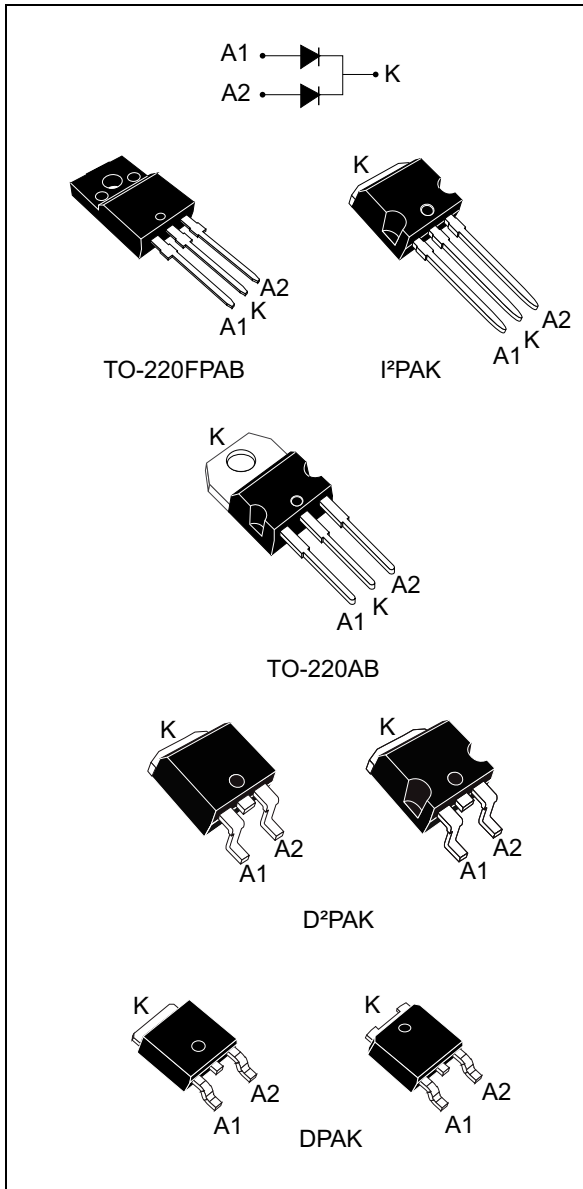


## High efficiency ultrafast diode

Datasheet - production data



### Features

- Suited for SMPS
- Low losses
- Low forward and reverse recovery times
- Insulated package: TO-220FPAB
  - Insulating voltage: 2000 V<sub>RMS</sub> sine
- High junction temperature
- Low leakage current
- ECOPACK<sup>®2</sup> compliant component for DPAK and D<sup>2</sup>PAK on demand

### Description

Dual center tap rectifier suited for switch mode power supplies and high frequency DC to DC converters.

Packaged in DPAK, D<sup>2</sup>PAK, TO-220AB, I<sup>2</sup>PAK and TO-220FPAB, this device is intended for use in low voltage, high frequency inverters, free wheeling and polarity protection applications.

Table 1. Device summary

Symbol	Value
$I_{F(AV)}$	Up to 2 x 8 A
$V_{RRM}$	200 V
$T_j$ (max)	175 °C
$V_F$ (typ)	0.78 V
$t_{rr}$ (typ)	20 ns

# 1 Characteristics

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

Symbol	Parameter		Value	Unit	
$V_{RRM}$	Repetitive peak reverse voltage		200	V	
$I_{F(RMS)}$	Forward rms current	$I^2$ PAK, D $^2$ PAK, TO-220AB, TO-220FPAB	20	A	
		DPAK	10		
$I_{F(AV)}$	Average forward current $\delta = 0.5$ , square wave	$I^2$ PAK, DPAK, D $^2$ PAK, TO-220AB	$T_c = 155\text{ °C}$ Per diode	5	A
			$T_c = 150\text{ °C}$ Per device	10	
			$T_c = 135\text{ °C}$ Per diode	8	
			$T_c = 125\text{ °C}$ Per device	16	
		TO-220FPAB	$T_c = 140\text{ °C}$ Per diode	5	
			$T_c = 120\text{ °C}$ Per device	10	
			$T_c = 110\text{ °C}$ Per diode	8	
			$T_c = 75\text{ °C}$ Per device	16	
$I_{FSM}$	Surge non repetitive forward current	$t_p = 10\text{ ms}$ sinusoidal	50	A	
$T_{stg}$	Storage temperature range		-65 to +175	°C	
$T_j$	Maximum operating junction temperature		175	°C	

**Table 3. Thermal parameter**

Symbol	Parameter		Max. value	Unit	
$R_{th(j-c)}$	Junction to case	$I^2$ PAK, DPAK, D $^2$ PAK, TO-220AB	Per diode	4.0	°C/W
			Per device	2.5	
		TO-220FPAB	Per diode	6.5	
			Per device	5.0	
$R_{th(c)}$	Coupling	$I^2$ PAK, DPAK, D $^2$ PAK, TO-220AB	1.0		
		TO-220FPAB	3.5		

When the diodes 1 and 2 are used simultaneously:

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



Table 4. Static electrical characteristics (per diode)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$I_R^{(1)}$	Reverse leakage current	$T_j = 25\text{ °C}$	$V_R = V_{RRM}$	-		5	$\mu\text{A}$
		$T_j = 125\text{ °C}$		-	3	40	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ °C}$	$I_F = 5\text{ A}$	-		1.10	V
			$I_F = 10\text{ A}$	-		1.25	
		$T_j = 150\text{ °C}$	$I_F = 5\text{ A}$	-	0.78	0.89	
			$I_F = 10\text{ A}$	-		1.05	

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

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

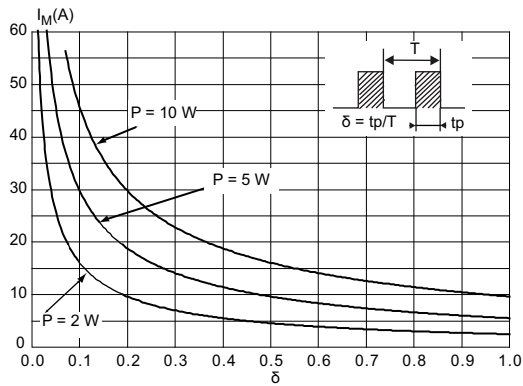
To evaluate the conduction losses, use the following equation:

$$P = 0.73 \times I_{F(AV)} + 0.032 \times I_{F(RMS)}^2$$

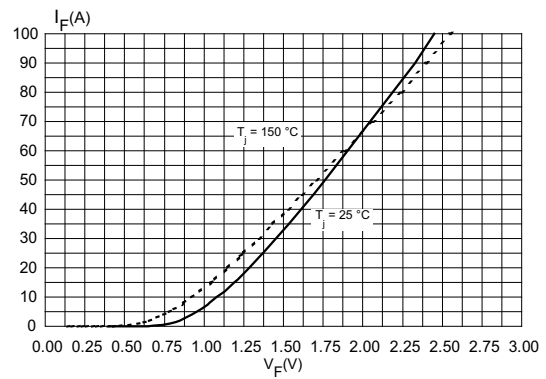
Table 5. Dynamic electrical characteristics (per diode)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$t_{rr}$	Reverse recovery time	$T_j = 25\text{ °C}$	$I_F = 1\text{ A}$ $V_R = 30\text{ V}$ $dI_F/dt = 100\text{ A}/\mu\text{s}$	-	20	25	ns
$I_{RM}$	Reverse recovery current	$T_j = 125\text{ °C}$	$I_F = 5\text{ A}$ $V_R = 160\text{ V}$ $dI_F/dt = 200\text{ A}/\mu\text{s}$	-	5.9	7.6	A
$t_{fr}$	Forward recovery time	$T_j = 25\text{ °C}$	$I_F = 5\text{ A}$ $V_{FR} = 1.1 \times V_{Fmax}$ $dI_F/dt = 100\text{ A}/\mu\text{s}$	-		110	ns
$V_{FP}$	Forward recovery voltage		$I_F = 5\text{ A}$ $dI_F/dt = 100\text{ A}/\mu\text{s}$	-	2.4		V

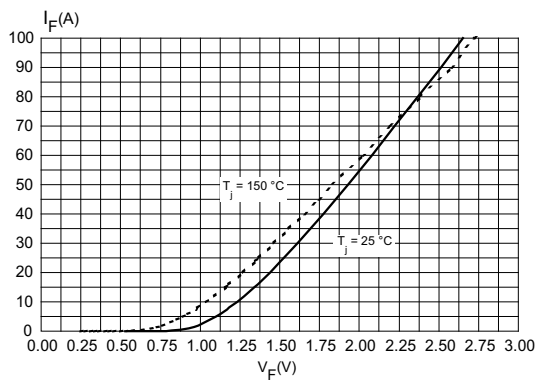
**Figure 1. Peak current versus duty cycle (per diode)**



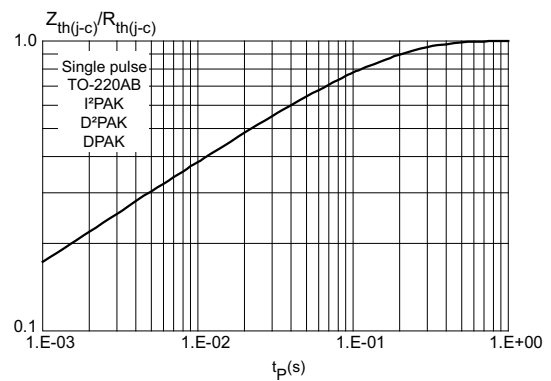
**Figure 2. Forward voltage drop versus forward current (typical values, per diode)**



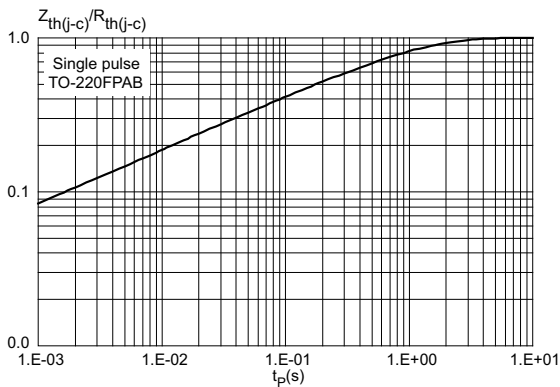
**Figure 3. Forward voltage drop versus forward current (maximum values, per diode)**



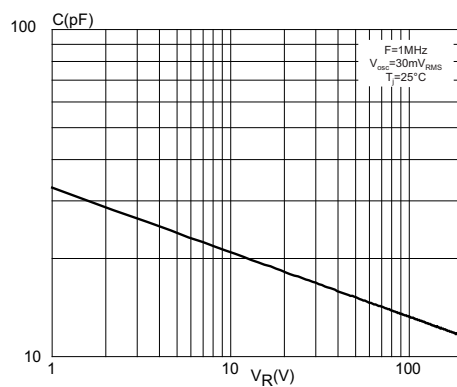
**Figure 4. Relative variation of thermal impedance junction to case versus pulse duration**



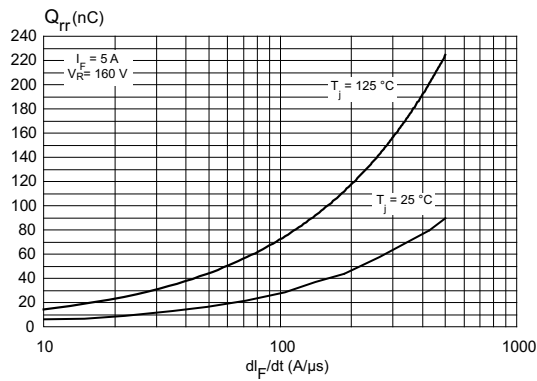
**Figure 5. Relative variation of thermal impedance junction to case versus pulse duration**



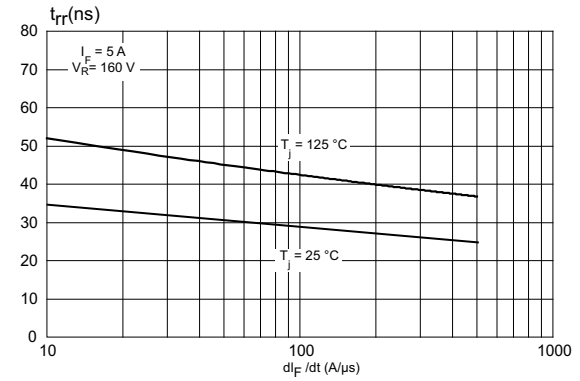
**Figure 6. Junction capacitance versus reverse voltage applied (typical values, per diode)**



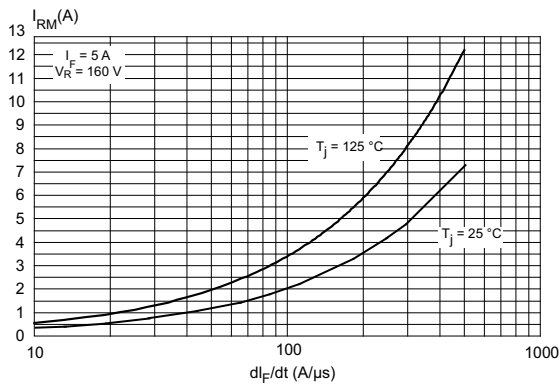
**Figure 7. Reverse recovery charges versus  $di_F/dt$  (typical values, per diode)**



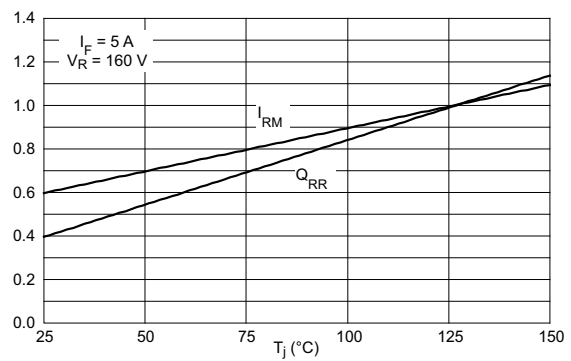
**Figure 8. Reverse recovery time versus  $di_F/dt$  (typical values, per diode)**



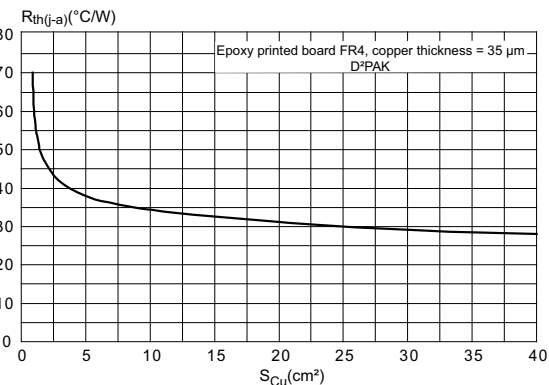
**Figure 9. Peak reverse recovery current versus  $di_F/dt$  (typical values, per diode)**



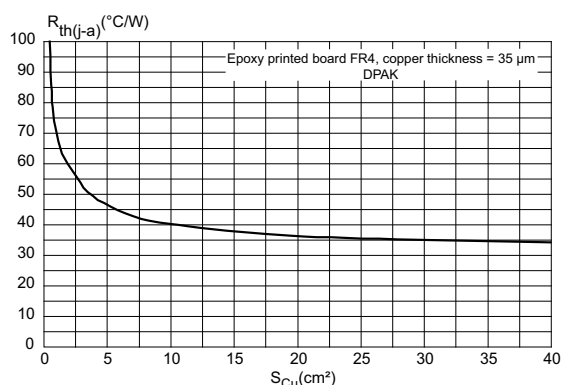
**Figure 10. Dynamic parameters versus junction temperature (reference:  $T_j = 125^\circ\text{C}$ )**



**Figure 11. Thermal resistance junction to ambient versus copper surface under tab**



**Figure 12. Thermal resistance junction to ambient versus copper surface under tab**



## 2 Package information

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

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.

### 2.1 TO-220AB package information

Figure 13. TO-220AB package outline

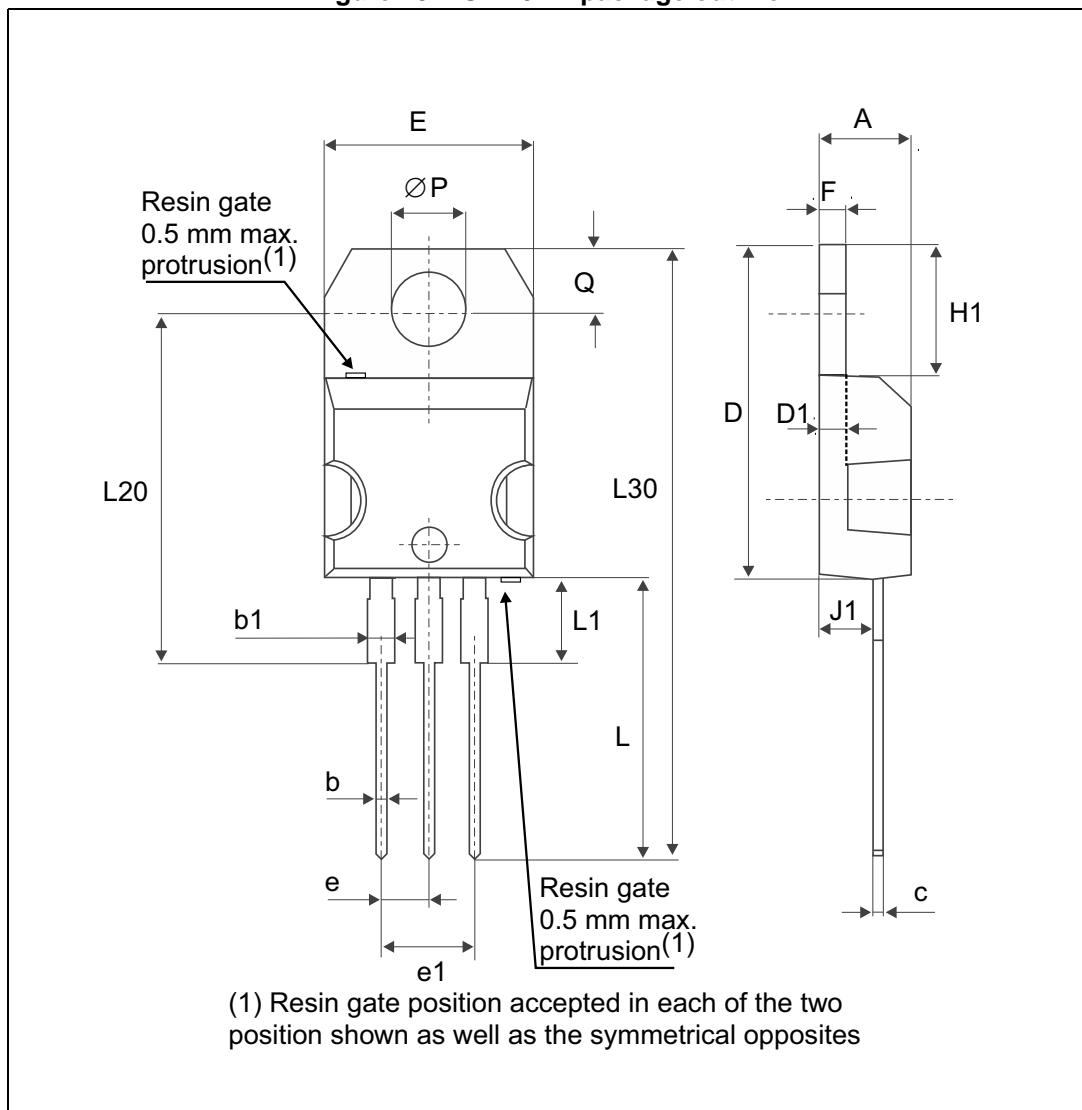


Table 6. TO-220AB package mechanical data

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.170	0.181
b	0.61	0.88	0.024	0.035
b1	1.14	1.70	0.045	0.067
c	0.48	0.70	0.019	0.027
D	15.25	15.75	0.600	0.620
D1	1.27 typ.		0.050 typ.	
E	10.00	10.40	0.393	0.41
e	2.40	2.70	0.094	0.106
e1	4.95	5.15	0.194	0.202
F	1.23	1.32	0.048	0.052
H1	6.20	6.60	0.244	0.259
J1	2.40	2.72	0.094	0.107
L	13.00	14.00	0.511	0.551
L1	3.50	3.93	0.137	0.154
L20	16.40 typ.		0.645 typ.	
L30	28.90 typ.		1.137 typ.	
ØP	3.75	3.85	0.147	0.151
Q	2.65	2.95	0.104	0.116

## 2.2 TO-220FPAB package information

Figure 14. TO-220FPAB package outline

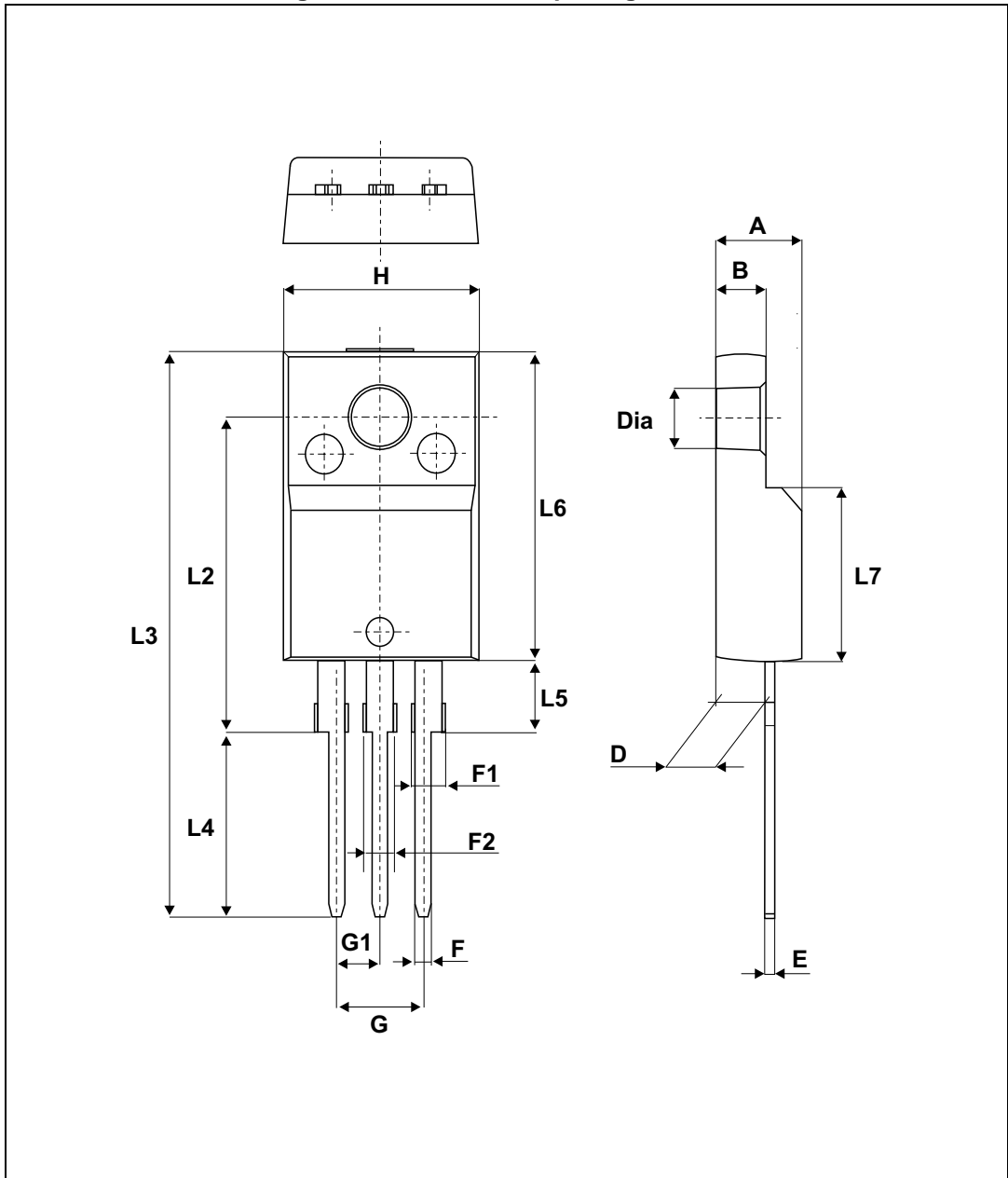


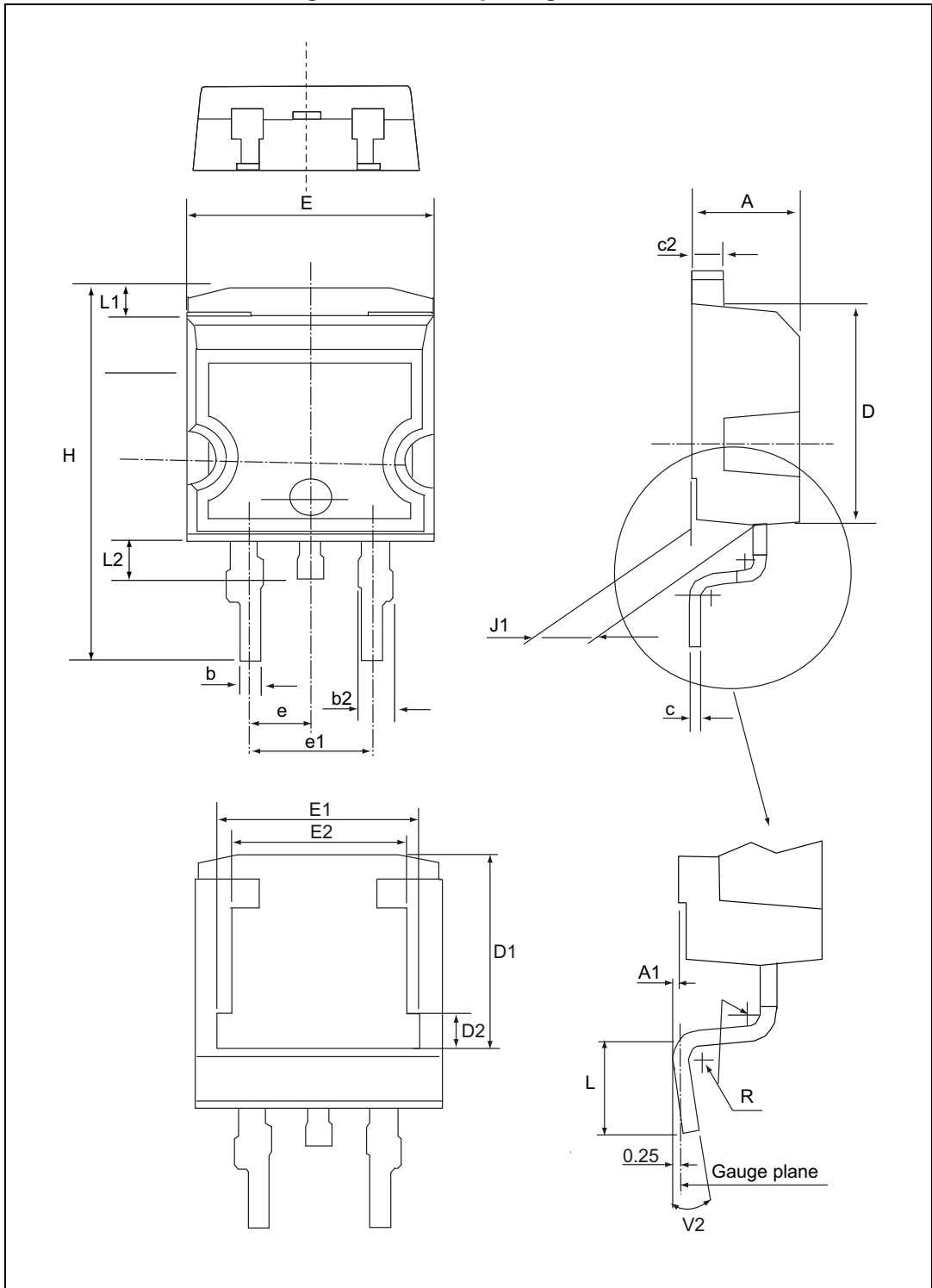


Table 7. TO-220FPAB package mechanical data

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
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.		0.630 Typ.	
L3	28.60	30.60	1.126	1.205
L4	9.80	10.60	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.	3.00	3.20	0.118	0.126

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

Figure 15. D<sup>2</sup>PAK package outline

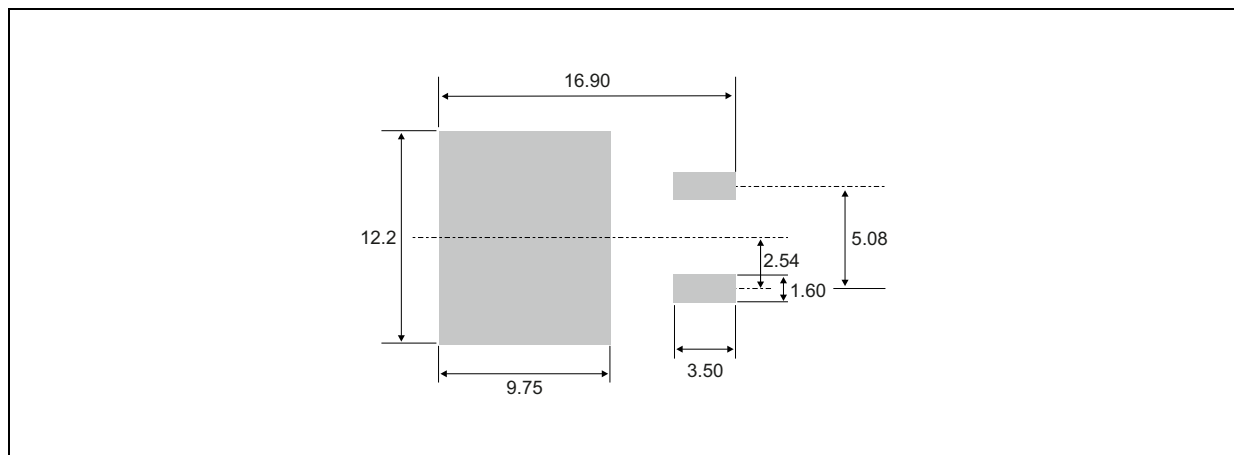


Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 8. D<sup>2</sup>PAK package mechanical data

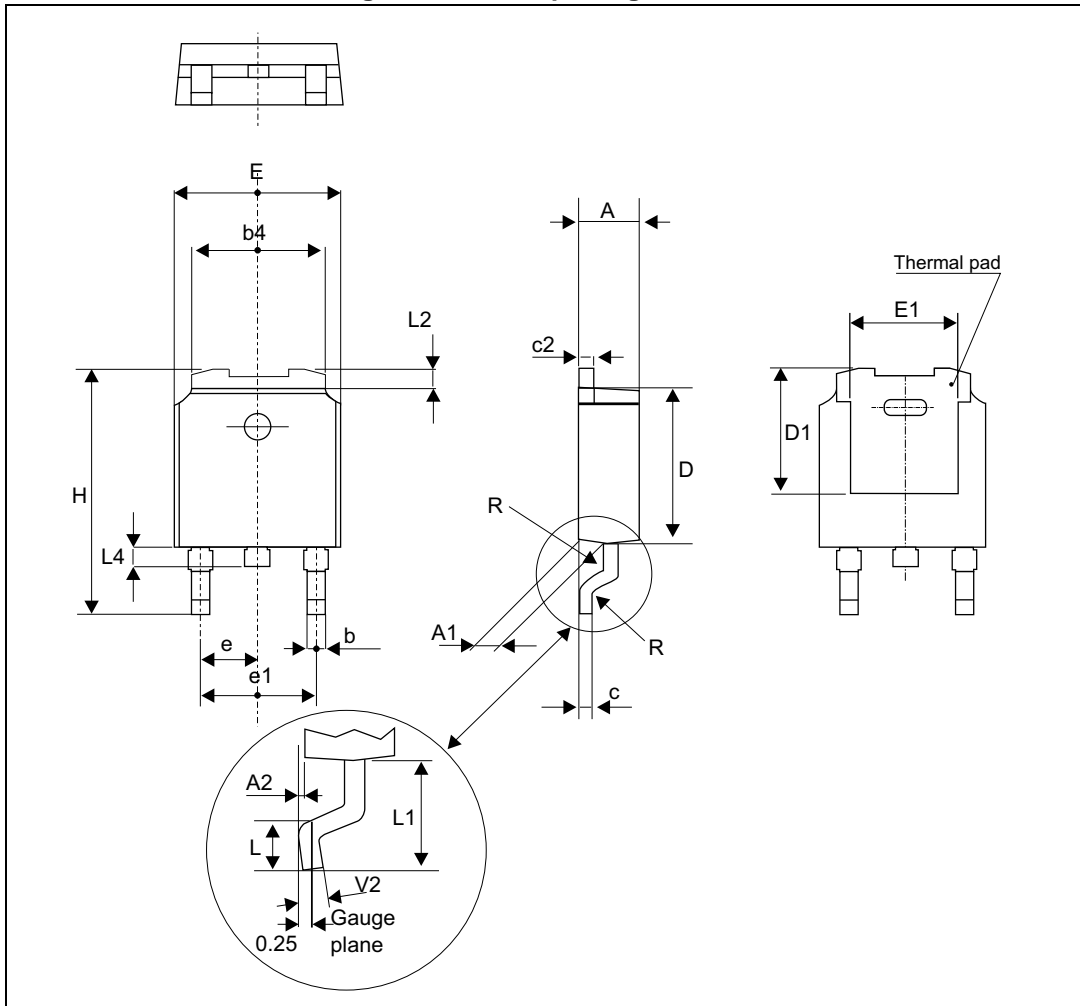
Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.36		4.60	0.171		0.181
A1	0		0.25			0.010
b	0.70		0.93	0.027		0.037
b2	1.14		1.70	0.045		0.067
c	0.38		0.69	0.014		0.027
c2	1.19		1.36	0.046		0.053
D	8.60		9.35	0.338		0.368
D1	6.90		8.00	0.271		0.315
D2	1.10		1.50	0.043		0.060
E	10.00		10.55	0.393		0.415
E1	8.10		8.90	0.318		0.350
E2	6.85		7.25	0.269		0.285
e		2.54			0.100	
e1	4.88		5.28	0.192		0.208
H	15.00		15.85	0.590		0.624
J1	2.49		2.90	0.098		0.114
L	1.90		2.79	0.074		0.110
L1	1.27		1.65	0.050		0.065
L2	1.30		1.78	0.051		0.070
R		0.40		0.016		
V2	0°		8°	0°		8°

Figure 16. Footprint (dimensions in mm)



## 2.4 DPAK package information

Figure 17. DPAK package outline

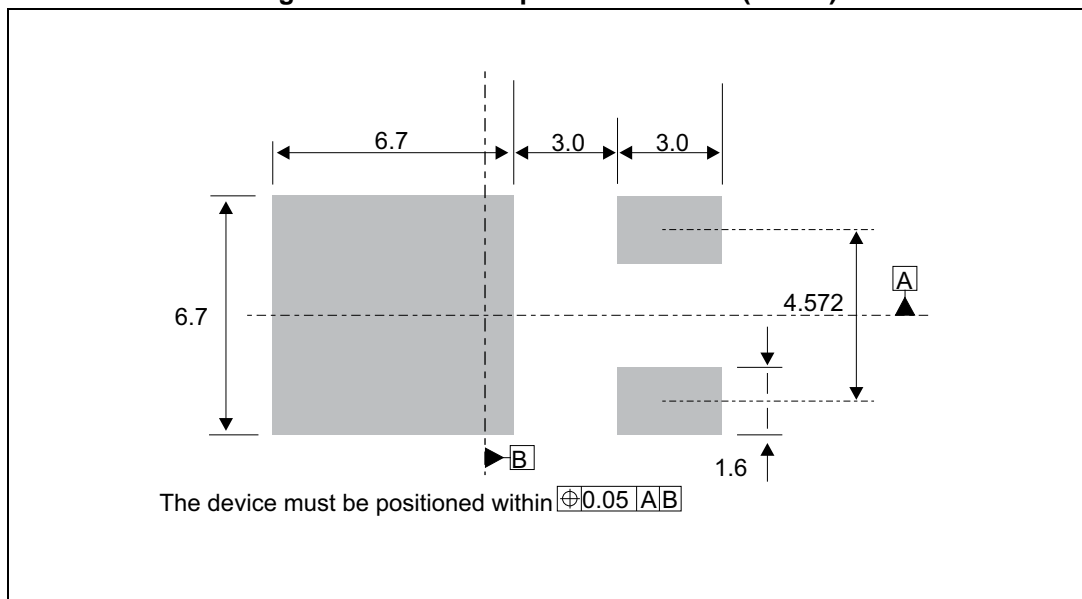


Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 9. DPAK package mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.18		2.40	0.085		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
b	0.64		0.90	0.025		0.035
b4	4.95		5.46	0.194		0.214
c	0.46		0.61	0.018		0.024
c2	0.46		0.60	0.018		0.023
D	5.97		6.22	0.235		0.244
D1	4.95		5.60	0.194		0.220
E	6.35		6.73	0.250		0.264
E1	4.32		5.50	0.170		0.216
e		2.28			0.090	
e1	4.40		4.70	0.173		0.185
H	9.35		10.40	0.368		0.409
L	1.00		1.78	0.039		0.070
L2			1.27			0.050
L4	0.60		1.02	0.023		0.040
V2	-8°		+8°	-8°		8°

Figure 18. DPAK footprint dimensions (in mm)



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

Figure 19. I<sup>2</sup>PAK package outline

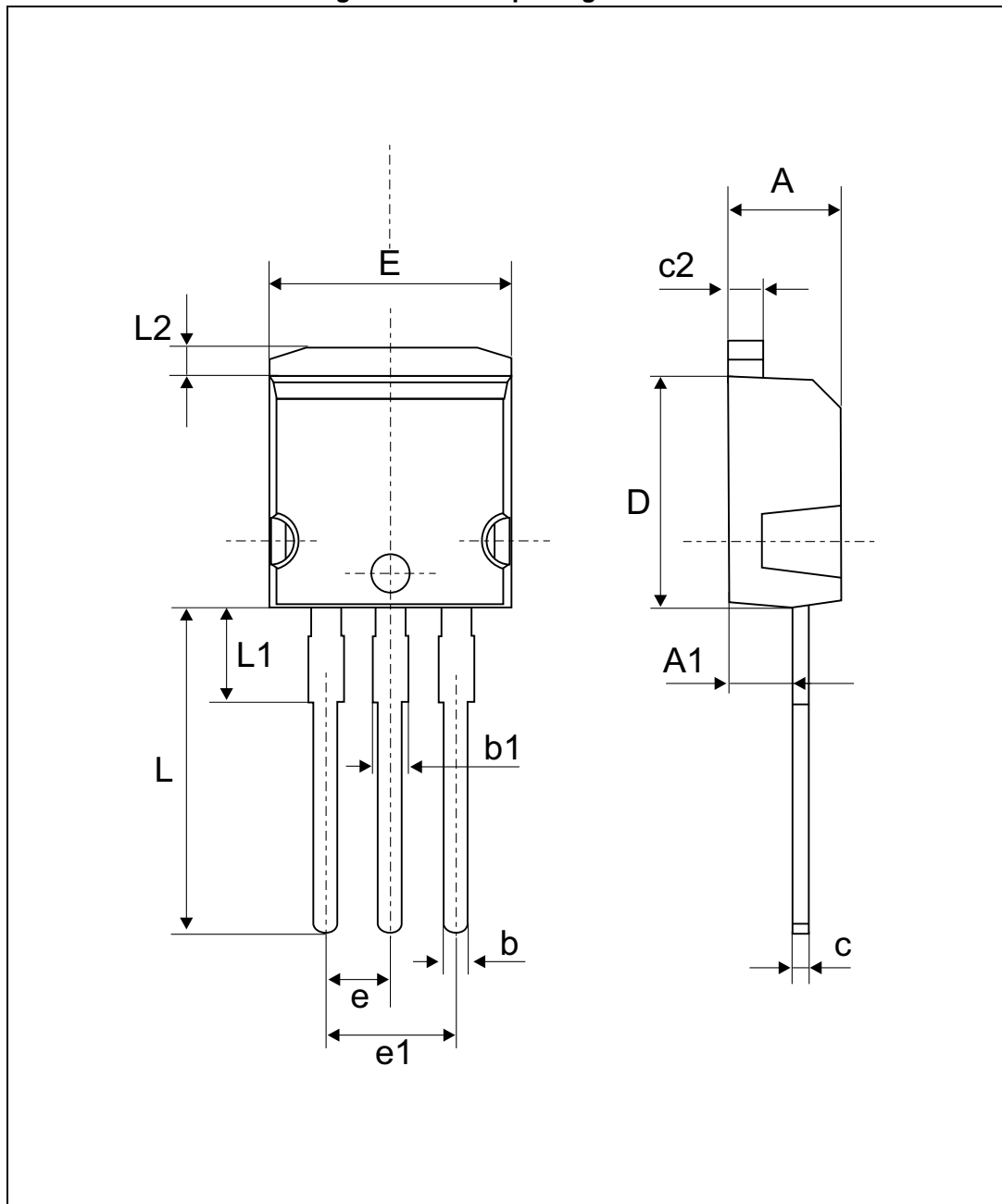


Table 10. I<sup>2</sup>PAK package mechanical data

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
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

### 3 Ordering information

**Table 11. Ordering information**

Order code	Marking	Package	Weight	Base qty	Delivery mode
STTH1002CB	STTH1 002CB	DPAK	0.32 g	75	Tube
STTH1002CB-TR	STTH1 002CB	DPAK	0.32 g	2500	Tape and reel
STTH1002CT	STTH1002CT	TO-220AB	1.9 g	50	Tube
STTH1002CG-TR	STTH1002CG	D <sup>2</sup> PAK	1.38 g	1000	Tape and reel
STTH1002CR	STTH1002CR	I <sup>2</sup> PAK	1.5 g	50	Tube
STTH1002CFP	STTH1002CFP	TO-220FPAB	1.9 g	50	Tube

### 4 Revision history

**Table 12. Document revision history**

Date	Revision	Changes
Mar-2004	4	Last issue.
22-Mar-2013	5	Updated Table 7.
05-Jan-2015	6	Updated DPAK and D <sup>2</sup> PAK package information.
24-Apr-2015	7	Updated Figure 15.
20-Sep-2016	8	Updated DPAK package information and reformatted to current standard.



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