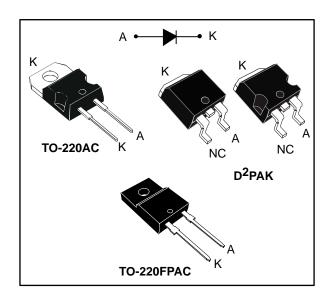
# life.augmented

#### **STTH20R04**

## High efficiency rectifier

Datasheet - production data



#### **Features**

- Ultrafast recovery
- Low power losses
- High surge capability
- Low leakage current
- High junction temperature
- Insulated package: TO-220FPAC
  - insulating voltage: 2000 V<sub>RMS</sub> sine
- ECOPACK<sup>®</sup>2 compliant component for D<sup>2</sup>PAK on demand

#### **Description**

This device is an ultrafast recovery power rectifier dedicated to energy recovery in PDP applications.

Especially designed for the clamping function in energy recovery blocks, the performance is optimized thanks to a compromise between forward voltage drop and recovery time.

**Table 1: Device summary** 

Symbol	Value
I <sub>F(AV)</sub>	20 A
V <sub>RRM</sub>	400 V
T <sub>j</sub> (max.)	175 °C
V <sub>F</sub> (typ.)	1.15 V
t <sub>rr</sub> (typ.)	18 ns

Characteristics STTH20R04

#### 1 Characteristics

Table 2: Absolute ratings (limiting values, at 25 °C, unless otherwise specified)

Symbol	Pa	Value	Unit		
$V_{RRM}$	Repetitive peak reverse voltage	Repetitive peak reverse voltage			V
I <sub>F(RMS)</sub>	Forward rms current			50	Α
	Peak working forward current δ = 0.5, square wave	TO-220AC, D2PAK	T <sub>C</sub> = 135 °C	00	^
IF(peak)		TO-220FPAC	T <sub>C</sub> = 105 °C	20	Α
I <sub>FSM</sub>	Surge non repetitive forward current	t <sub>p</sub> = 10 ms sinusoidal		150	Α
T <sub>stg</sub>	Storage temperature range			-65 to +175	°C
Tj	Maximum operating junction temperature			175	°C

**Table 3: Thermal parameter** 

Symbol	Parameter Max. value			Unit
Б	lunction to coop	TO-220AC, D <sup>2</sup> PAK	2.8	°C ///
R <sub>th(j-c)</sub>	Junction to case	TO-220FPAC	5	°C/W

**Table 4: Static electrical characteristics** 

Symbol	Parameter	Test conditions		Min.	Тур.	Max.	Unit
I <sub>R</sub> <sup>(1)</sup>	Doverso lookaga aurrant	T <sub>j</sub> = 25 °C	\/ \/	-		20	
IR	Reverse leakage current $T_j = 125 ^{\circ}\text{C}$ $V_R = V_{RRM}$	-	20	200	μA		
$V_{F}^{(2)}$ Forward voltage drop $T_j = 25 ^{\circ}\text{C}$ $I_F = 20 \text{A}$		-	1.50	1.70	\/		
V F (2)	Forward voltage drop	T <sub>j</sub> = 125 °C	I <sub>F</sub> = 20 A	-	1.15	1.35	V

#### Notes:

 $^{(1)}$ Pulse test: t<sub>p</sub> = 5 ms,  $\delta$  < 2%

 $^{(2)}$ Pulse test: tp = 380 µs,  $\delta$  < 2%

To evaluate the conduction losses use the following equation:

 $P = 1.05 \text{ x } I_{F(AV)} + 0.015 \text{ x } I_{F^2(RMS)}$ 

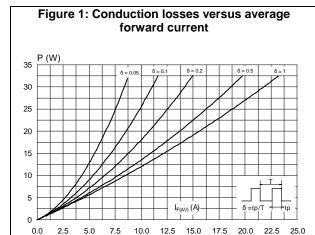
STTH20R04 Characteristics

**Table 5: Dynamic electrical characteristics** 

Symbol	Parameter	Test conditions			Тур.	Max.	Unit
	Doverse receive time		$I_F = 0.5 A,$ $I_{rr} = 0.25 A,$ $I_R = 1 A$	-	18	25	9
trr	Reverse recovery time	T <sub>i</sub> = 25 °C	I <sub>F</sub> = 1 A, V <sub>R</sub> = 30 V, dI <sub>F</sub> /dt = -50 A/µs	-	35	45	ns
t <sub>fr</sub>	Forward recovery time	, == =	$I_F = 20 \text{ A},$ $dI_F/dt = 100 \text{ A/}\mu\text{s}$ $V_{FR} = 1.1 \text{ x V}_{Fmax}$	-		150	ns
V <sub>FP</sub>	Forward recovery voltage		I <sub>F</sub> = 20 A, dI <sub>F</sub> /dt = 100 A/µs	-	1.7	2.5	V
I <sub>RM</sub>	Reverse recovery current	T <sub>j</sub> = 125 °C	I <sub>F</sub> = 20 A, dI <sub>F</sub> /dt = -200 A/μs	-	8	11	Α
Sfactor	Softness factor		V <sub>R</sub> = 200 V	-	0.3		-

Characteristics STTH20R04

#### 1.1 Characteristics (curves)



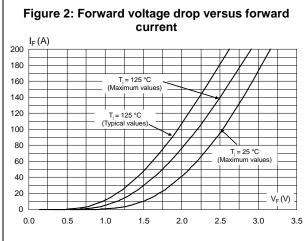
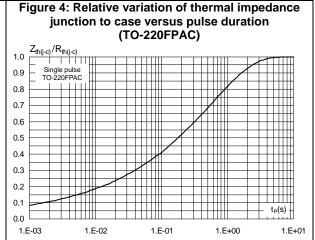
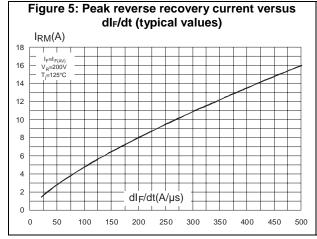
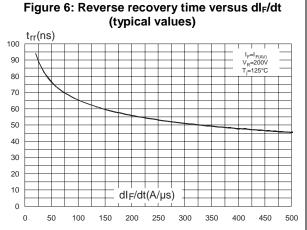


Figure 3: Relative variation of thermal impedance junction to case versus pulse duration (TO-220AC, D2PAK) 1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0.0 1.E-04 1.E-02 1.E-01 1.E+00 1.E-03







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 $dI_F/dt$  (A/ $\mu$ s)

450

(typical values)

Q<sub>rr</sub> (nC)

400

| I<sub>p</sub> = I<sub>p(N)</sub> | V<sub>p</sub> = 2000 | V<sub>p</sub> = 125 °C

300

250

200

150

100

50

0

0

50 100 150 200 250 300 350 400

Figure 7: Reverse recovery charges versus dl<sub>F</sub>/dt

Figure 8: Reverse recovery softness factor versus dl<sub>F</sub>/dt (typical values) I<sub>F</sub> < 2 x I<sub>F(AV)</sub> V<sub>R</sub> = 200 V T<sub>j</sub> = 125 °C 0.8 0.6 0.5 0.4 0.2  $dI_F/dt$  (A/µs) 0.0 100 250 300 350 400 450 0 150 200

Figure 9: Relative variation of dynamic parameters versus junction temperature

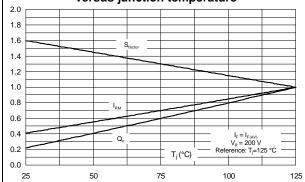


Figure 10: Transient peak forward voltage versus dlr/dt (typical values)

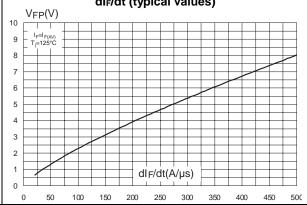


Figure 11: Forward recovery time versus dl<sub>F</sub>/dt (typical values)

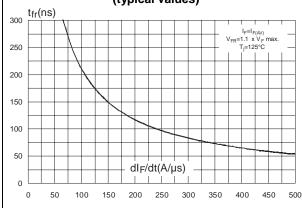
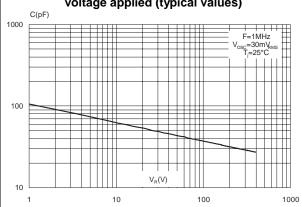
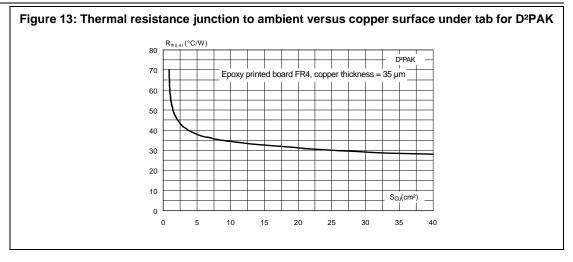


Figure 12: Junction capacitance versus reverse voltage applied (typical values)



Characteristics STTH20R04



STTH20R04 Package information

#### 2 Package information

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.

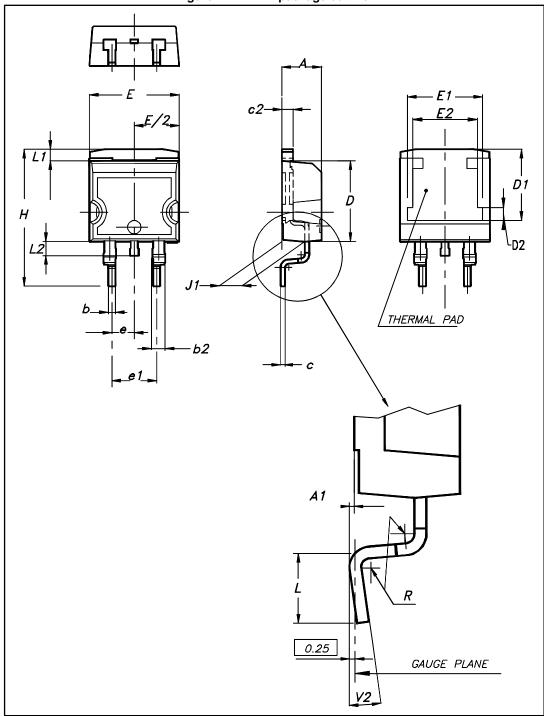
- Cooling method: by conduction (C)
- Epoxy meets UL94,V0
- Recommended torque value: 0.55 N.m (for TO-220AC and TO-220FPAC)
- Maximum torque value: 0.70 N.m (for TO-220AC and TO-220FPAC)



Package information STTH20R04

## 2.1 D<sup>2</sup>PAK package information

Figure 14: D<sup>2</sup>PAK package outline



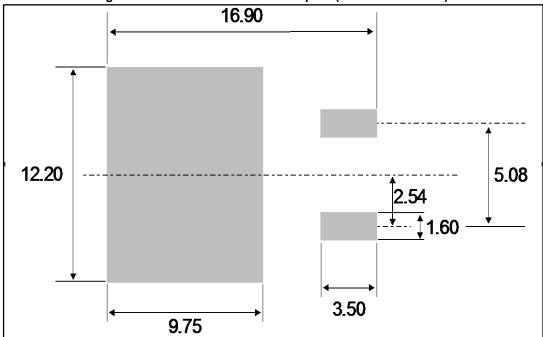
This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

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Table 6: D<sup>2</sup>PAK package mechanical data

Dimensions					
Ref.	Millin	neters	Inc	hes	
	Min.	Max.	Min.	Max.	
А	4.36	4.60	0.172	0.181	
A1	0.00	0.25	0.000	0.010	
b	0.70	0.93	0.028	0.037	
b2	1.14	1.70	0.045	0.067	
С	0.38	0.69	0.015	0.027	
c2	1.19	1.36	0.047	0.053	
D	8.60	9.35	0.339	0.368	
D1	6.90	8.00	0.272	0.311	
D2	1.10	1.50	0.043	0.060	
Е	10.00	10.55	0.394	0.415	
E1	8.10	8.90	0.319	0.346	
E2	6.85	7.25	0.266	0.282	
е	2.54	typ.	0.1	00	
e1	4.88	5.28	0.190	0.205	
Н	15.00	15.85	0.591	0.624	
J1	2.49	2.90	0.097	0.112	
L	1.90	2.79	0.075	0.110	
L1	1.27	1.65	0.049	0.065	
L2	1.30	1.78	0.050	0.070	
R	0.4	typ.	0.0	)15	
V2	0°	8°	0° 8°		

Figure 15: D<sup>2</sup>PAK recommended footprint (dimensions in mm)



STTH20R04 Package information

# 2.2 TO-220AC package information

Figure 16: TO-220AC package outline

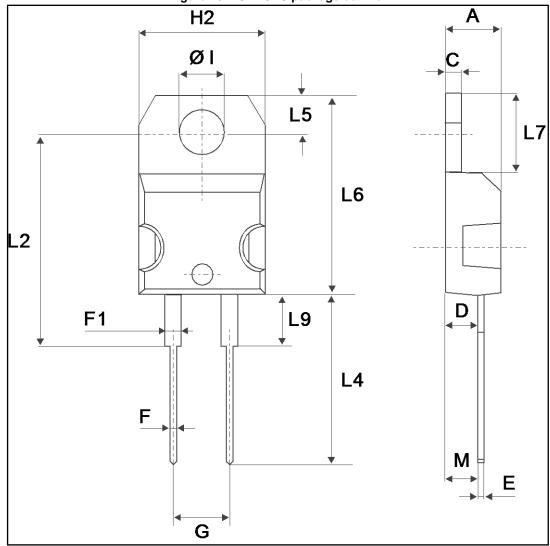


Table 7: TO-220AC package mechanical data

		Dimer	nsions	
Ref.	Millim	neters	Incl	nes
	Min.	Max.	Min.	Max.
Α	4.40	4.60	0.173	0.181
С	1.23	1.32	0.048	0.051
D	2.40	2.72	0.094	0.107
Е	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
М	2.6	2.6 typ.		2 typ.
ØI	3.75	3.85	0.147	0.151

STTH20R04 Package information

# 2.3 TO-220FPAC package information

Figure 17: TO-220FPAC package outline

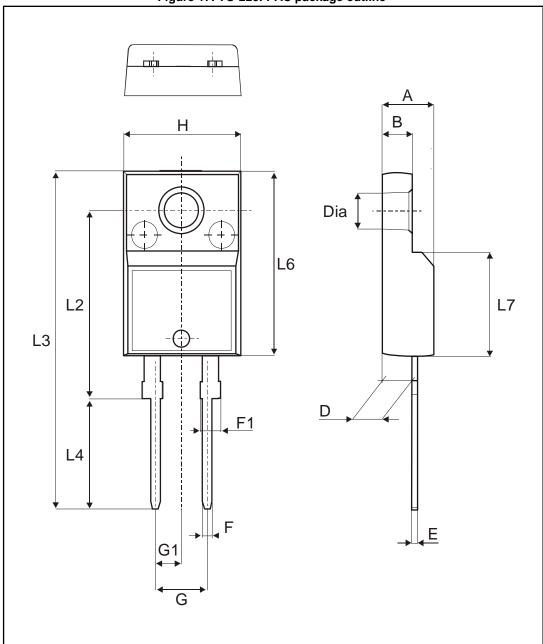


Table 8: TO-220FPAC package mechanical data

	Dimensions				
Ref.	Millim	neters	Incl	hes	
	Min.	Max.	Min.	Max.	
А	4.40	4.60	0.173	0.181	
В	2.50	2.70	0.098	0.106	
D	2.50	2.75	0.098	0.108	
Е	0.45	0.70	0.018	0.027	
F	0.75	1.00	0.030	0.039	
F1	1.15	1.70	0.045	0.067	
G	4.95	5.20	0.195	0.205	
G1	2.40	2.70	0.094	0.106	
Н	10.00	10.40	0.393	0.409	
L2	16.00	O typ.	0.630	) typ.	
L3	28.60	30.60	0.126	1.205	
L4	9.80	10.60	0.386	0.417	
L6	15.90	16.40	0.626	0.646	
L7	9.00	9.30	0.354	0.366	
Dia.	3.00	3.20	0.118	0.126	

STTH20R04 Ordering information

# 3 Ordering information

**Table 9: Ordering information** 

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STTH20R04G-TR	STTH20R04G	D <sup>2</sup> PAK	1.38 g	1000	Tape and reel
STTH20R04FP	STTH20R04FP	TO-220FPAC	1.90 g	50	Tube
STTH20R04D	STTH20R04D	TO-220AC	1.87 g	50	Tube

# 4 Revision history

**Table 10: Document revision history** 

Date	Revision	Changes
08-Nov-2007	1	First issue.
16-Aug-2017	2	Updated features and package silhouette. Updated Section 1: "Characteristics", Section 1.1: "Characteristics (curves)" and Section 3: "Ordering information".

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