

FMOSAE014N02

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FMOSAE014N02

1.4A 20V N-Channel MOSFET ESD Protection

Features

- $V_{DS}=20V$, $I_D=1.4A$.
- $R_{DS(ON)} < 0.23\Omega @ V_{GS}=4.5V$.
- $R_{DS(ON)} < 0.305\Omega @ V_{GS}=2.5V$.
- $R_{DS(ON)} < 0.455\Omega @ V_{GS}=1.8V$.
- Reliable and rugged.
- Surface mount package.
- ESD Protected.
- Green device available.
- Lead-free parts meet RoHS requirements.
- Suffix "-H" indicates Halogen-free part, ex.FMOSAE014N02-H.

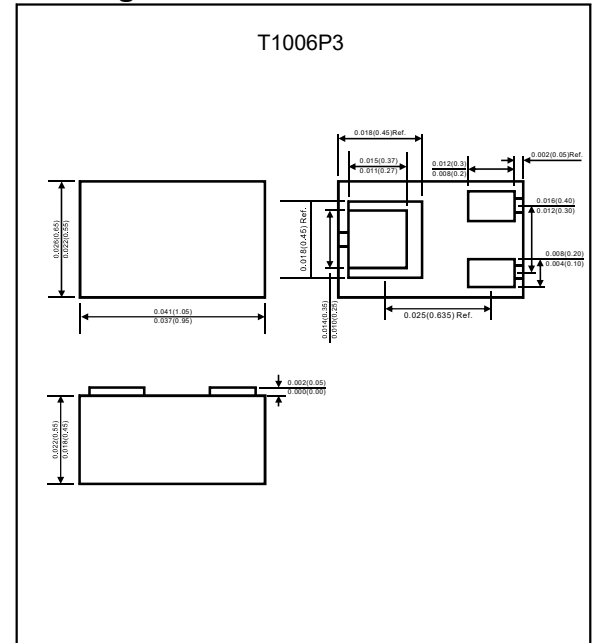
Applications

- Small signal switch.
- Load Switch.

Mechanical data

- Epoxy:UL94-V0 rated flame retardant.
- Case : Molded plastic, T1006P3.
- Terminals : Solder plated, solder able per MIL-STD-750, Method 2026.
- Weight : Approximated 0.8mg.

Package outline



Maximum ratings (At $T_c=25^\circ C$ unless otherwise noted)

Parameter	Symbol	Ratings	Unit
Drain-source voltage	V_{DS}	20	V
Gate-source voltage	V_{GS}	± 8	V
Continuous drain Current - Continuous ($T_c=25^\circ C$) - Continuous ($T_c=70^\circ C$)	I_D	1.4 1.1	A
Diode continuous forward current	I_S	0.83	A
Pulsed drain current (Note 1)	I_{DM}	3.5	A
Power dissipation ($T_c=25^\circ C$) ($T_c=70^\circ C$)	P_D	0.7 0.4	W
Maximum operating junction temperature	T_J	+150	$^\circ C$
Storage temperature range	T_{STG}	-55 to +150	$^\circ C$
Thermal resistance junction to ambient	$R\theta_{JA}$	180	$^\circ C/W$

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Electrical characteristics (At $T_c=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Off characteristics						
Drain-source breakdown voltage	BV_{DSS}	$I_D=250\mu A, V_{GS}=0V$	20			V
Zero gate voltage drain current	I_{DSS}	$V_{DS}=16V, V_{GS}=0V, T_J=25^{\circ}C$			1	μA
Gate-source leakage current	I_{GSS}	$V_{GS}=\pm 8V, V_{DS}=0V$			± 10	μA
On characteristics						
Gate threshold voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	0.5		1	V
Forward trans conductance	g_{FS}	$V_{DS}=5V, I_D=0.55A$		1.7		S
Static drain-source on-resistance (Note 2)	$R_{DS(ON)}$	$V_{GS}=4.5V, I_D=0.55A$		0.19	0.23	Ω
		$V_{GS}=2.5V, I_D=0.45A$		0.234	0.305	
		$V_{GS}=1.8V, I_D=0.35A$		0.303	0.455	
Dynamic parameters						
Input capacitance	C_{iss}	$V_{GS}=0V, V_{DS}=10V, f=1.0MHz$		43		pF
Out capacitance	C_{oss}			9		
Reverse transfer capacitance	C_{rss}			6		
Switching parameters						
Total gate charge	Q_g	$V_{DS}=10V, V_{GS}=4.5, I_D=1A$		2		nC
Gate source charge	Q_{gs}			0.3		
Gate drain charge	Q_{gd}			0.3		
Turn-on delay time	$t_{d(on)}$	$V_{DS}=10V, V_{GS}=4.5V, R_G=6\Omega, I_D=2A$		1.2		ns
Rise time	t_r			25		
Turn-off delay time	$t_{d(off)}$			14		
Fall time	t_f			15		
Source-drain diode ratings and characteristics						
Reverse recovery time	t_{rr}	$I_F=1A, V_{GS}=0V, dI_F/dt=100A/\mu s$		9		ns
Reverse recovery charge	Q_{rr}			1		nC
Diode forward voltage	V_{SD}	$I_S=0.35A, V_{GS}=0V$	0.4	0.75	1.1	V

Notes :

1. Pulse test : Pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
2. Guaranteed by design, not subject to production testing.

Typical Performance Characteristics (FMOSAE014N02)

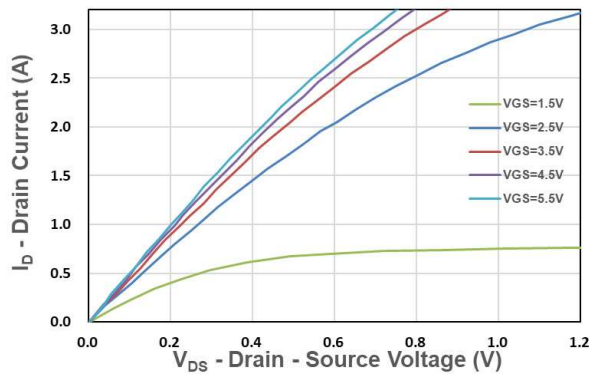


Figure 1. Output Characteristics

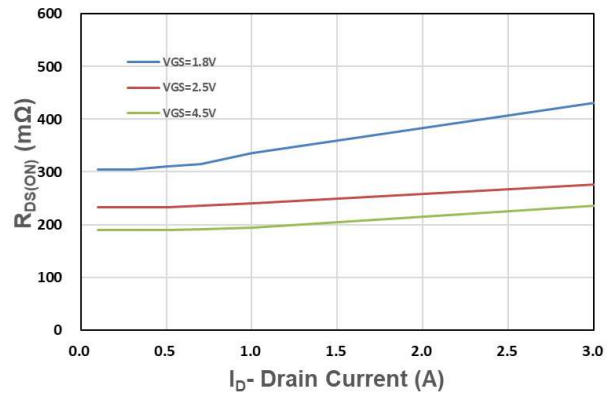


Figure 2. On-Resistance vs. I_D

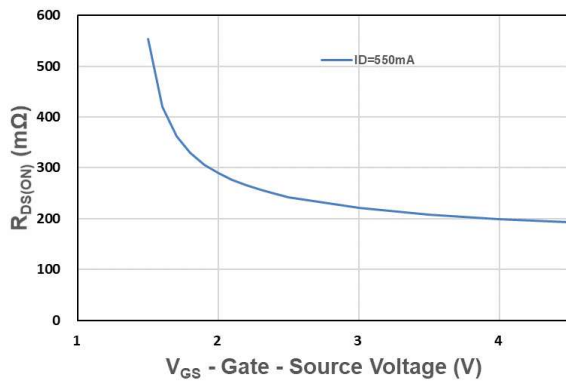


Figure 3. On-Resistance vs. V_{GS}

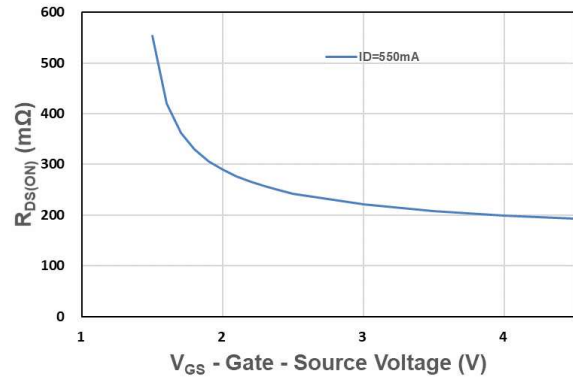


Figure 4. Gate Threshold Voltage

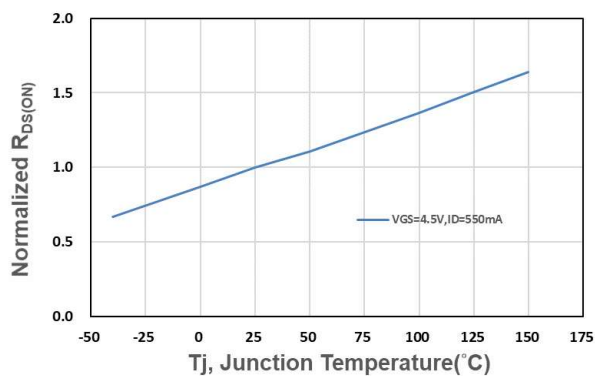


Figure 5. Drain-Source On Resistance

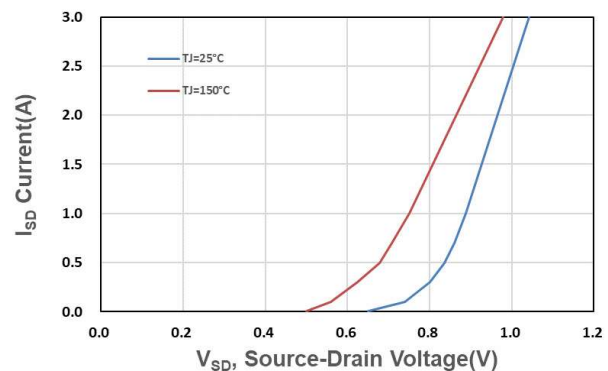


Figure 6. Source-Drain Diode Forward

Typical Performance Characteristics (FMOSAE014N02)

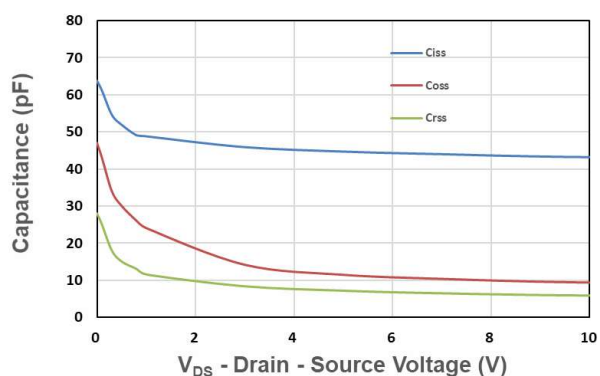


Figure 7. Capacitance

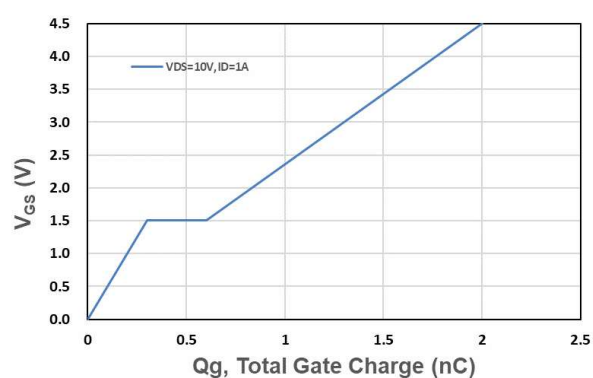


Figure 8. Gate Charge Characteristics

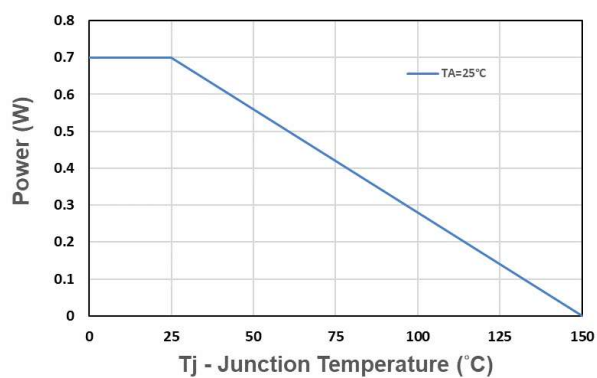


Figure 9. Power Dissipation

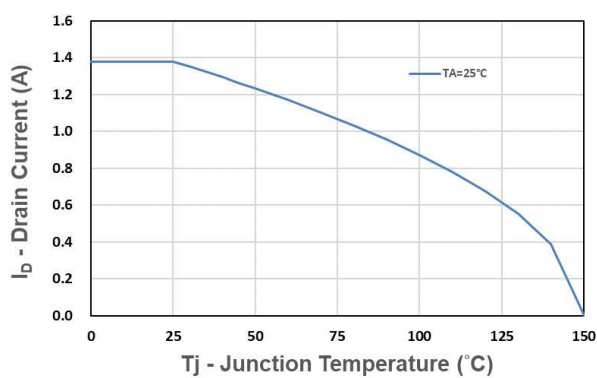


Figure 10. Drain Current

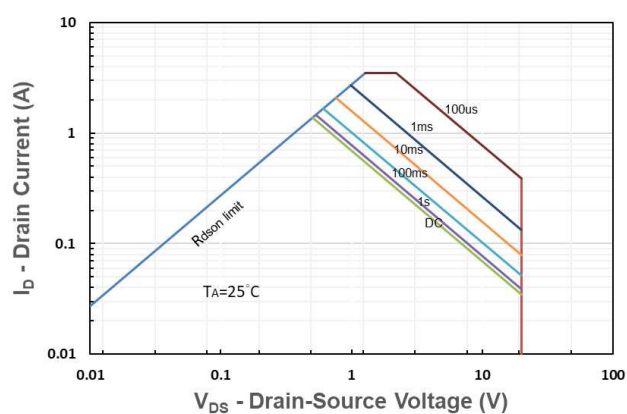


Figure 11. Safe Operating Area

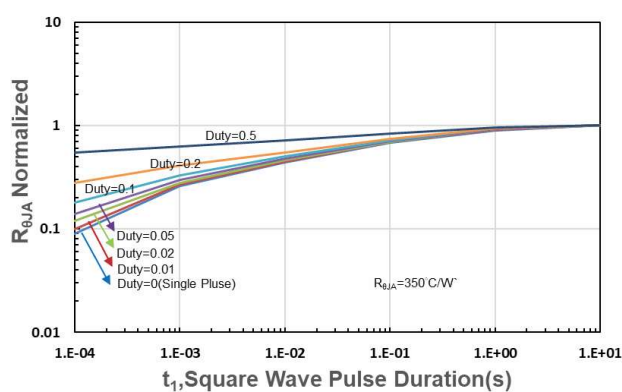
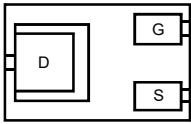
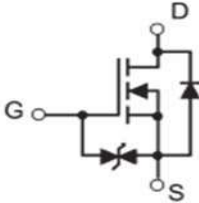
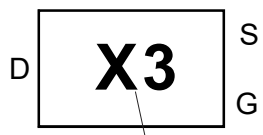


Figure 12. $R_{\theta JA}$ Transient Thermal Impedance

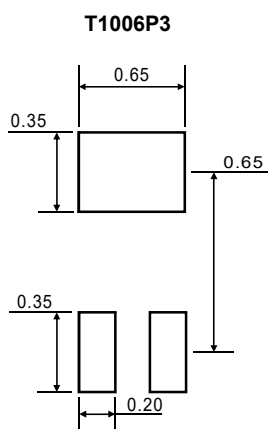
FMOSAE014N02**Pinning information**

Pin	Simplified outline	Symbol
PinD Drain PinG Gate PinS Source	 Bottom View	

Marking

Type number	Marking code	Example
FMOSAE014N02	X3	 Top View

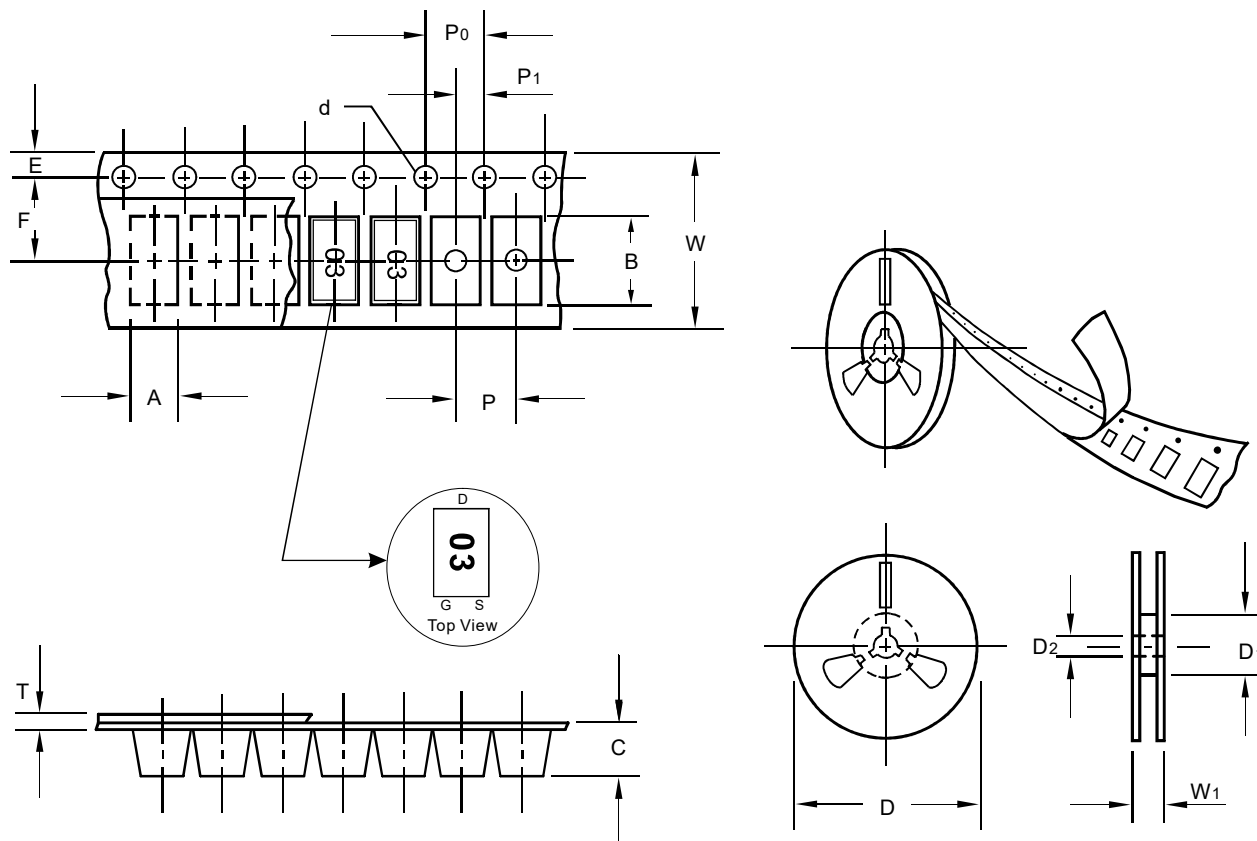
Note: X=Date code

Suggested solder pad layout

DIMENSIONS: MILLIMETERS

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Packing information



unit:mm

Item	Symbol	Tolerance	T1006P3
Carrier width	A	0.1	0.66
Carrier length	B	0.1	1.15
Carrier depth	C	0.1	0.66
Sprocket hole	d	0.1	1.50
13" Reel outside diameter	D	2.0	-
13" Reel inner diameter	D1	min	-
7" Reel outside diameter	D	2.0	178.00
7" Reel inner diameter	D1	min	55.00
Feed hole diameter	D2	0.5	13.00
Sprocket hole position	E	0.1	1.75
Punch hole position	F	0.1	3.50
Punch hole pitch	P	0.1	2.00
Sprocket hole pitch	P0	0.1	4.00
Embossment center	P1	0.1	2.00
Overall tape thickness	T	0.1	0.23
Tape width	W	0.3	8.00
Reel width	W1	1.0	9.50

Note: Devices are packed in accordance with EIA standard RS-481-A and specifications listed above.

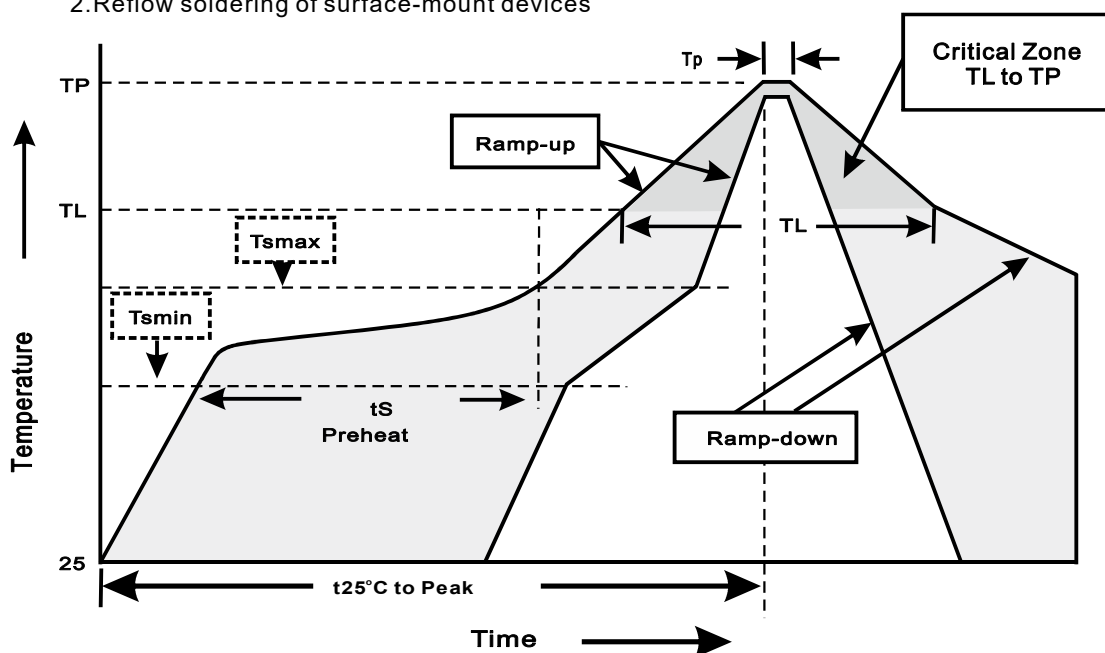
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Reel packing

PACKAGE	REEL SIZE	REEL (pcs)	COMPONENT SPACING (m/m)	BOX (pcs)	INNER BOX (m/m)	REEL DIA, (m/m)	CARTON SIZE (m/m)	CARTON (pcs)	APPROX. GROSS WEIGHT (kg)
T1006P3	7"	10,000	4.0	100,000	183*123*183	178	382*257*387	800,000	15.0

Suggested thermal profiles for soldering processes

- 1.Storage environment: Temperature=5°C~40°C Humidity=55%±25%
- 2.Reflow soldering of surface-mount devices



3.Reflow soldering

Profile Feature	Soldering Condition
Average ramp-up rate(T _L to T _P)	<3°C/sec
Preheat -Temperature Min(T _{smmin}) -Temperature Max(T _{smmax}) -Time(min to max)(t _s)	150°C 200°C 60~120sec
T _{smmax} to T _L -Ramp-upRate	<3°C/sec
Time maintained above: -Temperature(T _L) -Time(t _L)	217°C 60~260sec
Peak Temperature(T _P)	255°C-0/+5°C
Time within 5°C of actual Peak Temperature(t _P)	10~30sec
Ramp-down Rate	<6°C/sec
Time 25°C to Peak Temperature	<6minutes

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High reliability test capabilities

Item Test	Conditions	Reference
1. Solder Resistance	at $260 \pm 5^{\circ}\text{C}$ for 10 sec.	MIL-STD-750D METHOD-2031
2. Solderability	at $245 \pm 5^{\circ}\text{C}$ for 5 sec.	MIL-STD-202F METHOD-208
3. High Temperature Reverse Bias	$V_{DS}=0.8 \times BV_{DSS}$, at $T_J=150^{\circ}\text{C}$ for 168 hrs.	MIL-STD-750D METHOD-1038
4. Pressure Cooker	$15P_{SIG}$ at $T_A=121^{\circ}\text{C}$ 100%RH for 4 hrs.	JESD22-A102
5. Temperature Cycling	-55°C to $+125^{\circ}\text{C}$ dwelled for 30 min total 10 cycles.	MIL-STD-750D METHOD-1051
6. Humidity	at $T_A=85^{\circ}\text{C}$, 85%RH for 1000 hrs.	MIL-STD-750D METHOD-1021
7. High Temperature Storage Life	at $T_A=175^{\circ}\text{C}$ for 1000 hrs.	MIL-STD-750D METHOD-1031