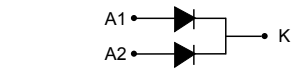
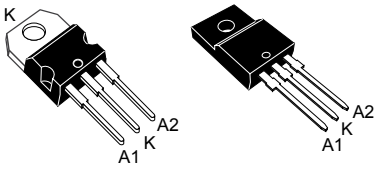
STTH2003

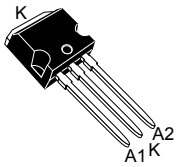
Datasheet

300 V ultrafast rectifier

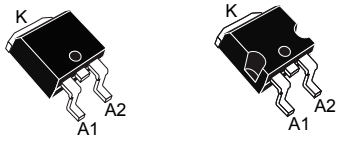




TO-220AB TO-220FPAB



I²PAK



D²PAK

Product status
STTH2003

Product summary	
$I_{F(AV)}$	2 x 10 A
V_{RRM}	300 V
T_j (max.)	175 °C
V_F (typ.)	0.85 V
t_{rr} (max.)	25 ns

Features

- Combines highest recovery and reverse voltage performance
- Ultra-fast, soft and noise-free recovery
- Insulated package: TO-220FPAB
  - Insulating voltage = 2000 V_{RMS} sine
- ECOPACK®2 compliant component for D²PAK on demand

Applications

- Secondary rectification
- Switching diode
- Telecom power supply
- DC/DC converter

Description

The STTH2003 is a 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, I²PAK or D²PAK, this device is especially intended for secondary rectification.

1 Characteristics

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

Symbol	Parameter				Value	Unit
V_{RRM}	Repetitive peak reverse voltage				300	V
$I_{F(RMS)}$	Forward rms current				30	A
$I_{F(AV)}$	Average forward current δ = 0.5, square wave	TO-220AB, D²PAK, I²PAK	T_C = 140 °C	Per diode	10	A
		TO-220FPAB	T_C = 115 °C			
		All types	Per device		20	
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal			110	A
T_{stg}	Storage temperature range				-65 to +175	°C
T_j	Maximum operating junction temperature				175	°C

Table 2. Thermal resistance parameters

Symbol	Parameter			Value	Unit
$R_{th(j-c)}$	Junction to case	TO-220AB, D²PAK, I²PAK	Per diode	2.5	°C/W
		TO-220FPAB		4.6	
		TO-220AB, D²PAK, I²PAK	Total	1.3	
		TO-220FPAB		4.0	
$R_{th(c)}$	Coupling	TO-220AB, D²PAK, I²PAK		0.1	°C/W
		TO-220FPAB		3.5	

For more information, please refer to the following application note:

- AN5088: Rectifiers thermal management, handling and mounting recommendations

When the diodes 1 and 2 are used simultaneously:

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

Table 3. Static electrical characteristics (per diode)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_R (1)	Reverse leakage current	T_j = 25 °C	V_R = 300 V	-		20	µA
		T_j = 125 °C		-	30	300	
V_F (2)	Forward voltage drop	T_j = 25 °C	I_F = 10 A	-		1.25	V
		T_j = 125 °C		-	0.85	1.0	

1. *Pulse test: t_p = 5 ms, δ < 2%*
2. *Pulse test: t_p = 380 µs, δ < 2%*

To evaluate the conduction losses, use the following equation:

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

For more information, please refer to the following application notes related to the power losses:

- AN604: Calculation of conduction losses in a power rectifier
- AN4021: Calculation of reverse losses in a power diode

Table 4. Recovery characteristics (per diode)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
t_{rr}	Reverse recovery time	T_j = 25 °C	I_F = 0.5 A, I_{rr} = 0.25 A, I_R = 1 A	-		25	ns
			I_F = 1 A, V_R = 30 V,dI_F/dt = -50 A/µs	-		35	
t_{fr}	Forward recovery time	T_j = 25 °C	I_F = 10 A, V_{FR} = 1.1 x V_{Fmax}, dI_F/dt = 100 A/µs	-		230	ns
V_{FP}	Peak forward voltage	T_j = 25 °C	I_F = 10 A, dI_F/dt = 100 A/µs	-		3.5	V
I_{RM}	Reverse recovery current	T_j = 125 °C	I_F = 10 A, V_{CC} = 200 V, dI_F/dt = -200 A/µs	-		8	A
S factor	Softness factor			-	0.3		-

1.1 Characteristics (curves)

Figure 1. Conduction losses versus average forward current (per diode)

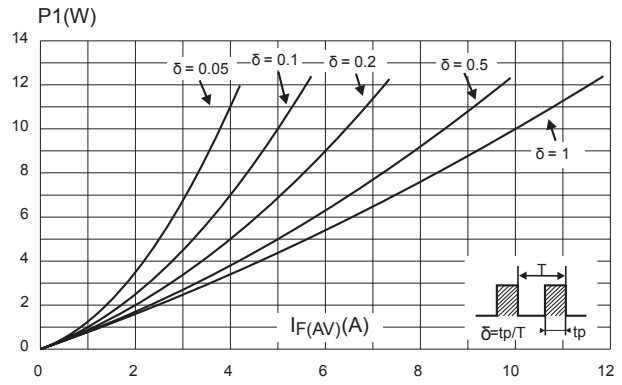


Figure 2. Forward voltage drop versus forward current (maximum values, per diode)

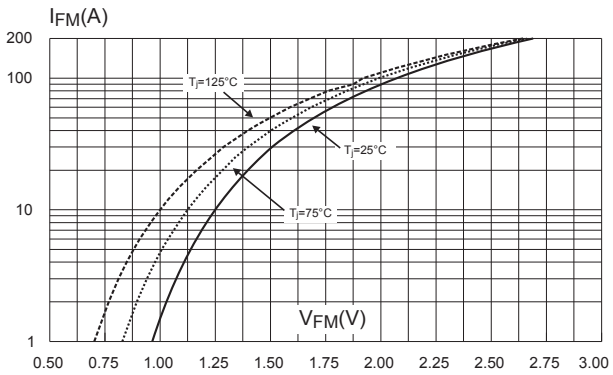


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration (TO-220AB, D²PAK, I²PAK)

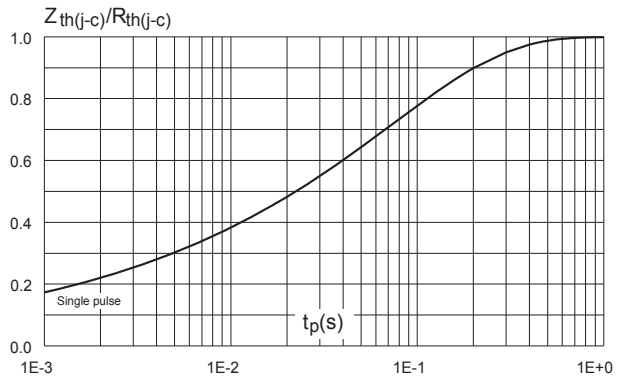


Figure 4. Relative variation of thermal impedance junction to case versus pulse duration (TO-220FPAB)

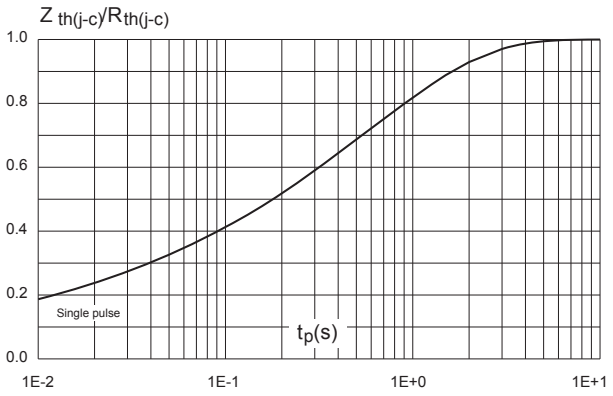


Figure 5. Peak reverse recovery current versus dI_F/dt (typical values, per diode)

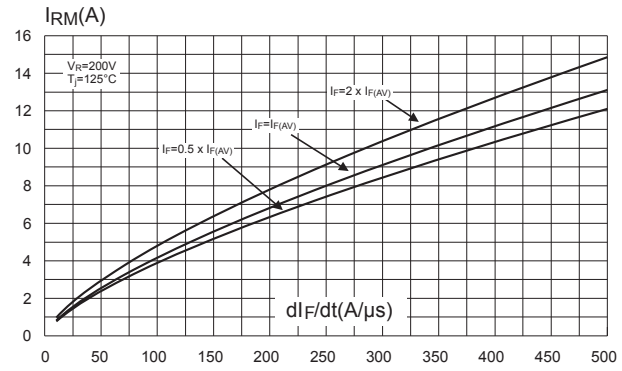


Figure 6. Reverse recovery time versus dI_F/dt (typical values, per diode)

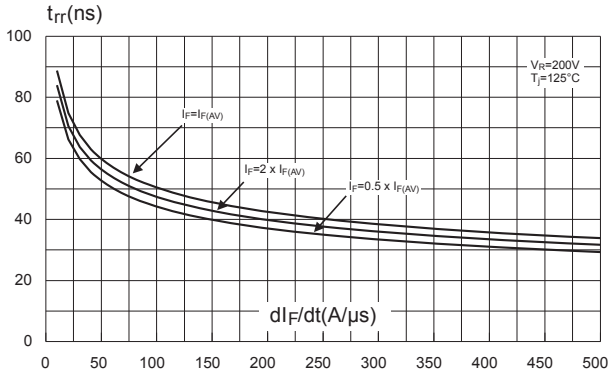


Figure 7. Softness factor versus dI_F/dt (typical values, per diode)

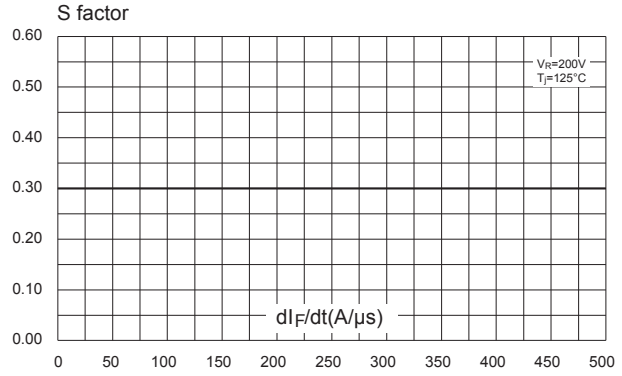


Figure 8. Relative variation of dynamic parameters versus junction temperature (reference: T_j = 125 °C)

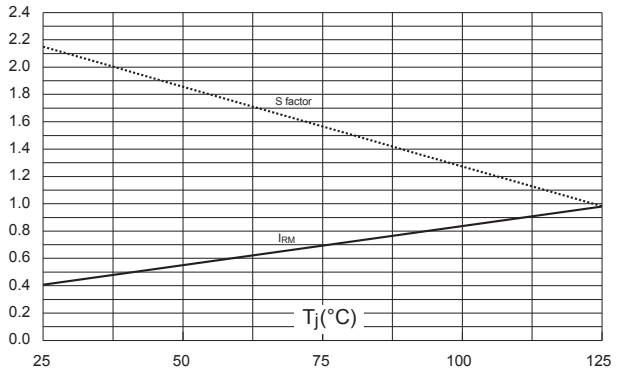


Figure 9. Transient peak forward voltage versus dI_F/dt (typical values, per diode) (TO-220AB)

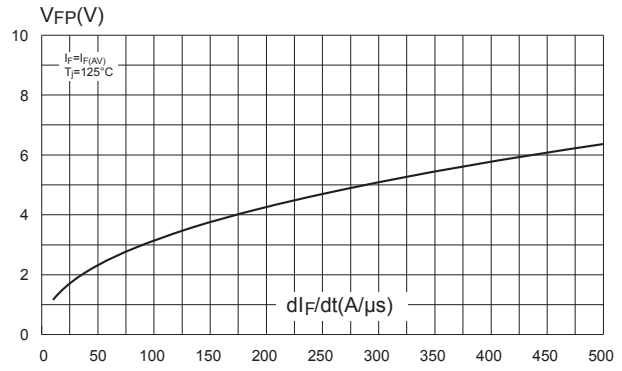


Figure 10. Forward recovery time versus dI_F/dt (typical values, per diode)

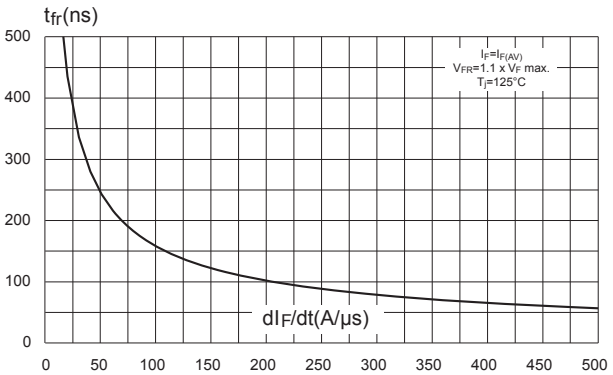


Figure 11. Thermal resistance, junction to ambient, versus copper surface under tab (epoxy printed board FR4, e_{Cu} = 35µm) (D²PAK)

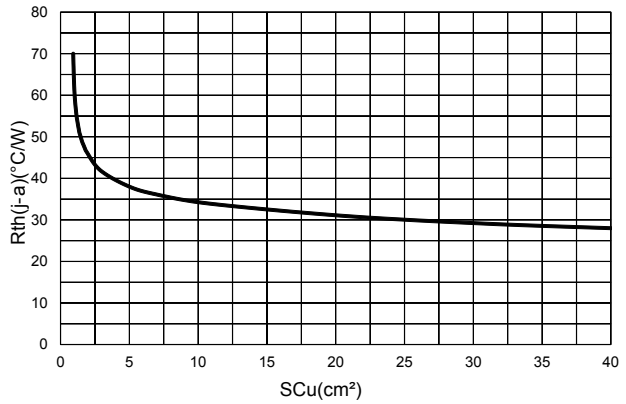
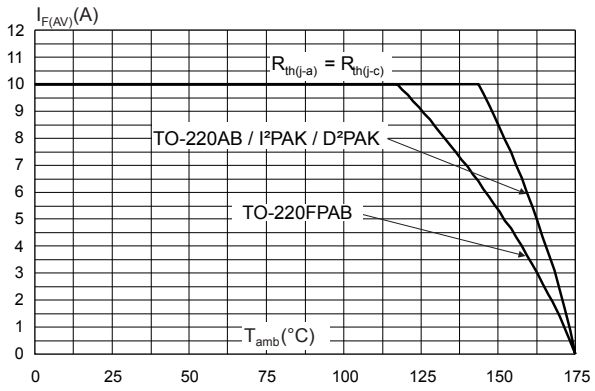


Figure 12. Average forward current versus ambient temperature (δ = 0.5, per diode)



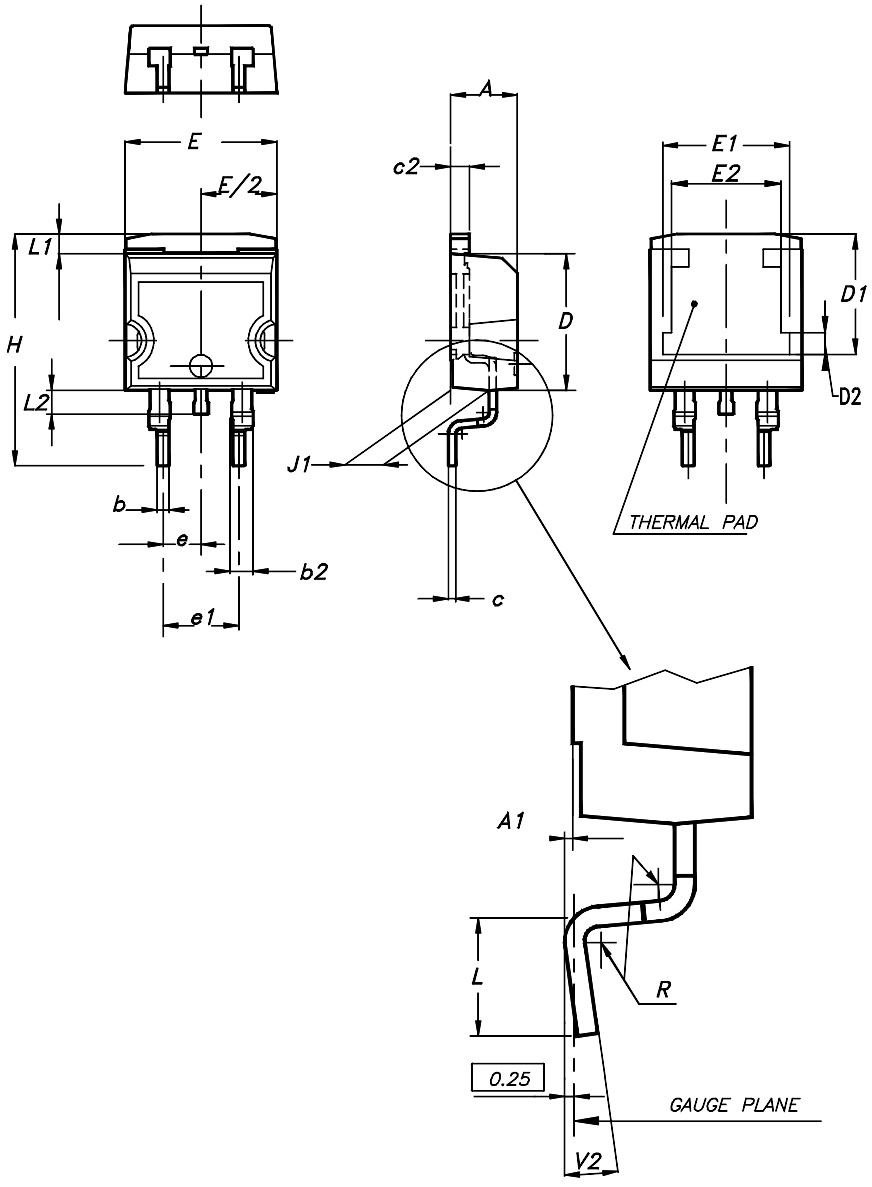
2 Package information

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. ECOPACK® is an ST trademark.

2.1 D²PAK package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)

Figure 13. D²PAK package outline

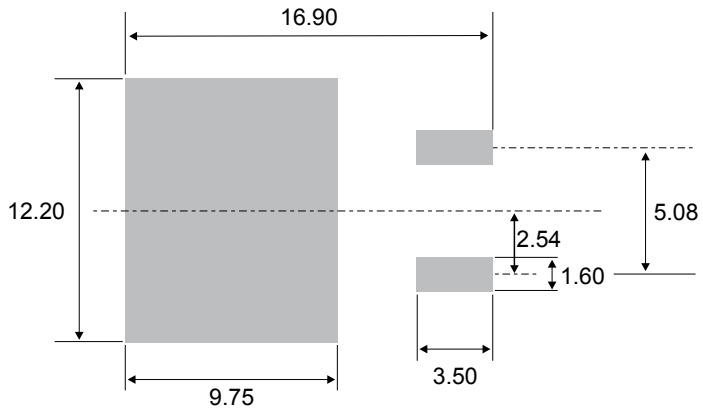


Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 5. D²PAK package mechanical data

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	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. D²PAK recommended footprint (dimensions in mm)



2.2 I²PAK package information

- Epoxy meets UL 94,V0
- Cooling method: by conduction (C)

Figure 15. I²PAK package outline

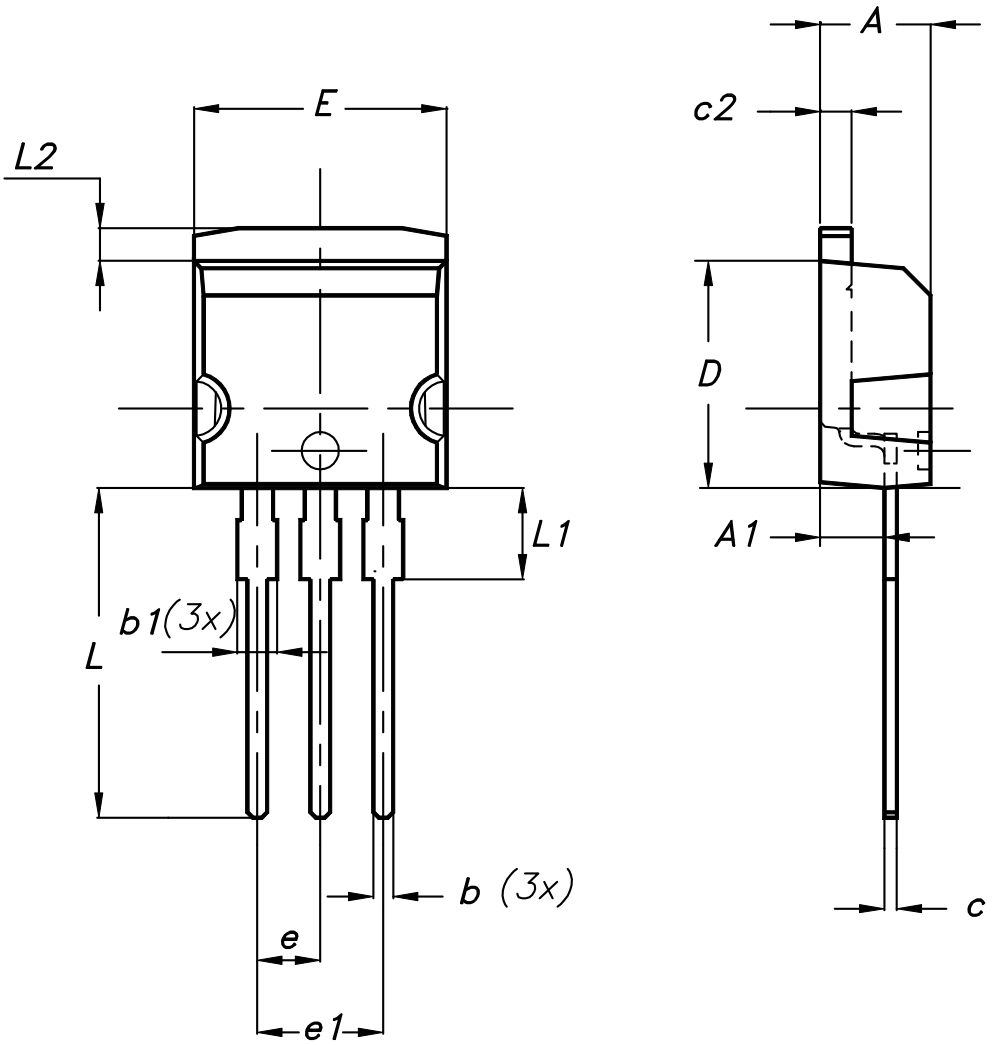


Table 6. I²PAK package mechanical data

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	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
c	0.49	0.70	0.019	0.028
c2	1.23	1.32	0.048	0.052
D	8.95	9.35	0.352	0.368
e	2.40	2.70	0.094	0.106
e1	4.95	5.15	0.195	0.203
E	10.00	10.40	0.394	0.409
L	13.00	14.00	0.512	0.551
L1	3.50	3.93	0.138	0.155
L2	1.27	1.40	0.050	0.055

2.3 TO-220AB package information

- Epoxy meets UL 94,V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

Figure 16. **TO-220AB package outline**

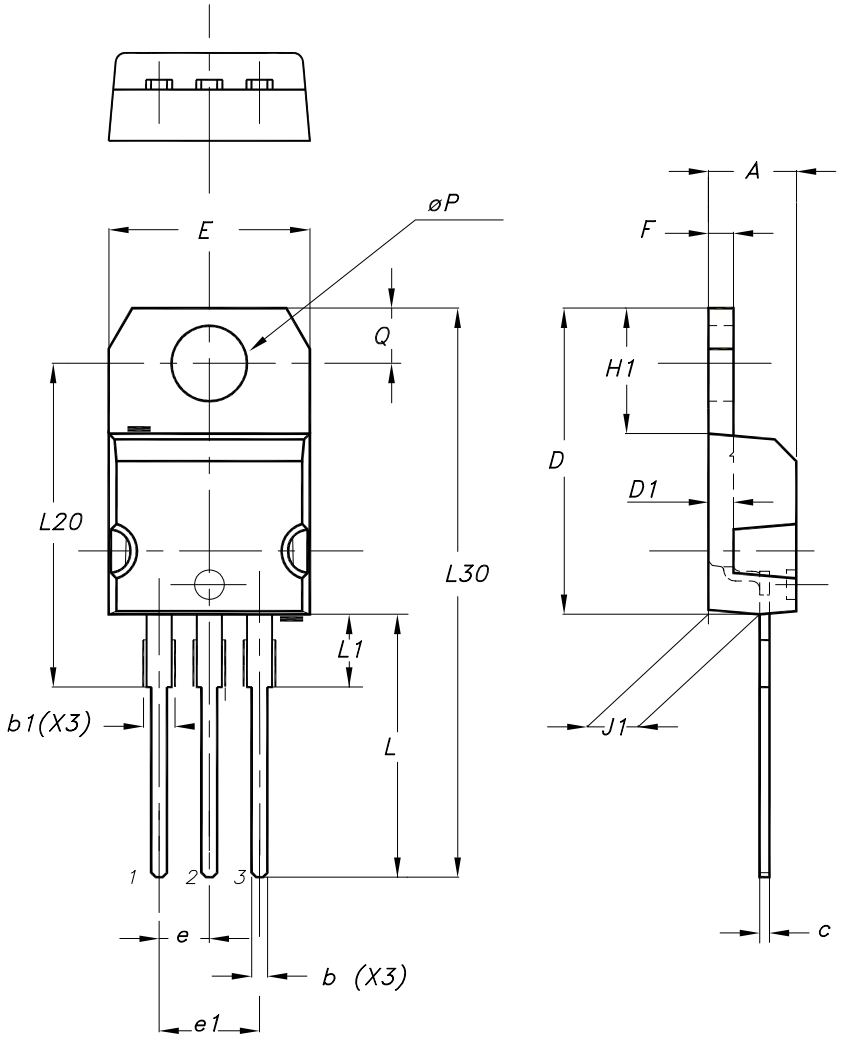


Table 7. **TO-220AB package mechanical data**

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
b	0.61	0.88	0.240	0.035
b1	1.14	1.55	0.045	0.061

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	Min.	Max.	Min.	Max.
c	0.48	0.70	0.019	0.028
D	15.25	15.75	0.600	0.620
D1	1.27 typ.		0.050 typ.	
E	10.00	10.40	0.394	0.409
e	2.40	2.70	0.094	0.106
e1	4.95	5.15	0.195	0.203
F	1.23	1.32	0.048	0.052
H1	6.20	6.60	0.244	0.260
J1	2.40	2.72	0.094	0.107
L	13.00	14.00	0.512	0.551
L1	3.50	3.93	0.138	0.155
L20	16.40 typ.		0.646 typ.	
L30	28.90 typ.		1.138 typ.	
θP	3.75	3.85	0.148	0.152
Q	2.65	2.95	0.104	0.116

2.4 TO-220FPAB package information

- Epoxy meets UL 94,V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

Figure 17. TO-220FPAB package outline

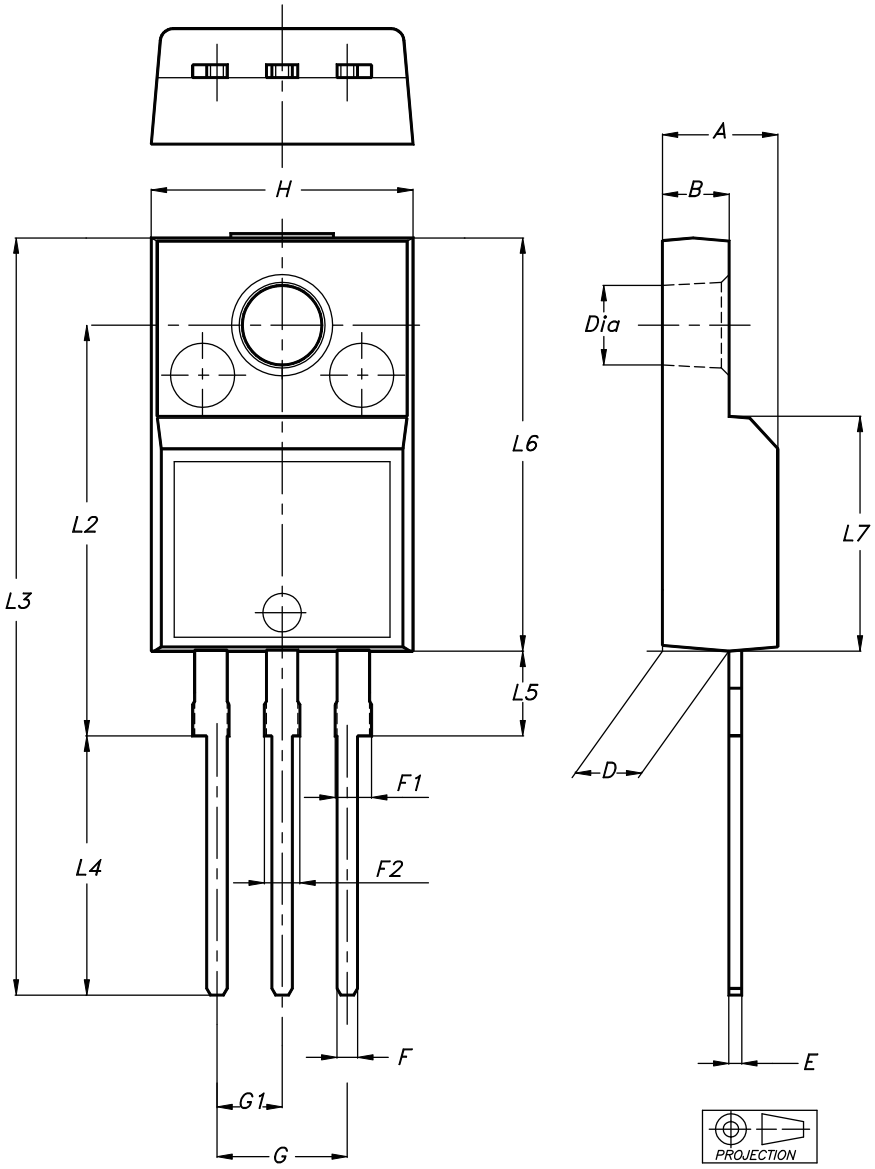


Table 8. **TO-220FPAB package mechanical data**

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.1739	0.1818
B	2.50	2.70	0.0988	0.1067
D	2.50	2.75	0.0988	0.1087
E	0.45	0.70	0.0178	0.0277
F	0.75	1.00	0.0296	0.0395
F1	1.15	1.70	0.0455	0.0672
F2	1.15	1.70	0.0455	0.0672
G	4.95	5.20	0.1957	0.2055
G1	2.40	2.70	0.0949	0.1067
H	10.00	10.40	0.3953	0.4111
L2	16.00 typ.		0.6324 typ.	
L3	28.60	30.60	1.1304	1.2095
L4	9.80	10.60	0.3874	0.4190
L5	2.90	3.60	0.1146	0.1423
L6	15.90	16.40	0.6285	0.6482
L7	9.00	9.30	0.3557	0.3676
Dia	3.00	3.20	0.1186	0.1265

3 Ordering information

Table 9. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STTH2003CT	STTH2003CT	TO-220AB	1.95 g	50	Tube
STTH2003CG	STTH2003CG	D^2PAK	1.38 g	50	Tube
STTH2003CG-TR	STTH2003CG	D^2PAK	1.38 g	1000	Tape and reel
STTH2003CFP	STTH2003CFP	TO-220FPAB	1.90 g	50	Tube
STTH2003CR	STTH2003CR	I^2PAK	1.50 g	50	Tube

Revision history

Table 10. **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, *Table 1: "Device summary"* and packages silhouette in cover page. Updated *Section 1: "Characteristics"*. Updated *Section 2.2: "D²PAK package information"*.
07-Aug-2018	12	Updated I²PAK package information. Minor text changes to improve readability.