THYRISTORS

Glass-passivated 25 ampere thyristors intended for use in applications involving high fatigue stress due to thermal cycling and repeated switching. These thyristors feature a high surge current capability. Typical applications include motor and heating control, regulators for transfomerless power supply circuits, relay and coil pulsing and power supply crowbar protection circuits.

QUICK REFERENCE DATA

			BT145-500R	600R	800R	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	500	600	800	V
Average on-state current	$I_{T(AV)}$	max.		16		A
R.M.S. on-state current	$I_{T(RMS)}$	max.		25		A
Non-repetitive peak on-state current	I_{TSM}	max.		300		A

MECHANICAL DATA

Dimensions in mm

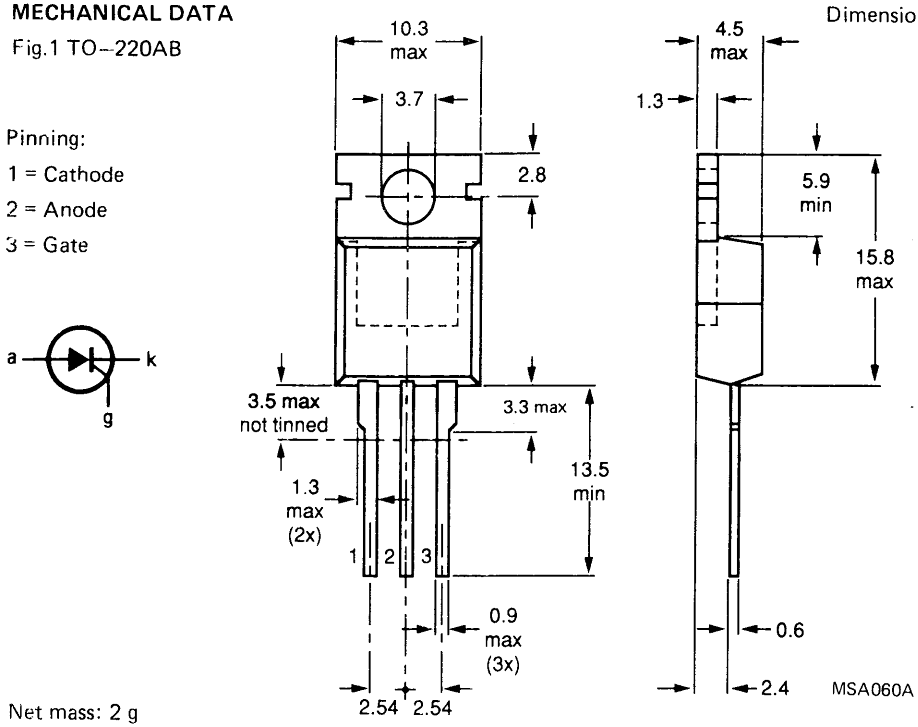
Fig.1 TO–220AB

Pinning:

1 = Cathode

2 = Anode

3 = Gate



Net mass: 2 g

Note: The exposed metal mounting base is directly connected to the anode.

Accessories supplied on request: see data sheets Mounting instructions and accessories for TO–220 envelopes.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134).

			BT145-500R	600R	800R	
Anode to cathode						
→ Non-repetitive peak voltages	V_{DSM}/V_{RSM}	max.	500	600	800	V*
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	500	600	800	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	400	400	400	V
→ Continuous voltages	V_D/V_R	max.	400	400	400	V
Average on-state current (averaged over any 20 ms period) up to T_{mb} = 93 °C	$I_{T(AV)}$	max.		16		A
RMS on-state current	$I_{T(RMS)}$	max.		25		A
Repetitive peak on-state current	I_{TRM}	max.		300		A
Non-repetitive peak on-state current; t = 10 ms; half sinewave; → T_j = 110 °C prior to surge; with reapplied $V_{RWM\,max}$	I_{TSM}	max.		300		A
I^2t for fusing (t = 10 ms)	I^2t	max.		450		A^2s
Rate of rise of on-state current after triggering with I_G = 160 mA to I_T = 50 A; dI_G/dt = 160 A/ms	dI_T/dt	max.		200		A/µs
Gate to cathode						
Reverse peak voltage	V_{RGM}	max.		5		V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.		0.5		W
Peak power dissipation; t ⩽ 10 µs	P_{GM}	max.		20		W
Temperature						
Storage temperature	T_{stg}			−40 to +150		°C
Junction temperature	T_j	max.		110		°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\,j\text{-}mb}$	=	1.0	K/W
From mounting base to heatsink with heatsink compound	$R_{th\,mb\text{-}h}$	=	0.3	K/W

→ *Although not recommended, higher off-state voltages may be applied without damage, but the thyristor may switch into the on-state. The rate of rise of on-state current should not exceed 15 A/µs.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.0	K/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0.09	K/W

Influence of mounting method

1. Heatsink-mounted with clip (see mounting instructions)

Thermal resistance from mounting base to heatsink

a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
b. with heatsink compound and 0.06 mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. with heatsink compound and 0.1 mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25 mm maximum alumina insulator (56367)	$R_{th\ mb\text{-}h}$	=	0.8	K/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1.4	K/W

2. Free-air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-point.

Thermal resistance from junction to ambient in free air:
mounted on a printed-circuit board at a = any lead length $R_{th\ j\text{-}a}$ = 60 K/W

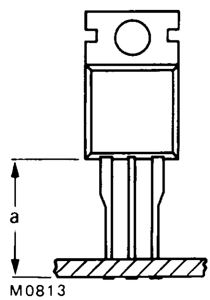


Fig.2.

CHARACTERISTICS

Anode to cathode

On-state voltage (measured under pulse conditions)				
I_T = 30 A; T_j = 25 °C	V_T	<	1.5	V
Rate of rise of off-sate voltage that will not trigger any device				
T_j = 110 °C; R_{GK} = open circuit	dV_D/dt	<	200	V/µs
Reverse current				
$V_R = V_{RWMmax}$; T_j = 110 °C	I_R	<	1.0	mA
Off-state current				
$V_D = V_{DWMmax}$; T_j = 110 °C	I_D	<	1.0	mA
Latching current; T_j = 25 °C	I_L	<	80	mA
Holding current; T_j = 25 °C	I_H	<	60	mA

Gate to cathode

Voltage that will trigger all devices				
V_D = 12 V; T_j = −40 °C	V_{GT}	>	1.5	V
V_D = 12 V; T_j = 25 °C	V_{GT}	>	1.0	V
Voltage that will not trigger any device				
$V_D = V_{DRMmax}$; T_j = 110 °C	V_{GD}	<	0.25	V
Current that will trigger all devices				
V_D = 12V; T_j = −40 °C	I_{GT}	>	55	mA
V_D = 12 V; T_j = 25 °C	I_{GT}	>	35	mA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) when switched from $V_D = V_{DRMmax}$ to I_T = 40 A; I_{GT} = 100 mA; dI_G/dt = 5 A/µs; T_j = 25 °C	t_{gt}	typ.	2	µs

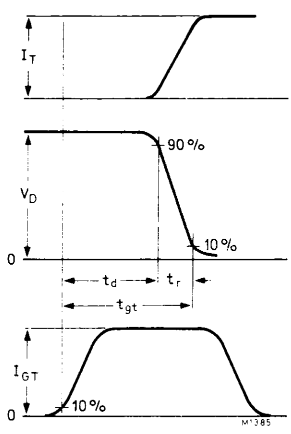


Fig.3 Gate controlled turn-on time definition.

MOUNTING INSTRUCTIONS

1. The device may be soldered directly into the circuit, but the maximum permissible temperature of the soldering iron or bath is 275 °C; it must not be in contact with the joint for more than 5 seconds. Soldered joints must be at least 4.7 mm from the seal.
2. The leads should not be bent less than 2.4 mm from the seal, and should be supported during bending. The leads can be bent, twisted or straightened by 90° maximum. The minimum bending radius is 1 mm.
3. It is recommended that the circuit connection be made to the anode tag, rather than direct to the heatsink.
4. Mounting by means of a spring clip is the best mounting method because it offers:
   a. a good thermal contact under the crystal area and slightly lower $R_{th\ mb\text{-}h}$ values than screw mounting.
   b. safe isolation for mains operation.

   However, if a screw is used, it should be M3 cross-recess pan-head. Care should be taken to avoid damage to the plastic body.
5. For good thermal contact, heatsink compound should be used between mounting base and heatsink. Values of $R_{th\ mb\text{-}h}$ given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
6. Rivet mounting (only possible for non-insulated mounting)

   Devices may be rivetted to flat heatsinks; such a process must neither deform the mounting tab, nor enlarge the mounting hole. The maximum recommended hole size for rivet mounting is 3.5 mm. The pre-formed head of the rivet should be on the device side and any rivet tool used should not damage the plastic body of the device.
7. The heatsink must have a flatness in the mounting area of 0.02 mm maximum per 10 mm. Mounting holes must be deburred.

OPERATING NOTES

Dissipation and heatsink considerations:

a. The various components of junction temperature rise above ambient are illustrated in Fig.4.

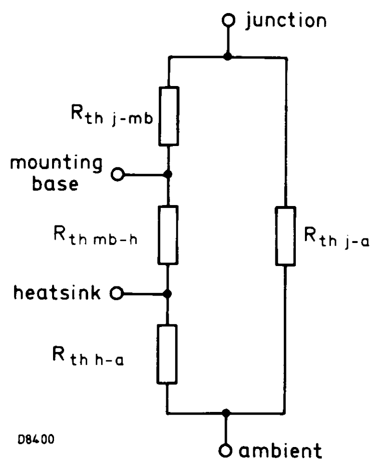


Fig.4

b. The method of using Fig.5 is as follows:
Starting with the required current on the $I_{T(AV)}$ axis, trace upwards to meet the appropriate form factor curve. Trace right horizontally and upwards from the appropriate value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can now be calculated from:

$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}.$$

c. Any measurement of heatsink temperature should be made immediately adjacent to the device.

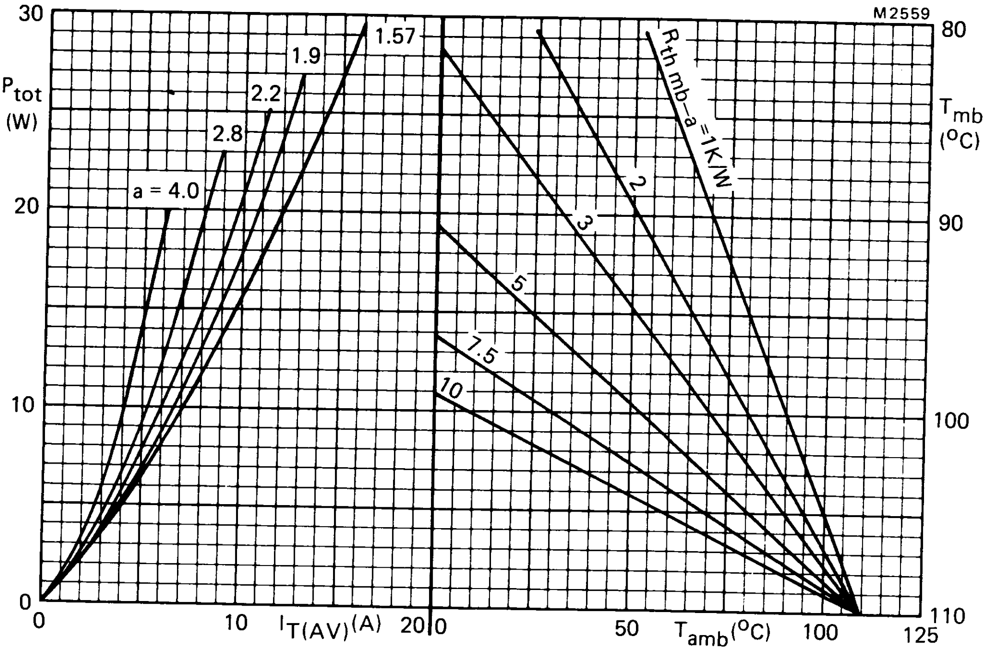
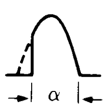


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.



α = conduction angle per half cycle

$$a = \text{form factor} = \frac{I_{T\,(RMS)}}{I_{T(AV)}}$$

α	a
30°	4
60°	2.8
90°	2.2
120°	1.9
180°	1.57

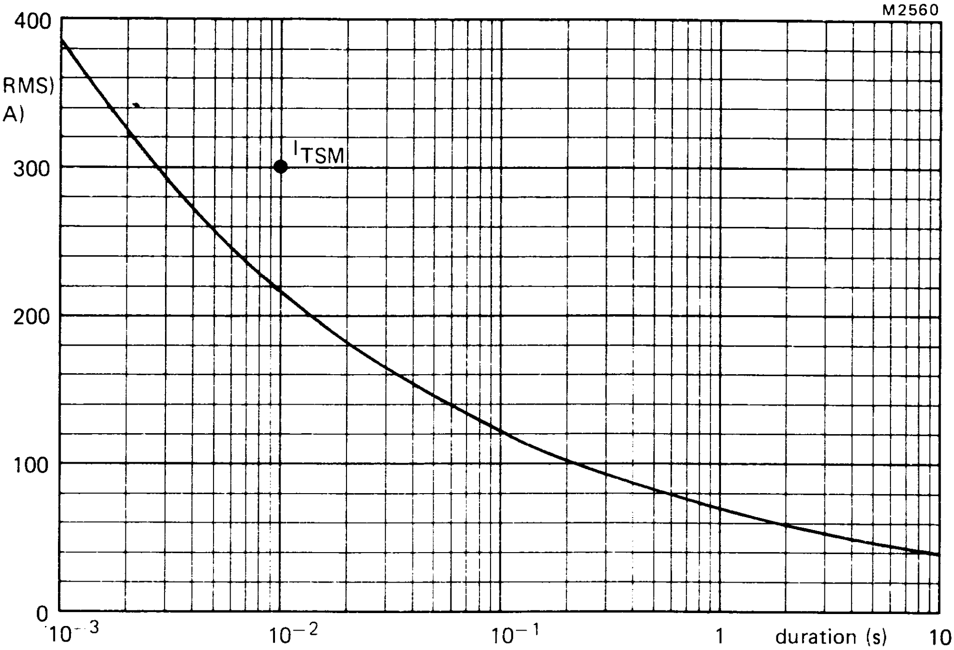
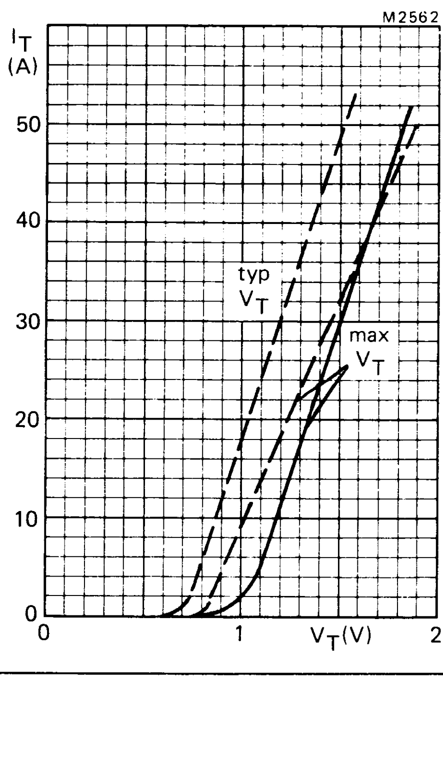


Fig.6 Maximum permissible non-repetitive r.m.s. on-state current based on sinusoidal currents (f=50Hz) with re-applied V_{RWMmax}; T_j = 110 °C prior to surge.



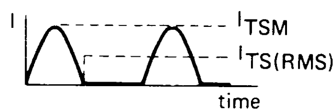


Fig.7 —— T_j = 25 °C; – – – T_j = 110 °C.

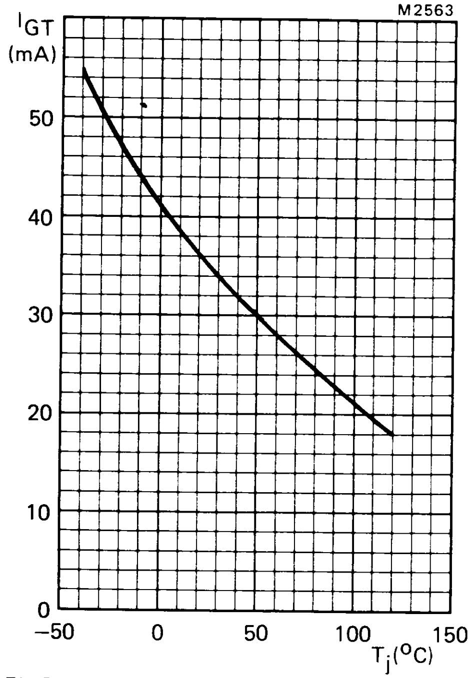


Fig.8 Minimum gate current that will trigger all devices as a function of junction temperature.

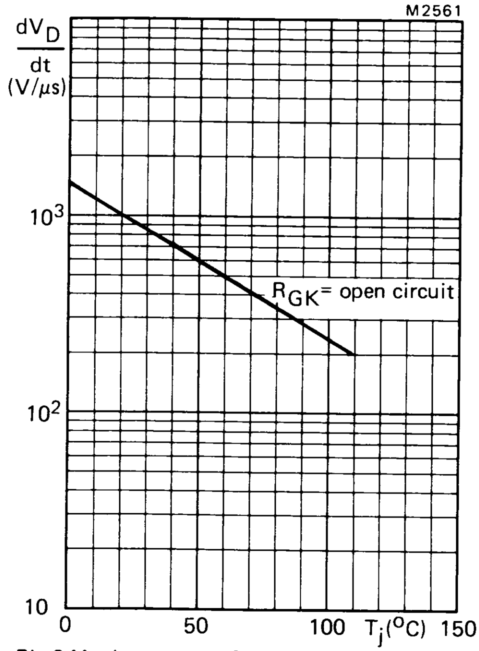


Fig.9 Maximum rate of rise of off-state voltage that will not trigger any device as a function of junction temperature.

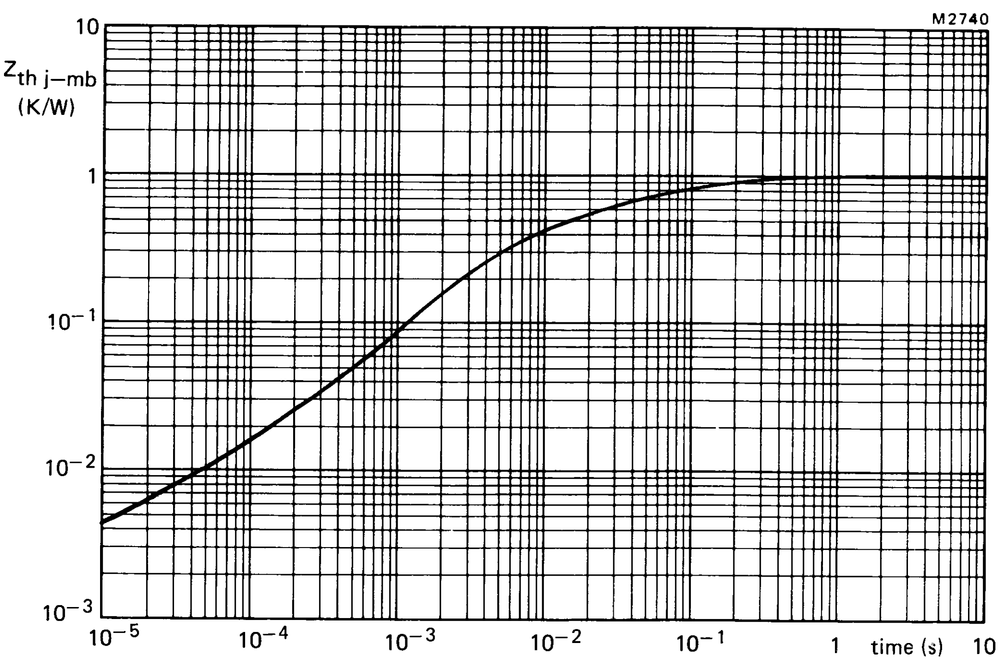


Fig. 10 Transient thermal impedance.

THYRISTORS

Glass-passivated thyristor in TO-220AB envelope, featuring sensitive gate triggering as low as 200 μA. Particularly suitable in applications where high fatigue stresses due to thermal cycling and repeated switching are present. Typical applications include temperature and motor control, relay and coil pulsing and power supply crowbar protection circuits and regulators in transformerless power supply systems.

QUICK REFERENCE DATA

Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	500	V
Average on-state current	$I_{T(AV)}$	max.	2.5	A
rms on-state current	$I_{T(RMS)}$	max.	4	A
Non-repetitive on-state current	I_{TSM}	max.	25	A

MECHANICAL DATA

Dimensions in mm

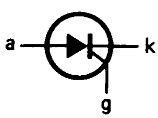
Fig.1 TO-220AB

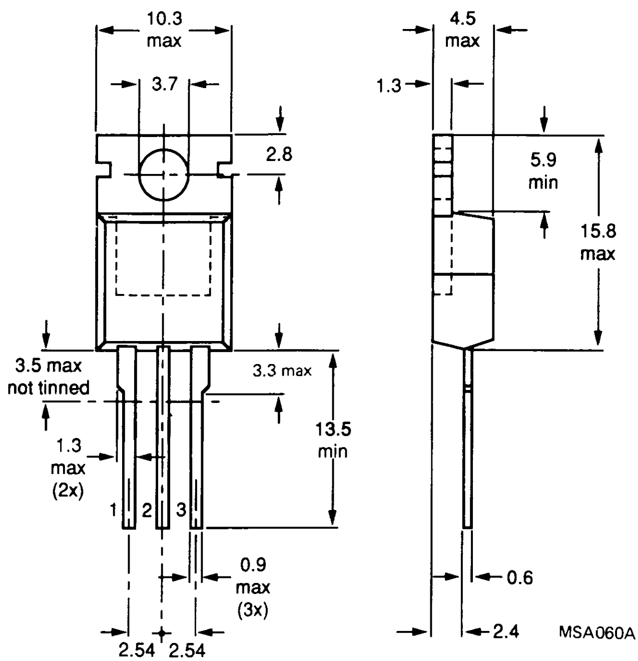
Pinning:

1 = Cathode

2 = Anode

3 = Gate





Net mass: 2 g

Note: The exposed metal mounting base is directly connected to the anode.

Accessories supplied on request, see data sheets Mounting instructions and accessories for TO-220 envelopes.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134).

Anode to cathode

Non-repetitive peak voltages ($t \leqslant 10$ ms)	V_{DSM}/V_{RSM}	max.	500	V*
Repetitive peak voltage ($\delta \leqslant 0.01$)	V_{DRM}/V_{RRM}	max.	500	V
Crest working voltages	V_{DWM}/V_{RWM}	max.	400	V
Continuous voltages	V_D/V_R	max.	400	V
Average on-state current (averaged over any 20 ms period) up to T_{mb} = 98 °C	$I_{T(AV)}$	max.	2.5	A
R.M.S. on-state current	$I_{T(RMS)}$	max.	4	A
Repetitive peak on-state current	I_{TRM}	max.	25	A
Non-repetitive peak on-state current t = 10 ms; half sine-wave; T_j = 110 °C prior to surge; with reapplied V_{RWMmax}	I_{TSM}	max.	25	A
I^2t for fusing (t = 10 ms)	I^2t	max.	3	A^2s
Rate of rise of on-state current after triggering with I_G = 50 mA; to I_T = 10 A; dI_G/dt = 50 mA/μs	dI_T/dt	max.	50	A/μs

Gate to cathode

Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0.5	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−40 to +125	°C
Junction temperature	T_j	max.	110	°C

*Although not recommended, higher off-state voltages may be applied without damage, but the thyristor may switch into the on-state. The rate of rise of on-state current should not exceed 15 A/μs.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.5	K/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0.2	K/W

Influence of mounting method

1. Heatsink mounted with clip (see mounting instructions)

Thermal resistance from mounting base to heatsink

a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
b. with heatsink compound and 0.06 mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. with heatsink compound and 0.1 mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25 mm maximum alumina insulator (56367)	$R_{th\ mb\text{-}h}$	=	0.8	K/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1.4	K/W

2. Free air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-point.

Thermal resistance from junction to ambient in free air; mounted on a printed-circuit board at a = any lead length	$R_{th\ j\text{-}a}$	=	60	K/W

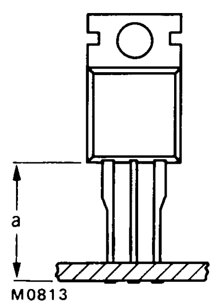


Fig.2

CHARACTERISTICS (T_j = 25 °C unless otherwise stated)

Anode to cathode

On-state voltage I_T = 5 A	V_T	<	1.8	V*
Rate of rise of off-state voltage that will not trigger any device R_{GK} = 100 Ω; T_j = 110 °C	dV_D/dt	typ.	5	V/μs
Reverse current $V_R = V_{RWMmax}$; T_j = 110 °C	I_R	<	0.5	mA
Off-state current $V_D = V_{DWMmax}$; T_j = 110 °C	I_D	<	0.5	mA
Latching current	I_L	<	10	mA
Holding current	I_H	<	6	mA

Gate to cathode

Voltage that will trigger all devices V_D = 12 V	V_{GT}	>	1.5	V
V_D = 12 V; T_j = −40 °C	V_{GT}	>	2.3	V
Voltage that will not trigger any device V_D = 12 V; T_j = 110 °C	V_{GD}	<	250	mV
Current that will trigger all devices V_D = 12 V	I_{GT}	>	200	μA
V_D = 12 V; T_j = −40 °C	I_{GT}	>	260	μA

Switching characteristics

Gate-controlled turn-on time ($t_{gt} = t_d + t_r$) with switched from $V_D = V_{DWMmax}$ to I_T = 10 A; I_{GT} = 5 mA; dI_G/dt = 0.2 A/μs	t_{gt}	typ.	2	μs

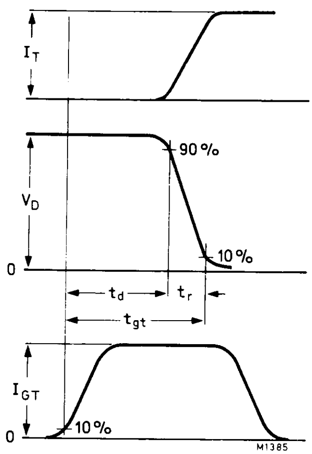


Fig.3 Gate-controlled turn-on time definition.

*Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

1. The device may be soldered directly into the circuit, but the maximum permissible temperature of the soldering iron or bath is 275 °C; it must not be in contact with the joint for more than 5 seconds. Soldered joints must be at least 4.7 mm from the seal.
2. The leads should not be bent less than 2.4 mm from the seal, and should be supported during bending. The leads can be bent, twisted or straightened by 90° maximum. The minimum bending radius is 1 mm.
3. It is recommended that the circuit connection be made to the anode tag, rather than direct to the heatsink.
4. Mounting by means of a spring clip is the best mounting method because it offers:
   a. a good thermal contact under the crystal area and slightly lower $R_{th\ mb\text{-}h}$ values than screw mounting.
   b. safe isolation for mains operation.
   However, if a screw is used, it should be M3 cross-recess pan-head. Care should be taken to avoid damage to the plastic body.
5. For good thermal contact, heatsink compound should be used between mounting base and heatsink. Values of $R_{th\ mb\text{-}h}$ given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
6. Rivet mounting (only possible for non-insulated mounting).
   Devices may be rivetted to flat heatsinks; such a process **must neither** deform the mounting tab, **nor** enlarge the mounting hole.
7. The heatsink must have a flatness in the mounting area of 0.02 mm maximum per 10 mm. Mounting holes must be deburred.

OPERATING NOTES

Dissipation and heatsink considerations:

a. The various components of junction temperature rise above ambient are illustrated in Fig.4.

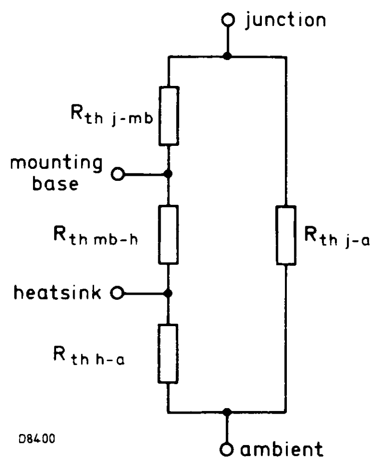


Fig.4

b. The method of using Fig.5 is as follows:
   Starting with the required current on the $I_{T(AV)}$ axis, trace upwards to meet the appropriate form factor curve. Trace right horizontally and upwards from the appropriate value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can now be calculated from:

$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}.$$

c. Any measurement of heatsink temperature should be made immediately adjacent to the device.

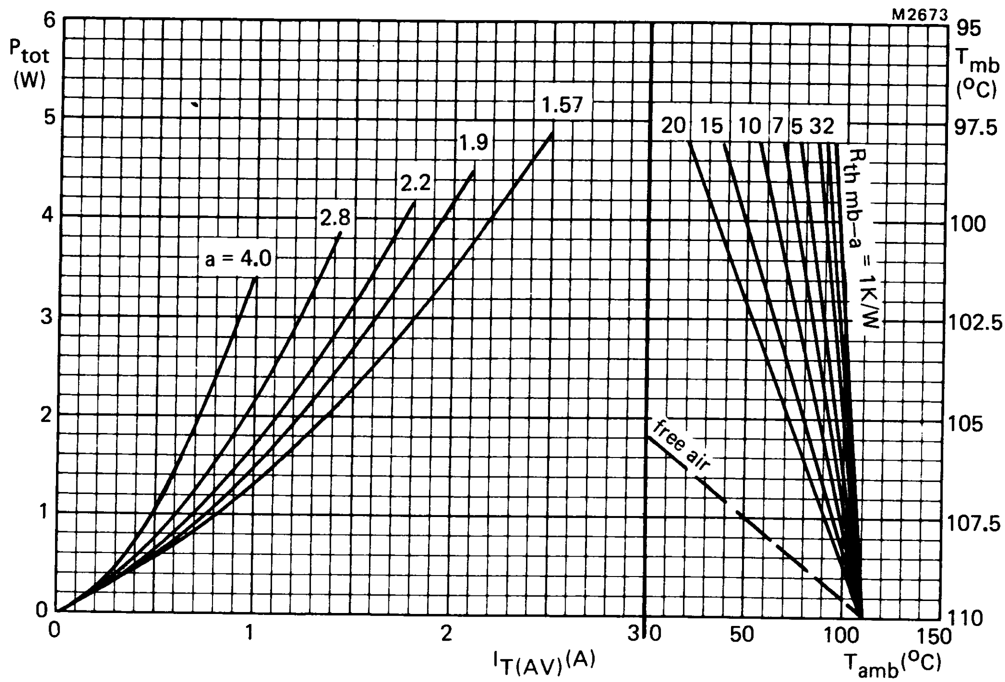
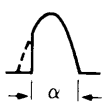


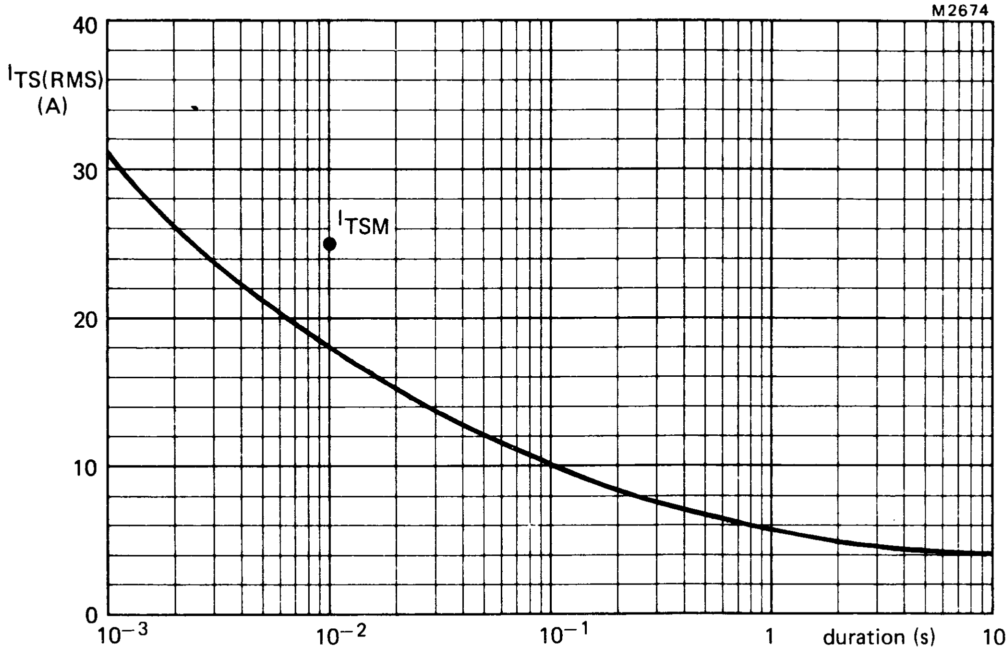
Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.



α = conduction angle per half cycle

$$a = \text{form factor} = \frac{I_{T(RMS)}}{I_{T(AV)}}$$

α	a
30°	4
60°	2.8
90°	2.2
120°	1.9
180°	1.57



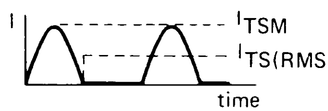


Fig.6 Maximum permissible non-repetitive r.m.s. on-state current based on sinusoidal currents (f = 50 Hz) with reapplied V_{RWMmax}. T_j = 110 °C prior to surge.

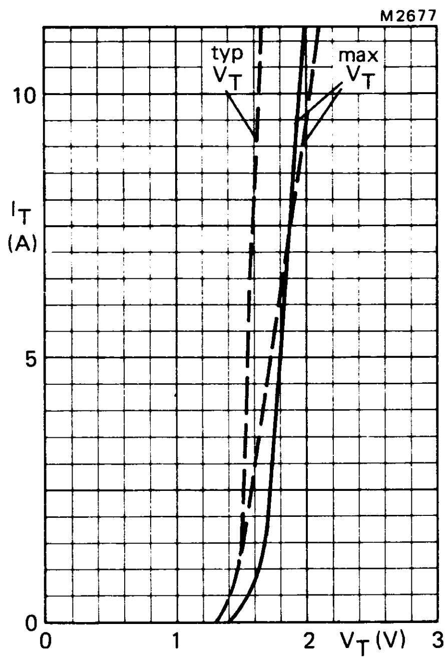


Fig.7 —— T_j = 25 °C; – – – T_j = 110 °C.

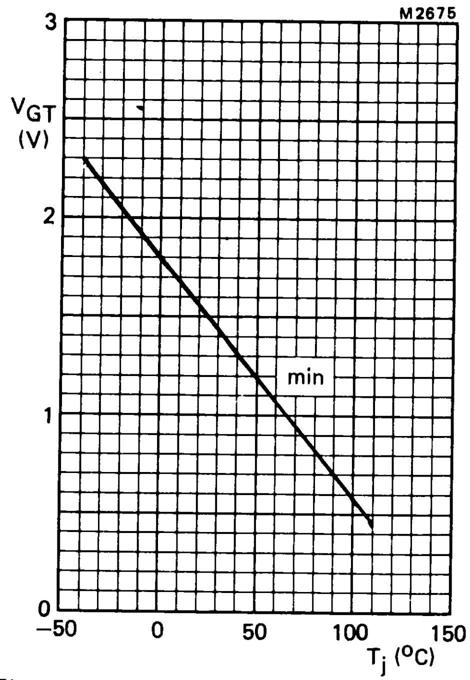


Fig.8 Minimum gate voltage that will trigger all devices as a function of junction temperature.

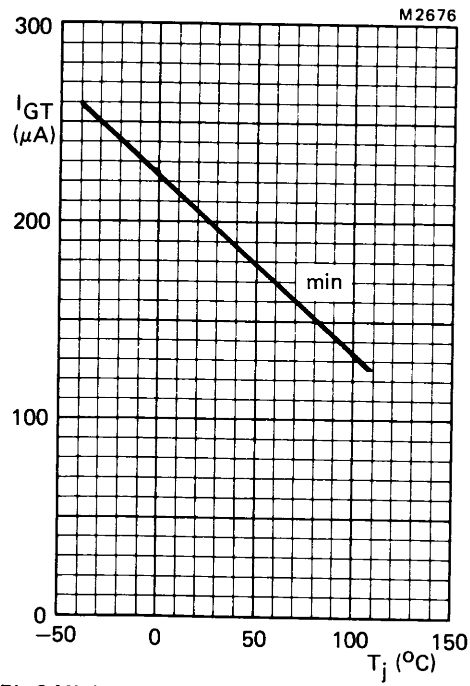


Fig.9 Minimum gate current that will trigger all devices as a function of junction temperature.

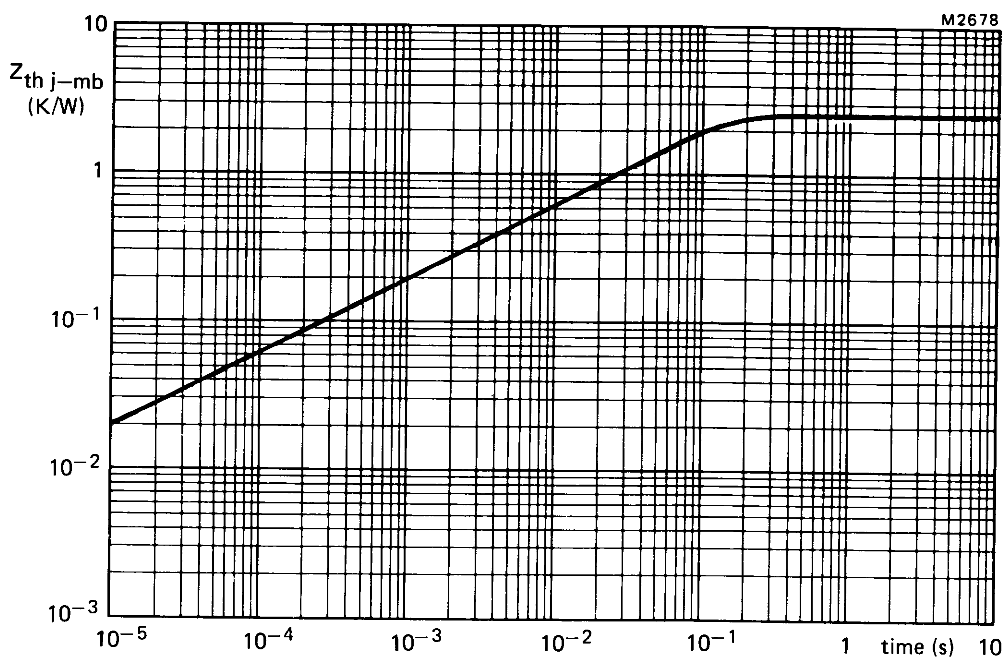


Fig.10 Transient thermal impedance.

THYRISTORS

Fully-diffused thyristors in TO—92 package, with low gate current requirement suitable for driving from IC outputs. Applications include relay and coil pulsing, control of small DC motors, small lamps, etc.

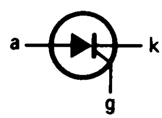
QUICK REFERENCE DATA

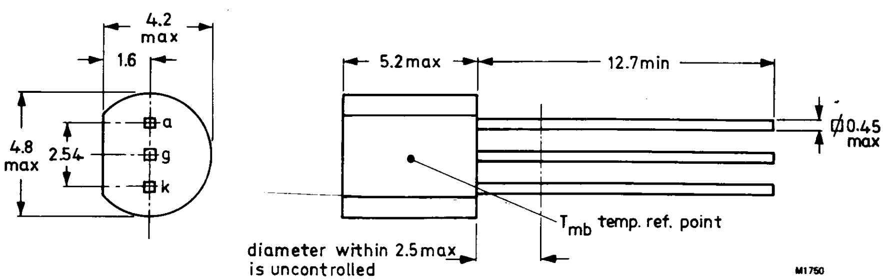
			BT169—B	D	E	G	
Repetitive peak voltages	V_{DRM}/V_{RRM}	max.	200	400	500	600	V
Average on-state current	$I_{T(AV)}$	max.	0.5				A
RMS on-state current	$I_{T(RMS)}$	max.	0.8				A
Non-repetitive peak on-state current	I_{TSM}	max.	8				A

MECHANICAL DATA

Dimensions in mm

Fig.1 TO—92 variant





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134).

Anode to cathode			BT169–B	D	E	G	
Non-repetitive peak voltages ($t \leqslant 10$ ms)	V_{DSM}/V_{RSM}	max.	200	400	500	600	V
Repetitive peak voltages ($\delta \leqslant 0.01$)	V_{DRM}/V_{RRM}	max.	200	400	500	600	V
Crest-working off-state voltage	V_{DWM}/V_{RWM}	max.	200	400	400	400	V

Average on-state current (averaged over any 20 ms period up to T_c = 55 °C	$I_{T(AV)}$	max.	0.5	A
RMS on-state current	$I_{T(RMS)}$	max.	0.8	A
Repetitive peak on-state current	I_{TRM}	max.	8	A
Non-repetitive peak on-state current; t = 10 ms; half sinewave; T_j = 125 °C prior to surge; with reapplied V_{RWMmax}	I_{TSM}	max.	8	A
I^2t for fusing (t = 10 ms)	I^2t	max.	0.32	A^2s
Gate to cathode				
Peak reverse voltage	V_{RGM}	max.	5	V
Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0.1	W
Peak power dissipation	P_{GM}	max.	2	W
Temperatures				
Storage temperature	T_{stg}		−40 to +150	°C
Operating junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	150	K/W*

*Device mounted on printed circuit board, max. lead length 4 mm.

CHARACTERISTICS

Anode to cathode

On-state voltage $I_T = 1$ A; $T_j = 25$ °C	V_T	<	1.35	V*
Rate of rise of off-state voltage that will not trigger any device; exponential method; $V_D = 2/3\ V_{DRM\ max}$; $R_{GK} = 1$ kΩ; $T_j = 125$ °C	dV/dt	typ.	25	V/μs
Reverse current $V_R = V_{RRMmax}$; $R_{GK} = 1$ kΩ; $T_j = 125$ °C	I_R	<	0.1	mA
Off-state current $V_D = V_{DRMmax}$; $R_{GK} = 1$ kΩ; $T_j = 125$ °C	I_D	<	0.1	mA
Latching current $V_D = 12$ V; $R_{GK} = 1$ kΩ; $T_j = 25$ °C	I_L	<	6	mA
Holding current $V_D = 12$ V; $R_{GK} = 1$ kΩ; $T_j = 25$ °C	I_H	<	5	mA

Gate to cathode

Voltage that will trigger all devices $V_D = 12$ V; $T_j = 25$ °C	V_{GT}	>	0.8	V
Current that will trigger all devices $V_D = 12$ V; $T_j = 25$ °C	I_{GT}	>	0.2	mA

*Measured under pulse conditions to avoid excessive dissipation.

TRIACS

Glass-passivated 25 ampere triacs intended for use in applications requiring high bidirectional transient and blocking voltage capability and high thermal cycling performance with very low thermal resistances. These triacs feature a high surge current capability. Typical applications include AC power control applications such as motor, industrial lighting, industrial and domestic heating control and static switching systems.

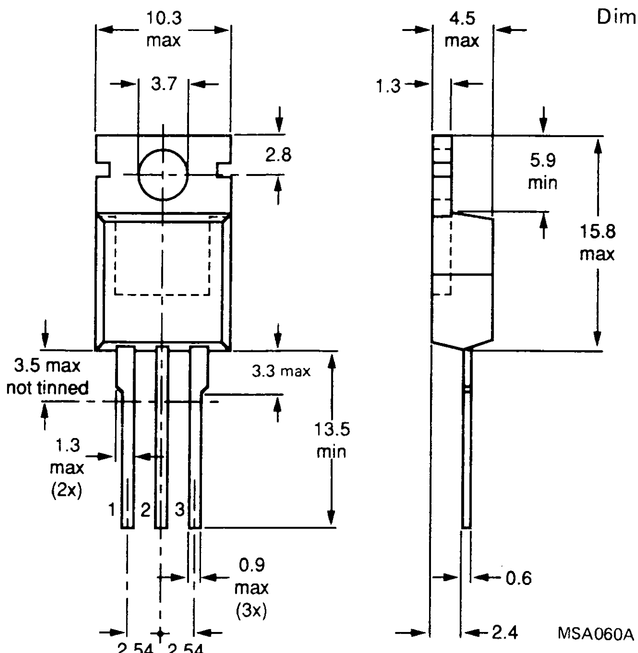
QUICK REFERENCE DATA

			BTA140–500	600	700	800	
Repetitive peak off-state voltage	V_{DRM}	max.	500	600	700	800	V
RMS on-state current	$I_{T(RMS)}$	max.	25				A
Non-repetitive peak on-state current (50 Hz)							
at 50 Hz	I_{TSM}	max.	180				A
at 60 Hz	I_{TSM}	max.	200				A

MECHANICAL DATA

Dimensions in mm

Fig.1 TO–220AB

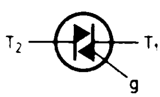


Pinning:

1 = Terminal 1

2 = Terminal 2

3 = Gate



Net mass- 2 g

Note: The exposed metal mounting base is directly connected to terminal T_2.

Accessories supplied on request: see data sheet Mounting instructions and accessories for TO-220 envelopes.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).

→ **Voltages** (in either direction)

			BTA140–500	600	700	800	
Non-repetitive peak off-state voltage ($t \leqslant 10$ ms)	V_{DSM}	max.	500*	600*	700*	800	V
Repetitive peak off-state voltage ($\delta \leqslant 0.01$)	V_{DRM}	max.	500	600	700	800	V
Crest working off-state voltage	V_{DWM}	max.	400	400	400	400	V

Currents (in either direction)

RMS on-state current (conduction angle 360°) up to T_{mb} = 89 °C	$I_{T(RMS)}$	max.	25	A
Average on-state current for half-cycle operation (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{T(AV)}$	max.	18	A
Repetitive peak on-state current	I_{TRM}	max.	180	A
Non-repetitive peak on-state current; T_j = 120 °C prior to surge; full sinewave				
t = 20 ms	I_{TSM}	max.	180	A
t = 16.7 ms	I_{TSM}	max.	200	A
I^2t for fusing (t = 10 ms)	I^2t	max.	160	A^2s
Rate of rise of on-state current after triggering with I_G = 200 mA to I_T = 30 A; dI_G/dt = 0.2 A/µs	dI_T/dt	max.	30	A/µs

Gate to terminal 1

Power dissipation

Average power dissipation (averaged over any 20 ms period)	$P_{G(AV)}$	max.	0.5	W
Peak power dissipation	P_{GM}	max.	5	W

Temperatures

Storage temperature	T_{stg}		−40 to +125	°C
Operating junction temperature				
full-cycle operation	T_j	max.	120	°C
half-cycle operation	T_j	max.	110	°C

*Although not recommended, off-state voltages up to 800 V may be applied without damage, but the triac may switch into the on-state. The rate of rise of on-state current should not exceed 15 A/µs.

THERMAL RESISTANCE

From junction to mounting base	
full-cycle operation	$R_{th\ j\text{-}mb}$ = 1.0 K/W
half-cycle operation	$R_{th\ j\text{-}mb}$ = 1.4 K/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$ = 0.1 K/W

Influence of mounting method

1. Heatsink mounted with clip (see mounting instructions)

Thermal resistance from mounting base to heatsink

a. with heatsink compound	$R_{th\ mb\text{-}h}$ = 0.3 K/W
b. with heatsink compound and 0.06 mm maximum mica insulator	$R_{th\ mb\text{-}h}$ = 1.4 K/W
c. with heatsink compound and 0.1 mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$ = 2.2 K/W
d. with heatsink compound and 0.25 mm maximum alumina insulator (56367)	$R_{th\ mb\text{-}h}$ = 0.8 K/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$ = 1.4 K/W

2. Free-air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie-point.

Thermal resistance from junction to ambient in free air:

mounted on a printed-circuit board at a = any lead length	$R_{th\ j\text{-}a}$ = 60 K/W

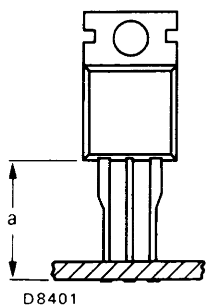


Fig.2

CHARACTERISTICS (T_j = 25 °C unless otherwise stated)

Polarities, positive or negative, are identified with respect to T_1.

Voltages and currents (in either direction)

On-state voltage (measured under pulse conditions to prevent excessive dissipation)				
I_T = 30 A	V_T	<	1.55	V
Rate of rise of off-state voltage that will not trigger any device; T_j = 120 °C; gate open circuit	dV_D/dt	<	100	V/µs
Rate of change of commutating voltage that will not trigger any device when $-dI_{com}/dt$ = 9.0 A/ms $I_{T(RMS)}$ = 25 A; T_{mb} = 75 °C; gate open circuit; $V_D = V_{DWMmax}$	dV_{com}/dt	typ.	10	V/µs
Off-state current				
$V_D = V_{DWMmax}$; T_j = 120 °C	I_D	<	0.5	mA
Gate voltage that will trigger all devices	V_{GT}	>	1.5	V
Gate voltage that will not trigger any device				
$V_D = V_{DWMmax}$; T_j = 120 °C; T_2 and G positive or negative	V_{GD}	<	250	mV

			T_2+ G+	T_2+ G−	T_2− G−	T_2− G+	
Gate current that will trigger all devices; G to T_1	I_{GT}	>	35	35	35	70	mA
Holding Current	I_H	<	30	30	30	30	mA
Latching current; V_D = 12 V; T_j = 25 °C	I_L	<	40	60	40	60	mA

MOUNTING INSTRUCTIONS

1. The device may be soldered directly into the circuit, but the maximum permissible temperature of the soldering iron or bath is 275 °C; it must not be in contact with the joint for more than 5 seconds. Soldered joints must be at least 4.7 mm from the seal.
2. The leads should not be bent less than 2.4 mm from the seal, and should be supported during bending. The leads can be bent, twisted or straightened by 90° maximum. The minimum bending radius is 1 mm.
3. It is recommended that the circuit connection be made to tag T_2, rather than direct to the heatsink.
4. Mounting by means of a spring clip is the best mounting method because it offers:
   a. a good thermal contact under the crystal area and slightly lower $R_{th\ mb\text{-}h}$ values than screw mounting.
   b. safe isolation for mains operation.
   However, if a screw is used, it should be M3 cross-recess pan-head. Care should be taken to avoid damage to the plastic body.
5. For good thermal contact, heatsink compound should be used between mounting base and heatsink. Values of $R_{th\ mb\text{-}h}$ given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
6. Rivet mounting (only possible for non-insulated mounting)
   Devices may be rivetted to flat heatsinks; such a process must neither deform the mounting tab, nor enlarge the mounting hole. The maximum recommended hole size for rivet mounting is 3.5 mm. The pre-formed head of the rivet should be on the device side and any rivet tool used should not damage the plastic body of the device.
7. The heatsink must have a flatness in the mounting area of 0.02 mm maximum per 10 mm. Mounting holes must be deburred.

OPERATING NOTES

Dissipation and heatsink considerations:

a. The various components of junction temperature rise above ambient are illustrated in Fig.3.

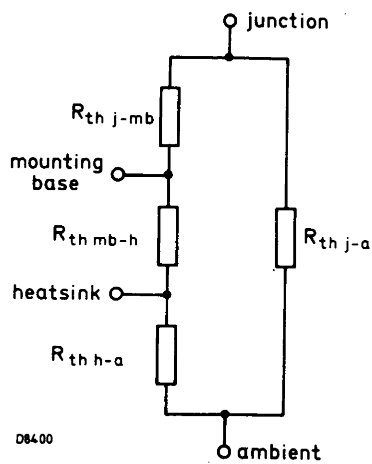


Fig.3.

b. The method of using Fig.4 is as follows:
   Starting with the required current on the $I_{T(RMS)}$ axis, trace upwards to meet the appropriate conduction angle curve. Trace right horizontally and upwards from the appropriate value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can now be calculated from:

$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}.$$

c. Any measurement of heatsink temperature should be made immediately adjacent to the device.

FULL-CYCLE OPERATION

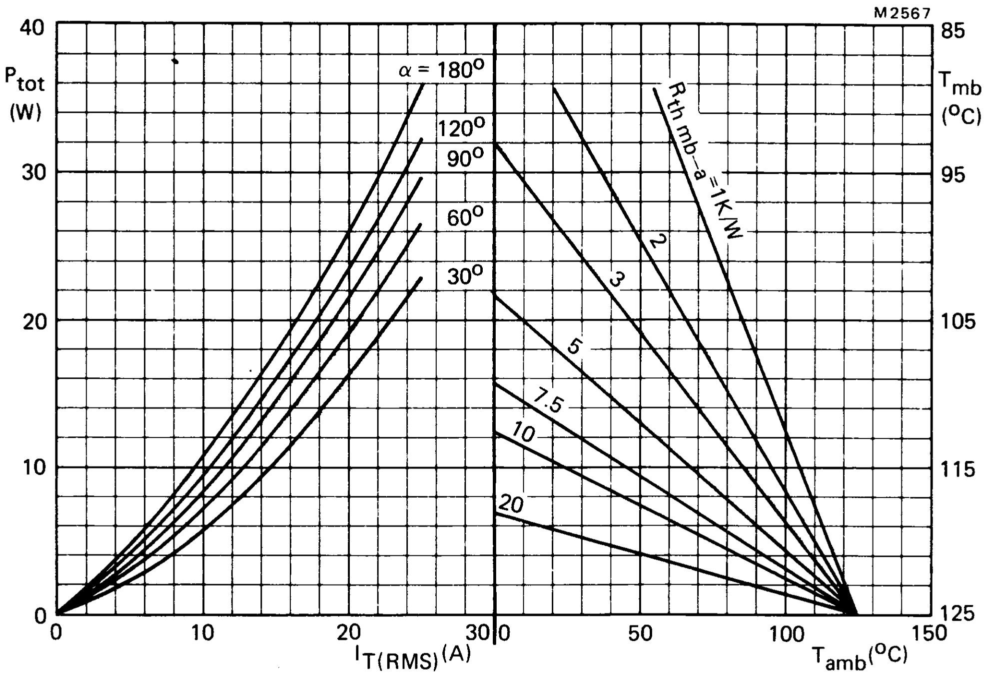
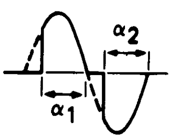


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.



$\alpha = \alpha_1 = \alpha_2$: conduction angle per half cycle

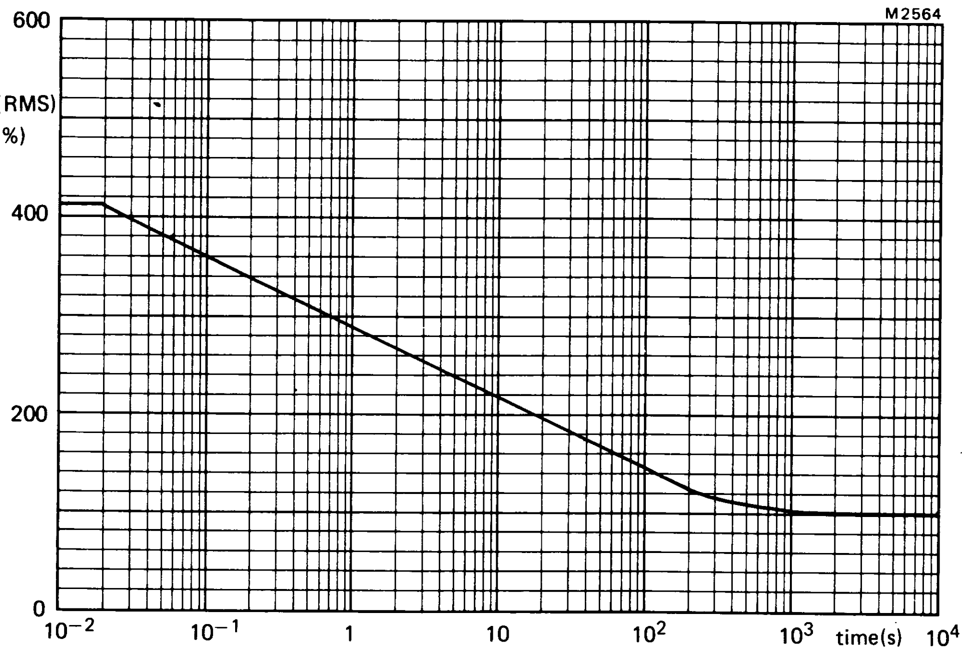


Fig.5 Maximum permissible duration of steady overload (provided that T_{mb} does not exceed 120 °C during and after overload) expressed as a percentage of the steady state r.m.s. rated current. For high r.m.s. overload currents precautions should be taken so that the temperature of the terminals does not exceed 125 °C. During these overload conditions the triac may lose control. Therefore the overload should be terminated by a separate protection device.

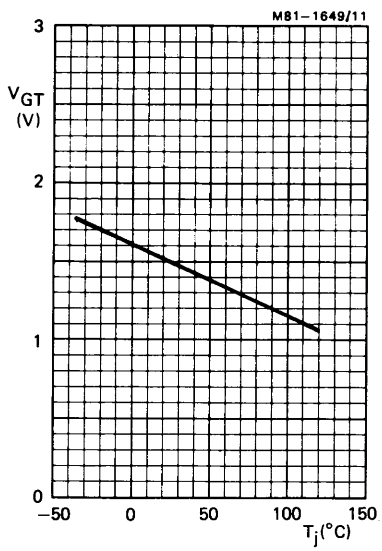


Fig.6 Minimum gate voltage that will trigger all devices; all conditions.

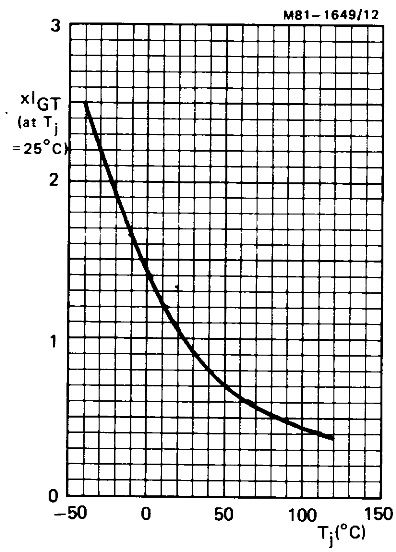


Fig.7 Normalised gate current that will trigger all devices; all conditions.

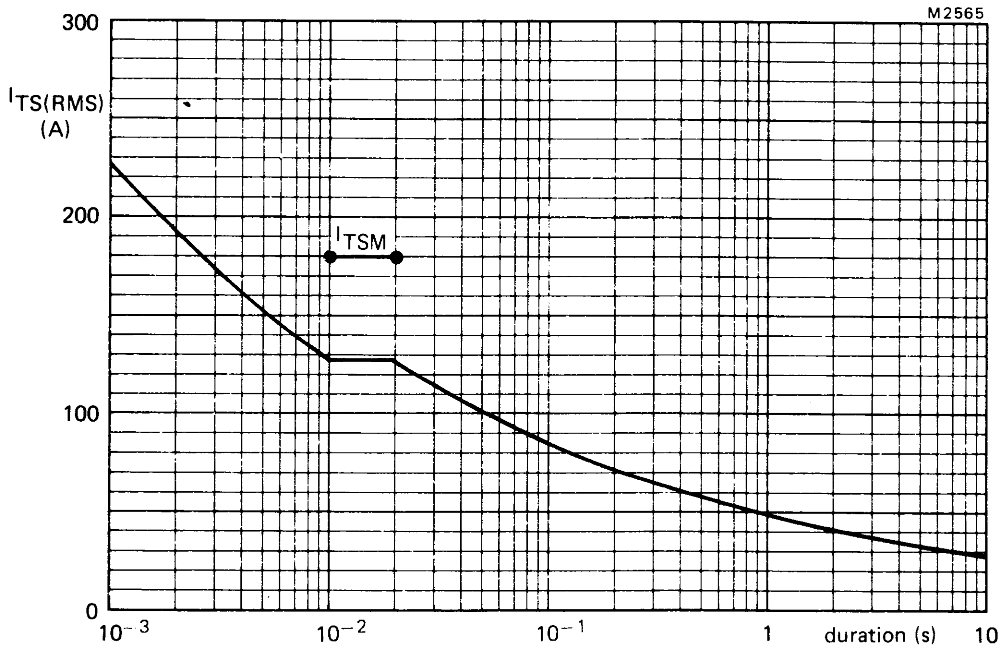
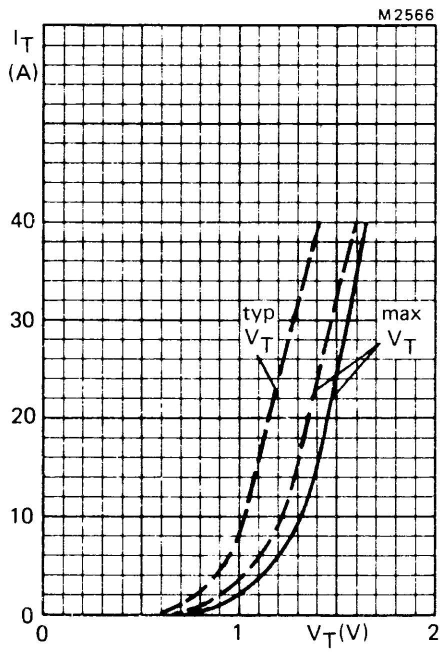


Fig.8 Maximum permissible non-repetitive r.m.s. on-state current based on sinusoidal currents (f = 50 Hz); T_j = 120 °C prior to surge. The triac may temporarily lose control following the surge.



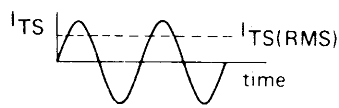


Fig.9 —— T_j = 25 °C; ––– T_j = 120 °C.

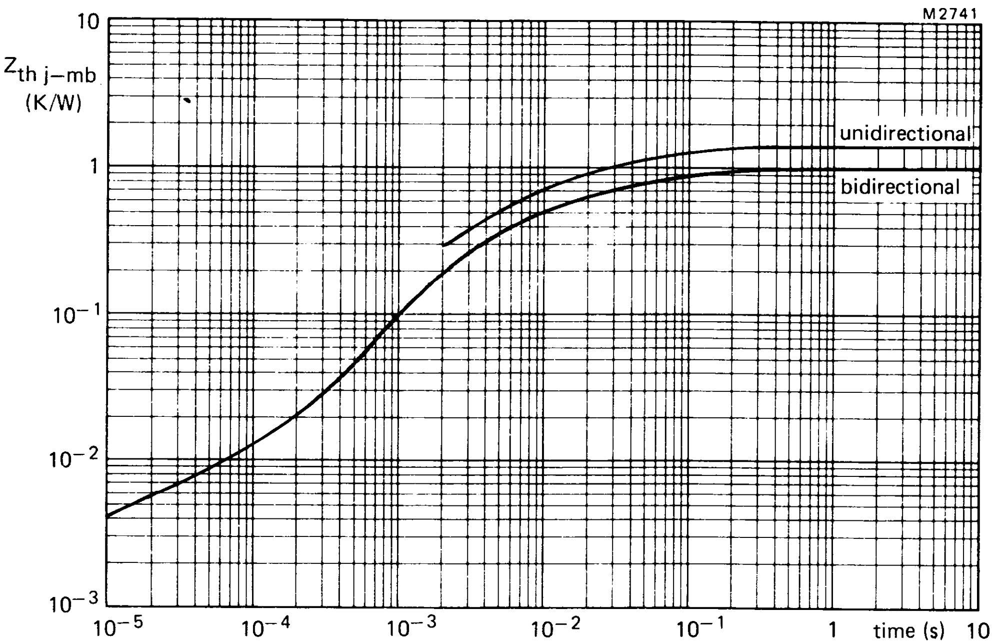


Fig.10 Transient thermal impedance.

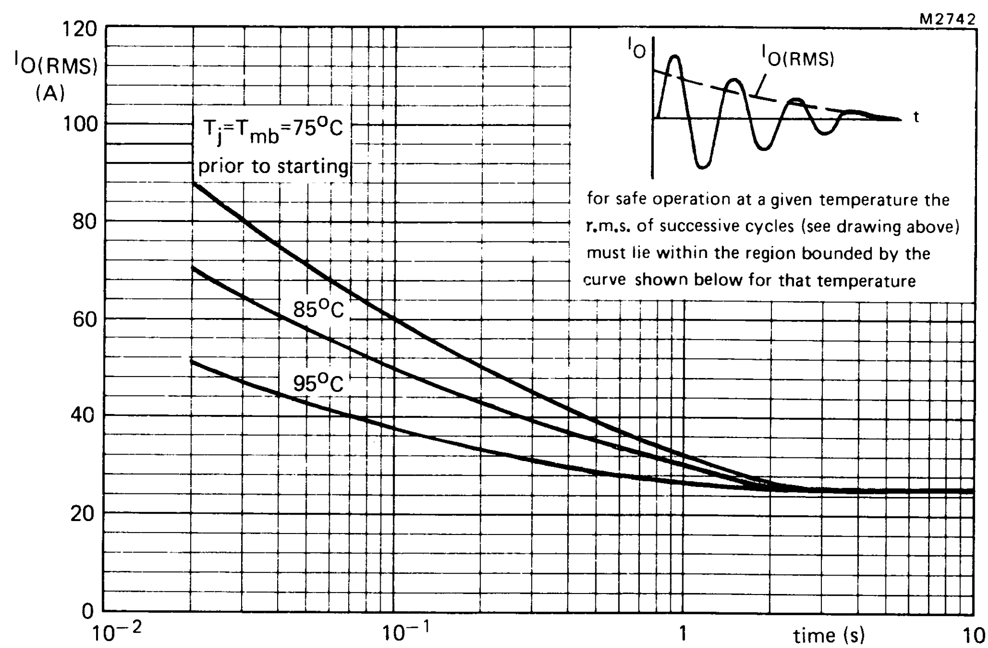


Fig.11 Limits for starting or inrush currents — full-cycle operation