



Pages 1 to 18

DIODES, SILICON, SWITCHING

**BASED ON TYPES 1N5802, 1N5804, 1N5806, 1N5802US, 1N5804US, 1N5806US AND
1N5806U**

ESCC Detail Specification No. 5101/014

Issue 2	April 2009
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Document Custodian: European Space Agency - see <https://escies.org>

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DCR No.	CHANGE DESCRIPTION
443, 447	Specification up issued to incorporate editorial and technical 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: 510101401

- Detail Specification Reference: 5101014
- 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)	Terminal Material and/or Finish	Weight max g
01	1N5806	UU	160	150	O1	0.25
02	1N5806	UU	160	150	A3 or A4	0.25
03	1N5804	UU	110	100	O1	0.25
04	1N5804	UU	110	100	A3 or A4	0.25
05	1N5802	UU	60	50	O1	0.25
06	1N5802	UU	60	50	A3 or A4	0.25
07	1N5806	A	160	150	A3 or A4	0.4

Variant Number	Based on Type	Case	Breakdown Voltage $V_{(BR)}$ (V)	Working Peak Reverse Voltage V_{RWM} (V)	Terminal Material and/or Finish	Weight max g
08	1N5804	A	110	100	A3 or A4	0.4
09	1N5802	A	60	50	A3 or A4	0.4
10	1N5806US	MELF	160	150	O4	0.3
11	1N5804US	MELF	110	100	O4	0.3
12	1N5802US	MELF	60	50	O4	0.3
13	1N5806U	LCC2A	160	150	2	0.12
14	1N5806U	LCC2A	160	150	4	0.12

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 Variant 01 to 12 Variants 13, 14	I_{FSM}	35 33	A	Notes 1, 2
Working Peak Reverse Voltage	V_{RWM}	Note 3	V	
Average Output Rectified Current	I_O	2.5	A	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 Variants 01 to 09 Variants 10 to 12 Variants 13, 14	$R_{th(j-c)}$	36 20 13	°C/W	

NOTES:

1. Sinusoidal pulse of 8.3ms duration for Variants 01 to 12 and 10ms for Variants 13, 14.
2. At $T_{amb} \leq +25^{\circ}\text{C}$.
3. See Component Type Variants for V_{RWM} value.
4. For Variants 01 to 12: At $T_{case} \geq +75^{\circ}\text{C}$, derate linearly to 0A at $+175^{\circ}\text{C}$.
For Variants 13, 14: At $T_{case} \geq +142^{\circ}\text{C}$, derate linearly to 0A at $+175^{\circ}\text{C}$.
5. For Variants 02, 04, 06, 07, 08, 09, 10, 11, 12, 14 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.
6. For Variants 01 to 09: 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 10 to 12: Duration 10s maximum and the same package shall not be resoldered until 3 minutes have elapsed.
For Variants 13, 14: Duration 5s maximum and the same package shall not be resoldered until 3 minutes have elapsed.

1.6

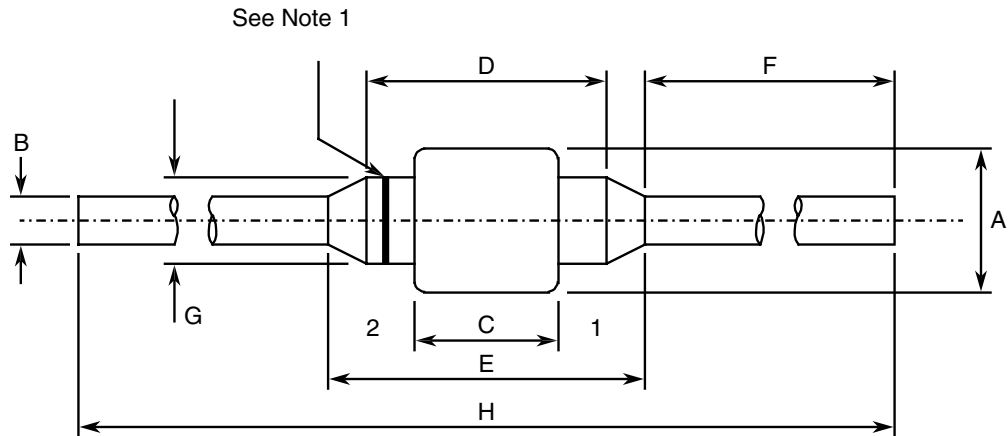
HANDLING PRECAUTIONS

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 15000 Volts.

1.7 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

1.7.1 Axial Lead Package (UU)

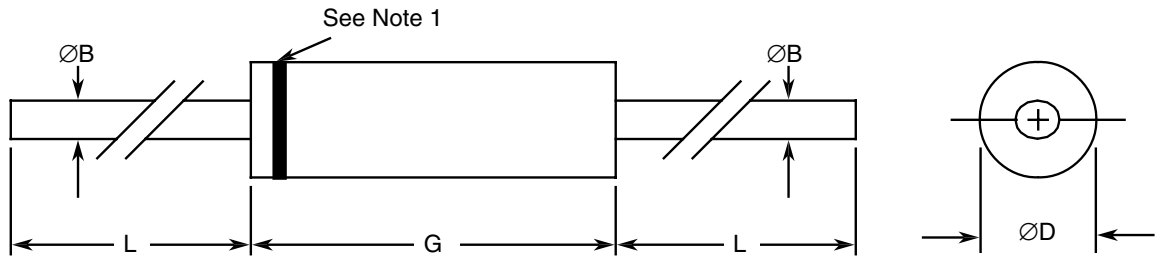


Symbols	Dimensions mm		Notes
	Min	Max	
A	-	2.2	
B	0.68	0.74	
C	-	2.3	
D	-	4	
E	-	6.35	
F	17.8	-	
G	-	1.5	
H	41.3	-	

NOTES:

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

1.7.2 Axial Lead Package (A)

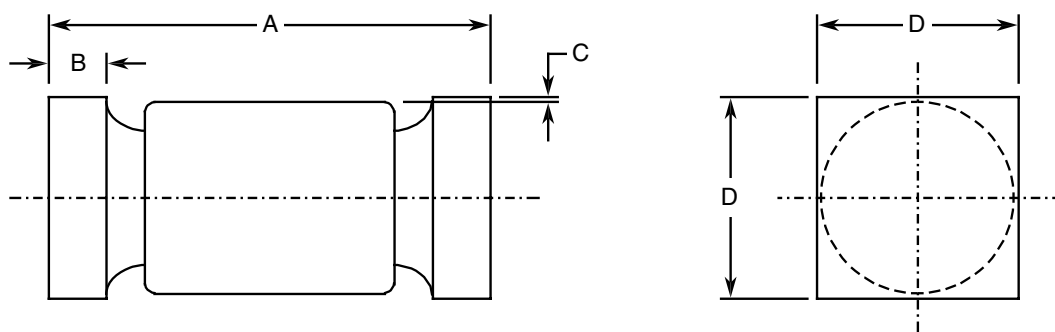


Symbols	Dimensions mm		Notes
	Min	Max	
ØB	0.66	0.84	
ØD	1.65	2.79	2
G	3.18	6.35	3
L	17.78	33.02	

NOTES:

1. Terminal identification: The cathode end shall be marked with a contrasting coloured band.
2. Dimension ØD shall be measured at the largest diameter.
3. Dimension G shall include the sections of the lead over which the diameter is uncontrolled. This uncontrolled area is defined as the zone between the edge of the diode body and extending 1.27mm onto the leads.

1.7.3 Surface Mount Package (MELF)

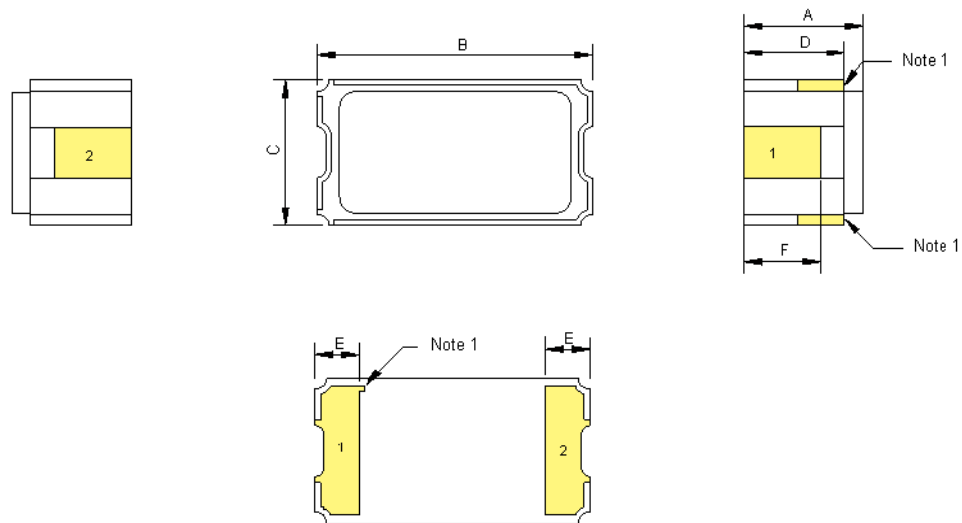


Symbols	Dimensions mm		Notes
	Min	Max	
A	4.27	5.08	
B	0.48	0.71	
C	0.08	-	
D	2.31	2.62	

NOTES:

1. Terminal identification: The cathode end shall be marked with a minimum of 3 contrasting coloured dots or a black band.

1.7.4 Leadless Chip Carrier Package (LCC2A) - 2 Terminal



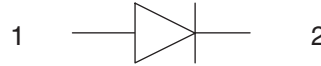
Symbols	Dimensions mm		Notes
	Min	Max	
A	1.86	2.2	2
B	4.54	4.87	
C	2.33	2.59	
D	1.53	1.87	
E	0.48	0.71	

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 14 dimension limits apply prior to solder coating of terminals.

1.8 FUNCTIONAL DIAGRAM

Terminal 1: Anode
Terminal 2: Cathode



NOTES:

1. For LCC2A, the lid is not connected to any terminal.

1.9 MATERIALS AND FINISHES

Materials and finishes shall be as follows:

- a) Case
For Variants 01 to 12 the case shall be hermetically sealed and have a glass body.
For Variants 13, 14 the case shall be hermetically sealed and have an Aluminium Nitride body with a Kovar lid.
- b) Terminal Finish
As specified in 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

2.1.1.1 *Deviations from Special In-Process Controls (Chart F2)*

- (a) Bond Strength: Not applicable for Variants 01 to 12.
- (b) Die Shear: Not applicable for Variants 01 to 12.

2.1.1.2 *Deviations from Screening Tests (Chart F3)*

- (a) For Variants 01 to 12 only, following Temperature Cycling, Room Temperature Electrical Measurements shall be performed as specified herein.
Immediately following Room Temperature Electrical Measurements a Surge Current test shall be performed on a sample of 32 components with 0 failures allowed. The Surge Current test shall be

as follows:

MIL-STD-750, Test Method 4066, condition A

- $I_{FSM} = 35A$ (pk)
- $I_O = 1.0A$
- $V_{RWM} =$ See Component Type Variants for value.
- 10 surges at a rate of 1 per minute maximum and of duration 8.3ms or 10ms.

After the Surge Current test, Parameter Drift Values shall be performed as specified herein referred to the measurements prior to the test.

Immediately following the Surge Current test components shall be subjected to Scope Display analysis of the reverse breakdown characteristic as follows:

MIL-STD-750, Test Method 4023

- Display calibration: $50\mu A$ to $100\mu A$ and 20 V to 50V per division
- Reverse current over the knee: $500\mu A$ minimum.

Any discontinuity or dynamic instability of the trace shall be cause for lot rejection.

- (b) Particle Impact Noise Detection: Not applicable for Variants 01 to 12.
- (c) Seal, Fine Leak: Not applicable for Variants 01 to 12.
- (d) Radiographic Inspection: Not applicable for Variants 01 to 12.

2.1.1.3 *Deviations from Qualification and Periodic Tests (Chart F4)*

- (a) Bond Strength: Not applicable for Variants 01 to 12.
- (b) Die Shear: Not applicable for Variants 01 to 12.

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) Terminal Identification.
- (b) The ESCC qualified components symbol (for ESCC qualified components only).
- (c) The ESCC Component Number.
- (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 to 09, Test Condition A with applied force 17.8N and duration 15s.
- For Variants 10 to 14, 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.

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 $I_F=1A$, Note 1 Variants 01 to 12 Variants 13, 14	- -	0.875 0.88	V
	V_{F2}	4011	Pulse Method $I_F=2.5A$, Note 1 Variants 01 to 12 Variants 13, 14	- -	0.975 1	V
Reverse Current 1	I_{R1}	4016	DC Method $V_R=V_{RWM}$, Note 2 Variants 01 to 12 Variants 13, 14	- -	1 0.5	μA
Reverse Current 2 (Breakdown Voltage)	I_{R2}	4021	Variants 13, 14 only DC Method $V_R=V_{(BR)}$, Note 2	-	10	μA
Breakdown Voltage	$V_{(BR)}$	4021	Variants 01 to 12 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 $f=1MHz$	-	25	pF
Reverse Recovery Time	t_{rr}	4031	Variants 01 to 12 Test Condition A $I_F=I_R=500mA$ $I_{rr}=50mA(pk)$ $di/dt=65A/\mu s$ (min) Note 3	-	25	ns
			Variants 13, 14 Test Condition A $I_F=1A$ $V_R=30V$ $dI_F/dt=-50A/\mu s$	-	30	ns
Forward Recovery Time	t_{fr}	4026	Variants 01 to 12 $I_F=250mA$ $t_r=8.0ns$ $V_{fr}=1.1V_F$ Note 3	-	15	ns
			Variants 13, 14 $I_F=250mA$ $V_{fr}=1.1V_F$	-	15	ns

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Forward Recovery Voltage	V_{fr}	4026	Variants 01 to 12 $I_F=250mA$ $t_r=8.0ns$ $V_{fr}=1.1V_F$ Note 3	-	2.2	V
			Variants 13, 14 $I_F=250mA$ $V_{fr}=1.1V_F$	-	2.2	V
Thermal Impedance, Junction to Case	$Z_{th(j-c)}$	3101	Variants 01 to 12 $I_H = 5.0A$ $t_H = 10ms$ $I_M = 1mA$ to 10mA $t_{md} = 100\mu s$ (max) Note 4	-	4.5	$^{\circ}C/W$
			Variants 13, 14 $I_H = 1$ to 10A $t_H = 50ms$ $I_M = 50mA$ $t_{md} = 100\mu s$ Note 4	(Calculate ΔV_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 3	Limits		Units
				Min	Max	
Forward Voltage 1	V_{F1}	4011	$T_{amb}=+125(+0 -5)^{\circ}C$ Pulse Method $I_F=1A$, Note 1	-	0.8	V
			$T_{amb}=-65(+5 -0)^{\circ}C$ Pulse Method $I_F=1A$, 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 to 12 Variants 13, 14	-	50	μA
			-	20		
Reverse Current 2 (Breakdown Voltage)	I_{R2}	4021	Variants 13, 14 only $T_{amb}= -65(+5 -0)^{\circ}C$ DC Method $V_R=V_{(BR)}$, Note 2	-	10	μA
Breakdown Voltage	$V_{(BR)}$	4021	Variants 01 to 12 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 Measurement Tables

1. For Variants 01 to 12 Pulse Width $\leq 8.3\text{ms}$, Duty Cycle $\leq 2\%$. For Variants 13, 14 Pulse Width $\leq 680\mu\text{s}$, Duty Cycle $\leq 2\%$.
2. See Component Type Variants for V_{RWM} and $V_{(BR)}$ values.
3. Read and record measurements shall be performed on a sample of 5 components with 0 failures allowed. Alternatively a 100% inspection may be performed.
4. Performed only during Screening Tests Parameter Drift Values (Initial Measurements), go-no-go.
5. 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 $R_{th(j-c)}$ limits specified in Maximum Ratings.

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 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 1 Variants 01 to 12 Variants 13, 14	V_{F1}	± 0.05	- -	0.875 0.88	V
Reverse Current 1 Variants 01 to 12 Variants 13, 14	I_{R1}	± 0.15 or (1) $\pm 100\%$	- -	1 0.5	μA

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 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 Note 2	Absolute		
			Min		Max
Forward Voltage 1 Variants 01 to 12 Variants 13, 14	V_{F1}	± 0.05	- -	0.875 0.88	V
Reverse Current 1 Variants 01 to 12 Variants 13, 14	I_{R1}	± 0.15 or (1) $\pm 100\%$	- -	1 0.5	μA

NOTES:

1. Whichever is the greater referred to the initial value.
2. Drift values only apply to Variants 01 to 12.

2.7 HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS

Characteristics	Symbols	Limits	Units
Ambient Temperature	T_{amb}	+150 (+0 -5)	$^{\circ}C$
Reverse Voltage	V_R	$0.8 \times V_{RWM}$ (Note 1)	V
Duration	t	72 (Variants 01 to 12) ≥ 48 (Variants 13, 14)	hours

NOTES:

1. See Component Type Variants for V_{RWM} value.

2.8 POWER BURN-IN CONDITIONS

For Variants 01 to 12

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	$+22 \pm 3$	$^{\circ}C$
Working Peak Reverse Voltage	V_{RWM}	Note 1	V
Average Output Rectified Current	I_O	1.0 f=50 to 60 Hz	A

For Variants 13, 14

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	T_{amb}	$+22 \pm 3$	$^{\circ}C$
Junction Temperature	T_j	+175 (+0 -5)	$^{\circ}C$
Average Output Rectified Current	I_O	Note 2	A

NOTES:

1. See Component Type Variants for V_{RWM} value.
2. The output current may be adjusted, within the given limit range, to attain the specified junction temperature.

2.9

OPERATING LIFE CONDITIONS

The conditions shall be as specified for Power Burn-in.

APPENDIX 'A'

AGREED DEVIATIONS FOR STMICROELECTRONICS (F)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Deviations from Production Control-Chart F2	Special In-process Control Internal Visual Inspection. Wedge bonds equal to 1.1 wire diameters are acceptable for bonding with a V-Groove tool.
	Special In-process Control 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 procedure 7050651.
Deviations from Screening Tests - Chart F3	Solderability is not applicable unless otherwise stipulated in the Purchase Order.
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 procedure 7188211 on the wafer lot, 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.
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 procedure 7188211 on the wafer lot, 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.