

## Product Summary

BV <sub>DSS</sub>	Max R <sub>DS(ON)</sub>	Max I <sub>D</sub> T <sub>A</sub> = +25°C (Note 3)
60V	40mΩ @ V <sub>GS</sub> = 10V	7.7A
	60mΩ @ V <sub>GS</sub> = 4.5V	6.3A

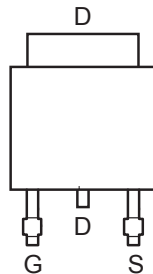
## Description and Applications

This MOSFET has been 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.

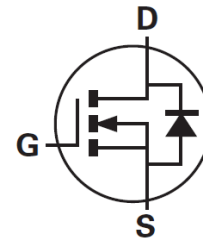
- DC-DC Converters
- Power Management Functions
- Disconnect Switches
- Motor Control



Top View



Pin Out -Top View



Equivalent Circuit

## Features and Benefits

- Low On-Resistance
- Fast Switching Speed
- Low Gate Drive
- **Lead-Free Finish; RoHS compliant (Note 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Available (Note 4)**

## Mechanical Data

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

## Ordering Information (Note 4 & 5)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXMN6A09KQTC	ZXMN6A09	13	16	2,500

- Notes:
1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) 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 [http://www.diodes.com/quality/product\\_grade\\_definitions/](http://www.diodes.com/quality/product_grade_definitions/).
  5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



ZXMN6A09 = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 10 = 2010)  
 WW = Week (01 - 53)

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

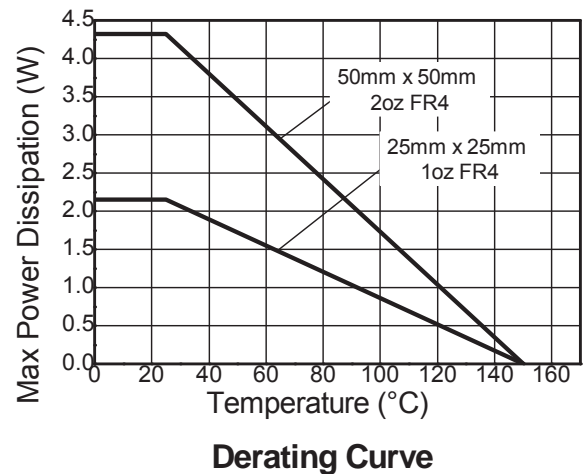
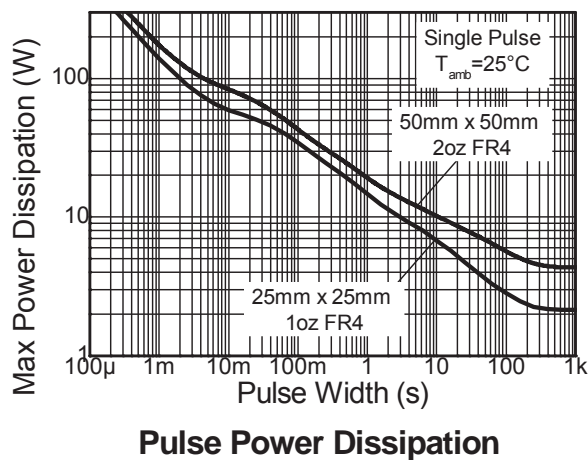
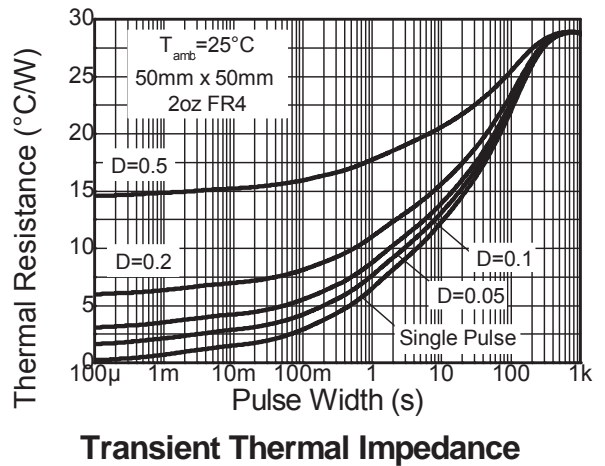
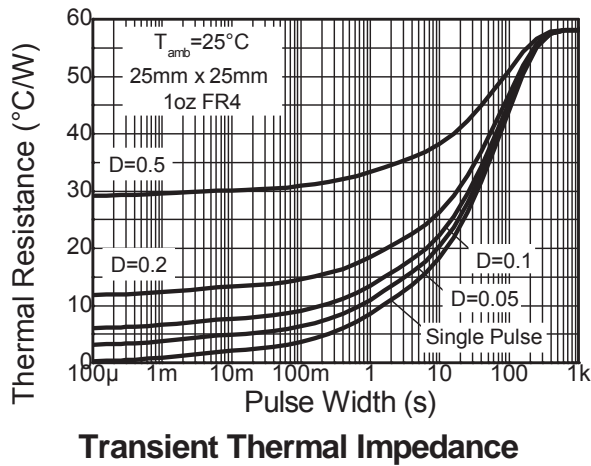
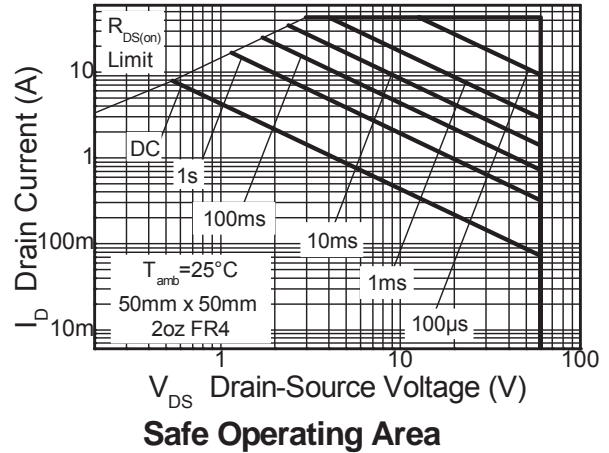
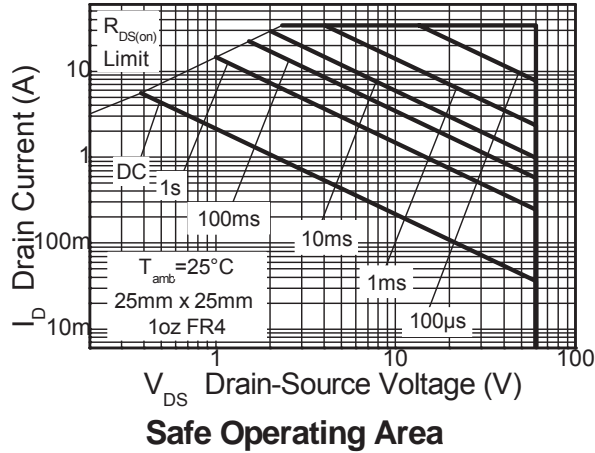
Characteristic		Symbol	Value	Unit	
Drain-Source Voltage		$V_{DS}$	60	V	
Gate-Source Voltage		$V_{GS}$	$\pm 20$	V	
Continuous Drain Current	$V_{GS} = 10\text{V}$	(Note 7)	11.8	A	
		$T_A = +70^\circ\text{C}$ (Note 7)	9.6		
		(Note 6)	7.7		
Pulsed Drain Current		(Note 8)	$I_{DM}$	43	A
Continuous Source Current (Body Diode)		(Note 7)	$I_S$	10.8	A
Pulsed Source Current (Body Diode)		(Note 8)	$I_{SM}$	43	A

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

Characteristic		Symbol	Value	Unit
Power Dissipation Linear Derating Factor	(Note 6)	$P_D$	4.3	W mW/ $^\circ\text{C}$
			34.4	
	(Note 7)		10.1	
	(Note 9)		80.8	
Thermal Resistance, Junction to Ambient	(Note 6)	$R_{\theta JA}$	2.15	$^\circ\text{C/W}$
	(Note 7)		17.2	
	(Note 9)		29	
Thermal Resistance, Junction to Lead	(Note 7)	$R_{\theta JL}$	12.3	$^\circ\text{C/W}$
	(Note 9)		58.1	
Operating and Storage Temperature Range		$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$

- Notes:
6. For a device surface mounted on 50mm x 50mm x 1.6mm FR4 PCB with high coverage of single sided 2oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
  7. For a device surface mounted on FR4 PCB measured at  $t \leq 10$  sec.
  8. Repetitive rating 50mm x 50mm x 1.6mm FR4 PCB,  $D = 0.02$  and pulse width 300  $\mu\text{s}$ . The pulse current is limited by the maximum junction temperature.
  9. For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
  10. Thermal resistance from junction to solder-point (at the end of the drain lead).

**Thermal Characteristics**

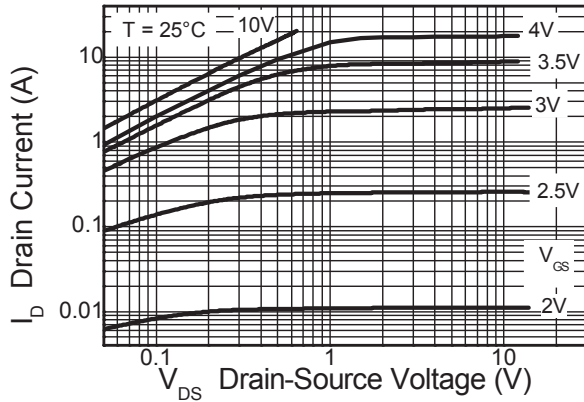


**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

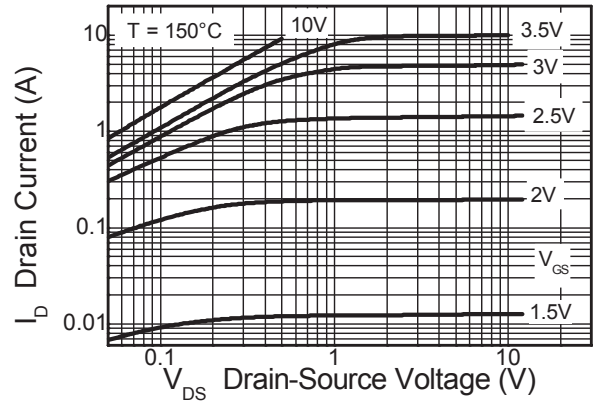
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	60	—	—	V	I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	1	μA	V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	1.0	—	3.0	V	I <sub>D</sub> = 250μA, V <sub>DS</sub> = V <sub>GS</sub>
Static Drain-Source On-Resistance (Note 11)	R <sub>DS(on)</sub>	—	—	40	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 7.3A
				60		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 5.6A
Forward Transconductance (Notes 11 & 12)	g <sub>fs</sub>	—	15	—	S	V <sub>DS</sub> = 15V, I <sub>D</sub> = 7.3A
Diode Forward Voltage (Note 11)	V <sub>SD</sub>	—	0.85	0.95	V	I <sub>S</sub> = 6.6A, V <sub>GS</sub> = 0V, T <sub>J</sub> = +25°C
Reverse recovery time (Note 12)	t <sub>rr</sub>	—	25.6	—	ns	I <sub>S</sub> = 3A, di/dt = 100A/μs
Reverse recovery charge (Note 12)	Q <sub>rr</sub>	—	26.0	—	nC	T <sub>J</sub> = +25°C
<b>DYNAMIC CHARACTERISTICS (Note 12)</b>						
Input Capacitance	C <sub>iss</sub>	—	1426	—	pF	V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V f = 1MHz
Output Capacitance	C <sub>oss</sub>	—	134	—	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	64	—	pF	
Total Gate Charge (Note 13)	Q <sub>g</sub>	—	15	—	nC	V <sub>GS</sub> = 4.5V, V <sub>DS</sub> = 30V, I <sub>D</sub> = 5.6A
Total Gate Charge (Note 13)	Q <sub>g</sub>	—	29	—	nC	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 30V I <sub>D</sub> = 7.3A
Gate-Source Charge (Note 13)	Q <sub>gs</sub>	—	7.0	—	nC	
Gate-Drain Charge (Note 13)	Q <sub>gd</sub>	—	4.7	—	nC	
Turn-On Delay Time (Note 13)	t <sub>D(on)</sub>	—	4.8	—	ns	V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V I <sub>D</sub> = 1A, R <sub>G</sub> ≅ 6.0Ω
Turn-On Rise Time (Note 13)	t <sub>r</sub>	—	4.6	—	ns	
Turn-Off Delay Time (Note 13)	t <sub>D(off)</sub>	—	32.5	—	ns	
Turn-Off Fall Time (Note 13)	t <sub>f</sub>	—	14.5	—	ns	

- Notes:
11. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%
  12. For design aid only, not subject to production testing.
  13. Switching characteristics are independent of operating junction temperatures.

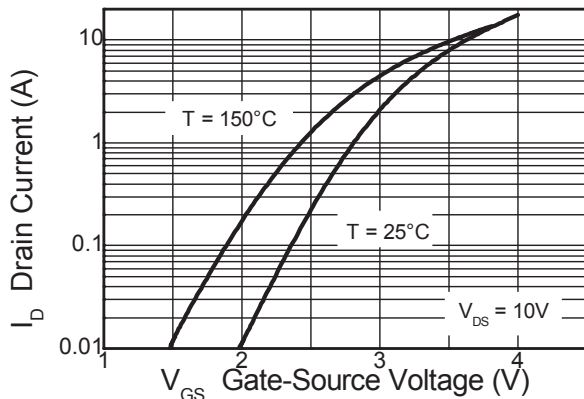
**Typical Characteristics**



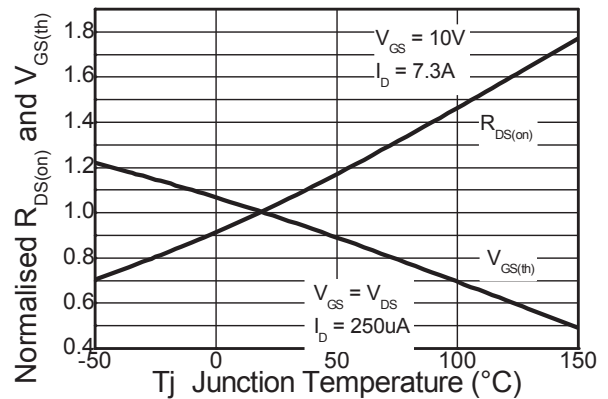
**Output Characteristics**



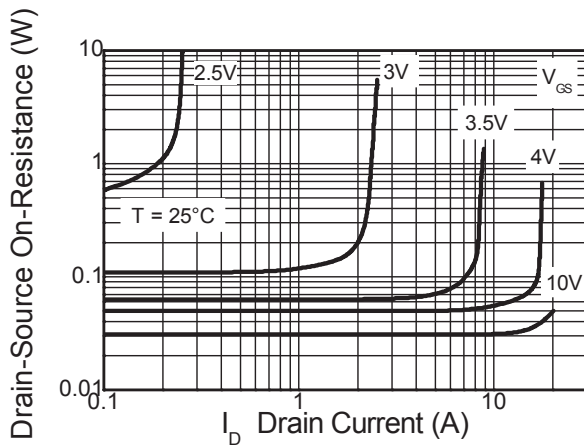
**Output Characteristics**



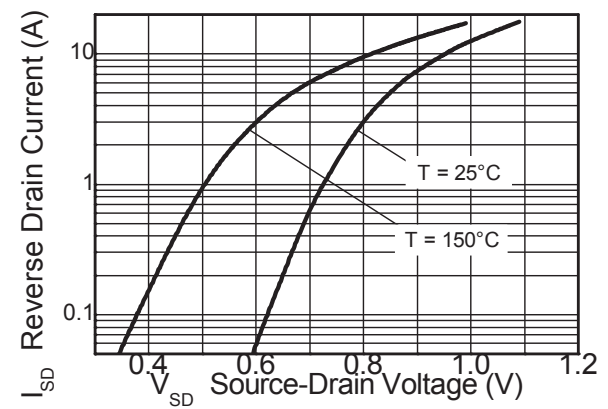
**Typical Transfer Characteristics**



**Normalised Curves v Temperature**

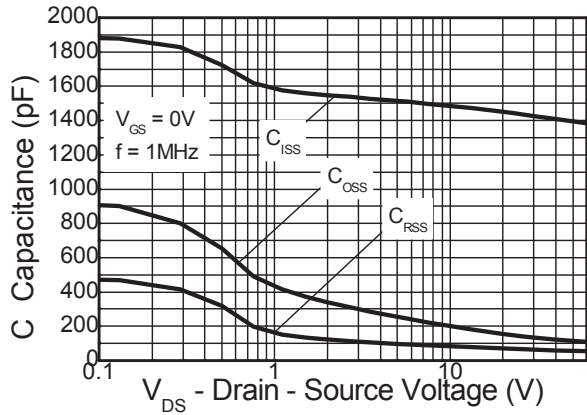


**On-Resistance v Drain Current**

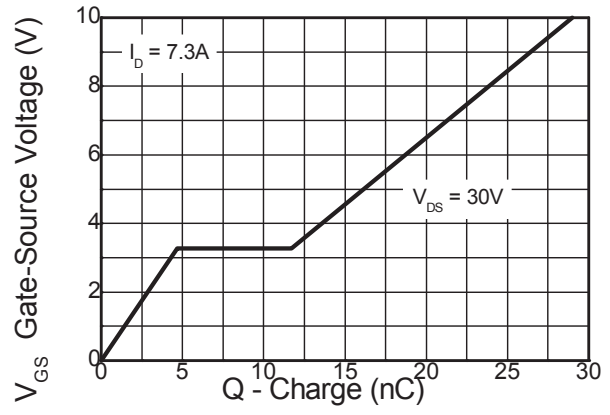


**Source-Drain Diode Forward Voltage**

**Typical Characteristics (cont.)**

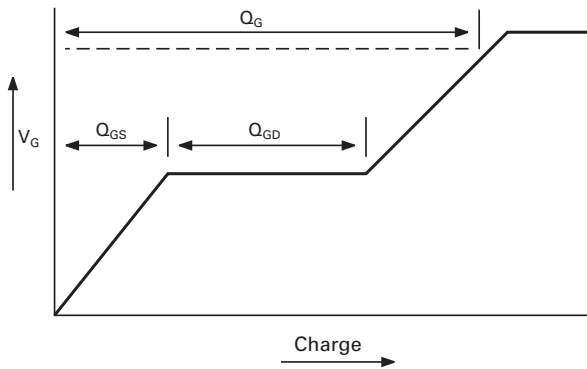


**Capacitance v Drain-Source Voltage**

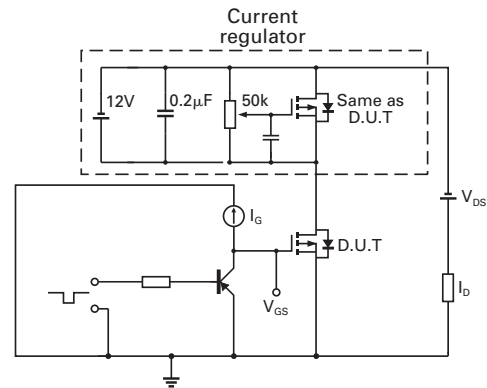


**Gate-Source Voltage v Gate Charge**

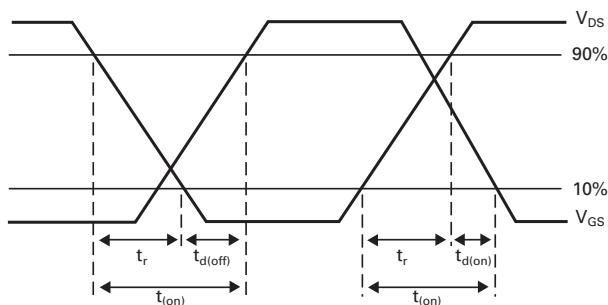
**Test Circuits**



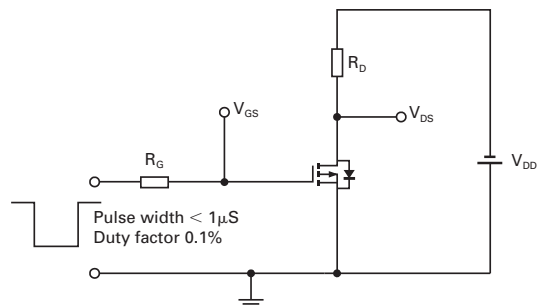
**Basic gate charge waveform**



**Gate charge test circuit**



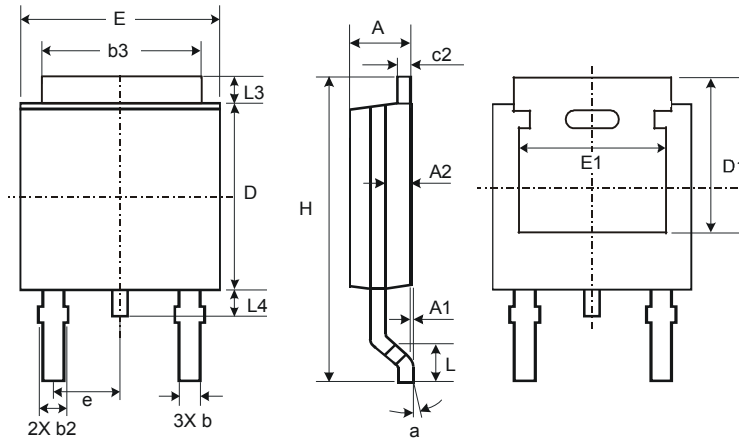
**Switching time waveforms**



**Switching time test circuit**

**Package Outline Dimensions**

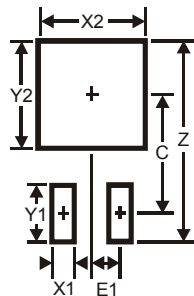
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



TO252			
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
c2	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 AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



Dimensions	Value (in mm)
Z	11.6
X1	1.5
X2	7.0
Y1	2.5
Y2	7.0
C	6.9
E1	2.3

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