

## FR13N15D-VB Datasheet

### N-Channel 150 V (D-S) MOSFET

#### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
150	0.074 at $V_{GS} = 10$ V	25.4	23 nC
	0.077 at $V_{GS} = 8$ V	22.5	

#### FEATURES

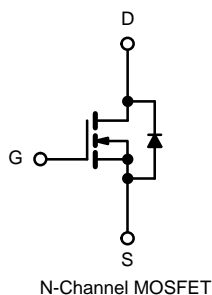
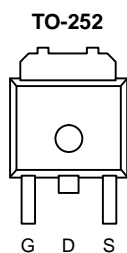
- Halogen-free According to IEC 61249-2-21 Definition
- Extremely Low  $Q_{gd}$  for Switching Losses
- 100 %  $R_g$  Tested
- 100 % Avalanche Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

#### APPLICATIONS

- Primary Side Switch



#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	150	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150$ °C)	$T_C = 25$ °C	25.4	A
	$T_C = 70$ °C	23.1	
	$T_A = 25$ °C	15.5 <sup>b, c</sup>	
	$T_A = 70$ °C	14.5 <sup>b, c</sup>	
Pulsed Drain Current	$I_{DM}$	50	A
Continuous Source-Drain Diode Current	$T_C = 25$ °C	4.5	
	$T_A = 25$ °C	2.6 <sup>b, c</sup>	mJ
Single Pulse Avalanche Current	$L = 0.1$ mH	20	
Single Pulse Avalanche Energy	$E_{AS}$	20	W
Maximum Power Dissipation	$T_C = 25$ °C	5.9	
	$T_C = 70$ °C	3.8	
	$T_A = 25$ °C	3.1 <sup>b, c</sup>	
	$T_A = 70$ °C	2 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b, f</sup>	$t \leq 10$ s	$R_{thJA}$	33	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	$R_{thJF}$	17	

Notes:

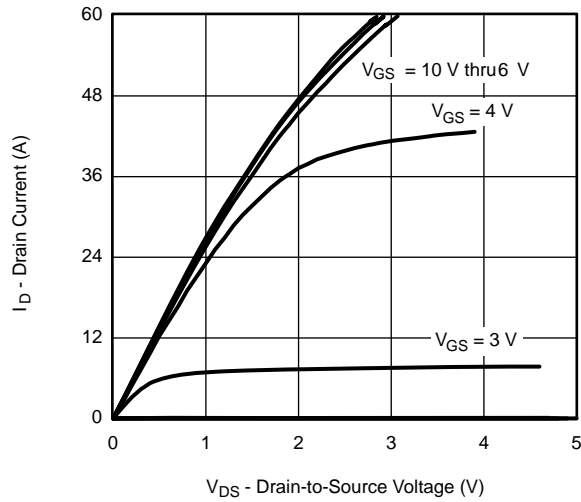
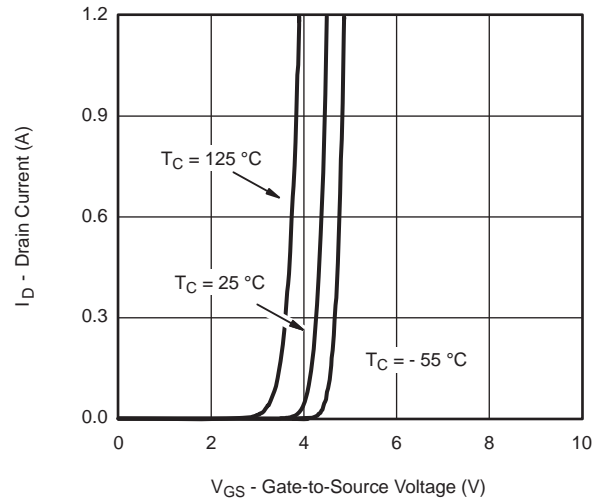
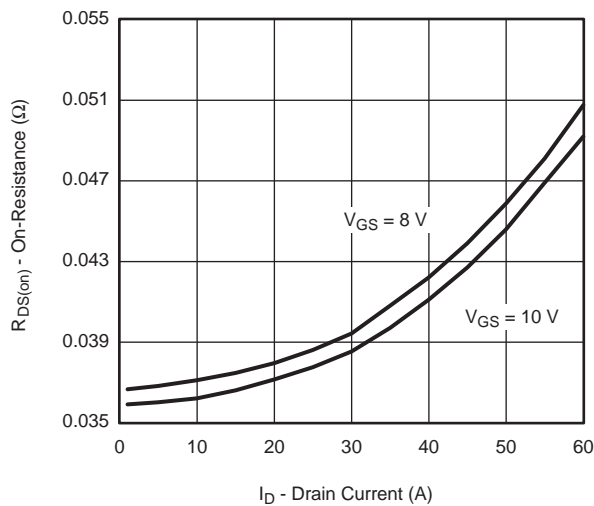
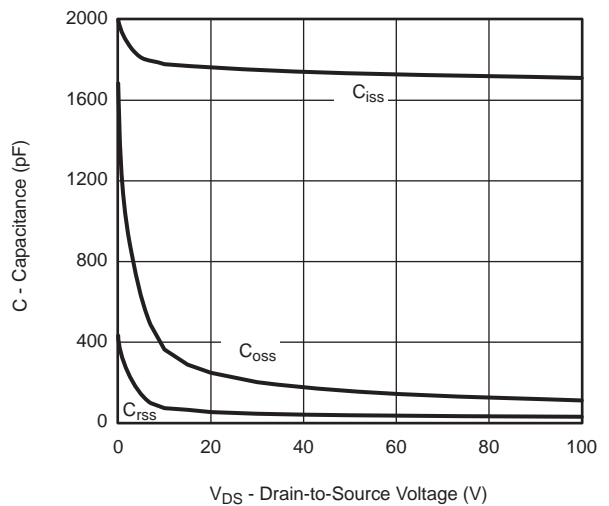
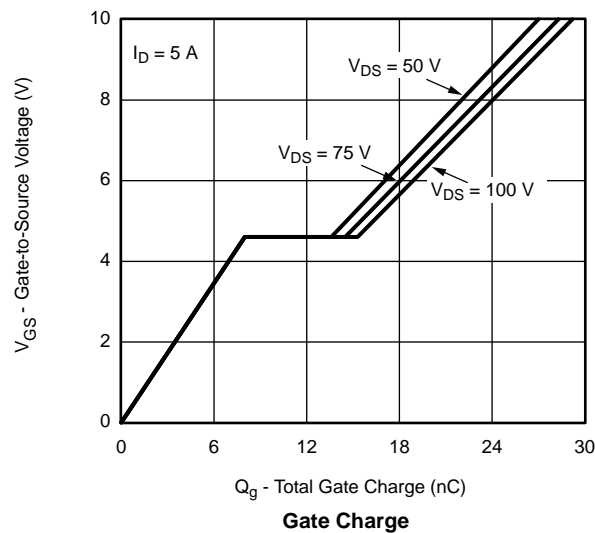
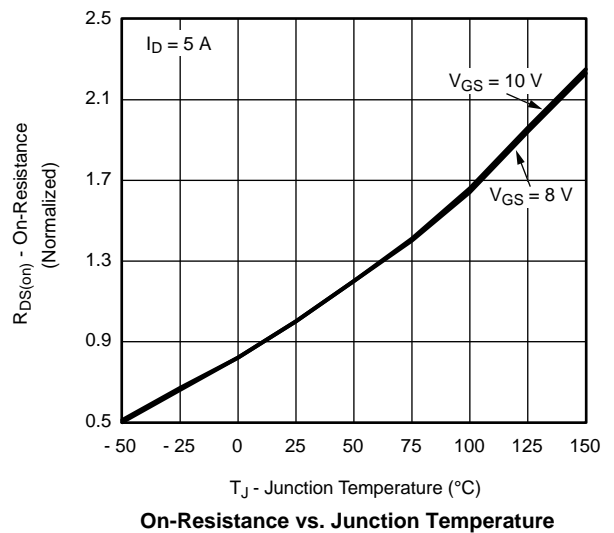
- Based on  $T_C = 25$  °C.
- Surface mounted on 1" x 1" FR4 board.
- $t = 10$  s.
- Maximum under steady state conditions is 80 °C/W.

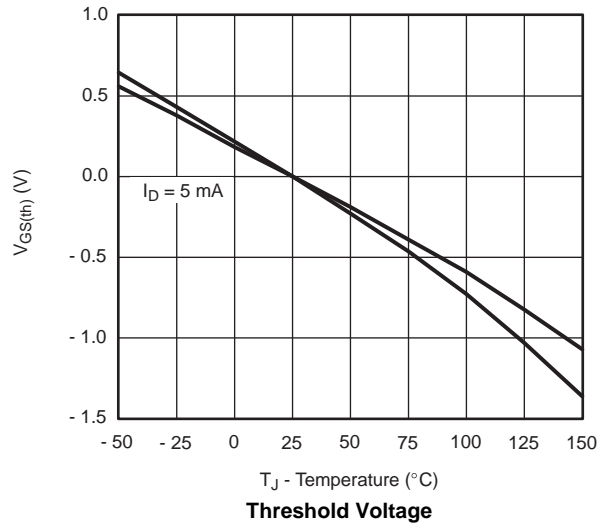
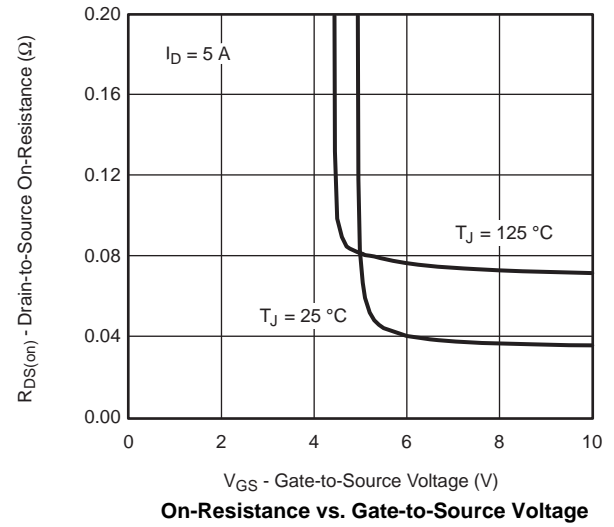
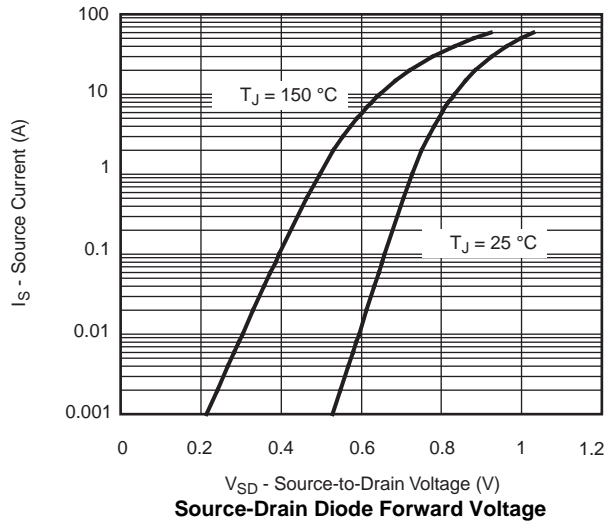
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	150			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA		172		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			- 10		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.5		3.0	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 150 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 120 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			10	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 10 V, V <sub>GS</sub> = 10 V	30			A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 5 A		0.074		Ω
		V <sub>GS</sub> = 8 V, I <sub>D</sub> = 5 A		0.077		
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 5 A		23		S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 50 V, V <sub>GS</sub> = 0 V, f = 1 MHz		1735		pF
Output Capacitance	C <sub>oss</sub>			160		
Reverse Transfer Capacitance	C <sub>rss</sub>			37		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 75 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 5 A		28.5	43	nC
		V <sub>DS</sub> = 75 V, V <sub>GS</sub> = 8 V, I <sub>D</sub> = 5 A		23	35	
Gate-Source Charge	Q <sub>gs</sub>			8		
Gate-Drain Charge	Q <sub>gd</sub>			6.5		
Gate Resistance	R <sub>g</sub>	f = 1 MHz		0.85	1.3	Ω
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 50 V, R <sub>L</sub> = 10 Ω I <sub>D</sub> ≡ 5 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω		14	21	ns
Rise Time	t <sub>r</sub>			12	18	
Turn-Off Delay Time	t <sub>d(off)</sub>			22	33	
Fall Time	t <sub>f</sub>			6	10	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 50 V, R <sub>L</sub> = 10 Ω I <sub>D</sub> ≡ 5 A, V <sub>GEN</sub> = 8 V, R <sub>g</sub> = 1 Ω		16	24	
Rise Time	t <sub>r</sub>			12	18	
Turn-Off Delay Time	t <sub>d(off)</sub>			20	30	
Fall Time	t <sub>f</sub>			7	12	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			7.7	A
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				50	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 2.6 A		0.77	1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 5 A, dI/dt = 100 A/μs, T <sub>J</sub> = 25 °C		63	95	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			110	165	nC
Reverse Recovery Fall Time	t <sub>a</sub>			49		ns
Reverse Recovery Rise Time	t <sub>b</sub>			14		

Notes:

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

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.

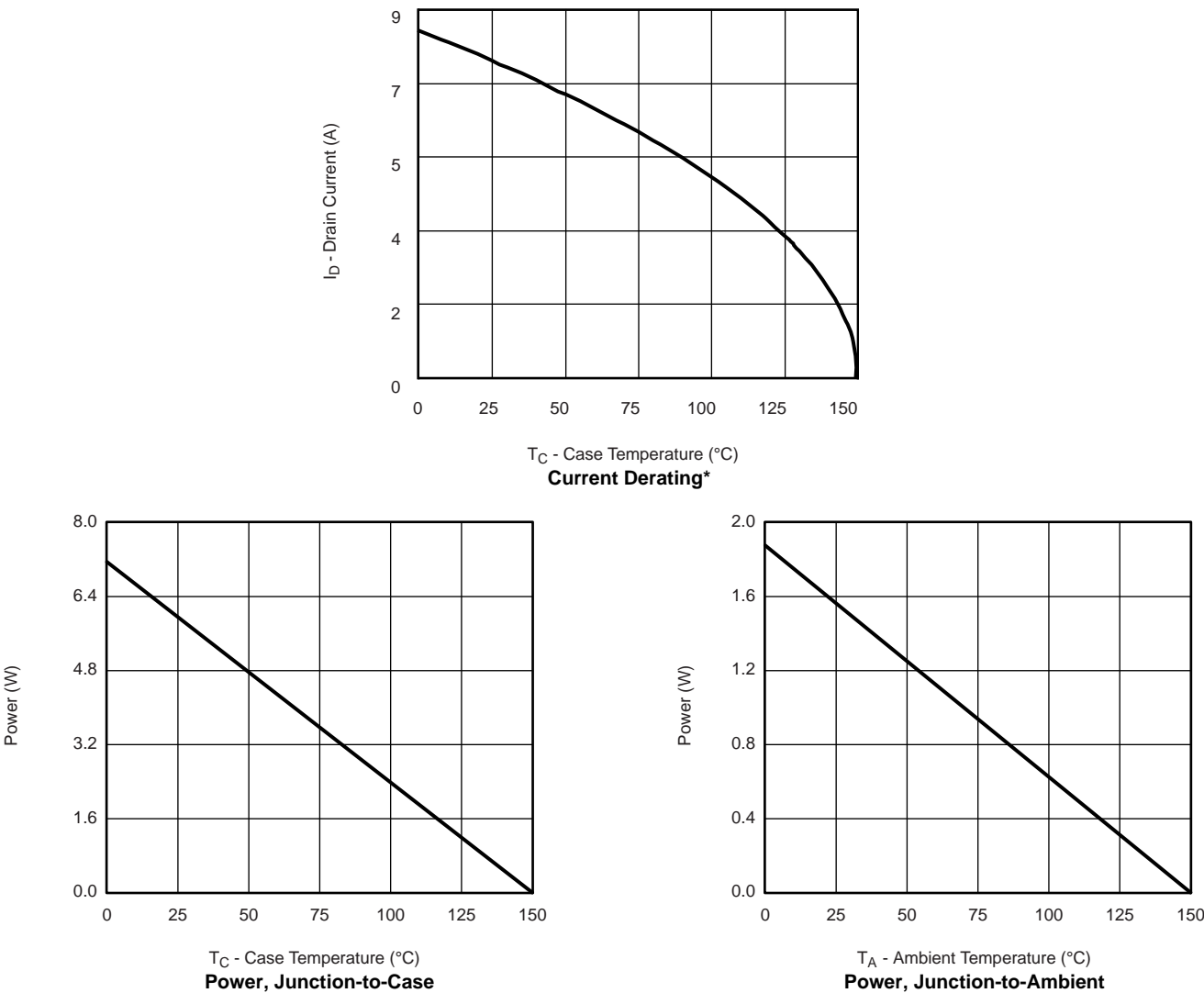
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Output Characteristics**

**Transfer Characteristics**

**On-Resistance vs. Drain Current and Gate Voltage**

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

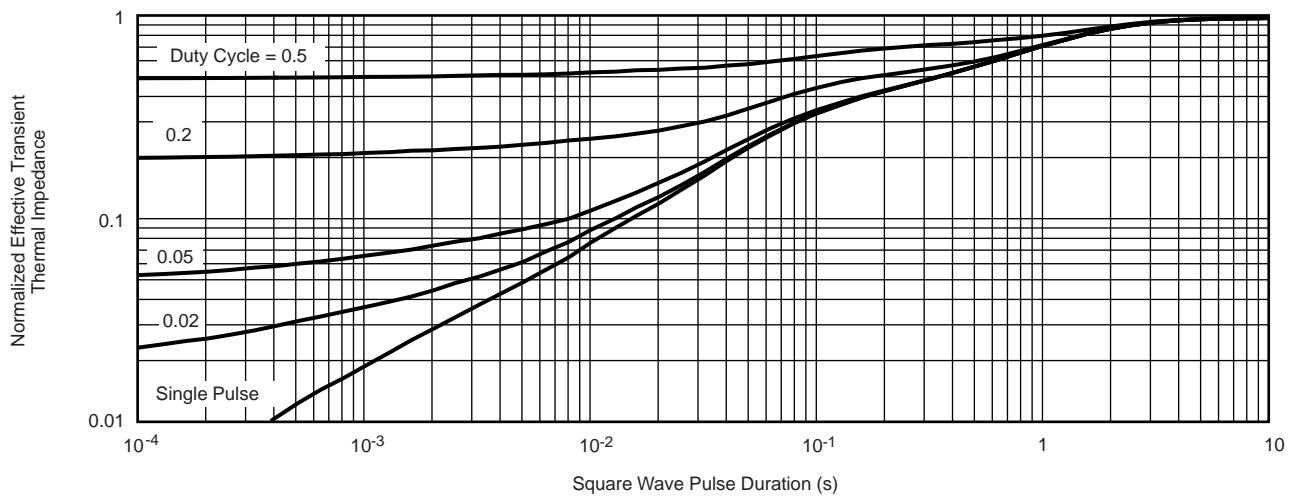
**Safe Operating Area, Junction-to-Ambient**

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

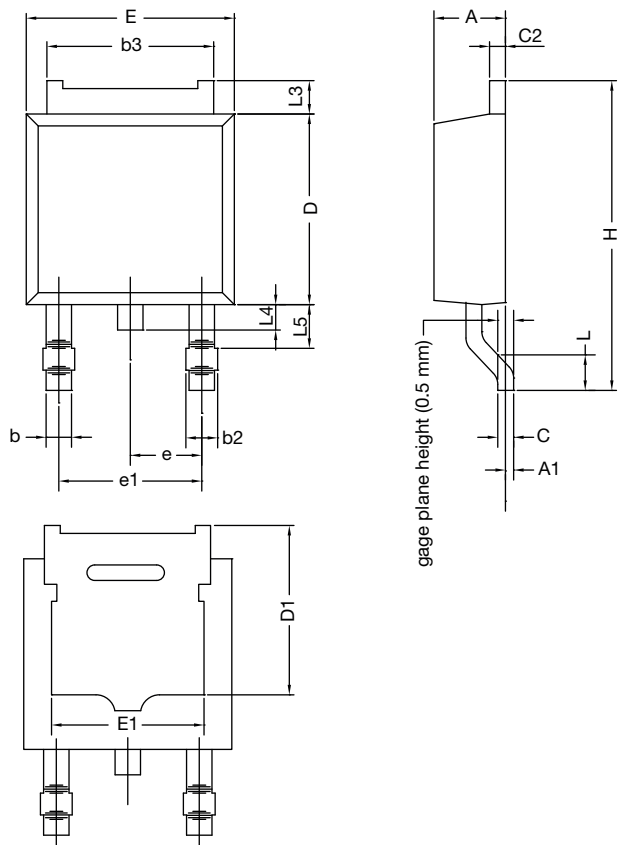


\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Normalized Thermal Transient Impedance, Junction-to-Ambient**

**Normalized Thermal Transient Impedance, Junction-to-Foot**

TO-252AA CASE OUTLINE



DIM.	MILLIMETERS		INCHES	
	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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