# 0.8 A 600 V logic level gate thyristor SCR in TO-92 package



TO-92 (preform)    TO-92 (straight)
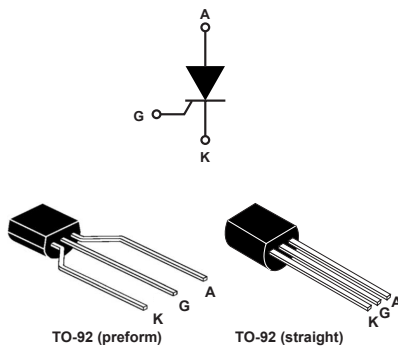
## Features

- On-state RMS current, $I_{T(RMS)}$ 0.8 A
- Repetitive peak off-state voltage 600 V
- Triggering gate current 200 µA
- ECOPACK2 compliant

## Applications

- Limited gate current topologies
- Ground fault circuit interrupters
- Overvoltage crowbar protection in power supplies
- Protection in electronic ballasts
- Capacitive discharge ignitions
- Ignitors (lighting, oven...)

## Description

Available in through hole package, the X006 SCR can be used as on/off function in applications where topology does not offer high current for gate triggering.

This device is optimized in forward voltage drop and inrush current capabilities for reduced power losses and high reliability in harsh environments.

Thanks to its highly sensitive triggering current the X006 is suitable for the applications such as breaker, ground fault interrupter, overvoltage crowbar protection of power supplies or capacitive ignition circuits.

| Product status link |
|---|
| X006 |

| Product summary | |
|---|---|
| $I_{T(RMS)}$ | 0.8 A |
| $V_{DRM}/V_{RRM}$ | 600 V |
| $I_{GT}$ | 200 µA |
| $T_j$max. | 125 °C |

**DS1704 - Rev 6 - January 2022**
For further information contact your local STMicroelectronics sales office.

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# 1 Characteristics

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

| Symbol | Parameters | | | Value | Unit |
|---|---|---|---|---|---|
| $I_{T(RMS)}$ | On-state RMS current (180° conduction angle) | TO-92 | $T_L$ = 83 °C | 0.8 | A |
| $I_{T(AV)}$ | Average on-state current (180° conduction angle) | TO-92 | $T_L$ = 83 °C | 0.5 | A |
| $I_{TSM}$ | Non repetitive surge peak on-state current, $T_j$ initial = 25 °C | $t_p$ = 8.3 ms | $T_j$ = 25 °C | 10 | A |
| | | $t_p$ = 10 ms | | 9 | |
| $I^2t$ | $I^2t$ value for fusing | $t_p$ = 10 ms | $T_j$ = 25 °C | 0.4 | $A^2s$ |
| dI/dt | Critical rate of rise of on-state current $I_G$ = 2 x $I_{GT}$ , $t_r$ ≤ 100 ns | F = 60 Hz | $T_j$ = 125 °C | 50 | A/µs |
| $I_{GM}$ | Peak gate current | $t_p$ = 20 µs | $T_j$ = 125 °C | 1 | A |
| $P_{G(AV)}$ | Average gate power dissipation | | $T_j$ = 125 °C | 0.1 | W |
| $T_{stg}$ | Storage junction temperature range | | | -40 to +150 | °C |
| $T_j$ | Operating junction temperature range | | | -40 to +125 | °C |

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

| Symbol | Parameters | | Value | Unit |
|---|---|---|---|---|
| $I_{GT}$ | $V_D$ = 12 V, $R_L$ = 140 Ω | Min. | 15 | µA |
| | | Max. | 200 | |
| $V_{GT}$ | | Max. | 0.8 | V |
| $V_{GD}$ | $V_D$ = $V_{DRM}$, $R_L$ = 3.3 kΩ, $R_{GK}$ = 1 kΩ, $T_j$ = 125 °C | Min. | 0.2 | V |
| $V_{RG}$ | $I_{RG}$ = 10 µA | Min. | 5 | |
| $I_H$ | $I_T$ = 50 mA, $R_{GK}$ = 1 kΩ | Max. | 5 | mA |
| $I_L$ | $I_G$ = 1 mA, $R_{GK}$ = 1 kΩ | Max. | 6 | mA |
| dV/dt | $V_D$ = 67 % $V_{DRM}$, $R_{GK}$ = 1 kΩ, $T_j$ = 125 °C | Min. | 25 | V/µs |

**Table 3. Static electrical characteristics**

| Symbol | Test conditions | | | Value | Unit |
|---|---|---|---|---|---|
| $V_{TM}$ | $I_{TM}$ = 1 A, $t_p$ = 380 µs | 25 °C | Max. | 1.35 | V |
| $V_{TO}$ | Threshold on-state voltage | 125 °C | Max. | 0.85 | V |
| $R_d$ | Dynamic resistance | 125 °C | Max. | 245 | mΩ |
| $I_{DRM}$ | $V_{DRM}$ = $V_{RRM}$, $R_{GK}$ = 1 kΩ | 25 °C | Max. | 1 | µA |
| $I_{RRM}$ | $V_{DRM}$ = $V_{RRM}$, $R_{GK}$ = 1 kΩ | 125 °C | | 100 | |

**Table 4. Thermal resistance**

| Symbol | Parameters | | Max. value | Unit |
|---|---|---|---|---|
| $R_{th(j-l)}$ | Junction to leads (DC) | TO-92 | 70 | °C/W |
| $R_{th(j-a)}$ | Junction to ambient (DC) | TO-92 | 150 | |

## 1.1 Characteristics (curves)

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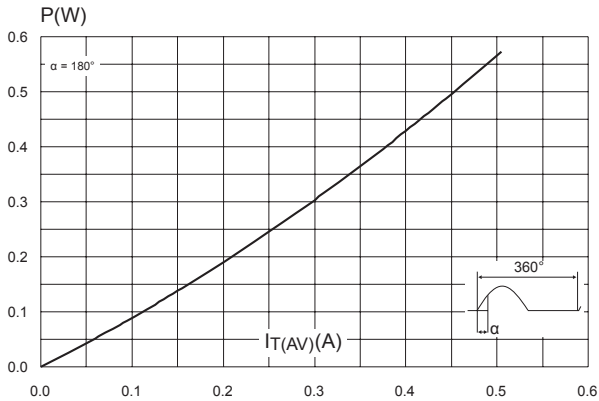


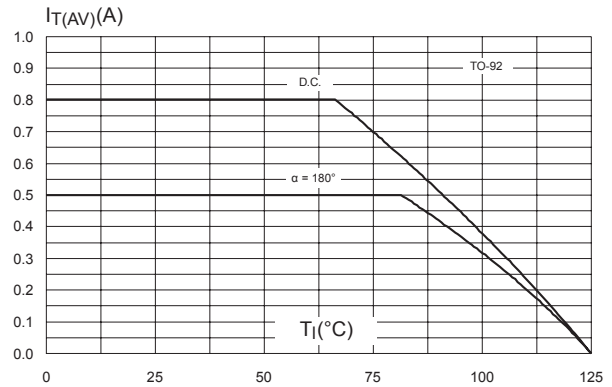**Figure 2. Average and DC on-state current versus lead temperature (TO-92)**



**Figure 3. Average and DC on-state current versus ambient temperature (epoxy printed circuit board FR4, copper thickness = 35 µm, $S_{CU}$ = 0.5 cm2)(TO-92)**
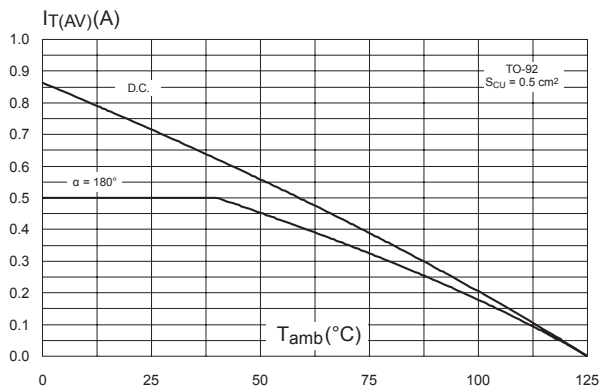


**Figure 4. Relative variation of thermal impedance junction to ambient versus pulse duration (PCB FR4, copper thickness = 35 µm, $S_{CU}$ = 0.5 cm2)(TO-92)**
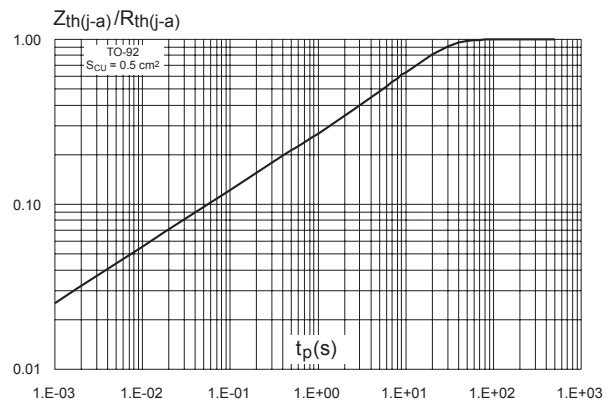


**Figure 5. Relative variation of gate trigger, holding and latching current versus junction temperature (typical values)**
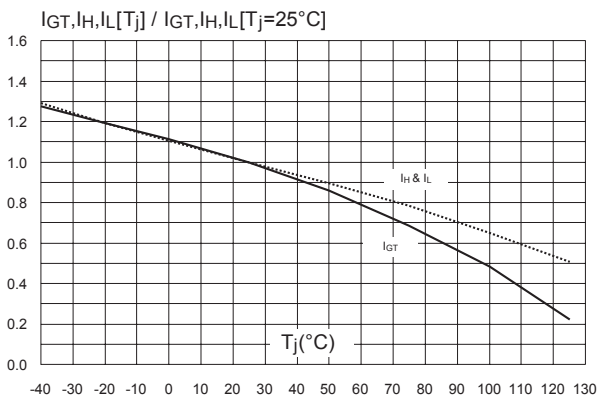


**Figure 6. Relative variation of holding current versus gate-cathode resistance (typical values)**
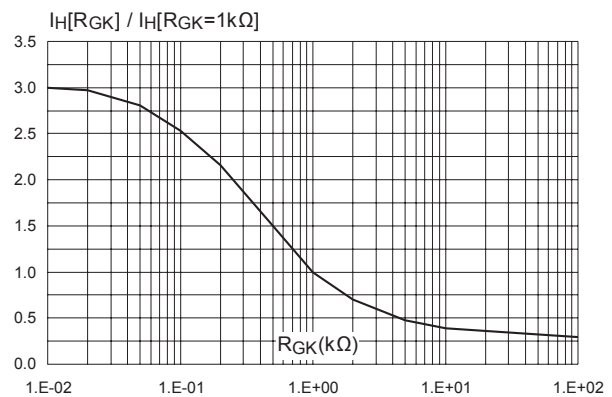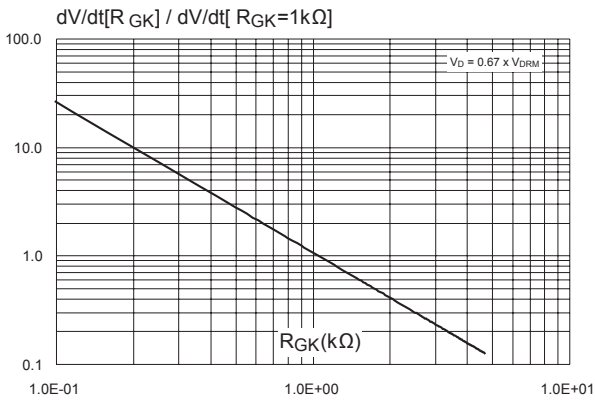
**Figure 7. Relative variation of static dV/dt immunity versus gate-cathode resistance (typical values)**



$dV/dt[R_{GK}] / dV/dt[R_{GK}=1k\Omega]$

$V_D = 0.67 \times V_{DRM}$
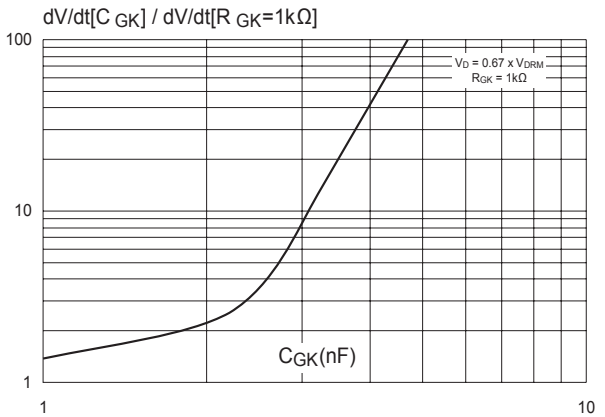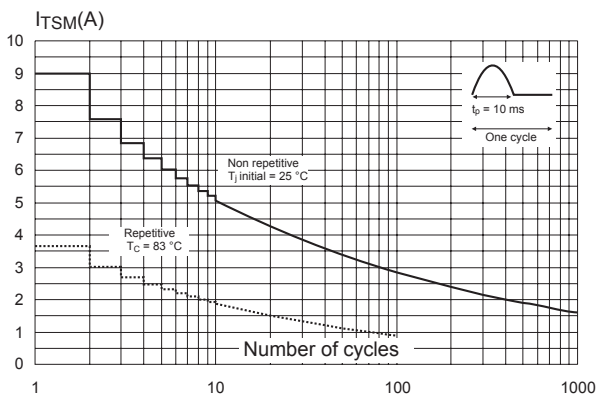
$R_{GK}(k\Omega)$

**Figure 8. Relative variation of static dV/dt immunity versus gate-cathode capacitance (typical values)**



$dV/dt[C_{GK}] / dV/dt[R_{GK}=1k\Omega]$

$V_D = 0.67 \times V_{DRM}$
$R_{GK} = 1k\Omega$

$C_{GK}(nF)$

**Figure 9. Surge peak on-state current versus number of cycles**



$I_{TSM}(A)$

$t_p = 10$ ms

One cycle

Non repetitive
$T_j$ initial = 25 °C

Repetitive
$T_C$ = 83 °C

Number of cycles

**Figure 10. Non-repetitive surge peak on-state current for sinusoidal pulse ($t_p$< 10 ms)**



$I_{TSM}(A)$

$T_j$ initial = 25 °C

$I_{TSM}$

$t_p$(ms)
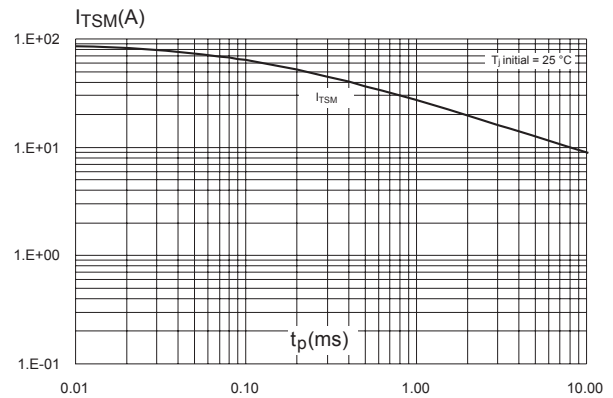
**Figure 11. On-state characteristics (maximum values)**



$I_{TM}(A)$

$T_j$ max.:
$V_{t0}$ = 0.85 V
$R_d$ = 245 m$\Omega$

$T_j$ = 125 °C

$T_j$ = 25 °C

$V_{TM}(V)$
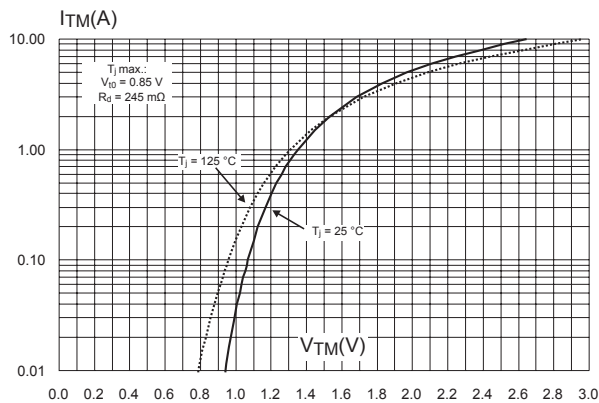
# 2    Package information

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-92 with straight leads (plastic) package information

- Lead free plating + halogen-free molding resin
- Epoxy meets UL94, V0

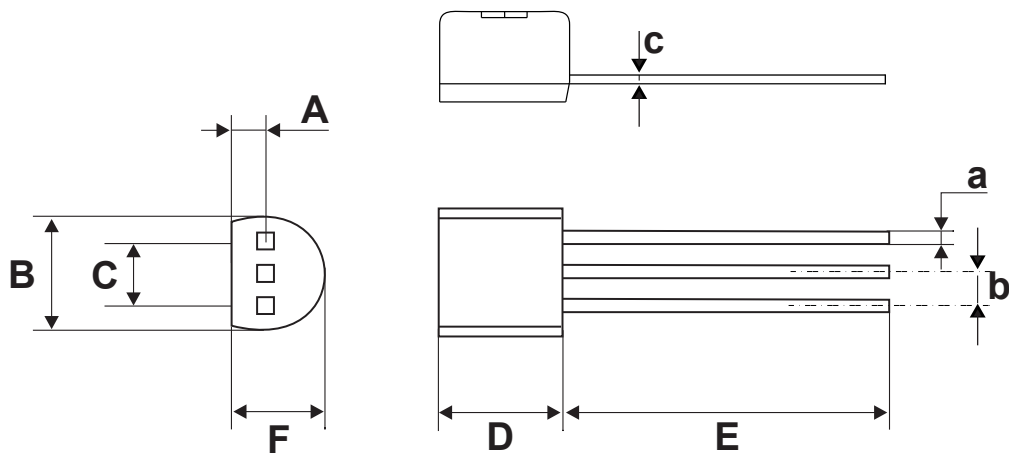**Figure 12. TO-92 with straight leads (plastic) package outline**



**Table 5. TO-92 with straight leads (plastic) package mechanical data**

| Ref. | Dimensions | | | | | |
|------|------------|---|---|---|---|---|
|      | Millimeters | | | Inches[1] | | |
|      | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A |  | 1.35 |  |  | 0.048 |  |
| B |  |  | 4.70 |  |  | 0.190 |
| C |  | 2.54 |  |  | 0.100 |  |
| D | 4.40 |  |  | 0.172 |  |  |
| E | 12.70 |  |  | 0.554 |  |  |
| F |  |  | 3.70 |  |  | 0.152 |
| a |  |  | 0.50 |  |  | 0.022 |
| b |  | 1.27 |  |  | 0.050 |  |
| c |  |  | 0.48 |  |  | 0.019 |

1.   Inches dimensions given for information

## 2.2 TO-92 with leads preform (plastic) package information

- Lead free plating + halogen-free molding resin
- Epoxy meets UL94, V0

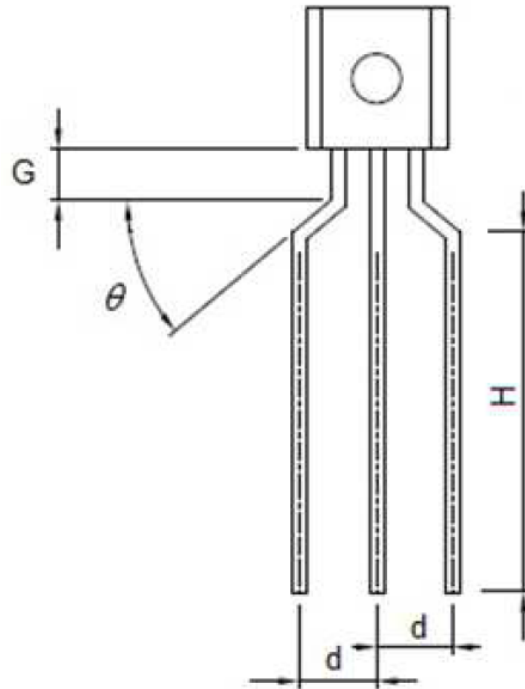**Figure 13. TO-92 with leads preform (plastic) package outline**



**Table 6. TO-92 with leads preform (plastic) package mechanical data**

| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches[1] | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| G | 1.30 | 1.70 | 2.00 | 0.051 | 0.067 | 0.079 |
| H | 7.69 | | 9.69 | 0.303 | | 0.381 |
| d | 2.40 | | 2.90 | 0.094 | | 0.114 |
| θ | 30° | 40° | 50° | 30° | 40° | 50° |

1. Inches dimensions given for information

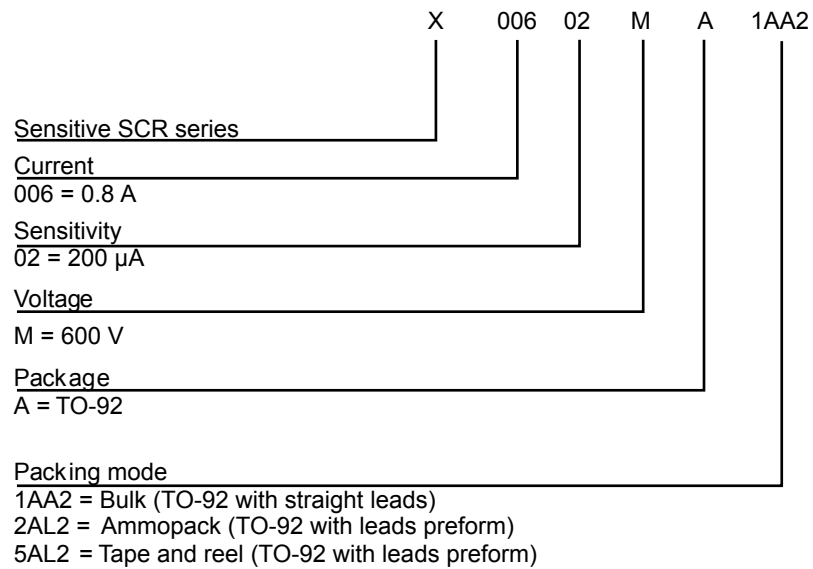# 3 Ordering information

**Figure 14. Ordering information scheme**

```
          X    006   02   M   A   1AA2
```

Sensitive SCR series

Current
006 = 0.8 A

Sensitivity
02 = 200 µA

Voltage
M = 600 V

Package
A = TO-92

Packing mode
1AA2 = Bulk (TO-92 with straight leads)
2AL2 = Ammopack (TO-92 with leads preform)
5AL2 = Tape and reel (TO-92 with leads preform)

**Table 7. Ordering information**

| Order code | Marking | Package | Weight | Base qty. | Delivery mode |
|---|---|---|---|---|---|
| X00602MA 1AA2 | X0602 MA | TO-92 straight leads | 0.2 g | 2500 | Bulk |
| X00602MA 2AL2 | | TO-92 leads preform | 0.2 g | 2000 | Ammopack |
| X00602MA 5AL2 | | | 0.2 g | 2000 | Tape and reel |

# Revision history

Table 8. **Document revision history**

| Date | Revision | Changes |
|------|----------|---------|
| 26-May-2009 | 3 | Last update. |
| 03-May-2012 | 4 | SOT-223 package added. |
| 03-Sep-2021 | 5 | Reformatted to current standards. Device X00605 removed. Updated dimensions in Table 5. |
| 18-Jan-2022 | 6 | Removed SOT-223 package information. Added Section 2.2  TO-92 with leads preform (plastic) package information. |

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