



# STI50DE100

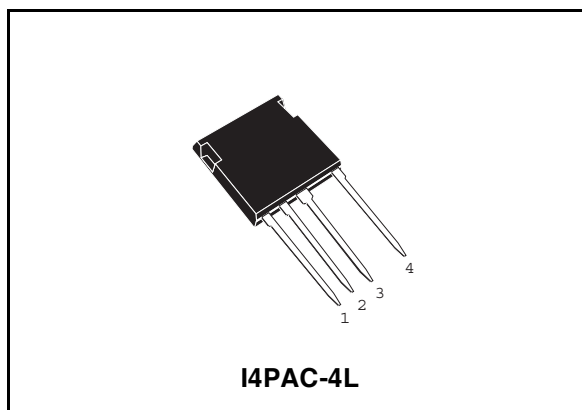
## Hybrid Emitter Switched Bipolar Transistor ESBT<sup>®</sup> 1000 V - 50 A - 0.026 Ω

Preliminary Data

### General features

$V_{CS(ON)}$	$I_C$	$R_{CS(ON)}$
1.3 V	50 A	0.026 Ω

- High voltage / high current Cascode configuration
- Ultra low equivalent on resistance
- Very fast-switch up to 150 kHz
- Ultra low  $C_{iss}$
- Low dynamic  $V_{CS(ON)}$



### Applications

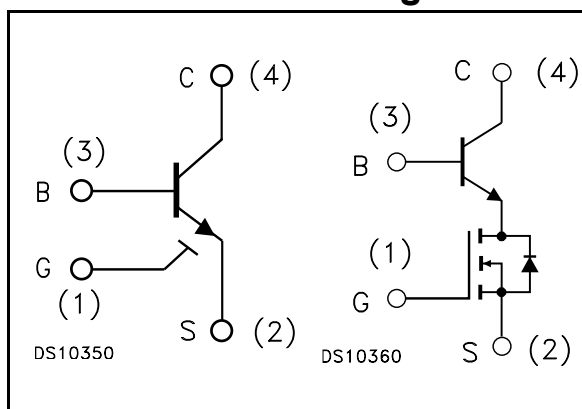
- Industrial converters
- Welding

### Description

The STI50DE100 is manufactured in a hybrid structure, using dedicated high voltage Bipolar and low voltage MOSFET technologies, aimed to providing the best performance in ESBT topology.

The STI50DE100 is designed for use in industrial converters and/or welding equipment.

### Internal schematic diagrams



### Order codes

Part Number	Marking	Package	Packing
STI50DE100	STI50DE100	I4PAC-4L	Tube

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# 1 Electrical ratings

**Table 1. Absolute maximum rating**

Symbol	Parameter	Value	Unit
$V_{CS(SS)}$	Collector-source voltage ( $V_{BS} = V_{GS} = 0$ V)	1000	V
$V_{BS(OS)}$	Base-source voltage ( $I_C = 0$ , $V_{GS} = 0$ V)	40	V
$V_{SB(OS)}$	Source-base voltage ( $I_C = 0$ , $V_{GS} = 0$ V)	12	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_C$	Collector current	50	A
$I_{CM}$	Collector peak current ( $t_P < 5$ ms)	150	A
$I_B$	Base current	10	A
$I_{BM}$	Base peak current ( $t_P < 5$ ms)	50	A
$P_{tot}$	Total dissipation at $T_c = 25^\circ\text{C}$	83	W
$V_{INS}$	Insulation withstand voltage (RMS) from all three leads to external heatsink	2500	V
$T_{stg}$	Storage temperature	-40 to 150	$^\circ\text{C}$
$T_J$	Max. operating junction temperature	150	$^\circ\text{C}$

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.5	$^\circ\text{C/W}$

## 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
$I_{\text{CS(SS)}}$	Collector-source current ( $V_{\text{BS}} = V_{\text{GS}} = 0$ )	$V_{\text{CE}} = 1000\text{V}$			100	$\mu\text{A}$
$I_{\text{BS(OS)}}$	Base-source current ( $I_{\text{C}} = 0, V_{\text{GS}} = 0$ )	$V_{\text{BS(OS)}} = 40\text{V}$			10	$\mu\text{A}$
$I_{\text{SB(OS)}}$	Source-base current ( $I_{\text{C}} = 0, V_{\text{GS}} = 0$ )	$V_{\text{SB(OS)}} = 10\text{V}$			100	$\mu\text{A}$
$I_{\text{GS(OS)}}$	Gate-source leakage	$V_{\text{GS}} = \pm 20\text{V}$			500	nA
$V_{\text{CS(ON)}}$	Collector-source ON voltage	$V_{\text{GS}} = 10\text{V } I_{\text{C}} = 50\text{A } I_{\text{B}} = 10\text{A}$ $V_{\text{GS}} = 10\text{V } I_{\text{C}} = 30\text{A } I_{\text{B}} = 3\text{A}$		1.3 1.1		V V
$h_{\text{FE}}$	DC current gain	$V_{\text{GS}} = 10\text{V } I_{\text{C}} = 50\text{A } V_{\text{CS}} = 1\text{V}$ $V_{\text{GS}} = 10\text{V } I_{\text{C}} = 30\text{A } V_{\text{CS}} = 1\text{V}$	3 6		7 13	
$V_{\text{BS(ON)}}$	Base Source ON voltage	$V_{\text{GS}} = 10\text{V } I_{\text{C}} = 50\text{A } I_{\text{B}} = 10\text{A}$ $V_{\text{GS}} = 10\text{V } I_{\text{C}} = 30\text{A } I_{\text{B}} = 3\text{A}$		2.2 1.4		V V
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{BS}} = V_{\text{GS}} \quad I_{\text{B}} = 250\mu\text{A}$	3	3.7	4.5	V
$C_{\text{ISS}}$	Input capacitance	$V_{\text{CS}} = 25\text{V} \quad f = 1\text{MHz}$ $V_{\text{GS}} = V_{\text{CB}} = 0$		2500		pF
$Q_{\text{GS(tot)}}$	Gate-source charge	$V_{\text{CS}} = 25\text{V} \quad V_{\text{GS}} = 10\text{V}$ $V_{\text{CB}} = 0 \quad I_{\text{C}} = 50\text{A}$		60		nC
$t_{\text{s}}$ $t_{\text{f}}$	INDUCTIVE LOAD Storage time Fall time	$I_{\text{C}} = 25\text{A } I_{\text{B}} = 5\text{A } V_{\text{GS}} = 10\text{V}$ $V_{\text{Clamp}} = 800\text{V } R_{\text{G}} = 47\Omega$ $t_{\text{p}} = 4\mu\text{s} \quad (\text{see figure 13})$		650 10		ns ns
$t_{\text{s}}$ $t_{\text{f}}$	INDUCTIVE LOAD Storage time Fall time	$I_{\text{C}} = 25\text{A } I_{\text{B}} = 2.5\text{A } V_{\text{GS}} = 10\text{V}$ $V_{\text{Clamp}} = 800\text{V } R_{\text{G}} = 47\Omega$ $t_{\text{p}} = 4\mu\text{s} \quad (\text{see figure 13})$		430 6		ns ns
$V_{\text{CSW}}$	Maximum collector- source voltage switched without snubber	$R_{\text{G}} = 47\Omega \quad h_{\text{FE}} = 5\text{A } I_{\text{C}} = 35\text{A}$	1000			V
$V_{\text{CS(dyn)}}$	Collector-source dynamic voltage (500ns)	$V_{\text{CC}} = V_{\text{Clamp}} = 300\text{V } V_{\text{GS}} = 10\text{V}$ $R_{\text{G}} = 47\Omega \quad I_{\text{C}} = 5\text{A } I_{\text{B}} = 5\text{A}$ $I_{\text{Bpeak}} = I_{\text{C}} = 25\text{A } t_{\text{peak}} = 500\text{ns}$		5.5		V
$V_{\text{CS(dyn)}}$	Collector-source dynamic voltage (1 $\mu\text{s}$ )	$V_{\text{CC}} = V_{\text{Clamp}} = 300\text{V } V_{\text{GS}} = 10\text{V}$ $R_{\text{G}} = 47\Omega \quad I_{\text{C}} = 5\text{A } I_{\text{B}} = 5\text{A}$ $I_{\text{Bpeak}} = I_{\text{C}} = 25\text{A } t_{\text{peak}} = 500\text{ns}$		4.8		V

## 2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

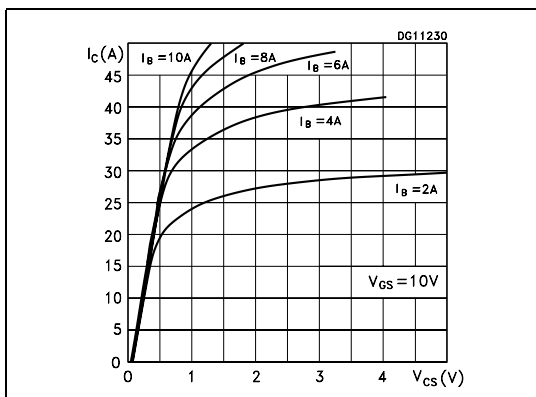


Figure 2. DC current gain

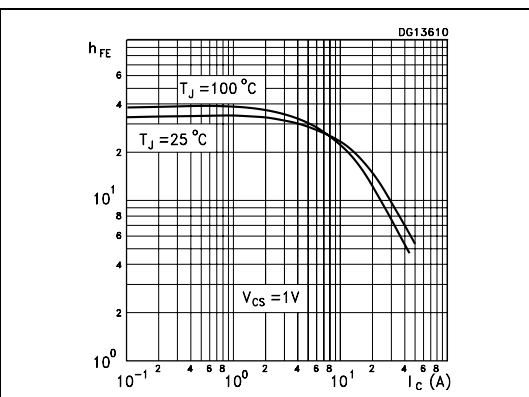


Figure 3. Collector-source On voltage

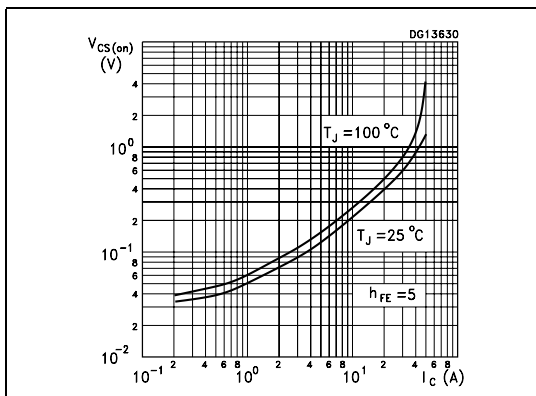


Figure 4. Collector-source On voltage

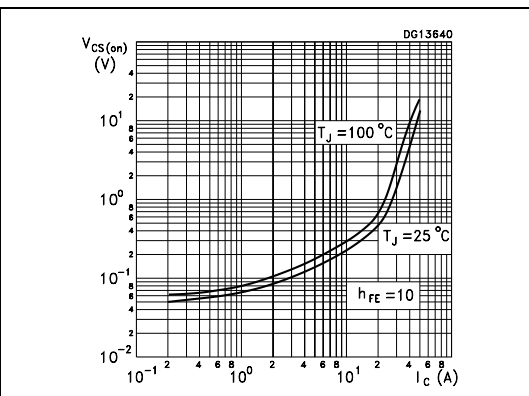


Figure 5. Base-source On voltage

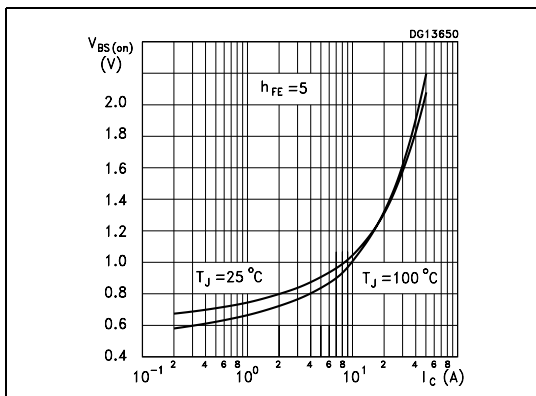


Figure 6. Base-source On voltage

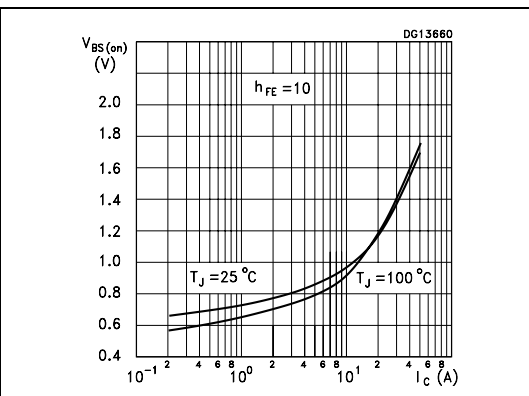


Figure 7. Reverse biased safe operating area

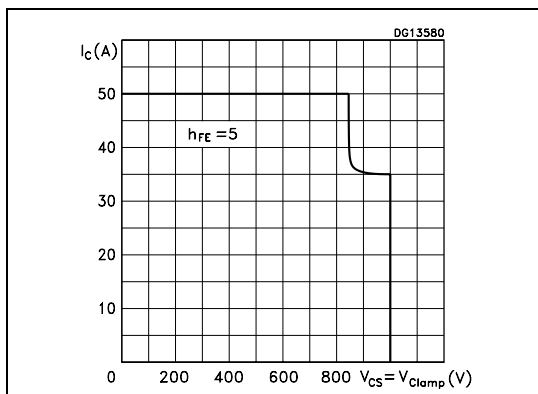


Figure 8. Gate threshold voltage vs temperature

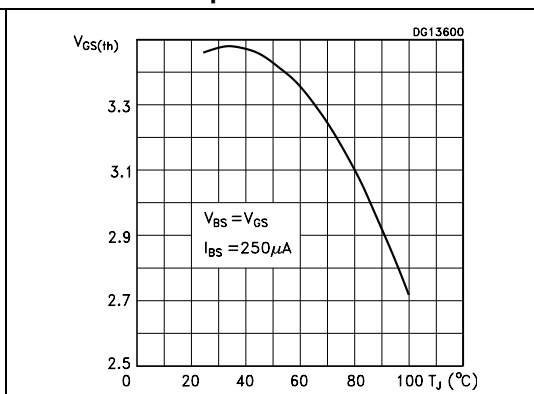


Figure 9. Dynamic collector-emitter saturation voltage

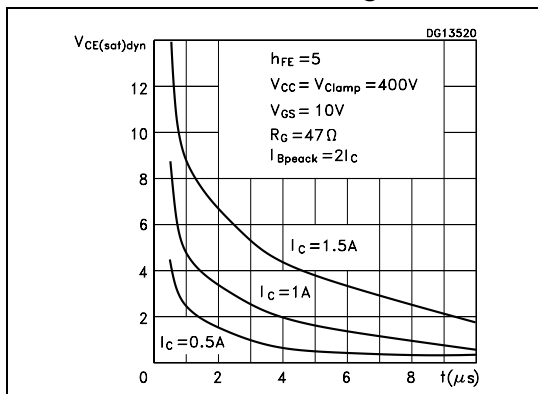


Figure 10. Inductive load switching time

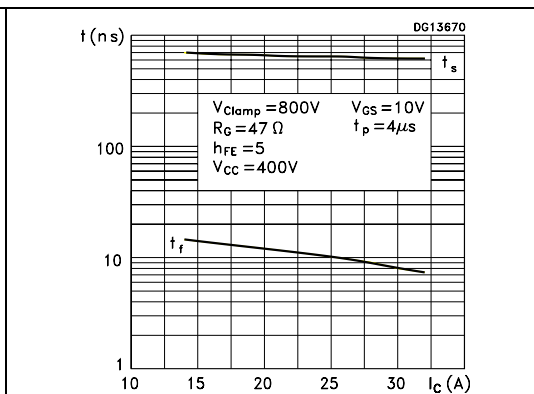
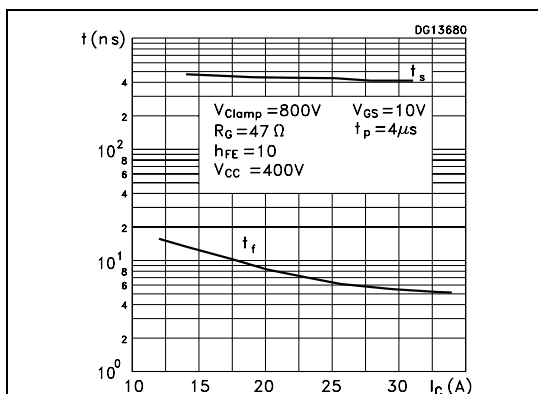


Figure 11. Inductive load switching time



## 2.2 Test circuits

Figure 12. Static  $V_{CS(ON)}$  test circuit

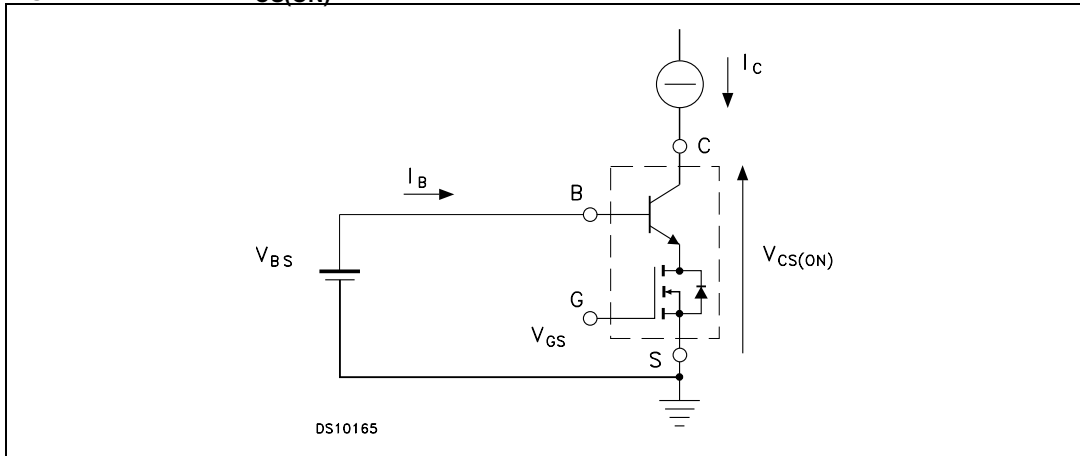


Figure 13. Inductive load switching and RBSOA test circuit

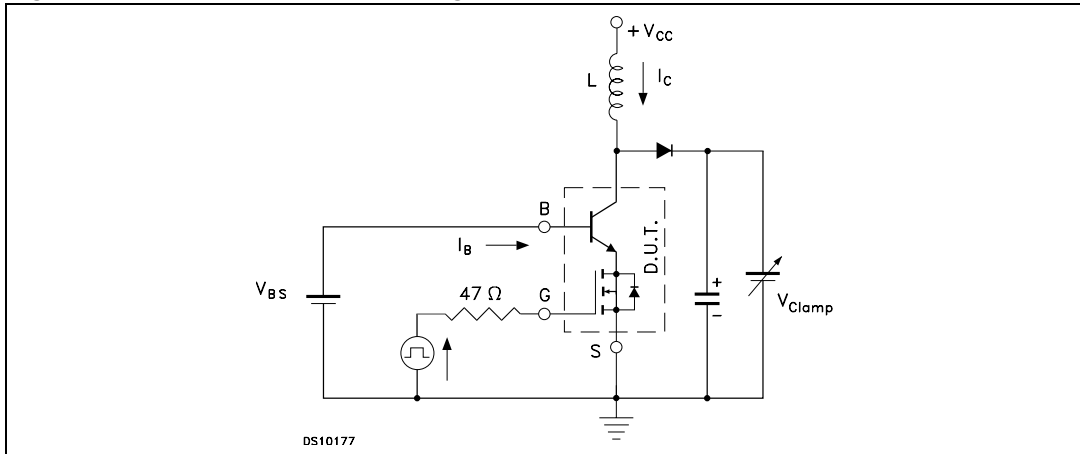
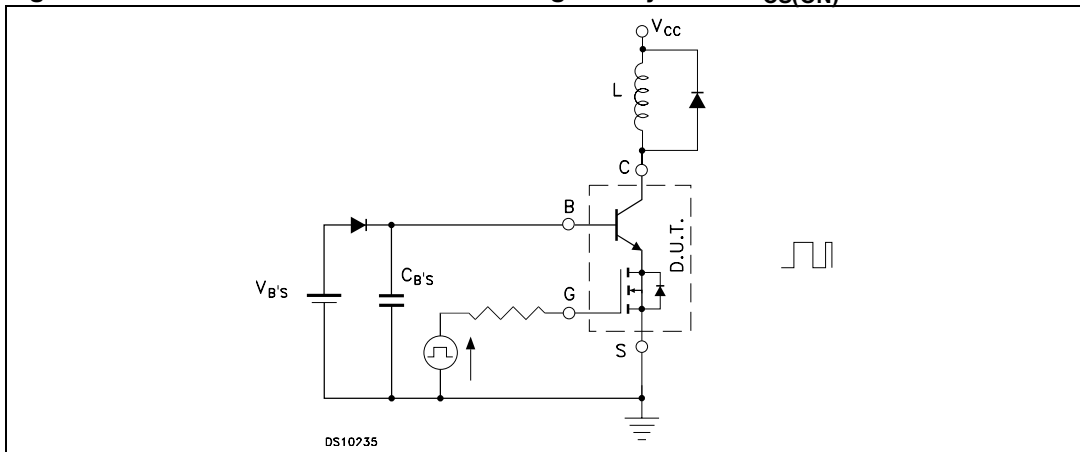


Figure 14. Inductive load turn-on switching and dynamic  $V_{CS(ON)}$  test circuit



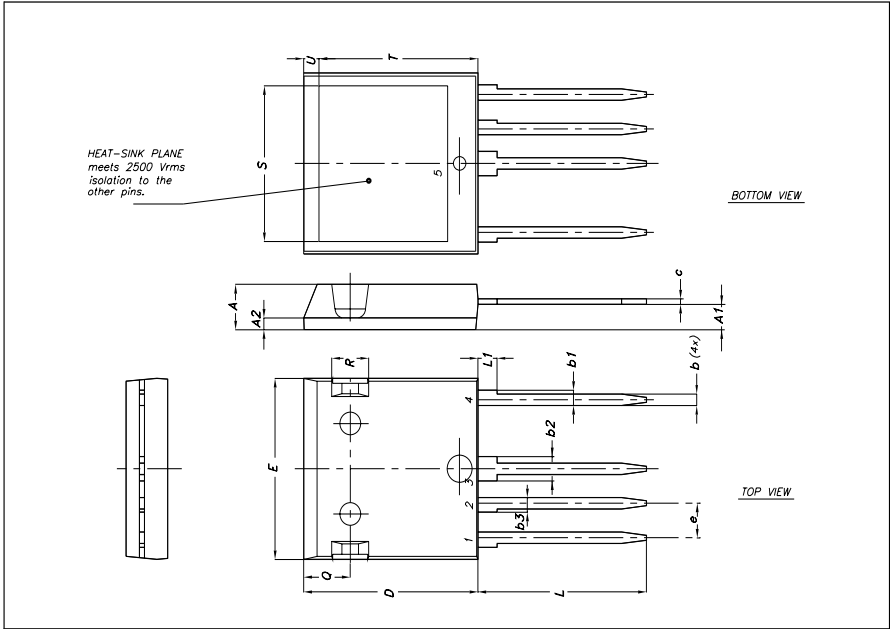
### 3 Package mechanical data

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)



**ISOPLUS I4PAC-4L MECHANICAL DATA**

DIM.	mm.		
	MIN.	TYP	MAX.
A	4.83		5.21
A1	2.59		3
A2	1.17		1.40
b	1.14		1.40
b1	1.60		1.83
b2	2.54		2.79
b3	1.47		1.73
c	0.51		0.74
D	20.62		21.13
E	19.56		20.29
e		3.81	
L	19.81		20.83
L1	2.03		2.59
Q	5.33		5.97
R	3.81		4.57
S	16.97		17.48
T	15.24		15.75
U	1.65		2.03



## 4 Revision history

Table 4. Revision history

Date	Revision	Changes
10-Jan-2007	1	Initial release.

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