

FEATURES

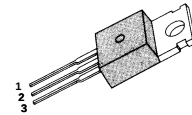
- Advanced New Design
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Very Low Intrinsic Capacitances
- Excellent Switching Characteristics
- Unrivalled Gate Charge: 27nC (Typ.)
- Extended Safe Operating Area
- Lower $R_{DS(ON)}$: 0.38 Ω (Typ.)

$$BV_{DSS} = 400V$$

$$R_{DS(ON)} = 0.48\Omega$$

$$I_D = 11.4A$$

TO-220



1. Gate 2. Drain 3. Source

ABSOLUTE MAXIMUM RATINGS

Symbol	Characteristics	Value	Units
V_{DSS}	Drain-to-Source Voltage	400	V
I_D	Continuous Drain Current ($T_C = 25^\circ C$)	11.4	A
	Continuous Drain Current ($T_C = 100^\circ C$)	7.2	
I_{DM}	Drain Current-Pulsed ①	46	A
V_{GS}	Gate-to-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy ②	520	mJ
I_{AR}	Avalanche Current ①	11.4	A
E_{AR}	Repetitive Avalanche Energy ①	14.7	mJ
dv/dt	Peak Diode Recovery dv/dt ③	4.5	V/ns
P_D	Total Power Dissipation ($T_C = 25^\circ C$)	147	W
	Linear Derating Factor	1.87	
T_J, T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	$^\circ C$
T_L	Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5-seconds	300	

THERMAL RESISTANCE

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.85	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink	0.5	—	
$R_{\theta JA}$	Junction-to-Ambient	—	62.5	

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

Symbol	Characteristics	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS}	Drain-Source Breakdown Voltage	400	–	–	V	$V_{GS}=0V$, $I_D=250\mu A$
$\Delta BV/\Delta T_J$	Breakdown Voltage Temp. Coeff.	–	0.42	–	V/ $^\circ\text{C}$	$I_D=250\mu A$, See Fig 7
$V_{GS(th)}$	Gate Threshold Voltage	3.0	–	5.0	V	$V_{DS}=5V$, $I_D=250\mu A$
I_{GSS}	Gate-Source Leakage, Forward	–	–	100	nA	$V_{GS}=30V$
	Gate-Source Leakage, Reverse	–	–	–100		$V_{GS}= -30V$
I_{DSS}	Drain-to-Source Leakage Current	–	–	1	μA	$V_{DS}=400V$
		–	–	10		$V_{DS}=320V$, $T_C=125^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-State Resistance	–	0.38	0.48	Ω	$V_{GS}=10V$, $I_D=5.7A$ ④
g_{fs}	Forward Transconductance	–	7.6	–	S	$V_{DS}=50V$, $I_D=5.7A$ ④
C_{iss}	Input Capacitance	–	1080	1400	pF	$V_{GS}=0V$, $V_{DS}=25V$ $f=1\text{MHz}$ See Fig 5
C_{oss}	Output Capacitance	–	180	240		
C_{rss}	Reverse Transfer Capacitance	–	20	30		
$t_{d(on)}$	Turn-On Delay Time	–	30	70	ns	$V_{DD}=200V$, $I_D=11.4A$ $R_G=50\Omega$ See Fig 13 ④ ⑤
t_r	Rise Time	–	105	220		
$t_{d(off)}$	Turn-Off Delay Time	–	60	130		
t_f	Fall Time	–	60	130		
Q_g	Total Gate Charge	–	27	35	nC	$V_{DS}=320V$, $V_{GS}=10V$ $I_D=11.4A$ See Fig 6 & Fig 12 ④ ⑤
Q_{gs}	Gate-Source Charge	–	7.3	–		
Q_{gd}	Gate-Drain (Miller) Charge	–	12.3	–		

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Symbol	Characteristics	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current	–	–	11.4	A	Integral reverse pn-diode in the MOSFET
I_{SM}	Pulsed-Source Current ①	–	–	46		
V_{SD}	Diode Forward Voltage ④	–	–	1.5	V	$T_J=25^\circ\text{C}$, $I_S=11.4A$, $V_{GS}=0V$
t_{rr}	Reverse Recovery Time	–	240	–	ns	$T_J=25^\circ\text{C}$, $I_F=11.4A$, $V_{DD}=320V$ $di_F/dt=100A/\mu s$ ④
Q_{rr}	Reverse Recovery Charge	–	1.8	–	μC	

Notes:

- ① Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
 ② $L=7\text{mH}$, $I_{AS}=11.4A$, $V_{DD}=50V$, $R_G=25\Omega$, Starting $T_J=25^\circ\text{C}$
 ③ $I_{SD} \leq 11.4$, $di/dt \leq 200A/\mu s$, $V_{DD} \leq BV_{DSS}$, Starting $T_J=25^\circ\text{C}$
 ④ Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$
 ⑤ Essentially Independent of Operating Temperature

Fig 1. Output Characteristics

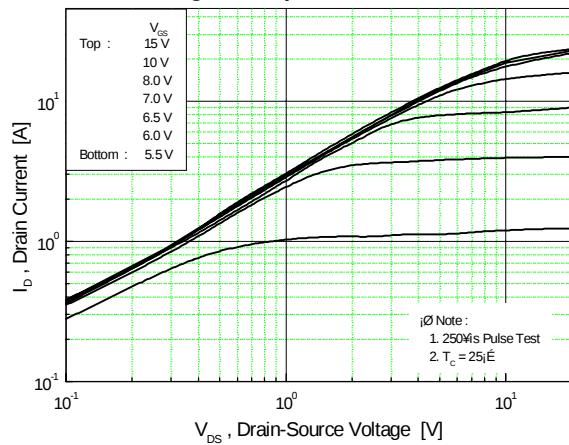


Fig 2. Transfer Characteristics

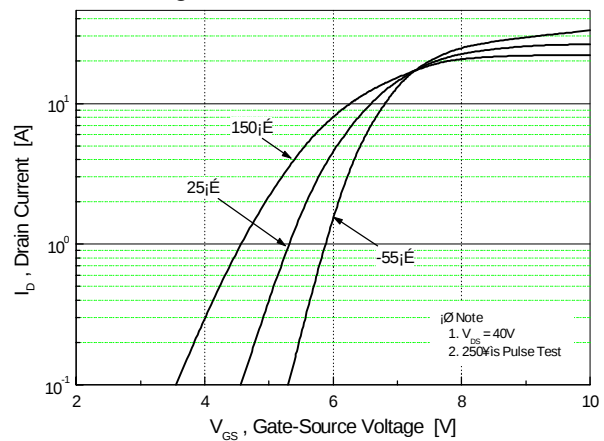


Fig 3. On-Resistance vs. Drain Current

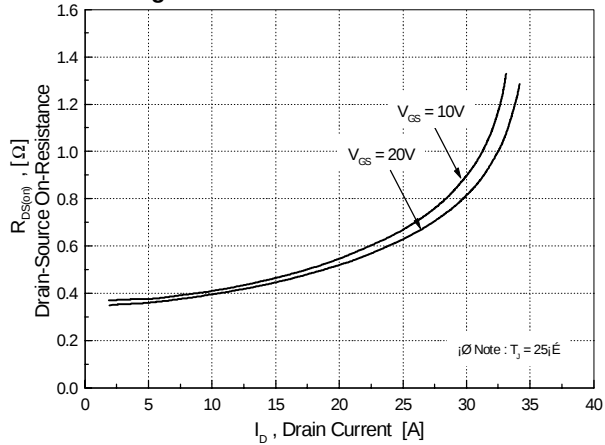


Fig 4. Source-Drain Diode Forward Voltage

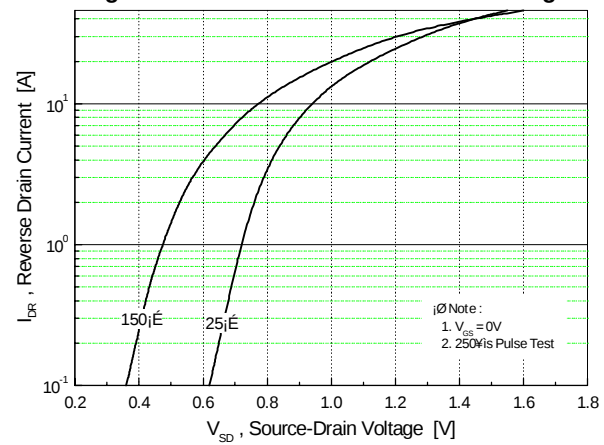


Fig 5. Capacitance vs. Drain-Source Voltage

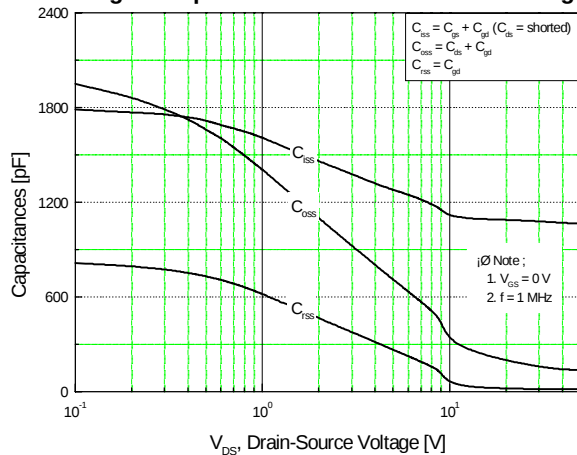


Fig 6. Gate Charge vs. Gate-Source Voltage

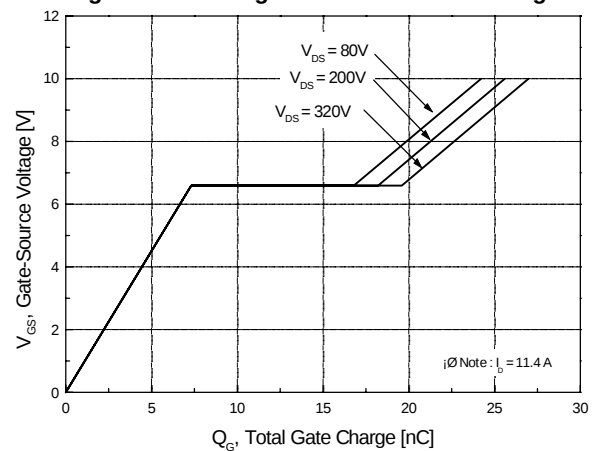


Fig 7. Breakdown Voltage vs. Temperature

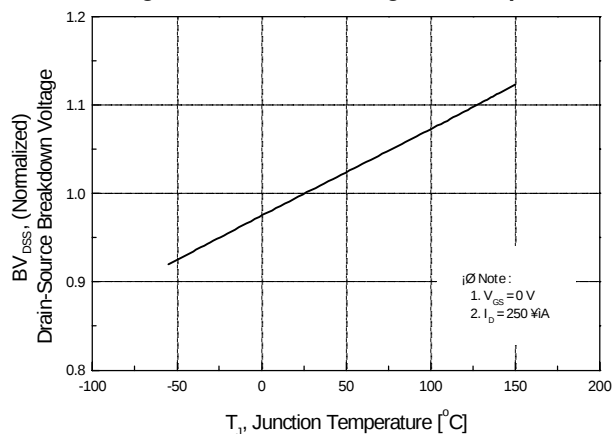


Fig 8. On-Resistance vs. Temperature

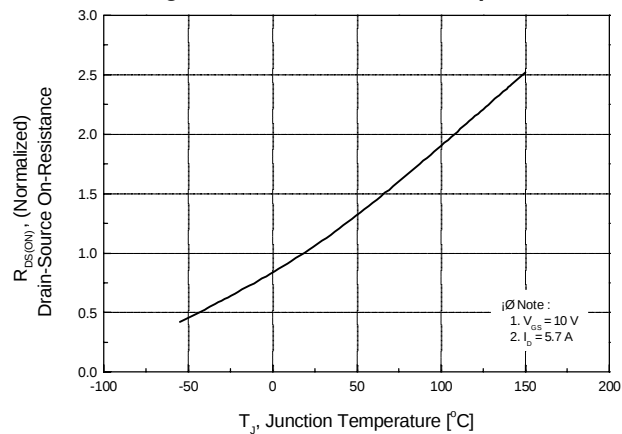


Fig 9. Max. Safe Operating Area

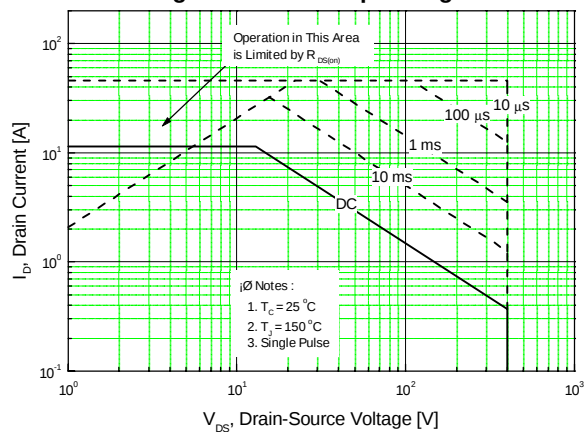


Fig 10. Max. Drain Current vs. Case Temperature

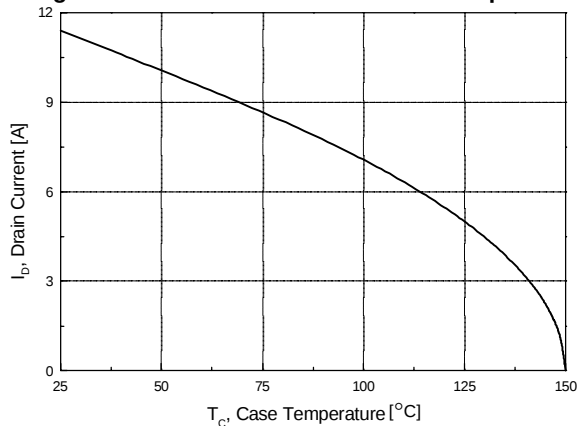


Fig 11. Thermal Response

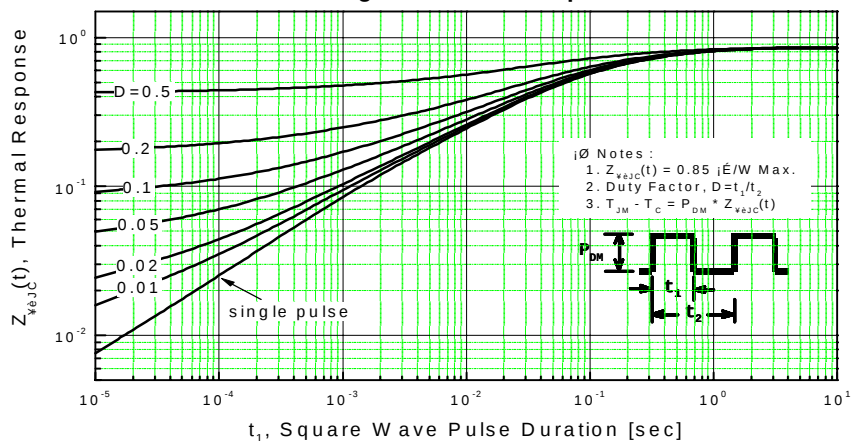


Fig 12. Gate Charge Test Circuit & Waveform

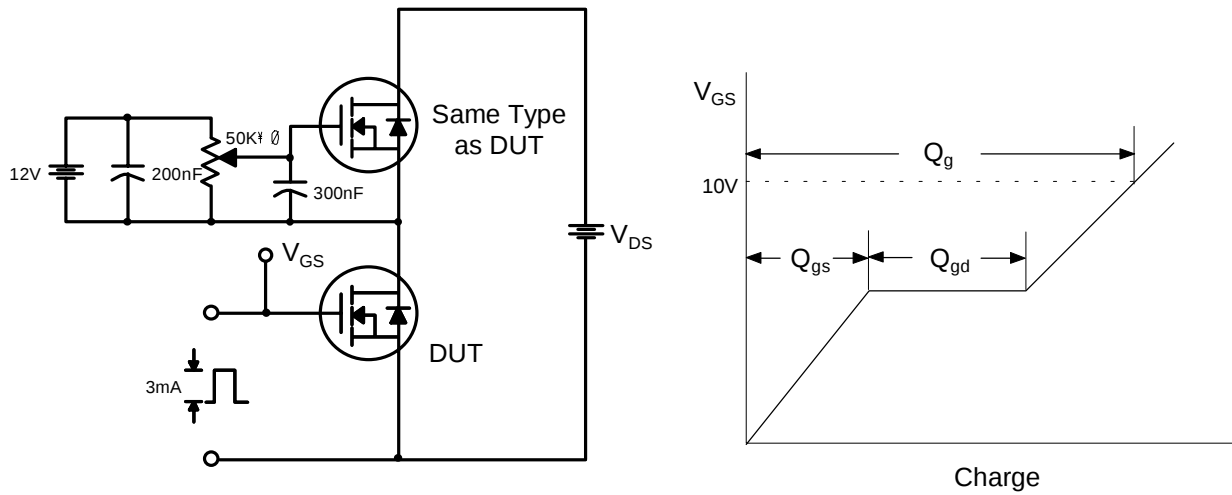


Fig 13. Resistive Switching Test Circuit & Waveforms

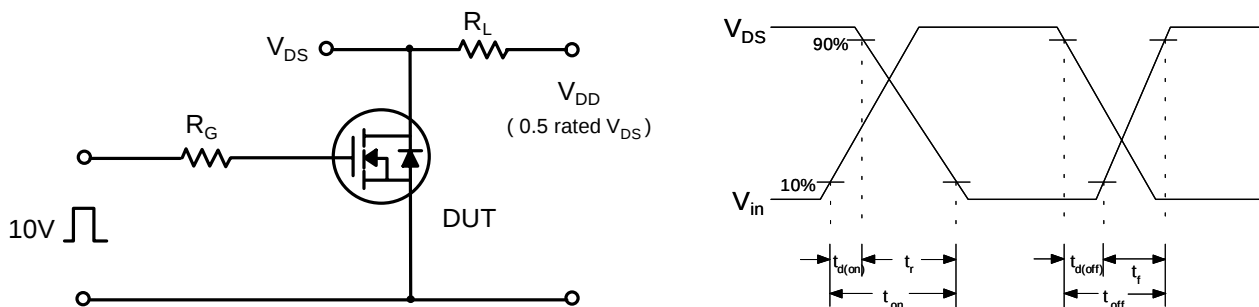


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

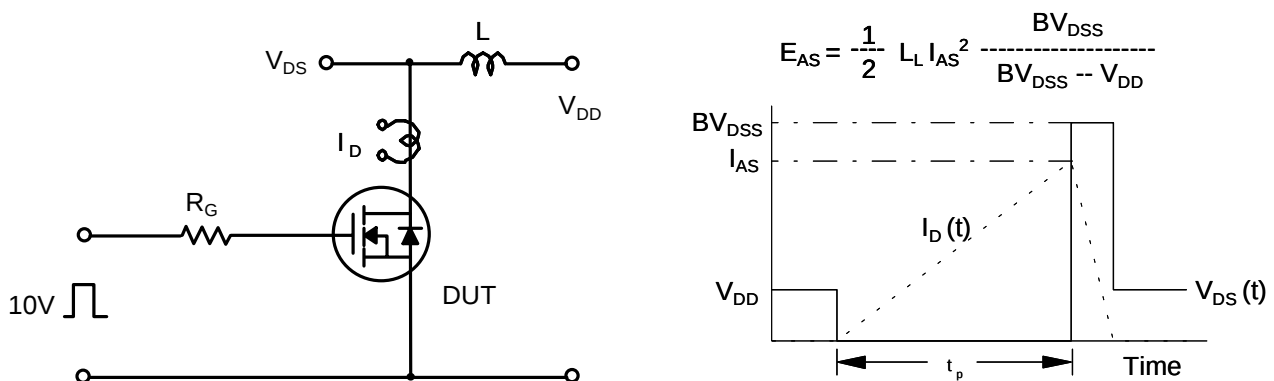
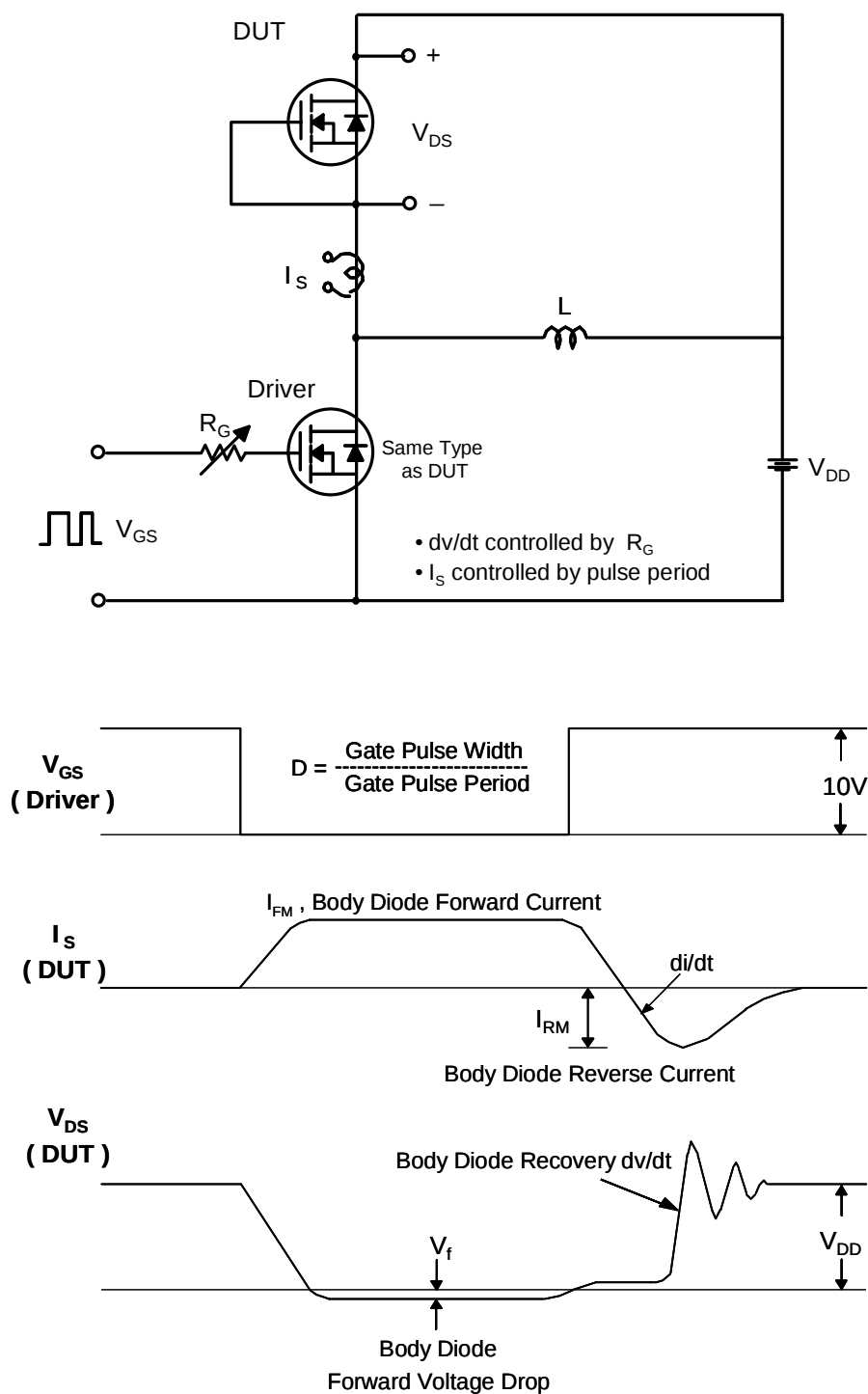
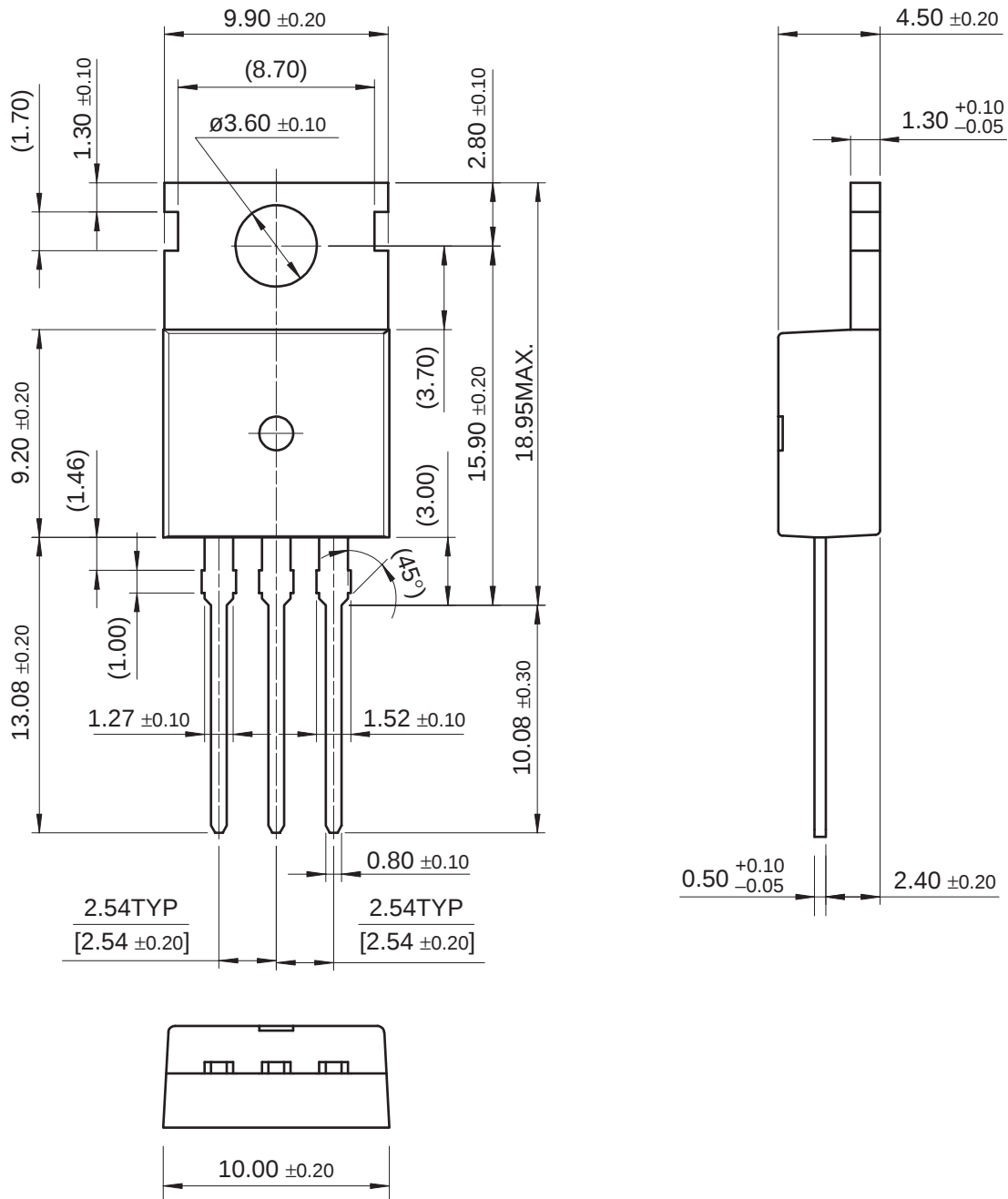


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



TO-220 Package Dimensions

TO-220 (FS PKG CODE AE)



Dimensions in Millimeters

September 1999, Rev B

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