

VBQG2216 Datasheet

P-Channel 20-V (D-S) MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (Typ.)
- 20	0.020 at $V_{GS} = -10$ V	- 10 ^a	20 nC
	0.028 at $V_{GS} = -4.5$ V	- 8 ^a	
	0.040 at $V_{GS} = -2.5$ V	- 6	

FEATURES

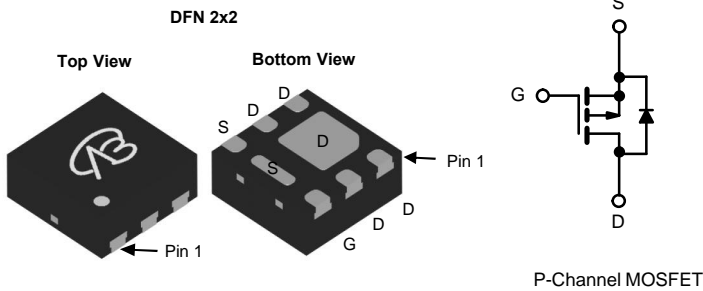
- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Portable Devices
 - Load Switch
 - Battery Switch
 - Charger Switch



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}	± 12	
Continuous Drain Current ($T_J = 150$ °C)	$T_C = 25$ °C	I_D	- 10 ^a	
	$T_C = 70$ °C		- 7 ^a	
	$T_A = 25$ °C		- 8 ^{b, c}	
	$T_A = 70$ °C		- 7.1 ^{b, c}	
Pulsed Drain Current		I_{DM}	- 30	A
Continuous Source-Drain Diode Current	$T_C = 25$ °C	I_S	- 6 ^a	
	$T_A = 25$ °C		- 2.9 ^{b, c}	
Maximum Power Dissipation	$T_C = 25$ °C	P_D	19	W
	$T_C = 70$ °C		12	
	$T_A = 25$ °C		3.5 ^{b, c}	
	$T_A = 70$ °C		2.2 ^{b, c}	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150	°C
Soldering Recommendations (Peak Temperature) ^{d, e}			260	

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^{b, e}		R_{thJA}	28	36	°C/W
Maximum Junction-to-Case (Drain)		R_{thJC}	5.3	6.5	

Notes:

a. Package limited.

b. Surface Mounted on 1" x 1" FR4 board.

c. $t = 5$ s.

d. Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.

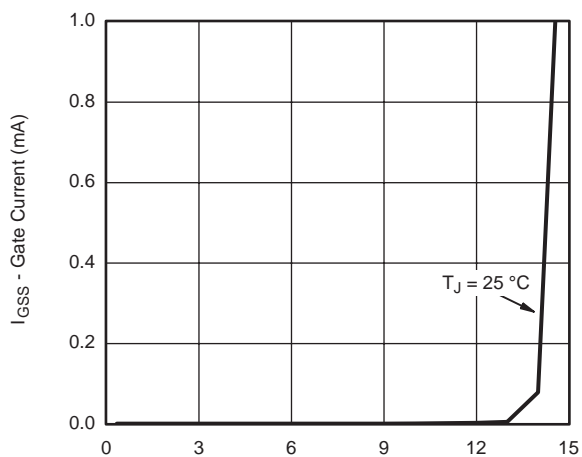
e. Maximum under Steady State conditions is 80 °C/W.

SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	- 20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		- 12		mV/ $^{\circ}\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			3		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$		- 0.6		V
Gate-Source Leakage	I_{GSS}	$V_{DS} = -20\text{ V}, V_{GS} = \pm 12\text{ V}$			± 20	μA
		$V_{DS} = -20\text{ V}, V_{GS} = \pm 4.5\text{ V}$			± 0.5	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$			- 1	
		$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^{\circ}\text{C}$			- 10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \leq -5\text{ V}, V_{GS} = -4.5\text{ V}$	- 20			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -5.6\text{ A}$		0.020		Ω
		$V_{GS} = -4.5\text{ V}, I_D = -5.3\text{ A}$		0.028		
		$V_{GS} = -2.5\text{ V}, I_D = -2.5\text{ A}$		0.040		
Forward Transconductance ^a	g_{fs}	$V_{DS} = -10\text{ V}, I_D = -5.6\text{ A}$		35		S
Dynamic ^b						
Total Gate Charge	Q_g	$V_{DS} = -10\text{ V}, V_{GS} = -8\text{ V}, I_D = -5\text{ A}$		50	75	nC
Gate-Source Charge		$V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -5\text{ A}$		20	30	
	Q_{gs}			3.3		
Gate-Drain Charge	Q_{gd}			8.4		
Gate Resistance	R_g	$f = 1\text{ MHz}$	0.2	1	2	k Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 1\text{ }\Omega$ $I_D \cong -5\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\text{ }\Omega$		0.71	1.1	μs
Rise Time	t_r			1.7	2.6	
Turn-Off Delay Time	$t_{d(off)}$			6	9	
Fall Time	t_f			3.2	5	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 1\text{ }\Omega$ $I_D \cong -5\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\text{ }\Omega$		0.3	0.45	
Rise Time	t_r			0.6	0.9	
Turn-Off Delay Time	$t_{d(off)}$			10	15	
Fall Time	t_f			3.5	5.5	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^{\circ}\text{C}$			- 10	A
Pulse Diode Forward Current	I_{SM}				- 30	
Body Diode Voltage	V_{SD}	$I_S = -5\text{ A}, V_{GS} = 0\text{ V}$		- 0.85	- 1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 6\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^{\circ}\text{C}$		30	60	ns
Body Diode Reverse Recovery Charge	Q_{rr}			20	40	nC
Reverse Recovery Fall Time	t_a			13		ns
Reverse Recovery Rise Time	t_b			17		

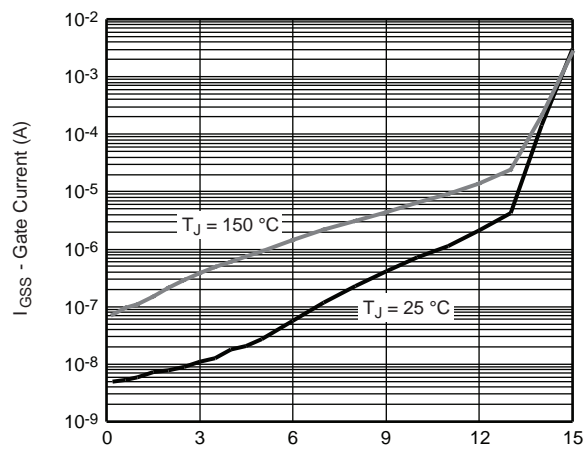
Notes:

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

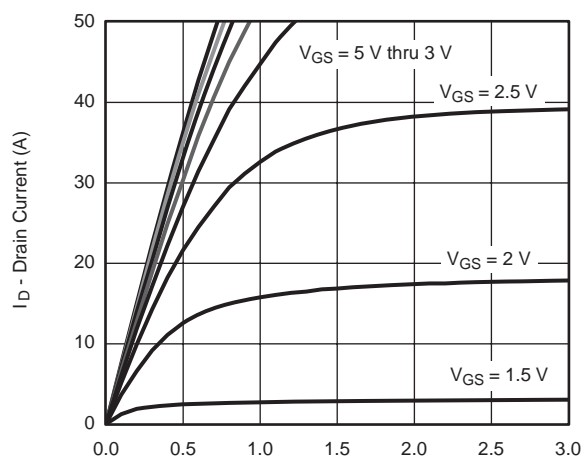
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted


V_{GS} - Gate-to-Source Voltage (V)
Gate Current vs. Gate-Source Voltage

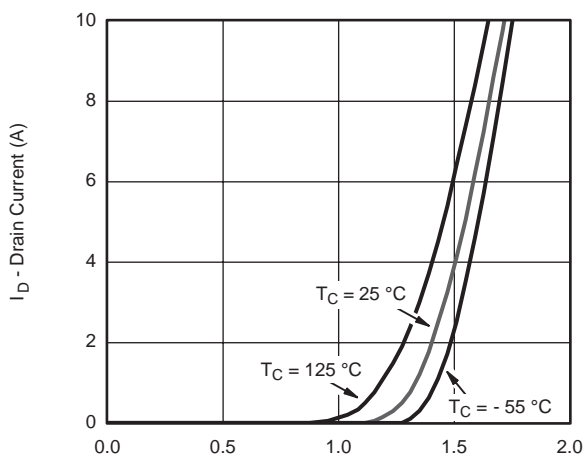


Gate Current vs. Gate-Source Voltage



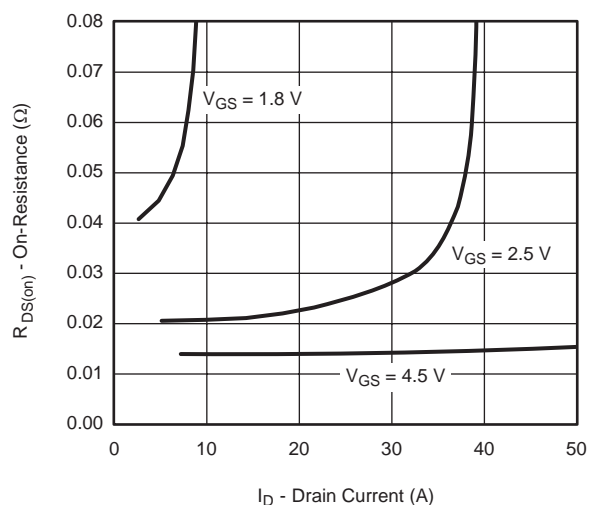
V_{DS} - Drain-to-Source Voltage (V)

Output Characteristics

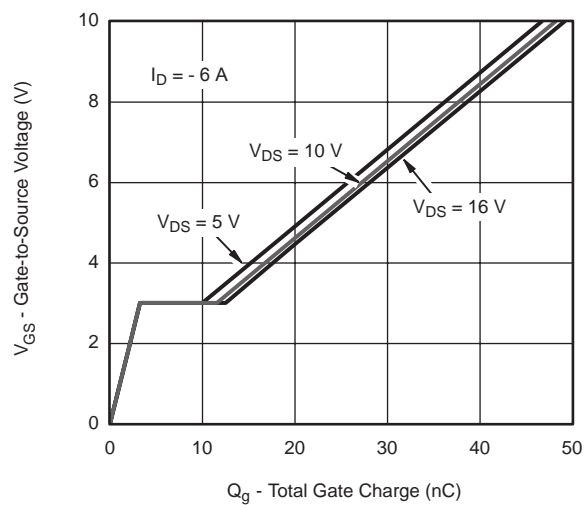


V_{GS} - Gate-to-Source Voltage (V)

Transfer Characteristics

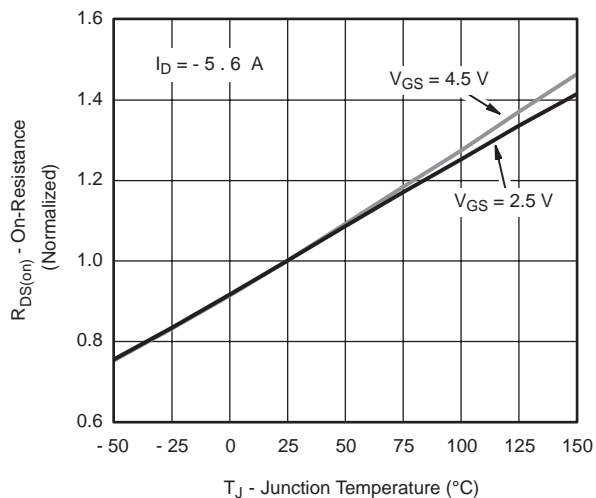
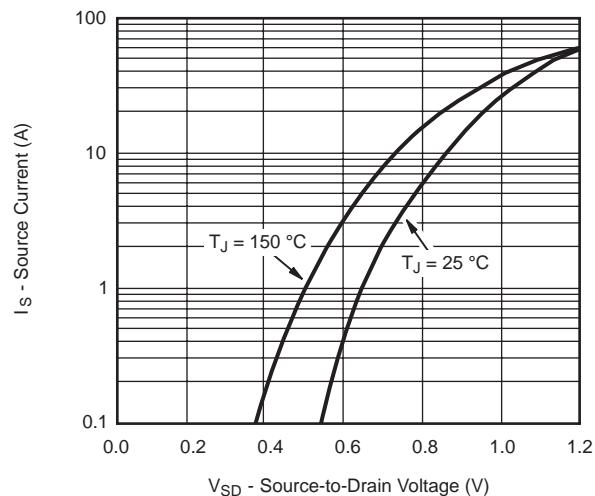
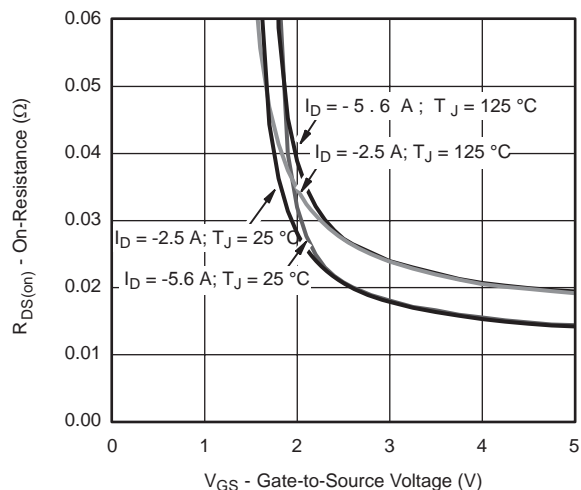
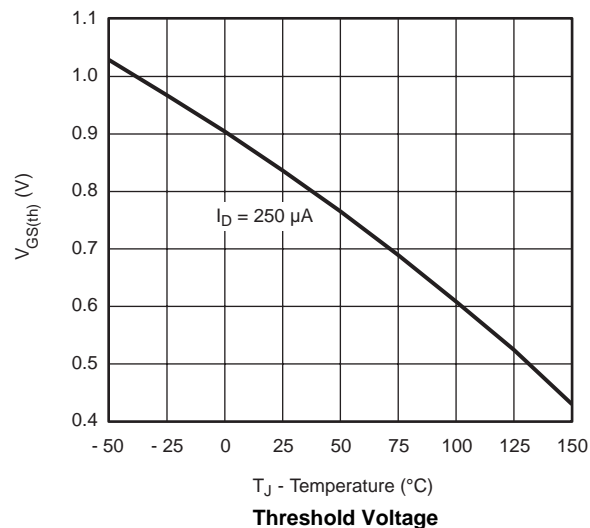
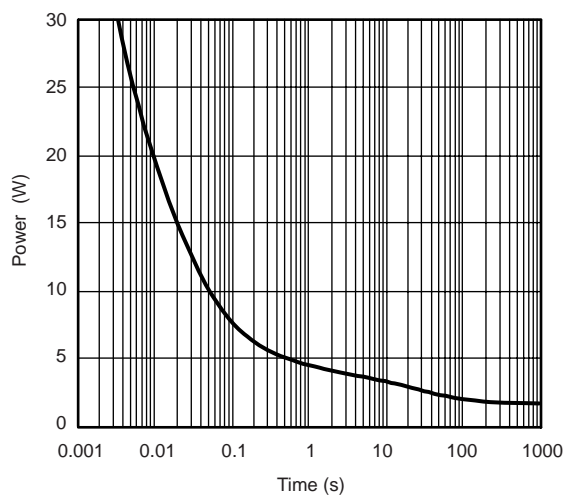
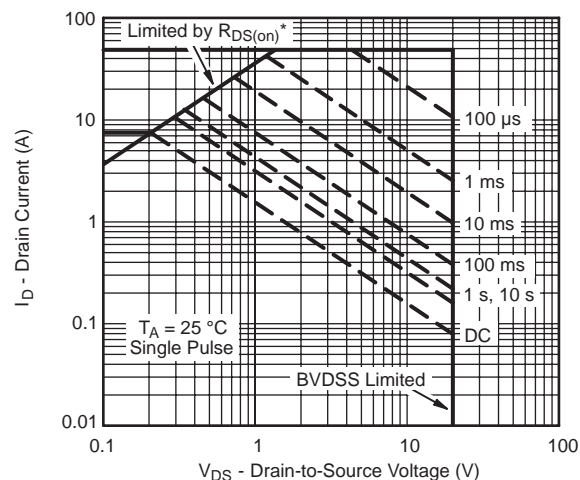


I_D - Drain Current (A)
On-Resistance vs. Drain Current



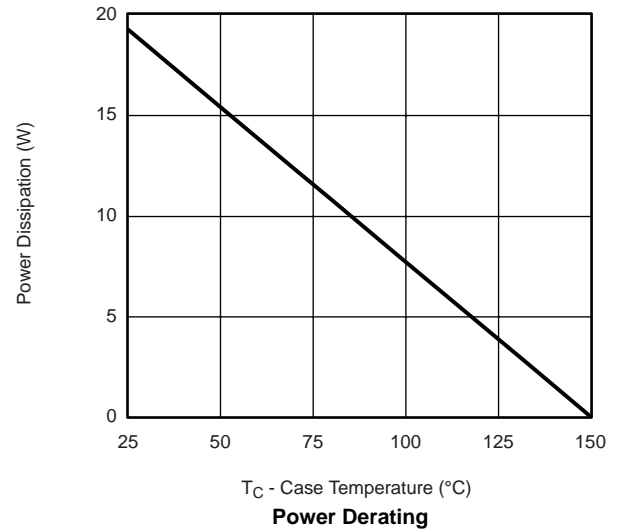
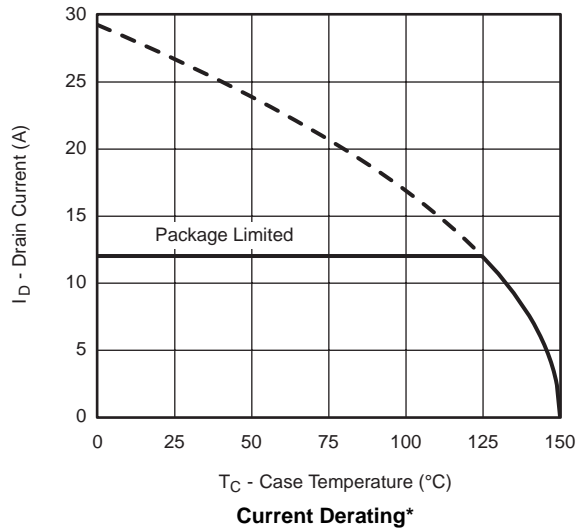
Q_g - Total Gate Charge (nC)

Gate Charge

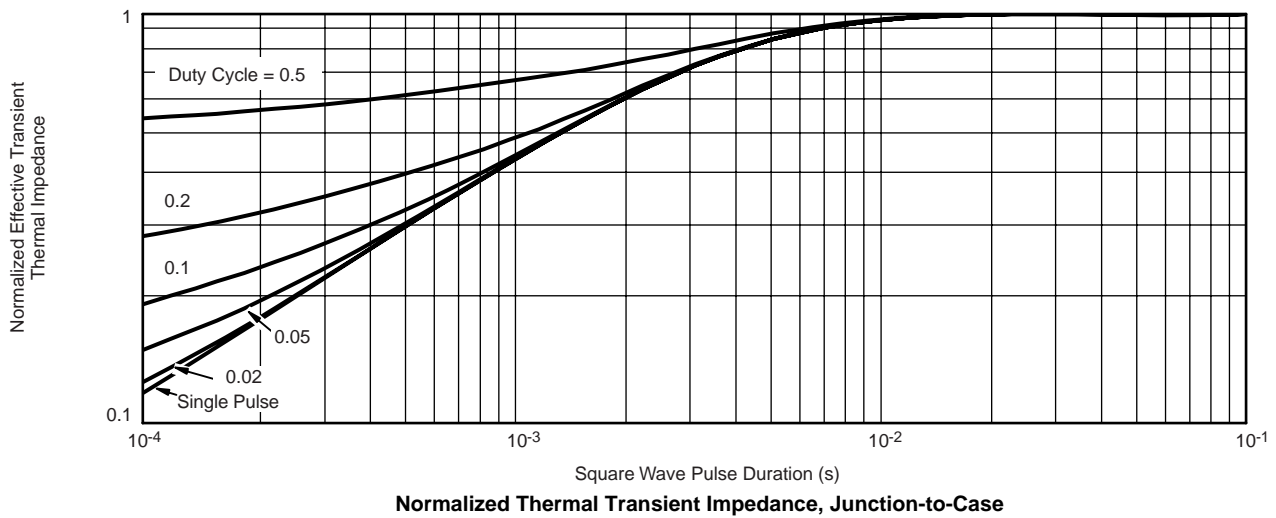
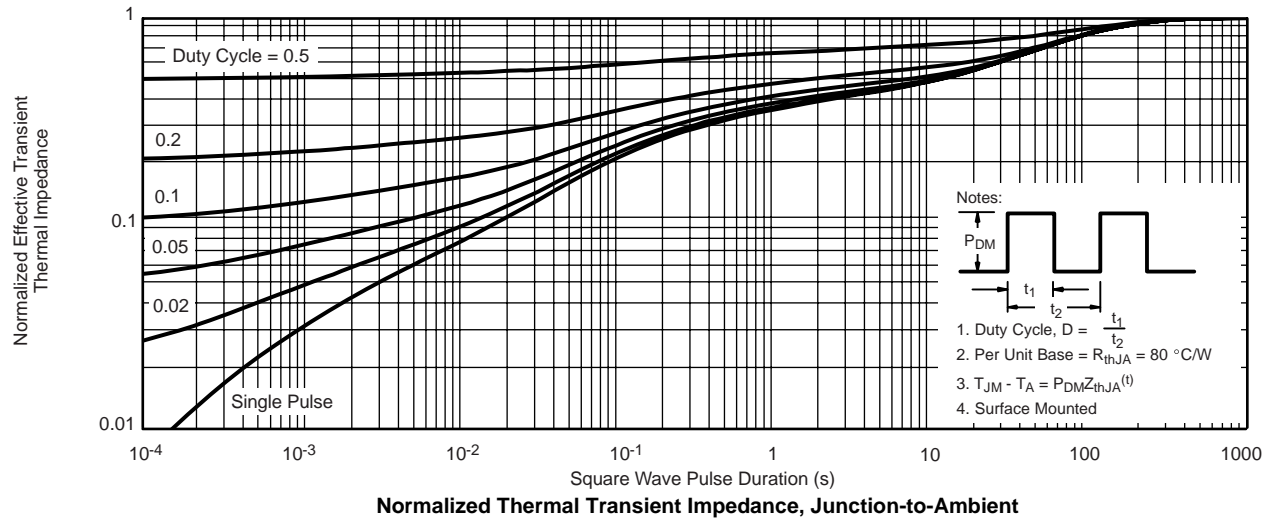
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

On-Resistance vs. Junction Temperature

Source-Drain Diode Forward Voltage

On-Resistance vs. Gate-to-Source Voltage

Threshold Voltage

Single Pulse Power, Junction-to-Ambient


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

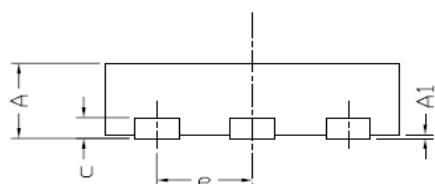
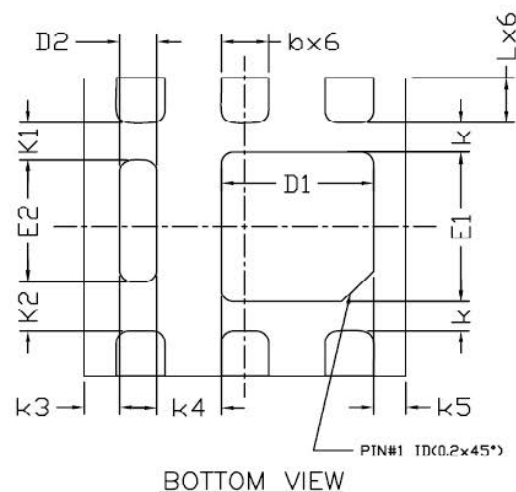
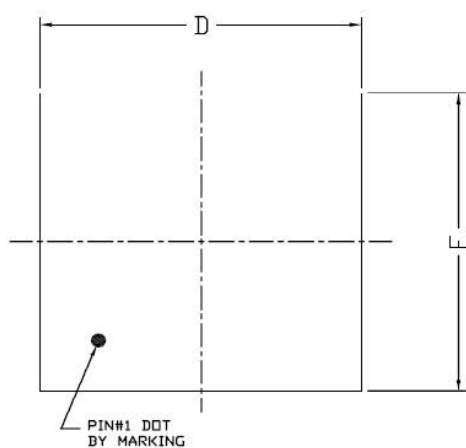
Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

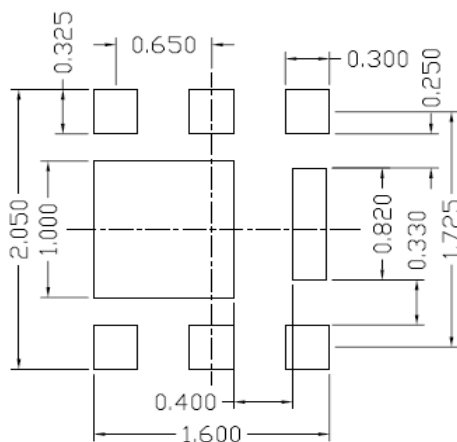
* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted


DFN2x2 _6L_EP1_S PACKAGE OUTLINE



RECOMMENDED LAND PATTERN



UNIT: mm

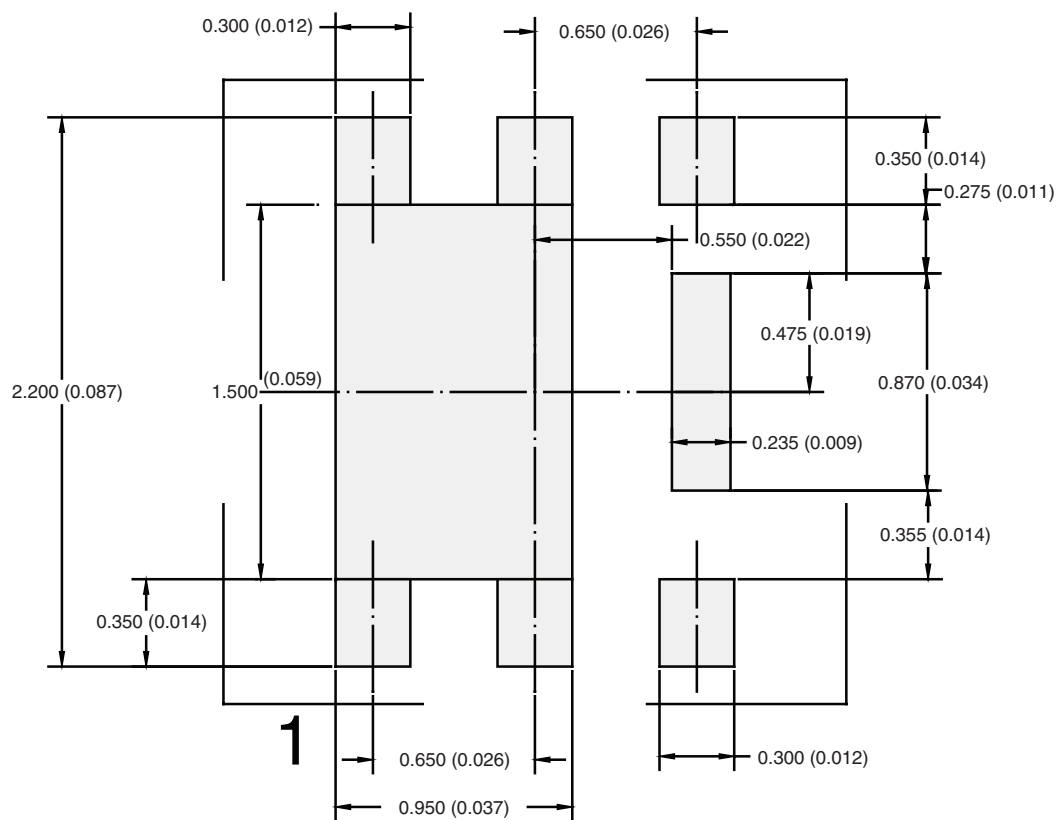
NOTE

1. CONTROLLING DIMENSION IS MILLIMETER.

CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.50	0.55	0.60	0.020	0.022	0.024
A1	0.00	—	0.05	0.000	—	0.002
b	0.25	0.30	0.35	0.010	0.012	0.014
c	0.152 REF			0.006 REF		
D	1.90	2.00	2.10	0.075	0.079	0.083
D1	0.85	0.95	1.05	0.033	0.037	0.041
D2	0.13	0.23	0.33	0.005	0.009	0.013
E	1.90	2.00	2.10	0.075	0.079	0.083
E1	0.90	1.00	1.10	0.035	0.039	0.043
E2	0.72	0.82	0.92	0.028	0.032	0.036
e	0.65 BSC			0.026 BSC		
K	0.20 BSC			0.008 BSC		
K1	0.25 BSC			0.010 BSC		
K2	0.33 BSC			0.013 BSC		
K3	0.22 BSC			0.009 BSC		
K4	0.40 BSC			0.016 BSC		
K5	0.20 BSC			0.008 BSC		
L	0.25	0.30	0.35	0.010	0.012	0.014

RECOMMENDED PAD LAYOUT FOR DFN2X2



Dimensions in mm/(Inches)

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