



FCPF150N65FL1

N-Channel SuperFET® II FRFET® MOSFET

650 V, 24 A, 150 mΩ

Features

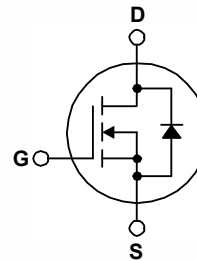
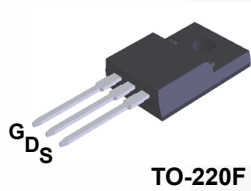
- 700 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 133\text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 72\text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 361\text{ pF}$)
- 100% Avalanche Tested
- RoHS Compliant

Description

SuperFET® II MOSFET is Fairchild Semiconductor's brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. SuperFET II FRFET® MOSFET combines a faster and more rugged intrinsic body diode performance with fast switching, aimed at achieving better reliability and efficiency especially in resonant switching applications. SuperFET II FRFET is very suitable for the switching power applications such as server/telecom power, Solar inverter, FPD TV power, computing power, lighting and industrial power applications.

Applications

- Telecom/Server Power Supplies
- Solar Inverters
- Computing Power Supplies
- FPD TV Power/Lighting



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

Symbol	Parameter	FCPF150N65FL1	Unit
V_{DSS}	Drain to Source Voltage	650	V
V_{GSS}	Gate to Source Voltage	- DC	± 20
		- AC ($f > 1\text{ Hz}$)	± 30
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	24*
		- Continuous ($T_C = 100^\circ\text{C}$)	14.9*
I_{DM}	Drain Current	- Pulsed (Note 1)	72*
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	663
I_{AR}	Avalanche Current	(Note 1)	4.7
E_{AR}	Repetitive Avalanche Energy	(Note 1)	2.98
dv/dt	MOSFET dv/dt	100	V/ns
	Peak Diode Recovery dv/dt	(Note 3)	
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	39
		- Derate Above 25°C	0.31
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

*Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FCPF150N65FL1	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	3.2	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCPF150N65FL1	FCPF150N65F	TO-220F	Tube	N/A	N/A	50 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 to Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 10\text{ mA}, T_J = 25^\circ\text{C}$	650	-	-	V
		$V_{GS} = 0\text{ V}, I_D = 10\text{ mA}, T_J = 150^\circ\text{C}$	700	-	-	
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, Referenced to 25°C	-	0.72	-	$V/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	-	-	10	μA
		$V_{DS} = 520\text{ V}, V_{GS} = 0\text{ V}, T_C = 125^\circ\text{C}$	-	86	-	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 2.4\text{ mA}$	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 12\text{ A}$	-	133	150	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS} = 20\text{ V}, I_D = 12\text{ A}$	-	22	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	2810	3737	pF
C_{oss}	Output Capacitance		-	91	121	pF
C_{riss}	Reverse Transfer Capacitance		-	0.77	-	pF
C_{oss}	Output Capacitance	$V_{DS} = 380\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	54	-	pF
$C_{oss\text{ eff.}}$	Effective Output Capacitance	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	361	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{ V}, I_D = 12\text{ A}, V_{GS} = 10\text{ V}$	-	72	94	nC
Q_{gs}	Gate to Source Gate Charge		-	15	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		(Note 4)	-	31	-
ESR	Equivalent Series Resistance	$f = 1\text{ MHz}$	-	0.69	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{ V}, I_D = 12\text{ A}, V_{GS} = 10\text{ V}, R_g = 4.7\text{ }\Omega$	-	28	66	ns	
t_r	Turn-On Rise Time		-	15	40	ns	
$t_{d(off)}$	Turn-Off Delay Time		(Note 4)	-	73	156	ns
t_f	Turn-Off Fall Time		(Note 4)	-	6	22	ns

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current	-	-	24	A	
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	72	A	
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_{SD} = 12\text{ A}$	-	-	1.2	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_{SD} = 12\text{ A}$	-	123	-	ns
Q_{rr}	Reverse Recovery Charge	$di_F/dt = 100\text{ A}/\mu\text{s}$	-	597	-	nC

Notes:

1. Repetitive rating: pulse width limited by maximum junction temperature.
2. $I_{AS} = 4.7\text{ A}, R_G = 25\text{ }\Omega$, Starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 12\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq 380\text{ V}$, Starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

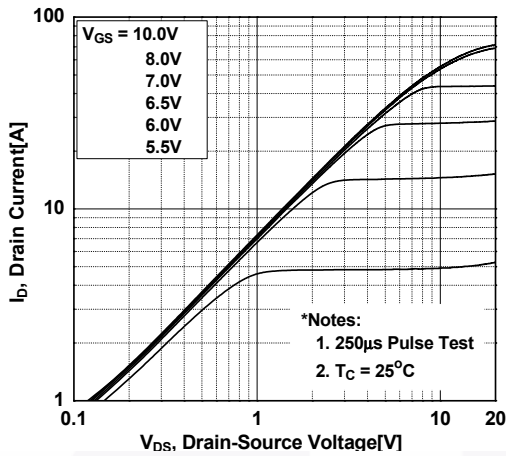


Figure 2. Transfer Characteristics

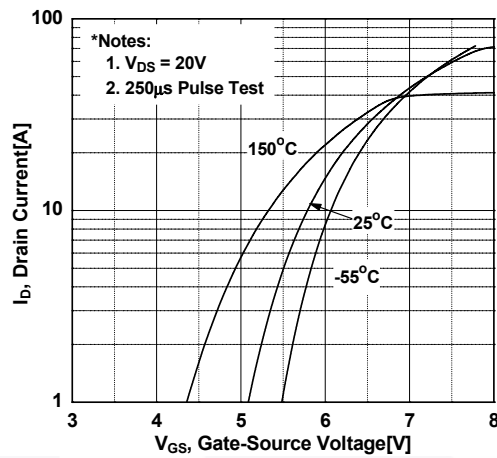


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

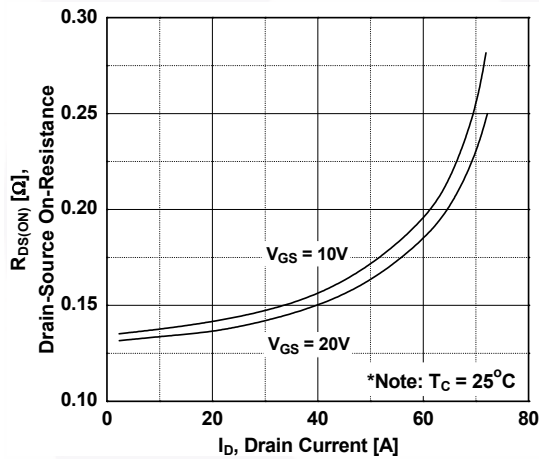


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

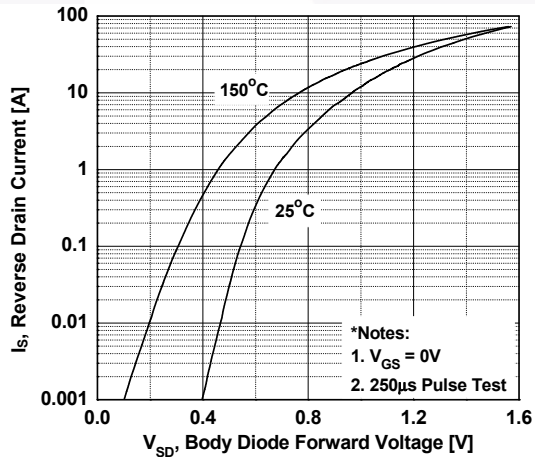


Figure 5. Capacitance Characteristics

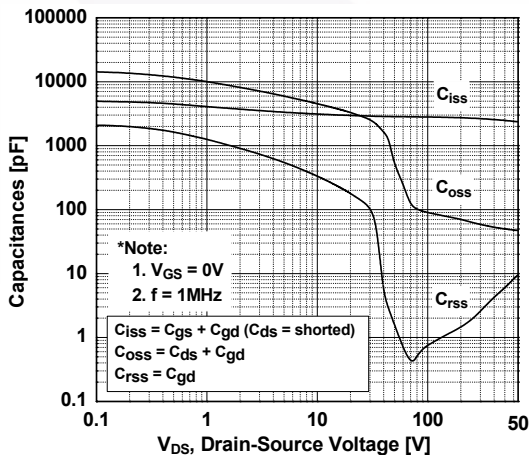
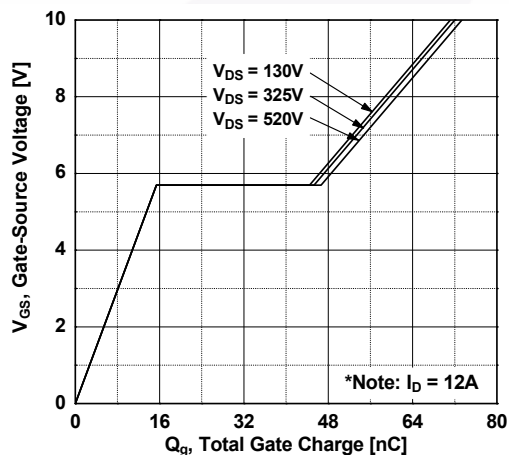


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

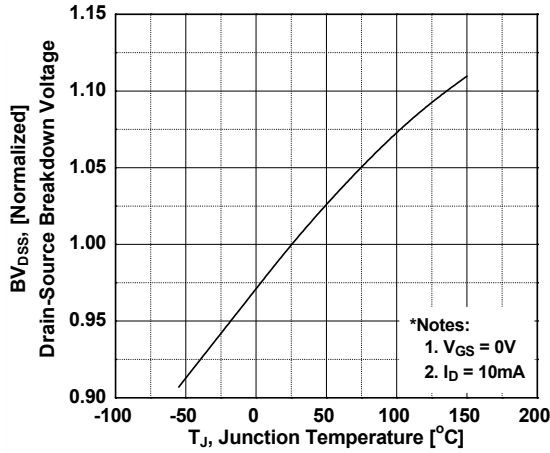


Figure 8. On-Resistance Variation vs. Temperature

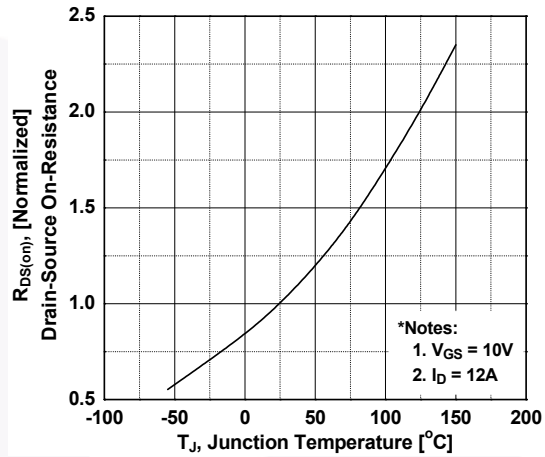


Figure 9. Maximum Safe Operating Area

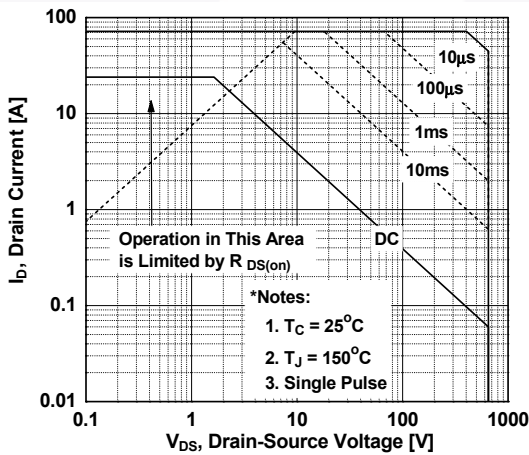


Figure 10. Maximum Drain Current vs. Case Temperature

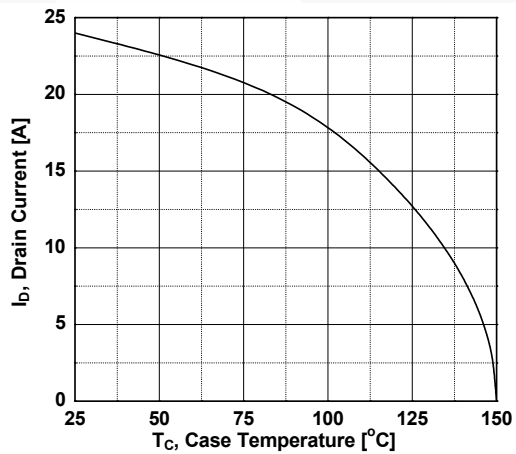
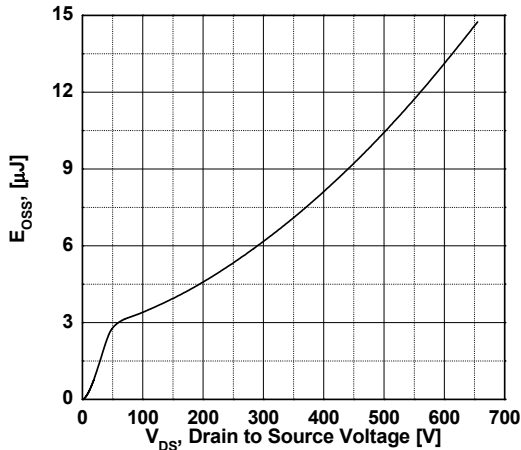
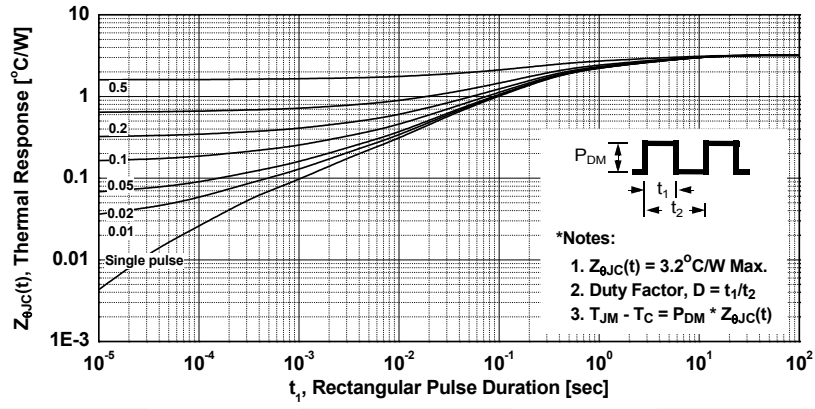


Figure 11. E_oss vs. Drain to Source Voltage



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



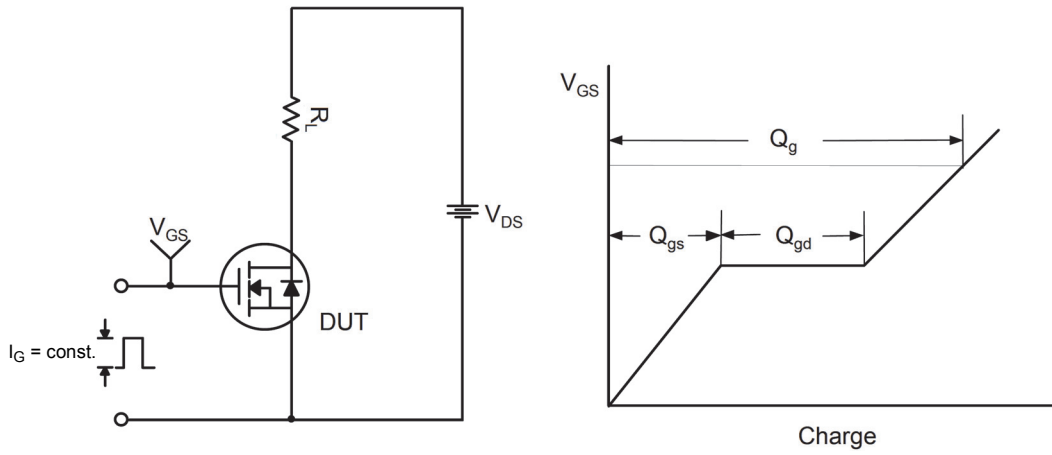


Figure 13. Gate Charge Test Circuit & Waveform

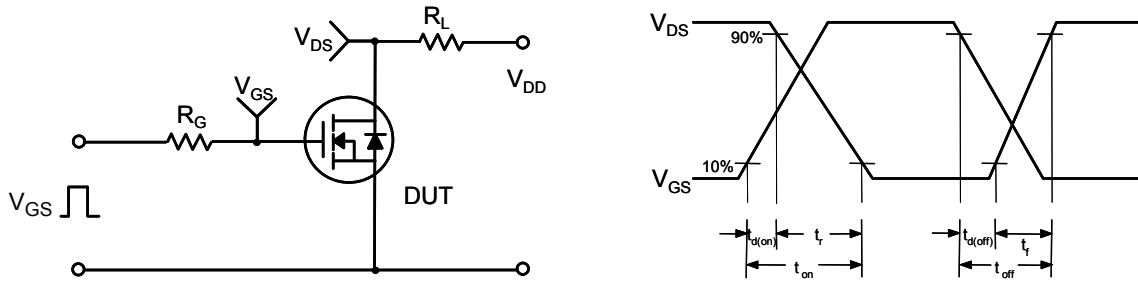


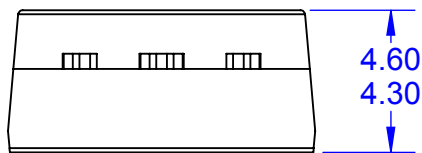
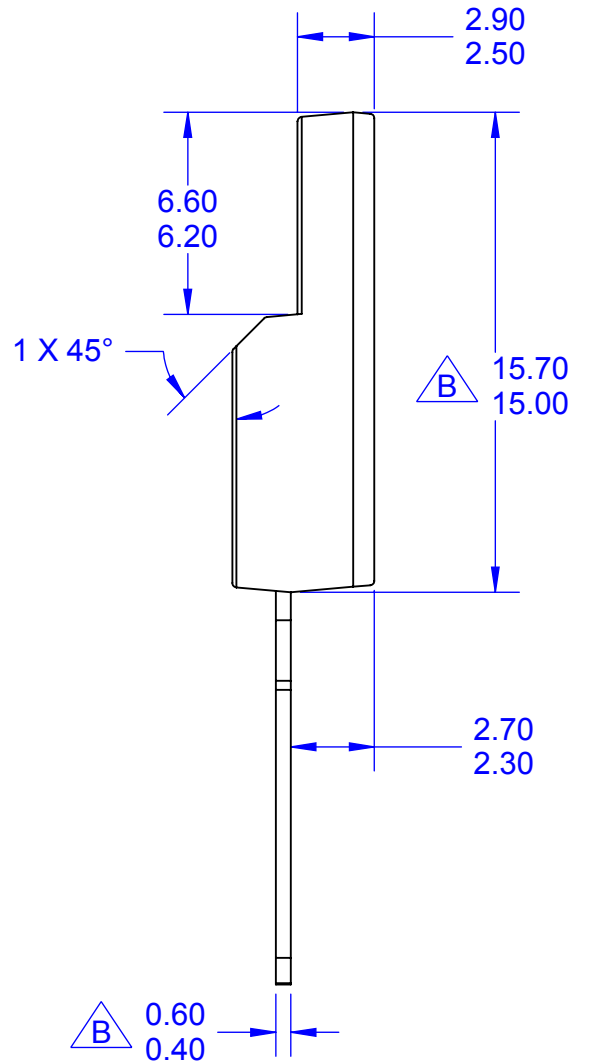
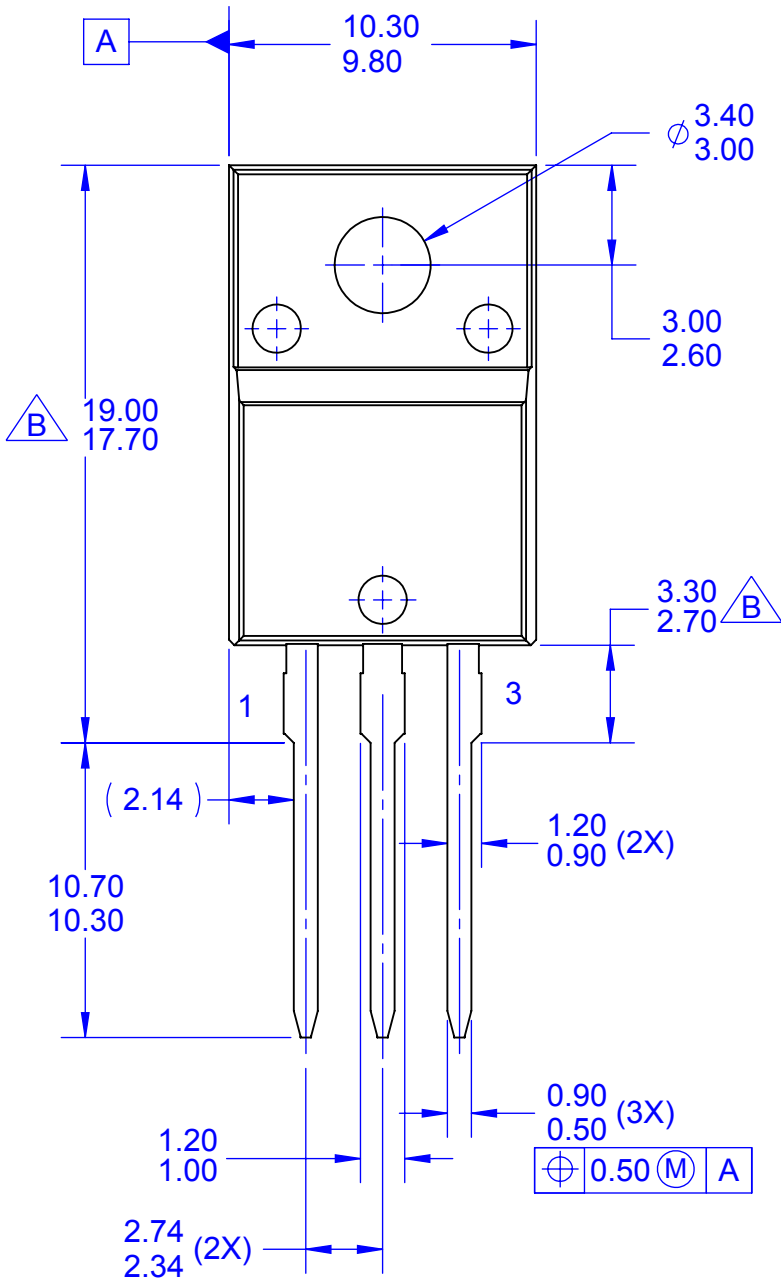
Figure 14. Resistive Switching Test Circuit & Waveforms



Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms



Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms



NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- $\triangle B$ DOES NOT COMPLY EIAJ STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-2009.
- F. DRAWING FILE NAME: TO220V03REV1
- G. FAIRCHILD SEMICONDUCTOR



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Datasheet Identification	Product Status	Definition
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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.
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