

# FCP16N60N / FCPF16N60NT

## N-Channel MOSFET

600V, 16A, 0.170Ω

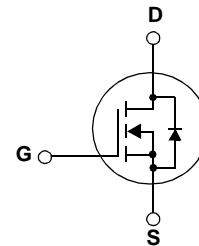
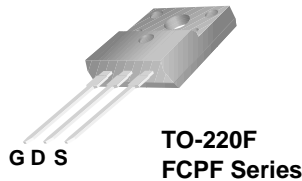
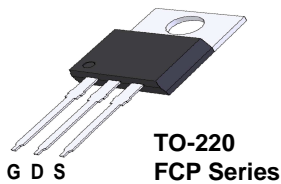
### Features

- $R_{DS(on)} = 0.17\Omega$  (Typ.) @  $V_{GS} = 10V, I_D = 8A$
- Ultra low gate charge (Typ.  $Q_g = 40.2nC$ )
- Low effective output capacitance
- 100% avalanche tested
- RoHS compliant

### Description

The SupreMOS MOSFET, Fairchild's next generation of high voltage super-junction MOSFETs, employs a deep trench filling process that differentiates it from preceding multi-epi based technologies. By utilizing this advanced technology and precise process control, SupreMOS provides world class  $R_{sp}$ , superior switching performance and ruggedness.

This SupreMOS MOSFET fits the industry's AC-DC SMPS requirements for PFC, server/telecom power, FPD TV power, ATX power, and industrial power applications.



FCP16N60N / FCPF16N60NT N-Channel MOSFET

### MOSFET Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted\*

Symbol	Parameter	FCP16N60N	FCPF16N60NT	Units
$V_{DSS}$	Drain to Source Voltage	600		V
$V_{GSS}$	Gate to Source Voltage	±30		V
$I_D$	Drain Current	-Continuous ( $T_C = 25^\circ C$ )	16.0	16.0*
		-Continuous ( $T_C = 100^\circ C$ )	10.1	10.1*
$I_{DM}$	Drain Current	- Pulsed (Note 1)	48.0	48.0*
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	355		mJ
$I_{AR}$	Avalanche Current	5.3		A
$E_{AR}$	Repetitive Avalanche Energy	1.34		mJ
dv/dt	MOSFET dv/dt Ruggedness	100		V/ns
	Peak Diode Recovery dv/dt (Note 3)	20		V/ns
$P_D$	Power Dissipation	( $T_C = 25^\circ C$ )	134.4	35.7
		- Derate above $25^\circ C$	1.08	0.29
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150		$^\circ C$
$T_L$	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300		$^\circ C$

\*Drain current limited by maximum junction temperature

### Thermal Characteristics

Symbol	Parameter	FCP16N60N	FCPF16N60NT	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.93	3.5	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case to Heat Sink (Typical)	0.5	0.5	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	62.5	

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCP16N60N	FCP16N60N	TO-220	-	-	50
FCPF16N60NT	FCPF16N60NT	TO-220F	-	-	50

## Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 1\text{mA}, V_{GS} = 0\text{V}, T_C = 25^\circ\text{C}$	600	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 1\text{mA}$ , Referenced to $25^\circ\text{C}$	-	0.73	-	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}$	-	-	10	$\mu\text{A}$
		$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}, T_C = 125^\circ\text{C}$	-	-	100	$\mu\text{A}$
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2.0	-	4.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 8\text{A}$	-	0.170	0.199	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{V}, I_D = 8\text{A}$	-	13	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 100\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	1630	2170	pF
$C_{oss}$	Output Capacitance		-	70	95	pF
$C_{rss}$	Reverse Transfer Capacitance		-	5	10	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 380\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$	-	40	60	pF
$C_{oss\text{eff}}$	Effective Output Capacitance	$V_{DS} = 0\text{V to } 480\text{V}, V_{GS} = 0\text{V}$	-	176	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{V}, I_D = 8\text{A},$ $V_{GS} = 10\text{V}$ (Note 4)	-	40.2	52.3	nC
$Q_{gs}$	Gate to Source Gate Charge		-	6.7	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	12.9	-	nC
ESR	Equivalent Series Resistance (G-S)	Drain Open	-	2.9	-	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{V}, I_D = 8\text{A}$ $R_G = 4.7\Omega$ (Note 4)	-	15.8	41.6	ns
$t_r$	Turn-On Rise Time		-	15.5	41.0	ns
$t_{d(off)}$	Turn-Off Delay Time		-	60.3	130.6	ns
$t_f$	Turn-Off Fall Time		-	20.2	50.4	ns

### Drain-Source Diode Characteristics

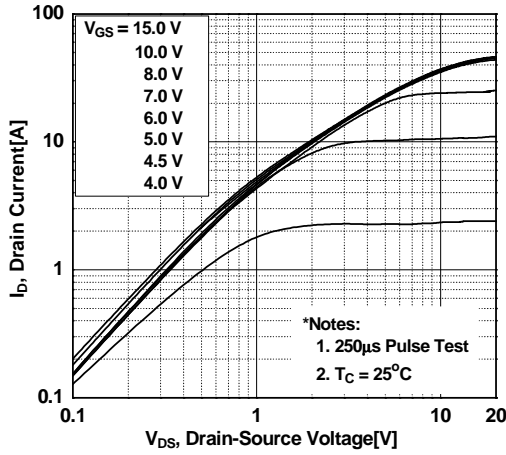
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	16	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	48	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 8\text{A}$	-	-	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 8\text{A}$	-	319	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100\text{A}/\mu\text{s}$	-	4.4	-	$\mu\text{C}$

#### Notes:

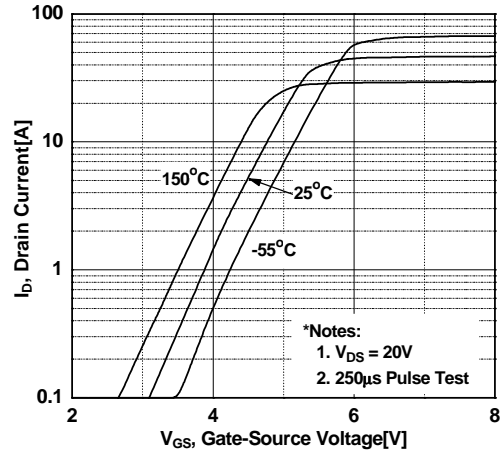
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS} = 5.3\text{A}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 16\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} = 380\text{V}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

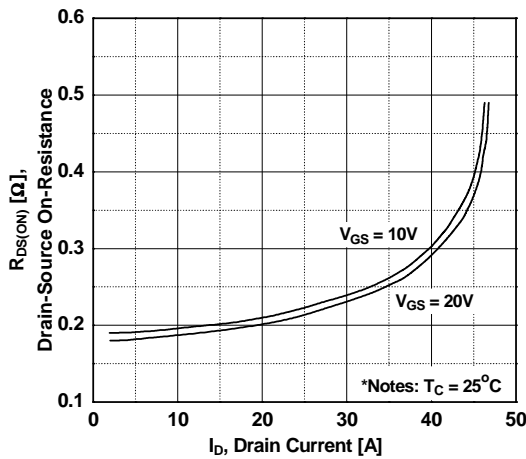
**Figure 1. On-Region Characteristics**



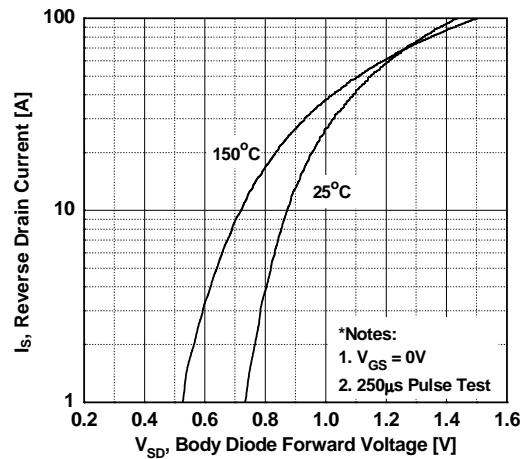
**Figure 2. Transfer Characteristics**



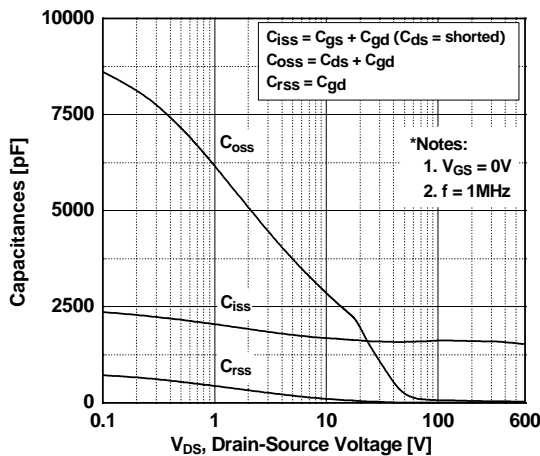
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



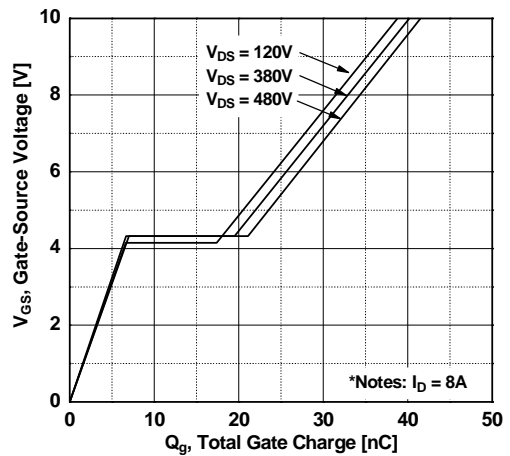
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

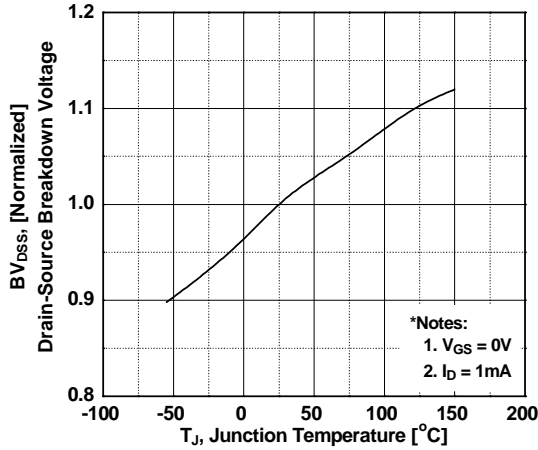


Figure 8. On-Resistance Variation vs. Temperature

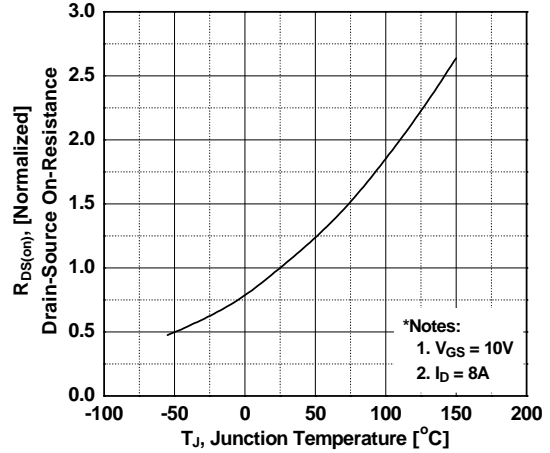


Figure 9. Maximum Safe Operating Area \_ FCP16N60N

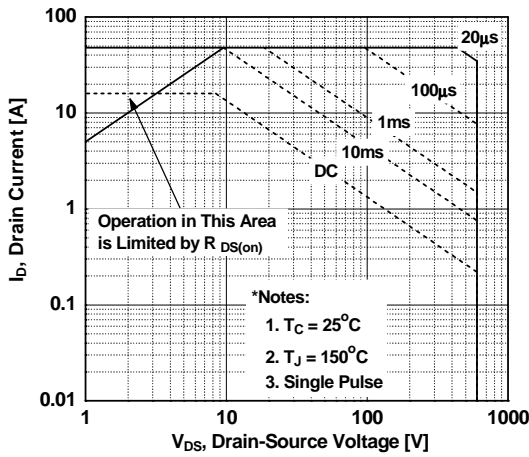


Figure 10. Maximum Safe Operating Area \_ FCPF16N60NT

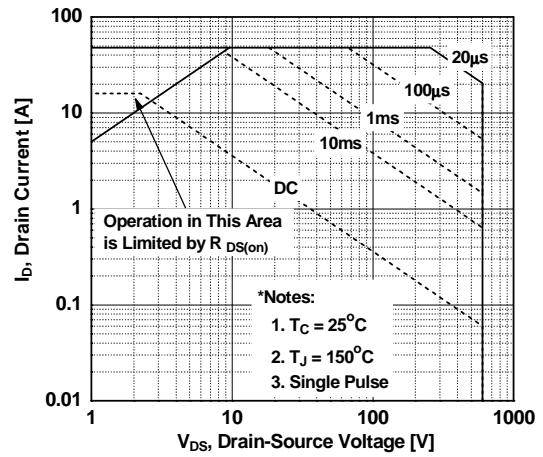
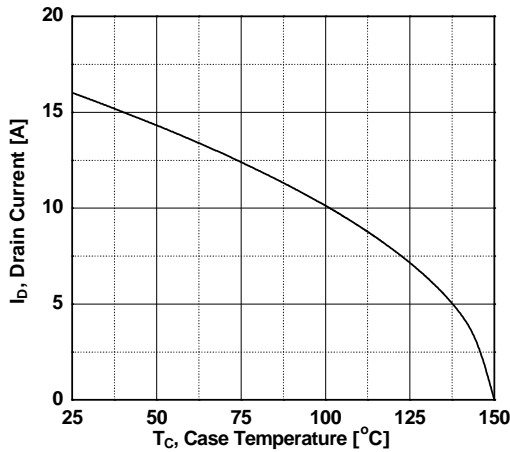


Figure 11. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve \_ FCP16N60N

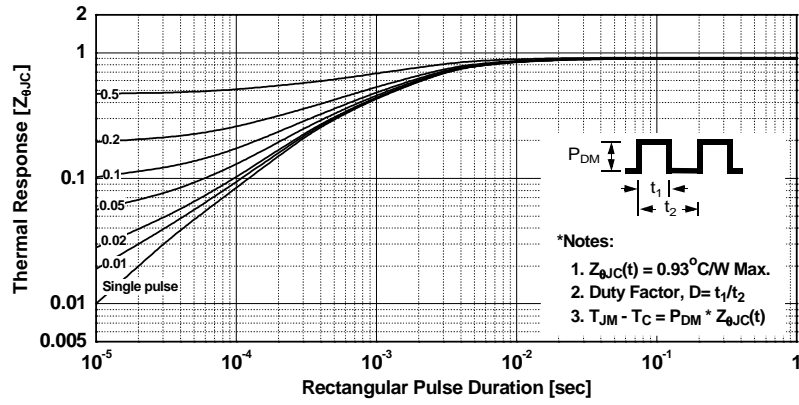
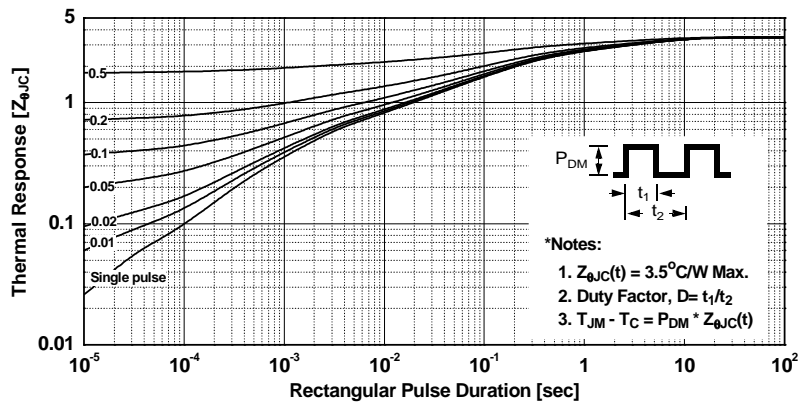
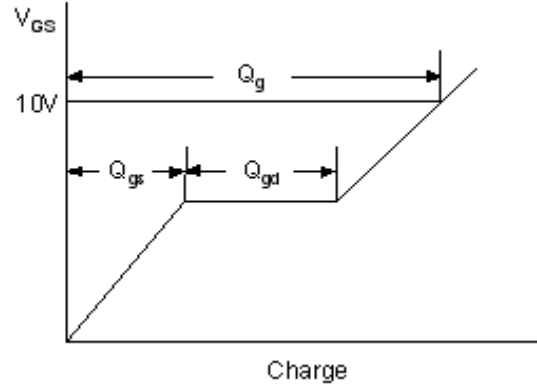
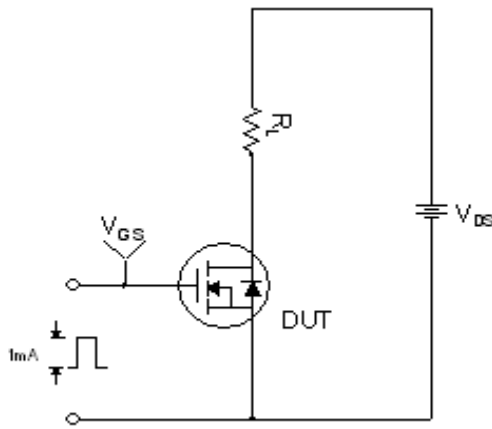


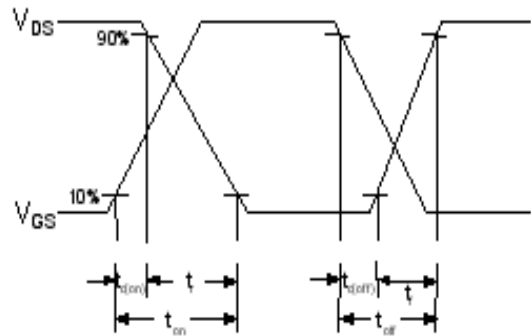
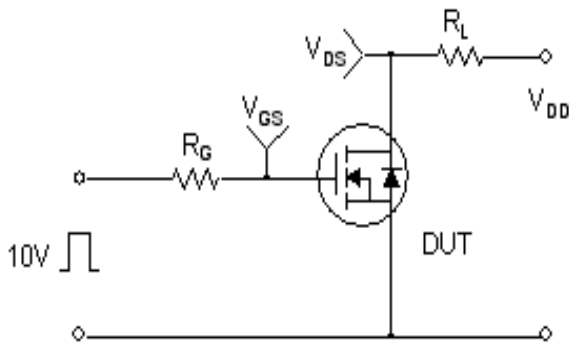
Figure 13. Transient Thermal Response Curve \_ FCPF16N60NT



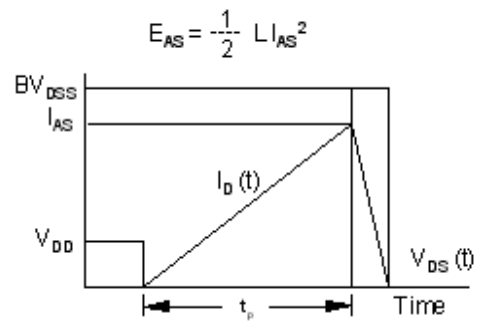
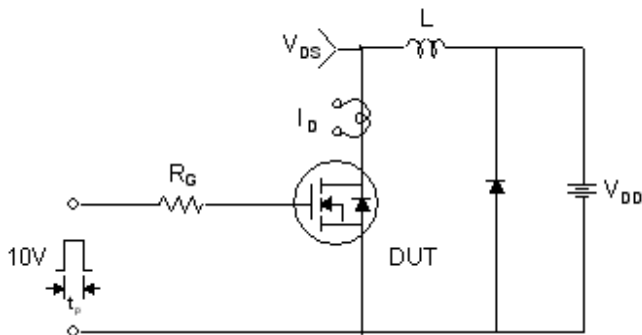
**Gate Charge Test Circuit & Waveform**



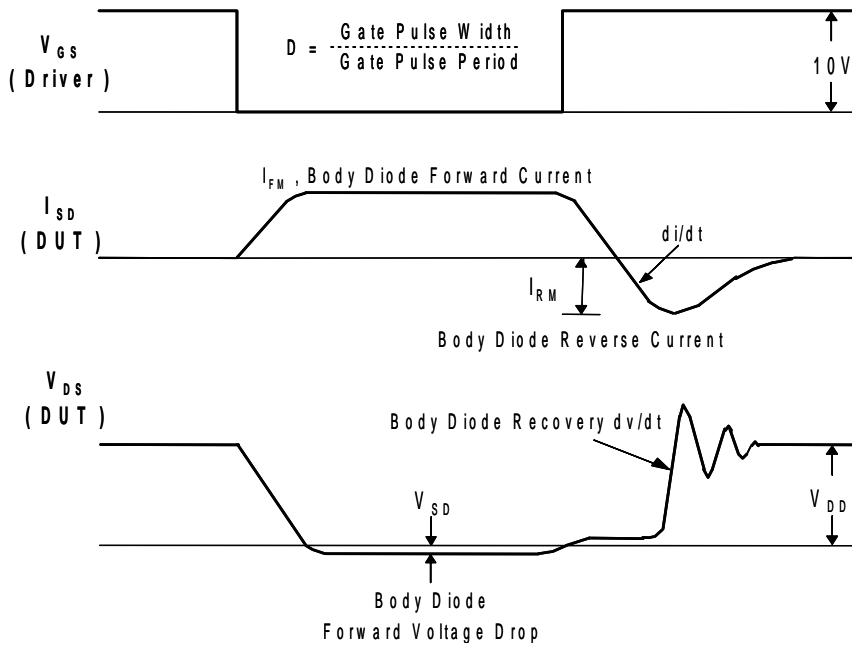
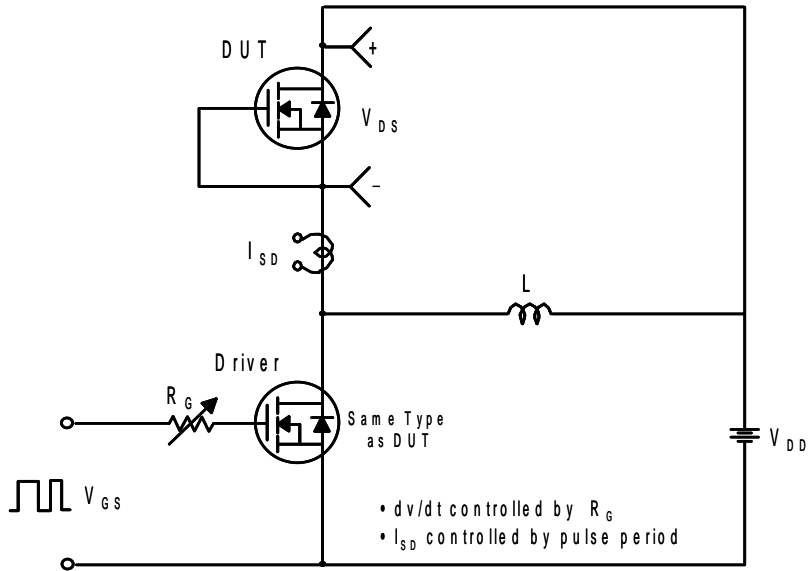
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

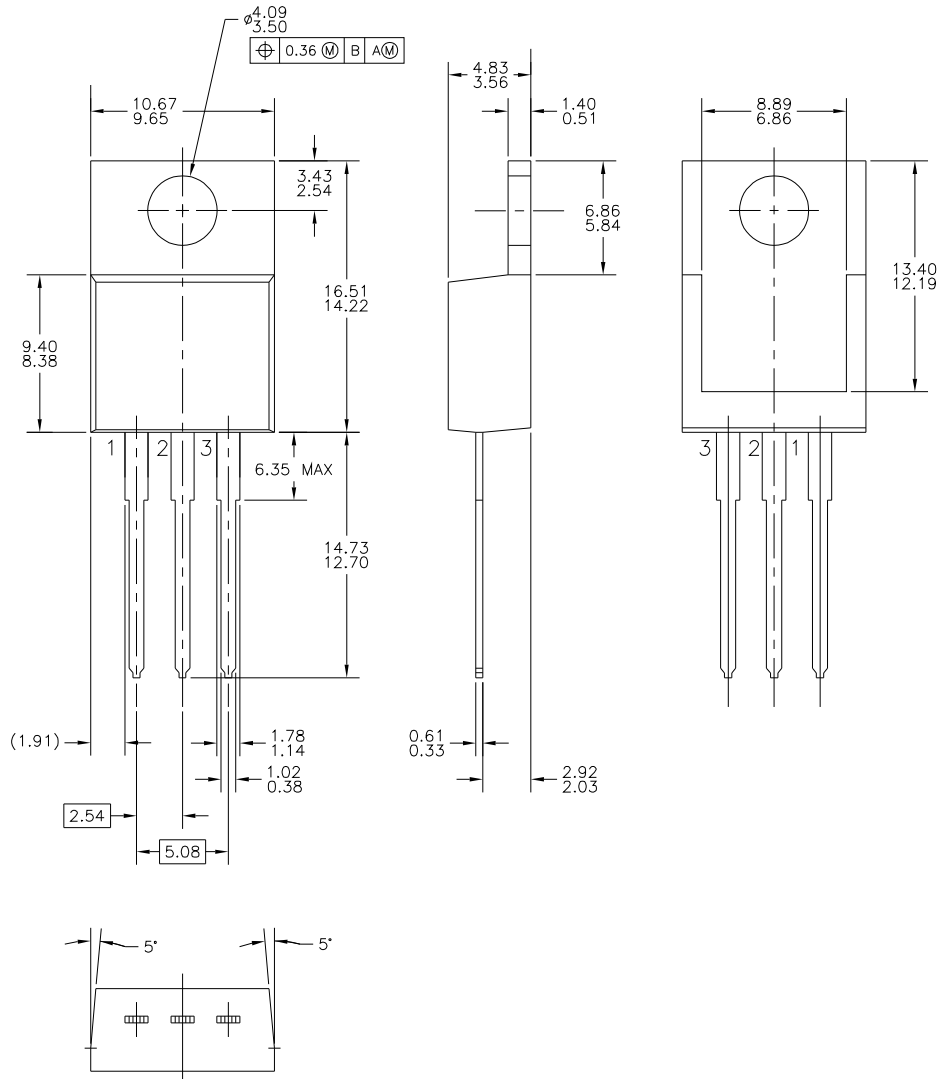


Peak Diode Recovery dv/dt Test Circuit & Waveforms



**Mechanical Dimensions**

**TO-220**

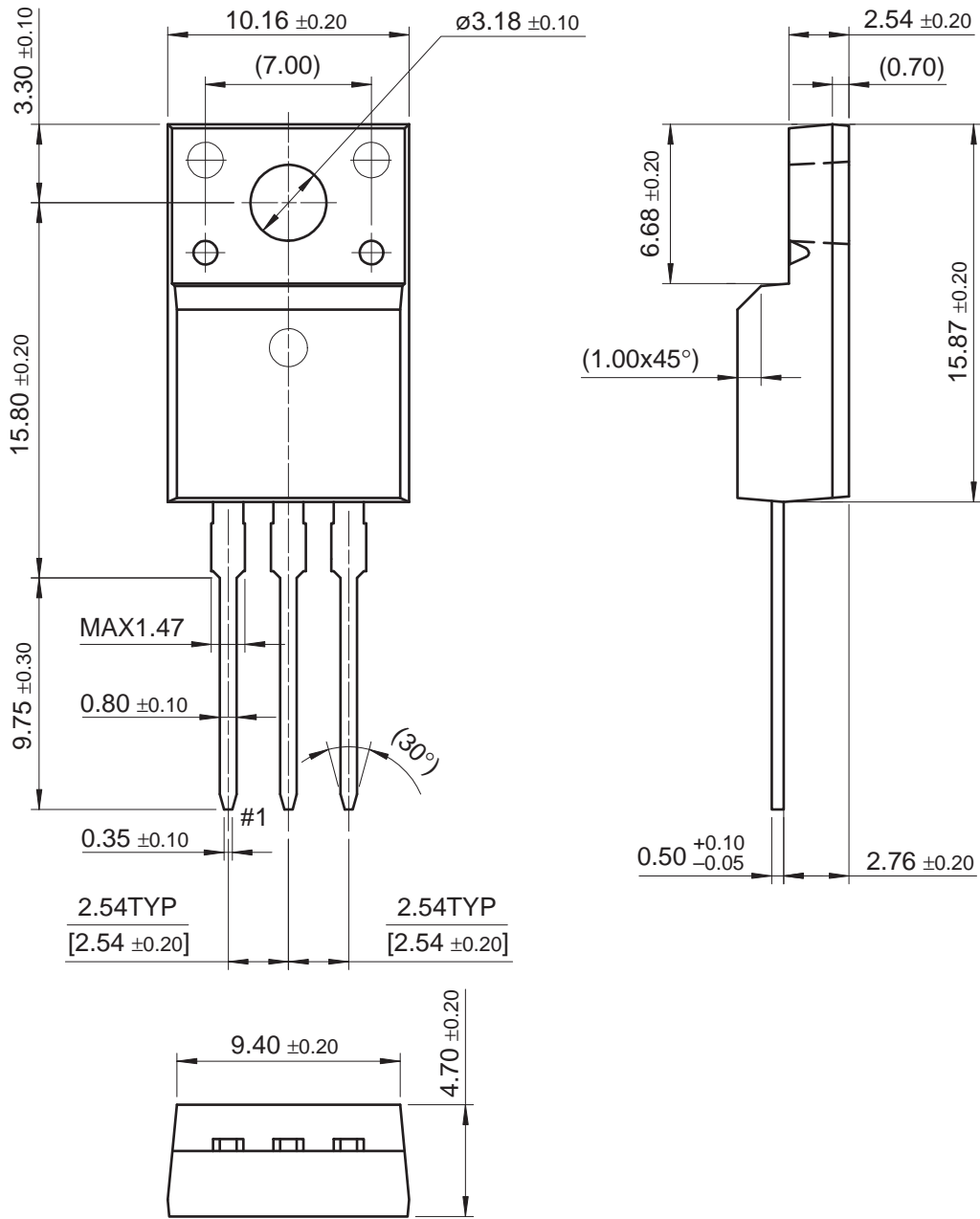


Dimensions in Millimeters



Mechanical Dimensions

TO-220F



Dimensions in Millimeters



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|                                                                                      | Power-SPM™                                                                          |                                                                                      |                                                                                       |

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