

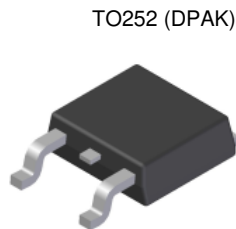
## Product Summary

BV <sub>DSS</sub>	R <sub>DS(ON)</sub> MAX	I <sub>D</sub> MAX T <sub>A</sub> = +25°C
-40V	51mΩ @ V <sub>GS</sub> = -10V	-10.5A
	85mΩ @ V <sub>GS</sub> = -4.5V	-8.4A

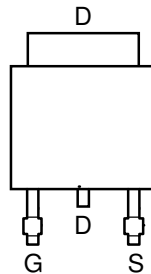
## Description and Applications

This MOSFET is designed to minimize the on-state resistance (R<sub>DS(ON)</sub>) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

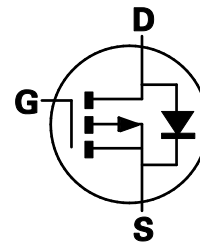
- Backlighting
- DC-DC Converters
- Power Management Functions



Top View



Top View  
Pin-Out



Equivalent Circuit

## Features and Benefits

- 100% Unclamped Inductive Switch (UIS) Test in Production
- Low On-Resistance
- Fast Switching Speed
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Mechanical Data

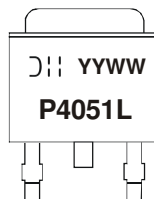
- Case: TO252 (DPAK)
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 Ⓔ3
- Weight: 0.33 grams (Approximate)

## Ordering Information (Notes 4 and 5)

Product	Grade	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
DMP4051LK3-13	Commercial	P4051L	13	16	2,500
DMP4051LK3Q-13	Automotive	P4051L	13	16	2,500

- Notes:
1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
  2. See [http://www.diodes.com/quality/lead\\_free/](http://www.diodes.com/quality/lead_free/) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free..
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  4. Automotive products are AEC-Q101 qualified and are PPAP capable. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to <https://www.diodes.com/quality/>.
  5. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information



D = Manufacturer's Marking  
 P4051L = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 18 = 2018)  
 WW = Week (01 to 53)

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

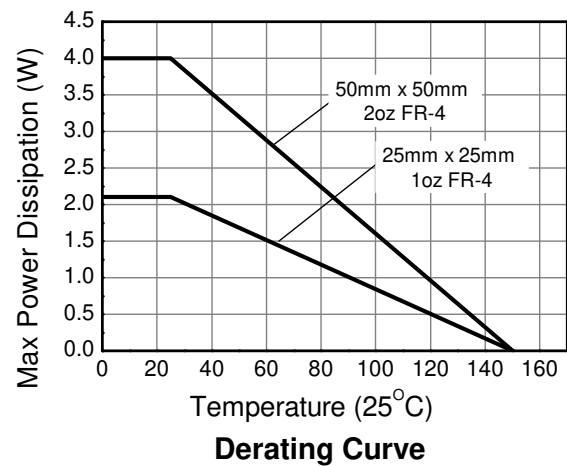
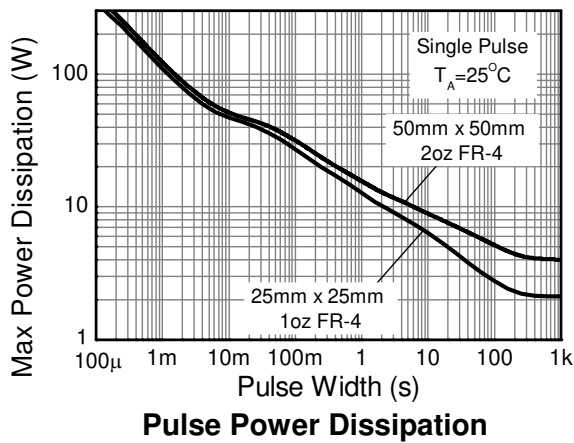
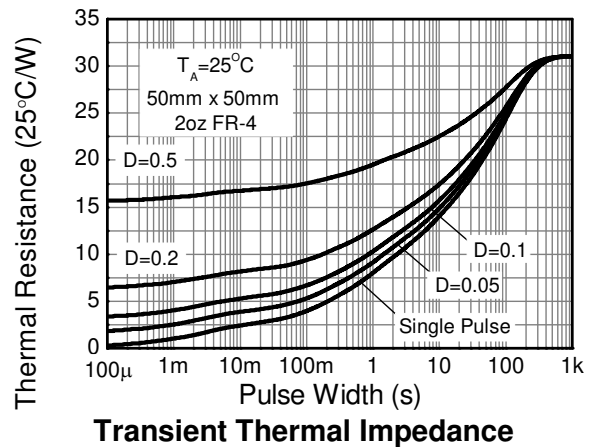
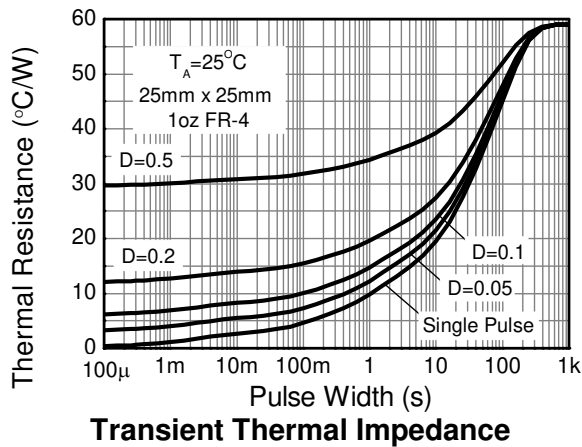
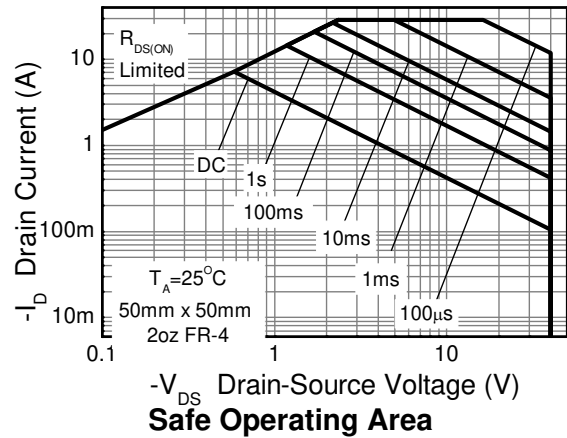
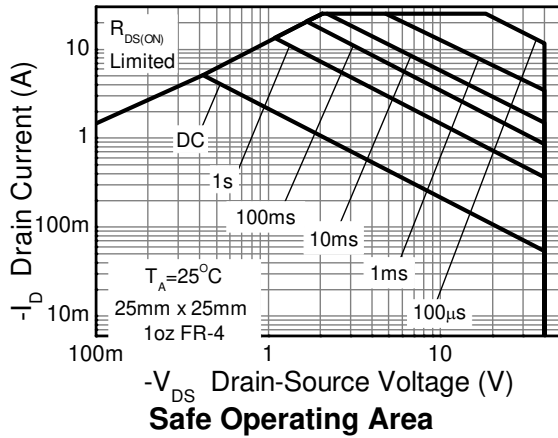
Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V <sub>DSS</sub>	-40	V
Gate-Source Voltage		(Note 6)	V <sub>GS</sub>	±20	V
Single Pulsed Avalanche Energy		(Note 12)	E <sub>AS</sub>	50	mJ
Single Pulsed Avalanche Current			I <sub>AS</sub>	-20.3	A
Continuous Drain Current	V <sub>GS</sub> = -10V	(Note 8)	I <sub>D</sub>	-10.5	A
		T <sub>A</sub> = +70°C (Note 8)		-8.40	
		(Note 7)		-7.2	
Pulsed Drain Current	V <sub>GS</sub> = -10V	(Note 9)	I <sub>DM</sub>	-28.9	A
Continuous Source Current (Body Diode)			I <sub>S</sub>	-10.1	A
Pulsed Source Current (Body Diode)			I <sub>SM</sub>	-28.9	A

**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic		Symbol	Value	Unit	
Power Dissipation Linear Derating Factor	(Note 7)	P <sub>D</sub>	4.18	W mW/°C	
			33.4		
	(Note 8)		8.9		
	(Note 10)		71.4		
Thermal Resistance, Junction to Ambient	(Note 7)	R <sub>θJA</sub>	2.14	°C/W	
	(Note 8)		17.1		
	(Note 10)		29.9		
Thermal Resistance, Junction to Lead	(Note 8)	R <sub>θJL</sub>	14.0	°C/W	
	(Note 10)		58.4		
	(Note 11)		2.46		
Operating and Storage Temperature Range			T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

- Notes:
6. AEC-Q101 V<sub>GS</sub> maximum is ±16V.
  7. For a device surface mounted on 50mm x 50mm x 1.6mm FR-4 PCB with high coverage of single sided 2oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
  8. Same as note 7, except the device is measured at t ≤ 10s.
  9. Same as note 7, except the device is pulsed with D = 0.02 and pulse width 300μs. The pulse current is limited by the maximum junction temperature.
  10. For a device surface mounted on 25mm x 25mm x 1.6mm FR-4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
  11. Thermal resistance from junction to solder-point (at the end of the drain lead).
  12. UIS in production with L = 100μH, V<sub>DD</sub> = -40V.

**Thermal Characteristics**

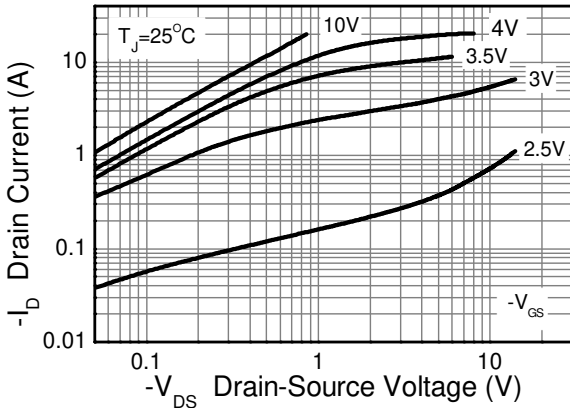


**Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

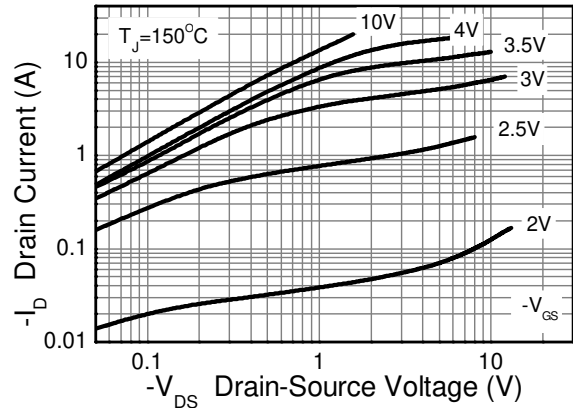
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	-40	—	—	V	$I_D = -250\mu\text{A}$ , $V_{GS} = 0\text{V}$
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	-0.5	$\mu\text{A}$	$V_{DS} = -40\text{V}$ , $V_{GS} = 0\text{V}$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 100$	nA	$V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	-1.0	—	-3.0	V	$I_D = -250\mu\text{A}$ , $V_{DS} = V_{GS}$
Static Drain-Source On-Resistance (Note 14)	$R_{DS(ON)}$	—	0.041	0.051	$\Omega$	$V_{GS} = -10\text{V}$ , $I_D = -12\text{A}$
			0.059	0.085		$V_{GS} = -4.5\text{V}$ , $I_D = -8\text{A}$
Forward Transconductance (Notes 13 & 14)	$g_{fs}$	—	16.6	—	s	$V_{DS} = -15\text{V}$ , $I_D = -12\text{A}$
Diode Forward Voltage (Note 13)	$V_{SD}$	—	-0.98	-1.2	V	$I_S = -12\text{A}$ , $V_{GS} = 0\text{V}$
Reverse Recovery Time (Note 14)	$t_{rr}$	—	138	—	ns	$I_S = -12\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$
Reverse Recovery Charge (Note 13)	$Q_{rr}$	—	841	—	nC	
<b>DYNAMIC CHARACTERISTICS (Note 14)</b>						
Input Capacitance	$C_{ISS}$	—	674	—	pF	$V_{DS} = -20\text{V}$ , $V_{GS} = 0\text{V}$ $f = 1\text{MHz}$
Output Capacitance	$C_{OSS}$	—	115	—	pF	
Reverse Transfer Capacitance	$C_{RSS}$	—	67.7	—	pF	
Total Gate Charge (Note 15)	$Q_G$	—	7.0	—	nC	$V_{GS} = -4.5\text{V}$
Total Gate Charge (Note 15)	$Q_G$	—	14	—	nC	$V_{GS} = -10\text{V}$ $V_{DS} = -20\text{V}$ $I_D = -12\text{A}$
Gate-Source Charge (Note 15)	$Q_{GS}$	—	2.2	—	nC	
Gate-Drain Charge (Note 15)	$Q_{GD}$	—	3.7	—	nC	
Turn-On Delay Time (Note 15)	$t_{d(on)}$	—	2.3	—	ns	$V_{DD} = -20\text{V}$ , $V_{GS} = -10\text{V}$ $I_D = -12\text{A}$ , $R_G \cong 6.0\Omega$
Turn-On Rise Time (Note 15)	$t_r$	—	14.1	—	ns	
Turn-Off Delay Time (Note 15)	$t_{d(off)}$	—	25.1	—	ns	
Turn-Off Fall Time (Note 15)	$t_f$	—	14.3	—	ns	

- Notes:
13. Measured under pulsed conditions. Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
  14. For design aid only, not subject to production testing.
  15. Switching characteristics are independent of operating junction temperatures.

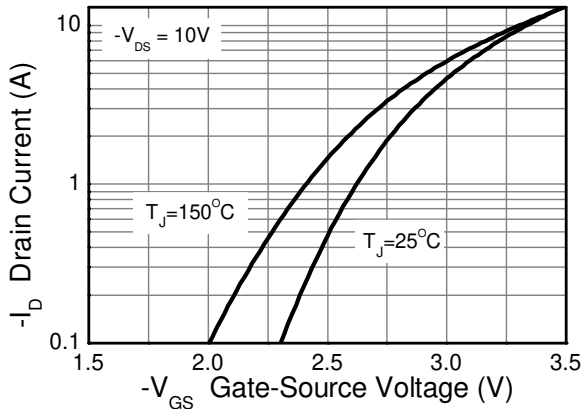
**Typical Characteristics**



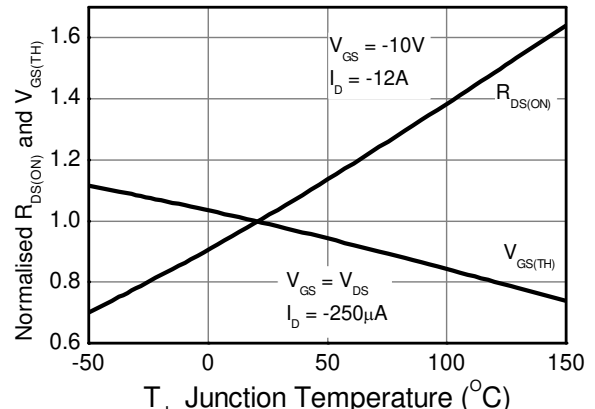
**Output Characteristics**



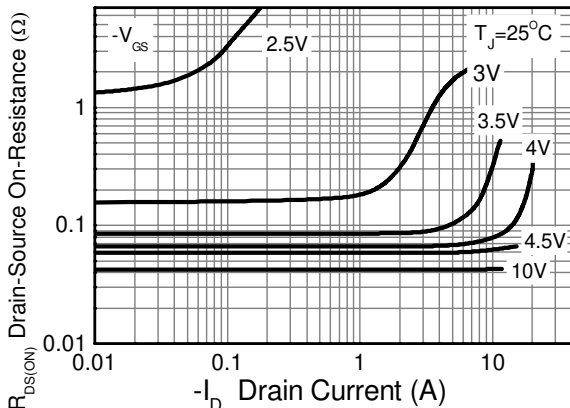
**Output Characteristics**



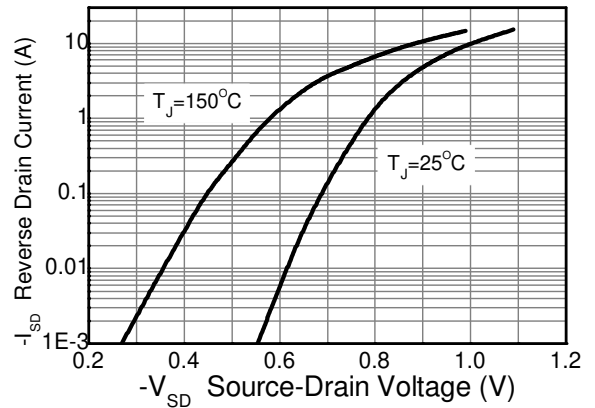
**Typical Transfer Characteristics**



**Normalised Curves v Temperature**

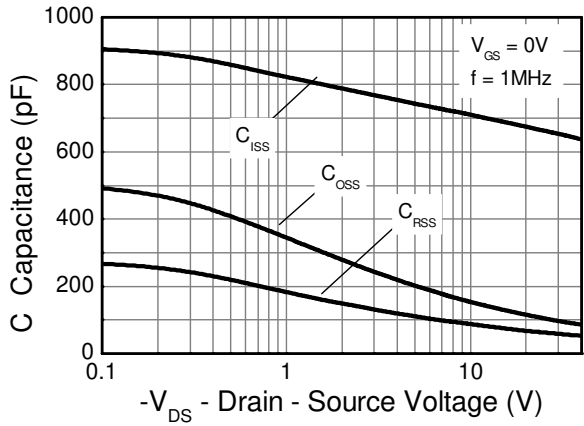


**On-Resistance v Drain Current**

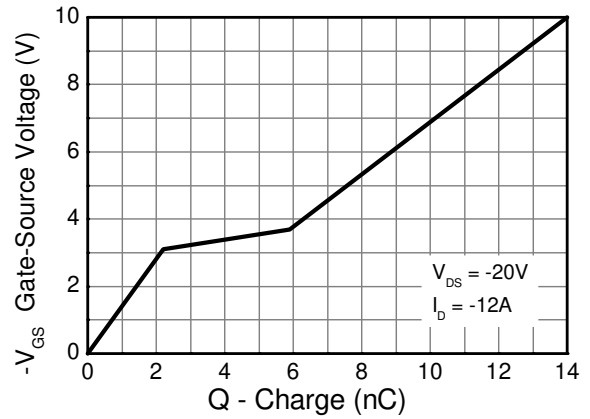


**Source-Drain Diode Forward Voltage**

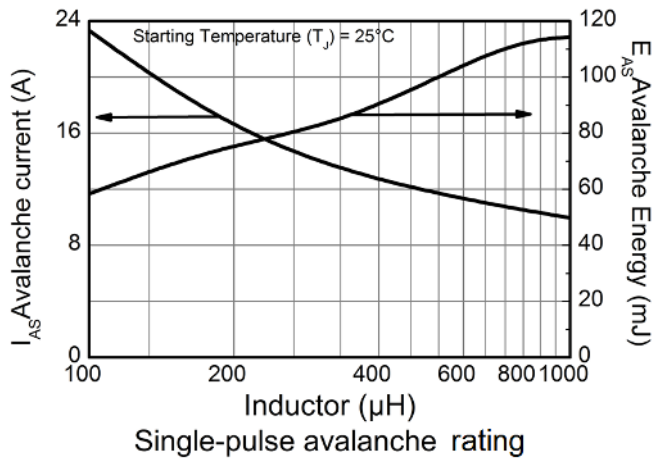
**Typical Characteristics (Cont.)**



**Capacitance v Drain-Source Voltage**

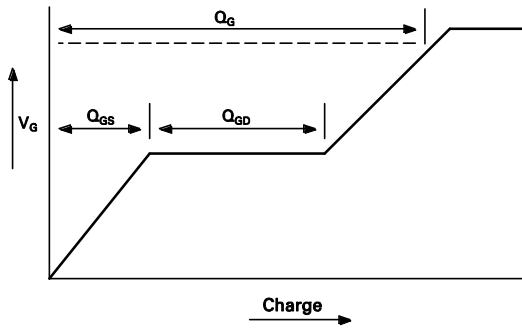


**Gate-Source Voltage v Gate Charge**

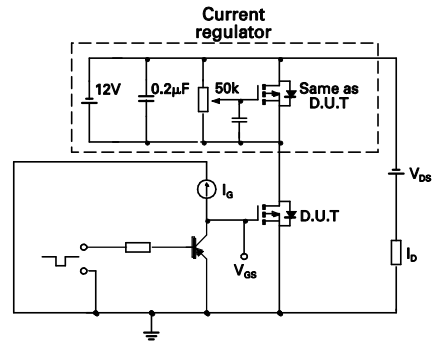


**Single-pulse avalanche rating**

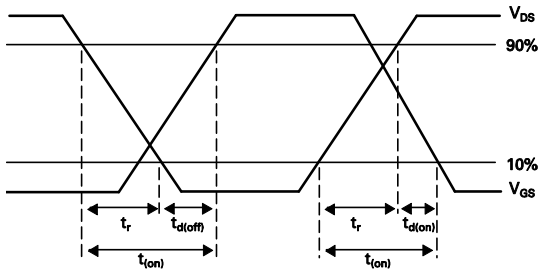
**Test Circuits**



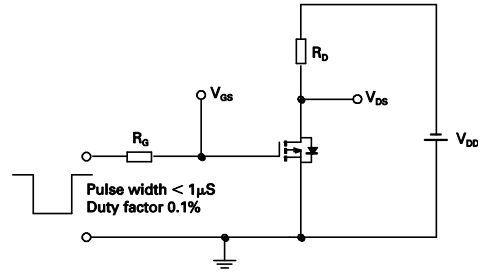
**Basic gate charge waveform**



**Gate charge test circuit**



**Switching time waveforms**

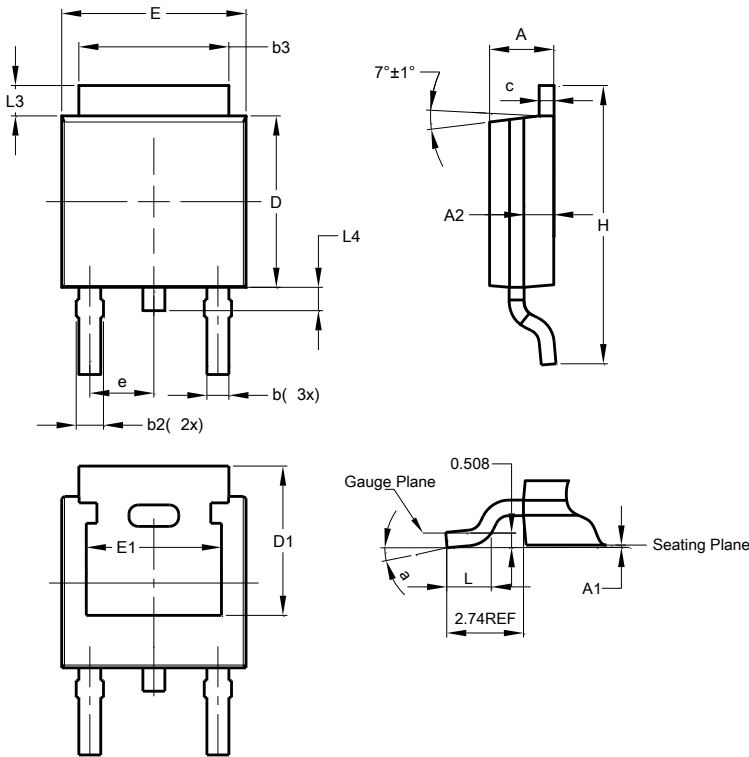


**Switching time test circuit**

**Package Outline Dimensions**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**TO252 (DPAK)**

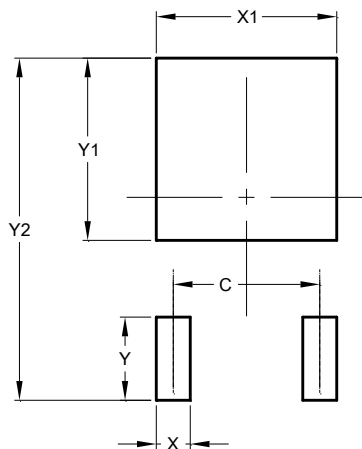


TO252 (DPAK)			
Dim	Min	Max	Typ
A	2.19	2.39	2.29
A1	0.00	0.13	0.08
A2	0.97	1.17	1.07
b	0.64	0.88	0.783
b2	0.76	1.14	0.95
b3	5.21	5.46	5.33
c	0.45	0.58	0.531
D	6.00	6.20	6.10
D1	5.21	-	-
e	-	-	2.286
E	6.45	6.70	6.58
E1	4.32	-	-
H	9.40	10.41	9.91
L	1.40	1.78	1.59
L3	0.88	1.27	1.08
L4	0.64	1.02	0.83
a	0°	10°	-
<b>All Dimensions in mm</b>			

**Suggested Pad Layout**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**TO252 (DPAK)**



Dimensions	Value (in mm)
C	4.572
X	1.060
X1	5.632
Y	2.600
Y1	5.700
Y2	10.700



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