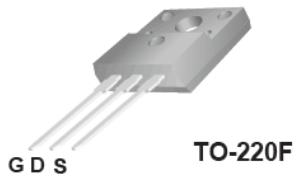


# TSF60R150WT

## 600V 22A N-Channel SJ-MOSFET

### General Description

Truesemi SJ-FET is new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance. This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. SJ-FET is suitable for various AC/DC power conversion in switching mode operation for higher efficiency.



### Features

- 650V @T<sub>J</sub> = 150 °C
- Max. RDS(on) = 0.15Ω
- Ultra Low gate charge (typ. Q<sub>g</sub> = 41nC)
- 100% avalanche tested



### Absolute Maximum Ratings T<sub>C</sub>=25°C unless otherwise specified

Symbol	Parameter	Value	Unit
V <sub>DSS</sub>	Drain-Source Voltage	600	V
I <sub>D</sub>	Drain Current -Continuous (T <sub>C</sub> = 25°C)	22.0*	A
	-Continuous (T <sub>C</sub> = 100°C)	13.9*	
I <sub>DM</sub>	Drain Current – Pulsed (Note 1)	60*	A
V <sub>GSS</sub>	Gate-Source voltage	±30	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	180	mJ
P <sub>D</sub>	Power Dissipation (T <sub>C</sub> = 25°C)	34.5	W
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	260	°C

\* Drain current limited by maximum junction temperature.

### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	--	3.6	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient	--	62.5	°C/W

# Electrical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A,$	600	--	--	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 600V, V_{GS} = 0V$ $T_J = 25^\circ\text{C}$	--	--	10	$\mu A$
		$V_{DS} = 480V, V_{GS} = 0V$ $T_J = 125^\circ\text{C}$	--	--	100	$\mu A$
$I_{GSS}$	Gate-Body Leakage Current,	$V_{GS} = \pm 30V, V_{DS} = 0V$	--	--	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 11A$	--	0.13	0.15	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10V, I_D = 11A$	--	18.8	--	S
<b>Dynamic Characteristics</b>						
$C_{ISS}$	Input Capacitance	$V_{DS} = 50V, V_{GS} = 0V,$ $f = 1.0\text{MHz}$	--	1600	2100	pF
$C_{OSS}$	Output Capacitance		--	225	295	pF
$C_{RSS}$	Reverse Transfer Capacitance		--	14	18.5	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 300V, I_D = 22A$ $R_G = 25\Omega$	--	48	104	ns
$t_r$	Turn-On Rise Time		--	108	220	ns
$t_{d(off)}$	Turn-Off Delay Time		--	176	360	ns
$t_f$	Turn-Off Fall Time		--	50	108	ns
$Q_g$	Total Gate Charge	$V_{DS} = 480V, I_D = 22A$ $V_{GS} = 10V$	--	41	53	nC
$Q_{gs}$	Gate-Source Charge		--	8	--	nC
$Q_{gd}$	Gate-Drain Charge		--	15	--	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current		--	--	22	A
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current		--	--	60	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0V, I_F = 22A$	--	--	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0V, I_F = 22A$ $di_F/dt = 100A/\mu s$	--	440	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	5	--	$\mu C$

**NOTES:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS}=6A, V_{DD}=50V, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
3. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$

# Typical Performance Characteristics

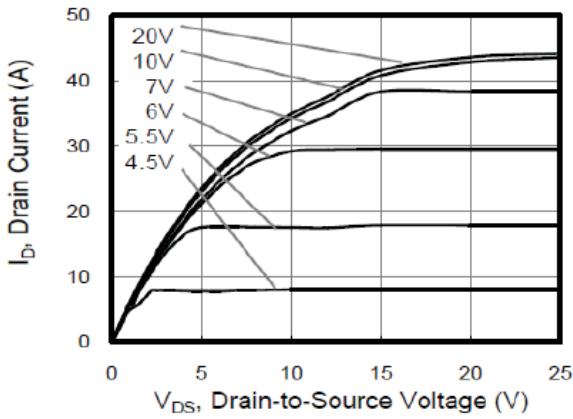


Figure 1. On Region Characteristics

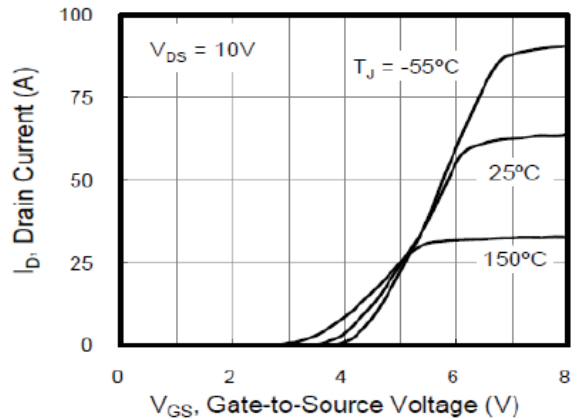


Figure 2. Transfer Characteristics

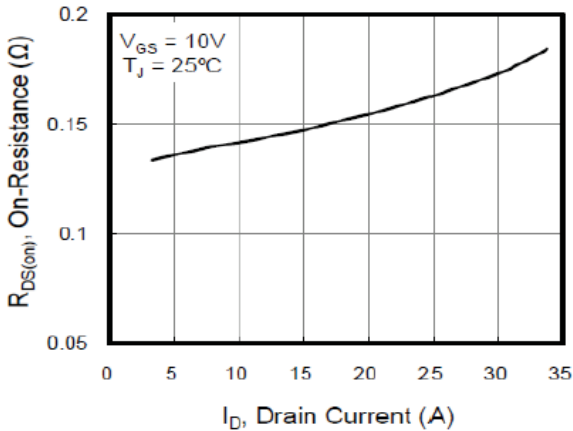


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

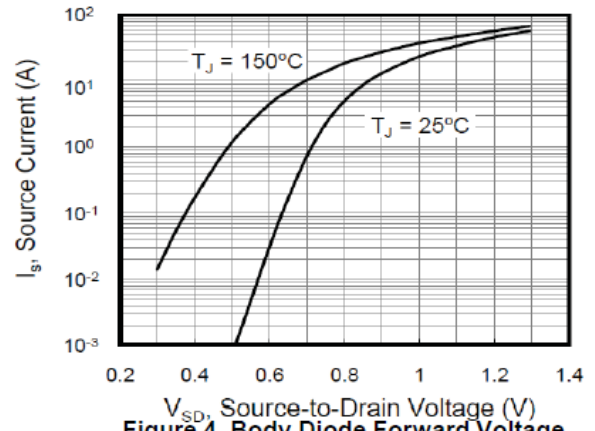


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

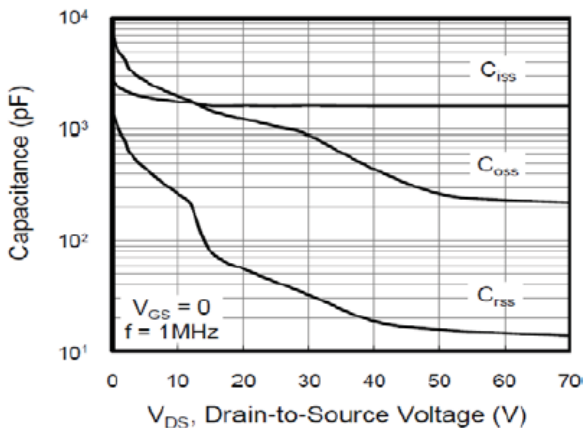


Figure 5. Capacitance Characteristics

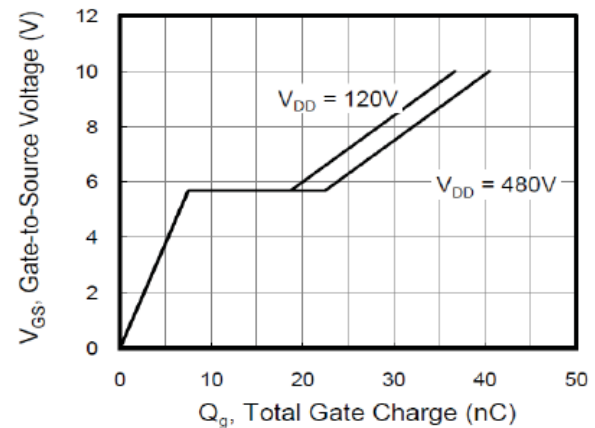
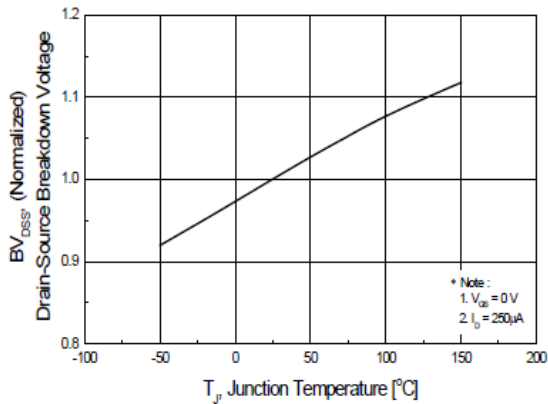
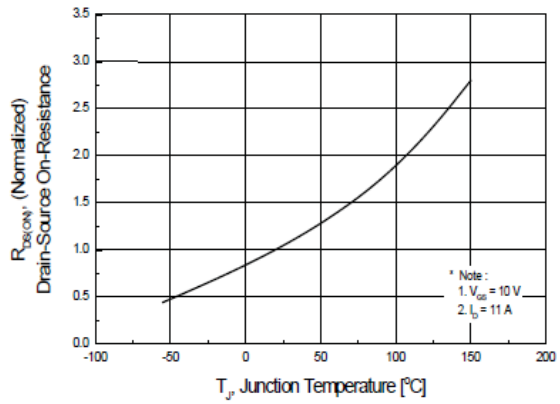


Figure 6. Gate Charge Characteristics

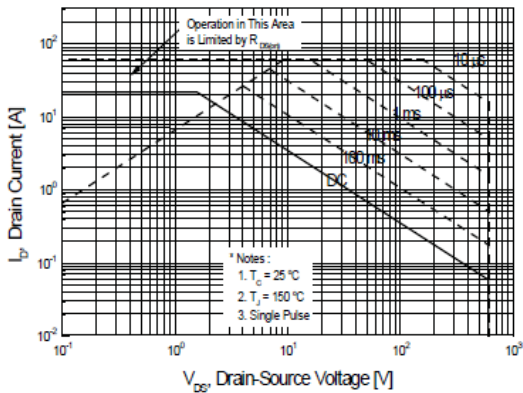
# Typical Performance Characteristics



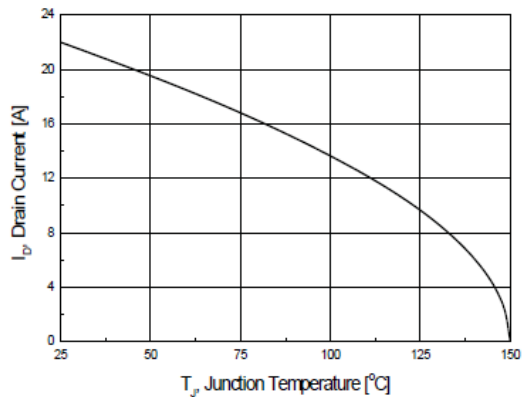
**Figure 7. Breakdown Voltage Variation vs Temperature**



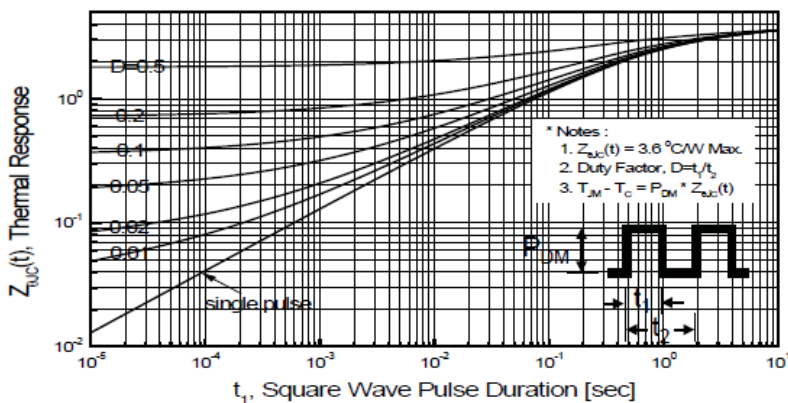
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9. Maximum Safe Operating Area**



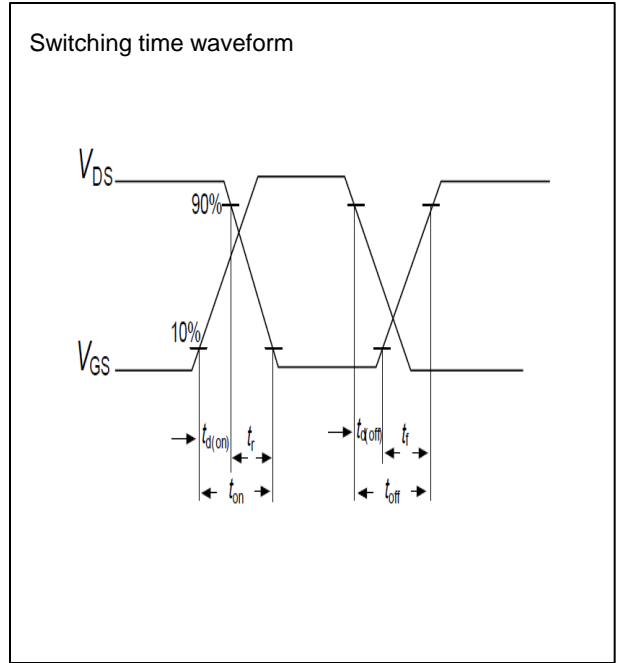
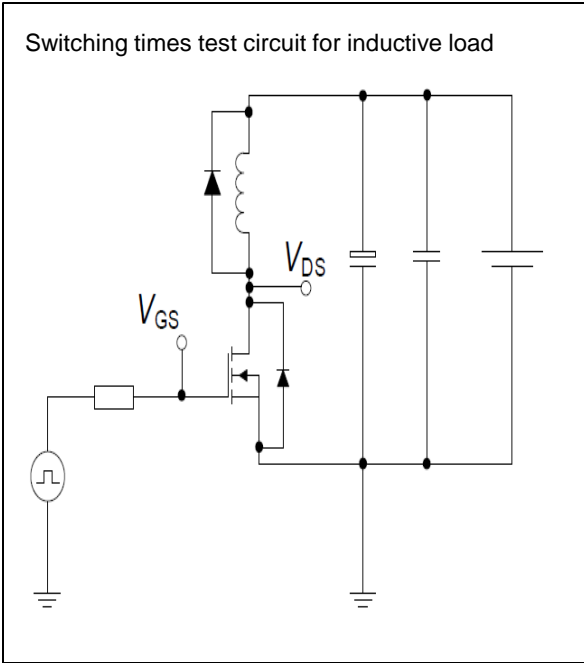
**Figure 10. Maximum Drain Current vs Case Temperature**



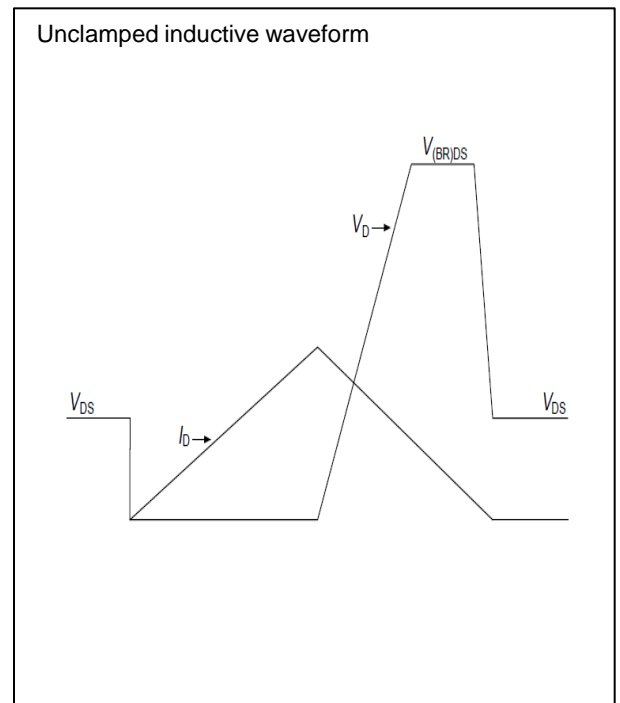
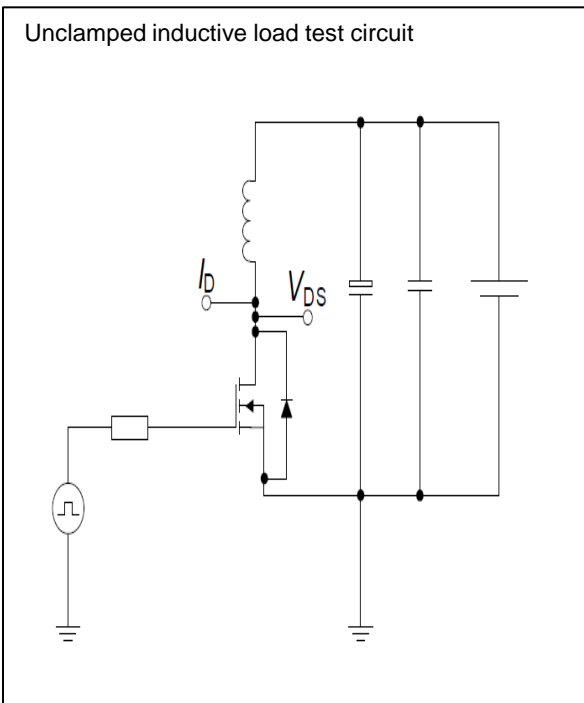
**Figure 11. Transient Thermal Response Curve**

# Test circuits

## Switching times test circuit and waveform for inductive load

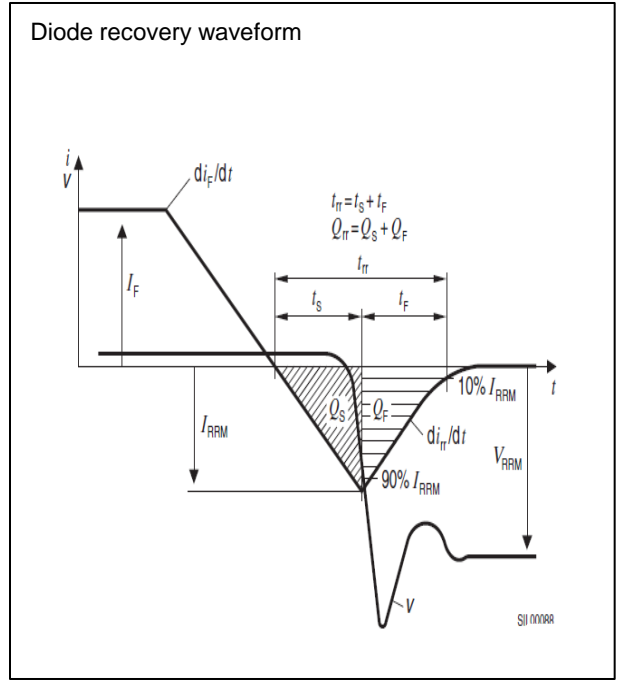
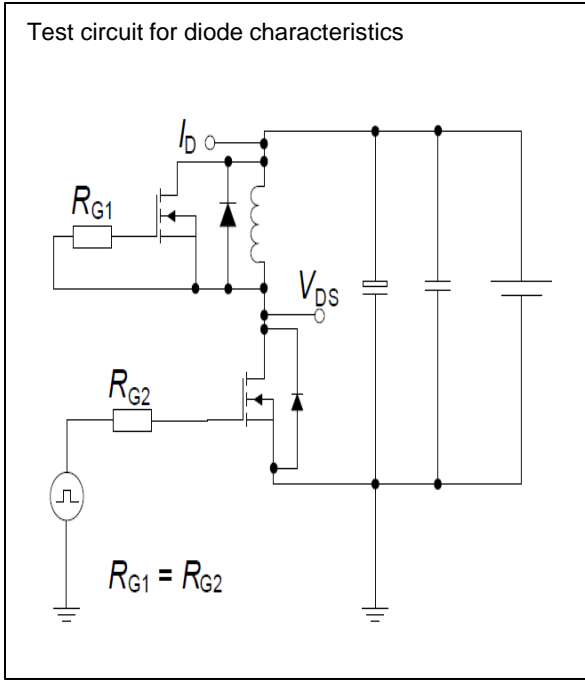


## Unclamped inductive load test circuit and waveform



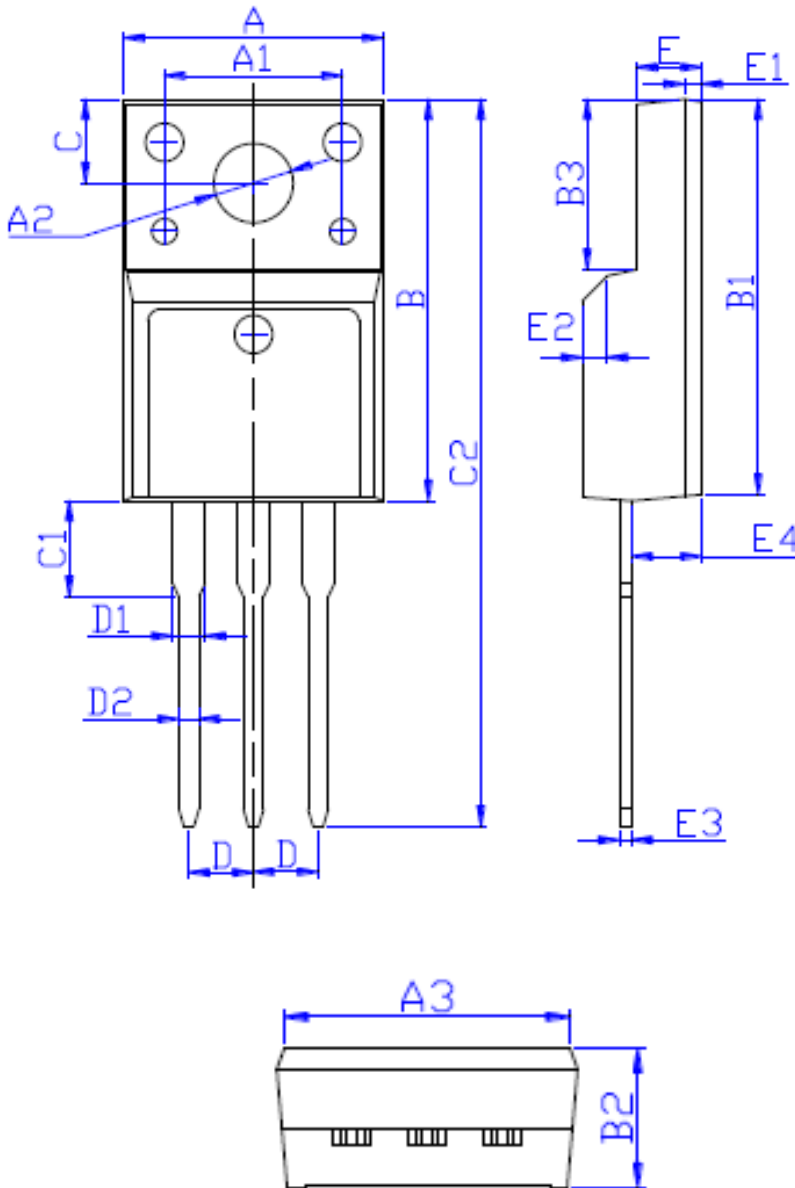
# Test circuits

## Test circuit and waveform for diode characteristics



# Package Outline TO-220F

TSF60R150WT 600V 22A N-Channel SJ-MOSFET



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