N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω) MAX.	I_D (A) [a]	Q_g (TYP.)
20	0.037 at V_{GS} = 4.5 V	5.7	5.9 nC
	0.041 at V_{GS} = 2.5 V	5.4	
	0.047 at V_{GS} = 1.8 V	5.0	
	0.068 at V_{GS} = 1.5 V	4.2	

FEATURES

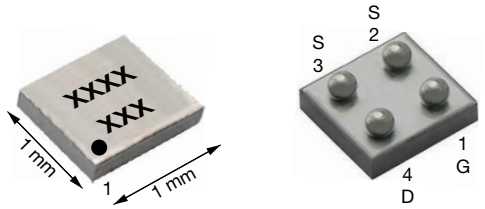
- TrenchFET® power MOSFET
- Ultra small 1 mm x 1 mm maximum outline
- Ultra-thin 0.548 mm maximum height
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

HALOGEN FREE

MICRO FOOT® 1 x 1



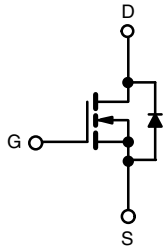
Backside View | Bump Side View

Marking Code: xxxx = 8410
xxx = Date / lot traceability code

Ordering Information:
Si8410DB-T2-E1 (lead (Pb)-free and halogen-free)

APPLICATIONS

- Load switch
- Power management
- High speed switching



N-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}	± 8	
Continuous Drain Current (T_J = 150 °C)	T_A = 25 °C	I_D	5.7 [a]	A
	T_A = 70 °C		4.5 [a]	
	T_A = 25 °C		3.8 [c]	
	T_A = 70 °C		3.0 [c]	
Pulsed Drain Current (t = 100 µs)		I_{DM}	20	
Continuous Source-Drain Diode Current	T_C = 25 °C	I_S	1.5 [a]	
	T_A = 25 °C		0.65 [c]	
Maximum Power Dissipation	T_A = 25 °C	P_D	1.8 [a]	W
	T_A = 70 °C		1.1 [a]	
	T_A = 25 °C		0.78 [c]	
	T_A = 70 °C		0.5 [c]	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to +150	°C
Package Reflow Conditions [e]	VPR		260	
	IR/Convection		260	

THERMAL RESISTANCE RATINGS					
PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum Junction-to-Ambient [a, b]	t = 10 s	R_{thJA}	55	70	°C/W
Maximum Junction-to-Ambient [c, d]	t = 10 s		125	160	

Notes

a. Surface mounted on 1" x 1" FR4 board with full copper, t = 10 s, T_A = 25 °C.
b. Maximum under steady state conditions is 100 °C/W.
c. Surface mounted on 1" x 1" FR4 board with minimum copper, t = 10 s.
d. Maximum under steady state conditions is 190 °C/W.
e. Refer to IPC/JEDEC® (J-STD-020), no manual or hand soldering.
f. In this document, any reference to case represents the body of the MICRO FOOT device and foot is the bump.

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	20	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA	-	17	-	mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		-	-2.6	-	
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	0.4	-	0.85	V
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 8 V	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V	-	-	1	µA
		V_{DS} = 20 V, V_{GS} = 0 V, T_J = 70 °C	-	-	10	
On-State Drain Current [a]	$I_{D(on)}$	$V_{DS} \leq$ -5 V, V_{GS} = 4.5 V	10	-	-	A
Drain-Source On-State Resistance [a]	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 1.5 A	-	0.030	0.037	Ω
		V_{GS} = 2.5 V, I_D = 1 A	-	0.033	0.041	
		V_{GS} = 1.8 V, I_D = 1 A	-	0.038	0.047	
		V_{GS} = 1.5 V, I_D = 0.5 A	-	0.044	0.068	
Forward Transconductance [a]	g_{fs}	V_{DS} = 10 V, I_D = 1.5 A	-	17	-	S
Dynamic [b]						
Input Capacitance	C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	-	620	-	pF
Output Capacitance	C_{oss}		-	110	-	
Reverse Transfer Capacitance	C_{rss}		-	40	-	
Total Gate Charge	Q_g	V_{DS} = 10 V, V_{GS} = 8 V, I_D = 1.5 A	-	10.4	16	nC
		V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 1.5 A	-	5.9	9	
Gate-Source Charge	Q_{gs}		-	0.7	-	
Gate-Drain Charge	Q_{gd}		-	0.66	-	
Gate Resistance	R_g	V_{GS} = 0.1 V, f = 1 MHz	-	5.3	-	Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = -10 V, R_L = 6.7 Ω $I_D \cong$ 1.5 A, V_{GEN} = -4.5 V, R_g = 1 Ω	-	5	10	ns
Rise Time	t_r		-	25	50	
Turn-Off Delay Time	$t_{d(off)}$		-	26	50	
Fall Time	t_f		-	10	20	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = -10 V, R_L = 6.7 Ω $I_D \cong$ -1.5 A, V_{GEN} = -8 V, R_g = 1 Ω	-	5	10	
Rise Time	t_r		-	22	45	
Turn-Off Delay Time	$t_{d(off)}$		-	23	45	
Fall Time	t_f		-	10	20	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	T_A = 25 °C	-	-	1.5	A
Pulse Diode Forward Current	I_{SM}		-	-	20	
Body Diode Voltage	V_{SD}	I_S = 1.5 A, V_{GS} = 0	-	0.7	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	I_F = 1.5 A, dI/dt = 100 A/µs, T_J = 25 °C	-	15	30	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	6	15	nC
Reverse Recovery Fall Time	t_a		-	8.5	-	ns
Reverse Recovery Rise Time	t_b		-	6.5	-	

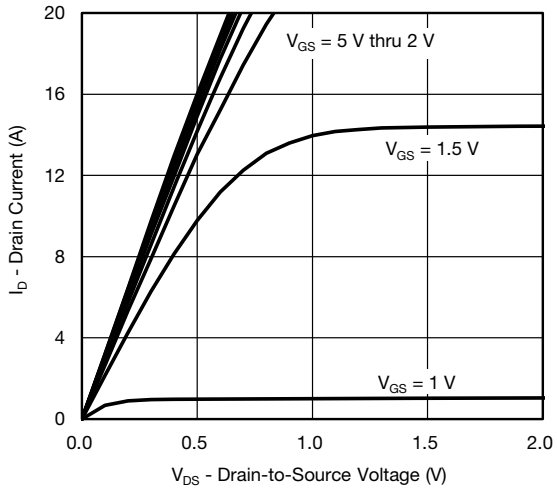
Notes

a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.

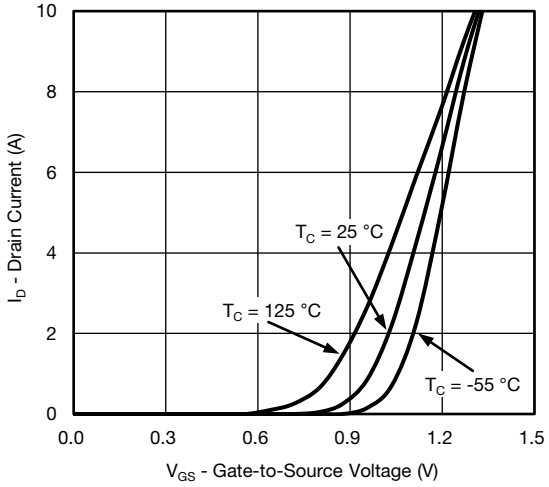
b. Guaranteed by design, not subject to production testing.

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.

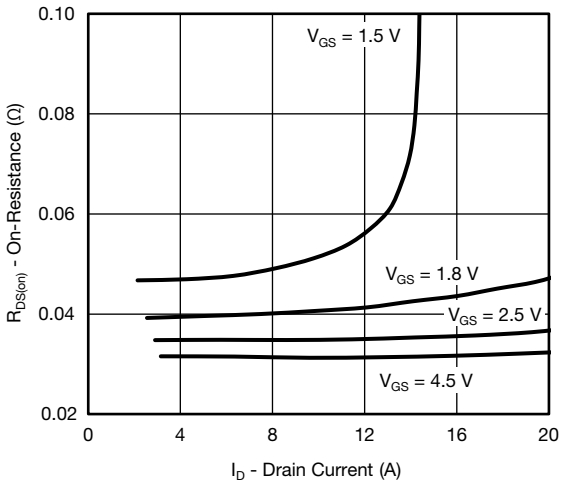
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



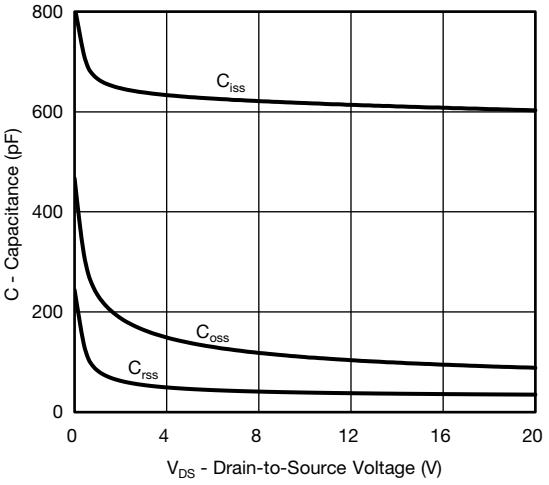
Output Characteristics



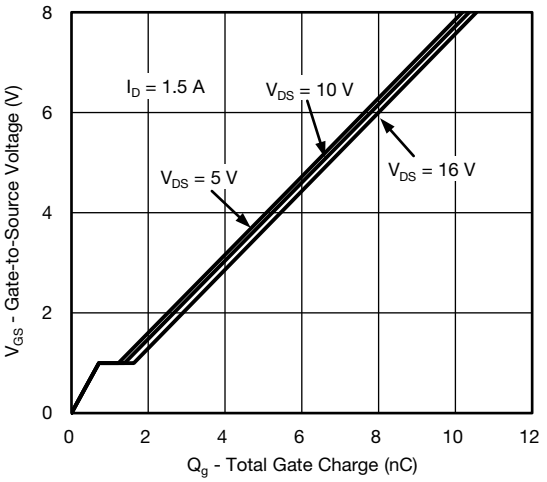
Transfer Characteristics



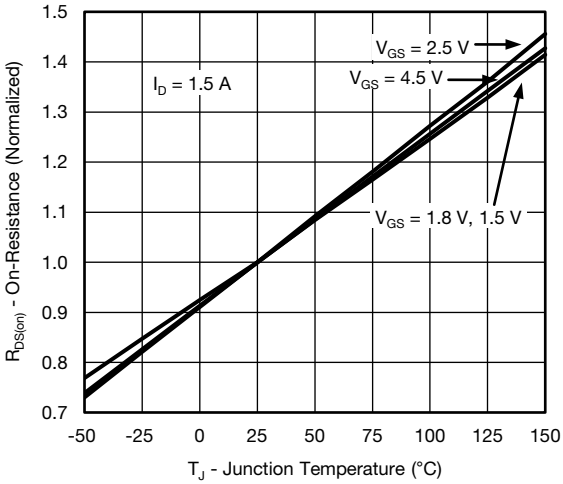
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

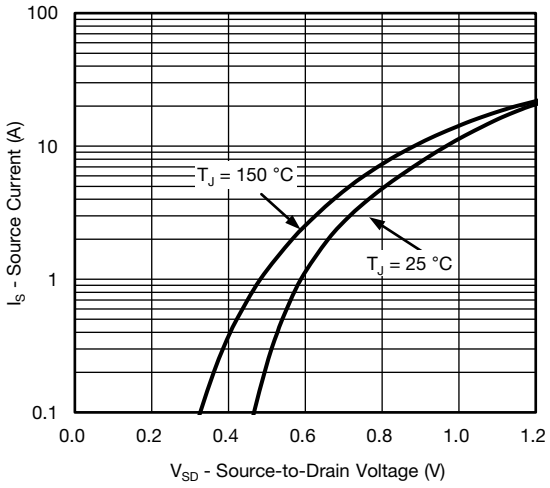


Gate Charge

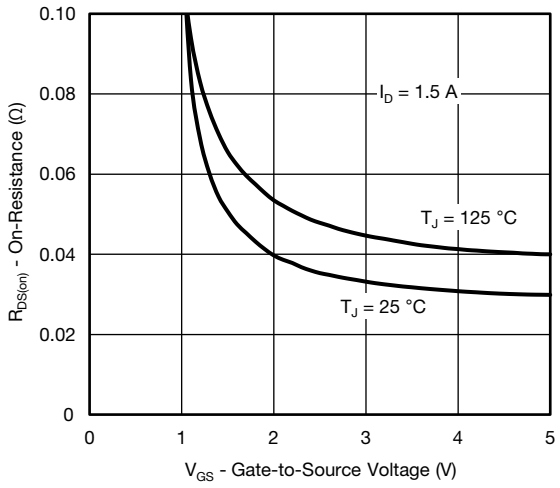


On-Resistance vs. Junction Temperature

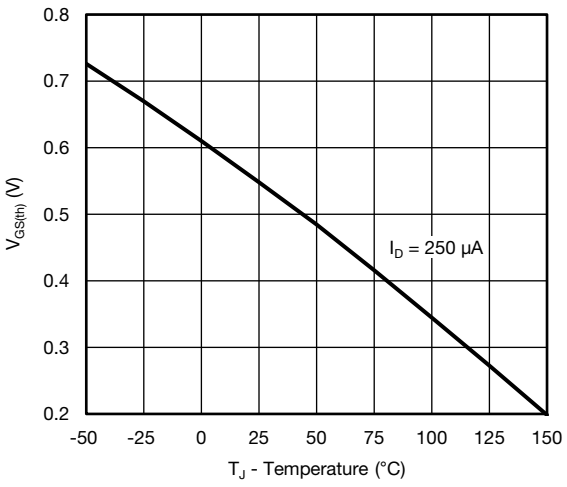
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



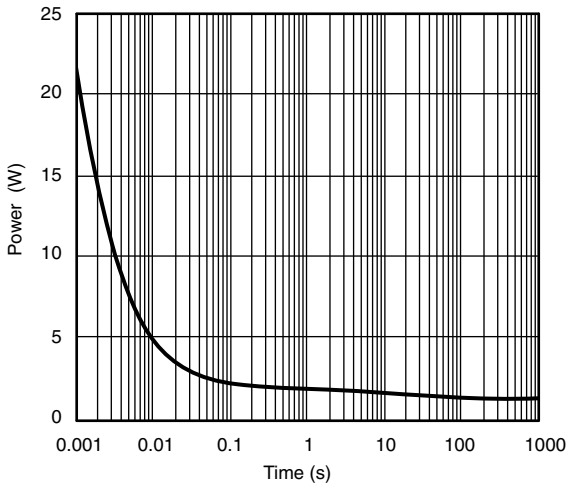
Source-Drain Diode Forward Voltage



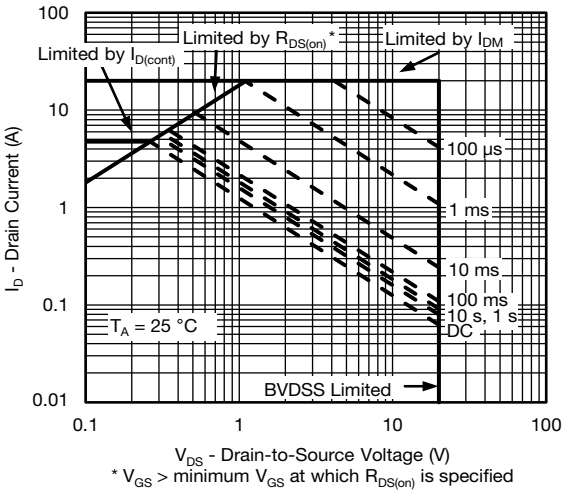
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

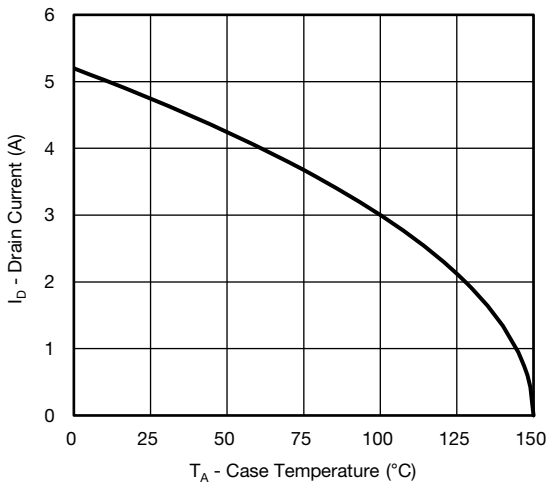


Single Pulse Power, Junction-to-Ambient

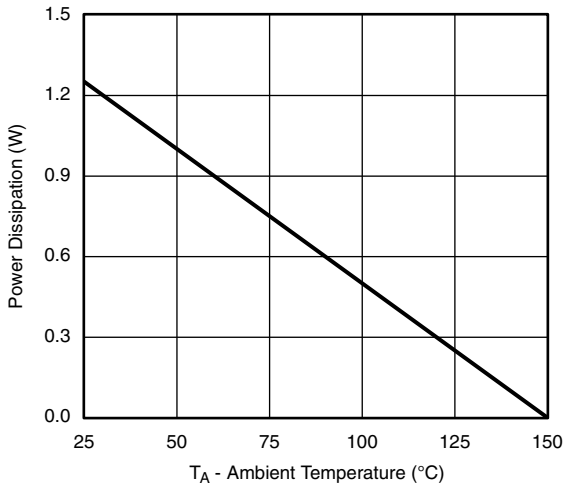


Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating [a]



Power Derating

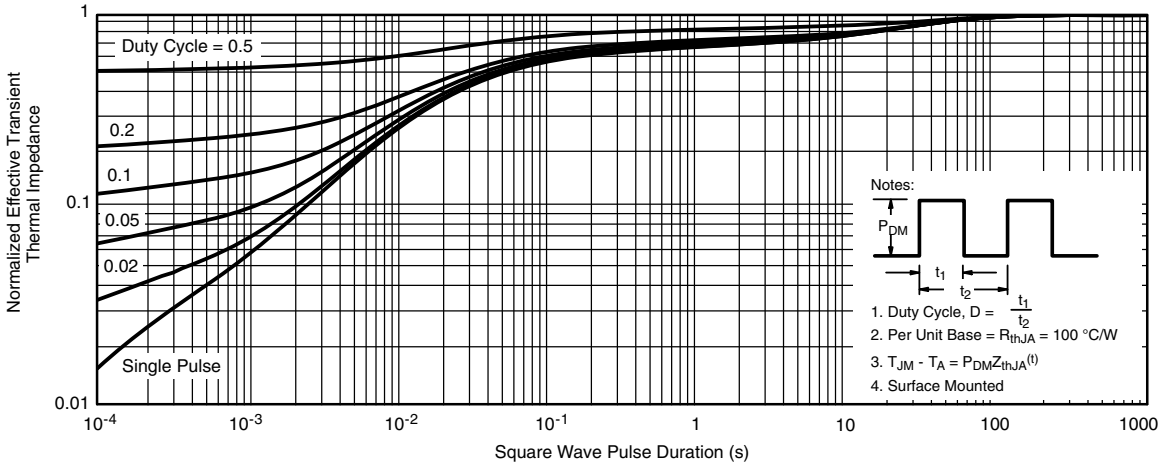
Note

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

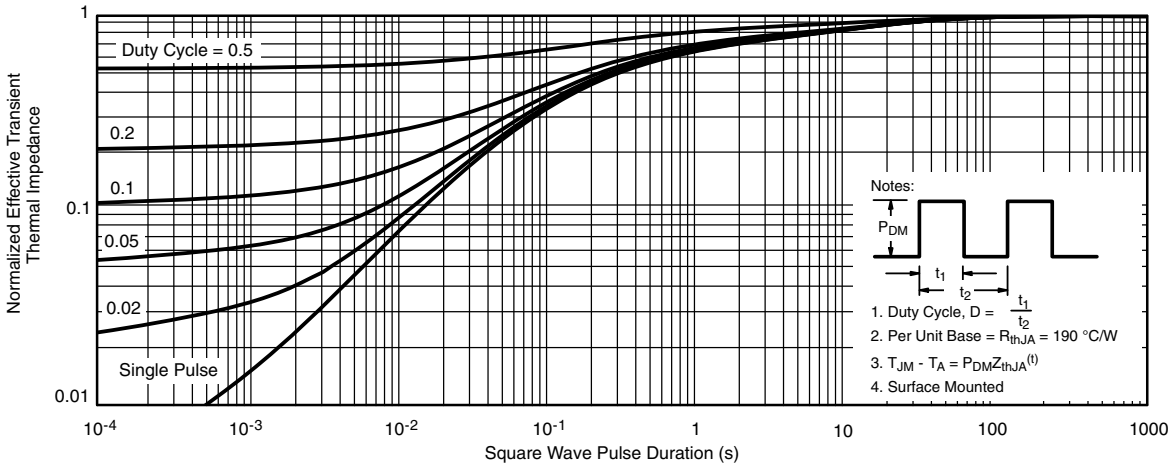
Note

a. 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)



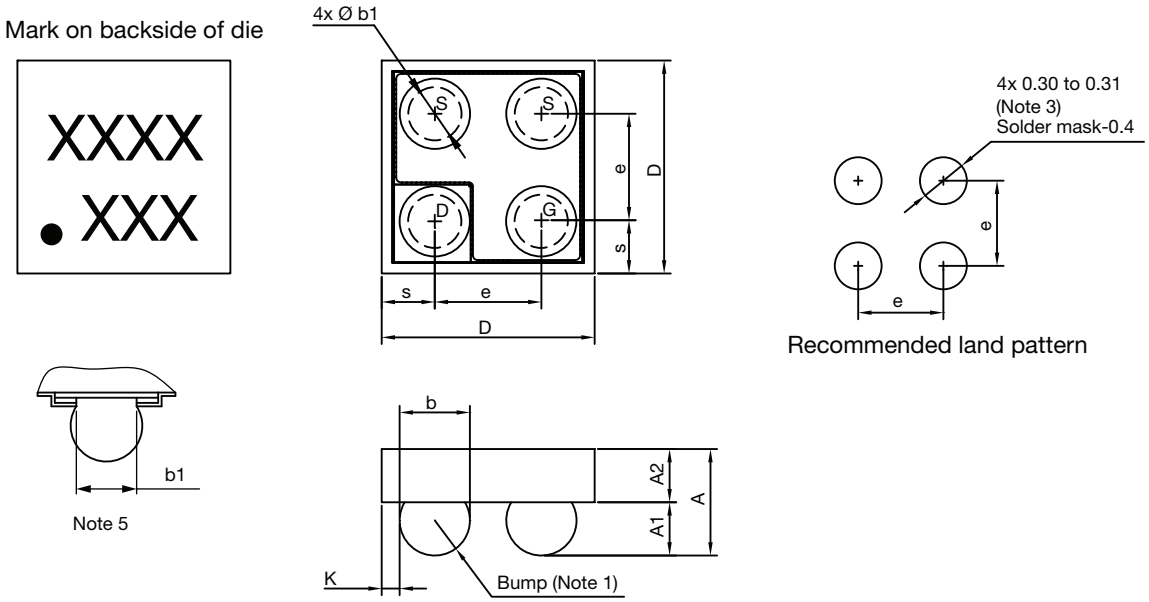
Normalized Thermal Transient Impedance, Junction-to-Ambient (1" x 1" FR4 Board with Full Copper)



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

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?62961.

MICRO FOOT®: 4-Bumps
(1 mm x 1 mm, 0.5 mm Pitch, 0.286 mm Bump Height)



Notes

1. Bumps are 95.5/3.8/0.7 Sn/Ag/Cu.
2. Backside surface is coated with a Ti/Ni/Ag layer.
3. Non-solder mask defined copper landing pad.
4. Laser mark on the backside surface of die.
5. “b1” is the diameter of the solderable substrate surface, defined by an opening in the solder resist layer solder mask defined.
6. • is the location of pin 1

DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.458	0.504	0.550	0.0180	0.0198	0.0217
A1	0.214	0.250	0.286	0.0084	0.0098	0.0113
A2	0.244	0.254	0.264	0.0096	0.0100	0.0104
b	0.297	0.330	0.363	0.0117	0.0130	0.0143
b1		0.250			0.0098	
e		0.500			0.0197	
s	0.210	0.230	0.250	0.0083	0.0091	0.0096
D	0.920	0.960	1.000	0.0362	0.0378	0.0394
K	0.029	0.065	0.102	0.0011	0.0026	0.0040

Note

- Use millimeters as the primary measurement.

ECN: T15-0176-Rev. A, 27-Apr-15
DWG: 6039

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.