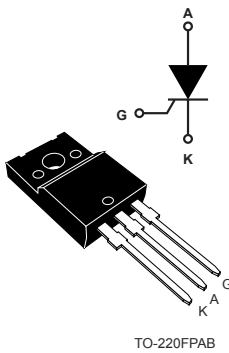


## High temperature 16 A 600 V TO220FP thyristor SCRs



### Features

- High junction temperature:  $T_j = 150\text{ }^\circ\text{C}$
- High noise immunity  $dV/dt = 1000\text{V}/\mu\text{s}$  up to  $150\text{ }^\circ\text{C}$
- Gate triggering current  $I_{GT} = 10\text{ mA}$
- Peak off-state voltage  $V_{DRM}/V_{RRM} = 600\text{ V}$
- High turn-on current rise  $dI/dt = 100\text{ A}/\mu\text{s}$
- ECOPACK<sup>®</sup>2 compliant
- Complies with UL standards (File ref: E81734)
- Insulated package TO-220FPAB:
  - Insulated voltage:  $2000\text{ V}_{RMS}$

### Applications

- Motorbike voltage regulator circuits
- Inrush current limiting circuits
- Motor control circuits and starters
- Light dimmers
- Solid state relays

### Description

Thanks to a junction temperature  $T_j$  up to  $150\text{ }^\circ\text{C}$  and an isolated TO-220FPAB package, the TN1610H-6FP offers high thermal performance operation up to 16 A rms.

The trade-off between the device's noise immunity ( $dV/dt = 1\text{ kV}/\mu\text{s}$ ), its gate triggering current ( $I_{GT} = 10\text{ mA}$ ) and its turn-on current rise ( $dI/dt = 100\text{ A}/\mu\text{s}$ ) allows the design of robust and compact control circuits for voltage regulators in motorbikes and industrial drives, overvoltage crowbar protection, motor control circuits in power tools and kitchen appliances and inrush current limiting circuits.

The insulated fullpack package allows a back-to-back configuration.

Product status	
TN1610H-6FP	
Product summary	
Order code	TN1610H-6FP
Package	TO-220FPAB
$V_{DRM}/V_{RRM}$	600 V
$I_{GT}$	10 mA

# 1 Characteristics

**Table 1. Absolute maximum ratings (limiting values),  $T_j = 25\text{ °C}$  unless otherwise specified**

Symbol	Parameter		Value	Unit
$I_{T(RMS)}$	RMS on-state current (180 ° conduction angle)		$T_c = 83\text{ °C}$ 16	A
$I_{T(AV)}$	Average on-state current (180 ° conduction angle)		$T_c = 83\text{ °C}$ 10	A
			$T_c = 102\text{ °C}$ 8	
			$T_c = 117\text{ °C}$ 6	
$I_{TSM}$	Non repetitive surge peak on-state current ( $T_j$ initial = 25 °C)		$t_p = 8.3\text{ ms}$ 153	A
			$t_p = 10\text{ ms}$ 140	
$I^2t$	$I^2t$ value for fusing, ( $T_j$ initial = 25 °C)		$t_p = 10\text{ ms}$ 98	$A^2s$
$di/dt$	$I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$ Critical rate of rise of on-state current		$f = 60\text{ Hz}$ 100	$A/\mu s$
$V_{DRM}/V_{RRM}$	Repetitive peak off-state voltage		600	V
$I_{GM}$	Peak gate current	$t_p = 20\text{ }\mu s$	$T_j = 150\text{ °C}$ 4	A
$P_{G(AV)}$	Average gate power dissipation		$T_j = 150\text{ °C}$ 1	W
$T_{stg}$	Storage junction temperature range		-40 to +150	°C
$T_j$	Maximum operating junction temperature		-40 to +150	°C
$T_l$	Maximum lead temperature soldering during 10 s		260	°C
$V_{ins}$	Insulation rms voltage, 1 minute, TO-220FPAB		2000	V

**Table 2. Electrical characteristics ( $T_j = 25\text{ °C}$  unless otherwise specified)**

Symbol	Test conditions		Value	Unit
$I_{GT}$	$V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$		Typ. 4.5	mA
			Max. 10	
$V_{GT}$			Max. 1.3	V
$V_{GD}$	$V_D = V_{DRM}$ , $R_L = 3.3\text{ k}\Omega$	$T_j = 150\text{ °C}$	Min. 0.2	V
$I_H$	$I_T = 500\text{ mA}$ , gate open		Max. 30	mA
$I_L$	$I_G = 1.2 \times I_{GT}$		Max. 60	mA
$dV/dt$	$V_D = 402\text{ V}$ , gate open	$T_j = 150\text{ °C}$	Min. 1000	$V/\mu s$
$t_{gt}$	$I_T = 32\text{ A}$ , $V_D = 600\text{ V}$ , $I_G = 100\text{ mA}$ , $(dI_G/dt)_{max} = 0.2\text{ A}/\mu s$		Typ. 1.9	$\mu s$
$t_q$	$I_T = 32\text{ A}$ , $V_D = 402\text{ V}$ , $(dI_T/dt)_{OFF} = 30\text{ A}/\mu s$ , $V_R = 25\text{ V}$ , $dV_D/dt = 40\text{ V}/\mu s$	$T_j = 150\text{ °C}$	Typ. 70	$\mu s$

**Table 3. Static characteristics**

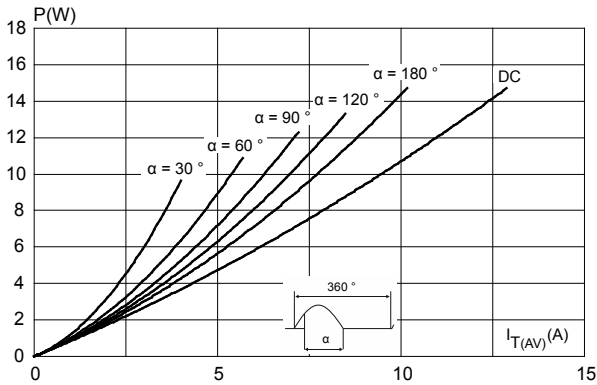
Symbol	Test conditions			Value	Unit
$V_{TM}$	$I_T = 32\text{ A}$ , $t_p = 380\ \mu\text{s}$	$T_j = 25\text{ °C}$	Max.	1.60	V
$V_{TO}$	Threshold voltage	$T_j = 150\text{ °C}$	Max.	0.82	
$R_D$	Dynamic resistance	$T_j = 150\text{ °C}$	Max.	25	mΩ
$I_{DRM}$ , $I_{RRM}$	$V_D = V_{DRM}$ ; $V_R = V_{RRM}$	$T_j = 25\text{ °C}$	Max.	5	μA
		$T_j = 150\text{ °C}$		1.5	mA

**Table 4. Thermal parameters**

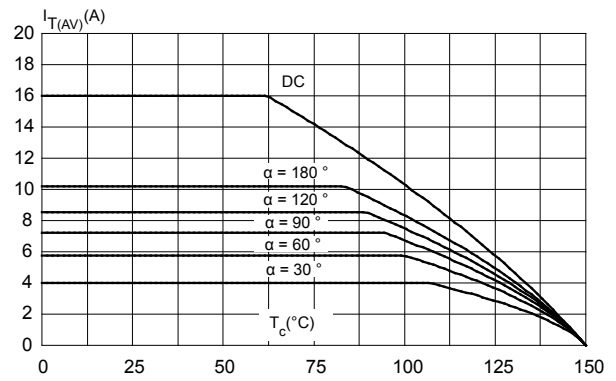
Symbol	Parameter		Value	Unit
$R_{th(j-c)}$	Junction to case (DC)	Max.	4.5	°C/W
$R_{th(j-a)}$	Junction to ambient (DC)	Typ.	60	

## 1.1 Characteristics curves

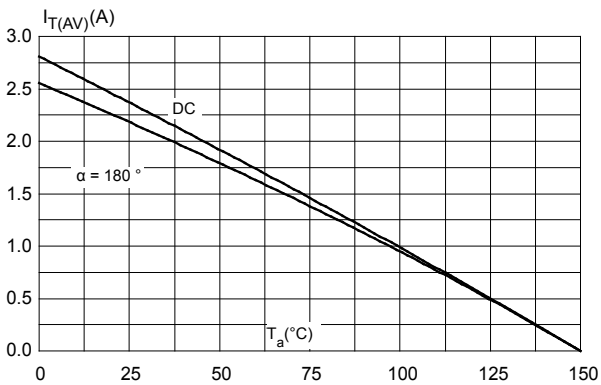
**Figure 1. Maximum power dissipation versus average on-state current**



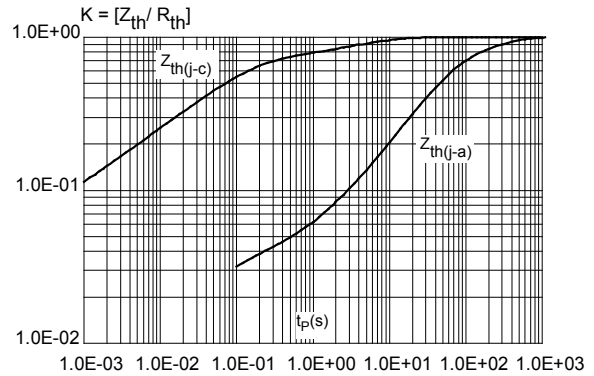
**Figure 2. Average and DC on-state current versus case temperature**



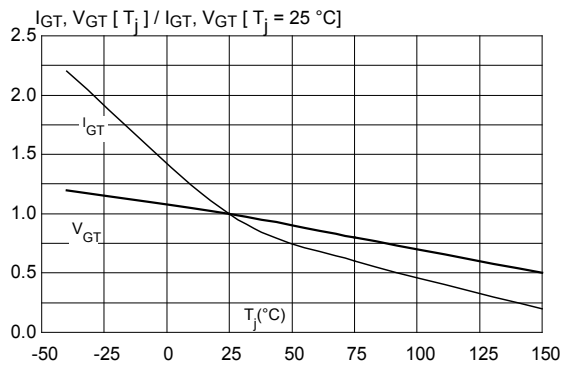
**Figure 3. Average and D.C. on state current versus ambient temperature**



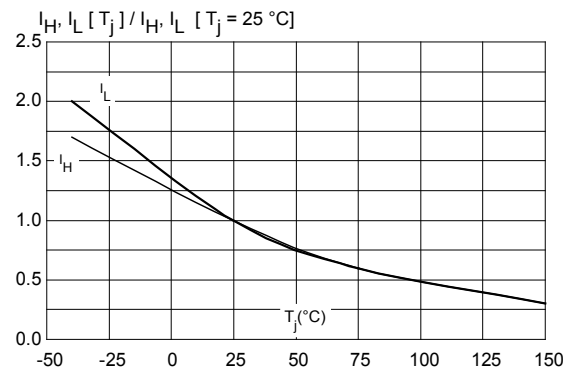
**Figure 4. Relative variation of thermal impedance versus pulse duration**



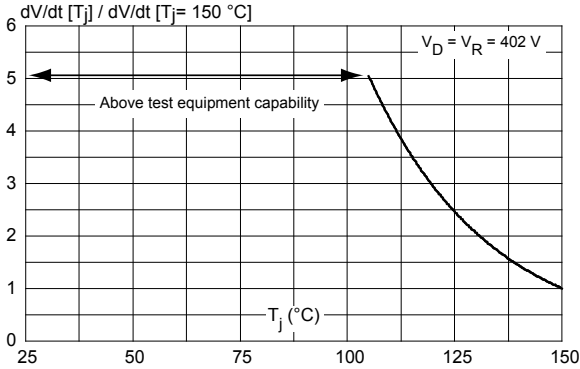
**Figure 5. Relative variation of gate triggering current and gate voltage versus junction temperature (typical values)**



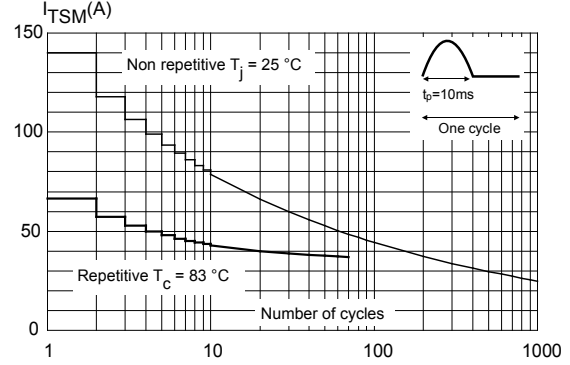
**Figure 6. Relative variation of holding and latching current versus junction temperature (typical values)**



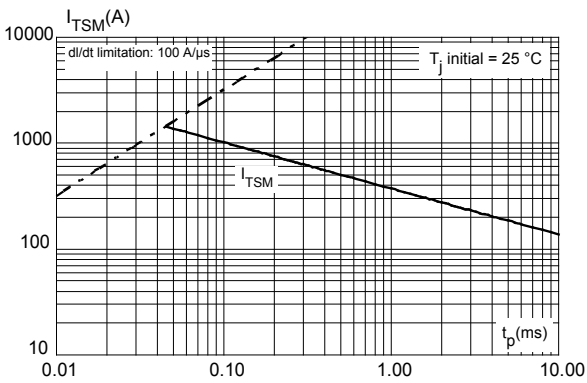
**Figure 7. Relative variation of static dV/dt immunity versus junction temperature (typical values)**



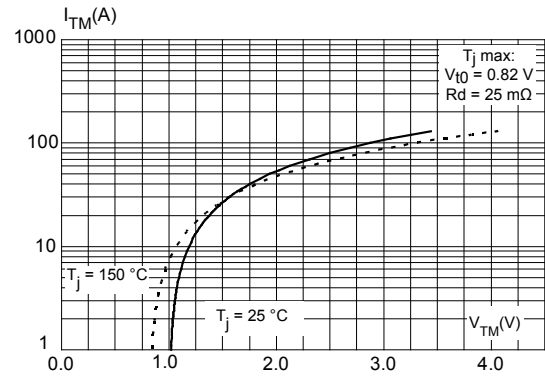
**Figure 8. Surge peak on-state current versus number of cycles**



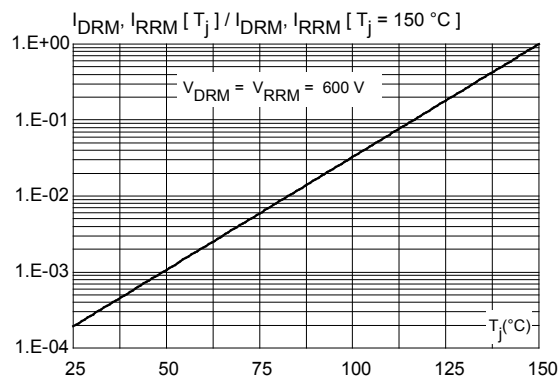
**Figure 9. Non repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 10$  ms**



**Figure 10. On-state characteristics (maximum values)**



**Figure 11. Relative variation of leakage current versus junction temperature ( $t_p < 10$  ms)**



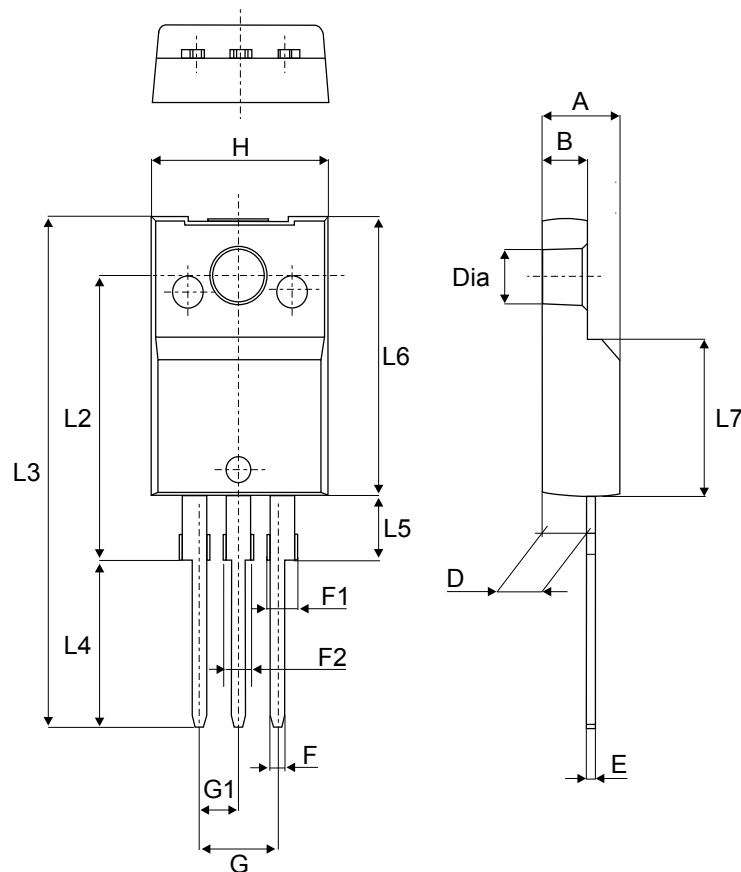
## 2 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

### 2.1 TO-220FPAB package information

- ECOPACK<sup>®</sup>2 compliant
- Lead-free package leads finishing
- Molding compound resin is halogen-free and meets UL94 level V0
- Recommended torque: 0.4 to 0.6 N·m

Figure 12. TO-220FPAB package outline



**Table 5. TO-220FPAB package mechanical data**

Ref.	Dimensions			
	Millimeters		Inches <sup>(1)</sup>	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.1739	0.1818
B	2.5	2.7	0.0988	0.1067
D	2.50	2.75	0.0988	0.1087
E	0.45	0.70	0.0178	0.0277
F	0.75	1.0	0.0296	0.0395
F1	1.15	1.70	0.0455	0.0672
F2	1.15	1.70	0.0455	0.0672
G	4.95	5.20	0.1957	0.2055
G1	2.40	2.70	0.0949	0.1067
H	10.00	10.40	0.3953	0.4111
L2	16.00 typ.		0.6324 typ.	
L3	28.60	30.60	1.1304	1.2095
L4	9.80	10.6	0.3874	0.4190
L5	2.90	3.60	0.1146	0.1423
L6	15.90	16.40	0.6285	0.6482
L7	9.00	9.30	0.3557	0.3676
Diam	3.0	3.20	0.1186	0.1265

1. Inch dimensions are for reference only.

### 3 Ordering information

Figure 13. Ordering information scheme

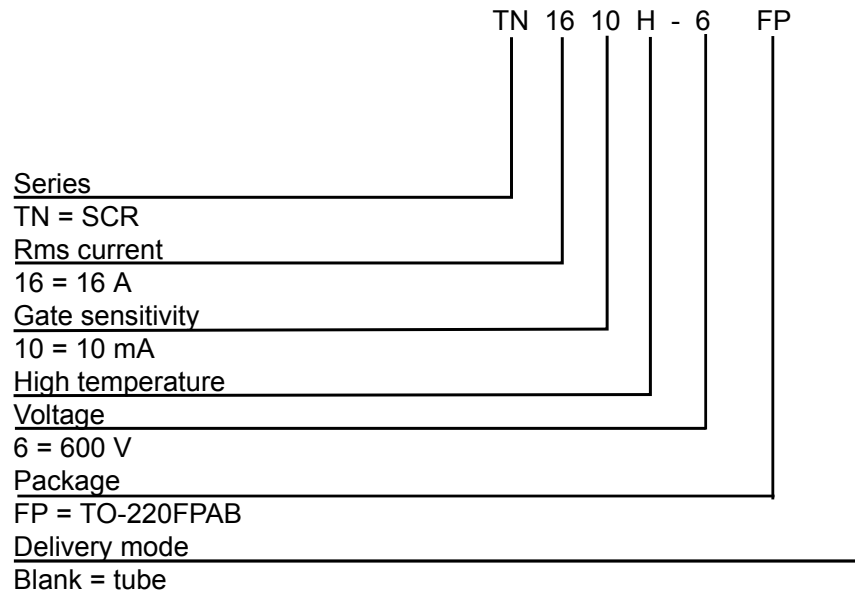


Table 6. Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
TN1610H-6FP	TN1610H6	TO-220FPAB	2.0 g	50	Tube



## Revision history

**Table 7. Document revision history**

Date	Revision	Changes
24-Feb-2015	1	Initial release.
22-Feb-2019	2	Updated <a href="#">Table 4</a> . Thermal parameters.

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