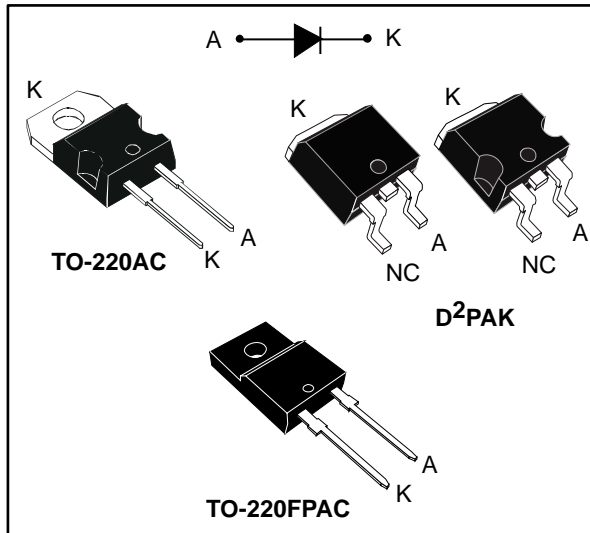


## High efficiency rectifier

Datasheet - production data


**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
$I_{F(AV)}$	20 A
$V_{RRM}$	400 V
$T_j$ (max.)	175 °C
$V_F$ (typ.)	1.15 V
$t_{rr}$ (typ.)	18 ns

**Features**

- Ultrafast recovery
- Low power losses
- High surge capability
- Low leakage current
- High junction temperature
- Insulated package: TO-220FPAC
  - insulating voltage: 2000  $V_{RMS}$  sine
- ECOPACK®2 compliant component for D²PAK on demand

# 1 Characteristics

**Table 2: 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>	Forward rms current			50	A
I <sub>F(peak)</sub>	Peak working forward current δ = 0.5, square wave	TO-220AC, D <sup>2</sup> PAK	T <sub>C</sub> = 135 °C	20	A
		TO-220FPAC	T <sub>C</sub> = 105 °C		
I <sub>FSM</sub>	Surge non repetitive forward current	t <sub>p</sub> = 10 ms sinusoidal		150	A
T <sub>stg</sub>	Storage temperature range			-65 to +175	°C
T <sub>j</sub>	Maximum operating junction temperature			175	°C

**Table 3: Thermal parameter**

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

**Table 4: Static electrical characteristics**

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I <sub>R</sub> <sup>(1)</sup>	Reverse leakage current	T <sub>j</sub> = 25 °C	V <sub>R</sub> = V <sub>RRM</sub>	-		20	μA
		T <sub>j</sub> = 125 °C		-	20	200	
V <sub>F</sub> <sup>(2)</sup>	Forward voltage drop	T <sub>j</sub> = 25 °C	I <sub>F</sub> = 20 A	-	1.50	1.70	V
		T <sub>j</sub> = 125 °C		-	1.15	1.35	

**Notes:**

(1)Pulse test: t<sub>p</sub> = 5 ms, δ < 2%

(2)Pulse test: t<sub>p</sub> = 380 μs, δ < 2%

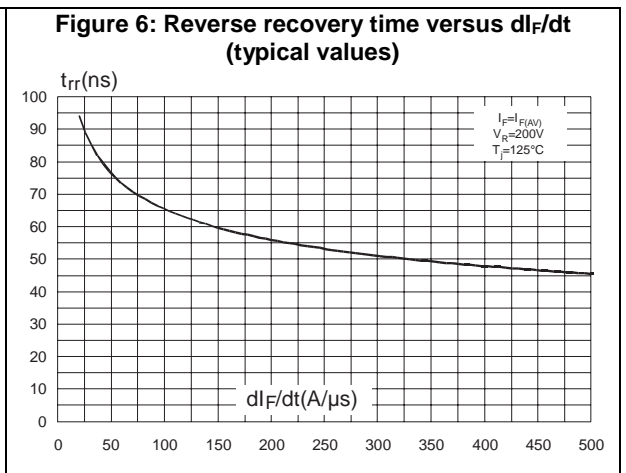
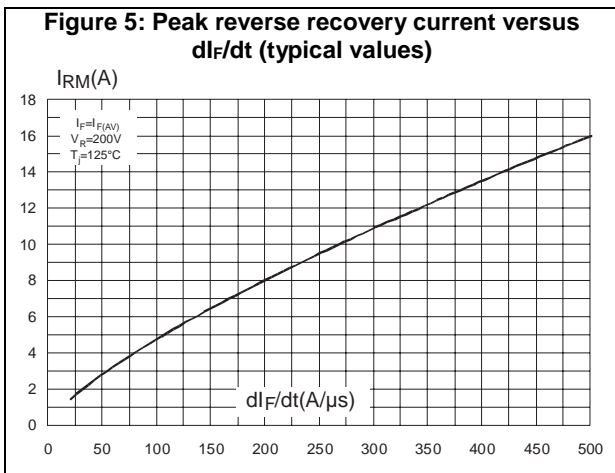
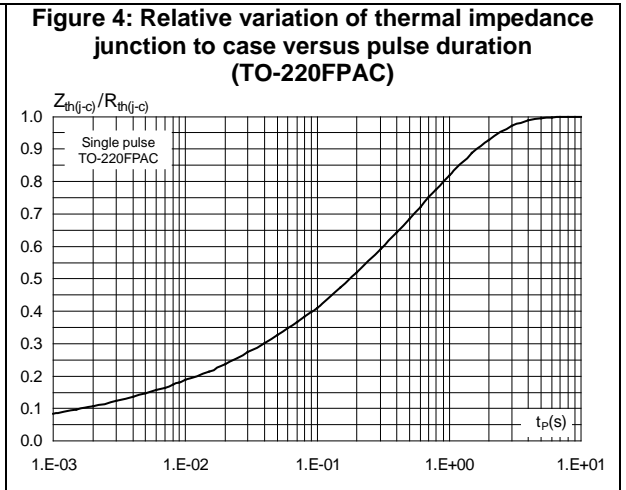
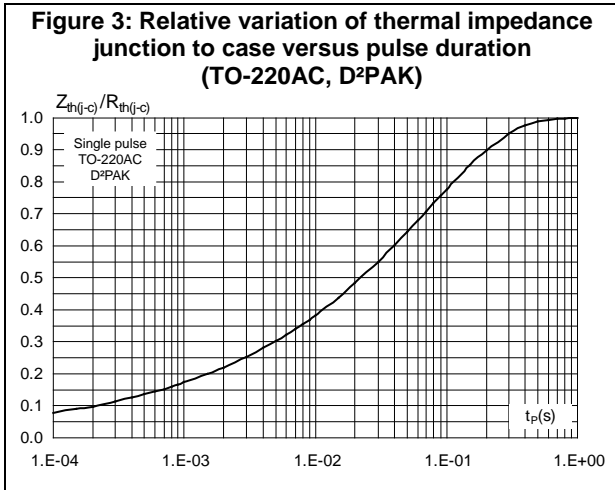
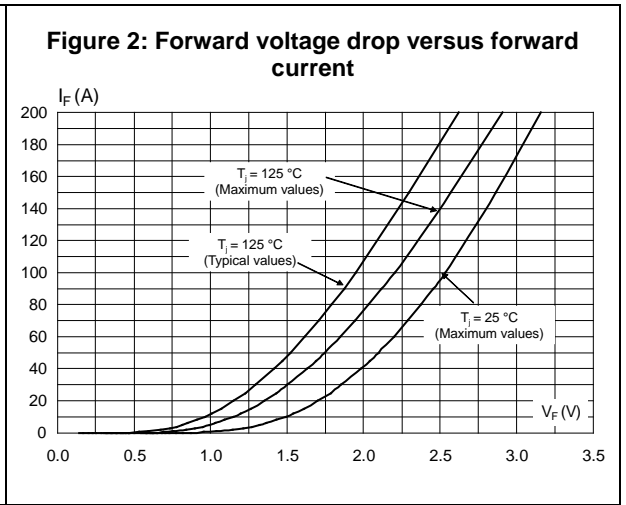
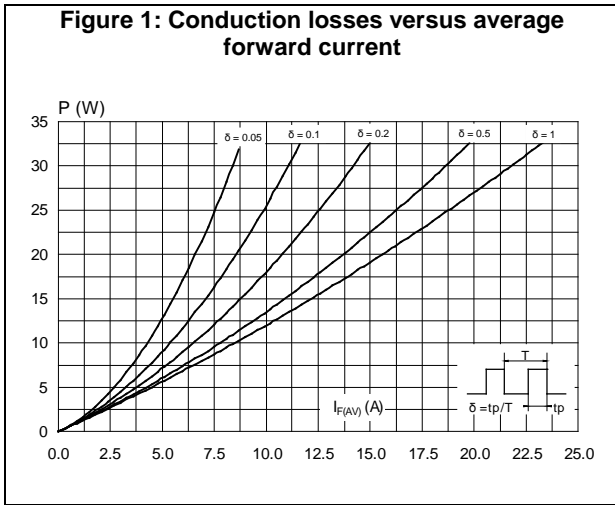
To evaluate the conduction losses use the following equation:

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

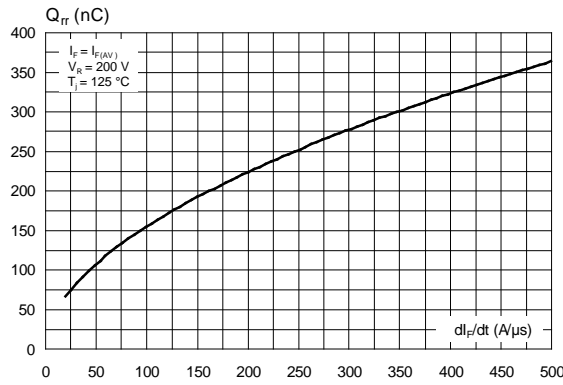
Table 5: Dynamic electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$t_{rr}$	Reverse recovery time	$T_j = 25\text{ °C}$	$I_F = 0.5\text{ A}$ , $I_{rr} = 0.25\text{ A}$ , $I_R = 1\text{ A}$	-	18	25	ns
			$I_F = 1\text{ A}$ , $V_R = 30\text{ V}$ , $di_F/dt = -50\text{ A}/\mu\text{s}$	-	35	45	
$t_{fr}$	Forward recovery time	$T_j = 25\text{ °C}$	$I_F = 20\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ $V_{FR} = 1.1 \times V_{Fmax}$	-		150	ns
$V_{FP}$	Forward recovery voltage		$I_F = 20\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$	-	1.7	2.5	V
$I_{RM}$	Reverse recovery current		$I_F = 20\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$	-	8	11	A
$S_{factor}$	Softness factor	$T_j = 125\text{ °C}$	$V_R = 200\text{ V}$	-	0.3		-

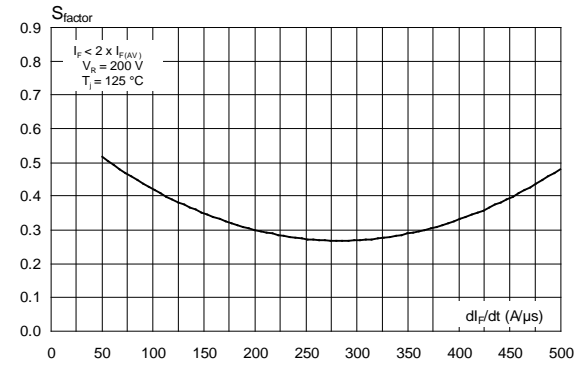
### 1.1 Characteristics (curves)



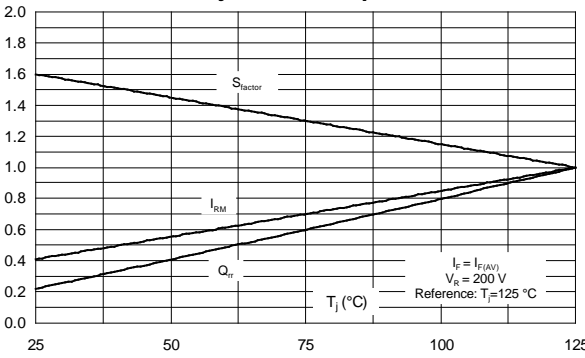
**Figure 7: Reverse recovery charges versus  $di_F/dt$  (typical values)**



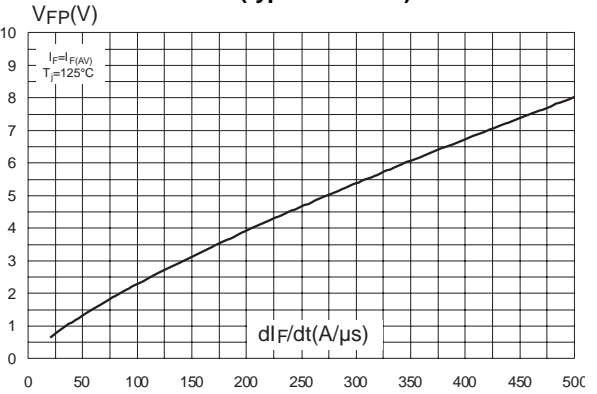
**Figure 8: Reverse recovery softness factor versus  $di_F/dt$  (typical values)**



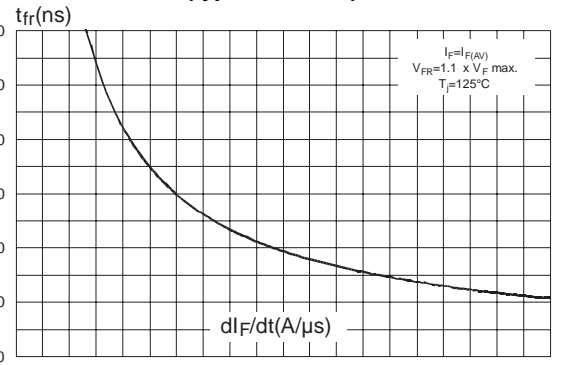
**Figure 9: Relative variation of dynamic parameters versus junction temperature**



**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)**

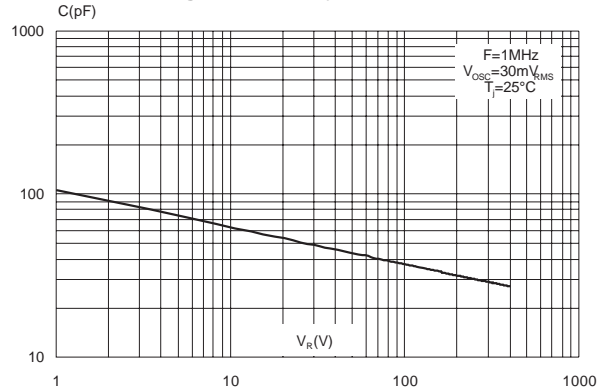
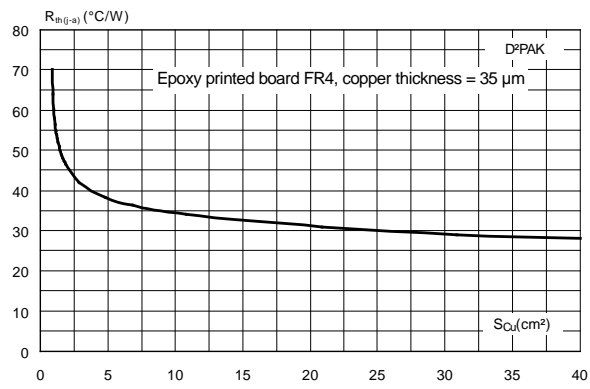


Figure 13: Thermal resistance junction to ambient versus copper surface under tab for D<sup>2</sup>PAK



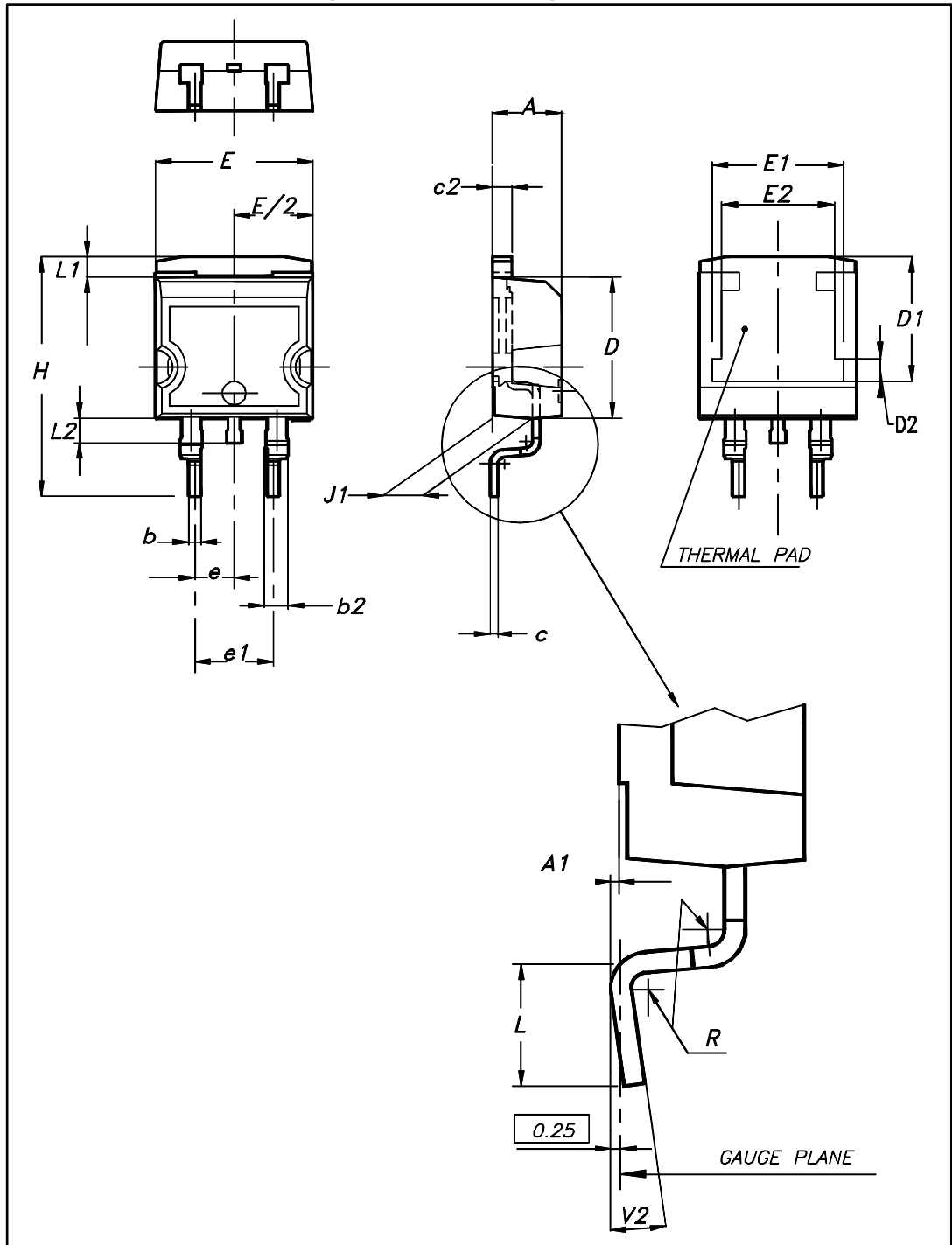
## 2 Package information

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](http://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)

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

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



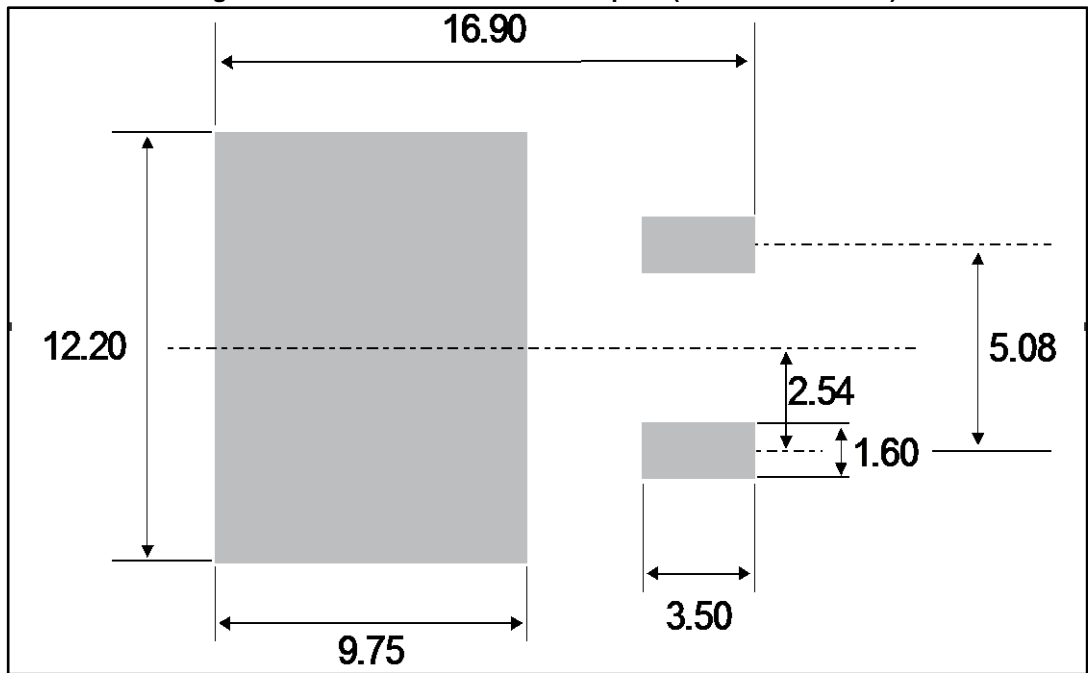
This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.



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

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	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
c	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
E	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
e	2.54 typ.		0.100	
e1	4.88	5.28	0.190	0.205
H	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.		0.015	
V2	0°	8°	0°	8°

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



## 2.2 TO-220AC package information

Figure 16: TO-220AC package outline

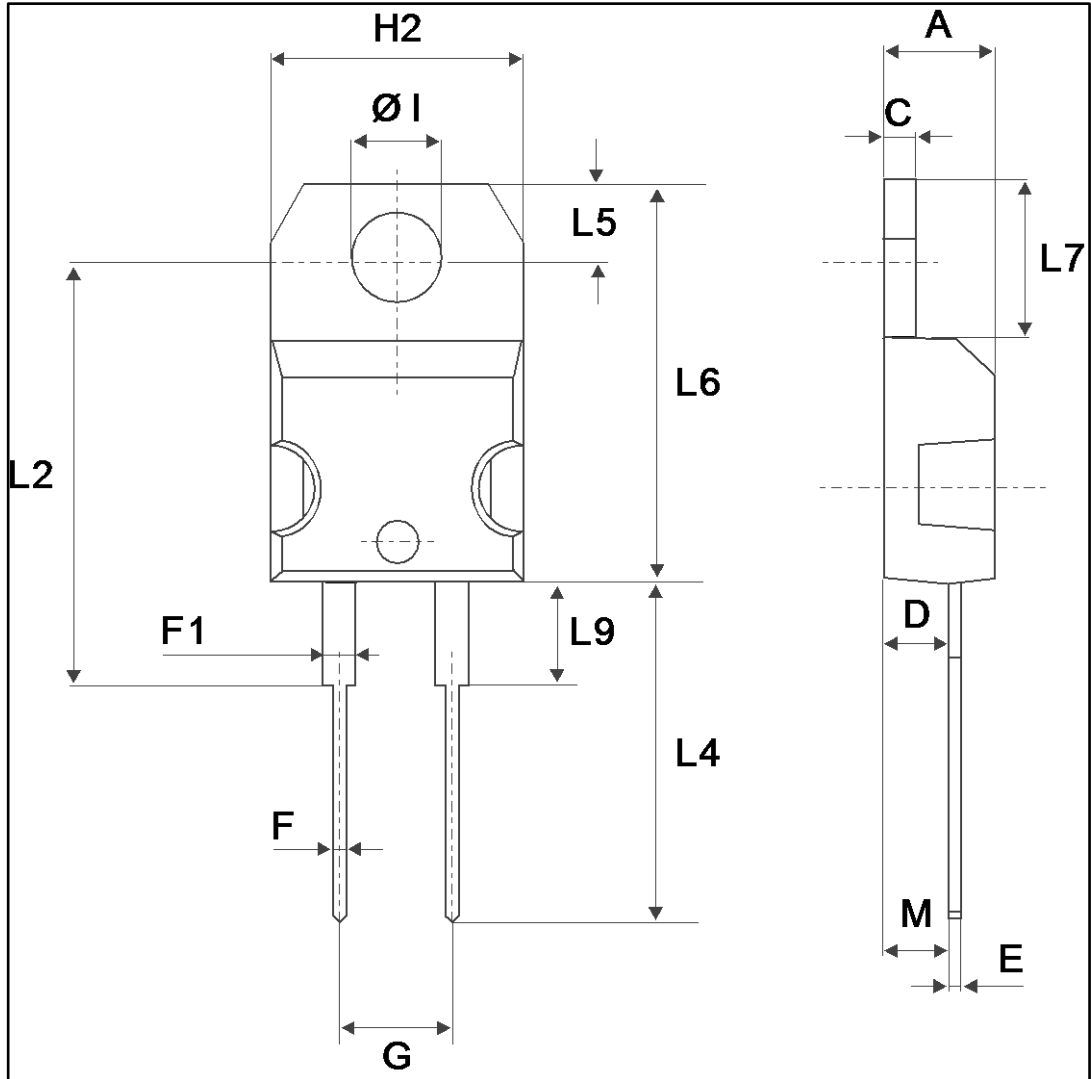


Table 7: TO-220AC package mechanical data

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.	
ØI	3.75	3.85	0.147	0.151

### 2.3 TO-220FPAC package information

Figure 17: TO-220FPAC package outline

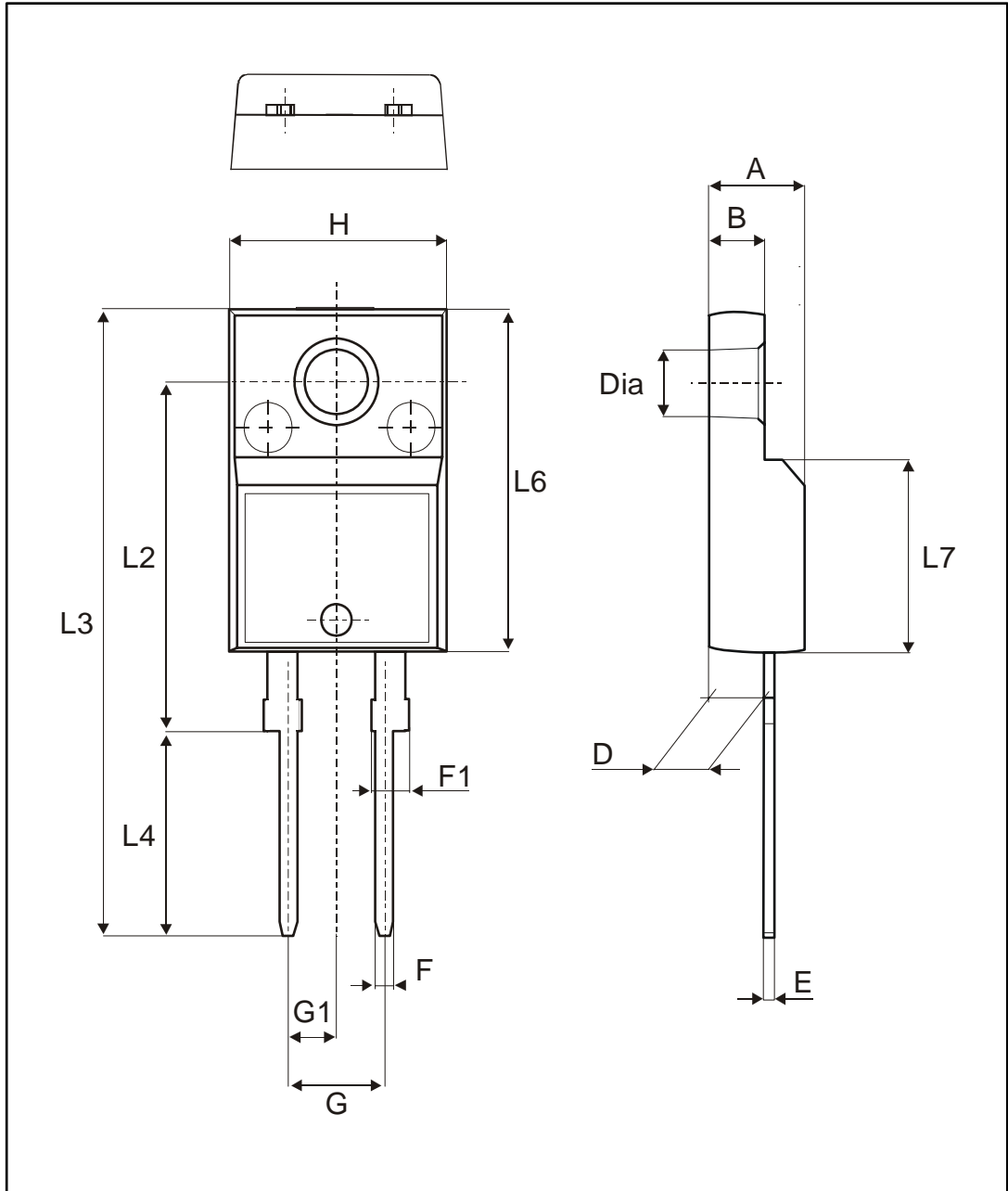


Table 8: TO-220FPAC package mechanical data

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
B	2.50	2.70	0.098	0.106
D	2.50	2.75	0.098	0.108
E	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
H	10.00	10.40	0.393	0.409
L2	16.00 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

### 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 <a href="#">Section 1: "Characteristics"</a> , <a href="#">Section 1.1: "Characteristics (curves)"</a> and <a href="#">Section 3: "Ordering information"</a> .

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