

TL7757 SUPPLY-VOLTAGE SUPERVISOR AND PRECISION VOLTAGE DETECTOR

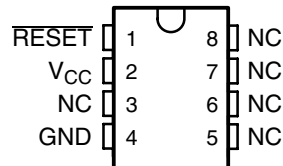
SLVS0411 – SEPTEMBER 1991 – REVISED AUGUST 2003

- Power-On Reset Generator
- Automatic Reset Generation After Voltage Drop
- Low Standby Current . . . 20 μ A
- RESET Output Defined When V_{CC} Exceeds 1 V
- Precision Threshold Voltage 4.55 V \pm 120 mV
- High Output Sink Capability . . . 20 mA
- Comparator Hysteresis Prevents Erratic Resets

description/ordering information

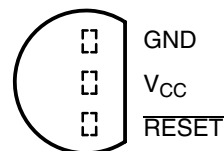
The TL7757 is a supply-voltage supervisor designed for use in microcomputer and microprocessor systems. The supervisor monitors the supply voltage for undervoltage conditions. During power up, when the supply voltage, V_{CC} , attains a value approaching 1 V, the RESET output becomes active (low) to prevent undefined operation. If the supply voltage drops below threshold voltage level (V_{IT-}), the RESET output goes to the active (low) level until the supply undervoltage fault condition is eliminated.

**D PACKAGE
(TOP VIEW)**

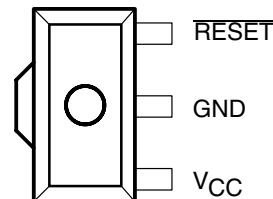


NC—No internal connection

**LP PACKAGE
(TOP VIEW)**



**PK PACKAGE
(TOP VIEW)**



GND is in electrical contact with the tab.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	SOIC (D)	Tube of 75	TL7757CD	7757C
		Reel of 2500	TL7757CDR	
	TO226 / TO-92 (LP)	Reel of 1000	TL7757CLP	TL7757C
		Reel of 2000	TL7757CLPR	
-40°C to 85°C	SOIC (D)	Tube of 75	TL7757ID	7757I
		Reel of 2500	TL7757IDR	
	TO226 / TO-92 (LP)	Bulk of 1000	TL7757ILP	TL7757I
		Reel of 2000	TL7757ILPR	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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.

**TEXAS
INSTRUMENTS**

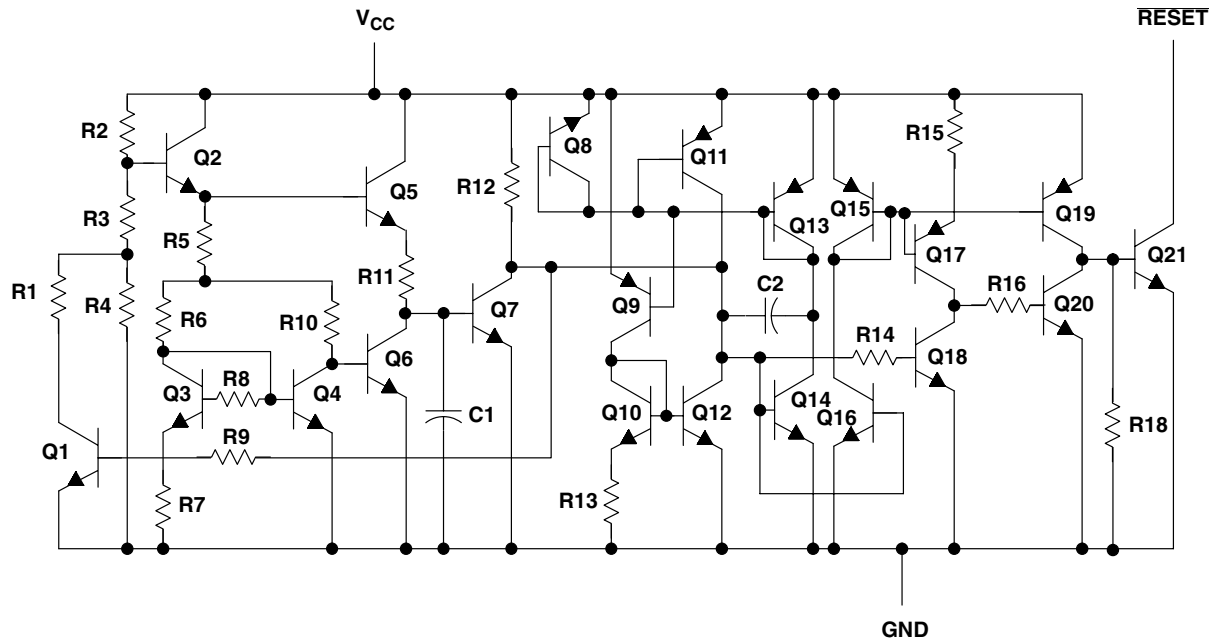
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2003, Texas Instruments Incorporated

TL7757 SUPPLY-VOLTAGE SUPERVISOR AND PRECISION VOLTAGE DETECTOR

SLVS0411 – SEPTEMBER 1991 – REVISED AUGUST 2003

equivalent schematic



ACTUAL DEVICE COMPONENT COUNT	
Transistors	27
Resistors	20
Capacitors	2

absolute maximum ratings over operating junction temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} (see Note 1)	-0.3 V to 20 V
Off-state output voltage range (see Note 1)	-0.3 V to 20 V
Output current, I_O	30 mA
Package thermal impedance, θ_{JA} (see Notes 2 and 3):	
D package	97°C/W
LP package	140°C/W
PK package	52°C/W
Operating virtual junction temperature, T_J	150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C
Storage temperature range, T_{stg}	-65°C to 150°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.

NOTES: 1. All voltage values are with respect to network terminal ground.

2. Maximum power dissipation is a function of $T_J(\max)$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\max) - T_A) / \theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.

3. The package thermal impedance is calculated in accordance with JESD 51-7.

TL7757
SUPPLY-VOLTAGE SUPERVISOR
AND PRECISION VOLTAGE DETECTOR

SLVS0411 – SEPTEMBER 1991 – REVISED AUGUST 2003

recommended operating conditions

		MIN	MAX	UNIT	
V_{CC}	Supply voltage	1	7	V	
V_{OH}	High-level output voltage		15	V	
I_{OL}	Low-level output current		20	mA	
T_A	Operating free-air temperature	TL7757C	0	70	°C
		TL7757I	-40	85	

electrical characteristics at specified free-air temperature

PARAMETER	TEST CONDITIONS	T_A	TL7757C			UNIT
			MIN	TYP	MAX	
V_{IT-}	Negative-going input threshold voltage at V_{CC}	25°C	4.43	4.55	4.67	V
		0°C to 70°C	4.4		4.7	
V_{hys}^\dagger	Hysteresis at V_{CC}	25°C	40	50	60	mV
		0°C to 70°C	30		70	
V_{OL}	Low-level output voltage $I_{OL} = 20$ mA, $V_{CC} = 4.3$ V	25°C		0.4	0.8	V
		0°C to 70°C			0.8	
I_{OH}	High-level output current $V_{CC} = 7$ V, $V_{OH} = 15$ V, See Figure 1	25°C			1	μA
		0°C to 70°C			1	
V_{res}^\ddagger	Power-up reset voltage $R_L = 2.2$ kΩ, V_{CC} slew rate ≤ 5 V/μs	25°C		0.8	1	V
		0°C to 70°C			1.2	
I_{CC}	Supply current $V_{CC} = 4.3$ V	25°C		1400	2000	μA
		0°C to 70°C			2000	
		$V_{CC} = 5.5$ V	0°C to 70°C			

† This is the difference between positive-going input threshold voltage, V_{IT+} , and negative-going input threshold voltage, V_{IT-} .

‡ This is the lowest voltage at which RESET becomes active.

switching characteristics at specified free-air temperature

PARAMETER	TEST CONDITIONS	T_A	TL7757C			UNIT
			MIN	TYP	MAX	
t_{PLH}	Propagation delay time, low-to-high-level output V_{CC} slew rate ≤ 5 V/μs, See Figures 2 and 3	25°C		3.4	5	μs
		0°C to 70°C			5	
t_{PHL}	Propagation delay time, high-to-low-level output See Figures 2 and 3	25°C		2	5	μs
		0°C to 70°C			5	
t_r	Rise time V_{CC} slew rate ≤ 5 V/μs, See Figures 2 and 3	25°C		0.4	1	μs
		0°C to 70°C			1	
t_f	Fall time See Figures 2 and 3	25°C		0.05	1	μs
		0°C to 70°C			1	
$t_{w(min)}$	Minimum pulse duration at V_{CC} for output response	25°C			5	μs
		0°C to 70°C			5	



TL7757 SUPPLY-VOLTAGE SUPERVISOR AND PRECISION VOLTAGE DETECTOR

SLVS0411 – SEPTEMBER 1991 – REVISED AUGUST 2003

electrical characteristics at specified free-air temperature

PARAMETER	TEST CONDITIONS	T _A	TL7757I			UNIT
			MIN	TYP	MAX	
V _{IT-} Negative-going input threshold voltage at V _{CC}		25°C	4.43	4.55	4.67	V
		-40°C to 85°C	4.4		4.7	
V _{hys} [†] Hysteresis at V _{CC}		25°C	40	50	60	mV
		-40°C to 85°C	30		70	
V _{OL} Low-level output voltage	I _{OL} = 20 mA, V _{CC} = 4.3 V	25°C		0.4	0.8	V
		-40°C to 85°C			0.8	
I _{OH} High-level output current	V _{CC} = 7 V, V _{OH} = 15 V, See Figure 1	25°C			1	μA
		-40°C to 85°C			1	
V _{res} [‡] Power-up reset voltage	R _L = 2.2 kΩ, V _{CC} slew rate ≤ 5 V/μs	25°C		0.8	1	V
		-40°C to 85°C			1.2	
I _{CC} Supply current	V _{CC} = 4.3 V	25°C		1400	2000	μA
		-40°C to 85°C			2100	
		-40°C to 85°C			40	

[†] This is the difference between positive-going input threshold voltage, V_{IT+}, and negative-going input threshold voltage, V_{IT-}.

[‡] This is the lowest voltage at which RESET becomes active.

switching characteristics at specified free-air temperature

PARAMETER	TEST CONDITIONS	T _A	TL7757I			UNIT
			MIN	TYP	MAX	
t _{PLH} Propagation delay time, low-to-high-level output	V _{CC} slew rate ≤ 5 V/μs, See Figures 2 and 3	25°C		3.4	5	μs
		-40°C to 85°C			5	
t _{PHL} Propagation delay time, high-to-low-level output	See Figures 2 and 3	25°C		2	5	μs
		-40°C to 85°C			5	
t _r Rise time	V _{CC} slew rate ≤ 5 V/μs, See Figures 2 and 3	25°C		0.4	1	μs
		-40°C to 85°C			1	
t _f Fall time	See Figures 2 and 3	25°C		0.05	1	μs
		-40°C to 85°C			1	
t _{w(min)} Minimum pulse duration at V _{CC} for output response		25°C			5	μs
		-40°C to 85°C			5	

PARAMETER MEASUREMENT INFORMATION

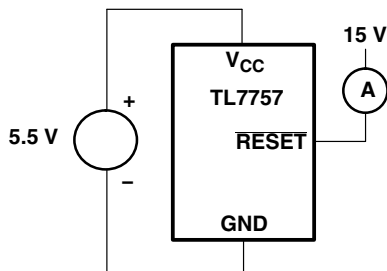
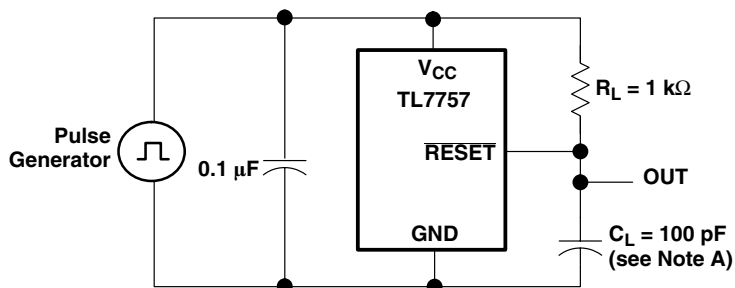
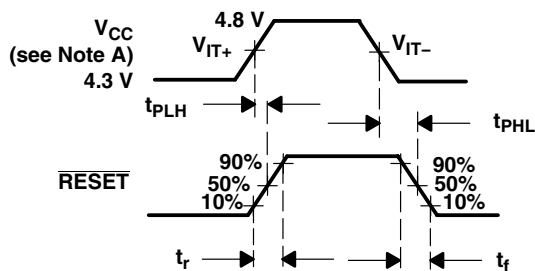


Figure 1. Test Circuit for Output Leakage Current



NOTE A: Includes jig and probe capacitance

Figure 2. Test Circuit for $\overline{\text{RESET}}$ Output Switching Characteristics



NOTE A: V_{CC} slew rate $\leq 5 \mu\text{s}$

Figure 3. Switching Diagram

TL7757
SUPPLY-VOLTAGE SUPERVISOR
AND PRECISION VOLTAGE DETECTOR

SLVS0411 – SEPTEMBER 1991 – REVISED AUGUST 2003

TYPICAL CHARACTERISTICS†

Table of Graphs

	FIGURE
V _{CC} Supply voltage vs $\overline{\text{RESET}}$ output voltage	4
I _{CC} Supply current vs Supply voltage	5
I _{CC} Supply current vs Free-air temperature	6
V _{OL} Low-level output voltage vs Low-level output current	7
V _{OL} Low-level output voltage vs Free-air temperature	8
I _{OL} Output current vs Supply voltage	9
V _{IT-} Input threshold voltage (negative-going V _{CC}) vs Free-air temperature	10
V _{res} Power-up reset voltage vs Free-air temperature	11
V _{res} Power-up reset voltage and supply voltage vs Time	12
Propagation delay time	13

**SUPPLY VOLTAGE
vs
RESET OUTPUT VOLTAGE**

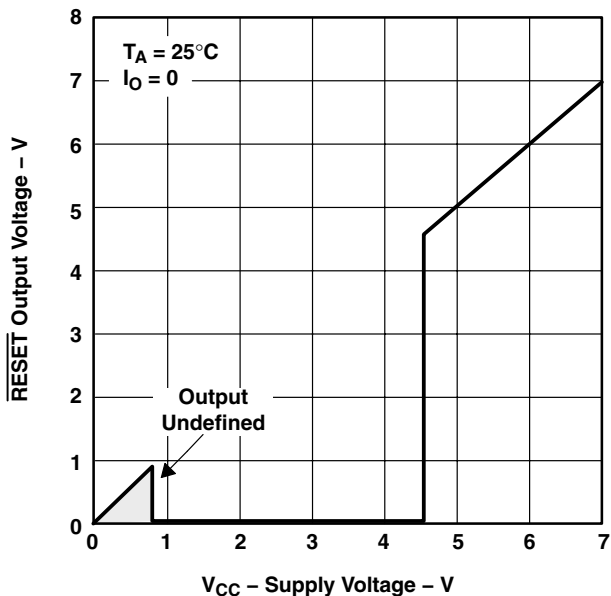


Figure 4

**SUPPLY CURRENT
vs
SUPPLY VOLTAGE**

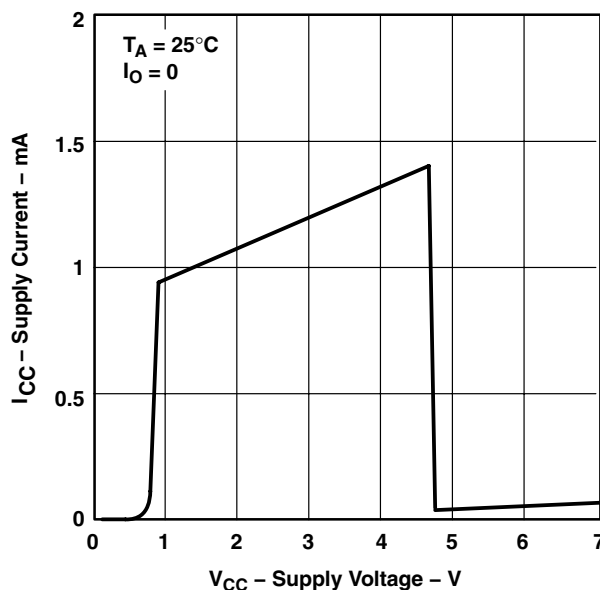


Figure 5

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS†

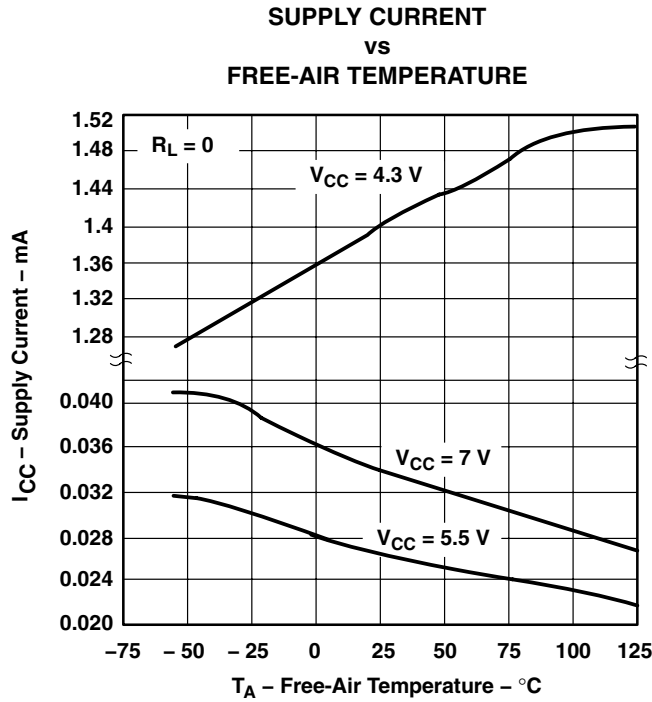


Figure 6

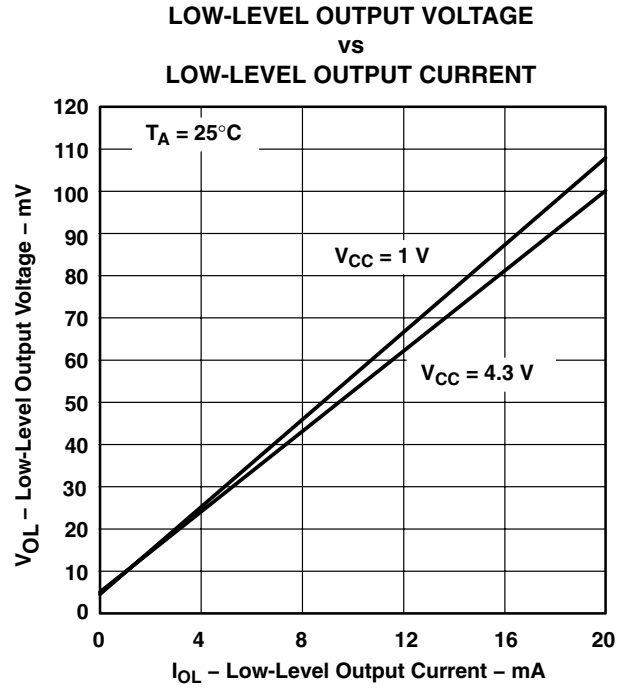


Figure 7

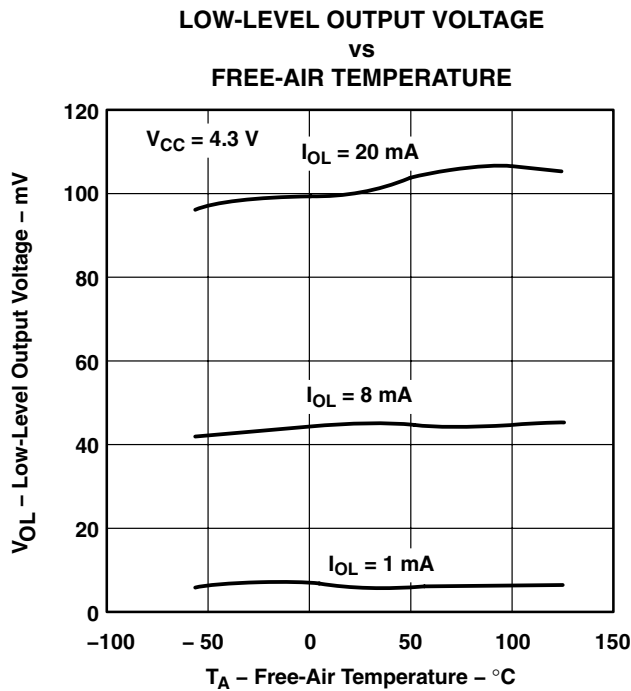


Figure 8

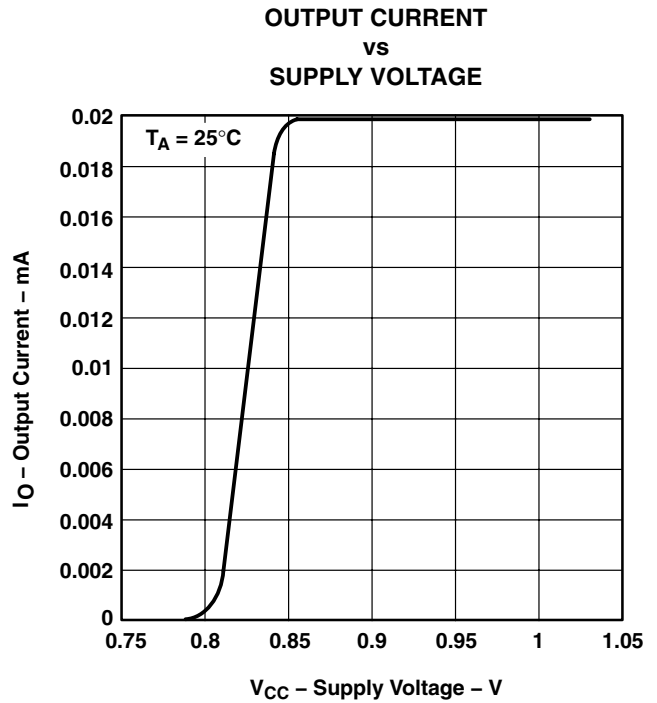


Figure 9

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TL7757
SUPPLY-VOLTAGE SUPERVISOR
AND PRECISION VOLTAGE DETECTOR

SLVS0411 – SEPTEMBER 1991 – REVISED AUGUST 2003

TYPICAL CHARACTERISTICS†

**INPUT THRESHOLD VOLTAGE
 (NEGATIVE-GOING V_{CC})
 vs
 FREE-AIR TEMPERATURE**

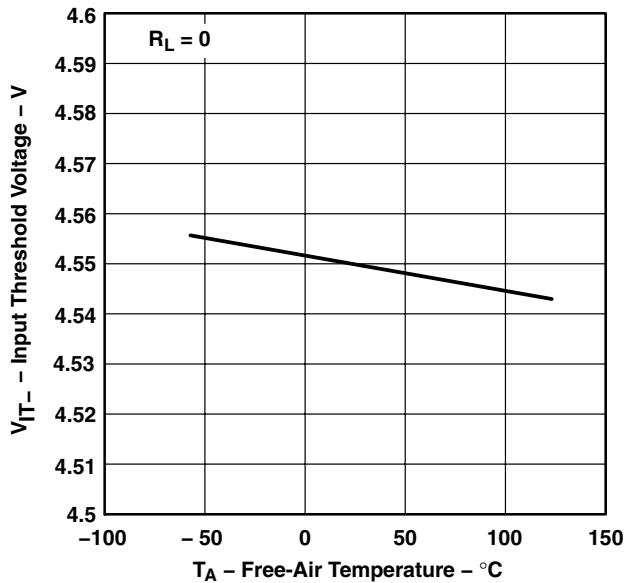


Figure 10

**POWER-UP RESET VOLTAGE
 vs
 FREE-AIR TEMPERATURE**

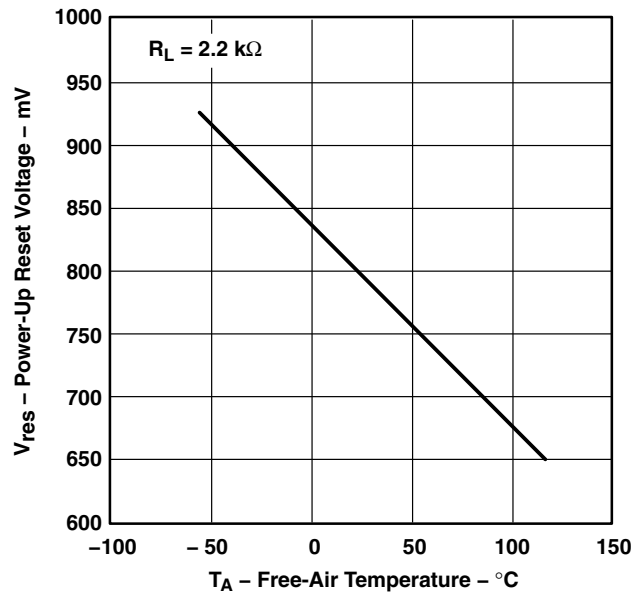


Figure 11

**POWER-UP RESET VOLTAGE
 AND SUPPLY VOLTAGE
 vs
 TIME**

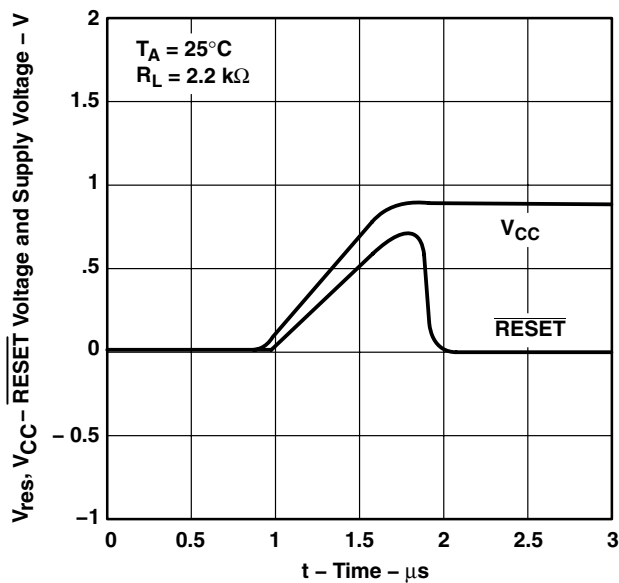


Figure 12

PROPAGATION DELAY TIME

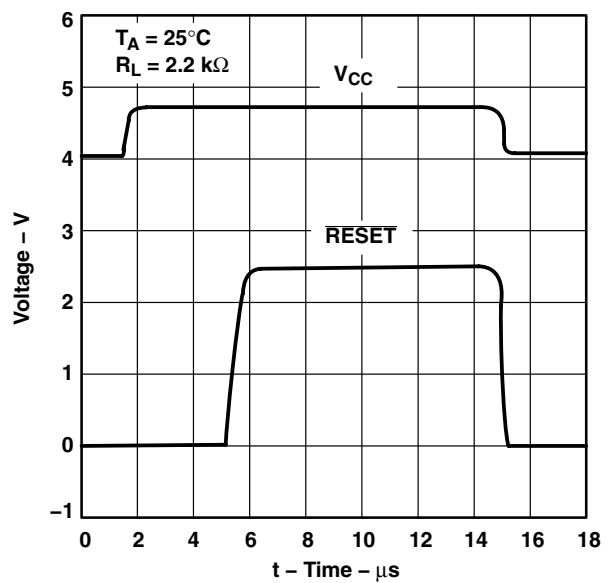
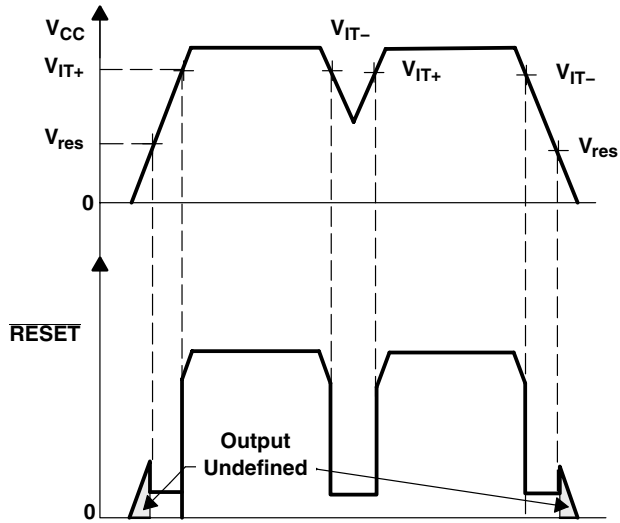


Figure 13

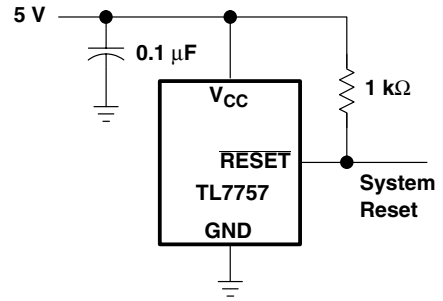
† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

APPLICATION INFORMATION

TYPICAL TIMING DIAGRAM



TYPICAL APPLICATION DIAGRAM



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)	Top-Side Markings (4)	Samples
TL7757CD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	7757C	Samples
TL7757CDE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	7757C	Samples
TL7757CDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	7757C	Samples
TL7757CDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	7757C	Samples
TL7757CDRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	7757C	Samples
TL7757CDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	7757C	Samples
TL7757CLP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	0 to 70	TL7757C	Samples
TL7757CLPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	0 to 70	TL7757C	Samples
TL7757CLPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	0 to 70	TL7757C	Samples
TL7757CLPRE3	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	0 to 70	TL7757C	Samples
TL7757CPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	0 to 70	T 7	Samples
TL7757CPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	0 to 70	T 7	Samples
TL7757ID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	7757I	Samples
TL7757IDE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	7757I	Samples
TL7757IDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	7757I	Samples
TL7757IDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	7757I	Samples
TL7757IDRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	7757I	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
TL7757IDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	77571	Samples
TL7757ILP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	TL77571	Samples
TL7757ILPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	-40 to 85	TL77571	Samples
TL7757IPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	-40 to 85	71	Samples
TL7757IPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	-40 to 85	71	Samples
TL7757MD	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI	-55 to 125		
TL7757MDR	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI	-55 to 125		
TL7757MLP	OBSOLETE	TO-92	LP	3		TBD	Call TI	Call TI	-55 to 125		

(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) Only one of markings shown within the brackets will appear on the physical device.

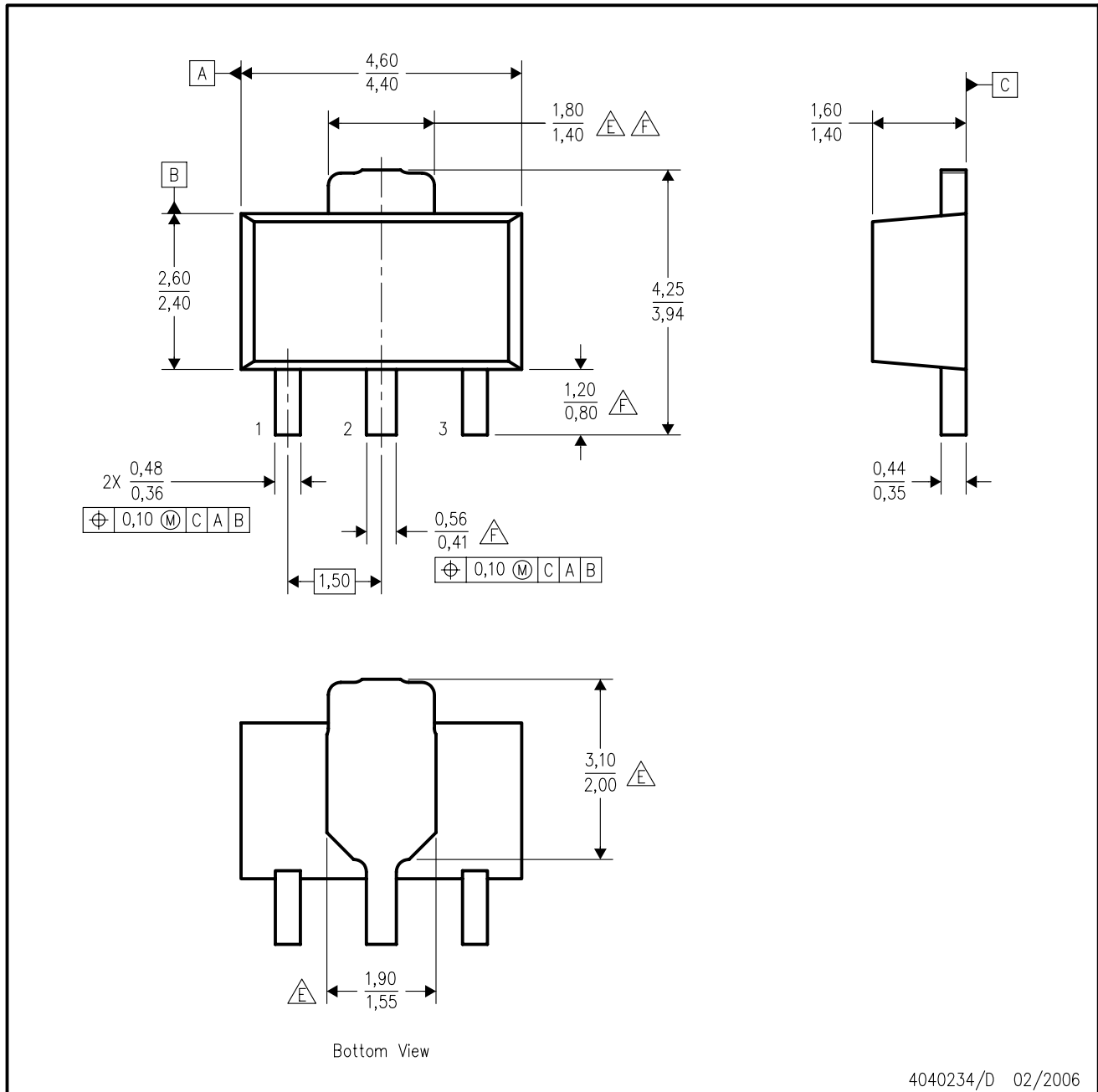
Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. 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.

PK (R-PSS0-F3)

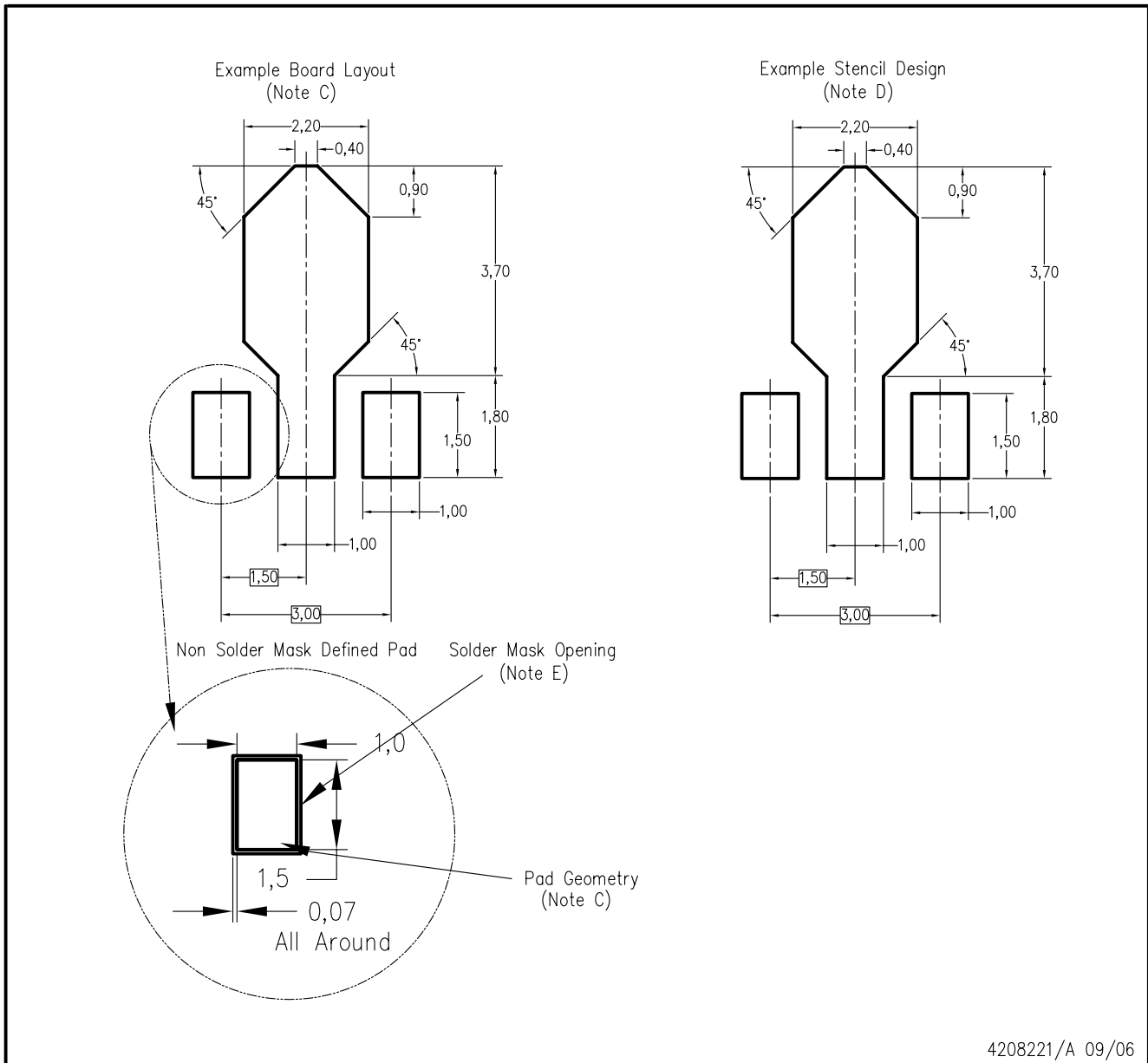
PLASTIC SINGLE-IN-LINE PACKAGE



4040234/D 02/2006

- 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. The center lead is in electrical contact with the tab.
 - D. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion not to exceed 0.15 per side.
 - $\triangle E$ Thermal pad contour optional within these dimensions.
 - $\triangle F$ Falls within JEDEC TO-243 variation AA, except minimum lead length, pin 2 minimum lead width, minimum tab width.

PK (R-PDSO-G3)

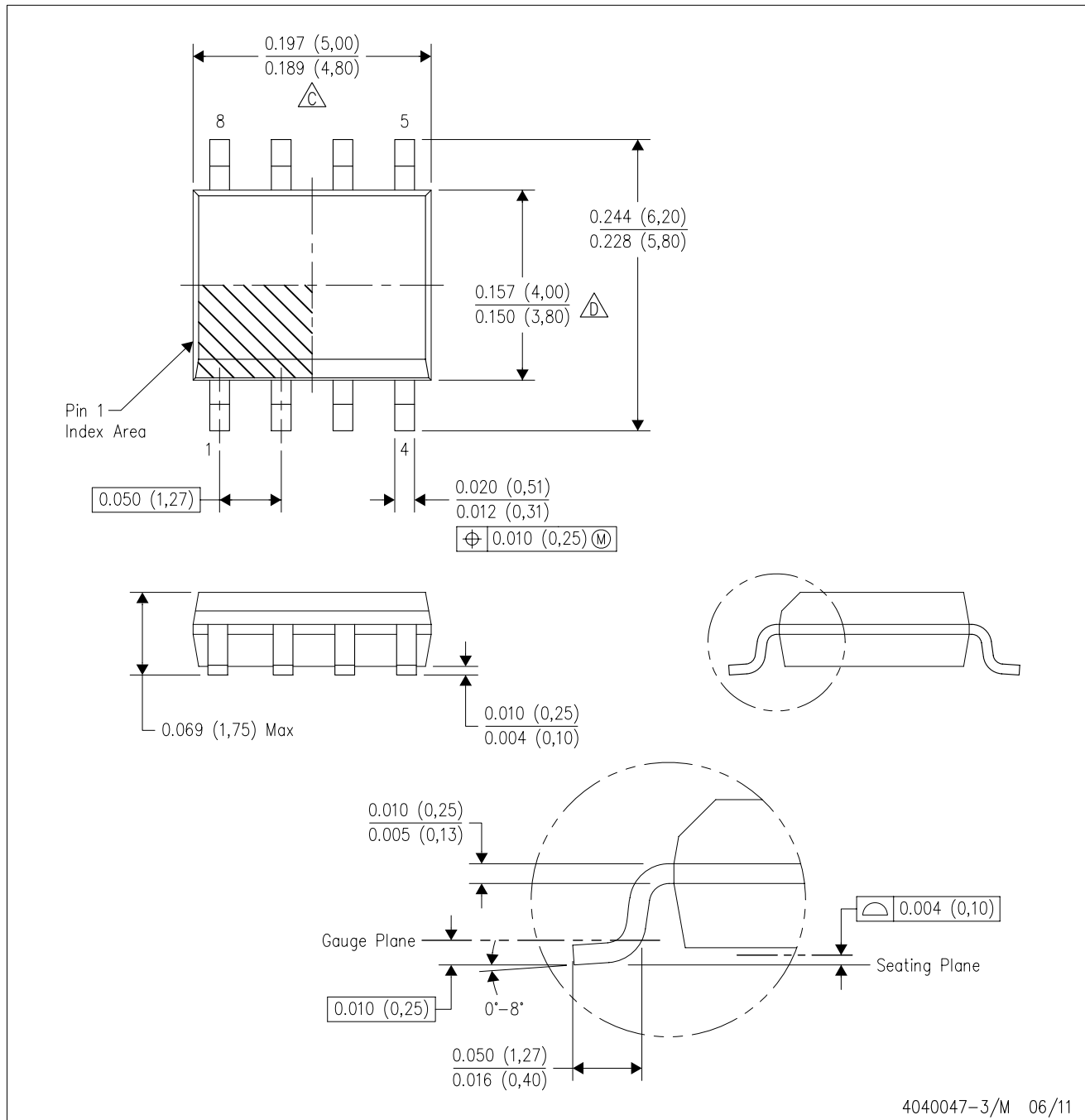


4208221/A 09/06

- 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 designs.
 - 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.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

D (R-PDSO-G8)

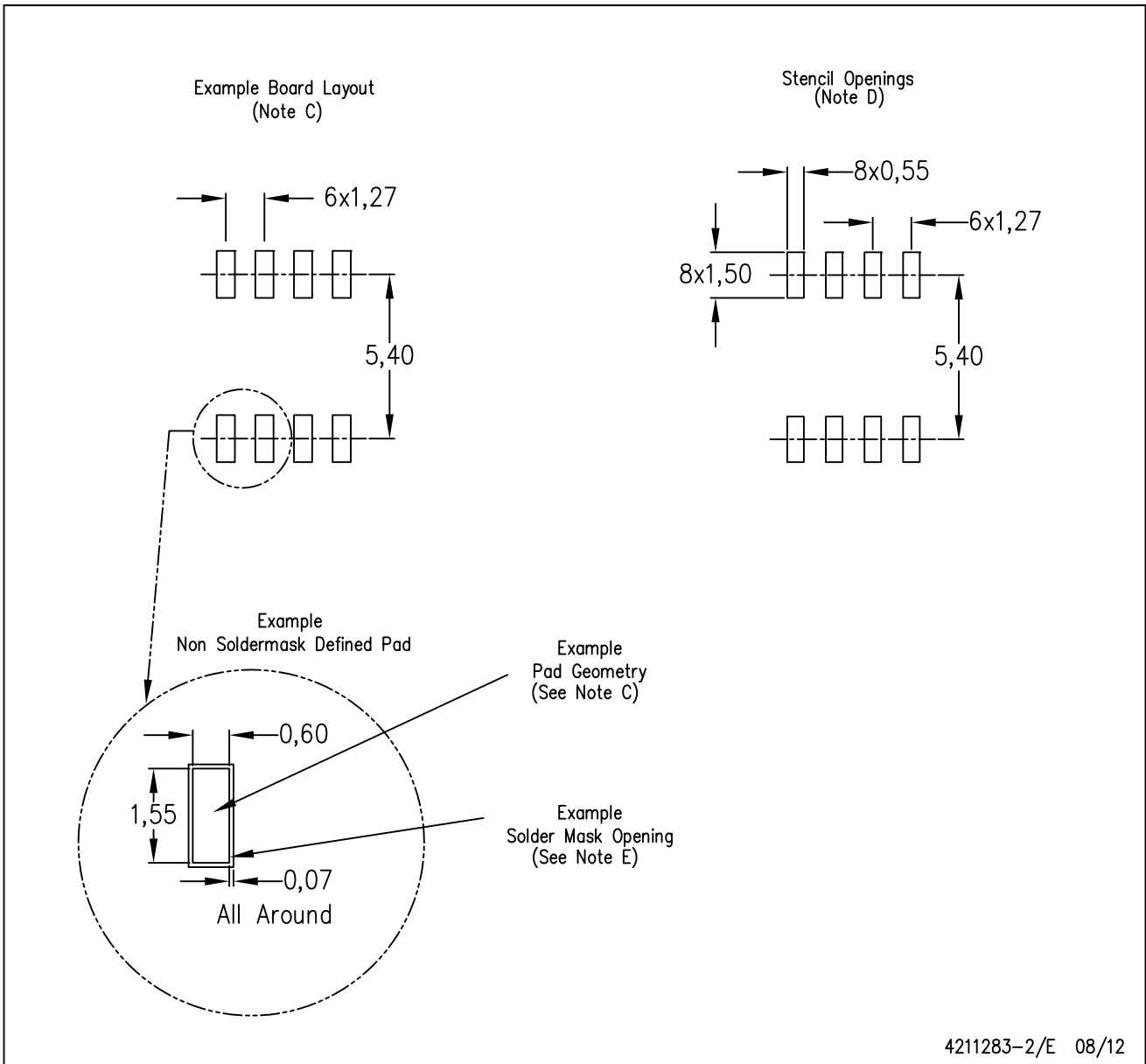
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - 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 0.006 (0,15) each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AA.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE

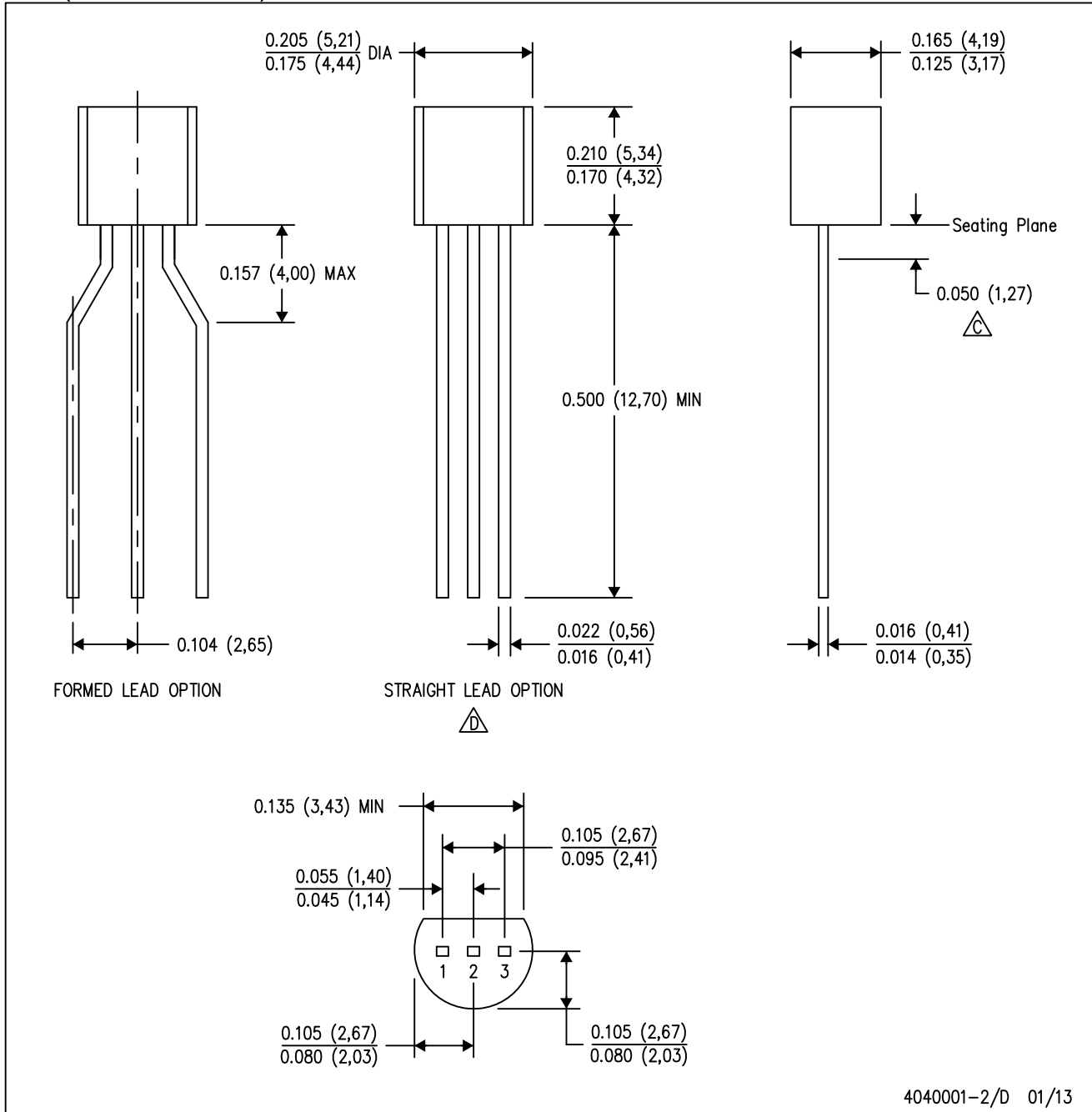


- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should 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.

MECHANICAL DATA

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE

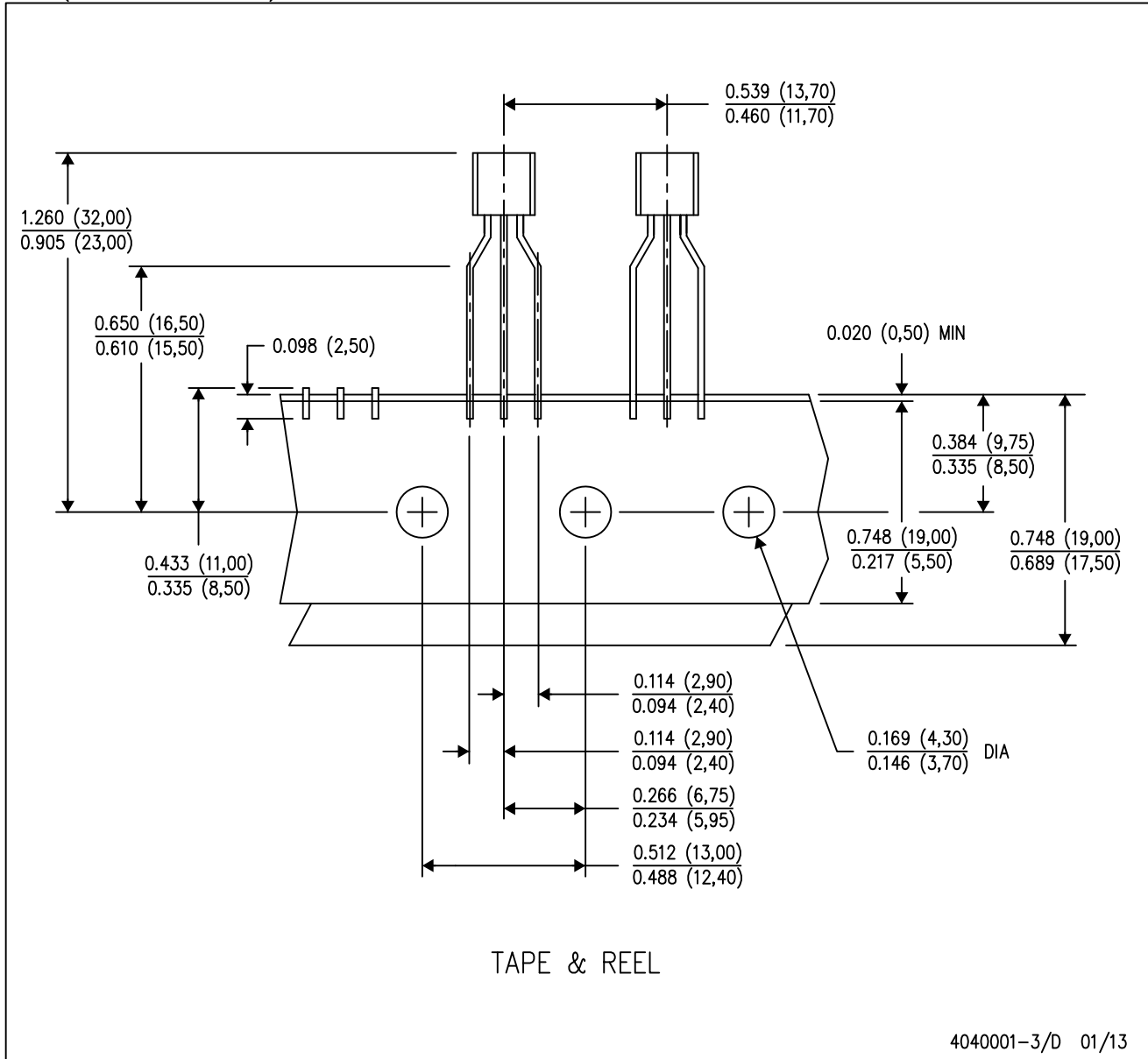


- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - $\triangle C$ Lead dimensions are not controlled within this area.
 - $\triangle D$ Falls within JEDEC TO-226 Variation AA (TO-226 replaces TO-92).
 - Shipping Method:
 - Straight lead option available in either bulk pack or tape & reel.
 - Formed lead option available in tape & reel or ammo pack.
 - Specific products can be offered in limited combinations of shipping mediums and lead options.
 - Consult product folder for more information on available options.

MECHANICAL DATA

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Tape and Reel information for the Formed Lead Option package.

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