TI Space Products Guide

Radiation-hardened and radiation-tolerant products to help innovate your space designs

Texas Instruments

www.ti.com/space

2025

Space Products Guide
Overview/table of contents

TI space products

Our heritage in space applications spans over 60 years, dating as far back as 1958 when the first satellite launched by the U.S., Explorer I, carried aloft radiation detection circuitry using the newly released TI 2N335 silicon-grown junction transistor. From that first satellite, to the first moon landing and first comet landing, to exploring the planets, TI semiconductor devices have been there.

We focus on radiation performance and best-in-class performance products to both our **QMLV/QMLP (typically identified by the -SP suffix)** and **radiation tolerant (identified by the -SEP suffix)** portfolios. The breadth of TI's space portfolio provides a full signal-chain solution. The portfolio includes the smallest RHA point-of-load power solutions, fast discrete SerDes and some of the world's highest performance data converters.

TI's Space products include MIL-PRF-38535 QMLV/QMLP, RHA, and radiation tolerant plastic components. These devices are typically supported with Total Ionizing Dose (TID) and Single Event Effects (SEE) test reports to address potential product degradation in a space environment. The test results for these devices are available in the product folder under the Technical documents tab.

Satellite applications

- Communications payload
- Laser communications payload
- Radar imaging payload
- Optical imaging payload
- Navigation payload
- Scientific exploration payload
- Command & data handling (C&DH)
- Attitude & orbit control system (AOCS)
- Satellite electrical power system (EPS)
- Satellite mechanisms
- Launchers, landers and rovers

TI space products portfolio

TI offers RHA and radiation-tolerant, hermetically packaged components highlighted in each of the red blocks to the right. TI also offers many of these space grade products in die form (known good die or tested die).

For acronyms specific to space terminology, see the end of this document.

Table of contents

Additional resources

- TI space products and applications: **www.ti.com/space**.
- Radiation-tolerant portfolio: **www.ti.com/SEP**.
- The "Radiation Handbook for Electronics" eBook: **www.ti.com/RadBook**.

Space-grade power management
Featured products

3V to 7V_{IN}, 18A, current-mode monolithic point-of-load DC/DC converter
TPS7H4001-SP/TPS7H4003-SEP

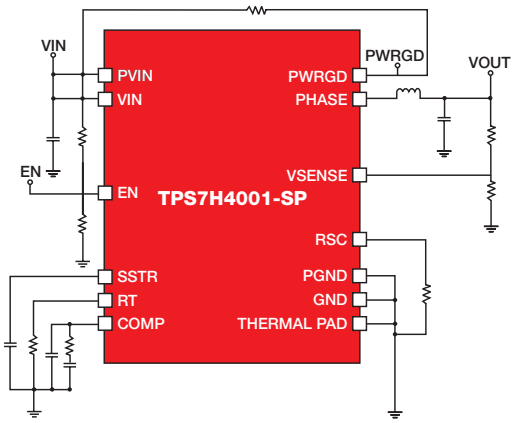
Key features
- 0.6V ±1.5% V_{REF} accuracy over load, line, temp and TID
- Integrated high-side and low-side power MOSFETs
- Programmable frequency from 100–1000kHz
- Parallel support for 2–4 devices with 180° or 90° Φ shifted SYNC1 and SYNC2 pins (50-kHz master/slave operation)
- Configurable softstart/tracking, external compensation, power good, enable
- Configurable slope compensation
- QML Class-V: 34-pin CDFP, 7.6mm x 21.6mm
- QML Class-P: 44-pin HTSSOP, 6.1mm x 14.0mm
- Space EP: 44-pin HTSSOP, 6.1mm x 14.0mm

Radiation performance
- Rad-hard (RHA) TPS7H4001-SP:
  - TID characterization to 100krad(Si)
  - SEL immunity to 75MeV-cm^2/mg at 125°C
- Rad-tolerant TPS7H4003-SEP:
  - TID characterization to 50krad(Si)
  - SEL immune to 43MeV-cm^2/mg at 125°C

More information at **www.ti.com/product/TPS7H4001-SP** and at **www.ti.com/product/TPS7H4003-SEP**

Applications
- Space satellite power management and distribution
- Radiation-hardened and tolerant power-tree applications

Benefits
- Higher output current in smaller footprint for powering high-current FPGA and ASIC core voltage rails
- Ease of implementing sequencing schemes
- Easily paralleled for even higher currents with no external components and no external clock needed



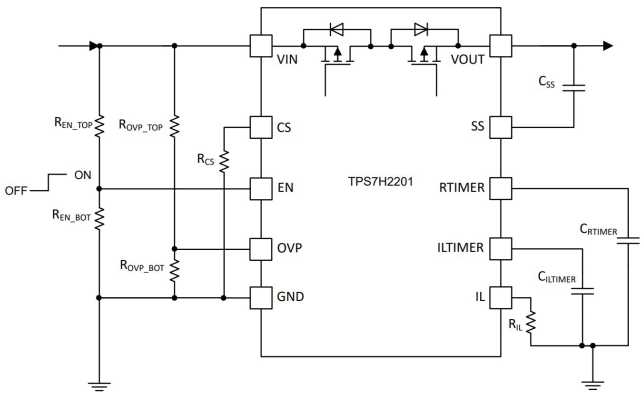
1.5V to 7V input 6A eFuse
TPS7H2201-SP/TPS7H2201-SEP

Key features
- On Resistance (RON) of 35mΩ max at V_{IN}=5V at 25°C
- Configurable rise time
- Programmable current limiting and fault timers
- OVP and UVLO
- Low control input threshold enables use of 1.8, 2.5 and 3.3V logic
- QMLV package: 16-pin CDFP, body: 9.6mm x 11.0mm
- QMLP & -SEP package: 32-pin HTSSOP, body: 6.1mm x 11.0mm

Applications
- Space satellite power management and distribution
- Radiation hardened and tolerant power tree applications

Radiation performance
- Rad-hard (RHA) TPS7H2201-SP:
  - TID: 100krad(Si)
  - SEL immune to 75MeV-cm^2/mg
- Rad-tolerant TPS7H2201-SEP:
  - TID: 50krad(Si)
  - SEL immune to 43MeV-cm^2/mg

Benefits
- Highly integrated solution eliminating the need for discrete FETs for power management
- Controlled inrush current during system power-up
- Reverse current protection for cold sparing applications
- Able to parallel for current sharing and reduced RON
- Low threshold enable compatible with multiple IO standards
- Over current system protection with programmable fault timer



More information at **www.ti.com/product/TPS7H2201-SP** and at **www.ti.com/product/TPS7H2201-SEP**

Space-grade power management
Featured products

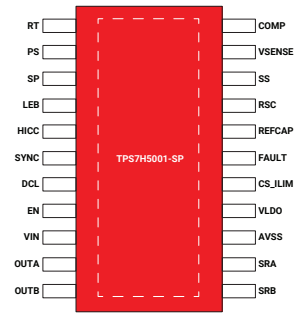
Radiation-hardened high-speed dual-output current-mode pulse-width modulation controller
TPS7H5001-SP/TPS7H5005-SEP

Key features
- 0.6V ±1% V_{REF} accuracy over load, line, temperature and TID
- Configurable switching frequency from 100kHz to 2MHz. External synchronization using SYNC pin
- 5V outputs, 150mA drive, R_{OUT} = 15Ω
- Synchronous rectification outputs, dead time (PS and SP) and duty cycle limit configurable (leading edge blanking)
- Configurable soft start, EN (UVLO), FAULT (OCP, OVP and OTP) slope compensation and current limit, Hiccup OCP mode
- QML Class-V: 22-pin CDFP, 6.2mm x 7.7mm
- QML Class-P: 24-pin TSSOP, 4.4mm x 7.7mm
- Space EP: 24-pin TSSOP, 4.4mm x 7.7mm

Radiation performance
- Rad-hard (RHA) TPS7H5001-SP:
  - TID characterization to 100krad(Si)
  - SEL immunity to 75MeV-cm^2/mg at 125°C
- Rad-tolerant TPS7H5005-SEP:
  - TID characterization to 50krad(Si)
  - SEL immunity to 43MeV-cm^2/mg at 125°C

Applications
- Space satellite power management and distribution
- Radiation-hardened and tolerant power tree applications

Benefits
- Support for non-isolated (buck, boost) and isolated (flyback, forward, active clamp, push-pull, half/full-bridge) topologies
- External driver allows support of Si MOSFETs and GaN FETs
- High level of features integration minimizes radiation risks and overall solution size
- Synchronous rectification to enable higher efficiency
- During the cross conduction SET testing, zero events were recorded



More information at **www.ti.com/product/TPS7H5001-SP** and at **www.ti.com/product/TPS7H5005-SEP**

4.5 to 14V_{IN}, 12A, current mode POL DC-DC converter
TPS7H4011-SP/TPS7H4011-SEP

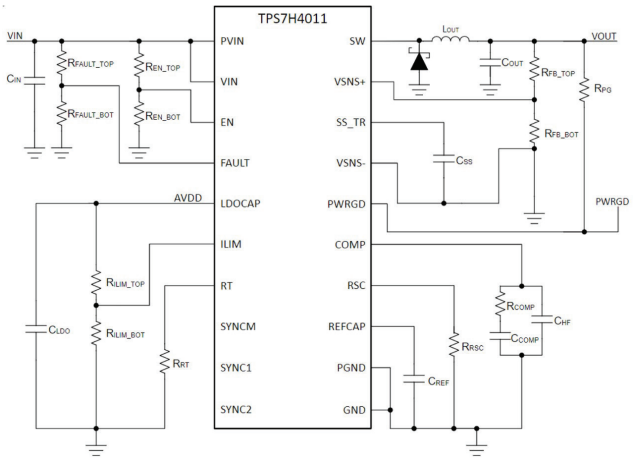
Key features
- Integrated high side and low side power MOSFETs
- 0.6V ±0.67% V_{REF} + offset error accuracy over load, line, temperature, and TID
- Configurable high side current limit
- Differential remote sensing capability
- Programmable frequency from 100kHz – 1MHz at 15% accuracy
- Parallel 2 - 4 devices with 90° or 180° phase shifted outputs (100kHz–1MHz freq)
- External input FAULT pin for flexible fault management
- Configurable slope compensation and external OTA compensation
- Adjustable soft-start, power good, and enable for sequencing
- QML Class-V: 30-pin CDFP, 7.84mm x 19.28mm
- QML Class-P: 44-pin TSSOP, 6.1mm x 14.0mm
- Space EP: 44-pin TSSOP, 6.1mm x 14.0mm

Radiation performance
- Rad-hard (RHA) TPS7H4011-SP:
  - TID characterization to 100krad(Si)
  - SEL immunity to 75MeV-cm^2/mg at 125°C
- Rad-tolerant TPS7H4011-SEP:
  - TID characterization to 50krad(Si)
  - SEL immunity to 43MeV-cm^2/mg at 125°C

More information at **www.ti.com/product/TPS7H4011-SP** and at **www.ti.com/product/TPS7H4011-SEP**

Applications
- Space satellite point of load supply
- Space satellite payloads

Benefits
- Wide input voltage range allows for operation directly from 12V distribution rail
- Programmable current limit allows user to optimize overall solution size by tailoring output inductor ratings to application needs
- Differential remote sense allows for voltage drop mitigation that is ideal for low-voltage, high-current applications



Space-grade power management

Featured products

3 to 14V_{IN}, 4 channel sequencer

TPS7H3014-SP/TPS7H3014-SEP

Key features

- Sequence up and down with ability to daisy chain
- Programmable delay from 0.25 to 25ms (±10% accuracy), or no delay
- Logical input compatible with 1.2V Logic Programmable hysteresis 24µA ±3%
- Trip Point = 0.6V ±1% (across voltage, temp & radiation)
- Push-Pull EN outputs with external inputs for the pull-up voltage domain
- QML Class-V: 22-pin CDFP, 6.21mm x 7.69mm
- QML Class-P: 24-pin TSSOP, 4.5mm x 7.9mm
- Space EP: 44-pin TSSOP, 4.5mm x 7.9mm

Radiation performance

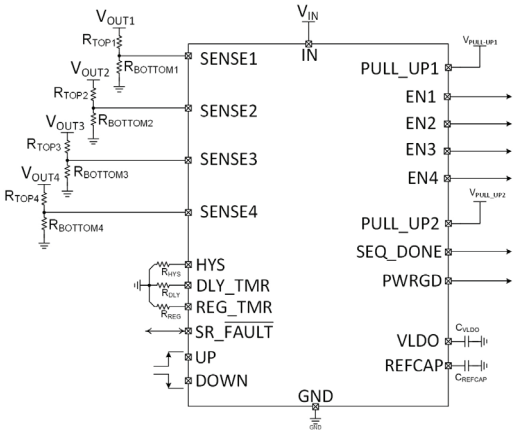
- Rad-hard (RHA) TPS7H3014-SP:
  - TID characterization to 100krad(Si)
  - SEL immunity to 75MeV-cm2/mg at 125°C
- Rad-tolerant TPS7H3014-SEP:
  - TID characterization to 50krad(Si)
  - SEL immunity to 43MeV-cm2/mg at 125°C

Applications

- Satellite electrical power system (EPS)
- Control sequence and monitoring for complex digital processors such as: FPGAs, SoCs, AFEs, and power systems for space applications

Benefits

- Compelling radiation performance support for complex FPGA and ASIC power-up and power-down sequences
- Multiple devices can be cascaded to sequence as many supplies as needed
- Highest accuracy radiation-validated device
- Smallest ceramic solution in the industry



More information at **www.ti.com/product/TPS7H3014-SP** and at **www.ti.com/product/TPS7H3014-SEP**

Half-bridge GaN FET gate drivers

TPS7H6003/13/23-SP, TPS7H6005/15/25-SP, TPS7H6005/15/25-SEP

Key features

- TPS7H6003-SP, TPS7H6005-SP/-SEP V_{IN} 200V
- TPS7H6013-SP, TPS7H6015-SP/-SEP V_{IN} 60V
- TPS7H6023-SP, TPS7H6025-SP/-SEP V_{IN} 22V
- V_{IN} = 10 to 14V (8.5V UVLO).
- Integrated 5V LDOs for both high-side and low-side GaN FETs
- f_{SW} ≥ 5MHz, 1.3A peak source current, 2.5A peak sink current
- 30ns typical propagation delay and 5.5ns typical delay matching
- Split outputs for adjustable turn-on and turn-off times
- Input modes: Independent input mode & PWM input mode
- QML Class-V: 48-pin CDFP, 8.48mm x 16.71mm
- QML Class-P: 56-pin TSSOP, 6.1mm x 14.0mm
- Space EP: 56-pin TSSOP, 6.1mm x 14.0mm

Radiation performance

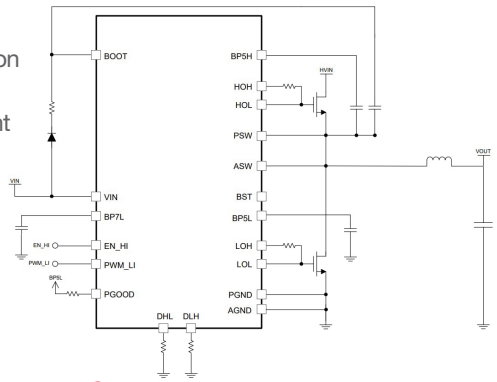
- Rad-hard (RHA) TPS7H6003/13/23-SP and TPS7H6005/15/25-SP:
  - TID characterization to 100krad(Si)
  - SEL immunity to 75MeV-cm^2/mg at 125°C
- Rad-tolerant TPS7H6005/15/25-SEP:
  - TID characterization to 50krad(Si)
  - SEL immunity to 43MeV-cm^2/mg at 125°C

Applications

- Space satellite power supplies
- Communications payload
- Command and data handling
- Optical imaging payload
- Satellite electrical power system

Benefits

- Internal regulator supports GaN applications by properly controlling gate drive voltage
- Dead time configuration in PWM mode allows system optimization in high frequency applications
- Input interlock protection can be enabled or disabled in independent input mode to accommodate multiple converter topologies



More information at **www.ti.com/product/TPS7H6003-SP** and at **www.ti.com/product/TPS7H6013-SP** and at **www ti.com/product/TPS7H6023-SP** and at **www.ti.com/product/TPS7H6005-SP** and at **www.ti.com/product/TPS7H6015-SP** and at **www.ti.com/product/TPS7H6025-SP** and at **www.ti.com/product/TPS7H6005-SEP** and at **www.ti.com/product/TPS7H6015-SEP** and at **www.ti.com/product/TPS7H6025-SEP**

Space-grade power management
Featured products

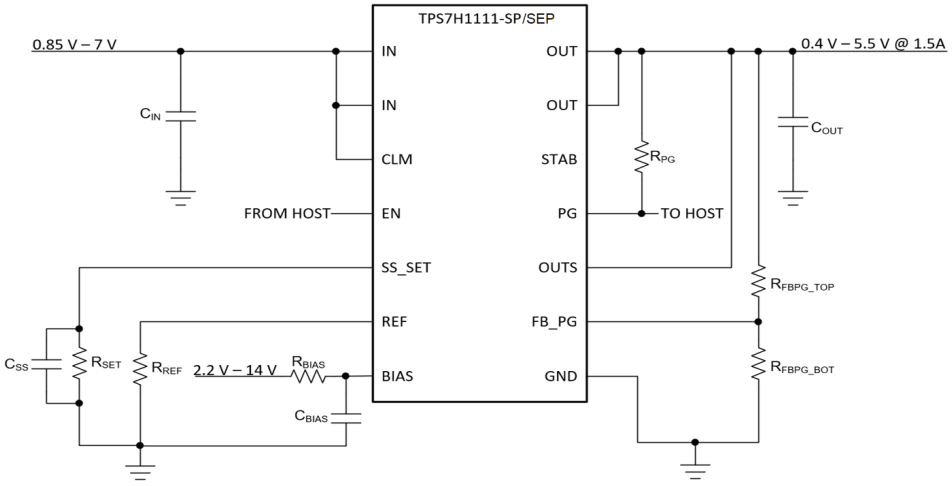
0.85V – 7V V_{IN}, 2.2V – 14V V_{BIAS}, 1.5A, low-noise, high PSRR performance LDO
TPS7H1111-SP/TPS7H1111-SEP

Key features
- Ultra-Low Noise: 1.68µ VRMS (10Hz – 100kHz)
- Ultra-low 1/f noise: 100nV/Hz½ (typ at 10Hz)
- High PSRR: 71dB at 100kHz, 67dB at 1MHz
- V_{OUT}: 0.4V to 5.5V
- Very high accuracy: ±1.5% across line, load, temperature, & radiation
- Low dropout: 200mV (typ) at 1A, 450mV (max) at 1.5A
- Bias supply to minimize power dissipation (Set $V_{BIAS} \geq V_{OUT}$ + 1.6V)
- Ability to easily parallel multiple devices for higher output current
- Programmable soft start
- Enable and configurable power good threshold and indicator
- Exposed control loop with the external compensation STAB pin
- Configurable current limit behavior (brick-wall or turn-off)
- QML Class-V: 14-pin CDFP, 8.0mm x 9.1mm
- QML Class-P & -SEP 28-pin HTSSOP, 4.4mm x 9.7mm

Radiation performance
- Rad Hard (RHBD) TPS7H1111-SP:
  - TID (LDR & HDR) = 100krad(Si)
  - SEL/SEB/SEGR immune to 75MeV-cm^2/mg
  - SET/SEFI characterized to LET = 75MeV-cm^2/mg
- Rad Tolerant TPS7H1111-SEP:
  - TID characterization to 50krad(Si)
  - SEL/SEB/SEGR immune to 43MeV-cm^2/mg
  - SET/SEFI characterized to LET = 43MeV-cm^2/mg

Applications
- Power for high-speed and high-accuracy circuits
  - VCOs (voltage controlled oscillators)
  - Data Converters: ADCs and DACs (analog-to digital and digital-to-analog converters)
  - PLLs (phase-lock-loops), SerDes (serializer and
  - deserializers), Imaging sensors
- Accurate supply for precision ASIC and FPGA supply rails

Benefits
- Lowest noise, highest PSRR LDO in space industry
- Enable full performance of high speed and high precision circuits through clean power supply generation without bulky filters recorded



More information at **www.ti.com/product/TPS7H1111-SP** and at **www.ti.com/product/TPS7H1111-SEP**

Space-grade interface
Featured products

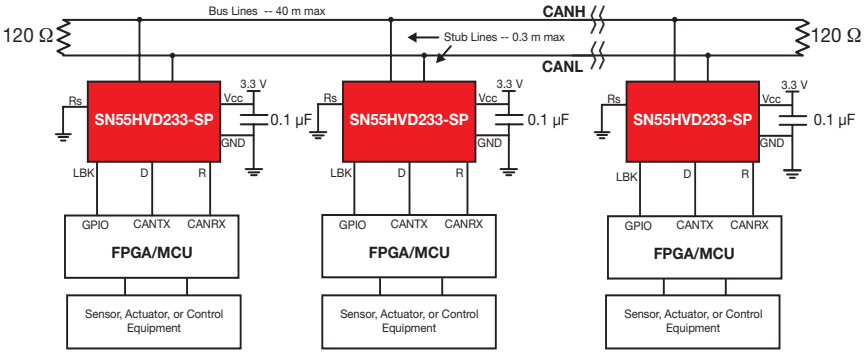
3.3V CAN transceiver
SN55HVD233-SP/SN55HVD233-SEP

Key features
- Compatible with ISO 11898-2
- Data rates up to 1Mbps
- Extended –7V to 12V common mode range
- High-input impedance allows for 120 nodes
- LVTTL I/Os are 5-V tolerant
- Unpowered node does not disturb the bus
- Temperature range: –55°C to 125°C
- Available in 8-pin 6.48mm × 6.48mm ceramic flat pack (HKX)
- Bus pins ESD protection exceeds ±16kV HBM

Radiation performance
- Rad Hard (RHA) SN55HVD2331-SP:
  - TID = 50krad(Si) RHA
  - SEL immune to 86MeV-cm^2/mg
- Rad Tolerant SN55HVD2331-SEP:
  - TID characterization to 30krad(Si)
  - SEL immune to 43MeV-cm^2/mg

Applications
- Spacecraft backplane data bus communication and control
- Telemetry/Sensor data transmission
- CAN bus standards such as CANopen, DeviceNet, CAN Kingdom, ISO 11783, NMEA 2000, SAE J1939

Benefits
- RHA qualified and orderable as SMD: 5962L1420901VXC
- Thermal shutdown protection
- Adjustable driver transition times for improved signal quality



More information at **www.ti.com/product/SN55HVD233-SP** and at **www.ti.com/product/SN55HVD233-SEP**

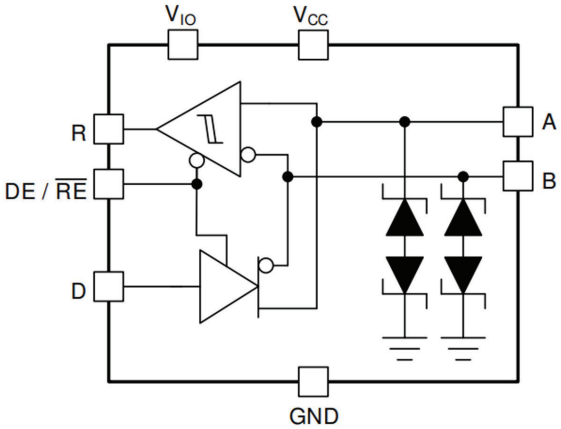
3V to 5.5V RS-485 transceiver with flexible I/O supply and IEC ESD
THVD9491-SEP

Key features
- 3V – 5.5V supply voltage (1.65V-5.5V operation support for I/Os)
- Fully integrated system-level EMC protection on bus pins
- ±15kV HBM ESD protection
- Common-mode range: ±12V
- Bus fault protection for DC shorts: ±15V
- Large receiver hysteresis: 250mV
- Data rates up to 12Mbps
- Open, short, and idle bus failsafe receiver
- 1/8th unit load to support up to 256 nodes on a bus

Radiation performance
- TID = 30krad(Si) RHA
- SEL immune to 43MeV-cm^2/mg

Applications
- Low/mid orbit satellite applications

Benefits
- 1.8V – 5V logic supply support eliminates the need for level translator when interfacing with processors with 1.8V I/Os
- Fully integrated IEC ESD, EFT and surge protection – Eliminate system level protection components and reduce system BOM



More information at **www.ti.com/product/THVD9491-SEP**

Space-grade interface
Featured products

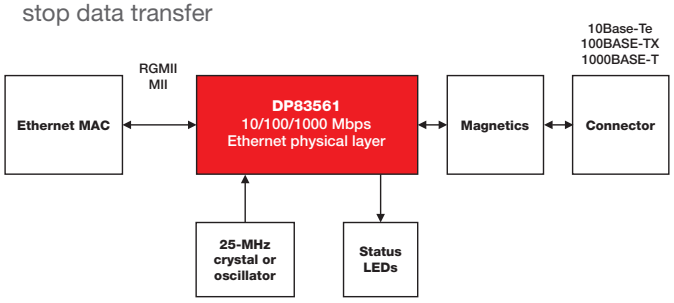
Radiation-hardness-assured (RHA), 10/100/1000 Gigabit Ethernet PHY with SEFI monitor
DP83561-SP

Key features
- TID: 300krad(Si), QMLV-RHA qualified
- SEL immune > 121MeV-cm^2/mg at max temp and voltage ratings
- SEU: No link drops and low packet loss up to 48MeV-cm^2/mg
- SEFI support suite:
  - Configuration registers protection: ECC corrects SEFI related bit changes
  - PHY state machine monitor: Looks for invalid changes
  - Supply current monitor: Indicates general PHY health to system
  - Interrupt indication for monitors
  - PLL lock monitor
- Operating temperature range: –55 to 125°C
- MAC I/Fs: RGMII, MII
- IEEE 1000Base-T, 100Base-TX, 10Base-Te
- 64-pin CFP (11mm × 11mm)

Radiation performance
- TID = 300krad(Si) RHA
- SEL immune to LET = 121MeV-cm^2/mg

Applications
- Space/satellite communications

Benefits
- **EMDIO register monitor:** Changes in PHY configuration registers will be indicated to system for action/correction
- **PHY PCS state machine monitor:** Invalid state changes may be indicative of SEFI, system is notified to adjust accordingly
- **Supply current monitor:** SEFI events may cause PHY failure modes undetectable by other method
- **PLL lock monitor:** Loss of lock indication can be used to stop data transfer



More information at **www.ti.com/product/DP83561-SP**

Space-grade data converters
Featured products

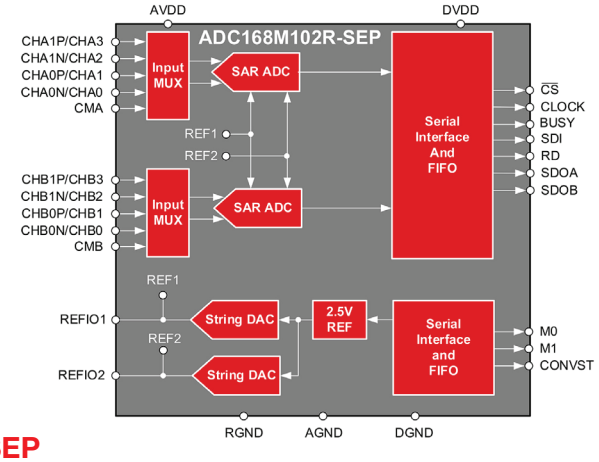
16-bit, 1MSPS, 8-Ch SE / 4-Ch DIFF, Dual Simultaneous Sampling SAR ADC w/ Internal Reference
ADC168M102R-SEP

Key features
- Dual SAR ADC Cores 1 MSPS per ADC
- 8 single ended and 4 differential channels
- Dual programmable internal reference
- Digital Interface: SPI
- AVDD: 2.5V to 5.5V
- DVDD: 2.3V to 5.5V
- Power: 67mW
- Operating temperature –55 to 125°C
- 5mm x 5mm QFN

Radiation performance
- Rad Tolerant ADC168M102R-SEP:
  - TID characterization (ELDRS free) to 30krad(Si)
  - SEL immune to 43MeV-cm2/mg at 125°C

Applications
- Telemetry
  - Latch-Up Diagnostics, Module Temperature Sensing
  - Environmental Sensing
- Closed Loop-Controls
  - Inertial Measurement Units
  - Gyroscope AFE

Benefits
- Radiation tolerant performance in a small plastic package for high-volume LEO deployments reducing size, cost, & weight
- Dual programmable internal reference enables input range scaling and monitoring for up to 8 signals
- 1MSPS sampling rate enables faster response for closed loop controls



More information at **www.ti.com/product/ADC168M102R-SEP**

Space-grade data converters
Featured products

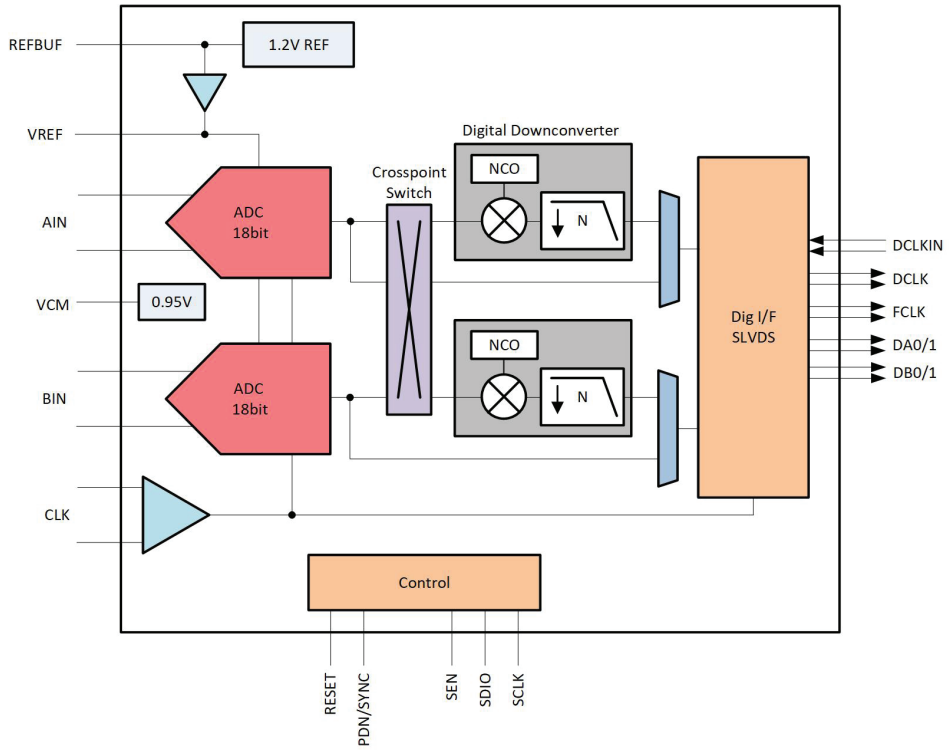
2-channel, ultra-low power, 0.5 to 65MSPS, 18-bit ADC
ADC3683-SP/ADC3683-SEP

Key features
- Resolution: 18-bit, no missing codes
- Ultra-low power: 50mW/ch (10MSPS), 94mW/ch (65MSPS)
- Noise spectral density: -160dBFS/Hz
- Spectral performance (f_{IN} = 5MHz)
  - SNR: 83.5dBFS
  - SFDR: 87dBc HD2, HD3, SFDR: 99dBFS worst spur
- Analog input bandwidth (-3dB): 400MHz
- Low latency: 1 to 2 clock cycles
- INL/DNL: ±9.0 / ±0.7LSB (typ)
- Reference: Integrated or external (buffer integrated)
- Interface: Serial LVDS (SLVDS) – options: 2-, 1-, and 1/2-wire

Radiation performance
- Rad Hard ADC3683-SP:
  - TID = 300krad(Si) RHA
  - SEL immune to 75MeV-cm^2/mg
- Rad Tolerant ADC3683-SEP:
  - TID = 30krad(Si)
  - SEL immune to 43MeV-cm^2/mg

Applications
- Narrow band radio/radar
- Precision telemetry
- Satellite optical communications payload
- Satellite imaging payloads

Benefits
- Integrates digital filter options to reduce processing requirements
  - Decimation by 2, 4, 8, 16, or 32, and 32-Bit NCO
- Low latency (1 to 2 clock cycles) for high-speed control loops
- Low offset voltage and offset voltage drift parameters allow for accurate measurements across temperature
- Offers excellent DC precision together with IF sampling support which makes it ideally suited for a wide range of applications
- SLVDS interface minimizes the number of digital interconnects



More information at **www.ti.com/product/ADC3683-SP** and at **www.ti.com/product/ADC3683-SEP**

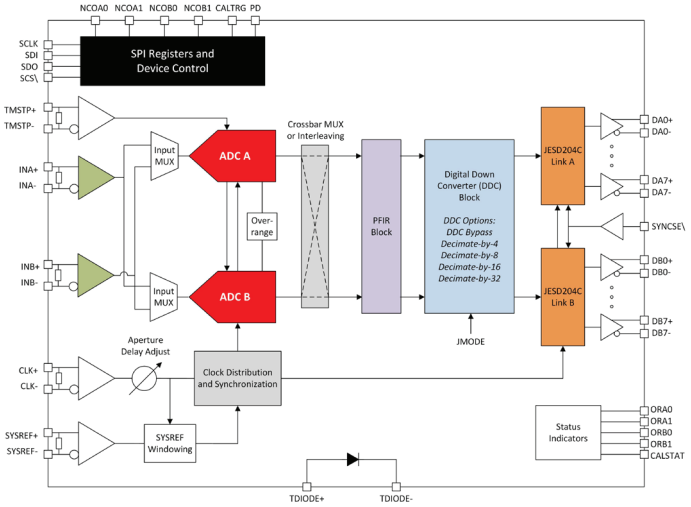
Space-grade data converters
Featured products

12-bit, dual 5.2GSPS or single 10.4GSPS ADC
ADC12DJ5200-SP/ADC12DJ5200-SEP

Key features
- 12-bit ADC with 8GHz input bandwidth
- 10.4GSPS as single, 5.2GSPS as dual
- Noise Floor: –154.4dBFS/Hz
- ENOB: 8.6 bits
- Easy-to-use synchronization features
- 17.16Gbps JESD204B/C serial data interface
- Optional 4x-32x complex decimation
- Peak RF Input Power (Diff): +26.5dBm
- Programmable FIR filter for equalization
- Power consumption: 4W

Radiation performance
- Rad Hard ADC12DJ5200-SP:
  - TID = 300krad(Si) RHA
  - SEL and SEFI immune to LET > 120MeV-cm^2/mg
- Rad Tolerant ADC12DJ5200-SEP:
  - TID characterization to 30krad(Si)
  - SEL immune to 43MeV-cm^2/mg at 125°C

Applications
- Wideband Satellite communications (SATCOM)
- RF-sampling software-defined radio (SDR)
- Spectrometry
- RADAR / LIDAR



More information at **www.ti.com/product/ADC12DJ5200-SP** and at **www.ti.com/product/ADC12DJ5200-SEP**

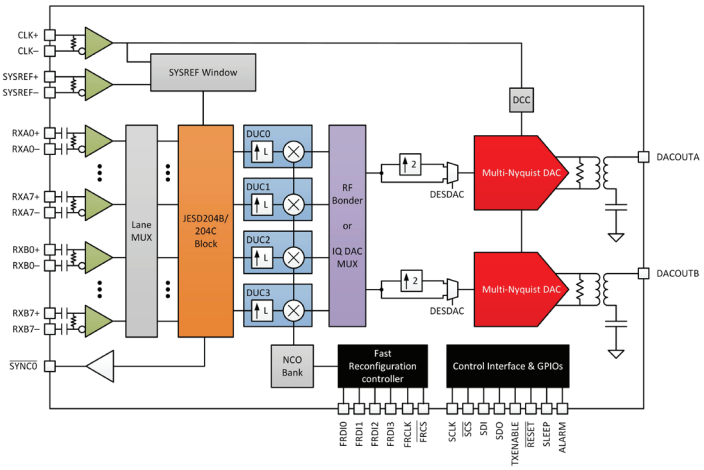
16-bit, 2-channel, up to 20.8GSPS 12GHz RF digital-to-analog converter
DAC39RF10-SP/DAC39RF10-SEP

Key features
- Sample rate: 10.4GSPS (single edge) and 20.8GSPS (dual edge)
- 16-bits resolution
- Max input rates (real data, 1-ch)
  - 20.8GSPS at 8-bits, 15.52GSPS at 12-bits, 10.4GSPS at 16-bits
- Max input rates (real data, 2-ch)
  - 7.75GSPS at 12-bits, 6.2GSPS at 16-bits
- Output current: 5 - 42mA w/ 7-bit control
- Interface: 16x JESD204C at 12.8Gbps

Radiation performance
- Rad Hard DAC39RF10-SP:
  - TID = 300krad(Si) RHA
  - SEL immune to 120MeV-cm^2/mg
- Rad Tolerant DAC39RF10-SEP:
  - TID = 30krad(Si)
  - SEL immune to 43MeV-cm^2/mg

Applications
- Satellite Communications (SATCOM)
- Phased array antenna systems
- Synthetic Aperture Radar (SAR) exciter
- Wireless communications testers
- Arbitrary Waveform Generator (AWG)

Benefits
- Low Phase Noise: -148dBc/Hz at 1GHz/10kHz offset
- DAC Speed & Modes: 2x faster speed, 12GHz+ output
- Digital Up-Converters: 1-256x interpolation, 64-bit NCO phase coherent frequency hopping covering 4x30MHz to 1x5GHz signals
- SERDES Lanes: Lower baud rate, in-package AC caps, & 1mm ball pitch for small PCB size & easier RF routing



More information at **www.ti.com/product/DAC39RF10-SP** and at **www.ti.com/product/DAC39RF10-SEP**

Eight-channel 12-bit 50kSPS to 1MSPS analog-to-digital converter

ADC128S102QML-SP/ADC128S102-SEP

Key features

- Eight input channels
- V_A: 2.7V to 5.25V; V_D: 2.7V to V_A
- 2.3mW with 3V supply and 0.06µW at shutdown
- DNL: –0.5 to +0.9LSB (typ); INL: ±0.9LSB (typ)
- SPI digital output
- ADC addressing through CS decoder
- SPI/QSPI/MICROWIRE/DSP compatible
- ADC128S102QML-SP: 16-pin ceramic SOIC, CFP and die
  ADC128S102-SEP: 16-pin plastic TSSOP package
  (5mm x 4.4mm)

Radiation performance

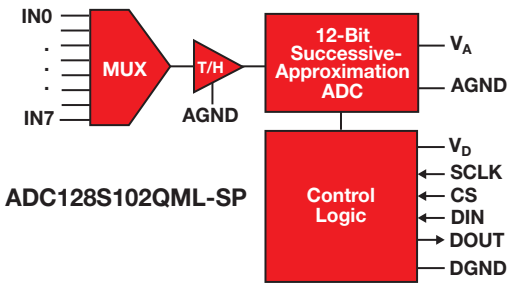
- Rad Hard (RHBD) ADC128S102QML-SP:
  - TID = 100krad(Si) RHA
  - SEL and SEFI immune to LET > 120MeV-cm^2/mg
- Rad Tolerant ADC128S102-SEP:
  - TID characterization (ELDRS free) to 30krad(Si)
  - SEL immune to 43MeV-cm^2/mg at 125°C

Applications

- Sensors, thermistors, motor control
- Satellite system health, power-supply voltage and current monitoring

Benefits

- Eight sensors can be monitored with one ADC
- All ADC serialized data shares the same input bus to onboard FPGA/ASIC
- Ultra-low power consumption



More information at **www.ti.com/product/ADC128S102QML-SP** and at **www.ti.com/product/ADC128S102-SEP**

4-transmit, 6-receive RF-sampling transceiver up to 10.2GHz

AFE7950-SP/AFE7950-SEP

Key features

- Four RF sampling 12GSPS TX DACs
- Six RF sampling 3GSPS RX ADCs
- Maximum RF signal bandwidth: 1200MHz (or 2400MHz for 2TX)
- RF frequency range:
  - TX: 600MHz - 10.2GHz, RX: 5MHz - 10.2GHz
- Digital step attenuators (DSA):
  - TX: 40dB range, 0.125dB steps, RX or FB: 25dB range, 0.5dB steps
- 8 SerDes transceivers up to 24.75Gbps
- Package: 17mm × 17mm FCBGA, 0.8mm pitch

Radiation performance

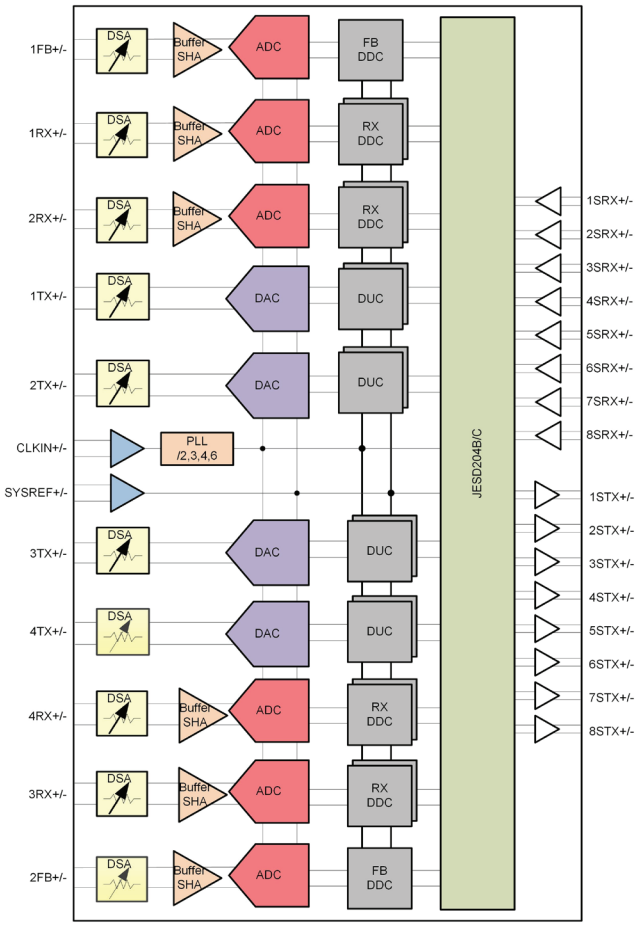
- Rad Hard AFE7950-SP:
  - TID = 100krad(Si) RHA
  - SEL immune to 70MeV-cm^2/mg
- Rad Tolerant AFE7950-SEP:
  - TID characterization to 30krad(Si)
  - SEL immune to 43MeV-cm^2/mg at 125°C

Applications

- Satellite communications payload downlink
- Satellite telemetry payload downlink

Benefits

- Wide bandwidth multi-channel transceiver
- Direct RF sampling in the L, S, C and X-band frequency ranges
- Density and flexibility enables high-channel count, multi-mission systems



More information at **www.ti.com/product/AFE7950-SP** and at **www.ti.com/product/AFE7950-SEP**

Space-grade data converters
Featured products

12-bit telemetry & control – 16 ADC, 12 DAC, and temperature sensor with GPIO
AFE11612-SEP

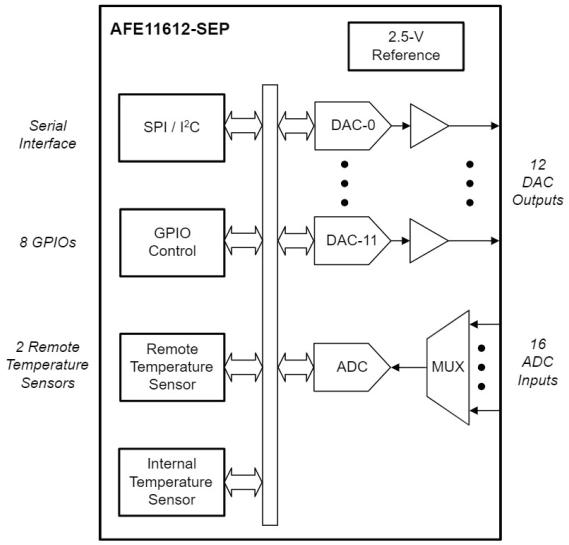
Key features
- ADC, 12-bit, 16-ch, single-ended or differential options
- DAC, 12-bit, 12-ch, 0 to 5V or 0 to 12.5V
- Temperature sensors
  - Two (2) remote sensors
  - One (1) local/internal sensor
- Internal 2.5V reference
- I^2C or SPI interface
- 8 GPIO
- 64-pin plastic HTQFP package (10mm x 10mm)

Applications
- Command and data handling (C&DH)
- Communications payload
- Radar imaging payload
- Optical imaging payload
- General analog monitoring and control

Benefits
- High integration
- Vendor Item Drawing (VID)

More information at **www.ti.com/product/AFE11612-SEP**

Radiation performance
- TID = 20krad(Si) RLAT
- SEL/SEB/SEGR immune to LET = 43MeV-cm^2/mg
- SET/SEFI characterized to LET = 43MeV-cm^2/mg



Space-grade amplifiers
Featured products

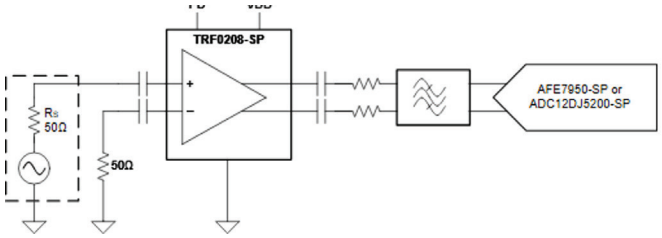
Radiation-tolerant near-DC to >11GHz, fully differential (D2D & S2D) RF amplifier
TRF0208-SP/TRF0208-SEP

Key features
- RF FDA that enables compact multi-channel designs
- 9GHz ,-1dB bandwidth
- 10.5GHz, -3dB bandwidth
- 16dB fixed gain

Radiation performance
- Rad-hard (RHA) TRF0208-SP:
  - TID characterization to 100krad(Si)
  - SEL immunity to 75MeV-cm2/mg at 125°C
- Rad-tolerant TRF0208-SEP:
  - TID characterization to 30krad(Si)
  - SEL immune to 43MeV-cm2/mg at 125°C

Applications
- Space Phased Array Radar
- UHF & C-Band Sat Uplink RX
- Space High Speed Digitizer
- RF Active Balun Benefits

Benefits
- Directly drive RF sampling or GSPS ADCs up to 8GHz
- Suitable for Aerospace & Defense Application with up to C-band support
- Low Noise Figure for better signal integrity
- Reduced system size with small foot print and elimination of passive RF balun
- Low power, with power-down mode for optimized system design



More information at **www.ti.com/product/TRF0208-SP** and at **www.ti.com/product/TRF0208-SEP**

Space-grade amplifiers
Featured products

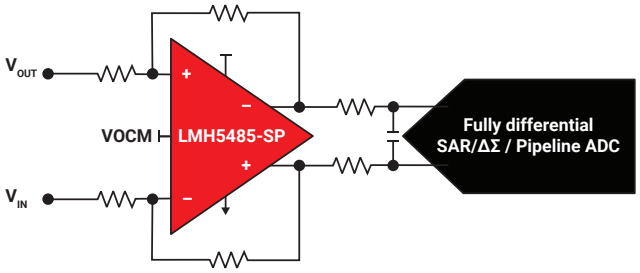
850MHz gain bandwidth, rail-to-rail output, negative rail input precision fully differential amplifier
LMH5485-SP/LMH5485-SEP

Key features
- Single channel, fully differential amplifier (FDA)
- Single supply range: 2.7V to 5.4V
- I_Q: 10.1mA
- Power-down current: ~2µA
- Bandwidth: ≈500MHz at G = 2V/V (GBW = 850MHz)
- Input voltage noise: 2.2nV/√Hz,
- THD: –140dBc at $2V_{PP}$, 1MHz
- Typical V_{OS}/V_{OS} drift: ±100µV/±0.5µV/°C
- Operating temperature range: –55°C to 125°C

Radiation performance
- Rad-hard (RHA) LMH5485-SP:
  - TID characterization to 100krad(Si)
  - SEL immunity to 85MeV-cm²/mg at 125°C
- Rad-tolerant LMH5485-SEP:
  - TID characterization to 30krad(Si)
  - SEL immune to 43MeV-cm²/mg at 125°C

Applications
- SE to DE
- ADC driver
- Narrow-band radar

Benefits
- Low offset voltage and offset voltage drift parameters allow for accurate measurements across temperature
- Offers excellent DC precision together with IF sampling support which makes it ideally suited for a wide range of applications
- Supports single-ended to differential conversion
- RLAT to 100krad qualified for GEO applications



More information at **www.ti.com/product/LMH5485-SP** and at **www.ti.com/product/LMH5485-SEP**

Four-channel, 11MHz gain bandwidth, low-noise (5.1nV/√Hz), rail-to-rail output precision (120µV) junction FET operational amplifier
OPA4H014-SEP

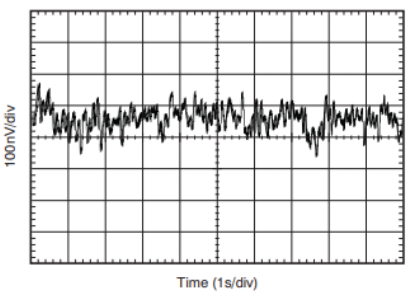
Key features
- Gain bandwidth 11MHz
- Slew rate 20V/µs
- Input stage offset voltage 20µV (max)
- Offset voltage drift 1µV/°C (max)
- Input bias current 10pA (max)
- Supply current 1.8mA (typ)
- Input stage voltage noise 5.1nV/√Hz at 1kHz
- Current noise 0.8 fA/√Hz at 1kHz
- 0.1Hz to 10Hz noise $250nV_{pp}$
- 14-pin plastic package – TSSOP (PW) (5.0mm × 4.4mm)

Radiation performance
- TID characterization (ELDRS free) to 30krad(Si)
- SEL immune to 43MeV-cm²/mg at 125°C

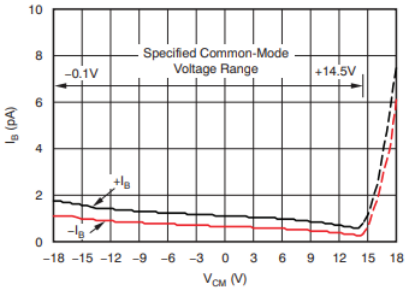
Applications
- Sensors
- Thermistors
- Instrumentation
- Telemetry/monitoring

Benefits
- High accuracy, stability over full military temperature range
- Precision JFET provides better matching to high-impedance sources such as sensor outputs and very-low-input bias current
- Low total noise (voltage and current) enables a wide range of input impedance sources for minimal error contributions
- Better matching to high-impedance sources such as sensor outputs
- RLAT to 40krad qualified for new space LEO applications

0.1-Hz to 10-Hz Voltage Noise



Low input bias across Vcm range



More information at **www.ti.com/product/OPA4H014-SEP**

Space-grade amplifiers
Featured products

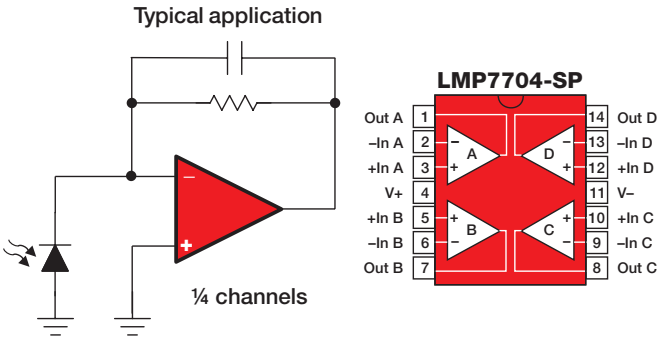
12V, quad femtoampere bias current, precision rail-to-rail input/output operational amplifier
LMP7704-SP

Key features
- Ultra-low input bias current: ±500fA (typ)
- Low offset voltage: ±260µV (max)
- +2.7V to +12V supply operation
- Rail-to-rail input and output
- Unity gain bandwidth: 2.5MHz
- Input voltage noise: 9nV/$\sqrt{Hz}$
- Supply current: 725µA/ch
- Package: 14-lead CFP, 9.9mm × 6.35mm

Radiation performance
- TID = 100krad(Si) RHA
- SEL = 85MeV-cm^2/mg (125°C)

Applications
- Precision transimpedance amplifier for satellite telemetry
- High-impedance satellite sensor interface
- High-gain amplifiers

Benefits
- RHA qualified
- Exceptional DC performance with lowest bias current available for space applications
- Unity gain stable operation
- Rail-to-rail with precision allows single op amp for most board applications



More information at **www.ti.com/product/LMP7704-SP**

Space-grade amplifiers
Featured products

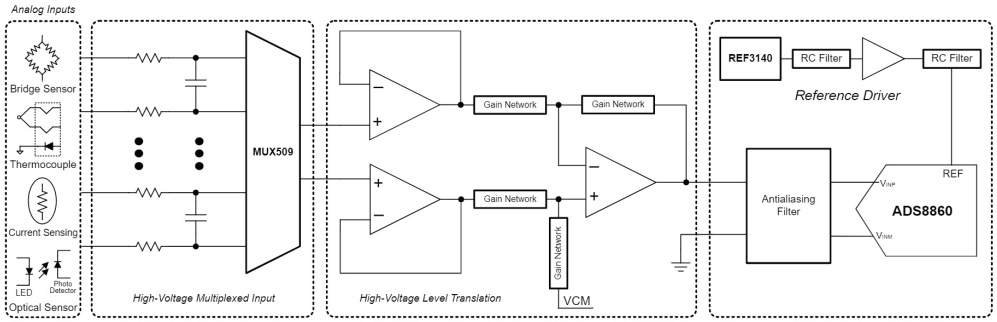
Quad, 40V 4.5MHz rail-to-rail input and output operational amplifier
OPA4H199-SEP

Key features
- Low offset voltage: ±125µV
- Low noise: 10.8nV/√Hz at 1kHz
- High common-mode rejection: 130dB
- Low bias current: ±10pA
- Rail-to-rail input and output
- Wide bandwidth: 4.5MHz GBW
- High slew rate: 21V/µs
- High capacitive load drive: 1nF
- MUX-friendly/comparator inputs
- Low quiescent current: 560µA per amplifier
- Wide supply: ±1.35V to ±20V, 2.7V to 40V
- Robust EMIRR performance: EMI/RFI filters on input and supply pins)

Radiation performance
- TID characterization to 30krad(Si)
- SEL immune to 43MeV-cm^2/mg at 125°C

Applications
- Support low earth orbit space applications
- Space sensor and control (telemetry)
- Satellite electrical power system (EPS)
- Flight control
- Satellite command & data handling
- Satellite payloads

Benefits
- Broadest supply voltage (2.7V - 40V) rail-to-rail input and output support offers exceptional flexibility in a range of applications
- Smallest Radiation Tolerant, 4-ch op amp in the industry
- Low offset voltage and offset voltage drift parameters allow for accurate measurements across temperature
- Low noise and THD+N enables audio/high-gain configurations
- Strong output current and cap load drive with low settling time ideal for ADC applications



More information at **www.ti.com/product/OPA4H199-SEP**

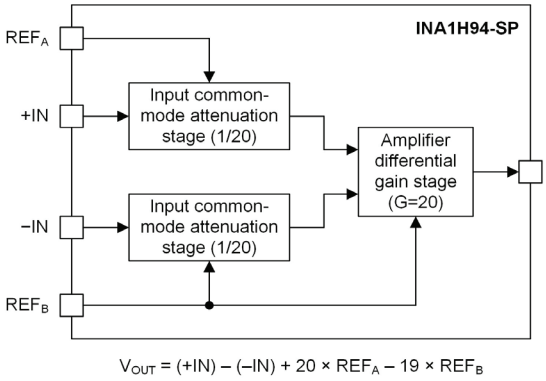
High common-mode Voltage (±120V) difference amplifier
INA1H94-SP

Key features
- Common-mode volt. range: ±120V
- CMRR (minimum): 90dB
- VOS/VOS drift: 1.1mV/15µV/°C
- Max. gain error: 0.02%
- Max. gain error drift: 10ppm/°C
- Max. gain non-linearity: 0.001% FSR
- Bandwidth: 500kHz
- Slew rate: 5V/µs (typ)
- Supply current: 0.9mA (max)

Radiation performance
- TID = 100krad(Si) RHA
- SEL = 75MeV-cm^2/mg at 125°C

Applications
- HV current sensing
- Battery cell voltage monitor
- Motor sensingr

Benefits
- Accurately measure small differential voltages in the presence of common-mode signals up to ±275V
- In many applications, where galvanic isolation in not required, the INA1H94-SP can replace isolation amplifiers



More information at **www.ti.com/product/INA1H94-SP**

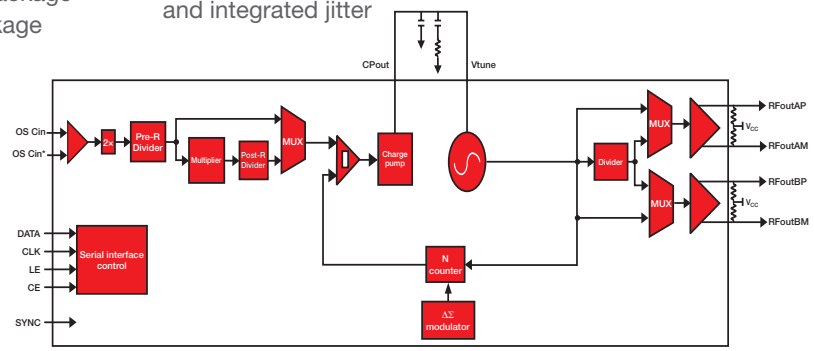
15GHz low-noise wideband phase-locked loop with integrated voltage controlled oscillator (VCO) LMX2615-SP/LMX2694-SEP

Key features
- Space grade 40MHz to 15GHz wideband synthesizer with phase synchronization and JESD204B support
- –110dBc/Hz closed-loop phase noise at 100kHz offset at 15GHz carrier frequency
- 45fs RMS jitter at 8GHz (100Hz - 100MHz)
- Ability to synchronize output phase with OSCin
- > 50 fixed-pin programmable options
- Single 3.3V supply
- LMX2615-SP: 11mm × 11mm² 64-lead CQFP ceramic package
- LMX2694-SEP: 7mm x 7mm² 48-lead VQFN plastic package

Radiation performance
- Rad-hard (RHA) LMX2615-SP:
  - TID = 100krad(Si) RHA
  - SEL/SEU immune to LET = 120MeV-cm^2/mg (125°C)
- Rad-tolerant LMX2694-SEP:
  - TID characterization to 30krad(Si)
  - SEL/SEU immune to LET = 43MeV-cm^2/mg (125°C)

Applications
- Space communications
- Space radar systems
- Phased-array antennas and beam forming

Benefits
- Wideband clock source to generate any clock frequency for high-speed data converters
- Support for generating or repeating SYSREF compliant to JESD204B standard
- Save board space and complexity by replacing discrete components with LMX2615
- High-performance PLL can attain very low in-band noise and integrated jitter



More information at **www.ti.com/product/LMX2615-SP** and at **www.ti.com/product/LMX2694-SEP**
Learn about TI's 28GHz space systhesizer, LMX2624-SP, at **www.ti.com/product/LMX2624-SP**.

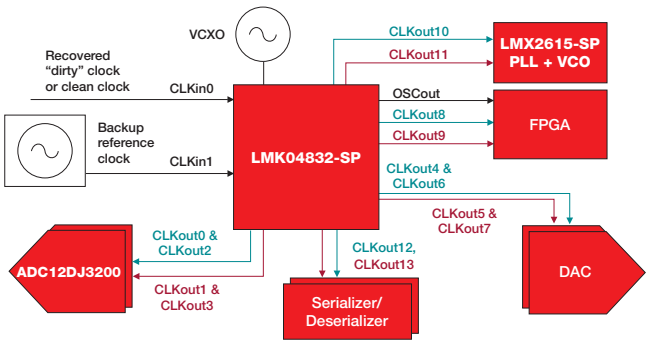
JESD204B clock generator and jitter cleaner LMK04832-SP/LMK04832-SEP

Key features
- Supports 7 JESD204B targets (7 device clock and 7 SYSREF) or 14 differential output clocks
- Dual-loop platinum PLL architecture
- 54fs RMS jitter at 2.5GHz, 61fs RMS jitter at 3.2GHz (12kHz–20MHz)
- Noise floor –156.5dBc/Hz at 3200MHz
- CML swing: 1.2V_{PP} differential at 3.2GHz
- 2 integrated VCO to support 2 independent frequency plans
  - VCO0 = 2440 to 2580MHz
  - VCO1 = 2945 to 3255MHz
- 320MHz PLL2 maximum phase detector frequency
- –230dBc/Hz PLL2 FOM and –128dBc/Hz PLL2 1/f
- SYSREF analog delay 25-ps step resolution
- 0-delay mode for either dual loop or single loop
- JESD204B sourced from distribution or clock generation mode/Hz
- Holdover mode when input clock is lost
- LMK04832-SP: 10.9mm × 10.9mm² 64-lead CFP ceramic package
- LMK04832-SEP: 10mm x 10mm² 64-lead TQFP plastic package

More information at **www.ti.com/product/LMK04832-SP**
and at **www.ti.com/product/LMK04832-SEP**

Radiation performance
- Rad-hard (RHA) LMK04832-SP:
  - TID characterization to 100krad(Si)
  - SEL immunity to 120MeV-cm^2/mg at 125°C
- Rad-tolerant LMK04832-SEP:
  - TID characterization to 30krad(Si)
  - SEL immune to 43MeV-cm^2/mg at 125°C

Applications
Low jitter noise with JEDEC JESD204B
- Space communications
- JESD204B clocking systems



Space-grade clocks and timing
Featured products

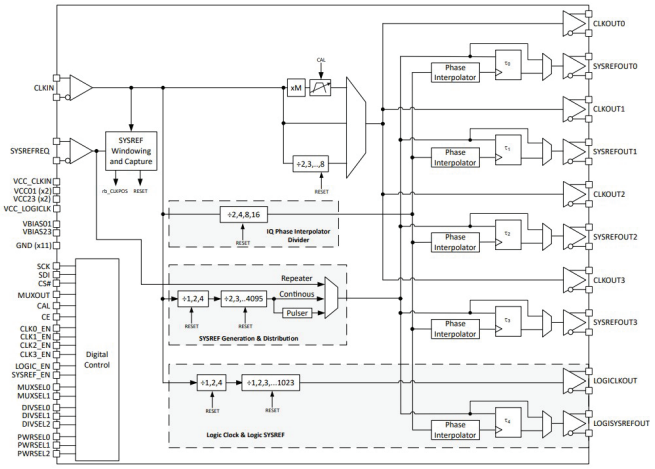
15GHz buffer, multiplier and divider with SYSREF and FPGA clock
LMX1906-SP/LMX1860-SEP

Key features
- Up to 15GHz output frequency
  - SYSREF and SYNC features work with up to 12.8GHz input
- Noise Floor of -158dBc/Hz for a 6GHz output
- 4 high frequency clock outputs
  - Can be used as a buffer, divider (divide by 2, 3, 4, 5, 6, 7 or 8) or multiplier (x2, x3, x4)
- 1 LOGICLK Output for FPGA clocking
  - Includes divider values of 1, 2, 3, ... up to 1023
- SYSREF paired with each clock output
  - Individual delay adjustment
  - Supports both master and repeater mode
- SYSREF Windowing optimizes setup and hold times of SYSREFREQ

Radiation performance
- Rad-hard (RHA) LMX1906-SP:
  - TID = 100krad(Si) RHA
  - SEL/SEU immune to LET = 87MeV-cm^2/mg (125°C)
- Rad-tolerant LMX1860-SEP:
  - TID characterization to 30krad(Si)
  - SEL/SEU immune to LET = 43MeV-cm^2/mg (125°C)

Applications
- Radar imaging payload
- Communications payloads
- Command and data handling
- Data converter clocking
- Clock distribution/ multiplication/division

Benefits
- High integration reduces components & improves skew variation
- Low noise floor minimizes clock degradation of data converter SNR
- Pin modes for easy device configuration without SPI – power, divider, mux selection and output EN



More information at **www.ti.com/product/LMX1906-SP**and at **www.ti.com/product/LMX1860-SEP**

Space-grade microcontrollers
Featured product

16MHz ultra-low-power microcontroller with ferroelectric RAM and 40 inputs/outputs
MSP430FR5969-SP

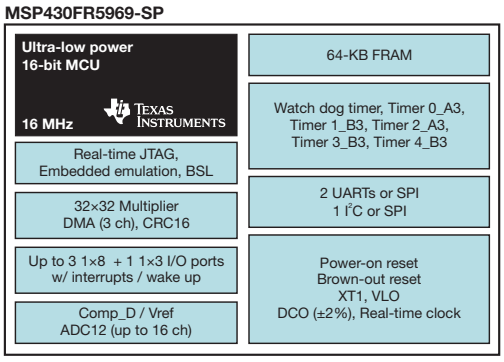
Key features
- Extremely low power consumption 16-bit RISC architecture:
  - 100µA/MHz active
  - 0.02µA shutdown, 0.4µA standby
- 64KB of non-volatile, ferroelectric RAM (FRAM)
- Integrated peripherals for system housekeeping, telemetry
  - Real-time clock (RTC)
  - Five 16-bit timers
  - 16-channel analog comparator
  - 12-bit analog-to-digital converter (ADC) with 16 inputs, internal reference and sample-and-hold
  - Serial interfaces supporting UART, SPI, I^2C
  - Multi-function I/O ports
- Support for 32kHz crystals or internal clock sources
- 48-pin VQFN and TQFP plastic packages for reduced size/weight

Radiation performance
- TID = 75krad(Si), 50krad(Si) RHA
- SEL immune to LET = 72MeV-cm^2/mg

More information at **www.ti.com/product/MSP430FR5969-SP**

Applications
- Spacecraft distributed telemetry and housekeeping
- Sensor management and data logging
- Satellite remote terminal units

Benefits
- Reduced SWaP needed for system housekeeping functions
- Housekeeping/telemetry can be offloaded from FPGA
- Reusable RTU architecture across subsystems



Radiation Tolerant, Hercules™ ARM® Cortex®-R5F MCU
TMS570LC4357-SEP

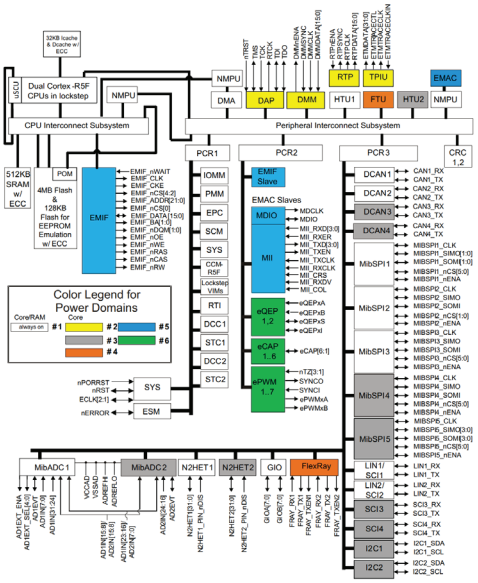
Key features
- Space enhanced plastic
  - Controlled baseline, one fabrication site, one assembly/test site
  - Gold Au wire
  - Available in extended (–55°C to 125°C) temperature range
  - Extended product life cycle & extended product-change notification
  - Product traceability
  - Enhanced mold compound for low outgassing
- High-performance microcontroller with advanced fault detection, safety-critical applications
  - Lockstep Arm® Cortex-R5F CPUs at 300MHz with ECC-protected caches, ECC on Flash and RAM interfaces
  - Built-in self-test (BIST) for CPU, high-end, timers, and on-chip RAMs
  - Error Signaling Module (ESM) with error pin
  - Voltage and clock monitoring, 3 temperature sensors on die
  - 4MB on-chip flash
- Advanced integration & networking
  - 10/100 ENET, CAN, SPI, I^2C, UART interfaces
  - 2x high-end timers (N2HET), 2x A12-bit ADCs, enhanced timing peripherals
  - Up to 145 GPIOs

Radiation performance
- TID characterization (ELDRS free) to 30krad(Si)
- SEL immune to 43MeV-cm^2/mg at 125°C

More information at **www.ti.com/product/TMS570LC4357-SEP**

Applications
- Spacecraft distributed processing
- Sensing & control

Benefits
- Radiation Lot Acceptance Testing (RLAT) to 20krad(Si)
- Vendor Item Drawing (VID) TBD
- Lockstep ARM Cortex-R based MCU – with up to 500 peak DMIPS and 128KB to 4MB flash memory
- Flexible communication and control – Ethernet, Flexray, CAN. Up to 84 timer and 41 12-bit ADC channels



Space-grade sensor products
Featured products

Very wide common voltage current-sense amplifier with split stage for filtering
INA901-SP

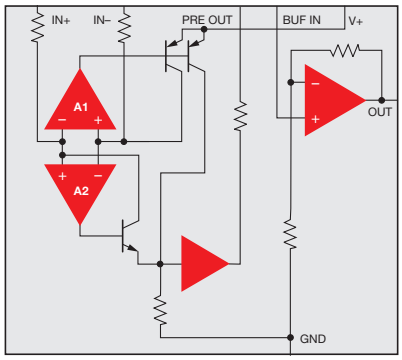
Key features
- –15V to 65V common-mode range independent of supply
- 2.7V to 16V supply
- Split stages for filtering
- Bandwidth up to 130kHz
- Gain: 20V/V
- Package: Ceramic 8-lead HKX 6.5mm × 6.5mm

Radiation performance
- TID = 50krad(Si) RHA
- SEL immune to LET = 75MeV-cm^2/mg

Applications
- Current monitor for current-mode control DC/DC converter
- Current measurement in an H-Bridge for motor control
- Latching current limiters on high common-mode bus
- Current sensing on GaN modules for increased efficiency

More information at **www.ti.com/product/INA901-SP**

Benefits
- Eliminates need for additional protective components in the event of CMR reversals
- Preserves buffered voltage output and saves using an additional op amp
- Simplifies design of current control loops
- Enables a flexible circuit design
- Orderable as SMD: 5962L1821001VXC



Very wide common voltage, 1.1MHz bandwidth, ultra-precise unidirectional current-sense amplifier
INA950-SEP

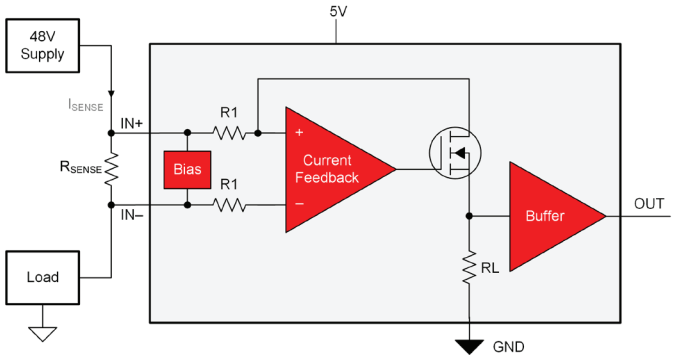
Key features
- 2.7V to 80V common-mode range independent of supply
  - -20V to 80V survivability
- 2.7V to 5.5V supply
- High current monitoring accuracy
- Bandwidth up to 1.1MHz with 2V/µA Slew Rate
- Gain: 20V/V
- Package: 8-lead TSSOP 6.4mm x 3.0mm

Radiation performance
- TID = 30krad(Si) RHA
- SEL immune to LET = 43MeV-cm^2/mg

Applications
- Current monitor for power supplies
- High-Side overcurrent/fault Detection
- Latching current limiters on high common-mode bus
- High-Side solenoid control

More information at **www.ti.com/product/INA950-SEP**

Benefits
- Simplifies design and reduces component count when compared to discrete implementations
- Allows accurate current measurement over a wide common-mode range
- High bandwidth and slew rate supports faster signal throughput
  - Ripple current measurement
  - Faster current throughput for protection



Space-grade sensor products
Featured products

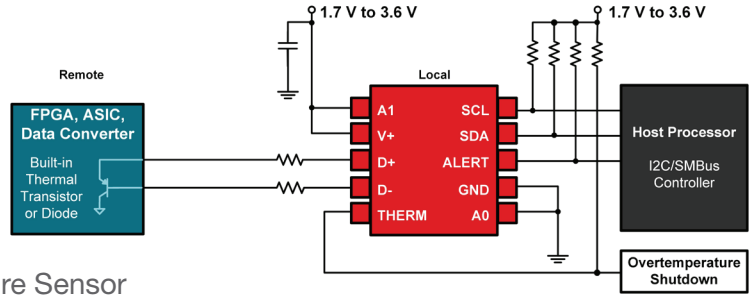
Remote and local digital temperature sensor with QMLV, QMLP, and radiation tolerant variants
TMP461-SP, TMP9R01-SP, TMP9R01-SEP

Key features
- Enables measurement of remote diode temperatures in the range of -64°C to 191°C
- Programmable calibration registers
- Remote diode temperature sensor accuracy: ±1.5°C
- Local temperature sensor accuracy: ±2°C
- Accuracy post calibration : ±0.1°C
- Supply and logic voltage range: 1.7V to 3.6V
- 35-µA operating current (1 SPS), 3-µA shutdown current

Radiation performance
- TMP461-SP (QMLV) and TMP9R01-SP (QMLP)
  - TID = 100krad(Si) RHA
  - SEL Immune to LET = 75MeV-cm^2/mg
- TMP9R01-SEP (Radiation Tolerant)
  - TID Characterization = 50krad(Si)
  - TID RLAT/RHA = 30krad(Si)
  - SEL Immune to LET = 43MeV-cm^2/mg

Benefits
- RHA and radiation tolerant versions available
- Available in ceramic package with thermal pad, as well as a small VSSOP with 3mm x 3mm body size.
- Supports measurements of integrated thermal diode in FPGAs and ASICs, as well as discrete diodes for accurate temperature monitoring.

Variants
- **TMP461-SP** – QMLV-RHA, 100krad(Si), 76MeV
- **TMP9R01-SP** – QMLP-RHA, 100krad(Si), 76MeV
- **TMP9R01-SEP** – Rad Tolerant, 50krad(Si), 43MeV



For more information see TI Space-Grade Temperature Sensor Selection Guide at **www.ti.com/lit/SBOA607**

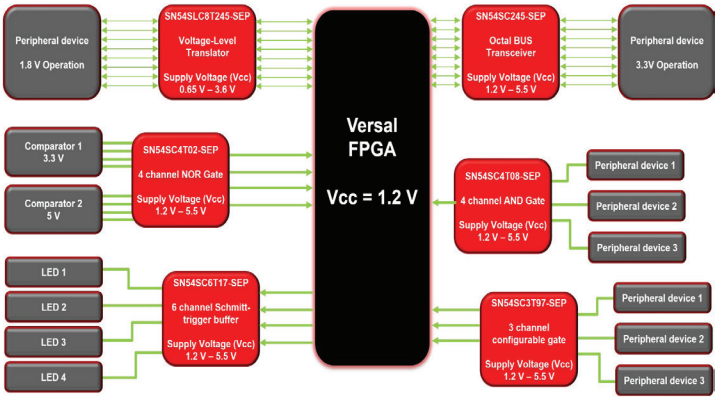
Space-grade logic products
Featured products

Space CMOS Logic Family
SN54SCxT-SEP

Key features and benefits
- Wide supply voltage range of 1.2V to 5.5V, enabling compatibility with modern FPGAs
- SCxT enhanced input voltage enables single-supply voltage translation
- Supports ±24mA continuous output drive at 5V
- Fast operation with typical propagation delays (tpd) near 10ns
- SEU/SET Immune Latches (43MeV LETEFF)
- Built-in triple redundancy feature for Latches, Flip-Flops, and Shift Registers
- Configurable multi-function gates enable design flexibility (SC3T97 & SC3T98)

Applications
- Power sequencing
- Fault control and detection
- Driving signals across long board traces and transmission lines
- Single or dual supply level translation
- System reset and redundancy
- GPIO Expansion

Radiation performance
- TID = 30-50krad(Si)
- SEL immune to LET = 43MeV-cm^2/mg



29 Logic Functions across 7 product categories
- Logic Gates
- Configurable Gates
- Buffers and Inverters
- Transceivers
- Flip-Flops, Latches, and shift Registers
- Voltage Translators
- Digital Multiplexers and Demultiplexers

More information at **www.ti.com/product/SN54SCxT-SEP**

Space-grade motor drive products
Featured products

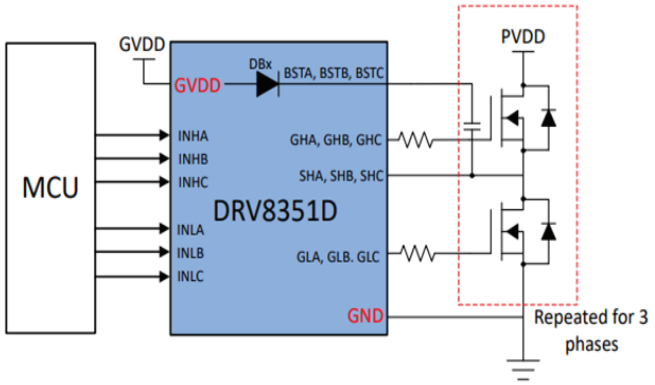
40V, 3-Phase BLDC Gate Driver with Integrated Bootstrap Diode
DRV8351-SEP

Key features
- Triple ½ H-Bridge Driver with Bootstrap gate drive architecture
- PVDD Voltage Range: 40V Three Phase Half-Bridge Gate driver (BSTx Abs Max: 57.5V)
- GVDD Voltage Range: 5V to 15V
- Sources/ Sink Current: 0.75A / 1.5A
- Extended Temperature: -55 to 150 °C
- Low leakage current on SHx pins (<55 µA)
- Integrated Protections:
  - BST Undervoltage Lockout
  - GVDD undervoltage

Radiation performance
- TID = 30krad(Si) RHA
- SEL immune to LET = 43MeV-cm^2/mg

Applications
- Thruster Gimbal mechanism
- Antenna Pointing mechanism
- Reaction Wheel
- Propellant Control Valve

Benefits
- Wide motor voltage to support up to 40V to accommodate platform designs and various battery and regulated power supply rails
- Reduced system cost and size through integration of 3 half-bridges and bootstrap diodes
- Three half bridge can be independently controlled to support different motor and actuators



More information at **www.ti.com/product/DRV8351-SEP**

Space-grade amplifiers and comparators

Comparators

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Ch #	V_S Min (V)	V_S Max (V)	Propagation Delay Time (µs)	VICR (Max) (V)	VICR (Min) (V)	V_{OS} Max at 25°C (Max) (mV)	Input Bias Current (±) (Max) (nA)	Rail-to-Rail	I_q per Ch (Typ) (mA)	Package Group	ECCN[2]
LM139AQML-SP	5962-96738	QMLV-RHA	100	100	Bipolar	4	2.0	36	0.7	34	0	2	100	Out	0.2	CDIP, CFP, Die	EAR99
LM193QML-SP	5962-94526	QMLV-RHA	100	100	Bipolar	2	2.0	36	0.7	34.5	0	5	100	Out	0.2	CDIP, TO-99, Die	EAR99
LM111QML-SP	5962-00524	QMLV-RHA	100	50, 100	Bipolar	1	5.0	36	0.2	34	0.5	3	100	No	5.1	CDIP, CFP, TO-99, Die	EAR99
LM119QML-SP	5962-96798	QMLV-RHA	100	100	Bipolar	2	5.0	36	0.025	33	3	4	500	Out	4	CDIP, CFP, TO-100, Die	EAR99
LM139-SP	5962-96738	QMLV	40	–	Bipolar	4	2.0	36	1.3	34.5	0	2	25	Out	0.2	CDIP, Die	EAR99
LM139-SP	5962-77008	QMLV	–	–	Bipolar	4	2.0	36	1.3	34.5	0	2	25	Out	0.2	CDIP	EAR99

General-Purpose Op Amps

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Ch #	V_S Min (V)	V_S Max (V)	GBW (MHz)	Slew Rate (typ) (V/µs)	V_{OS} Max at 25°C (mV)	Drift Typ (µV/C)	Rail-to-Rail	V_n (nV/√Hz)	I_{sc} Typ (mA)	I_{Bias} (Typ) (nA)	Available Packages	ECCN[2]
LM124AQML-SP	5962-99504	QMLV-RHA	100	100	Bipolar	4	3	3	1.0	1	2	7	In to V–	40	60	45	CDIP, CFP, Die	EAR99
LM158QML-SP	5962-87710	QMLV-RHA	100	100	Bipolar	2	3	32	0.7	0.5	2	7	In to V–	40	30	45	CDIP, CFP, TO-99, Die	EAR99
LF411QML-SP	5962-11222	QMLV-RHA	100	100	Bipolar	1	10	44	3.0	15	2	10	No	18	25	0.05	CFP	EAR99
LM101AQML-SP	5962-99515	QMLV-RHA	50	50	Bipolar	1	10	44	1.0	0.3	2	3	In to V+	15	25	30	CDIP, TO-99, Die	EAR99
LM124-SP	5962-99504	QMLV	50	–	Bipolar	4	3	32	1.2	0.5	3	7	In to V–	35	40	30	CDIP, Die	EAR99
LM124-SP	5962-77043	QMLV	–	–	Bipolar	4	3	32	1.2	0.5	5	7	In to V–	35	40	20	CDIP	EAR99
LM148JAN-SP	M38510/110	JANS	–	–	Bipolar	4	10	44	1.0	0.5	5	15	No	60	25	30	CDIP	EAR99
OPA4H199-SP	5962-23214	QMLP	100	100	75	4	2.7	40	4.5	21	0.895	0.3	In, Out	10.8	75	0.01	SOT-23-14	EAR99

Precision Op Amps (V_{OS} < 1mV)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Ch #	V_S Min (V)	V_S Max (V)	GBW (Typ) (MHz)	Slew Rate (Typ) (V/µs)	V_{OS} Max at 25°C (mV)	Drift Typ (µV/C)	Rail-to-Rail	I_q Typ (mA)	V_n (nV/√Hz) 1kHz	I_{Bias} (Typ) (pA)	Available Packages	ECCN[2]
LMP7704-SP	5962-19206	QMLV-RHA	100	100	85	4	2.7	12	2.5	1.5	0.200	1	In, Out	0.73	9	0.2	CFP	EAR99
LMP2012QML-SP	5962-06206	QMLV-RHA	50	50	77.5	2	2.7	5	3	4.0	0.036	0.015	In to V–, Out	0.93	35	3	CDIP, CFP, Die	EAR99
OPA4277-SP	5962-16209	QMLV-RHA	50	50	85	4	4	36	1	0.8	0.065	0.1	No	0.79	8	500	CFP, CDIP-SB, Die	EAR99
TLC2201-SP	5962-90882	QMLV	–	–	–	1	4.6	16	1.8	2.5	0.200	0.50	In to V–, Out	1.1	8	1	LCCC	EAR99

Difference Amplifiers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	V_S Min (V)	V_S Max (V)	Max I_q (µA)	BW (kHz)	Slew Rate (V/µs)	Gain Error (max)	Vcm (V)	Available Packages	ECCN[2]
INA1H94-SP	5962-21212	QMLV-RHA	100	–	75	4	18V	900	500	5	±0.047 %FSR	±150	CFP	EAR99

[1]All device operating temperatures are –55 to +125°C.
*[2]ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email: **gtc_eccn-hts-naftateam@list.ti.com**.*

Space-grade amplifiers and comparators (cont'd)

High-Speed Op Amps (≥50MHz)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Ch #	V_S Min (V)	V_S Max (V)	GBW (MHz)	Slew Rate (Typ) (V/µs)	V_n (nV/√Hz)	V_{OS} Max at 25°C (mV)	Drift Typ (µV/C)	Rail-to-Rail	I_q typ (mA) per Ch	I_{SC} Typ (mA)	I_{Bias} (Typ) (nA)	I_{Bias} (max) (nA)	Available Packages	ECCN[2]
LM6172QML-SP	5962-95604	QMLV-RHA	300	100, 300	Bipolar	2	5.5	36	100	3000	12	1.5	6	No	2.3	85	1200	2500	CDIP, CFP, Die	EAR99
LM7171QML-SP	5962-95536	QMLV-RHA	300	300	Bipolar	1	5.5	36	200	4100	14	1	35	No	6.5	100	2700	10000	CDIP, CFP	EAR99
LMH6628QML-SP	5962-02545	QMLV-RHA	300	300	Bipolar	2	5	12	300	550	2	2		No	9.0	85	7000	10000	CDIP, CFP	EAR99
LMH6702QML-SP	5962-02546	QMLV-RHA	300	300	Bipolar	1	10	12	1700	3100	4.5	4.5	7	No	12.5	80	6000	15000	CDIP, CFP	EAR99
LMH6715QML-SP	5962-02547	QMLV-RHA	300	300	Bipolar	2	8	12	480	1300	3.4	6	30	No	5.8	70	5000	12000	CDIP	EAR99
THS4304-SP	5962-07219	QMLV	150	–	Bipolar	1	2.7	5	3000	790	8.5	4	5	No	18	100	—	12000	CFP	EAR99

Fully Differential Amplifiers (FDAs)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	V_S Min (V)	V_S Max (V)	GBW (MHz)	BW at A_{CL} (MHz)	Min. A_{CL} (MHz)	Slew Rate (Typ) (V/µs)	$V_{n\ at\ Flatband}$ (nV/√Hz)	CMRR (Typ) (dB)	Rail-to-Rail	V_{OS} Max at 25°C (mV)	I_{Bias} (Max) (µA)	I_q Typ (mA) per Ch	Available Packages	ECCN[2]
LMH5401-SP	5962-17214	QMLV-RHA	100	100	85	3.15	5.25	6500	4100	5	17500	1.25	72	No	5	60	60	LCCC	EAR99
LMH5485-SP	5962-19204	QMLV-RHA	100	100	75	2.7	5.2	850	620	1	1500	2.2	100	In to V–, Out	0.45	14.5	10.1	CFP	EAR99
THS4511-SP	5962-07222	QMLV	150	–	62	3.75	5.25	3000	1100	2	5100	2	80	In to V–	4	15.5	39.2	CFP	EAR99
THS4513-SP	5962-07223	QMLV	150	–	–	3	5.5	3000	1100	2	5100	2.2	90	No	4	15.5	37.7	CFP	EAR99

RF Fully Differential Amplifiers (FDAs)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Min Freq (GHz)	Max Freq (GHz)	Supply Voltage (V)	P1dB (dBm)	Gain (dB)	OIP3 (dBm)	NF (dB)	Available Packages	ECCN[2]
TRF0108-SP	TBD	QMLP-RHA	100	100	75	0.01	11	5	12	15.5	28	11	WQFN	EAR99
TRF0206-SP	5962-21220	QMLV-RHA	100	100	75	0.01	6.5	3.3	12	12.5	38	8	LCCC	EAR99
TRF0208-SP	5962-24202	QMLP-RHA	100	100	75	0.01	11	3.3	14.5	16	36	6.8	WQFN	EAR99
LMH5401-SP	5962-17214	QMLV-RHA	100	100	85	0	2	5	12	12	37.5	12.5	LCCC	EAR99

Sample-and-Hold Amplifiers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	V_S Min (V)	V_S Max (V)	Acquisition Time (µs)	PSRR (dB)	V_{OS} Max at 25°C (mV)	Droop Rate (V/ms)	I_q Typ (mA)	Available Packages	ECCN[2]
LF198QML-SP	5962-87608	QMLV	–	–	Bipolar	10	36	6	80	3.5	0.001	5.5	CFP	EAR99
LF198JAN-SP	M38510/125	JANS	–	–	Bipolar	10	36	6	80	3	0.001	5.5	TO-99	EAR99

Space-grade data converters

RF-Sampling Transceivers

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/RHA	SEL (MeV•cm²/mg)	Resolution	Number of DAC Channels	Number of ADC Channels	# of DUCs per TX	# of DDCs per RX	Package Group	ECCN[2]
AFE7950-SP	–	SHP-RHA	100	100	70	14 bits	4	6	2	2	FCBGA	–

[1] *All device operating temperatures are –55 to +125°C.*
[2] *ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email:* ***gtc_eccn-hts-naftateam@list.ti.com****.*

Space-grade data converters (cont'd)

Precision ADCs (< = 10MSPS)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Res. (Bits)	Sample Rate (Max) (kSPS)	# of Ch	Multi-Ch Config.	SNR (dB)	INL (Max) (± LSB)	Input Type	Ref. Voltage (V)	Power (Typ) (mW)	Type	Package Group	ECCN[2]
ADC128S102QML-SP	5962-07227	QMLV-RHA	100	100	120	12	1000	8	Multiplexed	72	1.1	Single ended	Supply	2.3	SAR	CFP, Die	EAR99†
ADS1278-SP	–	TI Space Grade	75	50	68	24	128	8	Simultaneous	111	201.4	Differential	External	530	ΔΣ	CQFP	EAR99‡
ADS1282-SP	5962-14231	QMLV-RHA	50	50	60	31	4	2	Multiplexed	130	–	Differential	External	25	ΔΣ	CFP	EAR99‡

*†EAR99 only pertains to the Engineering Model device, ADC128S102WGMPR. For up-to-date ECCN information contact: **gtc_eccn-hts-naftateam@list.ti.com***

‡EAR99 only pertains to certain device variants, including Engineering Models (ADS1278HFQ/EM and ADS1282HKV/EM), and some Flight Models (ADS1278WHFQ-MLS and 5962L1423102VXC).

Precision DACs (≤10MSPS)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Res. (Bits)	Sample/ Update Rate (MSPS)	Settling Time (Typ) (µs)	DNL (Typ) (±LSB)	INL (Typ) (±LSB)	Zero Code Error (mV)	Supply Voltage (V)	Power (Typ) (mW)	Architecture	Package Group	ECCN[2]
DAC121S101QML-SP	5962-07226	QMLV-RHA	100	100	120	12	1.8	12.5	–0.15/+0.25	2.75	2.12	2.7 to 5.5	0.57	String	CFP, Die	EAR99†

*†EAR99 only pertains to the Engineering Model device, DAC121S101WGMPR. For up-to-date ECCN information contact: **gtc_eccn-hts-naftateam@list.ti.com***

High-Speed ADCs (>1GSPS)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Sample Rate (Max) (MSPS)	Res. (Bits)	# of Ch	Analog Input BW (–3 dB) (GHz)	SNR (dB)	ENOB (Bits)	SFDR (dB)	Input Range (V_{p-p})	Input Buffer	Power (Typ) (mW)	Architecture	Package Group
ADC12DJ5200-SP	–	SHP-RHA	300	300	120	10400, 5200	12	1, 2	8	55.6	8.8	65	0.80	Yes	4000	Folding-Interpolating	FCBGA
ADC12QJ1600-SP	–	SHP-RHA	300	300	120	1600	12	4	6	57	9.1	64	0.80	Yes	1900	Folding-Interpolating	FCBGA
ADC12DJ3200QML-SP	5962-18209	QMLV-RHA	300	300	120	3200, 6400	12	1, 2	7.3	57.2	8.9	76.0	0.80	Yes	3000	Folding Interpolating	CCGA, CLGA
ADC12D1620QML-SP	5962-12205	QMLV-RHA	300	300	120	1600, 3200	12	1, 2	2.4	59.8	9.5	67.4	0.80	Yes	3880	Folding Interpolating	CCGA, CLGA
ADC12D1600QML-SP	–	TI Space Grade RHA	300	300	120	1600, 3200	12	1, 2	2.4	58.2	9.3	67.3	0.80	Yes	3880	Folding Interpolating	CCGA
ADC08D1520QML-SP	5962-07214	QMLV-RHA	300	300	120	1500, 3000	8	1, 2	2.0	47.0	7.4	55.5	0.87	Yes	2000	Folding Interpolating	CQFP
ADC10D1000QML-SP	–	TI Space Grade RHA	100	100	120	1000, 2000	10	1, 2	2.8	56.8	9.0	67.6	0.80	Yes	2770	Folding Interpolating	CCGA

High-Speed ADCs (>10MSPS and <1GSPS)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Sample Rate (Max) (MSPS)	Res. (Bits)	# of Ch	Analog Input BW (MHz)	SNR (dB)	ENOB (Bits)	SFDR (dB)	Input Range (V_{p-p})	Input Buffer	Power (Typ) (mW)	Type	Pkg. Group	ECCN[2]
ADS5400-SP	5962-09240	QMLV	50	–	–	1000	12	1	2150	58.5	9.55	77.9	2.0	Yes	2200	Pipeline	CQFP	–
ADS5463-SP	5962-07208	QMLV-RHA	100	100	86	500	12	1	2000	65.4	10.1	65.0	2.2	Yes	2250	Pipeline	CQFP	–
ADS5474-SP	5962-13208	QMLV-RHA	200	100	87	400	14	1	1440	70.5	10.9	78.0	2.2	Yes	2500	Pipeline	CQFP	–
ADS5444-SP	5962-07207	QMLV	–	–	86	250	13	1	500	69.1	11.3	84.0	2.2	Yes	2250	Pipeline	CQFP	–
ADC14155QML-SP	5962-06262	QMLV-RHA	100	100	121	155	14	1	1100	70.1	11.3	82.3	2.0	No	967	Pipeline	CQFP	EAR99†
ADS5424-SP	5962-07206	QMLV	150	–	–	105	14	1	570	72.4	11.7	82.6	2.2	No	1900	Pipeline	CQFP	–
ADC3683-SP	5962-23204	QMLV-RHA	300	300	75	65	18	2	400	83.8	13.7	89	3.2	No	186	Serial LVDS	CQFP	–
ADC3664-SP	5962-23205	QMLV-RHA	300	300	75	125	14	2	700	77.5	12.6	84	3.2	No	200	Serial LVDS	CQFP	–

†EAR99 only pertains to the engineering model device, ADC14155W-MPR.

[1]All device operating temperatures are –55 to +125°C.

*[2]ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email: **gtc_eccn-hts-naftateam@list.ti.com**.*

Space-grade data converters (cont'd)

High-Speed DACs (>10MSPS)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Res. (Bits)	# of Ch	Update Rate (Max) (MSPS)	Settling Time (Typ) (ns)	SNR (dB)	SFDR (dBc)	THD (dBc)	Interpolation	Power (Typ) (mW)	Architecture	Interface	Pkg. Group	ECCN[2]
DAC5670-SP	5962-07247	QMLV	100	–	–	14	1	2400	3.5	52	55	52	1×, 2×	2000	Current Sink	Parallel LVDS	CBGA	–
DAC5675A-SP	5962-07204	QMLV	100	–	109	14	1	400	12	67	82	70	None	660	Current Sink	Parallel LVDS	CQFP	EAR99†
DAC39RF10-SP	–	SHP-RHA	300	300	120	16	2	20800	36	–	85	–	128x, 12x, 16x, 192x, 1x, 24x, 256x, 2x, 32x, 3x, 48x, 4x, 64x, 6x, 8x, 96x	3800	Current Source	JESD204B, JESD204C	FCBGA	–
DAC39RFS10-SP	–	SHP-RHA	300	300	120	16	1	20800	36	–	85	–	128x, 12x, 16x, 192x, 1x, 24x, 256x, 2x, 32x, 3x, 48x, 4x, 64x, 6x, 8x, 96x	2800	Current Source	JESD204B, JESD204C	FCBGA	–

†EAR99 only pertains to certain device variants, including the Engineering Model (DAC5675AHFG/EM) and one Flight Model variant (5962-0720402VXC).
*For up-to-date ECCN information please email: **gtc_eccn-hts-naftateam@list.ti.com***

Analog Front Ends: CCD/CIS Imaging

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	# of Ch	Resolution (Bit)	Sampling Rate (MSPS)	PGA Range (dB)	Fine Offset DAC Range (mV)	Power per Channel (mW/Ch)	Package	ECCN[2]
LM98640QML-SP	5962-18203	QMLV-RHA	100	100	120	2	14	5 to 40	-3 to 18	±5	122	CQFP	EAR99

Space-grade clocks and timing

RF PLLs and Synthesizer

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Normalized PLL Phase Noise (dBc/Hz)	1/f Noise (10-kHz Offset at 1-GHz Carrier) (dBc/Hz)	Output Frequency (Min) (MHz)	Output Frequency (Max) (MHz)	Supply Voltage (V)	Features	Package Body Size – W × L (mm²)	Package Group	ECCN[2]
LMX2615-SP	5962-17236	QMLV	100	100	120	–236	–129	40	15200	3.2 to 3.45	JESD204B	10.90 × 10.90	CQFP	EAR99
LMX1906-SP	5962-23202	QMLV-RHA QMLP-RHA	100	100	87	–159	–161	300	15000	2.4 to 2.6	JESD204B/C	10.00 × 10.00	HTQFP	EAR99
LMX2624-SP	5962-23210	QMLP-RHA	100	100	75	–236	–129	5	28000	3.3	JESD204B/C	10.00 × 10.00	QFP	EAR99

Clock Jitter Cleaners

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	# of In	# of Out	RMS Jitter (fs)	Output Freq. (Min) (MHz)	Output Freq. (Max) (MHz)	Supply Voltage (V)	Input Type	Output Type	Package Group	ECCN[2]
CDCM7005-SP	5962-07230	QMLV	100	–	60	2	5	–	0	1500	3.0 to 3.6	LVCMOS (REF_CLK), LVPECL (VCXO_CLK)	LVCMOS, LVPECL	CQFP	EAR99
LMK04832-SP	5962-17237	QMLV-RHA	100	100	120	3	15	54	0.305	3255	3.135 to 3.465	LVCMOS, LVDS, LVPECL	CML, LVPECL, LCPECL, HSDS, LVDS, LVCMOS	CQFP	EAR99

Clock Buffers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Additive RMS Jitter (Typ) (fs)	Output Freq. (Max) (MHz)	Number of Outputs	Output Skew (ps) (MHz)	Supply Voltage (V)	Input Type	Output Type	Package Body Size – W × L (mm²)	Package Group	ECCN[2]
CDCLVP111-SP	5962-16207	QMLV	75	–	69	40	3500	10	50	2.375 to 3.8	CML, LVDS, LVPECL, SSTL	LVPECL	9.078 × 9.078	CQFP	EAR99

Timers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	V_{CC} Range (V)	Output Level	Package	ECCN[2]
SE555-SP	5962-98555	QMLV	25	–	Bipolar	4.5 to 16.5	TTL	CDIP	EAR99

[1]All device operating temperatures are –55 to +125°C.
*[2]ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email: **gtc_eccn-hts-naftateam@list.ti.com**.*

Space-grade interface

LVDS

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Device Function	# of TX	# of RX	Supply Voltage (V)	Speed (Mbps)	Common-Mode Range (V)	Offset Voltage (V)	ESD (HBM) [kV]	Protocols	Package Group	ECCN[2]
DS90C031QML-SP	5962-95833	QMLV-RHA	100	100	120	Driver	4	–	5.0	155.5	–	1.2	3.5	LVDS	CFP, Die	–
DS90LV031AQML-SP	–	TI Space Grade	–	–	–	Driver	4	–	3.3	400	–	1.2	6	LVDS	CFP	EAR99
SN55LVDS31-SP	5962-97621	QMLV	150	–	110	Driver	4	–	3.3	400	–	1.2	8	LVDS	CFP	EAR99
SN55LVDS32-SP	5962-97622	QMLV	100	–	110	Receiver	–	4	3.3	100	0.2 to 2.2	–	8	LVDS	CFP	EAR99
SN55LVDS33-SP	5962-07248	QMLV	100	–	90	Receiver	–	4	3.3	400	–4.0 to 5.0	–	15	LVDS	CFP	EAR99
DS90C032QML-SP	5962-95834	QMLV-RHA	50	50	120	Receiver	–	4	5.0	155.5	0.2 to 2.2	–	2	LVDS	CFP, Die	EAR99
DS90LV032AQML-SP	–	TI Space Grade	–	–	–	Receiver	–	4	3.3	400	0.2 to 2.2	–	4.5	LVDS	CFP	EAR99
SN55LVCP22-SP	5962-11242	QMLV	100	–	–	Crosspoint	2	2	3.3	1000	0.05 to 3.95	1.2	5	LVDS, LVPECL, CML	CFP	–
SN55LVCP22A-SP	5962-11242	QMLV-RHA	100	100	75	Crosspoint	2	2	3.3	1000	0.05 to 3.95	1.2	5	LVDS, LVPECL, CML	CFP	EAR99

RS-485 and RS-422

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Device Type	No. of TX	No. of RX	Duplex	Supply Voltage (Nom) (V)	Signaling Rate (Max) (Mbps)	Fault Protection (V)	# of nodes	Common mode range	I_{CC} (Max) (mA)	Package Group	ECCN[2]
DS16F95QML-SP	5962-89615	QMLV-RHA	300	300	Bipolar	Transceiver	1	1	Half	5.0	10	–12 to 12	32	–7 to 12	0.5	CFP, Die	EAR99
DS26F31MQML-SP	5962-78023	QMLV-RHA	300	300	Bipolar	Driver	4	–	Half	5.0	10	–	10	–6 to 6	40	CFP	EAR99
DS96F174MQML-SP	5962-90765	QMLV	–	–	Bipolar	Driver	4	–	Half	5.0	10	–	32	–7 to 12	50	CDIP	EAR99
DS26F32MQML-SP	5962-78020	QMLV-RHA	100	100	Bipolar	Receiver	–	4	Half	5.0	10	–	10	–6 to 6	50	CFP, CDIP	EAR99
DS96F175MQML-SP	5962-90766	QMLV	–	–	Bipolar	Receiver	–	4	Half	5.0	10	–	32	–7 to 12	75	CDIP	EAR99
AM26LS33A-SP	5962-78020	QMLV	25	–	Bipolar	Receiver	–	4	Half	5.0	10	–25 to 25	32	–15 to 15	70	CDIP	EAR99

CAN

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Signaling Rate (Max) (Mbps)	Supply Voltage (Nom) (V)	Common Mode Range	Fault Protection (V)	Features	Package Group	ECCN[2]
SN55HVD233-SP	5962-14209	QMLV-RHA	50	50	86	1	3.0 to 3.6	–7 to 12	–16 to 16	Diagnostic loopback	CFP	EAR99

Ethernet PHY

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Data Rate (Mbps)	Interface Type	Supply Voltage (V)	IO Supply Options (Typ) (V)	Features	Package Body Size–W × L (mm²)	Package Group	ECCN[2]
DP83561-SP	5962-20216	QMLV-RHA	300	300	121	10/100/1000	RGMII, MII	1.1 and 2.5	1.8, 2.5, 3.3	SEFI Monitoring Suite	10.90 × 10.90	CQFP	EAR99

Serializers, Deserializers (SerDes)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Signaling Rate (Gbps)	V_{CC} (V)	Power (mW)	Package Group	ECCN[2]
TLK2711-SP	5962-05221	QMLV	25	–	67.9	1.6 to 2.5	2.5	< 500	CQFP	EAR99

Line Drivers, Line Receivers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Device Type	No. of TX	No. of RX	Supply Voltage (Nom) (V)	Common Mode Range	I_{CC} (Max) (mA)	Input Signal	Output Signal	Package Group	ECCN[2]
SN55183-SP	5962-79009	QMLV	40	–	Bipolar	Driver	2	–	5.0	–	10	TTL	Differential	CDIP	EAR99
SN55182-SP	5962-79008	QMLV	40	–	Bipolar	Receiver	–	2	5.0	–15 to 15	9.4	Differential	TTL	DFP, CDIP	EAR99

[1]All device operating temperatures are –55 to +125°C.
*[2]ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email: **gtc_eccn-hts-naftateam@list.ti.com**.*

Space-grade sensing

Current-Sense Amplifiers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	V_S Min (V)	V_S Max (V)	Common-Mode Voltage (V)	Bandwidth (kHz)	Gain (V/V)	V_{OS} Max at 25°C (mV)	Gain Error (%)	I_q Typ (mA)	Available Packages	ECCN[2]
INA901-SP	5962-18210	QMLV-RHA	50	50	75	2.7	16	–15 to 65	130	20	2.5	1	0.9	CFP	EAR99

Digital Output Temperature Sensors

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	# of Remote Temp. Sensor	# of Local Temp. Sensor	Remote Sensor Accuracy (±°C)	Local Sensor Accuracy (±°C)	Remote Temp. Range (°C)	Local Temp. Range (°C)	Temp. Resolution (°C)	Interface	Available Package	ECCN[2]
TMP461-SP	5962-17218	QMLV-RHA	100	100	76	1	1	1.5	2.0	–64 to 191	–55 to 125	0.0625	I²C, SMBus, 2-Wire	CFP	EAR99
TMP9R01-SP	5962-17218	QMLP-RHA	100	100	75	1	1	1.5	2	-64 to 191	–55 to 125	0.0625	I²C, SMBus, 2-Wire	VSSOP	EAR99
TMP9R00-SP	5962-20214	QMLV-RHA	100	100	75	8	1	2	1.50	–55 to 150	–55 to 125	0.0625	I²C, SMBus, 2-Wire	CFP	EAR99

Space-grade motor control

Brushless-DC (BLDC) Drivers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Architecture	VS (Min) (V)	VS (Max) (V)	VS (ABS Max) (V)	Peak Output Current (A)	Gate Drive (A)	Control Interface	Package Body Size (W×L, mm)	Package Group	ECCN[2]
UC1625-SP	5962-91689	QMLV	40	–	Bipolar	Gate driver	10	18	20	0.5	0.2	1 × PWM	35.56 × 7.49	CDIP-SB	EAR99

Brushed-DC (BDC) and Stepper Drivers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	VS (Min) (V)	VS (Max) (V)	Peak Output Current (A)	Control Mode	Control Interface	Package Body Size (W×L, mm)	Package Group	ECCN[2]
UC1637-SP	5962-89957	QMLV	50	–	Bipolar	±2.5	±20	0.5	PWM	Hardware	6.92 × 13.09	CFP	EAR99

Space-grade power management

Buck Converters

Part Number[1]	Military Spec	Qualification Level	TID Char. Max. (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²/mg)	I_{out} (Max) (A)	V_{IN} (Min) (V)	V_{IN} (Max) (V)	V_{OUT} (Min) (V)	V_{OUT} (Max) (V)	Control Mode	f_S (Min) (kHz)	f_S (Max) (kHz)	Duty Cycle (Max) (%)	Minimum On-Time (Max) (ns)	Iq (Typ) (mA)	Package Group	ECCN[2]
TPS50601-SP	5962-10221	QMLV-RHA	100	100	85	6	3	6.3	0.795	6.35	Current mode	100	1000	95%	175	5	CFP, Die	EAR99
TPS50601A-SP	5962-10221	QMLV-RHA	100	100	75	6	3	7	0.804	6.70	Current mode	100	1000	100%	235	5	CFP, Die	EAR99
TPS7H4001-SP	5962-18205	QMLV-RHA QMLP-RHA	100	100	75	18	3	7	0.604	6.65	Current mode	100	1000	100%	235	4	CFP, Die, HTSSOP	EAR99
TPS7H4002-SP	5962-20210	QMLV-RHA	100	100	75	3	3	5.5	0.804	5.30	Current mode	100	1000	100%	235	2.5	CFP, Die	EAR99
TPS7H4011-SP	5962-21221	QMLV-RHA QMLP-RHA	100	100	75	12	4.5	14	0.6	13.2	Current mode	100	1000	100%	250	8	CFP, HTSSOP	EAR99
TPS7H4012-SP	5962-21221	QMLP-RHA	100	100	75	6	4.5	14	0.6	13.2	Current mode	100	1000	100%	250	6	HTSSOP	EAR99
TPS7H4013-SP	5962-21221	QMLP-RHA	100	100	75	3	4.5	14	0.6	13.2	Current mode	100	1000	100%	250	4	HTSSOP	EAR99
TPS7H4104-SP	5962-23208	QMLP-RHA	100	100	75	12	3	7	0.6	6.5	Current mode	100	1000	100%	250	15	HTSSOP	EAR99

Low-Dropout (LDO) Linear Regulators (Typical VDO ≤400mV)

Part Number[1]	Military Spec	Qualification Level	TID Char. Max. (krad)	TID RLAT (krad)	SEL (Max.) (MeV•cm²/mg)	I_{OUT} (Max) (A)	V_{IN} (Min) (V)	V_{IN} (Max) (V)	V_{OUT} (Min) (V)	V_{OUT} (Max) (V)	V_{DO} (Typ) (mV)	Acc. (%)	Noise (µVrms)	PSRR at 100 KHz (dB)	PSRR at 1MHz (dB)	PSRR at 10MHz (dB)	Output Options	Package Group	ECCN[2]
TPS7A4501-SP	5962-12224	QMLV-RHA	100	100	86	1.5	2.3	20	1.21	19.2	270	3	50	44	35	32	Adj.	CFP, Die	EAR99
TPS7H1101A-SP	5962-13202	QMLV-RHA	100	100	85	3	1.5	7	0.8	6.65	210	2	20	25	15	12	Adj.	CFP, Die	EAR99
TPS7H1111-SP	5962-21203	QMLV-RHA QMLP-RHA	100	100	75	1.5	0.85	7	0.4	5.5	200	1.5	1.68	71	67	30	Adj	HBL, HTSSOP	EAR99
TPS7H1121-SP	5962-23203	QMLV-RHA QMLP-RHA	100	100	75	2	2.25	14	0.6	13.9	250 at1A, 500 at 2A	1.5	50	40	34	33	Adj.	CFP, HTSSOP	EAR99

[1] *All device operating temperatures are –55 to +125°C.*

[2] *ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email:* ***gtc_eccn-hts-naftateam@list.ti.com***.

Space-grade power management (cont'd)

Standard Linear Regulators (Typical VDO >400mV)

Part Number[1]	Military Spec	Qualification Level	TID Char. Max. (krad)	TID RLAT (krad)	SEL (Max.) (MeV•cm²/mg)	I_{OUT} (Max) (A)	V_{IN} (Min) (V)	V_{IN} (Max) (V)	V_{OUT} (Min) (V)	V_{OUT} (Max) (V)	V_{DO} (Typ) (mV)	Acc. (%)	Noise (µVrms)	PSRR at 100 KHz (dB)	Output Options	Package Group	ECCN[2]
LM117QML-SP	5962-99517	QMLV-RHA	100	100	Bipolar	1.5	4.2	40	1.25	37	1200	4	120	40	Adj.	CFP, TO-3, TO-2, Die	EAR99
LM117HVQML-SP	5962-07229	QMLV-RHA	100	100	Bipolar	0.5	4.2	60	1.25	57	1500	2	1710	40	Adj.	CFP, TO-3, Die	EAR99
LM137QML-SP	5962-99517	QMLV-RHA	30	30	Bipolar	1.5	–40	–4.2	–37.0	–1.2	3000	4	1110	30	Adj.	TO-3	EAR99
LM137JAN-SP	M38510/118	JANS	–	–	Bipolar	1.5	–40	–4.2	–37.0	–1.2	3000	4	1110	30	Adj.	TO-2	EAR99
LM2940QML-SP	5962-89587	QMLV-RHA	100	100	Bipolar	1	6	26	5	5	500	5	350	50	5.0	CFP, Die	EAR99
LM2941QML-SP	5962-91667	QMLV-RHA	100	100	Bipolar	1	6	26	5	20	500	5	600	67	Adj.	CFP, Die	EAR99
LM723JAN-SP	M38510/102	JANS	–	–	Bipolar	0.15	9.5	40	2	37	3000	3	86	–	Adj.	CDIP, TO-100	EAR99
LP2953QML-SP	5962-92336	QMLV	–	–	Bipolar	0.25	2.3	30	1.2	29	470	3	80	32	Adj., 5.0	CFP, Die	EAR99

Linear Regulator (LDO) Controllers

Part Number[1]	Military Spec	Qualification Level	TID Char. Max. (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²/mg)	I_{drive} (Max) (mA)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	Package	ECCN[2]
UC1832-SP	5962-93265	QMLV	40	–	Bipolar	100	2	40	CDIP, LCCC	EAR99
UC1834-SP	5962-87742	QMLV	40	–	Bipolar	200	1.5	40	CDIP, LCCC	EAR99

DDR Memory Power

Part Number[1]	Military Spec	Qualification Level	TID Char. (Max) (krad)	TID RLAT (Max) (krad)	SEL (Max) (MeV•cm²/mg)	Regulator Type	I_{OUT} VTT (Max) (A)	V_{IN} (Min) (V)	V_{IN} (Max) (V)	V_{OUT} VTT (Min) (V)	DDR Memory Type(s)	V_{IN} Bias (Min) (V)	V_{IN} Bias (Max) (V)	Package Group	ECCN[2]
TPS7H3301-SP	5962-14228	QMLV-RHA	100	100	70	Linear	3.0	0.9	3.5	0.6	DDR2, DDR3, DDR4	2.375	3.5	CFP	EAR99
TPS7H3302-SP	5962-14228	QMLP-RHA	100	100	70	Linear	3.0	0.9	3.5	0.6	DDR2, DDR3, DDR4	2.375	3.5	HTSSOP	EAR99

eFuses and Load Switches

Part Number[1]	Military Spec	Qualification Level	TID Char. (Max) (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²mg)	V_{IN} Range (V)	Type	R_{ON} (Typ) (mΩ)	Continuous Current Load (Max) (A)	Programmable Current Limit Range (A)	Package	ECCN[2]
TPS7H2201-SP	5962-17220	QMLV-RHA QMLP-RHA	100	100	75	1.5 to 7.0	eFuse	35	6	0.5–7.0	CFP, HTSSOP	EAR99
TPS7H2211-SP	5962-18220	QMLV-RHA QMLP-RHA	100	100	75	4.5 to 14	eFuse	60	3.5	–	CFP, HTSSOP	EAR99

Shunt Voltage References

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	V_O (V)	Initial Accuracy (Max) (%)	Accuracy Over Temp. (%)	I_Z for Reg. (Min) (µA)	I_{out}/I_Z (Max) (mA)	Output Noise (µVrms)*	V_n (nV/√Hz) at 1kHz	Temp. Coeff. (Typ) at 25°C (ppm/°C)	Operating Temp. Range (°C)	Package Group	ECCN[2]
LM136A-2.5QML-SP	5962-00501	QMLV-RHA	100	100	Bipolar	2.5	1.0	–2.4/+1.6	400	10	–	120	26	–55 to 125	TO, Die	EAR99
LM185-1.2QML-SP	5962-87594	QMLV-RHA	100	100	Bipolar	1.2	1.0	+0.42/+5	10	20	28	400	–	–55 to 125	TO	EAR99
LM185-2.5QML-SP	5962-87594	QMLV	100	–	Bipolar	2.5	0.8	±3	20	20	42	800	–	–55 to 125	TO	EAR99
LM4050QML-SP (2.5V)	5962-09235	QMLV-RHA	100	100	Bipolar	2.5	0.1	±0.7	65	15	50	–	3	–55 to 125	CFP	EAR99
LM4050QML-SP (5.0V)	5962-09235	QMLV-RHA	100	100	Bipolar	5	0.1	±0.74	74	15	100	–	9	–55 to 125	CFP	EAR99
TL1431-SP	5962-99620	QMLV-RHA	150	100	86	2.5–36	0.4	±2	450	100	–	122	38	–55 to 125	CDIP, CFP	EAR99
TL1431-DIE	–	Tested die	100	–	Bipolar	2.5–36	0.4	–	450	100	–	122	–	25	Die	EAR99

** For frequencies 10Hz ≤ f ≤ 10KHz.*

[1] *All device operating temperatures are –55 to +125°C.*

[2] *ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email:* ***gtc_eccn-hts-naftateam@list.ti.com***.

Space-grade power management (cont'd)

PWM Controllers

Part Number[1]	Military Spec	Qualification Level	TID Char. Max (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²/mg)	V_{CC} (Min) (V)	V_{CC} (Max) (V)	Duty Cycle (Max) (%)	UVLO Thresholds On/Off(V)	Frequency (Max) (kHz)	Gate Drive (Typ) (A)	PWM Outputs (#)	Operating Temp. Range (°C)	Package	ECCN[2]
TPS7H5001-SP	5962-18222	QMLV-RHA QMLP-RHA	100	100	75	4	14	50, 75, 100	Adjustable	2000	0.15	2	–55 to 125	CFP,Die TSSOP	EAR99
TPS7H5002-SP	5962-18222	QMLV-RHA QMLP-RHA	100	100	75	4	14	75, 100	Adjustable	2000	0.15	1	–55 to 125	CFP, HTSSOP	EAR99
TPS7H5003-SP	5962-18222	QMLV-RHA QMLP-RHA	100	100	75	4	14	75, 100	Adjustable	2000	0.15	1	–55 to 125	CFP, HTSSOP	EAR99
TPS7H5004-SP	5962-18222	QMLV-RHA QMLP-RHA	100	100	75	4	14	50	Adjustable	2000	0.15	2	–55 to 125	CFP, HTSSOP	EAR99
TPS7H5020-SP	5962-24201	QMLP-RHA	100	100	75	4	14	100	Adjustable	1000	1.2	1	–55 to 125	HTSSOP	EAR99
TPS7H5021-SP	5962-24201	QMLP-RHA	100	100	75	4	14	50	Adjustable	1000	1.2	1	–55 to 125	HTSSOP	EAR99
UC1525B-SP	5962-89511	QMLV	40	–	Bipolar	8	35	50	7/6.8	400	0.5	2	–55 to 125	CDIP, LCCC	EAR99
UC1823A-SP	5962-89905	QMLV	–	–	Bipolar	12	20	100	9.2/8.4	1000	2	1	–55 to 125	CDIP	EAR99
UC1825-DIE	–	Tested die	30	–	Bipolar	12	20	50	9.2/8.4	1000	2	2	25	Die	EAR99
UC1825-SP	5962-87681	QMLV	40	–	Bipolar	12	20	50	9.2/8.4	1000	2	2	–55 to 125	CDIP, LCCC	EAR99
UC1825A-DIE	–	Tested die	30	–	Bipolar	10	30	50	9.2/8.4	1000	2	2	25	Die	EAR99
UC1825A-SP	5962-87681	QMLV-RHA	40	30	Bipolar	10	30	50	9.2/8.4	1000	2	2	–55 to 125	CFP, CDIP, LCCC	EAR99
UC1825B-SP	5962-87681	QMLV-RHA	100	100	Bipolar	10	30	50	10.0/9.2	1000	2	2	–55 to 125	CFP, Die	EAR99
UC1842-SP	5962-86704	QMLV	–	–	Bipolar	12	28	100	16/10	500	1	1	–55 to 125	CDIP	EAR99
UC1842A-SP	5962-86704	QMLV	30	–	Bipolar	12	25	100	16/10	500	1	1	–55 to 125	CDIP	EAR99
UC1843-SP	5962-86704	QMLV	50	–	Bipolar	8.5	30	100	8.4/7.6	500	1	1	–55 to 125	CDIP, LCCC, Die	EAR99
UC1843A-DIE	–	Tested die	30	–	Bipolar	12	25	100	8.4/7.6	500	1	1	25	Die	EAR99
UC1843A-SP	5962-86704	QMLV-RHA	40	30	Bipolar	12	25	100	8.4/7.6	500	1	1	–55 to 125	CFP, CDIP, LCCC	EAR99
UC1843B-SP	5962-86704	QMLV-RHA	100	100	Bipolar	12	25	100	8.4/7.6	500	1	1	–55 to 125	CFP, Die	EAR99
UC1844-SP	5962-86704	QMLV	–	–	Bipolar	12	30	50	16/10	500	1	1	–55 to 125	LCCC	EAR99
UC1844A-SP	5962-86704	QMLV	30	–	Bipolar	12	30	50	16/10	500	1	1	–55 to 125	CDIP	EAR99
UC1845-SP	5962-86704	QMLV	–	–	Bipolar	12	30	50	8.4/7.6	500	1	1	–55 to 125	CDIP, LCCC	EAR99
UC1845A-SP	5962-86704	QMLV-RHA	45	30	Bipolar	12	25	50	8.4/7.6	500	1	1	–55 to 125	CFP, CDIP, LCCC	EAR99
UC1846-DIE	–	Tested die	–	–	Bipolar	12	40	50	7.70/6.95	500	1	1	25	Die	EAR99
UC1846-SP	5962-86806	QMLV-RHA	40	30	Bipolar	12	40	50	7.70/6.95	500	0.5	2	–55 to 125	CFP, CDIP, LCCC, Die	EAR99
UC1856-SP	5962-94530	QMLV	–	–	Bipolar	12	40	50	7.7/7.0	1000	1.5	2	–55 to 125	CFP, CDIP	EAR99
UC1863-SP	5962-92031	QMLV	–	–	Bipolar	12	22	50	8.0/7.0	500	1	2	–55 to 125	LCCC	EAR99
UC1875-SP	5962-94555	QMLV	50	–	Bipolar	10.8	18	100	10.75/11.75	1000	2	4	–55 to 125	CFP, CDIP	EAR99
UCC1806-SP	5962-94575	QMLV	–	–	Bipolar	8	14.5	50	7.5/6.75	1000	0.5	2	–55 to 125	CDIP, LCCC	EAR99

Low-Side Gate Drivers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	# of Ch	Output Channel Types	Power Switch	Input V_{CC} (Min) (V)	Input V_{CC} (Max) (V)	Peak Output Current (A)	Rise Time (ns)	Fall Time (ns)	Prop Delay (ns)	Package Group	ECCN[2]
UC1705-SP	5962-95798	QMLV	–	–	Bipolar	1	Single low-side	MOSFET, IGBT	5	40	1.5	40	40	100	CDIP	EAR99
UC1707-SP	5962-87619	QMLV	50	–	Bipolar	2	Single low-side	MOSFET, IGBT	5	40	1.5	40	40	100	CFP, LCCC, CDIP	EAR99
UC1708-SP	5962-00514	QMLV	40	–	Bipolar	2	Dual low-side	MOSFET, IGBT	5	35	3	25	25	25	LCCC, CDIP	EAR99
UC1709-SP	5962-01512	QMLV	–	–	Bipolar	2	Dual low-side	MOSFET, IGBT	5	40	1.5	40	40	25	CDIP	EAR99
UC1710-SP	5962-01520	QMLV	–	–	Bipolar	1	Single low-side	MOSFET, IGBT	5	18	6	25	20	35	CDIP	EAR99
UC1715-SP	5962-00521	QMLV	50	–	Bipolar	2	Low-side, Aux low-side	MOSFET	7	20	2	30	25	50	CFP	EAR99

[1]Device operating temperatures are –55 to +125°C, as noted.
*[2]ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email: **gtc_eccn-hts-naftateam@list.ti.com**.*

Space-grade power management (cont'd)

Half-bridge Gate Drivers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Channel Input Logic	Power Switch	Input V_{CC} (Min) (V)	Input V_{CC} (Max) (V)	Peak Output Current (A)	Bus Voltage (max) (V)	Package Group	ECCN[2]
TPS7H6003-SP	5962-22201	QMLV-RHA	100	100	75	TTL/PWM	GaNFET	10	16	1.3	200	CFP	EAR99
TPS7H6013-SP	5962-22201	QMLV-RHA	100	100	75	TTL/PWM	GaNFET	10	16	1.3	60	CFP	EAR99
TPS7H6023-SP	5962-22201	QMLV-RHA	100	100	75	TTL/PWM	GaNFET	10	16	1.3	22	CFP	EAR99
TPS7H6005-SP	5862-22201	QMLP-RHA	100	100	75	TTL/PWM	GaNFET	10	16	1.3	200	HTSSOP	EAR99
TPS7H6015-SP	5962-22201	QMLP-RHA	100	100	75	TTL/PWM	GaNFET	10	16	1.3	60	HTSSOP	EAR99
TPS7H6025-SP	5962-22201	QMLP-RHA	100	100	75	TTL/PWM	GaNFET	10	16	1.3	22	HTSSOP	EAR99

Isolated Feedback Generators

Part Number[1]	Military Spec	Qualification Level	TID Char. (Max) (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²mg)	V_{IN} Range (V)	Ref. Voltage	Ref. Tolerance (%)	Package	ECCN[2]
UC1901-SP	5962-89441	QMLV	–	–	Bipolar	4.5 to 40	1.5	1	CDIP	EAR99

Precision Analog Controllers

Part Number[1]	Military Spec	Qualification Level	TID Char. (Max) (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²mg)	I_{drive} (Max) (mA)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	Package	ECCN[2]
UC19432-SP	5962-09233	QMLV	30	–	Bipolar	100	2	40	CDIP, LCCC	EAR99

Schottky Diode Arrays

Part Number[1]	Military Spec	Qualification Level	TID Char. (Max) (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²mg)	# of Ch	V_F (typ) (mV)	Leakage Current (typ) (mA)	Package	ECCN[2]
UC1611-SP	5962-90538	QMLV	–	–	Bipolar	4	400	0.01	CDIP, LCCC	EAR99

Sequencers

Part Number[1]	Military Spec	Qualification Level	TID Char. (Max) (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²mg)	V_{IN} (min)	V_{OUT} (max)	# of Ch.	Package	ECCN[2]
TPS7H3014-SP	5962-23201	QMLV	100	100	75	3	14	4	CFP	–

Supervisors and Reset ICs

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²mg)	V_{CC} Range (V)	Threshold Voltage	Accuracy (%)	Operating Temp. Range (°C)	Package	ECCN[2]
TPS7H3024-SP	5962-24206	QMLV-RHA	100	100	75	14	Adjustable	+/- 1%	-55 to 125	CFP	EAR99

Space-grade embedded processing and memory

MSP430™ Mixed-Signal Microcontrollers (MCUs)

Part Number[1]	Military Spec	Qualification Level	TID Char. (Max) (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²/mg)	ADC	FRAM (KB)	RAM (KB)	ADC #	GPIO #	I²C (#)	SPI (#)	UART (#)	Compa-rators (# of Ch)	16-bit Timers #	Operating Temp. Range (°C)	Package	ECCN[2]
MSP430FR5969-SP	–	RH Plastic	75	50	72	12-bit SAR	64	2	16	40	1	3	2	16	5	–55 to 105	QFP, QFN	EAR99

Digital Signal Processors (DSPs)

Part Number[1]	Military Spec	Qualification Level	TID Char. Max. (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²/mg)	DSP	CPU	DSP Max Freq. (MHz)	GFLOPS	I/O Supply (V)	Package
SMJ320C6701-SP	5962-98661	QMLV	100	–	117	C67x	32/64-bit	140	1	3.3	CBGA, CLGA
SMV320C6727B-SP	–	RH Ceramic	150	100	100	C67x+	32/64-bit	250	1.5	3.3	CQFP

SRAM Memory

Part Number[1]	Military Spec	Qualification Level	TID Char. (Max) (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²/mg)	Memory Density (Mb)	Memory Configuration	Read Time (ns)	Write Time (ns)	Error Mitigation	Package
SMV512K32-SP	5962-11237	QMLV	300	–	110	16	512k x 32	20	13.8	Built-In EDAC	CFP

[1]All device operating temperatures are –55 to +125°C.

*[2]ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email: **gtc_eccn-hts-naftateam@list.ti.com**.*

Space-grade logic

Logic

Generic Part Number	Military Spec	Qualification	TID Char. (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²/mg)	Sub-Family (Part Type)	Family	# of Ch	V_{CC} Range (V)	Package	Operating Temp. (°C)	ECCN[1]
SN54AC00-SP	5962-87549	QMLV-RHA	100	100	86	NAND gate	AC	4	2 to 6	CDIP, CFP, Die	–55 to 125	EAR99†
SN54HC00-DIE	–	Tested die	–	–	–	NAND gate	HC	4	2 to 6	Die	25	EAR99
SN54HC00-SP	5962-84037	QMLV	–	–	–	NAND gate	HC	4	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HC10-SP	5962-84038	QMLV	–	–	–	NAND gate	HC	3	2 to 6	CDIP	–55 to 125	EAR99
SN54HC132-SP	5962-89845	QMLV	–	–	–	NAND gate	HC	4	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HC20-SP	5962-84039	QMLV	–	–	–	NAND gate	HC	2	2 to 6	CDIP	–55 to 125	EAR99
SN54LS00-SP	M38510/300	JANS	–	–	Bipolar	NAND gate	LS	4	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54LS10-SP	M38510/300	JANS	–	–	Bipolar	NAND gate	LS	3	4.5 to 5.5	CFP	–55 to 125	EAR99
SN54LS26-SP	5962-76020	QMLV	–	–	Bipolar	NAND gate	LS	4	4.5 to 5.5	CFP	–55 to 125	EAR99
SN54LVC00A-SP	5962-97533	QMLV	–	–	–	NAND gate	LVC	4	2 to 6	CFP	–55 to 125	EAR99
SN54AC02-DIE	–	Tested die	50	–	–	NOR gate	AC	4	2 to 6	Die	25	EAR99
SN54AC02-SP	5962-87612	QMLV	50	–	–	NOR gate	AC	4	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HC02-SP	5962-84041	QMLV	–	–	–	NOR gate	HC	4	2 to 6	CDIP	–55 to 125	EAR99
SN54LS02-SP	M38510/303	JANS	–	–	Bipolar	NOR gate	LS	4	4.5 to 5.5	CFP	–55 to 125	EAR99
SN54AHCT08-SP	5962-96821	QMLV	–	–	–	AND gate	AHCT	4	4.5 to 5.5	CFP	–55 to 125	EAR99
SN54HC08-DIE	–	Tested die	–	–	–	AND gate	HC	4	2 to 6	Die	25	EAR99
SN54HC08-SP	5962-84047	QMLV	–	–	–	AND gate	HC	4	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HC11-SP	5962-84048	QMLV	–	–	–	AND gate	HC	3	2 to 6	CDIP	–55 to 125	EAR99
SN54LS08-SP	M38510/310	JANS	–	–	Bipolar	AND gate	LS	4	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54HC32-SP	5962-84045	QMLV	–	–	–	OR gate	HC	4	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54LS32-SP	M38510/305	JANS	–	–	Bipolar	OR gate	LS	4	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54AC14-SP	5962-87624	QMLV	50	–	–	Inverting buffer	AC	6	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54ACT04-SP	5962-89734	QMLV	–	–	–	Inverting buffer	ACT	6	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54AHCT14-SP	5962-96801	QMLV	–	–	–	Inverting buffer	AHCT	6	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54HC04-SP	5962-84098	QMLV	–	–	–	Inverting buffer	HC	6	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HC14-SP	5962-84091	QMLV	–	–	–	Inverting buffer	HC	6	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HCT04-SP	5962-89747	QMLV	–	–	–	Inverting buffer	HCT	6	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54LS04-SP	M38510/300	JANS	–	–	Bipolar	Inverting buffer	LS	6	4.5 to 5.5	CDIP	–55 to 125	EAR99
SN54LS14-SP	5962-96658	QMLV	–	–	Bipolar	Inverting buffer	LS	6	4.5 to 5.5	CFP	–55 to 125	EAR99
SN54LS240-SP	5962-78012	QMLV	–	–	Bipolar	Inverting buffer	LS	8	4.5 to 5.5	CFP	–55 to 125	EAR99
SN54LVC14A-SP	5962-97615	QMLV	–	–	–	Inverting buffer	LVC	6	2 to 3.6	CDIP, CFP, LCCC	–55 to 125	EAR99
SN54AC244-SP	5962-87552	QMLV	–	–	–	Non-inverting buffer	AC	8	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54ACT244-SP	5962-87760	QMLV	–	–	–	Non-inverting buffer	ACT	8	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54AHC244-SP	5962-96782	QMLV	–	–	–	Non-inverting buffer	AHC	8	2 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54ALS244C-SP	5962-86839	QMLV	–	–	Bipolar	Non-inverting buffer	ALS	8	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54HC244-SP	5962-84096	QMLV	–	–	–	Non-inverting buffer	HC	8	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HCT244-SP	5962-85130	QMLV	–	–	–	Non-inverting buffer	HCT	8	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54LS244-SP	M38510/324	JANS	–	–	Bipolar	Non-inverting buffer	LS	8	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54LVCH244A-SP	5962-97542	QMLV	–	–	–	Non-inverting buffer	LVC	8	2 to 3.6	CFP, LCCC	–55 to 125	EAR99
SN54LVTH162244-SP	5962-96809	QMLV	–	–	–	Non-inverting buffer	LVT	16	2.7 to 3.6	CFP	–55 to 125	EAR99
SN54LVTH16244A-SP	5962-96685	QMLV	–	–	–	Non-inverting buffer	LVT	16	2.7 to 3.6	CFP	–55 to 125	EAR99
SN54LVTH244A-SP	5962-95844	QMLV	–	–	–	Non-inverting buffer	LVT	8	2.7 to 3.6	CDIP, CFP, LCCC	–55 to 125	EAR99
SN54AC74-SP	5962-88520	QMLV	–	–	–	D-type flip-flop	AC	2	2 to 6	CFP	–55 to 125	EAR99
SN54ACT374-SP	5962-87631	QMLV	–	–	–	D-type flip-flop	ACT	8	4.5 to 5.5	CFP	–55 to 125	EAR99
SN54HC273-DIE	–	Tested die	–	–	–	D-type flip-flop	HC	8	2 to 6	Die	25	EAR99
SN54HC273-SP	5962-84099	QMLV	–	–	–	D-type flip-flop	HC	8	2 to 6	CDIP, CFP	–55 to 125	EAR99

Note: *TI Rhei started releasing QMLV devices in 2001; at that time several logic devices were released as QMLV. However, TI did not perform any radiation testing on these early releases – as such, although third-party data might be available, most of these TI QMLV logic devices do not have radiation data available. In the tables above, radiation performance data is only included for devices where TI has performed radiation testing.*

Space-grade logic (cont'd)

Logic (cont'd)

Generic Part Number	Military Spec	Qualification	TID Char. (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²/mg)	Sub-Family (Part Type)	Family	# of Ch	V_{CC} Range (V)	Package	Operating Temp. (°C)	ECCN[1]
SN54HC374-SP	5962-84071	QMLV	–	–	–	D-type flip-flop	HC	8	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HC74-SP	5962-84056	QMLV	–	–	–	D-type flip-flop	HC	2	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54LS273-SP	5962-78010	QMLV	–	–	Bipolar	D-type flip-flop	LS	8	4.5 to 5.5	CDIP	–55 to 125	EAR99
SN54LS74A-SP	M38510/301	JANS	–	–	Bipolar	D-type flip-flop	LS	2	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54LVC74A-SP	5962-97616	QMLV	–	–	–	D-type flip-flop	LVC	2	2 to 3.6	CFP	–55 to 125	EAR99
SN54LVTH162374-SP	5962-98542	QMLV	–	–	–	D-type flip-flop	LVT	16	2.7 to 3.6	CFP	–55 to 125	EAR99
SN54LVTH574-SP	5962-95832	QMLV	–	–	–	D-type flip-flop	LVT	8	2.7 to 3.6	CFP	–55 to 125	EAR99
SN54HC109-SP	5962-84150	QMLV	–	–	–	J-K flip-flop	HC	2	2 to 6	CFP	–55 to 125	EAR99
SN54AC373-SP	5962-87555	QMLV	–	–	–	D-type latch	AC	8	2 to 6	CFP	–55 to 125	EAR99
SN54ACT373-SP	5962-87556	QMLV	–	–	–	D-type latch	ACT	8	4.5 to 5.5	CDIP	–55 to 125	EAR99
SN54HC373-DIE	–	Tested die	–	–	–	D-type latch	HC	8	2 to 6	Die	25	EAR99
SN54HC373-SP	5962-84072	QMLV	–	–	–	D-type latch	HC	8	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HC573A-SP	5962-85128	QMLV	–	–	–	D-type latch	HC	8	2 to 6	CDIP	–55 to 125	EAR99
SN54HCT373-SP	5962-86867	QMLV	–	–	–	D-type latch	HCT	8	4.5 to 5.5	CFP	–55 to 125	EAR99
SN54LS373-SP	M38510/325	JANS	–	–	Bipolar	D-type latch	LS	8	4.75 to 5.25	CDIP, CFP	–55 to 125	EAR99
SN54LVTH162373-SP	5962-97638	QMLV	–	–	–	D-type latch	LVT	16	2.7 to 3.6	CFP	–55 to 125	EAR99
SN54HC161-SP	5962-84075	QMLV	–	–	–	Counter	HC	–	2 to 6	CDIP	–55 to 125	EAR99
SN54LS161A-SP	5962-76008	QMLV	–	–	Bipolar	Counter	LS	–	4.75 to 5.25	CDIP	–55 to 125	EAR99
SN54LS193-SP	M38510/315	JANS	–	–	Bipolar	Counter	LS	–	4.75 to 5.25	CFP	–55 to 125	EAR99
SN54LS393-SP	M38510/327	JANS	–	–	Bipolar	Counter	LS	–	4.75 to 5.25	CFP	–55 to 125	EAR99
SN54LS283-SP	5962-76043	QMLV	–	–	Bipolar	Adder	LS	–	4.75 to 5.25	CDIP	–55 to 125	EAR99
SN54HC138-SP	5962-84062	QMLV	–	–	–	Encoders & decoders	HC	1	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HC139-SP	5962-84092	QMLV	–	–	–	Encoders & decoders	HC	2	2 to 6	CFP	–55 to 125	EAR99
SN54HC153-SP	5962-84093	QMLV	–	–	–	Encoders & decoders	HC	2	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HC157-SP	5962-86061	QMLV	–	–	–	Encoders & decoders	HC	4	2 to 6	CDIP	–55 to 125	EAR99
SN54LS138-SP	M38510/307	JANS	–	–	Bipolar	Encoders & decoders	LS	1	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54LS139A-SP	M38510/307	JANS	–	–	Bipolar	Encoders & decoders	LS	2	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54LS145-SP	5962-85084	QMLV	–	–	Bipolar	Encoders & decoders	LS	1	4.5 to 5.5	CDIP	–55 to 125	EAR99
SN54LVC138A-SP	5962-97526	QMLV	–	–	–	Encoders & decoders	LVC	1	2 to 3.6	CFP	–55 to 125	EAR99
SN54LS123-SP	5962-76039	QMLV	–	–	Bipolar	Monostable multivibrator	LS	2	4.75 to 5.25	CDIP, CFP	–55 to 125	EAR99
SN54LVC646A-SP	5962-97626	QMLV	50	–	–	Registered transceiver	LVC	–	2 to 3.6	CFP	–55 to 125	EAR99
SN54HC164-SP	5962-84162	QMLV	–	–	–	Shift register	HC	8	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HC166-SP	5962-90501	QMLV	–	–	–	Shift register	HC	8	2 to 6	CDIP	–55 to 125	EAR99
SN54HC595-SP	5962-86816	QMLV	–	–	–	Shift register	HC	8	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54LS164-SP	M38510/306	JANS	–	–	Bipolar	Shift register	LS	8	4.75 to 5.25	CDIP, CFP	–55 to 125	EAR99
SN54LS165A-SP	5962-77006	QMLV	–	–	Bipolar	Shift register	LS	8	4.75 to 5.25	CDIP, CFP	–55 to 125	EAR99
SN54AC245-SP	5962-87758	QMLV	–	–	–	Standard transceiver	AC	–	2 to 6	CFP	–55 to 125	EAR99
SN54ACT245-SP	5962-87663	QMLV	–	–	–	Standard transceiver	ACT	–	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54AHC245-SP	5962-96818	QMLV	–	–	–	Standard transceiver	AHC	–	2 to 5.5	CFP	–55 to 125	EAR99
SN54HC245-SP	5962-84085	QMLV	–	–	–	Standard transceiver	HC	–	2 to 6	CDIP, CFP	–55 to 125	EAR99
SN54HCT245-SP	5962-85506	QMLV	–	–	-	Standard transceiver	HCT	–	4.5 to 5.5	CDIP, CFP	–55 to 125	EAR99
SN54LS245-SP	5962-80021	QMLV	–	–	Bipolar	Standard transceiver	LS	–	4.5 to 5.5	CFP	–55 to 125	EAR99
SN54LVCH245A-SP	5962-97543	QMLV	–	–	–	Standard transceiver	LVC	–	2 to 3.6	CDIP, CFP, LCCC	–55 to 125	EAR99
SN54LVTH162245-SP	5962-96780	QMLV	–	–	–	Standard transceiver	LVT	–	2.7 to 3.6	CFP	–55 to 125	EAR99
SN54LVTH16245A-SP	5962-96686	QMLV	–	–	–	Standard transceiver	LVT	–	2.7 to 3.6	CFP	–55 to 125	EAR99
SN54LVTH245A-SP	5962-95642	QMLV	–	–	–	Standard transceiver	LVT	–	2.7 to 3.6	CDIP, CFP, LCCC	–55 to 125	EAR99

Note: *TI HiRel started releasing QMLV devices in 2001; at that time several logic devices were released as QMLV. However, TI did not perform any radiation testing on these early releases – as such, although third-party data might be available, most of these TI QMLV logic devices do not have radiation data available. In the tables above, radiation performance data is only included for devices where TI has performed radiation testing.*

Radiation-tolerant portfolio overview
Space EP

The space-enhanced plastic (Space EP) is a portfolio of radiation-tolerant devices designed for emerging NewSpace and LEO commercial applications. Space EP offers a cost-effective radiation-tolerant solution for shorter-duration and higher-volume space missions while providing the features highlighted below. TI identifies radiation-tolerant devices with the -SEP suffix.

Radiation performance
- TID characterization (ELDRS-free) to 30–50krad(Si).
- TID RLAT to 20, 30 or 50krad(Si).
- SEL immunity to 43MeV-cm^2/mg.

Reliability
- Military temperature range: –55°C to +125°C.
- Improved material set (gold-bond wires, no pure tin).
- Enhanced qualification (highly accelerated stress tests, extended temperatures, meets MIL-PRF 38535 Class N).
- Meets NASA's American Society for Testing and Materials 3595 outgassing specification.

Traceability
- Single-controlled baseline and lot traceability.
- Vendor item drawing.

For more information about TI's Space EP device roadmap and offerings, see **ti.com/SEP**, contact your TI representative, or reach out to TI through the TI E2E™ design support forums.

Minimum orderable quantity (MOQ) is one (1) for any of TI's radiation-tolerant products when ordering through TI.com. Check TI.com product folder for availability and ordering.

Reduce the risk in NewSpace with Space Enhanced Plastic products

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Space EP

Comparators

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm^2/ mg)	Ch #	V_S Min (V)	V_S Max (V)	Propagation Delay Time (µs)	VICR (Max) (V)	VICR (Min) (V)	V_{OS} Max at 25°C (Max) (mV)	Input Bias Current (±) (Max) (nA)	Rail-to-Rail	I_q per Ch (Typ) (mA)	Output type	Package Group	ECCN[1]
TLV1704-SEP	V62/18613	TI Space EP	30	30	43	4	2.2	24	0.56	24	2	2.5	15	In	0.055	Open-Collector	TSSOP	EAR99
TLV4H290-SEP	V62/24636	TI Space EP	30	30	43	4	1.65	5.5	0.1	5.7	0	3	0.005	In	0.025	Open-Drain	SOT-23-14	EAR99
TLV4H390-SEP	V62/24636	TI Space EP	30	30	43	4	1.65	5.5	0.1	5.7	0	3	0.005	In	0.025	Push-Pull	SOT-23-14	EAR99
TLV1H103-SEP	V62/23605	TI Space EP	30	30	43	1	2.4	5.5	0.0035	VCC + 0.2	VEE - 0.2	10	5000	In	6	Push-Pull	DBV SOT-23-6	EAR99

General-Purpose Op Amps

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm^2/ mg)	Ch #	V_S Min (V)	V_S Max (V)	GBW (MHz)	Slew Rate (typ) (V/µs)	V_{OS} Max	Drift Typ (µV/C)	Rail-to-Rail	V_n (nV/√Hz)	I_{SC} Typ (mA)	I_{Bias} (Typ) (nA)	Available Packages	ECCN[1]
OPA4H199-SEP	V62/21615-02XE	TI Space EP	30	30	43	4	2.7	40	4.5	21	0.895	0.3	In, Out	10.8	75	0.01	SOT-23-14	EAR99

Precision Op Amps (V_{OS} <1mV)

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm^2/ mg)	Ch #	V_S Min (V)	V_S Max (V)	GBW (MHz)	Slew Rate (typ) (V/ µs)	V_{OS} Max at 25°C (Max) (mV)	Rail-to-Rail	I_q Typ (mA)	V_n Max (nV/√Hz)	IBias (Typ) (nA)	Available Packages	ECCN[1]
OPA4H014-SEP	V62/21607	TI Space EP	30	30	43	4	4.5	18	11	20	120	In to V-, Out	1.8	5.1	0.0005	TSSOP	EAR99

Difference Amplifiers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm^2/ mg)	V_S Min (V)	V_S Max (V)	Max Iq (uA)	BW (kHz)	Slew Rate (V/µs)	Gain Error (max)	Vcm (V)	Package	ECCN[1]
INA1H94-SEP	VID/TBD	TI Space EP	30	30	43	4	18	900	500	5	+/-0.047 %FSR	+/-150	SOIC	EAR99

Instrumentation Amplifiers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm^2/ mg)	V_S Min (V)	V_S Max (V)	Max Iq (uA)	BW (MHz)	Slew Rate (V/µs)	Gain Error (max)	Vcm (V)	Package	ECCN[1]
INA1H182-SEP	VID/TBD	TI Space EP	30	30	43	4.5	18	650	4.7 @ G=1	2	G = 100: 0.15%	(V+) - 2, (V-) +2	DGK	EAR99

*[1]ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email: **gtc_eccn-hts-naftateam@list.ti.com**.*

Space EP (cont'd)

Fully Differential Amplifiers (FDAs)

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/ mg)	V_s Min (V)	V_s Max (V)	GBW (MHz)	BW at Acl (MHz)	Min. ACL (MHz)	Slew Rate (V/ µs)	V_n at Flatband (nV/ √Hz)	CMRR (Typ) (dB)	Rail-to-Rail	V_{os} Max at 25°C (Max) (mV)	IBias (Typ) (nA)	I_q per Ch (Typ) (mA)	Available Packages	ECCN[1]
LMH5485-SEP	V62/TBD	TI Space EP	30	30	43	2.7	5.2	850	620	1	1500	2.2	100	In to V-, Out	0.45	14.5	10.1	MSOP	EAR99

RF Fully Differential Amplifiers (FDAs)

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/ mg)	Min Freq (GHz)	Max Freq (GHz)	Supply Voltage (V)	P1dB at 2GHz (dBm)	Gain at 2GHz (dB)	OIP3 at 2GHz (dBm)	NF at 2GHz (dB)	Available Packages	ECCN[1]
TRF0108-SEP	TBD	TI Space EP	30	30	43	0.01	11	5	12	15.5	28	11	WQFN	EAR99
TRF0208-SEP	V62/23605	TI Space EP	30	30	43	0.01	11	3.3	14.5	16	36	6.8	WQFN	EAR99

[1]*ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email:* ***gtc_eccn-hts-naftateam@list.ti.com****.*

Integrated Precision ADC and DAC

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/ mg)	Res. (Bits)	Number of DAC Channels	DAC Architecture	Number ADC Channels	Input Type	Number of GPIOs	Ref Voltage	INL MAX	Package Group	Package Body Size - W x L (mm)	ECCN[1]
AFE11612-SEP	V62/22614	TI Space EP	30	20	43	12	12	String	16	Single-Ended or Fully-differential	8	Internal 2.5V or External	+/- 1LSB	HTQFP	10 x 10	EAR99

[1]*ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email:* ***gtc_eccn-hts-naftateam@list.ti.com****.*

RF-Sampling Transceivers

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/ mg)	Res. (Bits)	Number of DAC Channels	Number of ADC Channels	Number of DUCs per TXe	Number of DDCs per RX	RF Range	Package Group	ECCN[1]
AFE7950-SEP	–	TI Space EP	50	30	43	14	4	6	2	2	0.6-10.2	FCBGA	–

[1]*ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email:* ***gtc_eccn-hts-naftateam@list.ti.com****.*

Precision ADCs (≤10MSPS)

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/ mg)	Res. (Bits)	Sample rate (Max) (kSPS)	Number of input Channels	Multi-Ch Configuration	SNR (dB)	INL (Max) (± LSB)	Input Type	Reference Voltage (V)	Power (Typ) (mW)	Architecture	Packages	ECCN[1]
ADC128S102-SEP	V62/22608	TI Space EP	30	30	43	12	1000	8	Multiplexed	72	1.1	Single-Ended	Analog supply	2.3	SAR	TSSOP-16	–
ADC168M102R-SEP	V62/24631	TI Space EP	30	30	43	16	1000	8 SE/ 4 DIFF	Multiplexed, simultaneous sampling	93	+/- 3	SE/DIFF	INT/EXT	67	Dual SAR ADC Cores	QFN	–

High-Speed ADCs (>1GSPS)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/ mg)	Sample Rate (Max) (MSPS)	Res. (Bits)	# of Ch	Analog Input BW (GHz)	SNR (dB)	ENOB (Bits)	SFDR (dB)	Input Range (V_{p-p})	Input Buffer	Power (Typ) (mW)	Type	Pkg. Group
ADC12DJ5200-SEP	–	TI Space EP	30	30	43	10400, 5200	12	1, 2	8	55.6	8.8	65	0.8	Yes	4000	Folding-Interpolating	FCBGA
ADC12QJ1600-SEP	–	TI Space EP	30	30	43	1600	12	4	6	57	9.1	64	0.8	Yes	1900	Folding-Interpolating	FCBGA

High-Speed ADCs (>10MSPS and <1GSPS)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/ mg)	Sample Rate (Max) (MSPS)	Res. (Bits)	# of Ch	Analog Input BW (MHz)	SNR (dB)	ENOB (Bits)	SFDR (dB)	Input Range (V_{p-p})	Input Buffer	Power (Typ) (mW)	Type	Pkg. Group	ECCN[1]
ADC3683-SEP	V62/24602	TI Space EP	50	30	43	65	18	2	400	83.8	13.7	89	3.2	No	186	Serial LVDS	QFN	–
ADC3664-SEP	V62/24601	TI Space EP	50	30	43	125	14	2	700	77.5	12.6	84	3.2	No	200	Serial LVDS	QFN	–

[†]*EAR99 only pertains to the Engineering Model device, DAC121S101WGMPR. For up-to-date ECCN information contact:* ***gtc_eccn-hts-naftateam@list.ti.com***

Space EP (cont'd)

High-Speed DACs (>10MSPS)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Res. (Bits)	Update Rate (Max) (MSPS)	Settling Time (Typ) (ns)	SNR (dB)	SFDR (dBc)	THD (dBc)	Interpolation	Power (Typ) (mW)	Architecture	Interface	Pkg. Group	ECCN[1]
DAC39RF10-SEP	–	TI Space EP	50	30	43	16	20800	36	–	85	–	128x, 12x,16x, 192x, 1x, 24x, 256x, 2x, 32x, 3x, 48x, 4x, 64x, 6x, 8x, 96x	3800	Current Source	JESD204B, JESD204C	FCBGA	–
DAC39RFS10-SEP	–	TI Space EP	50	30	43	16	20800	36	–	85	–	128x, 12x,16x, 192x, 1x, 24x, 256x, 2x, 32x, 3x, 48x, 4x, 64x, 6x, 8x, 96x	2800	Current Source	JESD204B, JESD204C	FCBGA	–

[†]EAR99 only pertains to certain device variants, including the Engineering Model (DAC5675AHFG/EM) and one Flight Model variant (5962-0720402VXC).

Precision DACs (≤10MSPS)

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Res. (Bits)	Sample/ Update Rate (MSPS)	DNL (Typ) (±LSB)	INL (Typ) (±LSB)	Zero Code Error (mV)	Supply Voltage (V)	Power (Typ) (mW)	Architecture	Package Group	ECCN[1]
DAC121S101-SEP	V62/TBD	TI Space EP	30	–	43	12	1.8	–0.10/+0.21	2.75	2.23	2.7 to 5.5	0.52	String	VSSOP	EAR99[†]

Mux

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/mg)	Configuration	Input Voltage Range	On-resistance (Ω)	Switch Input Off Leakage (nA)	Transition Time (ns)	Overvoltage Protection (V)	Power-off protection	Package Group:	Package Body Size - W x L (mm)	ECCN[1]
TMUX582F-SEP	V62/23607	TI Space EP	30	30	43	Single 8:1	5V to 22V	180	15	250	60V	Yes	TSSOP	6.5 x 4.4	EAR99

Clock Jitter Cleaners

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/mg)	# of In	# of Out	RMS Jitter (fs)	Output Freq. (MHz)	Supply Voltage (V)	Input Type	Output Type	Package Group:	ECCN[1]
LMK04832-SEP	V62/22612	TI Space EP	30	30	43	3	15	54	0.305 to 3255	3.135 to 3.465	LVCMOS, LVDS, LVPECL	CML, LVPECL, LCPECL, HSDS, LVDS, LVCMOS	QFP	EAR99

RF PLLs and Synthesizers

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/mg)	Normalized PLL Phase Noise (dBc/Hz)	1/f Noise (10-kHz Offset at 1-GHz Carrier) (dBc/Hz)	Output Frequency (Min) (MHz)	Output Frequency (Max) (MHz)	Supply Voltage (V)	Features	Package Body Size - W × L (mm)	Package Group	ECCN[1]
LMX2694-SEP	V62/19616	TI Space EP	30	30	43	–236	–129	39.3	15100	3.2 to 3.45	JESD204B	7.0 × 7.0	VQFN	EAR99
LMX1860-SEP	V62/24630	TI Space EP	30	–	43	–159	–161	300	15000	2.4 to 2.6	JESD204B/C	–	–	EAR99
LMX2695-SEP	V62/TBD	TI Space EP	50	50	43	–236	–129	5	28000	3.3	JESD204B/C	10.00 × 10.00	QFP	EAR99

Clock Buffers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Additive RMS Jitter (fs)	Output Freq. (Max) (MHz)	Number of Outputs	Output Skew (ps) (MHz)	Supply Voltage (V)	Input Type	Output Type	Package Body Size - W × L (mm)	Package Group	ECCN[1]
CDCLVP111-SEP	V62/TBD	TI Space EP	30	–	43	40	3500	10	50	2.375 to 3.8	CML, LVDS, LVPECL, SSTL	LVPECL	9.078 × 9.078	LQFP	EAR99

LVDS

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Device Type	# of TX	# of RX	Supply Voltage (V)	Common-Mode Range (V)	I_{cc} (Max) (mA)	Input Signal	Output Signal	Package Group	ECCN[2]
SN55LVTA4-SEP	V62/25605	TI Space EP	30	30	43	Driver	4	–	3.3	1.125V - 1.375V	35mA	LVTTL	LVDS Differential	SOIC	EAR99
SN55LVRA4-SEP	V62/25606	TI Space EP	30	30	43	Receiver	–	4	3.3	-4.0V - 5.0V	25mA	LVDS Differential	LVTTL	SOIC	EAR99

RS-485 and RS-422

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/mg)	Device Type	No. of TX	No. of RX	Duplex	Supply Voltage (Nom) (V)	Signaling Rate (Max) (Mbps)	Fault Protection (V)	# of nodes	Common mode range	I_{cc} (Max) (mA)	Package Group	ECCN[1]
SN65C1168E-SEP	V62/19606	TI Space EP	30	20	43	Transceiver	2	2	Full	5.0	10	–10 to 15	32	–7 to 7	17	TSSOP	EAR99
THVD9491-SEP	V62/24626	TI Space EP	30	30	43	Transceiver	1	1	Full	3.3, 5	50	–70 to 70	256	–12 to 12	72	SOIC	–

*[1]ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email: **gtc_eccn-hts-naftateam@list.ti.com**.*

Space EP (cont'd)

CAN

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/ mg)	Signaling Rate (Max) (Mbps)	Supply Voltage (Nom) (V)	Common Mode Range	Fault Protection (V)	Features	Package Group	ECCN[1]
SN55HVD233-SEP	V62/18617	TI Space EP	30	20	43	1	3.0 to 3.6	–7 to 12	–16 to 16	Diagnostic loopback	SOIC	EAR99

Voltage Translator

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/ mg)	Signaling Rate (Max) (Mbps)	Supply Voltage (Nom) (V)	Bit Count	Description	Features	Package Group	Package Body Size - W x L (mm)	ECCN[1]
SN54SC4T125-SEP	V62/23631	TI Space EP	50	30	43	150	1.2 to 5.5	4	Fixed Direction w/ 3 State Output	Over-voltage tolerant inputs, balanced outputs	TSSOP	5.0 x 4.4	EAR99
SN54SC6T06-SEP	V62/24618	TI Space EP	50	30	43	-	1.2 to 5.5	6	Inverting Fixed Direction w/ 3 State Output	Over-voltage tolerant inputs, balanced outputs	TSSOP	5.0 x 4.4	EAR99
SN54SC6T07-SEP	V62/24617	TI Space EP	50	30	43	-	1.2 to 5.5	6	Fixed Direction w/ Open-Drain outputs	Over-voltage tolerant inputs, balanced outputs	TSSOP	5.0 x 4.4	EAR99
SN54SC6T14-SEP	V62/24618	TI Space EP	50	30	43	-	1.2 to 5.5	6	Inverting Fixed Direction w/ Schmitt-Tigger inputs	Over-voltage tolerant inputs, balanced outputs	TSSOP	6.5 x 4.4	EAR99
SN54SLC8T245-SEP	V62/22604	TI Space EP	20	20	43	380	0.65 to 3.6	8	Direction Controlled w/ 3 State Output	VCC Isolation, Partial Power Down (Ioff), Overvoltage tolerant inputs	TSSOP	4.40 x 7.80	EAR99
SN54SC8T541-SEP	V62/25632	TI Space EP	50	30	50	150	1.2 to 5.5	8	Fixed Direction w/ 3 State Output	Over-voltage tolerant inputs, balanced outputs	TSSOP	4.40 x 7.80	EAR99
SN54SC8T244-SEP	V62/25631	TI Space EP	50	30	50	150	1.2 to 5.5	8	Fixed Direction w/ 3 State Output	Over-voltage tolerant inputs, balanced outputs	TSSOP	6.5 x 4.4	EAR99
SN54SC8T240-SEP	V62/25630	TI Space EP	50	30	50	150	1.2 to 5.5	8	Inverting Fixed Direction w/ 3-State Output	Over-voltage tolerant inputs, balanced outputs	TSSOP	6.5 x 4.4	EAR99
SN54SC8T9541-SEP	V62/25633	TI Space EP	50	30	50	150	1.2 to 5.5	8	Fixed Direction w/ Schmitt-Trigger inputs	Over-voltage tolerant inputs, balanced outputs	TSSOP	6.5 x 4.4	EAR99

Digital Isolators

Part Number	Military Spec	Quali-fication Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/ mg)	Signaling Rate (Max) (Mbps)	Supply Voltage (V)	Working Voltage (V)	Features	Package Group	Package Body Size - W × L (mm)	ECCN[1]
ISOS141-SEP	V62/21610	TI Space EP	30	30	43	100	2.25 to 5.5	600	Signal Isolation	SSOP	3.9 x 4.9	EAR99

Analog Isolators

Part Number	Military Spec	Quali-fication Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/ mg)	Isolation Voltage	Propagation Delay	Bandwidth (max)	Input Current (mA)	Package Group	Package Body Size - W × L (mm)	ECCN[1]
ISOS510-SEP	V62/TBD	TI Space EP	30	30	43	3750 Vrms	5 µV	680 kHz	0.7 to 10	SOIC	4.8 x 2.54	EAR99

Digital Output Temperature Sensors

Part Number[1]	Military Spec	Qualifi-cation Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/ mg)	# of Remote Temp. Sensor	# of Local Temp. Sensor	Remote Sensor Accuracy (±°C)	Local Sensor Accuracy (±°C)	Remote Temp. Range (°C)	Local Temp. Range (°C)	Temp. Resolution (°C)	Interface	Available Package	ECCN[2]
TMP9R01-SEP	V62/TBD	TI Space EP	50	30	43	1	1	1.5	2.0	–64 to 191	–55 to 125	0.0625	I²C, SMBus, 2-Wire	VSSOP	EAR99

*[1]ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email: **gtc_eccn-hts-naftateam@list.ti.com**.*

Space EP (cont'd)

Current-Sense Amplifiers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	V_S Min (V)	V_S Max (V)	Common-Mode Voltage (V)	Bandwidth (kHz)	Gain (V/V)	V_{OS} Max at 25°C (mV)	Gain Error (%)	I_q Typ (mA)	Available Packages	ECCN[2]
INA950-SEP	V62/25635	TI Space EP	30	30	43	2.7	5.5	2.7 to 80	1.1	20	±25	0.1	370	TSSOP	EAR99

Brushless-DC (BLDC) Drivers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Architecture	V_S (Min) (V)	V_S (Max) (V)	V_S (ABS Max) (V)	Peak Output Current (A)	Gate Drive (A)	Control Interface	Package Body Size (W×L, mm)	Package Group	ECCN[2]
DRV8351-SEP	V62/24612	TI Space EP	30	30	43	Gate Driver	5	15	15	1.5	0.75	–	4 × 4, 6.4 x 4.4	TSSOP	EAR99

Buck Converters

Part Number	Military Spec	Qualification Level	TID Char. (Max) (krad)	TID RLAT/ RHA	SEL (Max) (MeV•cm²/mg)	I_{OUT} (Max) (A)	V_{IN} (Min) (V)	V_{IN} (Max) (V)	V_{OUT} (Min) (V)	V_{OUT} (Max) (V)	Control Mode	Switching Frequency (min) (kHz)	Switching Frequency (max) (kHz)	Duty Cycle (max) (%)	Min. On-Time (max) (ns)	Iq (Typ) (mA)	ECCN[1]
TPS7H4010-SEP	V62/19623	TI Space EP	30	20	43	6	3.5	32	1.0	30.4	Current Mode	350	2200	95%	82	0.015	EAR99
TPS7H4003-SEP	V62/21609	TI Space EP	50	50	43	18	3	7	0.604	6.65	Current Mode	100	1000	100%	235	4	EAR99
TPS7H4011-SEP	V62/TBD	TI Space EP	50	30	43	12	4.5	14	0.6	13.5	Current Mode	100	1000	100%	250	8	EAR99
TPS7H4012-SEP	V62/TBD	TI Space EP	50	50	43	6	4.5	14	0.6	13.2	Current Mode	100	1000	100%	250	6	EAR99
TPS7H4013-SEP	V62/TBD	TI Space EP	50	50	43	3	4.5	14	0.6	13.5	Current Mode	100	1000	100%	250	4	EAR99
TPS7H4104-SEP	V62/TBD	TI Space EP	50	50	43	12	3	7	0.6	6.5	Current Mode	100	1000	100%	250	15	EAR99

eFuses and Load Switches

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/mg)	V_{IN} Range (V)	Type	R_{ON} (Typ) (mΩ)	Continuous Current Load (Max) (A)	Programmable Current Limit Range (A)	Package	ECCN[1]
TPS7H2221-SEP	V62/22609	TI Space EP	30	20	43	1.6 to 5.5	Load Switch	90 at V_{IN} =5V	1.25	–	SC70 (DCK)	EAR99
TPS7H2201-SEP	V62/23608	TI Space EP	50	50	43	1.5 to 7.0	eFuse	35	6	0.5-7.0	HTSSOP	EAR99
TPS7H2211-SEP	V62/23609	TI Space EP	50	50	43	4.5 to 14	eFuse	60	3.5	–	HTSSOP	EAR99
TPS7H2140-SEP	V62/23610	TI Space EP	30	20	43	4.5 to 32	eFuse	160	4Ch at 1.35 A/Ch	0-11	HTSSOP	EAR99

Low-Dropout (LDO) Linear Regulators (Typical VDO ≤400mV)

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (Max) (MeV•cm²/mg)	I_{OUT} (Max) (A)	V_{IN} (Min) (V)	V_{IN} (Max) (V)	V_{OUT} (Min) (V)	V_{OUT} (Max) (V)	Dropout (Vdo) (Typ) (mV)	Accuracy (%)	Noise (µVrms)	PSRR at 100 KHz (dB)	PSRR at 1MHz (dB)	Output options	ECCN[1]
TPS73801-SEP	V62/18616	TI Space EP	50	20	43	1	2.2	20	1.2	20.0	240	3	45	45	23	Adjustable	EAR99
TPS7H1210-SEP	V62/21616	TI Space EP	30	20	43	1	–16.5	–3	–15	–1.2	363	2	13.7	52	55	Adjustable	EAR99
TPS7H1111-SEP	V62/23602	TI Space EP	50	50	43	1.5	0.85	7	0.4	5.5	200	1.5	1.68	71	67	Adjustable	EAR99
TPS7H1121-SEP	V62/TBD	TI Space EP	30	20	43	2	2.25	14	.06	13.5	300	1.5	40	60	60	Adjustable	EAR99

DDR Memory Power

Part Number[1]	Military Spec	Qualification Level	TID Char. (Max) (krad)	TID RLAT (Max) (krad)	SEL (Max) (MeV•cm²/mg)	Regulator Type	I_{OUT} VTT (Max) (A)	V_{IN} (Min) (V)	V_{IN} (Max) (V)	V_{OUT} VTT (Min) (V)	DDR Memory Type(s)	V_{IN} Bias (Min) (V)	V_{IN} Bias (Max) (V)	Package Group	ECCN[1]
TPS7H3302-SEP	V62/22615	TI Space EP	50	50	43	Linear	3.0	0.9	3.5	0.6	DDR, DDR2, DR3, DDR3L, DDR4, LPDDR2, LPDDR3	2.375	3.5	HTSSOP	EAR99

Supervisors and Reset ICs

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/mg)	V_{CC} Range (V)	Threshold Voltage	Accuracy (%)	Operating Temp. Range (°C)	Packages	ECCN[1]
TL7700-SEP	V62/19602	TI Space EP	30	20	43	1.8 to 40	Adjustable	2	–55 to 125	TSSOP	EAR99

[1] *ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email:* ***gtc_eccn-hts-naftateam@list.ti.com***.

Space EP (cont'd)

PWM Controllers

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (Max) (MeV•cm²/mg)	V_{CC} Range (Min) (V)	V_{CC} (Max) (V)	Duty Cycle (Max) (%)	UVLO Thresholds On/Off(V)	Frequency (Max) (kHz)	Gate Drive (Typ) (A)	PWM Outputs (#)	Synchronous Rectification Outputs (#)	Operating Temp Range (°C)	Package	ECCN[1]
TPS7H5005-SEP	V62/22607	TI Space EP	50	50	43	4	14	50,75,100	Adjustable	2000	0.15	2	2	-55 to 125	TSSOP	EAR99
TPS7H5006-SEP	V62/22607	TI Space EP	50	50	43	4	14	75,100	Adjustable	2000	0.15	1	1	-55 to 125	TSSOP	EAR99
TPS7H5007-SEP	V62/22607	TI Space EP	50	50	43	4	14	75,100	Adjustable	2000	0.15	1	1	-55 to 125	TSSOP	EAR99
TPS7H5008-SEP	V62/22607	TI Space EP	50	50	43	4	14	50	Adjustable	2000	0.15	2	0	-55 to 125	TSSOP	EAR99
TPS7H5020-SEP	V62/TBD	TI Space EP	50	50	43	4	14	100	Adjustable	2000	1.2	1	0	-55 to 125	HTSSOP	EAR99
TPS7H5021-SEP	V62/TBD	TI Space EP	50	50	43	4	14	50	Adjustable	2000	1.2	1	1	-55 to 125	HTSSOP	EAR99

Half-bridge Gate Drivers

Part Number[1]	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT (krad)	SEL (MeV•cm²/mg)	Channel Input Logic	Power Switch	Input V_{CC} (Min) (V)	Input V_{CC} (Max) (V)	Peak Output Current (A)	Bus Voltage (max) (V)	Package Group	ECCN[1]
TPS7H6005-SEP	V62/TBD	TI Space EP	50	50	43	TLL/PWM	GaNFET	10	16	1.3	200	HTSSOP	EAR99
TPS7H6015-SEP	V62/TBD	TI Space EP	50	50	43	TLL/PWM	GaNFET	10	16	1.3	60	HTSSOP	EAR99
TPS7H6025-SEP	V62/TBD	TI Space EP	50	50	43	TLL/PWM	GaNFET	10	16	1.3	22	HTSSOP	EAR99

Arm®-Based Microcontrollers (MCUs)

Part Number	Military Spec	Qualification Level	TID Char. (krad)	TID RLAT/ RHA	SEL (MeV•cm²/mg)	CPU	Frequency (MHz)	Flash Memory (kB)	RAM (kB)	ADC	ADC #	GPIO #	I²C (#)	SPI (#)	UART (#)	CAN	Ethernet	Package	ECCN[1]
TMS570LC4357-SEP	V62/18621	TI Space EP	30	30	43	Arm Cortex-R5F	300	4096	2	12-Bit ×2	41	168	2	5	4	4	10/100 Mbps EMAC	NFBGA	–

Logic

Generic Part Number	Military Spec	Qualification	TID Char. (krad)	TID RLAT (krad)	SEL (Max) (MeV•cm²/mg)	Sub-Family (Part Type)	Family	# of Ch	V_{CC} Range (V)	Package	Operating Temp. (°C)	ECCN[1]
SN54SC245-SEP	V62/23616	TI Space EP	50	30	43	Standard Transceiver	SC	8	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC4T08-SEP	V62/23620	TI Space EP	50	30	43	AND Gate	SCxT	4	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC2T74-SEP	V62/23632	TI Space EP	50	30	43	D-Type Flip-Flop	SCxT	2	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC4T00-SEP	V62/23627	TI Space EP	50	30	43	NAND Gate	SCxT	4	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC4T02-SEP	V62/23628	TI Space EP	50	30	43	NOR Gate	SCxT	4	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC4T32-SEP	V62/23629	TI Space EP	50	30	43	OR Gate	SCxT	4	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC4T86-SEP	V62/23630	TI Space EP	50	30	43	XOR Gate	SCxT	4	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC3T97-SEP	V62/23633	TI Space EP	50	30	43	Configurable Gate	SCxT	3	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC3T98-SEP	V62/23626	TI Space EP	50	30	43	Configurable Gate	SCxT	3	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC6T17-SEP	V62/24619	TI Space EP	50	30	43	Schmitt Trigger Buffer	SCxT	6	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC8T595-SEP	V62/25621	TI Space EP	50	30	50	Shift Register	SCxT	8	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC8T138-SEP	V62/25622	TI Space EP	50	30	50	3-line to 8-line Demultiplexer	SCxT	8	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC8T139-SEP	V62/25623	TI Space EP	50	30	50	2-line to 4-Line Demultiplexer	SCxT	8	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC8T151-SEP	V62/25634	TI Space EP	50	30	50	8-to-1 Multiplexer	SCxT	8	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC8T157-SEP	V62/25624	TI Space EP	50	30	50	2-to-1 multiplexer	SCxT	8	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC8T164-SEP	V62/25620	TI Space EP	50	30	50	8-bit Shift Register	SCxT	8	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC8T165-SEP	V62/25625	TI Space EP	50	30	50	8-bit Shift Register	SCxT	8	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC8T373-SEP	V62/25626	TI Space EP	50	30	50	D-type Latch	SCxT	8	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC8T374-SEP	V62/25627	TI Space EP	50	30	50	D-type Flip-Flop	SCxT	8	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC8T573-SEP	V62/25628	TI Space EP	50	30	50	D-type Latch	SCxT	8	1.2 to 5.5	TSSOP	–55 to 125	EAR99
SN54SC8T574-SEP	V62/25629	TI Space EP	50	30	50	D-type Flip-Flop	SCxT	8	1.2 to 5.5	TSSOP	–55 to 125	EAR99

*[1] ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email: **gtc_eccn-hts-naftateam@list.ti.com**.*

[†] EAR99 only pertains to certain device variants, including the following flight model devices: 5962-8754903VCA and 5962-8754903VDA.

***Note:** TI HiRel started releasing QMLV devices in 2001; at that time several logic devices were released as QMLV. However, TI did not perform any radiation testing on these early releases – as such, although third-party data might be available, most of these TI QMLV logic devices do not have radiation data available. In the tables above, radiation performance data is only included for devices where TI has performed radiation testing.*

TI space products – engineering models

TI engineering evaluation (/EM and -MPR) models are units intended for engineering evaluation only. While using the same die as fully qualified and processed space-grade products (QMLV or products appended with the suffix -MLS), they are processed to a noncompliant flow (for example, no burn-in) and tested to a temperature rating of +25°C only. These units are not suitable for qualification, production, radiation testing or flight use. Engineering models are not specified for performance over the full military specified temperature range of –55°C to +125°C or for operating life. For more information about engineering models, see the "**Texas Instruments Engineering Evaluation Units Versus MIL-PRF-38535 QML Class V Processing**"application report.

Engineering models

Generic Part Number	TI Orderable Part Number	Device Type Description	Package | Pins	ECCN[1]
ADC08D1520QML-SP	ADC08D1520WGMPR	/EM	CFP (NBC) | 128	–
ADC10D1000QML-SP	ADC10D1000CCMPR	/EM	CCGA (NAA) | 376	–
ADC128S102QML-SP	ADC128S102WGMPR	/EM	CFP (NAC) | 16	–
ADC12D1600QML-SP	ADC12D1600CCMPR	/EM	CCGA (NAA) | 376	–
ADC12D1620QML-SP	ADC12D1620CCMPR	/EM	CCGA (NAA) | 376	–
ADC12D1620QML-SP	ADC12D1620LGMPR	TI Space-Grade RHA	CLGA (FVA) | 256	–
ADC12DJ3200QML-SP	ADC12DJ3200ZMX/EM	/EM	CLGA (ZMX) | 196	–
ADC12DJ3200QML-SP	ADC12DJ3200NWE/EM	/EM	CCGA (NWE) | 196	–
ADC14155QML-SP	ADC14155W-MPR	/EM	CFP (NBA) | 48	–
ADS1278-SP	ADS1278HFQ/EM	/EM	CFP (HFQ) | 84	EAR99
ADS1282-SP	ADS1282HKV/EM	/EM	CFP (HKV) | 28	EAR99
ADS5400-SP	ADS5400HFS/EM	/EM	CFP (HFS) | 100	–
ADS5424-SP	ADS5424HFG/EM	/EM	CFP (HFG) | 52	–
ADS5444-SP	ADS5444HFG/EM	/EM	CFP (HFG) | 84	–
ADS5463-SP	ADS5463HFG/EM	/EM	CFP (HFG) | 84	–
ADS5474-SP	ADS5474HFG/EM	/EM	CFP (HFG) | 84	–
CDCLVP111-SP	CDCLVP111HFG/EM	/EM	CFP (HFG) | 36	EAR99
CDCM7005-SP	CDCM7005HFG/EM	/EM	CFP (HFG) | 52	EAR99
DAC121S101QML-SP	DAC121S101WGMPR	/EM	CFP (NAC) | 10	EAR99
DAC5670-SP	DAC5670MGEM/EM	/EM	CBGA (GEM) | 192	–
DAC5675A-SP	DAC5675AHFG/EM	/EM	CFP (HFG) | 52	EAR99
DP83561-SP	DP83561HBE/EM	/EM	CFP (HBE) | 64	EAR99
INA901-SP	INA901HKX/EM	/EM	CFP (HKX) | 8	EAR99
INA1H94-SP	INA1H94HKX/EM	/EM	CFP (HKX) | 8	EAR99
LM117HVQML-SP	LM117HVNAC/EM	/EM	CFP (NAC) | 10	EAR99
LM117QML-SP	LM117K/EM	/EM	TO (K) | 2	EAR99
LM117QML-SP	LM117NDT/EM	/EM	TO (NDT) | 3	EAR99
LM4050QML-SP	LM4050WG2.5-MPR	/EM	CFP (NAC) | 10	EAR99
LM4050QML-SP	LM4050WG5.0-MPR	/EM	CFP (NAC) | 10	EAR99
LM7171QML-SP	LM7171NAB/EM	/EM	CDIP (NAB) | 8	EAR99
LM7171QML-SP	LM717NAC/EM	/EM	CFP (NAC) | 10	EAR99
LM7171QML-SP	LM7171NAD/EM	/EM	CFP (NAD) | 10	EAR99
LM98640QML-SP	LM98640W-MPR	/EM	CFP (NBB) | 68	–
LMH5401-SP	LMH5401FFK/EM	/EM	LCCC (FFK) | 14	EAR99
LMH5485-SP	PLMH5485HKX/EM	/EM	CFP (HKX) | 8	EAR99
LMK04832-SEP	LMK04832PAP/EM	/EM	HTQFP (PAP) | 64	EAR99
LMK04832-SP	LMK04832W/EM	/EM	CFP (HBE) | 64	EAR99
LMP7704-SP	LMP7704HBH/EM	/EM	CFP (HBH) | 14	EAR99
LMX1906-SP	LMX1906PAP/EM	/EM	HTQFP (PAP) | 64	EAR99
LMX2615-SP	LMX2615W-MPR	/EM	CFP (HBD) | 64	EAR99
OPA4277-SP	OPA4277HFR/EM	/EM	CFP (HFR) | 14	EAR99
SMJ320C6701-SP	SMV320C6701GLP/EM	/EM	CFCBGA (GLP) | 429	EAR99
SMV320C6727B-SP	SMV320C6727BHFH/EM	/EM	CFP (HFH) | 256	–

Generic Part Number	TI Orderable Part Number	Device Type Description	Package | Pins	ECCN[1]
SMV512K32-SP	SMV512K32HFG/EM	/EM	CFP (HFG) | 76	–
SN55HVD233-SP	HVD233HKX/EM	/EM	CFP (HKX) | 8	EAR99
SN55LVCP22-SP	SN55LVCP22W/EM	/EM	CFP (W) | 16	EAR99
THS4511-SP	THS4511HKT/EM	/EM	CFP (HKT) | 16	EAR99
THS4513-SP	THS4513HKT/EM	/EM	CFP (HKT) | 16	EAR99
TL1431-SP	TL1431U/EM	/EM	CFP (U) | 10	EAR99
TLK2711-SP	TLK2711HFG/EM	/EM	CFP (HFG) | 68	EAR99
TMP461-SP	TMP461HKU/EM	/EM	CFP (HKU) | 10	EAR99
TMP9R00-SP	TMP9R00HKT/EM	/EM	CFP (HKT) | 16	EAR99
TPS50601-SP	TPS50601HKH/EM	/EM	CFP (HKH) | 20	EAR99
TPS50601A-SP	TPS50601AY/EM	/EM Die	(Y) | 0	EAR99
TPS50601A-SP	TPS50601AHKH/EM	/EM	CFP (HKH) | 20	EAR99
TPS7A4501-SP	TPS7A4501HKU/EM	/EM	CFP (HKU) | 10	EAR99
TPS7A4501-SP	TPS7A4501U/EM	/EM	CFP (U) | 10	EAR99
TPS7H1101A-SP	TPS7H1101HKR/EM	/EM	CFP (HKR) | 16	EAR99
TPS7H1101A-SP	TPS7H1101AY/EM	/EM Die	(Y) | 0	EAR99
TPS7H1111-SP	TPS7H1111HBL/EM	/EM	CFP(HBL) | 14	EAR99
TPS7H1121-SP	TPS7H1121HFT/EM	/EM	CFP (HFT) | 22	EAR99
TPS7H2201-SP	TPS7H2201Y/EM	/EM Die	(Y) | 0	EAR99
TPS7H2201-SP	TPS7H2201HKR/EM	/EM	CFP (HKR) | 16	EAR99
TPS7H2211-SP	TPS7H2211HKR/EM	/EM	CFP (HKR) | 16	EAR99
TPS7H2211-SP	TPS7H2211Y/EM	/EM Die	(Y) | 0	EAR99
TPS7H3014-SP	TPS7H3014HFT/EM	/EM	CFP (HFT) | 22	EAR99
TPS7H3301-SP	TPS7H3301HKR/EM	/EM	CFP (HKR) | 16	EAR99
TPS7H4001-SP	TPS7H4001Y/EM	/EM Die	(Y) | 0	EAR99
TPS7H4001-SP	TPS7H4001HKY/EM	/EM	(HKY) | 34	EAR99
TPS7H4001-SP	TPS7H4011HLB/EM	/EM	CFP (HLB) | 30	EAR99
TPS7H4002-SP	TPS7H4002HKH/EM	/EM	CFP (HKH) | 20	EAR99
TPS7H4002-SP	TPS7H4002Y/EM	/EM Die	(Y) | 0	EAR99
TPS7H5001-SP	TPS7H5001Y/EM	/EM Die	(Y) | 0	EAR99
TPS7H5001-SP	TPS7H5001HFT/EM	/EM	CFP (HFT) | 22	EAR99
TPS7H5002-SP	TPS7H5002HFT/EM	/EM	CFP (HFT) | 22	EAR99
TPS7H5003-SP	TPS7H5003HFT/EM	/EM	CFP (HFT) | 22	EAR99
TPS7H5004-SP	TPS7H5004HFT/EM	/EM	CFP (HFT) | 22	EAR99
TPS7H6003-SP	TPS7H6003HBX/EM	/EM	CFP (HBX) | 48	EAR99
TPS7H6013-SP	TPS7H6013HBX/EM	/EM	CFP (HBX) | 48	EAR99
TPS7H6023-SP	TPS7H6023HBX/EM	/EM	CFP (HBX) | 48	EAR99
TRF0206-SP	TRF0206FFM/EM	/EM	LCCC (FFM) | 12	EAR99
TRF0208-SEP	TRF0208RPVT/EM	/EM	WQFN-FCRLF (RPV) | 12	EAR99
TRF0208-SP	TRF0208RPVTSP/EM	/EM	WQFN-FCRLF (RPV) | 12	EAR99
UC1825B-SP	UC1825BHKT/EM	/EM	CFP (HKT) | 16	EAR99
UC1843B-SP	UC1843BHKU/EM	/EM	CFP (HKU) | 10	EAR99

[1]*ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email:* ***gtc_eccn-hts-naftateam@list.ti.com****.*

TI space products – die products

In addition to packaged QMLV products and radiation-tolerant products, TI also offers a variety of space-grade die options, including:

QMLV known good die (KGD): TI fabricates, tests, and qualifies this die product in compliance with MIL-PRF-38535 QMLV with specification in an SMD. RHA versions are available.

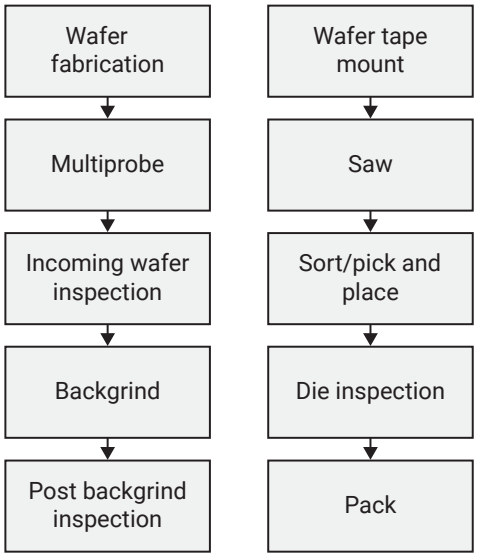
TI space-grade KGD: TI qualifies this die product by wafer lots manufactured and tested in accordance with MIL-PRF-38535; it is not included in an SMD, however.

TI Space EP KGD: TI qualifies this die product with TI's radiation-tolerant Space EP flow. See **ti.com/SEP**.

TI space-grade tested die: TI fabricates this die product on a MIL-PRF-38535-certified manufacturing line; it does not follow the QML manufacturing flow, however, and is tested for DC and functional performance only at ambient temperatures.

Engineering model (EM) die: This die product is intended only for engineering evaluation of its QMLV equivalent. EM die are processed to a noncompliant flow (no burn-in) and tested to a temperature rating of +25°C only. These units are not suitable for qualification, production, radiation testing or flight use. For more information about engineering models, see the "**Texas Instruments Engineering Evaluation Units Versus MIL-PRF-38535 QML Class V Processing** application report.

Example flow (QMLV Class V KGD)



Die products

Generic Part Number	Sub-Family (Part Type)	DLA	TI Orderable Part Number	MIL Orderable Part Number	Device Type Description	Radiation[1]			Temp	ECCN[2]
		Mil Spec (SMD, VID, SS)				Max. TID (krad) Characte-rization	RHA: TID RLAT (krad)	RHA: HDR or LDR		
LM111QML-SP	Comparator	5962-00524	LM111-MDE	5962R0052402V9A	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
LM119QML-SP	Comparator	5962-96798	LM119 MDR	5962R9679801V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
LM119QML-SP	Comparator	5962-96798	LM119 MDE	5962R9679802V9A	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
LM139-SP	Comparator	5962-96738	–	5962-9673802V9B	QMLV Die	40	–	–	-55 to 125°C	EAR99
LM139AQML-SP	Comparator	5962-96738	LM139 MDR	5962R9673801V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
LM139AQML-SP	Comparator	5962-96738	LM139 MDE	5962R9673802V9A	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
LM193QML-SP	Comparator	5962-94526	LM193 MDR	5962R9452602V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
LM193QML-SP	Comparator	5962-94526	LM193 MDE	5962R9452603V9A	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
LM101AQML-SP	General-Purpose Op Amps	5962-99515	LM101 MDR	–	TI Space-Grade RHA Die	100	50	HDR	-55 to 125°C	EAR99
LM124-SP	General-Purpose Op Amps	5962-99504	–	5962-9950403V9B	QMLV Die	50	–	–	-55 to 125°C	EAR99
LM124AQML-SP	General-Purpose Op Amps	5962-99504	LM124 MDR	5962R9950401V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
LM124AQML-SP	General-Purpose Op Amps	5962-99504	LM124 MDE	5962R9950402V9A	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
LM158QML-SP	General-Purpose Op Amps	5962-87710	LM158A MDR	5962R8771002V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
LM158QML-SP	General-Purpose Op Amps	5962-87710	LM158A MDE	5962R8771003V9A	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
LM6172QML-SP	High-Speed Op Amps (>=50MHz)	5962-95604	LM6172 MDR	5962F9560401V9A	QMLV RHA Die	300	300	HDR	-55 to 125°C	EAR99
LM6172QML-SP	High-Speed Op Amps (>=50MHz)	5962-95604	LM6172-MDE	5962R9560403V9A	QMLV RHA Die	300	100	LDR	-55 to 125°C	EAR99
LMP2012QML-SP	Precision Op Amps (Vos<1mV)	5962-06206	LMP2012 MDE	5962L0620602V9A	QMLV RHA Die	50	50	LDR	-55 to 125°C	EAR99
LMP2012QML-SP	Precision Op Amps (Vos<1mV)	5962-06206	LMP2012 MDR	–	TI Space-Grade RHA Die	50	50	HDR	-55 to 125°C	EAR99

[1]Devices with "–" in the radiation data columns might not have updated detailed radiation data or reports.
*[2]ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email: **gtc_eccn-hts-naftateam@list.ti.com**.*

Space products – die products (cont'd)

Die products (cont'd)

Generic Part Number	Sub-Family (Part Type)	DLA	TI Orderable Part Number	MIL Orderable Part Number	Device Type Description	Radiation[1]			Temp	ECCN[2]
		Mil Spec (SMD, VID, SS)				Max. TID (krad) Characte-rization	RHA: TID RLAT (krad)	RHA: HDR or LDR		
OPA4277-SP	Precision Op Amps (Vos<1mV)	5962-16209	–	5962L1620901V9A	QMLV RHA Die	50	50	LDR	-55 to 125°C	EAR99
ADC128S102QML-SP	Precision ADCs (<= 10MSPS)	5962-07227	ADC128S102 MDR	5962R0722701V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	–
DAC121S101QML-SP	Precision DACs (<= 10MSPS)	5962-07226	DAC121S101 MDR	5962R0722601V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	–
DS90C031QML-SP	LVDS	5962-95833	DS90C031 MDR	–	TI Space-Grade RHA Die	100	100	HDR	-55 to 125°C	–
DS90C032QML-SP	LVDS	–	DS90C032 MDR	–	TI Space-Grade RHA Die	50	50	HDR	-55 to 125°C	EAR99
DS16F95QML-SP	RS-485 & RS-422	5962-89615	DS16F95 MDR	5962F8961501V9A	QMLV RHA Die	300	300	HDR	-55 to 125°C	EAR99
TPS50601-SP	Buck Converter	5962-10221	–	5962R1022101V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
TPS50601A-SP	Buck Converter	5962-10221	–	5962R1022102V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
TPS50601A-SP	Buck Converter	5962-10221	TPS50601AY/EM		/EM Die	–	–	–	25°C	EAR99
TPS7H4001-SP	Buck Converter	5962-18205		5962R1820501V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
TPS7H4001-SP	Buck Converter	5962-18205	TPS7H4001Y/EM		/EM Die	–	–	–	25°C	EAR99
TPS7H4002-SP	Buck Converter	5962-20210	–	5962R2021001V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
TPS7H4002-SP	Buck Converter	5962-20210	TPS7H4002Y/EM	–	/EM Die	–	–	–	25°C	EAR99
TPS7H4010-SEP	Buck Converter	–	TPS7H4010KGDSEP		TI Space-Grade Die	30	30	HDR	-55 to 125°C	EAR99
TPS7H2201-SP	eFuses & Hot Swap Controllers	5962-17220	–	5962R1722001V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
TPS7H2201-SP	eFuses & Hot Swap Controllers	5962-17220	TPS7H2201Y/EM	–	/EM Die	–	–	–	25°C	EAR99
TPS7H2211-SP	eFuses & Hot Swap Controllers	5962-18220	–	5962R1822001V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
TPS7H2211-SP	eFuses & Hot Swap Controllers	5962-18220	TPS7H2211Y/EM	–	/EM Die	–	–	–	25°C	EAR99
LM117HVQML-SP	Linear Regulators (LDOs)	5962-07229	LM117HVH MDR	5962R0722901V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
LM117HVQML-SP	Linear Regulators (LDOs)	5962-07229	LM117HVH MDE	5962R0722961V9A	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
LM117QML-SP	Linear Regulators (LDOs)	5962-99517	LM117H MDR	5962R9951703V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
LM117QML-SP	Linear Regulators (LDOs)	5962-99517	LM117H MDE	5962R9951705V9A	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
LM2940QML-SP	Linear Regulators (LDOs)	5962-89587	LM2940-5.0 MDE	–	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
LM2941QML-SP	Linear Regulators (LDOs)	5962-91667	LM2941 MDE	5962R9166702V9A	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
LP2953QML-SP	Linear Regulators (LDOs)	5962-92336	LP2953 MDS	–	TI Space-Grade Die	–	–	–	-55 to 125°C	EAR99
TPS7A4501-SP	Linear Regulators (LDOs)	5962-12224	–	5962-1222402V9A	QMLV Die	100	–	–	-55 to 125°C	EAR99
TPS7A4501-SP	Linear Regulators (LDOs)	5962-12224	–	5962R1222403V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
TPS7H1101A-SP	Linear Regulators (LDOs)	5962-13202	–	5962R1320202V9A	QMLV RHA Die	100	100	?	-55 to 125°C	EAR99
TPS7H1101A-SP	Linear Regulators (LDOs)	–	TPS7H1101AY/EM		/EM Die	–	–	–	25°C	EAR99
TPS7H1111-SP	Linear Regulators (LDOs)	–	–	5962R2120301V9A	QMLV-RHA KGD	100	100	LDR	-55 to 125°C	EAR99
UC1834-DIE	Linear Regulators (LDOs)	–	UC1834VTD1	–	Tested Die	–	–	–	25°C	EAR99
UC1834-DIE	Linear Regulators (LDOs)	–	UC1834VTD2	–	Tested Die	–	–	–	25°C	EAR99
UC1825-DIE	PWM Controllers	–	UC1825VTD1	–	Tested Die	30	–	–	25°C	EAR99
UC1825-DIE	PWM Controllers	–	UC1825VTD2	–	Tested Die	30	–	–	25°C	EAR99
UC1825A-DIE	PWM Controllers	–	UC1825AVTD1	–	Tested Die	30	–	–	25°C	EAR99
UC1825A-DIE	PWM Controllers	–	UC1825AVTD2	–	Tested Die	30	–	–	25°C	EAR99
UC1825B-SP	PWM Controllers	5962-87681	–	5962R8768106V9A	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
UC1843-SP	PWM Controllers	5962-86704	–	5962-8670410V9A	QMLV Die	50	–	–	-55 to 125°C	EAR99
UC1843A-DIE	PWM Controllers	–	UC1843AVTD1	–	Tested Die	30	–	–	25°C	EAR99
UC1843A-DIE	PWM Controllers	–	UC1843AVTD2	–	Tested Die	30	–	–	25°C	EAR99
UC1843B-SP	PWM Controllers	5962-86704	–	5962R8670412V9A	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
UC1846-DIE	PWM Controllers	–	UC1846VTD1	–	Tested Die	45	–	–	25°C	EAR99
UC1846-DIE	PWM Controllers	–	UC1846VTD2	–	Tested Die	45	–	–	25°C	EAR99
UC1846-SP	PWM Controllers	5962-86806	–	5962-8680603V9A	QMLV Die	40	–	–	-55 to 125°C	EAR99
TPS7H5001-SP	PWM Controllers	5962-18222	–	5962R1822201V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
TPS7H5001-SP	PWM Controllers	5962-18222	TPS7H5001Y/EM	–	/EM Die	–	–	–	25°C	EAR99
LM136A-2.5QML-SP	Shunt Voltage Reference	5962-00501	LM136-2.5 MDR	5962R0050101V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	EAR99
LM136A-2.5QML-SP	Shunt Voltage Reference	5962-00501	LM136-2.5 MDE	5962R0050102V9A	QMLV RHA Die	100	100	LDR	-55 to 125°C	EAR99
TL1431-DIE	Shunt Voltage Reference	–	TL1431VTDB1	–	Tested Die	100	–	–	25°C	EAR99
TL1431-DIE	Shunt Voltage Reference	–	TL1431VTDB2	–	Tested Die	100	–	–	25°C	EAR99
SN54HC08-DIE	AND gate	–	SN54HC08VTDF1	–	Tested Die	–	–	–	25°C	EAR99

[1] *Devices with "-" in the radiation data columns might not have updated detailed radiation data or reports.*

[2] *ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email:* ***gtc_eccn-hts-naftateam@list.ti.com***.

Space products – die products (cont'd)

Die products (cont'd)

Generic Part Number	Sub-Family (Part Type)	DLA	TI Orderable Part Number	MIL Orderable Part Number	Device Type Description	Radiation[1]			Temp	ECCN[2]
		Mil Spec (SMD, VID, SS)				Max. TID (krad) Characte-rization	RHA: TID RLAT (krad)	RHA: HDR or LDR		
SN54HC08-DIE	AND gate	–	SN54HC08VTDF2	–	Tested Die	–	–	–	25°C	EAR99
SN54HC273-DIE	D-type flip-flop	–	SN54HC273VTDG1	–	Tested Die	–	–	–	25°C	EAR99
SN54HC273-DIE	D-type flip-flop	–	SN54HC273VTDG2	–	Tested Die	–	–	–	25°C	EAR99
SN54HC373-DIE	D-type latch	–	SN54HC373VTDG1	–	Tested Die	–	–	–	25°C	EAR99
SN54HC373-DIE	D-type latch	–	SN54HC373VTDG2	–	Tested Die	–	–	–	25°C	EAR99
SN54AC00-DIE	NAND gate	–	SN54AC00VTD1	–	Tested Die	100	–	–	25°C	EAR99
SN54AC00-DIE	NAND gate	–	SN54AC00VTD2	–	Tested Die	100	–	–	25°C	EAR99
SN54AC00-SP	NAND gate	5962-87549	–	5962R8754903V9A	QMLV RHA Die	100	100	HDR	-55 to 125°C	–
SN54AC02-DIE	NOR gate	–	SN54AC02VTD1	–	Tested Die	50	–	–	25°C	EAR99
SN54AC02-DIE	NOR gate	–	SN54AC02VTD2	–	Tested Die	50	–	–	25°C	EAR99

[1]Devices with "-" in the radiation data columns might not have updated detailed radiation data or reports.
*[2]ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email: **gtc_eccn-hts-naftateam@list.ti.com**.*

TI space products – mechanical samples

Mechanical samples (dummy packages) are nonelectrically functional packages (typically without the die) used for mechanical evaluations or process setups. TI offers a number of space product mechanical samples.

Refer to the orderable part number listed in the tables below when ordering mechanical samples.

Mechanical samples

Generic Part Number	Orderable Part Number	Package | Pins	ECCN[1]
LM111QML-SP	MKT-W10A-MS	CFP (NAD) | 10	EAR99
LM111QML-SP	MKT-WG10A-MS	CFP (NAC) | 10	EAR99
LM119QML-SP	MKT-W10A-MS	CFP (NAD) | 10	EAR99
LM119QML-SP	MKT-WG10A-MS	CFP (NAC) | 10	EAR99
LM139AQML-SP	MKT-W14B-MS	CFP (NAD) | 14	EAR99
LF411QML-SP	MKT-WG10A-MS	CFP (NAC) | 10	EAR99
LM124AQML-SP	MKT-W14B-MS	CFP (NAD) | 14	EAR99
LM158QML-SP	MKT-WG10A-MS	CFP (NAC) | 10	EAR99
LM6172QML-SP	MKT-WG16A-MS	CFP (NAC) | 16	EAR99
LM7171QML-SP	MKT-W10A-MS	CFP (NAD) | 10	EAR99
LM7171QML-SP	MKT-WG10A-MS	CFP (NAC) | 10	EAR99
LMH6628QML-SP	MKT-WG10A-MS	CFP (NAC) | 10	EAR99
LMH6702QML-SP	MKT-WG10A-MS	CFP (NAC) | 10	EAR99
LMP2012QML-SP	MKT-WG10A-MS	CFP (NAC) | 10	EAR99
CDCM7005-SP	SN00052HFG-DC	CFP (HFG) | 52	EAR99
LMK04832-SP	SN0064HBE	CFP (HBE) | 64	EAR99
LMX2615-SP	LMX2615-MKT-MS	CFP (HBD) | 64	EAR99
LM98640QML-SP	MKT-EL68D-MS	CFP (NBB) | 68	EAR99
ADC10D1000QML-SP	ADC10D1000DAISY	CCGA (NAA) | 376	–
ADC12D1600QML-SP	ADC10D1000DAISY	CCGA (NAA) | 376	–
ADC12D1620QML-SP	ADC10D1000DAISY	CCGA (NAA) | 376	–
ADC14155QML-SP	MKT-EL48A-MS	CFP (NBA) | 48	EAR99
ADS5424-SP	SN00052HFG-DC	CFP (HFG) | 52	EAR99
DAC5675A-SP	SN00052HFG-DC	CFP (HFG) | 52	EAR99
ADC128S102QML-SP	MKT-W16A-MS	CFP (NAD) | 16	EAR99
ADC128S102QML-SP	MKT-WG16A-MS	CFP (NAC) | 16	EAR99
DAC121S101QML-SP	MKT-WG10A-MS	CFP (NAC) | 10	EAR99
DP83561-SP	SN0064HBE	CFP (HBE) | 64	EAR99
DS90C031QML-SP	MKT-W16A-MS	CFP (NAD) | 16	EAR99
DS90C031QML-SP	MKT-WG16A-MS	CFP (NAC) | 16	EAR99
DS90C032QML-SP	MKT-W16A-MS	CFP (NAD) | 16	EAR99
DS90C032QML-SP	MKT-WG16A-MS	CFP (NAC) | 16	EAR99
DS90LV031AQML-SP	MKT-WG16A-MS	CFP (NAC) | 16	EAR99
DS90LV032AQML-SP	MKT-W16A-MS	CFP (NAD) | 16	EAR99
DS16F95QML-SP	MKT-W10A-MS	CFP (NAD) | 10	EAR99
DS26F31MQML-SP	MKT-W16A-MS	CFP (NAD) | 16	EAR99
DS26F32MQML-SP	MKT-W16A-MS	CFP (NAD) | 16	EAR99
TLK2711-SP	SN0068HFG	CFP (HFG) | 68	EAR99
TLK2711-SP	SN00068HFG-DC	CFP (HFG) | 68	EAR99
ADC12DJ3200QML-SP	ADC12DJ3200NWE/DC	CCGA (NWE) | 196	EAR99
ADC12DJ5200-SP	SN0144ALR-DC	FCCSP (ALR) | 144	EAR99
ADC12QJ1600-SP	SN0144ALR-DC	FCCSP (ALR) | 144	EAR99
DAC39RF10-SP	SN0256ACL-DC	FCBGA (ACK) | 256	EAR99
AFE7950-SP	SN0400ALK-DC	FCBGA (ALK) | 400	EAR99
TPS50601-SP	SN0020HKH	CFP (HKH) | 20	EAR99

Generic Part Number	Orderable Part Number	Package | Pins	ECCN[1]
TPS50601A-SP	SN0020HKH	CFP (HKH) | 20	EAR99
TPS7H4001-SP	SN0034HKY	CFP (HKY) | 34	EAR99
TPS7H4002-SP	SN0020HKH	CFP (HKH) | 20	EAR99
TPS7H3301-SP	SN0016HKR	CFP (HKR) | 16	EAR99
UC1611-SP	SN00020FK	LCCC (FK) | 20	EAR99
TPS7H2201-SP	SN0016HKR	CFP (HKR) | 16	EAR99
TPS7H2211-SP	SN0016HKR	CFP (HKR) | 16	EAR99
LM117HVQML-SP	MKT-WG16A-MS	CFP (NAC) | 16	EAR99
LM117QML-SP	MKT-WG16A-MS	CFP (NAC) | 16	EAR99
LM2940QML-SP	MKT-WG16A-MS	CFP (NAC) | 16	EAR99
LM2941QML-SP	MKT-WG16A-MS	CFP (NAC) | 16	EAR99
LP2953QML-SP	MKT-WG16A-MS	CFP (NAC) | 16	EAR99
TPS7A4501-SP	SN0010HKU	CFP (HKU) | 10	EAR99
TPS7H1101A-SP	SN0016HKR	CFP (HKR) | 16	EAR99
UC1832-SP	SN00020FK	LCCC (FK) | 20	EAR99
UC1834-SP	SN00020FK	LCCC (FK) | 20	EAR99
UC1707-SP	SN00020FK	LCCC (FK) | 20	EAR99
UC1708-SP	SN00020FK	LCCC (FK) | 20	EAR99
UC1525B-SP	SN00020FK	LCCC (FK) | 20	EAR99
UC1825-SP	SN00020FK	LCCC (FK) | 20	EAR99
UC1825A-SP	SN00020FK	LCCC (FK) | 20	EAR99
UC1843-SP	SN00020FK	LCCC (FK) | 20	EAR99
UC1843A-SP	SN0010HKU	CFP (HKU) | 10	EAR99
UC1843B-SP	SN0010HKU	CFP (HKU) | 10	EAR99
UC1844-SP	SN00020FK	LCCC (FK) | 20	EAR99
UC1845-SP	SN00020FK	LCCC (FK) | 20	EAR99
UC1845A-SP	SN0010HKU	CFP (HKU) | 10	EAR99
UC1845A-SP	SN00020FK	LCCC (FK) | 20	EAR99
UC1846-SP	SN00020FK	LCCC (FK) | 20	EAR99
UC1863-SP	SN00020FK	LCCC (FK) | 20	EAR99
UCC1806-SP	SN00020FK	LCCC (FK) | 20	EAR99
TPS7H5001-SP	SN0022HFT	CFP (HFT) | 22	EAR99
TPS7H5002-SP	SN0022HFT	CFP (HFT) | 22	EAR99
TPS7H5003-SP	SN0022HFT	CFP (HFT) | 22	EAR99
TPS7H5004-SP	SN0022HFT	CFP (HFT) | 22	EAR99
LM4050QML-SP	MKT-WG10A-MS	CFP (NAC) | 10	EAR99
SMV512K32-SP	SN0076HFG	CFP (HFG) | 76	EAR99
TMP461-SP	SN0010HKU	CFP (HKU) | 10	EAR99
TPS7H1111-SP	SN0014HBL	CFP (HBL) | 14	EAR99
TPS7H1121-SP	SN0022HFT	CFP (HFT) | 22	EAR99
TPS7H3014-SP	SN0022HFT	CFP (HFT) | 22	EAR99
TPS7H4001-SP	SN0034HKY	CFP(HKY) | 34	EAR99
TPS7H4011-SP	SN0030HLB	CFP (HLB) | 30	EAR99
TPS7H6003-SP	SN0048HBX	CFP (HBX) | 48	EAR99
TPS7H6013-SP	SN0048HBX	CFP (HBX) | 48	EAR99
TPS7H6023-SP	SN0048HBX	CFP (HBX) | 48	EAR99

[1] *ECCN information for products that are EAR99 are shown. For up-to-date ECCN information on any product, please email:* ***gtc_eccn-hts-naftateam@list.ti.com***.

Acronyms

ADC analog-to-digital converter
AMU atomic mass unit
ASET analog single-event transient
ASTM American Society for Testing and Materials
ATE automated test equipment
BiCMOS bipolar complementary metal-oxide semiconductor
BJT bipolar junction transistor
BL bitline
BOX buried oxide
BPSG boron-doped phosphosilicate glass
CAT computerized axial tomography
CCD charge-coupled device
CMEs coronal mass ejections
CMOS complementary metal-oxide semiconductor
COTS commercial off-the-shelf
CT computer tomography
DAC digital-to-analog converter
DBU double-bit upset
DD displacement damage
DDD displacement damage dose
DEC-TED double-error correct-triple-error detect
DICE dual interlocked storage cell
DMOSFET double-diffused metal-oxide semiconductor field-effect transistor
DMR dual-modular redundant
DRAM dynamic random-access memory
DSET digital single-event transient
DTI deep trench isolation
DUT device under test
e-h electron hole
ECC error correction circuit
ELDRS enhanced low-dose-rate sensitivity
EMP electromagnetic pulse
ESA European Space Agency
ESCC European Space Components Coordination
FET field-effect transistor
FIT failures in time
FPGA field-programmable gate array
GCR galactic cosmic ray
GEO geostationary orbit
GSO geosynchronous orbit
Gy gray
HDR high dose rate
HEO high Earth orbit
hFE bipolar transistor gain
IC integrated circuit
IGBT insulated gate bipolar transistor
LBNL Lawrence Berkeley National Labs
LDO low-dropout regulator
LDR low dose rate
LEO low Earth orbit
LET linear energy transfer
LOCOS local oxidation of silicon
MAAT metal-oxide semiconductor accelerated anneal test
MBU multiple-bit upset
MCU microcontroller
MEO medium Earth orbit
MIL-STD military standard
MOS metal-oxide semiconductor
MOSFET metal-oxide semiconductor field-effect transistor
MUX multiplexer
ND/PD neutron dose/proton dose
NIEL nonionizing energy loss
NMOS N-channel metal-oxide semiconductor
NPN NPN transistor
NYC New York City
OM optical microscope
PMOS P-channel metal-oxide semiconductor
PNP PNP transistor
PNPN PNPN silicon controlled rectifier
QML Qualified Manufacturers List
R read
RFID radio-frequency identification
RHA radiation hardness assurance
RHBD radiation hardening by design
RHBP radiation hardening by process
RLAT radiation lot acceptance testing
SAA South Atlantic Anomaly
SBU single-bit upset
SEB single-event burnout
SEC-DED single-error correct-double-error detect
SEDR single-event dielectric rupture
SEE single-event effect
SEFI single-event functional interrupt
SEGR single-event gate rupture
SEL single-event latch-up
SEM scanning electron microscope
SEP solar energetic particles
SER soft-error rate
SET single-event transient
SEU single-event upset
Si silicon
SiGe silicon germanium
SMD standard microcircuit drawing
SOA safe operating area
SoC system-on-chip
SOI silicon-on-insulator
SOS silicon-on-sapphire
SRAM static random-access memory
SRIM Stopping and Range of Ions in Matter
STI shallow trench isolation
TAMU Texas A&M University
TDE time-dependent effect
TEM transmission electron microscope
TID total ionizing dose
TM test method
TMR triple-modular redundant
TPA two-photon absorption
ULA ultra-low alpha
W write
WL wordline

TI Product Classifications and Qualifications

Rating		Space				
Classification		Space EP	SHP	QMLP	QMLY	QMLV
Production Testing and Documentation Provided	Vendor Item Drawing (VID)	✓	✓	x	x	x
	Standard Microcircuit Drawing (SMD)	x	x	✓	✓	✓
	Process Conformance Report	✓	✓	✓	✓	✓
	Process Conformance Report Content	See Product Page		MIL-PRF-38535 Group A, B, C, D, E		
Manufacturing	Single Controlled Baseline	✓	✓	✓	✓	✓
	Multiple Wafer Lots Per Reel Possible	x	x	x	x	x
	Life Test Per Wafer Lot	x	✓	✓	✓	✓
Packaging	Package Construction	Plastic	Plastic	Plastic - Wirebond or Flip Chip with Overmold	Plastic - Flip Chip w/o Overmold	Hermetic
	Bond Wires	Au	Au	Au	N/A	Al
	Pure Tin (Sn) Lead Finish Possible?	x	x	x	x	x
	>97% Tin (Sn) Inside Package Possible	✓For Flip Chip				x
	Production Burn-In Required	x	✓	✓	✓	✓
	Outgassing Tested Per ASTM E595	✓	✓	✓	✓	N/A
Radiation	TID Characterization Range (krad/Si)	30 to 50	50 to 300			
	TID Radiation Lot Acceptance Testing (RLAT) Range – RHA (krad/Si)	20, 30 or 50	50, 100 or 300			
	SEL Immunity (MeV*cm^2/mg)	≥43	≥60			
Typical Temperature Range		–55–125°C				

Table illustrates typical values for each classification rating. For precise data or detailed information, please refer to the product-specific page.

*BI unless optimization aligned with DLA

TID = Total Ionizing Dose
VID = Vendor Item Drawing
SEL = Single-Event Latch-up
RHA = Radiation Hardness Assured
QML = Qualified Manufacturers List
SMD = Standard Microcircuit Drawing

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