

IRFR9024TR-VB Datasheet

P-Channel 60-V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (Typ)
- 60	0.061 at $V_{GS} = - 10$ V	- 30	10
	0.072 at $V_{GS} = - 4.5$ V	- 25	

FEATURES

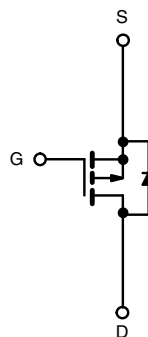
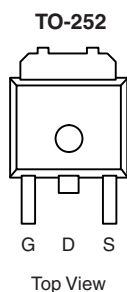
- Trench Power MOSFET
- 100 % UIS Tested

APPLICATIONS

- Load Switch



RoHS
COMPLIANT
HALOGEN
FREE



P-Channel MOSFET

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

Parameter		Symbol	Limit	Unit
Gate-Source Voltage		V_{GS}	± 20	V
Continuous Drain Current ($T_J = 175\text{ }^\circ\text{C}$)	$T_C = 25\text{ }^\circ\text{C}$	I_D	- 30	A
	$T_C = 100\text{ }^\circ\text{C}$		- 25	
Pulsed Drain Current		I_{DM}	- 30	
Continuing Source Current (Diode Conduction)		I_S	- 20	
Avalanche Current		I_{AS}	- 20	
Single Pulse Avalanche Energy	$L = 0.1\text{ mH}$	E_{AS}	7.2	mJ
Maximum Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$	P_D	34 ^a	W
	$T_A = 25\text{ }^\circ\text{C}$		4 ^b	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 175	$^\circ\text{C}$

THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Junction-to-Ambient ^b	$t \leq 10\text{ sec}$	R_{thJA}	20	25	$^\circ\text{C/W}$
	Steady State		62	75	
Junction-to-Case		R_{thJC}	5	6	

Notes:

a. See SOA curve for voltage derating.

b. Surface Mounted on 1" x 1" FR-4 board.

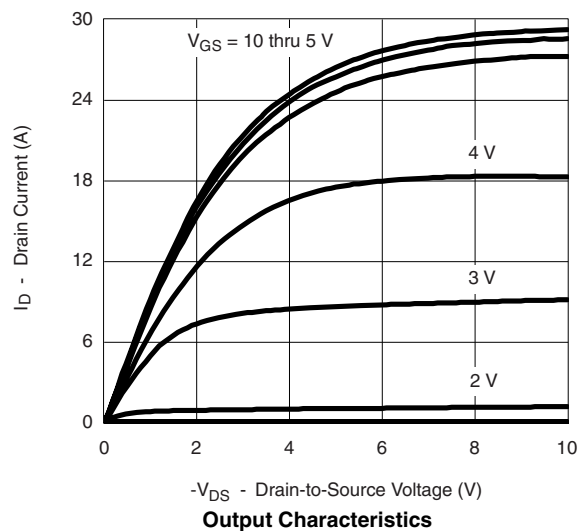
SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min	Typ ^a	Max	Unit
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$, $I_D = -250\text{ }\mu\text{A}$	- 60			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = -250\text{ }\mu\text{A}$	- 1.0	- 2.0	- 3.0	
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -60\text{ V}$, $V_{GS} = 0\text{ V}$			- 1	μA
		$V_{DS} = -60\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$			- 50	
		$V_{DS} = -60\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 175\text{ }^{\circ}\text{C}$			- 150	
On-State Drain Current ^b	$I_{D(on)}$	$V_{DS} = -5\text{ V}$, $V_{GS} = -10\text{ V}$	- 10			A
Drain-Source On-State Resistance ^b	$r_{DS(on)}$	$V_{GS} = -10\text{ V}$, $I_D = -5\text{ A}$		0.061		Ω
		$V_{GS} = -10\text{ V}$, $I_D = -5\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$		0.100		
		$V_{GS} = -10\text{ V}$, $I_D = -5\text{ A}$, $T_J = 175\text{ }^{\circ}\text{C}$		0.150		
		$V_{GS} = -4.5\text{ V}$, $I_D = -2\text{ A}$		0.072		
Forward Transconductance ^b	g_{fs}	$V_{DS} = -15\text{ V}$, $I_D = -5\text{ A}$		8		S
Dynamic						
Input Capacitance	C_{iss}	$V_{DS} = -25\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$		1000		pF
Output Capacitance	C_{oss}			120		
Reverse Transfer Capacitance	C_{rss}			100		
Total Gate Charge	Q_g	$V_{DS} = -30\text{ V}$, $V_{GS} = -10\text{ V}$, $I_D = -8.4\text{ A}$		10		nC
Gate-Source Charge	Q_{gs}			2.1		
Gate-Drain Charge	Q_{gd}			3.2		
Gate Resistance	R_g	$f = 1\text{ MHz}$		8.0		Ω
Turn-On Delay Time ^c	$t_{d(on)}$	$V_{DD} = -30\text{ V}$, $R_L = 3.57\text{ }\Omega$ $I_D \cong -8.4\text{ A}$, $V_{GEN} = -10\text{ V}$, $R_G = 2.5\text{ }\Omega$		6		ns
Rise Time ^c	t_r			15		
Turn-Off Delay Time ^c	$t_{d(off)}$			16		
Fall Time ^c	t_f			8		
Source-Drain Diode Ratings and Characteristics ($T_C = 25\text{ }^{\circ}\text{C}$) ^b						
Pulsed Current	I_{SM}				- 30	A
Forward Voltage ^b	V_{SD}	$I_F = -2\text{ A}$, $V_{GS} = 0\text{ V}$		- 0.9	- 1.3	V
Reverse Recovery Time	t_{rr}	$I_F = -8\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$		50		ns
Reverse Recovery Time	Q_{rr}			80		nC

Notes:

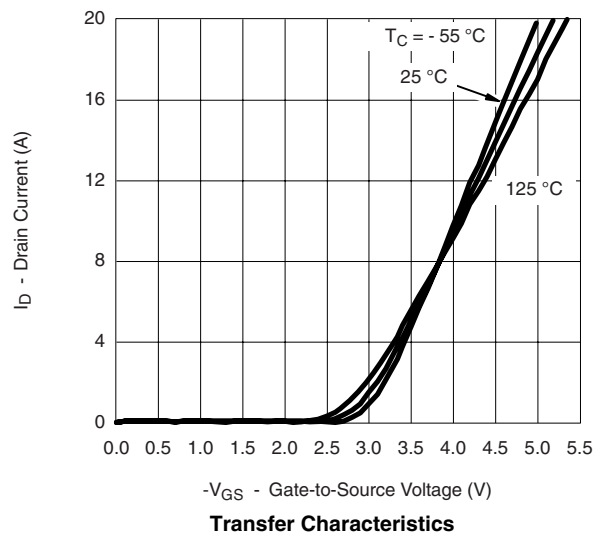
- a. Guaranteed by design, not subject to production testing.
 b. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
 c. Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

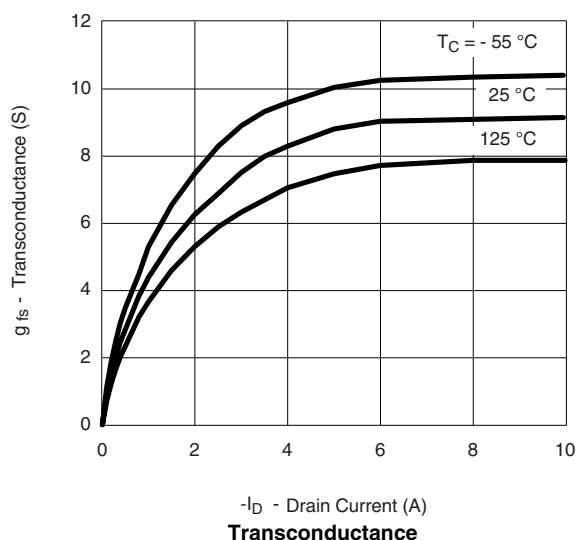
TYPICAL CHARACTERISTICS 25 °C unless noted



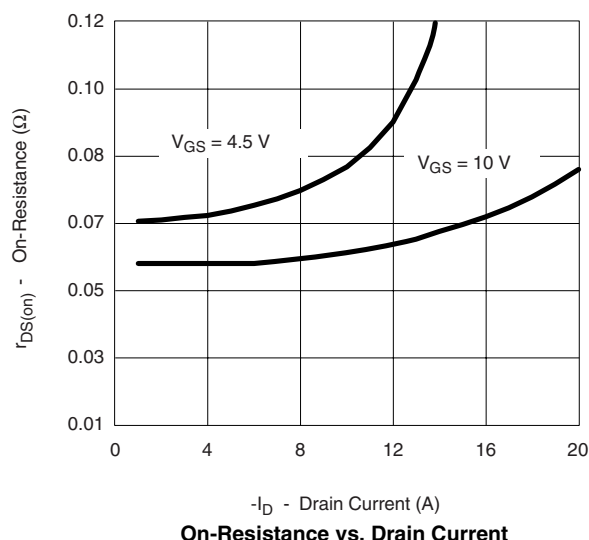
Output Characteristics



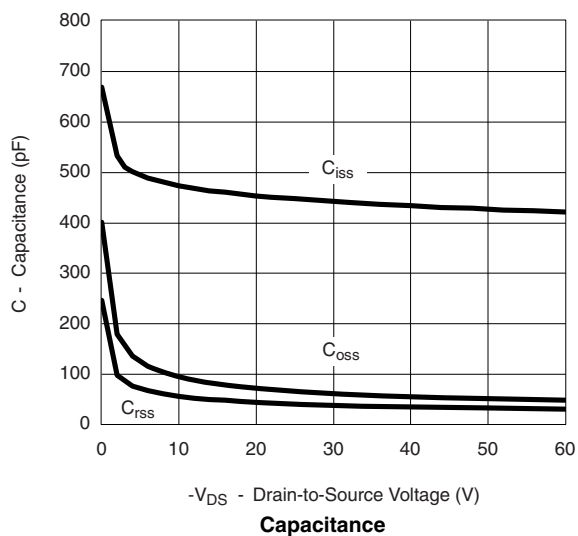
Transfer Characteristics



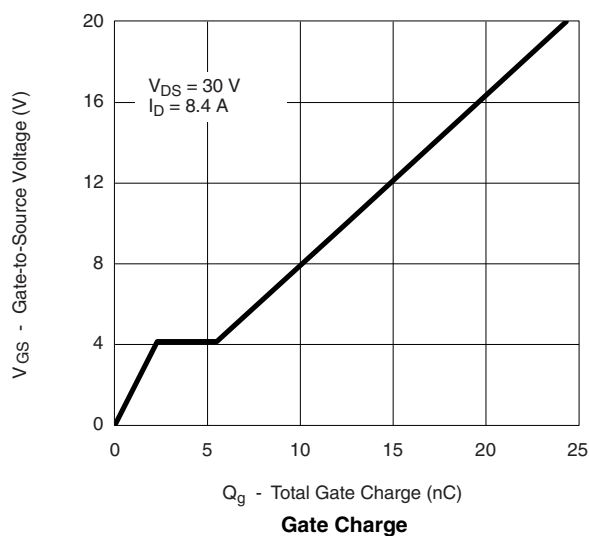
Transconductance



On-Resistance vs. Drain Current

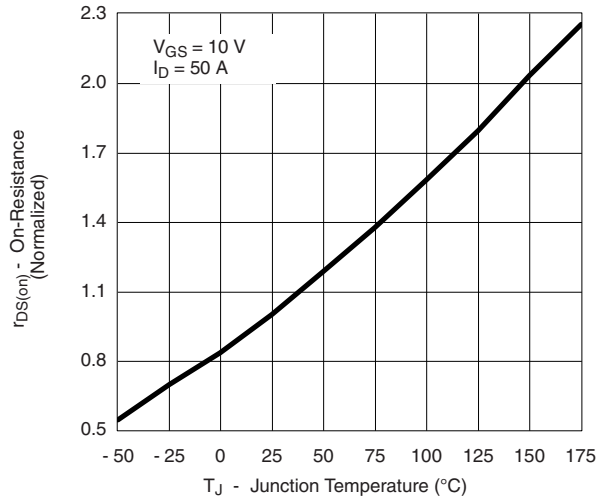


Capacitance

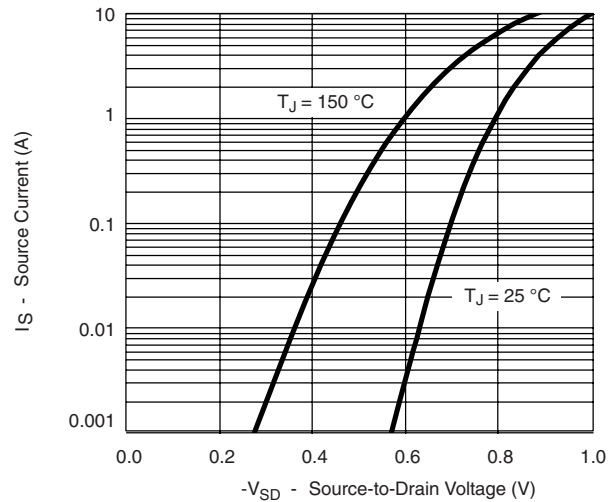


Gate Charge

TYPICAL CHARACTERISTICS 25 °C unless noted

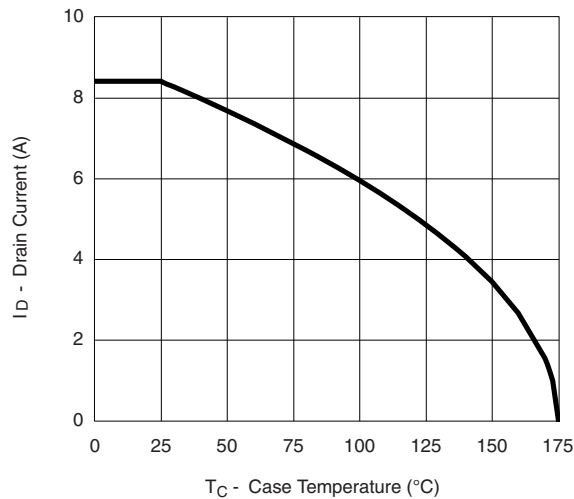


On-Resistance vs. Junction Temperature

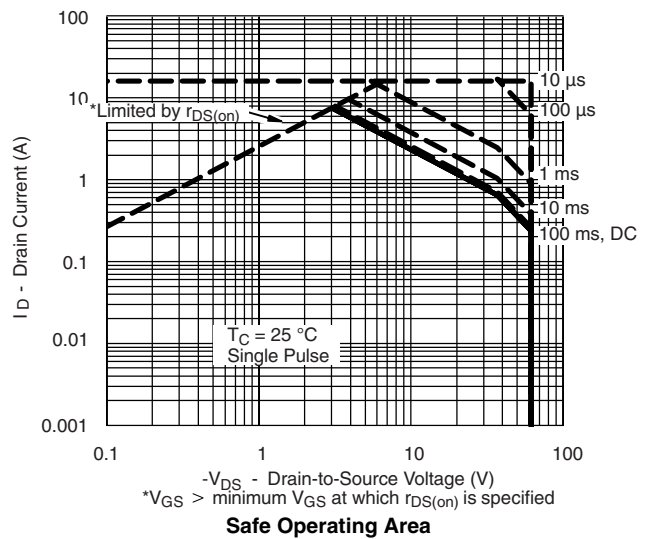


Source-Drain Diode Forward Voltage

THERMAL RATINGS

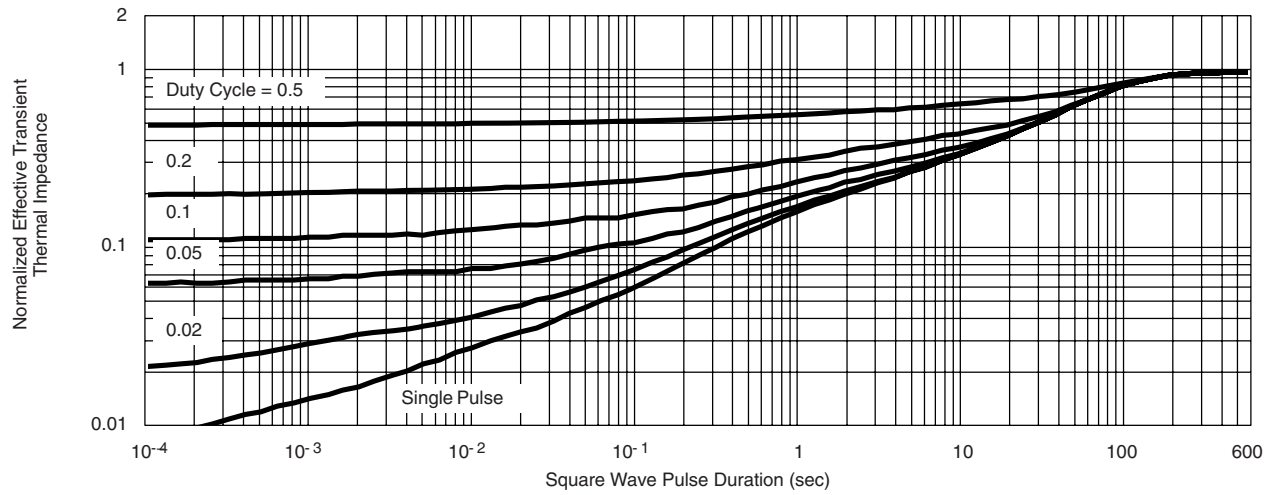


Drain Current vs. Case Temperature

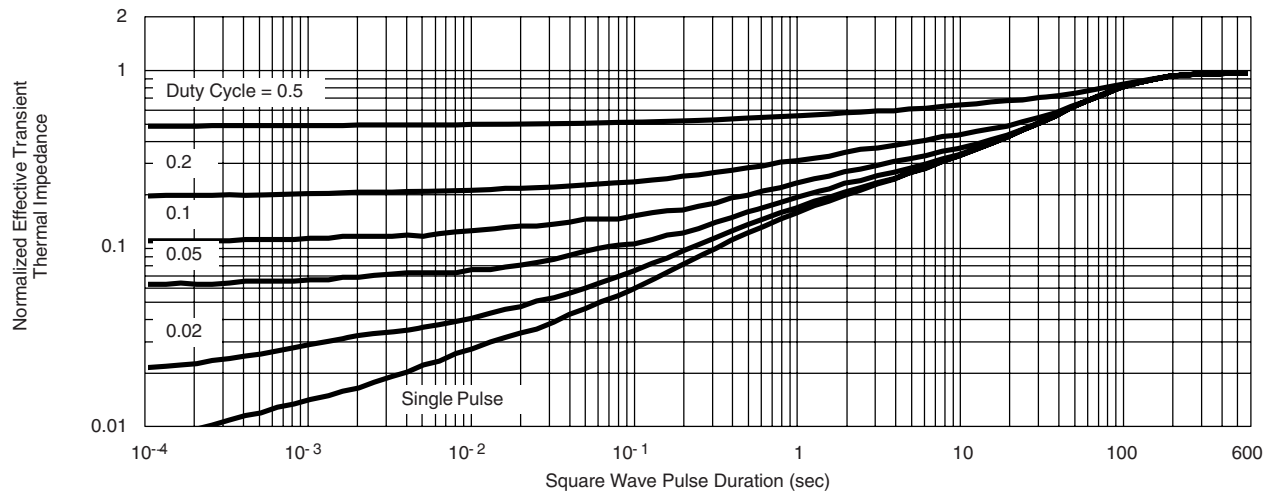


Safe Operating Area

THERMAL RATINGS

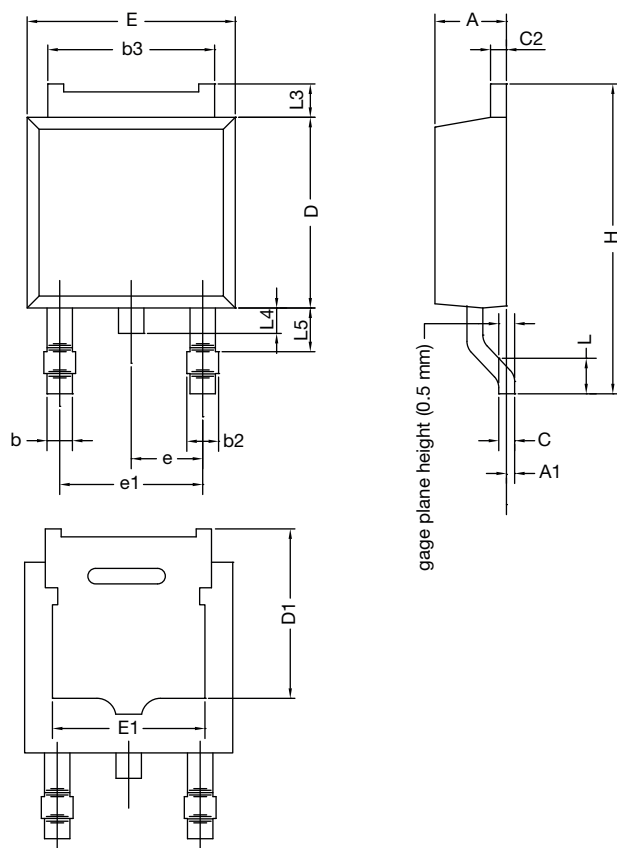


Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

TO-252AA CASE OUTLINE

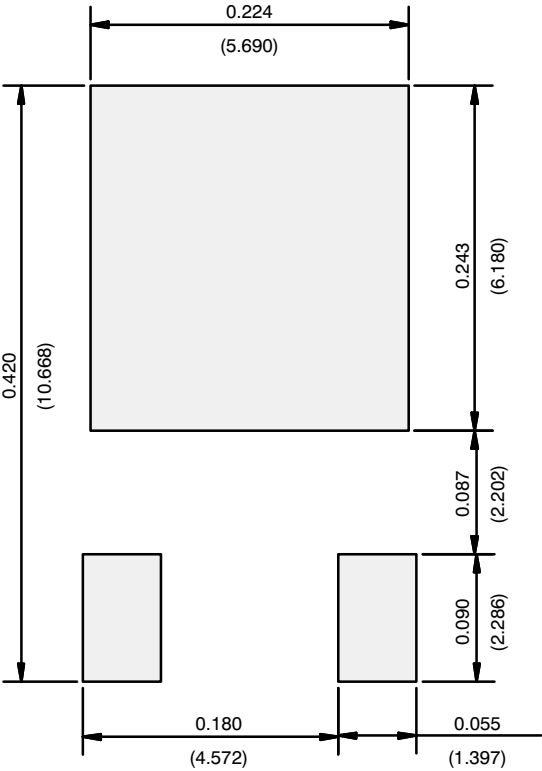


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.38	0.086	0.094
A ₁	-	0.127	-	0.005
b	0.64	0.88	0.025	0.035
b ₂	0.76	1.14	0.030	0.045
b ₃	4.95	5.46	0.195	0.215
C	0.46	0.61	0.018	0.024
C ₂	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D ₁	5.21	-	0.205	-
E	6.35	6.73	0.250	0.265
E ₁	4.32	-	0.170	-
H	9.40	10.41	0.370	0.410
e	2.28 BSC		0.090 BSC	
e ₁	4.56 BSC		0.180 BSC	
L	1.40	1.78	0.055	0.070
L ₃	0.89	1.27	0.035	0.050
L ₄	-	1.02	-	0.040
L ₅	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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