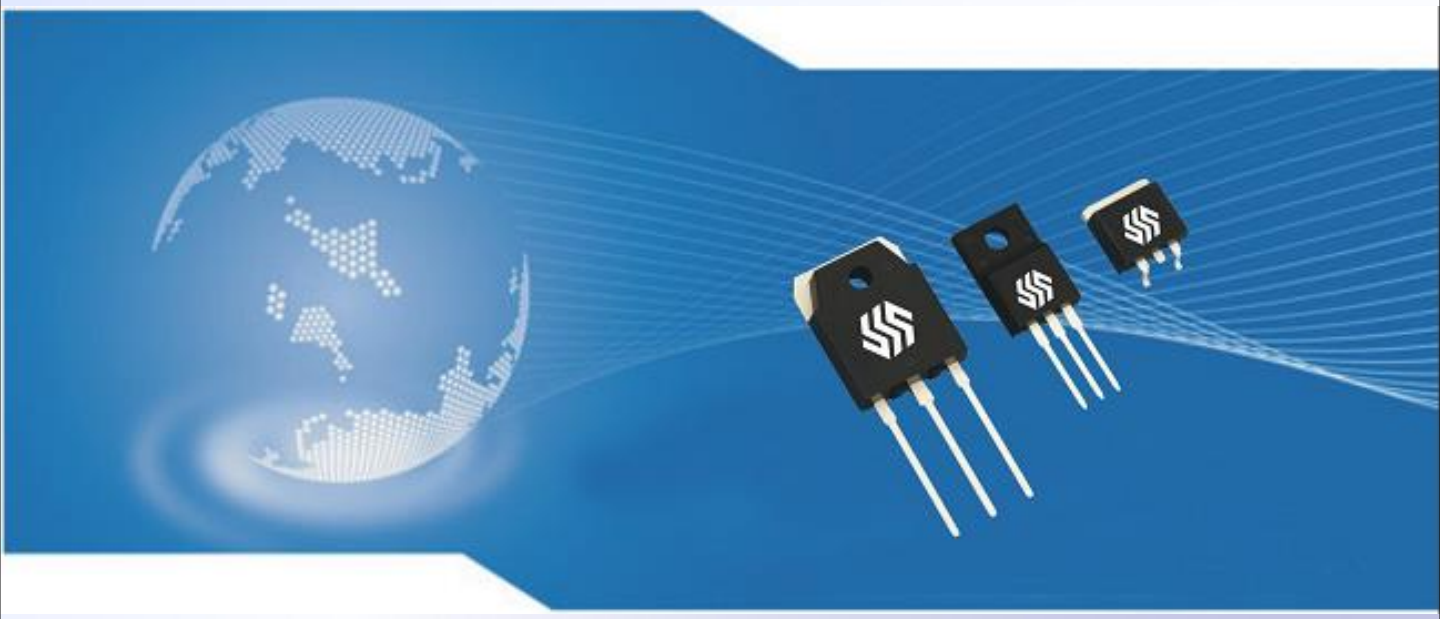
SUPER-SEMI



SUPER-MOSFET

Super Junction Metal Oxide Semiconductor Field Effect Transistor

600V Super Junction Power Transistor
SS*20N60S

Rev. 1.2
May. 2018

www.supersemi.com.cn

SUPER

September, 2013

SJ-FET

SSW20N60S/SSA20N60S
600V N-Channel MOSFET

Description

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.

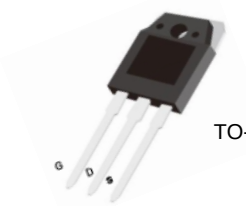
Features

- Multi-Epi process SJ-FET
- 650V @TJ = 150 ℃
- Typ. RDS(on) = 0.16Ω
- Ultra Low Gate Charge (typ. Qg = 30nC)
- 100% avalanche tested

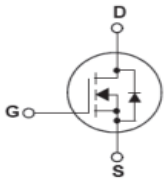
SSW20N60S

TO-247

SSA20N60S



TO-3P



Absolute Maximum Ratings

Symbol	Parameter	SSW_A20N60S	Unit
V_{DSS}	Drain-Source Voltage	600	V
I_D	Drain Current -Continuous (TC = 25℃) -Continuous (TC = 100℃)	 20* 12.6*	A
I_{DM}	Drain Current – Pulsed (Note 1)	62	A
V_{GSS}	Gate-Source voltage	±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	485	mJ
I_{AR}	Avalanche Current (Note 1)	3.5	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	1	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℃) -Derate above 25℃	151 1.67	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. Maximum duty cycle D=0.75.

Thermal Characteristics

Symbol	Parameter	SSW_A 20N60S	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.83	℃/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

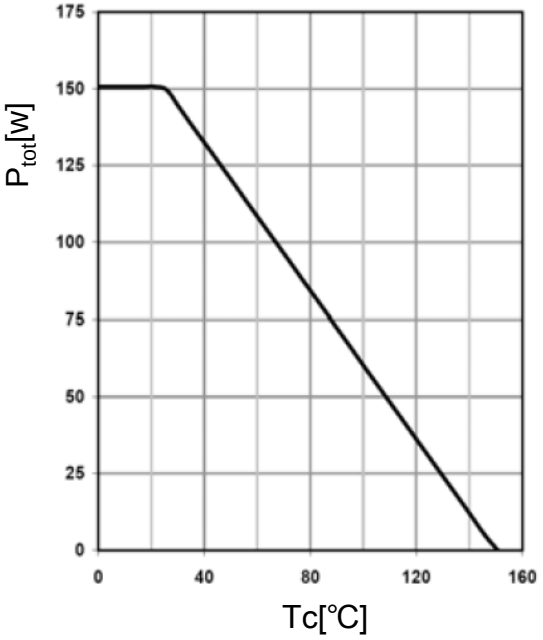
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BVDSS	Drain-Source Breakdown Voltage	VGS = 0V, ID = 250μA, TJ = 25℃	600	-	-	V
		VGS = 0V, ID = 250μA, TJ = 150℃	-	650	-	V
ΔBVDSS / ΔTJ	Breakdown Voltage Temperature Coefficient	ID = 250μA, Referenced to 25℃	-	0.6	-	V/℃
IDSS	Zero Gate Voltage Drain Current	VDS = 600V, VGS = 0V -TJ = 150℃	-	- 10	1 -	μA μA
IGSSF	Gate-Body Leakage Current, Forward	VGS = 30V, VDS = 0V	-	-	100	nA
IGSSR	Gate-Body Leakage Current, Reverse	VGS = -30V, VDS = 0V	-	-	-100	nA
On Characteristics						
VGS(th)	Gate Threshold Voltage	VDS = VGS, ID = 250μA	2.5	-	4.5	V
RDS(on)	Static Drain-Source On-Resistance	VGS = 10V, ID = 10A	-	0.16	0.19	Ω
gFS	Forward Trans conductance	VDS = 40V, ID = 20A	-	19	-	S
Dynamic Characteristics						
Ciss	Input Capacitance	VDS = 25V, VGS = 0V, f = 1.0MHz	-	1440	-	pF
Coss	Output Capacitance		-	370	-	pF
Crss	Reverse Transfer Capacitance		-	11	-	pF
Switching Characteristics						
td(on)	Turn-On Delay Time	VDD = 400V, ID = 10A RG = 20Ω(Note 4)	-	15	-	ns
tr	Turn-On Rise Time		-	11	-	ns
td(off)	Turn-Off Delay Time		-	110	-	ns
tf	Turn-Off Fall Time		-	9	-	ns
Qg	Total Gate Charge	VDS = 480V, ID = 20A VGS = 10V (Note 4)	-	30	-	nC
Qgs	Gate-Source Charge		-	10	-	nC
Qgd	Gate-Drain Charge		-	9	-	nC
Drain-Source Diode Characteristics and Maximum Ratings						
IS	Maximum Continuous Drain-Source Diode Forward Current		-	-	20	A
ISM	Maximum Pulsed Drain-Source Diode Forward Current		-	-	60	A
VSD	Drain-Source Diode Forward Voltage	VGS = 0V, IF = 10A	-	1	1.5	V
trr	Reverse Recovery Time	VR = 480V, IF = 20A di_F/dt =100A/μs	-	500	-	ns
Qrr	Reverse Recovery Charge		-	6	-	μC
Irrm	Peak reverse recovery Current		-	20	-	A

NOTES:

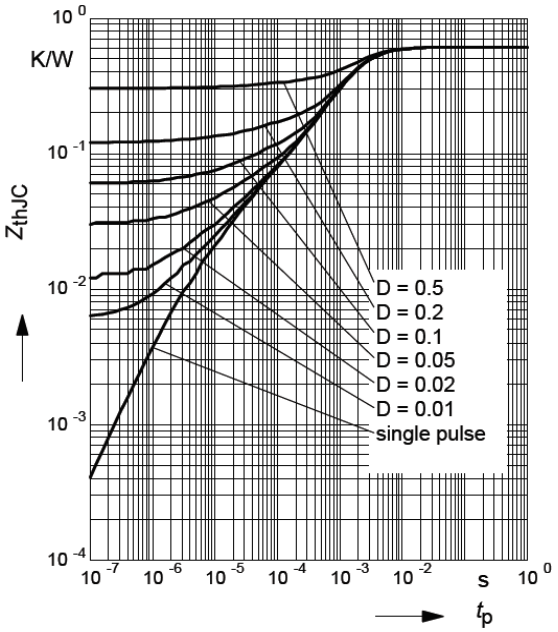
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS}=3.5A, VDD=50V, Starting TJ=25 ℃
3. I_{SD}≤ID, di/dt ≤ 200A/us, V_{DD} ≤ BV_{DSS}, Starting TJ = 25 ℃
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

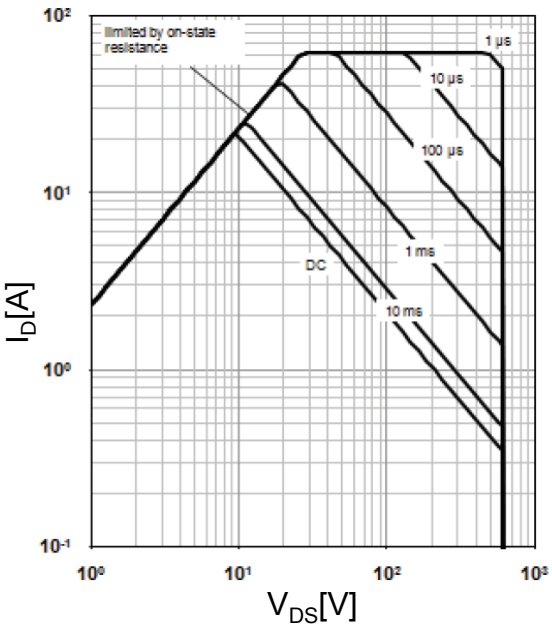
Power dissipation



Max. transient thermal impedance

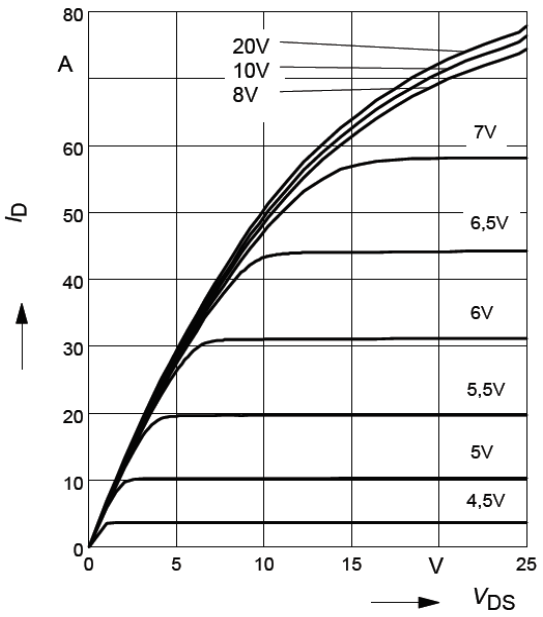


Safe operating area *TC=25 ℃*



I_D=f(V_{DS}); T_C=25 ℃; V_{GS} > 7V; D=0; parameter t_p

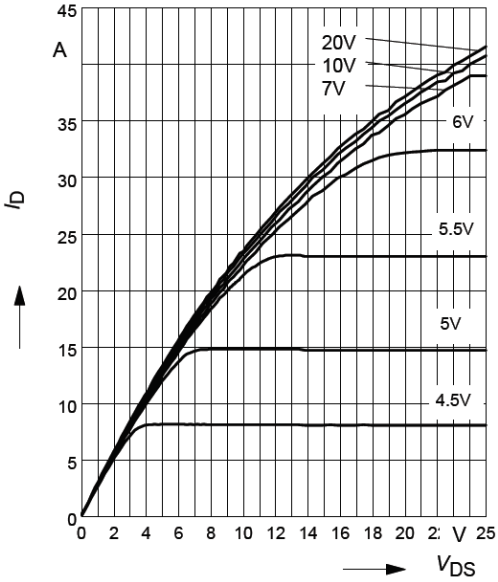
Typ. output characteristic



I_D=f(V_{DS}); T_j=25 ℃; parameter t_p=10us,V_{GS}

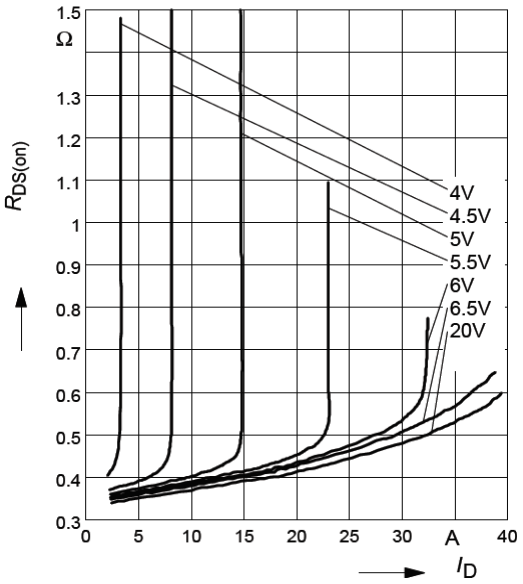
Typical Performance Characteristics

Typ. output characteristic



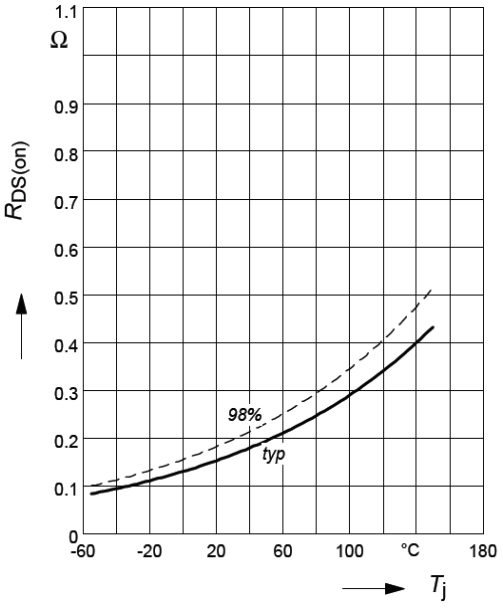
I_D=f(V_{DS}); T_j=150 ℃;
parameter t_p=10us,V_{GS}

Typ. Drain-Source on resistance



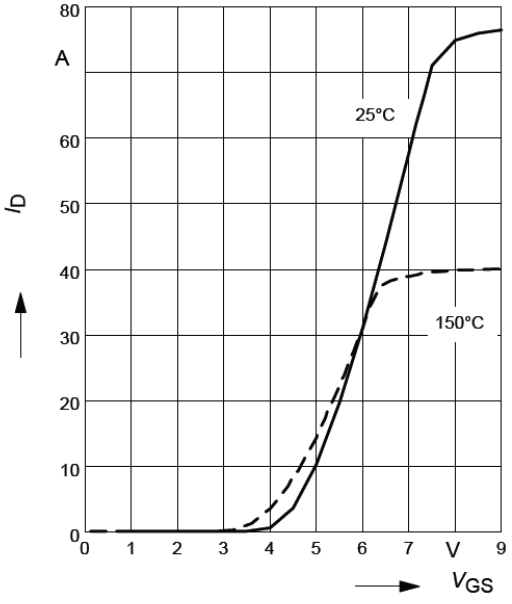
R_{Dson}=f(I_D); T_j=150 ℃; parameter V_{GS}

Typ. Drain-Source on resistance



R_{Dson}=f(T_j); T_j=150 ℃;
parameter I_D=13.1A, V_{GS}=10V

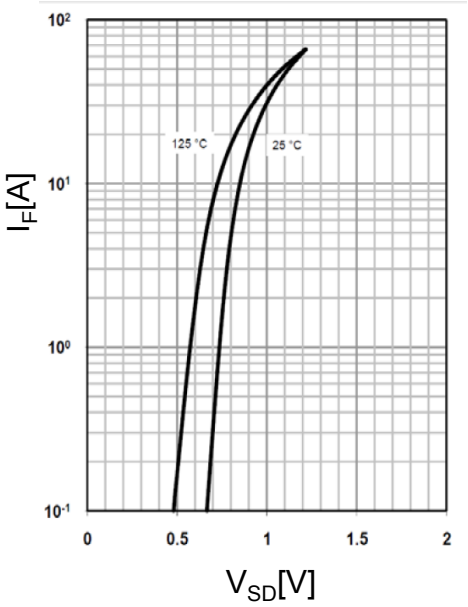
Typ. Transfer characteristic



I_D=f(V_{DS}); V_{DS}>2xI_Dx$R_{DS(on)max}$;
parameter t_p=10us,

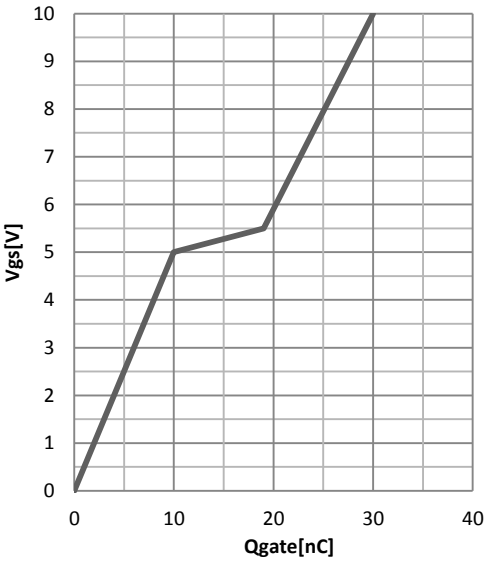
Typical Performance Characteristics

Forward characteristics of reverse diode



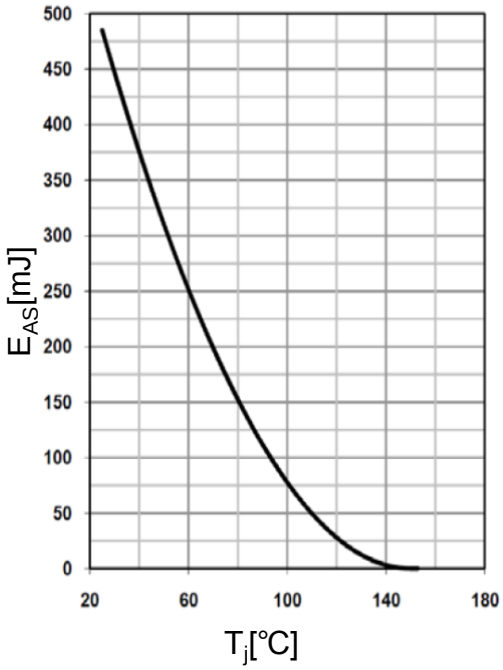
$I_F=f(V_{SD})$; parameter: T_j

Typ. gate charge



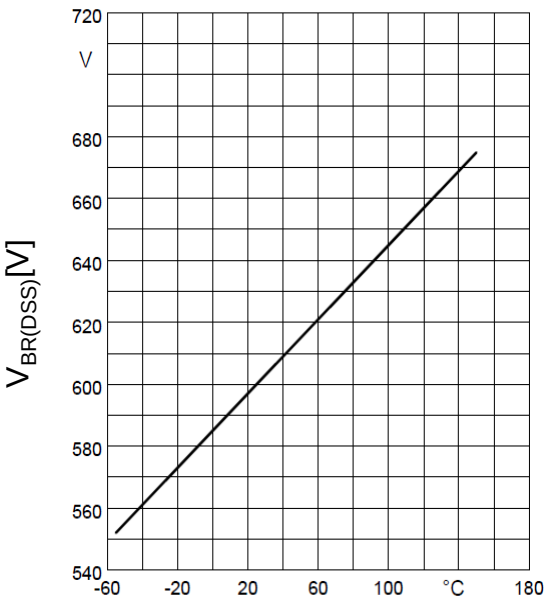
$V_{GS}=f(Q_g)$, I_D=20 A pulsed

Avalanche energy



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

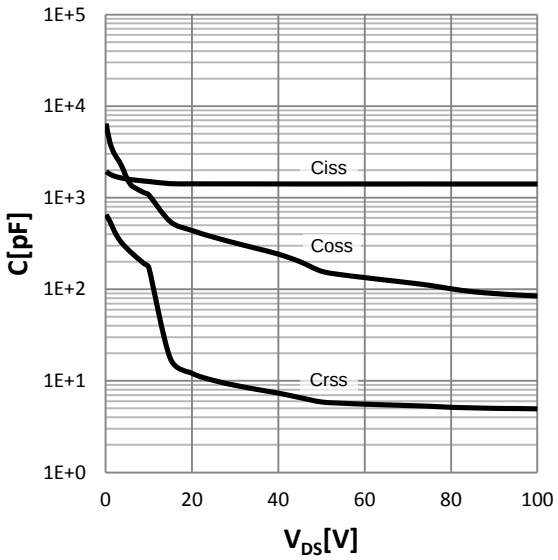
Drain-source breakdown voltage



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

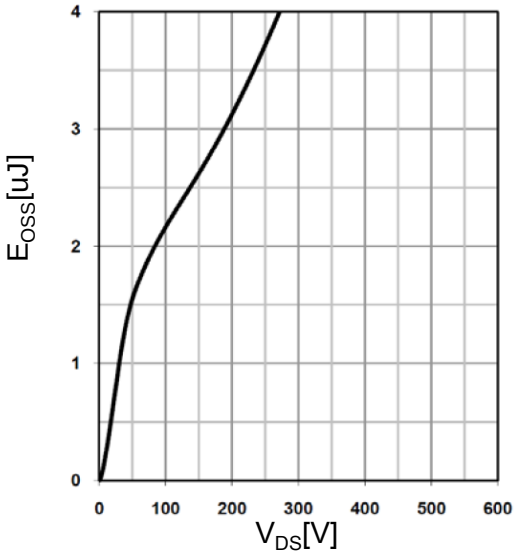
Typical Performance Characteristics

Typ. capacitances



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

Typ. Coss stored energy

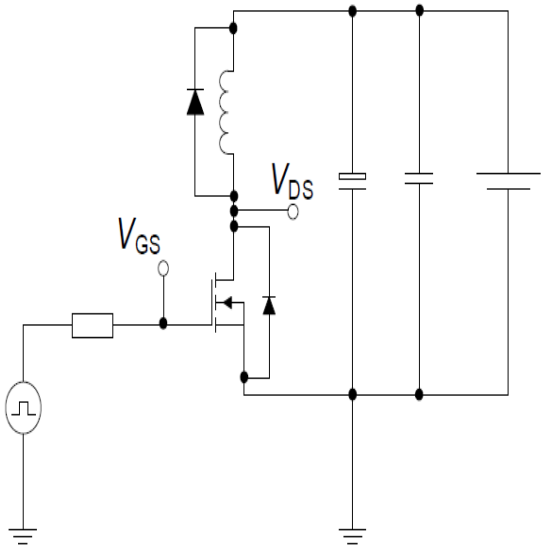


E_{OSS}=f(V_{DS})

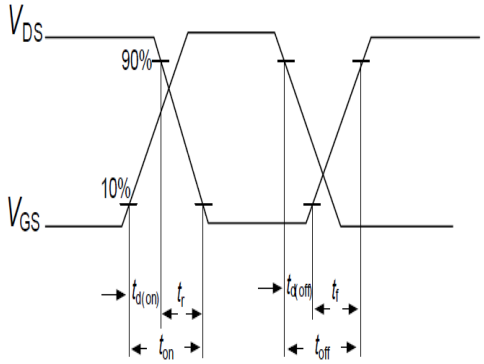
Test circuits

Switching times test circuit and waveform for inductive load

Switching times test circuit for inductive load

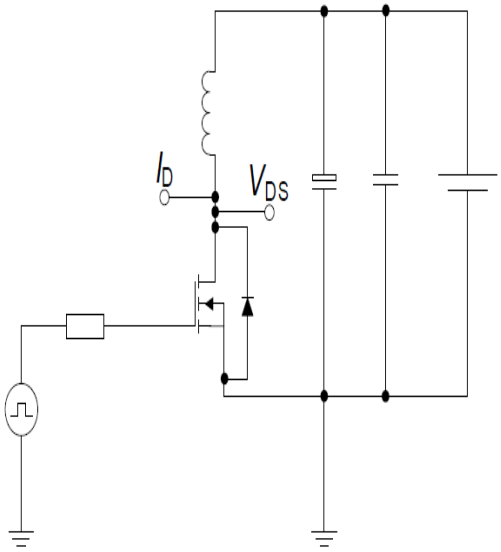


Switching time waveform

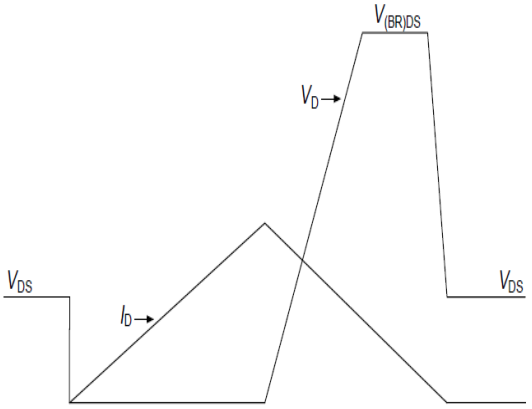


Unclamped inductive load test circuit and waveform

Unclamped inductive load test circuit



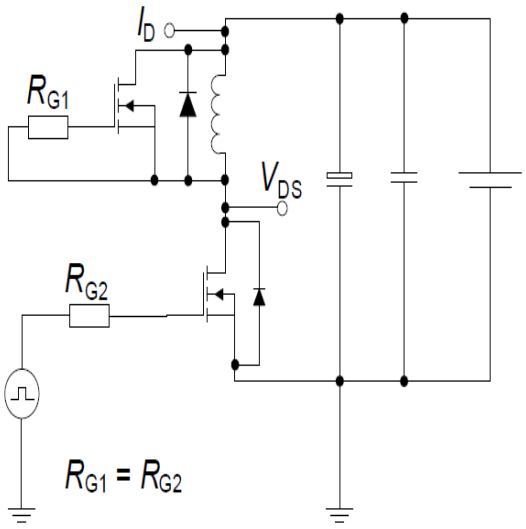
Unclamped inductive waveform



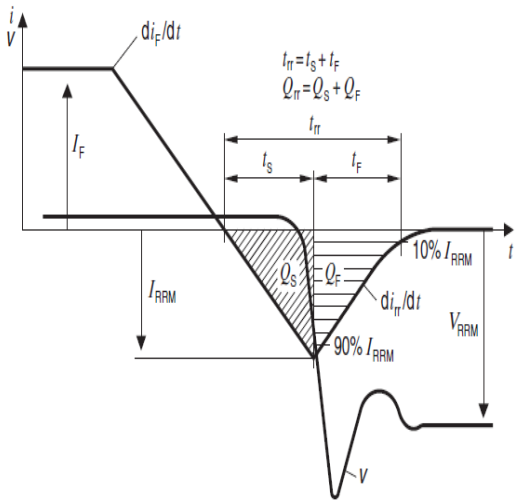
Test circuits

Test circuit and waveform for diode characteristics

Test circuit for diode characteristics

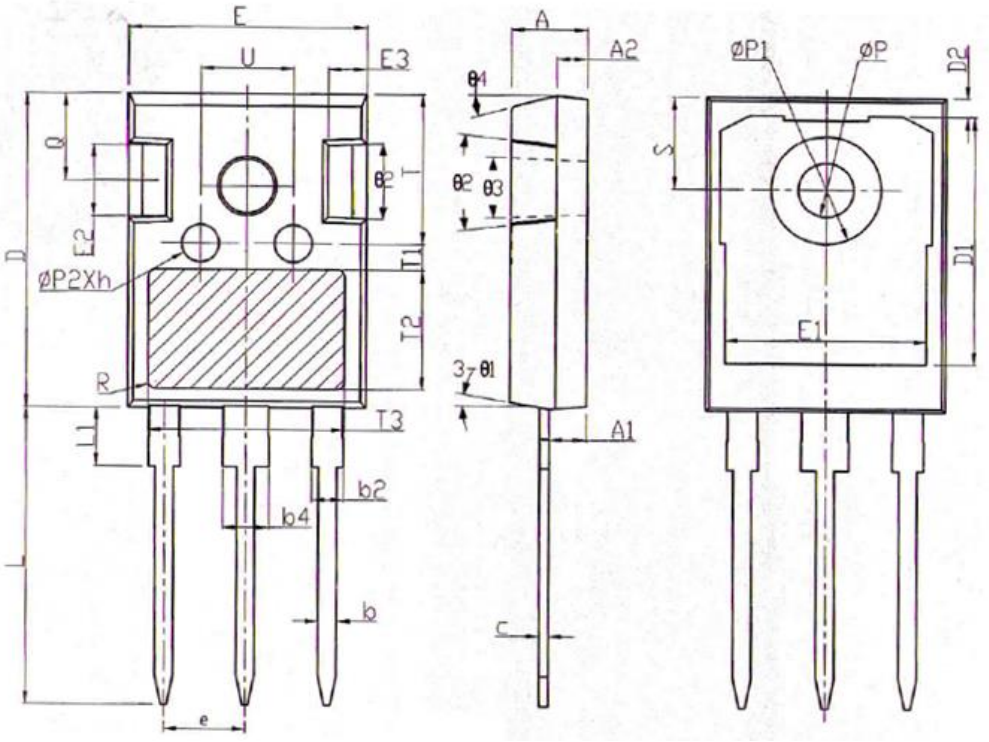


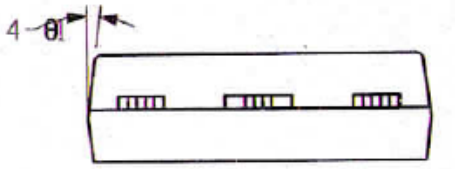
Diode recovery waveform



Package Outline

TO-247



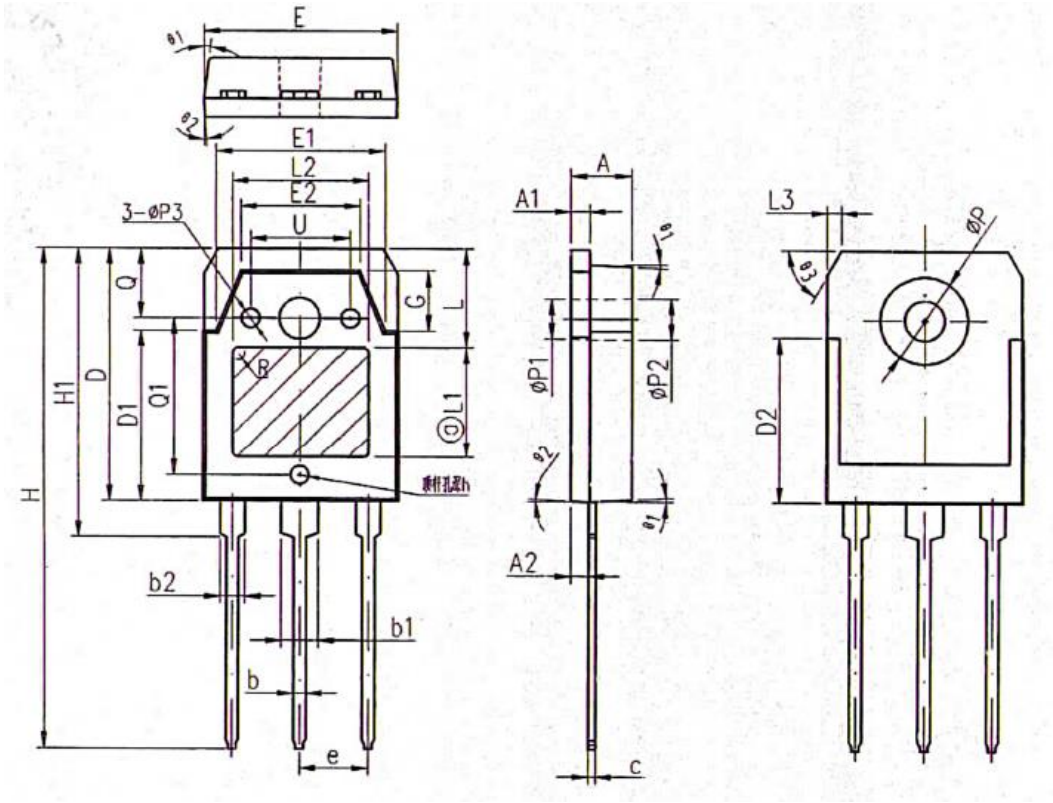


COMMON DIMENSIONS

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
ΦP1	-	-	7.30
ΦP2	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
θ1	6°	7°	8°
θ2	4°	5°	6°
θ3	1°	-	1.5°
θ4	14°	15°	16°

Package Outline

TO-3P



COMMON DIMENSIONS

SYMBOL	MM		
	MIN	NOM	MAX
A	4.60	4.80	5.00
A1	1.40	1.50	1.60
A2	1.33	1.38	1.43
b	0.80	1.00	1.20
b1	2.80	3.00	3.20
b2	1.80	2.00	2.20
c	0.50	0.60	0.70
D	19.75	19.90	20.05
D1	13.70	13.90	14.10
D2	12.90REF		
E	15.40	15.60	15.80
E1	13.40	13.60	13.80
E2	9.40	9.60	9.80
e	5.45 TYP		
G	4.60	4.80	5.00
H	40.30	40.50	40.70
H1	23.20	23.40	23.60
h	0.05	0.10	0.15
L	7.40 TYP		
L1	9.00 TYP		
L2	11.00 TYP		
L3	1.00 REF		
ΦP	6.90	7.00	7.10
ΦP1	3.20 REF		
ΦP2	3.50 REF		
ΦP3	1.40	1.50	1.60
R	0.50 REF		
Q	5.00 REF		
Q1	12.56	12.76	12.96
U	7.8	8	8.2
θ1	5°	7°	9°
θ2	1°	3°	5°
θ3	60° REF		

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