

# TSA80R240S1

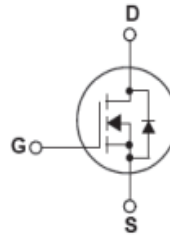
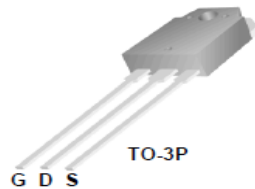
## 800V 18.4A N-Channel SJ-MOSFET

### 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<sub>J</sub> = 150 °C
- Typ. R<sub>DS(on)</sub> = 0.21Ω
- Ultra Low gate charge (typ. Q<sub>g</sub> = 27.5nC)
- 100% avalanche tested

### Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V <sub>DSS</sub>	Drain-Source Voltage	800	V
I <sub>D</sub>	Drain Current -Continuous (TC = 25°C) -Continuous (TC = 100°C)	18.4* 11.6*	A
I <sub>DM</sub>	Drain Current – Pulsed (Note 1)	51*	A
V <sub>GSS</sub>	Gate-Source voltage	±30	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	485	mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	3.5	A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	1	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15	V/ns
P <sub>D</sub>	Power Dissipation (TC = 25°C)	151	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	300	°C

\* Drain current limited by maximum junction temperature.

### Thermal Characteristics

Symbol	Parameter	Value	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	0.83	°C/W
R <sub>θCS</sub>	Thermal Resistance, Case-to-Sink Typ.	0.5	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient	62	°C/W

**Electrical Characteristics TC = 25 °C unless otherwise noted**

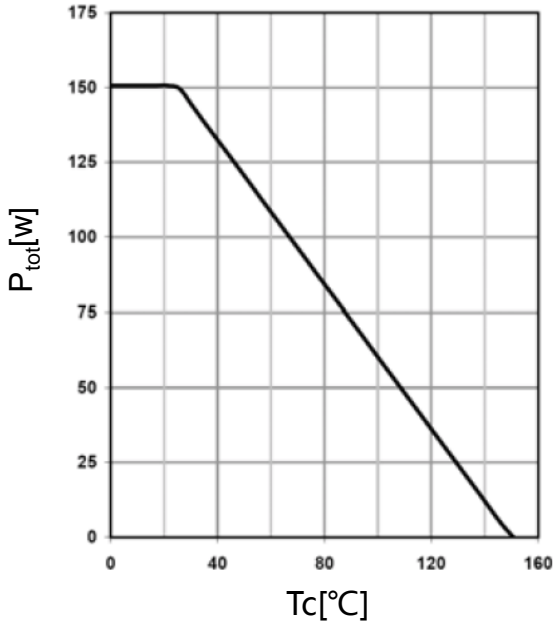
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA, T <sub>J</sub> = 25 °C	800	--	--	V
		V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA, T <sub>J</sub> = 150 °C	--	850	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25 °C	--	0.6	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 800V, V <sub>GS</sub> = 0V -T <sub>J</sub> = 150 °C	--	-- 10	1 --	μA μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V	--	--	-100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.5	--	4.5	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 9A	--	0.21	0.24	Ω
g <sub>FS</sub>	Forward Trans conductance	V <sub>DS</sub> = 40V, I <sub>D</sub> = 18A	--	16	--	S
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz	--	1290	--	pF
C <sub>oss</sub>	Output Capacitance		--	380	--	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	22	--	pF
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 400V, I <sub>D</sub> = 10A R <sub>G</sub> = 20Ω(Note 4)	--	40	--	ns
t <sub>r</sub>	Turn-On Rise Time		--	21	--	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	139	--	ns
t <sub>f</sub>	Turn-Off Fall Time		--	21	--	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 480V, I <sub>D</sub> = 10A V <sub>GS</sub> = 10V (Note 4)	--	27.5	--	nC
Q <sub>gs</sub>	Gate-Source Charge		--	6.3	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	11.2	--	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	18	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	51	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>F</sub> = 10A	--	1	1.5	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>F</sub> = 10A di <sub>F</sub> /dt = 100A/μs	--	475	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	5.8	--	μC
I <sub>rrm</sub>	Peak reverse recovery Current		--	35	--	A

**NOTES:**

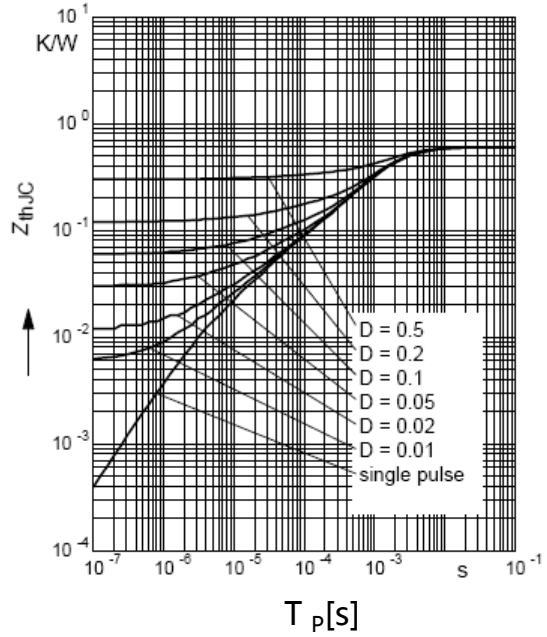
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I<sub>AS</sub>=3.5A, V<sub>DD</sub>=50V, Starting T<sub>J</sub>=25 °C
3. I<sub>SD</sub>≤18.4A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25 °C
4. Essentially Independent of Operating Temperature Typical Characteristics

# Typical Performance Characteristics

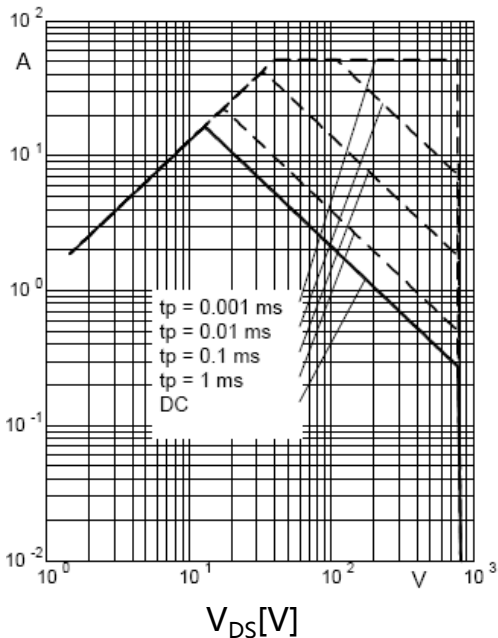
Power dissipation



Max. transient thermal impedance

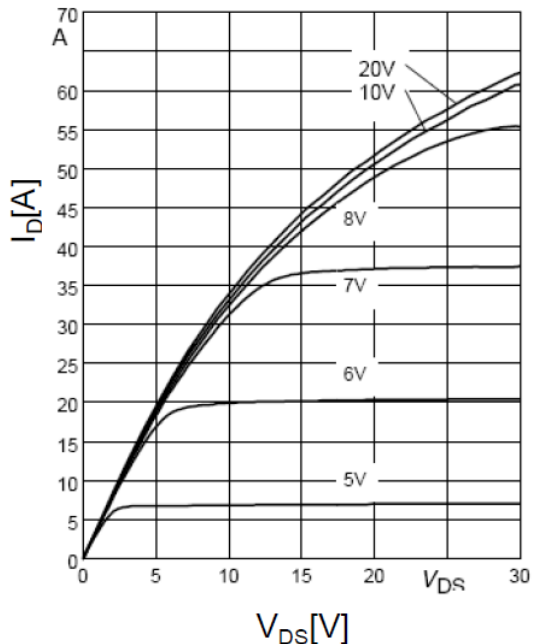


Safe operating area  $T_C=25^\circ C$



$I_D = f(V_{DS}); T_C = 25^\circ C; V_{GS} > 7V;$   
 $D = 0; \text{parameter } t_p$

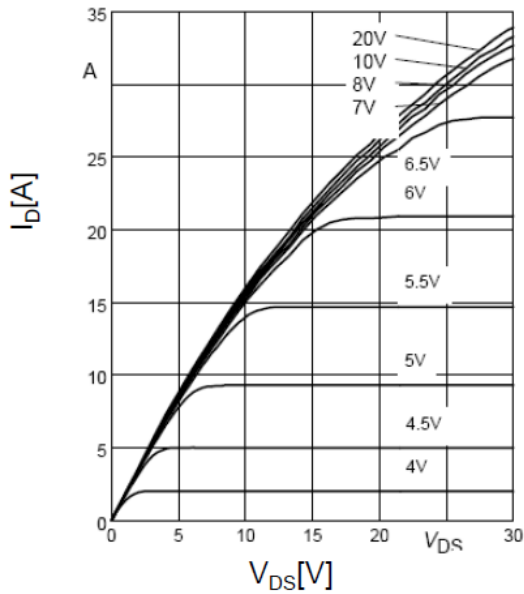
Typ. output characteristic



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

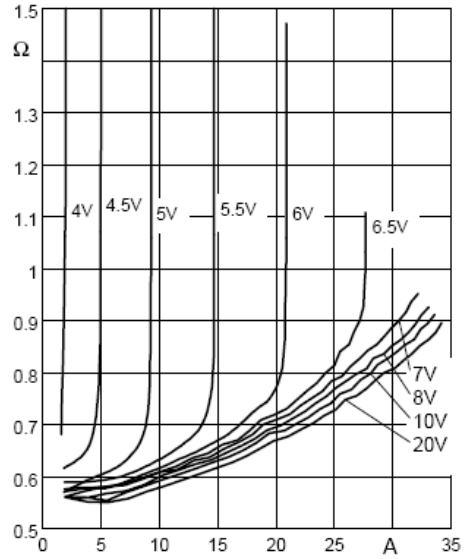
# Typical Performance Characteristics

Typ. output characteristic



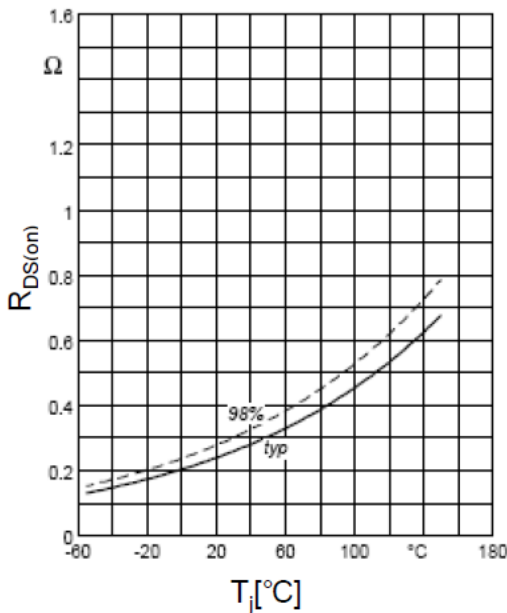
$I_D = f(V_{DS}); T_j = 150\text{ }^\circ\text{C};$   
parameter  $t_p = 10\mu\text{s}, V_{GS}$

Typ. Drain-Source on resistance



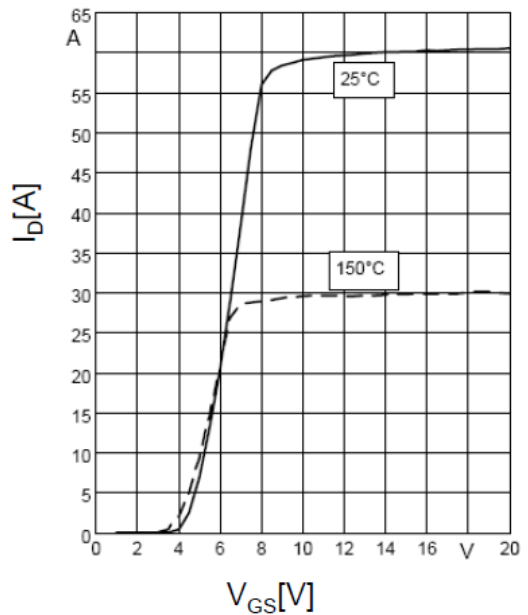
$R_{DS(on)} = f(I_{DS(on)}); T_j = 150\text{ }^\circ\text{C};$   
parameter  $V_{GS}$

Typ. Drain-Source on resistance



$R_{Dson} = f(T_j); T_j = 150\text{ }^\circ\text{C};$  parameter  
 $I_D = 11\text{ A}, V_{GS} = 10\text{ V}$

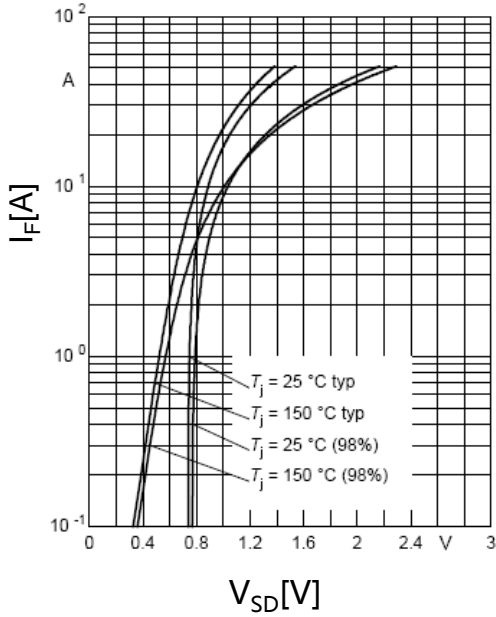
Typ. Transfer characteristic



$I_D = f(V_{GS}); V_{DS} = 20\text{ V};$   
parameter  $t_p = 10\mu\text{s},$

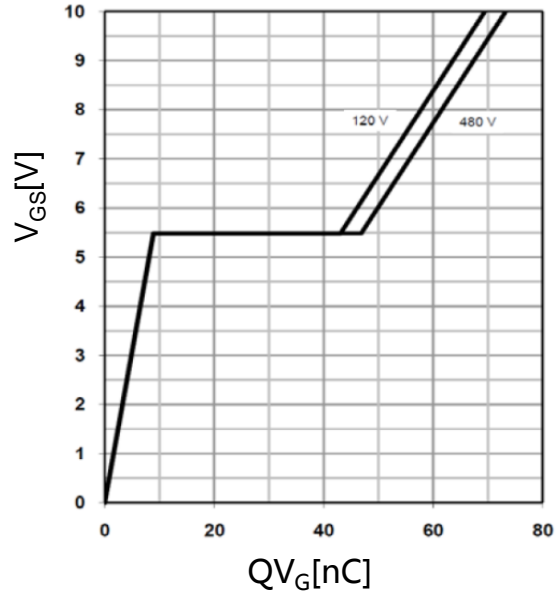
# Typical Performance Characteristics

Forward characteristics of reverse diode



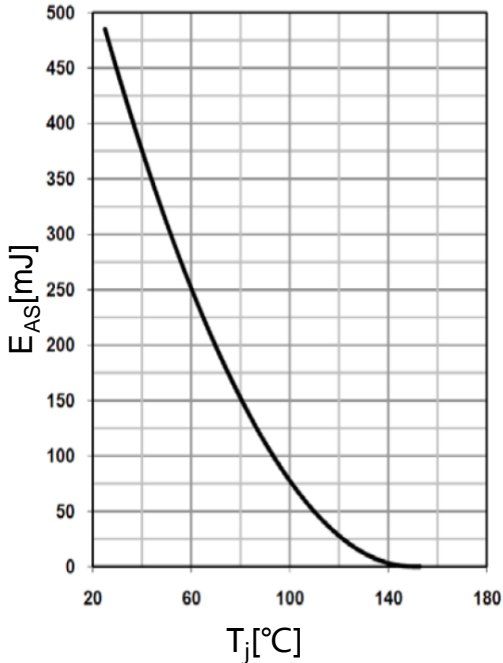
$I_F=f(V_{SD});$  parameter:  $T_j$

Typ. gate charge



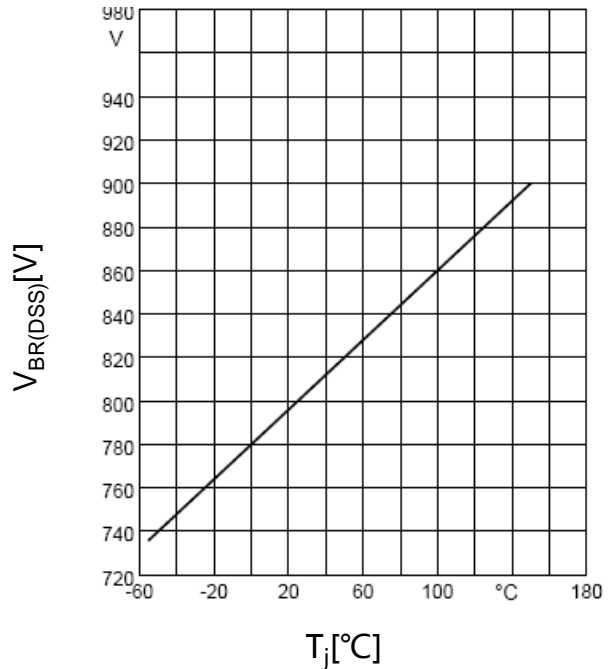
$V_{GS}=f(Q_g), I_D=11$  A pulsed

Avalanche energy



$E_{AS}=f(T_j); I_D=3.5$  A;  $V_{DD}=50$  V

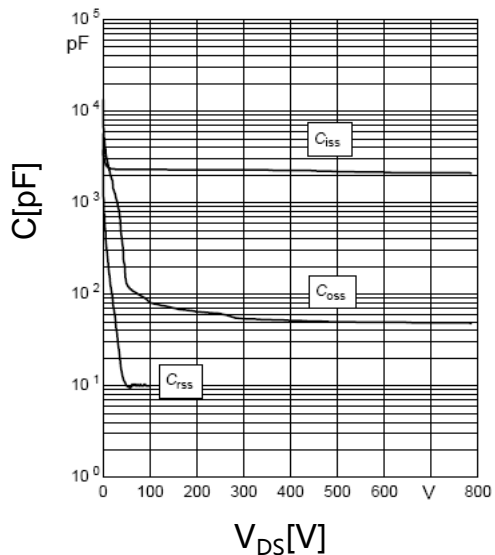
Drain-source breakdown voltage



$V_{BR(DSS)}=f(T_j); I_D=1.0$  mA

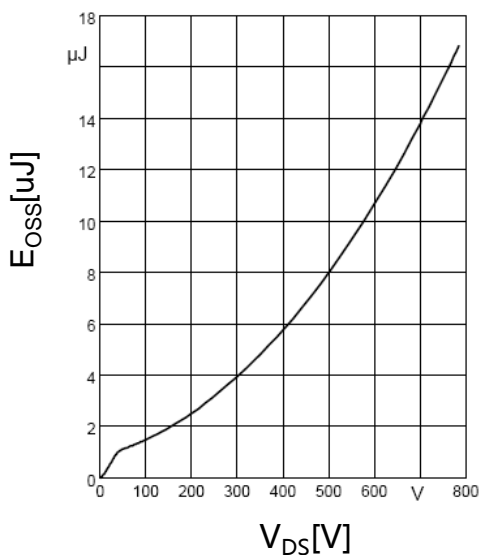
# Typical Performance Characteristics

Typ. capacitances



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

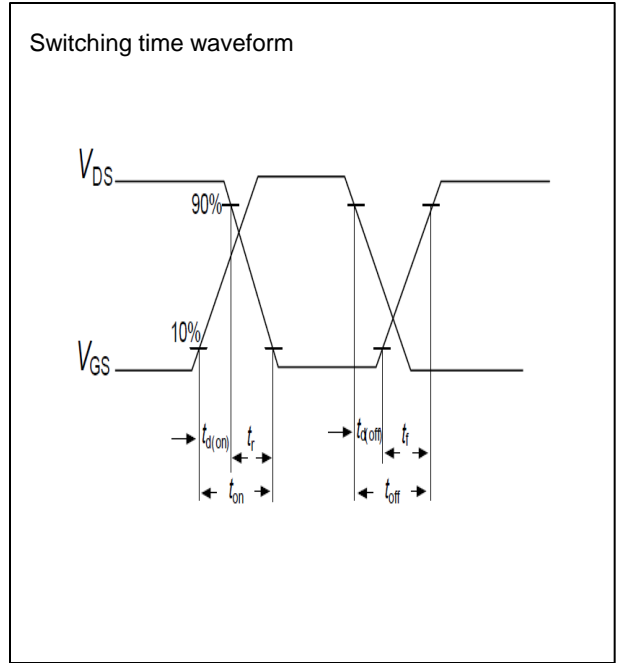
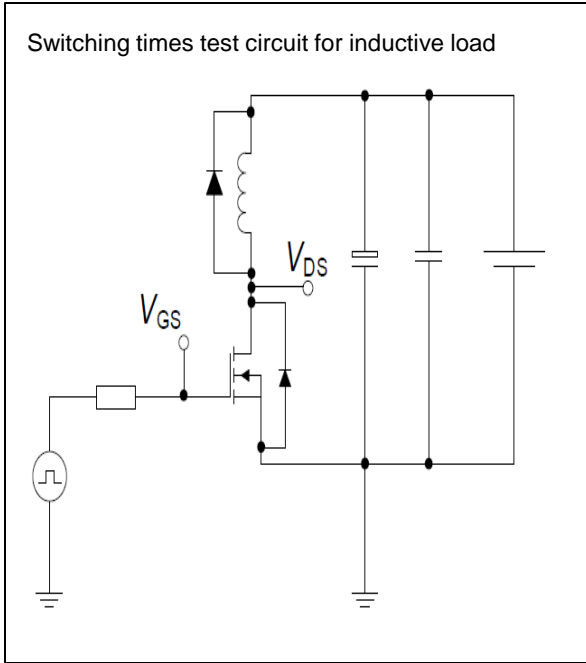
Typ.  $C_{oss}$  stored energy



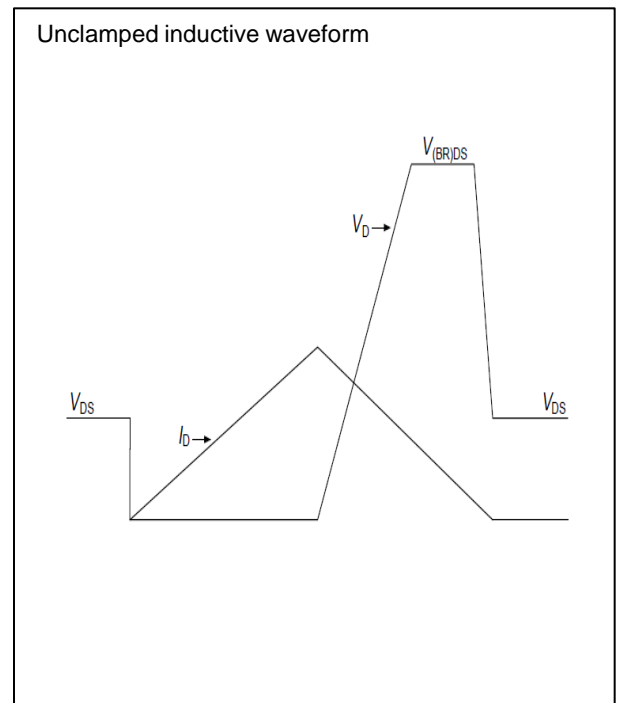
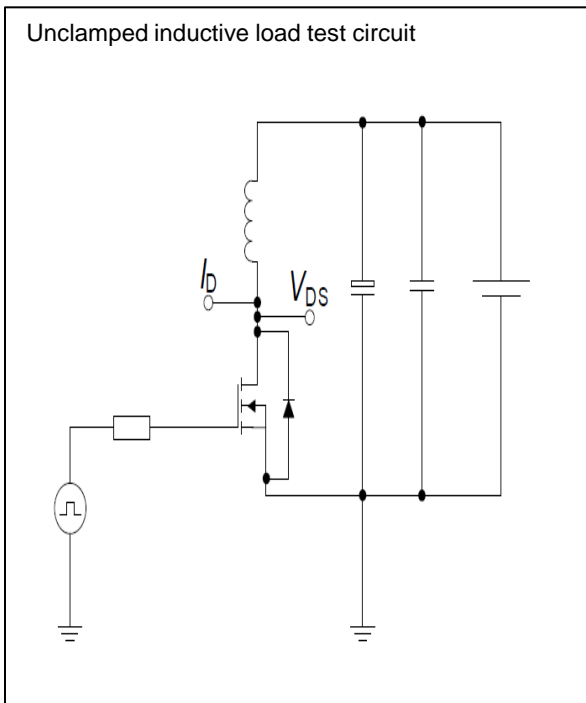
$E_{oss}=f(V_{DS})$

# Test circuits

## Switching times test circuit and waveform for inductive load

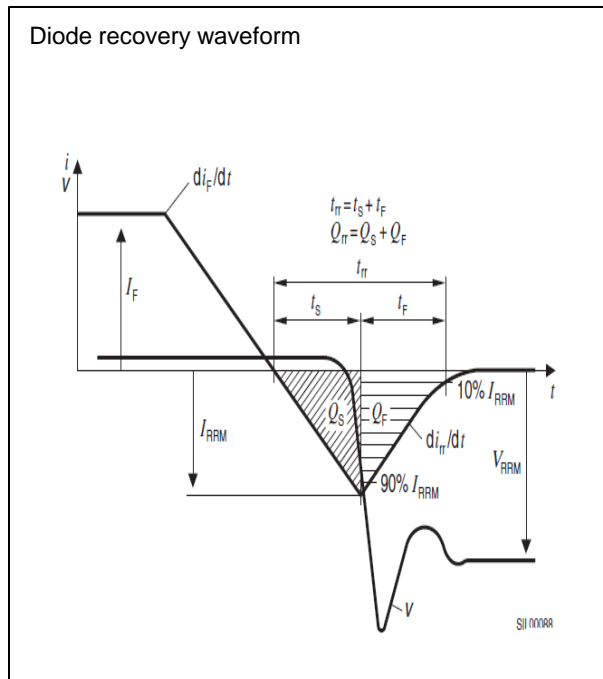
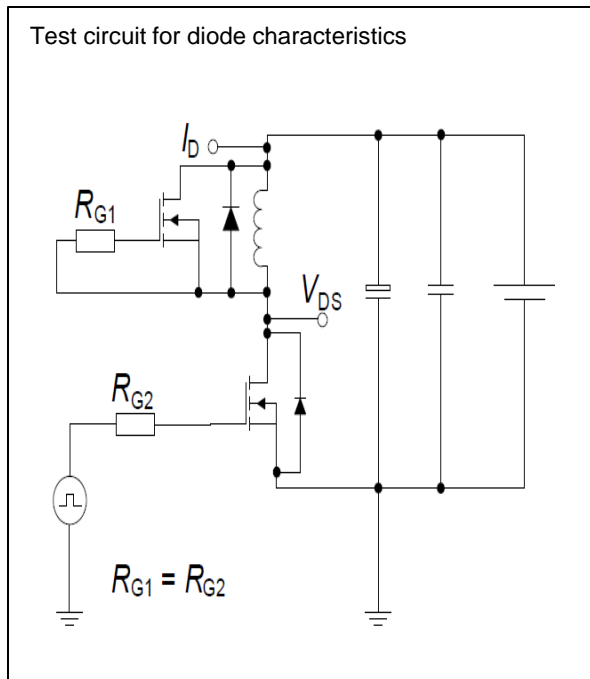


## Unclamped inductive load test circuit and waveform



# Test circuits

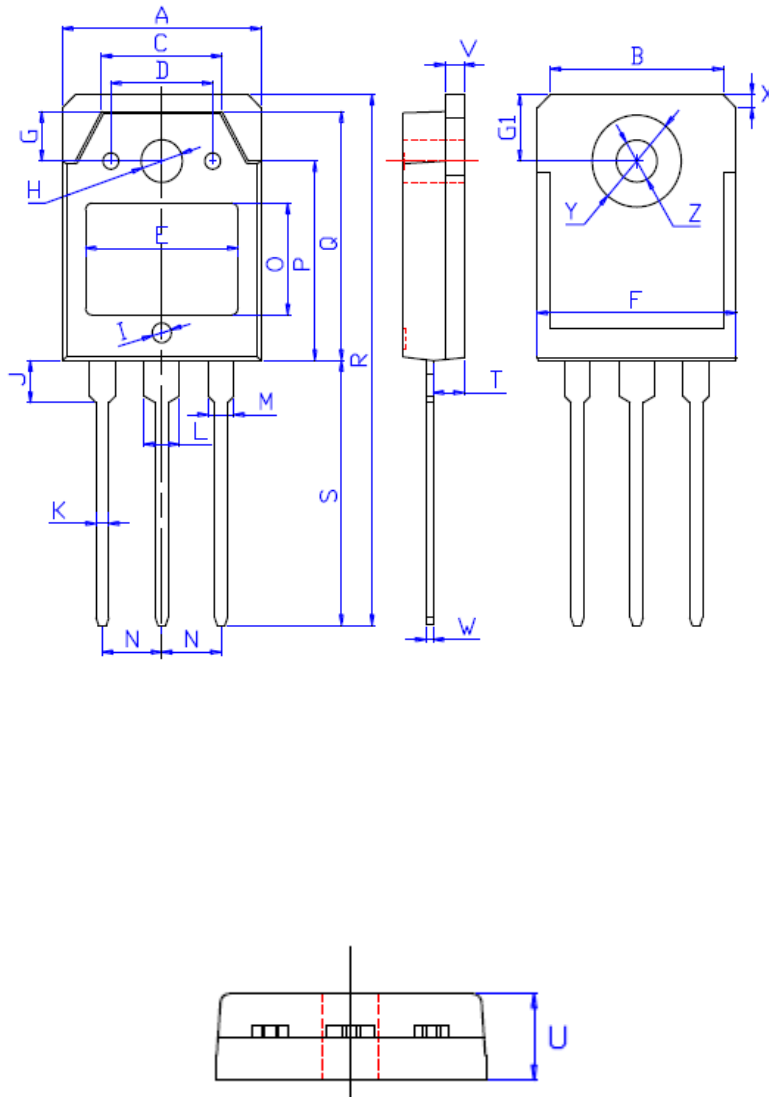
## Test circuit and waveform for diode characteristics





# Package Outline TO-3P

TS480R240S1 800V 18.4A N-Channel SJ-MOSFET



DIM	MILLIMETERS
A	15.60 ± 0.30
B	13.60 ± 0.30
C	9.50 ± 0.30
D	8.00 ± 0.30
E	11.85 ± 0.30
F	15.65 ± 0.30
G	3.80 ± 0.30
G1	5.00 ± 0.30
H	φ 3.50 ± 0.30
I	φ 1.50 ± 0.30 深 0.15 ± 0.15
J	3.20 ± 0.30
K	1.00 ± 0.15
L	3.10 ± 0.15
M	2.10 ± 0.15
N	5.45 ± 0.30
O	8.40 ± 0.30
P	13.90 ± 0.30
Q	18.70 ± 0.30
R	40.00 ± 0.60
S	20.00 ± 0.40
T	2.40 ± 0.30
U	4.80 ± 0.30
V	1.50 ± 0.15
W	0.60 ± 0.15
X	1.80 ± 0.40
Y	7.00 ± 0.30
Z	3.20 ± 0.30