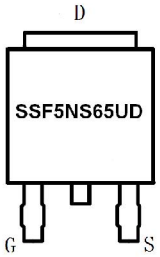
SSF5NS65UD

650V N-Channel MOSFET

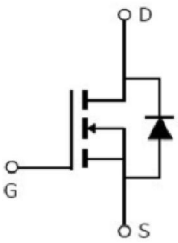
Main Product Characteristics

V_{DSS}	650V
R_{DS}(on)	0.74Ω (typ.)
I_D	5A ①

TO-252 (DPAK)



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 SSF5NS65UD series MOSFETs 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°C	Continuous Drain Current, V_{GS} @ 10V	5 ①	A
I_D @ TC = 100°C	Continuous Drain Current, V_{GS} @ 10V	3.2 ①	
I_{DM}	Pulsed Drain Current ②	15	
P_D @TC = 25°C	Power Dissipation ③	50	W
	Linear Derating Factor	0.4	W/°C
V_{DS}	Drain-Source Voltage	650	V
V_{GS}	Gate-to-Source Voltage	± 30	V
E_{AS}	Single Pulse Avalanche Energy @ L=22.4mH	54	mJ
I_{AR}	Avalanche Current @ L=22.4mH	2.2	A
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C

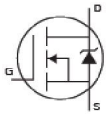
Thermal Resistance

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-case ③	—	2.5	℃/W
$R_{\theta JA}$	Junction-to-ambient (t ≤ 10s) ④	—	75	℃/W

Electrical Characteristics @T_A=25℃ unless otherwise specified

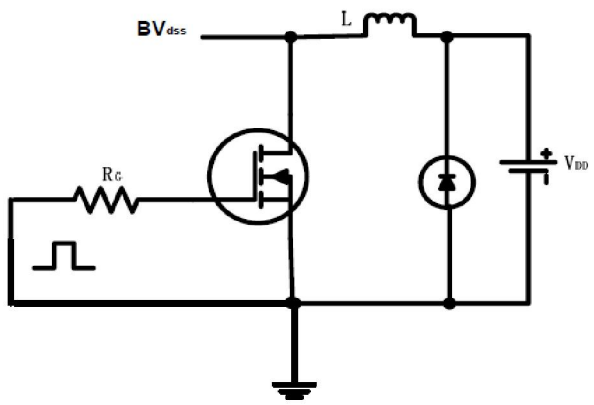
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source breakdown voltage	650	—	—	V	V_{GS} = 0V, I_D = 250μA
$R_{DS(on)}$	Static Drain-to-Source on-resistance	—	0.74	1.0	Ω	V_{GS}=10V,I_D = 1A
		—	1.54	—		T_J = 125°C
$V_{GS(th)}$	Gate threshold voltage	2	—	4	V	V_{DS} = V_{GS}, I_D = 250μA
		—	2.2	—		T_J = 125°C
I_{DSS}	Drain-to-Source leakage current	—	—	1	μA	V_{DS} = 650V,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	—	8.1	—	nC	I_D = 4A,
Q_{gs}	Gate-to-Source charge	—	2.4	—		V_{DS}=100V,
Q_{gd}	Gate-to-Drain("Miller") charge	—	2.8	—		V_{GS} = 10V
$t_{d(on)}$	Turn-on delay time	—	9.0	—	ns	V_{GS}=10V, V_{DS} =200V, R_{GEN}=12.2Ω,I_D =1.9A
t_r	Rise time	—	5.9	—		
$t_{d(off)}$	Turn-Off delay time	—	23	—		
t_f	Fall time	—	11	—		
C_{iss}	Input capacitance	—	336	—	pF	V_{GS} = 0V
C_{oss}	Output capacitance	—	18	—		V_{DS} = 100V
C_{rss}	Reverse transfer capacitance	—	2.8	—		f = 1MHz

Source-Drain Ratings and Characteristics

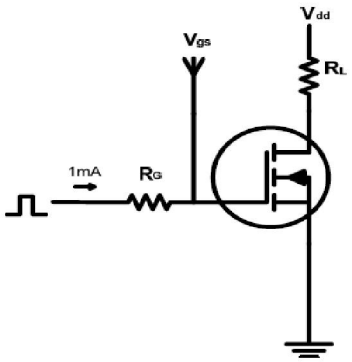
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	5 ①	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode)	—	—	15	A	
V_{SD}	Diode Forward Voltage	—	0.83	1.2	V	I_S=2.8A, V_{GS}=0V
t_{rr}	Reverse Recovery Time	—	105	—	nS	T_J = 25°C, I_F = 1.9A, di/dt = 100A/μs
Q_{rr}	Reverse Recovery Charge	—	514	—	nC	

Test Circuits and Waveforms

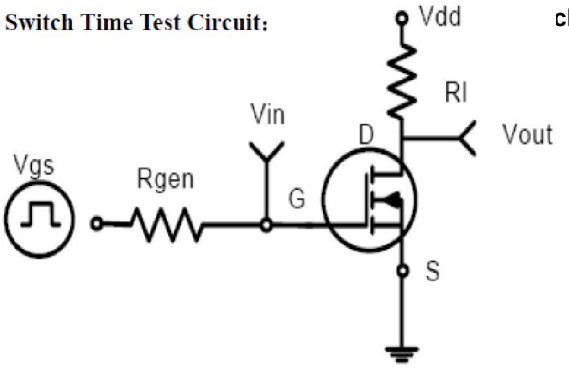
EAS test circuits:



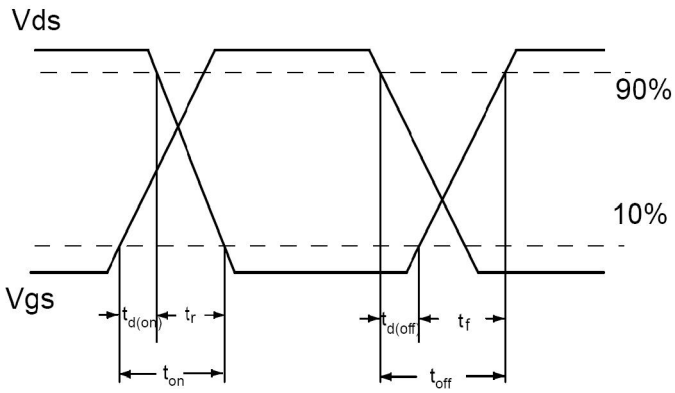
Gate charge test circuit:



Switch Time Test Circuit:



ch 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 T_A =25°C

Typical Electrical and Thermal Characteristics

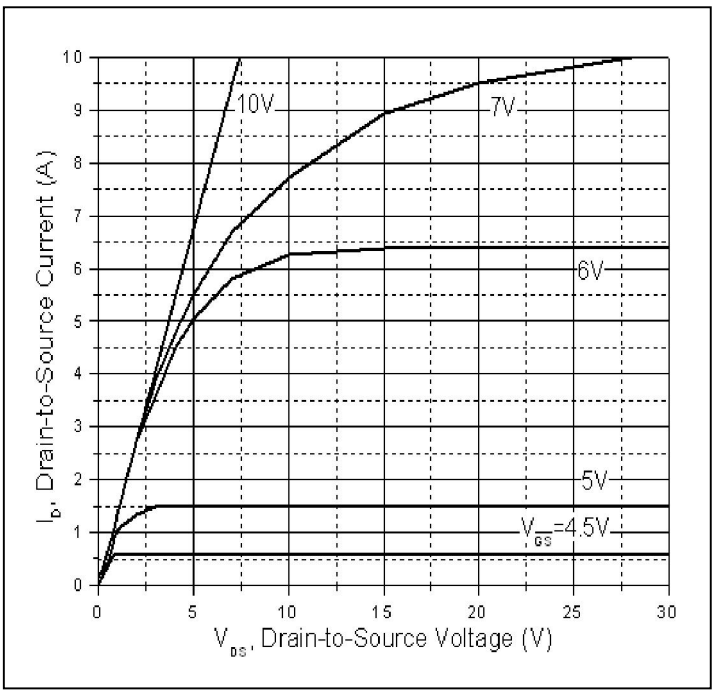


Figure 1: Typical Output Characteristics

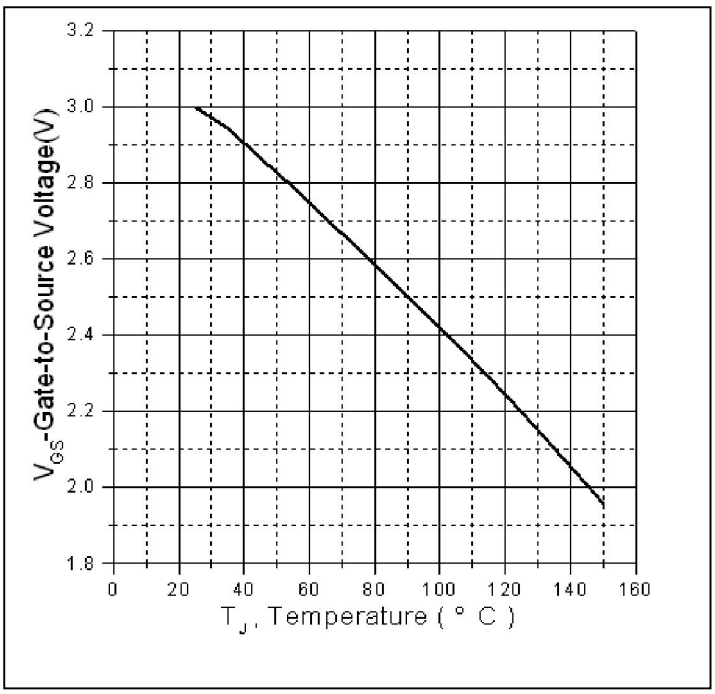


Figure 2. Gate to source cut-off voltage

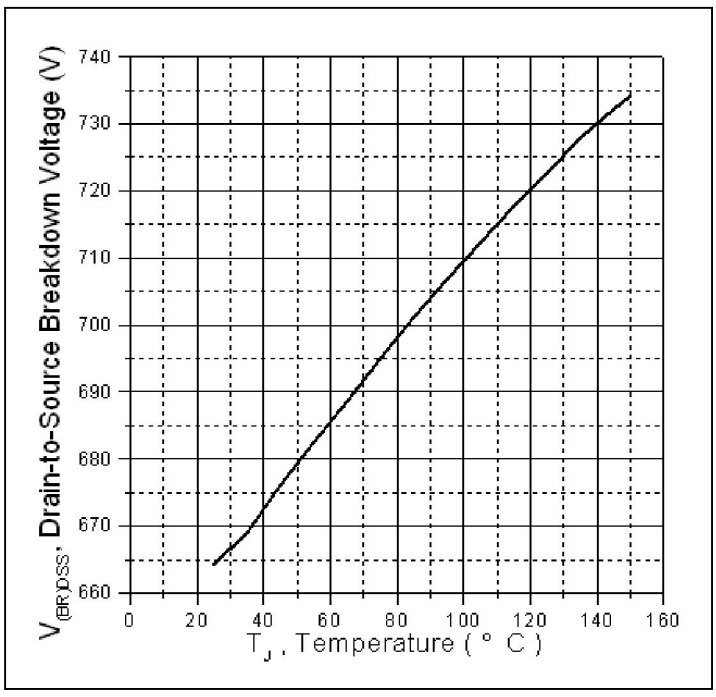


Figure 3. Drain-to-Source Breakdown Voltage Vs. Case Temperature

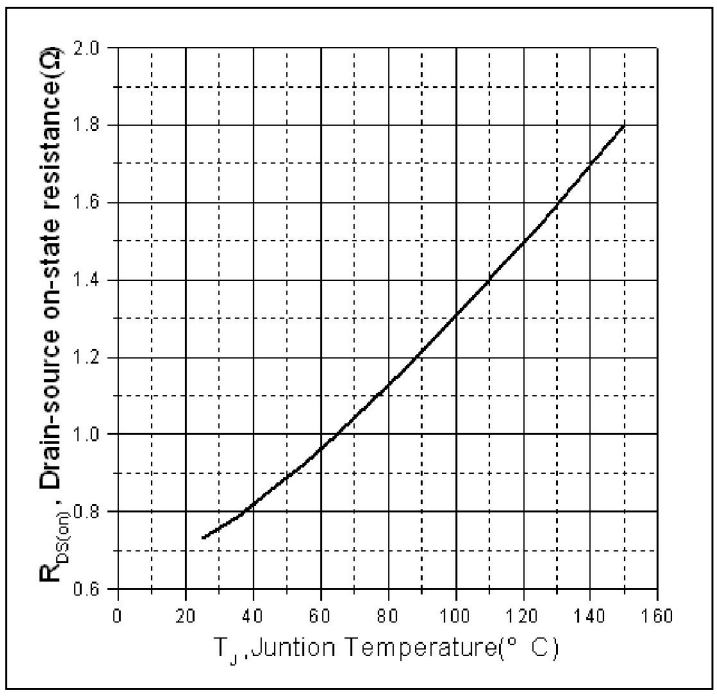


Figure 4: Normalized On-Resistance Vs. Case Temperature

Typical Electrical and Thermal Characteristics

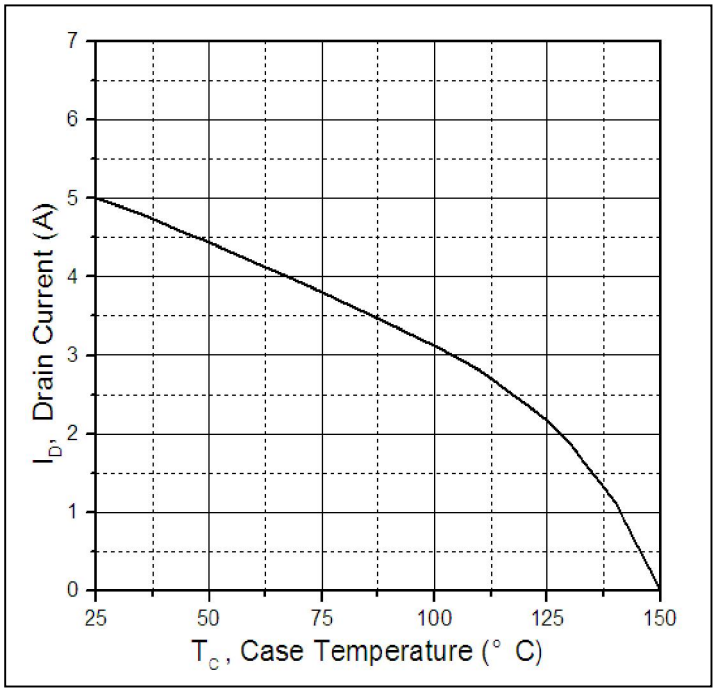


Figure 5. Maximum Drain Current Vs. Case Temperature

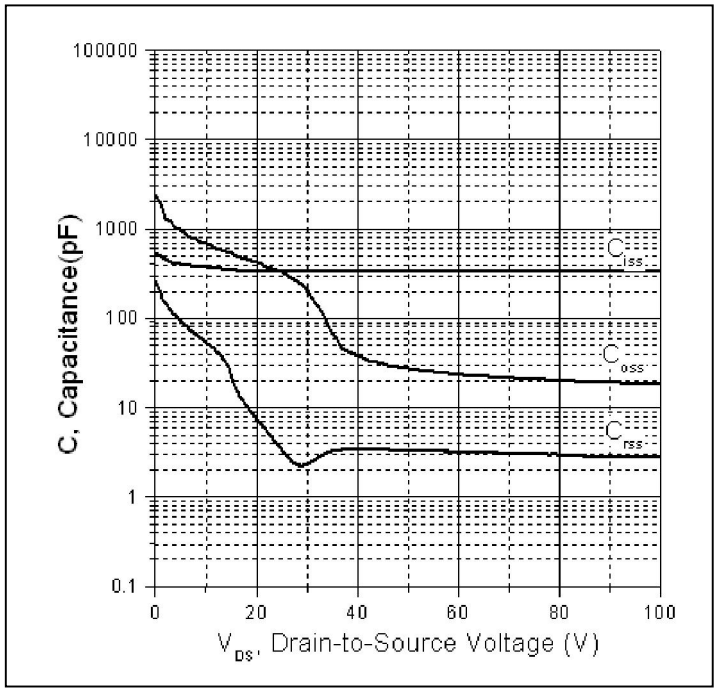


Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage

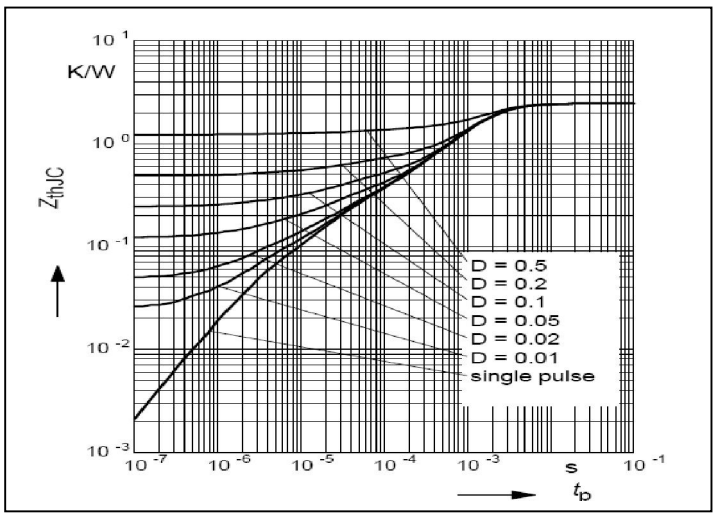
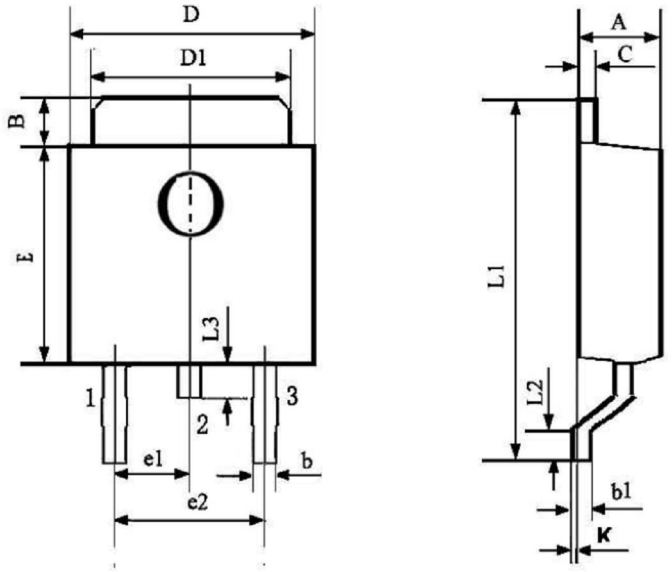


Figure7. Maximum Effective Transient Thermal Impedance Junction-to-Case

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: SSF5NS65UD

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℃ 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