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ON Semiconductor®

FCPF190N60-F152

N-Channel SuperFET® II MOSFET
600 V, 20.2 A, 199 mΩ

Features

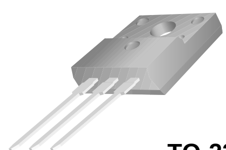
- 650 V @T_J = 150°C
- Max. $R_{DS(on)}$ = 199 mΩ
- Ultra low gate charge (typ. Q_g = 57 nC)
- Low effective output capacitance (typ. C_{oss}.eff = 160 pF)
- 100% avalanche tested

Description

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-resis-tance and lower gate charge performance. This advanced tech-nology 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 minia-turization and higher efficiency.

Aplications

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



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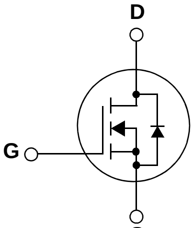


Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter		FCPF190N60-F152	Unit
V_{DSS}	Drain to Source Voltage		600	V
V_{GSS}	Gate to Source Voltage	-DC	±20	V
		-AC (f >1Hz)	±30	
I_D	Drain Current	-Continuous (T_C = 25°C)	20.2*	A
		-Continuous (T_C = 100°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°C)	39	W
		- Derate above 25°C	0.31	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	FCPF190N60-F152	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.2	°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

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

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0V$, $I_D = 10mA$, $T_J = 25°C$	600	-	-	V
		$V_{GS} = 0V$, $I_D = 10mA$, $T_J = 150°C$	650	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10mA$, Referenced to 25^oC	-	0.67	-	$V/^oC$
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	μA
		$V_{DS} = 480V$, $T_C = 125^oC$	-	-	10	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 20V$, $V_{DS} = 0V$	-	-	±100	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\mu A$	2.5	-	3.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10V$, $I_D = 10A$	-	0.17	0.199	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 20V$, $I_D = 10A$	-	21	-	S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input Capacitance	$V_{DS} = 25V$, $V_{GS} = 0V$, f = 1MHz	-	2220	2950	pF
C_{oss}	Output Capacitance		-	1630	2165	pF
C_{rss}	Reverse Transfer Capacitance		-	85	128	pF
C_{oss}	Output Capacitance	$V_{DS} = 380V$, $V_{GS} = 0V$, f = 1MHz	-	42	-	pF
C_{oss} eff.	Effective Output Capacitance	$V_{DS} = 0V$ to $480V$, $V_{GS} = 0V$	-	160	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380V$, $I_D = 10A$, $V_{GS} = 10V$ (Note 4)	-	57	74	nC
Q_{gs}	Gate to Source Gate Charge		-	9	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	21	-	nC
ESR	Equivalent Series Resistance	f = 1MHz	-	1	-	Ω

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380V$, $I_D = 10A$, $V_{GS} = 10V$, $R_g = 4.7\Omega$ (Note 4)	-	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		-	5	20	ns

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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	$V_{GS} = 0V$, $I_{SD} = 10A$, $dI_F/dt = 100A/\mu s$	-	280	-	ns
Q_{rr}	Reverse Recovery Charge		-	3.8	-	μC

Notes:

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

Typical Performance Characteristics

Figure 1. On-Region Characteristics

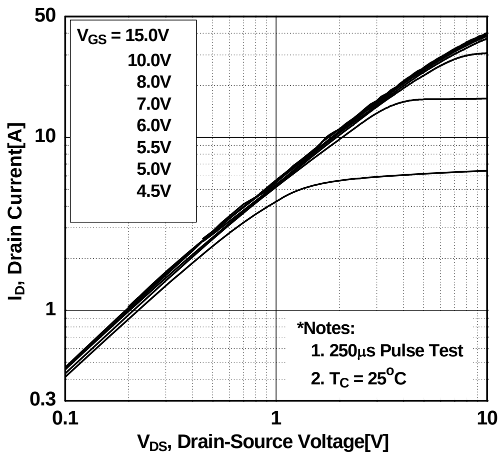


Figure 2. Transfer Characteristics

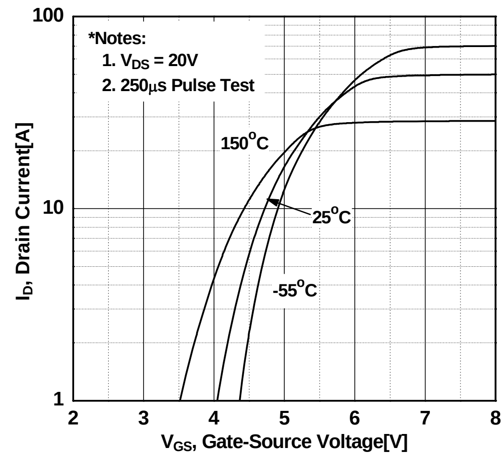


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

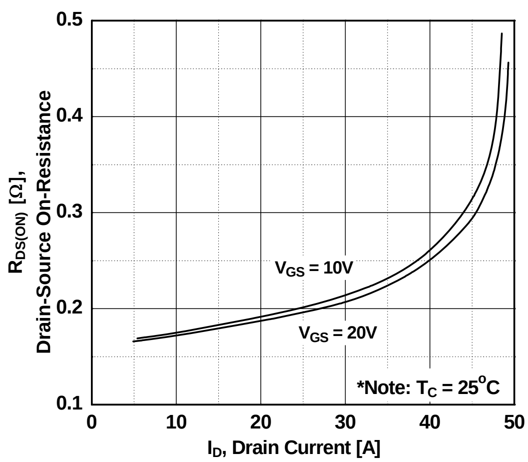


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

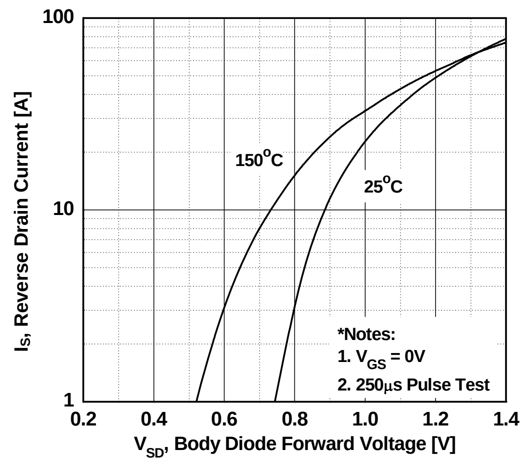


Figure 5. Capacitance Characteristics

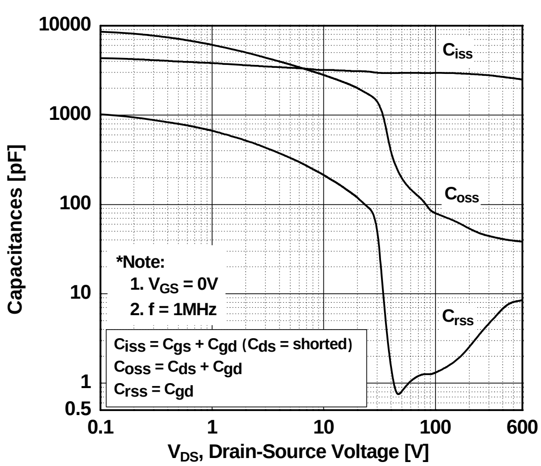
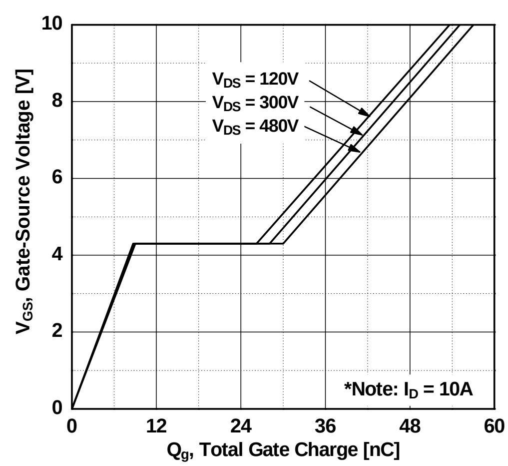


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

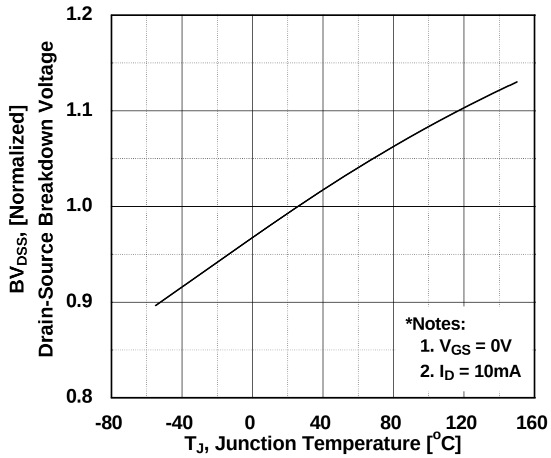


Figure 8. On-Resistance Variation vs. Temperature

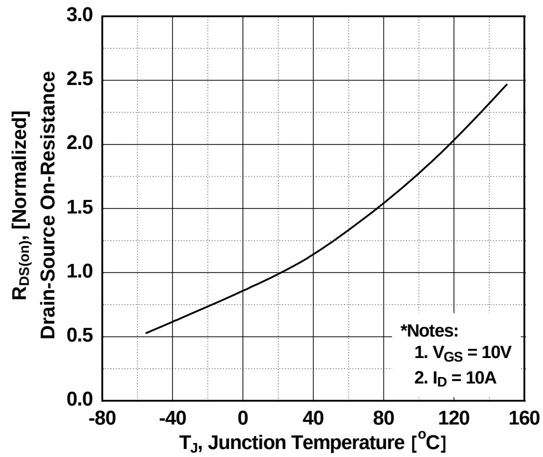


Figure 9. Maximum Safe Operating Area vs. Case Temperature

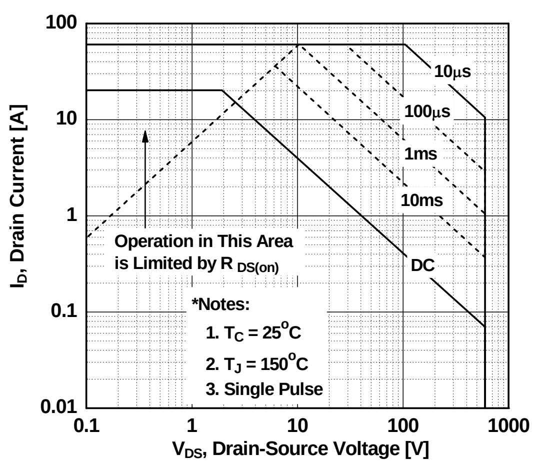


Figure 10. Eoss vs. Drain to Source Voltage Switching Capability

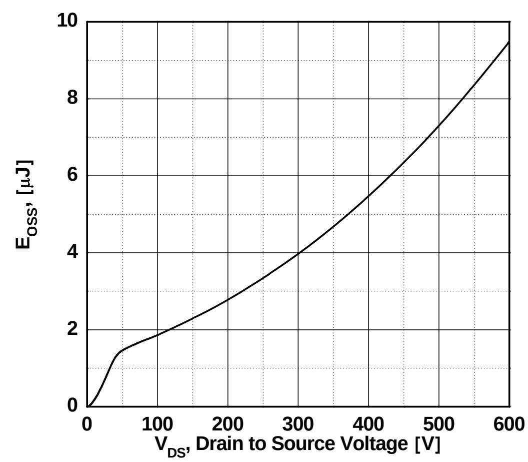
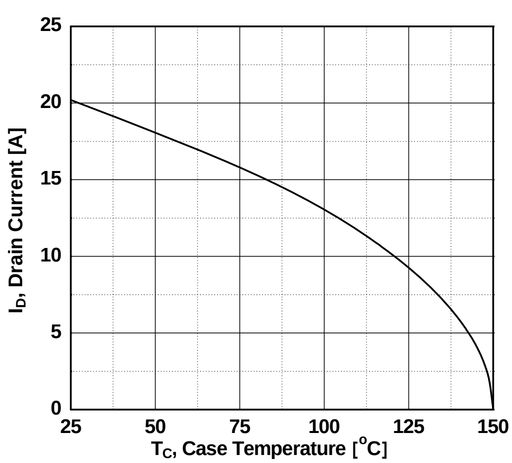
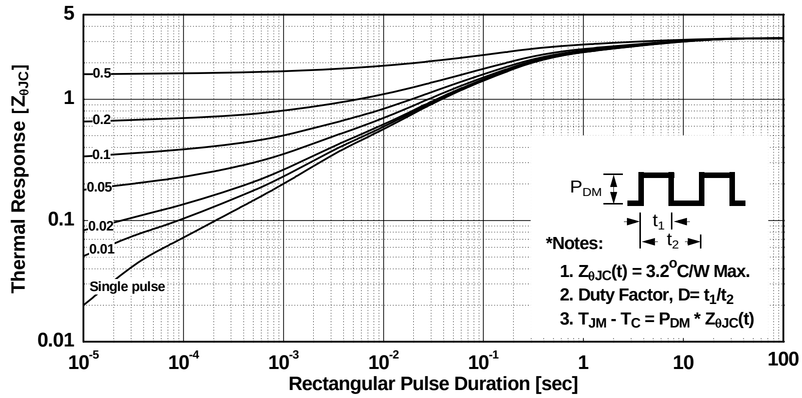


Figure 11. Maximum Drain Current

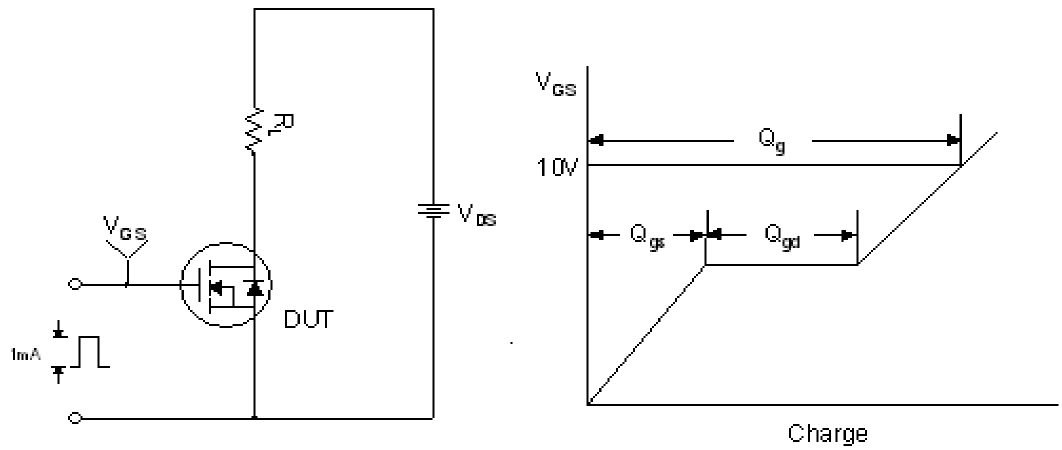


Typical Performance Characteristics (Continued)

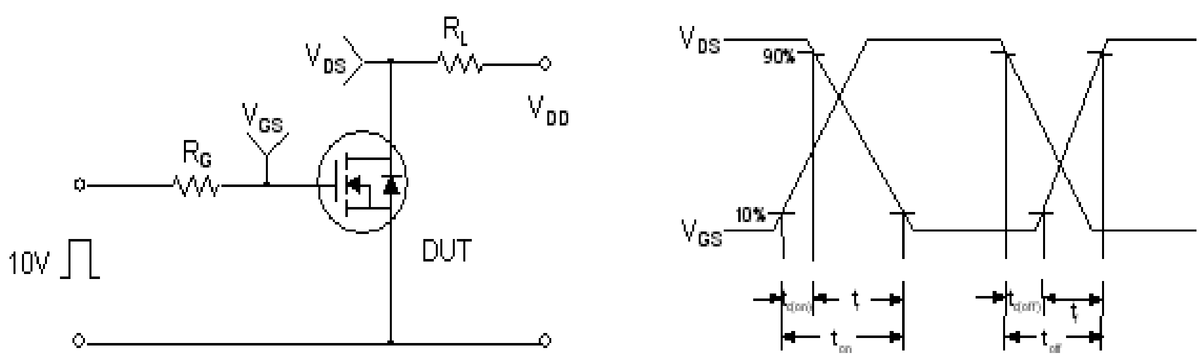
Figure 12. Transient Thermal Response Curve



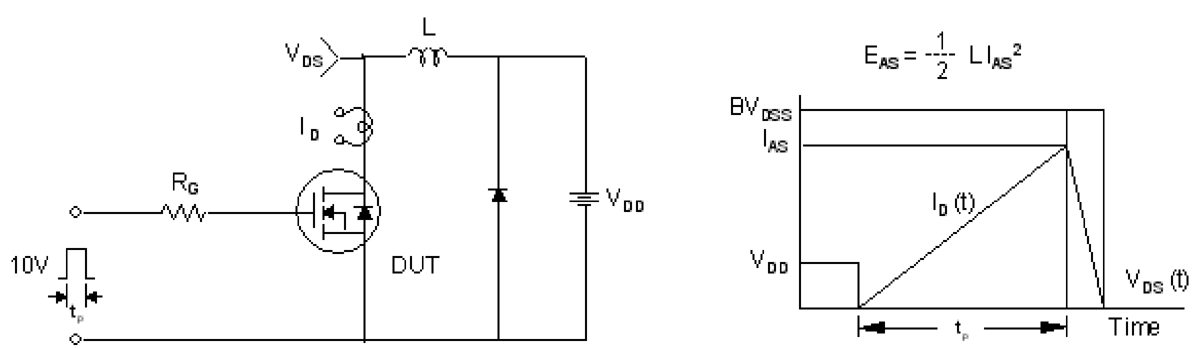
Gate Charge Test Circuit & Waveform



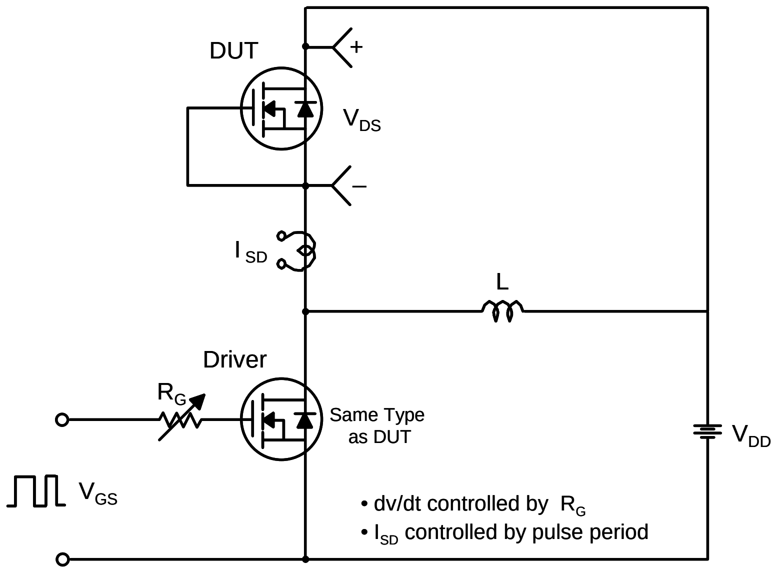
Resistive Switching Test Circuit & Waveforms

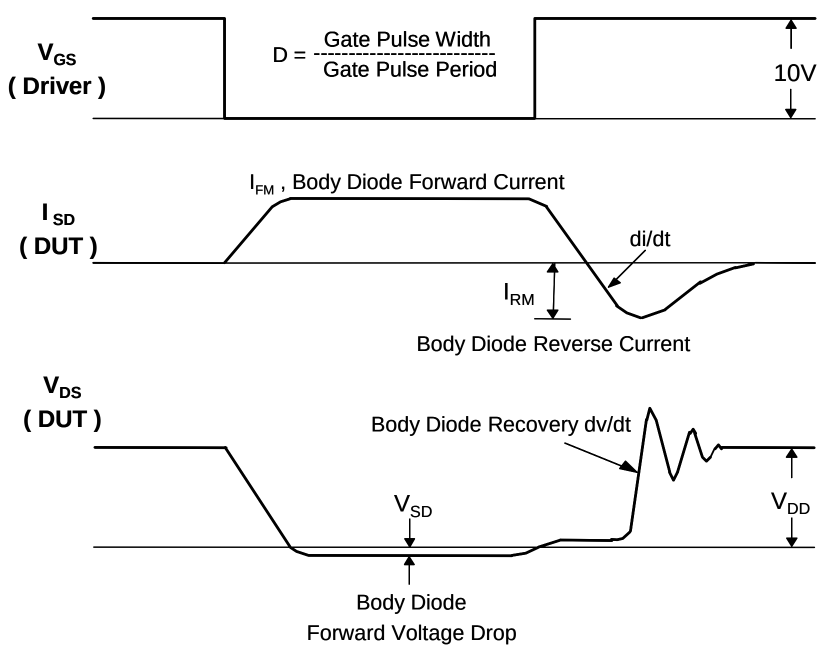


Unclamped Inductive Switching Test Circuit & Waveforms



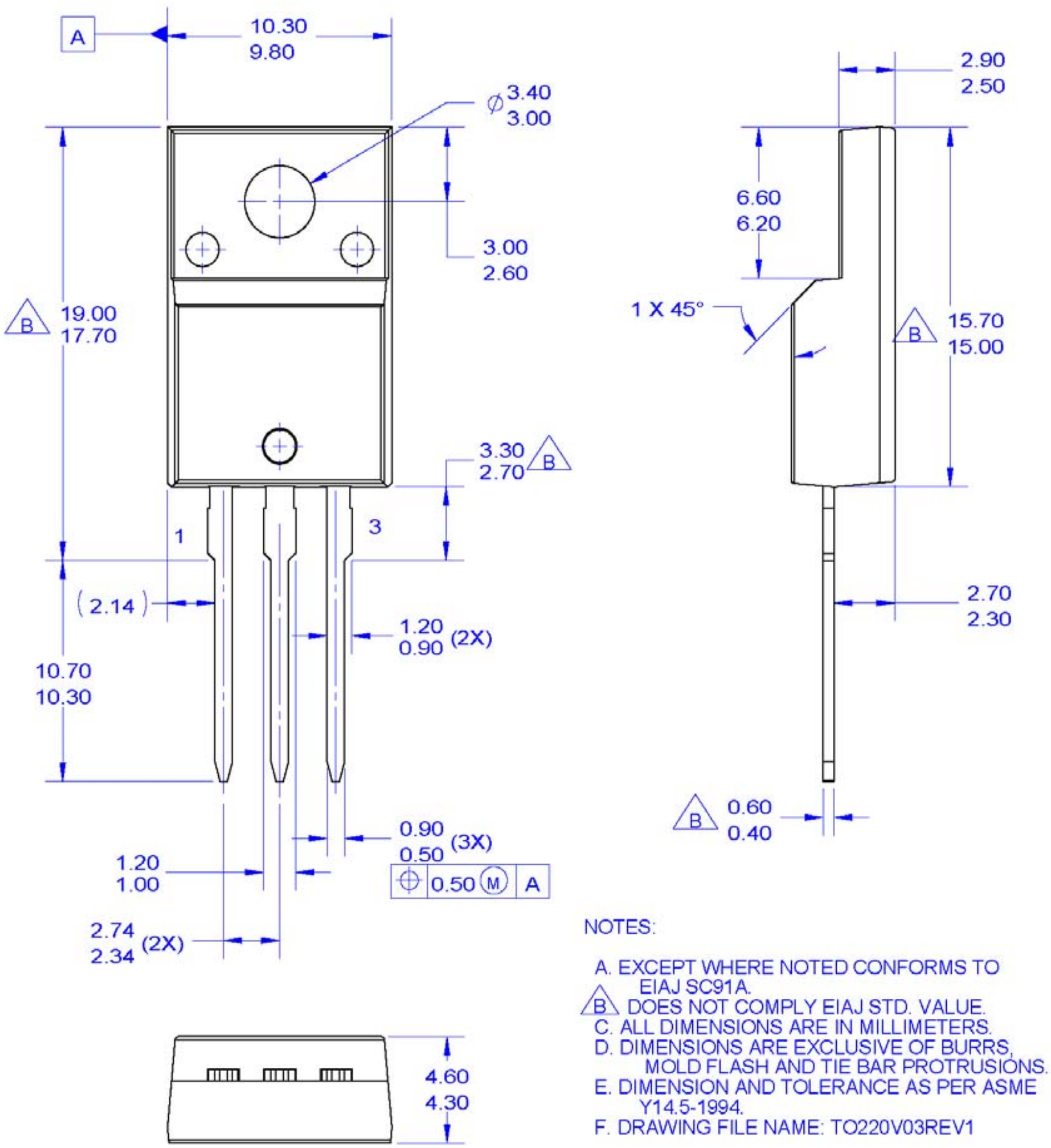
Peak Diode Recovery dv/dt Test Circuit & Waveforms





Mechanical Dimensions

TO-220F



* Front/Back Side Isolation Voltage : AC 2500V

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

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