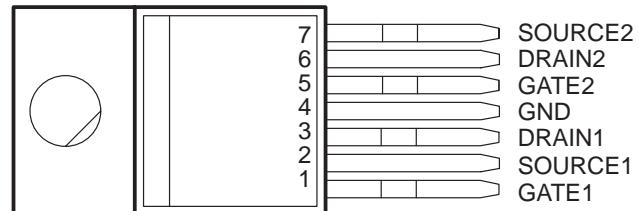


- Two 7.5-A Independent Output Channels, Continuous Current Per Channel
- Low $r_{DS(on)}$ 0.09 Ω Typical
- Output Voltage 60 V
- Pulsed Current 15 A Per Channel
- Avalanche Energy 120 mJ

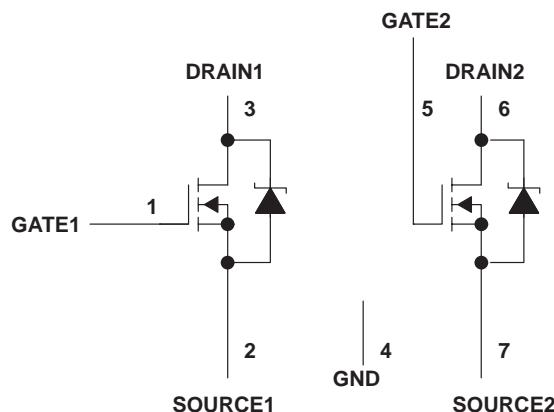
description

The TPIC5201 is a power monolithic DMOS array that consists of dual independent N-channel enhancement-mode DMOS transistors.

KV PACKAGE
(TOP VIEW)

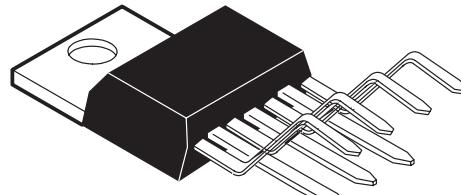


schematic



To ensure correct device operation, the source and the drain of the same transistor cannot simultaneously be taken below GND.

The tab is electrically connected to GND.



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

Drain-source voltage, V_{DS}	60 V
Source-GND voltage	60 V
Drain-GND voltage	60 V
Gate-source voltage, V_{GS}	± 20 V
Continuous source-drain diode current	7.5 A
Pulsed drain current, each output, all outputs on, I_D (see Note 1)	15 A
Continuous drain current, each output, all outputs on	7.5 A
Single-pulse avalanche energy, E_{AS} (see Figure 4)	120 mJ
Continuous power dissipation at (or below) $T_A = 25^\circ\text{C}$ (see Note 2)	2 W
Continuous power dissipation at (or below) $T_C = 75^\circ\text{C}$, all outputs on (see Note 2)	31 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, T_{stg}	-40°C to 125°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

NOTES: 1. Pulse duration = 10 ms, duty cycle = 6%

2. For operation above 25°C free-air temperature, derate linearly at the rate of 16 mW/ $^\circ\text{C}$. For operation above 75°C case temperature, and with all outputs conducting, derate linearly at the rate of 0.42 W/ $^\circ\text{C}$. To avoid exceeding the design maximum virtual junction temperature, these ratings should not be exceeded.

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
$V_{(\text{BR})\text{DS}}$	Drain-source breakdown voltage $I_D = 1 \mu\text{A}, V_{GS} = 0$	60			V	
V_{TGS}	Gate-source threshold voltage $I_D = 1 \text{ mA}, V_{DS} = V_{GS}$	1.2	1.75	2.4	V	
$V_{\text{DS}(\text{on})}$	Drain-source on-state voltage $I_D = 7.5 \text{ A}, V_{GS} = 15 \text{ V}$, See Notes 3 and 4	0.68	0.94		V	
V_{DSS}	Zero-gate-voltage drain current $V_{DS} = 48 \text{ V}, V_{DS} = 0$	$T_C = 25^\circ\text{C}$	0.07	1	μA	
			$T_C = 125^\circ\text{C}$	1.3		
I_{GSSF}	Forward gate current, drain short circuited to source $V_{GS} = 20 \text{ V}, V_{DS} = 0$	10	100		nA	
I_{GSSR}	Reverse gate current, drain short circuited to source $V_{GS} = -20 \text{ V}, V_{DS} = 0$	10	100		nA	
$r_{\text{DS}(\text{on})}$	Static drain-source on-state resistance See Notes 3 and 4 and Figures 5 and 6	$V_{GS} = 15 \text{ V}, I_D = 7.5 \text{ A},$ See Notes 3 and 4 and Figures 5 and 6	$T_C = 25^\circ\text{C}$	0.09	0.125	Ω
			$T_C = 125^\circ\text{C}$	0.15	0.21	
g_{fs}	Forward transconductance $V_{DS} = 15 \text{ V}, I_D = 5 \text{ A}$, See Notes 3 and 4	2.5	4.7		S	
C_{iss}	Short-circuit input capacitance, common source	$V_{DS} = 25 \text{ V}, V_{GS} = 0, f = 300 \text{ kHz}$	490		pF	
C_{oss}	Short-circuit output capacitance, common source		285			
C_{rss}	Short-circuit reverse transfer capacitance, common source		90			

NOTES: 3. Technique should limit $T_J - T_C$ to 10°C maximum.

4. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts.

source-drain diode characteristics, $T_C = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{SD}	Forward on voltage $I_S = 7.5 \text{ A}, V_{GS} = 0,$ $\text{di/dt} = 100 \text{ A}/\mu\text{s}, V_{DS} = 48 \text{ V},$ See Figure 1	0.8	1.3		V
t_{rr}		200			ns
Q_{RR}		1.5			μC

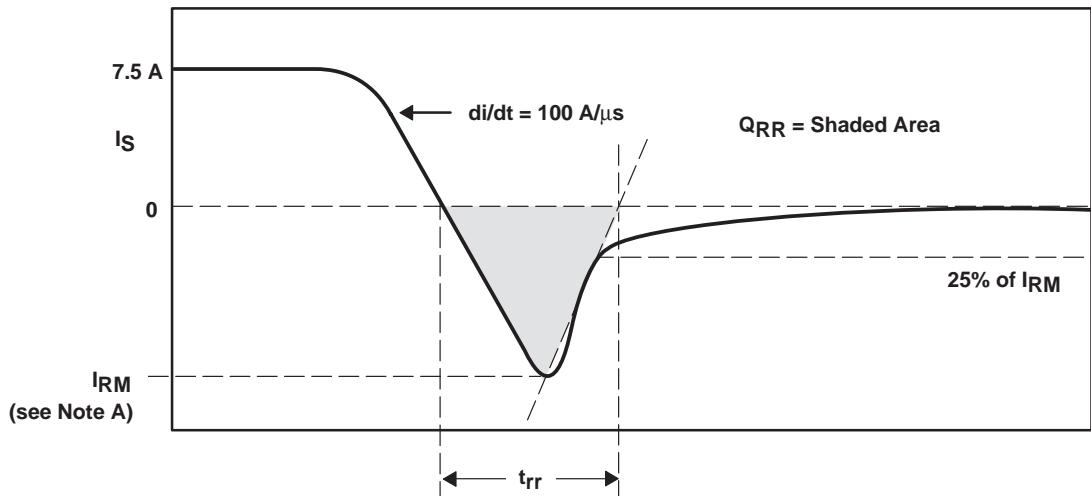
resistive-load switching characteristics, $T_C = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{\text{d}(\text{on})}$	Turn-on delay time $V_{DD} = 25 \text{ V}, R_L = 6.7 \Omega, t_{\text{en}} = 10 \text{ ns},$ $t_{\text{dis}} = 10 \text{ ns},$ See Figure 2	12			ns
t_r		43			
$t_{\text{d}(\text{off})}$		100			
t_f		5			
Q_g	Total gate charge $V_{DD} = 48 \text{ V}, I_D = 2.5 \text{ A}, V_{GS} = 15,$ See Figure 3	13.6	18		nC
Q_{gs}		8.3	11		
Q_{gd}		5.3	7		
L_D	Internal drain inductance	7			nH
L_S	Internal source inductance	7			

thermal resistance

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$R_{\theta\text{JA}}$	Junction-to-ambient thermal resistance All outputs with equal power			62.5	$^\circ\text{C}/\text{W}$
$R_{\theta\text{JC}}$	Junction-to-case thermal resistance All outputs with equal power			2.4	$^\circ\text{C}/\text{W}$
	One output dissipating power			3.3	$^\circ\text{C}/\text{W}$

PARAMETER MEASUREMENT INFORMATION



NOTE A: I_{RM} = maximum recovery current

Figure 1. Reverse-Recovery-Current Waveforms of Source-Drain Diode

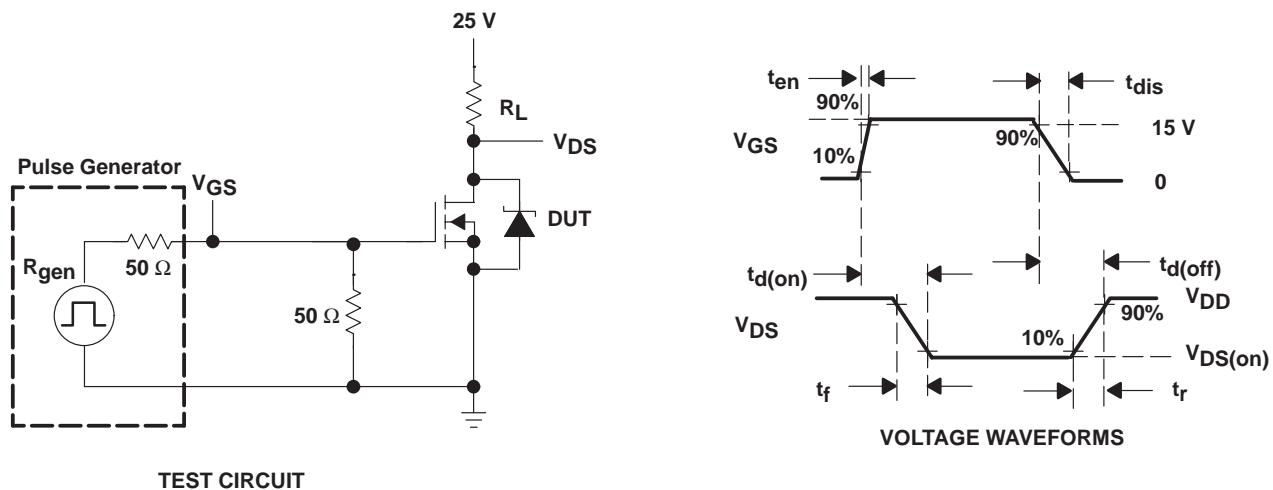


Figure 2. Resistive Switching

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PARAMETER MEASUREMENT INFORMATION

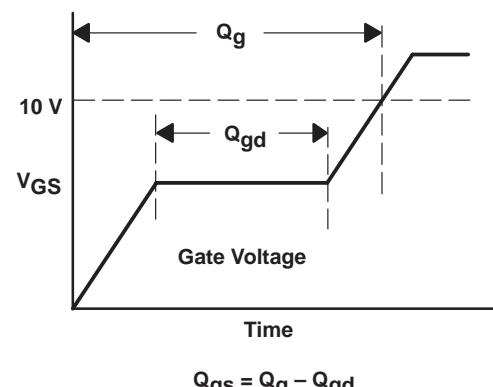
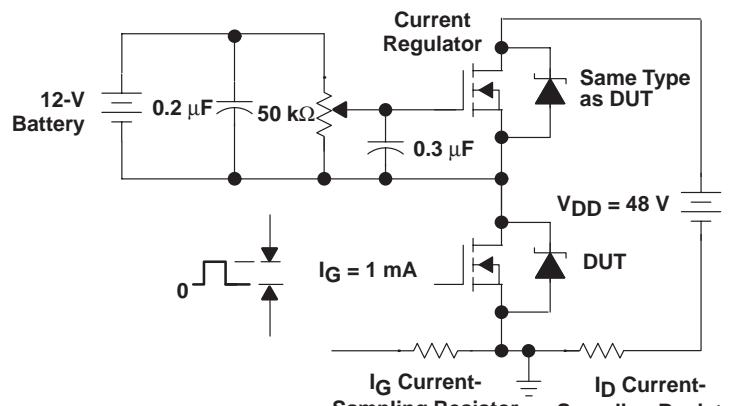
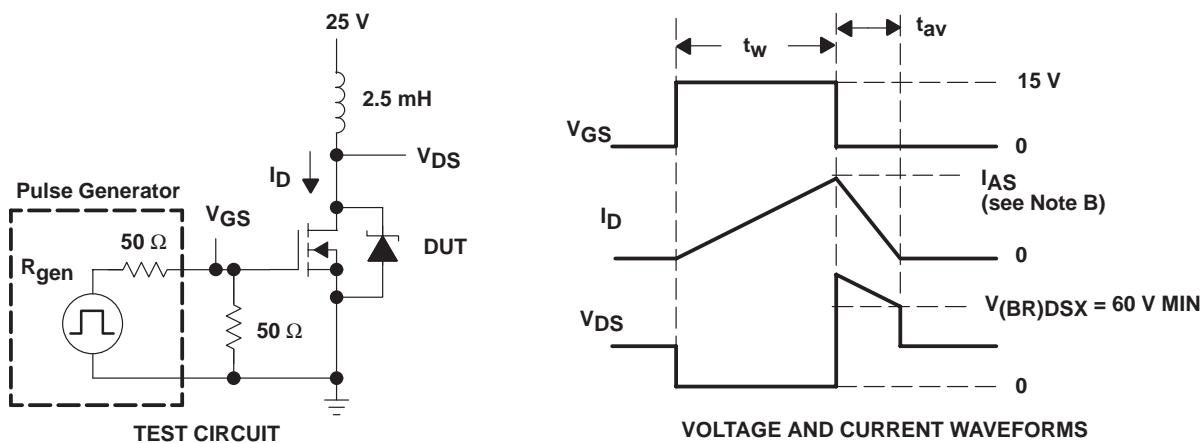


Figure 3. Gate Charge Test Circuit and Waveform



NOTES: A. The pulse generator has the following characteristics: $t_r \leq 10$ ns, $t_f \leq 10$ ns, $Z_O = 50$ Ω.
 B. Input pulse duration (t_w) is increased until peak current $I_{AS} = 7.5$ A.

$$\text{Energy test level is defined as } E_{AS} = \frac{I_{AS} \times V_{(BR)DSX} \times t_{av}}{2} = 120 \text{ mJ min.}$$

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

TYPICAL CHARACTERISTICS

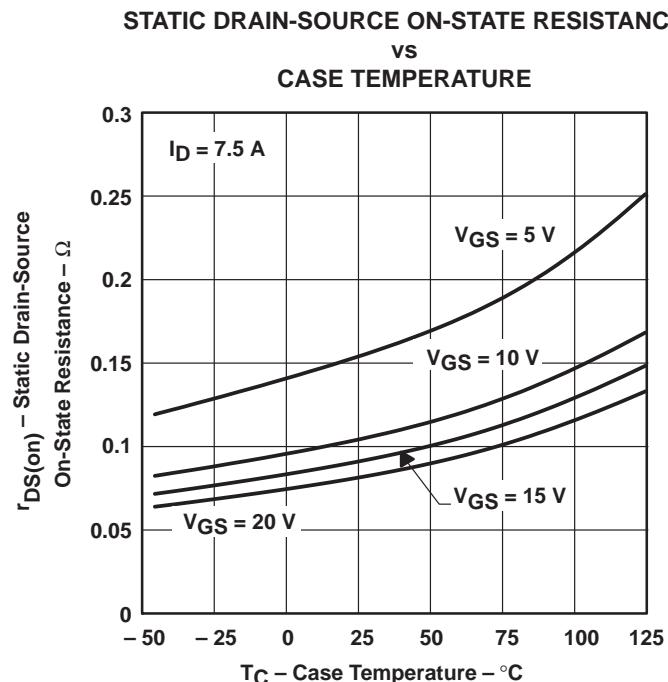


Figure 5

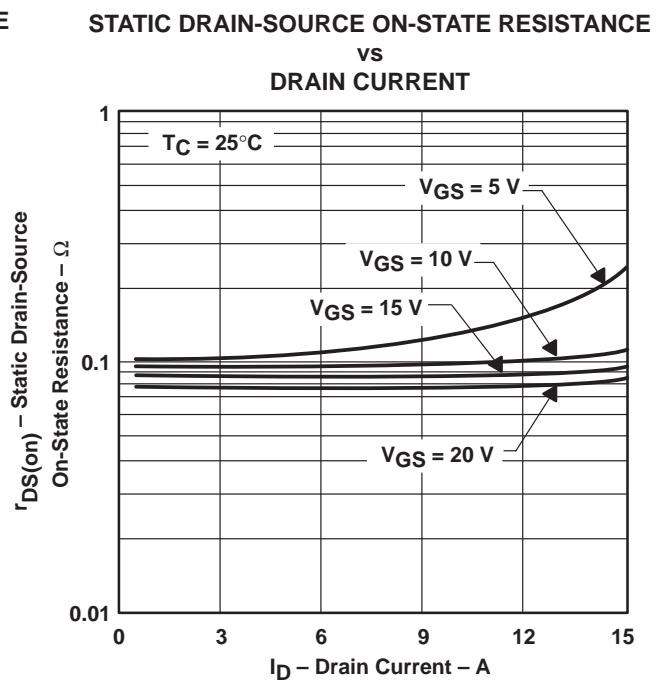


Figure 6

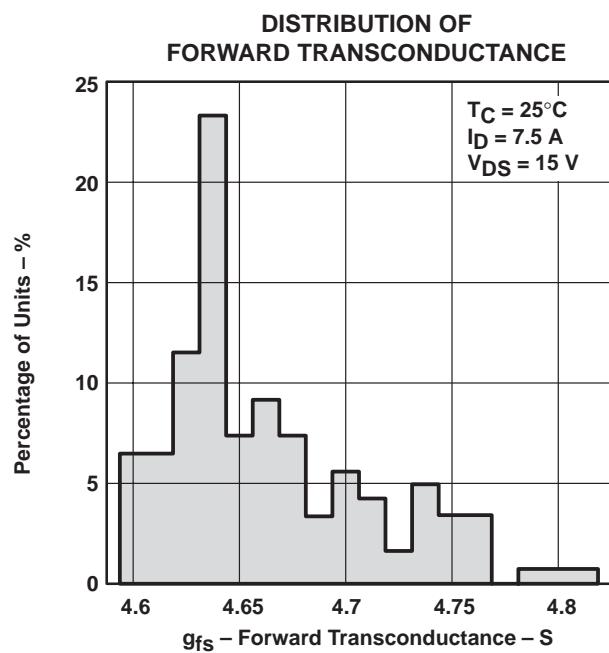


Figure 7

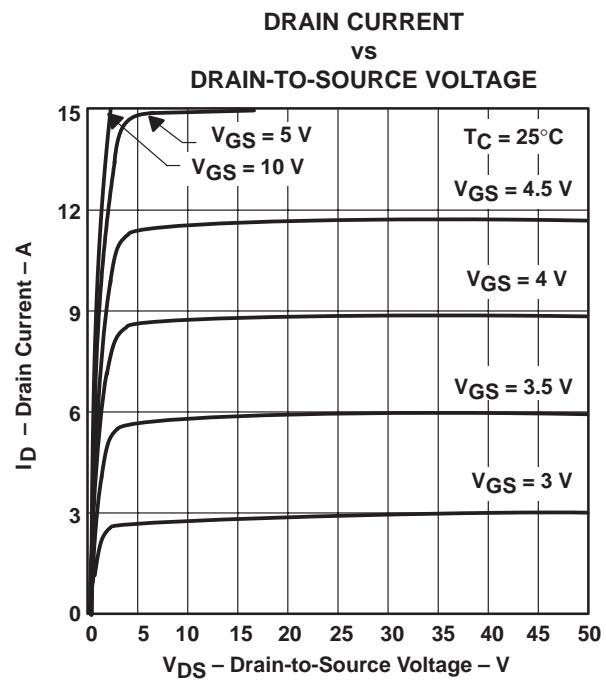


Figure 8

TYPICAL CHARACTERISTICS

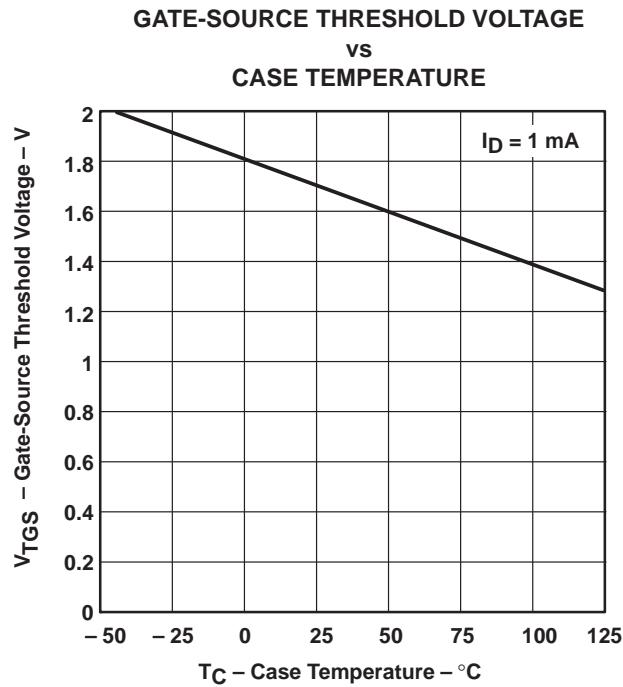


Figure 9

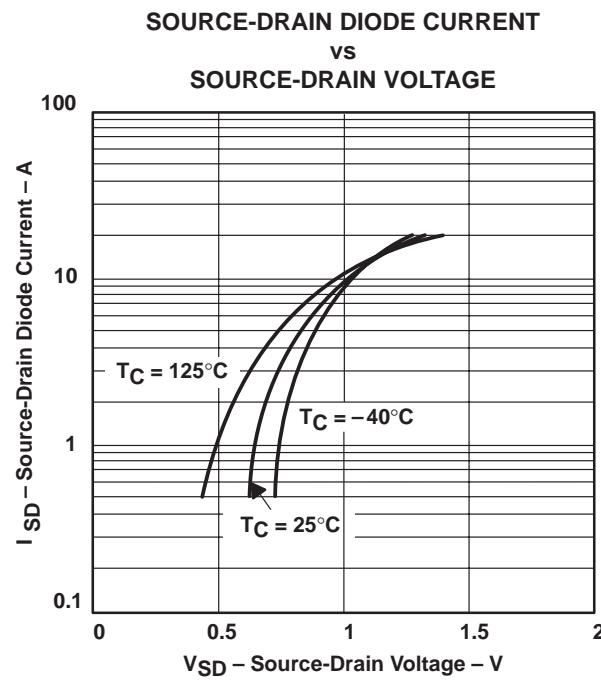


Figure 10

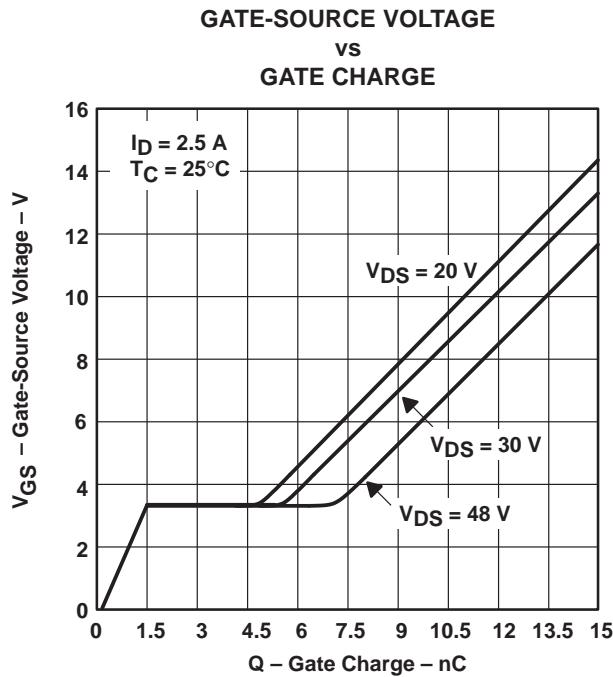


Figure 11

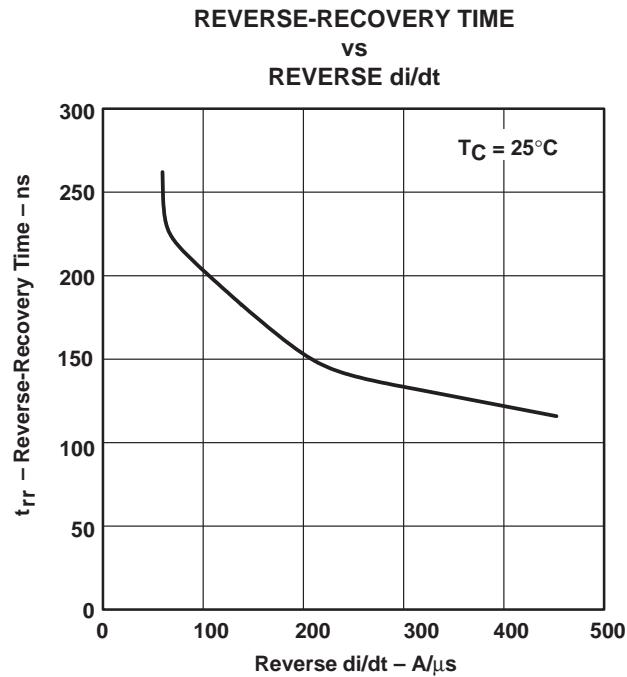


Figure 12

TYPICAL CHARACTERISTICS

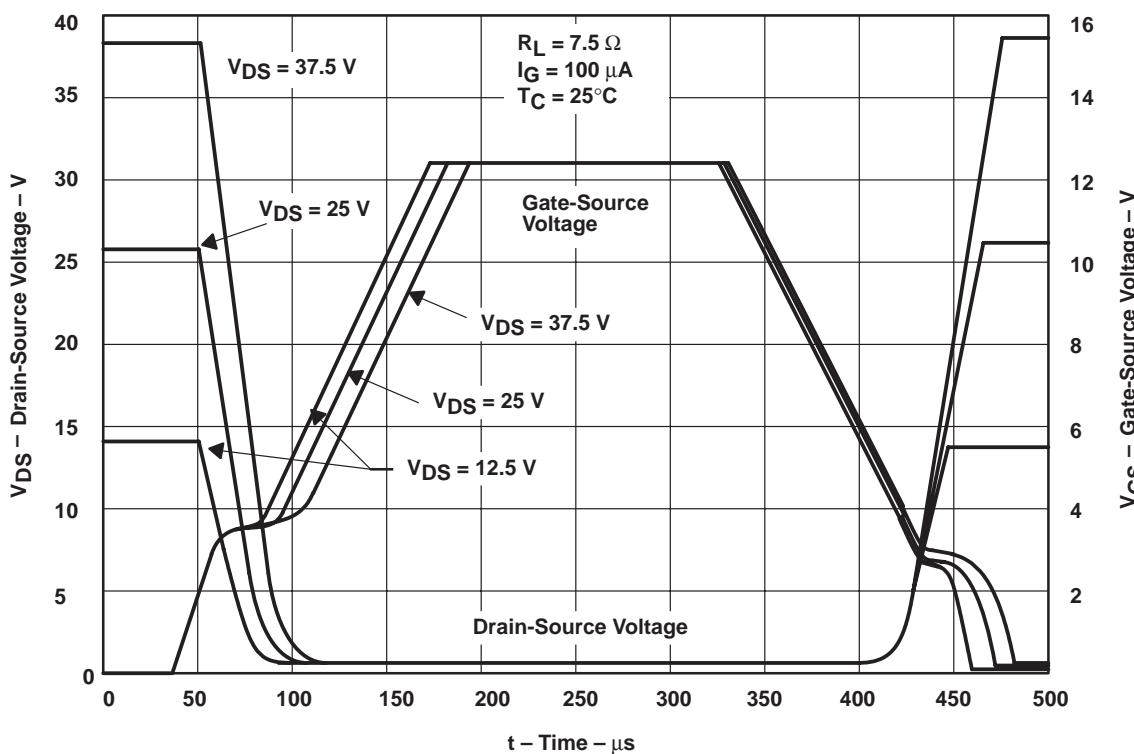


Figure 13. Resistive Switching Waveforms

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THERMAL INFORMATION

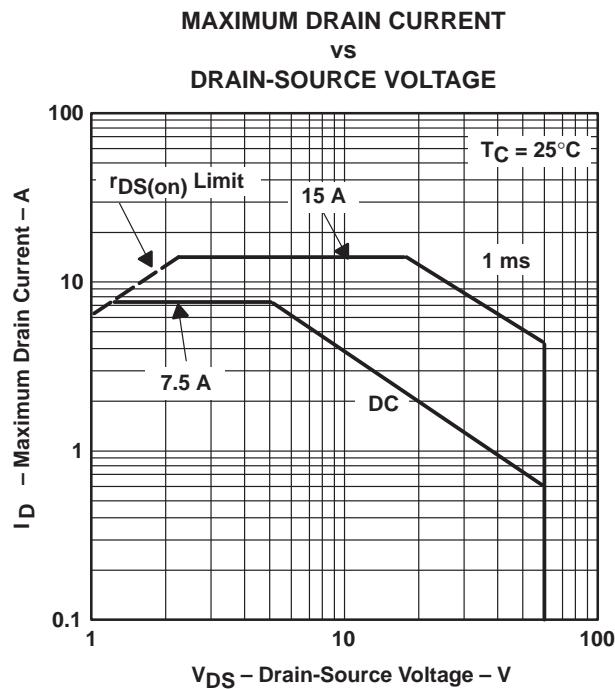


Figure 14

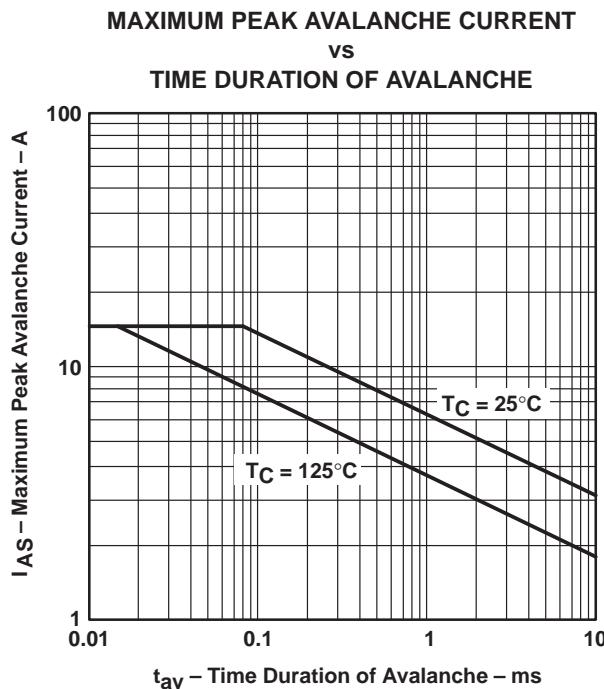
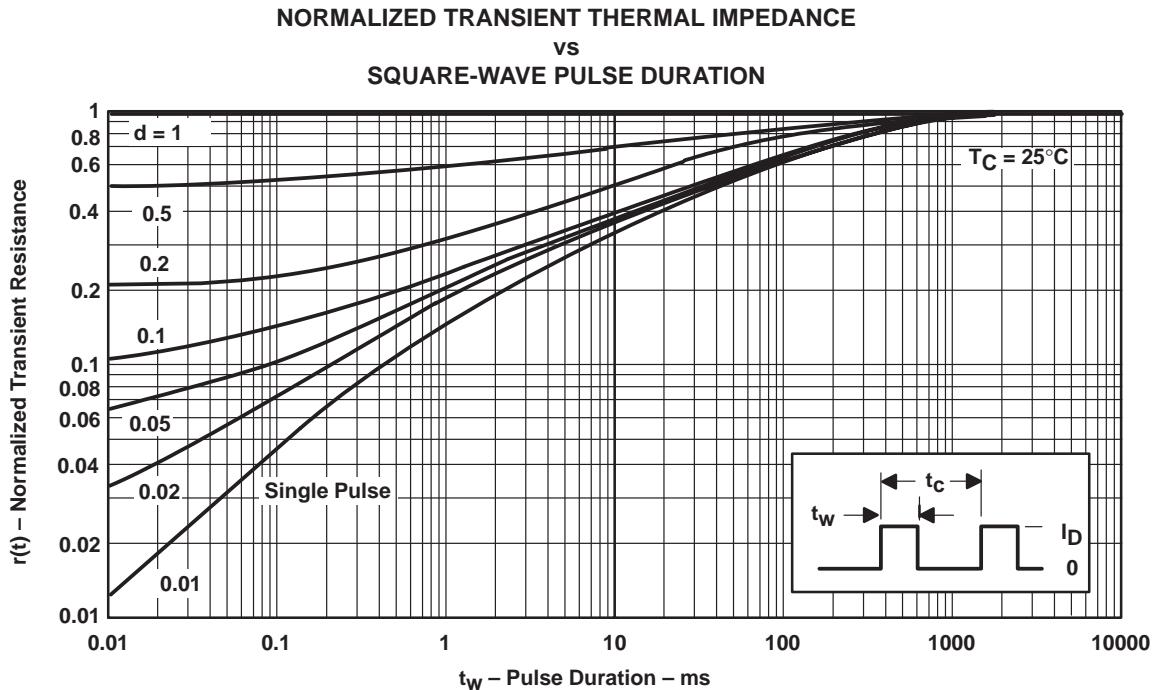


Figure 15



NOTES: $Z_{\theta JC}(t) = r(t) R_{\theta JC}$
 t_w = pulse duration
 t_c = period
 d = duty cycle = t_w/t_c

Figure 16

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TPIC5201KC	OBsolete	TO-220	KC	7		TBD	Call TI	Call TI
TPIC5201KV	OBsolete	TO-220	KV	7		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)

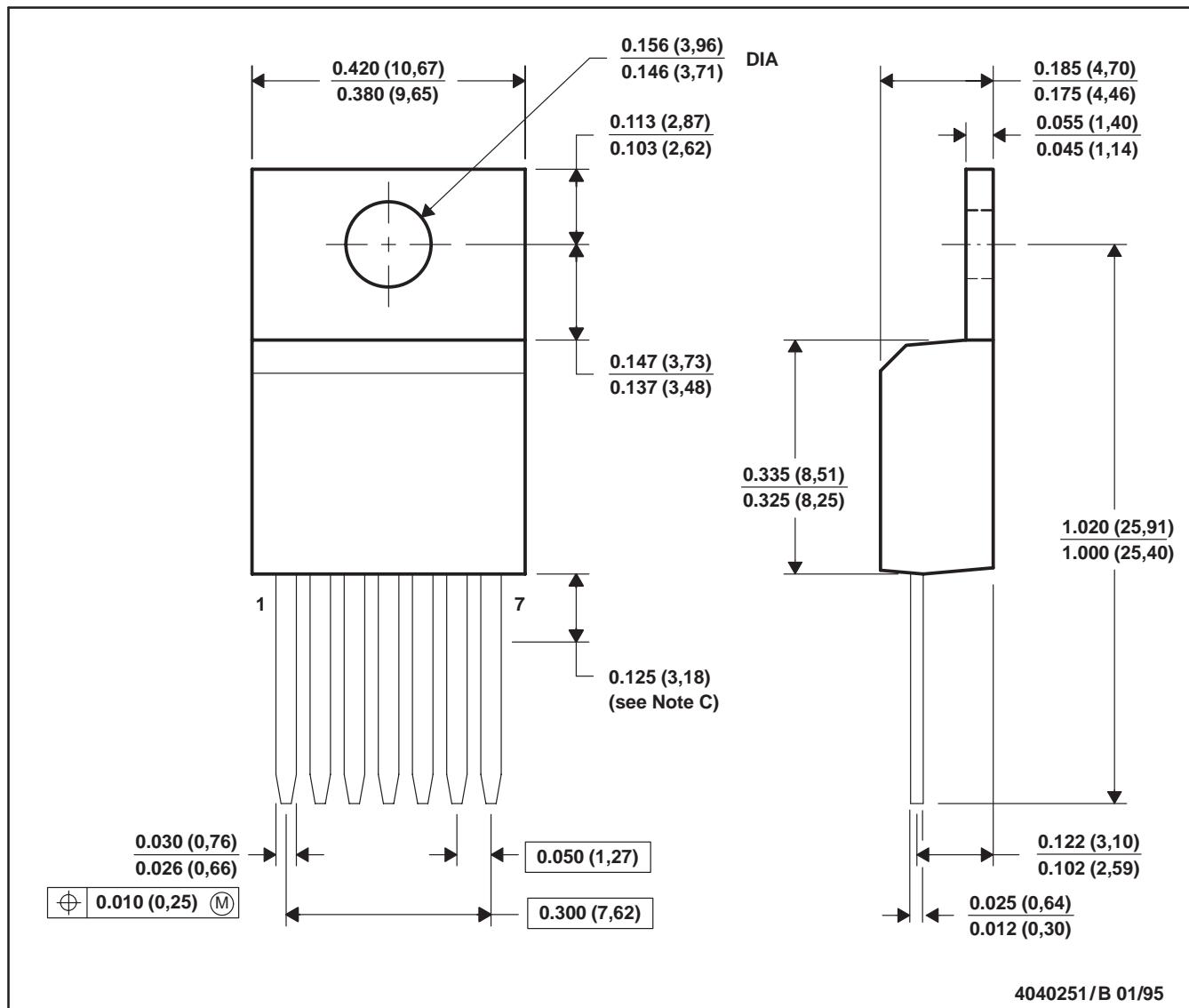
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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KC (R-PSFM-T7)

PLASTIC FLANGE-MOUNT PACKAGE

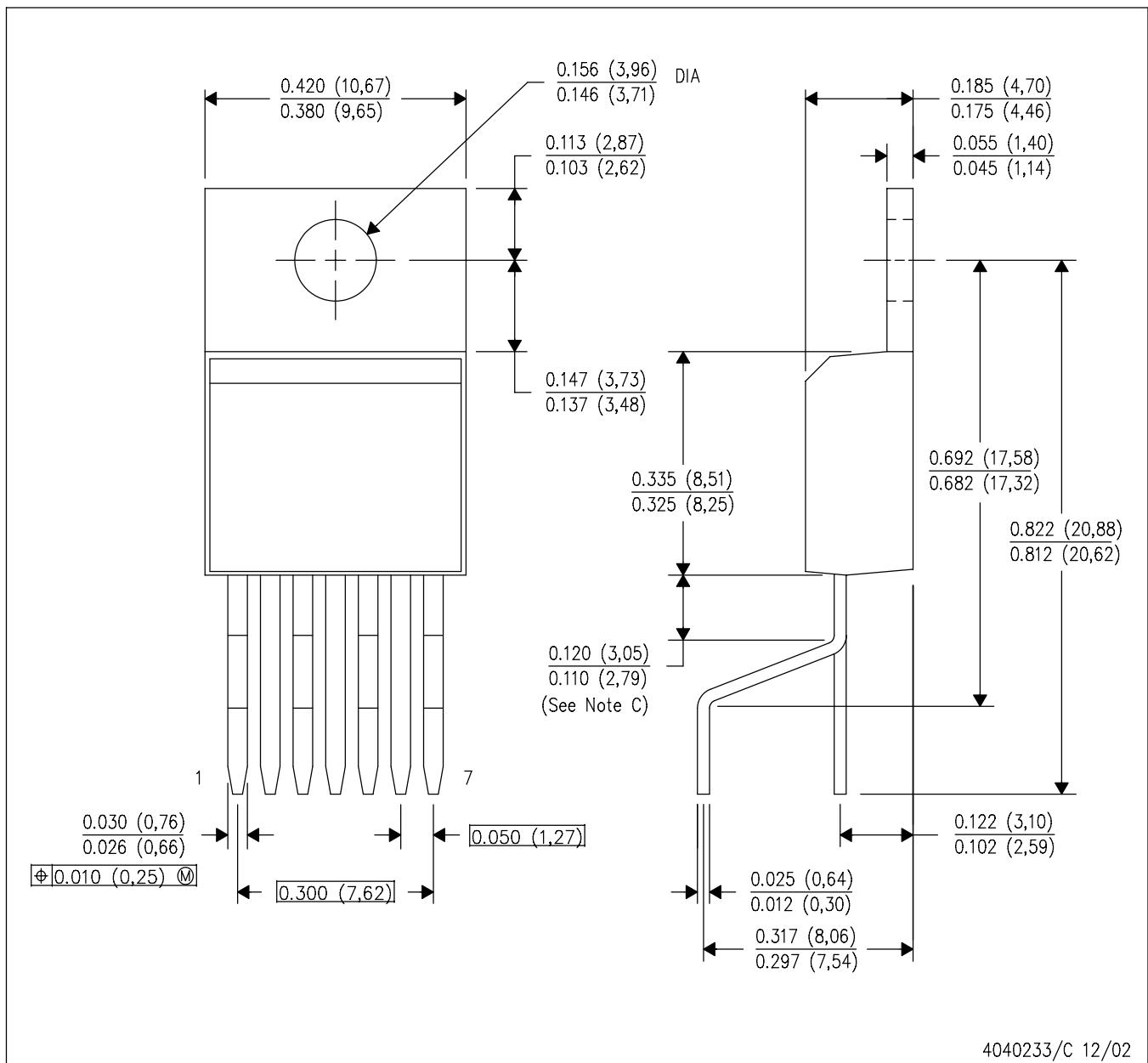


NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Lead dimensions are not controlled within this area.
- D. All lead dimensions apply before solder dip.
- E. The center lead is in electrical contact with the mounting tab.

KV (R-PZFM-T7)

PLASTIC FLANGE MOUNT PACKAGE



NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Lead dimensions are not controlled within this area.
- D. All dimensions apply before solder dip.
- E. The center lead is in electrical contact with the mounting tab.

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