FAIRCHILD SEMICONDUCTOR®

November 2013

FQP11N40C / FQPF11N40C

N-Channel QFET® MOSFET

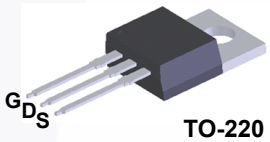
400 V, 10.5 A, 530 mΩ

Features

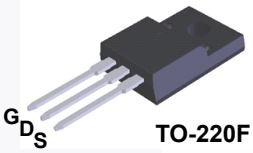
- 10.5 A, 400 V, $R_{DS(on)}$ = 530 mΩ (Max.) @ V_{GS} = 10 V, I_D = 5.25 A
- Low Gate Charge (Typ. 28 nC)
- Low Crss (Typ. 85 pF)
- 100% Avalanche Tested

Description

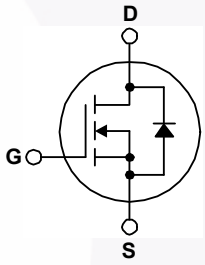
This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength.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



TO-220



TO-220F



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

Symbol	Parameter		FQP11N40C	FQPF11N40C	Unit
V_{DSS}	Drain to Source Voltage		400		V
I_D	Drain Current	-Continuous (T_C = 25°C)	10.5	10.5 *	A
		-Continuous (T_C = 100°C)	6.6	6.6 *	A
I_{DM}	Drain Current	- Pulsed (Note 1)	42	42 *	A
V_{GSS}	Gate to Source Voltage		± 30		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	360		mJ
I_{AR}	Avalanche Current	(Note 1)	11		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	13.5		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5		V/ns
P_D	Power Dissipation	(T_C = 25°C)	135	44	W
		- Derate above 25°C	1.07	0.35	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300		°C

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FQP11N40C	FQPF11N40C	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max	0.93	2.86	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max	62.5	62.5	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQP11N40C	FQP11N40C	TO-220	Tube	N/A	50 units
FQPF11N40C	FQPF11N40C	TO-220F	Tube	N/A	50 units

Electrical Characteristics $T_C = 25^oC$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	400	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.54	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 400 V, V_{GS} = 0 V	--	--	1	μA
		V_{DS} = 320 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	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 5.25 A	--	0.43	0.53	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 5.25 A	--	7.1	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	840	1090	pF
C_{oss}	Output Capacitance		--	250	325	pF
C_{rss}	Reverse Transfer Capacitance		--	85	110	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 200 V, I_D = 10.5 A, R_G = 25 Ω (Note 4)	--	14	40	ns
t_r	Turn-On Rise Time		--	89	190	ns
$t_{d(off)}$	Turn-Off Delay Time		--	81	170	ns
t_f	Turn-Off Fall Time		--	81	170	ns
Q_g	Total Gate Charge	V_{DS} = 320 V, I_D = 10.5 A, V_{GS} = 10 V (Note 4)	--	28	35	nC
Q_{gs}	Gate-Source Charge		--	4	--	nC
Q_{gd}	Gate-Drain Charge		--	15	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	10.5	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	42	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 10.5 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 10.5 A, dI_F / dt = 100 A/μs	--	290	--	ns
Q_{rr}	Reverse Recovery Charge		--	2.4	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2. L = 5.7 mH, I_{AS} = 10.5 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 10.5 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

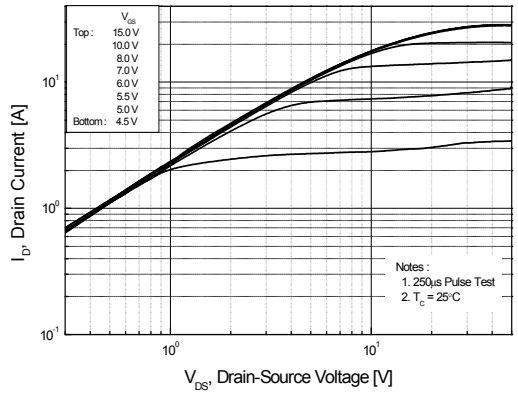


Figure 2. Transfer Characteristics

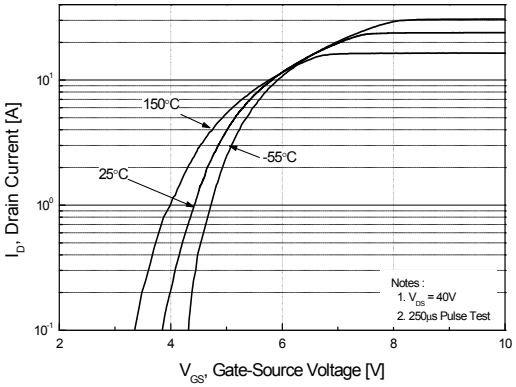


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

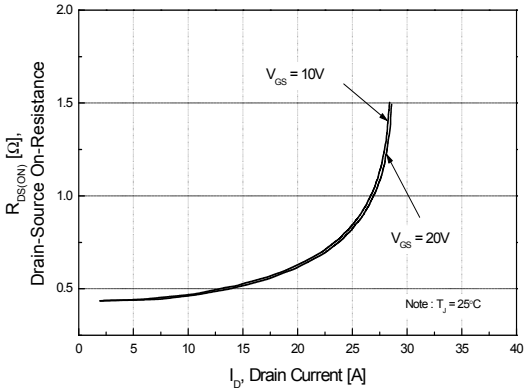


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

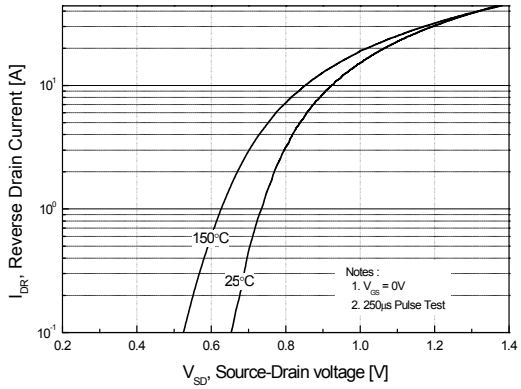


Figure 5. Capacitance Characteristics

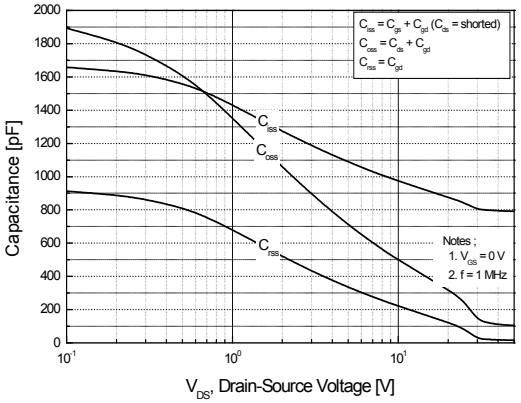
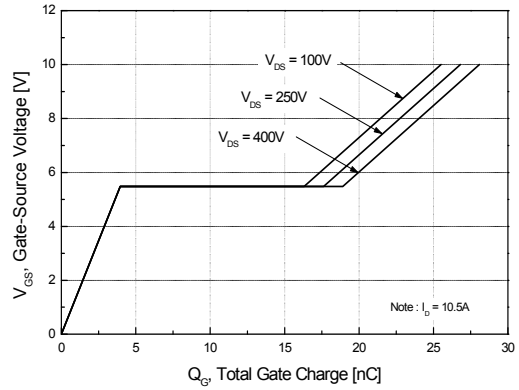


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

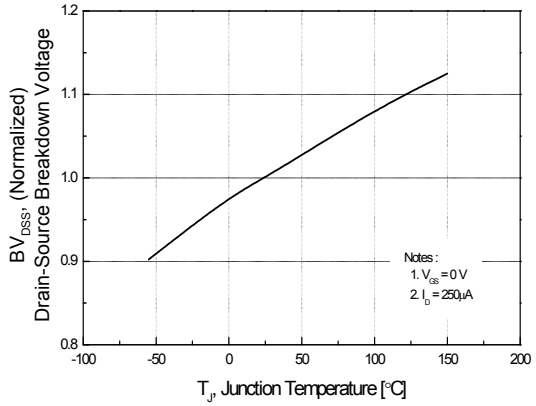


Figure 8. On-Resistance Variation vs. Temperature

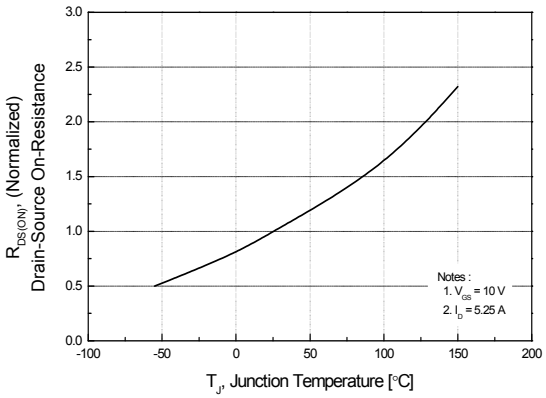


Figure 9-1. Maximum Safe Operating Area of FQP11N40C

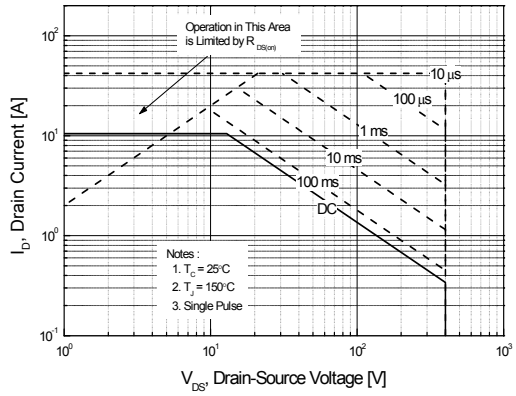


Figure 9-2. Maximum Safe Operating Area of FQPF11N40C

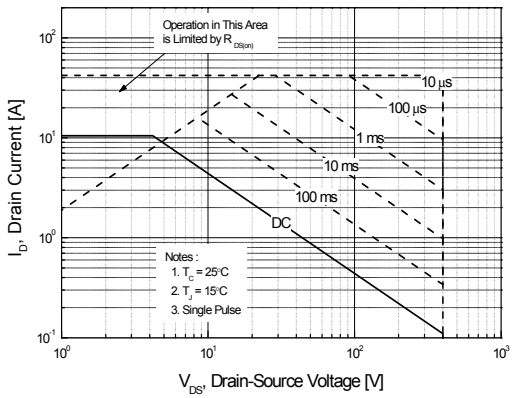
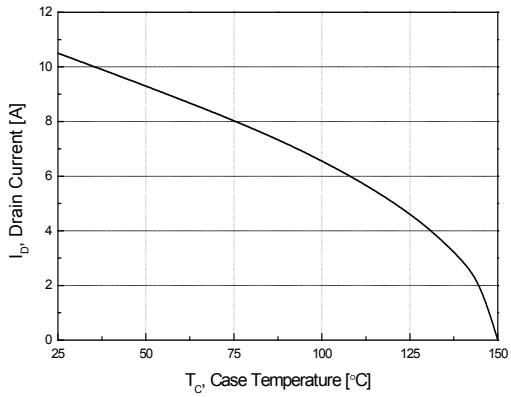


Figure10.MaximumDrainCurrent



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve of FQP11N40C

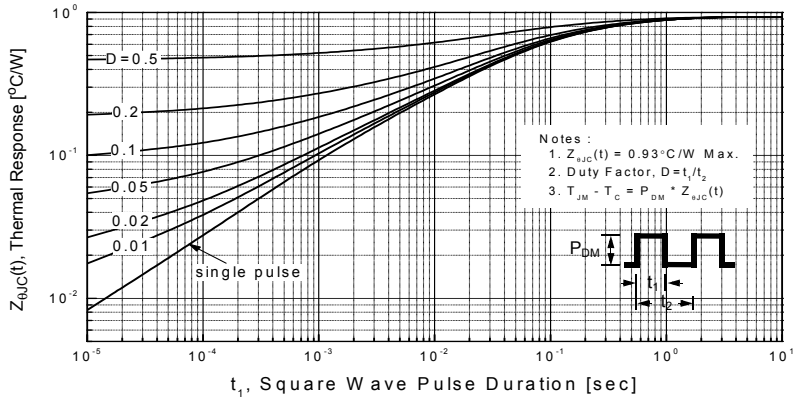


Figure 11-2. Transient Thermal Response Curve of FQPF11N40C

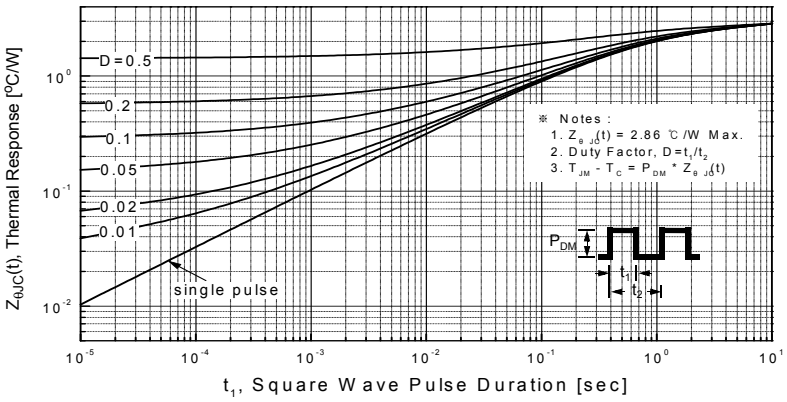


Figure 12. Gate Charge Test Circuit & Waveform

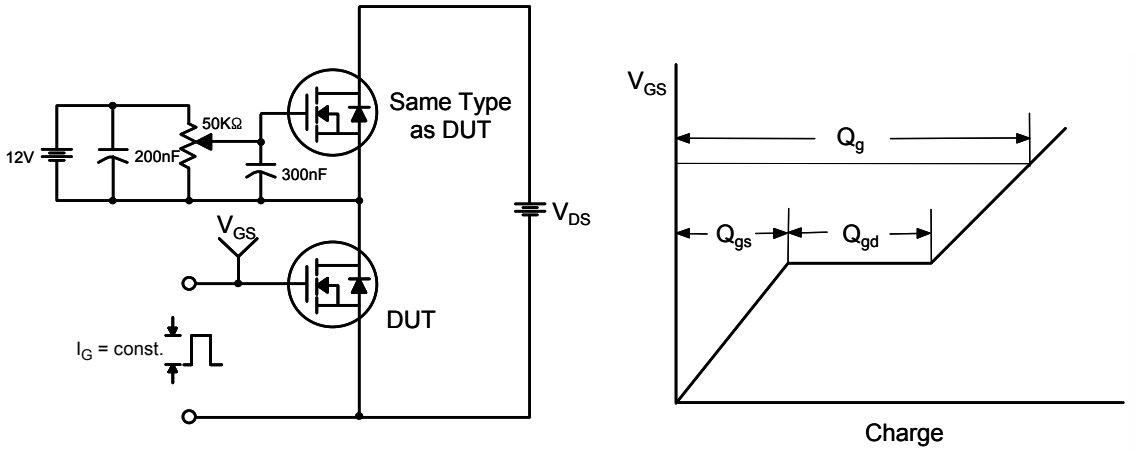


Figure 13. Resistive Switching Test Circuit & Waveforms

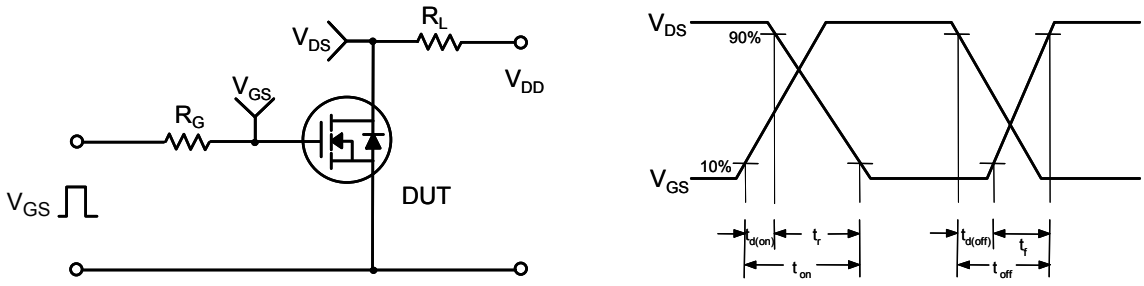


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

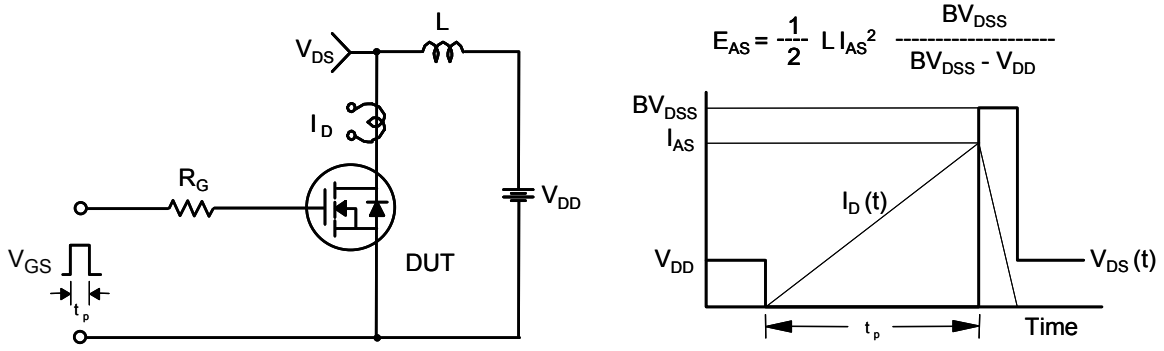
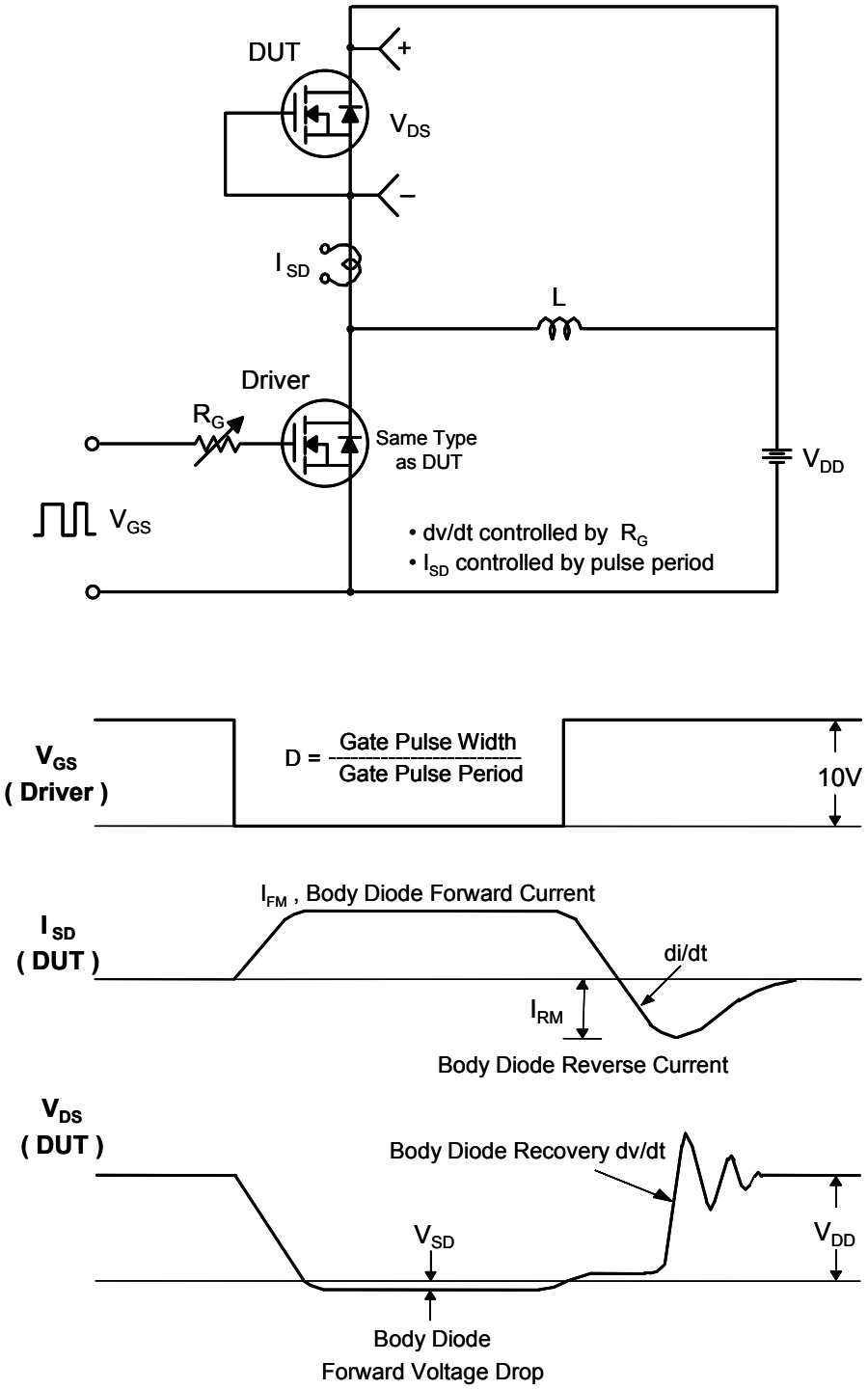


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

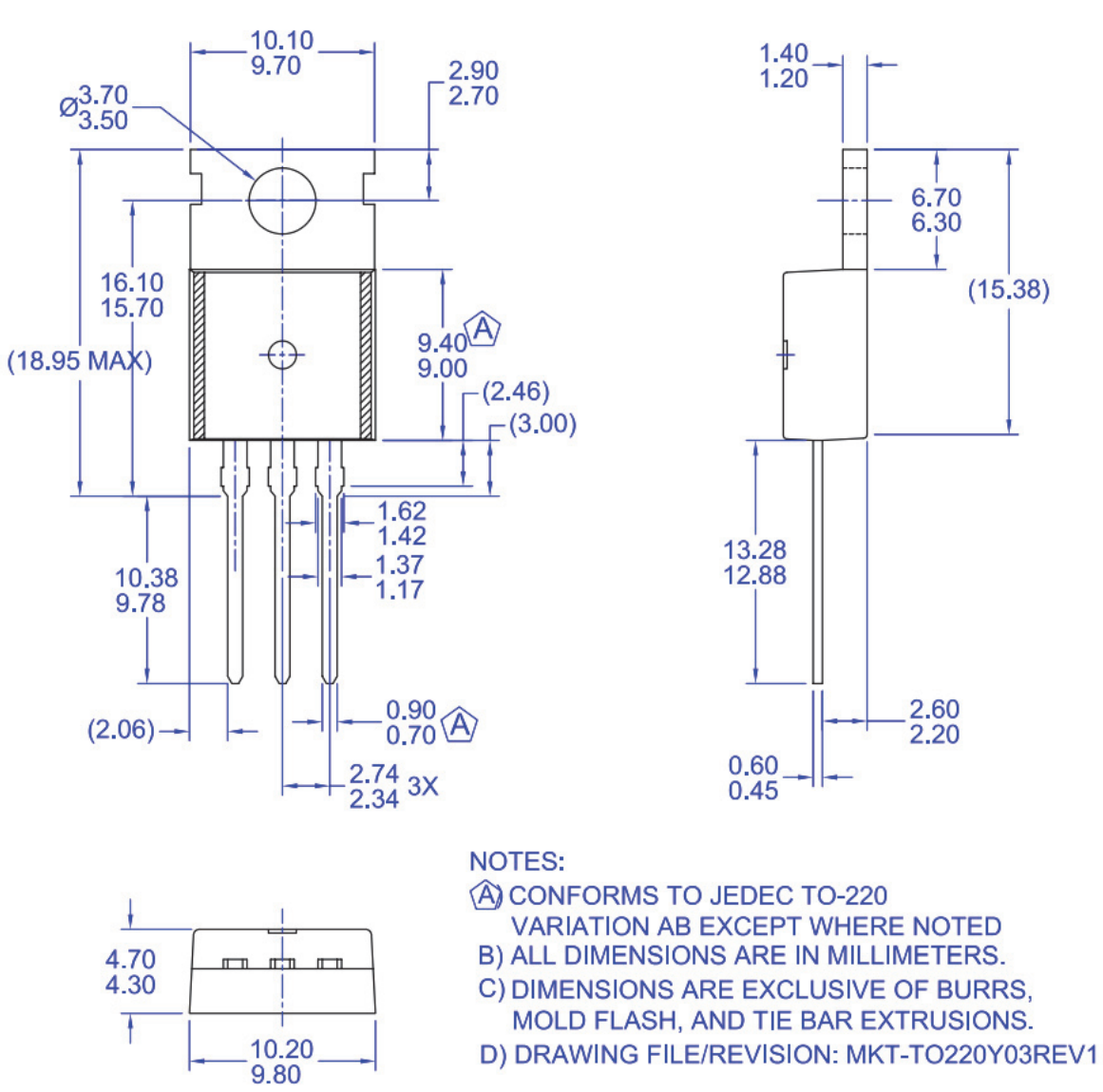


Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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Mechanical Dimensions

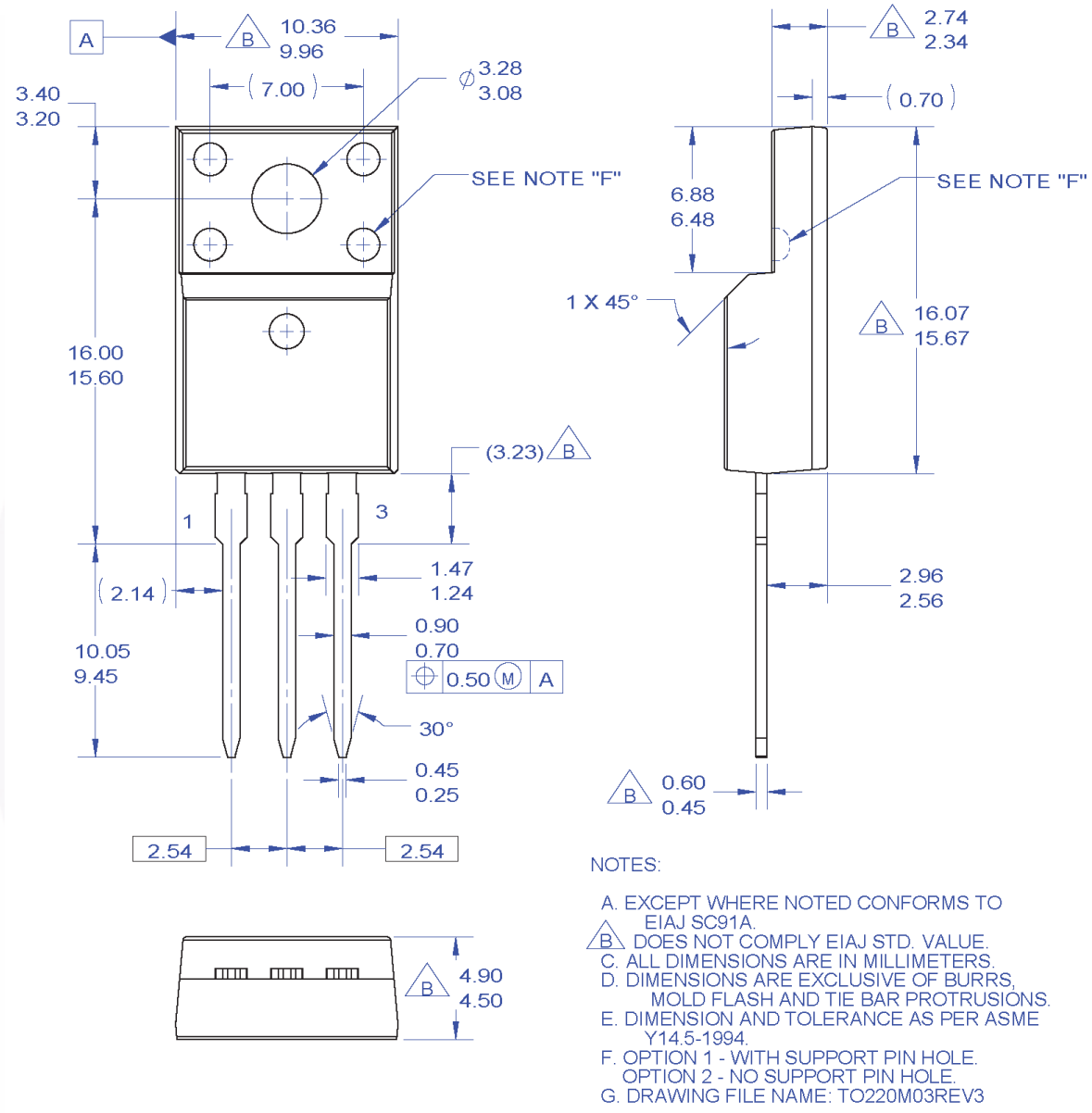

Figure 17. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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