

Advanced Power MOSFET

IRL510A

FEATURES

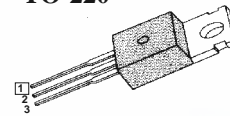
- ◆ Logic-Level Gate Drive
- ◆ Avalanche Rugged Technology
- ◆ Rugged Gate Oxide Technology
- ◆ Lower Input Capacitance
- ◆ Improved Gate Charge
- ◆ Extended Safe Operating Area
- ◆ Lower Leakage Current: 10 μ A (Max.) @ $V_{DS} = 100V$
- ◆ Lower $R_{DS(ON)}$: 0.336 Ω (Typ.)

$$BV_{DSS} = 100 V$$

$$R_{DS(on)} = 0.44\Omega$$

$$I_D = 5.6 A$$

TO-220



1. Gate 2. Drain 3. Source

Absolute Maximum Ratings

Symbol	Characteristic	Value	Units
V_{DSS}	Drain-to-Source Voltage	100	V
I_D	Continuous Drain Current ($T_C=25^\circ C$)	5.6	A
	Continuous Drain Current ($T_C=100^\circ C$)	4.0	
I_{DM}	Drain Current-Pulsed (1)	20	A
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulsed Avalanche Energy (2)	62	mJ
I_{AR}	Avalanche Current (1)	5.6	A
E_{AR}	Repetitive Avalanche Energy (1)	3.7	mJ
dv/dt	Peak Diode Recovery dv/dt (3)	6.5	V/ns
P_D	Total Power Dissipation ($T_C=25^\circ C$)	37	W
	Linear Derating Factor	0.25	
T_J, T_{STG}	Operating Junction and Storage Temperature Range	- 55 to +175	$^\circ C$
T_L	Maximum Lead Temp. for Soldering Purposes, 1/8. from case for 5-seconds	300	

Thermal Resistance

Symbol	Characteristic	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	--	4.1	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink	0.5	--	
$R_{\theta JA}$	Junction-to-Ambient	--	62.5	

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Rev. B



Electrical Characteristics ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
BV_{DSS}	Drain-Source Breakdown Voltage	100	--	--	V	$V_{GS}=0V, I_D=250\mu A$
$\Delta BV/\Delta T_J$	Breakdown Voltage Temp. Coeff.	--	0.1	--	V/ $^\circ\text{C}$	$I_D=250\mu A$ See Fig 7
$V_{GS(th)}$	Gate Threshold Voltage	1.0	--	2.0	V	$V_{DS}=5V, I_D=250\mu A$
I_{GSS}	Gate-Source Leakage, Forward	--	--	100	nA	$V_{GS}=20V$
	Gate-Source Leakage, Reverse	--	--	-100		$V_{GS}=-20V$
I_{DSS}	Drain-to-Source Leakage Current	--	--	10	μA	$V_{DS}=100V$
		--	--	100		$V_{DS}=80V, T_C=150^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-State Resistance	--	--	0.44	Ω	$V_{GS}=5V, I_D=2.8A$ (4)
g_{fs}	Forward Transconductance	--	3.2	--	\bar{O}	$V_{DS}=40V, I_D=2.8A$ (4)
C_{iss}	Input Capacitance	--	180	235	pF	$V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$ See Fig 5
C_{oss}	Output Capacitance	--	50	65		
C_{rss}	Reverse Transfer Capacitance	--	20	25		
$t_{d(on)}$	Turn-On Delay Time	--	8	25	ns	$V_{DD}=50V, I_D=5.6A,$ $R_G=12\Omega$ See Fig 13 (4) (5)
t_r	Rise Time	--	10	30		
$t_{d(off)}$	Turn-Off Delay Time	--	17	45		
t_f	Fall Time	--	8	25		
Q_g	Total Gate Charge	--	5.5	8	nC	$V_{DS}=80V, V_{GS}=5V,$ $I_D=5.6A$ See Fig 6 & Fig 12 (4) (5)
Q_{gs}	Gate-Source Charge	--	0.9	--		
Q_{gd}	Gate-Drain (. Miller.) Charge	--	3.5	--		

Source-Drain Diode Ratings and Characteristics

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
I_S	Continuous Source Current	--	--	5.6	A	Integral reverse pn-diode in the MOSFET
I_{SM}	Pulsed-Source Current (1)	--	--	20		
V_{SD}	Diode Forward Voltage (4)	--	--	1.5	V	$T_J=25^\circ\text{C}, I_S=5.6A, V_{GS}=0V$
t_{rr}	Reverse Recovery Time	--	85	--	ns	$T_J=25^\circ\text{C}, I_F=5.6A$
Q_{rr}	Reverse Recovery Charge	--	0.23	--	μC	$di_F/dt=100A/\mu s$

Notes;

- (1) Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
- (2) $L=3\text{mH}, I_{AS}=5.6A, V_{DD}=25V, R_G=27\Omega,$ Starting $T_J=25^\circ\text{C}$
- (3) $I_{SD} \leq 5.6A, di/dt \leq 250A/\mu s, V_{DD} \leq BV_{DSS},$ Starting $T_J=25^\circ\text{C}$
- (4) Pulse Test: Pulse Width = $250\mu s,$ Duty Cycle $\leq 2\%$
- (5) Essentially Independent of Operating Temperature

Fig 1. Output Characteristics

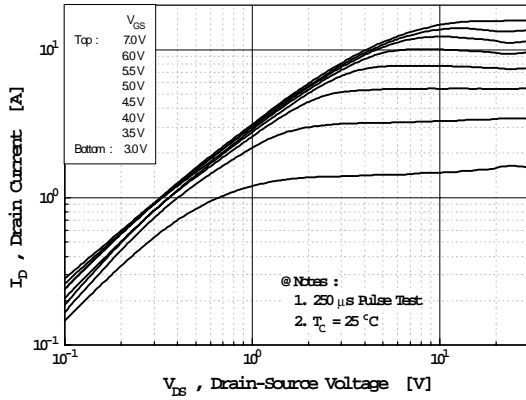


Fig 2. Transfer Characteristics

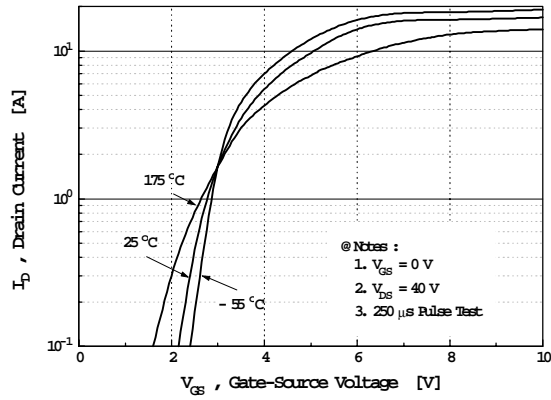


Fig 3. On-Resistance vs. Drain Current

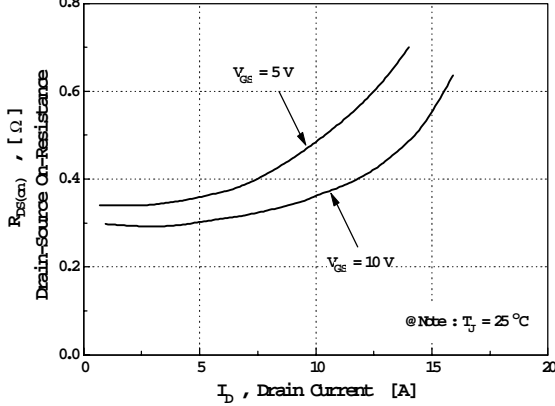


Fig 4. Source-Drain Diode Forward Voltage

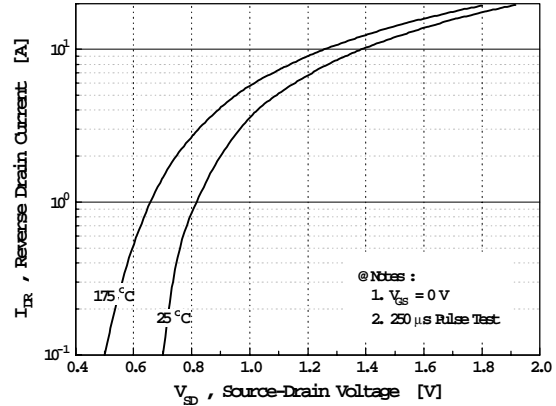


Fig 5. Capacitance vs. Drain-Source Voltage

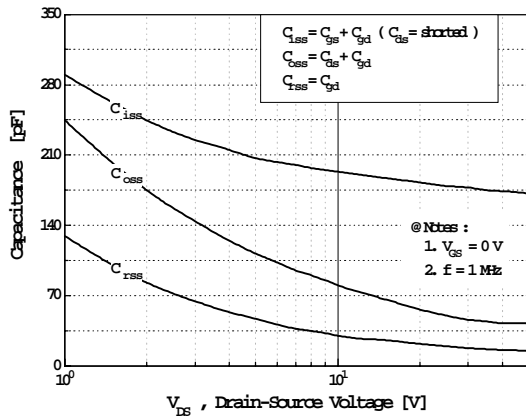


Fig 6. Gate Charge vs. Gate-Source Voltage

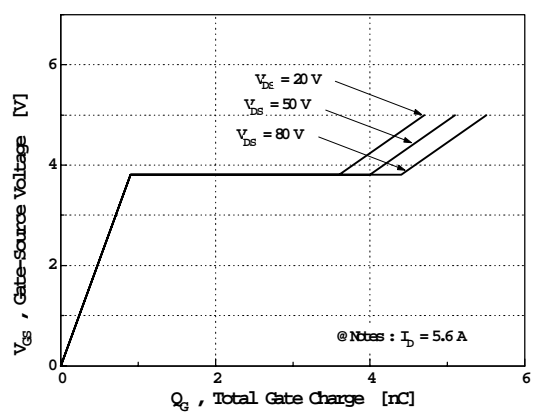


Fig 7. Breakdown Voltage vs. Temperature

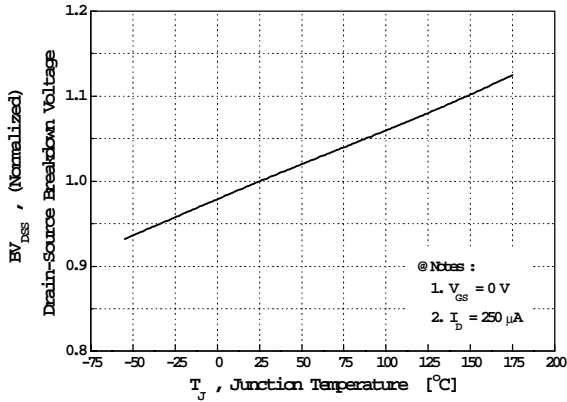


Fig 8. On-Resistance vs. Temperature

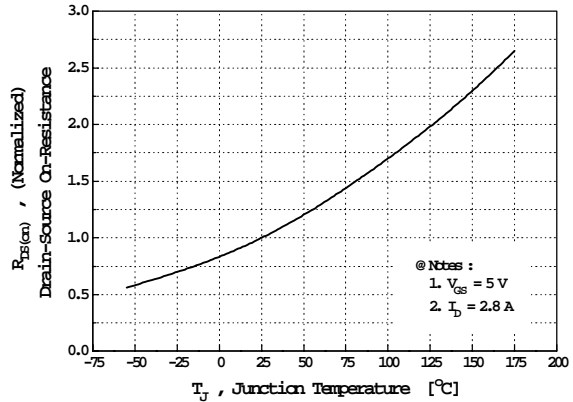


Fig 9. Max. Safe Operating Area

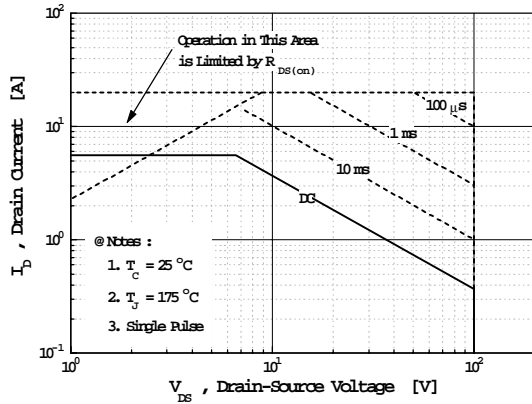


Fig 10. Max. Drain Current vs. Case Temperature

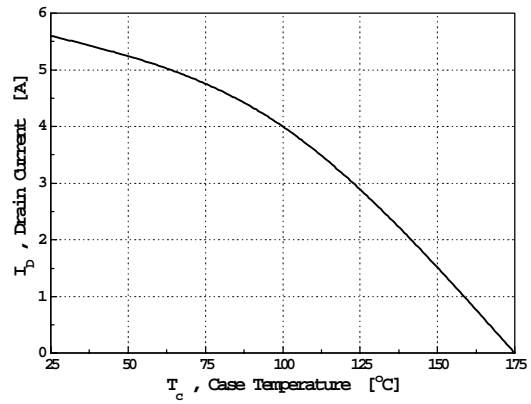


Fig 11. Thermal Response

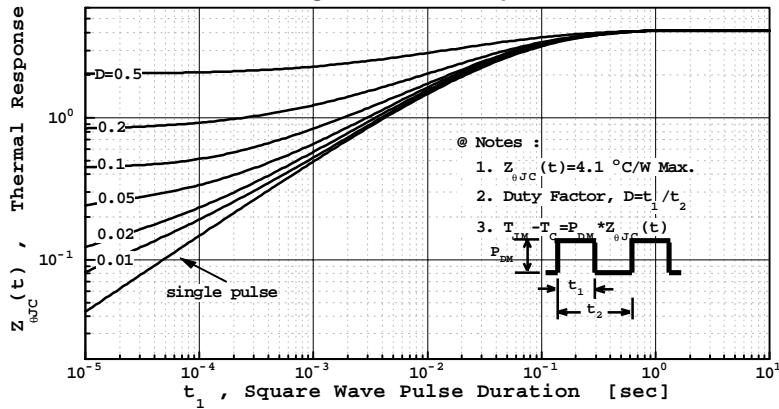


Fig 12. Gate Charge Test Circuit & Waveform

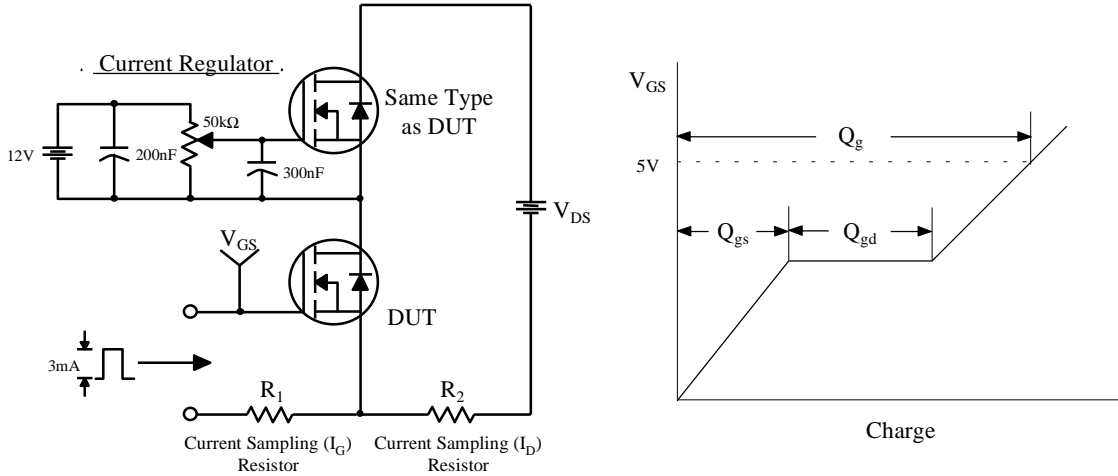


Fig 13. Resistive Switching Test Circuit & Waveforms

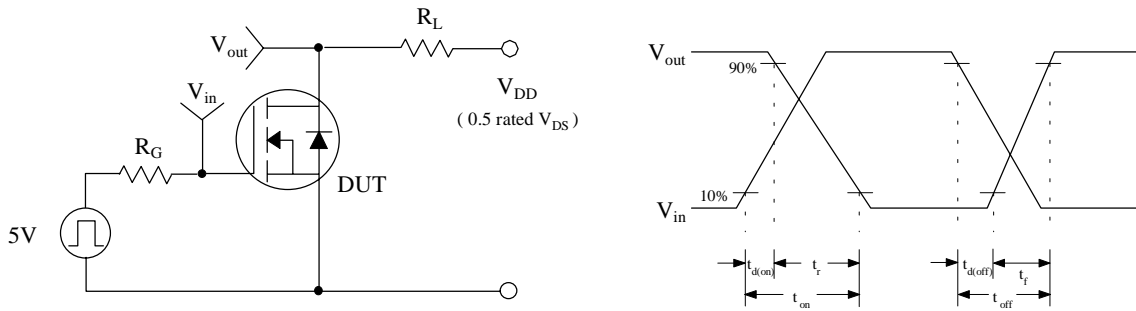


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

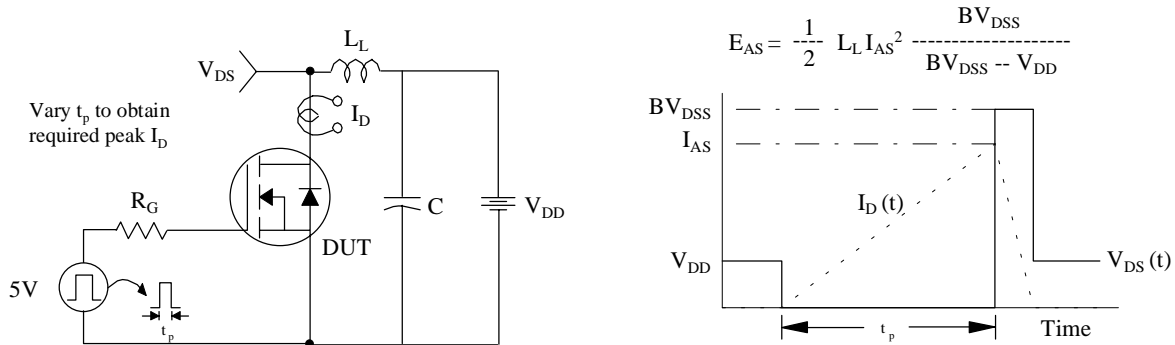
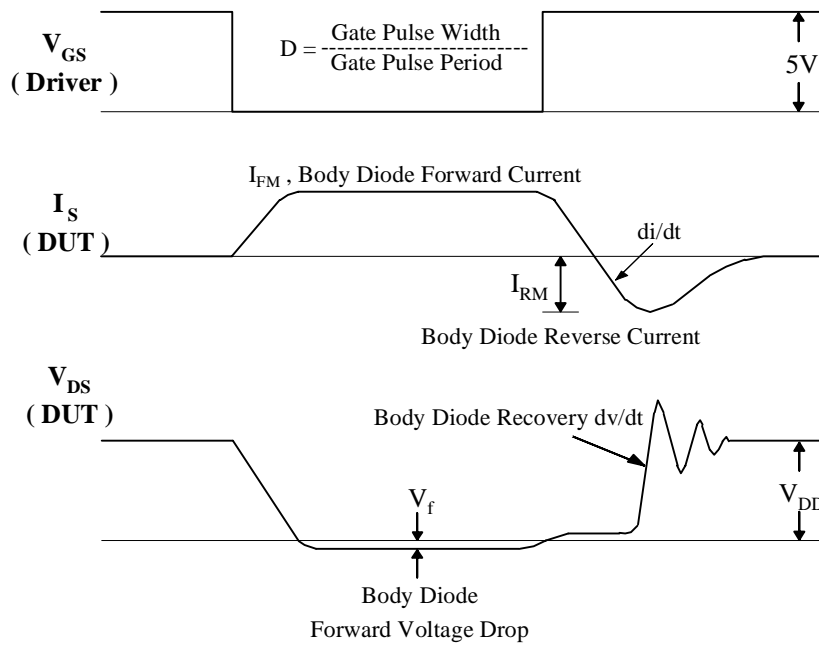
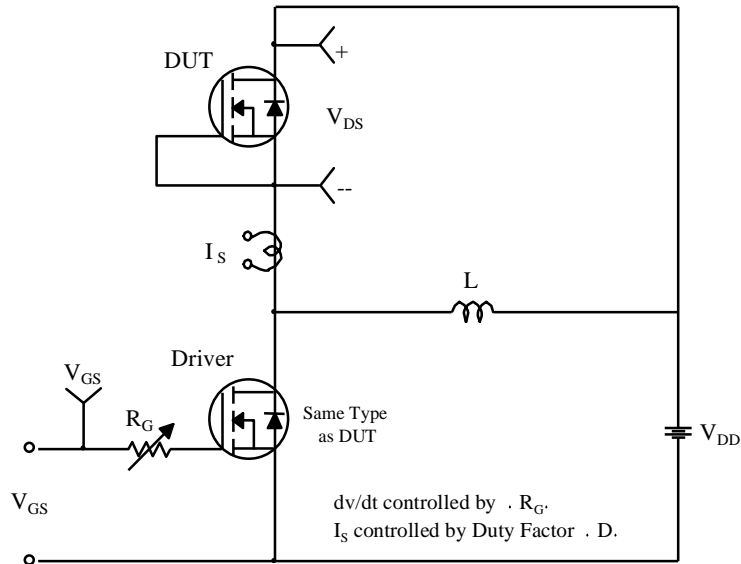


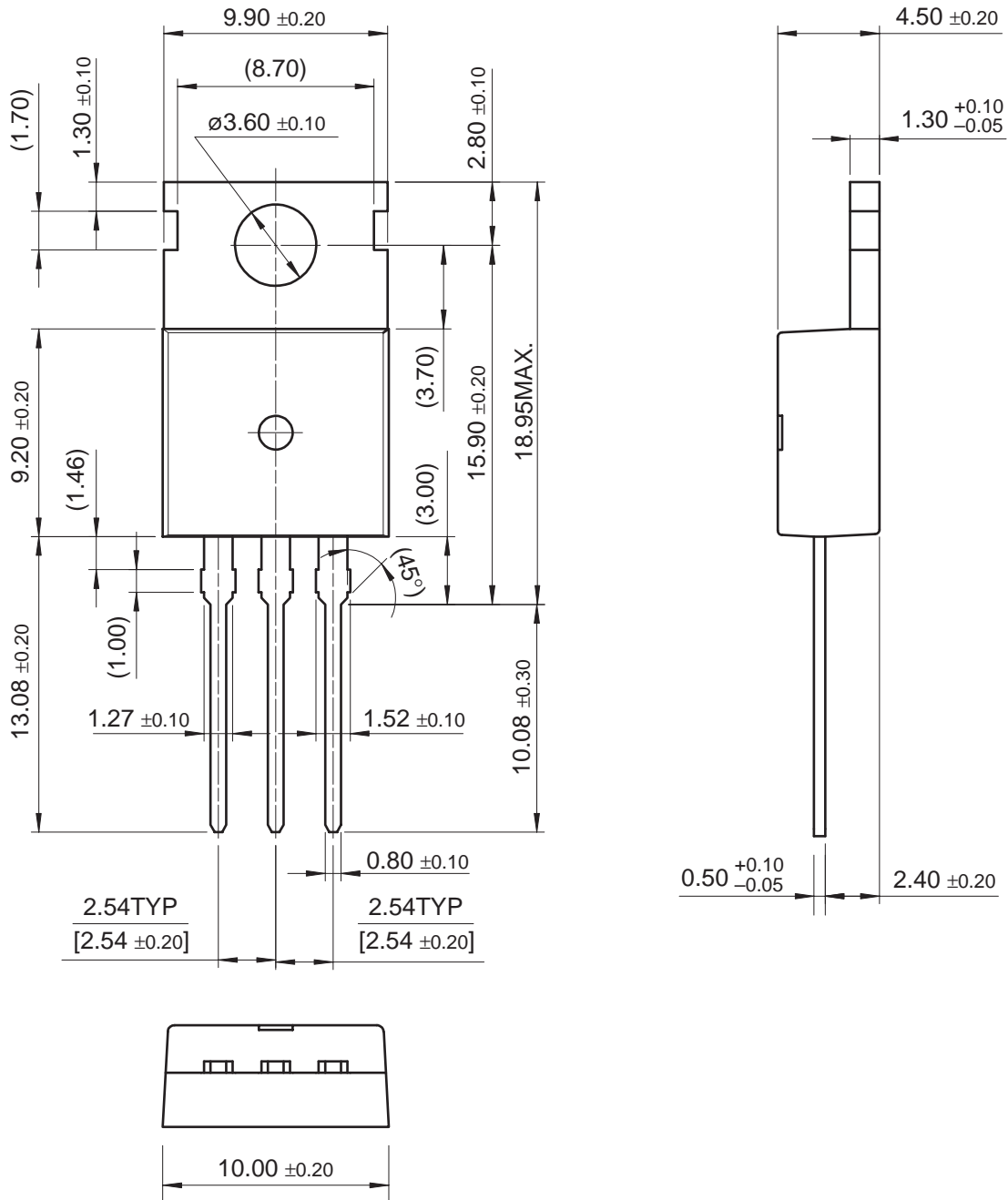
Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



TO-220 Package Dimensions



TO-220 (FS PKG CODE AE)



Dimensions in Millimeters

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