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# FQP12P10

## P-Channel QFET<sup>®</sup> MOSFET

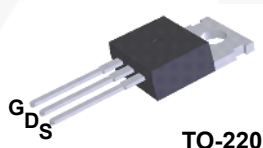
-100 V, -11.5 A, 290 mΩ

### Description

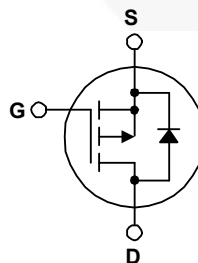
These P-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for low voltage applications such as audio amplifier, high efficiency switching DC/DC converters, and DC motor control.

### Features

- -11.5 A, -100 V,  $R_{DS(on)} = 290 \text{ m}\Omega$  (Max.) @  $V_{GS} = -10 \text{ V}$ ,  $I_D = -5.75 \text{ A}$
- Low Gate Charge (Typ. 21 nC)
- Low Crss (Typ. 65 pF)
- 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating



TO-220



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

Symbol	Parameter	FQP12P10	Unit
$V_{DSS}$	Drain-Source Voltage	-100	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) - Continuous ( $T_C = 100^\circ\text{C}$ )	-11.5	A
		-8.1	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	-46	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	370	mJ
$I_{AR}$	Avalanche Current (Note 1)	-11.5	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	7.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	-6.0	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	75	W
		0.5	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	FQP12P10	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	2.0	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.5	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	$^\circ\text{C}/\text{W}$

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQP12P10	FQP12P10	TO-220	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-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-100	--	--	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	-0.1	--	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -100\text{ V}, V_{GS} = 0\text{ V}$	--	--	-1	$\mu\text{A}$
		$V_{DS} = -80\text{ V}, T_C = 150^\circ\text{C}$	--	--	-10	$\mu\text{A}$
$I_{GSSF}$	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

### On Characteristics

$V_{GS(th)}$	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	$V_{GS} = -10\text{ V}, I_D = -5.75\text{ A}$	--	0.24	0.29	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = -40\text{ V}, I_D = -5.75\text{ A}$	--	6.7	--	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	620	800	pF
$C_{oss}$	Output Capacitance		--	220	290	pF
$C_{rss}$	Reverse Transfer Capacitance		--	65	85	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -50\text{ V}, I_D = -11.5\text{ A},$ $R_G = 25\ \Omega$	--	15	40	ns	
$t_r$	Turn-On Rise Time		--	160	330	ns	
$t_{d(off)}$	Turn-Off Delay Time		(Note 4)	--	35	80	ns
$t_f$	Turn-Off Fall Time		(Note 4)	--	60	130	ns
$Q_g$	Total Gate Charge	$V_{DS} = -80\text{ V}, I_D = -11.5\text{ A},$ $V_{GS} = -10\text{ V}$	--	21	27	nC	
$Q_{gs}$	Gate-Source Charge		(Note 4)	--	4.6	--	nC
$Q_{gd}$	Gate-Drain Charge		(Note 4)	--	11.5	--	nC

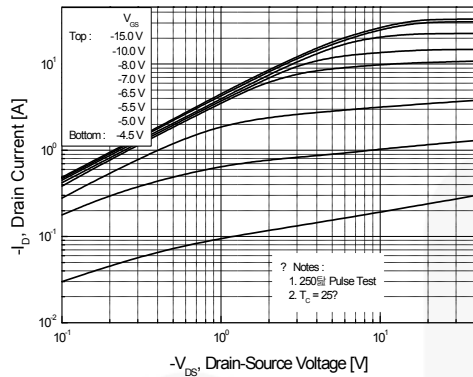
### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	-11.5	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	-46	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -11.5\text{ A}$	--	--	-4.0	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = -11.5\text{ A},$ $dI_F / dt = 100\text{ A}/\mu\text{s}$	--	110	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	0.47	--	$\mu\text{C}$

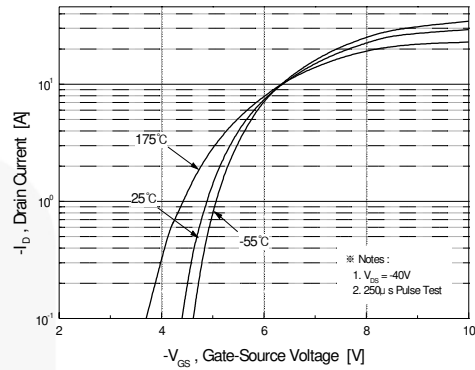
#### Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $L = 4.2\text{ mH}, I_{AS} = -11.5\text{ A}, V_{DD} = -25\text{ V}, R_G = 25\ \Omega,$  starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq -11.5\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS},$  starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature.

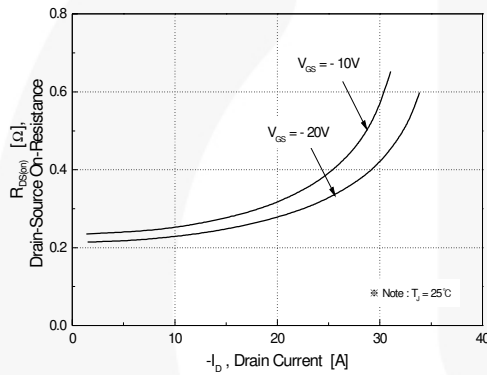
## Typical Characteristics



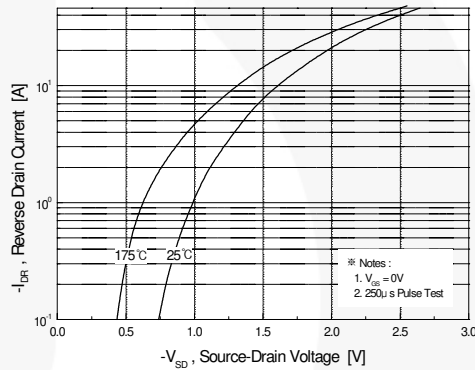
**Figure 1. On-Region Characteristics**



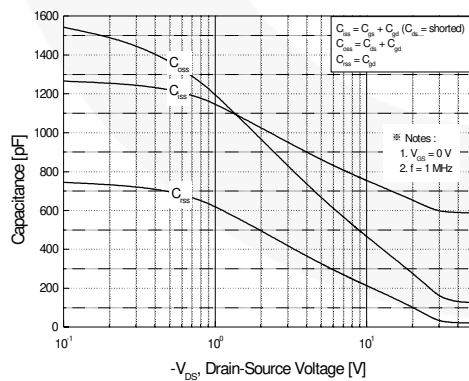
**Figure 2. Transfer Characteristics**



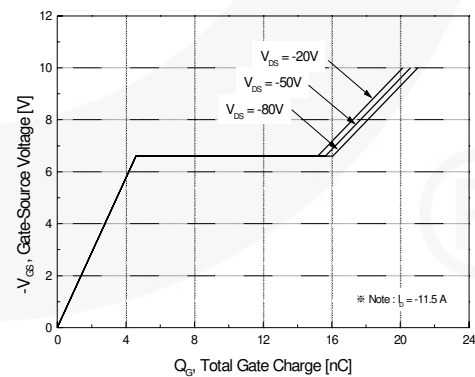
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



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

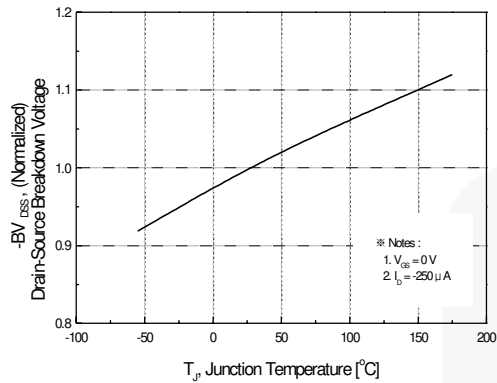


**Figure 5. Capacitance Characteristics**

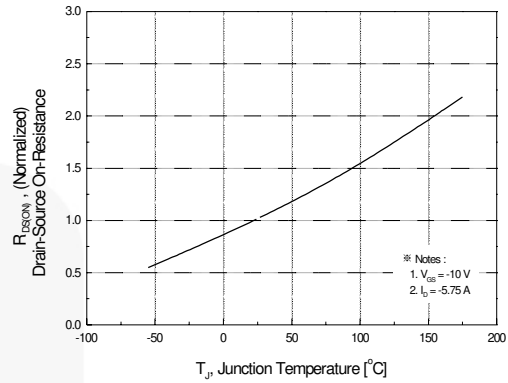


**Figure 6. Gate Charge Characteristics**

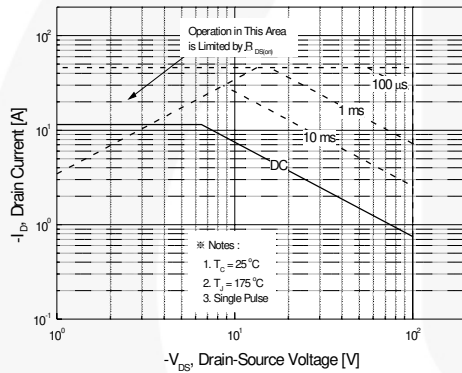
**Typical Characteristics** (Continued)



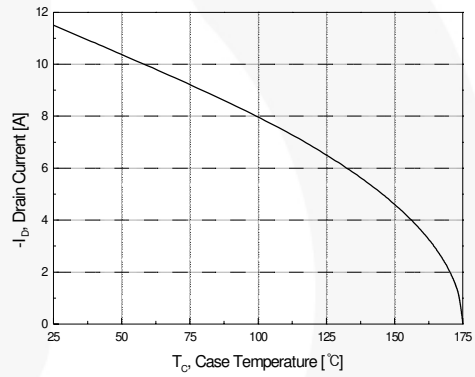
**Figure 7. Breakdown Voltage Variation vs. Temperature**



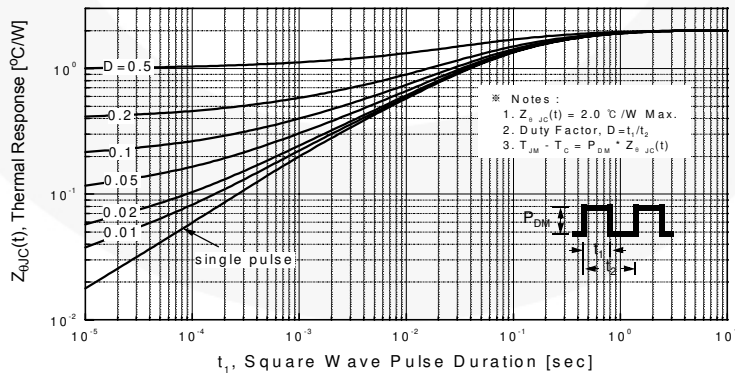
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**



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



**Figure 11. Transient Thermal Response Curve**

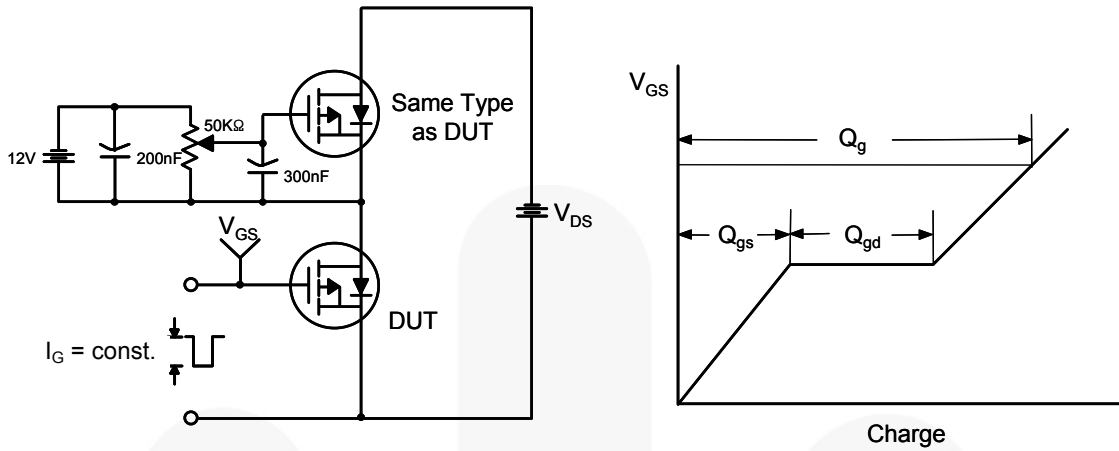


Figure 12. Gate Charge Test Circuit & Waveform

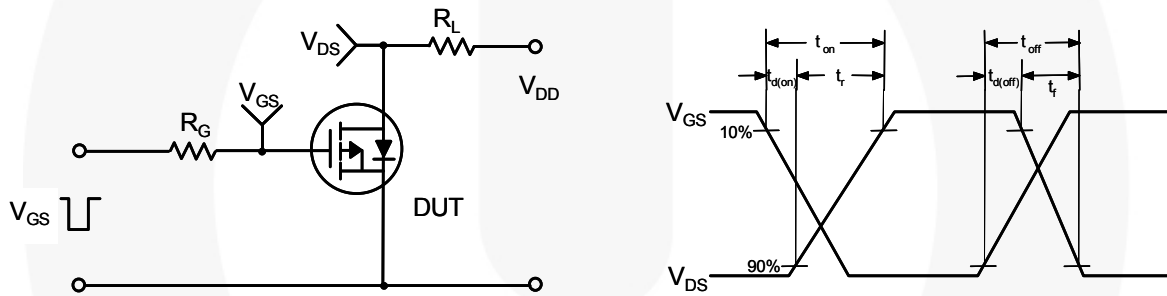


Figure 13. Resistive Switching Test Circuit & Waveforms

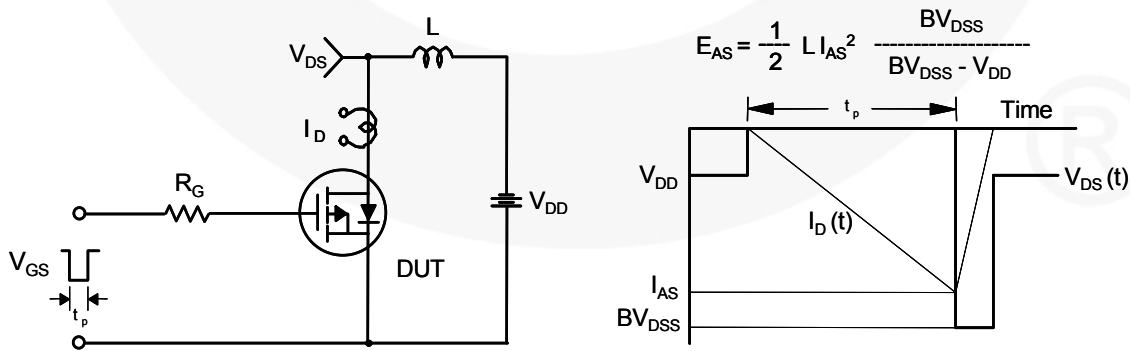


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

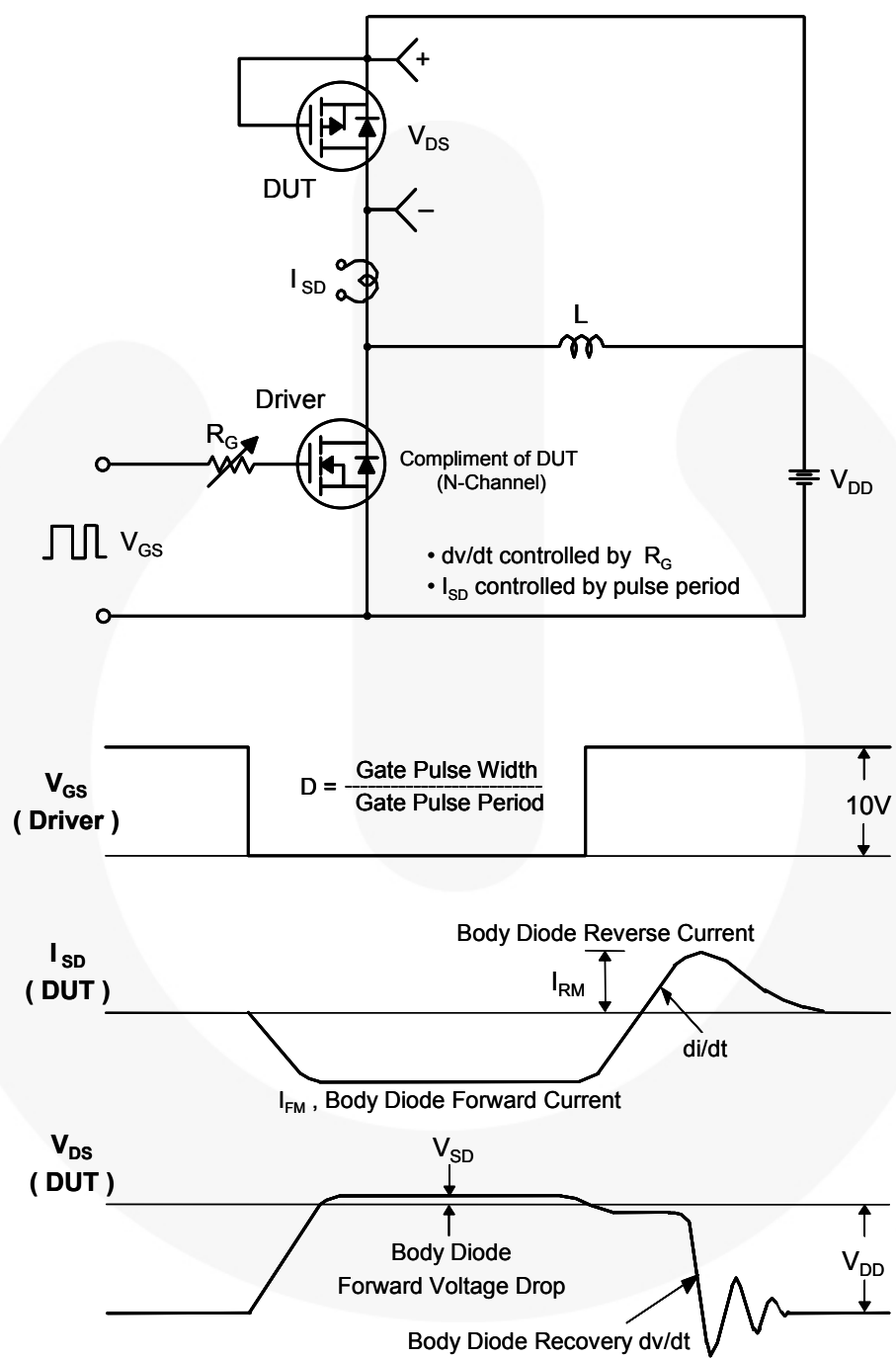
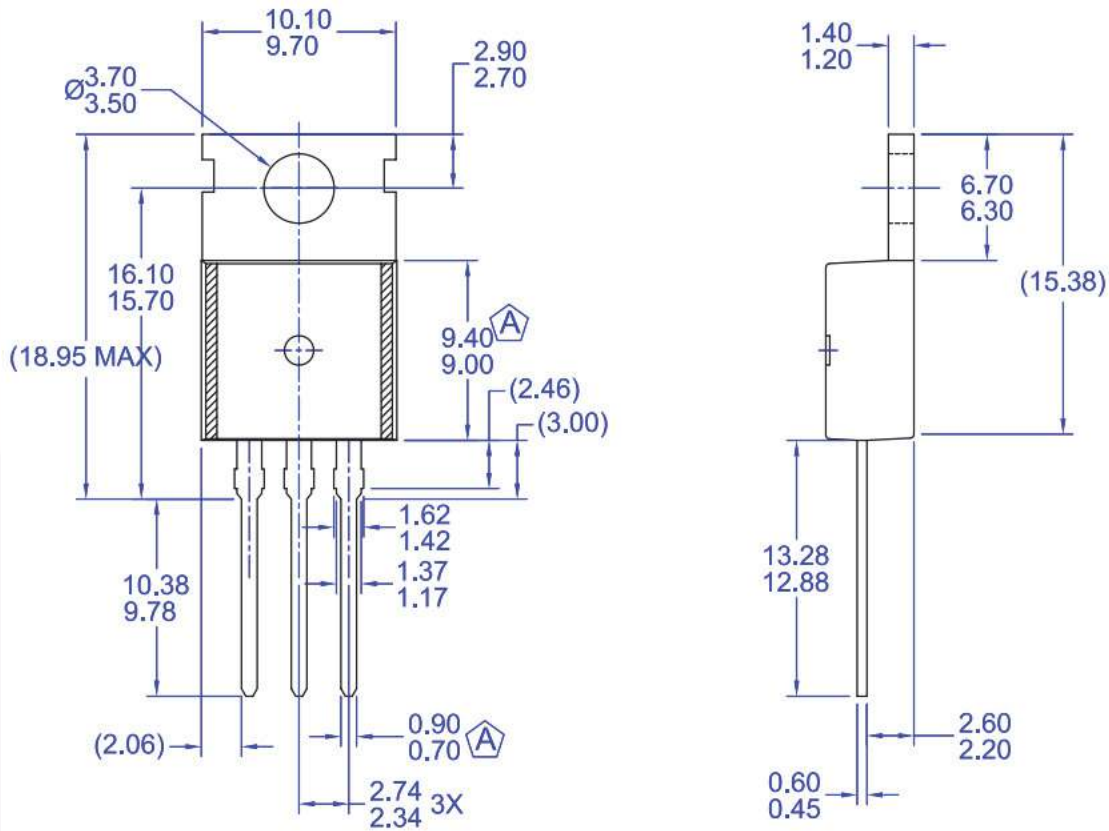


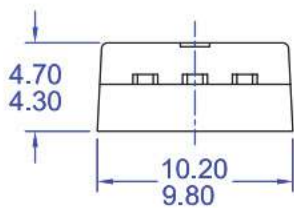
Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions



### NOTES:

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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D) DRAWING FILE/REVISION: MKT-TO220Y03REV1



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

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