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**DIODE, RECTIFIER, HIGH VOLTAGE**

**BASED ON TYPES STTH40200 AND STTH60200**

**ESCC Detail Specification No. 5103/033**

|         |           |
|---------|-----------|
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| DCR No.              | CHANGE DESCRIPTION                                    |
|----------------------|-------------------------------------------------------|
| <a href="#">1820</a> | 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](#)

### 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: 510303301

- Detail Specification Reference: 5103033
- 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     | Average Output Rectified Current per Device (Io) | Lead/Terminal Material and Finish | Weight Max (g) |
|----------------|---------------|----------|--------------------------------------------------|-----------------------------------|----------------|
| 01             | STTH40200     | TO-254AA | 40                                               | S14                               | 9.4            |
| 02             | STTH40200     | TO-254AA | 40                                               | S4                                | 9.4            |
| 03             | STTH60200     | SMD1     | 60                                               | Q14                               | 2.4            |
| 04             | STTH60200     | SMD1     | 60                                               | Q4                                | 2.4            |

The lead/terminal material and 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      | Units | Remarks    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------|-------|------------|
| Forward Surge Current                                                                                                                                                     | $I_{FSM}$     | 300                  | A     | Notes 1, 2 |
| Working Peak Reverse Voltage                                                                                                                                              | $V_{RWM}$     | 200                  | V     |            |
| Repetitive Peak Reverse Voltage                                                                                                                                           | $V_{RRM}$     | 200                  | V     |            |
| Average Output Rectified Current<br>Variants 01, 02 (per diode):<br>Variants 01, 02 (per device):<br>Variants 03, 04 (per diode):<br>Variants 03, 04 (per device):        | $I_o$         | 40<br>40<br>40<br>60 | A     | Note 3     |
| Operating Temperature Range (Case Temperature)                                                                                                                            | $T_{op}$      | -65 to +175          | °C    |            |
| Junction Temperature                                                                                                                                                      | $T_j$         | +175                 | °C    |            |
| Storage Temperature Range                                                                                                                                                 | $T_{stg}$     | -65 to +175          | °C    |            |
| Soldering Temperature                                                                                                                                                     | $T_{sol}$     | +245                 | °C    | Note 4     |
| Thermal Resistance, Junction to Case<br>Variants 01, 02 (per diode):<br>Variants 01, 02 (per device):<br>Variants 03, 04 (per diode):<br>Variants 03, 04 (per device):    | $R_{th(j-c)}$ | 1.4<br>1<br>2.4<br>2 | °C/W  |            |
| Thermal Resistance, Junction to Ambient<br>Variants 01, 02 (per diode):<br>Variants 01, 02 (per device):<br>Variants 03, 04 (per diode):<br>Variants 03, 04 (per device): | $R_{th(j-a)}$ | 45<br>45<br>55<br>55 | °C/W  |            |

#### NOTES:

- Sinusoidal pulse of 10ms duration.
- At  $T_{amb} \leq 25^{\circ}\text{C}$ .
- For Variants 01, 02 per diode, at  $T_{case} > +110^{\circ}\text{C}$ , derate linearly to 0A at  $+175^{\circ}\text{C}$ .  
For Variants 01, 02 per device, at  $T_{case} > +134^{\circ}\text{C}$ , derate linearly to 0A at  $+175^{\circ}\text{C}$ .  
For Variants 03, 04 per diode at  $T_{case} > +64^{\circ}\text{C}$ , derate linearly to 0A at  $+175^{\circ}\text{C}$ .  
For Variants 03, 04 per device at  $T_{case} > +44^{\circ}\text{C}$ , derate linearly to 0A at  $+175^{\circ}\text{C}$ .
- Duration 5s maximum and the same package shall not be resoldered until 3 minutes have elapsed.

### 1.6 HANDLING PRECAUTIONS

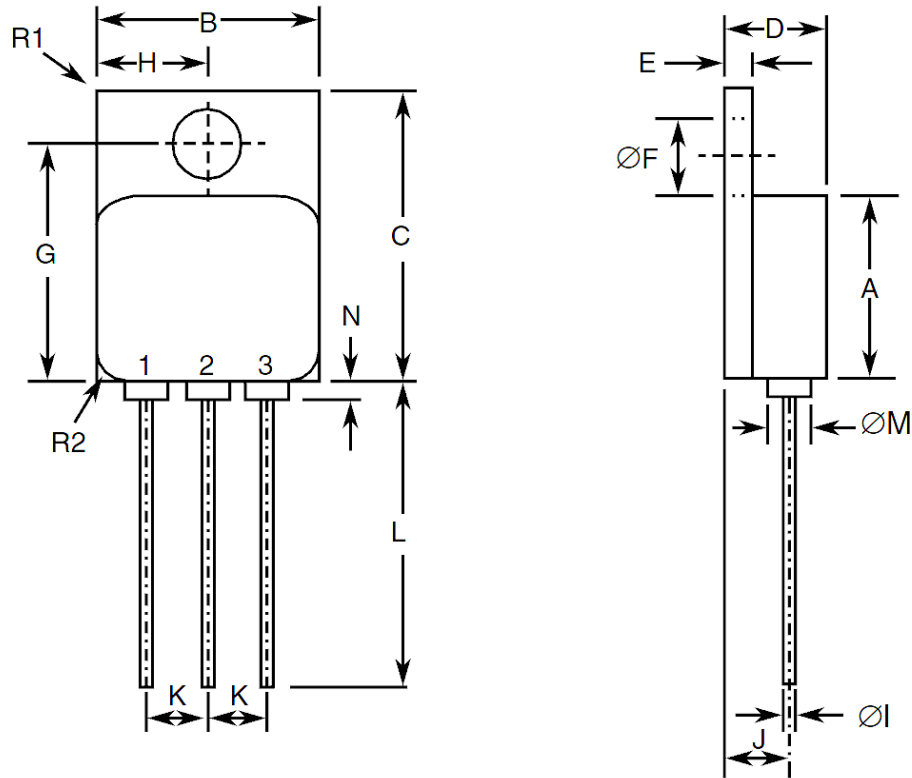
These devices are susceptible to damage by electrostatic discharge. Therefore, suitable precautions shall be employed for protection during all phases of manufacture, testing, packaging, shipment and any handling.

These components are categorised as Class 3 per ESCC Basic Specification No. [23800](#) with a Minimum Critical Path Failure Voltage of 8kV.

The TO-254AA package contains Beryllium Oxide (BeO) and therefore must not be ground, machined, sandblasted or subjected to any mechanical operation which will produce dust. The case must not be subjected to any chemical process (e.g. etching) which will produce fumes.

## 1.7 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

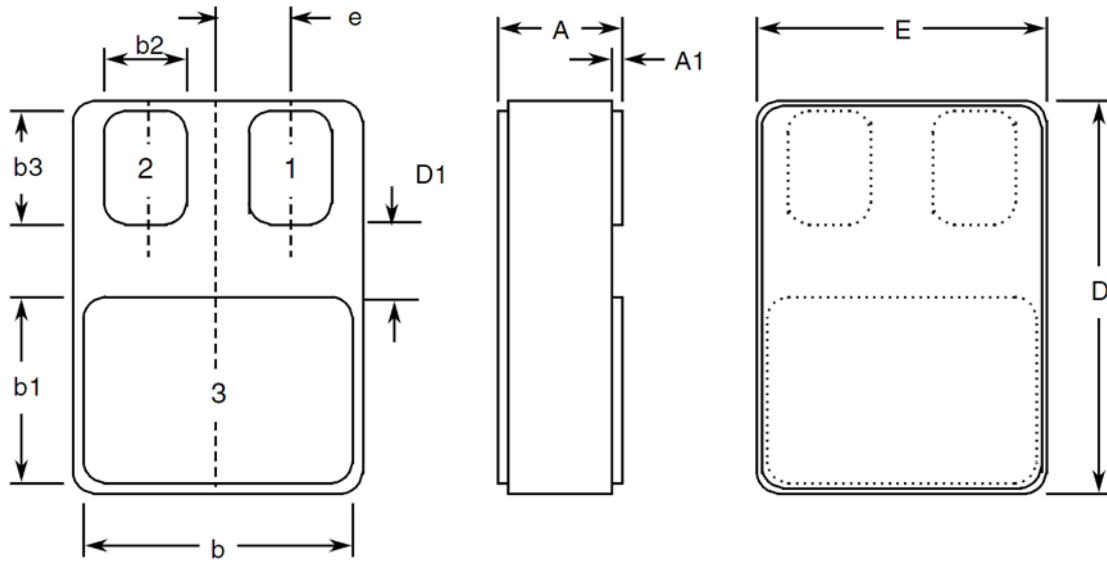
### 1.7.1 Metal Flange Mount Package (TO-254AA) - 3 Lead (Variants 01, 02)



| Symbols | Dimensions mm |       | Notes |
|---------|---------------|-------|-------|
|         | Min           | Max   |       |
| A       | 13.59         | 13.84 |       |
| B       | 13.59         | 13.84 |       |
| C       | 20.07         | 20.32 |       |
| D       | 6.3           | 6.7   |       |
| E       | 1             | 1.35  |       |
| ØF      | 3.5           | 3.9   |       |
| G       | 16.89         | 17.4  |       |
| H       | 6.86 BSC      |       |       |
| ØI      | 0.89          | 1.14  | 2     |
| J       | 3.81 BSC      |       |       |
| K       | 3.81 BSC      |       |       |
| L       | 12.95         | 14.5  |       |
| ØM      | 3.05 Typical  |       | 2     |

| Symbols | Dimensions mm |      | Notes |
|---------|---------------|------|-------|
|         | Min           | Max  |       |
| N       | -             | 0.71 | 2     |
| R1      | -             | 1    | 3     |
| R2      | 1.65 Typical  |      | 4     |

### 1.7.2 Surface Mount Package (SMD1) - 3 Terminal (Variants 03, 04)



| Symbols | Dimensions mm |       | Notes |
|---------|---------------|-------|-------|
|         | Min           | Max   |       |
| A       | 3.3           | 3.61  |       |
| A1      | 0.25          | 0.51  |       |
| b       | 9.4           | 9.65  |       |
| b1      | 10.41         | 10.67 |       |
| b2      | 3.43          | 3.68  | 5     |
| b3      | 3.86          | 4.11  | 5     |
| D       | 15.75         | 16    |       |
| D1      | 0.76          | -     | 5     |
| E       | 11.3          | 11.56 |       |
| e       | 2.67 BSC      |       | 5     |

### 1.7.3 Notes to Para. 1.7 Physical Dimensions and Terminal Identification

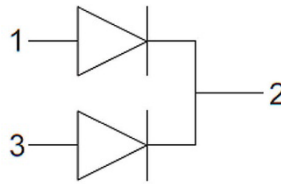
- Terminal identification is specified by the component's geometry. See Para. 1.8 Functional Diagram for the terminal connections.
- 3 places.
- Radius of heatsink flange corner, 4 places.
- Radius of body corner, 4 places.
- 2 places.



## 1.8 FUNCTIONAL DIAGRAM

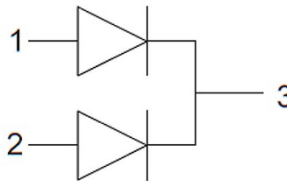
Terminal 1: Anode 1  
Terminal 2: Common Cathode  
Terminal 3: Anode 2

### Variants 01, 02



Terminal 1: Anode 1  
Terminal 2: Anode 2  
Terminal 3: Common Cathode

### Variants 03, 04



### **NOTES:**

1. For Variants 01, 02, the case is not connected to any lead.
2. For Variants 03, 04, the lid is not connected to any terminal.

## 1.9 MATERIALS AND FINISHES

Materials and finishes shall be as follows:

### (a) Case

For the metal flange mount package the case shall be hermetically sealed and have a metal body. The leads pass through ceramic eyelets brazed into the frame and the lid shall be welded.

For the surface mount package the case shall be hermetically sealed and have a ceramic body with a Kovar lid.

### (b) Lead/Terminal Finish

As specified in Para. 1.4.2 Component Type Variants.

## 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

None.

## 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 shall be:

- (a) The ESCC qualified components symbol (for ESCC qualified components only).
- (b) The ESCC Component Number (see Para. 1.4.1).
- (c) Traceability information.
- (d) Warning sign for beryllium oxide (applicable to Variants 01 and 02 only).

## 2.3 CASE ISOLATION

For Variants 01 and 02, Case Isolation shall be performed as specified in the ESCC Generic Specification and as follows:

- Test Conditions:
  - Test voltage: 500Vdc
  - Duration of application of test voltage: 1s
  - Points of application of test voltage: between case metal tab and all terminals connected together.
  - Maximum leakage current: 10nA

## 2.4 TERMINAL STRENGTH

For Variants 01 and 02, the test conditions for Terminal Strength, tested as specified in the ESCC Generic Specification, shall be as follows:

- Test Condition: A, tension, with an applied force of 10N for a duration of 10s.

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

Electrical measurements shall be performed at room, high and low temperatures. Consolidated notes are given in Para. 2.5.3.

### 2.5.1 Room Temperature Electrical Measurements

The measurements shall be performed at  $T_{amb} = +25 \pm 3^{\circ}\text{C}$ .

| Characteristics   | Symbols  | MIL-STD-750<br>Test Method | Test Conditions<br>Note 1                                                    | Limits |      | Units         |
|-------------------|----------|----------------------------|------------------------------------------------------------------------------|--------|------|---------------|
|                   |          |                            |                                                                              | Min    | Max  |               |
| Reverse Current   | $I_R$    | 4016                       | DC Method<br>$V_R = 200\text{V}$                                             | -      | 30   | $\mu\text{A}$ |
| Forward Voltage 1 | $V_{F1}$ | 4011                       | $I_{F1} = 5\text{A}$ , Note 2                                                | -      | 0.87 | V             |
| Forward Voltage 2 | $V_{F2}$ | 4011                       | $I_{F2} = 10\text{A}$ , Note 2                                               | -      | 0.92 | V             |
| Forward Voltage 3 | $V_{F3}$ | 4011                       | $I_{F3} = 20\text{A}$ , Note 2                                               | -      | 1.02 | V             |
| Forward Voltage 4 | $V_{F4}$ | 4011                       | $I_{F4} = 30\text{A}$ , Note 2                                               | -      | 1.09 | V             |
| Forward Voltage 5 | $V_{F5}$ | 4011                       | $I_{F5} = 40\text{A}$ , Note 2                                               | -      | 1.15 | V             |
| Capacitance       | C        | 4001                       | $V_R = 10\text{V}$<br>$V_{sig} = 30\text{mV (p-p) max}$<br>$f = 1\text{MHz}$ | -      | 225  | pF            |

| Characteristics                     | Symbols       | MIL-STD-750<br>Test Method | Test Conditions<br>Note 1                           | Limits                |     | Units |
|-------------------------------------|---------------|----------------------------|-----------------------------------------------------|-----------------------|-----|-------|
|                                     |               |                            |                                                     | Min                   | Max |       |
| Reverse Recovery Time               | $t_{rr}$      | 4031                       | $I_F = 1A$<br>$V_R = 30V$<br>$dI_F/dt = -50A/\mu s$ | -                     | 60  | ns    |
| Thermal Impedance, Junction to Case | $Z_{th(j-c)}$ | 3101                       | Note 3                                              | $\Delta V_F$ , Note 4 |     | °C/W  |

### 2.5.2 High and Low Temperatures Electrical Measurements

| Characteristics   | Symbols  | MIL-STD-750<br>Test Method | Test Conditions<br>Notes 1 and 5                               | Limits |      | Units   |
|-------------------|----------|----------------------------|----------------------------------------------------------------|--------|------|---------|
|                   |          |                            |                                                                | Min    | Max  |         |
| Reverse Current   | $I_R$    | 4016                       | $T_{amb} = +125 (+0 -5) ^\circ C$<br>DC Method<br>$V_R = 200V$ | -      | 300  | $\mu A$ |
| Forward Voltage 1 | $V_{F1}$ | 4011                       | $T_{amb} = +125 (+0 -5) ^\circ C$<br>$I_{F1} = 5A$ , Note 2    | -      | 0.66 | V       |
|                   |          |                            | $T_{amb} = -55 (+5 -0) ^\circ C$<br>$I_{F1} = 5A$ , Note 2     | -      | 1.04 | V       |
| Forward Voltage 2 | $V_{F2}$ | 4011                       | $T_{amb} = +125 (+0 -5) ^\circ C$<br>$I_{F2} = 10A$ , Note 2   | -      | 0.75 | V       |
|                   |          |                            | $T_{amb} = -55 (+5 -0) ^\circ C$<br>$I_{F2} = 10A$ , Note 2    | -      | 1.07 | V       |
| Forward Voltage 3 | $V_{F3}$ | 4011                       | $T_{amb} = +125 (+0 -5) ^\circ C$<br>$I_{F3} = 20A$ , Note 2   | -      | 0.87 | V       |
|                   |          |                            | $T_{amb} = -55 (+5 -0) ^\circ C$<br>$I_{F3} = 20A$ , Note 2    | -      | 1.15 | V       |
| Forward Voltage 4 | $V_{F4}$ | 4011                       | $T_{amb} = +125 (+0 -5) ^\circ C$<br>$I_{F4} = 30A$ , Note 2   | -      | 0.95 | V       |
|                   |          |                            | $T_{amb} = -55 (+5 -0) ^\circ C$<br>$I_{F4} = 30A$ , Note 2    | -      | 1.2  | V       |
| Forward Voltage 5 | $V_{F5}$ | 4011                       | $T_{amb} = +125 (+0 -5) ^\circ C$<br>$I_{F5} = 40A$ , Note 2   | -      | 1.02 | V       |
|                   |          |                            | $T_{amb} = -55 (+5 -0) ^\circ C$<br>$I_{F5} = 40A$ , Note 2    | -      | 1.25 | V       |

### 2.5.3 Notes to Electrical Measurements Tables

- Measurement per each diode.
- Pulsed measurement: Pulse Width  $\leq 680\mu s$ , Duty Cycle  $\leq 2\%$ .
- Performed only during Screening Tests Parameter Drift Values (Initial Measurements), go-no-go.
- 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  $R_{th(j-c)}$  limits specified in Para. 1.5 Maximum Ratings.
- Read and record measurements shall be performed on a sample of 5 components with 0 failures allowed. Alternatively a 100% inspection may be performed.

## 2.6 PARAMETER DRIFT VALUES

Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +25 \pm 3^{\circ}\text{C}$ .

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<br>$\Delta$          | Absolute |      |         |
|                   |          |                                  | Min      | Max  |         |
| Reverse Current   | $I_R$    | $\pm 5$<br>or (1)<br>$\pm 100\%$ | -        | 30   | $\mu A$ |
| Forward Voltage 5 | $V_{F5}$ | $\pm 0.05$                       | -        | 1.15 | V       |

### **NOTES:**

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

## 2.7 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +25 \pm 3^{\circ}\text{C}$ .

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         |
|-------------------|----------|--------|------|---------------|
|                   |          | Min    | Max  |               |
| Reverse Current   | $I_R$    | -      | 30   | $\mu\text{A}$ |
| Forward Voltage 5 | $V_{F5}$ | -      | 1.15 | V             |

## 2.8 HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS

| Characteristics     | Symbols   | Test Conditions | Units              |
|---------------------|-----------|-----------------|--------------------|
| Ambient Temperature | $T_{amb}$ | +150 (+0 -5)    | $^{\circ}\text{C}$ |
| Reverse Voltage     | $V_R$     | 160             | V                  |
| Duration            | t         | $\geq 48$       | Hours              |

2.9 POWER BURN-IN CONDITIONS

| Characteristics                  | Symbols   | Test Conditions | Units |
|----------------------------------|-----------|-----------------|-------|
| Ambient Temperature              | $T_{amb}$ | +25 (+0 -5)     | °C    |
| Junction Temperature             | $T_J$     | +175 (+0 -5)    | °C    |
| Average Output Rectified Current | $I_o$     | Note 1          | A     |
| Duration                         | $t$       | $\geq 168$      | Hours |

**NOTES:**

1. The output current may be adjusted, within the given limit range, to attain the specified junction temperature.

2.10 OPERATING LIFE CONDITIONS

The conditions shall be as specified in Para. 2.9 Power Burn-in Conditions.

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

| ITEMS AFFECTED                                                                                                                 | DESCRIPTION OF DEVIATIONS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Para. 2.1.1, Deviations from the Generic Specification:<br>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. 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, Deviations from the Generic Specification:<br>Deviations from Production Control – Chart F2                       | Special In-Process Controls - Internal Visual Inspection: Wedge bonds equal to 1.1 wire diameter are acceptable for bonding with a V-Groove tool.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Para. 2.1.1, Deviations from the Generic Specification:<br>Deviations from Screening Tests for Packaged Components – Chart F3A | Solderability: Solderability is not applicable unless specifically stipulated in the Purchase Order.<br><br>Room Temperature Electrical Measurements: Capacitance and Reverse Recovery Time 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. |