



**DIODES, MICROWAVE, SILICON, PIN**  
**BASED ON PLANAR TYPES BXY43C AND BXY44K**

**ESCC Detail Specification No. 5513/030**

Issue 2	March 2013
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## **1 GENERAL**

### **1.1 SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for a Diode, Microwave, Silicon, PIN, based on Planar Types BXY43C and BXY44K. It shall be read in conjunction with ESCC Generic Specification No. 5010, 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**

The derating information applicable to the diodes specified herein, is shown in 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 1 with a Minimum Critical Path Failure Voltage of 550V for Variants 01 to 04 and Class 2 with a Minimum Critical Path Failure Voltage of 1.2kV for Variants 05 to 08.

## **2 APPLICABLE DOCUMENTS**

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

- (a) ESCC Generic Specification No. 5010 for Discrete Microwave Semiconductor Components.
- (b) MIL-STD-750, Test Methods for Semiconductor Devices.

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

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

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

Variant	Based On Type	Figure	Terminal/Lead Material And Finish
01	BXY43C	2(a)	Cathode = D2, Anode = E2
02	BXY43C	2(b)	E2
03	BXY43C	2(c)	D2
04	BXY43C	2(d)	D2
05	BXY44K	2(a)	Cathode = D2, Anode = E2
06	BXY44K	2(b)	E2
07	BXY44K	2(e)	Cathode = D2, Anode = E2
08	BXY44K	2(d)	D2

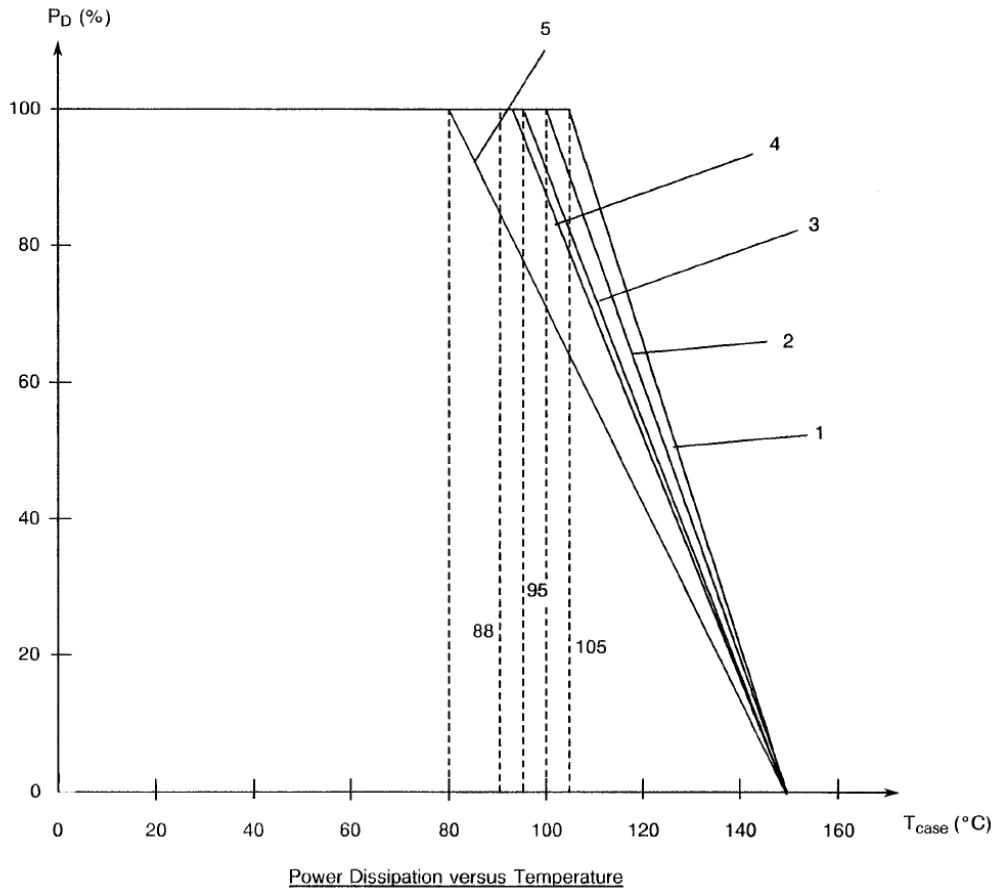
**TABLE 1(b) - MAXIMUM RATINGS**

No.	Characteristics	Symbol	Maximum Rating	Unit	Remarks
1	DC Reverse Voltage Variants 01 to 04 Variants 05 to 08	$V_R$	-150 -200	V	-
2	Forward Current (Continuous)	$I_F$	400	mA	-
3	Power Dissipation	$P_D$	500	mW	Note 1
4	Operating Temperature Range	$T_{op}$	-55 to +150	°C	$T_{case}$
5	Storage Temperature Range	$T_{stg}$	-65 to +175	°C	-
6	Soldering Temperature	$T_{sol}$	+235	°C	Note 2
7	Junction Temperature	$T_J$	+175	°C	-
8	Thermal Resistance (Junction to Case) Variant 01 Variant 02 Variant 03 Variant 04 Variant 05 Variant 06 Variant 07 Variant 08	$R_{TH(J-C)}$	100 125 90 100 110 140 110 110	°C/W	$I_F = 1.0mA$

**NOTES**

1. For derating, see Figure 1.
2. Duration 5 seconds maximum and the same termination shall not be resoldered until 5 minutes have elapsed.

**FIGURE 1 - PARAMETER DERATING INFORMATION**



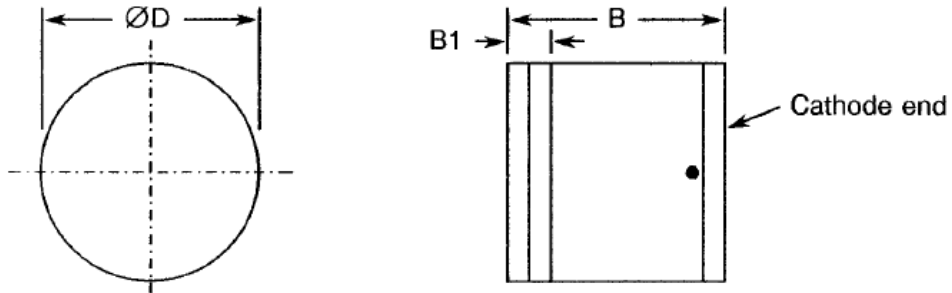
**NOTES**

1. Curve 1 for Variant 03.
2. Curve 2 for Variants 01 and 04.
3. Curve 3 for Variants 05, 07 and 08.
4. Curve 4 for Variant 02.
5. Curve 5 for Variant 06.



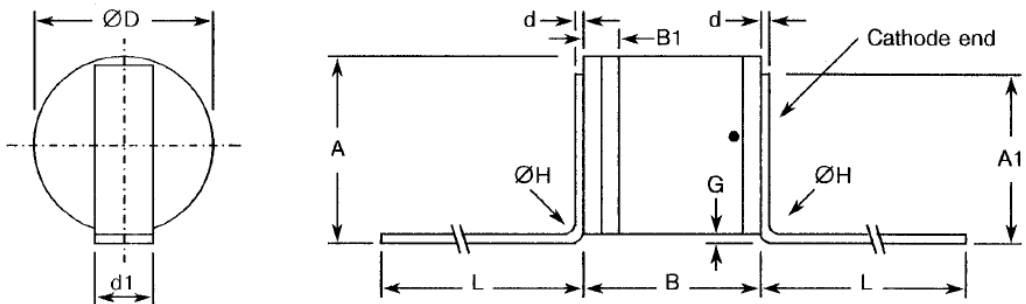
**FIGURE 2 - PHYSICAL DIMENSIONS**

**FIGURE 2(a) - VARIANTS 01 AND 05**



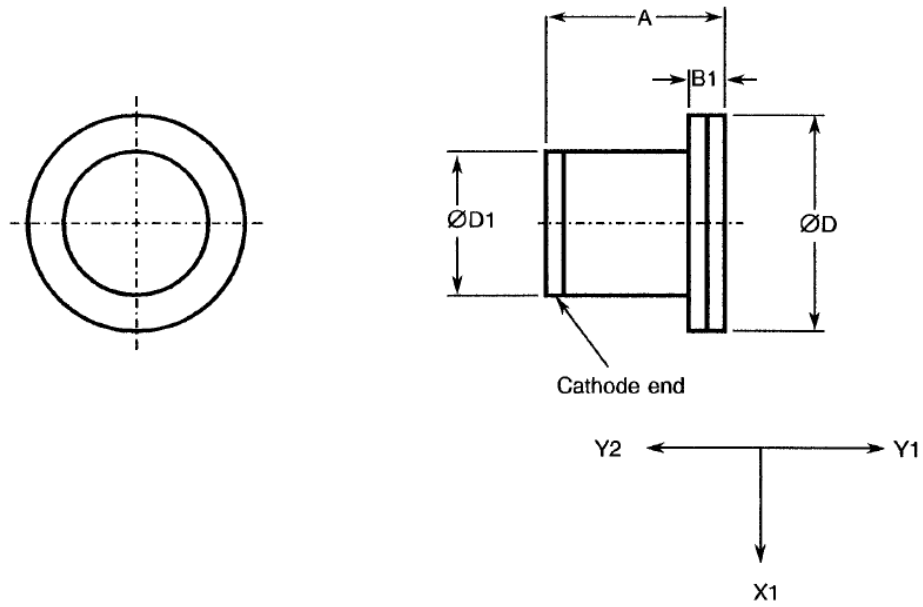
Symbol	Millimetres	
	Min	Max
B	1.15	1.35
B1	-	0.4
ØD	1.3	1.45

**FIGURE 2(b) - VARIANTS 02 AND 06**



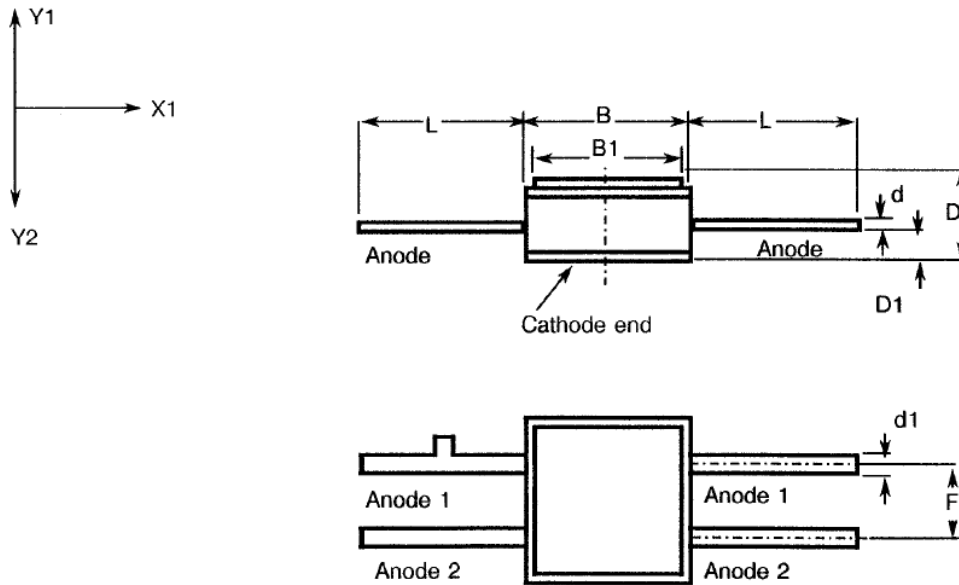
Symbol	Millimetres	
	Min	Max
A	1.4	1.95
A1	1.05	1.25
B	1.15	1.35
B1	-	0.4
d	0.06	0.1
d1	0.4	0.6
ØD	1.3	1.45
G	0.1	0.5
ØH	-	0.3
L	5.5	-

FIGURE 2(c) - VARIANT 03



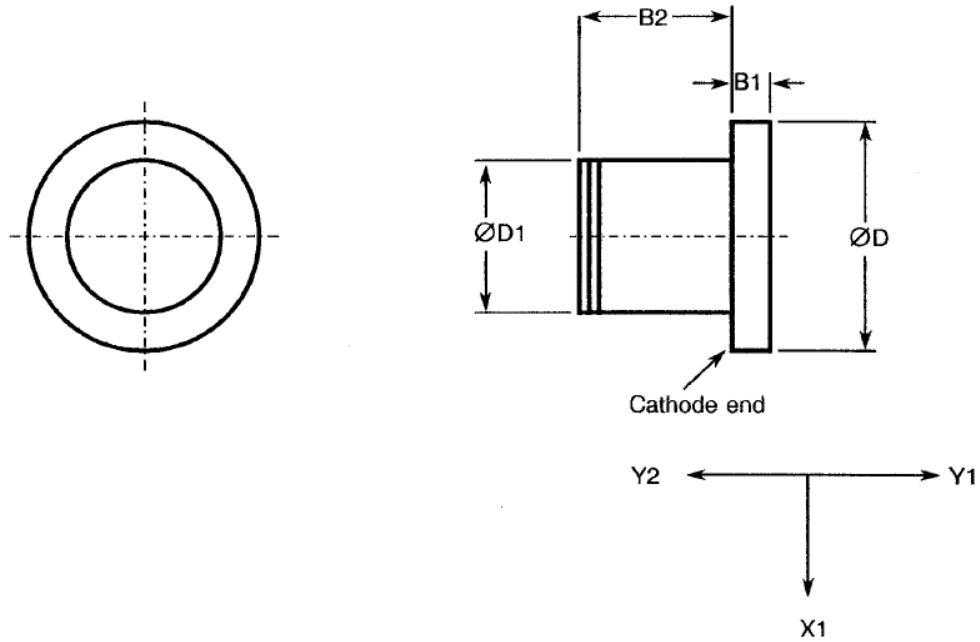
Symbol	Millimetres	
	Min	Max
A	1.45	1.7
B1	0.4	0.6
$\varnothing D$	3	3.2
$\varnothing D1$	2	2.2

FIGURE 2(d) – VARIANTS 04 AND 08



Symbol	Millimetres	
	Min	Max
B	3.1	3.55
B1	3	3.3
D	1.3	1.7
D1	0.55	0.65
d	0.1	0.15
d1	0.25	0.4
F	2.4	2.6
L	5.5	-

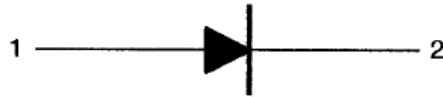
FIGURE 2(e) - VARIANT 07



Symbol	Millimetres	
	Min	Max
B1	0.08	0.2
B2	0.6	1.25
$\varnothing D$	2	2.2
$\varnothing D1$	1.3	1.45

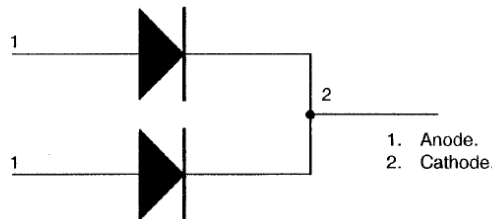
**FIGURE 3 - FUNCTIONAL DIAGRAM**

VARIANTS 01 TO 03 AND 05 TO 07



- 1. Anode
- 2. Cathode

VARIANTS 04 AND 08



- 1. Anode.
- 2. Cathode.

**NOTES**

1. For Variants 01, 02, 05 and 06, the cathode end shall be marked with a black dot or band. The marking will not be on the cathode connection but adjacent to it.

**4 REQUIREMENTS**

**4.1 GENERAL**

The complete requirements for procurement of the diodes specified herein shall be as stated in this specification and ESCC Generic Specification No. 5010 for Discrete Microwave Semiconductor Components. 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 ESCC 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**

- (a) Para. 5.3, Wafer Lot Acceptance: Shall be performed as an SEM Inspection only.

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

- (a) Para. 6.2, Pre-burn-in: Shall be performed for 168 hours with Conditions as per Table 5(b) of this specification.
- (b) Para. 9.2.2, Die Shear: Forces need not be recorded and the residual die area shall be 50% of the original die size.
- (c) Para. 9.6, Constant Acceleration: Shall not be performed.
- (d) Para. 9.7, Particle Impact Noise Detection (PIND) test: May be performed at any point after its position in Chart II.
- (e) Para. 9.14, Vibration, Variable Frequency: Shall not be performed.

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

- (a) Para. 9.1.1, Initial Parameter Drift Value Measurements: Parameters measured in Chart II shall not be repeated during Electrical Measurements at Room Temperature.
- (b) Para. 9.12, Radiographic Inspection: Shall be performed in X and Z axes only, exposure 100kV, duration 5 minutes.

4.2.4 Deviations from Qualification Tests (Chart IV)

- (a) Para. 9.2.2, Die Shear: Forces need not be recorded and the residual die area shall be 50% of the original die size.
- (b) Para. 9.13, Shock Test: Shall not be performed.
- (c) Para. 9.14, Vibration Test: Shall not be performed.
- (d) Para. 9. 15, Constant Acceleration: Shall not be performed.
- (e) Para. 9.20, Operating Life: Only one Operating Life Test shall be performed on 30 components.
- (f) Para. 9.23, Special Testing: Shall not be performed.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

- (a) Para. 9.13, Shock Test: Shall not be performed.
- (b) Para. 9.14, Vibration Test: Shall not be performed.
- (c) Para. 9.15, Constant Acceleration: Shall not be performed.
- (d) Para. 9.20, Operating Life: Only one Operating Life Test shall be performed on 16 components.
- (e) Para. 9.23, Special Testing: Shall not be performed.

4.3 Mechanical and Environmental 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 0.02 grammes for Variants 01, 02 and 05 to 07 and 0.1 grammes for Variants 03, 04 and 08.

4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Section 9 of ESCC Generic Specification No. 5010. The test conditions shall be as follows:

	<u>Variants 02, 06</u>	<u>Variants 04, 08</u>	<u>Variants 04, 08</u>
Test Condition	: 'A' (Tension)	: 'A' (Tension)	: 'F' (Bending Stress)
Force	: 1.22 Newtons	: 5.0 Newtons	: 2.0 Newtons
Duration	: 5.0 seconds	: 5.0 seconds	: 5.0 seconds
Distance to case	: -	: -	: > 1mm
Angle	: -	: -	: 90°

#### 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 diodes specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material shall not guarantee acceptance of the finished product.

##### 4.4.1 Case

Metal - Ceramic.

##### 4.4.2 Lead Materials and Finish

The terminal and lead materials and finishes shall be as specified in Table 1(a) of this specification, in accordance with the requirements of ESCC Basic Specification No. 23500.

#### 4.5 MARKING

##### 4.5.1 General

The marking of components delivered to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate 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) Cathode Identification.
- (b) The ESCC Component Number.
- (c) Traceability Information.

##### 4.5.2 Cathode Identification

Cathode identification shall be as shown in Figures 2 and 3 of this specification.

##### 4.5.3 ESCC Component Number

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

Example: 551303001B

- Detail Specification Number: 5513030
- Type Variant (see Table 1(a)): 01
- Testing Level (B or C, as applicable): B

##### 4.5.4 Traceability Information

Each component shall be marked in respect of traceability information in accordance with the requirements of ESCC 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  $T_{amb} = +25 \pm 3^{\circ}\text{C}$ .

##### 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. Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +100 (+0 -5)^{\circ}\text{C}$ .

##### 4.6.3 Circuits for Electrical Measurements

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

#### 4.7 BURN-IN TESTS

Burn-in shall be Category 3 of Chart III(a)

##### 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, the measurements shall be performed at  $T_{amb} = +25 \pm 3^{\circ}\text{C}$ . The parameter drift values ( $\Delta$ ) 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 Burn-in

The requirements for the high temperature reverse bias burn-in are specified in Section 7 of ESCC Generic Specification No. 5010. The conditions for high temperature reverse bias burn-in shall be as specified in Table 5(a) of this specification.

##### 4.7.3 Electrical Circuit for High Temperature Reverse Bias Burn-in

The circuit for use in performing the H.T.R.B. burn-in tests is shown in Figure 5(a) of this specification.

##### 4.7.4 Conditions for Power Burn-in

The requirements for power burn-in are specified in Section 7 of ESCC Generic Specification No. 5010. The conditions for power burn-in shall be as specified in Table 5(b) of this specification.

##### 4.7.5 Electrical Circuits for Power Burn-in

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



**TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - DC PARAMETERS**

No.	Characteristics	Symbol	MIL-STD-750 Test Method	Test Conditions	Limits		Unit
					Min.	Max.	
1	Reverse Current 1	$I_{R1}$	4016	Variants 01 to 04: $V_R = -150V$ Variants 05 to 08: $V_R = -200V$	-	100	nA
2	Reverse Current 2	$I_{R2}$	4016	$V_R = -100V$ Variants 01 to 04 Variants 05 to 08	- -	10 5	nA
3	Forward Voltage	$V_F$	4011	$I_F = 100mA$ Variants 01 to 04 Variants 05 to 08	- -	1 1.05	V

**TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - AC PARAMETERS**

No.	Characteristics	Symbol	MIL-STD-750 Test Method	Test Fig.	Test Conditions	Limits		Unit
						Min.	Max.	
4	Total Capacitance	$C_T$	4001	-	$V_R = -50V$ $f = 1.0MHz$ Variants 01, 02 Variant 03 Variant 04 Variants 05 to 07 Variant 08	- 0.3 0.4 - -	0.45 0.75 0.85 0.35 0.75	pF
5	Forward Resistance 1	$r_{f1}$	4056	-	$f = 100MHz$ $I_{F1} = 20\mu A$ Variants 01 to 04 $I_{F1} = 10\mu A$ Variants 05 to 07 Variant 08	- 800 700	70 1300 1200	$\Omega$
6	Forward Resistance 2	$r_{f2}$	4056	-	$f = 100MHz$ $I_{F2} = 1.0mA$ Variants 01 to 04 Variants 05 to 07 Variant 08	- 12 11	3 28 27	$\Omega$
7	Forward Resistance 3	$r_{f3}$	4056	-	$f = 100MHz$ $I_{F3} = 10mA$ Variants 01 to 04 Variants 05 to 08	- 2	1.5 5	$\Omega$
8	Charge Carrier Lifetime	$\tau$	-	4	$I_F = 10mA$ $I_R = -6.0mA$ Variants 01 to 04 Variants 05 to 08	250 300	- -	ns
9	Difference in Forward Resistance 2	$\Delta r_{f2}$	4056	-	$f = 100MHz$ $I_{F2} = 1.0mA$ Notes 1, 2 and 3	-	15	%
10	Difference in Forward Resistance 3	$\Delta r_{f3}$	4056	-	$f = 100MHz$ $I_{F3} = 10mA$ Notes 1, 2 and 3	-	15	%

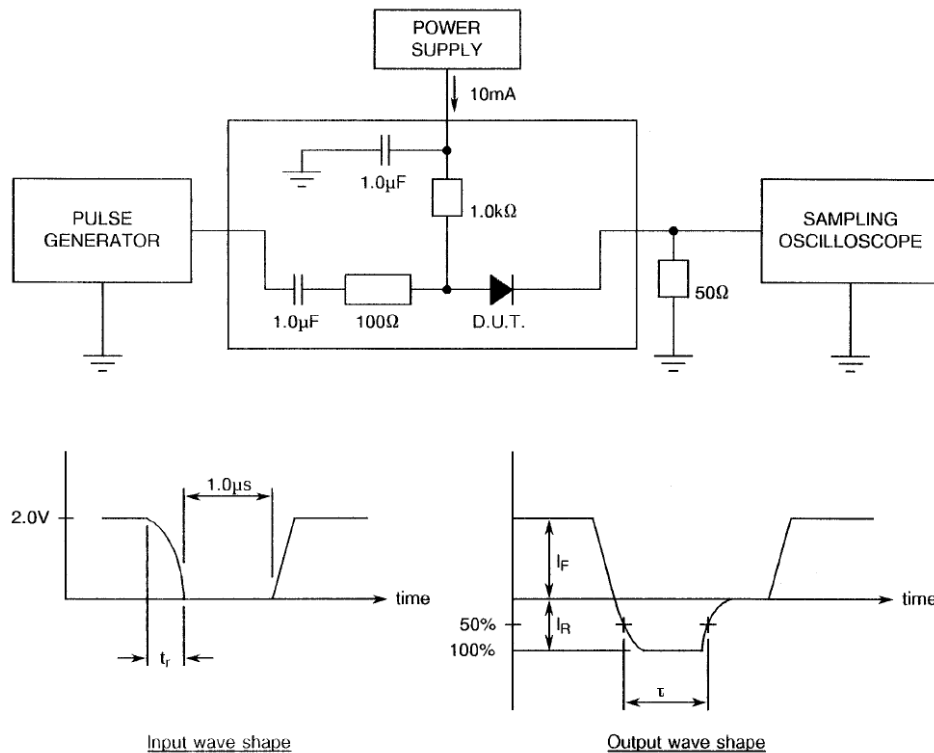
**NOTES**

1. These are matching parameters for Variant 04 only.
2. Measurements shall be performed during Chart III only and shall not be counted for PDA calculation.
3.  $\Delta r_f = 100 \times (R_f \text{ Diode 2} - R_f \text{ Diode 1} / R_f \text{ Diode 1})\%$ .

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

No.	CHARACTERISTICS	SYMBOL	MIL-STD-750 TEST METHOD	TEST CONDITIONS	LIMITS		UNIT
					MIN.	MAX.	
2	Reverse Current 2	$I_{R2}$	4016	$V_R = -100V$	-	0.25	$\mu A$

**FIGURE 4 - TEST CIRCUIT FOR CHARGE CARRIER LIFETIME MEASUREMENT**



**NOTES**

1. The value of the reverse current  $I_R$  is  $-6.0mA$  and the forward current  $I_F$  is  $10mA$ .
2. The lifetime ( $\tau$ ) is measured across the 50% points of the observed wave shape. The input pulse is provided by a pulse generator having a rise time of less than  $5ns$ . The output pulse is amplified and observed on a sampling oscilloscope.
3. Pulse length:  $1.0\mu s$ .
4. Duty cycle:  $\leq 33\%$ .

**TABLE 4 - PARAMETER DRIFT VALUES**

No.	Characteristics	Symbol	Spec. And/Or Test Method	TEST CONDITIONS	Change Limits ( $\Delta$ )	Unit
2	Reverse Current 2	$I_{R2}$	As per Table 2	As per Table 2	$\pm 3$ (1)	nA
3	Forward Voltage	$V_F$	As per Table 2	As per Table 2	$\pm 30$ (1)	mV
6	Forward Resistance 2	$r_{f2}$	As per Table 2	As per Table 2	$\pm 15$ (1)	%

**NOTES**

- $\Delta 1 = \Delta 2 = \Delta 3$ .

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

No.	Characteristics	Symbol	Conditions	Unit
1	Ambient Temperature Variants 01 to 03 and 05 to 07 Variants 04 and 08	$T_{amb}$	+150 (+0 -3) +135 (+0 -3)	$^{\circ}\text{C}$
2	Reverse Voltage Variants 01 to 04 Variants 05 to 08	$V_R$	-120 -160	V

**NOTES**

- At the end of the H.T.R.B.,  $T_{amb}$  shall be decreased to room temperature and the reverse bias shall remain applied until  $T_{amb}$  is less than  $+35^{\circ}\text{C}$ .

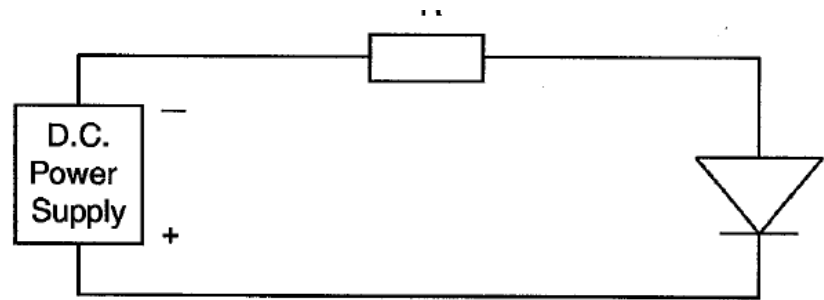
**TABLE 5(b) - CONDITIONS FOR POWER BURN-IN AND OPERATING LIFE TESTS**

No.	Characteristics	Symbol	Conditions	Unit
1	Ambient Temperature	$T_{amb}$	+140 (+0 -3)	$^{\circ}\text{C}$
2	Power Dissipation Variants 01 and 04 Variant 02 Variant 03 Variants 05, 07 and 08 Variant 06	$P_D$	90 65 100 80 50 Note 1	mW

**NOTES**

- $T_{amb}$  shall be controlled to achieve  $T_J = +150^{\circ}\text{C}$ .

**FIGURE 1**

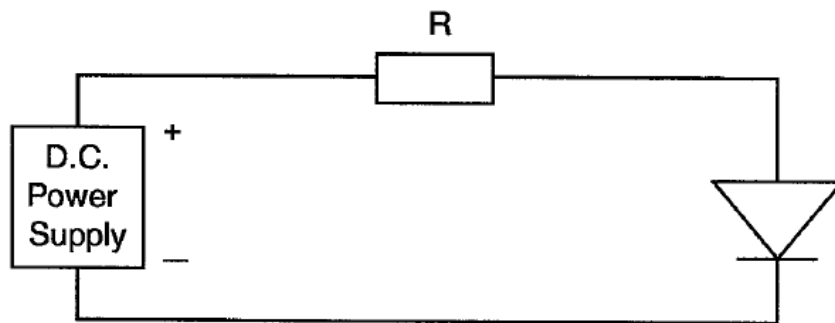


**BURN-IN**

**NOTES**

1.  $R = 22k\Omega$ .

**FIGURE 5(B) - ELECTRICAL CIRCUIT FOR POWER BURN-IN AND OPERATING LIFE TESTS**



**NOTES**

1.  $R = 3.9\Omega$ .

- 4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESCC GENERIC SPECIFICATION No. 5010)
- 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  $T_{amb} = +25 \pm 3^{\circ}\text{C}$ .
- 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 tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at  $T_{amb} = +25 \pm 3^{\circ}\text{C}$ .
- 4.8.3 Conditions for Operating Life Tests (Part of Endurance Testing)  
The requirements for operating life testing are specified in Section 9 of ESCC Generic Specification No. 5010. The conditions for operating life testing are specified in Table 5(b) of this specification.
- 4.8.4 Electrical Circuits for Operating Life Tests  
The circuit to be used for performance of the operating life test shall be the same as shown in Figure 5(b) for Power Burn-in.
- 4.9 TOTAL DOSE IRRADIATION TESTING  
Not applicable.
- 4.10 SPECIAL TESTING  
Not applicable.

**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	Reverse Current 1	$I_{R1}$	As per Table 2	As per Table 2	As per Table 2		nA
2	Reverse Current 2	$I_{R2}$	As per Table 2	As per Table 2	As per Table 2		nA
3	Forward Voltage	$V_F$	As per Table 2	As per Table 2	As per Table 2		V

**FIGURE 6 - BIAS CONDITIONS FOR IRRADIATION TESTING**

Not applicable.

**TABLE 7 - ELECTRICAL MEASUREMENTS DURING AND ON COMPLETION OF IRRADIATION TESTING**

Not applicable.