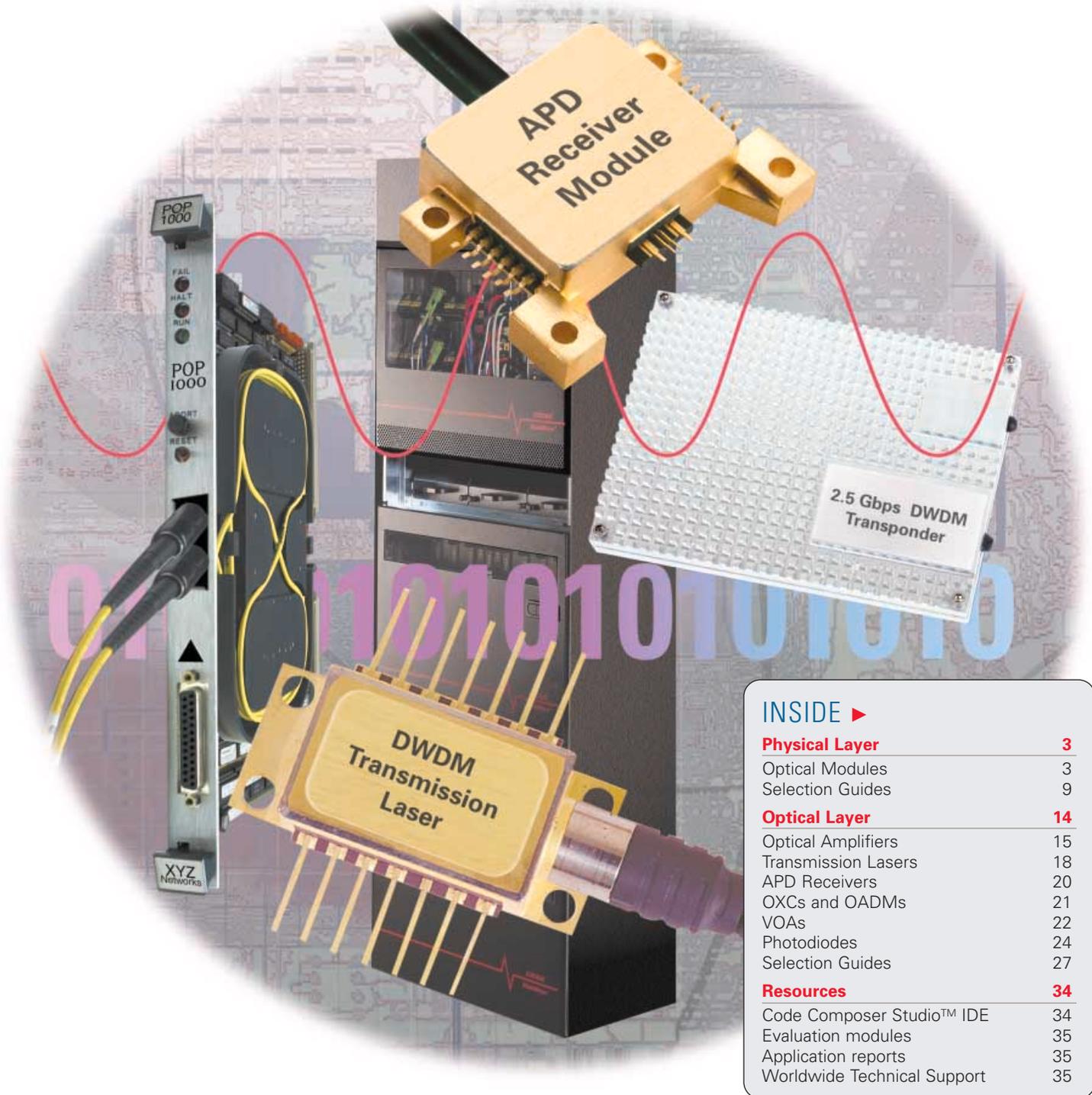


OPTICAL NETWORKING SOLUTIONS GUIDE

Amplifiers, Clock Distribution, Data Converters, Digital Light Processing™, Digital Signal Processors, Logic, Microcontrollers, Power Management, Serial Gigabit Solutions

4Q 2001



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TI SOLUTIONS ENABLE THE INTELLIGENT OPTICAL NETWORKS OF TODAY AND TOMORROW

Global communications traffic in both voice and data has grown tremendously throughout the past decade. To support this demand, communications bandwidth capacity and geographic coverage have been substantially expanded. Optical signals sent over fiber networks have enabled these tremendous advances. However, the growth in tele- and data-communications traffic is just beginning. As increasing numbers of people access the Internet via broadband, they gain exposure to a new world of choices and possibilities. Streaming audio, teleconferencing, video-on-demand and 3-D virtual reality are just a few of the applications. Optical networking, with its inherent advantages, will be key in making this new world of communications possible.

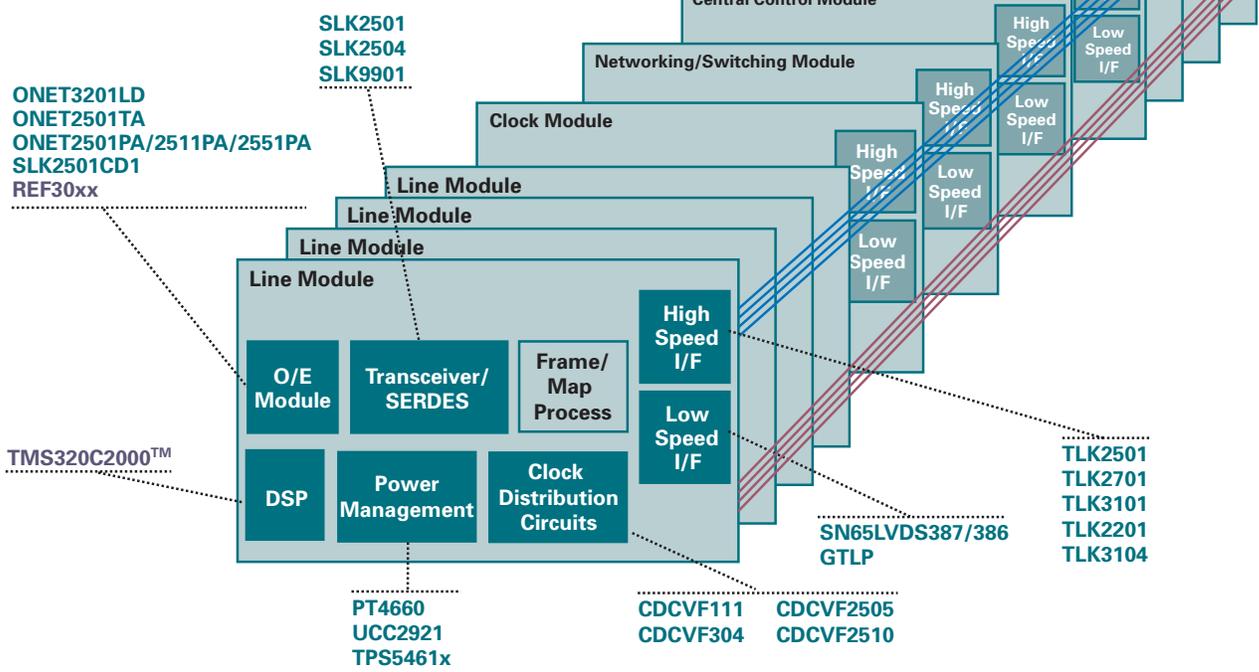
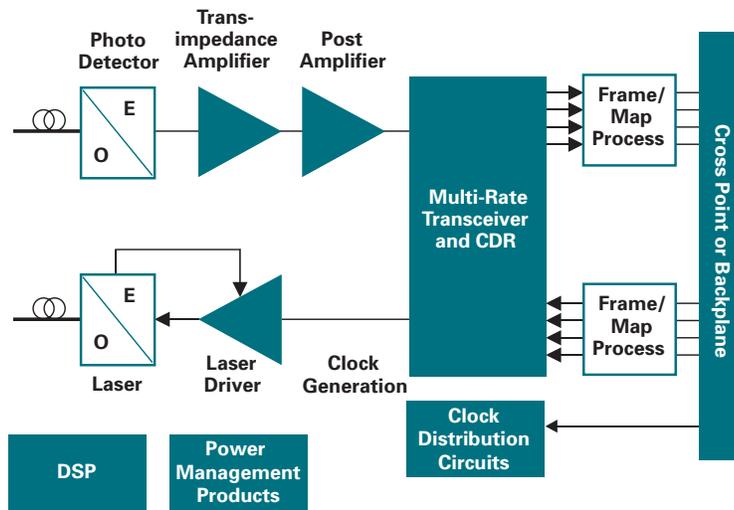
TI's optical networking portfolio supports a broad application base that is enabling the intelligent optical networks of today and tomorrow. This portfolio includes market-leading, fully integrated serial gigabit transceivers, ASICs, DSPs, high-performance analog and Digital Light Processing™ technologies. TI delivers products that will benefit companies building systems or delivering services based on optical networking technology.

OPTICAL MODULES

Fiber optic transceivers and modules are the “on/off ramps” of the optical network. As optical links push into the metropolitan area network (MAN), footprint and power consumption are key design concerns. Whether it’s a fiber optic module or a complete optical line card, Texas Instruments’ highly integrated, low power, “across the board” solutions enable leading designs for 10 Gigabit Ethernet, SONET, Fibre Channel, or any proprietary application.

For transceivers and other high-speed interfaces, TI offers the Serial Gigabit Solutions family of devices, providing the industry’s lowest power dissipation while enabling multi-gigabit transmissions. Other devices profiled in this section for optical line cards include physical media dependent devices, clock distribution solutions, power management products, low speed interface solutions, and DSPs for monitoring and control applications.

Optical Modules Applications



ONET3201LD
ONET2501TA
ONET2501PA/2511PA/2551PA
SLK2501CD1
REF30xx

SLK2501
SLK2504
SLK9901

TMS320C2000™

PT4660
UCC2921
TPS5461x

CDCVF111 CDCVF2505
CDCVF304 CDCVF2510

SN65LVDS387/386
GTLp

TLK2501
TLK2701
TLK3101
TLK2201
TLK3104

TO KNOW MORE ▶

For detailed information about ICs for optical modules:

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FULLY INTEGRATED OC-48 SONET/SDH TRANSCEIVER

SLK2501

Get samples, datasheet and app. reports at:
www.ti.com/sc/device/SLK2501

SLK2501 is a single-chip, multi-rate transceiver IC used to derive high-speed timing signals for SONET/SDH-based equipment. The chip performs clock and data recovery, serial-to-parallel, parallel-to-serial conversion and frame detection function conforming to SONET/SDH standards.

Key Features

- Multi-rate support including OC-48, OC-24, OC-12 and OC-3
- Low power consumption: <900 mW for OC-48
- 4-bit LVDS 622-MHz parallel interface
- LVPECL compatible serial interface
- Auto rate detection
- Support for both 155-MHz or 622-MHz reference clocking
- Built-in PRBS generation and verification
- Targeted to meet or exceed all SONET/SDH jitter requirements

Applications

- Optical transceivers
- SONET add/drop MUX
- DWDM optical add/drop MUX
- Optical switches
- Optical routers
- Optical system interconnects

2.5-Gbps LIMITING AMPLIFIER, 2.5-Gbps TRANSIMPEDANCE AMPLIFIER AND 3.2-Gbps LASER DRIVER

ONET3201LD*, ONET2501PA*, ONET2511PA*,
 ONET2551PA* and ONET2501TA*



Get samples, datasheets, app. reports and EVMs at:
www.ti.com/sc/device/partnumber

Replace partnumber in URL with ONET3201LD, ONET2501PA, ONET2511PA, ONET2551PA or ONET2501TA

The ONET products are low-power, 3.3-V solutions for optical modules.

Key Features

ONET3201LD

- 3.2-Gbps operation
- Bias and modulation currents independently programmable from 1 mA to 90 mA
- APC and fault detection

ONET2501TA

- 2.2-GHz bandwidth
- 4-kΩ differential transimpedance
- 10-pA/√Hz typical input referred noise

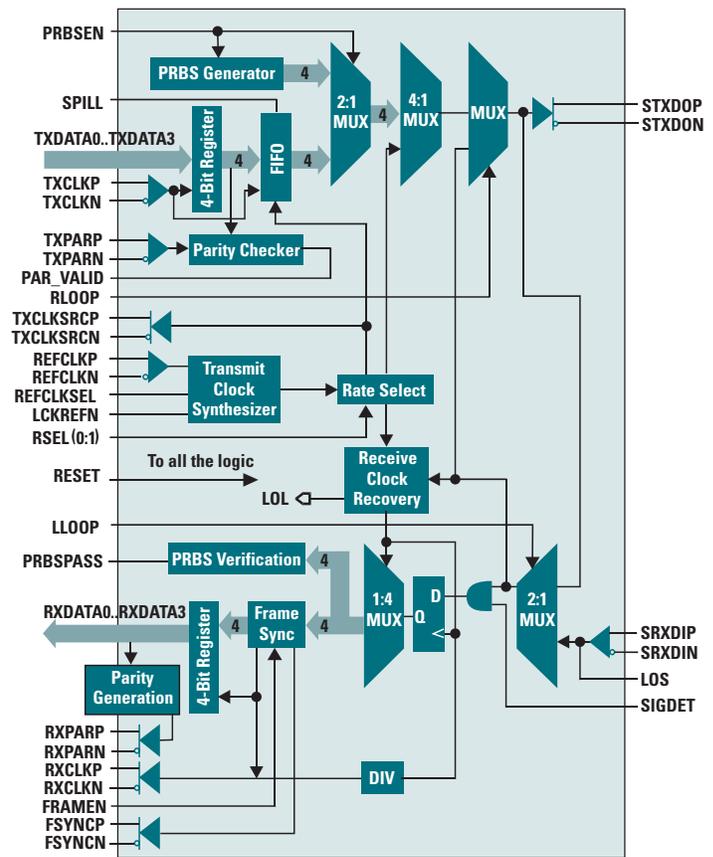
ONET2501PA/2511PA/2551PA

- 3-GHz bandwidth
- 40-dB gain
- Fully differential architecture

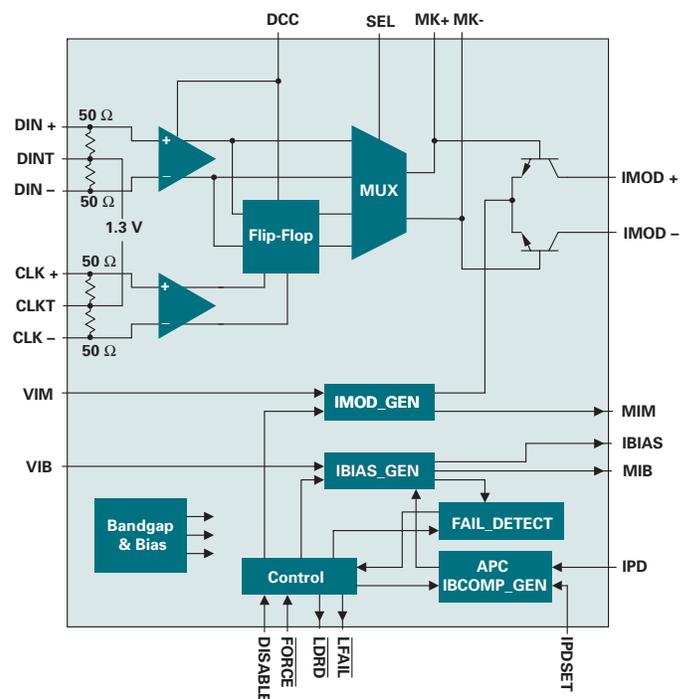
Applications

- SONET OC-48
- SDH STM-16
- Fiber optic data links

Multi-Rate SONET Transceiver

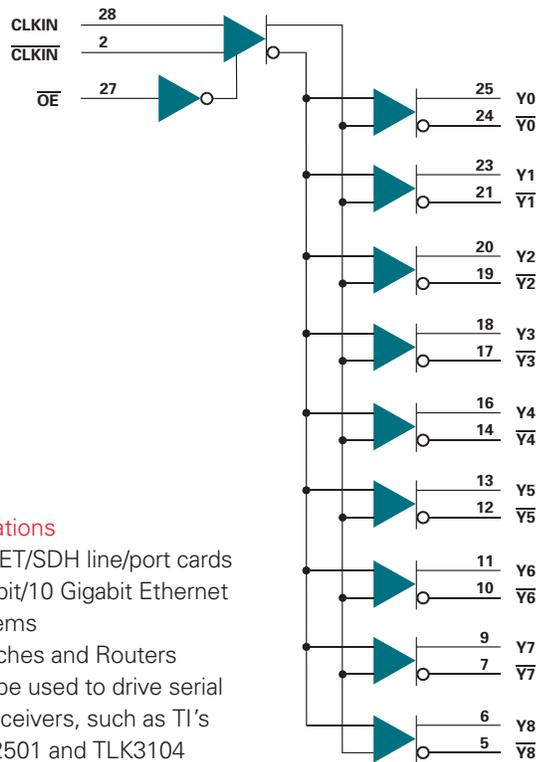


ONET3201LD Block Diagram



*The ONET3201LD, ONET2501PA, ONET2511PA, ONET2551PA and ONET2501TA are in the product preview stage of development. Expected availability is 1Q 2002.

CDCVF111 Functional Block Diagram

**Applications**

- SONET/SDH line/port cards
- Gigabit/10 Gigabit Ethernet systems
- Switches and Routers
- Can be used to drive serial transceivers, such as TI's SLK2501 and TLK3104

1-LINE TO 9-LINE DIFFERENTIAL LVPECL CLOCK DRIVER**CDCVF111**

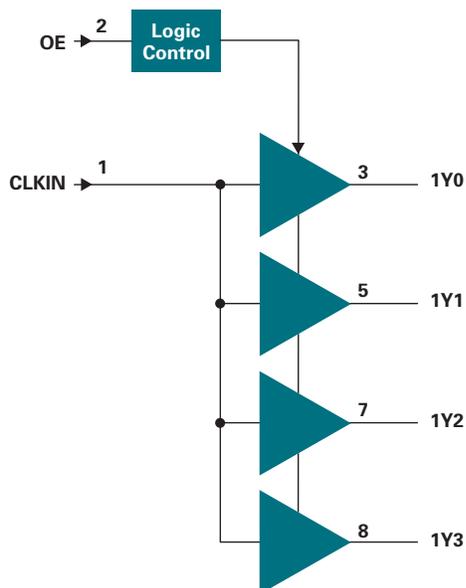
Get datasheet and app. reports at:
www.ti.com/sc/device/CDCVF111

TI's LVPECL clock driver provides distribution of high speed clock signals with extremely low jitter and skew. The CDCVF111 distributes one differential clock input to nine differential outputs for frequencies up to 650 MHz. The CDCVF111 can be used to support TI's SONET/SDH and Gigabit Ethernet transceivers.

Key Features

- Low-output skew of less than 50 ps
- Differential low-voltage ECL and low-voltage pseudo-ECL (LVPECL)-compatible input and output
- Distributes one differential clock input to nine differential clock output
- Output reference voltage (V_{REF}) allows distribution from a single-ended clock input
- Single-ended LVPECL-compatible output enable
- Packaging: 28-pin PLCC
- Supports industrial temperature ranges
- Operating frequency up to 650 MHz
- Operates from 3.3-V supply

CDCV304 Functional Block Diagram

**1:4 HIGH-PERFORMANCE LVTTTL CLOCK DRIVER****CDCV304**

Get samples, datasheet and app. reports at:
www.ti.com/sc/device/CDCV304

The CDCV304 provides 1-line to 4-line clock distribution for up to 4 additional outputs with guaranteed performance up to 140 MHz. It also features a small 8-pin TSSOP package.

Key Features

- Distributes one clock input to four outputs
- Operating frequency up to 140 MHz
- Low-output skew of less than 200 ps
- Supports industrial temperature ranges
- Output enable control drives outputs low when OE is low
- Packaging: 8-pin TSSOP
- Operates from 3.3-V supply

Applications

- Gigabit/10 Gigabit Ethernet systems
- Network switches and routers
- Can be used to drive serial transceivers, such as TI's TLK1501/2201/2501/2701/3101

16-CHANNEL LVDS DRIVERS/RECEIVERS SAVE SPACE AND COST

SN65LVDS387, SN65LVDS386

Get samples, datasheets, app. reports and EVMs at:

www.ti.com/sc/device/partnumber

Replace partnumber in URL with SN65LVDS387 or SN65LVDS386

TI's 16-channel LVDS driver and receiver devices allow designers a simple way to interface high-speed data. They can be used to drive data across a backplane or between shelves. 16-channel devices provide better channel-to-channel skew performance, need less board space and cost less than using four separate quad devices.

Key Features

- Flow-through pinout
- Integrated 110- Ω line termination option
- Parallel transfer rates up to 300 Mbps
- Output skew: less than 300 ps
- Power dissipation at 200 MHz per channel
 - Driver (35 mW typ)
 - Receiver (65 mW typ)
- Bus-terminal ESD exceeds 15 kV
- Packaging: 64-pin TSSOP (DGG)
- 8-channel parts also available

INDUSTRY'S FIRST 8-BIT, BI-DIRECTIONAL REGISTERED TRANSCEIVER WITH LVDS LEVELS

SN65LVDM320

Get samples, datasheet and app. reports at:

www.ti.com/sc/device/SN65LVDM320

The SN65LVDM320 is the world's first registered bus transceiver to benefit from the advantages of differential LVDS output levels. It offers very high throughput to designers while allowing them to maintain traditional multipoint data bus architecture. Control buses at lower operating speeds benefit from the low power consumption and low EMI generated by LVDS devices.

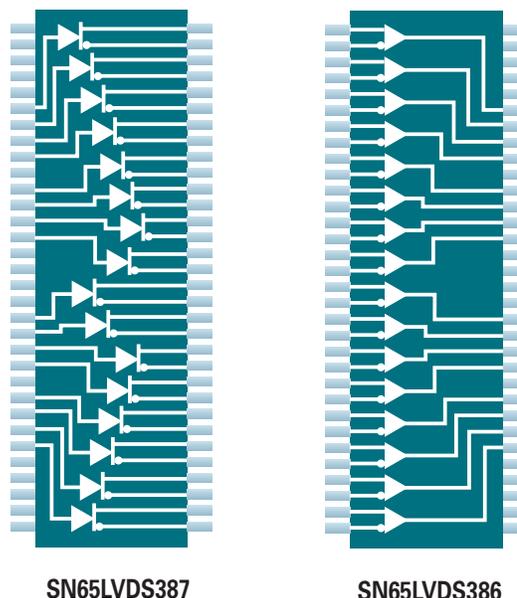
Key Features

- Designed for transfer rates up to:
 - Buffer mode: 475 Mbps
 - Flip-flop mode: 330 Mbps
 - Latch mode: 330 Mbps
- Bus and logic loopback capability
- Pulse skew: <100 ps
- Output skew: <320 ps
- Hot plugging capability
- Packaging: 64-pin TSSOP (DGG)

Applications

- Control bus
- Parallel multipoint databus

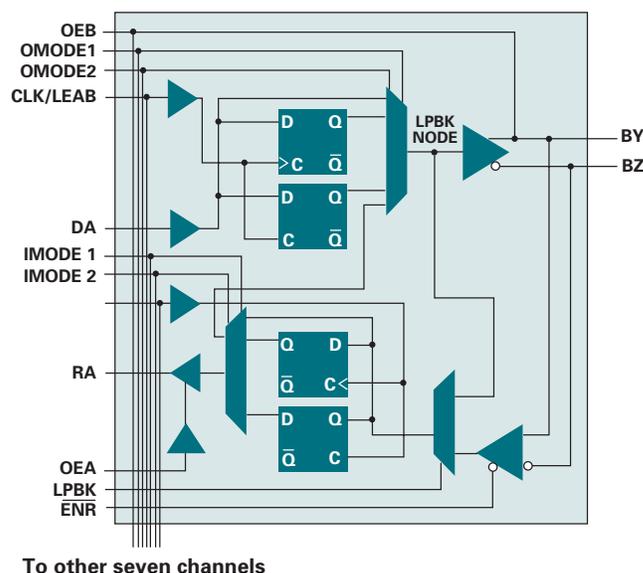
16-Channel Drivers and Receivers



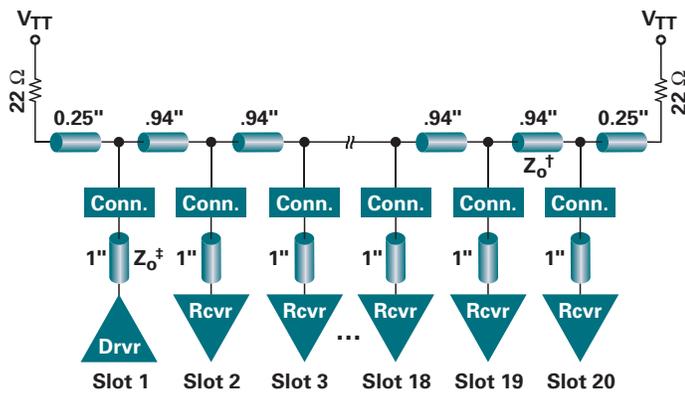
Applications

- Backplane driver
- Point-to-point interface

SN65LVDM320, One of Eight Channels



Typical GTLP Backplane



† Unloaded backplane trace natural impedance (Z_o) is 45 Ω . 45 to 60 Ω is allowed with 50 Ω being ideal.

‡ Card stub natural impedance (Z_o) is 60 Ω .

GUNNING TRANSCEIVER LOGIC PLUS (GTLP)

Get samples, datasheets and app. reports at:
www.ti.com/sc/gtlp

TI provides backplane interface solutions for telecomm/data-comm end-equipment with the open-drain GTLP technology, which provides better signal integrity and overall system improvement over traditional logic such as ABT, LVT, or FB/BTL+ allowing customers to drive heavily-loaded backplanes. GTLP was specifically designed for use in multi-slot high-performance parallel backplanes where higher frequency and higher data throughput is required. These high-speed transceivers are 5-V tolerant and can be used as translators between LVTTTL-to-GTLP and GTLP-to-LVTTTL environments.

GTLP offers a reduced output swing (>1 V), small input thresholds (± 50 mV) and significantly improved output edge control (OEC) circuitry on the rising and falling edges to reduce line reflections and electromagnetic interference while improving overall signal integrity. TI-OPC™ circuitry actively limits overshoot caused by improper termination or uneven card loading. These features allow GTLP to achieve backplane clock frequencies between 25 and 125 MHz.

Key Features and Benefits

- GTLP low-output voltage swing reduces electromagnetic interference
- Reduced-input GTLP threshold provides adequate noise margin
- TI-OPC and OEC circuitry provide improved signal integrity
- I_{off} , power-up 3-state, and BIAS V_{CC} support live insertion
- Bi-directional interface between GTLP and LVTTTL signal levels
- Bus-hold on A-port LVTTTL inputs eliminates need for pull-up and pull-down termination
- 5-V tolerant LVTTTL I/Os allowing mixed-voltage systems where 3.3-V and 5-V devices are used
- Up to 100 mA drive capability to drive heavily loaded backplanes
- Packaging: TSSOP (DGG), TVSOP (DGV), and LFBGA (GKE/GKF) space-saving packages

Applications

- Multipoint parallel backplanes

PWM SWITCHER WITH INTEGRATED FETS (SWIFT™)

TPS54616, TPS54615, TPS54614, TPS54613, TPS54612, TPS54611

Get samples, datasheets, software tool and app. reports at:
power.ti.com/swift

For point-of-load regulation for high-performance FPGAs, ASICs, DSPs, and microprocessors on optical communications modules and line cards, the SWIFT family of DC/DC regulators are low-input voltage high-output current synchronous-buck PWM converters with all required active components integrated. Evaluation modules and the SWIFT Designer software tool aid in quickly achieving high-performance power supply solution designs to meet aggressive equipment development cycles.

Key Features

- 30-W, 12-A peak MOSFET switches for high efficiency at 6-A continuous output source and sink
- 0.9-V, 1.2-V, 1.5-V, 1.8-V, 2.5-V and 3.3-V fixed output voltage devices
- Internally compensated for easy use and minimal component count
- Fast transient response—16- μ s recovery
- Wide PWM frequency:
 - Fixed 350 kHz, 550 kHz or
 - Adjustable 280 kHz to 700 kHz
- Load protected by peak current limit and thermal shutdown
- Integrated solution reduces board area and total cost communications infrastructure

5-V/3.3-V, 20-A, DUAL OUTPUT, 48-V INPUT ISOLATED DC/DC CONVERTER

PT4661

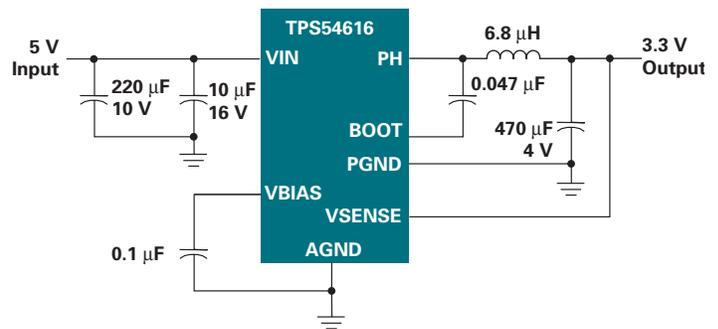
Get datasheet and app. reports at:
www.ti.com/sc/device/PT4661

The PT4660 Excalibur™ series is a dual-output isolated DC/DC converter that combines state-of-the-art power conversion technology with unparalleled flexibility. Operating from a standard telecom (–48 V) central office supply, the PT4660 series provides up to 20 ADC of output current from two independently regulated voltages (each output 15 ADC max).

Key Features

- Dual outputs
- Power-up sequencing
- Input voltage range of 36 V to 75 V
- 1500 VDC isolation
- Temperature range of –40° to 100°C
- High efficiency of 88%
- Fixed frequency operation

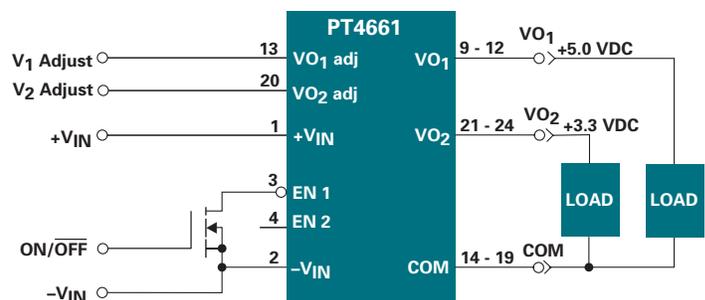
TPS54616 Block Diagram



Applications

- Low-voltage, high-density systems with power distributed at 5 V or 3.3 V
- Point-of-load regulation for high-performance DSPs, FPGAs, ASICs and microprocessors
- Broadband, networking and optical communications infrastructure

PT4661 Block Diagram



Applications

- Isolated DC/DC power modules for telecom and optical networking line cards and modules

SERIAL GIGABIT SOLUTIONS

Device	Function	Data Rate	Serial I/F	Parallel I/F	Power	Special Features	Price ¹
TLK1501	Single-ch. 16:1 SERDES	0.6-1.5 Gbps	1 CML ch.	16 LVTTTL lines	200 mW	Built-in testability	Web
TLK2501	Single-ch. 16:1 SERDES	1.6-2.5 Gbps	1 CML ch.	16 LVTTTL lines	300 mW	Built-in testability	Web
TLK2701	Single-ch. 16:1 SERDES	1.6-2.7 Gbps	1 CML ch.	16 LVTTTL lines	300 mW	Built-in testability and K character control	Web
TLK2711	Single-ch. 16:1 SERDES	1.6-2.7 Gbps	VML	16 LVTTTL lines	350 mW	MicroStar Jr.™ BGA packaging	Web
TLK3101	Single-ch. 16:1SERDES	2.5-3.125 Gbps	1 VML ch.	16 LVTTTL lines	350 mW	Built-in testability	Web
TLK2201	Single-ch.	1.0-1.6 Gbps	1 LVPECL ch.	10 LVTTTL lines	200 mW	JTAG; 5-bit DDR mode	Web
TLK22011	Single-ch. 10:1 Gigabit Ethernet Xcvr	1.2-1.6 Gbps	1 LVPECL ch.	10 LVTTTL lines	200 mW	JTAG; 5-bit DDR mode, industrial temp. qualified	Web
TLK2201JR	Single-ch. 10:1 Gigabit Ethernet Xcvr	1.0-1.6 Gbps	1 LVPECL ch.	10 LVTTTL lines	200 mW	MicroStar Jr.™ 5 x 5 Land Grid Array (LGA)	Web
TLK1201	Single-ch. 10:1 Gigabit Ethernet Xcvr	0.6-1.3 Gbps	1 LVPECL ch.	10 LVTTTL lines	200 mW	Industrial temperature	Web
TLK3104SA	Four ch. of 10/8:1 Xcvr	2.5-3.125 Gbps	4x 3.125 Gbps LVPECL (XAUI)	4x 10/8-bit SSTL/HSTL	750 mW/ch.	JTAG; programmable pre-emphasis; and XAUI I/F	Web
TLK3114SA ²	Four ch. of 10/8:1 Xcvr	2.5-3.125 Gbps	4x 3.125 Gbps LVPECL (XAUI)	4x 8/10 SSTL2/HSTL (XGMII)	600 mW	IEEE 802.3ae backplane transceiver Draft 3.1 compliant	Web
TLK3104SC	Four ch. of 4:1: Xcvr	3.0-3.125 Gbps	4x LVPECL ch.	20x622 LVDS lines	750 mW/ch.	JTAG; 8b/10b on/off	Web
DLKPC192H ² & DLKPC192S ²	Physical Coding Sublayer for 10 Gigabit Ethernet	10.3-Gbps, Aggregate	16-bit LVDS XSBI	4x 8/10 SSTL/HSTL (XGMII)	750 mW	PCS layer with MDIO control	Web
SLK2501	Single-ch. 4:1 Multirate SONET Tcvr with CDR	OC-3/12/24/48	1 LVPECL ch.	4x622 LVDS lines	900 mW	Auto-rate detection local and remote loop back	Web
SLK2501CD ¹⁴	OC-48/24/12/3 CDR	OC-3/12/24/48	1 PECL ch.	–	500 mW	Multi-rate capable	Web
SLK2504 ⁵	Four-ch. Xcvr	2.5 and 2.7 Gbps	–	622 MHz/ch	–	–	–
SLK9901 ⁵	Integrated OC-192 Xcvr	9.95 Gbps, 10.3 Gbps	Low-jitter CML	16-bit LVDS OIF99.102 compliant	800 mW	OC-192 and 10 Gigabit Ethernet support	Web
TLK10001 ⁶	10-Gigabit Ethernet LAN PHY	10.3 Gbps	Low-jitter CML	4x 3.125 Gbps LVPECL (XAUI)	2 W	PMA, PCS, and XAUI functions integrated	Web
ONET3201LD ³	3.2-Gbps Laser Driver	2.5-3.2 Gbps	PECL	–	250 mW	Automatic power control (APC), fault detection and current monitor	11.26
ONET2501PA ³	2.5-Gbps Limiting Amplifier	2.5 Gbps	PECL	–	260 mW	Low power; min 40-dB gain	5.85
ONET2511PA ³	2.5-Gbps Transimpedance Amplifier	2.5 Gbps	–	–	165 mW	Low power; min 40-dB gain; output enable	5.85
ONET2551TA ³	2.5-Gbps Limiting Amplifier	2.5 Gbps	CML	–	260 mW	Low power; min 40-dB gain CML output	5.35
ONET2501TA ³	2.5-Gbps Transimpedance Amplifier	2.5 Gbps	–	–	165 mW	2.2-GHz bandwidth; 4-k Ω transimpedance	5.85
TLK2501SAB ³	InfiniBand™ SERDES	2.5 Gbps	InfiniBand Compliant Differential	10-bit SSTL2/HSTL	250 mW	8b/10b bypass; PRBS generation and verification	17.77
TLK3101SAB ³	InfiniBand SERDES	2.5-3.125 Gbps	InfiniBand Compliant Differential	10-bit SSTL2/HSTL	350 mW	8b/10b bypass; PRBS generation and verification	20.88

¹Suggested resale price in U.S. dollars in quantities of 1,000. Please check www.ti.com for current pricing on these products.

²Planned release December, 2001.

³Planned release Q1 2002.

⁴Planned release Q2 2002.

⁵Planned release Q4 2002.

⁶Planned release Q1 2003.

CLOCK DISTRIBUTION

Device	Description	Package Options	I/O Levels (Input/Output)	Frequency (MHz)	V _{CC} (V)	Output Skew t _{sk(o)} max (ns)	Price ¹
Buffer-Based Clock Distribution							
CDC111	1:9 diff LVPECL	28-pin PLCC	LVPECL/LVPECL	0-500	3.3	0.05	Web
CDCVF111	1:9 diff LVPECL	28-pin PLCC	LVPECL/LVPECL	0-650	3.3	0.05	Web
CDC318A	1:18 clock driver with I ² C control interface	48-pin SSOP	LVTTTL/LVTTTL, TTL	0-100	3.3	0.25	Web
CDC341	1:8 w/fast t _{pd} fanout	20-pin SOIC	TTL/TTL	0-80	5	0.6	Web
CDC351/2351	1:10 w/fast t _{pd} fanout, 3-state outputs	24-pin SOIC/SSOP	LVTTTL/LVTTTL	0-100	3.3	0.5	Web
CDC391	1:6 clock driver with selectable polarity and 3-state outputs	16-pin SOIC	TTL/TTL	0-100	5	0.5	Web
CDCV304	1:4 fanout for PCI-X and general applications	8-pin TSSOP	LVTTTL/CMOS	0-140	3.3	0.17	Web
CDCVF2310	1:10 clock driver w/2 banks for general-purpose applications	24-pin TSSOP	LVTTTL/LVTTTL	0-170 (V _{DD} =2.3-2.7 V) 0-200 (V _{DD} =3-3.6 V)	2.5/3.3	(V _{DD} =2.5 V)	Web
LVDS104	1:4 diff LVDS	16-pin SOIC/TSSOP	LVDS/LVDS	0-315	3.3	0.1	2.22
LVDS105	1:5 diff LVDS	16-pin SOIC/TSSOP	LVDS/LVDS	0-315	3.3	0.1	2.22
LVDS108	1:8 diff LVDS	38-pin TSSOP	LVDS/LVDS	0-311	3.3	0.3	4.55
LVDS116	1:16 diff LVDS	64-pin TSSOP	LVDS/LVDS	0-311	3.3	0.3	5.97
PLL-Based Clock Distribution							
CDC516/2516 ²	1:16 PLL clock driver	48-pin TSSOP	LVTTTL/LVTTTL	25-125	3.3	0.2	Web
CDC536/2536 ²	1:6 PLL clock driver w/(3) at 1/2x or 2x output, 3-state outputs	28-pin SSOP	LVTTTL/LVTTTL	25-100	3.3	0.5	Web
CDC582/2582 ²	1:12 LV diff PECL PLL clock driver w/(9) at 1/2x or 2x output	52-pin TQFP	LVPECL/LVTTTL	25-100	3.3	0.5	Web
CDC586/2586 ²	1:12 PLL clock driver w/(9) at 1/2x or 2x output, 3-state outputs	52-pin TQFP	LVTTTL/LVTTTL	25-100	3.3	0.5	Web
CDCVF2505	1:5 PLL clock driver for general purpose, SSC	8-pin TSSOP/SOIC	LVTTTL/LVTTTL	24-200	3.3	0.15	Web
CDCVF2508	1:8 low-power PLL clock driver with two banks, SSC	16-pin TSSOP/SOIC	LVTTTL/LVTTTL	10-170	2.5/3.3	0.15	Web
CDCVF2509	1:9 low-power PLL clock driver for PC 133 and beyond application, SSC	24-pin TSSOP	LVTTTL/LVTTTL	50-175	3.3	0.1	Web
CDCVF2510	1:10 low-power PLL clock driver for PC 133 and beyond application, SSC	24-pin TSSOP	LVTTTL/LVTTTL	50-175	3.3	0.1	Web
PLL-Based Clocks for Memory Applications							
CDCF2509 ²	1:9 PLL clock driver for PC 133 application, SSC	24-pin TSSOP	LVTTTL/LVTTTL	25-140	3.3	0.2	Web
CDCF2510 ²	1:10 PLL clock driver for PC 133 application, SSC	24-pin TSSOP	LVTTTL/LVTTTL	25-140	3.3	0.2	Web
CDCV850	1:10 PLL clock driver for DDR SDRAM application, SSC compatible with two-line serial interface	48-pin TSSOP	HCSL, Universal (except ECL)/SSTL-II	60-140	2.5/3.3	0.075	Web
CDCV855	1:4 (plus feedback pair) PLL differential clock driver for DDR applications, SSC	28-pin TSSOP	SSTL-II/SSTL-II, LVTTTL	60-180	2.5	0.075	Web
CDCV857A	1:10 PLL differential clock driver for DDR applications, SSC	48-pin TSSOP	SSTL-II/SSTL-II	60-180	2.5	0.075	Web
CDCR83	400-MHz direct Rambus™ clock generator, SSC	24-pin SSOP	CMOS/RSL ³	267-400	3.3	–	Web
CDCFR83	533-MHz direct Rambus clock generator, SSC	24-pin SSOP	CMOS/RSL ³	287-533	3.3	–	Web

¹Suggested resale price in U.S. dollars in quantities of 1,000. Please check www.ti.com for current pricing on these products.

²With series output resistors.

³Rambus signaling levels.

Notes: For more information regarding test conditions used to obtain measurements, see datasheet.

Converted from V/ns datasheet value to ns value, based on 0.4- to 2-V voltage rise/fall.

LVDS LINE DRIVERS AND RECEIVERS

Device	Max Drvr/Rcvr t_{pd} (ns)	Max Speed (Mbps)	Max Supply Current (mA)	HBM ESD Protection (kV)	# Inputs	# Outputs	Output Skew (ps) ²	Pulse Skew (ps) ²	Package Options	Comments	Price ¹
SN65LVDS1	3.1	630	8	15	1 LVTTTL	1 LVDS	–	300 typ	5-pin SOT-23, 8-pin SOIC	Single driver	0.76
SN65LVDS2	3.6	400	7	15	1 LVDS	1 LVTTTL	–	600 max	5-pin SOT-23, 8-pin SOIC	Single receiver	0.76
SN65LVDS22	6	400	20	12	2 LVDS	2LVDS	–	200 typ	16-pin SOIC 16-pin TSSOP	2:2 MUX (crosspoint)	3.01
SN65LVDS31	2.5	400	35	8	4 LVTTTL	4 LVDS	300 max	300 max	16-pin SOIC 16-pin TSSOP	Quad driver	2.12
SN65LVDS32 ³	3	400	18	8	4 LVDS	4 LVTTTL	300 max	400 max	16-pin SOIC 16-pin TSSOP	Quad receiver	2.84
SN65LVDS33 ³	6	400	23	15	4 LVDS	4 LVTTTL	150 typ	200 typ	16-pin SOIC, 16-pin TSSOP	Quad receiver	2.53
SN65LVDS047	2.8	400	26	8	4 LVTTTL	4 LVDS	300 max	300 max	16-pin SOIC, 16-pin TSSOP	Quad driver	1.83
SN65LVDS048A	3.7	400	15	10	4 LVDS	4 LVTTTL	500 max	450 max	16-pin SOIC, 16-pin TSSOP	Quad receiver	2.00
SN65LVDS104	4.2	630	35	15	1 LVDS	4 LVDS	100	500	16-pin SOIC, 16-pin TSSOP	4-port repeater	2.22
SN65LVDS105	3.5	630	35	15	1 LVTTTL	4 LVDS	100	500	16-pin SOIC, 16-pin TSSOP	4-port LVTTTL-to-LVDS repeater	2.22
SN65LVDS108	4.5	630	85	12	1 LVDS	8 LVDS	300	500	38-pin SOIC, 38-pin TSSOP	8-port repeater	4.55
SN65LVDS109	4.5	630	64	12	2 LVDS	8 LVDS	550	500	38-pin SOIC, 38-pin TSSOP	Dual 4-port repeater	4.55
SN65LVDS116	4.7	622	115	12	1 LVDS	16 LVDS	300	500	64-pin SOIC, 64-pin TSSOP	16-port repeater	5.97
SN65LVDS117	4.5	630	122	12	2 LVDS	16 LVDS	550	500	64-pin SOIC, 64-pin TSSOP	Dual 8-port repeater	5.97
SN65LVDS386 ³	4	300	70	4	16 LVDS	16 LVTTTL	400 max	600 max	64-pin TSSOP	16-ch. receiver	8.21
SN65LVDS387	2.9	630	95	15	16 LVTTTL	16 LVDS	150 max	500 max	64-pin TSSOP	16-ch. receiver	8.21
SN75LVDS388A ³	4	300	40	4	8 LVDS	8 LVTTTL	400 max	600 max	38-pin TSSOP	Octal receiver	3.60
SN65LVDS389	2.9	300	70	4	8 LVTTTL	8 LVDS	150 max	500 max	38-pin TSSOP	Octal driver	4.15

¹Suggested resale price in U.S. dollars in quantities of 1,000.

² $R_L = 100 \Omega$, $C_L = 10 \text{ pF}$ with max. spec.

³Integrated termination option.

GTLP TRANSCEIVERS

Device	Description	Price ¹
SN74GTLP1394	2-bit LVTTTL-to-GTLP adjustable-edge-rate bus Xcvr w/split LVTTTL port, feedback path, & selectable polarity	3.76
SN74GTLP817	GTLP-to-LVTTTL 1-to-6 fanout driver	5.43
SN74GTLP1612	18-bit LVTTTL-to-GTLP adjustable-edge-rate universal bus transceiver	9.19
SN74GTLP1616	17-bit LVTTTL-to-GTLP adjustable-edge-rate universal bus transceiver with buffered clock outputs	9.19
SN74GTLP1655	16-bit LVTTTL-to-GTLP adjustable-edge-rate universal bus transceiver	9.19
SN74GTLP16612	18-bit LVTTTL-to-GTLP universal bus transceiver	7.35
SN74GTLP16912	18-bit LVTTTL-to-GTLP universal bus transceiver	7.93
SN74GTLP16916	17-bit LVTTTL-to-GTLP universal bus transceiver with buffered clock outputs	7.93
SN74GTLP306	8-bit LVTTTL-to-GTLP bus transceiver	4.68

¹Suggested resale price in U.S. dollars in quantities of 1,000.

POWER MANAGEMENT PRODUCTS

Device	Input Bus Voltage	Description	P _{OUT} or I _{OUT}	V _O Range (V)	V _O Adjustable	Price ¹
Plug-In Power Solutions						
Isolated						
PT4660	48 V	20 A dual output 48V-input DC/DC converter	20 A	2.5/1.8, 3.3/1.5, 3.3/1.8, 3.3/2.5, 5/1.8, 5/3.3	x	99.19
PT4560	48 V	30 watt 48V-input DC/DC converter	30 W	1.8, 2, 2.5, 3.3, 5, 5.2, 12, 15	x	38.52
Non-Isolated						
PT5020	5 V	6 watt 5V-input plus to minus voltage ISR	6 W	-1.7, -3.3, -5, -5.2, -5.5, -6, -6.5, -8, -9, -12, -15	-	9.50
PT6640	12 V	24 watt 12V-input plus to minus voltage ISR	24 W	-2.5, -3.3, -5, -9, -12, -15	x	18.99
PT6910	3.3 V/ 5 V	12 watt 3.3V/5V input plus to minus voltage ISR	12 W	-2, -5.2, -1.5	x	26.25
PT6935	3.3 V/ 5 V	11 A 5V-input dual output ISR	11 A	3.3/2.5, 3.3/1.8, 3.3/1.5	x	27.36
PT7760	5 V	40 A 5V-input programmable ISR	40 A	1.3 to 3.5 programmable	x	50.84
PT8000	5 V	60 A 5V-input multi-phase programmable ISR	60 A	1.075 to 1.850, 1.3 to 3.5 programmable	x	102.81

¹Suggested resale price in U.S. dollars in quantities of 1,000.

Device	Description	V _{IN} Range (V)	Fault Reporting	Average Power Limiting	Supply Current (mA)	Enable/Shutdown	Price ¹
Hot-Swap Controllers							
UCC2913	Negative floating, di/dt control	<-10.5	Yes	Yes	1	SH: Active-High	1.51
UCC2921	Latchable, neg. floating, di/dt control	<-10.5	Yes	Yes	1	SH: Active-High	1.73

¹Suggested resale price in U.S. dollars in quantities of 1,000.

Device	V _{CC} (min-max) (V)	V _O (V)	V _O Accuracy (%)	Output Current (A)	Switching Freq. (kHz)	Quiescent Current (mA)	Shutdown Current (mA)	Eff. (%)	Power Good	Low Battery Warning	Shutdown	UVLO	Price ¹
PWM Switcher with Integrated FETs (SWIFT™)													
TPS54610	3.0-6.0	Adj	1%	6	280-700	11	1	87% @6A	Y	X	Y	Internal	5.05
TPS54611	3.0-6.0	0.9	2%	6	280-700	11	1	87% @6A	Y	X	Y	Internal	5.15
TPS54612	3.0-6.0	1.2	2%	6	280-700	11	1	87% @6A	Y	X	Y	Internal	5.15
TPS54613	3.0-6.0	1.5	2%	6	280-700	11	1	87% @6A	Y	X	Y	Internal	5.15
TPS54614	3.0-6.0	1.8	3%	6	280-700	11	1	87% @6A	Y	X	Y	Internal	5.15
TPS54615	3.0-6.0	2.5	3%	6	280-700	11	1	87% @6A	Y	X	Y	Internal	5.15
TPS54616	3.0-6.0	3.3	3%	6	280-700	11	1	87% @6A	Y	X	Y	Internal	5.15

¹Suggested resale price in U.S. dollars in quantities of 1,000.

Device	V _{IN} (V)	V _O		V _{REF} Tol (%)	Driver Current (A)	Output Current (A) ²	Multiple Outputs	Adaptive Voltage Positioning	Protection ³	Comments	Price ¹
		(max) (V)	(min) (V)								
Switching DC/DC Controllers (non-isolated applications)											
TPS56300	2.8 - 5.5	3.3	1.3	1.5	2	30	Yes	Yes	OCP, OVP, UVLO, PG	Switcher for core(s), LDO for I/O power	4.10
TPS56302	2.8 - 5.5	3.3	1.3	1.5	2	30	Yes	Yes	OCP, OVP, UVLO, PG	LDO for core, switcher for I/O and rest of system power	4.10
TPS5100	2.7 - 7.0	Depends	1.25	1	0.02	Depends on FET driver	Yes	No	OCP, UVLO	Dual PWM boost and one PWM buck/invert	1.46
TPS5102	4.5 - 2.5	24	1.2	1.5	1.5	15 (each)	Yes	No	OCP, UVLO	Dual controller for Notebook system power	3.13
TPS5103	4.5 - 2.5	24	1.2	1.5	1.5	20	No	No	OCP, UVLO	Wide input voltage controller	2.12
TPS5120	4.5 - 28	26	0.9	1.5	1500	15 (each)	Yes	No	OCP, UVLO, PG, OVP	Dual 180 degree out-of-phase operation	3.33
UC3573	4.75 - 30	24	1.5	2	0.5	5	No	No	OCP, UVLO	PWM Simple Buck	1.62
UCC3585	3 - 6	5	0.9	1	1	7	No	Yes	OCP, UVLO	Low output voltage application	1.89
TL5001	3.6 - 40	50	1	5	0.02	Depends on FET driver	No	No	UVLO, SCP	PWM Buck/Boost	0.41

¹Suggested resale price in U.S. dollars in quantities of 1,000.

²Current levels of this magnitude and beyond can be supported.

³Over-current protection (OCP), under-voltage lockout (UVLO), short-circuit protection (SCP), power good (PG), over-voltage protection (OVP).

Continued on next page

POWER MANAGEMENT PRODUCTS (CONTINUED)

Device	Typical Power Level (W)	Practical Freq. (max) (MHz)	Start-up Current (μ A)	Operating Current (μ A)	Supply Voltage (V)	UVLO On/Off (V)	V_{REF} Tol. (%)	Max Duty Cycle (%)	Soft Start	Shutdown	Internal Drive Sink/Source (A)	Package Options	Price ¹
PWM DC/DC Converter Controllers													
UCC2800	–	–	–	–	7.2 - 12	7.2/6.9	–	100	–	–	–	8-pin SOIC/TSSOP/PDIP	1.76
UCC2801	10 - 200	1	100	500	7.2 - 12	7.2/6.9	1.5	100	Yes	No	1 / 1	8-pin SOIC/TSSOP/PDIP	1.76
UCC2802	10 - 200	1	100	500	9.4 - 12	9.4/7.4	1.5	100	Yes	No	1 / 1	8-pin SOIC/TSSOP/PDIP	1.76
UCC2803	10 - 200	1	100	500	12.5 - 12	12.5/8.3	1.5	100	Yes	No	1 / 1	8-pin SOIC/TSSOP/PDIP	1.76
UCC2804	10 - 200	1	100	500	4.1 - 12	4.1/3.6	1.5	50	Yes	No	1 / 1	8-pin SOIC/TSSOP/PDIP	1.76
UCC2805	10 - 200	1	100	500	12.5 - 12	12.5/8.3	1.5	50	Yes	No	1 / 1	8-pin SOIC/TSSOP/PDIP	1.76
UCC2807-3	10 - 200	1	100	1300	4.3 - 13.5	4.3/4.1	2.5	78	Yes	No	1 / 1	8-pin SOIC/TSSOP/PDIP	1.91
UCC2809-1	10 - 200	1	100	600	10 - 19	10/8	–	Prog.	Yes	No	1/1	8-pin MSOP/TSSOP/SOIC/PDIP	0.87
UCC28C42	10 - 200	1	50	2300	9 - 18	14.5/9.0	5	100	No	No	1/1	8-pin MSOP/TSSOP/SOIC/PDIP	1.11
UCC2581	10 - 250	1	50	300	7.3 - 15	7.3/6.8	2	100	Yes	Yes	1/1	8-pin MSOP/SOIC/PDIP	1.92
UCC25705	5 - 200	4	85	4300	8.8 - 15	8.8/8.2	1.5	Prog.	No	No	0.25/0.5	8-pin MSOP/SOIC/PDIP	1.14
UCC2960	25 - 250	0.4	150	2300	10 - 17.5	10/8	5	72	Yes	No	1.5/0.75	8-pin SOIC/PDIP	1.31
UCC2895	100 - 1200	1	150	5000	11 - 17	11/19	1	100	Yes	Yes	0.1/0.1	20-pin SOIC/PDIP TSSOP/PLCC	4.91

¹Suggested resale price in U.S. dollars in quantities of 1,000.

Device	V_{CC} (min-max) (V)	V_O (V)	V_O Accuracy (%)	Output Current (A)	Switching Freq. (kHz)	Quiescent Current (typ) (mA)	Shutdown Current (typ) (mA)	Eff. (%)	Shutdown	Under-Voltage Lockout	Price ¹
DC/DC SEPIC Converters and Inverters											
TPS6735	4 - 6.2	–5	4	200	160	1900	10	78	X	X	1.25
TPS6755	2.7 - 9	Adj.	4	200	160	1900	10	78	X	–	1.25

¹Suggested resale price in U.S. dollars in quantities of 1,000.

Device	Input Bus Voltage (V)	Package Options	Description	P_{OUT} or I_{OUT}	V_O Range (V)	Isolation Voltage (V_{RMS})	V_O Adjustable (V)	Price ¹
Integrated Power Products								
DCT104803	48	DIL-28, Gull Wing	6.6-W telecom, isolated DC/DC converter, soft start, remote sensing, under-voltage lockout, basic insulation	2 A	3.3	1500	\pm 10	19.50
DCT104805	48	DIL-28, Gull Wing	6.6-W telecom, isolated DC/DC converter, soft start, remote sensing, under-voltage lockout, basic insulation	2 A	5	1500	\pm 10	19.50

¹Suggested resale price in U.S. dollars in quantities of 1,000.

TEXAS INSTRUMENTS — ENABLING DYNAMIC INTELLIGENT OPTICAL NETWORKING

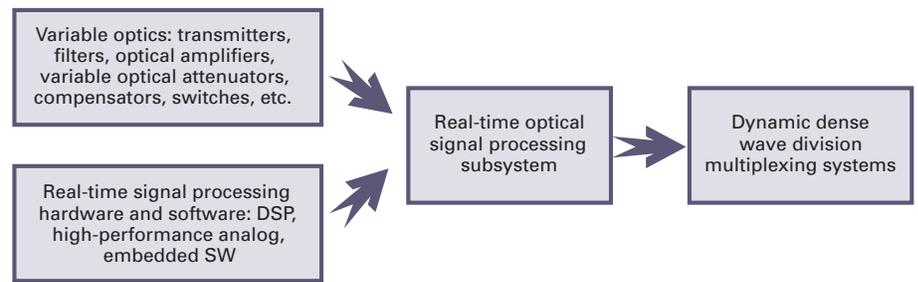
As the next-generation of optical networking emerges, it will evolve from the existing fixed point-to-point optical links to a dynamic network, with all-optical switches, varying path lengths, and a new level of flexibility available at the optical layer.

What's driving this requirement?

In the metro area network (MAN), service providers now need faster provisioning times, improved asset utilization, and economical fault recovery techniques. However, without a new level of functionality from optical components and sub-systems, optical layer flexibility won't happen. At the same time, optical components must become more cost effective, occupy less space, and consume less power.

Texas Instruments is ready with a wide array of semiconductor solutions to make it all happen. Profiled in this guide: high efficiency TEC drivers, highly integrated monitoring and control solutions for transmission and pump lasers, TMS320™ DSP and MSP430 microcontroller options ranging from highest performance to smallest footprint, linear products for photodiode

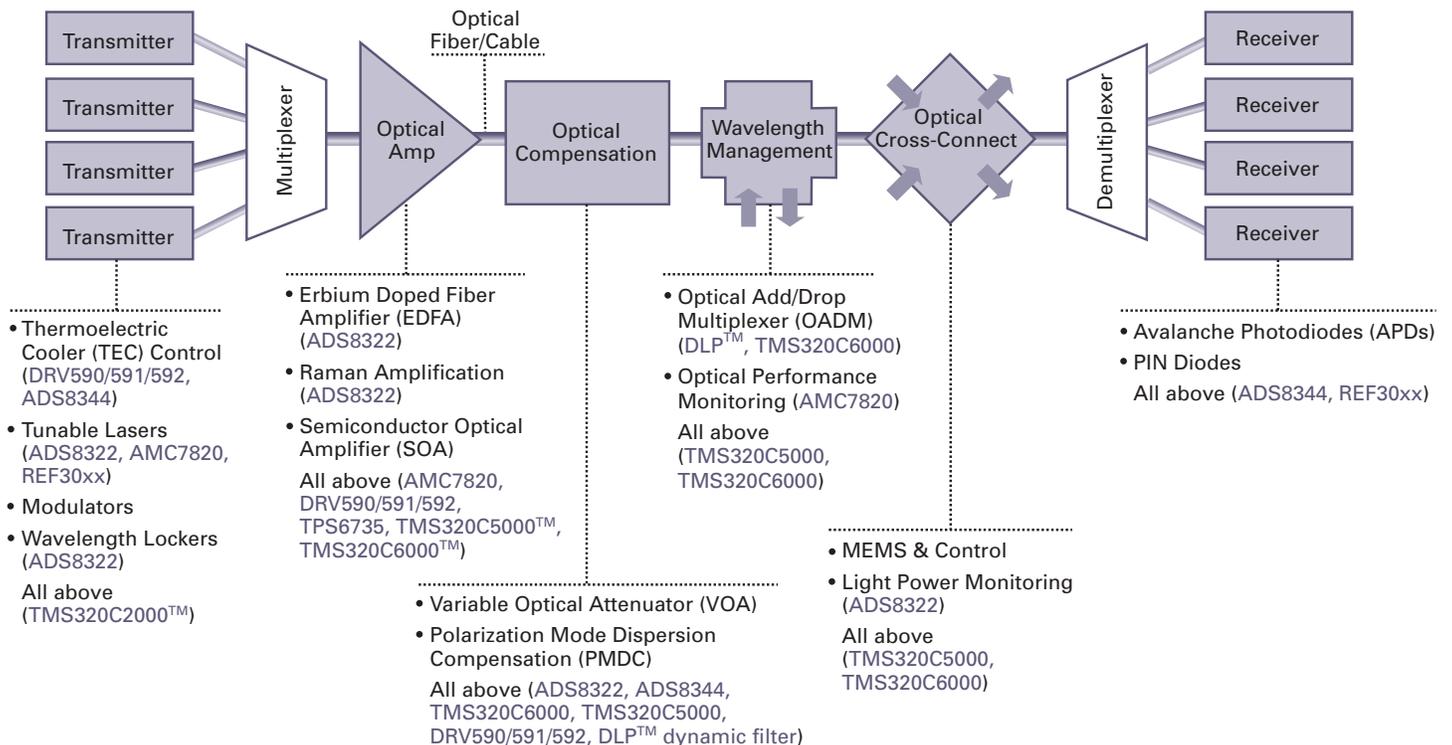
Dynamic Optical Networking



conditioning and biasing, unique Digital Light Processing™ technology, and much more. The diagram directly below highlights applications and some of the available TI solutions.

Combining variable optics with the power of TI High-Performance Analog and DSP, dynamic DWDM systems can become a reality. Real-time signal processing, available at every optical networking node, will enable the intelligent optical layer. This means the opportunity for advanced features such as optical signaling, auto-discovery, and automatic provisioning and reconfiguration, all happening at the optical layer.

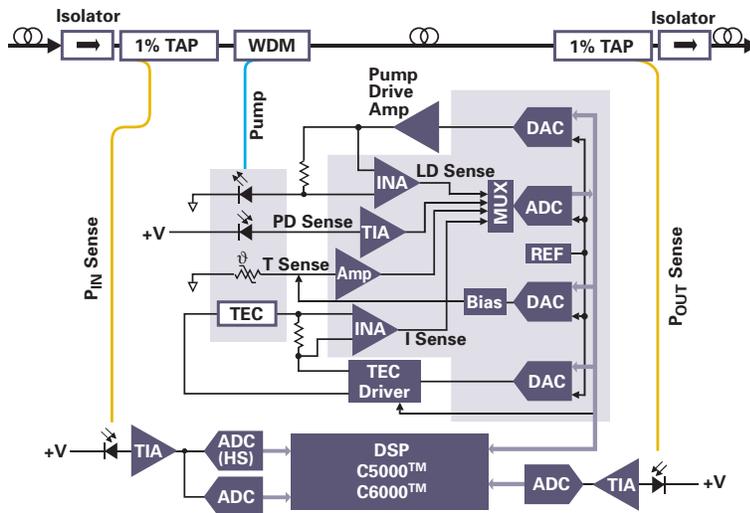
Applications for Real-Time Signal Processing & TI Optical Components



OPTICAL AMPLIFIERS

Dynamic optical amplifiers (e.g., EDFAs, Raman amplifiers, SOAs), capable of operation in complex switched networking environments, are increasingly important sub-systems in the creation of a dynamic optical layer. Texas Instruments offers the semiconductor products required to design and build optical amplifiers for all applications whether long haul or metro. Available devices are an analog monitor and control interface IC (AMC7820), high-efficiency TEC drivers (DRV590/591/592) for pump lasers, as well as other high-performance analog products and TMS320™ DSPs.

Erbium-Doped Fiber Amplifier (EDFA) Application



TO KNOW MORE ▶

For detailed information about ICs for optical amplifiers:

AMC7820 analog interface	15
DRV591 TEC driver	16
TMS320C5000™ DSP	16
ADS8322 A/D converter	17
TPS6735 DC/DC converter	17
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ADS8344 A/D converter	22
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ANALOG INTERFACE CIRCUIT

AMC7820*



Get samples, datasheet, app. reports and EVMs at: www.ti.com/sc/device/AMC7820

The AMC7820 is a high-performance and space-saving solution for DWDM applications. The industry's first single-chip solution integrates ADC, DAC and operational amplifiers to provide monitoring and control of the analog signal and an efficient interface to host processor.

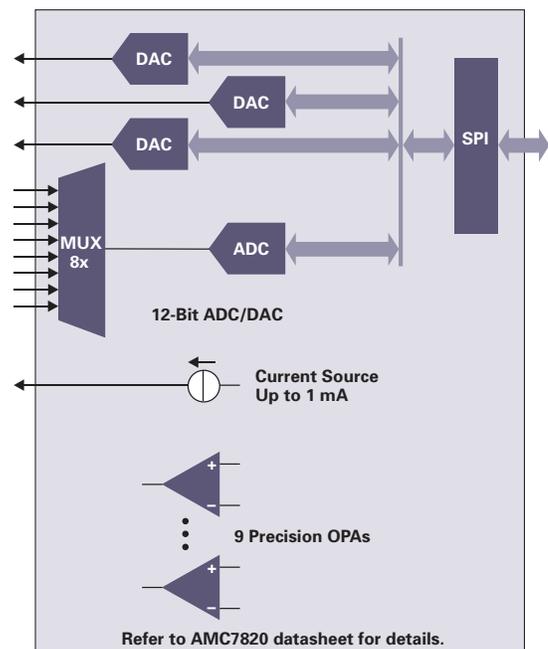
Key Features

- 100-kHz sampling rate ADC
- Three DACs
- Nine operational amplifiers
- Thermistor current source
- SPI serial interface
- Low power: 60 mW (3-V/5-V logic)
- Packaging: 48-pin TQFP
- Eight input channels
- Internal 2.5-V reference

Applications

- Thermoelectric cooler (TEC) and pump laser control in EDFA and Raman
- Optical performance monitoring
- Tunable lasers

AMC7820 Block Diagram



*The AMC7820 is in the product preview stage of development. Expected availability is 1Q 2002.

±3-A HIGH-EFFICIENCY PWM POWER DRIVER

DRV591*



Get samples, datasheet, app. reports and EVMs at:
www.ti.com/sc/device/DRV591

The DRV591 is a high-efficiency, high-current power amplifier ideal for driving a wide variety of thermoelectric cooler elements in systems powered from 2.7 V to 5.5 V. PWM operation and low output stage on-resistance significantly decrease power dissipation in the amplifier.

Key Features

- ±3-A output current
- Low supply voltage operation: 2.7 V to 5.5 V
- High efficiency generates less heat
- Overcurrent and temperature protection
- Fault indicators for over-current, temperature, and under-voltage lockout
- Two selectable switching frequencies
- Internal or external clock sync
- PWM scheme optimized for EMI
- Packaging: 9x9-mm PowerPAD™ quad flatpack or 5x5-mm MicroStar Jr.™ packages

*The DRV591 is in the product preview stage of development. Expected availability is December, 2001

PERFORMANCE AND FOOTPRINT OPTIMIZED DSPs

TMS320C5000™ DSP Platform

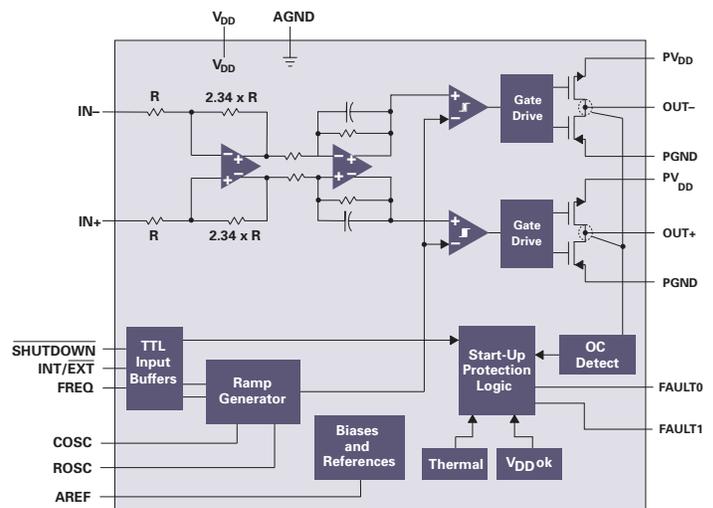
Get samples, datasheets and app. reports at:
<http://dspvillage.ti.com/c5000>

TI's TMS320C5000™ DSP platform provides high-performance signal analysis and control for optical networking component design. The C5000™ DSP family offers a wide range of DSP performance, memory configurations and interfaces, control and communications peripherals and packaging options. The C5000 DSP family meets the space, low power dissipation, performance and time-to-market needs of optical component developers.

Key Features

- MIPS: C54x: 30-160, C55x: up to 400
- High-density BGA packaging
- Serial communications; SPI, I²C, UART, McBSP
- 6-channel DMA controller per core
- Host port interface
- Very low power dissipation
- Supported by eXpressDSP™ Real-Time Software Technology including Code Composer Studio™ Integrated Development Environment (IDE) and DSP/BIOS™ real-time kernel

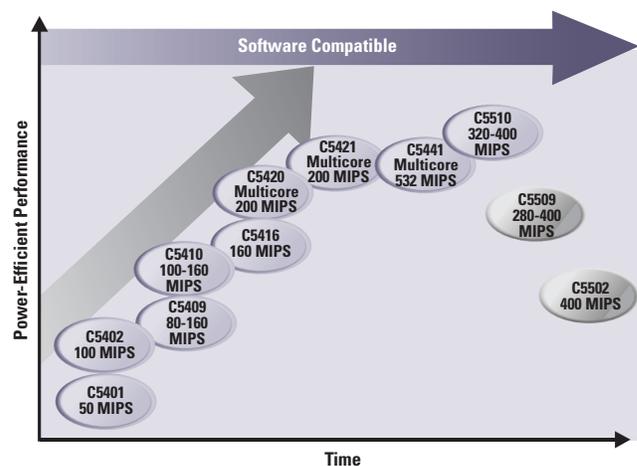
DRV591 Block Diagram



Applications

- Thermoelectric cooler (TEC) driver
- Laser diode biasing

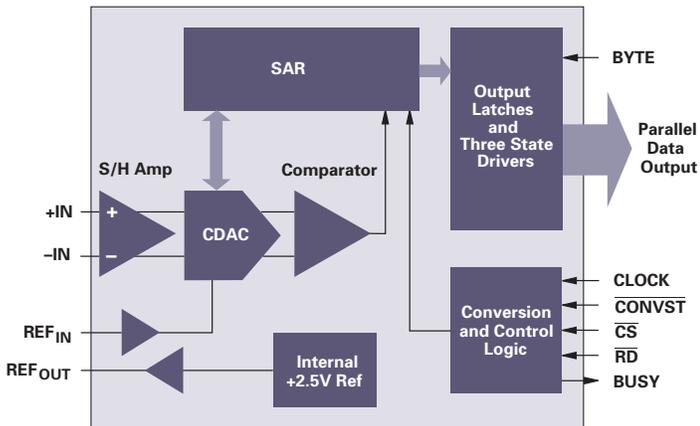
TMS320C5000™ DSP Platform Roadmap



Applications

- Optical amplifier control - EDFA and Raman
- Variable optical attenuators (VOAs)
- Tunable lasers
- Optical performance monitors (OPMs)
- Optical cross connects (OXC)
- Optical add/drop multiplexers (OADMs)

ADS8322 Block Diagram



16-BIT, 500-kHz, MICROPOWER SAMPLING ANALOG-TO-DIGITAL CONVERTER

ADS8322

Get samples, datasheet and app. reports at:
www.ti.com/sc/device/ADS8322

The ADS8322 delivers the industry's best combination of price/performance for a 16-bit, 500-kSPS ADC. Complete with 2.5-V internal reference and simple processor interface, the ADS8322 needs only 85 mW of power at full speed. With the smallest package available there is no better alternative than the ADS8322.

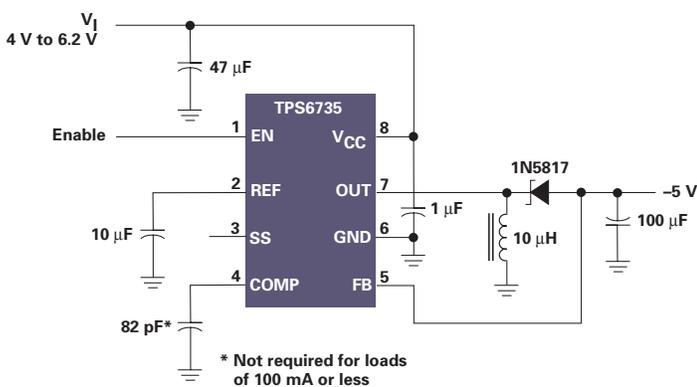
Key Features

- High-speed parallel interface
- 500-kHz sampling rate
- Low power: 85 mW at 500 kHz
- Internal 2.5-V reference
- Unipolar input range
- Packaging: 32-pin TQFP

Applications

- Control, tunable lasers
- Wavelength lockers
- Erbium doped fiber amplifier (EDFA)
- Raman amplification
- PMDC
- Optical performance monitoring
- Light power monitoring

TPS6735 Block Diagram



FIXED NEGATIVE 5-V 200-mA INVERTING DC/DC CONVERTER

TPS6735

Get samples, datasheet, app. reports and EVMs at:
www.ti.com/sc/device/TPS6735

The TPS6735 is a 160-kHz current-mode pulse-width-modulation (PWM) controller with a p-channel MOSFET power switch. It is attractive for board-level DC/DC conversion in equipment requiring high efficiency and low supply current.

Key Features

- Negative 5-V 200-mA output ($V_{CC} \geq 4.5\text{ V}$)
- 4-V to 6.2-V input operating range
- 78% typical efficiency
- 160-kHz fixed-frequency current-mode PWM controller
- EN input inhibits operation and reduces supply current to 1 μA
- Soft start
- Packaging: 8-pin SOIC and 8-pin DIP
- -40°C to 85°C free-air temperature range
- Pin-for-pin compatible with MAX735

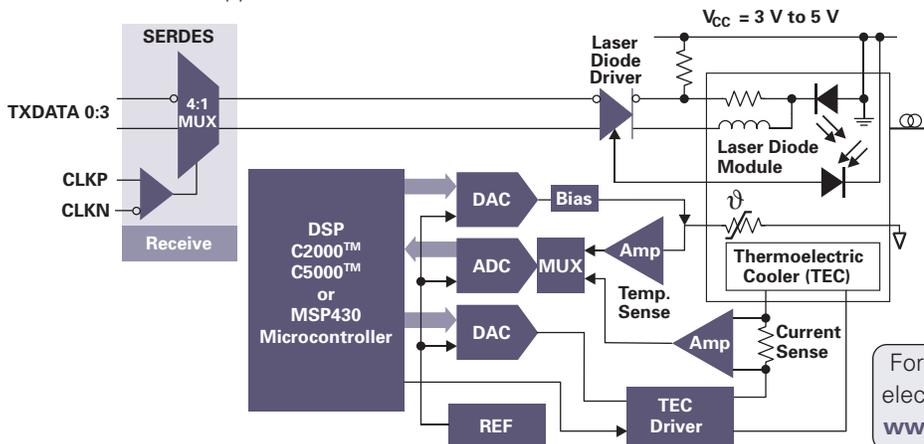
Applications

- Optical amplifier biasing

TRANSMISSION LASERS

Transmission lasers for optical networking/DWDM, whether fixed-frequency or tunable, require suitable integrated circuit solutions. Applications include driving and biasing diodes, and monitoring and control of laser parameters. Texas Instruments offers high-performance integrated solutions that also lead the industry in meeting demanding footprint and power requirements. The MSP430 ultra-low-power microcontroller, the C2000™ DSP family for tunable lasers, and high-efficiency TEC drivers, are only a partial list of available products. In addition to this section, also refer to the “Physical Layer” and “Optical Layer: Photodiodes” sections of this guide for information about other available products.

Transmission Laser Application



TO KNOW MORE ▶

For detailed information about ICs for transmission lasers:

TMS320C2000™ DSP	18
MSP430F149 microcontroller	19
INA121 instrumentation amp	19
AMC7820 analog interface	15
DRV591 TEC driver	16
ADS8322 A/D converter	17
REF30xx voltage references	23
ADS8344 A/D converter	22
Photodiodes	24

For an application report with details on opto-electronic circuits useful in laser modules, refer to: www-s.ti.com/sc/psheets/sbea001/sbea001.pdf

CONTROL-OPTIMIZED DSPs

TMS320C2000™ DSP Platform

Get samples, datasheets and app. reports at: <http://dspvillage.ti.com/c2000>

TI's TMS320C2000™ DSP platform provides the highest level of on-chip integration and powerful computational ability for tunable laser applications. The C2000™ DSP's integrated flash memory, multi-channel analog-to-digital converter and serial communications and control peripherals offer high-performance control in a minimum of space. TI's advanced TMS320C28x™ DSP product family additions bring even higher levels of DSP performance and peripherals.

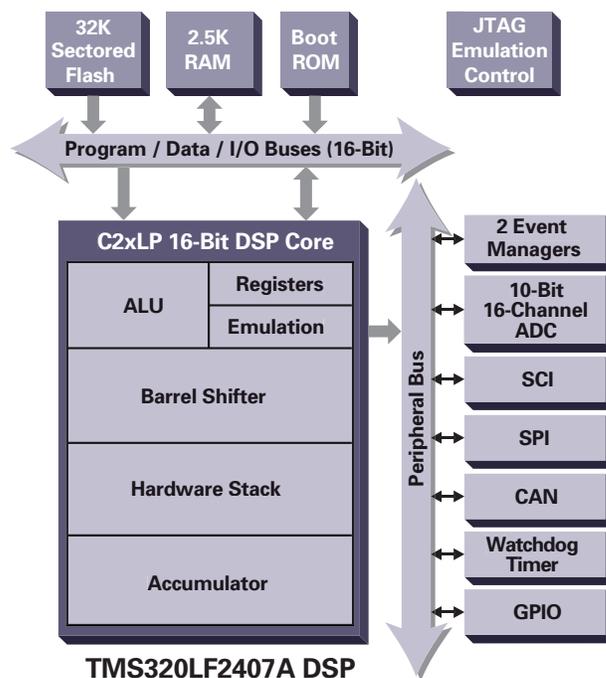
Key Features

- MIPS: C24x: Up to 40, C28x: Up to 150
- On-chip Flash memory
- On-chip A/D converters
- High level of integration in ultra-small BGA and LQFP packages
- Serial communications interface (SCI)
- Serial peripheral interface (SPI)
- Integrated control peripherals; timers, PWM, watchdog
- C2000™ DSP optical networking software library

Applications

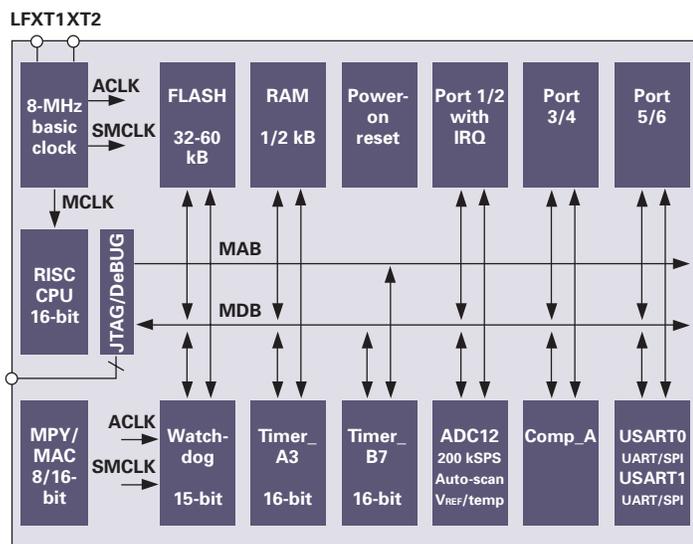
- Tunable lasers
- Thermoelectric cooler (TEC) control
- Monitoring and control in optical transponders and modules
- EDFA amplifier pump laser control
- Raman amplifier pump laser control

TMS320LF2407A DSP Block Diagram



New—Available Soon
 TMS320F2810/TMS320F2812 — 150 MHz, 64/128K Flash, 12-bit A/D. See selection guides on p. 31 for more details or <http://dspvillage.ti.com>

MSP430F149 Block Diagram



HIGH-PERFORMANCE 16-BIT RISC FLASH MCU

MSP430F149

Get samples, datasheet, app. reports and EVMs at:
www.ti.com/sc/device/MSP430F149

Ultra-low power consumption and integrated high-performance analog peripherals make the MSP430F149 ideal for cost, power and space-sensitive optical networking applications.

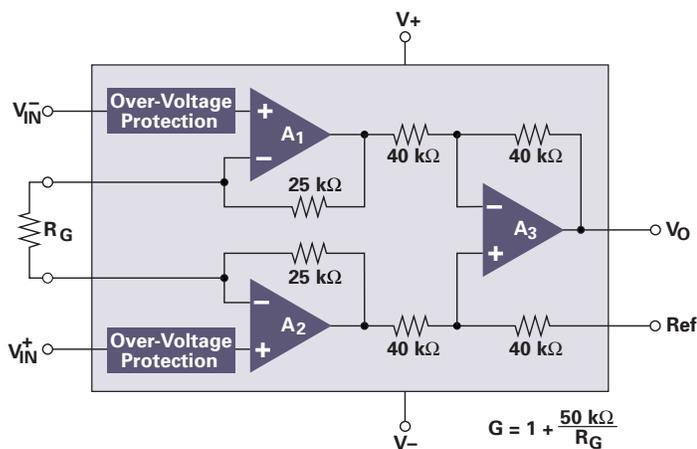
Key Features

- Ultra-low power consumption: 250- μ A active mode, 0.8- μ A standby mode at 2.2 V (typ)
- High-performance integrated analog peripherals reduce system cost and speed time-to-market
- 16-bit RISC architecture enables new applications at a fraction of the code size
- Two 16-bit PWM timers allow highly flexible multichannel capture and compare
- In-system programmable Flash permits last-minute code changes, field upgrades, and data logging to Flash
- The MSP-FET430P140 offers a completely integrated development environment for only \$99

Applications

- Optical transmitter/transponder monitoring and control
- Optical receiver monitoring and control
- TEC control

INA121 Block Diagram



Applications

- Low-level transducer amplifiers
 - Bridge, RTD, thermocouple
- High-impedance transducers
- Capacitive sensors

FET-INPUT, LOW-POWER INSTRUMENTATION AMPLIFIER FOR TEMPERATURE MONITORING

INA121

Get samples, datasheet and app. reports at:
www.ti.com/sc/device/INA121

The combination of low cost, low power, and low bias current make the INA121 an excellent choice for a wide variety of applications including conditioning of RTD devices found in laser diode modules.

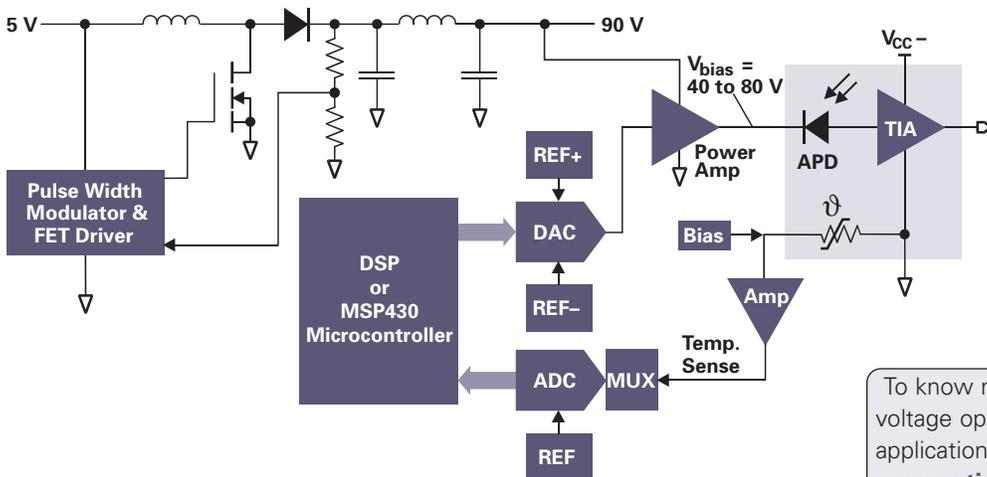
Key Features

- Low bias current: ± 4 pA
- Low quiescent current: ± 450 μ A
- Low-input offset voltage: ± 200 μ V
- Low-input offset drift: ± 2 μ V/ $^{\circ}$ C
- Low input noise: 20 nV/ $\sqrt{\text{Hz}}$ at $f = 1$ kHz ($G = 100$)
- High CMR: 106 dB
- Wide supply range: ± 2.25 V to ± 18 V
- Low nonlinearity error: 0.001% max
- Input protection to ± 40 V
- Packaging: 8-pin DIP and SO-8 surface mount

AVALANCHE PHOTODIODE (APD) RECEIVERS

For APD receivers, Texas Instruments offers integrated circuit solutions for signal conditioning, diode biasing, diode temperature monitoring and control, and intensity monitoring. These solutions include a wide range of high-performance analog ICs suitable for many applications, as well as space-saving and power efficient DSP and MSP430 microcontroller options for complex receiver module designs, where multiple parameters require monitoring and/or control. For profiles of other devices suitable for APD receiver designs, please refer to the "Optical Layer: Photodiodes" section.

APD Receiver Application



TO KNOW MORE ▶

For detailed information about ICs for APD receivers:

UCC2803 boost converter controller	20
TMS320C2000™ DSP	18
MSP430F419 microcontroller	19
ADS8344 A/D converter	22
REF30xx voltage references	23
Photodiodes	24

To know more about using TI's OPA445 (high-voltage op amp) to bias an APD for fiber optic applications, refer to:

www-s.ti.com/sc/psheets/sbea001/sbea001.pdf

LOW-POWER BICMOS CURRENT-MODE PWM

UCC2803

Get samples, datasheet and app. reports at:
www.ti.com/sc/device/UCC2803

High-frequency boost converter controller used to provide back bias for the Avalanche Photodiode in optical receivers. Current-mode control coupled with very high-frequency operation results in a compact high-voltage power supply that is temperature compensated and is also capable of varying output voltage to cover entire APD operating range based on system's DAC input.

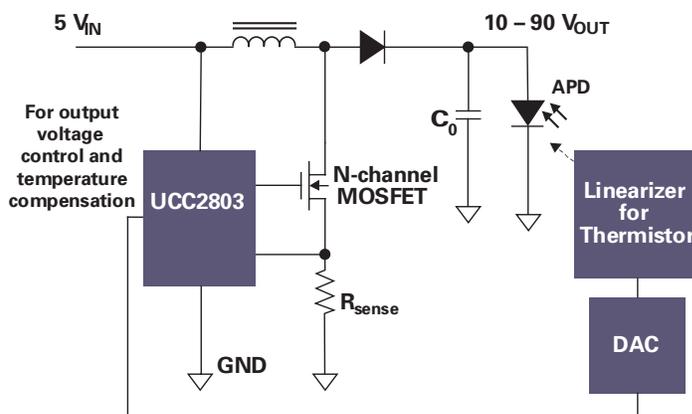
Key Features

- 100- μ A typical starting supply current
- 500- μ A typical operating supply current
- Operation to 1 MHz
- Internal soft start
- Internal fault soft start
- Internal leading-edge blanking of the current sense signal
- 1-amp totem-pole output
- 70-ns typical response from current-sense to gate drive output
- 1.5% tolerance voltage reference

Applications

- APD receiver back bias
- Power supply control

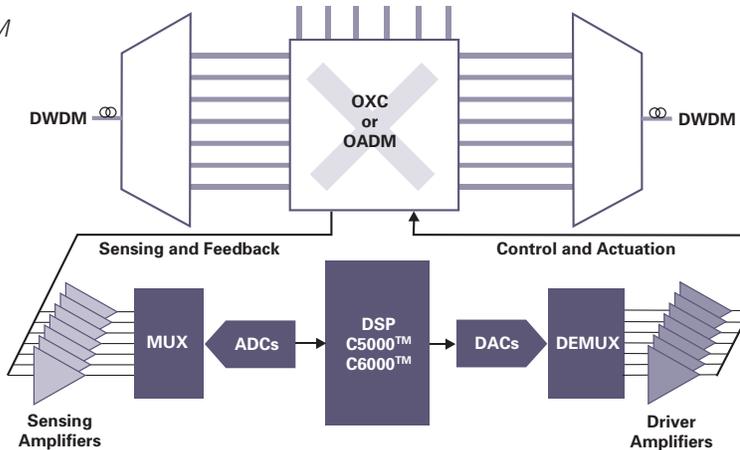
APD Receiver Back Bias Using the UCC2803



OPTICAL CROSS CONNECTS (OXCs) AND OPTICAL ADD/DROP MULTIPLEXERS (OADMs)

The all-optical network requires sub-systems capable of reliably switching and controlling light. Texas Instruments offers the critical semiconductor solutions that will enable the next-generation optical network. TI's high-performance analog products meet the advanced sensing requirements of optical switching systems. TI digital signal processors deliver real-time signal processing with a solid roadmap and tools, lowering risk and accelerating time-to-market. And for switching and modulating optical signals, TI offers Digital Light Processing™ technology for optical networks.

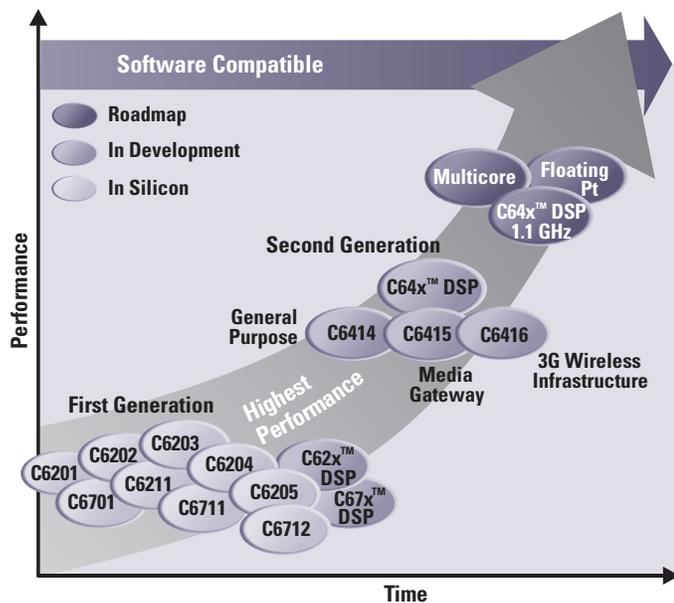
OXC and OADM Applications



TO KNOW MORE ▶

For detailed information about ICs for OXCs and OADM:

ADS8322 A/D converter	17
TMS320C5000™ DSP	16
TMS320C6000™ DSP	21
DLP™ dynamic filter	23
Photodiodes	24



Applications

- Variable optical attenuators (VOAs)
- Optical cross connects (OXCs)
- Optical add/drop multiplexers (OADMs)
- Polarization mode dispersion control (PMDC) (C67x floating-point DSPs available)
- EDFAs
- Optical performance monitors (OPMs)

HIGH-PERFORMANCE DSPs

TMS320C6000™ DSP Platform

Get samples, datasheets and app. reports at:
<http://dspvillage.ti.com/c6000>

TI's TMS320C6000™ DSP platform is optimized for highest performance and ease-of-use in high-level language programming. The C6000™ fixed- and floating-point DSPs provide the highest level of computational capability for demanding optical networking applications such as OXC and PMDC. Also, the new TMS320C64x™ DSPs provide 3200 MIPS today with a roadmap to 1.1-GHz performance.

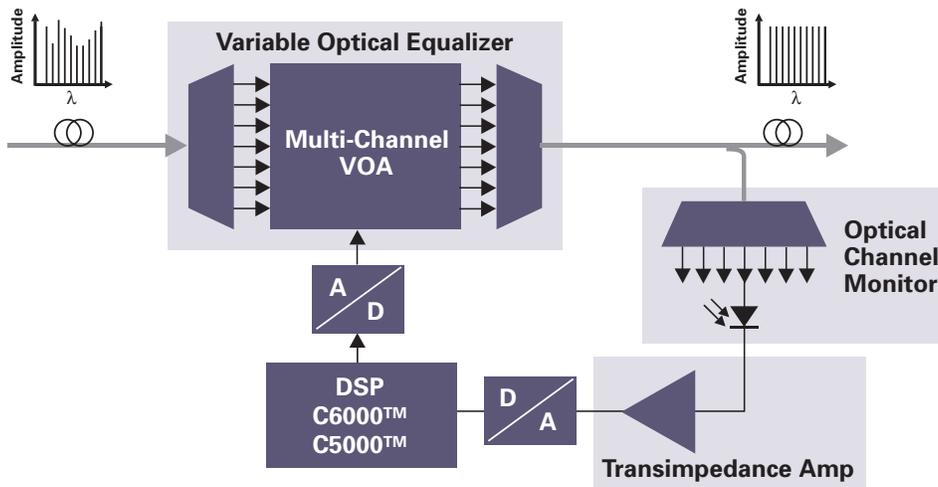
Key Features

- MIPS
 - C62x DSP: up to 2400 MIPS at 300 MHz
 - C67x DSP: 1 Gflops at 167 MHz
 - C64x DSP: up to 4800 MIPS (at up to 600 MHz)
- Multi-channel buffered serial ports (McBSPs)
- Host-port interface
- DMA controller
- High-density BGA packaging
- 100% software compatibility across the C6000 platforms
- Up to 7-Mbit on-chip memory
- Supported by eXpressDSP™ Real-Time Software Technology including Code Composer Studio™ Integrated Development Environment (IDE) and DSP/BIOS™ real-time kernel

VARIABLE OPTICAL ATTENUATORS (VOAs)

The metropolitan area network (MAN) is where optical networking will expand next. MAN operators require flexible service capabilities, thus driving the need for dynamic optical components such as VOAs and dynamic gain equalizers (DGEs). Texas Instruments offers a very strong range of semiconductor products for VOA applications. These include high-performance linear products for signal monitoring and conditioning, multi-channel high-precision data converters and DSPs for real-time signal processing requirements, and unique Digital Light Processing™ technology for modulating and controlling the optical signal.

Variable Optical Attenuator Application



TO KNOW MORE ▶

For detailed information about ICs for VOAs:

ADS8344 A/D converter	22
DLP™ dynamic filter	23
REF30xx voltage references	23
TMS320C6000™ DSP	21
TMS320C5000™ DSP	16
Photodiodes	24

16-BIT, 8-CHANNEL SERIAL OUTPUT SAMPLING ADC

ADS8344

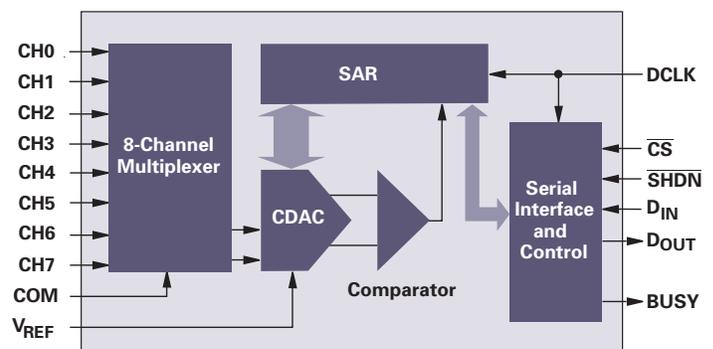
Get samples, datasheet and app. reports at: www.ti.com/sc/device/ADS8344

The ADS8344 is a high-performance, 8-channel, 16-bit ADC that is guaranteed to operate down to 2.7 V. It features unipolar input, serial interface, and low power for maximum design flexibility at a very reasonable cost.

Key Features

- Single supply: 2.7 V to 5 V
- 8-channel single-ended OR
- 4-channel differential input
- Up to 100-kHz conversion rate
- 84-dB SINAD
- Serial interface

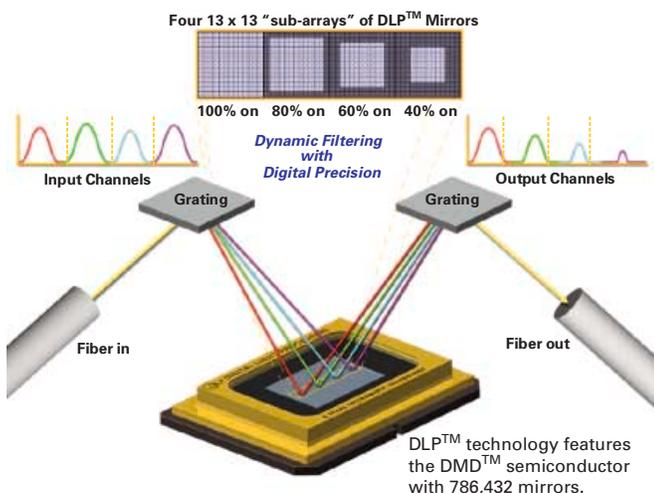
ADS8344 Block Diagram



Applications

- Thermoelectric cooler (TEC)
- Control, tunable lasers
- Wavelength lockers
- Erbium doped fiber amplifier (EDFA)
- Raman amplification
- PMDC
- Optical performance monitoring
- Light power monitoring
- Avalanche photodiodes (APDs)

DWDM Application Using DLP™ Technology



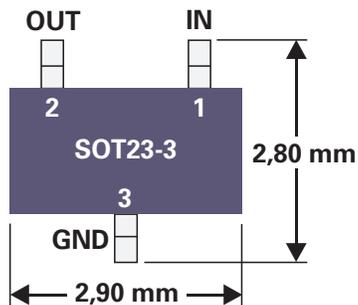
Applications

- For DWDM systems with dynamic filtration requirements to modulate, attenuate, phase adjust, equalize, or add/drop optical information channels.

SOT23-3 Package for REF30xx



(Actual Size)



Applications

- Optical modules
- Data acquisition

DIGITAL LIGHT PROCESSING™ DYNAMIC FILTER COMPONENT SET

Get datasheets and app. reports at:
www.dlp.com

The DLP™ Dynamic Filter Component Set is a high-performance solution for reliably filtering, modulating, equalizing, and controlling DWDM signals. At the heart of the solution is the Texas Instruments Digital Micromirror Device™, a semiconductor "light switch" array of thousands of individually addressable, tiltable, bistable mirror pixels optimized as a blazed light modulator for coherent light. OEMs can customize solutions to differentiate end-products based on the different needs of various markets and applications.

Key Features

- Digital Channel Modulation: 8-10 bits per channel
- Very Fast Switching Speeds: 15 μ s
- Dynamic Band or Channel Control:
 - Channel Count Independent (1-1,000+)
 - High Attenuation (>35 dB)
- Accuracy: ± 0.1 dB

MICROPACKAGE, MICROPOWER, LOW DROPOUT VOLTAGE REFERENCES

Product Preview*

REF3012*, REF3020*, REF3025*, REF3030*, REF3040*

Get samples and datasheets at:

www.ti.com/sc/device/partnumber

Replace partnumber in URL with REF3012, REF3020, REF3025, REF3030 or REF3040

The REF30xx is a micropower, precision voltage reference. Miniature packaging (SOT23-3), extended temperature range, and stability under any capacitive load make the REF30xx an optimal voltage reference for many optical networking applications. There are five available output voltages including 2.048 V and 4.096 V, common to optical networking applications. The REF30xx features 50- μ A supply current and a small footprint to accommodate even the most power- and space-limited designs. The REF30xx family is specified over the temperature range of -40°C to $+125^{\circ}\text{C}$.

Key Features

- Microsize package: SOT23-3
- Low dropout: 150 mV
- High output current: 25 mA
- Low temperature drift: 50 ppm/ $^{\circ}\text{C}$
- High accuracy: 0.2%
- Low I_Q : 50 μ A

*The REF3012, REF3020, REF3025, REF3030 and REF3040 are in the product preview stage of development. Expected availability is 1Q 2002.

PHOTODIODES

Optical systems frequently require wide dynamic range current-voltage conversion. Depending on the exact application, current ranges of 1 nA to 10 mA over a bandwidth of up to 10 MHz must be accommodated. Four basic topologies are typically used: simple transimpedance, switched gain transimpedance, logarithmic amplification, and switched integration. Each of these approaches have benefits and drawbacks related to accuracy, temperature and bandwidth performance.

Texas Instruments offers a wide variety of solutions for virtually all photodiode-conditioning circuits. These circuits are typically required in many applications at the optical layer (e.g., intensity monitors for both transmission and pump lasers, receiver diode biasing and control, optical cross-connect monitoring).

HIGH-VOLTAGE, PROGRAMMABLE-GAIN DIFFERENCE AMPLIFIER

INA146

Get samples, datasheet and app. reports at:
www.ti.com/sc/device/INA146

Frequently in optical applications it is necessary to monitor current through a shunt off of high-voltage power supplies. The INA146 is a high-common-mode voltage, programmable-gain, and low-power difference amplifier. The device is capable of conditioning very low-level signals in the presence of very high levels of common-mode voltage.

Key Features

- High common-mode voltage:
 - +40 V at $V_S = +5$ V
 - ± 100 V at $V_S = \pm 15$ V
- Differential gain = 0.1 V/V to 100 V/V: Set with external resistors
- Low quiescent current: 570 μ A
- Wide supply range:
 - Single supply: 4.5 V to 36 V
 - Dual supplies: ± 2.25 V to ± 18 V
- Low gain error: 0.025%
- High CMR: 80 dB
- Packaging: SO-8

Applications

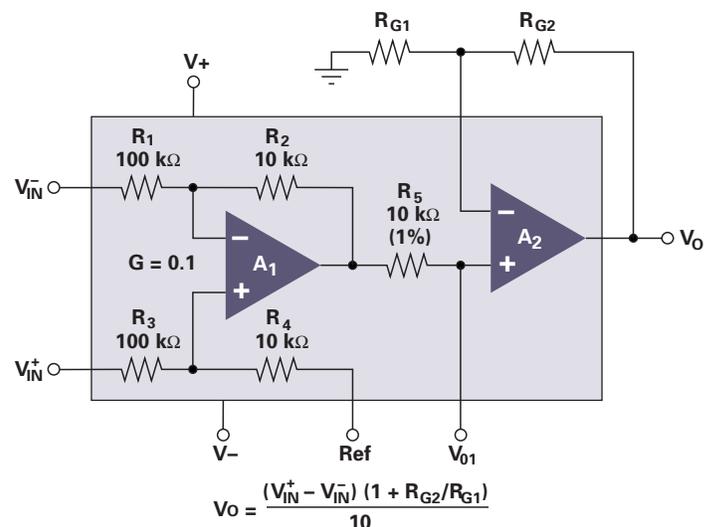
- Current shunt measurements
- Voltage-controlled current source
- Sensor amplifier

TO KNOW MORE ►

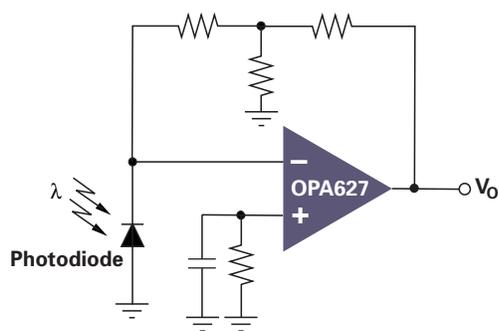
For detailed information about ICs for photodiodes:

INA146 difference amplifier	24
OPA627, OPA637 operational amplifiers	25
OPA655, OPA656, OPA657 operational amplifiers	25
LOG102 logarithmic amplifier	26
IVC102 switched integrator amplifier	26
UCC2803 boost converter controller	20

INA146 Block Diagram

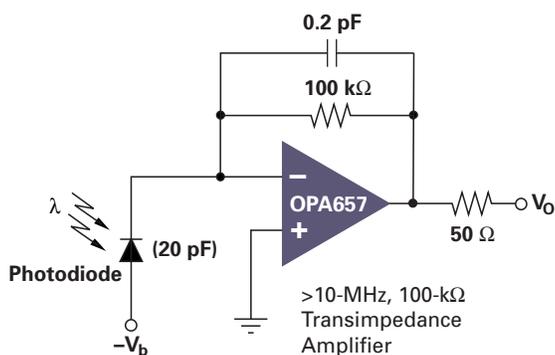


OPA627 Block Diagram

**Applications**

- Optoelectronics
- High-impedance sensor amps
- Active filters

OPA657 Block Diagram

**Applications**

- Wideband photodiode transimpedance amplifier
- DC precision high-gain amplifier
- High SFDR
- ADC input driver

*The OPA656 and OPA657 are in the product preview stage of development. Expected availability is December, 2001.

PRECISION HIGH-SPEED *Difet*[®] OPERATIONAL AMPLIFIERS

OPA627, OPA637

Get samples, datasheets and app. reports at:
www.ti.com/sc/device/partnumber

Replace partnumber in URL with OPA627 or OPA637

The OPA627 and OPA637 are precision, high-speed *Difet* op amps featuring wide power supply voltage range— ± 4.5 V to ± 18 V. *Difet* fabrication (dielectrically-isolated complementary NPN/PNP) achieves low input bias current without compromising input voltage noise performance. Low input bias current is maintained over a wide input common-mode voltage range with unique cascade circuitry.

Key Features

- Very low noise: $4.5 \text{ nV}/\sqrt{\text{Hz}}$ at 10 kHz
- Fast settling time:
 - OPA627: 550 ns to 0.01%
 - OPA637: 450 ns to 0.01%
- Low V_{OS} : 100 μV max
- Low drift: 0.8 $\mu\text{V}/^\circ\text{C}$ max
- Low I_B : 5 pA max
 - OPA627: Unity-gain stable
 - OPA637: Stable in gain ≥ 5
- Packaging: 8-pin DIP, 8-lead SOIC and TO-99

WIDEBAND, LOW-NOISE, FET-INPUT OPERATIONAL AMPLIFIERS

OPA655, OPA656*, OPA657*

Product Preview*

Get samples, datasheets app. reports and EVMs at:
www.ti.com/sc/device/partnumber

Replace partnumber in URL with OPA655, OPA656 or OPA657.

The OPA655, OPA656 and OPA657 are wideband, low noise FET-input, voltage-feedback op amps that provide wide dynamic range operation for high-precision ADC driving or wideband transimpedance applications. With the decoupled OPA657, photodiode applications will see improved noise and bandwidth. The OPA657's 1.6-GHz GBW product will give >10 -MHz signal bandwidths up to gains of 100 k Ω from up to 20 pF detection diodes.

Key Features

- Unity gain bandwidth: 400 MHz (OPA655, OPA656)
- High gain bandwidth product: 1.6 GHz (OPA657)
- Low-input bias current: 5 pA (OPA655)
- High-input impedance: $10^{12} \Omega \parallel 1.0 \text{ pF}$
- Low-input offset voltage: $<0.5 \text{ mV}$
- Low distortion: 90-dB SFDR at 5 MHz
- Low-input voltage noise: 3 nV (OPA657)
- High output current: $>60 \text{ mA}$
- Packaging: 5-lead SOT23 and 8-lead SOIC

LOGARITHMIC AMPLIFICATION

LOG102*



Get samples, datasheet, app. reports and EVMs at:
www.ti.com/sc/device/LOG102

The LOG102 is a versatile integrated circuit that computes the logarithm, log ratio or anti-log of an input current or voltage relative to a reference current or voltage. In log ratio applications, a signal current can come from a photodiode, and a reference current from a resistor in series with a precision external voltage reference.

Key Features

- Output scaling amplifier
- Comparator for indicating signal loss
- High accuracy: 0.4% FSO over 5 decades
- Wide dynamic input range: 6 decades, 1 nA to 1 mA
- Low quiescent current: 5 mA
- Packaging: 14-lead SOIC

**The LOG102 is in the product preview stage of development. Expected availability is December, 2001.*

PRECISION SWITCHED INTEGRATOR TRANSIMPEDANCE AMPLIFIER

IVC102

Get samples, datasheet and app. reports at:
www.ti.com/sc/device/IVC102

The IVC102 is a precision integrating amplifier with FET op amp, integrating capacitors, and low-leakage FET switches. It integrates low-level input current for a user-determined period, storing the resulting voltage on the integrating capacitor. The output voltage can be held for accurate measurement. The IVC102 provides a precision, lower-noise alternative to conventional transimpedance op amp circuits that require a very high-value feedback resistor. It is ideal for amplifying low-level sensor currents from photodiodes.

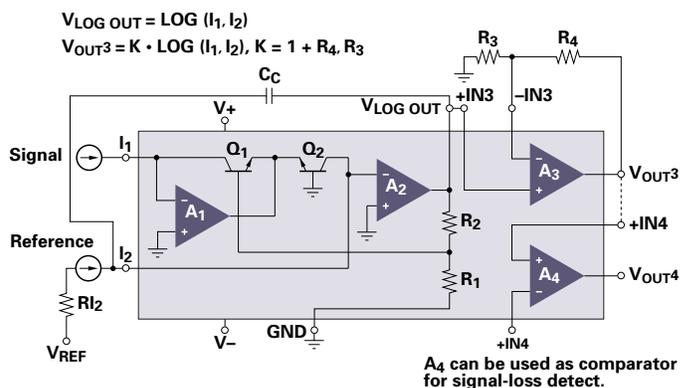
Key Features

- On-chip integrating capacitors
- Gain programmed by timing
- Low-input bias current: 750 fA max
- Low noise
- Low switch charge injection
- Fast pulse integration
- Low nonlinearity: 0.005% typ
- Packaging: 14-pin DIP and SO-14 surface mount

Applications

- Precision low-current measurement
- Photodiode measurements
- Current/charge-output sensors
- Leakage current measurement

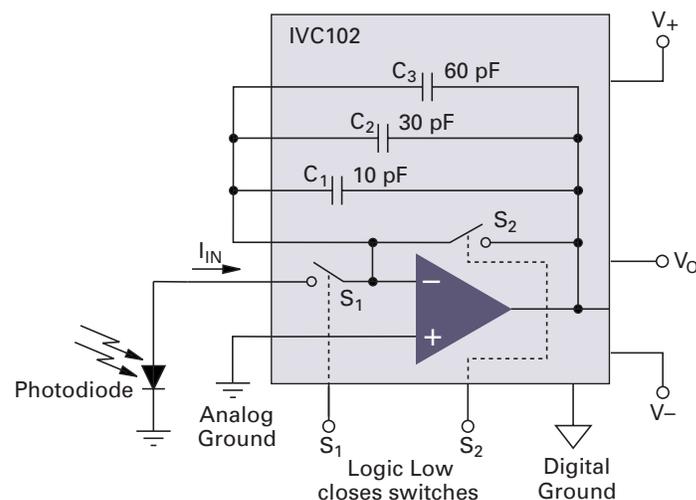
LOG102 Block Diagram



Applications

- Photodiode signal compression amp
- Absorbancy measurement
- Optical density measurement
- Analog signal compression in front of A/D converter

IVC102 Block Diagram



PWM POWER DRIVERS

Device	I _Q (max) (A)	V _{CC/VDD}		F _s		R _{ds(ON)} (Ω)	V _{ICM}		I _Q (mA)	PSRR (dB)	Price ¹
		(min) (V)	(max) (V)	Single-ended (kHz)	Differential (kHz)		(min) (V)	(max) (V)			
DRV590	1.2	2.7	5.5	250	500	0.4	1.2	3.8	4	77	6.95
DRV591 ²	3	2.7	5.5	500/100	500/100	0.065	1.2	3.8	7	77	12.34
DRV592 ²	3	2.7	5.5	–	–	0.065	–	–	7	77	12.34

¹Suggested resale price in U.S. dollars in quantities of 1,000.²Planned release December, 2001.

INSTRUMENTATION AMPLIFIERS

Device	Description	Input Range min (V)	CMRR min (dB)	I _Q typ (mA)	V _{CC} Range (V)	BW typ (MHz)	Voltage Noise (nV/√Hz)	Price ¹
INA114	Precision	±11	110	2.2	±2.25 to ±18	10	11	3.59
INA115	Precision, additional internal connections	±11	110	2.2	±2.25 to ±18	10	11	4.00
INA118	Single supply, precision, low power	+14 to –13.9	107	350	±1.35 to ±18	70	10	3.78
INA121	FET-input, lowest cost, lowest power	±12.5	96	450	±2.25 to ±18	50	20	2.38
INA122	Single supply, micropower, rail-to-rail out	+10 to –14.7	83	60	+2.2 to +36	5	60	1.97
INA163	Low noise low distortion	± 11	100	12	±4.5 to ±18	0.8	1	1.97

¹Suggested resale price in U.S. dollars in quantities of 1,000.

DIFFERENCE AMPLIFIERS

Device	Description	Gain Range (V/V)	Input Range (max) (V)	Output Swing (V)	CMRR (min) (dB)	I _Q (mA)	Supply Voltage (V)	BW (kHz)	Noise (nV/√Hz)	Price ¹
INA117	High common-mode voltage	1	±200	±10	86	1.5	±5 to ±18	200	550	2.73
INA132	Low-power single supply	1	+28, –15	+13.5, –14	76	0.16	±1.35 to ±18+2.7 to +36	300	65	1.00
INA145	Programmable gain	1 to 500	±28	+13.5, –14	76	0.6	±1.35 to ±18+2.7 to +36	500	100	1.42
INA146	High-voltage programmable gain	0.1 to 200	±200 (G=0.1)	+13.5, –14	70	0.6	±1.35 to ±18+2.7 to +36	500	50	1.62
INA152	Single supply	0.5, 1, 2	+18, –20	±9.9	86	0.45	±1.35 to ±10+2.7 to +20	700	80	1.11

¹Suggested resale price in U.S. dollars in quantities of 1,000.

OPERATIONAL AMPLIFIERS

Device	Offset Voltage (max)	Bias Current (max)	Current Noise	CMRR (min) (dB)	A _{OL} (min) (dB)	GBW (typ) (MHz)	SR (typ) (V/μs)	V _{CC} Range (V)	# of Channels S/D/Q	Price ¹
OPA227	75 μV	10 nA	0.4 pA/√Hz	120	132	8	2.3	±2.5 to ±18	S/D/Q	1.01
OPA228	75 μV	10 nA	0.4 pA/√Hz	120	132	33	11	±2.5 to ±18	S/D/Q	1.01
OPA2111	750 μV	8 pA	0.6 fA/√Hz	96	114	2	2	±5 to ±18	D	7.33
OPA2822	1.2 mV	12 μA	1.6 pA/√Hz	85	85	240	170	±2.5 to ±6	D	2.17
OPA121	2 mV	5 nA	0.8 fA/√Hz	86	106	2	2	±5 to ±18	S	4.84
OPA124	250 μV	1 nA	0.5 fA/√Hz	100	120	1.5	1.6	±5 to ±18	S	3.77
OPA128	500 μV	75 fA	0.12 fA/√Hz	90	110	1	3	±5 to ±18	S	12.16
OPA129	2 mV	100 fA	0.1 fA/√Hz	80	94	1	2.5	±5 to ±18	S	3.04
OPA132	0.5 mV	50 pA	3 fA/√Hz	96	110	8	20	±2.5 to ±18	S/D/Q	1.35
OPA404	750 μV	4 pA	0.6 fA/√Hz	88	88	4	24	±5 to ±18	Q	7.19
OPA627	250 μV	5 pA	1.6 fA/√Hz	106	112	16	40	±4.5 to ±24	S	9.63
OPA637	250 μV	5 pA	1.6 fA/√Hz	106	112	80	100	±4.5 to ±24	D	9.63
OPA655	2 mV	125 pA	1.3 fA/√Hz	55	53	240	210	±5	S	9.24
OPA656 ²	2 mV	20 pA	2.5 fA/√Hz	55	56	240	290	±5 to ±6	S	7.85
OPA657 ²	2 mV	20 pA	2.5 fA/√Hz	55	65	1600	800	±5 to ±6	S	8.19
OPA686	1 mV	10 μA	1.8 pA/√Hz	100	75	1800	600	±5 to ±6	S/D	2.79
THS4601	1 mV	90 pA	5.0 fA/√Hz	106	90	170	95	±4.5 to ±15	S/D/Q	9.95

¹Suggested resale price in U.S. dollars in quantities of 1,000.²Planned release December, 2001.

POWER OPERATIONAL AMPLIFIERS

Device	Output Current (\pm) (min) (A)	V _S		I _Q per Amp (\pm) (max) (mA)	Offset Voltage (\pm) (max) (mV)	Bias Current (max) (pA)	Slew Rate (min) (V/ μ s)	Small-Signal Bandwidth (typ) (MHz)	Package	Price ¹	Description
		(min) (V)	(max) (V)								
3581	0.03	64	150	8	3	20	20	5	TO-3	122.68	High-voltage op amps
3583	0.075	100	300	8.5	3	20	30	5	TO-3	99.57	High-voltage, high-current op amp
3584	0.015	140	300	6.5	3	20	150	7	TO-3	99.57	High-voltage op amp
OPA2541	5	20	80	25	1	50	6	1.6	TO-3	39.40	Dual high-power op amp
OPA2544	2	20	70	15	5	100	5	1.4	ZIP	11.43	High-voltage, high-current dual op amp
OPA445	0.015	20	90	4.7	3	50	15	2	DIP,SOIC,TO99	2.47	High-voltage, FET-input op amp
OPA452	0.05	20	80	6.5	5	100	8	2	DDpak,TO220	2.40	80-V, 50-mA op amps
OPA453	0.05	20	80	6.5	5	100	20	8	DDpak,TO220	2.40	80-V, 50-mA op amps
OPA501	10	20	80	10	5	20000	1.35	1	TO-3	47.55	High-current, high-power op amp
OPA541	5	20	80	25	1	50	6	1.6	TO-3,ZIP	10.55	High-power monolithic op amp
OPA544	2	20	70	15	5	100	5	1.4	DDpak,TO220	6.68	High-voltage, high-current op amp
OPA547	0.5	8	60	10	5	500000	6	1	DDpak,TO220	4.14	High-voltage, high-current op amp
OPA548	3	8	60	17	5	500000	10	1	DDpak,TO220	5.52	High-voltage, high-current op amp
OPA549	8	8	60	25	5	500000	10	1	ZIP	10.96	High-voltage, high-current op amp
OPA551	0.2	8	60	6.5	5	100	10	3	DDpak,DIP,SOIC	1.66	High-voltage, high-current op amps
OPA552	0.2	8	60	6.5	5	100	20	12	DDpak,DIP,SOIC	1.66	High-voltage, high-current op amps

¹Suggested resale price in U.S. dollars in quantities of 1,000.**DATA CONVERTERS**

Device	Resolution (Bits)	Sample Rate (kSPS)	Supply (V)	Data-Bus Interface	Analog Inputs	Power (typ) (mW)	V _{REF} (Int/Ext)	DNL (max) (\pm LSB)	INL (max) (\pm LSB)	Price ¹
Analog-to-Digital SAR 50 kSPS–200 kSPS										
AMC7820 ²	12	100	5	Serial	8	60	Int	1	1	9.25
ADS7804	12	100	5	P8/P12	1	100	Int	0.45	0.45	13.36
ADS7805	16	100	5	P8/P16	1	100	Int	1	3	20.75
ADS7808	12	100	5	Serial	1	100	Int	0.45	0.45	10.58
ADS7809	16	100	5	Serial	1	100	Int	1	2	20.75
ADS7816	12	200	2.7 to 5	Serial	1	3.5	Ext	0.75	1	1.97
ADS7817	12	200	2.7 to 5	Serial	1	4	Ext	1	1	1.97
ADS7820	12	100	5	P8/P12	1	100	Int	0.5	0.5	10.37
ADS7821	16	100	5	P8/P16	1	100	Int	1	3	21.12
ADS7822	12	75	2.7 to 3	Serial	1	1.625	Ext	0.75	0.75	1.47
ADS7832	12	117	3 to 5	P8	4	7.5	Int	0.75	0.75	16.19
ADS7841	12	200	2.7 to 5	Serial	4	3.5	Ext	1	1	2.53
ADS7842	12	200	2.7 to 5	P12	4	3.5	Ext	1	1	2.99
ADS7844	12	200	2.7 to 5	Serial	8	3.5	Ext	1	1	2.94
ADS8320	16	100	2.7 to 5	Serial	1	10	Ext	2	8	6.33
ADS8321	16	100	5	Serial	1	10	Ext	2	8	6.33
ADS8324	14	50	1.8 to 3.6	Serial	1	2.5	Ext	2	2	3.95
ADS8341	16	100	2.7 to 5	Serial	4	5	Ext	2	6	7.08
ADS8343	16	100	2.7 to 5	Serial	4	5	Ext	2	6	7.08
ADS8344	16	100	2.7 to 5	Serial	8	5	Ext	2	6	7.59
ADS8345	16	100	2.7 to 5	Serial	8	5	Ext	2	6	7.59
TLC2543	12	66	5	Serial	11	5	Ext	1	1	4.23
TLC2574	12	200	5	Serial	4	25.32	Ext	0.5	0.5	5.04
TLC2578	12	200	5	Serial	8	25.32	Ext	0.5	0.5	5.55
TLC3544	14	200	5	Serial	4	17.24	Int	1	1	7.08
TLC3548	14	200	5	Serial	8	17.24	Int	1	1	7.59
TLC3574	14	200	5	Serial	4	25.32	Ext	1	1.5	7.59
TLC3578	14	200	5	Serial	8	25.32	Ext	1	1.5	9.36
TLV2541	12	200	2.7 to 5.5	Serial	1	2.3	Ext	1	1	3.54
TLV2542	12	200	2.7 to 5.5	Serial	2	2.3	Ext	1	1	3.54

¹Suggested resale price in U.S. dollars in quantities of 1,000.²Planned release Q1 2002.

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DATA CONVERTERS (CONTINUED)

Device	Resolution (Bits)	Sample Rate (kSPS)	Supply (V)	Data-Bus Interface	Analog Inputs	Power (typ) (mW)	V _{REF} (Int/Ext)	DNL (max) (±LSB)	INL (max) (±LSB)	Price ¹		
Analog-to-Digital SAR 50 kSPS–200 kSPS (Continued)												
TLV2543	12	66	3.3	Serial	11	3.3	Ext	1	1	4.23		
TLV2544	12	200	2.7 to 5.5	Serial	4	2.7	Int	1	1	4.27		
TLV2545	12	200	2.7 to 5.5	Serial	1	2.3	Ext	1	1	3.54		
TLV2548	12	200	2.7 to 5.5	Serial	8	2.7	Int	1	1	4.71		
Analog-to-Digital SAR 200 kSPS–500 kSPS												
ADS7800	12	333	+5, –15	P8/P12	1	215	Int	0.75	0.5	26.66		
ADS7811	16	250	±5	P16	1	250	Int	2	4	34.41		
ADS7815	16	250	±5	P16	1	250	Int	2	4	20.24		
ADS7818	12	500	5	Serial	1	15	Int	1	1	2.63		
ADS7834	12	500	5	Serial	1	15	Int	1	1	2.65		
ADS7835	12	500	5	Serial	1	17.5	Int	1	1	3.01		
ADS7852	12	500	5	P12	8	12	Int	1	1	3.56		
ADS7861	12	500	5	Serial	4	40	Int	1	1	4.03		
ADS7862	12	500	5	P12	4	40	Int	1	1	5.99		
ADS7864	12	500	5	P12	6	50	Int	1	1	6.83		
ADS8322	16	500	5	Parallel	1	85	Int	2	6	7.59		
TLC2551	12	400	5	Serial	1	15	Ext	1	1	3.74		
TLC2552	12	400	5	Serial	2	15	Ext	1	1	3.74		
TLC2554	12	400	5	Serial	4	20	Int	1	1	5.06		
TLC2555	12	400	5	Serial	1	15	Ext	1	1	3.74		
TLC2558	12	400	5	Serial	8	20	Int	1	1	5.56		
Device	Resolution (Bits)	Sample Rate (MSPS)	Supply (V)	Analog Inputs	Power (typ) (mW)	Analog Input BW (MHz)	DNL (max) (±LSB)	INL (max) (±LSB)	SNR (dB)	Price ¹		
High-Speed Analog-to-Digital SAR & Pipeline 500 kSPS–80 MSPS												
ADS850	14	10	5	1	220	300	–	–	76	19.23		
THS1206	12	6	5	4	216	96	1	1.5	74	11.08		
THS1207	12	6	5	4	186	96	1	1.5	69	12.13		
THS12082	12	8	5	2	186	96	1	1.5	69	10.07		
THS1209	12	8	5	2	186	98	1	1.5	69	9.05		
THS1230	12	30	3.3	1	168	180	1	2.5	68	13.84		
THS1240	12	40	5	1	380	120	–	–	64	14.45		
THS1401	14	1	3.3	1	270	140	1	5	72	9.11		
THS1403	14	3	3.3	1	270	140	1	5	72	12.15		
THS1408	14	8	3.3	1	270	140	1	5	72	15.18		
THS14F01	14	1	3.3	1	270	140	1	2.5	72	9.86		
THS14F03	14	3	3.3	1	270	140	1	2.5	72	12.89		
Device	Resolution (Bits)	Supply (V)	Data-Bus Interface	Settling Time (µs)	Number of DACs	Power (typ) (mW)	Output (I or V)	V _{REF} (Int/Ext)	DNL (max) (±LSB)	INL (max) (±LSB)	INL (max) (±%FSR)	Price ¹
Digital-to-Analog												
DAC7512	12	2.7 to 5.5	Serial	10	1	0.7	V	V _{DD}	1	8	–	1.37
DAC7513	12	2.7 to 5.5	Serial	10	1	0.7	V	Ext	1	8	–	1.37
DAC7541	12	5 to 15	P12	1	1	30	I	Ext	0.5	1	–	6.40
DAC7545	12	5 to 15	P12	2	1	30	I	Ext	1	1	–	5.80
DAC7611	12	5	Serial	10	1	2.5	V	Int	1	1	–	2.39
DAC7612	12	5	Serial	10	2	3.7	V	Int	1	1	–	2.52
DAC7614	12	±5	Serial	10	4	10	V	Ext	1	1	–	6.38
DAC7615	12	±5	Serial	10	4	10	V	Ext	1	1	–	6.38
DAC7616	12	3	Serial	10	4	3	V	Ext	1	1	–	5.75
DAC7617	12	3	Serial	10	4	2.4	V	Ext	1	1	–	5.75
DAC7621	12	5	P12	10	1	2.5	V	Int	1	1	–	2.58
DAC7624	12	±5	P12	10	4	7.5	V	Ext	1	1	–	9.26

¹Suggested resale price in U.S. dollars in quantities of 1,000.

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DATA CONVERTERS (CONTINUED)

Device	Resolution (Bits)	Supply (V)	Data-Bus Interface	Settling Time (μ s)	Number of DACs	Power (typ) (mW)	Output (I or V)	V _{REF} (Int/Ext)	DNL (max) (\pm LSB)	INL (max) (\pm LSB)	INL (max) (\pm %FSR)	Price ¹
Digital-to-Analog (Continued)												
DAC7625	12	\pm 5	P12	10	4	7.5	V	Ext	1	1	–	9.26
DAC7631	16	\pm 5	Serial	10	1	1.8	V	Ext	2	3	–	5.57
DAC7634	16	\pm 5	Serial	10	4	7.5	V	Ext	2	3	–	18.98
DAC7641	16	\pm 5	P16	10	1	1.8	V	Ext	2	3	–	5.92
DAC7644	16	\pm 5	P16	10	4	7.5	V	Ext	2	3	–	18.98
DAC7714	12	\pm 15	Serial	10	4	45	V	Ext	1	1	–	10.88
DAC7715	12	\pm 15	Serial	10	4	45	V	Ext	1	1	–	10.88
DAC7724	12	\pm 15	P12	10	4	45	V	Ext	1	1	–	11.89
DAC7725	12	\pm 15	P12	10	4	45	V	Ext	1	1	–	11.89
DAC7734	16	\pm 15	Serial	10	4	50	V	Ext	1	2	–	29.93
DAC7744	16	\pm 15	P16	10	4	50	V	Ext	1	2	–	29.93
DAC7800	12	5	Serial	0.8	2	1	I	Ext	1	0.5	–	11.90
DAC7801	12	5	P8	0.8	2	1	I	Ext	1	0.5	–	14.26
DAC7802	12	5	P12	0.8	2	1	I	Ext	1	0.5	–	11.90
DAC8043	12	5	Serial	1	1	0.5	I	Ext	1	0.5	–	7.54
DAC8501	16	2.7 to 5.5	Serial	10	1	1.3	V	Ext	1	–	0.098	2.83
DAC8531	16	2.7 to 5.5	Serial	10	1	1.3	V	Ext	1	–	0.098	2.83
TLC5615	10	5	Serial	12.5	1	1.2	V	Ext	0.5	1	–	1.85
TLV5604	10	2.7 to 5.5	Serial	3	4	3.3	V	Ext	0.5	1	–	4.79
TLV5606	10	2.7 to 5.5	Serial	3	1	0.9	V	Ext	1	1.5	–	1.77
TLV5608	10	2.7 to 5.5	Serial	1	8	18	V	Ext	1	2	–	4.74
TLV5610	12	2.7 to 5.5	Serial	1	8	18	V	Ext	1	6	–	8.65
TLV5613	12	2.7 to 5.5	P8	1	1	1.2	V	Ext	1	4	–	3.58
TLV5614	12	2.7 to 5.5	Serial	3	4	3.6	V	Ext	1	4	–	8.26
TLV5616	12	2.7 to 5.5	Serial	3	1	0.9	V	Ext	1	4	–	2.86
TLV5617A	10	2.7 to 5.5	Serial	1	2	1.8	V	Ext	1	1	–	3.41
TLV5618A	12	2.7 to 5.5	Serial	1	2	2.4	V	Ext	1	4	–	4.25
TLV5619	12	2.7 to 5.5	P12	1	1	4.3	V	Ext	1	4	–	3.58
TLV5630	12	2.7 to 5.5	Serial	1	8	18	V	Int	1	6	–	9.02
TLV5631	10	2.7 to 5.5	Serial	1	8	18	V	Int	1	2	–	5.12
TLV5633	12	2.7 to 5.5	P8	1	1	2.7	V	Int	0.5	3	–	4.46
TLV5636	12	2.7 to 5.5	Serial	1	1	4.5	V	Int	1	4	–	3.82
TLV5637	10	2.7 to 5.5	Serial	1	2	4.2	V	Int	0.5	1	–	4.53
TLV5638	12	2.7 to 5.5	Serial	1	2	4.5	V	Int	1	4	–	4.89
TLV5639	12	2.7 to 5.5	P12	1	1	2.7	V	Int	0.5	3	–	4.46

¹Suggested resale price in U.S. dollars in quantities of 1,000.**VOLTAGE REFERENCES AND CURRENT REFERENCES**

Device	Description	Output	Initial Accuracy (max) (mV)	Drift (max) (ppm/°C)	Long Term Stability (typ) (ppm/kHr)	Noise 0.1 Hz to 10 Hz (typ) (mVp-p)	I _Q (max) (mA)	Temperature Range (°C)	Package Options	Price ¹
Voltage References										
REF02	Low Drift, Low Noise	5 V	\pm 10	10	50	4	1.4	–40 to +85	8-pin DIP/SO	1.66
REF3012 ²	MicroPower, Precision	1.25 V	\pm 2.5	50	–	25	0.075	–40 to +125	SOT23-3	TBD
REF3020 ²	MicroPower, Precision	2.048 V	\pm 4.096	50	–	55	0.075	–40 to +125	SOT23-3	TBD
REF3025 ²	MicroPower, Precision	2.5 V	\pm 5	50	–	70	0.075	–40 to +125	SOT23-3	TBD
REF3030 ²	MicroPower, Precision	3.3 V	\pm 6.6	50	–	70	0.075	–40 to +125	SOT23-3	TBD
REF3040 ²	MicroPower, Precision	4.096 V	\pm 8.19	50	–	110	0.075	–40 to +125	SOT23-3	TBD
Current References										
REF200	Dual-Current Reference	Two 100 μ A	\pm 1 μ A	25 (typ)	–	–	–	–25 to +85	8-pin DIP/SO	2.54

¹Suggested resale price in U.S. dollars in quantities of 1,000.²Production scheduled Q1 2002.

DIGITAL SIGNAL PROCESSORS—C6000™ DSP FAMILY

Device	RAM (bits)		McBSP	DMA	COM	MHz	Cycle (ns)	MIPS	Typical Activity		Voltage (V)		Packaging	Price ¹	
	Data	Prog							CPU Power (mA/MIPS)	Total Internal Power (W) (max speed)	Core	I/O			
C62x™ DSP—Fixed Point															
TMS320C6201-200	512K	512K	2	4	HPI/16	200	5	1600	0.15	1.3	1.8	3.3	352 BGA, 35/27 mm	82.70	
TMS320C6202-200	1M	2M	3	4	Exp. Bus/32	200	5	1600	0.15	1.7	1.8	3.3	352 BGA, 27 mm 384 BGA, 18 mm	94.03	
TMS320C6202-250	1M	2M	3	4	Exp. Bus/32	250	4	2000	0.15	2.1	1.8	3.3	352 BGA, 27 mm 384 BGA, 18 mm	110.08	
TMS320C6202C-250	1M	2M	3	4	Exp. Bus/32	250	4	2000	0.07	1.1	1.2	3.3	352 BGA, 27 mm 384 BGA, 18 mm	44.76	
TMS320C6202C-300	1M	2M	3	4	Exp. Bus/32	300	3.3	2400	0.07	1.3	1.2	3.3	352 BGA, 27 mm 384 BGA, 18 mm	55.95	
TMS320C6203B-250	4M	3M	3	4	Exp. Bus/32	250	4	2000	0.07	1.1	1.5	3.3	352 BGA, 27 mm 384 BGA, 18 mm	84.18	
TMS320C6203C-300	4M	3M	3	4	Exp. Bus/32	300	3.3	2400	0.07	1.3	1.2	3.3	384 BGA, 18 mm	67.14	
TMS320C6204-200	512K	512K	2	4	Exp. Bus/32	200	5	1600	0.07	0.8	1.5	3.3	340 BGA, 18 mm 288 BGA, 16 mm	22.03 18.35	
TMS320C6205-200	512K	512K	2	4	PCI/32	200	5	1600	0.07	0.8	1.5	3.3	288 BGA, 16 mm	21.54	
TMS320C6211B-150	32Kb/32Kb/512Kb ²		2	16 ³	HPI/16	150	6.7	1200	0.15	0.9	1.8	3.3	256 BGA, 27 mm	21.54	
TMS320C6211B-167	32Kb/32Kb/512Kb ²		2	16 ³	HPI/16	167	6	1336	0.15	1.0	1.8	3.3	256 BGA, 27 mm	26.93	
Device	Internal RAM (bits) L1 Program Cache/ L1 Data Cache/ L2 Unified RAM/Cache		McBSP	Enhanced DMA (channels)	COM ⁴	Timers	MHz	Cycle (ns)	MIPS	Typical Activity		Voltage (V)		Packaging	Price ¹
	CPU Power (mA/MIPS)	Total Internal Power (W) (max speed)								Core	I/O				
C64x™ DSP—Fixed Point															
TMS320C6414-400	128Kb/128Kb/8Mb		3	64	HPI 32/16	3	400	2.5	3200	0.03	0.44	1.2	3.3	532 BGA, 23 mm	102.55
TMS320C6414-500	128Kb/128Kb/8Mb		3	64	HPI 32/16	3	500	2	4000	0.03	0.55	1.2	3.3	532 BGA, 23 mm	156.52
TMS320C6414-600	128Kb/128Kb/8Mb		3	64	HPI 32/16	3	600	1.67	4800	0.04	0.9	1.2	3.3	532 BGA, 23 mm	210.50
TMS320C6415-400	128Kb/128Kb/8Mb		2+Utopia ⁵	64	PCI/HPI 32/16	3	400	2.5	3200	0.03	0.44	1.2	3.3	532 BGA, 23 mm	112.80
TMS320C6415-500	128Kb/128Kb/8Mb		2+Utopia ⁵	64	PCI/HPI 32/16	3	500	2	4000	0.03	0.55	1.2	3.3	532 BGA, 23 mm	172.19
TMS320C6415-600	128Kb/128Kb/8Mb		2+Utopia ⁵	64	PCI/HPI 32/16	3	600	1.67	4800	0.04	0.9	1.2	3.3	532 BGA, 23 mm	231.55
TMS320C6416-400	128Kb/128Kb/8Mb		2+Utopia ⁵	64	PCI/HPI 32/16	3	400	2.5	3200 ⁶	0.03	0.44	1.2	3.3	532 BGA, 23 mm	124.08
TMS320C6416-500	128Kb/128Kb/8Mb		2+Utopia ⁵	64	PCI/HPI 32/16	3	500	2	4000 ⁶	0.03	0.55	1.2	3.3	532 BGA, 23 mm	189.38
TMS320C6416-600	128Kb/128Kb/8Mb		2+Utopia ⁵	64	PCI/HPI 32/16	3	600	1.67	4800 ⁶	0.04	0.9	1.2	3.3	532 BGA, 23 mm	254.71
Device	RAM (bits)		McBSP	DMA	COM	MHz	Cycle (ns)	FLOPS	Typical Activity		Voltage (V)		Packaging	Price ¹	
	Data	Prog							CPU Power (mA/MIPS)	Total Internal Power (W) (max speed)	Core	I/O			
C67x™ DSP—Floating Point															
TMS320C6701-150	512K	512K	2	4	HPI/16	150	6.7	900M	0.22	1.3	1.8	3.3	352 BGA, 35 mm	82.70	
TMS320C6701-167	512K	512K	2	4	HPI/16	167	6	1G	0.22	1.4	1.9	3.3	352 BGA, 35 mm	119.09	
TMS320C6711B-100	32Kb/32Kb/512Kb ²		2	16 ³	HPI/16	100	10	600M	0.22	0.8	1.8	3.3	256 BGA, 27 mm	21.54	
TMS320C6711B-150	32Kb/32Kb/512Kb ²		2	16 ³	HPI/16	150	6.7	900M	0.22	1.1	1.8	3.3	256 BGA, 27 mm	30.77	
TMS320C6712-100	32Kb/32Kb/512Kb ²		2	16 ³	—	100	10	600M	0.22	0.8	1.8	3.3	256 BGA, 27 mm	18.06	

¹Prices are quoted in US dollars in quantities of 1,000 and represent year 2002 (effective November 2001) suggested resale pricing.

²The C6211's and C6711/12's 576 Kbits of cache memory is comprised of 32 Kbits data cache, 32 Kbits program cache and 512 Kbits unified cache memory.

³Enhanced DMA.

⁴HPI is selectable, 32-bit or 16-bit.

⁵UTOPIA pins muxed with a third McBSP.

⁶Plus on-chip Turbo (TCP) and Viterbi (VCP) coprocessors.

Notes: All C62x and C67x devices include two timers. C64x production quantities scheduled for late 1Q 2002.

DIGITAL SIGNAL PROCESSORS—C5000™ DSP FAMILY

Device ²	RAM (16-bit words)	ROM (16-bit words)	DAT/PRO (ADDR) (words)	McBSP ³	Voltage (V)		COM	Timers	PLL	Cycles (ns)	MIPS	Packaging	Price ¹						
					Core ²	I/O													
C54x™ DSP																			
TMS320VC5401-50	8K	4K	64K/1M	2	1.8	3.3	HPI 8	2	SW	20	50	144 BGA, LQFP	4.50						
TMS320VC5402-100	16K	4K	64K/1M	2	1.8	3.3	HPI 8	2	SW	10	100	144 BGA, LQFP	5.66						
TMS320UC5402-80	16K	4K	64K/1M	2	1.8	1.8–3.6	HPI 8	2	SW	12.5	80	144 BGA, LQFP	6.79						
TMS320VC5402A-160	16K	16K	64K/8M	3	1.6	3.3	HPI	1	SW/PLL	6.25	160	144 BGA, LQFP	10.13						
TMS320VC5404-120	16K	64K	64K/8M	3	1.6	3.3	HPI	1	SW/PLL	6.25	160	144 BGA, LQFP	8.77						
TMS320VC5407-120	40K	128K	64K/8M	3	1.6	3.3	HPI	1	SW/PLL	6.25	160	144 BGA, LQFP	14.83						
TMS320VC5409-80	32K	16K	64K/8M	3	1.8	3.3	HPI 8/16	1	SW	12.5	80	144 BGA, LQFP	9.26						
TMS320VC5409-100	32K	16K	64K/8M	3	1.8	3.3	HPI 8/16	1	SW	10	100	144 BGA, LQFP	11.95						
TMS320UC5409-80	32K	16K	64K/8M	3	1.8	1.8–3.6	HPI 8/16	1	SW	12.5	80	144 BGA, LQFP	14.34						
TMS320VC5409A-120	32K	16K	64K/8M	3	1.5	3.3	HPI 8/16	1	SW	8.33	120	144 BGA, LQFP	11.15						
TMS320VC5409A-160	32K	16K	64K/8M	3	1.6	3.3	HPI 8/16	1	SW	6.25	160	144 BGA, LQFP	12.73						
TMS320VC5410-100	64K	16K	64K/8M	3	2.5	3.3	HPI 8	1	SW	10	100	176 BGA, 144 LQFP	30.40						
TMS320VC5410A-120	64K	16K	64K/8M	3	1.5	3.3	HPI 8/16	1	SW	8.33	120	144 BGA, LQFP	13.81						
TMS320VC5410A-160	64K	16K	64K/8M	3	1.6	3.3	HPI 8/16	1	SW	6.25	160	144 BGA, LQFP	15.30						
TMS320VC5416-120	128K	16K	64K/8M	3	1.5	3.3	HPI 8/16	1	SW	8.33	120	144 BGA, LQFP	26.94						
TMS320VC5416-160	128K	16K	64K/8M	3	1.5	3.3	HPI 8/16	1	SW	6.25	160	144 BGA, LQFP	29.87						
TMS320VC5420-200 ^{4, 5}	200K	–	64K/256K	6	1.8	3.3	HPI 16	2	SW	10	200	144 BGA, LQFP	60.55						
TMS320VC5421-200 ⁴	256K	4K	64K/256K	6	1.8	3.3	HPI 16	2	SW	10	200	144 BGA, LQFP	71.30						
TMS320VC5441-532 ⁴	640K	–	64K/256K	12	1.5	3.3	HPI 16	4	SW	7.5	532	169 BGA, 176 LQFP	117.71						
Device ²	RAM (bytes)	ROM (bytes)	Security	DAT/PRO (ADDR) (words)	USB	ADC	UART	I ² C	RTC	McBSP ³	Memory ⁶ Stick/ MMC/SD	Voltage (V)		COM	Timers ⁷	Cycles (ns)	MIPS	Packaging	Price ¹
												Core	I/O						
C55x™ DSP																			
TMS320VC5502-200	64K	32K	Y ⁸	8M	–	–	Y	Y	–	3	–	1.5	3.3	UHPI16/8	3 ⁹	5	400	176 LQFP 176 BGA ¹⁰	10.18
TMS320VC5509-144	256K	64K	Y ⁸	32K 4M	Y	Y	–	Y	Y	3	Y	1.6	3.3	EHPI16	2 ⁹	6.9	288	144 LQFP 179 BGA ¹⁰	20.50
TMS320VC5509-200	256K	64K	Y ⁸	32K 4M	Y	Y	–	Y	Y	3	Y	1.6	3.3	EHPI16	2 ⁹	5	400	144 LQFP 179 BGA ¹⁰	26.40
TMS320VC5510-160	320K	32K	–	8M	–	–	–	–	–	3	–	1.5	3.3	EHPI16	2	6.25	320	240 BGA ¹⁰	25.50
TMS320VC5510-200	320K	32K	–	8M	–	–	–	–	–	3	–	1.5	3.3	EHPI16	2	5	400	240 BGA ¹⁰	28.50

¹Prices are quoted in U.S. dollars in quantities of 1,000 and represent year 2002 (effective November 2001) suggested resale pricing.

²Nomenclature for core: VC = 2.5 V or less; UC = 1.8 V or less, UVC = 1.2 V.

³Multichannel Buffered Serial Port (McBSP).

⁴Multi-core devices (VC542x = 2; VC544x = 4).

⁵Internal bootloader not available on VC5420.

⁶Memory Stick, MMC/SD; muxed.

⁷3 = Two general-purpose timers and one 32-bit DSP/BIOS™ Kernel counter.

⁸2 = Two general-purpose timers.

⁹8 kword Secure ROM and JTAG disconnect option.

¹⁰Plus 1 additional programmable watchdog timer.

¹⁰MicroStar BGA™ package.

Note: All C5000 DSP devices include 6-channel DMA and software PLL.

DIGITAL SIGNAL PROCESSORS—C2000™ DSP FAMILY

Device	RAM (16-bit words)	ROM (16-bit words)	Flash (16-bit words)	Boot ROM (words)	EMIF	General- Purpose Timers	Watch- dog Timer	PWM Ch.	Captures/ QEP	SPI	SCI	CAN	10-Bit A/D Channels Conversion Time (ms)	I/O Pins	Voltage (V)	MIPS	Packaging	Price ¹	
C24x™ DSP																			
TMS320LF2407A ²	2.5K	—	32K	256	Y	4	Y	16	6c/4q	Y	Y	Y	16 ch 0.375	41	3.3	40	144 LQFP	10.56	
TMS320LF2406A ²	2.5K	—	32K	256	—	4	Y	16	6c/4q	Y	Y	Y	16 ch 0.375	41	3.3	40	100 LQFP	10.03	
TMS320LF2403A ²	1K	—	16K	256	—	2	Y	8	3c/2q	Y	Y	Y	8 ch 0.375	21	3.3	40	64 TQFP	9.38	
TMS320LF2402A ²	1K	—	8K	256	—	2	Y	8	3c/2q	—	Y	—	8 ch 0.375	21	3.3	40	64 PQFP	8.21	
TMS320LF2401A ²	1K	—	8K	256	—	2	Y	7	1c/—	—	Y	—	5 ch 0.5	13	3.3	40	32 LQFP	7.24	
TMS320LC2406A ^{2,3}	2.5K	32K	—	—	—	4	Y	16	6c/4q	Y	Y	Y	16 ch 0.375	41	3.3	40	100 LQFP	5.70	
TMS320LC2404A ^{2,3}	1.5K	16K	—	—	—	4	Y	16	6c/4q	Y	Y	—	16 ch 0.375	41	3.3	40	100 LQFP	5.27	
TMS320LC2402A ^{2,3}	544	6K	—	—	—	2	Y	8	3c/2q	—	Y	—	8 ch 0.425	21	3.3	40	64 PQFP 64 TQFP	2.95	
TMS320F243	544	—	8K	—	Yes	2	Y	8	3c/2q	Y	Y	Y	8 ch 0.9	26	5	20	144 LQFP	13.99	
TMS320F241	544	—	8K	—	—	2	Y	8	3c/2q	Y	Y	Y	8 ch 0.9	26	5	20	64 PQFP	12.37	
TMS320C242 ⁴	544	4K	—	—	—	2	Y	8	3c/2q	—	Y	—	8 ch 0.9	26	5	20	64 PQFP	3.69	
TMS320F240	544	—	16K	—	Yes	3	Y	12	4c/2q	Y	Y	—	16 ch 6.1	28	5	20	132 PQFP	16.21	
Device	RAM (16-bit words)	ROM (16-bit words)	Flash (16-bit words)	Boot ROM (words)	EMIF	General- Purpose Timers	Watch- dog Timer	PWM Ch.	Captures/ QEP	SPI	SCI	eCAN	McBSP w/SPI Mode	12-Bit A/D Channels Conversion Time (ns)	I/O Pins	Voltage Core, I/O (V)	MIPS	Packaging	Price ¹
C28x™ DSP																			
TMS320F2810	18K	2K	64K ²	4K	—	4	Y	16	6/2	1	2	Y	Y	16 ch 200	56	1.8 3.3	150	128 LQFP	19.92
TMS320F2812	18K	2K	128K ²	4K	Y	4	Y	16	6/2	1	2	Y	Y	16 ch 200	56	1.8 3.3	150	176 LQFP 179 BGA ⁵	25.47

¹Prices are quoted in U.S. dollars in quantities of 1,000 and represent year 2002 (effective November 2001) suggested resale pricing.

²128-bit security key/lock protects flash/OTP and LQ/L1 SARAM.

³10 KU minimum requirements due to factory ROM code, \$9,000 NRE.

⁴5 KU minimum requirements due to factory ROM code, \$5,000 NRE.

⁵MicroStar BGA™ package.

MSP430 ULTRA-LOW-POWER MICROCONTROLLERS

Device	Flash (kB)	RAM	I/O	WDT	Comp_A	Timer_A	USART	Timer_B	ADC	MPY	Price ¹
MSP430F1101	1	128	14	✓	✓	✓	—	—	—	—	0.99 ²
MSP430F1111	2	128	14	✓	✓	✓	—	—	—	—	1.34
MSP430F1121	4	256	14	✓	✓	✓	—	—	—	—	1.76
MSP430F1122	4	256	22	✓	✓	✓	✓	—	—	—	2.43
MSP430F1123	8	256	22	✓	✓	✓	✓	—	—	—	2.54
MSP430F1222 ³	4	256	22	✓	—	✓	✓	—	10-bit	—	2.62
MSP430F1232 ³	8	256	22	✓	—	✓	✓	—	10-bit	—	2.79
MSP430F133	8	256	48	✓	✓	✓	✓	✓	12-bit	—	2.98
MSP430F135	16	512	48	✓	✓	✓	✓	✓	12-bit	—	3.59
MSP430F147	32	1024	48	✓	✓	✓	✓	✓	12-bit	✓	5.01
MSP430F148	48	2048	48	✓	✓	✓	✓	✓	12-bit	✓	5.72
MSP430F149	60	2048	48	✓	✓	✓	✓	✓	12-bit	✓	6.03

¹Suggested resale price in U.S. dollars in quantities of 1,000.

²Suggested resale price in U.S. dollars in quantities of 10,000.

³Planned release Q2 2002.

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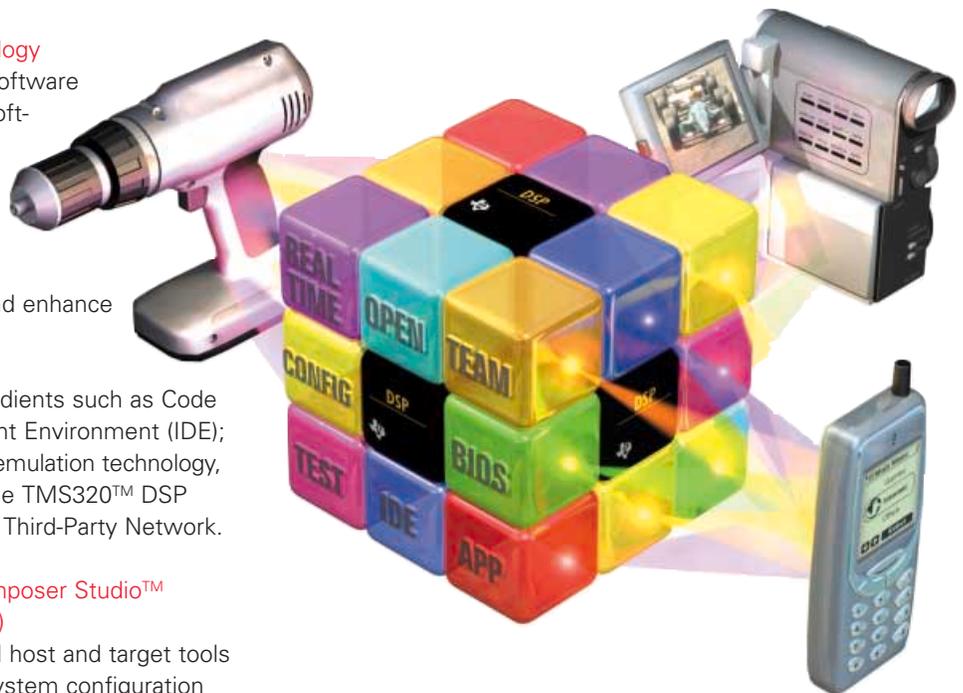
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