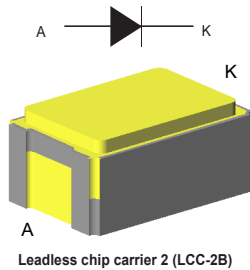


## Aerospace 45 V, 1 A Schottky diode in LCC-2B package



### Features

- Low forward voltage drop:  $V_F = 0.49$  V at 1 A and +25 °C
- Very small conduction losses
- Ultrafast switchings with negligible losses
- High thermal conductivity materials
- Surface mount hermetic package
- Radiation performance
  - 150 krad (Si) low dose rate
  - 3 Mrad (Si) high dose rate
- ESCC qualified: detail specification 5106/021

### Applications

- Satellite and spacecraft power systems
- Switch mode power supply
- 5 V flyback or forward converter output rectification
- DC motor chopper free wheeling diode
- Reverse polarity protection
- Redundancy OR-Ing diode

### Description

The 1N5819U Schottky diode is ESCC qualified. It is housed in a surface mount hermetically sealed ceramic LCC-2B package whose footprint is fully compatible with industry standard as D5B.

Its full planar technology allows superior performances and high reliability up to 150 °C junction temperature.

This diode is ESCC qualified, which makes it eligible for use in space programs. It is typically used in switching mode power supplies, high frequency DC-to-DC converters or low voltage step-down chopper drive to perform secondary rectification, redundancy OR-Ing, free wheeling diode or reverse polarity protection.

#### Product status

1N5819U

#### Product summary

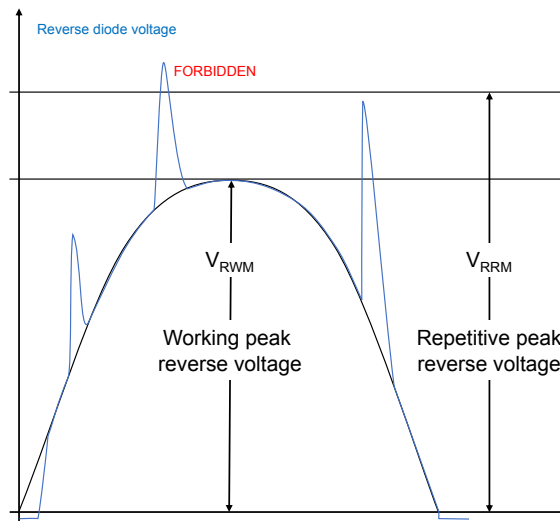
$I_{F(AV)}$	1A
$V_{RRM}$	45 V
$V_F(max.)$	0.49 V
$T_J(max.)$	150 °C

# 1 Characteristics

**Table 1. Absolute ratings (limiting values)**

Symbol	Parameter		Value	Unit
$V_{RRM}$	Repetitive peak reverse voltage		45	V
$V_{RWM}^{(1)}$	Peak working reverse voltage		45	V
$I_{F(RMS)}$	RMS forward current		10	A
$I_{F(AV)}$	Average forward current	$T_C \geq 142\text{ °C}, \delta = 0.5$	1	A
$I_{FSM}$	Non repetitive surge forward current	$t_p = 10\text{ ms sinusoidal}, T_{AMB} = 25\text{ °C}$	25	A
$T_{stg}$	Storage temperature range		-65 to +150	°C
$T_j$	Maximum operating junction temperature <sup>(2)</sup>		150	°C
$T_{sol}$	Maximum soldering temperature <sup>(3)</sup>		245	°C
ESD	Electro static discharge, air discharge, HBM model, class 3B		8	kV

1. See Figure 1.
2.  $(dP_{tot}/dT_j) < (1/R_{th(j-a)})$  condition to avoid thermal runaway for a diode on its own heatsink.
3. Maximum duration 5 s. The same package cannot be resoldered until 3 minutes have elapsed after initial soldering.

**Figure 1.  $V_{RRM}$  and  $V_{RWM}$  definition with their waveform**

**Table 2. Thermal parameters**

Symbol	Parameter	Max. value	Unit
$R_{th(j-c)}$	Junction to case	16	C/W

For more information, you can refer to the application note:

- [AN5088: Rectifiers thermal management, handling and mounting recommendation](#)

**Table 3. Static electrical characteristics**

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit		
$I_R^{(1)}$	Reverse leakage current	$T_j = -55\text{ °C}$	$V_R = 45\text{ V}$	-	-	20	$\mu\text{A}$		
		$T_j = 25\text{ °C}$		-	-	20			
		$T_j = 100\text{ °C}$		-	-	3.5		mA	
		$T_j = -55\text{ °C}$	$V_R = 40\text{ V}$			10	$\mu\text{A}$		
		$T_j = 25\text{ °C}$				15			
		$T_j = 100\text{ °C}$				3			
				$T_j = 100\text{ °C}$	$V_R = 35\text{ V}$			2.5	mA
				$T_j = 100\text{ °C}$	$V_R = 24\text{ V}$			1.6	
				$T_j = 100\text{ °C}$	$V_R = 12\text{ V}$			1.2	
				$T_j = 100\text{ °C}$	$V_R = 6\text{ V}$			1	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ °C}$	$I_F = 0.1\text{ A}$	-	-	350	mV		
		$T_j = -55\text{ °C}$				650			
		$T_j = 25\text{ °C}$	$I_F = 1\text{ A}$	-	-	490			
		$T_j = 100\text{ °C}$		-	-	450			
		$T_j = 25\text{ °C}$	$I_F = 3.1\text{ A}$	-	-	800			

1. Pulse test:  $t_p = 5\text{ ms}$ ,  $\delta < 2\%$

2. Pulse test:  $t_p = 680\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses, use the following equation:

$$P = 0.285 \times I_{F(AV)} + 0.165 \times I_F^2 (RMS)$$

For more information, you can refer to the following application notes related to the power losses:

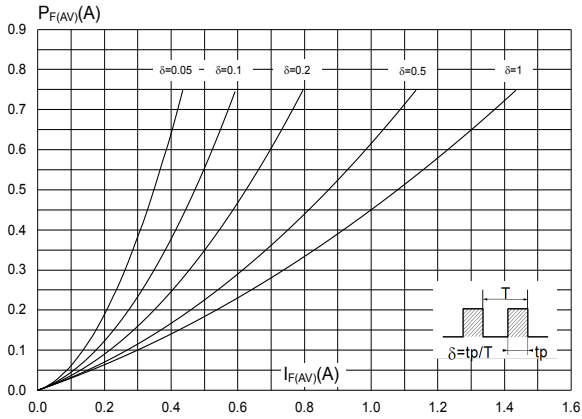
- [AN604](#): Calculation of conduction losses in a power rectifier
- [AN4021](#): Calculation of reverse losses on a power diode

**Table 4. Dynamic characteristics**

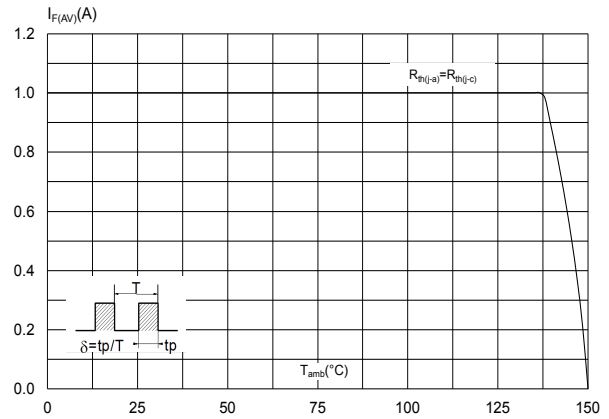
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_j$	Total diode capacitance	$V_R = 5\text{ V}$ , $F = 1\text{ MHz}$			70	pF

## 1.1 Characteristics (curves)

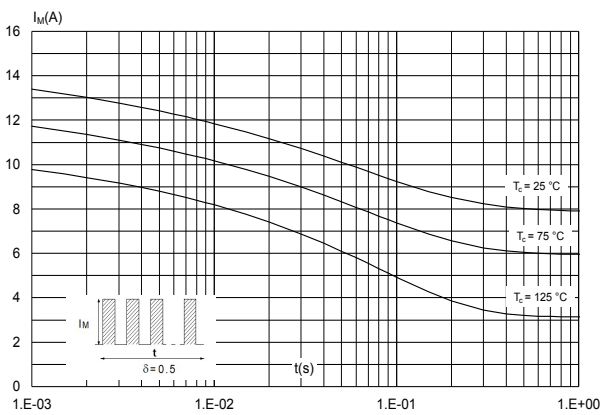
**Figure 2. Average forward power dissipation versus average forward current**



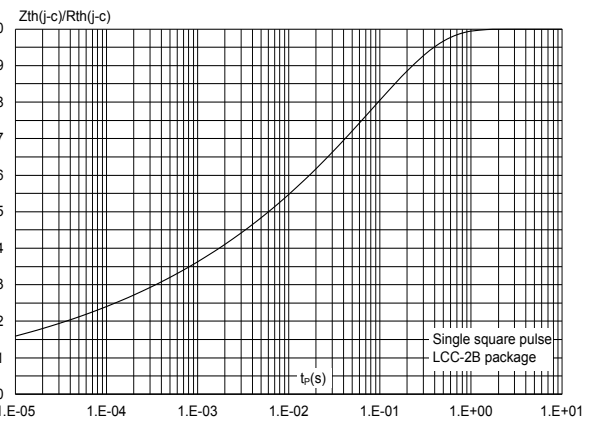
**Figure 3. Average forward current versus ambient temperature ( $\delta = 0.5$ )**



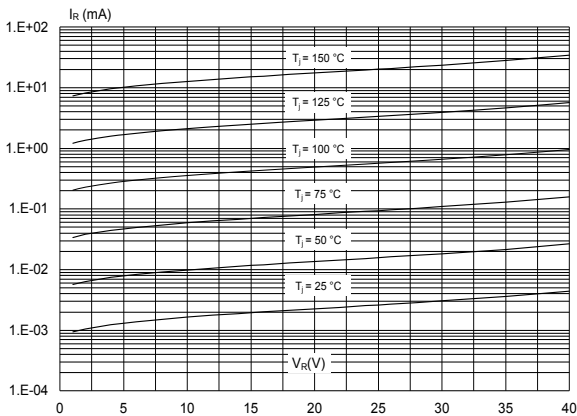
**Figure 4. Non repetitive surge peak forward current versus overload duration (maximum values)**



**Figure 5. Relative variation of thermal impedance junction to case versus single square pulse duration**



**Figure 6. Reverse leakage current versus reverse voltage applied (typical values)**



**Figure 7. Forward voltage drop versus forward current (typical values)**

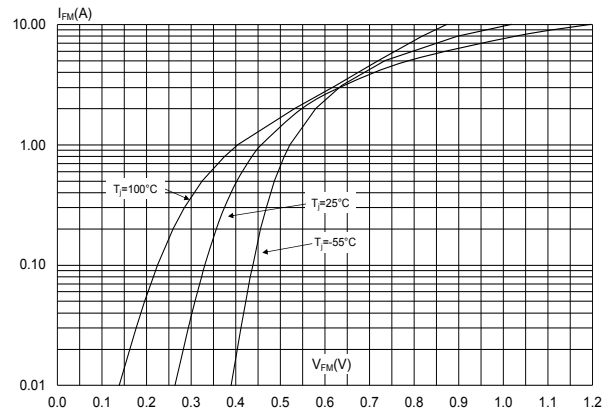
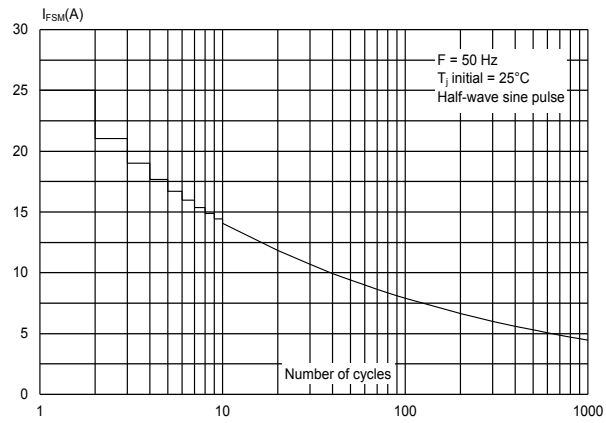


Figure 8. Non repetitive surge peak forward current versus number of cycles



## 2 Radiation

The Schottky switching diodes are intrinsically resistant to total ionization dose (TID) up to 300 krad(Si), as described in the ECSS-Q-ST-60-15C1 radiation hardness assurance standard.

Indeed, the 1N5819U goes beyond the standard, as demonstrated by its TID characterization up to 3 Mrad(Si), as detailed below

### 2.1 Total ionisation dose

A characterization at both high and low dose rates (HDR and LDR) is done on two sets of 15 samples housed in LCC-2B, 5 reverse biased, 5 forward biased and 5 unbiased.

The irradiation is done according to the ESCC 22900 specification, at 620krad/h for the high dose rate HDR test and at 0.220 krad/h for the low rate LDR test.

Both pre-irradiation and post-irradiation performances are tested using the same circuitry and the same test conditions for a direct comparison ( $T_{amb} = 22 \pm 3 \text{ }^\circ\text{C}$  unless otherwise specified).

The following parameters are measured:

- Before irradiation
- After irradiation (target 3 Mrad (Si) HDR or 150 krad(Si) LDR)
- After 24 hours at room temperature
- After 168 hours of annealing at 100 °C

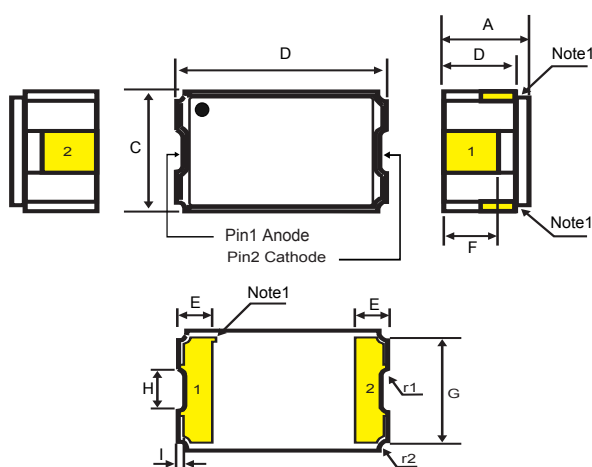
### 3 Package information

In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

#### 3.1 LCC-2B package information

The LCC-2B package is available with two lead tinning versions : Gold plated or SnPb 63/37 solder dip leads. Its metallic lid is electrically floating and not connected to any pin. Connecting it to ground doesn't affect the electrical characteristics.

Figure 9. LCC-2B package outline



The anode is identified by metalization in two top internal angles and the index mark.

Table 5. LCC-2B package mechanical data

Ref.	Dimensions					
	Millimeters			Inches (for reference only)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.04	2.23	2.42	0.080	0.088	0.095
B	5.27	5.40	5.60	0.207	0.213	0.220
C	3.49	3.62	3.76	0.137	0.143	0.150
D	1.71	1.90	2.09	0.067	0.075	0.082
E	0.48		0.71	0.019		0.028
F		1.4			0.055	
G		3.32			0.131	
H		1.82			0.072	
I		0.15			0.006	
r1		0.15			0.006	
r2		0.20			0.008	

Dimension data specified for the gold plated version and the solder dip version before tinning.

## 4 Ordering information

**Table 6. Ordering information**

Order code	ESCC detail specification	Quality level	Package	Lead finishing	Product marking	Mass	Base qty.	Packing
1N5819UB1	-	Engineering model	LCC-2B	Gold	1N5819UB1	180 mg	50	Waffle pack
1N5819U01B	5106/021/02	Flight model		Gold	510602102			
1N5819U02B	5106/021/03	Flight model		Solder dip	510602103			

*Note:* Contact ST sales office for information about the specific conditions for products in die form.

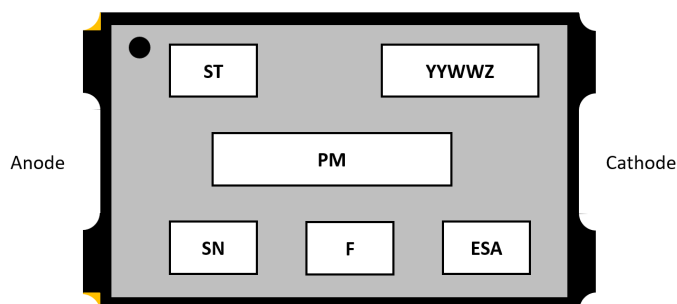


## 5 Other information

### 5.1 Product marking description

Here below is described the marking of the package of both the engineering and flight models.

**Figure 10. ESCC flight model marking outline**

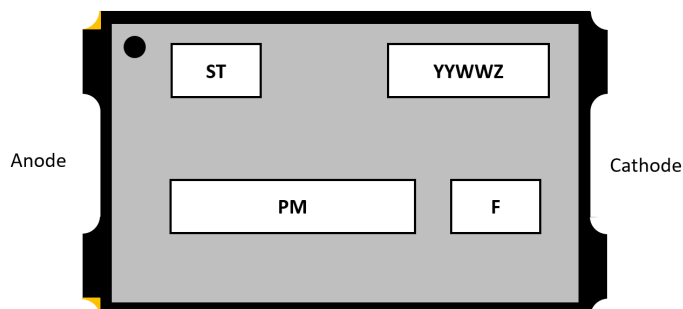


**Table 7. ESCC flight model marking**

Field	Description
ST	ST logo
YYWWZ	Date code and lot index in the week <sup>(1)</sup>
PM	Product marking
SN	Serialization number
F	Country of origin
ESA	ESA logo

1. YY = two-digit year, WW = two-digit week, Z = lot week index.

**Figure 11. Engineering model marking outline**



**Table 8. Engineering model marking**

Field	Description
ST	ST logo
YYWWZ	Date code and lot index in the week <sup>(1)</sup>
PM	Product marking
F	Country of origin

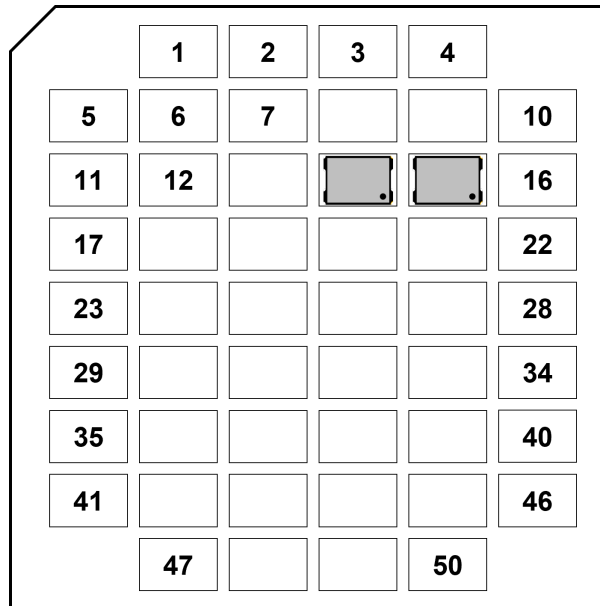
1. YY = two-digit year, WW = two-digit week, Z = lot week index.

## 5.2 Packing information

The 1N5819U versions are delivered in a 50-position, 50 x 50 mm<sup>2</sup> waffle pack consecutively populated from position 1.

The Figure 12 shows how to identify position 1, the orientation of the product in the waffle pack.

**Figure 12. 1N5819 waffle pack outline**



The diode anode is on the right pin of the device, and the anode identification dot is orientated at the opposite of the waffle pack truncated corner.

### 5.3 Documentation

In the Table 9 is a summary of the documentation provided with each type of products.

**Table 9. Documentation provided for each type of product**

Quality level	Documentation
Engineering model	Certificate of conformance including : <ul style="list-style-type: none"> <li>• Customer name</li> <li>• Customer purchase order number</li> <li>• ST sales order number and item</li> <li>• ST part number</li> <li>• Quantity delivered</li> <li>• Date code</li> <li>• Reference data sheet</li> <li>• Reference to <a href="#">TN1181</a> on engineering models</li> <li>• ST Rennes assembly lot ID</li> </ul>
Flight model	Certificate of conformance including : <ul style="list-style-type: none"> <li>• Customer name</li> <li>• Customer purchase order number</li> <li>• ST sales order number and item</li> <li>• ST part number</li> <li>• Quantity delivered</li> <li>• Date code</li> <li>• Serial numbers</li> <li>• Diffusion line (plant + wafer size)</li> <li>• Diffusion run (wafer lot number) and wafer ID</li> <li>• Reference of the applicable ESCC qualification maintenance lot</li> <li>• Reference to the ESCC detail specification</li> <li>• ST Rennes assembly lot ID number</li> </ul>

## Revision history

**Table 10. Document revision history**

Date	Revision	Changes
10-Aug-2009	1	First issue.
07-Jun-2010	2	Updated ESCC specification codes in Table 1 and Table 7.
23-Sep-2011	3	Updated Table 1 and Table 7 for ESCC qualification.
8-Nov-2013	4	Updated Table 1, Table 5 and Table 7 and inserted Other information.
04-Dec-2015	5	Updated Table 7 and reformatted to current standard.
18-Jan-2024	6	Inserted <a href="#">Section Applications</a> , and <a href="#">Figure 1. <math>V_{RRM}</math> and <math>V_{RWM}</math> definition with their waveform</a> . Updated <a href="#">Table 1</a> , and <a href="#">Section 5: Other information</a> . Minor text changes.

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