TOGGLE SWITCHES,

BASED ON SERIES 12100 AND 11100

ESCC Detail Specification No. 3701/001

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space components
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		This Issue supersedes Issue 1 and incorporates all modifications defined in DCR 22884 and other editorial modifications.	

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1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Toggle Switches, based on Series 12100 or 11100. It shall be read in conjunction with ESA/SCC Generic Specification No. 3701, the requirements of which are supplemented herein.

1.2 COMPONENT TYPE VARIANTS

Variants of the 12100 and 11100 series 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 switches specified herein, are as scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION (FIGURE 1)

Not applicable.

1.5 PHYSICAL DIMENSIONS

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

1.6 FUNCTIONAL DIAGRAM

The functional diagram of the switches specified herein is shown in Table 1(a) and Figure 3.

TABLE 1(a) - TYPE VARIANTS

VARIANT	PART NO.	FUNCTION (NOTE 1)	NUMBER OF POLES	NUMBER OF LOCKING POSITIONS (NOTE 2)	BUSHING DIAMETER (mm)	WEIGHT MAX. (g)
01	12146	ON - ON	2	0	11.9	20
02	12146	ON - ON	2	1	11.9	23
03	12146	ON - ON	2	2	11.9	23
04	12156	ON - ON	3	0	11.9	22
05	12156	ON - ON	3	1	11.9	25
06	12156	ON - ON	3	2	11.9	25
07	12166	ON - ON	4	0	11.9	25
08	12166	ON - ON	4	1	11.9	28
09	12166	ON - ON	4	2	11.9	28
10	12147	MOM OFF MOM	2	0	11.9	20
11	12157	MOM OFF MOM	3	0	11.9	22
12	12167	MOM OFF MOM	4	0	11.9	25
13	12148	ON OFF MOM	2	0	11.9	20
14	12158	ON OFF MOM	3	0	11.9	22
15	12168	ON OFF MOM	4	0	11.9	25
16	12149	ON OFF ON	2	0	11.9	20
17	12149	ON OFF ON	2	3	11.9	23
18	12159	ON OFF ON	3	0	11.9	22
19	12159	ON OFF ON	3	3	11.9	25
20	12169	ON OFF ON	4	0	11.9	25
21	12169	ON OFF ON	4	3	11.9	28
22	11146	ON - ON	2	0	6.35	10
23	11147	MOM OFF MOM	2	0	6.35	10
24	11148	ON OFF MOM	2	0	6.35	10
25	11149	ON OFF ON	2	0	6.35	10

NOTES

1. The functions are as follows:-

   ON = Alternate position with closed contacts.
   OFF = Alternate position with open contacts.
   MOM = Passing/Momentary position with closed contacts.

2. The ON and OFF positions may be locked according to the variants. See details in Figure 3(b).

TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	LIMITS		UNIT	REMARKS
			MIN.	MAX.		
1	Rated DC Current on Resistive Load	I_N	- 100 (1) 10 (1)	4.0 - -	A µA mA	at 28 ± 2.0V at 3.0V at 30mV
2	Rated AC Current on Resistive Load	I_N	-	2.0	A	at 250V 50Hz
3	Rated DC Current on Inductive Load	I_N	-	2.0	A	at 28 ± 2.0V 2.0 ≤ L/R ≤ 3.0ms
4	Rated DC Current on Capacitive Load	I_N	-	1.0	A	at 28 ± 2.0V
5	Overload DC Current on Resistive Load	-	-	6.0	A	-
6	Operating Temperature Range	T_{amb}	– 40	+ 125	°C	-
7	Storage Temperature Range	T_{stg}	– 55	+ 125	°C	-
8	Soldering Conditions Soldering Temperature Soldering Duration Distance from Case Interval between Soldering of 2 Terminations	 T_{sol} t d i	 - - 1.5 15	 + 350 5.0 - -	 °C s mm s	See ESA/SCC No. 3701 Para. 9.16

NOTES

1. The switches can be used at these low levels as long as they have not been submitted to a high level condition. If they have, new minimum rated DC current is 100mA.

FIGURE 1 - PARAMETER DERATING INFORMATION

Not applicable

FIGURE 2 - PHYSICAL DIMENSIONS

FIGURE 2(a) -VARIANTS 01-02-03-10-13-16-17 - DOUBLE-POLE TYPE

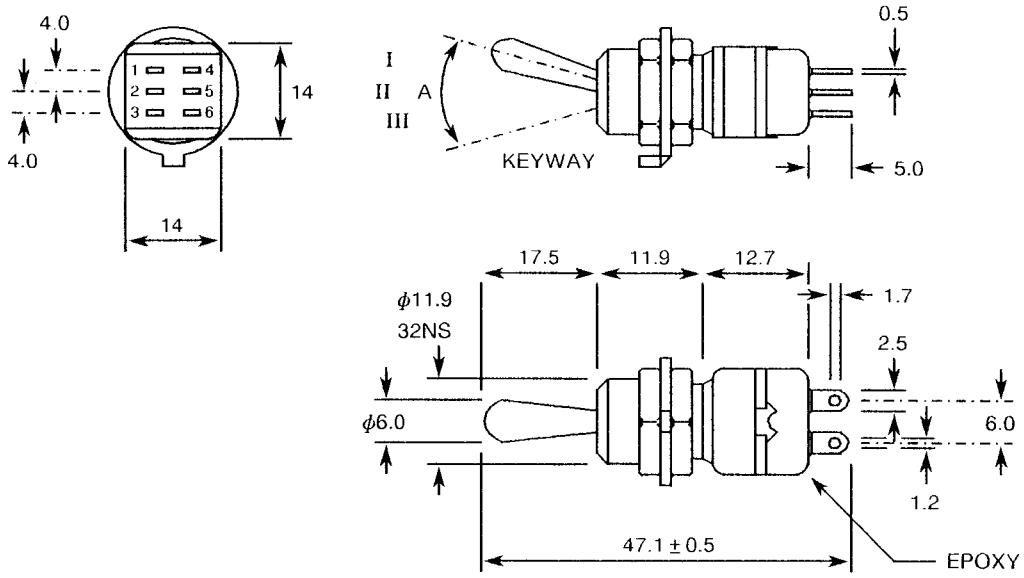
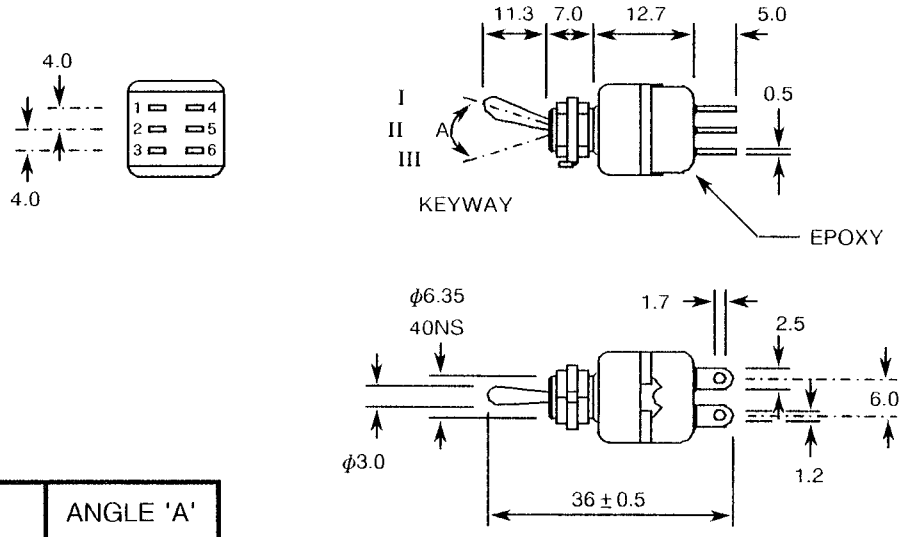


FIGURE 2(b) -VARIANTS 22-23-24-25 - DOUBLE-POLE TYPE



FUNCTION	ANGLE 'A'
ON - ON	28
MOM - OFF - MOM	24
ON - OFF - MOM	24
ON - OFF - ON	24

NOTES

1. All dimensions are in millimetres.

FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

FIGURE 2(c) - VARIANTS 04-05-06-11-14-18-19 - THREE-POLE TYPE

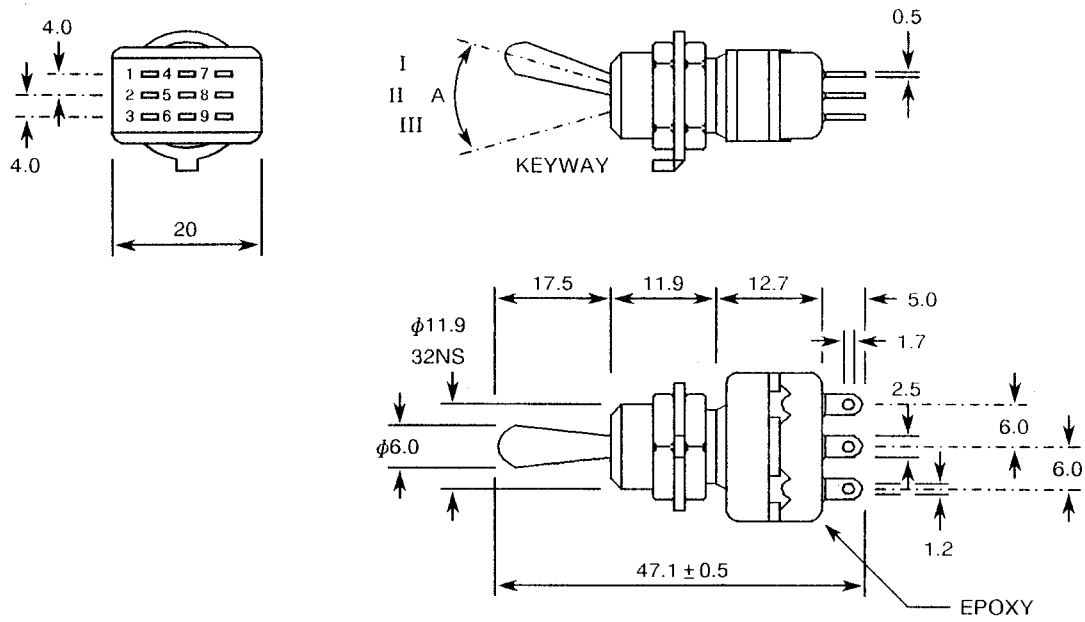
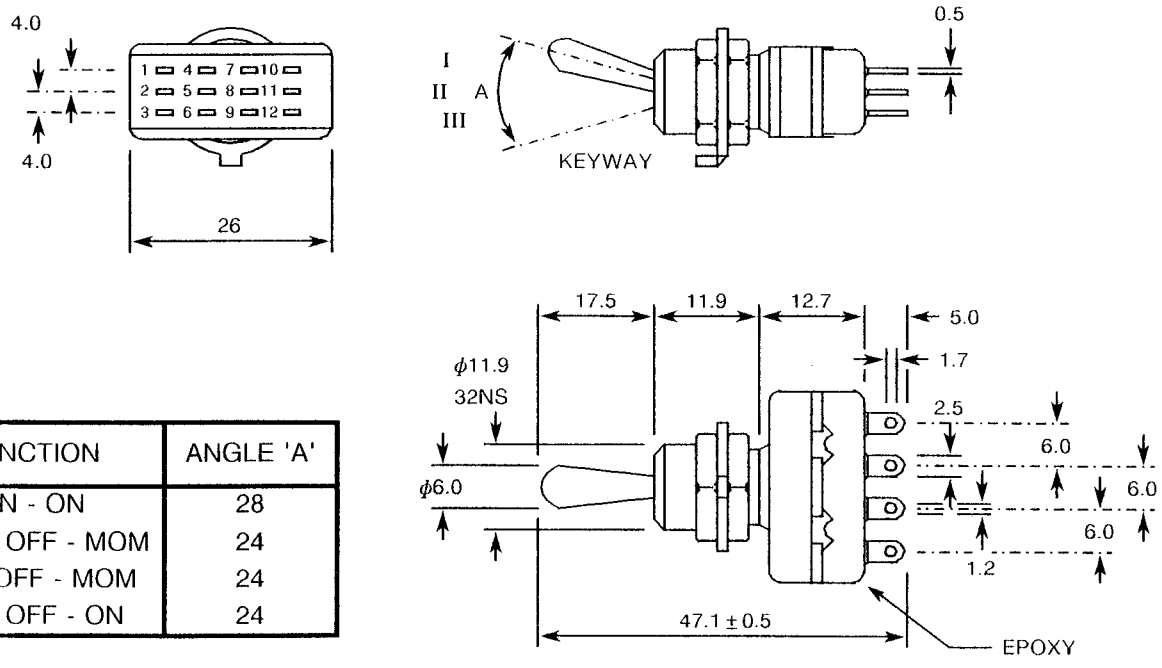


FIGURE 2(d) - VARIANTS 07-08-09-12-15-20-21 - FOUR-POLE TYPE



FUNCTION	ANGLE 'A'
ON - ON	28
MOM - OFF - MOM	24
ON - OFF - MOM	24
ON - OFF - ON	24

NOTES

1. All dimensions are in millimetres.

FIGURE 3 - FUNCTIONAL DIAGRAM

FIGURE 3(a) - SWITCH FUNCTIONAL DIAGRAM

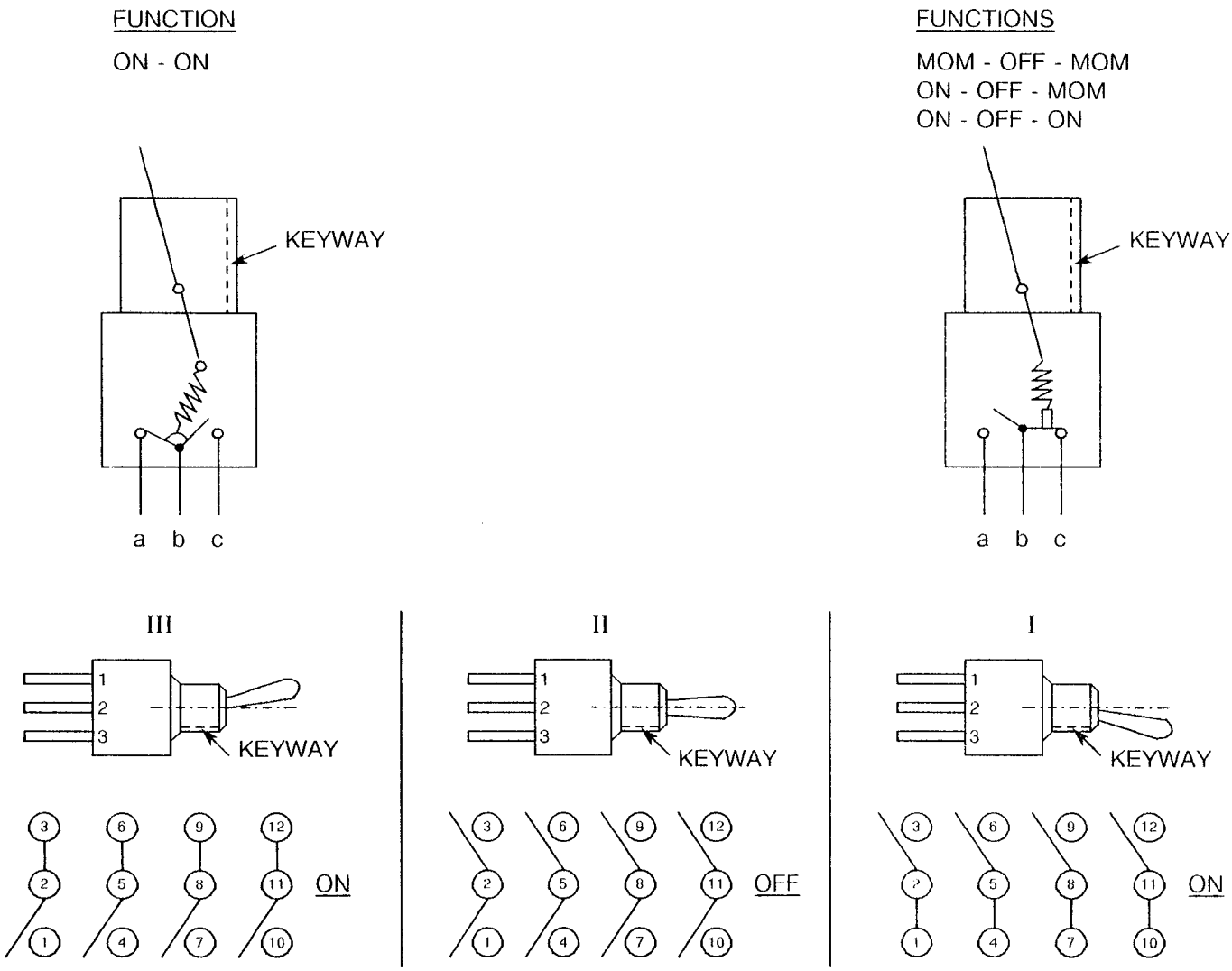
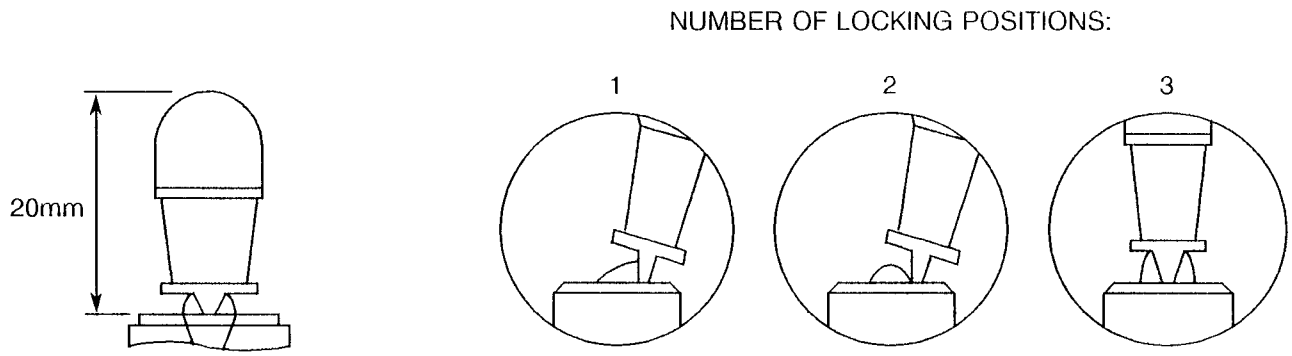


FIGURE 3(b) - LEVER LOCKING DETAILS



VARIANTS: 02-05-08 03-06-09 17-19-21

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. 3701, Electromechanical Switches.

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 and ESA/SCC Generic Specification No. 3701 shall apply.

4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the switches specified herein shall be as stated in this specification and ESA/SCC Generic Specification No. 3701 for Electromechanical Switches. 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. 9.4.1.3, Voltage Proof: Duration of voltage application shall be 5.0s.

4.2.3 Deviations from Screening Tests (Chart III)

(a) Para. 9.4.1.3, Voltage Proof: Duration of voltage application shall be 5.0s.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.4.1.3, Voltage Proof: Duration of voltage application shall be 5.0s.

(b) Para. 9.10, Shock: Peak acceleration shall be 75g.

(c) Para. 9.12, Damp Heat: Not applicable.

(d) Para. 9.13, Current Carrying Capability: Temperature for test shall not exceed 125°C.

(e) Para. 9.16, Resistance to Soldering Heat: Test duration shall be 5.0s ± 1.0s. Intervals between two soldering operations shall be 15s minimum.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.4.1.3, Voltage Proof: Duration of voltage application shall be 5.0s.

(b) Para. 9.10, Shock: Peak acceleration shall be 75g.

(c) Para. 9.12, Damp Heat: Not applicable.

(d) Para. 9.13, Current Carrying Capability: Temperature for test shall not exceed 125°C.

(e) Para. 9.16, Resistance to Soldering Heat: Test duration shall be 5.0s ± 1.0s. Intervals between two soldering operations shall be 15s minimum.

4.3 MECHANICAL AND ENVIRONMENTAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the switches specified herein shall be checked in accordance with ESA/SCC Generic Specification No. 3701, Section 9. They shall conform to those shown in Figure 2.

4.3.2 Weight

The maximum weight of the switches specified herein shall be as specified in Table 1(a).

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 switches 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

Isolator: diallylphtalate.

4.4.2 Lever

Chrome-plated Brass.

4.4.3 Contacts

2.0µ gold-plated silver rivets with nickel barrier.

4.4.4 Terminals

Gold-plated Brass.

4.4.5 Locking Washer

Nickel-plated Brass.

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.

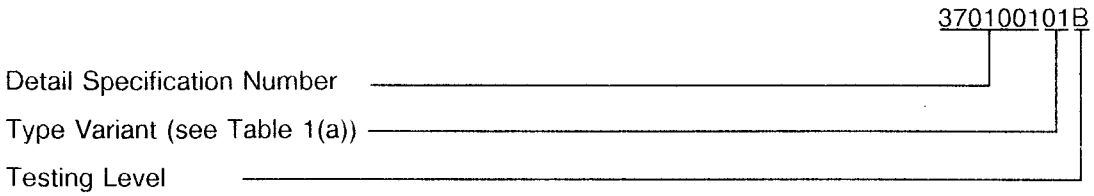
(c) Traceability Information.

4.5.2 Terminal Identification

Terminal identification shall be marked on the switch in accordance with Figure 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

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. 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 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

Not applicable.

4.7 RUN-IN TESTS

4.7.1 Parameter Drift Values

Not applicable.

4.7.2 Conditions for Run-in

The requirements for run-in are specified in Section 7 of ESA/SCC Generic Specification No. 3701. The conditions for run-in shall be as specified in Table 5(a) of this specification.

4.7.3 Electrical Circuits for Run-in

Not applicable.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
1	Bounce Time	T_b	ESA/SCC No. 3701	Para. 9.4.1.2	-	2.0	ms
2	Contact Resistance	R_c	ESA/SCC No. 3701	Para. 9.4.1.1	-	10	mΩ
3	Insulation Resistance	R_i	ESA/SCC No. 3701	Para. 9.4.1.4 At 500 Vdc	1000	-	MΩ
4	Voltage Proof Between Open Contacts Between Terminals and Case	V_p	ESA/SCC No. 3701	Para. 9.4 1.3	 1000 1500	 - -	 Vrms Vrms

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES (NOTE 1), +125(+0-5) °C AND -55(+5-0) °C

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
1	Voltage Proof Between Terminals and Case	V_p	ESA/SCC No. 3701	Para. 9.4.1.3	 1500	 -	 Vrms
2	Insulation Resistance (Note 2)	R_i	ESA/SCC No. 3701	Para. 9.4.1.4 At 500 Vdc	100	-	MΩ

NOTES

1. On 20 units. If the lot is smaller than 20 units, this test shall be performed at 100%.
2. Insulation Resistance is to be performed only at high temperature.

TABLE 4 - PARAMETER DRIFT VALUES

Not applicable

TABLE 5(a) - CONDITIONS FOR RUN-IN

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	Ambient Temperature	T_{amb}	$+22 \pm 3$	°C
2	Duration Cycling Rate Monitoring Resistive Load DC Current DC Voltage	 I_{DC} V_{DC}	500 cycles 10 to 18 cycles/minutes Detection of misses 10mA max. 6.0V max.	 mA V

TABLE 5(b) - CONDITIONS FOR ENDURANCE AND LOW LEVEL LIFE

No.	CHARACTERISTICS	SYMBOL	CONDITIONS	UNIT
1	DC Resistive Endurance			
	Resistive Load			
	Duration		10,000 cycles	
	Cycling rate		10 to 18 cycles/minutes	
	DC Current	I_{DC}	4.0	A
	DC Voltage	V_{DC}	28	V
2	AC Resistive Endurance			
	Resistive Load			
	Duration		10,000 cycles	
	Cycling rate		10 to 18 cycles/minutes	
	AC Current	I_{AC}	2.0	A
	AC Voltage	V_{AC}	250	V
3	DC Inductive Endurance			
	Inductive Load		L/R = 2.5 ± 0.5	ms
	Pressure	P	50	mBar
	Duration		10,000 cycles	
	Cycling rate		10 to 18 cycles/minutes	A
	DC Current	I_{DC}	2.0	V
	DC Voltage	V_{DC}	28	
4	DC Capacitive Endurance			
	Capacitive Load		See Para. 4.8.5 of this specification	
	Pressure	P	50	mBar
	Duration		10,000 cycles	
	Cycling rate		10 to 18 cycles/minutes	
	DC Current	I_{DC}	1.0	A
	DC Voltage	V_{DC}	28	V
	DC Peak Current	I_p	15	A
	Time Peak Current	t	1.0	ms
5	Low Level Life			
	Duration		40,000 cycles for Lot Acceptance 100,000 cycles for Qualification	
	Cycling rate		10 to 18 cycles/minutes	
	Monitoring		Detection of misses	
	Resistive Load			
	DC Current/Voltage		10mA/30mV 100µA/3.0mV 35mA/28V	

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 5000)

4.8.1 Measurements and Inspections on Completion of Environmental Tests

The parameters to be measured and inspections to be performed 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 Measurements at Intermediate Points during Endurance Tests

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

4.8.3 Measurements and Inspections on Completion of Endurance Tests

The parameters to be measured and inspections on completion of endurance tests are as specified in Table 6. 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. 3701. The conditions for operating life testing shall be as specified in Table 5 of this specification.

4.8.5 Electrical Circuit for Capacitive Endurance Test

Electrical circuit for capacitive endurance test is defined in ESA/SCC Generic Specification No. 3701, Para. 9.14.3. The parameters for the circuit shall be as specified in Table 5.

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

No.	ESA/SCC GENERIC SPECIFICATION NO. 3701		SYMBOL	MEASUREMENTS/ INSPECTIONS	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS	TEST METHOD AND CONDITIONS		IDENTIFICATION AND CONDITIONS	MIN.	MAX.	
1	Functional Test	Para. 9.2	-	Continuity Current	-	10	mA
2	Seal Test	Para. 9 .6	-	Gross Leak	No bubbling		
3	External Visual Inspection	Para. 9.7	-	-	-	-	-
4	Rapid Change of Temperature	Para. 9.8	-	Visual Examination	-	-	-
5	Vibration	Para. 9.9	-	Intermittent contacts Visual Examination	-	100	µs
6	Shock	Para. 9.10	-	Intermittent contacts Voltage Proof Between open contacts Between terminals and case Contact Resistance Visual Examination	- 1000 1500 -	100 - - 10	µs Vrms Vrms mΩ
7	Mechanical Measurements	Para. 9.11	-	Robustness of Terminations Strength of Mounting Bushing Variants 1 to 21 Variants 22 to 25 Strength of Actuator Variants 1 to 21 Variants 22 to 25 Functional Test	20 2.5 1.7 50 30	- - - - -	N Nm Nm N N
8	Damp Heat	Para. 9.12	-	-	Not applicable		
9	Current Carrying Capability	Para. 9.13	-	Contact Resistance Functional Test	-	100	mΩ

TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS DURING AND ON COMPLETION OF ENDURANCE TESTING (CONTINUED)

No.	ESA/SCC GENERIC SPECIFICATION NO. 3701		SYMBOL	MEASUREMENTS/ INSPECTIONS	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS	TEST METHOD AND CONDITIONS		IDENTIFICATION AND CONDITIONS	MIN.	MAX.	
10	Resistive Endurance	Para. 9.14.1	-	Initial Measurements Contact Resistance	-	10	mΩ
				Intermediate Measurements Contact Resistance	-	100	mΩ
				Final Measurements Contact Resistance	-	100	mΩ
				Voltage Proof Between open contacts	1000		Vrms
				Between terminals and case	1500		Vrms
11	Inductive Endurance	Para. 9.14.2	-	Initial Measurements Contact Resistance	-	10	mΩ
				Intermediate Measurements Contact Resistance	-	100	mΩ
				Final Measurements at Room Conditions Contact Resistance	-	100	mΩ
				Voltage Proof Between open contacts	1000		Vrms
				Between terminals and case	1500		Vrms
12	Capacitive Endurance	Para. 9.14.3	-	Initial Measurements Contact Resistance	-	10	mΩ
				Intermediate Measurements Contact Resistance	-	100	mΩ
				Final Measurements at Room Conditions Contact Resistance	-	100	mΩ
				Voltage Proof Between open contacts	1000		Vrms
				Between terminals and case	1500		Vrms

TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS DURING AND ON COMPLETION OF ENDURANCE TESTING (CONTINUED)

No.	ESA/SCC GENERIC SPECIFICATION NO. 3701		SYMBOL	MEASUREMENTS/ INSPECTIONS IDENTIFICATION AND CONDITIONS	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS	TEST METHOD AND CONDITIONS			MIN.	MAX.	
13	Temperature Rise	Para. 9.15	ΔT	Temperature Rise Measurement	-	30	°C
14	Resistance to Soldering Heat	Para. 9.16	-	Contact Resistance	-	10	mΩ
				Voltage Proof			
				Between open contacts	1000	-	Vrms
				Between terminals and case	1500	-	Vrms
				Functional Test			
				Visual Examination			
15	Solderability	Para. 9.17	-	Visual Examination	-	-	-
16	Permanence of Marking	Para. 9.18	-	Visual Examination	-	-	-
17	Low Level Life	Para. 9.20	-	Initial Measurements			
				Contact Resistance	-	10	mΩ
				Intermediate Measurements			
				Contact Resistance	-	50	mΩ
				Final Measurements			
				Number of Closing		No misses	
				Contact Resistance	-	50	mΩ
				Voltage Proof			
				Between open contacts	1000	-	Vrms
				Between terminals and case	1500	-	Vrms
18	Overload	Para. 9.22	-	Contact Resistance	-	100	mΩ