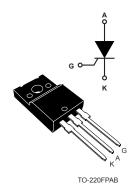


High temperature 16 A 600 V TO220FP thyristor SCRs



Features

- High junction temperature: T_j = 150 °C
- High noise immunity dV/dt = 1000V/µs up to 150 °C
- Gate triggering current I_{GT} = 10 mA
- Peak off-state voltage V_{DRM}/V_{RRM} = 600 V
- High turn-on current rise dI/dt = 100 A/μs
- ECOPACK®2 compliant
- Complies with UL standards (File ref: E81734)
- Insulated package TO-220FPAB:
 - Insulated voltage: 2000 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 °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 kV/ μ s), its gate triggering current (I_{GT} = 10 mA) and its turn-on current rise (dI/dt = 100 A/ μ 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-6FF			
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 °C unless otherwise specified

Symbol	Parameter				Unit	
I _{T(RMS)}	RMS on-state current (180 $^{\circ}$ conduction angle) $T_c = 83 ^{\circ}C$				Α	
			T _c = 83 °C	10	A	
$I_{T(AV)}$			T _c = 102 °C	8		
			T _c = 117 °C	6		
	$t_p = 8.3 \text{ ms}$		153	A		
Non repetitive surge peak on-state current (T _j initial = 25 °C)		t _p = 10 ms	140			
l ² t	I^2 t value for fusing, (T_j initial = 25 °C) t_p = 10 ms				A ² s	
dl/dt	$I_G = 2 \times I_{GT}$, tr $\leq 100 \text{ ns}$ Critical rate of rise of on-state current		100	A/µs		
V _{DRM} /V _{RRM}	Repetitive peak off-state voltage			600	V	
I _{GM}	Peak gate current $t_p = 20 \mu s$ $T_j = 150 ° C$		T _j = 150 °C	4	Α	
P _{G(AV)}	Average gate power dissipation $T_j = 150 ^{\circ}\text{C}$			1	W	
T _{stg}	Storage junction temperature range			-40 to +150	°C	
Tj	Maximum operating junction temperature			-40 to +150	°C	
T _I	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 °C unless otherwise specified)

Symbol	Test conditions				Unit
I _{GT}			Тур.	4.5	mA
'G1	$V_D = 12 \text{ V}, R_L = 33 \Omega$		Max.	10	ША
V_{GT}			Max.	1.3	V
V_{GD}	$V_D = V_{DRM}, R_L = 3.3 \text{ k}\Omega$ $T_j = 150 ^{\circ}\text{C}$				V
I _H	I _T = 500 mA, gate open Max.				mA
IL	$I_G = 1.2 \times I_{GT}$ Max.				mA
dV/dt	V_D = 402 V, gate open T_j = 150 °C Min.				V/µs
t _{gt}	$I_T = 32 \text{ A}, V_D = 600 \text{ V}, I_G = 100 \text{ mA}, (dI_G/dt) \text{ max} = 0.2 \text{ A/µs}$ Typ.			1.9	μs
t _q	I_T = 32 A, V_D = 402 V, (dI_T/dt) OFF = 30 A/ μ s, V_R = 25 V, dV_D/dt = 40 V/ μ s T_j = 150 °C Typ.				μs

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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 °C	Max.	1.60	V
V _{TO}	Threshold voltage	T _j = 150 °C	Max.	0.82	V
R _D	Dynamic resistance	T _j = 150 °C	Max.	25	mΩ
I_{DRM} , I_{RRM} $V_D = V_{DRM}$; $V_R = V_{RRM}$	V V · · · · - V · ·	T _j = 25 °C	Max.	5	μA
	VD - VDRM, VR - VRRM	T _j = 150 °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)	Тур.	60	C/VV

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1.1 Characteristics curves

Figure 1. Maximum power dissipation versus average onstate current 18 16 α = 180 DC 14 $\alpha = 120$ α = 90 12 $\alpha = 30^{\circ}$ 10 8 6 2 $I_{\mathsf{T}(\mathsf{AV})}(\mathsf{A})$ 0 5 10 15

Figure 2. Average and DC on-state current versus case temperature I_{T(AV)}(A) 20 18 DC 16 14 12 α = 180 10 α = 120 8 a = 90 $\alpha = 60$ 6 α = 30 2 T_c(°C) 0 0 25 50 75 100 125 150

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

3.0 | T(AV)(A) | 2.5 | 2.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0

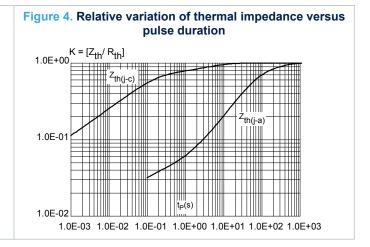
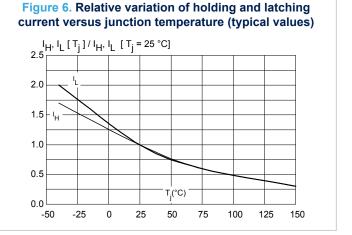


Figure 5. Relative variation of gate triggering current and



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

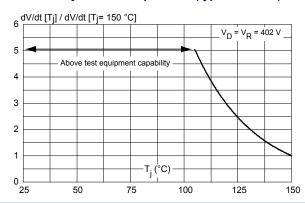


Figure 8. Surge peak on-state current versus number of cycles

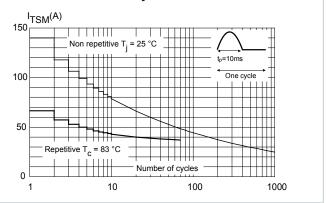


Figure 9. Non repetitive surge peak on-state current for a sinusoidal pulse with width $t_p < 10$ ms

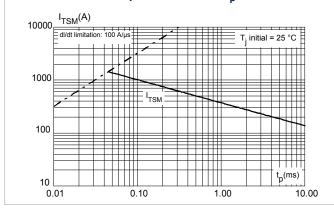


Figure 10. On-state characteristics (maximum values)

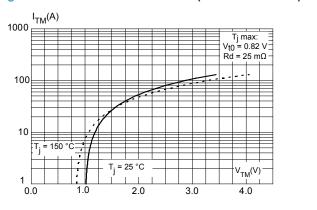
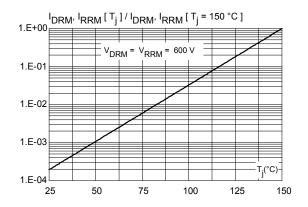


Figure 11. Relative variation of leakage current versus junction temperature ($t_p < 10 \text{ ms}$)



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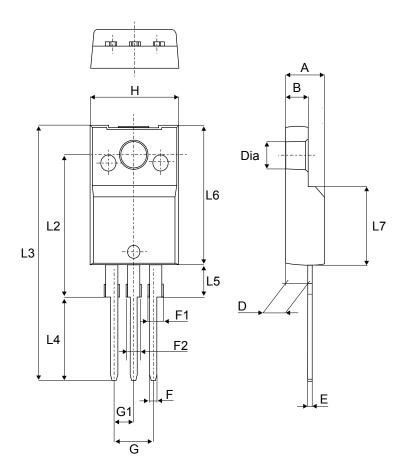
2 Package information

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

2.1 TO-220FPAB package information

- ECOPACK®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



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Table 5. TO-220FPAB package mechanical data

		Dimensions				
Ref.	Millin	Millimeters		es ⁽¹⁾		
	Min.	Max.	Min.	Max.		
А	4.40	4.60	0.1739	0.1818		
В	2.5	2.7	0.0988	0.1067		
D	2.50	2.75	0.0988	0.1087		
Е	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		
Н	10.00	10.40	0.3953	0.4111		
L2	16.00	0 typ.	0.632	4 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.

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3 Ordering information

Figure 13. Ordering information scheme

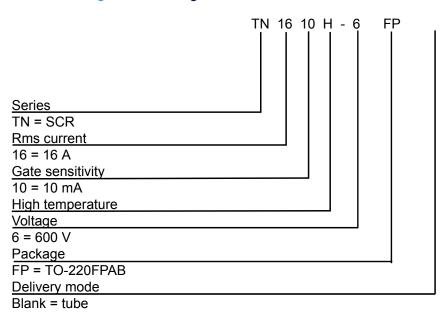


Table 6. Ordering information

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

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Revision history

Table 7. Document revision history

Date	Revision	Changes	
24-Feb-2015	1	Initial release.	
22-Feb-2019	2	2 Updated Table 4. Thermal parameters.	



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