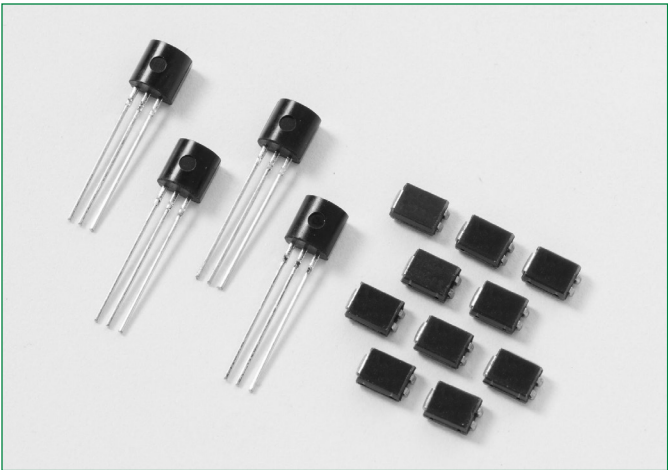
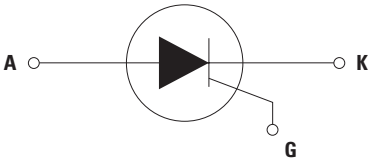


# EC103xx and SxSx Series

0.8 A Sensitive SCRs



## Schematic Symbol



## Description:

Excellent unidirectional switches for phase control applications such as heating and motor speed controls.

Sensitive gate SCRs are easily triggered with microAmps of current as furnished by sense coils, proximity switches, and microprocessors.

## Features and Benefits:

- RoHS compliant
- Voltage capability up to 600 V
- Glass-passivated junctions
- Surge capability up to 20 A

## Applications:

Typical applications are capacitive discharge systems for strobe lights and gas engine ignition. Also controls for power tools, home/brown goods and white goods appliances.

## Product Summary

| Characteristic    | Value      | Unit    |
|-------------------|------------|---------|
| $I_{T(RMS)}$      | 0.8        | A       |
| $V_{DRM}/V_{RRM}$ | 400 to 600 | V       |
| $I_{GT}$          | 12 to 500  | $\mu A$ |

## Absolute Maximum Ratings – Sensitive SCRs

| Symbol       | Characteristics                           | Conditions                                                                       | Value      | Units                  |
|--------------|-------------------------------------------|----------------------------------------------------------------------------------|------------|------------------------|
| $I_{T(RMS)}$ | RMS On-state Current                      | $T_C = 75^\circ\text{C}$                                                         | 0.8        | A                      |
| $I_{T(AV)}$  | Average On-state Current                  | $T_C = 75^\circ\text{C}$                                                         | 0.51       |                        |
| $I_{TSM}$    | Peak Non-repetitive Surge Current         | Single Half Cycle, $f = 50\text{ Hz}$ , $T_J(\text{initial}) = 25^\circ\text{C}$ | 16         | A                      |
|              |                                           | Single Half Cycle, $f = 60\text{ Hz}$ , $T_J(\text{initial}) = 25^\circ\text{C}$ | 20         |                        |
| $I^2t$       | $I^2t$ Value for Fusing                   | $t_p = 8.3\text{ ms}$                                                            | 1.6        | $\text{A}^2\text{s}$   |
| $di/dt$      | Critical Rate-of-Rise of On-state Current | $T_J = 110^\circ\text{C}$<br>$f = 60\text{ Hz}$                                  | 50         | $\text{A}/\mu\text{s}$ |
| $I_{GM}$     | Peak Gate Current                         | $T_J = 110^\circ\text{C}$                                                        | 1          | A                      |
| $P_{G(AV)}$  | Average Gate Power Dissipation            | $T_J = 110^\circ\text{C}$                                                        | 0.1        | W                      |
| $T_{stg}$    | Storage Temperature Range                 | –                                                                                | –40 to 150 | $^\circ\text{C}$       |
| $T_J$        | Operating Junction Temperature Range      | –                                                                                | –40 to 110 | $^\circ\text{C}$       |

Electrical Characteristics ( $T_J = 25^\circ\text{C}$  unless otherwise specified)

| Symbol    | Characteristic                             | Conditions                                                                                                         |      | Value           |                 |                          |                 | Unit                   |
|-----------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------|------|-----------------|-----------------|--------------------------|-----------------|------------------------|
|           |                                            |                                                                                                                    |      | SxS1<br>EC103X1 | SxS2<br>EC103X2 | SxS/<br>2N6565<br>EC103X | SxS3<br>EC103X3 |                        |
| $I_{GT}$  | Gate Trigger Current                       | $V_D = 6\text{ V}$ $R_L = 100\ \Omega$                                                                             | Max. | 12              | 50              | 200                      | 500             | $\mu\text{A}$          |
| $V_{GT}$  | Gate Trigger Voltage                       |                                                                                                                    | Max. | 0.8             |                 |                          |                 | V                      |
| $V_{GRM}$ | Peak Reverse Gate Voltage                  | $I_{RG} = 10\ \mu\text{A}$                                                                                         | Min. | 5               |                 |                          |                 | V                      |
| $dv/dt$   | Critical Rate of Rise of Off-stage Voltage | $V_D = V_{DRM}$ ; $R_{GK} = 1\text{ k}\Omega$                                                                      | Min. | 20              | 25              | 30                       | 40              | $\text{V}/\mu\text{s}$ |
|           |                                            |                                                                                                                    |      | 10              | 10              | 15                       | 20              |                        |
| $V_{GD}$  | Gate Non-trigger Voltage                   | $V_D = V_{DRM}$ ; $R_L = 3.3\text{ k}\Omega$ $T_J = 110^\circ\text{C}$                                             | Min. | 0.2             | 0.25            |                          |                 | V                      |
| $I_H$     | Holding Current                            | $I_T = 20\text{ mA}$ (initial); $R_{GK} = 1\text{ k}\Omega$                                                        | Max. | 5               |                 |                          | 8               | mA                     |
| $t_q$     | Turn-off Time                              | $I_T = 1\text{ A}$ ; $t_p = 50\ \mu\text{s}$ ; $dv/dt = 5\text{ V}/\mu\text{s}$ ; $di/dt = 5\text{ A}/\mu\text{s}$ | Max. | 60              |                 | 50                       | 45              | $\mu\text{s}$          |
| $t_{gt}$  | Turn-on Time                               | $I_G = 2 \times I_{GT}$ $P_W = 15\ \mu\text{s}$ $I_T = 1.6\text{ A}$                                               | Typ. | 2               | 5               | 20                       | 30              | $\mu\text{s}$          |

## Static Characteristics

| Symbol                             | Characteristic                    | Conditions                                                   |                        | Value |      |      | Unit |
|------------------------------------|-----------------------------------|--------------------------------------------------------------|------------------------|-------|------|------|------|
|                                    |                                   |                                                              |                        | Min.  | Typ. | Max. |      |
| V <sub>TM</sub>                    | Peak On-state Voltage Drop        | I <sub>T</sub> = 1.2A; t <sub>p</sub> = 380 μs               |                        | –     | –    | 1.4  | V    |
| I <sub>DRM</sub> /I <sub>RRM</sub> | Repetitive Peak Off-state Current | V <sub>DRM</sub> = V <sub>RRM</sub><br>R <sub>GK</sub> = 1kΩ | T <sub>J</sub> = 25°C  | –     | –    | 1    | μA   |
|                                    |                                   |                                                              | T <sub>J</sub> = 100°C | –     | –    | 50   |      |
|                                    |                                   |                                                              | T <sub>J</sub> = 110°C | –     | –    | 100  |      |

## Thermal Resistances

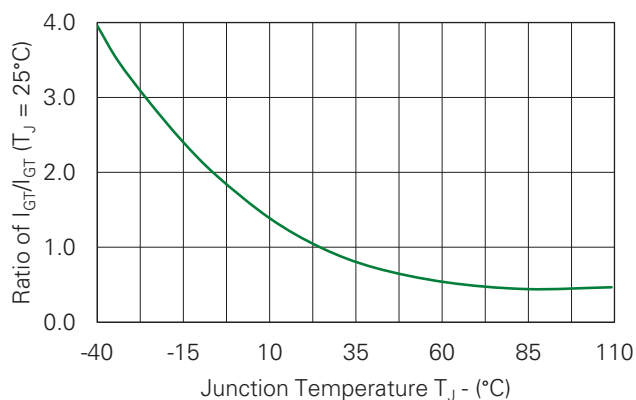
| Symbol           | Characteristic                            | Conditions                  | Value           | Unit                      |
|------------------|-------------------------------------------|-----------------------------|-----------------|---------------------------|
| $R_{\theta(JC)}$ | Thermal Resistance, Junction to case (AC) | EC103xy/2N6565 <sup>2</sup> | 75              | $^\circ\text{C}/\text{W}$ |
|                  |                                           | SxSy <sup>2</sup>           | 60 <sup>1</sup> |                           |
| $R_{\theta(JA)}$ | Thermal Resistance, Junction to ambient   | EC103xy/2N6565 <sup>2</sup> | 160             | $^\circ\text{C}/\text{W}$ |

Notes 1: Mounted on 1 cm<sup>2</sup> copper (two-ounce) foil surface

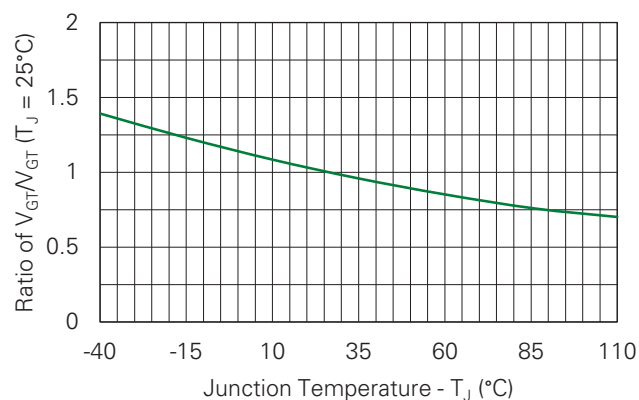
2: x = voltage, y = sensitivity

## Characteristic Curves

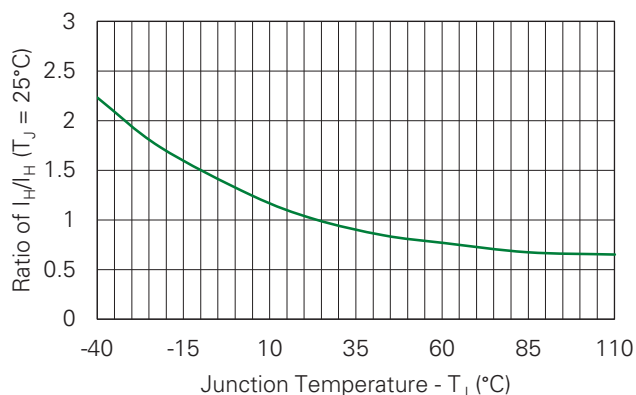
**Fig. 1. Normalized DC Gate Trigger Current vs. Junction Temperature**



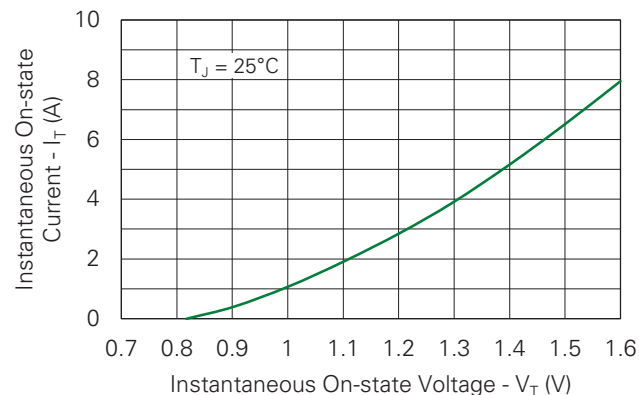
**Fig. 2. Normalized DC Gate Trigger Voltage vs. Junction Temperature**



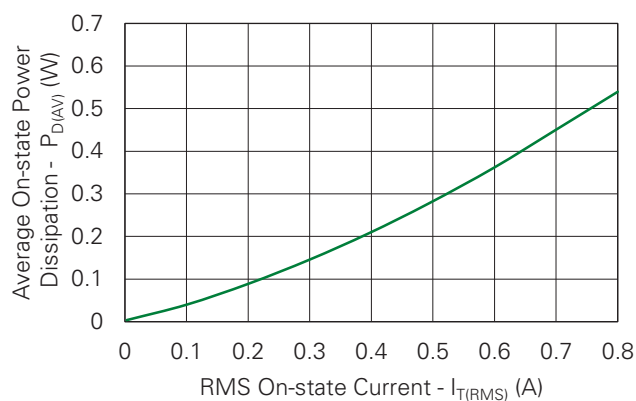
**Fig. 3. Normalized DC Holding Current vs. Junction Temperature**



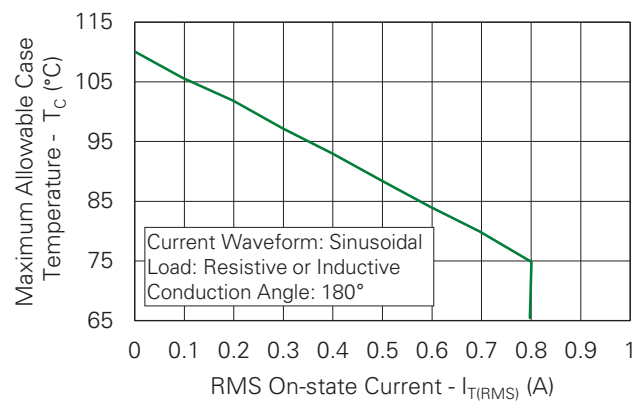
**Fig. 4. Typical On-state Current vs. On-state Voltage**

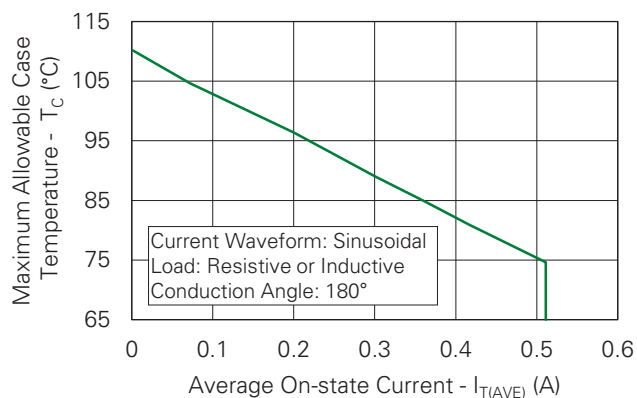
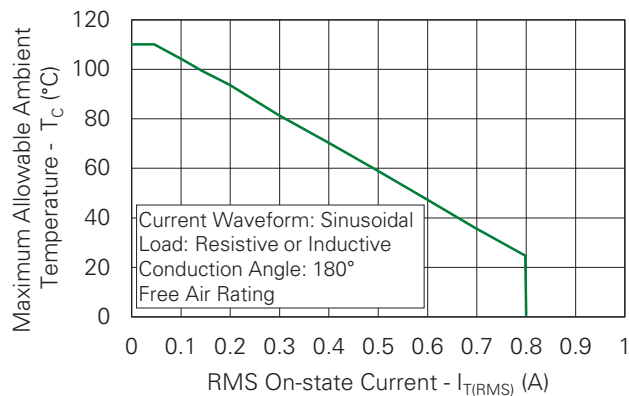
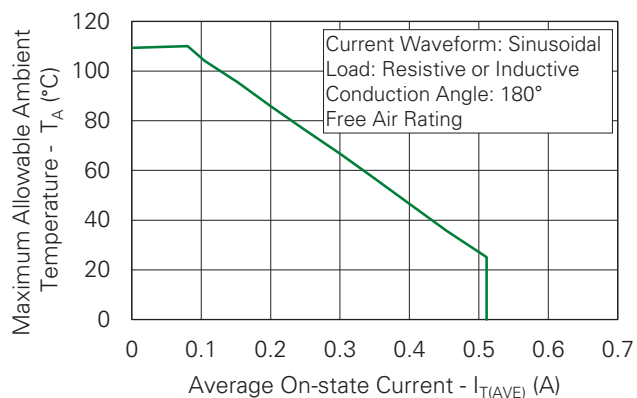
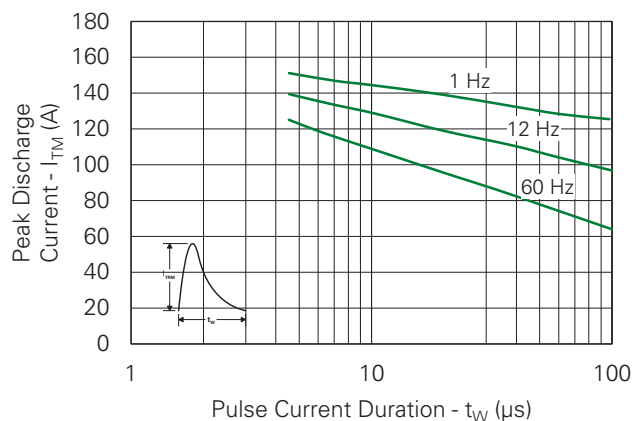
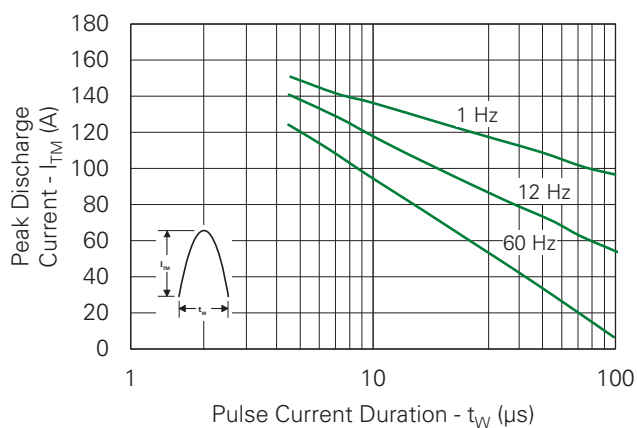


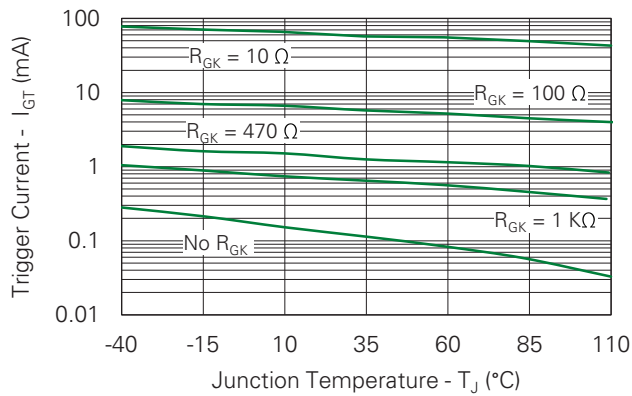
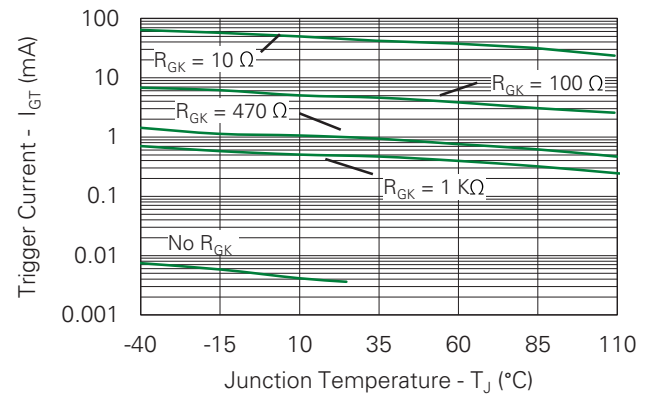
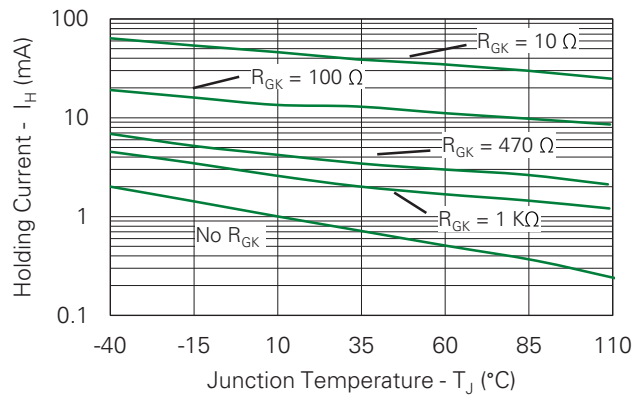
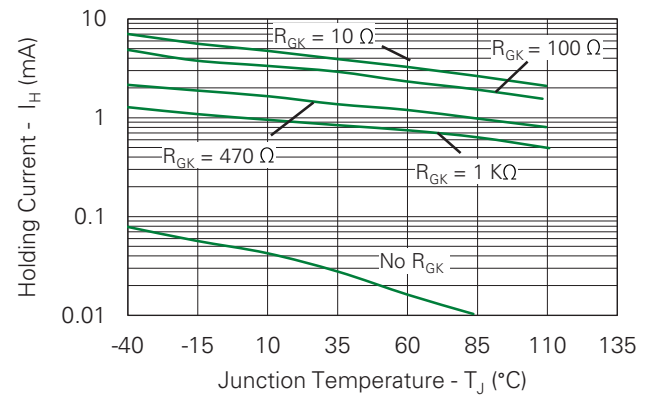
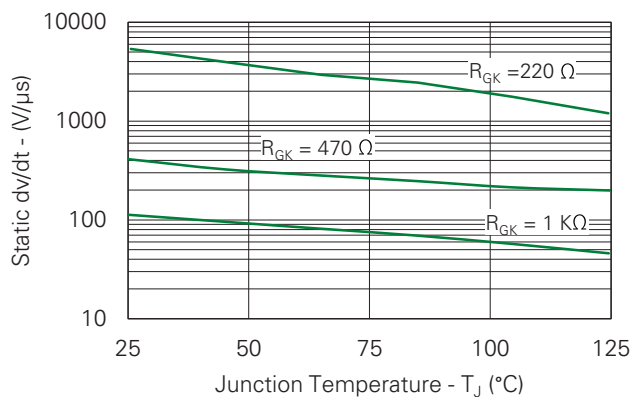
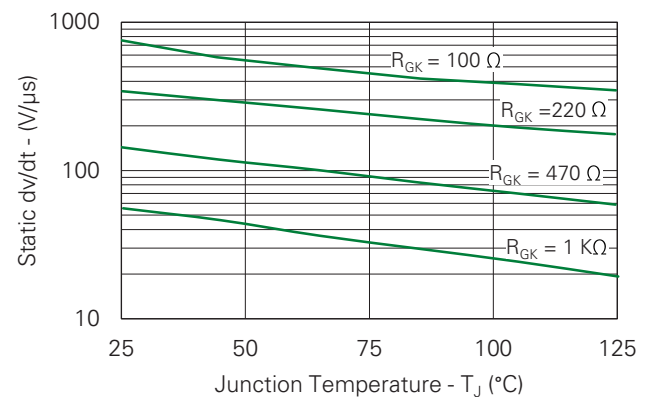
**Fig. 5. Typical Power Dissipation vs. RMS On-state Current**



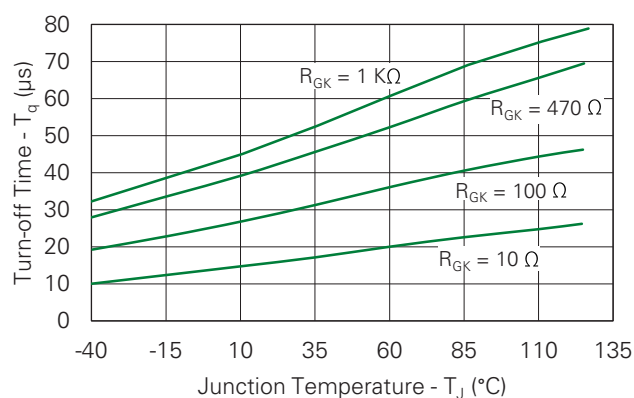
**Fig. 6. Maximum Allowable Case Temperature vs. RMS On-state Current**



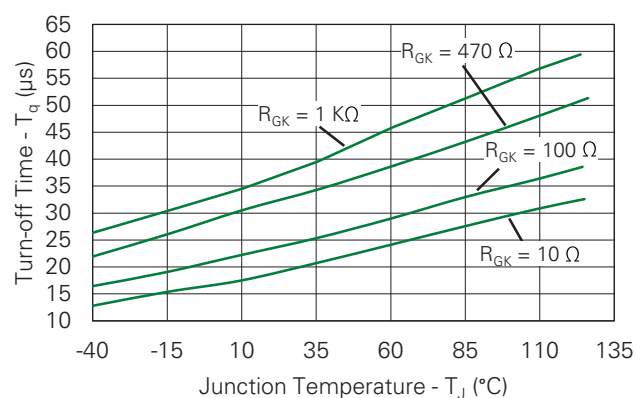
**Fig. 7. Maximum Allowable Case Temperature vs. Average On-state Current****Fig. 8. Maximum Allowable Ambient Temperature vs. RMS On-state Current****Fig. 9. Maximum Allowable Ambient Temperature vs. Average On-state Current****Fig. 10. Peak Capacitor Discharge Current****Fig. 11. Peak Repetitive Sinusoidal Pulse Current**

**Fig. 12-1. Typical DC Gate Trigger Current with  $R_{GK}$  vs. Junction Temperature for EC103x****Fig. 12-2. Typical DC Gate Trigger Current with  $R_{GK}$  vs. Junction Temperature for EC103x1****Fig. 13-1. Typical DC Holding Current with  $R_{GK}$  vs. Junction Temperature for EC103x****Fig. 13-2. Typical DC Holding Current with  $R_{GK}$  vs. Junction Temperature for EC103x1****Fig. 14-1. Typical Static dv/dt with  $R_{GK}$  vs. Junction Temperature for EC103x****Fig. 14-2. Typical Static dv/dt with  $R_{GK}$  vs. Junction Temperature for EC103x1**

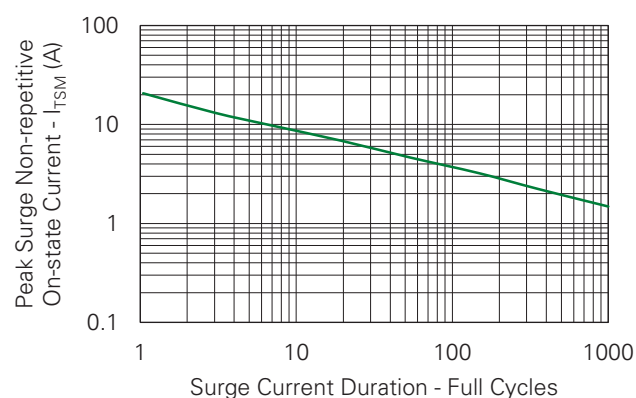
**Fig. 15-1. Typical turn-off time with  $R_{GK}$  vs. Junction Temperature for EC103x**



**Fig. 15-2. Typical turn-off time with  $R_{GK}$  vs. Junction Temperature for EC103x1**



**Fig. 16. Surge Peak On-state Current vs. Number of Cycles**



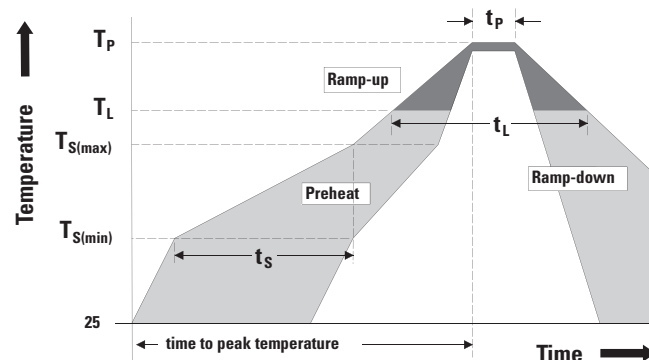
SUPPLY FREQUENCY: 60 Hz Sinusoidal  
 LOAD: Resistive  
 RMS On-State Current:  $[I_{T(RMS)}]$ : Maximum Rated Value at Specified Case Temperature

**Notes:**

1. Gate control may be lost during and immediately following surge current interval.
2. Overload may not be repeated until junction temperature has returned to steady-state rated value.

## Soldering Parameters

| Characteristic                                        |                                  | Value                   |
|-------------------------------------------------------|----------------------------------|-------------------------|
| Reflow Condition                                      |                                  | Pb – Free assembly      |
| Pre-heat                                              | Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|                                                       | Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|                                                       | Time (min to max) ( $t_s$ )      | 60 – 120 secs           |
| Average ramp up rate (Liquidus Temp)( $T_L$ ) to peak |                                  | 3°C/second max          |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                  |                                  | 3°C/second max          |
| Reflow                                                | Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|                                                       | Time ( $t_L$ )                   | 60 – 150 seconds        |
| Peak Temperature ( $T_p$ )                            |                                  | 260 <sup>+0/-5</sup> °C |
| Time within 5°C of actual peak Temperature ( $t_p$ )  |                                  | 30 seconds max          |
| Ramp-down Rate                                        |                                  | 6°C/second max          |
| Time 25°C to peak Temperature ( $T_p$ )               |                                  | 8 minutes max           |
| Do Not Exceed                                         |                                  | 260°C                   |



## Physical Specifications

| Characteristic  | Value                                                  |
|-----------------|--------------------------------------------------------|
| Terminal Finish | 100% Matte Tin-plated/ Pb-free Solder Dipped           |
| Body Material   | UL Recognized compound meeting flammability rating V-0 |
| Lead Material   | Copper Alloy                                           |

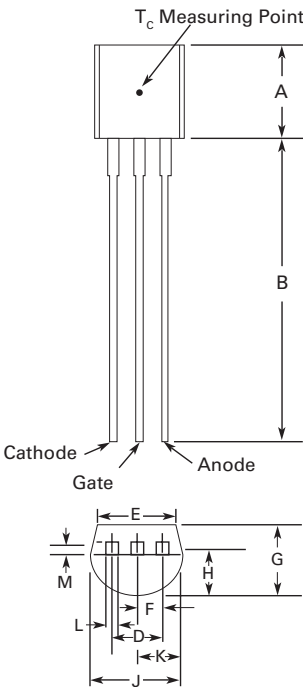
## Design Considerations

Careful selection of the correct component for the application's operating parameters and environment will go a long way toward extending the operating life of the Thyristor. Good design practice should limit the maximum continuous current through the main terminals to 75% of the component rating. Other ways to ensure long life for a power discrete semiconductor are proper heat sinking and selection of voltage ratings for worst case conditions. Overheating, overvoltage (including dv/dt), and surge currents are the main killers of semiconductors. Correct mounting, soldering, and forming of the leads also help protect against component damage.

## Environmental Specifications

| Test                      | Specifications and Conditions                                                |
|---------------------------|------------------------------------------------------------------------------|
| AC Blocking               | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @110°C for 1008 hours    |
| Temperature/Humidity      | EIA / JEDEC, JESD22-A101, 1008 hours; 320V - DC: 85°C; 85% relative humidity |
| Temperature Cycling       | MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C; 15-min dwell-time          |
| High Temp Storage         | MIL-STD-750, M-1031, 1008 hours, 150°C                                       |
| Low Temp Storage          | 1008 hours, -40°C                                                            |
| Resistance to Solder Heat | MIL-STD-750 Method 2031                                                      |
| Solderability             | ANSI/J-STD-002, category 3, Test A                                           |
| Lead Bend                 | MIL-STD-750, M-2036 Cond E                                                   |

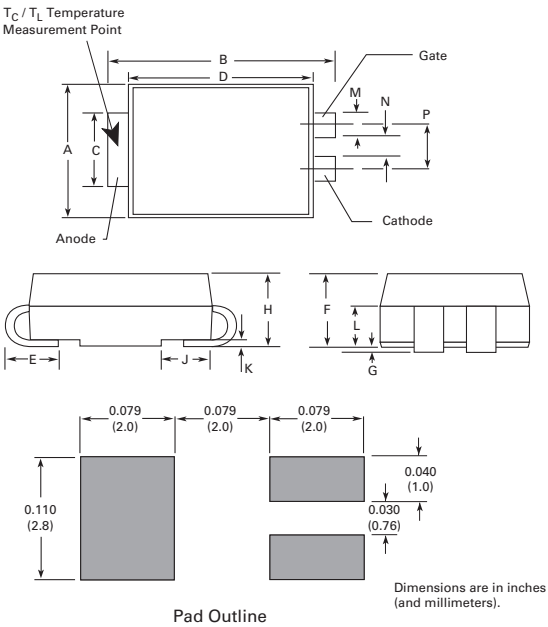
Part Outline Drawing (TO-92) (E Package)



| Symbol | Inches |         |       | Millimeters |         |      |
|--------|--------|---------|-------|-------------|---------|------|
|        | Min.   | Typical | Max.  | Min.        | Typical | Max  |
| A      | 0.176  | –       | 0.196 | 4.47        | –       | 4.98 |
| B      | 0.500  | –       | –     | 12.70       | –       | –    |
| D      | 0.095  | –       | 0.105 | 2.41        | –       | 2.67 |
| E      | 0.150  | –       | –     | 3.81        | –       | –    |
| F      | 0.046  | –       | 0.054 | 1.16        | –       | 1.37 |
| G      | 0.135  | –       | 0.145 | 3.43        | –       | 3.68 |
| H      | 0.088  | –       | 0.096 | 2.23        | –       | 2.44 |
| J      | 0.176  | –       | 0.186 | 4.47        | –       | 4.73 |
| K      | 0.088  | –       | 0.096 | 2.23        | –       | 2.44 |
| L      | 0.013  | –       | 0.019 | 0.33        | –       | 0.48 |
| M      | 0.013  | –       | 0.017 | 0.33        | –       | 0.43 |

All leads insulated from case. Case is electrically nonconductive.

Part Outline Drawing (Compak) (C Package)



| Symbol | Inches |         |       | Millimeters |         |      |
|--------|--------|---------|-------|-------------|---------|------|
|        | Min.   | Typical | Max.  | Min.        | Typical | Max  |
| A      | 0.130  | –       | 0.156 | 3.30        | –       | 3.95 |
| B      | 0.201  | –       | 0.220 | 5.10        | –       | 5.60 |
| C      | 0.077  | –       | 0.087 | 1.95        | –       | 2.20 |
| D      | 0.159  | –       | 0.181 | 4.05        | –       | 4.60 |
| E      | 0.030  | –       | 0.063 | 0.75        | –       | 1.60 |
| F      | 0.075  | –       | 0.096 | 1.90        | –       | 2.45 |
| G      | 0.002  | –       | 0.008 | 0.05        | –       | 0.20 |
| H      | 0.077  | –       | 0.104 | 1.95        | –       | 2.65 |
| J      | 0.043  | –       | 0.053 | 1.09        | –       | 1.35 |
| K      | 0.006  | –       | 0.016 | 0.15        | –       | 0.41 |
| L      | 0.030  | –       | 0.055 | 0.76        | –       | 1.40 |
| M      | 0.022  | –       | 0.028 | 0.56        | –       | 0.71 |
| N      | 0.027  | –       | 0.033 | 0.69        | –       | 0.84 |
| P      | 0.052  | –       | 0.058 | 1.32        | –       | 1.47 |

## Product Selector

| Part Number | Voltage    |       | Gate Sensitivity | Type          | Package |
|-------------|------------|-------|------------------|---------------|---------|
|             | 400 V      | 600 V |                  |               |         |
| EC103 x 1   | X          | X     | 12 $\mu$ A       | Sensitive SCR | TO-92   |
| EC103 x 2   | X          | X     | 50 $\mu$ A       | Sensitive SCR | TO-92   |
| EC103 x     | X / 2N6565 | X     | 200 $\mu$ A      | Sensitive SCR | TO-92   |
| EC103 x 3   | X          | X     | 500 $\mu$ A      | Sensitive SCR | TO-92   |
| S x S1      | X          | X     | 12 $\mu$ A       | Sensitive SCR | Compak  |
| S x S2      | X          | X     | 50 $\mu$ A       | Sensitive SCR | Compak  |
| S x S       | X          | X     | 200 $\mu$ A      | Sensitive SCR | Compak  |
| S x S3      | X          | X     | 500 $\mu$ A      | Sensitive SCR | Compak  |

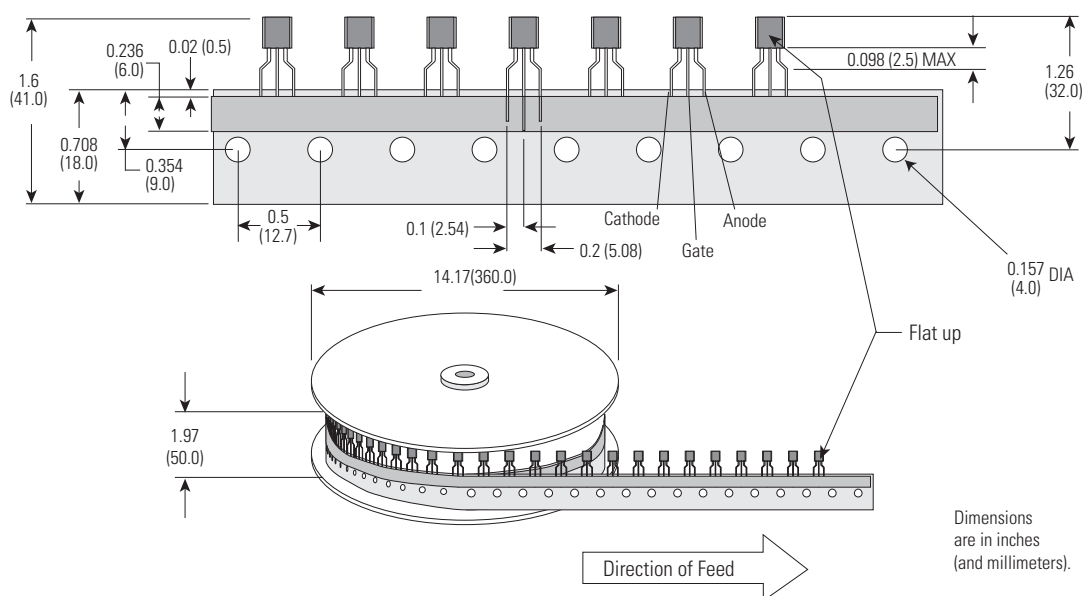
**Note:** x = voltage

## Packing Options

| Part Number     | Marking         | Weight | Packing Mode     | Base Quantity |
|-----------------|-----------------|--------|------------------|---------------|
| EC103xy/ 2N6565 | EC103xy/ 2N6565 | 0.19 g | Bulk             | 2000          |
| EC103xyRP       | EC103xy         | 0.19 g | Reel Pack        | 2000          |
| EC103xyAP       | EC103xy         | 0.19 g | Ammo Pack        | 2000          |
| SxSyRP          | SxSy            | 0.08 g | Embossed Carrier | 2500          |

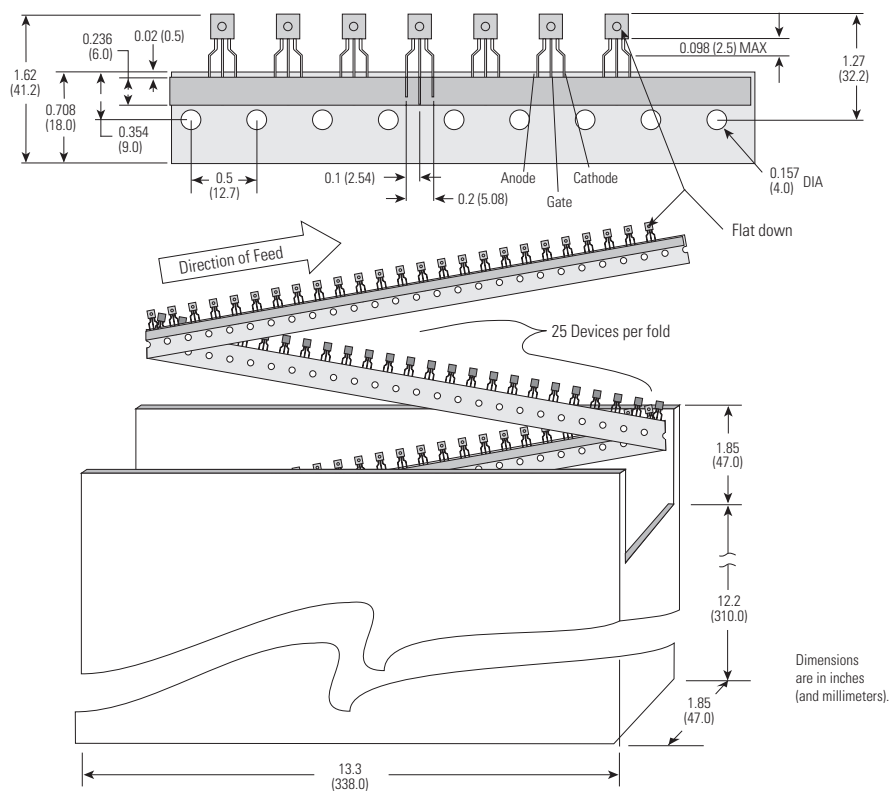
**Note:** x = voltage, y = sensitivity

## TO-92 (3-lead) Reel Pack (RP) Radial Leaded Specifications Meets all EIA-468-C Standards



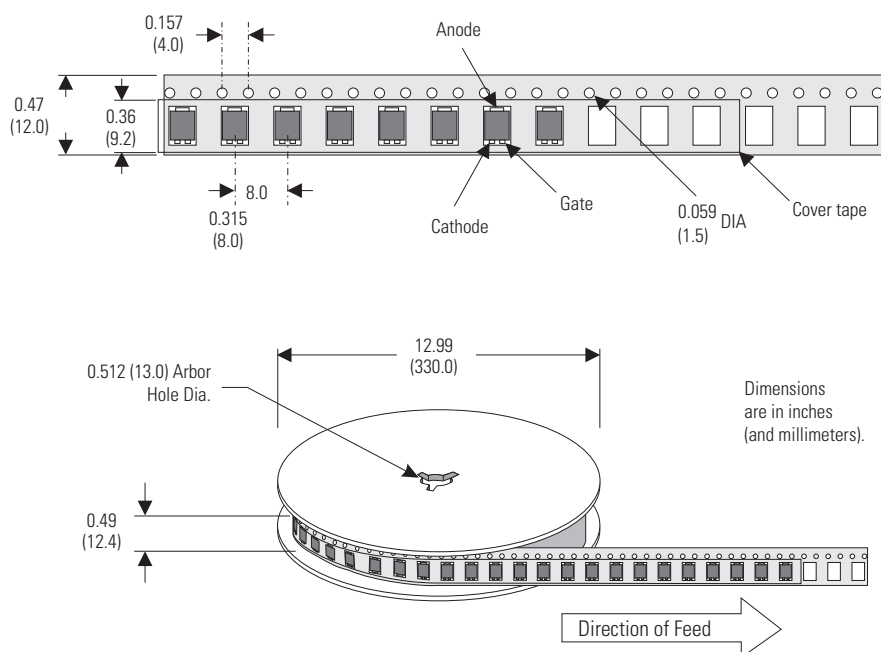
## TO-92 (3-lead) Ammo Pack (AP) Radial Leaded Specifications

Meets all EIA-468-C Standards

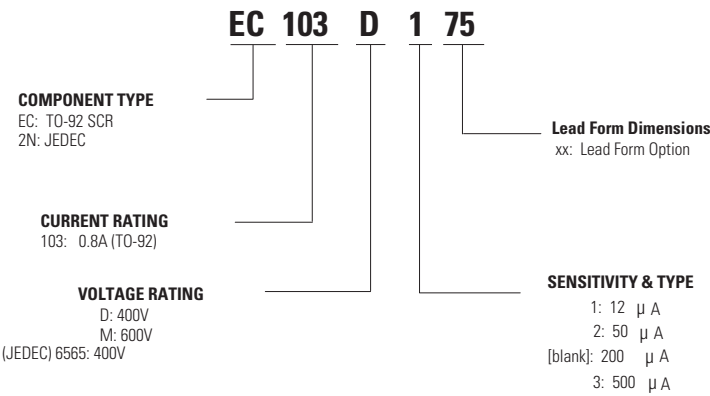


## Compak Embossed Carrier Reel Pack (RP) Specifications

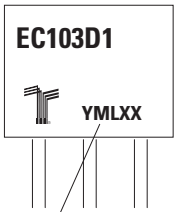
Meets all EIA-481-1 Standards



Part Numbering and Marking (TO-92)

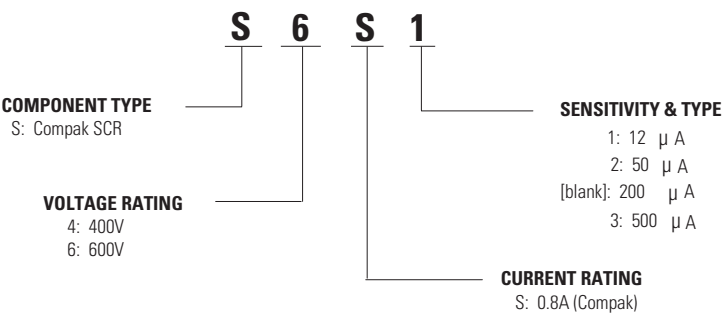


TO-92 (E Package)



Date Code Marking  
Y: Year Code  
M: Month Code  
L: Location Code  
XX: Lot Serial Code

Part Numbering and Marking (Compak)



Compak (C Package)



Date Code Marking  
Y: Year Code  
M: Month Code  
XXX: Lot Trace Code

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Part of:

