# 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.
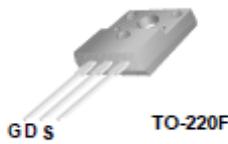
Features

- 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

GD S   TO-220F
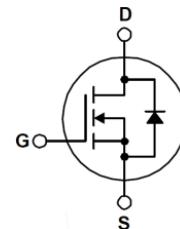
Absolute Maximum Ratings T_C=25℃ unless otherwise specified

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
$R_{θJC}$	Thermal Resistance,Junction-to-Case	3.13	℃/W
$R_{θJA}$	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}	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
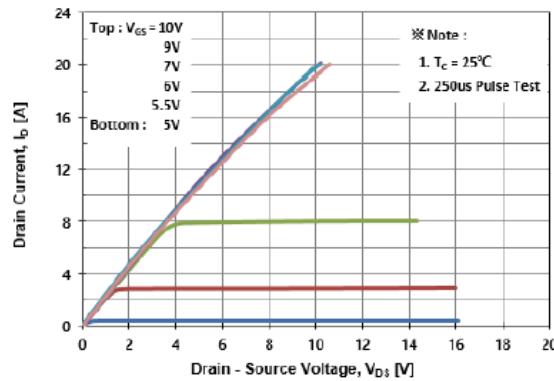

### Fig. 2 Typical Output Characteristics
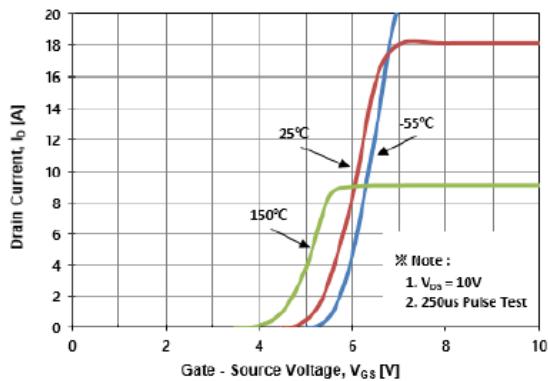
### Fig.3 On-Resistance Variation with Drain Current and Gate Voltage
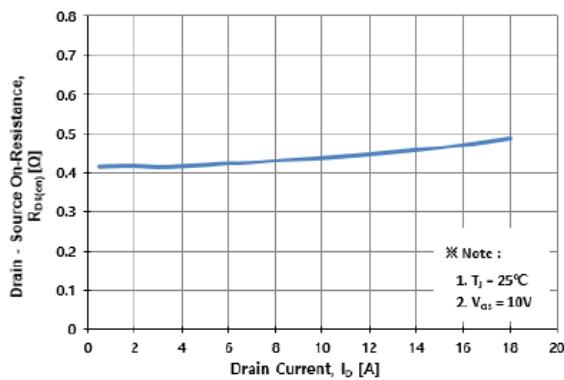
### Fig. 4 Body Diode Forward Voltage Variation with Source Current
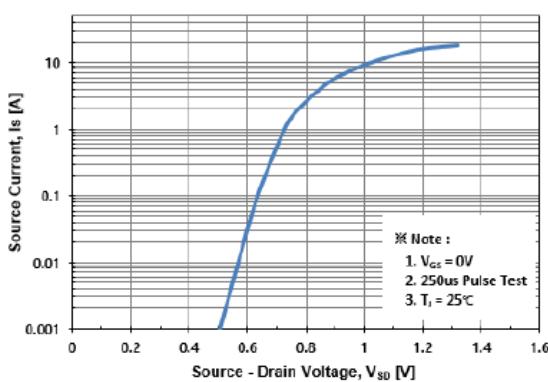
### Fig. 5 Typical Capacitance Characteristics
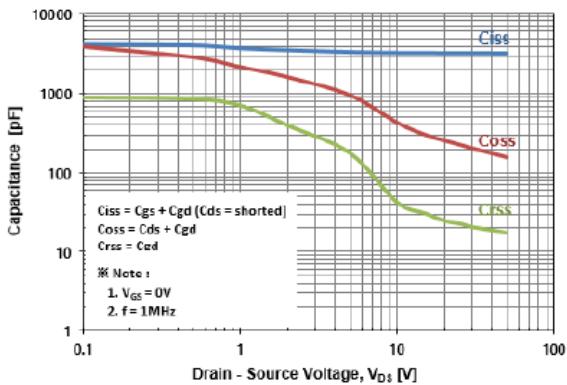
Fig. 6 Typical Total Gate Charge Characteristics
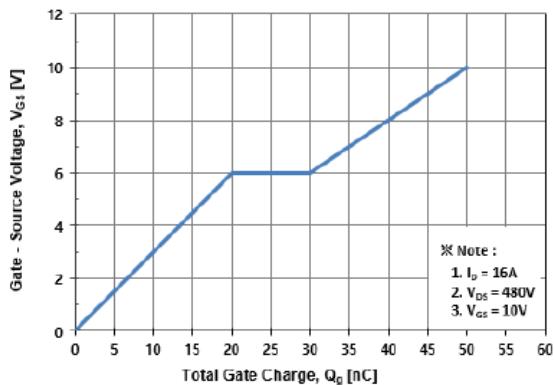
Typical Characteristics

Fig. 7 Breakdown Voltage Variation vs. Temperature

※ Note :
1. $V_{GS} = 0V$
2. $I_{DS} = 250uA$
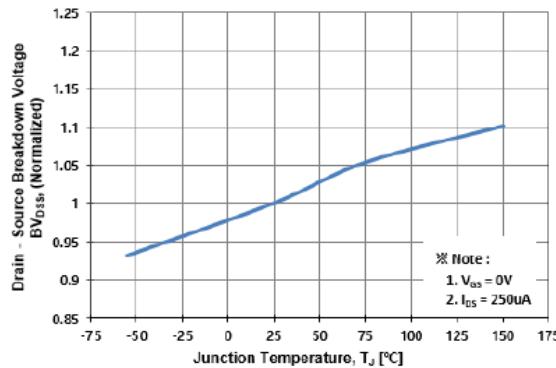
Fig. 8 On-Resistance Variation vs. Temperature

※ Note :
1. $V_{GS} = 10V$
2. $I_D = 8A$
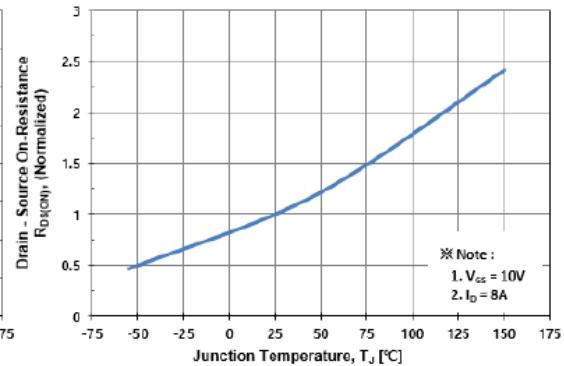
Fig. 9 Maximum Drain Current vs. Case Temperature
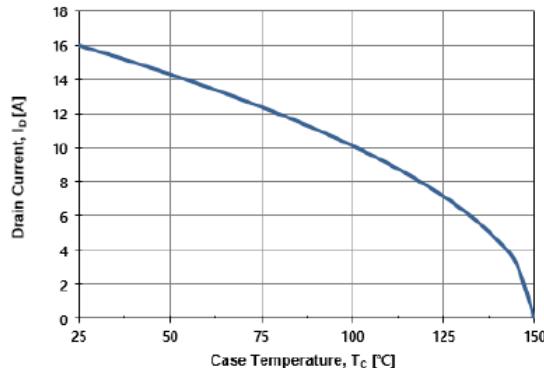
Fig. 10 Maximum Safe Operating Area

DC

Operation in This Area is Limited by $R_{DS(on)}$

※ Note :
1. $T_C = 25°C$
2. $T_J = 150°C$
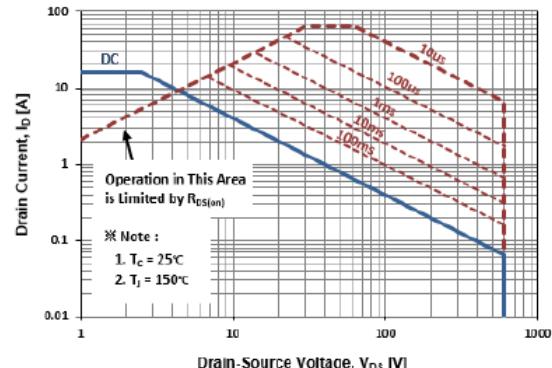
Fig. 11 Transient Thermal Impedance

Single Pulse
δ=0.01
δ=0.02
δ=0.05
δ=0.1
δ=0.2
δ=0.5

※ Note :
1. $Z_{θJC}(t) = 3.13°C/W$ Max.
2. Duty Factor, δ = t1 / t2
3. $T_{JM} - T_C = P_{DM} \times Z_{θJC}(t)$
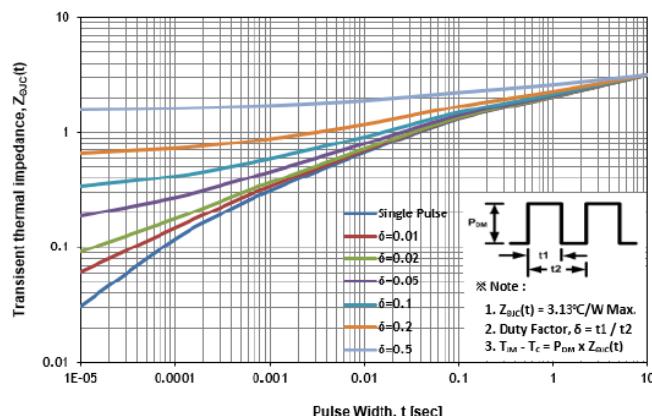
Fig 12. Gate Charge Test Circuit & Waveform
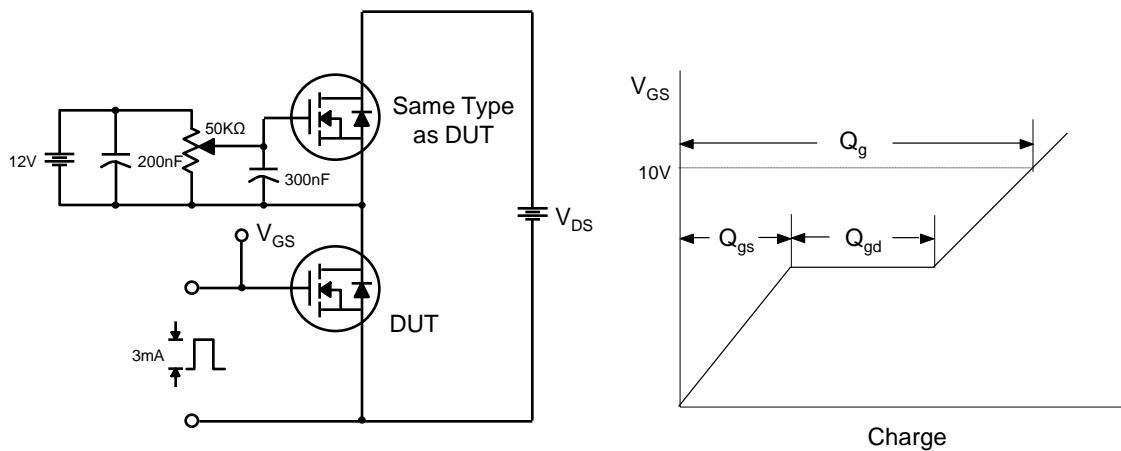
**Fig 13. Resistive Switching Test Circuit & Waveforms**

V_{DD}
(0.5 rated V_{DS})
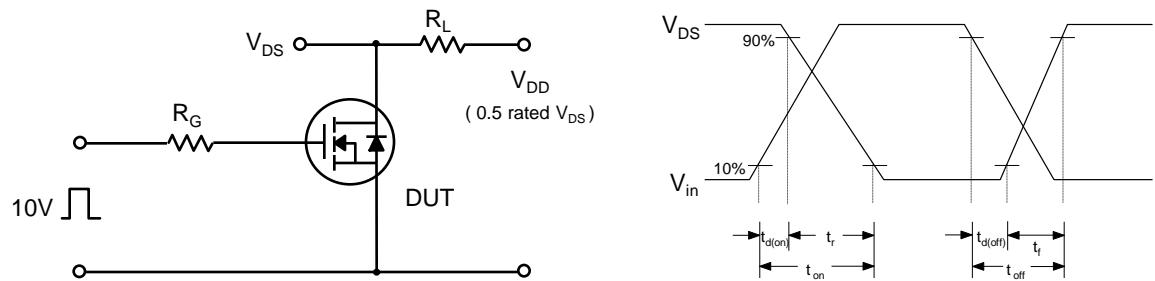
Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} \ L_L I_{AS}^2$$
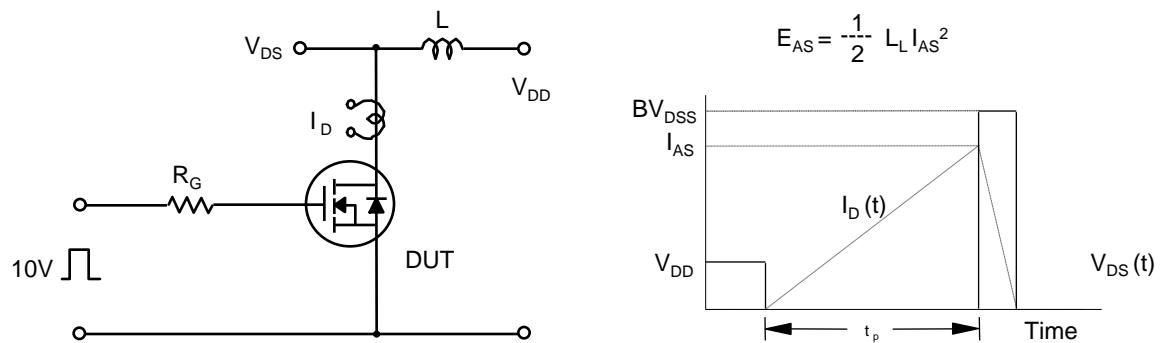
**Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms**
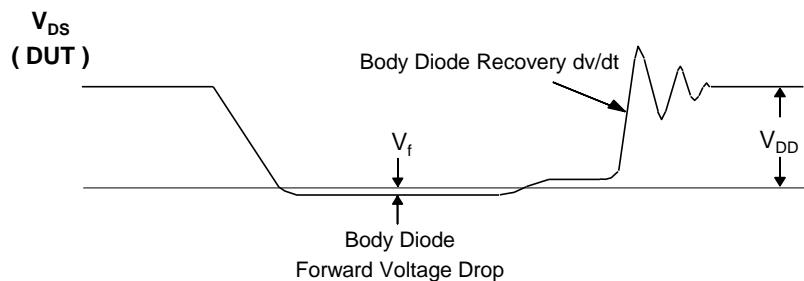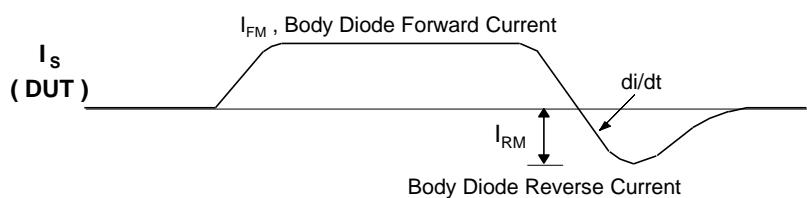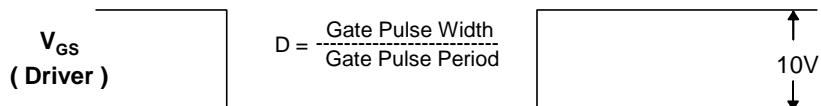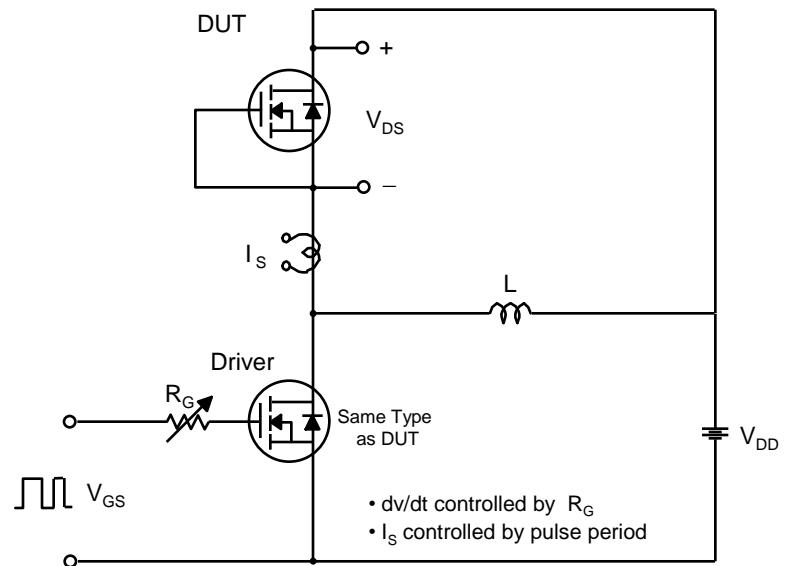
Package Dimension

TO-220F
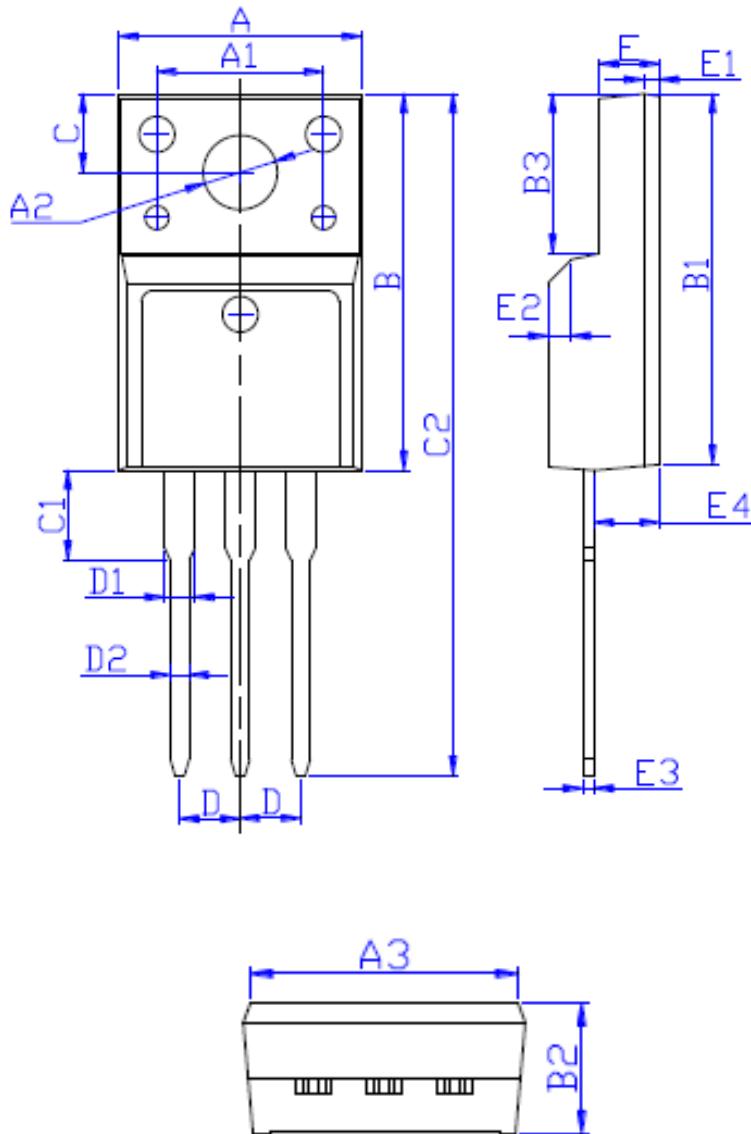
DIM	MILLIMETERS
A	10.16±0.30
A1	7.00±0.20
A2	3.12±0.20
A3	9.70±0.30
B	15.90±0.50
B1	15.60±0.50
B2	4.70±0.30
B3	6.70±0.30
C	3.30±0.25
C1	3.25±0.30
C2	28.70±0.50
D	Typical 2.54
D1	1.47 (MAX)
D2	0.80±0.20
E	2.55±0.25
E1	0.70±0.25
E2	1.0×45°
E3	0.50±0.20
E4	2.75±0.30

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