INTEGRATED CIRCUITS, SILICON MONOLITHIC,

PRECISION TIMER,

BASED ON TYPE LM 122

ESCC Detail Specification No. 9108/002

ISSUE 1

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Pages 1 to 27

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PRECISION TIMER,

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space components
coordination group

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DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	CHANGE Reference / Item	Approved DCR No.
		This Issue incorporates all modifications agreed on the basis of Policy DCR No. 21016 for adaptation to new qualification requirements.	
'A'	Dec. '91	P1. Cover Page P2. DCN P15. Para. 4.2.1 : Deviation deleted, "None" added	None None 21048
		This specification has been transferred from hardcopy to electronic format. The content is unchanged but minor differences in presentation exist.	

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TABLES

FIGURES

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 silicon monolithic, precision timer, based on Type LM 122. It shall be read in conjunction with ESA/SCC Generic Specification No. 9000, the requirements of which are supplemented herein.

1.2 COMPONENT TYPE VARIANTS

Variants of the basic type integrated circuits 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 integrated circuits 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 integrated circuits specified herein are shown as Figure 2.

1.6 PIN ASSIGNMENT

As per Figure 3(a).

1.7 TRUTH TABLE

Not applicable.

1.8 CIRCUIT SCHEMATIC

As per Figure 3(b).

1.9 FUNCTIONAL DIAGRAM

As per Figure 3(c).

TABLE 1(a) - TYPE VARIANTS

DASH No.	CASE	FIGURE	LEAD FINISH
-01	TO91	2(a)	Gold plated
-02	TO91	2(a)	Tin-plated/solder-dipped
-03	TO-100	2(b)	Gold plated
-04	TO-100	2(b)	Tin-plated/solder-dipped

TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNITS	REMARKS
1	Supply Voltage	V_{CC}	40	V	
2	Collector Output Voltage	V_C	40	V	
3	V_{ref} Current	I_{REF}	5.0	mA	
4	Trigger Voltage	V_T	± 40	V	
5	V_{ADJ} Voltage (Forced)	V_{ADJ}	5.0	V	
6	Logic Reverse Voltage	V_{LRV}	5.5	V	
7	Output Short Circuit Duration	t_{IOS}	-	-	Note 1
8	Power Dissipation	P_{tot}	500	mW	
9	Operating Temperature Range	T_a	−55 to +125	°C	
10	Storage Temperature Range	T_{stg}	−65 to +150	°C	

NOTES

1. Continuous output shorts are not allowed. Short circuit duration at ambient temperature of 40°C may be calculated from $t = 120/V_{CE}$ seconds, where V_{CE} is the collector to emitter voltage across the output transistor during the short.

FIGURE 1 - DEVICE DISSIPATION DERATING WITH TEMPERATURE

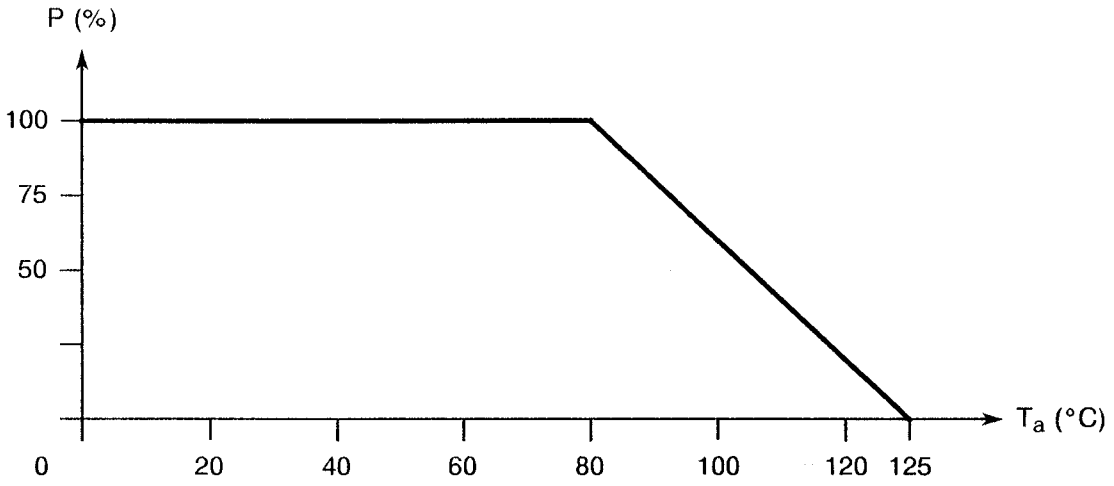
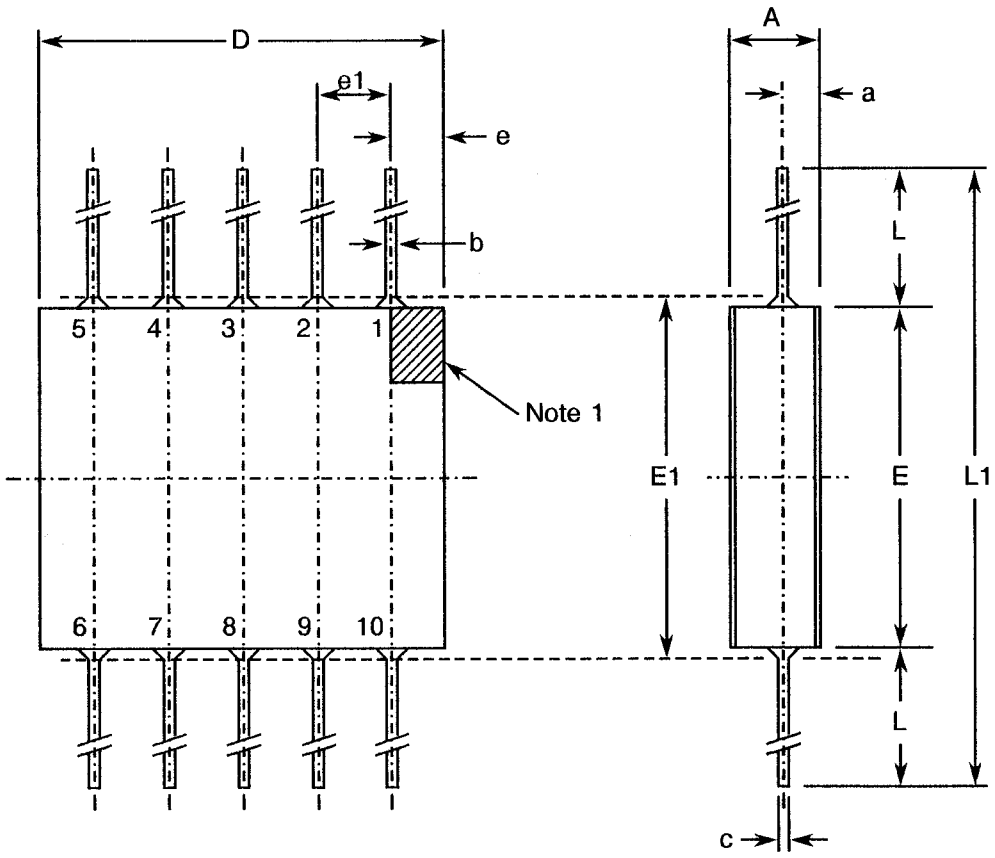


FIGURE 2 - PHYSICAL DIMENSIONS

FIGURE 2(a) - FLAT PACKAGE, TO91



SYMBOL	INCHES		MILLIMETRES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	-	0.080	-	2.03	
a	0.020	0.040	0.508	1.016	
b	0.015	0.019	0.381	0.483	
c	0.004	0.006	0.102	0.152	
D	-	0.260	-	6.60	
E	-	0.260	-	6.60	
E1	-	0.275	-	6.99	
e	0.065	0.085	1.65	2.159	
e1	0.045	0.055	1.14	1.40	
L	0.245	0.255	6.22	6.48	
L1	0.750	0.770	19.05	19.56	

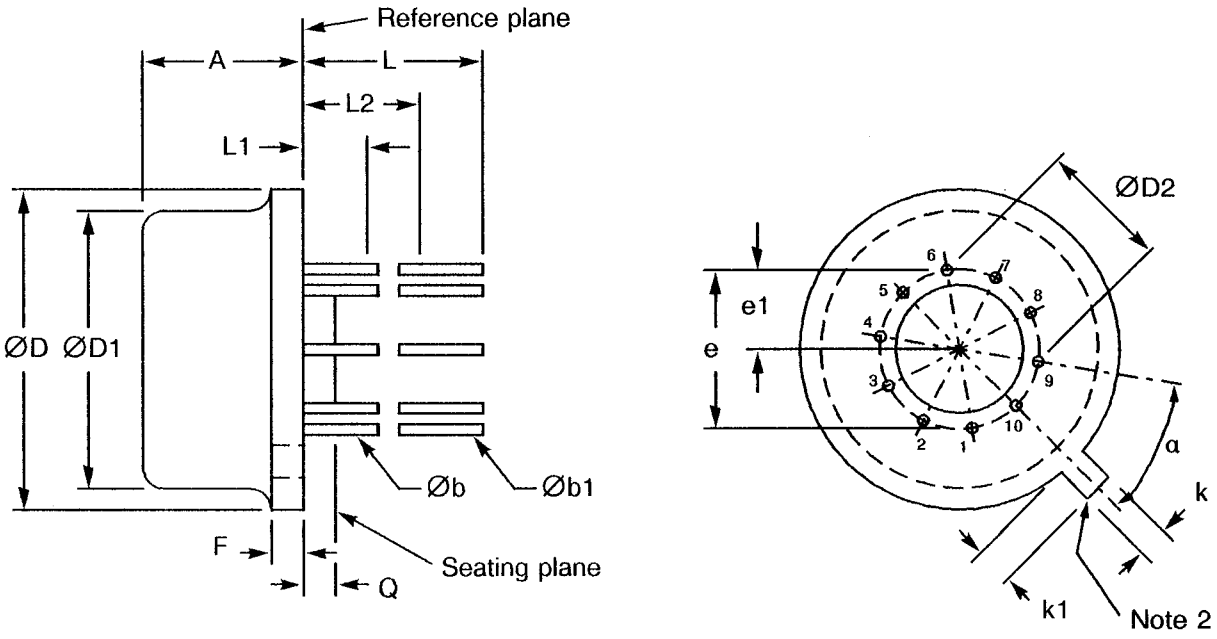
FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

NOTES TO FIGURES 2

1. TO91 - Flat Pack. Index shall be identified by a dot which shall be located within the shaded area shown.
2. TO100 - Metal Can. Index shall be identified by a tab located as shown.

FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(b) - METAL CAN PACKAGE, TO100

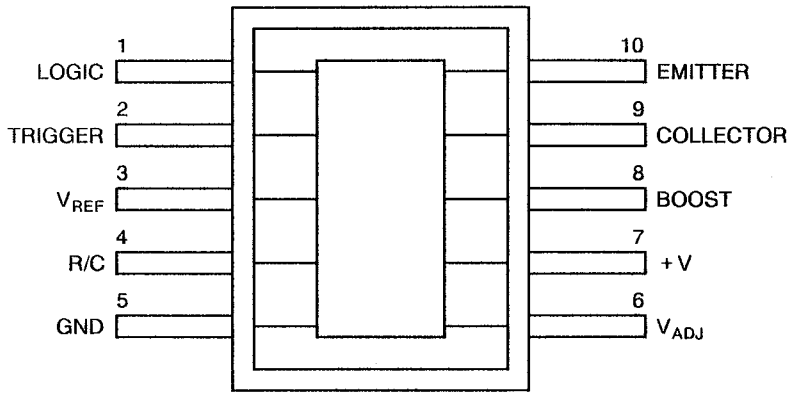


SYMBOL	INCHES		MILLIMETRES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.155	0.185	3.94	4.69	
Øb	0.016	0.019	0.41	0.48	
ØD	0.335	0.370	8.51	9.40	
ØD1	0.305	0.335	7.75	8.51	
ØD2	0.140	0.160	3.56	4.06	
e	0.230 TYPICAL		5.84 TYPICAL		
e1	0.115 TYPICAL		2.92 TYPICAL		
F	-	0.040	-	1.02	
L	0.50	-	1.27	-	
k	0.028	0.034	0.71	0.86	
k1	0.029	0.045	0.74	1.14	
Q	-	0.040	-	1.02	
α	36° BSC		36° BSC		

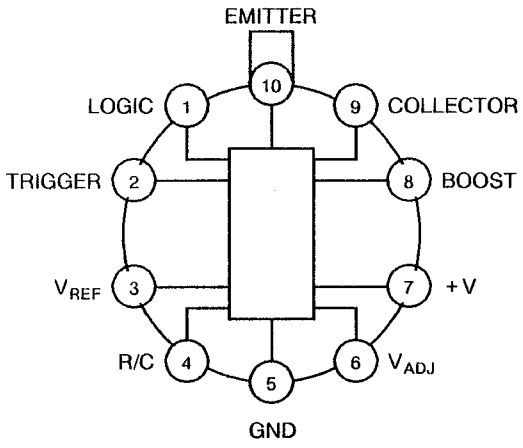
NOTES: See Page 9.

FIGURE 3(a) - PIN ASSIGNMENT

FLAT PACKAGE - TO91



METAL CAN PACKAGE - TO100



TOP VIEW

FIGURE 3(b) - CIRCUIT SCHEMATIC

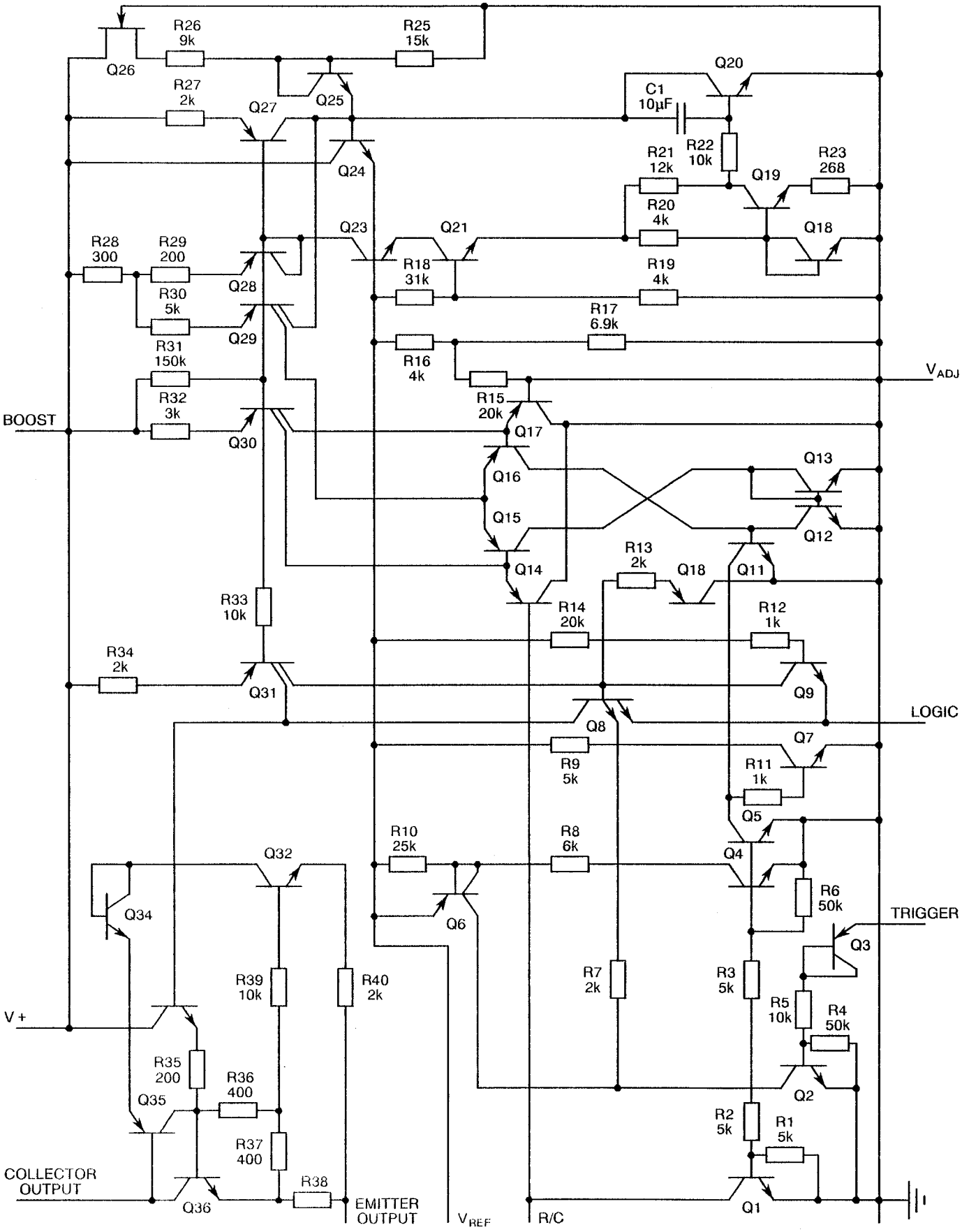
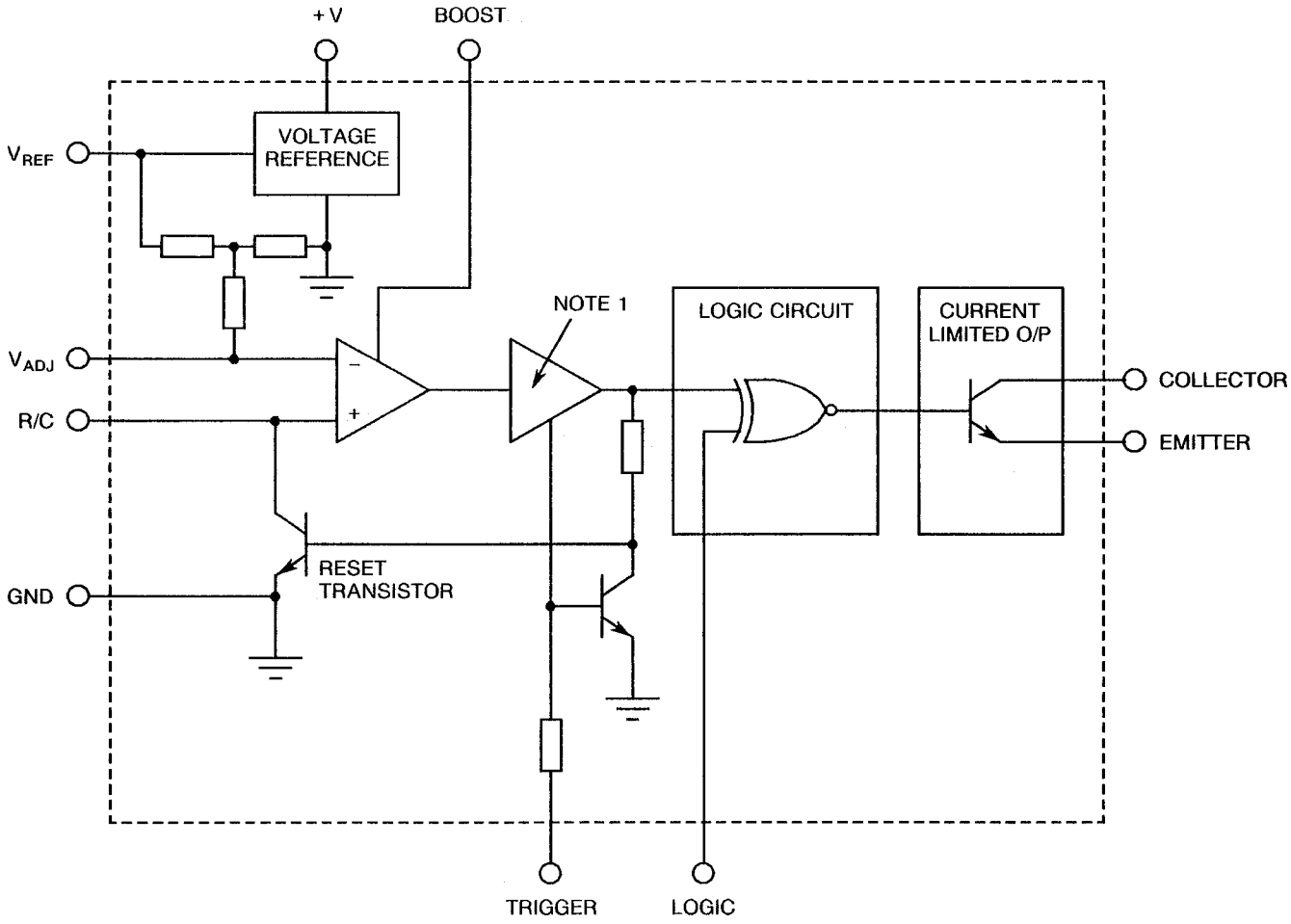


FIGURE 3(c) - FUNCTIONAL DIAGRAM



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. 9000 for Integrated Circuits.

(b) MIL-STD-883, Test Methods and Procedures for Micro-electronics.

(c) MIL-STD-1276, Leads, Weldable, for Electronic Component Parts.

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:-

V_C = Collector Output Voltage.
V_{REF} = Reference Voltage.
I_{REF} = Reference Current.
I_T = Trigger Current.
V_T = Trigger Voltage.
V_{ADJ} = Adjusting Voltage, Forced.
V_{LRV} = Logic Reverse Voltage.
t_{IOS} = Output Short Circuit Duration.
V_{CSAT} = Collector Saturation Voltage.
V_{ESAT} = Emitter Saturation Voltage.
V_{SAT} = Capacitor Saturation Voltage.
r = Timing Ratio.
pw(t) = Minimum Trigger Width.

4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the integrated circuits specified herein are stated in this specification and ESA/SCC Generic Specification No. 9000 for Integrated Circuits. Deviations from the Generic Specification applicable to this specification only, are listed in Para. 4.2.

4.2 DEVIATIONS FROM GENERIC SPECIFICATION

The following deviations from ESA/SCC Generic Specification No. 9000 shall apply:-

4.2.1 Deviations from Final Production Tests (Chart II)

None.

4.2.2 Deviations from Burn-in Tests (Chart III)

Test "High Temperature Reverse Bias" (Para. 7.1.1) and subsequent electrical measurements related to this test shall be omitted. For the test "Electrical Measurements at High and Low Temperature" (Para. 9.9.2) only a test result summary is required on go-no-go test and presented in histogram form.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

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

4.3.2 Weight

The maximum weight of the integrated circuits specified herein shall be 0.25 grammes for the TO91 package and 1.0 grammes for the TO100 package.

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 integrated circuits 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 hermetically sealed and have a metal body with hard glass seals or a ceramic body and the lids shall be welded, brazed, preform-soldered or glass frit-sealed.

4.4.2 Lead Material and Finish

Kovar in accordance with type MIL-STD-1276 gold plated or solder-dipped/tin plated. (See Table 1(a) for Type Variants).

4.5 MARKING

4.5.1 General

The marking of components delivered to this specification shall be in accordance with ESA/SCC Basic Specification No. 21700. Each component shall be marked in respect of:-

(a) Lead Identification.

(b) The SCC Component Number.

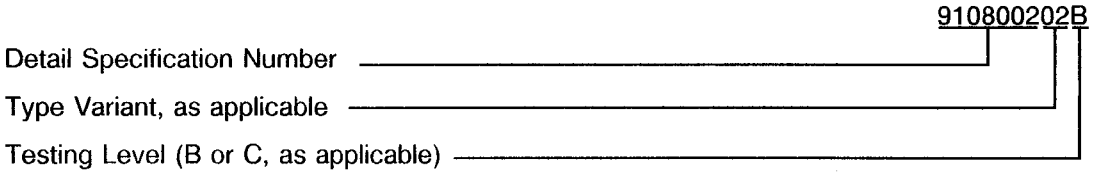
(c) Traceability Information.

4.5.2 Lead Identification

An index shall be located at the top of the package in the position defined in Note 1 to Figure 2 for flat packs or alternatively a tab will be used to identify Pin No. 10 of TO100 cans. The pin numbering shall be read with the index on the left-hand side for flat packs and on the left for TO100's when viewed from below.

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 ESA/SCC Basic Specification No. 21700.

4.6 ELECTRICAL CHARACTERISTICS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured in respect of electrical characteristics are scheduled in Table 2. Unless otherwise specified, the 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 Tables 3. The measurements shall be performed at $T_{amb} = +125$°C and -55°C respectively.

4.6.3 Circuits for Electrical Measurements

Circuits and functional test sequence 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 (Δ) 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 Burn-in

The requirements for burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 9000. The conditions for burn-in shall be as specified in Table 5 of this specification.

4.7.3 Electrical Circuits for Burn-in

Circuits for use in performing the burn-in tests are shown in Figure 5 of this specification.

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

No.	Characteristics	Symbol	Test Method MIL-STD 883	Test Fig.	Test Conditions	Limits		Unit
						Min	Max	
1	Comparator Input Current (1)	$I_{IB(1)}$	-	4(a)	$V_{CC} = 40V$	-	1.0	nA
2	Comparator Input Current (2)	$I_{IB(2)}$	-	4(b)	Boost tied to V_{CC} $V_{CC} = 40V$	-	100	nA
3	Trigger Voltage	V_T	-	4(c)	$V_{CC} = 4.5V$ $I_T = 100\mu A$	1.2	2.0	V
4	Trigger Current	I_T	-	4(c)	$V_{CC} = 4.5V$ $V_T = 2.0V$	-	100	µA
5	Supply Current	I_{CC}	-	4(d)	$V_{CC} = 40V$	-	4.0	mA
6	Output Leakage Current	I_{OL}	-	4(e)	$V_{CE} = 40V$	-	1.0	µA
7	Reference Voltage	V_{REF}	-	4(f)	$I_{REF} = 4.0mA$	3.0	3.3	V
8	Collector Saturation Voltage (1)	$V_{CSAT(1)}$	-	4(g)	$I_C = 8.0mA$	-	0.4	V
9	Collector Saturation Voltage (2)	$V_{CSAT(2)}$	-	4(g)	$I_L = 50mA$	-	1.4	V
10	Emitter Saturation Voltage (1)	$V_{ESAT(1)}$	-	4(h)	$I_E = 2.5mA$	-	2.2	V
11	Emitter Saturation Voltage (2)	$V_{ESAT(2)}$	-	4(h)	$I_E = 50mA$	-	3.0	V
12	Reference Line Regulation	V_L	-	4(f)	$V_{CC} = 40V$	-	25	mV
13	Reference Load Regulation	V_R	-	4(f)	$I_{REF} = 3.0mA$	-	50	mV

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

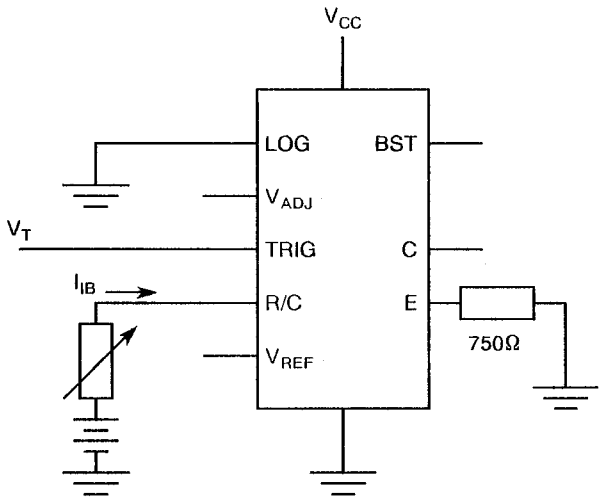
No.	Characteristics	Symbol	Test Method MIL-STD 883	Test Fig.	Test Conditions	Limits		Unit
						Min	Max	
14	Timing Ratio (1)	r (1)	-	4(i)	V_{CC} = 4.5V	0.626	0.638	-
15	Timing Ratio (2)	r (2)	-	4(i)	Boost tied to V_{CC} V_{CC} = 4.5V	0.620	0.644	-
16	Minimum Trigger Width	pWC(+)	-	4(i)	V_T = 3.0V	-	1.0	µs
17	Capacitor Saturation Voltage	V_{SAT}	-	4(i)	R_t = 1.0MΩ	-	5.0	mV
					R_t = 10kΩ	-	50	mA

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES, +125°C, −55°C

No.	Characteristics	Symbol	Test Method MIL-STD 883	Test Fig.	Test Conditions	Limits		Unit
						Min	Max	
1	Comparator Input Current (1)	$I_{IB(1)}$	-	4(a)	$V_{CC} = 40V$	-	1.0	nA
2	Comparator Input Current (2)	$I_{IB(2)}$	-	4(b)	Boost tied to V_{CC} $V_{CC} = 40V$	-	100	nA
3	Trigger Voltage	V_T	-	4(c)	$V_{CC} = 4.5V$	1.2	2.0	V
4	Trigger Current	I_T	-	4(c)	$V_{CC} = 4.5V$ $V_T = 2.0V$	-	100	µA
5	Supply Current	I_{CC}	-	4(d)	$V_{CC} = 40V$	-	4.0	mA
6	Output Leakage Current	I_{OL}	-	4(e)	$V_{CE} = 40V$	-	1.0	µA
7	Reference Voltage	V_{REF}	-	4(f)	$I_{REF} = 4.0mA$	3.0	3.3	V
8	Collector Saturation Voltage (1)	$V_{CSAT(1)}$	-	4(g)	$I_C = 8.0mA$	-	0.4	V
9	Collector Saturation Voltage (2)	$V_{CSAT(2)}$	-	4(g)	$I_L = 50mA$	-	1.4	V
10	Emitter Saturation Voltage (1)	$V_{ESAT(1)}$	-	4(h)	$I_E = 5.0mA$	-	2.2	V
11	Emitter Saturation Voltage (2)	$V_{ESAT(2)}$	-	4(h)	$I_E = 50mA$	-	3.0	V
12	Reference Line Regulation	V_L	-	4(f)	$V_{CC} = 40V$	-	25	mV
13	Reference Load Regulation	V_R	-	4(f)	$I_{REF} = 3.0mA$	-	50	mV

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

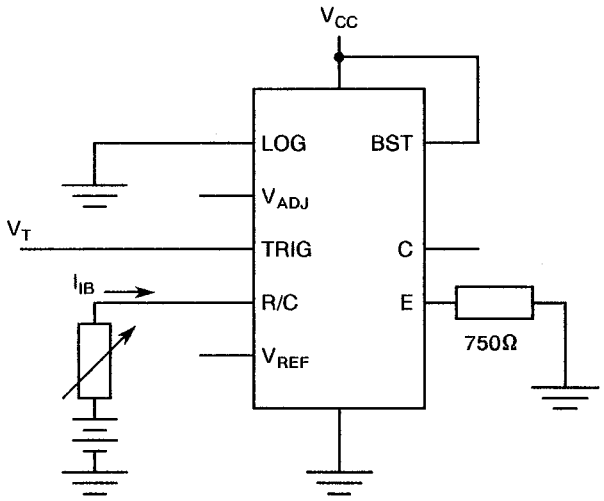
FIGURE 4(a) - COMPARATOR CURRENT



NOTES

1. $V_{CC} = 40V$, $V_T = -20V$, $V_{IN} = 2.2V$.

FIGURE 4(b) - COMPARATOR CURRENT V_{CC} AND BOOST TIED



NOTES

1. $V_{CC} = 40V$, $V_T = -20V$, $V_{IN} = 2.2V$.

FIGURE 4(c) - TRIGGER VOLTAGE AND CURRENT

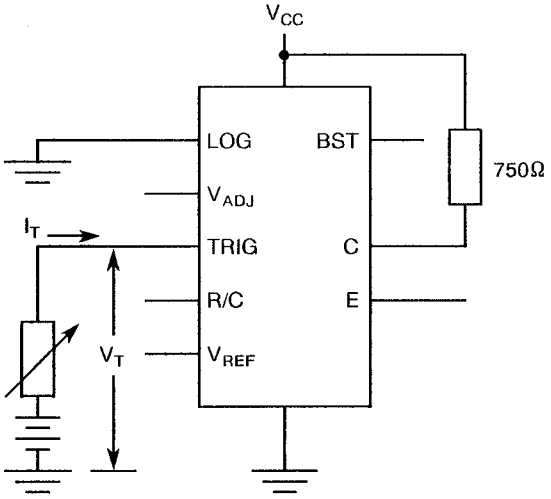


FIGURE 4(d) - SUPPLY CURRENT

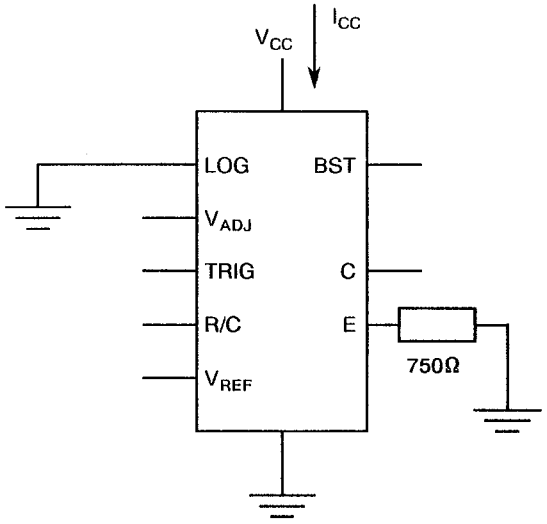


FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS (CONTINUED)

FIGURE 4(e) - OUTPUT LEAKAGE CURRENT

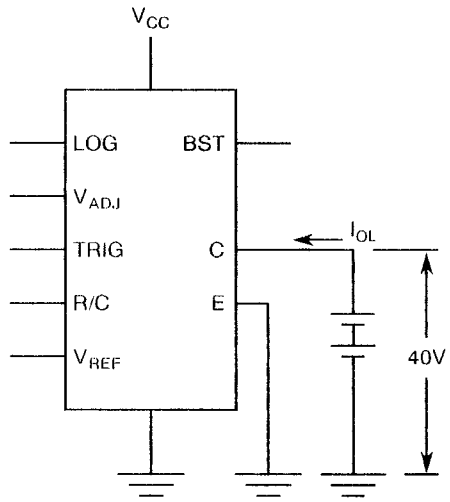


FIGURE 4(f) - REFERENCE VOLTAGE AND REFERENCE LINE AND LOAD REGULATION

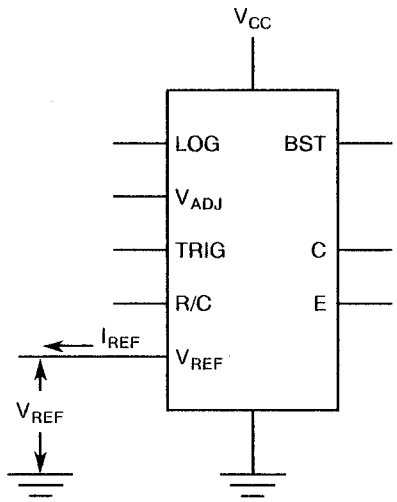


FIGURE 4(g) - COLLECTOR SATURATION VOLTAGE

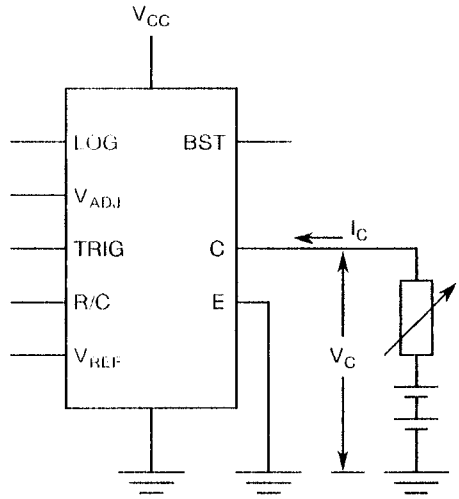


FIGURE 4(h) - EMITTER SATURATION VOLTAGE

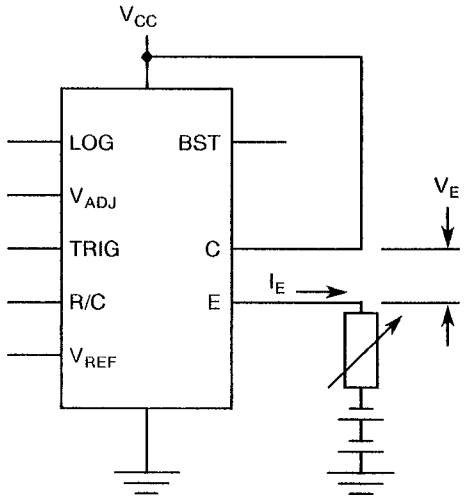
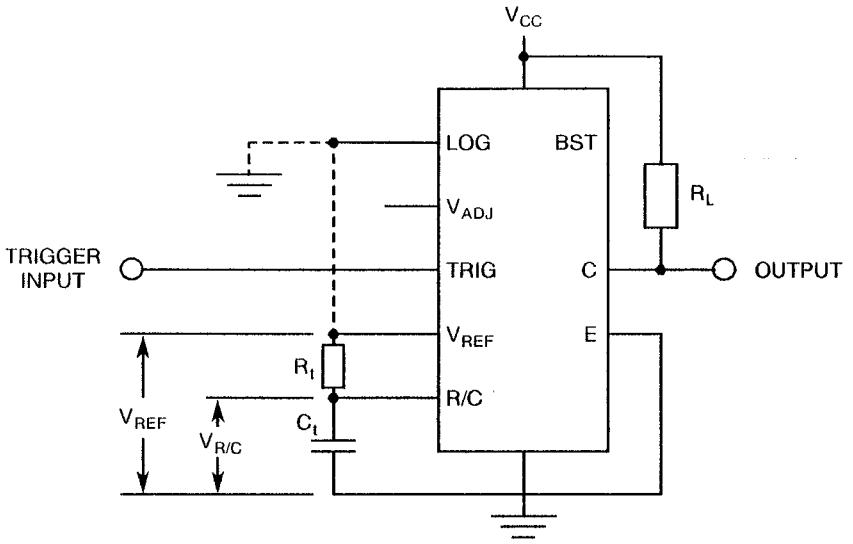
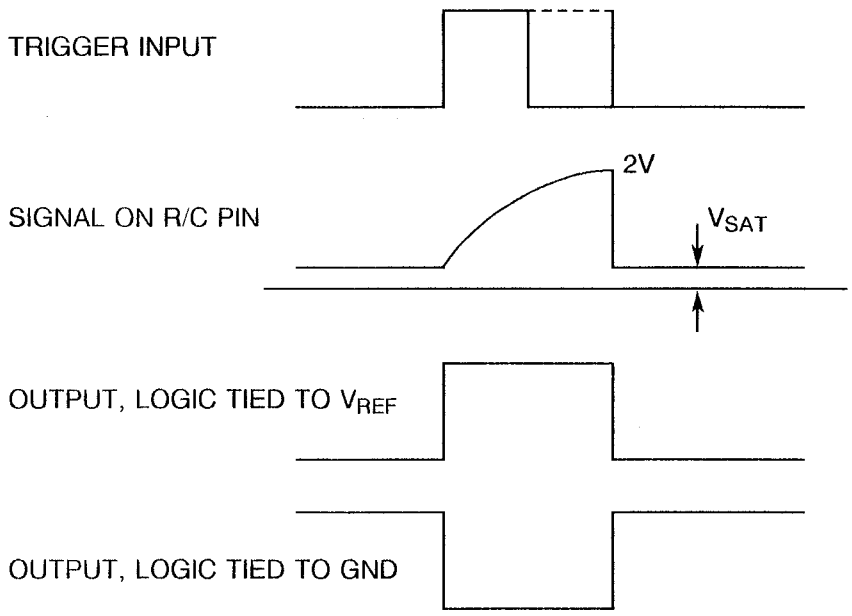


FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS (CONTINUED)

FIGURE 4(i) - TIMING RATIO, MINIMUM TRIGGER VOLTAGE WIDTH, CAPACITOR SATURATION VOLTAGE



$$\text{OUTPUT PULSE WIDTH} = (R_t)\,(C_t)\left[1 - 2\,(0.632 - r) - \frac{V_C}{V_{REF}}\right] \Omega\,(R_t)\,(C_t)$$



NOTES

1. Timing Ratio $r = \frac{V_{R/C}}{V_{REF}}$ (firing voltage).
2. Capacitor saturation voltage, V_{SAT} = offset voltage across C_t after discharge.

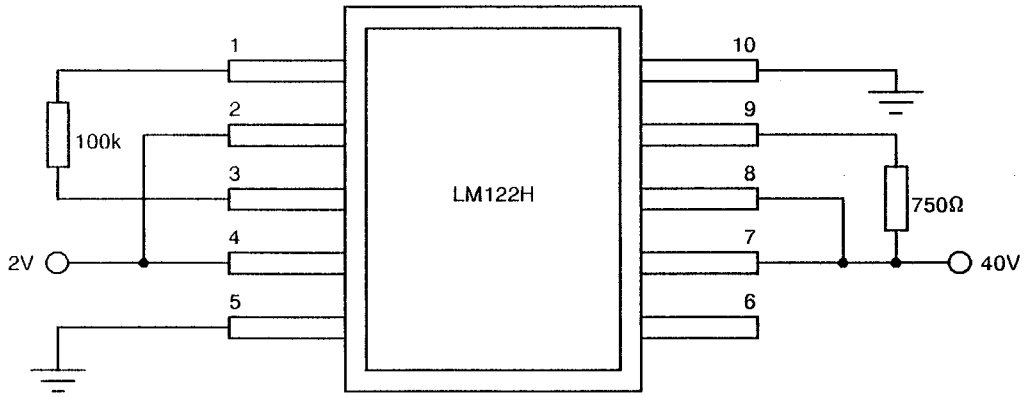
TABLE 4 - PARAMETER DRIFT VALUES

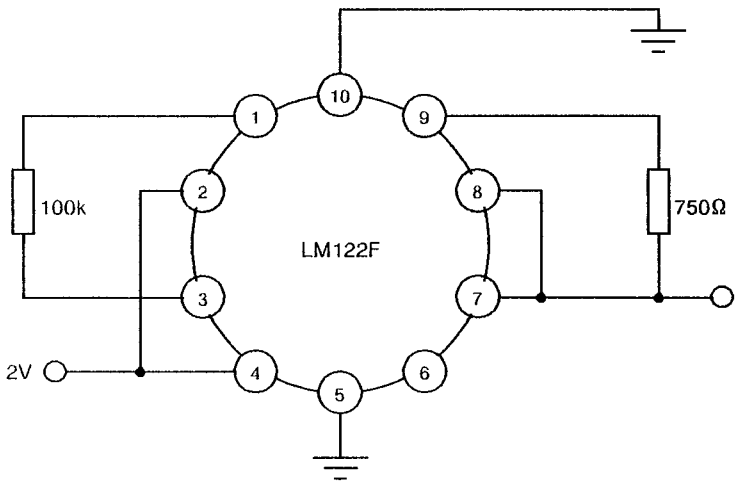
No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ)	UNIT
2	Comparator Input Current	I_{IB}	As per Table 2	As per Table 2	±20	nA
4	Trigger Current	I_T	As per Table 2	As per Table 2	±10	μA
6	Output Leakage Current	I_{OL}	As per Table 2	As per Table 2	±50	nA
7	Reference Voltage	V_{REF}	As per Table 2	As per Table 2	±0.1	V
10	Timing Ratio	r	As per Table 2	As per Table 2	±10	%

TABLE 5 - CONDITIONS FOR BURN-IN AND OPERATING LIFE TEST

No.	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	T_{amb}	+125(+0−5)	°C
2	Power Supply Voltage (Boost tied to V_{CC})	V_{CC}	40	V
3	Trigger Voltage	V_T	2.0	V
4	R/C Voltage	$V_{R/C}$	2.0	V
5	Collector Load	R_L	750	Ω
6	Ref Load (Tied to Logic I/D)	R_{REF}	100	kΩ
7	Emitter	E	Gnd	-

FIGURE 5 - ELECTRICAL CIRCUIT FOR BURN-IN AND OPERATING LIFE TEST





4.8 ENVIRONMENTAL AND ENDURANCE TESTS

4.8.1 Electrical Measurements on Completion of Environmental Tests

The parameters to be measured on completion of environmental tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

4.8.2 Electrical Measurements at Intermediate Points during Endurance Tests

The parameters to be measured at intermediate points during endurance tests are as scheduled in Table 6 of this specification.

4.8.3 Electrical Measurements on Completion of Endurance Tests

The parameters to be measured on completion of endurance testing are as scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

4.8.4 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. 9000. The conditions for operating life testing shall be as specified in Table 5 of this specification.

4.8.5 Electrical Circuits for Operating Life Tests

Circuits for use in performing the operating life tests are shown in Figure 5.

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. 9000. The conditions for high temperature storage shall be $T_{amb} = +150(+0-5)$ °C.

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	
2	Comparator Input Current	I_{IB}	As per Table 2	As per Table 2	-	100	nA
4	Trigger Current	I_T	As per Table 2	As per Table 2	-	100	µA
6	Output Leakage Current	I_{OL}	As per Table 2	As per Table 2	-	1.0	µA
7	Reference Voltage	V_{REF}	As per Table 2	As per Table 2	3.0	3.3	V
10	Timing Ratio	r	As per Table 2	As per Table 2	0.626	0.638	-
16	Minimum Trigger Width	pw(t)	As per Table 2	As per Table 2	-	1.0	µs