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ON Semiconductor®

# IRFNL210B

## N-Channel B-FET

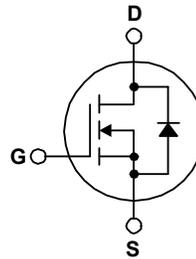
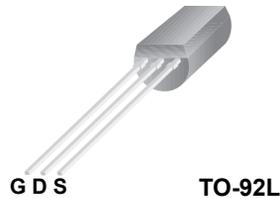
200 V, 1.0 A, 1.5 Ω

### Description

These N-Channel enhancement mode power field effect transistors are produced using ON Semiconductor's proprietary, planar, 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 high efficiency switching DC/DC converters, switch mode power supplies, DC-AC converters for uninterrupted power supply and motor control.

### Features

- 1.0 A, 200 V,  $R_{DS(on)} = 1.5 \Omega @ V_{GS} = 10 V$
- Low Gate Charge ( typical 7.2 nC)
- Low Crss ( typical 6.8 pF)
- Fast Switching
- 100% Avalanche Tested
- Improved dv/dt Capability



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

Symbol	Parameter	IRFNL210BTA-FP001	Unit
$V_{DSS}$	Drain-Source Voltage	200	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ C$ ) - Continuous ( $T_C = 100^\circ C$ )	1.0	A
		0.93	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	10	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	40	mJ
$I_{AR}$	Avalanche Current (Note 1)	3.3	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	0.031	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.0	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ C$ ) - Derate above $25^\circ C$	3.1	W
		0.025	W/ $^\circ C$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ C$

### Thermal Characteristics

Symbol	Parameter	IRFNL210BTA-FP001	Unit
$R_{\theta JL}$	Thermal Resistance, Junction-to-Lead, Max.	40	$^\circ C/W$

IRFNL210B — N-Channel B-FET

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
IRFNL210BTA-FP001	210B	TO-92L	AMMO	N/A	N/A	2000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	200	--	--	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.2	--	$\text{V}/^\circ\text{C}$
$I_{DSS}$	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

### 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	$V_{GS} = 10\text{ V}, I_D = 0.5\text{ A}$	--	1.16	1.5	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 1.0\text{ A}$	--	2.4	--	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	175	225	pF
$C_{oss}$	Output Capacitance		--	30	40	pF
$C_{rss}$	Reverse Transfer Capacitance		--	6.8	9.0	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 100\text{ V}, I_D = 3.3\text{ A},$ $R_G = 25\ \Omega$	--	5.2	20	ns	
$t_r$	Turn-On Rise Time		--	35	80	ns	
$t_{d(off)}$	Turn-Off Delay Time		--	20	50	ns	
$t_f$	Turn-Off Fall Time		(Note 4)	--	25	60	ns
$Q_g$	Total Gate Charge	$V_{DS} = 160\text{ V}, I_D = 3.3\text{ A},$ $V_{GS} = 10\text{ V}$	--	7.2	9.3	nC	
$Q_{gs}$	Gate-Source Charge		(Note 4)	--	1.3	--	nC
$Q_{gd}$	Gate-Drain Charge		--	3.5	--	nC	

### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	3.3	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	10	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 3.3\text{ A}$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 3.3\text{ A},$	--	106	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F / dt = 100\text{ A}/\mu\text{s}$	--	0.37	--	$\mu\text{C}$

#### Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2.  $L = 5.5\text{ mH}, I_{AS} = 3.3\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 3.3\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature.

Typical Characteristics

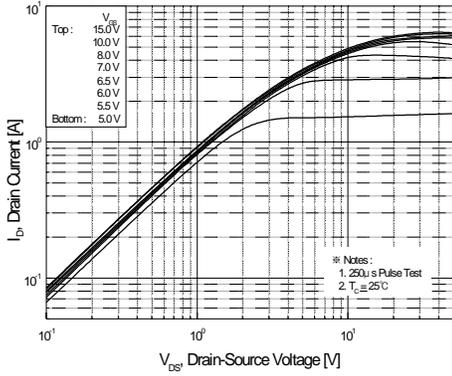


Figure 1. On-Region Characteristics

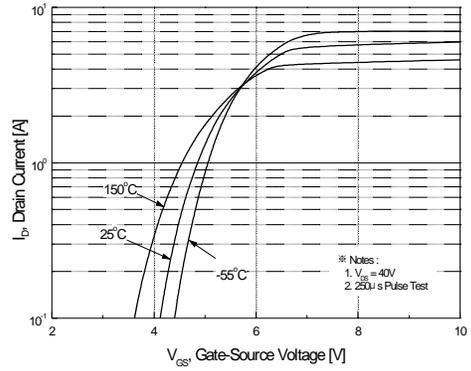


Figure 2. Transfer Characteristics

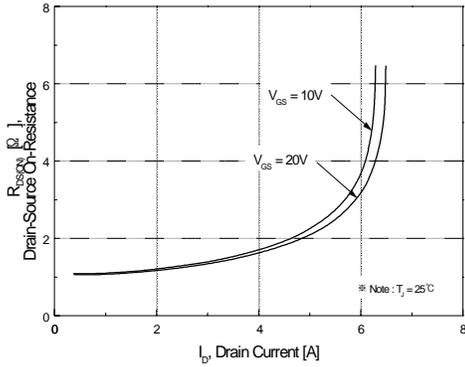


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

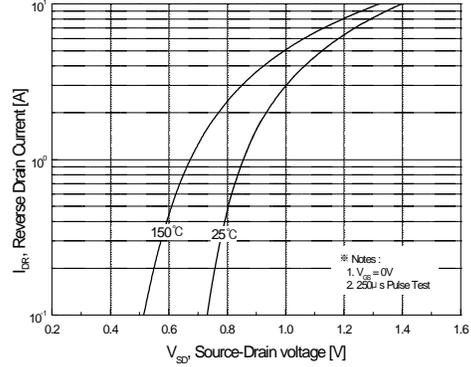


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

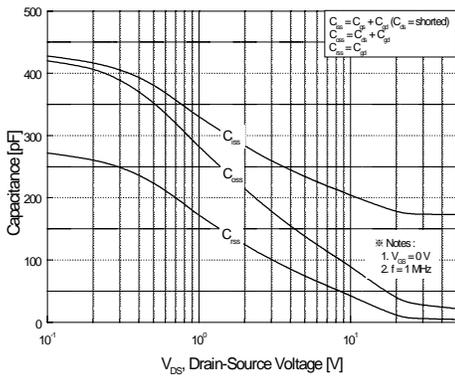


Figure 5. Capacitance Characteristics

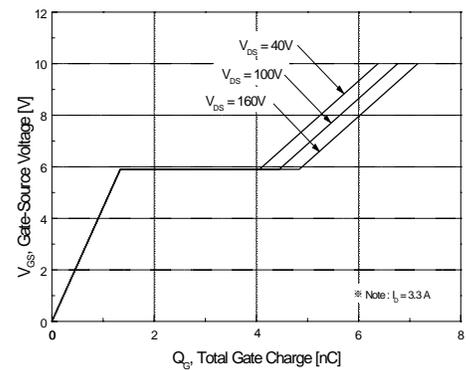


Figure 6. Gate Charge Characteristics

Typical Characteristics (continued)

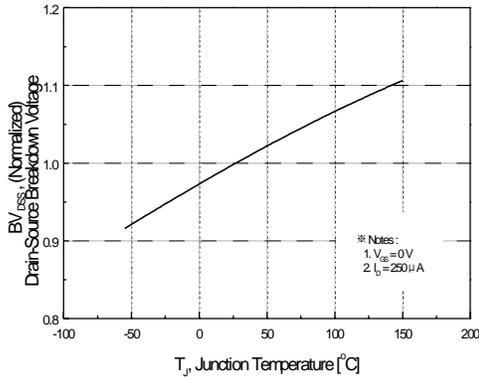


Figure 7. Breakdown Voltage Variation

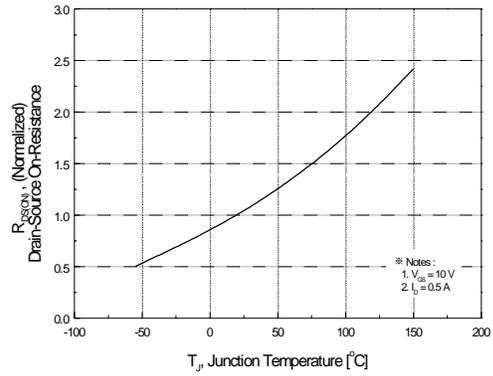


Figure 8. On-Resistance Variation vs Temperature

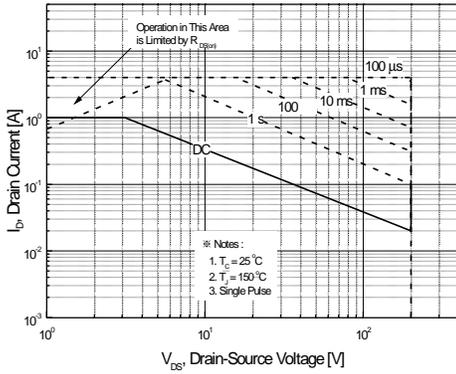


Figure 9. Maximum Safe Operating Area

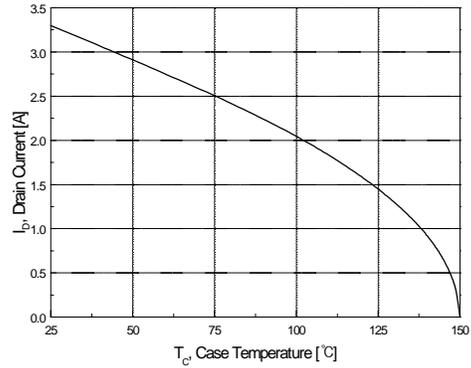


Figure 10. Maximum Drain Current vs Case Temperature

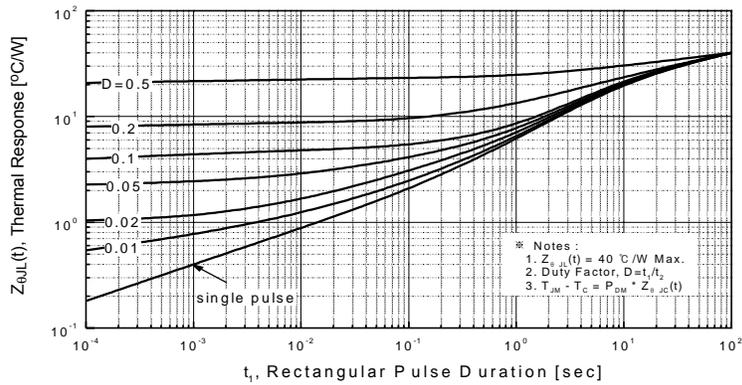


Figure 11. Transient Thermal Response Curve

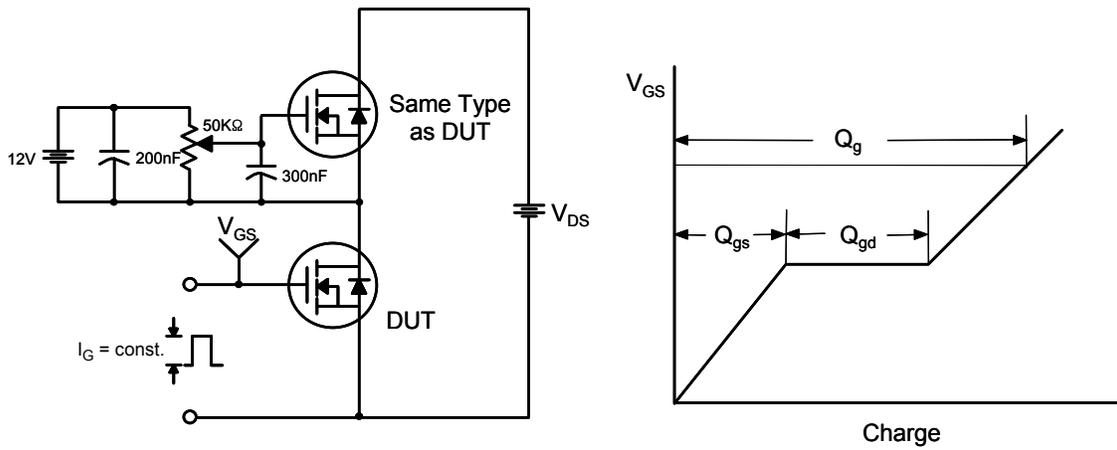


Figure 12. Gate Charge Test Circuit & Waveform

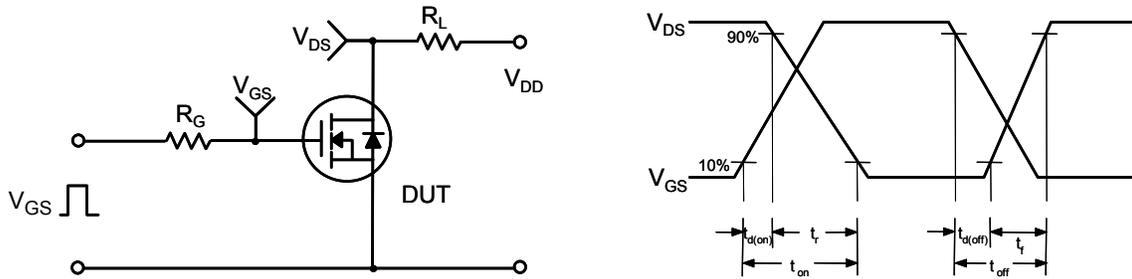


Figure 13. Resistive Switching Test Circuit & Waveforms

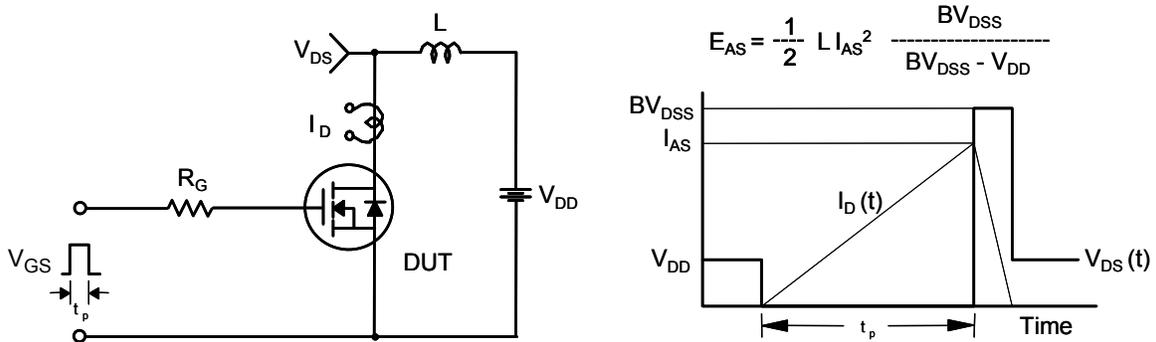


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

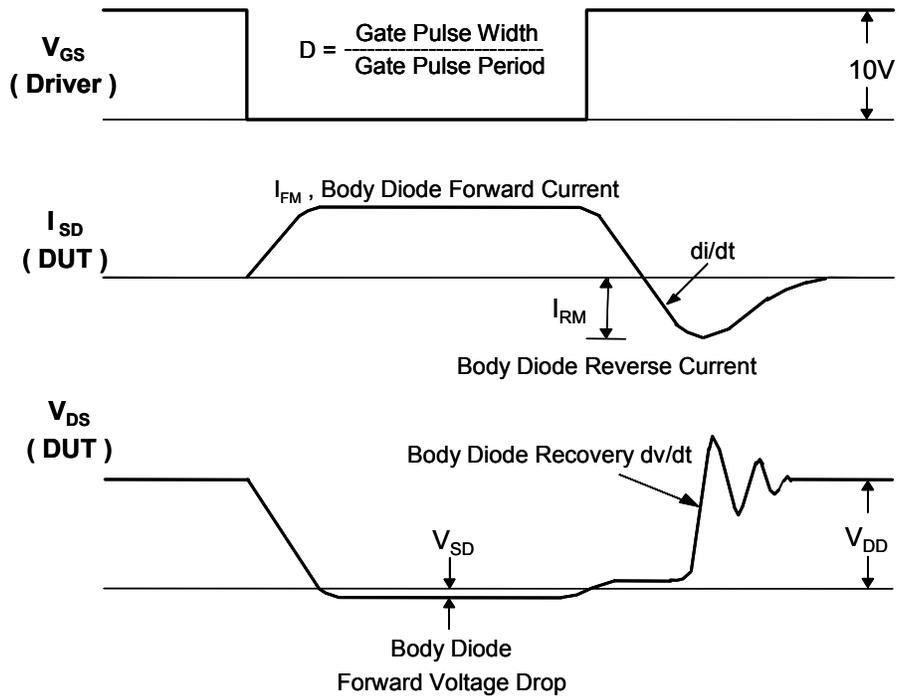
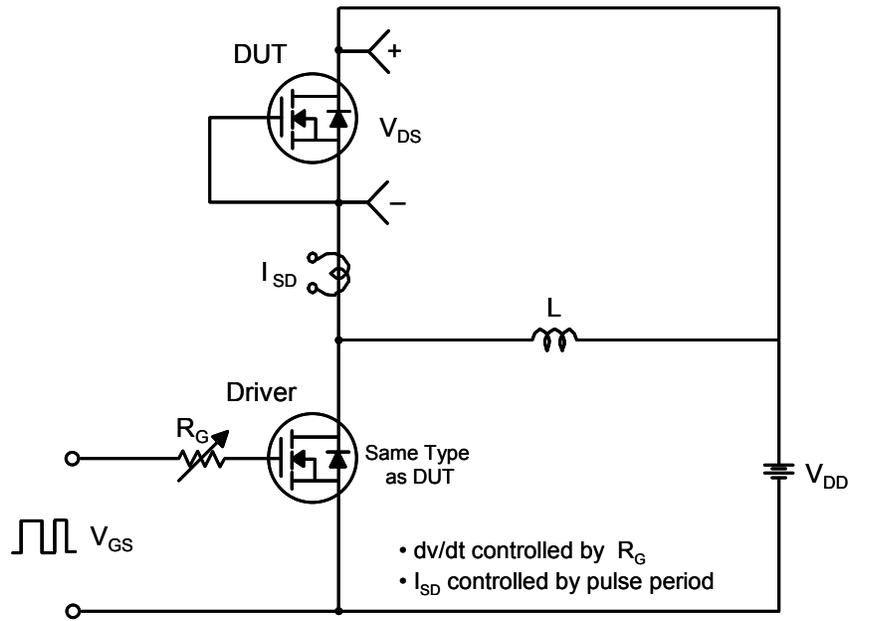
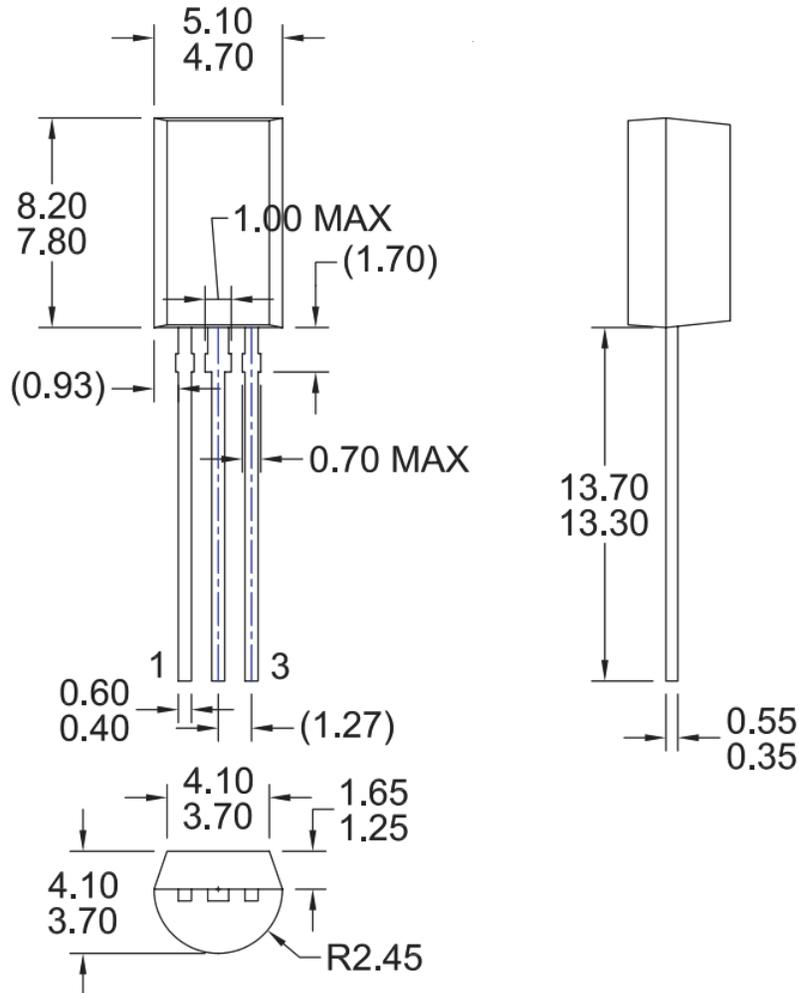


Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

**Mechanical Dimensions**



- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE DOES NOT CONFORM TO ANY STANDARD
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
  - D) FORMERLY NAMED BD1409
  - E) DRAWING FILE NAME: MKT-ZA03HREV1

**Figure 16. TO92L, 3-Lead, 8 mm Long Body**

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