

Schottky Barrier Diode

## CRS13

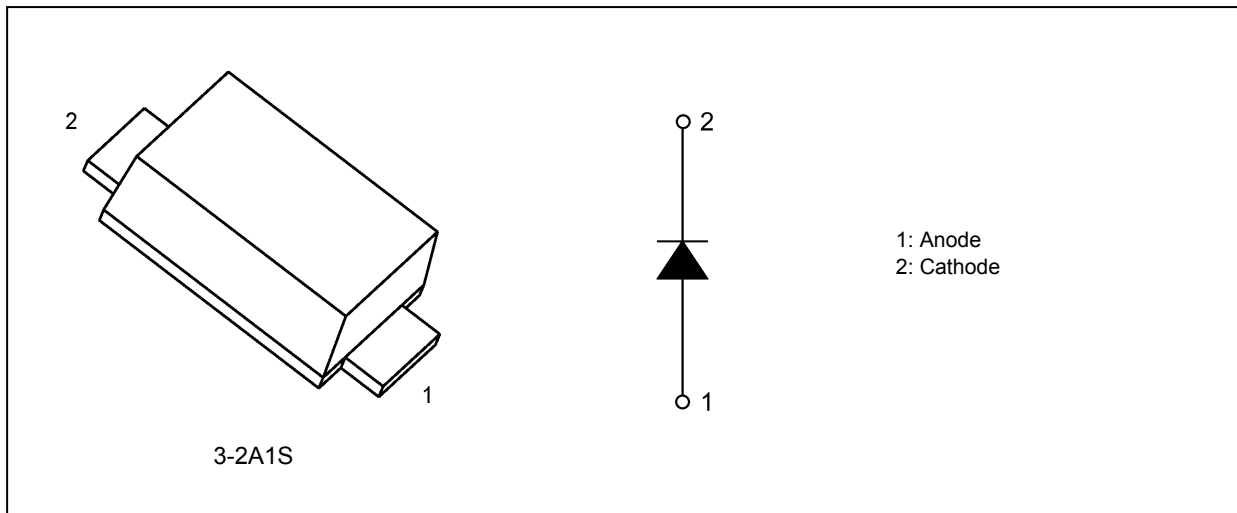
### 1. Applications

- Secondary Rectification in Switching Regulators
- Reverse-Current Protection in Mobile Devices

### 2. Features

- (1) Peak forward voltage:  $V_{FM} = 0.55 \text{ V (max) @ } I_{FM} = 1 \text{ A}$
- (2) Average forward current:  $I_{F(AV)} = 1 \text{ A}$
- (3) Repetitive peak reverse voltage:  $V_{RRM} = 60 \text{ V}$
- (4) Small, thin package suitable for high-density board assembly  
Toshiba Nickname: S-FLAT™

### 3. Packaging and Internal Circuit



### 4. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25 \text{ }^\circ\text{C}$ )

Characteristics	Symbol	Note	Rating	Unit
Repetitive peak reverse voltage	$V_{RRM}$		60	V
Average forward current	$I_{F(AV)}$	(Note 1)	1	A
Non-repetitive peak forward surge current	$I_{FSM}$	(Note 2)	20	
Junction temperature	$T_j$		150	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-40 to 150	

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1:  $T_a = 82 \text{ }^\circ\text{C}$ , Device mounted on a ceramic board, Board size: 50 mm × 50 mm, Soldering land size: 2 mm × 2 mm, Board thickness: 0.64 mm, square wave ( $\alpha = 180^\circ$ ),  $V_R = 30 \text{ V}$

Note 2:  $f = 50 \text{ Hz}$ , half-sine wave

Start of commercial production  
2007-12

## 5. Thermal Characteristics

Characteristics	Symbol	Note	Test Condition	Max	Unit
Thermal resistance (junction-to-ambient)	$R_{th(j-a)}$		Device mounted on a ceramic board (board size: 50 mm × 50 mm) (soldering land size: 2 mm × 2 mm) (board thickness: 0.64 mm)	70	°C/W
			Device mounted on a glass-epoxy board (board size: 50 mm × 50 mm) (soldering land size: 6 mm × 6 mm) (board thickness: 1.6 mm)	140	
			Device mounted on a glass-epoxy board (board size: 50 mm × 50 mm) (soldering land size: 1.2 mm × 1.2 mm) (board thickness: 1.6 mm)	240	
Thermal resistance (junction-to-lead)	$R_{th(j-l)}$		Junction to cathode lead	20	°C/W

## 6. Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ °C}$ )

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Peak forward voltage	$V_{FM(1)}$		$I_{FM} = 0.7\text{ A}$ (pulse measurement)	—	0.48	—	V
	$V_{FM(2)}$		$I_{FM} = 1\text{ A}$ (pulse measurement)	—	0.52	0.55	
Repetitive peak reverse current	$I_{RRM(1)}$		$V_{RRM} = 5\text{ V}$ (pulse measurement)	—	0.4	—	μA
	$I_{RRM(2)}$		$V_{RRM} = 60\text{ V}$ (pulse measurement)	—	5	50	
Junction capacitance	$C_j$		$V_R = 10\text{ V}$ , $f = 1\text{ MHz}$	—	40	—	pF

## 7. Marking

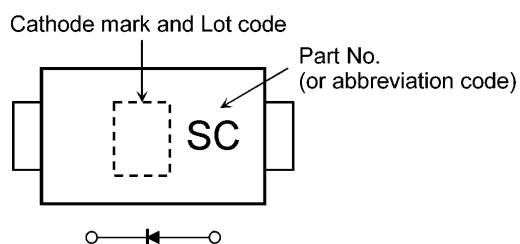


Fig. 7.1 Marking

Marking Code	Part Number
SC	CRS13

## 8. Usage Considerations

- (1) Schottky barrier diodes (SBDs) have reverse current greater than other types of diodes. This makes SBDs more vulnerable to damage due to thermal runaway under high-temperature and high-voltage conditions. Thus, both forward and reverse power losses of SBDs should be considered for thermal and safety design.
- (2) The absolute maximum ratings are rated values that must not be exceeded during operation, even for an instant. The following are the recommended general derating methods for designing a circuit board using this device.

$V_{RRM}$ : Use this rating with reference to (1) above.  $V_{RRM}$  has a temperature coefficient of 0.1 %/°C at low temperatures. Take this coefficient into account when designing a circuit board that will be operated in a low-temperature environment.

$I_{F(AV)}$ : We recommend that the worst-case current be no greater than 80 % of the absolute maximum rating of  $I_{F(AV)}$  and that the worst-case junction temperature,  $T_j$ , be kept below 120 °C. When using this device, allow margins, referring to the  $T_{a(max)}-I_{F(AV)}$  curve.

$I_{FSM}$ : This rating specifies peak non-repetitive forward surge current. This only applies to an abnormal operation, which seldom occurs during the lifespan of a device.

$T_j$ : Derate device parameters in proportion to this rating in order to ensure high reliability. We recommend that the junction temperature ( $T_j$ ) of a device be kept below 120 °C.

- (3) Thermal resistance (junction-to-ambient) varies with the mounting conditions of a device on a circuit board. An appropriate thermal resistance value should be used, considering the heatsink, circuit board design and land pattern dimensions (provided for reference only).
- (4) For other design considerations, see the Rectifiers databook or the Toshiba Semiconductor website.

## 9. Land Pattern Dimensions (for reference only)

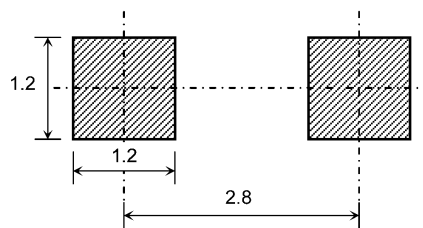


Fig. 9.1 Land Pattern Dimensions (for reference only) (Unit: mm)

## 10. Characteristics Curves (Note)

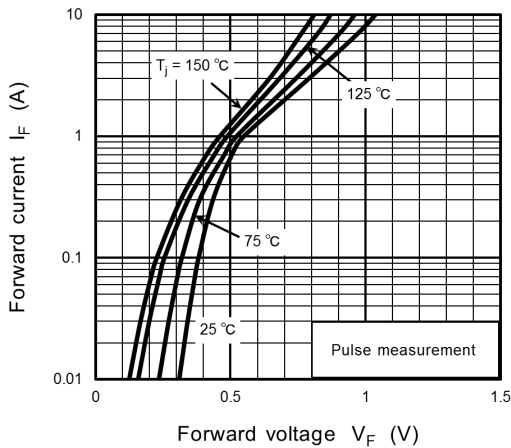


Fig. 10.1  $I_F - V_F$

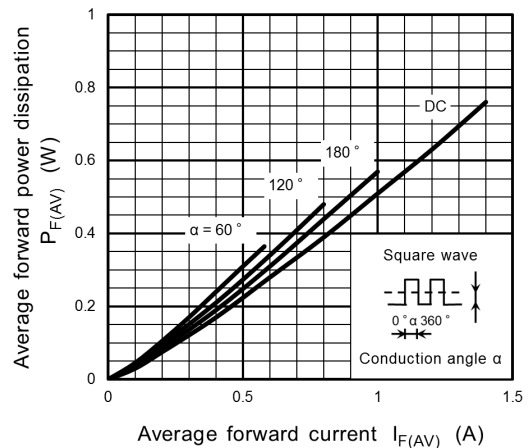


Fig. 10.2  $P_{F(AV)} - I_{F(AV)}$

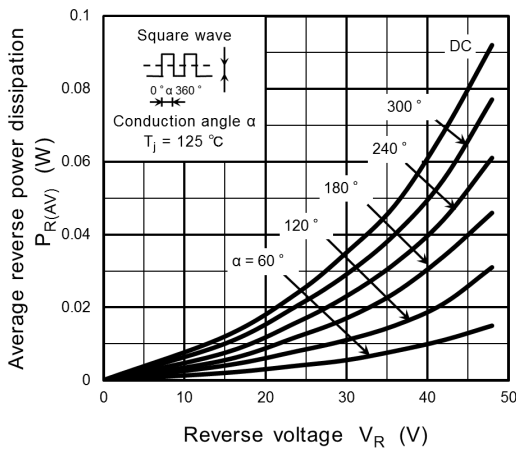


Fig. 10.3  $P_{R(AV)} - V_R$

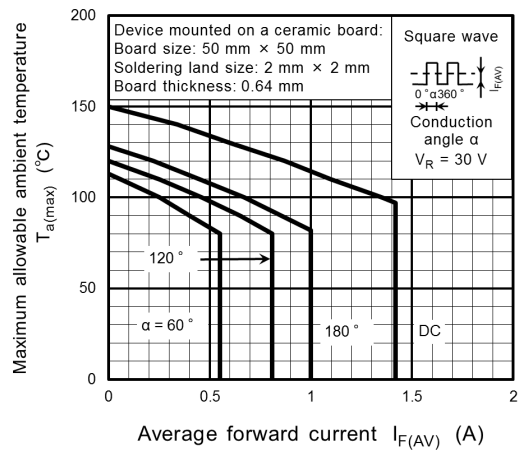


Fig. 10.4  $T_{a(max)} - I_{F(AV)}$

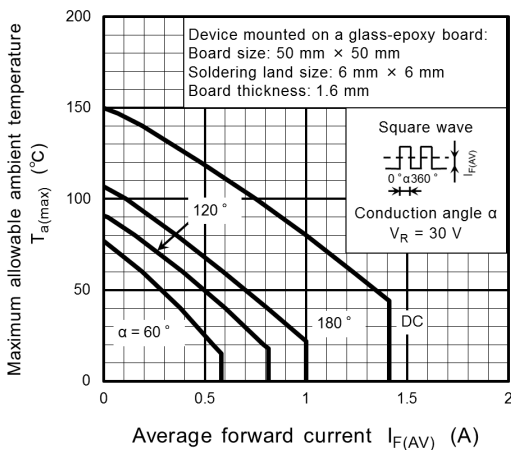


Fig. 10.5  $T_{a(max)} - I_{F(AV)}$

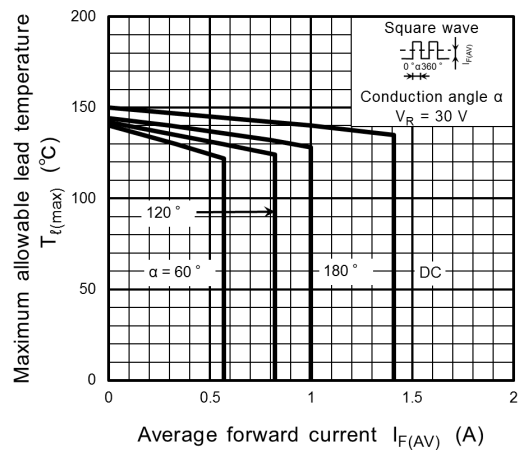
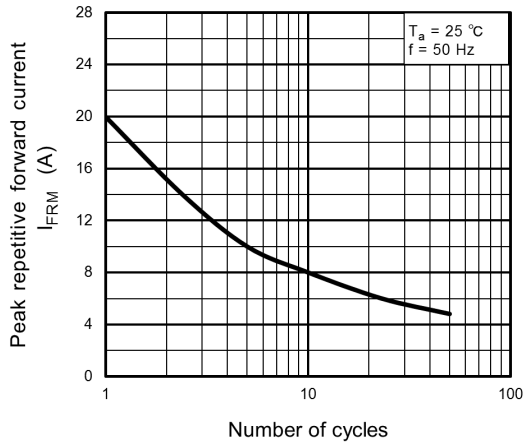
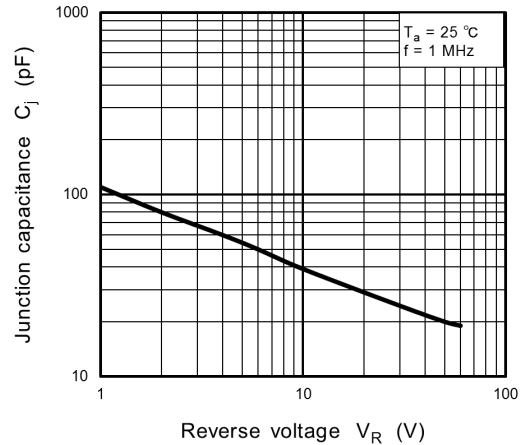


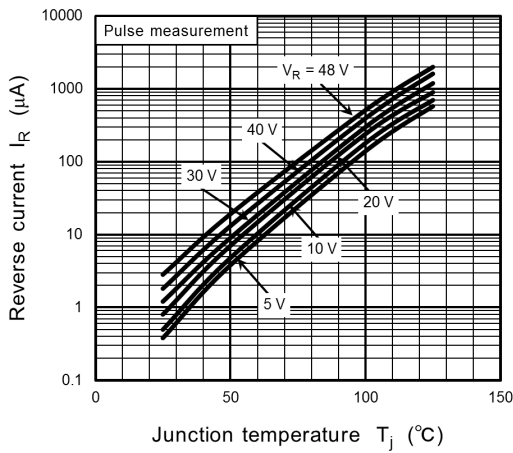
Fig. 10.6  $T_{l(max)} - I_{F(AV)}$



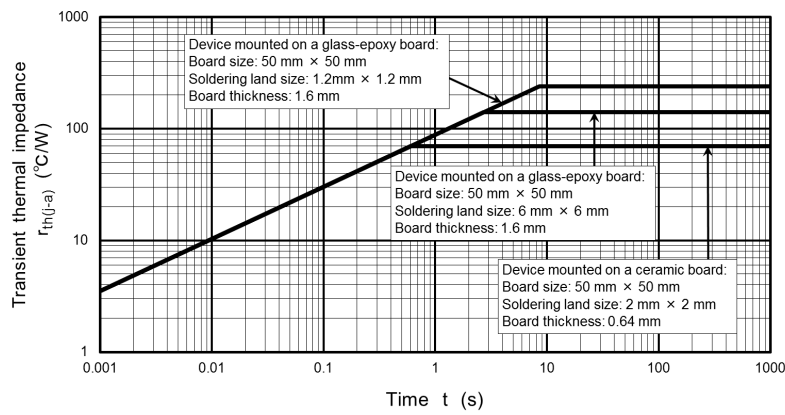
**Fig. 10.7 Peak Repetitive Forward Current**



**Fig. 10.8 C<sub>j</sub> - V<sub>R</sub>**



**Fig. 10.9 I<sub>R</sub> - T<sub>j</sub>**

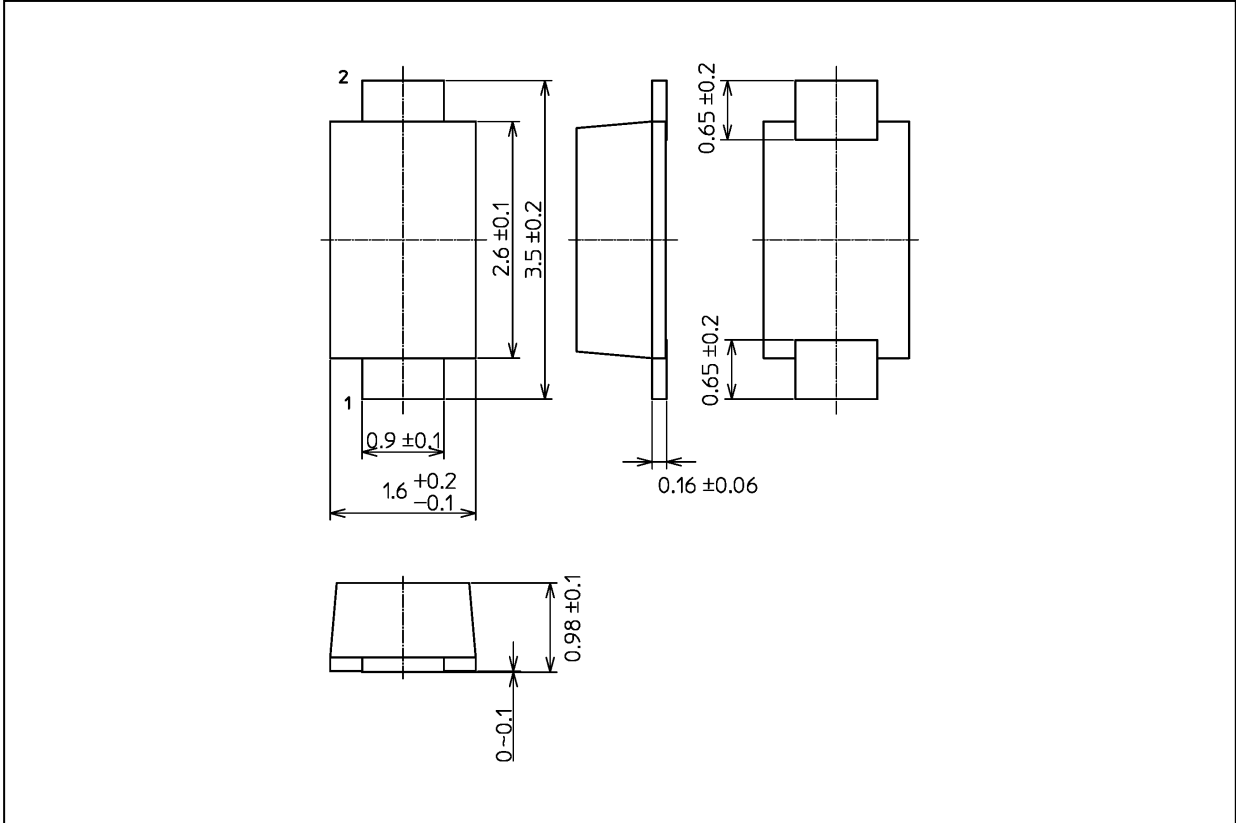


**Fig. 10.10 r<sub>th(j-a)</sub> - t**

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

Package Dimensions

Unit: mm



Weight: 0.013 g (typ.)

Package Name(s)
TOSHIBA: 3-2A1S
Nickname: S-FLAT

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