



ON Semiconductor®

FDD6N50 / FDU6N50

N-Channel UniFET™ MOSFET

500 V, 6 A, 900 mΩ

Features

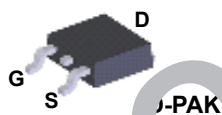
- $R_{DS(on)} = 900\text{ m}\Omega$ (Max.) @ $V_{GS} = 10\text{ V}$, $I_D = 3\text{ A}$
- Low Gate Charge (Typ. 12.8 nC)
- Low C_{rss} (Typ. 9 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability

Applications

- LCD/LED/PDP TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

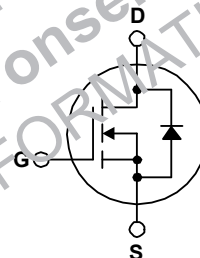
UniFET™ MOSFET is ON Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (PDP) TV power supply and electronic lamp ballasts.



DPAK



I-PAK



Absolute Maximum Ratings

$T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	FDD6N50TM / FDD6N50TM-WS / FDU6N50TU	Unit
V_{GS}	Gate-Source Voltage	500	V
I_D	Drain Current	6 3.8	A A
	- Continuous ($T_C = 25^\circ\text{C}$)		
	- Continuous ($T_C = 100^\circ\text{C}$)		
I_{DM}	Drain Current	24	A
	- Pulsed (Note 1)		
V_{GSS}	Gate-Source voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy	270	mJ
I_{AR}	Avalanche Current	6	A
	(Note 1)		
E_{AR}	Repetitive Avalanche Energy	8.9	mJ
	(Note 1)		
dv/dt	Peak Diode Recovery dv/dt	4.5	V/ns
	(Note 3)		
P_D	Power Dissipation	89 0.71	W W/°C
	($T_C = 25^\circ\text{C}$) - Derate Above 25°C		
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	°C

Thermal Characteristics

Symbol	Parameter	FDD6N50TM / FDD6N50TM-WS / FDU6N50TU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.4	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	83	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDD6N50TM	FDD6N50	DPAK	Tape and Reel	330 mm	16 mm	2500 units
FDD6N50TM-WS	FDD6N50S	DPAK	Tape and Reel	330 mm	16 mm	2500 units
FDU6N50TU	FDU6N50	IPAK	Tube	N/A	N/A	75 units

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

Symbol	Parameter	Conditions	Min.	Typ.	Max	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	500	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	--	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 500 V, V _{GS} = 0 V V _{DS} = 400 V, T _C = 125°C	--	--	1 10	μA μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30 V, V _{DS} = 0 V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30 V, V _{DS} = 0 V	--	--	100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	3.0	--	5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 3 A	--	0.70	0.9	Ω
g _{FS}	Forward Transconductance	V _{DS} = 4 V, I _D = 3 A	--	2.5	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V	--	720	940	pF
C _{oss}	Output Capacitance	f = 1 MHz	--	95	190	pF
C _{rss}	Reverse Transfer Capacitance		--	9	13.5	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 250 V, I _D = 6 A, V _{GS} = 10 V, R _G = 25 Ω	--	6	20	ns
t _r	Turn-On Rise Time		--	55	120	ns
t _{d(off)}	Turn-Off Delay Time		--	25	60	ns
t _f	Turn-Off Fall Time	(Note 4)	--	35	80	ns
Q _{gs}	Turn-On Gate Charge	V _{DS} = 400 V, I _D = 6 A, V _{GS} = 10 V	--	12.8	16.6	nC
Q _{gd}	Gate-Source Charge		--	3.7	--	nC
Q _{gd}	Gate-Drain Charge		(Note 4)	--	5.8	--
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	6	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	24	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 6 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 6 A, dI _F /dt = 100 A/μs	--	275	--	ns
Q _{rr}	Reverse Recovery Charge		--	1.7	--	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. $I_{AS} = 6\text{ A}$, $V_{DD} = 50\text{ V}$, $L = 13.5\text{ mH}$, $R_G = 25\text{ }\Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 6\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

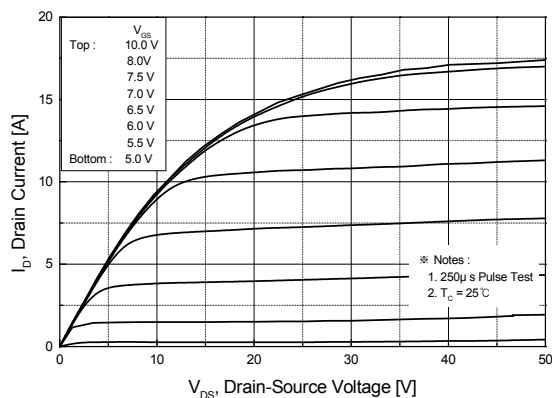


Figure 2. Transfer Characteristics

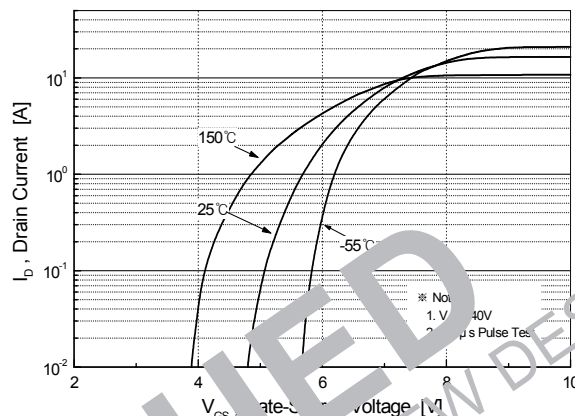


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

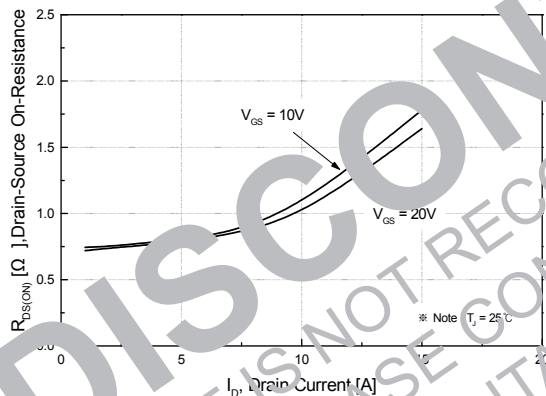


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

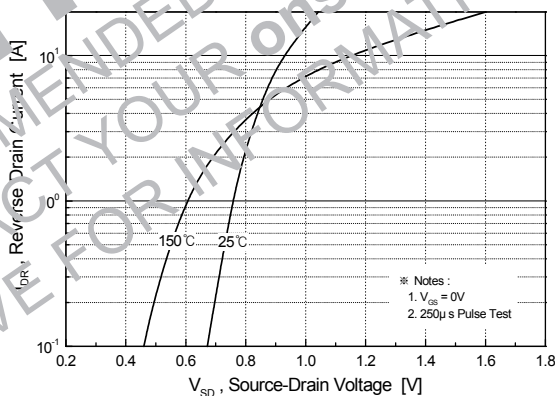


Figure 5. Capacitance Characteristics

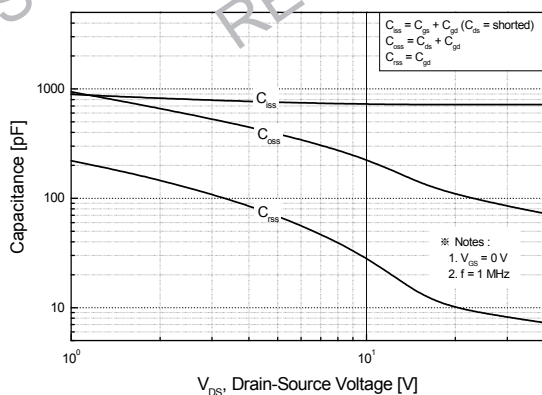
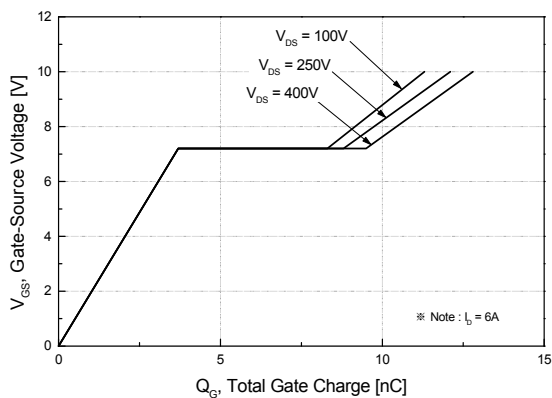


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

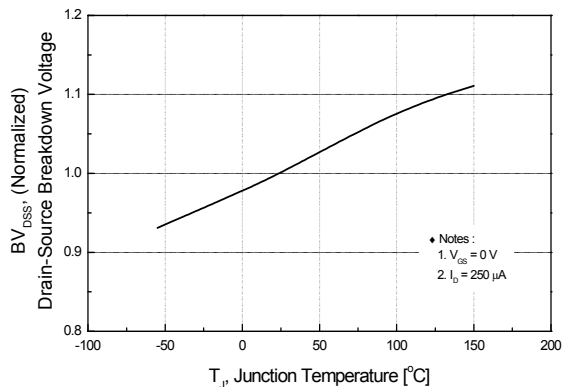


Figure 8. On-Resistance Variation vs. Temperature

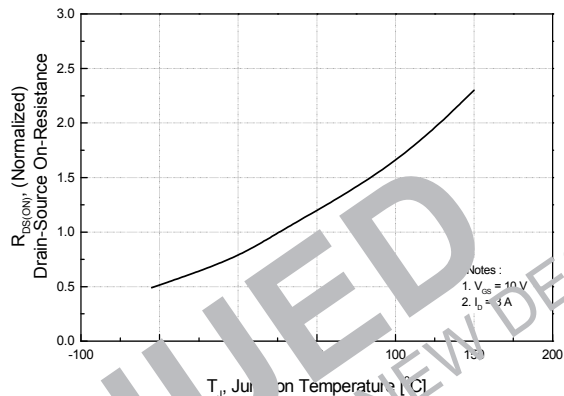


Figure 9. Maximum Safe Operating Area

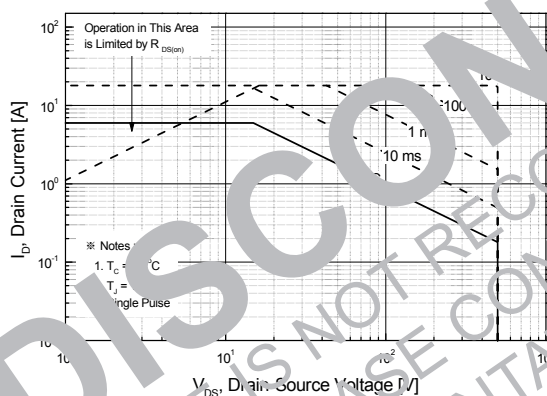


Figure 10. Maximum Drain Current vs. Case Temperature

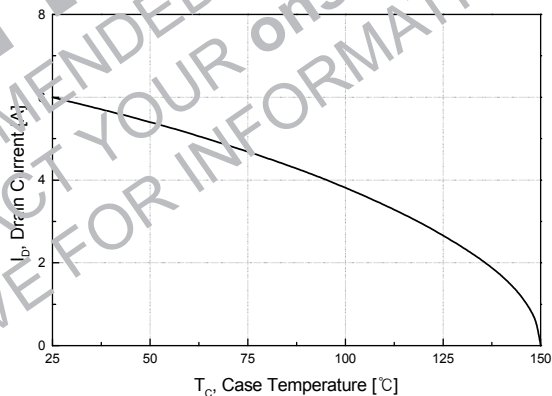
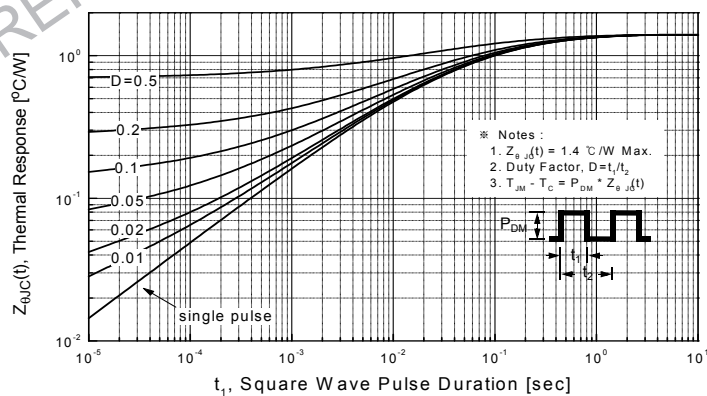
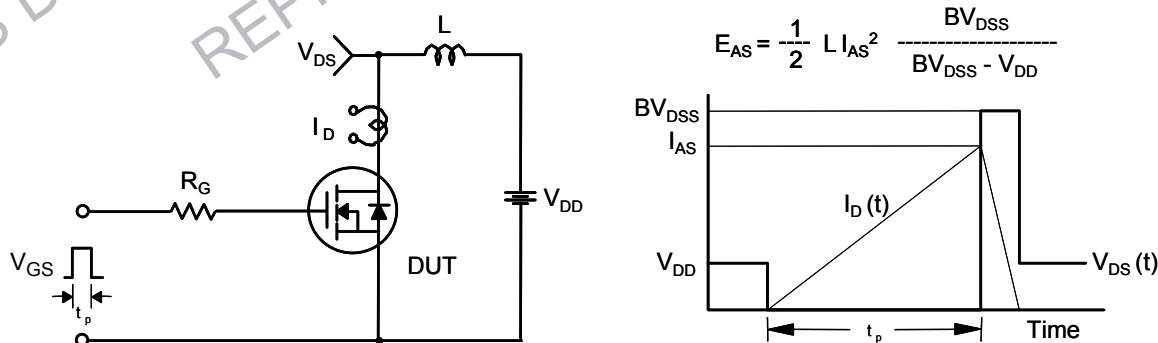
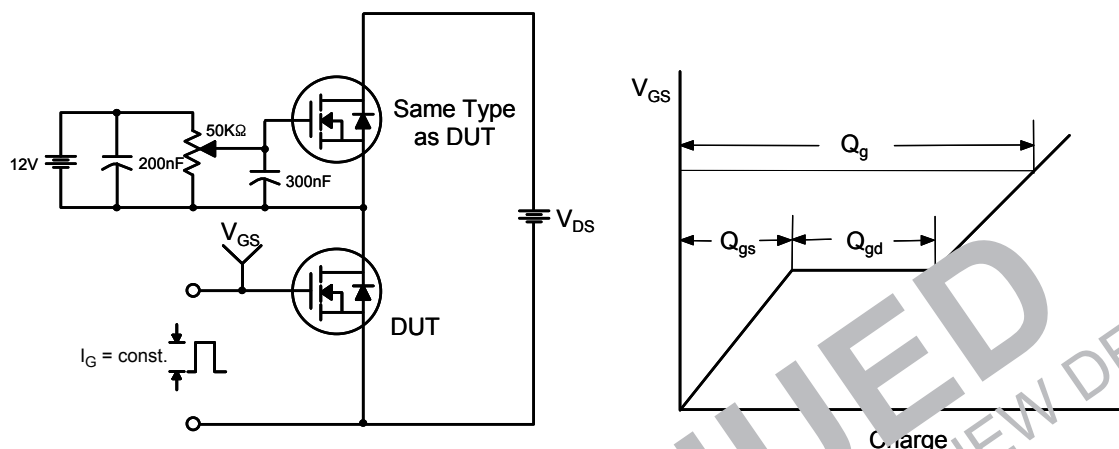


Figure 11. Transient Thermal Response Curve





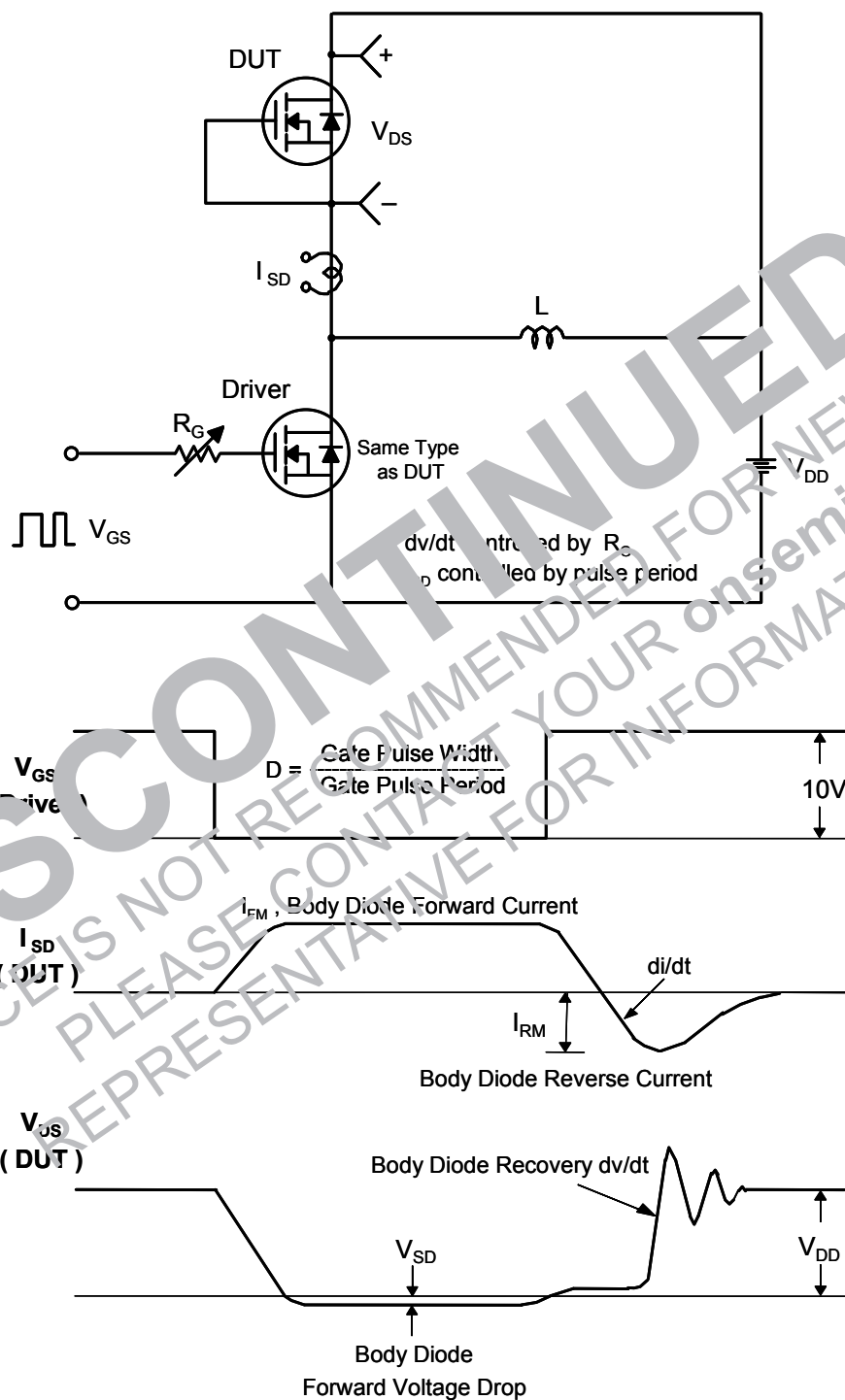


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

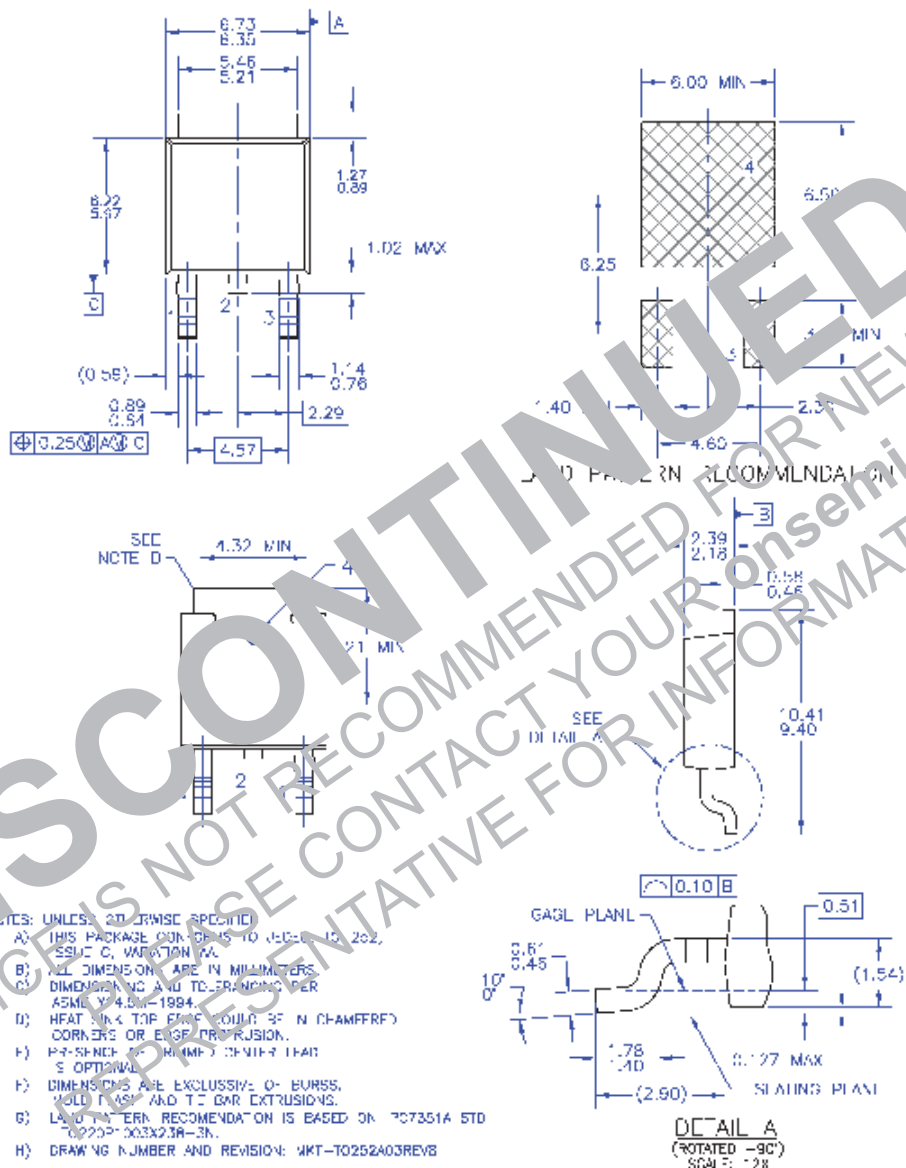
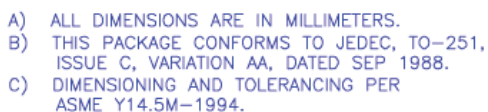


Figure 16. TO252 (D-PAK), Molded, 3-Lead, Option AA&AB

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