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Pages 1 to 18

**LIGHT EMITTING DIODE, INFRARED,
GaAIAs, HERMETIC, BASED ON TYPE OP224
ESA/SCC Detail Specification No. 5402/005**



**space components
coordination group**

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SCC

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ISSUE 1

DOCUMENTATION CHANGE NOTICE

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APPENDICES (Applicable to specific Manufacturers only)

None.

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

This specification details the ratings, physical and electrical characteristics, test and inspection data for a Light Emitting Diode, Infrared, GaAIAs, Hermetic, based on Type OP224. 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 diodes 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 diodes specified herein, are as scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION

As per Figure 1.

1.5 PHYSICAL DIMENSIONS

The physical dimensions of the diodes specified herein, are shown in Figure 2.

1.6 FUNCTIONAL DIAGRAM

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

1.7 HANDLING PRECAUTIONS

These devices are susceptible to damage by electrostatic discharge. Therefore, suitable precautions shall be employed for protection during all phases of manufacture, testing, packaging, shipment and any handling.

These components are categorised as Class 3 with a Minimum Critical Path Failure Voltage of 4000Volts.

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

VARIANT	BASED ON TYPE	CASE	FIGURE	BODY AND FLANGE MATERIAL AND FINISH
01	OP224	Pill	2	D7

TABLE 1(b) - MAXIMUM RATINGS

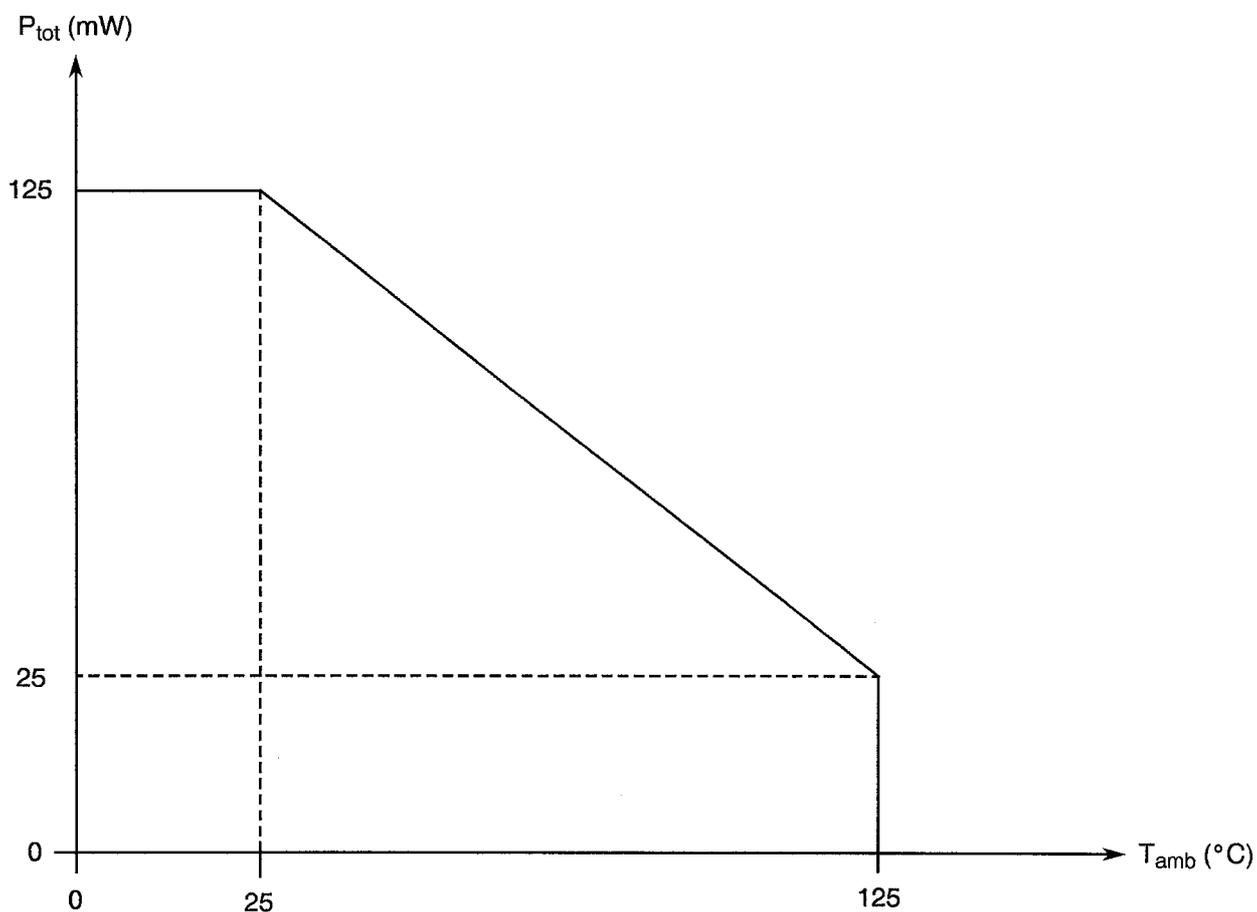
No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATING	UNIT	REMARKS
1	Forward Current	I_F	100	mA	
2	Reverse Voltage	V_{BR}	-2.0	Vdc	
3	Power Dissipation	P_{tot}	125	mW	Note 1
4	Wavelength at Peak Emission	λ_P	850 to 910	nm	-
5	Operating Temperature Range	T_{op}	-65 to +125	°C	-
6	Storage Temperature Range	T_{stg}	-65 to +150	°C	-
7	Soldering Temperature	T_{sol}	+240	°C	Note 2

NOTES

1. At $T_{amb} = +25^\circ\text{C}$. For derating at $T_{amb} > +25^\circ\text{C}$, see Figure 1.
2. Duration 5 seconds maximum at a distance of not less than 1.5mm from the body and the same termination shall not be resoldered until 3 minutes have elapsed.



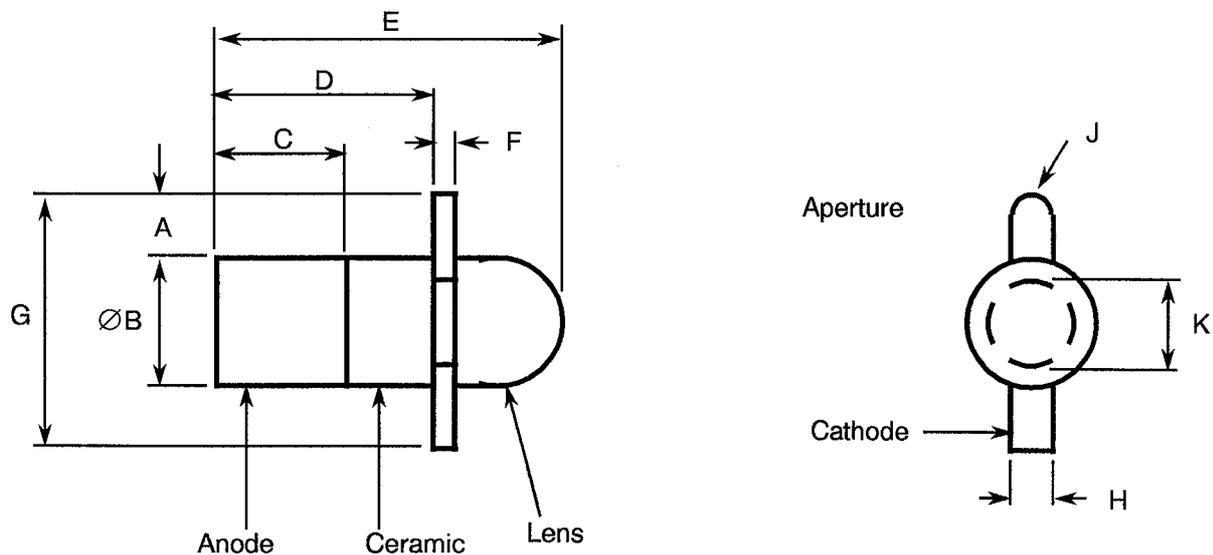
FIGURE 1 - PARAMETER DERATING INFORMATION



Power Dissipation versus Temperature

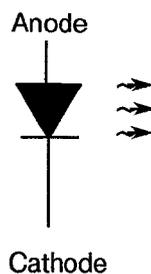


FIGURE 2 - PHYSICAL DIMENSIONS



SYMBOL	MILLIMETRES	
	MIN.	MAX.
A	0.23	0.48
ØB	1.50	1.57
C	1.57	1.75
D	2.03	2.26
E	3.02	3.46
F	0.13	0.25
G	2.13	2.34
H	0.41	0.61
J	0.20	0.31
K	0.88	1.15

FIGURE 3 - FUNCTIONAL DIAGRAM



**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 Semiconductors.

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. In addition the following abbreviations are used:-

- $E_e(\text{APT})$ = Apertured Radiant Incidence.
 I_e = Radiant Intensity.
 λ_p = Wavelength at Peak Emission.

4. REQUIREMENTS**4.1 GENERAL**

The complete requirements for procurement of the diodes specified herein shall be as stated in this specification and ESA/SCC Generic Specification No. 5000 for Discrete Semiconductors. Deviations from the Generic Specification, applicable to this Detail Specification only, are listed in Para. 4.2.

Deviations from the applicable Generic Specifications 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)

None.

4.2.3 Deviations from Burn-in Tests (Chart III)

(a) Para. 7.1.1(a), High Temperature Reverse Bias: This test and the subsequent electrical measurements associated with this test shall not be performed.

(b) Para. 9.12, Radiographic Inspection: Shall be performed on a 100% basis as specified in ESA/SCC Basic Specification No. 2095000, Radiographic Inspection of Discrete Semiconductors, Figure 1, Configurations C, D and E.

4.2.4 Deviations from Qualification Tests (Chart IV)

None.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

None.



4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

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

4.3.2 Weight

The maximum weight of the diodes specified herein shall be 0.04 grammes.

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 light emitting diodes 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

The case shall be mounted in a hermetically sealed miniature glass-lensed 'Pill' package.

4.4.2 Lens

The lens shall be plastic coated 7052 Corning glass.

4.4.3 Body and Flange Material and Finish

The body and the flange material shall be Type 'D' with Type '7' 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. Each component shall be marked in respect of:-

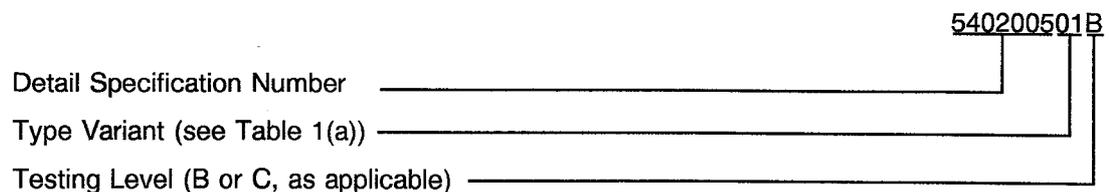
- (a) Lead Identification.
- (b) The SCC Component Number.
- (c) Traceability Information.

4.5.2 Lead Identification

The lead identification shall be as per 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 as defined in ESA/SCC Basic Specification No. 21700.

4.6 ELECTRICAL MEASUREMENTS

Unless otherwise specified, measurements shall be performed during the last 500ns of a 1.0ms test pulse, as heating due to an increased pulse rate or width will cause a change in measurement result.

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. Unless otherwise specified, the measurements shall be performed at $T_{amb} = +25 \pm 3$ °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. The measurements shall be performed at $T_{amb} = +125 (+0-5)$ °C and $-55 (+5-0)$ °C respectively.

4.6.3 Circuits for Electrical Measurements

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

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 $T_{amb} = +25 \pm 3$ °C. The parameter drift values (Δ) applicable to the scheduled parameters shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit value specified in Table 2 shall not be exceeded.

4.7.2 Conditions for High Temperature Reverse Bias

Not applicable.

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) of this specification.

4.7.4 Electrical Circuit for High Temperature Reverse Bias

Not applicable.

4.7.5 Electrical Circuit for Power Burn-in

The circuit for use in performing Power Burn-in is shown in Figure 5(b) of this specification.

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TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - D.C. PARAMETERS

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST FIGURE	TEST CONDITIONS	LIMITS		UNIT
						MIN.	MAX.	
1	Forward Voltage	V_F	4011	-	$I_F = 50\text{mA}$	0.8	1.8	V
2	Reverse Current	I_R	4016	-	$V_R = -2.0\text{V}$	-	100	μA
3	Apertured Radiant Incidence	$E_e(\text{APT})$	-	4(a)	$I_F = 50\text{mA}$	3.5	-	mW/cm^2
4	Radiant Intensity	I_e	-	4(a)	$I_F = 50\text{mA}$	5.64	-	mW/SR
5	Wavelength at Peak Emission	λ_p	-	4(b)	$I_F = 50\text{mA}$	850	910	nm
6	Radiant Power Output	P_0	-	4(c)	$I_F = 50\text{mA}$	1.5	-	mW

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - A.C. PARAMETERS

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST FIGURE	TEST CONDITIONS	LIMITS		UNIT
						MIN.	MAX.	
7	Capacitance	C	4001	-	$V_R = 0$ $f = 1.0\text{MHz}$	-	50	pF
8	Rise Time	t_r	-	4(d)	$I_F(\text{peak}) = 100\text{mA}$ Pulse Width = $10\mu\text{s}$ Duty Cycle = 10%	-	0.8	μs
9	Fall Time	t_f	-	4(d)	$I_F(\text{peak}) = 100\text{mA}$ Pulse Width = $10\mu\text{s}$ Duty Cycle = 10%	-	0.8	μs

**TABLE 3(a) - ELECTRICAL MEASUREMENTS AT HIGH TEMPERATURE, +125 (+0-5) °C**

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST FIGURE	TEST CONDITIONS	LIMITS		UNIT
						MIN.	MAX.	
1	Forward Voltage	V_F	4011	-	$I_F = 50\text{mA}$	0.8	1.8	V
2	Reverse Current	I_R	4016	-	$V_R = -2.0\text{V}$	-	1.0	mA
3	Apertured Radiant Incidence	$E_e(\text{APT})$	-	4(a)	$I_F = 50\text{mA}$	1.0	-	mW/cm ²
4	Radiant Intensity	I_e	-	4(a)	$I_F = 50\text{mA}$	1.69	-	mW/SR
6	Radiant Power Output	P_0	-	4(c)	$I_F = 50\text{mA}$	0.5	-	mW

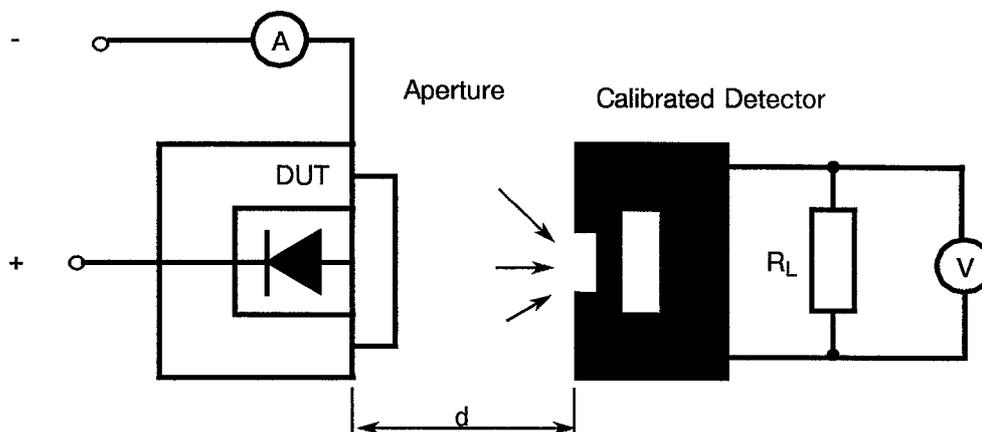
TABLE 3(b) - ELECTRICAL MEASUREMENTS AT LOW TEMPERATURE, -55 (+5-0) °C

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST FIGURE	TEST CONDITIONS	LIMITS		UNIT
						MIN.	MAX.	
1	Forward Voltage	V_F	4011	-	$I_F = 50\text{mA}$	0.8	1.8	V
3	Apertured Radiant Incidence	$E_e(\text{APT})$	-	4(a)	$I_F = 50\text{mA}$	5.0	-	mW/cm ²
4	Radiant Intensity	I_e	-	4(a)	$I_F = 50\text{mA}$	8.05	-	mW/SR
6	Radiant Power Output	P_0	-	4(c)	$I_F = 50\text{mA}$	1.5	-	mW



FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

FIGURE 4(a) - APERTURED RADIANT INCIDENCE MEASUREMENT AND RADIANT INTENSITY



$E_e(\text{APT})$ is measured using a 0.79mm diameter apertured sensor placed at $d = 12.7\text{mm}$ distance from the mounting plane.

I_e shall be calculated from $E_e(\text{APT})$ values utilising the following formula:

$$\text{mW/SR} = \frac{\text{mw/cm}^2 \times \text{Aperture Area(cm}^2\text{)}}{\text{cone ang (SR)}}$$

To further simplify, a 1.6114 conversion factor will be used.

NOTES

1. R_L is the detector internal resistance.

FIGURE 4(b) - WAVELENGTH AT PEAK EMISSION

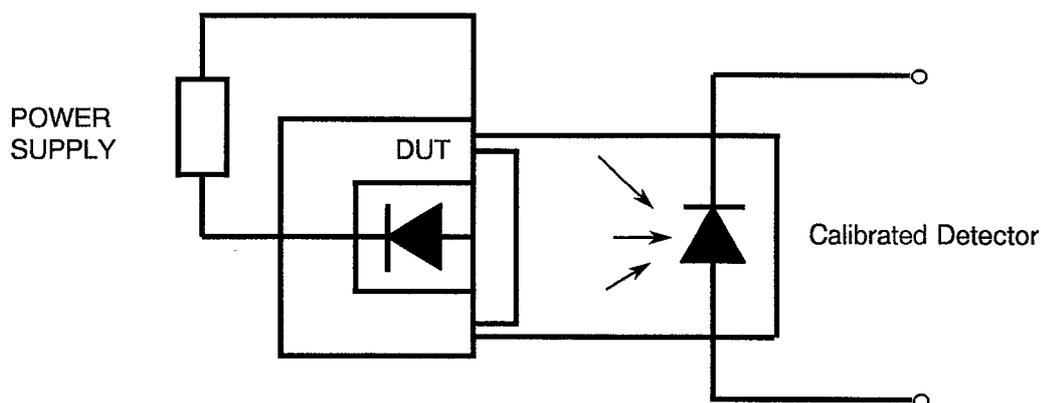




FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS (CONT'D)

FIGURE 4(c) - RADIANT POWER OUTPUT

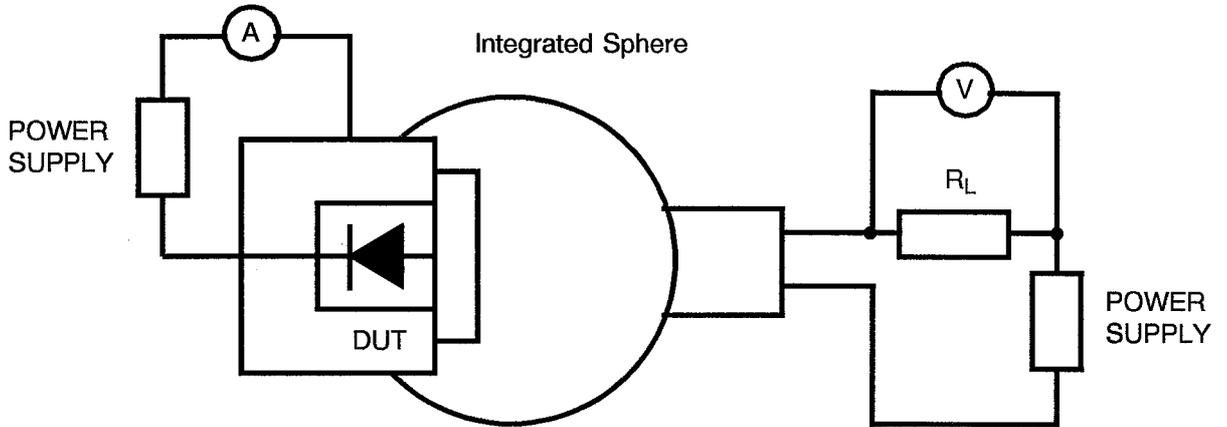
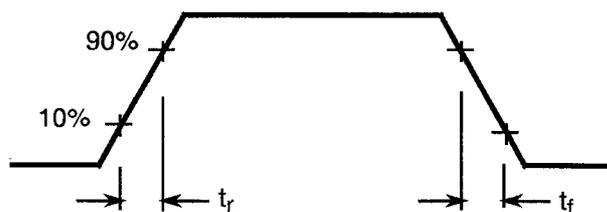
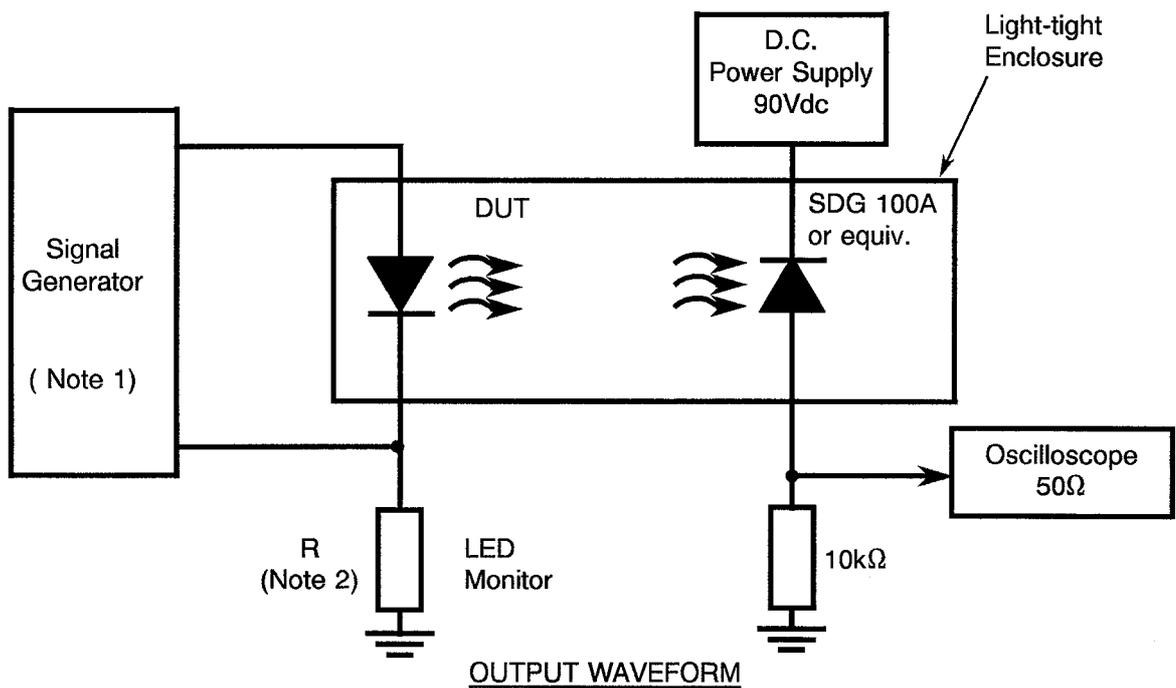


FIGURE 4(d) - SWITCHING TIME



NOTES

1. The output of the signal generator shall have the following characteristics: $t_r = t_f \leq 5.0\text{ns}$, amplitude = 4.0V peak, $f = 400\text{Hz}$, pulse width = $10\mu\text{s}$, duty cycle $\leq 0.1\%$.
2. R shall be such a value as to limit I_F .

TABLE 4 - PARAMETER DRIFT VALUES

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS	UNIT
1	Forward Voltage	V_F	As per Table 2	As per Table 2	± 100	mV
6	Radiant Power Output	P_0	As per Table 2	As per Table 2	± 15	%

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

Not applicable.

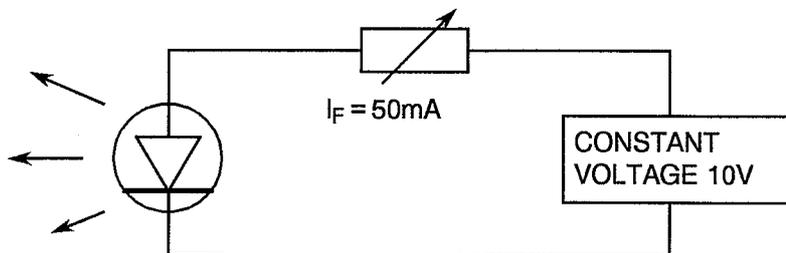
TABLE 5(b) - CONDITIONS FOR POWER BURN-IN AND OPERATING LIFE TEST

No.	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	T_{amb}	+ 25 (+ 0-3)	°C
2	Forward Current	I_F	50	mA

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

Not applicable.

FIGURE 5(b) - ELECTRICAL CIRCUIT FOR POWER BURN-IN AND OPERATING LIFE TEST





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 $T_{amb} = +25 \pm 3$ °C.

4.8.2 Electrical Measurements at Intermediate Points during Endurance Tests

The parameters to be measured at intermediate points during endurance tests are scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +25 \pm 3$ °C.

4.8.3 Electrical Measurements on Completion of Endurance Tests

The parameters to be measured on completion of endurance tests are scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +25 \pm 3$ °C.

4.8.4 Conditions for Operating Life Tests

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 as specified in Table 5(b) of this specification.

4.8.5 Electrical Circuit for Operating Life Tests

The circuit for use in performing the operating life tests is shown in Figure 5(b) of this specification.

4.8.6 Conditions for High Temperature Storage Test

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	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
1	Forward Voltage	V_F	As per Table 2	As per Table 2	0.8	1.8	V
2	Reverse Current	I_R	As per Table 2	As per Table 2	-	100	μA
4	Radiant Intensity	I_e	As per Table 2	As per Table 2	5.64	-	mW/SR
5	Wavelength at Peak Emission	λ_p	As per Table 2	As per Table 2	850	910	nm
6	Radiant Power Output	P_0	As per Table 2	As per Table 2	1.5	-	mW