

- LVD-Only Active Termination
- 2.7 V to 5.25 V Operation
- Differential Failsafe Bias
- Built-In SPI-3 Mode Change Filter/Delay

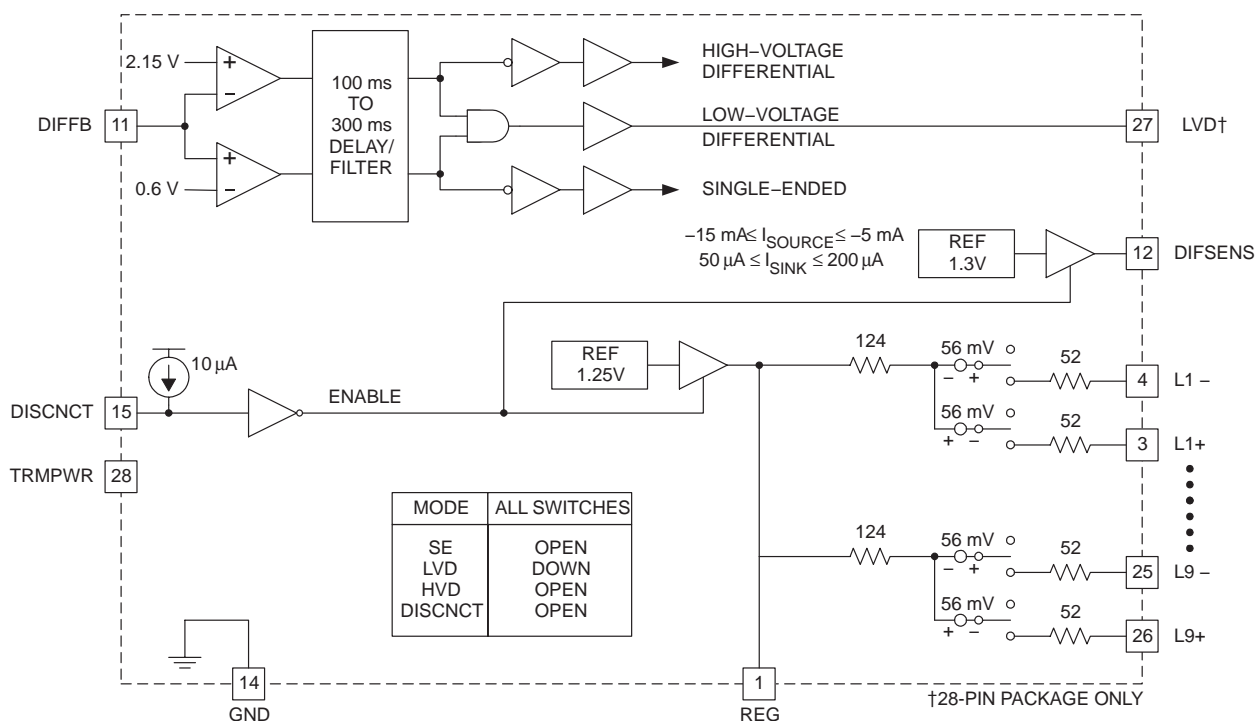
- Standards Supported: SPI-2, SPI-3, SPI-4, Ultra2 (Fast 40), Ultra3/Ultra160 (Fast 80) and Ultra320 (Fast 160)

description

The UCC5680 is an LVD-only Small Computer System Interface (SCSI) terminator that integrates the mode change delay function required by the SPI-3 specification. The device senses what types of SCSI drivers are present on the bus via the voltage on the DIFFSENS SCSI control line. Single-ended (SE) and high-voltage differential (HVD) SCSI drivers (EIA485) are not supported. If the chip detects the presence of an SE or HVD SCSI driver, it disconnects itself by switching all terminating resistors off the bus and enters a high-impedance state. The terminator can also be commanded to disconnect the terminating resistors with the DISCNCT input. Impedance is trimmed for accuracy and maximum effectiveness. Bus lines are biased to a failsafe state to ensure signal integrity.

The UCC5680 is offered in both 24-pin and 28-pin TSSOP (PW) packages for a temperature range of 0°C to 70°C.

functional block diagram



UDG-00067



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

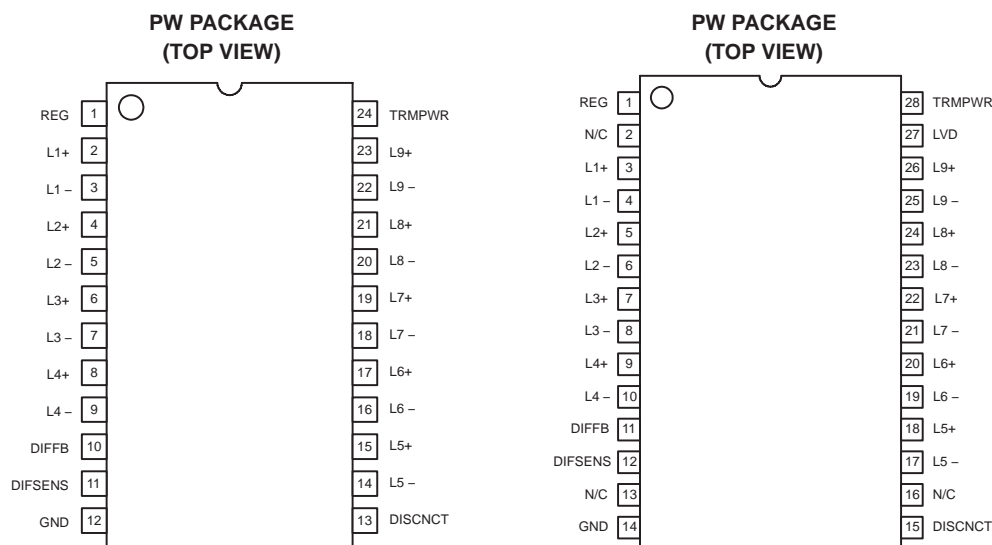
UCC5680

9-LINE LVD ONLY SCSI TERMINATOR

WITH INTEGRATED SPI-3 DELAYS

SLUS313D – MARCH 1999 - REVISED NOVEMBER 2003

TSSOP PACKAGE (TOP VIEW)



ordering information

$T_A = T_J$	PACKAGED DEVICE†	
	TSSOP-24 (PW)	TSSOP-28 (PW)
0°C to 70°C	UCC5680PW24	UCC5680PW28

† The PW package is available taped and reeled in quantities of 2,000. Add TR suffix to device type (e.g. UCC5680PWTR) to order quantities of 2,000 devices per reel.

absolute maximum ratings over operating free-air temperature (unless otherwise noted)†

TERMPWR Voltage	6 V
Signal Line Voltage	0 V to 5 V
Package Dissipation	0.5 W
Storage Temperature	-65°C to 150°C
Junction Temperature	-55°C to 150°C
Lead Temperature (Soldering, 10 sec.)	300°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions

TERMPWR Voltage	2.7 V to 5.25 V
Operating Temperature Range	0°C to 70°C

electrical characteristics over recommended operating free-air temperature range,
 $T_A = T_J = 0^\circ\text{C}$ to 70°C , $\text{TRMPWR} = 2.7\text{ V}$ to 5.25 V

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
TRMPWR Supply Current Section					
TRMPWR supply current	LVD Mode (No Load)			35	mA
	Disabled Mode			500	μA
Regulator Section					
Regulator output voltage	$0.5\text{ V} \leq V_{\text{CM}} \leq 2.0$, See Note 1	1.15	1.25	1.35	V
Regulator short-circuit source current	$V_{\text{REG}} = 0\text{ V}$		-100	-80	mA
Regulator short-circuit sink current	$V_{\text{REG}} = 3.0\text{ V}$	80	100		mA
DIFSENS Output Section					
Output voltage	$-5\text{ mA} \leq I_{\text{DIFSENS}} \leq 50\text{ }\mu\text{A}$	1.2	1.3	1.4	V
Short-circuit source current	$V_{\text{DIFSENS}} = 0\text{ V}$	-15		-5	mA
Short-circuit sink current	$V_{\text{DIFSENS}} = 2.75\text{ V}$	50		200	μA
Differential Termination Section (Applies to each line pair, 1-9, in LVD mode)					
Differential impedance		100	105	110	Ω
Common-mode impedance	L+ and L- shorted together, See Note 2	110	150	165	Ω
Differential bias voltage		100		125	mV
Common-mode bias voltage	L+ and L- shorted together	1.15	1.25	1.35	V
Disconnected Termination Section (Applies to each line pair, 1-9, in DISCNCT, SE or HVD mode)					
Output leakage				400	nA
Output capacitance	Single-ended measurement to ground, See Note 3			3	pF
DISCNCT and DIFFB Input Section					
DISCNCT threshold		0.8		2.0	V
DISCNCT input current	$V_{\text{DISCNCT}} = 0\text{ V}$ and 2.0 V	-30	-10		μA
DIFFB SE to LVD threshold		0.5		0.7	V
DIFFB LVD to HVD threshold		1.9		2.4	V
DIFFB input current	$0\text{ V} \leq V_{\text{DIFFB}} \leq 2.75\text{ V}$	-10		10	μA
Low Voltage Differential (LVD) Status Bit Section (See Note 4)					
I_{SOURCE}	$V_{\text{LOAD}} = 2.4\text{ V}$		-6	-4	mA
I_{SINK}	$V_{\text{LOAD}} = 0.4\text{ V}$	2	5		mA
Time Delay/Filter Section					
Mode change delay	A new mode change can start any time after a previous mode change has been detected	100	190	300	ms
Thermal Shutdown Section					
Thermal shutdown threshold	For increasing temperature	140	155	170	$^\circ\text{C}$
Thermal shutdown hysteresis			10		$^\circ\text{C}$

- NOTES: 1. V_{CM} is applied to all L+ and L- lines simultaneously.
2. $Z_{\text{CM}} = \frac{(2.0\text{V} - 0.5\text{V})}{I_{\text{VCM(max)}} - I_{\text{VCM(min)}}}$ @ $V_{\text{CM(max)}} = 2.0$, $V_{\text{CM(min)}} = 0.5\text{ V}$
3. Ensured by design, not production tested.
4. This applies to the 28-pin package only.

UCC5680

9-LINE LVD ONLY SCSI TERMINATOR WITH INTEGRATED SPI-3 DELAYS

SLUS313D – MARCH 1999 - REVISED NOVEMBER 2003

pin descriptions

DIFFB: DIFFSENS input pin. Connect through a 20-k Ω resistor to DIFSENS and through a 0.1- μ F capacitor to ground. Input to comparators that detect what types of drivers are connected to the SCSI bus.

DIFSENS: SCSI bus DIFSENS line driver.

DISCNET: Disconnect pin. Shuts down the terminator (switches terminating resistors off the bus) when open or active (high). The disconnect pin low enables the terminator.

GND: Power supply return.

LINE n -: Line termination pins. Negative line in differential pair.

LINE n +: Line termination pins. Positive line in differential pair.

LVD: (28-pin package only) Indicates that the bus is in LVD mode.

REG: Regulator bypass pin. Bypass near the terminator with a 4.7- μ F and a high-frequency, low-ESR 0.01- μ F capacitor to ground.

TRMPWR: V_{IN} 2.75 V to 5.25 V supply. Bypass near the terminator with a 4.7- μ F and a high-frequency, low-ESR 0.01- μ F capacitor to ground.

APPLICATION INFORMATION

All SCSI buses require a termination network at each end to function properly. Specific termination requirements differ, depending on which types of SCSI driver devices are present on the bus. The UCC5680 is a low-voltage differential (LVD)-only device. It senses which types of drivers are present on the bus. If it detects the presence of a single-ended (SE) or high-voltage differential (HVD) driver, the UCC5680 will place itself in a high-impedance input state, effectively disconnecting the chip from the bus.

The UCC5680 senses what kinds of drivers are present on the bus by the voltage on SCSI bus control line DIFFSENS, which is monitored by the DIFFB input pin. The DIFSENS output pin on the UCC5680 attempts to drive a DIFFSENS control line to 1.3 V. If only LVD devices are present, the DIFFSENS line will be successfully driven to that voltage. If HVD drivers are present, they will pull the DIFFSENS line high. If any single-ended drivers are present, they pull the DIFSENS line to ground (even if HVD drivers are also present on the bus). If the voltage on the DIFFB is below 0.5 V or above 2.4 V, the UCC5680 enters the high-impedance SE/HVD state. If it is between 0.7 V and 1.9 V, the UCC5680 enters the LVD mode. These thresholds accommodate differences in ground potential that can occur between the ends of long bus lines.

Three UCC5680 ICs are required at each end of the SCSI bus to terminate 27 lines (18 data, 9 control). Every UCC5680 contains a DIFSENS driver, but only one should be used to drive the line at each end. The DIFSENS pin on the other devices should be left unconnected.

On power up (the voltage on the TRMPWR pin rising above 2.7 V), the UCC5680 assumes the SE/HVD mode. If the voltage on the DIFFB input indicates LVD mode, the chip waits 100 ms to 300 ms before changing the mode of the bus. If the voltage at the DIFFB input later crosses one of the thresholds, the UCC5680 again waits 100 ms to 300 ms before changing the mode of the bus. The magnitude of the delay is the same when changing in or out of either bus mode. A new mode change can start anytime after a previous mode change has been detected.

The DIFFB inputs on all three chips at each end of the bus should be connected together. Properly filtered, noise on DIFFB will not cause a false mode change. There should be a shared 50-Hz noise filter implemented on DIFFB at each end of the bus as close as possible to the DIFFB pins. This is implemented with a 20-k Ω resistor between the DIFFB and DIFSENS pins, and a 0.1- μ F capacitor from DIFFB to ground. See the *Typical Application* diagram at the end of this datasheet.

APPLICATION INFORMATION (continued)

In LVD mode, the regulated voltage is switched to 1.25 V and a resistor network is presented to each line pair that provides common-mode impedance of 150 Ω and differential impedance of 105 Ω . The lines in each differential pair are biased so that when not driven, Line(n)+ and Line(n)– are driven 56 mV below and above the common-mode bias voltage (1.25 V) respectively.

In SE/HVD mode, all the terminating resistors are switched off the bus. The 1.25-V and 1.3-V (DIFSENS) regulators are left on.

When the disconnect input (DISCNCT) is active (high), the terminating resistors are switched off the bus and both voltage regulators are turned off to save power. The mode change filter/delay function is still active and the LVD pin (in the 28-pin package) continues to indicate the correct bus mode.

The UCC5680 operates down to a TRMPWR voltage of 2.7 V. This accommodates a 3.3-V system with allowance for supply tolerance ($\pm 10\%$), a unidirectional fusing device, and cable drop. The UCC3916 is recommended in place of a fuse and diode implementation, as its lower voltage drop provides additional voltage margin for the system.

Layout is important in all SCSI implementations and critical in SPI-3 systems, which have stringent requirements on both the absolute value of capacitance on differential signal lines and the balancing of capacitance between paired lines and from pair to pair.

Feedthroughs, through-hole connections, and etch lengths need to be carefully balanced. Standard multilayer power and ground plane spacing adds about 1 pF to each plane. Each feed-through will add 2.5 pF to 3.5 pF. Enlarging the clearance holes on both power and ground planes reduces capacitance. Opening up the power and ground planes under a through-hole connector reduces added capacitance in those applications. Capacitance is also affected by components in close proximity on both sides of the board.

maximum capacitance

SCSI Class	Trace to GND: REQ, ACK, DATA, Parity, P_CRCA	Trace to Trace: REQ, ACK, DATA, Parity, P_CRCA	Trace to GND: Other signals	Trace to Trace: Other Signals
Ultra1	25 pF	N/A	25 pF	N/A
Ultra2	20 pF	10 pF	25 pF	13 pF
Ultra3/Ultra160	15 pF	8 pF	25 pF	13 pF
Ultra320	13 pF	6.5 pF	21 pF (est.)	10 pF (est.)

TI terminators are designed with very tightly controlled capacitance on their signal lines. Between the positive and negative lines in a differential pair the difference is typically no more than 0.1 pF, and only 0.3 pF between pairs.

Multi-layer boards need to adhere to the 120- Ω impedance standard, including the connector and feedthroughs. Bus traces are normally run on the outer layers of the board with 4-mil etch and 4-mil spacing between the two lines in each differential pair, and a minimum of 8-mil spacing to adjacent pairs to minimize crosstalk. Microstrip technology is too low in impedance and should not be used—it is designed for 50 Ω rather than 120- Ω differential systems.

Decoupling capacitors should be installed as close as possible to the following input pins of the UCC5680:

TRMPWR: 4.7- μ F capacitor to ground, 0.01- μ F capacitor to ground (high-frequency, low ESR)

REG: 4.7- μ F capacitor to ground, 0.01- μ F capacitor to ground (high-frequency, low ESR)

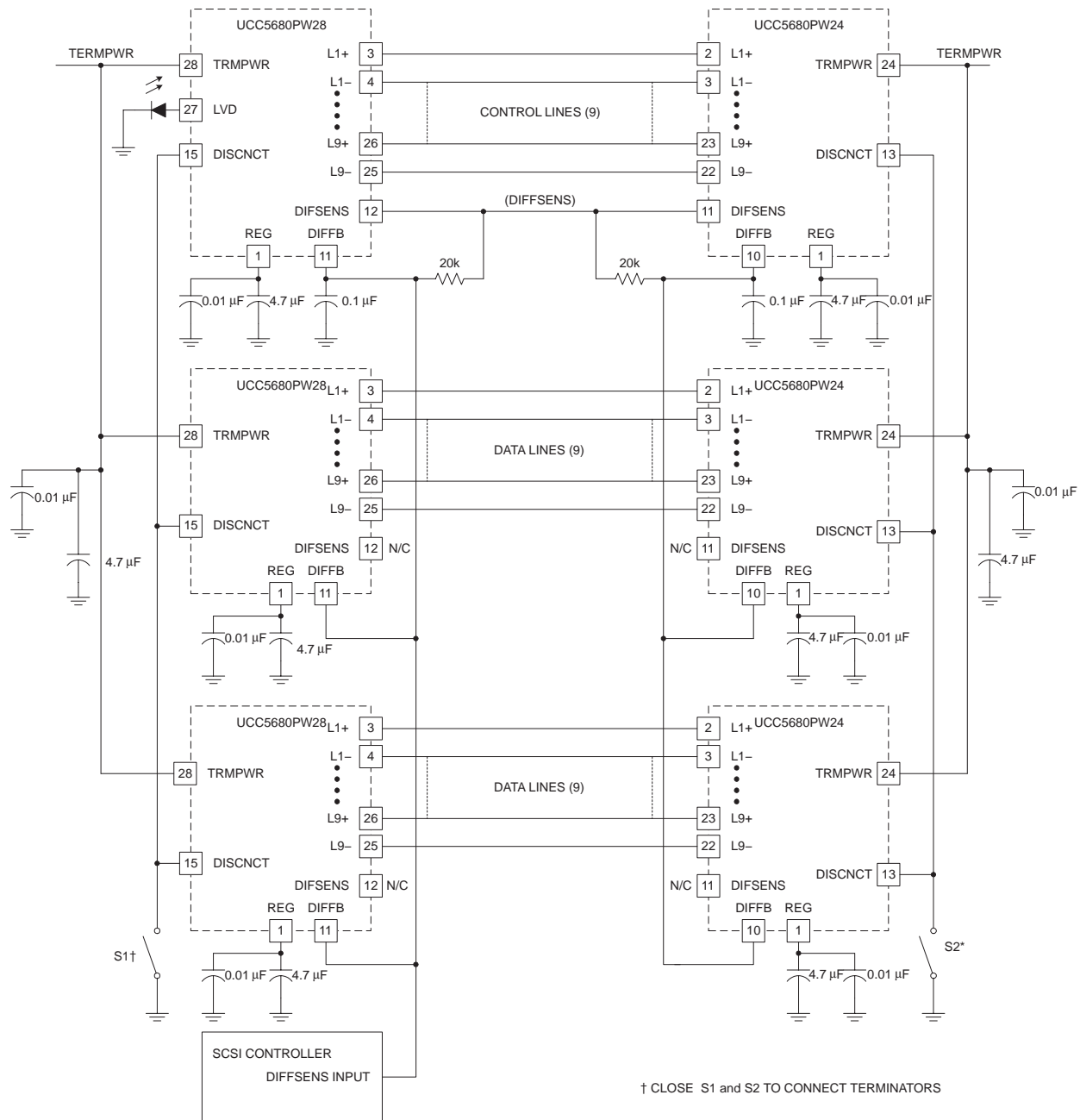
UCC5680

9-LINE LVD ONLY SCSI TERMINATOR

WITH INTEGRATED SPI-3 DELAYS

SLUS313D – MARCH 1999 - REVISED NOVEMBER 2003

TYPICAL APPLICATION



UDG-00005

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
UCC5680PW24	LIFEBUY	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UCC5680PW -24	
UCC5680PW24G4	LIFEBUY	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UCC5680PW -24	
UCC5680PW28	LIFEBUY	TSSOP	PW	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UCC5680PW -28	
UCC5680PW28G4	LIFEBUY	TSSOP	PW	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UCC5680PW -28	
UCC5680PW28TR	LIFEBUY	TSSOP	PW	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UCC5680PW -28	
UCC5680PW28TRG4	LIFEBUY	TSSOP	PW	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	UCC5680PW -28	

(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) 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.

(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.

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.

PW (R-PDSO-G24)

PLASTIC SMALL OUTLINE

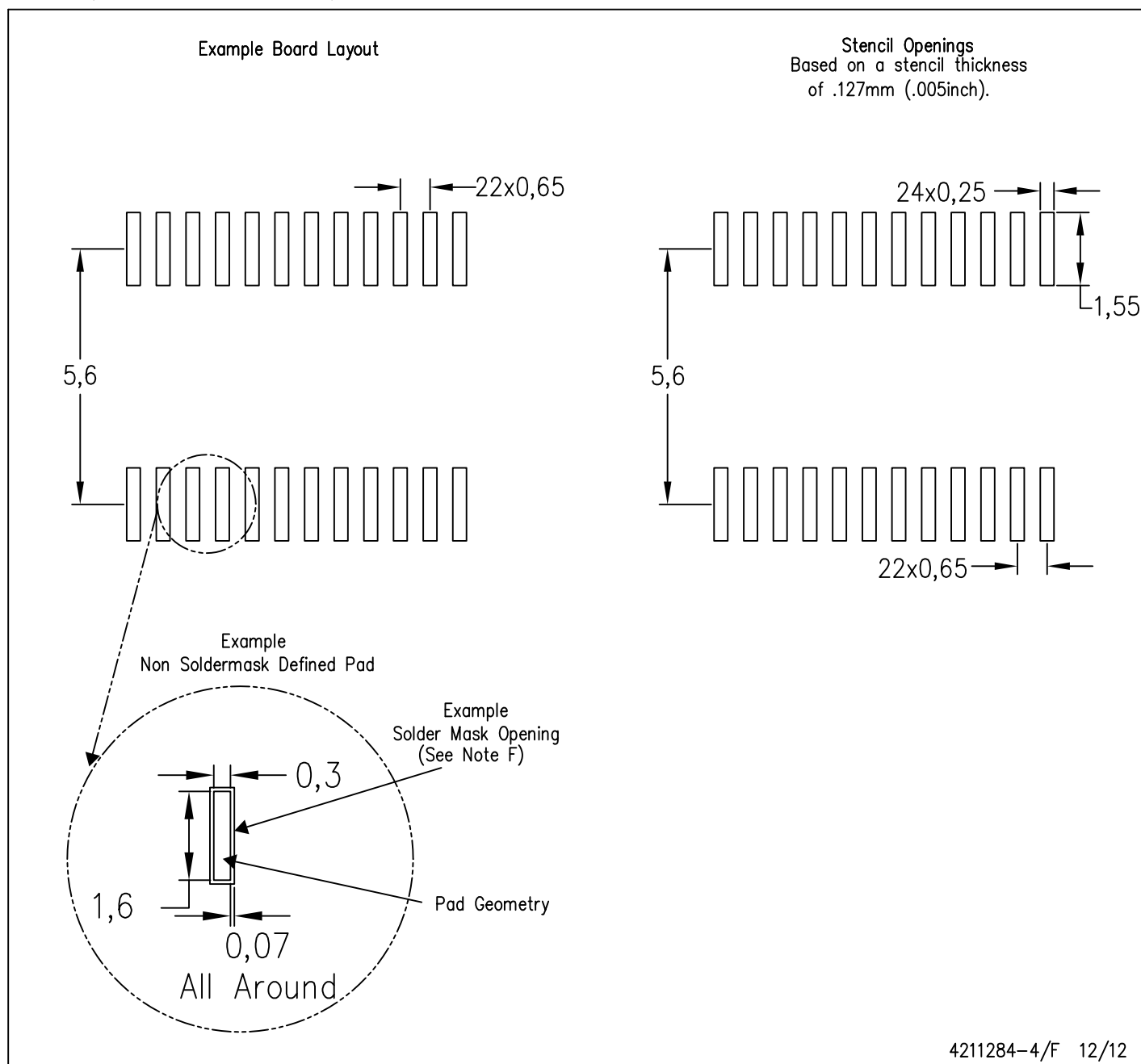


4040064-6/G 02/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
 - E. Falls within JEDEC MO-153

PW (R-PDSO-G24)

PLASTIC SMALL OUTLINE

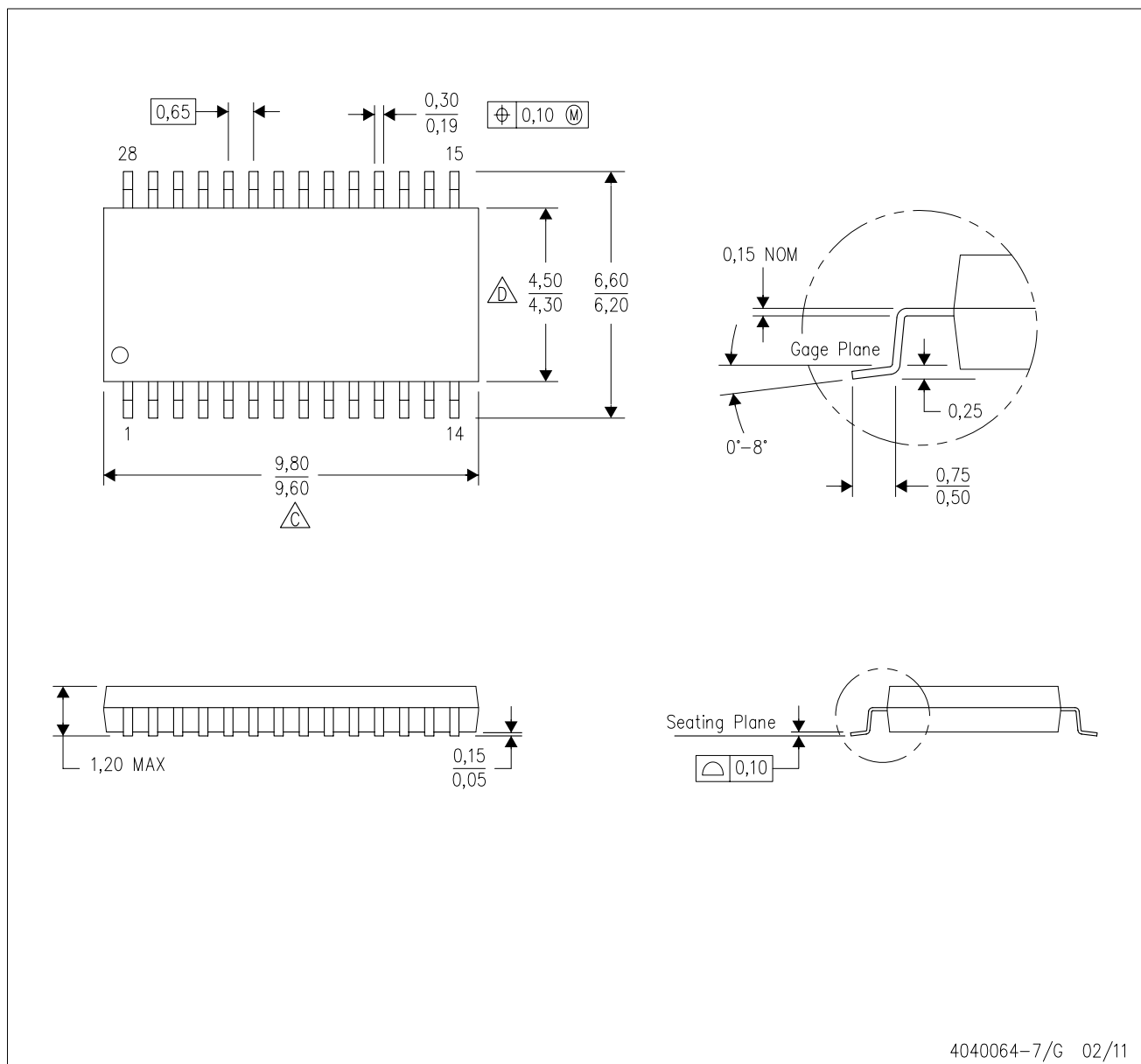


NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate design.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G28)

PLASTIC SMALL OUTLINE

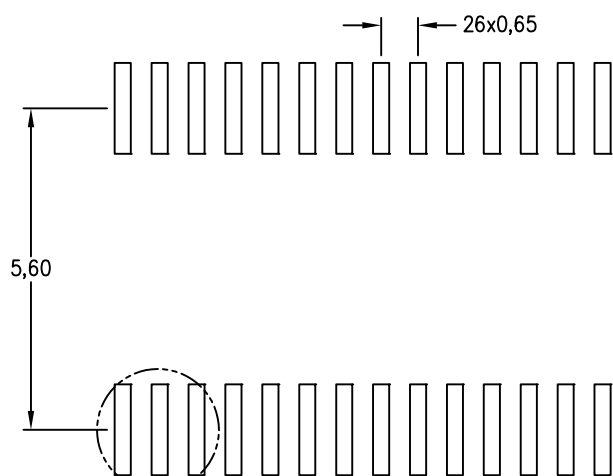


- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
 - E. Falls within JEDEC MO-153

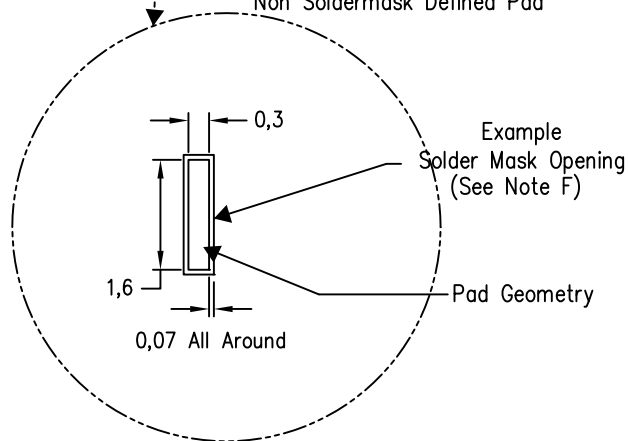
PW (R-PDSO-G28)

PLASTIC SMALL OUTLINE

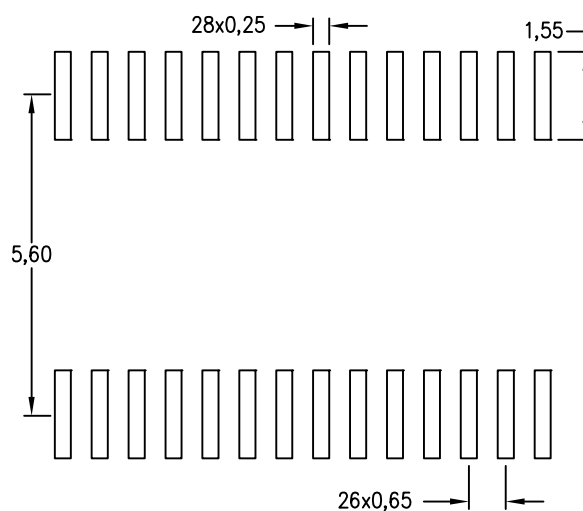
Example Board Layout



Example
Non Soldermask Defined Pad



Stencil Openings
Based on a stencil thickness
of .127mm (.005inch).



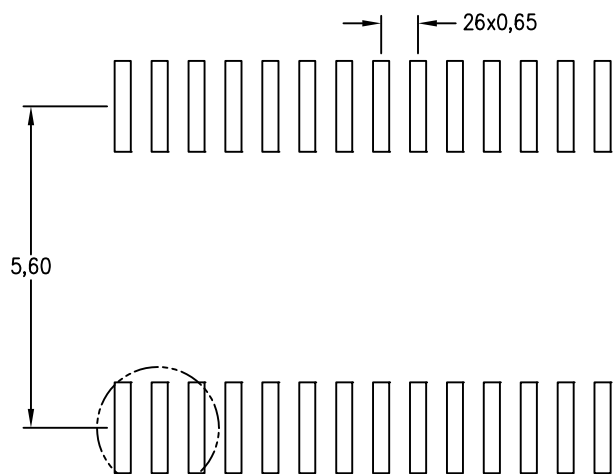
4211284-6/F 12/12

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate design.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

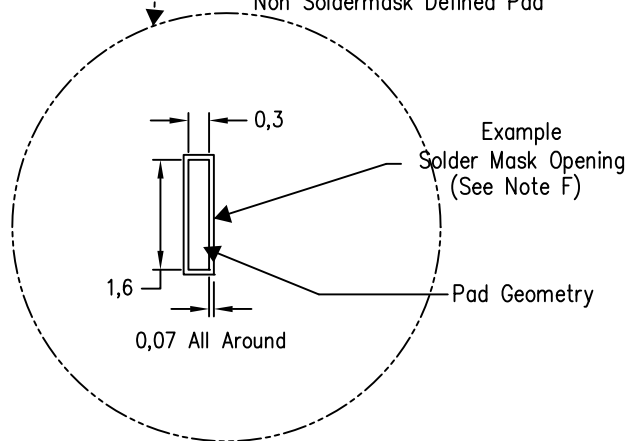
PW (R-PDSO-G28)

PLASTIC SMALL OUTLINE

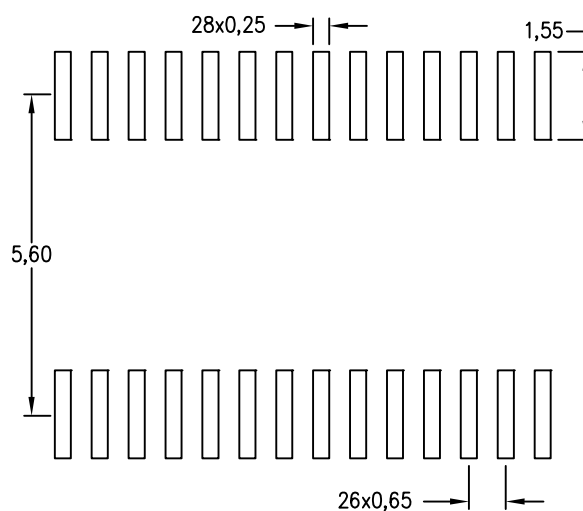
Example Board Layout



Example
Non Soldermask Defined Pad



Stencil Openings
Based on a stencil thickness
of .127mm (.005inch).



4211284-6/F 12/12

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate design.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license 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 significant portions 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. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

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

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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 Applications 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

e2e.ti.com