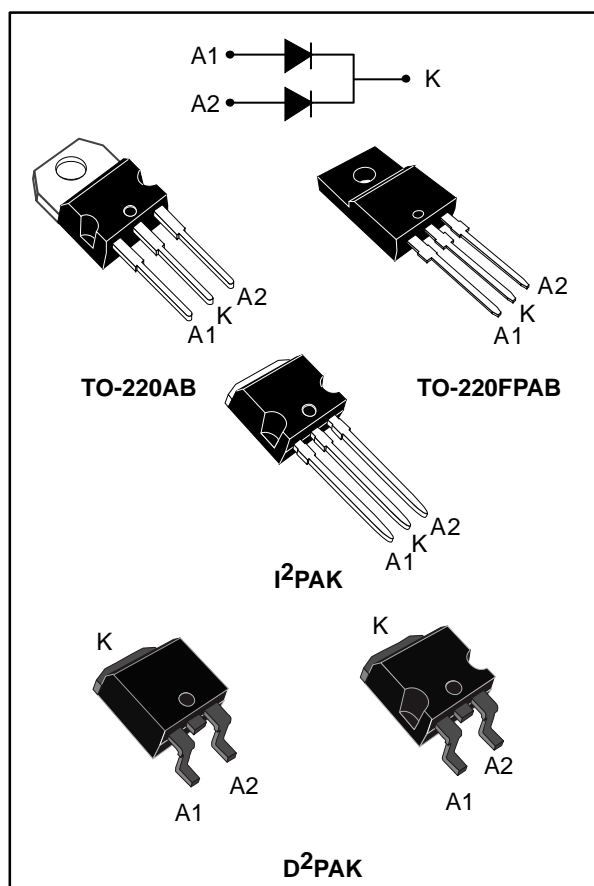


## High frequency secondary rectifier

Datasheet - production data



### Features

- Combines highest recovery and reverse voltage performance
- Ultra-fast, soft and noise-free recovery
- Insulated package: TO-220FPAB
  - Insulating voltage = 2000 V<sub>RMS</sub> sine
- ECOPACK<sup>®</sup>2 compliant component for D<sup>2</sup>PAK on demand

### 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 <sub>F(AV)</sub>	2 x 10 A
V <sub>RRM</sub>	300 V
T <sub>j</sub> (max)	175 °C
V <sub>F</sub> (typ)	0.85 V
t <sub>rr</sub> (max)	25 ns

# 1 Characteristics

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

Symbol	Parameter			Value	Unit	
V <sub>RRM</sub>	Repetitive peak reverse voltage			300	V	
I <sub>F(RMS)</sub>	Forward rms current			30	A	
I <sub>F(AV)</sub>	Average forward current $\delta = 0.5$ , square wave	TO-220AB, D <sup>2</sup> PAK, I <sup>2</sup> PAK	T <sub>C</sub> = 140 °C	Per diode	10	A
		TO-220FPAB	T <sub>C</sub> = 115 °C			
		All types	Per device	20		
I <sub>FSM</sub>	Surge non repetitive forward current	tp = 10 ms sinusoidal		110	A	
T <sub>stg</sub>	Storage temperature range			-65 to + 175	°C	
T <sub>j</sub>	Maximum operating junction temperature <sup>(1)</sup>			+ 175	°C	

**Notes:**

<sup>(1)</sup>(dP<sub>tot</sub>/dT<sub>j</sub>) < (1/R<sub>th(j-a)</sub>) condition to avoid thermal runaway for a diode on its own heatsink.

**Table 3: Thermal parameter**

Symbol	Parameter			Value	Unit
R <sub>th(j-c)</sub>	Junction to case	TO-220AB, D <sup>2</sup> PAK, I <sup>2</sup> PAK	Per diode	2.5	°C/W
		TO-220FPAB		4.6	
		TO-220AB, D <sup>2</sup> PAK, I <sup>2</sup> PAK	Total	1.3	
		TO-220FPAB		4	
R <sub>th(c)</sub>	Coupling	TO-220AB, D <sup>2</sup> PAK, I <sup>2</sup> PAK	-	0.1	°C/W
		TO-220FPAB		3.5	

When the diodes 1 and 2 are used simultaneously:

$$\Delta T_j (\text{diode1}) = P_{(\text{diode1})} \times R_{\text{th(j-c)}} (\text{per diode}) + P_{(\text{diode2})} \times R_{\text{th(c)}}$$

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

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> = 300 V	-		20	μA
		T <sub>j</sub> = 125 °C		-	30	300	
V <sub>F</sub> <sup>(2)</sup>	Forward voltage drop	T <sub>j</sub> = 25 °C	I <sub>F</sub> = 10 A	-		1.25	V
		T <sub>j</sub> = 125 °C		-	0.85	1	

**Notes:**

<sup>(1)</sup>Pulse test: tp = 5 ms,  $\delta < 2\%$

<sup>(2)</sup>Pulse test: tp = 380 μs,  $\delta < 2\%$

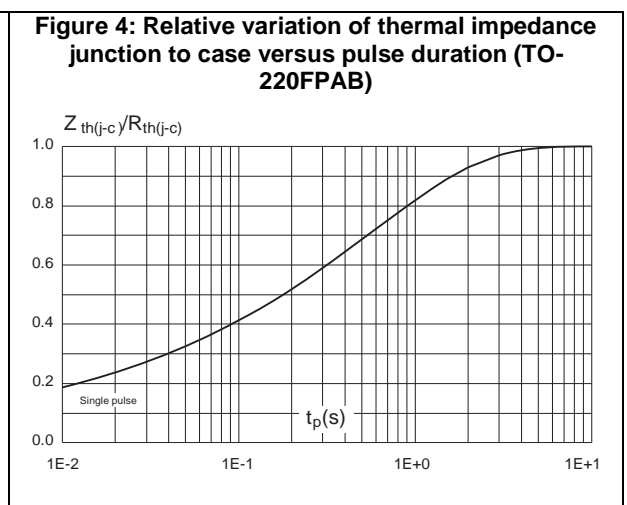
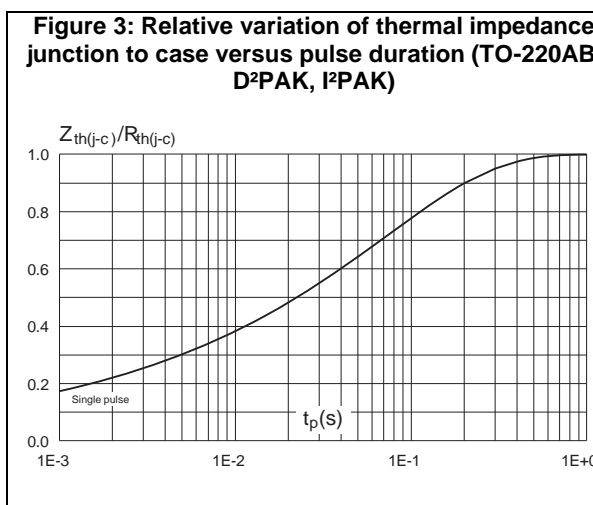
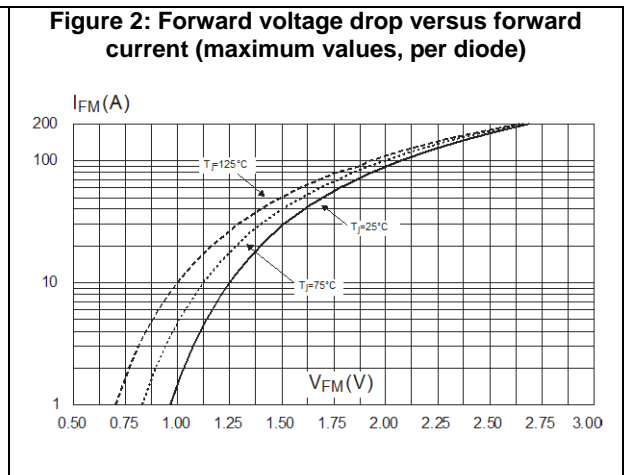
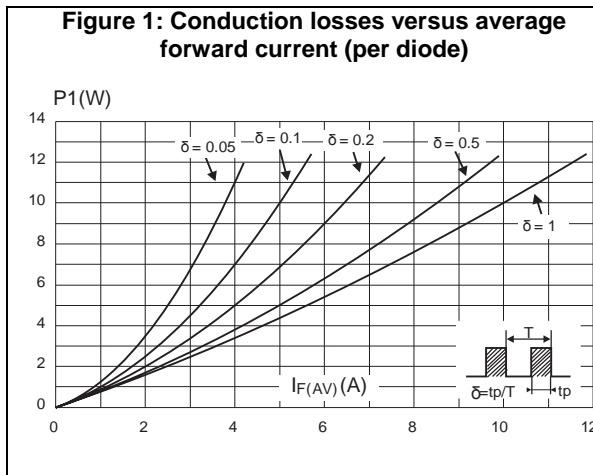
To evaluate the conduction losses use the following equation:

$$P = 0.75 \times I_{F(AV)} + 0.025 I_{F(RMS)}^2$$

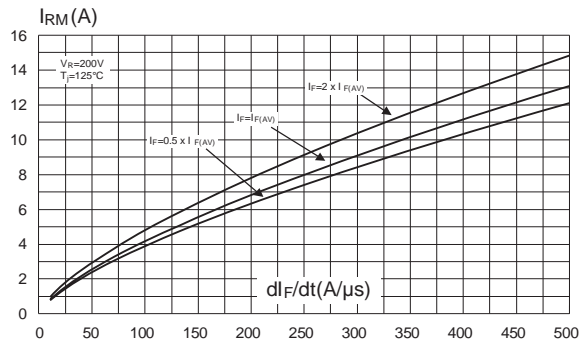
Table 5: Recovery characteristics (per diode)

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
			$I_F = 1\text{ A}, V_R = 30\text{ V}, dI_F/dt = -50\text{ A}/\mu\text{s}$	-		35	
$t_{fr}$	Forward recovery time	$T_j = 25^\circ\text{C}$	$I_F = 10\text{ A}, V_{FR} = 1.1 \times V_{Fmax}, dI_F/dt = 100\text{ A}/\mu\text{s}$	-		230	ns
$V_{FP}$	Peak forward voltage	$T_j = 25^\circ\text{C}$	$I_F = 10\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}$	-		3.5	V
$I_{RM}$	Reverse recovery current	$T_j = 125^\circ\text{C}$	$I_F = 10\text{ A}, V_{CC} = 200\text{ V}, dI_F/dt = 200\text{ A}/\mu\text{s}$	-		8	A
S factor	Softness factor			-	0.3		-

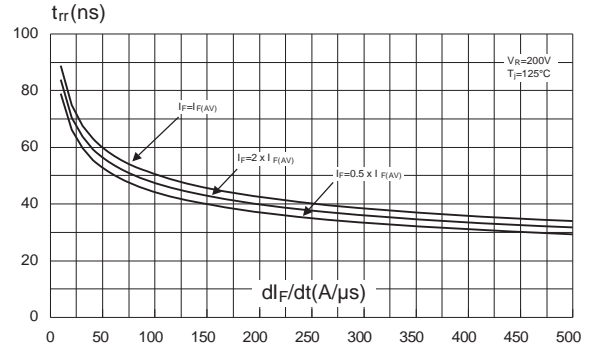
### 1.1 Characteristics (curves)



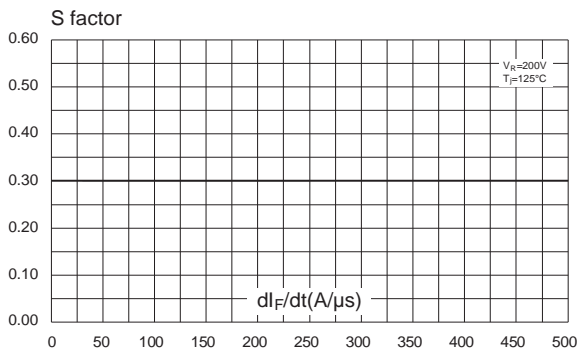
**Figure 5: Peak reverse recovery current versus dI<sub>F</sub>/dt (typical values, per diode)**



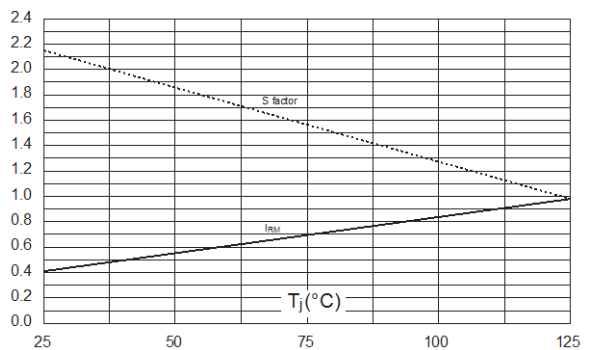
**Figure 6: Reverse recovery time versus dI<sub>F</sub>/dt (typical values, per diode)**



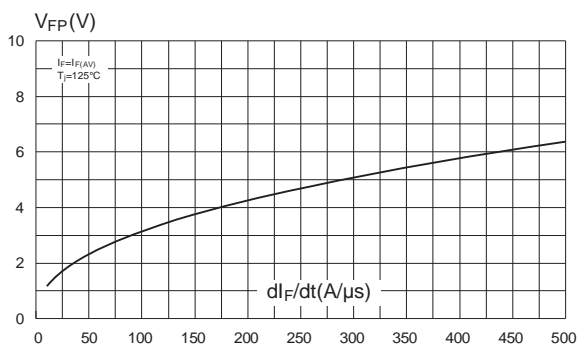
**Figure 7: Softness factor versus dI<sub>F</sub>/dt (typical values, per diode)**



**Figure 8: Relative variation of dynamic parameters versus junction temperature (reference: T<sub>J</sub> = 125 °C)**



**Figure 9: Transient peak forward voltage versus dI<sub>F</sub>/dt (typical values, per diode) (TO-220AB)**



**Figure 10: Forward recovery time versus dI<sub>F</sub>/dt (typical values, per diode)**

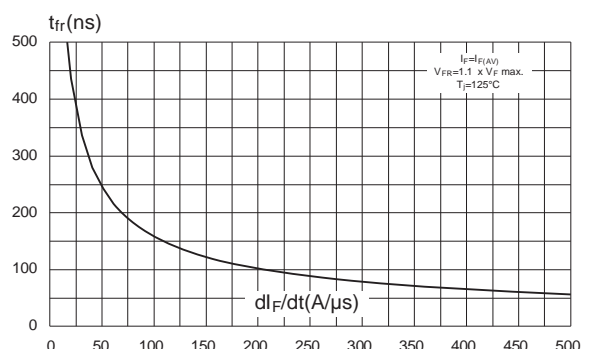


Figure 11: Thermal resistance, junction to ambient, versus copper surface under tab (epoxy printed board FR4, eCu = 35µm) (D<sup>2</sup>PAK)

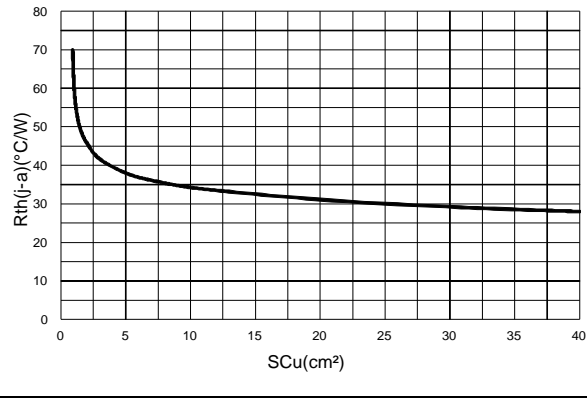
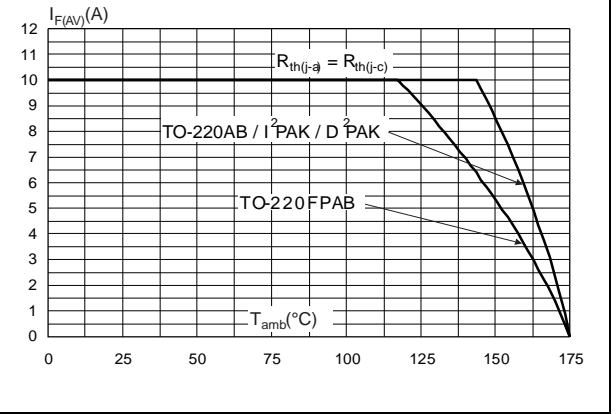


Figure 12: Average forward current versus ambient temperature (δ = 0.5, per diode)



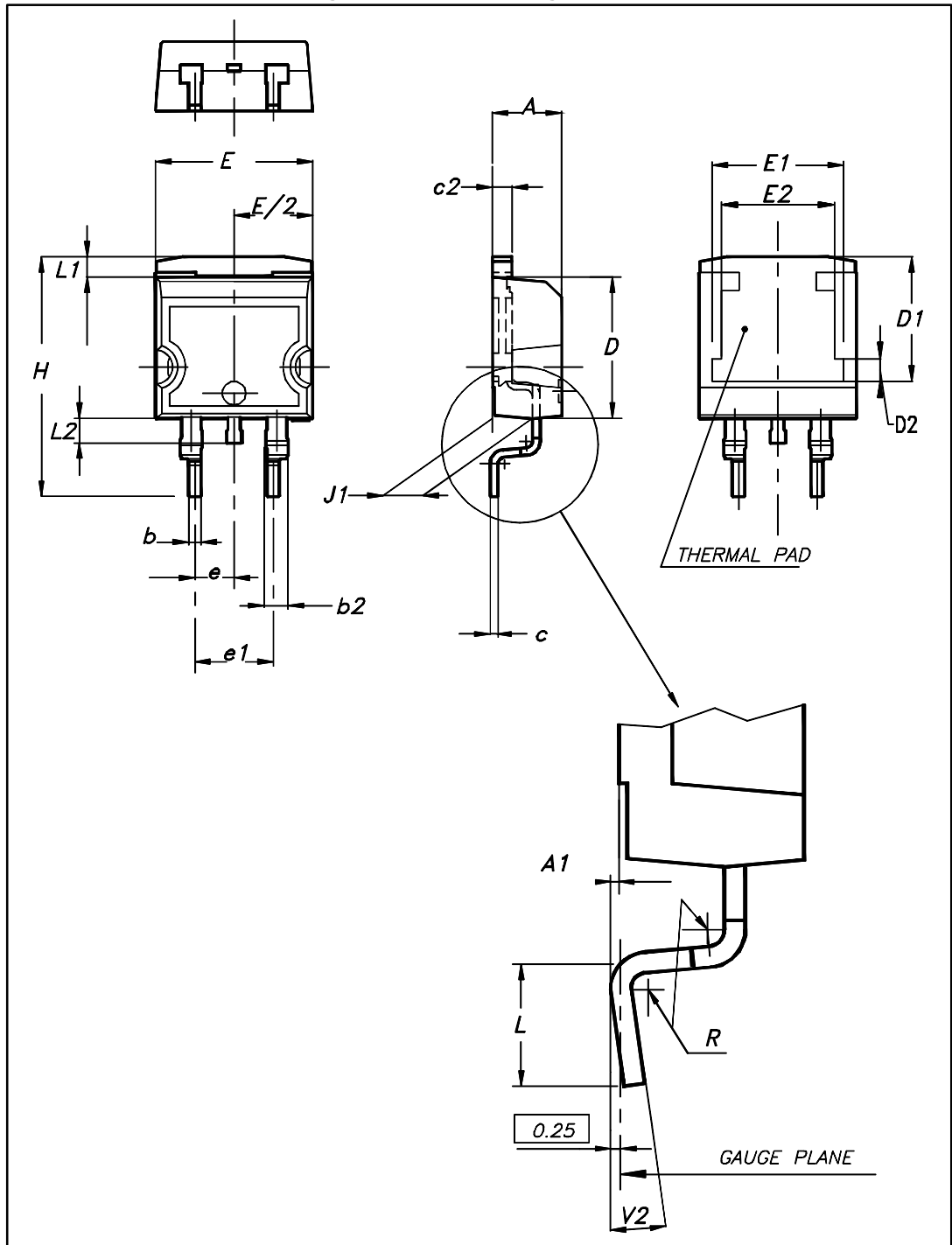
## 2 Package information

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 UL 94,V0
- Recommended torque value: 0.55 N·m (for TO-220AB and TO-220FPAB)
- Maximum torque value: 0.7 N·m (for TO-220AB and TO-220FPAB)

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

Figure 13: D<sup>2</sup>PAK package outline

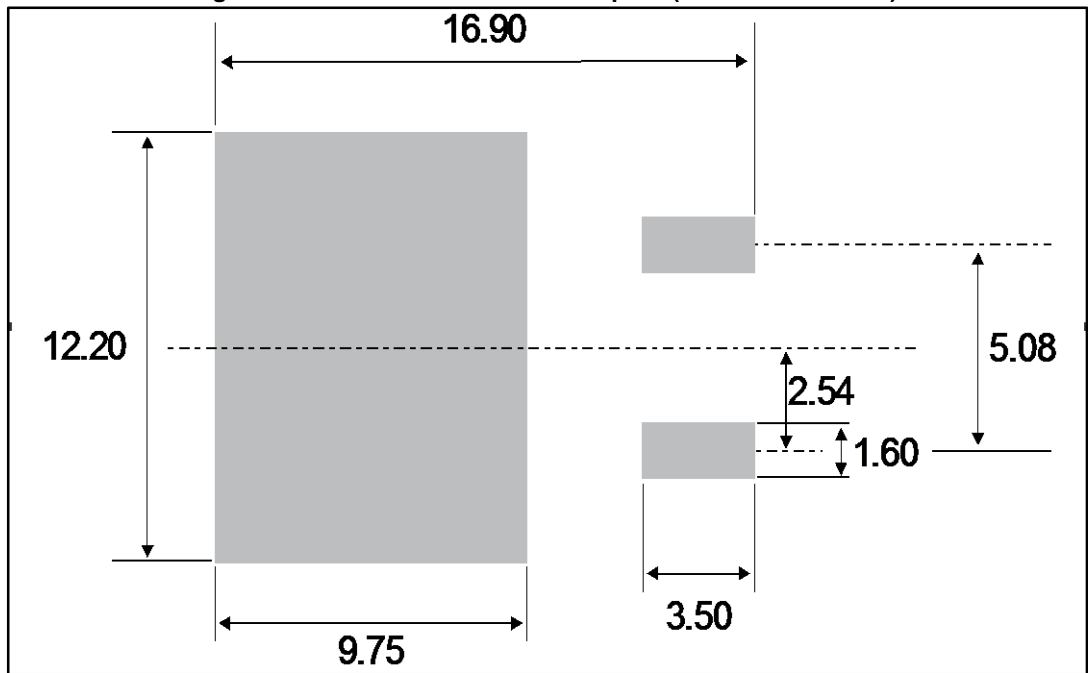


This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

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



## 2.2 I<sup>2</sup>PAK package information

Figure 15: I<sup>2</sup>PAK package outline

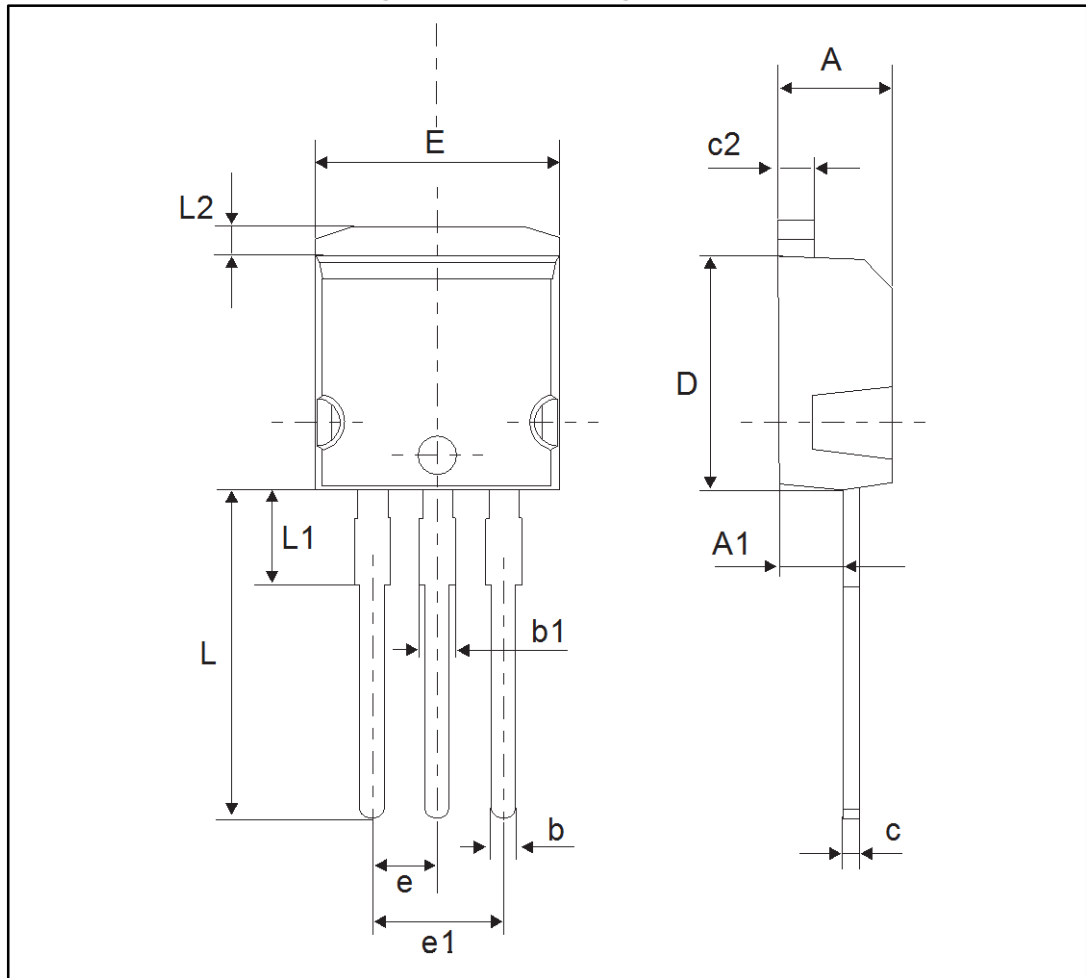


Table 7: I<sup>2</sup>PAK package mechanical data

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
F	0.75	1.0	0.03	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	2.40	2.70	0.094	0.106
H	10.00	10.40	0.393	0.409
L2	16.00 typ.		0.63 typ.	
L3	28.60	30.60	1.126	1.205
L4	9.80	10.6	0.386	0.417
L5	2.90	3.60	0.114	0.142
L6	15.90	16.40	0.626	0.646
L7	9.00	9.30	0.354	0.366
Dia	3.0	3.20	0.118	0.126

Mounting (soldering) the I<sup>2</sup>PAK metal slug (heatsink) with alloy, like a surface mount device, IS NOT PERMITTED. A standard through-hole mounting is mandatory.

### 2.3 TO-220AB package information

Figure 16: TO-220AB package outline

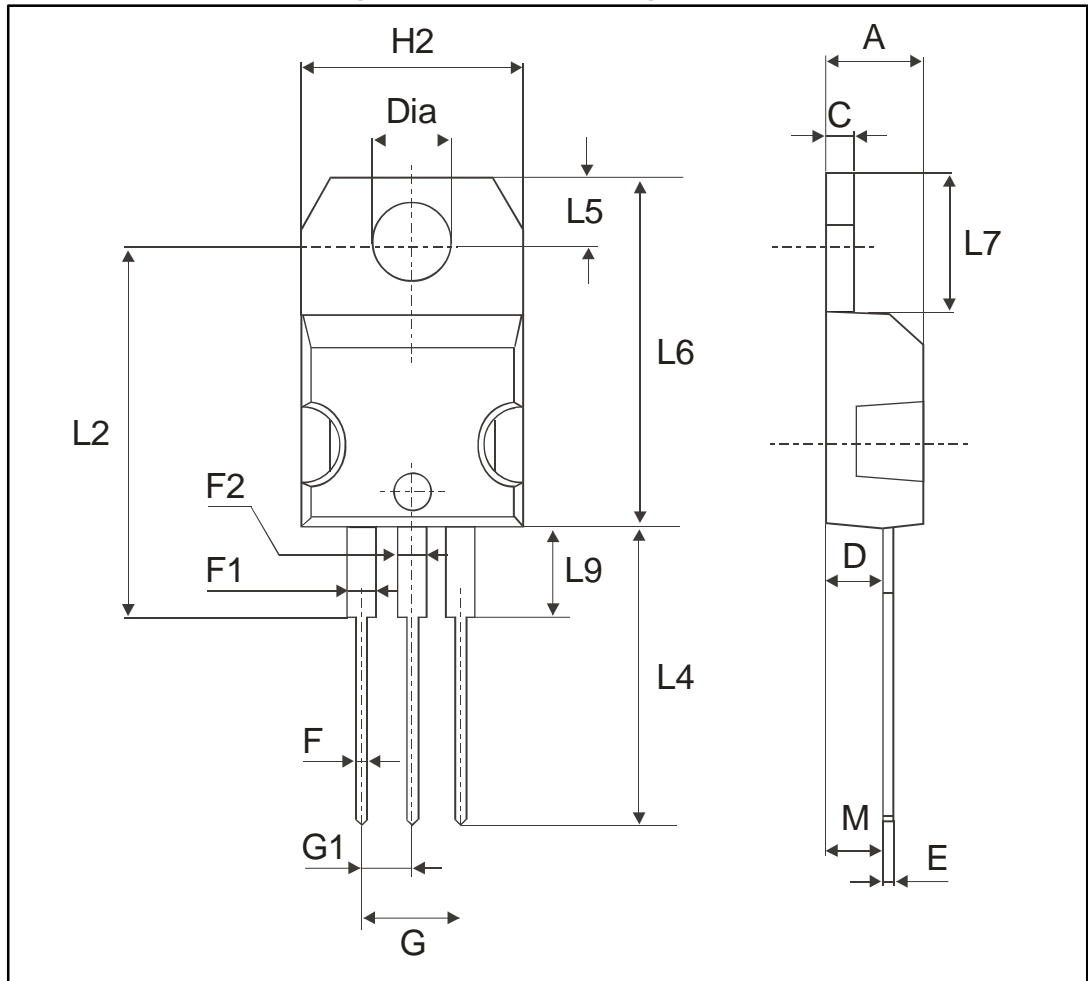


Table 8: TO-220AB package mechanical data

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
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	10.00	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	3.75	3.85	0.147	0.151

## 2.4 TO-220FPAB package information

Figure 17: TO-220FPAB package outline

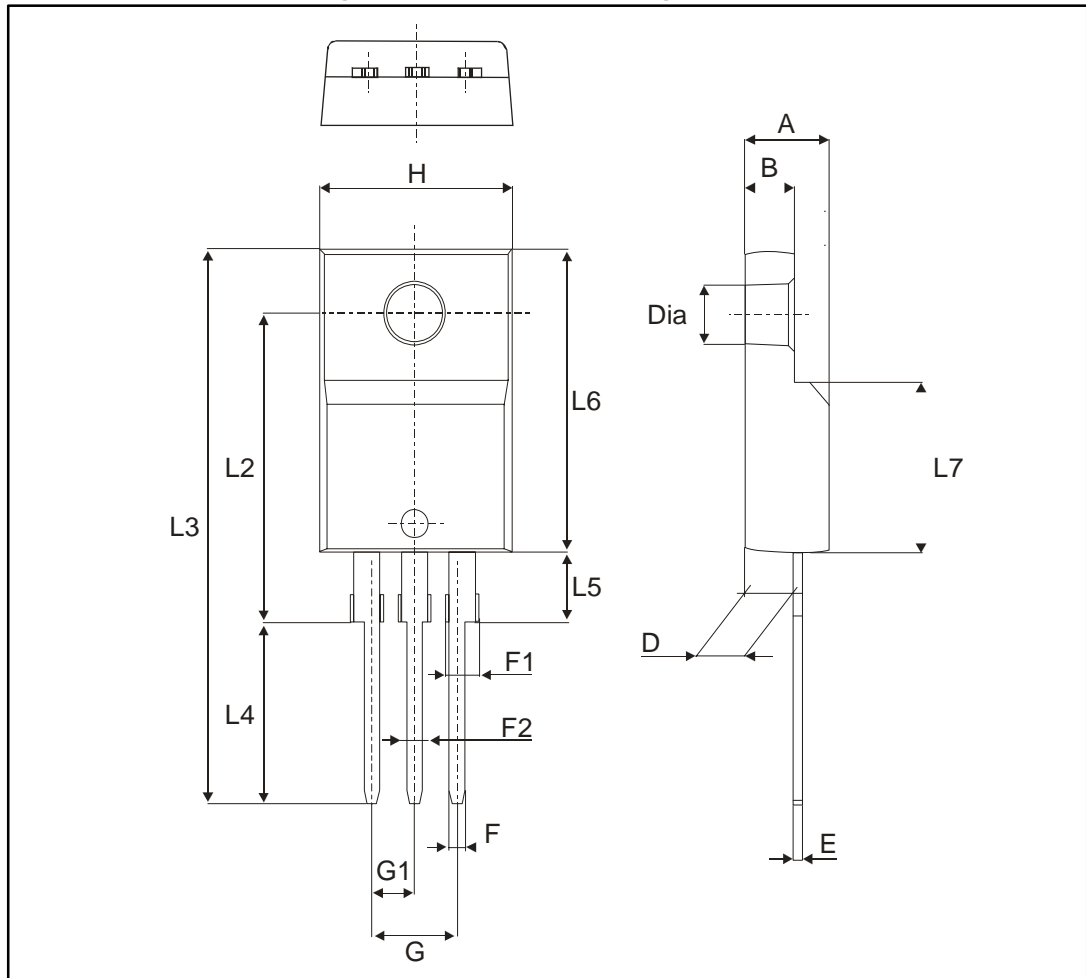


Table 9: TO-220FPAB package mechanical data

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
B	2.5	2.7	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	1.0	0.03	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	2.40	2.70	0.094	0.106
H	10.00	10.40	0.393	0.409
L2	16.00 typ.		0.63 typ.	
L3	28.60	30.60	1.126	1.205
L4	9.80	10.6	0.386	0.417
L5	2.90	3.60	0.114	0.142
L6	15.90	16.40	0.626	0.646
L7	9.00	9.30	0.354	0.366
Dia	3.0	3.20	0.118	0.126

### 3 Ordering information

Table 10: Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
STTH2003CT	STTH2003CT	TO-220AB	1.95g	50	Tube
STTH2003CG	STTH2003CG	D <sup>2</sup> PAK	1.38g	50	Tube
STTH2003CG-TR	STTH2003CG	D <sup>2</sup> PAK	1.38g	1000	Tape and reel
STTH2003CFP	STTH2003CFP	TO-220FPAB	1.9g	50	Tube
STTH2003CR	STTH2003CR	I <sup>2</sup> PAK	1.5g	50	Tube

### 4 Revision history

Table 11: Document revision history

Date	Revision	Changes
Aug-2003	7G	Previous release
26-Mar-2007	8	Removed ISOWATT package
11-Feb-2011	9	Updated base quantity for tape and reel delivery. Corrected temperature in Table 1. Added warning paragraph above Table 7.
06-Sep-2011	10	Updated Table 2. Added Figure 12
28-May-2015	11	Updated features, <a href="#">Table 1: "Device summary"</a> and packages silhouette in cover page. Updated <a href="#">Section 1: "Characteristics"</a> . Updated <a href="#">Section 2.2: "D<sup>2</sup>PAK package information"</a> .

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