

# FCPF190N60\_F152

## N-Channel SuperFET® II MOSFET

600 V, 20.2 A, 199 mΩ

### Features

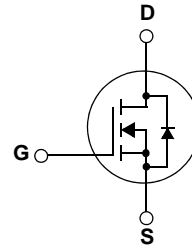
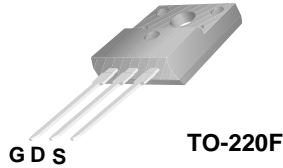
- 650 V @  $T_J = 150^\circ\text{C}$
- Max.  $R_{DS(on)} = 199\text{ m}\Omega$
- Ultra low gate charge (typ.  $Q_g = 57\text{ nC}$ )
- Low effective output capacitance (typ.  $C_{oss,eff} = 160\text{ pF}$ )
- 100% avalanche tested

### Applications

- LCD / LED / PDP TV Lighting
- Solar Inverter
- AC-DC Power Supply

### Description

SuperFET® II MOSFET is Fairchild Semiconductor®'s first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This advanced technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme  $dv/dt$  rate and higher avalanche energy. Consequently, SuperFET® II MOSFET is suitable for various AC/DC power conversion for system miniaturization and higher efficiency.



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


Symbol	Parameter	FCPF190N60_F152	Unit
$V_{DSS}$	Drain to Source Voltage	600	V
$V_{GSS}$	Gate to Source Voltage	-DC	$\pm 20$
		-AC ( $f > 1\text{Hz}$ )	$\pm 30$
$I_D$	Drain Current	-Continuous ( $T_C = 25^\circ\text{C}$ )	20.2*
		-Continuous ( $T_C = 100^\circ\text{C}$ )	12.7*
$I_{DM}$	Drain Current - Pulsed (Note 1)	60.6*	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	400	mJ
$I_{AR}$	Avalanche Current (Note 1)	4.0	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	2.1	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 3)	20	V/ns
	MOSFET $dv/dt$	100	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	39	W
		- Derate above $25^\circ\text{C}$	0.31
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

\*Drain current limited by maximum junction temperature

### Thermal Characteristics

Symbol	Parameter	FCPF190N60_F152	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.2	$^\circ\text{C/W}$
$R_{\theta CS}$	Thermal Resistance, Case to Heat Sink (Typical)	0.5	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	

## Package Marking and Ordering Information

Device Marking	Device	Package	Eco Status	Packaging Type	Quantity
FCPF190N60	FCPF190N60_F152	TO-220F	Green 	Tube	50

For Fairchild's definition of "green" Eco Status, please visit: [http://www.fairchildsemi.com/company/green/rohs\\_green.html](http://www.fairchildsemi.com/company/green/rohs_green.html).

## 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	$V_{GS} = 0V, I_D = 10mA, T_J = 25^\circ\text{C}$	600	-	-	V
		$V_{GS} = 0V, I_D = 10mA, T_J = 150^\circ\text{C}$	650	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10mA$ , Referenced to $25^\circ\text{C}$	-	0.67	-	$V/^\circ\text{C}$
$BV_{DS}$	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0V, I_D = 20A$	-	700	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 480V, V_{GS} = 0V$	-	-	10	$\mu\text{A}$
		$V_{DS} = 480V, T_C = 125^\circ\text{C}$	-	-	10	$\mu\text{A}$
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2.5	-	3.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10V, I_D = 10A$	-	0.17	0.199	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20V, I_D = 10A$	-	21	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V$ $f = 1\text{MHz}$	-	2220	2950	pF
$C_{oss}$	Output Capacitance		-	1630	2165	pF
$C_{rfs}$	Reverse Transfer Capacitance		-	85	128	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 380V, V_{GS} = 0V, f = 1\text{MHz}$	-	42	-	pF
$C_{oss \text{ eff.}}$	Effective Output Capacitance	$V_{DS} = 0V \text{ to } 480V, V_{GS} = 0V$	-	160	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380V, I_D = 10A$ $V_{GS} = 10V$	-	57	74	nC
$Q_{gs}$	Gate to Source Gate Charge		-	9	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		(Note 4)	-	21	-
ESR	Equivalent Series Resistance	$f = 1\text{MHz}$	-	1	-	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380V, I_D = 10A$ $V_{GS} = 10V, R_g = 4.7\Omega$	-	20	50	ns
$t_r$	Turn-On Rise Time		-	10	30	ns
$t_{d(off)}$	Turn-Off Delay Time		-	64	138	ns
$t_f$	Turn-Off Fall Time		(Note 4)	-	5	20

### Drain-Source Diode Characteristics

$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	20.2	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	60.6	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0V, I_{SD} = 10A$	-	-	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0V, I_{SD} = 10A$	-	280	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100A/\mu\text{s}$	-	3.8	-	$\mu\text{C}$

#### Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS} = 4A, V_{DD} = 50V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 10A, di/dt \leq 200A/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

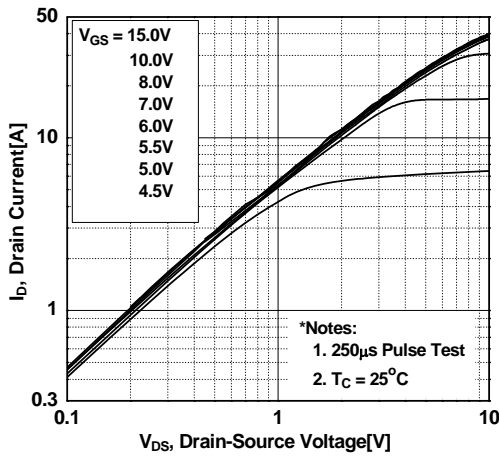


Figure 2. Transfer Characteristics

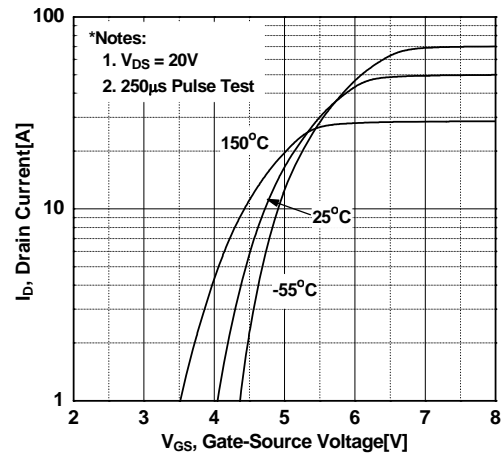


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

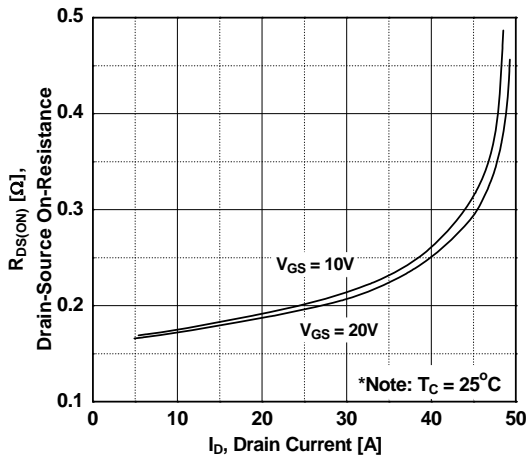


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

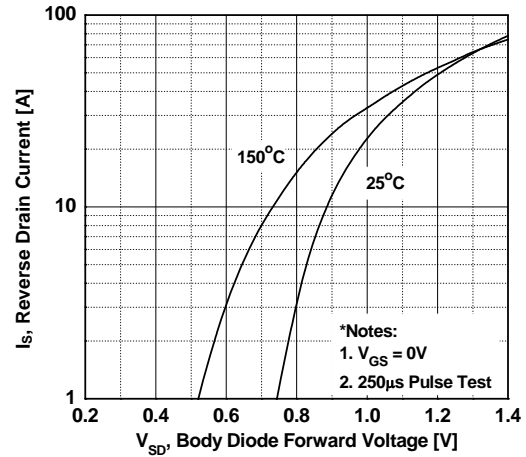


Figure 5. Capacitance Characteristics

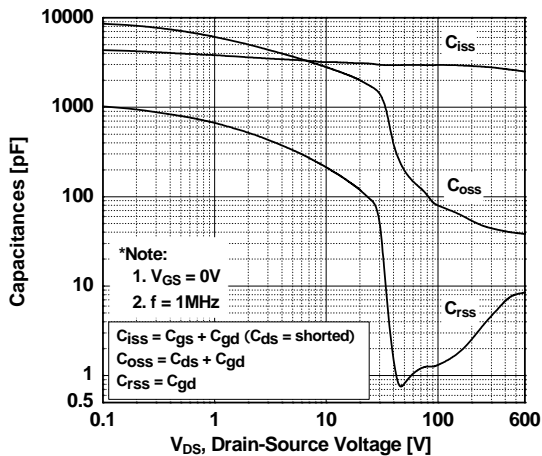
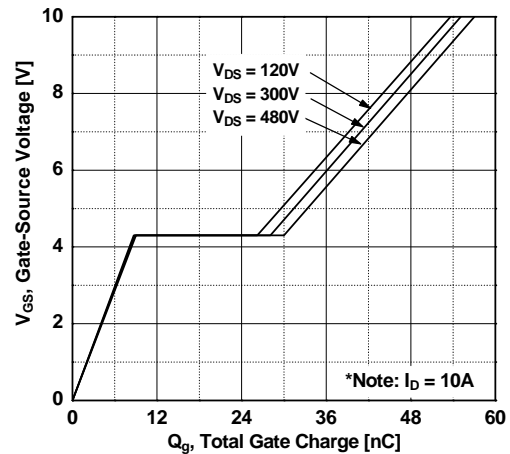


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

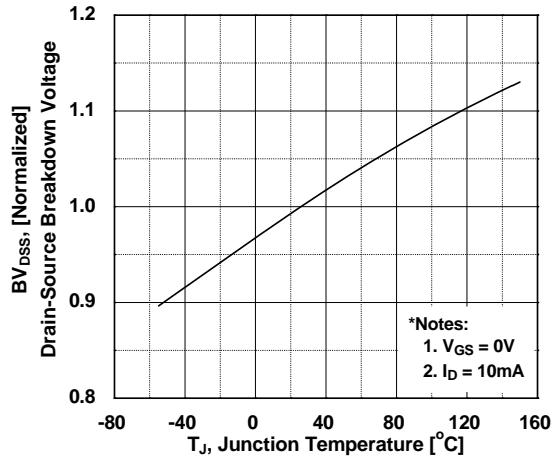


Figure 8. On-Resistance Variation vs. Temperature

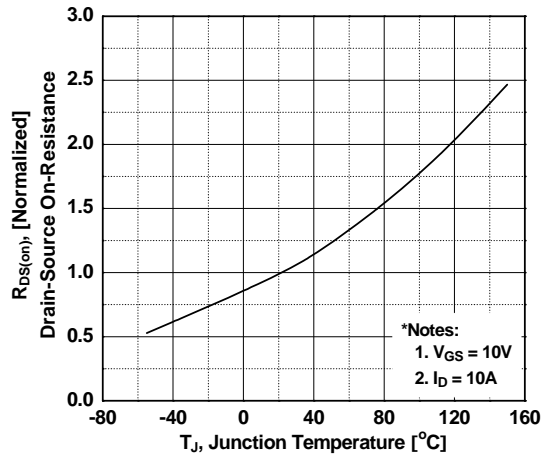


Figure 9. Maximum Safe Operating Area vs. Case Temperature

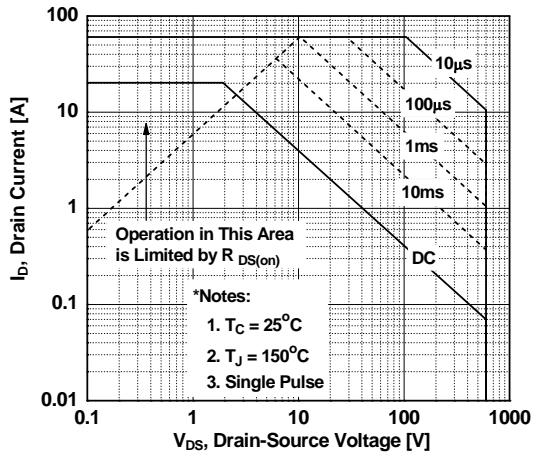


Figure 10. E\_oss vs. Drain to Source Voltage Switching Capability

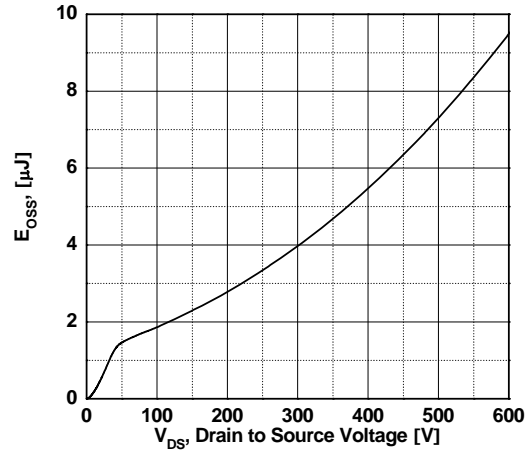
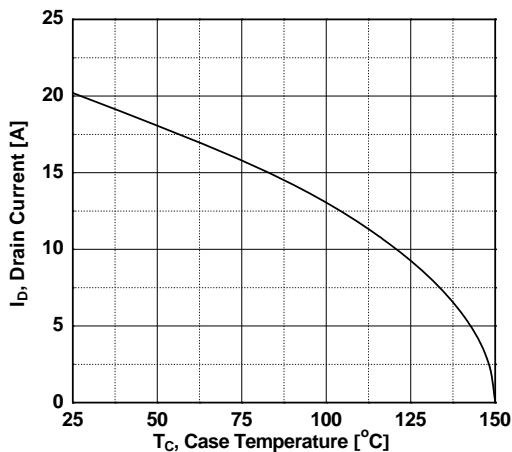
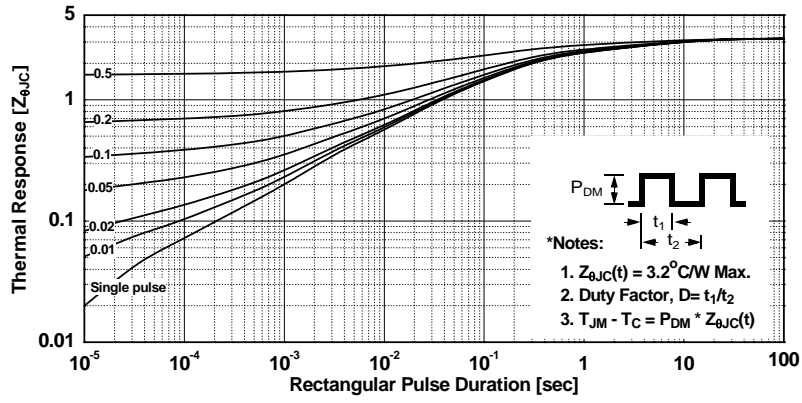


Figure 11. Maximum Drain Current

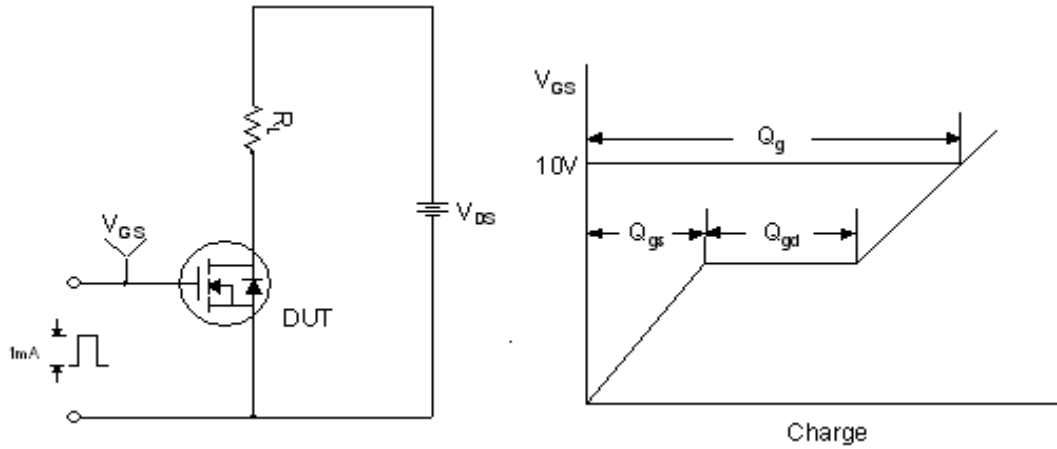


Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



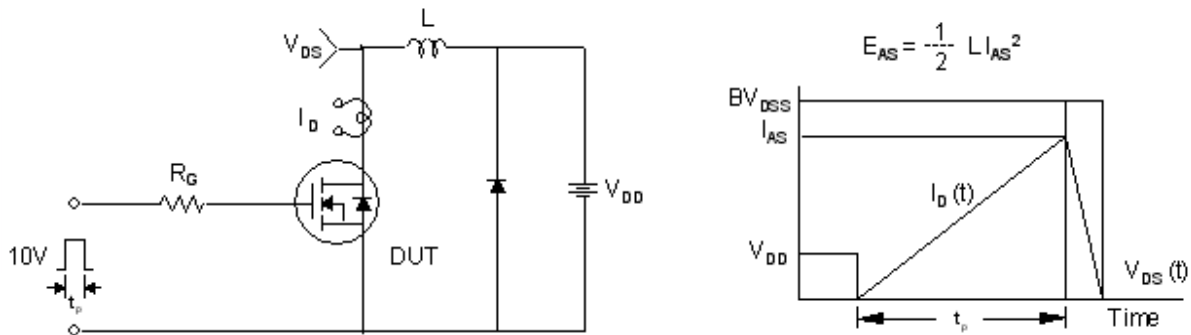
Gate Charge Test Circuit & Waveform



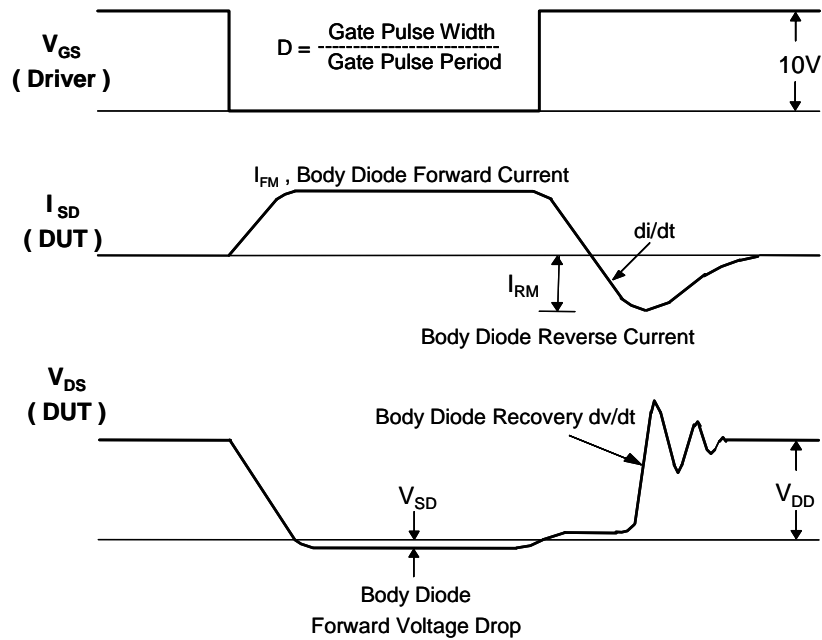
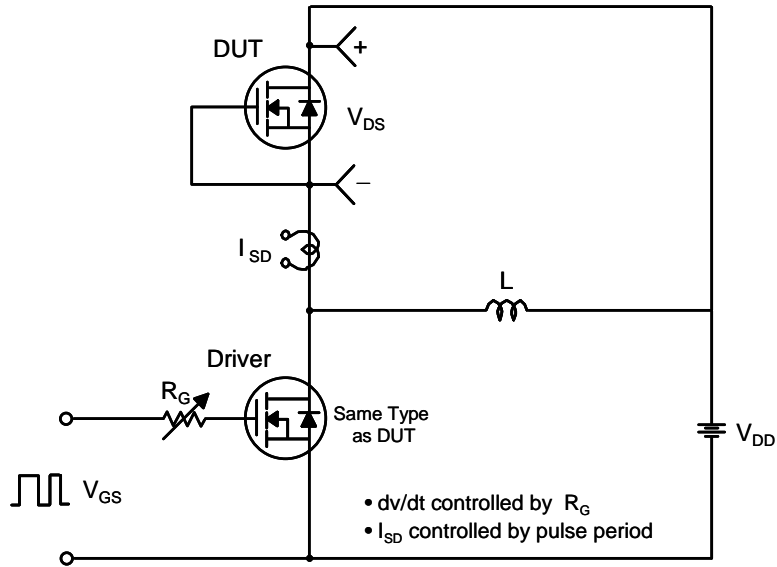
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

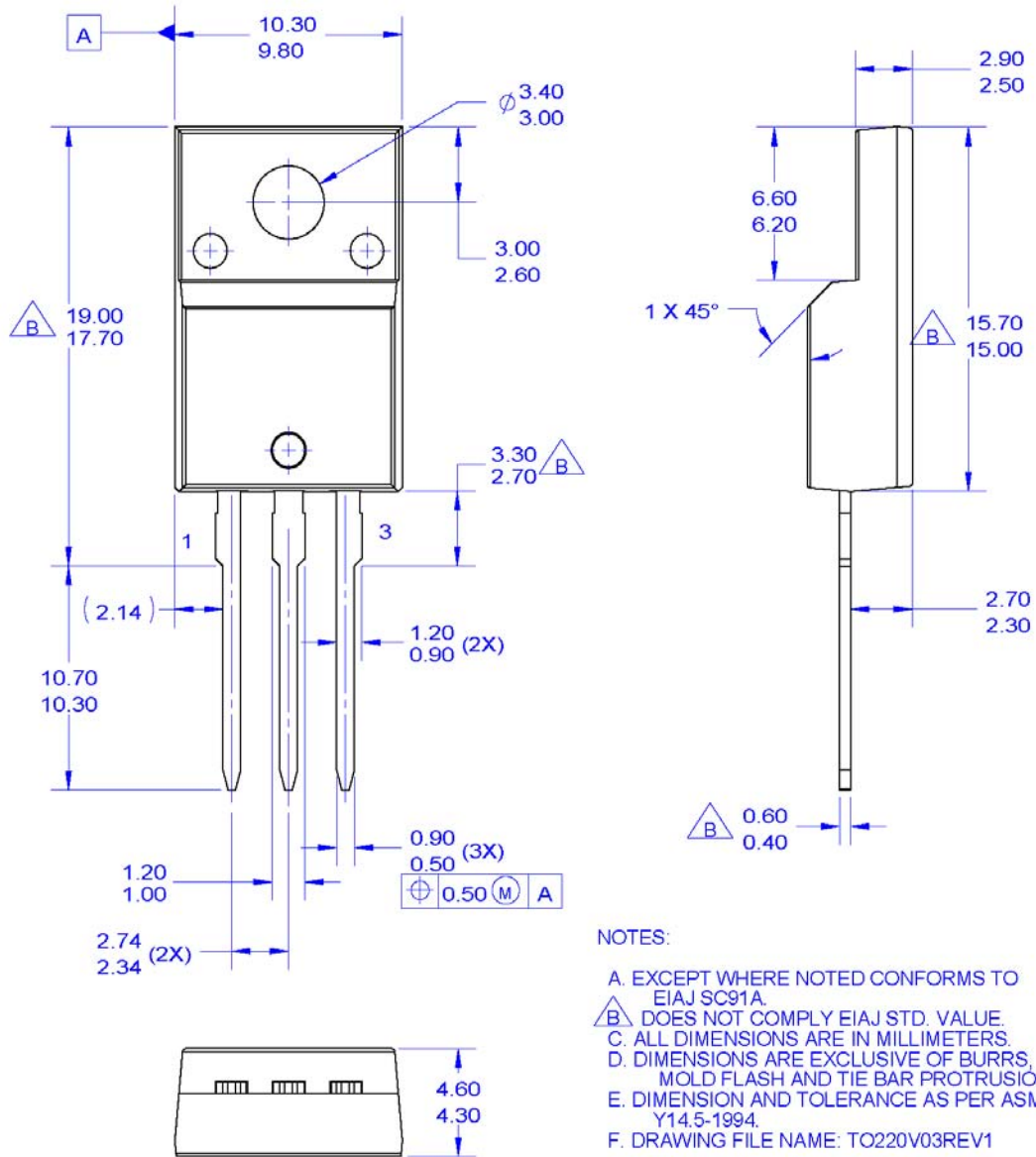


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

TO-220F



NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- 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 Y14.5-1994.
- F. DRAWING FILE NAME: TO220V03REV1

\* Front/Back Side Isolation Voltage : AC 2500V

TO-220, MOLDED, 3LD, FULL PACK, EIAJ SC91

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|  | MicroPak™                                       | SuperFET®                             |  |
| Fairchild®  | MicroPak2™                                      | SuperSOT™-3                           | UHC®  |
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| FACT®   | mWSaver™  | SupreMOS®                             | VCX™  |
| FAST®   | OptoHiT™  | SyncFET™                              | VisualMax™  |
| FastvCore™  | OPTOLOGIC®                                      |                                       | VoltagePlus™  |
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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.
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