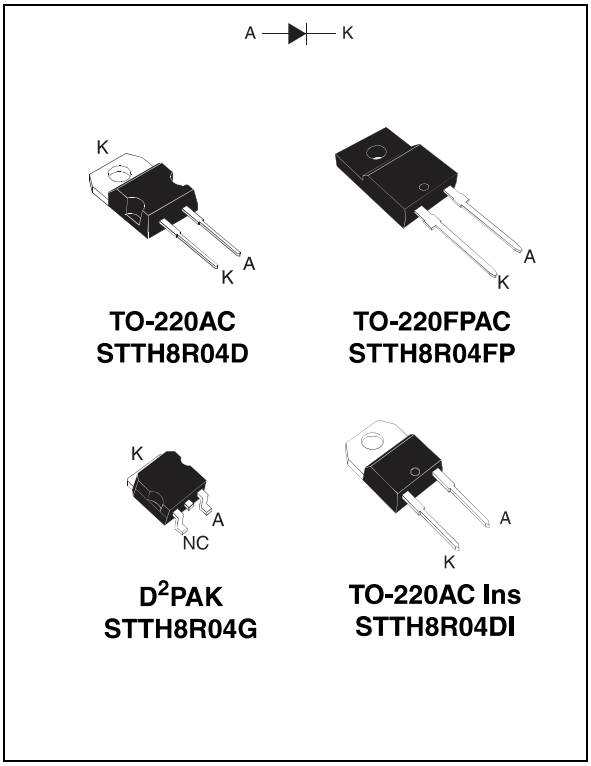
# STTH8R04

## Ultrafast recovery diode

## Main product characteristics

| | |
|---|---|
| $I_{F(AV)}$ | 8 A |
| $V_{RRM}$ | 400 V |
| $T_{j\ (max)}$ | 175° C |
| $V_{F\ (typ)}$ | 0.9 V |
| $t_{rr\ (typ)}$ | 25 ns |




**TO-220AC**
**STTH8R04D**

**TO-220FPAC**
**STTH8R04FP**

**$D^2PAK$**
**STTH8R04G**

**TO-220AC Ins**
**STTH8R04DI**

## Features and benefits

- Very low switching losses
- High frequency and high pulsed current operation
- High junction temperature
- Insulated packages
  - TO-220AC Ins
    Electrical insulation = 2500 $V_{RMS}$
    Capacitance = 7 pF
  - TO-220FPAC
    Electrical insulation = 1500 $V_{RMS}$
    Capacitance = 12 pF

## Description

The STTH8R04 series uses ST's new 400 V planar Pt doping technology. The STTH8R04 is specially suited for switching mode base drive and transistor circuits.

Packaged in through-the-hole and surface mount packages, this device is intended for use in low voltage, high frequency inverters, free wheeling and polarity protection.

### Order codes

| Part Number | Marking |
|---|---|
| STTH8R04D | STTH8R04D |
| STTH8R04DI | STTH8R04DI |
| STTH8R04FP | STTH8R04FP |
| STTH8R04G | STTH8R04G |
| STTH8R04G-TR | STTH8R04G |

# 1 Characteristics

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

| Symbol | Parameter | | | Value | Unit |
|---|---|---|---|---|---|
| $V_{RRM}$ | Repetitive peak reverse voltage | | | 400 | V |
| $V_{RSM}$ | Repetitive peak reverse voltage | | | 400 | V |
| $I_{F(RMS)}$ | RMS forward current | TO-220AC / $D^2$PAK / TO220FPAC | | 30 | A |
| | | TO220AC Ins | | 20 | |
| $I_{F(AV)}$ | Average forward current, δ = 0.5 | TO-220AC / $D^2$PAK | $T_c$ = 145° C | 8 | A |
| | | TO220FPAC | $T_c$ = 110° C | | |
| | | TO220AC Ins | $T_c$ = 115° C | | |
| $I_{FRM}$ | Repetitive peak forward current | | $t_p$ = 10 µs, F = 1 kHz | 165 | A |
| $I_{FSM}$ | Surge non repetitive forward current | $t_p$ = 10 ms Sinusoidal | | 120 | A |
| $T_{stg}$ | Storage temperature range | | | -65 to +175 | ° C |
| $T_j$ | Operating junction temperature range | | | -40 to +175 | ° C |

**Table 2. Thermal parameters**

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $R_{th(j-c)}$ | Junction to case | TO-220AC / $D^2$PAK | 2.5 | °C/W |
| | | TO220FPAC | 6 | |
| | | TO220AB Ins | 5.5 | |

**Table 3. Static electrical characteristics**

| Symbol | Parameter | Test conditions | | Min. | Typ | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $I_R$(1) | Reverse leakage current | $T_j$ = 25° C | $V_R = V_{RRM}$ | | | 10 | µA |
| | | $T_j$ = 125° C | | | 10 | 100 | |
| $V_F$(2) | Forward voltage drop | $T_j$ = 25° C | $I_F$ = 8 A | | | 1.5 | V |
| | | $T_j$ = 100° C | | | 1.05 | 1.3 | |
| | | $T_j$ = 150° C | | | 0.9 | 1.1 | |

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:
$P = 0.83 \times I_{F(AV)} + 0.034 \times I_F{}^2{}_{(RMS)}$

**Table 4. Dynamic characteristics**

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{rr}$ | Reverse recovery time | $I_F$ = 1 A, $dI_F/dt$ = -50 A/µs, $V_R$ = 30 V, $T_j$ = 25° C | | 35 | 50 | ns |
| | | $I_F$ = 1 A, $dI_F/dt$ = -100 A/µs, $V_R$ = 30 V, $T_j$ = 25° C | | 25 | 35 | |
| $I_{RM}$ | Reverse recovery current | $I_F$ = 8 A, $dI_F/dt$ = -200 A/µs, $V_R$ = 320 V, $T_j$ = 125° C | | 5.5 | 8 | A |
| S | Softness factor | $I_F$ = 8 A, $dI_F/dt$ = -200 A/µs, $V_R$ = 320 V, $T_j$ = 125° C | | 0.4 | | |
| $t_{fr}$ | Forward recovery time | $I_F$ = 8 A, $dI_F/dt$ = 100 A/µs $V_{FR}$ = 1.1 x $V_{Fmax}$, $T_j$ = 25° C | | | 150 | ns |
| $V_{FP}$ | Forward recovery voltage | $I_F$ = 8 A, $dI_F/dt$ = 100 A/µs | | 2.9 | | V |

**Figure 1. Conduction losses versus average current**

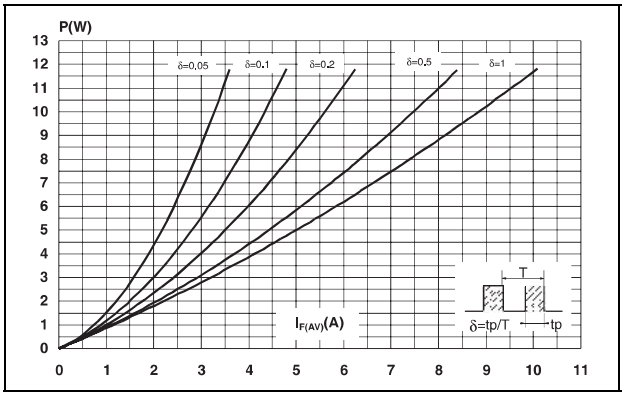



**Figure 2. Forward voltage drop versus forward current**

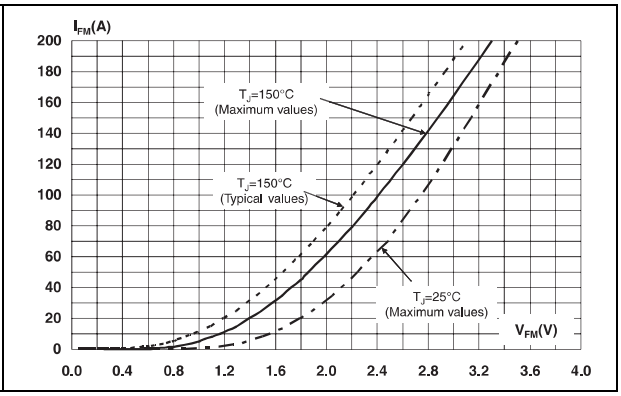



**Figure 3. Relative variation of thermal impedance junction to case versus pulse duration**

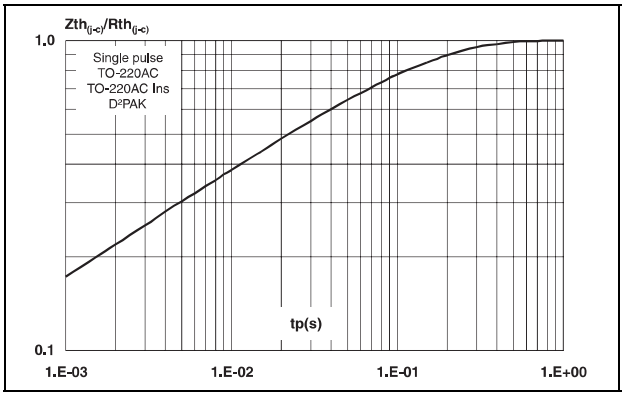



**Figure 4. Relative variation of thermal impedance junction to case versus pulse duration TO-220FPAB**

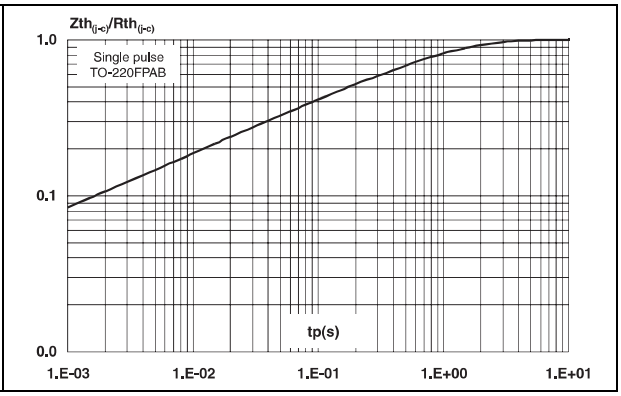


**Figure 5. Peak reverse recovery current versus $dI_F/dt$ (typical values)**

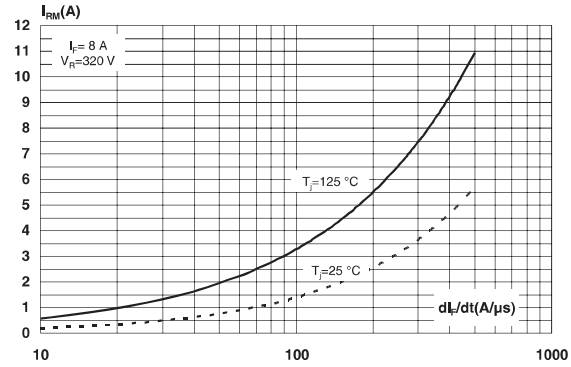



**Figure 6. Reverse recovery time versus $dI_F/dt$ (typical values)**

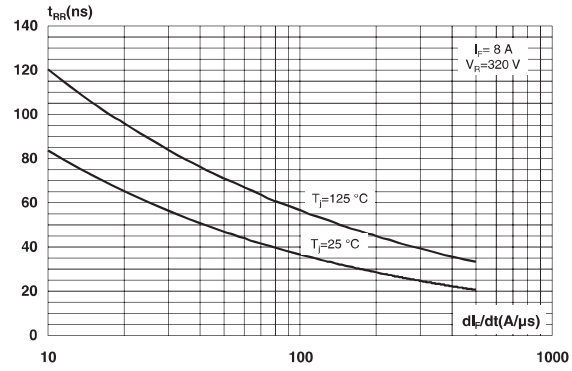



**Figure 7. Reverse recovery charges versus $dI_F/dt$ (typical values)**

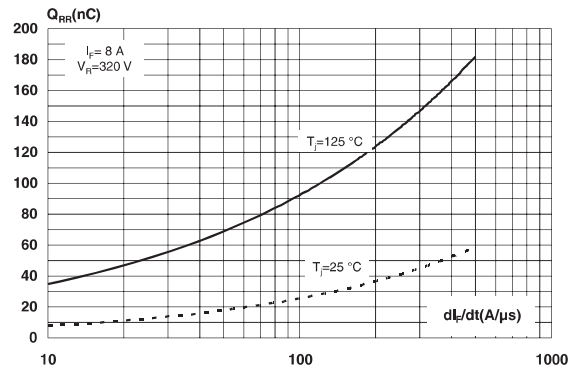



**Figure 8. Thermal resistance junction to ambient versus copper surface under tab (Epoxy printed circuit board FR4, $e_{CU}$=35µm)**

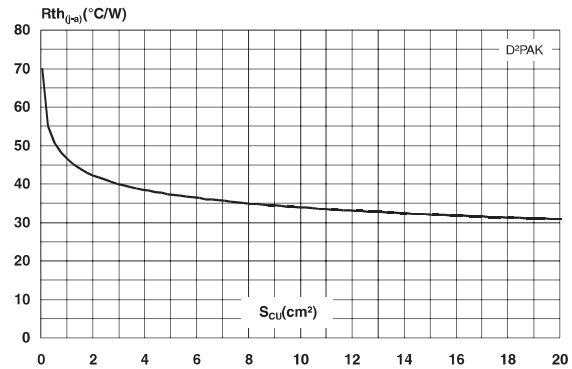


**Figure 9. Relative variations of dynamic parameters versus junction temperature**

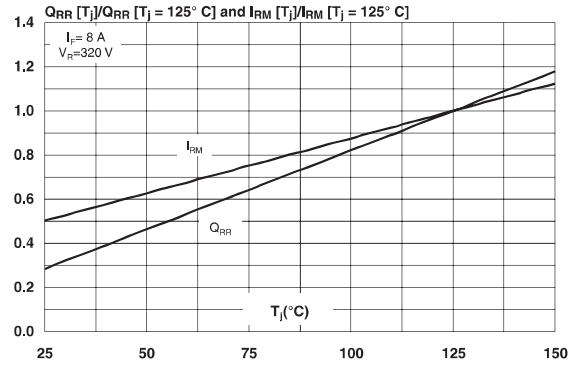



**Figure 10. Transient peak forward voltage versus $dI_F/dt$ (typical values)**

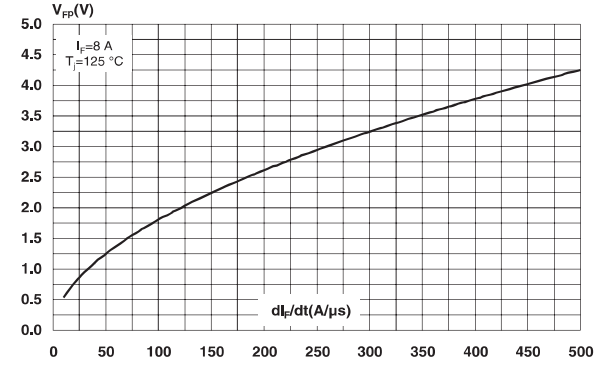



**Figure 11. Forward recovery time versus $dI_F/dt$ (typical values)**

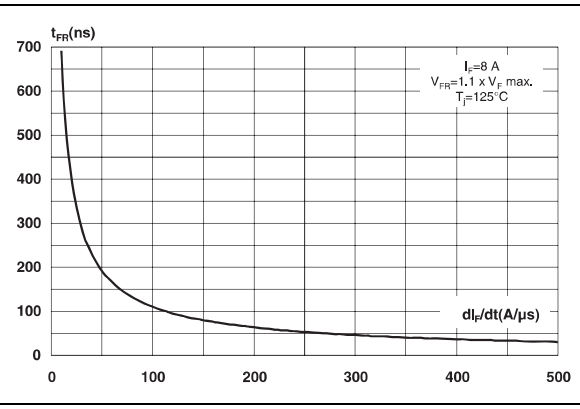
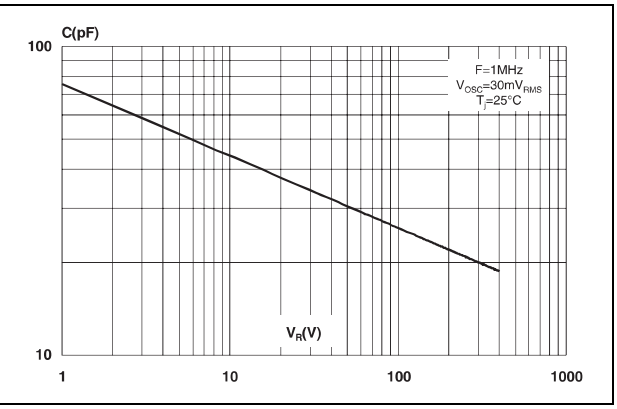


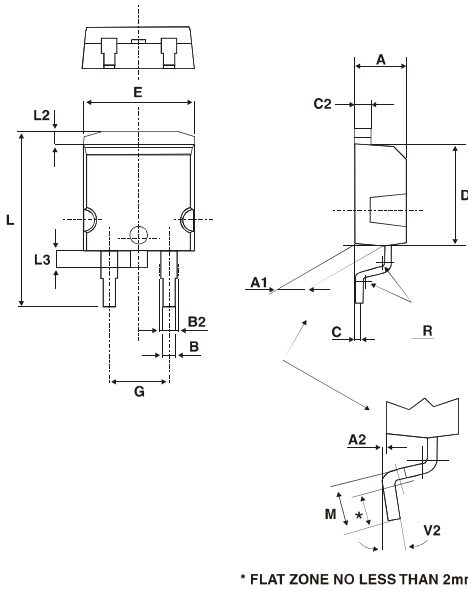

**Figure 12. Junction capacitance versus reverse voltage applied (typical values)**



# 2 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.55 Nm (TO-220AC, TO-220AC Ins, TO-220FPAC)
- Maximum torque value: 0.70 Nm (TO-220AC, TO-220AC Ins, TO-220FPAC)

**Table 5. D²PAK dimensions**




| Ref. | Dimensions | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 4.40 | 4.60 | 0.173 | 0.181 |
| A1 | 2.49 | 2.69 | 0.098 | 0.106 |
| A2 | 0.03 | 0.23 | 0.001 | 0.009 |
| B | 0.70 | 0.93 | 0.027 | 0.037 |
| B2 | 1.14 | 1.70 | 0.045 | 0.067 |
| C | 0.45 | 0.60 | 0.017 | 0.024 |
| C2 | 1.23 | 1.36 | 0.048 | 0.054 |
| D | 8.95 | 9.35 | 0.352 | 0.368 |
| E | 10.00 | 10.40 | 0.393 | 0.409 |
| G | 4.88 | 5.28 | 0.192 | 0.208 |
| L | 15.00 | 15.85 | 0.590 | 0.624 |
| L2 | 1.27 | 1.40 | 0.050 | 0.055 |
| L3 | 1.40 | 1.75 | 0.055 | 0.069 |
| M | 2.40 | 3.20 | 0.094 | 0.126 |
| R | 0.40 typ. | | 0.016 typ. | |
| V2 | 0° | 8° | 0° | 8° |

**Figure 13. D²PAK footprint (dimensions in mm)**

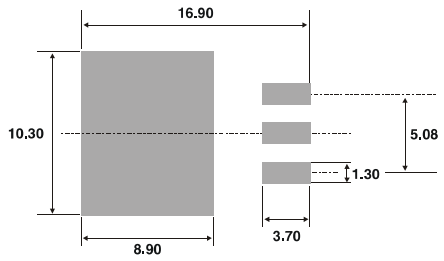
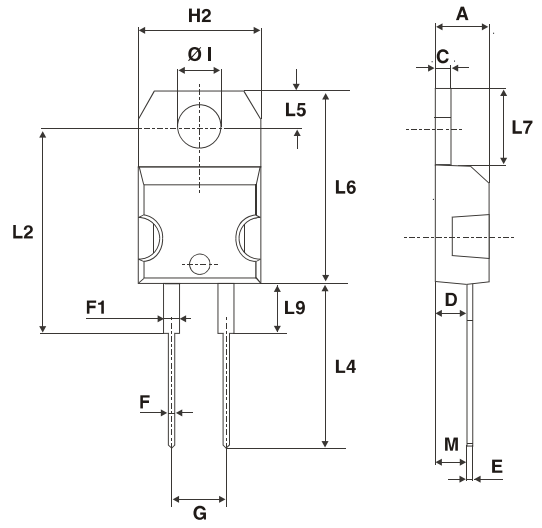
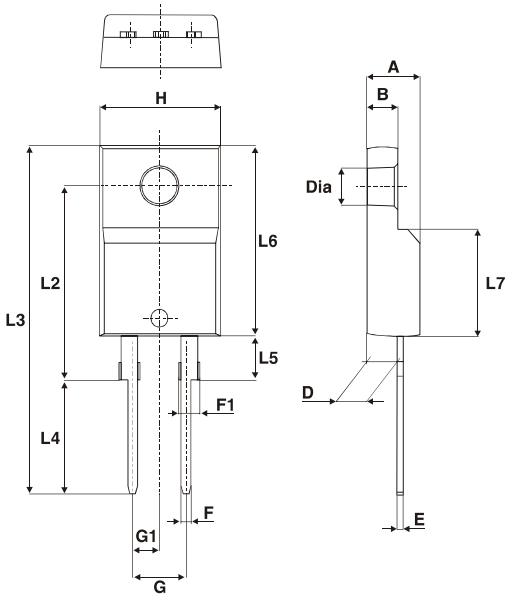


Table 6. TO-220AC dimensions



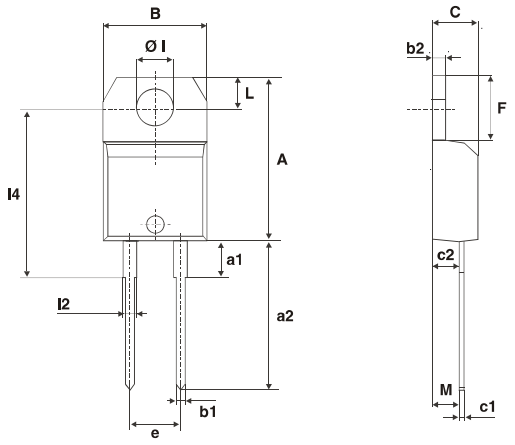

| Ref. | Dimensions | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 4.40 | 4.60 | 0.173 | 0.181 |
| C | 1.23 | 1.32 | 0.048 | 0.051 |
| D | 2.40 | 2.72 | 0.094 | 0.107 |
| E | 0.49 | 0.70 | 0.019 | 0.027 |
| F | 0.61 | 0.88 | 0.024 | 0.034 |
| F1 | 1.14 | 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. | |
| Diam. I | 3.75 | 3.85 | 0.147 | 0.151 |

**Table 7. TO-220FPAC dimensions**




| 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 |
| 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 |

**Table 8. TO-220AC Ins. dimensions**




| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 15.20 | | 15.90 | 0.598 | | 0.625 |
| a1 | | 3.75 | | | 0.147 | |
| a2 | 13.00 | | 14.00 | 0.511 | | 0.551 |
| B | 10.00 | | 10.40 | 0.393 | | 0.409 |
| b1 | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b2 | 1.23 | | 1.32 | 0.048 | | 0.051 |
| C | 4.40 | | 4.60 | 0.173 | | 0.181 |
| c1 | 0.49 | | 0.70 | 0.019 | | 0.027 |
| c2 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| e | 4.80 | | 5.40 | 0.189 | | 0.212 |
| F | 6.20 | | 6.60 | 0.244 | | 0.259 |
| ØI | 3.75 | | 3.85 | 0.147 | | 0.151 |
| I4 | 15.80 | 16.40 | 16.80 | 0.622 | 0.646 | 0.661 |
| L | 2.65 | | 2.95 | 0.104 | | 0.116 |
| I2 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| M | | 2.60 | | | 0.102 | |

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

# 3 Ordering information

| Part Number | Marking | Package | Weight | Base qty | Delivery mode |
|---|---|---|---|---|---|
| STTH8R04D | STTH8R04D | TO-220AC | 1.86 g | 50 | Tube |
| STTH8R04DI | STTH8R04DI | TO-220 Ins | 2.3 g | 50 | Tube |
| STTH8R04FP | STTH8R04FP | TO220FPAC | 1.64 g | 50 | Tube |
| STTH8R04G | STTH8R04G | $D^2PAK$ | 1.48 g | 50 | Tube |
| STTH8R04G-TR | STTH8R04G | $D^2PAK$ | 1.48 g | 1000 | Tape and reel |

# 4 Revision history

| Date | Revision | Description of Changes |
|---|---|---|
| 11-Mar-2007 | 1 | First issue. |

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