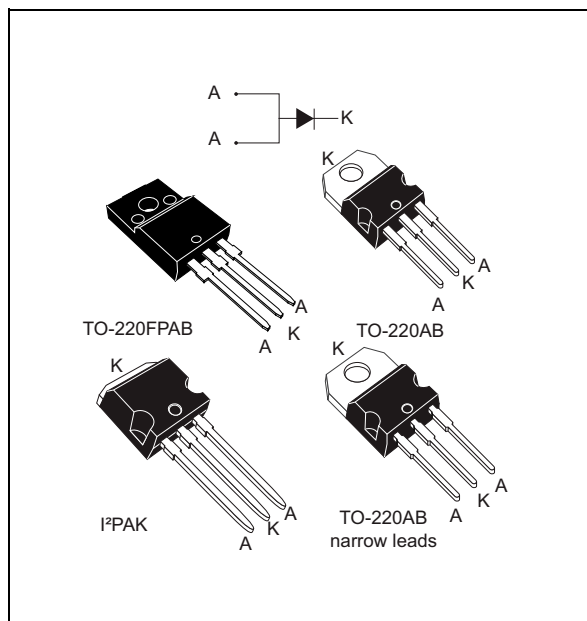




## Features

- High current capability
- Avalanche rated
- Low forward voltage drop
- High frequency operation
- Insulated package TO220FP-AB:
  - Insulated voltage: 2000 V<sub>RMS</sub> sine
- ECOPACK®2 compliant component on TO-220AB and TO-220FPAB.

### Description

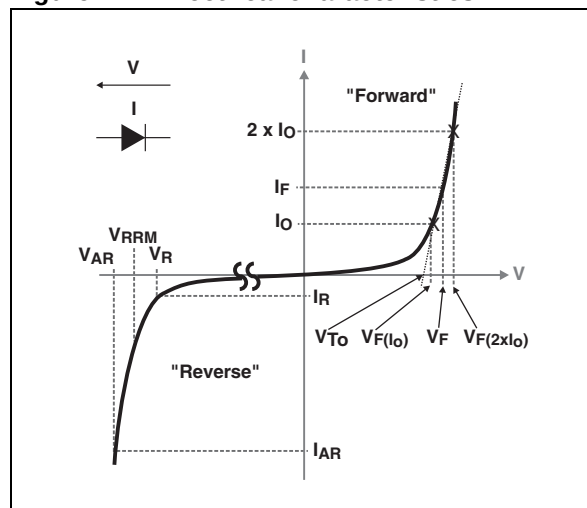
This Schottky diode is suited for high frequency switch mode power supply.

Packaged in TO-220AB narrow leads, TO-220AB, TO-220FPAB and I<sup>2</sup>PAK, this device is intended to be used in notebook, game station and desktop adapters, providing in these applications a good efficiency at both low and high load.

### Table 1. Device summary

| Symbol      | Value  |
|-------------|--------|
| $I_{F(AV)}$ | 20 A   |
| $V_{RRM}$   | 120 V  |
| $T_j$       | 150 °C |
| $V_F$ (typ) | 0.49 V |

**Figure 1. Electrical characteristics<sup>(a)</sup>**



- a.  $V_{\text{ARM}}$  and  $I_{\text{ARM}}$  must respect the reverse safe operating area defined in [Figure 9](#).  $V_{\text{AR}}$  and  $I_{\text{AR}}$  are pulse measurements ( $t_p < 10 \mu\text{s}$ ).  $V_{\text{R}}$ ,  $I_{\text{R}}$ ,  $V_{\text{RRM}}$  and  $V_{\text{F}}$  are static characteristics

# 1 Characteristics

**Table 2. Absolute ratings (limiting values with terminals 1 and 3 short circuited at  $T_{amb} = 25\text{ °C}$ , unless otherwise specified)**

| Symbol          | Parameter                                             |                                                                         | Value       | Unit |
|-----------------|-------------------------------------------------------|-------------------------------------------------------------------------|-------------|------|
| $V_{RRM}$       | Repetitive peak reverse voltage                       |                                                                         | 120         | V    |
| $I_{F(RMS)}$    | Forward rms current                                   |                                                                         | 50          | A    |
| $I_{F(AV)}$     | Average forward current                               |                                                                         | 20          | A    |
| $I_{FSM}$       | Surge non repetitive forward current                  | $t_p = 10\text{ ms sine-wave}$                                          | 220         | A    |
| $P_{ARM}^{(1)}$ | Repetitive peak avalanche power                       | $T_j = 125\text{ °C}, t_p = 10\text{ }\mu\text{s}$                      | 900         | W    |
| $V_{ARM}^{(2)}$ | Maximum repetitive peak avalanche voltage             | $t_p < 10\text{ }\mu\text{s}, T_j < 125\text{ °C}, I_{AR} < 6\text{ A}$ | 150         | V    |
| $V_{ASM}^{(2)}$ | Maximum single-pulse peak avalanche voltage           | $t_p < 10\text{ }\mu\text{s}, T_j < 125\text{ °C}, I_{AR} < 6\text{ A}$ | 150         | V    |
| $T_{stg}$       | Storage temperature range                             |                                                                         | -65 to +175 | °C   |
| $T_j$           | Maximum operating junction temperature <sup>(3)</sup> |                                                                         | 150         | °C   |

- For pulse time duration deratings, please refer to [Figure 4](#). More details regarding the avalanche energy measurements and diode validation in the avalanche are provided in the STMicroelectronics Application notes AN1768, "Admissible avalanche power of Schottky diodes" and AN2025, "Converter improvement using Schottky rectifier avalanche specification".
- See [Figure 9](#)
- $\frac{dP_{tot}}{dT_j} < \frac{1}{R_{th(j-a)}}$  condition to avoid thermal runaway for a diode on its own heatsink

**Table 3. Thermal resistance**

| Symbol        | Parameter        |                                    | Value | Unit |
|---------------|------------------|------------------------------------|-------|------|
| $R_{th(j-c)}$ | Junction to case | TO-220AB and TO-220AB narrow leads | 1.55  | °C/W |
|               |                  | TO-220FPAB                         | 4     |      |

**Table 4. Static electrical characteristics (terminals 1 and 3 short circuited)**

| Symbol      | Parameter               | Test conditions       |                     | Min. | Typ. | Max. | Unit          |
|-------------|-------------------------|-----------------------|---------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$  | $V_R = V_{RRM}$     | -    | 40   | 210  | $\mu\text{A}$ |
|             |                         | $T_j = 125\text{ °C}$ |                     | -    | 15   | 40   | mA            |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 125\text{ °C}$ | $I_F = 5\text{ A}$  | -    | 0.49 | 0.54 | V             |
|             |                         | $T_j = 25\text{ °C}$  | $I_F = 10\text{ A}$ | -    |      | 0.75 |               |
|             |                         | $T_j = 125\text{ °C}$ |                     | -    | 0.57 | 0.62 |               |
|             |                         | $T_j = 25\text{ °C}$  | $I_F = 20\text{ A}$ | -    |      | 0.89 |               |
|             |                         | $T_j = 125\text{ °C}$ |                     | -    | 0.65 | 0.72 |               |
|             |                         |                       |                     | -    |      |      |               |

- Pulse test:  $t_p = 5\text{ ms}, \delta < 2\%$
- Pulse test:  $t_p = 380\text{ }\mu\text{s}, \delta < 2\%$

To evaluate the conduction losses use the following equation:

$$P = 0.56 \times I_{F(AV)} + 0.008 \times I_{F(RMS)}^2$$

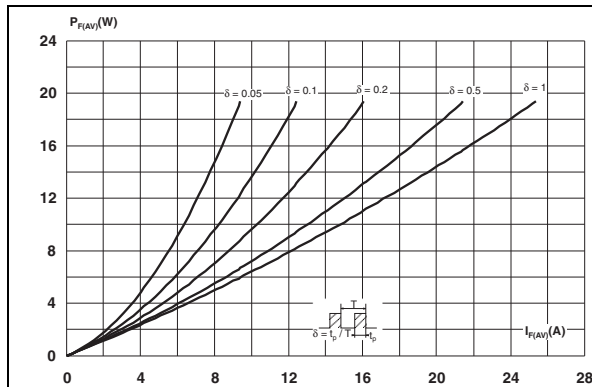
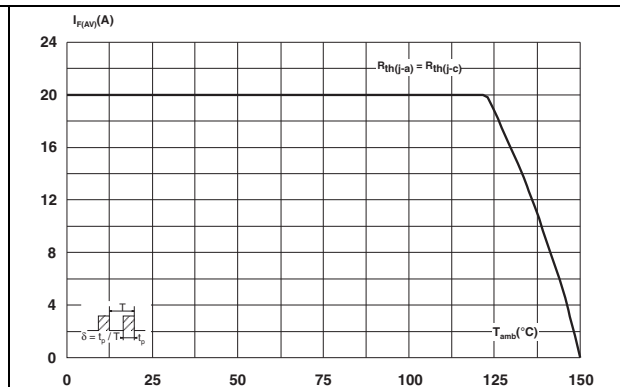
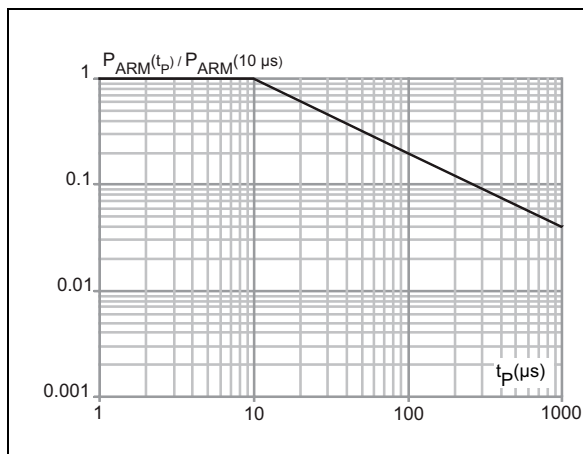
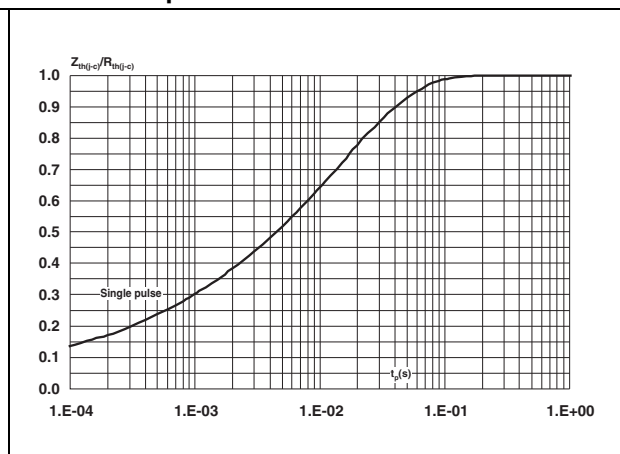
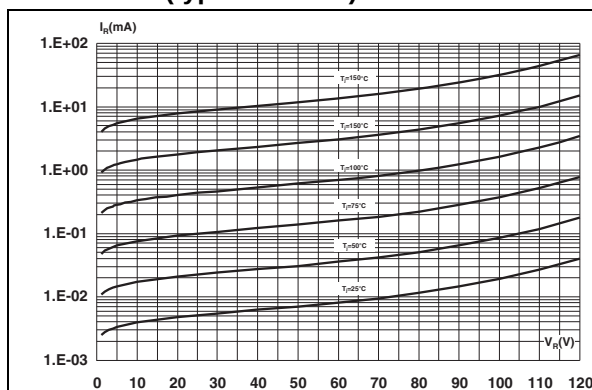
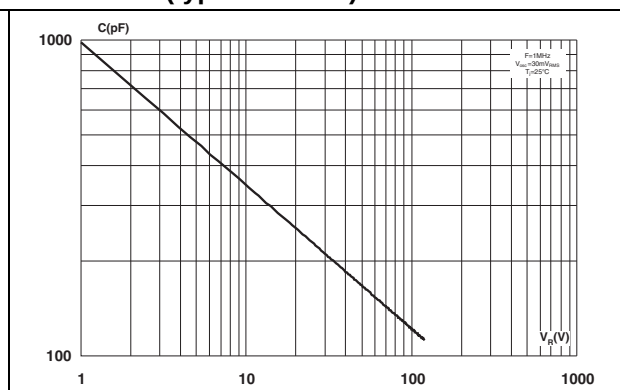
**Figure 2. Average forward power dissipation versus average forward current****Figure 3. Average forward current versus ambient temperature ( $\delta = 0.5$ )****Figure 4. Normalized avalanche power derating versus pulse duration****Figure 5. Relative variation of thermal impedance junction to case versus pulse duration****Figure 6. Reverse leakage current versus reverse voltage applied (typical values)****Figure 7. Junction capacitance versus reverse voltage applied (typical values)**

Figure 8. Forward voltage drop versus forward current

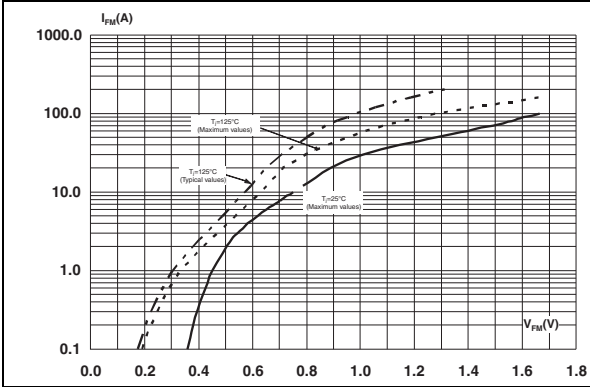
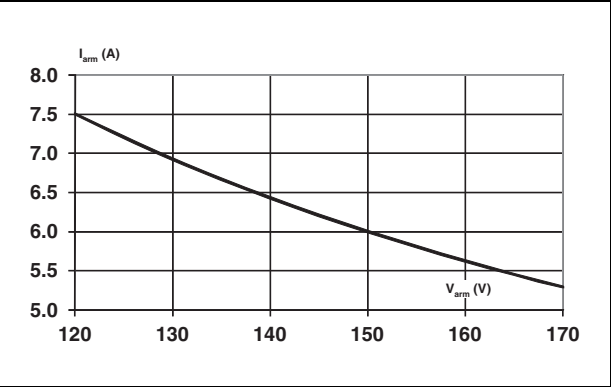


Figure 9. Reverse safe operating area ( $t_p < 10 \mu\text{s}$  and  $T_j < 125^\circ\text{C}$ )



## 2 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value for TO-220AB and TO-220FPAB: 0.4 N·m to 0.6 N·m

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.

**Figure 10. TO-220AB narrow leads dimension definitions**

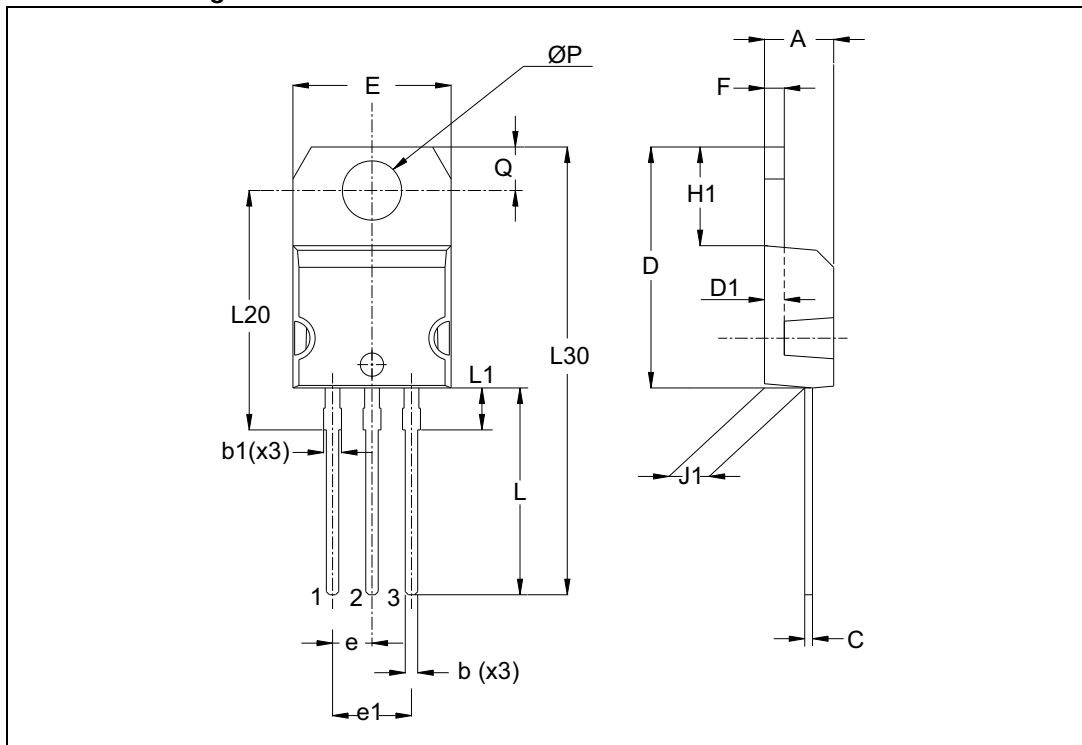


Table 5. TO-220AB narrow leads dimension values

| Ref. | Dimensions  |      |       |        |      |       |
|------|-------------|------|-------|--------|------|-------|
|      | Millimeters |      |       | Inches |      |       |
|      | Min.        | Typ. | Max.  | Min.   | Typ. | Max.  |
| A    | 4.40        |      | 4.60  | 0.17   |      | 0.18  |
| b    | 0.61        |      | 0.88  | 0.024  |      | 0.034 |
| b1   | 0.95        |      | 1.20  | 0.037  |      | 0.047 |
| c    | 0.48        |      | 0.70  | 0.019  |      | 0.027 |
| D    | 15.25       |      | 15.75 | 0.60   |      | 0.62  |
| D1   | 1.27        |      |       | 0.05   |      |       |
| E    | 10.00       |      | 10.40 | 0.39   |      | 0.41  |
| e    | 2.40        |      | 2.70  | 0.094  |      | 0.106 |
| e1   | 4.95        |      | 5.15  | 0.19   |      | 0.20  |
| F    | 1.23        |      | 1.32  | 0.048  |      | 0.052 |
| H1   | 6.20        |      | 6.60  | 0.24   |      | 0.26  |
| J1   | 2.40        |      | 2.72  | 0.095  |      | 0.107 |
| L    | 13.00       |      | 14.00 | 0.51   |      | 0.55  |
| L1   | 2.60        |      | 2.90  | 0.102  |      | 0.114 |
| L20  | 15.40       |      |       | 0.61   |      |       |
| L30  | 28.90       |      |       | 1.14   |      |       |
| ØP   | 3.75        |      | 3.85  | 0.147  |      | 0.151 |
| Q    | 2.65        |      | 2.95  | 0.104  |      | 0.116 |

Figure 11. TO-220AB dimension definitions

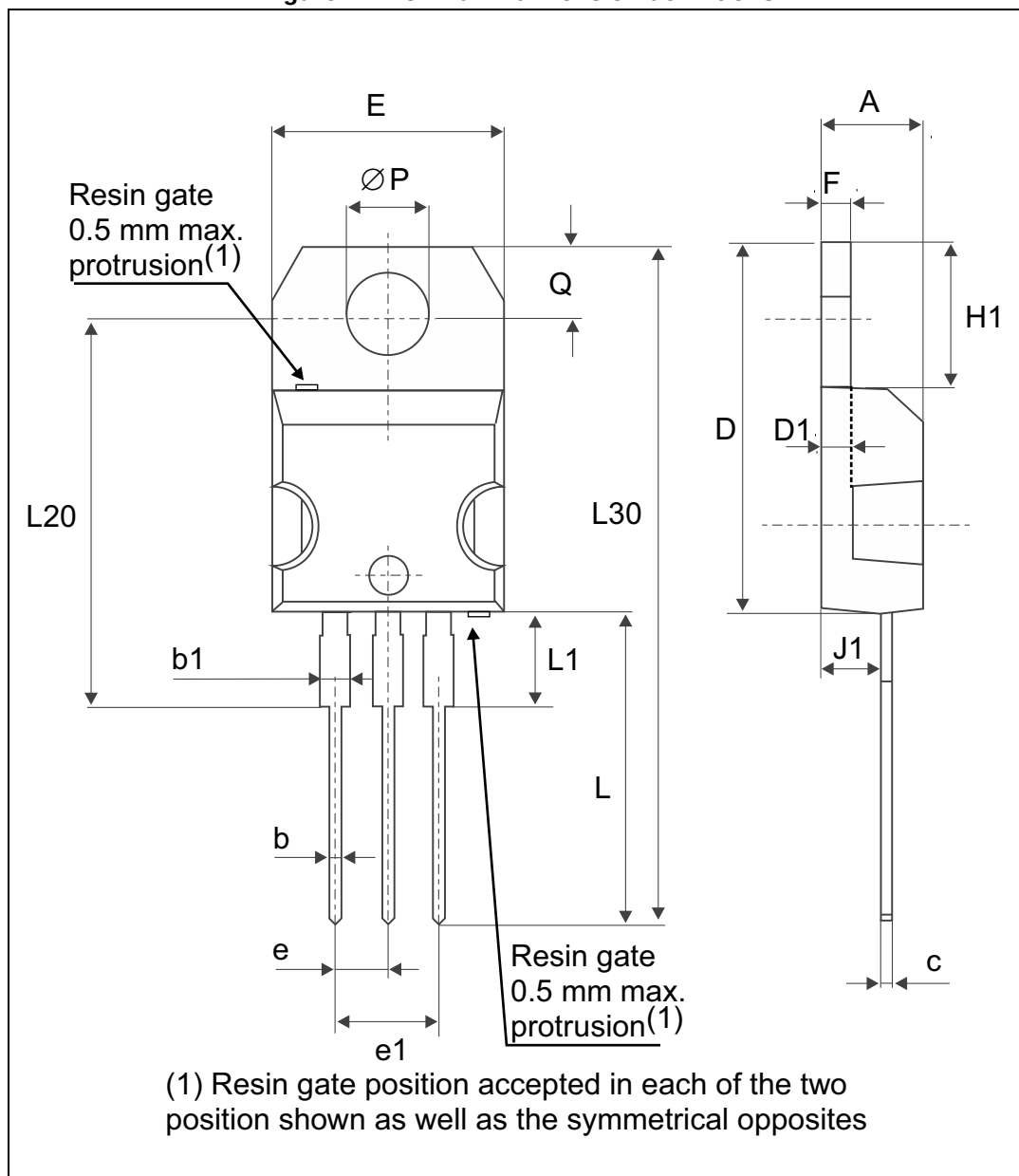


Table 6. TO-220AB dimension values

| Ref. | Dimensions  |       |           |       |
|------|-------------|-------|-----------|-------|
|      | Millimeters |       | Inches    |       |
|      | Min.        | Max.  | Min.      | Max.  |
| A    | 4.40        | 4.60  | 0.17      | 0.181 |
| b    | 0.61        | 0.88  | 0.024     | 0.035 |
| b1   | 1.14        | 1.50  | 0.045     | 0.059 |
| c    | 0.48        | 0.70  | 0.019     | 0.027 |
| D    | 15.25       | 15.75 | 0.60      | 0.62  |
| D1   | 1.27 typ.   |       | 0.05 typ. |       |
| E    | 10          | 10.40 | 0.39      | 0.41  |
| e    | 2.40        | 2.70  | 0.094     | 0.106 |
| e1   | 4.95        | 5.15  | 0.19      | 0.20  |
| F    | 1.23        | 1.32  | 0.048     | 0.052 |
| H1   | 6.20        | 6.60  | 0.24      | 0.26  |
| J1   | 2.40        | 2.72  | 0.094     | 0.107 |
| L    | 13          | 14    | 0.51      | 0.55  |
| L1   | 3.50        | 3.93  | 0.137     | 0.154 |
| L20  | 16.40 typ.  |       | 0.64 typ. |       |
| L30  | 28.90 typ.  |       | 1.13 typ. |       |
| ØP   | 3.75        | 3.85  | 0.147     | 0.151 |
| Q    | 2.65        | 2.95  | 0.104     | 0.116 |

Figure 12. TO-220FPAB dimension definitions

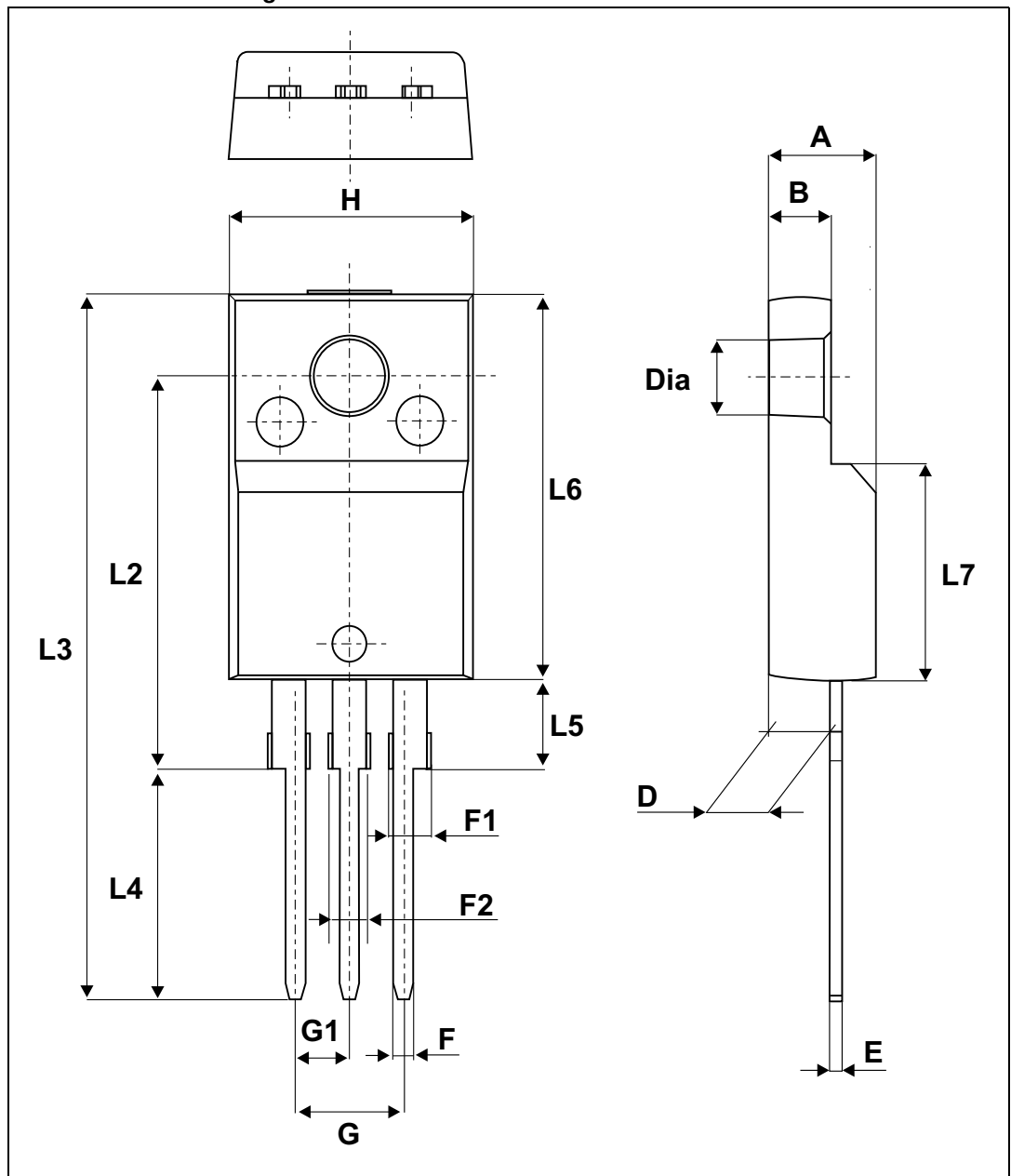


Table 7. TO-220FPAB dimension values

| Ref. | Dimensions  |      |           |       |
|------|-------------|------|-----------|-------|
|      | Millimeters |      | Inches    |       |
|      | Min.        | Max. | Min.      | Max.  |
| A    | 4.4         | 4.6  | 0.173     | 0.181 |
| B    | 2.5         | 2.7  | 0.098     | 0.106 |
| D    | 2.5         | 2.75 | 0.098     | 0.108 |
| E    | 0.45        | 0.70 | 0.018     | 0.027 |
| F    | 0.75        | 1    | 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   | 2.4         | 2.7  | 0.094     | 0.106 |
| H    | 10          | 10.4 | 0.393     | 0.409 |
| L2   | 16 Typ.     |      | 0.63 Typ. |       |
| L3   | 28.6        | 30.6 | 1.126     | 1.205 |
| L4   | 9.8         | 10.6 | 0.386     | 0.417 |
| L5   | 2.9         | 3.6  | 0.114     | 0.142 |
| L6   | 15.9        | 16.4 | 0.626     | 0.646 |
| L7   | 9.00        | 9.30 | 0.354     | 0.366 |
| Dia. | 3.00        | 3.20 | 0.118     | 0.126 |

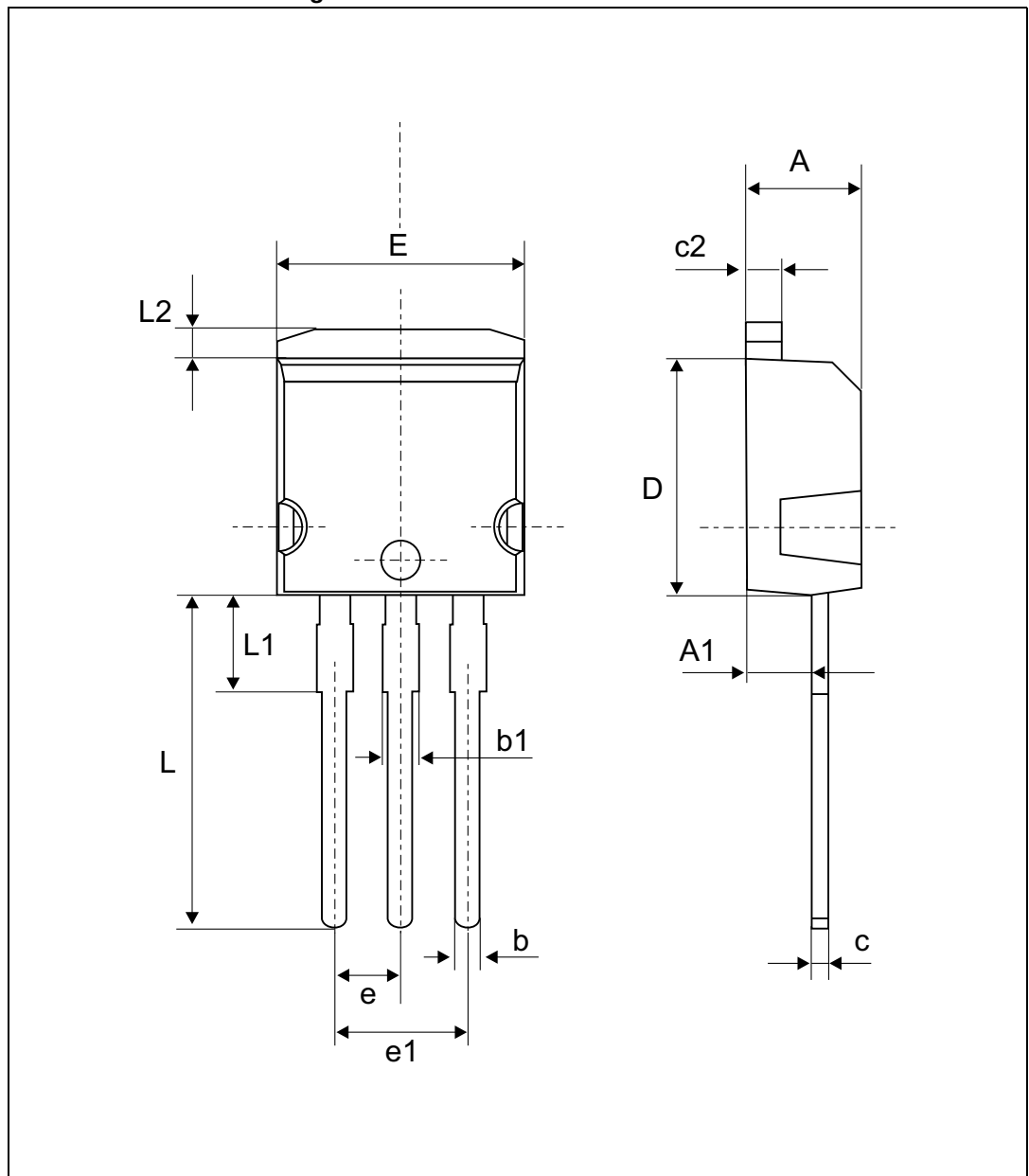
Figure 13. I<sup>2</sup>PAK dimension definitions

Table 8. I<sup>2</sup>PAK dimension values

| 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          | 10.40 | 0.394  | 0.409 |
| L    | 13          | 14    | 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 9. Ordering information

| Order code     | Marking      | Package                  | Weight | Base qty | Delivery mode |
|----------------|--------------|--------------------------|--------|----------|---------------|
| STPS20SM120SR  | PS20SM120SR  | I <sup>2</sup> PAK       | 1.49 g | 50       | Tube          |
| STPS20SM120STN | PS20SM120STN | TO-220AB<br>narrow leads | 1.9 g  | 50       | Tube          |
| STPS20SM120ST  | PS20SM120ST  | TO-220AB                 | 2.2 g  | 50       | Tube          |
| STPS20SM120SFP | PS20SM120SFP | TO-220FPAB               | 1.7 g  | 50       | Tube          |

### 4 Revision history

Table 10. Document revision history

| Date        | Revision | Changes                                            |
|-------------|----------|----------------------------------------------------|
| 02-Apr-2012 | 1        | First issue.                                       |
| 13-Nov-2014 | 2        | Added TO-220AB and TO-220FPAB package information. |

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