

## Turbo 2 ultrafast high voltage rectifier

### Main product characteristics

$I_{F(AV)}$	12 A
$V_{RRM}$	600 V
$I_{RM}$ (typ)	7 A
$T_j$	175° C
$V_F$ (typ)	1.4 V
$t_{rr}$ (max)	25 ns

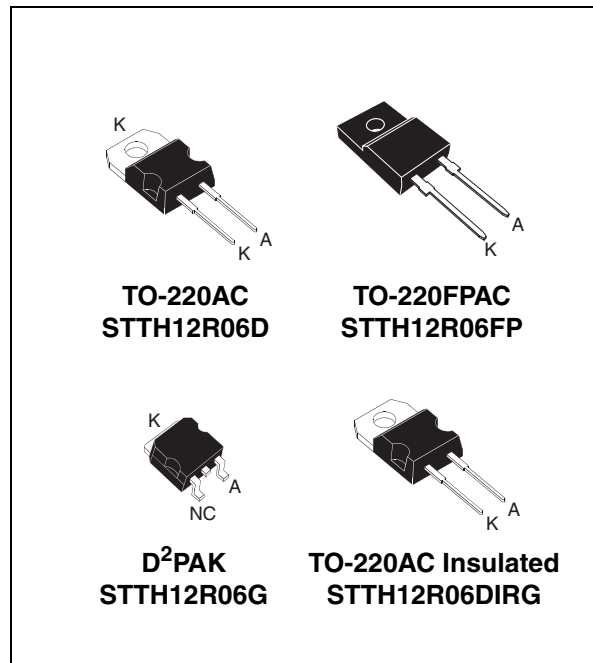
### Features and benefits

- Ultrafast switching
- Low reverse recovery current
- Low thermal resistance
- Reduces switching losses
- Package insulation voltage:  
TO220AC Ins: 2500 V<sub>RMS</sub>  
TO-220FPAC: 2000 V<sub>DC</sub>

### Description

The STTH12R06, which is using ST Turbo 2 600V technology, is specially suited as boost diode in continuous mode power factor corrections and hard switching conditions.

This device is also intended for use as a free wheeling diode in power supplies and other power switching applications.



### Order codes

Part Number	Marking
STTH12R06D	STTH12R06D
STTH12R06FP	STTH12R06FP
STTH12R06G	STTH12R06G
STTH12R06G-TR	STTH12R06G
STTH12R06DIRG	STTH12R06DI

# 1 Characteristics

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

Symbol	Parameter		Value	Unit	
$V_{RRM}$	Repetitive peak reverse voltage		600	V	
$I_{F(RMS)}$	RMS forward voltage	TO-220AC / TO-220FPAC / D <sup>2</sup> PAK	30	A	
		TO-220AC Ins.	24		
$I_{F(AV)}$	Average forward current $\delta = 0.5$	TO-220AC / D <sup>2</sup> PAK	12	A	
		TO-220FPAC			$T_c = 125^\circ\text{C}$
		TO-220AC Ins.			$T_c = 50^\circ\text{C}$
$I_{FSM}$	Surge non repetitive forward current		$t_p = 10\text{ ms sinusoidal}$	100	A
$T_{stg}$	Storage temperature range		-65 to + 175	$^\circ\text{C}$	
$T_j$	Maximum operating junction temperature		175	$^\circ\text{C}$	

**Table 2. Thermal Resistance**

Symbol	Parameter		Value (max).	Unit
$R_{th(j-c)}$	Junction to case	TO-220AC / D <sup>2</sup> PAK	1.7	$^\circ\text{C/W}$
		TO-220FPAC	4.4	
		TO-220AC Ins.	3.3	

**Table 3. Static Electrical Characteristics**

Symbol	Parameter	Test conditions		Min.	Typ	Max.	Unit
$I_R$	Reverse leakage current	$T_j = 25^\circ\text{C}$	$V_R = V_{RRM}$			45	$\mu\text{A}$
		$T_j = 125^\circ\text{C}$			50	600	
$V_F$	Forward voltage drop	$T_j = 25^\circ\text{C}$	$I_F = 12\text{ A}$			2.9	V
		$T_j = 125^\circ\text{C}$			1.4	1.8	

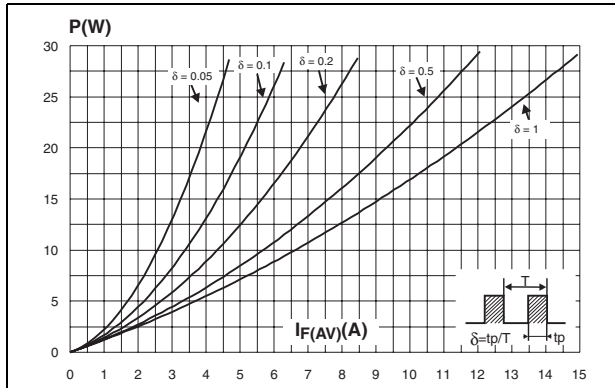
To evaluate the conduction losses use the following equation:

$$P = 1.16 \times I_{F(AV)} + 0.053 I_{F(RMS)}^2$$

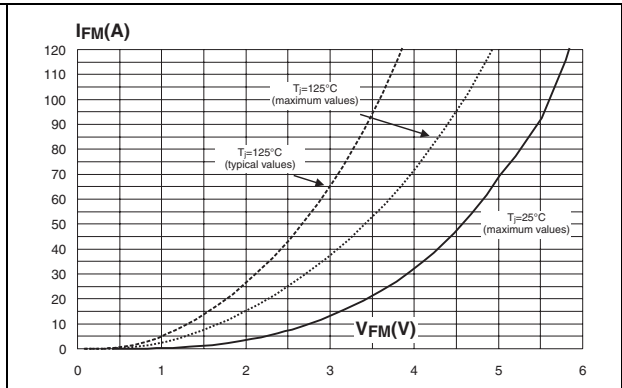
**Table 4. Dynamic Characteristics**

Symbol	Parameter	Test conditions			Min	Typ	Max	Unit
$t_{rr}$	Reverse recovery time	$T_j = 25^\circ\text{C}$	$I_F = 0.5\text{ A } I_{rr} = 0.25\text{ A } I_R = 1\text{ A}$				25	ns
			$I_F = 1\text{ A } di_F/dt = -50\text{ A}/\mu\text{s } V_R = 30\text{ V}$				45	
$I_{RM}$	Reverse recovery current	$T_j = 125^\circ\text{C}$	$I_F = 12\text{ A } V_R = 400\text{ V}$ $di_F/dt = -200\text{ A}/\mu\text{s}$			7.0	8.4	A
S factor	Softness factor					0.2		
Q <sub>rr</sub>	Reverse recovery charges					180		
$t_{fr}$	Forward recovery time	$T_j = 25^\circ\text{C}$	$I_F = 12\text{ A } di_F/dt = 96\text{ A}/\mu\text{s}$ $V_{FR} = 1.1 \times V_{Fmax}$				200	ns
$V_{FP}$	Forward recovery voltage						5.5	V

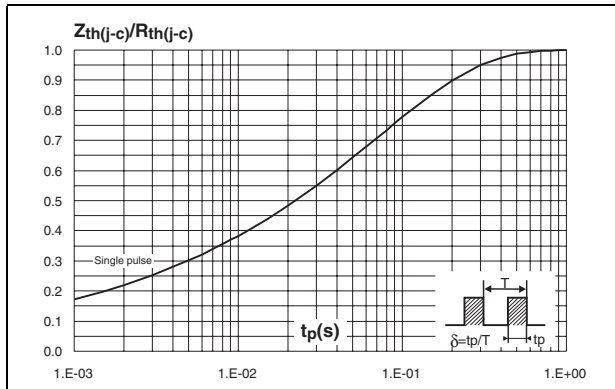
**Figure 1. Conduction losses versus average current**



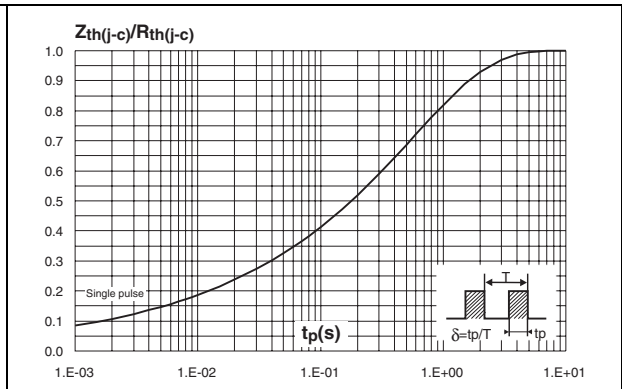
**Figure 2. Forward voltage drop versus forward current**



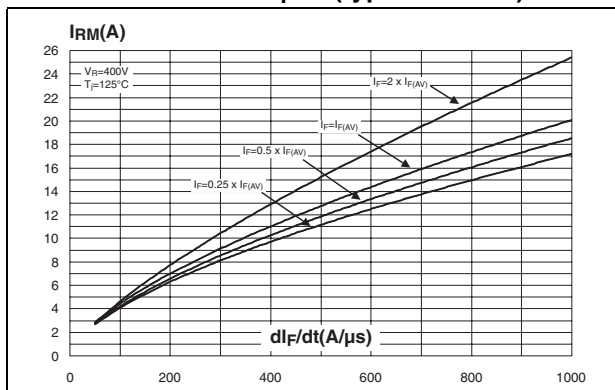
**Figure 3. Relative variation of thermal impedance junction to case versus pulse duration (TO-220AC, TO-220AC Ins, D<sup>2</sup>PAK)**



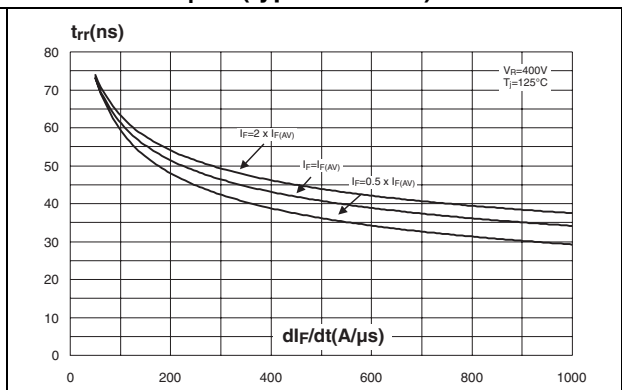
**Figure 4. Relative variation of thermal impedance junction to case versus pulse duration (TO-220FPAC)**



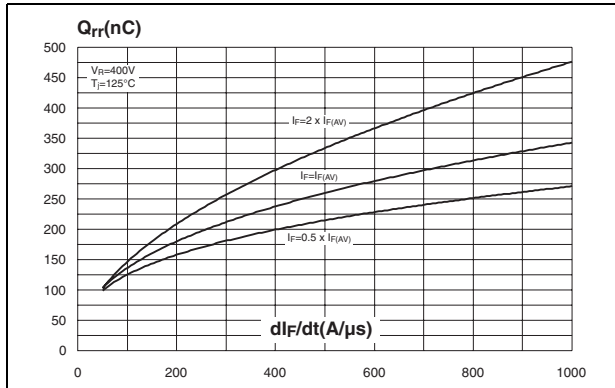
**Figure 5. Peak reverse recovery current versus di\_F/dt (typical values)**



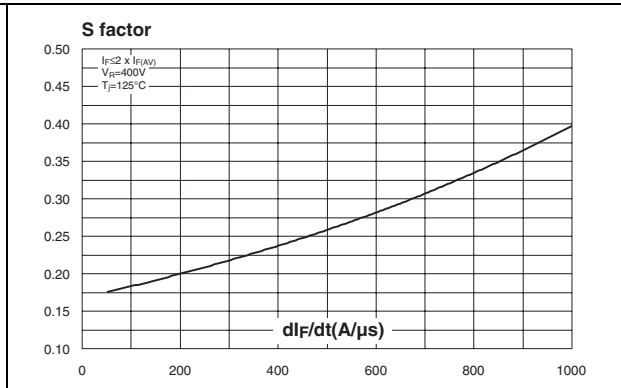
**Figure 6. Reverse recovery time versus di\_F/dt (typical values)**



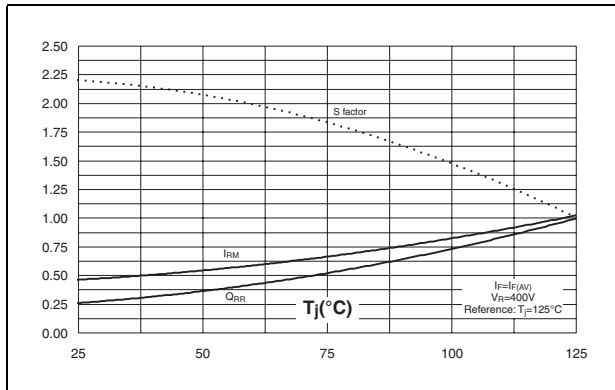
**Figure 7. Reverse recovery charges versus  $di_F/dt$  (typical values)**



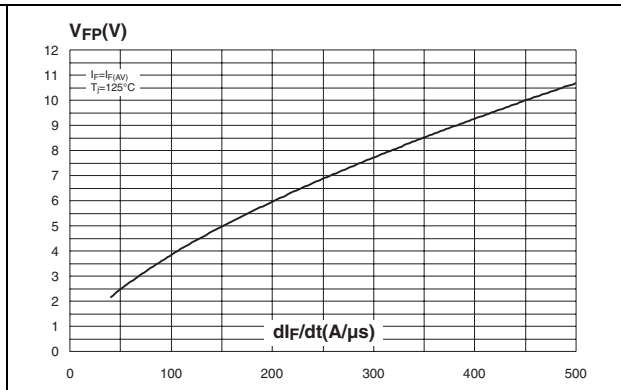
**Figure 8. Softness factor versus  $di_F/dt$  (typical values)**



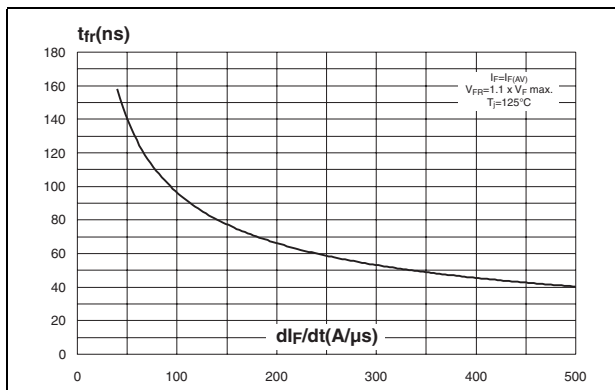
**Figure 9. Relative variations of dynamic parameters versus junction temperature**



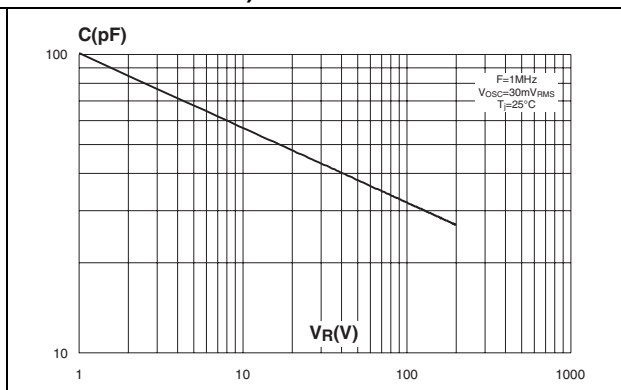
**Figure 10. Transient peak forward voltage versus  $di_F/dt$  (typical values)**



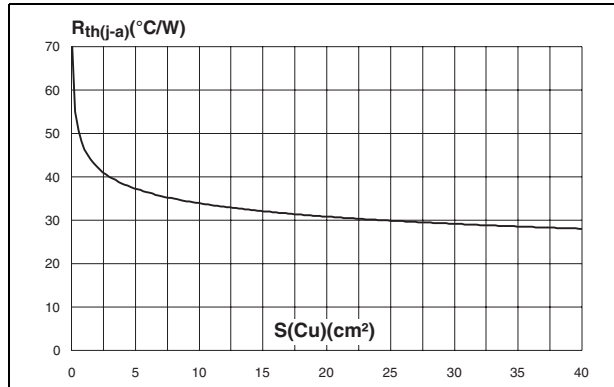
**Figure 11. Forward recovery time versus  $di_F/dt$  (typical values)**



**Figure 12. Junction capacitance versus reverse voltage applied (typical values)**



**Figure 13. Thermal resistance junction to ambient versus copper surface under tab (epoxy FR4,  $e_{Cu} = 35 \mu m$ ) (D<sup>2</sup>PAK)**



## 2 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.8 Nm (TO-220FPAC) / 0.55 Nm (TO-220AC)
- Maximum torque value: 1.0 Nm (TO-220FPAC) / 0.70 Nm (TO-220AC)

Table 5. TO-220AC dimensions

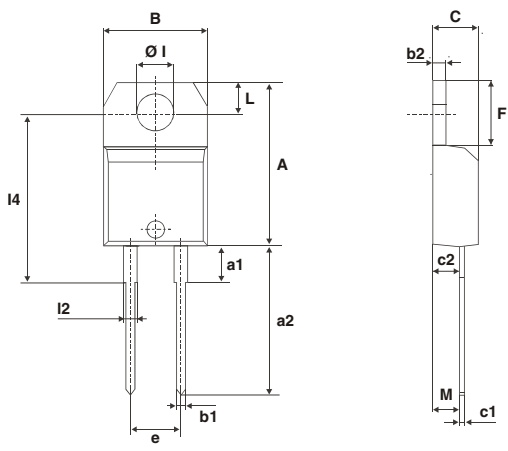
The technical drawing shows two views of the TO-220AC package. The front view (left) shows a rectangular body with a central circular feature of diameter  $\varnothing 1$ . Dimensions include H2 (width), L5 (height from top to center), L6 (total height), L9 (height from center to base), L4 (height from base to mounting tab), F1 (width of mounting tab), F (width of base), and G (width of base). The side view (right) shows the profile of the package with dimensions A (total height), C (height of top flange), L7 (height from top flange to base), D (width of base), M (width of mounting tab), and E (width of base).

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
G	4.95	5.15	0.194	0.202
H2	10.00	10.40	0.393	0.409
L2	16.40 typ.		0.645 typ.	
L4	13.00	14.00	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. I	3.75	3.85	0.147	0.151

Table 6. TO-220FPAC Dimensions

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.4	4.6	0.173	0.181
B	2.5	2.7	0.098	0.106
D	2.5	2.75	0.098	0.108
E	0.45	0.70	0.018	0.027
F	0.75	1	0.030	0.039
F1	1.15	1.70	0.045	0.067
G	4.95	5.20	0.195	0.205
G1	2.4	2.7	0.094	0.106
H	10	10.4	0.393	0.409
L2	16 Typ.		0.63 Typ.	
L3	28.6	30.6	1.126	1.205
L4	9.8	10.6	0.386	0.417
L5	2.9	3.6	0.114	0.142
L6	15.9	16.4	0.626	0.646
L7	9.00	9.30	0.354	0.366
Dia.	3.00	3.20	0.118	0.126

Table 7. TO-220AC (Nlns. & Ins. 20-up) Dimensions



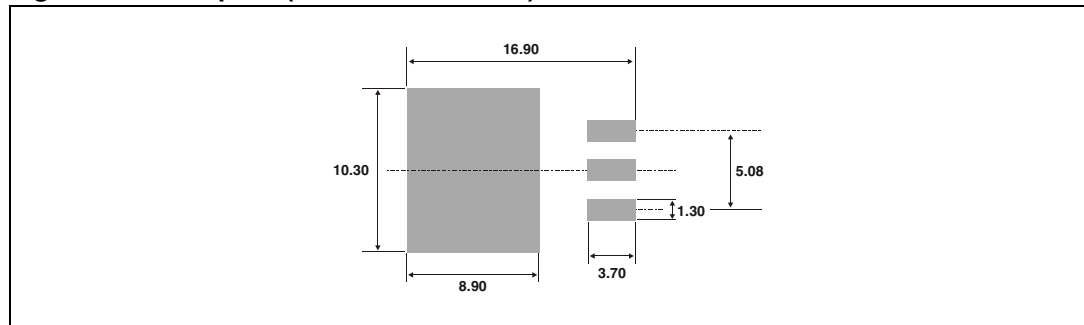
Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	15.20		15.90	0.598		0.625
a1		3.75			0.147	
a2	13.00		14.00	0.511		0.551
B	10.00		10.40	0.393		0.409
b1	0.61		0.88	0.024		0.034
b2	1.23		1.32	0.048		0.051
C	4.40		4.60	0.173		0.181
c1	0.49		0.70	0.019		0.027
c2	2.40		2.72	0.094		0.107
e	4.80		5.40	0.189		0.212
F	6.20		6.60	0.244		0.259
Ø1	3.75		3.85	0.147		0.151
I4	15.80	16.40	16.80	0.622	0.646	0.661
L	2.65		2.95	0.104		0.116
I2	1.14		1.70	0.044		0.066
M		2.60			0.102	



Table 8. 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 14. Footprint (dimensions in mm)



### 3 Ordering information

Ordering type	Marking	Package	Weight	Base qty	Delivery mode
STTH12R06D	STTH12R06D	TO-220AC	1.90 g	50	Tube
STTH12R06G	STTH12R06G	D <sup>2</sup> PAK	1.48 g	50	Tube
STTH12R066G-TR	STTH12R06G	D <sup>2</sup> PAK	1.48 g	1000	Tape & reel
STTH12R06FP	STTH12R06FP	TO-220FPAC	1.70 g	50	Tube
STTH12R06DIRG	STTH12R06DI	TO-220AC Ins.	1.86 g	50	Tube

### 4 Revision history

Date	Revision	Changes
January-2002	1	First issue
18-Oct-2004	2	D <sup>2</sup> PAK and TO-220AC Insulated packages added
10-Aug-2006	3	Reformatted to current standard. Added Package insulation voltages on page 1

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