

40V P-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

$V_{(BR)DSS}$	$R_{DS(on)}$	I_D $T_A = 25^\circ\text{C}$
-40V	51m Ω @ $V_{GS} = -10\text{V}$	-10.5A
	85m Ω @ $V_{GS} = -4.5\text{V}$	-8.4A

Description and Applications

This MOSFET has been designed to minimize the on-state resistance ($R_{DS(on)}$) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

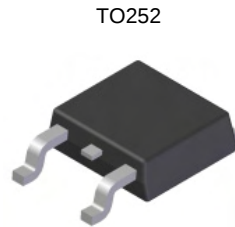
- Backlighting
- DC-DC Converters
- Power management functions

Features and Benefits

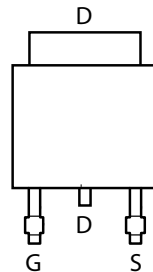
- 100% Unclamped Inductive Switch (UIS) test in production
- Low on-resistance
- Fast switching speed
- “Green” component and RoHS compliant (Note 1)
- Qualified to AEC-Q101 Standards for High Reliability

Mechanical Data

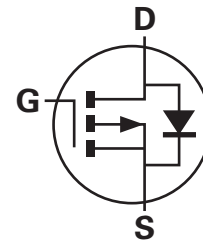
- Case: TO252
- Case Material: Molded Plastic, “Green” Molding Compound. UL Flammability Classification Rating 94V-0 (Note 1)
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208
- Weight: 0.33 grams (approximate)



Top View



Top View
Pin-Out



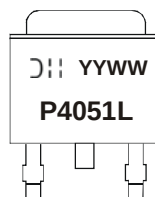
Equivalent Circuit

Ordering Information (Notes 1 & 2)

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. Diodes, Inc. defines “Green” products as those which are RoHS compliant and contain no halogens or antimony compounds; further information about Diodes Inc.’s “Green” Policy can be found on our website. For packaging details, go to our website.
 2. Products with Q-suffix are automotive grade. Automotive products are electrical and thermal the same as the commercial, except where specified.

Marking Information



DII = Manufacturer's Marking
 P4051L = Product Type Marking Code
 YYWW = Date Code Marking
 YY = Year (ex: 09 = 2009)
 WW = Week (01 - 53)

Maximum Ratings @T_A = 25°C unless otherwise specified

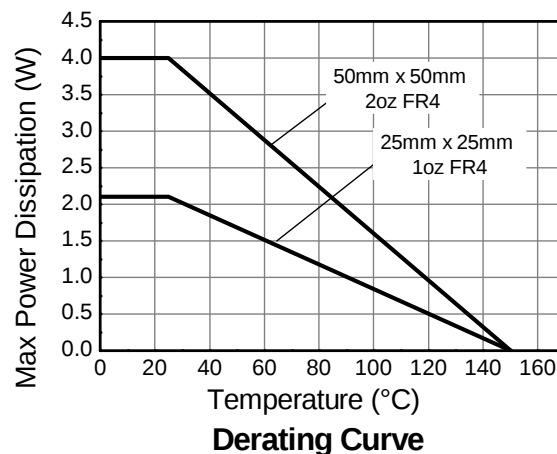
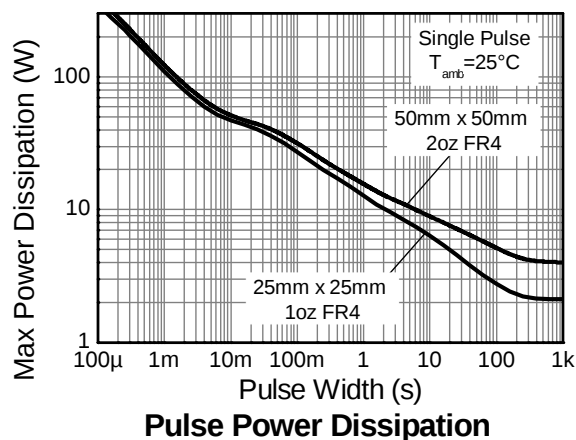
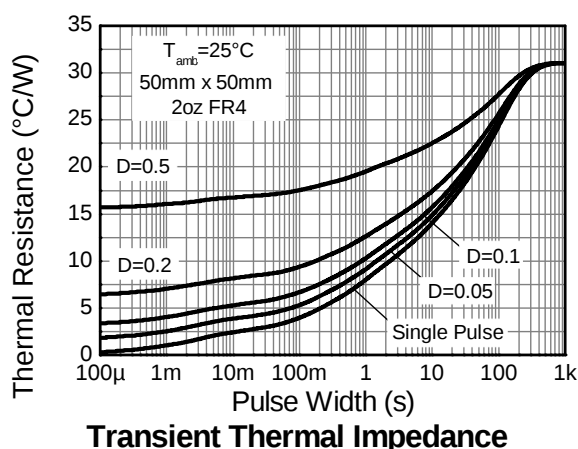
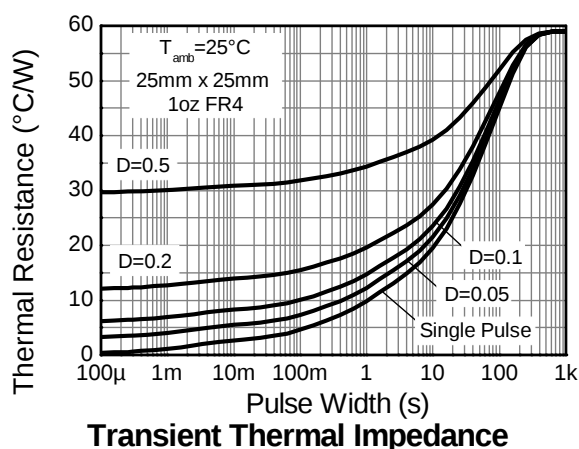
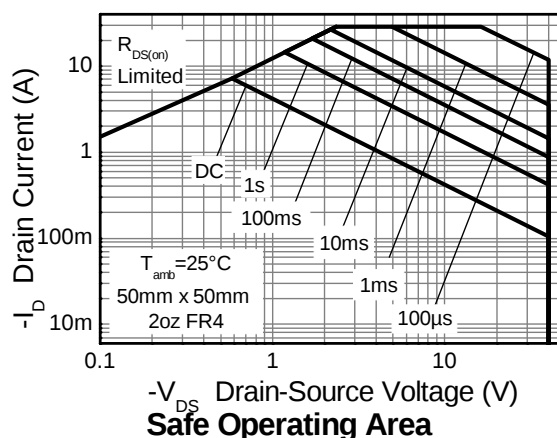
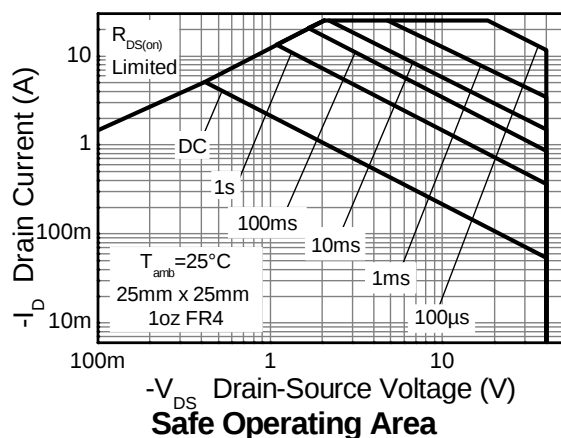
Characteristic			Symbol	Value	Unit
Drain-Source voltage			V _{DSS}	-40	V
Gate-Source voltage	(Note 3)		V _{GS}	±20	V
Single Pulsed Avalanche Energy	(Note 9)		E _{AS}	50	mJ
Single Pulsed Avalanche Current	(Note 9)		I _{AS}	20.3	A
Continuous Drain current	V _{GS} = 10V	(Note 5)	I _D	-10.5	A
		T _A = 70°C (Note 5)		-8.40	
		(Note 4)		-7.2	
Pulsed Drain current	V _{GS} = 10V	(Note 6)	I _{DM}	-28.9	A
Continuous Source current (Body diode)	(Note 5)		I _S	-10.1	A
Pulsed Source current (Body diode)	(Note 5)		I _{SM}	-28.9	A

Thermal Characteristics @T_A = 25°C unless otherwise specified

Characteristic		Symbol	Value	Unit
Power dissipation Linear derating factor	(Note 4)	P _D	4.18	W mW/°C
			33.4	
	(Note 5)		8.9	
			71.4	
Thermal Resistance, Junction to Ambient	(Note 7)	R _{θJA}	2.14	°C/W
			17.1	
	(Note 4)		29.9	
	(Note 5)		14.0	
Thermal Resistance, Junction to Lead	(Note 7)		58.4	
Thermal Resistance, Junction to Lead	(Note 8)	R _{θJL}	2.46	
Operating and storage temperature range		T _J , T _{STG}	-55 to 150	°C

- Notes:
- AEC-Q101 V_{GS} maximum is ±16V.
 - 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.
 - Same as note 4, except the device is measured at t ≤ 10 sec.
 - Same as note 4, except the device is pulsed with D = 0.02 and pulse width 300μs. The pulse current is limited by the maximum junction temperature.
 - 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.
 - Thermal resistance from junction to solder-point (at the end of the drain lead).
 - UIS in production with L = 100μH, V_{DD} = -40V.

Thermal Characteristics

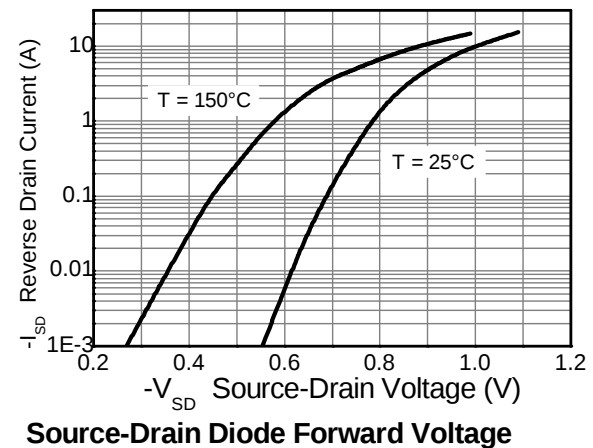
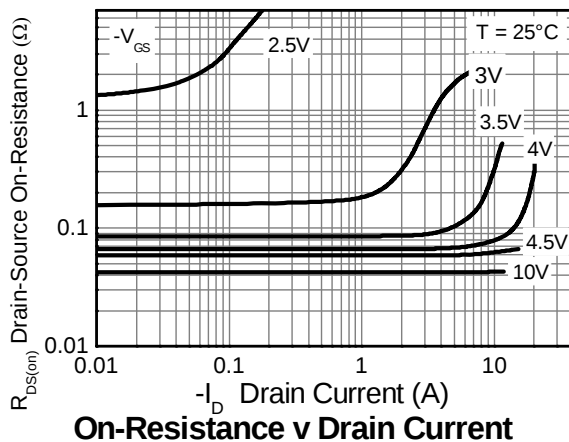
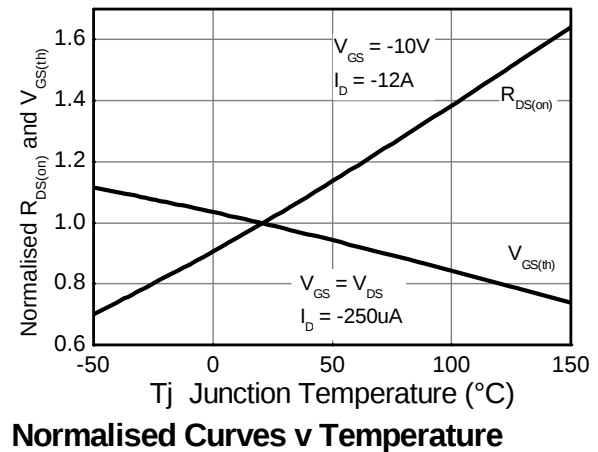
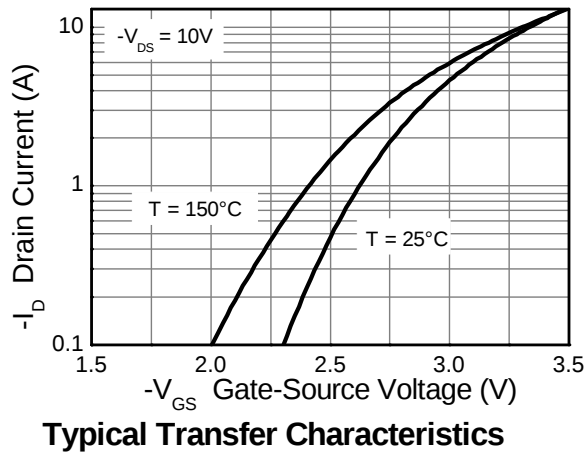
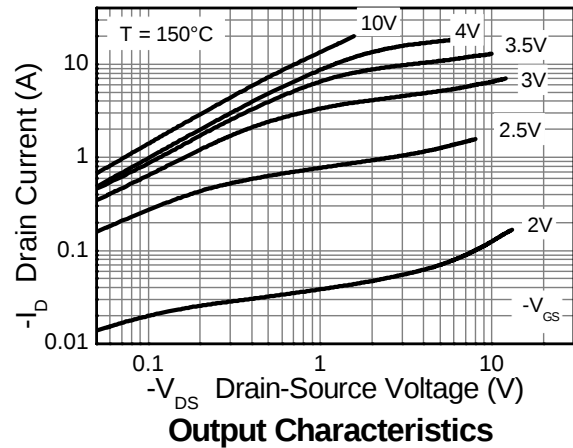
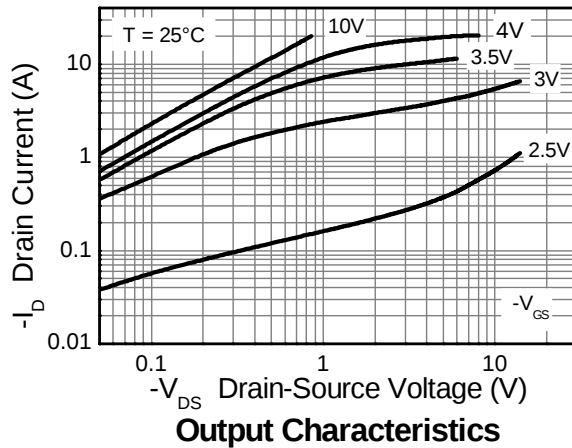


Electrical Characteristics @T_A = 25°C unless otherwise specified

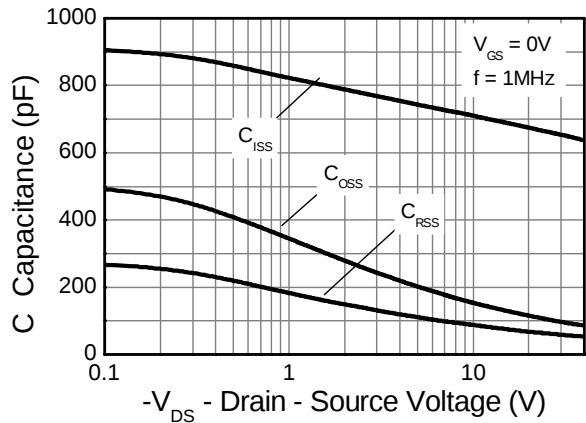
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition	
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage	BV _{DSS}	-40	—	—	V	I _D = -250μA, V _{GS} = 0V	
Zero Gate Voltage Drain Current	I _{DSS}	—	—	-0.5	μA	V _{DS} = -40V, V _{GS} = 0V	
Gate-Source Leakage	I _{GSS}	—	—	±100	nA	V _{GS} = ±20V, V _{DS} = 0V	
ON CHARACTERISTICS							
Gate Threshold Voltage	V _{GS(th)}	-1.0	—	-3.0	V	I _D = -250μA, V _{DS} = V _{GS}	
Static Drain-Source On-Resistance (Note 10)	R _{DS (ON)}	—	0.041	0.051	Ω	V _{GS} = -10V, I _D = -12A	
			0.059	0.085		V _{GS} = -4.5V, I _D = -8A	
Forward Transconductance (Notes 10 & 11)	g _{fs}	—	16.6	—	S	V _{DS} = -15V, I _D = -12A	
Diode Forward Voltage (Note 10)	V _{SD}	—	-0.98	-1.2	V	I _S = -12A, V _{GS} = 0V	
Reverse recovery time (Note 11)	t _{rr}	—	138	—	ns	I _S = -12A, di/dt = 100A/μs	
Reverse recovery charge (Note 11)	Q _{rr}	—	841	—	nC		
DYNAMIC CHARACTERISTICS (Note 11)							
Input Capacitance	C _{iss}	—	674	—	pF	V _{DS} = -20V, V _{GS} = 0V f = 1MHz	
Output Capacitance	C _{oss}	—	115	—	pF		
Reverse Transfer Capacitance	C _{rss}	—	67.7	—	pF		
Total Gate Charge (Note 12)	Q _g	—	7.0	—	nC	V _{GS} = -4.5V	V _{DS} = -20V I _D = -12A
Total Gate Charge (Note 12)	Q _g	—	14	—	nC	V _{GS} = -10V	
Gate-Source Charge (Note 12)	Q _{gs}	—	2.2	—	nC		
Gate-Drain Charge (Note 12)	Q _{gd}	—	3.7	—	nC		
Turn-On Delay Time (Note 12)	t _{D(on)}	—	2.3	—	ns	V _{DD} = -20V, V _{GS} = -10V I _D = -12A, R _G ≅ 6.0Ω	
Turn-On Rise Time (Note 12)	t _r	—	14.1	—	ns		
Turn-Off Delay Time (Note 12)	t _{D(off)}	—	25.1	—	ns		
Turn-Off Fall Time (Note 12)	t _f	—	14.3	—	ns		

Notes: 10. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%
11. For design aid only, not subject to production testing.
12. Switching characteristics are independent of operating junction temperatures.

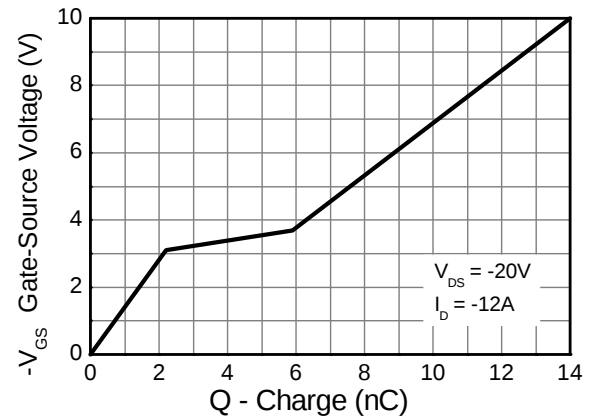
Typical Characteristics



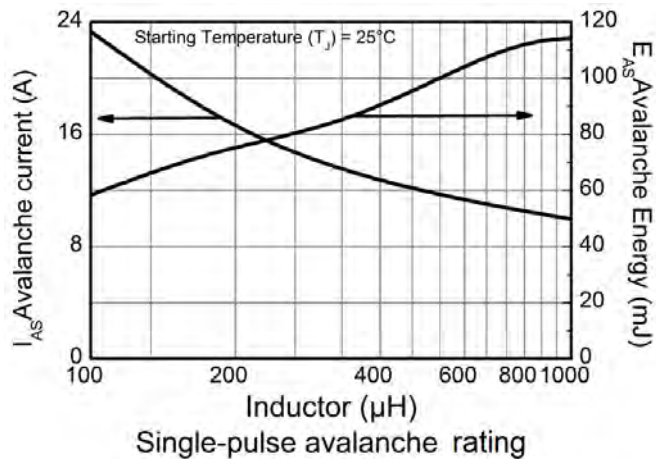
Typical Characteristics - continued



Capacitance v Drain-Source Voltage

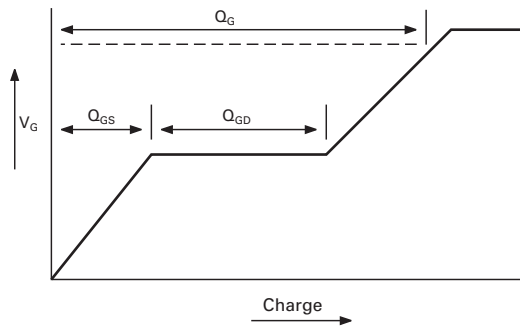


Gate-Source Voltage v Gate Charge

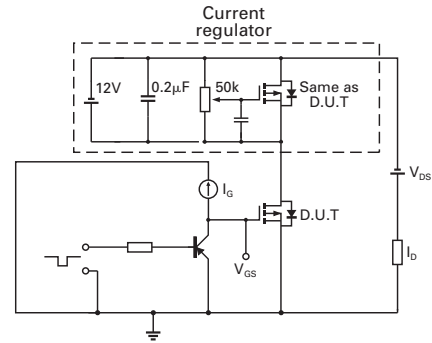


Single-pulse avalanche rating

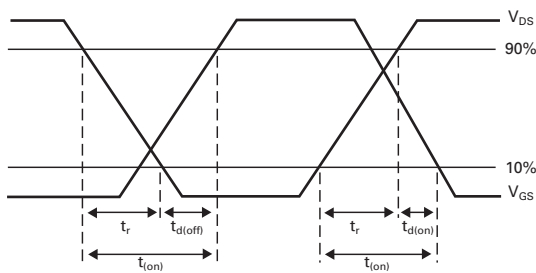
Test Circuits



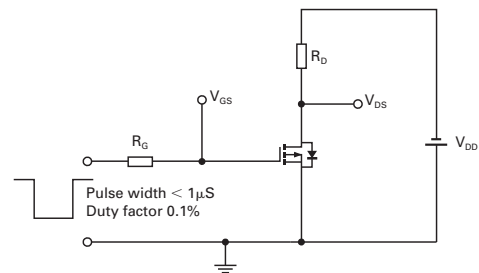
Basic gate charge waveform



Gate charge test circuit

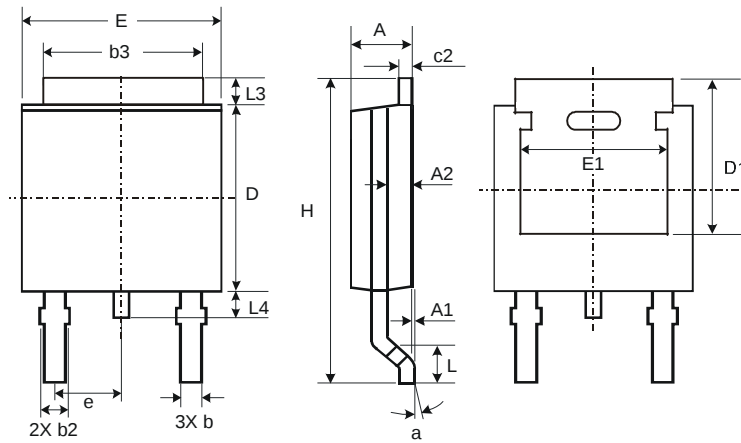


Switching time waveforms



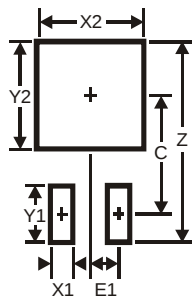
Switching time test circuit

Package Outline Dimensions



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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