

## Ultrafast recovery diode

### Main product characteristics

$I_{F(AV)}$	2 X 8 A
$V_{RRM}$	400 V
$T_j$	175° C
$V_F$ (typ)	0.9 V
$t_{rr}$ (typ)	25 ns

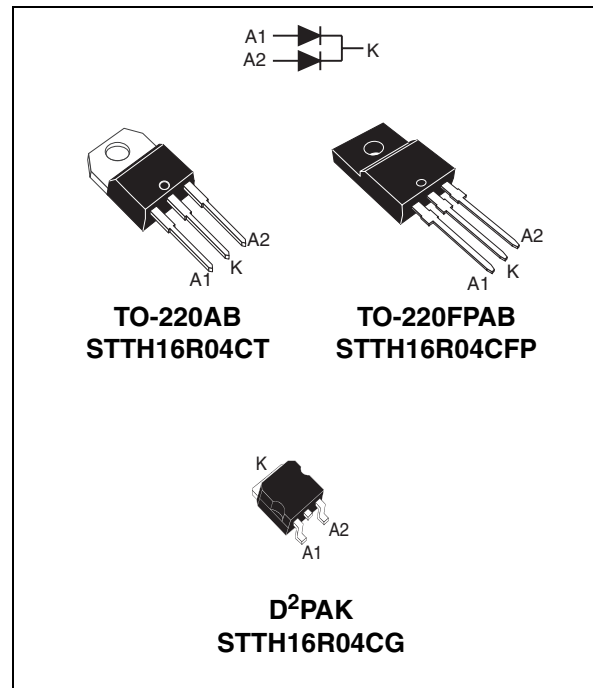
### Features and benefits

- Very low switching losses
- High frequency and/or high pulsed current operation
- High junction temperature
- Insulated package:
  - TO-220FPAB  
Electrical insulation = 1500 V<sub>RMS</sub>  
Capacitance = 12 pF

### Description

The STTH16R04C series uses ST's new 400 V planar Pt doping technology. The STTH16R04C is specially suited for switching mode base drive and transistor circuits.

Packaged in through-the-hole and surface mount packages, this device is intended for use in low voltage, high frequency inverters, free wheeling and polarity protection.



### Order codes

Part Number	Marking
STTH16R04CT	STTH16R04CT
STTH16R04CG	STTH16R04CG
STTH16R04CG-TR	STTH16R04CG
STTH16R04CFP	STTH16R04CFP

# 1 Characteristics

**Table 1. Absolute ratings (limiting values at 25° C, unless otherwise specified)**

Symbol	Parameter		Value	Unit	
V <sub>RRM</sub>	Repetitive peak reverse voltage		400	V	
I <sub>F(RMS)</sub>	RMS forward current		30	A	
I <sub>F(AV)</sub>	Average forward current, δ = 0.5	TO-220AB / D <sup>2</sup> PAK	Per diode T <sub>c</sub> = 150° C	8	A
			Per device T <sub>c</sub> = 145° C	16	
		TO-220FPAB	Per diode T <sub>c</sub> = 125° C	8	
			Per device T <sub>c</sub> = 90° C	16	
I <sub>FSM</sub>	Surge non repetitive forward current	t <sub>p</sub> = 10 ms Sinusoidal	120	A	
T <sub>stg</sub>	Storage temperature range		-65 to +175	° C	
T <sub>j</sub>	Maximum operating junction temperature range		-40 to +175	° C	

**Table 2. Thermal parameters**

Symbol	Parameter		Value	Unit	
R <sub>th(j-c)</sub>	Junction to case	TO-220AC / D <sup>2</sup> PAK	Per diode	2	°C/W
			Per device	1.15	
		TO-220FPAB	Per diode	4.6	
			per device	3.8	
R <sub>th(c)</sub>	Coupling	TO-220AC / D <sup>2</sup> PAK	Per device	0.3	°C/W
		TO-220FPAB	per device	3	

When the diodes are used simultaneously:

$$\Delta T_{j(\text{diode } 1)} = P_{(\text{diode } 1)} \times R_{th(j-c)(\text{Per diode})} + P_{(\text{diode } 2)} \times R_{th(c)}$$

**Table 3. Static electrical characteristics**

Symbol	Parameter	Test conditions		Min	Typ	Max	Unit
$I_R^{(1)}$	Reverse leakage current	$T_j = 25^\circ \text{C}$	$V_R = V_{RRM}$			10	$\mu\text{A}$
		$T_j = 125^\circ \text{C}$			10	100	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25^\circ \text{C}$	$I_F = 8 \text{ A}$			1.5	V
		$T_j = 100^\circ \text{C}$			1.05	1.3	
		$T_j = 150^\circ \text{C}$			0.9	1.1	
		$T_j = 25^\circ \text{C}$	$I_F = 16 \text{ A}$			1.75	
		$T_j = 100^\circ \text{C}$			1.25	1.55	
		$T_j = 150^\circ \text{C}$			1.12	1.37	

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

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

To evaluate the conduction losses use the following equation:

$$P = 0.83 \times I_{F(AV)} + 0.034 \times I_{F(RMS)}^2$$

**Table 4. Dynamic characteristics**

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$t_{rr}$	Reverse recovery time	$I_F = 1 \text{ A}$ , $di_F/dt = -50 \text{ A}/\mu\text{s}$ , $V_R = 30 \text{ V}$ , $T_j = 25^\circ \text{C}$		35	50	ns
		$I_F = 1 \text{ A}$ , $di_F/dt = -100 \text{ A}/\mu\text{s}$ , $V_R = 30 \text{ V}$ , $T_j = 25^\circ \text{C}$		25	35	
$I_{RM}$	Reverse recovery current	$I_F = 8 \text{ A}$ , $di_F/dt = -200 \text{ A}/\mu\text{s}$ , $V_R = 320 \text{ V}$ , $T_j = 125^\circ \text{C}$		5.5	8	A
S	Softness factor	$I_F = 8 \text{ A}$ , $di_F/dt = -200 \text{ A}/\mu\text{s}$ , $V_R = 320 \text{ V}$ , $T_j = 125^\circ \text{C}$		0.4		
$t_{fr}$	Forward recovery time	$I_F = 8 \text{ A}$ , $di_F/dt = 100 \text{ A}/\mu\text{s}$ $V_{FR} = 1.1 \times V_{Fmax}$ , $T_j = 25^\circ \text{C}$			150	ns
$V_{FP}$	Forward recovery voltage	$I_F = 8 \text{ A}$ , $di_F/dt = 100 \text{ A}/\mu\text{s}$ $T_j = 25^\circ \text{C}$		2.9		V

Figure 1. Conduction losses versus average current

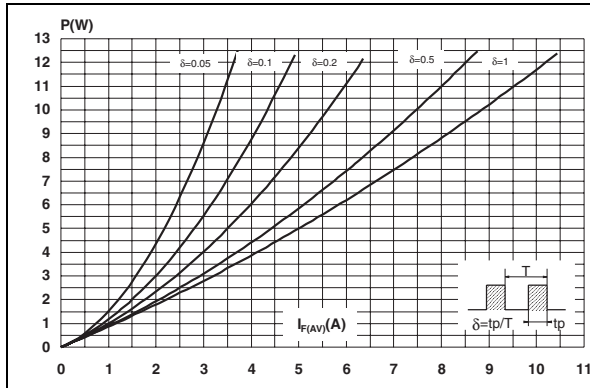


Figure 2. Forward voltage drop versus forward current

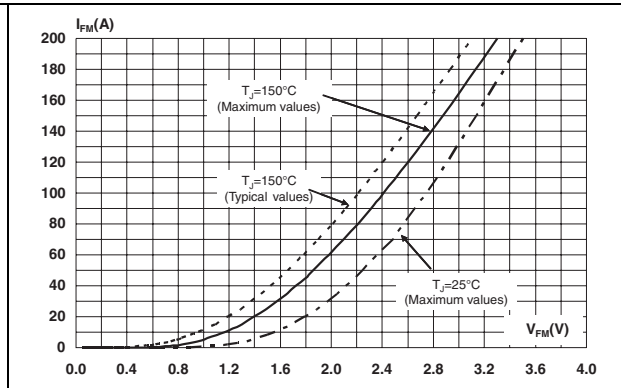


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

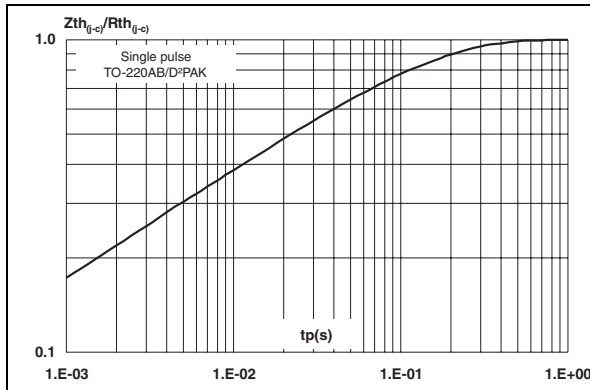


Figure 4. Relative variation of thermal impedance junction to case versus pulse duration TO-220FPAB

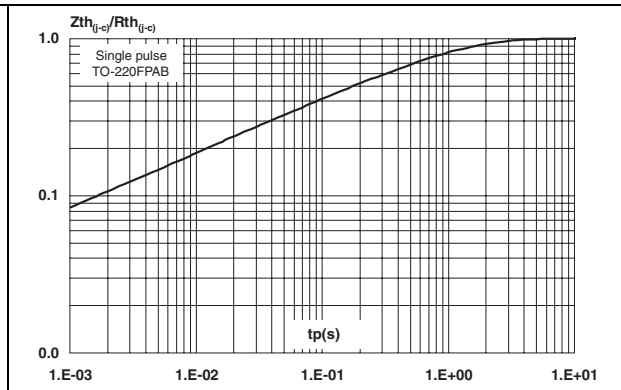


Figure 5. Peak reverse recovery current versus di\_F/dt (typical values)

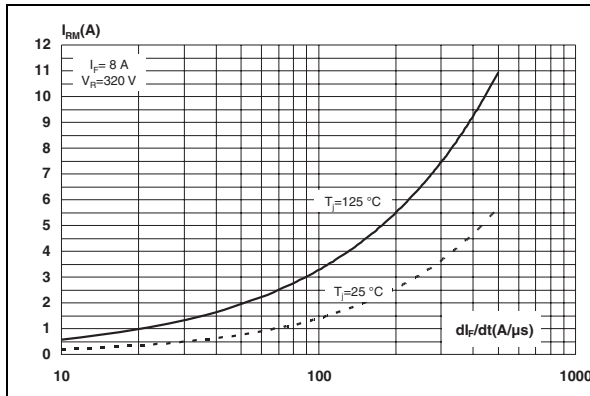


Figure 6. Reverse recovery time versus di\_F/dt (typical values)

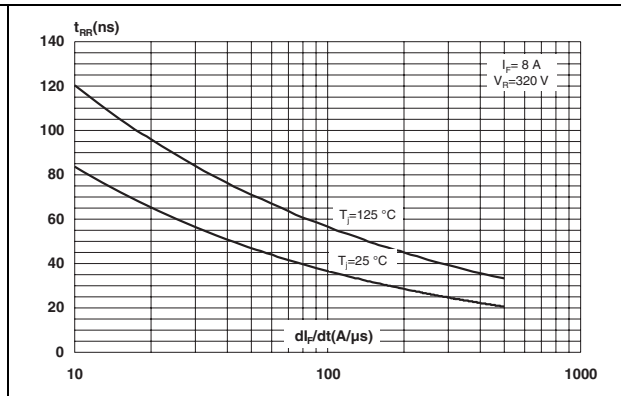


Figure 7. Reverse recovery charges versus  $di_F/dt$  (typical values)

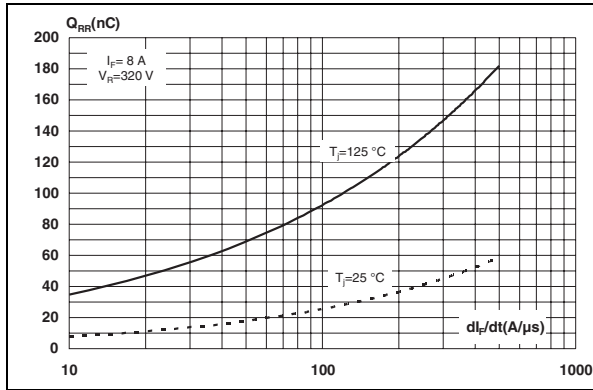


Figure 8. Thermal resistance junction to ambient versus copper surface under tab (Epoxy printed circuit board FR4,  $\epsilon_{CU} = 35 \mu m$ )

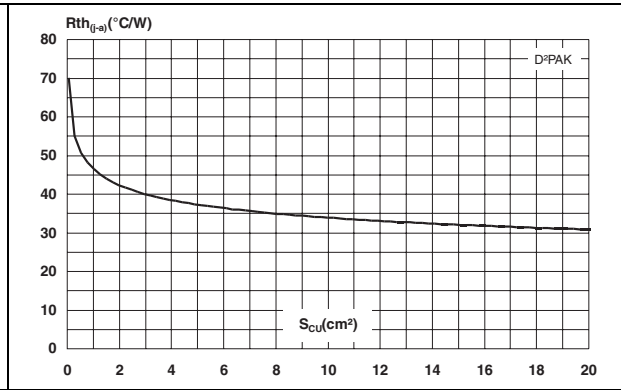


Figure 9. Relative variations of dynamic parameters versus junction temperature

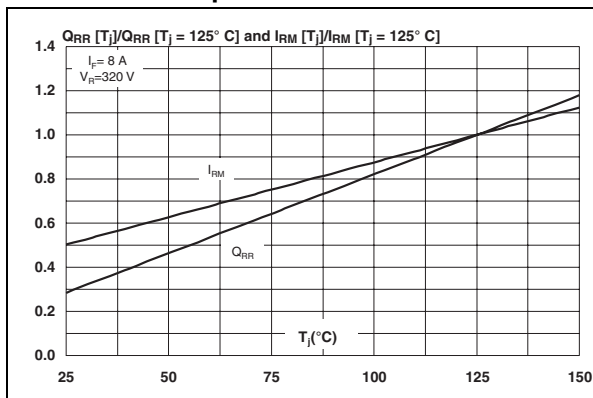


Figure 10. Transient peak forward voltage versus  $di_F/dt$  (typical values)

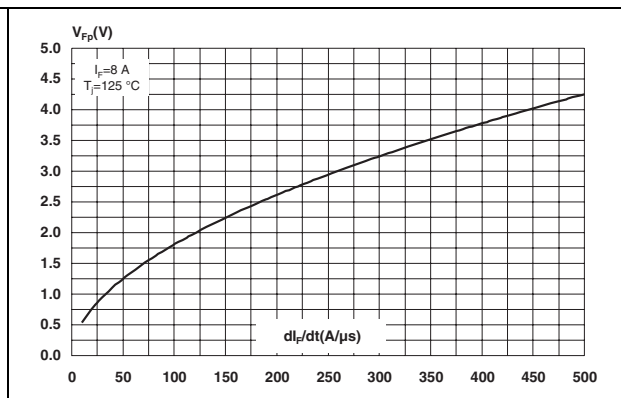


Figure 11. Forward recovery time versus  $di_F/dt$  (typical values)

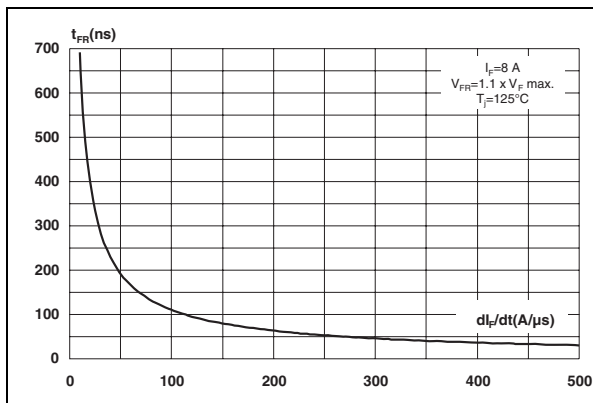
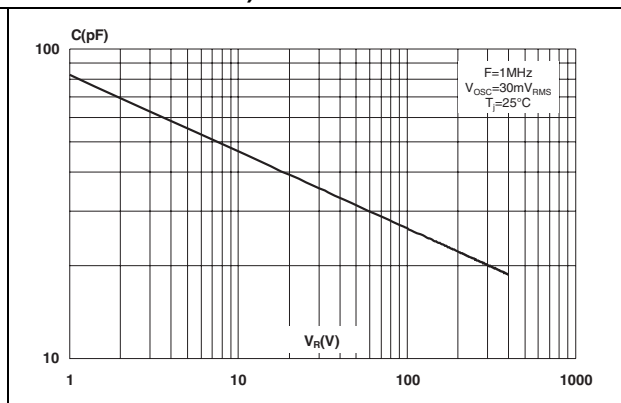


Figure 12. Junction capacitance versus reverse voltage applied (typical values)



## 2 Package information

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

Table 5. 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. D<sup>2</sup>PAK footprint (dimensions in mm)

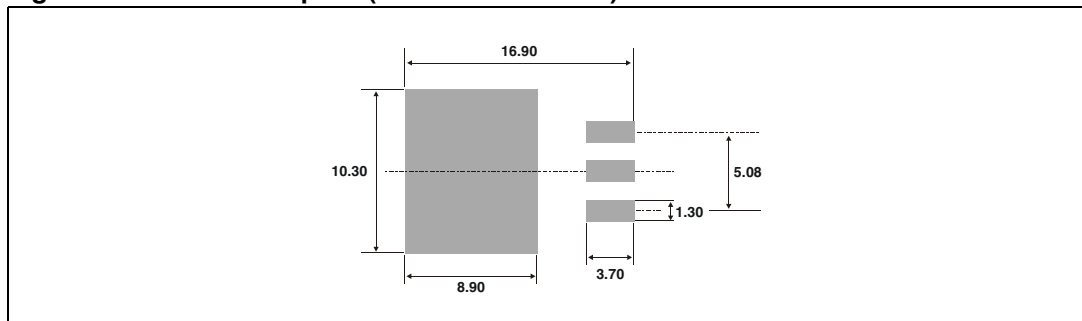
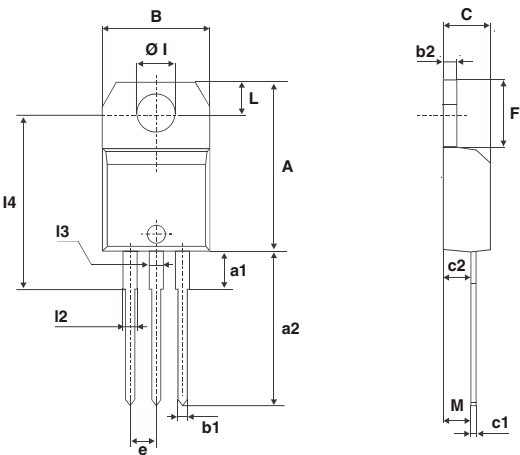


Table 6. TO-220AB dimensions



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	2.40		2.70	0.094		0.106
F	6.20		6.60	0.244		0.259
ØI	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
I3	1.14		1.70	0.044		0.066
M		2.60			0.102	

Table 7. TO-220FPAB 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
F2	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

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com).



### 3 Ordering information

Part Number	Marking	Package	Weight	Base qty	Delivery mode
STTH16R04CT	STTH16R04CT	TO-220AB	1.92 g	50	Tube
STTH16R04CG	STTH16R04CG	D <sup>2</sup> PAK	1.48 g	50	Tube
STTH16R04CG-TR	STTH16R04CG	D <sup>2</sup> PAK	1.48 g	1000	Tape and reel
STTH16R04CFP	STTH16R04CFP	TO-220FPAB	1.69 g	50	Tube

### 4 Revision history

Date	Revision	Description of Changes
31-Mar-2007	1	First issue

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