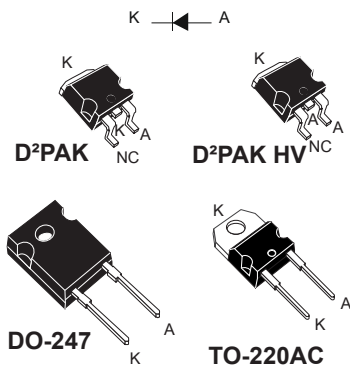


Turbo 2 ultrafast high voltage rectifier



Features

- High junction temperature capability
- Ultrafast with soft recovery behavior
- Low reverse current
- Low thermal resistance
- Reduce switching and conduction losses
- D²PAK HV creepage distance (anode to cathode) = 5.38 mm min. (with top coating)
- **ECOPACK^{®2}** compliant (DO-247, TO-220AC)

Applications

- Output rectification
- PFC
- UPS
- Air conditioning
- Charging station

Description

The **STTH15RQ06** has been developed to be used in application requiring a high-voltage secondary rectification for LLC Full Bridge topology.

It is also suited for use in switching power supplies, industrial applications, as rectification, freewheeling and clamping diode.

Product status link

[STTH15RQ06](#)

Product summary

| | |
|------------------------------|--------|
| I_{F(AV)} | 15 A |
| V_{RRM} | 600 V |
| V_F (max.) | 1.45 V |
| t_{rr} (max.) | 25 ns |
| T_j (max.) | 175 °C |

1 Characteristics

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

| Symbol | Parameter | Value | Unit |
|--------------|--|--|------|
| V_{RRM} | Repetitive peak reverse voltage | 600 | V |
| $I_{F(RMS)}$ | Forward rms current | 50 | A |
| $I_{F(AV)}$ | Average forward current $\delta = 0.5$, square wave | $T_C = 115\text{ °C}$ 15 | A |
| I_{FSM} | Surge non repetitive forward current | $t_p = 10\text{ ms}$ sinusoidal 120 | A |
| T_{stg} | Storage temperature range | -65 to +175 | °C |
| T_j | Maximum operating junction temperature | 175 | °C |

Table 2. Thermal parameters

| Symbol | Parameter | Max. value | Unit |
|---------------|------------------|------------|------|
| $R_{th(j-c)}$ | Junction to case | 1.5 | °C/W |

Table 3. Static electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit | |
|-------------|-------------------------|-----------------------|----------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$ | $V_R = V_{RRM}$ | - | | 20 | μA |
| | | $T_j = 150\text{ °C}$ | | - | 40 | 400 | |
| $V_F^{(2)}$ | Forward voltage drop | $T_j = 25\text{ °C}$ | $I_F = 7.5\text{ A}$ | - | | 2.45 | V |
| | | $T_j = 150\text{ °C}$ | | - | 1.15 | 1.45 | |
| | | $T_j = 25\text{ °C}$ | $I_F = 15\text{ A}$ | - | | 2.95 | |
| | | $T_j = 150\text{ °C}$ | | - | 1.45 | 1.85 | |

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:

$$P = 1.05 \times I_{F(AV)} + 0.053 \times I_F^2 (RMS)$$

Table 4. Dynamic electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit | |
|----------|--------------------------|-----------------------|---|------|------|------|----|
| t_{rr} | Reverse recovery time | $T_j = 25\text{ °C}$ | $I_F = 0.5\text{ A}$, $I_R = 1\text{ A}$, $I_{rr} = 0.25\text{ A}$ $I_F = 1\text{ A}$, $V_R = 30\text{ V}$, $dI_F/dt = -50\text{ A}/\mu\text{s}$ | - | | 25 | ns |
| | | | | - | 35 | 50 | |
| I_{RM} | Reverse recovery current | $T_j = 125\text{ °C}$ | $I_F = 15\text{ A}$, $V_R = 400\text{ V}$, $dI_F/dt = -200\text{ A}/\mu\text{s}$ | - | 6 | 8 | A |
| Q_{RR} | Reverse recovery charge | | | - | 250 | | nC |
| t_{rr} | Reverse recovery time | | | - | 70 | | ns |

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

1.1 Characteristics (curves)

Figure 1. Average forward power dissipation versus average forward current (square waveform)

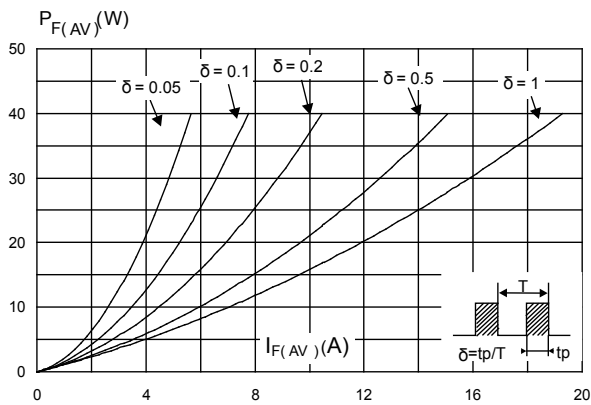


Figure 2. Average forward power dissipation versus average forward current (sinusoidal waveform)

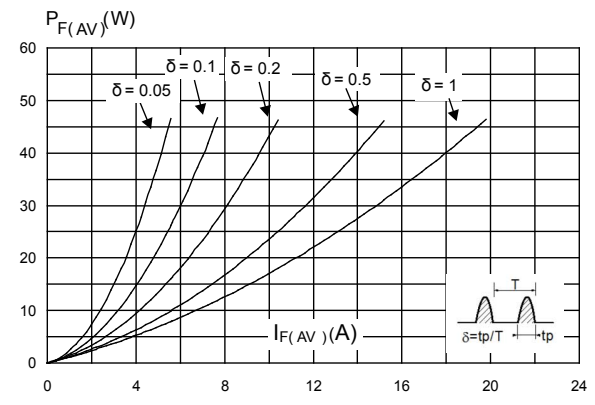


Figure 3. Forward voltage drop versus forward current (typical values)

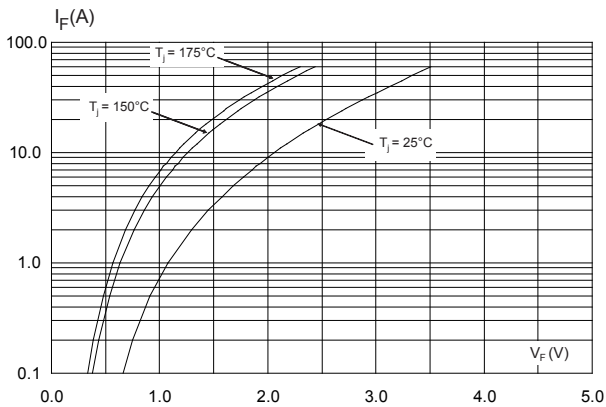


Figure 4. Forward voltage drop versus forward current (maximum values)

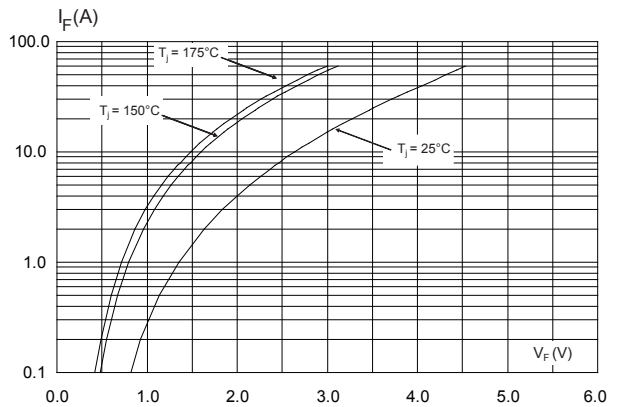


Figure 5. Relative variation of thermal impedance junction to case versus pulse duration

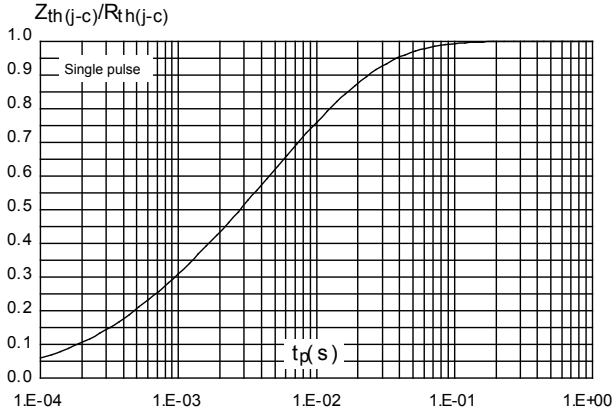


Figure 6. Peak reverse recovery current versus di_F/dt (typical values)

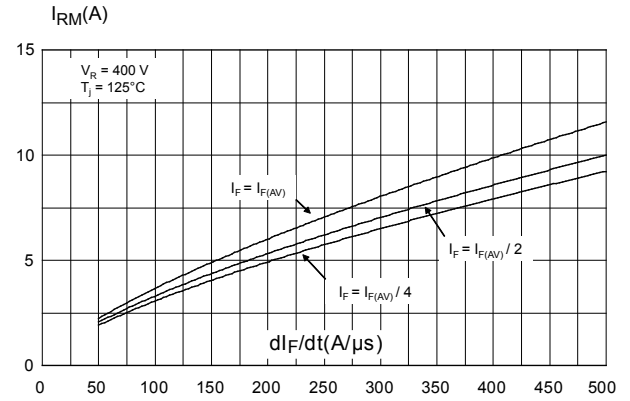


Figure 7. Reverse recovery time versus di_F/dt (typical values)

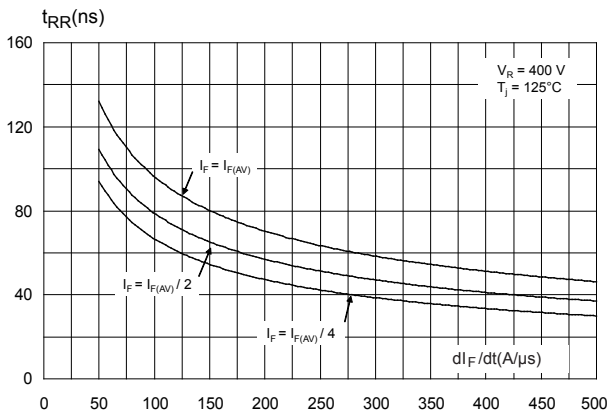


Figure 8. Reverse recovery charges versus di_F/dt (typical values)

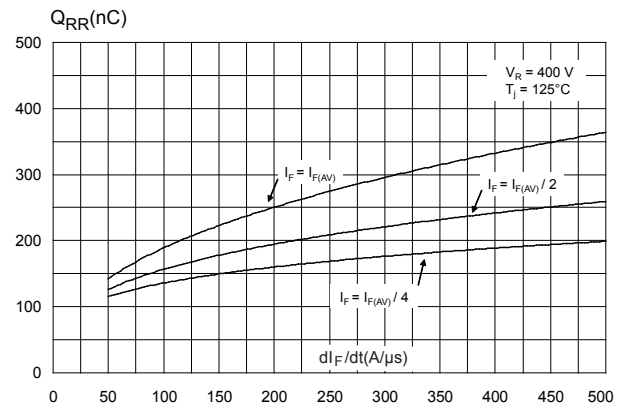


Figure 9. Reverse recovery softness factor versus di_F/dt (typical values)

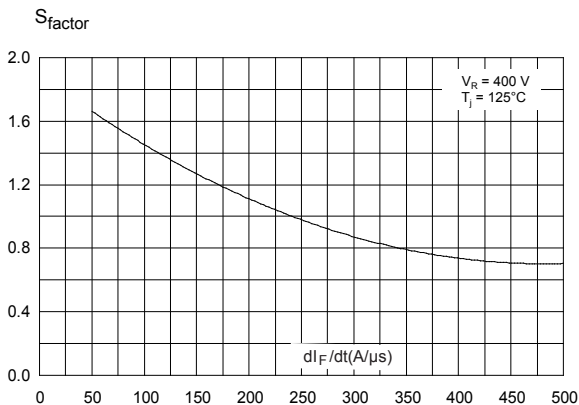


Figure 10. Relative variations of dynamic parameters versus junction temperature

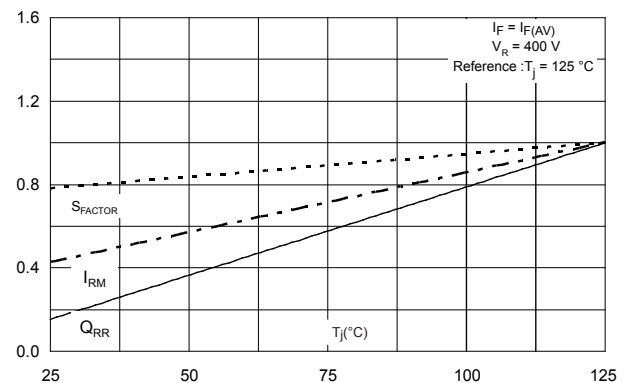


Figure 11. Junction capacitance versus reverse voltage applied (typical values)

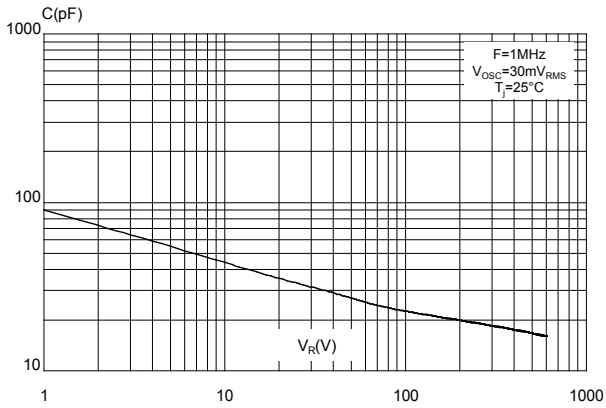


Figure 12. Thermal resistance junction to ambient versus copper surface under tab (typical values, epoxy printed board FR4, $\epsilon_{\text{Cu}} = 35 \mu\text{m}$) (D²PAK and D²PAK HV)

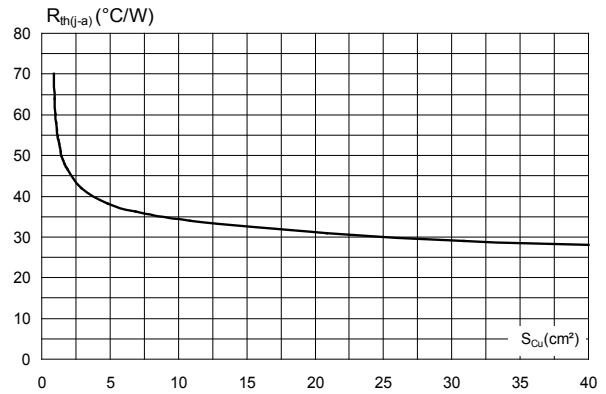


Figure 13. Relative variation of non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

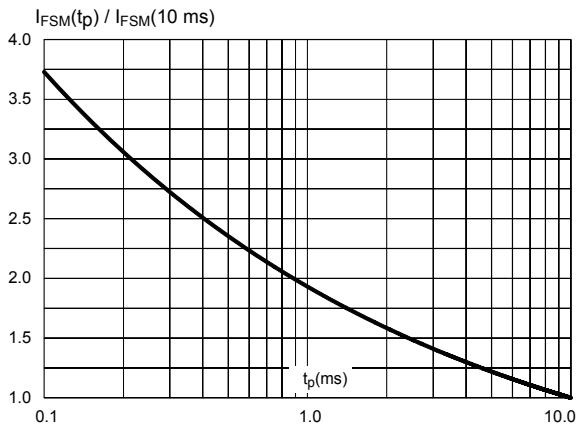
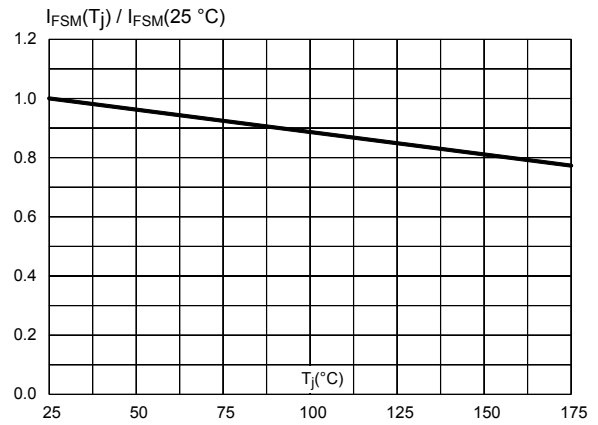


Figure 14. Relative variation of non-repetitive peak surge forward current versus initial junction temperature (sinusoidal waveform)



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 DO-247 package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.8 N·m (DO-247)
- Maximum torque value: 1.0 N·m (DO-247)

Figure 15. DO-247 package outline

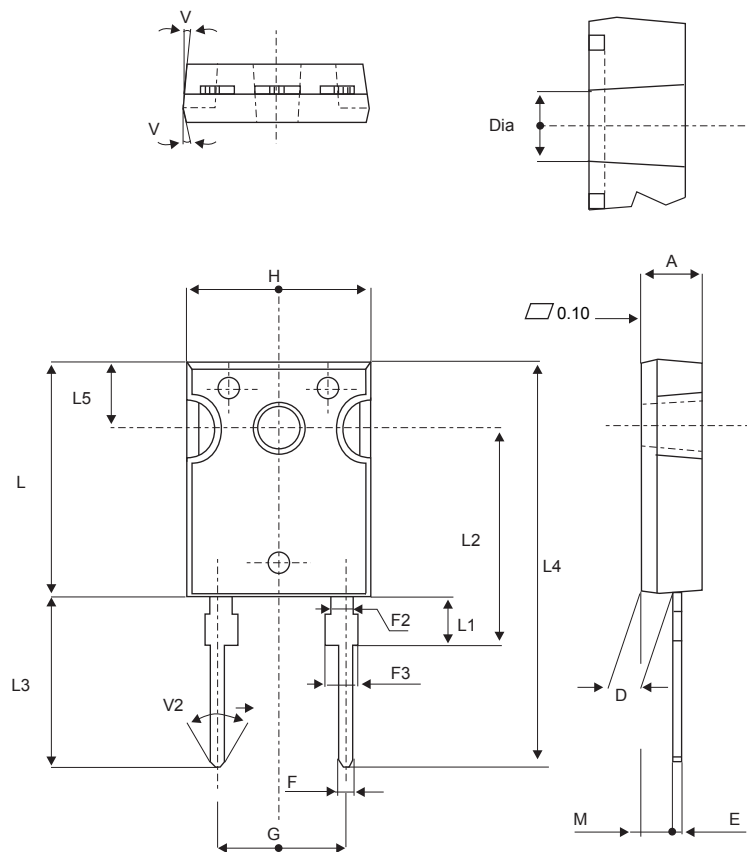


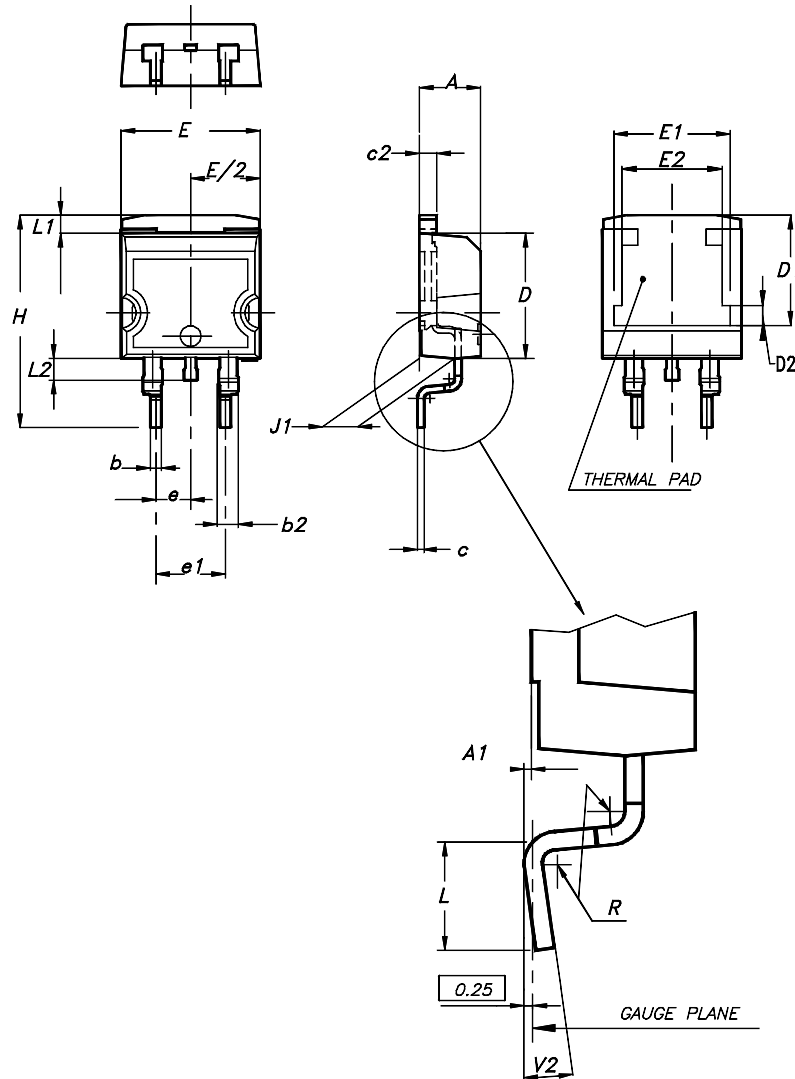
Table 5. DO-247 package mechanical data

| Ref. | Dimensions | | | |
|------|-------------|-------|------------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 4.85 | 5.15 | 0.191 | 0.203 |
| D | 2.20 | 2.60 | 0.086 | 0.102 |
| E | 0.40 | 0.80 | 0.015 | 0.031 |
| F | 1.00 | 1.40 | 0.039 | 0.055 |
| F2 | 2.00 typ. | | 0.078 typ. | |
| F3 | 2.00 | 2.40 | 0.078 | 0.094 |
| G | 10.90 typ. | | 0.429 typ. | |
| H | 15.45 | 15.75 | 0.608 | 0.620 |
| L | 19.85 | 20.15 | 0.781 | 0.793 |
| L1 | 3.70 | 4.30 | 0.145 | 0.169 |
| L2 | 18.50 typ. | | 0.728 typ. | |
| L3 | 14.20 | 14.80 | 0.559 | 0.582 |
| L4 | 34.60 typ. | | 1.362 typ. | |
| L5 | 5.50 typ. | | 0.216 typ. | |
| M | 2.00 | 3.00 | 0.078 | 0.118 |
| V | 5° | | 5° | |
| V2 | 60° | | 60° | |
| Dia. | 3.55 | 3.65 | 0.139 | 0.143 |

2.2 D²PAK package information

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

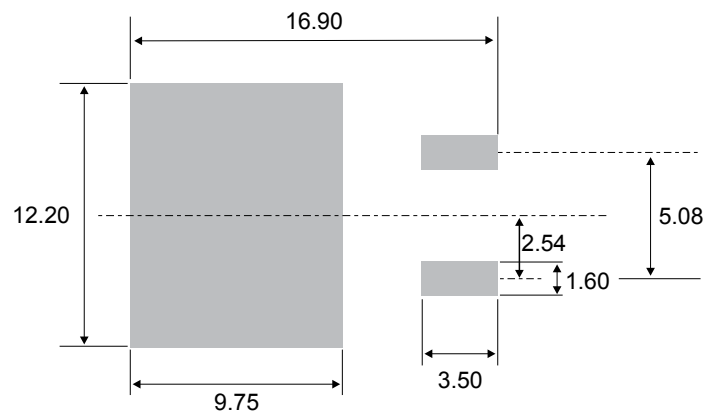
Figure 16. D²PAK package outline



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

Table 6. 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 17. D²PAK recommended footprint (dimensions in mm)


2.3 TO-220AC 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 18. TO-220AC package outline

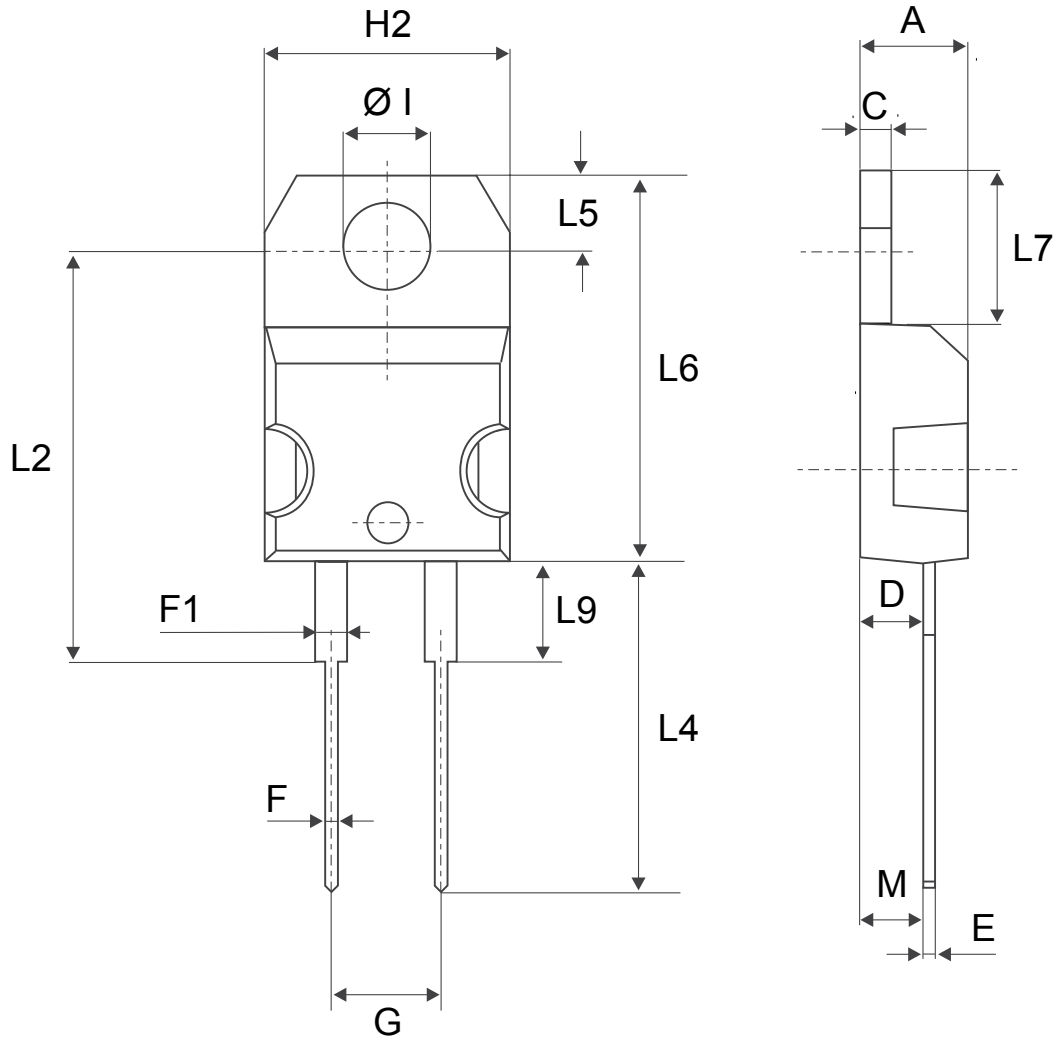


Table 7. TO-220AC package mechanical data

| 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 |

2.4 D²PAK HV package information

Figure 19. D²PAK high voltage package outline

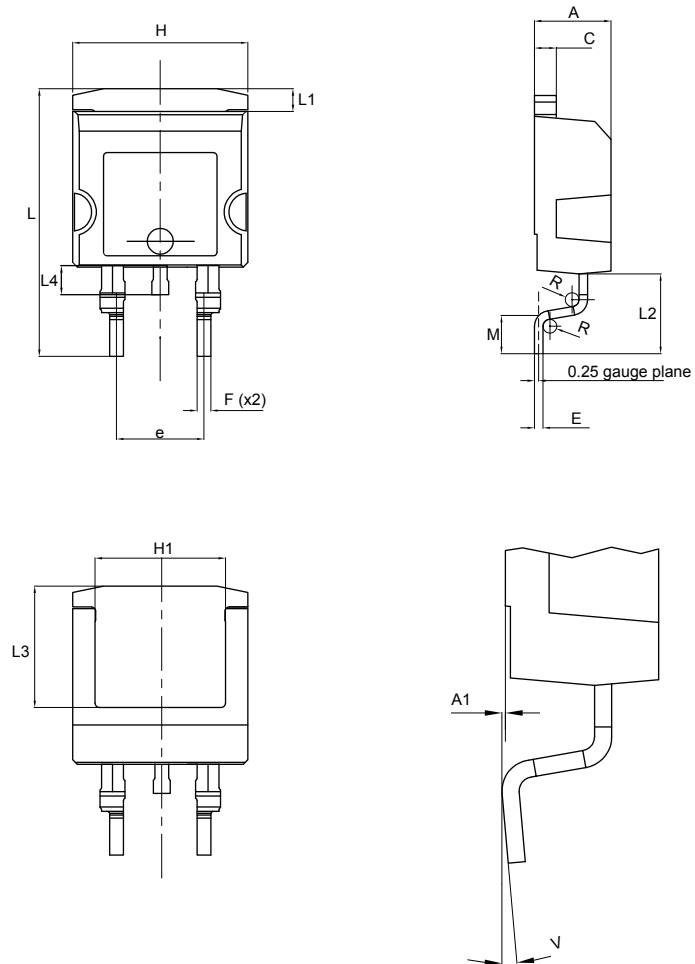
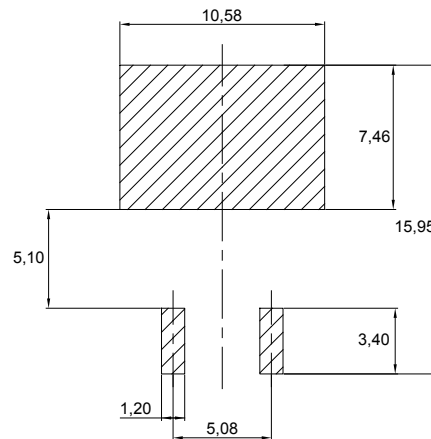


Table 8. D²PAK high voltage package mechanical data

| Ref. | Dimensions | | |
|------|------------|------|-------|
| | Min. | Typ. | Max. |
| A | 4.30 | | 4.70 |
| A1 | 0.03 | | 0.20 |
| C | 1.17 | | 1.37 |
| e | 4.98 | | 5.18 |
| E | 0.50 | | 0.90 |
| F | 0.78 | | 0.85 |
| H | 10.00 | | 10.40 |
| H1 | 7.40 | | 7.80 |
| L | 15.30 | | 15.80 |
| L1 | 1.27 | | 1.40 |
| L2 | 4.93 | | 5.23 |
| L3 | 6.85 | | 7.25 |
| L4 | 1.5 | | 1.7 |
| M | 2.6 | | 2.9 |
| R | 0.20 | | 0.60 |
| V | 0° | | 8° |

Figure 20. D²PAK High Voltage footprint in mm



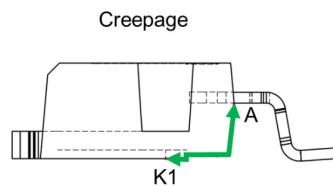
2.4.1 Creepage distance between anode and cathode

Table 9. Creepage distance between anode and cathode

| Symbol | Parameter | | Value | Unit |
|--------------------|--|-----------------------|-------|------|
| Cd _{A-K1} | Minimum creepage distance between A and K1 (with top coating) | D ² PAK HV | 5.38 | mm |
| Cd _{A-K2} | Minimum creepage distance between A and K2 (without top coating) | | 3.48 | |

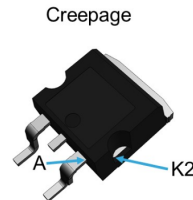
Note: D²PAK HV creepage distance (anode to cathode) = 5.38 mm min. (refer to IEC 60664-1)

Figure 21. Creepage with top coating



Minimum distance between A & K1 = 5.38 mm (with top coating)

Figure 22. Creepage without top coating



Minimum distance between A & K2 = 3.48 mm (without top coating)

3 Ordering information

Table 10. Ordering information

| Order code | Marking | Package | Weight | Base qty. | Delivery mode |
|-----------------|-------------|-----------------------|--------|-----------|---------------|
| STTH15RQ06G-TR | STTH15RQ06G | D ² PAK | 1.48 g | 1000 | Tape and reel |
| STTH15RQ06D | STTH15RQ06D | TO-220AC | 1.86 g | 50 | Tube |
| STTH15RQ06W | STTH15RQ06W | DO-247 | 4.40 g | 30 | Tube |
| STTH15RQ06G2-TR | TH15RQ06G2 | D ² PAK HV | 1.48 g | 1000 | Tape and reel |

Revision history

Table 11. Document revision history

| Date | Revision | Changes |
|-------------|----------|--------------------------------------|
| 12-Jun-2017 | 1 | Initial release. |
| 22-Nov-2018 | 2 | Added D ² PAK HV package. |

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