

## Main Product Characteristics

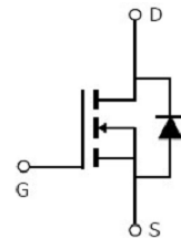
$V_{DSS}$	650V
$R_{DS(on)}$	0.6Ω (typ.)
$I_D$	7A <sup>①</sup>



TO-220F



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 SSF7NS65UF combines an innovative super junction technology and advanced process. This technology achieves low  $R_{dson}$ , energy savings, high reliability and uniformity, superior power density and space saving.

## Absolute Max Rating

Symbol	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	7 <sup>①</sup>	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	5 <sup>①</sup>	
$I_{DM}$	Pulsed Drain Current <sup>②</sup>	28	
$P_D @ T_C = 25^\circ\text{C}$	Power Dissipation <sup>③</sup>	33	W
	Linear Derating Factor	0.264	W/°C
$V_{DS}$	Drain-Source Voltage	650	V
$V_{GS}$	Gate-to-Source Voltage	± 30	V
$E_{AS}$	Single Pulse Avalanche Energy @ L=100mH	98	mJ
$I_{AS}$	Avalanche Current @ L=100mH	1.4	A
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +150	°C

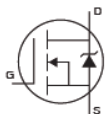
## Thermal Resistance

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ③	—	3.8	$^{\circ}C/W$
$R_{\theta JA}$	Junction-to-Ambient ( $t \leq 10s$ ) ④	—	80	$^{\circ}C/W$

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

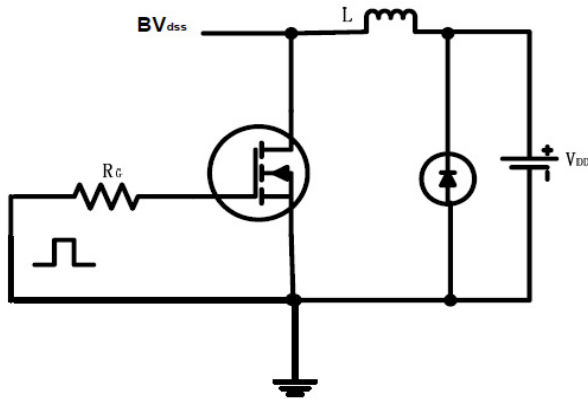
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	650	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$R_{DS(on)}$	Static Drain-to-Source On-resistance	—	0.6	0.75	$\Omega$	$V_{GS}=10V, I_D = 1A$
		—	1.3	—		$T_J = 125^{\circ}C$
		—	0.64	0.9	$\Omega$	$V_{GS}=10V, I_D = 2.8A$
		—	1.5	—		$T_J = 125^{\circ}C$
$V_{GS(th)}$	Gate Threshold Voltage	2	—	4	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
		—	2.2	—		$T_J = 125^{\circ}C$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	1	$\mu A$	$V_{DS} = 650V, V_{GS} = 0V$
		—	—	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	—	13	—	nC	$I_D = 5A,$
$Q_{gs}$	Gate-to-Source Charge	—	2.6	—		$V_{DS}=200V,$
$Q_{gd}$	Gate-to-Drain("Miller") Charge	—	3.1	—		$V_{GS} = 10V$
$t_{d(on)}$	Turn-on Delay Time	—	12	—	ns	$V_{GS}=10V, V_{DS} = 400V,$ $R_{GEN}=10.2\Omega, I_D = 1.5A$
$t_r$	Rise Time	—	7.5	—		
$t_{d(off)}$	Turn-Off Delay Time	—	30	—		
$t_f$	Fall Time	—	18	—		
$C_{iss}$	Input Capacitance	—	500	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	24	—		$V_{DS} = 100V$
$C_{rss}$	Reverse Transfer Capacitance	—	3	—		$f = 1MHz$

## Source-Drain Ratings and Characteristics

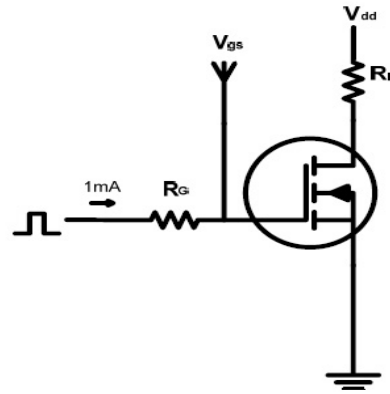
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	7 ①	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode)	—	—	28	A	
$V_{SD}$	Diode Forward Voltage	—	0.8	1.2	V	$I_S=2.8A, V_{GS}=0V$
$t_{rr}$	Reverse Recovery Time	—	126	—	nS	$T_J = 25^{\circ}C, I_F = 1.5A,$
$Q_{rr}$	Reverse Recovery Charge	—	560	—	nC	$di/dt = 100A/\mu s$

## Test Circuits and Waveforms

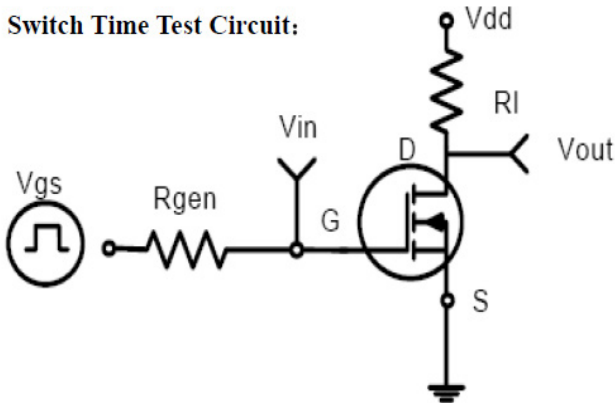
EAS test circuits:



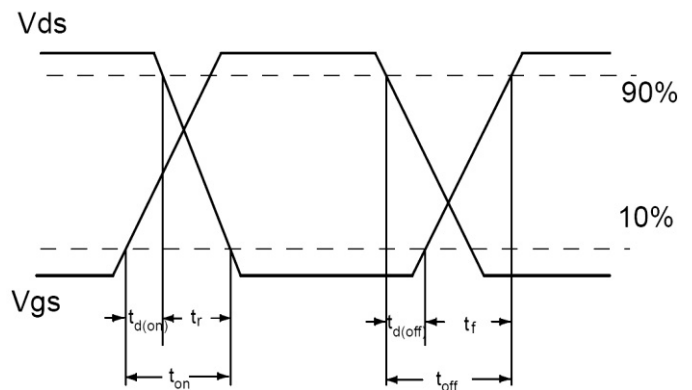
Gate charge test circuit:



Switch Time Test Circuit:



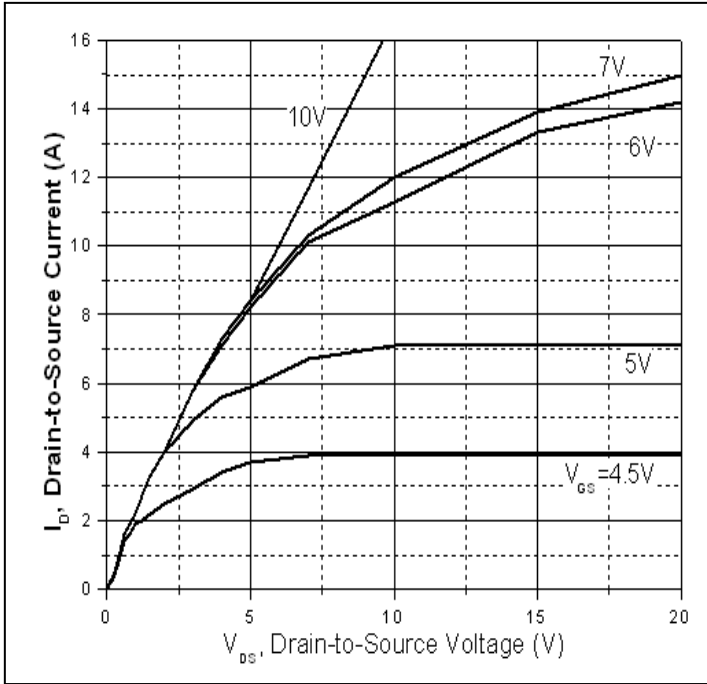
Switching Waveforms:



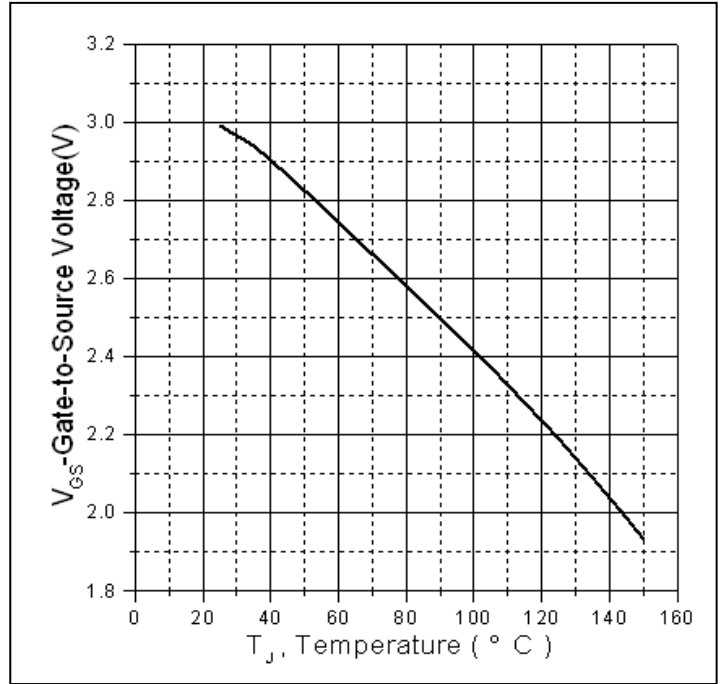
### Notes:

- ① Calculated continuous current based on maximum allowable junction temperature.
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ The power dissipation  $P_D$  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 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A = 25^\circ\text{C}$

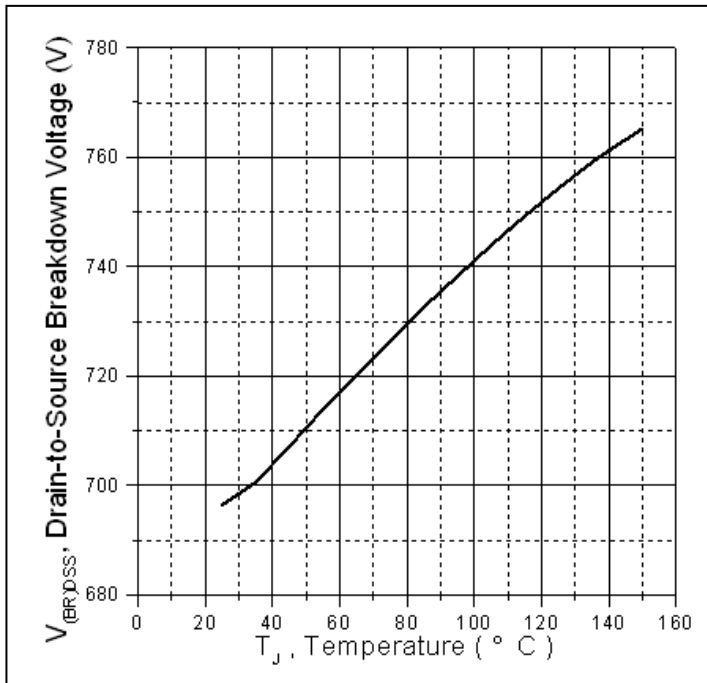
**Typical Electrical and Thermal Characteristics**



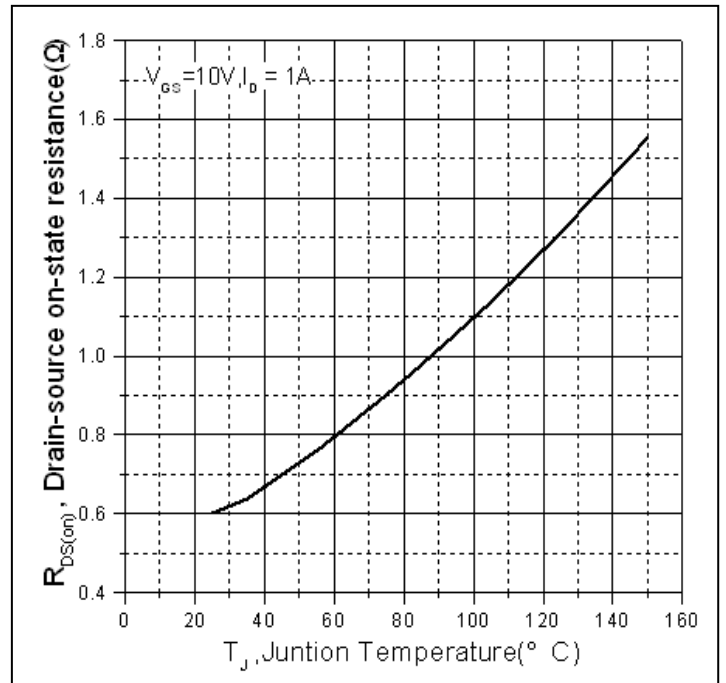
**Figure 1. Typical Output Characteristics**



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

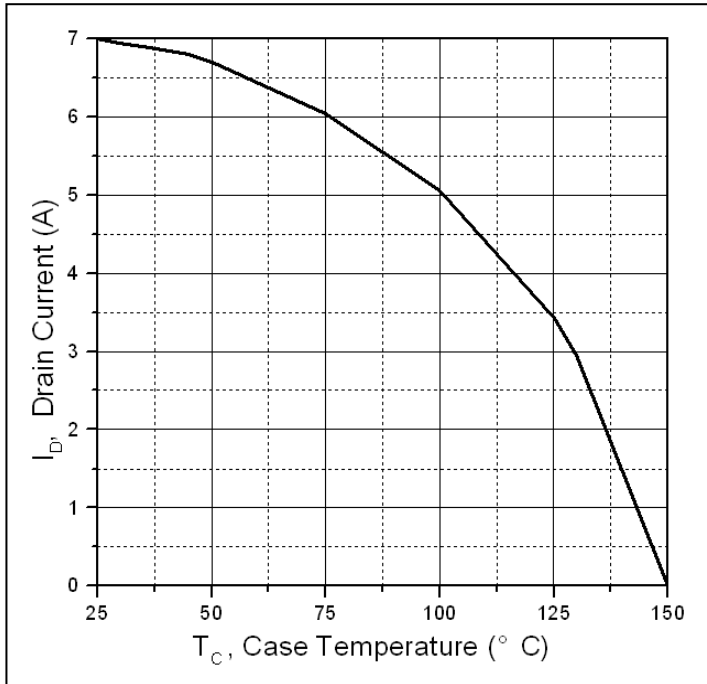


**Figure 3. Drain-to-Source Breakdown Voltage Vs. Case Temperature**

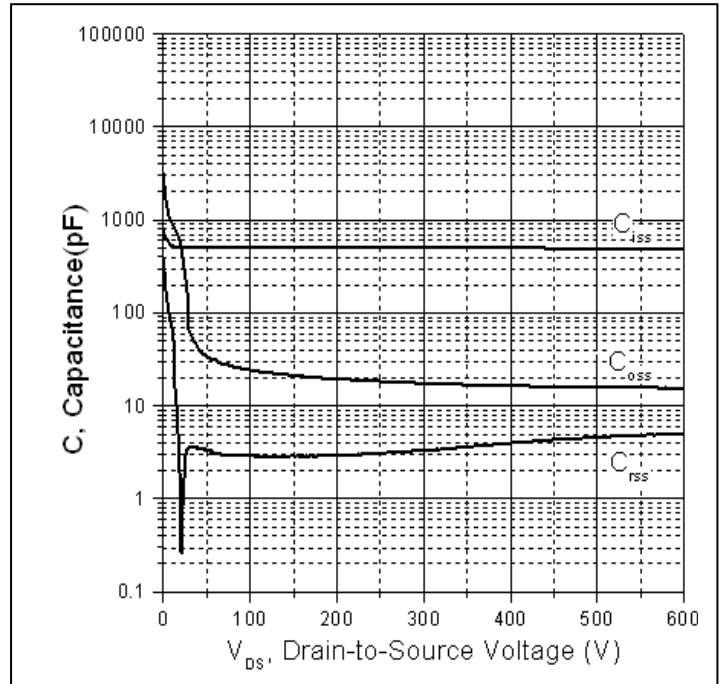


**Figure 4. Normalized On-Resistance Vs. Case Temperature**

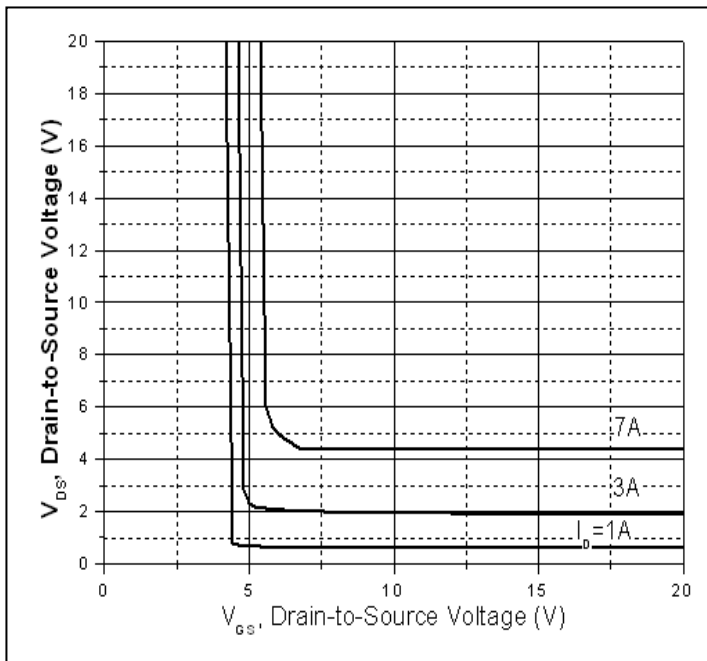
**Typical Electrical and Thermal Characteristics**



**Figure 5. Maximum Drain Current Vs. Case Temperature**



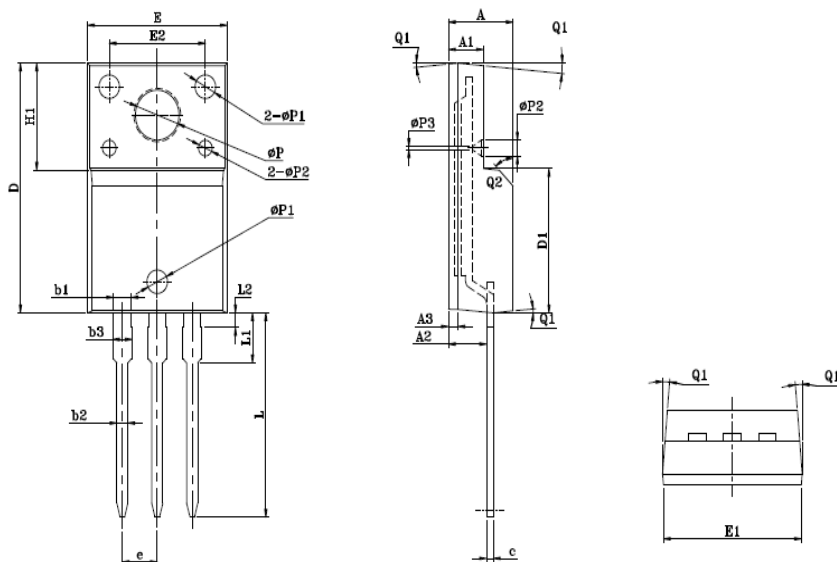
**Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage**



**Figure 7. Drain-to-Source Voltage Vs. Gate-to-Source Voltage**

**Mechanical Data**

**TO-220F PACKAGE OUTLINE DIMENSION**



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
E	9.960	10.160	10.360	0.392	0.400	0.408
E1	9.840	10.040	10.240	0.387	0.395	0.403
E2	6.800	7.000	7.200	0.268	0.276	0.283
A	4.600	4.700	4.800	0.181	0.185	0.189
A1	2.440	2.540	2.640	0.096	0.100	0.104
A2	2.660	2.760	2.860	0.105	0.109	0.113
A3	0.600	0.700	0.800	0.024	0.028	0.031
c	-	0.500	-	-	0.020	-
D	15.780	15.870	15.980	0.621	0.625	0.629
D1	8.970	9.170	9.370	0.353	0.361	0.369
H1	6.500	6.700	6.800	0.256	0.264	0.268
e	2.54BSC			0.10BSC		
φP	3.080	3.180	3.280	0.121	0.125	0.129
φP1	1.400	1.500	1.600	0.055	0.059	0.063
φP2	0.900	1.000	1.100	0.035	0.039	0.043
φP3	0.100	0.200	0.300	0.004	0.008	0.012
L	12.780	12.980	13.180	0.503	0.511	0.519
L1	2.970	3.170	3.370	0.117	0.125	0.133
L2	0.830	0.930	1.030	0.033	0.037	0.041
Q1	3°	5°	7°	3°	5°	7°
Q2	43°	45°	47°	43°	45°	47°
b1	1.180	1.280	1.380	0.046	0.050	0.054
b2	0.760	0.800	0.840	0.030	0.031	0.033
b3	-	-	1.420	-	-	0.056

## Ordering and Marking Information

### Device Marking: SSF7NS65UF

Package (Available)  
TO-220F  
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-220F	50	20	1000	10	10000

## 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