

TSF80R1K3S1

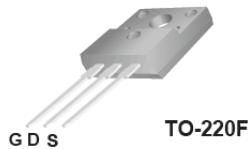
800V 4.4A N-Channel SJ-MOSFET

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.

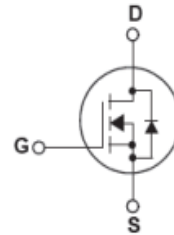
This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy.

SJ-FET is suitable for various AC/DC power conversion in switching mode operation for higher efficiency.



Features

- 850V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 1.1\Omega$
- Ultra Low gate charge (typ. $Q_g = 6\text{nC}$)
- 100% avalanche tested



Absolute Maximum Ratings

| Symbol | Parameter | Value | Unit |
|----------------|--|--------------|------------------|
| V_{DSS} | Drain-Source Voltage | 800 | V |
| I_D | Drain Current -Continuous ($T_C = 25^\circ\text{C}$) -Continuous ($T_C = 100^\circ\text{C}$) | 4.4* 2.8* | A |
| I_{DM} | Drain Current – Pulsed (Note 1) | 12* | 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 ($T_C = 25^\circ\text{C}$) | 26 | W |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to +150 | $^\circ\text{C}$ |
| T_L | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds | 300 | $^\circ\text{C}$ |

* Drain current limited by maximum junction temperature.

Thermal Characteristics

| Symbol | Parameter | Value | Unit |
|-----------------|---|-------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | 4.9 | $^\circ\text{C/W}$ |
| $R_{\theta CS}$ | Thermal Resistance, Case-to-Sink Typ. | -- | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 80 | $^\circ\text{C/W}$ |

Electrical Characteristics TC = 25 °C unless otherwise noted

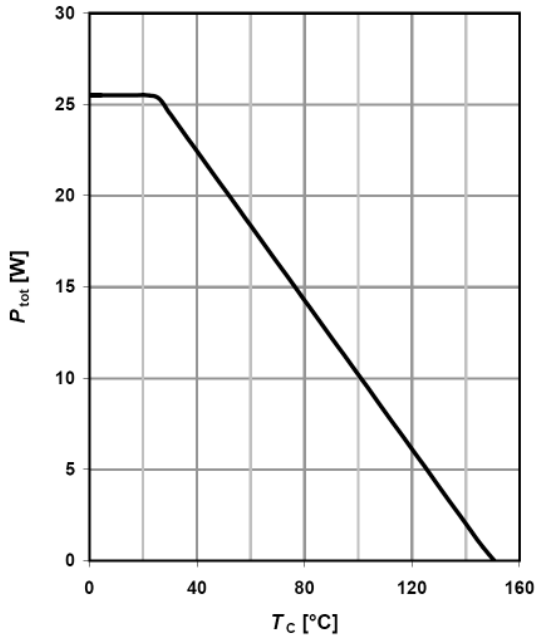
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|---|---|-----|----------|---------|----------|
| Off Characteristics | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | V _{GS} = 0V, I _D = 250μA, T _J = 25 °C | 800 | -- | -- | V |
| | | V _{GS} = 0V, I _D = 250μA, T _J = 150 °C | -- | 850 | -- | V |
| ΔBV _{DSS} / ΔT _J | Breakdown Voltage Temperature Coefficient | I _D = 250μA, Referenced to 25 °C | -- | 0.6 | -- | V/°C |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} = 800V, V _{GS} = 0V -T _C = 150 °C | -- | -- 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 = 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 = 4A (Note 4) | -- | 4 | -- | 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 | -- | 290 | -- | pF |
| C _{oss} | Output Capacitance | | -- | 90 | -- | pF |
| C _{rss} | Reverse Transfer Capacitance | | -- | 7.5 | -- | pF |
| Switching Characteristics | | | | | | |
| t _{d(on)} | Turn-On Delay Time | V _{DD} = 400V, I _D = 2A R _G = 20Ω (Note 4, 5) | -- | 19 | -- | ns |
| t _r | Turn-On Rise Time | | -- | 19 | -- | ns |
| t _{d(off)} | Turn-Off Delay Time | | -- | 36 | -- | ns |
| t _f | Turn-Off Fall Time | | -- | 21 | -- | ns |
| Q _g | Total Gate Charge | V _{DS} = 480V, I _D = 2A V _{GS} = 10V (Note 4, 5) | -- | 6 | -- | nC |
| Q _{gs} | Gate-Source Charge | | -- | 1.5 | -- | nC |
| Q _{gd} | Gate-Drain Charge | | -- | 2.5 | -- | 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:

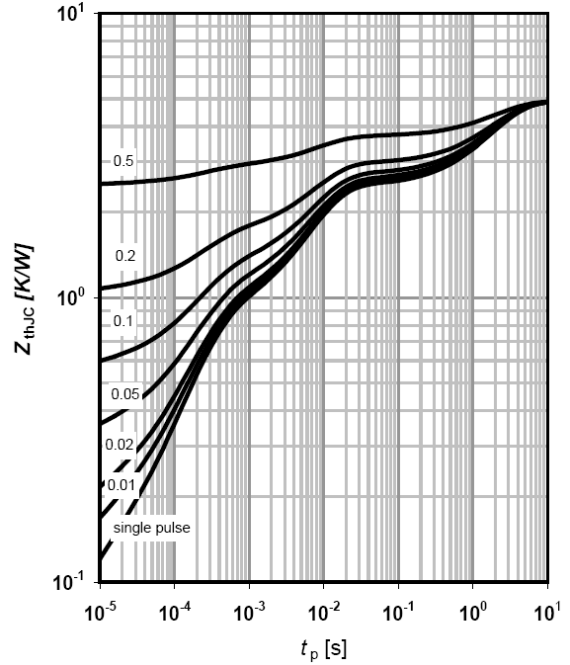
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS}=1A, V_{DD}=50V, Starting T_J=25 °C
3. I_{SD}≤4A, di/dt ≤ 200A/us, V_{DD} ≤ BV_{DSS}, Starting T_J = 25 °C
4. Pulse Test: Pulse width ≤ 300us, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical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

Typical Performance Characteristics

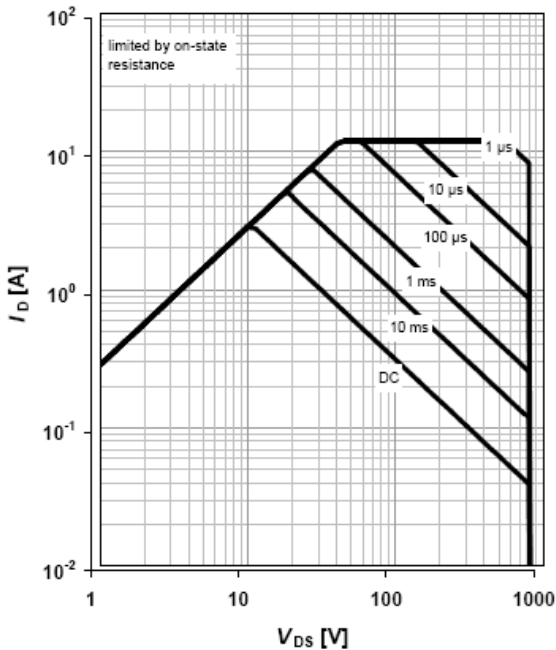
Power dissipation



Max. transient thermal impedance

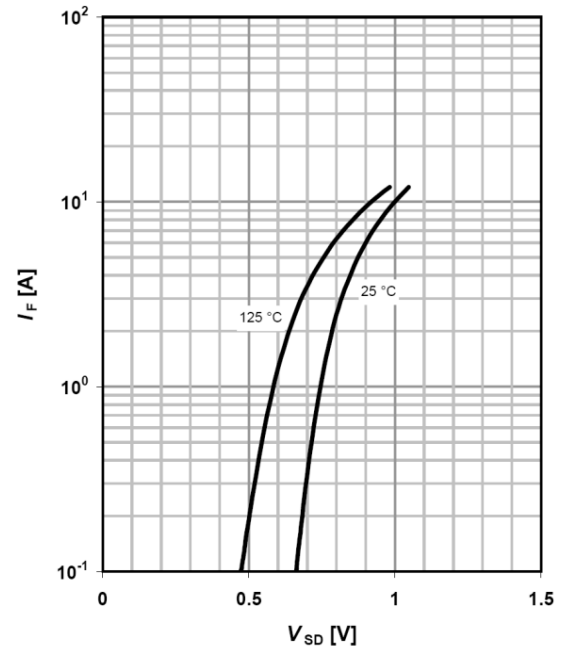


Safe operating area $T_C=25^\circ\text{C}$



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

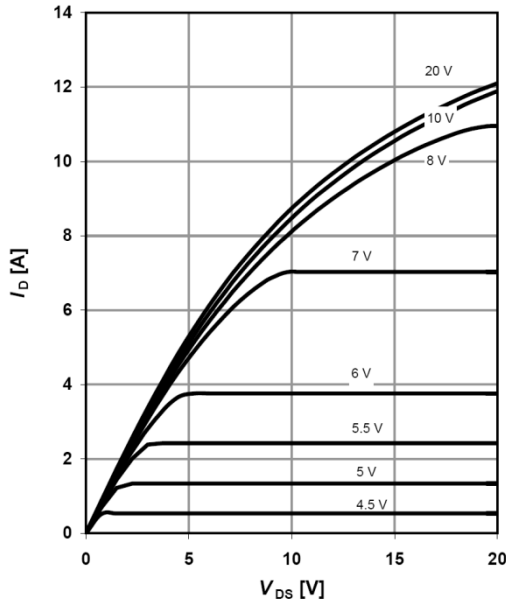
Forward characteristics of reverse diode



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

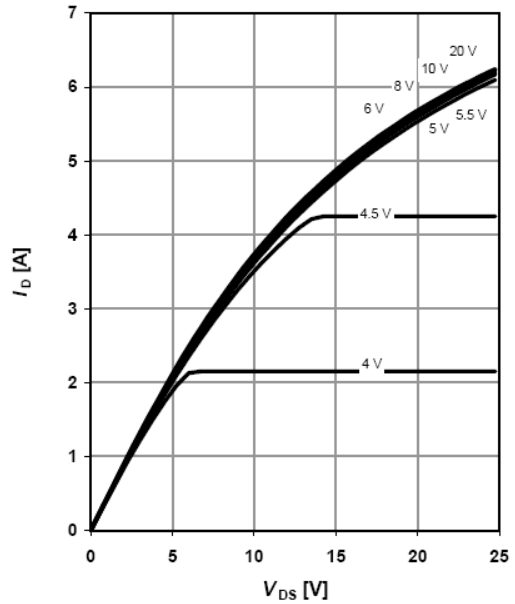
Typical Performance Characteristics

Typ. output characteristic



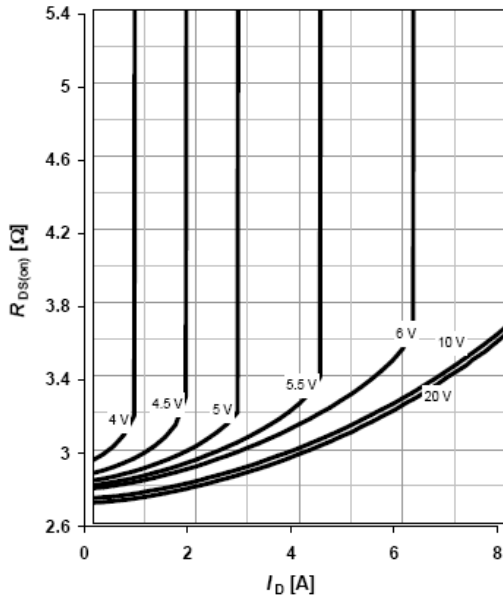
$I_D = f(V_{DS}); T_j = 25\text{ }^\circ\text{C};$
parameter $t_p = 10\text{ }\mu\text{s}, V_{GS}$

Typ. output characteristic



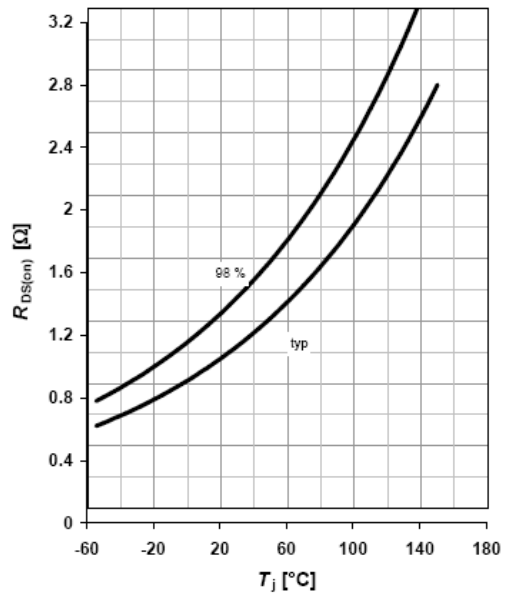
$I_D = f(V_{DS}); T_j = 150\text{ }^\circ\text{C};$
parameter $t_p = 10\text{ }\mu\text{s}, V_{GS}$

Typ. Drain-Source on resistance



$R_{Dson} = f(I_D); T_j = 125\text{ }^\circ\text{C};$ parameter V_{GS}

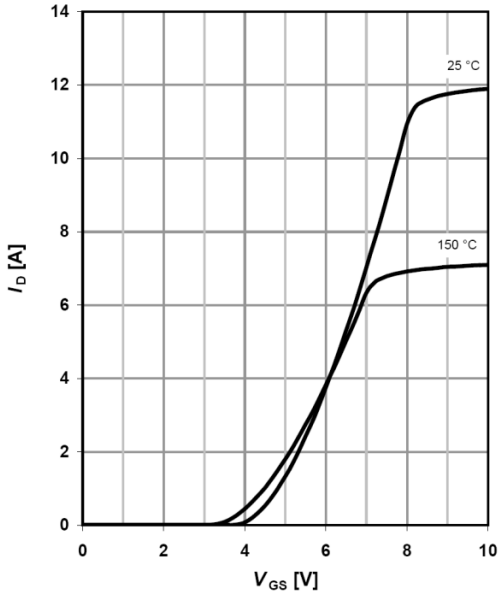
Typ. Drain-Source on resistance



$R_{Dson} = f(T_j); T_j = 125\text{ }^\circ\text{C};$ parameter $I_D = 2.5\text{ A}, V_{GS} = 10\text{ V}$

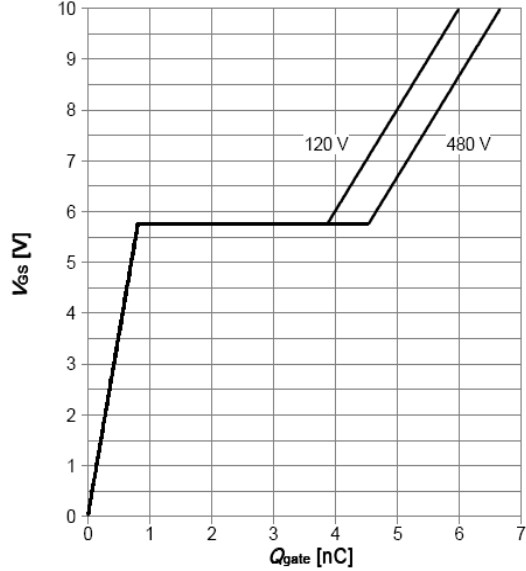
Typical Performance Characteristics

Typ. Transfer characteristic



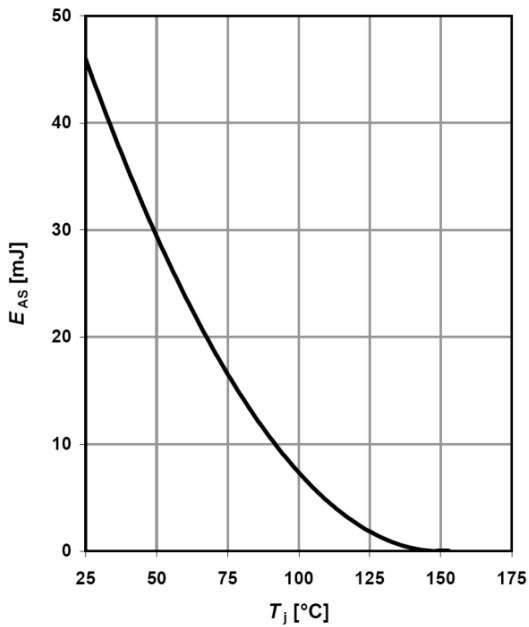
$I_D=f(V_{DS}); V_{DS}=20V$;
parameter $t_p=10\mu s$,

Typ. gate charge



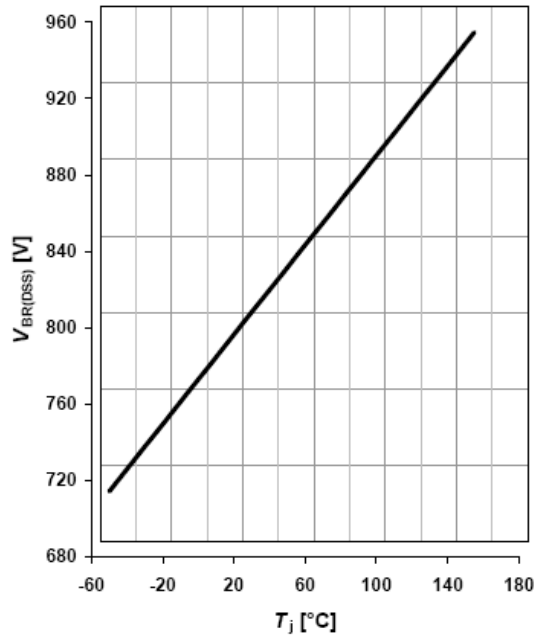
$V_{GS}=f(Q_g), I_D=2A$ pulsed

Avalanche energy



$E_{AS}=f(T_j); I_D=1 A; V_{DD}=50 V$

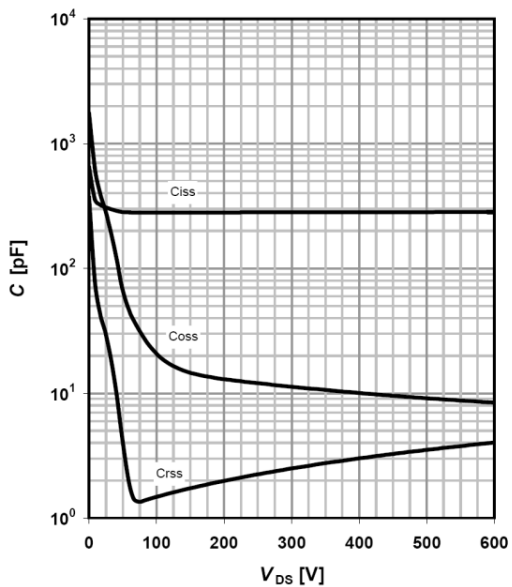
Drain-source breakdown voltage



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

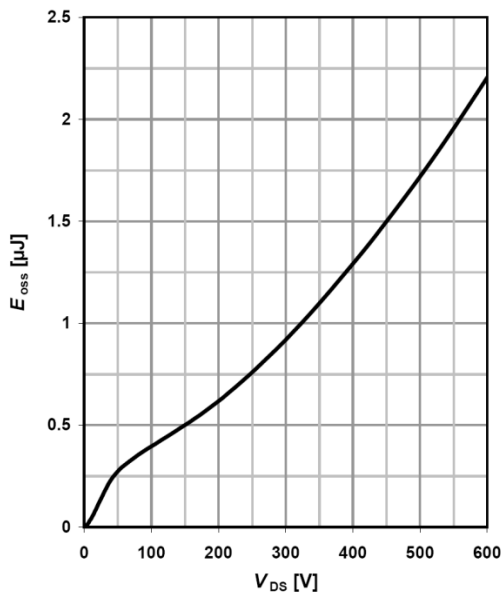
Typical Performance Characteristics

Typ. capacitances



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

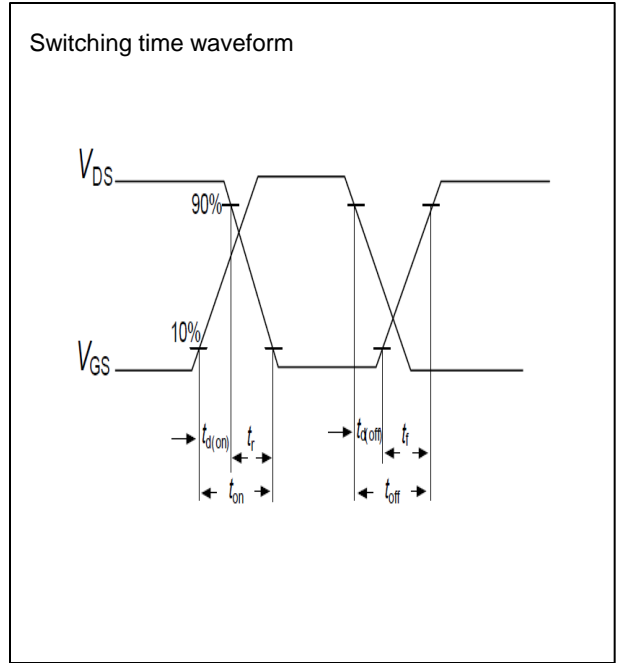
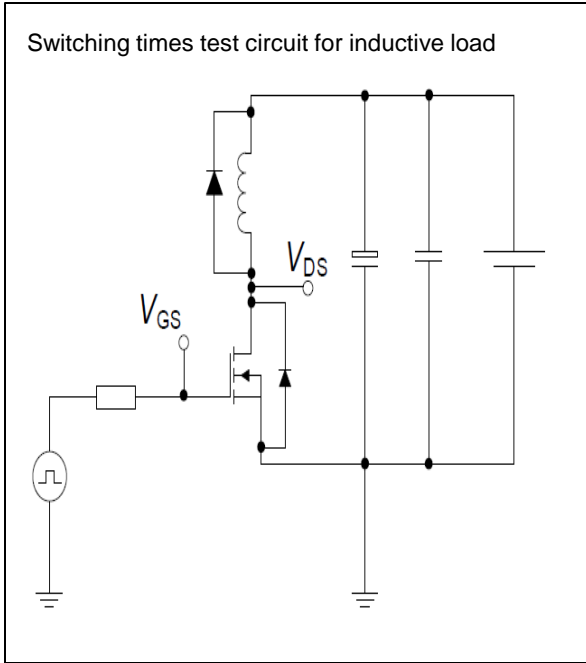
Typ. *Coss* stored energy



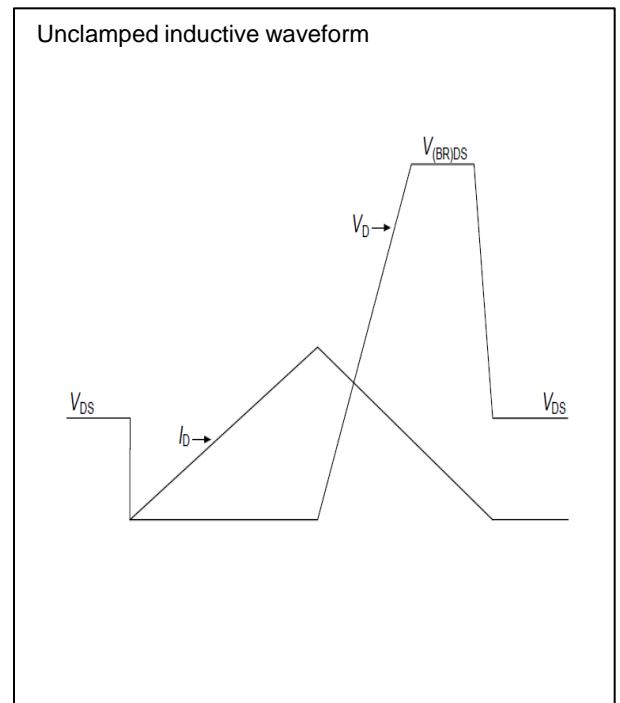
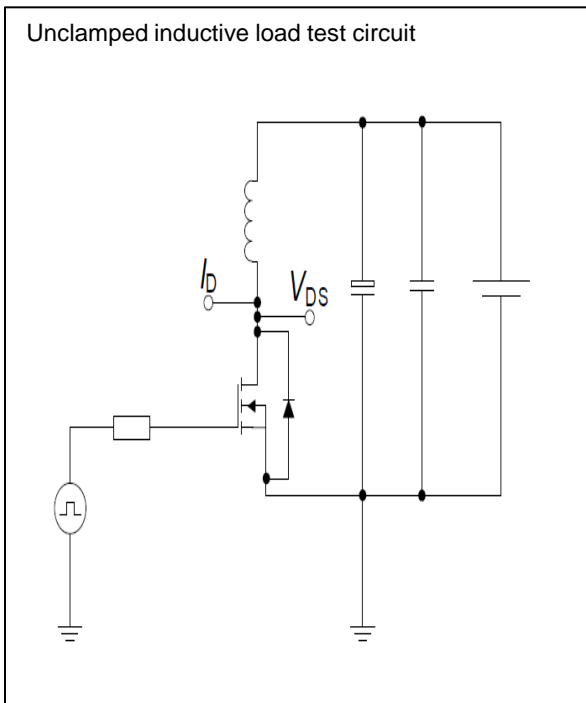
$E_{OSS}=f(V_{DS})$

Test circuits

Switching times test circuit and waveform for inductive load

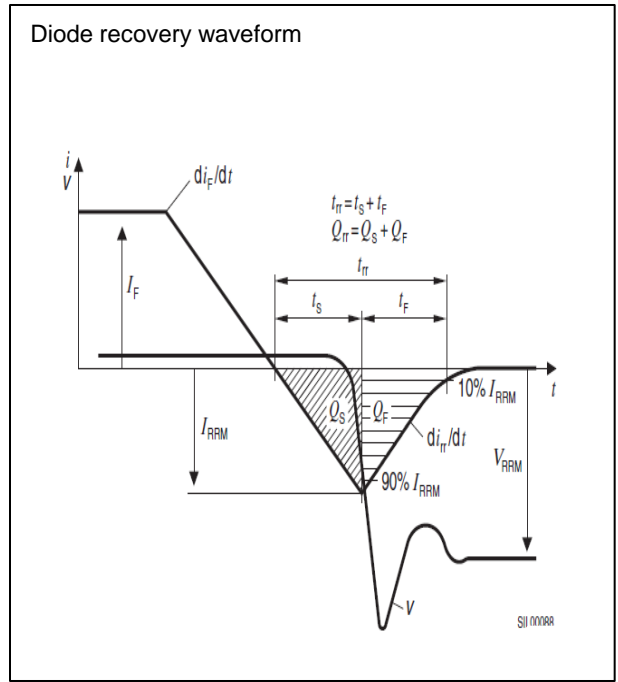
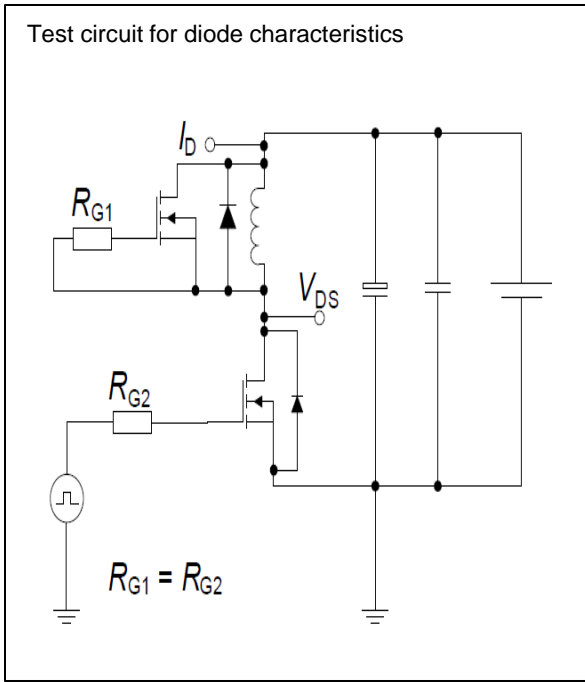


Unclamped inductive load test circuit and waveform



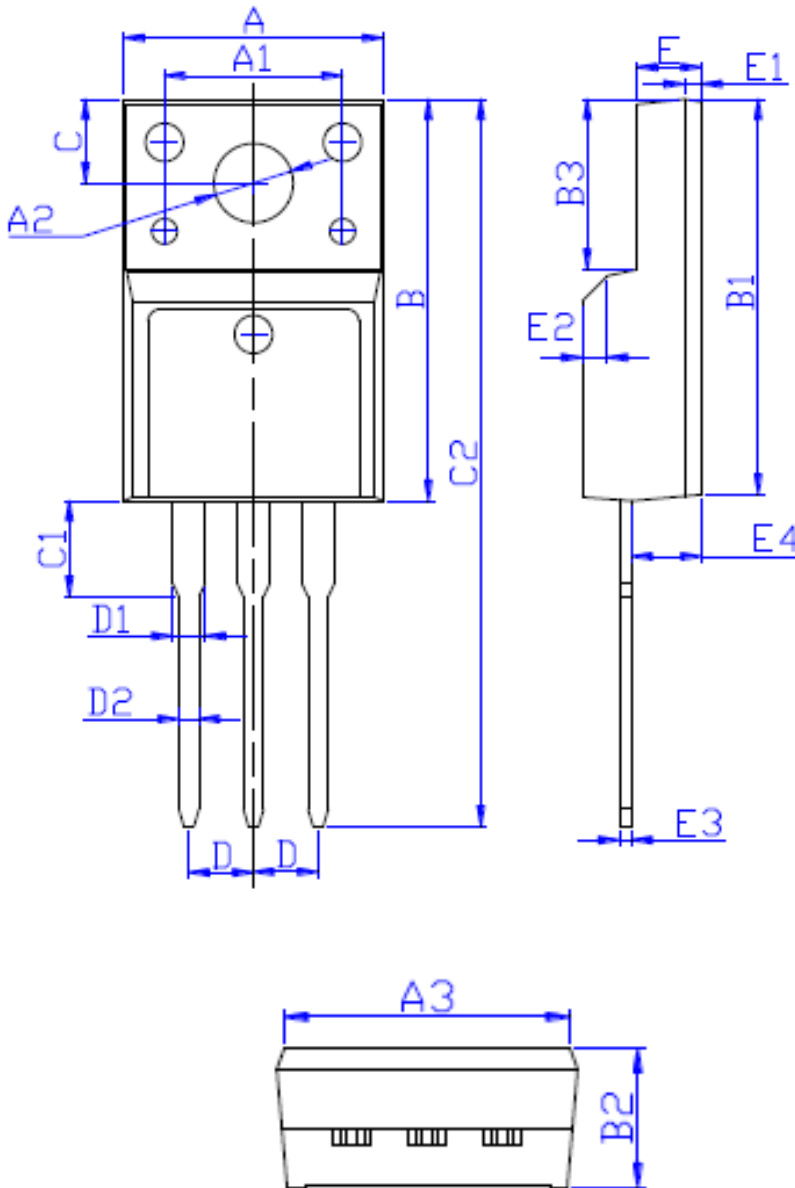
Test circuits

Test circuit and waveform for diode characteristics



Package Outline TO-220F

TSF80R1K3S1 800V 4.4A 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 |