

**PART NUMBER**

**CSMR140**

**COMPONENT SPECIFICATION**

**ISSUE 9**



## Component Specification for Ceramic Hermetically Sealed, Radiation Hard Optically Coupled Solid State Relay

Features	Applications
<ul style="list-style-type: none"> <li>▪ Compact Isolation Solid State Switches</li> <li>▪ Continuous Output Current of 0.8A</li> <li>▪ 3A Output Surge</li> <li>▪ High Level of Transient Immunity</li> <li>▪ Optically Coupled between Input and Output</li> <li>▪ Space/Military Screening available</li> <li>▪ Full Military temperature range -55°C to +125°C</li> </ul>	<ul style="list-style-type: none"> <li>▪ Space equipment and systems</li> <li>▪ Military equipment and hi-reliability systems</li> <li>▪ Aircraft Controls</li> <li>▪ Electromechanical and Solid State Relay Replacement</li> <li>▪ Computer Systems</li> <li>▪ Motor Driver</li> <li>▪ H Bridge Driver</li> </ul>

### DESCRIPTION

The CSMR140 is a power MOSFET optocoupler housed in a 4 Pin LCC package, designed for applications where independent switches with radiation-tolerant performance are necessary. With 1000 V<sub>DC</sub> isolation between input/output isolated relay, the CSMR140 is well-suited for solid-state relay applications. Its performance is rated for the full military temperature range, making it ideal for demanding environments.

Functionally, the CSMR140 acts as (Single Pole Single Throw), normally open (2 Form A) solid-state relay. The relay is activated by an input current, typically driven by a standard TTL device. The input current biases an AlGaAs emitter that is optically coupled to an integrated diode array, which in turn powers control circuitry to operate the output power MOSFET.

The device is available with screening in accordance with MIL-PRF-38534, Class K/H, or custom screening options or as COTS. The lead options support both through-hole and surface-mount assemblies, with gold-plated leads being standard, though other lead finishes are available.

#### Key Features:

- **Radiation Tolerant:** While the device contains radiation-hardened components, the specific radiation hardness must be determined through lot-specific testing,
- **High Voltage Isolation:** 1000 V<sub>DC</sub> isolation between input/output and the relays, ensuring robust performance in high-voltage environments.
- **Versatile Packaging:** Supports surface-mount assembly, with various lead finishes available.

This single MOSFET optocoupler is suitable for military and aerospace applications where high reliability, radiation tolerance, and solid-state relay functionality are required.



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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	January 2017	First issue
2	November 2018	Updated Quality Management Section. Removed IECQ Logos.
3	January 2021	Removed Screening and Group Testing Information
4	August 2022	Updated Formatting
5	September 2022	Updated Functional Diagram
6	February 2023	Updated Electrical data
7	April 2023	Updated Functional Diagram
8	August 2024	Correction on test parameters and Package details
9	September 2024	Updated Template, Functional Diagrams and Added Screening Flow

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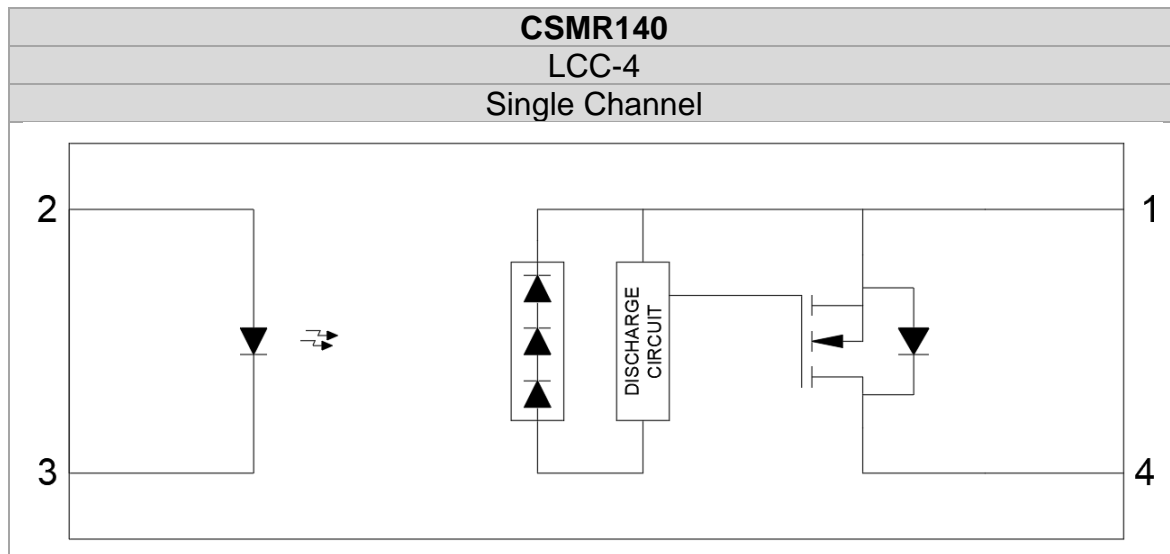
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## PACKAGE STYLES AND CONFIGURATION OPTIONS

Package	4-Pin LCC
Lead Style	-
Channels	1
Common Channel Wiring	-
Isocom Part Number and Options	
Commercial	CSMR140
Defense Screen Level	CSMR140/L2
Space Screen Level	CSMR140/L2S
Standard Gold Plate Finish	Gold Plate
Solder Dipped	Option #20

## FUNCTIONAL DIAGRAMS



## TRUTH TABLE

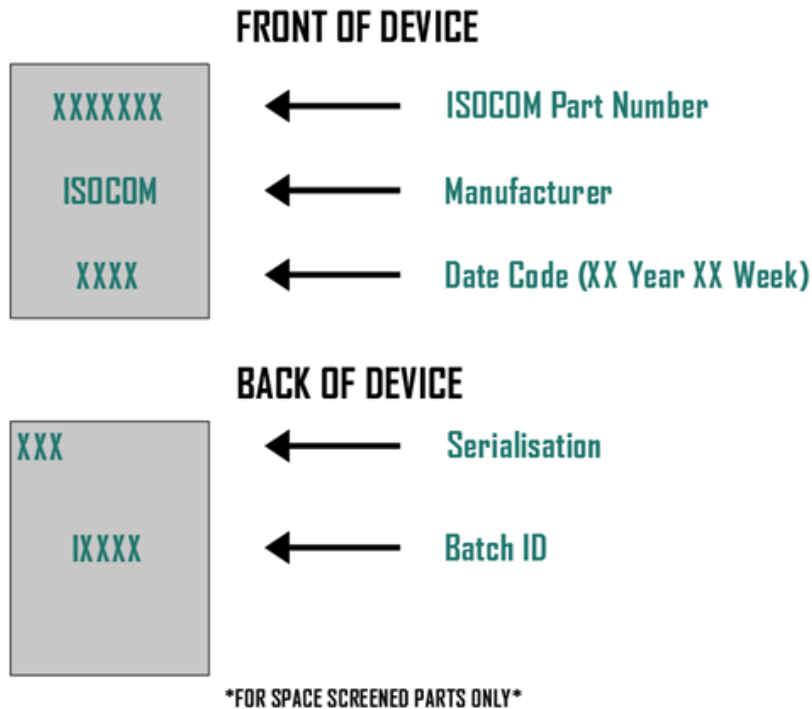
CSMR140 Truth Table	
INPUT	OUTPUT
HIGH	CLOSED
LOW	OPEN

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## DEVICE MARKING



## ABSOLUTE MAXIMUM RATINGS

$T_A = 25^\circ\text{C}$  U.O.S

Storage Temperature	-65°C to +150°C
Operating Temperature – $T_A$	-55°C to +125°C
Junction Temperature – $T_J$	+150°C
Lead Soldering Temperature (for 10 seconds)	260°C (1.6mm below seating plane)
Average Input Current – $I_F$	20 mA
Peak Repetitive Input Current – $I_{Fpk}$	40 mA (pulse width < 100mS; duty cycle < 50%)
Peak Surge Input Current – $I_{Fpk\ surge}$	100 mA (pulse width < 0.2mS; duty cycle < 0.1%)
Continuous Output Current per relay – $I_O$	0.8 A
Peak Surge Output Current – $I_{Opk\ surge}$	3.0 A (pulse width < 10ms)
Output Voltage – $V_O$	100 V <sub>DC</sub>
Input-to-Output Isolation Voltage	↑1000 V <sub>DC</sub>

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## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Max	Units
Input Current (ON)	$I_{F(ON)}$	10	20	mA
Input Voltage (OFF)	$V_{F(OFF)}$	0	0.6	V <sub>DC</sub>
Operating Temperature	$T_A$	-55	+125	°C

## ELECTRICAL CHARACTERISTICS

$T_A = -55$  to  $+125^\circ\text{C}$  U.O.S

Parameter	Symbol	Conditions	Limits		Unit
			Min	Max	
Output Withstand Voltage	$V_{O(OFF)}$	$V_{F(OFF)} = 0.6\text{V}$ , $I_o = 10\mu\text{A}$	100	–	V
Output On-Resistance	$R(ON)$	$I_{F(ON)} = 10\text{mA}$ , $I_o = 800\text{mA}$ , pulse duration $\leq 30\text{ms}$ , duty cycles $< 10\%$	–	0.9	$\Omega$
Output Leakage Current	$I_o(OFF)$	$V_{F(OFF)} = 0.6\text{V}$ , $V_o = 100\text{V}$	–	10	$\mu\text{A}$
Input Forward Voltage	$V_{F(ON)}$	$I_{F(ON)} = 10\text{mA}$	1.0	1.7	V
Input Reverse Breakdown Voltage	$V_R$	$I_R = 10\mu\text{A}$	5.0	–	V
Input-Output Isolation Current	$I_{I-O}$	$V_{I-O} = 1000\text{Vdc}$ , $t = 5\text{s}$ , $R_H \leq 45\%$ , $T_A = 25^\circ\text{C}$	–	1.0	$\mu\text{A}$
Turn-On Time	$T(ON)$	$I_{F(ON)} = 10\text{mA}$ , $I_o = 800\text{mA}$ , pulse duration $\leq 30\text{ms}$ , duty cycles $< 10\%$	–	6.0	ms
Turn-Off Time	$T(OFF)$	$I_{F(ON)} = 10\text{mA}$ , $I_o = 800\text{mA}$ , pulse duration $\leq 30\text{ms}$ , duty cycles $< 10\%$	–	2.0	ms

### Notes

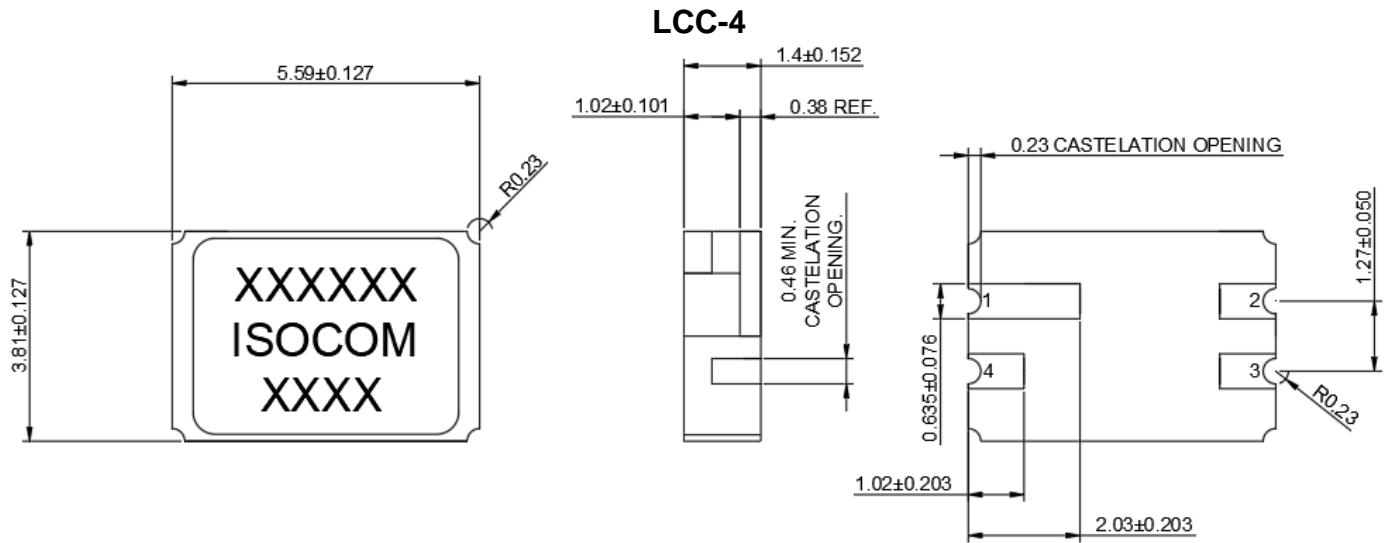
1. Maximum average current rating where the case temperature ( $T_C$ ) is maintained below  $120^\circ\text{C}$ .
2. During the pulsed  $R(ON)$  measurement ( $I_o$  duration  $< 30\text{ms}$ ), ambient ( $T_A$ ) and case temperature ( $T_C$ ) are equal.
3. This is a momentary withstand test, not a continuous operating condition.
4. Typical junction to case thermal resistance ( $R_{\theta JC}$ ) for the device is  $15^\circ\text{C/W}$ , where the case temperature ( $T_C$ ) is measured at the centre of the package bottom.

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## OUTLINE DRAWINGS



## PIN OUT INFORMATION

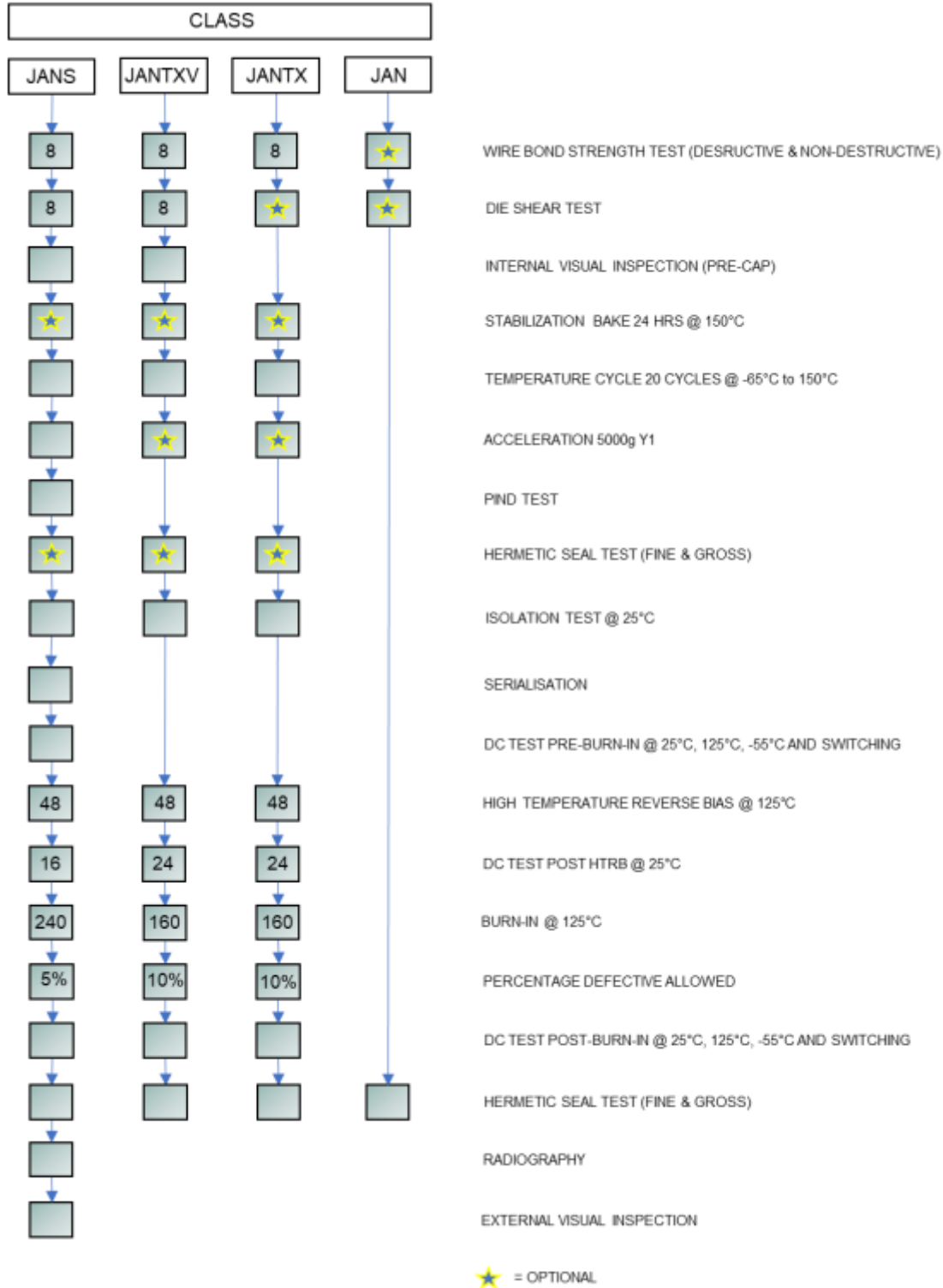
Pin Number	Pin Function
1	Source
2	Anode
3	Cathode
4	Drain

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## 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)
	4	SEM	750-2077	11 (0)	6 (0)
		Die shear	750-2017	11 (0)	6 (0)
		Intermittent operation life (2000 cycles) Electrical measurements	750-1037 GRP-A-SG2	22 (0)	12 (0)
		(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		
	3	Electrical measurements	GRP-A-SG2		
		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**

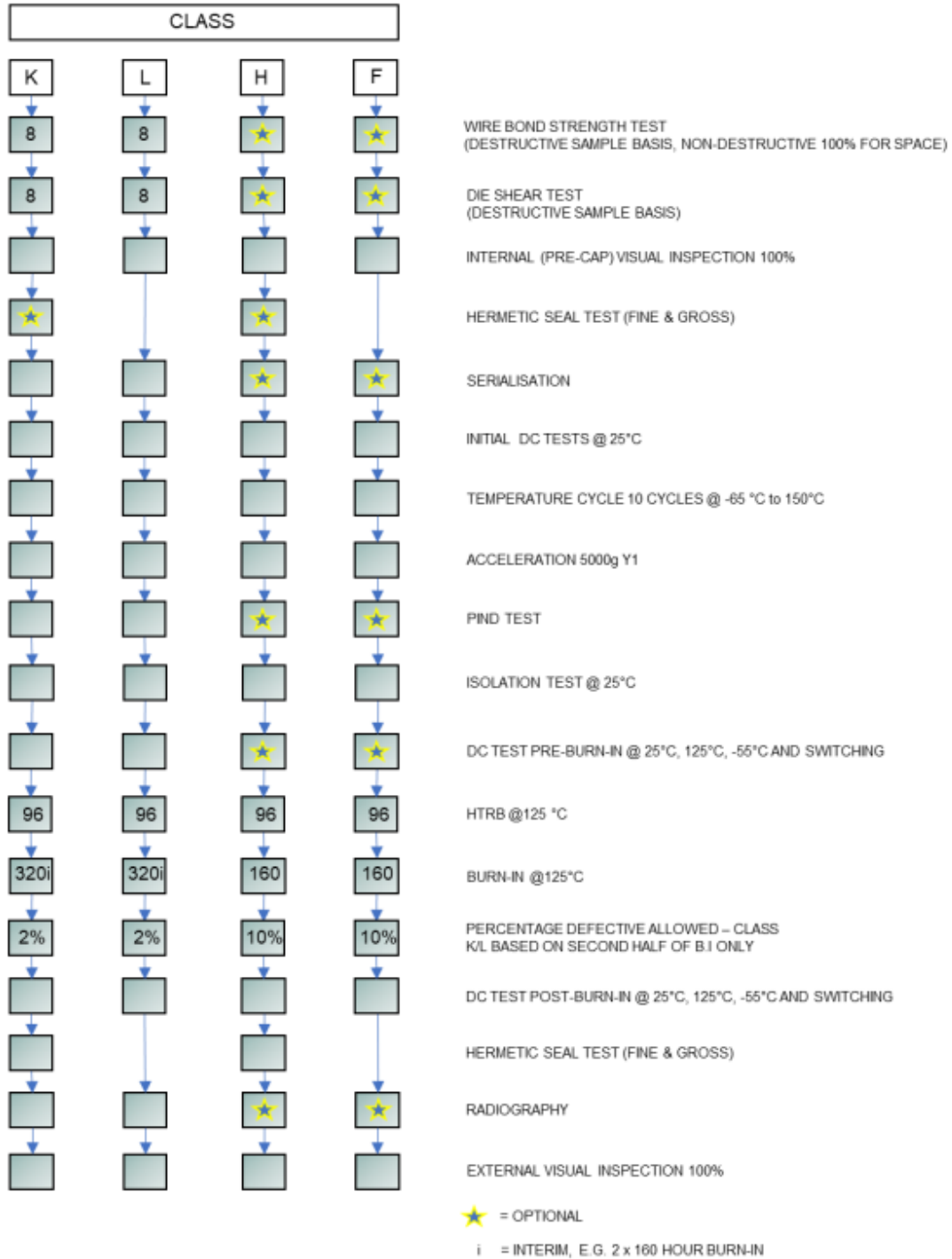
Group	Sub Group	Parameters	TM	Sample plan	Small LOT (accept)
C (PI)	1	Physical dimensions (Not Req. JANS)	750-2066	15 (0)	6 (0)
	2	Thermal shock (25 cycles, con B)	750-1056	22 (0)	6 (0)
		Temperature cycling (45 cycles incl. screening)	750-1051		
		Terminal strength	750-2036		
		Hermetic seal (fine and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

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## SCREENING IN ACCORDANCE WITH MIL-PRF 38534



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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%

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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)
	2	End-point electrical	GRP-A	5 (0)	5 (0)
		Steady-state life test	883-1005	22 (0) or 5 (0)	22 (0) or 5 (0)
	3	End-point electrical	GRP-A	22 (0) or 5 (0)	22 (0) or 5 (0)
		Internal gas analysis 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	32	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

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Bracken Hill Business Park  
Peterlee  
County Durham  
SR8 2RR  
United Kingdom

W – [www.isocom.uk.com](http://www.isocom.uk.com)  
E – [sales@isocom.uk.com](mailto:sales@isocom.uk.com)  
T - +44 (0) 191 416 6546



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