



# STC03DE150

## HYBRID EMITTER SWITCHED BIPOLAR TRANSISTOR ESBT™ 1500 V - 3 A - 0.55 Ω

**Table 1: General Features**

$V_{CS(ON)}$	$I_C$	$R_{CS(ON)}$
1 V	1.8 A	0.55 Ω

- LOW EQUIVALENT ON RESISTANCE
- VERY FAST-SWITCH, UP TO 150 kHz
- SQUARED RBSOA, UP TO 1500 V
- VERY LOW  $C_{ISS}$  DRIVEN BY  $R_G = 4.7 \Omega$

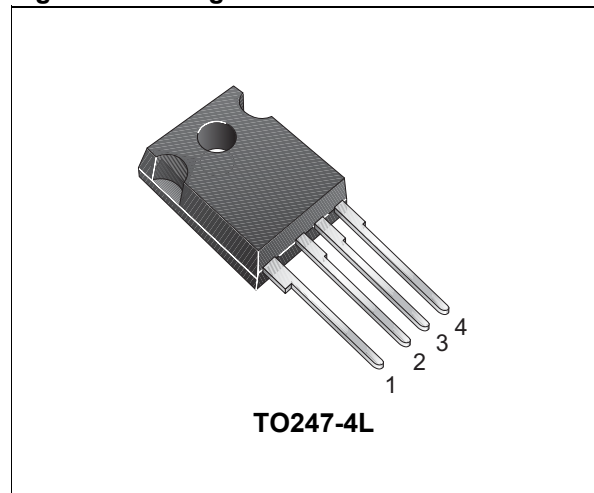
### APPLICATION

- AUX SMPS FOR THREE PHASE MAINS

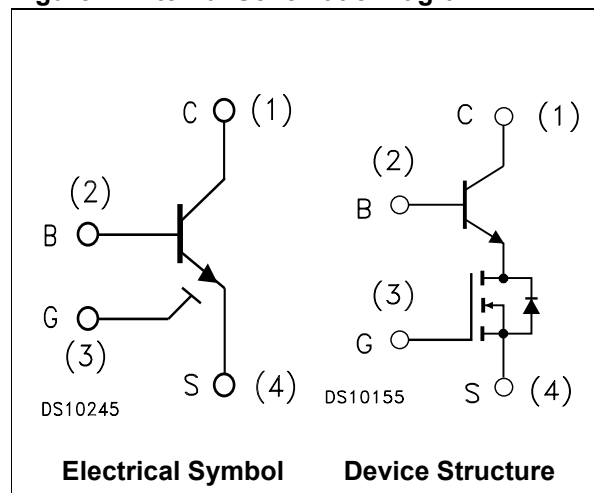
### DESCRIPTION

The STC03DE150 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 STC03DE150 is designed for use in aux flyback smps for any three phase application.

**Figure 1: Package**



**Figure 2: Internal Schematic Diagram**



**Table 2: Order Code**

Part Number	Marking	Package	Packaging
STC03DE150	STC03DE150	TO247-4L	TUBE

## STC03DE150

Table 3: Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
$V_{CS(SS)}$	Collector-Source Voltage ( $V_{BS} = V_{GS} = 0\text{ V}$ )	1500	V
$V_{BS(OS)}$	Base-Source Voltage ( $I_C = 0, V_{GS} = 0\text{ V}$ )	30	V
$V_{SB(OS)}$	Source-Base Voltage ( $I_C = 0, V_{GS} = 0\text{ V}$ )	9	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_C$	Collector Current	3	A
$I_{CM}$	Collector Peak Current ( $t_p < 5\text{ ms}$ )	6	A
$I_B$	Base Current	2	A
$I_{BM}$	Base Peak Current ( $t_p < 1\text{ ms}$ )	4	A
$P_{tot}$	Total Dissipation at $T_C = 25\text{ }^\circ\text{C}$	100	W
$T_{stg}$	Storage Temperature	-65 to 125	$^\circ\text{C}$
$T_J$	Max. Operating Junction Temperature	125	$^\circ\text{C}$

Table 4: Thermal Data

Symbol	Parameter	Unit
$R_{thj-case}$	Thermal Resistance Junction-Case Max	1 $^\circ\text{C/W}$

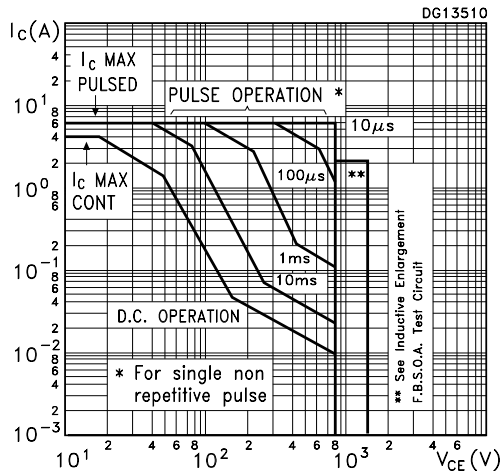
Table 5: Electrical Characteristics ( $T_{case} = 25\text{ }^\circ\text{C}$  unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{CS(SS)}$	Collector-Source Current ( $V_{BS} = V_{GS} = 0\text{ V}$ )	$V_{CS(SS)} = 1500\text{ V}$			100	$\mu\text{A}$
$I_{BS(OS)}$	Base-Source Current ( $I_C = 0, V_{GS} = 0\text{ V}$ )	$V_{BS(OS)} = 30\text{ V}$			10	$\mu\text{A}$
$I_{SB(OS)}$	Source-Base Current ( $I_C = 0, V_{GS} = 0\text{ V}$ )	$V_{SB(OS)} = 9\text{ V}$			100	$\mu\text{A}$
$I_{GS(OS)}$	Gate-Source Leakage	$V_{GS} = \pm 20\text{ V}$			500	nA
$V_{CS(ON)}$	Collector-Source ON Voltage	$V_{GS} = 10\text{ V } I_C = 1.8\text{ A } I_B = 0.36\text{ A}$ $V_{GS} = 10\text{ V } I_C = 0.7\text{ A } I_B = 70\text{ mA}$		1 1	1.5 1.3	V V
$h_{FE}$	DC Current Gain	$I_C = 1.8\text{ A } V_{CS} = 1\text{ V } V_{GS} = 10\text{ V}$ $I_C = 0.7\text{ A } V_{CS} = 1\text{ V } V_{GS} = 10\text{ V}$	3.5 6	5 10		
$V_{BS(ON)}$	Base-Source ON Voltage	$V_{GS} = 10\text{ V } I_C = 1.8\text{ A } I_B = 0.36\text{ A}$ $V_{GS} = 10\text{ V } I_C = 0.7\text{ A } I_B = 70\text{ mA}$		1 0.8	1.2 1	V V
$V_{GS(th)}$	Gate Threshold Voltage	$V_{BS} = V_{GS} \quad I_B = 250\text{ }\mu\text{A}$	1.5	2.2	3	V
$C_{iss}$	Input Capacitance	$V_{CS} = 25\text{ V} \quad f = 1\text{ MHz}$ $V_{GS} = V_{CB} = 0$		750		pF
$Q_{GS(tot)}$	Gate-Source Charge	$V_{CS} = 15\text{ V} \quad V_{GS} = 10\text{ V}$ $V_{CB} = 0 \quad I_C = 1.8\text{ A}$		12.5		nC
$t_s$	INDUCTIVE LOAD Storage Time	$V_{GS} = 10\text{ V}$ $R_G = 47\text{ }\Omega \quad V_{Clamp} = 1200\text{ V}$		760		ns
$t_f$	Fall Time	$t_p = 4\text{ }\mu\text{s} \quad I_C = 1.8\text{ A } I_B = 0.36\text{ A}$		14		ns

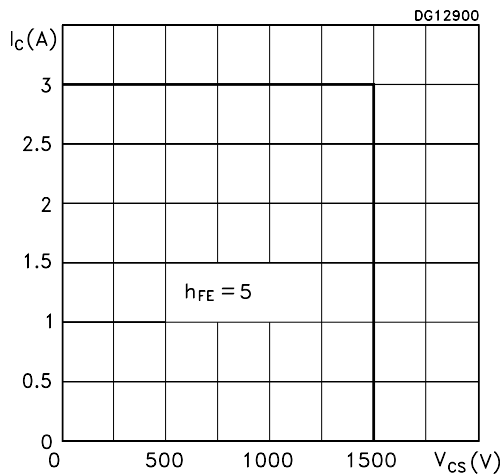
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_s$ $t_f$	INDUCTIVE LOAD	$V_{GS} = 10\text{ V}$				
	Storage Time	$R_G = 47\ \Omega$ $V_{Clamp} = 1200\text{ V}$		690		ns
	Fall Time	$t_p = 4\ \mu\text{s}$ $I_C = 0.7\text{ A}$ $I_B = 70\text{ mA}$		32		ns
$V_{CSW}$	Maximum Collector-Source Voltage without Snubber	$R_G = 47\ \Omega$ $h_{FE} = 5\text{ A}$ $I_C = 3\text{ A}$	1500			V
$V_{CS(dyn)}$	Collector-Source Dynamic Voltage (500 ns)	$V_{CC} = V_{Clamp} = 400\text{ V}$ $V_{GS} = 10\text{ V}$ $R_G = 47\ \Omega$ $I_C = 0.5\text{ A}$ $I_B = 0.1\text{ A}$ $I_{Bpeak} = 1\text{ A}$ $t_{peak} = 500\text{ ns}$		3.9		V
$V_{CS(dyn)}$	Collector-Source Dynamic Voltage (1 $\mu\text{s}$ )	$V_{CC} = V_{Clamp} = 400\text{ V}$ $V_{GS} = 10\text{ V}$ $R_G = 47\ \Omega$ $I_C = 0.5\text{ A}$ $I_B = 0.1\text{ A}$ $I_{Bpeak} = 1\text{ A}$ $t_{peak} = 500\text{ ns}$		2.2		V

# STC03DE150

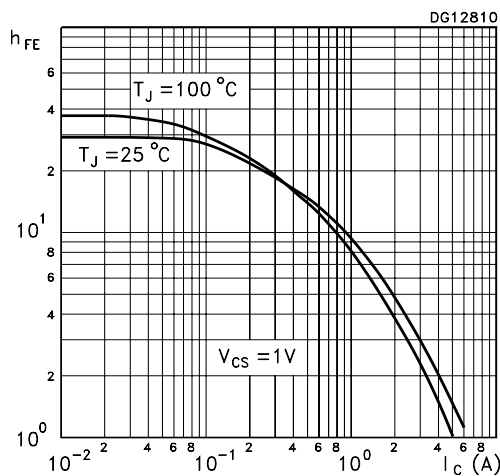
**Figure 3: Safe Operating Area**



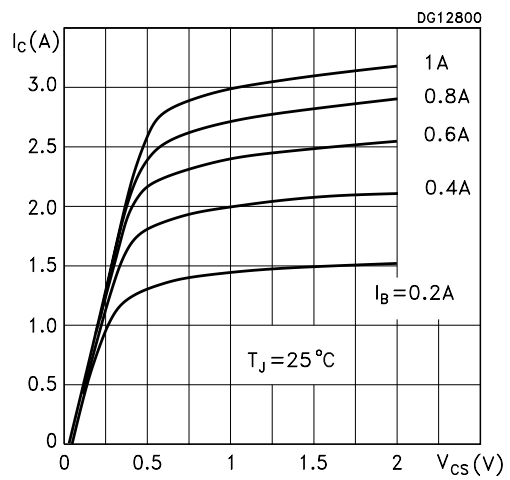
**Figure 4: Reverse Biased Safe Operating Area**



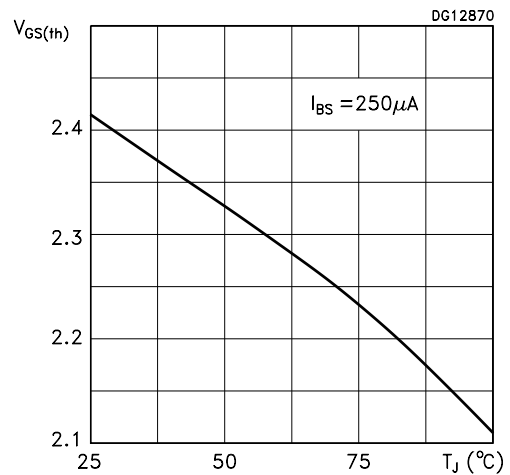
**Figure 5: DC Current Gain**



**Figure 6: Output Characteristics**



**Figure 7: Gate Threshold Voltage vs Temperature**



**Figure 8: DC Current Gain**

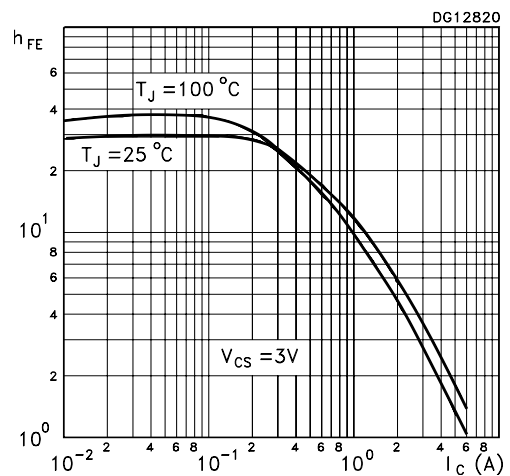


Figure 9: Collector-Source On Voltage

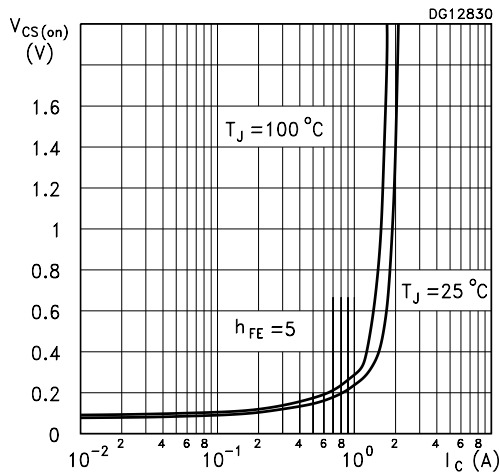


Figure 10: Base-Source On Voltage

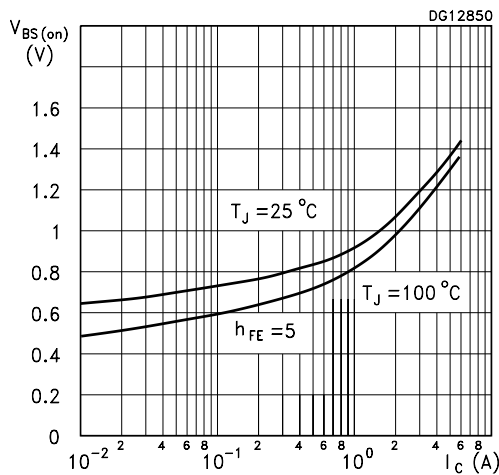


Figure 11: Inductive Load Switching Time

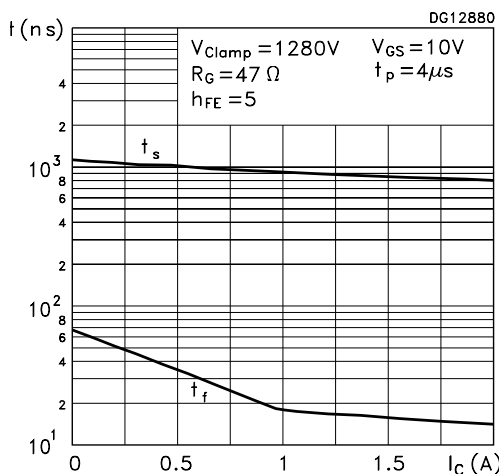


Figure 12: Collector-Source On Voltage

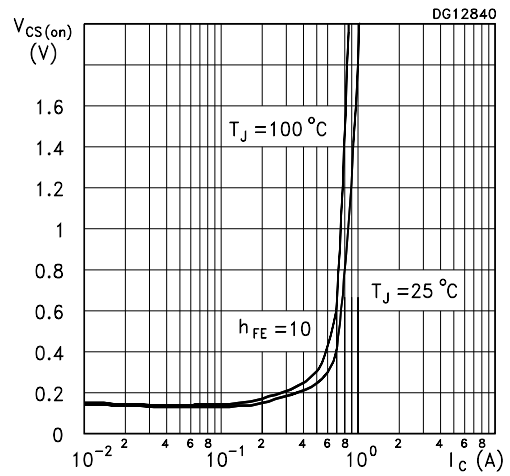


Figure 13: Base-Source On Voltage

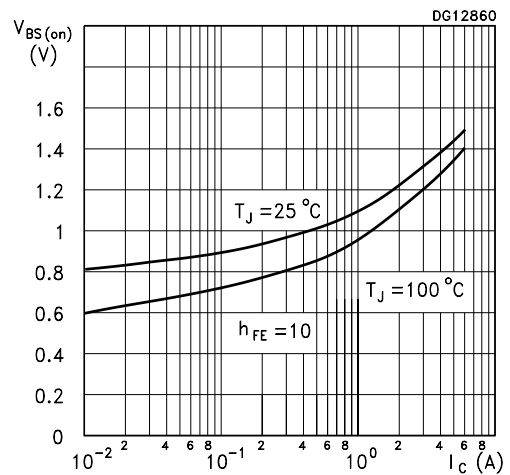
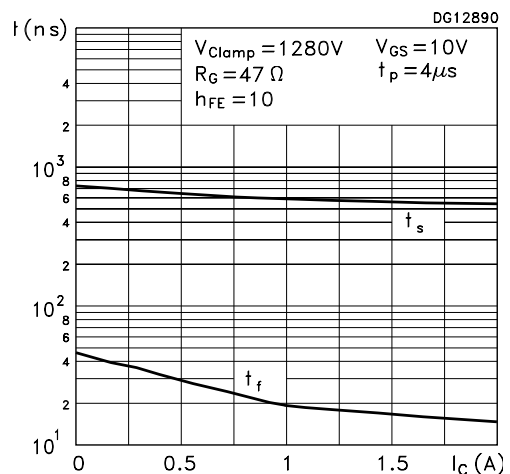
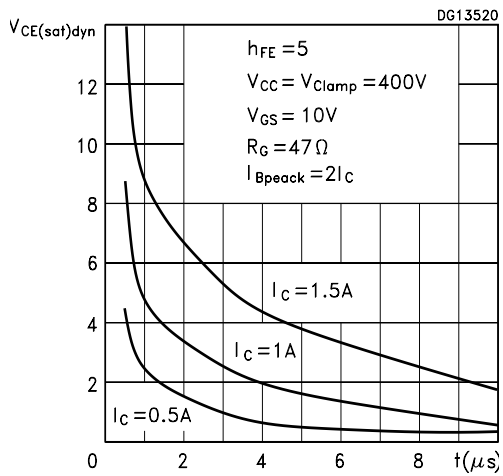


Figure 14: Inductive Load Switching Time

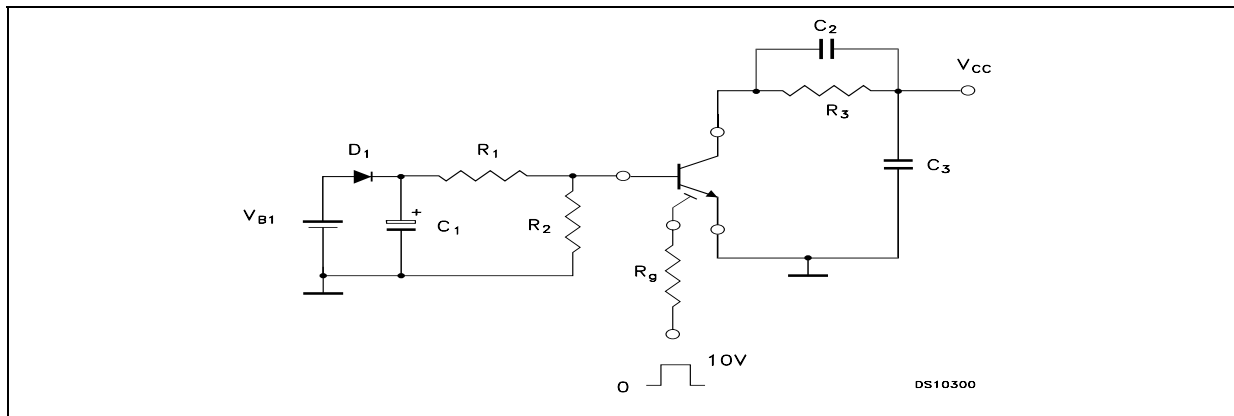


## STC03DE150

**Figure 15: Dynamic Collector-Emitter Saturation Voltage**



**Figure 16: Inductive Load Enlargement FBSOA Circuit**

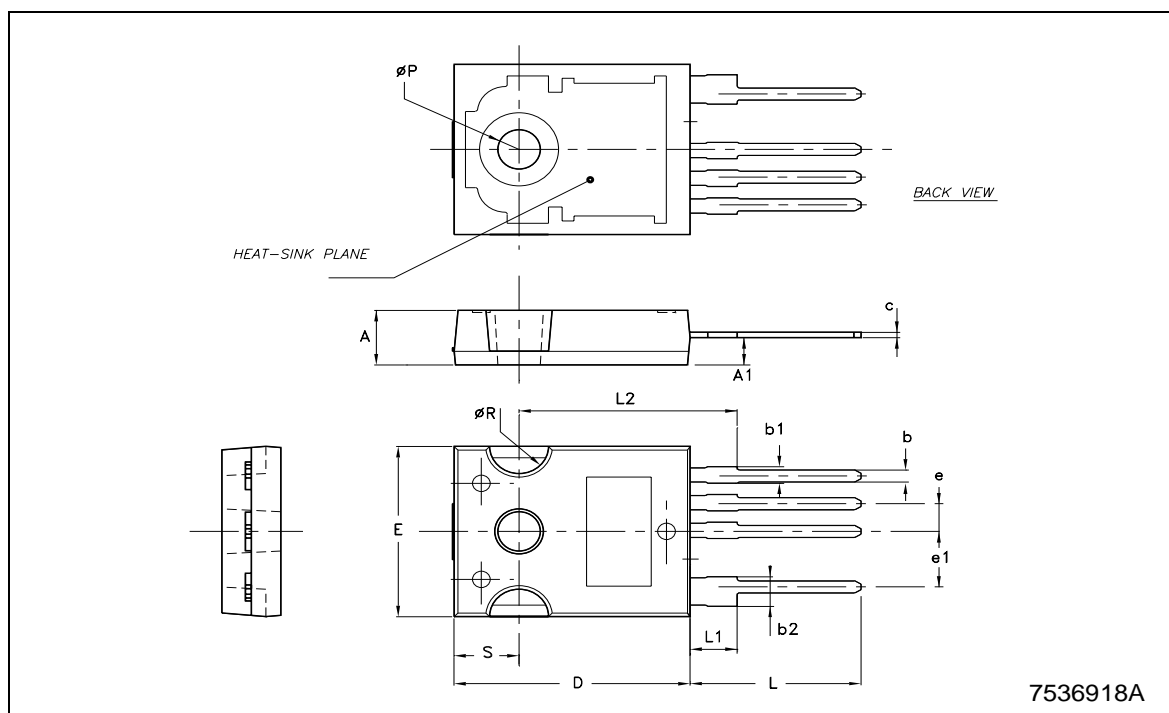


**Table 6: Components, Values**

$V_{B1} = 4.16 V$	$C_1 = 220 nF$
$D_1 = BA157$	$C_2 \leq 70 pF$
$R_1 = 1 \Omega$	$C_3 = 50 nF$
$R_2 = 100 \Omega$	$V_g = 10 V$
$R_3 = V_{CC} / I_{Cn}$	Pulse Time = $5 \mu s$
$R_g = 47 \Omega$	

## TO247-4L MECHANICAL DATA

DIM.	mm		
	MIN.	TYP.	MAX.
A	4.85		5.15
A1	2.20		2.60
b	0.95	1.10	1.30
b1	1.30		1.70
b2	2.50		2.90
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		2.54	
e1		5.08	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S		5.50	



**STC03DE150**

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**Table 7: Revision History**

<b>Date</b>	<b>Release</b>	<b>Change Designator</b>
13-Sep-2004	1	First Release.
04-Oct-2004	2	Figure 15 has been updated on page 6.



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