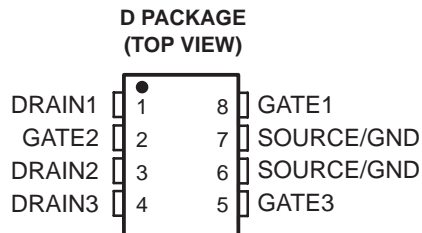


TPIC2322L

3-CHANNEL COMMON-SOURCE LOGIC-LEVEL POWER DMOS ARRAY

SLIS036A – JUNE 1994 – REVISED OCTOBER 1994

- Low $r_{DS(on)}$. . . 0.6 Ω Typ
- High-Voltage Outputs . . . 60 V
- Pulsed Current . . . 2.25 A Per Channel
- Fast Commutation Speed
- Direct Logic-Level Interface

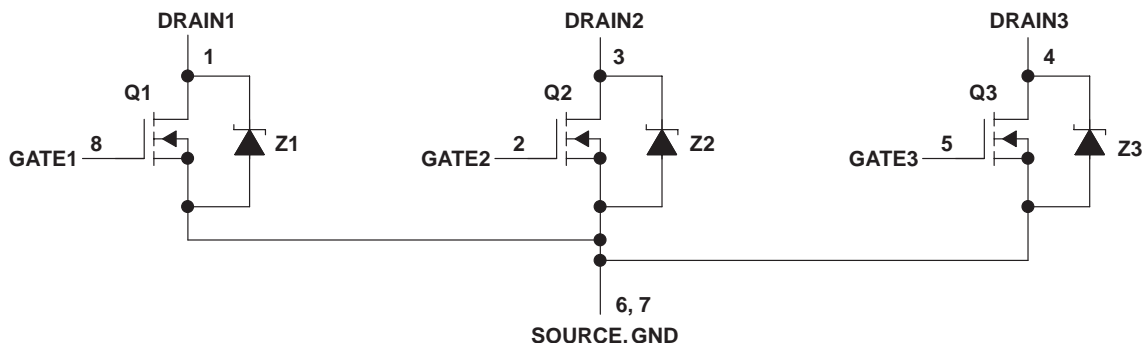


description

The TPIC2322L is a monolithic logic-level power DMOS array that consists of three electrically isolated N-channel enhancement-mode DMOS transistors configured with a common source and open drains.

The TPIC2322L is offered in a standard eight-pin small-outline surface-mount (D) package and is characterized for operation over the case temperature range of -40°C to 125°C .

schematic



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

Drain-to-source voltage, V_{DS}	60 V
Gate-to-GND voltage	100 V
Drain-to-GND voltage	100 V
Gate-to-source voltage, V_{GS}	± 20 V
Continuous drain current, each output, all outputs on, $T_C = 25^{\circ}\text{C}$	0.75 A
Continuous source-to-drain diode current, $T_C = 25^{\circ}\text{C}$	0.75 A
Pulsed drain current, each output, I_{max} , $T_C = 25^{\circ}\text{C}$ (see Note 1 and Figure 15)	2.25 A
Single-pulse avalanche energy, E_{AS} , $T_C = 25^{\circ}\text{C}$ (see Figure 4)	30.4 mJ
Continuous total power dissipation at (or below) $T_C = 25^{\circ}\text{C}$ (see Figure 15)	0.95 W
Operating virtual junction temperature range, T_J	-40°C to 150°C
Operating case temperature range, T_C	-40°C to 125°C
Storage temperature range	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°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.

NOTE 1: Pulse duration = 10 ms and duty cycle = 2%.

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.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265
POST OFFICE BOX 1443 • HOUSTON, TEXAS
77251-1443

Copyright © 1994, Texas Instruments Incorporated

TPIC2322L

3-CHANNEL COMMON-SOURCE LOGIC-LEVEL POWER DMOS ARRAY

SLIS036A – JUNE 1994 – REVISED OCTOBER 1994

electrical characteristics, $T_C = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
$V_{(BR)DSX}$	Drain-to-source breakdown voltage	$I_D = 250 \mu\text{A}$,	$V_{GS} = 0$	60			V
$V_{GS(th)}$	Gate-to-source threshold voltage	$I_D = 1 \text{ mA}$, See Figure 5	$V_{DS} = V_{GS}$	1.5	1.85	2.2	V
$V_{(BR)}$	Reverse drain to GND breakdown voltage	Drain to GND current = $250 \mu\text{A}$		100			V
$V_{DS(on)}$	Drain-to-source on-state voltage	$I_D = 0.75 \text{ A}$, See Notes 2 and 3	$V_{GS} = 5 \text{ V}$,		0.45	0.53	V
$V_{F(SD)}$	Forward on-state voltage, source-to-drain	$I_S = 0.75 \text{ A}$, See Notes 2 and 3 and Figure 12	$V_{GS} = 0$		0.85	1	V
I_{DSS}	Zero-gate-voltage drain current	$V_{DS} = 48 \text{ V}$, $V_{GS} = 0$	$T_C = 25^\circ\text{C}$		0.05	1	μA
			$T_C = 125^\circ\text{C}$		0.5	10	
I_{GSSF}	Forward gate current, drain short circuited to source	$V_{GS} = 16 \text{ V}$,	$V_{DS} = 0$		10	100	nA
I_{GSSR}	Reverse gate current, drain short circuited to source	$V_{SG} = 16 \text{ V}$,	$V_{DS} = 0$		10	100	nA
I_{lkg}	Leakage current, drain-to-GND	$V_{DGND} = 48 \text{ V}$	$T_C = 25^\circ\text{C}$		0.05	1	μA
			$T_C = 125^\circ\text{C}$		0.5	10	
$r_{DS(on)}$	Static drain-to-source on-state resistance	$V_{GS} = 5 \text{ V}$, $I_D = 0.75 \text{ A}$, See Notes 2 and 3 and Figures 6 and 7	$T_C = 25^\circ\text{C}$		0.6	0.7	Ω
			$T_C = 125^\circ\text{C}$		0.94	1	
g_{fs}	Forward transconductance	$V_{DS} = 15 \text{ V}$, See Notes 2 and 3 and Figure 9	$I_D = 0.5 \text{ A}$,	0.75	0.9		S
C_{iss}	Short-circuit input capacitance, common source				115	145	pF
C_{oss}	Short-circuit output capacitance, common source	$V_{DS} = 25 \text{ V}$, $f = 1 \text{ MHz}$,	$V_{GS} = 0$, See Figure 11		60	75	
C_{rss}	Short-circuit reverse transfer capacitance, common source				30	40	

- NOTES: 2. Technique should limit $T_J - T_C$ to 10°C maximum.
3. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts.

source-to-drain diode characteristics, $T_C = 25^\circ\text{C}$ (see schematic diagram)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{rr}	Reverse-recovery time	$I_F = 0.375 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$,	$V_{DS} = 48 \text{ V}$, See Figures 1 and 14		85		ns
Q_{RR}	Total diode charge				0.19		μC

TPIC2322L

3-CHANNEL COMMON-SOURCE LOGIC-LEVEL POWER DMOS ARRAY

SLIS036A – JUNE 1994 – REVISED OCTOBER 1994

resistive-load switching characteristics, $T_C = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{d(on)}$ Turn-on delay time	$V_{DD} = 25\text{ V}$, $R_L = 67\ \Omega$, $t_{en} = 10\text{ ns}$, $t_{dis} = 10\text{ ns}$, See Figure 2		21	42	ns
$t_{d(off)}$ Turn-off delay time			26	52	
t_r Rise time			14	28	
t_f Fall time			13	26	
Q_g Total gate charge	$V_{DS} = 48\text{ V}$, $I_D = 0.375\text{ A}$, $V_{GS} = 5\text{ V}$, See Figure 3		1.8	2.3	nC
$Q_{gs(th)}$ Threshold gate-to-source charge			0.4	0.5	
Q_{gd} Gate-to-drain charge			1.1	1.4	
L_D Internal drain inductance			5		nH
L_S Internal source inductance			5		
R_g Internal gate resistance			0.25		Ω

thermal resistance

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$R_{\theta JA}$ Junction-to-ambient thermal resistance, See Note 4	All outputs with equal power		130		$^\circ\text{C}/\text{W}$
$R_{\theta JP}$ Junction-to-pin thermal resistance			44		$^\circ\text{C}/\text{W}$

NOTE 4: Package mounted on an FR4 printed-circuit board with no heat sink.

PARAMETER MEASUREMENT INFORMATION

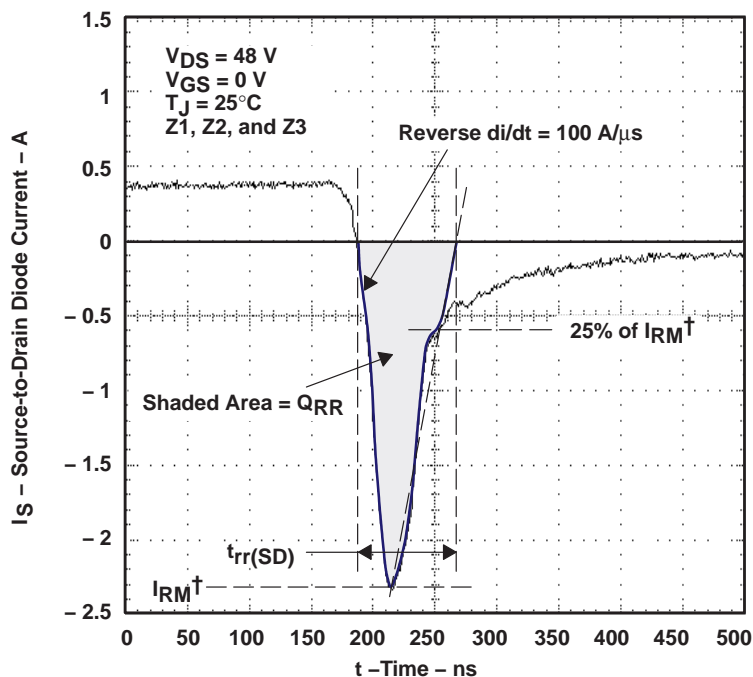


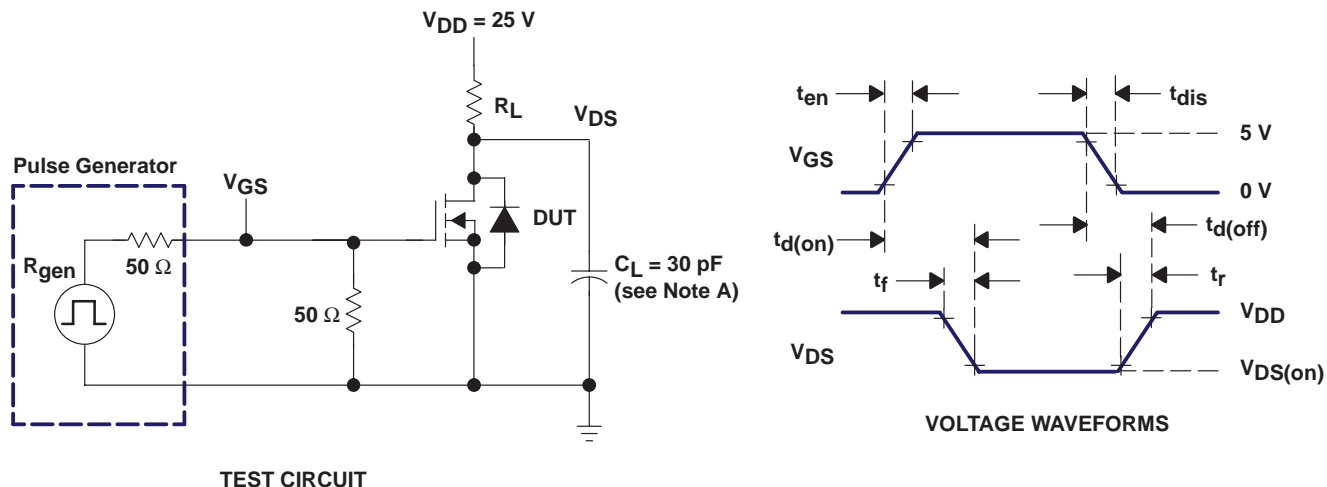
Figure 1. Reverse-Recovery-Current Waveform of Source-to-Drain Diode



TPIC2322L 3-CHANNEL COMMON-SOURCE LOGIC-LEVEL POWER DMOS ARRAY

SLIS036A – JUNE 1994 – REVISED OCTOBER 1994

PARAMETER MEASUREMENT INFORMATION



NOTE A: C_L includes probe and jig capacitance.

Figure 2. Resistive-Switching Test Circuit and Voltage Waveforms

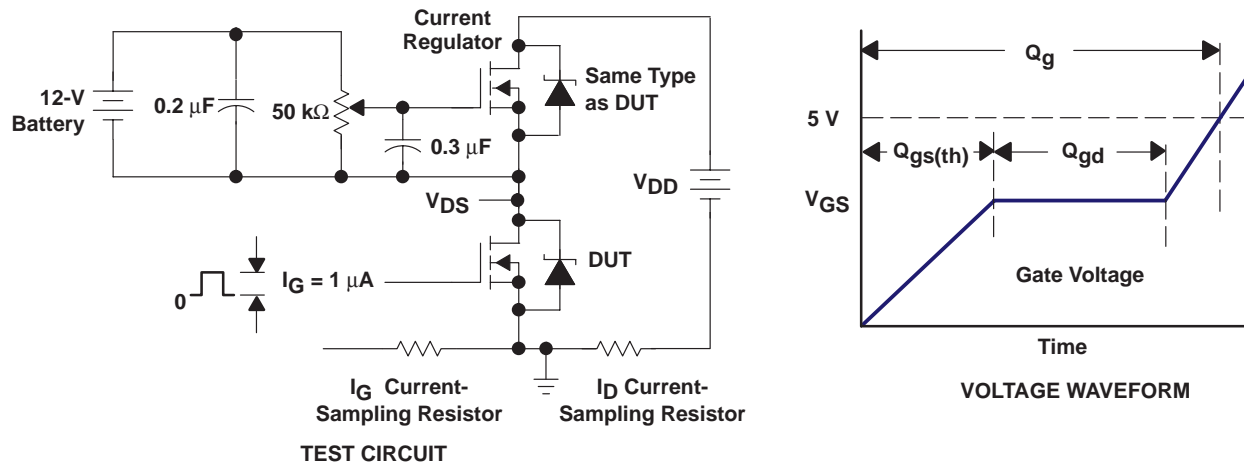
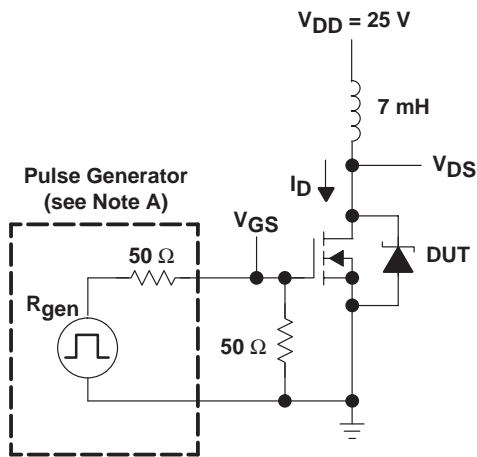
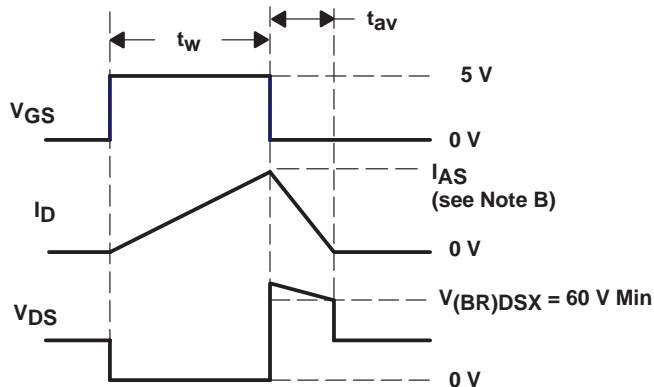


Figure 3. Gate-Charge Test Circuit and Voltage Waveform

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE AND CURRENT WAVEFORMS

- NOTES: A. The pulse generator has the following characteristics: $t_r \leq 10$ ns, $t_f \leq 10$ ns, $Z_O = 50 \Omega$.
 B. Input pulse duration (t_w) is increased until peak current $I_{AS} = 2.25$ A.

$$\text{Energy test level is defined as } E_{AS} = \frac{I_{AS} \times V_{(BR)DSX} \times t_{av}}{2} = 30.4 \text{ mJ.}$$

Figure 4. Single-Pulse Avalanche Energy Test Circuit and Waveforms

TYPICAL CHARACTERISTICS

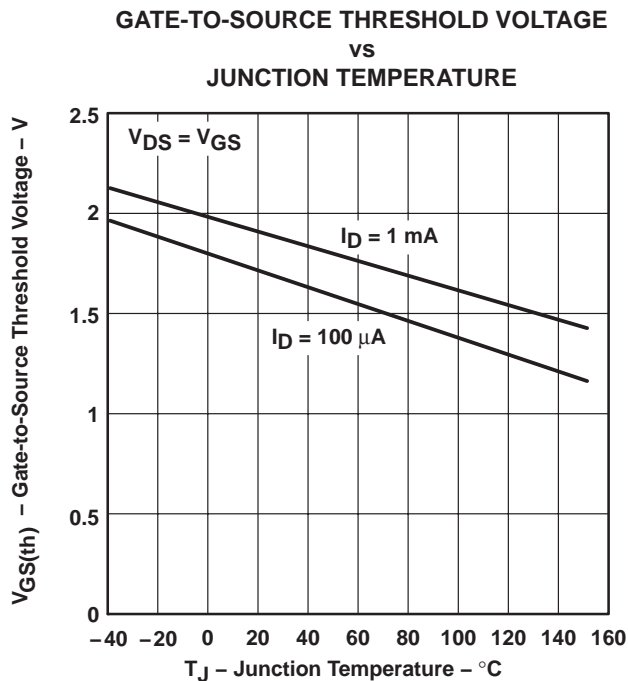


Figure 5

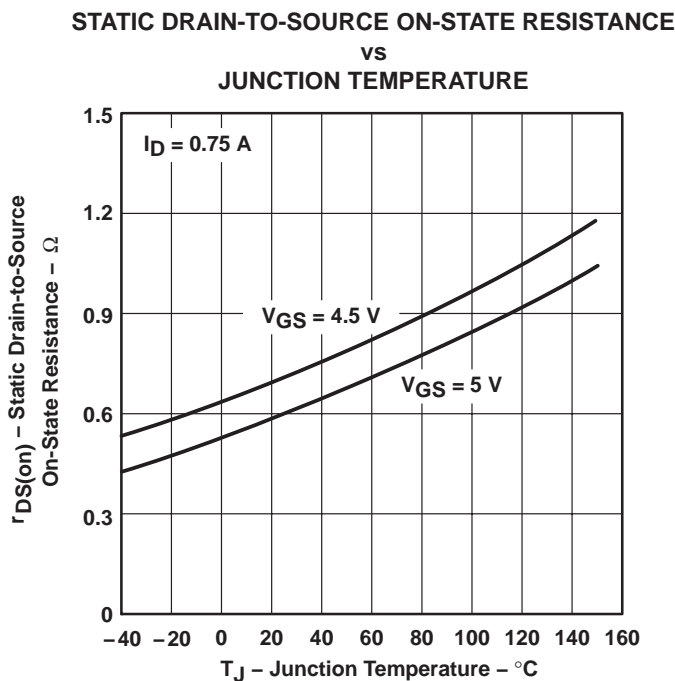


Figure 6



TPIC2322L 3-CHANNEL COMMON-SOURCE LOGIC-LEVEL POWER DMOS ARRAY

SLIS036A – JUNE 1994 – REVISED OCTOBER 1994

TYPICAL CHARACTERISTICS

STATIC DRAIN-TO-SOURCE ON-STATE RESISTANCE
vs
DRAIN CURRENT

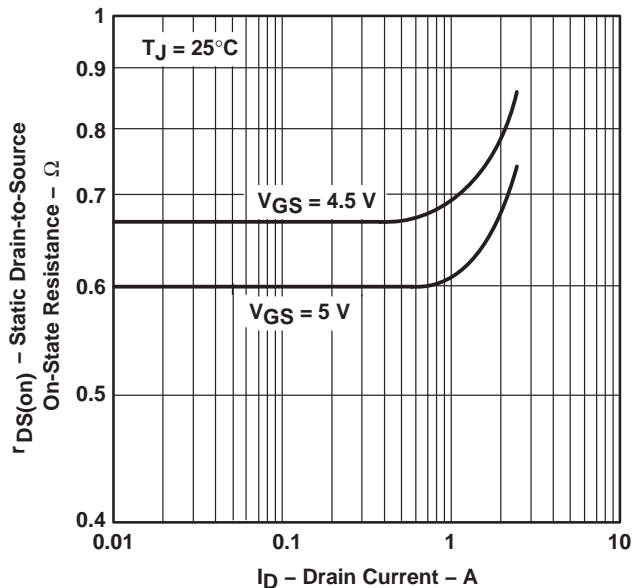


Figure 7

DRAIN CURRENT
vs
DRAIN-TO-SOURCE VOLTAGE

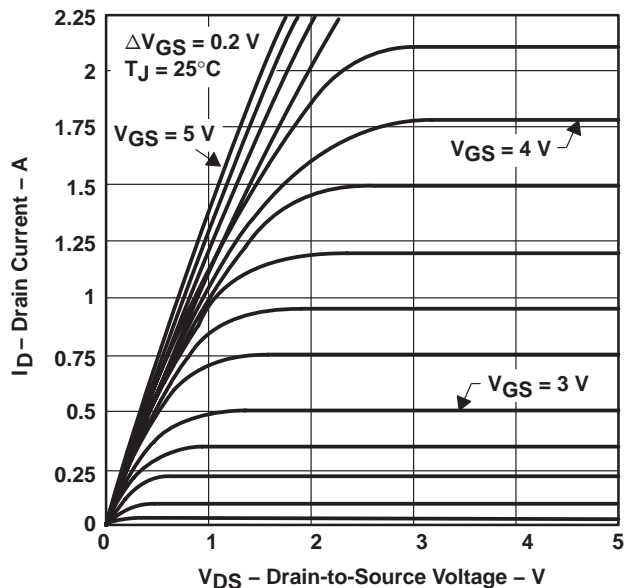


Figure 8

DISTRIBUTION OF
FORWARD TRANSCONDUCTANCE

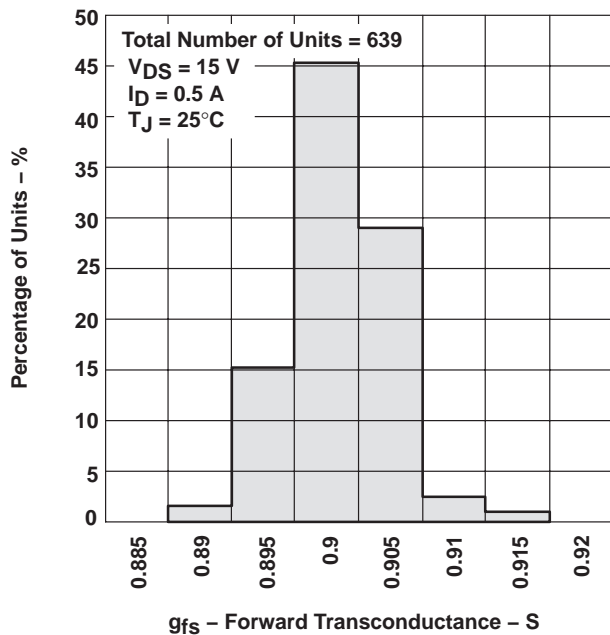


Figure 9

DRAIN CURRENT
vs
GATE-TO-SOURCE VOLTAGE

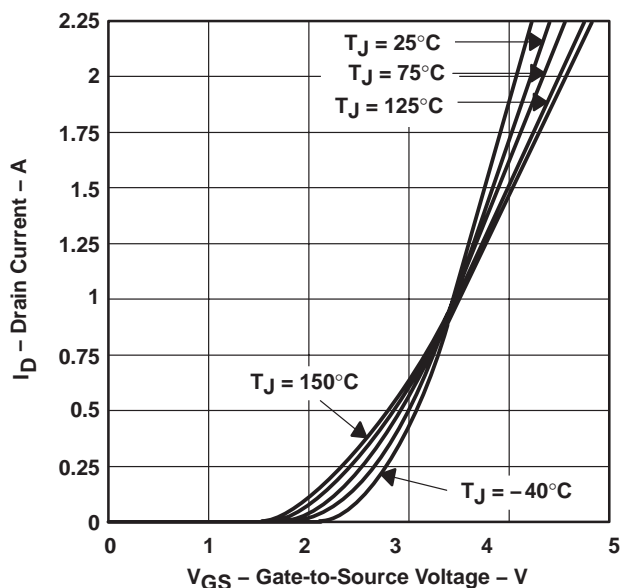
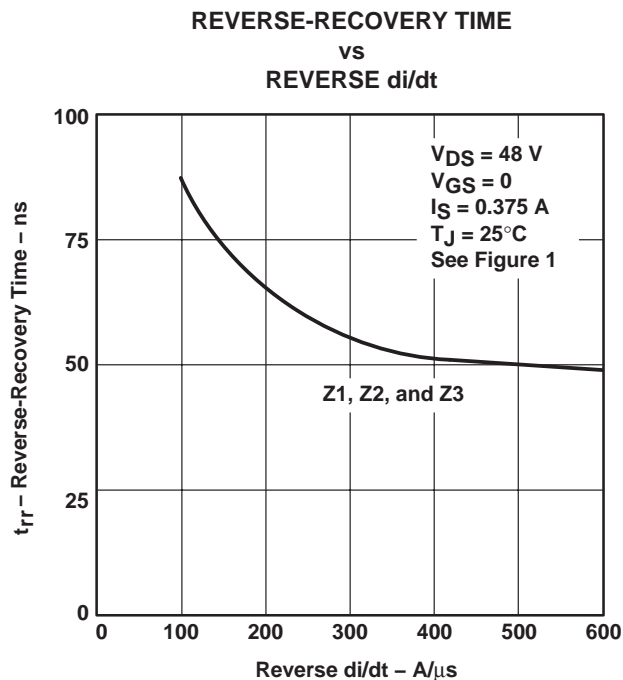
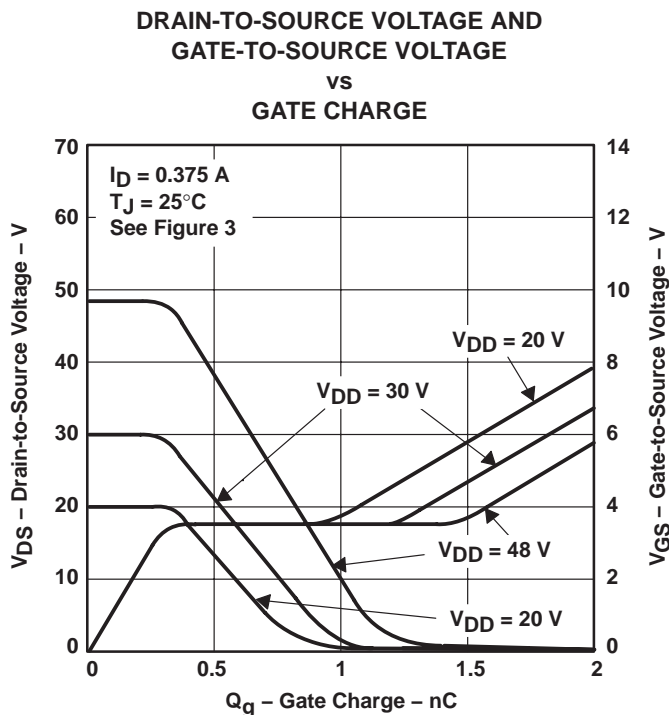
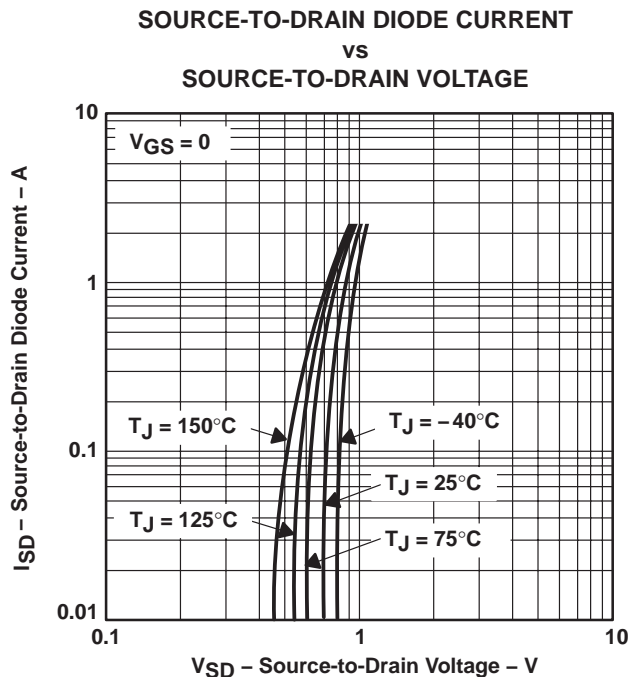
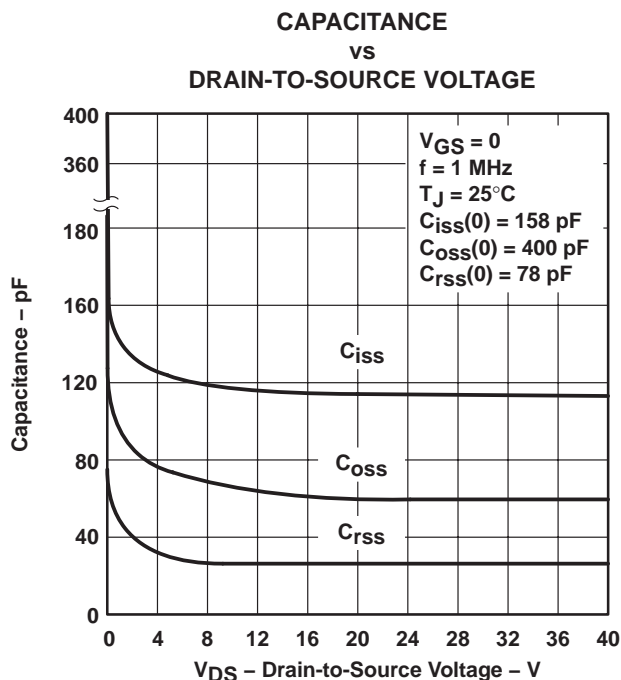


Figure 10

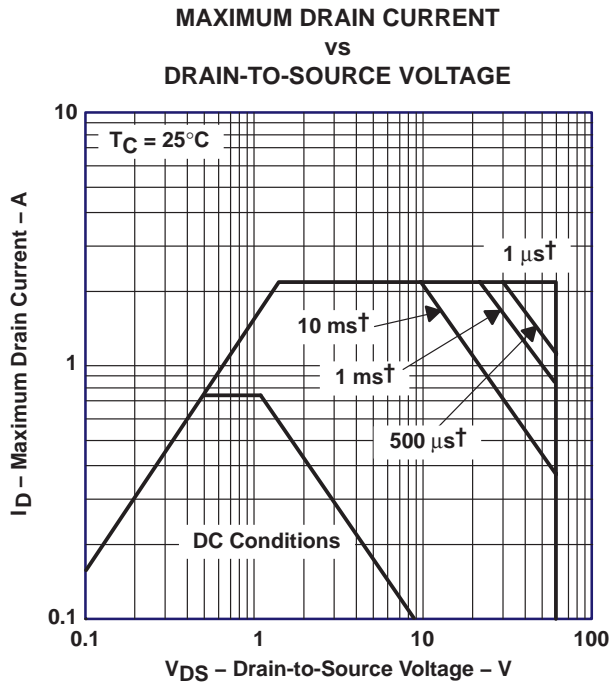
TYPICAL CHARACTERISTICS



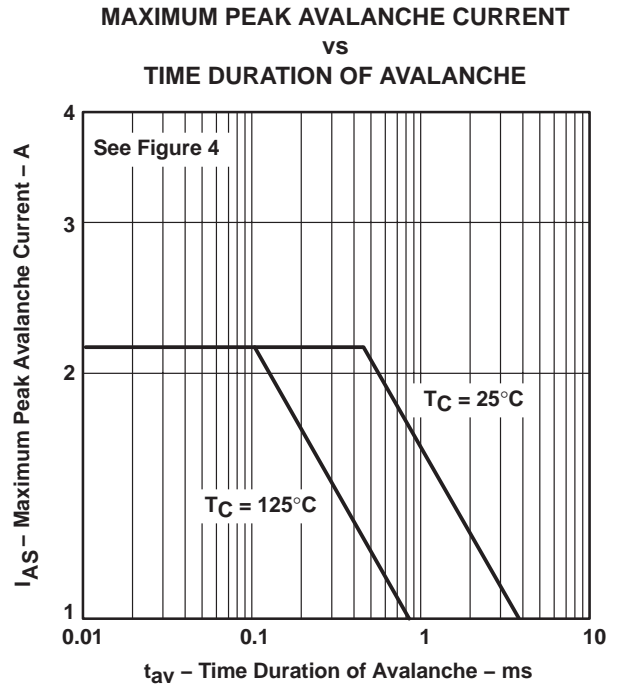
TPIC2322L
3-CHANNEL COMMON-SOURCE LOGIC-LEVEL POWER DMOS ARRAY

SLIS036A – JUNE 1994 – REVISED OCTOBER 1994

THERMAL INFORMATION

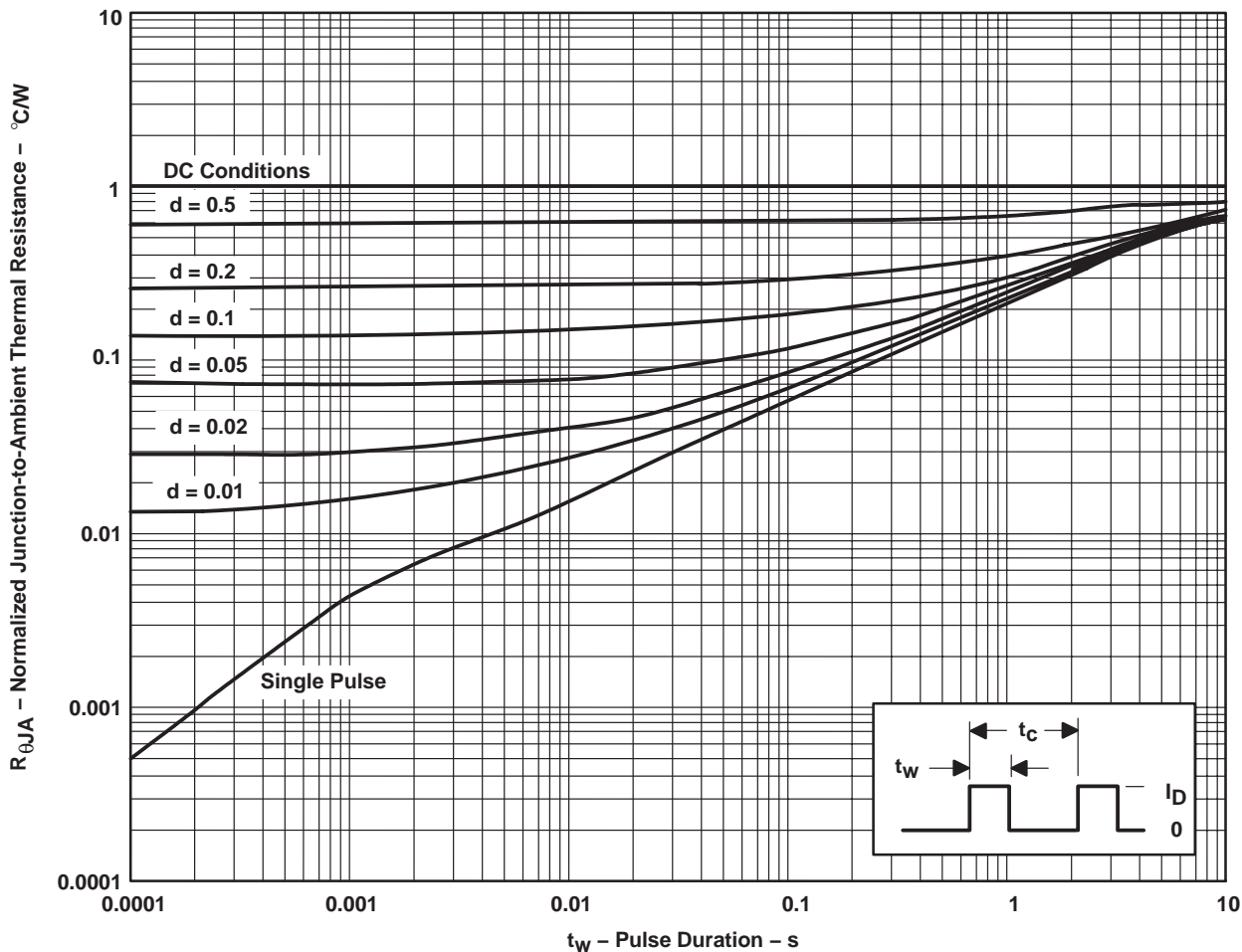


† Less than 2% duty cycle



THERMAL INFORMATION

D PACKAGE†
NORMALIZED JUNCTION-TO-AMBIENT THERMAL RESISTANCE
VS
PULSE DURATION



† Device mounted on FR4 printed-circuit board with no heat sink.

- NOTES: $Z_{\theta A}(t) = r(t) R_{\theta JA}$
 t_w = pulse duration
 t_c = cycle time
 d = duty cycle = t_w/t_c

Figure 17

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TPIC2322LD	OBSOLETE	SOIC	D	8		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.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) 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.

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)

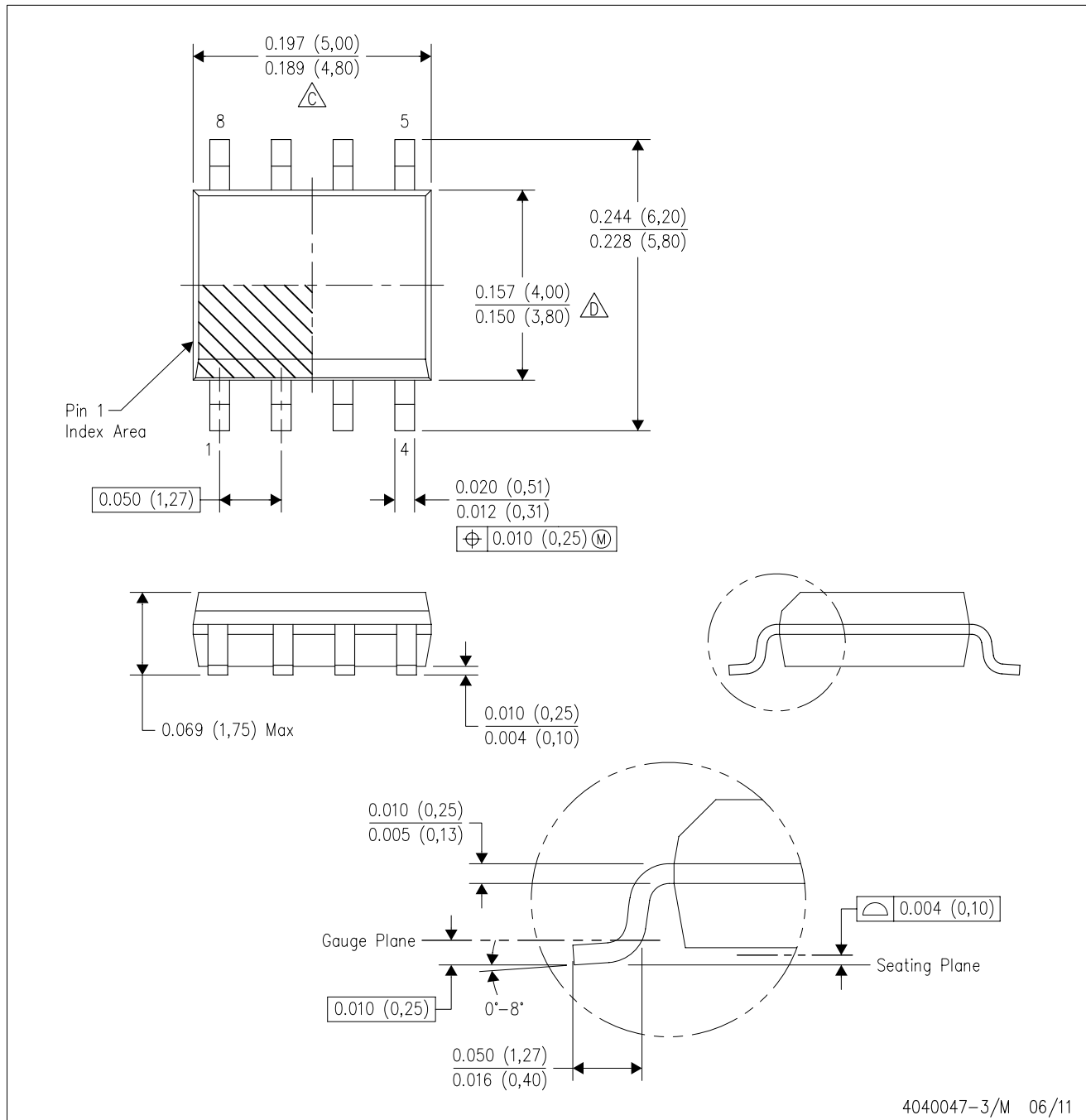
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.



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.

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.
 -  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.
 -  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.

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