

# NXP TYN16X-600RT Thyristor datasheet

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Planar passivated Silicon Controlled Rectifier (SCR) in a SOT186A (TO-220F) "full pack" plastic package intended for use in applications requiring very high inrush current capability, high thermal cycling performance and high junction temperature capability ( $T_j(\text{max}) = 150\text{ }^\circ\text{C}$ ).

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# TYN16X-600RT

SCR

20 March 2014

Product data sheet

## 1. General description

Planar passivated Silicon Controlled Rectifier (SCR) in a SOT186A (TO-220F) "full pack" plastic package intended for use in applications requiring very high inrush current capability, high thermal cycling performance and high junction temperature capability ( $T_{j(max)} = 150\text{ °C}$ ).

## 2. Features and benefits

- High junction operating temperature capability
- High thermal cycling performance
- High voltage capability
- Isolated package
- Planar passivated for voltage ruggedness and reliability
- Very high current surge capability

## 3. Applications

- Ignition circuits
- Motor control
- Protection circuits e.g. SMPS inrush current
- Voltage regulation

## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	-	600	V
$V_{RRM}$	repetitive peak reverse voltage		-	-	600	V
$I_{TSM}$	non-repetitive peak on-state current	half sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 10\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	-	210	A
		half sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 8.3\text{ ms}$	-	-	231	A
$T_j$	junction temperature		-	-	150	°C
$I_{T(AV)}$	average on-state current	half sine wave; $T_h \leq 86\text{ °C}$ ; <a href="#">Fig. 1</a>	-	-	10.2	A



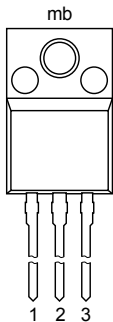

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Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_h \leq 86\text{ °C}$ ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	-	16	A
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	-	4.5	25	mA
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 402\text{ V}$ ; $T_j = 150\text{ °C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit	300	-	-	V/ $\mu$ s

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode	 <p style="text-align: center;">TO-220F (SOT186A)</p>	
2	A	anode		
3	G	gate		
mb	n.c.	mounting base; isolated		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
TYN16X-600RT	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A

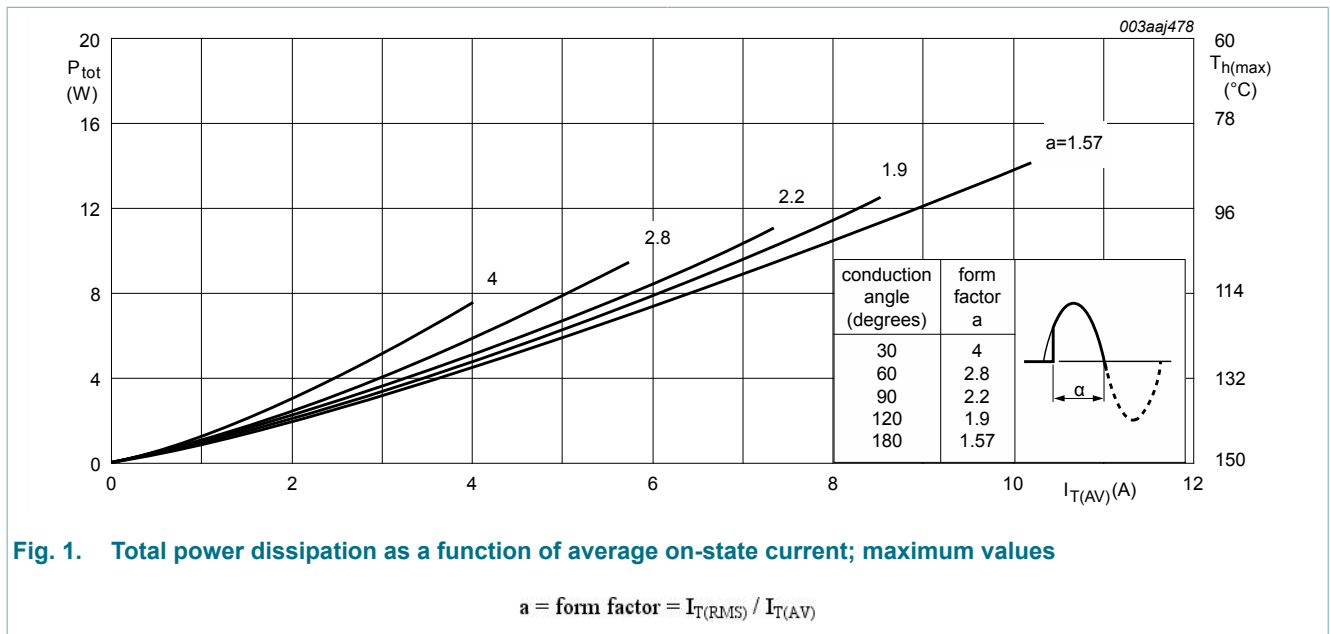
## 7. Limiting values

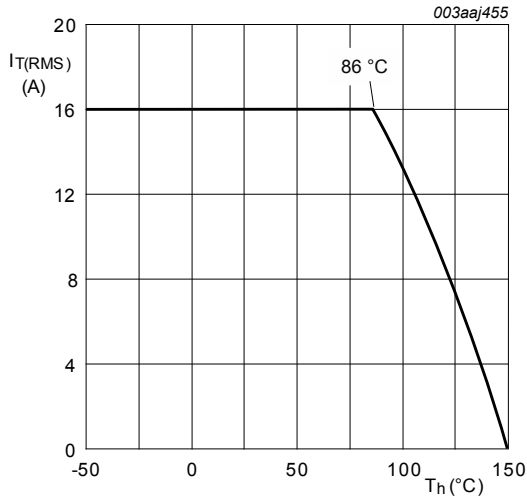
Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

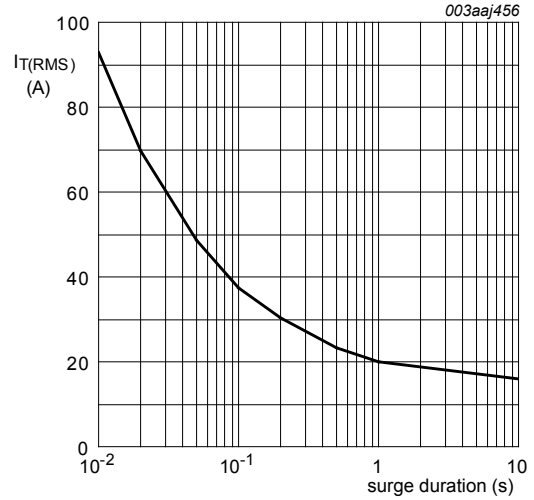
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	600	V
$V_{RRM}$	repetitive peak reverse voltage		-	600	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_h \leq 86\text{ °C}$ ; <a href="#">Fig. 1</a>	-	10.2	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_h \leq 86\text{ °C}$ ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	16	A

Symbol	Parameter	Conditions	Min	Max	Unit
I <sub>TSM</sub>	non-repetitive peak on-state current	half sine wave; T <sub>j(init)</sub> = 25 °C; t <sub>p</sub> = 10 ms; Fig. 4; Fig. 5	-	210	A
		half sine wave; T <sub>j(init)</sub> = 25 °C; t <sub>p</sub> = 8.3 ms	-	231	A
I <sup>2</sup> t	I <sup>2</sup> t for fusing	t <sub>p</sub> = 10 ms; SIN	-	220.5	A <sup>2</sup> s
di <sub>T</sub> /dt	rate of rise of on-state current	I <sub>T</sub> = 40 A; I <sub>G</sub> = 200 mA; di <sub>G</sub> /dt = 200 mA/μs	-	50	A/μs
I <sub>GM</sub>	peak gate current		-	5	A
V <sub>RGM</sub>	peak reverse gate voltage		-	5	V
P <sub>GM</sub>	peak gate power		-	20	W
P <sub>G(AV)</sub>	average gate power	over any 20 ms period	-	1	W
T <sub>stg</sub>	storage temperature		-40	150	°C
T <sub>j</sub>	junction temperature		-	150	°C



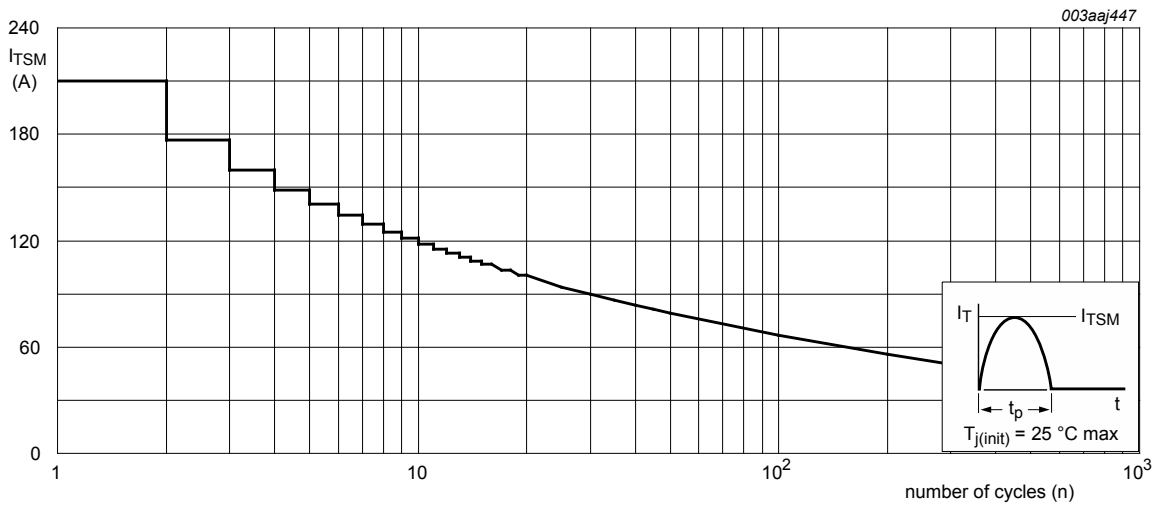


**Fig. 2. RMS on-state current as a function of heatsink temperature; maximum values**



**Fig. 3. RMS on-state current as a function of surge duration; maximum values**

f = 50 Hz; T<sub>h</sub> = 86 °C



**Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values**

f = 50 Hz

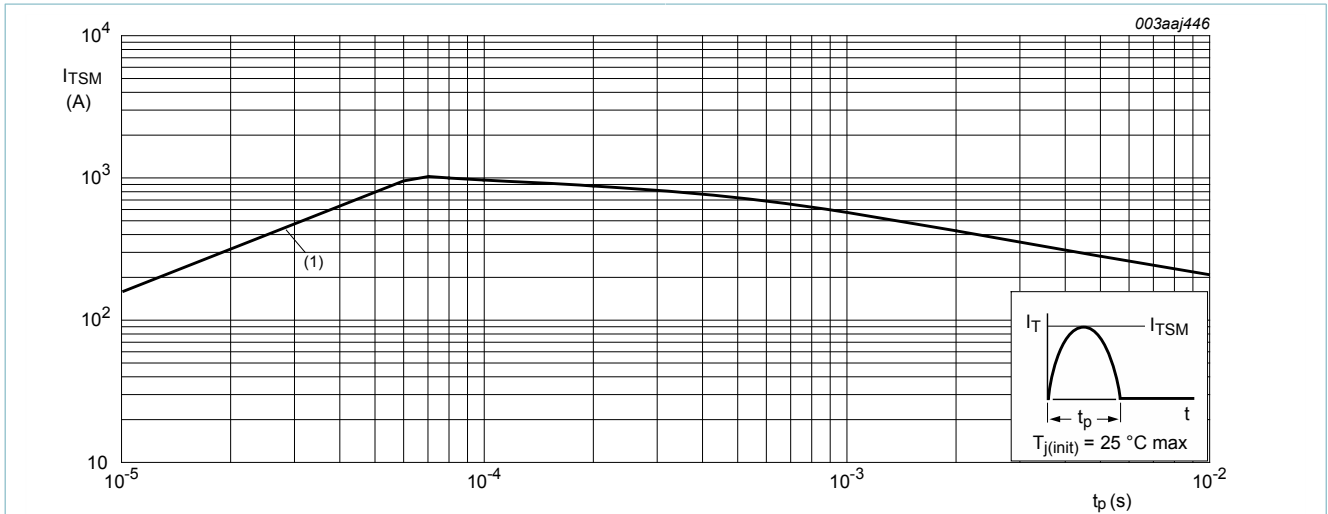


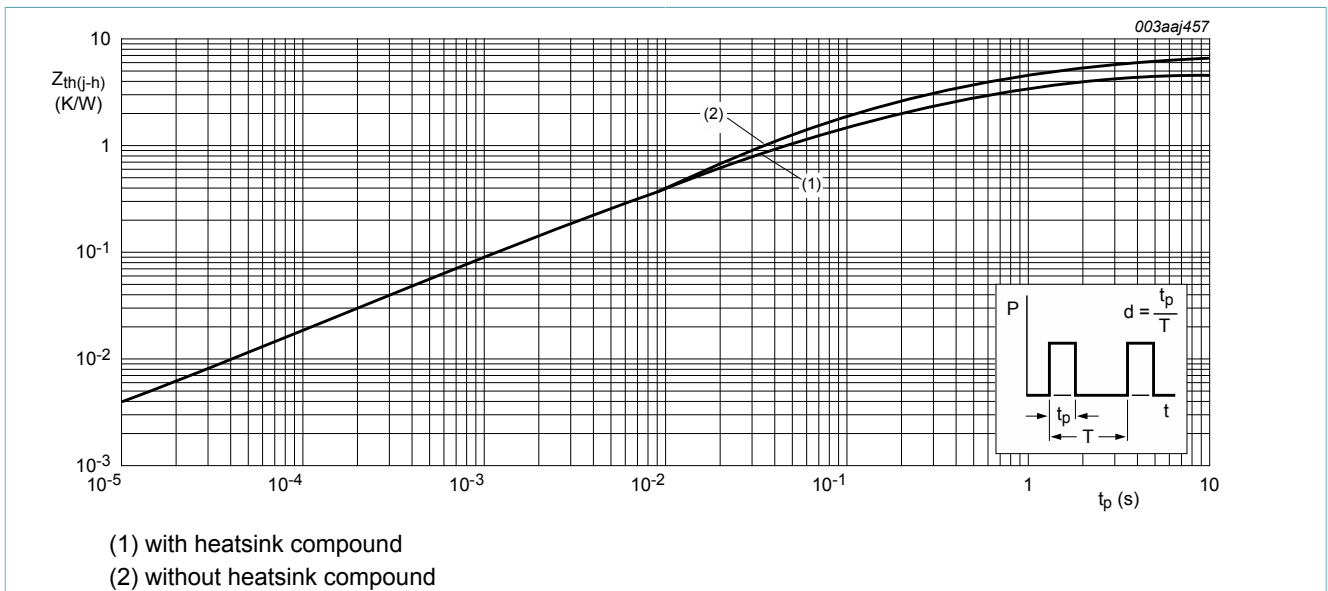
Fig. 5. Non-repetitive peak on-state current as a function of pulse width for sinusoidal currents; maximum values

$t_p \leq 10 \text{ ms}$ ; (1)  $dI_T / dt$  limit

### 8. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	with heatsink compound; Fig. 6	-	-	4.5	K/W
		without heatsink compound; Fig. 6	-	-	6.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	55	-	K/W



(1) with heatsink compound  
 (2) without heatsink compound

Fig. 6. Transient thermal impedance from junction to heatsink as a function of pulse width

## 9. Isolation characteristics

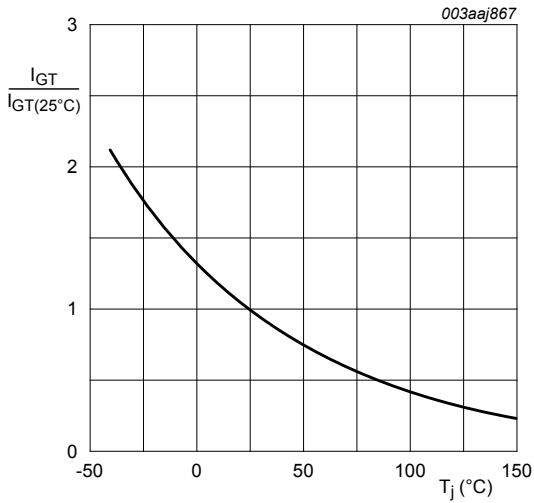
Table 6. Isolation characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{\text{isol(RMS)}}$	RMS isolation voltage	from all terminals to external heatsink; sinusoidal waveform; clean and dust free; $50 \text{ Hz} \leq f \leq 60 \text{ Hz}$ ; $\text{RH} \leq 65 \%$ ; $T_h = 25 \text{ }^\circ\text{C}$	-	-	2500	V
$C_{\text{isol}}$	isolation capacitance	from anode to external heatsink; $f = 1 \text{ MHz}$ ; $T_h = 25 \text{ }^\circ\text{C}$	-	10	-	pF

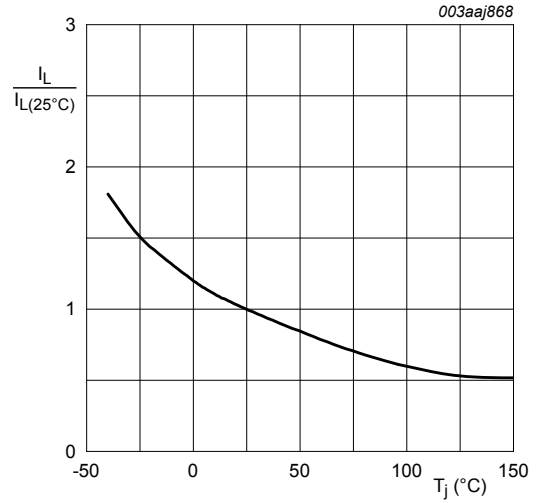
## 10. Characteristics

Table 7. Characteristics

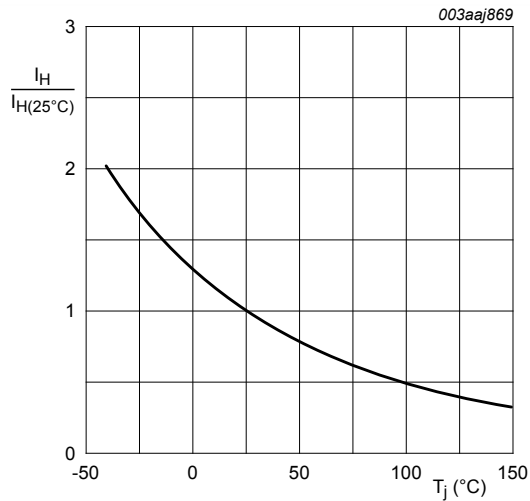
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{\text{GT}}$	gate trigger current	$V_D = 12 \text{ V}$ ; $I_T = 0.1 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>	-	4.5	25	mA
$I_L$	latching current	$V_D = 12 \text{ V}$ ; $I_G = 0.1 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>	-	21	60	mA
$I_H$	holding current	$V_D = 12 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>	-	16	40	mA
$V_T$	on-state voltage	$I_T = 32 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>	-	1.2	1.5	V
$V_{\text{GT}}$	gate trigger voltage	$V_D = 12 \text{ V}$ ; $I_T = 0.1 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 11</a>	-	0.7	1.3	V
		$V_D = 400 \text{ V}$ ; $I_T = 0.1 \text{ A}$ ; $T_j = 150 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 11</a>	0.2	0.4	-	V
$I_D$	off-state current	$V_D = 600 \text{ V}$ ; $T_j = 150 \text{ }^\circ\text{C}$	-	0.2	1	mA
$I_R$	reverse current	$V_R = 600 \text{ V}$ ; $T_j = 150 \text{ }^\circ\text{C}$	-	0.2	1	mA
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{\text{DM}} = 402 \text{ V}$ ; $T_j = 150 \text{ }^\circ\text{C}$ ; ( $V_{\text{DM}} = 67\%$ of $V_{\text{DRM}}$ ); exponential waveform; gate open circuit	300	-	-	V/ $\mu\text{s}$



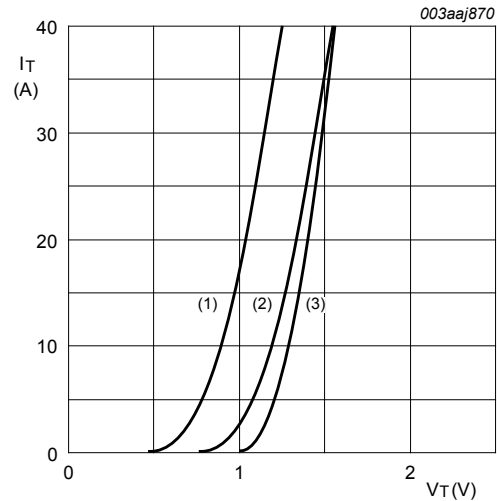
**Fig. 7. Normalized gate trigger current as a function of junction temperature**



**Fig. 8. Normalized latching current as a function of junction temperature**



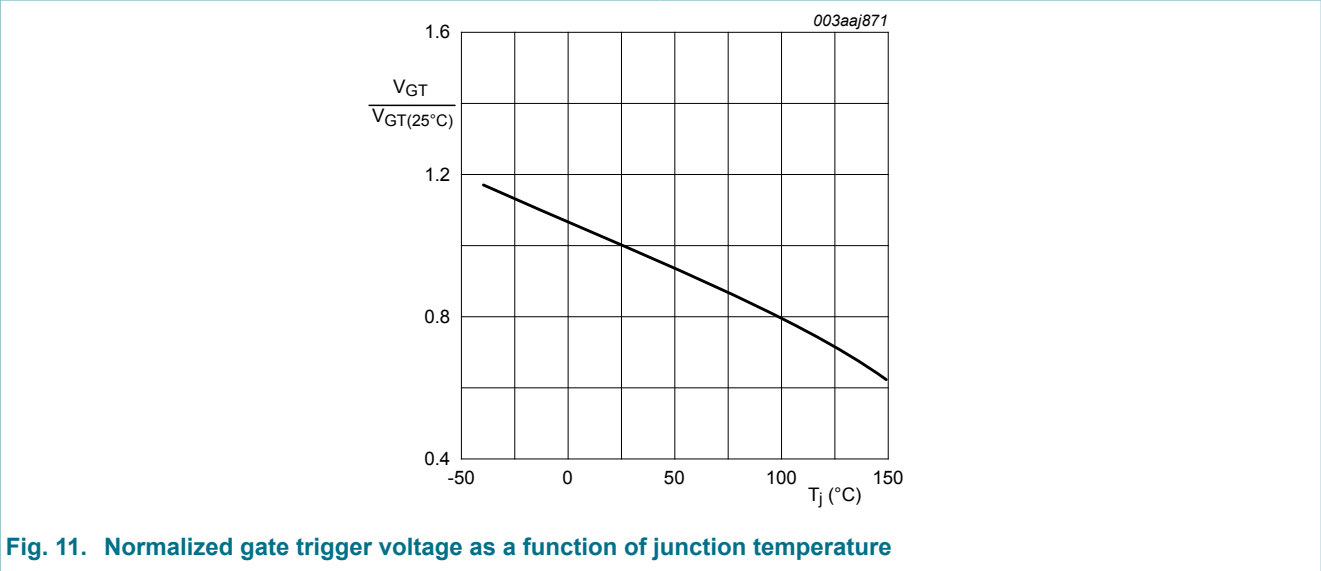
**Fig. 9. Normalized holding current as a function of junction temperature**



$V_o = 1.0336 \text{ V}; R_s = 0.0141 \Omega$   
 (1)  $T_j = 150 \text{ }^\circ\text{C}$ ; typical values  
 (2)  $T_j = 150 \text{ }^\circ\text{C}$ ; maximum values  
 (3)  $T_j = 25 \text{ }^\circ\text{C}$ ; maximum values

**Fig. 10. On-state current as a function of on-state voltage**





### 11. Package outline

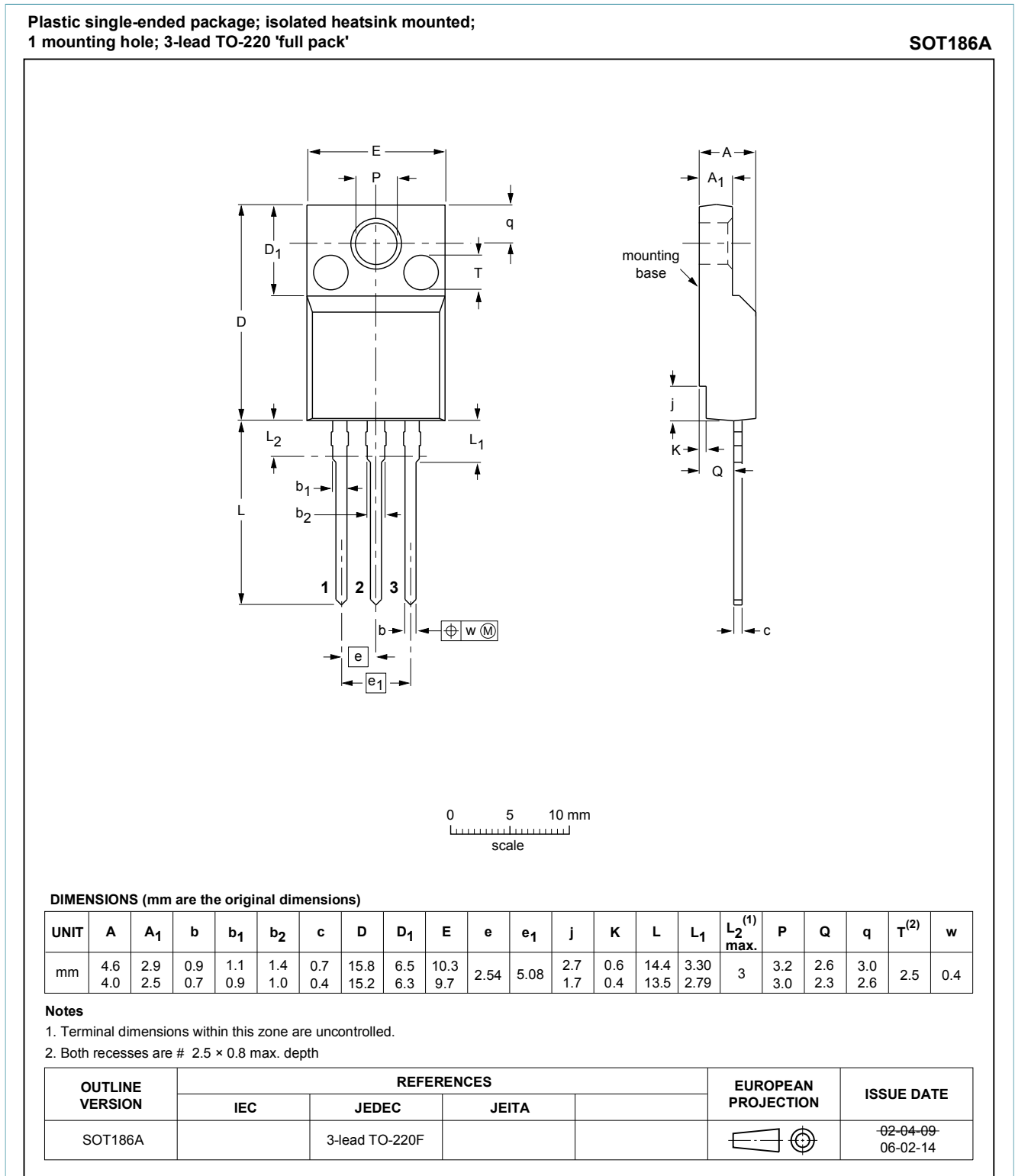


Fig. 12. Package outline TO-220F (SOT186A)

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Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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