

# DATA SHEET

## **MAC223 series** **Triacs**

Product specification

July 2001



# Triacs

# MAC223 series

## GENERAL DESCRIPTION

Passivated triacs in a plastic envelope, intended for use in applications requiring high bidirectional transient and blocking voltage capability and high thermal cycling performance. Typical applications include motor control, industrial and domestic lighting, heating and static switching.

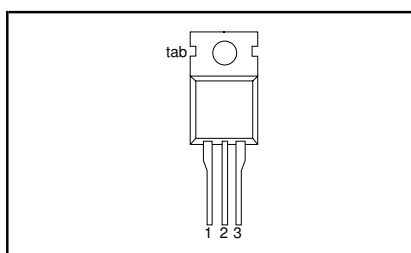
## QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.		UNIT
		A6	A8	
$V_{DRM}$	Repetitive peak off-state voltages	400	600	V
$I_{T(RMS)}$	RMS on-state current	25	25	A
$I_{TSM}$	Non-repetitive peak on-state current	230	230	A

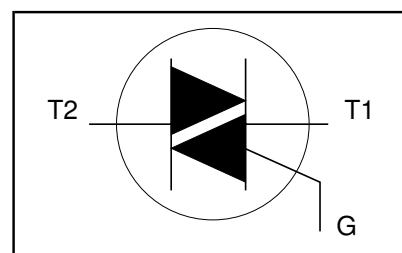
## PINNING - TO220AB

PIN	DESCRIPTION
1	main terminal 1
2	main terminal 2
3	gate
tab	main terminal 2

## PIN CONFIGURATION



## SYMBOL



## LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.		UNIT
				A6	A8	
$V_{DRM}$	Repetitive peak off-state voltages	MAC223	-	400 <sup>1</sup>	600 <sup>1</sup>	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 91\text{ }^\circ\text{C}$	-	25		A
$I_{TSM}$	Non-repetitive peak on-state current	full sine wave; $T_j = 25\text{ }^\circ\text{C}$ prior to surge	-	230		A
$I^2t$	$I^2t$ for fusing	$t = 20\text{ ms}$	-	190		A
$di_T/dt$	Repetitive rate of rise of on-state current after triggering	$t = 16.7\text{ ms}$	-	230		A
		$t = 10\text{ ms}$	-	180		A <sup>2</sup> s
		$I_{TM} = 30\text{ A}; I_G = 0.2\text{ A}; di_G/dt = 0.2\text{ A}/\mu\text{s}$				
		T2+ G+	-	50		A/ $\mu\text{s}$
		T2+ G-	-	50		A/ $\mu\text{s}$
		T2- G-	-	50		A/ $\mu\text{s}$
		T2- G+	-	10		A/ $\mu\text{s}$
$I_{GM}$	Peak gate current		-	2		A
$V_{GM}$	Peak gate voltage		-	5		V
$P_{GM}$	Peak gate power		-	5		W
$P_{G(AV)}$	Average gate power	over any 20 ms period	-	0.5		W
$T_{stg}$	Storage temperature		-40	150		$^\circ\text{C}$
$T_j$	Operating junction temperature		-	125		$^\circ\text{C}$

<sup>1</sup> Although not recommended, off-state voltages up to 800V may be applied without damage, but the triac may switch to the on-state. The rate of rise of current should not exceed 15 A/ $\mu\text{s}$ .

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**THERMAL RESISTANCES**

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$R_{th\ j-mb}$	Thermal resistance junction to mounting base	full cycle	-	-	1.0	K/W
		half cycle	-	-	1.4	K/W
$R_{th\ j-a}$	Thermal resistance junction to ambient	in free air	-	60	-	K/W

**STATIC CHARACTERISTICS** $T_j = 25\text{ °C}$  unless otherwise stated

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$I_{GT}$	Gate trigger current	$V_D = 12\text{ V}; I_T = 0.1\text{ A}$				
		T2+ G+	-	6	50	mA
		T2+ G-	-	10	50	mA
		T2- G-	-	11	50	mA
		T2- G+	-	23	75	mA
$I_L$	Latching current	$V_D = 12\text{ V}; I_{GT} = 0.1\text{ A}$				
		T2+ G+	-	8	40	mA
		T2+ G-	-	30	60	mA
		T2- G-	-	18	40	mA
		T2- G+	-	15	60	mA
$I_H$	Holding current	$V_D = 12\text{ V}; I_{GT} = 0.1\text{ A}$				
		T2+	-	7	30	mA
		T2-	-	12	30	mA
$V_T$	On-state voltage	$I_T = 30\text{ A}$	-	1.3	1.55	V
$V_{GT}$	Gate trigger voltage	$V_D = 12\text{ V}; I_T = 0.1\text{ A}$	-	0.7	1.5	V
		$V_D = 400\text{ V}; I_T = 0.1\text{ A}; T_j = 125\text{ °C}$	0.25	0.4	-	V
$I_D$	Off-state leakage current	$V_D = V_{DRM(max)}; T_j = 125\text{ °C}$	-	0.1	0.5	mA

**DYNAMIC CHARACTERISTICS** $T_j = 25\text{ °C}$  unless otherwise stated

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$dV_D/dt$	Critical rate of rise of off-state voltage	$V_{DM} = 67\% V_{DRM(max)}; T_j = 125\text{ °C};$ exponential waveform; gate open circuit	100	300	-	V/ $\mu$ s
$dV_{com}/dt$	Critical rate of change of commutating voltage	$V_{DM} = 400\text{ V}; T_j = 95\text{ °C}; I_{T(RMS)} = 25\text{ A};$ $dI_{com}/dt = 9\text{ A/ms};$ gate open circuit	-	10	-	V/ $\mu$ s
$t_{gt}$	Gate controlled turn-on time	$I_{TM} = 30\text{ A}; V_D = V_{DRM(max)}; I_G = 0.1\text{ A};$ $dI_G/dt = 5\text{ A}/\mu$ s	-	2	-	$\mu$ s

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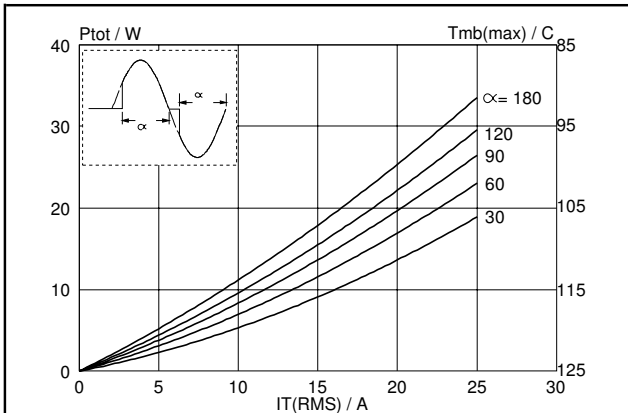


Fig.1. Maximum on-state dissipation,  $P_{tot}$ , versus rms on-state current,  $I_{T(RMS)}$ , where  $\alpha$  = conduction angle.

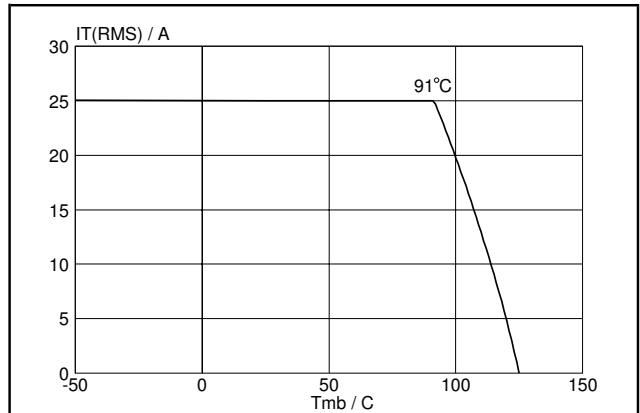


Fig.4. Maximum permissible rms current  $I_{T(RMS)}$ , versus mounting base temperature  $T_{mb}$ .

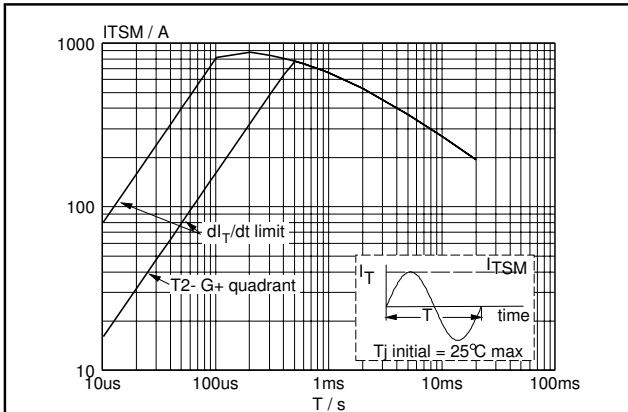


Fig.2. Maximum permissible non-repetitive peak on-state current  $I_{TSM}$ , versus pulse width  $t_p$ , for sinusoidal currents,  $t_p \leq 20ms$ .

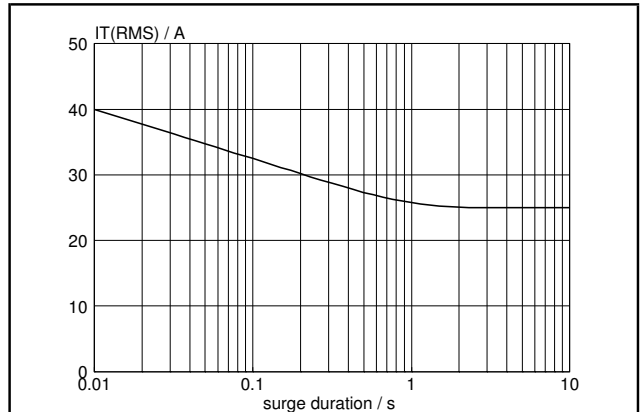


Fig.5. Maximum permissible repetitive rms on-state current  $I_{T(RMS)}$ , versus surge duration, for sinusoidal currents,  $f = 50 Hz$ ;  $T_{mb} \leq 91^\circ C$ .

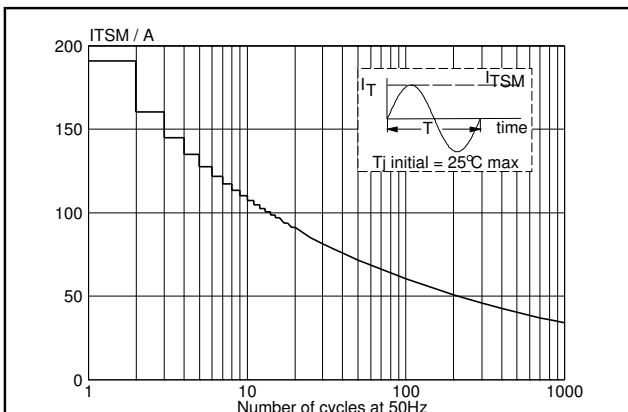


Fig.3. Maximum permissible non-repetitive peak on-state current  $I_{TSM}$ , versus number of cycles, for sinusoidal currents,  $f = 50 Hz$ .

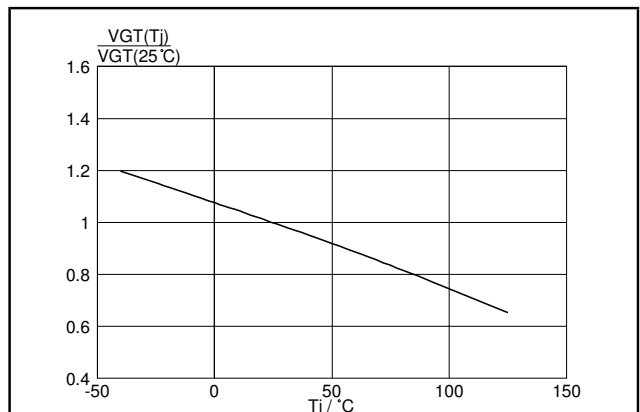


Fig.6. Normalised gate trigger voltage  $V_{GT}(T_j) / V_{GT}(25^\circ C)$ , versus junction temperature  $T_j$ .

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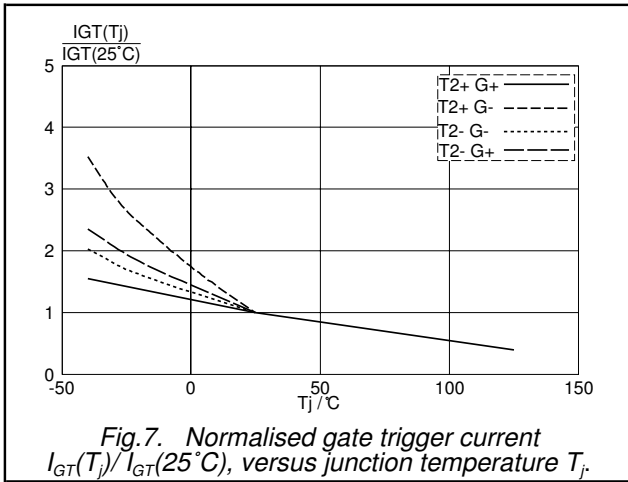


Fig. 7. Normalised gate trigger current  $I_{GT}(T_j)/I_{GT}(25^\circ\text{C})$ , versus junction temperature  $T_j$ .

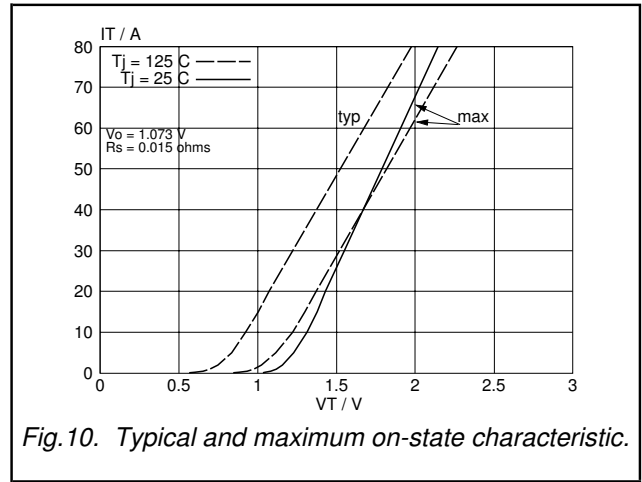


Fig. 10. Typical and maximum on-state characteristic.

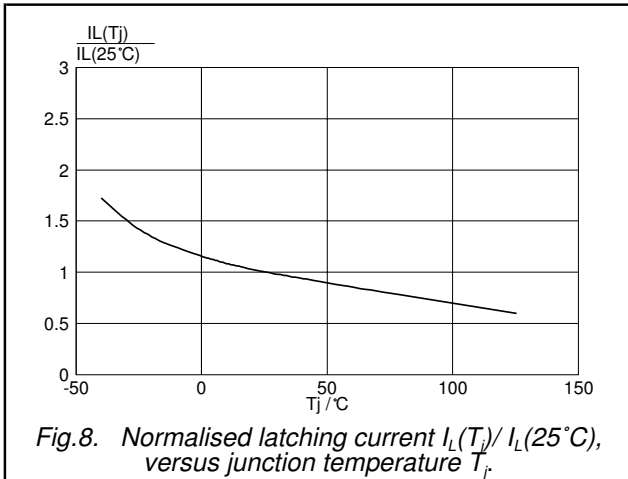


Fig. 8. Normalised latching current  $I_L(T_j)/I_L(25^\circ\text{C})$ , versus junction temperature  $T_j$ .

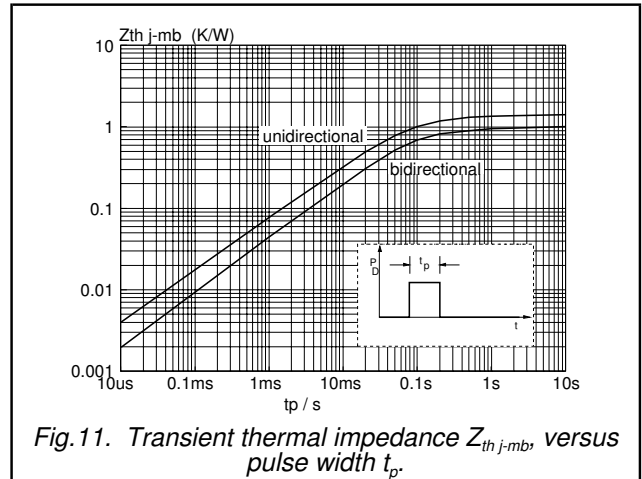


Fig. 11. Transient thermal impedance  $Z_{th\ j-mb}$ , versus pulse width  $t_p$ .

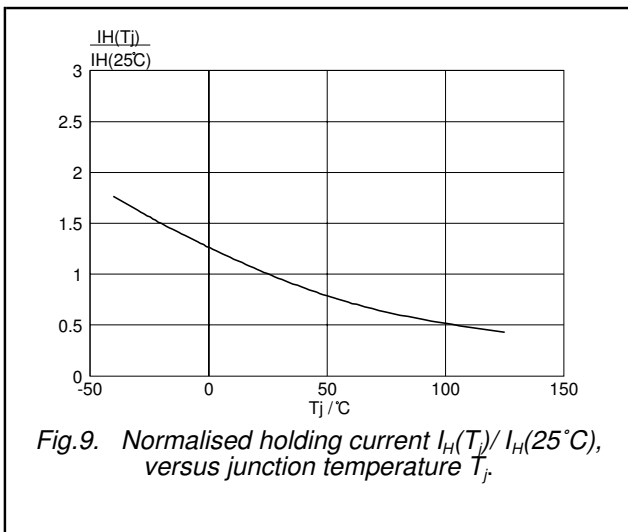


Fig. 9. Normalised holding current  $I_H(T_j)/I_H(25^\circ\text{C})$ , versus junction temperature  $T_j$ .

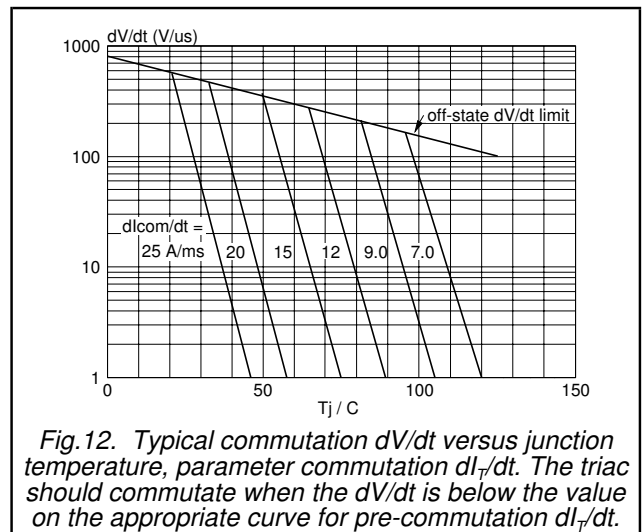


Fig. 12. Typical commutation  $dV/dt$  versus junction temperature, parameter commutation  $dI_{com}/dt$ . The triac should commute when the  $dV/dt$  is below the value on the appropriate curve for pre-commutation  $dI_T/dt$ .



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DOCUMENT STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)</sup>	DEFINITION
Objective data sheet	Development	This document contains data from the objective specification for product development.
Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
Product data sheet	Production	This document contains the product specification.

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