

## MIXED SIGNAL MICROCONTROLLER

### FEATURES

- Low Supply-Voltage Range, 1.8 V to 3.6 V
- Ultralow Power Consumption
- Five Power-Saving Modes
- Wake-Up From Standby Mode
- Frequency-Locked Loop (FLL+)
- 16-Bit RISC Architecture
- 16-Bit Timer\_A With Three or Five Capture/Compare Registers
- Integrated LCD Driver for 96 Segments
- On-Chip Comparator
- Brownout Detector
- Supply Voltage Supervisor/Monitor – Programmable Level Detection
- Serial Onboard Programming, No External Programming Voltage Needed, Programmable Code Protection by Security Fuse
- Bootstrap Loader in Flash Devices

### DESCRIPTION

The Texas Instruments MSP430 family of ultra-low-power microcontrollers consists of several devices featuring different sets of peripherals targeted for various applications. The architecture, combined with five low power modes, is optimized to achieve extended battery life in portable measurement applications. The device features a powerful 16-bit RISC CPU, 16-bit registers, and constant generators that contribute to maximum code efficiency. The digitally controlled oscillator (DCO) allows wake-up from low-power modes to active mode in less than 6  $\mu$ s.

The MSP430F417 is a microcontroller configuration with one or two built-in 16-bit timers, a comparator, 96 LCD segment drive capability, and 48 I/O pins.

Typical applications include sensor systems that capture analog signals, convert them to digital values, and process the data and transmit them to a host system. The comparator and timer make the configurations ideal for industrial meters, counter applications and handheld meters.

### ORDERING INFORMATION<sup>(1)</sup>

PRODUCT	PACKAGE DESIGNATOR	PACKAGE	ORDERABLE PART NUMBER	PACKAGE QUANTITY
MSP430F417	TD	Bare die in waffle pack <sup>(2)</sup>	MSP430F417TDE1	100
			MSP430F417TDE2	10

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).

(2) Processing is per the Texas Instruments commercial production baseline and is in compliance with the Texas Instruments Quality Control System in effect at the time of manufacture. Electrical screening consists of DC parametric and functional testing at room temperature only. Unless otherwise specified by Texas Instruments AC performance and performance over temperature is not warranted. Visual Inspection is performed in accordance with MIL-STD-883 Test Method 2010 Condition B at 75X minimum.



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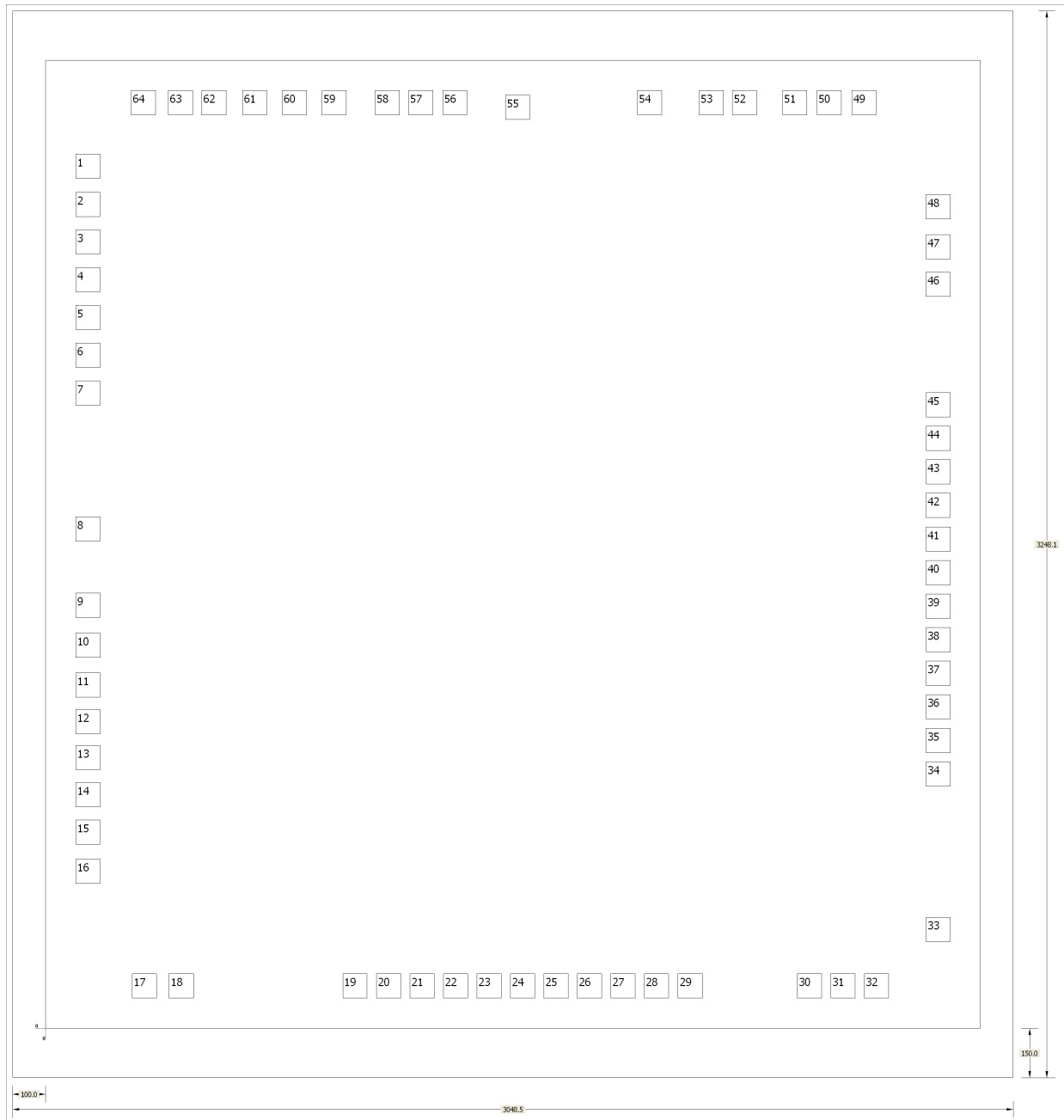


This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

**BARE DIE INFORMATION**

DIE THICKNESS	BACKSIDE FINISH	BACKSIDE POTENTIAL	BOND PAD METALLIZATION COMPOSITION	BOND PAD THICKNESS
11 mils.	Silicon with backgrind	Floating	AlCu/TiN	800 nm



**Table 1. Bond Pad Coordinates in Microns**

DESCRIPTION	PAD NUMBER	X MIN	Y MIN	X MAX	Y MAX
DVCC	1	91.95	2586.7	166.95	2661.7
P6.3	2	91.95	2470.75	166.95	2545.75
P6.4	3	91.95	2356.7	166.95	2431.7
P6.5	4	91.95	2241.7	166.95	2316.7
P6.6	5	91.95	2126.7	166.95	2201.7
P6.7	6	91.95	2011.7	166.95	2086.7
N/C	7	91.95	1896.7	166.95	1971.7
XIN	8	91.95	1483.4	166.95	1558.4
XOUT	9	91.95	1251.25	166.95	1326.25
AVSS2	10	91.95	1129.05	166.95	1204.05
N/C	11	91.95	1008.45	166.95	1083.45
P5.1/S0	12	91.95	896.5	166.95	971.5
P5.0/S1	13	91.95	787.45	166.95	862.45
P4.7/S2	14	91.95	674.2	166.95	749.2
P4.6/S3	15	91.95	559.6	166.95	634.6
P4.5/S4	16	91.95	440.95	166.95	515.95
P4.4/S5	17	264.05	91.95	339.05	166.95
P4.3/S6	18	376.5	91.95	451.5	166.95
P4.2/S7	19	905.5	91.95	980.5	166.95
P4.1/S8	20	1007.6	91.95	1082.6	166.95
P4.0/S9	21	1109.7	91.95	1184.7	166.95
P3.7/S10	22	1211.8	91.95	1286.8	166.95
P3.6/S11	23	1313.9	91.95	1388.9	166.95
P3.5/S12	24	1416	91.95	1491	166.95
P3.4/S13	25	1518.1	91.95	1593.1	166.95
P3.3/S14	26	1620.2	91.95	1695.2	166.95
P3.2/S15	27	1722.3	91.95	1797.3	166.95
P3.1/S16	28	1824.4	91.95	1899.4	166.95
P3.0/S17	29	1926.5	91.95	2001.5	166.95
P2.7/S18	30	2290.1	91.95	2365.1	166.95
P2.6/CAOUT/S19	31	2392.3	91.95	2467.3	166.95
P2.5/TA1CLK/S20	32	2494.4	91.95	2569.4	166.95
P2.4/TA1.4/S21	33	2681.55	263.5	2756.55	338.5
P2.3/TA1.3/S22	34	2681.55	737.3	2756.55	812.3
P2.2/TA1.2/S23	35	2681.55	839.4	2756.55	914.4
COM0	36	2681.55	941.5	2756.55	1016.5
P5.2/COM1	37	2681.55	1044.05	2756.55	1119.05
P5.3/COM2	38	2681.55	1146.15	2756.55	1221.15
P5.4/COM3	39	2681.55	1248.25	2756.55	1323.25
R03	40	2681.55	1350.35	2756.55	1425.35
P5.5/R13	41	2681.55	1452.45	2756.55	1527.45
P5.6/R23	42	2681.55	1554.55	2756.55	1629.55
P5.7/R33	43	2681.55	1656.65	2756.55	1731.65
P2.1/TA1.1	44	2681.55	1758.75	2756.55	1833.75
P2.0/TA0.2	45	2681.55	1860.85	2756.55	1935.85
P1.7/CA1	46	2681.55	2228.25	2756.55	2303.25
P1.6/CA0	47	2681.55	2341.95	2756.55	2416.95

**Table 1. Bond Pad Coordinates in Microns (continued)**

DESCRIPTION	PAD NUMBER	X MIN	Y MIN	X MAX	Y MAX
P1.5/TA0CLK/ACLK	48	2681.55	2464.1	2756.55	2539.1
P1.4/TA1.0	49	2456.25	2781.15	2531.25	2856.15
P1.3/TA1.0/SVSOUT	50	2350	2781.15	2425	2856.15
P1.2/TA0.1	51	2245.35	2781.15	2320.35	2856.15
P1.1/TA0.0/MCLK	52	2092	2781.15	2167	2856.15
P1.0/TA0.0	53	1991	2781.15	2066	2856.15
TDO/TDI	54	1803.2	2781.15	1878.2	2856.15
TDI/TCLK	55	1401.45	2766.8	1476.45	2841.8
TMS	56	1209.6	2781.15	1284.6	2856.15
TCK	57	1105.85	2781.15	1180.85	2856.15
RST/NMI	58	1003.75	2781.15	1078.75	2856.15
P6.0	59	842.45	2781.15	917.45	2856.15
P6.1	60	721.45	2781.15	796.45	2856.15
P6.2	61	600.45	2781.15	675.45	2856.15
AVSS1	62	475.95	2781.15	550.95	2856.15
DVSS	63	373.75	2781.15	448.75	2856.15
AVCC	64	260.9	2781.15	335.9	2856.15

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
MSP430F417TDE1	ACTIVE			0	100	TBD	Call TI	N / A for Pkg Type	
MSP430F417TDE2	ACTIVE			0	10	TBD	Call TI	N / A for Pkg Type	

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSELETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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