

CONTROLLER ENTRY DEVICE WITH INTEGRATED DST80 AUTHENTICATION, EEPROM, AND LF IMMOBILIZER INTERFACE

Check for Samples: [TMS37F158](#)

FEATURES

- **Wide Supply Voltage Range: 2.0 V to 3.6 V**
- **Ultra-Low Power Consumption**
 - CPU Active Mode: 200 μ A/MHz at 2.2 V
 - Standby Mode (LPM3): 0.7 μ A
 - Off Mode (LPM4): 0.1 μ A
 - Power Down Mode: 60 nA
- **Microcontroller System and Peripherals**
 - 16-Bit RISC Architecture, 125-ns Instruction Cycle Time
 - Wake-Up From Standby Mode in $<6 \mu$ s
 - Basic Clock Module Configurations
 - Single External Resistor
 - 32-kHz Crystal
 - High-Frequency Crystal
 - Resonator
 - External Clock Source
 - 16-Bit Timer_A With Three Capture/Compare Registers
 - 8KB + 256B Flash Memory
 - 256B RAM
 - 150-Byte EEPROM
 - Serial Onboard Programming, No External Programming Voltage Needed
 - Programmable Code Protection by Security Fuse
 - 80-Bit DST80 Security Authentication Coprocessor
 - 12 I/O Ports
 - Integrated Push-Button Logic
- **Low-Frequency (LF) Immobilizer Interface**
 - Integrated Batteryless Immobilizer Interface
 - Half-Duplex (HDX) Immobilizer Communication Achieves up to 4-in (10-cm) Read Range
 - Special Selective Addressing Mode Allows Reliable Learn-In Sequence
 - 80-Bit Authentication Key Length
 - Up to 8-kbit/s Uplink Data Rate
 - 5/3-Byte Challenge/Response Algorithm
 - Fast Authentication Within 42 ms
 - Fast Mutual Authentication Within 65 ms
 - 150-Byte EEPROM
 - 124-Byte Available EEPROM User Memory
 - 32-Bit Unique Serial Number
 - High EEPROM Security and Flexibility
 - Write-Only Authentication Keys
 - Pages Are Irreversibly Lockable and Protectable
 - Protected Pages Programmable Only Through Mutual Authentication
 - Battery Check and Charge Functions
 - Each User Page is Lockable
 - Resonant Frequency: 134.2 kHz
 - Integrated Resonant Frequency Trimming

DESCRIPTION

The TMS37F158 Controller Entry Device (CED80) combines an ultra-low-power 16-bit RISC microcontroller with the proven TI DST80 immobilizer interface and a sophisticated power management system. It is the ideal device for any remote control or remote keyless entry application. The embedded DST80 low-frequency (LF) immobilizer interface offers a high level of security through its hardware encryption and mutual authentication with 80-bit security key length. The immobilizer interface is always accessible and operates without the need for a battery. The low-power microcontroller MSP430 core offers a 16-bit RISC architecture, 8KB program memory, battery charge and check functions, and 12 user-accessible I/O ports.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

The CED80 manages the immobilizer communication and push-button interaction. During sleep state, the device enters a special low-power mode with only 60 nA of current consumption. By sensing the pressing of a push button, the device wakes up and controls an external UHF transmitter or UHF transceiver. Security keys and rolling codes can be stored in the integrated EEPROM memory. This memory is accessible over the LF interface without support from the battery in the keyfob or by the internal microcontroller if the battery is functional. The CED80 offers a special battery-charge mode; to achieve faster charging, it is recommend to add a charging amplifier device on the base station side. The external resonant circuit with an LF coil and a resonant capacitor can be trimmed to the correct resonant frequency with the integrated trimming capability, which eliminates part tolerances.

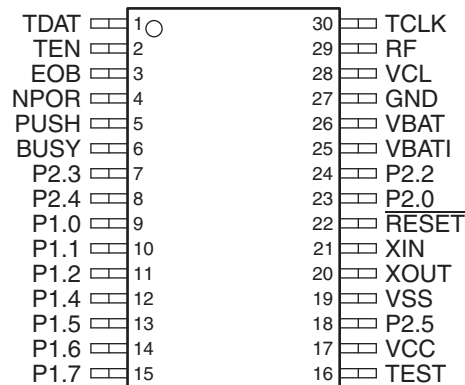
The small DBT 30-pin package together with only a few external components results in cost-efficient design.

Ordering Information⁽¹⁾

T_A	PACKAGE ⁽²⁾	ORDERABLE PART NUMBER
-40°C to 85°C	TSSOP – DBT	TMS37F158LGIDBTRG4

- (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) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

DBT PACKAGE (TOP VIEW)



Functional Block Diagram

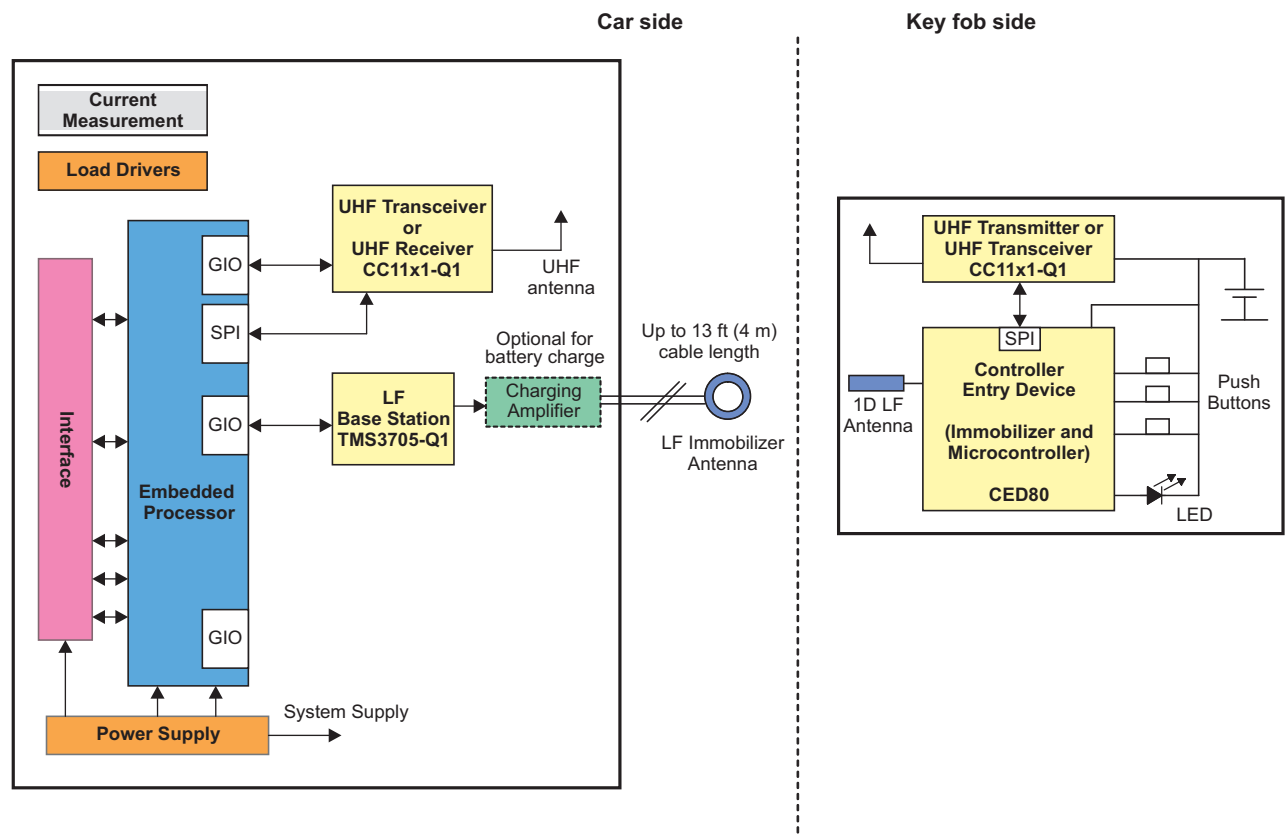
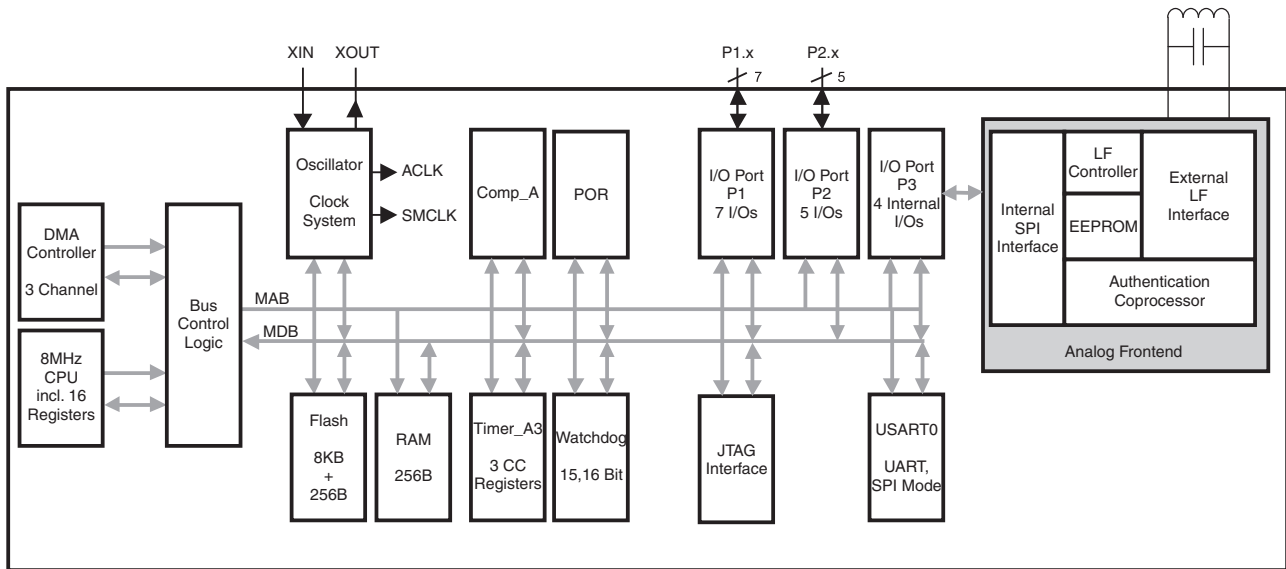


Figure 1. Application Diagram

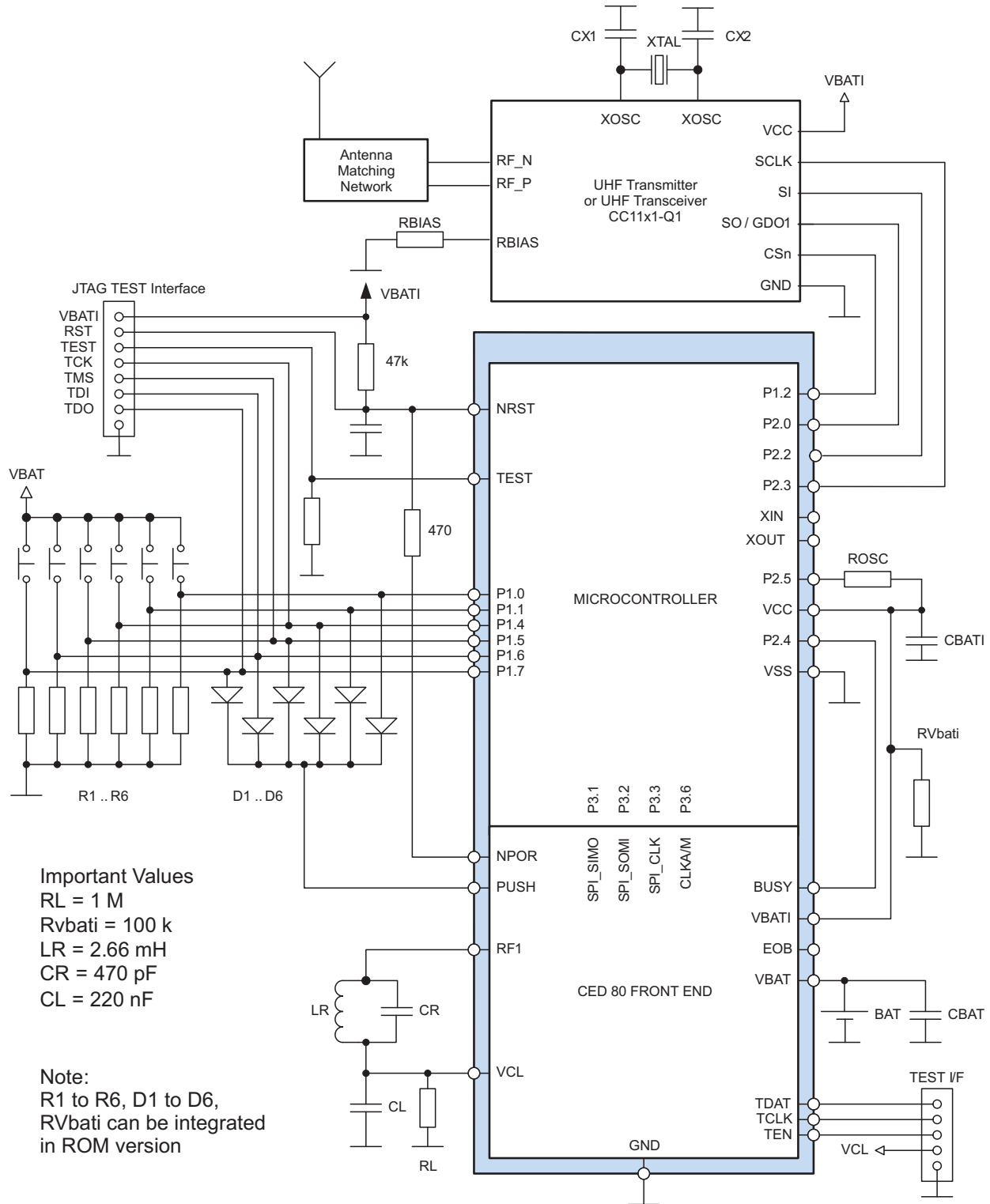


Figure 2. Application Schematic

Operating Characteristics

PART NUMBER	TMS37F158ADBTRG4	
Features	Immobilizer plus microcontroller with integrated power management	
DST80 authentication logic	80-bit key length, 4-byte or 5-byte challenge, 3-byte signature	
DST80 encryption time	Mutual authentication: 65 ms Fast authentication: 42 ms	
Microcontroller	16-bit RISC ultra-low power based on MSP430F123 core	
Supply voltage (VBAT)	2.0 V to 3.6 V	
Active current consumption	200 μ A ($V_{CC} = 2.2$ V, $f_{osc} = 1$ MHz)	
Standby current consumption	60 nA (typ) (with PUSH logic)	
Transponder		
Transmission principle	HDX (half duplex telegram protocol)	
Operating frequency	134.2 kHz Integrated resonant frequency trimming capability via LF or test interface	
Security	Challenge/response, mutual authentication	
Downlink	100% AM, PPM bit coding with 2 kbit/s (typ)	
Uplink	FSK modulation with 7.9 kbit/s (typ)	
EEPROM memory	150 bytes	124-byte free available EEPROM user memory
		32-bit unique serial number
EEPROM endurance	200 000 cycles ($T_A = 25^\circ\text{C}$) (min)	
Clock reference for microcontroller	Resonant circuit can be used as clock reference for the microcontroller	
Battery check	Two free programmable voltage levels: 2.0 V to 3.6 V with 0.1-V steps	
Battery charge	Integrated battery-charge functionality	
Key learn-in	Special selective addressing to provide secure learn-in procedure	
Microcontroller		
Memory	8KB program memory , 256-byte RAM	
User data flash memory	256-byte information memory	
Flash program and erase endurance	100 000 cycles (typ)	
Flash data retention	100 years (min)	
Program, erase, read supply voltage	2.7 V (min)	
I/O ports	12	
Operating temperature	-40 to 85°C	
Package	30-pin TSSOP (DBT)	

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
TMS37F158LGIDBTRG4	ACTIVE	TSSOP	DBT	30		TBD	Call TI	Call TI	

⁽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.

OBSELETE: TI has discontinued the production of the device.

⁽²⁾ 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)

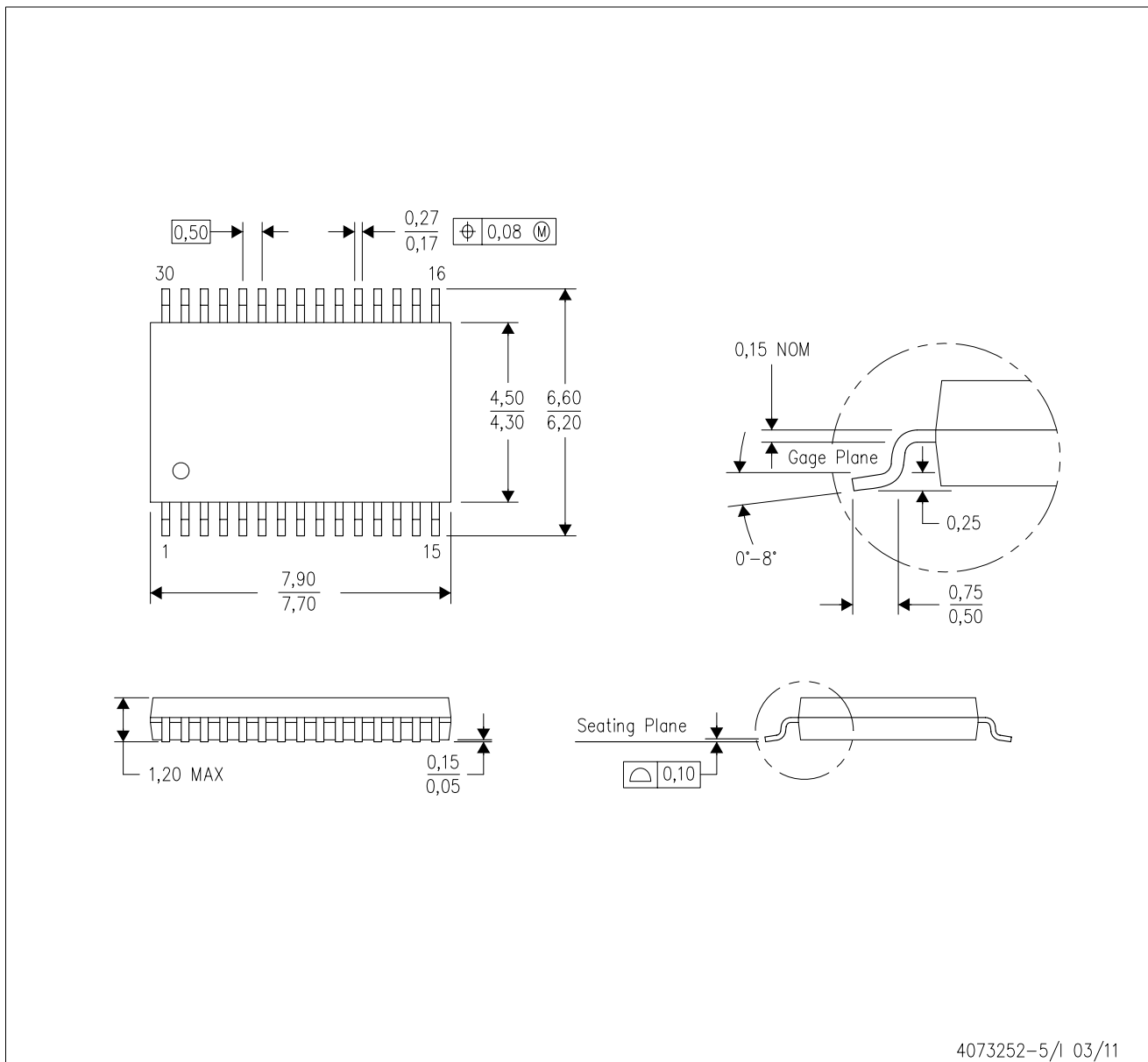
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

DBT (R-PDSO-G30)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion.
 - Falls within JEDEC MO-153.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Mobile Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community Home Page

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2012, Texas Instruments Incorporated