

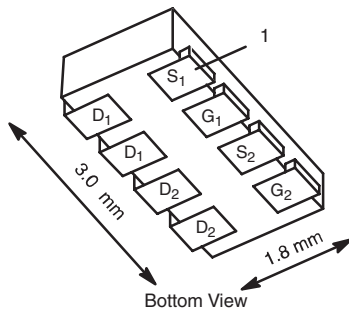
## AM5931P-T1-PF-VB Datasheet

### Dual P-Channel 20 V (D-S) MOSFET

#### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
- 20	0.083 at $V_{GS} = - 4.5$ V	- 4 <sup>g</sup>	6.2 nC
	0.100 at $V_{GS} = - 2.5$ V	- 4 <sup>g</sup>	
	0.130 at $V_{GS} = - 1.8$ V	- 3.8	

DFN 3x2



#### FEATURES

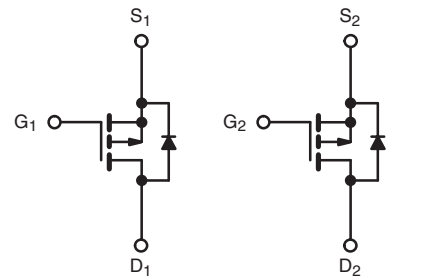
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET<sup>®</sup> Power MOSFETs
- 100 %  $R_g$  Tested
- Compliant to RoHS Directive 2002/95/EC



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

#### APPLICATIONS

- Load Switch for Portable Devices
- Battery Switch



P-Channel MOSFET

P-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	- 20	V
Gate-Source Voltage	$V_{GS}$	$\pm 8$	
Continuous Drain Current ( $T_J = 150$ °C)	$I_D$	$T_C = 25$ °C	A
		$T_C = 70$ °C	
		$T_A = 25$ °C	
		$T_A = 70$ °C	
Pulsed Drain Current	$I_{DM}$	- 10	A
Source Drain Current Diode Current	$I_S$	$T_C = 25$ °C	
		$T_A = 25$ °C	
Maximum Power Dissipation	$P_D$	$T_C = 25$ °C	W
		$T_C = 70$ °C	
		$T_A = 25$ °C	
		$T_A = 70$ °C	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>		260	

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typ.	Max.	Unit
Maximum Junction-to-Ambient <sup>b, f</sup>	$R_{thJA}$	77	95	°C/W
Maximum Junction-to-Foot (Drain)	$R_{thJF}$	33	40	

Notes:

a. Based on  $T_C = 25$  °C.

b. Surface mounted on 1" x 1" FR4 board.

c.  $t = 5$  s.

d. See Reliability Manual for profile. The DFN3x2 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.

e. Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.

f. Maximum under steady state conditions is 130 °C/W.

g. Package limited.

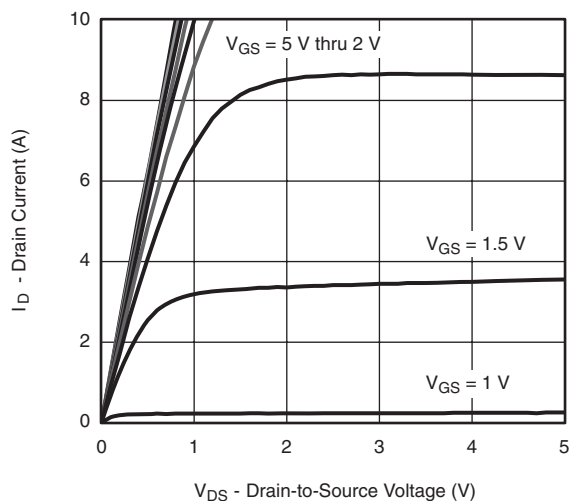
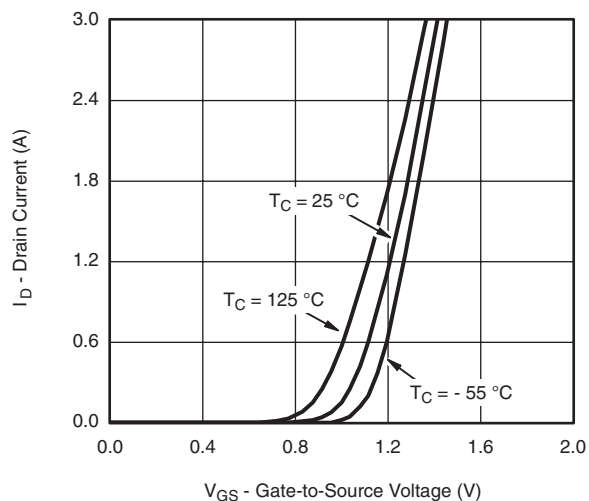
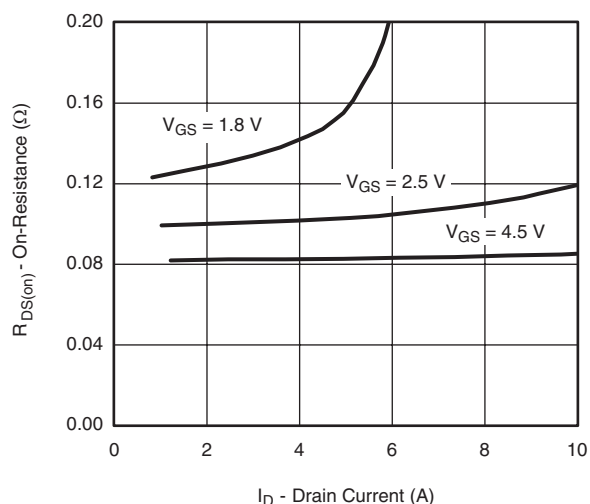
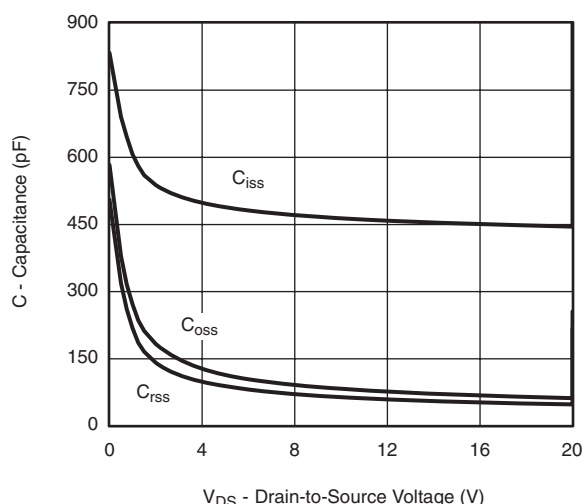
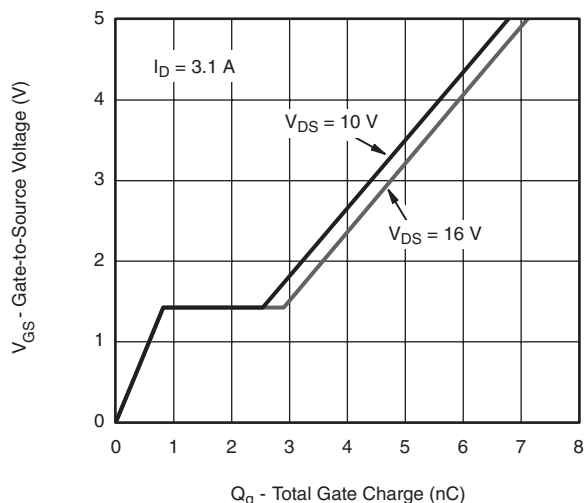
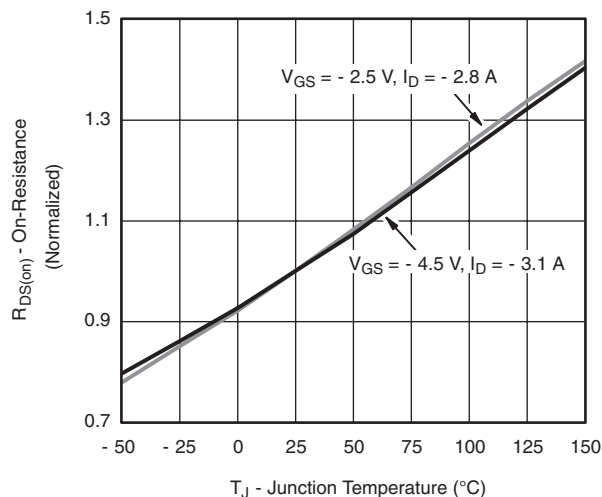
SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ. <sup>a</sup>	Max.	Unit
Static						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	- 20			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		- 19		mV/ $^{\circ}\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	$I_D = -250\text{ }\mu\text{A}$		2.5		
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	- 0.4		- 1.0	V
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$			- 100	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$			- 1	$\mu\text{A}$
		$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^{\circ}\text{C}$			- 5	
On-State Drain Current <sup>b</sup>	$I_{D(on)}$	$V_{DS} \leq -5\text{ V}, V_{GS} = -4.5\text{ V}$	- 10			A
Drain-Source On-State Resistance <sup>b</sup>	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -3.1\text{ A}$		0.083		$\Omega$
		$V_{GS} = -2.5\text{ V}, I_D = -2.8\text{ A}$		0.100		
		$V_{GS} = -1.8\text{ V}, I_D = -2.5\text{ A}$		0.130		
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = -10\text{ V}, I_D = -3.1\text{ A}$		9.5		S
Dynamic <sup>a</sup>						
Input Capacitance	$C_{iss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		455		pF
Output Capacitance	$C_{oss}$			70		
Reverse Transfer Capacitance	$C_{rss}$			54		
Total Gate Charge	$Q_g$	$V_{DS} = -10\text{ V}, V_{GS} = -5\text{ V}, I_D = -3.1\text{ A}$		7	11	nC
		$V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -3.1\text{ A}$		6.2	9.3	
Gate-Source Charge	$Q_{gs}$			0.85		
Gate-Drain Charge	$Q_{gd}$			1.75		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	1.22	6.1	12.2	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 4.2\text{ }\Omega$ $I_D \cong -2.4\text{ A}, V_{GEN} = -8\text{ V}, R_g = 1\text{ }\Omega$		3	6	ns
Rise Time	$t_r$			11	17	
Turn-Off Delay Time	$t_{d(off)}$			21	32	
Fall Time	$t_f$			6	12	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 4.2\text{ }\Omega$ $I_D \cong -2.4\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\text{ }\Omega$		10	20	
Rise Time	$t_r$			32	48	
Turn-Off Delay Time	$t_{d(off)}$			25	38	
Fall Time	$t_f$			6	12	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^{\circ}\text{C}$			- 2.6	A
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				- 10	
Body Diode Voltage	$V_{SD}$	$I_S = -2.4\text{ A}, V_{GS} = 0\text{ V}$		- 0.8	- 1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = -2.4\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^{\circ}\text{C}$		21	32	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			13	20	nC
Reverse Recovery Fall Time	$t_a$			17		ns
Reverse Recovery Rise Time	$t_b$			4		

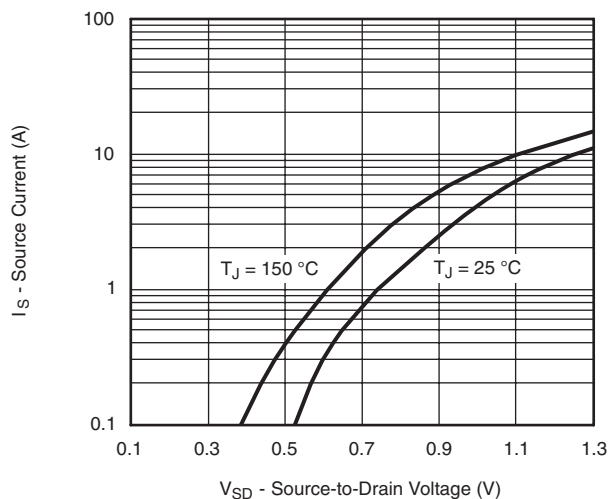
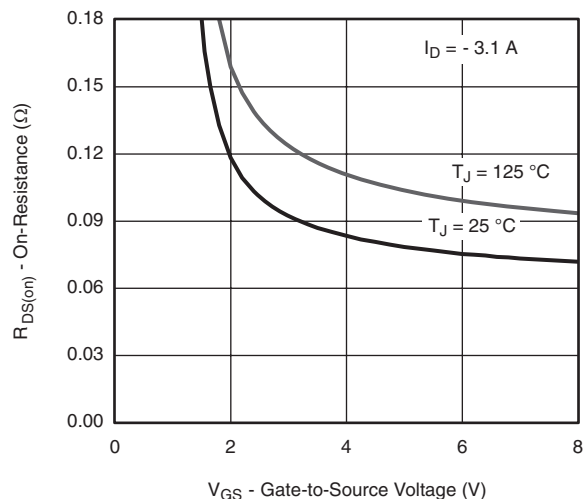
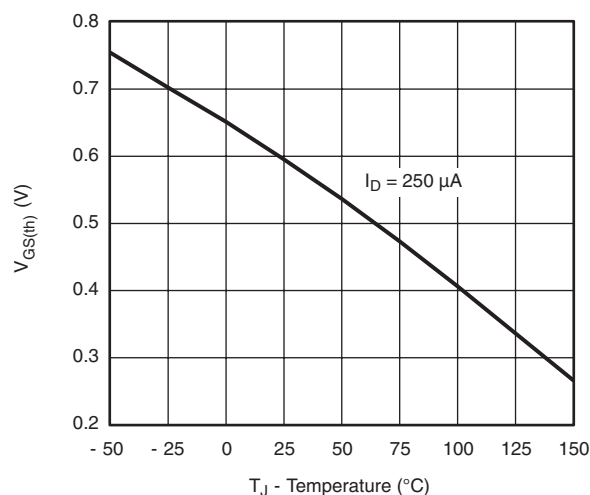
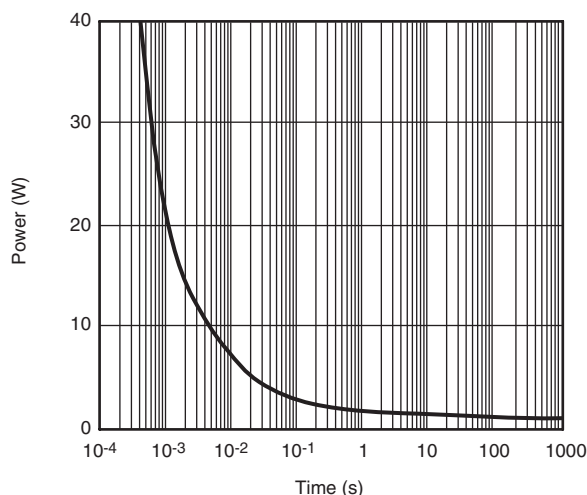
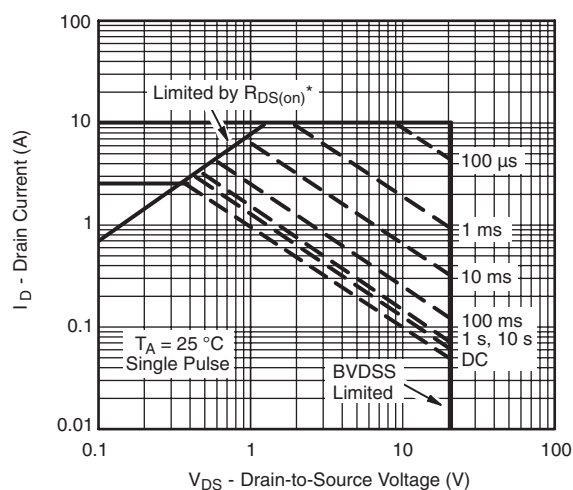
Notes:

a. Guaranteed by design, not subject to production testing.

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

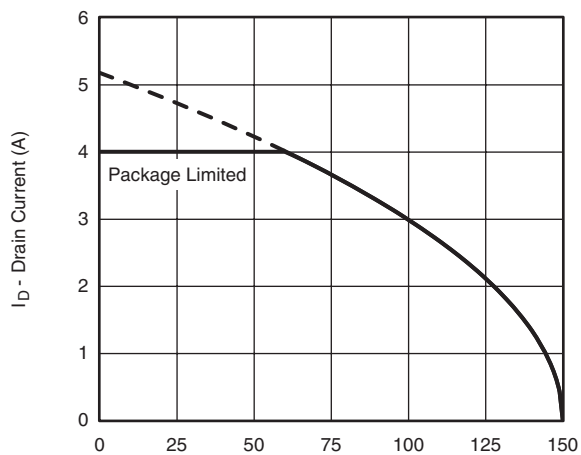
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

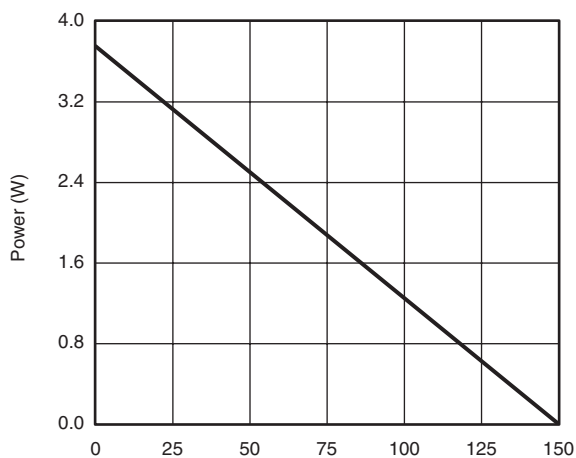
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Output Characteristics**

**Transfer Characteristics**

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

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

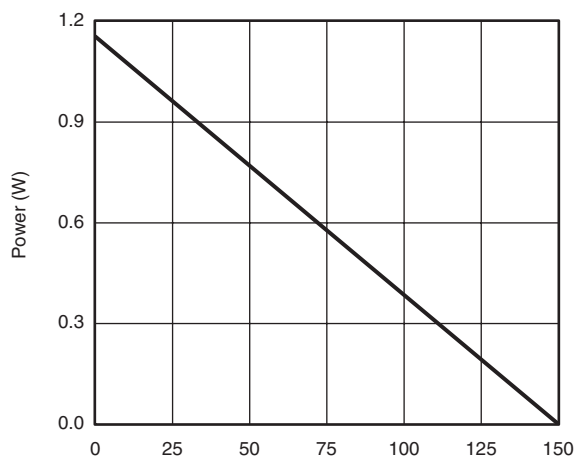
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Source-Drain Diode Forward Voltage**

**On-Resistance vs. Gate-to-Source Voltage**

**Threshold Voltage**

**Single Pulse Power**


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

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

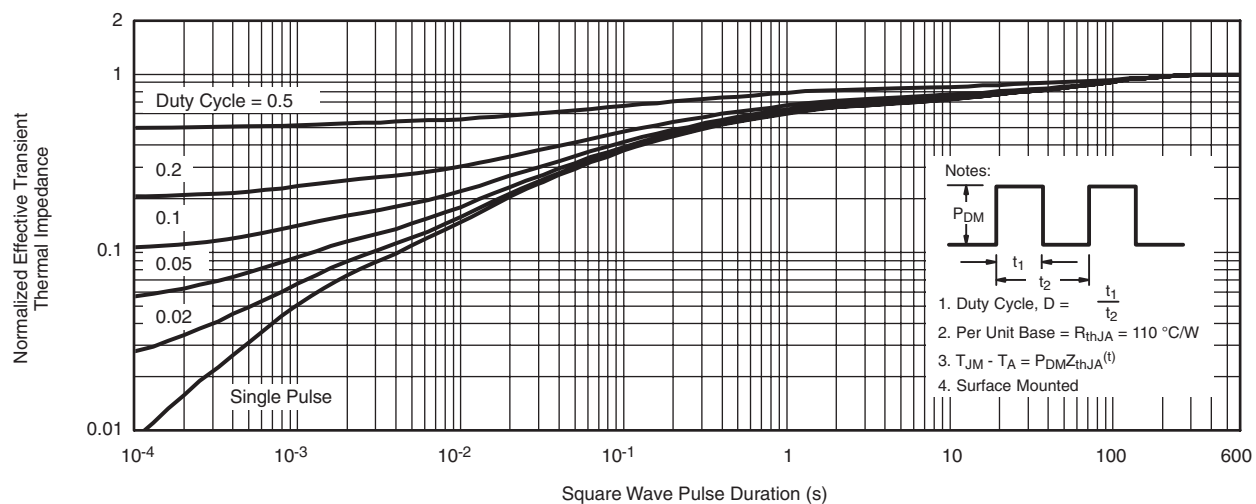
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

 $T_C$  - Case Temperature (°C)

**Current Derating\***

 $T_C$  - Case Temperature (°C)

**Power Derating, Junction-to-Foot**

 $T_A$  - Ambient Temperature (°C)

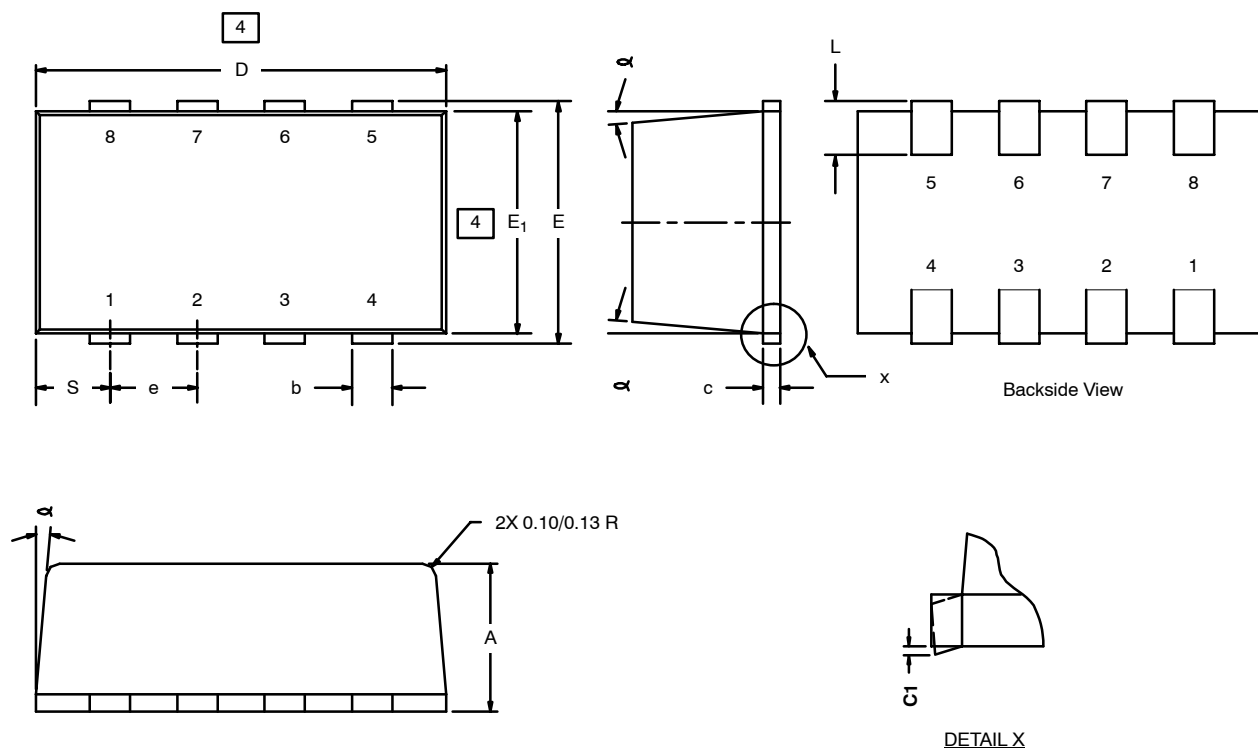
**Power Derating, Junction-to-Ambient**

\* 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**

## DFN 3x2

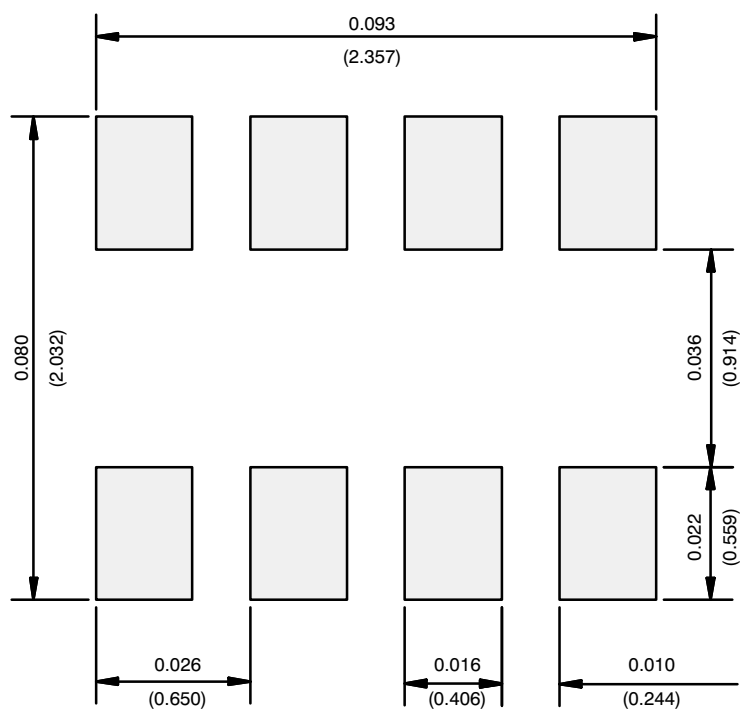


## NOTES:

1. All dimensions are in millimeters.
2. Mold gate burrs shall not exceed 0.13 mm per side.
3. Leadframe to molded body offset is horizontal and vertical shall not exceed 0.08 mm.
4. Dimensions exclusive of mold gate burrs.
5. No mold flash allowed on the top and bottom lead surface.

	MILLIMETERS			INCHES		
Dim	Min	Nom	Max	Min	Nom	Max
A	1.00	–	1.10	0.039	–	0.043
b	0.25	0.30	0.35	0.010	0.012	0.014
c	0.1	0.15	0.20	0.004	0.006	0.008
c1	0	–	0.038	0	–	0.0015
D	2.95	3.05	3.10	0.116	0.120	0.122
E	1.825	1.90	1.975	0.072	0.075	0.078
E <sub>1</sub>	1.55	1.65	1.70	0.061	0.065	0.067
e	0.65 BSC			0.0256 BSC		
L	0.28	–	0.42	0.011	–	0.017
S	0.55 BSC			0.022 BSC		
α	5°Nom			5°Nom		
ECN: C-03528—Rev. F, 19-Jan-04 DWG: 5547						

## RECOMMENDED MINIMUM PADS



Recommended Minimum Pads  
Dimensions in Inches/(mm)



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