

## Features

- High junction temperature:  $T_j = 150\text{ °C}$
- High noise immunity  $dV/dt = 750\text{ V}/\mu\text{s}$  up to  $150\text{ °C}$
- Gate triggering current  $I_{GT} = 15\text{ mA}$
- Blocking voltage  $V_{DRM}/V_{RRM} = 600\text{ V}$
- High turn on current rise  $di/dt: 100\text{ A}/\mu\text{s}$
- ECOPACK<sup>®2</sup> compliant component
- Complies with UL standards (File ref: E81734)
- Insulated package TO-220FPAB:
  - Insulated voltage:  $2000\text{ VRMS}$

## Applications

- Voltage regulator circuits for motorbikes
- Inrush current limiting circuits
- Motor control circuits and starters
- Light dimmers
- Solid state relays

## Description

Thanks to a junction temperature  $T_j$  up to  $150\text{ °C}$  and an insulated TO-220FPAB package, the TN2015H-6FP offers high thermal performance operation up to  $20\text{ A rms}$ .

The trade-off between the device's noise immunity ( $dV/dt = 750\text{ V}/\mu\text{s}$ ), its gate triggering current ( $I_{GT} = 15\text{ mA}$ ) 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 aids, inrush current limiting circuits.

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

**Table 1. Device summary**

Order code	Package	$V_{DRM}/V_{RRM}$	$I_{GT}$
TN2015H-6FP	TO-220FPAB	600 V	15 mA

# 1 Characteristics

**Table 2. Absolute ratings**

Symbol	Parameter		Value	Unit	
$I_{T(RMS)}$	On-state rms current (180° conduction angle)		$T_c = 80\text{ °C}$	20	A
$I_{T(AV)}$	Average on-state current (180° conduction angle)		$T_c = 80\text{ °C}$	12.7	A
			$T_c = 99\text{ °C}$	10	
			$T_c = 112\text{ °C}$	8	
$I_{TSM}$	Non repetitive surge peak on-state current ( $T_j$ initial = 25 °C)		$t = 8.3\text{ ms}$	197	A
			$t = 10\text{ ms}$	180	
$I^2t$	$I^2t$ value for fusing ( $T_j$ initial = 25 °C)		$t_p = 10\text{ ms}$	162	A <sup>2</sup> s
$di/dt$	Critical rate of rise of on-state current $I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$ , $T_j = 25\text{ °C}$		$F = 60\text{ Hz}$	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
$T_{stg}$ $T_j$	Storage junction temperature range			- 40 to + 150	°C
	Operating junction temperature range			- 40 to + 150	
$T_L$	Maximum lead temperature for soldering during 10 s			260	°C
$V_{ins}$	Insulation rms voltage, 1 minute		TO-220FPAB	2000	V

**Table 3. 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.	6	mA
			Max.	15	
$V_{GT}$	$V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$		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.	50	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.	750	V/ $\mu$ s
$t_{gt}$	$I_T = 40\text{ A}$ , $V_D = 600\text{ V}$ , $I_G = 100\text{ mA}$ , ( $dI_G/dt$ ) <sub>max</sub> = 0.2 A/ $\mu$ s		Typ	1.9	$\mu$ s
$t_q$	$V_D = 402\text{ V}$ , $V_R = 25\text{ V}$ , $I_T = 20\text{ A}$ , ( $dI_G/dt$ ) <sub>max</sub> = 30 A/ $\mu$ s, $dV_D/dt = 50\text{ V}/\mu$ s	$T_j = 150\text{ °C}$	Typ	70	$\mu$ s

Table 4. Static characteristics

Symbol	Test conditions		Value	Unit	
$V_{TM}$	$I_{TM} = 40\text{ A}$ , $t_p = 380\ \mu\text{s}$	$T_j = 25\text{ }^\circ\text{C}$	Max.	1.6	V
$V_{t0}$	Threshold voltage	$T_j = 150\text{ }^\circ\text{C}$	Max.	0.82	V
$R_d$	Dynamic resistance	$T_j = 150\text{ }^\circ\text{C}$	Max.	17.5	m $\Omega$
$I_{DRM}$ , $I_{RRM}$	$V_D = V_{DRM}$ , $V_R = V_{RRM}$	$T_j = 25\text{ }^\circ\text{C}$	Max.	5	$\mu\text{A}$
		$T_j = 150\text{ }^\circ\text{C}$		2	mA

Table 5. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{th(j-c)}$	Junction to case (AC)	4.0	$^\circ\text{C/W}$
$R_{th(j-a)}$	Junction to ambient (DC)	60	$^\circ\text{C/W}$

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

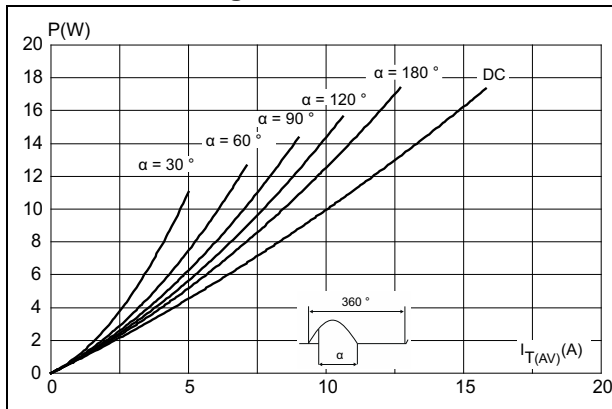


Figure 2. Average and DC on-state current versus case temperature

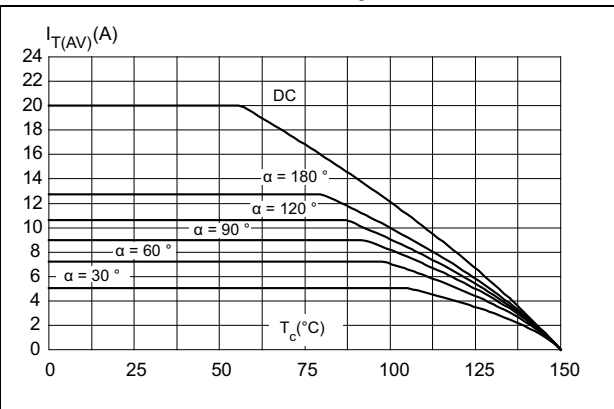


Figure 3. Average and DC on-state current versus ambient temperature

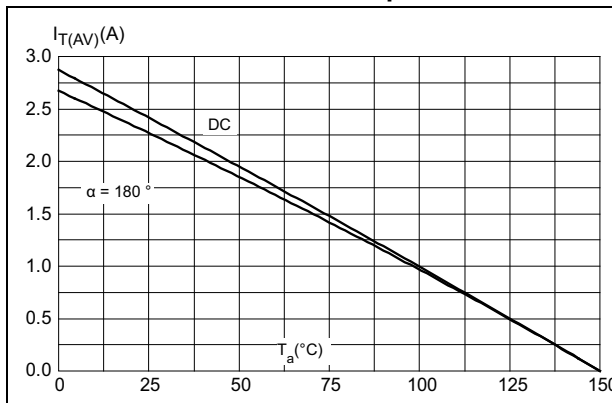
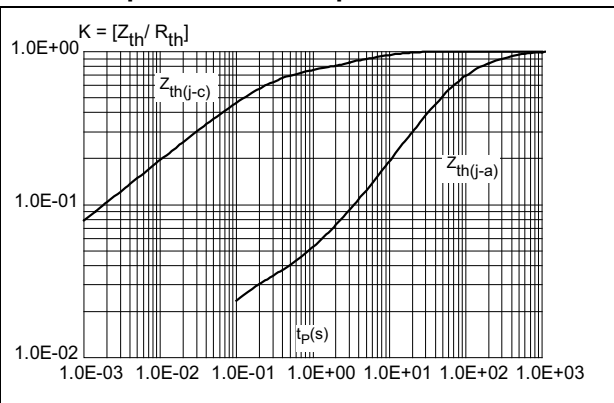
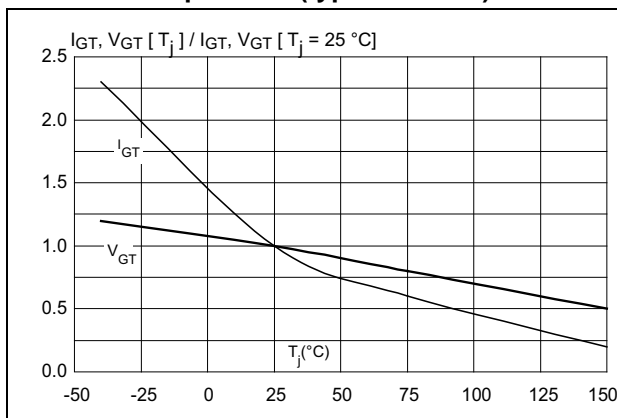


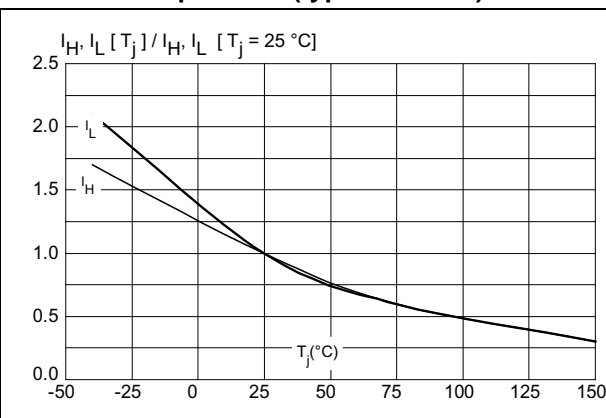
Figure 4. Relative variation of thermal impedance versus pulse duration



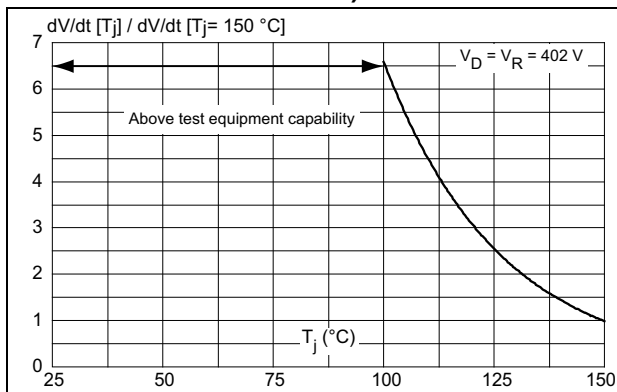
**Figure 5. Relative variation of gate triggering current and gate voltage versus junction temperature (typical values)**



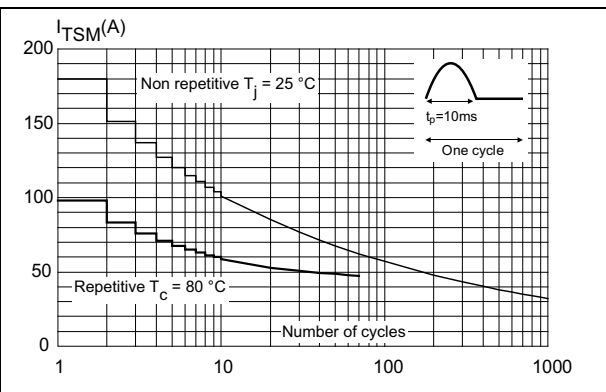
**Figure 6. Relative variation of holding current and latching current versus junction temperature (typical values)**



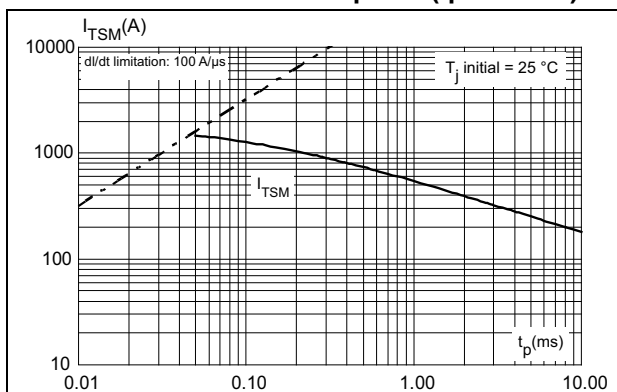
**Figure 7. Relative variation of static dV/dt immunity versus junction temperature (typical values)**



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



**Figure 9. Non-repetitive surge peak on-state current for a sinusoidal pulse ( $t_p < 10\text{ ms}$ )**



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

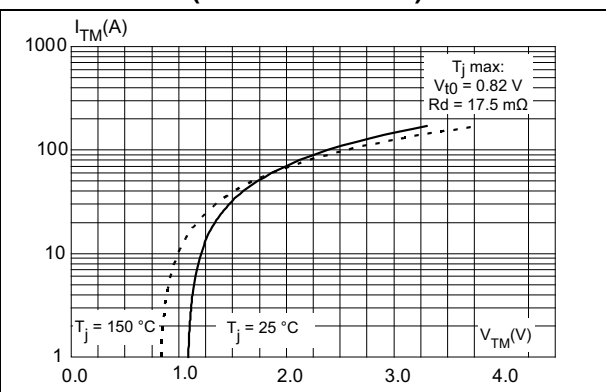
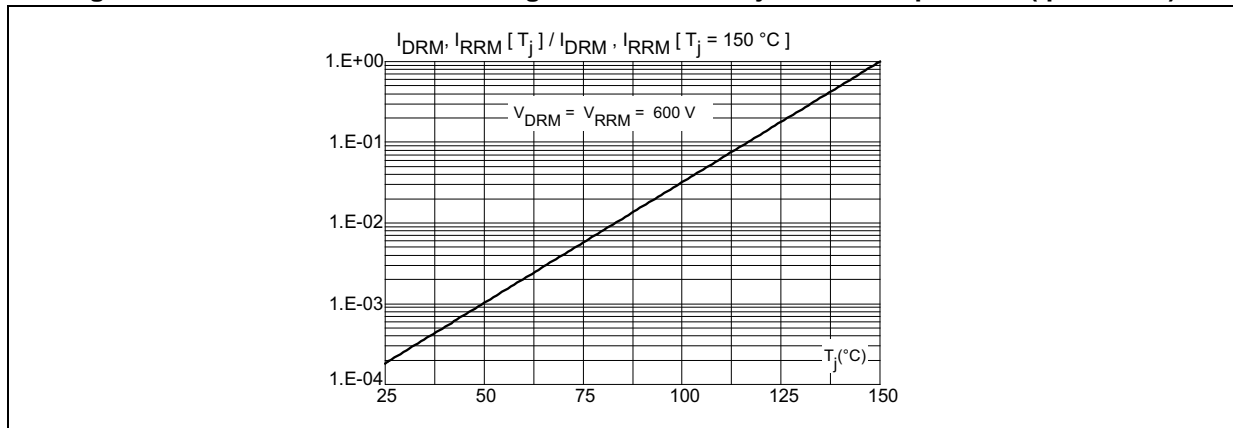


Figure 11. Relative variation of leakage current versus junction temperature (tp < 10 ms)



## 2 Package information

- Epoxy meets UL94, V0
- Lead-free package
- Halogen free molding compound
- Recommended torque: 0.4 to 0.6 N·m

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](http://www.st.com). ECOPACK® is an ST trademark.

Figure 12. TO-220FPAB dimension definitions

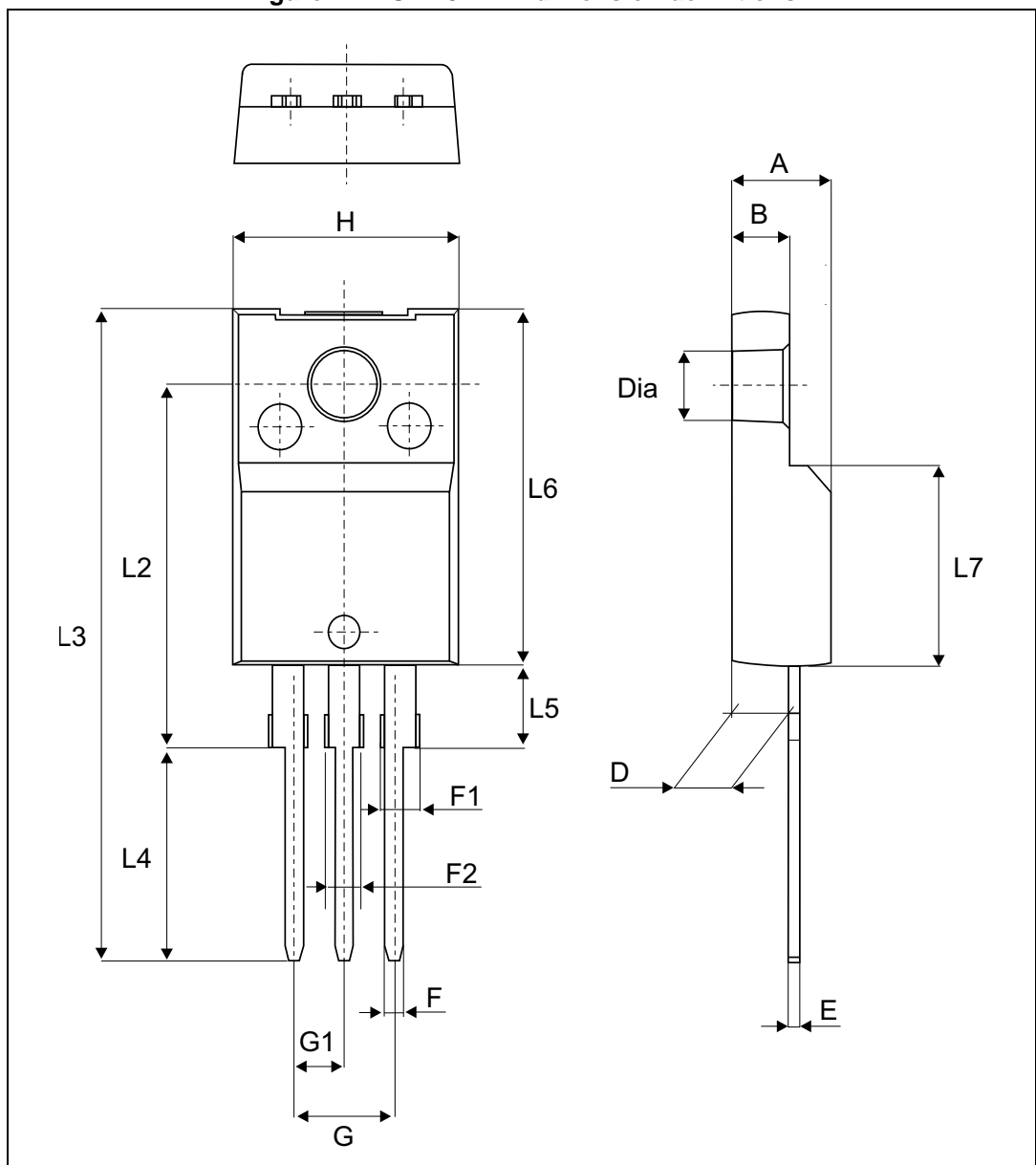


Table 6. TO-220FPAB dimensions

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.4	4.6	0.173	0.181
B	2.5	2.7	0.098	0.106
D	2.5	2.75	0.098	0.108
E	0.45	0.70	0.018	0.027
F	0.75	1	0.030	0.039
F1	1.15	1.70	0.045	0.067
F2	1.15	1.70	0.045	0.067
G	4.95	5.20	0.195	0.205
G1	2.4	2.7	0.094	0.106
H	10	10.4	0.393	0.409
L2	16 Typ.		0.63 Typ.	
L3	28.6	30.6	1.126	1.205
L4	9.8	10.6	0.386	0.417
L5	2.9	3.6	0.114	0.142
L6	15.9	16.4	0.626	0.646
L7	9.00	9.30	0.354	0.366
Dia.	3.00	3.20	0.118	0.126

### 3 Ordering information

Figure 13. Ordering information scheme

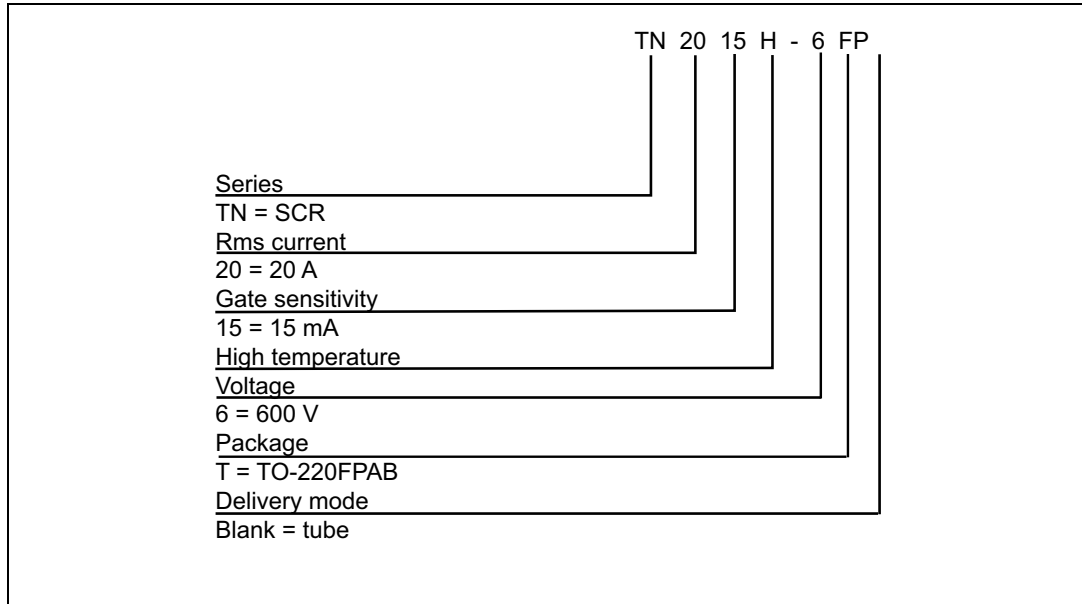


Table 7. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
TN2015H-6FP	TN2015H6	TO-220FPAB	2.0 g	50	Tube

### 4 Revision history

Table 8. Document revision history

Date	Revision	Changes
25-Feb-2015	1	Initial release.



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