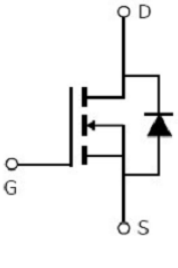
Main Product Characteristics:

V_{DSS}	600V
R_{DS}(on)	0.32Ω (typ.)
I_D	11A

TO-220F

Marking and pin Assignment



Schematic diagram

Features and Benefits:

Feathers:

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

Description:

The SSF11NS60UF series MOSFETs is a new technology, which combines an innovative super junction technology and advance process. This new technology achieves low Rdson, 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} @ 10V①	11	A
I_D @ TC = 100°C	Continuous Drain Current, V_{GS} @ 10V①	7	
I_{DM}	Pulsed Drain Current②	44	
P_D @TC = 25°C	Power Dissipation③	31	W
	Linear Derating Factor	0.25	W/°C
V_{DS}	Drain-Source Voltage	600	V
V_{GS}	Gate-to-Source Voltage	± 30	V
E_{AS}	Single Pulse Avalanche Energy @ L=133mH	250	mJ
I_{AS}	Avalanche Current @ L=133mH	1.94	A
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C

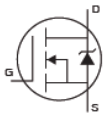
Thermal Resistance

Symbol	Characterizes	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-case③	—	4.0	℃/W
$R_{\theta JA}$	Junction-to-ambient (t ≤ 10s) ④	—	80	℃/W

Electrical Characterizes @T_A=25℃ unless otherwise specified

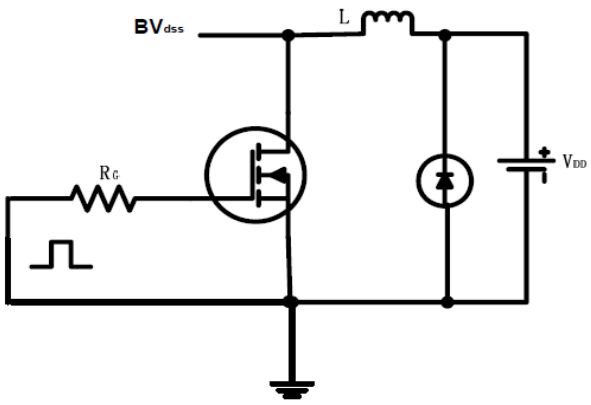
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source breakdown voltage	600	—	—	V	V_{GS} = 0V, ID = 1mA
$R_{DS(on)}$	Static Drain-to-Source on-resistance	—	0.32	0.36	Ω	V_{GS}=10V,I_D = 3.2A
		—	0.72	—		T_J = 125°C
$V_{GS(th)}$	Gate threshold voltage	2	—	4	V	V_{DS} = V_{GS}, I_D = 0.32mA
		—	2.1	—		T_J = 125°C
I_{DSS}	Drain-to-Source leakage current	—	—	1	μA	V_{DS} =600V,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	—	22	—	nC	I_D= 6A, V_{DS}= 200V, V_{GS} = 10V
Q_{gs}	Gate-to-Source charge	—	4.3	—		
Q_{gd}	Gate-to-Drain("Miller") charge	—	8	—		
$t_{d(on)}$	Turn-on delay time	—	11	—	ns	V_{GS}=10V, VDS=400V, R_L=81.6Ω,R_{GEN}=3.4Ω ID=4.9A
t_r	Rise time	—	6	—		
$t_{d(off)}$	Turn-Off delay time	—	29	—		
t_f	Fall time	—	6	—		
C_{iss}	Input capacitance	—	804	—	pF	V_{GS} = 0V V_{DS} = 100V f = 600KHz
C_{oss}	Output capacitance	—	34	—		
C_{rss}	Reverse transfer capacitance	—	3.4	—		

Source-Drain Ratings and Characteristics

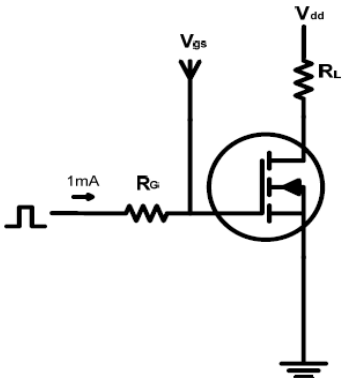
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	11	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode)	—	—	44	A	
V_{sd}	Diode Forward Voltage	—	0.82	1.2	V	I_S=4.9A, V_{GS}=0V
t_{rr}	Reverse Recovery Time	—	247	—	ns	TJ = 25°C, IF =11A, di/dt = 100A/μs
Q_{rr}	Reverse Recovery Charge	—	2.46	—	μC	

Test circuits and Waveforms

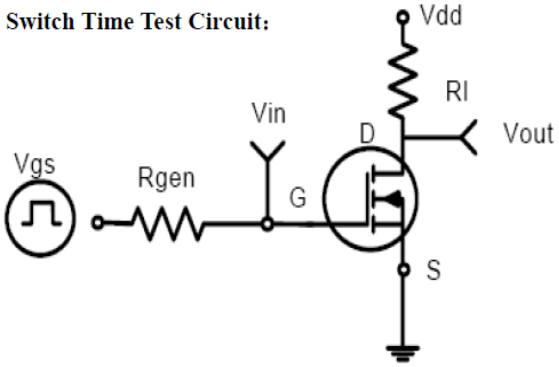
EAS test circuits:



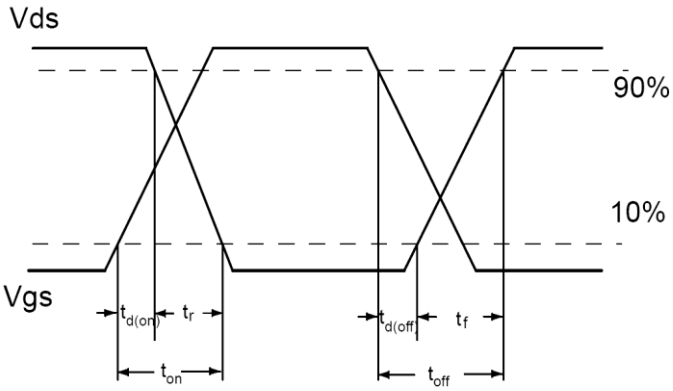
Gate charge test circuit:



Switch Time Test Circuit:



Switch Waveforms:



Notes:

①Calculated continuous current based on maximum allowable junction temperature.

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

Typical electrical and thermal characteristics

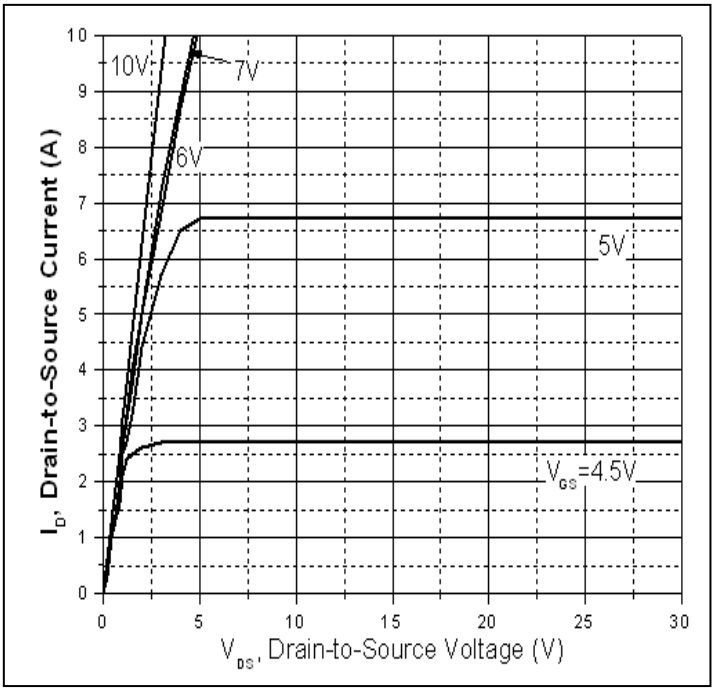


Figure 1: Typical Output Characteristics

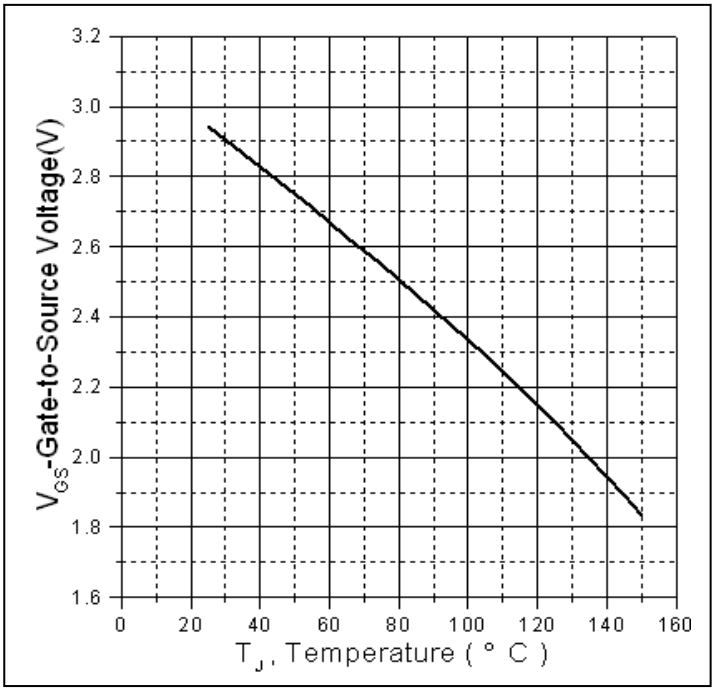


Figure 2. Gate to source cut-off voltage

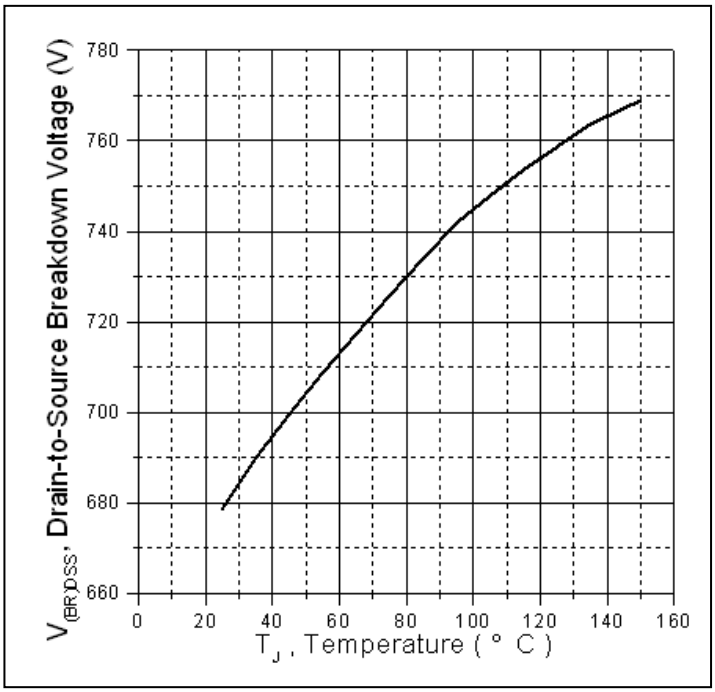


Figure 3. Drain-to-Source Breakdown Voltage Vs. Case Temperature

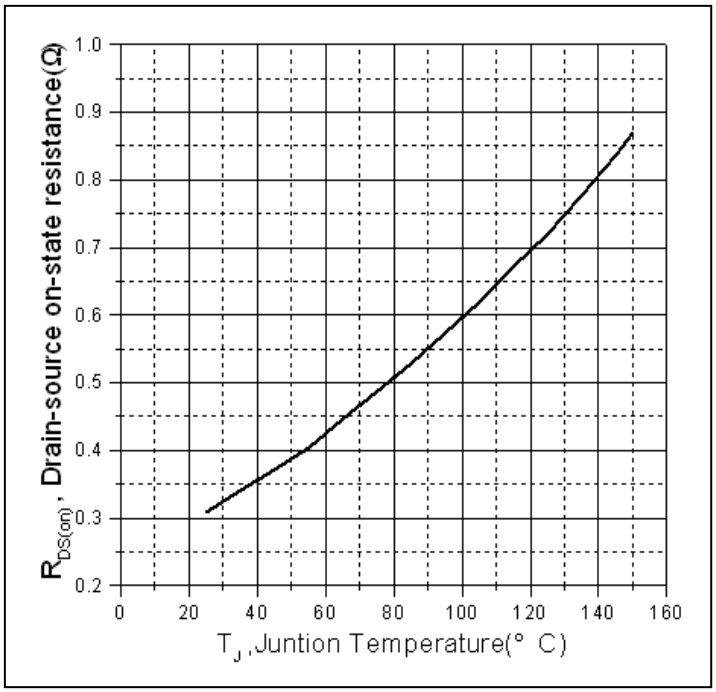


Figure 4: Normalized On-Resistance Vs. Case Temperature

Typical electrical and thermal characteristics

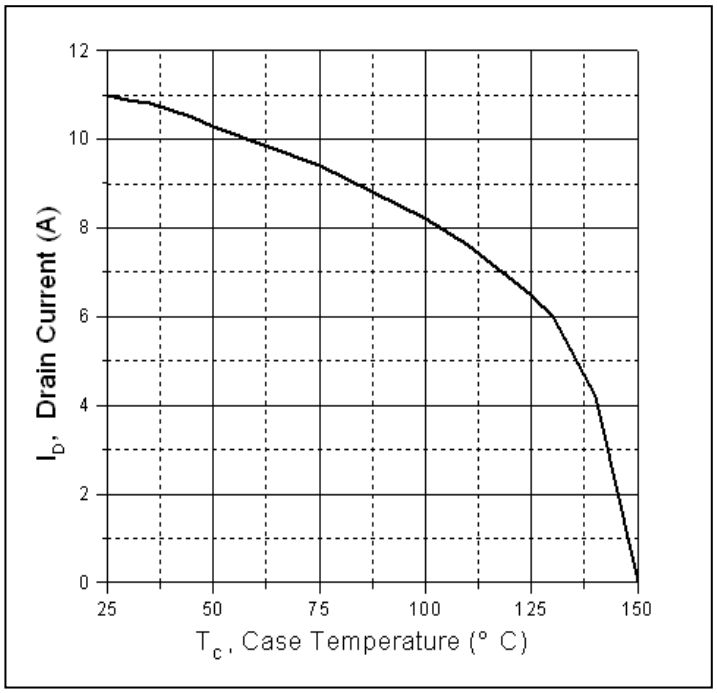


Figure 5. Maximum Drain Current Vs. Case Temperature

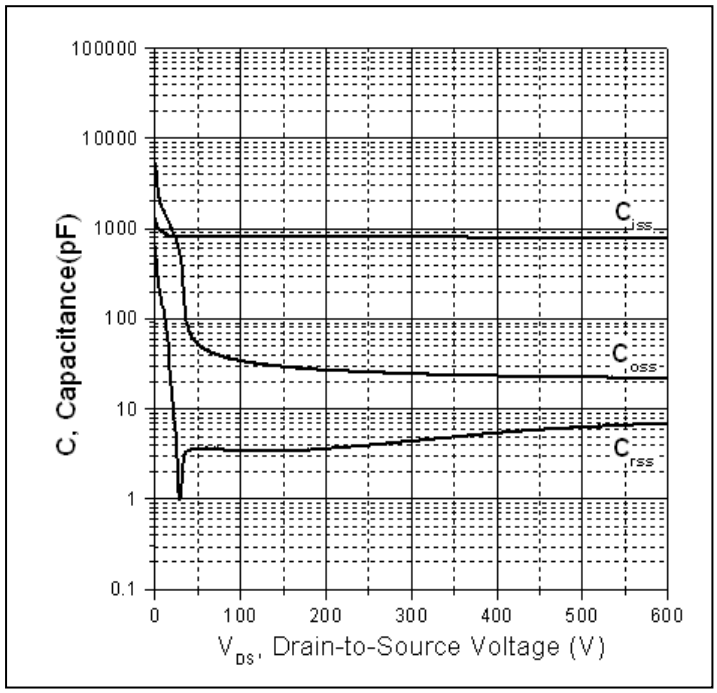


Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage

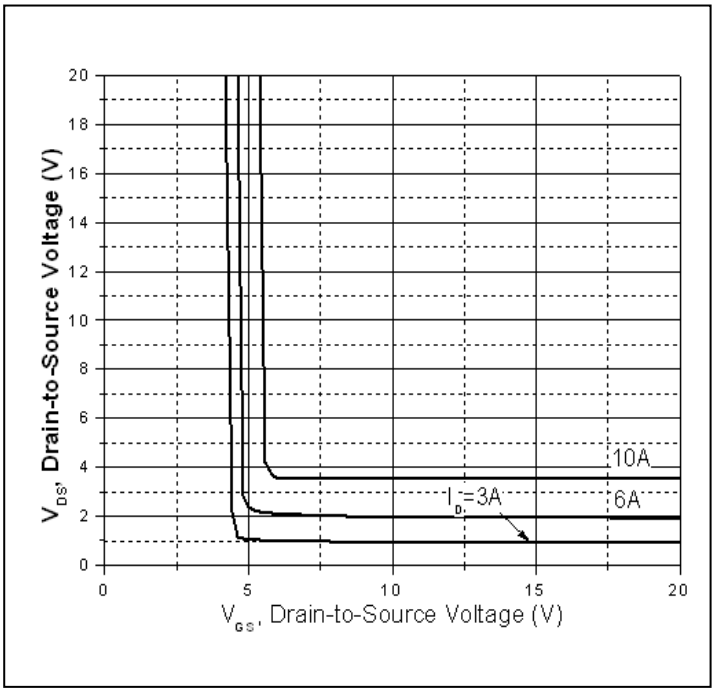
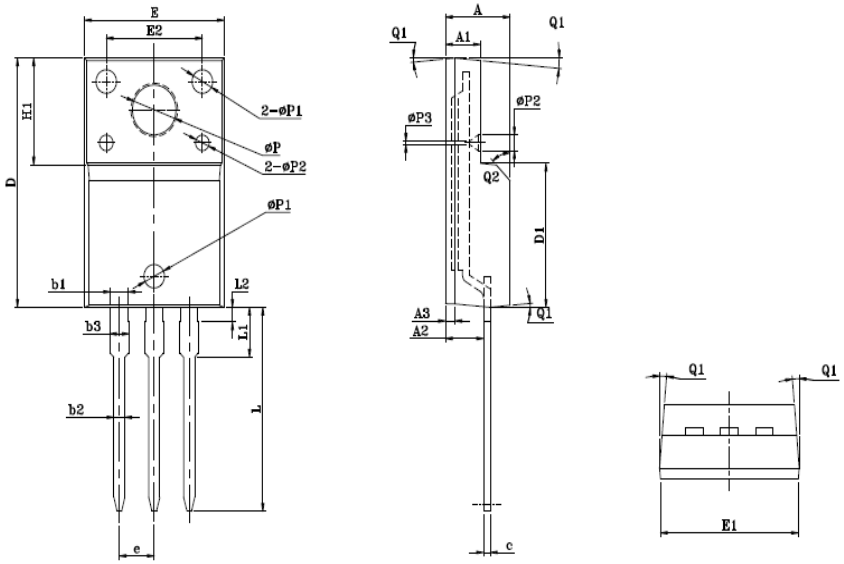


Figure7. Drain-to-Source Voltage Vs. Gate-to-Source Voltage

Mechanical Data：

TO220F PACKAGE OUTLINE DIMENSION_GN



Symbol	Dimension In Millimeters			Dimension In Inches		
	Min	Nom	Max	Min	Nom	Max
E	9.960	10.160	10.360	0.392	0.400	0.408
E1	9.840	10.040	10.240	0.387	0.395	0.403
E2	6.800	7.000	7.200	0.268	0.276	0.283
A	4.600	4.700	4.800	0.181	0.185	0.189
A1	2.440	2.540	2.640	0.096	0.100	0.104
A2	2.660	2.760	2.860	0.105	0.109	0.113
A3	0.600	0.700	0.800	0.024	0.028	0.031
c	-	0.500	-	-	0.020	-
D	15.780	15.870	15.980	0.621	0.625	0.629
D1	8.970	9.170	9.370	0.353	0.361	0.369
H1	6.500	6.700	6.800	0.256	0.264	0.268
e	2.54BSC			0.10BSC		
ΦP	3.080	3.180	3.280	0.121	0.125	0.129
ΦP1	1.400	1.500	1.600	0.055	0.059	0.063
ΦP2	0.900	1.000	1.100	0.035	0.039	0.043
ΦP3	0.100	0.200	0.300	0.004	0.008	0.012
L	12.780	12.980	13.180	0.503	0.511	0.519
L1	2.970	3.170	3.370	0.117	0.125	0.133
L2	0.830	0.930	1.030	0.033	0.037	0.041
Q1	3^o	5^o	7^o	3^o	5^o	7^o
Q2	43^o	45^o	47^o	43^o	45^o	47^o
b1	1.180	1.280	1.380	0.046	0.050	0.054
b2	0.760	0.800	0.840	0.030	0.031	0.033
b3	-	-	1.420	-	-	0.056

Ordering and Marking Information

Device Marking: SSF11NS60UF

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	6	6000

Reliability Test Program

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

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