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December 2014

# FCPF380N65FL1

## N-Channel SuperFET<sup>®</sup> II FRFET<sup>®</sup> MOSFET

650 V, 10.2 A, 380 mΩ

### Features

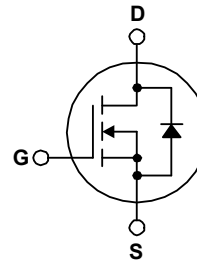
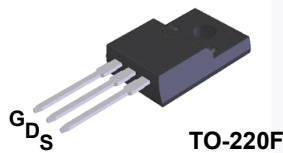
- 700 V @T<sub>J</sub> = 150°C
- R<sub>DS(on)</sub> = 320 mΩ (Typ.)
- Ultra Low Gate Charge (Typ. Q<sub>g</sub> = 33 nC)
- Low Effective Output Capacitance (Typ. C<sub>oss(eff.)</sub> = 165 pF)
- 100% Avalanche Tested
- RoHS Compliant

### Applications

- LCD / LED / PDP TV
- Telecom / Server Power Supplies
- Solar Inverter
- AC - DC Power Supply

### Description

SuperFET<sup>®</sup> 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. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SuperFET II MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications. SuperFET II FRFET<sup>®</sup> MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.



### Absolute Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted.

Symbol	Parameter	FCPF380N65FL1	Unit
V <sub>DSS</sub>	Drain to Source Voltage	650	V
V <sub>GSS</sub>	Gate to Source Voltage	- DC	±20
		- AC (f > 1 Hz)	±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)	212
I <sub>AR</sub>	Avalanche Current	(Note 1)	2.3
E <sub>AR</sub>	Repetitive Avalanche Energy	(Note 1)	0.33
dv/dt	MOSFET dv/dt		100
	Peak Diode Recovery dv/dt	(Note 3)	50
P <sub>D</sub>	Power Dissipation	(T <sub>C</sub> = 25°C)	33
		- Derate Above 25°C	0.26
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, 1/8" from Case for 5 Seconds	300	°C

### Thermal Characteristics

Symbol	Parameter	FCPF380N65FL1	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction to Case, Max.	3.8	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient, Max.	62.5	

FCPF380N65FL1 — N-Channel SuperFET<sup>®</sup> II FRFET<sup>®</sup> MOSFET

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCPF380N65FL1	FCPF380N65F	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	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}, \text{Referenced to } 25^\circ\text{C}$	-	0.72	-	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	-	-	10	$\mu\text{A}$
		$V_{DS} = 520\text{ V}, V_{GS} = 0\text{ V}, T_C = 125^\circ\text{C}$	-	40	-	$\mu\text{A}$
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	-	-	$\pm 100$	$\mu\text{A}$

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1\text{ mA}$	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 5.1\text{ A}$	-	320	380	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20\text{ V}, I_D = 5.1\text{ A}$	-	9.9	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	1265	1680	pF
$C_{oss}$	Output Capacitance		-	42	55	pF
$C_{riss}$	Reverse Transfer Capacitance		-	1.0	-	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 380\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	25	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	165	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{ V}, I_D = 5.1\text{ A}, V_{GS} = 10\text{ V}$	-	33	43	nC
$Q_{gs}$	Gate to Source Gate Charge		-	6.6	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		(Note 4)	-	14	-
ESR	Equivalent Series Resistance	$f = 1\text{ MHz}$	-	0.46	-	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{ V}, I_D = 5.1\text{ A}, V_{GS} = 10\text{ V}, R_g = 4.7\text{ }\Omega$	-	18	46	ns
$t_r$	Turn-On Rise Time		-	7.8	25.6	ns
$t_{d(off)}$	Turn-Off Delay Time		-	45	100	ns
$t_f$	Turn-Off Fall Time		(Note 4)	-	8	26

### Drain-Source Diode Characteristics

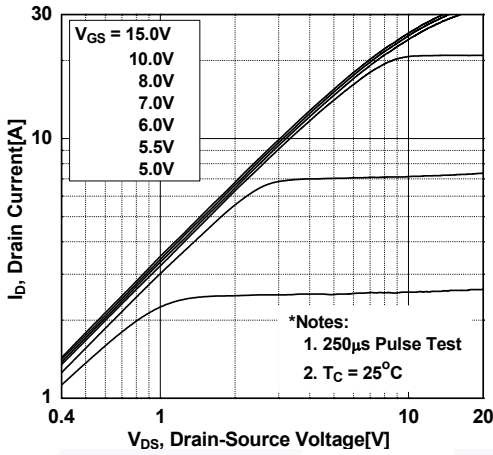
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	10.2	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	30.6	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_{SD} = 5.1\text{ A}$	-	-	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_{SD} = 5.1\text{ A}$	-	84	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100\text{ A}/\mu\text{s}$	-	224	-	nC

#### Notes:

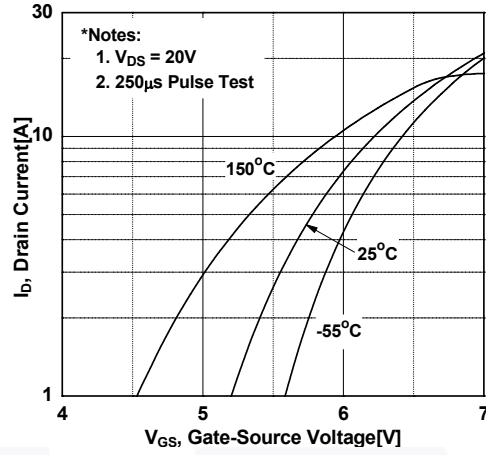
1. Repetitive rating: pulse width limited by maximum junction temperature.
2.  $I_{AS} = 2.3\text{ A}, R_G = 25\text{ }\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 5.1\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq 380\text{ V}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially independent of operating temperature.

## Typical Performance Characteristics

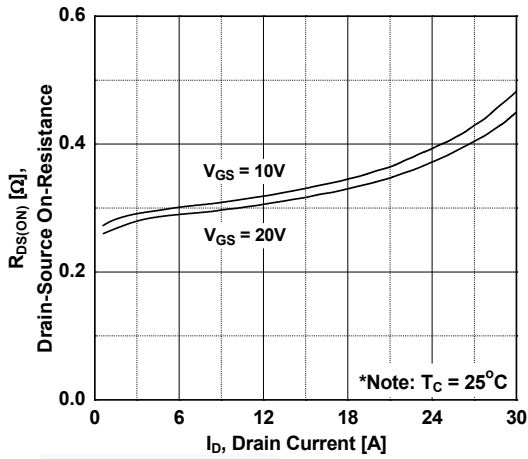
**Figure 1. On-Region Characteristics**



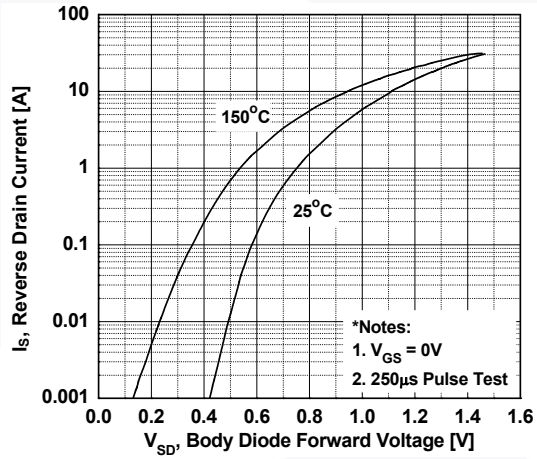
**Figure 2. Transfer Characteristics**



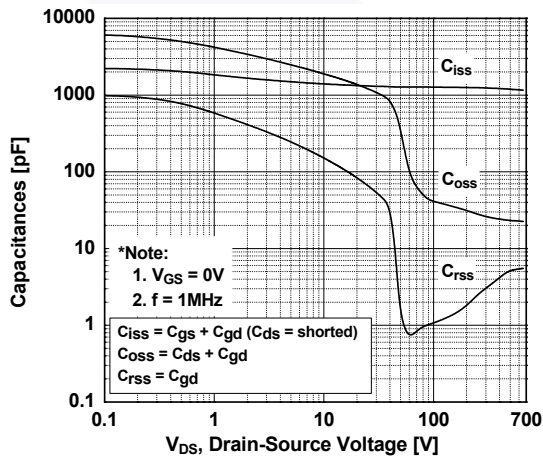
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



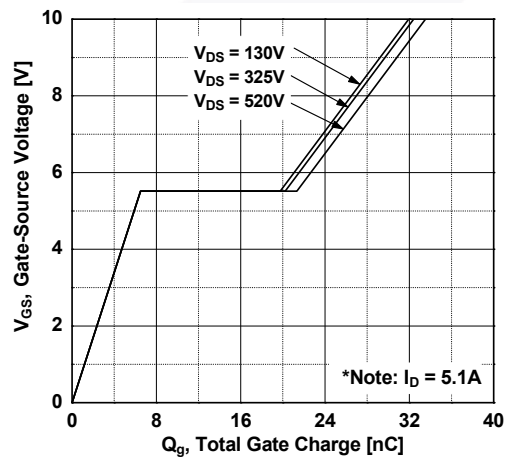
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

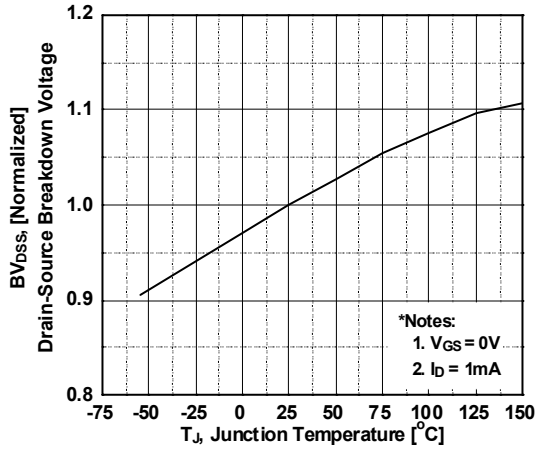


**Figure 6. Gate Charge Characteristics**

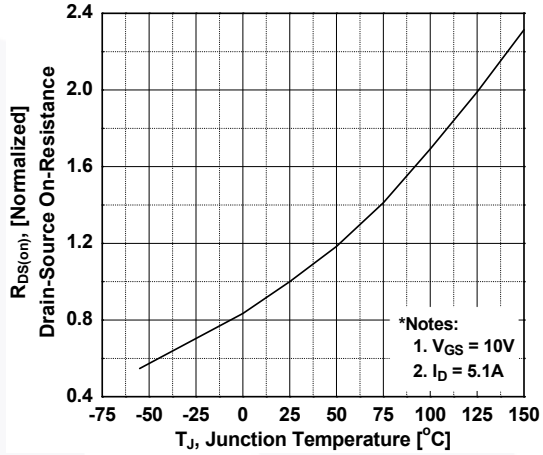


**Typical Performance Characteristics** (Continued)

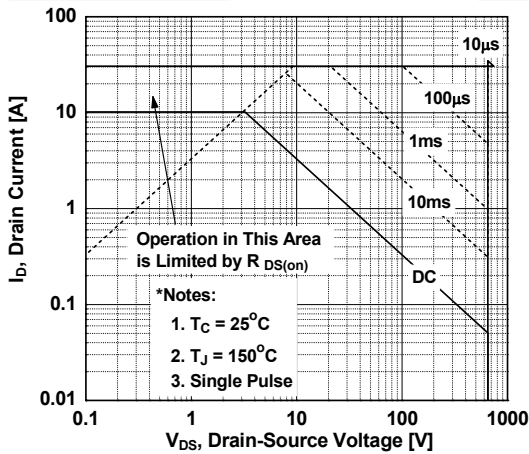
**Figure 7. Breakdown Voltage Variation vs. Temperature**



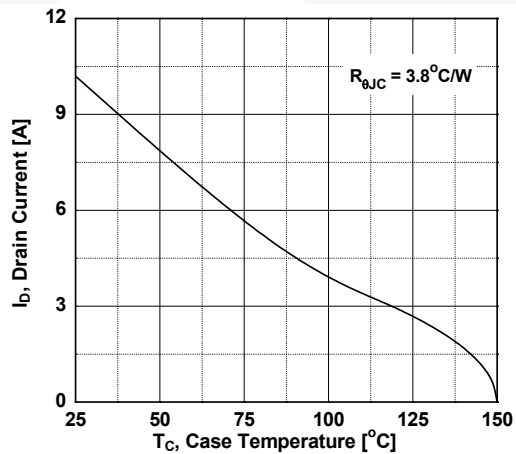
**Figure 8. On-Resistance Variation vs. Temperature**



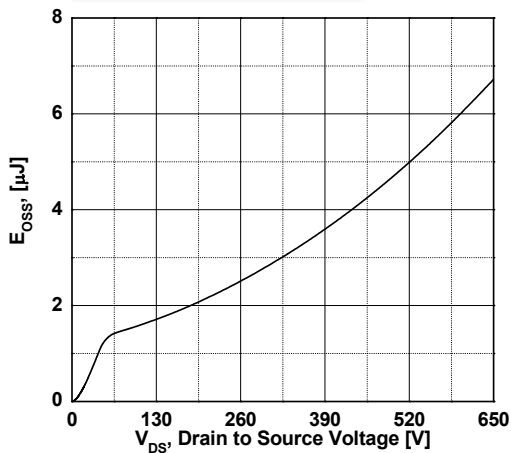
**Figure 9. Maximum Safe Operating Area**



**Figure 10. Maximum Drain Current vs. Case Temperature**

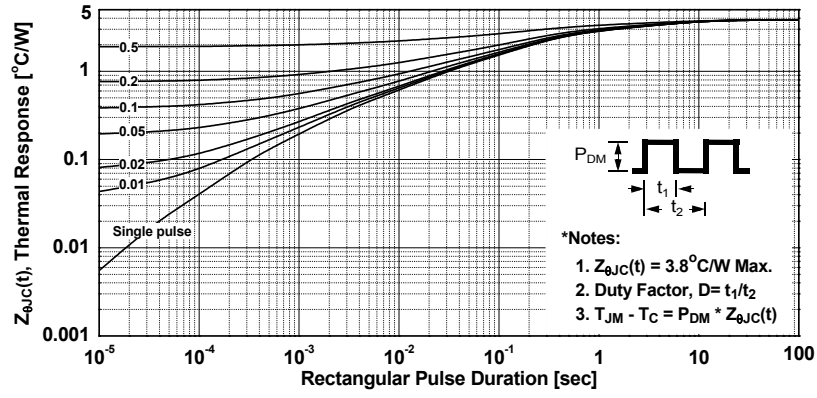


**Figure 11. Eoss vs. Drain to Source Voltage**



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



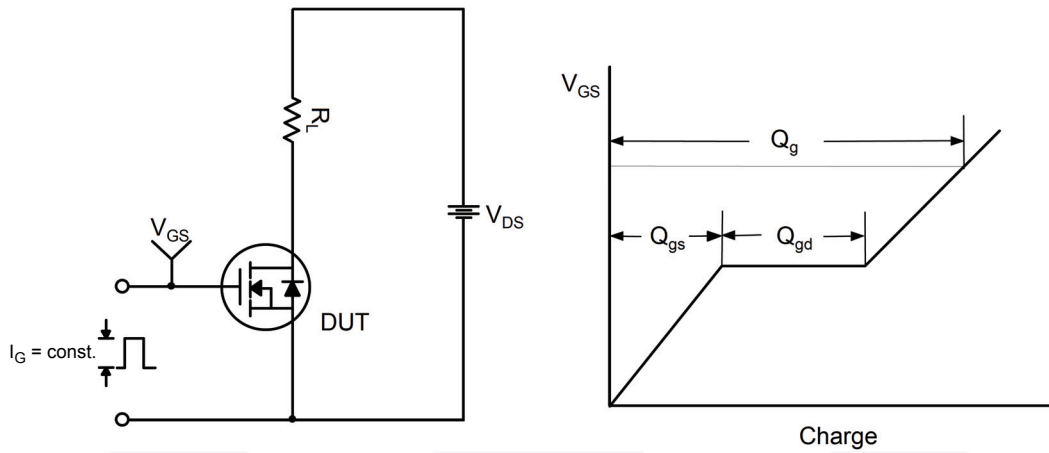


Figure 13. Gate Charge Test Circuit & Waveform

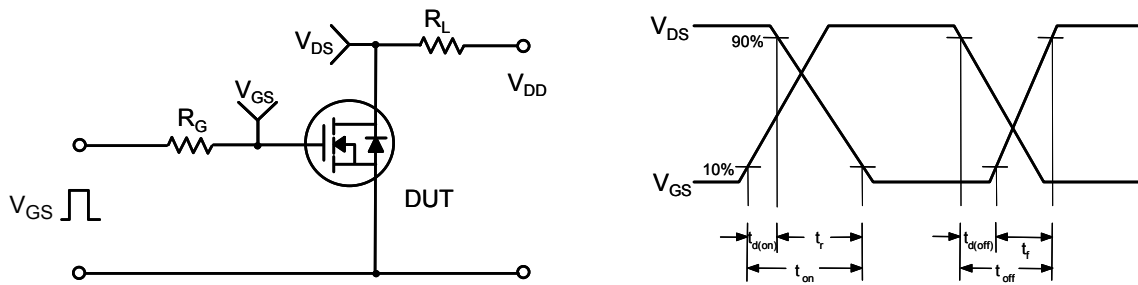


Figure 14. Resistive Switching Test Circuit & Waveforms

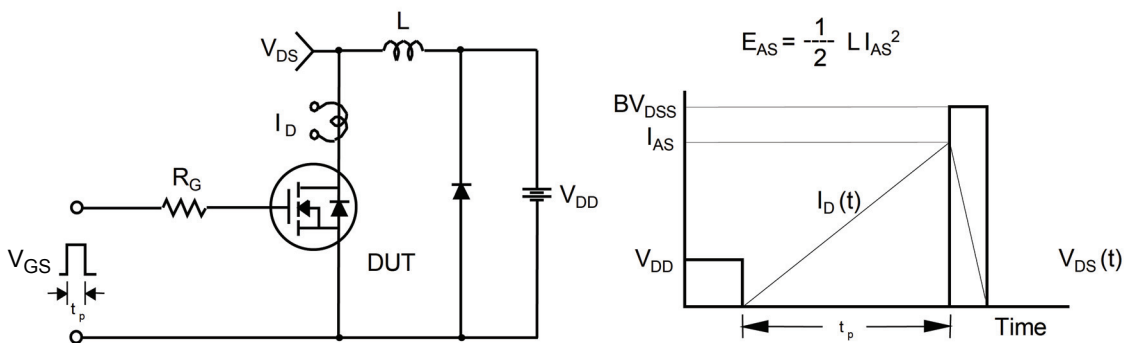


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

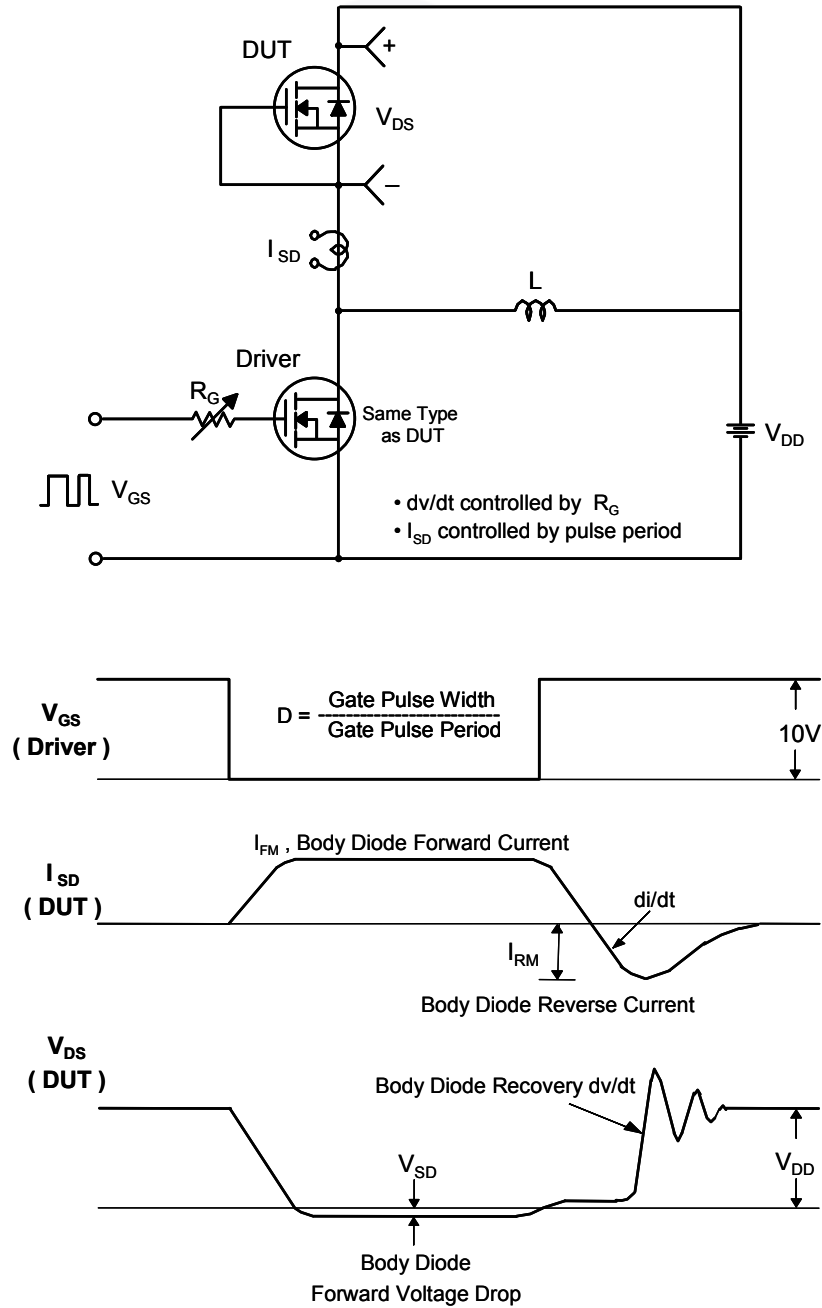
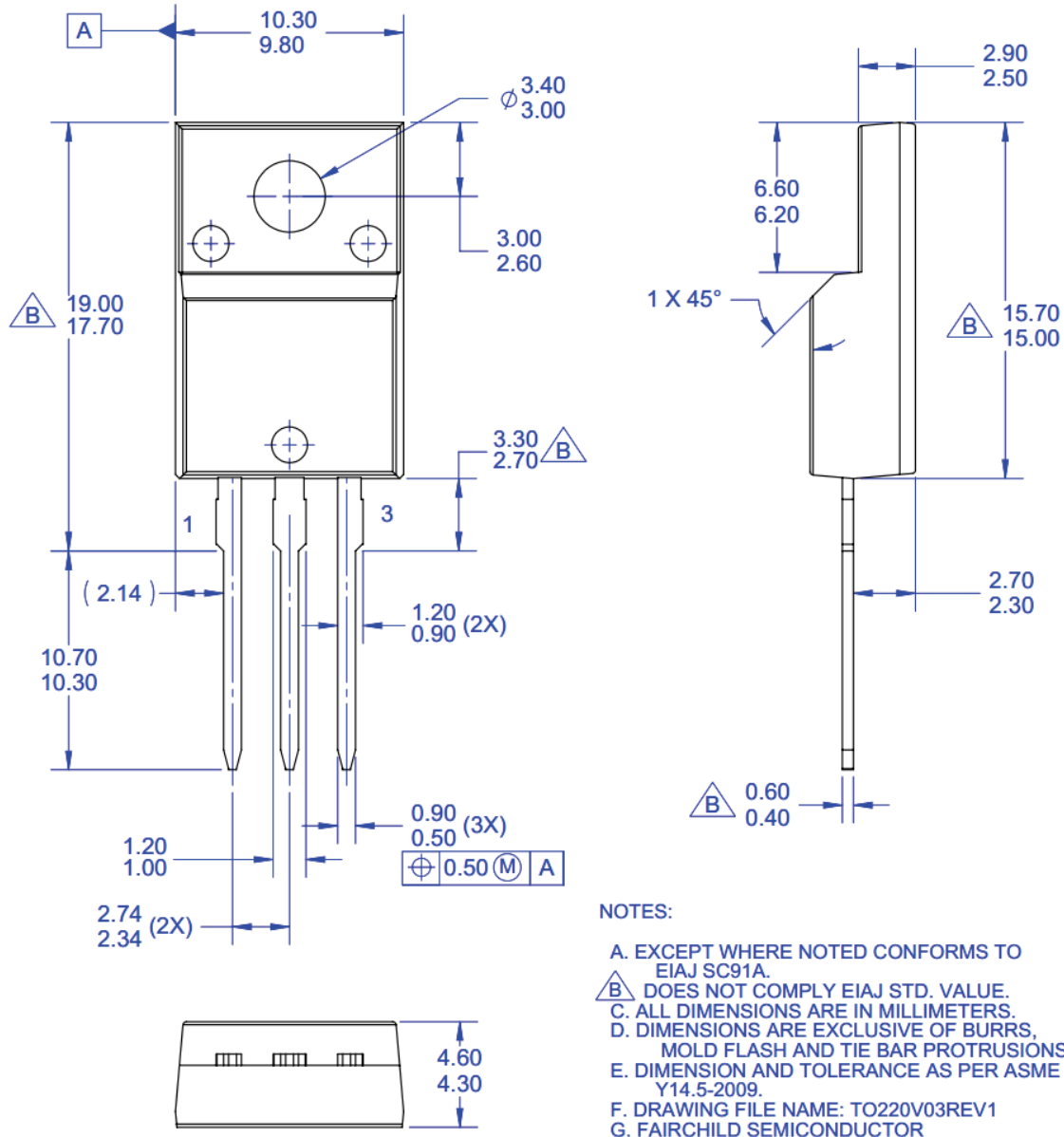


Figure 16. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms



## Mechanical Dimensions



**Figure 17. TO220, Molded, 3LD, Full Pack, EIAJ SC91, Takcheong**

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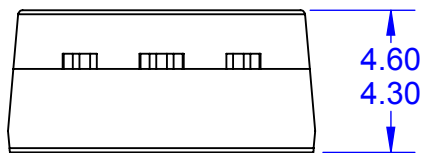
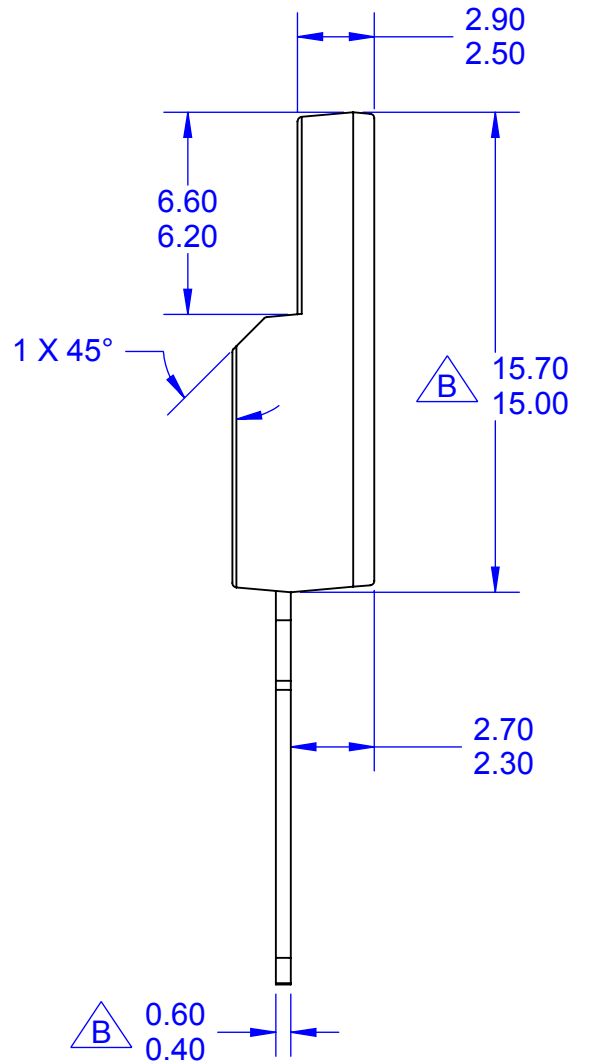
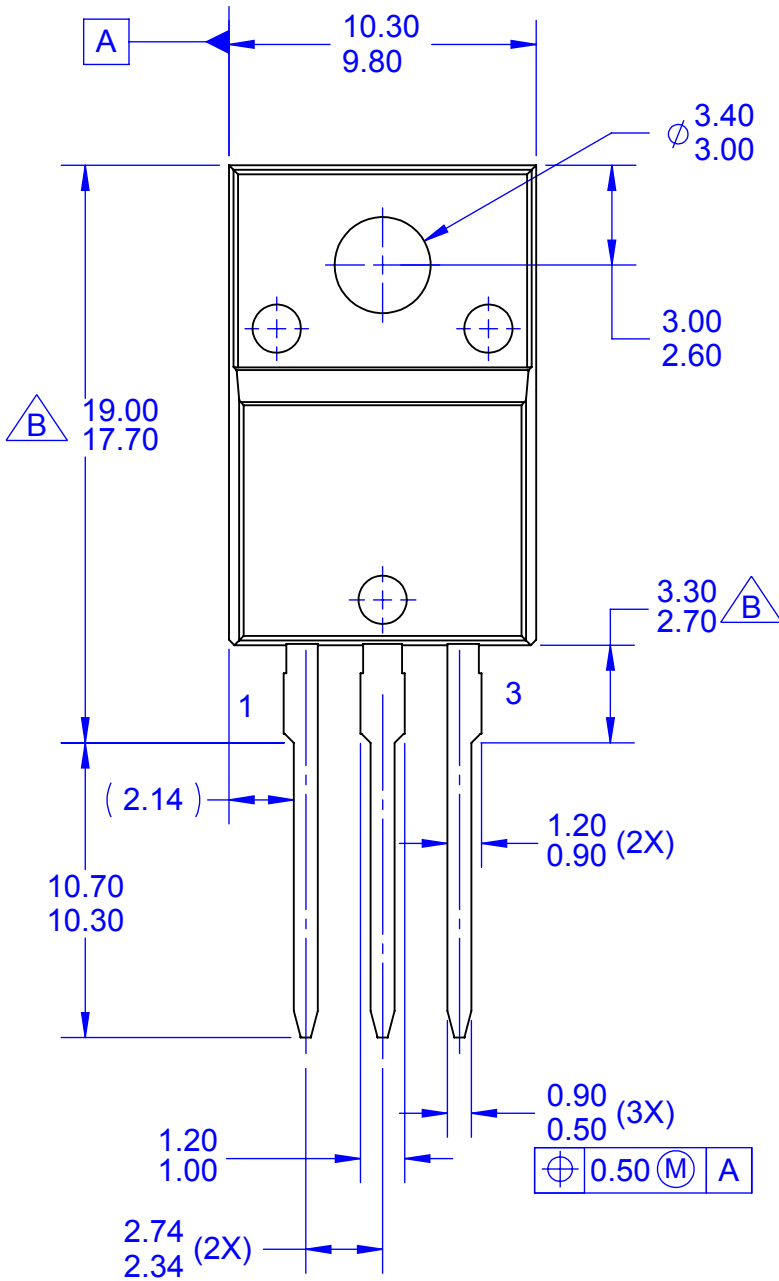
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