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FDD86540

N-Channel PowerTrench[®] MOSFET 60 V, 136 A, 4.1 mΩ

Features

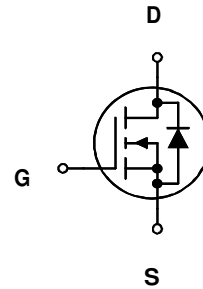
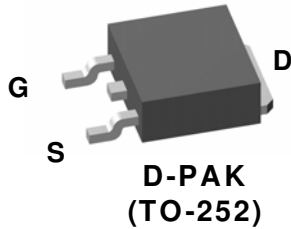
- Max $r_{DS(on)}$ = 4.1 mΩ at $V_{GS} = 10\text{ V}$, $I_D = 21.5\text{ A}$
- Max $r_{DS(on)}$ = 5 mΩ at $V_{GS} = 8\text{ V}$, $I_D = 19.5\text{ A}$
- 100% UIL tested
- RoHS Compliant

General Description

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

Applications

- Primary Switch in isolated DC-DC
- Synchronous Rectifier
- Load Switch



MOSFET Maximum Ratings $T_C = 25\text{ °C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	60	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current -Continuous	$T_C = 25\text{ °C}$ (Note 5)	136
	-Continuous	$T_C = 100\text{ °C}$ (Note 5)	86
	-Continuous	$T_A = 25\text{ °C}$ (Note 1a)	21.5
	-Pulsed	(Note 4)	240
E_{AS}	Single Pulse Avalanche Energy	(Note 3)	228
P_D	Power Dissipation	$T_C = 25\text{ °C}$	127
	Power Dissipation	$T_A = 25\text{ °C}$ (Note 1a)	3.1
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.98	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	40	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD86540	FDD86540	D-PAK(TO-252)	13 "	16 mm	2500 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\ \mu\text{A}, V_{GS} = 0\ \text{V}$	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, referenced to 25°C		28		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 48\ \text{V}, V_{GS} = 0\ \text{V}$			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	3.1	4	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°C		-11		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}, I_D = 21.5\ \text{A}$		3.4	4.1	m Ω
		$V_{GS} = 8\ \text{V}, I_D = 19.5\ \text{A}$		4.1	5	
		$V_{GS} = 10\ \text{V}, I_D = 21.5\ \text{A}, T_J = 125^\circ\text{C}$		5.2	6.3	
g_{FS}	Forward Transconductance	$V_{DS} = 10\ \text{V}, I_D = 21.5\ \text{A}$		75		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 30\ \text{V}, V_{GS} = 0\ \text{V},$ $f = 1\ \text{MHz}$		4767	6340	pF
C_{oss}	Output Capacitance			1409	1880	pF
C_{riss}	Reverse Transfer Capacitance			48	90	pF
R_g	Gate Resistance			0.6		Ω

Switching Characteristics

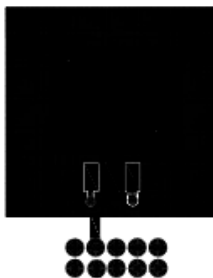
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\ \text{V}, I_D = 21.5\ \text{A},$ $V_{GS} = 10\ \text{V}, R_{GEN} = 6\ \Omega$		26	42	ns
t_r	Rise Time			15	28	ns
$t_{d(off)}$	Turn-Off Delay Time			31	49	ns
t_f	Fall Time			6.9	14	ns
Q_g	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $10\ \text{V}$	$V_{DD} = 30\ \text{V},$ $I_D = 21.5\ \text{A}$	65	90	nC
Q_g	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $8\ \text{V}$		54	75	nC
Q_{gs}	Gate to Source Charge			23		nC
Q_{gd}	Gate to Drain "Miller" Charge			12		nC

Drain-Source Diode Characteristics

V_{SD}	Source-Drain Diode Forward Voltage	$V_{GS} = 0\ \text{V}, I_S = 21.5\ \text{A}$ (Note 2)		0.8	1.3	V
		$V_{GS} = 0\ \text{V}, I_S = 2.6\ \text{A}$ (Note 2)		0.7	1.2	V
t_{rr}	Reverse Recovery Time	$I_F = 21.5\ \text{A}, di/dt = 100\ \text{A}/\mu\text{s}$		56	90	ns
Q_{rr}	Reverse Recovery Charge			43	69	nC

Notes:

- 1: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.
 $R_{\theta JA}$ is determined by the user's board design.



a) $40^\circ\text{C}/\text{W}$ when mounted on a $1\ \text{in}^2$ pad of 2 oz copper



b) $96^\circ\text{C}/\text{W}$ when mounted on a minimum pad

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

3: Starting $T_J = 25^\circ\text{C}$, $L = 0.3\ \text{mH}$, $I_{AS} = 39\ \text{A}$, $V_{DD} = 54\ \text{V}$, $V_{GS} = 10\ \text{V}$.

4: Pulsed I_d please refer to Fig 11 SOA graph for more details.

5: Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

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

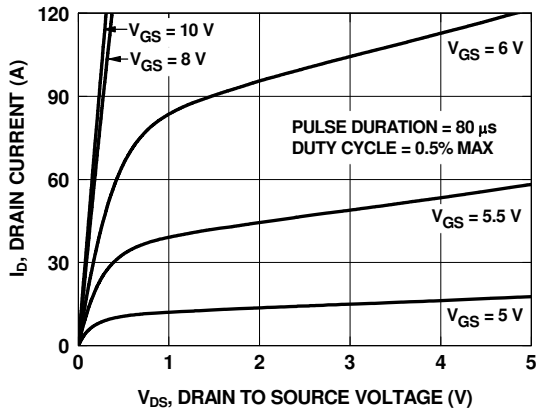


Figure 1. On-Region Characteristics

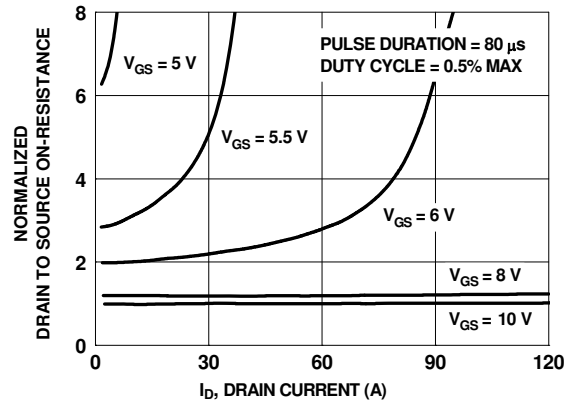


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

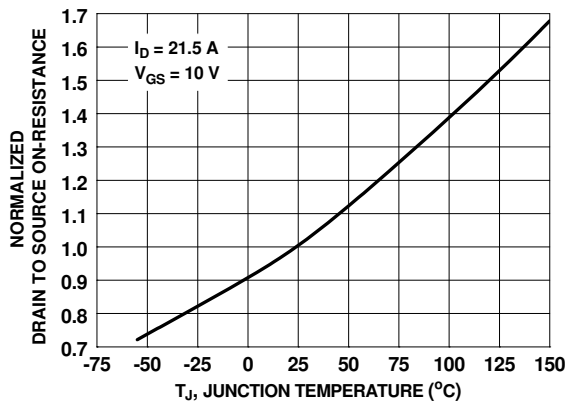


Figure 3. Normalized On-Resistance vs Junction Temperature

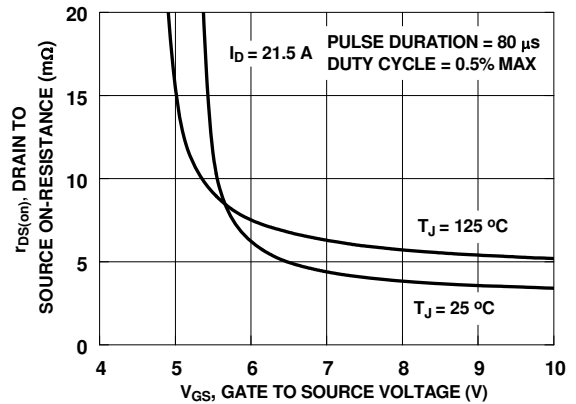


Figure 4. On-Resistance vs Gate to Source Voltage

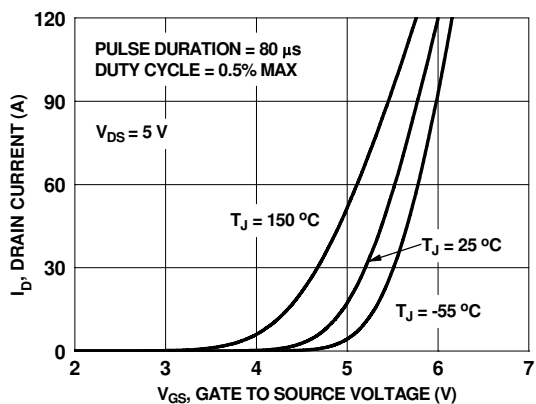


Figure 5. Transfer Characteristics

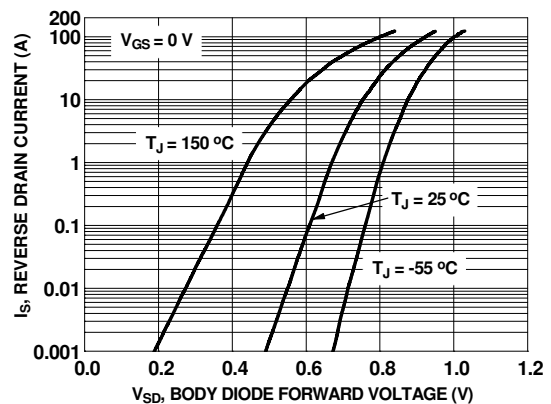


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

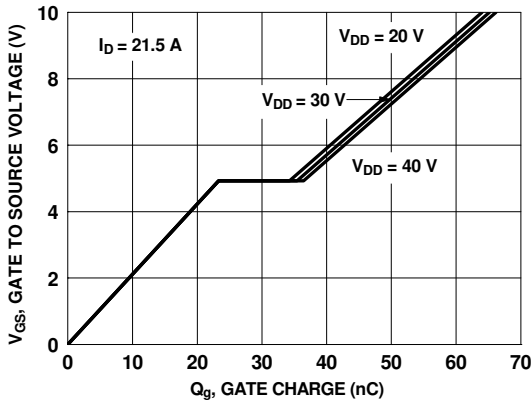


Figure 7. Gate Charge Characteristics

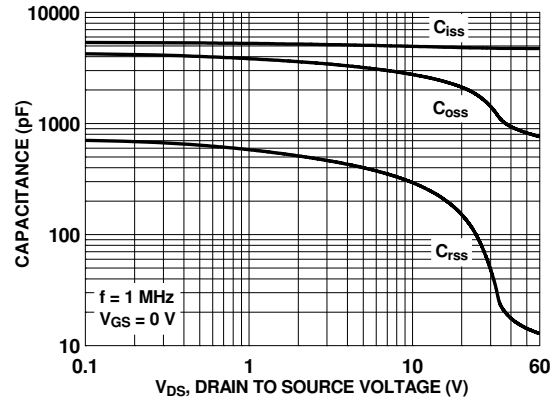


Figure 8. Capacitance vs Drain to Source Voltage

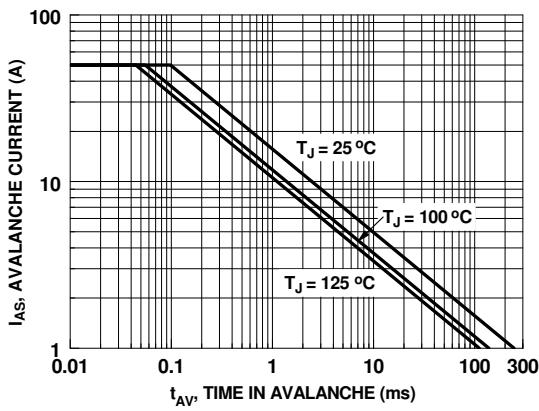


Figure 9. Unclamped Inductive Switching Capability

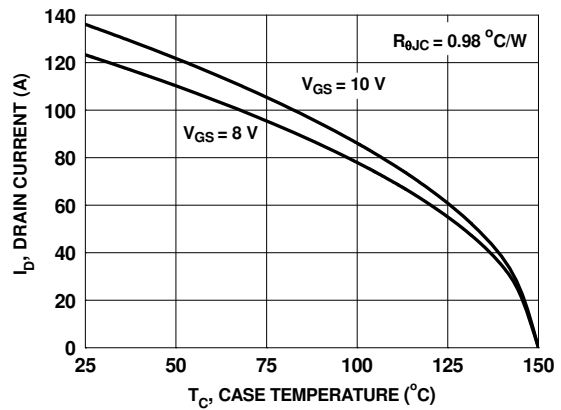


Figure 10. Maximum Continuous Drain Current vs Case Temperature

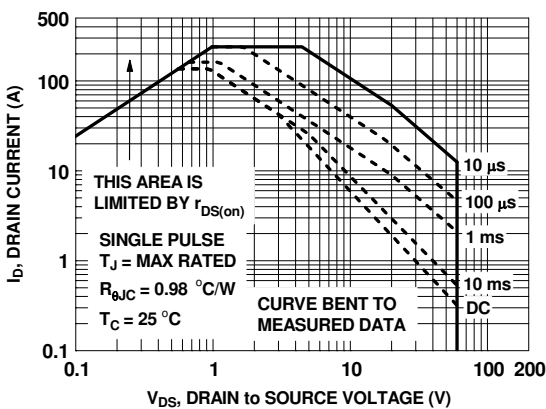


Figure 11. Forward Bias Safe Operating Area

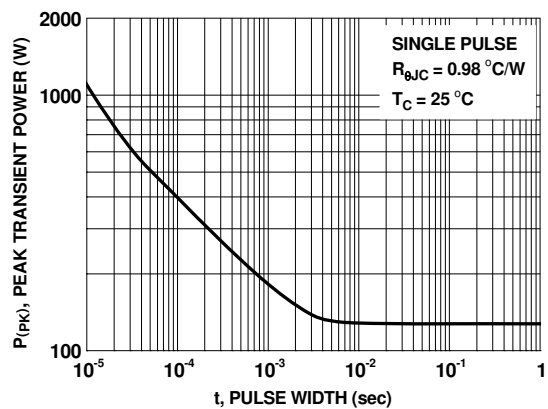


Figure 12. Single Pulse Maximum Power Dissipation

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

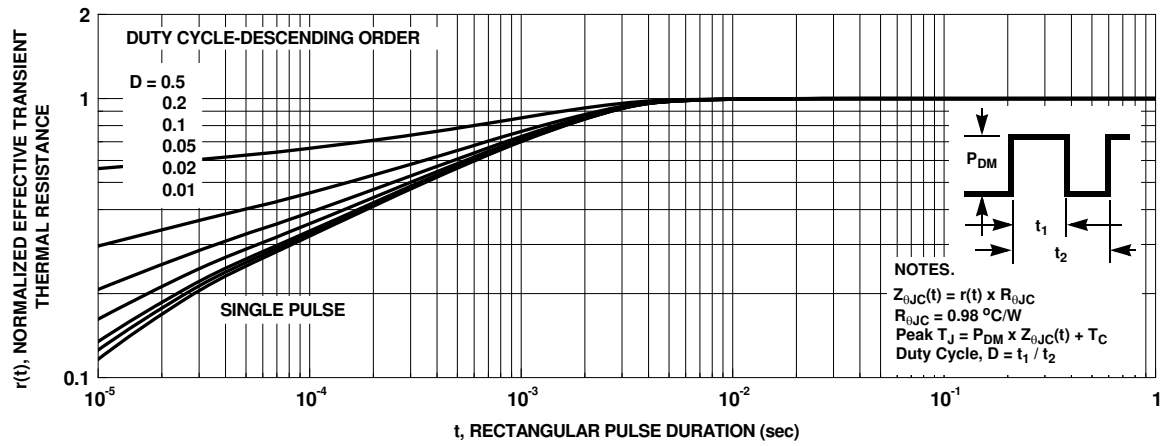
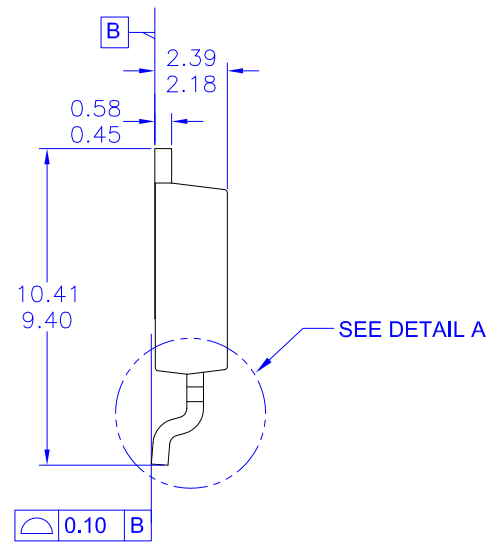
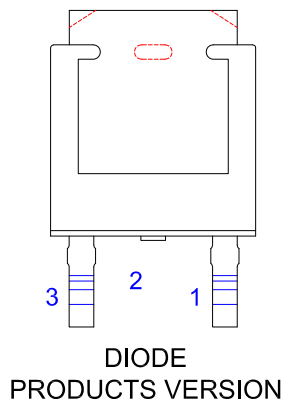
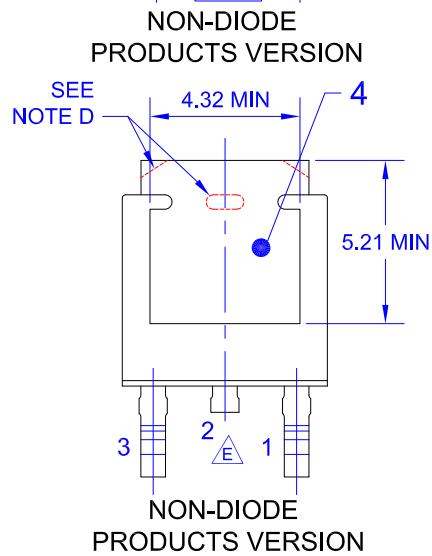
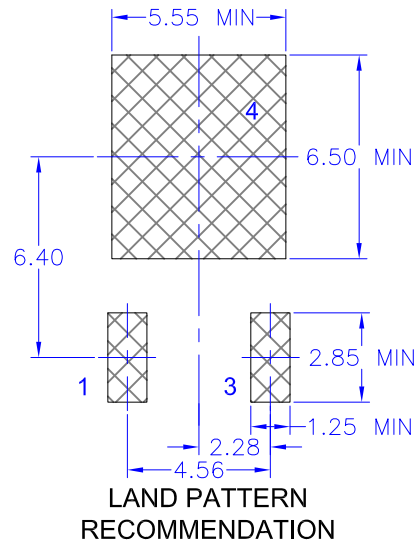
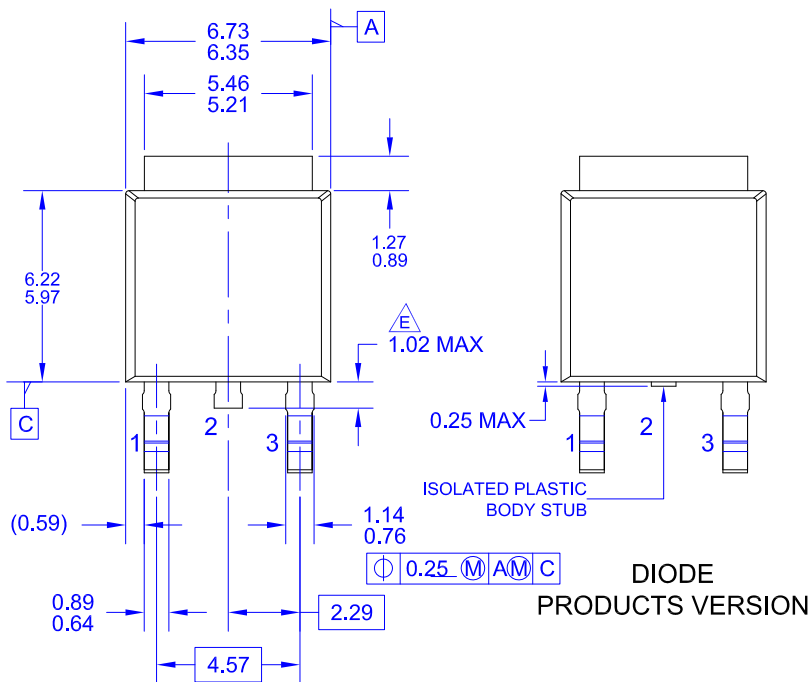
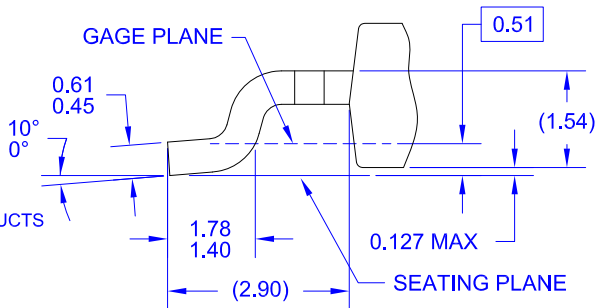


Figure 13. Junction-to-Case Transient Thermal Response Curve



- 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



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