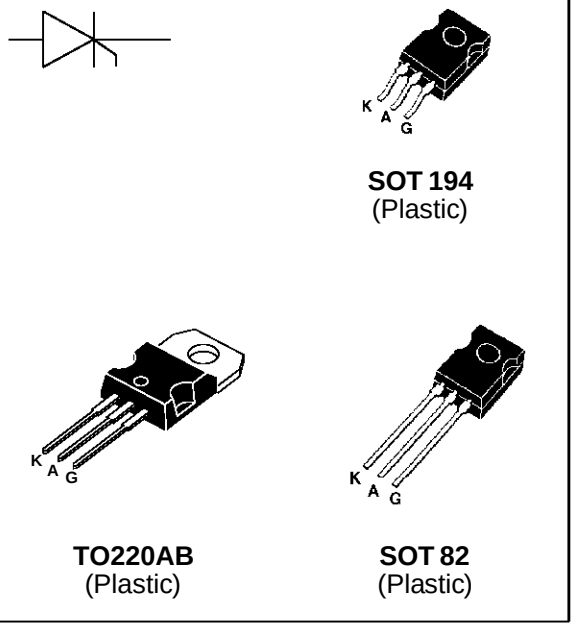
SGS-THOMSON MICROELECTRONICS

TN22

STARTLIGHT

FEATURES

- V_{BR} : 1200 - 1500 V and 1000 - 1600 V versions
- I_H > 175 mA
- I_{GT} < 1.5 mA



SOT 194
(Plastic)

TO220AB
(Plastic)

SOT 82
(Plastic)

DESCRIPTION

The TN22 is an high performance asymetrical SCR in high voltage PNPN diffused planar technology.

Package either in TO220AB, SOT 82 or SOT 194, these parts are intended for use in electronic

ABSOLUTE RATINGS (limiting values)

Symbol	Parameter		Value	Unit
V_{DRM}	Repetitive peak off-state voltage	T_j = 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 sine ware (180° conduction angle)	Tc= 95°C	1.8	A
I_{TSM}	Non repetitive surge peak on-state current (T_j 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 = 5 mA 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

THERMAL RESISTANCES

Symbol	Parameter		Value	Unit
Rth(j-a)	Junction to ambient	TO220AB	60	°C/W
		SOT 82 / SOT 194	100	
Rth(j-c)	Junction to case		3	°C/W

GATE CHARACTERISTICS (maximum values)

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

ELECTRICAL CHARACTERISTICS

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

Symbol	Test Conditions		Suffix		Unit
			TN22-1500	TN22-1600	
V_{BR}	I_D= 5mA V_{GK} = 0V Tj = 25°C	MIN	1200	1000	V
		MAX	1500	1600	V

ORDERING INFORMATION

T N 2 2 - XXXX X

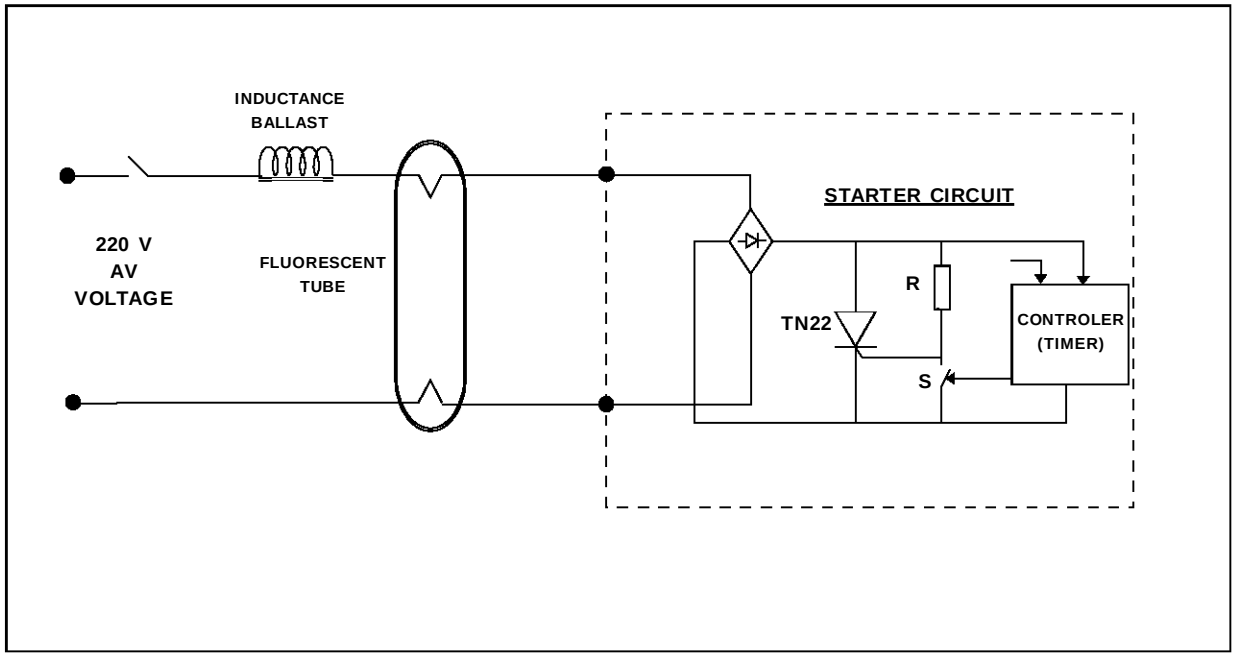
- **T** — THYRISTOR FAMILY
- **N** — STARLIGHT
- **2** — $I_{T(RMS)}$ MAX
  - 2 : 2 A
- **2** — I_{GT} MAX
  - 2 : 1.5 mA
- **XXXX** — V_{BR} MAX
  - 1500 : 1500 V
  - 1600 : 1600V
- **X** — Packages
  - T : TO220AB
  - D : SOT 82
  - K : SOT 194

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

Au 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.

BASIC APPLICATION DIAGRAM



PRINCIPLE OF OPERATION

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 thyristor 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 the instantaneously.

When the thyristor turns off the current flowing through the ballas 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...
This component is a low voltage device (< 50V) and the maximum current sink 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.

Fig.1 : Maximum average power dissipation versus average on-state current (rectified full sine wave).

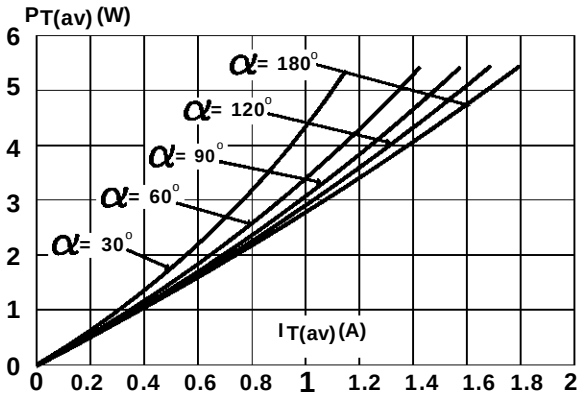


Fig.2 : Correlation between maximum average power dissipation and maximum allowable temperature (Tamb and Tcase) for different thermal resistances heatsink + contact.

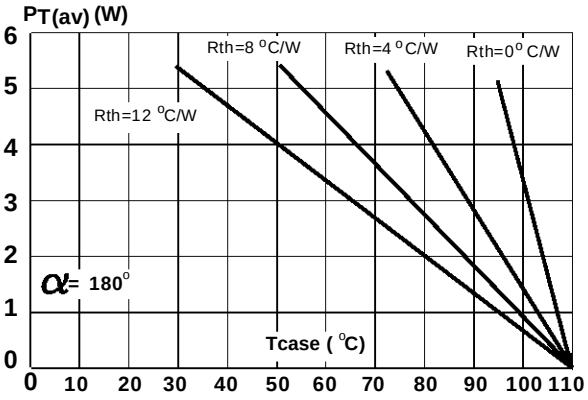


Fig.3 : Average on-state current versus case temperature (rectified full sine wave).

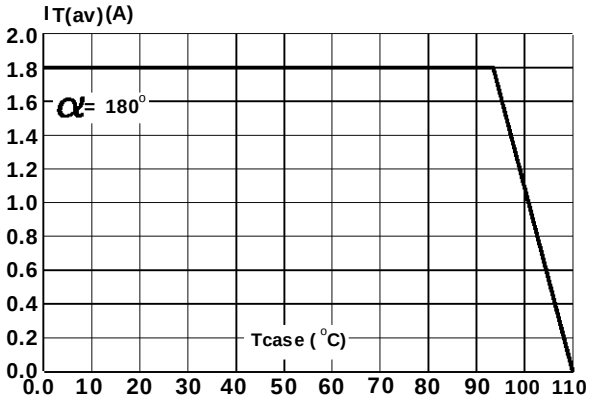


Fig.4 : Thermal transient impedance junction to ambient versus pulse duration.

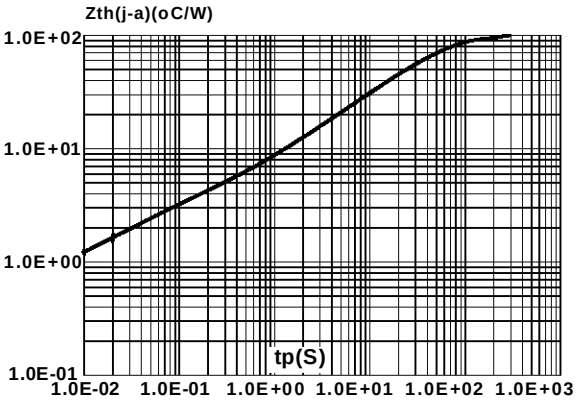


Fig.5 : Relative variation of gate trigger current and holding current versus junction temperature.

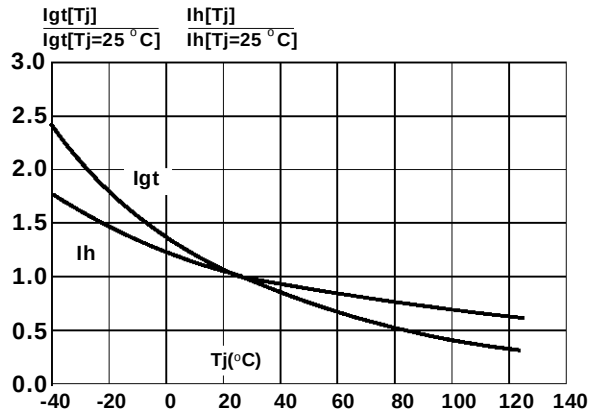


Fig.6 : Non repetitive surge peak on-state current versus number of cycles.

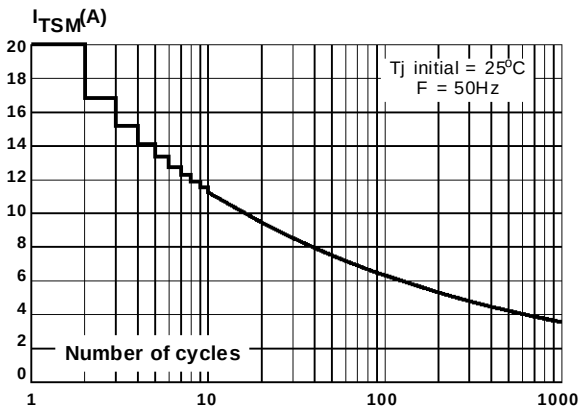


Fig.7 : Non repetitive surge peak on-state current for a sinusoidal pulse with width : tp ≤ 10ms, and corresponding value of I^2t.

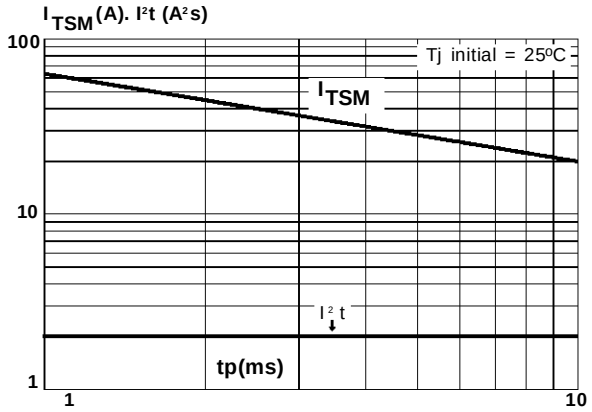


Fig.8 : On-state characteristics (maximum values).

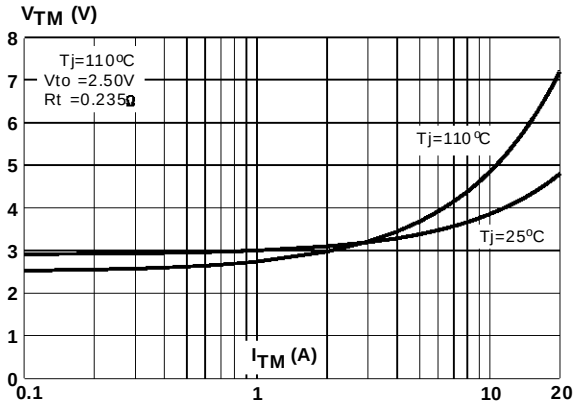


Fig.9 : Relative variation of holding current versus gate-cathode resistance (typical values).

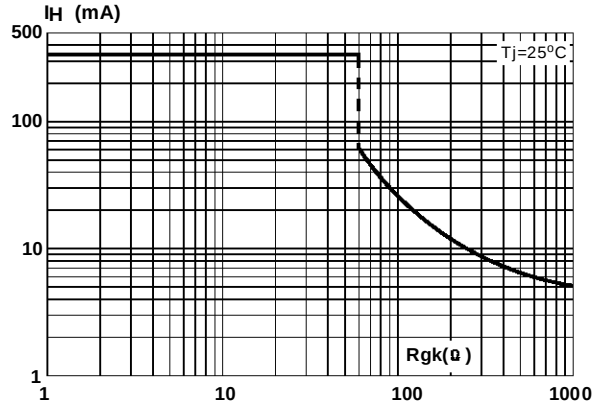
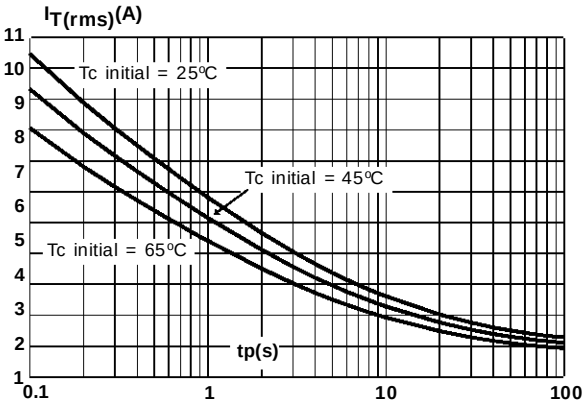
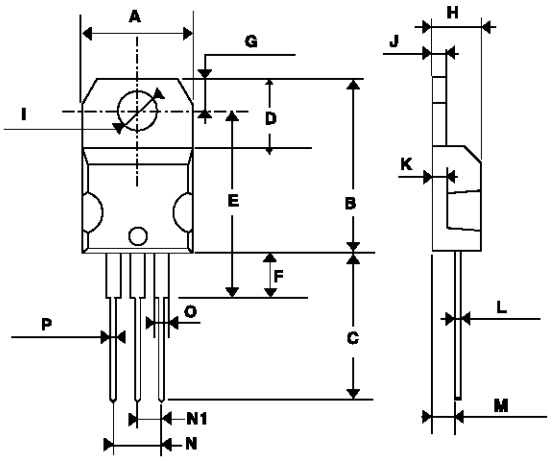


Fig.10 : Maximum allowable RMS current versus time conduction and initial case temperature (Package : SOT 82).
Note : Calculation made fot Tj max = 135°C (the failure mode will be short circuit)



PACKAGE MECHANICAL DATA

TO220AB (Plastic)



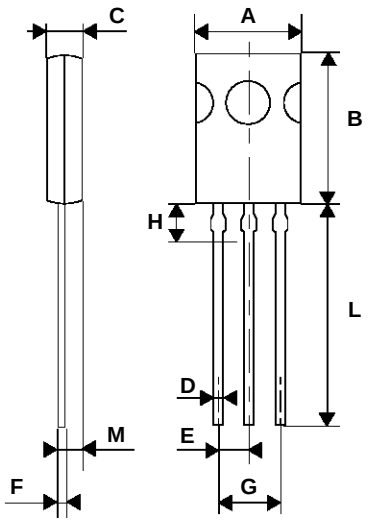
REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	10.0	10.4	0.393	0.409
B	15.2	15.9	0.598	0.626
C	13	14	0.511	0.551
D	6.2	6.6	0.244	0.260
E	16.4 typ.		0.645 typ.	
F	3.5	4.2	0.137	0.165
G	2.65	2.95	0.104	0.116
H	4.4	4.6	0.173	0.181
I	3.75	3.85	0.147	0.151
J	1.23	1.32	0.048	0.051
K	1.27 typ.		0.050 typ.	
L	0.49	0.70	0.019	0.027
M	2.4	2.72	0.094	0.107
N	4.95	5.15	0.194	0.203
N1	2.40	2.70	0.094	0.106
O	1.14	1.70	0.044	0.067
P	0.61	0.88	0.024	0.034

Cooling method : C
Marking : Type number
Weight : 2 g

Recommended torque values : 5.5 m.N.
Maximum torque values : 0.70 m.N.

PACKAGE MECHANICAL DATA

SOT 82 (Plastic)



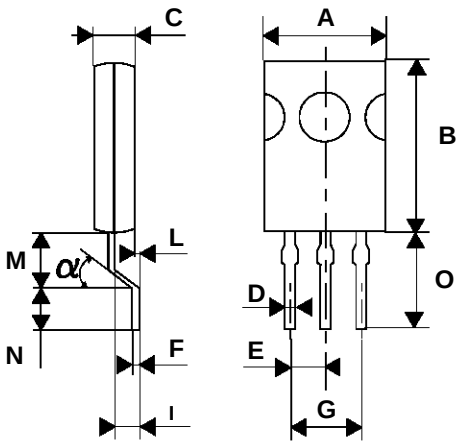
REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	7.4	7.8	0.291	0.307
B	10.5	10.8	0.413	0.425
C	2.4	2.7	0.094	0.106
D	0.7	0.9	0.027	0.035
E	2.2 typ.		0.087 typ.	
F	0.49	0.75	0.019	0.029
G	4.15	4.65	0.163	0.183
H (1)		2.54		0.100
L	15.7 typ.		0.618 typ.	
M	1.0	1.3	0.039	0.051

(1) Within this region the cross-section of the leads is uncontrolled

Marking : Type number
Weight : 0.72 g

PACKAGE MECHANICAL DATA

SOT 194 (Plastic)



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	Millimeters		Inches	
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A	7.4	7.8	0.291	0.307
B	10.5	10.8	0.413	0.425
C	2.4	2.7	0.094	0.106
D	0.7	0.9	0.027	0.035
E	2.2 typ.		0.087 typ.	
F	0.49	0.75	0.019	0.020
G	4.15	4.65	0.163	0.183
I	1.3 typ.		0.051 typ.	
L	0.1 typ.		0.004 typ.	
M	4 typ		0.158 typ	
N	2 typ.		0.078 typ.	
O	6 typ.		0.236 typ.	
α	45°		45°	

Marking : Type number
Weight : 0.68 g

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