

## N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω) MAX.	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (TYP.)
20	0.072 at V <sub>GS</sub> = 4.5 V	2.9	3 nC
	0.079 at V <sub>GS</sub> = 2.5 V	2.8	
	0.092 at V <sub>GS</sub> = 1.8 V	2.6	
	0.125 at V <sub>GS</sub> = 1.5 V	2.2	

### FEATURES

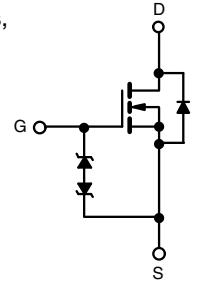
- TrenchFET<sup>®</sup> power MOSFET
- Ultra small 0.8 mm x 0.8 mm outline
- Ultra thin 0.357 mm height
- Typical ESD protection 2000 V (HBM)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



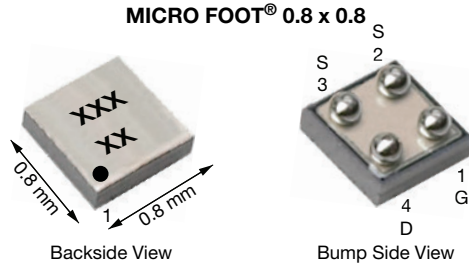
**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### APPLICATIONS

- Portable devices such as cell phones, smart phones, and tablet PCs
  - Load switch
  - Small signal switch
  - High speed switching



N-Channel MOSFET



**Marking Code:** xx = AJ  
xxx = Date/Lot traceability code

**Ordering Information:**  
Si8810EDB-T2-E1 (lead (Pb)-free and halogen-free)

ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V <sub>DS</sub>	20	V
Gate-Source Voltage	V <sub>GS</sub>	± 8	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>A</sub> = 25 °C	2.9 <sup>a</sup>
		T <sub>A</sub> = 70 °C	2.3 <sup>a</sup>
		T <sub>A</sub> = 25 °C	2.1 <sup>b</sup>
		T <sub>A</sub> = 70 °C	1.7 <sup>b</sup>
Pulsed Drain Current (t = 300 μs)	I <sub>DM</sub>	15	A
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>A</sub> = 25 °C	
		T <sub>A</sub> = 25 °C	0.4 <sup>b</sup>
Maximum Power Dissipation	P <sub>D</sub>	T <sub>A</sub> = 25 °C	0.9 <sup>a</sup>
		T <sub>A</sub> = 70 °C	0.6 <sup>a</sup>
		T <sub>A</sub> = 25 °C	0.5 <sup>b</sup>
		T <sub>A</sub> = 70 °C	0.3 <sup>b</sup>
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C
Soldering Recommendations (Peak Temperature) <sup>c</sup>		260	

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum Junction-to-Ambient <sup>a, d</sup>	R <sub>thJA</sub>	105	135	°C/W
Maximum Junction-to-Ambient <sup>b, e</sup>		200	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<sup>®</sup> (J-STD-020), no manual or hand soldering.
- Maximum under steady state conditions is 185 °C/W.
- 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	20	-	-	V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA	-	21	-	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	-	-	± 0.5	μA
		V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 8 V	-	-	± 5	
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V	-	-	1	
		V <sub>DS</sub> = 20 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> ≥ 5 V, V <sub>GS</sub> = 4.5 V	10	-	-	A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 1 A	-	0.058	0.072	Ω
		V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 1 A	-	0.063	0.079	
		V <sub>GS</sub> = 1.8 V, I <sub>D</sub> = 1 A	-	0.072	0.092	
		V <sub>GS</sub> = 1.5 V, I <sub>D</sub> = 0.5 A	-	0.080	0.125	
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 A	-	12	-	S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	245	-	pF
Output Capacitance	C <sub>oss</sub>		-	55	-	
Reverse Transfer Capacitance	C <sub>rss</sub>		-	25	-	
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 8 V, I <sub>D</sub> = 1 A	-	5.2	8	nC
		V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 1 A	-	3	4.5	
Gate-Source Charge	Q <sub>gs</sub>		-	0.35	-	
Gate-Drain Charge	Q <sub>gd</sub>		-	0.45	-	
Gate Resistance	R <sub>g</sub>	f = 1 MHz	-	5	-	Ω
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 10 V, R <sub>L</sub> = 10 Ω I <sub>D</sub> ≅ 1 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω	-	7	15	ns
Rise Time	t <sub>r</sub>		-	12	25	
Turn-Off Delay Time	t <sub>d(off)</sub>		-	25	50	
Fall Time	t <sub>f</sub>		-	7	15	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 10 V, R <sub>L</sub> = 10 Ω I <sub>D</sub> ≅ 1 A, V <sub>GEN</sub> = 8 V, R <sub>g</sub> = 1 Ω	-	5	10	
Rise Time	t <sub>r</sub>		-	10	20	
Turn-Off Delay Time	t <sub>d(off)</sub>		-	15	30	
Fall Time	t <sub>f</sub>		-	7	15	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</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 A, V <sub>GS</sub> = 0 V	-	0.7	1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 1 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C	-	11	20	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>		-	5	10	nC
Reverse Recovery Fall Time	t <sub>a</sub>		-	7	-	ns
Reverse Recovery Rise Time	t <sub>b</sub>		-	4	-	

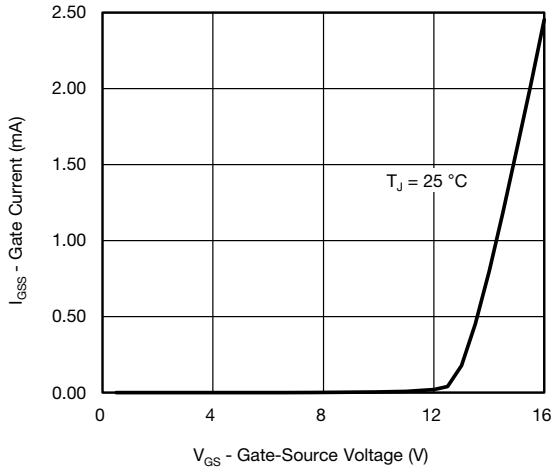
**Notes**

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

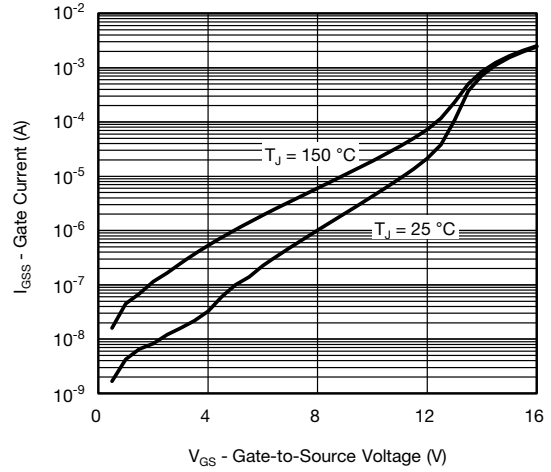
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



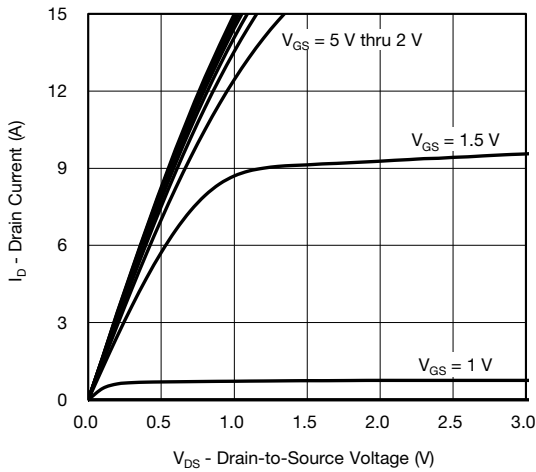
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



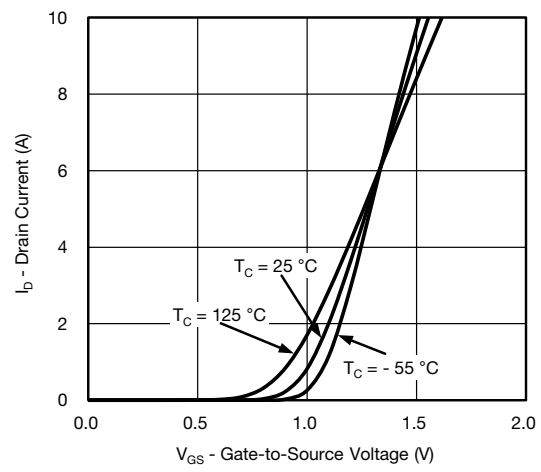
Gate Current vs. Gate-Source Voltage



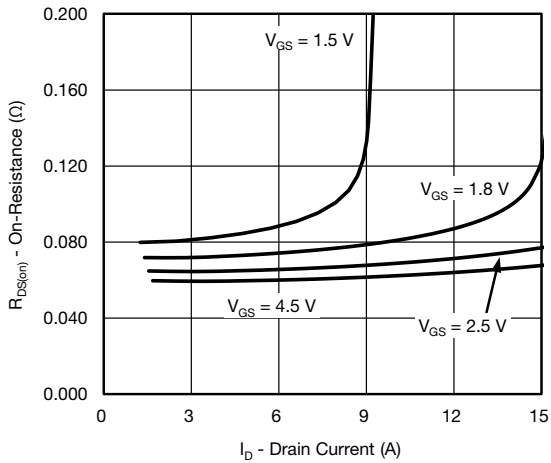
Gate Current vs. Gate-Source Voltage



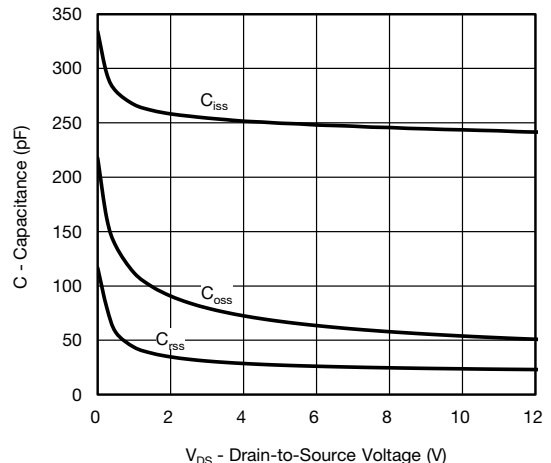
Output Characteristics



Transfer Characteristics

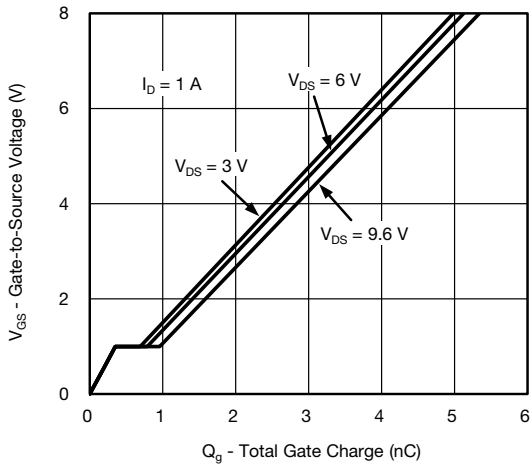


On-Resistance vs. Drain Current

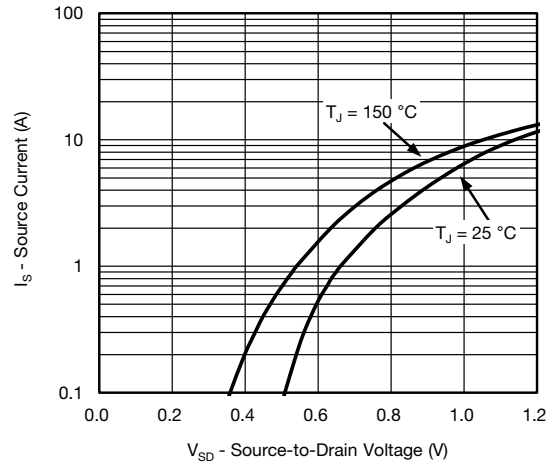


Capacitance vs. Drain-to-Source Voltage

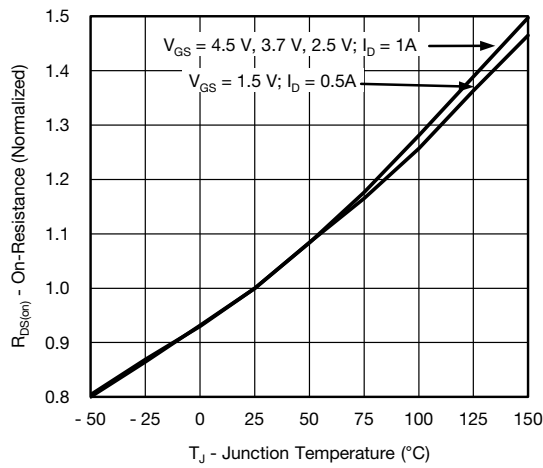
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



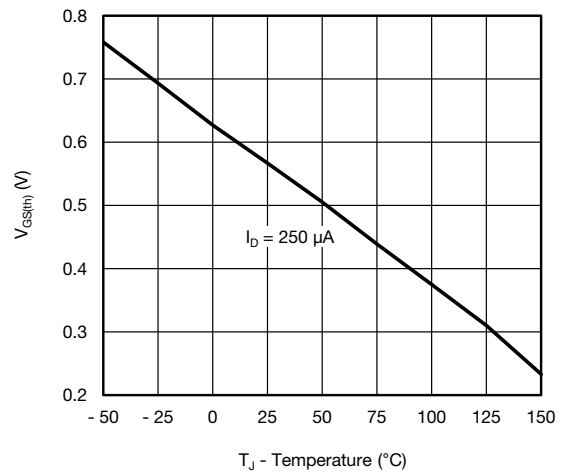
**Gate Charge**



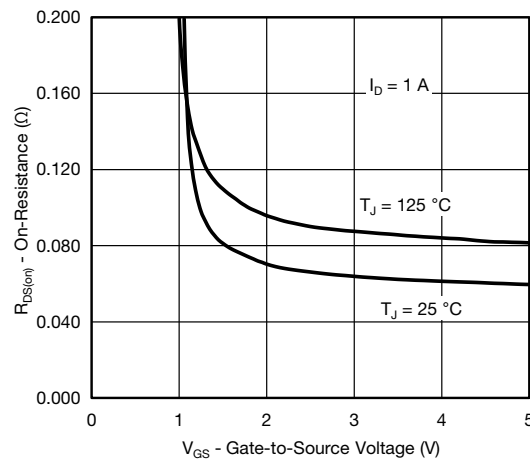
**Source-Drain Diode Forward Voltage**



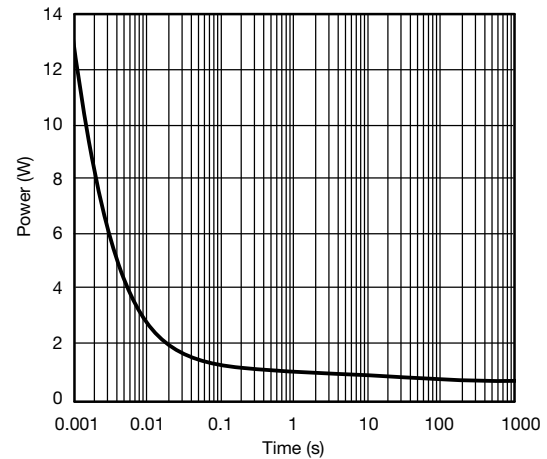
**On-Resistance vs. Junction Temperature**



**Threshold Voltage**



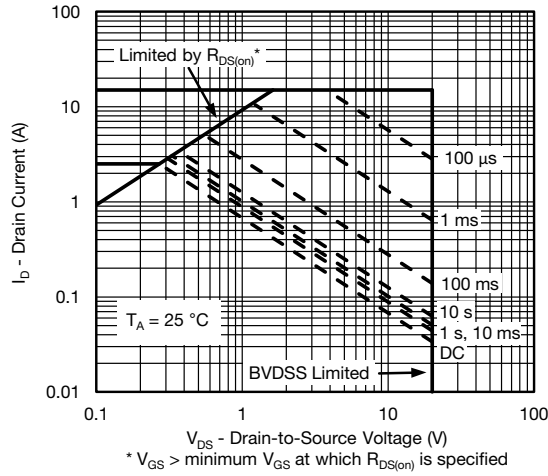
**On-Resistance vs. Gate-to-Source Voltage**



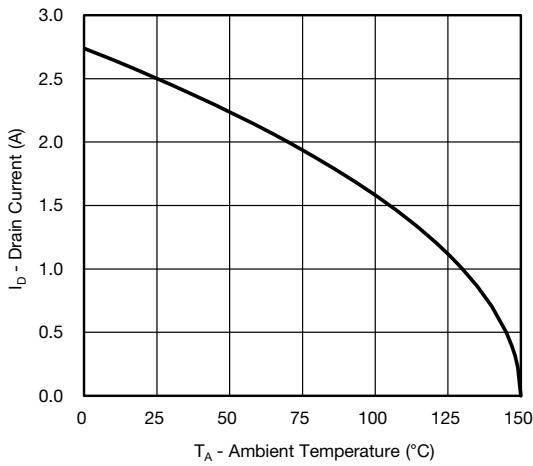
**Single Pulse Power (Junction-to-Ambient)**



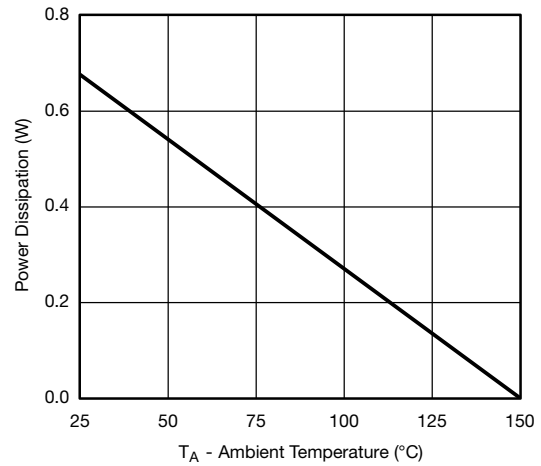
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



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



**Current Derating\***



**Power Derating**

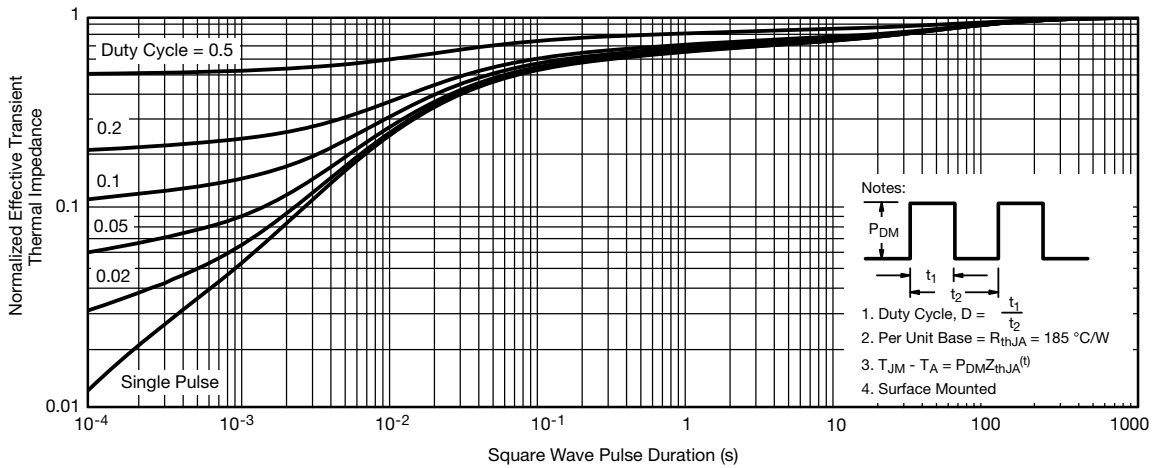
**Note**

When mounted on 1" x 1" FR4 with full copper.

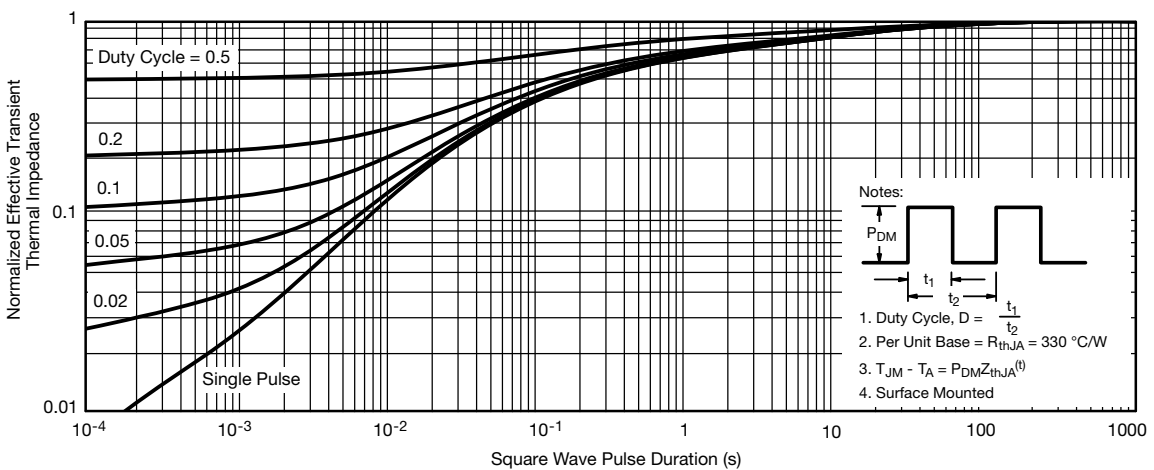
\* The power dissipation  $P_D$  is based on  $T_{J(max.)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package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



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



**Normalized Thermal Transient Impedance, Junction-to-Ambient (on 1" x 1" FR4 board with maximum copper)**

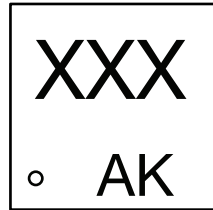


**Normalized Thermal Transient Impedance, Junction-to-Ambient (on 1" x 1" FR4 board with minimum copper)**

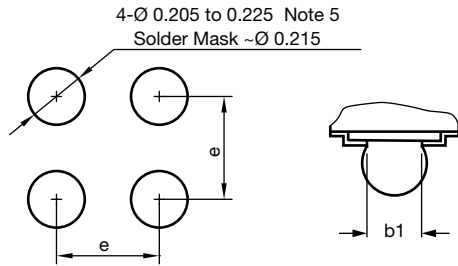
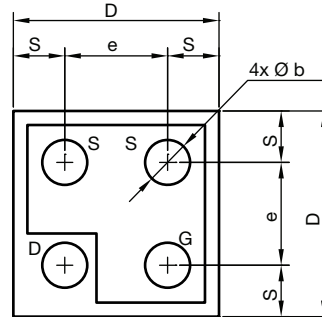
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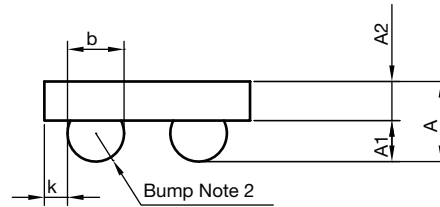
# MICRO FOOT®: 4-Bump (0.8 mm x 0.8 mm, 0.4 mm Pitch)



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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