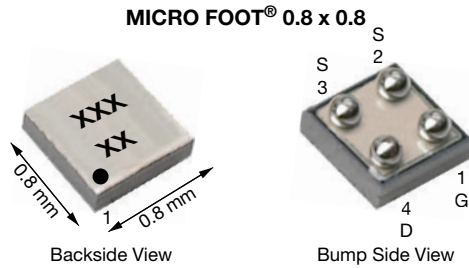


## P-Channel 12 V (D-S) MOSFET



**Marking code:** xx = AK  
xxx = Date / lot traceability code

PRODUCT SUMMARY	
$V_{DS}$ (V)	-12
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -3.7$ V	0.080
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -2.5$ V	0.100
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -1.8$ V	0.190
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -1.5$ V	0.280
$Q_g$ typ. (nC)	7
$I_D$ (A) <sup>a, e</sup>	-2.9
Configuration	Single

ORDERING INFORMATION	
Package	MICRO FOOT
Lead (Pb)-free and halogen-free	Si8819EDB-T2-E1

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)			
Parameter	Symbol	Limit	Unit
Drain-source voltage	$V_{DS}$	-12	V
Gate-source voltage	$V_{GS}$	$\pm 8$	
Continuous drain current ( $T_J = 150$ °C)	$I_D$	$T_A = 25$ °C	-2.9 <sup>a</sup>
		$T_A = 70$ °C	-2.3 <sup>a</sup>
		$T_A = 25$ °C	-2.1 <sup>b</sup>
		$T_A = 70$ °C	-1.7 <sup>b</sup>
Pulsed drain current ( $t = 100$ $\mu$ s)	$I_{DM}$	-15	A
Continuous source-drain diode current	$I_S$	$T_C = 25$ °C	-0.7 <sup>a</sup>
		$T_A = 25$ °C	-0.4 <sup>b</sup>
Maximum power dissipation	$P_D$	$T_A = 25$ °C	0.9 <sup>a</sup>
		$T_A = 70$ °C	0.6 <sup>a</sup>
		$T_A = 25$ °C	0.5 <sup>b</sup>
		$T_A = 70$ °C	0.3 <sup>b</sup>
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +150	
Package reflow conditions <sup>c</sup>	VPR	260	°C
	IR/Convection	260	

### Notes

- Surface mounted on 1" x 1" FR4 board with full copper,  $t = 5$  s
- Surface mounted on 1" x 1" FR4 board with minimum copper,  $t = 5$  s
- Refer to IPC/JEDEC® (J-STD-020), no manual or hand soldering
- In this document, any reference to case represents the body of the MICRO FOOT device and foot is the bump
- Based on  $T_A = 25$  °C

### FEATURES

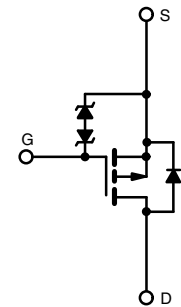
- TrenchFET® power MOSFET
- Small 0.8 mm x 0.8 mm outline area
- Low 0.4 mm max. profile
- Typical ESD protection 1700 V HBM
- Material categorization:  
for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### APPLICATIONS

- Load switches and battery switches
- High speed switching
- For smart phones, tablet PCs, and mobile computing



P-Channel MOSFET



THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typical	Maximum	Unit
Maximum junction-to-ambient <sup>a, b</sup>	t = 5 s	R <sub>thJA</sub>	105	135	°C/W
Maximum junction-to-ambient <sup>c, d</sup>	t = 5 s		200	260	

**Notes**

- a. Surface mounted on 1" x 1" FR4 board with full copper
- b. Maximum under steady state conditions is 185 °C/W
- c. Surface mounted on 1" x 1" FR4 board with minimum copper
- d. Maximum under steady state conditions is 330 °C/W

SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA	-12	-	-	V
V <sub>DS</sub> temperature coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = -250 μA	-	-7	-	mV/°C
V <sub>GS(th)</sub> temperature coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>		-	2.7	-	
Gate-source threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA	-0.4	-	-0.9	V
Gate-source leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 4.5 V	-	-	± 0.2	μA
		V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 8 V	-	-	± 1	
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = -12 V, V <sub>GS</sub> = 0 V	-	-	-1	μA
		V <sub>DS</sub> = -12 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 70 °C	-	-	-10	
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≤ -5 V, V <sub>GS</sub> = -3.7 V	-5	-	-	A
Drain-source on-state resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -3.7 V, I <sub>D</sub> = -1.5 A	-	0.063	0.080	Ω
		V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -1.5 A	-	0.079	0.100	
		V <sub>GS</sub> = -1.8 V, I <sub>D</sub> = -1 A	-	0.118	0.190	
		V <sub>GS</sub> = -1.5 V, I <sub>D</sub> = -0.1 A	-	0.180	0.280	
Forward transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = -5 V, I <sub>D</sub> = -1.5 A	-	7	-	S
<b>Dynamic <sup>b</sup></b>						
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -6 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	620	-	pF
Output capacitance	C <sub>oss</sub>		-	140	-	
Reverse transfer capacitance	C <sub>rss</sub>		-	130	-	
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> = -6 V, V <sub>GS</sub> = -8 V, I <sub>D</sub> = -1.5 A	-	12	17	nC
			-	7	8	
Gate-source charge	Q <sub>gs</sub>	V <sub>DS</sub> = -6 V, V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -1.5 A	-	0.9	-	nC
Gate-drain charge	Q <sub>gd</sub>		-	1.9	-	
Gate resistance	R <sub>g</sub>	V <sub>GS</sub> = -0.1 V, f = 1 MHz	-	15	-	Ω
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = -6 V, R <sub>L</sub> = 4 Ω I <sub>D</sub> ≅ -1.5 A, V <sub>GEN</sub> = -4.5 V, R <sub>g</sub> = 1 Ω	-	17	30	ns
Rise time	t <sub>r</sub>		-	23	45	
Turn-off delay time	t <sub>d(off)</sub>		-	44	90	
Fall time	t <sub>f</sub>		-	30	60	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = -6 V, R <sub>L</sub> = 4 Ω I <sub>D</sub> ≅ -1.5 A, V <sub>GEN</sub> = -8 V, R <sub>g</sub> = 1 Ω	-	7	15	ns
Rise time	t <sub>r</sub>		-	16	30	
Turn-off delay time	t <sub>d(off)</sub>		-	58	120	
Fall time	t <sub>f</sub>		-	31	60	



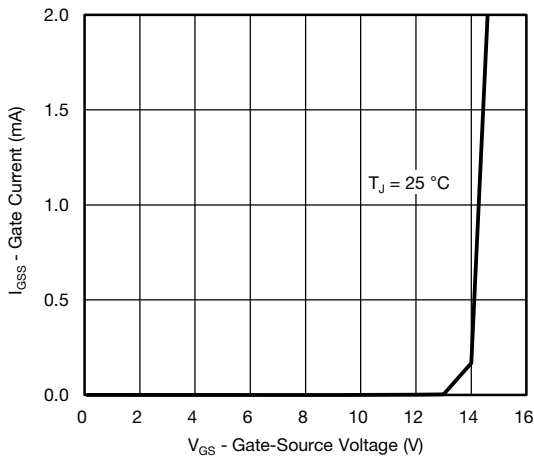
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Drain-Source Body Diode Characteristics</b>						
Continuous source-drain diode current	I <sub>S</sub>	T <sub>A</sub> = 25 °C	-	-	-0.7	A
Pulse diode forward current	I <sub>SM</sub>		-	-	-15	
Body diode voltage	V <sub>SD</sub>	I <sub>S</sub> = -1.5 A, V <sub>GS</sub> = 0 V	-	-0.82	-1.2	V
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = -1.5 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C	-	47	100	ns
Body diode reverse recovery charge	Q <sub>rr</sub>		-	26	55	nC
Reverse recovery fall time	t <sub>a</sub>		-	16	-	ns
Reverse recovery rise time	t <sub>b</sub>		-	31	-	

Notes

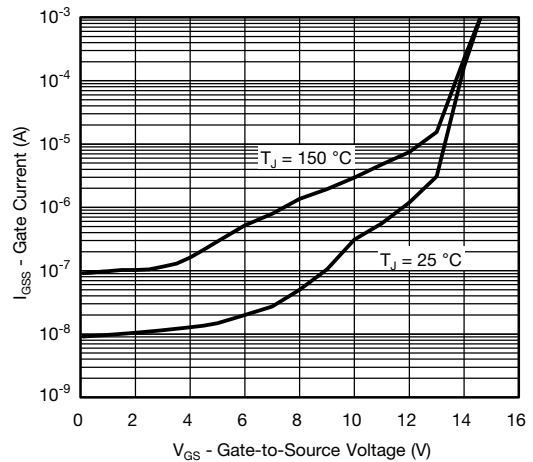
- a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %
- b. Guaranteed by design, not subject to production testing

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.

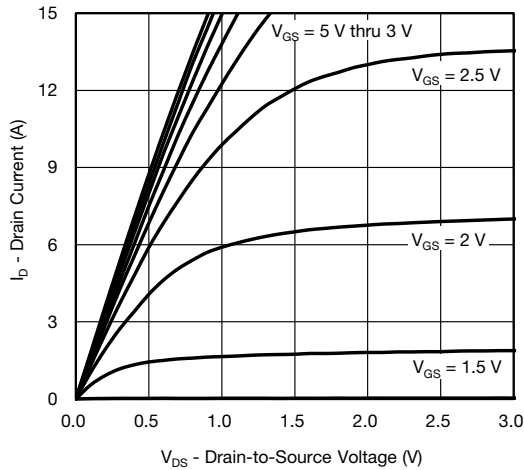
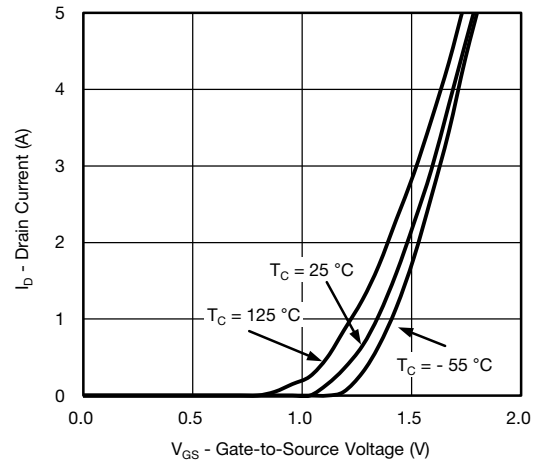
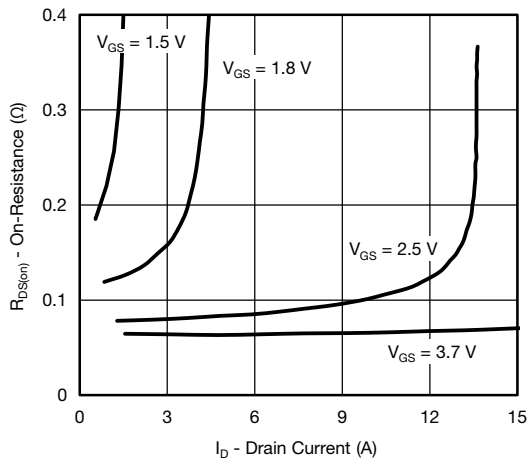
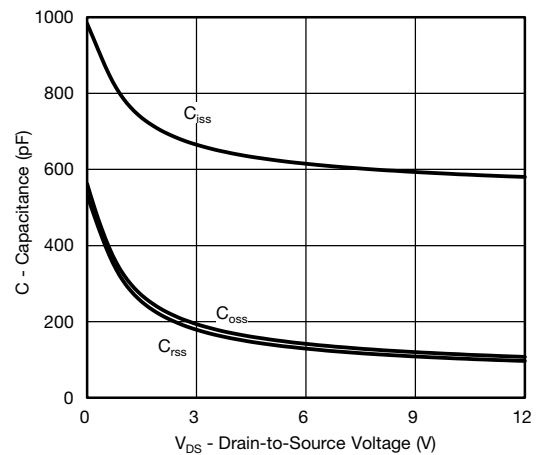
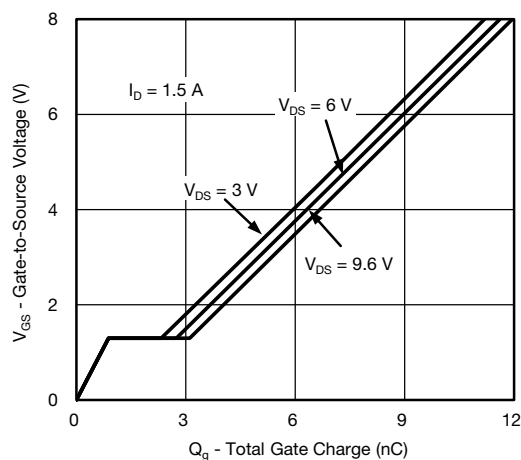
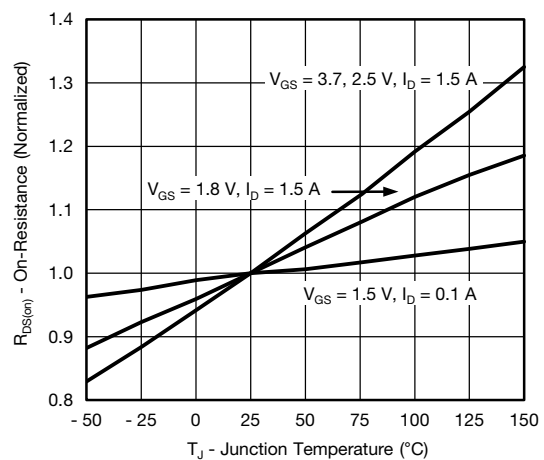
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Gate Current vs. Gate-Source Voltage

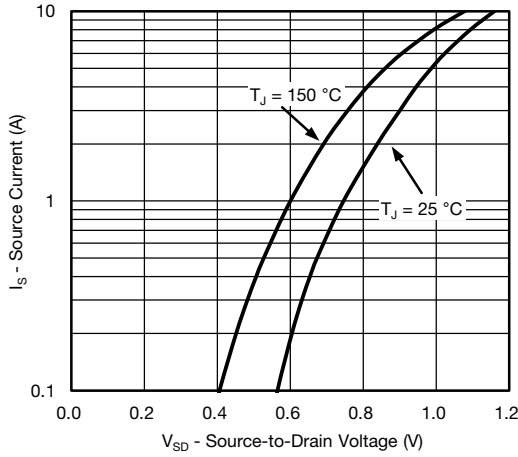


Gate Current vs. Gate-Source Voltage

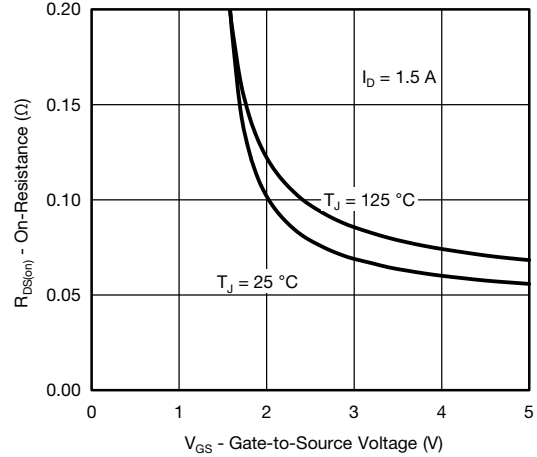
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Output Characteristics**

**Transfer Characteristics**

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

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**



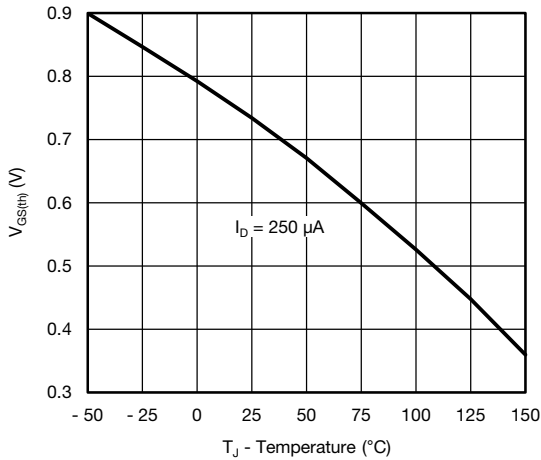
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



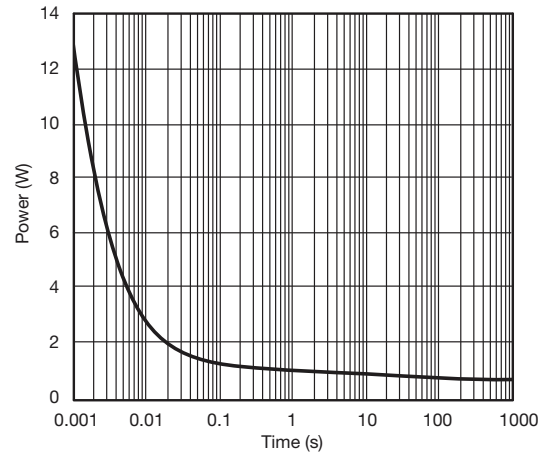
Source-Drain Diode Forward Voltage



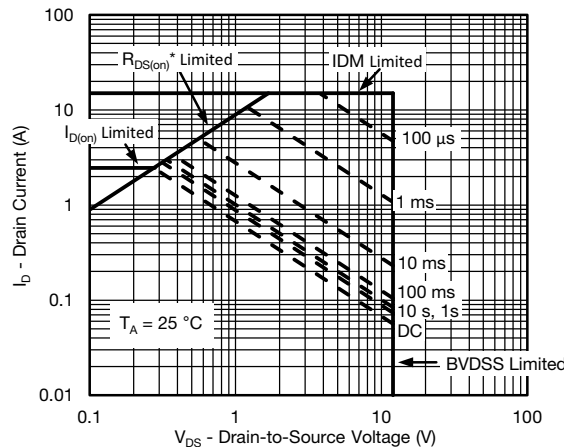
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



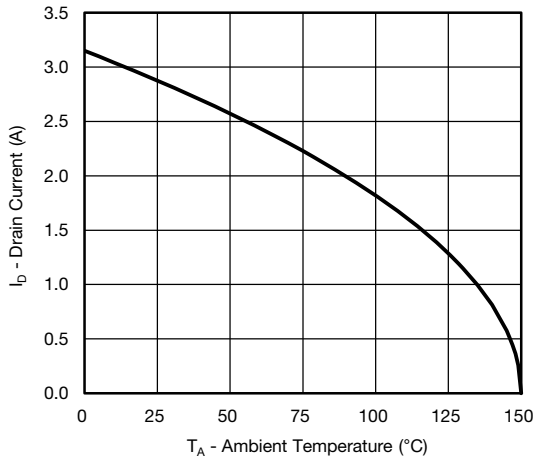
Single Pulse Power, Junction-to-Ambient



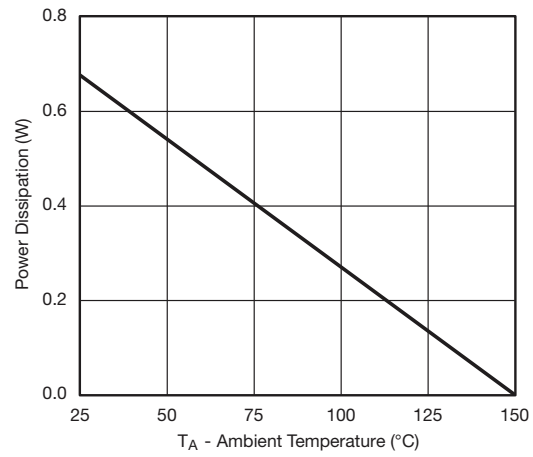
Safe Operating Area, Junction-to-Ambient



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



**Current Derating <sup>a</sup>**



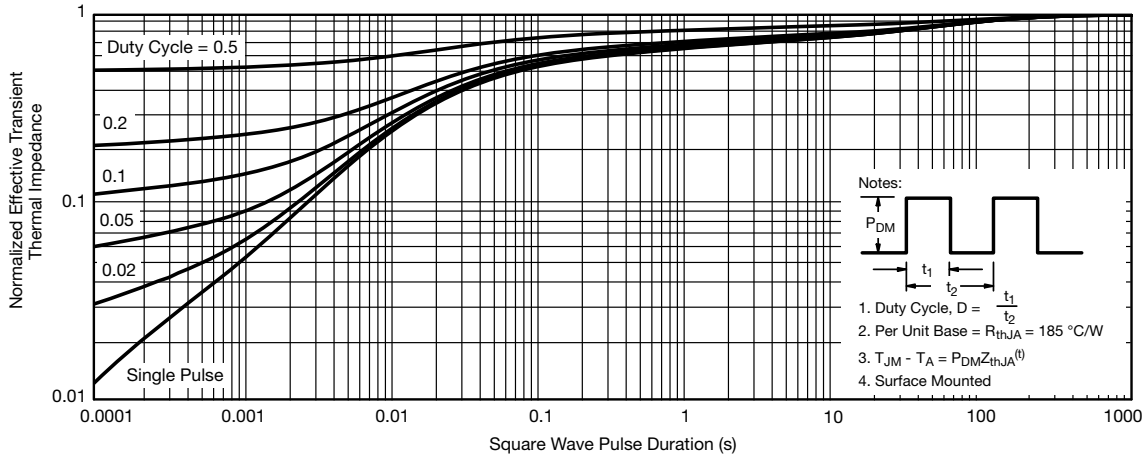
**Power Derating**

**Note**

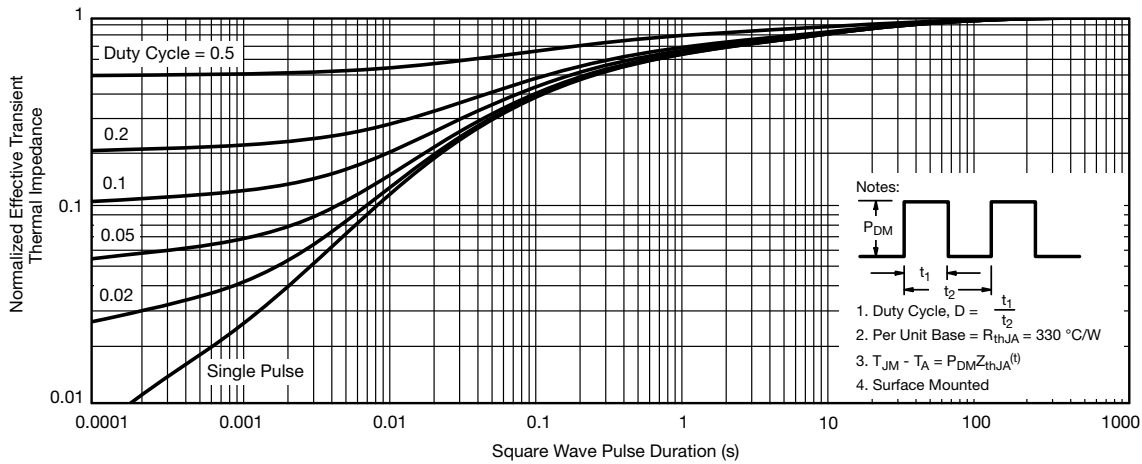
- When mounted on 1" x 1" FR4 with full copper, t = 5 s
- a. The power dissipation  $P_D$  is based on  $T_J \text{ max.} = 150 \text{ }^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. 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 (On 1" x 1" FR4 Board with Maximum Copper)

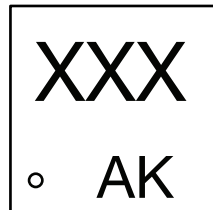


Normalized Thermal Transient Impedance, Junction-to-Ambient (On 1" x 1" FR4 Board with Minimum Copper)

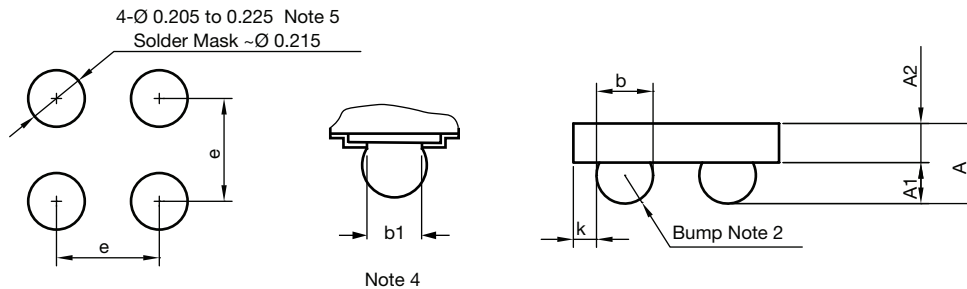
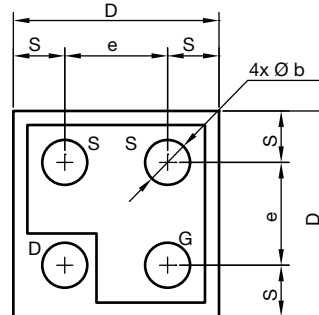
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# MICRO FOOT®: 4-Bump (0.8 mm x 0.8 mm, 0.4 mm Pitch)



Mark on Backside of die



Note 4

**Notes**

- (1) Laser mark on the backside surface of die
- (2) Bumps are 95.5 % Sn,3.8 % Ag,0.7 % Cu
- (3) "i" is the location of pin 1
- (4) "b1" is the diameter of the solderable substrate surface, defined by an opening in the solder resist layer solder mask defined.
- (5) Non-solder mask defined copper landing pad.

DIM.	MILLIMETERS <sup>a</sup>			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.328	0.365	0.402	0.0129	0.0144	0.0158
A1	0.136	0.160	0.184	0.0053	0.0062	0.0072
A2	0.192	0.205	0.218	0.0076	0.0081	0.0086
b	0.200	0.220	0.240	0.0078	0.0086	0.0094
b1	0.175			0.0068		
e	0.400			0.0157		
S	0.160	0.180	0.200	0.0062	0.0070	0.0078
D	0.720	0.760	0.800	0.0283	0.0299	0.0314
K	0.040	0.070	0.100	0.0015	0.0027	0.0039

**Note**

a. Use millimeters as the primary measurement.

ECN: T15-0053-Rev. A, 16-Feb-15  
 DWG: 6033





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