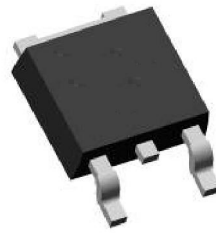


## Main Product Characteristics

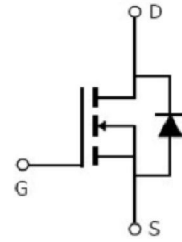
$V_{DSS}$	600V
$R_{DS(on)}$	2.0 $\Omega$ (typ.)
$I_D$	4A



TO-252



Marking and Pin Assignment



Schematic Diagram

## Features and Benefits

- Advanced MOSFET process technology
- Special designed for PWM, load switching and general purpose applications
- Ultra low on-resistance with low gate charge
- Fast switching and reverse body recovery
- 150°C operating temperature
- Lead free product



## Description:

It utilizes the latest processing techniques to achieve the high cell density and reduces the on-resistance with high repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in power switching application and a wide variety of other applications.

## Absolute Max Rating:

Symbol	Parameter	Max.	Units
$I_D @ TC = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ <sup>①</sup>	4	A
$I_D @ TC = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ <sup>①</sup>	2.53	
$I_{DM}$	Pulsed Drain Current <sup>②</sup>	16	
$P_D @ TC = 25^\circ C$	Power Dissipation <sup>③</sup>	48	W
	Linear Derating Factor	0.384	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=25.9mH	117	mJ
$I_{AS}$	Avalanche Current @ L=25.9mH	3	A
$T_J \quad T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +150	°C

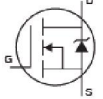
### Thermal Resistance

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-case <sup>③</sup>	—	2.6	°C/W
$R_{\theta JA}$	Junction-to-ambient ( $t \leq 10s$ ) <sup>④</sup>	—	62.5	°C/W

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

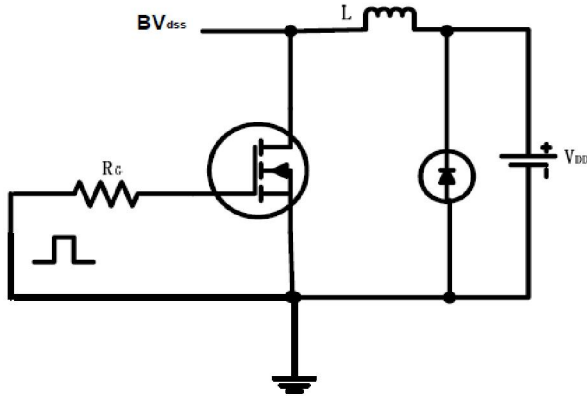
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source breakdown voltage	600	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$R_{DS(on)}$	Static Drain-to-Source on-resistance	—	2.0	2.5	$\Omega$	$V_{GS}=10V, I_D = 2A$ $T_J = 125^\circ\text{C}$
		—	4.43	—		
$V_{GS(th)}$	Gate threshold voltage	2	—	4	V	$V_{DS} = V_{GS}, I_D = 250\mu A$ $T_J = 125^\circ\text{C}$
		—	2.37	—		
$I_{DSS}$	Drain-to-Source leakage current	—	—	1	$\mu A$	$V_{DS} = 600V, V_{GS} = 0V$ $T_J = 125^\circ\text{C}$
		—	—	50		
$I_{GSS}$	Gate-to-Source forward leakage	—	—	100	nA	$V_{GS} = 30V$
		—	—	-100		$V_{GS} = -30V$
$Q_g$	Total gate charge	—	11.9	—	nC	$I_D = 4A,$ $V_{DS}=480V,$ $V_{GS} = 10V$
$Q_{gs}$	Gate-to-Source charge	—	4.0	—		
$Q_{gd}$	Gate-to-Drain("Miller") charge	—	3.1	—		
$t_{d(on)}$	Turn-on delay time	—	11.0	—	ns	$V_{GS}=10V, V_{DS}=300V,$ $R_{GEN}=25\Omega, I_D=4A$
$t_r$	Rise time	—	13.5	—		
$t_{d(off)}$	Turn-Off delay time	—	38.4	—		
$t_f$	Fall time	—	19.7	—		
$C_{iss}$	Input capacitance	—	652	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output capacitance	—	57	—		$V_{DS} = 25V$
$C_{rss}$	Reverse transfer capacitance	—	5.1	—		$f = 1\text{MHz}$

### Source-Drain Ratings and Characteristics

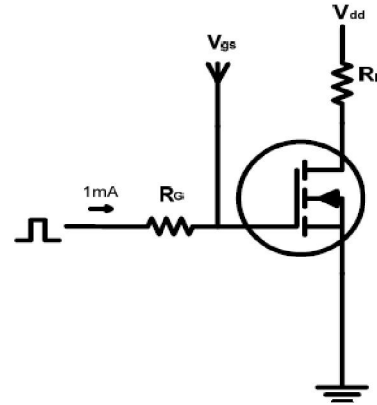
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	4	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode)	—	—	16	A	
$V_{SD}$	Diode Forward Voltage	—	—	1.4	V	$I_S=4A, V_{GS}=0V$
$t_{rr}$	Reverse Recovery Time	—	532	—	nS	$T_J = 25^\circ\text{C}, I_F = 4A,$
$Q_{rr}$	Reverse Recovery Charge	—	1860	—	nC	$di/dt = 100A/\mu s$

## Test Circuits and Waveforms

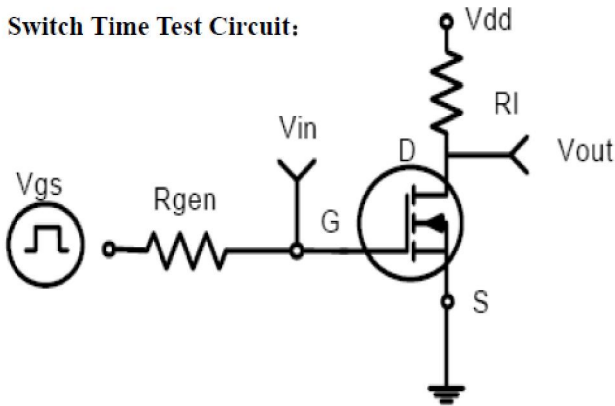
EAS test circuits:



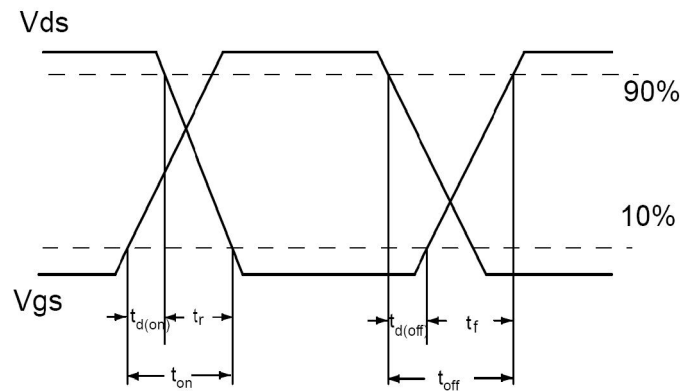
Gate charge test circuit:



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  $T_A = 25^\circ\text{C}$

## Typical Electrical and Thermal Characteristics

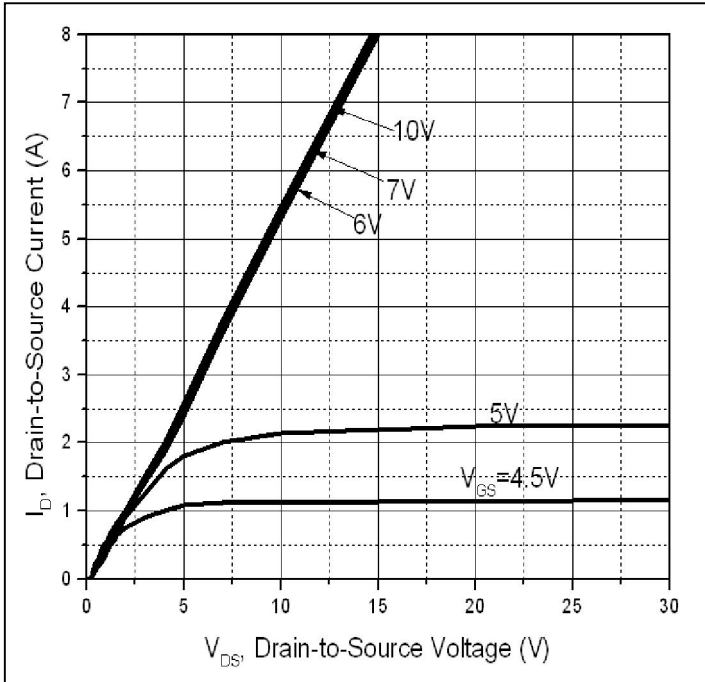


Figure 1: Typical Output Characteristics

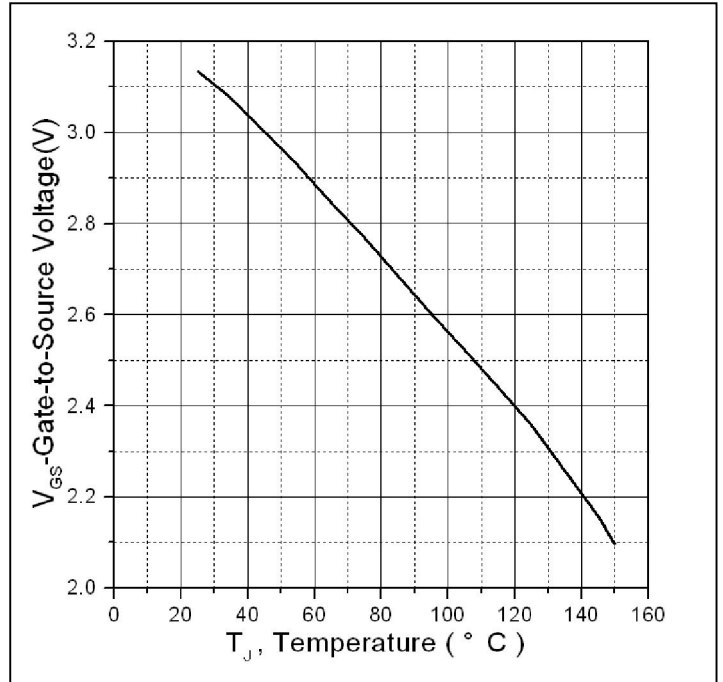


Figure 2: Gate to source cut-off voltage

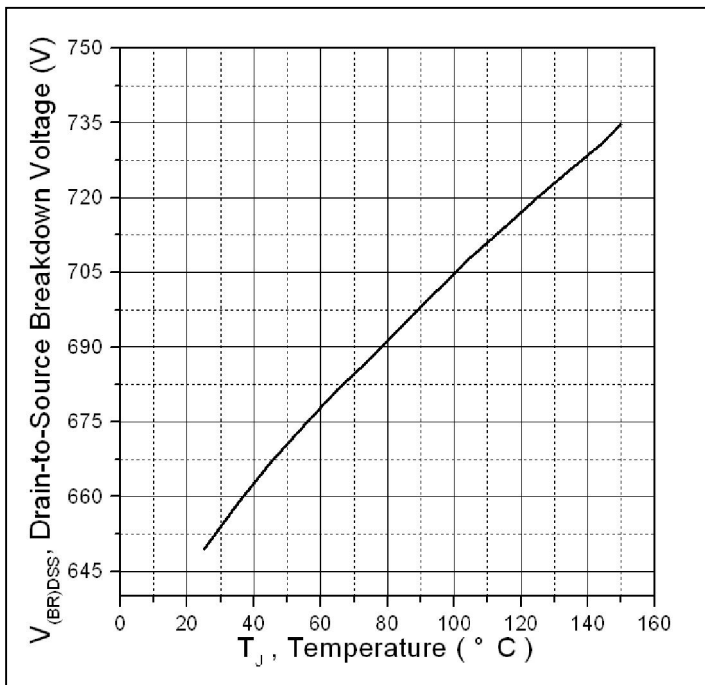


Figure 3: Drain-to-Source Breakdown Voltage Vs. Case Temperature

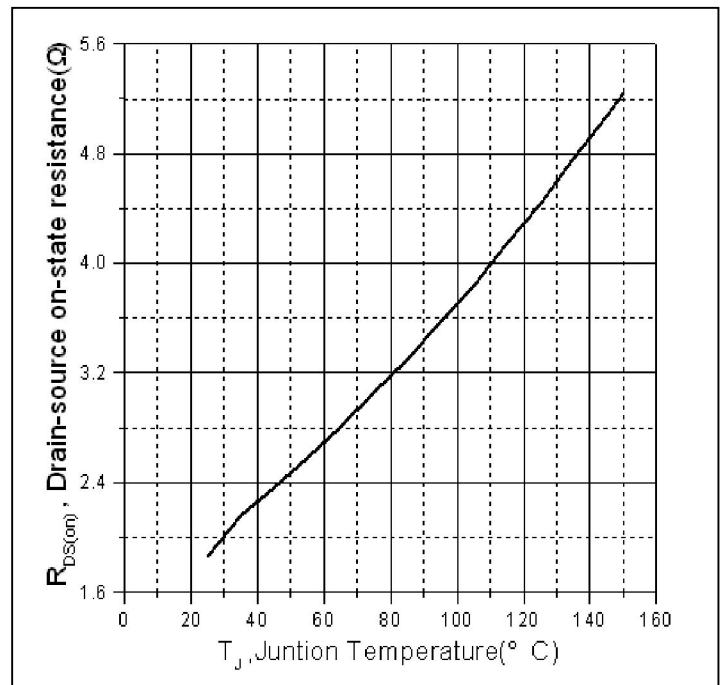


Figure 4: Normalized On-Resistance Vs. Case Temperature

## Typical Electrical and Thermal Characteristics

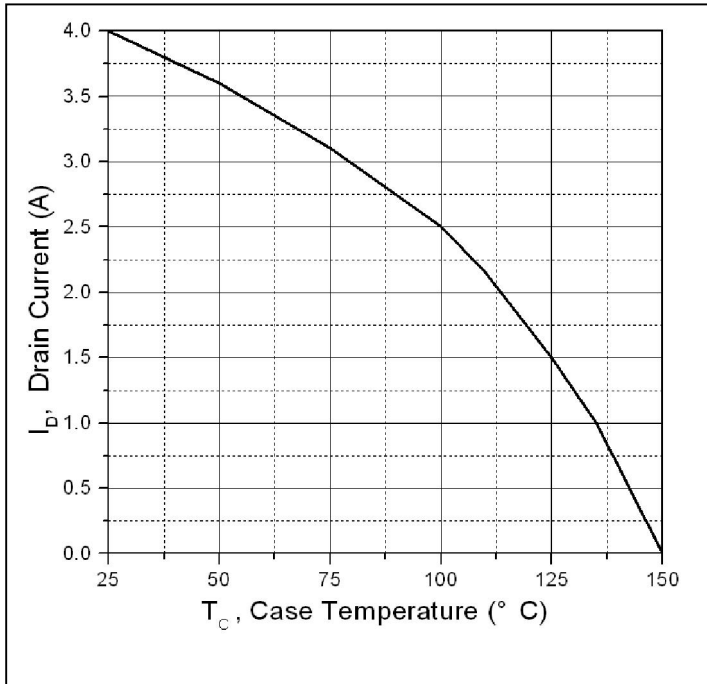


Figure 5. Maximum Drain Current Vs. Case Temperature

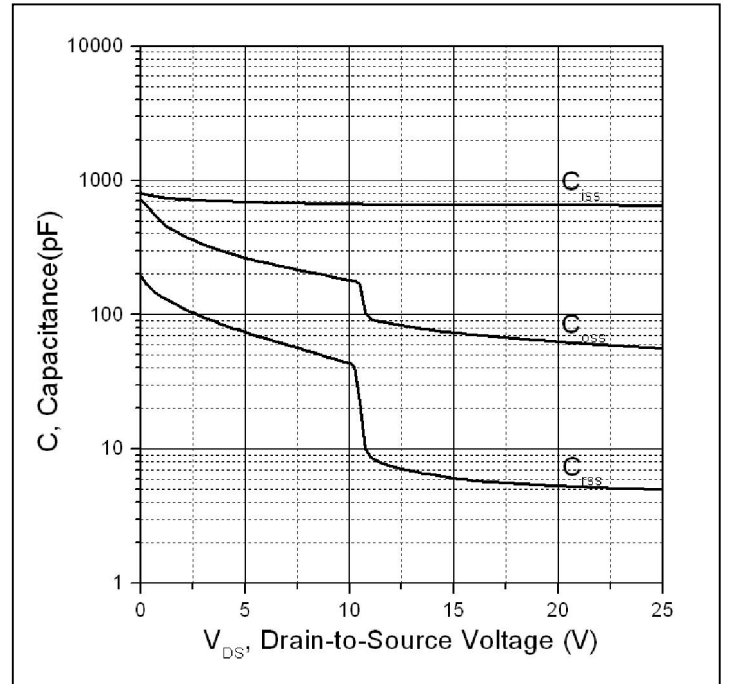
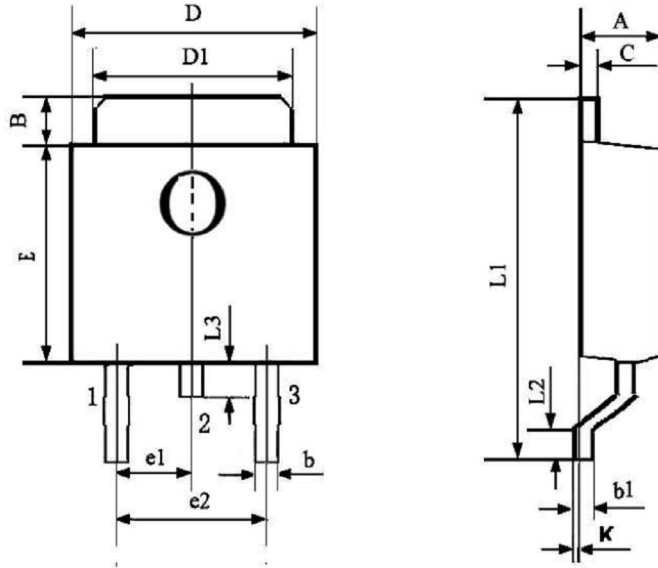


Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage

**Mechanical Data**

**TO-252 PACKAGE OUTLINE DIMENSION**



Symbol	Dimension In Millimeters			Dimension In Inches		
	Min	Nom	Max	Min	Nom	Max
A	2.200	-	2.400	0.087	-	0.094
B	0.950	-	1.250	0.037	-	0.049
b	0.500	-	0.700	0.020	-	0.028
b1	0.450	-	0.550	0.018	-	0.022
C	0.450	-	0.550	0.018	-	0.022
D	6.450	-	6.750	0.254	-	0.266
D1	5.200	-	5.400	0.205	-	0.213
E	5.950	-	6.250	0.234	-	0.246
e1	2.240	-	2.340	0.088	-	0.092
e2	4.430	-	4.730	0.174	-	0.186
L1	9.450	-	9.950	0.372	-	0.392
L2	1.250	-	1.750	0.049	-	0.069
L3	0.600	-	0.900	0.024	-	0.035
K	0.000	-	0.100	0.000	-	0.004



### Ordering and Marking Information

**Device Marking: SSF4N60D**

Package (Available)  
TO-252 (DPAK)  
Operating Temperature Range  
C : -55 to 150 °C

### Devices per Unit (options)

Package Type	Units/Tape	Tapes/Inner Box	Units/Inner Box	Inner Boxes/Carton Box	Units/Carton Box
TO-252	2500	2	5000	7	35000
TO-252	2500	1	2500	10	25000
TO-252	800	5	4000	8	32000

### 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 $V_{DSS}/V_{CES}/V_R$	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