



DIODES, SILICON, SWITCHING

BASED ON TYPES 1N6642 AND 1N6642U

ESCC Detail Specification No. 5101/026

| | |
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DOCUMENTATION CHANGE NOTICE

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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: 510102607

- Detail Specification Reference: 5101026
- Component Type Variant Number: 07

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) | Terminal Finish (Note 1) | Weight max g |
|----------------|---------------|-------|----------------------------------|--|--------------------------|--------------|
| 07 | 1N6642U | LCC2D | 100 | 75 | 2 (Note 2) | 0.12 |
| 08 | 1N6642U | LCC2D | 100 | 75 | 4 | 0.12 |
| 09 | 1N6642 | Die | 100 | 75 | N/A | N/A |

NOTES:

1. The terminal finish shall be in accordance with the requirements of ESCC Basic Specification No. [23500](#).
2. With electrolytic nickel underplating.

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} | 2 | A | Notes 1, 2 |
| Working Peak Reverse Voltage | V_{RWM} | Note 3 | V | |
| Average Output Rectified Current | I_o | 300 | mA | Note 4 |
| Operating Temperature Range (Case Temperature) | T_{op} | -65 to +175 | °C | Note 5 |
| Junction Temperature | T_j | +175 | °C | |
| Storage Temperature Range | T_{stg} | -65 to +175 | °C | Note 5 |
| Soldering Temperature | T_{sol} | +245 | °C | Note 6 |
| Thermal Resistance, Junction to Case | $R_{th(j-c)}$ | 60 | °C/W | Note 7 |
| Thermal Resistance, Junction to Ambient | $R_{th(j-a)}$ | 280 | °C/W | |

NOTES:

1. Sinusoidal pulse of 8.3ms duration.
2. At $T_{amb} \leq +25^{\circ}C$.
3. See Para. 1.4.2 for V_{RWM} value.
4. At $T_{case} \geq +155^{\circ}C$, derate linearly to 0A at +175°C.
5. For Variants with hot solder dip lead finish, all testing and any handling performed at $T_{amb} > +125^{\circ}C$ shall be carried out in a 100% inert atmosphere.
6. Duration 5s maximum and the same package shall not be resoldered until 3 minutes have elapsed.
7. Package mounted on an infinite heat sink.

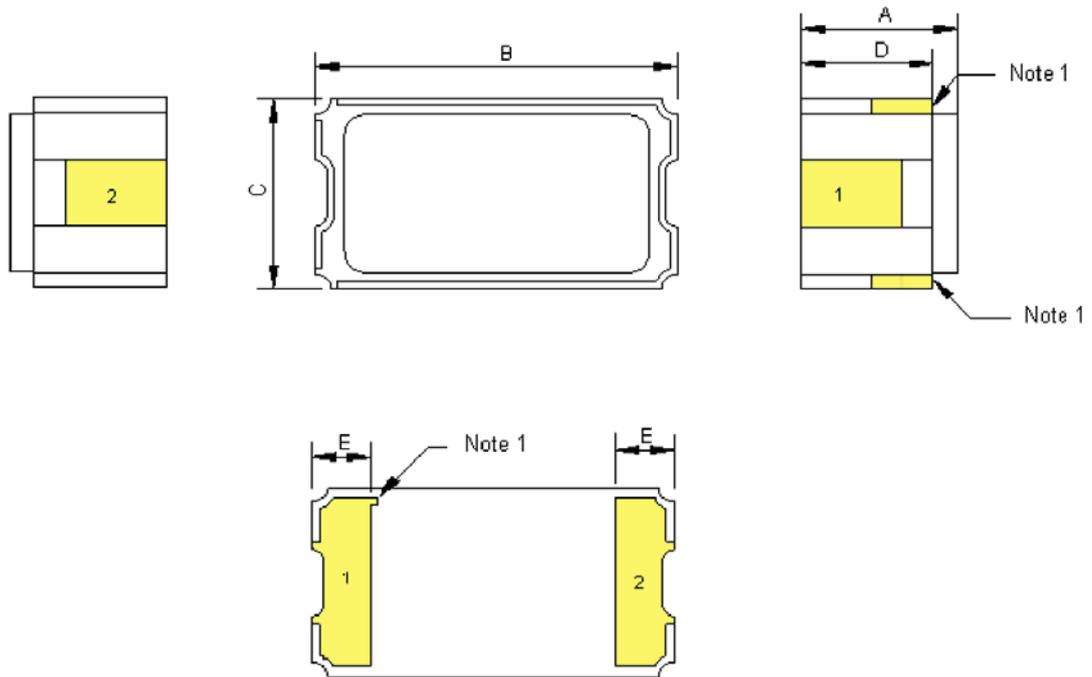
1.6 HANDLING PRECAUTIONS

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 5800 Volts.

1.7 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

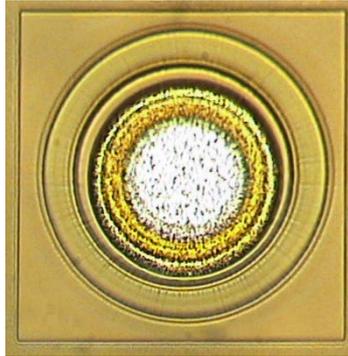
1.7.1 Leadless Chip Carrier Package (LCC2D) - 2 Terminal



| Symbols | Dimensions mm | | Notes |
|---------|---------------|------|-------|
| | Min | Max | |
| A | 1.86 | 2.2 | 2 |
| B | 4.44 | 4.77 | |
| C | 1.84 | 2.1 | |
| D | 1.53 | 1.87 | |
| 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 08, dimension limits apply prior to solder coating of terminals.

1.7.2 Die**NOTES:**

1. Die materials and dimensions:
 - Die substrate: Silicon
 - Die length: 390 μm
 - Die width: 390 μm
 - Die thickness: 235 $\pm 20\mu\text{m}$
 - Top passivation: Probimide with thickness 4 μm
 - Top metallisation: Al with thickness 3 μm
 - Backside metallisation: Ti/Ni/Au with thickness 0.1/0.3/0.05 μm
 - Pad dimensions: 110 μm diameter
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 LCC2D (Variants 07, 08), the lid is not connected to any terminal.
2. For Die Components (Variant 09), the terminal numbering is not applicable.

1.9 MATERIALS AND FINISHES1.9.1 Materials and Finishes of Packaged Components

For Variants 07 and 08, the materials and finishes shall be as follows:

- (a) Case
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 09, the materials and finishes shall be as specified in Para. 1.7.2.

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 or its primary package shall be:

- (a) Terminal Identification (see Para. 1.7; not applicable to Variant 09).
- (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 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. 2.3.3.

2.3.1 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 1 | V_{F1} | 4011 | Pulse Method $I_F = 10mA$, Note 1 | - | 0.8 | V |
| Forward Voltage 2 | V_{F2} | 4011 | Pulse Method $I_F = 100mA$, Note 1 | - | 1.2 | V |
| Reverse Current 1 | I_{R1} | 4016 | DC Method $V_R = 20V$ | - | 25 | nA |
| Reverse Current 2 | I_{R2} | 4016 | DC Method $V_R = V_{RWM}$, Note 2 | - | 50 | nA |
| Reverse Current 3 (Breakdown Voltage) | I_{R3} | 4016 | DC Method $V_R = V_{(BR)}$, Note 2 | - | 60 | nA |
| Capacitance 1 | C_1 | 4001 | $V_R = 0V$ $V_{sig} = 50mV$ (p-p) max $f = 1MHz$, Notes 3, 4 | - | 5 | pF |

| Characteristics | Symbols | MIL-STD-750 Test Method | Test Conditions | Limits | | Units |
|--|----------------------|----------------------------|---|--|-----|-------|
| | | | | Min | Max | |
| Capacitance 2 | C ₂ | 4001 | V _R = 1.5V V _{sig} = 50mV (p-p) max f = 1MHz, Notes 3, 4 | - | 2.8 | pF |
| Reverse Recovery Time 1 | t _{rr1} | 4031 | Test Condition A I _F = I _R = 10mA I _{rr} = 1mA, Note 5 | - | 9 | ns |
| Reverse Recovery Time 2 | t _{rr2} | 4031 | Test Condition A I _F = 1A, V _R = 30V dI/dt = -15A/μs Notes 3, 4 | - | 20 | ns |
| Forward Recovery Time | t _{fr} | 4026 | I _F = 200mA V _{fr} = 1.1V _F Notes 3, 4 | - | 20 | ns |
| Forward Recovery Voltage | V _{fr} | 4026 | I _F = 200mA V _{fr} = 1.1V _F Notes 3, 4 | - | 5 | V |
| Thermal Impedance, Junction to Ambient | Z _{th(j-a)} | 3101 | I _H = 0.1A to 0.3A t _H = 50ms to 10s I _M = 10mA t _{MD} = 100μs Note 6 | (Calculate ΔV _F , see Note 7) | | °C/W |

2.3.2 High and Low Temperatures Electrical Measurements

| Characteristics | Symbols | MIL-STD-750 Test Method | Test Conditions Note 8 | Limits | | Units |
|---------------------------------------|-----------------|----------------------------|--|--------|-----|-------|
| | | | | Min | Max | |
| Forward Voltage 1 | V _{F1} | 4011 | T _{amb} = +150 (+0 -5)°C Pulse Method I _F = 10mA, Note 1 | - | 0.8 | V |
| Forward Voltage 2 | V _{F2} | 4011 | T _{amb} = -55 (+5 -0)°C I _F = 100mA, Note 1 | - | 1.2 | V |
| Reverse Current 1 | I _{R1} | 4016 | T _{amb} = +150 (+0 -5)°C DC Method V _R = 20V | - | 30 | μA |
| Reverse Current 2 | I _{R2} | 4016 | T _{amb} = +150 (+0 -5)°C Method V _R = V _{RWM} , Note 2 | - | 40 | μA |
| Reverse Current 3 (Breakdown Voltage) | I _{R3} | 4016 | T _{amb} = -55 (+5 -0)°C DC Method V _R = V _(BR) , Note 2 | - | 50 | μA |

2.3.3 Notes to Electrical Measurements Tables

1. Pulse Width $\leq 680\mu\text{s}$, Duty Cycle $\leq 2\%$.
2. See Para. 1.4.2 for V_{RWM} and $V_{(BR)}$ values.
3. For Packaged Components (Variants 07, 08) all AC characteristics read and record measurements shall be performed on a sample of 32 components with 0 failures allowed. Alternatively a 100% inspection may be performed.
4. For Die Components (Variant 09) all AC characteristics read and record measurements shall be performed on either a sample of 32 components or 100% of the Packaged Test Sublot, whichever is less, with 0 failures allowed.
5. Guaranteed by t_{rr2} but not tested.
6. Performed only during Screening Tests Parameter Drift Values (Initial Measurements), go-no-go.
7. The limits for ΔV_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.
8. Read and record measurements shall be performed on a sample of 5 components with 0 failures allowed. Alternatively a 100% inspection may be performed.

2.4 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. 2.3.1, Room Temperature Electrical Measurements.

The drift values (Δ) 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 Δ | Absolute | | |
| | | | Min | Max | |
| Forward Voltage 2 | V_{F2} | ± 0.03 | - | 1.2 | V |
| Reverse Current 2 | I_{R2} | ± 10 or (1) $\pm 100\%$ | - | 50 | nA |

NOTES:

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

2.5 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. 2.3.1, Room Temperature Electrical Measurements.

| Characteristics | Symbols | Limits | | Units |
|---------------------------------------|----------|--------|-----|-------|
| | | Min | Max | |
| Forward Voltage 2 | V_{F2} | - | 1.2 | V |
| Reverse Current 2 | I_{R2} | - | 50 | nA |
| Reverse Current 3 (Breakdown Voltage) | I_{R3} | - | 60 | nA |

2.6 HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS

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

NOTES:

1. See Para. 1.4.2 for $V_{(BR)}$ value.

2.7 POWER BURN-IN CONDITIONS

| Characteristics | Symbols | Test Conditions | Units |
|----------------------------------|-----------|-----------------|--------------------|
| Ambient Temperature | T_{amb} | +125 (+0 -5) | $^{\circ}\text{C}$ |
| Junction Temperature | T_J | +175 (+0 -5) | $^{\circ}\text{C}$ |
| Average Output Rectified Current | I_o | Note 1 | mA |

NOTES:

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

2.8 OPERATING LIFE CONDITIONS

The conditions shall be as specified in Para. 2.7, Power Burn-in.

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"> • No. 20400, Internal Visual Inspection: replaced by MIL-STD-750 Test Method 2078. • No. 20500, External Visual Inspection: replaced by MIL-STD-750 Test Method 2071. • No. 20900, Radiographic Inspection of Electronic Components: replaced by MIL-STD-750 Test Method 2076. |
| Para. 2.1.1, Deviations from the Generic Specification: Deviations from Production Control - 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, Deviations from the Generic Specification: Deviations from Screening Tests - Chart F3 | Solderability is not applicable unless specifically stipulated in the Purchase Order. |
| Para. 2.3.1, Room Temperature Electrical Measurements | All AC characteristics (Para. 2.3.1 Notes 3 and 4) 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. 2.3.2, 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. |