



# STP50NE10

N-channel 100V - 0.021Ω - 50A TO-220  
STripFET™ Power MOSFET

## General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STP50NE10	100V	<0.027Ω	50A

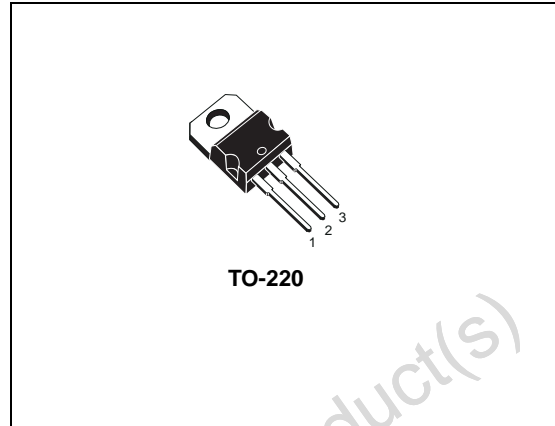
- Exceptional high dv/dt capability
- 100% avalanche tested
- Low gate charge at 100 °C
- Application oriented characterization

## Description

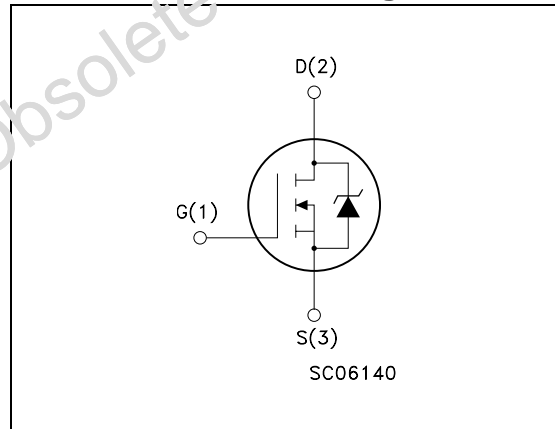
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing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

## Applications

- Switching application



## Internal schematic diagram



## Order codes

Part number	Marking	Package	Packaging
STP50NE10	P50NE10	TO-220	Tube

## Contents

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	100	V
$V_{DGR}$	Drain-gate voltage ( $R_{GS} = 20K\Omega$ )	100	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	50	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	35	A
$I_{DM}^{(1)}$	Drain current (pulsed)	200	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	180	W
	Derating factor	1	W/ $^\circ\text{C}$
$dv/dt^{(2)}$	Peak diode recovery voltage slope	6	V/ns
$T_J$	Operating junction temperature	175	$^\circ\text{C}$
$T_{stg}$	Storage temperature	-65 to 175	$^\circ\text{C}$

1. Pulse width limited by safe operating area
2.  $I_{SD} \leq 50\text{A}$ ,  $di/dt \leq 300\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq T_{JMAX}$

**Table 2. Thermal data**

$R_{thj-case}$	Thermal resistance junction-case Max	1	$^\circ\text{C}/\text{W}$
$R_{thj-a}$	Thermal resistance junction-ambient Max	62.5	$^\circ\text{C}/\text{W}$
$R_{thc-sink}$	Thermal resistance case-sink typ	0.5	$^\circ\text{C}/\text{W}$
$T_I$	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

**Table 3. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_J$ Max)	50	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25^\circ\text{C}$ , $I_d = I_{AR}$ , $V_{dd} = 50\text{V}$ )	300	mJ

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250 \mu A, V_{GS} = 0$	100			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating},$ $V_{DS} = \text{Max rating} @ 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 25A$		0.021	0.027	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max},$ $I_D = 25A$	20	35		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25V, f = 1 \text{ MHz}, V_{GS} = 0$		4350 5000 175	6000 675 238	pF pF pF
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{DD} = 50V, I_D = 25A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 12)		25 100	34 135	ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 80V, I_D = 50A$ $V_{GS} = 10V$		123 24 47	166	nC nC nC

1. Pulsed: pulse duration=300 $\mu s$ , duty cycle 1.5%

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current				6	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				24	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=50A, V_{GS}=0$			1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}=50A,$ $di/dt = 100A/\mu s,$ $V_{DD}=30V, T_j=150^\circ C$ (see Figure 14)		155 700 9		ns $\mu C$ A

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

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## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

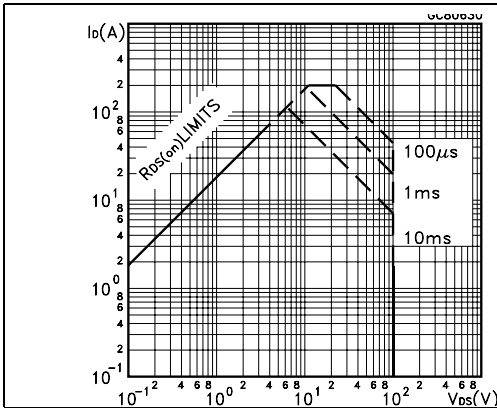


Figure 2. Thermal impedance

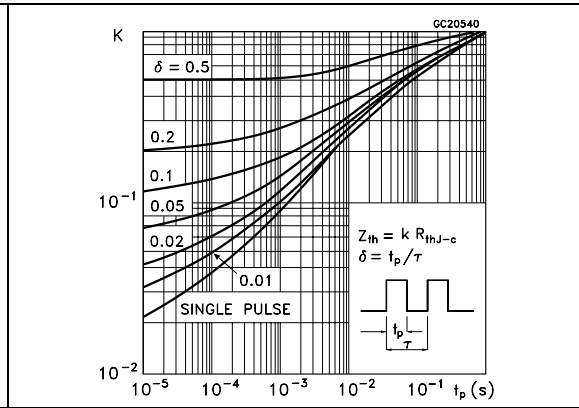


Figure 3. Output characteristics

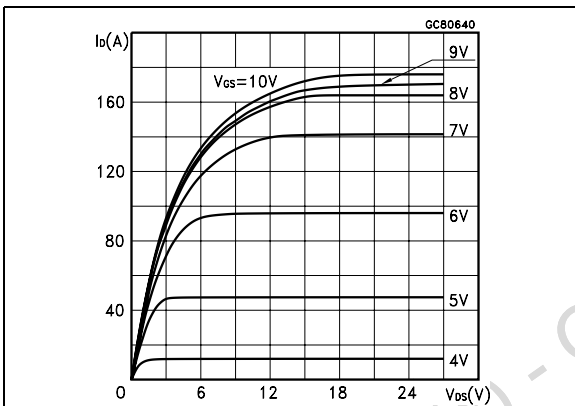


Figure 4. Transfer characteristics

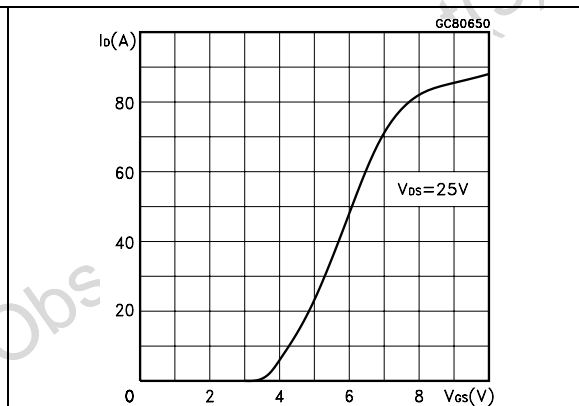


Figure 5. Transconductance

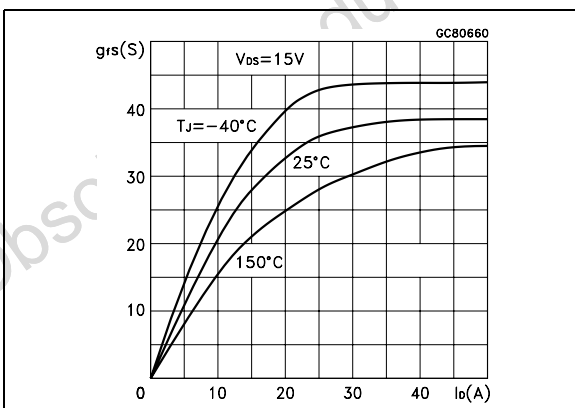


Figure 6. Static drain-source on resistance

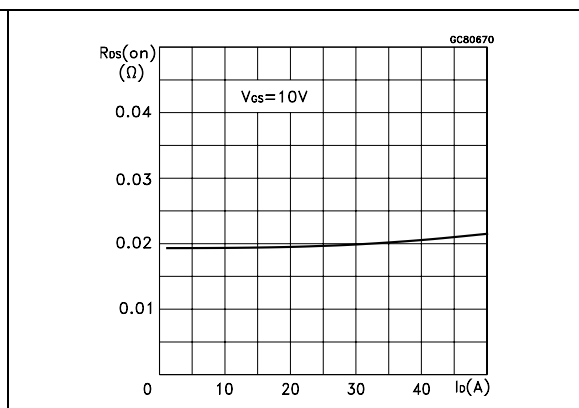


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

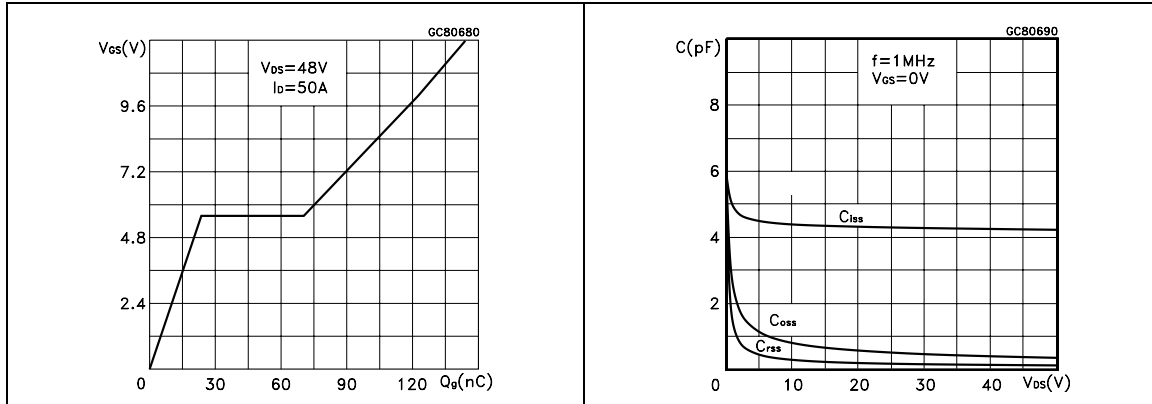


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

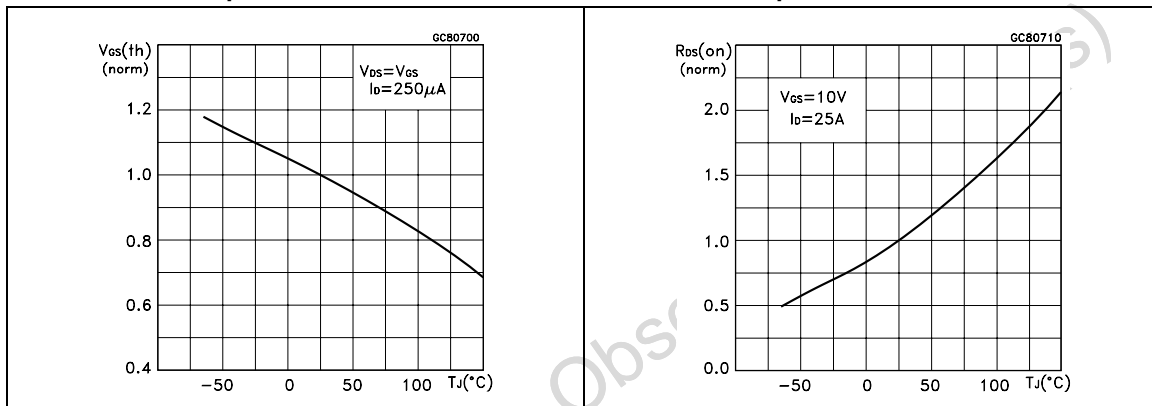
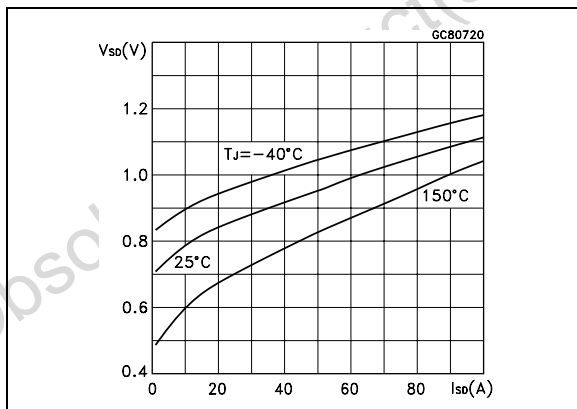


Figure 11. Source-drain diode forward characteristics



### 3 Test circuit

Figure 12. Switching times test circuit for resistive load

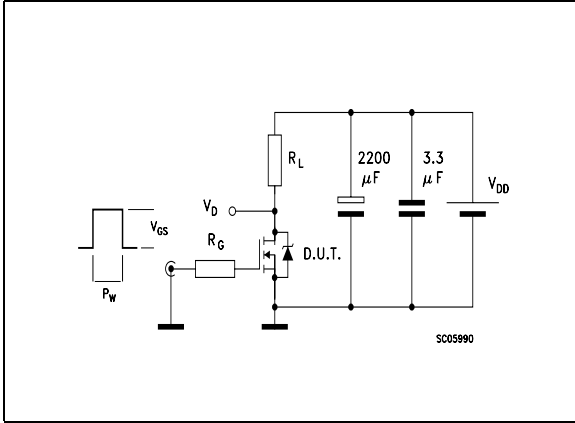


Figure 13. Gate charge test circuit

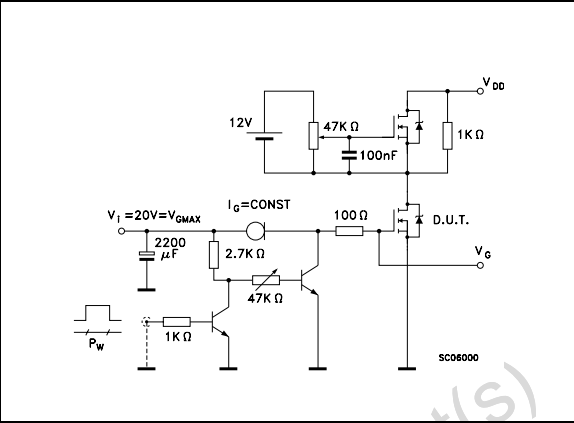


Figure 14. Test circuit for inductive load switching and diode recovery times

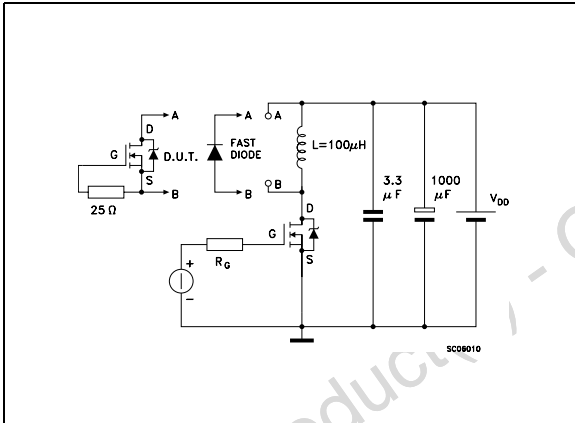


Figure 15. Unclamped Inductive load test circuit

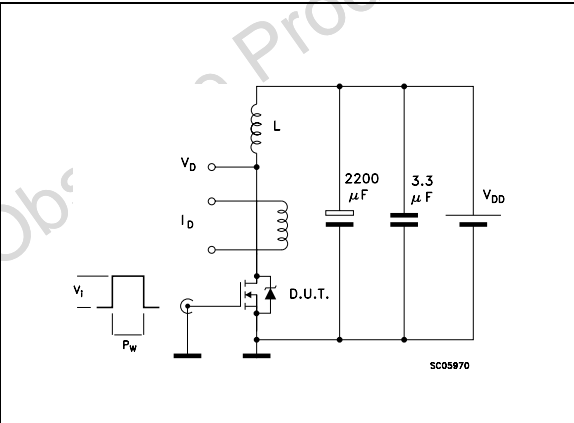


Figure 16. Unclamped inductive waveform

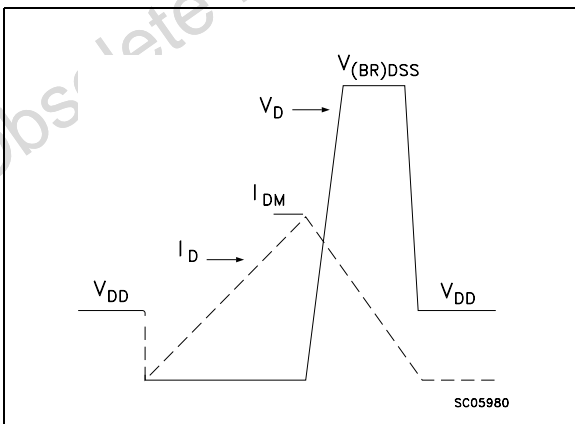
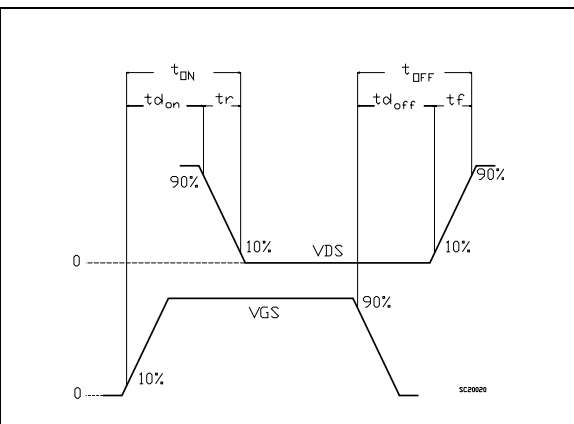


Figure 17. Switching time waveform





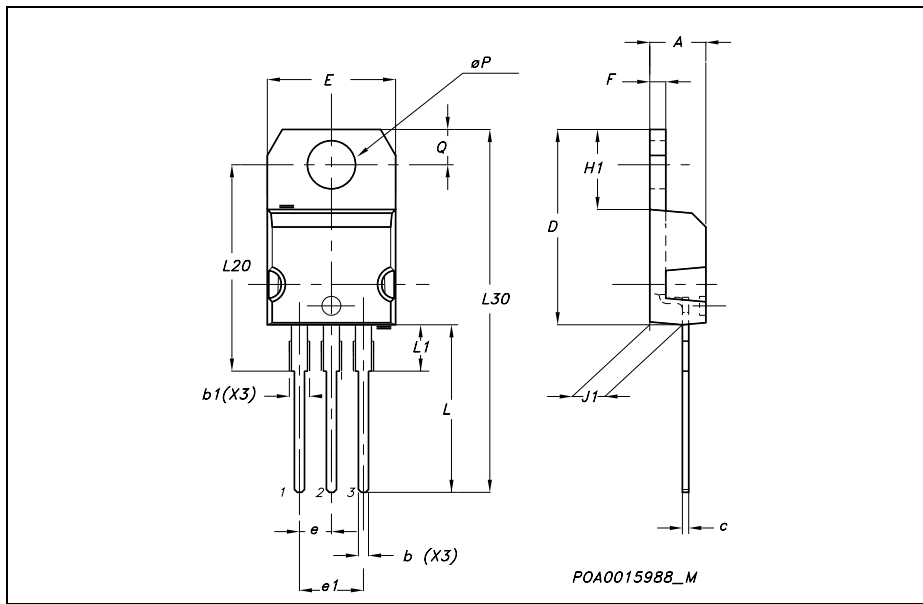
## 4 Package mechanical data

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](http://www.st.com)

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**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



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## 5 Revision history

Table 7. Revision history

Date	Revision	Changes
09-Sep-2004	7	Complete version
10-Aug-2006	8	New template, no content change

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