

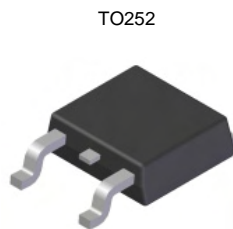
## Product Summary

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

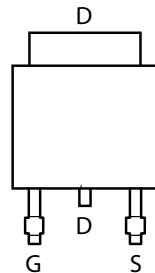
## Description and Applications

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.

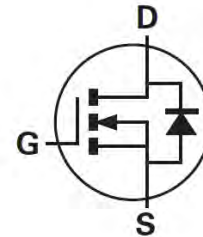
- DC-DC converters
- Power management functions
- Disconnect switches
- Motor control



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)**
- **Halogen and Antimony Free. "Green" Device (Note 2)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Mechanical Data

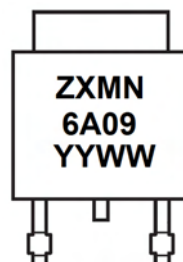
- Case: TO252
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0 (Note 1)
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish. Solderable per MIL-STD-202, Method 208
- Weight: 0.33 grams (approximate)

## Ordering Information (Note 1 & 2)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXMN6A09KTC	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. Halogen and Antimony free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

## Marking Information



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

**Maximum Ratings** @T<sub>A</sub> = 25°C unless otherwise specified

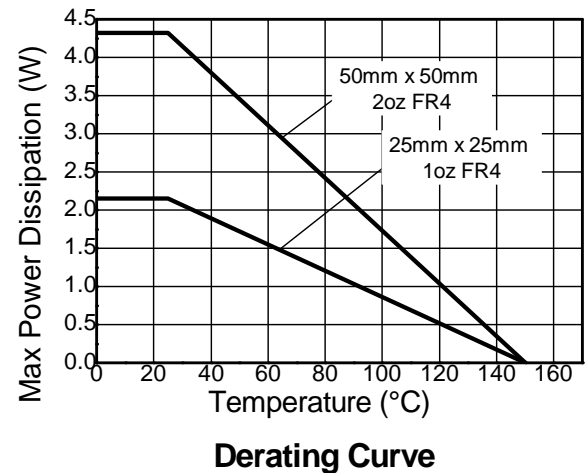
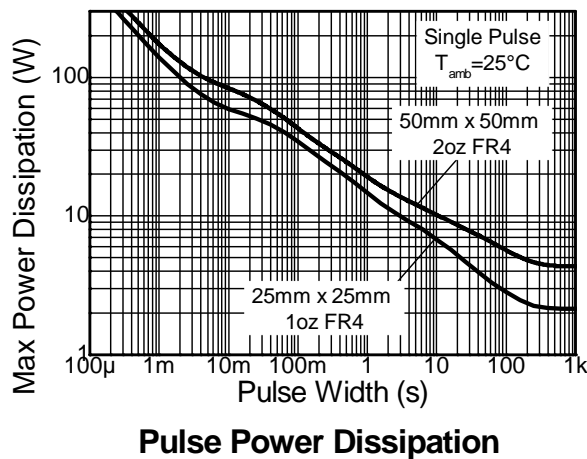
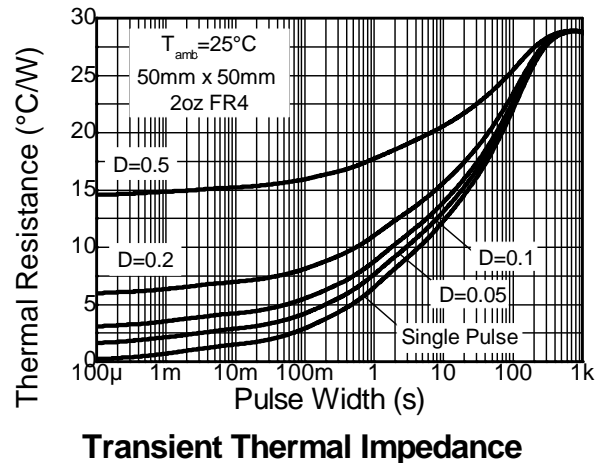
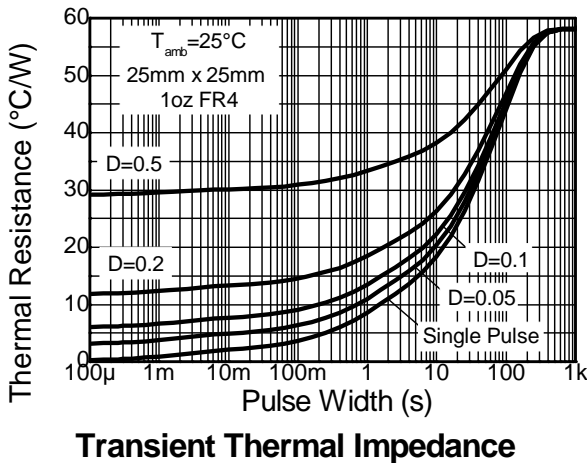
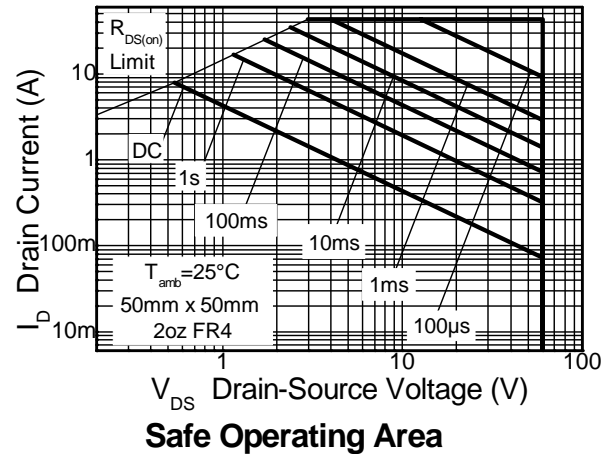
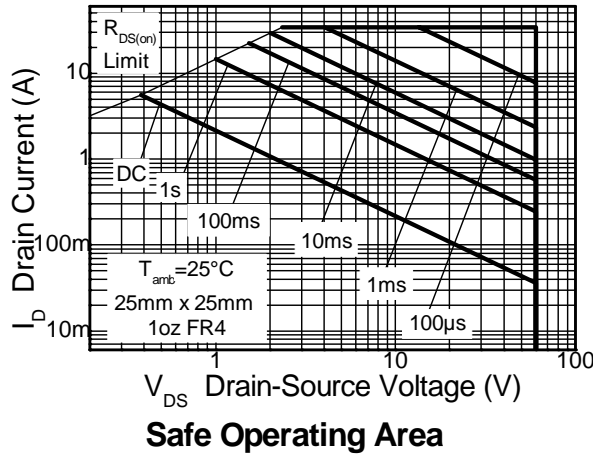
Characteristic		Symbol	Value	Unit	
Drain-Source voltage		V <sub>DSS</sub>	60	V	
Gate-Source voltage		V <sub>GS</sub>	±20	V	
Continuous Drain current	V <sub>GS</sub> = 10V	I <sub>D</sub>	(Note 4)	11.8	A
			T <sub>A</sub> = 70°C (Note 4)	9.6	
			(Note 3)	7.7	
Pulsed Drain current		I <sub>DM</sub>	43	A	
Continuous Source current (Body diode)		I <sub>S</sub>	10.8	A	
Pulsed Source current (Body diode)		I <sub>SM</sub>	43	A	

**Thermal Characteristics** @T<sub>A</sub> = 25°C unless otherwise specified

Characteristic		Symbol	Value	Unit
Power dissipation Linear derating factor	(Note 3)	P <sub>D</sub>	4.3	W mW/°C
			34.4	
	(Note 4)		10.1	
			80.8	
	(Note 6)		2.15 17.2	
Thermal Resistance, Junction to Ambient	(Note 3)	R <sub>θJA</sub>	29	°C/W
	(Note 4)		12.3	
	(Note 6)		58.1	
Thermal Resistance, Junction to Lead	(Note 7)	R <sub>θJL</sub>	1.04	
Operating and storage temperature range		T <sub>J</sub> , T <sub>STG</sub>	-55 to 150	°C

- Notes:
3. 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.
  4. For a device surface mounted on FR4 PCB measured at t ≤ 10 sec.
  5. Repetitive rating 50mm x 50mm x 1.6mm FR4 PCB, D = 0.02 and pulse width 300 μs. The pulse current is limited by the maximum junction temperature.
  6. 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.
  7. Thermal resistance from junction to solder-point (at the end of the drain lead).

**Thermal Characteristics**

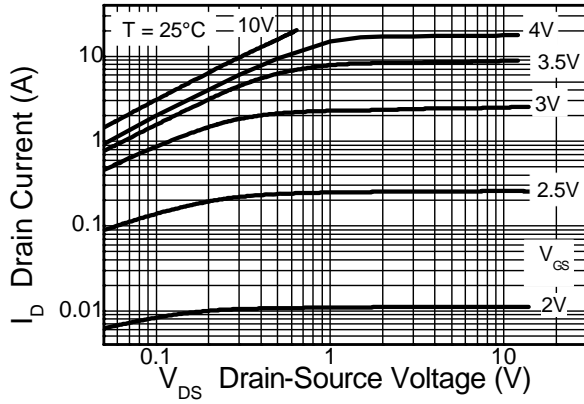


**Electrical Characteristics** @  $T_A = 25^\circ\text{C}$  unless otherwise specified

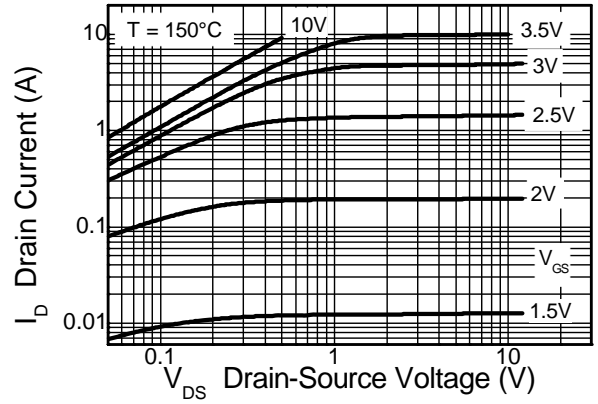
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	60	—	—	V	$I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	1	$\mu\text{A}$	$V_{DS} = 60\text{V}$ , $V_{GS} = 0\text{V}$
Gate-Source 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 8)	$R_{DS(on)}$	—	—	40	m $\Omega$	$V_{GS} = 10\text{V}$ , $I_D = 7.3\text{A}$
				60		$V_{GS} = 4.5\text{V}$ , $I_D = 5.6\text{A}$
Forward Transconductance (Notes 8 & 9)	$g_{fs}$	—	15	—	S	$V_{DS} = 15\text{V}$ , $I_D = 7.3\text{A}$
Diode Forward Voltage (Note 8)	$V_{SD}$	—	0.85	0.95	V	$I_S = 6.6\text{A}$ , $V_{GS} = 0\text{V}$ , $T_J = 25^\circ\text{C}$
Reverse recovery time (Note 9)	$t_{rr}$	—	25.6	—	ns	$I_S = 3\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$
Reverse recovery charge (Note 9)	$Q_{rr}$	—	26.0	—	nC	$T_J = 25^\circ\text{C}$
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	$C_{iss}$	—	1426	—	pF	$V_{DS} = 30\text{V}$ , $V_{GS} = 0\text{V}$ $f = 1\text{MHz}$
Output Capacitance	$C_{oss}$	—	134	—	pF	
Reverse Transfer Capacitance	$C_{rss}$	—	64	—	pF	
Total Gate Charge (Note 10)	$Q_g$	—	15	—	nC	$V_{GS} = 4.5\text{V}$ , $V_{DS} = 30\text{V}$ , $I_D = 5.6\text{A}$
Total Gate Charge (Note 10)	$Q_g$	—	29	—	nC	$V_{GS} = 10\text{V}$ , $V_{DS} = 30\text{V}$ $I_D = 7.3\text{A}$
Gate-Source Charge (Note 10)	$Q_{gs}$	—	7.0	—	nC	
Gate-Drain Charge (Note 10)	$Q_{gd}$	—	4.7	—	nC	
Turn-On Delay Time (Note 10)	$t_{D(on)}$	—	4.8	—	ns	$V_{DD} = 30\text{V}$ , $V_{GS} = 10\text{V}$ $I_D = 1\text{A}$ , $R_G \cong 6.0\Omega$
Turn-On Rise Time (Note 10)	$t_r$	—	4.6	—	ns	
Turn-Off Delay Time (Note 10)	$t_{D(off)}$	—	32.5	—	ns	
Turn-Off Fall Time (Note 10)	$t_f$	—	14.5	—	ns	

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

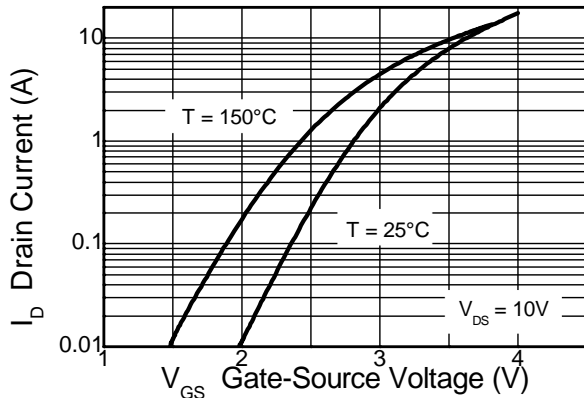
**Typical Characteristics**



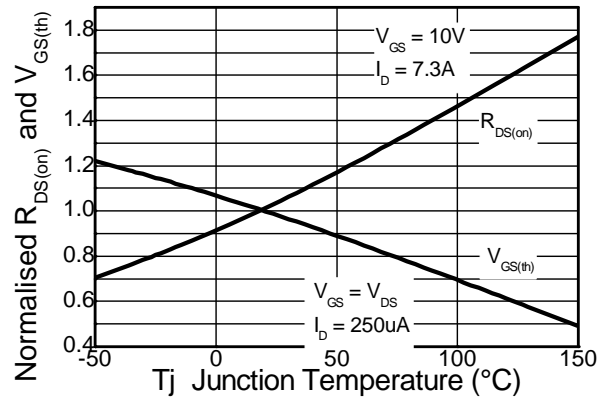
**Output Characteristics**



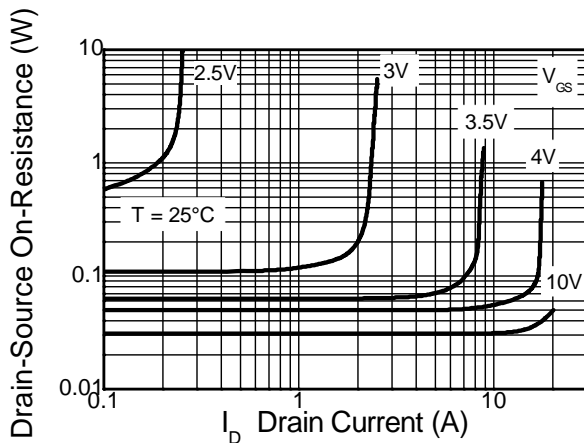
**Output Characteristics**



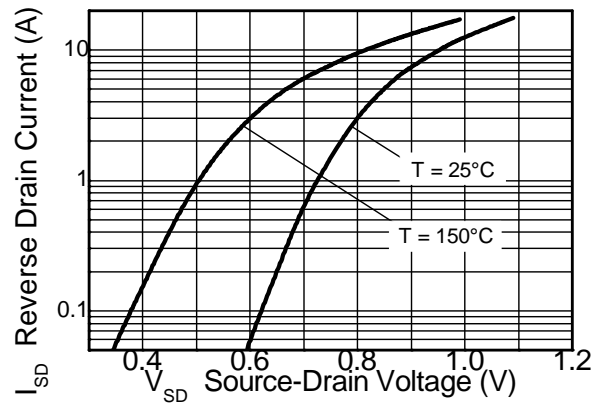
**Typical Transfer Characteristics**



**Normalised Curves v Temperature**

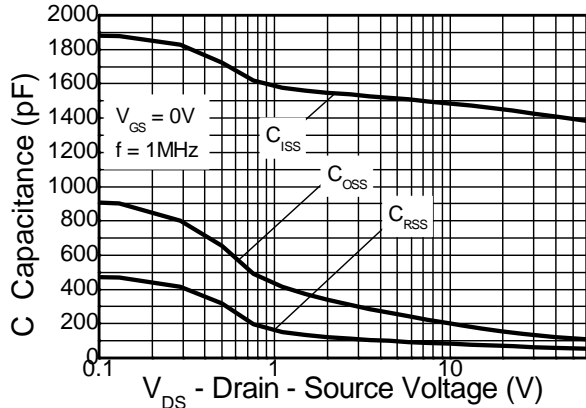


**On-Resistance v Drain Current**

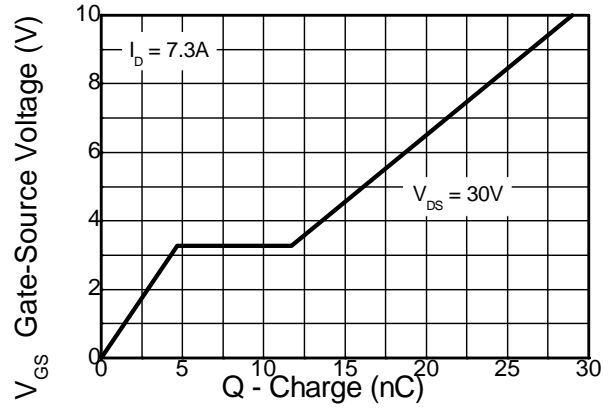


**Source-Drain Diode Forward Voltage**

**Typical Characteristics - continued**

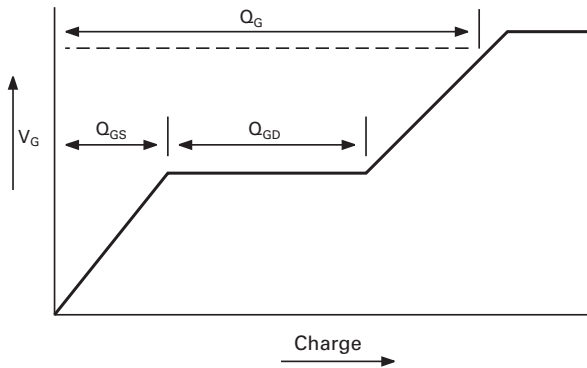


**Capacitance v Drain-Source Voltage**

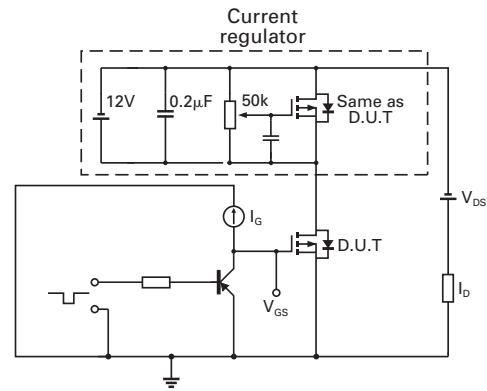


**Gate-Source Voltage v Gate Charge**

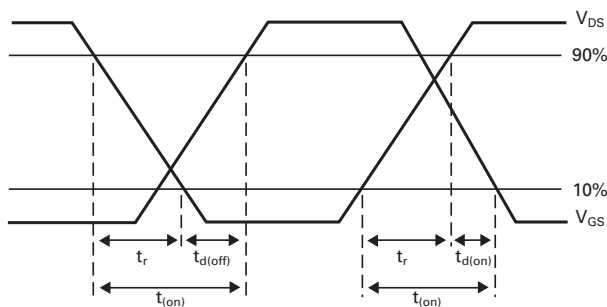
**Test Circuits**



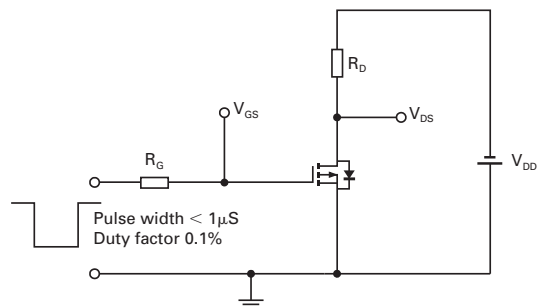
**Basic gate charge waveform**



**Gate charge test circuit**

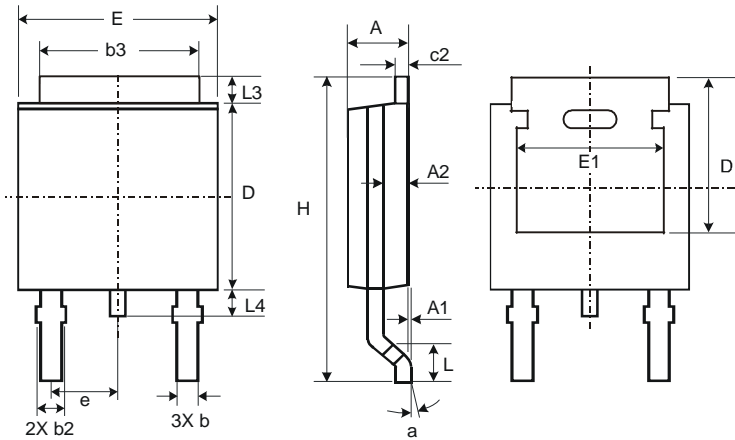


**Switching time waveforms**



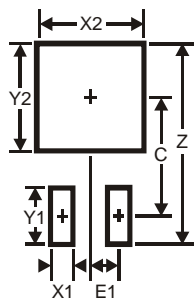
**Switching time test circuit**

**Package Outline Dimensions**



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°	-
All Dimensions in mm			

**Suggested Pad Layout**



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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