N-Channel 1.5-V (G-S) MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)[a]	Q_g (Typ.)
8	0.031 at V_{GS} = 4.5 V	12.2	20 nC
	0.033 at V_{GS} = 2.5 V	11.6	
	0.035 at V_{GS} = 1.8 V	11.2	
	0.043 at V_{GS} = 1.5 V	10.2	

FEATURES

- TrenchFET® Power MOSFET
- Industry First 1.5 V Rated MOSFET
- Ultra Small MICRO FOOT® Chipscale Packaging Reduces Footprint Area, Profile (0.62 mm) and On-Resistance Per Footprint Area

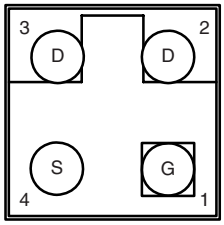
Pb-free
RoHS COMPLIANT

APPLICATIONS

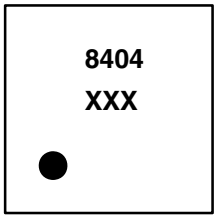
- Low Threshold Load Switch for Portable Devices
  - Low Power Consumption
  - Increased Battery Life

MICRO FOOT

Bump Side View

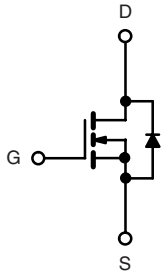


Backside View



Device Marking: 8404
xxx = Date/Lot Traceability Code

Ordering Information: Si8404DB-T1-E1 (Lead (Pb)-free)



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T_A = 25 °C, unless otherwise noted				
Parameter		**Symbol**	**Limit**	**Unit**
Drain-Source Voltage		V_{DS}	8	V
Gate-Source Voltage		V_{GS}	± 5	
Continuous Drain Current (T_J = 150 °C)	T_C = 25 °C	I_D	12.2	A
	T_C = 70 °C		9.8	
	T_A = 25 °C		8.1[b,c]	
	T_A = 70 °C		6.5[b,c]	
Pulsed Drain Current		I_{DM}	20	
Continuous Source-Drain Diode Current	T_C = 25 °C	I_S	5.2	
	T_A = 25 °C		2.3[b,c]	
Maximum Power Dissipation	T_C = 25 °C	P_D	6.25	W
	T_C = 70 °C		4	
	T_A = 25 °C		2.78[b,c]	
	T_A = 70 °C		1.78[b,c]	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150	°C
Package Reflow Conditions[d]	IR/Convection		260	

Notes:
a. Based on T_C = 25 °C.
b. Surface Mounted on 1" x 1" FR4 board.
c. t = 10 s.
d. Refer to IPC/JEDEC (J-STD-020C), no manual or hand soldering.
e. In this document, any reference to the Case represents the body of the MICRO FOOT device and Foot is the bump.

THERMAL RESISTANCE RATINGS					
Parameter		**Symbol**	**Typical**	**Maximum**	**Unit**
Maximum Junction-to-Ambient[a b]		R_{thJA}	35	45	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	16	20	

Notes:
a. Surface Mounted on 1" x 1" FR4 board.
b. Maximum under steady state conditions is 72 °C/W.

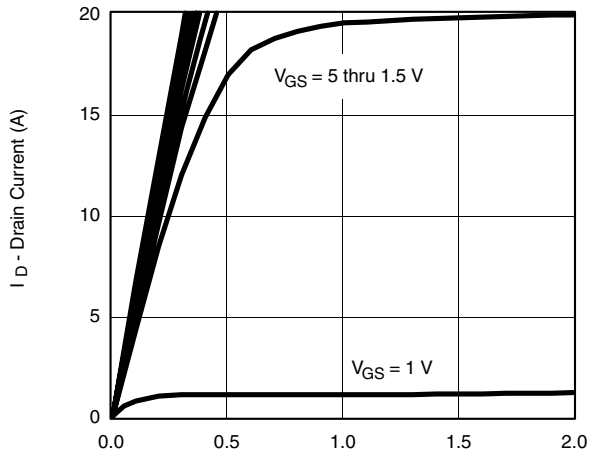
SPECIFICATIONS T_J = 25 °C, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	8			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA		8.9		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 2.5		
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	0.35		1.0	V
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = 5 V			100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 8 V, V_{GS} = 0 V			1	µA
		V_{DS} = 8 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	20			A
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 1 A		0.025	0.031	Ω
		V_{GS} = 2.5 V, I_D = 1 A		0.027	0.033	
		V_{GS} = 1.8 V, I_D = 1 A		0.029	0.035	
		V_{GS} = 1.5 V, I_D = 1 A		0.032	0.043	
Forward Transconductance[a]	g_{fs}	V_{DS} = 4 V, I_D = 1 A		8.3	13	S
Dynamic[b]						
Input Capacitance	C_{iss}	V_{DS} = 4 V, V_{GS} = 0 V, f = 1 MHz		1950		pF
Output Capacitance	C_{oss}			610		
Reverse Transfer Capacitance	C_{rss}			350		
Total Gate Charge	Q_g	V_{DS} = 4 V, V_{GS} = 5 V, I_D = 1 A		22	33	nC
		V_{DS} = 4 V, V_{GS} = 4.5 V, I_D = 1 A		20	30	
Gate-Source Charge	Q_{gs}			3.5		
Gate-Drain Charge	Q_{gd}			1.8		
Gate Resistance	R_g	V_{GS} = 0.1 V, f = 1 MHz		13		Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 4 V, R_L = 4 Ω $I_D \cong$ 1 A, V_{GEN} = - 4.5 V, R_g = 1 Ω		8	12	ns
Rise Time	t_r			12	18	
Turn-Off Delay Time	$t_{d(off)}$			110	165	
Fall Time	t_f			40	60	

SPECIFICATIONS T_J = 25 °C, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	T_C = 25 °C			6.25	A
Pulse Diode Forward Current	I_{SM}				20	
Body Diode Voltage	V_{SD}	I_S = 1 A, V_{GS} = 0 V		0.6	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	I_F = - 1 A, dI/dt = 100 A/µs, T_J = 25 °C		104	156	ns
Body Diode Reverse Recovery Charge	Q_{rr}			88	132	nC
Reverse Recovery Fall Time	t_a			26		ns
Reverse Recovery Rise Time	t_b			78		

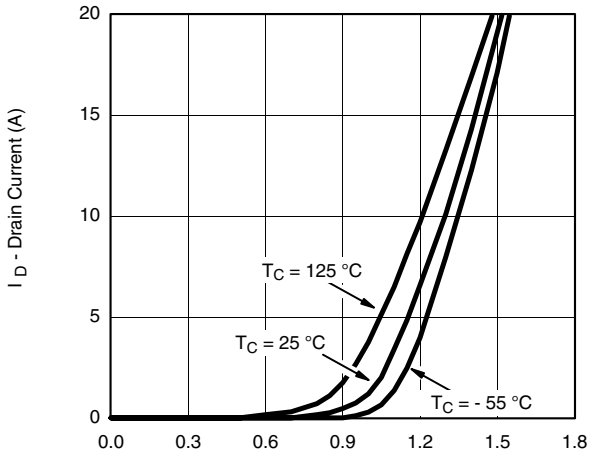
Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

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 T_A = 25 °C, unless otherwise noted

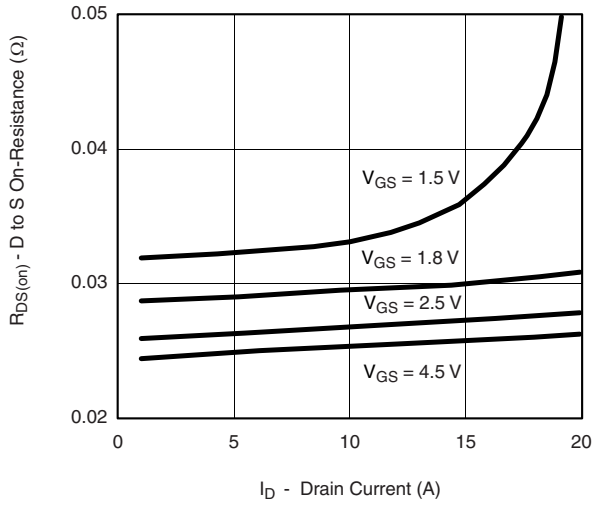


Output Characteristics

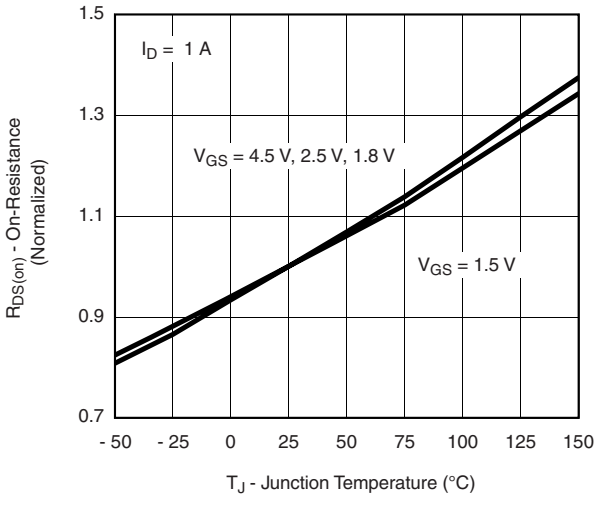


Transfer Characteristics

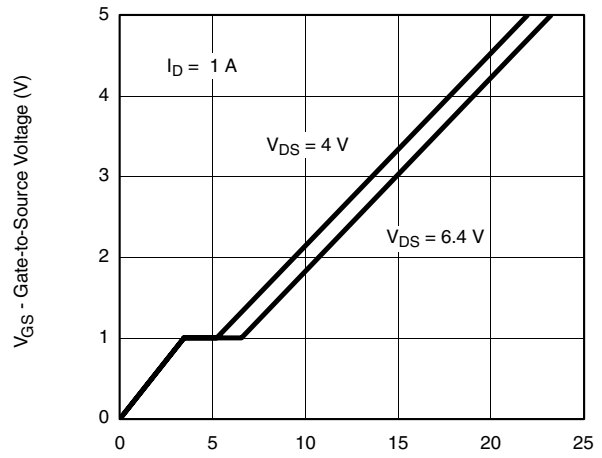
TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



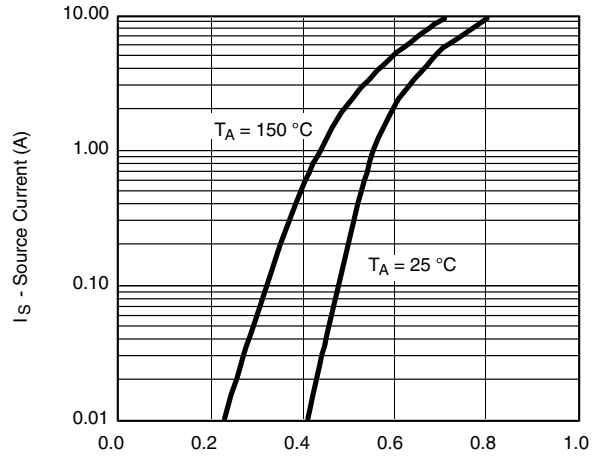
$R_{DS(on)}$ vs. Drain Current



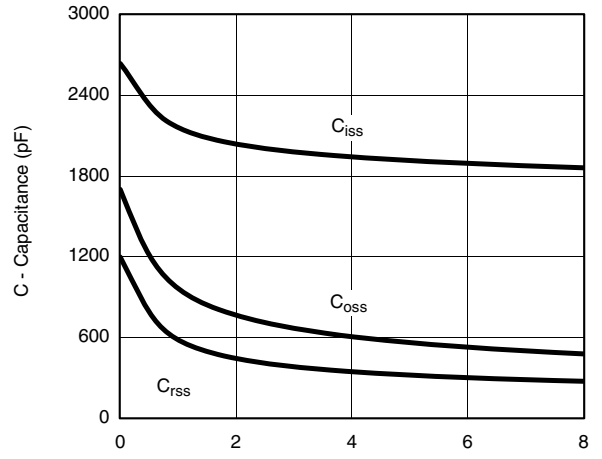
On-Resistance vs. Junction Temperature



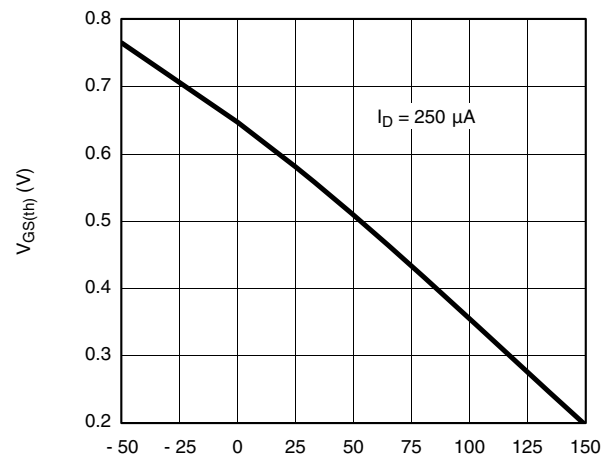
Gate Charge



Forward Diode Voltage vs Temp

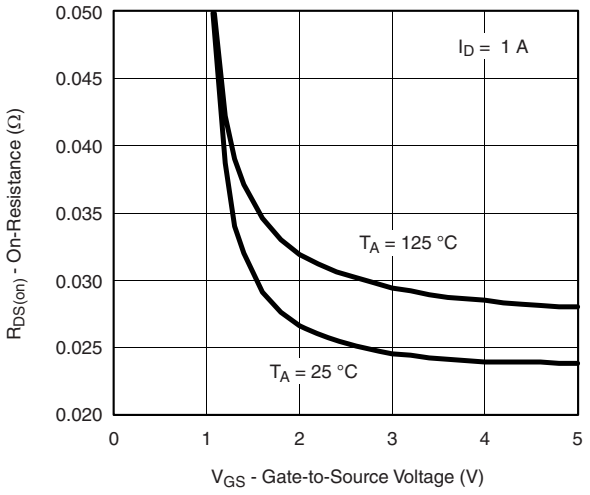


Capacitance

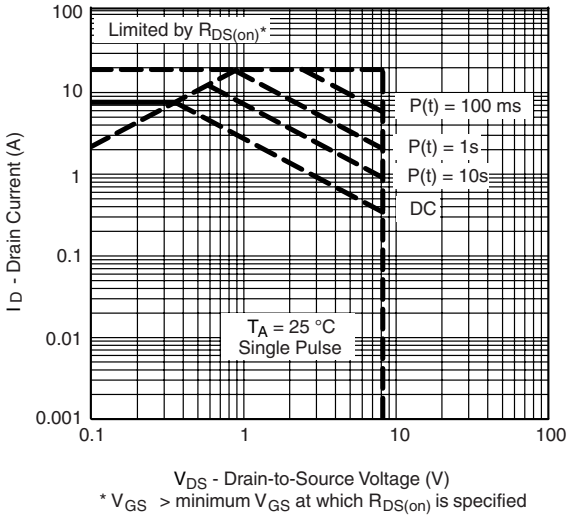


Threshold Voltage

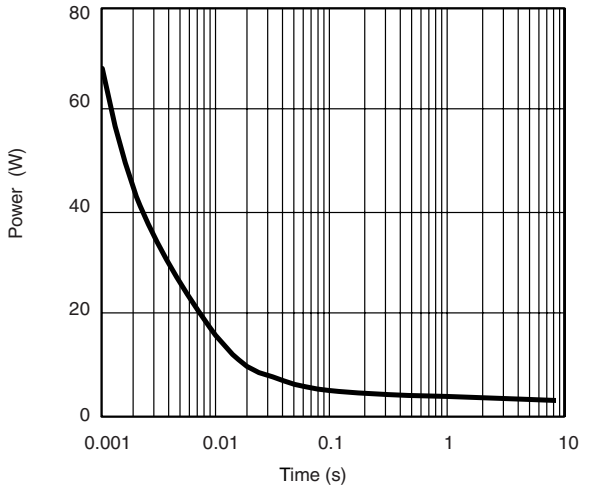
TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



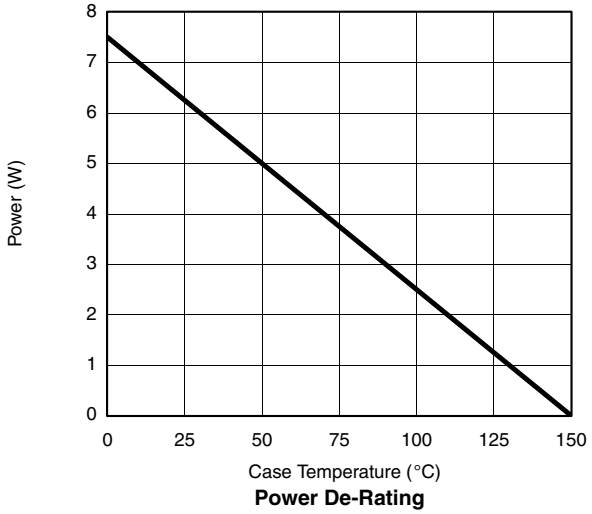
$R_{DS(on)}$ vs V_{GS} vs Temperature



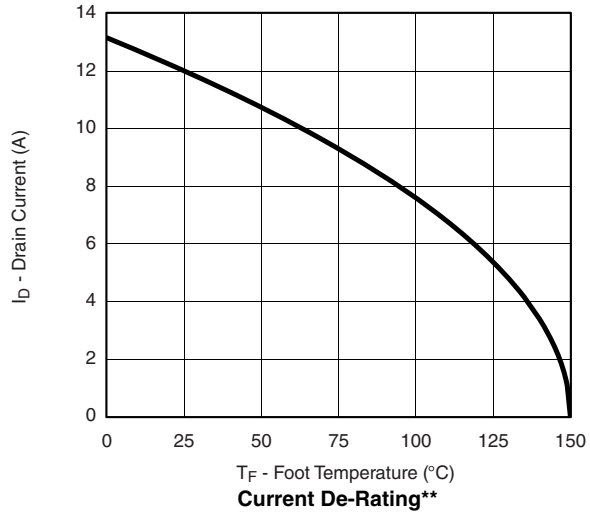
Safe Operating Area, Junction-to-Ambient



Single Pulse Power, Junction-to-Ambient



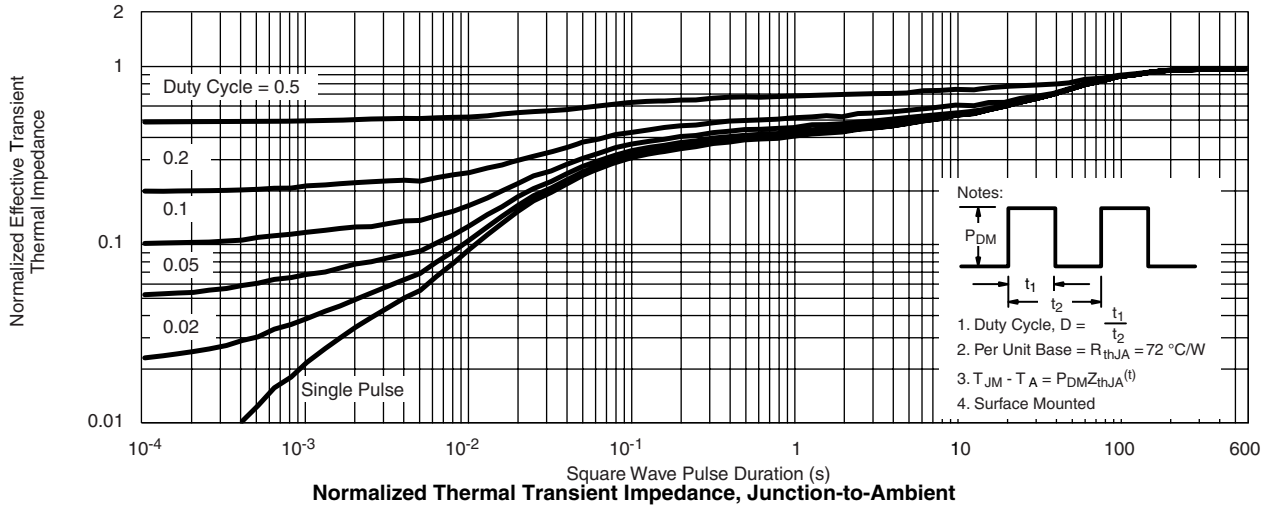
Power De-Rating



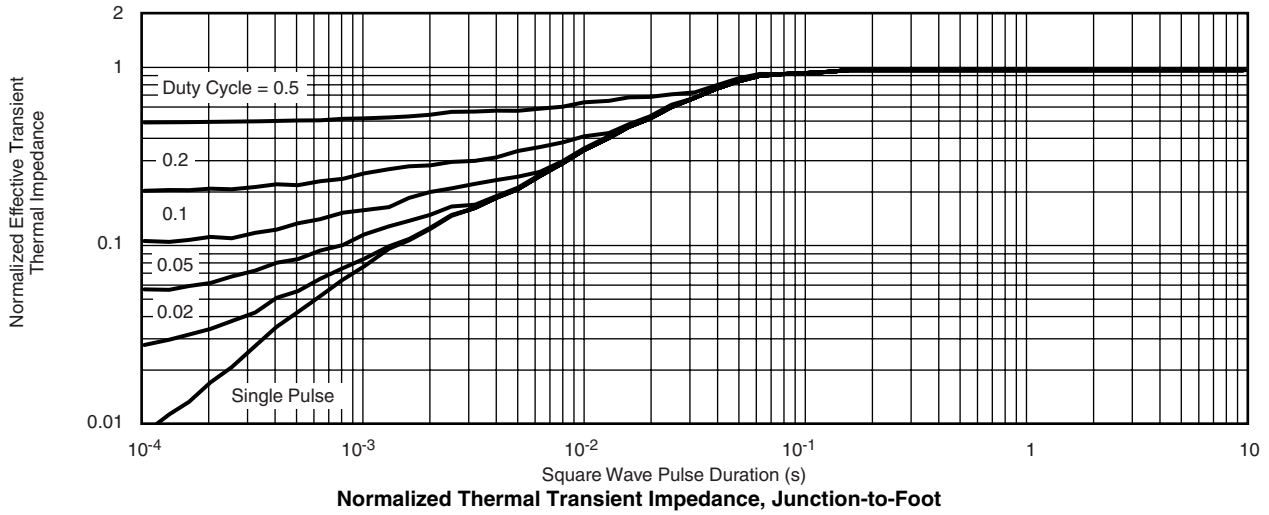
Current De-Rating**

** The power dissipation P_D is based on $T_{J(max)}$ = 150 °C, using junction-to-foot 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 T_A = 25 °C, unless otherwise noted



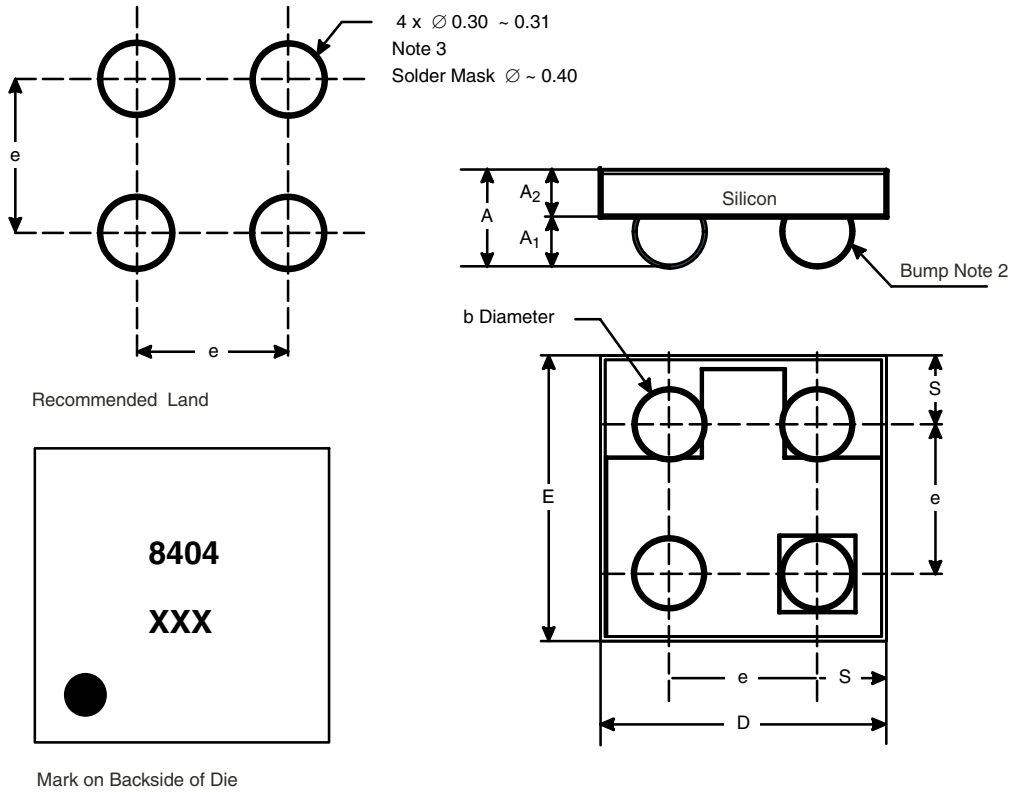
Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

PACKAGE OUTLINE

MICRO FOOT: 4-BUMP (2 x 2, 0.8-mm PITCH)



Notes (Unless Otherwise Specified):
1. Laser mark on the silicon die back, coated with a thin metal.
2. Bumps are 95.5/3.8/0.7 Sn/Ag/Cu.
3. Non-solder mask defined copper landing pad.
4. The flat side of wafers is oriented at the bottom.

Dim.	Millimeters[a]		Inches	
	Min.	Max.	Min.	Max.
A	0.600	0.650	0.0236	0.0256
A_1	0.260	0.290	0.0102	0.0114
A_2	0.340	0.360	0.0134	0.0142
b	0.370	0.410	0.0146	0.0161
D	1.520	1.600	0.0598	0.0630
E	1.520	1.600	0.0598	0.0630
e	0.750	0.850	0.0295	0.0335
S	0.370	0.380	0.0146	0.0150

Notes:
a. Use millimeters as the primary measurement.

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