



ST13005

High voltage fast-switching NPN power transistor

Features

- Low spread of dynamic parameters
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed

Applications

- Electronic ballast for fluorescent lighting
- Switch mode power supplies

Description

The device is manufactured using high voltage multi-epitaxial planar technology for high switching speeds and medium voltage capability. It uses a cellular emitter structure with planar edge termination to enhance switching speeds while maintaining the wide RBSOA.

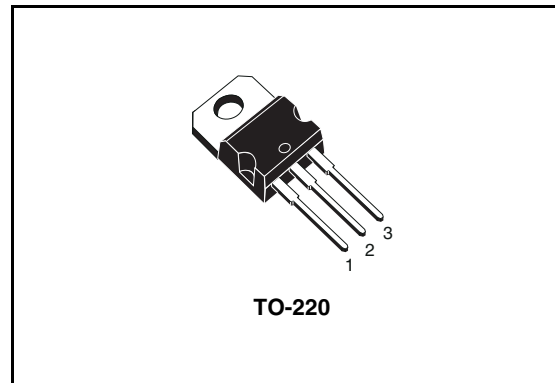


Figure 1. Internal schematic diagram

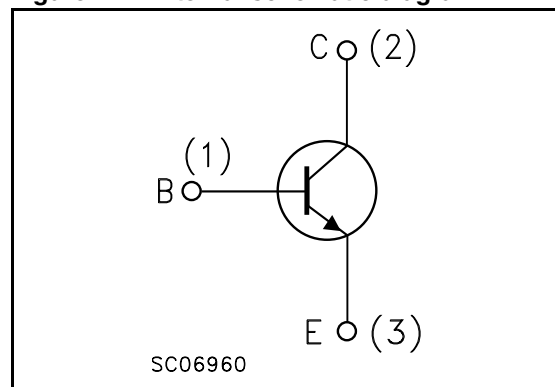


Table 1. Device summary

| Order code | Marking ⁽¹⁾ | Package | Packaging |
|------------|------------------------|---------|-----------|
| ST13005 | 13005A | TO-220 | Tube |
| ST13005 | 13005B | TO-220 | Tube |

1. Product is pre-selected in DC current gain (group A and group B). STMicroelectronics reserves the right to ship either groups according to production availability. Please contact your nearest STMicroelectronics sales office for delivery details.

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1 Electrical ratings

Table 2. Absolute maximum rating

| Symbol | Parameter | Value | Unit |
|-----------|---|------------|------------------|
| V_{CES} | Collector-emitter voltage ($V_{BE} = 0$) | 700 | V |
| V_{CEO} | Collector-emitter voltage ($I_B = 0$) | 400 | V |
| V_{EBO} | Emitter-base voltage ($I_C = 0$) | 9 | V |
| I_C | Collector current | 4 | A |
| I_{CM} | Collector peak current ($t_p < 5\text{ms}$) | 8 | A |
| I_B | Base current | 2 | A |
| I_{BM} | Base peak current ($t_p < 5\text{ms}$) | 4 | A |
| P_{tot} | Total dissipation at $T_c = 25^\circ\text{C}$ | 75 | W |
| T_{stg} | Storage temperature | -65 to 150 | $^\circ\text{C}$ |
| T_J | Max. operating junction temperature | 150 | $^\circ\text{C}$ |

2 Electrical characteristics

($T_{\text{case}} = 25^{\circ}\text{C}$ unless otherwise specified)

Table 3. Electrical characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------------------|---|---|---------------|------|-----------------|--------------------------------|
| I_{CES} | Collector cut-off current ($V_{\text{BE}} = 0$) | $V_{\text{CE}} = 700 \text{ V}$ $V_{\text{CE}} = 700 \text{ V}$ $T_{\text{C}} = 125^{\circ}\text{C}$ | | | 1 5 | mA mA |
| I_{EBO} | Emitter cut-off current ($I_{\text{C}} = 0$) | $V_{\text{EB}} = 9 \text{ V}$ | | | 1 | mA |
| $V_{\text{CEO(sus)}}^{(1)}$ | Collector-emitter sustaining voltage ($I_{\text{B}} = 0$) | $I_{\text{C}} = 10 \text{ mA}$ | 400 | | | V |
| $V_{\text{CE(sat)}}^{(1)}$ | Collector-emitter saturation voltage | $I_{\text{C}} = 1 \text{ A}$ $I_{\text{B}} = 0.2 \text{ A}$ $I_{\text{C}} = 2 \text{ A}$ $I_{\text{B}} = 0.5 \text{ A}$ $I_{\text{C}} = 4 \text{ A}$ $I_{\text{B}} = 1 \text{ A}$ | | | 0.5 0.6 1 | V V V |
| $V_{\text{BE(sat)}}^{(1)}$ | Base-emitter saturation voltage | $I_{\text{C}} = 1 \text{ A}$ $I_{\text{B}} = 0.2 \text{ A}$ $I_{\text{C}} = 2 \text{ A}$ $I_{\text{B}} = 0.5 \text{ A}$ | | | 1.2 1.6 | V V |
| $h_{\text{FE}}^{(1)(2)}$ | DC current gain | $I_{\text{C}} = 1 \text{ A}$ $V_{\text{CE}} = 5 \text{ V}$ Group A Group B $I_{\text{C}} = 2 \text{ A}$ $V_{\text{CE}} = 5 \text{ V}$ | 15 27 8 | | 32 45 40 | |
| t_{s} t_{f} | Resistive load Storage time Fall time | $I_{\text{C}} = 2 \text{ A}$ $V_{\text{CC}} = 125 \text{ V}$ $I_{\text{B1}} = - I_{\text{B2}} = 0.4 \text{ A}$ $t_{\text{p}} = 30 \mu\text{s}$ | 1.5 | 0.2 | 3 | μs μs |

1. Pulsed duration = 300 ms, duty cycle $\leq 1.5\%$
2. Product is pre-selected in DC current gain (group A and group B). STMicroelectronics reserves the right to ship either groups according to production availability. Please contact your nearest STMicroelectronics sales office for delivery details.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

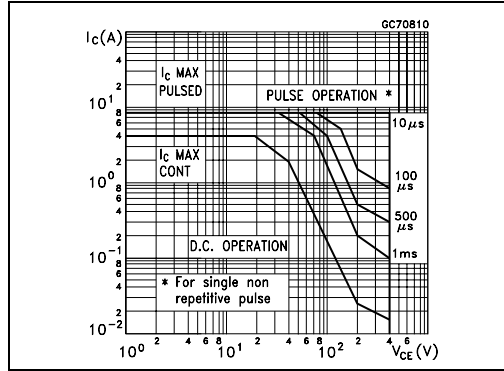


Figure 3. Derating curve

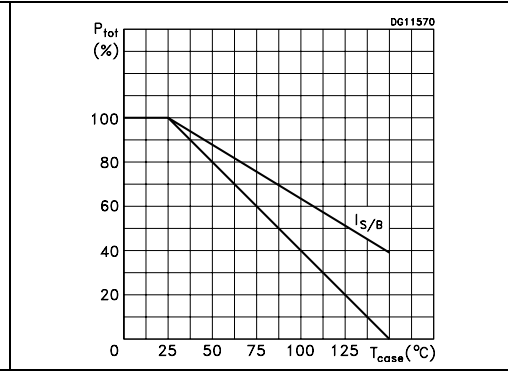


Figure 4. DC current gain

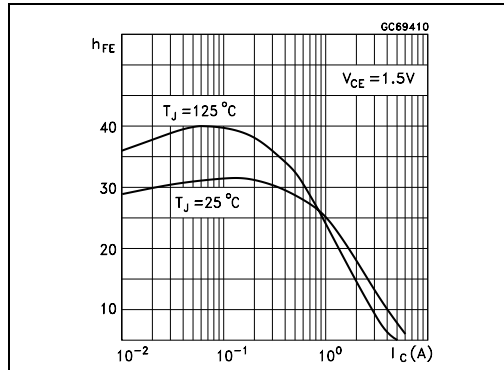


Figure 5. DC current gain

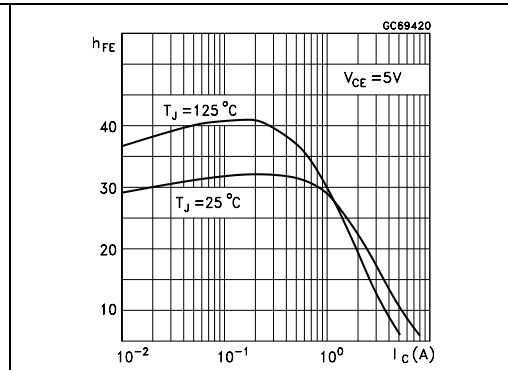


Figure 6. Collector-emitter saturation voltage

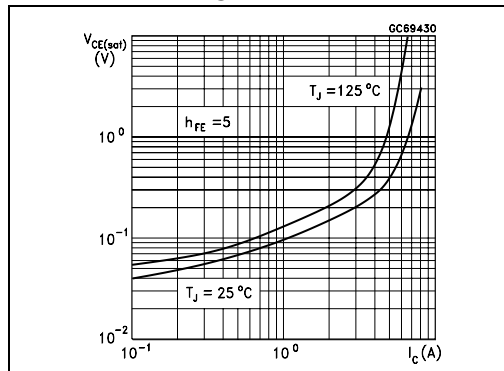


Figure 7. Base-emitter saturation voltage

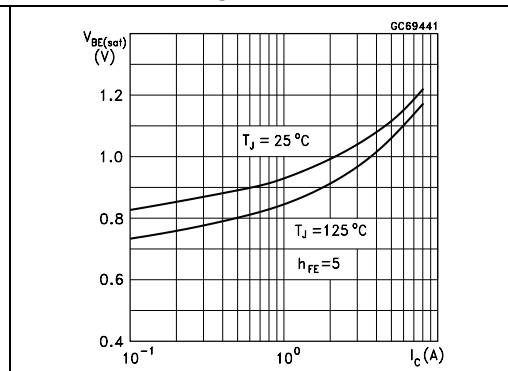


Figure 8. Inductive load fall time

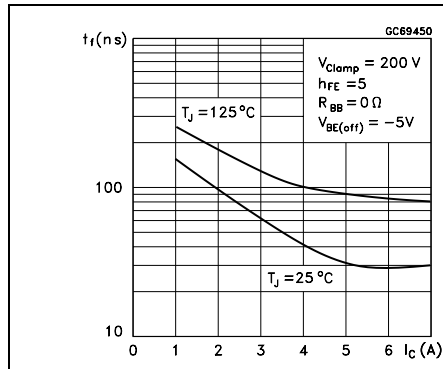


Figure 9. Inductive load storage time

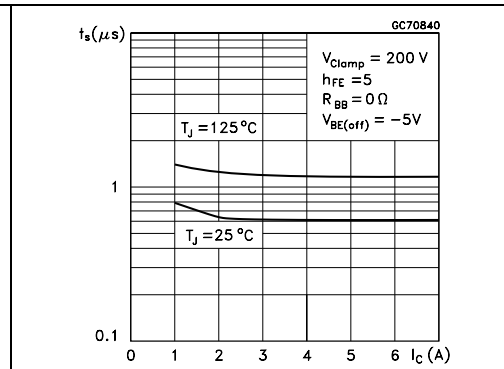


Figure 10. Resistive load fall time

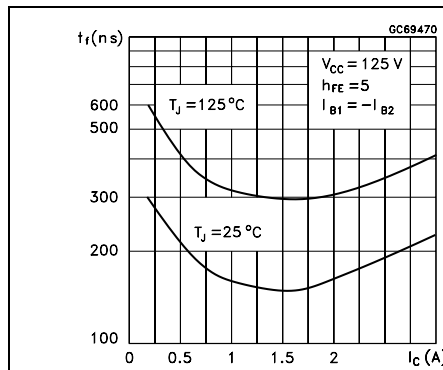


Figure 11. Resistive load storage time

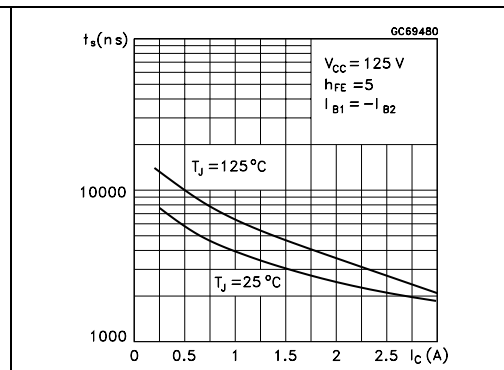
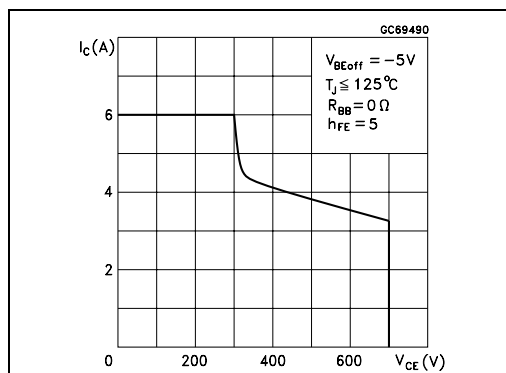


Figure 12. Reverse biased operating area



3 Test circuit

Figure 13. Inductive load switching test circuit

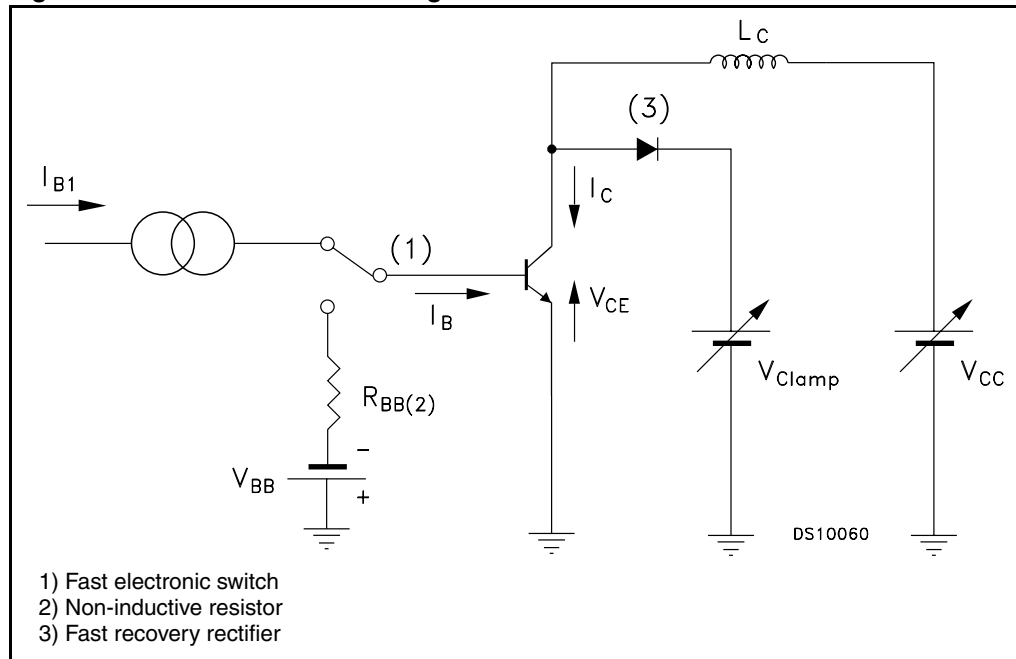
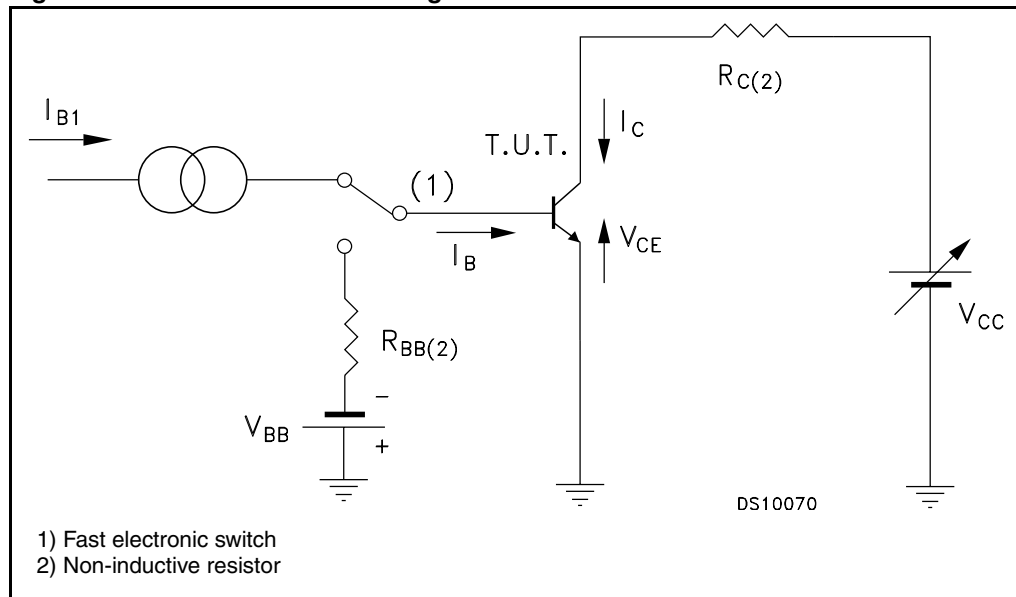


Figure 14. Resistive load switching test circuit

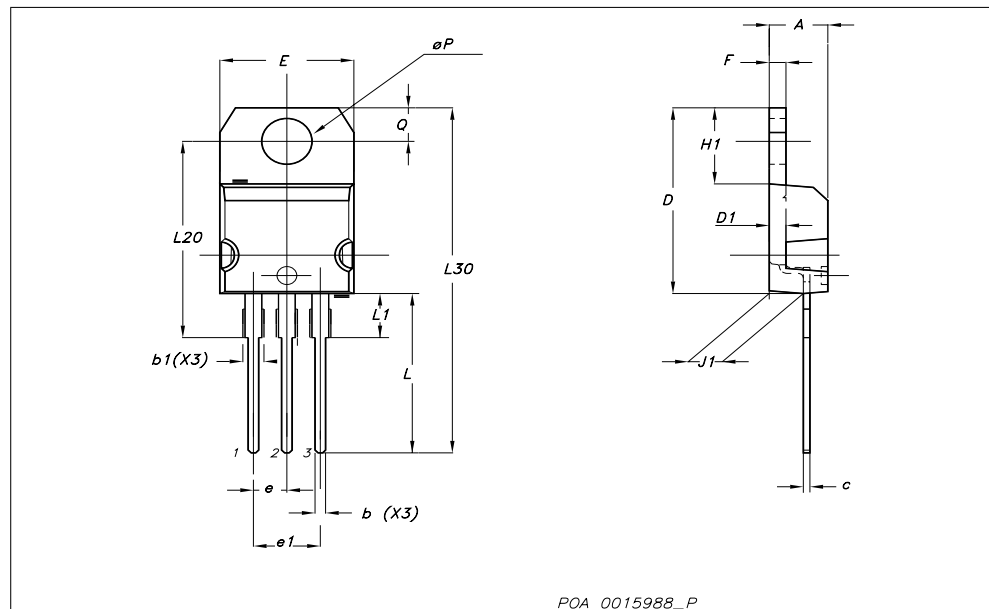


4 Package mechanical data

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

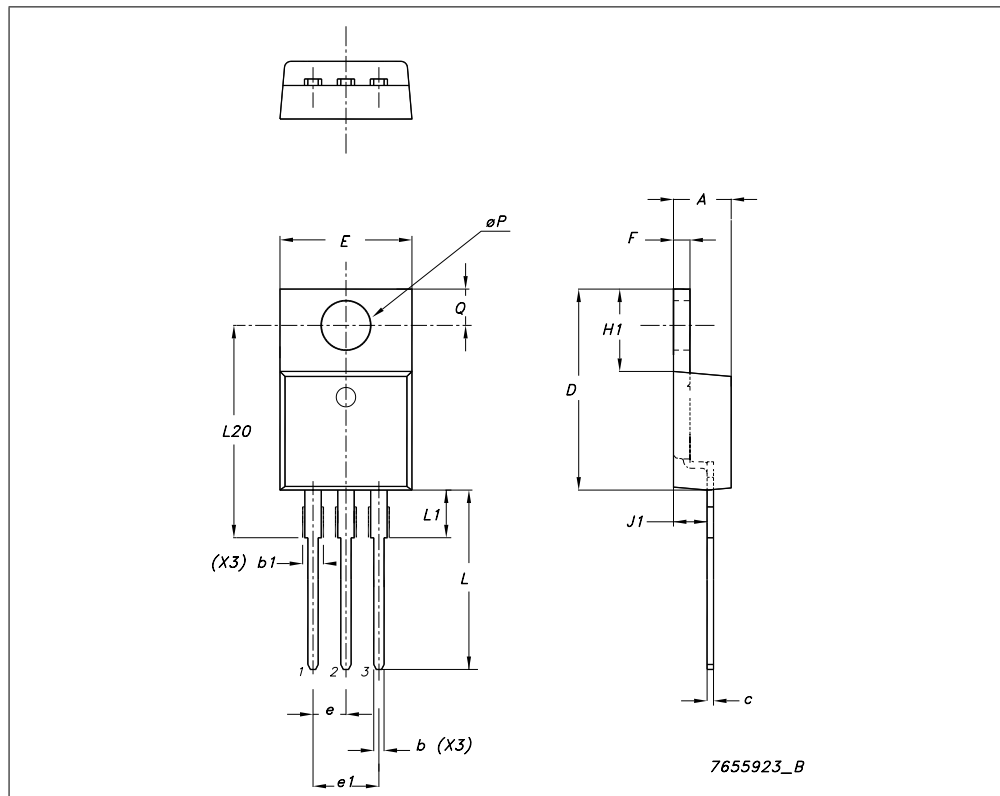
TO-220 mechanical data

| Dim | mm | | | inch | | |
|-----|-------|-------|-------|-------|-------|-------|
| | Min | Typ | Max | Min | Typ | Max |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| b | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b1 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| c | 0.49 | | 0.70 | 0.019 | | 0.027 |
| D | 15.25 | | 15.75 | 0.6 | | 0.62 |
| D1 | | 1.27 | | | 0.050 | |
| E | 10 | | 10.40 | 0.393 | | 0.409 |
| 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 | | 0.051 |
| H1 | 6.20 | | 6.60 | 0.244 | | 0.256 |
| J1 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| L | 13 | | 14 | 0.511 | | 0.551 |
| L1 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| L20 | | 16.40 | | | 0.645 | |
| L30 | | 28.90 | | | 1.137 | |
| ∅P | 3.75 | | 3.85 | 0.147 | | 0.151 |
| Q | 2.65 | | 2.95 | 0.104 | | 0.116 |



TO-220 (option 1) mechanical data

| Dim | mm | | |
|-----|-------|------|-------|
| | Min | Typ | Max |
| A | 4.47 | | 4.67 |
| b | 0.70 | | 0.91 |
| b1 | 1.17 | | 1.37 |
| c | 0.31 | | 0.53 |
| D | 14.60 | | 15.70 |
| E | 9.96 | | 10.36 |
| e | | 2.54 | |
| e1 | 4.98 | 5.08 | 5.18 |
| F | 1.17 | | 1.37 |
| H1 | 6.10 | | 6.80 |
| J1 | 2.52 | | 2.82 |
| L | 12.70 | | 13.80 |
| L1 | 3.20 | | 3.96 |
| L20 | 15.21 | | 16.77 |
| øP | 3.73 | | 3.94 |
| Q | 2.59 | | 2.89 |



5 Revision history

Table 4. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 21-Jun-2004 | 6 | |
| 22-Aug-2007 | 7 | Updated mechanical data on page 10 according to PCN APM-PWR/07/2804 |
| 12-Oct-2007 | 8 | Updated marking in Table 1 |

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