# 40 A 600 V 150 °C junction temperature SCR in TO-220AB package

TO-220AB
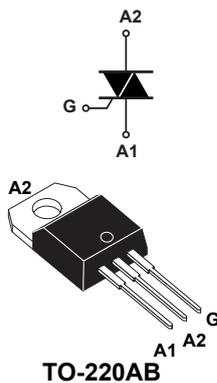
Features

- High junction temperature : T_j = 150 °C
- High noise immunity dV/dt = 500 V/µs up to 150 °C
- Gate triggering current I_{GT} = 15 mA
- Off-state voltage 600 V V_{DRM}/V_{RRM}
- High turn on current rise dI/dt = 100 A/µs
- ECOPACK2 compliant component

Applications

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

Description

The TN4015H-6T in non-isolated TO-220AB package offers high thermal performances up to 40 A, thanks to its junction temperature up to 150°C.

Its trade-off noise immunity (dV/dt = 500 V/µs) versus its gate triggering current (I_{GT} = 15 mA) and its turn-on current rise (dI/dt = 100 A/µs) allows to design robust and compact control circuit for voltage regulator in motorbikes and industrial drives, overvoltage crowbar protection, motor control circuits in power tools and kitchen aids, inrush current limiting circuits.

Product status link
TN4015H-6T

Product summary	
$I_{T(RMS)}$	40 A
V_{DRM}/V_{RRM}	600 V
V_{DSM}/V_{RSM}	800 V
I_{GT}	15 mA
Package	TO-220AB

DS11764 - **Rev 2** - **December 2021**
For further information contact your local STMicroelectronics sales office.

www.st.com

1 TN4015H-6T_Characteristics

Table 1. Absolute maximum ratings (limiting values), T_j = 25 °C unless otherwise specified

Symbol	Parameter		Value	Unit
$I_{T(RMS)}$	RMS on-state current (180 ° conduction angle)	T_c = 119 °C	40	A
$I_{T(AV)}$	Average on-state current (180 ° conduction angle)	T_c = 120 °C	25	A
		T_c = 125 °C	22	
		T_c = 128 °C	20	
I_{TSM}	Non repetitive surge peak on-state current	t_p = 8.3 ms	394	A
		t_p = 10 ms	360	
I^2t	I^2t value for fusing	t_p = 10 ms	648	A^2s
dI/dt	Critical rate of rise of on-state current I_G = 2 x I_{GT}, tr ≤ 100 ns	f = 60 Hz	100	A/µs
V_{DRM}/V_{RRM}	Repetitive peak off-state voltage	T_j = 150 °C	600	V
V_{DSM}/V_{RSM}	Non repetitive surge peak off-state voltage	t_p = 10 ms	800	V
I_{GM}	Peak gate current	t_p = 20 µs	T_j = 150 °C	4	A
$P_{G(AV)}$	Average gate power dissipation	T_j = 150 °C	1	W
V_{RGM}	Maximum peak reverse gate voltage		5	V
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

Table 2. Electrical characteristics (T_j = 25 °C unless otherwise specified)

Symbol	Test Conditions			Value	Unit
I_{GT}	V_D = 12 V, R_L = 33 Ω		Max.	15	mA
V_{GT}			Max.	1.3	V
V_{GD}	V_D = V_{DRM}, R_L = 3.3 kΩ	T_j = 150 °C	Min.	0.15	V
I_H	I_T = 500 mA, gate open		Max.	60	mA
I_L	I_G = 1.2 x I_{GT}		Max.	80	mA
dV/dt	V_D = 402 V, gate open	T_j = 150 °C	Min.	500	V/µs
t_{gt}	I_T = 80 A, V_D = 600 V, I_G = 100 mA, (dI_G/dt) max = 0.2 A/µs		Typ.	1.9	µs
t_q	V_D = 402 V, I_T = 40 A, V_R = 25 V, dV_D/dt = 50 V/µs, (dI_G/dt)max = 30 A/µs	T_j = 150 °C	Typ.	85	µs

Table 3. Static characteristics

Symbol	Test conditions			Value	Unit
V_{TM}	I_{TM} = 80 A, t_p = 380 µs	T_j = 25 °C	Max.	1.6	V
V_{TO}	Threshold voltage	T_j = 150 °C	Max.	0.85	
R_D	Dynamic resistance	T_j = 150 °C	Max.	10	mΩ
I_{DRM}, I_{RRM}	V_D = V_{DRM} = V_{RRM}	T_j = 25 °C	Max.	10	µA
		T_j = 150 °C		6	mA

Table 4. Thermal parameters

Symbol	Parameter		Value	Unit
$R_{th(j-c)}$	Junction to case (DC)	Max.	0.8	°C/W
$R_{th(j-a)}$	Junction to ambient (DC)	Typ.	60	

1.1 Characteristics curves

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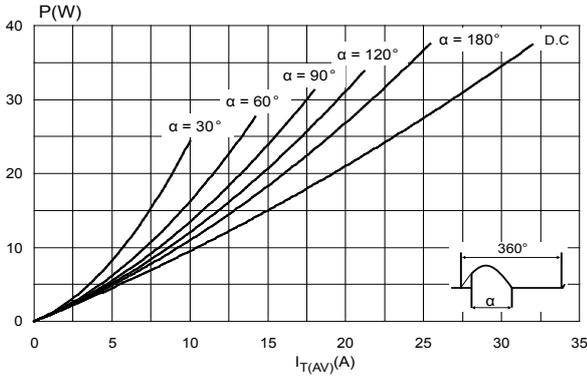

Figure 2. **Average and DC on-state current versus case temperature**
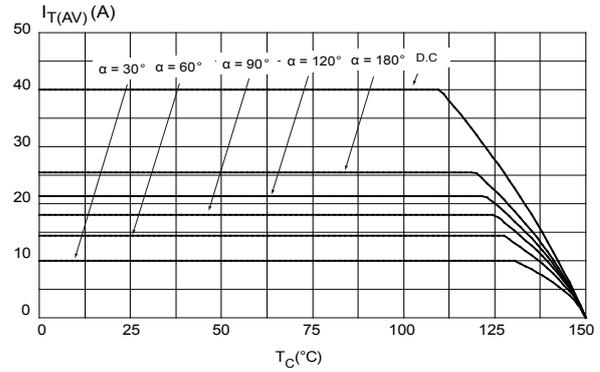
Figure 3. **Average and D.C. on state current versus ambient temperature**
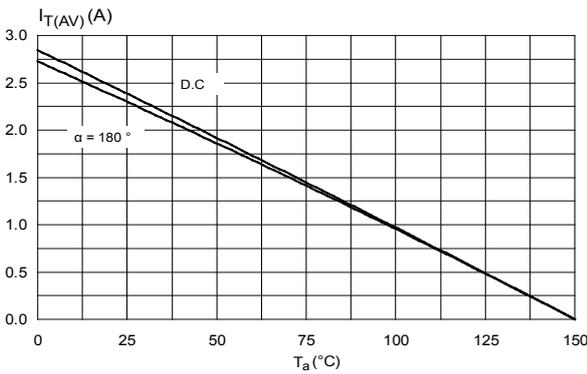

Figure 4. **Relative variation of thermal impedance versus pulse duration**
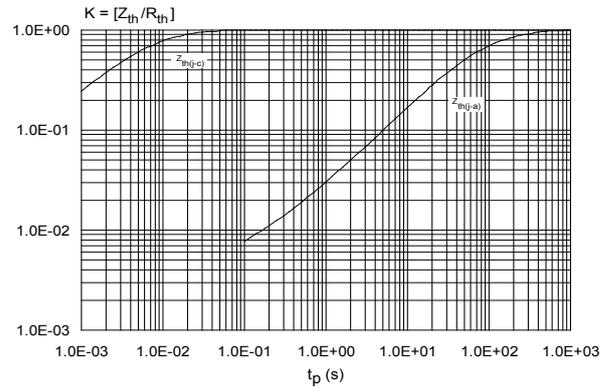
Figure 5. **Relative variation of gate trigger current and gate voltage versus junction temperature (typical values)**
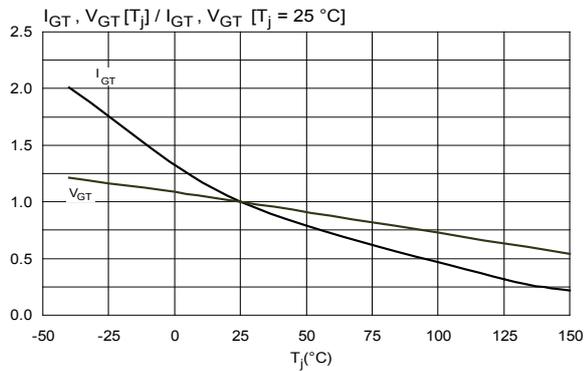

Figure 6. **Relative variation of holding and latching current versus junction temperature (typical values)**
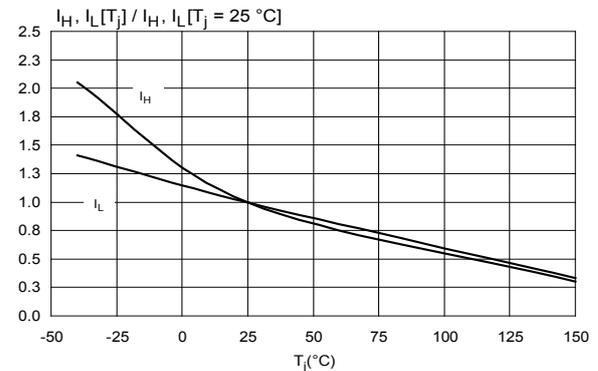
## Figure 7. Relative variation of static dV/dt immunity versus junction temperature

dV/dt [T_j] / dV/dt [T_j = 150 °C]

V_D = 402 V

Above test equipment capability

T_j(°C)
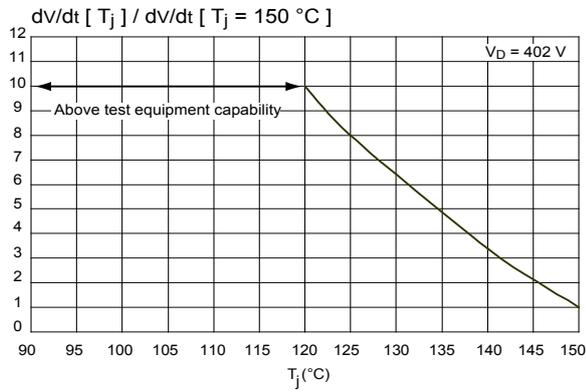
Figure 8. Surge peak on-state current versus number of cycles

I_{TSM}(A)

Non repetitive
T_j initial = 25 °C

t_p=10ms

One cycle

Repetitive
T_c = 119 °C

Number of cycles
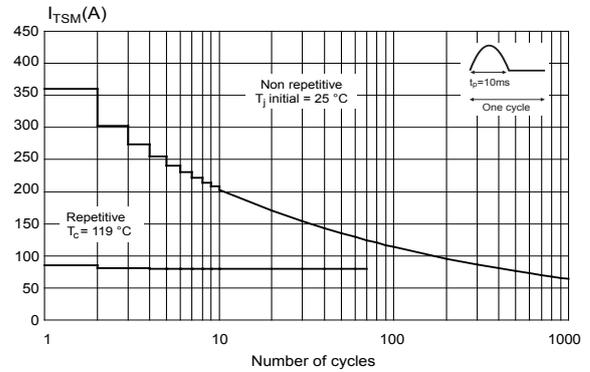
Figure 9. Non repetitive surge peak on-state current for a sinusoidal pulse with width tp < 10 ms

I_{TSM} (A)

dI/dt limitation: 100 A/μs

T_j initial = 25 °C

I_{TSM}

t_p(ms)
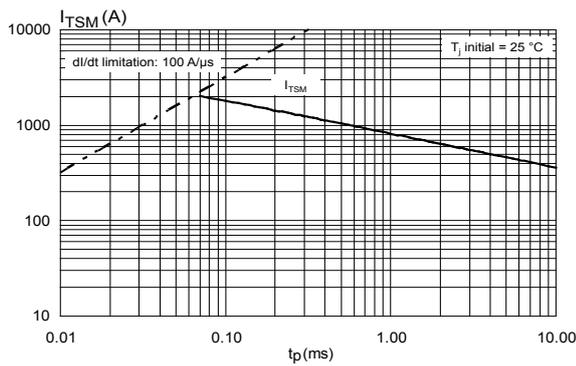
Figure 10. On-state characteristics (maximum values)

I_{TM} (A)

T_j = 150 °C

T_j = 25 °C

T_j max :
V_{TO} = 0.85 V
R_d = 10 mΩ

V_{TM}(V)
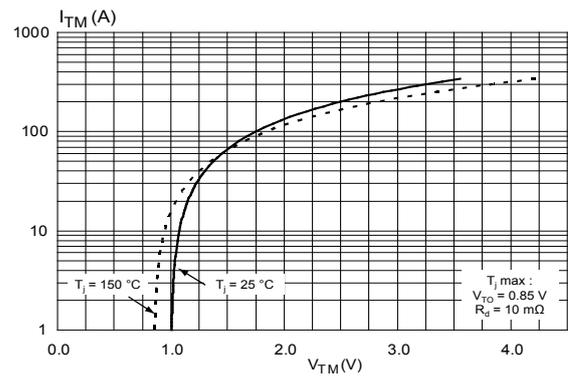
Figure 11. Relative variation of leakage current versus junction temperature

I_{DRM} , I_{RRM} [T_j; V_{DRM} , V_{RRM}] / I_{DRM} , I_{RRM} [150 °C; 600 V]

V_{DRM} = V_{RRM} = 600 V

T_j(°C)
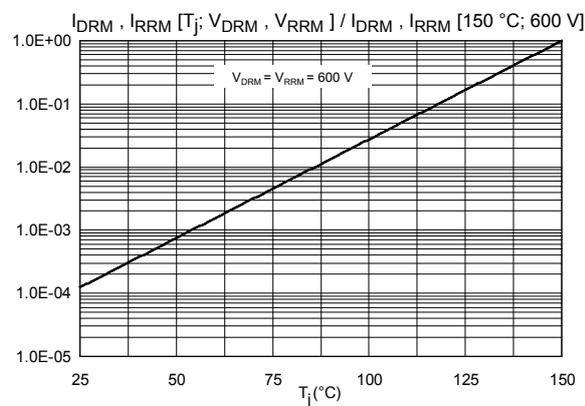
2 Package information

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-220AB package information

- Molding compound resin is halogen free and meets UL94 flammability standard, level V0
- Lead-free plating package leads
- Recommended torque: 0.4 to 0.6 N·m

Figure 12. TO-220AB package outline
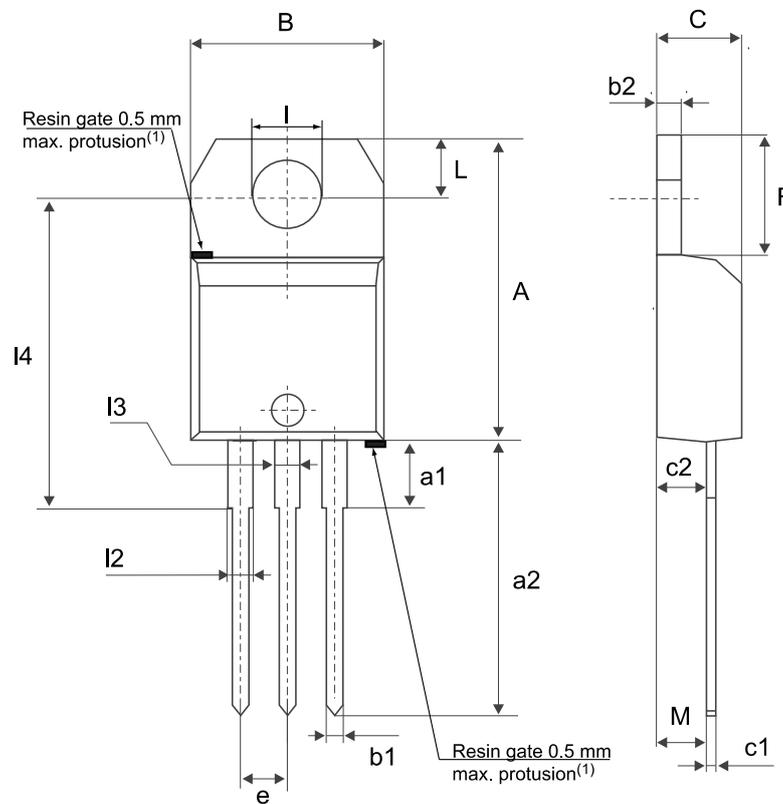
(1)Resin gate position accepted in one of the two positions or in the symmetrical opposites.

Table 5. TO-220AB package mechanical data

Ref.	Dimensions					
	Millimeters			Inches[1]		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	15.20		15.90	0.5984		0.6260
a1		3.75			0.1476	
a2	13.00		14.00	0.5118		0.5512
B	10.00		10.40	0.3937		0.4094
b1	0.61		0.88	0.0240		0.0346
b2	1.23		1.32	0.0484		0.0520
C	4.40		4.60	0.1732		0.1811
c1	0.49		0.70	0.0193		0.0276
c2	2.40		2.72	0.0945		0.1071
e	2.40		2.70	0.0945		0.1063
F	6.20		6.60	0.2441		0.2598
I	3.73		3.88	0.1469		0.1528
L	2.65		2.95	0.1043		0.1161
l2	1.14		1.70	0.0449		0.0669
l3	1.14		1.70	0.0449		0.0669
l4	15.80	16.40	16.80	0.6220	0.6457	0.6614
M		2.6			0.1024	

1. Inch dimensions are for reference only.

3 Ordering information

Figure 13. Ordering information scheme

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                          TN   40  15    H    6    T
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Series
TN = SCR

Current
40 = 40 A

Gate sensitivity
15 = 15 m A

High temperature

Voltage
6 = 600 V

Package
T=TO-220AB

Packing mode
Blank = tube
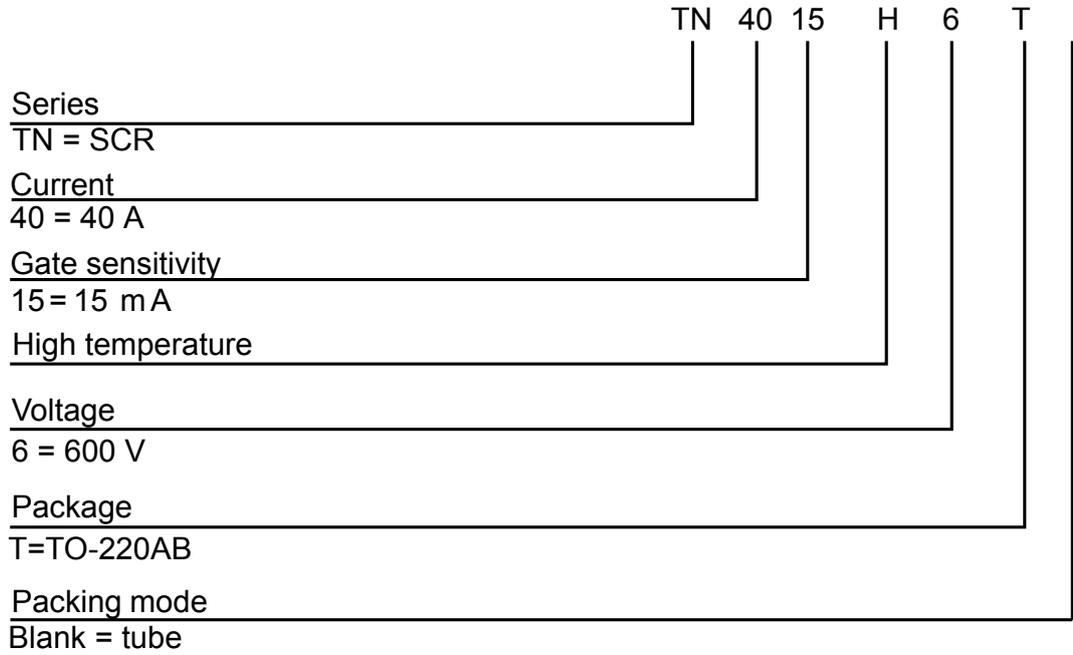
Table 6. Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
TN4015H-6T	TN4015H6	TO-220AB	2.3 g	50	Tube

Revision history

Table 7. Document revision history

Date	Revision	Changes
03-Aug-2016	1	Initial release.
10-Dec-2021	2	Updated Table 1.

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