



**DIODES, SILICON, SWITCHING**

**BASED ON TYPES 1N5807, 1N5809, 1N5811 AND  
1N5811U**

**ESCC Detail Specification No. 5101/013**

Issue 6	October 2020
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DCR No.	CHANGE DESCRIPTION
1365	Specification updated to incorporate changes per DCR.

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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. [5000](#)
- (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: 510101301

- Detail Specification Reference: 5101013
- Component Type Variant Number: 01 (as required)

1.4.2 Component Type Variants

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

Variant Number	Based on Type	Case	Breakdown Voltage $V_{(BR)}$ (V)	Working Peak Reverse Voltage $V_{RWM}$ (V)	Forward Surge Current $I_{FSM}$ (A)	Terminal Material and/or Finish	Weight max g
01	1N5807	Axial Lead	60	50	125	O1	0.9
02	1N5807	Axial Lead	60	50	125	A3 or A4	0.9
05	1N5809	Axial Lead	110	100	125	O1	0.9
06	1N5809	Axial Lead	110	100	125	A3 or A4	0.9
09	1N5811	Axial Lead	160	150	125	O1	0.9
10	1N5811	Axial Lead	160	150	125	A3 or A4	0.9
11	1N5811U	LCC2B	160	150	100	2	0.18
12	1N5811U	LCC2B	160	150	100	4	0.18
13	1N5807US	MELF-E	60	50	125	A3 or A4	0.65
14	1N5809US	MELF-E	110	100	125	A3 or A4	0.65
15	1N5811US	MELF-E	160	150	125	A3 or A4	0.65
16	1N5811	Die	160	150	125	N/A	N/A

The terminal material and/or finish shall be in accordance with the requirements of ESCC Basic Specification No. [23500](#).

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
Forward Surge Current	$I_{FSM}$	Note 1	A	Notes 2, 3
Working Peak Reverse Voltage	$V_{RWM}$	Note 1	V	
Average Output Rectified Current	$I_o$	6	A	Note 4, 5
Operating Temperature Range (Ambient Temperature)	$T_{op}$	-65 to +175	°C	Note 6
Junction Temperature	$T_j$	+175	°C	
Storage Temperature Range	$T_{stg}$	-65 to +175	°C	Note 6
Soldering Temperature	$T_{sol}$	+245	°C	Note 7
Thermal Resistance Variants 01, 02, 05, 06, 09, 10 Variants 11 to 15	$R_{th}$	22 6.5	°C/W	Note 8

**NOTES:**

- See Para. 1.4.2 for value.
- Sinusoidal pulse of 8.3ms duration for Variants 01, 02, 05, 06, 09, 10, 13, 14, 15 and 10ms for Variants 11, 12.
- At  $T_{amb} \leq +25^\circ\text{C}$ .
- For Variants 01, 02, 05, 06, 09, 10: specified on the lead 9.5mm from the body ( $T_{lead}$ ).  
For Variants 11, 12: specified at the body terminal ( $T_{case}$ ).  
For Variants 13 to 15: specified at the body terminal ( $T_{lead}$  at 0mm).
- For Variants 01, 02, 05, 06, 09, 10, 13, 14, 15: At  $T_{lead} \leq +75^\circ\text{C}$ , derate linearly to 0A at  $+175^\circ\text{C}$ .  
For Variants 11, 12: At  $T_{case} \leq +136^\circ\text{C}$ , derate linearly to 0A at  $+175^\circ\text{C}$ .
- For Variants 02, 06, 10, 12, 13, 14, 15 with hot solder dip or tin-lead plating terminal finish, all testing performed at  $T_{amb} > +125^\circ\text{C}$  shall be carried out in a 100% inert atmosphere.
- For Variants 01, 02, 05, 06, 09, 10: Duration 10s maximum at a distance of not less than 1.5mm from the device body and the same package shall not be resoldered until 3 minutes have elapsed.  
For Variants 11 to 15: Duration 5s maximum and the same package shall not be resoldered until 3 minutes have elapsed.
- For Variants 01, 02, 05, 06, 09, 10:  $R_{th(j-l)}$  specified on the lead 9.5mm from the body ( $T_{lead}$ ).  
For Variants 11, 12:  $R_{th(j-c)}$  specified at the body terminal ( $T_{case}$ ).  
For Variants 11 to 15:  $R_{th(j-l)}$  specified at the body terminal ( $T_{lead}$  at 0mm).

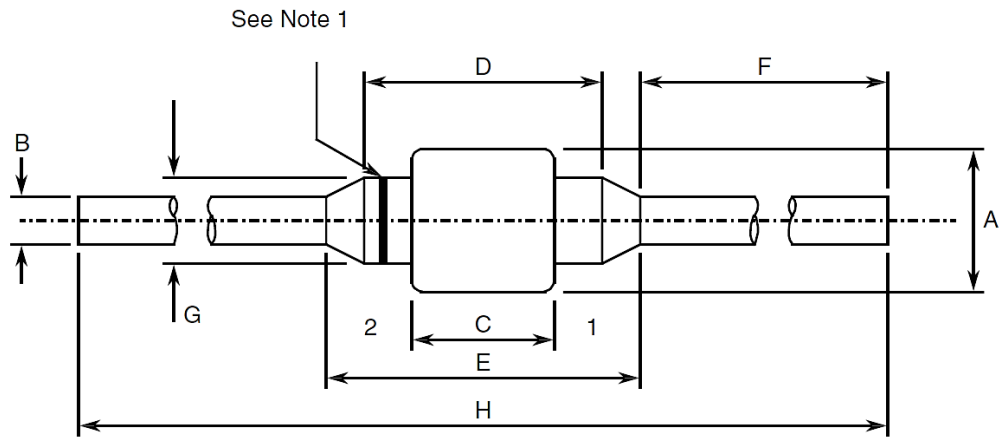
1.6 HANDLING PRECAUTIONS

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 3 per ESCC Basic Specification No. [23800](#) with a Minimum Critical Path Failure Voltage of 15000 Volts.

1.7 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

1.7.1 Axial Lead Package



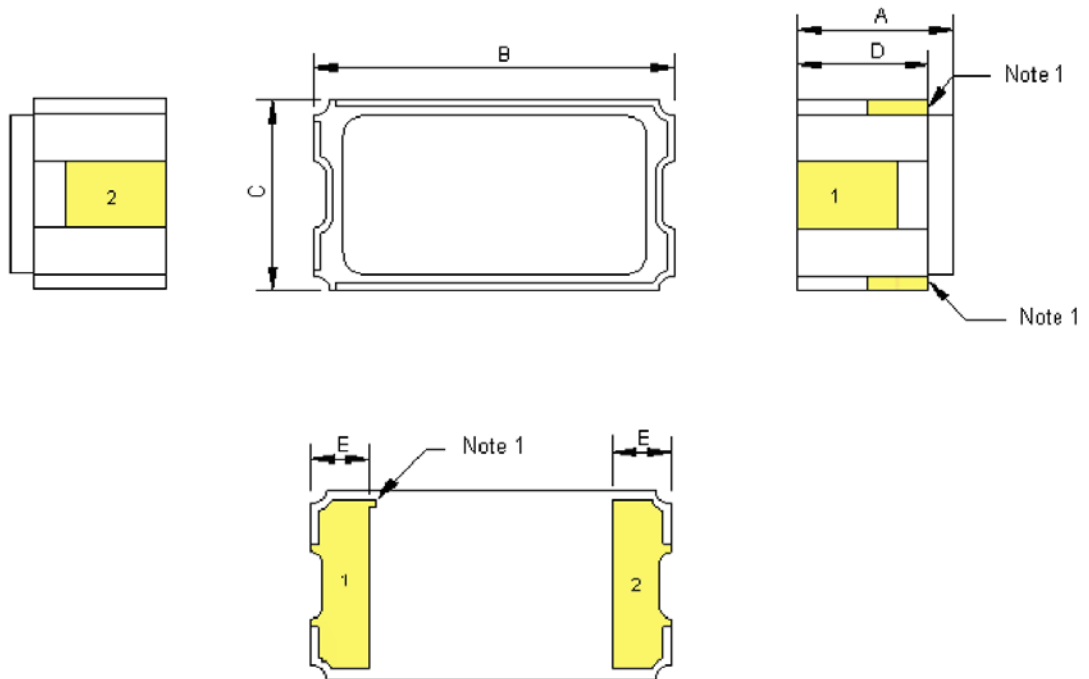
Symbols	Dimensions mm	
	Min	Max
A	-	3.7
B	0.99	1.04
C	-	2.8
D	-	4.6
E	-	7.6
F	24.8	-
G	-	3
H	58.4	-

**NOTES:**

- Terminal identification: The cathode end shall be marked with a contrasting coloured band.



1.7.2 Leadless Chip Carrier Package (LCC2B) - 2 Terminal

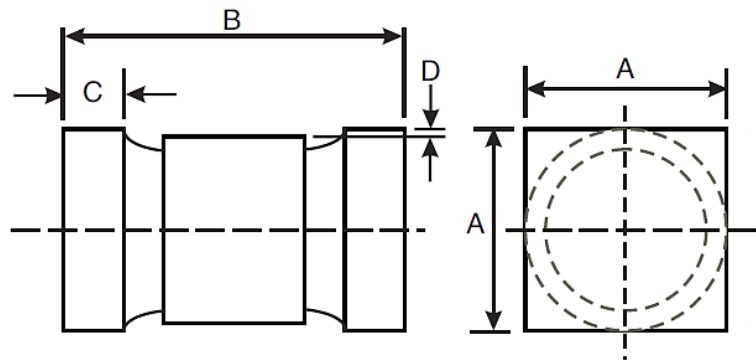


Symbols	Dimensions mm		Notes
	Min	Max	
A	2.04	2.42	2
B	5.27	5.6	
C	3.49	3.76	
D	1.71	2.09	
E	0.48	0.71	

**NOTES:**

1. Terminal identification: The anode is identified by metallisation in the two castellations and by the index mark on the bottom metallisation.
2. For Variant 12, dimension limits apply prior to solder coating of terminals.

1.7.3 Metal Electrode Face Package (MELF-E) - 2 Terminal

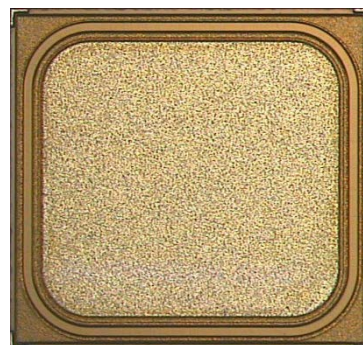


Symbols	Dimensions mm		Notes
	Min	Max	
A	3.48	3.76	2
B	5.08	5.72	2
C	0.48	0.71	2
D	0.08	-	3

**NOTES:**

1. Terminal identification: The cathode end shall be marked with either a contrasting coloured band, three dots spaced equally, or a colour dot on the face of the end tab.
2. Dimension limits apply prior to solder coating of terminals.
3. Minimum clearance of glass body to mounting surface on all orientations.

1.7.4 Die

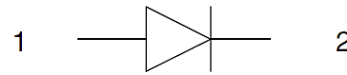


**NOTES:**

1. Die materials and dimensions:
  - Die substrate: Silicon
  - Die length: 1.75 mm
  - Die width: 1.65 mm
  - Die thickness: 280 ±20µm
  - Top passivation: Proximide with thickness 4µm
  - Top metallisation: Al with thickness 6µm
  - Backside metallisation: Ti/Ni/Au with thickness 0.1/0.3/0.05µm
  - Pad dimensions: 1.41 × 1.31 mm
2. Terminal identification is not applicable
3. Bias details: top contact = anode, backside contact = cathode

## 1.8 FUNCTIONAL DIAGRAM

Terminal 1: Anode  
Terminal 2: Cathode



### **NOTES:**

1. For LCC2B (Variants 11, 12), the lid is not connected to any terminal.
2. For Die Components (Variant 16), the terminal numbering is not applicable.

## 1.9 MATERIALS AND FINISHES

### 1.9.1 Materials and Finishes of Packaged Components

For Variants 01, 02, 05, 06, 09, 10, 11, 12, 13, 14 and 15, the materials and finishes shall be as follows:

- (a) Case  
For Variants 01, 02, 05, 06, 09, 10, 13, 14 and 15, the case shall be hermetically sealed and have a glass body.  
For Variants 11 and 12, the case shall be hermetically sealed and have an Aluminium Nitride body with a Kovar lid.
- (b) Terminal Finish  
As specified in Para. 1.4.2, Component Type Variants.

### 1.9.2 Materials and Finishes of Die Components

For Variant 16, the materials and finishes shall be as specified in Para. 1.7.4.

## 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 Special In-Process Controls - Chart F2*

- (a) Bond Strength: Not applicable for Variants 01, 02, 05, 06, 09, 10, 13, 14 and 15.
- (b) Die Shear: Not applicable for Variants 01, 02, 05, 06, 09, 10, 13, 14 and 15.

### 2.1.1.2 *Deviations from Screening Tests - Chart F3*

- (a) For Variants 01, 02, 05, 06, 09, 10, 13, 14 and 15 only, following Temperature Cycling but prior to initial Parameter Drift Values, a Surge Current test shall be performed on all components as follows:

[MIL-STD-750, Test Method 4066](#), condition A

- $I_{FSM} = 125A$
- 5 surges at a rate of 1 per minute and of duration 8.3ms.

After the Surge Current test, Room Temperature Electrical Measurements shall be performed as specified in Para. 2.4.1 herein. Any Failures shall be rejected.

- (b) Particle Impact Noise Detection: Not applicable for Variants 01, 02, 05, 06, 09, 10, 13, 14 and 15.
- (c) Seal, Fine Leak: Not applicable for Variants 01, 02, 05, 06, 09, 10, 13, 14 and 15.
- (d) Radiographic Inspection: Not applicable for Variants 01, 02, 05, 06, 09, 10, 13, 14 and 15.

### 2.1.1.3 *Deviations from Qualification and Periodic Tests - Chart F4*

- (a) Bond Strength: Not applicable for Variants 01, 02, 05, 06, 09, 10, 13, 14 and 15.
- (b) Die Shear: Not applicable for Variants 01, 02, 05, 06, 09, 10, 13, 14 and 15.
- (c) Seal, Fine Leak: Not applicable for Variants 01, 02, 05, 06, 09, 10, 13, 14 and 15.

## 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 (see Para. 1.7; not applicable to Variant 16).
- (b) The ESCC qualified components symbol (for ESCC qualified components only).
- (c) The ESCC Component Number (see Para. 1.4.1).
- (d) Traceability information.

## 2.3 TERMINAL STRENGTH

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

- For Variants 01, 02, 05, 06, 09, 10, 13, 14 and 15, Test Condition A with applied force 22.2N and duration 15s.
- For Variants 11 and 12, as specified in the ESCC Generic Specification.

## 2.4 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

Electrical measurements shall be performed at room, high and low temperatures. Consolidated notes are given after the tables; see Para. 2.4.3.

2.4.1 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	
Forward Voltage	$V_{F1}$	4011	Pulse Method $I_F = 3A$ , Note 1	-	0.865	V
	$V_{F2}$	4011	Pulse Method $I_F = 4A$ , Note 1 Variants 01, 02, 05, 06, 09, 10, 13, 14, 15, 16 Variants 11, 12	-	0.875 0.9	V
	$V_{F3}$	4011	Pulse Method $I_F = 6A$ , Note 1 Variants 01, 02, 05, 06, 09, 10, 13, 14, 15, 16 Variants 11, 12	-	0.925 0.955	V
Reverse Current 1	$I_{R1}$	4016	DC Method $V_R = V_{RWM}$ , Note 2 Variants 01, 02, 05, 06, 09, 10, 13, 14, 15, 16 Variants 11, 12	-	5	$\mu A$
				-	2	
Reverse Current 2 (Breakdown Voltage)	$I_{R2}$	4021	Variants 11, 12 only DC Method $V_R = V_{(BR)}$ , Note 2	-	10	$\mu A$
Breakdown Voltage	$V_{(BR)}$	4021	Variants 01, 02, 05, 06, 09, 10, 13, 14, 15, 16 only Pulse Method $I_R = 100\mu A$ , Note 1	Note 2	-	V
Capacitance	C	4001	$V_R = 10V$ $V_{sig} = 50mV$ (p-p) max $f = 1MHz$	-	60	pF
Reverse Recovery Time	$t_{rr}$	4031	Variants 01, 02, 05, 06, 09, 10, 13, 14, 15, 16 only Test Condition B $I_F = I_R = 1A$ $I_{rr} = 100mA$ (pk) $di/dt = 100A/\mu s$ (min) Note 3	-	30	ns
			Variants 11, 12 only Test Condition B $I_F = 1A$ $V_R = 30V$ $dI_F/dt = -50A/\mu s$	-	35	ns
Forward Recovery Time	$t_{fr}$	4026	$I_F = 500mA$ $V_{fr} = 1.1V_F$	-	15	ns
Forward Recovery Voltage	$V_{fr}$	4026	$I_F = 500mA$	-	2.2	V

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Thermal Impedance, Junction to Reference Point	$Z_{th(j-x)}$	3101	Variants 01, 02, 05, 06, 09, 10, 13, 14, 15 only $I_H = 30A$ $t_H = 10ms$ $I_M = 10mA$ $t_{MD} = 70\mu s$ max Note 4	(Calculate $\Delta V_F$ , see Note 5)		$^{\circ}C/W$
Thermal Impedance, Junction to Case	$Z_{th(j-c)}$	3101	Variants 11, 12 only $I_H = 1$ to 10A $t_H = 50ms$ $I_M = 50mA$ $t_{MD} = 100\mu s$ Note 4	(Calculate $\Delta V_F$ , see Note 5)		$^{\circ}C/W$

2.4.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions Note 6	Limits		Units
				Min	Max	
Forward Voltage 2	$V_{F2}$	4011	$T_{amb} = +125 (+0 -5)^{\circ}C$ Pulse Method $I_F = 4A$ , Note 1	-	0.8	V
			$T_{amb} = -65 (+5 -0)^{\circ}C$ Pulse Method $I_F = 4A$ , Note 1	-	1.075	V
Reverse Current 1	$I_{R1}$	4016	$T_{amb} = +125 (+0 -5)^{\circ}C$ DC Method $V_R = V_{RWM}$ , Note 2 Variants 01, 02, 05, 06, 09, 10, 13, 14, 15	-	525	$\mu A$
			Variants 11, 12	-	30	
Reverse Current 2 (Breakdown Voltage)	$I_{R2}$	4021	Variants 11, 12 only $T_{amb} = -65 (+5 -0)^{\circ}C$ DC Method $V_R = V_{(BR)}$ , Note 2	-	10	$\mu A$
Breakdown Voltage	$V_{(BR)}$	4021	Variants 01, 02, 05, 06, 09, 10, 13, 14, 15 only $T_{amb} = -65 (+5 -0)^{\circ}C$ Pulse Method $I_R = 100\mu A$ , Note 1	Note 2	-	V

2.4.3 Notes to Electrical Measurements Tables

- For Variants 01, 02, 05, 06, 09, 10, 13, 14, 15, 16, Pulse Width  $\leq 8.3ms$ , Duty Cycle  $\leq 2\%$ .  
For Variants 11 and 12, Pulse Width  $\leq 680\mu s$ , Duty Cycle  $\leq 2\%$ .
- See Para. 1.4.2 for  $V_{RWM}$  and  $V_{(BR)}$  values.
- For Variants 01, 02, 05, 06, 09, 10, 13, 14, 15, read and record measurements shall be performed on a sample of 5 components with 0 failures allowed. Alternatively a 100% inspection may be performed.
- Performed only during Screening Tests Parameter Drift Values (Initial Measurements), go-no-go.

5. The limits for  $\Delta V_F$  shall be defined by the Manufacturer on every lot in accordance with [MIL-STD-750 Method 3101](#) and shall guarantee the  $R_{th}$  limits specified in Para. 1.5, Maximum Ratings.
6. Read and record measurements shall be performed on a sample of 5 components with 0 failures allowed. Alternatively a 100% inspection may be performed.

2.5 PARAMETER DRIFT VALUES

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

The test methods and test conditions shall be as per the corresponding test defined in Para. 2.4.1, 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 $\Delta$	Absolute		
			Min	Max	
Forward Voltage 2 Variants 01, 02, 05, 06, 09, 10, 13, 14, 15 Variants 11, 12	$V_{F2}$	$\pm 0.05$	-	0.875	V
			-	0.9	
Reverse Current 1  Variants 01, 02, 05, 06, 09, 10, 13, 14, 15 Variants 11, 12	$I_{R1}$	$\pm 0.5$ or (1) $\pm 100\%$	-	5	$\mu\text{A}$
			-	2	

**NOTES:**

1. Whichever is the greater referred to the initial value.

2.6 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

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

The test methods and test conditions shall be as per the corresponding test defined in Para. 2.4.1, Room Temperature Electrical Measurements.

Characteristics	Symbols	Limits		Units
		Min	Max	
Forward Voltage 1 (Variants 11, 12 only)	$V_{F1}$	-	0.865	V
Forward Voltage 2 (Variants 01, 02, 05, 06, 09, 10, 13, 14, 15 only)	$V_{F2}$	-	0.875	V
Forward Voltage 3 (Variants 11, 12 only)	$V_{F3}$	-	0.955	V
Reverse Current 1 Variants 01, 02, 05, 06, 09, 10, 13, 14, 15 Variants 11, 12	$I_{R1}$	-	5	$\mu\text{A}$
		-	2	

2.7 HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS

Characteristics	Symbols	Limits	Units
Ambient Temperature	$T_{amb}$	+150 (+0 -5)	°C
Reverse Voltage	$V_R$	$0.8 \times V_{RWM}$ (Note 1)	V
Duration	t	≥ 48	hours

**NOTES:**

1. See Para. 1.4.2 for  $V_{RWM}$  value.

2.8 POWER BURN-IN CONDITIONS

For Variants 01, 02, 05, 06, 09, 10, 13, 14, 15

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	$T_{amb}$	+55 maximum	°C
Junction Temperature	$T_j$	+135 minimum	°C
Reverse Voltage	$V_R$	$V_{RWM}$ (Note 1)	V
Average Output Rectified Current	$I_o$	3 minimum (Notes 2, 3)	A

For Variants 11, 12

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	$T_{amb}$	+22 ±3	°C
Junction Temperature	$T_j$	+175 (+0 -5)	°C
Average Output Rectified Current	$I_o$	Note 3	A

**NOTES:**

1. See Para. 1.4.2 for  $V_{RWM}$  value.
2. Mounting shall be performed without bending or soldering leads. Lead length from body to mounting shall be 3.14mm minimum.
3. The output current may be adjusted, within the given limit range, to attain the specified junction temperature.



2.9 OPERATING LIFE CONDITIONS

For Variants 01, 02, 05, 06, 09, 10, 13, 14, 15

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	$T_{amb}$	+55 maximum	°C
Junction Temperature	$T_j$	+175 minimum	°C
Reverse Voltage	$V_R$	$V_{RWM}$ (Note 1)	V
Average Output Rectified Current	$I_o$	3 minimum (Notes 2, 3)	A

For Variants 11, 12

The conditions shall be as specified in Para. 2.8, Power Burn-in.

**NOTES:**

1. See Para. 1.4.2 for  $V_{RWM}$  value.
2. Mounting shall be performed without bending or soldering leads. Lead length from body to mounting shall be 3.14mm minimum.
3. The output current may be adjusted, within the given limit range, to attain the specified junction temperature.

**APPENDIX A**  
**AGREED DEVIATIONS FOR STMICROELECTRONICS (F)**

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Para. 2.1.1, Deviations from the Generic Specification: Para. 8, Test Methods and Procedures	For qualification and qualification maintenance, or procurement of qualified or unqualified components, the following replacement test method specifications shall be used instead of the following ESCC Basic Specifications: <ul style="list-style-type: none"> <li>• No. 20400, Internal Visual Inspection: replaced by <a href="#">MIL-STD-750 Test Method 2078</a>.</li> <li>• No. 20500, External Visual Inspection: replaced by <a href="#">MIL-STD-750 Test Method 2071</a>.</li> <li>• No. 20900, Radiographic Inspection of Electronic Components: replaced by <a href="#">MIL-STD-750 Test Method 2076</a>.</li> </ul>
Para. 2.1.1.1, Deviations from the Generic Specification: Deviations from Special In-Process Controls - Chart F2	Internal Visual Inspection. Wedge bonds equal to 1.1 wire diameters are acceptable for bonding with a V-Groove tool.  Internal Visual Inspection. For CCP packages, the criteria specified for voids in the fillet and minimum die mounting material around the visible die perimeter for die mounting defects may be omitted providing that a radiographic inspection to verify the die-attach process is performed on a sample basis in accordance with STMICROELECTRONICS control plans internal procedure as specified in the PID.
Para. 2.1.1.2, Deviations from the Generic Specification: Deviations from Screening Tests - Chart F3	Solderability is not applicable unless specifically stipulated in the Purchase Order.
Para. 2.4.1, Room Temperature Electrical Measurements	All AC characteristics ( $C$ , $t_{rr}$ , $t_{fr}$ , $V_{fr}$ ) may be considered guaranteed but not tested if successful pilot lot testing has been performed in accordance with STMICROELECTRONICS "Acceptation wafers" internal procedure as specified in the PID, which includes AC characteristic measurements per the Detail Specification.  A summary of the pilot lot testing shall be provided if required by the Purchase Order.
Para. 2.4.2, High and Low Temperatures Electrical Measurements	Low temperature characteristic $I_{R2}$ may be considered guaranteed but not tested if successful pilot lot testing has been performed in accordance with STMICROELECTRONICS "Acceptation wafers" internal procedure, on the wafer lot as specified in the PID, which includes low temperature characteristic measurements per the Detail Specification.  A summary of the pilot lot testing shall be provided if required by the Purchase Order.