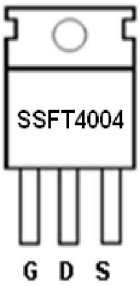
SSFT4004

40V N-Channel MOSFET

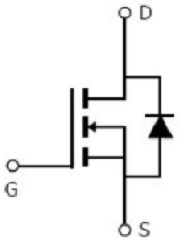
Main Product Characteristics

V_{DSS}	40V
R_{DS}(on)	2.87mohm(typ.)
I_D	120A ①

TO-220



Marking and Pin Assignment



Schematic Diagram

Features and Benefits

- Advanced trench MOSFET process technology
- Special designed for PWM, load switching and general purpose applications
- Ultra low on-resistance with low gate charge
- Fast switching and reverse body recovery
- 175℃ operating temperature
- Lead free product

Description

It utilizes the latest trench processing techniques to achieve the high cell density and reduces the on-resistance with high repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in power switching application and a wide variety of other applications.

Absolute Max Rating

Symbol	Parameter	Max.	Units
I_D @ TC = 25°C	Continuous Drain Current, V_{GS} @ 10V	120①	A
I_D @ TC = 100°C	Continuous Drain Current, V_{GS} @ 10V	90①	
I_{DM}	Pulsed Drain Current②	480	
P_D @TC = 25°C	Power Dissipation③	190	W
	Linear Derating Factor	1.27	W/°C
V_{DS}	Drain-Source Voltage	40	V
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy @ L=0.3mH	346	mJ
I_{AS}	Avalanche Current @ L=0.3mH	48	A
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C

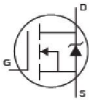
Thermal Resistance

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-case③	—	0.79	℃/W
$R_{\theta JA}$	Junction-to-ambient (t ≤ 10s) ④	—	62	℃/W
	Junction-to-Ambient (PCB mounted, steady-state) ④	—	40	℃/W

Electrical Characteristics @T_A=25℃ unless otherwise specified

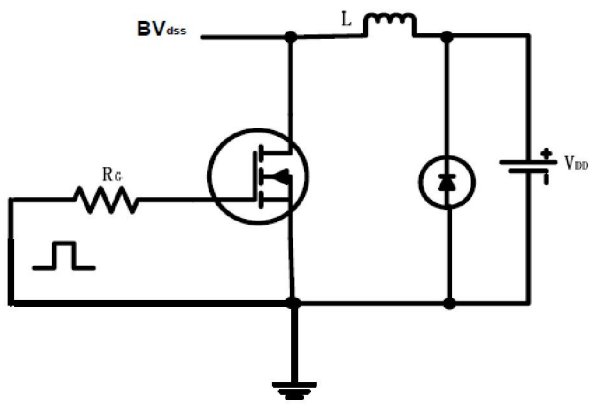
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source breakdown voltage	40	—	—	V	V_{GS} = 0V, I_D = 250μA
$R_{DS(on)}$	Static Drain-to-Source on-resistance	—	2.87	4	mΩ	V_{GS}=10V,I_D = 30A
		—	5.33	—		T_J = 125℃
$V_{GS(th)}$	Gate threshold voltage	1	—	3	V	V_{DS} = V_{GS}, I_D = 250μA
		—	1.0	—		T_J = 125℃
I_{DSS}	Drain-to-Source leakage current	—	—	1	μA	V_{DS} = 40V,V_{GS} = 0V
		—	—	50		T_J = 125°C
I_{GSS}	Gate-to-Source forward leakage	—	—	100	nA	V_{GS} =20V
		-100	—	—		V_{GS} = -20V
Q_g	Total gate charge	—	111.2	—	nC	I_D = 80A,
Q_{gs}	Gate-to-Source charge	—	21.0	—		V_{DS}=25V,
Q_{gd}	Gate-to-Drain("Miller") charge	—	30.3	—		V_{GS} = 10V
$t_{d(on)}$	Turn-on delay time	—	17.8	—	ns	V_{GS}=10V, V_{DS} =20V,
t_r	Rise time	—	139.4	—		R_L=0.5Ω,
$t_{d(off)}$	Turn-Off delay time	—	107.3	—		R_{GEN}=7Ω,
t_f	Fall time	—	142.3	—		I_D = 80A
C_{iss}	Input capacitance	—	7081	—	pF	V_{GS} = 0V,
C_{oss}	Output capacitance	—	496	—		V_{DS} = 25V,
C_{rss}	Reverse transfer capacitance	—	479	—		f = 1MHz

Source-Drain Ratings and Characteristics

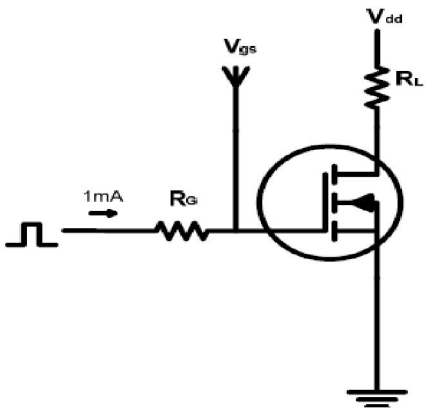
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	120 ①	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode)	—	—	480	A	
V_{SD}	Diode Forward Voltage	—	0.70	1.3	V	I_S=2.1A, V_{GS}=0V
t_{rr}	Reverse Recovery Time	—	19.2	—	ns	T_J = 25°C, I_F =75A, di/dt = 100A/μs
Q_{rr}	Reverse Recovery Charge	—	12.0	—	nC	

Test Circuits and Waveforms

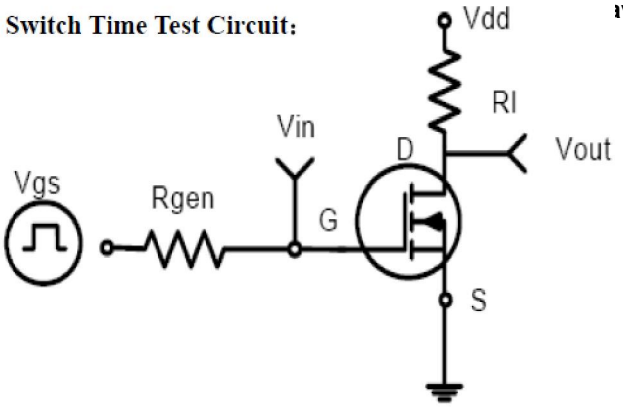
EAS test circuits:



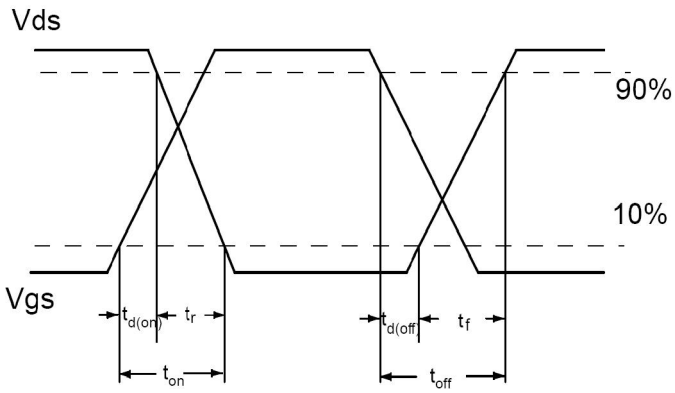
Gate charge test circuit:



Switch Time Test Circuit:



Waveforms:



Notes:

①Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.

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 TA =25°C

⑤These curves are based on the junction-to-case thermal impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=175°C.

Typical Electrical and Thermal Characteristics

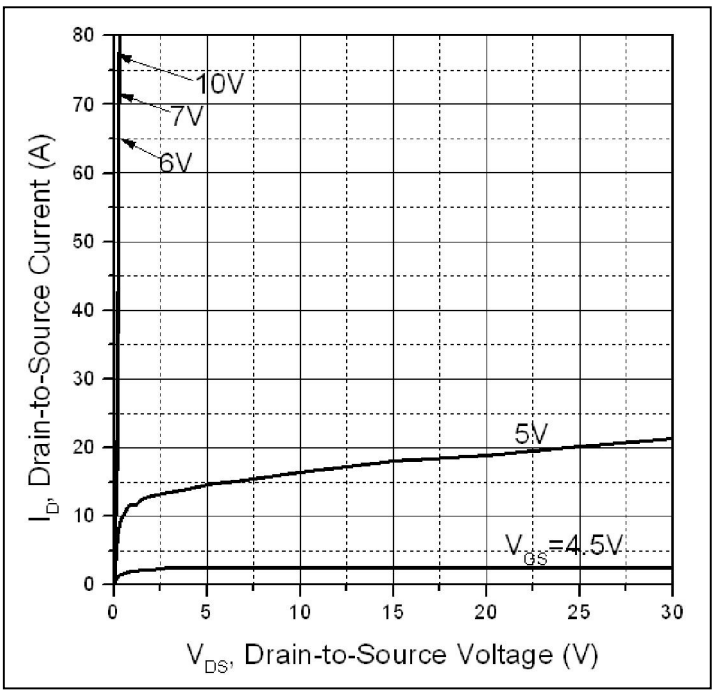


Figure 1: Typical Output Characteristics

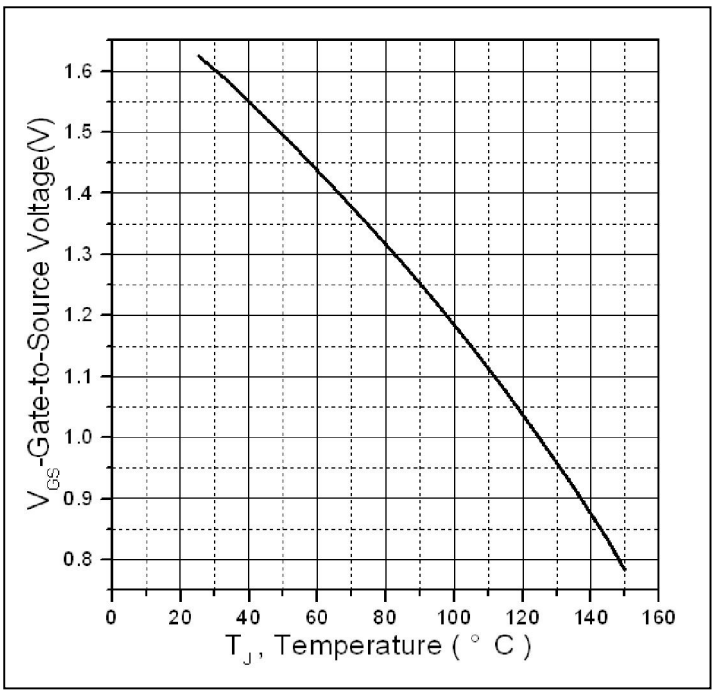


Figure 2. Gate to source cut-off voltage

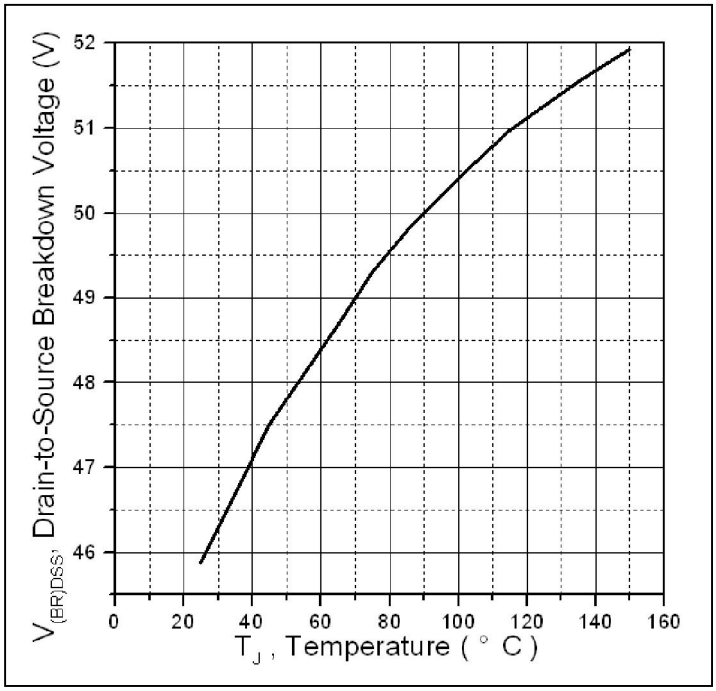


Figure 3. Drain-to-Source Breakdown Voltage vs. Temperature

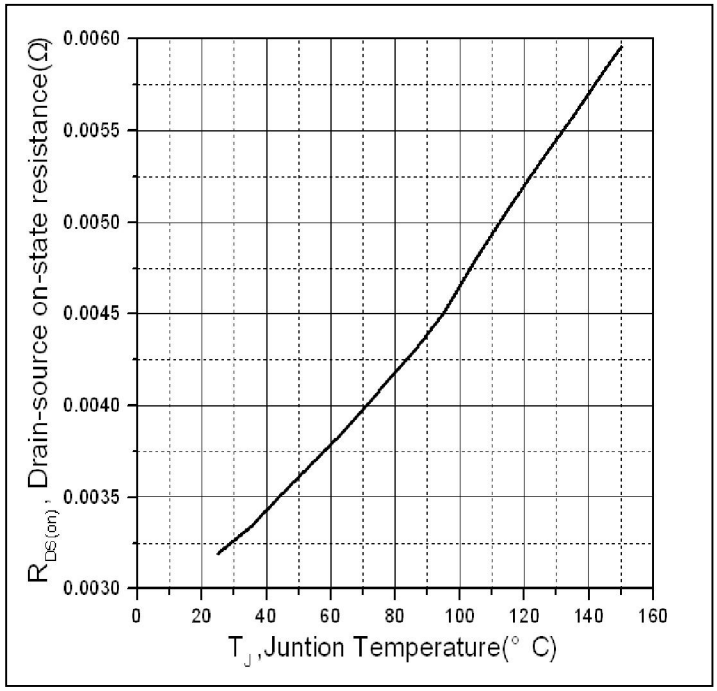


Figure 4: Normalized On-Resistance Vs. Case Temperature

Typical Electrical and Thermal Characteristics

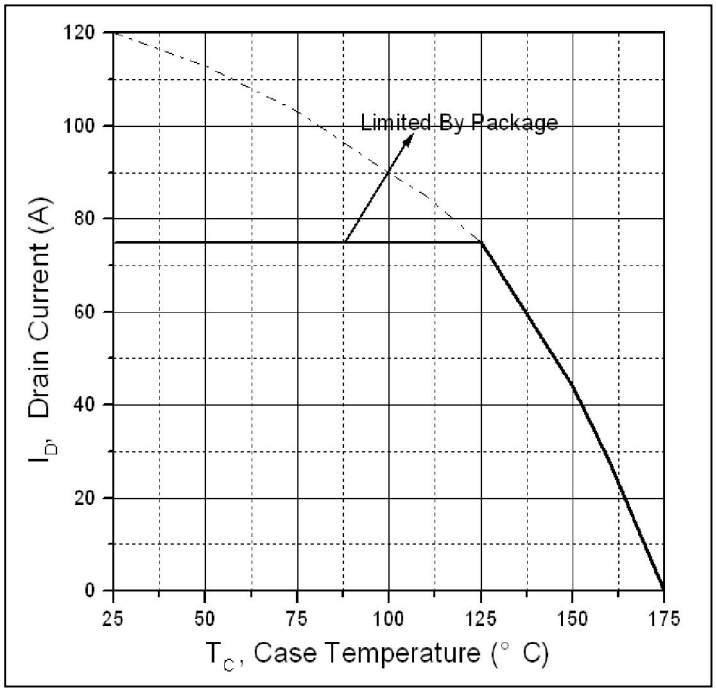


Figure 5. Maximum Drain Current Vs. Case Temperature

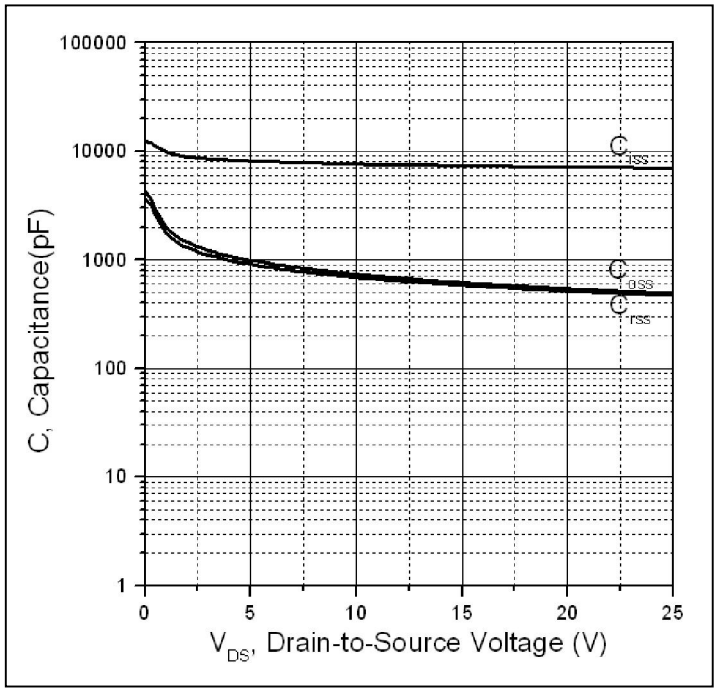


Figure 6.Typical Capacitance Vs. Drain-to-Source Voltage

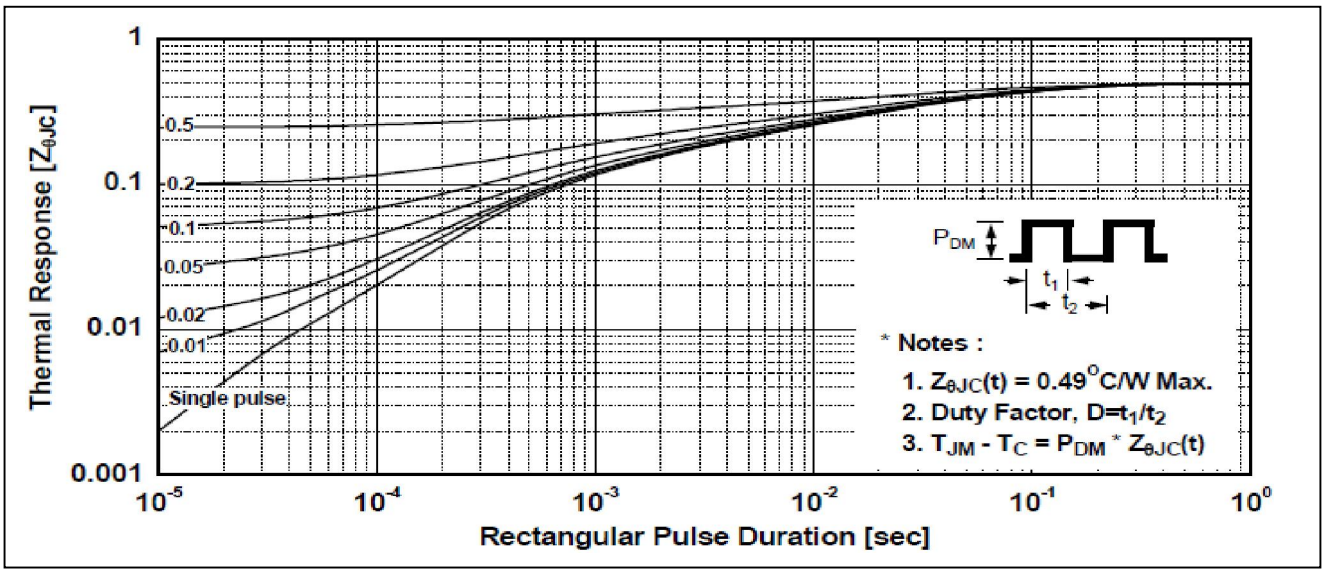
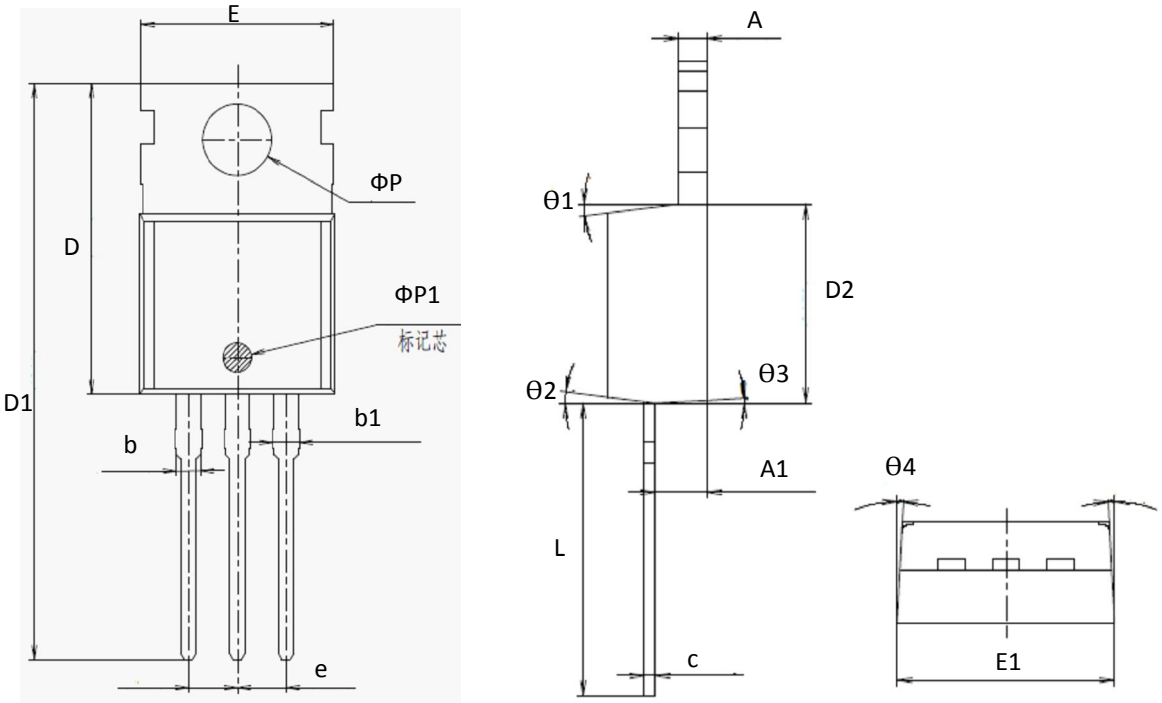


Figure7. Maximum Effective Transient Thermal Impedance, Junction-to-Case

Mechanical Data

TO220 PACKAGE OUTLINE DIMENSION_GN



Symbol	Dimension In Millimeters			Dimension In Inches		
	Min	Nom	Max	Min	Nom	Max
A	-	1.300	-	-	0.051	-
A1	2.200	2.400	2.600	0.087	0.094	0.102
b	-	1.270	-	-	0.050	-
b1	1.270	1.370	1.470	0.050	0.054	0.058
c	-	0.500	-	-	0.020	-
D	-	15.600	-	-	0.614	-
D1	-	28.700	-	-	1.130	-
D2	-	9.150	-	-	0.360	-
E	9.900	10.000	10.100	0.390	0.394	0.398
E1	-	10.160	-	-	0.400	-
ΦP	-	3.600	-	-	0.142	-
ΦP1		1.500		0.059		
e	2.54BSC			0.1BSC		
L	12.900	13.100	13.300	0.508	0.516	0.524
□1	-	7^0	-	-	7^0	-
□2	-	7^0	-	-	7^0	-
□3	-	3^0	-	5^0	7^0	9^0
□4	-	3^0	-	1^0	3^0	5^0

Ordering and Marking Information

Device Marking: SSFT4004

Package (Available)

TO220

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
TO220	50	20	1000	6	6000

Reliability Test Program

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