INTEGRATED CIRCUITS, SILICON MONOLITHIC,

BIPOLAR VOLTAGE REGULATOR

BASED ON TYPE LM104

ESCC Detail Specification No. 9102/001

ISSUE 1

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Pages 1 to 25

INTEGRATED CIRCUITS, SILICON MONOLITHIC

BIPOLAR VOLTAGE REGULATOR

BASED ON TYPE LM 104

ESA/SCC Detail Specification No. 9102/001

SCC

space components
coordination group

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		SCCG Chairman	ESA Director General or his Deputy
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DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This issue incorporates all modifications agreed on the basis of Policy DCR 21016 for adaptation to new qualification requirements		
'A'	Jul. '84	P1. Cover Page		None
		P2. DCN		None
		P4. Contents	: Figure 1 added	22286
			: Appendices added	21019
		P5. Para. 1.4	: Amended	22286
		P6. Table 1(a)	: Lead material redefined	21025
		Table 1(b)	: Note 1 thermal resistances added	22286
			Table moved to Page 6	
		P7. Figure 1	: New Figure 1 added on Page 7	22286
		P13. Para. 2	: MIL-STD-1276 deleted	21025
		Para. 4.1	: Rewritten	21019
		Para. 4.2.2	: PIND added	22240
		P15. Para. 4.4.2	: Rewritten	21025
'B'	Dec. '91	P1. Cover page		None
		P2. DCN	: Page added	None
		P3. T of C	: Para. 4.3.3 deleted	None
		P13. Para. 4.2.2	: Deviation deleted, "None." added	21048
		P14. Para. 4.2.4	: Deviation deleted, "None." added	22919
		Para. 4.2.5	: Deviation deleted, "None." added	22919
		Para. 4.3.3	: Paragraph deleted	22921
		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, bipolar voltage regulator, based on Type LM104. 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 in Figure 2.

1.6 PIN ASSIGNMENT

As per Figure 3(a).

1.7 TRUTH TABLE (FIGURE 3(b))

Not applicable.

1.8 CIRCUIT SCHEMATIC

As per Figure 3(c).

1.9 FUNCTIONAL DIAGRAM

As per Figure 3(d).

TABLE 1(a) - TYPE VARIANTS

DASH No.	CASE	FIGURE	LEAD MATERIAL AND FINISH
-01	FLAT	2(a)	D2
-02	FLAT	2(a)	D3 or D4
-03	TO100	2(b)	D2
-04	TO100	2(b)	D3 or D4
-05	DIL	2(c)	D2
-06	DIL	2(c)	D3 or D4

TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNITS	REMARKS
1	Input Voltage	V_I	50	V	
2	Input-Output Voltage Differential	$V_I - V_O$	50	V	
3	Output Current	I_O	25	mA	
4	Device Power Dissipation	P_D	500	mW	Note 1
5	Operating Temperature Range	T_{amb}	−55 to +125	°C	
6	Storage Temperature Range	T_{stg}	−55 to +125	°C	
7	Soldering Temperature	T_{sol}	+300	°C	Note 2

NOTES

1. Maximum junction temperature = +150°C.

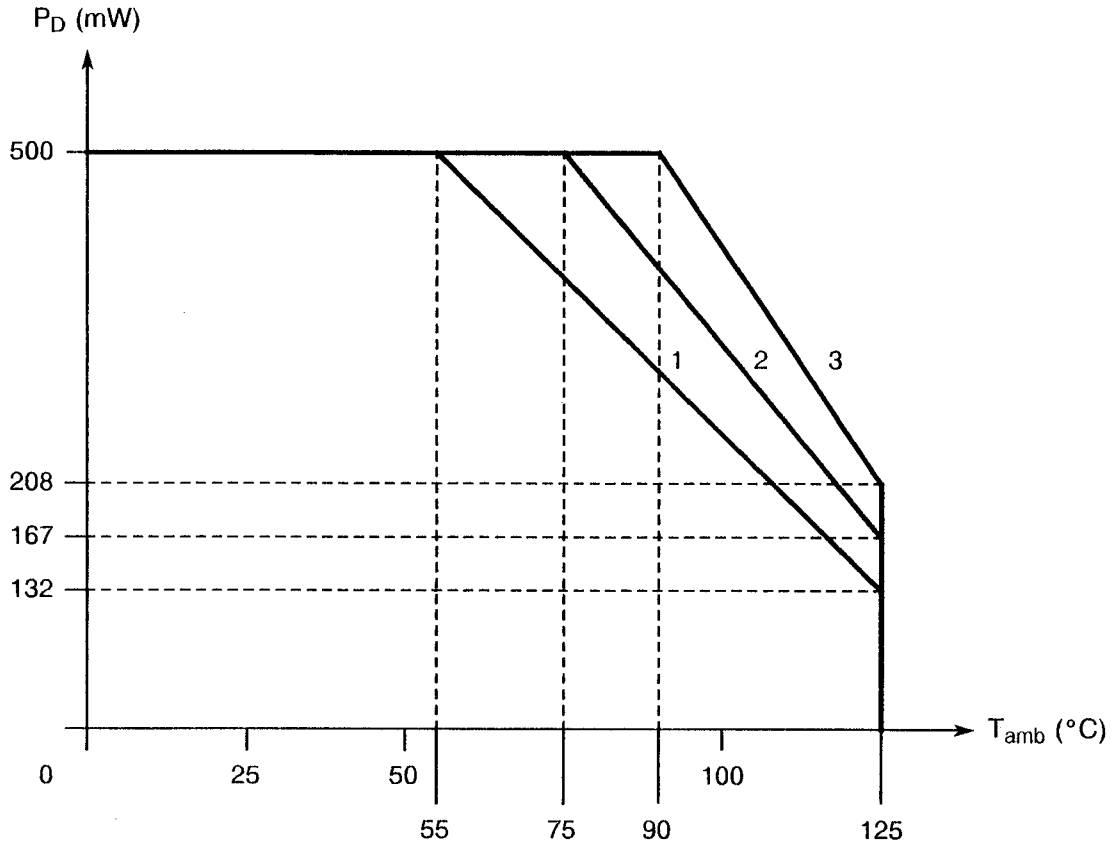
   Variants 01, 02 Thermal resistance, junction to ambient = 190°C/W.

   Variants 03, 04 Thermal resistance, junction to ambient = 150°C/W.

   Variants 05, 06 Thermal resistance, junction to ambient = 120°C/W.

2. Duration: ≤5 seconds.

FIGURE 1 - DEVICE DISSIPATION DERATING WITH TEMPERATURE

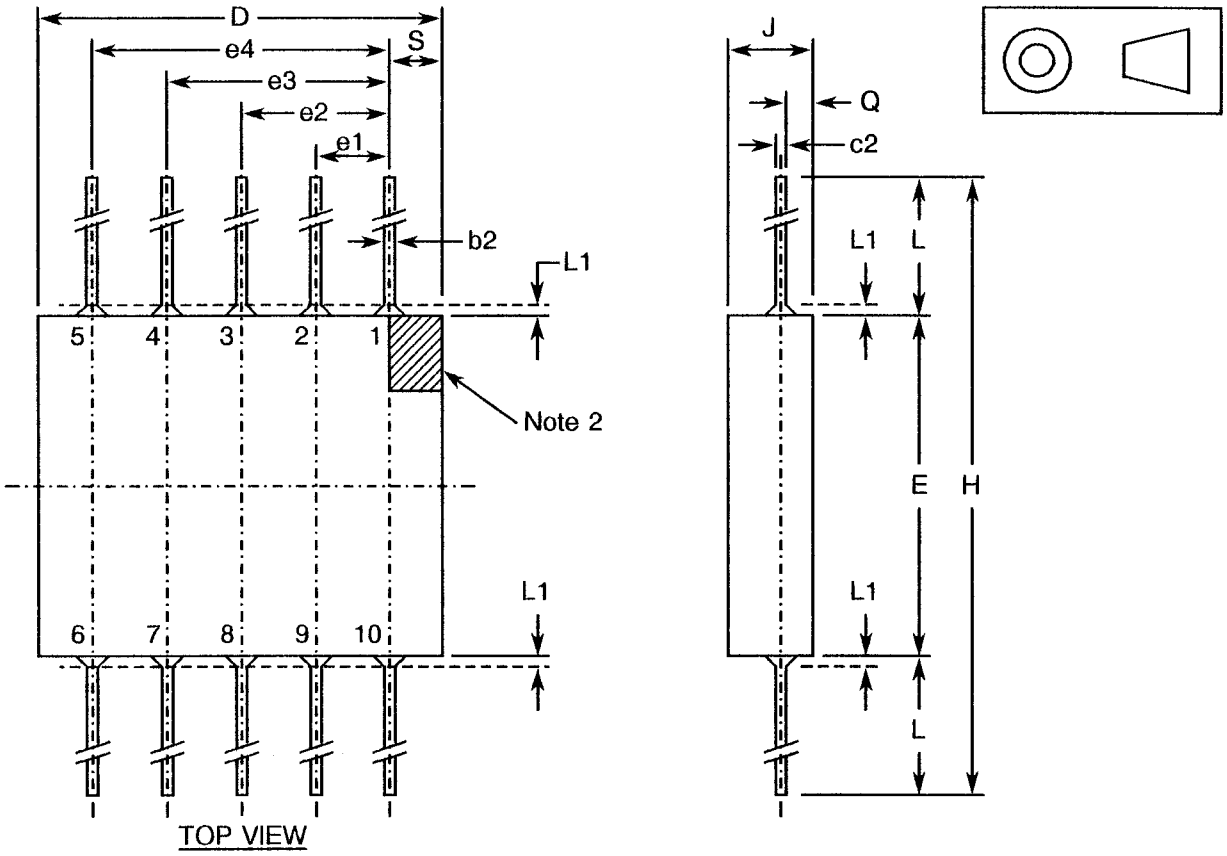


NOTES

1. Derating for type variants 01 and 02.
2. Derating for type variants 03 and 04.
3. Derating for type variants 05 and 06.

FIGURE 2 - PHYSICAL DIMENSIONS

FIGURE 2(a) - VARIANTS 01 AND 02, FLAT PACKAGE TO91



The metric dimensions are calculated from the original dimensions in inches.

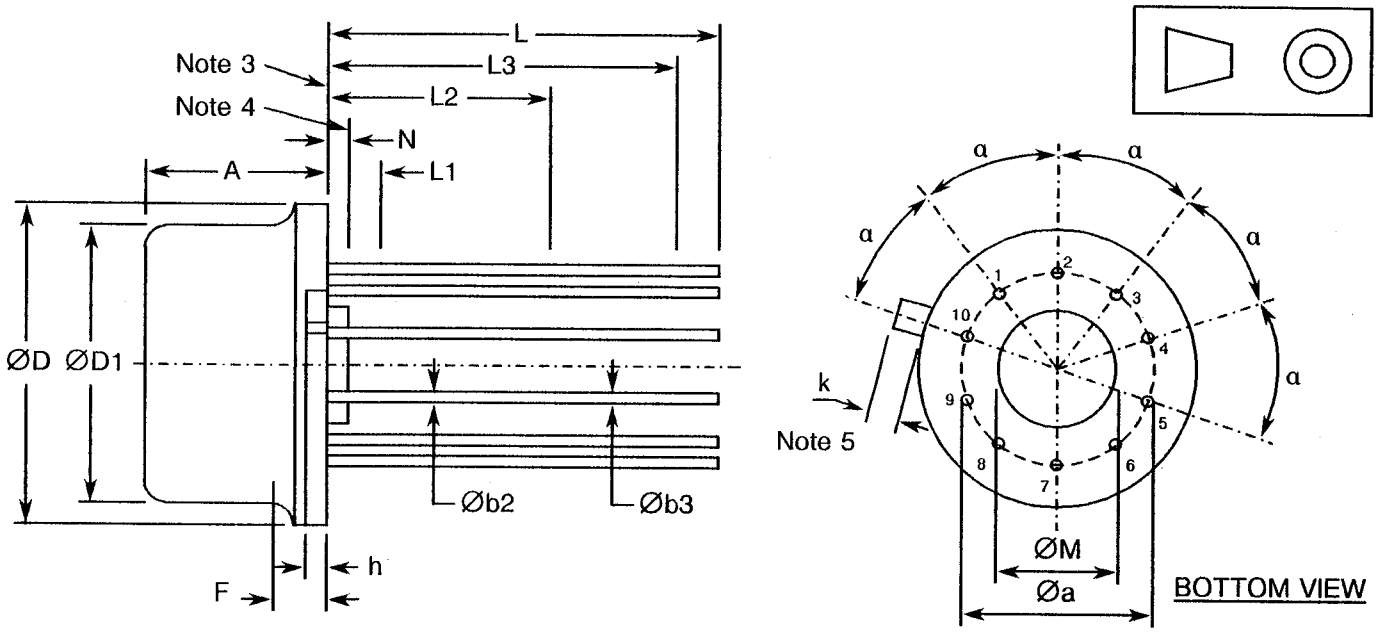
SYMBOL	MILLIMETRES		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
b2	0.254	0.482	0.010	0.019	
c2	0.077	0.152	0.003	0.006	
D	6.10	6.98	0.240	0.275	
E	6.10	6.60	0.240	0.260	
e1	1.15	1.39	0.045	0.055	1
e2	2.42	2.66	0.095	0.105	1
e3	3.69	3.93	0.145	0.155	1
e4	4.96	5.20	0.195	0.205	1
H	19.72	19.81	0.540	0.780	
J	0.77	1.77	0.030	0.070	
L	3.81	6.60	0.150	0.260	
L1	-	0.38	-	0.015	
Q	0.13	0.88	0.005	0.035	
S	0.52	0.88	0.020	0.035	

NOTES

1. The space between terminals has to be measured at a distance of 0.76mm maximum (0.030 inch) away from the case.
2. The top face and Pin No. 1 are marked.

FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(b) - VARIANTS 03 AND 04, METAL CAN TO100



SYMBOL	MILLIMETRES			INCHES			DEGR. NOM.	NOTES
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.		
Øa	-	5.84 (*)	-	-	0.230 (*)	-		1
A	4.20	-	4.69	0.165	-	0.185		
Øb2	0.407	-	0.482	0.016	-	0.019		
Øb3	-	-	0.53	-	-	0.021		
ØD	8.51	-	9.39	0.335	-	0.370		
ØD1	7.75	-	8.50	0.305	-	0.335		
F	-	-	1.27	-	-	0.050		
h	0.23	-	1.01	0.009	-	0.040		
j	0.712	0.787	0.863	0.028	0.031	0.034		
k	0.74	-	1.14	0.029	-	0.045		2
L	12.70	-	-	0.500	-	-		
L1	-	-	1.27	-	-	0.050		
L2	6.35	-	-	0.250	-	-		
L3	12.70	-	-	0.500	-	-		
ØM	3.56	-	4.06	0.140	-	0.160		
N	-	-	1.01	0.010	-	0.040		
α							36° (*)	1

NOTES

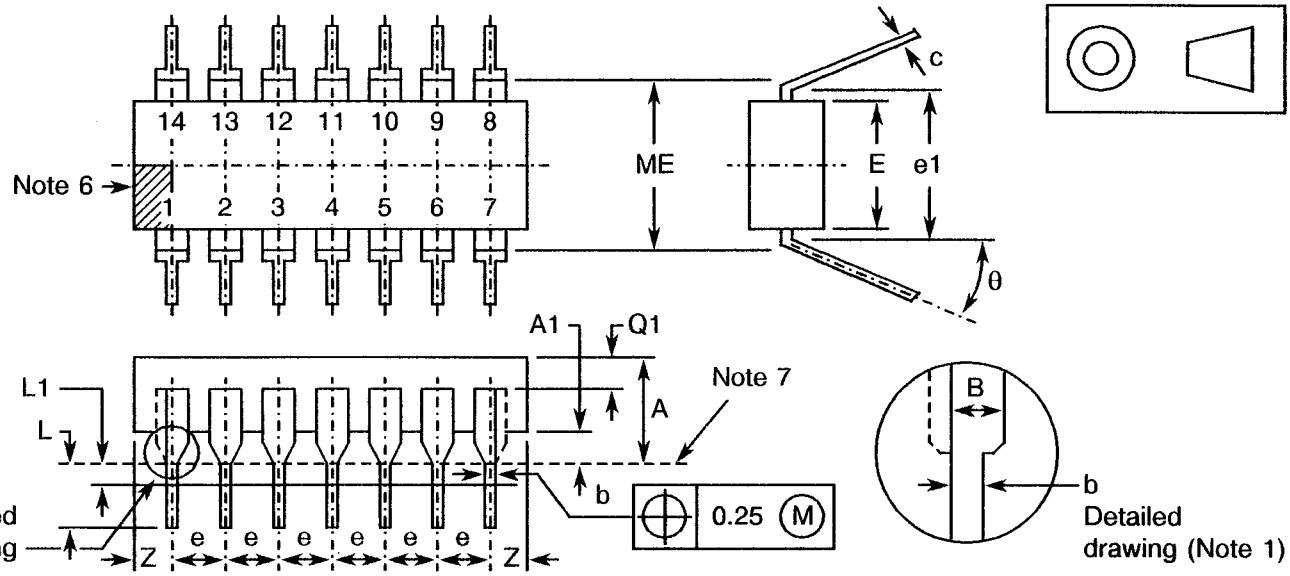
1. The section of each terminal, from a distance of 1.37mm (0.054 inch) to the reference plane, shall be located in a ring whose diameter is 0.99mm (0.039 inch), centred on the accurate geometrical point defining the terminal axis.
2. Measured from the D diameter.
3. Reference plane.
4. Base plane.
5. Reference index of Pin 8.

* = accurate geometrical location.

The metric dimensions are calculated from the original dimensions in inches.

FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(c) - VARIANTS 05 AND 06, DUAL-IN-LINE PACKAGE TO116



SYMBOL	MILLIMETRES			INCHES			DEGREES		NOTES
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	MAX.	
A	-	-	5.08	-	-	0.200			
A1	0.51	-	-	0.020	-	-			
B	-	-	1.77	-	-	0.070			1
b	0.381	-	0.508	0.015	-	0.020			1
c	0.204	-	0.304	0.008	-	0.012			
E	-	6.3	-	-	0.25	-			
e	-	2.54 *	-	-	0.100 *	-			2
e1	-	7.62 *	-	-	0.300 *	-			3
L	2.5	-	3.9	0.098	-	0.154			(a)
L1	-	-	0.76	-	-	0.030			
ME	7.62	-	8.25	0.300	-	0.325			3
Q1	-	-	2.03	-	-	0.080			
Z									4
θ							0	15	
n =	7×2								5

NOTES

1. The lead profile is not required for transition from B to b. The outline of the extreme outputs in the case of F.105A may differ from that of the others, as shown in the Figure.
2. The space between leads is measured on the area L1.
3. Measured when the value of the angle θ is zero.
4. Case F.105: Z between e/2 and e (1.27mm < Z < 2.54mm).
   Case F.105A: Z less than e/2 (Z < 1.27mm).
5. n = quantity of leads.
6. Area for visible reference mark on top face.
7. Base plane.

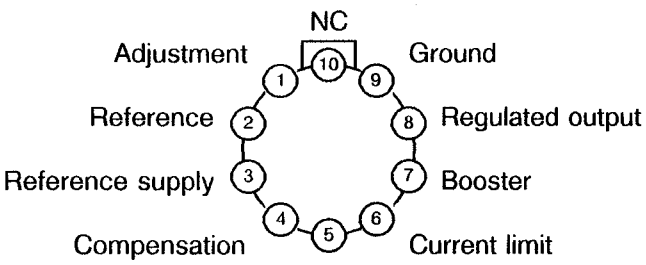
   * = accurate geometrical location.

(a) Recommended dimensions for the future: minimum 3.0mm (0.122 inch).
maximum 3.9mm (0.154 inch).

The metric dimensions are calculated from the original dimensions in inches.

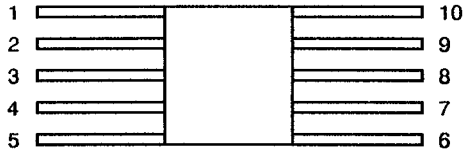
FIGURE 3(a) - PIN CONFIGURATION

TO-100 METAL CAN



TOP VIEW

TO-91 (CB-86) FLAT PACKAGE



Pin 5 connected to case

TOP VIEW

TO-116 (CB-2) DUAL-IN-LINE PACKAGE

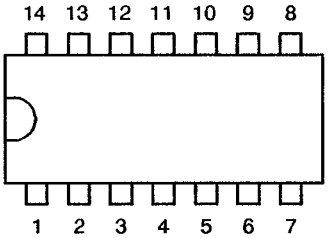
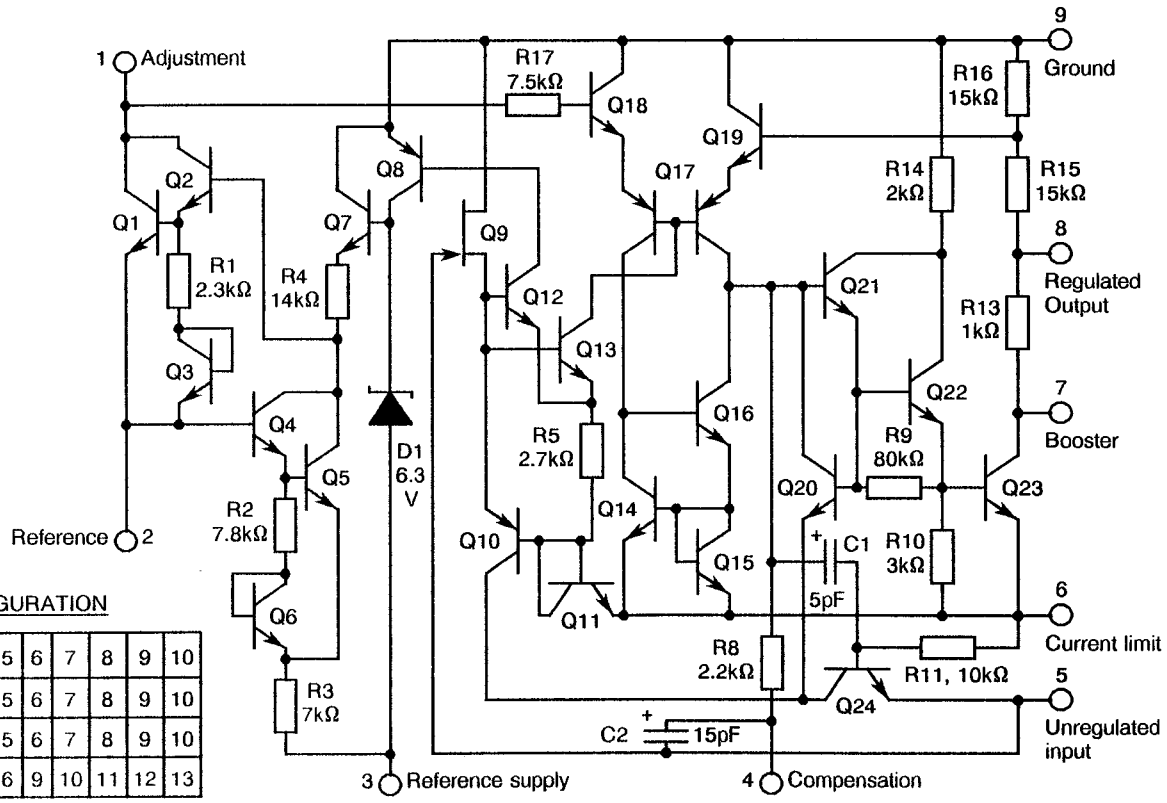


FIGURE 3(b) - TRUTH TABLE

Not applicable.

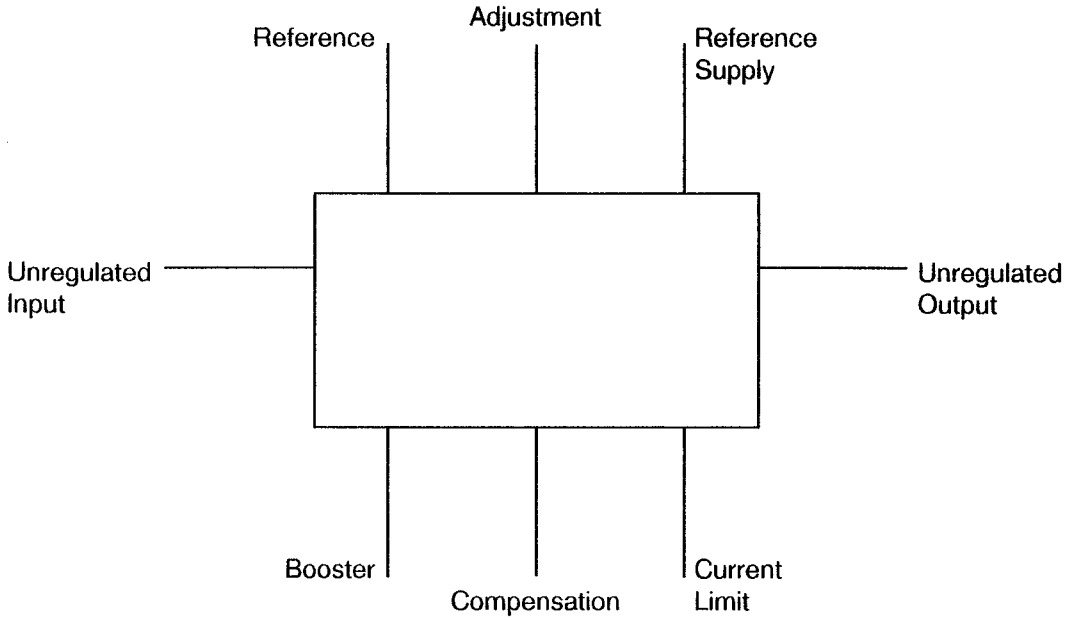
FIGURE 3(c) - CIRCUIT SCHEMATIC (FOR INFORMATION ONLY)



PIN CONFIGURATION

	1	2	3	4	5	6	7	8	9	10
TO-91	1	2	3	4	5	6	7	8	9	10
TO-100	1	2	3	4	5	6	7	8	9	10
TO-116	2	3	4	5	6	9	10	11	12	13

FIGURE 3(d) - 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.

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:-

K_{VI} = Input Regulation Coefficient.
K_{VO} = Output Regulation Coefficient.
K_{VT} = Regulation Temperature Coefficient.
I_Q = Standby Current.
I_{SC} = Short Circuit Current.

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.

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

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

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)

Subpara. 7.1.1(a), "High Temperature Reverse Bias" test and subsequent electrical measurements related to this test shall be omitted.

4.2.4 Deviations from Qualification, Environmental and Endurance 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 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 for:-

Variants 01, 02: 0.35 grammes.
Variants 03, 04: 1.50 grammes.
Variants 05, 06: 2.00 grammes.

4.4 MATERIALS

The materials 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

The lead material shall be Type 'D' with either Type '2' or Type '3 or 4' finish in accordance with ESA/SCC Basic Specification No. 23500 (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.

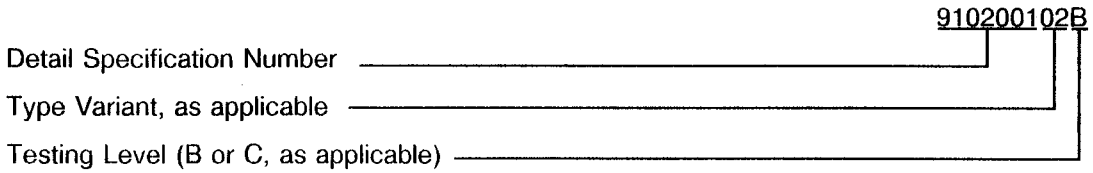
(c) Traceability Information.

4.5.2 Lead Identification

An index shall be located at the top of the package in the position defined in Note 2 of Figure 2 (Variants 01, 02), Note 5 of Figure 2 (Variants 03, 04) or Note 6 of Figure 2 (Variants 05, 06). Alternatively, a tab may be used to identify Pin No. 1. The pin numbering shall be read with the index or tab on the left-hand side.

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.

4.5.5 Marking of Small Components

When it is considered that the component is too small to accommodate the marking as specified above, as much as space permits shall be marked. The order of precedence shall be as follows:-

(a) Colour mark for type variant (additional marking).

(b) The SCC Component Number.

(c) Traceability Information.

The marking information in full shall accompany each component in its primary package.

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(a) and 3(b). The measurements shall be performed at $T_{amb} = +125$°C and -55°C respectively.

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 (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 (Note 1)	Limits		Unit
						Min	Max	
1	Output Regulation Coefficient	K_{VO}	-	4	$V_I = -10V$, $V_O = -5.0V$ $O \leq I_O \leq 20mA$ $R_S = 15\Omega$	-	0.1	%
2	Input Regulation Coefficient	K_{VI}	-	4	$-50V \leq V_I \leq -45V$ $V_O = -40V$, $I_O = 5.0mA$	-	0.0025	%/V
3	Input Regulation Coefficient	K_{VI}	-	4	$-10V \leq V_I \leq -8.0V$ $V_O = -5.0V$, $I_O = 5.0mA$	-	0.02	%/V
4	Output Voltage	V_O	-	4	$V_I = -50V$, $V_O = 0$ $I_O = 0$	-15	-	mV
5	Output Voltage	V_O	-	4	$V_I = -8.0V$, $V_O = 0$ $I_O = 0$	-15	-	mV
6	Output Voltage	V_O	-	4	$V_I = -46V$, $V_O = -40V$ $I_O = 20mA$	-44	-36	V
7	Output Voltage	V_O	-	4	$V_I = -50V$, $V_O = -1.0V$ $I_O = 10mA$	-1.1	-0.9	V
8	Standby Current	I_Q	-	4	$V_I = -50V$, $V_O = 0$ $I_O = 5.0mA$	-	2.5	mA
9	Standby Current	I_Q	-	4	$V_I = -50V$, $V_O = -40V$ $I_O = 5.0mA$	-	5.0	mA
10	Short Circuit Current	I_{SC}	-	4	$V_I = -10V$, $V_O = 0$ $R_{SC} = 15\Omega$	-	50	mA

NOTES

1. For pin configuration, see Figure 3(a).

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

No.	Characteristics	Symbol	Test Method MIL-STD 883	Test Fig.	Test Conditions (Note 1)	Limits		Unit
						Min	Max	
1	Output Regulation Coefficient	K_{VO}	-	4	$V_I = -10V$, $V_O = -5.0V$ $O \leq I_O \leq 20mA$ $R_S = 15\Omega$	-	0.1	%
2	Input Regulation Coefficient	K_{VI}	-	4	$-50V \leq V_I \leq -45V$ $V_O = -40V$, $I_O = 5.0mA$	-	0.0025	%/V
3	Input Regulation Coefficient	K_{VI}	-	4	$-10V \leq V_I \leq -8.0V$ $V_O = -5.0V$, $I_O = 5.0mA$	-	0.02	%/V
4	Output Voltage	V_O	-	4	$V_I = -50V$, $V_O = 0$ $I_O = 0$	-15	-	mV
5	Output Voltage	V_O	-	4	$V_I = -8.0V$, $V_O = 0$ $I_O = 0$	-15	-	mV
6	Output Voltage	V_O	-	4	$V_I = -46V$, $V_O = -40V$ $I_O = 20mA$	-44	-36	V
7	Output Voltage	V_O	-	4	$V_I = -50V$, $V_O = -1.0V$ $I_O = 10mA$	-1.1	-0.9	V
8	Standby Current	I_Q	-	4	$V_I = -50V$, $V_O = 0$ $I_O = 5.0mA$	-	2.5	mA
9	Standby Current	I_Q	-	4	$V_I = -50V$, $V_O = -40V$ $I_O = 5.0mA$	-	5.0	mA

NOTES

1. For pin assignment, see Figure 3(a).
2. $R_{SC} = 15$, unless otherwise specified.
3. Sample Test Inspection Level = II, AQL = 2.5%.

TABLE 3(b) - ELECTRICAL MEASUREMENTS AT HIGH TEMPERATURE, −55 °C

No.	Characteristics	Symbol	Test Method MIL-STD 883	Test Fig.	Test Conditions (Note 1)	Limits		Unit
						Min	Max	
1	Output Regulation Coefficient	K_{VO}	-	4	$V_I = -10V$, $V_O = -5.0V$ $O \leq I_O \leq 20mA$ $R_S = 15\Omega$	-	0.1	%
2	Input Regulation Coefficient	K_{VI}	-	4	$-50V \leq V_I \leq -45V$ $V_O = -40V$, $I_O = 5.0mA$	-	0.0025	%/V
3	Input Regulation Coefficient	K_{VI}	-	4	$-10V \leq V_I \leq -8.0V$ $V_O = -5.0V$, $I_O = 5.0mA$	-	0.02	%/V
4	Output Voltage	V_O	-	4	$V_I = -50V$, $V_O = 0$ $I_O = 0$	−15	-	mV
5	Output Voltage	V_O	-	4	$V_I = -8.0V$, $V_O = 0$ $I_O = 0$	−15	-	mV
6	Output Voltage	V_O	-	4	$V_I = -46V$, $V_O = -40V$ $I_O = 20mA$	−44	−36	V
7	Output Voltage	V_O	-	4	$V_I = -50V$, $V_O = -1.0V$ $I_O = 10mA$	−1.1	−0.9	V
8	Standby Current	I_Q	-	4	$V_I = -50V$, $V_O = 0$ $I_O = 5.0mA$	-	2.5	mA
9	Standby Current	I_Q	-	4	$V_I = -50V$, $V_O = -40V$ $I_O = 5.0mA$	-	5.0	mA

NOTES

1. For pin assignment, see Figure 3(a).
2. $R_{SC} = 15$, unless otherwise specified.
3. Sample Test Inspection Level = II, AQL = 2.5%.

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

FIGURE 4(a)

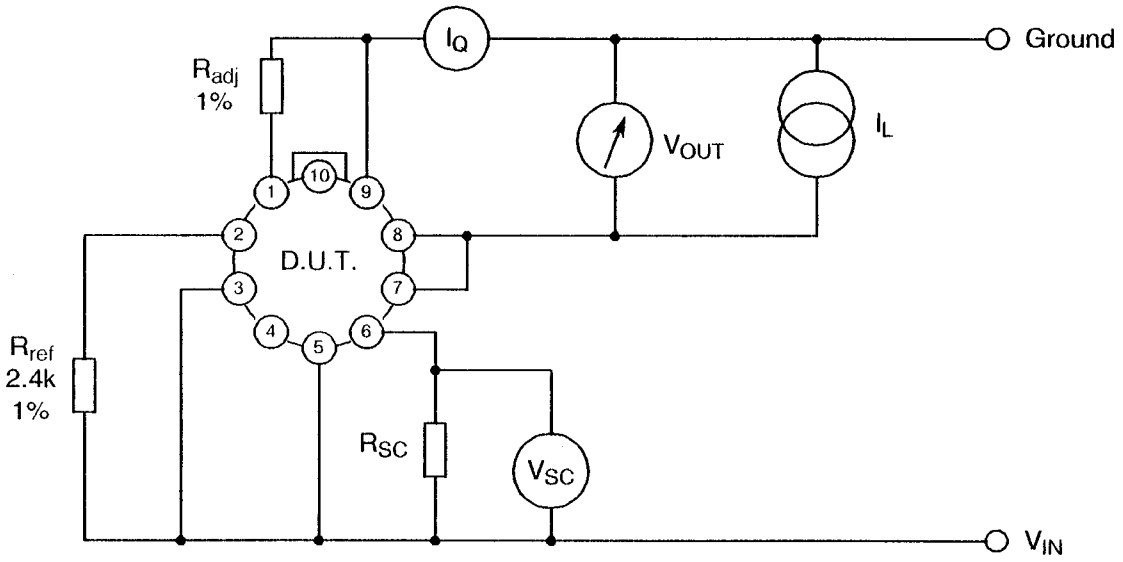


TABLE 4 - PARAMETER DRIFT VALUES

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	CHANGE LIMITS (Δ_1)	UNIT
2	Change in Input Regulation Coefficient	ΔK_{VI}	As per Table 2	As per Table 2	± 0.001	%/V
6	Change in Output Voltage	ΔV_O	As per Table 2	As per Table 2	Note 1	-
9	Change in Standby Current	$\Delta I_Q/I_Q$	As per Table 2	As per Table 2	± 10	%

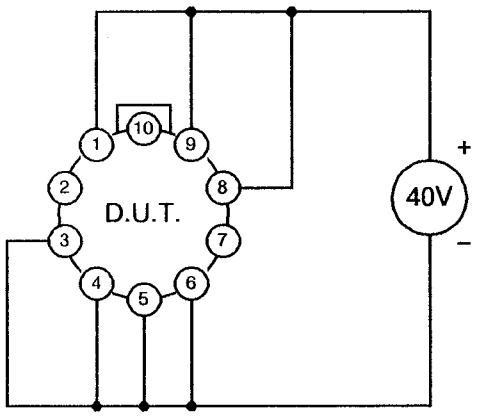
NOTES

1. Absolute limits of 36V minimum and 44V maximum shall not be exceeded.

TABLE 5 - CONDITIONS FOR BURN-IN

No.	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	T_{amb}	+ 125 ± 5	°C
2	Power Supply	V_{CC}	+ 40	V

FIGURE 5 - 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

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 $T_{amb} = +150 \pm 5$ °C.

TABLE 6 - ELECTRICAL MEASUREMENTS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS DURING ENDURANCE TESTING

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN	MAX	
1	Output Regulation Coefficient	K_{VO}	4	$V_I = -10V$ $O \leq I_O \leq 20mA$ $R_{SC} = 15$	-	0.1	%
2	Input Regulation Coefficient	K_{VI}	4	$-50V \leq V_I \leq -45V$ $V_O = -40V$, $I_O = 5.0mA$	-	0.0025	%/V
6	Output Voltage	V_O	4	$V_I = -46V$, $V_O = -40V$ $I_O = 20mA$	-44	-36	V
9	Standby Current	I_Q	4	$V_I = -50V$, $V_O = -40V$ $I_O = 5.0mA$	-	5.0	mA