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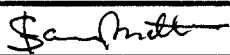

**OPTO-ISOLATORS**

**BASED ON TYPES 3C91 AND 3C92**

**ESA/SCC Detail Specification No. 5401/001**





**space components  
coordination group**

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 4	May 1998		


**DOCUMENTATION CHANGE NOTICE**

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 3 and incorporates all modifications defined in Revisions 'A', 'B', 'C', 'D' and 'E' to Issue 3 and the changes agreed in the following DCR's:-		
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		Para. 4.7.4	: New Para. 4.7.4 added	221471
		Table 4(a)	: Title amended	221471
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		Table 6	: Numbering aligned with Table 2 and format with Table 4	221471

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**1. GENERAL****1.1 SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for Opto-Isolators, based on Types 3C91 and 3C92. It shall be read in conjunction with ESA/SCC Generic Specification No. 5000, the requirements of which are supplemented herein.

**1.2 COMPONENT TYPE VARIANTS**

Variants of the basic type transistors specified herein, which are also covered by this specification, are given in Table 1(a).

**1.3 MAXIMUM RATINGS**

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the opto-isolators specified herein are scheduled in Table 1(b).

**1.4 PARAMETER DERATING INFORMATION**

The derating information applicable to the opto-isolators specified herein is shown in Figure 1.

**1.5 PHYSICAL DIMENSIONS**

The physical dimensions of the opto-isolators specified herein are shown in Figure 2.

**1.6 FUNCTIONAL DIAGRAM**

The functional diagram showing lead identification, of the opto-isolators specified herein, is shown in Figure 3.

**2. APPLICABLE DOCUMENTS**

The following documents form part of this specification and shall be read in conjunction with it:-

- (a) ESA/SCC Generic Specification No. 5000 for Discrete Semiconductor Components.
- (b) MIL-STD-202, Test Methods for Electronic and Electrical Component Parts.
- (c) MIL-STD-750, Test Methods and Procedures for Semiconductor Devices.
- (d) MIL-STD-883, Test Methods and Procedures for Microelectronics.

**3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS**

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESA/SCC Basic Specification No. 21300 shall apply.



**TABLE 1(a) - TYPE VARIANTS**

(1) VARIANT	(2) BASED ON TYPE	(3) I <sub>C</sub> (mA) AT +22°C	(4) I <sub>C</sub> (mA) AT -55°C	(5) I <sub>C</sub> (mA) AT (NOTE 1)	(6) 3dB BANDWIDTH (kHz)	(7) LEAD MATERIAL AND FINISH
01	3C91B	2.0	1.5	2.0	100	D2
02	3C91C	4.0	3.0	4.0	100	D2
03	3C92B	2.0	1.5	2.0	100	D2
04	3C92C	4.0	3.0	4.0	100	D2
05	3C91C1	4.0	3.0	4.0	90	D2
06	3C92C1	4.0	3.0	4.0	90	D2

**NOTES**

1. These values are applicable after performance of environmental and endurance tests (Table 6).

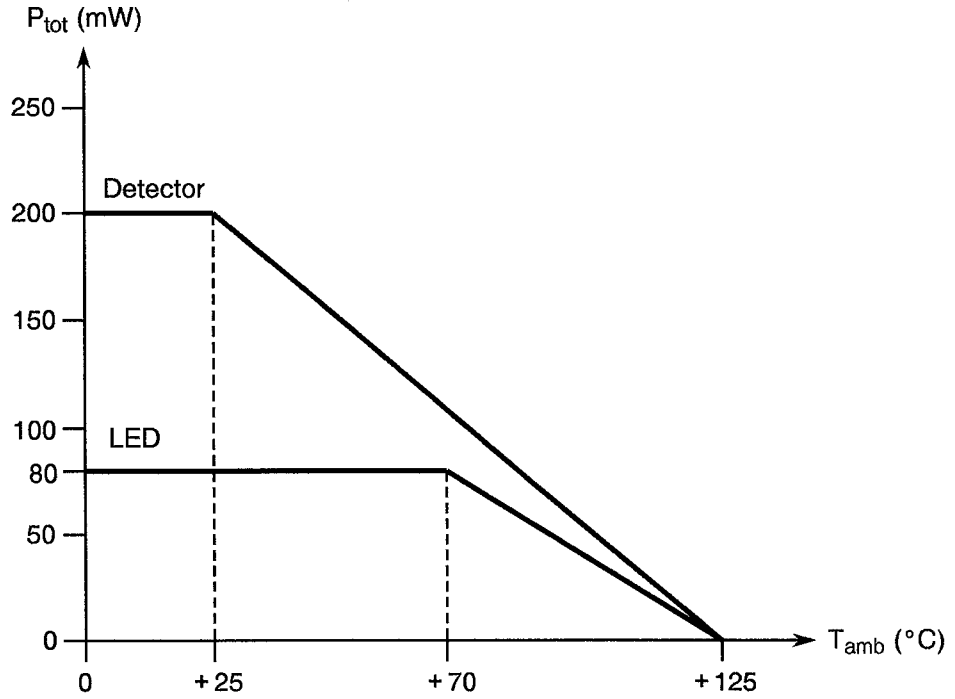
**TABLE 1(b) - MAXIMUM RATINGS**

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Input to Output Voltage	V <sub>IN-OUT</sub>	±500	V	
2	Input Diode Reverse Voltage	V <sub>R</sub>	7.0	V	
3	Input Diode Forward Current	I <sub>F</sub>	50	mA	
4	Input Diode Surge Forward Current	I <sub>FS</sub>	3.0	A	Non-repetitive t <sub>p</sub> = 100µs
5	Transistor Collector-Emitter Voltage	V <sub>CE</sub>	50	V	
6	Transistor Collector Current	I <sub>C</sub>	50	A	
7	Total Power Dissipation	P <sub>tot1</sub>	230	mW	T <sub>amb</sub> ≤ +25°C
8	LED Dissipation	P <sub>tot2</sub>	80	mW	T <sub>amb</sub> ≤ +70°C (Note 1)
9	Detector Dissipation	P <sub>tot3</sub>	200	mW	T <sub>amb</sub> ≤ +25°C (Note 1)
10	Operating Temperature Range	T <sub>op</sub>	-55 to +125	°C	T <sub>amb</sub>
11	Storage Temperature Range	T <sub>stg</sub>	-55 to +125	°C	
12	Soldering Temperature	T <sub>sol</sub>	+260	°C	Note 2
13	Thermal Resistance LED Detector	R <sub>TH(J-A)</sub>	600 500	°C/W	

**NOTES**

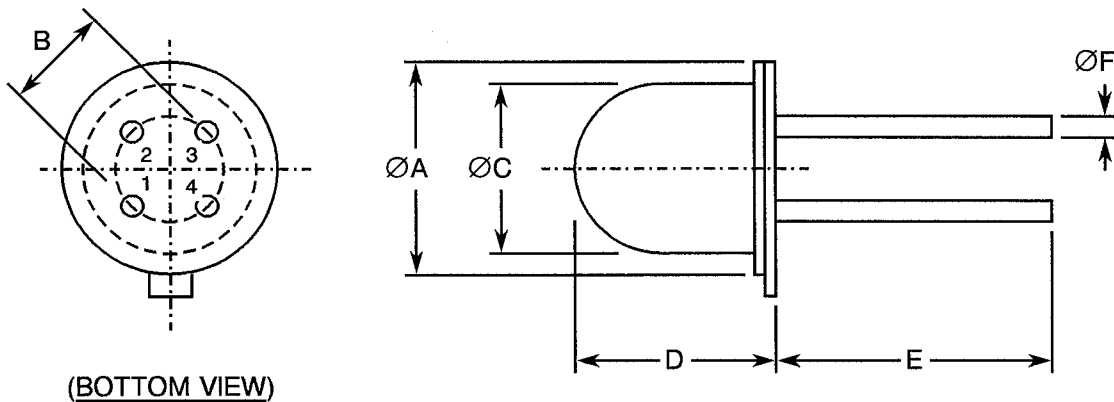
1. For derating with temperature, see Figure 1.
2. Duration 5 seconds maximum at a distance of not less than 1.5mm from the device body and the same lead shall not be resoldered until 3 minutes have elapsed.

**FIGURE 1 - PARAMETER DERATING INFORMATION**



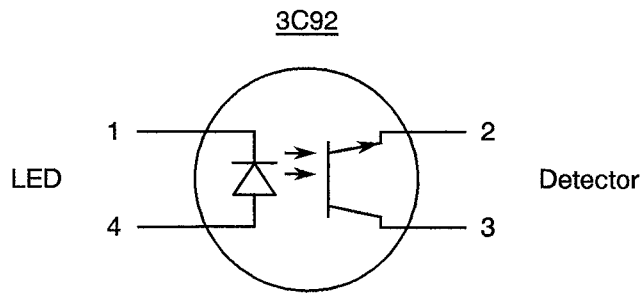
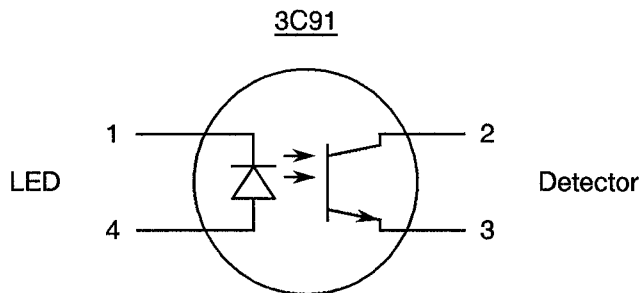
Power Dissipation versus Temperature

**FIGURE 2 - PHYSICAL DIMENSIONS**





SYMBOL	MILLIMETRES	
	MIN.	MAX.
ØA	5.33	5.86
B	2.37	2.72
ØC	4.54	4.97
D	4.33	5.35
E	12.75	-
ØF	0.41	0.48

**FIGURE 3 - FUNCTIONAL DIAGRAM**





		<p style="text-align: center;">ESA/SCC Detail Specification No. 5401/001</p>	<p>PAGE 9 ISSUE 4</p>
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#### 4. REQUIREMENTS

##### 4.1 GENERAL

The complete requirements for procurement of the opto-isolators specified herein are stated in this specification and ESA/SCC Generic Specification No. 5000. Deviations from the Generic Specification, applicable to this specification only, are listed in Para. 4.2.

Deviations from the applicable Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESA/SCC requirements and do not affect the components' reliability, are listed in the appendices attached to this specification.

##### 4.2 DEVIATIONS FROM GENERIC SPECIFICATION

###### 4.2.1 Deviations from Special In-process Controls

None.

###### 4.2.2 Deviations from Final Production Tests (Chart II)



- (a) Para. 9.2.2, Die Shear Test: If the die area is smaller than  $1.5 \times 10^{-4}$  minimum forces as given in MIL-STD-883, Method 2019, shall apply.
- (b) Para. 9.10, External Visual Inspection: Shall be performed as specified in ESA/SCC Basic Specification No. 2055000. However, cracks in glass seal within the distance of one lead diameter from the lead, collection of bubbles which cannot be separated from each other or whose spatial distribution cannot be determined, shall not be cause for rejection.

###### 4.2.3 Deviations from Burn-in and Electrical Measurements (Chart III)

- (a) The burn-in test shall be performed in 2 steps as specified below. The testing sequence shall be:-
  - (1) Transistor : Para. 7.1.1(a), High temperature reverse bias burn-in for full specified time with diode not operating, in accordance with Table 5(a) of this specification.
  - (2) LED : Para. 7.1.1(b), Power burn-in for full specified time with transistor not operating, in accordance with Table 5(b) of this specification.
- (b) Para. 9.10, External Visual Inspection: Shall be performed as specified in ESA/SCC Basic Specification No. 2055000. However, cracks in glass seal within the distance of one lead diameter from the lead, collection of bubbles which cannot be separated from each other or whose spatial distribution cannot be determined, shall not be cause for rejection.
- (c) Para. 9.12, Radiographic Inspection: Shall be performed on a 100% basis as specified in ESA/SCC Basic Specification No. 2095000, Figure 1 - Configuration C - Views 3, 4 and 5.

###### 4.2.4 Deviations from Qualification Tests (Chart IV)

- (a) Para. 9.2.4, Die Shear Test: Shall be performed, if die area is smaller than  $1.5 \times 10^{-4}$  minimum forces as given in MIL-STD-883, Method 2019 shall apply.
- (b) Para. 9.10, External Visual Inspection: Shall be performed as specified in ESA/SCC Basic Specification No. 2055000. However, cracks in glass seal within the distance of one lead diameter from the lead, collection of bubbles which cannot be separated from each other or whose spatial distribution cannot be determined, shall not be cause for rejection.
- (c) Para. 9.20.1, Operating Life Test: Shall be performed on 50% of the parts defined in Subgroup IV as specified in Table 5(a) of this specification and on the other 50% as specified in Table 5(b) of this specification.

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#### 4.2.5 Deviations from Lot Acceptance Tests (Chart V)

- (a) Para. 9.10, External Visual Inspection: Shall be performed as specified in ESA/SCC Basic Specification No. 2055000. However, cracks in glass seal within the distance of one lead diameter from the lead, collection of bubbles which cannot be separated from each other or whose spatial distribution cannot be determined, shall not be cause for rejection.
- (b) Para. 9.20.2, Operating Life Test: Shall be performed on 50% of the parts defined in LAT Level 2 as specified in Table 5(a) of this specification and on the other 50% as specified in Table 5(b) of this specification.

#### 4.3 MECHANICAL REQUIREMENTS

##### 4.3.1 Dimension Check

The dimensions of the opto-isolators specified herein shall be checked. They shall conform to those shown in Figure 2.

##### 4.3.2 Weight

The maximum weight of the opto-isolators specified herein shall be 0.3 grammes.

##### 4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Section 9 of ESA/SCC Generic Specification No. 5000. The test conditions shall be as follows:-

Test Condition: 'E', Lead Fatigue.  
 Applied Force: 5.0 Newtons.

#### 4.4 MATERIALS AND FINISHES

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the opto-isolators specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.

##### 4.4.1 Case

Can : Gold-plated Nickel.  
 Header : Gold-plated Kovar.

##### 4.4.2 Lead Material and Finish

The lead material shall be Type 'D' with Type '2' finish in accordance with the requirements of ESA/SCC Basic Specification No. 23500.

#### 4.5 MARKING

##### 4.5.1 General

The marking of all components delivered to this specification shall be in accordance with the requirements of ESA/SCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accomodate all of the marking specified, as much as space permits shall be marked and the marking information, in full, shall accompany the component in its primary package.

The information to be marked and the order of precedence, shall be as follows:-

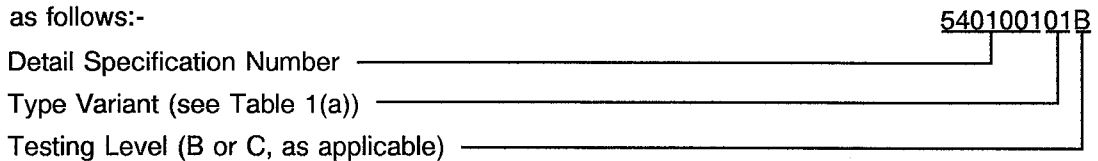
- (a) Lead Identification.
- (b) The SCC Component Number.
- (c) Traceability Information.

4.5.2 Lead Identification

Lead identification shall be as shown in Figures 2 and 3.

4.5.3 The SCC Component Number

Each component shall bear the SCC Component Number which shall be constituted and marked as follows:-



4.5.4 Traceability Information

Each component shall be marked in respect of traceability information in accordance with the requirements of ESA/SCC Basic Specification No. 21700.

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. Unless otherwise specified, measurements shall be performed at  $T_{amb} = +22 \pm 3$  °C.

4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Table 3.

4.6.3 Circuits for Electrical Measurements

Circuits for use in performing the electrical measurements listed in Tables 2 and 3 of this specification are shown in Figure 4.

4.7 BURN-IN TESTS

4.7.1 Parameter Drift Values

The parameter drift values applicable to burn-in are specified in Table 4 of this specification. Unless otherwise stated, measurements shall be performed at  $T_{amb} = +22 \pm 3$  °C. The parameter drift values ( $\Delta$ ) applicable to the parameters scheduled shall not be exceeded. In addition to these drift value requirements, the appropriate limit value specified for a given parameter in Table 2 shall not be exceeded.

4.7.2 Conditions for High Temperature Reverse Bias Burn-in

The requirements for high temperature reverse bias burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5000. The conditions for high temperature reverse bias burn-in shall be as specified in Table 5(a) and Para. 4.2.3 of this specification.

4.7.3 Conditions for Power Burn-in

The requirements for power burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5000. The conditions for power burn-in shall be as specified in Table 5(b) and Para. 4.2.3 of this specification.

4.7.4 Electrical Circuit for High Temperature Reverse Bias Burn-in

A circuit for use in performing the high temperature reverse bias burn-in tests is shown in Figure 5(a) of this specification.

4.7.5 Electrical Circuit for Power Burn-in

A circuit for use in performing the power burn-in tests is shown in Figure 5(b) of this specification.

**TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - d.c. PARAMETERS**

No.	CHARACTERISTICS (N.B.)	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN	MAX	
1	Forward Voltage 1	$V_{F1}$	MIL-STD-750 Method 4011	$I_F = 2.0\text{mA}$	-	1.3	V
2	Forward Voltage 2	$V_{F2}$	MIL-STD-750 Method 4011	$I_F = 50\text{mA}$	-	1.8	V
3	Breakdown Voltage	$V_{BR}$	MIL-STD-750 Method 4021	$I_R = 0.1\text{mA}$	7.0	-	V
4	Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	MIL-STD-750 Method 3011	$I_C = 10\text{mA}$	50	-	V
5	Dark Current	$I_{CEO}$	MIL-STD-750 Method 3036	$V_{CE} = 5.0\text{V}$ $I_F = 0\text{mA}$	-	50	nA
6	Output Current	$I_C$	MIL-STD-750 Method 3036	$V_{CE} = 5.0\text{V}$ $I_F = 10\text{mA}$	Note 1	-	mA
7	Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	MIL-STD-750 Method 3030	$I_C = 2.0\text{mA}$ $I_F = 50\text{mA}$	-	0.4	V
8	Isolation Voltage 1	$V_{IN} - V_{OUT}$	MIL-STD-202 Method 301	$t = 60\text{s}$ Notes 2 and 4	500	-	V
9	Isolation Voltage 2	$V_{IN} - V_{OUT}$	MIL-STD-202 Method 301	$t = 5.0\text{s}$ Note 3	800	-	V

**TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - a.c. PARAMETERS**

No.	CHARACTERISTICS (N.B.)	SYMBOL	MIL-STD-750 TEST METHOD	TEST FIG.	TEST CONDITIONS (NOTE 4)	LIMITS		UNIT
						MIN	MAX	
10	Rise Time	$t_r$	-	4(a)	$R_L = 100\Omega$ $I_C = 2.0\text{mA}$ $V_{CE} = 5.0\text{V}$	-	5.0	$\mu\text{s}$
11	Fall Time	$t_f$	-	4(a)	$R_L = 100\Omega$ $I_C = 2.0\text{mA}$ $V_{CE} = 5.0\text{V}$	-	5.0	$\mu\text{s}$
12	3dB Bandwidth	$f_{3dB}$	-	4(b)	$R_L = 100\Omega$ $I_C = 2.0\text{mA}$ $V_{CE} = 5.0\text{V}$	Note 5	-	kHz

**N.B.**

Test Nos. 1 to 3 relate to LED, Test Nos. 4 to 5 relate to Detector, Test Nos. 6 to 12 relate to Coupled Device.

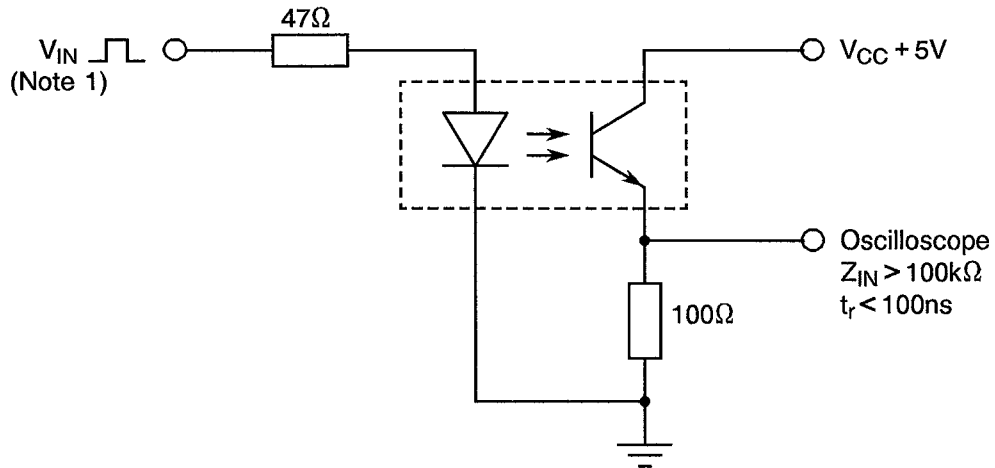
**NOTES**

1. See Column 3 of Table 1(a).
2. Measurement shall be performed after burn-in only.
3. Measurement shall be performed during final production tests only.
4. Measurements shall be performed on a sample basis, LTPD7 or less.
5. See Column 6 of Table 1(a).



**FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS**

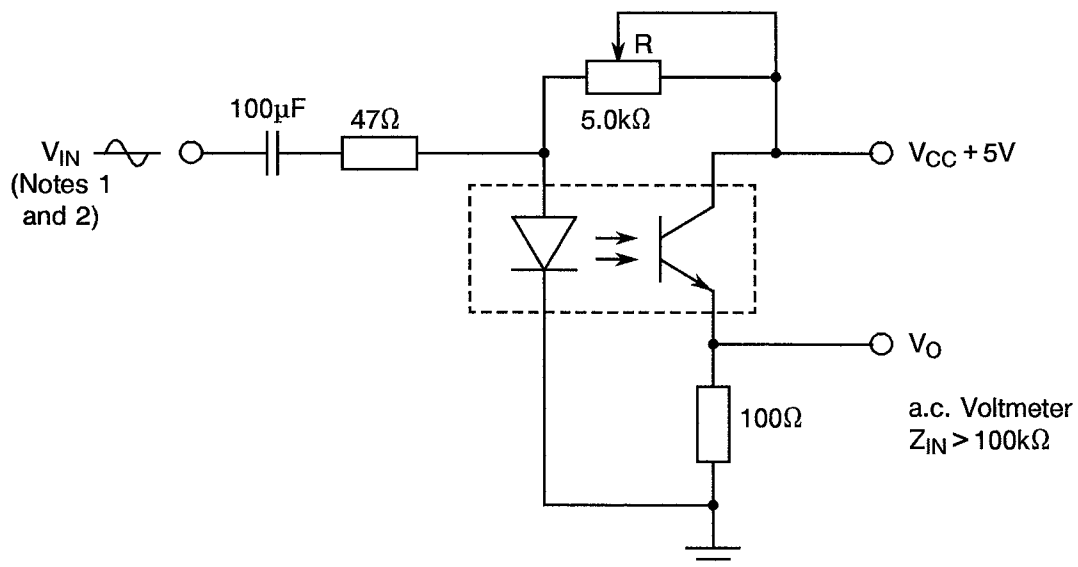
**FIGURE 4(a) - SWITCHING TIME TEST CIRCUIT**



**NOTES**

1.  $V_{IN}$  conditions:  $t_r < 10\text{ns}$ ,  $t_p = 100\mu\text{s}$ ,  $f = 100\text{Hz}$ ,  $Z_g = 50\Omega$ .

**FIGURE 4(b) - FREQUENCY TEST CIRCUIT**



**NOTES**

1.  $Z_g = 50$  to  $100\Omega$ .
2. Adjust R for  $I_C = 2.0\text{mA}$   
Adjust  $V_{IN}$  for  $V_O = 10\text{mV}$  a.c. at  $10\text{kHz}$ .  
Increase f until  $V_O = 7.0\text{mV} \approx f_{3\text{dB}}$ .

**TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES**

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN	MAX	
5	Dark Current	$I_{CEO}$	3036	$T_{amb} = +125^{\circ}C$ $V_{CE} = 5.0V$ $I_F = 0mA$	-	20	$\mu A$
6	Output Current	$I_C$	3036	$T_{amb} = -55^{\circ}C$ $V_{CE} = 5.0V$ $I_F = 10mA$	Note 1		mA

**NOTES**

- See Column 4 of Table 1(a).

**TABLE 4(a) - PARAMETER DRIFT VALUES FOR HIGH TEMPERATURE REVERSE BIAS BURN-IN**

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS ( $\Delta$ )	UNIT
5	Dark Current	$I_{CEO}$	As per Table 2	As per Table 2	10 or (1) $\pm 100$	nA  %

**NOTES**

- Whichever is greater, referred to the initial value.

**TABLE 4(b) - PARAMETER DRIFT VALUES FOR POWER BURN-IN**

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS ( $\Delta$ )	UNIT
6	Output Current	$I_C$	As per Table 2	As per Table 2	$\pm 10$	%

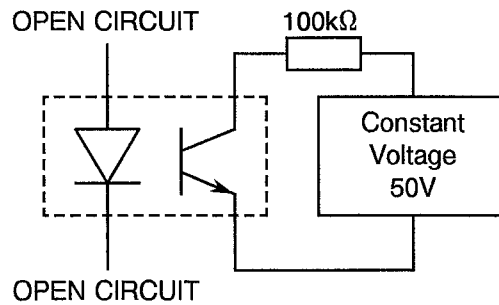
**TABLE 5(a) - CONDITIONS FOR HIGH TEMPERATURE REVERSE BIAS BURN-IN**

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	$T_{amb}$	+ 125( + 0 - 5)	°C
2	Diode Forward Current	$I_F$	0	mA
3	Collector-Emitter Voltage	$V_{CE}$	50	V
4	Duration	t	72	Hrs

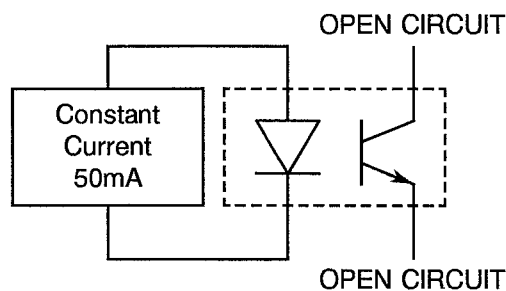
**TABLE 5(b) - CONDITIONS FOR POWER BURN-IN**

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	$T_{amb}$	+ 22 ± 3	°C
2	Diode Forward Current	$I_F$	50	mA
3	Collector-Emitter Voltage	$V_{CE}$	0	V

**FIGURE 5(a) - ELECTRICAL CIRCUIT FOR HIGH TEMPERATURE REVERSE BIAS BURN-IN**



**FIGURE 5(b) - ELECTRICAL CIRCUIT POWER BURN-IN**





- 4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 5000)
- 4.8.1 Electrical Measurements on Completion of Environmental Tests  
The parameters to be measured on completion of environmental tests are scheduled in Table 2. Unless otherwise stated, the measurements shall be performed at  $T_{amb} = +22 \pm 3$  °C.
- 4.8.2 Electrical Measurements at Intermediate Points and on Completion of Endurance Tests  
The parameters to be measured at intermediate points and on completion of endurance testing are scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at  $T_{amb} = +22 \pm 3$  °C.
- 4.8.3 Conditions for Operating Life Tests (Part of Endurance Testing)  
The requirements for operating life testing are specified in Section 9 of ESA/SCC Generic Specification No. 5000. The conditions for operating life testing shall be as specified in Paras. 4.2.4 or 4.2.5 of this specification.
- 4.8.4 Electrical Circuits for Operating Life Tests  
The circuits for performance of the operating life tests shall be the same as shown in Figures 5(a) and 5(b) for high temperature reverse bias and power burn-ins.
- 4.8.5 Conditions for High Temperature Storage Test (Part of Endurance Testing)  
The requirements for the high temperature storage test are specified in ESA/SCC Generic Specification No. 5000. The temperature to be applied shall be the maximum storage temperature specified in Table 1(b) of this specification.



**TABLE 6 - ELECTRICAL MEASUREMENTS AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING**


No.	CHARACTERISTICS (N.B.)	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
2	Forward Voltage 2	$V_{F2}$	As per Table 2	As per Table 2	-	1.8	V
3	Breakdown Voltage	$V_{BR}$	As per Table 2	As per Table 2	7.0	-	V
5	Dark Current	$I_{CEO}$	As per Table 2	As per Table 2	-	50	nA
6	Output Current	$I_C$	As per Table 2	As per Table 2	Note 1	-	mA
7	Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	As per Table 2	As per Table 2	-	0.4	V
8	Isolation Voltage 1	$V_{IN} - V_{OUT}$	As per Table 2	As per Table 2	500	-	V

**N.B.**

Test Nos. 2 to 3 relate to LED, Test No. 5 relates to Detector, Test Nos. 6 to 8 relate to Coupled Device.

**NOTES**

1. See Column 5 of Table 1(a).

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**APPENDIX 'A'**

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AGREED DEVIATIONS FOR HAFO (S)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Para. 4.2.2	(a) Para. 9.1, Internal (pre-encapsulation) Visual Inspection: Shall be performed according to HAFO Document No. 00075-00-4, Visual Inspection, Level 'A' for the Photo Diode (LED) and according to HAFO Document No. IF 00037-004 for the visual inspection of the Photo Transistor (Detector).