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FAIRCHILD SEMICONDUCTOR®

October 2013

FQD9N25 / FQU9N25

N-Channel QFET® MOSFET

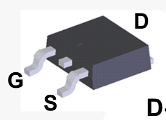
250 V, 7.4 A, 420 mΩ

Description

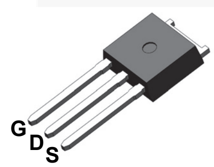
This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength.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

Features

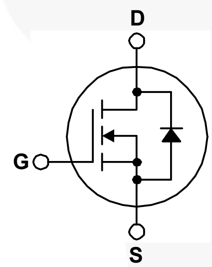
- 7.4 A, 250 V, $R_{DS(on)}$ = 420 mΩ (Max.) @V_{GS} = 10 V, I_D = 3.7 A
- Low Gate Charge (Typ. 15.5 nC)
- Low Crss (Typ. 15 pF)
- 100% Avalanche Tested



D-PAK



I-PAK



Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter		FQD9N25TM FQD9N25TM_F080 FQU9N25TU	Unit
V_{DSS}	Drain-Source Voltage		250	V
I_D	Drain Current - Continuous (T_C = 25°C)		7.4	A
	- Continuous (T_C = 100°C)		4.7	A
I_{DM}	Drain Current - Pulsed	(Note 1)	29.6	A
V_{GSS}	Gate-Source Voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	165	mJ
I_{AR}	Avalanche Current	(Note 1)	7.4	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°C) *		2.5	W
	Power Dissipation (T_C = 25°C)		55	W
	- Derate above 25°C		0.44	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300	°C

Thermal Characteristics

Symbol	Parameter	FQD9N25TM FQD9N25TM_F080 FQU9N25TU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	2.27	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (minimum pad of 2 oz copper), Max.	110	°C/W
	Thermal Resistance, Junction to Ambient (*1 in^2 pad of 2 oz copper), Max.	50	°C/W

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQD9N25TM	FQD9N25	D-PAK	Tape and Reel	330 mm	16 mm	2500 units
FQD9N25TM_F080	FQD9N25	D-PAK	Tape and Reel	330 mm	16 mm	2500 units
FQU9N25TU	FQU9N25	I-PAK	Tube	N/A	N/A	70 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	250	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C	--	0.2	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 250 V, V_{GS} = 0 V	--	--	1	µA
		V_{DS} = 200 V, T_C = 125°C	--	--	10	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 = 3.7 A	--	0.33	0.42	Ω
g_{FS}	Forward Transconductance	V_{DS} = 50 V, I_D = 3.7 A	--	6.8	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	540	700	pF
C_{oss}	Output Capacitance		--	110	145	pF
C_{rss}	Reverse Transfer Capacitance		--	15	20	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 125 V, I_D = 9.4 A, R_G = 25 Ω (Note 4)	--	13	35	ns
t_r	Turn-On Rise Time		--	105	220	ns
$t_{d(off)}$	Turn-Off Delay Time		--	25	60	ns
t_f	Turn-Off Fall Time		--	45	100	ns
Q_g	Total Gate Charge	V_{DS} = 200 V, I_D = 9.4 A, V_{GS} = 10 V (Note 4)	--	15.5	20	nC
Q_{gs}	Gate-Source Charge		--	3.8	--	nC
Q_{gd}	Gate-Drain Charge		--	8.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	7.4	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	29.6	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 7.4 A	--	--	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 9.4 A, dI_F / dt = 100 A/µs	--	150	--	ns
Q_{rr}	Reverse Recovery Charge		--	0.8	--	µC

Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 4.8 mH, I_{AS} = 7.4 A, V_{DD} = 50 V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 9.4 A, di/dt ≤ 300 A/µs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Essentially independent of operating temperature

Typical Characteristics

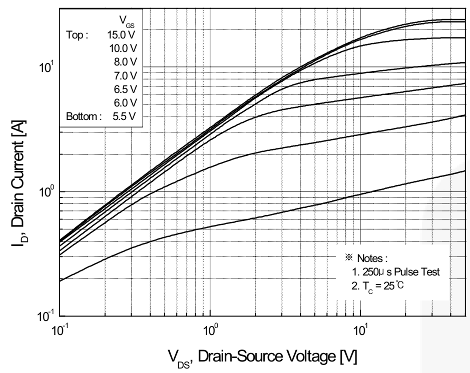


Figure 1. On-Region Characteristics

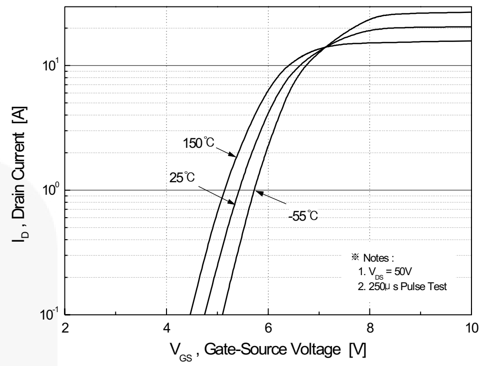


Figure 2. Transfer Characteristics

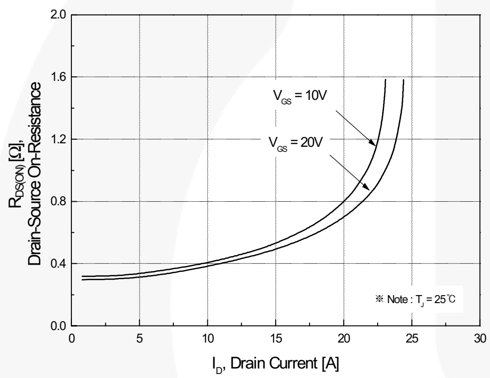


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

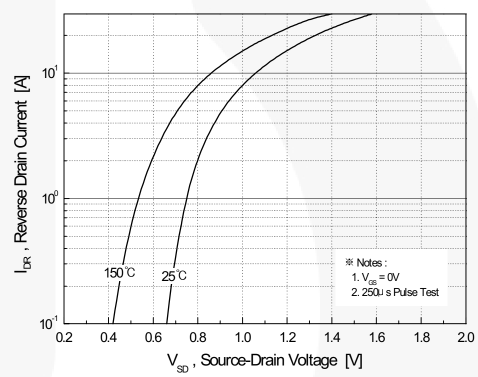


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

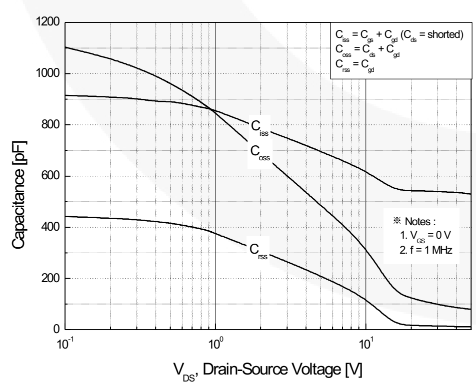


Figure 5. Capacitance Characteristics

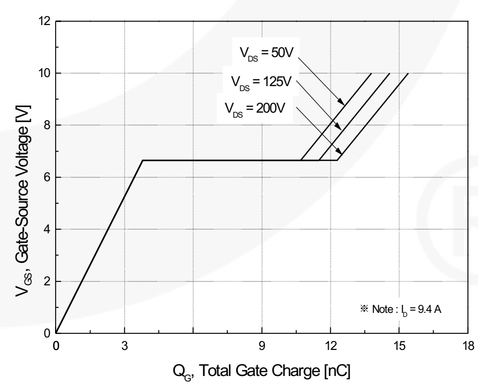


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

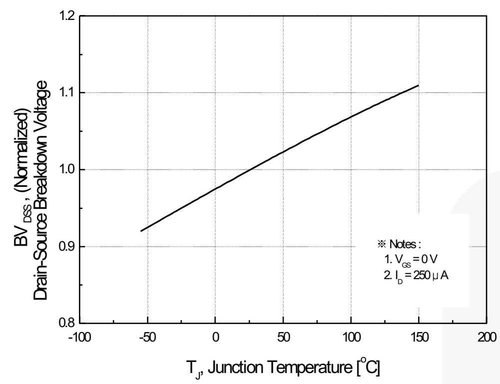


Figure 7. Breakdown Voltage Variation vs. Temperature

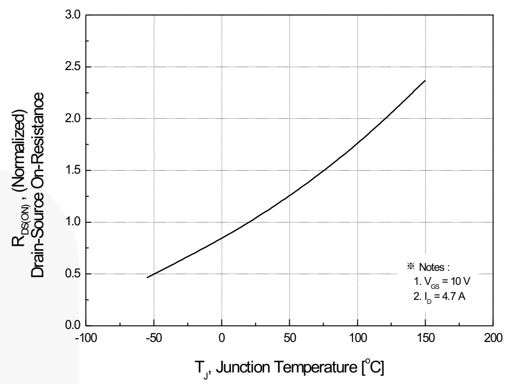


Figure 8. On-Resistance Variation vs. Temperature

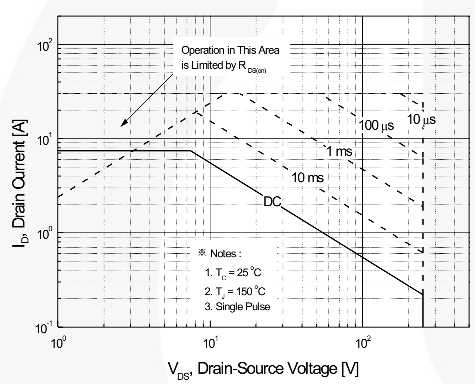


Figure 9. Maximum Safe Operating Area

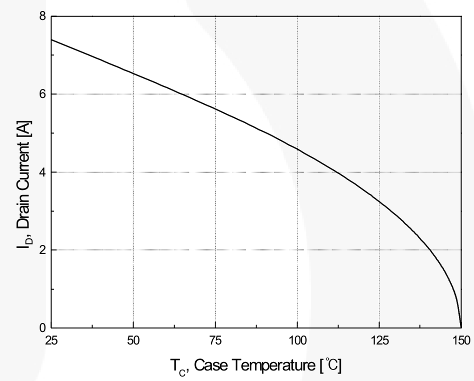


Figure 10. Maximum Drain Current vs. Case Temperature

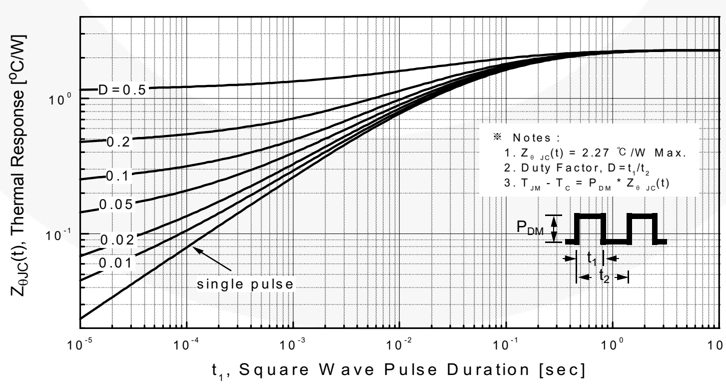


Figure 11. Transient Thermal Response Curve

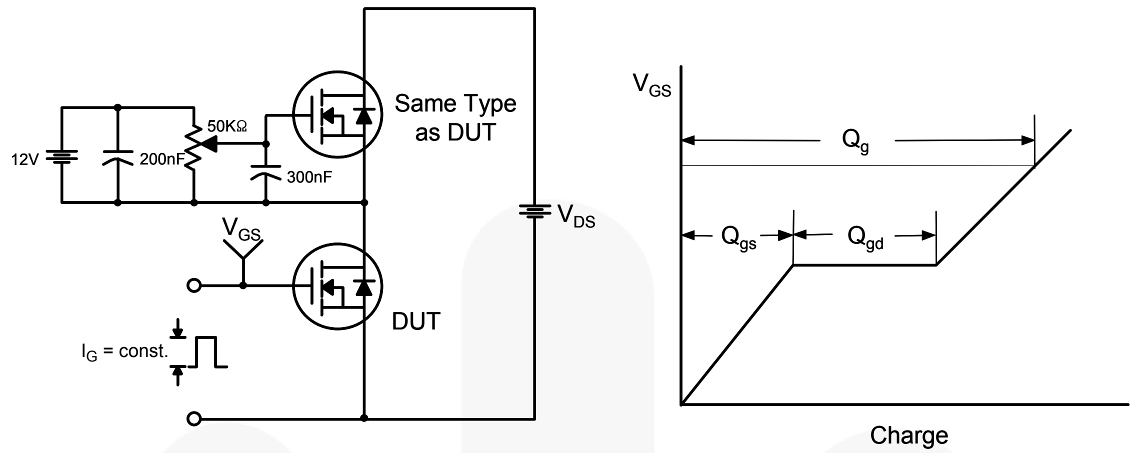


Figure 12. Gate Charge Test Circuit & Waveform

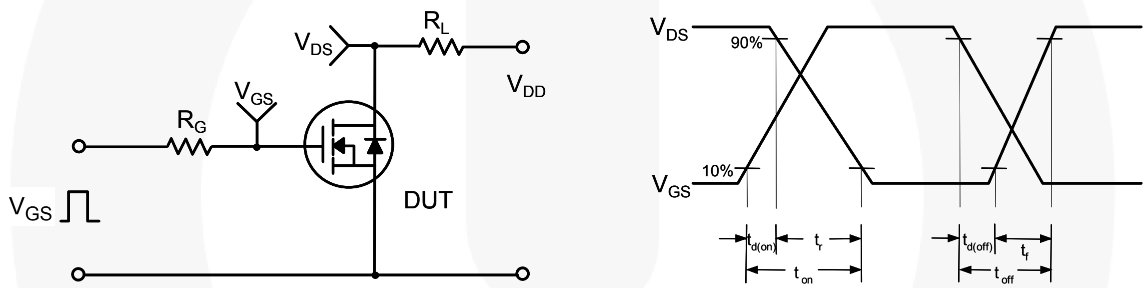


Figure 13. Resistive Switching Test Circuit & Waveforms

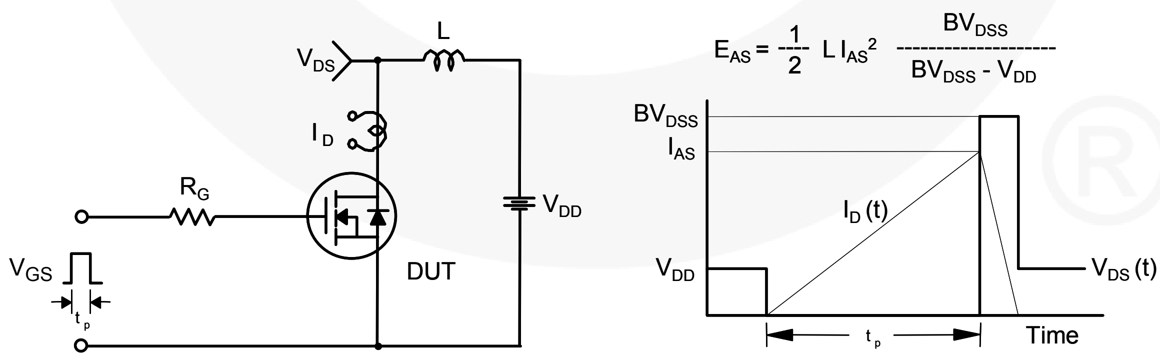


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

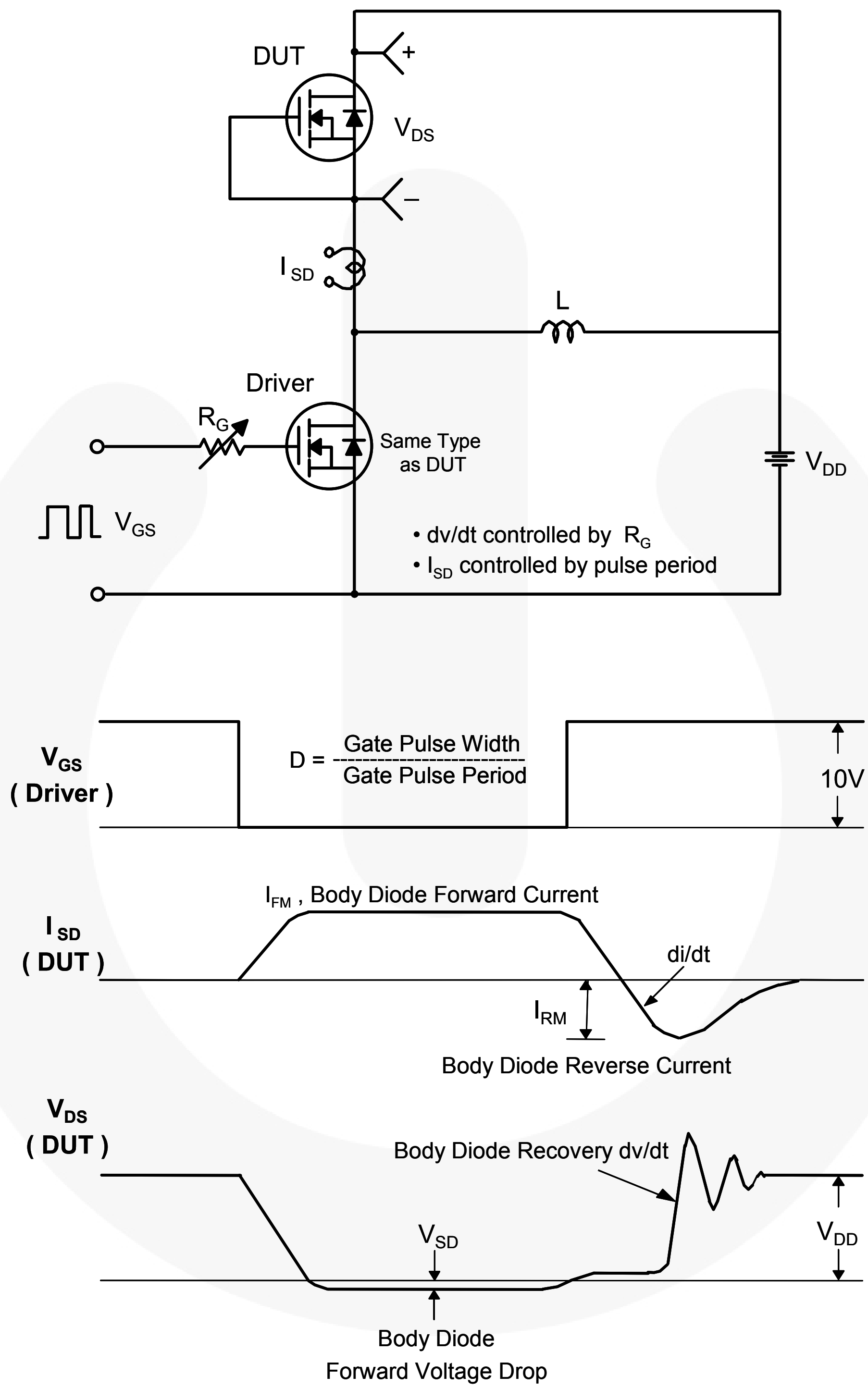


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

TO-252 3L (DPAK)

FQD9N25TM

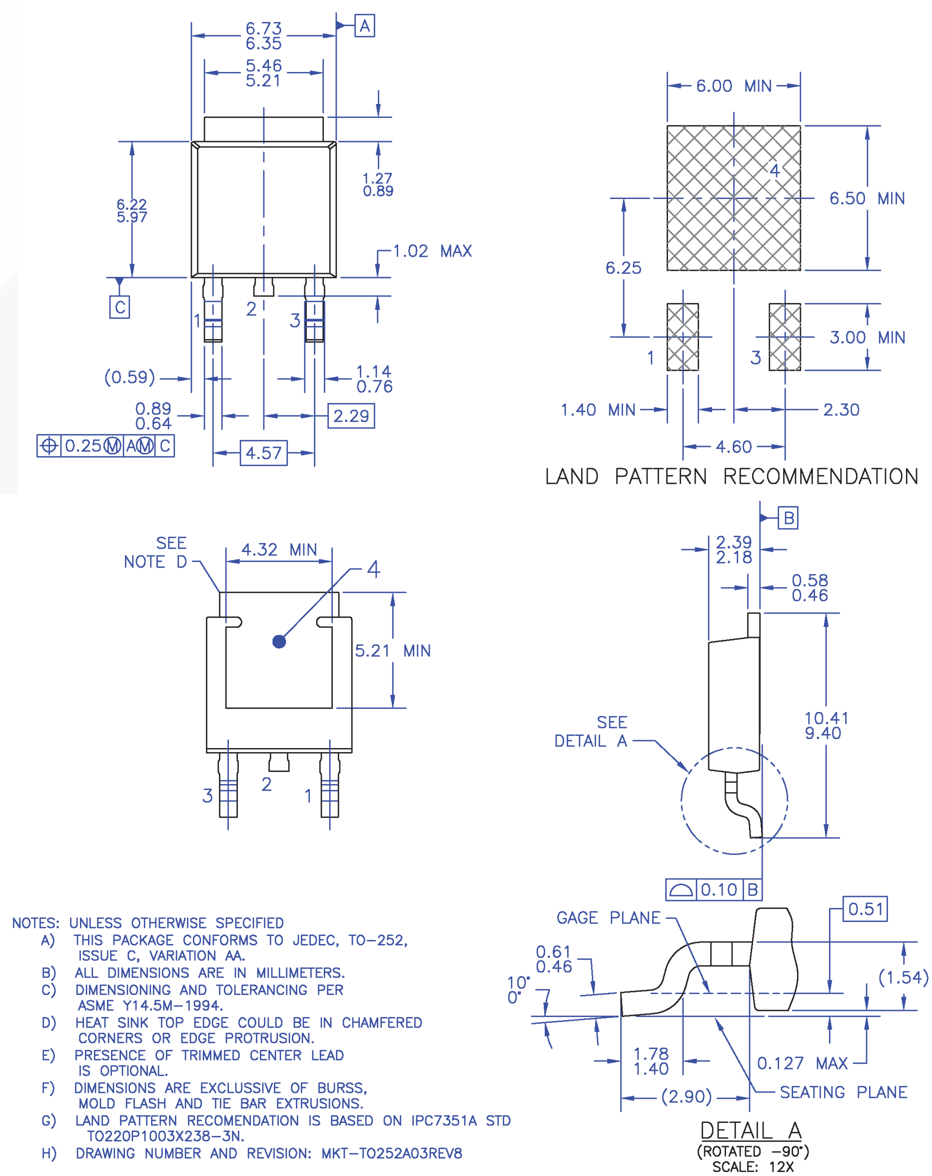


Figure 16. TO252 (D-PAK), Molded, 3 Lead, Option AA&AB

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Dimension in Millimeters

Mechanical Dimensions

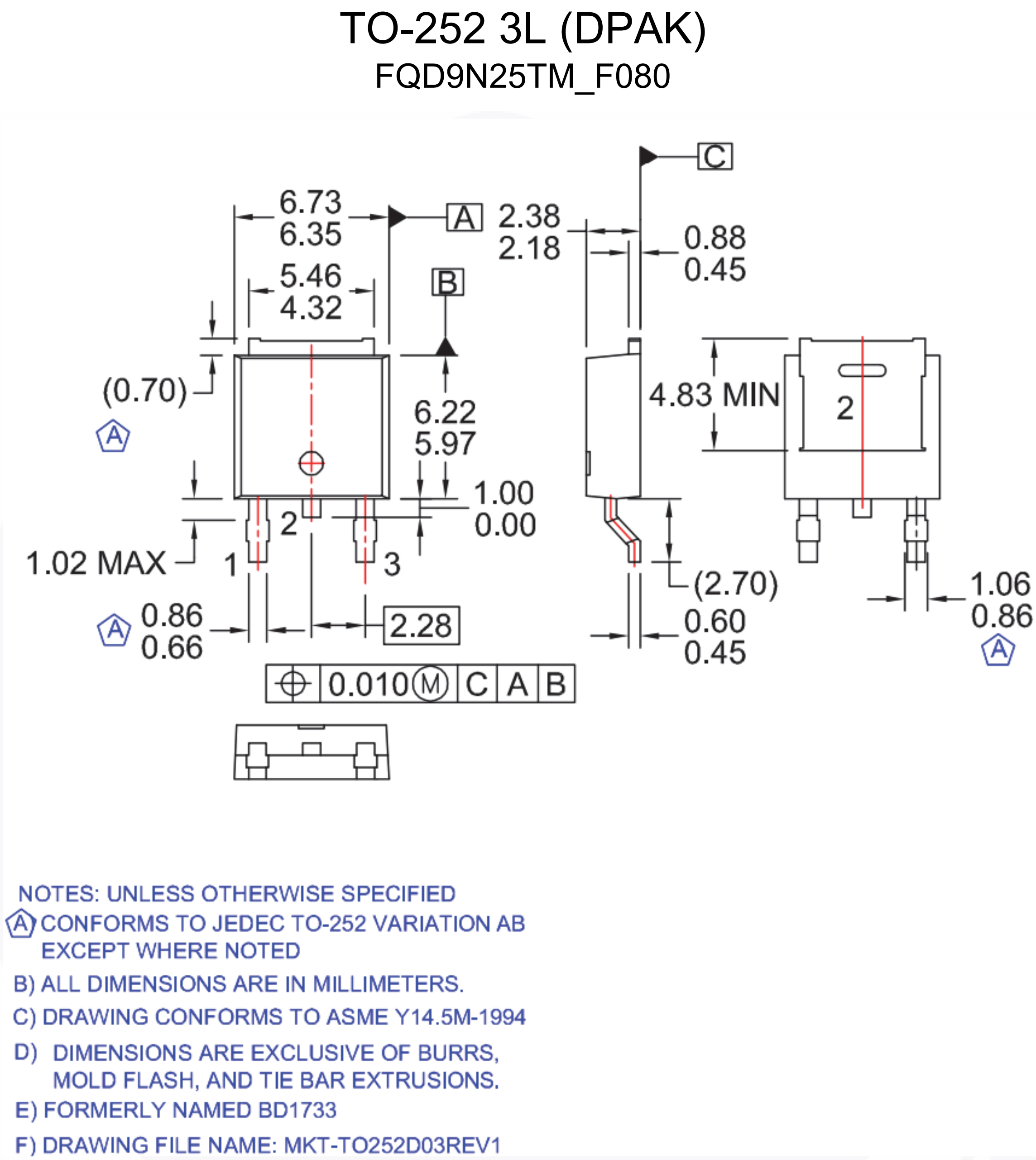

Figure 17. 3LD, TO-252, Jedec TO-252 VAR. AB, Surface Mount

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Dimension in Millimeters

Mechanical Dimensions

TO-251 3L (IPAK)

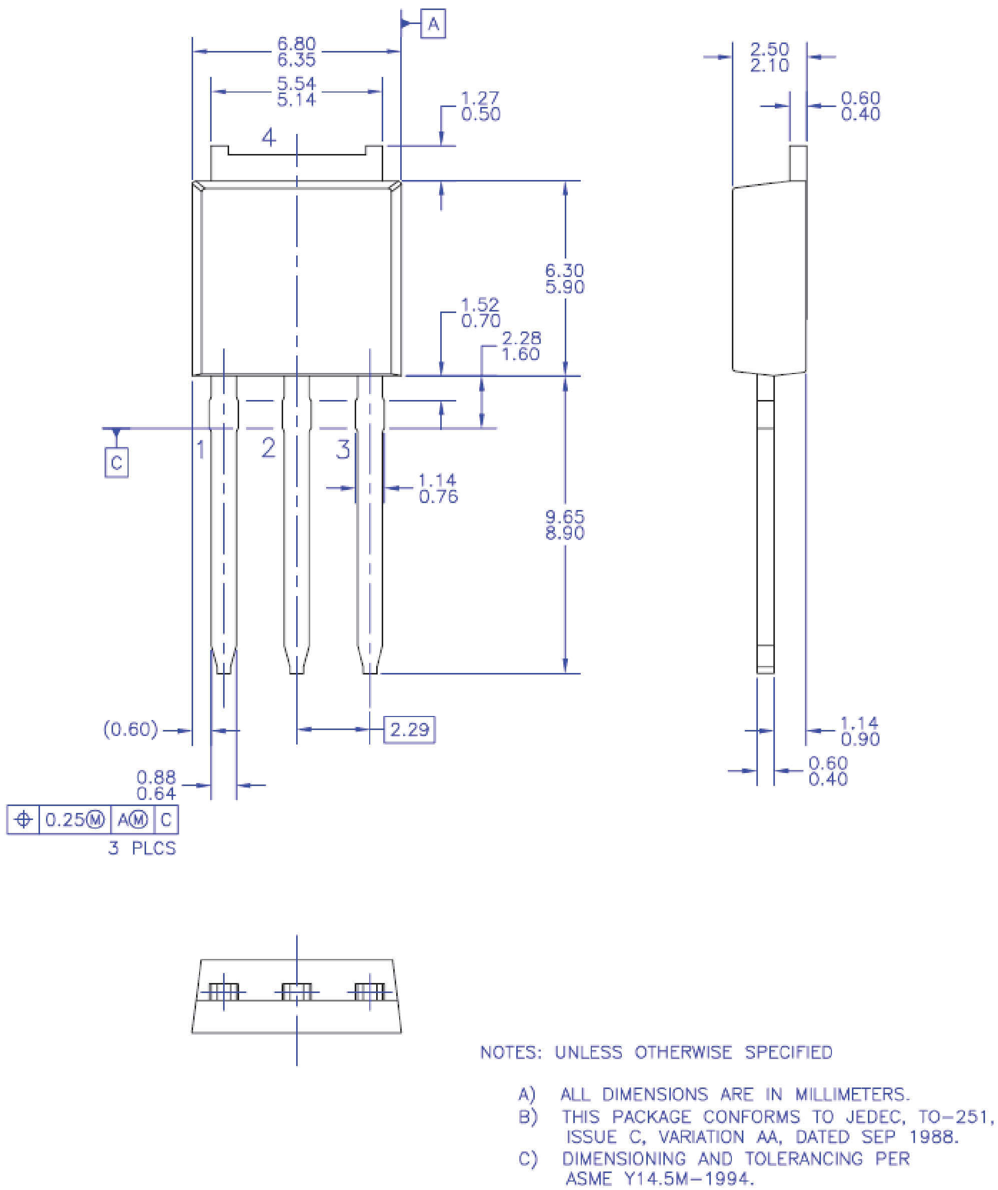

Figure 18. TO251 (IPAK) Molded 3 Lead

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Dimension in Millimeters

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