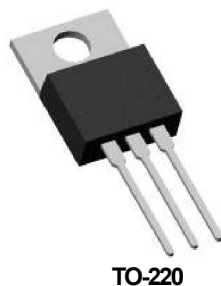
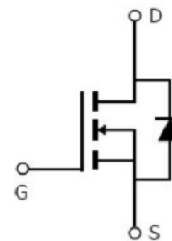


Main Product Characteristics

V_{DSS}	600V
$R_{DS(on)}$	170mΩ(typ.)
I_D	20A



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 SSF20NS60 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
$I_D @ TC = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ ①	20	A
$I_D @ TC = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ ①	13	
I_{DM}	Pulsed Drain Current②	80	
$P_D @ TC = 25^\circ C$	Power Dissipation③	208	W
	Linear Derating Factor	1.4	W/°C
V_{DS}	Drain-Source Voltage	600	V
V_{GS}	Gate-to-Source Voltage	± 30	V
E_{AS}	Single Pulse Avalanche Energy @ L=13.8mH	248	mJ
I_{AR}	Avalanche Current @ L=13.8mH	6	A
$T_J \quad T_{STG}$	Operating Junction and Storage Temperature Range	-55 to + 150	°C

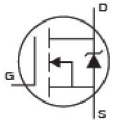
Thermal Resistance

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-case ^③	—	0.6	°C/W
$R_{\theta JA}$	Junction-to-ambient ($t \leq 10s$) ^④	—	62	°C/W

Electrical Characteristics @ $T_A=25^\circ C$ unless otherwise specified

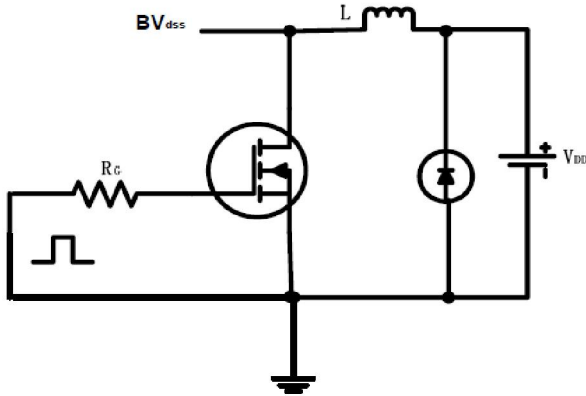
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source breakdown voltage	600	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$R_{DS(on)}$	Static Drain-to-Source on-resistance	—	170	190	mΩ	$V_{GS}=10V, I_D = 13A$
		—	475	—		$T_J = 125^\circ C$
$V_{GS(th)}$	Gate threshold voltage	2	—	4	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
		—	2.40	—		$T_J = 125^\circ C$
I_{DSS}	Drain-to-Source leakage current	—	—	1	μA	$V_{DS} = 600V, V_{GS} = 0V$
		—	—	50		$T_J = 125^\circ C$
I_{GSS}	Gate-to-Source forward leakage	—	—	100	nA	$V_{GS} = 30V$
		—	—	-100		$V_{GS} = -30V$
Q_g	Total gate charge	—	50.58	—	nC	$I_D = 20A,$ $V_{DS}=480V,$ $V_{GS} = 10V$
Q_{gs}	Gate-to-Source charge	—	11.71	—		
Q_{gd}	Gate-to-Drain("Miller") charge	—	21.63	—		
$t_{d(on)}$	Turn-on delay time	—	15.42	—	ns	$V_{GS}=10V, V_{DS}=380V,$ $R_L=18\Omega,$ $R_{GEN}=3.38\Omega$ $I_D=18A$
t_r	Rise time	—	44.80	—		
$t_{d(off)}$	Turn-Off delay time	—	30.92	—		
t_f	Fall time	—	40.36	—		
C_{iss}	Input capacitance	—	1514	—	pF	$V_{GS} = 0V$
C_{oss}	Output capacitance	—	57.44	—		$V_{DS} = 25V$
C_{rss}	Reverse transfer capacitance	—	8.43	—		$f = 500KHz$

Source-Drain Ratings and Characteristics

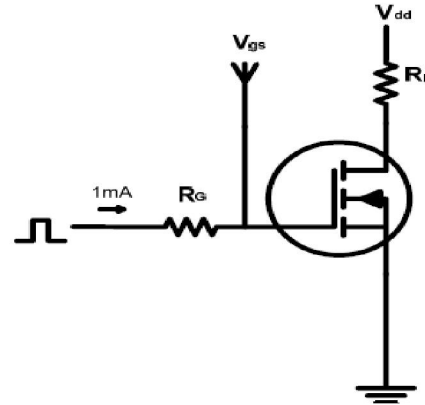
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	20	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode)	—	—	80	A	
V_{SD}	Diode Forward Voltage	—	0.87	1.3	V	$I_S=20A, V_{GS}=0V$
t_{rr}	Reverse Recovery Time	—	370	—	ns	$T_J = 25^\circ C, I_F = 20A, di/dt =$
Q_{rr}	Reverse Recovery Charge	—	5	—	μC	$100A/\mu s$

Test Circuits and Waveforms

EAS test circuits:



Gate charge test circuit:



Switch Time Test Circuit:



Waveforms:



Notes:

- ① The maximum current rating is limited by bond-wires.
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ The power dissipation PD is based on max. junction temperature, using junction-to-case thermal resistance.
- ④ The value of $R_{\theta JA}$ is measured with the device mounted on 1in 2 FR-4 board with 2oz. Copper, in a still air environment with $T_A = 25^\circ\text{C}$
- ⑤ These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)} = 150^\circ\text{C}$.

Typical Electrical and Thermal Characteristics

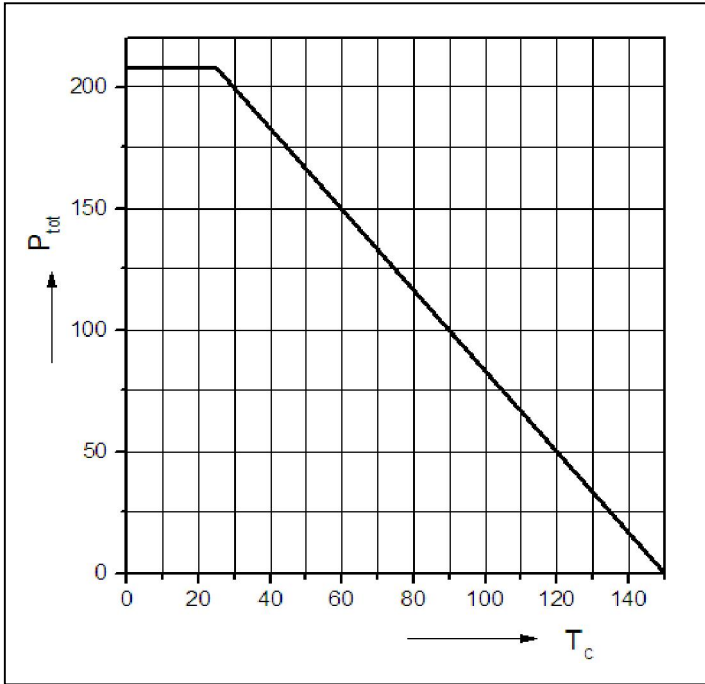


Figure 1: Power dissipation

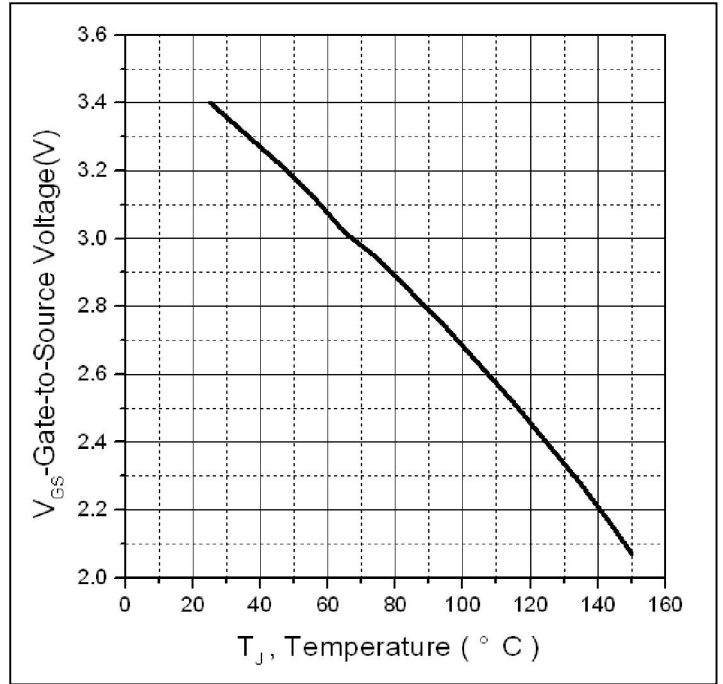


Figure 2: Typ. Gate to source cut-off voltage

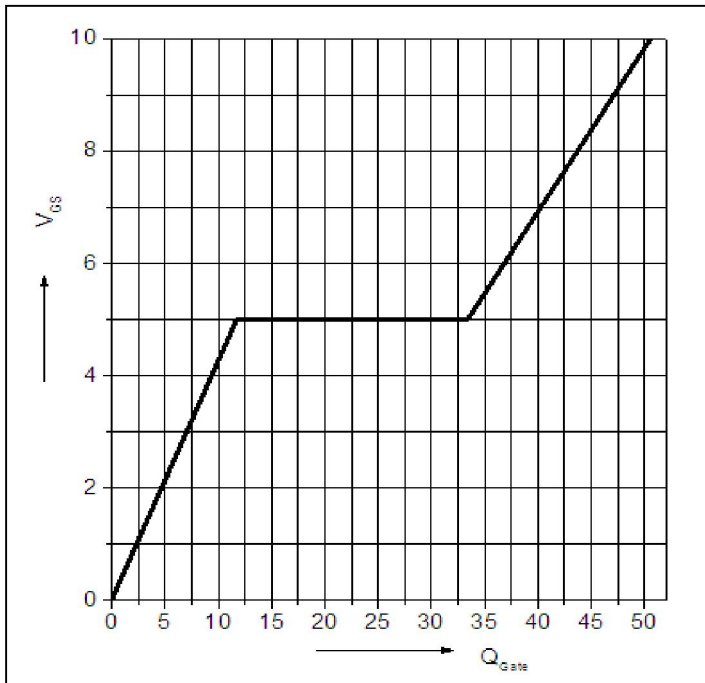


Figure 3: Typ. gate charge

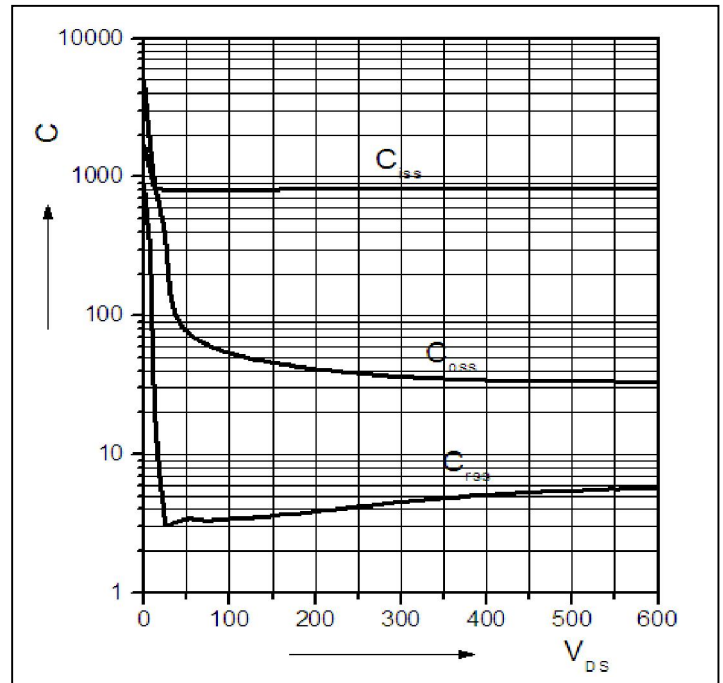


Figure 4: Typ. Capacitances

Typical Electrical and Thermal Characteristics

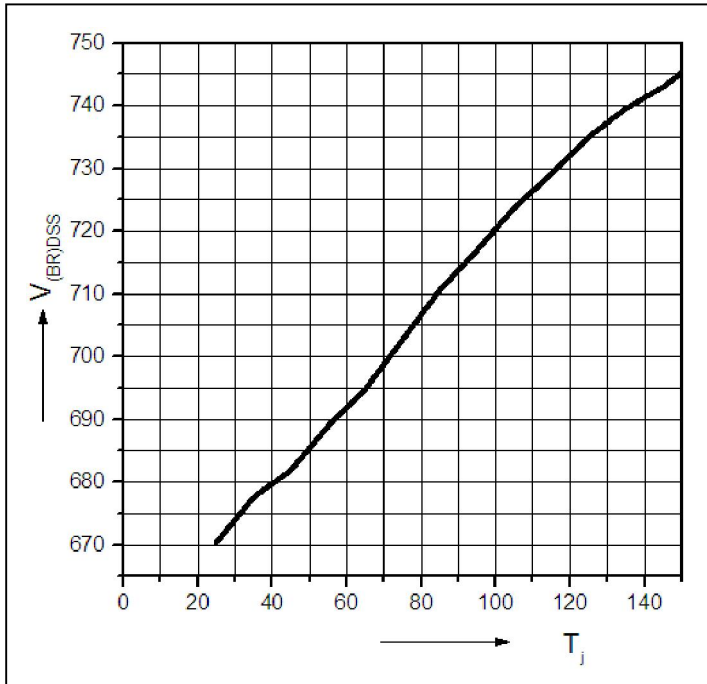


Figure 5. Drain-source breakdown voltage

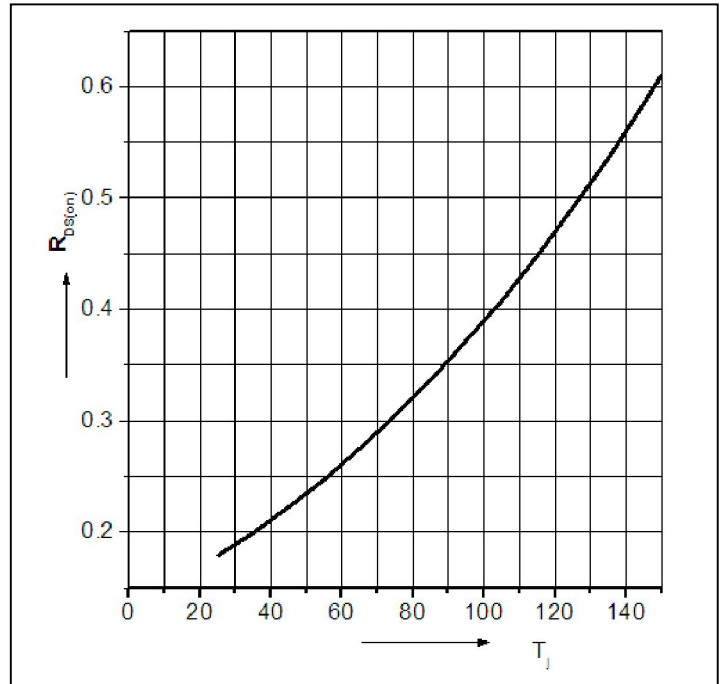
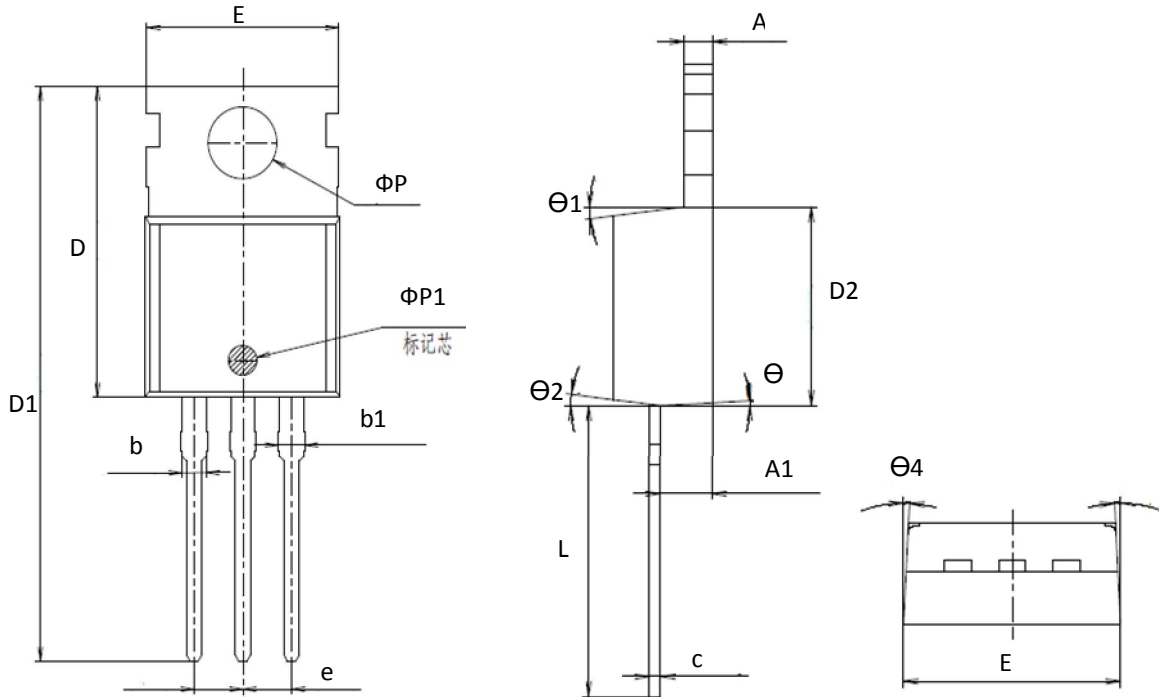


Figure 6. Drain-source on-state resistance

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: SSF20NS60

Package (Available)
TO-220
Operating Temperature Range
C : -55 to 150 °C

Devices per Unit

Package Type	Units/Tube	Tubes/Inner Box	Units/Inner Box	Inner Boxes/Carton Box	Units/Carton Box
TO-220	50	20	1000	6	6000

Reliability Test Program

Test Item	Conditions	Duration	Sample Size
High Temperature Reverse Bias(HTRB)	$T_j=125^{\circ}\text{C}$ to 150°C @ 80% of Max $V_{DSS}/V_{CES}/V_R$	168 hours 500 hours 1000 hours	3 lots x 77 devices
High Temperature Gate Bias(HTGB)	$T_j=150^{\circ}\text{C}$ @ 100% of Max V_{GSS}	168 hours 500 hours 1000 hours	3 lots x 77 devices