![Truesemi logo]

RoHS Compliant

TSF50R240S1
500V 18A 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

• 550V @TJ = 150 ℃
• Typ. RDS(on) = 0.21Ω
• Ultra Low gate charge (typ. Qg = 43nC)
• 100% avalanche tested

TO-220F

G D S

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-Source Voltage	500	V
I_D	Drain Current -Continuous (TC = 25℃) -Continuous (TC = 100℃)	18* 11*	A
I_{DM}	Drain Current – Pulsed (Note 1)	55*	A
V_{GSS}	Gate-Source voltage	±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	284	mJ
I_{AR}	Avalanche Current (Note 1)	2.4	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	0.43	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15	V/ns
P_D	Power Dissipation (TC = 25℃)	34	W
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	℃
T_L	Maximum Lead Temperature for Soldering Purpose,1/8" from Case for 5 Seconds	300	℃

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	3.9	℃/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	--	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	80	℃/W

Electrical Characteristics TC = 25℃ unless otherwise noted
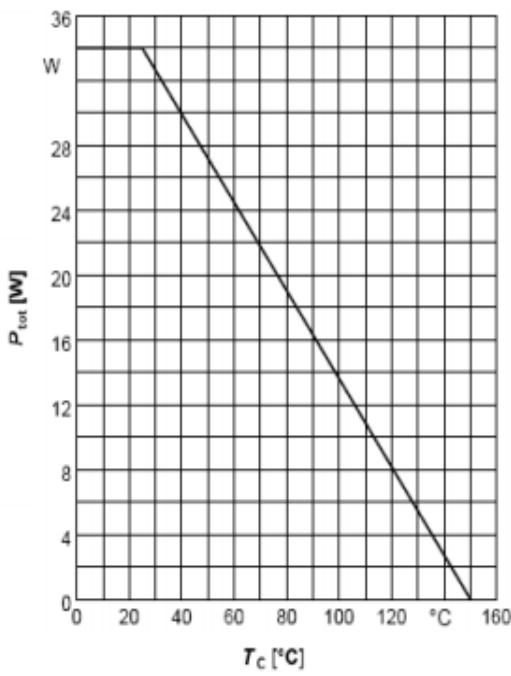
| Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0V$, $I_D = 250\mu A$, $T_J = 25℃$	500	--	--	V
		$V_{GS} = 0V$, $I_D = 250\mu A$, $T_J = 150℃$	--	550	--	V
$\Delta BV_{DSS} / \Delta_{TJ}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu A$, Referenced to 25℃	--	0.6	--	V/℃
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 500V$, $V_{GS} = 0V$ -$T_J = 150℃$	-- --	-- --	1 10	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30V$, $V_{DS} = 0V$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30V$, $V_{DS} = 0V$	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\mu A$	2.5	--	4.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10V$, $I_D = 9A$	--	0.21	0.24	Ω
g_{FS}	Forward Trans conductance	$V_{DS} = 40V$, $I_D = 18A$	--	16	--	S
R_g	Gate resietance	f = 1MHz ,open drain	--	3.5	--	Ω
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25V$, $V_{GS} = 0V$, f = 1.0MHz	--	800	--	pF
C_{oss}	Output Capacitance		--	180	--	pF
C_{rss}	Reverse Transfer Capacitance		--	8	--	pF
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 400V$, $I_D = 9A$ $R_G = 20Ω$(Note 4)	--	13	--	ns
t_r	Turn-On Rise Time		--	11	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	100	--	ns
t_f	Turn-Off Fall Time		--	12	--	ns
Q_g	Total Gate Charge	$V_{DS} = 480V$, $I_D = 9A$ $V_{GS} = 10V$ (Note 4)	--	43	--	nC
Q_{gs}	Gate-Source Charge		--	5	--	nC
Q_{gd}	Gate-Drain Charge		--	22	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	12	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	40	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0V$, $I_F = 9A$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0V$, $I_F = 9 A$ $di_F/dt = 100A/\mu s$	--	345	--	ns
Q_{rr}	Reverse Recovery Charge		--	4.5	--	μC
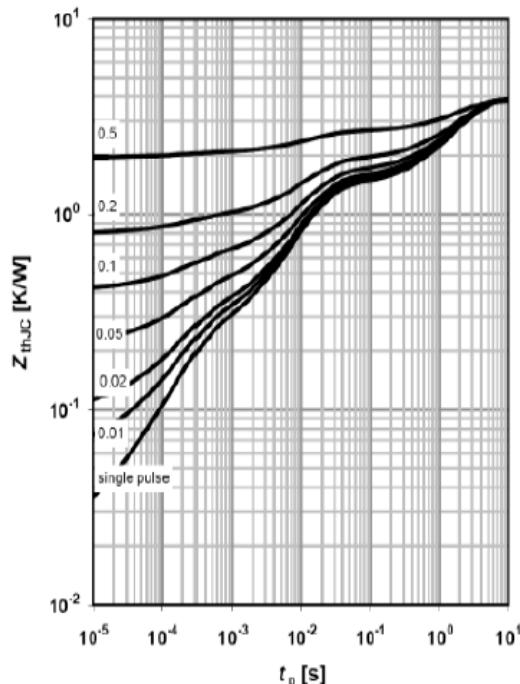
NOTES:
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS}=2.4A, V_{DD}=50V, Starting TJ=25 ℃
3. I_{SD}≤18A, di/dt ≤ 200A/us, V_{DD} ≤ BV_{DSS}, Starting TJ = 25 ℃
4. Essentially Independent of Operating Temperature Typical Characteristics

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Typical Performance Characteristics
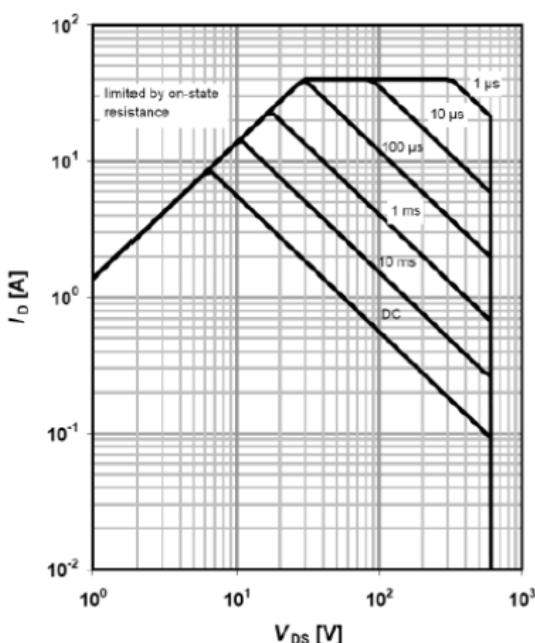
Power dissipation

Max. transient thermal impedance
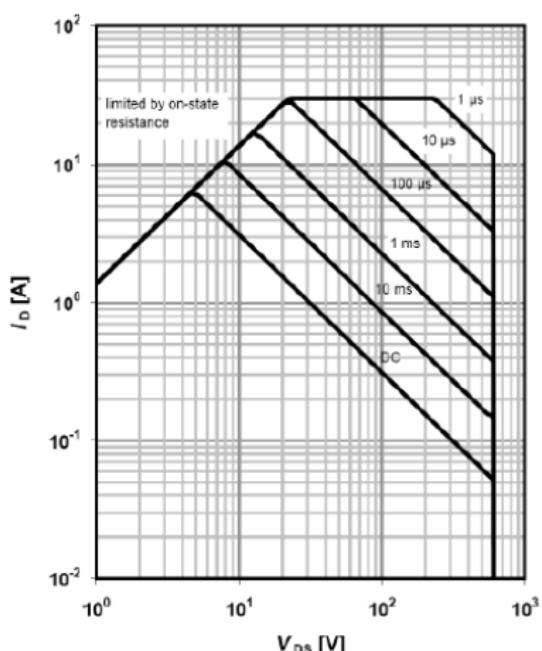
Safe operating area $TC=25\ ℃$

I_D=f(V_{DS}); T_C=25 ℃; V_{GS} > 7V;
D=0; parameter t_p
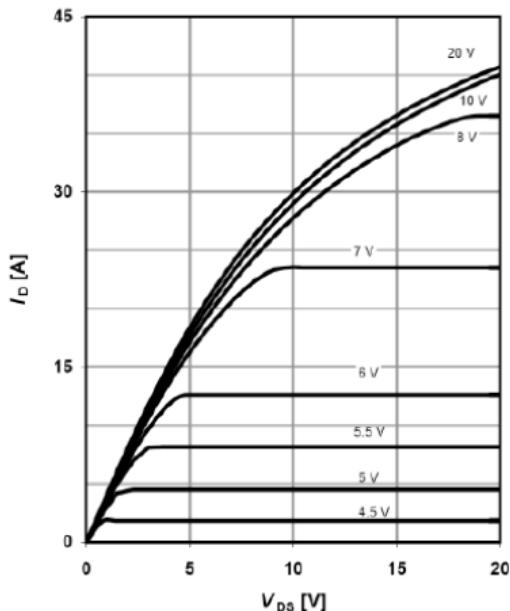
Safe operating area $TC=80℃$

I_D=f(V_{DS}); T_C=80 ℃; V_{GS} > 7V;
D=0; parameter t_p

3
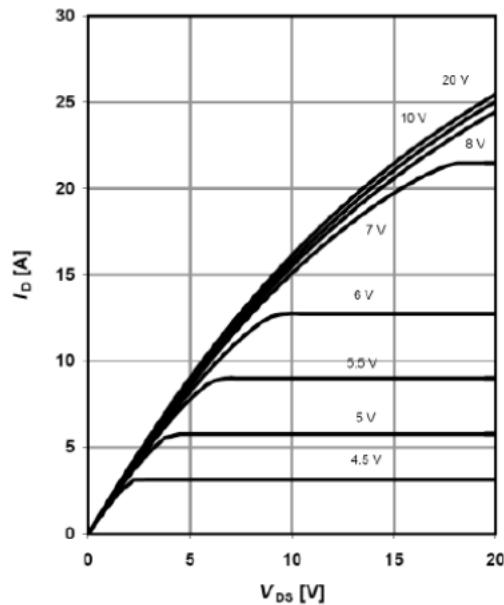
Typical Performance Characteristics

Typ. output characteristic
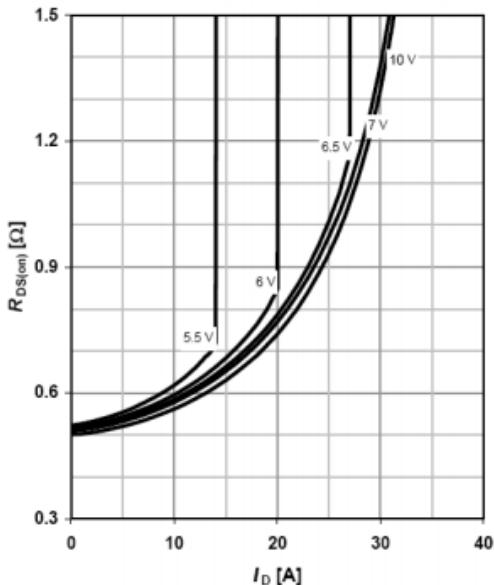
I_D=f(V_{DS}); T_j=25 ℃;
parameter t_p=10us,V_{GS}

Typ. output characteristic
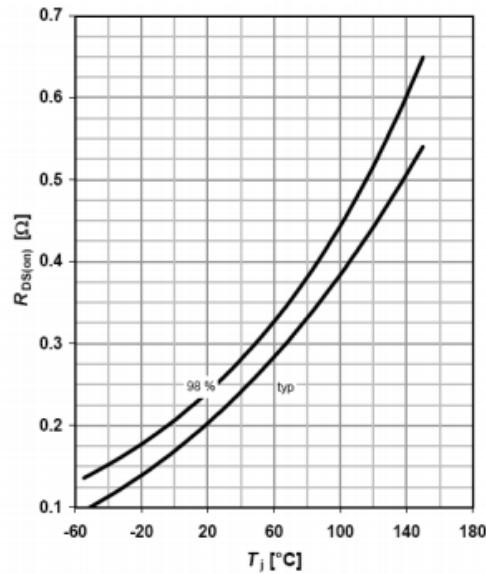
I_D=f(V_{DS}); T_j=125 ℃;
parameter t_p=10us,V_{GS}

Typ. Drain-Source on resistance

R_{Dson}=f(I_D); T_j=125 ℃; parameter V_{GS}
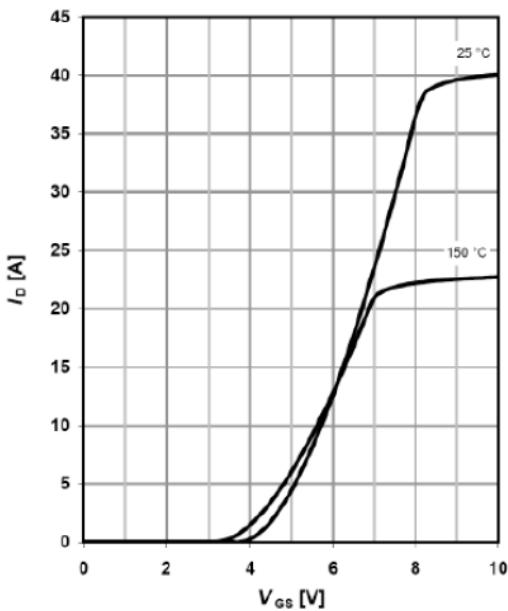
Typ. Drain-Source on resistance

R_{Dson}=f(T_j); T_j=125 ℃; parameter
I_D=6.5A V_{GS}=10V

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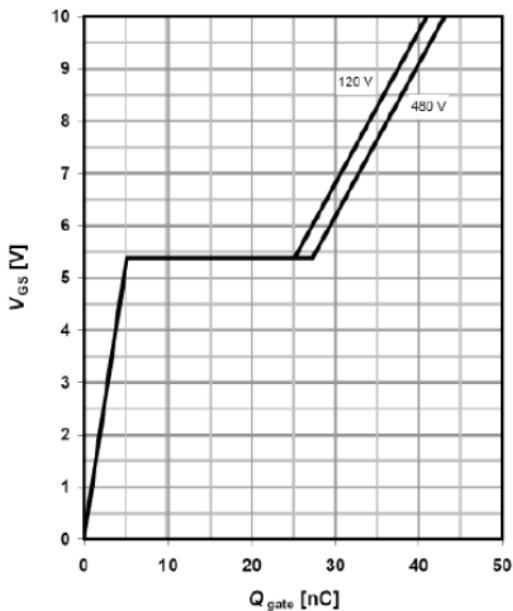
Typical Performance Characteristics

Typ. Transfer characteristic
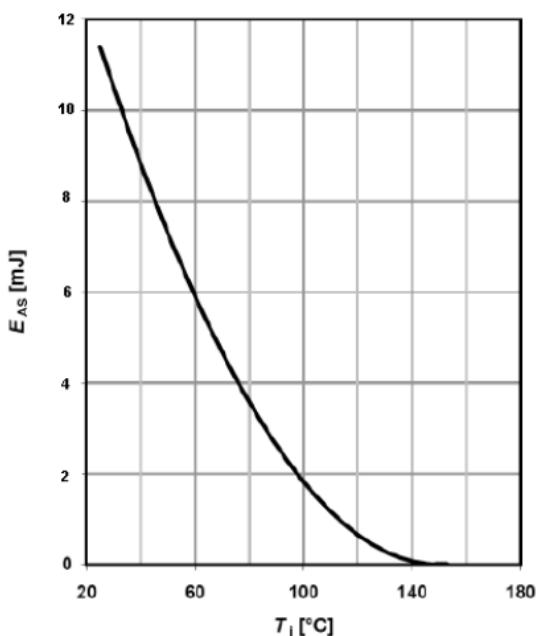
I_D=f(V_{DS}); V_{DS}>20V ;
parameter t_p=10us,

Typ. gate charge
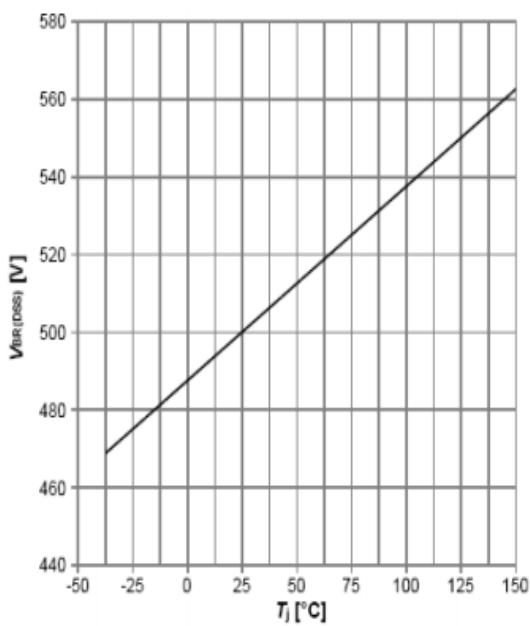
V_{GS}=f(Q_g), I_D=6.5 A pulsed

Avalanche energy
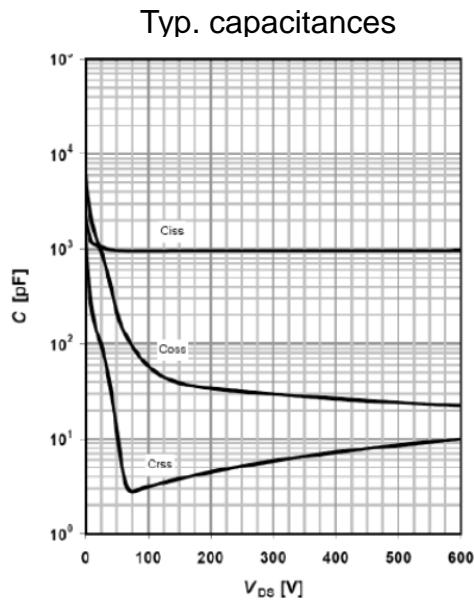
E_{AS}=f(T_j); I_D=2.4 A; V_{DD}=50 V

Drain-source breakdown voltage

$V_{BR(DSS)}$=f(T_j); I_D=1mA

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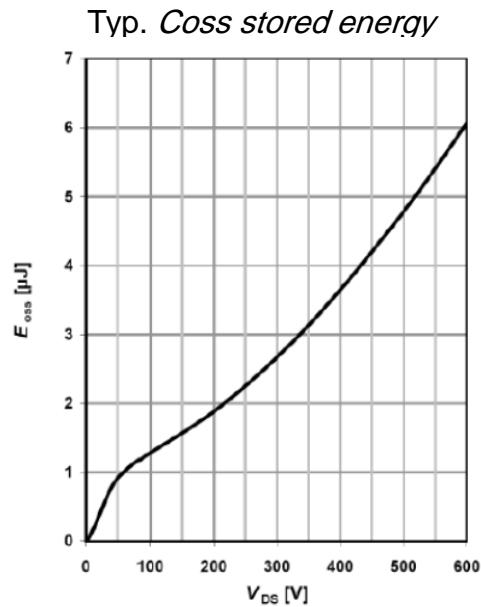
# Typical Performance Characteristics

Typ. capacitances

C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Typ. *Coss stored energy*
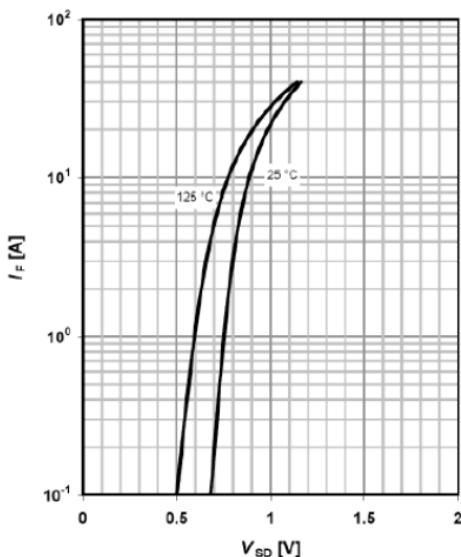

E_{OSS}=f(V_{DS})

Forward characteristics of reverse diode
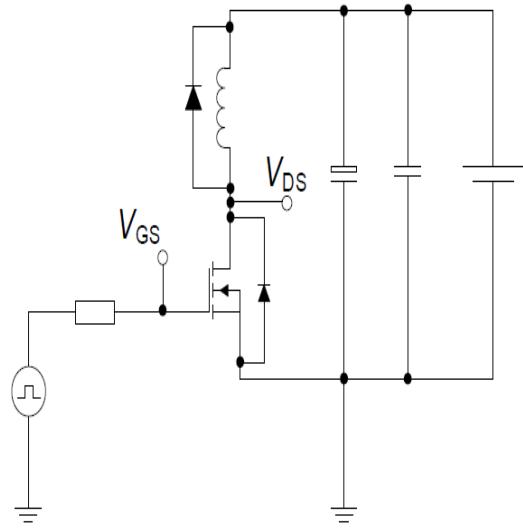
I_F=f(V_{SD}); parameter: T_j

6
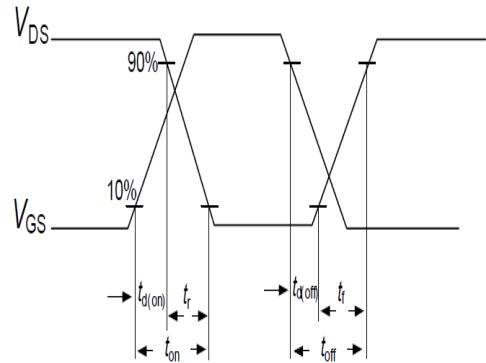
Test circuits

Switching times test circuit and waveform for inductive load

Switching times test circuit for inductive load

V_{DS}

V_{GS}
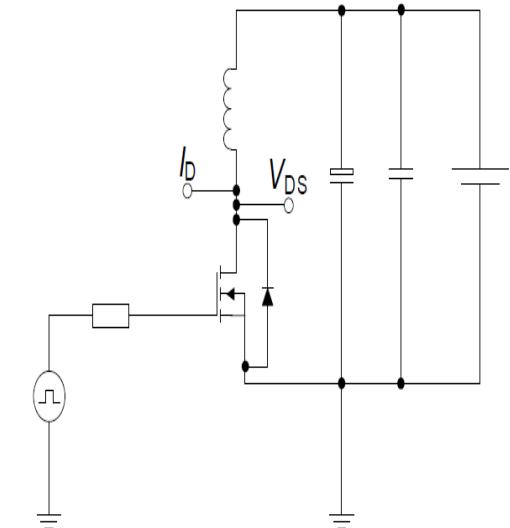
Switching time waveform

V_{DS}

90%

10%

V_{GS}

$t_{d(on)}$ t_r $t_{d(off)}$ t_f

t_{on} t_{off}
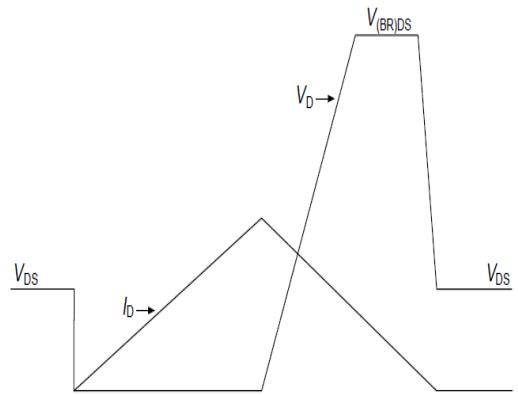
Unclamped inductive load test circuit and waveform

Unclamped inductive load test circuit

I_D V_{DS}
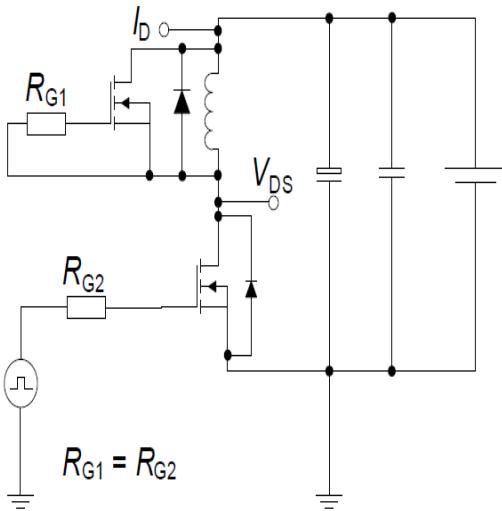
Unclamped inductive waveform

$V_{(BR)DS}$

V_D→

V_{DS}

I_D→

V_{DS}

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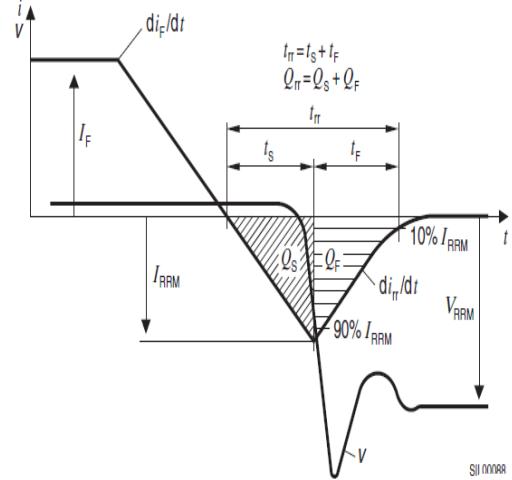
Test circuits

Test circuit and waveform for diode characteristics
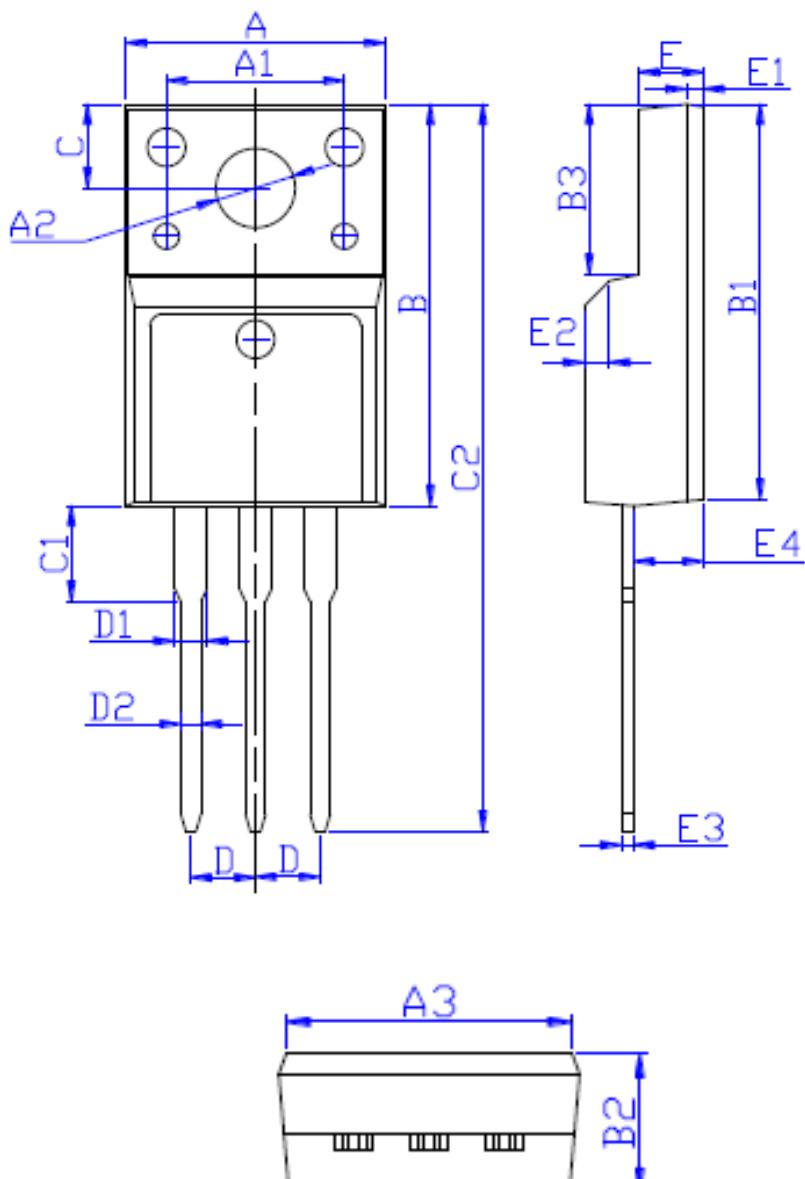
Test circuit for diode characteristics

$R_{G1} = R_{G2}$

Diode recovery waveform

$t_{rr} = t_S + t_F$
$Q_{rr} = Q_S + Q_F$

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TSF50R240S1 500V 18A 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

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