



ON Semiconductor®

# FCPF380N60-F152

## N-Channel SuperFET® II MOSFET Description

600 V, 10.2 A, 380 mΩ

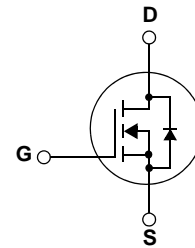
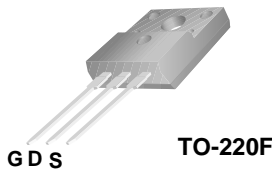
### Features

- 650 V @T<sub>J</sub> = 150°C
- Max. R<sub>DS(on)</sub> = 380 mΩ
- Ultra low gate charge (typ. Q<sub>g</sub> = 30 nC)
- Low effective output capacitance (typ. C<sub>oss,eff</sub> = 95 pF)
- 100% avalanche tested

### Applications

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

SuperFET®II MOSFET is ON 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<sub>C</sub> = 25°C unless otherwise noted


Symbol	Parameter	FCPF380N60-F152	Unit
V <sub>DSS</sub>	Drain to Source Voltage	600	V
V <sub>GSS</sub>	Gate to Source Voltage	-DC	±20
		-AC (f>1HZ)	±30
I <sub>D</sub>	Drain Current	-Continuous (T <sub>C</sub> = 25°C)	10.2*
		-Continuous (T <sub>C</sub> = 100°C)	6.4*
I <sub>DM</sub>	Drain Current	- Pulsed (Note 1)	30.6*
E <sub>AS</sub>	Single Pulsed Avalanche Energy	(Note 2)	211.6
I <sub>AR</sub>	Avalanche Current	(Note 1)	2.3
E <sub>AR</sub>	Repetitive Avalanche Energy	(Note 1)	1.06
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	20
	MOSFET dv/dt		100
P <sub>D</sub>	Power Dissipation	(T <sub>C</sub> = 25°C)	31
		- Derate above 25°C	0.25
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150	°C
T <sub>L</sub>	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	FCPF380N60-F152	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction to Case	4	°C/W
R <sub>θCS</sub>	Thermal Resistance, Case to Heat Sink (Typical)	0.5	
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient	62.5	

## Package Marking and Ordering Information

Device Marking	Device	Package	Eco Status	Packaging Type	Quantity
FCPF380N60	FCPF380N60-F152	TO-220F	Green 	Tube	50

## 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 $25^\circ\text{C}$	-	0.6	-	$V/^\circ\text{C}$
$BV_{DS}$	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0V, I_D = 10A$	-	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	$V_{GS} = 10V, I_D = 5A$	-	0.33	0.38	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20V, I_D = 5A$	-	11	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V$ $f = 1\text{MHz}$	-	1250	1665	pF
$C_{oss}$	Output Capacitance		-	905	1205	pF
$C_{rfs}$	Reverse Transfer Capacitance		-	45	60	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 380V, V_{GS} = 0V, f = 1\text{MHz}$	-	23	-	pF
$C_{oss \text{ eff.}}$	Effective Output Capacitance	$V_{DS} = 0V \text{ to } 480V, V_{GS} = 0V$	-	95	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380V, I_D = 5A$ $V_{GS} = 10V$	-	30	40	nC
$Q_{gs}$	Gate to Source Gate Charge		-	5	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		(Note 4)	-	10	-
ESR	Equivalent Series Resistance	$f = 1\text{MHz}$	-	1	-	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380V, I_D = 5A$ $V_{GS} = 10V, R = 4.7\Omega$	-	14	38	ns
$t_r$	Turn-On Rise Time		-	7	24	ns
$t_{d(off)}$	Turn-Off Delay Time		-	45	100	ns
$t_f$	Turn-Off Fall Time		(Note 4)	-	6	22

### Drain-Source Diode Characteristics

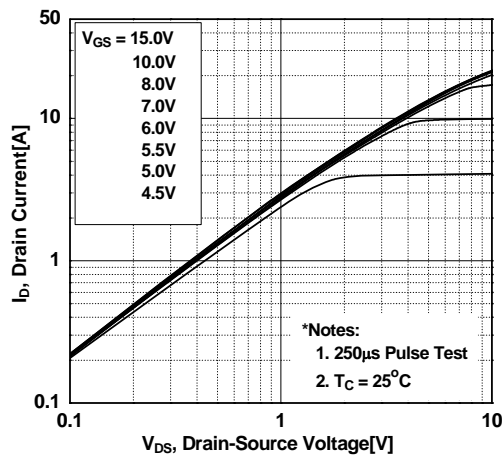
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	10.2	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	30.6	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0V, I_{SD} = 5A$	-	-	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0V, I_{SD} = 5A$	-	240	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100A/\mu\text{s}$	-	2.7	-	$\mu\text{C}$

#### Notes:

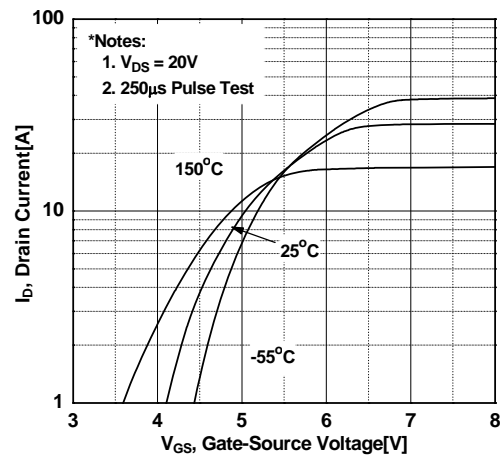
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS} = 2.3A, V_{DD} = 50V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 5.1A, di/dt \leq 200A/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

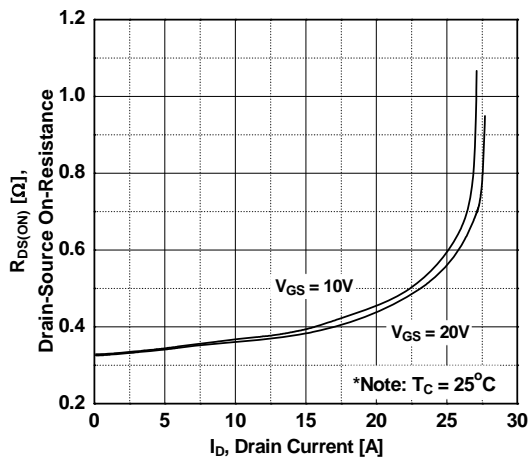
**Figure 1. On-Region Characteristics**



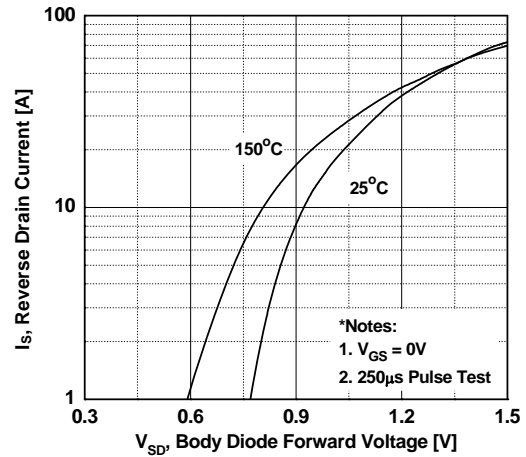
**Figure 2. Transfer Characteristics**



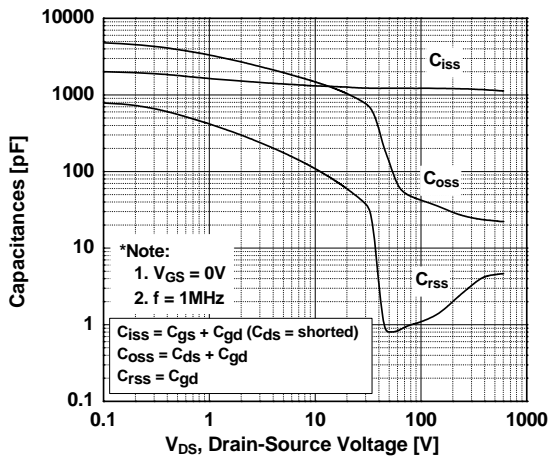
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



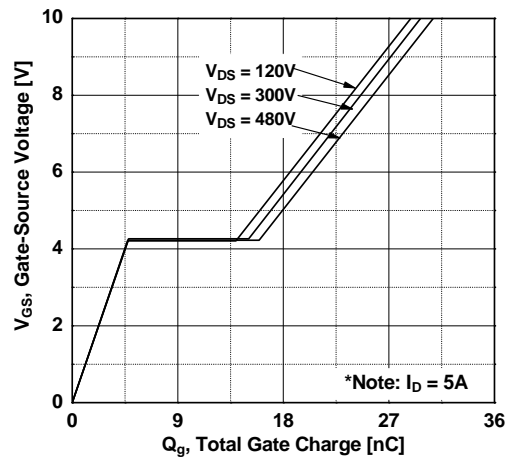
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

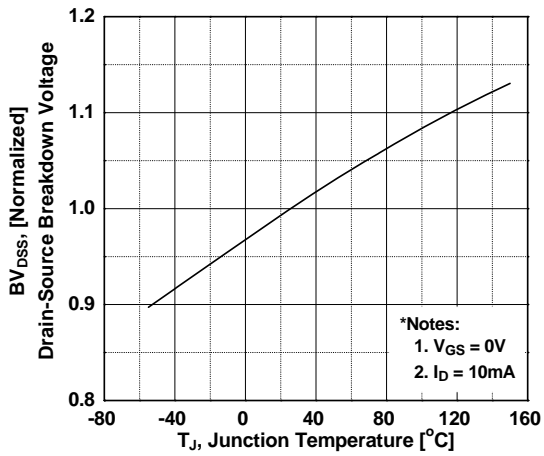


**Figure 6. Gate Charge Characteristics**

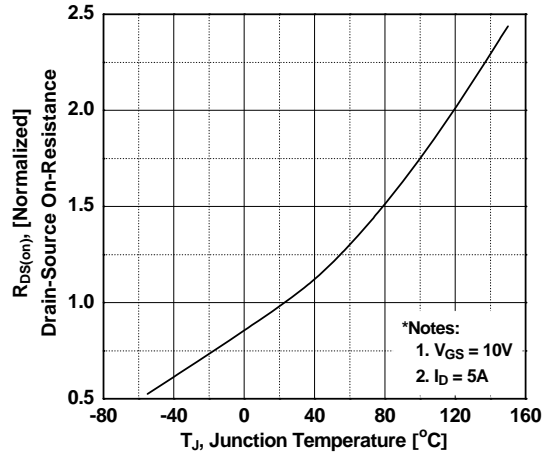


**Typical Performance Characteristics** (Continued)

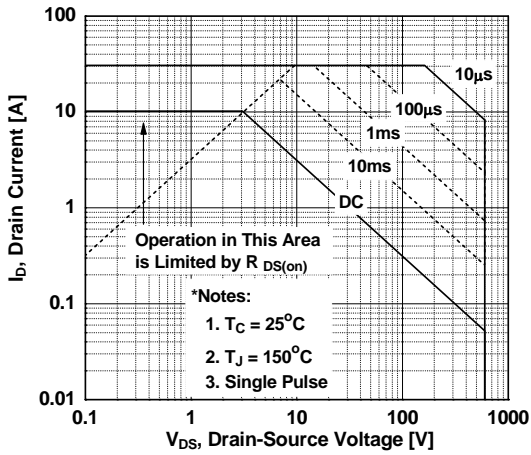
**Figure 7. Breakdown Voltage Variation vs. Temperature**



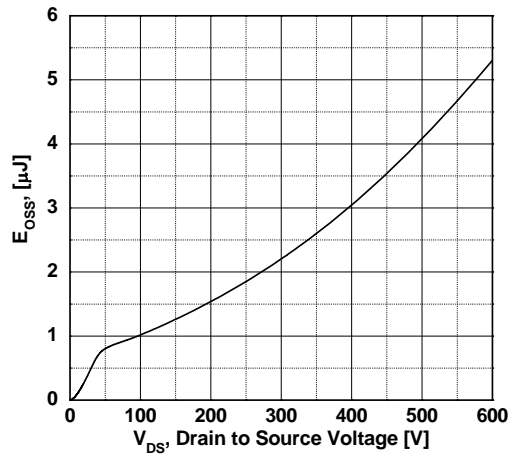
**Figure 8. On-Resistance Variation vs. Temperature**



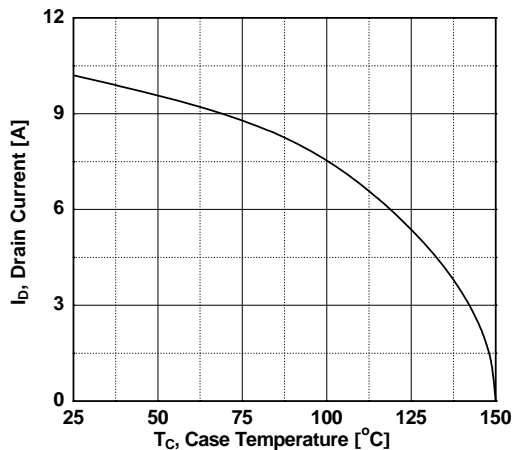
**Figure 9. Maximum Safe Operating Area vs. Case Temperature**



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

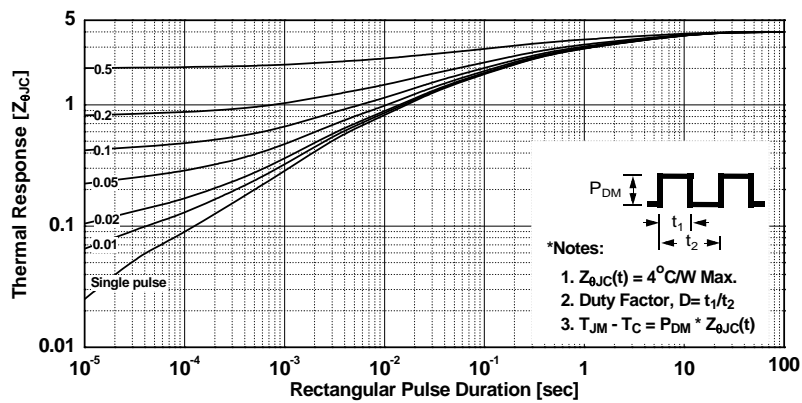


**Figure 11. Maximum Drain Current**



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



**Gate Charge Test Circuit & Waveform**



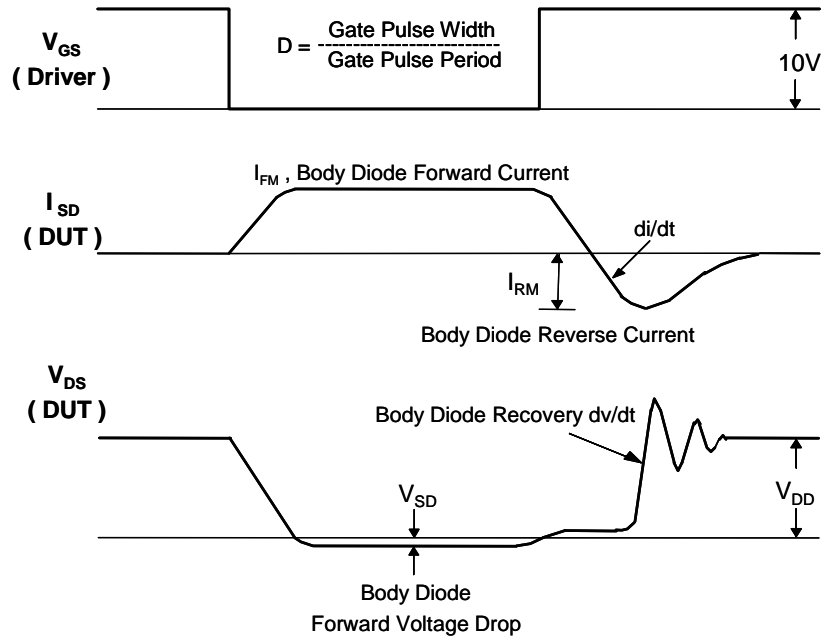
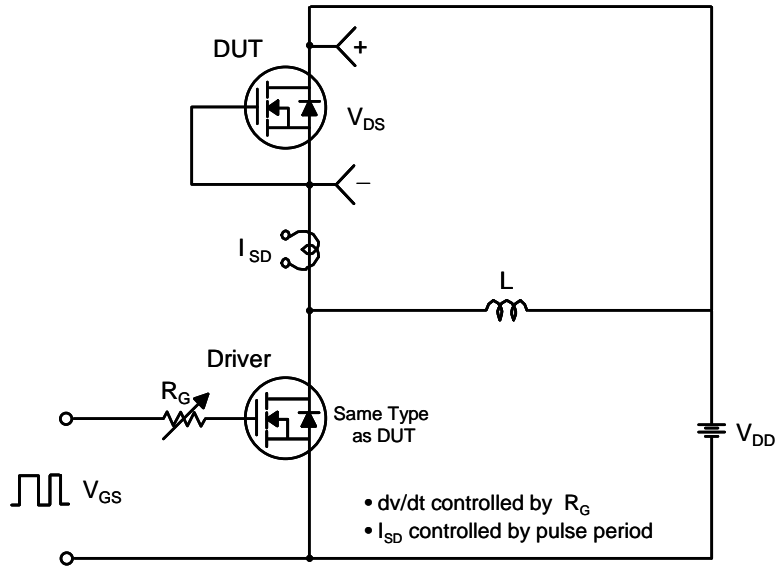
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

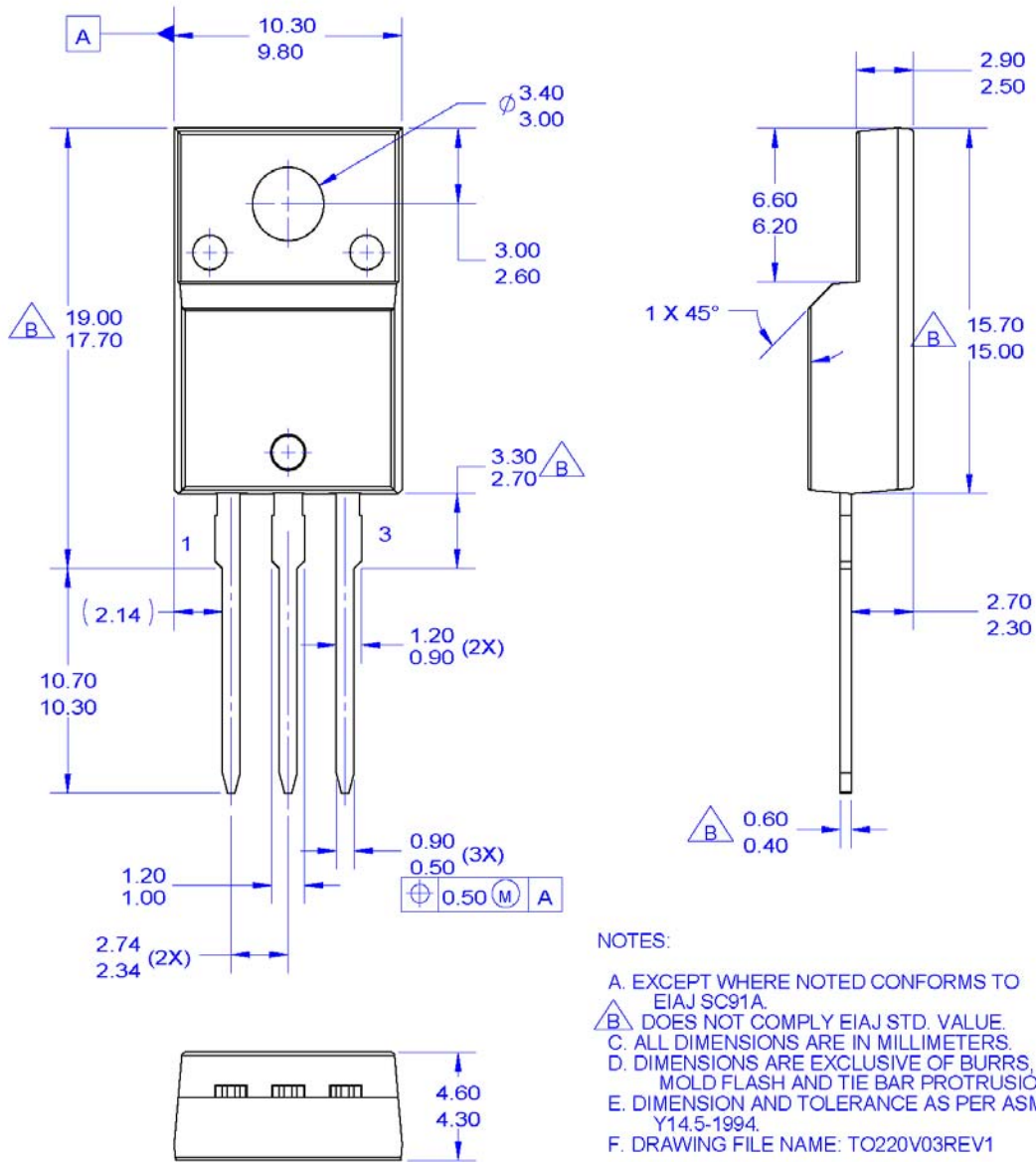


Peak Diode Recovery dv/dt Test Circuit & Waveforms



**Mechanical Dimensions**

**TO-220F**



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

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

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