

## P-Channel 1.5-V (G-S) MOSFET

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)
- 20	0.041 at V <sub>GS</sub> = - 4.5 V	- 10.0	22 nC
	0.048 at V <sub>GS</sub> = - 2.5 V	- 9.32	
	0.058 at V <sub>GS</sub> = - 1.8 V	- 8.48	
	0.075 at V <sub>GS</sub> = - 1.5 V	- 7.45	

### FEATURES

- TrenchFET<sup>®</sup> Power MOSFET
- Ultra Small MICRO FOOT<sup>®</sup> Chipscale Packaging Reduces Footprint Area, Profile (0.62 mm) and On-Resistance Per Footprint Area

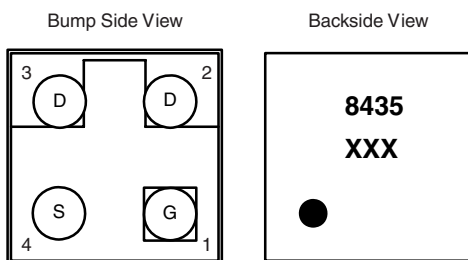


**RoHS**  
COMPLIANT

### APPLICATIONS

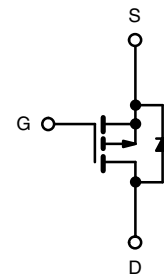
- Low Threshold Load Switch for Portable Devices
  - Low Power Consumption
  - Increased Battery Life

### MICRO FOOT



**Device Marking:** 8435  
xxx = Date/Lot Traceability Code

**Ordering Information:** Si8435DB-T1-E1 (Lead (Pb)-free)



P-Channel MOSFET

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>	± 5		
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	- 10.0	
		T <sub>C</sub> = 70 °C	- 8.06	
		T <sub>A</sub> = 25 °C	- 6.72 <sup>b,c</sup>	
		T <sub>A</sub> = 70 °C	- 5.37 <sup>b,c</sup>	
Pulsed Drain Current	I <sub>DM</sub>	- 15	A	
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C		- 5.21
		T <sub>A</sub> = 25 °C	- 2.31 <sup>b,c</sup>	
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	6.25	
		T <sub>C</sub> = 70 °C	4.0	
		T <sub>A</sub> = 25 °C	2.78 <sup>b,c</sup>	
		T <sub>A</sub> = 70 °C	1.78 <sup>b,c</sup>	
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C
Package Reflow Conditions <sup>d</sup>	IR/Convection	260		

Notes:

- Based on T<sub>C</sub> = 25 °C.
- Surface Mounted on 1" x 1" FR4 board.
- t = 10 s.
- Refer to IPC/JEDEC (J-STD-020C), no manual or hand soldering.
- 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 <sup>a,b</sup>	$R_{thJA}$	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**  $T_J = 25\text{ °C}$ , unless otherwise noted

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	- 20			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		- 15.5		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			2.5		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	- 0.35		- 1.0	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 5\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$			- 1	$\mu\text{A}$
		$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, T_J = 70\text{ °C}$			- 10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq -5\text{ V}, V_{GS} = -4.5\text{ V}$	- 15			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -1\text{ A}$		0.034	0.041	$\Omega$
		$V_{GS} = -2.5\text{ V}, I_D = -1\text{ A}$		0.040	0.048	
		$V_{GS} = -1.8\text{ V}, I_D = -1\text{ A}$		0.048	0.058	
		$V_{GS} = -1.5\text{ V}, I_D = -1\text{ A}$		0.055	0.075	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -10\text{ V}, I_D = -1\text{ A}$		10.5	16	S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		1600		pF
Output Capacitance	$C_{oss}$			265		
Reverse Transfer Capacitance	$C_{rss}$			175		
Total Gate Charge	$Q_g$	$V_{DS} = -10\text{ V}, V_{GS} = -5\text{ V}, I_D = -1\text{ A}$		23	35	nC
				22	33	
Gate-Source Charge	$Q_{gs}$	$V_{DS} = -16\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -1\text{ A}$		3.25		
Gate-Drain Charge	$Q_{gd}$			1.95		
Gate Resistance	$R_g$	$V_{GS} = -0.1\text{ V}, f = 1\text{ MHz}$		20		$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 10\text{ }\Omega$ $I_D \equiv -1\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\text{ }\Omega$		15	23	ns
Rise Time	$t_r$			29	44	
Turn-Off Delay Time	$t_{d(off)}$			230	345	
Fall Time	$t_f$			91	137	

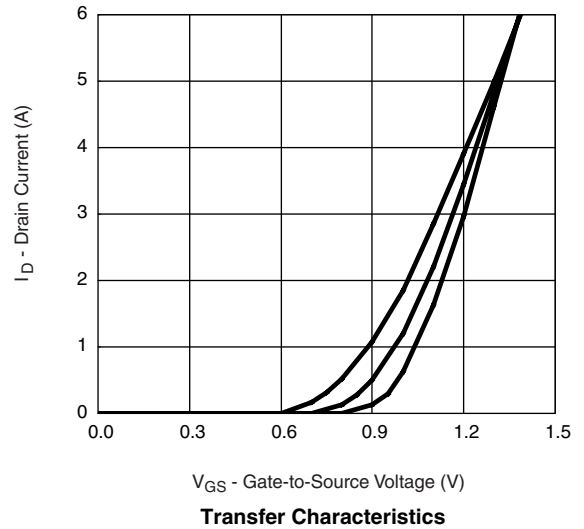
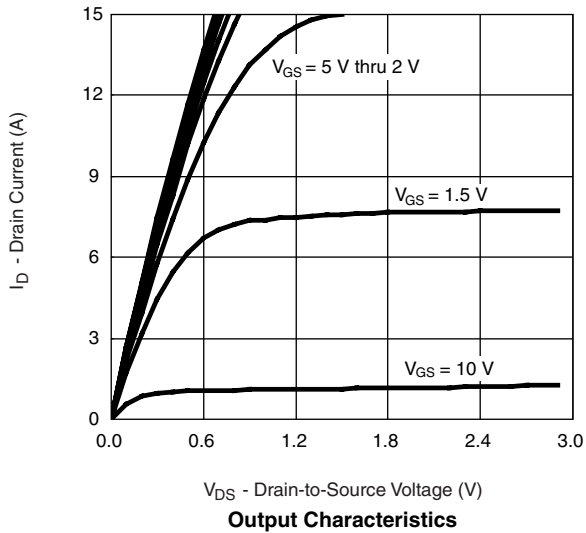
<b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			- 5.21	A
Pulse Diode Forward Current	$I_{SM}$				- 15	
Body Diode Voltage	$V_{SD}$	$I_S = -1\text{ A}, V_{GS} = 0\text{ V}$		0.6	1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = -1\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		116	174	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			203	305	nC
Reverse Recovery Fall Time	$t_a$			45		ns
Reverse Recovery Rise Time	$t_b$			71		

Notes:

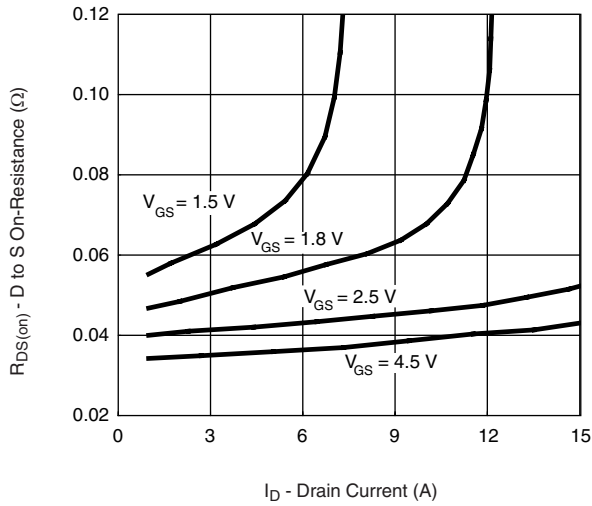
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- b. Guaranteed by design, not subject to production testing.

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.

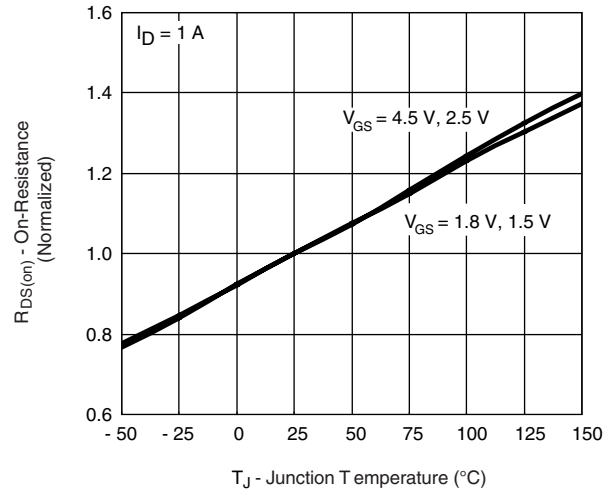
**TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



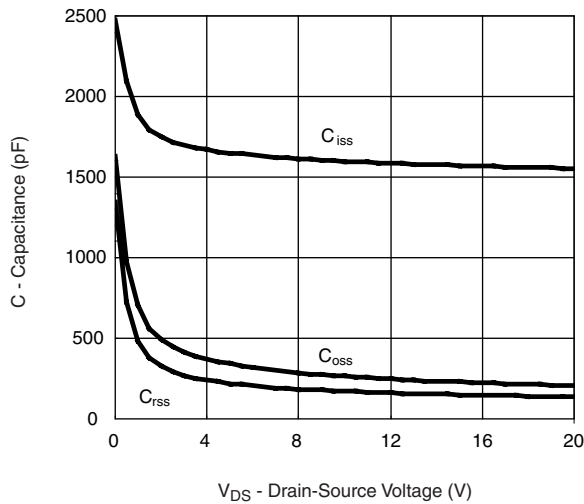
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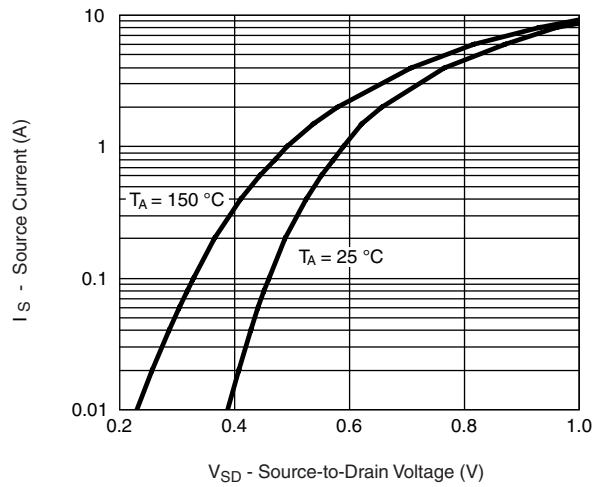
**$R_{DS(on)}$  vs. Drain Current**



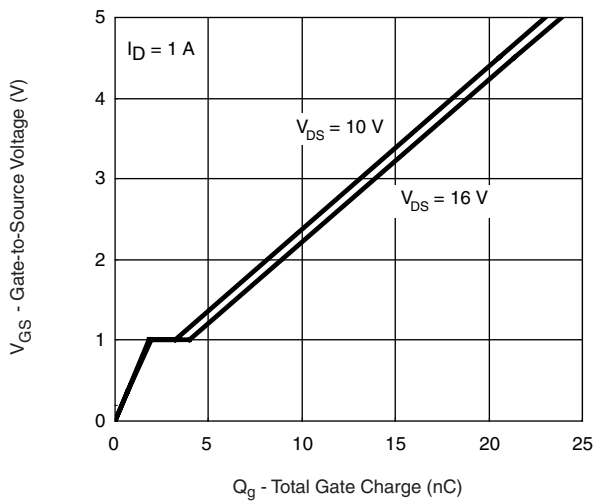
**On-Resistance vs. Junction Temperature**



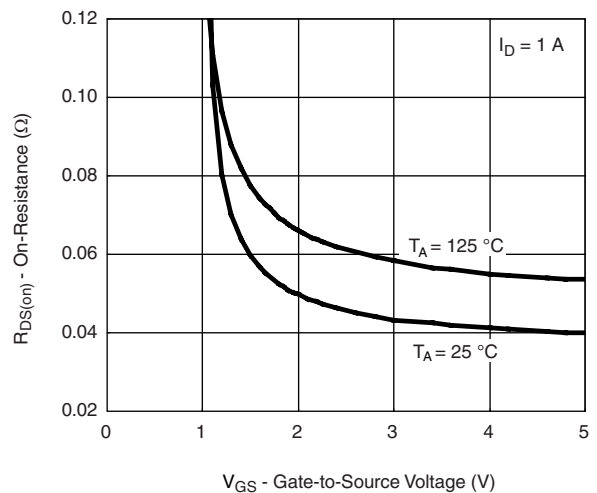
**Capacitance**



**Forward Diode Voltage vs. Temp.**

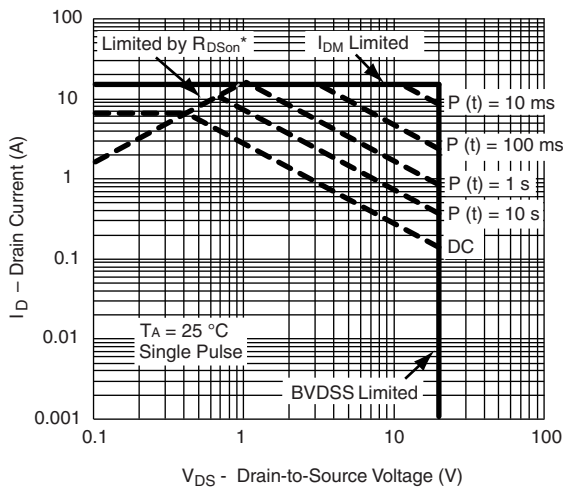
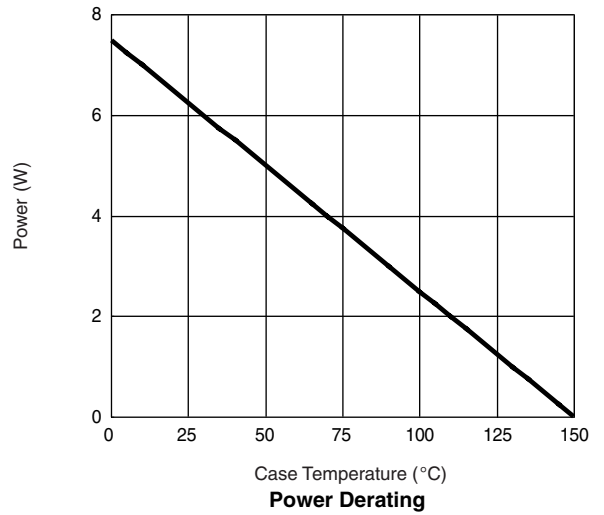
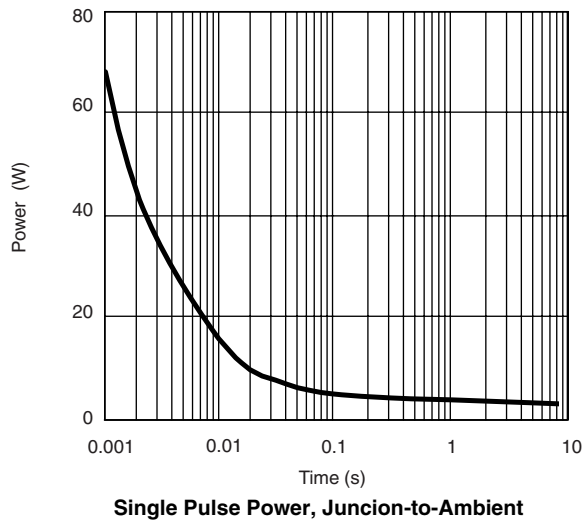
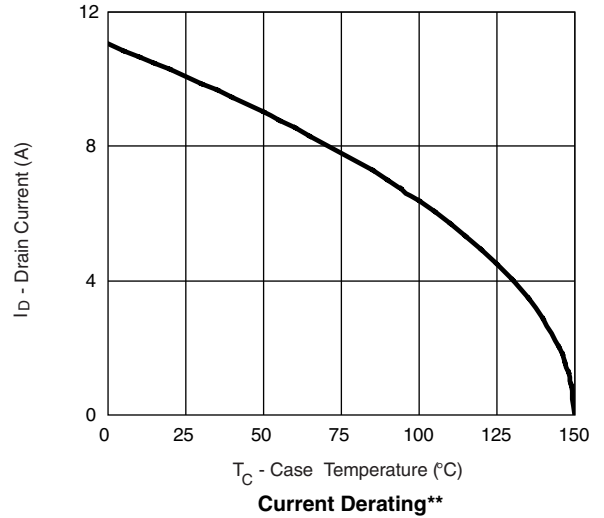
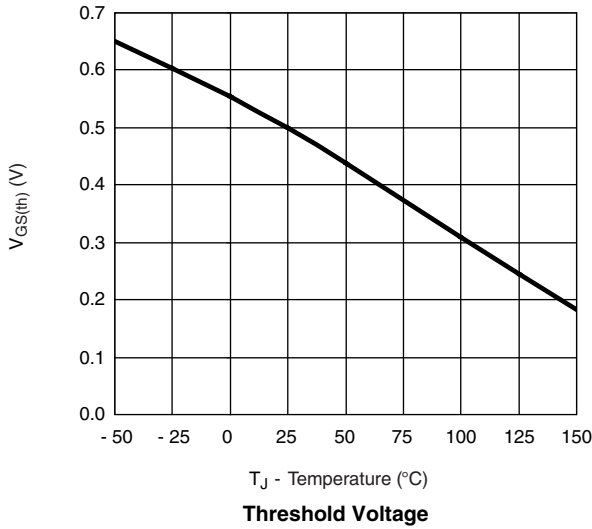


**Gate Charge**



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

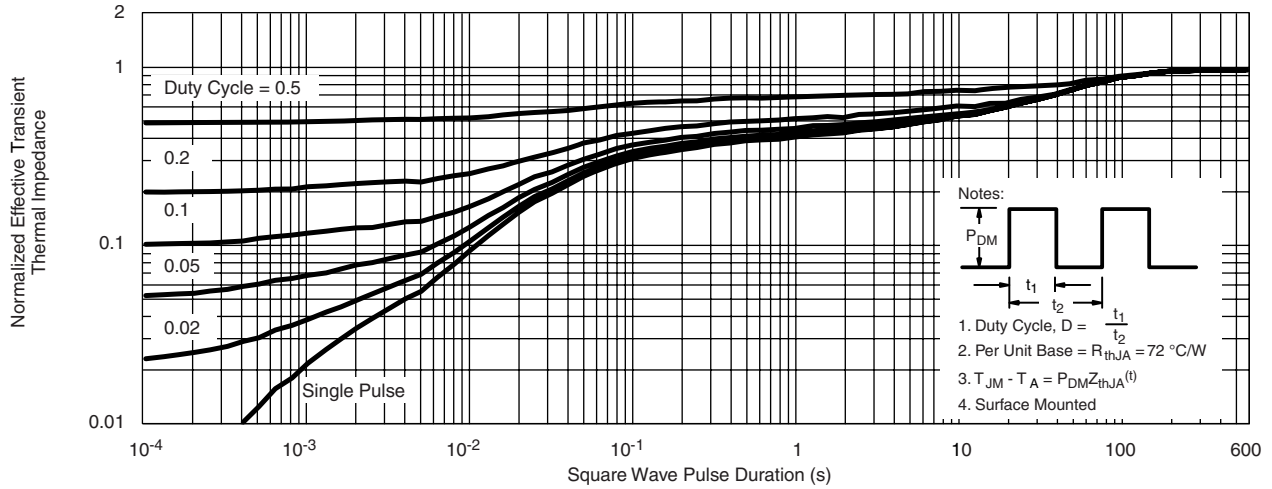
**TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



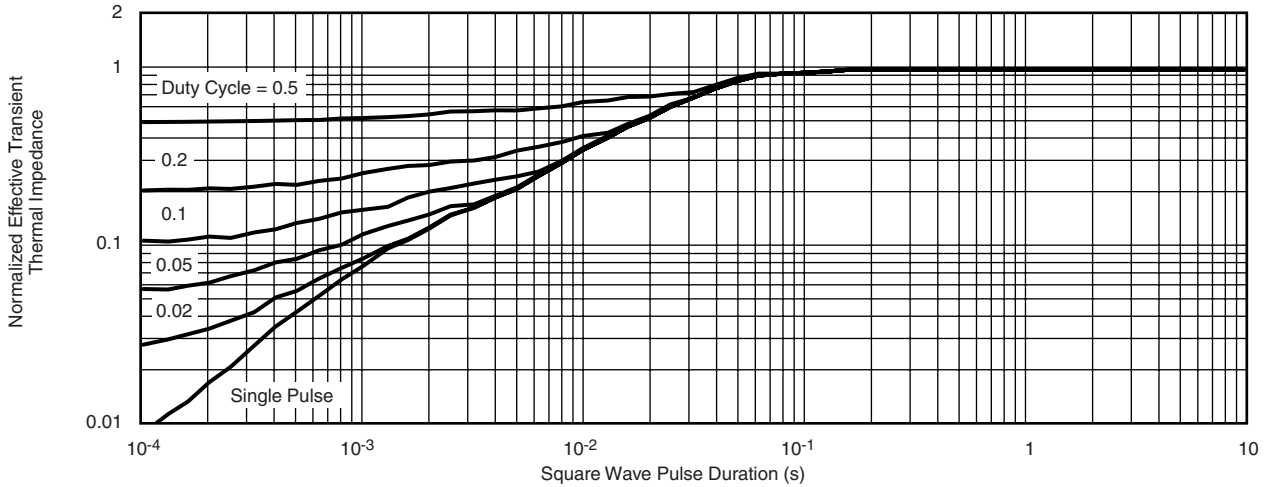
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

\*\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150\text{ }^\circ\text{C}$ , 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**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



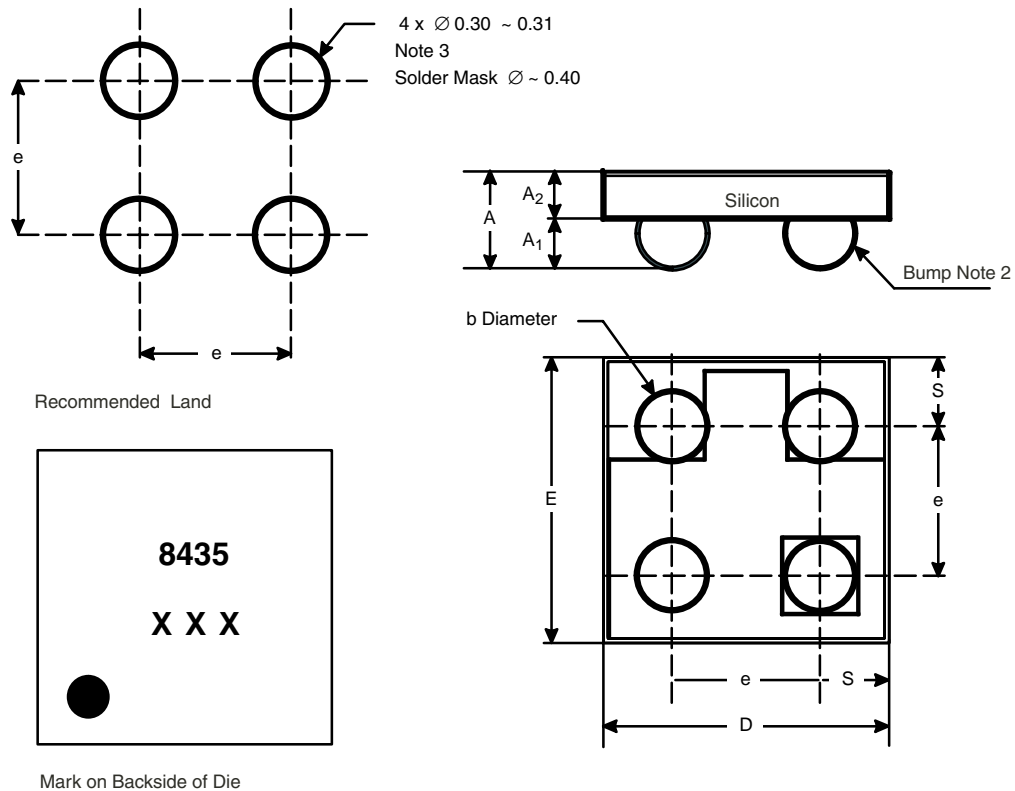
**Normalized Thermal Transient Impedance, Junction-to-Ambient**



**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 Sn/Ag/Cu.
3. Non-solder mask defined copper landing pad.
4. The flat side of wafers is oriented at the bottom.

Dim.	Millimeters <sup>a</sup>		Inches	
	Min.	Max.	Min.	Max.
A	0.600	0.650	0.0236	0.0256
A <sub>1</sub>	0.260	0.290	0.0102	0.0114
A <sub>2</sub>	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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