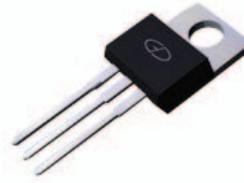
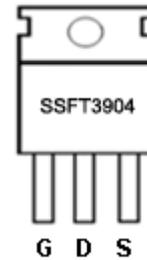


Main Product Characteristics

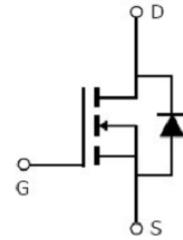
V_{DSS}	30V
$R_{DS(on)}$	2.6m Ω (typ.)
I_D	110A



TO-220



Marking and Pin Assignment



Schematic Diagram

Features and Benefits

- Advanced MOSFET process technology
- Ideal for PWM, load switching and general purpose applications
- Ultra low on-resistance with low gate charge
- Fast switching and reverse body recovery
- 175°C operating temperature



Description

The SSFT3904 utilizes the latest processing techniques to achieve high cell density, low on-resistance and high repetitive avalanche rating. These features make this device extremely efficient and reliable device for use in power switching applications and a wide variety of other applications.

Absolute Max Ratings

Symbol	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}^{(1)}$	110	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}^{(1)}$	80	
I_{DM}	Pulsed Drain Current ⁽²⁾	440	
$P_D @ T_C = 25^\circ\text{C}$	Power Dissipation ⁽³⁾	100	W
	Linear Derating Factor	0.55	W/°C
V_{DS}	Drain-Source Voltage	30	V
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy @ $L=0.1\text{mH}^{(2)}$	320	mJ
I_{AR}	Avalanche Current @ $L=0.1\text{mH}^{(2)}$	80	A
T_J, T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C

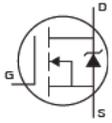
Thermal Resistance

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ^③	—	1.5	°C/W
$R_{\theta JA}$	Junction-to-Ambient ($t \leq 10s$) ^④	—	62	°C/W
	Junction-to-Ambient (PCB mounted, steady-state) ^④	—	40	°C/W

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

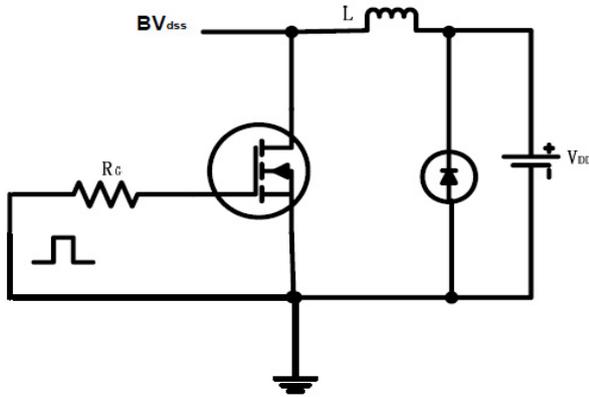
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	30	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$R_{DS(on)}$	Static Drain-to-Source On-resistance	—	2.6	3.6	m Ω	$V_{GS}=10V, I_D = 30A$ $T_J = 125^\circ\text{C}$
		—	3.8	—		
$R_{DS(on)}$	Static Drain-to-Source On-resistance	—	3.2	5	m Ω	$V_{GS}=4.5V, I_D = 16A$ $T_J = 125^\circ\text{C}$
		—	4.8	—		
$V_{GS(th)}$	Gate Threshold Voltage	1	—	3	V	$V_{DS} = V_{GS}, I_D = 250\mu A$ $T_J = 125^\circ\text{C}$
		—	1.3	—		
I_{DSS}	Drain-to-Source Leakage Current	—	—	1	μA	$V_{DS} = 30V, V_{GS} = 0V$ $T_J = 125^\circ\text{C}$
		—	—	50		
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$ $V_{GS} = -20V$
		—	—	-100		
Q_g	Total Gate Charge	—	68	—	nC	$V_{DS}=15V,$ $I_D=16A,$ $V_{GS}=5V$
Q_{gs}	Gate-to-Source Charge	—	19	—		
Q_{gd}	Gate-to-Drain("Miller") Charge	—	25	—		
$t_{d(on)}$	Turn-on Delay Time	—	19	—	ns	$V_{GS}=10V, V_{DS}=15V,$ $R_{GEN}=6\Omega, I_D=1A$
t_r	Rise Time	—	18	—		
$t_{d(off)}$	Turn-Off Delay Time	—	145	—		
t_f	Fall Time	—	63	—		
C_{iss}	Input Capacitance	—	9291	—	pF	$V_{GS} = 0V$ $V_{DS} = 15V$ $f = 1\text{MHz}$
C_{oss}	Output Capacitance	—	748	—		
C_{rss}	Reverse Transfer Capacitance	—	702	—		

Source-Drain Ratings and Characteristics

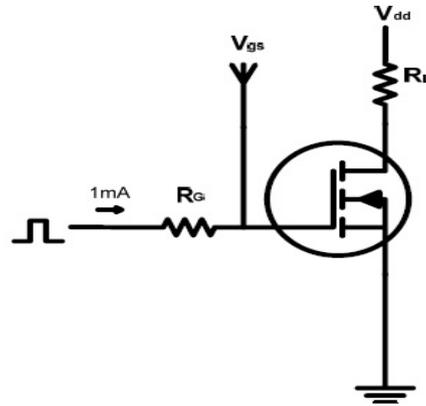
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	110	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode)	—	—	440	A	
V_{SD}	Diode Forward Voltage	—	0.85	1.3	V	$I_S=50A, V_{GS}=0V$
t_{rr}	Reverse Recovery Time	—	20	—	ns	$T_J = 25^\circ\text{C}, I_F = 32A,$
Q_{rr}	Reverse Recovery Charge	—	7.8	—	nC	$di/dt = 100A/\mu s$

Test Circuits and Waveforms

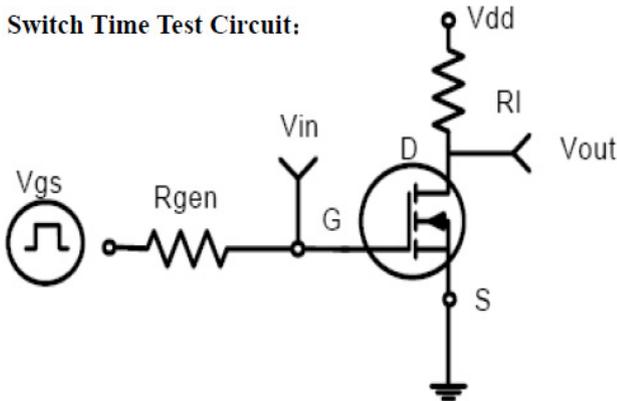
EAS test circuits:



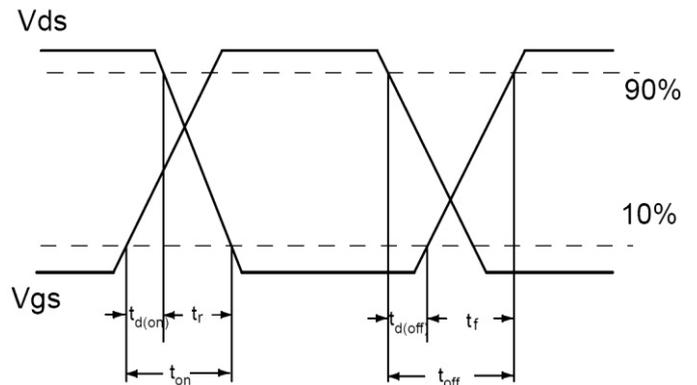
Gate charge test circuit:



Switch Time Test Circuit:



Switching Waveforms:



Notes:

- ① The maximum current rating is limited by bond-wires.
- 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 1in² FR-4 board with 2oz. Copper, in a still air environment with $T_A = 25^\circ\text{C}$

Typical Electrical Characteristics

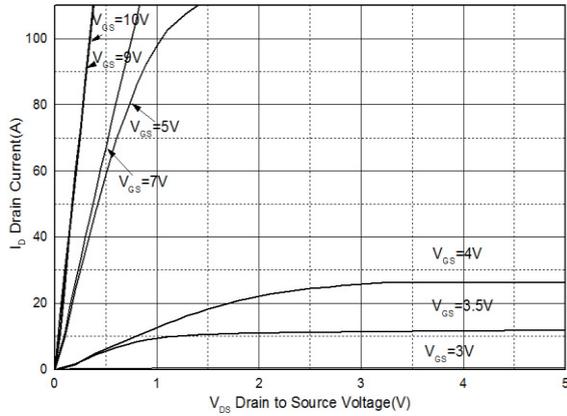


Figure 1. Typical Output Characteristics

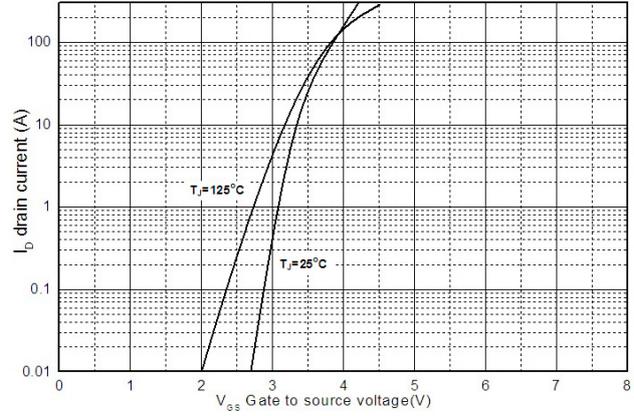


Figure 2. Typical Transfer Characteristics

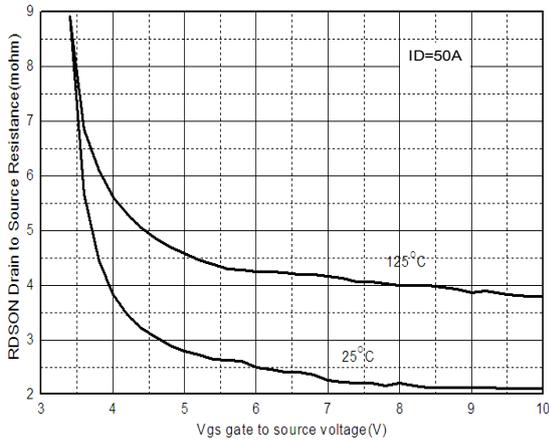


Figure 3. On-Resistance vs. Gate-Source Voltage

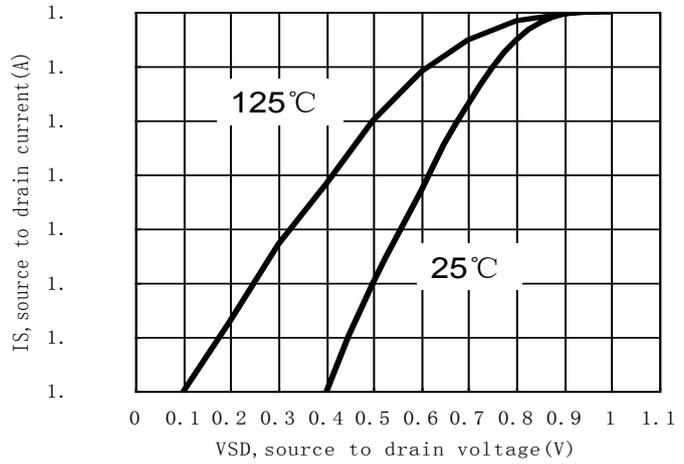


Figure 4. Body-Diode Characteristics

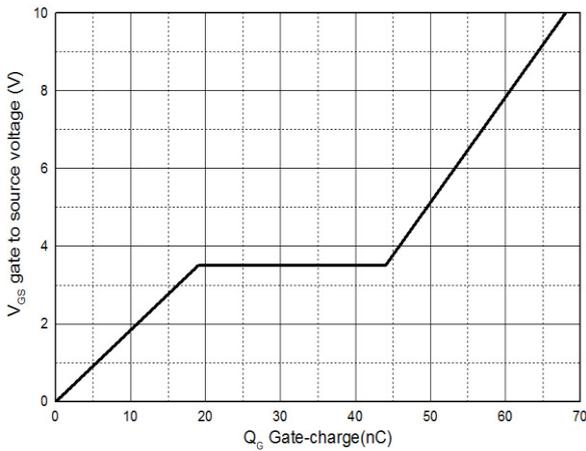


Figure 5. Gate-Charge Characteristics

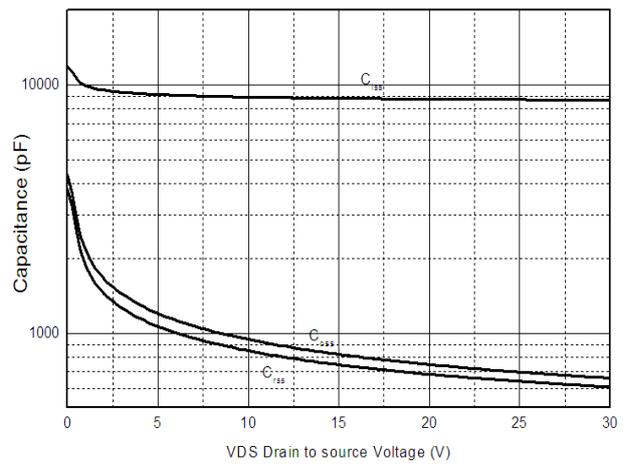


Figure 6. Capacitance Characteristics

Typical Thermal Characteristics

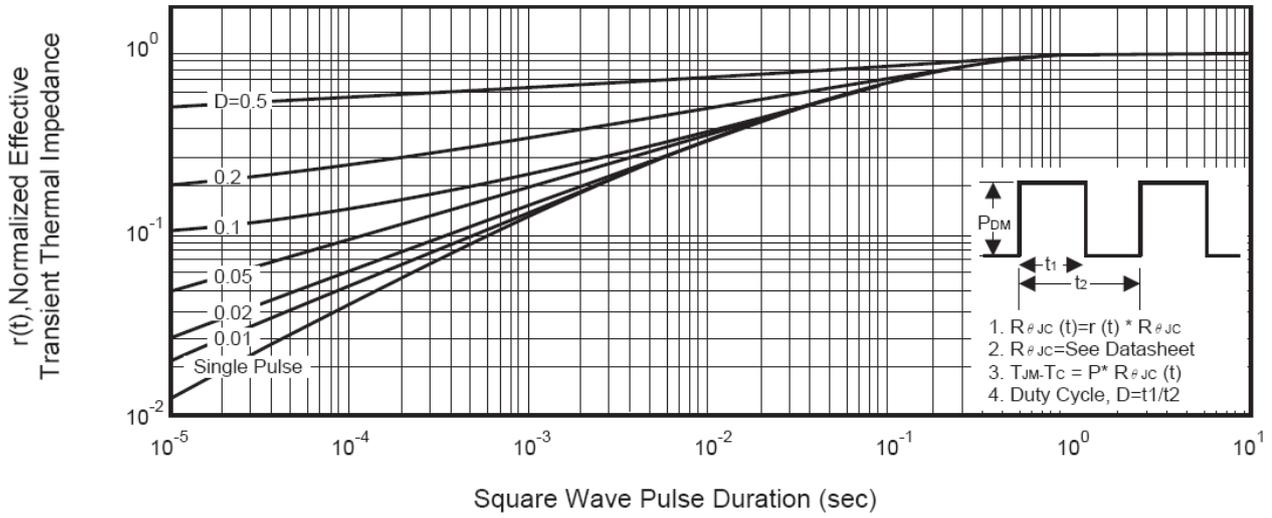
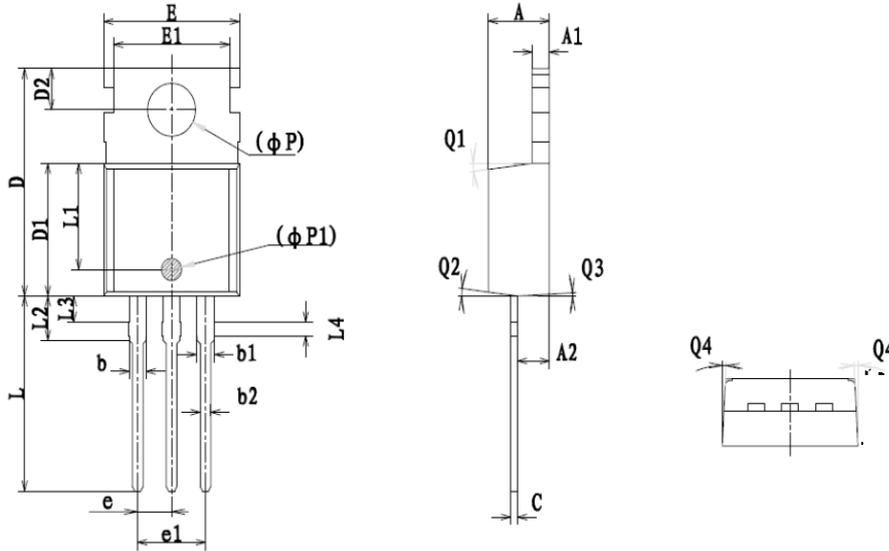


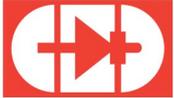
Figure 7. Normalized Thermal transient Impedance Curve

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	2.240	2.340	2.440	0.088	0.092	0.096
b	-	1.270	-	-	0.050	-
b1	1.270	1.370	1.470	0.050	0.054	0.058
b2	0.750	0.800	0.850	0.030	0.031	0.033
C	0.480	0.500	0.520	0.019	0.020	0.021
D	15.100	15.400	15.700	0.594	0.606	0.618
D1	8.800	8.900	9.000	0.346	0.350	0.354
D2	2.730	2.800	2.870	0.107	0.110	0.113
E	9.900	10.000	10.100	0.390	0.394	0.398
E1	-	8.700	-	-	0.343	-
φP	3.570	3.600	3.630	0.141	0.142	0.143
φP1	1.400	1.500	1.600	0.055	0.059	0.063
e	2.54BSC			0.1BSC		
e1	5.08BSC			0.2BSC		
L	13.150	13.360	13.570	0.518	0.526	0.534
L1	7.35REF			0.29REF		
L2	2.900	3.000	3.100	0.114	0.118	0.122
L3	1.650	1.750	1.850	0.065	0.069	0.073
L4	0.900	1.000	1.100	0.035	0.039	0.043
Q1	5 ⁰	7 ⁰	9 ⁰	5 ⁰	7 ⁰	9 ⁰
Q2	5 ⁰	7 ⁰	9 ⁰	5 ⁰	7 ⁰	9 ⁰
Q3	5 ⁰	7 ⁰	9 ⁰	5 ⁰	7 ⁰	9 ⁰
Q4	1 ⁰	3 ⁰	5 ⁰	1 ⁰	3 ⁰	5 ⁰



Ordering and Marking Information

Device Marking: SSFT3904

Package (Available)
TO-220
Operating Temperature Range
C : -55 to 175 °C

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)	$T_J=125^{\circ}\text{C}$ 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)	$T_J=125^{\circ}\text{C}$ to 175°C @ 100% of Max V_{GSS}	168 hours 500 hours 1000 hours	3 lots x 77 devices