TSF16N60MR

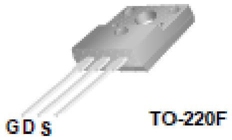
600V N-Channel MOSFET

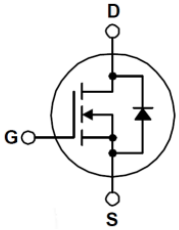
General Description

This Power MOSFET is produced using Truesemi's advanced 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 high efficiency switched mode power supplies, active power factor correction based on half bridge topology.

Features

- 16A,600V,Max.$R_{DS(on)}$=0.47 Ω @ V_{GS}=10V
- Low gate charge(typical 50nC)
- High ruggedness
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability





Absolute Maximum Ratings

T_C=25℃ unless otherwise specified

Symbol	Parameter		Value	Units
V_{DSS}	Drain-Source Voltage		600	V
V_{GS}	Gate-Source Voltage		±30	V
I_D	Drain Current	T_C = 25℃	16*	A
		T_C = 100℃	10.1*	A
I_{DM}	Pulsed Drain Current		64*	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		698	mJ
E_{AR}	Repetitive Avalanche Energy (Note 1)		4	mJ
I_{AR}	Repetitive avalanche current (Note 1)		16	A
P_D	Power Dissipation (T_C = 25℃)		40	W
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	℃

* Drain current limited by maximum junction temperature.

Thermal Resistance Characteristics

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance,Junction-to-Case	3.13	℃/W
$R_{\theta JA}$	Thermal Resistance,Junction-to-Ambient	62.5	℃/W

Electrical Characteristics T_C=25 ℃ unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, I_D = 250 uA	3	--	5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 8A	--	0.38	0.47	Ω
g_{fs}	Forward transfer conductance(note 3)	V_{DS} = 10 V, I_D = 8A (Note 3)	--	11	--	S

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 uA	600	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V	--	--	1	uA
		V_{DS} = 600 V, T_C =125℃	--	--	100	
I_{GSSF}	Gate-Body Leakage Current,Forward	V_{GS} = 30 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current,Reverse	V_{GS} =- 30 V, V_{DS} = 0 V	--	--	-100	nA

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	3325	--	pF
C_{oss}	Output Capacitance		--	225	--	pF
C_{rss}	Reverse Transfer Capacitance		--	22	--	pF

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Time	V_{DS} = 300 V, I_D = 16A, R_G = 25 Ω (Note 3,4)	--	175	--	ns
t_r	Turn-On Rise Time		--	121	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	373	--	ns
t_f	Turn-Off Fall Time		--	64	--	ns
Q_g	Total Gate Charge	V_{DS} = 480 V, I_D = 16A, V_{GS} = 10 V (Note 3,4)	--	50	55	nC
Q_{gs}	Gate-Source Charge		--	20	--	nC
Q_{gd}	Gate-Drain Charge		--	10	--	nC

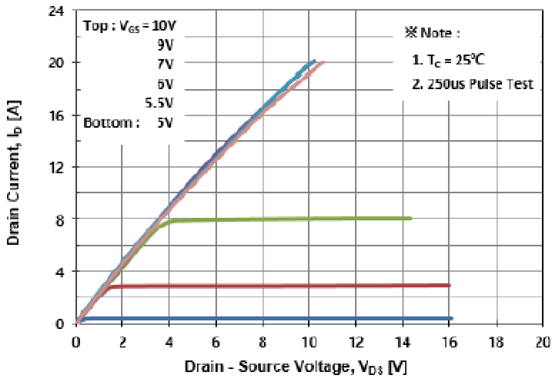
Source-Drain Diode Maximum Ratings and Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_S	Continuous Source-Drain Diode Forward Current		--	--	16	A
I_{SM}	Pulsed Source-Drain Diode Forward Current		--	--	64	
V_{SD}	Source-Drain Diode Forward Voltage	I_S = 16A, V_{GS} = 0 V	--	--	1.4	V
t_{rr}	Reverse Recovery Time	I_S =16A, V_{GS} = 0 V di_F/dt = 100 A/μs (Note 3,4)	--	484	--	ns
Q_{rr}	Reverse Recovery Charge		--	1.62	--	uC

Note:
1. Repeated rating: Pulse width limited by safe operating area
2. L=5mH, IAS=16A, VDD=50V, RG=25Ω, Starting TJ=25℃
3. Pulse test: Pulse width≤300us, Duty cycle≤2%
4. Essentially independent of operating temperature typical characteristics

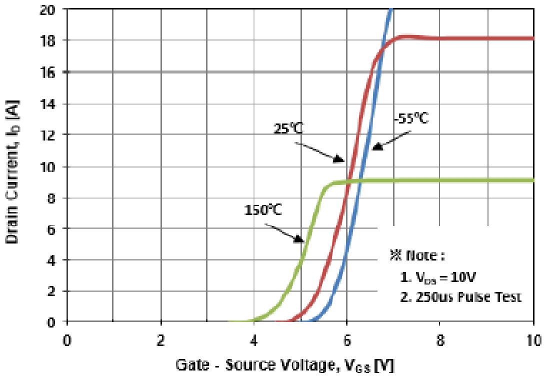
Typical Characteristics

Fig. 1 Typical Output Characteristics



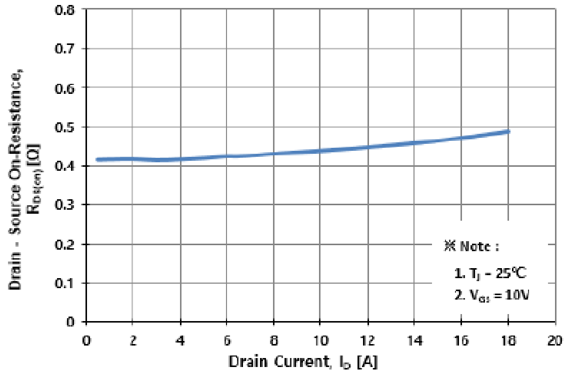
※ Note :
1. T_C = 25℃
2. 250us Pulse Test

Fig. 2 Typical Output Characteristics



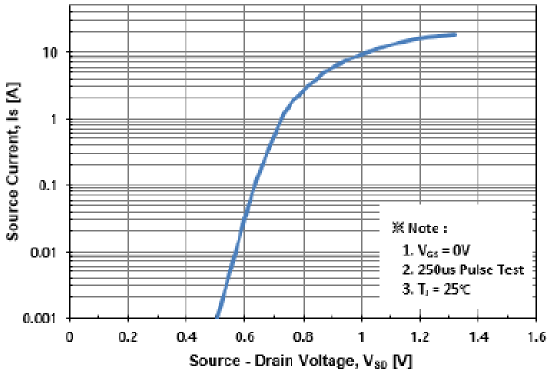
※ Note :
1. V_{DS} = 10V
2. 250us Pulse Test

Fig.3 On-Resistance Variation with Drain Current and Gate Voltage



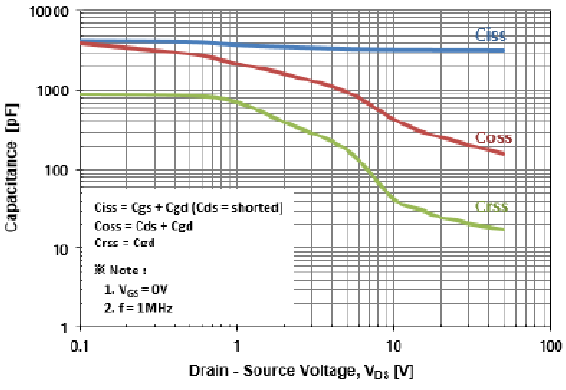
※ Note :
1. T_J = 25℃
2. V_{GS} = 10V

Fig. 4 Body Diode Forward Voltage Variation with Source Current



※ Note :
1. V_{GS} = 0V
2. 250us Pulse Test
3. T_J = 25℃

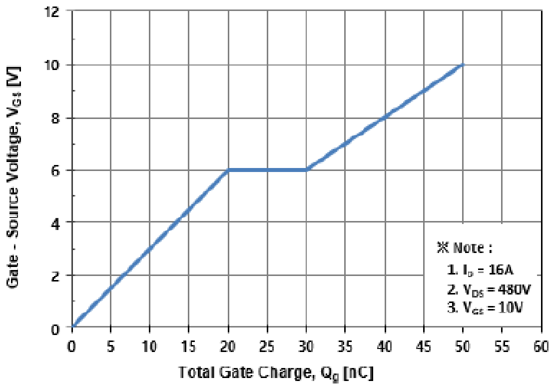
Fig. 5 Typical Capacitance Characteristics



Ciss = Cgs + Cgd (Cds = shorted)
Coss = Cds + Cgd
Crss = Cgd

※ Note :
1. V_{GS} = 0V
2. f = 1MHz

Fig. 6 Typical Total Gate Charge Characteristics



※ Note :
1. I_D = 16A
2. V_{DS} = 480V
3. V_{GS} = 10V

Typical Characteristics

Fig. 7 Breakdown Voltage Variation vs. Temperature

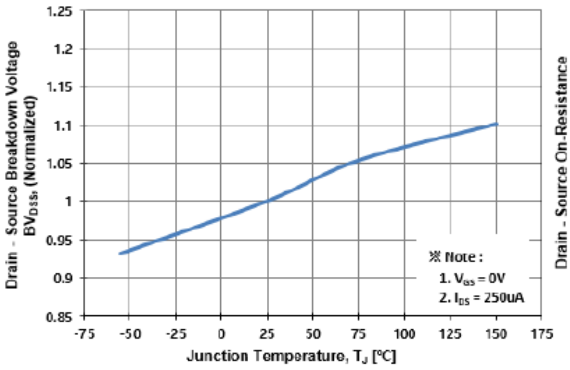


Fig. 8 On-Resistance Variation vs. Temperature

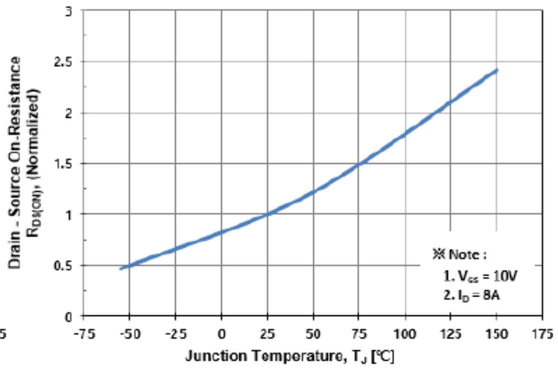


Fig. 9 Maximum Drain Current vs. Case Temperature

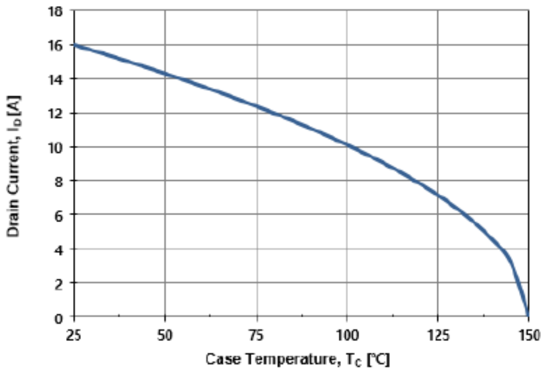


Fig. 10 Maximum Safe Operating Area

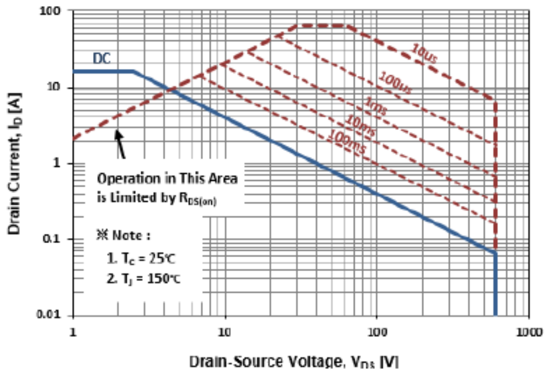


Fig. 11 Transient Thermal Impedance

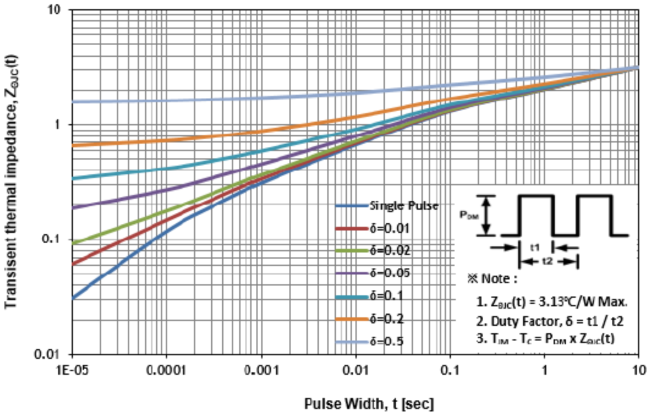


Fig 12. Gate Charge Test Circuit & Waveform

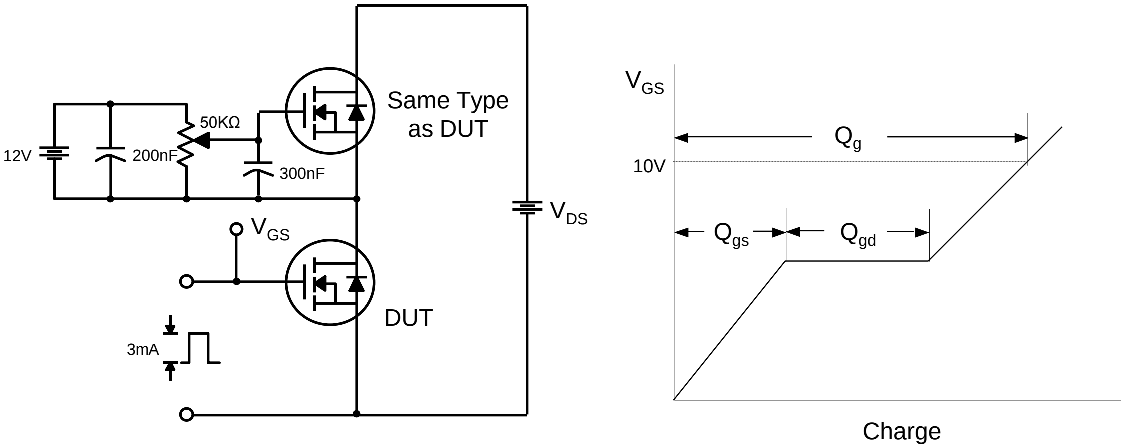


Fig 13. Resistive Switching Test Circuit & Waveforms

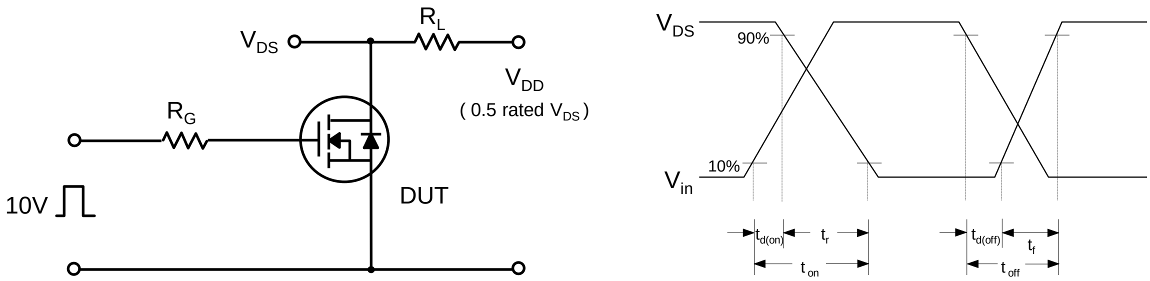


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} L_L I_{AS}^2$$

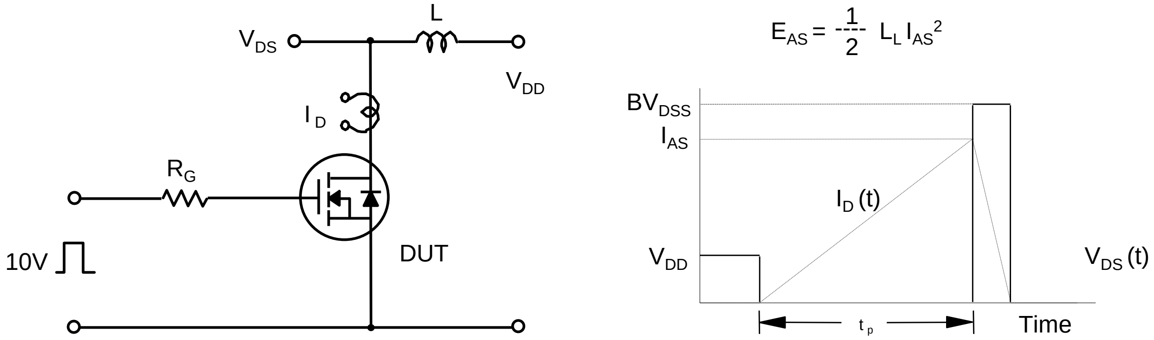
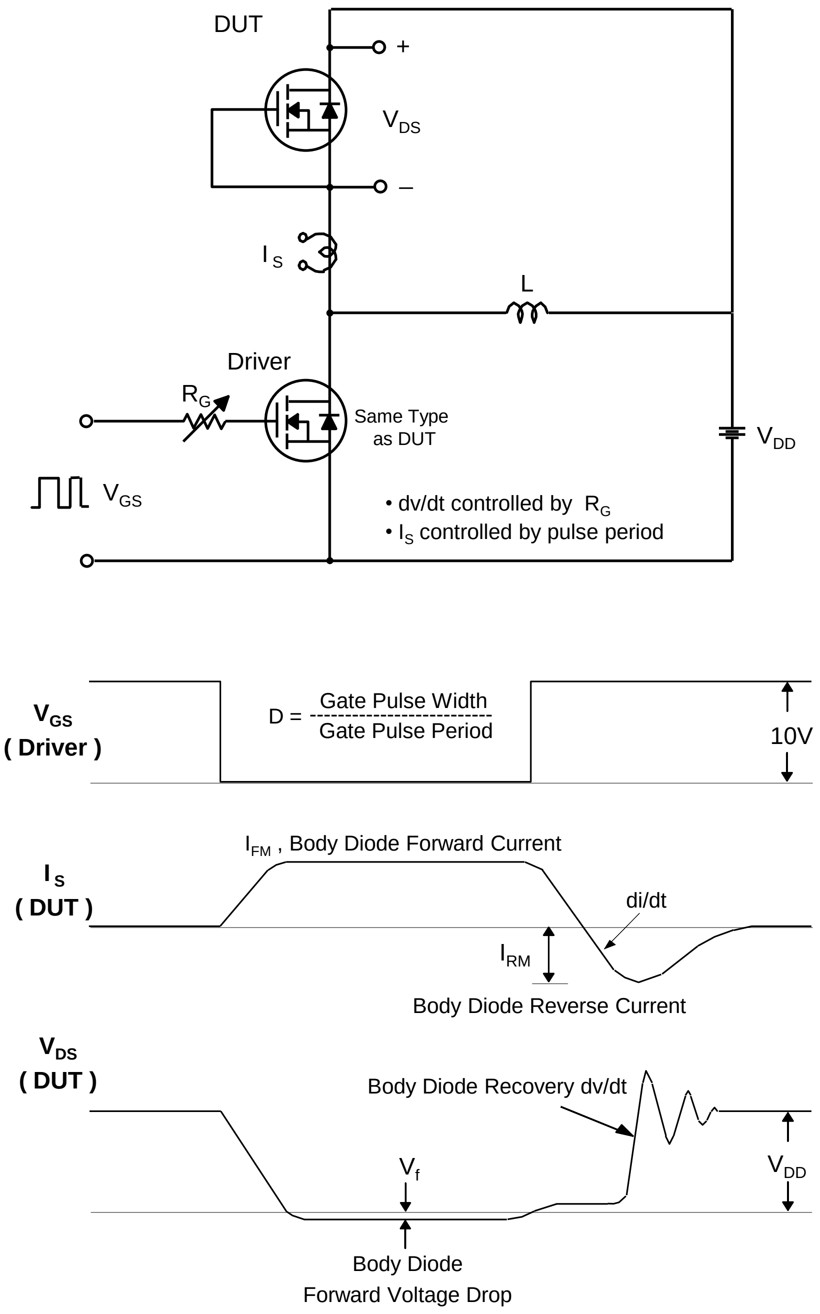
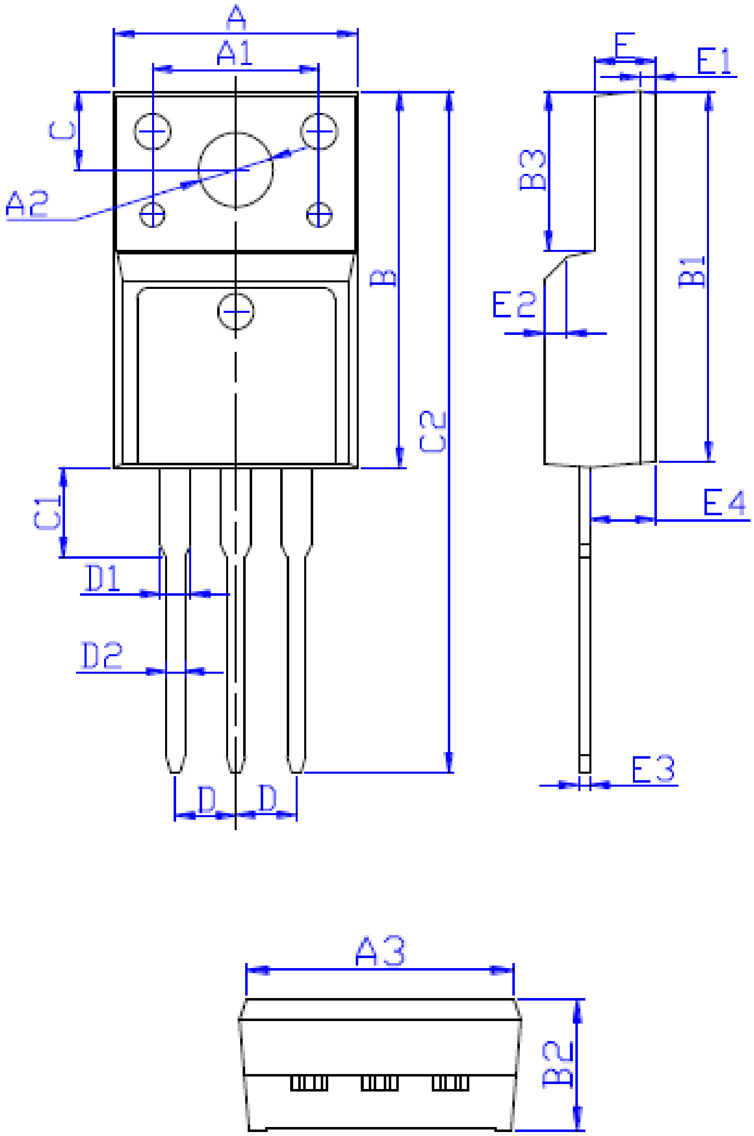


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimension

TO-220F



DIM	MILLIMETERS
A	10.16±0.30
A1	7.00±0.20
A2	3.12±0.20
A3	9.70±0.30
B	15.90±0.50
B1	15.60±0.50
B2	4.70±0.30
B3	6.70±0.30
C	3.30±0.25
C1	3.25±0.30
C2	28.70±0.50
D	Typical 2.54
D1	1.47（MAX）
D2	0.80±0.20
E	2.55±0.25
E1	0.70±0.25
E2	1.0×45°
E3	0.50±0.20
E4	2.75±0.30