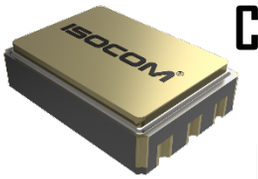
# PART NUMBER CSM1224



# COMPONENT SPECIFICATION ISSUE 6

# Component Specification For Hermetically Sealed, Radiation-Hard Transistor Optocouplers

| Features | Applications |
|---|---|
| ▪ Hermetically Sealed<br>▪ Radiation Tolerant tested to 150 Krad(si)<br>▪ High Isolation up to 1,000$V_{DC}$<br>▪ LCC-6 Package<br>▪ Low Input Requirements<br>▪ High Current Transfer Ratio | ▪ Space Equipment and Systems<br>▪ Military and High Reliability Systems<br>▪ Medical Instruments<br>▪ MOS/CMOS Applications<br>▪ Logic Interfacing<br>▪ Data Transmission<br>▪ Power Supply<br>▪ Modems |

# DESCRIPTION

This device is a single channel, hermetically sealed optically coupled isolator. It is composed of a Gallium Arsenide infrared emitting diode and a silicon phototransistor.

The CSM1224 series is being used in environments encountered by space applications. Package styles for this device include an LCC-6 package, with solder dip option available.

Absolute maximum ratings, recommended operating conditions, electrical specifications and performance characteristics are identical for all units. Any exceptions, due to packaging variations and limitations, are as note

*ISOCOM Limited is AS9100 certified for the design and manufacture of electronic and optoelectronic components.*

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# STANDARDS

The following specifications have been complied with in the manufacturing of this product -

## Aerospace Compliance Standards

AS9100D & ISO 9001:2015 – Design & Manufacture of Electronic and Optoelectronic Components *(Ref GB15/92780)*

## Military Compliance Specifications

MIL-PRF-38534 – General Specification for Hybrid Microcircuits
MIL-PRF-19500 – General Specification for Discrete Semiconductor Devices

## Military Compliance Standards

MIL-STD-202 – Test Method Standard Electronic and Electrical Component Parts
MIL-STD-883 – Test Method Standard Microcircuits
MIL-STD-750 – Test Method Standard for Semiconductor Devices

# SCREENING INFORMATION

Our products can be screened to MIL-PRF-38534, applying test methods from MIL-STD-883; MIL-PRF-19500, applying test methods of MIL-STD-750; or a combination thereof. Please contact us for more information relating to the applicable screening processes.

# AMENDMENT RECORD

| Issue No. | Date | Description |
|---|---|---|
| 1 | August 2013 | First issue |
| 2 | September 2020 | Updated Quality Management Logos and removed IECQ Logos |
| 3 | May 2022 | Added Radiation Testing and Electrical Testing Diagrams, Added Render |
| 4 | June 2022 | Updated Electrical Characteristics Graphs and Added Screening Flow |
| 5 | November 2022 | Updated Format |
| 6 | August 2023 | Added pin configuration, updated screening, updated circuit drawings and device marking |

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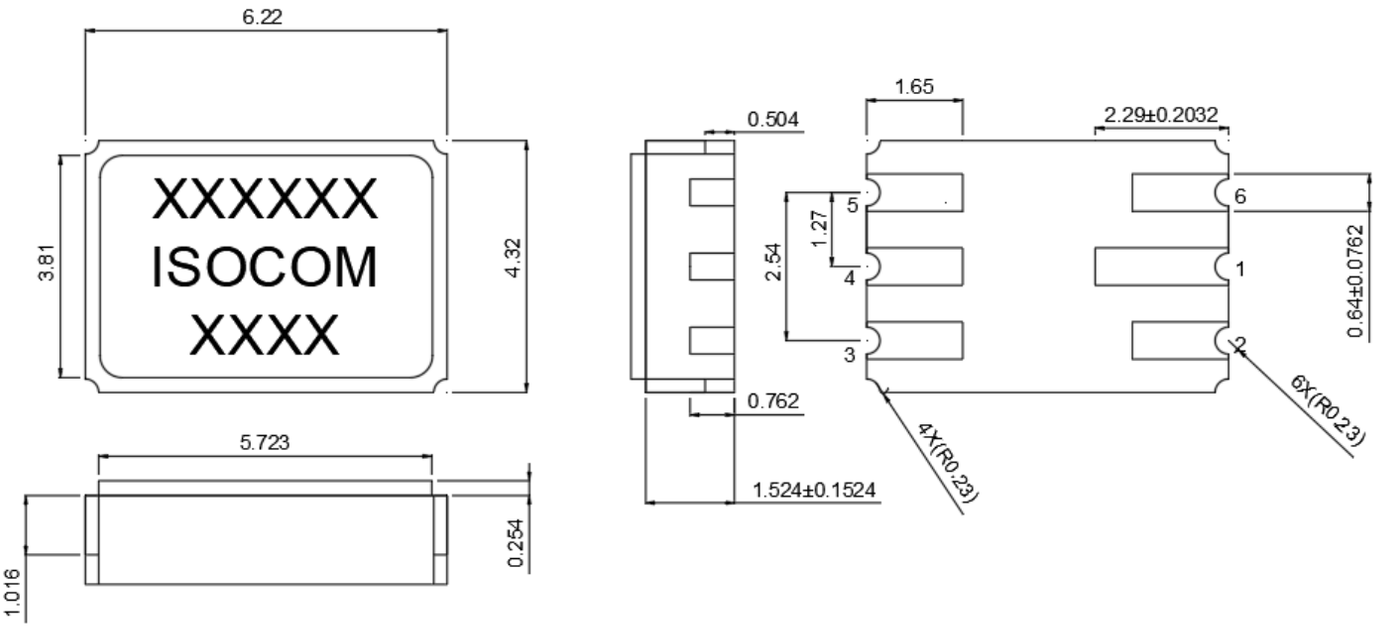
# OUTLINE DRAWING




# PACKAGE STYLES AND CONFIGURATION OPTIONS

| Package | 6-Pin LCC |
|---|---|
| Lead Style | - |
| Channels | 1 |
| Common Channel Wiring | - |
| **Isocom Part Number and Options** | |
| Commercial | CSM1224 |
| Defense Screen Level | CSM1224/L2 |
| Space Screen Level | CSM1224/L2S |
| Standard Gold Plate Finish | Gold Plate |
| Butt Joint | – |
| Solder Dipped | Option 20 |
| Gull Wing | – |
| Butt Joint | – |

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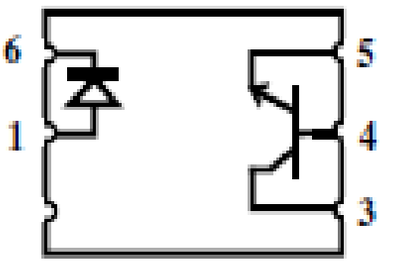
# FUNCTIONAL DIAGRAMS

| CSM1224 |
| --- |
| LCC-6 |
| Single Channel |
|  |



# PIN OUT INFORMATION

| Pin Number | Pin Function |
| --- | --- |
| 1 | LED Anode |
| 2 | N/C |
| 3 | Collector |
| 4 | Base |
| 5 | Emitter |
| 6 | LED Cathode |

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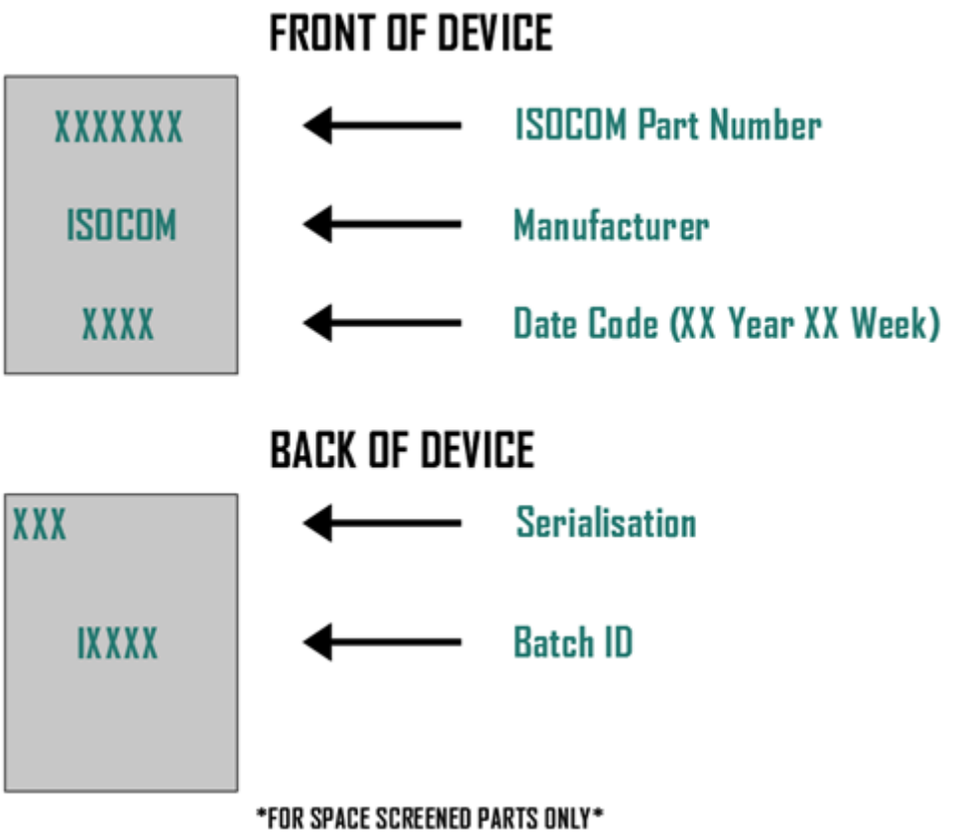
# DEVICE MARKING




# ABSOLUTE MAXIMUM RATINGS

$T_A$ = 25°C C.U.O.S

| | |
|---|---|
| Storage Temperature | -65°C to +150°C |
| Operating Temperature | -55°C to +125°C |
| Lead Soldering Temperature | 260°C 1.6mm from case for 10s |
| Input-to-Output Isolation Voltage | ⇧1,000$V_{DC}$ |
| **Input Diode** | |
| Average Forward Current | 50mA |
| Reverse Voltage | 7V |
| Peak forward Current | 1.5A |
| Power Dissipation | 100mW |
| **Output Transistor** | |
| Supply Voltage | 0.5V to 20V |
| Average Current | 8mA |
| Collector Current | 50mA |
| Power Dissipation | 150Mw |

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# ELECTRICAL CHARACTERISTICS

$T_A$ = -55°C - 125°C U.O.S.

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Input Diode Electrical Characteristics** | | | | | | |
| Forward Voltage | $V_F$ | $I_F$ = 10mA | 0.7 | 1.2 | 1.8 | V |
| Reverse Current | $I_R$ | $V_R$ = 3.0V | - | - | 100 | µA |
| **Output Detector Electrical Characteristics** | | | | | | |
| Collector-Emitter Breakdown Voltage | $V_{(BR)CEO}$ | $I_C$ = 0.1mA | 70 | 100 | - | V |
| Collector-Base Breakdown Voltage | $V_{(BR)CBO}$ | $I_B$ = 100µA | 70 | 200 | - | V |
| Emitter-Collector Breakdown Voltage | $V_{(BR)ECO}$ | $I_E$ = 0.1mA | 7 | 9 | - | V |
| Emitter-Base Breakdown Voltage | $V_{(BR)EBO}$ | $I_B$ = 1mA | 5 | - | - | V |
| Collector–Emitter Leakage Current | $I_{CEO}$ | $V_{CE}$ = 20V, $I_F$ = 0A | - | 7 | 100 | µA |
| **Coupled Electrical Characteristics** | | | | | | |
| DC Current Transfer Ratio (Pre-Radiation) | $I_C/I_F$ | $I_F$ = 1.0mA, $V_{CE}$ = 1V | 200 | - | - | % |
| | | $I_F$ = 3.0mA, $V_{CE}$ = 1V | 200 | - | - | % |
| | | $I_F$ = 15.0mA, $V_{CE}$ = 1V | 100 | - | - | % |
| | | $I_F$ = 10.0mA, $V_{CE}$ = 5V | 350 | - | - | % |
| | | $I_F$ = 15.0mA, $V_{CE}$ = 5V | 100 | - | - | % |
| | | $I_F$ = 1.0mA, $V_{CE}$ = 15V | 300 | | | % |
| Collector-Emitter Saturation Voltage | $V_{CE(Sat)}$ | $I_C$ = 10.0 mA<br>$I_F$ = 20 mA | - | - | 0.22 | V |
| Isolation Voltage (1) | V in-out | T = 5s | 1,500 | - | - | $V_{DC}$ |
| Input to Output Resistance (1) | R in-out | $V_{IO}$ = 500V | - | $10^{11}$ | | Ω |
| Rise Time | $t_r$ | $R_L$ = 100Ω, $V_{CC}$ = 10V, $I_F$ = 10mA | - | 6 | 12 | µs |
| Fall Time | $t_f$ | $R_L$ = 100Ω, $V_{CC}$ = 10V, $I_F$ = 10mA | - | 6 | 12 | µs |
| Propagation Delay – H-L | $t_{PHL}$ | $R_L$ = 100Ω, $V_{CC}$ = 10V, $I_F$ = 10mA | - | - | 5.0 | µs |
| Propagation Delay – L-H | $t_{PLH}$ | $R_L$ = 100Ω, $V_{CC}$ = 10V, $I_F$ = 10mA | - | - | 5.0 | µs |
| DC Current Transfer Ratio (Post-Radiation) | $I_C/I_F$ | $I_F$ = 1.0mA, $V_{CE}$ = 1V | 200 | - | - | % |
| | | $I_F$ = 3.0mA, $V_{CE}$ = 1V | 100 | - | - | % |
| | | $I_F$ = 15.0mA, $V_{CE}$ = 1V | 66 | - | - | % |
| | | $I_F$ = 10.0mA, $V_{CE}$ = 5V | 160 | - | - | % |
| | | $I_F$ = 15.0mA, $V_{CE}$ = 5V | 40 | - | - | % |
| | | $I_F$ = 1.0mA, $V_{CE}$ = 15V | 250 | - | - | % |

**Notes:**
1. Measurements with inputs shorted together and outputs shorted together.

# ELECTRICAL CHARACTERISTICS

Typical Graphs – Contact Office for more information

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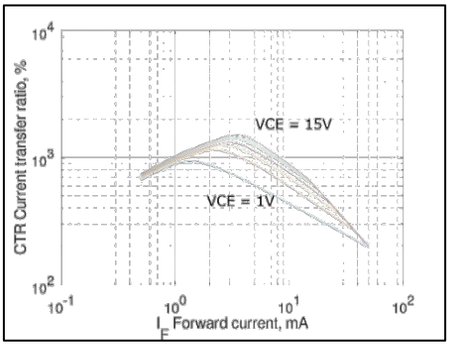
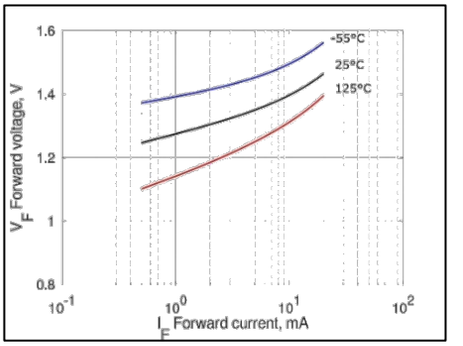
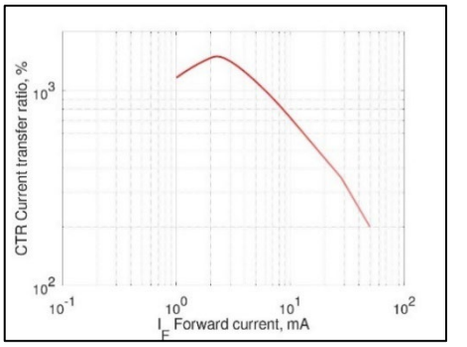
VCE = 1,3,5,7,10,12 and

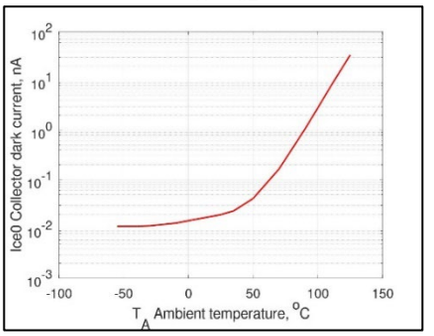


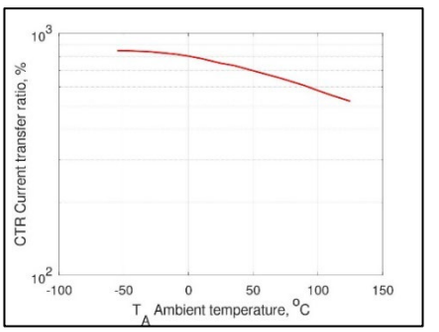

CTR vs $I_F$: $V_{CE}$ = 5V $T_A$ = 25°C



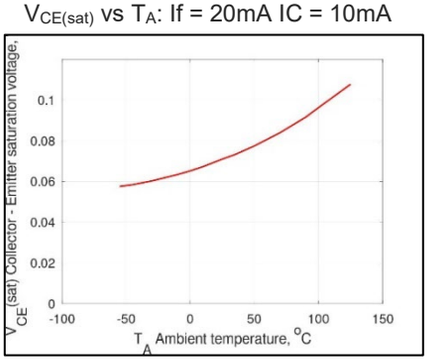

Iceo vs $T_A$: $V_{CE}$ = 20V



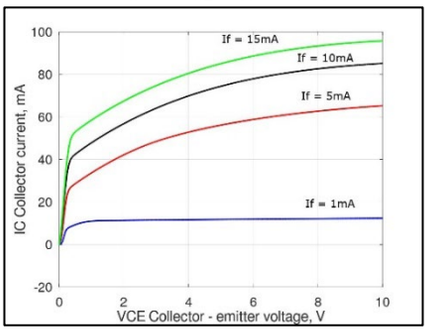

CTR vs $T_A$: If = 10mA VCE = 5V




$V_{CE(sat)}$ vs $T_A$: If = 20mA IC = 10mA




$I_C$ vs $V_{CE}$: $T_A$ = 25°C




# HTRB TEST CIRCUIT

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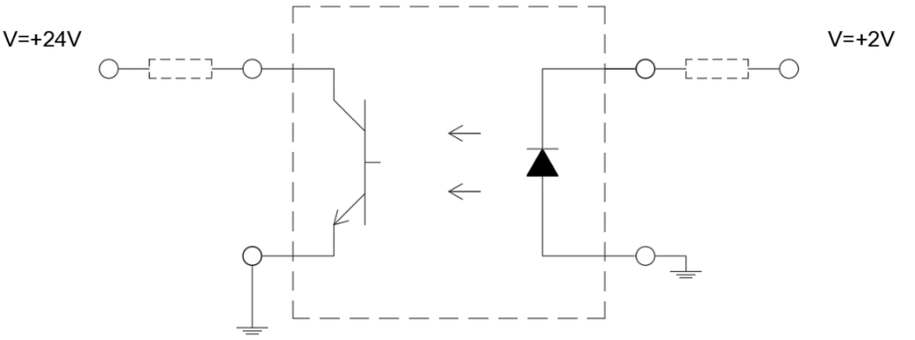
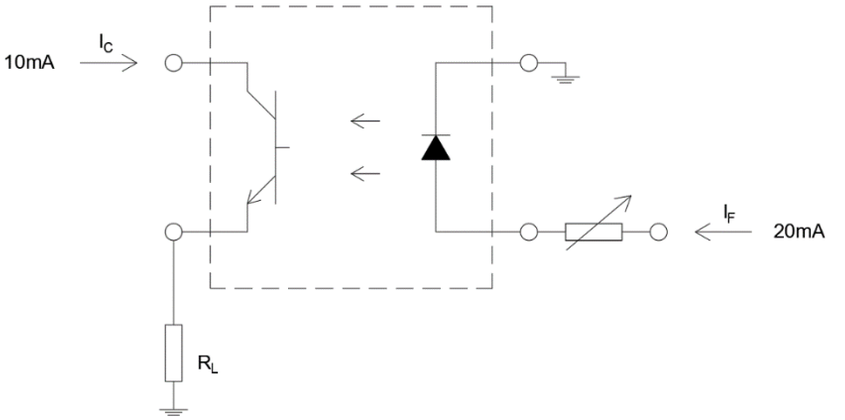
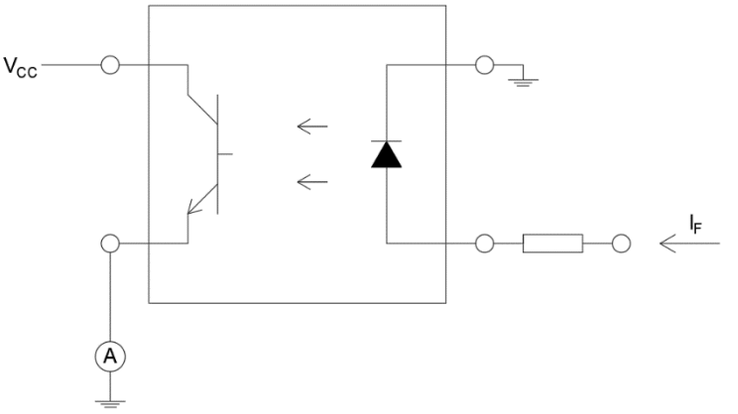



# ELECTRICAL CIRCUIT FOR BURN-IN AND OPERATING LIFE TESTS




# ELECTRICAL MEASUREMENT OF COLLECTOR CURRENT




# ELECTRICAL MEASUREMENT OF COLLECTOR EMITTER SATURATION VOLTAGE

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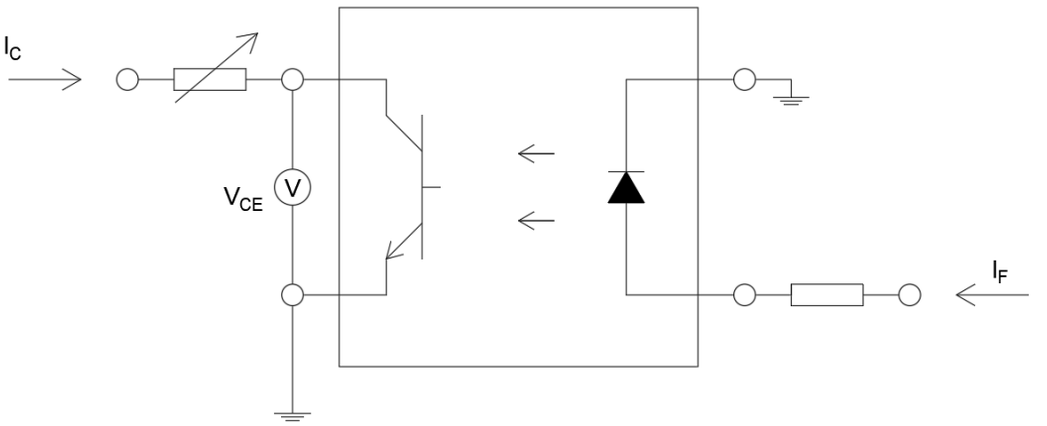
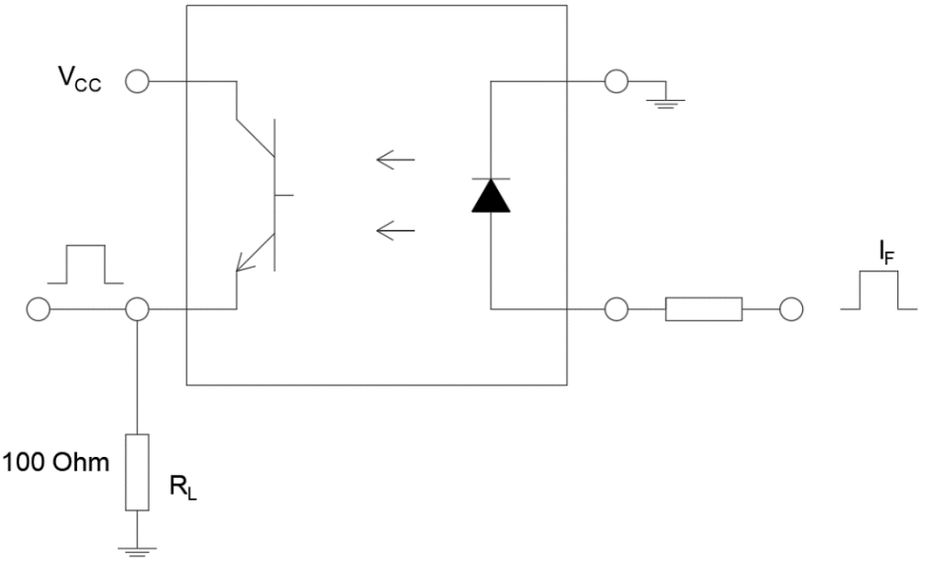
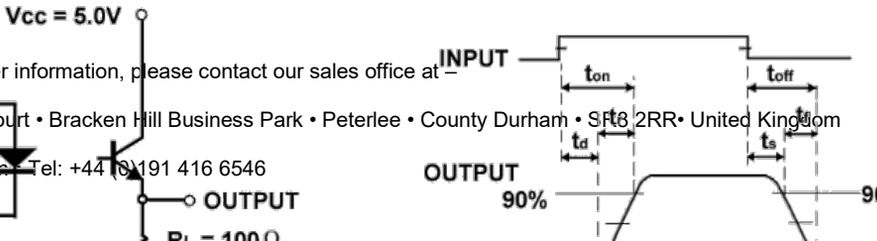


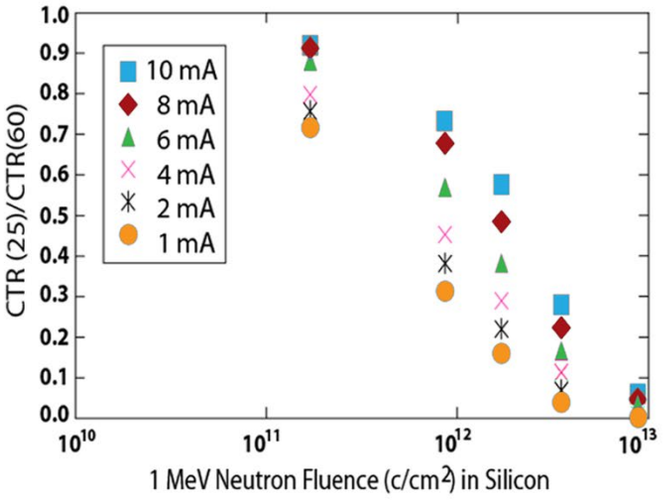

# ELECTRICAL MEASUREMENT OF A.C PARAMETERS

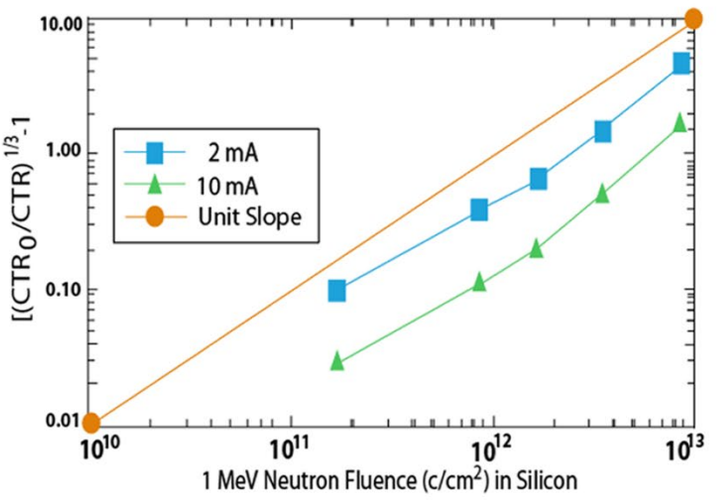



# SWITCHING TIME



# RADIATION TESTING

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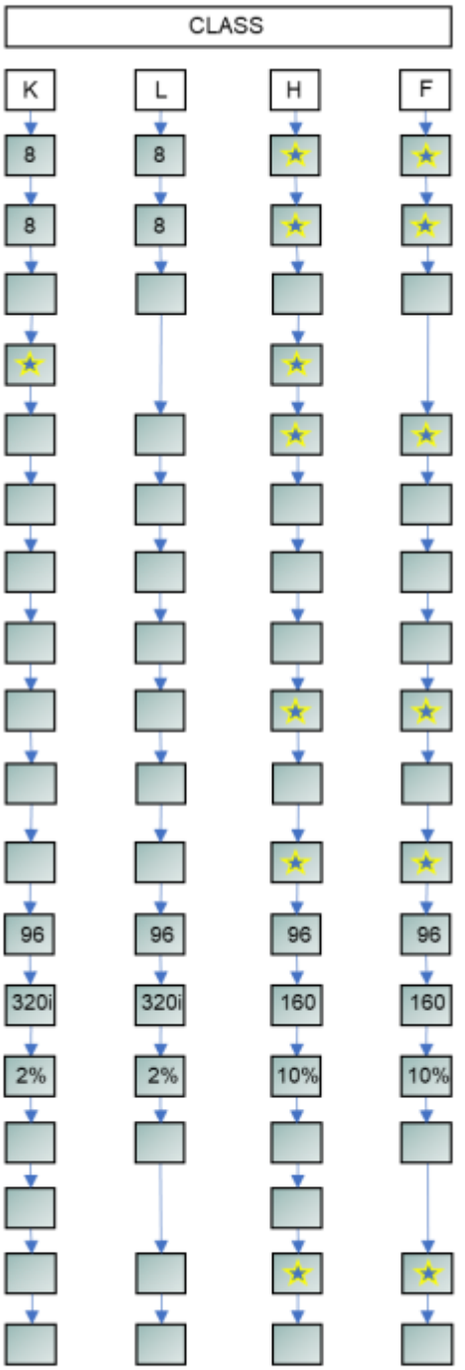
## SCREENING IN ACCORDANCE WITH MIL-PRF 38534




WIRE BOND STRENGTH TEST
(DESTRUCTIVE SAMPLE BASIS, NON-DESTRUCTIVE 100% FOR SPACE)

DIE SHEAR TEST
(DESTRUCTIVE SAMPLE BASIS)

INTERNAL (PRE-CAP) VISUAL INSPECTION 100%

HERMETIC SEAL TEST (FINE & GROSS)

SERIALISATION

INITIAL DC TESTS @ 25°C

TEMPERATURE CYCLE 10 CYCLES @ -65 °C to 150°C

ACCELERATION 5000g Y1

PIND TEST

ISOLATION TEST @ 25°C

DC TEST PRE-BURN-IN @ 25°C, 125°C, -55°C AND SWITCHING

HTRB @125 °C

BURN-IN @125°C

PERCENTAGE DEFECTIVE ALLOWED – CLASS
K/L BASED ON SECOND HALF OF B.I ONLY

DC TEST POST-BURN-IN @ 25°C, 125°C, -55°C AND SWITCHING

HERMETIC SEAL TEST (FINE & GROSS)

RADIOGRAPHY

EXTERNAL VISUAL INSPECTION 100%

★ = OPTIONAL

i = INTERIM, E.G. 2 x 160 HOUR BURN-IN

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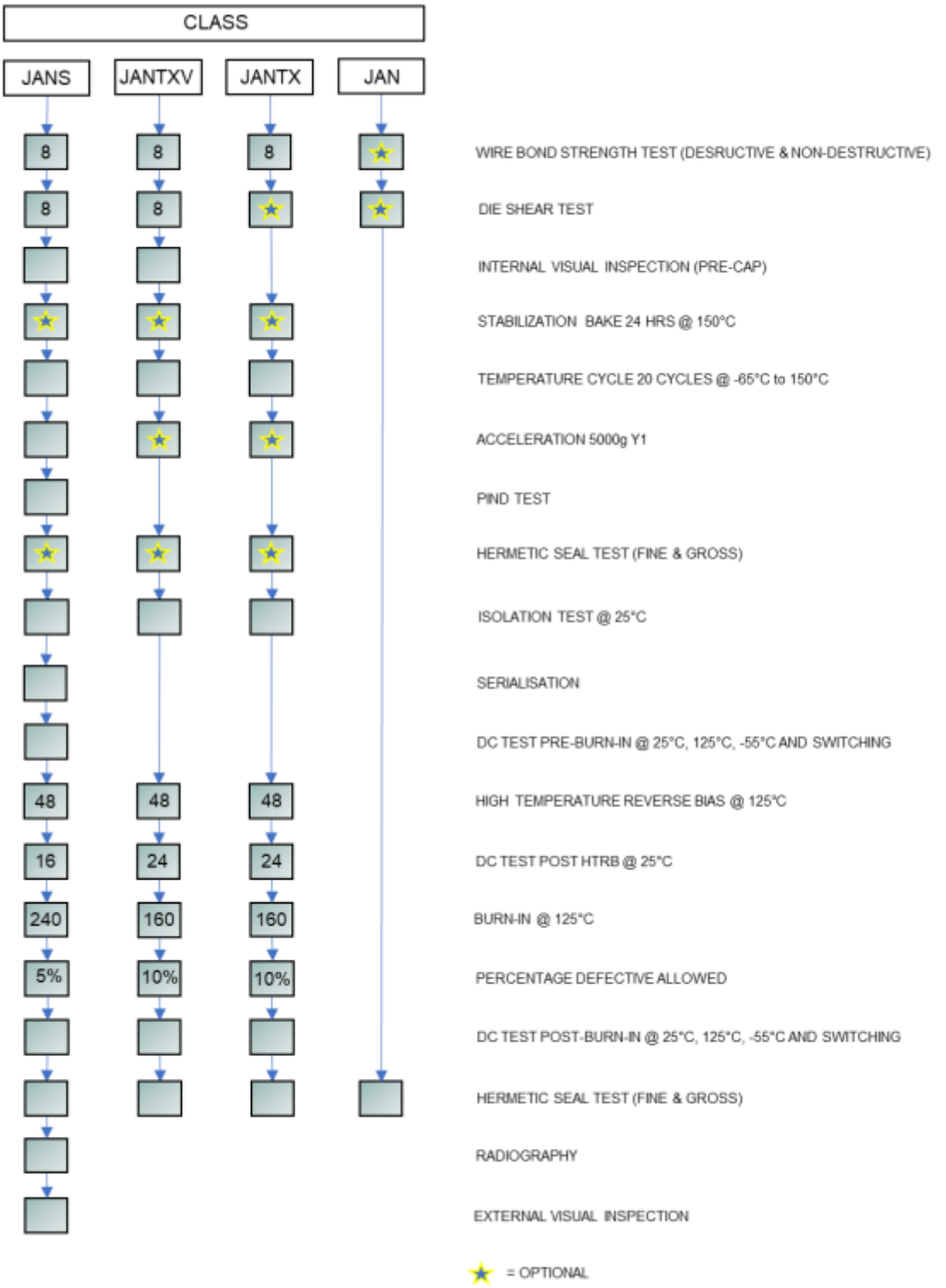
The following screening flow includes the electrical tests between each screening step, the referenced test method from MIL-STD 883 and the sample basis for Class K/L and H/F quality levels.

| Operation No. | Operation | MIL-STD 883 TEST METHOD | Class | |
|---|---|---|---|---|
| | | | H/F (L2) | K/L (L2S) |
| 1 | Wire bond strength (ND) | (883) 2023 | Optional | 100% |
| 2 | Wire bond strength (D) | (883) 2011 | Optional | 8 devices |
| 3 | Die Shear | (883) 2019 | Optional | 8 devices |
| 4 | Internal Visual | (883) 2017 | 100% | 100% |
| 5 | Fine leak, Helium bomb, Leak detector | (883) 1014, Con A1 | Optional | Optional |
| 6 | Gross leak, Liquid bomb, -Bubble chamber | (883) 1014, Con C1 | Optional | Optional |
| 7 | Serialisation of devices | | Optional | 100% |
| 8 | Electrical Test 25°C | | 100% | 100% |
| 9 | Temp cycle @ -65°C to 150°C | (883) 1010, Con C, 10 cycles | 100% | 100% |
| 10 | Electrical Test 25°C | | 100% | 100% |
| 11 | Constant acceleration | (883) 2001, 3000g, Y1 | 100% | 100% |
| 12 | Electrical Test 25°C | | 100% | 100% |
| 13 | P.I.N.D | (883) 2020, Con A | Optional | 100% |
| 14 | Electrical Test 25°C | | 100% | 100% |
| 15 | Isolation 100% @ 25°C | (MIL-STD 202) 301 | 100% | 100% |
| 16 | Electrical Test 25°C | | 100% | 100% |
| 17 | Electrical Test 125°C | | Optional | 100% |
| 18 | Electrical Test -55°C | | Optional | 100% |
| 19 | Switching time 100% @ 25°C | | Optional | 100% |
| 20 | HTRB @ 125°C - 96 hrs | (883) 1015, con A | 100% | 100% |
| 21 | Electrical Test 25°C | | 100% | 100% |
| 22 | Burn in @ 125°C | (883) 1015, con B | 100% 160 hours | 100% 160 hrs |
| 23 | Electrical Test 25°C | | 100% | 100% |
| 24 | Burn in @ 125°C | (883) 1015, con B | N/A | 100% 160 hrs |
| 25 | Percentage defective allowable | Pre/post Burn-in electrical and delta at 25°C only | Max. 10% | Max. 2% |
| 26 | Electrical Test 25°C | Group A - SG1 | 100% | 100% |
| 27 | Electrical Test 125°C | Group A - SG2 | 100% | 100% |
| 28 | Electrical Test -55°C | Group A - SG3 | 100% | 100% |
| 29 | Switching time 100% @ 25°C | Group A - SG9 | 100% | 100% |
| 30 | Fine leak, Helium bomb, Leak detector | (883) 1014, Con A1 | 100% | 100% |
| 31 | Gross leak, Liquid bomb, -Bubble chamber | (883) 1014, Con C1 | 100% | 100% |
| 32 | Radiography | (883) 2012 | Optional | 100% |
| 33 | External Visual | (883) 2009 | 100% | 100% |

## SCREENING IN ACCORDANCE WITH MIL-PRF 19500

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The following screening flow includes the electrical tests between each screening step, the referenced test method from MIL-STD 750 and the sample basis for Class JANTX, JANTXV and JANS quality levels.

| Operation No. | Operation | MIL-PRF 19500 | Class | | |
|---|---|---|---|---|---|
| | | | JANTX (L2) | JANTXV (L2) | JANS (L2S) |
| 1 | Wire bond strength (ND) | (883) 2023 | 100% | 100% | 100% |
| 2 | Wire bond strength (D) | (750) 2037, Con D | 4 devices | 4 devices | 8 devices |
| 3 | Die Shear | (750) 2017 | 4 devices | 4 devices | 8 devices |
| 4 | Internal Visual | (750) 2072 | Optional | 100% | 100% |
| 5 | Stabilization Bake | | Optional | Optional | Optional |
| 6 | Electrical Test @ 25°C | | 100% | 100% | 100% |
| 7 | Temp cycle (20 cycles @ -65°C to 150°C) | (750) 1051, Con F | 100% | 100% | 100% |
| 8 | Electrical Test @ 25°C | | 100% | 100% | 100% |
| 9 | Constant acceleration | (750) 2006, 5000g, Y1 | Optional | Optional | 100% |
| 10 | Electrical Test @ 25°C | | 100% | 100% | 100% |
| 11 | P.I.N.D | (750) 2052, Con A | N/A | N/A | 100% |
| 12 | Electrical Test @ 25°C | | N/A | N/A | 100% |
| 13 | Fine leak, Helium bomb, -Leak detector | (750) 1071 Con H1 | Optional | Optional | Optional |
| 14 | Gross leak, Liquid bomb, Bubble chamber | (750) 1071, Con C | Optional | Optional | Optional |
| 15 | Serialisation of devices | | N/A | N/A | 100% |
| 16 | Isolation 100% @ 25°C | (MIL-STD 202) 301 | 100% | 100% | 100% |
| 17 | Electrical Test @ 25°C | | 100% | 100% | 100% |
| 18 | Electrical Test @ 125°C | | 100% | 100% | 100% |
| 19 | Electrical Test @ -55°C | | 100% | 100% | 100% |
| 20 | Switching time @ 25°C | | 100% | 100% | 100% |
| 21 | HTRB (125°C) | (750) 1039, Con A (80% VDS) | 100% (48 hrs) | 100% (48 hrs) | 100% (48 hrs) |
| 22 | Electrical Test @ 25°C | | 100% (24 hrs) | 100% (24 hrs) | 100% (16 hrs) |
| 23 | Burn-In (125°C) | (750) 1039, Con B (80% VDS) | 100% (160 hrs) | 100% (160 hrs) | 100% (240 hrs) |
| 24 | Percentage defective allowable | Pre/post Burn-in electrical and delta at 25°C only | 100% @ 10% PDA | 100% @ 10% PDA | 100% @ 5% PDA |
| 25 | Electrical Test @ 25°C | | 100% (Group A, SG 2) | 100% (Group A, SG 2) | 100% (Group A, SG 2) |
| 26 | Electrical Test @ 125°C | | 100% (Group A, SG 3) | 100% (Group A, SG 3) | 100% (Group A, SG 3) |
| 27 | Electrical Test @ -55°C | | 100% (Group A, SG 3) | 100% (Group A, SG 3) | 100% (Group A, SG 3) |
| 28 | Switching time @ 25°C | | 100% (Group A, SG4) | 100% (Group A, SG4) | 100% (Group A, SG4) |
| 29 | Fine leak, Helium bomb, -Leak detector | (750) 1071 Con H1 | 100% | 100% | 100% |
| 30 | Gross leak, Liquid bomb, Bubble chamber | (750) 1071, Con C | 100% | 100% | 100% |
| 31 | Radiography | (750) 2076 | N/A | N/A | 100% |
| 32 | External Visual | (750) 2071 | N/A | N/A | 100% |

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# MIL-PRF 19500 TYPICAL QCI TESTING PROCESS FLOW

| Group | Sub Group | Parameters | TM | Quantity (accept number) | |
|---|---|---|---|---|---|
| | | | | JANS | JANTX, JANTXV |
| A (CI) | 1 | Visual and mechanical inspection | 750-2071 | 100% | 100% |
| | 2 | Static tests at +25°C | Datasheet | | |
| | 3 | Static tests at min and max. rated operating temp. | Datasheet | | |
| | 4 | Dynamic test at +25°C | Datasheet | | |
| | | (JANS) | | Large LOT (accept) | Small LOT (accept) |
| B (PI) | 1 | Physical dimension | 750-2066 | 22 (0) | 8 (0) |
| | 2 | Solderability | 750-2026 | 15 leads (0) | 6 leads (0) |
| | 3 | Temperature cycling (100 cycles) | 750-1051 | 22 (0) | 6 (0) |
| | | Hermetic seal (fine and gross leak) | 750-1071 | | |
| | | Electrical measurements | GRP-A-SG2 | | |
| | | Decap internal visual | 750-2075 | 6 (0) | 6 (0) |
| | | Bond strength | 750-2037 | 22 wires (0) or 11 (0) | 12 wires (0) or 6 (0) |
| | | SEM | 750-2077 | 11 (0) | 6 (0) |
| | | Die shear | 750-2017 | 11 (0) | 6 (0) |
| | 4 | Intermittent operation life (2000 cycles) | 750-1037 | 22 (0) | 12 (0) |
| | | Electrical measurements | GRP-A-SG2 | | |
| | | (JANTXV, JANTX) | | Large LOT (accept) | Small LOT (accept) |
| B (PI) | 1 | Solderability | 750-2026 | 15 leads (0) | 4 leads (0) |
| | 2 | Temperature cycling (45 cycles incl. screening) | 750-1051 | 22 (0) | 6 (0) |
| | | Hermetic Seal (fine and gross leak) | 750-1071 | | |
| | | Electrical measurements | GRP-A-SG2 | | |
| | 3 | Steady state op. life (340 Hrs) or intermittent op. life (2000 cycles) | 750-1026 or 750-1037 | 45 (0) | 12 (0) |
| | | Electrical measurements | GRP-A-SG2 | | |
| | 4 | Decap internal visual | 750-2075 | 1 (0) | 1 (0) |

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## MIL-PRF 19500 TYPICAL QCI TESTING PROCESS FLOW

| Group | Sub Group | Parameters | TM | Sample plan | Small LOT (accept) |
|---|---|---|---|---|---|
| C (PI) | 1 | Physical dimensions (Not Req. JANS) | 750-2066 | 15 (0) | 6 (0) |
| | 2 | Thermal shock (25 cycles, con B) | 750-1056 | 22 (0) | 6 (0) |
| | | Temperature cycling (45 cycles incl. screening) | 750-1051 | | |
| | | Terminal strength | 750-2036 | | |
| | | Hermetic seal (fine and gross leak) | 750-1071 | | |
| | | Electrical measurements | GRP-A-SG2 | | |
| | 3 | Constant acceleration (5000g, Y1 only) | 750-2006 | 22 (0) | 6 (0) |
| | | Electrical measurements | GRP-A-SG2 | | |
| | 6 | Steady state op. life (1000 Hrs) or intermittent op. life (6000 cycles) | 750-1026 or 750-1037 | 22 (0) | 12 (0) |
| | | Electrical measurements | GRP-A-SG2 | | |
| | 7 | Internal Gas Analysis - Moisture 10,000 ppmv limit | 750-1018 | 3 (0) | 3 (0) |

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## MIL-PRF 38534 TYPICAL QCI TESTING PROCESS FLOW

| Group | Sub Group | Parameters | Quantity (accept number) | | |
|---|---|---|---|---|---|
| | | | TM | K | H |
| A (CI) | 1 | Static tests at +25°C | Datasheet | 100% | 100% |
| | 2 | Static tests at max. rated operating temp. | Datasheet | 100% | 100% |
| | 3 | Static tests at min. rated operating temp. | Datasheet | 100% | 100% |
| | 9 | Switching tests at +25°C | Datasheet | 100% | 100% |
| | | | | | |
| B (PI) | 1 | Physical dimension | 883-2016 | 2 (0) | 2 (0) |
| | 4 | Internal visual and mechanical | 883-2014 | 1 (0) | 1 (0) |
| | 5 | Bond strength: Ultrasonic (on hotplate) | 883-2011 | 2 (0) | 2 (0) |
| | 6 | Die shear strength | 883-2019 | 2 (0) | 2 (0) |
| | 7 | Solderability | 883-2003 | 1 (0) | 1 (0) |
| | 8 | Seal: a. Fine, b. Gross | 883-1014 | N/A | 15 (0) |
| | | | | | |
| C (PI) | 1 | External visual | 883-2009 | 5 (0) | 5 (0) |
| | | Temperature Cycling | 883-1010 | 5 (0) | 5 (0) |
| | | Constant acceleration | 883-2001 | X | 5 (0) |
| | | Seal (fine and gross) | 883-1014 | 5 (0) | 5 (0) |
| | | PIND | 883-2020 | 5 (0) | 5 (0) |
| | | Visual examination | 883-1010 | 5 (0) | 5 (0) |
| | | End-point electrical | GRP-A | 5 (0) | 5 (0) |
| | 2 | Steady-state life test | 883-1005 | 22 (0) or 5 (0) | 22 (0) or 5 (0) |
| | | End-point electrical | GRP-A | 22 (0) or 5 (0) | 22 (0) or 5 (0) |
| | 3 | Internal gas analysis<br>Moisture 10,000 ppmv limit | 883-1018 | 3 (0) or 5 (1) | 3 (0) or 5 (1) |
| | | | | | |
| D (PI) | 1 | Thermal shock | 883-1011 | 5 (0) | 5 (0) |
| | | Stabilization bake | 883-1008 | 5 (0) | 5 (0) |
| | | Lead integrity | 883-2004 | 1 (0) | 1 (0) |
| | | Seal: a. Fine, b. Gross | 883-1014 | 5 (0) | 5 (0) |

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**Summary of key differences between MIL-PRF 19500 and MIL-PRF 38534 for space level testing:**

| | MIL-PRF 19500 - JANS | MIL-PRF 38534 – Class K |
|---|---|---|
| No. of Operation (Screening) Steps | 31 | 33 |
| Optional Hermeticity Testing | Occurs post P.I.N.D | Occurs post Internal Visual |
| Temp cycle – No. of Temp Cycles | 20 | 10 |
| Acceleration - Amount of g force | 5000g | 3000g |
| HTRB – No. of hours | 48 | 96 |
| Burn-in – No. of hours | 240 hrs in one successive burn-in | 320 hrs (2 x 160 hrs with interim electrical) |
| PDA post burn-in | 5% after 240 hrs burn-in | 2% after second 160 hrs burn-in |

# DISCLAIMER

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