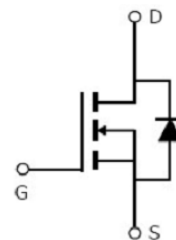


**Main Product Characteristics:**

$V_{DSS}$	40V
$R_{DS(on)}$	2.87mohm(typ.)
$I_D$	120A <sup>①</sup>


**TO220**

**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°C operating temperature


**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	120 <sup>①</sup>	A
$I_D$ @ TC = 100°C	Continuous Drain Current, $V_{GS}$ @ 10V	90 <sup>①</sup>	
$I_{DM}$	Pulsed Drain Current <sup>②</sup>	480	
$P_D$ @TC = 25°C	Power Dissipation <sup>③</sup>	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

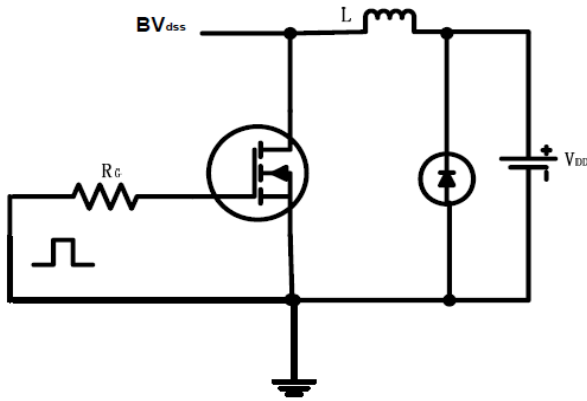
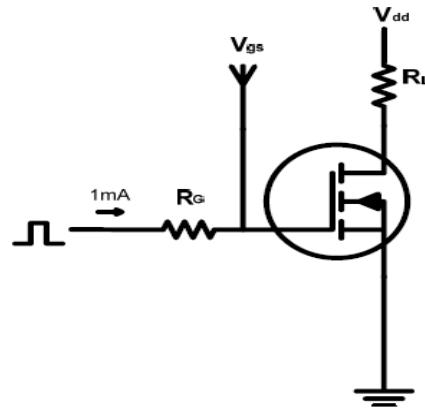
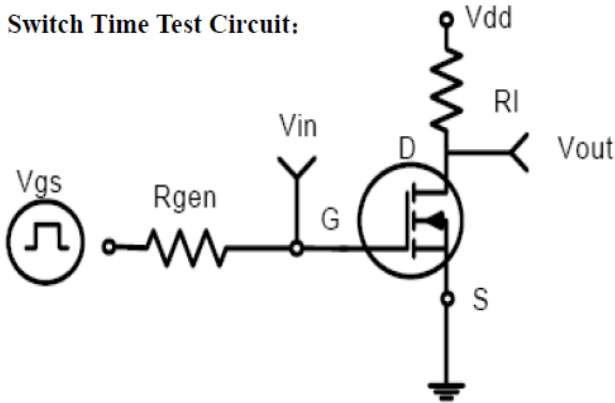
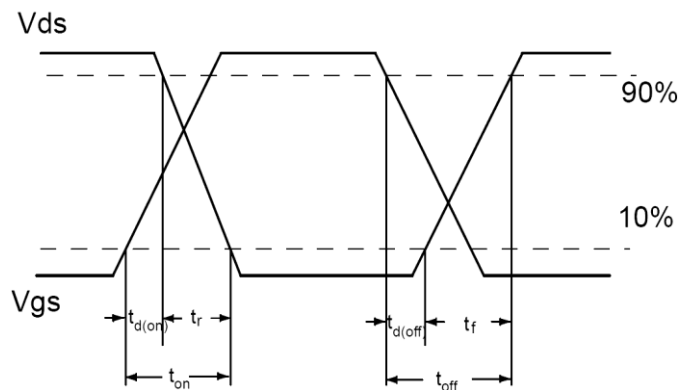
Symbol	Characterizes	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-case <sup>③</sup>	—	0.79	°C/W
$R_{\theta JA}$	Junction-to-ambient ( $t \leq 10s$ ) <sup>④</sup>	—	62	°C/W
	Junction-to-Ambient (PCB mounted, steady-state) <sup>④</sup>	—	40	°C/W

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

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

## Source-Drain Ratings and Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	120 <sup>①</sup>	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	$T_J = 25^\circ\text{C}, I_F = 75A, di/dt =$
$Q_{rr}$	Reverse Recovery Charge	—	12.0	—	nC	100A/ $\mu s$

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

**Gate charge test circuit:**

**Switch Time Test Circuit:**

**Switch Waveforms:**

**Notes:**

- ① Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.
- 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 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with  $T_A = 25^\circ\text{C}$
- 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  $T_{J(\text{MAX})} = 175^\circ\text{C}$ .

Typical electrical and thermal characteristics

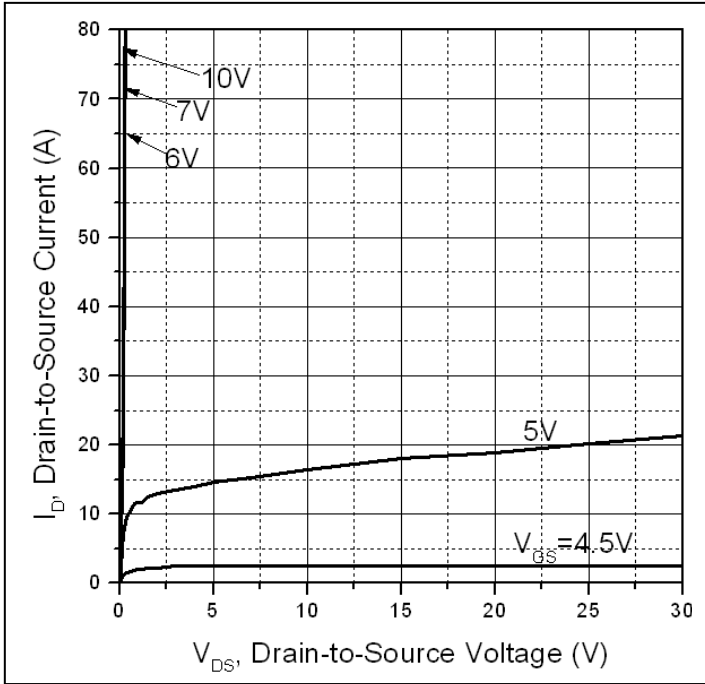


Figure 1: Typical Output Characteristics

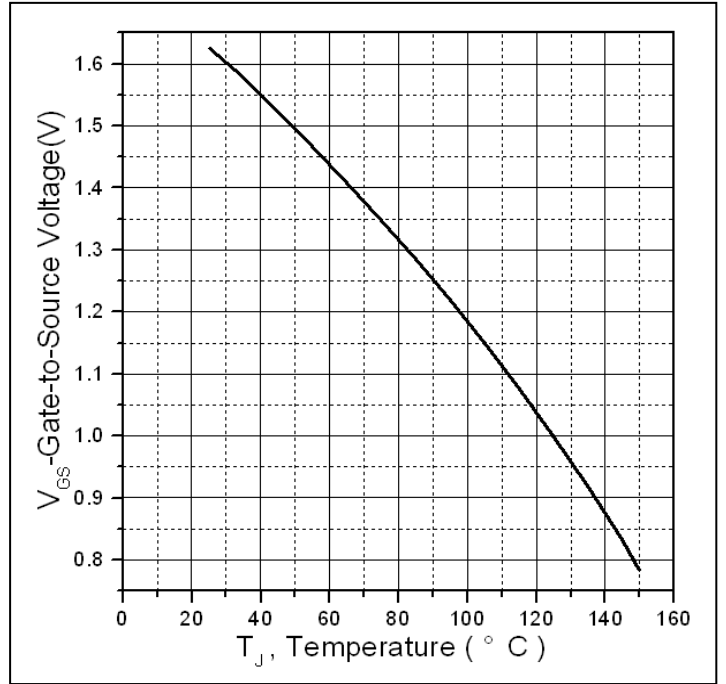


Figure 2: Gate to source cut-off voltage

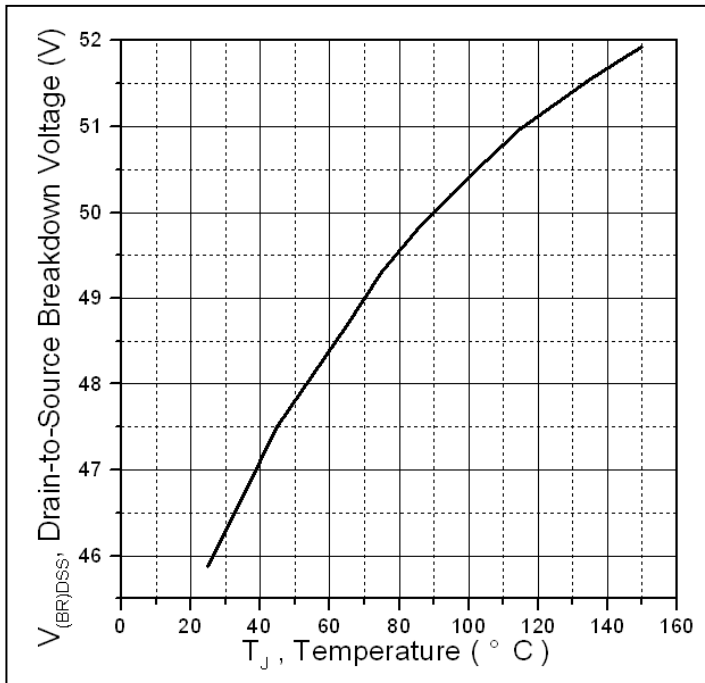


Figure 3: Drain-to-Source Breakdown Voltage vs. Temperature

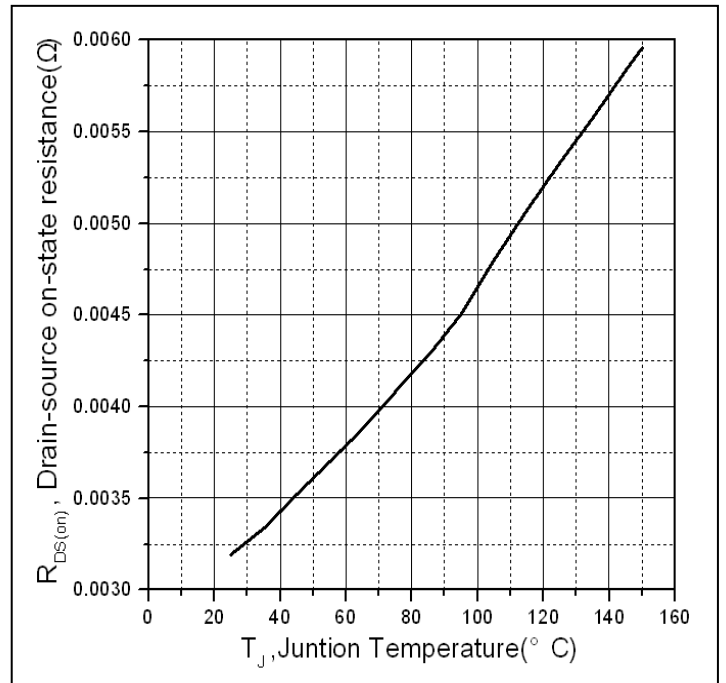


Figure 4: Normalized On-Resistance Vs. Case Temperature

Typical electrical and thermal characteristics

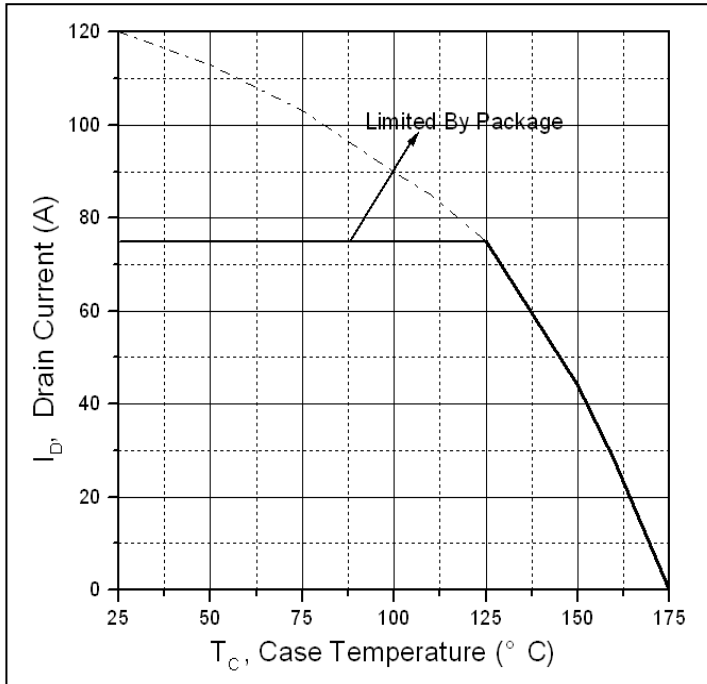


Figure 5. Maximum Drain Current Vs. Case Temperature

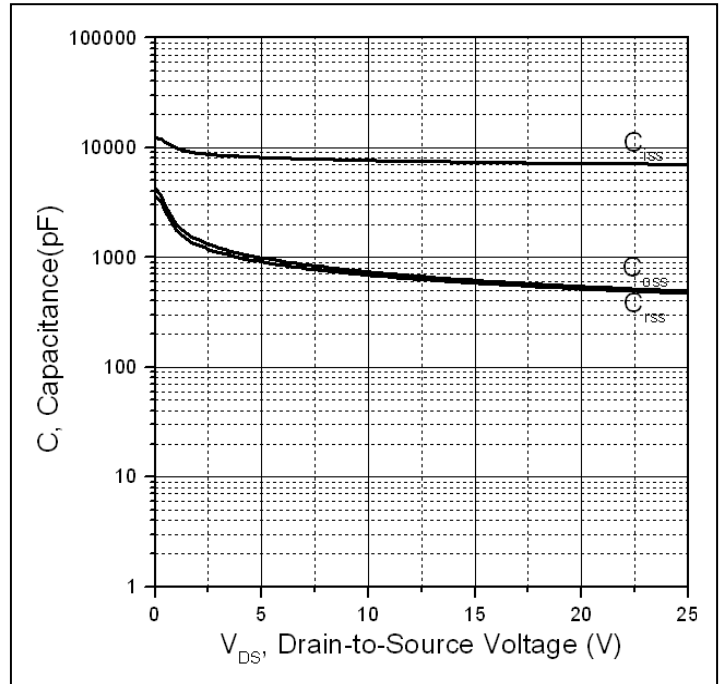


Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage

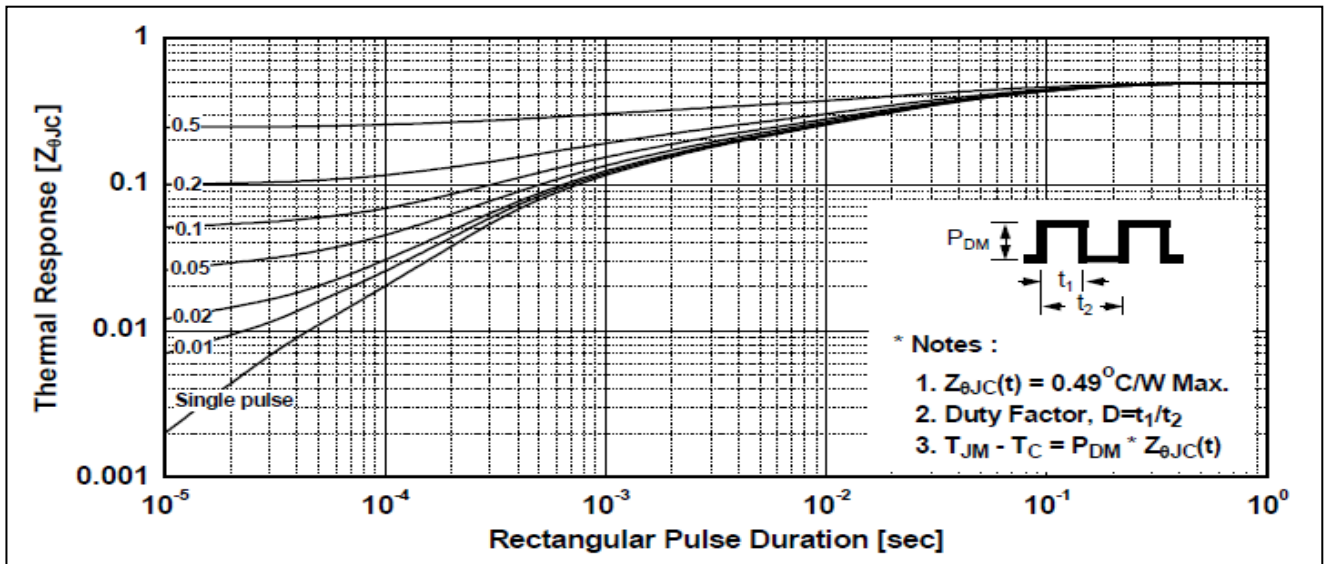
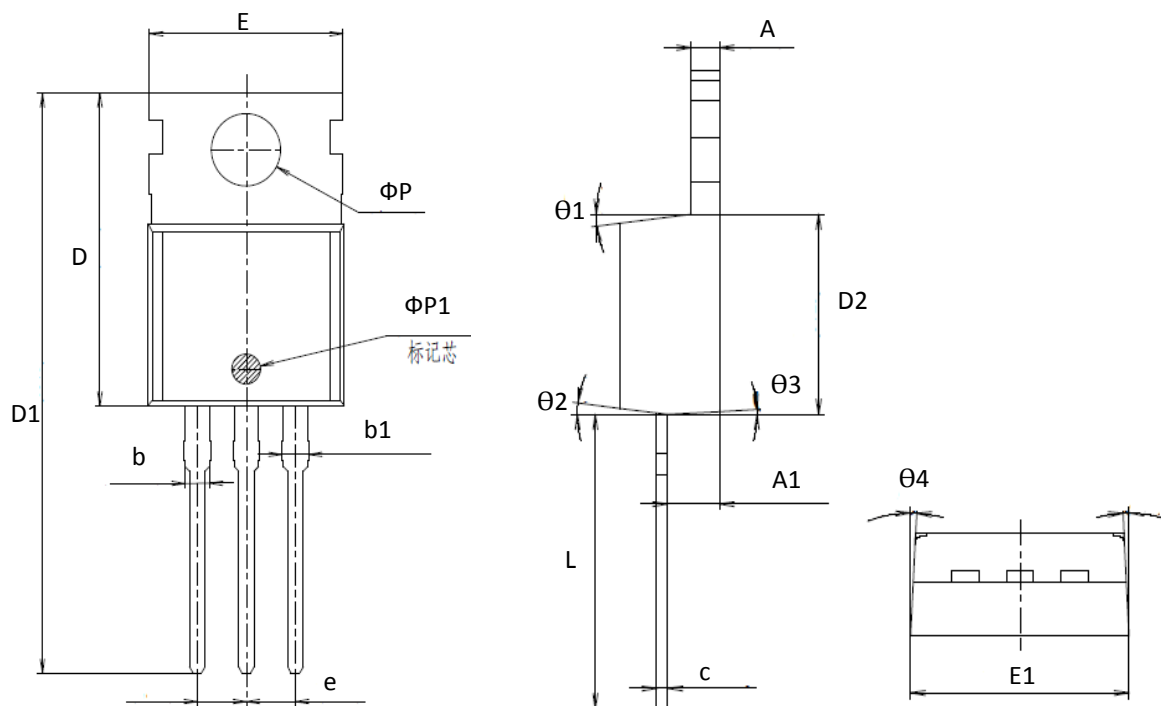


Figure7. Maximum Effective Transient Thermal Impedance, Junction-to-Case

**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
θ1	-	7°	-	-	7°	-
θ2	-	7°	-	-	7°	-
θ3	-	3°	-	5°	7°	9°
θ4	-	3°	-	1°	3°	5°

**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°C to 175°C @ 80% of Max V <sub>DSS</sub> /V <sub>CES</sub> /V <sub>R</sub>	168 hours 500 hours 1000 hours	3 lots x 77 devices
High Temperature Gate Bias(HTGB)	Tj=150°C or 175°C @ 100% of Max V <sub>GSS</sub>	168 hours 500 hours 1000 hours	3 lots x 77 devices

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