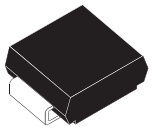
STTH3BCF060

600 V high voltage rectifier for BC^2 topology

Features

- optimized freewheel diode for BC^2 topology (ST patent)
- low conduction losses
- high voltage rectifier
- improves efficiency by up to 2.5% compared to conventional continuous mode PFC using standard ultrafast 600 V PN diodes
- performance efficiency improved by up to 0.5% compared to 600 V Schottky power diodes with no reverse recovery charges used in CCM PFC at 200 kHz
- provides a cost/performance optimized solution to meet the 80+ efficiency requirements
- supports PFC working up to 300 kHz
- suitable for PFC up to 400 W
- compatible with standard PFC controller ICs



SMB
STTH3BCF060U

Table 1. Device summary

Symbol	Value
$I_{F(AV)}$	3 A
V_{RRM}	600 V
I_R (max)	100 µA
T_j	175 °C

Description

The STTH3BCF060 is a specific freewheel diode used in continuous mode power factor correction working in the BC^2 topology. This diode has been especially designed for the dedicated BC^2 topology. Therefore, its electrical characteristics offer the best possible efficiency with a P-N optimized structured diode. As a result, SMPS efficiency growth up to 2.5% can be produced at an optimized cost.

1 Characteristics

Table 2. Absolute ratings (limiting values)

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		600	V
$I_{F(RMS)}$	Forward rms current		10	A
$I_{F(AV)}$	Average forward current $\delta = 0.5$	T_L = 55 °C	3	A
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal	45	A
T_{stg}	Storage temperature range		- 65 to + 175	°C
T_j	Maximum operating junction temperature		175	°C

Table 3. Thermal resistance

Symbol	Parameter	Maximum	Unit
$R_{th(j-l)}$	Junction to lead	25	°C/W

Table 4. Static electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_R	Reverse leakage current	T_j = 25 °C	$V_R = V_{RRM}$			3	µA
		T_j= 150 °C			15	100	
V_F	Forward voltage drop	T_j = 25 °C	I_F = 3 A			1.7	V
		T_j = 150 °C			1.0	1.25	

To evaluate the maximum conduction losses use the following equation:
$P = 1.03 \times I_{F(AV)} + 0.09\ I_F{}^2{}_{(RMS)}$

Table 5. Dynamic electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
t_{rr}	Reverse recovery time	T_j = 25 °C	I_F = 1 A, V_R = 30 V dI_F/dt = -50 A/µs		35		ns
t_{fr}	Forward recovery time	T_j = 25 °C	I_F = 3 A, dI_F/dt = 100 A/µs $V_{FR} = 1.1 \times V_{Fmax}$			100	ns
V_{FP}	Forward recovery voltage					10	V

Figure 1. Conduction losses versus average current

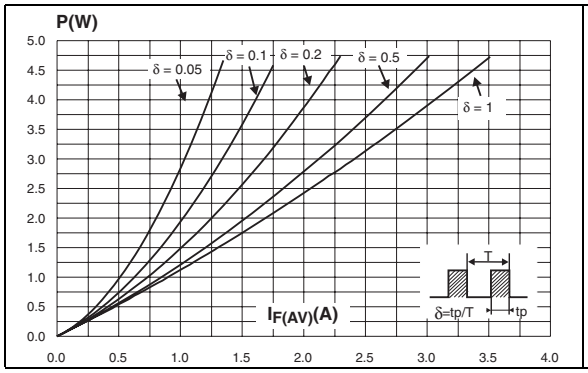


Figure 2. Forward voltage drop versus forward current

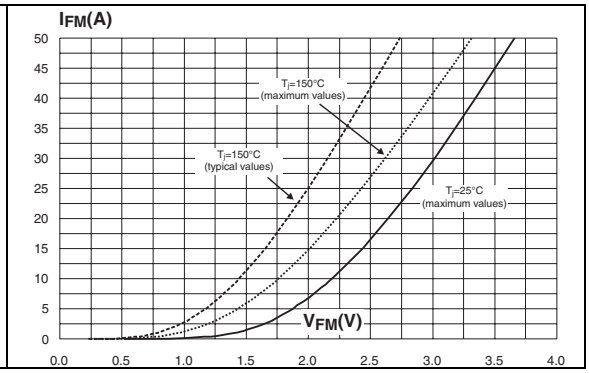


Figure 3. Relative variation of thermal impedance junction ambient versus pulse duration

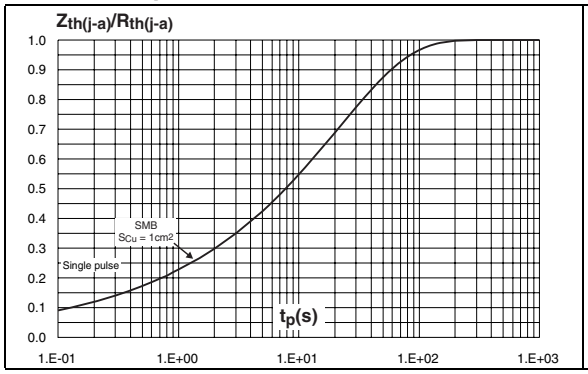


Figure 4. Peak reverse recovery current versus dI_F/dt (typical values)

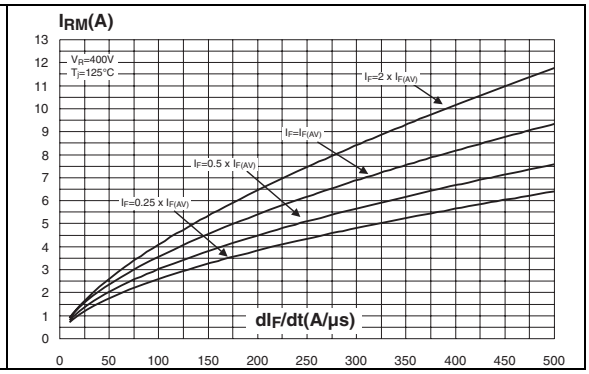


Figure 5. Reverse recovery time versus dI_F/dt (typical values)

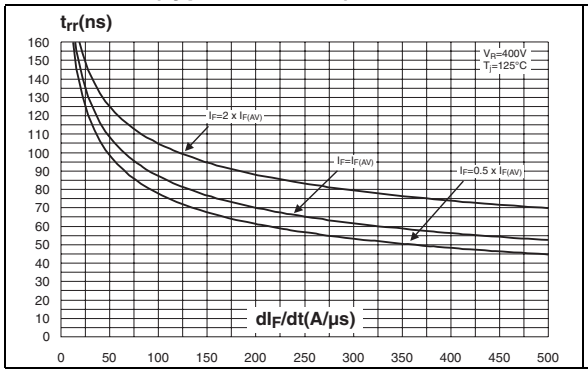


Figure 6. Reverse recovery charges versus dI_F/dt (typical values)

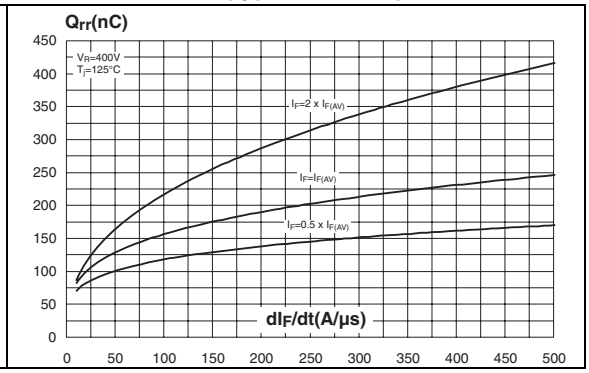


Figure 7. Softness factor versus d_{IF}/dt (typical values)

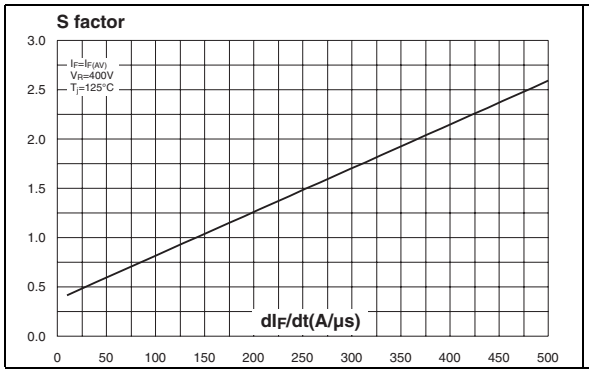


Figure 8. Relative variations of dynamic parameters versus junction temperature

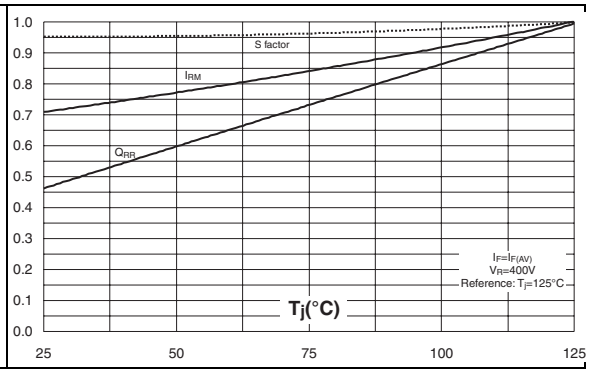


Figure 9. Transient peak forward voltage versus dI_F/dt (typical values)

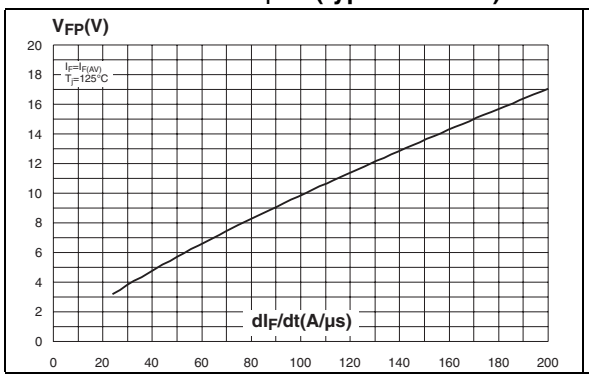


Figure 10. Forward recovery time versus dI_F/dt (typical values)

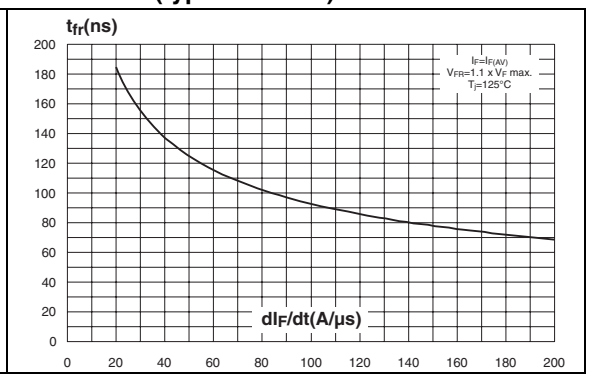


Figure 11. Junction capacitance versus reverse voltage applied (typical values)

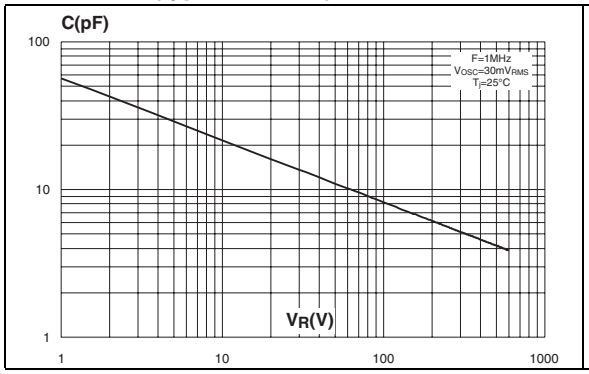
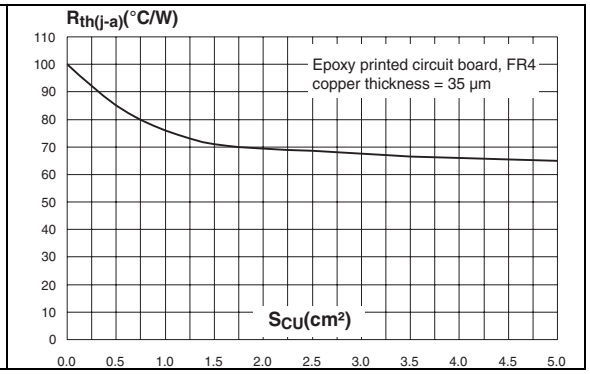
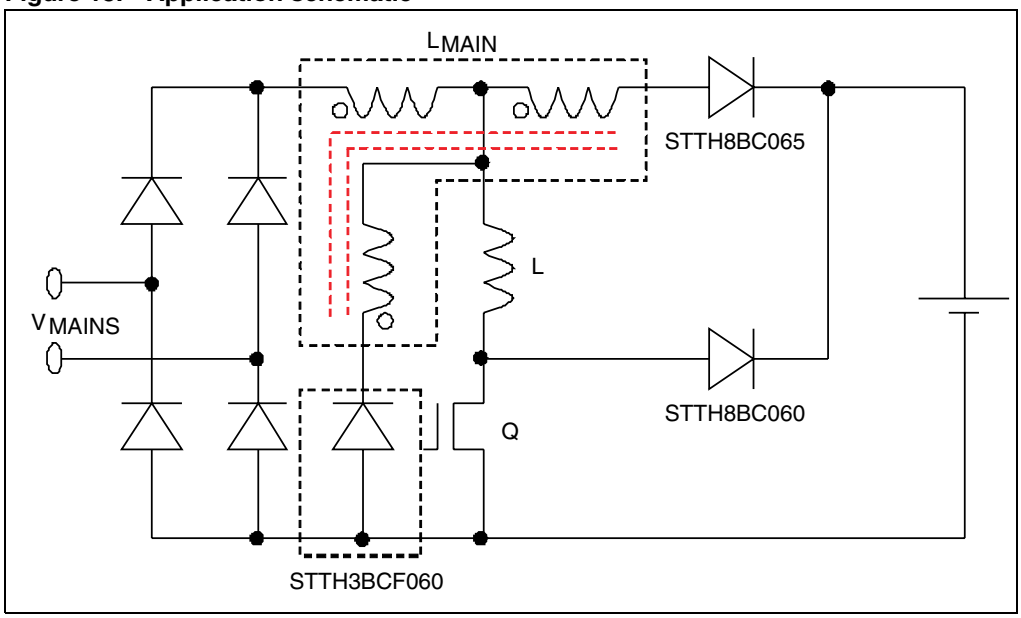


Figure 12. Thermal resistance junction to ambient versus copper surface under lead



2 Application information

Figure 13. Application schematic



2.1 BC^2 topology description (ST patent)

No hard switching occurs at turn-on with BC^2 topology. Inductor L in series with the power MOS Q configuration suppresses the switch-on losses. Added winding, coupled with the main boost inductor L_{main}, in series with the STTH3BCF060 freewheel diode brings back both recovery current from the STTH8BC065 and damping current towards the power circuit. Another added winding in series with STTH8BC065 boost diode discharges the nominal current stored in inductor L flowing through STTH8BC060 diode towards output bulk capacitor.

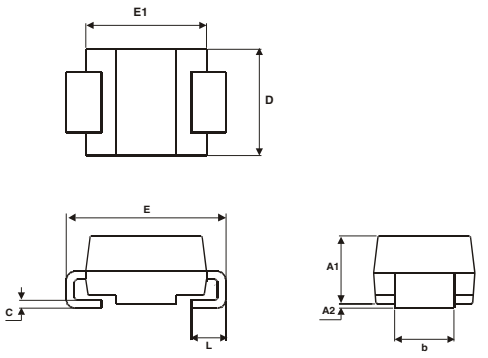
These two added phases compared with conventional continuous mode PFC, bring back the current corresponding to the usual switching losses in the circuit, hence BC^2 (back current circuit).

3 Package information

- Epoxy meets UL94, V0
- Lead-free packages

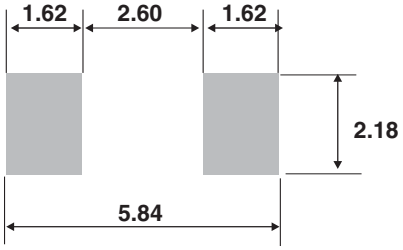
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Table 6. SMB dimensions



Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A1	1.90	2.45	0.075	0.096
A2	0.05	0.20	0.002	0.008
b	1.95	2.20	0.077	0.087
c	0.15	0.40	0.006	0.016
D	3.30	3.95	0.130	0.156
E	5.10	5.60	0.201	0.220
E1	4.05	4.60	0.159	0.181
L	0.75	1.50	0.030	0.059

Figure 14. Footprint (dimensions in mm)



4 Ordering information

Table 7. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
STTH3BCF060U	3BC6	SMB	0.11 g	2500	Tape and reel

5 Revision history

Table 8. Document revision history

Date	Revision	Changes
18-May-2010	1	First issue.
28-Oct-2010	2	Updated document title. Modified *Section 2.1*.

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