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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD SEMICONDUCTOR®

November 2013

FDP20N50 / FDPF20N50 / FDPF20N50T

N-Channel UniFET™ MOSFET

500 V, 20 A, 230 mΩ

Features

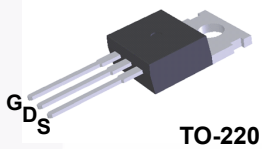
- $R_{DS(on)}$ = 200 mΩ (Typ.) @ V_{GS} = 10 V, I_D = 10 A
- Low Gate Charge (Typ. 45.6 nC)
- Low C_{rss} (Typ. 27 pF)
- 100% Avalanche Tested

Applications

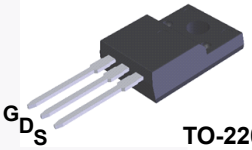
- LCD/LED/PDP TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

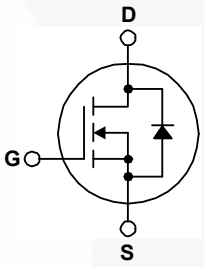
UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power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



TO-220



TO-220F



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted.

Symbol	Parameter		FDP20N50	FDPF20N50 / FDPF20N50T	Unit
V_{DSS}	Drain-Source Voltage		500		V
I_D	Drain Current	- Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	20 12.9	20 * 12.9 *	A A
I_{DM}	Drain Current	- Pulsed (Note 1)	80	80 *	A
V_{GSS}	Gate-Source voltage		±30		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	1110		mJ
I_{AR}	Avalanche Current	(Note 1)	20		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	25		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5		V/ns
P_D	Power Dissipation - Derate above 25°C	(T_C = 25°C)	250 2.0	38.5 0.3	W W/°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

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FDP20N50	FDPF20N50/ FDPF20N50T	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.5	3.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDP20N50	FDP20N50	TO-220	Tube	N/A	N/A	50 units
FDPF20N50	FDPF20N50	TO-220F	Tube	N/A	N/A	50 units
FDPF20N50T	FDPF20N50	TO-220F	Tube	N/A	N/A	50 units

Electrical Characteristics T_C = 25°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	--	0.5	--	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 = 10 A	--	0.20	0.23	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 10 A	--	24.6	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	2400	3120	pF
C_{oss}	Output Capacitance		--	355	465	pF
C_{rss}	Reverse Transfer Capacitance		--	27	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 250 V, I_D = 20 A, V_{GS} = 10 V, R_G = 25 Ω (Note 4)	--	95	200	ns
t_r	Turn-On Rise Time		--	375	760	ns
$t_{d(off)}$	Turn-Off Delay Time		--	100	210	ns
t_f	Turn-Off Fall Time		--	105	220	ns
Q_g	Total Gate Charge	V_{DS} = 400 V, I_D = 20 A, V_{GS} = 10 V (Note 4)	--	45.6	59.5	nC
Q_{gs}	Gate-Source Charge		--	14.8	--	nC
Q_{gd}	Gate-Drain Charge		--	21.6	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	20	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	80	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 20 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 20 A, dI_F/dt =100 A/μs	--	507	--	ns
Q_{rr}	Reverse Recovery Charge		--	7.20	--	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 5.0 mH, I_{AS} = 20 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 20 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

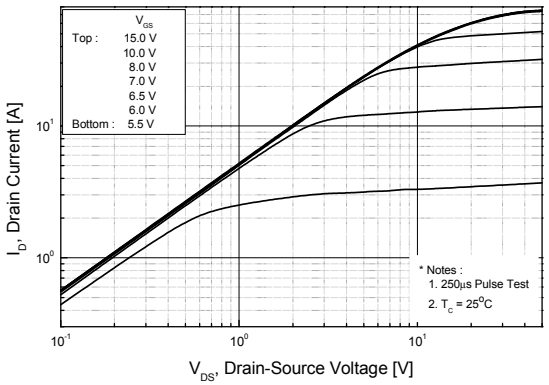


Figure 2. Transfer Characteristics

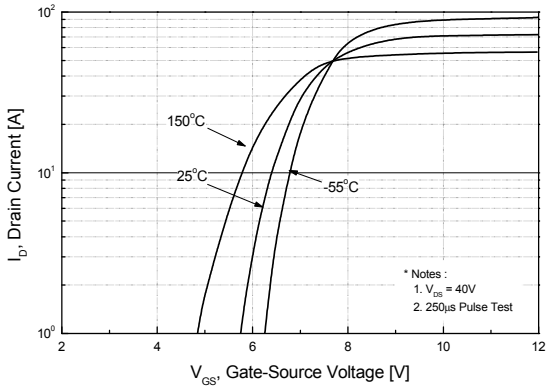


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

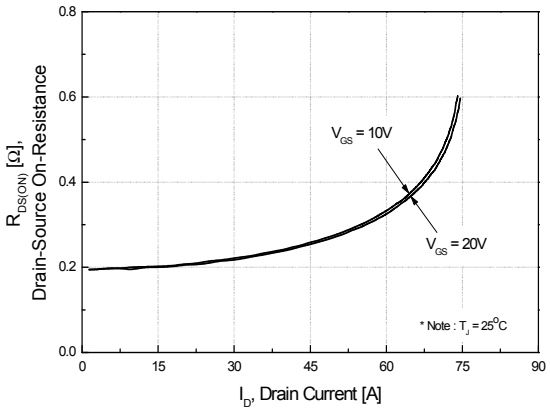


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

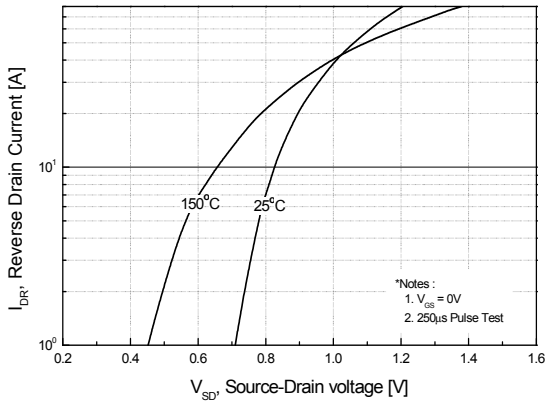


Figure 5. Capacitance Characteristics

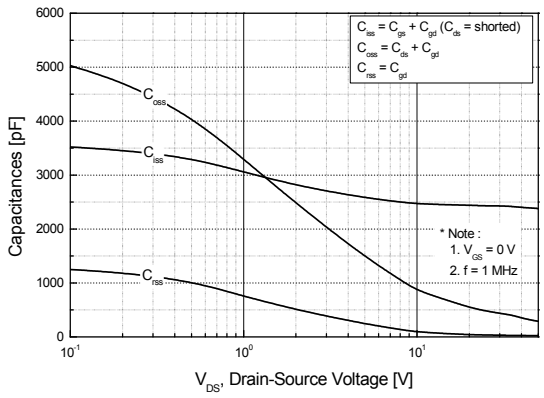
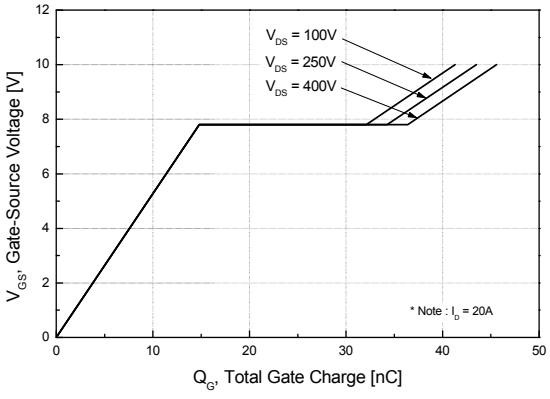


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

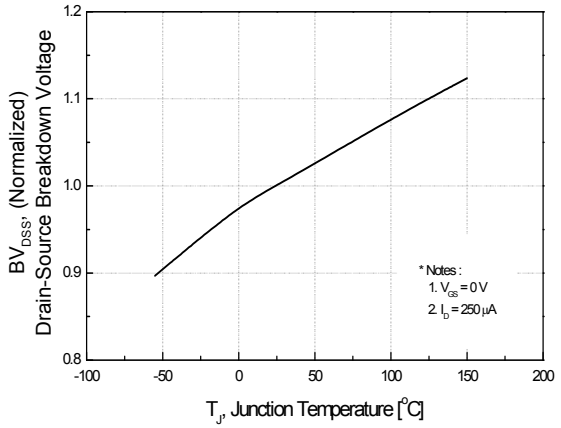


Figure 8. On-Resistance Variation vs. Temperature

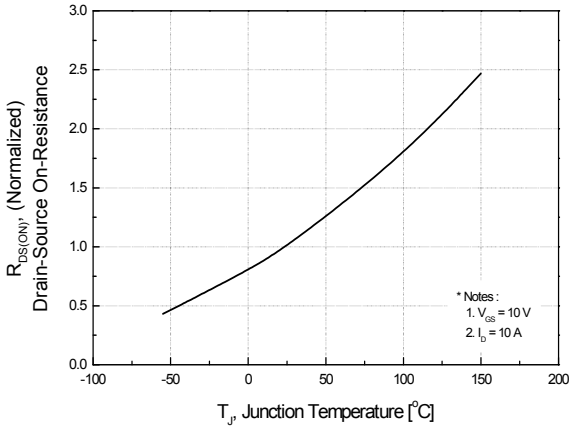


Figure 9-1. Maximum Safe Operating Area - FDP20N50

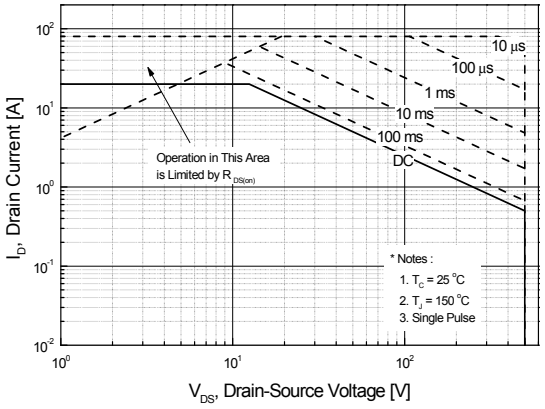


Figure 9-2. Maximum Safe Operating Area - FDPF20N50

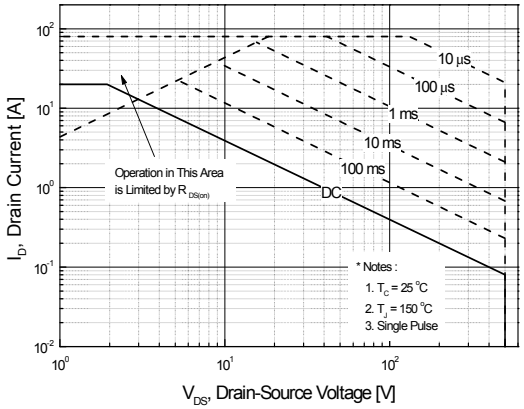
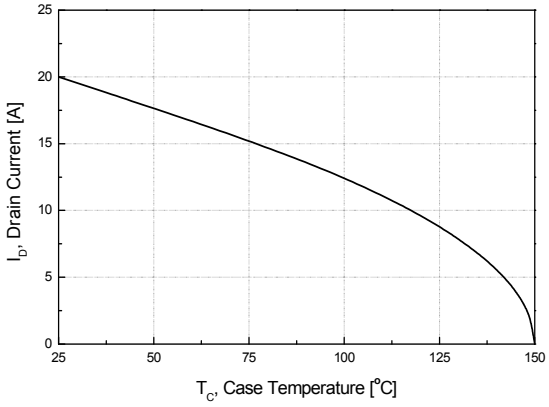


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve - FDP20N50

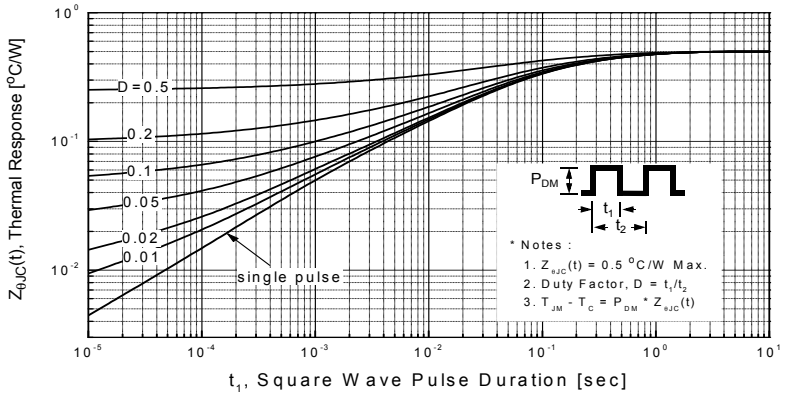
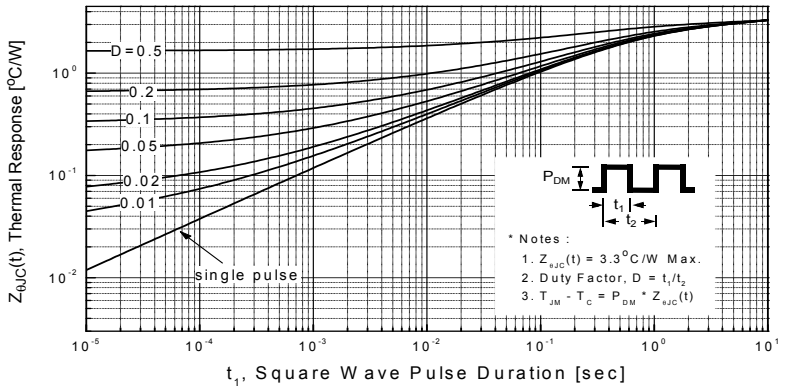


Figure 11-2. Transient Thermal Response Curve - FDPF20N50



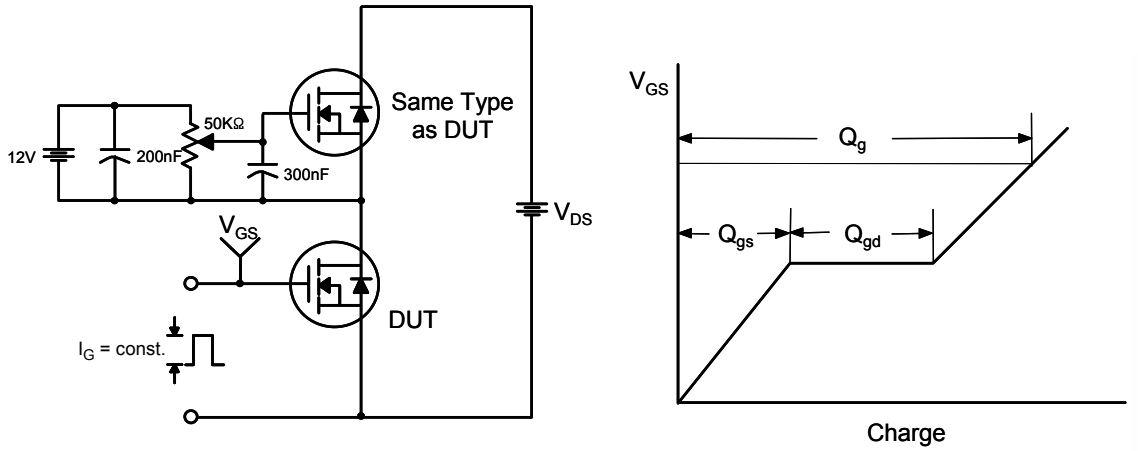


Figure 12. Gate Charge Test Circuit & Waveform

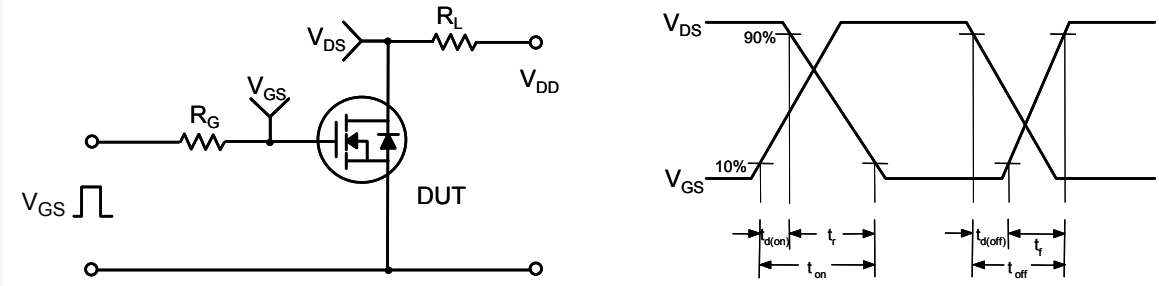


Figure 13. Resistive Switching Test Circuit & Waveforms

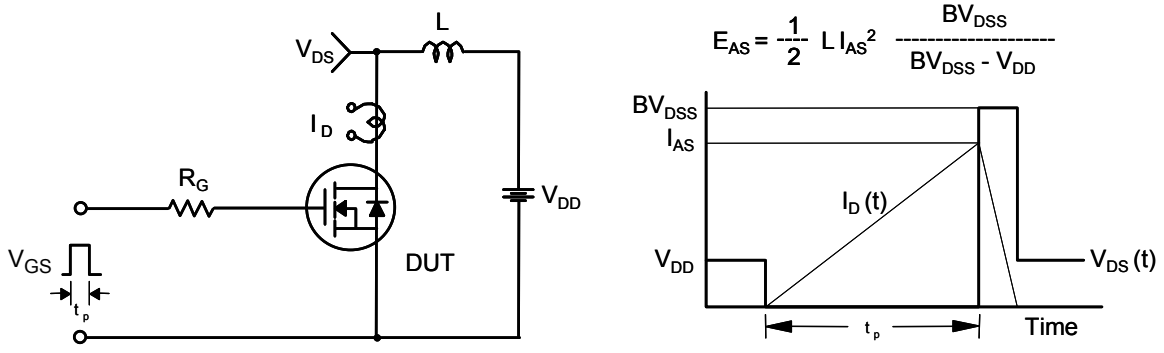


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

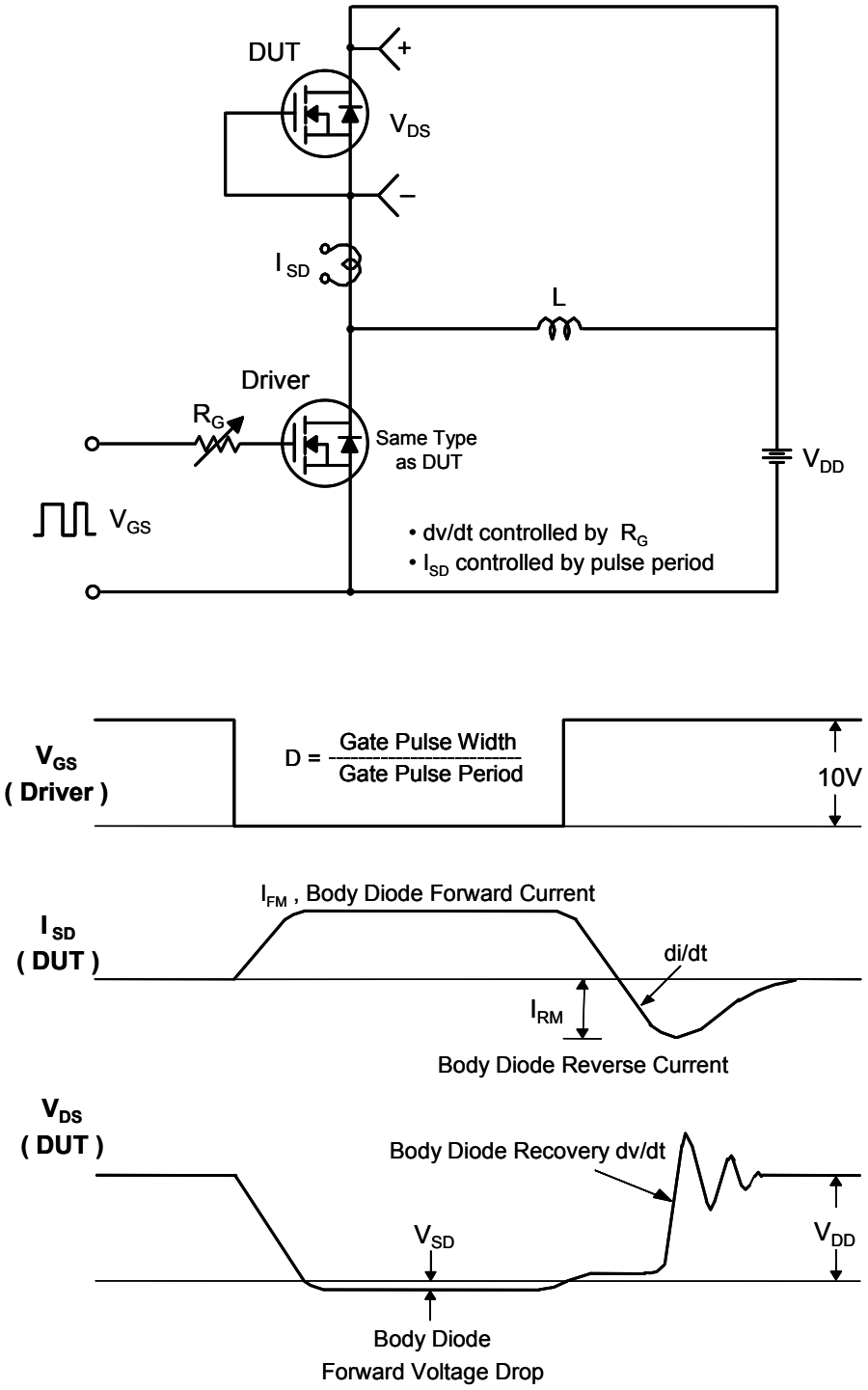


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

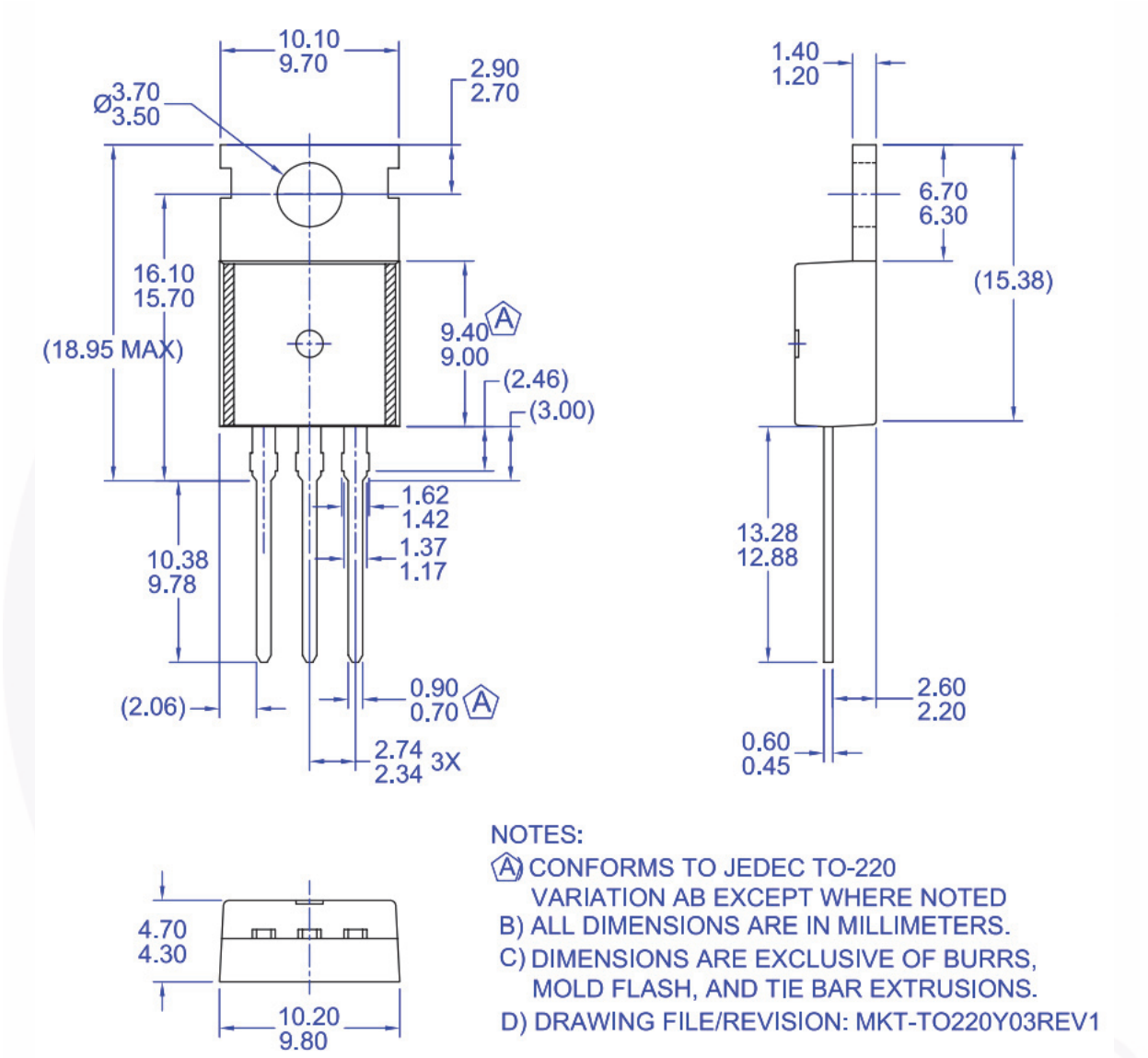


Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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Mechanical Dimensions

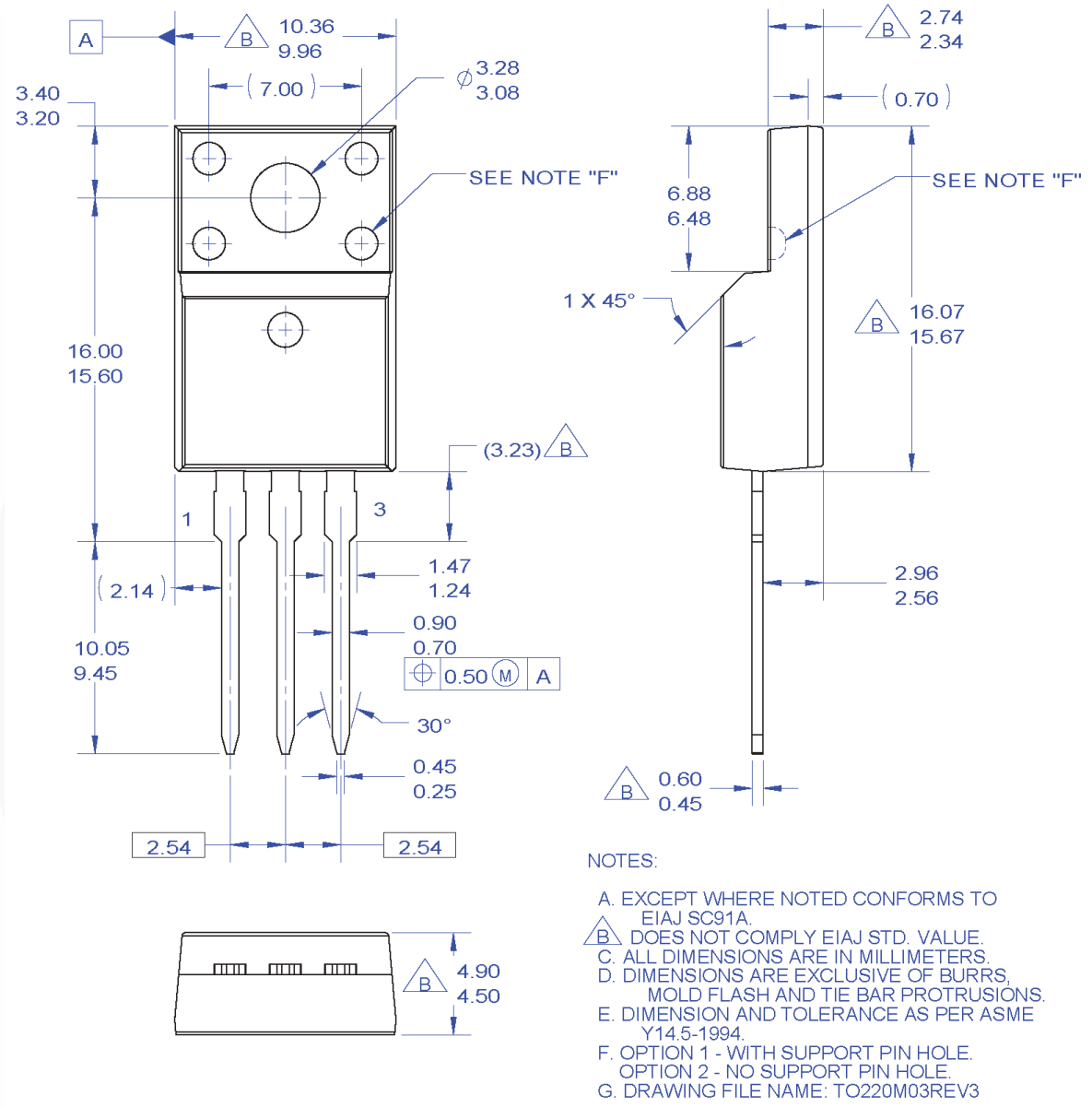

Figure 17. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I66

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