

ON Semiconductor

Is Now

The logo for onsemi, featuring the word "onsemi" in a dark teal, lowercase, sans-serif font. The letter "i" is stylized with a white dot and a teal vertical bar. A small orange triangle is positioned above the top right of the "i". A trademark symbol (TM) is located to the right of the logo.

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IRF644B

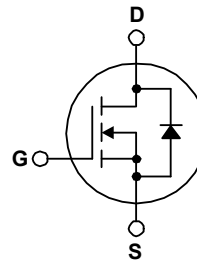
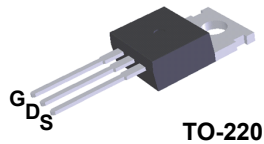
N-Channel BFET MOSFET 250 V, 14 A, 280 mΩ

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 and switch mode power supplies.

Features

- 14 A, 250 V, $R_{DS(on)} = 280 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$
- Low gate charge (Typ. 47 nC)
- Low Crss (Typ. 30 pF)
- Fast Switching
- 100% Avalanche Tested
- Improved dv/dt Capability



Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter	IRF644B_FP001	Unit
V _{DSS}	Drain-Source Voltage	250	V
I _D	Drain Current - Continuous (T _C = 25°C) - Continuous (T _C = 100°C)	14	A
		8.9	A
I _{DM}	Drain Current - Pulsed (Note 1)	56	A
V _{GSS}	Gate-Source Voltage	± 30	V
E _{AS}	Single Pulsed Avalanche Energy (Note 2)	480	mJ
I _{AR}	Avalanche Current (Note 1)	14	A
E _{AR}	Repetitive Avalanche Energy (Note 1)	13.9	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.8	V/ns
P _D	Power Dissipation (T _C = 25°C) - Derate Above 25°C	139	W
		1.11	W/°C
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to +150	°C
T _L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	°C

Thermal Characteristics

Symbol	Parameter	IRF644B-FP001	Unit
R _{θJC}	Thermal Resistance, Junction-to-Case	0.9	°C/W
R _{θCS}	Thermal Resistance, Case-to-Sink	0.5	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient	62.5	°C/W

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
IRF644B-FP001	IRF644B	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	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	250	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	--	0.24	--	$V/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 250\text{ V}, V_{GS} = 0\text{ V}$	--	--	10	μA
		$V_{DS} = 200\text{ V}, T_C = 125^\circ\text{C}$	--	--	100	μA
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	$V_{GS} = 10\text{ V}, I_D = 7.0\text{ A}$	--	0.22	0.28	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 7.0\text{ A}$	--	11.7	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	1250	1600	pF
C_{oss}	Output Capacitance		--	150	195	pF
C_{rss}	Reverse Transfer Capacitance		--	30	40	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 125\text{ V}, I_D = 14\text{ A},$ $R_G = 25\ \Omega$	--	20	50	ns
t_r	Turn-On Rise Time		--	115	240	ns
$t_{d(off)}$	Turn-Off Delay Time		--	150	310	ns
t_f	Turn-Off Fall Time		--	95	200	ns
Q_g	Total Gate Charge	$V_{DS} = 200\text{ V}, I_D = 14\text{ A},$ $V_{GS} = 10\text{ V}$	--	47	60	nC
Q_{gs}	Gate-Source Charge		--	6.2	--	nC
Q_{gd}	Gate-Drain Charge		--	23	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current	--	--	14	A	
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current	--	--	56	A	
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 14\text{ A}$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 14\text{ A},$ $dI_F / dt = 100\text{ A}/\mu\text{s}$	--	240	--	ns
Q_{rr}	Reverse Recovery Charge		--	1.96	--	μC

Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. $L = 3.9\text{ mH}, I_{AS} = 14\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 14\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature.

Typical Characteristics

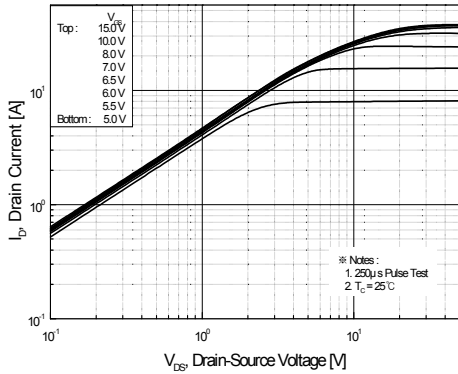


Figure 1. On-Region Characteristics

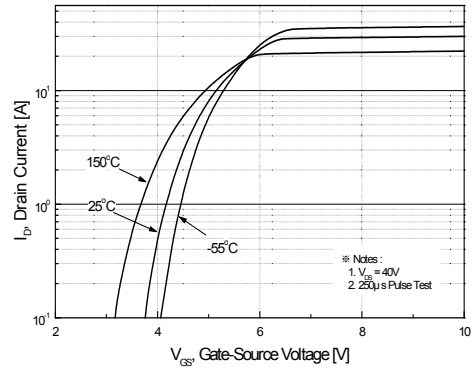


Figure 2. Transfer Characteristics

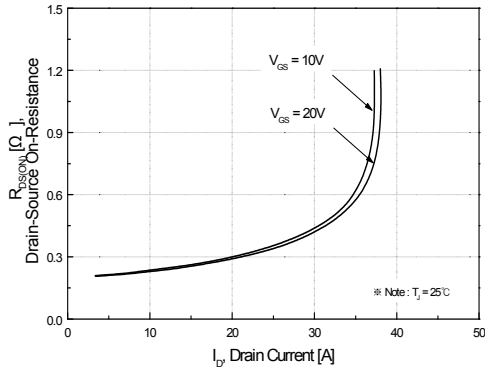


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

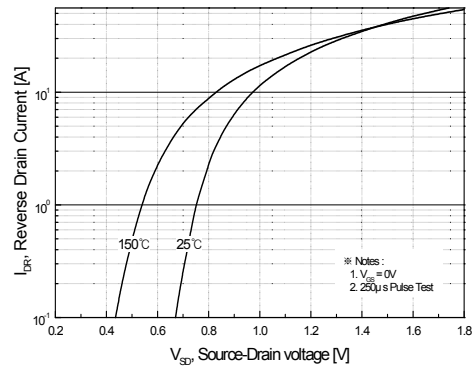


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

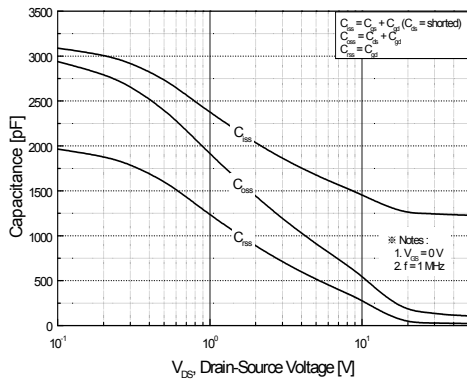


Figure 5. Capacitance Characteristics

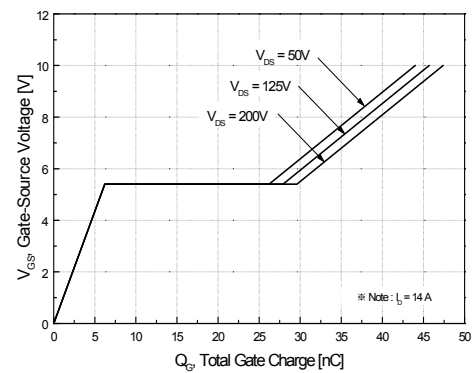


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

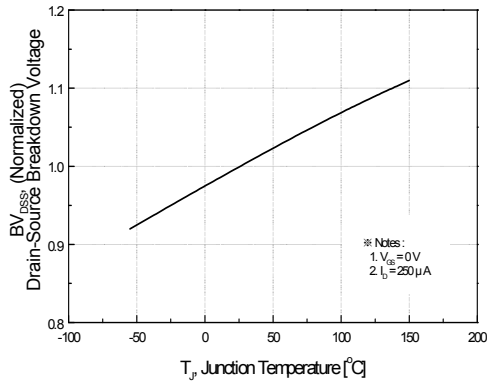


Figure 7. Breakdown Voltage Variation vs Temperature

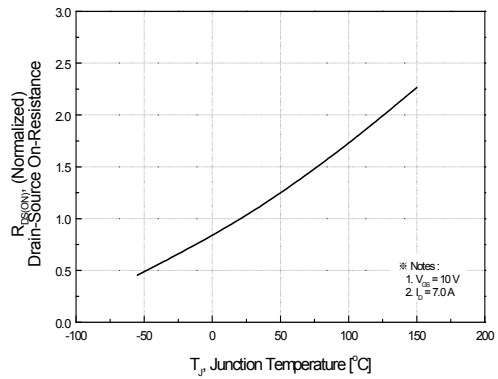


Figure 8. On-Resistance Variation vs Temperature

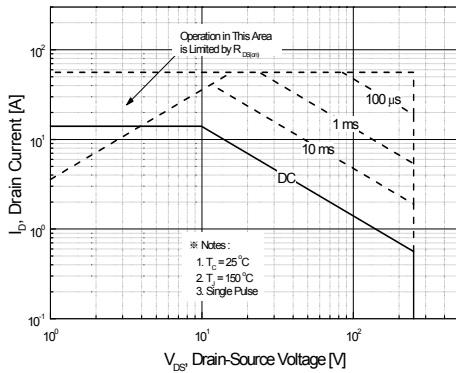


Figure 9. Maximum Safe Operating Area

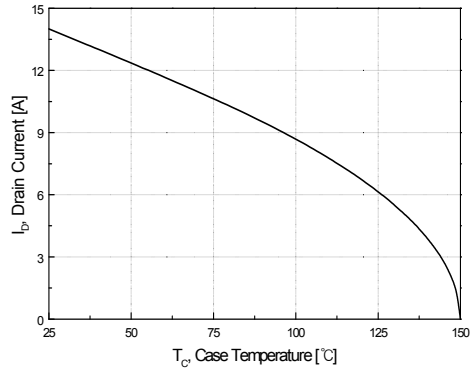


Figure 10. Maximum Drain Current vs Case Temperature

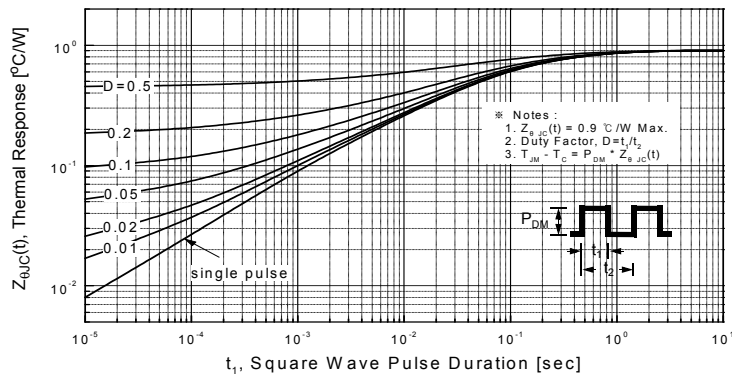


Figure 11. Transient Thermal Response Curve

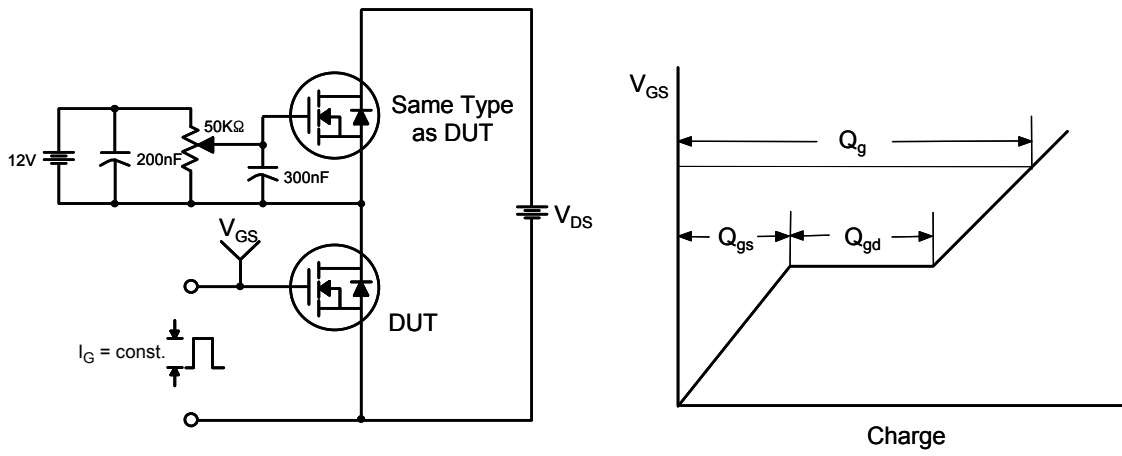


Figure 12. Gate Charge Test Circuit & Waveform

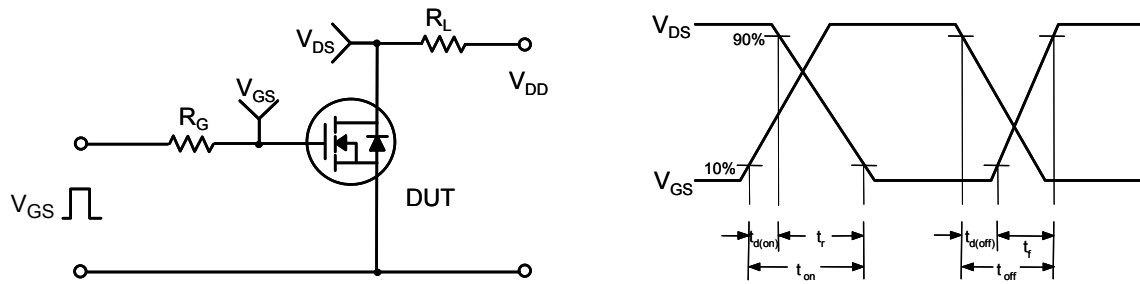


Figure 13. Resistive Switching Test Circuit & Waveforms

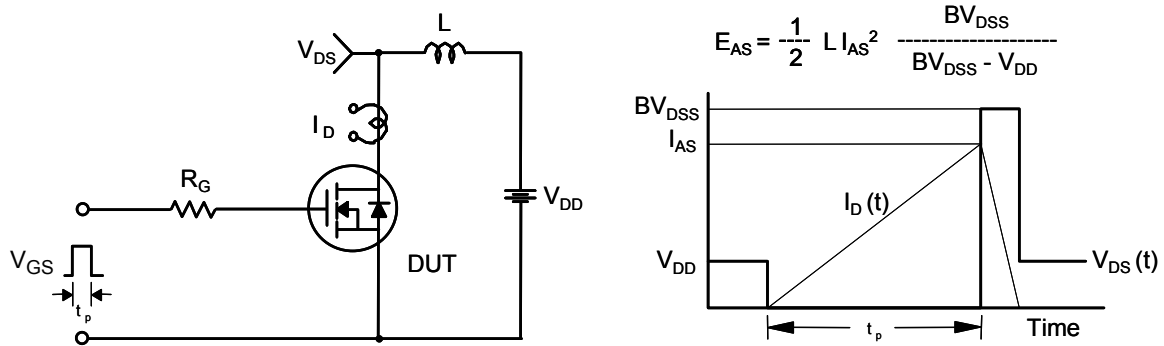


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

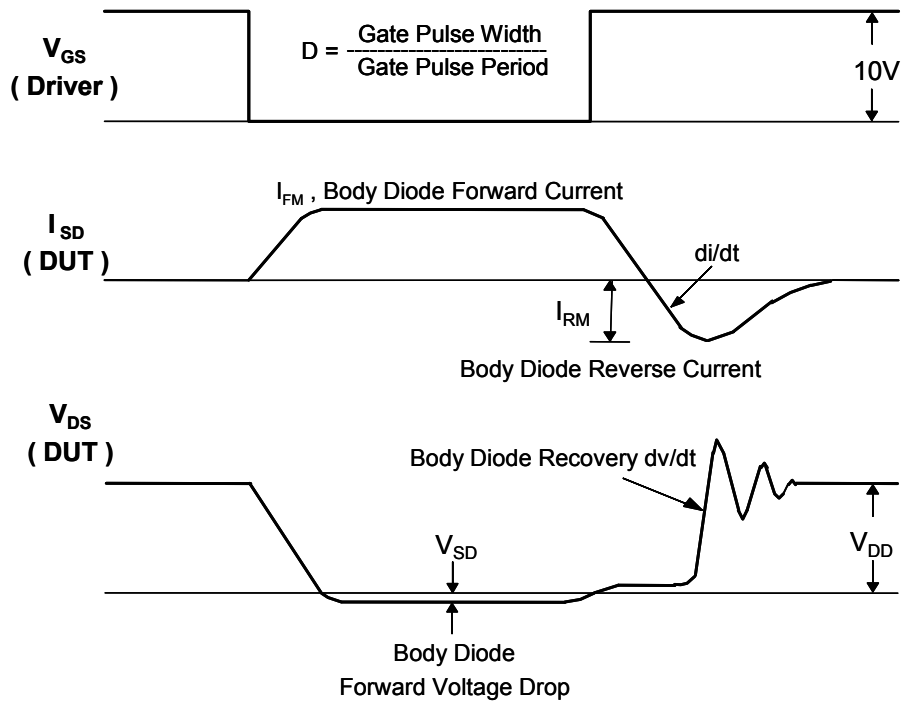
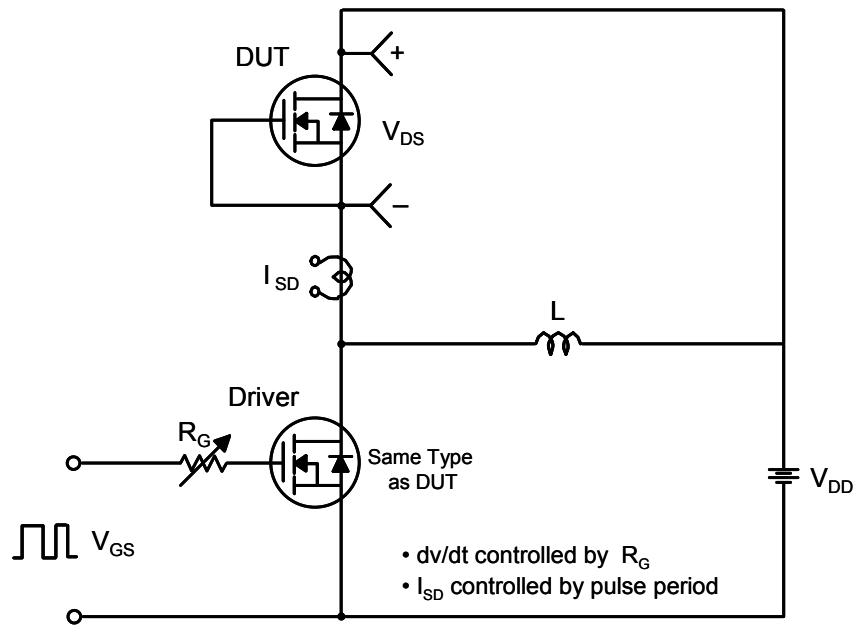
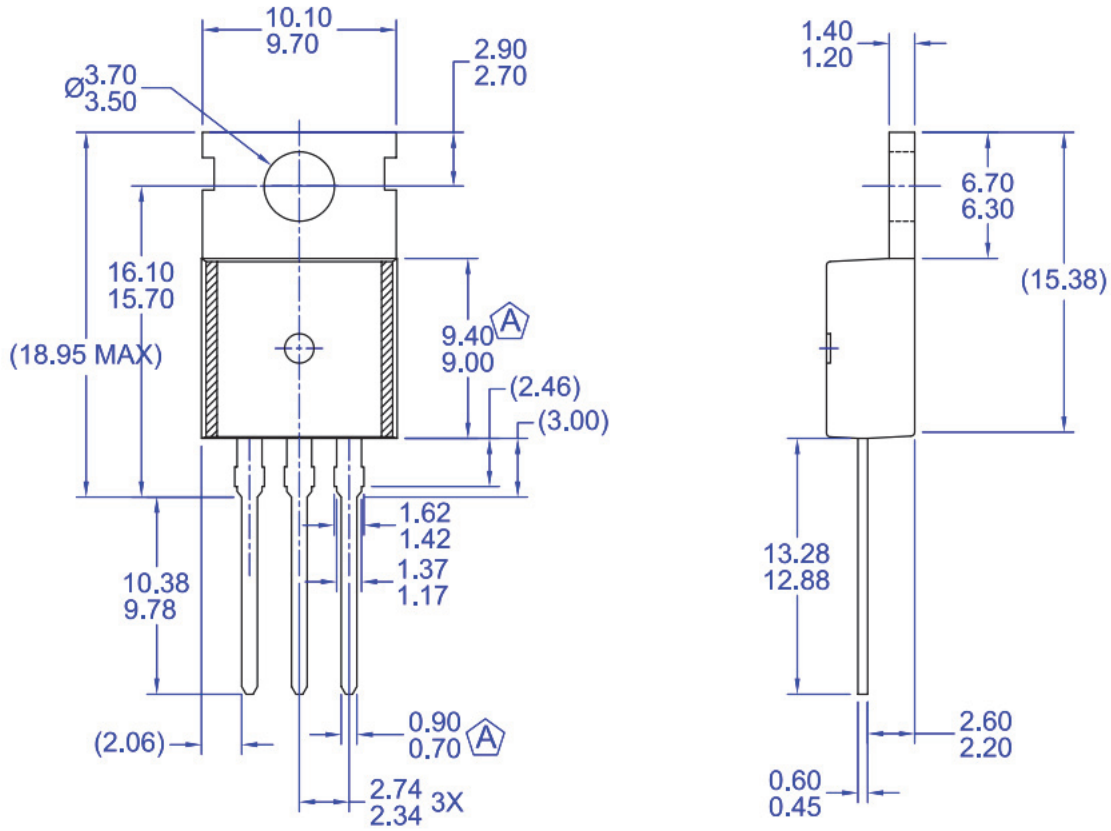


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions



NOTES:

- Ⓐ CONFORMS TO JEDEC TO-220 VARIATION AB EXCEPT WHERE NOTED
- 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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