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# FQP10N20C / FQPF10N20C

## N-Channel QFET® MOSFET

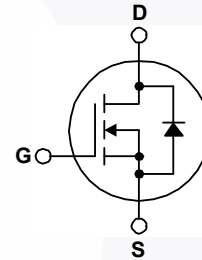
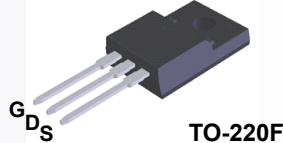
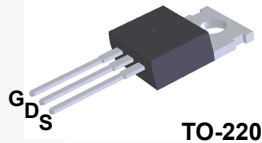
200 V, 9.5 A, 360 mΩ

### Features

- 9.5 A, 200 V,  $R_{DS(on)} = 360 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 4.75 \text{ A}$
- Low Gate Charge (Typ. 20 nC)
- Low Crss (Typ. 40.5 pF)
- 100% Avalanche Tested

### Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.



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

Symbol	Parameter	FQP10N20C	FQPF10N20C	Unit
$V_{DSS}$	Drain to Source Voltage	200		V
$I_D$	Drain Current	-Continuous ( $T_C = 25^\circ\text{C}$ )	9.5	9.5 *
		-Continuous ( $T_C = 100^\circ\text{C}$ )	6.0	6.0 *
$I_{DM}$	Drain Current - Pulsed (Note 1)	38	38 *	A
$V_{GSS}$	Gate to Source Voltage	$\pm 30$		V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	210		mJ
$I_{AR}$	Avalanche Current (Note 1)	9.5		A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	7.2		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5		V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	72	38	W
		0.57	0.3	W/ $^\circ\text{C}$
$T_J, T_{STG}$	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	FQP10N20C	FQPF10N20C	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max	1.74	3.33	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max	62.5	62.5	$^\circ\text{C}/\text{W}$

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQP10N20C	FQP10N20C	TO-220	Tube	N/A	50 units
FQPF10N20C	FQPF10N20C	TO-220F	Tube	N/A	50 units

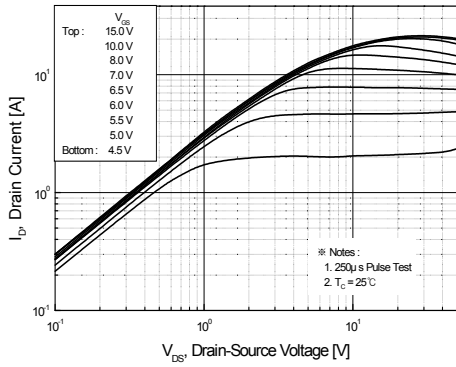
## Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit	
<b>Off Characteristics</b>							
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	200	--	--	V	
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.28	--	V/ $^\circ\text{C}$	
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$	--	--	10	$\mu\text{A}$	
		$V_{DS} = 160\text{ V}, T_C = 125^\circ\text{C}$	--	--	100	$\mu\text{A}$	
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA	
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA	
<b>On Characteristics</b>							
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2.0	--	4.0	V	
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 4.75\text{ A}$	--	0.29	0.36	$\Omega$	
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 4.75\text{ A}$	--	5.5	--	S	
<b>Dynamic Characteristics</b>							
$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	395	510	pF	
$C_{oss}$	Output Capacitance		--	97	125	pF	
$C_{riss}$	Reverse Transfer Capacitance		--	40.5	53	pF	
<b>Switching Characteristics</b>							
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 100\text{ V}, I_D = 9.5\text{ A},$ $R_G = 25\ \Omega$	--	11	30	ns	
$t_r$	Turn-On Rise Time		--	92	190	ns	
$t_{d(off)}$	Turn-Off Delay Time		(Note 4)	--	70	150	ns
$t_f$	Turn-Off Fall Time		(Note 4)	--	72	160	ns
$Q_g$	Total Gate Charge	$V_{DS} = 160\text{ V}, I_D = 9.5\text{ A},$ $V_{GS} = 10\text{ V}$	--	20	26	nC	
$Q_{gs}$	Gate-Source Charge		(Note 4)	--	3.1	--	nC
$Q_{gd}$	Gate-Drain Charge		(Note 4)	--	10.5	--	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>							
$I_S$	Maximum Continuous Drain-Source Diode Forward Current		--	--	9.5	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current		--	--	38	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 9.5\text{ A}$	--	--	1.5	V	
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 9.5\text{ A},$ $di_F / dt = 100\text{ A}/\mu\text{s}$	--	158	--	ns	
$Q_{rr}$	Reverse Recovery Charge		--	0.97	--	$\mu\text{C}$	

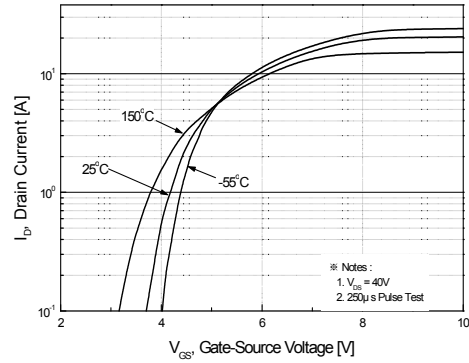
### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2.  $L = 3.5\text{ mH}, I_{AS} = 9.5\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 9.5\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature.

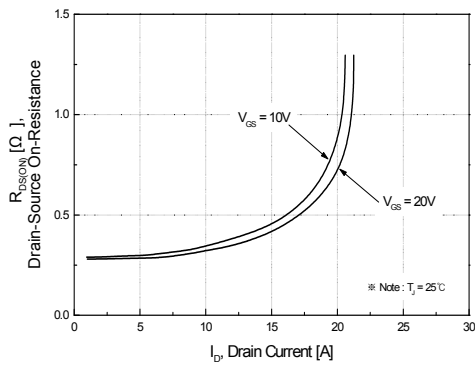
## Typical Characteristics



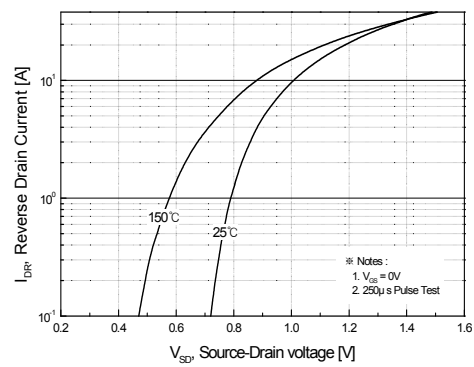
**Figure 1. On-Region Characteristics**



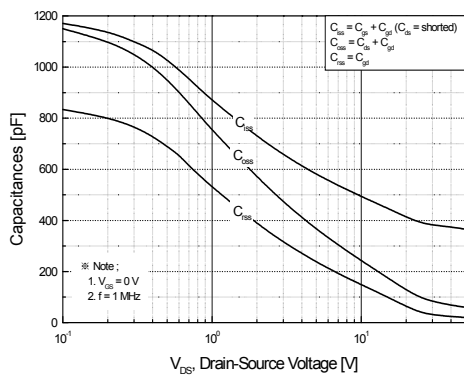
**Figure 2. Transfer Characteristics**



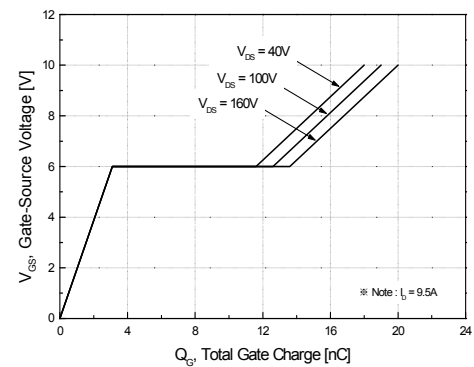
**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**



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

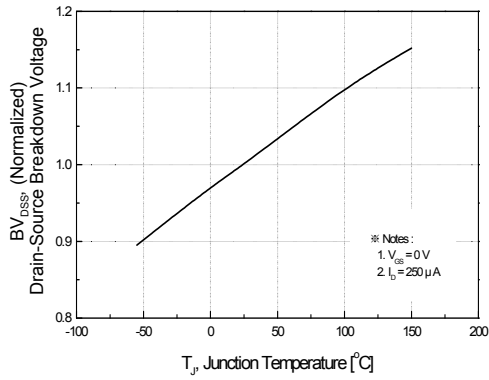


**Figure 5. Capacitance Characteristics**

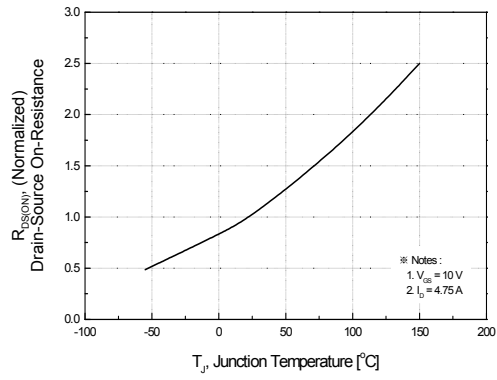


**Figure 6. Gate Charge Characteristics**

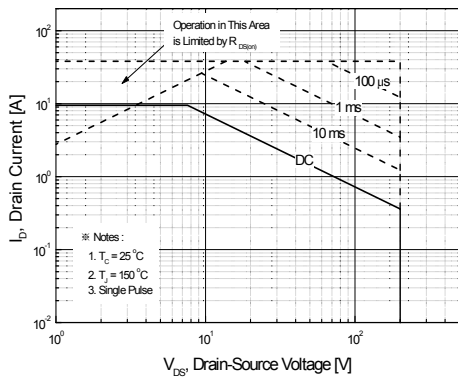
**Typical Characteristics** (Continued)



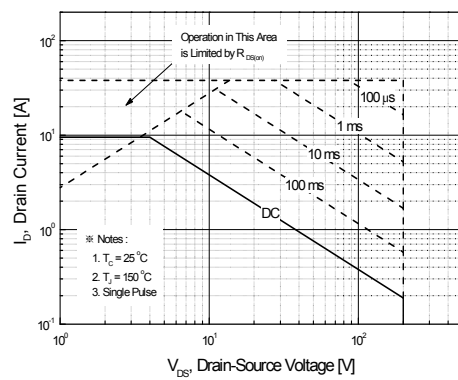
**Figure 7. Breakdown Voltage Variation vs Temperature**



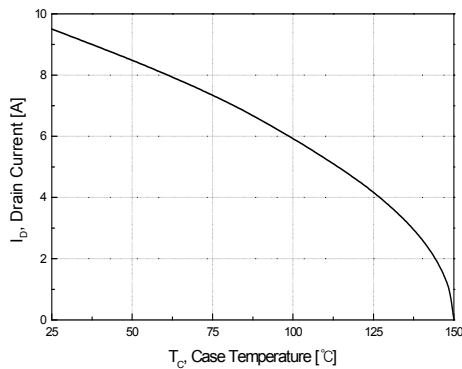
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9-1. Maximum Safe Operating Area for FQP10N20C**

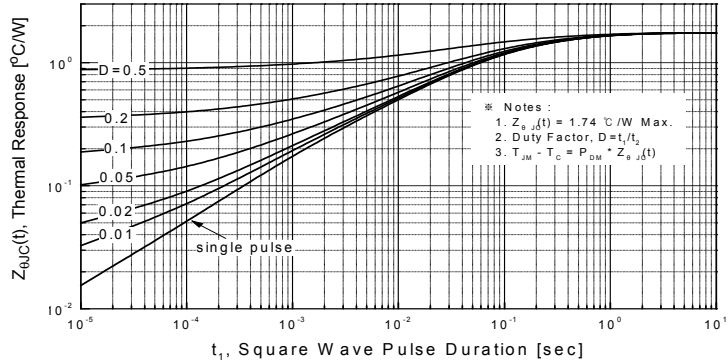


**Figure 9-2. Maximum Safe Operating Area for FQPF10N20C**

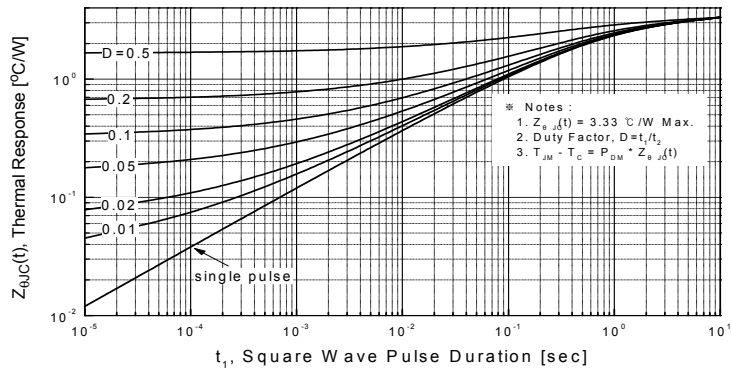


**Figure 10. Maximum Drain Current vs Case Temperature**

**Typical Characteristics** (Continued)

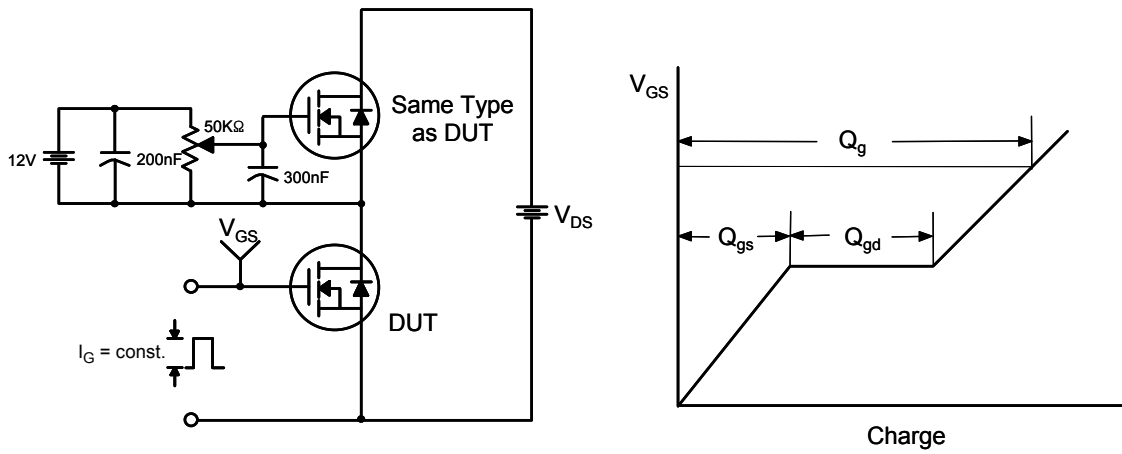


**Figure 11-1. Transient Thermal Response Curve for FQP10N20C**

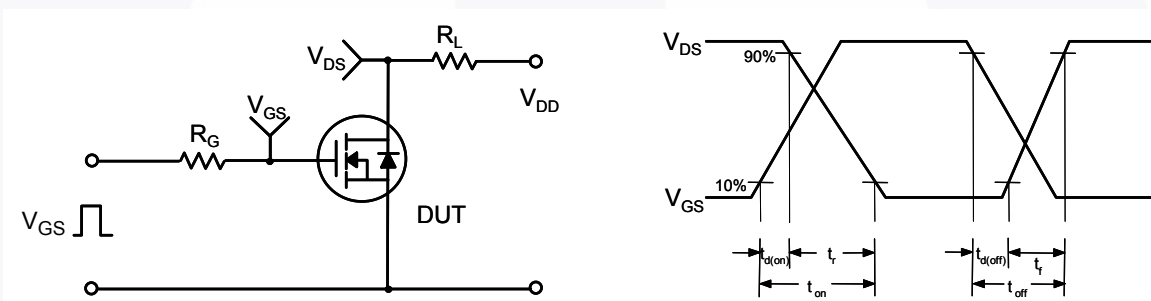


**Figure 11-2. Transient Thermal Response Curve for FQPF10N20C**

**Figure 12. Gate Charge Test Circuit & Waveform**



**Figure 13. Resistive Switching Test Circuit & Waveforms**



**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**

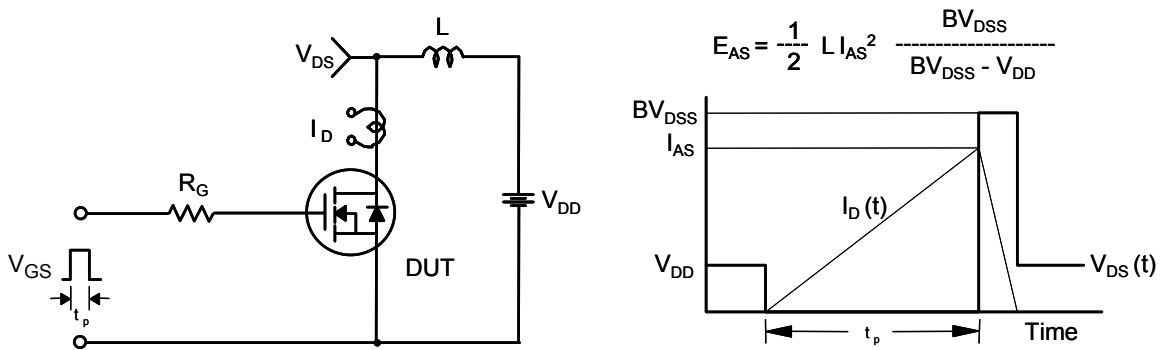
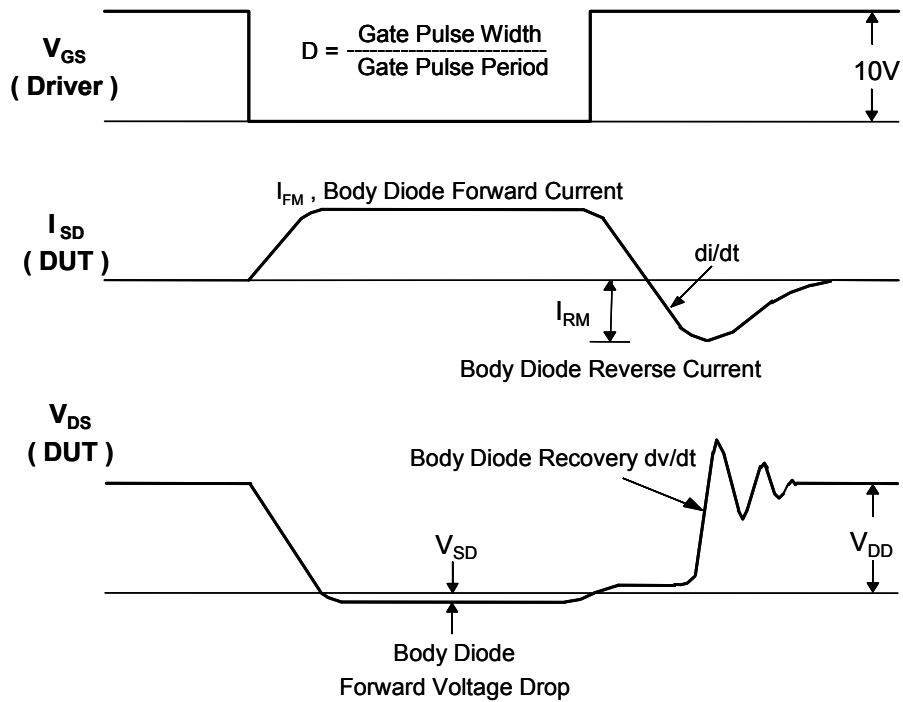
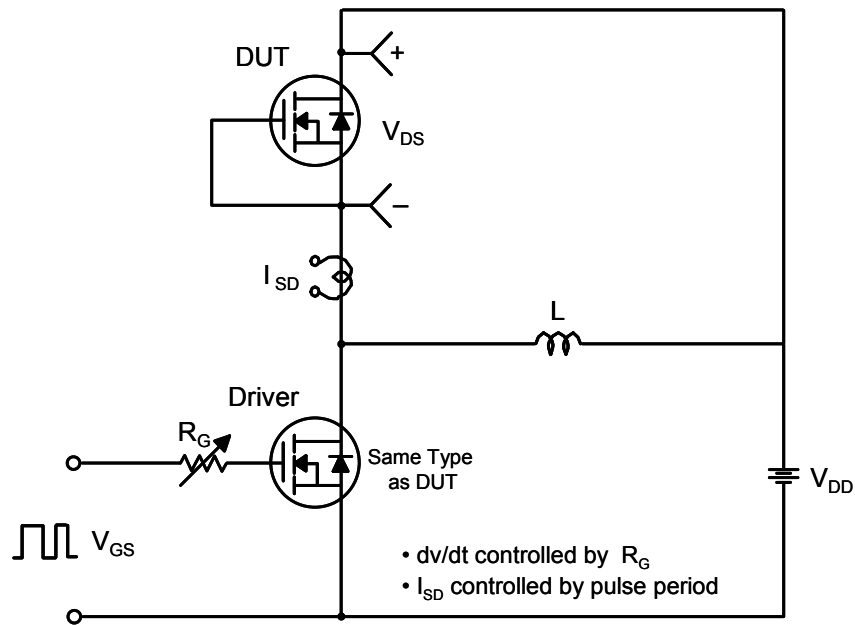
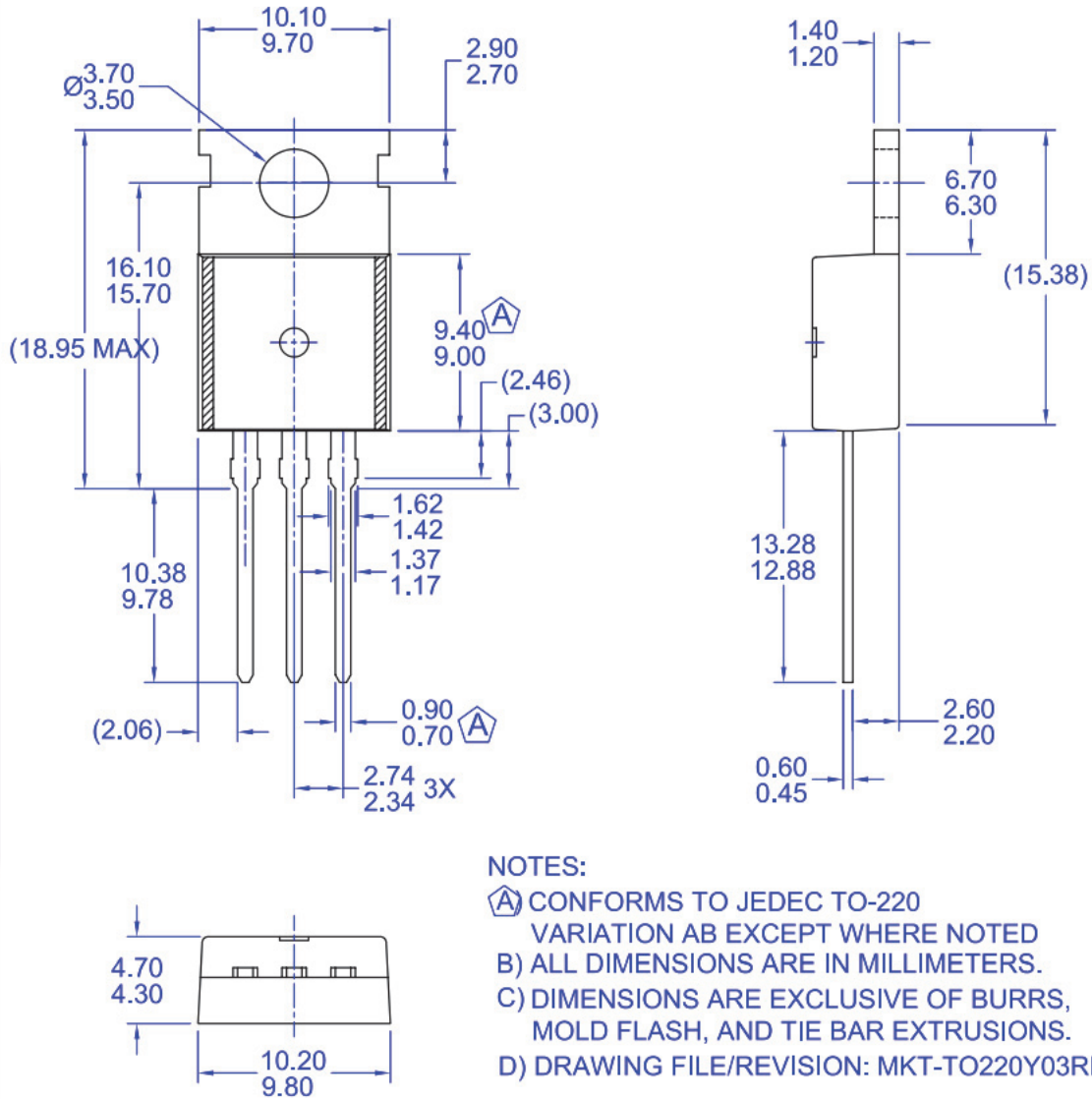


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms





## Mechanical Dimensions



**Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB**

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## Mechanical Dimensions



### 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. OPTION 1 - WITH SUPPORT PIN HOLE.  
OPTION 2 - NO SUPPORT PIN HOLE.
- G. DRAWING FILE NAME: TO220M03REV3

**Figure 17. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead**

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