### DISCRETE SEMICONDUCTORS

## DATA SHEET

# **BT152X series**Thyristors

Product specification

October 1997



NXP Semiconductors Product specification

Thyristors BT152X series

#### **GENERAL DESCRIPTION**

Glass passivated thyristors in a full pack, plastic envelope, intended for use in applications requiring high bidirectional blocking voltage capability and high thermal cycling performance. Typical applications include motor control, industrial and domestic lighting, heating and static switching.

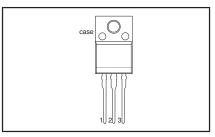
#### **QUICK REFERENCE DATA**

SYMBOL	PARAMETER	MAX.	MAX.	MAX.	UNIT
V <sub>DRM</sub> , V <sub>RRM</sub> I <sub>T(AV)</sub> I <sub>T(RMS)</sub> I <sub>TSM</sub>	BT152X- Repetitive peak off-state voltages Average on-state current RMS on-state current Non-repetitive peak on-state current	400R 450 13 20 200	600R 650 13 20 200	800R 800 13 20 200	V A A A

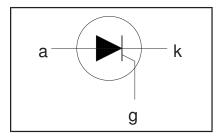
#### **PINNING - SOT186A**

PIN	DESCRIPTION			
1	cathode			
2	anode			
3	gate			
case	isolated			

#### **PIN CONFIGURATION**



#### **SYMBOL**



#### LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.		MAX.		UNIT
$V_{DRM}$	Repetitive peak off-state voltages		-	<b>-400R</b> 450 <sup>1</sup>	<b>-600R</b> 650 <sup>1</sup>	<b>-800R</b> 800	V
I <sub>T(AV)</sub> I <sub>T(RMS)</sub> I <sub>TSM</sub>	Average on-state current RMS on-state current Non-repetitive peak on-state current	half sine wave; $T_{hs} \le 43 ^{\circ}\text{C}$ all conduction angles half sine wave; $T_j = 25 ^{\circ}\text{C}$ prior to surge	- -		13 20		A A
l²t dl <sub>⊤</sub> /dt	I <sup>2</sup> t for fusing Repetitive rate of rise of on-state current after	t = 10 ms t = 8.3 ms t = 10 ms l <sub>TM</sub> = 50 A; l <sub>G</sub> = 0.2 A; dl <sub>G</sub> /dt = 0.2 A/µs	- - -		200 220 200 200		Α Α Α²s Α/μs
I <sub>GM</sub> V <sub>GM</sub> V <sub>RGM</sub> P <sub>GM</sub> P <sub>G(AV)</sub> T <sub>stg</sub> T <sub>j</sub>	triggering Peak gate current Peak gate voltage Peak reverse gate voltage Peak gate power Average gate power Storage temperature Operating junction temperature	over any 20 ms period	- - - - -40		5 5 20 0.5 150 125		A ∨ W C C

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

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#### **ISOLATION LIMITING VALUE & CHARACTERISTIC**

 $T_{hs}$  = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V <sub>isol</sub>	R.M.S. isolation voltage from all three terminals to external heatsink	f = 50-60 Hz; sinusoidal waveform; R.H. ≤ 65% ; clean and dustfree	-		2500	V
C <sub>isol</sub>	Capacitance from T2 to external heatsink	f = 1 MHz	-	10	-	pF

#### THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
R <sub>th j-hs</sub>	Thermal resistance junction to heatsink	with heatsink compound	-	-	4.0	K/W
R <sub>th j-hs</sub>	Thermal resistance junction to heatsink	without heatsink compound	-	-	5.5	K/W
R <sub>th j-a</sub>	Thermal resistance junction to ambient	in free air	-	55	-	K/W

#### STATIC CHARACTERISTICS

 $T_i = 25$  °C unless otherwise stated

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I <sub>GT</sub>	Gate trigger current	$V_D = 12 \text{ V}; I_T = 0.1 \text{ A}$	-	3	32	mA
	Latching current	$V_D^{S} = 12 \text{ V}; I_{GT}^{S} = 0.1 \text{ A}$	-	25	80	mA
l I <sub>H</sub>	Holding current	$V_D^0 = 12 \text{ V}, I_{GT}^{GT} = 0.1 \text{ A}$	-	15	60	mA
ĺΫ́τ	On-state voltage	$I_T = 40 \text{ A}$	-	1.4	1.75	V
V <sub>GT</sub>	Gate trigger voltage	$\dot{V}_{D} = 12 \text{ V}; I_{T} = 0.1 \text{ A}$	-	0.6	1.5	V
"		$V_D = V_{DRM(max)}$ ; $I_T = 0.1 A$ ; $T_j = 125 °C$	0.25	0.4	-	V
$I_D, I_R$	Off-state leakage current	$V_D = V_{DRM(max)}^{SHM(max)}; V_R = V_{RRM(max)}; T_j = 125 °C$	-	0.2	1.0	mΑ

#### **DYNAMIC CHARACTERISTICS**

 $T_i = 25$  °C unless otherwise stated

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
dV <sub>D</sub> /dt	Critical rate of rise of off-state voltage	V <sub>DM</sub> = 67% V <sub>DRM(max)</sub> ; T <sub>j</sub> = 125 °C; exponential waveform gate open circuit	200	300	-	V/μs
t <sub>gt</sub>	Gate controlled turn-on	$V_D = V_{DRM(max)}$ ; $I_G = 0.1$ Å; $dI_G/dt = 5$ Å/ $\mu$ s; $I_{TM} = 40$ Å	-	2	-	μs
t <sub>q</sub>	Circuit commutated turn-off time	$V_D = 67\% V_{DRM(max)}; T_j = 125 \text{ °C}; $ $I_{TM} = 50 \text{ A}; V_B = 25 \text{ V}; dI_{TM}/dt = 30 \text{ A/}\mu\text{s}; $	-	70	-	μs
		$dV_D/dt = 50 \text{ V/}\mu\text{s}; R_{GK} = 100 \Omega$				

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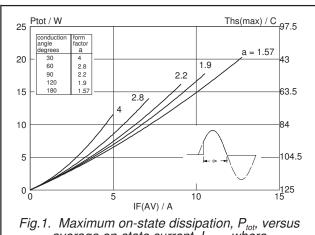


Fig.1. Maximum on-state dissipation,  $P_{tot}$ , versus average on-state current,  $I_{T(AV)}$ , where  $a = form \ factor = I_{T(RMS)} / I_{T(AV)}$ .

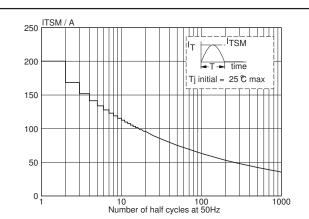


Fig.4. Maximum permissible non-repetitive peak on-state current  $I_{TSM}$ , versus number of cycles, for sinusoidal currents, f = 50 Hz.

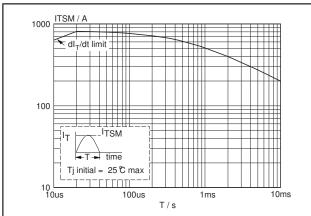


Fig.2. Maximum permissible non-repetitive peak on-state current  $I_{TSM}$ , versus pulse width  $t_p$ , for sinusoidal currents,  $t_p \le 10$ ms.

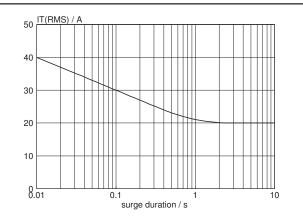


Fig.5. Maximum permissible repetitive rms on-state current  $I_{T(RMS)}$ , versus surge duration, for sinusoidal currents, f = 50 Hz;  $T_{hs} \le 43$  °C.

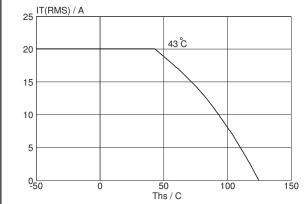
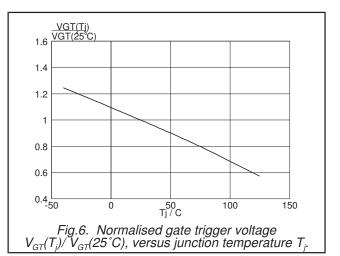
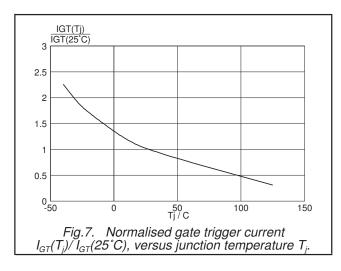


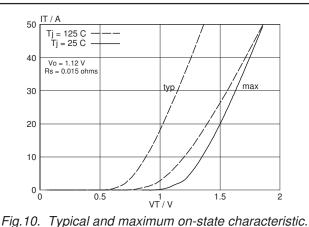
Fig.3. Maximum permissible rms current  $I_{T(RMS)}$ , versus heatsink temperature  $T_{hs}$ .

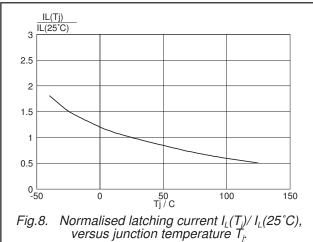


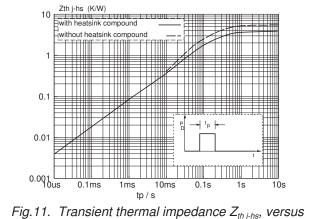
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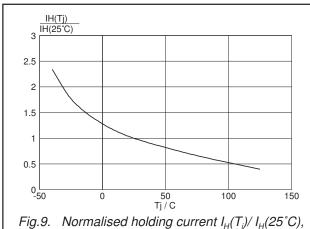








pulse width  $t_p$ . 10000 dVD/dt (V/us)



versus junction temperature Ti

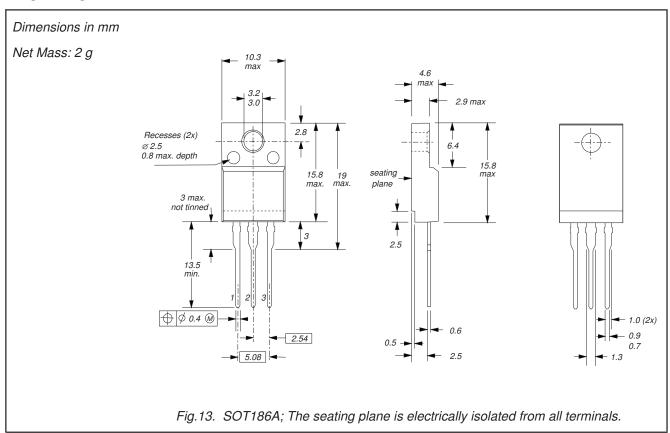
RGK = 100 Oh 1000 100 100 50 Tj / C

Fig.12. Typical, critical rate of rise of off-state voltage,  $d\dot{V}_D/dt$  versus junction temperature  $T_i$ 

Product specification **NXP Semiconductors** 

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#### **MECHANICAL DATA**



- Refer to mounting instructions for F-pack envelopes.
   Epoxy meets UL94 V0 at 1/8".

#### Legal information

#### **DATA SHEET STATUS**

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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