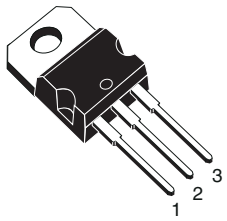
STP40NF12

N-channel 120V - 0.028Ω - 40A TO-220
Low gate charge STripFET™ II Power MOSFET

General features

Type	V_{DSS}	$R_{DS(on)}$	I_D
STP40NF12	120V	<0.032Ω	40A

- Exceptional dv/dt capability
- 100% avalanche tested
- Application oriented characterization

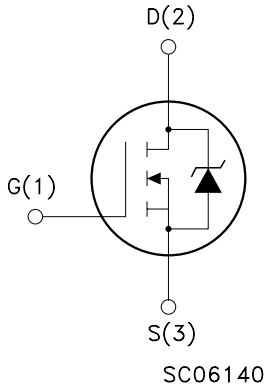


TO-220

Description

This Power MOSFET series realized with STMicroelectronics unique STripFET process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters for Telecom and Computer application. It is also intended for any application with low gate charge drive requirements.

Internal schematic diagram



Applications

- Switching application

Order codes

Part number	Marking	Package	Packaging
STP40NF12	P40NF12	TO-220	Tube

Contents

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (v_{gs} = 0)	120	V
V_{GS}	Gate- source voltage	±20	V
I_D	Drain current (continuous) at T_C = 25°C	40	A
I_D	Drain current (continuous) at T_C = 100°C	28	A
I_{DM} (1)	Drain current (pulsed)	160	A
P_{TOT}	Total dissipation at T_C = 25°C	150	W
	Derating factor	1	W/°C
dv/dt(2)	Peak diode recovery voltage slope	14	V/ns
E_{AS} (3)	Single pulse avalanche energy	150	mJ
T_{stg}	Storage temperature	– 55 to 175	°C
T_j	Max. operating junction temperature		

1. Pulse width limited by safe operating area
2. I_{SD} ≤40A, di/dt ≤600A/µs, V_{DD} ≤$V_{(BR)DSS}$, T_j ≤T_{JMAX}.
3. Starting T_j = 25°C, I_D= 40A, V_{DD}=50V

Table 2. Thermal data

$R_{thj\text{-}case}$	Thermal resistance junction-case Max	1	°C/W
$R_{thj\text{-}a}$	Thermal resistance junction-ambient Max	62.5	°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	120			V
I_{DSS}	Zero gate voltage Drain current (V_{GS} = 0)	V_{DS} = Max rating V_{DS}=Max rating,T_C=125°C			1 10	µA 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	2	2.8	4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10V, I_D = 20A		0.028	0.032	Ω

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} = 25V, I_D=20A		40		S
C_{iss}	Input capacitance	V_{DS} = 25V, f = 1 MHz, V_{GS} = 0		1880		pF
C_{oss}	Output capacitance			265		pF
C_{rss}	Reverse transfer capacitance			110		pF
Q_g	Total gate charge	V_{DD} = 80V, I_D = 40A, V_{GS} = 10V		60	80	nC
Q_{gs}	Gate-source charge			11		nC
Q_{gd}	Gate-drain charge			21		nC

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

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD} = 50V, I_D = 20A R_G = 4.7Ω V_{GS} = 10V (see Figure 13)		28 63		ns ns
$t_{d(off)}$ t_f	Turn-off-delay time Fall time	V_{DD} = 50V, I_D = 20A, R_G = 4.7Ω, V_{GS} = 10V (see Figure 13)		84 28		ns ns

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{SD}	Source-drain current				40	A
I_{SDM} (1)	Source-drain current (pulsed)				160	A
V_{SD} (2)	Forward on voltage	I_{SD} = 40A, V_{GS} = 0			1.3	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 40A, V_{DD} = 25V di/dt = 100A/µs, T_j = 150°C (see Figure 15)		114 456 8		ns nC A

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

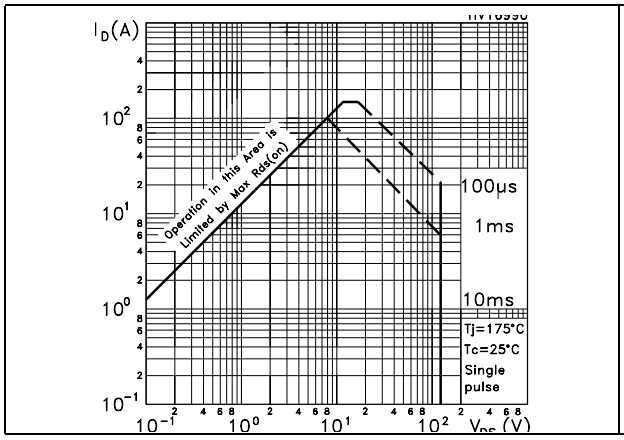


Figure 2. Thermal impedance

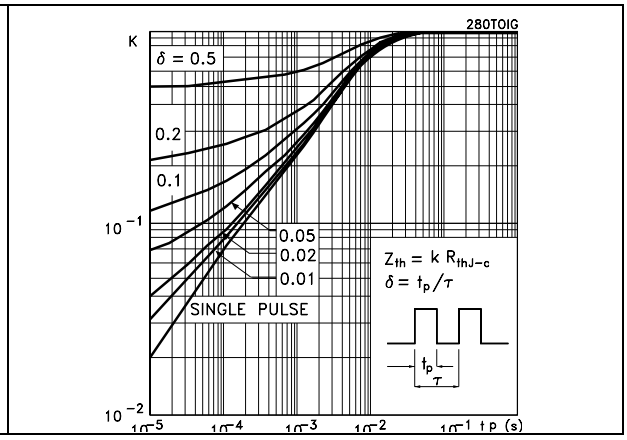


Figure 3. Output characteristics

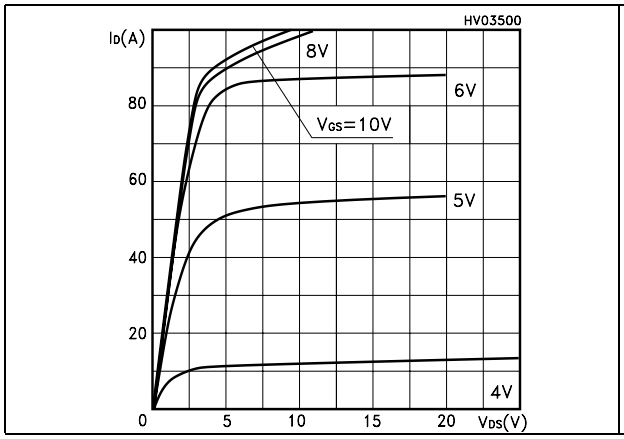


Figure 4. Transfer characteristics

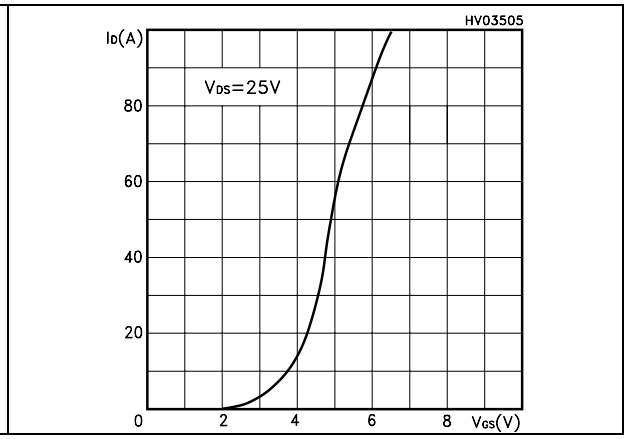


Figure 5. Transconductance

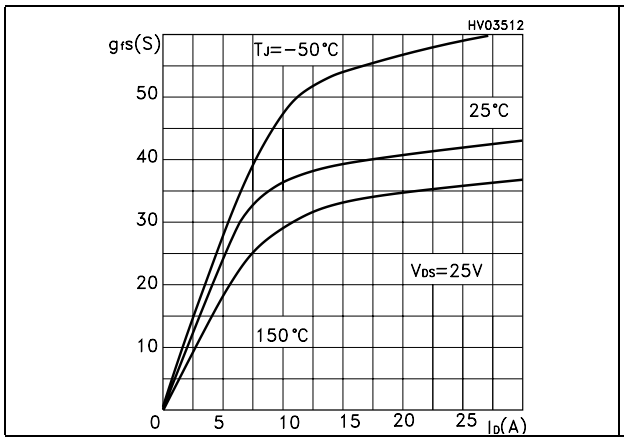


Figure 6. Static drain-source on resistance

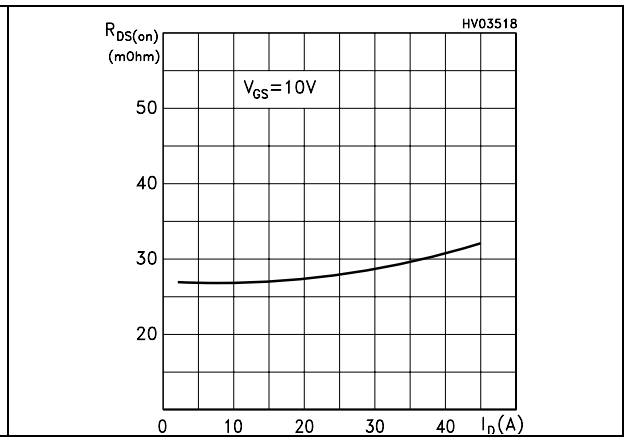


Figure 7. Gate charge vs. gate-source voltage

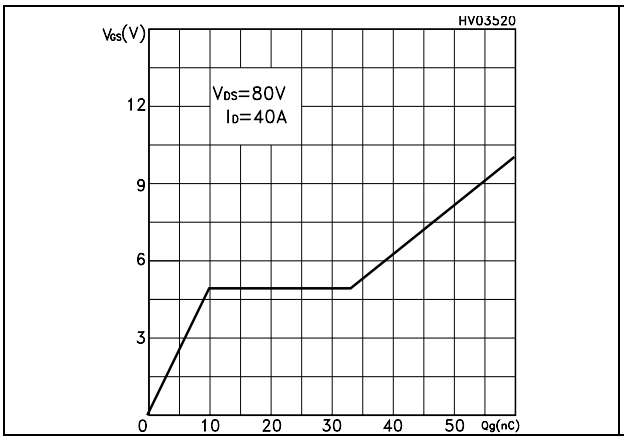


Figure 8. Capacitance variations

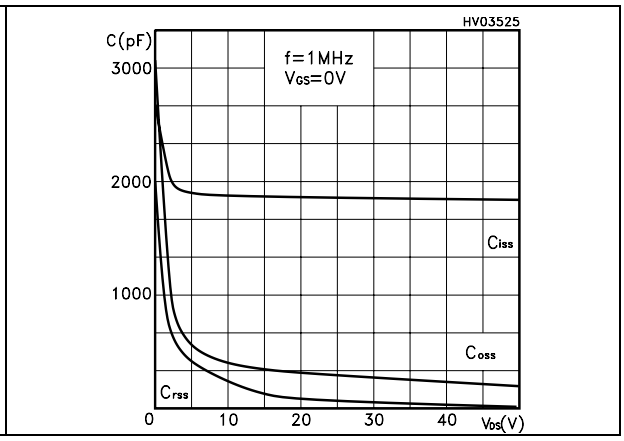


Figure 9. Normalized gate threshold voltage vs. temperature

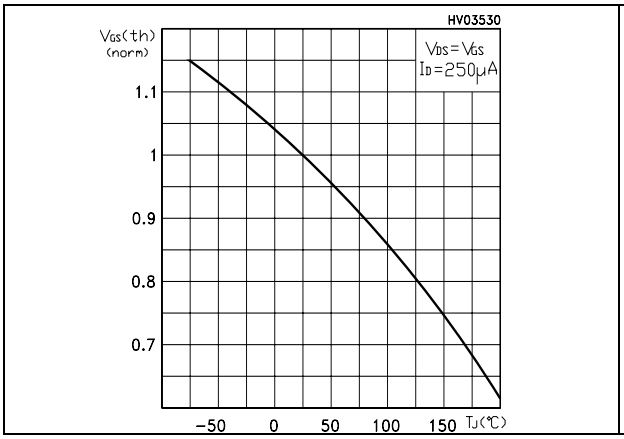


Figure 10. Normalized on resistance vs. temperature

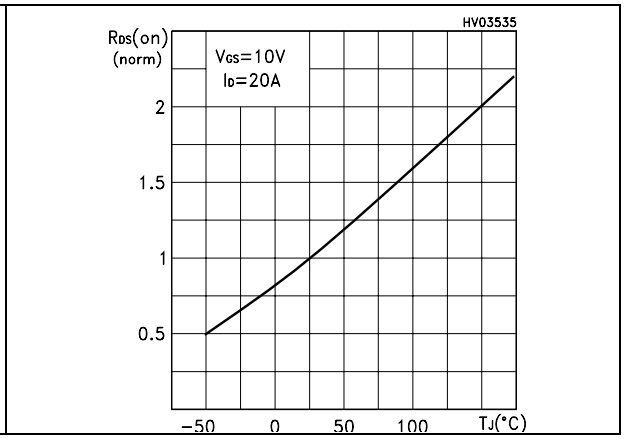


Figure 11. Source-drain diode forward characteristics

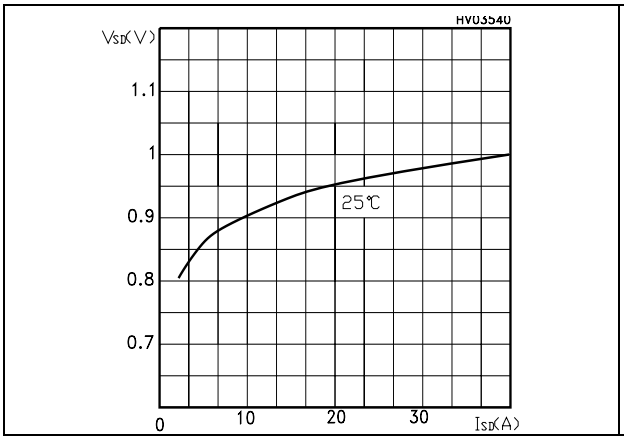
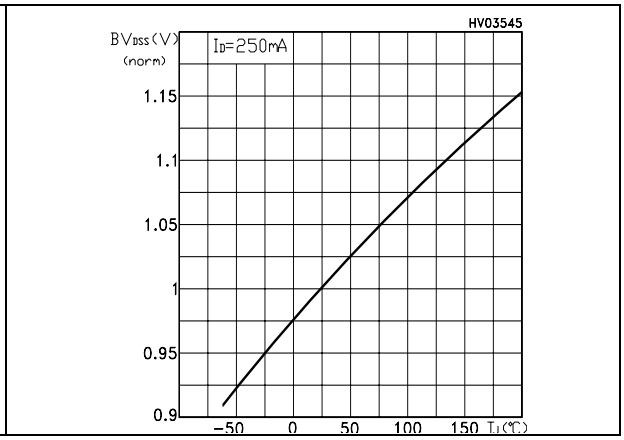


Figure 12. Normalized breakdown voltage vs. tj



3 Test circuit

Figure 13. Switching times test circuit for resistive load

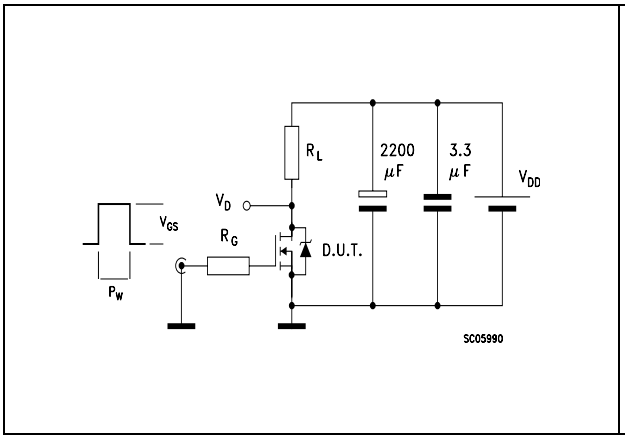


Figure 14. Gate charge test circuit

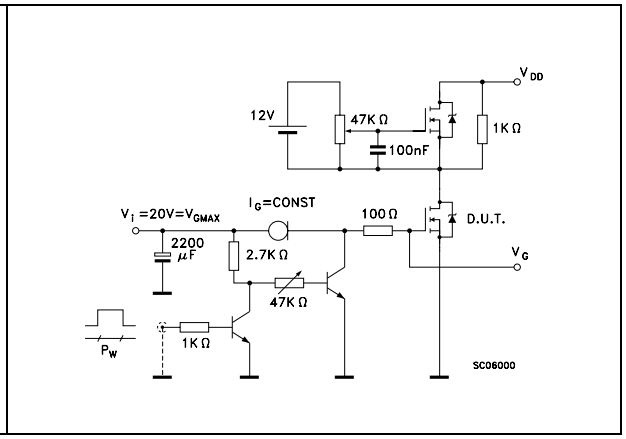


Figure 15. Test circuit for inductive load switching and diode recovery times

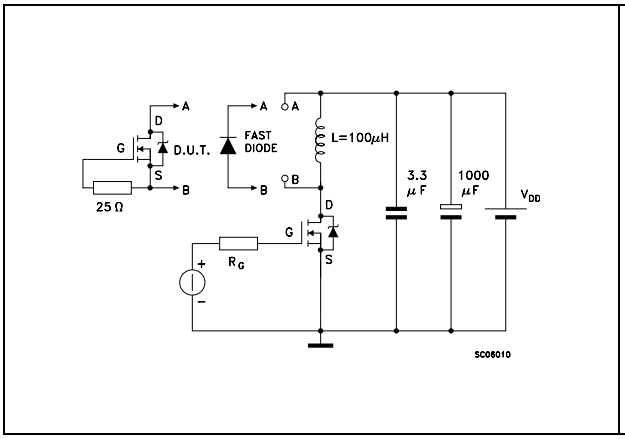


Figure 16. Unclamped Inductive load test circuit

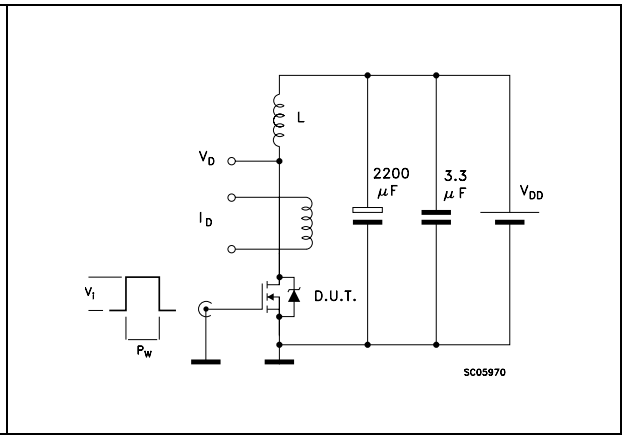


Figure 17. Unclamped inductive waveform

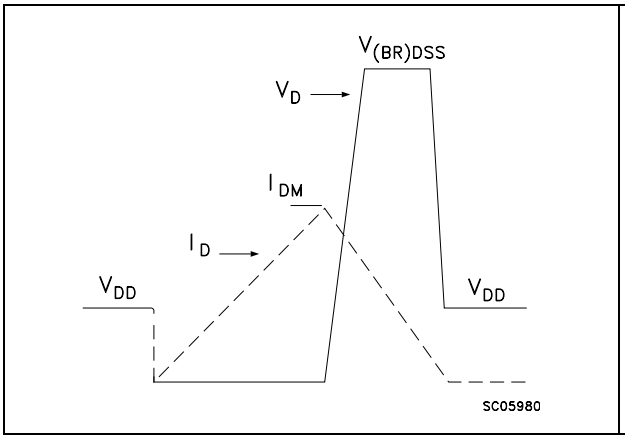
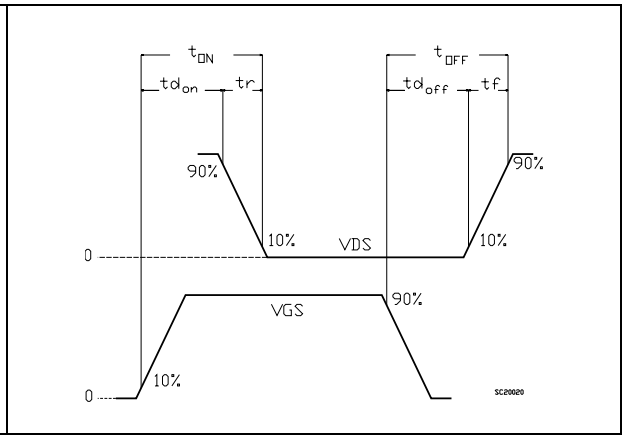


Figure 18. Switching time waveform

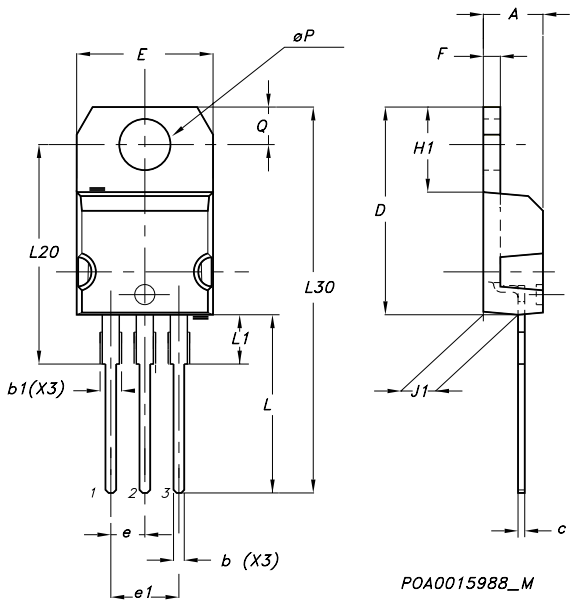


4 Package mechanical data

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 7. Revision history

Date	Revision	Changes
09-Sep-2004	1	First version.
17-Aug-2006	2	The document has been reformatted.
31-Jan-2007	3	Typo mistake on *Table 1*.

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