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FQD12N20 / FQU12N20

N-Channel QFET® MOSFET

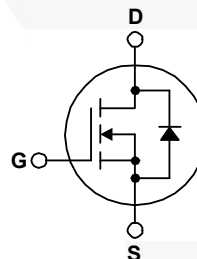
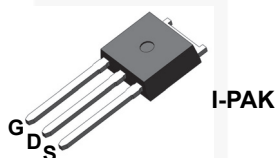
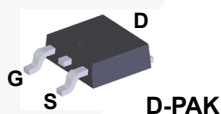
200 V, 9 A, 280 mΩ

Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.

Features

- 9 A, 200 V, $R_{DS(on)} = 280 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 4.5 \text{ A}$
- Low Gate Charge (Typ. 18 nC)
- Low Crss (Typ. 18 pF)
- 100% Avalanche Tested
- RoHS Compliant



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

Symbol	Parameter	FQD12N20TM / FQU12N20TU	Unit
V_{DSS}	Drain-Source Voltage	200	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$)	9.0	A
		5.7	A
I_{DM}	Drain Current - Pulsed (Note 1)	36	A
V_{GSS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	210	mJ
I_{AR}	Avalanche Current (Note 1)	9.0	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	5.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
P_D	Power Dissipation ($T_A = 25^\circ\text{C}$) *	2.5	W
	Power Dissipation ($T_C = 25^\circ\text{C}$)	55	W
	- Derate above 25°C	0.44	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FQD12N20TM FQU12N20TU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	2.27	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (minimum pad of 2 oz copper), Max.	110	
	Thermal Resistance, Junction to Ambient (*1 in ² pad of 2 oz copper), Max.	50	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQD12N20TM	FQD12N20	D-PAK	Tape and Reel	330 mm	16 mm	2500 units
FQU12N20TU	FQU12N20	I-PAK	Tube	N/A	N/A	70 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	200	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	--	0.14	--	V/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 160\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 4.5\text{ A}$	--	0.21	0.28	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 4.5\text{ A}$	--	7.3	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	700	910	pF
C_{oss}	Output Capacitance		--	125	160	pF
C_{rfs}	Reverse Transfer Capacitance		--	18	25	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 100\text{ V}, I_D = 11.6\text{ A},$ $R_G = 25\ \Omega$	--	13	35	ns
t_r	Turn-On Rise Time		--	120	250	ns
$t_{d(off)}$	Turn-Off Delay Time		--	30	70	ns
t_f	Turn-Off Fall Time		(Note 4)	--	55	120
Q_g	Total Gate Charge	$V_{DS} = 160\text{ V}, I_D = 11.6\text{ A},$ $V_{GS} = 10\text{ V}$	--	18	23	nC
Q_{gs}	Gate-Source Charge		--	5	--	nC
Q_{gd}	Gate-Drain Charge		(Note 4)	--	8	--

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current	--	--	9.0	A	
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current	--	--	36	A	
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 9.0\text{ A}$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 11.6\text{ A},$ $di_F / dt = 100\text{ A}/\mu\text{s}$	--	130	--	ns
Q_{rr}	Reverse Recovery Charge		--	0.63	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $L = 3.9\text{ mH}, I_{AS} = 9.0\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 11.6\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Essentially independent of operating temperature

Typical Characteristics

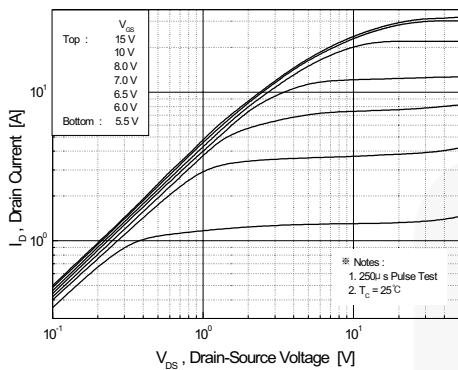


Figure 1. On-Region Characteristics

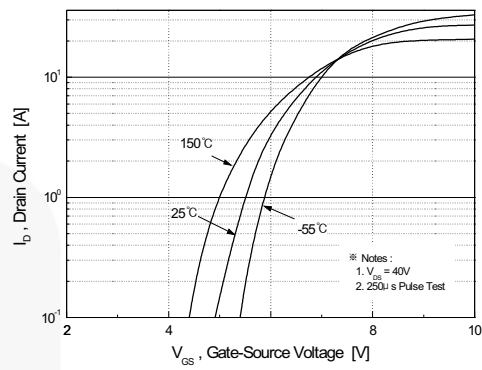


Figure 2. Transfer Characteristics

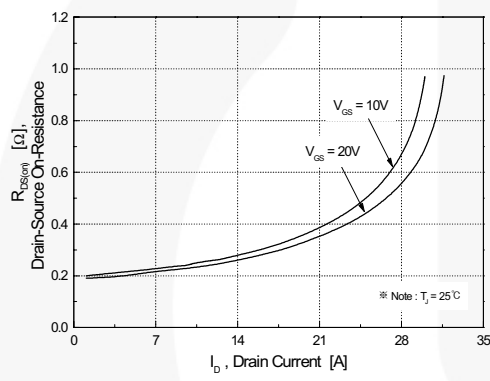


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

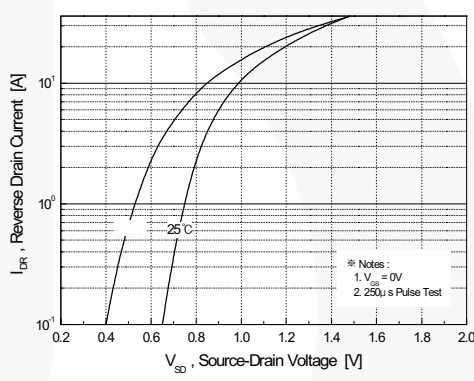


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

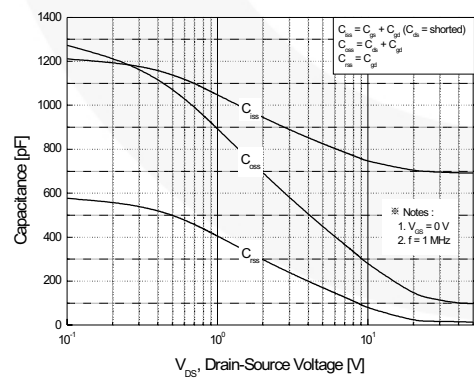


Figure 5. Capacitance Characteristics

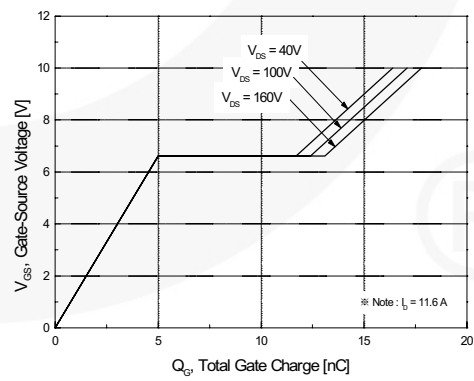


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

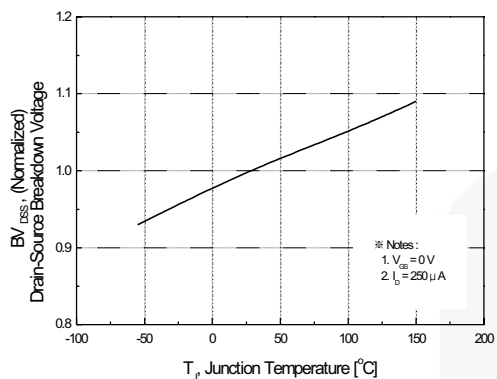


Figure 7. Breakdown Voltage Variation vs. Temperature

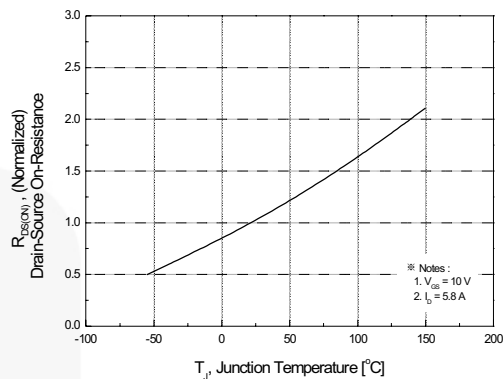


Figure 8. On-Resistance Variation vs. Temperature

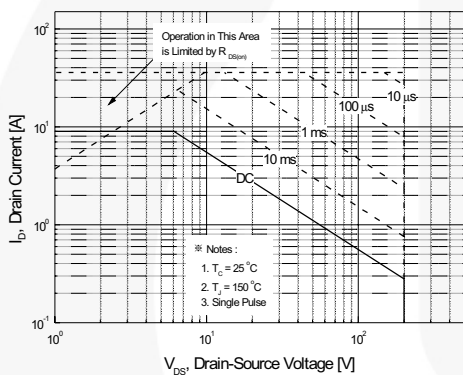


Figure 9. Maximum Safe Operating Area

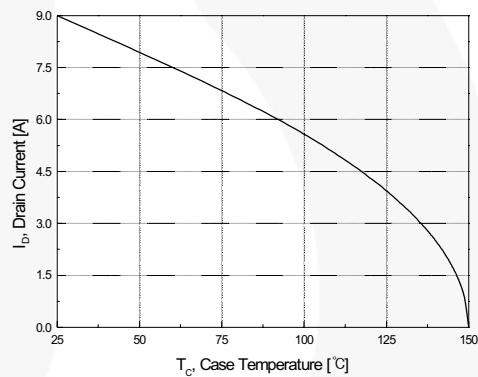


Figure 10. Maximum Drain Current vs. Case Temperature

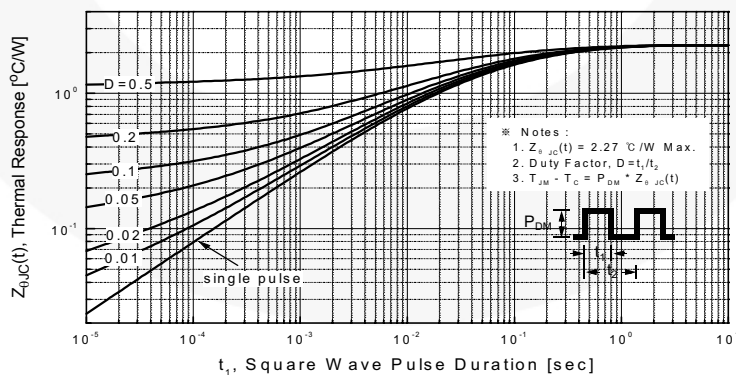


Figure 11. Transient Thermal Response Curve

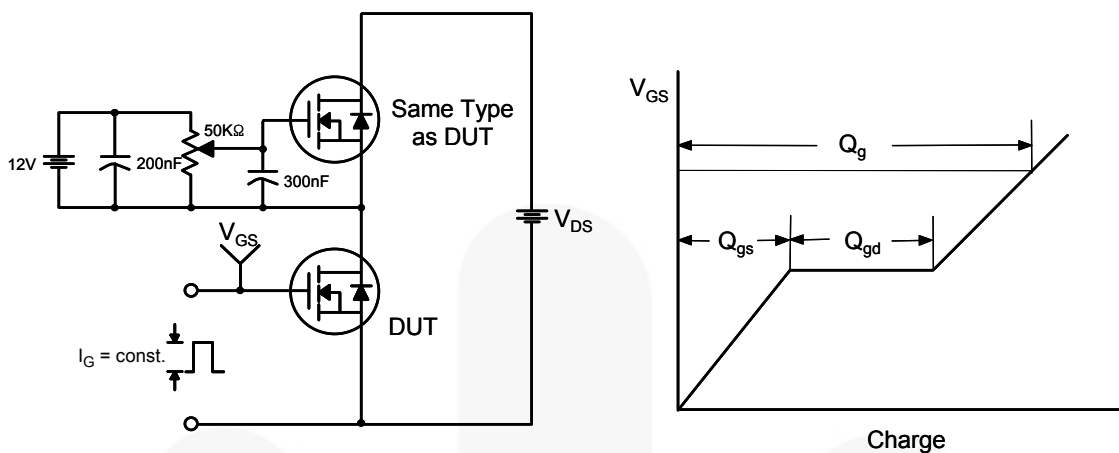


Figure 12. Gate Charge Test Circuit & Waveform

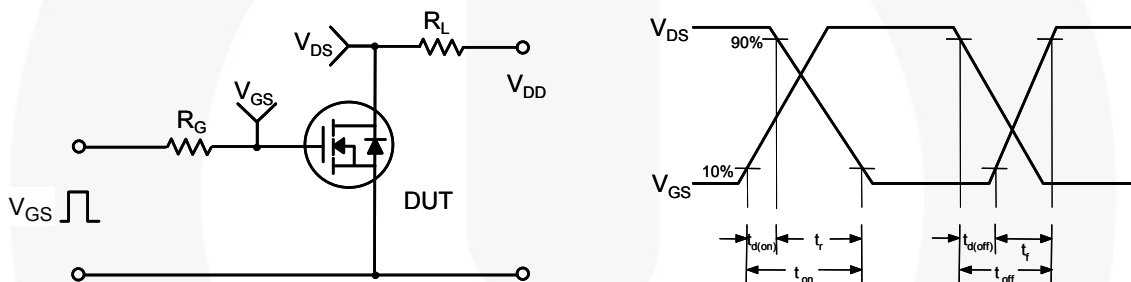


Figure 13. Resistive Switching Test Circuit & Waveforms

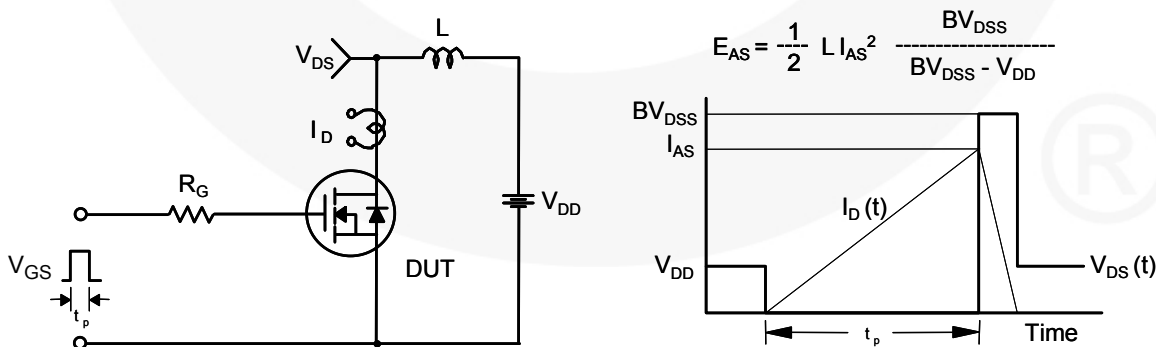


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

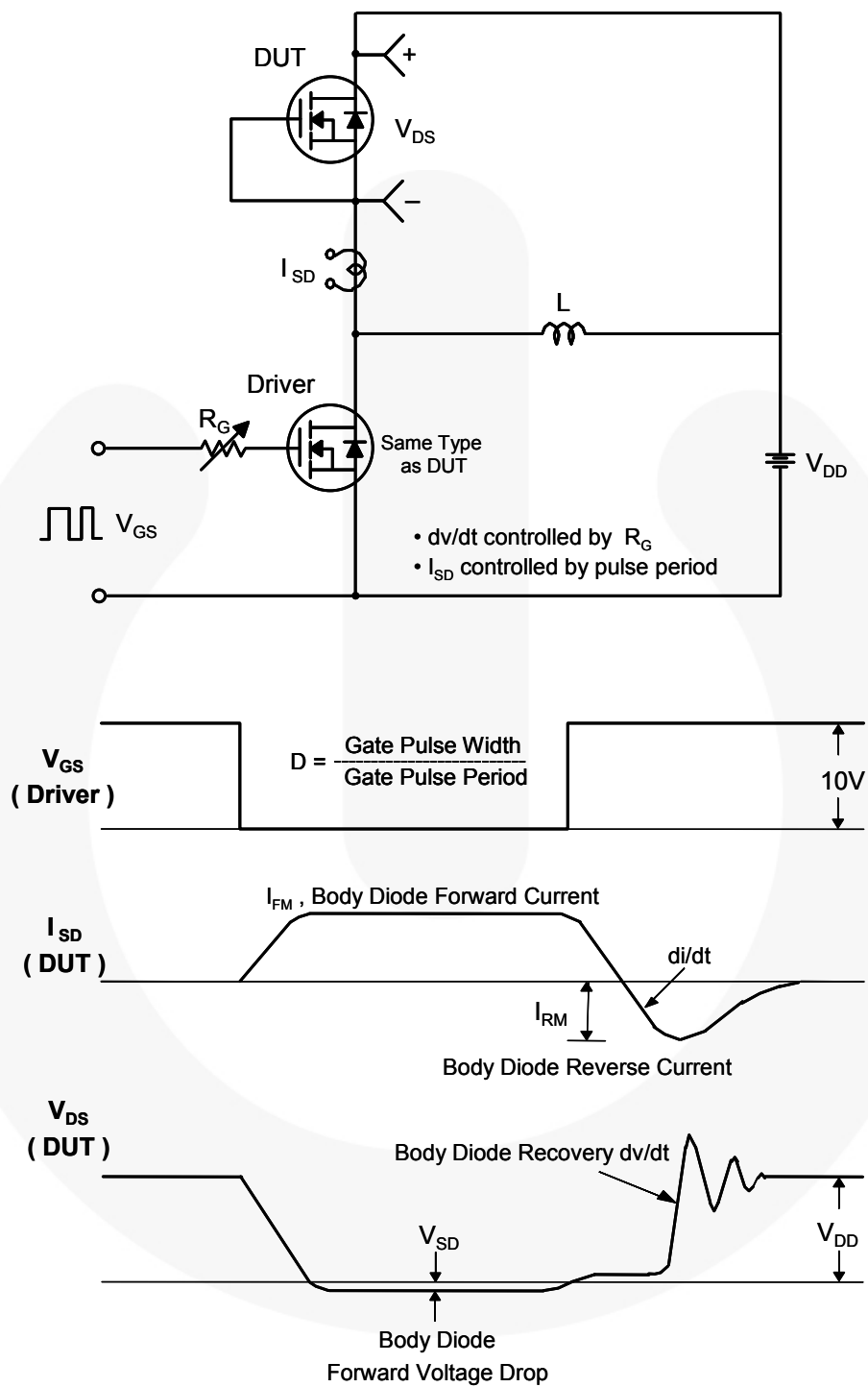


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

TO-252 3L (DPAK)

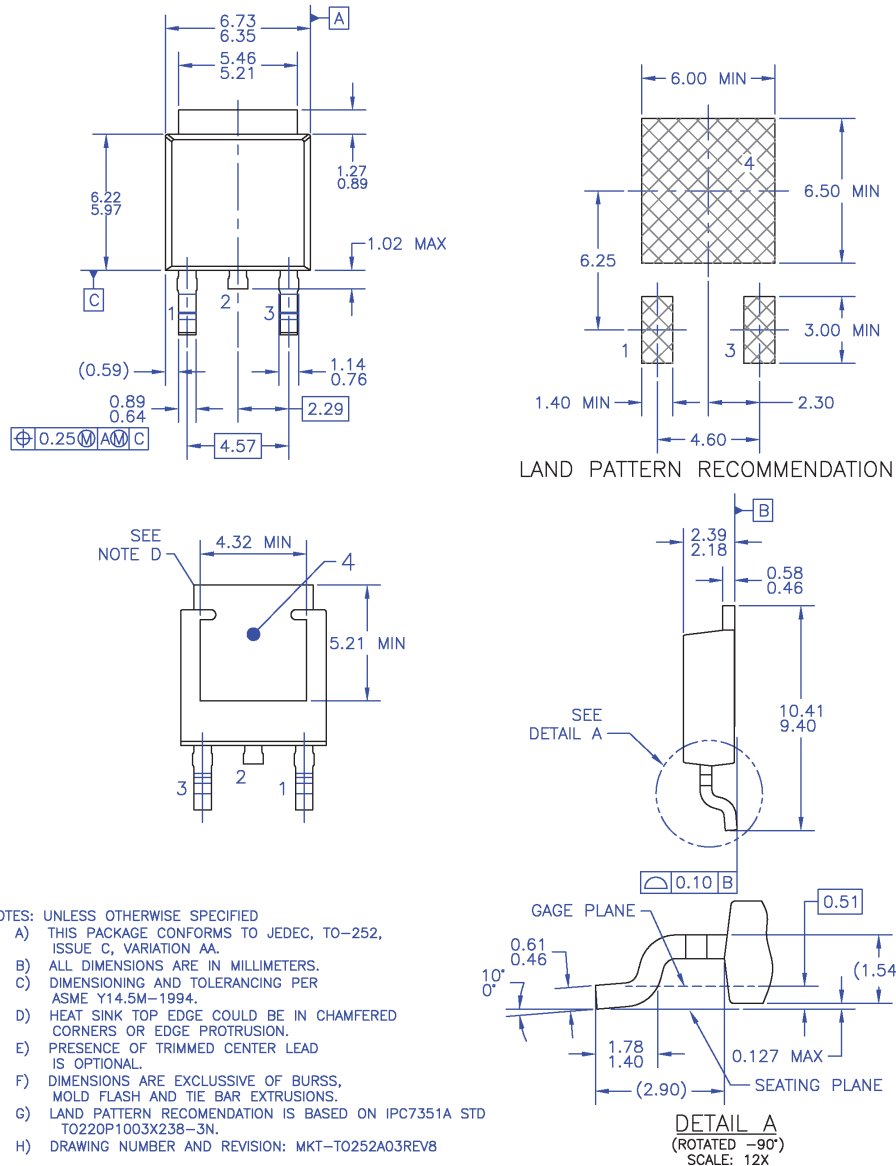


Figure 16. TO252 (D-PAK), Molded, 3 Lead, Option AA&AB

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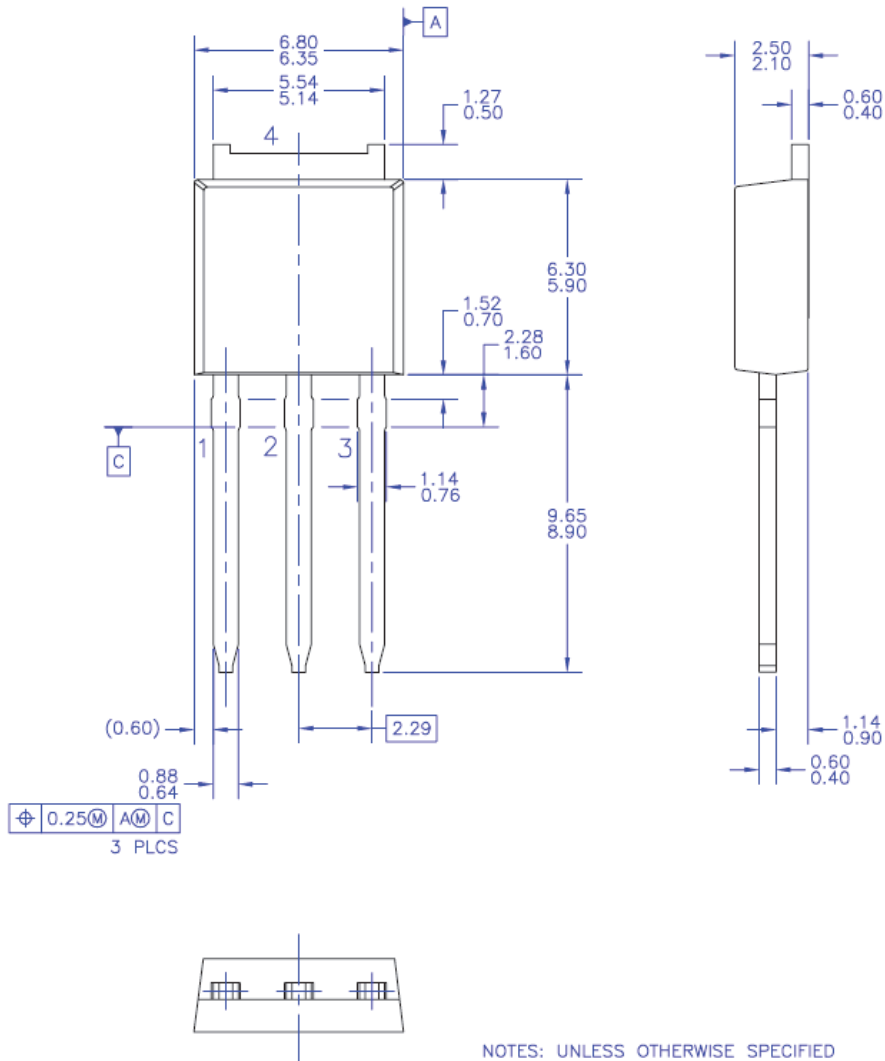
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Dimension in Millimeters

Mechanical Dimensions

TO-251 3L (IPAK)



NOTES: UNLESS OTHERWISE SPECIFIED

- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) THIS PACKAGE CONFORMS TO JEDEC, TO-251, ISSUE C, VARIATION AA, DATED SEP 1988.
- C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.

Figure 17. TO251 (IPAK) Molded 3 Lead

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Dimension in Millimeters



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