![Truesemi logo]

TSD60R380S1
600V 10.6A 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 @TJ = 150 ℃
• Typ. RDS(on) = 0.34Ω
• Ultra Low gate charge (typ. Qg = 38nC)
• 100% avalanche tested

Top View   **Bottom View**

TO-252
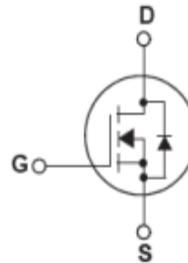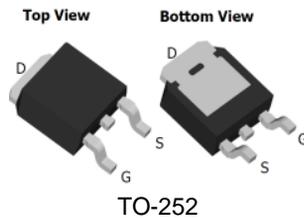
Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-Source Voltage	600	V
I_D	Drain Current -Continuous (TC = 25℃) -Continuous (TC = 100℃)	10.6 6.7	A
I_{DM}	Drain Current – Pulsed (Note 1)	32	A
V_{GSS}	Gate-Source voltage	±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	210	mJ
I_{AR}	Avalanche Current (Note 1)	1.8	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	0.32	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15	V/ns
P_D	Power Dissipation (TC = 25℃) -Derate above 25℃	83 1.5	W 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	1.5	℃/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62	℃/W

Electrical Characteristics TC = 25℃ unless otherwise noted

| Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0V$, $I_D = 250\mu A$, $T_J = 25℃$	600	--	--	V
		$V_{GS} = 0V$, $I_D = 250\mu A$, $T_J = 150℃$	--	650	--	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	$V_{DS} = 600V$, $V_{GS} = 0V$ -$T_J = 150℃$	--	-- 10	1 --	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	$V_{GS} = 10V$, $I_D = 5.5A$	--	0.34	0.38	Ω
g_{FS}	Forward Trans conductance	$V_{DS} = 40V$, $I_D = 5.5A$ (Note 4)	--	16	--	S
R_g	Gate resistance	f=1 MHz, open drain	--	3	--	Ω
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25V$, $V_{GS} = 0V$, f = 1.0MHz	--	680	--	pF
C_{oss}	Output Capacitance		--	240	--	pF
C_{rss}	Reverse Transfer Capacitance		--	7	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 400V$, $I_D = 5.5A$ $R_G = 20\Omega$(Note 4, 5)	--	15	--	ns
t_r	Turn-On Rise Time		--	10	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	110	--	ns
t_f	Turn-Off Fall Time		--	9	--	ns
Q_g	Total Gate Charge	$V_{DS} = 480V$, $I_D = 5.5A$ $V_{GS} = 10V$ (Note 4, 5)	--	38	--	nC
Q_{gs}	Gate-Source Charge		--	4	--	nC
Q_{gd}	Gate-Drain Charge		--	4.2	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	11	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	30	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0V$, $I_F = 5.5A$	--	0.9	1.5	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0V$, $I_F = 5.5A$ $di_F/dt = 100A/\mu s$ (Note 4)	--	270	--	ns
Q_{rr}	Reverse Recovery Charge		--	3.3	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS}=1.8A, V_{DD}=50V, Starting TJ=25 ℃
3. I_{SD}≤10.6A, di/dt ≤ 200A/us, V_{DD} ≤ BV_{DSS}, Starting TJ = 25 ℃
4. Pulse Test: Pulse width ≤ 300us, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

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# Typical Performance Characteristics

Power dissipation

$P_{tot} = f(T_C)$
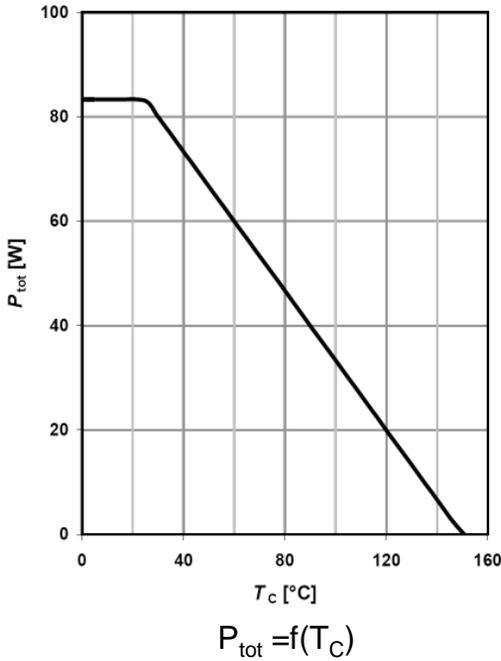
Max. transient thermal impedance

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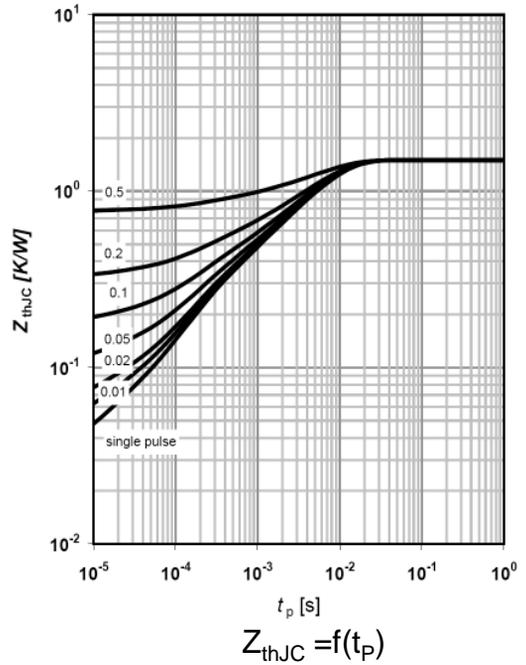
Safe operating area $T_C=25\ ℃$
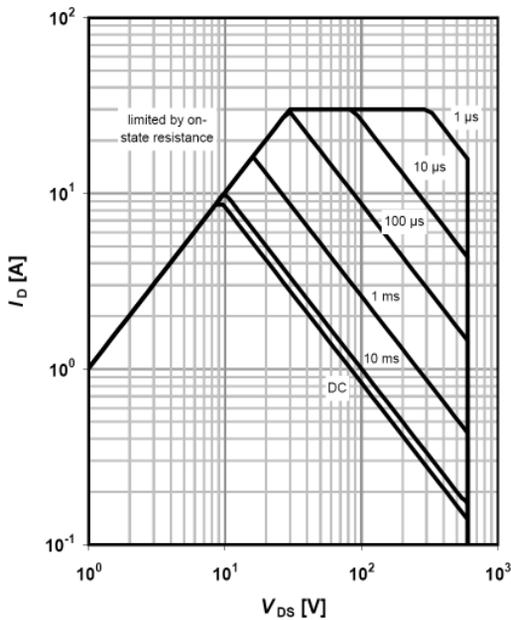
$I_D = f(V_{DS})$; $T_C = 25\ ℃$; $V_{GS} > 7V$; D=0; parameter t_p

Safe operating area $T_C=80\ ℃$

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

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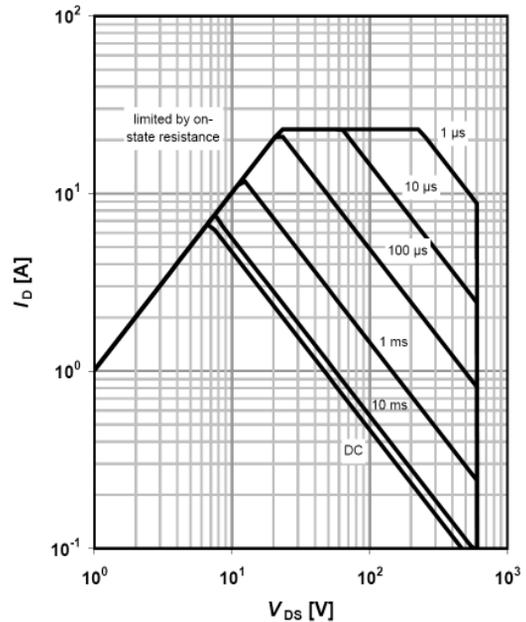
Typical Performance Characteristics

Typ. output
characteristics $T_j=25\ ℃$
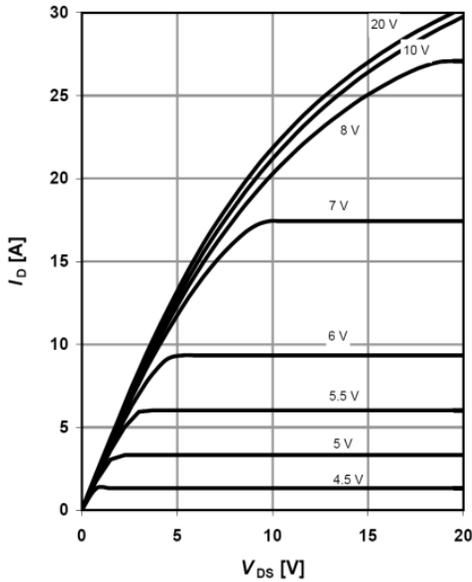
I_D=f(V_{DS}); T_j=25 ℃ ; parameter: V_{GS}

Typ. output
characteristics $T_j=125\ ℃$
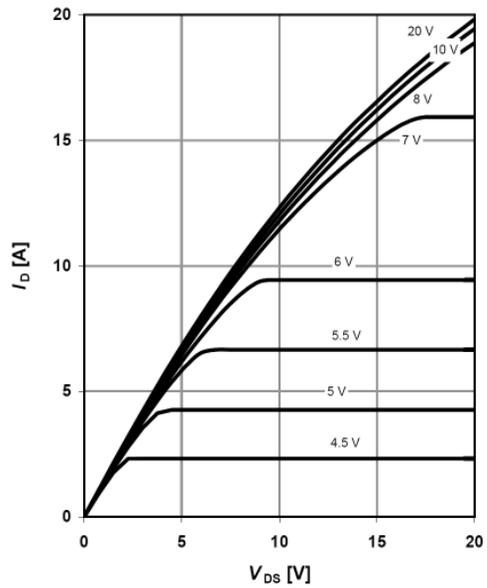
I_D=f(V_{DS}); T_j=125 ℃ ; parameter: V_{GS}

Typ. drain-source on-state resistance
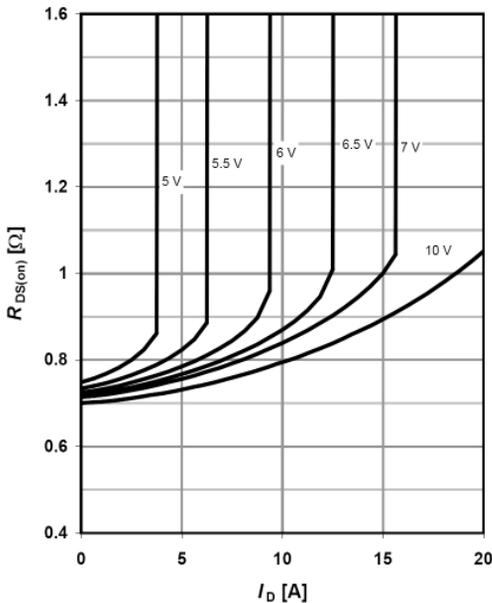
R_{DS}(on)=f(I_D); T_j=125 ℃ ;
parameter:V_{GS}

Typ. drain-source on-state resistance
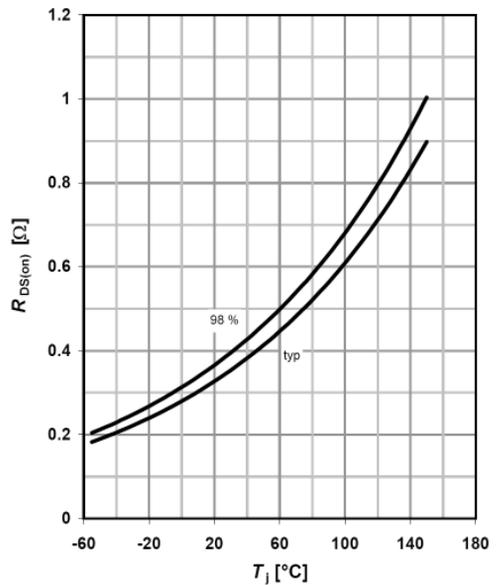
R_{DS}(on)=f(T_j); I_D=3.8 A; V_{GS}=10 V

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Typical Performance Characteristics

Typ. transfer characteristics
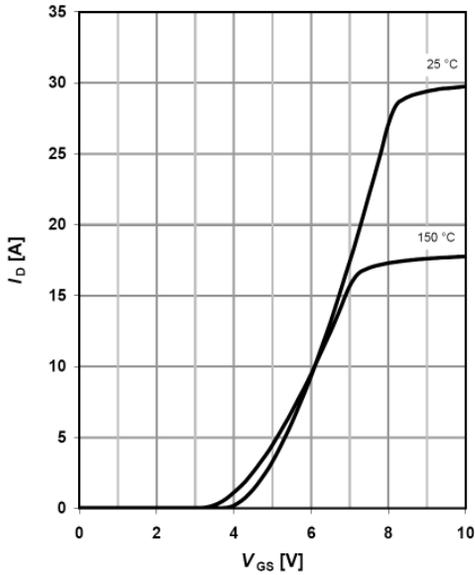

I_D=f(V_{GS}); V_{DS}=20V

Typ. gate charge
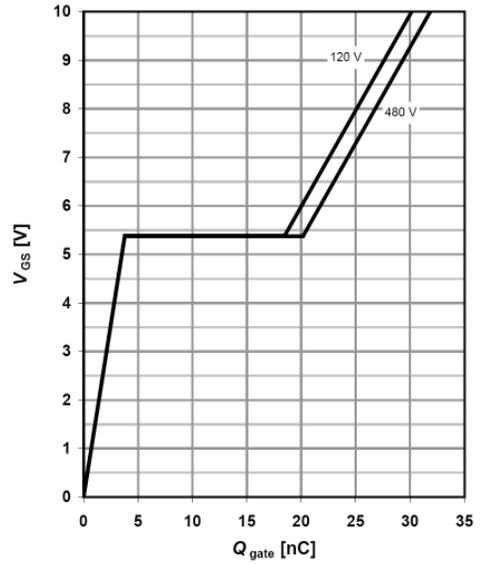
V_{GS}=f(Q_g), I_D=4.8 A pulsed

Avalanche energy
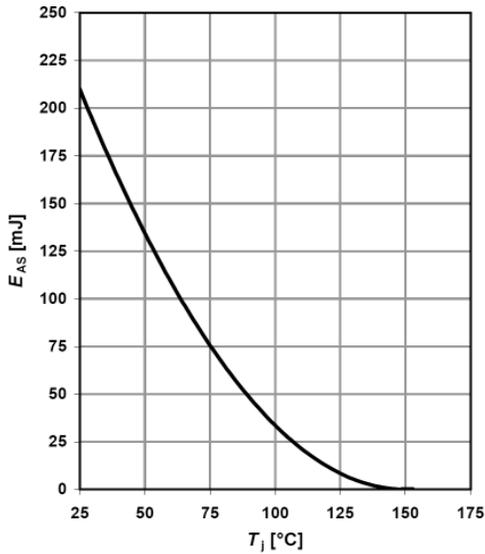
E_{AS}=f(T_j); I_D=1.8 A; V_{DD}=50 V

### Drain-source breakdown voltage
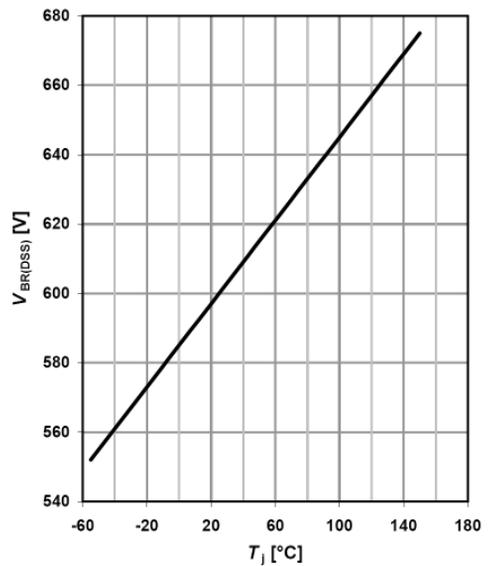
$V_{BR(DSS)}$=f(T_j); I_D=0.25 mA

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Typical Performance Characteristics

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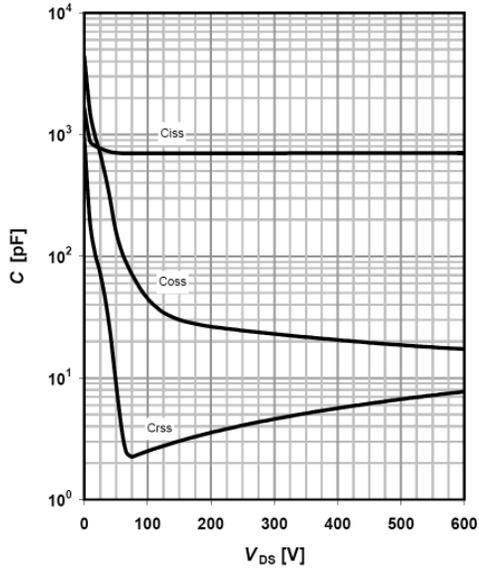
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

### Typ. *Coss stored energy*
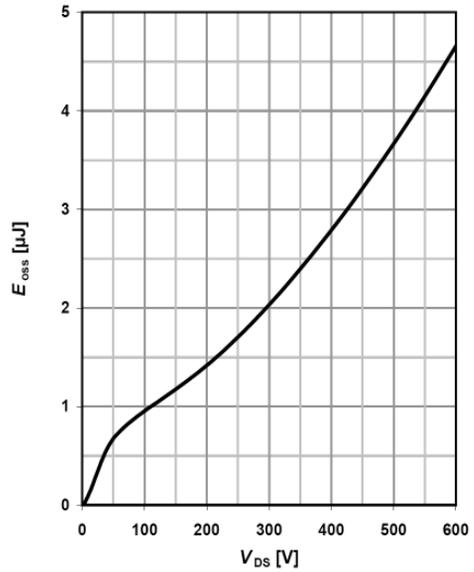
E_{OSS}=f(V_{DS})

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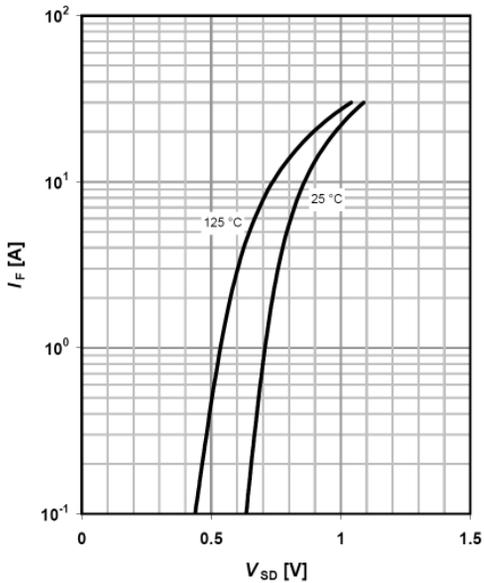
I_F=f(V_{SD}); parameter: T_j

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Test circuits

**Switching times test circuit and waveform for inductive load**

Switching times test circuit for inductive load

Switching time waveform

Unclamped inductive load test circuit and waveform
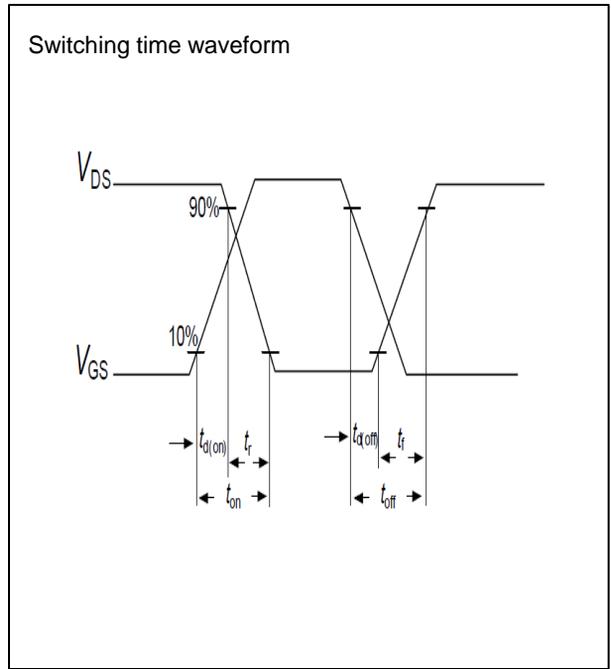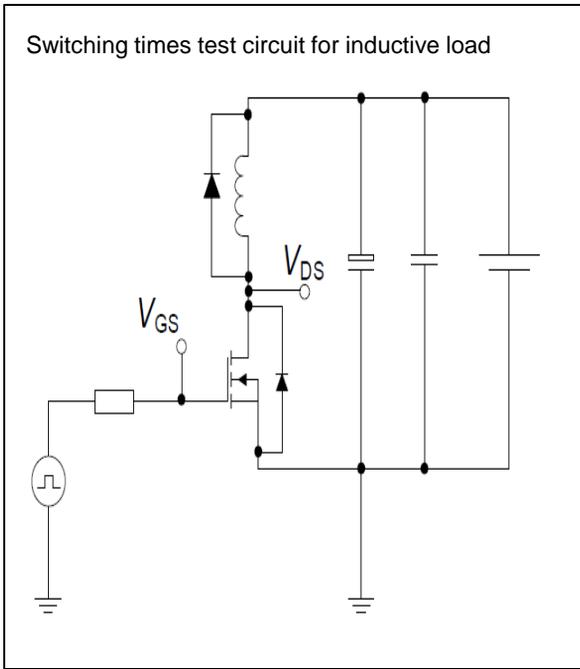
Unclamped inductive load test circuit

Unclamped inductive waveform
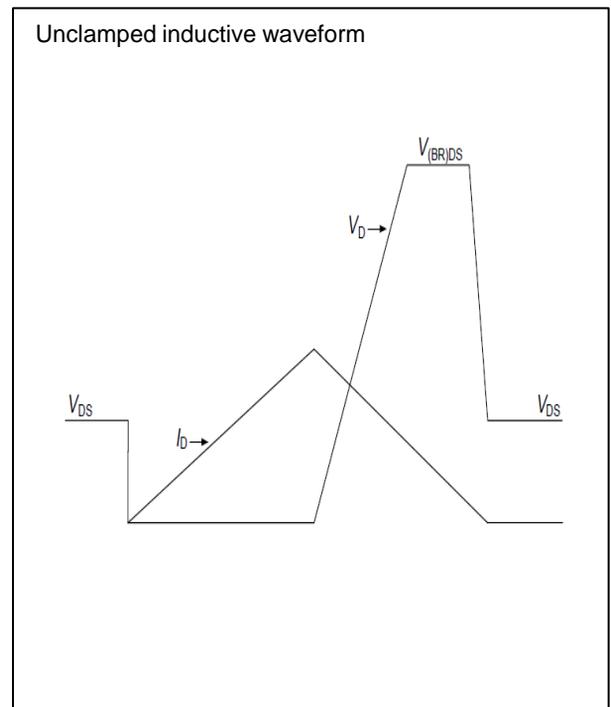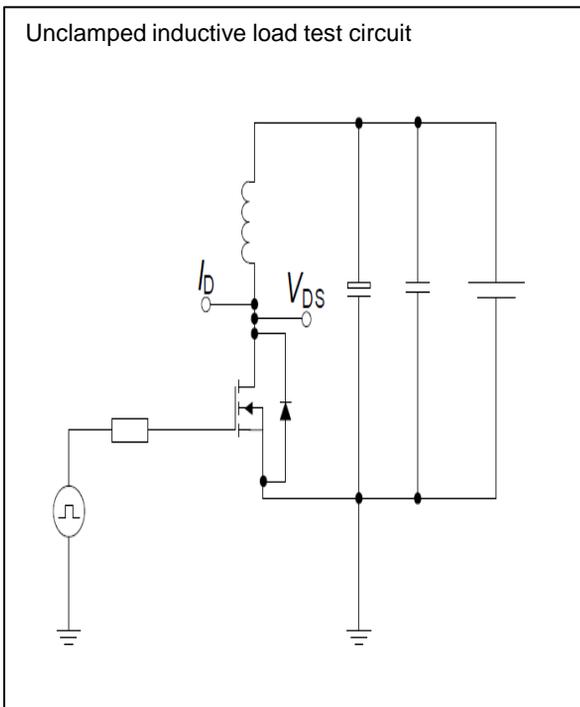
Test circuits

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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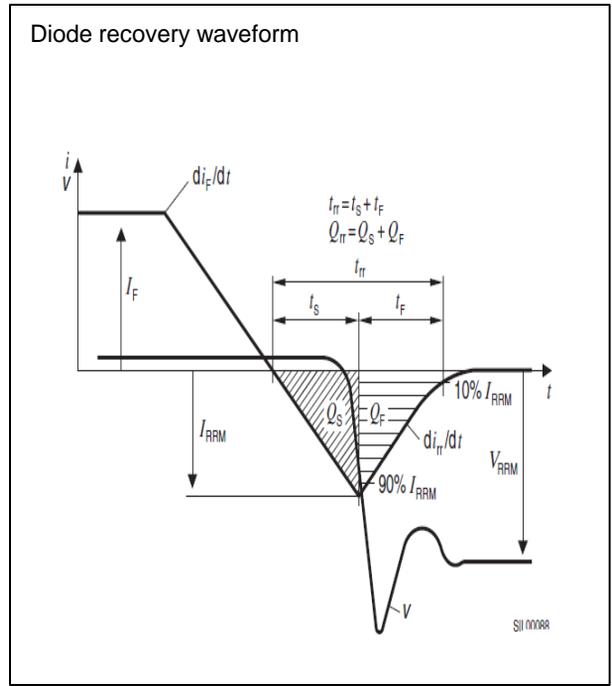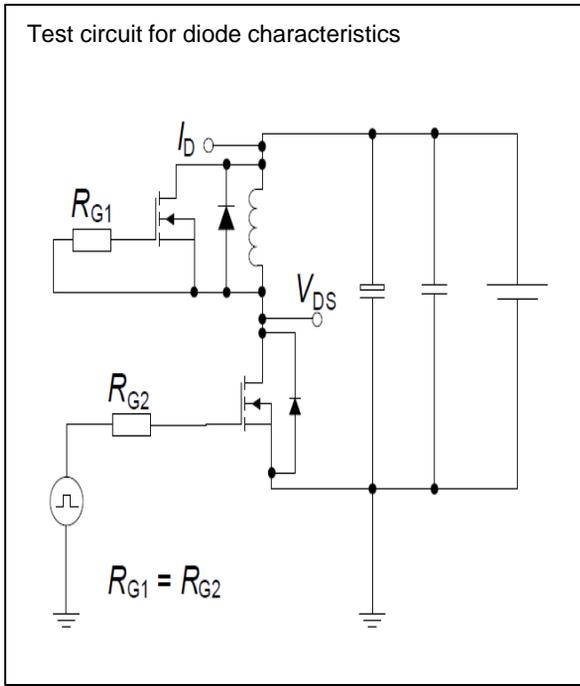
Package Outline   TO-252

TSD60R380S1 600V 10.6A N-Channel SJ-MOSFET
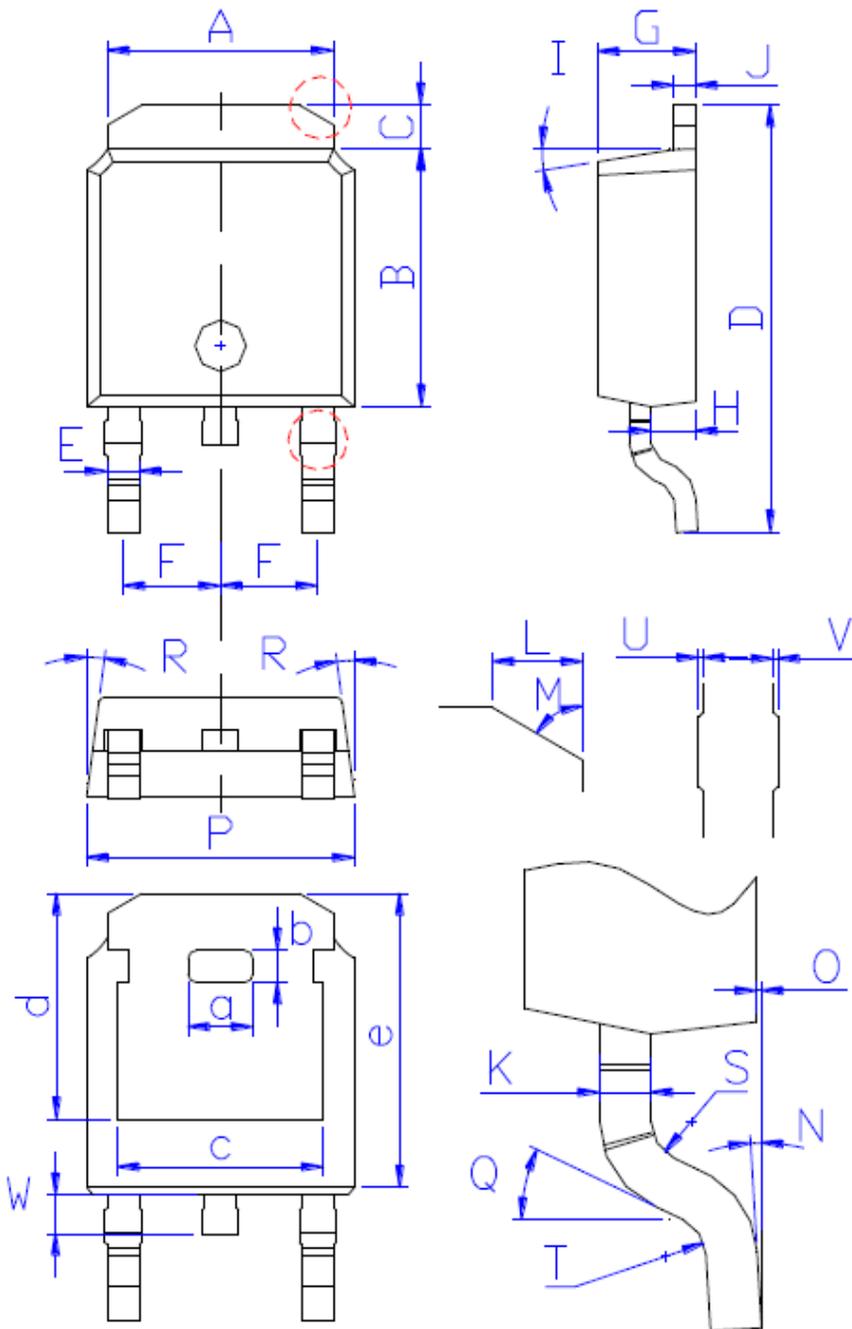
DIM	MILLIMETERS
A	5.34±0.30
B	6.00±0.30
C	1.05±0.30
D	9.95±0.30
E	0.76±0.15
F	2.28±0.15
G	2.30±0.30
H	1.06±0.30
I	(4-10)°
J	0.51±0.15
K	0.52±0.15
L	0.80±0.30
M	60°
N	(0-10)°
O	0.05±0.05
P	6.60±0.30
Q	25°
R	(4-8.5)°
S	R0.40
T	R0.40
U	0.05±0.05
V	0.05±0.05
W	0.90±0.30
a	1.80±0.30
b	0.75±0.30
c	4.85±0.30
d	5.30±0.30
e	6.90±0.30

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