

TSD80R1K3S1/TSU80R1K3S1

800V 4A N-Channel SJ-MOSFET

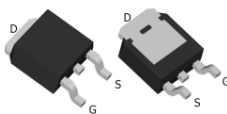
General Description

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

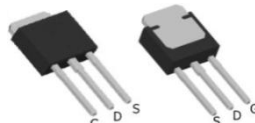
- 850V @T_J = 150 °C
- Typ. R_{DS(on)} = 1.1Ω
- Ultra Low gate charge (typ. Q_g = 15nC)
- 100% avalanche tested

TSD80R1K3S1
Top View Bottom View

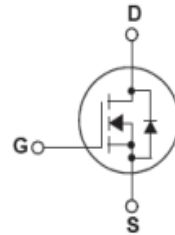


TO-252

TSU80R1K3S1



TO-251



Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V _{DSS}	Drain-Source Voltage	800	V
I _D	Drain Current -Continuous (TC = 25°C) -Continuous (TC = 100°C)	4* 2.5*	A
I _{DM}	Drain Current – Pulsed (Note 1)	11*	A
V _{GSS}	Gate-Source voltage	±30	V
E _{AS}	Single Pulsed Avalanche Energy (Note 2)	46	mJ
I _{AR}	Avalanche Current (Note 1)	1	A
E _{AR}	Repetitive Avalanche Energy (Note 1)	0.2	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15	V/ns
P _D	Power Dissipation (TC = 25°C) -Derate above 25°C	37 0.8	W W/°C
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to +150	°C
T _L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	°C

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
R _{θJC}	Thermal Resistance, Junction-to-Case	3.41	°C/W
R _{θCS}	Thermal Resistance, Case-to-Sink Typ.	0.5	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient	62	°C/W

Electrical Characteristics TC = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA, T _J = 25℃	800	--	--	V
		V _{GS} = 0V, I _D = 250μA, T _J = 150℃	--	850	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25℃	--	0.6	--	V/℃
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 800V, V _{GS} = 0V T _C = 25℃	--	--	1	μA
		V _{DS} = 640V, V _{GS} = 0V T _C = 150℃		10	--	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 = 250μA	2.5	--	4.5	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10V, I _D = 2A	--	1.1	1.3	Ω
g _{FS}	Forward Trans conductance	V _{DS} = 40V, I _D = 2A (Note 4)	--	8	--	S
R _g	Gate resistance	f=1MHz, open drain	--	3.5	--	Ω
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz	--	320	--	pF
C _{oss}	Output Capacitance		--	75	--	pF
C _{rss}	Reverse Transfer Capacitance		--	5	--	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 400V, I _D = 2A R _G = 20Ω(Note 4, 5)	--	10	--	ns
t _r	Turn-On Rise Time		--	8	--	ns
t _{d(off)}	Turn-Off Delay Time		--	60	--	ns
t _f	Turn-Off Fall Time		--	13	--	ns
Q _g	Total Gate Charge	V _{DS} = 480V, I _D = 2A V _{GS} = 10V (Note 4, 5)	--	15	--	nC
Q _{gs}	Gate-Source Charge		--	3	--	nC
Q _{gd}	Gate-Drain Charge		--	6	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	4	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	12	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0V, I _F = 2A	--	0.9	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _F = 2A di _F /dt =100A/μs (Note 4)	--	180	--	ns
Q _{rr}	Reverse Recovery Charge		--	1.5	--	μC

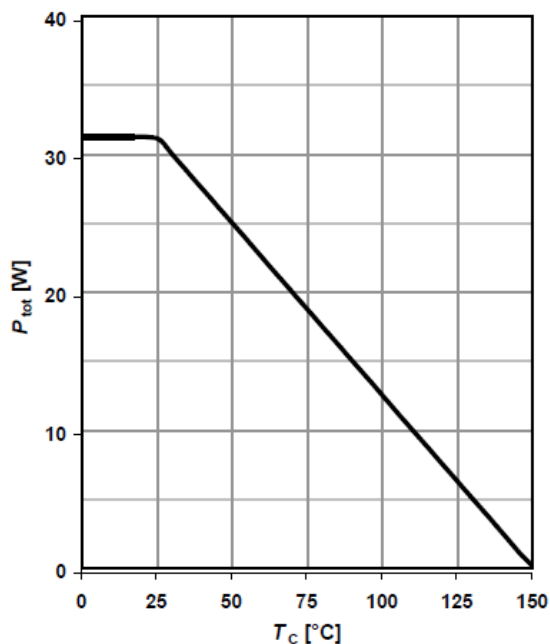
NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS}=1A, V_{DD}=50V$, Starting $T_J=25^\circ C$
3. $I_{SD}\leq 4A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ C$
4. Pulse Test: Pulse width $\leq 300\mu s$, Duty Cycle $\leq 2\%$
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

1 Power dissipation

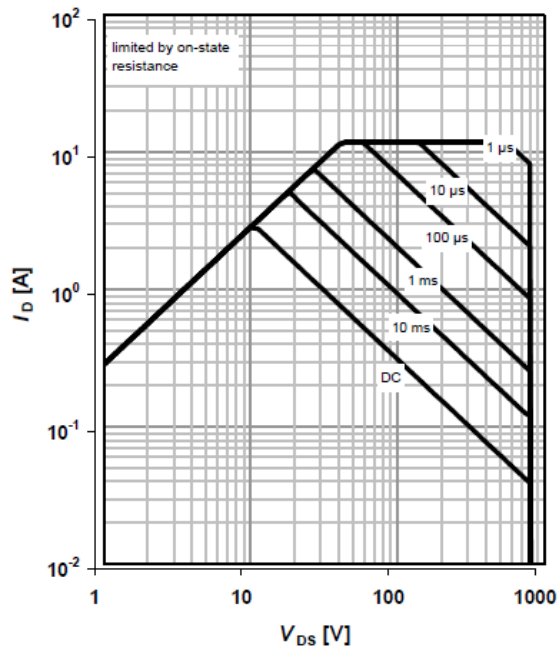
$$P_{\text{tot}} = f(T_C)$$



2 Safe operating area

$$I_D = f(V_{DS}); T_C = 25^\circ\text{C}; D = 0$$

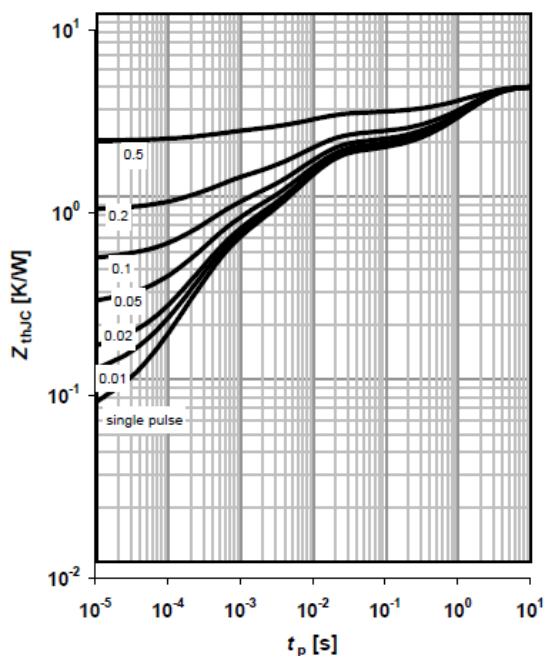
parameter: t_p



3 Max. transient thermal impedance

$$Z_{\text{thJC}} = f(t_p)$$

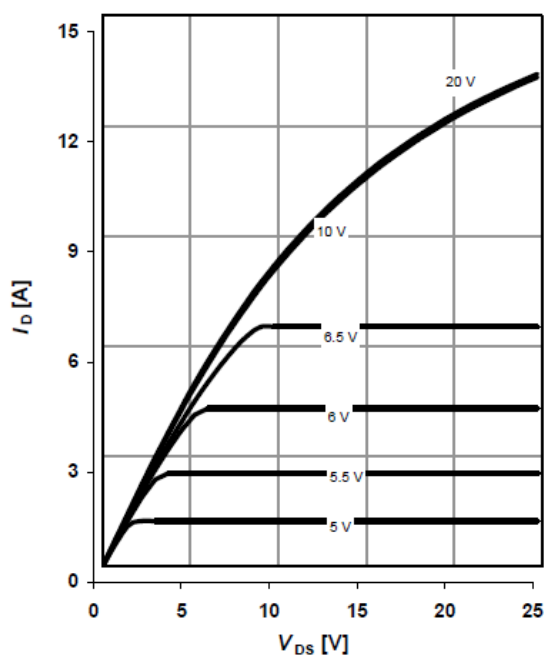
parameter: $D = t_p/T$



4 Typ. output characteristics

$$I_D = f(V_{DS}); T_J = 25^\circ\text{C}; t_p = 10 \mu\text{s}$$

parameter: V_{GS}

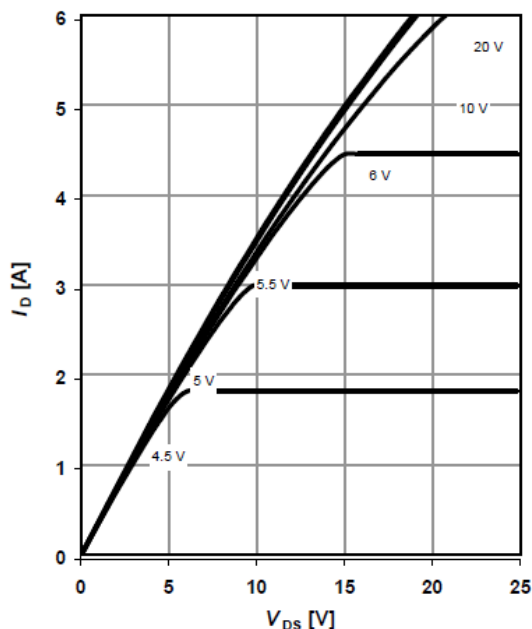


Typical Performance Characteristics

5 Typ. output characteristics

$I_D = f(V_{DS}); T_j = 150^\circ\text{C}; t_p = 10\ \mu\text{s}$

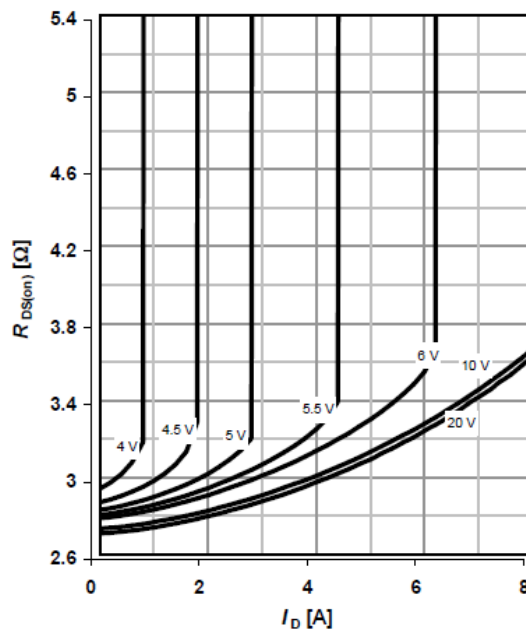
parameter: V_{GS}



6 Typ. drain-source on-state resistance

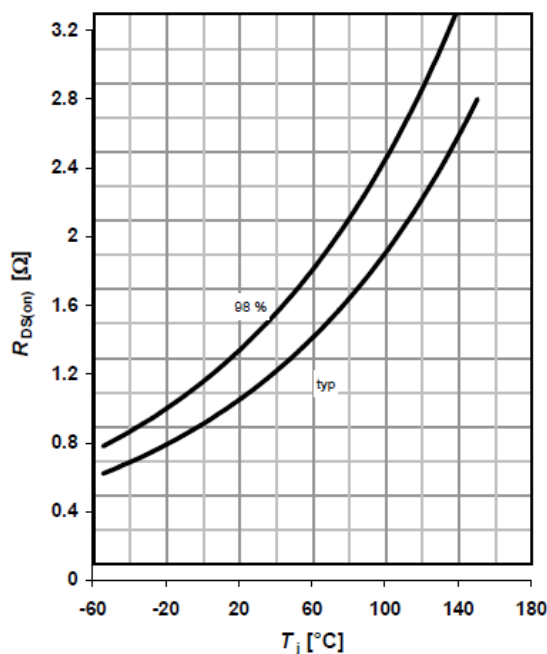
$R_{DS(on)} = f(I_D); T_j = 150^\circ\text{C}$

parameter: V_{GS}



7 Drain-source on-state resistance

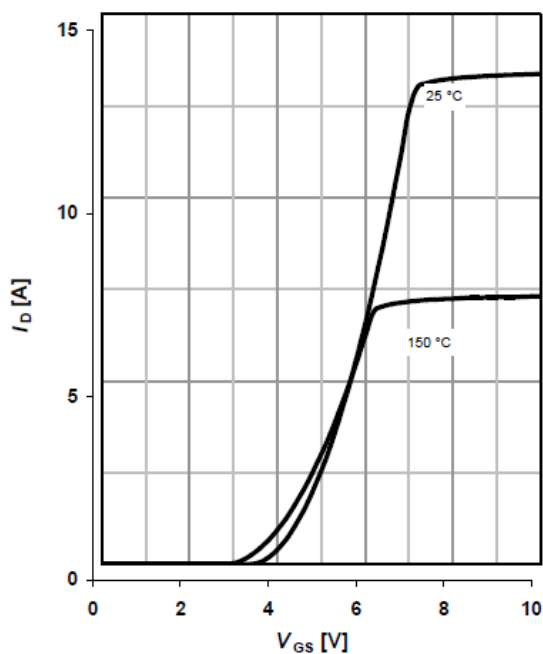
$R_{DS(on)} = f(T_j); I_D = 2.5\ \text{A}; V_{GS} = 10\ \text{V}$



8 Typ. transfer characteristics

$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)\max}; t_p = 10\ \mu\text{s}$

parameter: T_j

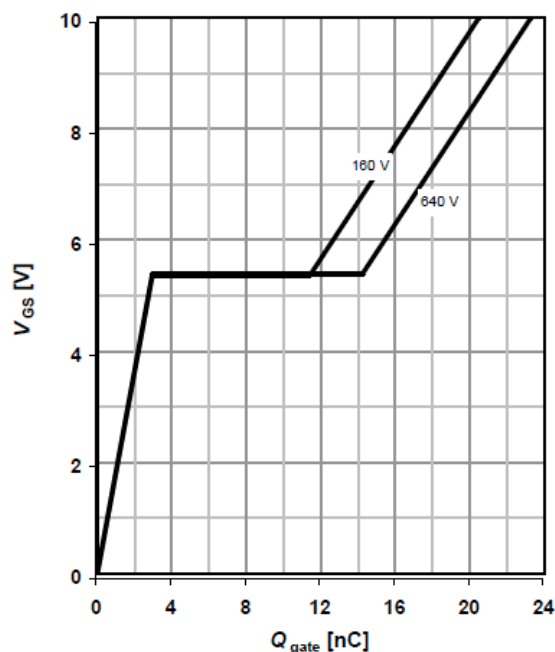


Typical Performance Characteristics

9 Typ. gate charge

$V_{GS}=f(Q_{gate}); I_D=4\text{ A pulsed}$

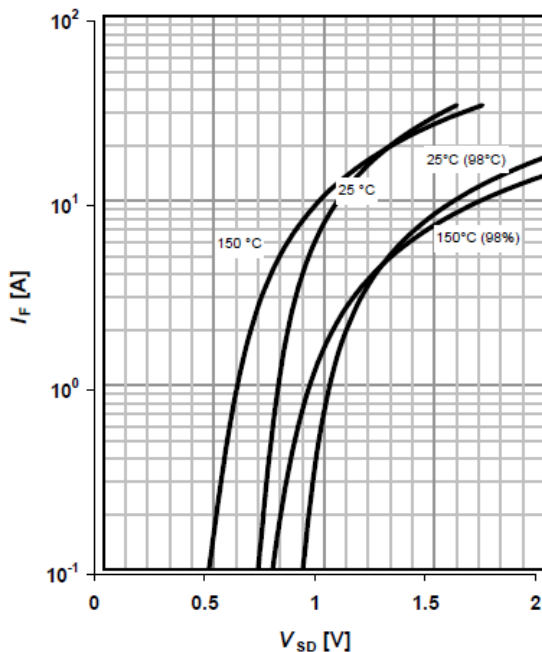
parameter: V_{DD}



10 Forward characteristics of reverse diode

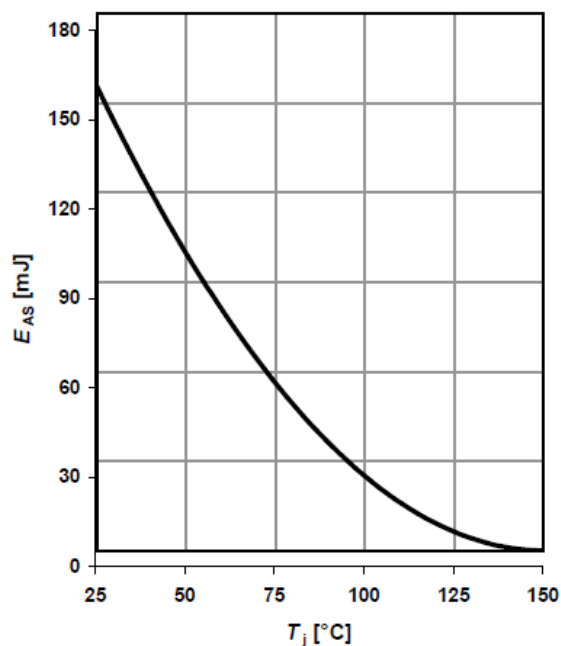
$I_F=f(V_{SD}); t_p=10\text{ }\mu\text{s}$

parameter: T_j



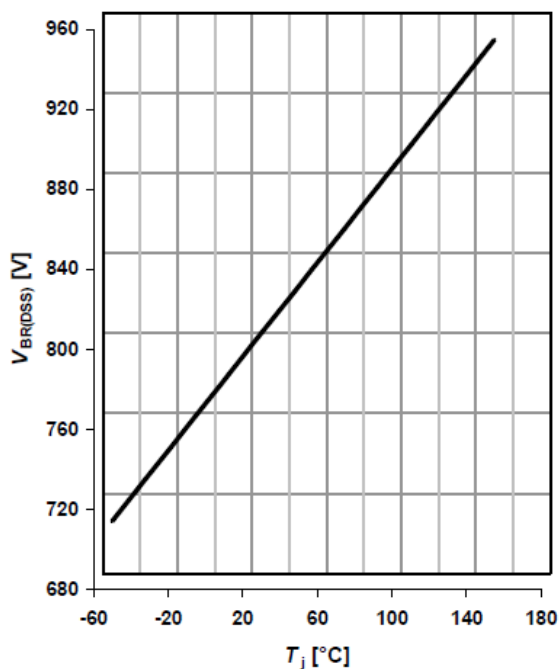
11 Avalanche energy

$E_{AS}=f(T_j); I_D=0.8\text{ A}; V_{DD}=50\text{ V}$



12 Drain-source breakdown voltage

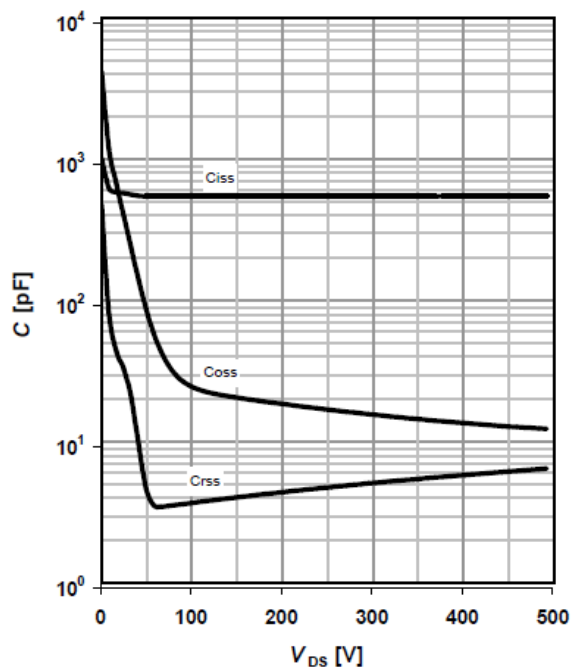
$V_{BR(DSS)}=f(T_j); I_D=0.25\text{ mA}$



Typical Performance Characteristics

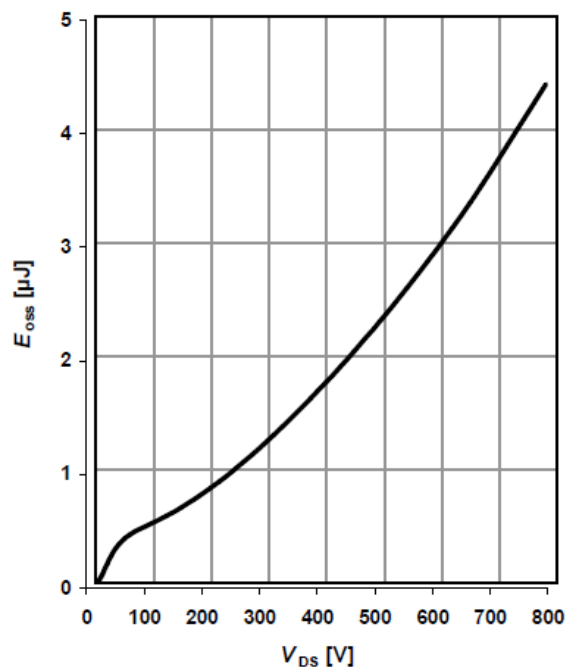
13 Typ. capacitances

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



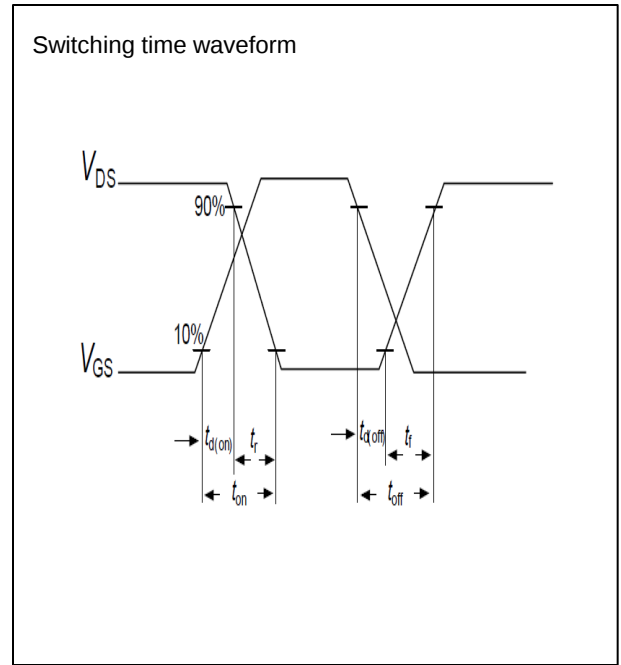
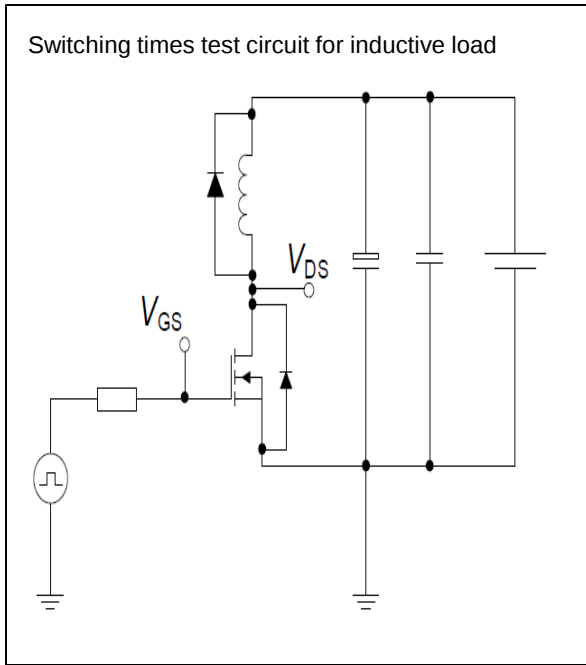
14 Typ. C_{oss} stored energy

$E_{oss}=f(V_{DS})$

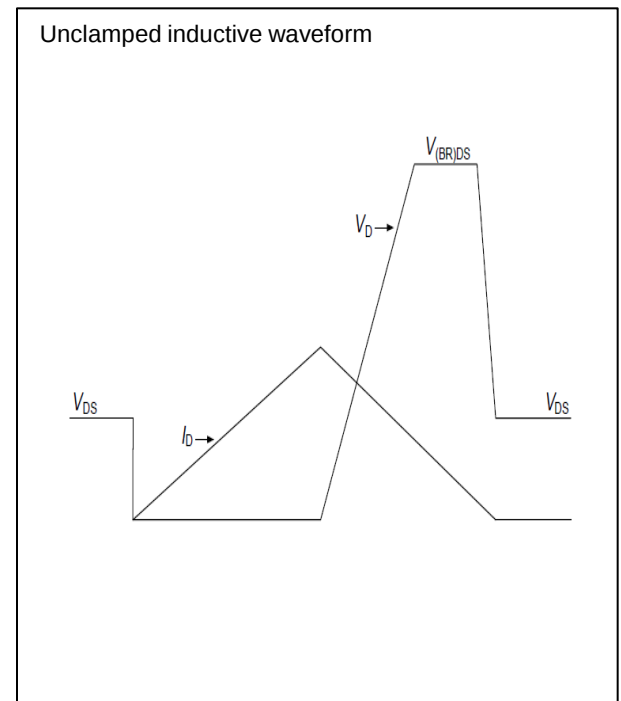
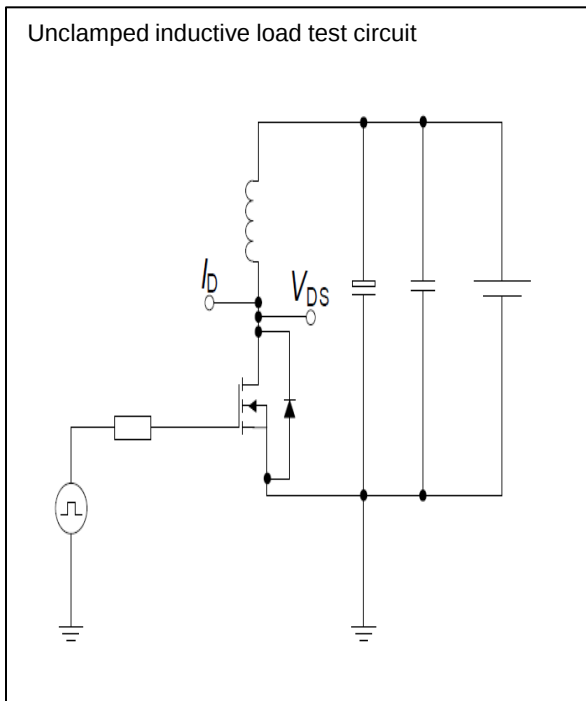


Test circuits

Switching times test circuit and waveform for inductive load

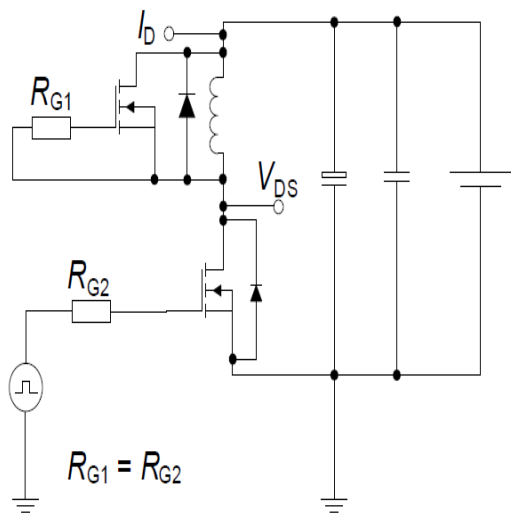


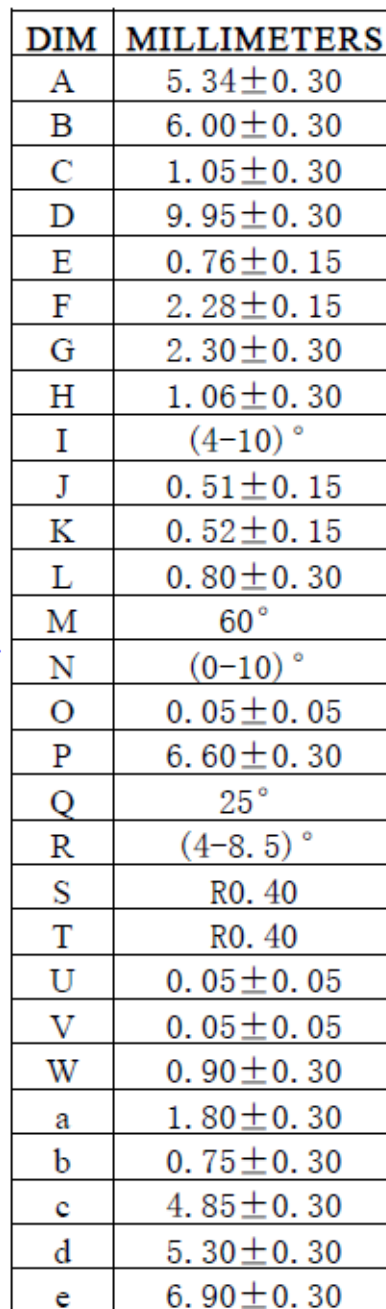
Unclamped inductive load test circuit and waveform

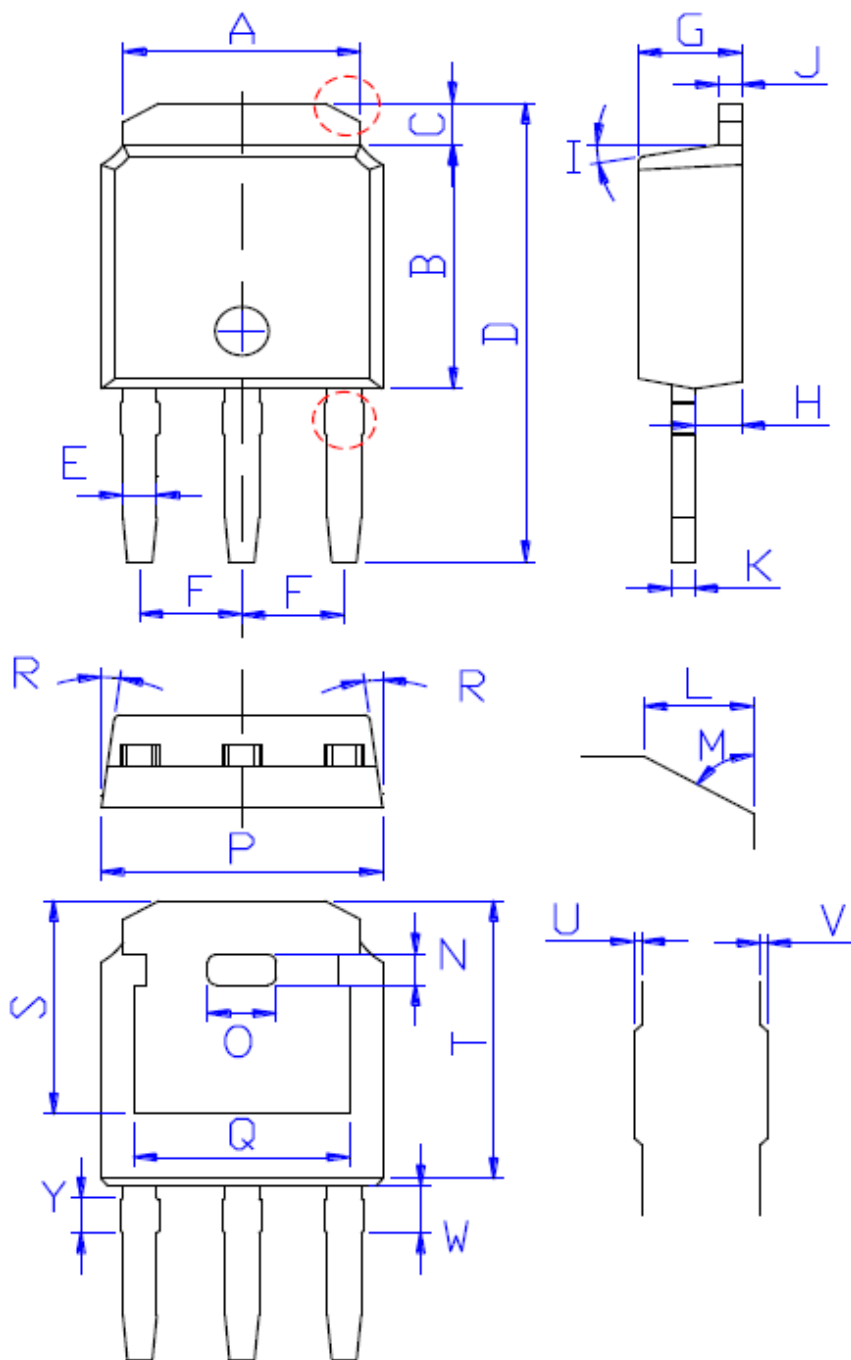


TSD80R1K3S1/TSU80R1K3S1 800V 4A N-Channel SJ-MOSFET

Test circuit for diode characteristics







DIM	MILLIMETERS
A	5.34±0.30
B	6.00±0.30
C	1.05±0.30
D	11.31±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	0.75±0.30
O	1.80±0.30
P	6.60±0.30
Q	4.85±0.30
R	(4-8.5)°
S	5.30±0.30
T	6.90±0.30
U	0.05±0.05
V	0.05±0.05
W	1.15±0.25
Y	0.85±0.25