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ON Semiconductor®

# FDMQ8203

## GreenBridge™ Series of High-Efficiency Bridge Rectifiers

### Dual N-Channel and Dual P-Channel PowerTrench® MOSFET

N-Channel: 100 V, 6 A, 110 mΩ P-Channel: -80 V, -6 A, 190 mΩ

#### Features

Q1/Q4: N-Channel

- Max  $r_{DS(on)}$  = 110 mΩ at  $V_{GS} = 10$  V,  $I_D = 3$  A
- Max  $r_{DS(on)}$  = 175 mΩ at  $V_{GS} = 6$  V,  $I_D = 2.4$  A

Q2/Q3: P-Channel

- Max  $r_{DS(on)}$  = 190 mΩ at  $V_{GS} = -10$  V,  $I_D = -2.3$  A
- Max  $r_{DS(on)}$  = 235 mΩ at  $V_{GS} = -4.5$  V,  $I_D = -2.1$  A

- Substantial efficiency benefit in PD solutions
- RoHS Compliant

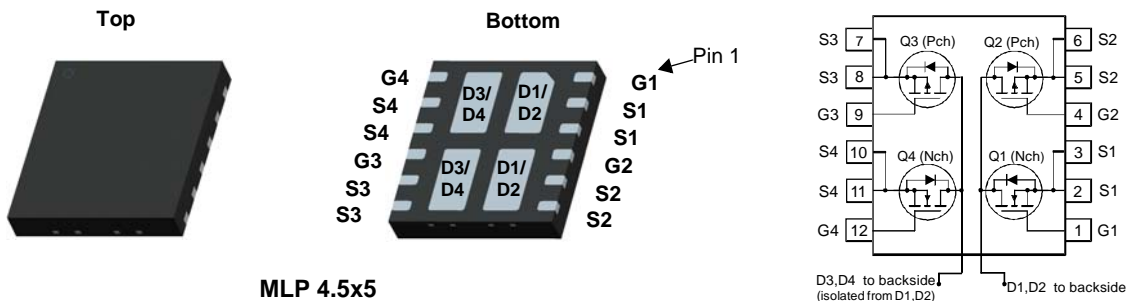


#### General Description

This quad mosfet solution provides ten-fold improvement in power dissipation over diode bridge.

#### Application

- High-Efficiency Bridge Rectifiers



#### MOSFET Maximum Ratings $T_A = 25$ °C unless otherwise noted

Symbol	Parameter	Q1/Q4	Q2/Q3	Units
$V_{DS}$	Drain to Source Voltage	100	-80	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	$\pm 20$	V
$I_D$	Drain Current -Continuous (Package limited) $T_C = 25$ °C	6	-6	A
	-Continuous (Silicon limited) $T_C = 25$ °C	10	-10	
	-Continuous $T_A = 25$ °C (Note 1a)	3.4	-2.6	
	-Pulsed	12	-10	
$P_D$	Power Dissipation for Single Operation $T_C = 25$ °C	22	37	W
	Power Dissipation for Dual Operation $T_A = 25$ °C (Note 1a)	2.5		
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150		°C

#### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	160	

#### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMQ8203	FDMQ8203	MLP4.5x5	13 "	12 mm	3000 units

**Electrical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$ $I_D = -250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$	Q1/Q4 Q2/Q3	100 -80			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$ $I_D = -250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$	Q1/Q4 Q2/Q3		72 -79		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 80\text{ V}, V_{GS} = 0\text{ V}$ $V_{DS} = -64\text{ V}, V_{GS} = 0\text{ V}$	Q1/Q4 Q2/Q3			1 -1	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	Q1/Q4 Q2/Q3			$\pm 100$ $\pm 100$	nA nA

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$ $V_{GS} = V_{DS}, I_D = -250\text{ }\mu\text{A}$	Q1/Q4 Q2/Q3	2 -1	3 -1.6	4 -3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$ $I_D = -250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$	Q1/Q4 Q2/Q3		-8 5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 3\text{ A}$ $V_{GS} = 6\text{ V}, I_D = 2.4\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 3\text{ A}, T_J = 125\text{ }^\circ\text{C}$ $V_{GS} = -10\text{ V}, I_D = -2.3\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -2.1\text{ A}$ $V_{GS} = -10\text{ V}, I_D = -2.3\text{ A}, T_J = 125\text{ }^\circ\text{C}$	Q1/Q4  Q2/Q3		85 118 147 161 188 273	110 175 191 190 235 323	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 3\text{ A}$ $V_{DS} = -10\text{ V}, I_D = -2.3\text{ A}$	Q1/Q4 Q2/Q3		6 6		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	Q1/Q4: $V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	Q1/Q4 Q2/Q3		158 639	210 850	pF
$C_{oss}$	Output Capacitance	Q2/Q3:	Q1/Q4 Q2/Q3		41 46	55 65	pF
$C_{rss}$	Reverse Transfer Capacitance	$V_{DS} = -40\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	Q1/Q4 Q2/Q3		2.6 24	5 40	pF

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	Q1/Q4:	Q1/Q4 Q2/Q3		3.8 4.7	10 10	ns
$t_r$	Rise Time	$V_{DD} = 50\text{ V}, I_D = 3\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$	Q1/Q4 Q2/Q3		1.3 2.8	10 10	ns
$t_{d(off)}$	Turn-Off Delay Time	Q2/Q3:	Q1/Q4 Q2/Q3		7.5 22	15 35	ns
$t_f$	Fall Time	$V_{DD} = -40\text{ V}, I_D = -2.3\text{ A},$ $V_{GS} = -10\text{ V}, R_{GEN} = 6\text{ }\Omega$	Q1/Q4 Q2/Q3		1.9 2.7	10 10	ns
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to }10\text{ V}$ $V_{GS} = 0\text{ V to }-10\text{ V}$	Q1/Q4: Q2/Q3		2.9 13	5 19	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to }5\text{ V}$ $V_{GS} = 0\text{ V to }-4.5\text{ V}$	Q1/Q4: Q2/Q3		1.6 6.4	3 10	nC
$Q_{gs}$	Gate to Source Gate Charge	Q2/Q3: $V_{DD} = -40\text{ V},$ $I_D = -2.3\text{ A}$	Q1/Q4 Q2/Q3		0.8 1.6		nC
$Q_{gd}$	Gate to Drain "Miller" Charge		Q1/Q4 Q2/Q3		0.8 2.6		nC

**Electrical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
<b>Drain-Source Diode Characteristics</b>							
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 3\text{ A}$ (Note 2)	Q1/Q4		0.86	1.3	V
		$V_{GS} = 0\text{ V}, I_S = -2.3\text{ A}$ (Note 2)	Q2/Q3		-0.82	-1.3	
$t_{rr}$	Reverse Recovery Time	$I_F = 3\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	Q1/Q4		32	52	ns
			Q2/Q3		26	42	
$Q_{rr}$	Reverse Recovery Charge	$I_F = -2.3\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	Q1/Q4		21	34	nC
			Q2/Q3		26	42	

**Notes:**

1:  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a. 50 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper, the board designed Q1+Q3 or Q2+Q4.



b. 160 °C/W when mounted on a minimum pad of 2 oz copper, the board designed Q1+Q3 or Q2+Q4.

2: Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.

**Typical Characteristics (N-Channel)**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted

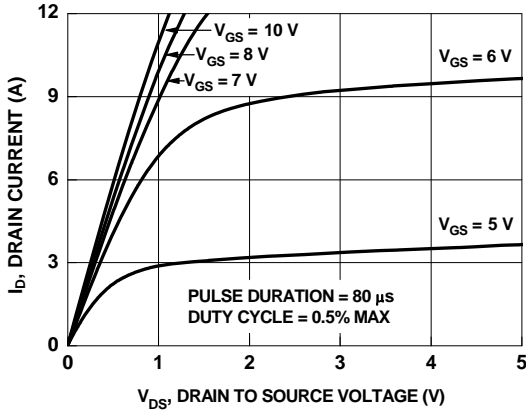


Figure 1. On Region Characteristics

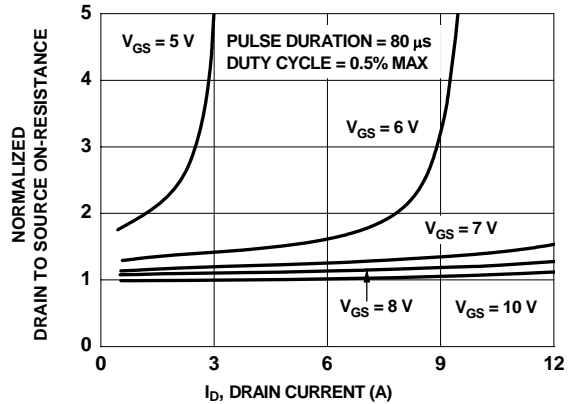


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

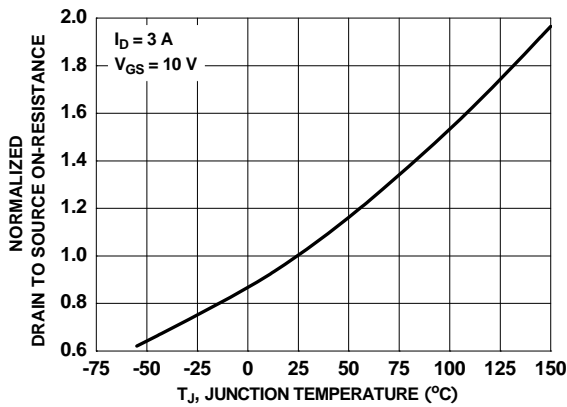


Figure 3. Normalized On Resistance vs Junction Temperature

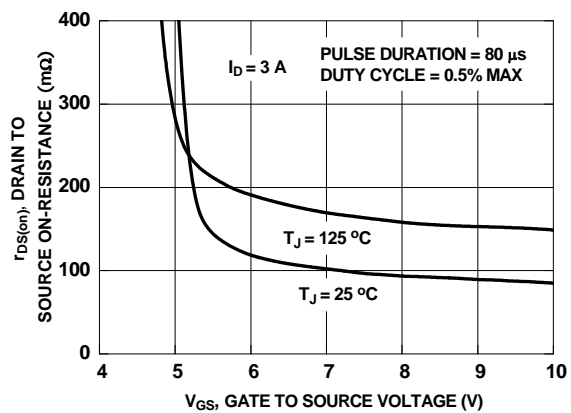


Figure 4. On-Resistance vs Gate to Source Voltage

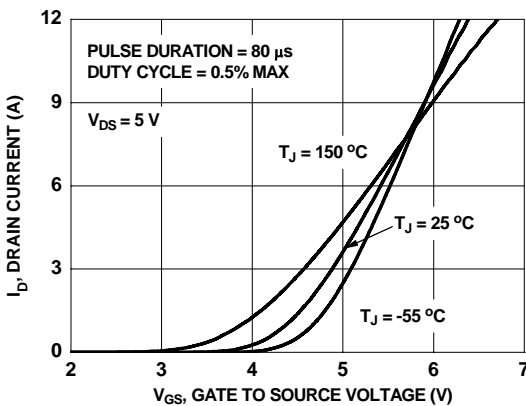


Figure 5. Transfer Characteristics

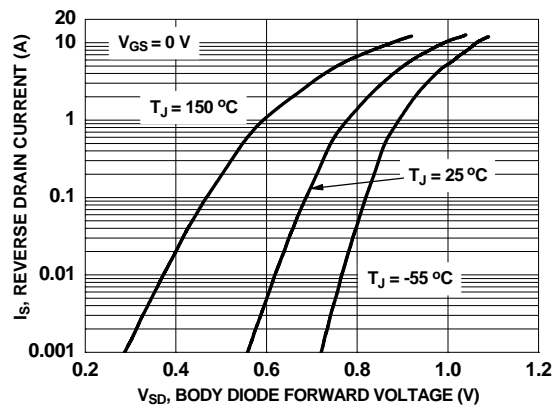
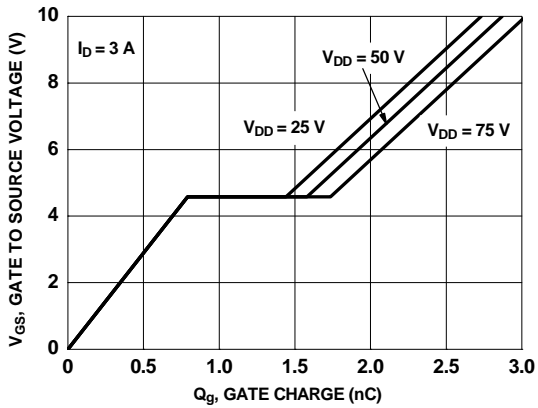
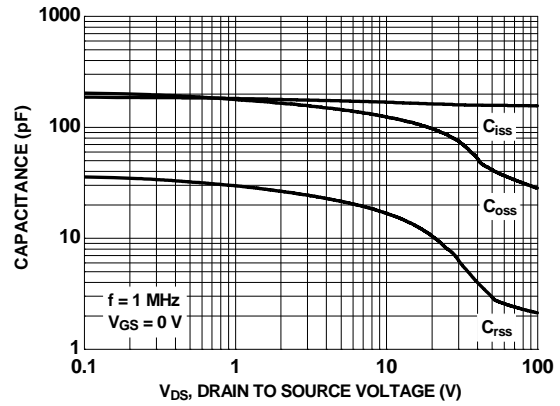


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

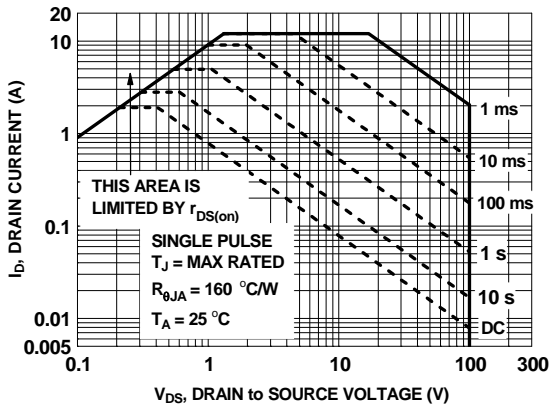
**Typical Characteristics (N-Channel)**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



**Figure 7. Gate Charge Characteristics**



**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Forward Bias Safe Operating Area**

**Typical Characteristics (P-Channel)**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted

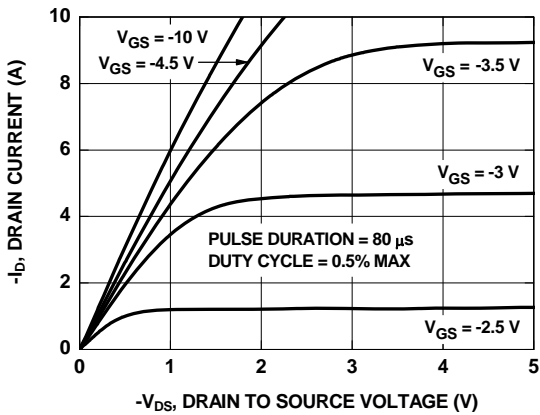


Figure 10. On-Region Characteristics

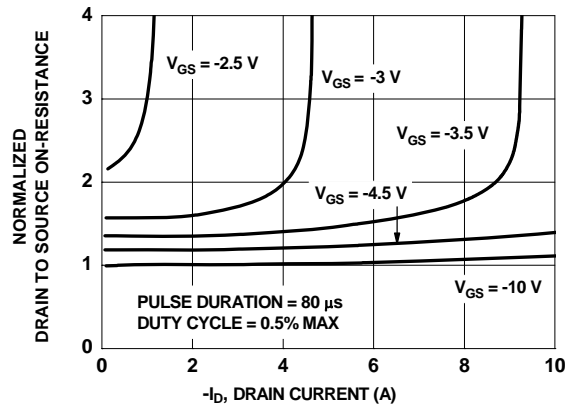


Figure 11. Normalized on-Resistance vs Drain Current and Gate Voltage

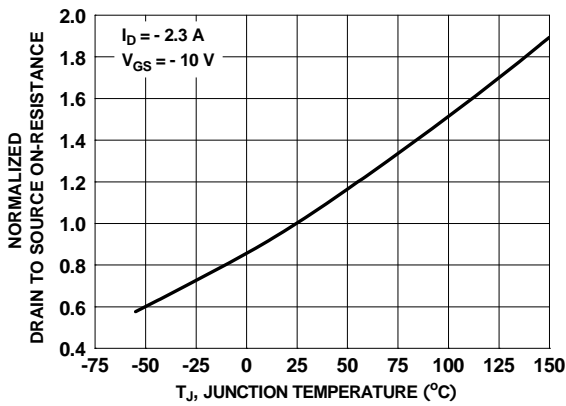


Figure 12. Normalized On-Resistance vs Junction Temperature

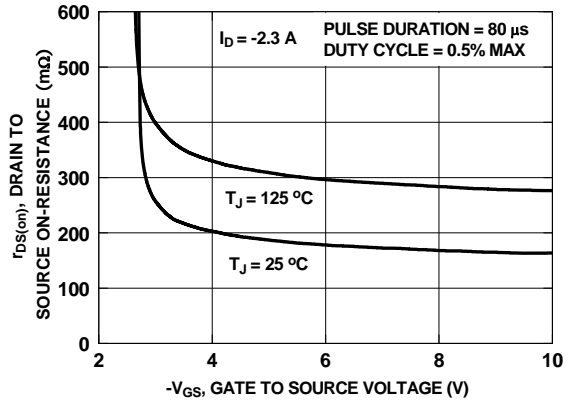


Figure 13. On-Resistance vs Gate to Source Voltage

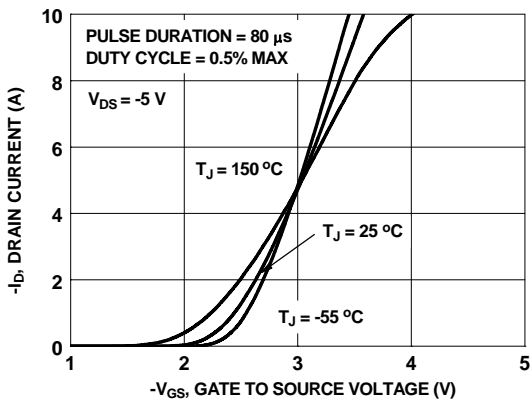


Figure 14. Transfer Characteristics

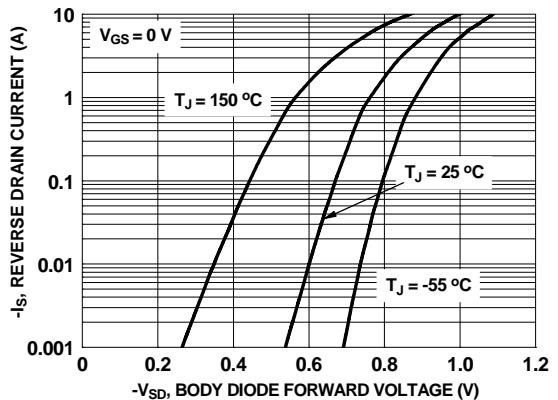


Figure 15. Source to Drain Diode Forward Voltage vs Source Current

**Typical Characteristics (P-Channel)**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted

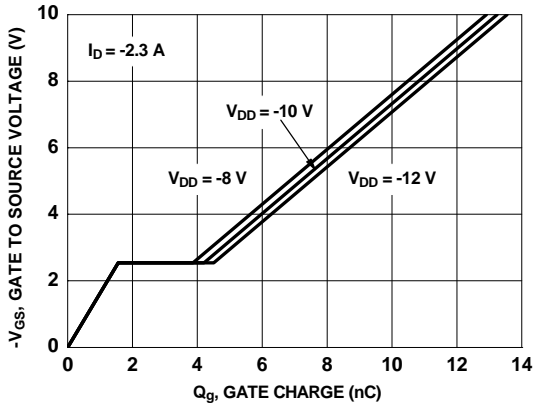


Figure 16. Gate Charge Characteristics

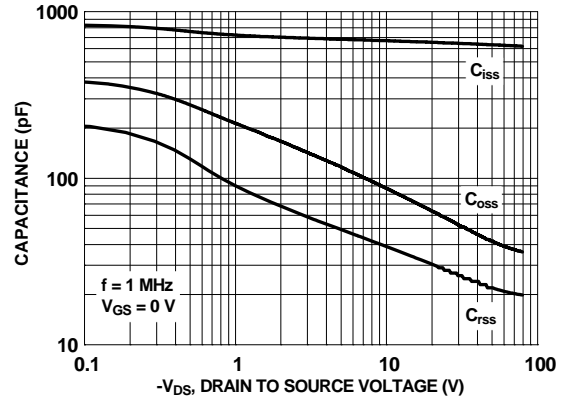


Figure 17. Capacitance vs Drain to Source Voltage

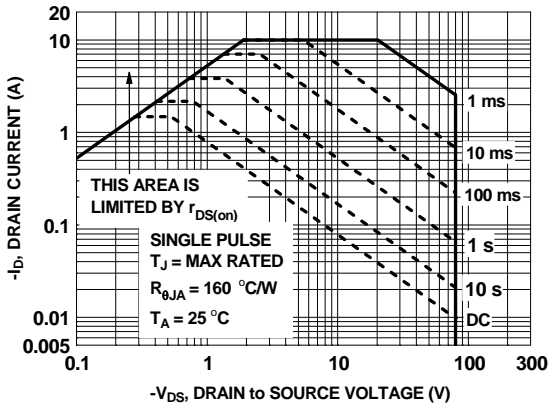
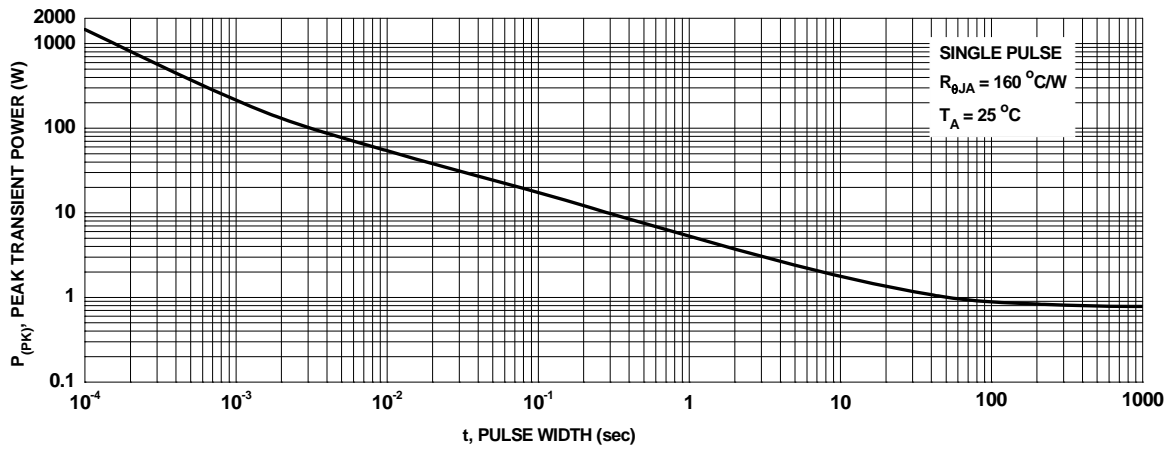


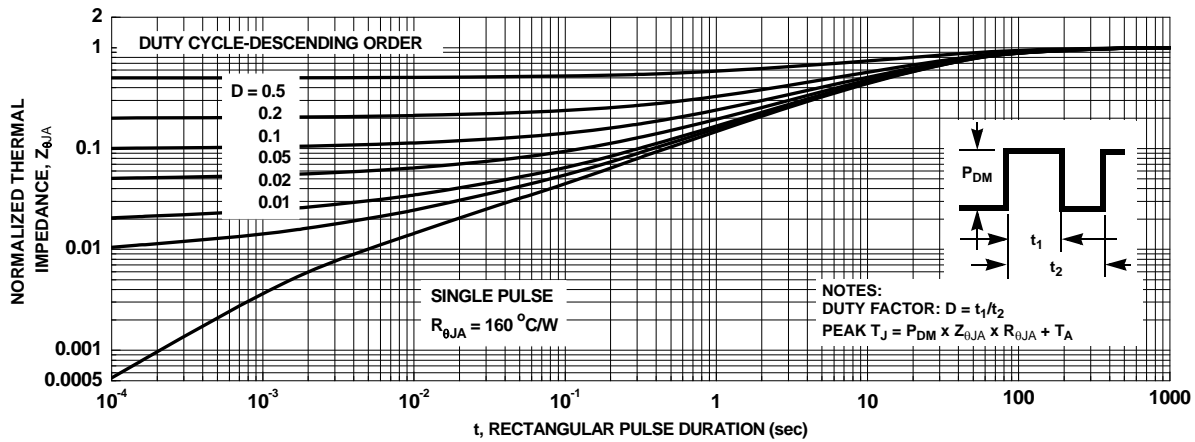
Figure 18. Forward Bias Safe Operating Area



**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted

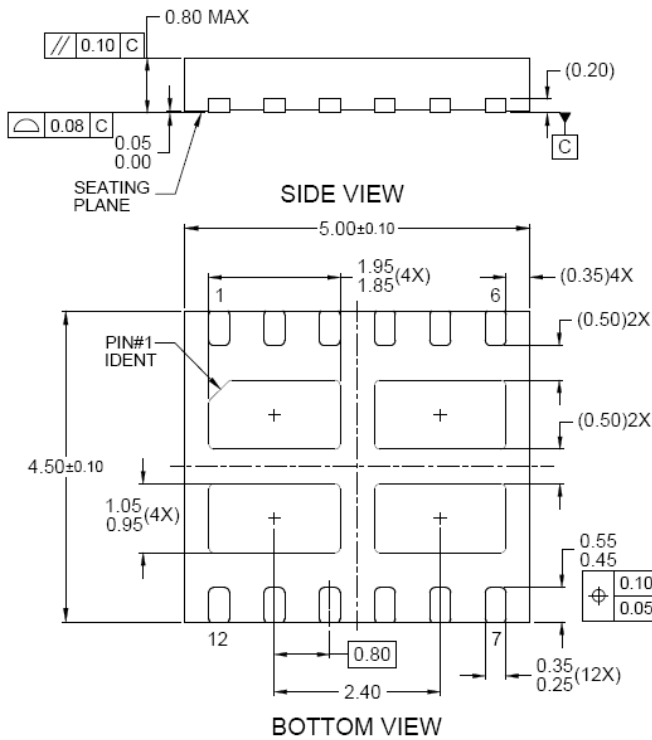
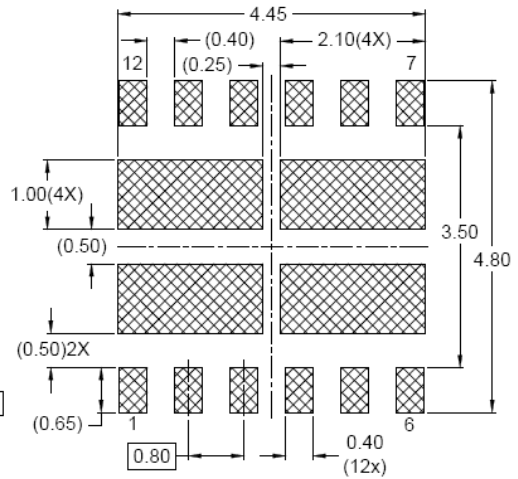
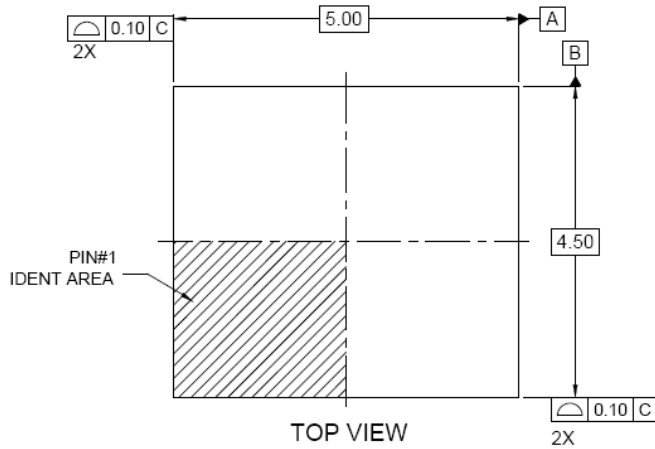


**Figure 19. Single Pulse Maximum Power Dissipation**



**Figure 20. Junction-to-Ambient Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout



### NOTES:

- A. PACKAGE DOES NOT FULLY CONFORM TO JEDEC MO-229 REGISTRATION
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
- D. LAND PATTERN RECOMMENDATION IS BASED ON FSC DESIGN ONLY.
- E. DRAWING FILENAME: MKT-MLP12Erev2.

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