

**Main Product Characteristics:**

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


**TO220**

**Marking and pin Assignment**

**Schematic diagram**
**Features and Benefits:**
**Features:**

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


**Description:**

The SSF20NS65 series MOSFETs is a new technology, which combines an innovative super junction technology and advanced 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	20	A
$I_D @ TC = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ ①	13	
$I_{DM}$	Pulsed Drain Current②	80	
$P_D @ TC = 25^\circ C$	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

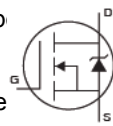
## Thermal Resistance

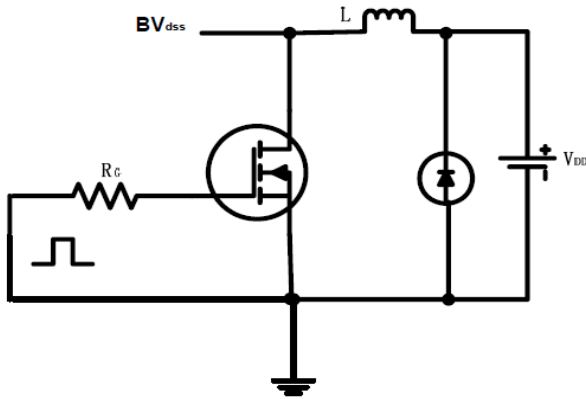
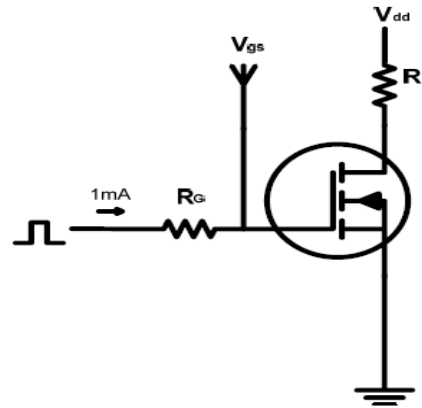
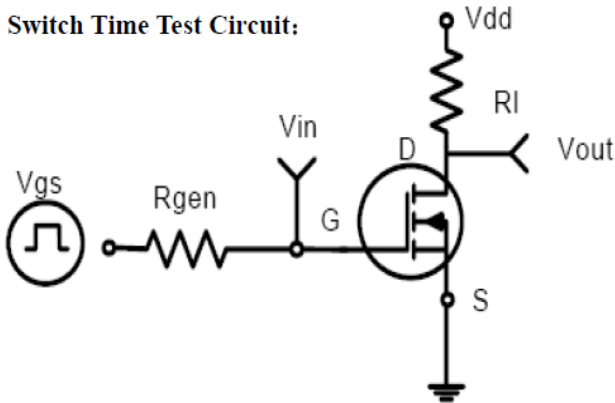
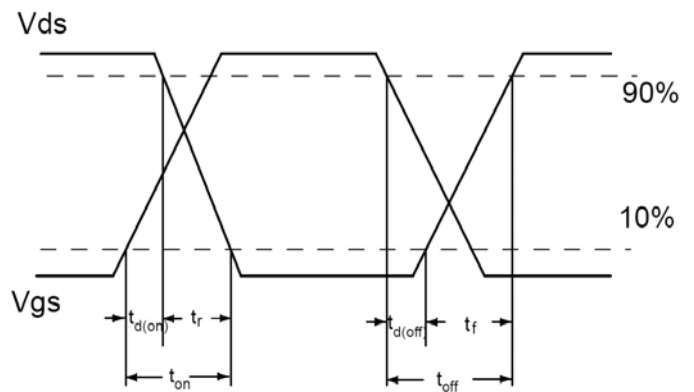
Symbol	Characterizes	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-case <sup>③</sup>	—	0.6	°C/W
$R_{\theta JA}$	Junction-to-ambient ( $t \leq 10s$ ) <sup>④</sup>	—	62	°C/W

## Electrical Characterizes @ $T_A=25^\circ C$ unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source breakdown voltage	680	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$R_{DS(on)}$	Static Drain-to-Source on-resistance	—	180	200	mΩ	$V_{GS}=10V, I_D = 13A$
		—	517	—		$T_J = 125^\circ C$
$V_{GS(th)}$	Gate threshold voltage	2	—	4	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
		—	2.40	—		$T_J = 125^\circ C$
$I_{DSS}$	Drain-to-Source leakage current	—	—	1	μA	$V_{DS} = 650V, V_{GS} = 0V$
		—	—	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	—	50.58	—	nC	$I_D = 20A,$ $V_{DS}=480V,$ $V_{GS} = 10V$
$Q_{gs}$	Gate-to-Source charge	—	11.71	—		
$Q_{gd}$	Gate-to-Drain("Miller") charge	—	21.63	—		
$t_{d(on)}$	Turn-on delay time	—	15.42	—	ns	$V_{GS}=10V, V_{DS}=380V,$ $R_L=18\Omega,$ $R_{GEN}=3.38\Omega$ $I_D=18A$
$t_r$	Rise time	—	44.80	—		
$t_{d(off)}$	Turn-Off delay time	—	30.92	—		
$t_f$	Fall time	—	40.36	—		
$C_{iss}$	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	$T_J = 25^\circ C, I_F = 20A, di/dt = 100A/\mu s$
$Q_{rr}$	Reverse Recovery Charge	—	5	—	μC	

**Test circuits and Waveforms**
**EAS test circuits:**

**Gate charge test circuit:**

**Switch Time Test Circuit:**

**Switch 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  $T_A = 25^{\circ}C$
- 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  $T_{J(MAX)} = 150^{\circ}C$ .
- ⑥ The maximum current rating is limited by bond-wires.

Typical electrical and thermal characteristics

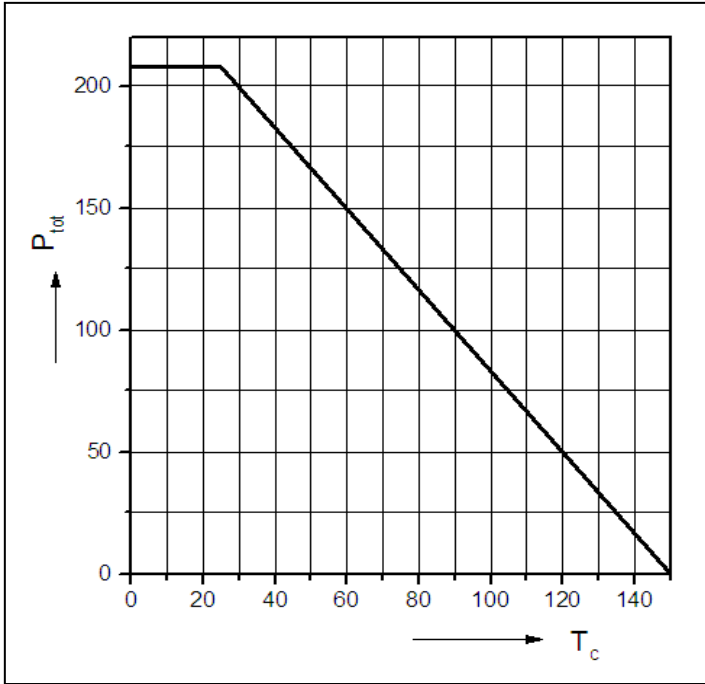


Figure 1: Power dissipation

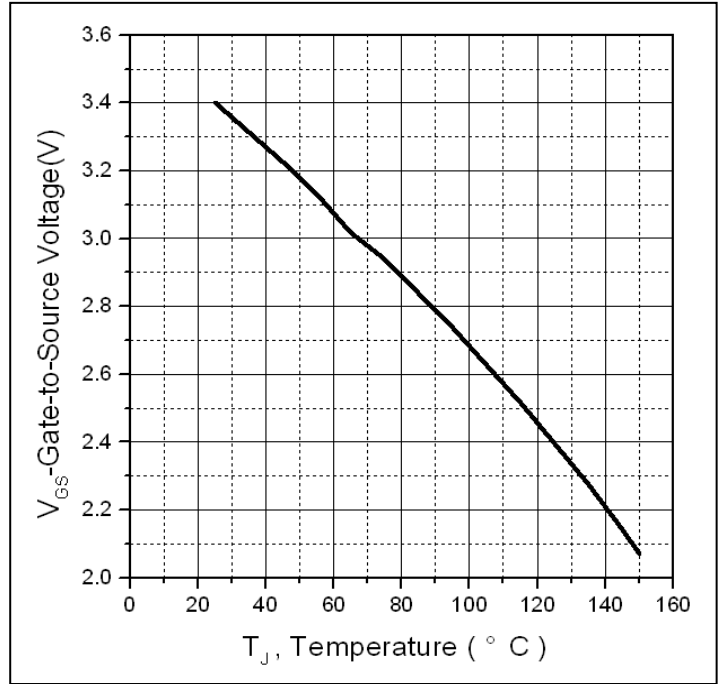


Figure 2. Typ. Gate to source cut-off voltage

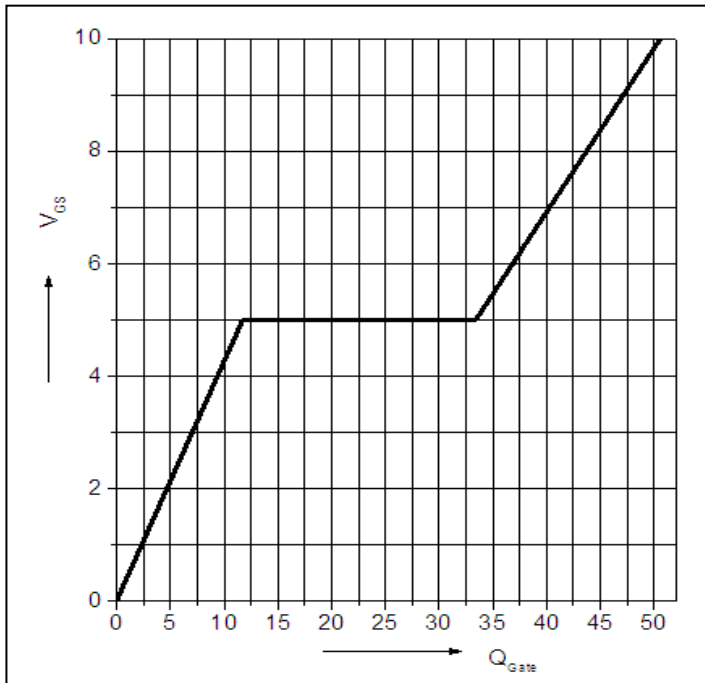


Figure 3. Typ. gate charge

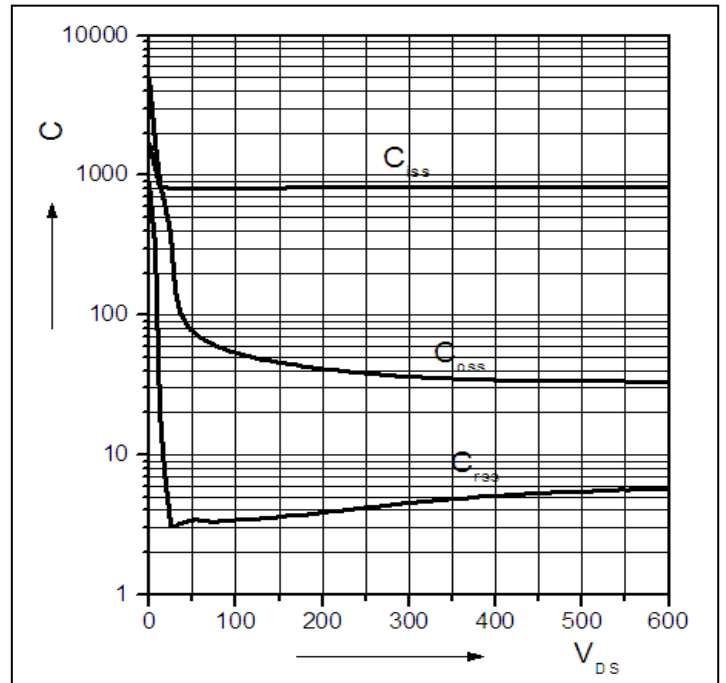


Figure 4: Typ. Capacitances

Typical electrical and thermal characteristics

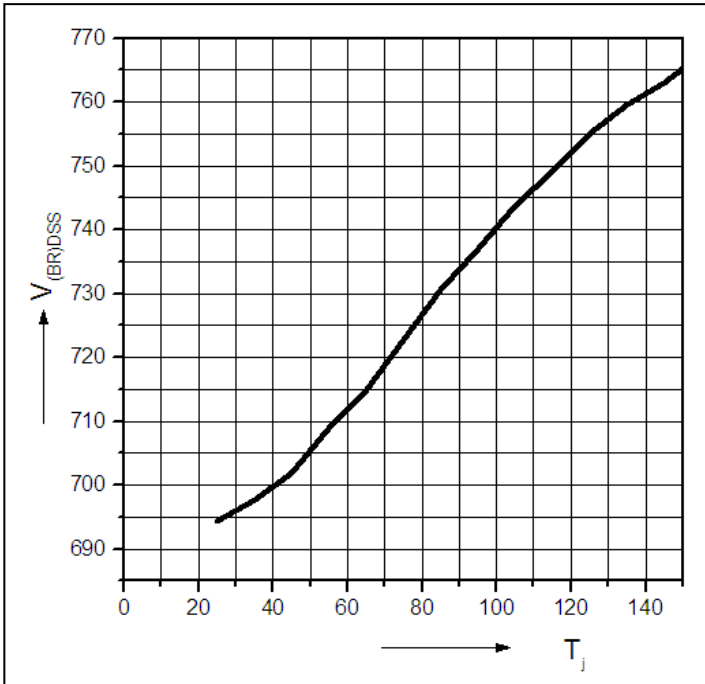


Figure 5. Drain-source breakdown voltage

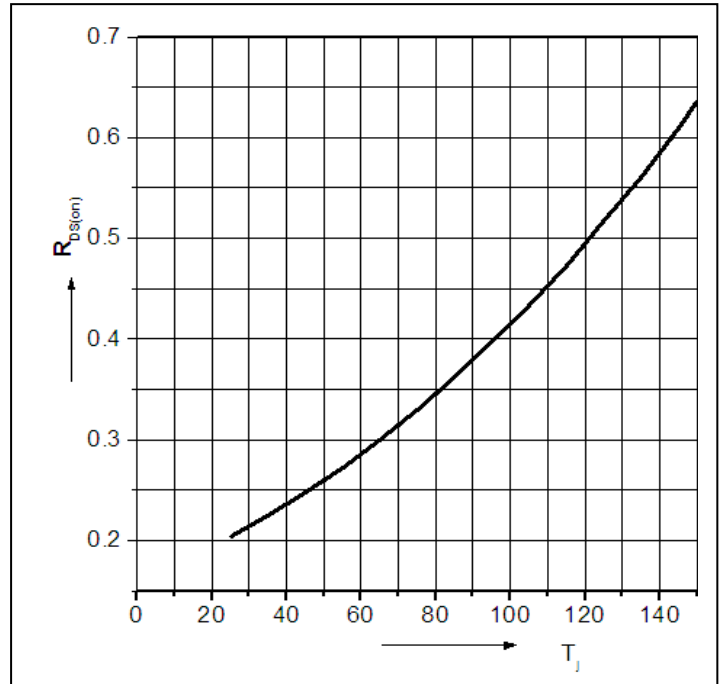
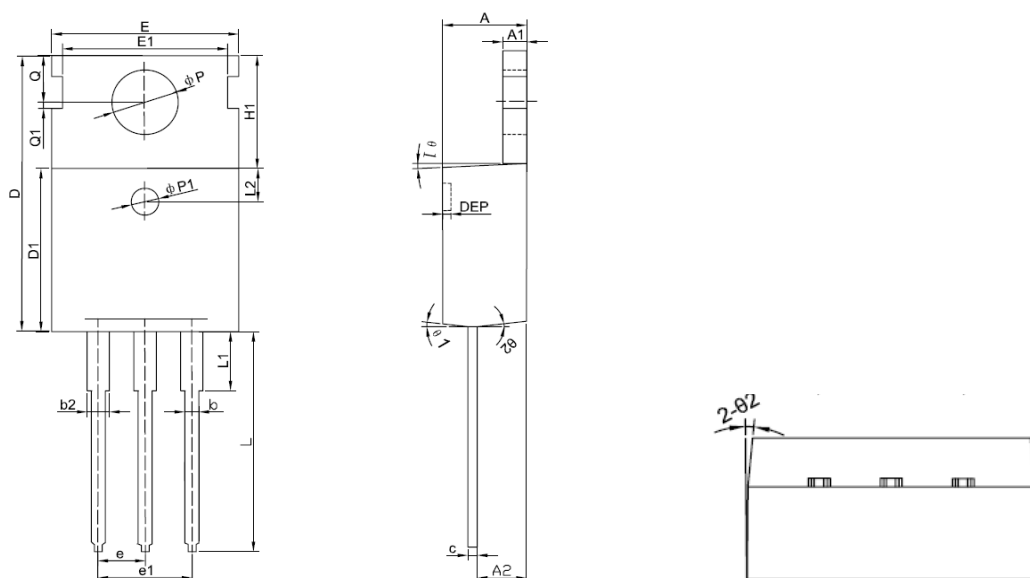


Figure 6. Drain-source on-state resistance

**Mechanical Data:**
**TO220 PACKAGE OUTLINE DIMENSION**


Symbol	Dimension In Millimeters			Dimension 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 <sup>0</sup>	7 <sup>0</sup>	9 <sup>0</sup>	5 <sup>0</sup>	7 <sup>0</sup>	9 <sup>0</sup>
Θ2	1 <sup>0</sup>	3 <sup>0</sup>	5 <sup>0</sup>	1 <sup>0</sup>	3 <sup>0</sup>	5 <sup>0</sup>

**Ordering and Marking Information**
**Device Marking: SSF20NS65**

**Package (Available)**  
**TO220**  
**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
TO220	50	20	1000	6	6000

**Reliability Test Program**

Test Item	Conditions	Duration	Sample Size
High Temperature Reverse Bias(HTRB)	$T_j=125^{\circ}\text{C}$ to $175^{\circ}\text{C}$ @ 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)	$T_j=150^{\circ}\text{C}$ or $175^{\circ}\text{C}$ @ 100% of Max $V_{GSS}$	168 hours 500 hours 1000 hours	3 lots x 77 devices

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