

Power MOSFET

D²PAK (TO-263)


N-Channel MOSFET

PRODUCT SUMMARY

V_{DS} (V)	400
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$ 3.6
Q_g max. (nC)	17
Q_{gs} (nC)	3.4
Q_{gd} (nC)	8.5
Configuration	Single

FEATURES

- Surface-mount
- Available in tape and reel
- Dynamic dv/dt rating
- Repetitive avalanche rated
- Fast switching
- Ease of paralleling
- Simple drive requirements
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS*
Available
HALOGEN
FREE
Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

DESCRIPTION

Third generation power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The D²PAK (TO-263) is a surface-mount power package capable of accommodating die size up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface-mount package. The D²PAK (TO-263) is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2.0 W in a typical surface-mount application.

ORDERING INFORMATION

Package	D ² PAK (TO-263)	D ² PAK (TO-263)
Lead (Pb)-free and halogen-free	SiHF710S-GE3	SiHF710STRL-GE3 ^a
Lead (Pb)-free	IRF710SPbF	IRF710STRLPbF ^a

Note

a. See device orientation

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	V_{DS}	400	V
Gate-source voltage	V_{GS}	± 20	
Continuous drain current	V_{GS} at 10 V	$T_C = 25\text{ }^{\circ}\text{C}$	A
		$T_C = 100\text{ }^{\circ}\text{C}$	
Pulsed drain current ^a	I_{DM}	6.0	
Linear derating factor		0.29	W/ $^{\circ}\text{C}$
Linear derating factor (PCB mount) ^e		0.025	
Single pulse avalanche energy ^b	E_{AS}	120	mJ
Avalanche current ^a	I_{AR}	2.0	A
Repetitive avalanche energy ^a	E_{AR}	3.6	mJ
Maximum power dissipation	P_D	$T_C = 25\text{ }^{\circ}\text{C}$	W
Maximum power dissipation (PCB mount) ^e		$T_A = 25\text{ }^{\circ}\text{C}$	
Peak diode recovery dv/dt ^c	dv/dt	4.0	V/ns
Operating junction and storage temperature range	T_J, T_{stg}	-55 to +150	$^{\circ}\text{C}$
Soldering recommendations (peak temperature) ^d	For 10 s	300	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- $V_{DD} = 50\text{ V}$, starting $T_J = 25\text{ }^{\circ}\text{C}$, $L = 52\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 2.0\text{ A}$ (see fig. 12)
- $I_{SD} \leq 2.0\text{ A}$, $di/dt \leq 40\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^{\circ}\text{C}$
- 1.6 mm from case
- When mounted on 1" square PCB (FR-4 or G-10 material).

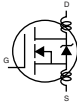
**THERMAL RESISTANCE RATINGS**

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	R_{thJA}	-	62	°C/W
Maximum junction-to-ambient (PCB mount) ^a	R_{thJA}	-	40	
Maximum junction-to-case (drain)	R_{thJC}	-	3.5	

Note

a. When mounted on 1" square PCB (FR-4 or G-10 material)

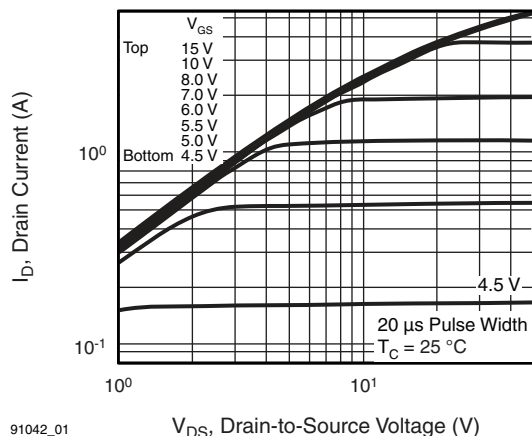
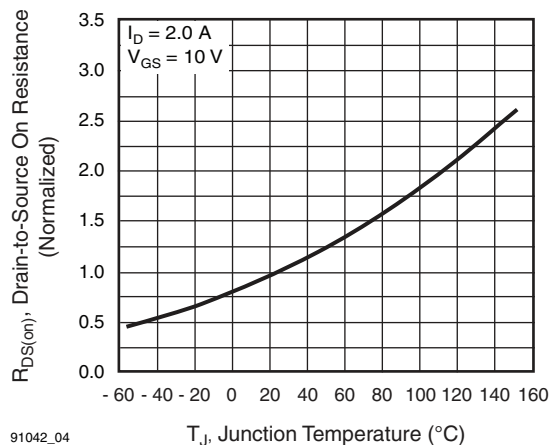
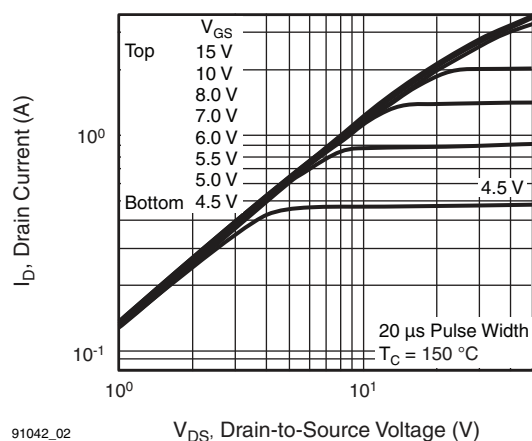
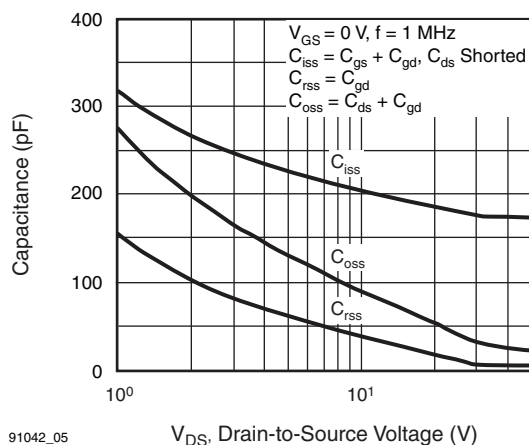
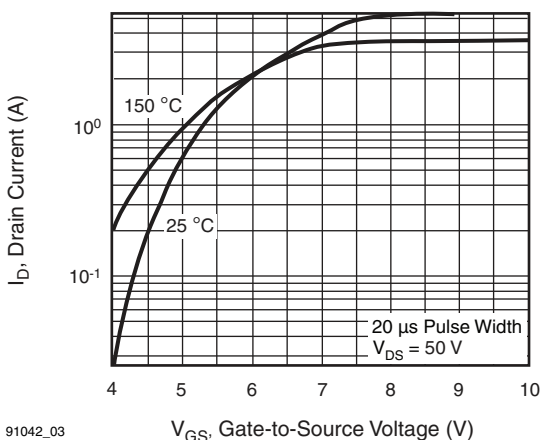
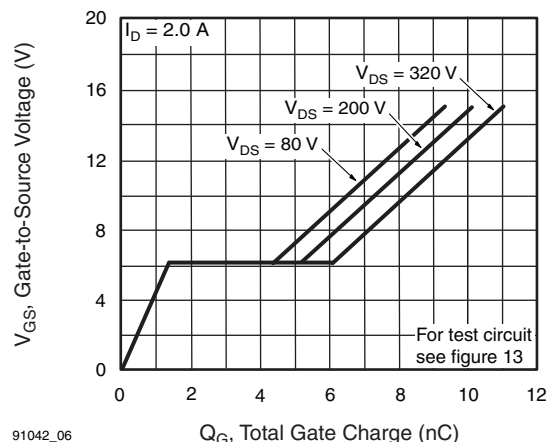
SPECIFICATIONS ($T_J = 25^\circ\text{C}$, unless otherwise noted)

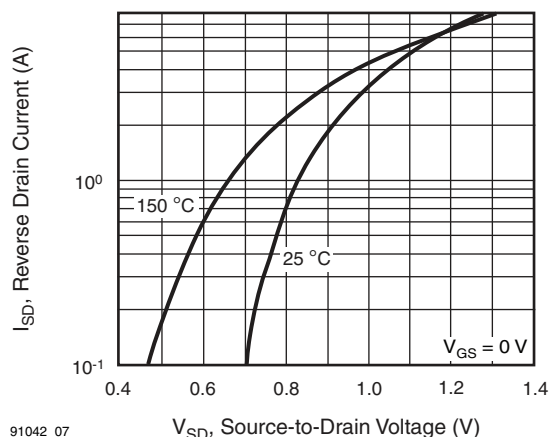
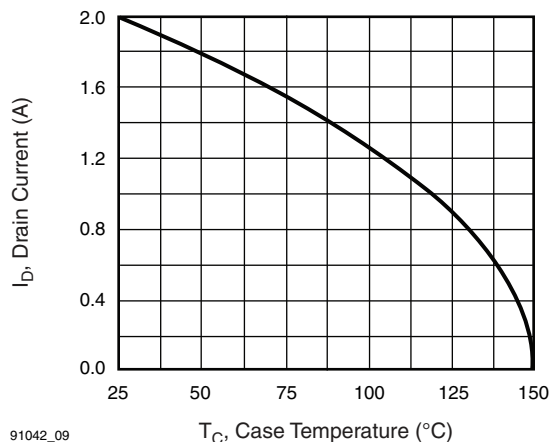
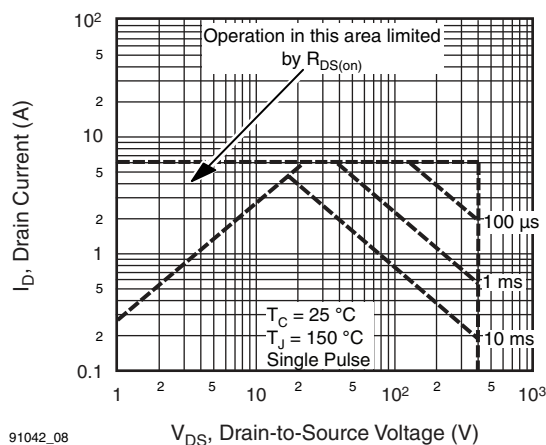
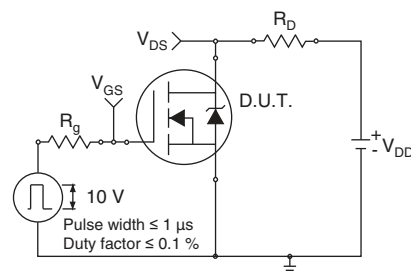
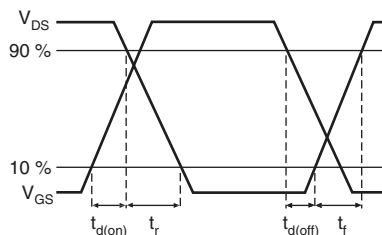
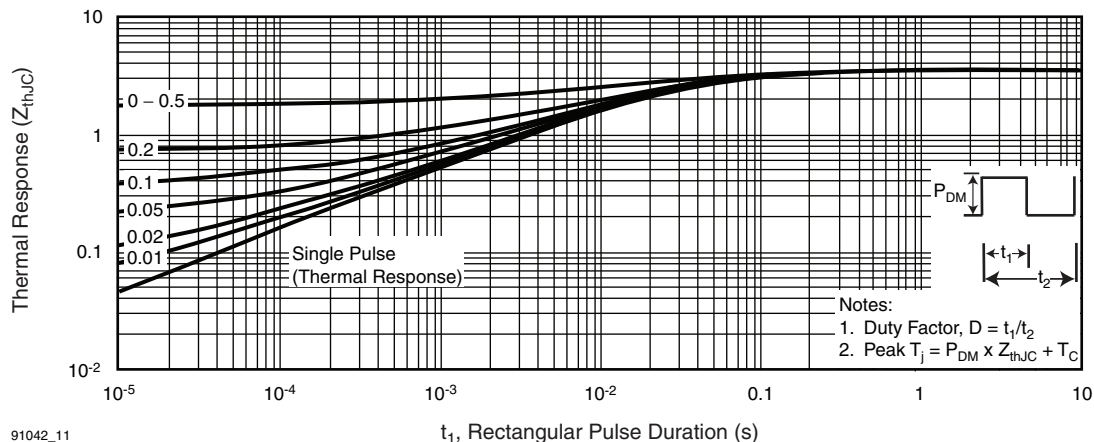
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-source breakdown voltage	V_{DS}	$V_{GS} = 0, I_D = 250\text{ }\mu\text{A}$		400	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, $I_D = 1\text{ mA}$		-	0.47	-	V/°C
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.0	-	4.0	V
Gate-source leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}$		-	-	25	μA
		$V_{DS} = 320\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	250	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 1.2\text{ A}^b$	-	-	3.6	Ω
Forward transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 1.2\text{ A}^b$		1.0	-	-	S
Dynamic							
Input capacitance	C_{iss}	$V_{GS} = 0\text{ V},$ $V_{DS} = 25\text{ V},$ $f = 1.0\text{ MHz},$ see fig. 5		-	170	-	pF
Output capacitance	C_{oss}			-	34	-	
Reverse transfer capacitance	C_{rss}			-	6.3	-	
Total gate charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 2.0\text{ A}, V_{DS} = 320\text{ V},$ see fig. 6 and 13 ^b	-	-	17	nC
Gate-source charge	Q_{gs}			-	-	3.4	
Gate-drain charge	Q_{gd}			-	-	8.5	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 200\text{ V}, I_D = 2.0\text{ A},$ $R_g = 24\text{ }\Omega, R_D = 95\text{ }\Omega,$ see fig. 10 ^b		-	8.0	-	ns
Rise time	t_r			-	9.9	-	
Turn-off delay time	$t_{d(off)}$			-	21	-	
Fall time	t_f			-	11	-	
Gate input resistance	R_g	$f = 1\text{ MHz},$ open drain		1.7	-	11.2	Ω
Internal drain inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact 		-	4.5	-	nH
Internal source inductance	L_S			-	7.5	-	
Drain-Source Body Diode Characteristics							
Continuous source-drain diode current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	2.0	A
Pulsed diode forward current ^a	I_{SM}			-	-	6.0	
Body diode voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 2.0\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	1.6	V
Body diode reverse recovery time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 2.0\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$		-	240	540	ns
Body diode reverse recovery charge	Q_{rr}			-	0.85	1.6	μC
Forward turn-on time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)					

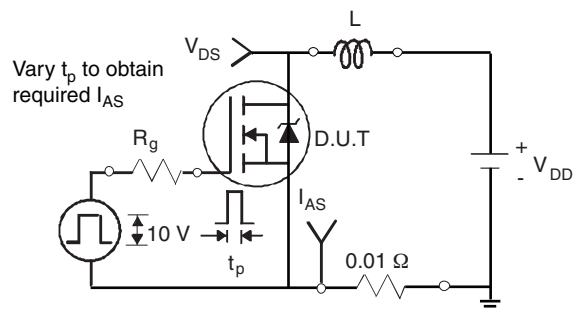
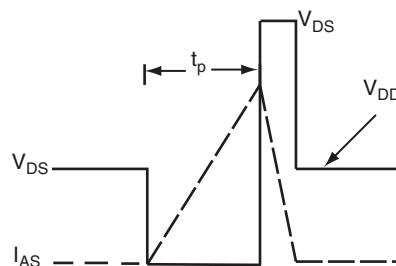
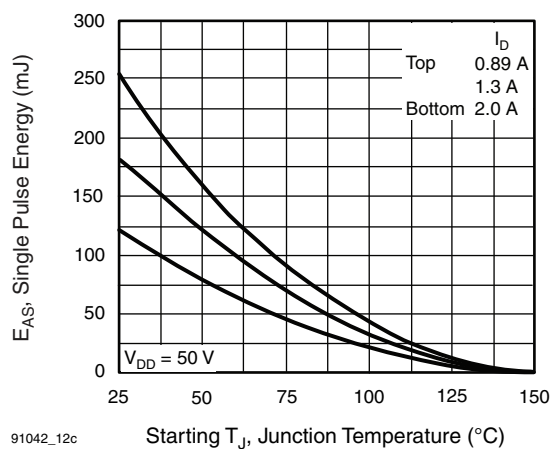
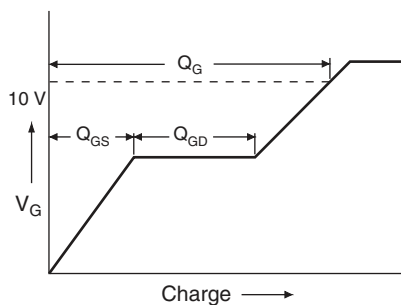
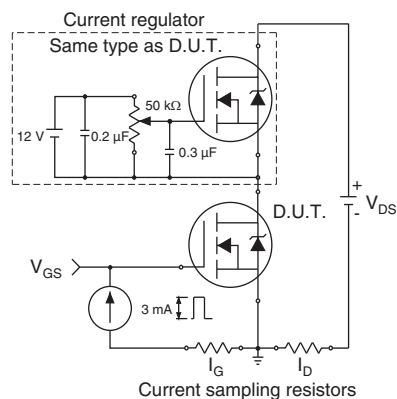
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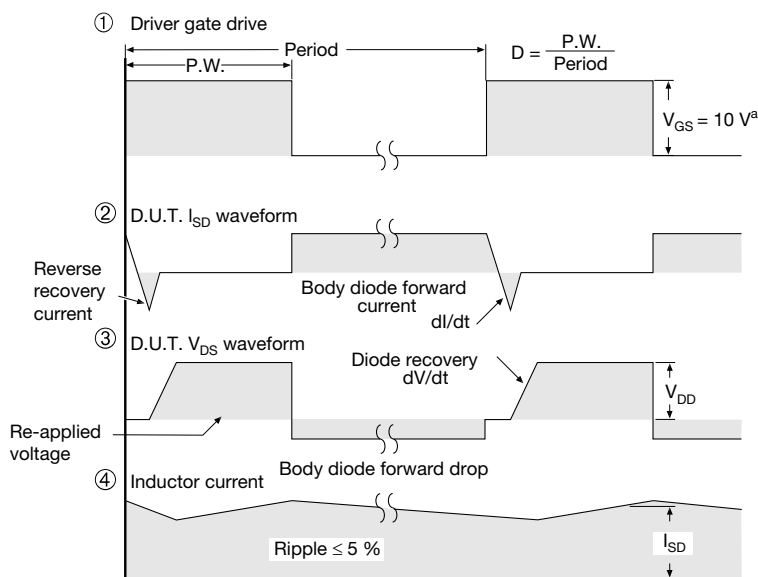
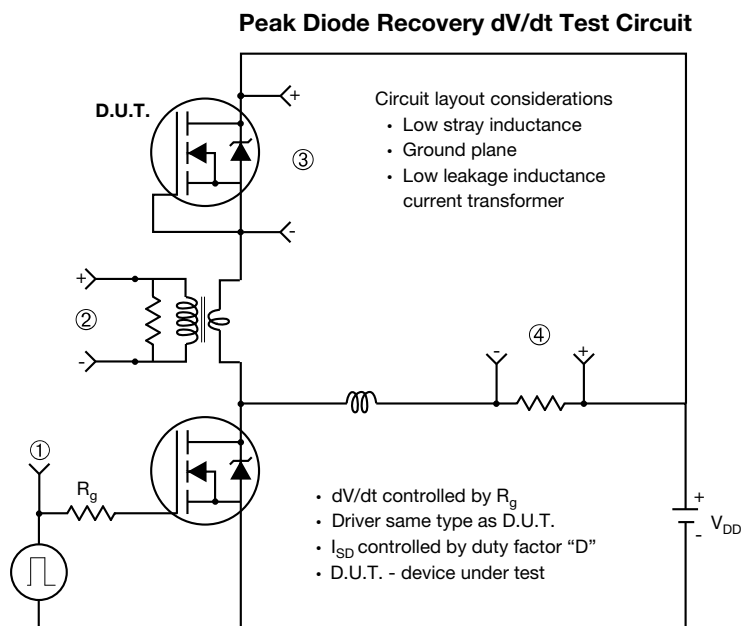
a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)

b. Pulse width $\leq 300\ \mu\text{s}$; duty cycle $\leq 2\ \%$

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Fig. 1 - Typical Output Characteristics, $T_C = 25^\circ\text{C}$

Fig. 4 - Normalized On-Resistance vs. Temperature

Fig. 2 - Typical Output Characteristics, $T_C = 150^\circ\text{C}$

Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

Fig. 3 - Typical Transfer Characteristics

Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage


Fig. 7 - Typical Source-Drain Diode Forward Voltage

Fig. 9 - Maximum Drain Current vs. Case Temperature

Fig. 8 - Maximum Safe Operating Area

Fig. 10a - Switching Time Test Circuit

Fig. 10b - Switching Time Waveforms

Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case


Fig. 12a - Unclamped Inductive Test Circuit

Fig. 12b - Unclamped Inductive Waveforms

Fig. 12c - Maximum Avalanche Energy vs. Drain Current

Fig. 13a - Basic Gate Charge Waveform

Fig. 13b - Gate Charge Test Circuit


Note

a. $V_{GS} = 5 V$ for logic level devices

Fig. 14 - For N-Channel

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	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
D1	6.86	-	0.270	-
E	9.65	10.67	0.380	0.420
E1	6.22	-	0.245	-
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	-	1.65	-	0.066
L2	-	1.78	-	0.070
L3	0.25 BSC		0.010 BSC	
L4	4.78	5.28	0.188	0.208

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RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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