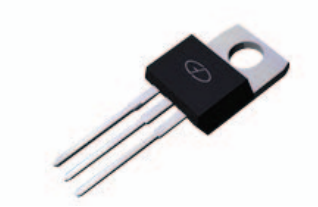
GOOD-ARK
SEMICONDUCTOR

SSF20NS65

680V N-Channel MOSFET

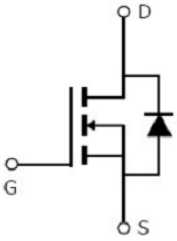
Main Product Characteristics

V_{DSS}	680V
$R_{DS(on)}$	180mΩ(typ.)
I_D	20A



TO-220

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 SSF20NS65 combines an innovative super junction technology and advanced process. This technology achieves low R_{dson}, energy savings, high reliability and uniformity, superior power den sity and space saving

Absolute Max Ratings

Symbol	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V①	20	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V①	13	
I_{DM}	Pulsed Drain Current②	80	
P_D @T_C = 25°C	Power Dissipation③	208	W
	Linear Derating Factor	1.4	W/°C
V_{DS}	Drain-Source Voltage	680	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

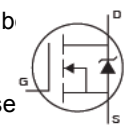
Thermal Resistance

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case③	—	0.6	Ç/W
$R_{\theta JA}$	Junction-to-Ambient (t ≤ 10s) ④	—	62	°C/W

Electrical Characteristics @T_A=25°C unless otherwise specified

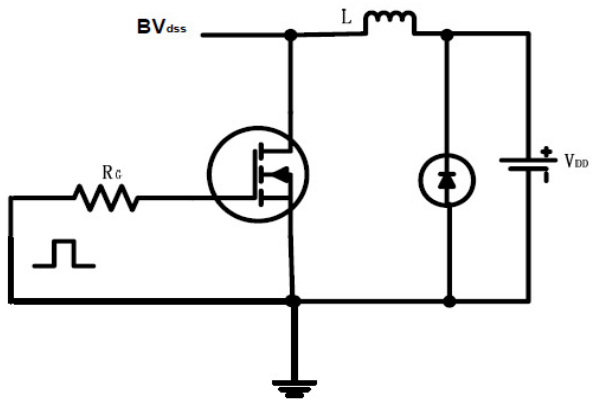
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	680	—	—	V	V_{GS} = 0V, I_D = 250μA
$R_{DS(on)}$	Static Drain-to-Source On-resistance	—	180	200	mΩ	V_{GS}=10V,I_D = 13A
		—	517	—		T_J = 125°C
$V_{GS(th)}$	Gate Threshold Voltage	2	—	4	V	V_{DS} = V_{GS}, I_D = 250μA
		—	2.40	—		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	—	50.58	—	nC	I_D = 20A,
Q_{gs}	Gate-to-Source Charge	—	11.71	—		V_{DS}=480V,
Q_{gd}	Gate-to-Drain("Miller") Charge	—	21.63	—		V_{GS} = 10V
$t_{d(on)}$	Turn-on Delay Time	—	15.42	—	ns	V_{GS}=10V, V_{DS}=380V,
t_r	Rise Time	—	44.80	—		R_L=18Ω,
$t_{d(off)}$	Turn-Off Delay Time	—	30.92	—		R_{GEN}=3.38Ω
t_f	Fall Time	—	40.36	—		I_D=18A
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 = 1MHz

Source-Drain Ratings and Characteristics

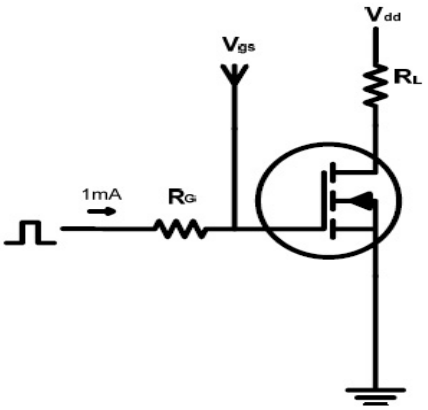
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	20	A	MOSFET symb showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode)	—	—	80	A	
V_{sd}	Diode Forward Voltage	—	0.87	1.3	V	I_S=20A, V_{GS}=0V
t_{rr}	Reverse Recovery Time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

Test Circuits and Waveforms

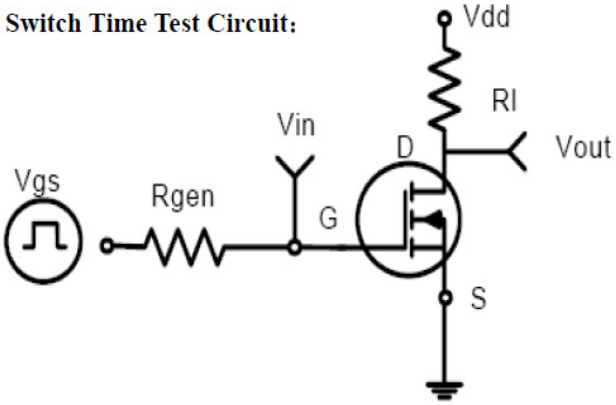
EAS test circuits:



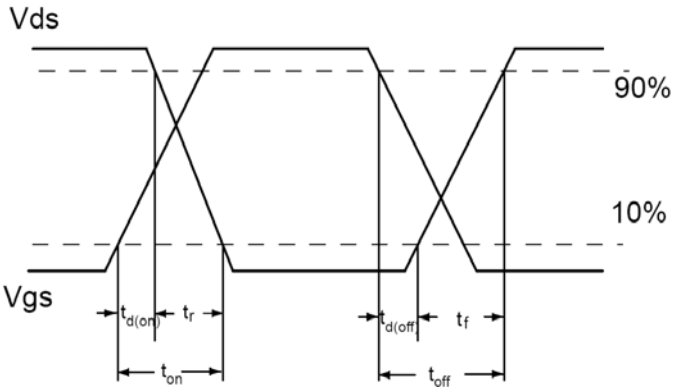
Gate charge test circuit:



Switch Time Test Circuit:



Switch Waveforms:



Notes:

①The maximum current rating is limited by bond-wires.
②Repetitive rating; pulse width limited by max. junction temperature.
③The power dissipation P_D 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 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A =25°C

Typical Electrical and Thermal Characteristics

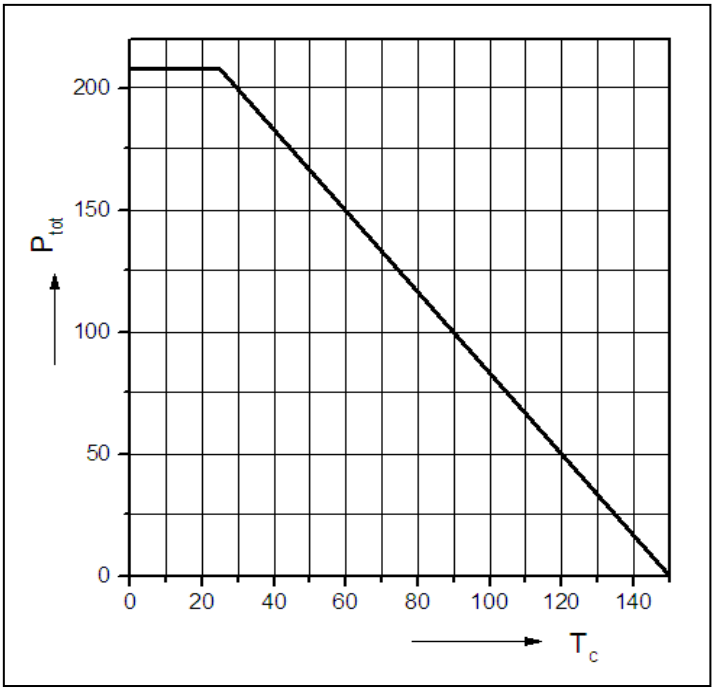


Figure 1. Power Dissipation

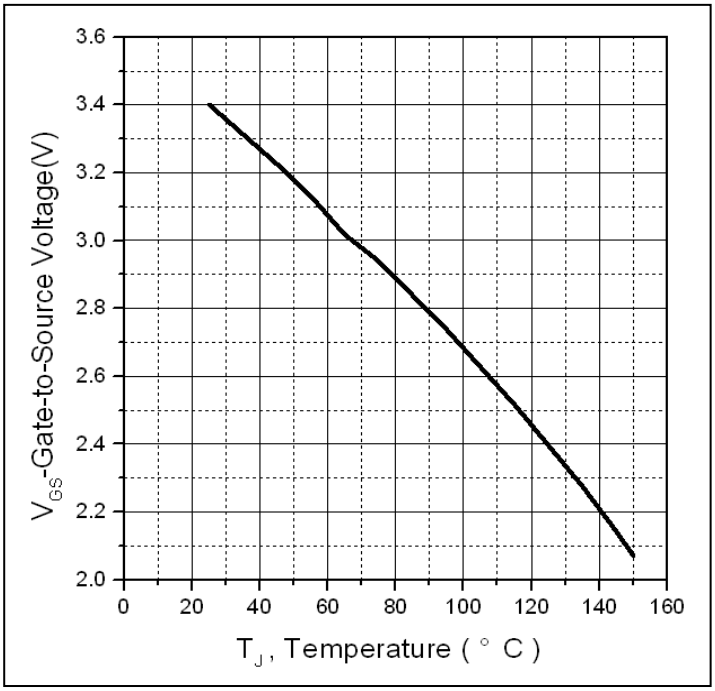


Figure 2. Typ. Gate to Source Cut-off Voltage

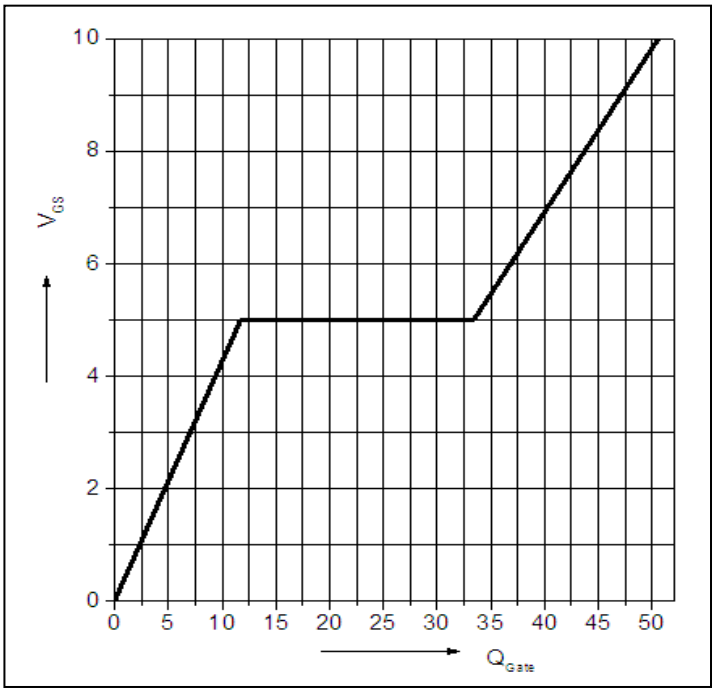


Figure 3. Typ. Gate Charge

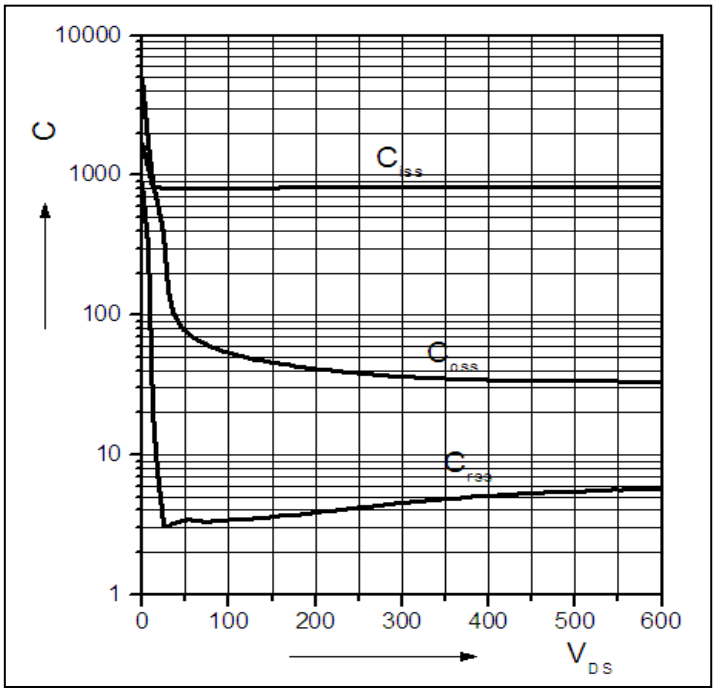


Figure 4. Typ. Capacitances

Typical Electrical and Thermal Characteristics

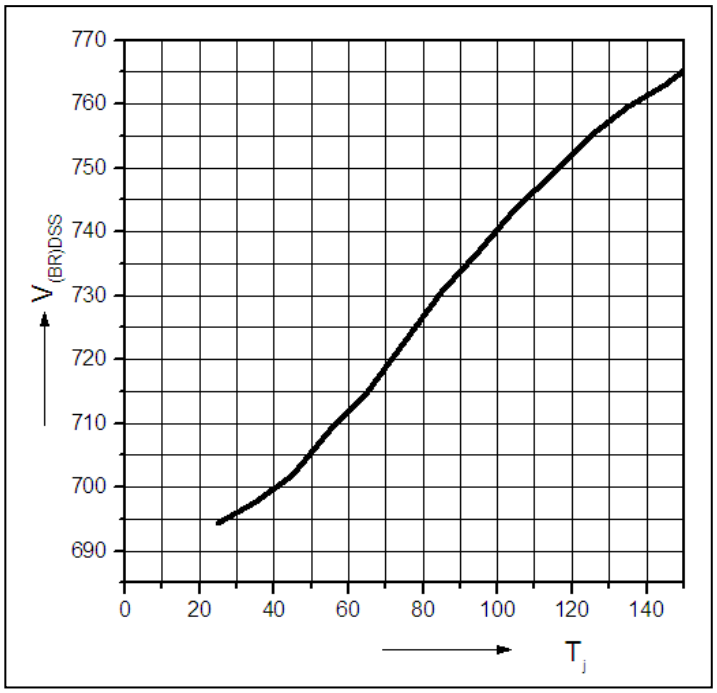


Figure 5. Drain-source Breakdown Voltage

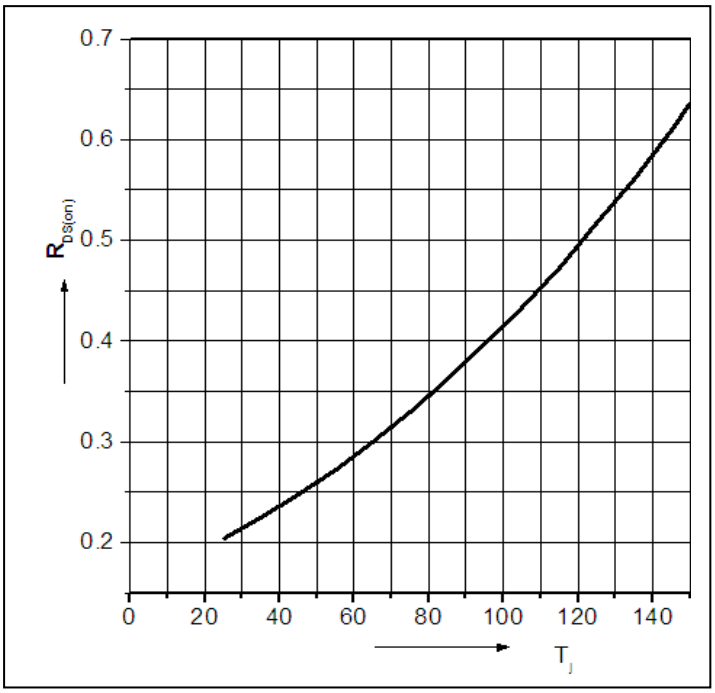
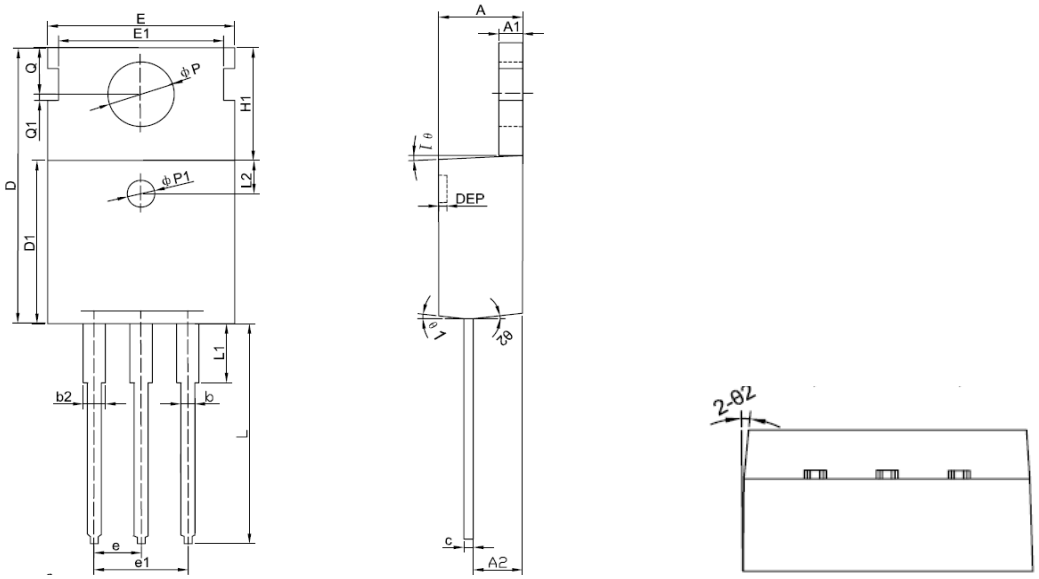


Figure 6. Drain-source on-state resistance

Mechanical Data

TO-220 PACKAGE OUTLINE DIMENSION



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	4.400	4.550	4.700	0.173	0.179	0.185
A1	1.270	1.300	1.330	0.050	0.051	0.052
A2	2.590	2.690	2.790	0.102	0.106	0.110
b	0.770	-	0.900	0.030	-	0.035
b2	1.230	-	1.360	0.048	-	0.054
c	0.480	0.500	0.520	0.019	0.020	0.020
D	15.100	15.400	15.700	-	0.606	-
D1	9.000	9.100	9.200	0.354	0.358	0.362
DEP	0.050	0.285	0.520	0.002	0.011	0.020
E	10.060	10.160	10.260	0.396	0.400	0.404
E1	-	8.700	-	-	0.343	-
ΦP1	1.400	1.500	1.600	0.055	0.059	0.063
e	2.54BSC			0.1BSC		
e1	5.08BSC			0.2BSC		
H1	6.100	6.300	6.500	0.240	0.248	0.256
L	12.750	12.960	13.170	0.502	0.510	0.519
L1	-	-	3.950	-	-	0.156
L2	1.85REF			0.073REF		
ΦP	3.570	3.600	3.630	0.141	0.142	0.143
Q	2.730	2.800	2.870	0.107	0.110	0.113
Q1	-	0.200	-	-	0.008	-
Θ1	5^0	7^0	9^0	5^0	7^0	9^0
Θ2	1^0	3^0	5^0	1^0	3^0	5^0

Ordering and Marking Information

Device Marking: SSF20NS65

Package (Available)

TO-220

Operating Temperature Range

C : -55 to 150 ºC

Devices per Unit

Package Type	Units/ Tube	Tubes/Inner Box	Units/Inner Box	Inner Boxes/Carton Box	Units/Carton Box
TO-220	50	20	1000	10	10000

Reliability Test Program

Test Item	Conditions	Duration	Sample Size
High Temperature Reverse Bias(HTRB)	T_j=125°C to 175°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°C or 175°C @ 100% of Max V_{GSS}	168 hours 500 hours 1000 hours	3 lots x 77 devices