

Main Product Characteristics

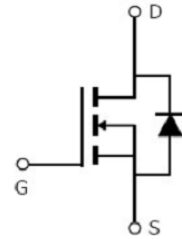
V_{DSS}	600V
$R_{DS(on)}$	170mΩ(typ.)
I_D	20A



TO-220F



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



Description

The SSF20NS60F combines an innovative super junction technology and advanced process. This technology achieves low R_{dson} , energy savings, high reliability and uniformity, superior power density and space saving.

Absolute Max Ratings

Symbol	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ ①	20	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ ①	13	
I_{DM}	Pulsed Drain Current②	80	
$P_D @ T_C = 25^\circ C$	Power Dissipation③	34.7	W
	Linear Derating Factor	0.27	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, T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C

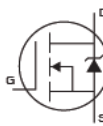
Thermal Resistance

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ^③	—	3.6	°C/W
$R_{\theta JA}$	Junction-to-Ambient ($t \leq 10s$) ^④	—	80	°C/W

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

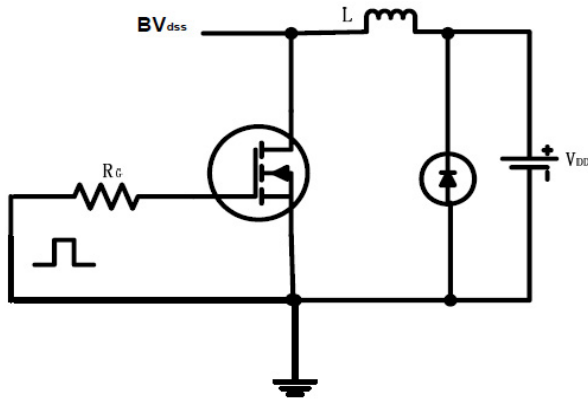
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	600	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$R_{DS(on)}$	Static Drain-to-Source On-resistance	—	170	190	mΩ	$V_{GS}=10V, I_D = 13A$
		—	475	—		$T_J = 125^\circ C$
$V_{GS(th)}$	Gate Threshold Voltage	2	—	4	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
		—	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	$V_{GS}=10V, V_{DS}=380V,$ $R_L=18\Omega,$ $R_{GEN}=3.38\Omega$ $ID=18A$
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

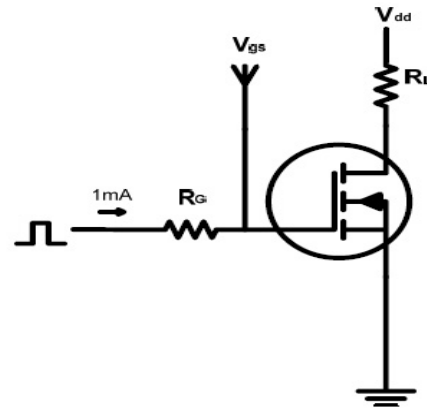
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	20	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode)	—	—	80	A	
V_{SD}	Diode Forward Voltage	—	0.87	1.3	V	$I_S=20A, V_{GS}=0V$
t_{rr}	Reverse Recovery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

Test Circuits and Waveforms

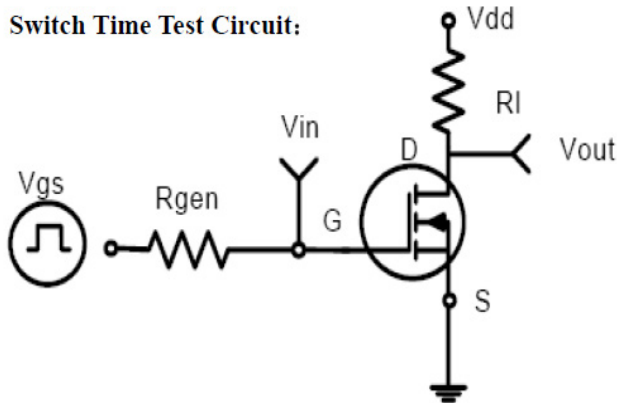
EAS test circuits:



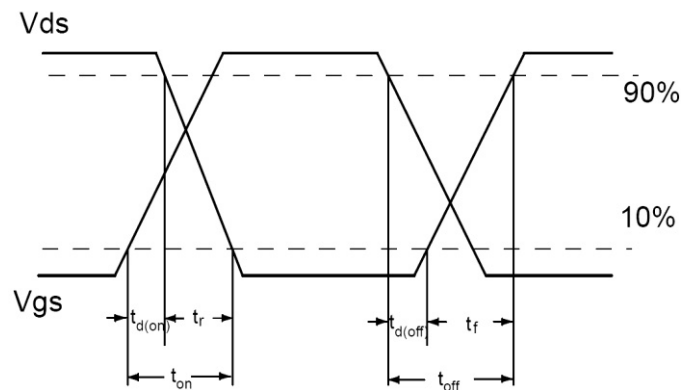
Gate charge test circuit:



Switch Time Test Circuit:



Switching 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 P_D 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 1in² FR-4 board with 2oz. Copper, in a still air environment with $T_A = 25^\circ\text{C}$

Typical Electrical and Thermal Characteristics

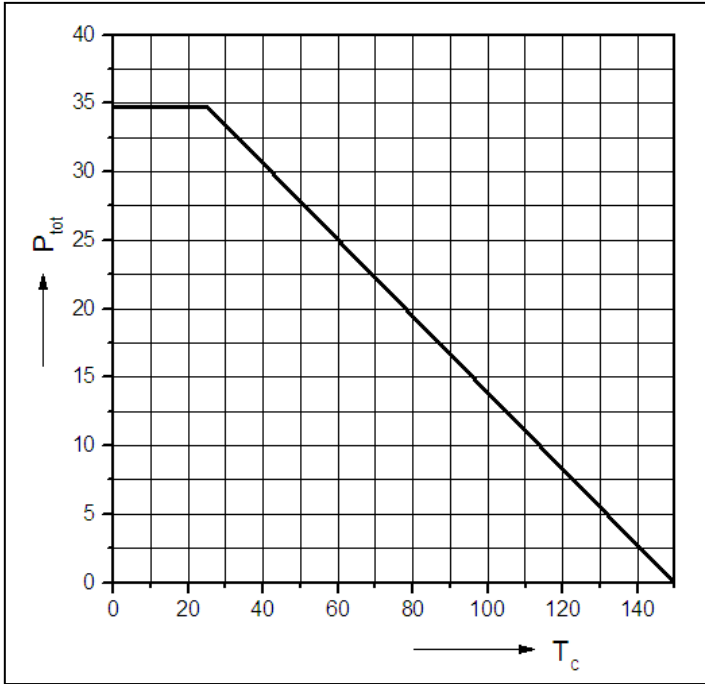


Figure 1. Power Dissipation

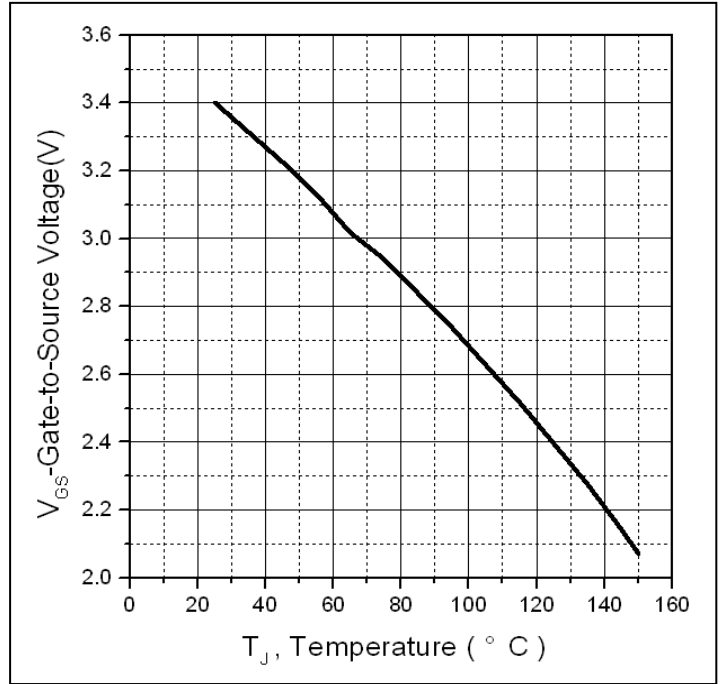


Figure 2. Typ. Gate to Source Cut-off Voltage

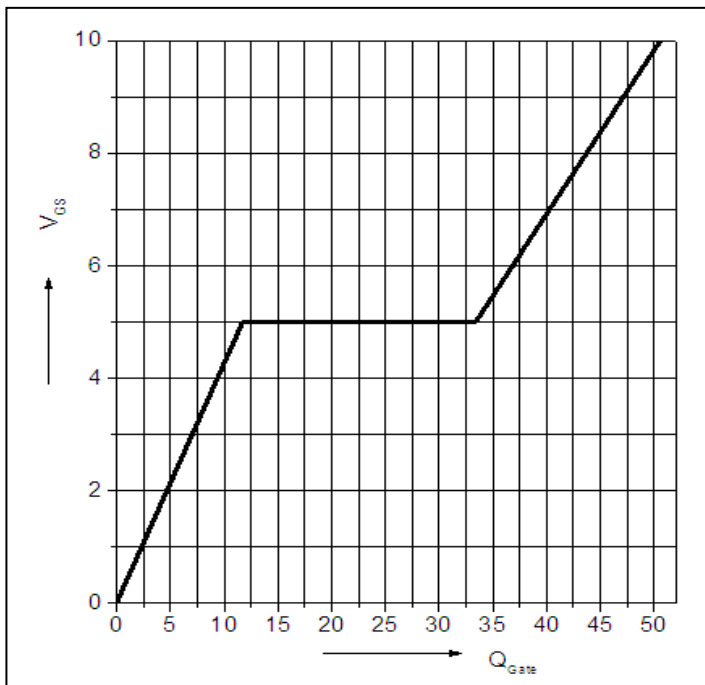


Figure 3. Typ. Gate Charge

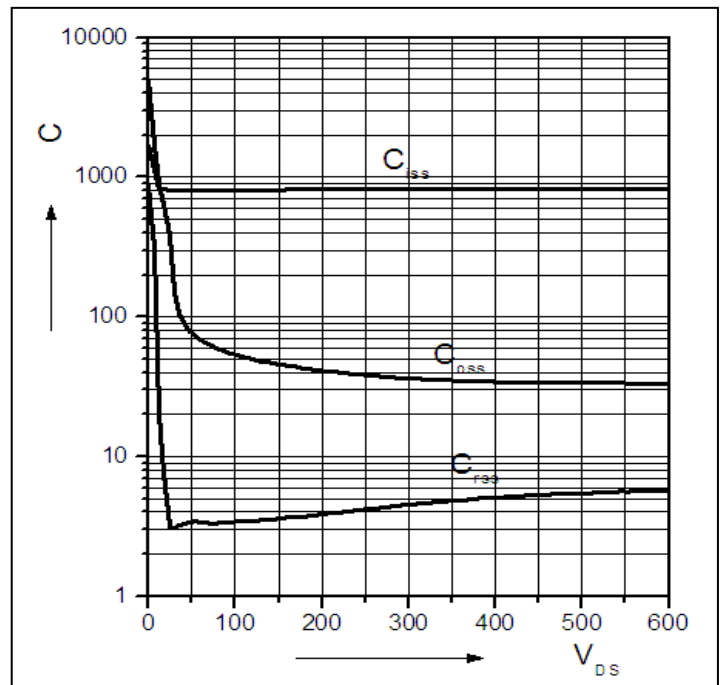


Figure 4. Typ. Capacitances

Typical Electrical and Thermal Characteristics

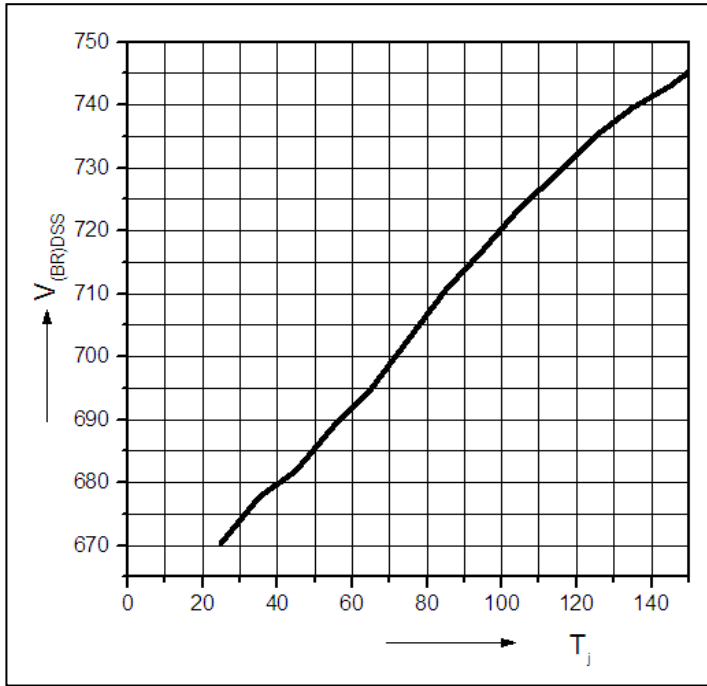


Figure 5. Drain-source Breakdown Voltage

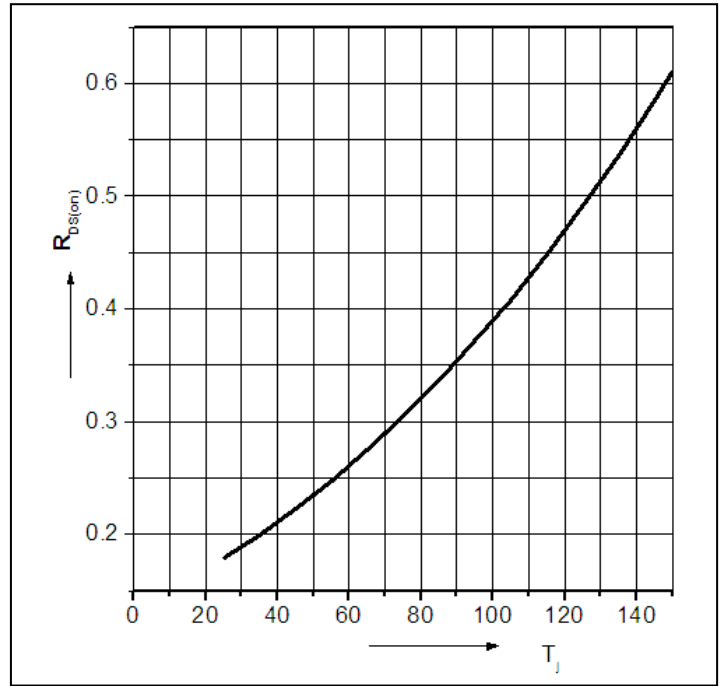
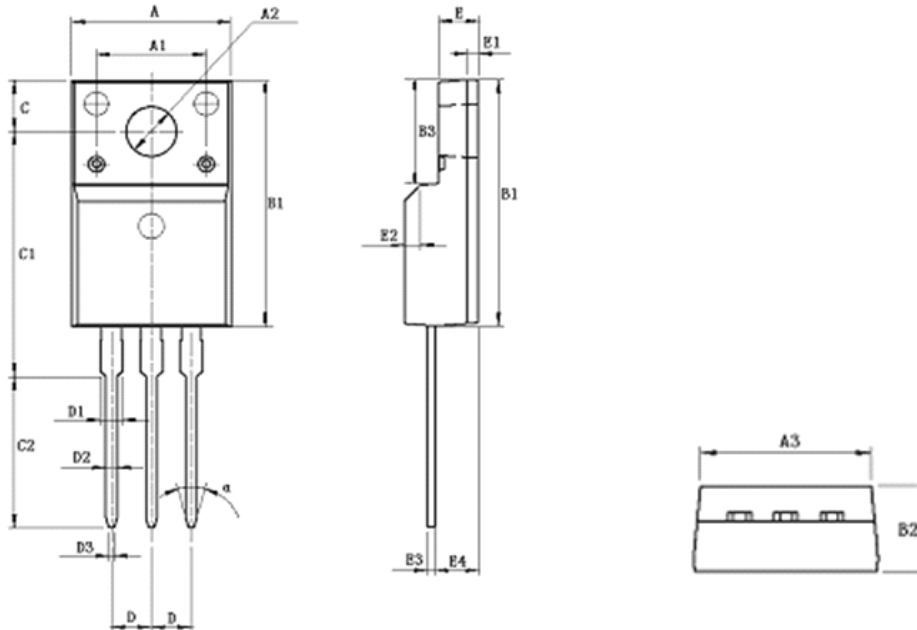


Figure 6. Drain-source On-state Resistance

Mechanical Data

TO-220F PACKAGE OUTLINE DIMENSION



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	9.960	10.160	10.360	0.392	0.400	0.408
A1	7.000			0.276	0.000	0.000
A2	3.080	3.180	3.280	0.121	0.125	0.129
A3	9.260	9.460	9.660	0.365	0.372	0.380
B1	15.670	15.870	16.070	0.617	0.625	0.633
B2	4.500	4.700	4.900	0.177	0.185	0.193
B3	6.480	6.680	6.880	0.255	0.263	0.271
C	3.200	3.300	3.400	0.126	0.130	0.134
C1	15.600	15.800	16.000	0.614	0.622	0.630
C2	9.550	9.750	9.950	0.376	0.384	0.392
D	2.54 (TYP)			1.00 (TYP)		
D1	-	-	1.470	-	-	0.058
D2	0.700	0.800	0.900	0.028	0.031	0.035
D3	0.250	0.350	0.450	0.010	0.014	0.018
E	2.340	2.540	2.740	0.092	0.100	0.108
E1	0.700			0.028		
E2	1.0*45 ⁰			1.0*45 ⁰		
E3	0.450	0.500	0.600	0.018	0.020	0.024
E4	2.560	2.760	2.960	0.101	0.109	0.117
Θ	30 ⁰			30 ⁰		

Ordering and Marking Information

Device Marking: SSF20NS60F

Package (Available)
TO-220F
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-220F	50	20	1000	10	10000

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