TN22

STARTLIGHT

FEATURES AND BENEFITS

- High clamping voltage structure (1200 -1500V)
- Low gate triggering current for direct drive from line (< 1.5mA)
- High holding current (> 175mA), ensuring high striking energy.

DESCRIPTION

The TN22 has been specifically developed for use in electronic starter circuits. Use in conjunction with a sensitive SCR and a resistor, it provides high energy striking characteristics with low triggering power. Thanks to its electronic concept, this TN22 based starter offers high reliability levels and extended life time of the fluorescent tubelamps.

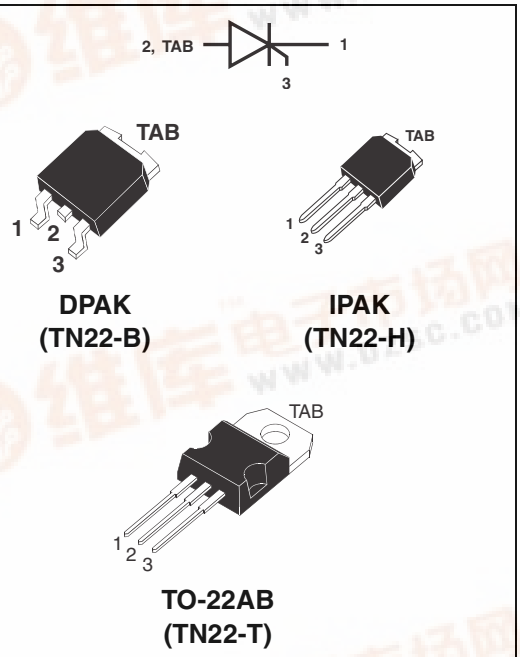


Table 1: Absolute ratings (limiting values)

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak off-state voltage	Tj = 110°C	400	V
$I_{T(RMS)}$	RMS on-state current Full sine ware (180° conduction angle)	Tc = 95°C	2	A
$I_{T(AV)}$	Mean on-state current Full sinewave (180° conduction angle)	Tc = 95°C	1.8	A
I_{TSM}	Non repetitive surge peak on-state current (Tj initial = 25°C)	tp = 8.3ms	22	A
		tp = 10ms	20	
I^2t	I^2t Value for fusing	tp = 10ms	2	A^2s
dI/dt	Critical rate of rise of on-state current I_G =5mA dI_G /dt = 70 mA/µs.		50	A/µs
T_{stg} T_j	Storage and operating junction temperature range		-40 to +150 -40 to +110	°C
Tl	Maximum lead temperature for soldering during 10s at 4.5mm from case		260	°C

Table 2: Thermal resistance

Symbol	Parameter		Value	Unit
$R_{th(j-a)}$	Junction to AMBIENT	DPAK / IPAK	100	°C/W
		TO-220AB	60	
$R_{th(j-c)}$	Junction to case		3	°C/W

GATE CHARACTERISTICS (maximum values)
$P_{G\ (AV)}$ = 300 mW P_{GM} = 2W(t_p = 20 µs) I_{FGM}=1 A (t_p = 20 µs) V_{RGM} = 6V

Table 3: Static electrical characteristics (per diode)

Symbol	Test conditions		Type	Value	Unit
I_{GT}	V_D=12V (DC) R_L= 33Ω	T_j = 25°C	MAX	1.5	mA
V_{GT}	V_D=12V (DC) R_L= 33Ω R_{GK} = 1 KΩ	T_j = 25°C	MAX	3	V
I_H	V_{GK} = 0V	T_j = 25°C	MIN	175	mA
V_{TM}	I_{TM} = 2A t_p = 380µs	T_j = 25°C	MAX	3.1	V
I_{DRM}	V_{DRM} Rated	T_j = 25°C	MAX	0.1	mA
dV/dt	Linear slope up to V_D=67%V_{DRM} V_{GK} = 0V	T_j = 110°C	MIN	500	V/µs

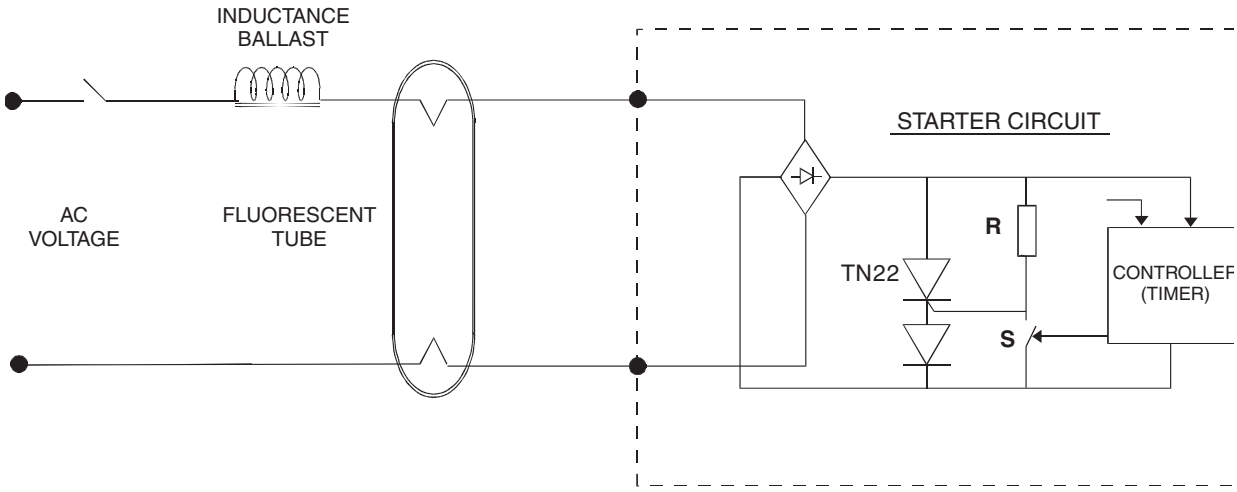
Symbol	Test conditions	Type	Value	Unit
			TN22-1500	
V_{BR}	I_D = 5mA V_{GK} = 0V T_j = 25°C	MIN	1200	V
		MAX	1500	V

This thyristor has been designed for use as a fluorescent tube starter switch.

An electronic starter circuit provides :

- A pre-heating period during which a heating current is applied to the cathode heaters.
- One or several high voltage striking pulses across the lamp.

Figure 1: Basic application diagram



1/ Pre-heating

At rest the switch S is opened and when the mains voltage is applied across the circuit a full wave rectified current flows through the resistor R and the TN22 gate : at every half-cycle when this current reaches the gate triggering current (I_{GT}) the thyris tor turns on.

When the device is turned on the heating current, limited by the ballast choke, flows through the tube heaters.

The pre-heating time is typically 2 or 3 seconds.

2/ Pulsing

At the end of the pre-heating phase the switch S is turned on. At this moment :

If the current through the devices is higher than the holding current (I_H) the thyristor remains on until the current falls below I_H. Then the thyristor turns off.

If the current is equal or lower than the holding current the thyristor turns off instantaneously.

When the thyristor turns off the current flowing through the ballast choke generates a high voltage pulse. This overvoltage is clamped by the thyristor avalanche characteristic (V_{BR}).

If the lamp is not struck after the first pulse, the system starts a new ignition sequence again.

3/ Steady state

When the lamp is on the running voltage is about 150V and the starter switch is in the off-state.

IMPLEMENTATION

The resistor R must be chosen to ensure a proper triggering in the worst case (minimum operating temperature) according to the specified gate triggering current and the peak line voltage.

Switch S : This function can be realized with a gate sensitive SCR type : P0130AA 1EA3

This component is a low voltage device (< 50V) and the maximum current sunk through this switch can reach the level of the thyristor holding current.

The pre-heating period can be determined by the time constant of a capacitor-resistor circuit charged by the voltage drop of diodes used in series in the thyristor cathode.

Figure 2: Maximum average power dissipation versus average on-state current (rectified full sinewave)

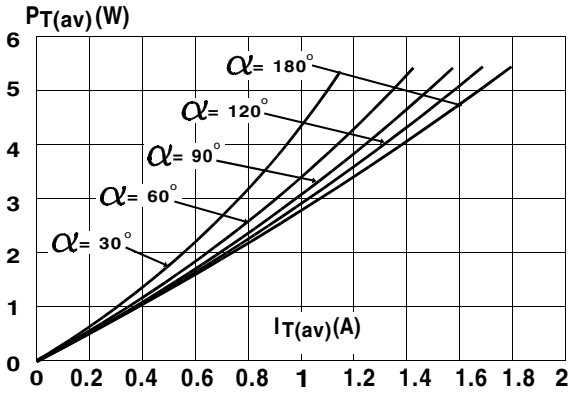


Figure 3: Correlation between maximum average power dissipation and maximum allowable temperature (T_{amb} and T_{case}) for different thermal resistances heatsink + contact

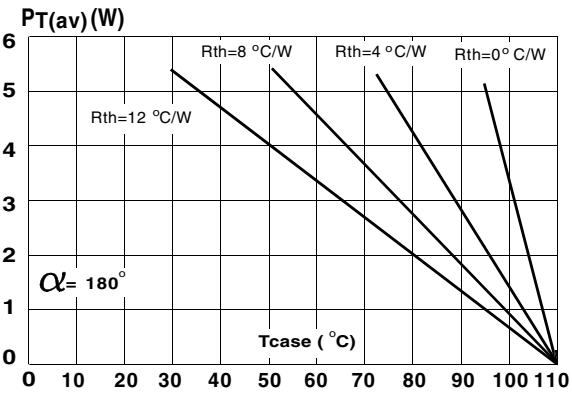


Figure 4: Averrage on-state current versus case temperature (rectified full sine wave)

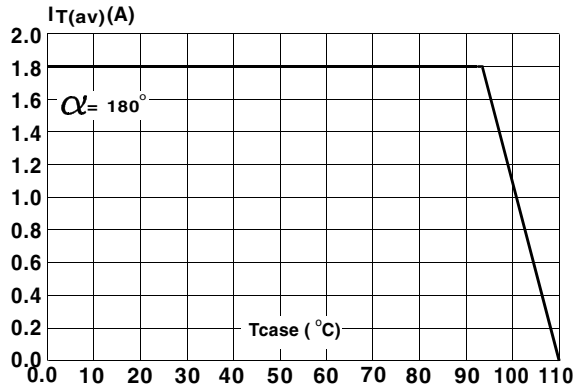


Figure 5: Thermal transient impedance junction to ambient versus pulse duration

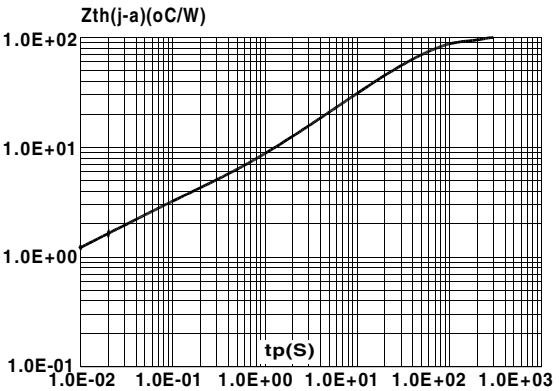


Figure 6: Relative variation of gate trigger current and holding current versus junction temperature

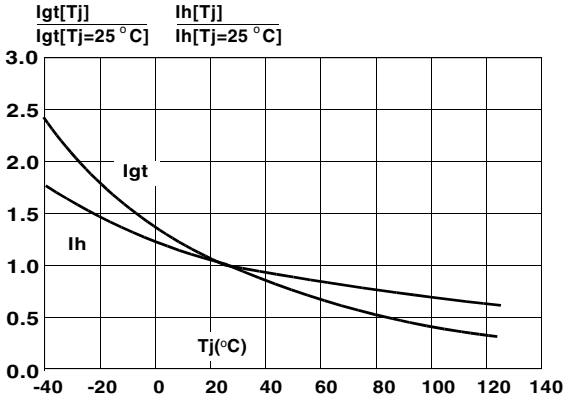


Figure 7: Non repetitive surge peak on-state current versus number of cycles

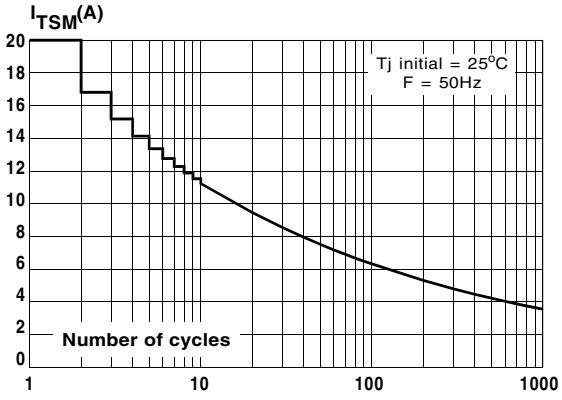


Figure 8: Non repetitive surge peak on-state current for a sinusoidal pulse with width : t_p = 10ms, and corresponding value fo I^2t

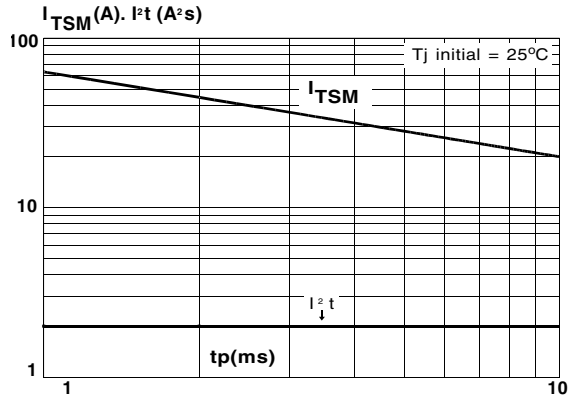


Figure 9: On-state characteristics (maximum values)

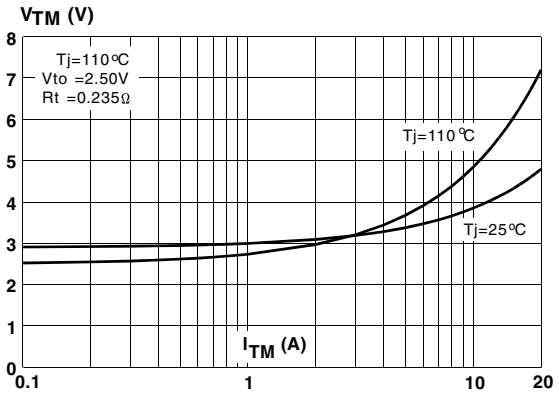


Figure 10: Relative variation of holding current versus gate-cathode resistance (typical values)

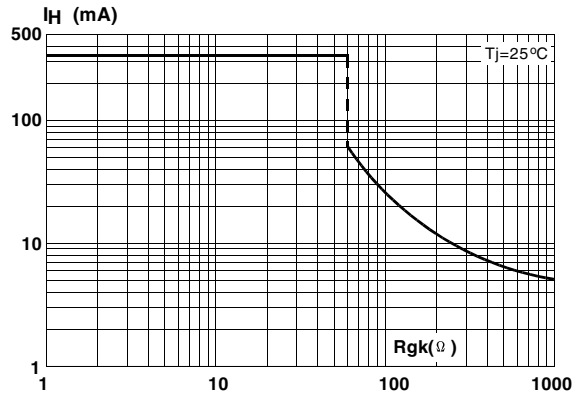


Figure 11: Maximum allowable RMS current versus time conduction and initial case temperature. Note: Calculation made fot T_j max = 135°C (the failure mode will be short circuit)

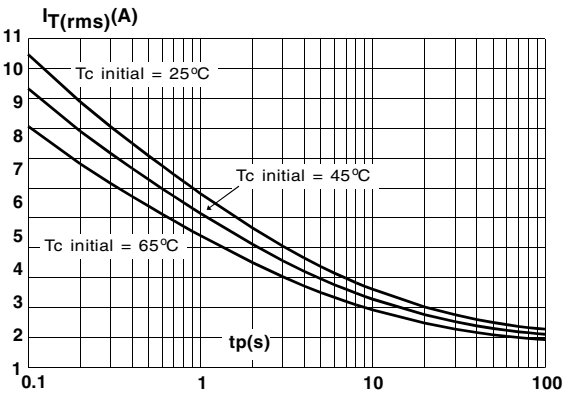


Figure 12: Ordering information scheme

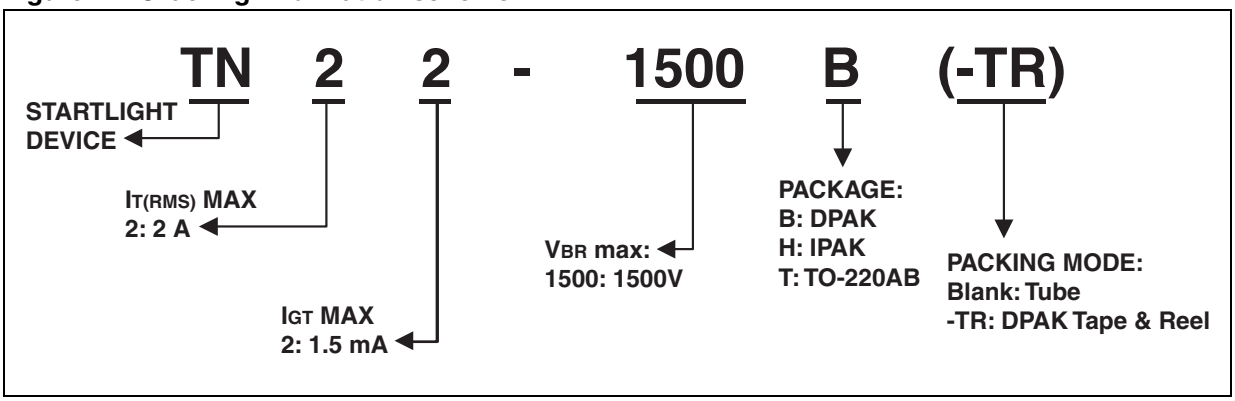
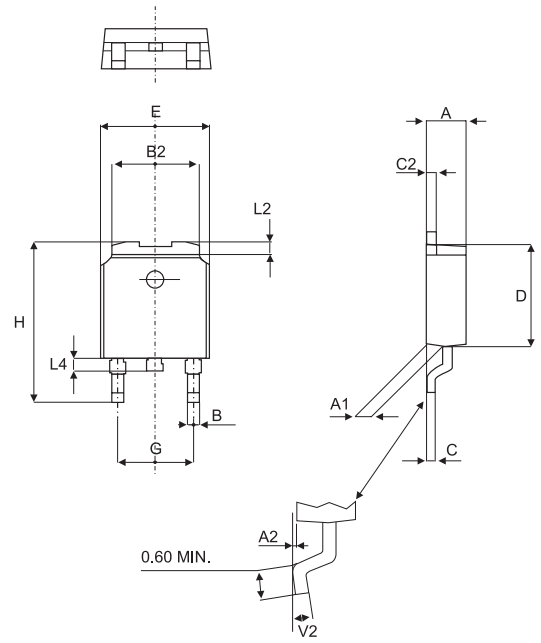


Figure 13: DPAK Package mechanical data



REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	2.2	2.4	0.086	0.094
A1	0.9	1.1	0.035	0.043
A2	0.03	0.23	0.001	0.009
B	0.64	0.9	0.025	0.035
B2	5.2	5.4	0.204	0.212
C	0.45	0.6	0.017	0.023
C2	0.48	0.6	0.018	0.023
D	6	6.2	0.236	0.244
E	6.4	6.6	0.251	0.259
G	4.4	4.6	0.173	0.181
H	9.35	10.1	0.368	0.397
L2	0.80 Typ.		0.031 Typ.	
L4	0.6	1.0	0.023	0.039
V2	0°	8°	0°	8°

Figure 14: Footprint dimensions (in millimeters)

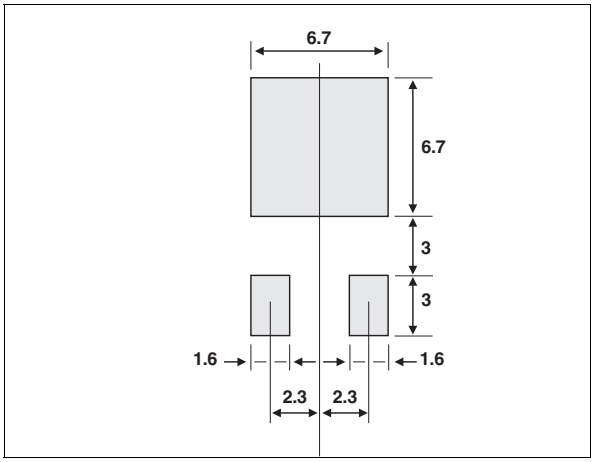
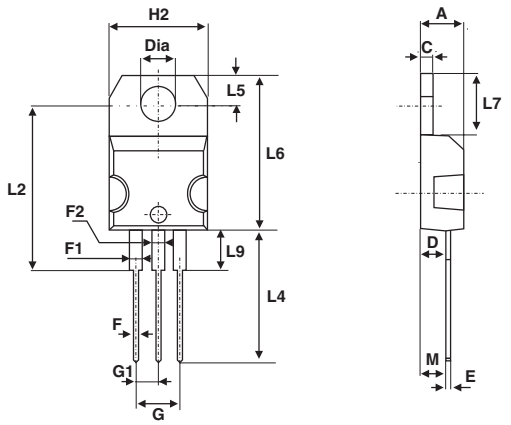
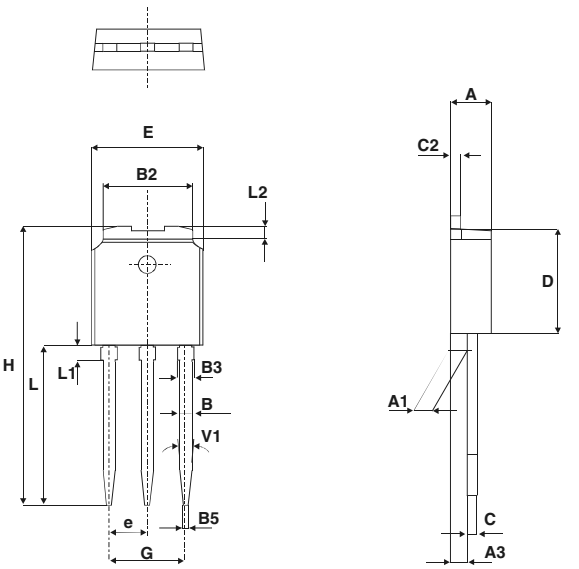


Figure 15: TO-220 Package mechanical data



REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
C	1.23	1.32	0.048	0.051
D	2.40	2.72	0.094	0.107
E	0.49	0.70	0.019	0.027
F	0.61	0.88	0.024	0.034
F1	1.14	1.71	0.044	0.066
F2	1.14	1.70	0.044	0.066
G	4.95	5.15	0.194	0.202
G1	2.40	2.70	0.094	0.106
H2	10	10.40	0.393	0.409
L2	16.4 Typ.		0.645 Typ.	
L4	13	14	0.511	0.551
L5	2.65	2.95	0.104	0.116
L6	15.25	15.75	0.600	0.620
L7	6.20	6.60	0.244	0.259
L9	3.50	3.93	0.137	0.154
M	2.6 Typ.		0.102 Typ.	
Diam	3.75	3.85	0.147	0.151

Figure 16: IPAK Package mechanical data



REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.20		2.40	0.086		0.094
A1	0.90		1.10	0.035		0.043
A3	0.70		1.30	0.027		0.051
B	0.64		0.90	0.025		0.035
B2	5.20		5.40	0.204		0.212
B3			0.95			0.037
B5		0.30			0.035	
C	0.45		0.60	0.017		0.023
C2	0.48		0.60	0.019		0.023
D	6		6.20	0.236		0.244
E	6.40		6.60	0.252		0.260
e		2.28			0.090	
G	4.40		4.60	0.173		0.181
H		16.10			0.634	
L	9		9.40	0.354		0.370
L1	0.8		1.20	0.031		0.047
L2		0.80	1		0.031	0.039
V1		10°			10°	

Table 4: Ordering information

Type	Marking	Package	Weight	Base Qty	Delivery mode
TN22-1500B	TN22-1500	DPAK	0.3 g	75	Tube
TN22-1500B-TR	TN22-1500	DPAK	0.3 g	2500	Tape & Reel
TN22-1500H	TN22-1500	IPAK	0.4 g	75	Tube
TN22-1500T	TN22-1500	TO-220AB	2.0 g	50	Tube

Table 5: Revision History

Date	Revision	Description of Changes
Oct-2000	1	First issue.
17-Sep-2005	2	TO-220AB package added.