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 µs.

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(1)

PRODUCT	PACKAGE DESIGNATOR	PACKAGE	ORDERABLE PART NUMBER	PACKAGE QUANTITY
MSP430F417	TD	Bare die in waffle pack(2)	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.

(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.

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

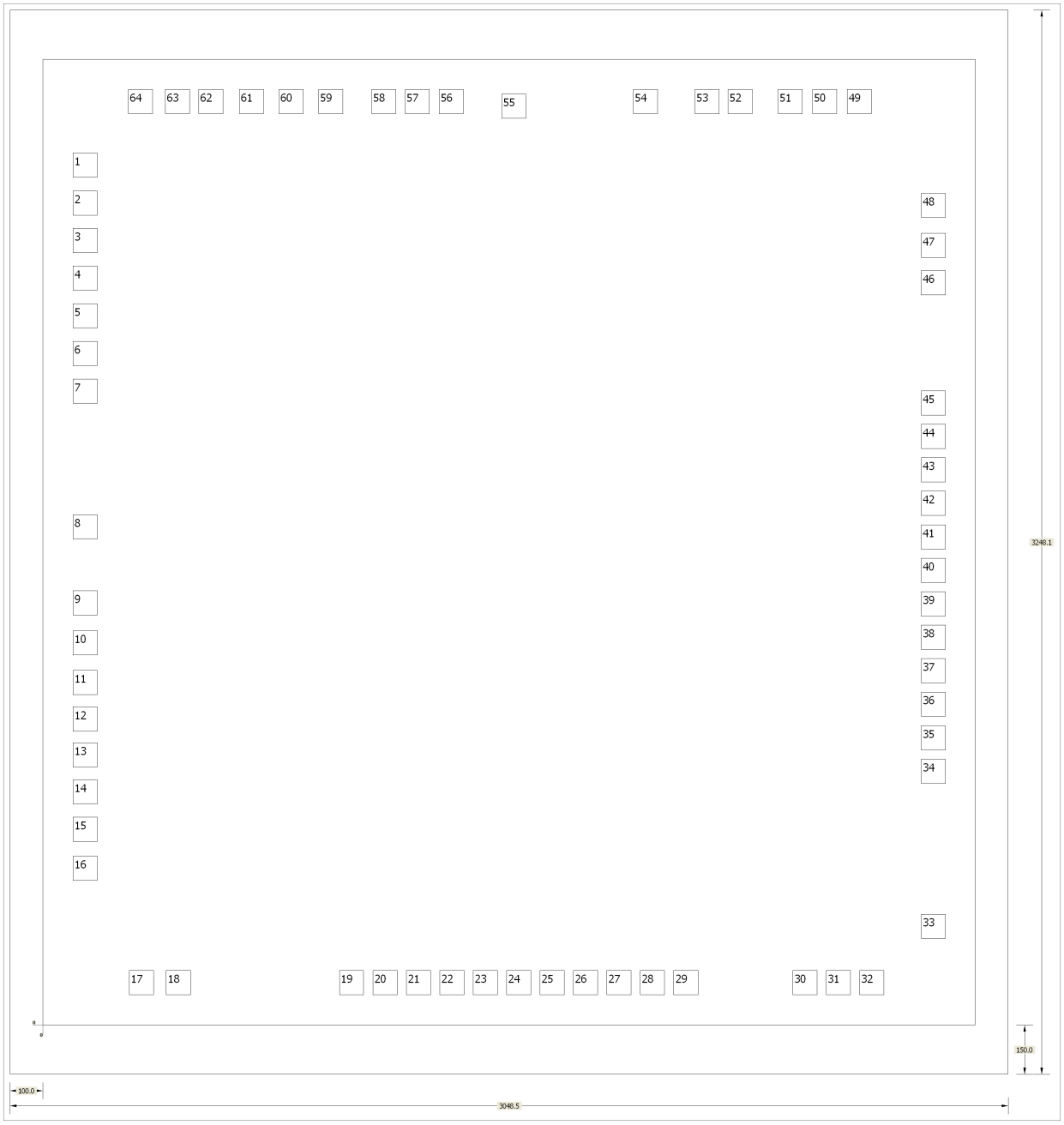

Table 1. Bond Pad Coordinates in Microns

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 (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
MSP430F417TDE1	ACTIVE			0	100	RoHS & Green	Call TI	N / A for Pkg Type			Samples
MSP430F417TDE2	ACTIVE			0	10	RoHS & Green	Call TI	N / A for Pkg Type			Samples

(1) 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.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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