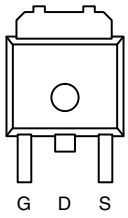
IRFR9210PBF-VB Datasheet
P-Channel 200V (D-S)MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	-200	
$R_{DS(on)}$ (Ω)	V_{GS} = -10 V	2.0
Q_g max. (nC)	29	
Q_{gs} (nC)	5.4	
Q_{gd} (nC)	15	
Configuration	Single	

FEATURES
- Surface mount
- Available in tape and reel
- Dynamic dV/dt rating
- Repetitive avalanche rated
- P-channel
- Fast switching
- Ease of paralleling

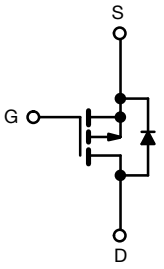
RoHS* Available
HALOGEN FREE Available

TO-252



Top View

Drain Connected to Tab



P-Channel MOSFET

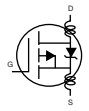
ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)					
PARAMETER			**SYMBOL**	**LIMIT**	**UNIT**
Drain-Source Voltage			V_{DS}	-200	V
Gate-Source Voltage			V_{GS}	± 20	
Continuous Drain Current	V_{GS} at -10 V	T_C = 25 °C	I_D	-3.6	A
		T_C = 100 °C		-2.5	
Pulsed Drain Current [a]			I_{DM}	-12	
Linear Derating Factor				0.59	W/°C
Linear Derating Factor (PCB mount) [e]				0.025	
Single Pulse Avalanche Energy [b]			E_{AS}	500	mJ
Avalanche Current [a]			I_{AR}	-6.4	A
Repetitive Avalanche Energy [a]			E_{AR}	7.4	mJ
Maximum Power Dissipation	T_C = 25 °C		P_D	74	W
Maximum Power Dissipation (PCB mount) [e]	T_A = 25 °C			3.0	
Peak Diode Recovery dV/dt [c]			dV/dt	-5.0	V/ns
Operating Junction and Storage Temperature Range			T_J, T_{stg}	-55 to +150	°C
Soldering Recommendations (Peak temperature) [d]	for 10 s			300	

Notes
a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. V_{DD} = -50 V, starting T_J = 25 °C, L = 17 mH, R_g = 25 Ω, I_{AS} = -6.5 A (see fig. 12).
c. I_{SD} ≤ -6.5 A, dI/dt ≤ 120 A/μs, V_{DD} ≤ V_{DS}, T_J ≤ 150 °C.
d. 1.6 mm from case.
e. 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}	-	1.7	

Note

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

SPECIFICATIONS (T_J = 25 °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 µA	-200	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = -1 mA	-	-0.24	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = -250 µA	-1.5	-	-4.0	V
Gate-Source Leakage	I_{GSS}	V_{GS} = ± 20 V	-	-	± 10	µA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = -200 V, V_{GS} = 0 V	-	-	- 100	µA
		V_{DS} = -160 V, V_{GS} = 0 V, T_J = 125 °C	-	-	-500	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = -10 V, I_D = -1.0 A [b]	-	2.00	-	Ω
Forward Transconductance	g_{fs}	V_{DS} = -50 V, I_D = -1.0 A [b]	2.8	-	-	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = -25 V, f = 1.0 MHz, see fig. 5	-	700	-	pF
Output Capacitance	C_{oss}		-	200	-	
Reverse Transfer Capacitance	C_{rss}		-	40	-	
Total Gate Charge	Q_g	V_{GS} = -10 V, I_D = -3.5A, V_{DS} = -160 V, see fig. 6 and 13 [b]	-	-	29	nC
Gate-Source Charge	Q_{gs}		-	-	5.4	
Gate-Drain Charge	Q_{gd}		-	-	15	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = -100 V, I_D = -3.5A, R_g = 12 Ω, R_D = 15 Ω, see fig. 10 [b]	-	12	-	ns
Rise Time	t_r		-	27	-	
Turn-Off Delay Time	$t_{d(off)}$		-	28	-	
Fall Time	t_f		-	24	-	
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	-	
Gate Input Resistance	R_g	f = 1 MHz, open drain	0.6	-	3.7	Ω
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	-3 .5	A
Pulsed Diode Forward Current [a]	I_{SM}		-	-	-6	
Body Diode Voltage	V_{SD}	T_J = 25 °C, I_S = -3.5A, V_{GS} = 0 V [b]	-	-	-6.5	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = -3.5A, dI/dt = 100 A/µs [b]	-	200	300	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	1.9	2.9	µC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)				

Notes

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

b. Pulse width ≤ 300 µs; duty cycle ≤ 2 %.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

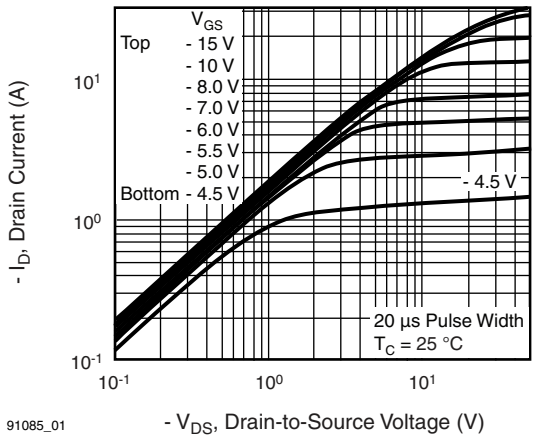


Fig. 1 - Typical Output Characteristics, T_C = 25 °C

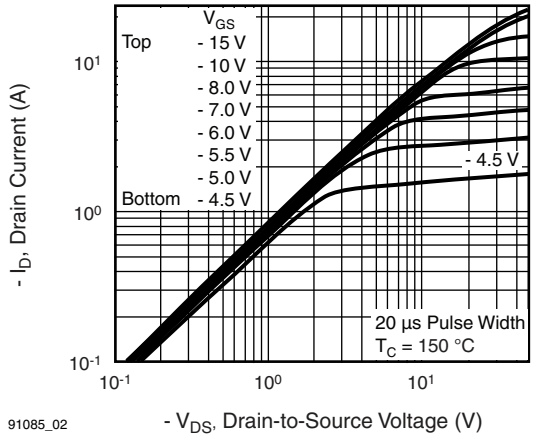


Fig. 2 - Typical Output Characteristics, T_C = 150 °C

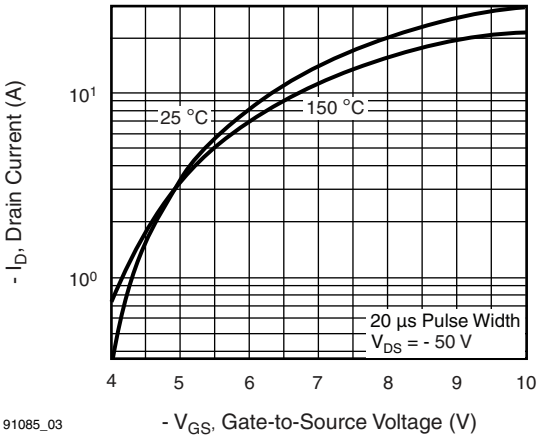


Fig. 3 - Typical Transfer Characteristics

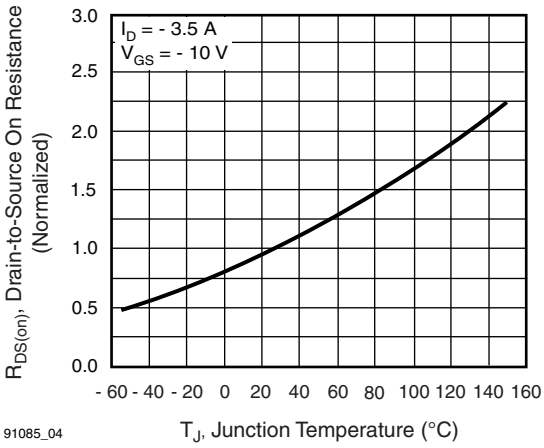


Fig. 4 - Normalized On-Resistance vs. Temperature

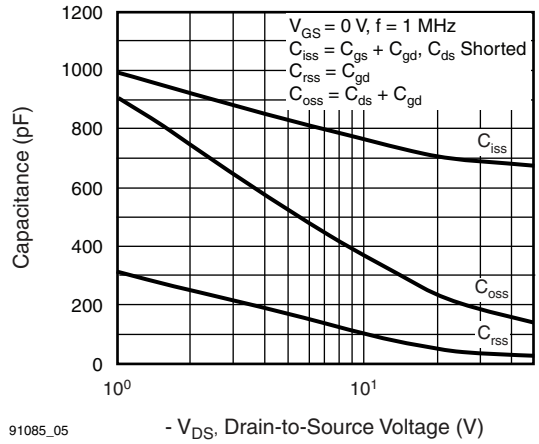


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

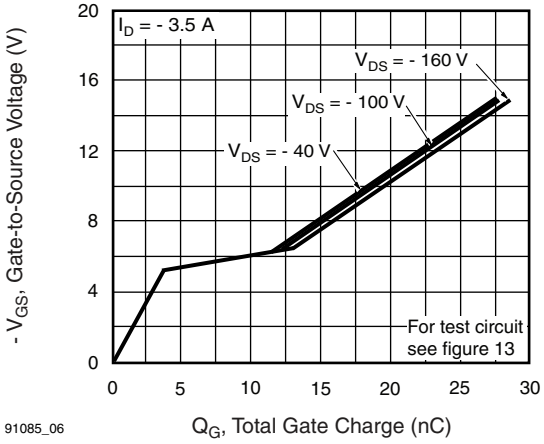


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

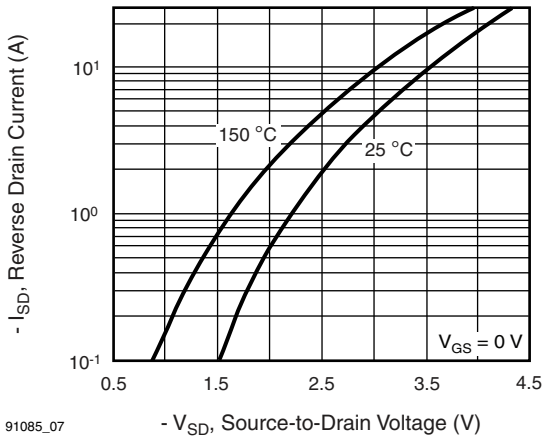


Fig. 7 - Typical Source-Drain Diode Forward Voltage

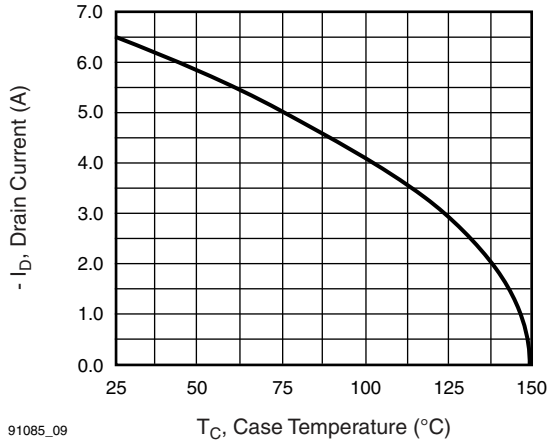


Fig. 9 - Maximum Drain Current vs. Case Temperature

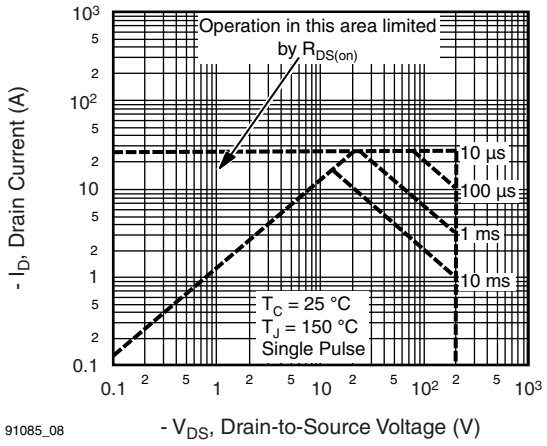


Fig. 8 - Maximum Safe Operating Area

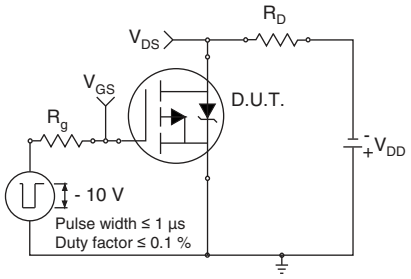


Fig. 10a - Switching Time Test Circuit

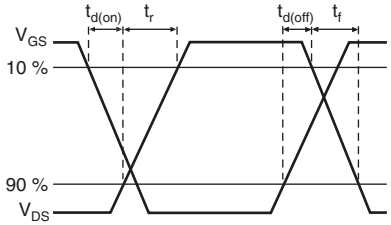


Fig. 10b - Switching Time Waveforms

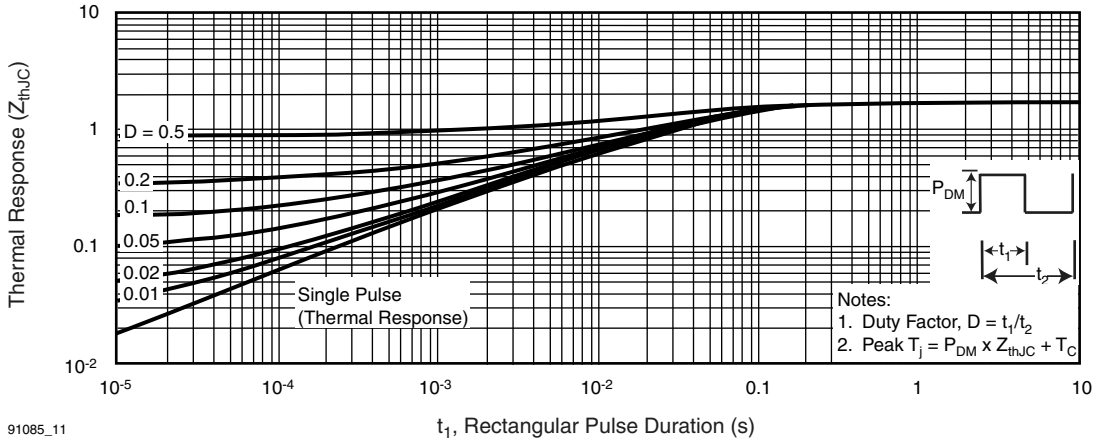


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

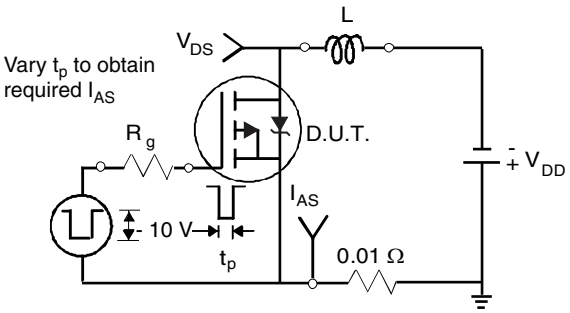


Fig. 12a - Unclamped Inductive Test Circuit

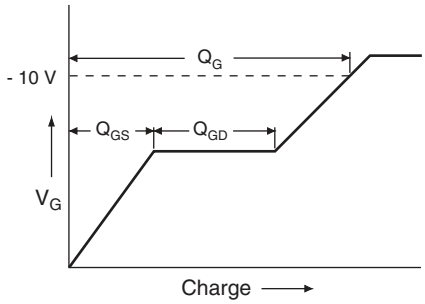


Fig. 13a - Basic Gate Charge Waveform

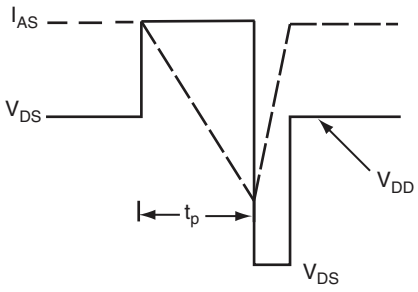


Fig. 12b - Unclamped Inductive Waveforms

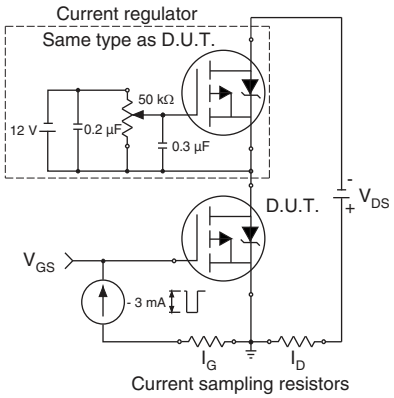


Fig. 13b - Gate Charge Test Circuit

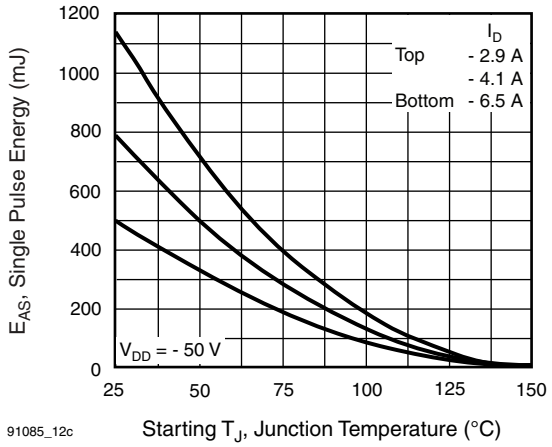
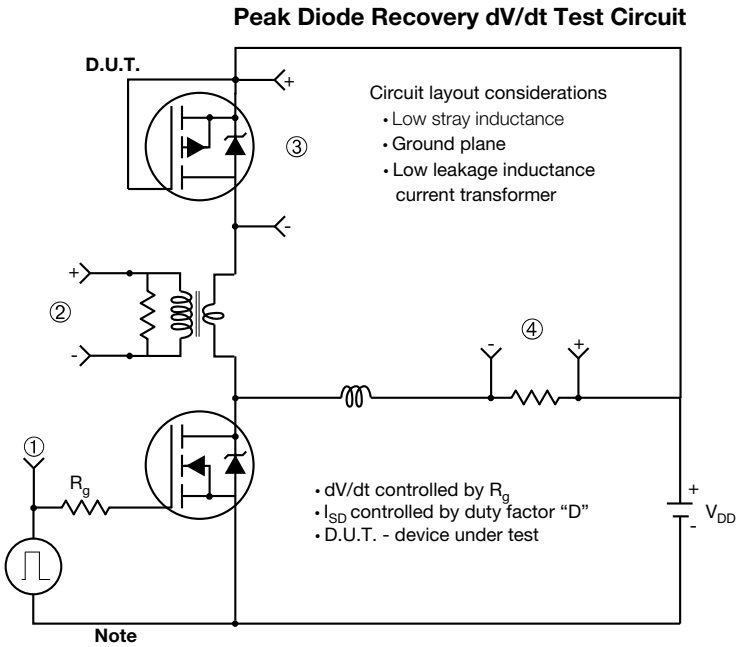


Fig. 12c - Maximum Avalanche Energy vs. Drain Current



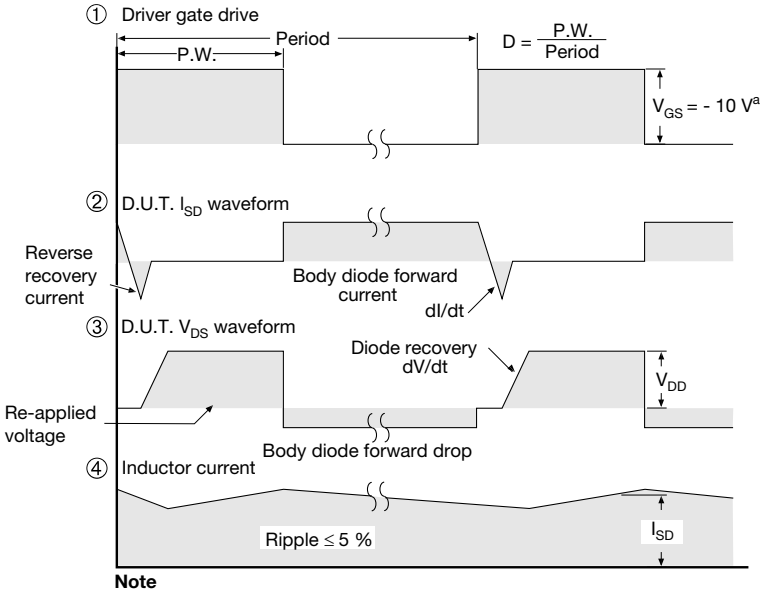
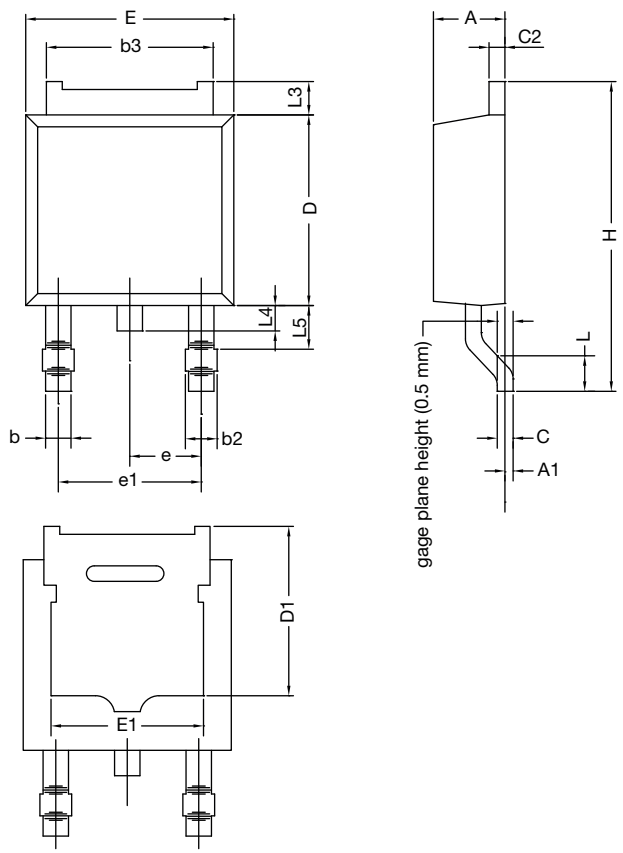


Fig. 14 - For P-Channel

TO-252AA CASE OUTLINE

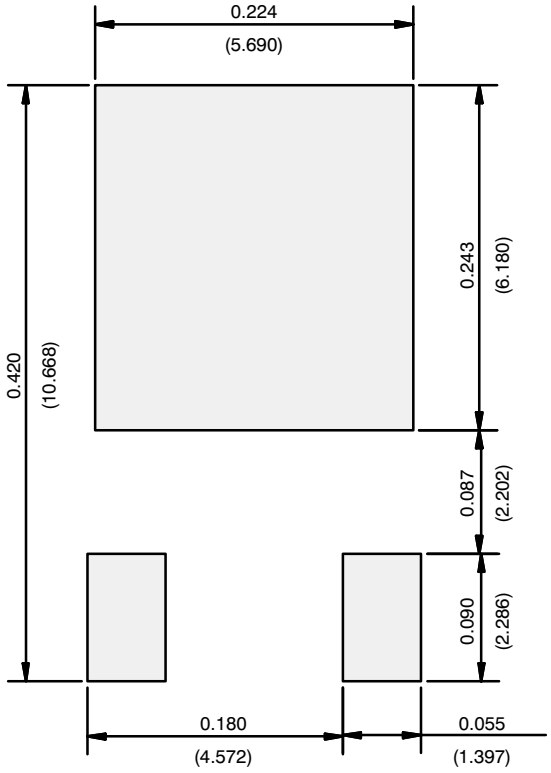


	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
A	2.18	2.38	0.086	0.094
A1	-	0.127	-	0.005
b	0.64	0.88	0.025	0.035
b2	0.76	1.14	0.030	0.045
b3	4.95	5.46	0.195	0.215
C	0.46	0.61	0.018	0.024
C2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	5.21	-	0.205	-
E	6.35	6.73	0.250	0.265
E1	4.32	-	0.170	-
H	9.40	10.41	0.370	0.410
e	2.28 BSC		0.090 BSC	
e1	4.56 BSC		0.180 BSC	
L	1.40	1.78	0.055	0.070
L3	0.89	1.27	0.035	0.050
L4	-	1.02	-	0.040
L5	1.14	1.52	0.045	0.060
ECN: X12-0247-Rev. M, 24-Dec-12 DWG: 5347				

Note

- Dimension L3 is for reference only.

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads
Dimensions in Inches/(mm)

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