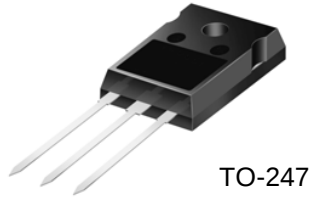


TSK60R070S1

600V 47A N-Channel SJ-MOSFET

General Description

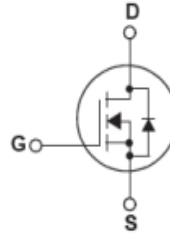
Truesemi SJ-FET is new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance. This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and 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.



TO-247

Features

- 650V @T_J = 150 °C
- Typ. RDS(on) = 60mΩ
- Ultra Low gate charge (typ. Qg = 170nC)
- 100% avalanche tested



Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V _{DSS}	Drain-Source Voltage	600	V
I _D	Drain Current -Continuous (TC = 25°C) -Continuous (TC = 100°C)	47* 29*	A
I _{DM}	Drain Current – Pulsed (Note 1)	140	A
V _{GSS}	Gate-Source voltage	±30	V
E _{AS}	Single Pulsed Avalanche Energy (Note 2)	1135	mJ
I _{AR}	Avalanche Current (Note 1)	9.3	A
E _{AR}	Repetitive Avalanche Energy (Note 1)	1.72	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15	V/ns
dvds/dt	Drain Source voltage slope (Vds=480V)	50	V/ns
P _D	Power Dissipation (TC = 25°C)	391	W
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	0.32	°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

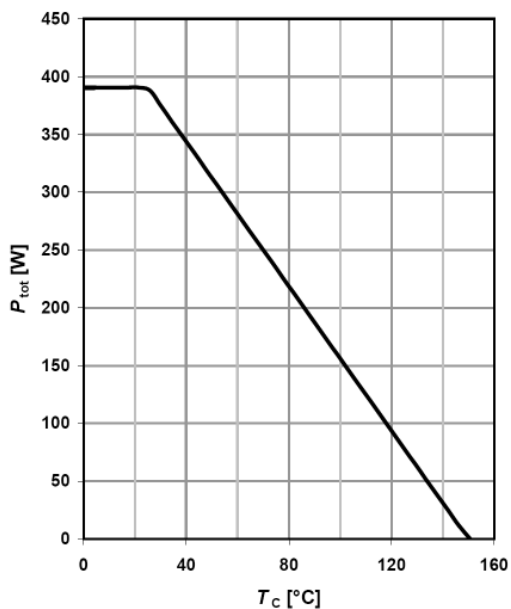
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA, T _J = 25℃	600	--	--	V
		V _{GS} = 0V, I _D = 250μA, T _J = 150℃	--	650	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25℃	--	0.6	--	V/℃
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600V, V _{GS} = 0V T _C = 25℃	--	--	1	μA
		-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 = 23A	--	60	70	mΩ
g _{FS}	Forward Trans conductance	V _{DS} = 40V, I _D = 25A	--	30	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHZ	--	3800	--	pF
C _{oss}	Output Capacitance		--	215	--	pF
C _{rss}	Reverse Transfer Capacitance		--	70	--	pF
t _{d(on)}	Turn-On Delay Time	V _{DD} = 480V, I _D = 23A R _G = 20Ω(Note 4)	--	16	--	ns
t _r	Turn-On Rise Time		--	12	--	ns
t _{d(off)}	Turn-Off Delay Time		--	83	--	ns
t _f	Turn-Off Fall Time		--	5	--	ns
Q _g	Total Gate Charge	V _{DS} = 480V, I _D = 23A V _{GS} = 10V (Note 4)	--	170	--	nC
Q _{gs}	Gate-Source Charge		--	21	--	nC
Q _{gd}	Gate-Drain Charge		--	87	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	47	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	140	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0V, I _F = 23A	--	0.9	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _F = 23A di _F /dt =100A/μs	--	720	--	ns
Q _{rr}	Reverse Recovery Charge		--	19	--	μC

NOTES:

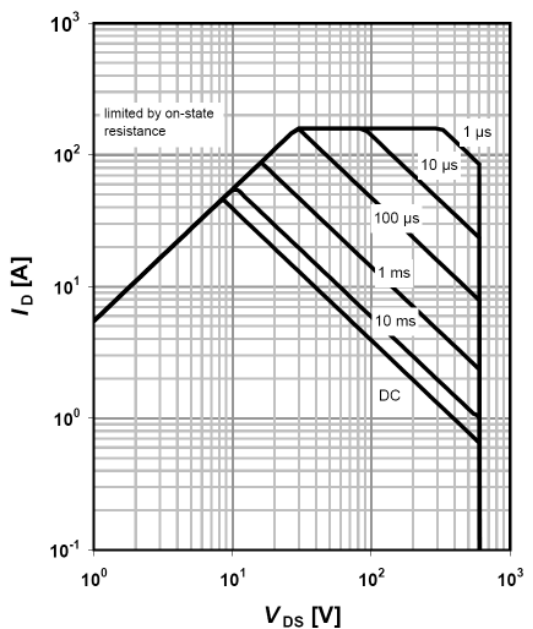
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS}=9.3A, V_{DD}=50V$, Starting $T_J=25^\circ C$
3. $I_{SD}\leq 23A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ C$
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Power dissipation

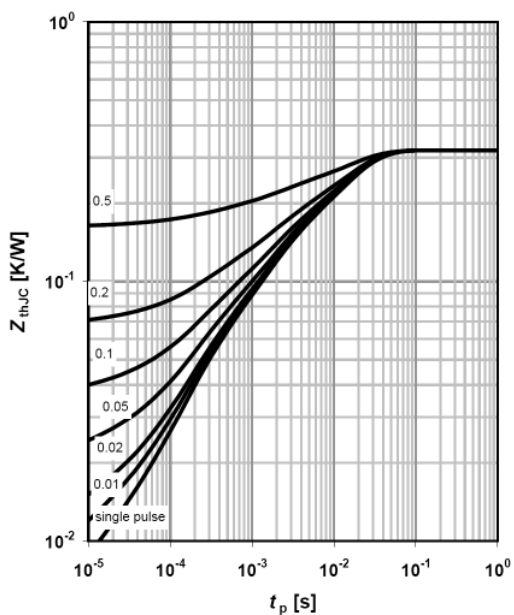


$$P_{tot} = f(T_c)$$

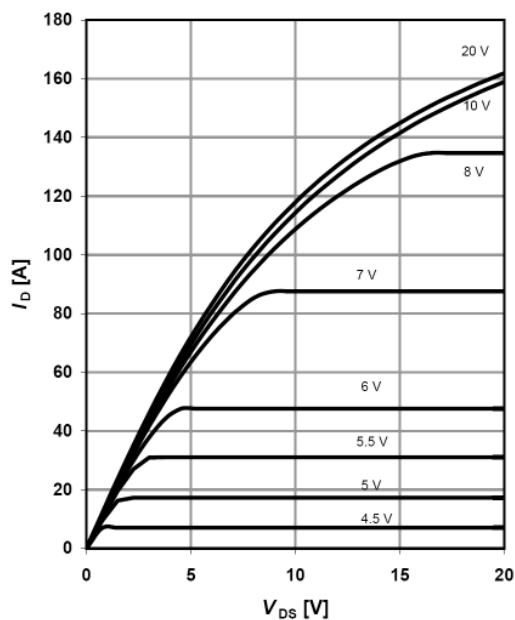
Safe operating area $T_C=25\text{ }^{\circ}\text{C}$ 

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

Max. transient thermal impedance



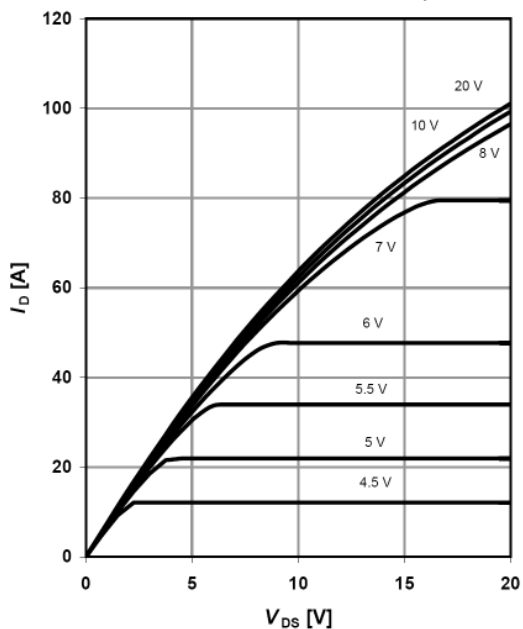
$$Z_{(th)JC} = f(t_p); \text{parameter } D = t_p / T$$

Typ. output characteristics $T_J=25\text{ }^{\circ}\text{C}$ 

$$I_D = f(V_{DS}); T_J = 25\text{ }^{\circ}\text{C}; \text{parameter: } V_{GS}$$

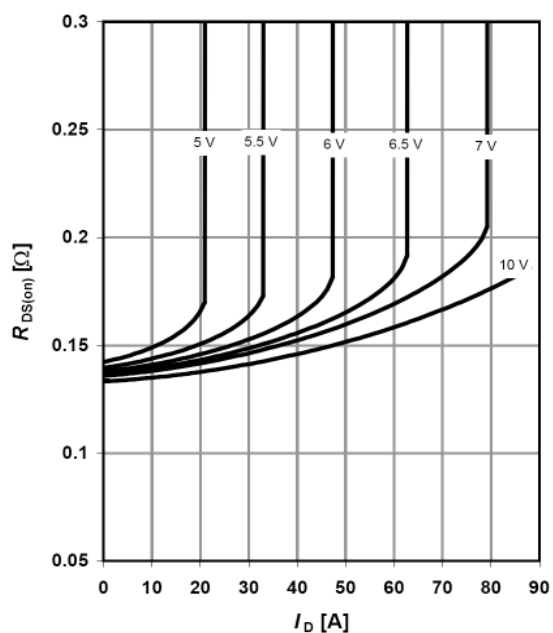
Typical Performance Characteristics

Typ. output characteristics $T_J=125\text{ }^{\circ}\text{C}$



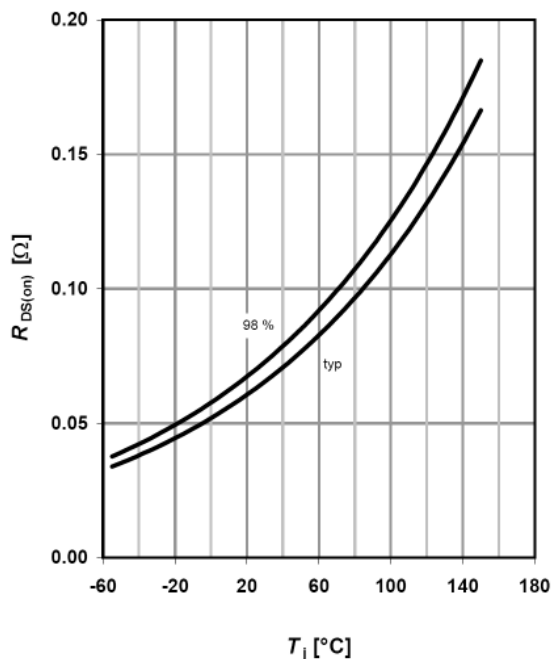
$$I_D = f(V_{DS}); T_J=125\text{ }^{\circ}\text{C}; \text{parameter: } V_{GS}$$

Typ. drain-source on-state resistance



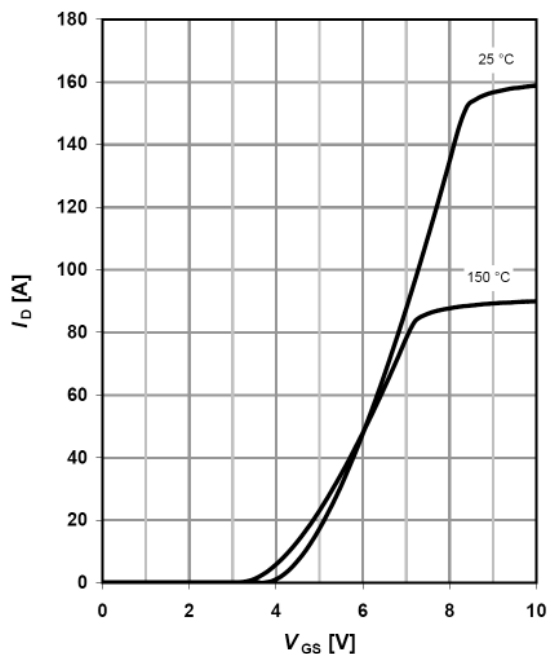
$$R_{DS(on)} = f(I_D); T_J=125\text{ }^{\circ}\text{C}; \text{parameter: } V_{GS}$$

Typ. drain-source on-state resistance



$$R_{DS(on)} = f(T_J); I_D=23\text{ A}; V_{GS}=10\text{ V}$$

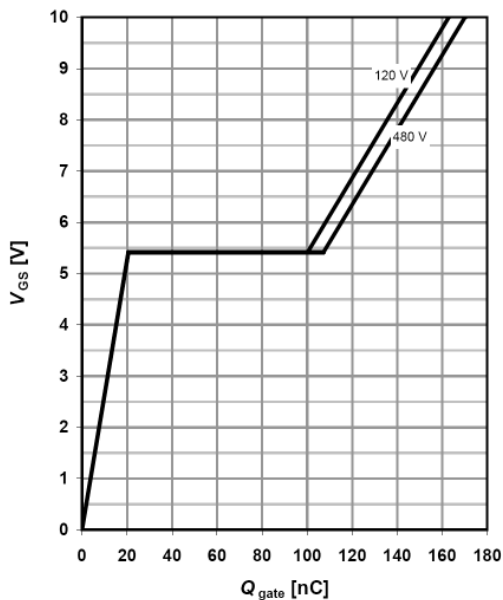
Typ. transfer characteristics



$$I_D = f(V_{GS}); V_{DS}=40\text{ V}$$

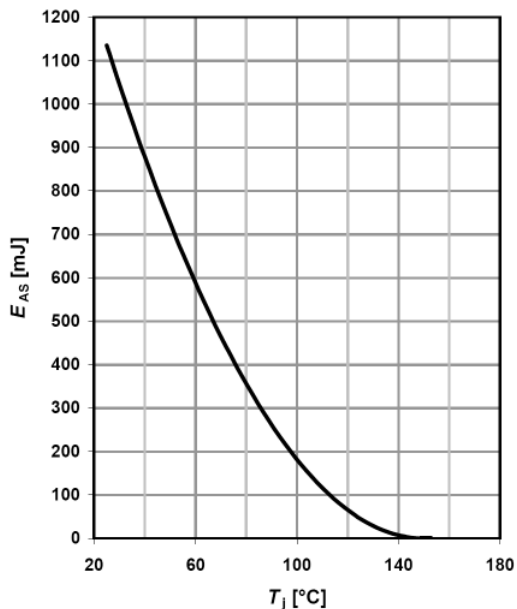
Typical Performance Characteristics

Typ. gate charge



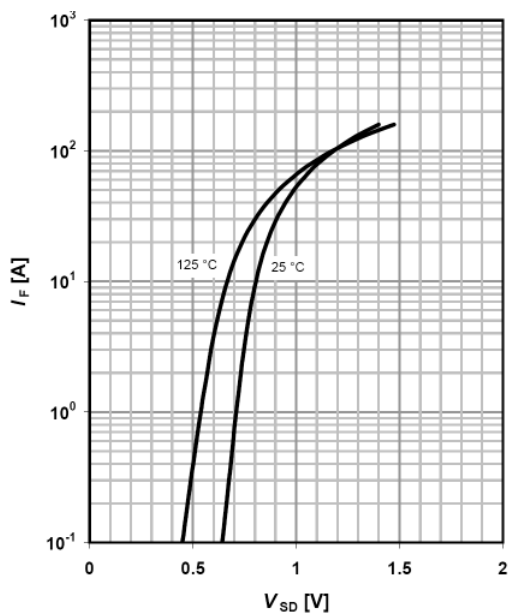
$$V_{GS}=f(Q_g), I_D=23A \text{ pulsed}$$

Avalanche energy



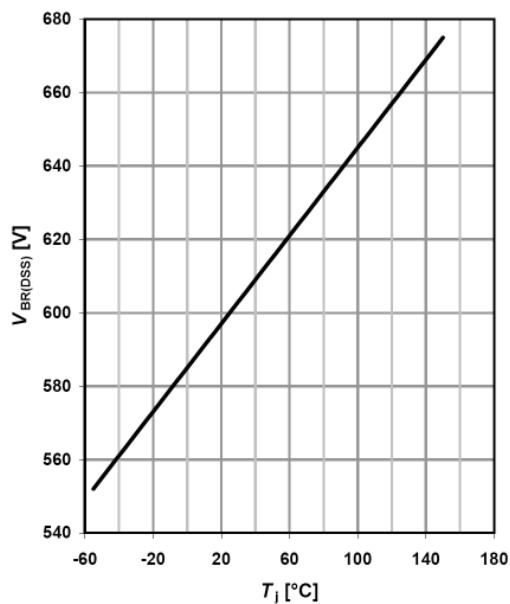
$$E_{AS}=f(T_j); I_D=9.3A; V_{DD}=50 V$$

Forward characteristics of reverse diode



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

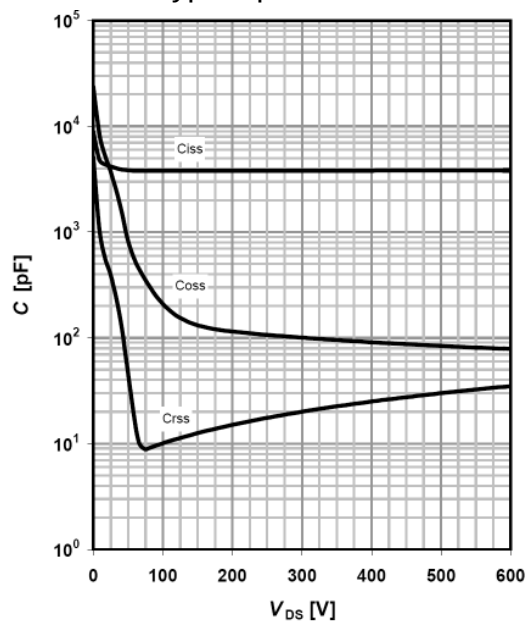
Drain-source breakdown voltage



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

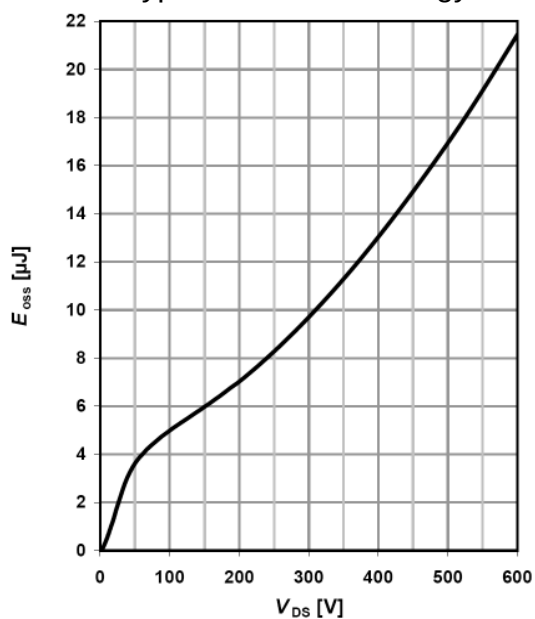
Typical Performance Characteristics

Typ. capacitances



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

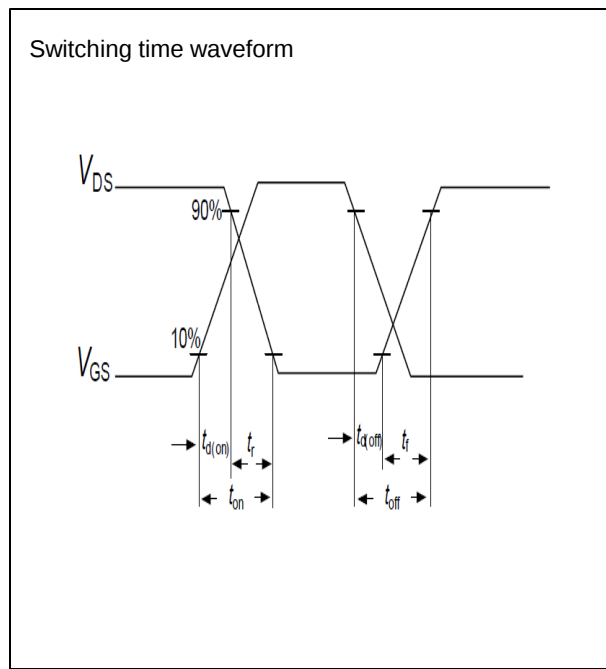
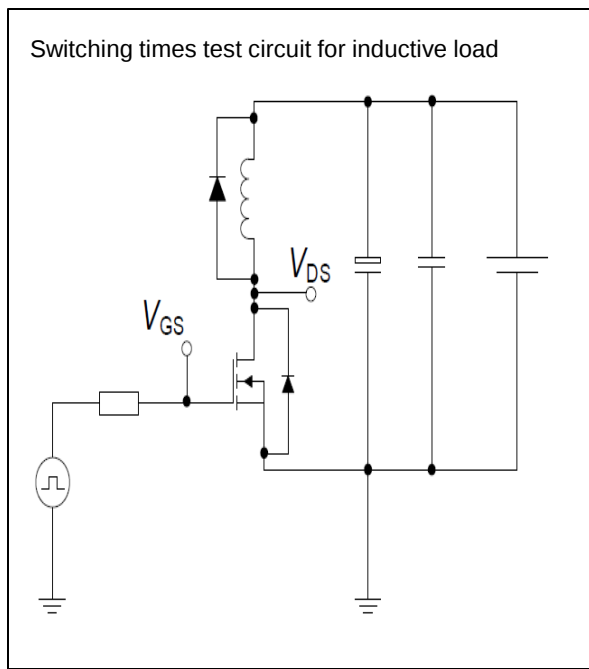
Typ. Coss stored energy



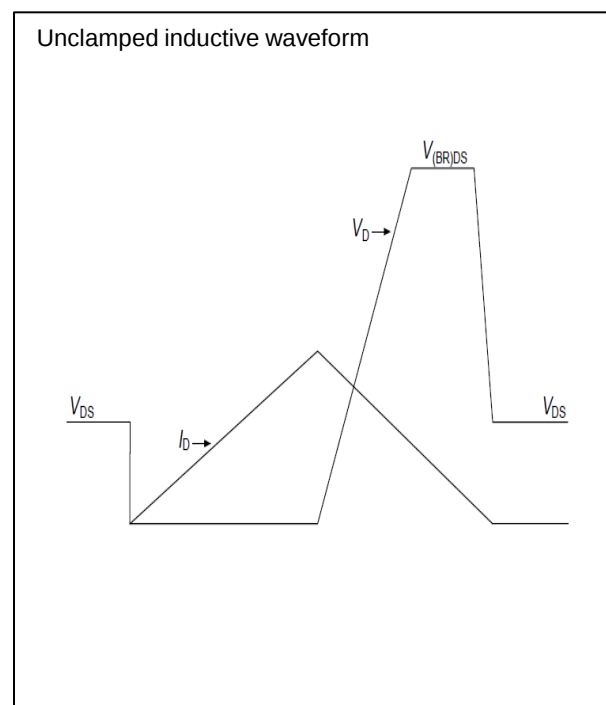
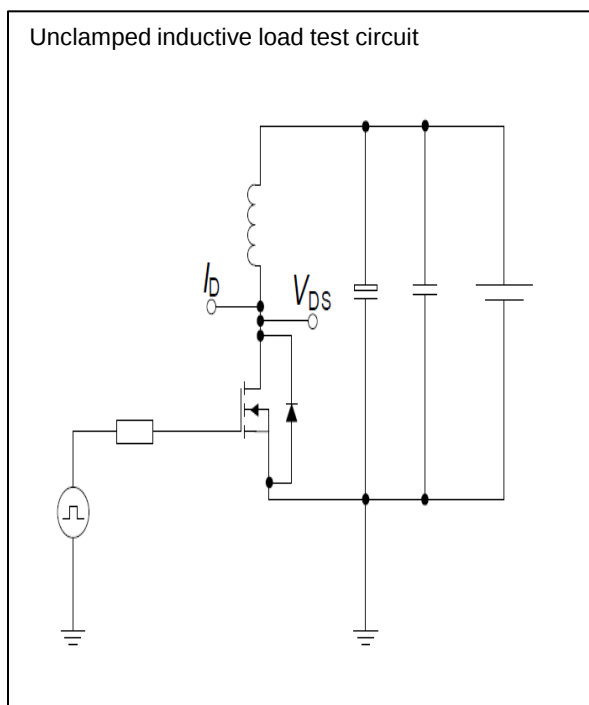
$$E_{OSS}=f(V_{DS})$$

Test circuits

Switching times test circuit and waveform for inductive load



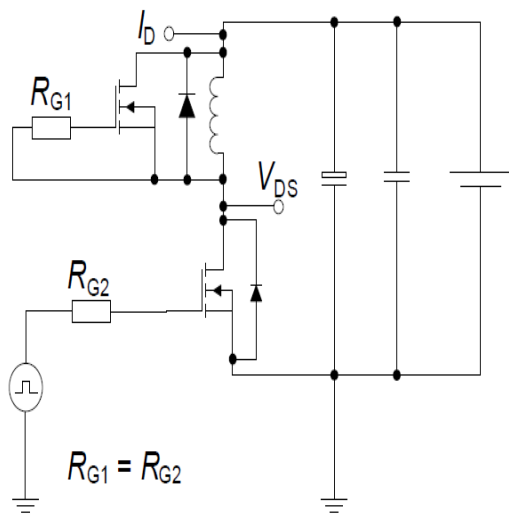
Unclamped inductive load test circuit and waveform



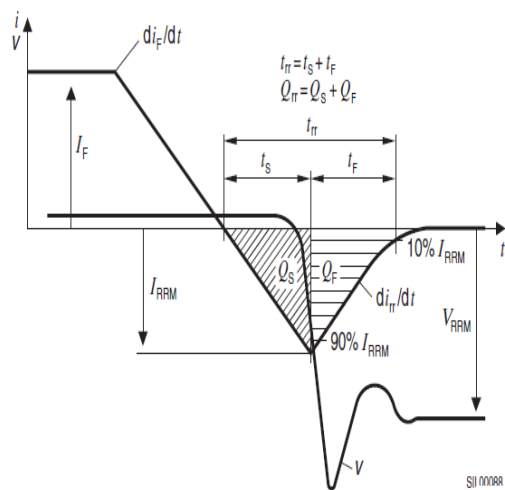
Test circuits

Test circuit and waveform for diode characteristics

Test circuit for diode characteristics

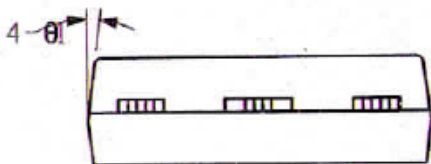
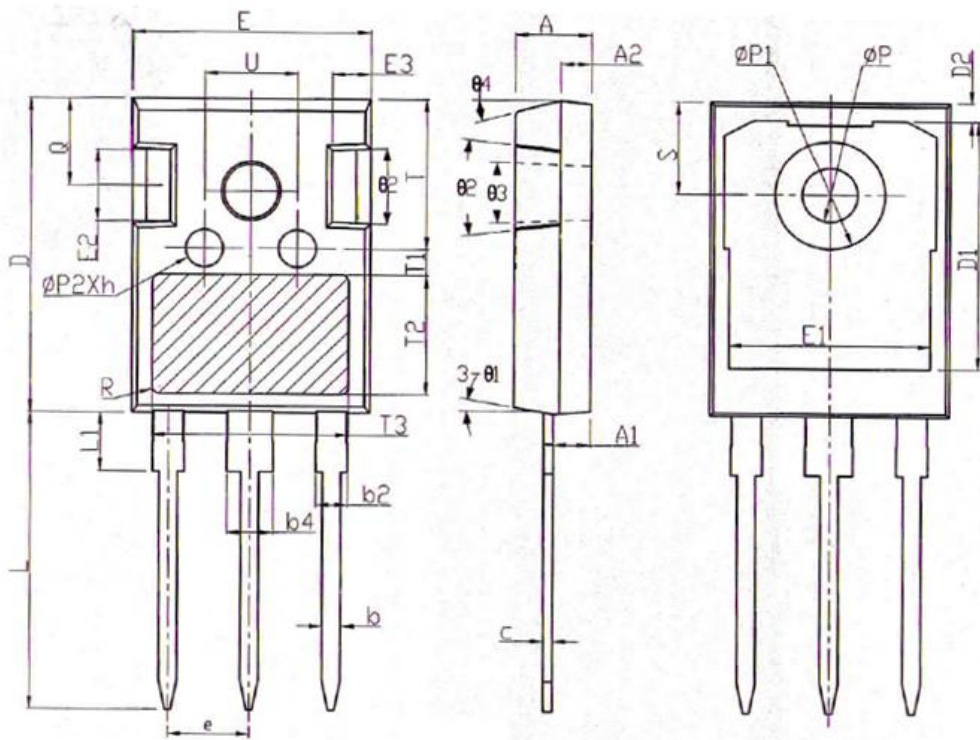


Diode recovery waveform



Package Outline TO-247

TSK60R070S1 600V 47A N-Channel SJ-MOSFET



COMMON DIMENSIONS

SYMBOL	MM		
	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
b	1.16	1.21	1.26
b2	1.96	2.01	2.06
b4	2.96	3.01	3.06
c	0.59	0.61	0.66
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	5.44BSC		
h	0.05	0.10	0.15
L	19.80	19.92	20.10
L1	-	-	4.30
ΦP	3.50	3.60	3.70
$\Phi P1$	-	-	7.30
$\Phi P2$	2.40	2.50	2.60
Q	5.60	5.80	6.00
S	6.15BSC		
R	0.50REF		
T	9.80	-	10.20
T1	1.65REF		
T2	8.00REF		
T3	12.80REF		
U	6.00	-	6.40
$\theta 1$	6°	7°	8°
$\theta 2$	4°	5°	6°
$\theta 3$	1°	-	1.5°
$\theta 4$	14°	15°	16°