

TPIC5621L SIX-OUTPUT POWER DMOS ARRAY

SLIS033 – JUNE 1994

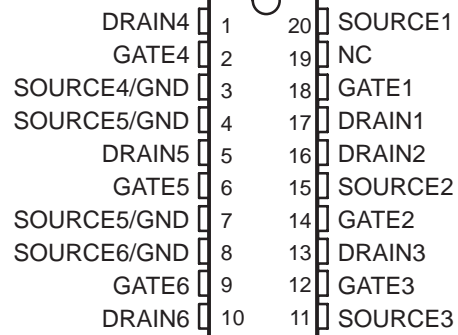
- Low $r_{DS(on)}$. . . 0.4 Ω Typ
- High-Voltage Output . . . 60 V
- Pulsed Current . . . 3 A Per Channel
- Fast Commutation Speed

description

The TPIC5621L is a monolithic logic-level power DMOS-transistor array that consists of six N-channel enhancement-mode DMOS transistors, three of which are configured with a common source.

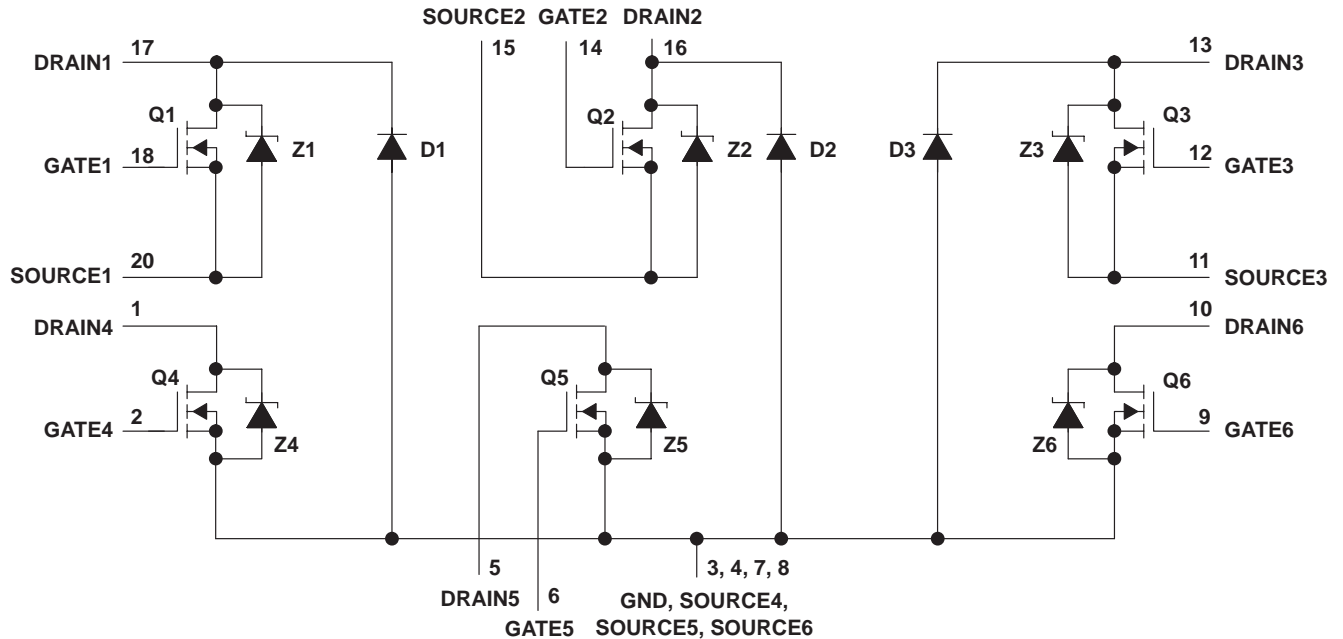
The TPIC5621L is offered in a wide-body surface-mount (DW) package and is characterized for operation over the case temperature range of -40°C to 125°C .

DW PACKAGE
(TOP VIEW)



NC – No internal connection

schematic



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.



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

Drain-to-source voltage, V_{DS}	60 V
Source-to-GND voltage (Q1, Q2, and Q3)	100 V
Drain-to-GND voltage (Q1, Q2, and Q3)	100 V
Drain-to-GND voltage (Q4, Q5, and Q6)	60 V
Gate-to-source voltage range, V_{GS}	± 20 V
Continuous drain current, each output, $T_C = 25^\circ\text{C}$	1 A
Continuous source-to-drain diode current, $T_C = 25^\circ\text{C}$	1 A
Pulsed drain current, I_{max} , $T_C = 25^\circ\text{C}$ (each output, see Note 1 and Figure 15)	3 A
Single-pulse avalanche energy, E_{AS} , $T_C = 25^\circ\text{C}$ (see Figures 4, 15 and 16)	18 mJ
Continuous total dissipation (see Figure 15)	See Dissipation Rating Table
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%.

DISSIPATION RATING TABLE

PACKAGE	$T_C \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_C = 25^\circ\text{C}$	$T_C = 125^\circ\text{C}$ POWER RATING
DW	1389 mW	11.1 mW/ $^\circ\text{C}$	279 mW

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 (across D1, D2, and D3)	Drain-to-GND current = $250\ \mu\text{A}$		100			V
$V_{DS(on)}$	Drain-to-source on-state voltage	$I_D = 1\ \text{A}$, See Notes 2 and 3	$V_{GS} = 5\ \text{V}$,		0.4	0.48	V
$V_{F(SD)}$	Forward on-state voltage, source-to-drain	$I_S = 1\ \text{A}$, $V_{GS} = 0$ (Z1, Z2, Z3, Z4, Z5, Z6), See Notes 2 and 3 and Figure 12			0.9	1.1	V
V_F	Forward on-state voltage, GND-to-drain	$I_D = 1\ \text{A}$ (D1, D2, D3), See Notes 2 and 3			4.6		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	$V_{DGND} = 48\ \text{V}$ (D1, D2, D3)	$T_C = 25^\circ\text{C}$		0.05	1	μA
			$T_C = 125^\circ\text{C}$		0.5	10	
$r_{DS(on)}$	Static drain-to-source on-state resistance	$V_{GS} = 5\ \text{V}$, $I_D = 1\ \text{A}$, See Notes 2 and 3 and Figures 6 and 7	$T_C = 25^\circ\text{C}$		0.4	0.48	Ω
			$T_C = 125^\circ\text{C}$		0.65	0.68	
g_{fs}	Forward transconductance	$V_{DS} = 15\ \text{V}$, See Notes 2 and 3 and Figure 9	$I_D = 0.5\ \text{A}$,	1	1.29	1.45	S
C_{iss}	Short-circuit input capacitance, common source	$V_{DS} = 25\ \text{V}$, $f = 1\ \text{MHz}$,	$V_{GS} = 0$, See Figure 11		190	240	pF
C_{oss}	Short-circuit output capacitance, common source				100	125	
C_{rss}	Short-circuit reverse transfer capacitance, common source				40	50	

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

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t _{rr}	Reverse recovery time	I _S = 0.5 A, V _{GS} = 0, See Figures 1 and 14	V _{DS} = 48 V, di/dt = 100 A/μs,	Z1, Z2, Z3	65		ns
				Z4, Z5, Z6	150		
				D1, D2, D3	200		
Q _{RR}	Total diode charge			Z1, Z2, Z3	0.06		μC
				Z4, Z5, Z6	0.3		
				D1, D2, D3	0.7		

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

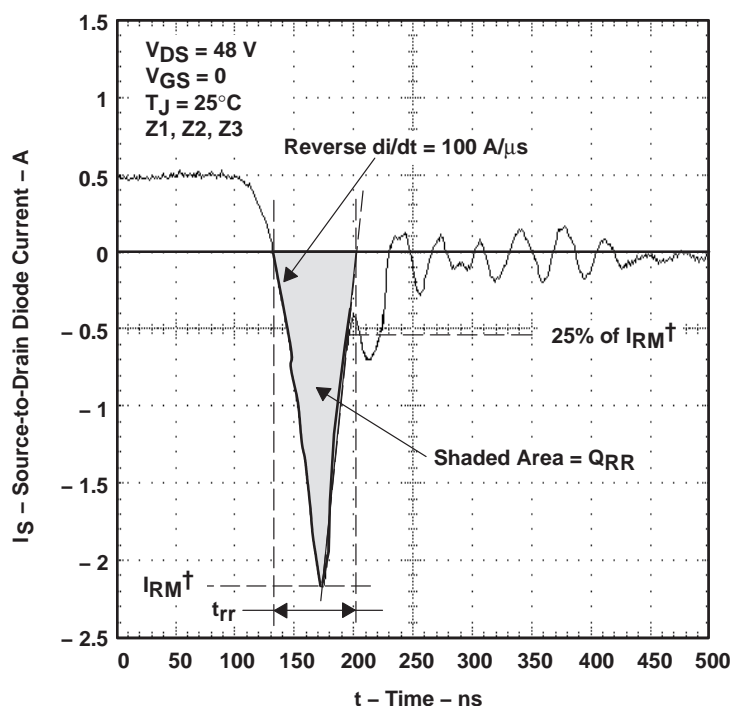
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{d(on)}$ Turn-on delay time	$V_{DD} = 25\text{ V}$, $R_L = 50\ \Omega$, $t_{en} = 10\text{ ns}$, $t_{dis} = 10\text{ ns}$, See Figure 2		9	18	ns
$t_{d(off)}$ Turn-off delay time			20	40	
t_r Rise time			21	42	
t_f Fall time			25	50	
Q_g Total gate charge	$V_{DS} = 48\text{ V}$, $I_D = 0.5\text{ A}$, $V_{GS} = 5\text{ V}$, See Figure 3		3.1	3.7	nC
$Q_{gs(th)}$ Threshold gate-to-source charge			0.5	0.6	
Q_{gd} Gate-to-drain charge			1.9	2.3	
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		90		$^\circ\text{C/W}$
$R_{\theta JC}$ Junction-to-case thermal resistance			27		

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

PARAMETER MEASUREMENT INFORMATION

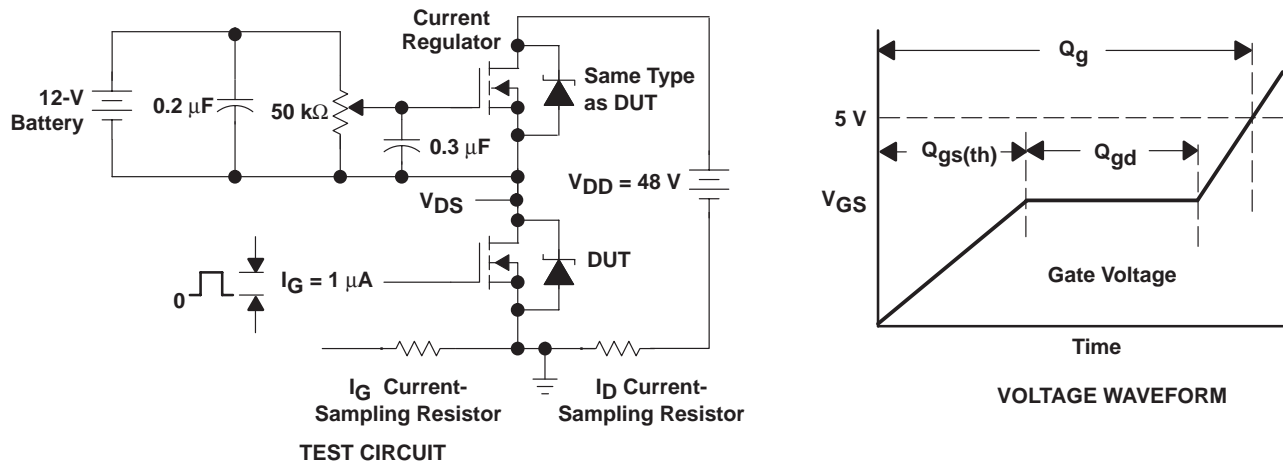
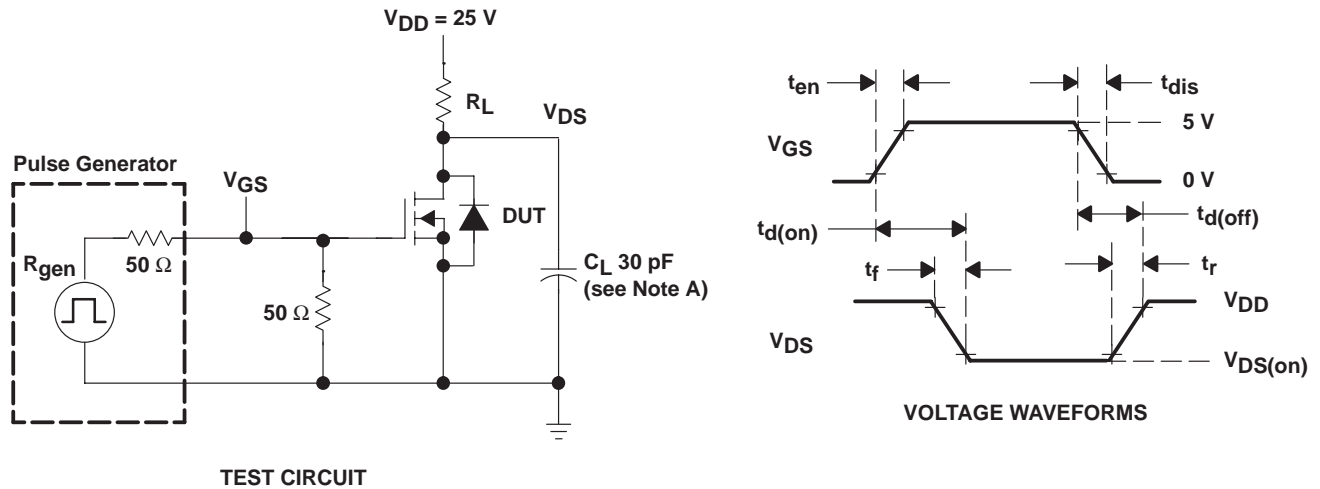


$^\dagger I_{RM}$ = maximum recovery current

NOTE A: The above waveform is representative of Z4, Z5, Z6, D1, D2, and D3 in shape only.

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

PARAMETER MEASUREMENT INFORMATION

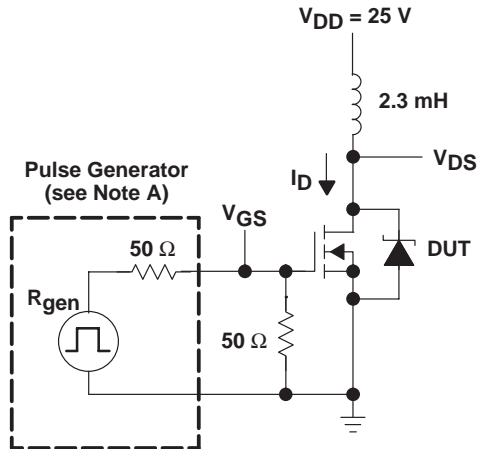


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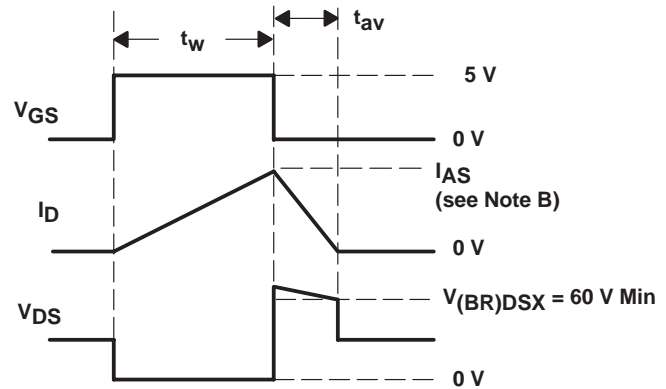
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PARAMETER MEASUREMENT INFORMATION



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 $I_{AS} = 3$ A.

$$\text{Energy test level is defined as } E_{AS} = \frac{I_{AS} \times V_{(BR)DSX} \times t_{av}}{2} = 18 \text{ mJ.}$$

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

TYPICAL CHARACTERISTICS

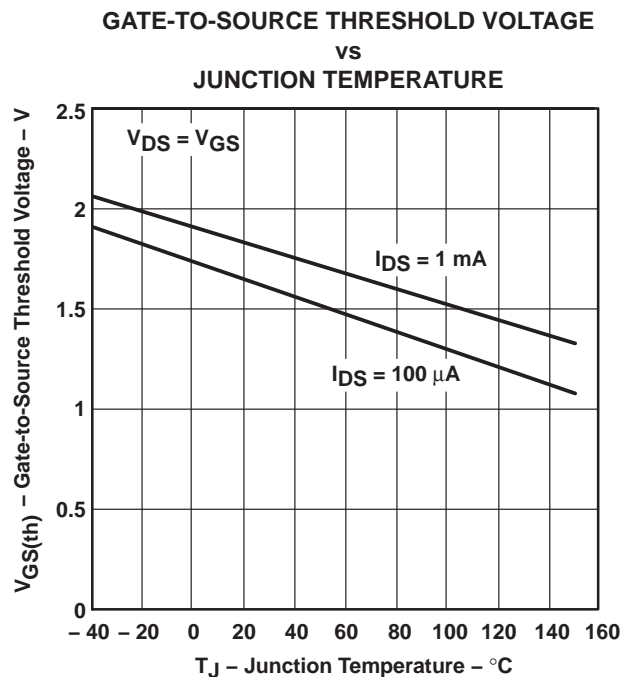


Figure 5

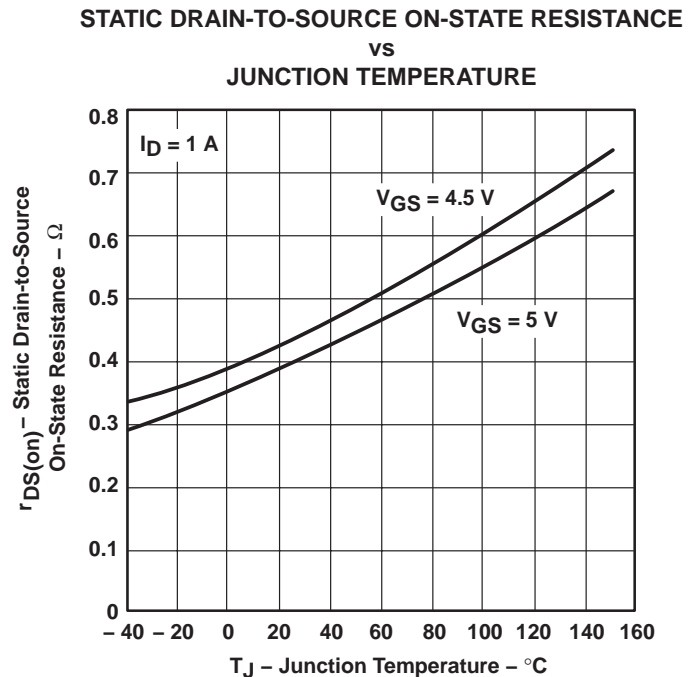


Figure 6



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TYPICAL CHARACTERISTICS

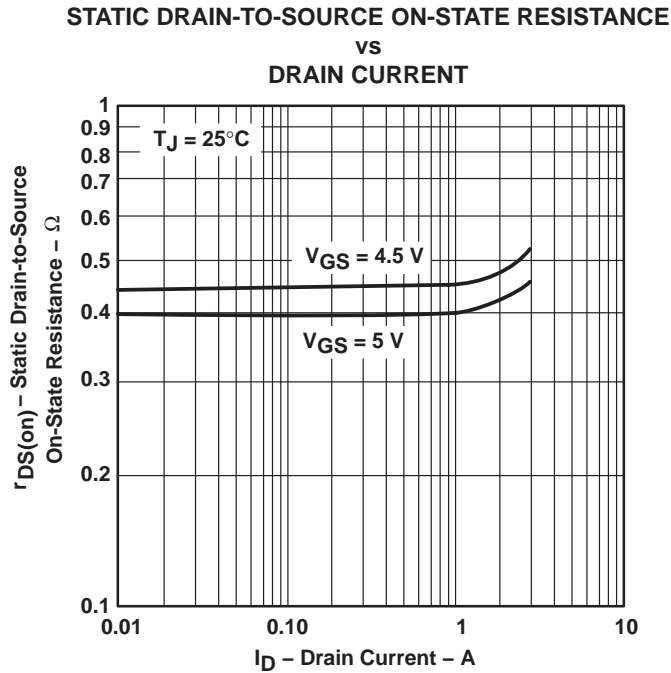


Figure 7

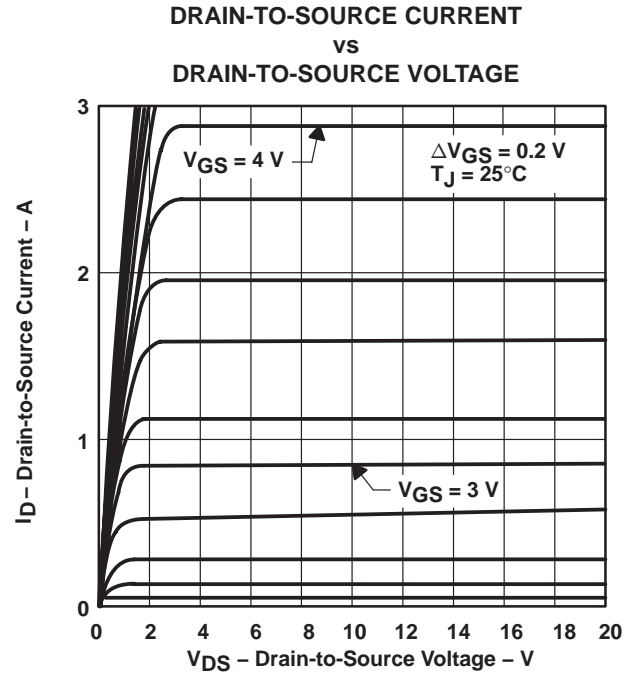


Figure 8

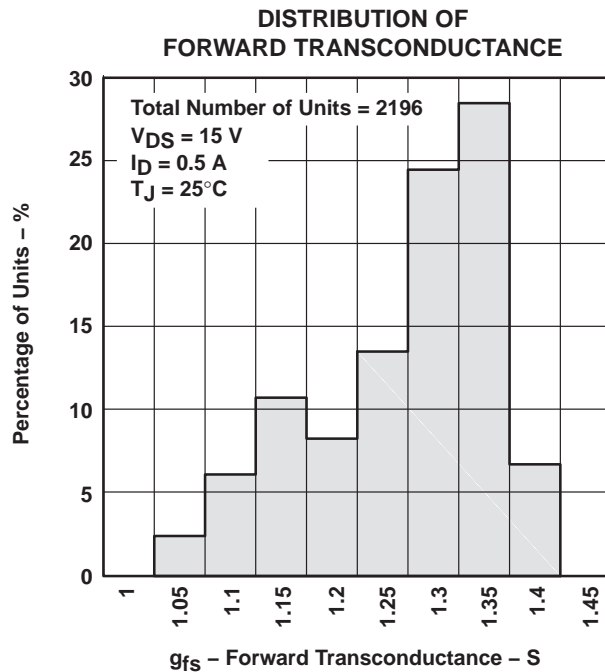


Figure 9

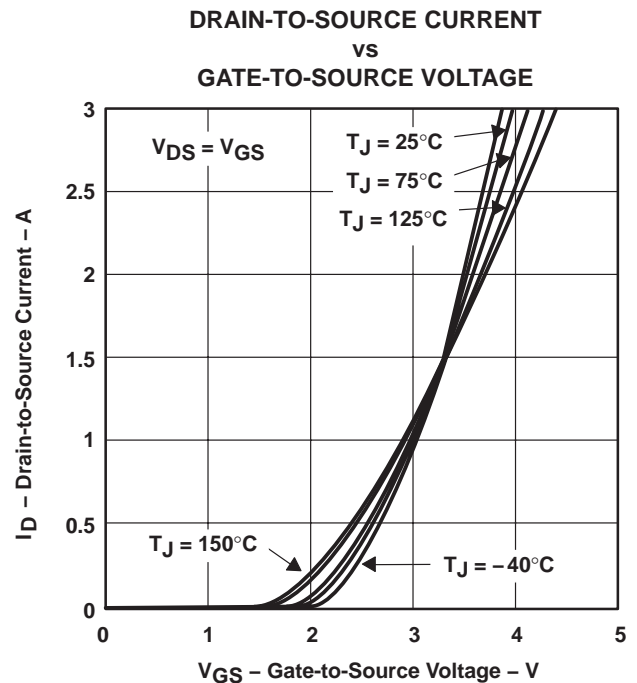


Figure 10

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TYPICAL CHARACTERISTICS

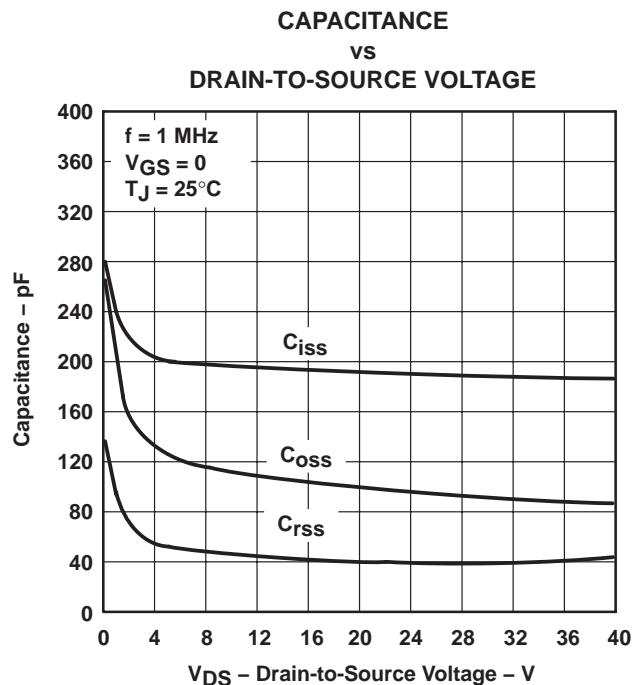


Figure 11

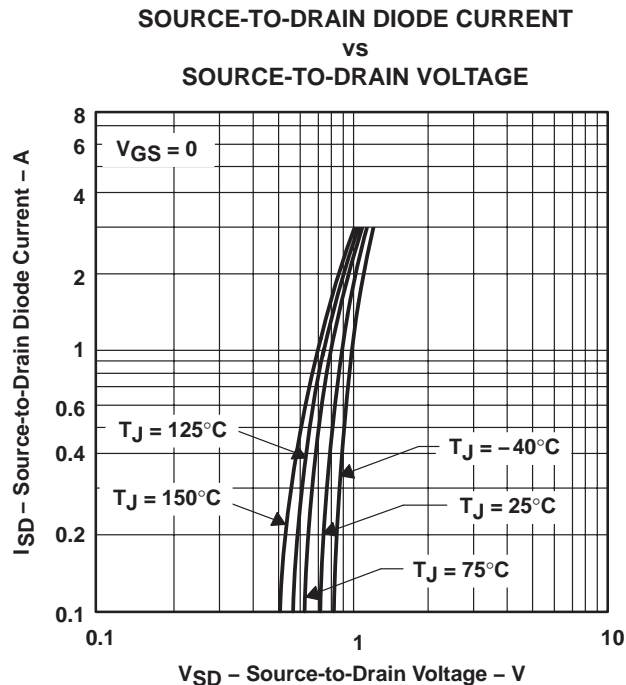


Figure 12

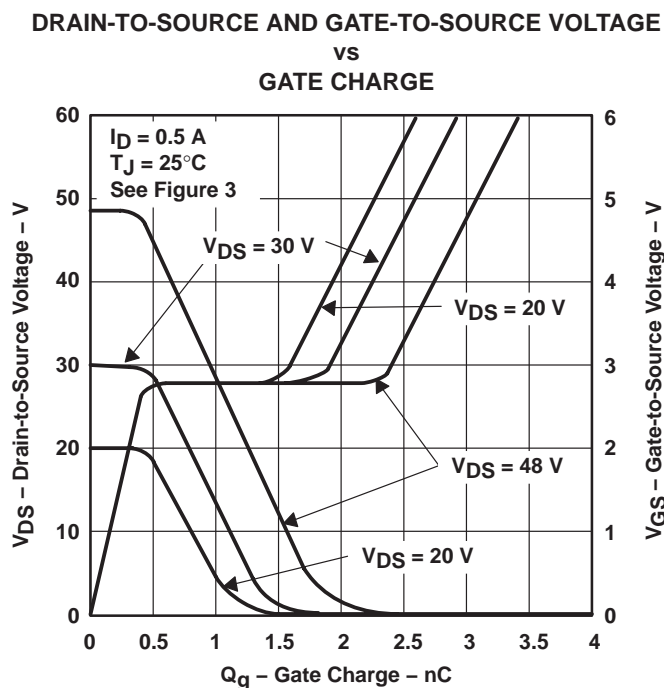


Figure 13

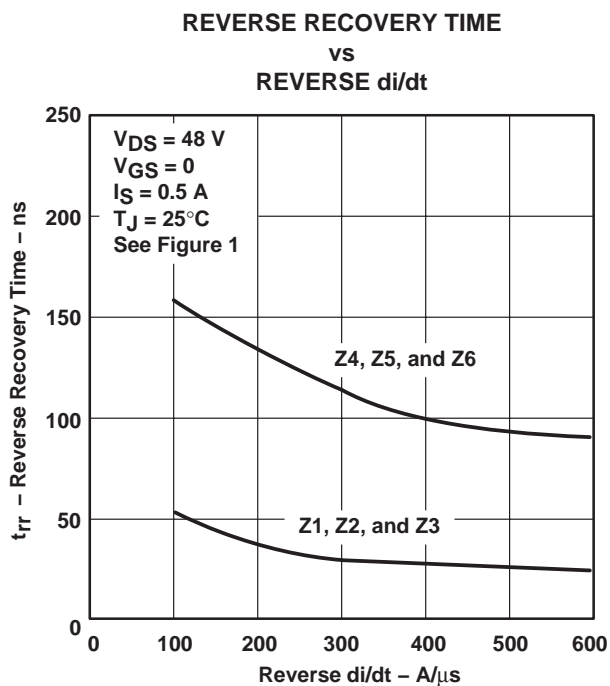
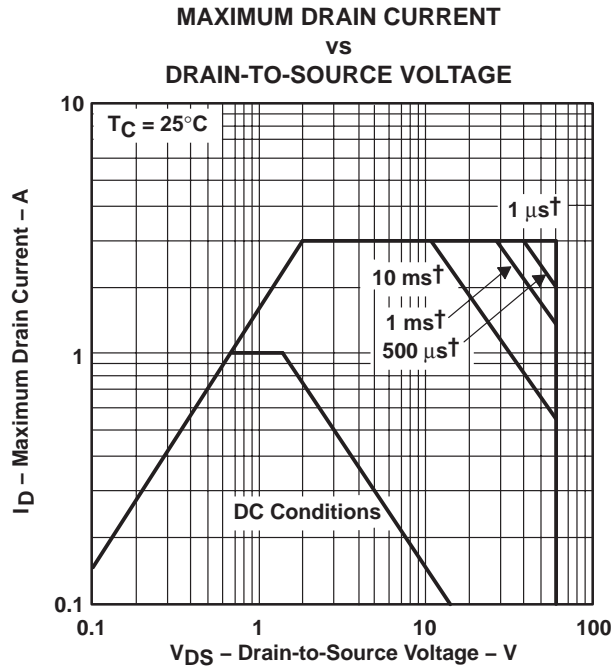


Figure 14



THERMAL INFORMATION



† Less than 2% duty cycle

Figure 15

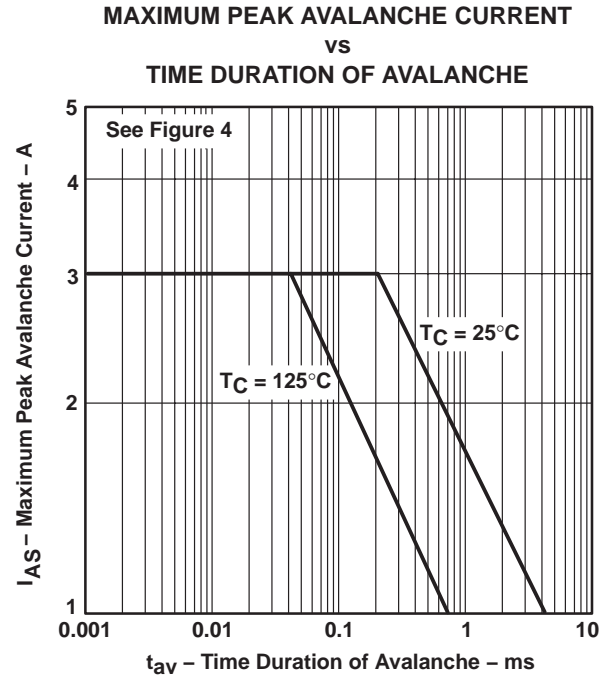
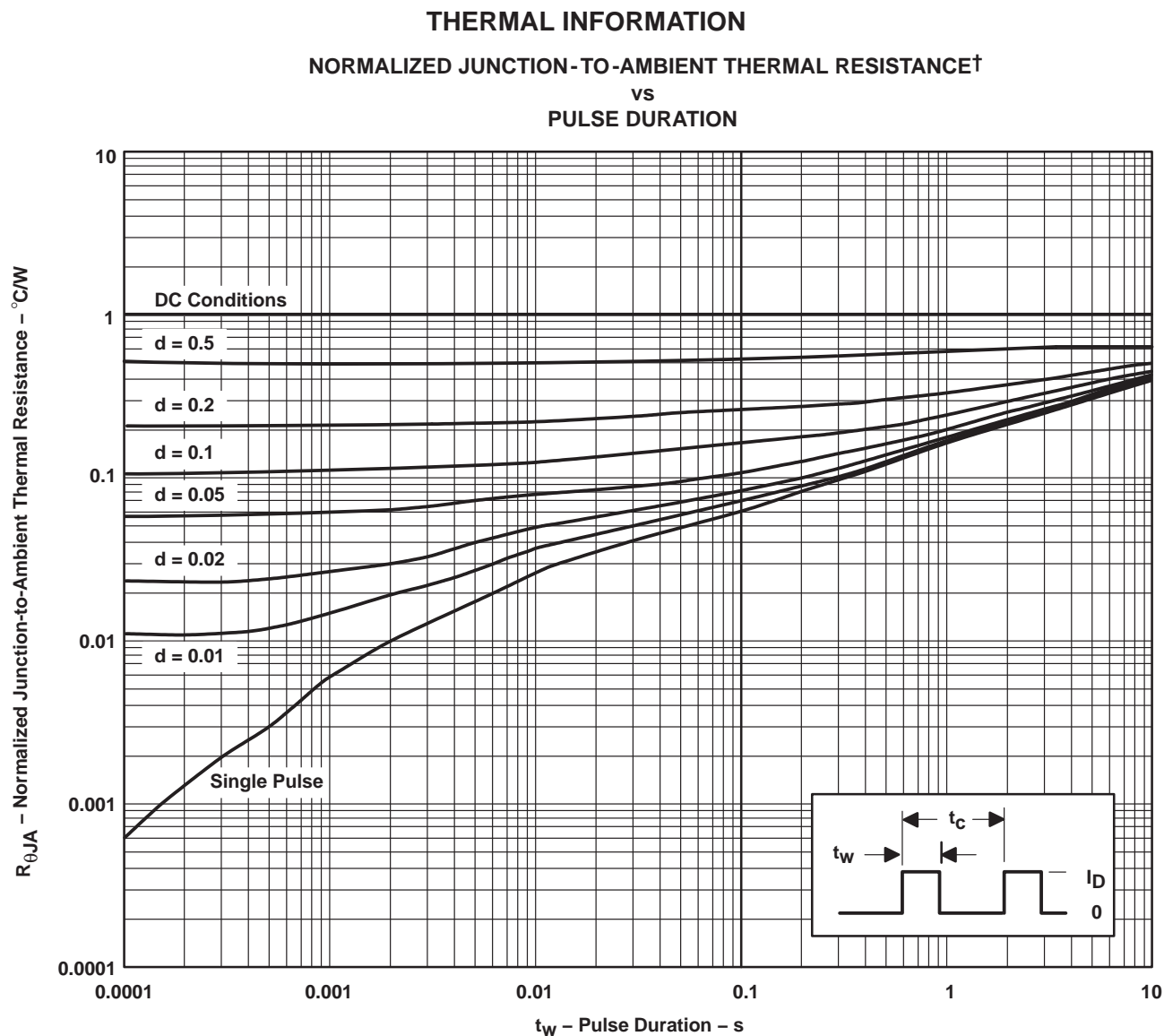


Figure 16

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† 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⁾
TPIC5621LDW	OBSOLETE	SOIC	DW	20		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.

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

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DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-013 variation AC.

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