

# FDMS86101DC

## N-Channel Dual Cool™ Power Trench® MOSFET

100 V, 60 A, 7.5 mΩ

### Features

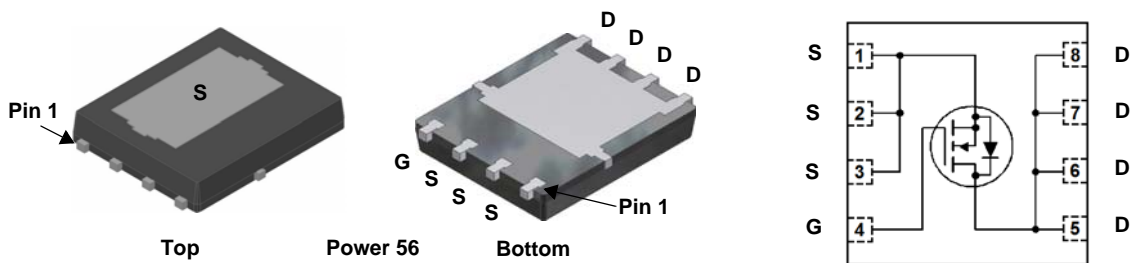
- Dual Cool™ Top Side Cooling PQFN package
- Max  $r_{DS(on)}$  = 7.5 mΩ at  $V_{GS} = 10$  V,  $I_D = 14.5$  A
- Max  $r_{DS(on)}$  = 12 mΩ at  $V_{GS} = 6$  V,  $I_D = 11.5$  A
- High performance technology for extremely low  $r_{DS(on)}$
- 100% UIL Tested
- RoHS Compliant

### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced Power Trench® process. Advancements in both silicon and Dual Cool™ package technologies have been combined to offer the lowest  $r_{DS(on)}$  while maintaining excellent switching performance by extremely low Junction-to-Ambient thermal resistance.

### Applications

- Primary DC-DC MOSFET
- Secondary Synchronous Rectifier
- Load Switch



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	100	V
$V_{GS}$	Gate to Source Voltage	±20	V
$I_D$	Drain Current -Continuous (Package limited) $T_C = 25$ °C	60	A
	-Continuous (Silicon limited) $T_C = 25$ °C	88	
	-Continuous $T_A = 25$ °C (Note 1a)	14.5	
	-Pulsed	200	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	216	mJ
$P_D$	Power Dissipation $T_C = 25$ °C	125	W
	Power Dissipation $T_A = 25$ °C (Note 1a)	3.2	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case (Top Source)	2.3	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Bottom Drain)	1.0	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	38	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	81	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1i)	16	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1j)	23	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1k)	11	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
86101	FDMS86101DC	Dual Cool™ Power 56	13"	12 mm	3000 units

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

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	100			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		70		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 80\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 100$	nA

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$	2	2.7	4	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 $25\text{ }^\circ\text{C}$		-10		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 14.5\text{ A}$		6	7.5	m $\Omega$
		$V_{GS} = 6\text{ V}$ , $I_D = 11.5\text{ A}$		8.3	12	
		$V_{GS} = 10\text{ V}$ , $I_D = 14.5\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$		10	13	
$g_{FS}$	Forward Transconductance	$V_{DD} = 10\text{ V}$ , $I_D = 14.5\text{ A}$		44		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 50\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		2354	3135	pF
$C_{oss}$	Output Capacitance			467	625	pF
$C_{rss}$	Reverse Transfer Capacitance			23	35	pF
$R_g$	Gate Resistance			1.4		$\Omega$

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\text{ V}$ , $I_D = 14.5\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		14	25	ns
$t_r$	Rise Time			8.2	17	ns
$t_{d(off)}$	Turn-Off Delay Time			25	40	ns
$t_f$	Fall Time			5.5	11	ns
$Q_g(TOT)$	Total Gate Charge	$V_{GS} = 0\text{ V to }10\text{ V}$	$V_{DD} = 50\text{ V}$ $I_D = 14.5\text{ A}$	31	44	nC
	Total Gate Charge	$V_{GS} = 0\text{ V to }5\text{ V}$		18	25	nC
$Q_{gs}$	Total Gate Charge			8.3		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			7		nC

**Drain-Source Diode Characteristics**

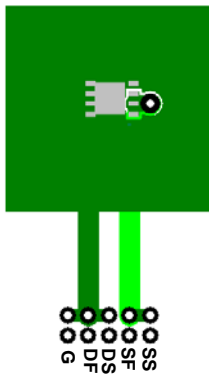
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 2.7\text{ A}$ (Note 2)		0.71	1.2	V
		$V_{GS} = 0\text{ V}$ , $I_S = 14.5\text{ A}$ (Note 2)		0.78	1.3	
$t_{rr}$	Reverse Recovery Time	$I_F = 14.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		54	87	ns
$Q_{rr}$	Reverse Recovery Charge			62	99	nC

## Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case (Top Source)	2.3	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Bottom Drain)	1.0	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	38	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	81	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1c)	27	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1d)	34	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1e)	16	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1f)	19	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1g)	26	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1h)	61	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1i)	16	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1j)	23	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1k)	11	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1l)	13	

### NOTES:

1.  $R_{\theta JA}$  is determined with the device mounted on a FR-4 board using a specified pad of 2 oz copper as shown below.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a. 38  $^{\circ}\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



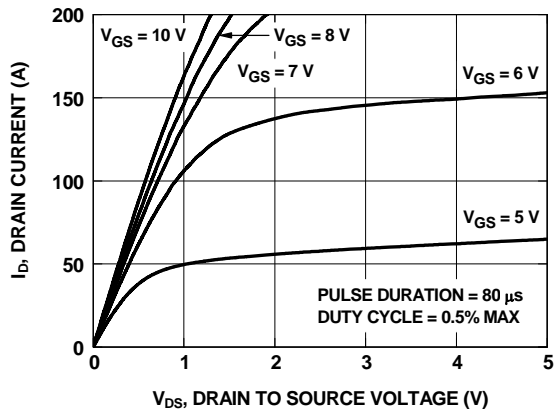
b. 81  $^{\circ}\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

- c. Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- d. Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
- e. Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- f. Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
- g. 200FPM Airflow, No Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- h. 200FPM Airflow, No Heat Sink, minimum pad of 2 oz copper
- i. 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- j. 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
- k. 200FPM Airflow, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- l. 200FPM Airflow, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper

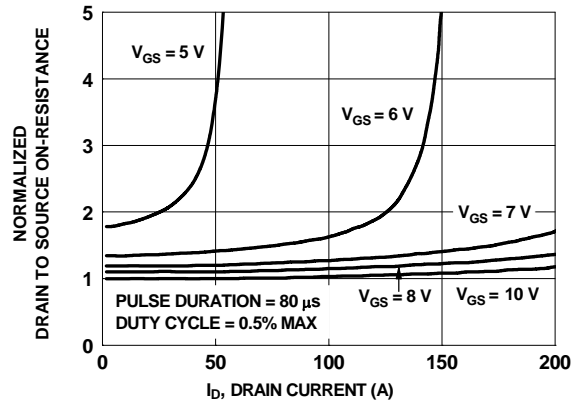
2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.

3. Starting  $T_J = 25^{\circ}\text{C}$ ; N-ch:  $L = 0.3 \text{ mH}$ ,  $I_{AS} = 38 \text{ A}$ ,  $V_{DD} = 90 \text{ V}$ ,  $V_{GS} = 10 \text{ V}$ .

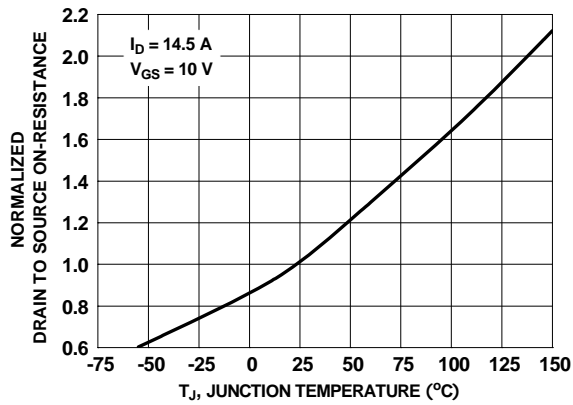
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



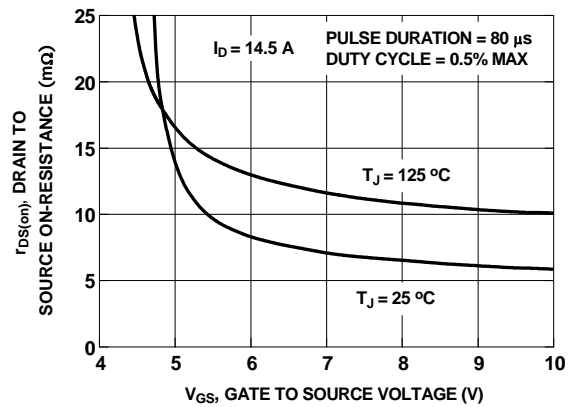
**Figure 1. On-Region Characteristics**



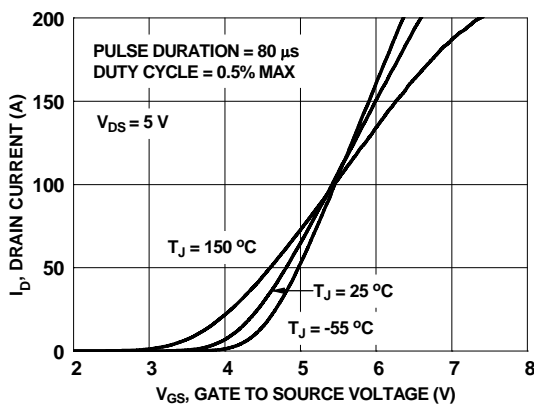
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



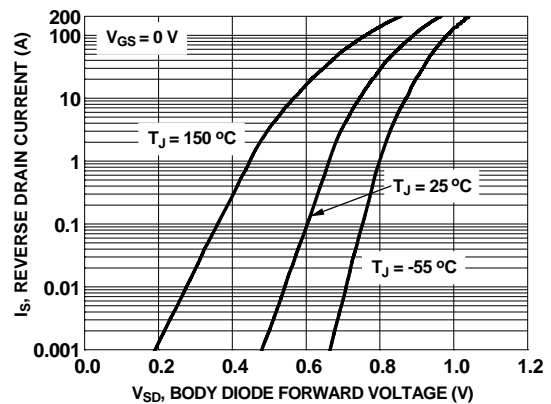
**Figure 3. Normalized On-Resistance vs Junction Temperature**



**Figure 4. On-Resistance vs Gate to Source Voltage**

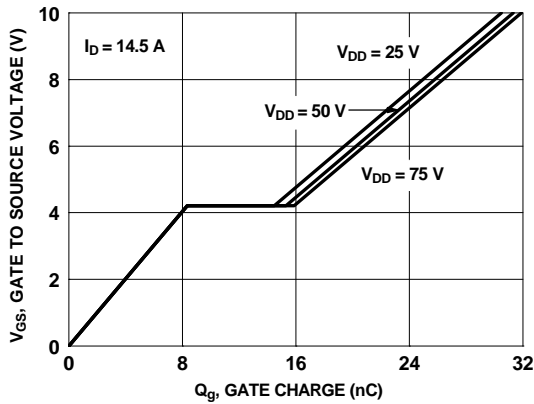


**Figure 5. Transfer Characteristics**

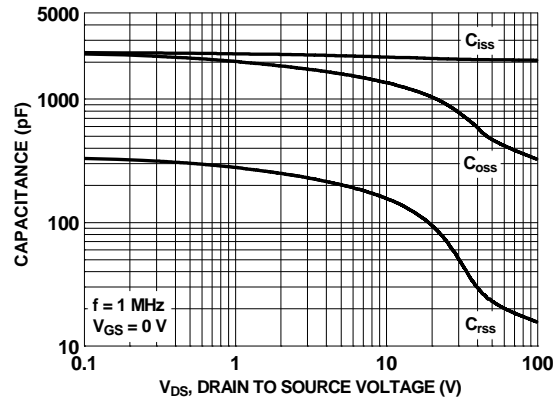


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

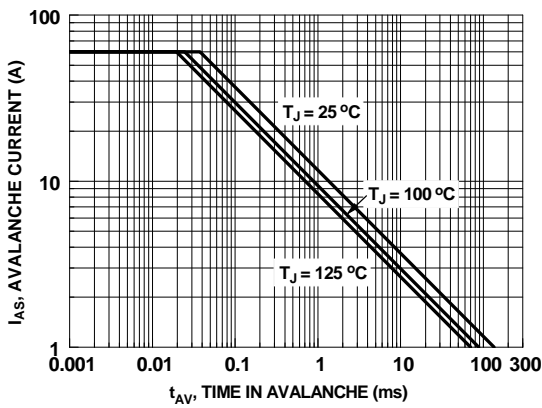
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



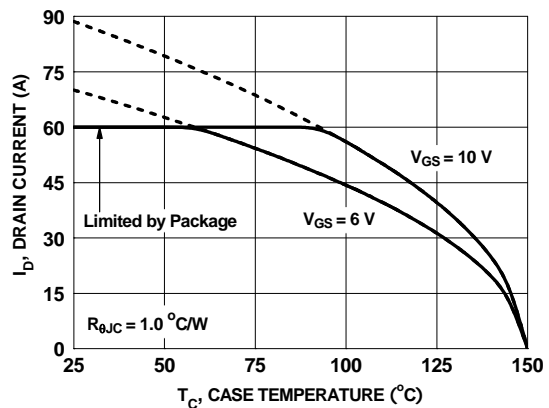
**Figure 7. Gate Charge Characteristics**



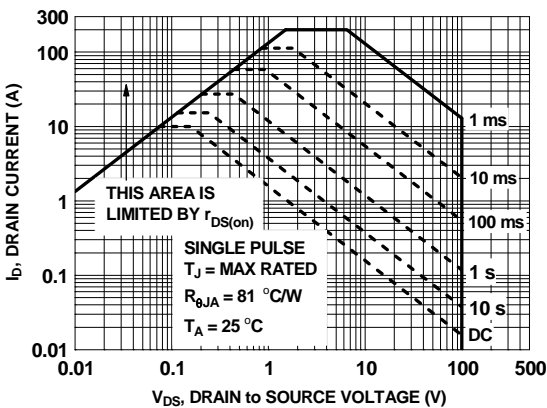
**Figure 8. Capacitance vs Drain to Source Voltage**



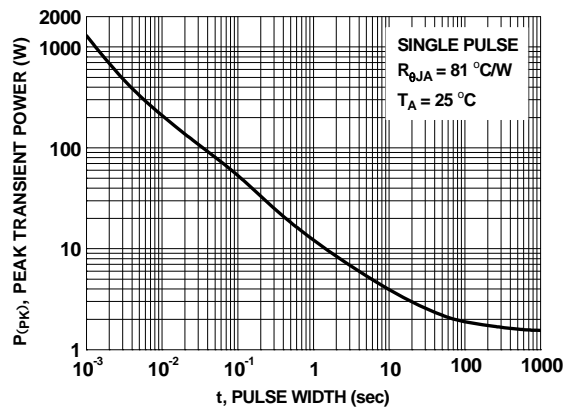
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs Case Temperature**

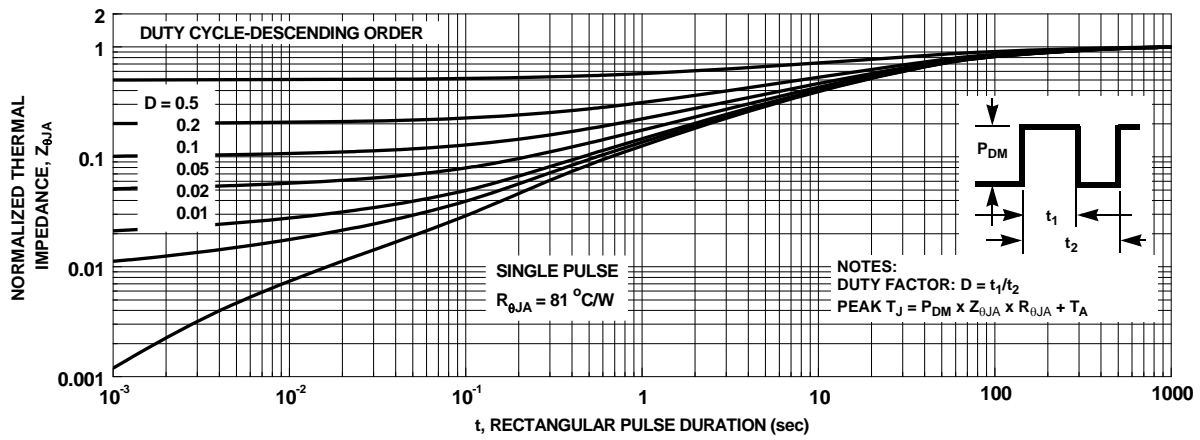


**Figure 11. Forward Bias Safe Operating Area**



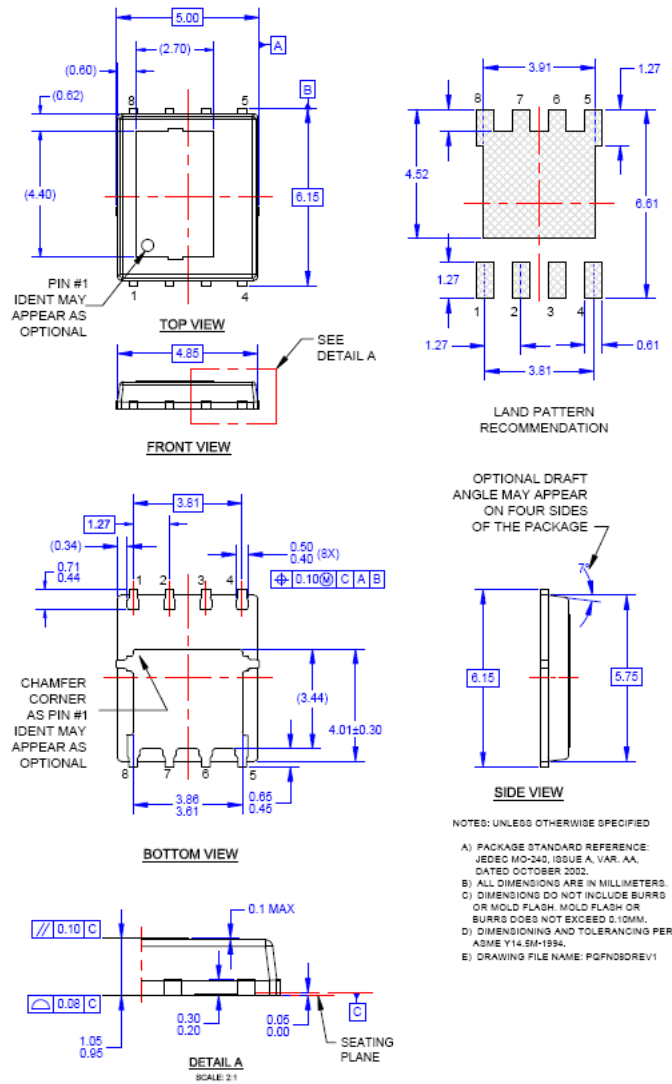
**Figure 12. Single Pulse Maximum Power Dissipation**

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



**Figure 13. Junction-to-Ambient Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout



- NOTES: UNLESS OTHERWISE SPECIFIED
- A) PACKAGE STANDARD REFERENCE: JEDEC MO-242, ISSUE A, VAR. AA, DATED OCTOBER 2002.
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
  - D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
  - E) DRAWING FILE NAME: PQFN080REV1



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- |   |   |   |   |
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| AccuPower™  | FRFET®  | PowerXS™  | the power®  |
| AX-CAP™*  | Global Power Resource™  | Programmable Active Droop™  | franchise   |
| BitSiC®   | Green Bridge™   | QFET®   | TinyBoost™  |
| Build it Now™   | Green FPS™  | QS™   | TinyBuck™   |
| CorePLUS™   | Green FPS™ e-Series™  | Quiet Series™   | TinyCalc™   |
| CorePOWER™  | Gmax™   | RapidConfigure™   | TinyLogic®  |
| CROSSVOLT™  | GTO™  | TM  | TINYOPTO™   |
| CTL™  | IntelliMAX™   |  | TinyPower™  |
| Current Transfer Logic™   | ISOPLANAR™  | Saving our world, 1mW/W/kW at a time™   | TinyPWM™  |
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| FAST®   | OptoHiT™  | SupreMOS®   | VisualMax™  |
| FastvCore™  | OPTOLOGIC®  | SyncFET™  | VoltagePlus™  |
| FETBench™   | OPTOPLANAR®   | Sync-Lock™  | XS™   |
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| FPS™  |   |   |   |

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