

**BAL99-Q1/BAV99-Q1/BAW56-Q1/BAV70-Q1**

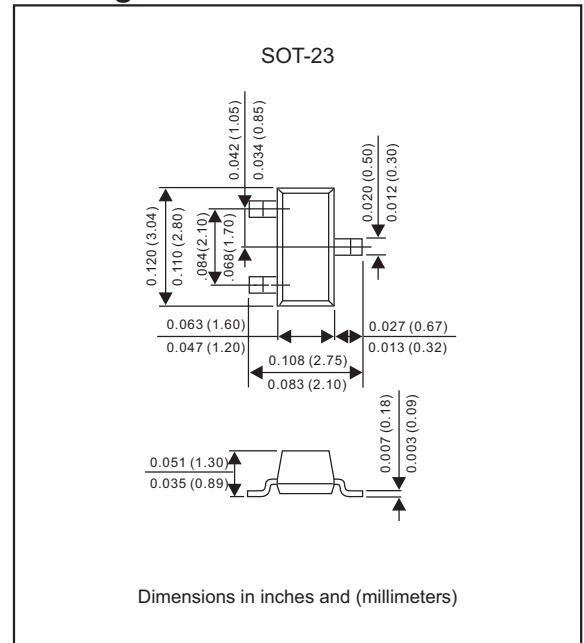
**100~215mA Surface Mount  
Switching Diode 70V~75V**

**Features**

- Fast speed switching
- For general purpose switching application
- High conductance
- Silicon epitaxial planar chip
- Lead-free parts meet RoHS requirements
- Qualified to AEC-Q101 standards for high reliability
- Suffix "-H" indicates Halogen-free part, ex. BAL99-Q1-H

**Mechanical data**

- Epoxy:UL94-V0 rated flame retardant
- Case : Molded plastic, SOT-23
- Terminals : Solder plated, solderable per  
MIL-STD-750, Method 2026
- Mounting Position : Any
- Weight : Approximated 0.009 gram

**Package outline****Maximum ratings** (AT  $T_A=25^{\circ}\text{C}$  unless otherwise noted)

| Parameter                                 | Symbol           | BAL99-Q1 | BAV99-Q1 | BAW56-Q1 | BAV70-Q1 | Unit |
|-------------------------------------------|------------------|----------|----------|----------|----------|------|
| Repetitive peak reverse voltage           | $V_{RRM}$        | 80       | 85       | -        | -        | V    |
| Reverse breakdown voltage                 | $V_{RM}$         | -        | -        | 70       | -        | V    |
| Reverse voltage                           | $V_R$            | 70       | 75       | 70       | -        | V    |
| Forward current                           | $I_F$            | 100      | 215      | 200      | -        | mA   |
| Repetitive peak forward current           | $I_{FRM}$        | 450      |          |          |          | mA   |
| Peak forward surge current                | $I_{FM}$ (Surge) | 500      |          |          |          | mA   |
| Non-repetitive peak forward surge current | $I_{FSM}$        | 2.0      | 2.0      | 2.0      | 2.0      | A    |
| @ $t=1.0\mu\text{s}$                      |                  | 1.0      | 1.0      | 1.0      | 1.0      |      |
| @ $t=1.0\text{ms}$                        |                  | 0.5      | 0.5      | 0.5      | 0.5      |      |
| @ $t=1.0\text{s}$                         |                  | -        | -        | -        | -        |      |
| @ $t=8.3\text{ms}$                        |                  | -        | -        | -        | 2.0      |      |

**Thermal characteristics**

| Parameter                                                                 | Symbol          | Limits      | Unit                        |
|---------------------------------------------------------------------------|-----------------|-------------|-----------------------------|
| Total device dissipation, FR-5 Board*1, $T_A = 25^{\circ}\text{C}$        | $P_D$           | 225         | mW                          |
| Derate above $25^{\circ}\text{C}$                                         |                 | 1.8         | mW/ $^{\circ}\text{C}$      |
| Thermal resistance junction to ambient                                    | $R_{\theta JA}$ | 556         | $^{\circ}\text{C}/\text{W}$ |
| Total device dissipation, alumina substrate*2, $T_A = 25^{\circ}\text{C}$ | $P_D$           | 300         | mW                          |
| Derate above $25^{\circ}\text{C}$                                         |                 | 2.4         | mW/ $^{\circ}\text{C}$      |
| Thermal resistance junction to ambient                                    | $R_{\theta JA}$ | 417         | $^{\circ}\text{C}/\text{W}$ |
| Operating junction temperature range                                      | $T_J$           | -55 to +150 | $^{\circ}\text{C}$          |
| Storage temperature range                                                 | $T_{STG}$       | -55 to +150 | $^{\circ}\text{C}$          |

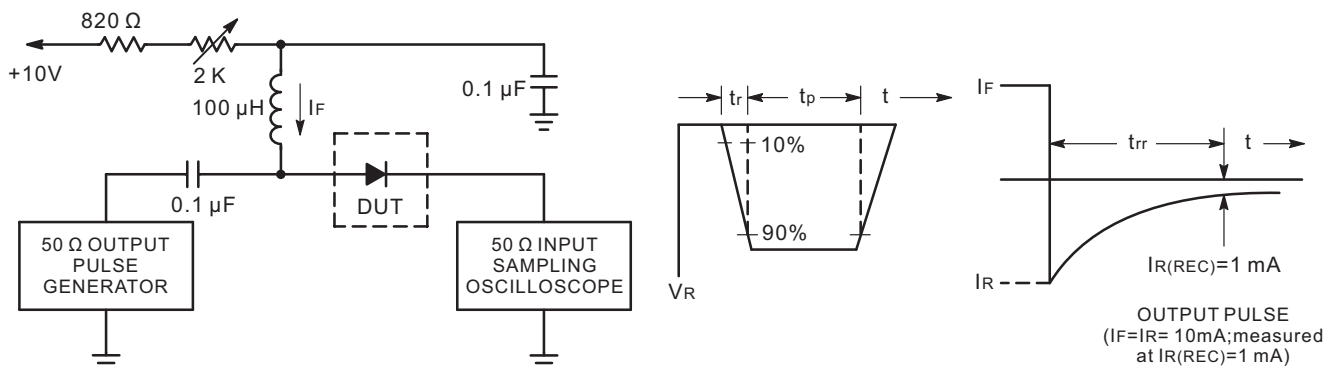
1. FR-5 =  $1.0 \times 0.75 \times 0.062$  in.

2. Alumina =  $0.4 \times 0.3 \times 0.024$  in. 99.5% alumina.

**BAL99-Q1/BAV99-Q1/BAW56-Q1/BAV70-Q1****Electrical characteristics** (AT  $T_A=25^\circ\text{C}$  unless otherwise noted)

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                | Symbol   | MIN. | MAX.                         | Unit          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|------------------------------|---------------|
| Reverse breakdown voltage ( $I_{BR}=100\mu\text{A}$ )                                                                                                                                                                                                                                                                                                                                                                    | $V_{BR}$ | 70   |                              | V             |
| Reverse voltage leakage current<br>(at $V_R = 70\text{V}$ , $T_J=25^\circ\text{C}$ ) BAL99-Q1/BAV99-Q1/BAW56-Q1/BAV70-Q1<br>(at $V_R = 25\text{V}$ , $T_J=150^\circ\text{C}$ ) BAL99-Q1/BAV99-Q1/BAW56-Q1<br>(at $V_R = 25\text{V}$ , $T_J=150^\circ\text{C}$ ) BAV70-Q1<br>(at $V_R = 70\text{V}$ , $T_J=150^\circ\text{C}$ ) BAL99-Q1/BAV99-Q1/BAW56-Q1<br>(at $V_R = 70\text{V}$ , $T_J=150^\circ\text{C}$ ) BAV70-Q1 | $I_R$    |      | 2.5<br>30<br>60<br>50<br>100 | $\mu\text{A}$ |
| Diode capacitance ( $V_R = 0\text{V}$ , $f = 1.0\text{MHz}$ )<br>BAL99-Q1/BAV70-Q1<br>BAV99-Q1/BAW56-Q1                                                                                                                                                                                                                                                                                                                  | $C_D$    |      | 1.5<br>2.0                   | pF            |
| Reverse recovery time ( $I_F = I_R = 10\text{mA}$ , $V_R = 5.0\text{V}$ ,<br>$I_{R(REC)} = 1.0\text{mA}$ , $R_L = 100\Omega$ )                                                                                                                                                                                                                                                                                           | $t_{rr}$ |      | 6.0                          | ns            |
| Forward voltage<br>(at $I_F = 1.0\text{mA}$ )<br>(at $I_F = 10\text{mA}$ )<br>(at $I_F = 50\text{mA}$ )<br>(at $I_F = 150\text{mA}$ )                                                                                                                                                                                                                                                                                    | $V_F$    |      | 715<br>855<br>1000<br>1250   | mV            |

Recovery Time Equivalent Test Circuit



- Notes : 1. A 2.0 KΩ variable resistor adjusted for a forward current ( $I_F$ ) of 10 mA  
 2. Input pulse is adjusted so  $I_{R(peak)}$  is equal to 10 mA  
 3.  $t_p \gg t_{rr}$

## Rating and characteristic curves for each diode

FIG.1-TYPICAL FORWARD

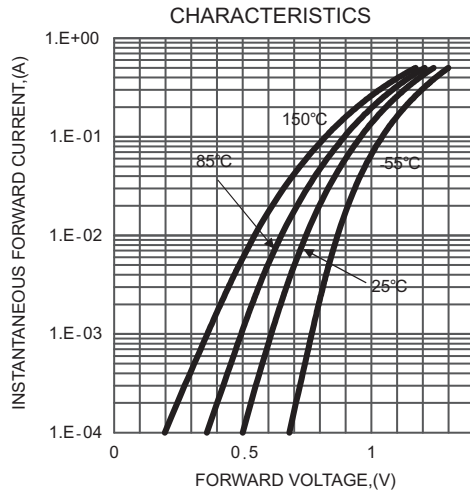


FIG.2 - TYPICAL REVERSE

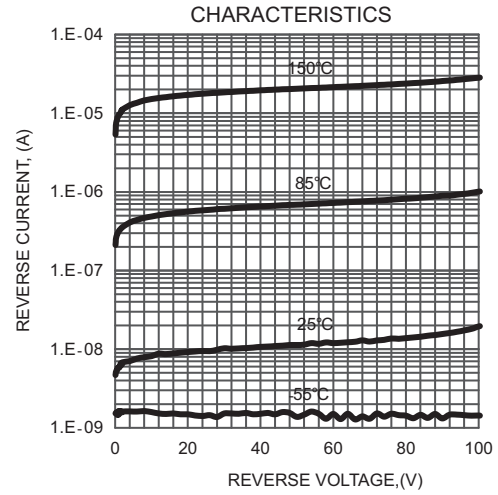


FIG.3a - TYPICAL DIODE CAPACITANCE  
BAL99-Q1/BAV70-Q1

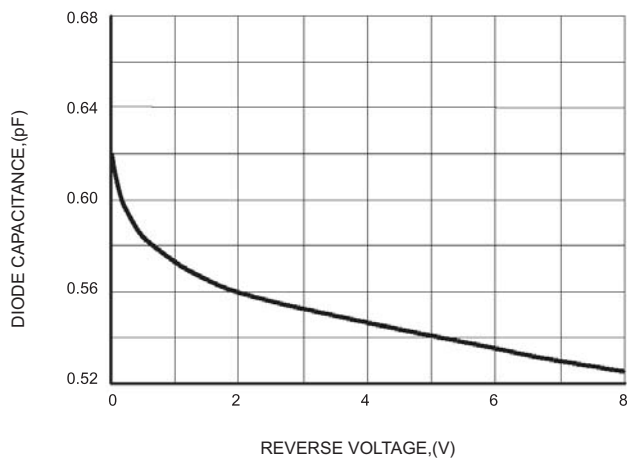
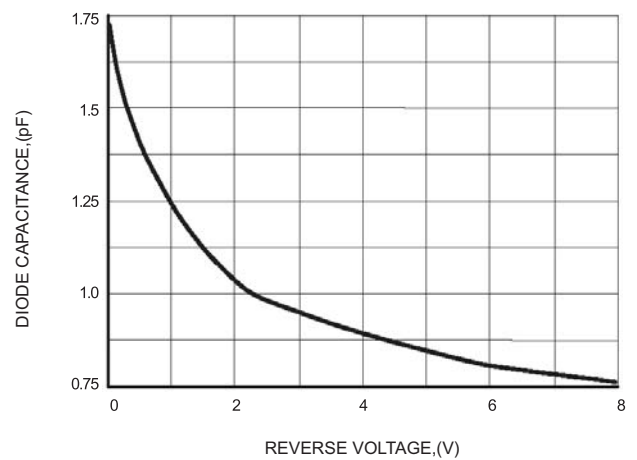
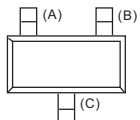
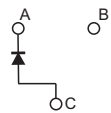
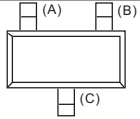
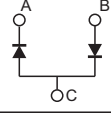
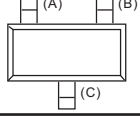
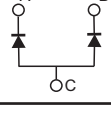
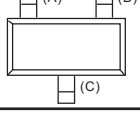
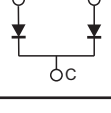


FIG.3b - TYPICAL DIODE CAPACITANCE  
BAV99-Q1/BAW56-Q1

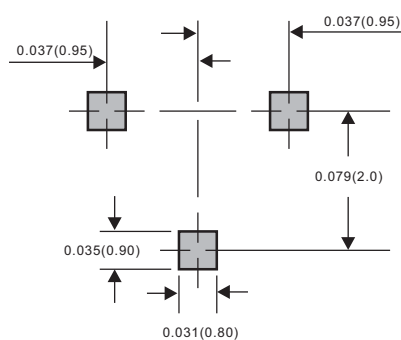


**BAL99-Q1/BAV99-Q1/BAW56-Q1/BAV70-Q1****Pinning information**

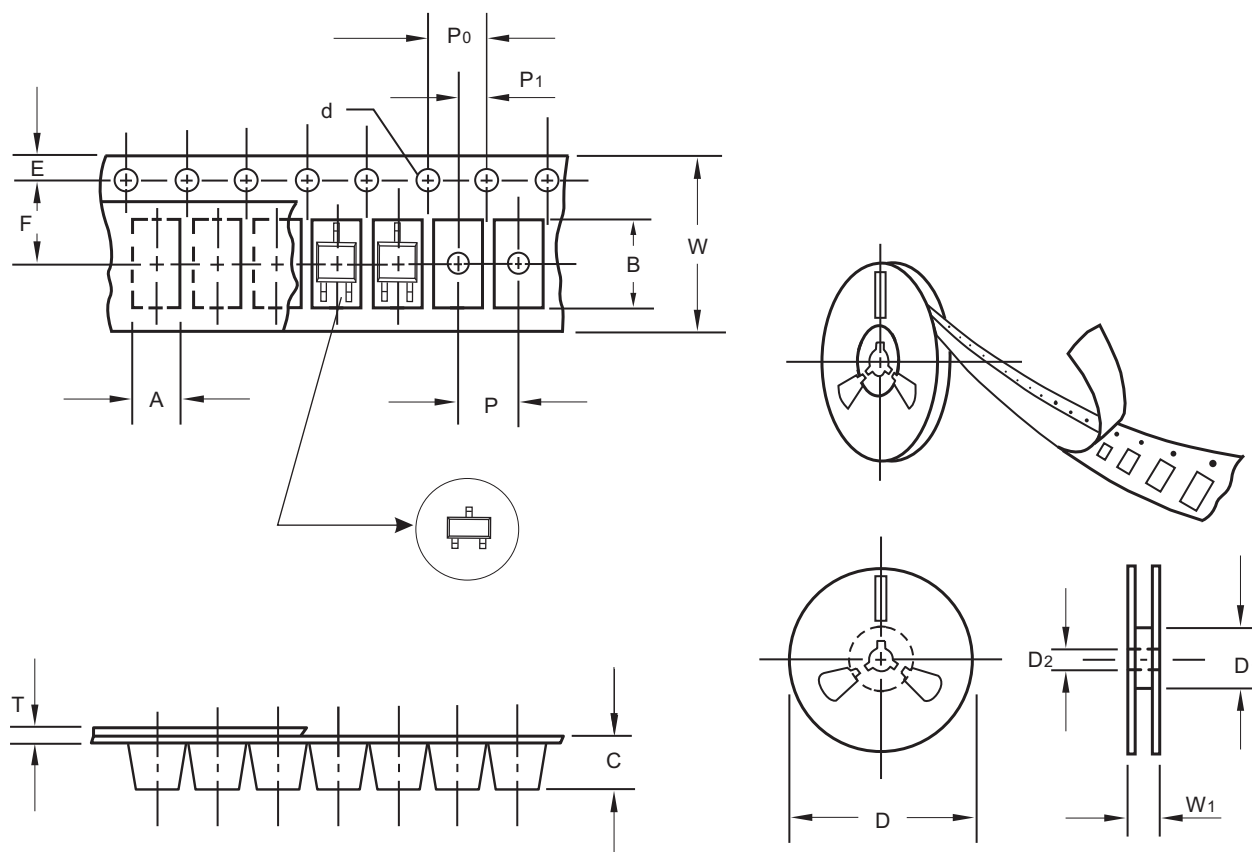
| Type number | Marking code | Simplified outline                                                                | Symbol                                                                              |
|-------------|--------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| BAL99-Q1    | JF           |  |  |
| BAV99-Q1    | A7           |  |  |
| BAW56-Q1    | A1           |  |  |
| BAV70-Q1    | A4           |  |  |

**Suggested solder pad layout**

SOT-23



Dimensions in inches and (millimeters)

**BAL99-Q1/BAV99-Q1/BAW56-Q1/BAV70-Q1****Packing information**

unit:mm

| Item                      | Symbol | Tolerance | SOT-23 |
|---------------------------|--------|-----------|--------|
| Carrier width             | A      | 0.1       | 3.15   |
| Carrier length            | B      | 0.1       | 2.77   |
| Carrier depth             | C      | 0.1       | 1.22   |
| 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       | 62.00  |
| 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       | 4.00   |
| 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       | 11.40  |

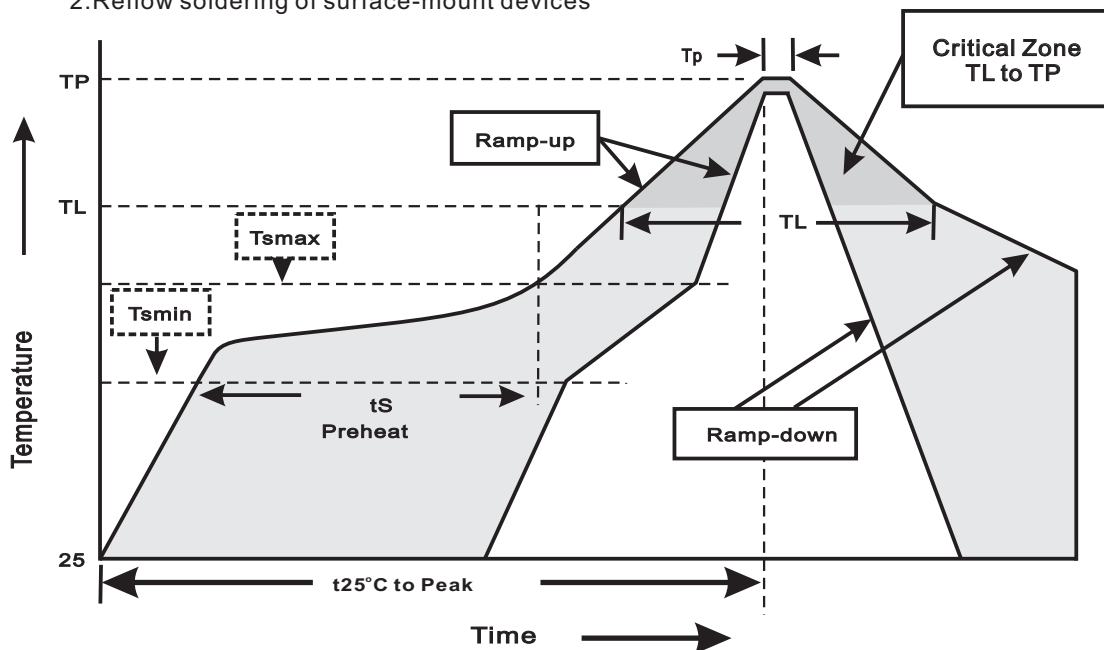
Note: Devices are packed in accordance with EIA standard RS-481-A and specifications listed above.

**BAL99-Q1/BAV99-Q1/BAW56-Q1/BAV70-Q1****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) |
|---------|-----------|------------|-------------------------|-----------|-----------------|-----------------|-------------------|--------------|---------------------------|
| SOT-23  | 7"        | 3,000      | 4.0                     | 30,000    | 183*123*183     | 178             | 382*257*387       | 240,000      | 11.6                      |

**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 $T_P$ )                                                                    | $<3^{\circ}\text{C/sec}$    |
| Preheat<br>-Temperature Min( $T_{smin}$ )<br>-Temperature Max( $T_{smax}$ )<br>-Time(min to max)( $t_s$ ) | 150°C<br>200°C<br>60~120sec |
| $T_{smax}$ to $T_L$<br>-Ramp-upRate                                                                       | $<3^{\circ}\text{C/sec}$    |
| Time maintained above:<br>-Temperature( $T_L$ )<br>-Time( $t_L$ )                                         | 217°C<br>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                                                                                            | $<6^{\circ}\text{C/sec}$    |
| Time 25°C to Peak Temperature                                                                             | $<6\text{minutes}$          |

**BAL99-Q1/BAV99-Q1/BAW56-Q1/BAV70-Q1****High reliability test capabilities**

| Item Test                                       | Conditions                                                                                                                                     | Reference                     |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| 1. MSL Preconditioning                          | 24hr bake@125°C+168hrs@85°C<br>/85%RH+3xIR@260°C+1flux<br>immersion+alcohol+DI H2O rinse                                                       | JESD22-A113                   |
| 2. Operation Life                               | Ta=25°C,Rated Current (Io=Io max.)Test Duration:1000hrs                                                                                        | MIL-STD-750E<br>METHOD 1027.3 |
| 3. High Temperature Reverse Bias                | 80% Rated VR (Tj=Tj max.)Test Duration:1000hrs                                                                                                 | JESD22-A108                   |
| 4. High Temperature Storage Life                | Ta=125°C Test Duration:1000hrs                                                                                                                 | JESD22 A-103                  |
| 5. Temperature Cycle                            | -55°C(15min) to 150°C(15min)Test Cycles:1000cycles                                                                                             | JESD22 A-104                  |
| 6. Autoclave                                    | P=2atm Ta=121°C RH=100% Test Duration:96hrs                                                                                                    | JESD22 A-102                  |
| 7. Intermittent Operational Life                | Ta=25°C,On/Io Max. 2min, Off/2min,<br>Test Cycles:15000cycles                                                                                  | MIL-STD-750E<br>METHOD 1037   |
| 8. Solderability                                | 245±5°C for 5sec                                                                                                                               | J-STD-002                     |
| 9. Moisture Resistance                          | Ta=85°C/85% Relative humidity Test Duration:1000hrs                                                                                            | MIL-STD-750E<br>METHOD 1021.2 |
| 10. Resistance To Solder Heat                   | 260±5°C for 10sec                                                                                                                              | JESD22 B-106                  |
| 11. High Temperature High Humidity Reverse Bias | Ta=85°C, 85%RH, with device reverse biased at 80% of rated breakdown voltage up to a maximum of 100V or limit of chamber Test Duration:1000hrs | JESD22-A101                   |