SSF11NS65

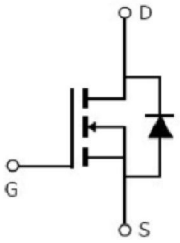
650V N-Channel MOSFET

Main Product Characteristics

V_{DSS}	650V
R_{DS}(on)	0.36ohm(typ.)
I_D	11A

TO-220

Marking and Pin Assignment



Schematic Diagram

Features and Benefits

- High dv/dt and avalanche capabilities
- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance
- Lead free product

Description

The SSF11NS65 series MOSFET is a new technology. which combines an innovative super junction technology and advance process. This new technology achieves low $R_{DS(ON)}$, energy saving, high reliability and uniformity, superior power density and space saving.

Absolute Max Rating

Symbol	Parameter	Max.	Units
I_D @ TC = 25°C	Continuous Drain Current, V_{GS} @ 10V ①	11	A
I_D @ TC = 100°C	Continuous Drain Current, V_{GS} @ 10V ①	7	
I_{DM}	Pulsed Drain Current ②	44	
P_D @TC = 25°C	Power Dissipation ③	162	W
	Linear Derating Factor	1.5	W/°C
V_{DS}	Drain-Source Voltage	650	V
V_{GS}	Gate-to-Source Voltage	± 30	V
E_{AS}	Single Pulse Avalanche Energy @ L=22.5mH	281	mJ
I_{AS}	Avalanche Current @ L=22.5mH	5	A
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C

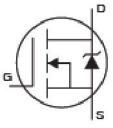
Thermal Resistance

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-case③	—	0.77	℃/W
$R_{\theta JA}$	Junction-to-ambient (t ≤ 10s) ④	—	62	℃/W
	Junction-to-Ambient (PCB mounted, steady-state) ④	—	40	℃/W

Electrical Characteristics @T_A=25℃ unless otherwise specified

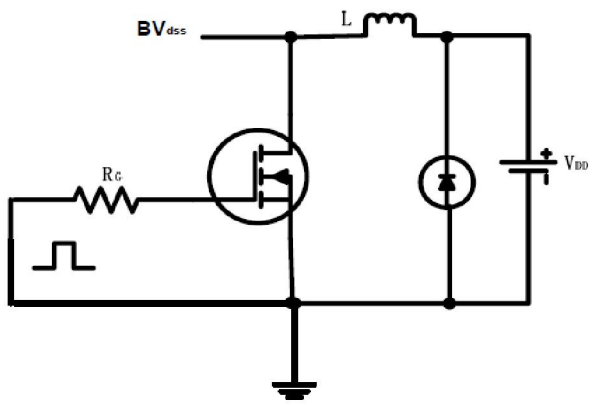
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source breakdown voltage	650	—	—	V	V_{GS} = 0V, ID = 250μA
$R_{DS(on)}$	Static Drain-to-Source on-resistance	—	0.36	0.41	Ω	V_{GS}=10V,I_D = 5.5A
		—	0.88	—		T_J = 125℃
$V_{GS(th)}$	Gate threshold voltage	2	—	4	V	V_{DS} = V_{GS}, I_D = 250μA
		—	2.46	—		T_J = 125℃
I_{DSS}	Drain-to-Source leakage current	—	—	1	μA	V_{DS} =650V,V_{GS} = 0V
		—	—	50		T_J = 125°C
I_{GSS}	Gate-to-Source forward leakage	—	—	100	nA	V_{GS} =30V
		-100	—	—		V_{GS} = -30V
Q_g	Total gate charge	—	28.41	—	nC	I_D = 11A,
Q_{gs}	Gate-to-Source charge	—	6.64	—		V_{DS}=480V,
Q_{gd}	Gate-to-Drain("Miller") charge	—	12.34	—		V_{GS} = 10V
$t_{d(on)}$	Turn-on delay time	—	12.85	—	ns	V_{GS}=10V, VDS=300V,
t_r	Rise time	—	9.45	—		R_L=54.5Ω,
$t_{d(off)}$	Turn-Off delay time	—	30.40	—		R_{GEN}=4.7Ω
t_f	Fall time	—	6.30	—		ID=5.5A
C_{iss}	Input capacitance	—	824.8	—	pF	V_{GS} = 0V
C_{oss}	Output capacitance	—	78.06	—		V_{DS} = 50V
C_{rss}	Reverse transfer capacitance	—	2.75	—		f = 600KHz

Source-Drain Ratings and Characteristics

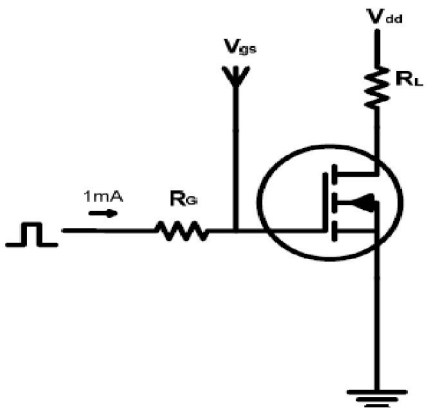
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	11	A	MOSFET symb showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode)	—	—	44	A	
V_{SD}	Diode Forward Voltage	—	—	1.5	V	I_S=11A, V_{GS}=0V
t_{rr}	Reverse Recovery Time	—	313	—	ns	T_J = 25°C, I_F =11A, di/dt = 100A/μs
Q_{rr}	Reverse Recovery Charge	—	2.98	—	uC	

Test Circuits and Waveforms

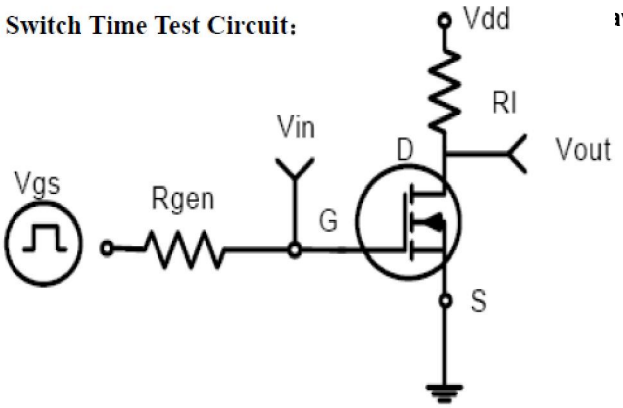
EAS test circuits:



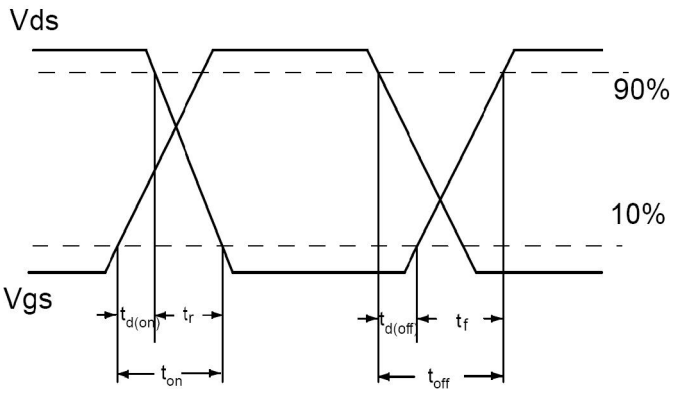
Gate charge test circuit:



Switch Time Test Circuit:



Waveforms:



Notes:

①Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.

②Repetitive rating; pulse width limited by max. junction temperature.

③The power dissipation PD is based on max. junction temperature, using junction-to-case thermal resistance.

④The value of $R_{\theta JA}$ is measured with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with TA =25°C

⑤These curves are based on the junction-to-case thermal impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=175°C.

Typical Electrical and Thermal Characteristics

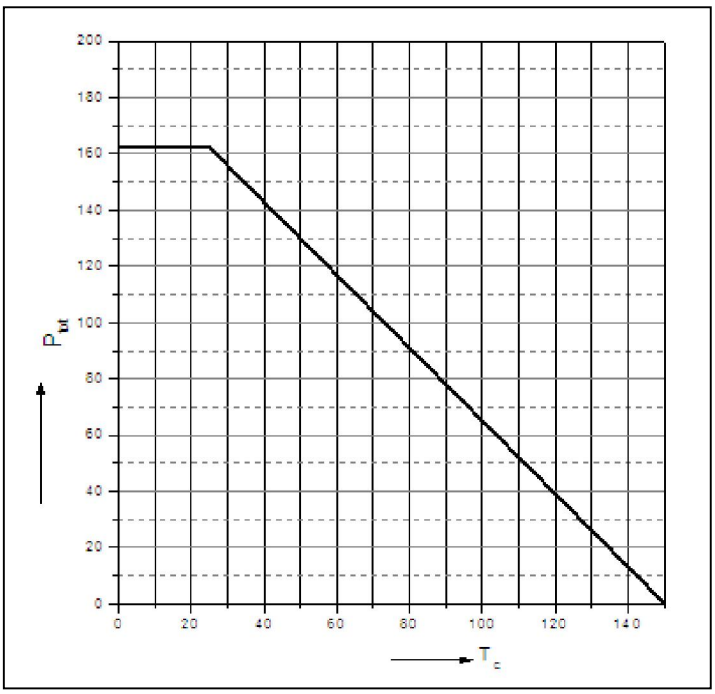


Figure 1: **Power dissipation**

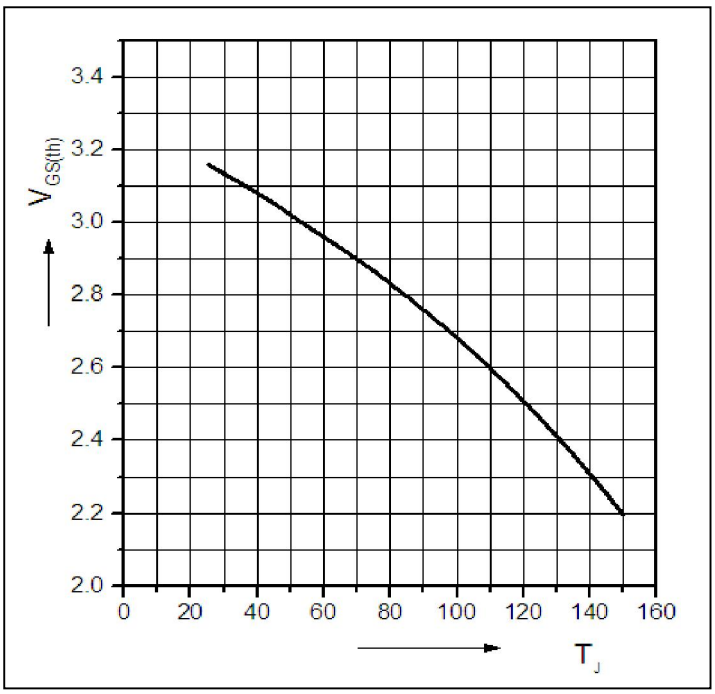


Figure 2. Typ. Gate to source cut-off voltage

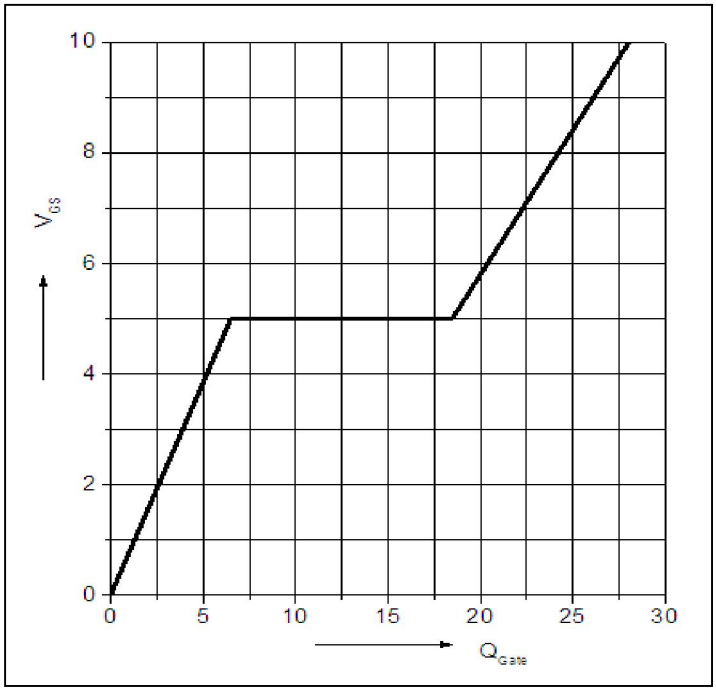


Figure 3. Typ. gate charge

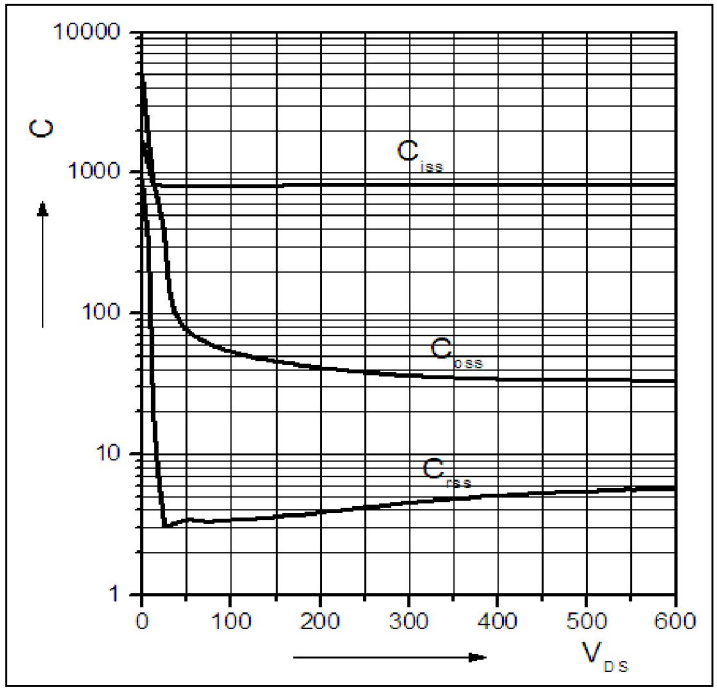


Figure 4: Typ. Capacitances

Typical Electrical and Thermal Characteristics

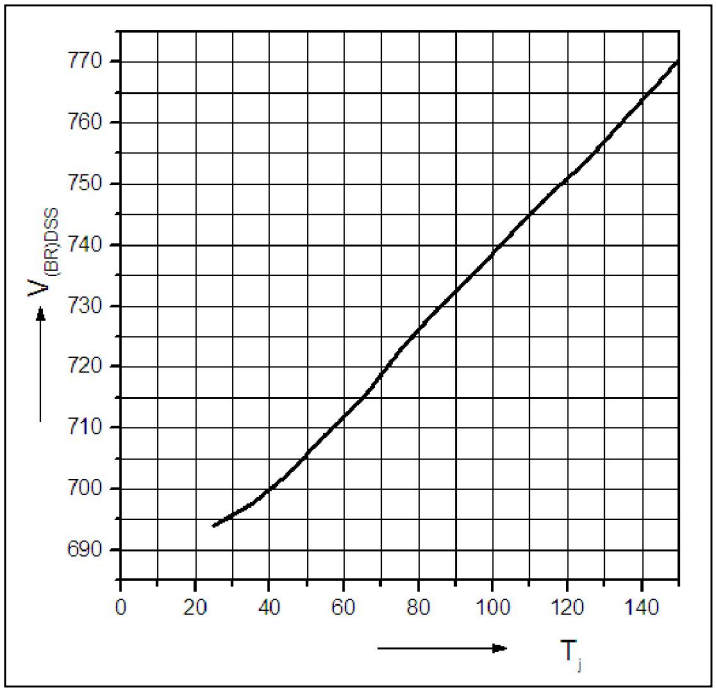


Figure 5. Drain-source breakdown voltage

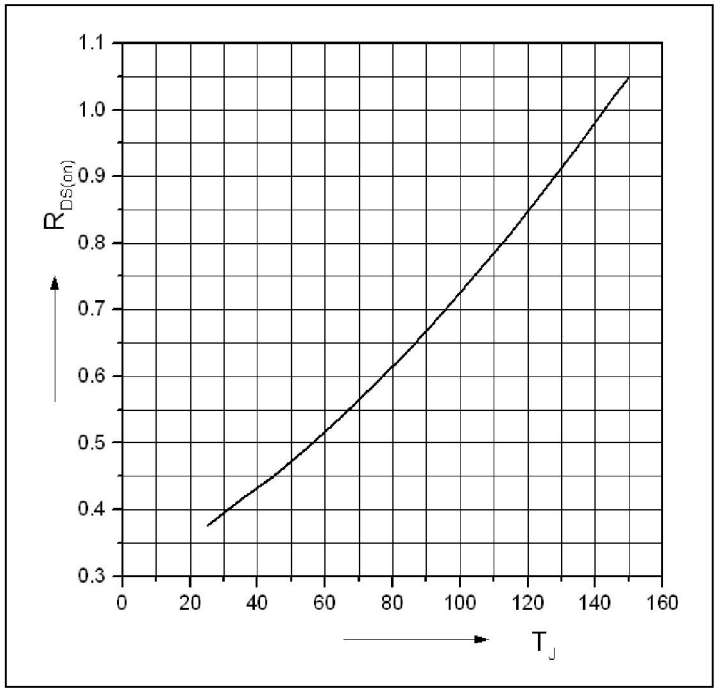
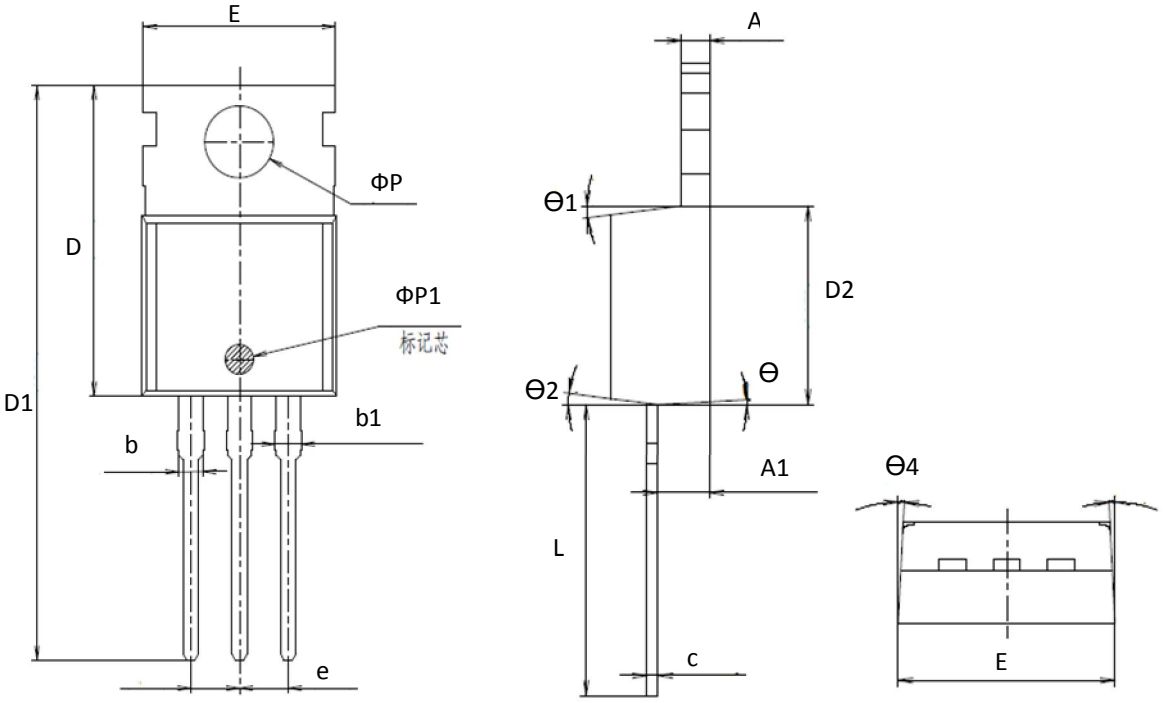


Figure 6. Drain-source on-state resistance

Mechanical Data

TO-220 PACKAGE OUTLINE DIMENSION_GN



Symbol	Dimension In Millimeters			Dimension In Inches		
	Min	Nom	Max	Min	Nom	Max
A	-	1.300	-	-	0.051	-
A1	2.200	2.400	2.600	0.087	0.094	0.102
b	-	1.270	-	-	0.050	-
b1	1.270	1.370	1.470	0.050	0.054	0.058
c	-	0.500	-	-	0.020	-
D	-	15.600	-	-	0.614	-
D1	-	28.700	-	-	1.130	-
D2	-	9.150	-	-	0.360	-
E	9.900	10.000	10.100	0.390	0.394	0.398
E1	-	10.160	-	-	0.400	-
ΦP	-	3.600	-	-	0.142	-
ΦP1		1.500			0.059	
e		2.54BSC			0.1BSC	
L	12.900	13.100	13.300	0.508	0.516	0.524
Θ1	-	7^0	-	-	7^0	-
Θ2	-	7^0	-	-	7^0	-
Θ3	-	3^0	-	5^0	7^0	9^0
Θ4	-	3^0	-	1^0	3^0	5^0

Ordering and Marking Information

Device Marking: SSF11NS65

Package (Available)

TO220

Operating Temperature Range

C : -55 to 150 ºC

Devices per Unit

Package Type	Units/Tube	Tubes/Inner Box	Units/Inner Box	Inner Boxes/Carton Box	Units/Carton Box
TO220	50	20	1000	6	6000

Reliability Test Program

Test Item	Conditions	Duration	Sample Size
High Temperature Reverse Bias(HTRB)	T_j=125℃ to 175℃ @ 80% of Max V_{DSS}/V_{CES}/VR	168 hours 500 hours 1000 hours	3 lots x 77 devices
High Temperature Gate Bias(HTGB)	T_j=150℃ or 175℃ @ 100% of Max V_{GSS}	168 hours 500 hours 1000 hours	3 lots x 77 devices