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July 2015

FDMS86200DC

N-Channel Dual Cool™ 56 Shielded Gate PowerTrench® MOSFET 150 V, 40 A, 17 mΩ

Features

- Shielded Gate MOSFET Technology
- Dual Cool™ Top Side Cooling PQFN package
- Max $r_{DS(on)}$ = 17 mΩ at $V_{GS} = 10$ V, $I_D = 9.3$ A
- Max $r_{DS(on)}$ = 25 mΩ at $V_{GS} = 6$ V, $I_D = 7.8$ A
- High performance technology for extremely low $r_{DS(on)}$
- 100% UIL tested
- RoHS Compliant

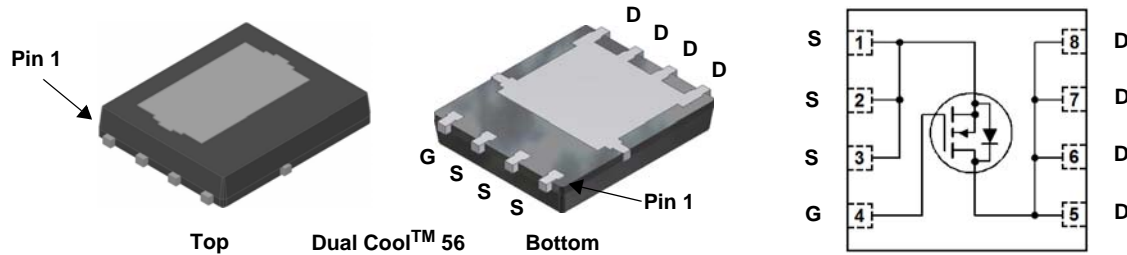


General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that incorporates Shielded Gate technology. 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 MOSFET in DC - DC converters
- 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	150	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current -Continuous	$T_C = 25$ °C	40
	-Continuous	$T_A = 25$ °C (Note 1a)	9.3
	-Pulsed	(Note 4)	100
E_{AS}	Single Pulse Avalanche Energy	(Note 3)	294 mJ
P_D	Power Dissipation	$T_C = 25$ °C	125
	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)	2.5	°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
86200	FDMS86200DC	Dual Cool™ 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	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$	150			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$		105		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 120\ \text{V}$, $V_{GS} = 0\ \text{V}$			1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\ \text{V}$, $V_{DS} = 0\ \text{V}$			± 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\ \mu\text{A}$	2.0	3.3	4.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$		-11		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}$, $I_D = 9.3\ \text{A}$		14	17	m Ω
		$V_{GS} = 6\ \text{V}$, $I_D = 7.8\ \text{A}$		17	25	
		$V_{GS} = 10\ \text{V}$, $I_D = 9.3\ \text{A}$, $T_J = 125\text{ }^\circ\text{C}$		29	35	
g_{FS}	Forward Transconductance	$V_{DS} = 10\ \text{V}$, $I_D = 9.3\ \text{A}$		32		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 75\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$		2110	2955	pF
C_{oss}	Output Capacitance			205	290	pF
C_{rss}	Reverse Transfer Capacitance			8.1	15	pF
R_g	Gate Resistance		0.1	1.5	3.0	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 75\ \text{V}$, $I_D = 9.3\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_{GEN} = 6\ \Omega$		16	29	ns
t_r	Rise Time			4	10	ns
$t_{d(off)}$	Turn-Off Delay Time			23	37	ns
t_f	Fall Time			5	10	ns
$Q_{g(TOT)}$	Total Gate Charge		$V_{GS} = 0\ \text{V}$ to $10\ \text{V}$	$V_{DD} = 75\ \text{V}$, $I_D = 9.3\ \text{A}$	30	42
	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $6\ \text{V}$	19		27	nC
Q_{gs}	Gate to Source Charge		9.7			nC
Q_{gd}	Gate to Drain "Miller" Charge		5.6			nC

Drain-Source Diode Characteristics

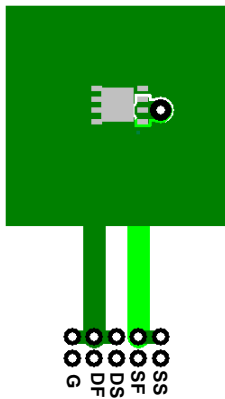
V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\ \text{V}$, $I_S = 9.3\ \text{A}$ (Note 2)		0.8	1.3	V
		$V_{GS} = 0\ \text{V}$, $I_S = 2.6\ \text{A}$ (Note 2)		0.7	1.2	
t_{rr}	Reverse Recovery Time	$I_F = 9.3\ \text{A}$, $di/dt = 100\ \text{A}/\mu\text{s}$		79	126	ns
Q_{rr}	Reverse Recovery Charge			126	176	nC

Thermal Characteristics

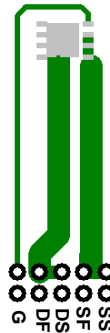
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Top Source)	2.5	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Bottom Drain)	1.0	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	38	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 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:

- $R_{\theta JA}$ 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 in² pad of 2 oz copper



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

- Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in² pad of 2 oz copper
- Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
- Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in² pad of 2 oz copper
- Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
- 200FPM Airflow, No Heat Sink, 1 in² pad of 2 oz copper
- 200FPM Airflow, No Heat Sink, minimum pad of 2 oz copper
- 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in² pad of 2 oz copper
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- 200FPM Airflow, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper

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

- E_{AS} of 294 mJ is based on starting $T_J = 25^{\circ}\text{C}$; N-ch: $L = 3\text{ mH}$, $I_{AS} = 14\text{ A}$, $V_{DD} = 150\text{ V}$, $V_{GS} = 10\text{ V}$. 100% test at $L = 0.1\text{ mH}$, $I_{AS} = 42\text{ A}$.

- Pulsed Id limited by junction temperature, $t_d \leq 10\mu\text{s}$, please refer to SOA curve for more details.

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

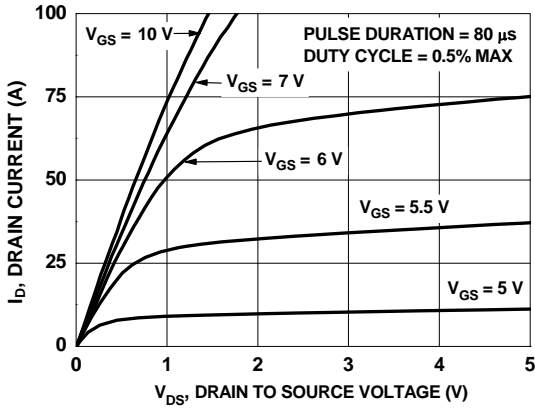


Figure 1. On-Region Characteristics

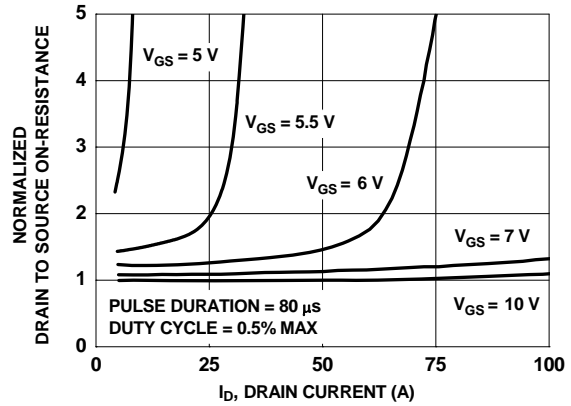


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

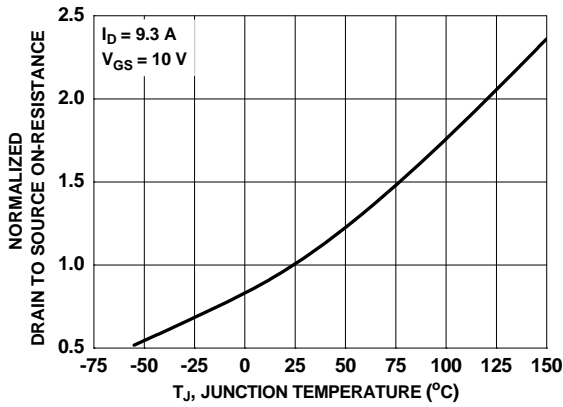


Figure 3. Normalized On-Resistance vs Junction Temperature

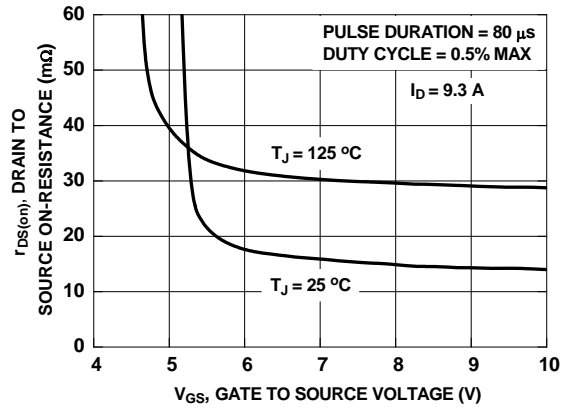


Figure 4. On-Resistance vs Gate to Source Voltage

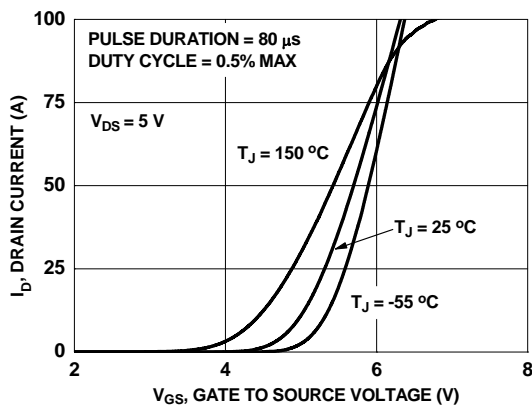


Figure 5. Transfer Characteristics

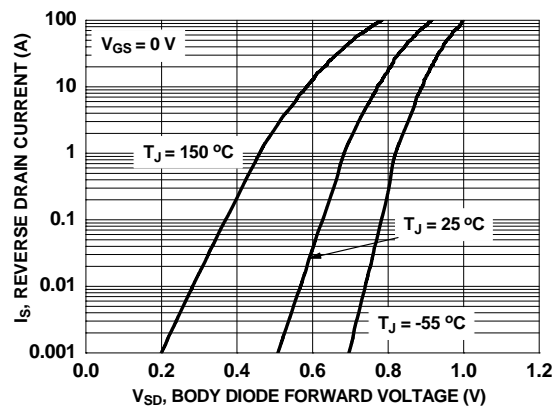


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

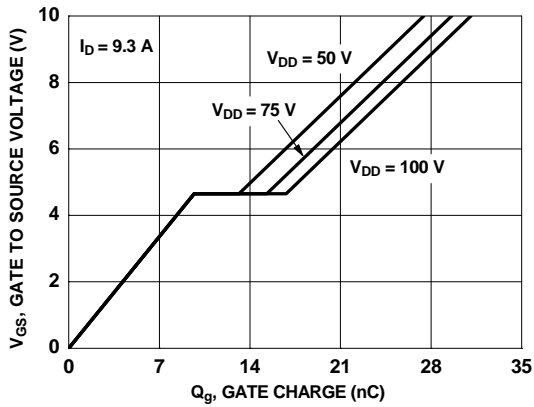


Figure 7. Gate Charge Characteristics

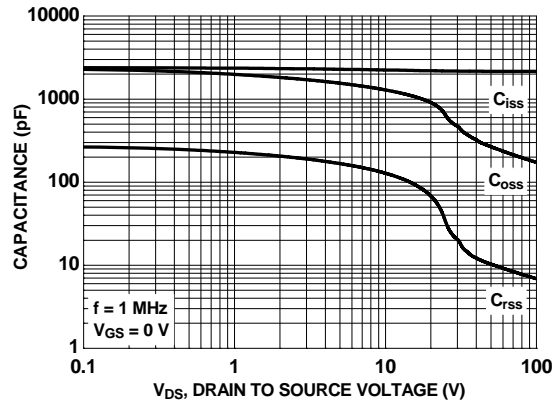


Figure 8. Capacitance vs Drain to Source Voltage

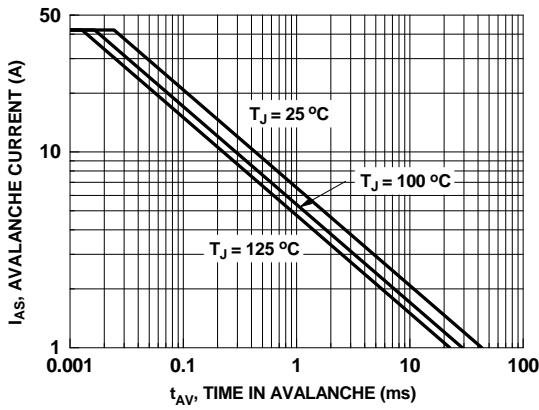


Figure 9. Unclamped Inductive Switching Capability

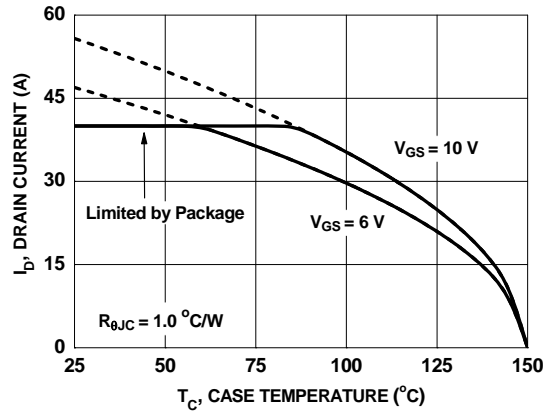


Figure 10. Maximum Continuous Drain Current vs Case Temperature

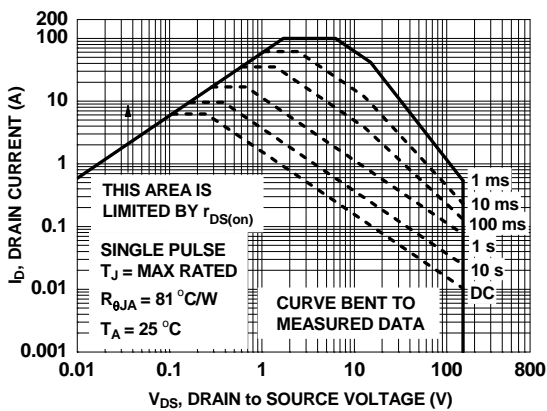


Figure 11. Forward Bias Safe Operating Area

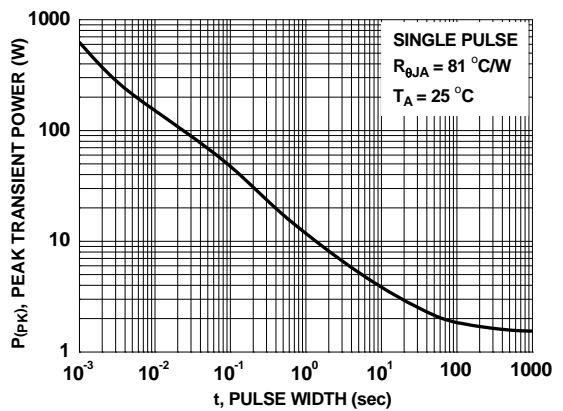


Figure 12. Single Pulse Maximum Power Dissipation

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

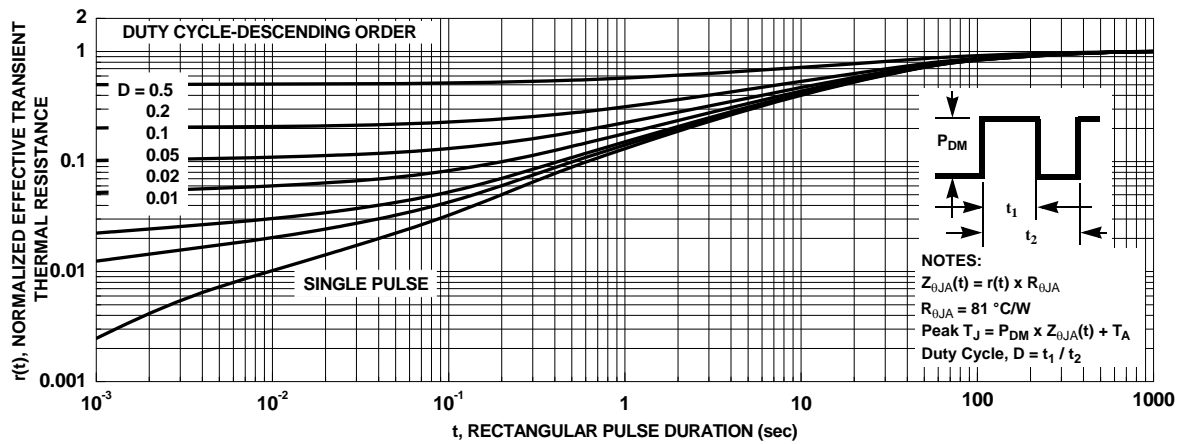
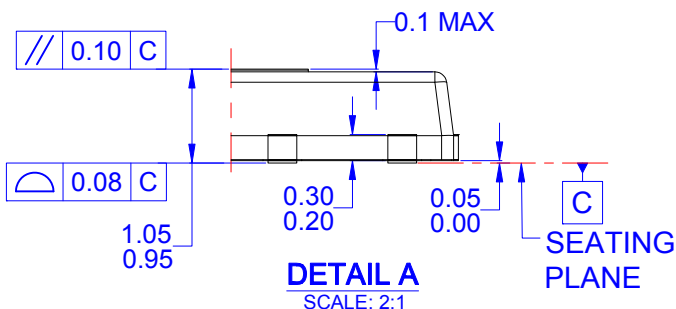
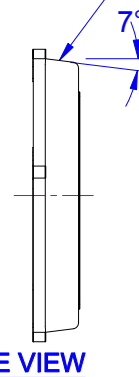
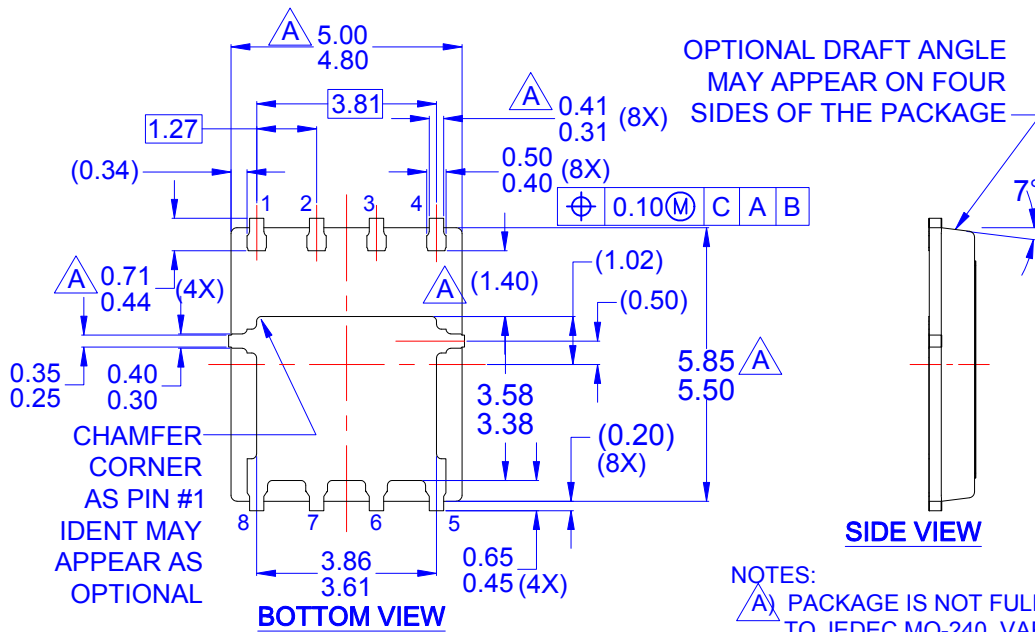
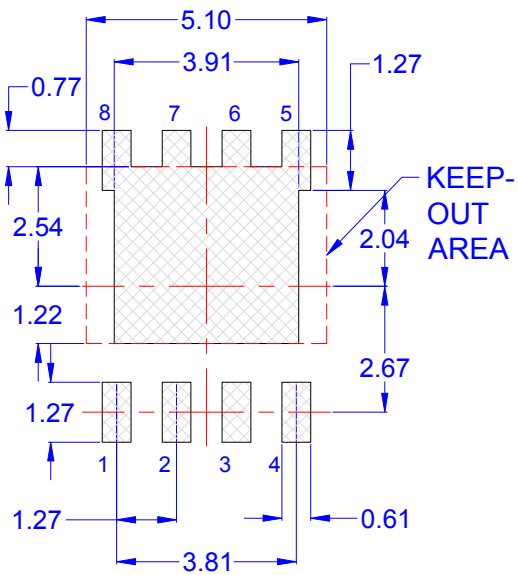
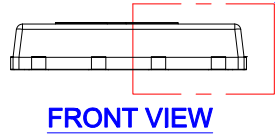
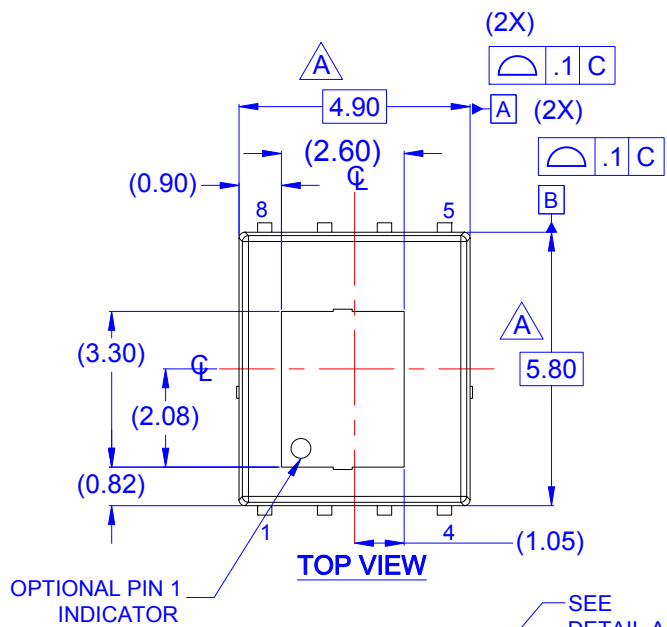


Figure 13. Junction-to-Ambient Transient Thermal Response Curve



- NOTES:
- A) PACKAGE IS NOT FULLY COMPLIANT TO JEDEC MO-240, VARIATION AA.
 - 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-2009.
 - E) IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.
 - F) DRAWING FILE NAME: PQFN08DREV4



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