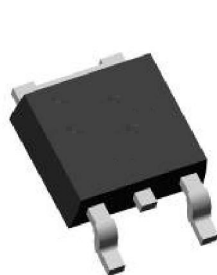


### Main Product Characteristics

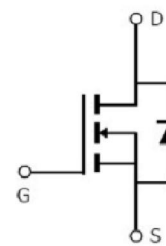
$V_{DSS}$	600V
$R_{DS(on)}$	0.36 $\Omega$ (typ.)
$I_D$	11A



TO-252



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 SSF11NS60D 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	11	A
$I_D @ TC = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ ①	7	
$I_{DM}$	Pulsed Drain Current②	44	
$P_D @ TC = 25^\circ C$	Power Dissipation③	125	W
	Linear Derating Factor	1.0	W/°C
$V_{DS}$	Drain-Source Voltage	600	V
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulse Avalanche Energy @ L=22.5mH	281	mJ
$I_{AS}$	Avalanche Current @ L=22.5mH	5	A
$T_J \quad T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +150	°C



# SSF11NS60D

## 600V N-Channel MOSFET

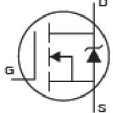
### Thermal Resistance

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-case <sup>③</sup>	—	1.0	$^{\circ}C/W$
$R_{\theta JA}$	Junction-to-ambient ( $t \leq 10s$ ) <sup>④</sup>	—	55	$^{\circ}C/W$

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

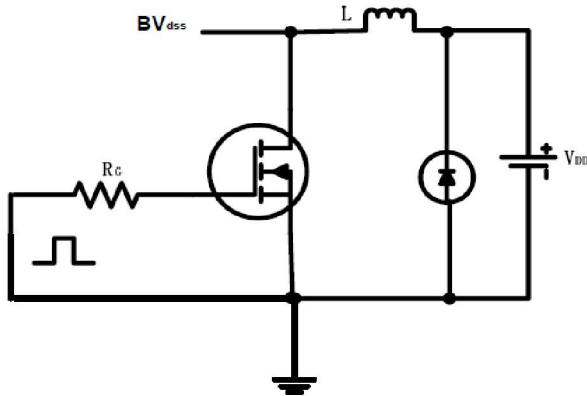
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source breakdown voltage	600	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$R_{DS(on)}$	Static Drain-to-Source on-resistance	—	0.36	0.41	$\Omega$	$V_{GS}=10V, I_D = 5.5A$
		—	0.88	—		$T_J = 125^{\circ}C$
$V_{GS(th)}$	Gate threshold voltage	2	—	4	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
		—	2.46	—		$T_J = 125^{\circ}C$
$I_{DSS}$	Drain-to-Source leakage current	—	—	1	$\mu A$	$V_{DS} = 600V, V_{GS} = 0V$
		—	—	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	—	28.41	—	nC	$I_D = 11A,$ $V_{DS}=480V,$ $V_{GS} = 10V$
$Q_{gs}$	Gate-to-Source charge	—	6.64	—		
$Q_{gd}$	Gate-to-Drain("Miller") charge	—	12.34	—		
$t_{d(on)}$	Turn-on delay time	—	12.85	—	ns	$V_{GS}=10V, V_{DS}=300V,$ $R_L=54.5\Omega,$ $R_{GEN}=4.7\Omega$ $I_D=5.5A$
$t_r$	Rise time	—	9.45	—		
$t_{d(off)}$	Turn-Off delay time	—	30.40	—		
$t_f$	Fall time	—	6.30	—		
$C_{iss}$	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

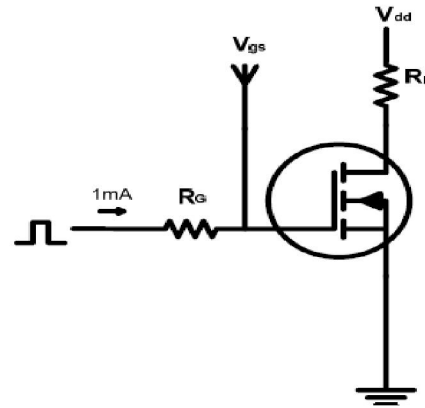
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	11	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode)	—	—	44	A	
$V_{SD}$	Diode Forward Voltage	—	—	1.5	V	$I_S=11A, V_{GS}=0V$
$t_{rr}$	Reverse Recovery Time	—	313	—	ns	$T_J = 25^{\circ}C, I_F = 11A, di/dt =$
$Q_{rr}$	Reverse Recovery Charge	—	2.97	—	$\mu C$	100A/ $\mu s$

### Test Circuits and Waveforms

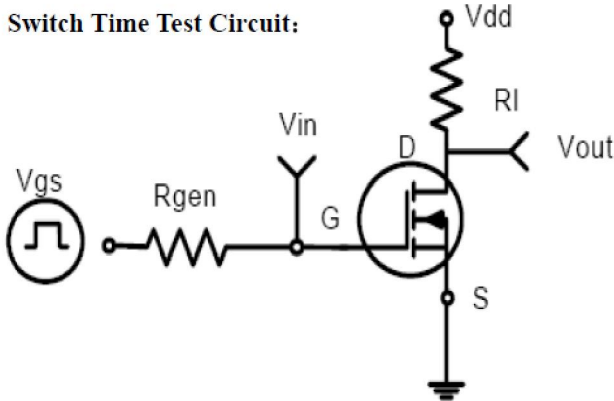
EAS test circuits:



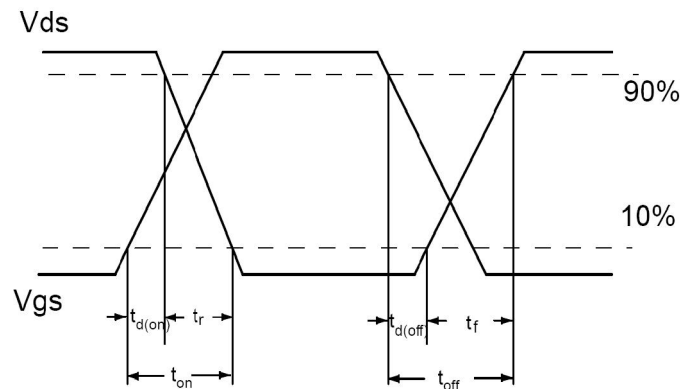
Gate charge test circuit:



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

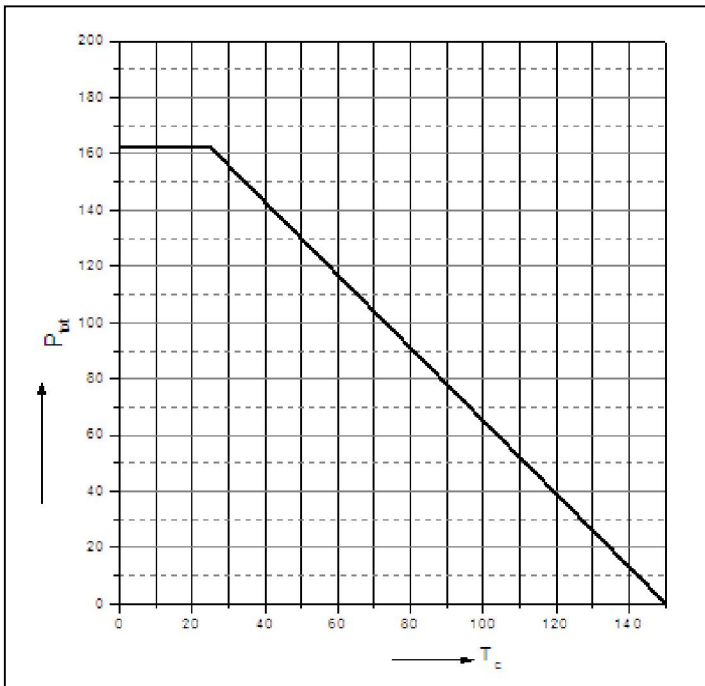


Figure 1: Power dissipation

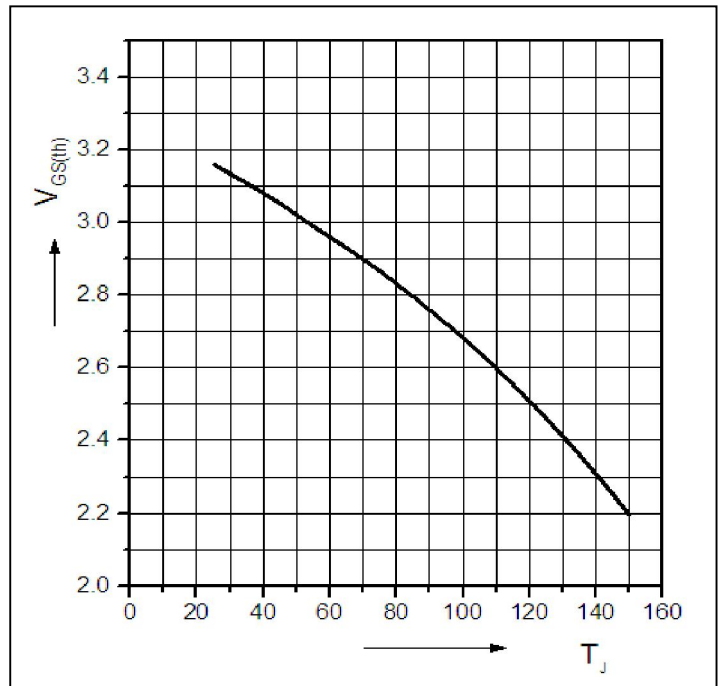


Figure 2: Typ. Gate to source cut-off voltage

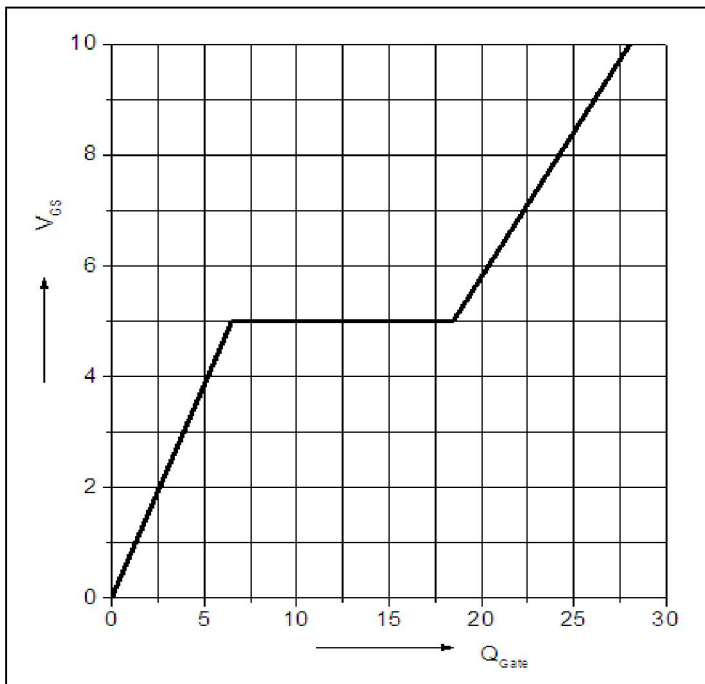


Figure 3: Typ. gate charge

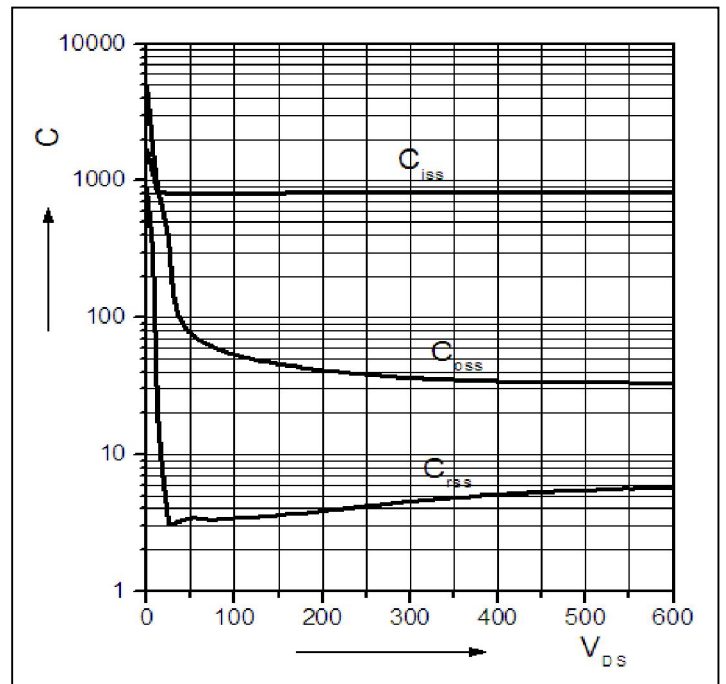


Figure 4: Typ. Capacitances

### Typical Electrical and Thermal Characteristics

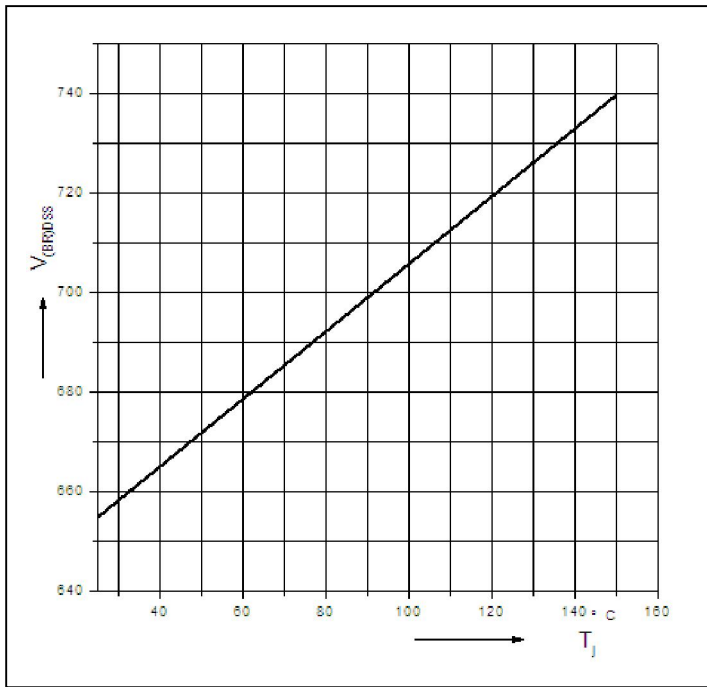


Figure 5. Drain-source breakdown voltage

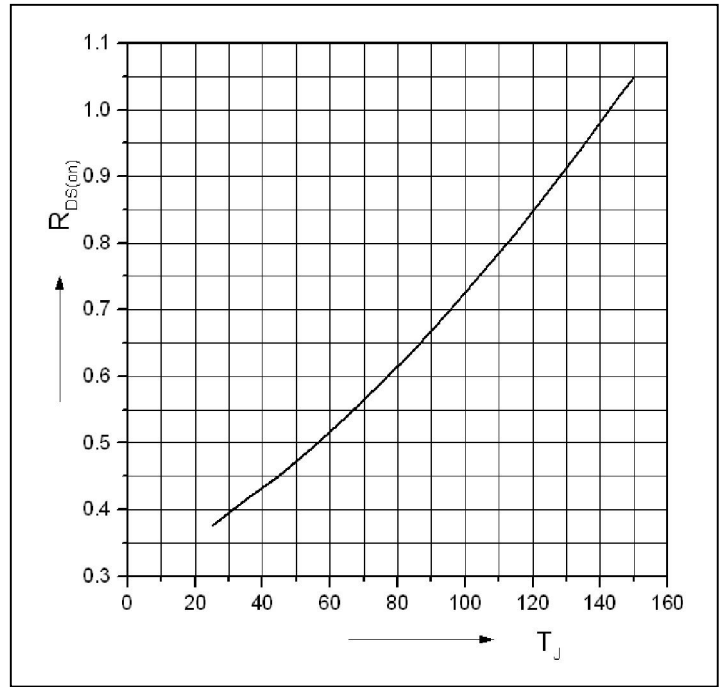
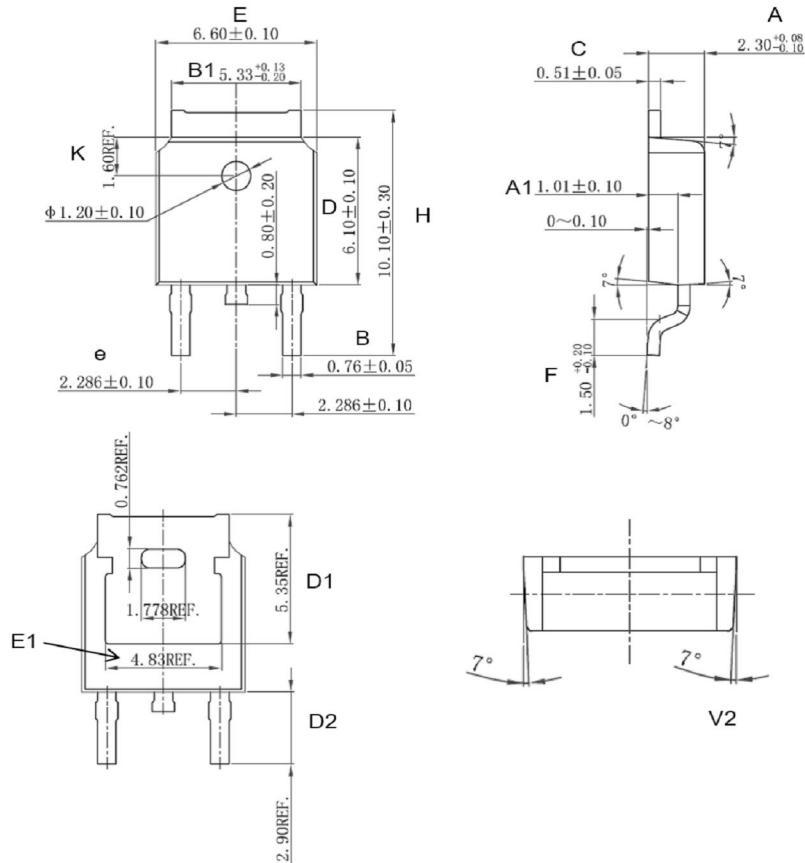


Figure 6. Drain-source on-state resistance

### Mechanical Data

TO-252 PACKAGE OUTLINE DIMENSION



Symbol	Dimension In Millimeters			Dimension In Inches		
	Min	Nom	Max	Min	Nom	Max
A	2.200	2.300	2.380	0.087	0.091	0.094
A1	0.910	1.010	1.110	0.036	0.040	0.044
B	0.710	0.760	0.810	0.028	0.030	0.032
B1	5.130	5.330	5.460	0.202	0.210	0.215
C	0.460	0.510	0.560	0.018	0.020	0.022
D	6.000	6.100	6.200	0.236	0.240	0.244
D1	5.350 (REF)			0.211 (REF)		
D2	2.900 (REF)			0.114 (REF)		
E	6.500	6.600	6.700	0.256	0.260	0.264
E1	4.83 (REF)			0.190 (REF)		
e	2.186	2.286	2.386	0.086	0.090	0.094
H	9.800	10.100	10.400	0.386	0.398	0.409
F	1.400	1.500	1.700	0.055	0.059	0.067
K	1.600 (REF)			0.063 (REF)		
V2	8° (REF)			8° (REF)		



# SSF11NS60D 600V N-Channel MOSFET

## Ordering and Marking Information

### Device Marking: SSF11NS60D

Package (Available)  
TO-252(DPAK)  
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-252	80	50	4000	10	40000

## Reliability Test Program

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