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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD

March 2015

FDD8780/FDU8780
N-Channel PowerTrench® MOSFET
25V, 35A, 8.5mΩ

General Description

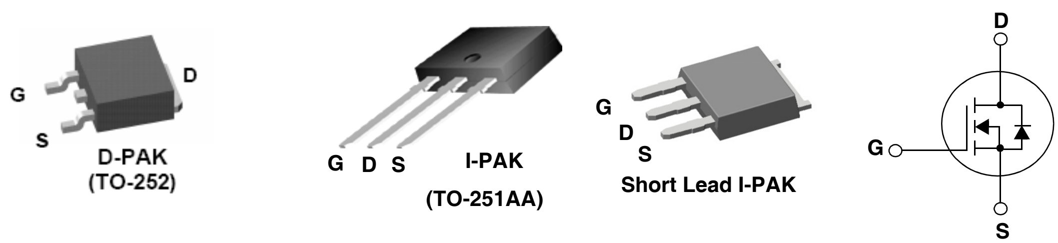
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(on)}$ and fast switching speed.

Application

- Vcore DC-DC for Desktop Computers and Servers
- VRM for Intermediate Bus Architecture

Features

- Max $r_{DS(on)}$ = 8.5mΩ at V_{GS} = 10V, I_D = 35A
- Max $r_{DS(on)}$ = 12.0mΩ at V_{GS} = 4.5V, I_D = 35A
- Low gate charge: $Q_{g(10)}$ = 21nC(Typ), V_{GS} = 10V
- Low gate resistance
- Avalanche rated and 100% tested
- RoHS Compliant



MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DS}	Drain to Source Voltage		25	V
V_{GS}	Gate to Source Voltage		±20	V
I_D	Drain Current -Continuous (Package Limited)		35	A
	-Continuous (Die Limited)		60	
	-Pulsed	(Note 1)	224	
E_{AS}	Single Pulse Avalanche Energy	(Note 2)	73	mJ
P_D	Power Dissipation		50	W
T_J, T_{STG}	Operating and Storage Temperature		-55 to 175	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case TO-252,TO-251	3.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient TO-252,TO-251	100	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient TO-252,1in^2 copper pad area	52	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD8780	FDD8780	TO-252AA	13"	16mm	2500 units
FDU8780	FDU8780	TO-251AA	N/A(Tube)	N/A	75 units
FDU8780	FDU8780_F071	TO-251AA	N/A(Tube)	N/A	75 units

Electrical Characteristics T_J = 25°C unless otherwise noted

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
B_{VDSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V	25			V
$\frac{\Delta B_{VDSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, referenced to 25°C		12		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 20V, V_{GS} = 0V			1	μA
		V_{DS} = 20V, V_{GS} = 0V, T_J = 150°C			250	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20V			±100	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA	1.2	1.8	2.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250μA, referenced to 25°C		-6.3		mV/°C
$r_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 10V, I_D = 35A		6.5	8.5	mΩ
		V_{GS} = 4.5V, I_D = 35A		9.1	12.0	mΩ
		V_{GS} = 10V, I_D = 35A, T_J = 175°C		10.4	15.0	mΩ

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 13V, V_{GS} = 0V, f = 1MHz		1080	1440	pF
C_{oss}	Output Capacitance			265	355	pF
C_{rss}	Reverse Transfer Capacitance			180	270	pF
R_g	Gate Resistance	f = 1MHz		0.9		Ω

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 13V, I_D = 35A, V_{GS} = 10V, R_{GS} = 17Ω		7	14	ns
t_r	Rise Time			9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			43	69	ns
t_f	Fall Time			24	38	ns
Q_g	Total Gate Charge	V_{GS} = 0V to 10V; V_{DD} = 13V, I_D = 35A, I_g = 1.0mA		21	29	nC
Q_g	Total Gate Charge	V_{GS} = 0V to 5V; V_{DD} = 13V, I_D = 35A, I_g = 1.0mA		11.2	16	nC
Q_{gs}	Gate to Source Gate Charge	V_{DD} = 13V, I_D = 35A, I_g = 1.0mA		3.5		nC
Q_{gd}	Gate to Drain "Miller"Charge			4.7		nC

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = 35A		0.92	1.25	V
		V_{GS} = 0V, I_S = 15A		0.84	1.0	V
t_{rr}	Reverse Recovery Time	I_F = 35A, di/dt = 100A/μs		28	42	ns
Q_{rr}	Reverse Recovery Charge	I_F = 35A, di/dt = 100A/μs		20	30	nC

Notes:

1: Pulse time < 300μs, Duty cycle = 2%.

2: Starting T_J = 25°C, L = 0.3mH, I_{AS} = 22A ,V_{DD} = 23V, V_{GS} = 10V.

Typical Characteristics T_J = 25°C unless otherwise noted

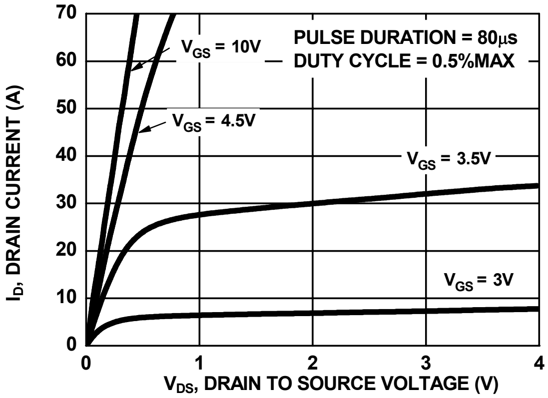


Figure 1. On Region Characteristics

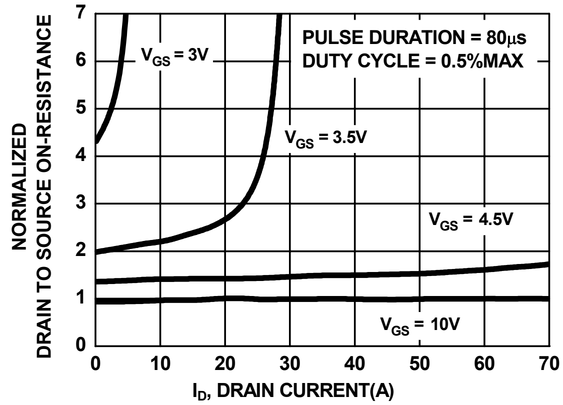


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

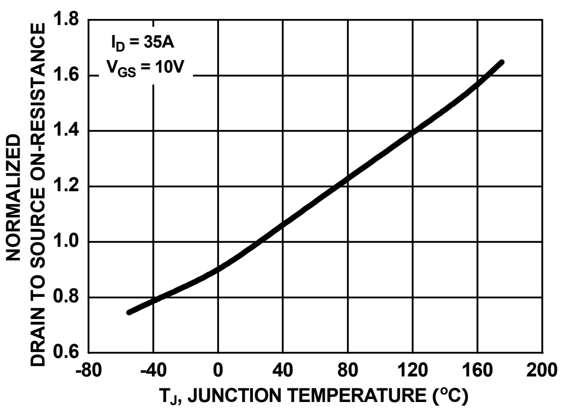


Figure 3. Normalized On Resistance vs Junction Temperature

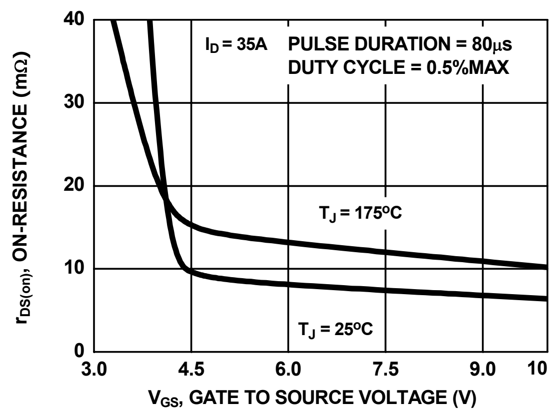


Figure 4. On-Resistance vs Gate to Source Voltage

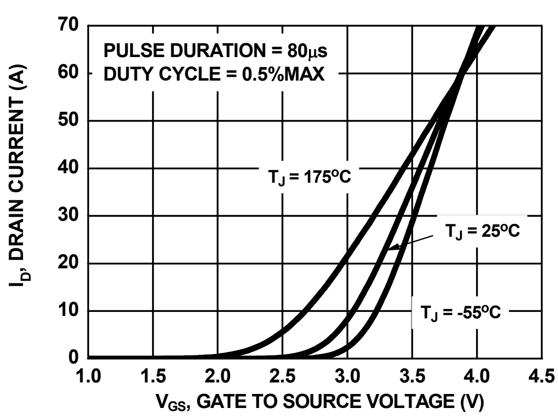


Figure 5. Transfer Characteristics

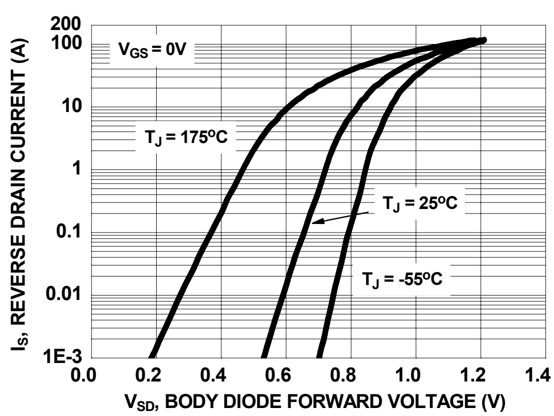


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

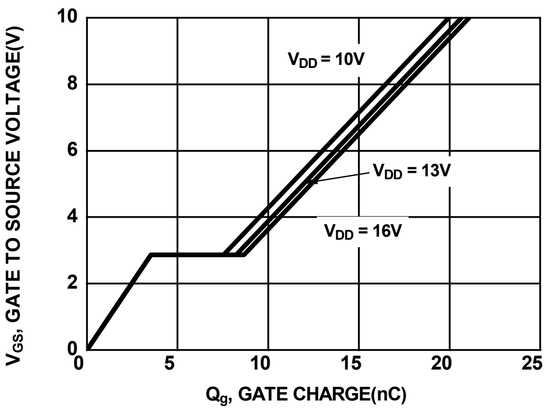


Figure 7. Gate Charge Characteristics

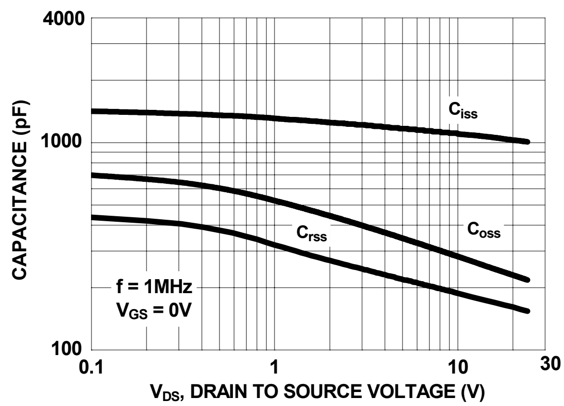


Figure 8. Capacitance vs Drain to Source Voltage

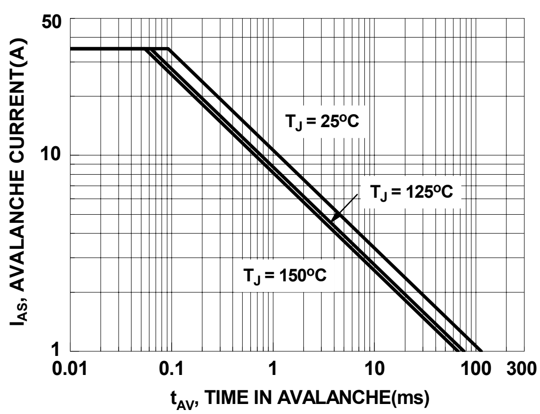


Figure 9. Unclamped Inductive Switching Capability

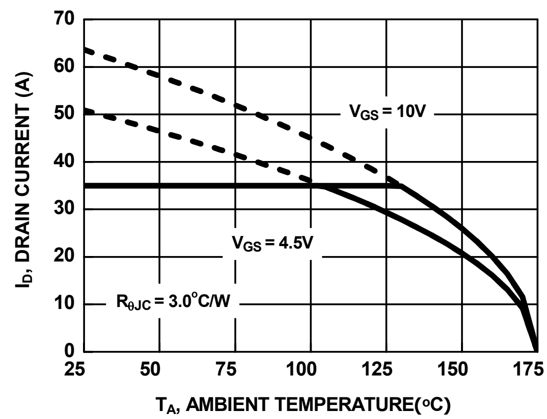


Figure 10. Maximum Continuous Drain Current vs Case Temperature

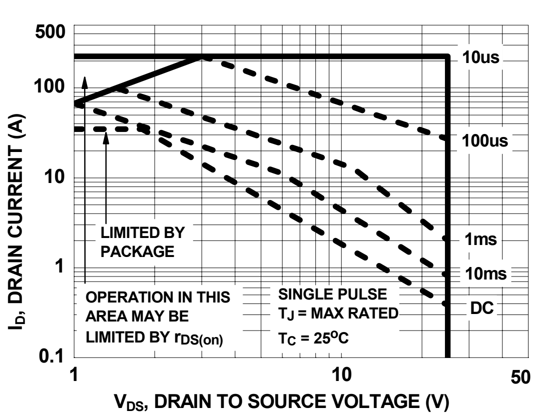


Figure 11. Forward Bias Safe Operating Area

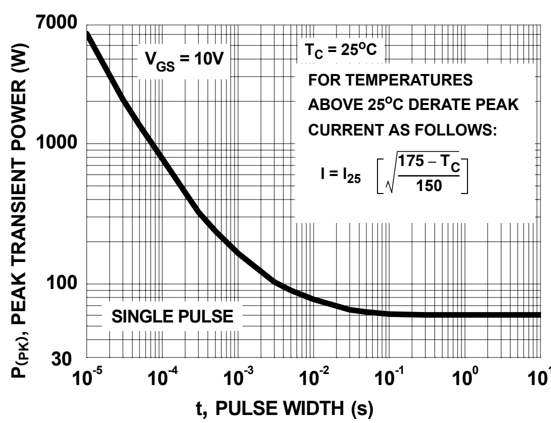


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25°C unless otherwise noted

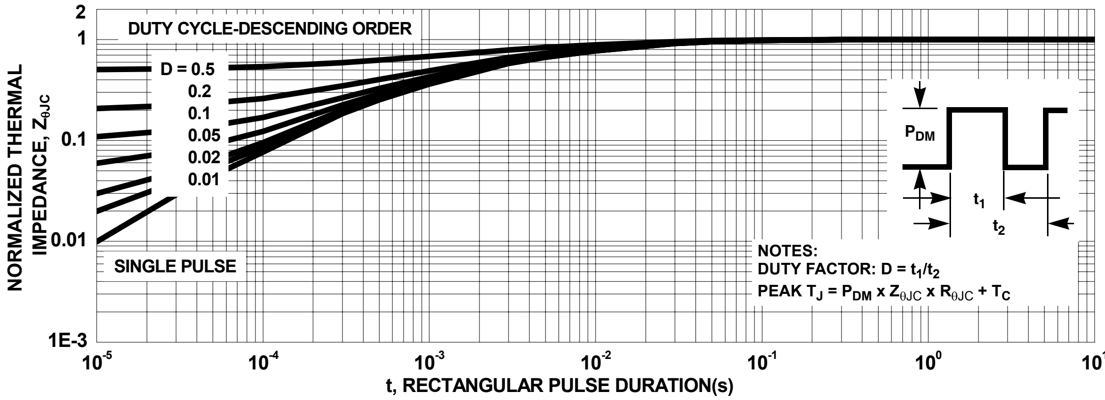
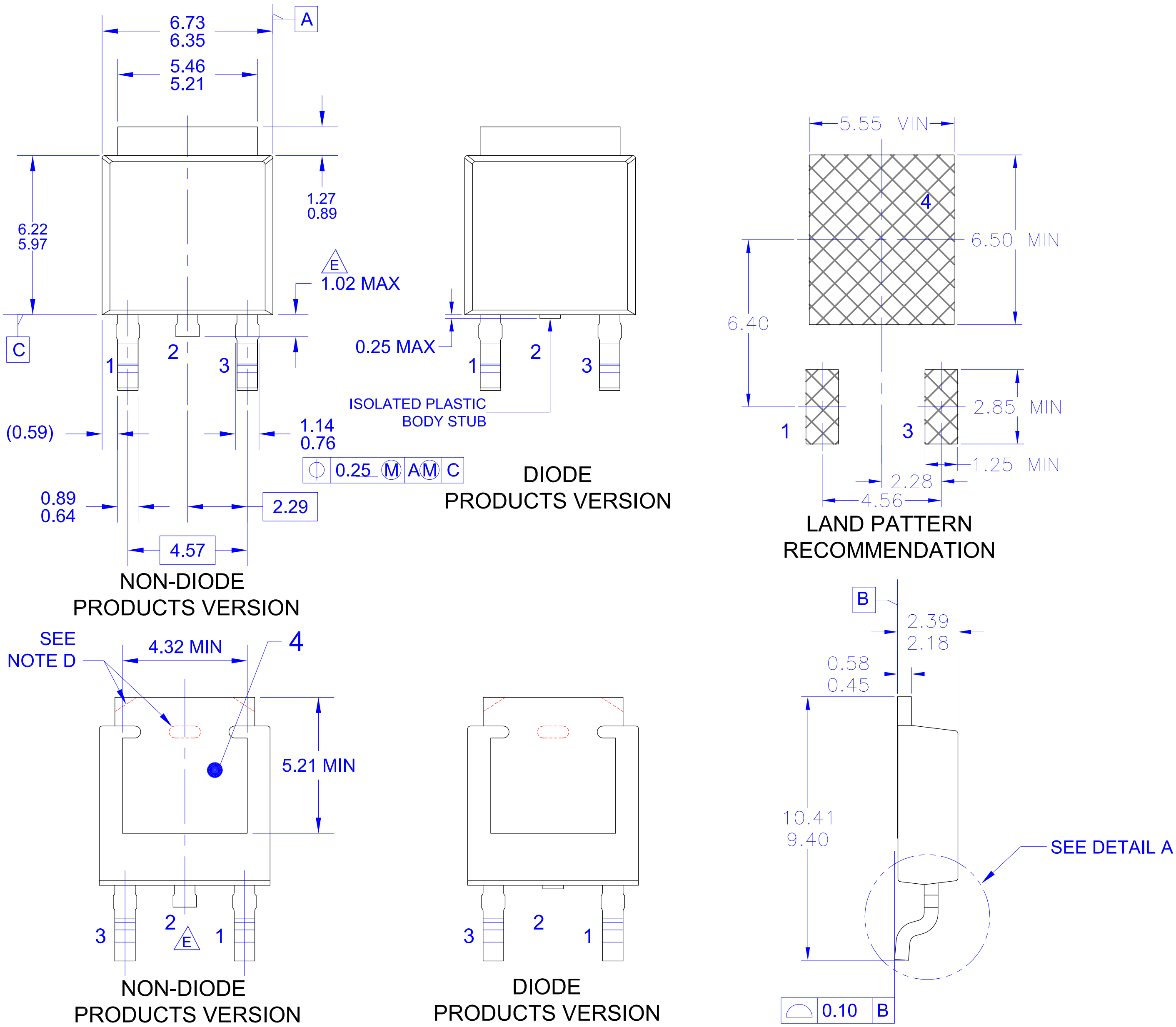
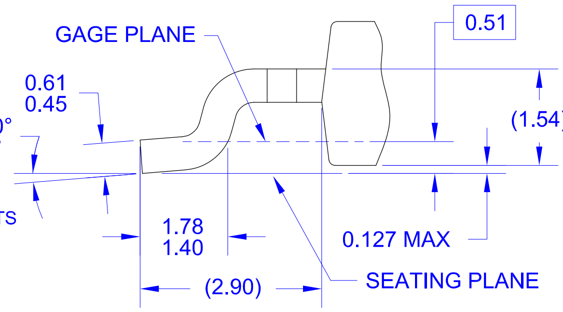


Figure 13. Transient Thermal Response Curve





DETAIL A
(ROTATED -90°)
SCALE: 12X

NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.
E) TRIMMED METAL CENTER LEAD IS PRESENT ON FOR NON-DIODE PRODUCTS
F) DIMENSIONS ARE EXCLUSIVE OF BURS, MOLD FLASH AND TIE BAR EXTRUSIONS.
G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.
H) DRAWING NUMBER AND REVISION: MKT-TO252A03REV11

PUBLICATION ORDERING INFORMATION

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