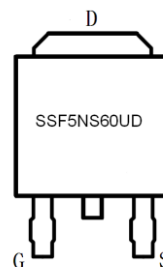


**Main Product Characteristics:**

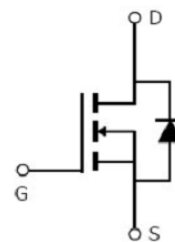
$V_{DSS}$	600V
$R_{DS(on)}$	0.73 $\Omega$ (typ.)
$I_D$	5A ①



TO-252 (D-PAK)



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 series MOSFETs is a new technology, which combines an innovative super junction technology and advance process. This new technology achieves low Rdson, energy saving, high reliability and uniformity, superior power density and space saving.

**Absolute max Rating:**

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

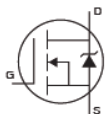
## Thermal Resistance

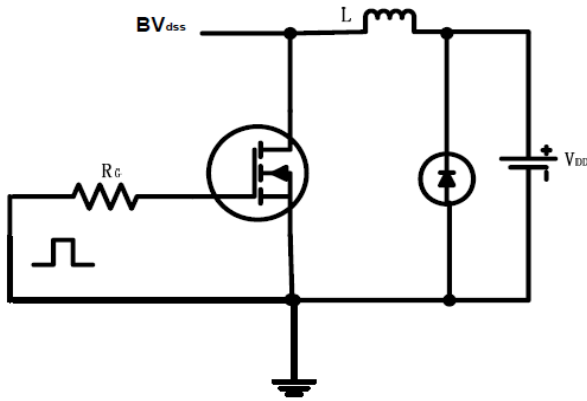
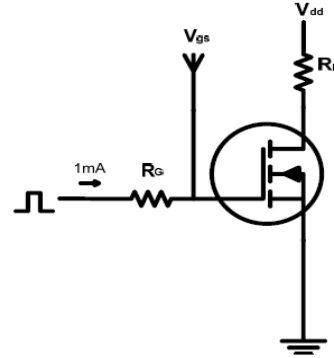
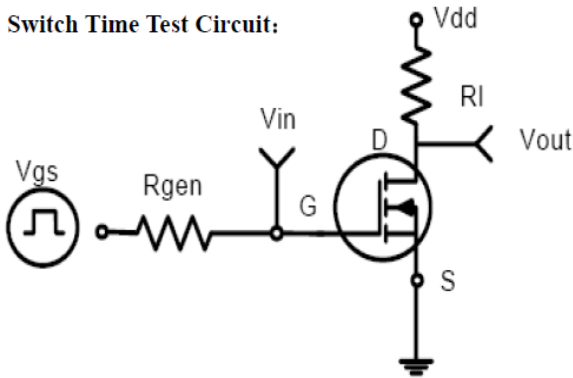
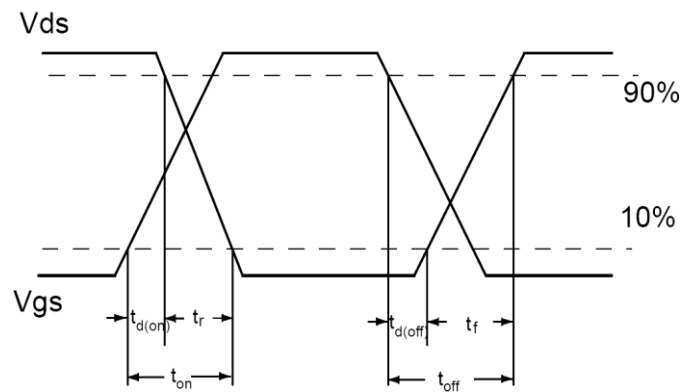
Symbol	Characterizes	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-case ③	—	3.2	°C/W
R <sub>θJA</sub>	Junction-to-ambient (t ≤ 10s) ④	—	62	°C/W

## Electrical Characterizes @T<sub>A</sub>=25°C unless otherwise specified

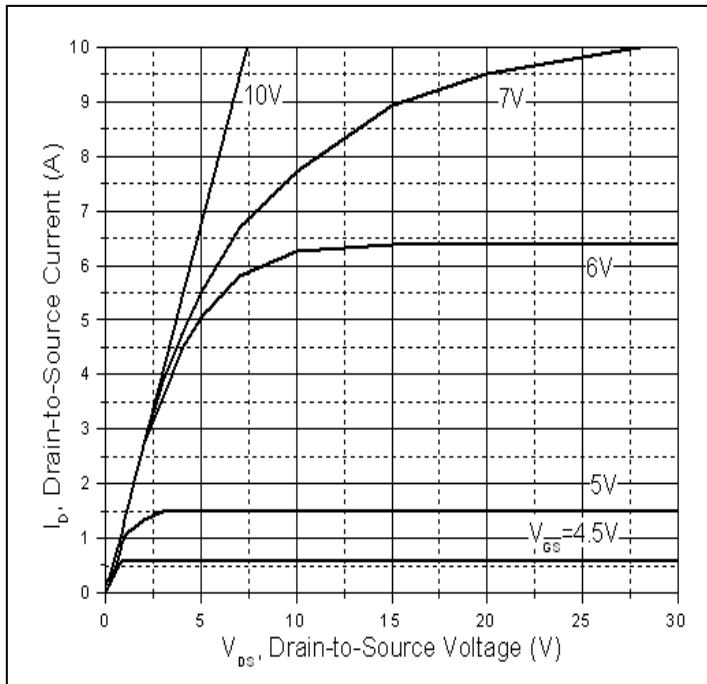
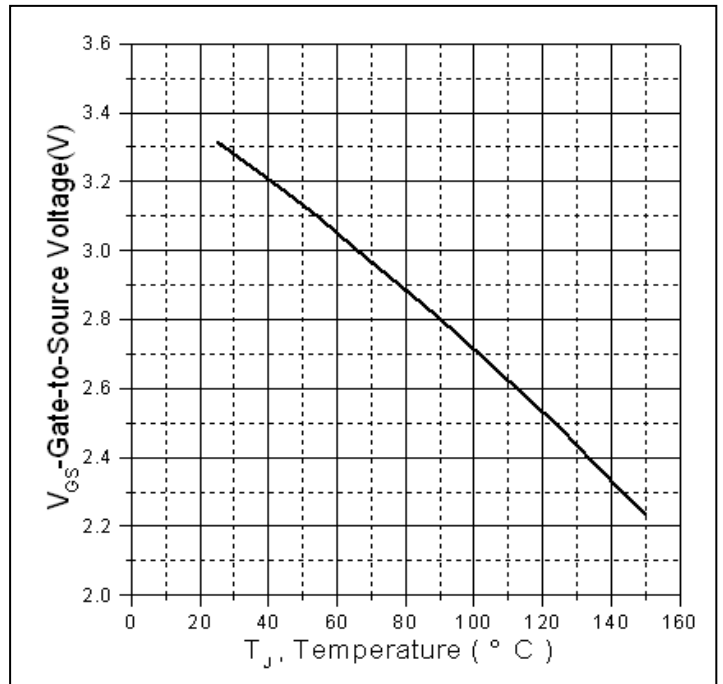
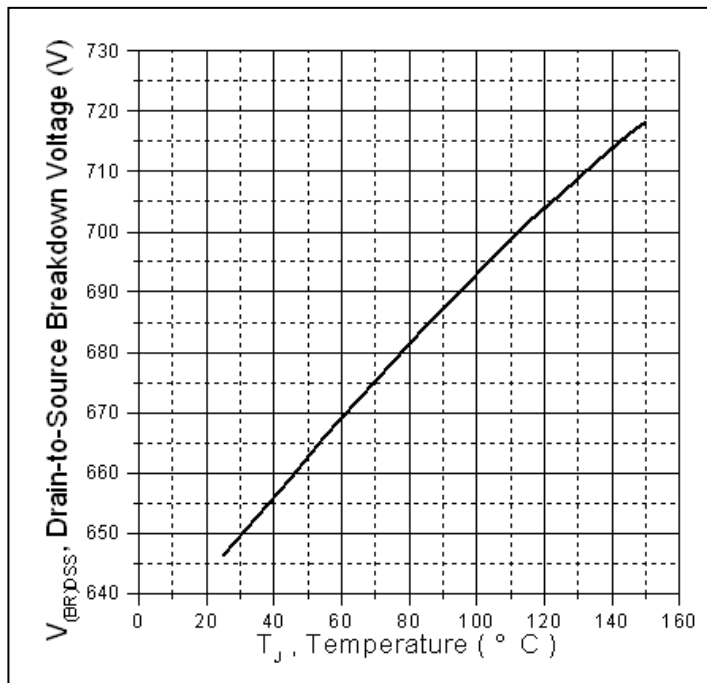
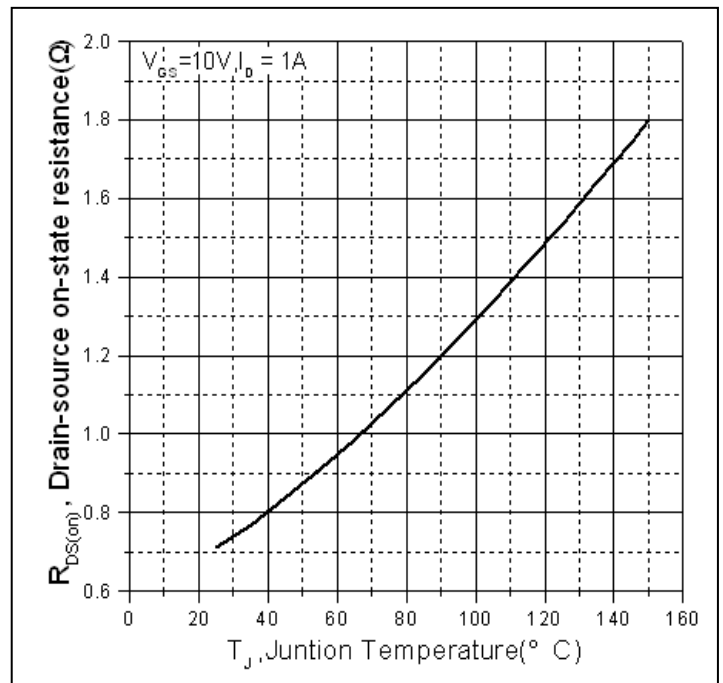
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source breakdown voltage	600	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
R <sub>DS(on)</sub>	Static Drain-to-Source on-resistance	—	0.73	0.85	Ω	V <sub>GS</sub> =10V, I <sub>D</sub> = 1A T <sub>J</sub> = 125°C
		—	1.54	—		
		—	0.79	1.0	Ω	V <sub>GS</sub> =10V, I <sub>D</sub> = 2.8A T <sub>J</sub> = 125°C
		—	1.77	—		
V <sub>GS(th)</sub>	Gate threshold voltage	2	—	4	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA T <sub>J</sub> = 125°C
		—	2.5	—		
I <sub>DSS</sub>	Drain-to-Source leakage current	—	—	1	μA	V <sub>DS</sub> = 600V, V <sub>GS</sub> = 0V T <sub>J</sub> = 125°C
		—	—	50		
I <sub>GSS</sub>	Gate-to-Source forward leakage	—	—	100	nA	V <sub>GS</sub> = 30V V <sub>GS</sub> = -30V
		—	—	-100		
Q <sub>g</sub>	Total gate charge	—	12	—	nC	I <sub>D</sub> = 4.6A, V <sub>DS</sub> =480V, V <sub>GS</sub> = 10V
Q <sub>gs</sub>	Gate-to-Source charge	—	2.1	—		
Q <sub>gd</sub>	Gate-to-Drain("Miller") charge	—	5.3	—		
t <sub>d(on)</sub>	Turn-on delay time	—	9.8	—	ns	V <sub>GS</sub> =10V, V <sub>DS</sub> =300V, R <sub>GEN</sub> =25Ω, I <sub>D</sub> =4.6A
t <sub>r</sub>	Rise time	—	14	—		
t <sub>d(off)</sub>	Turn-Off delay time	—	29	—		
t <sub>f</sub>	Fall time	—	14	—		
C <sub>iss</sub>	Input capacitance	—	346	—	pF	V <sub>GS</sub> = 0V V <sub>DS</sub> = 25V f = 1MHz
C <sub>oss</sub>	Output capacitance	—	320	—		
C <sub>rss</sub>	Reverse transfer capacitance	—	3.0	—		

## Source-Drain Ratings and Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	5 ①	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode)	—	—	15	A	
V <sub>SD</sub>	Diode Forward Voltage	—	0.83	1.2	V	I <sub>S</sub> =2.8A, V <sub>GS</sub> =0V
t <sub>rr</sub>	Reverse Recovery Time	—	181	—	nS	T <sub>J</sub> = 25°C, I <sub>F</sub> =4.6A,
Q <sub>rr</sub>	Reverse Recovery Charge	—	1.0	—	μC	di/dt = 100A/μs

**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.
- 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  $T_A = 25^\circ C$

**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

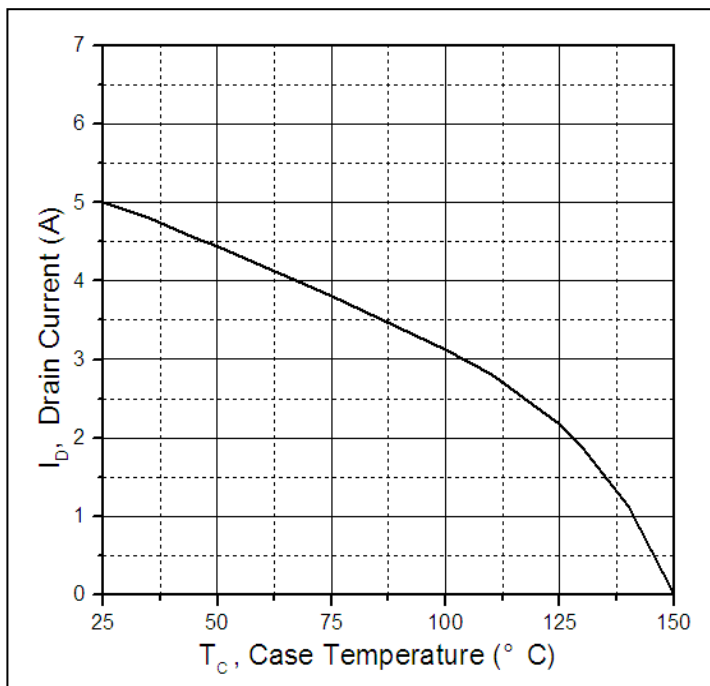


Figure 5. Maximum Drain Current Vs. Case Temperature

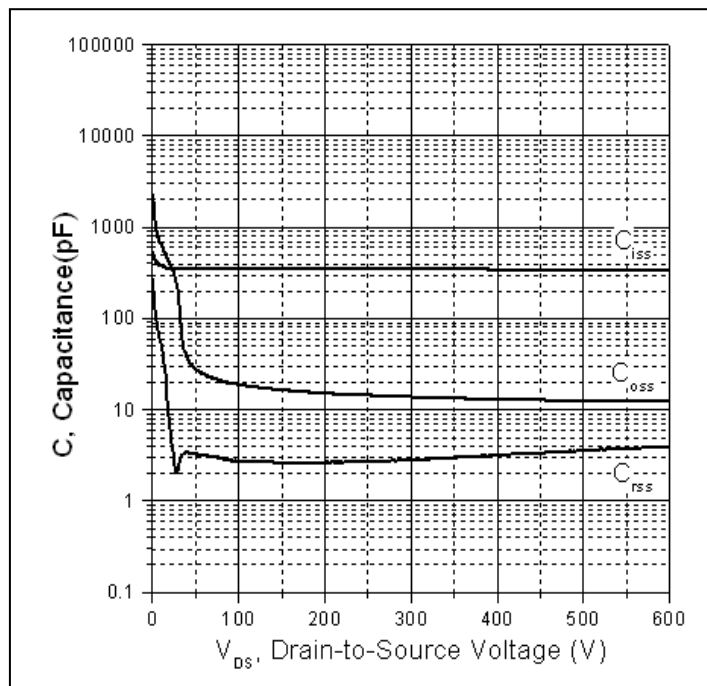


Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage

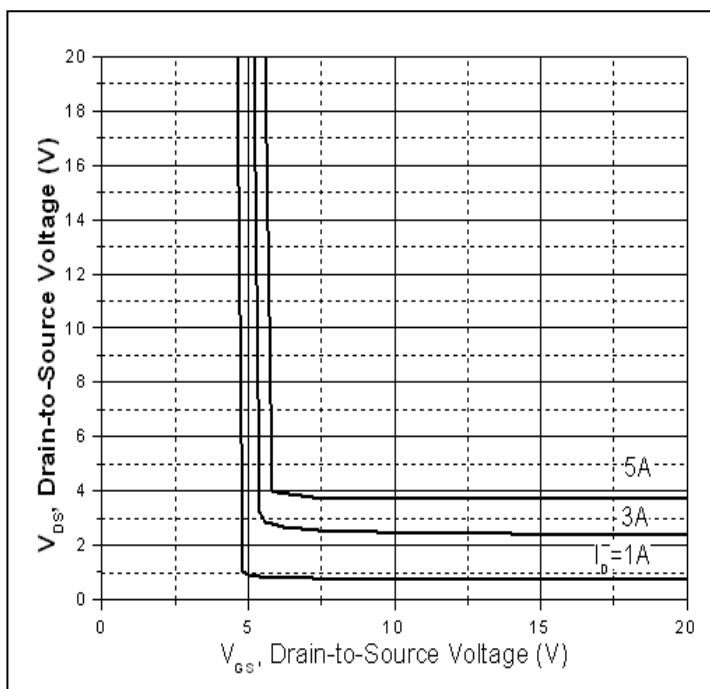


Figure7. Drain-to-Source Voltage Vs. Gate-to-Source Voltage

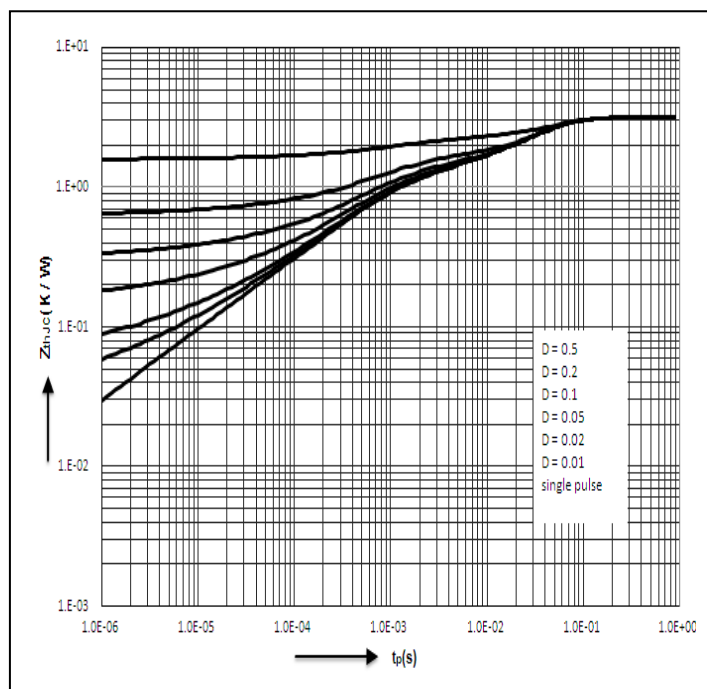
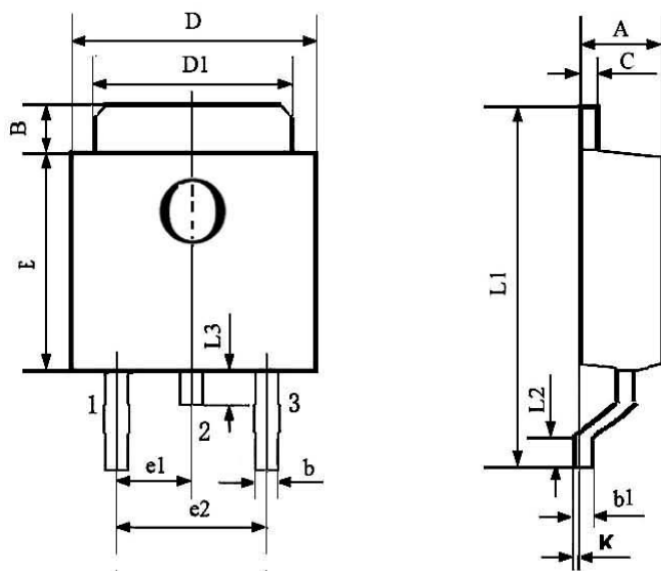


Figure8. Maximum Effective Transient Thermal Impedance, Junction-to-Case

**Mechanical Data:**
**TO-252 PACKAGE OUTLINE DIMENSION**


Symbol	Dimension In Millimeters			Dimension 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(D-PAK)**  
**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 <sub>j</sub> =125°C to 150°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)	T <sub>j</sub> =150°C @ 100% of Max V <sub>GSS</sub>	168 hours 500 hours 1000 hours	3 lots x 77 devices

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