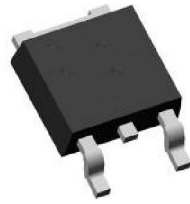
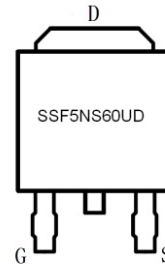


Main Product Characteristics

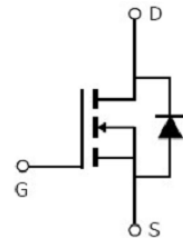
V_{DSS}	600V
$R_{DS(on)}$	0.73 Ω (typ.)
I_D	5A ①



TO-252 (DPAK)



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 SSF5NS60UD 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 for use in power switching applications and a wide variety of other applications.

Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	5 ①	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	3.2 ①	
I_{DM}	Pulsed Drain Current ②	15	
$P_D @ T_C = 25^\circ\text{C}$	Power Dissipation ③	39	W
	Linear Derating Factor	0.31	W/ $^\circ\text{C}$
V_{DS}	Drain-Source Voltage	600	V
V_{GS}	Gate-to-Source Voltage	± 30	V
E_{AS}	Single Pulse Avalanche Energy @ $L=60.1\text{mH}$	101	mJ
I_{AS}	Avalanche Current @ $L=60.1\text{mH}$	1.84	A
$T_J \quad T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +150	$^\circ\text{C}$

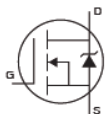
Thermal Resistance

Symbol	Characteristics	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ③	—	3.2	°C/W
$R_{\theta JA}$	Junction-to-Ambient ($t \leq 10s$) ④	—	62	°C/W

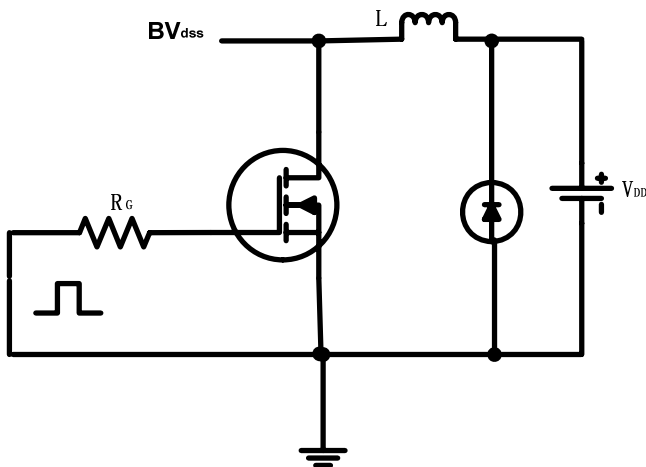
Electrical Characteristics ($T_A=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	600	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$R_{DS(on)}$	Static Drain-to-Source On-resistance	—	0.73	0.85	Ω	$V_{GS}=10V, I_D = 1A$
		—	1.54	—		$T_J = 125^\circ\text{C}$
		—	0.79	1.0	Ω	$V_{GS}=10V, I_D = 2.8A$
		—	1.77	—		$T_J = 125^\circ\text{C}$
$V_{GS(th)}$	Gate Threshold Voltage	2	—	4	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
		—	2.5	—		$T_J = 125^\circ\text{C}$
I_{DSS}	Drain-to-Source Leakage Current	—	—	1	μA	$V_{DS} = 600V, V_{GS} = 0V$
		—	—	50		$T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 30V$
		—	—	-100		$V_{GS} = -30V$
Q_g	Total Gate Charge	—	12	—	nC	$I_D = 4.6A,$ $V_{DS}=480V,$ $V_{GS} = 10V$
Q_{gs}	Gate-to-Source Charge	—	2.1	—		
Q_{gd}	Gate-to-Drain("Miller") Charge	—	5.3	—		
$t_{d(on)}$	Turn-on Delay Time	—	9.8	—	ns	$V_{GS}=10V, V_{DS} = 300V,$ $R_{GEN}=25\Omega, I_D = 4.6A$
t_r	Rise Time	—	14	—		
$t_{d(off)}$	Turn-Off Delay Time	—	29	—		
t_f	Fall Time	—	14	—		
C_{iss}	Input Capacitance	—	346	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	320	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	3.0	—		$f = 1MHz$

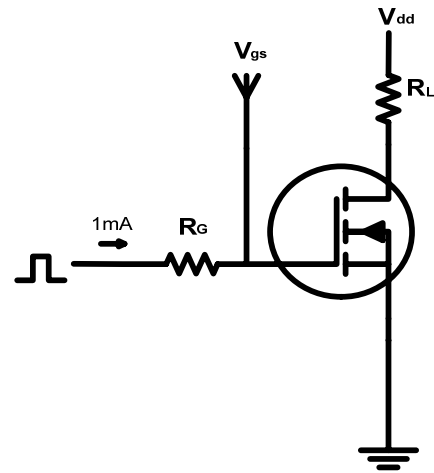
Source-Drain Ratings and Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	5 ①	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode)	—	—	15	A	
V_{SD}	Diode Forward Voltage	—	0.83	1.2	V	$I_S=2.8A, V_{GS}=0V$
t_{rr}	Reverse Recovery Time	—	181	—	nS	$T_J = 25^\circ\text{C}, I_F = 4.6A,$
Q_{rr}	Reverse Recovery Charge	—	1.0	—	μC	$di/dt = 100A/\mu s$

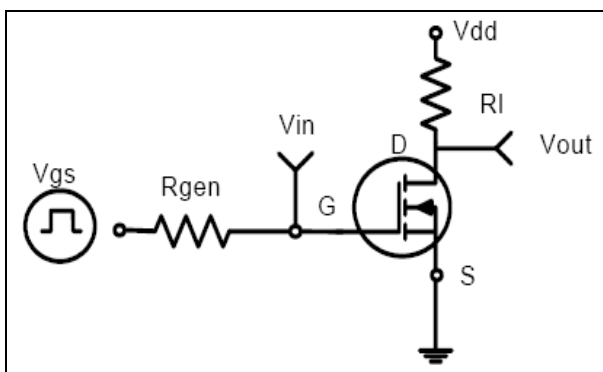
Test Circuits and Waveforms



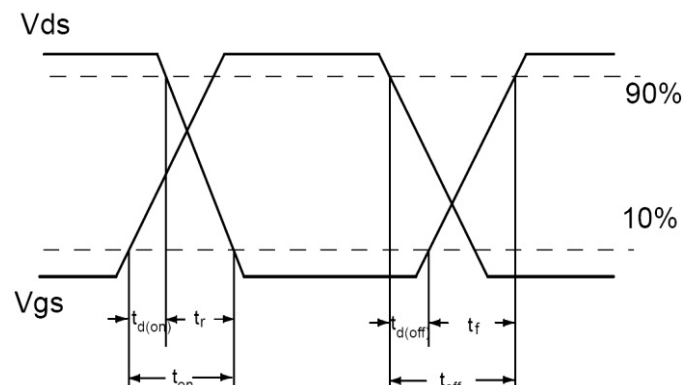
E_{AS} Test Circuit



Gate Charge Test Circuit



Switching 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 the max. junction temperature, using junction-to-case thermal resistance.
- ④ The value of $R_{\theta JA}$ is measured with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A = 25^\circ\text{C}$

Typical Electrical and Thermal Characteristics

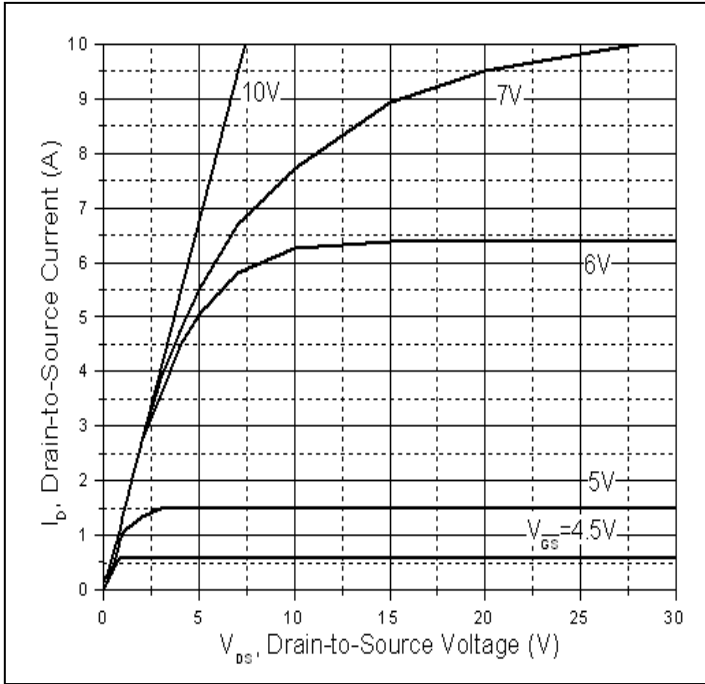


Figure 1. Typical Output Characteristics

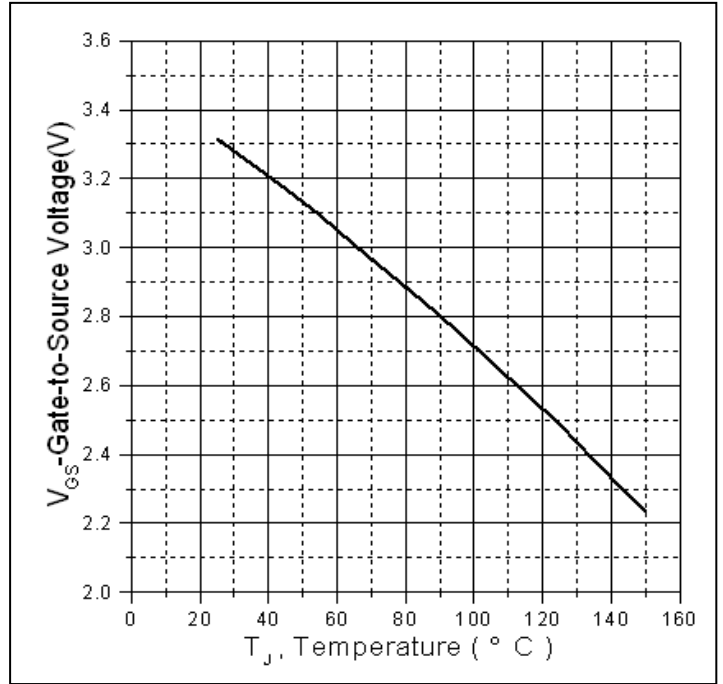


Figure 2. Gate to source Cut-off Voltage

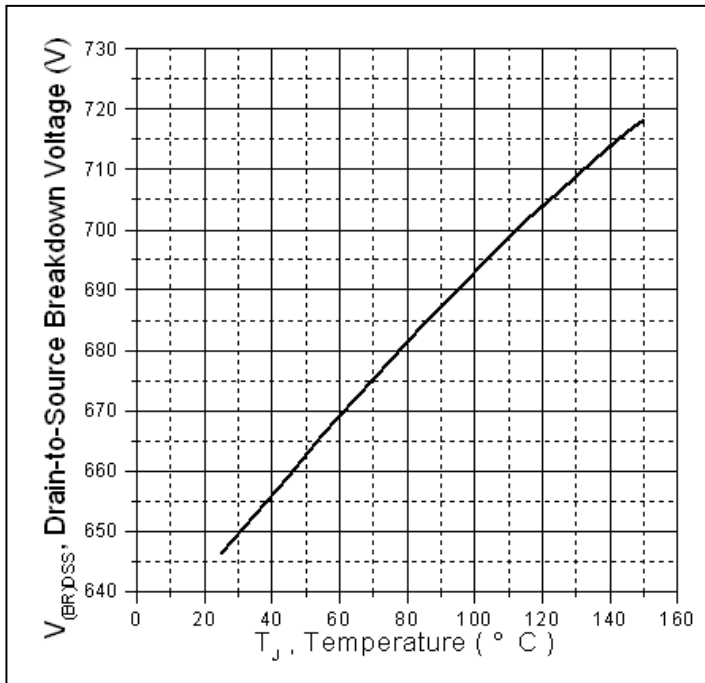


Figure 3. Drain-to-Source Breakdown Voltage Vs. Case Temperature

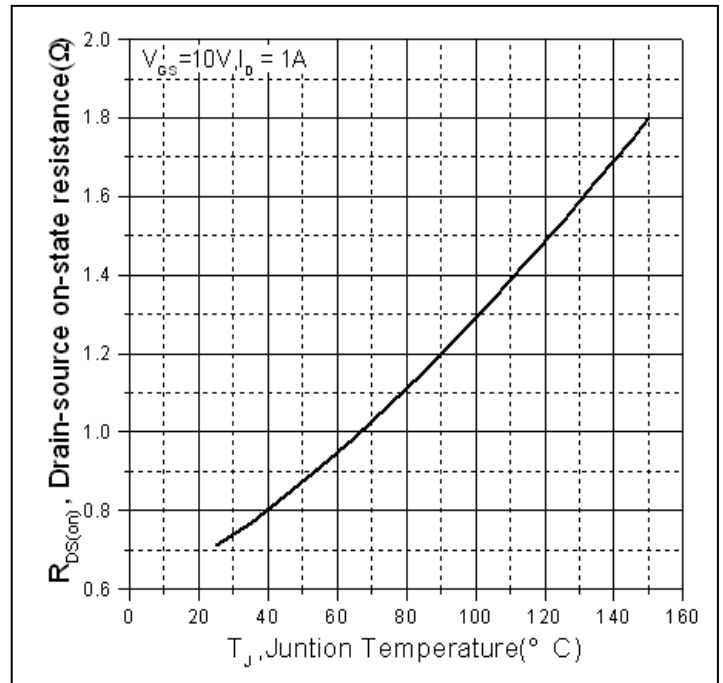


Figure 4. Normalized On-Resistance Vs. Case Temperature

Typical Electrical and Thermal Characteristics

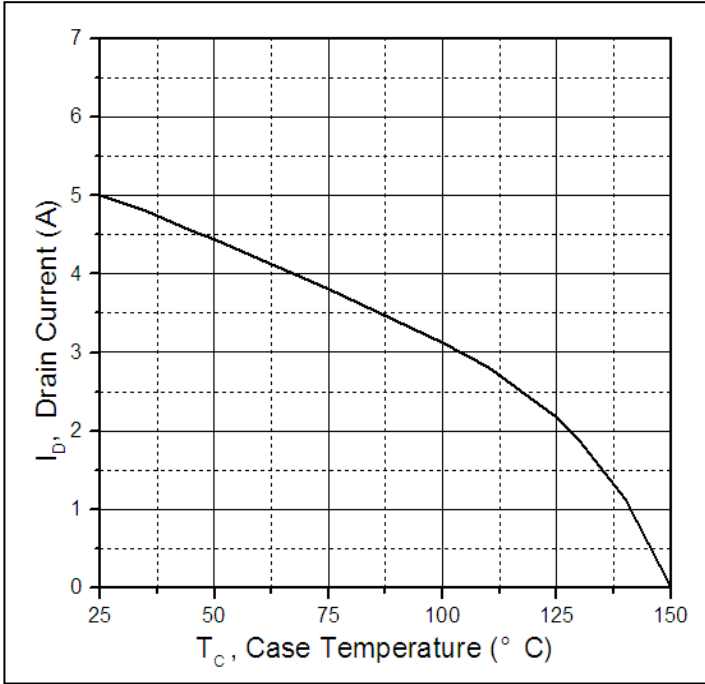


Figure 5. Maximum Drain Current Vs. Case Temperature

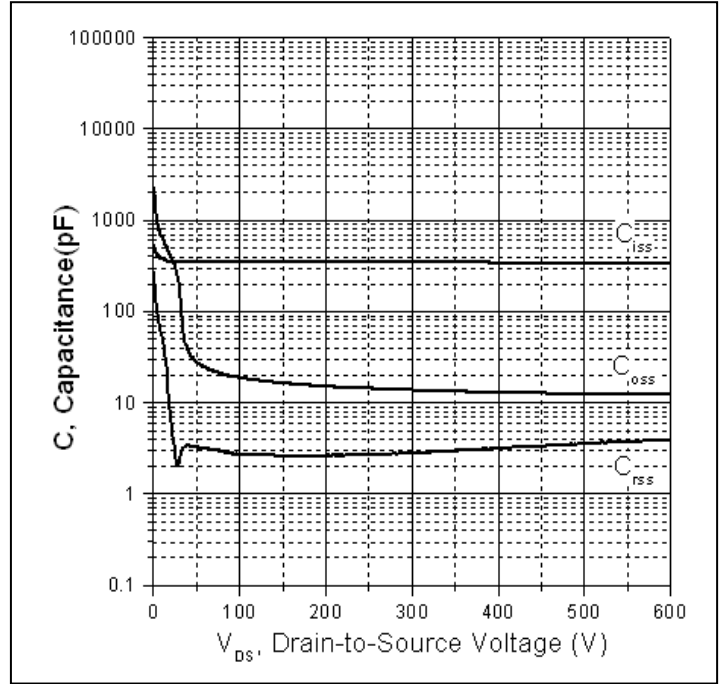


Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage

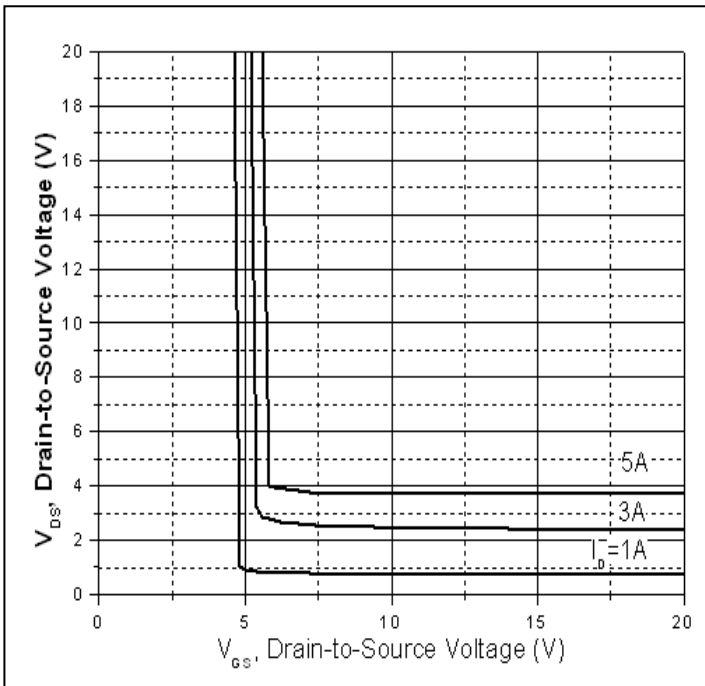


Figure 7. Drain-to-Source Voltage Vs. Gate-to-Source Voltage

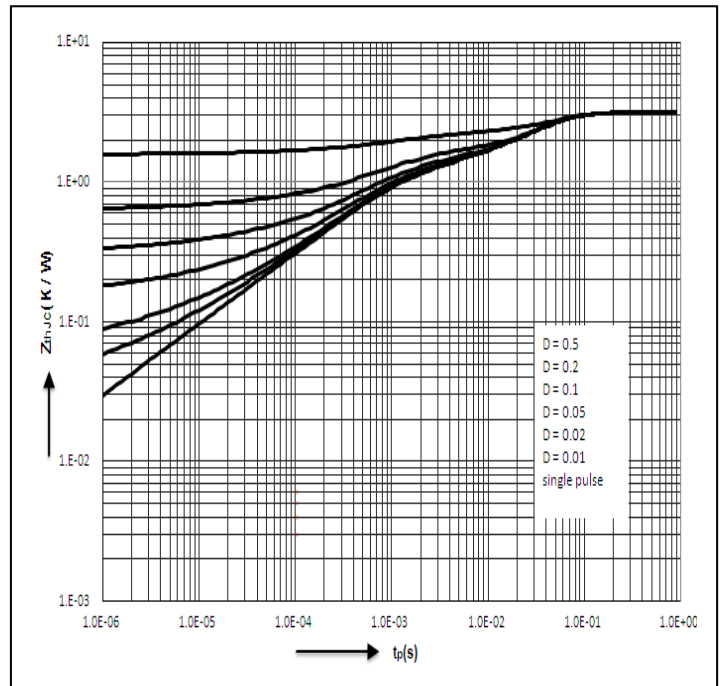
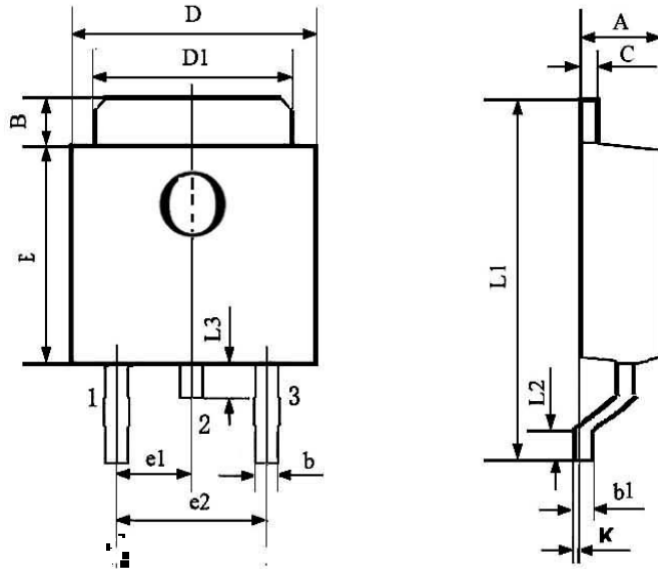


Figure 8. Maximum Effective Transient Thermal Impedance, Junction-to-Case

Mechanical Data

TO-252/DPAK Package Outline Dimensions



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	2.200	-	2.400	0.087	-	0.094
B	0.950	-	1.250	0.037	-	0.049
b	0.500	-	0.700	0.020	-	0.028
b1	0.450	-	0.550	0.018	-	0.022
C	0.450	-	0.550	0.018	-	0.022
D	6.450	-	6.750	0.254	-	0.266
D1	5.200	-	5.400	0.205	-	0.213
E	5.950	-	6.250	0.234	-	0.246
e1	2.240	-	2.340	0.088	-	0.092
e2	4.430	-	4.730	0.174	-	0.186
L1	9.450	-	9.950	0.372	-	0.392
L2	1.250	-	1.750	0.049	-	0.069
L3	0.600	-	0.900	0.024	-	0.035
K	0.000	-	0.100	0.000	-	0.004

Ordering and Marking Information

Device Marking: SSF5NS60UD

Package (Available)
TO-252/DPAK
Operating Temperature Range
C: -55 to 150°C

Devices per Unit (options)

Package Type	Units/Tape	Tapes/Inner Box	Units/Inner Box	Inner Boxes/ Carton Box	Units/ Carton Box
TO-252	2500	2	5000	7	35000
TO-252	2500	1	2500	10	25000
TO-252	800	5	4000	8	32000

Reliability Test Program

Test Item	Conditions	Duration	Sample Size
High Temperature Reverse Bias(HTRB)	$T_j=125^{\circ}\text{C}$ to 150°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