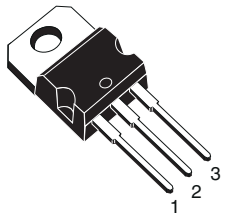
# STP60NF03L

## N-channel 30V - 0.008Ω - 60A TO-220 STripFET™ Power MOSFET

## General features

| Type | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STP60NF03L | 30V | <0.01Ω | 60A |

- Low threshold drive

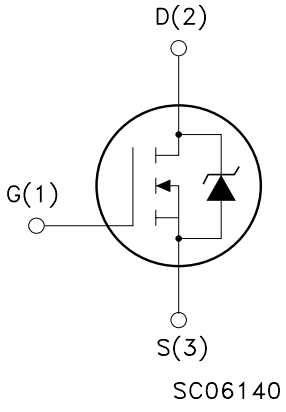



**TO-220**

## Description

This Power MOSFET is the latest development of STMicroelectronis unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

## Internal schematic diagram




## Applications

- Switching application

## Order codes

| Part number | Marking | Package | Packaging |
|---|---|---|---|
| STP60NF03L | P60NF03L | TO-220 | Tube |

# Contents

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{GS}$ | Gate-source voltage | 30 | V |
| $V_{DGR}$ | Drain-gate Voltage ($R_{GS}$ = 20 kΩ) | 30 | V |
| $V_{GS}$ | Gate- source Voltage | ± 20 | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25°C | 60 | A |
| $I_D$ | Drain current (continuous) at $T_C$=100°C | 42 | A |
| $I_{DM}$(1) | Drain current (pulsed) | 240 | A |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25°C | 100 | W |
| | Derating factor | 0.67 | W/°C |
| $E_{AS}$(2) | Single pulse avalanche energy | 650 | mJ |
| $T_J$<br>$T_{stg}$ | Operating junction temperature<br>Storage temperature | 175<br>-65 to 175 | °C |

1. Pulse width limited by safe operating area
2. Starting $T_j$ = 25°C, $I_D$ = 30A, $V_{DD}$ = 20V

**Table 2. Thermal data**

| | | | |
|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal resistance junction-case Max | 1.5 | °C/W |
| $R_{thj\text{-}a}$ | Thermal resistance junction-ambient Max | 62.5 | °C/W |
| Rthc-sink | Thermal resistance case-sink typ | 0.5 | °C/W |
| $T_l$ | Maximum lead temperature for soldering purpose | 300 | °C |

# 2 Electrical characteristics

($T_{CASE}$=25°C unless otherwise specified)

**Table 3. On/off states**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D$ = 250 µA, $V_{GS}$= 0 | 30 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current ($V_{GS}$ = 0) | $V_{DS}$ = Max rating,<br>$V_{DS}$ = Max rating @125°C | | | 1<br>10 | µA<br>µA |
| $I_{GSS}$ | Gate body leakage current ($V_{DS}$ = 0) | $V_{GS}$ = ±20V | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$= $V_{GS}$, $I_D$ = 250µA | 1 | 1.5 | 2.5 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS}$= 10V, $I_D$= 30A<br>$V_{GS}$= 4.5V, $I_D$= 30A | | 0.008<br>0.0095 | 0.010<br>0.015 | Ω<br>Ω |

**Table 4. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (1) | Forward transconductance | $V_{DS}$ > $I_{D(on)}$ x $R_{DS(on)max}$, $I_D$ = 30A | | 60 | | S |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS}$ =25V, f=1 MHz, $V_{GS}$=0 | | 2550<br>630<br>215 | | pF<br>pF<br>pF |
| $t_{d(on)}$<br>$t_r$ | Turn-on Delay Time<br>Rise Time | $V_{DD}$ = 15V, $I_D$ = 30A, $R_G$ = 4.7Ω, $V_{GS}$ = 4.5V (see Figure 12) | | 40<br>250 | | ns<br>ns |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total gate charge<br>Gate-source charge<br>Gate-drain charge | $V_{DD}$=24V, $I_D$ = 60A<br>$V_{GS}$ =5V | | 43<br>12<br>21 | 58 | nC<br>nC<br>nC |

1. Pulsed: pulse duration=300µs, duty cycle 1.5%

**Table 5. Source drain diode**

| Symbol | Parameter | Test conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain current | | | | 60 | A |
| $I_{SDM}$(1) | Source-drain current (pulsed) | | | | 240 | A |
| $V_{SD}$(2) | Forward on voltage | $I_{SD}$=60A, $V_{GS}$=0 | | | 1.5 | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}$=60A,<br>di/dt = 100A/µs,<br>$V_{DD}$=15V, Tj=150°C<br>(see Figure 14) | | 75<br>100<br>2.6 | | ns<br>µC<br>A |

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300µs, duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area**

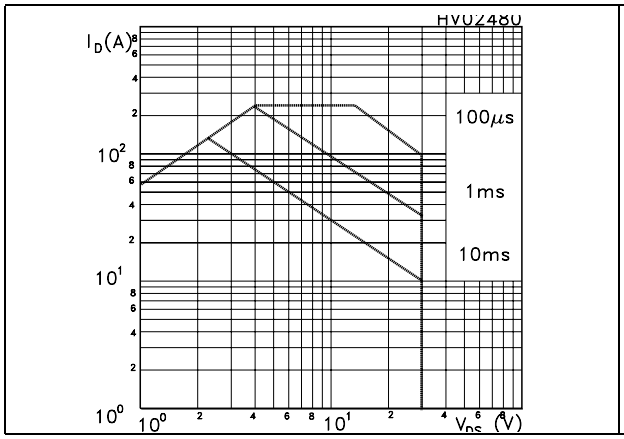



**Figure 2. Thermal impedance**

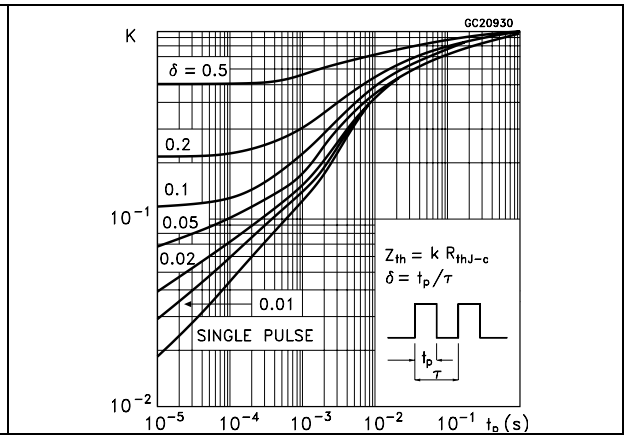



**Figure 3. Output characterisics**

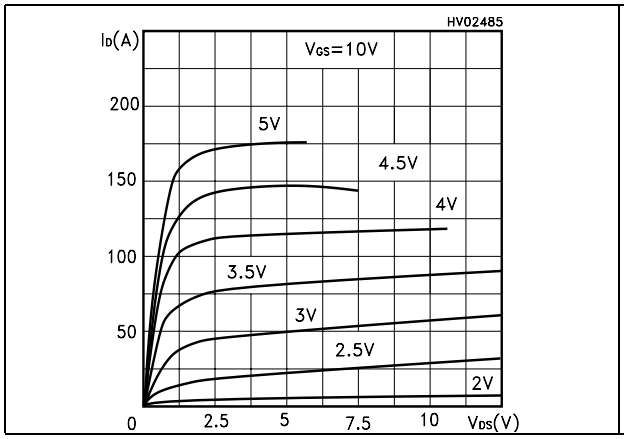



**Figure 4. Transfer characteristics**

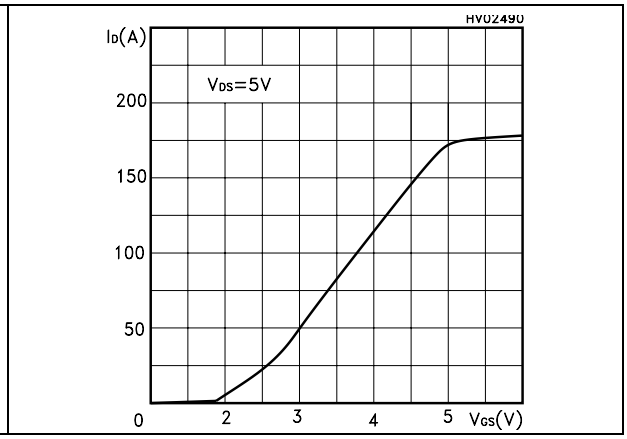



**Figure 5. Transconductance**

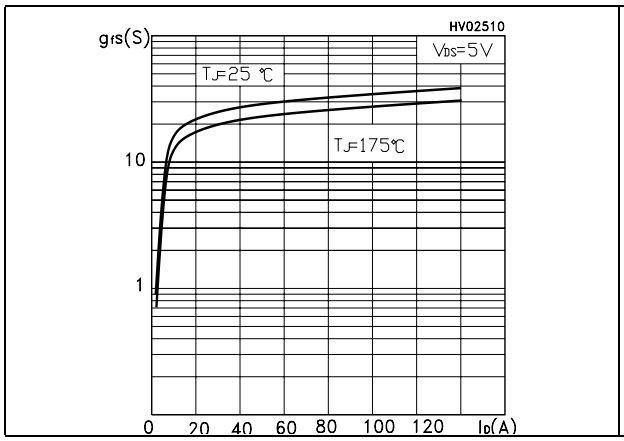



**Figure 6. Static drain-source on resistance**

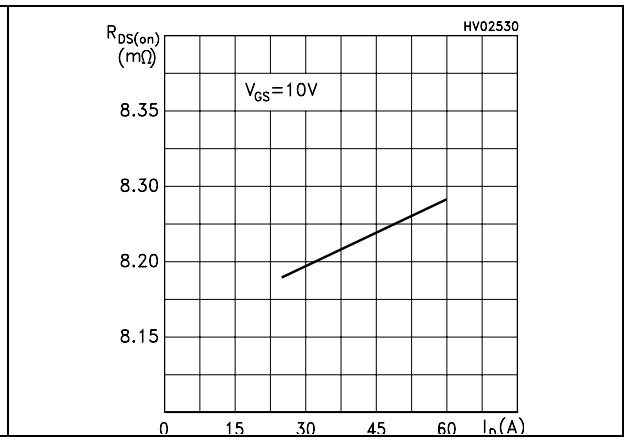


**Figure 7. Gate charge vs gate-source voltage**

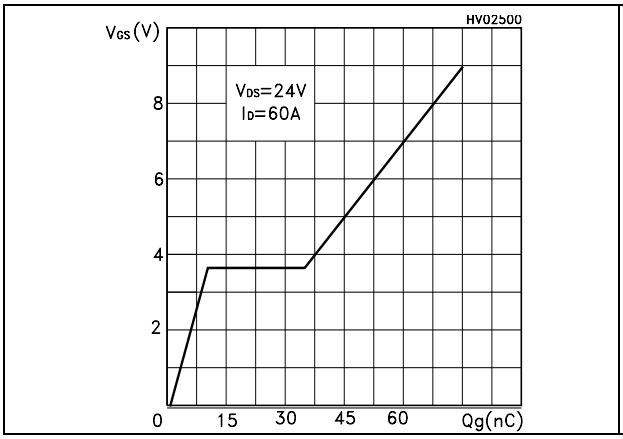



**Figure 8. Capacitance variations**

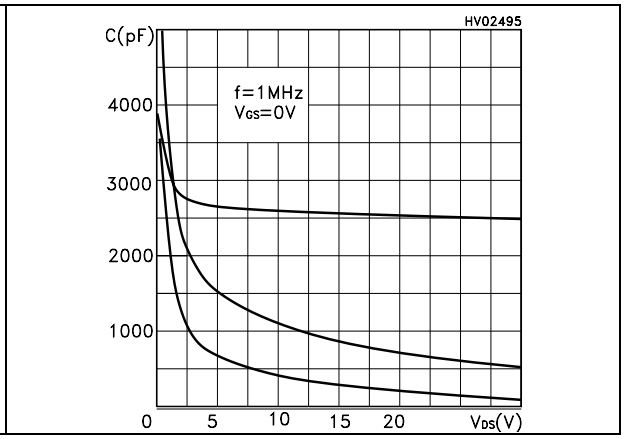



**Figure 9. Normalized gate threshold voltage vs temperature**

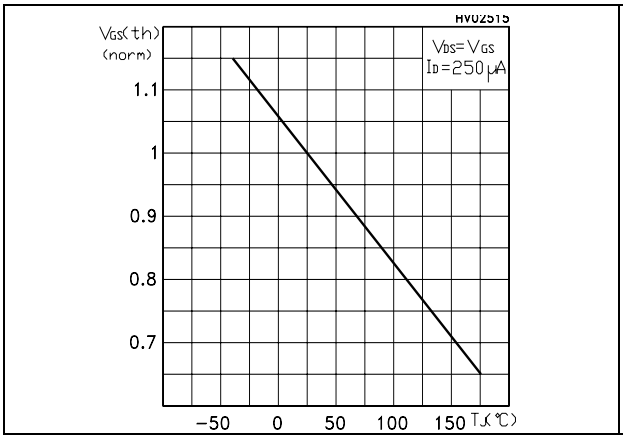



**Figure 10. Normalized on resistance vs temperature**

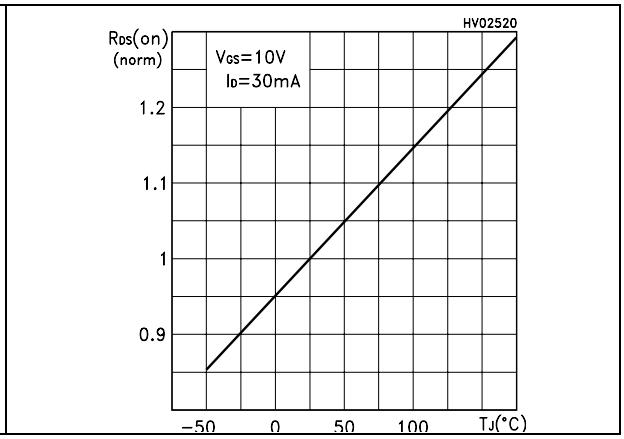
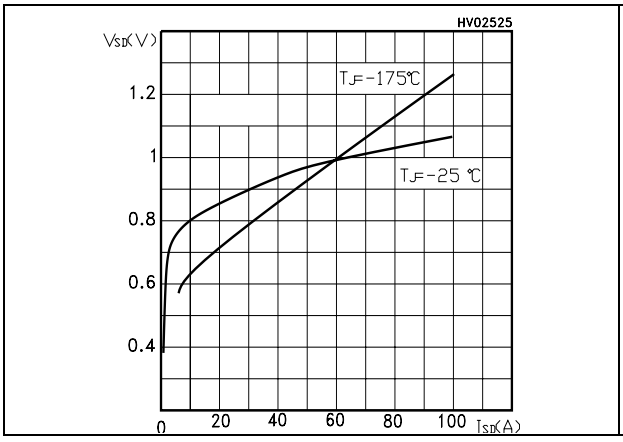



**Figure 11. Source-drain diode forward characteristics**



# 3 Test circuit

**Figure 12. Switching times test circuit for resistive load**

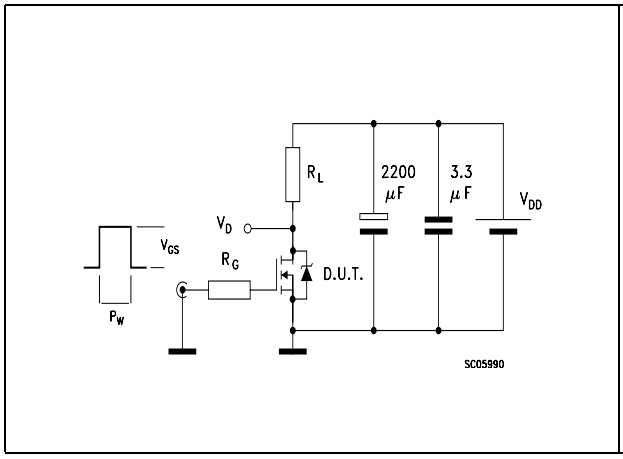



**Figure 13. Gate charge test circuit**

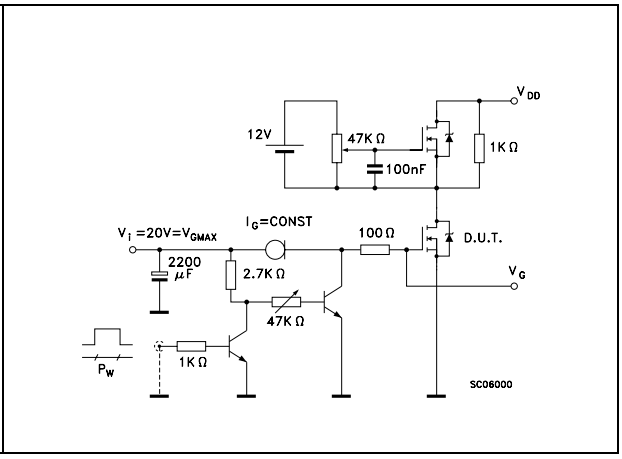



**Figure 14. Test circuit for inductive load switching and diode recovery times**

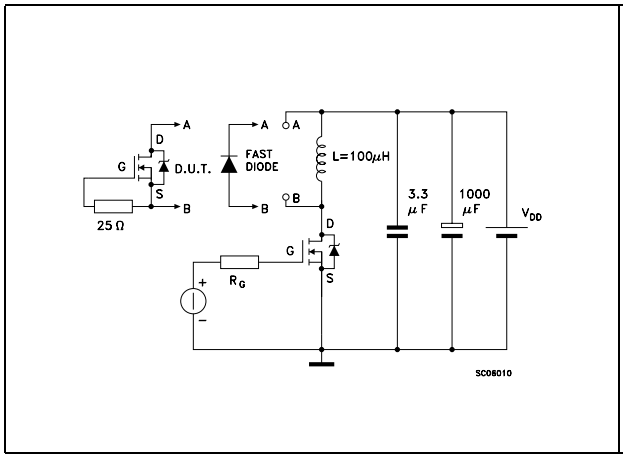



**Figure 15. Unclamped Inductive load test circuit**

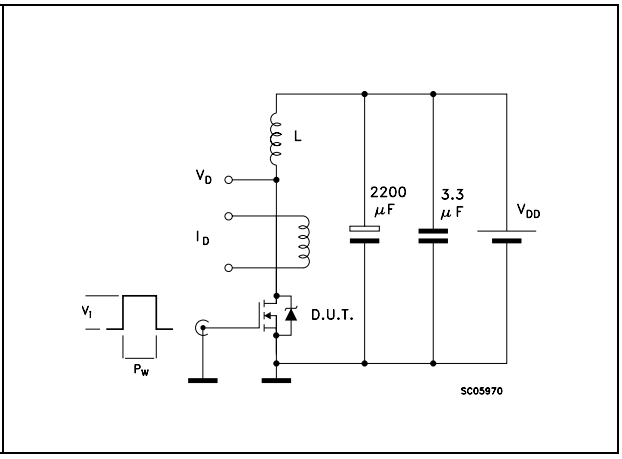



**Figure 16. Unclamped inductive waveform**

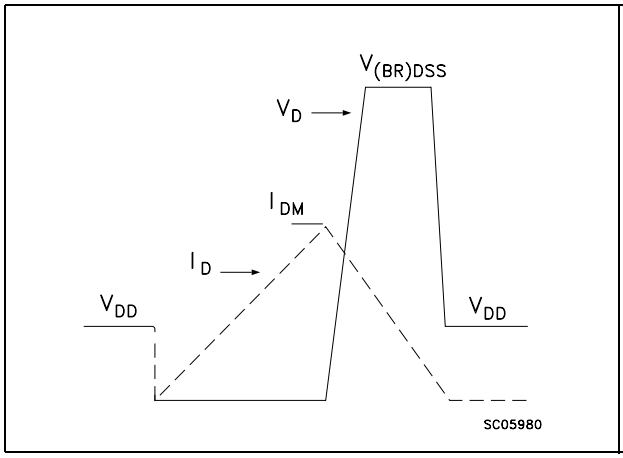
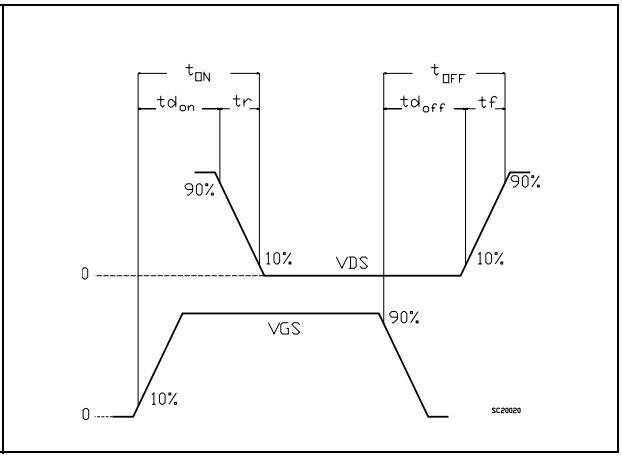



**Figure 17. Switching time waveform**

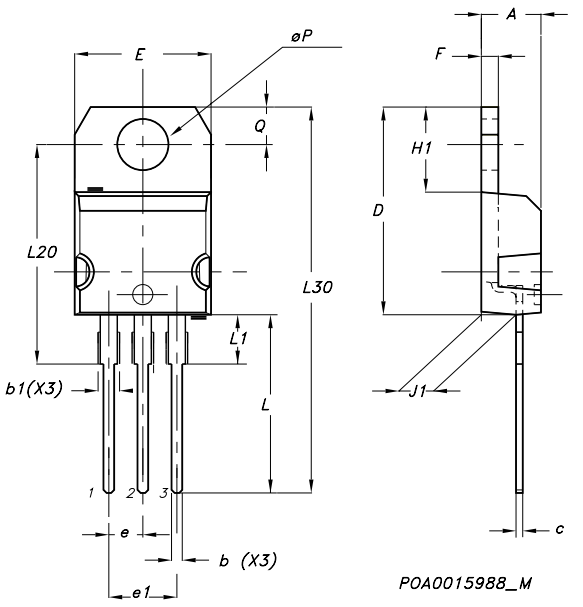


# 4 Package mechanical data

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 | 1.15 | | 1.70 | 0.045 | | 0.066 |
| c | 0.49 | | 0.70 | 0.019 | | 0.027 |
| D | 15.25 | | 15.75 | 0.60 | | 0.620 |
| 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 | | 0.052 |
| 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 | |
| øP | 3.75 | | 3.85 | 0.147 | | 0.151 |
| Q | 2.65 | | 2.95 | 0.104 | | 0.116 |



# 5 Revision history

**Table 6. Revision history**

| Date | Revision | Changes |
|---|---|---|
| 09-Sep-2004 | 3 | Complete document |
| 09-Aug-2006 | 4 | New template, no content change |

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