

## High frequency secondary rectifier

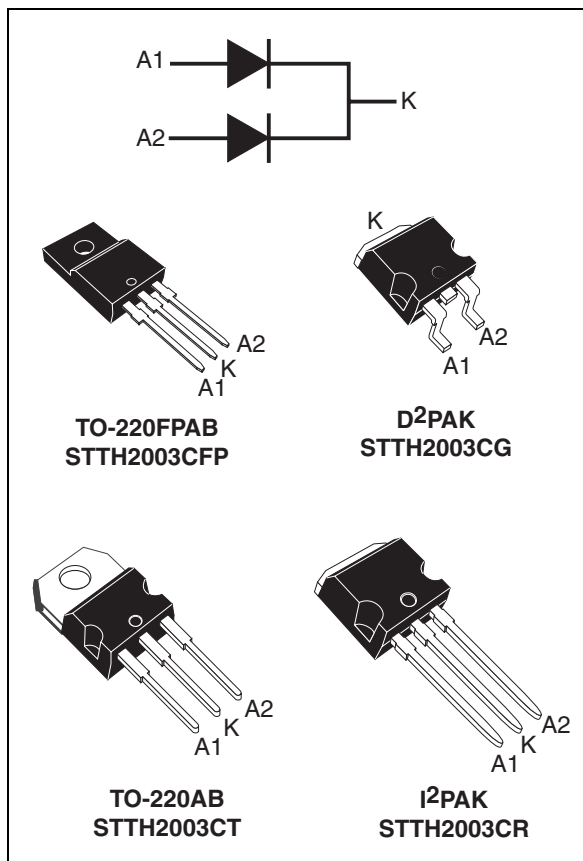
### Features

- Combines highest recovery and reverse voltage performance
- Ultra-fast, soft and noise-free recovery
- Insulated package TO-220FPAB:
  - Electrical insulation: 2000 V DC
  - Capacitance: 12 pF

### Description

Dual center tap fast recovery epitaxial diodes suited for switch mode power supply and high frequency DC/DC converters.

Packaged in TO-220AB, TO-220FPAB, I<sup>2</sup>PAK or D<sup>2</sup>PAK, this device is especially intended for secondary rectification.



**Table 1. Device summary**

Symbol	Value
$I_{F(AV)}$	2 x 10 A
$V_{RRM}$	300 V
$T_j$ (max)	175 °C
$V_F$ (max)	1 V
$t_{rr}$ (typ)	35 ns

# 1 Characteristics

**Table 2. Absolute ratings (limiting values, per diode)**

Symbol	Parameter			Value	Unit
$V_{RRM}$	Repetitive peak reverse voltage			300	V
$I_{F(RMS)}$	Forward current rms			30	A
$I_{F(AV)}$	Average forward current $\delta = 0.5$	I <sup>2</sup> PAK, D <sup>2</sup> PAK, TO-220AB	$T_c = 140\text{ }^\circ\text{C}$	Per diode 20	A
		TO-220FPAB	$T_c = 115\text{ }^\circ\text{C}$	Per device	
$I_{FSM}$	Surge non repetitive forward current		$t_p = 10\text{ ms sinusoidal}$	110	A
$I_{RSM}$	Non repetitive avalanche current		$t_p = 10\text{ }\mu\text{s square}$	5	A
$T_{stg}$	Storage temperature range			-65 to + 175	$^\circ\text{C}$
$T_j$	Maximum operating junction temperature			175	$^\circ\text{C}$

**Table 3. Thermal resistance**

Symbol	Parameter			Value (max)	Unit
$R_{th(j-c)}$	Junction to case	I <sup>2</sup> PAK, D <sup>2</sup> PAK, TO-220AB	Per diode	2.5	$^\circ\text{C/W}$
			Total	1.3	
		TO-220FPAB	Per diode	4.6	
			Total	4	
$R_{th(c)}$	Coupling	I <sup>2</sup> PAK, D <sup>2</sup> PAK, TO-220AB		0.1	
		TO-220FPAB		3.5	

**Table 4. Static electrical characteristics (per diode)**

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$I_R^{(1)}$	Reverse leakage current	$T_j = 25\text{ }^\circ\text{C}$	$V_R = 300\text{ V}$			20	$\mu\text{A}$
		$T_j = 125\text{ }^\circ\text{C}$			30	300	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ }^\circ\text{C}$	$I_F = 10\text{ A}$			1.25	V
		$T_j = 125\text{ }^\circ\text{C}$			0.85	1	

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

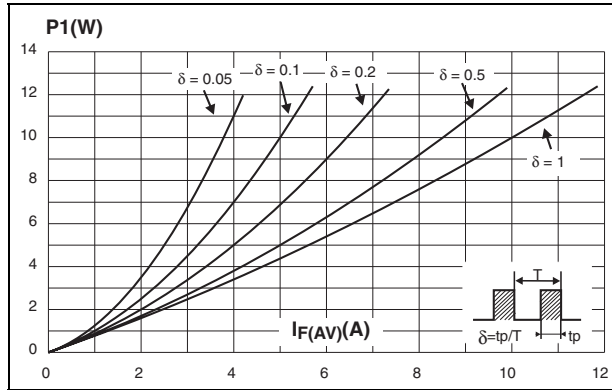
2. Pulse test:  $t_p = 380\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses use the following equation:  $P = 0.75 \times I_{F(AV)} + 0.025 I_{F(RMS)}^2$

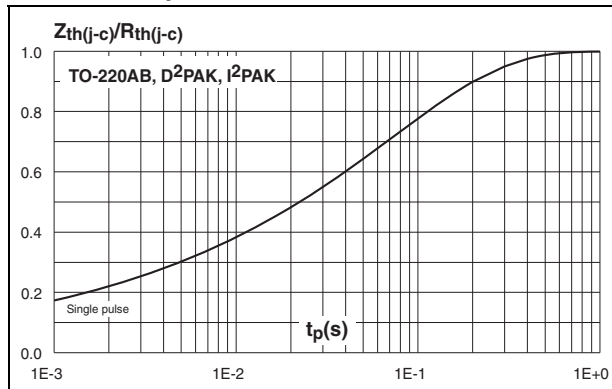
**Table 5. Recovery characteristics**

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$t_{rr}$	Reverse recovery time	$T_j = 25\text{ }^\circ\text{C}$	$I_F = 0.5\text{ A}, I_{rr} = 0.25\text{ A}$ $I_R = 1\text{ A}$			25	ns
			$I_F = 1\text{ A}, V_R = 30\text{ V}$ $di_F/dt = -50\text{ A}/\mu\text{s}$			35	
$t_{fr}$	Forward recovery time	$T_j = 25\text{ }^\circ\text{C}$	$I_F = 10\text{ A}$ $di_F/dt = 100\text{ A}/\mu\text{s}$ $V_{FR} = 1.1 \times V_{Fmax}$			230	ns
$V_{FP}$	Peak forward voltage	$T_j = 25\text{ }^\circ\text{C}$	$I_F = 10\text{ A},$ $di_F/dt = 100\text{ A}/\mu\text{s}$			3.5	V
$I_{RM}$	Reverse recovery current	$T_j = 125\text{ }^\circ\text{C}$	$I_F = 10\text{ A}, V_{CC} = 200\text{ V}$ $di_F/dt = 200\text{ A}/\mu\text{s}$			8	A
S factor	Softness factor				0.3	-	

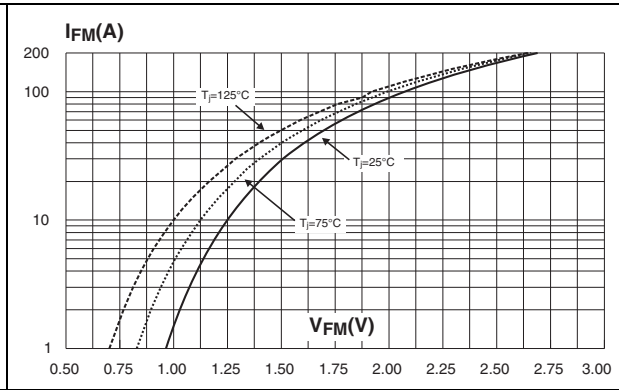
**Figure 1. Conduction losses versus average forward current (per diode)**



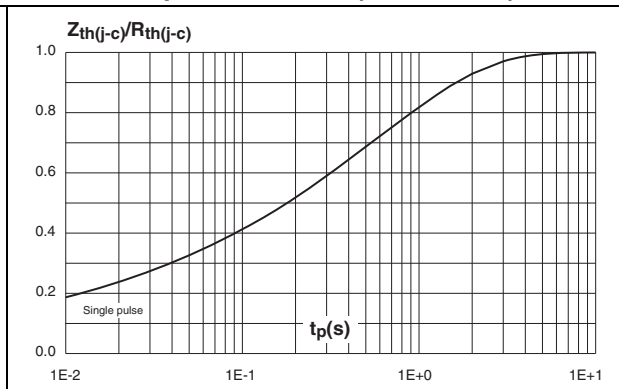
**Figure 3. Relative variation of thermal impedance junction to case versus pulse duration**



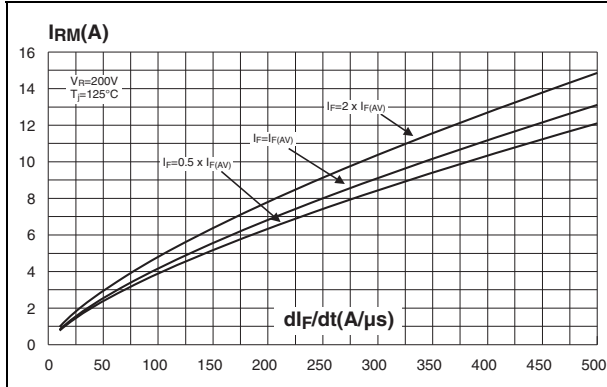
**Figure 2. Forward voltage drop versus forward current (maximum values, per diode)**



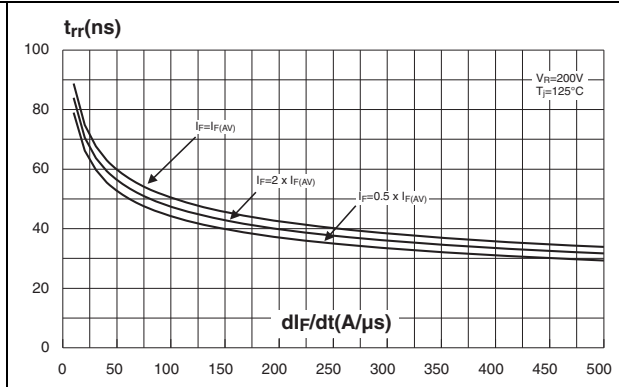
**Figure 4. Relative variation of thermal impedance junction to case versus pulse duration (TO-22FPAB)**



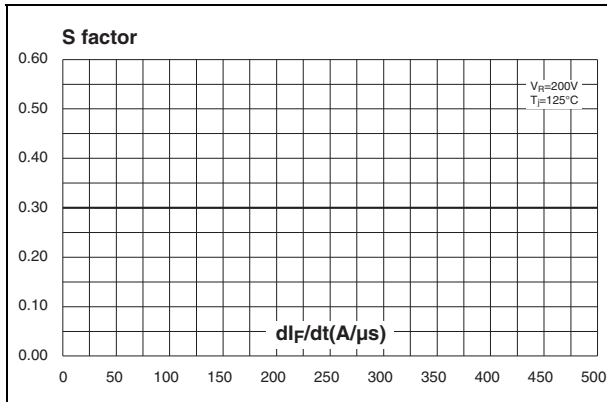
**Figure 5. Peak reverse recovery current versus  $di_F/dt$  (90% confidence, per diode)**



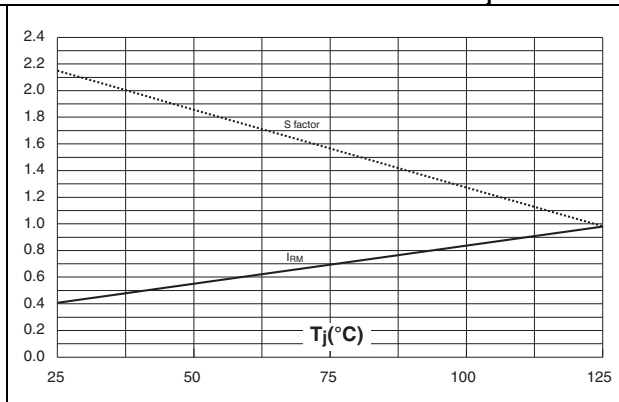
**Figure 6. Reverse recovery time versus  $di_F/dt$  (90% confidence, per diode)**



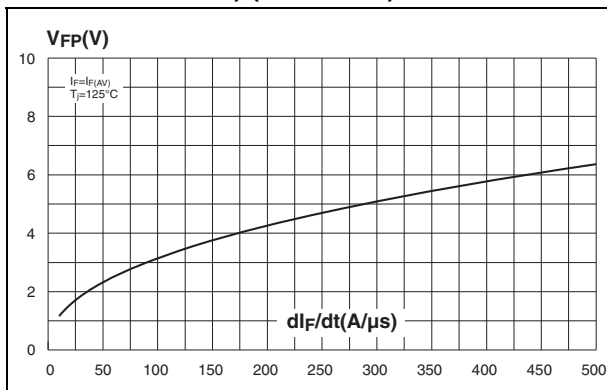
**Figure 7. Softness factor (tb/ta) versus  $di_F/dt$  (typical values, per diode)**



**Figure 8. Relative variation of dynamic parameters versus junction temperature (reference:  $T_j = 125^\circ C$ )**



**Figure 9. Transient peak forward voltage versus  $di_F/dt$  (90% confidence, per diode) (TO-220AB)**



**Figure 10. Forward recovery time versus  $di_F/dt$  (90% confidence, per diode)**

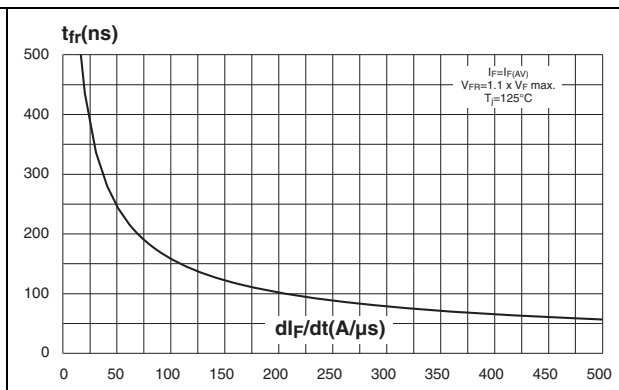


Figure 11. Thermal resistance, junction to ambient, versus copper surface under tab (D<sup>2</sup>PAK)

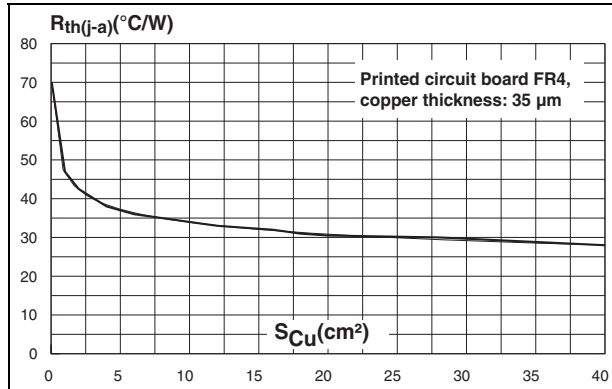
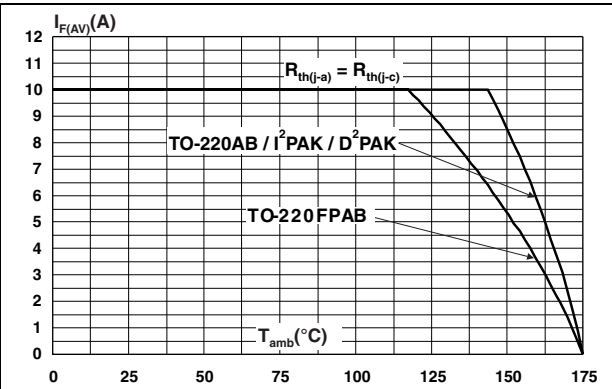


Figure 12. Average forward current versus ambient temperature ( $\delta = 0.5$ , per diode)



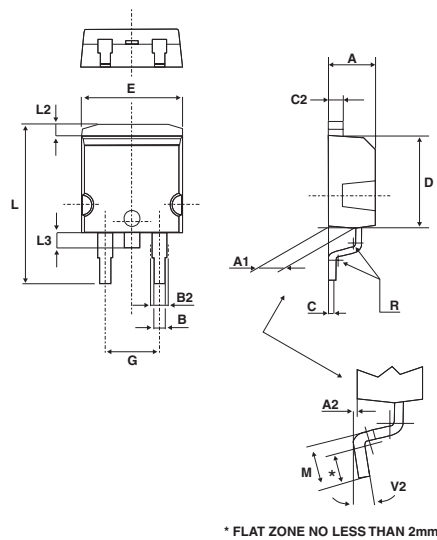
## 2 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.4 to 0.6 N·m

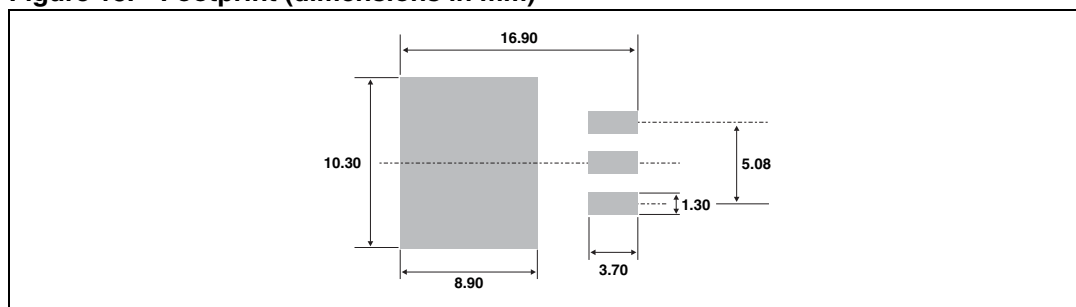
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK® is an ST trademark.

**Table 6. D<sup>2</sup>PAK dimensions**

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
A1	2.49	2.69	0.098	0.106
A2	0.03	0.23	0.001	0.009
B	0.70	0.93	0.027	0.037
B2	1.14	1.70	0.045	0.067
C	0.45	0.60	0.017	0.024
C2	1.23	1.36	0.048	0.054
D	8.95	9.35	0.352	0.368
E	10.00	10.40	0.393	0.409
G	4.88	5.28	0.192	0.208
L	15.00	15.85	0.590	0.624
L2	1.27	1.40	0.050	0.055
L3	1.40	1.75	0.055	0.069
M	2.40	3.20	0.094	0.126
R	0.40 typ.		0.016 typ.	
V2	0°	8°	0°	8°



**Figure 13. Footprint (dimensions in mm)**

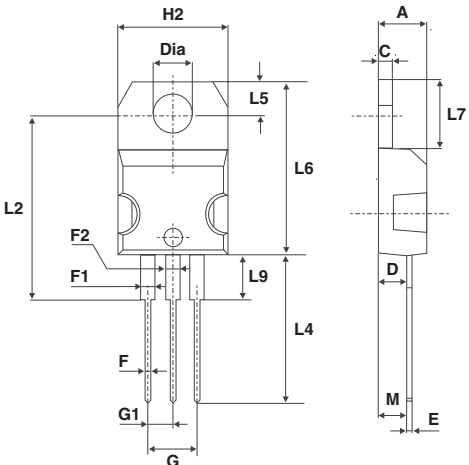


Devices in I<sup>2</sup>PAK with nickel-plated back frame must NOT be mounted by frame soldering like SMDs. Such devices are intended to be through-hole mounted ONLY and in no circumstances shall ST be held liable for any lack of performance or damage arising out of soldering of nickel-plated back frames.

**Table 7. I<sup>2</sup>PAK dimensions**

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
A1	2.40	2.72	0.094	0.107
b	0.61	0.88	0.024	0.035
b1	1.14	1.70	0.044	0.067
c	0.49	0.70	0.019	0.028
c2	1.23	1.32	0.048	0.052
D	8.95	9.35	0.352	0.368
e	2.40	2.70	0.094	0.106
e1	4.95	5.15	0.195	0.203
E	10	10.40	0.394	0.409
L	13	14	0.512	0.551
L1	3.50	3.93	0.138	0.155
L2	1.27	1.40	0.050	0.055

Table 8. TO-220AB dimensions



Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
C	1.23	1.32	0.048	0.051
D	2.40	2.72	0.094	0.107
E	0.49	0.70	0.019	0.027
F	0.61	0.88	0.024	0.034
F1	1.14	1.70	0.044	0.066
F2	1.14	1.70	0.044	0.066
G	4.95	5.15	0.194	0.202
G1	2.40	2.70	0.094	0.106
H2	10	10.40	0.393	0.409
L2	16.4 typ.		0.645 typ.	
L4	13	14	0.511	0.551
L5	2.65	2.95	0.104	0.116
L6	15.25	15.75	0.600	0.620
L7	6.20	6.60	0.244	0.259
L9	3.50	3.93	0.137	0.154
M	2.6 typ.		0.102 typ.	
Diam.	3.75	3.85	0.147	0.151



Table 9. TO-220FPAB 3 leads in-line dimensions

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.4	4.9	0.173	0.192
B	2.5	2.9	0.098	0.114
D	2.45	2.75	0.096	0.108
E	0.4	0.7	0.016	0.028
F	0.6	1	0.024	0.039
F1	1.15	1.7	0.045	0.067
F2	1.15	1.7	0.045	0.067
G	4.95	5.2	0.195	0.205
G1	2.4	2.7	0.094	0.106
H	10	10.7	0.394	0.421
L2	16 Typ.		0.630 Typ.	
L3	28.6	30.6	1.126	1.205
L4	9.8	10.7	0.386	0.421
L6	15.8	16.4	0.622	0.646
L7	9	9.9	0.354	0.390
Dia.	2.9	3.5	0.114	0.138

### 3 Ordering information

**Table 10. Ordering information**

Order code	Marking	Package	Weight	Base qty	Delivery mode
STTH2003CT	STTH2003CT	TO-220AB	2.2 g	50	Tube
STTH2003CG	STTH2003CG	D <sup>2</sup> PAK	1.48 g	50	Tube
STTH2003CG-TR	STTH2003CG	D <sup>2</sup> PAK	1.48 g	1000	Tape and reel
STTH2003CFP	STTH2003CFP	TO-220FPAB	2.08 g	50	Tube
STTH2003CR	STTH2003CR	I <sup>2</sup> PAK	1.49 g	50	Tube

### 4 Revision history

**Table 11. Document revision history**

Date	Revision	Changes
Aug-2003	7D	Previous release.
26-Mar-2007	8	Removed ISOWATT package.
11-Feb-2011	9	Updated base quantity for tape and reel delivery in <a href="#">Table 10</a> . Corrected temperature in <a href="#">Table 1</a> . Added warning paragraph above <a href="#">Table 7</a> .
06-Sep-2011	10	Updated <a href="#">Table 2</a> . Added <a href="#">Figure 12</a> .

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