



**DIODES, MICROWAVE, SILICON, PIN, ULTRA FAST SWITCHING**

**BASED ON TYPES DH50052 TO DH50057 AND EH50052 TO  
EH50057**

**ESCC Detail Specification No. 5513/036**

Issue 7	March 2023
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**1 GENERAL**

**1.1 SCOPE**

This specification details the ratings, physical and electrical characteristics and test and inspection data for the component type variants and/or the range of components specified below. It supplements the requirements of, and shall be read in conjunction with, the ESCC Generic Specification listed under Applicable Documents.

**1.2 APPLICABLE DOCUMENTS**

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

- (a) ESCC Generic Specification No. **5010**
- (b) **MIL-STD-750**, Test Methods and Procedures for Semiconductor Devices

**1.3 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.

**1.4 THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS**

**1.4.1 The ESCC Component Number**

The ESCC Component Number shall be constituted as follows:

Example: 551303601

- Detail Specification Reference: 5513036
- Component Type Variant Number: 01 (as required)

**1.4.2 Component Type Variants**

The component type variants applicable to this specification are as follows:

Packaged Components

Variant Number	Based On Type	Package Type / Description	Total Capacitance $C_T$ (pF) Max	Lead/Terminal Material and Finish (Note 1)		Weight Max (g)
				Anode	Cathode	
01	DH50052	Ceramic Pill A (2 Leads)	0.21	E2	E2	0.02
02	DH50052	Ceramic Pill B	0.21	D7	D7	0.02
03	DH50052	Ceramic Pill C (Cathode Lead)	0.21	D7	E2	0.02
04	DH50052	Ceramic Pill D (Anode Lead)	0.21	E2	D7	0.02
05	DH50052	Ceramic Pill E (2 Leads)	0.21	E2	E2	0.02
06	DH50052	Ceramic Pill F (Anode Lead)	0.21	E2	D7	0.02
07	DH50052	Ceramic Pill G	0.28	D7	A7	0.15
08	DH50053	Ceramic Pill A (2 Leads)	0.25	E2	E2	0.02
09	DH50053	Ceramic Pill B	0.25	D7	D7	0.02
10	DH50053	Ceramic Pill C (Cathode Lead)	0.25	D7	E2	0.02
11	DH50053	Ceramic Pill D (Anode Lead)	0.25	E2	D7	0.02

Variant Number	Based On Type	Package Type / Description	Total Capacitance $C_T$ (pF) Max	Lead/Terminal Material and Finish (Note 1)		Weight Max (g)
				Anode	Cathode	
12	DH50053	Ceramic Pill E (2 Leads)	0.25	E2	E2	0.02
13	DH50053	Ceramic Pill F (Anode Lead)	0.25	E2	D7	0.02
14	DH50053	Ceramic Pill G	0.32	D7	A7	0.15
15	DH50054	Ceramic Pill A (2 Leads)	0.3	E2	E2	0.02
16	DH50054	Ceramic Pill B	0.3	D7	D7	0.02
17	DH50054	Ceramic Pill C (Cathode Lead)	0.3	D7	E2	0.02
18	DH50054	Ceramic Pill D (Anode Lead)	0.3	E2	D7	0.02
19	DH50054	Ceramic Pill E (2 Leads)	0.3	E2	E2	0.02
20	DH50054	Ceramic Pill F (Anode Lead)	0.3	E2	D7	0.02
21	DH50054	Ceramic Pill G	0.37	D7	A7	0.15
22	DH50055	Ceramic Pill A (2 Leads)	0.36	E2	E2	0.02
23	DH50055	Ceramic Pill B	0.36	D7	D7	0.02
24	DH50055	Ceramic Pill C (Cathode Lead)	0.36	D7	E2	0.02
25	DH50055	Ceramic Pill D (Anode Lead)	0.36	E2	D7	0.02
26	DH50055	Ceramic Pill E (2 Leads)	0.36	E2	E2	0.02
27	DH50055	Ceramic Pill F (Anode Lead)	0.36	E2	D7	0.02
28	DH50055	Ceramic Pill G	0.43	D7	A7	0.15
29	DH50056	Ceramic Pill A (2 Leads)	0.53	E2	E2	0.02
30	DH50056	Ceramic Pill B	0.53	D7	D7	0.02
31	DH50056	Ceramic Pill C (Cathode Lead)	0.53	D7	E2	0.02
32	DH50056	Ceramic Pill D (Anode Lead)	0.53	E2	D7	0.02
33	DH50056	Ceramic Pill E (2 Leads)	0.53	E2	E2	0.02
34	DH50056	Ceramic Pill F (Anode Lead)	0.53	E2	D7	0.02
35	DH50056	Ceramic Pill G	0.6	D7	A7	0.15
36	DH50057	Ceramic Pill A (2 Leads)	0.73	E2	E2	0.02
37	DH50057	Ceramic Pill B	0.73	D7	D7	0.02
38	DH50057	Ceramic Pill C (Cathode Lead)	0.73	D7	E2	0.02
39	DH50057	Ceramic Pill D (Anode Lead)	0.73	E2	D7	0.02
40	DH50057	Ceramic Pill E (2 Leads)	0.73	E2	E2	0.02
41	DH50057	Ceramic Pill F (Anode Lead)	0.73	E2	D7	0.02
42	DH50057	Ceramic Pill G	0.8	D7	A7	0.15

Die Components (Note 2)

Variant Number	Based On Type	Junction Capacitance $C_J$ (pF) Max	Total Capacitance $C_T$ (pF) Max (Note 3)
49	EH50052	0.08	0.28
50	EH50053	0.12	0.32
51	EH50054	0.17	0.37
52	EH50055	0.23	0.43
53	EH50056	0.4	0.6
54	EH50057	0.6	0.8

**NOTES:**

1. The lead/terminal material and finish shall be in accordance with the requirements of ESCC Basic Specification No. [23500](#).
2. For Die Components, Variants 49 to 54, the default package selected for assembly of the Packaged Test Sublot shall be Ceramic Pill G. At the Manufacturer's option, any of the other packages specified herein with a Variant for the same die may be selected. The die applicable to each Variant is indicated by the based on type number.
3. In cases where the default package is not selected for the Packaged Test Sublot, the Total Capacitance limit of the selected package shall apply.

1.5 **MAXIMUM RATINGS**

The maximum ratings shall not be exceeded at any time during use or storage.

Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Unit	Remarks
DC Reverse Voltage	$V_{Rmax}$	-50	V	$I_R = 10\mu A$
DC Forward Current (Continuous) Variants 01 to 06, 08 to 13, 15 to 20, 22 to 27, 29 to 34, 36 to 41: Variants 07, 14: Variants 21, 28, 35, 42:	$I_{Fmax}$	150 180 240	mA	Note 1
RF Power Dissipation Variants 01 to 06, 08 to 13, 15 to 20, 22 to 27, 29 to 34, 36 to 41: Variants 07, 14: Variants 21, 28, 35, 42:	$P_{tot}$	0.5 0.62 0.83	W	Note 2
Operating Temperature Range	$T_{op}$	-55 to +150	°C	$T_{case}$
Storage Temperature Range	$T_{stg}$	-65 to +175	°C	
Junction Temperature	$T_j$	+150	°C	
Thermal Resistance, Junction-to-Case Variants 01 to 06, 08 to 13, 15 to 20, 22 to 27, 29 to 34, 36 to 41: Variants 07, 14, 49, 50: Variants 21, 28, 35, 42, 51 to 54:	$R_{th(j-c)}$	150 120 90	°C/W	Note 3
Soldering Temperature	$T_{sol}$	+230	°C	Note 4

**NOTES:**

- At  $T_{case} \leq +75^\circ C$ . For  $T_{case} > +75^\circ C$ , derate linearly to 0A at  $T_{case} = +150^\circ C$ .
- At  $T_{case} \leq +75^\circ C$ . For  $T_{case} > +75^\circ C$ , derate linearly to 0W at  $T_{case} = +150^\circ C$ .
- Thermal Resistance ratings for Die Components, Variants 49 to 54, refer to the Packaged Test Sublot assembled in the default Ceramic Pill G package. In cases where the default package is not used, the Thermal Resistance rating associated with the package used and the same die shall apply
- Duration 5 seconds maximum and the same terminal shall not be resoldered until 3 minutes have elapsed. Only applicable to Variants 01 to 42 (Packaged Components).

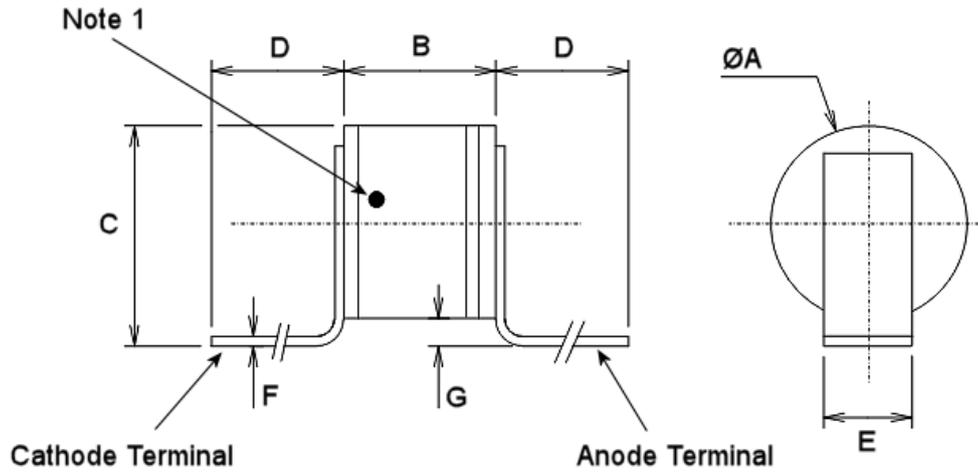
1.6 **HANDLING PRECAUTIONS**

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 per ESCC Basic Specification No. [23800](#) with a Minimum Critical Path Failure Voltage of 500V.

1.7 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

1.7.1 Ceramic Pill A (2 Leads) - Variants 01, 08, 15, 22, 29, 36

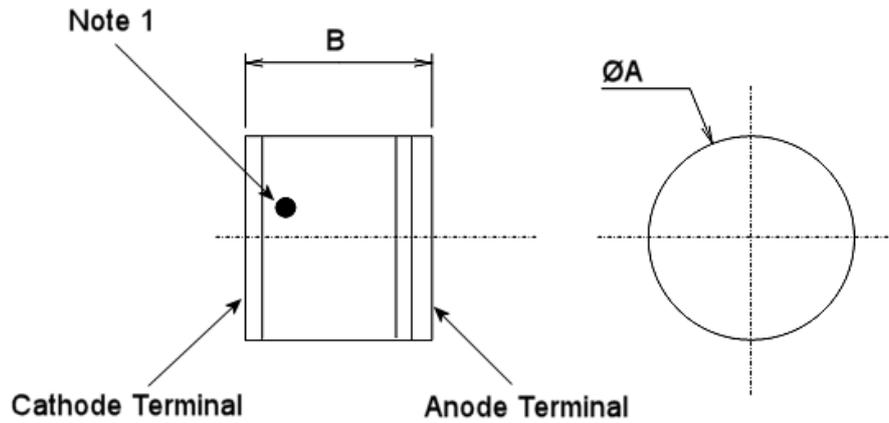


Symbols	Dimensions mm		Remarks
	Min	Max	
ØA	1.07	1.47	
B	0.95	1.35	
C	1.3	1.9	Both terminals
D	2.5	-	
E	0.55	0.65	Both terminals
F	0.06	0.1	Both terminals
G	0.1	0.5	Both terminals

**NOTES:**

- Terminal identification: The body shall be marked at a suitable location near the cathode terminal with a black dot.

1.7.2 Ceramic Pill B - Variants 02, 09, 16, 23, 30, 37

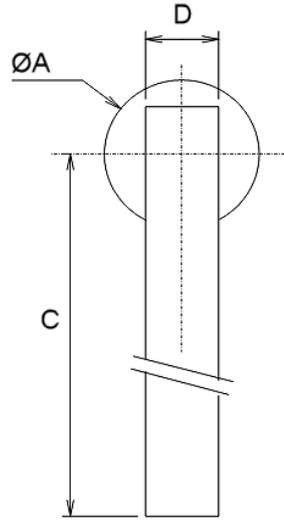
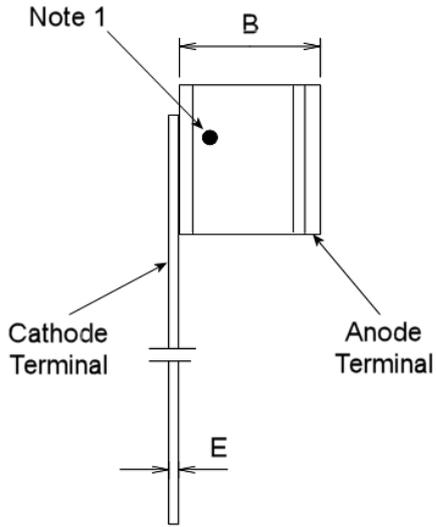


Symbols	Dimensions mm	
	Min	Max
$\text{Ø}A$	1.07	1.47
B	0.95	1.35

**NOTES:**

1. Terminal identification: The body shall be marked at a suitable location near the cathode terminal with a black dot.

1.7.3 Ceramic Pill C (Cathode Lead) - Variants 03, 10, 17, 24, 31, 38

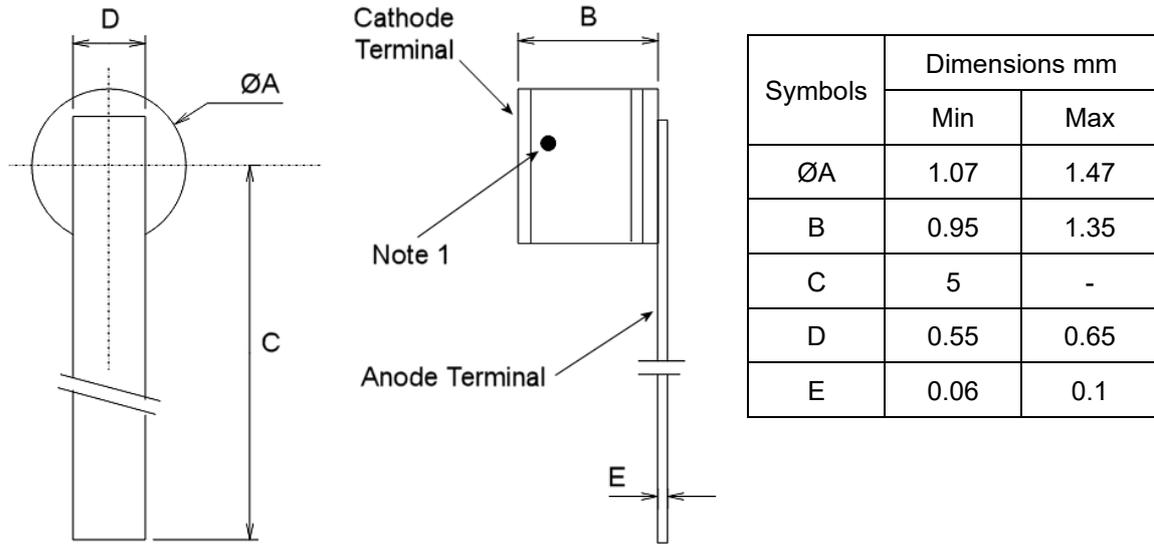


Symbols	Dimensions mm	
	Min	Max
ØA	1.07	1.47
B	0.95	1.35
C	5	-
D	0.55	0.65
E	0.06	0.1

**NOTES:**

1. Terminal identification: The body shall be marked at a suitable location near the cathode terminal with a black dot.

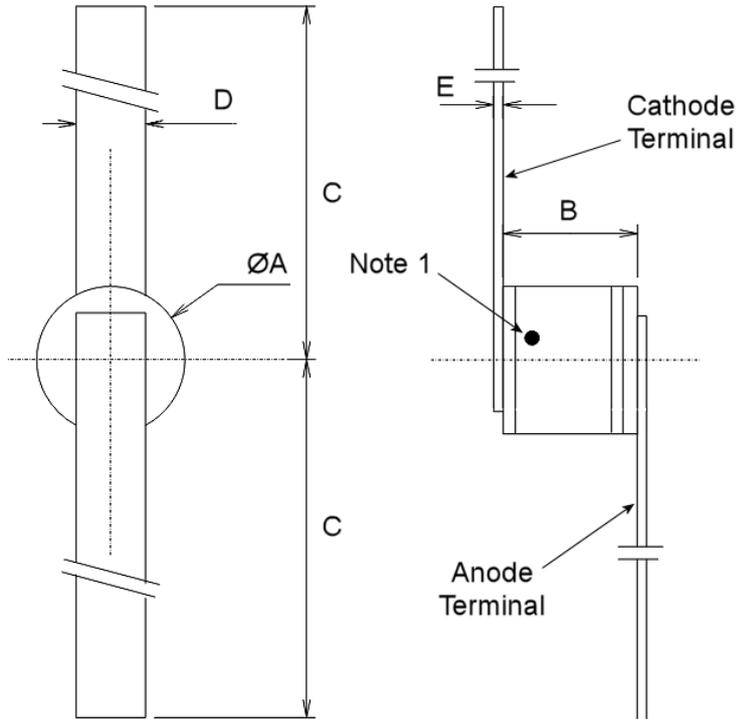
1.7.4 Ceramic Pill D (Anode Lead) - Variants 04, 11, 18, 25, 32, 39



**NOTES:**

1. Terminal identification: The body shall be marked at a suitable location near the cathode terminal with a black dot.

1.7.5 Ceramic Pill E (2 Leads) - Variants 05, 12, 19, 26, 33, 40

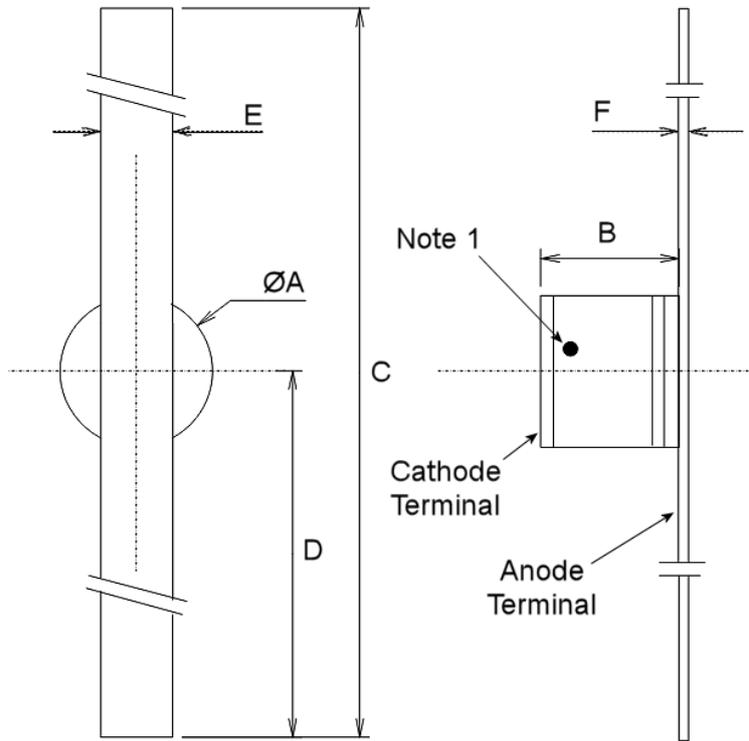


Symbols	Dimensions mm		Remarks
	Min	Max	
$\varnothing A$	1.07	1.47	
B	0.95	1.35	
C	5	-	
D	0.55	0.65	Both terminals
E	0.06	0.1	Both terminals

**NOTES:**

1. Terminal identification: The body shall be marked at a suitable location near the cathode terminal with a black dot.

1.7.6 Ceramic Pill F (Anode Lead) - Variants 06, 13, 20, 27, 34, 41

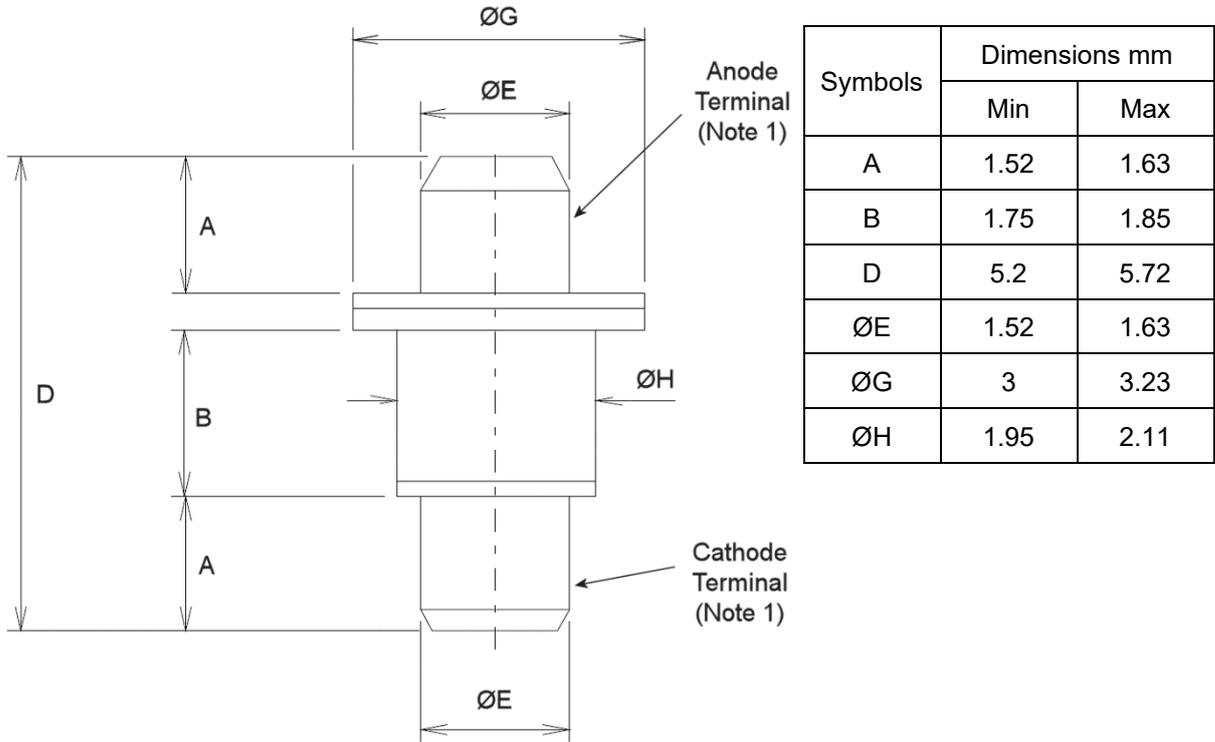


Symbols	Dimensions mm	
	Min	Max
ØA	1.07	1.47
B	0.95	1.35
C	10	10.4
D	5	-
E	0.55	0.65
F	0.06	0.1

**NOTES:**

- Terminal identification: The body shall be marked at a suitable location near the cathode terminal with a black dot.

1.7.7 Ceramic Pill G - Variants 07, 14, 21, 28, 35, 42

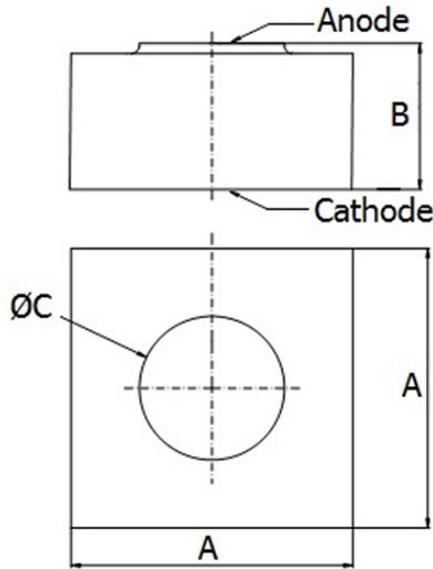


Symbols	Dimensions mm	
	Min	Max
A	1.52	1.63
B	1.75	1.85
D	5.2	5.72
ØE	1.52	1.63
ØG	3	3.23
ØH	1.95	2.11

**NOTES:**

1. Terminal identification shall be by means of the physical configuration of the package.

1.7.8 Die – Variants 49 to 54

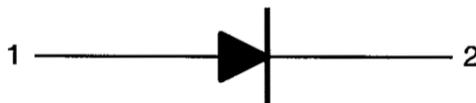


Symbols	Dimensions mm		Remarks
	Min	Max	
A	0.34	0.4	
B	0.16	0.26	
ØC	0.02	0.06	Variant 49
	0.03	0.07	Variant 50
	0.04	0.08	Variant 51
	0.05	0.1	Variant 52
	0.06	0.12	Variant 53
	0.08	0.14	Variant 54

**NOTES:**

1. Terminal identification shall be by means of the physical configuration.
2. Die construction, materials, finishes:
  - Die substrate: Silicon
  - Bond pad: The metallisation shall be TiPtAu with a layer of vacuum-deposited gold of thickness 0.7µm minimum.
  - Die backface: The metallisation shall be TiPtAu with a layer of gold of thickness 0.7µm minimum.
  - Glassivation: Silicon oxide of thickness 0.5µm typical.

1.8 FUNCTIONAL DIAGRAM



1. Anode
2. Cathode

## 1.9 MATERIALS AND FINISHES

### 1.9.1 Materials and Finishes of Packaged Components

For Variants 01 to 42, the materials and finishes shall be as follows:

- (a) Case  
The case shall be hermetically sealed and have a ceramic body with a metal base and lid.
- (b) Leads/Terminals  
As specified in Para. 1.4.2.

### 1.9.2 Materials and Finishes of Die Components

For Variants 49 to 54, the materials and finishes shall be as specified in Para. 1.7.9.

## 2 REQUIREMENTS

### 2.1 GENERAL

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

#### 2.1.1 Deviations from the Generic Specification

##### 2.1.1.1 *Deviations from Qualification and Periodic Tests – Chart F4*

- (a) Mechanical Shock: Shall not be performed.
- (b) Vibration: Shall not be performed.
- (c) Constant Acceleration: Shall not be performed.

### 2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. [21700](#) and as follows.

The information to be marked on the component or its primary package shall be:

- (a) Terminal identification, as specified in Para. 1.7.
- (b) The ESCC qualified components symbol (for ESCC qualified components only).
- (c) The ESCC Component Number.
- (d) Traceability information.

### 2.3 DIE SHEAR

In those cases where package clearances are such that a die shear test is not practicable, the die shall be pushed away with a suitable tool. The force required to remove the die need not be recorded. The die attachment area shall be inspected and the component shall be considered acceptable if more than 50% of the semiconductor material remains.

2.4 TERMINAL STRENGTH

The test conditions for terminal strength, tested as specified in the ESCC Generic Specification, shall be as follows:

- For Variants 01, 03 to 06, 08, 10 to 13, 15, 17 to 20, 22, 24 to 27, 29, 31 to 34, 36, 38 to 41: Test Condition A, tension, with a force of 1.25N for duration 10s.
- For Variants 02, 07, 09, 14, 16, 21, 23, 28, 30, 35, 37, 42: shall not be performed.
- For Variants 49 to 54: not applicable.

2.5 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

2.5.1 Room Temperature Electrical Measurements

The measurements shall be performed at  $T_{amb} = +22 \pm 3^{\circ}C$ .

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Reverse Current 1 (Note 1)	$I_{R1}$	4016	$V_R = -50V$	-	10	$\mu A$
Reverse Current 2 (Note 1)	$I_{R2}$	4016	$V_R = -25V$	-	100	nA
Forward Voltage (Note 1)	$V_F$	4011	$I_F = 10mA$	-	1.1	V
Thermal Resistance, Junction-to-Case (Note 2) Variants 01 to 06, 08 to 13, 15 to 20, 22 to 27, 29 to 34, 36 to 41:  Variants 07, 14, 21, 28, 35, 42, 49 to 54:	$R_{th(j-c)}$	3101	Note 3  $P = 0.25W$  $P = 0.5W$	-	Note 4	$^{\circ}C/W$
Total Capacitance (Note 2)	$C_T$	4001	$V_R = -6V, f = 1MHz$	-	Note 5	pF
Junction Capacitance (Note 6)	$C_J$	4001	$V_R = -6V, f = 1MHz$	-	Note 5	pF
Forward Series Resistance (Note 1)  Variants 01 to 07, 49: Variants 08 to 14, 50: Variants 15 to 21, 51: Variants 22 to 28, 52: Variants 29 to 35, 53: Variants 36 to 42, 54:	$R_{SF}$	4056	$I_F = 10mA$ $f = 120MHz$	-	1.6 1.4 1.1 1 0.9 0.7	$\Omega$

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Minority Carrier Lifetime (Note 7) Variants 01 to 07, 08 to 14, 49, 50: Variants 15 to 21, 51: Variants 22 to 28, 52: Variants 29 to 35, 53: Variants 36 to 42, 54:	$\tau_L$	4031	$I_F = 10\text{mA}$ $I_R = 6\text{mA}$	-	60	ns
				-	70	
				-	80	
				-	100	
				-	120	

**NOTES:**

1. This characteristic applies to all Variants tested during Charts F2 and F3 of the Generic Specification.
2. This characteristic applies to Variants 01 to 42 (Packaged Components) and Variants 49 to 54 (Packaged Test Sublot samples for Die Components), tested only during Chart F3 of the Generic Specification.
3. Pulsed measurement, pulse width = 10ms.
4. See Para. 1.5 for the applicable limits.
5. See Para. 1.4.2 for the applicable limits.
6. This characteristic only applies to Variants 49 to 54 (Die Components), tested only during Chart F2 of the Generic Specification.
7. Only performed during Chart F2 of the Generic Specification, on a sample of 27 dice per wafer. In the event of any failure, a 100% inspection shall be performed and all failures shall be clearly identified.

2.5.2 High and Low Temperatures Electrical Measurements

The measurements shall be performed only at  $T_{amb} = +150 (+0 -3)^\circ\text{C}$ .

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions Note 1	Limits		Units
				Min	Max	
Reverse Current 2 (Note 2)	$I_{R2}$	4016	$V_R = -25\text{V}$	-	1	$\mu\text{A}$

**NOTES:**

1. Measurements shall be performed on a sample basis as specified in the Generic Specification.
2. This characteristic applies to all Variants tested during Charts F2 and F3 of the Generic Specification.

2.6 PARAMETER DRIFT VALUES

Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +22 \pm 3^{\circ}C$ .

The test methods and test conditions shall be as per the corresponding test defined in Para. 2.5.1, Room Temperature Electrical Measurements.

The drift values ( $\Delta$ ) shall not be exceeded for each characteristic specified. The corresponding absolute limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits		Units	
		Drift Value (1) $\Delta$	Absolute		
			Min		Max
Reverse Current 2	$I_{R2}$	$\pm 10$ or (2) $\pm 100\%$	-	100	nA
Forward Voltage	$V_F$	$\pm 5\%$	-	1.1	V
Total Capacitance (Note 3)	$C_T$	$\pm 5\%$ (4) or $\pm 10\%$ (5)	-	Note 6	pF

**NOTES:**

- $\Delta 1 = \Delta 2$ .
- Whichever is the greater referred to the initial value.
- This characteristic applies to Variants 01 to 42 (Packaged Components) and Variants 49 to 54 (Packaged Test Sublot samples for Die Components).
- Applicable drift value for  $C_T > 0.5pF$  and rounded upwards to the nearest 0.01pF.
- Applicable drift value for  $C_T \leq 0.5pF$  and rounded upwards to the nearest 0.01pF.
- See Para. 1.4.2 for the applicable limits.

2.7 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +22 \pm 3^{\circ}C$ .

The test methods and test conditions shall be as per the corresponding test defined in Para. 2.5.1, Room Temperature Electrical Measurements.

The limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits		Units
		Min	Max	
Reverse Current 1	$I_{R1}$	-	10	$\mu A$
Reverse Current 2	$I_{R2}$	-	100	nA
Forward Voltage	$V_F$	-	1.1	V
Total Capacitance (Note 1)	$C_T$	-	Note 2	pF

**NOTES:**

- This characteristic applies to Variants 01 to 42 (Packaged Components) and Variants 49 to 54 (Packaged Test Sublot samples for Die Components).

2. See Para. 1.4.2 for the applicable limits.

2.8 BURN-IN 1 CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T <sub>amb</sub>	+150 (+0 -3)	°C
Reverse Voltage (Note 1)	V <sub>R</sub>	-37.5	V

**NOTES:**

1. Upon completion of Burn-in 1, the test voltage shall be maintained until T<sub>amb</sub> < +35°C.

2.9 BURN-IN 2 CONDITIONS

Characteristics	Symbols	Test Conditions	Units
Case Temperature	T <sub>case</sub>	+125 (+0 -3)	°C
Forward Current	I <sub>F</sub>		mA
Variants 01 to 06, 08 to 13, 15 to 20, 22 to 27, 29 to 34, 36 to 41:		50	
Variants 07, 14, 49, 50:		60	
Variants 21, 28, 35, 42, 51 to 54:		80	

2.10 OPERATING LIFE CONDITIONS

The conditions shall be as specified in Para. 2.9.

**APPENDIX 'A'**

**AGREED DEVIATIONS FOR EXENS SOLUTIONS (F)**

Items Affected	Description of Deviations
Para. 2.1.1, Deviations from the Generic Specification: Deviations from Special In-Process Controls – Chart F2	SEM Inspection: From each wafer selected for SEM Inspection, the sample of three dice shall be selected after die separation.  Bond Strength: The following pre-seal bond strength shall apply: <ul style="list-style-type: none"> <li>• 0.03N minimum</li> </ul>
Para. 2.1.1, Deviations from the Generic Specification: Deviations from Screening Tests for Packaged Components – Chart F3A	Radiographic Inspection: <ul style="list-style-type: none"> <li>• May be performed without serialisation and at any point during Chart F3A. Any components found to fail Radiographic Inspection shall be removed from the lot.</li> <li>• May be performed in the X and Z axes only.</li> </ul>
Para. 2.1.1.1, Deviations from Qualification and Periodic Tests – Chart F4	For the De-encapsulation Subgroup, the Internal Visual Inspection, Bond Strength and Die Shear tests may be replaced by measurements verifying the die solder integrity and wire integrity, as follows: <ul style="list-style-type: none"> <li>• Thermal Impedance test in accordance with <a href="#">MIL-STD-750, Test Method 3101</a>.               <ul style="list-style-type: none"> <li>• For Variants 01 to 06, 08 to 13, 15 to 20, 22 to 27, 29 to 34, 36 to 41: <math>P_D = 0.25W</math>.</li> <li>• For Variants 07, 14, 21, 28, 35, 42, 49 to 54: <math>P_D = 0.5W</math>.</li> </ul>               The Thermal Impedance shall be measured and shall not exceed the applicable value of Thermal Resistance, Junction-to-Case specified in Para. 1.5 herein.             </li> <li>• Forward Voltage test in accordance with <a href="#">MIL-STD-750, Test Method 4011</a>.               <ul style="list-style-type: none"> <li>• <math>I_F = 100mA</math>.</li> </ul>               The Forward Voltage shall be measured and shall not exceed 1.2V.             </li> </ul>