

# 2N6394 Series

## Silicon Controlled Rectifiers Reverse Blocking Thyristors

Designed primarily for half-wave ac control applications, such as motor controls, heating controls and power supplies.

### Features

- Glass Passivated Junctions with Center Gate Geometry for Greater Parameter Uniformity and Stability
- Small, Rugged, Thermowatt Construction for Low Thermal Resistance, High Heat Dissipation and Durability
- Blocking Voltage to 800 V
- These are Pb-Free Devices

### MAXIMUM RATINGS<sup>†</sup> (T<sub>J</sub> = 25°C unless otherwise noted)

| Rating  | Symbol                                 | Value                   | Unit             |
|---|--|-------------------------|------------------|
| Peak Repetitive Off-State Voltage (Note 1)<br>(T <sub>J</sub> = -40 to 125°C, Sine Wave,<br>50 to 60 Hz, Gate Open) | V <sub>DRM</sub> ,<br>V <sub>RRM</sub> | 50<br>100<br>400<br>800 | V                |
| On-State RMS Current<br>(180° Conduction Angles; T <sub>C</sub> = 90°C)   | I <sub>T(RMS)</sub>                    | 12                      | A                |
| Peak Non-Repetitive Surge Current<br>(1/2 Cycle, Sine Wave, 60 Hz, T <sub>J</sub> = 90°C)                           | I <sub>TSM</sub>                       | 100                     | A                |
| Circuit Fusing (t = 8.3 ms)   | I <sup>2</sup> t                       | 40                      | A <sup>2</sup> s |
| Forward Peak Gate Power<br>(Pulse Width ≤ 1.0 μs, T <sub>C</sub> = 90°C)  | P <sub>GM</sub>                        | 20                      | W                |
| Forward Average Gate Power<br>(t = 8.3 ms, T <sub>C</sub> = 90°C)   | P <sub>G(AV)</sub>                     | 0.5                     | W                |
| Forward Peak Gate Current<br>(Pulse Width ≤ 1.0 μs, T <sub>C</sub> = 90°C)  | I <sub>GM</sub>                        | 2.0                     | A                |
| Operating Junction Temperature Range  | T <sub>J</sub>                         | -40 to +125             | °C               |
| Storage Temperature Range   | T <sub>stg</sub>                       | -40 to +150             | °C               |

### MAXIMUM RATINGS<sup>†</sup> (T<sub>J</sub> = 25°C unless otherwise noted)

| Rating   | Symbol           | Max | Unit |
|--|------------------|-----|------|
| Thermal Resistance, Junction-to-Case   | R <sub>θJC</sub> | 2.0 | °C/W |
| Maximum Lead Temperature for Soldering<br>Purposes 1/8" from Case for 10 Seconds | T <sub>L</sub>   | 260 | °C   |

<sup>†</sup>Indicates JEDEC Registered Data

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. V<sub>DRM</sub> and V<sub>RRM</sub> for all types can be applied on a continuous basis. Ratings apply for zero or negative gate voltage; however, positive gate voltage shall not be applied concurrent with negative potential on the anode. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.



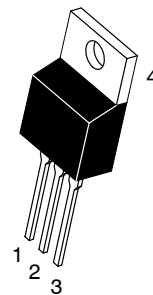
ON Semiconductor®

<http://onsemi.com>

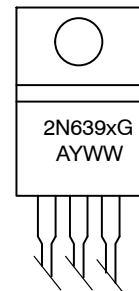
SCRs  
12 AMPERES RMS  
50 thru 800 VOLTS



### MARKING DIAGRAM



TO-220AB  
CASE 221A  
STYLE 3



2N639x = Device Code  
x = 4, 5, 7, or 9  
G = Pb-Free Package  
A = Assembly Location  
Y = Year  
WW = Work Week

### PIN ASSIGNMENT

| Pin | Assignment |
|-----|------------|
| 1   | Cathode    |
| 2   | Anode      |
| 3   | Gate       |
| 4   | Anode      |

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

# 2N6394 Series

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|   |                                     |                        |   |   |     |    |
|---|-------------------------------------|------------------------|---|---|-----|----|
| †Peak Repetitive Forward or Reverse Blocking Current (V <sub>AK</sub> = Rated V <sub>DRM</sub> or V <sub>RDM</sub> , Gate Open) | I <sub>DRM</sub> , I <sub>RDM</sub> | T <sub>J</sub> = 25°C  | - | - | 10  | μA |
|   |                                     | T <sub>J</sub> = 125°C | - | - | 2.0 | mA |

### ON CHARACTERISTICS

|  |                 |  |     |          |         |
|--|-----------------|--|-----|----------|---------|
| †Peak Forward On-State Voltage (Note 2) (I <sub>TM</sub> = 24 A Peak)                                      | V <sub>TM</sub> | -  | 1.7 | 2.2      | V       |
| †Gate Trigger Current (Continuous dc) (V <sub>D</sub> = 12 Vdc, R <sub>L</sub> = 100 Ohms)                 | I <sub>GT</sub> | -  | 5.0 | 30       | mA      |
| †Gate Trigger Voltage (Continuous dc) (V <sub>D</sub> = 12 Vdc, R <sub>L</sub> = 100 Ohms)                 | V <sub>GT</sub> | -  | 0.7 | 1.5      | V       |
| Gate Non-Trigger Voltage (V <sub>D</sub> = 12 Vdc, R <sub>L</sub> = 100 Ohms, T <sub>J</sub> = 125°C)      | V <sub>GD</sub> | 0.2  | -   | -        | V       |
| †Holding Current (V <sub>D</sub> = 12 Vdc, Initiating Current = 200 mA, Gate Open)                         | I <sub>H</sub>  | -  | 6.0 | 50       | mA      |
| Turn-On Time (I <sub>TM</sub> = 12 A, I <sub>GT</sub> = 40 mAdc, V <sub>D</sub> = Rated V <sub>DRM</sub> ) | t <sub>gt</sub> | -  | 1.0 | 2.0      | μs      |
| Turn-Off Time (V <sub>D</sub> = Rated V <sub>DRM</sub> )   | t <sub>q</sub>  | (I <sub>TM</sub> = 12 A, I <sub>R</sub> = 12 A)<br>(I <sub>TM</sub> = 12 A, I <sub>R</sub> = 12 A, T <sub>J</sub> = 125°C) | -   | 15<br>35 | -<br>μs |

### DYNAMIC CHARACTERISTICS

|   |       |   |    |   |      |
|---|-------|---|----|---|------|
| Critical Rate-of-Rise of Off-State Voltage Exponential (V <sub>D</sub> = Rated V <sub>DRM</sub> , T <sub>J</sub> = 125°C) | dv/dt | - | 50 | - | V/μs |
|---|-------|---|----|---|------|

† Indicates JEDEC Registered Data

2. Pulse Test: Pulse Width ≤ 300 μsec, Duty Cycle ≤ 2%.

## Voltage Current Characteristic of SCR

| Symbol           | Parameter                                 |
|------------------|---|
| V <sub>DRM</sub> | Peak Repetitive Off State Forward Voltage |
| I <sub>DRM</sub> | Peak Forward Blocking Current             |
| V <sub>RDM</sub> | Peak Repetitive Off State Reverse Voltage |
| I <sub>RDM</sub> | Peak Reverse Blocking Current             |
| V <sub>TM</sub>  | Peak On State Voltage                     |
| I <sub>H</sub>   | Holding Current                           |

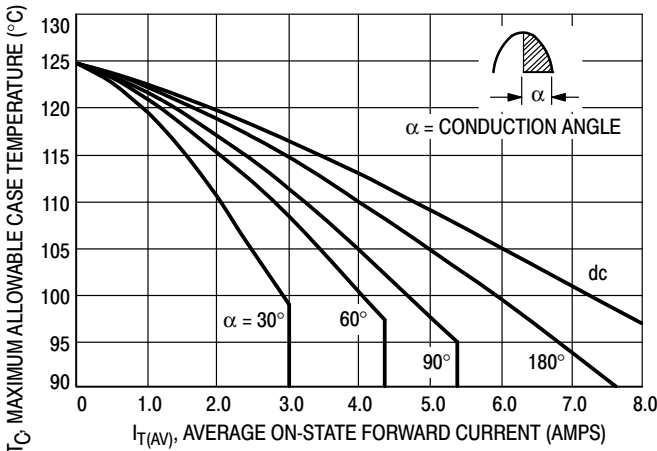
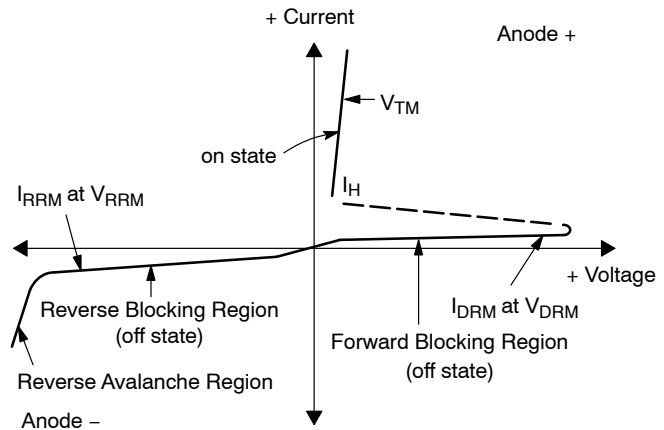


Figure 1. Current Derating

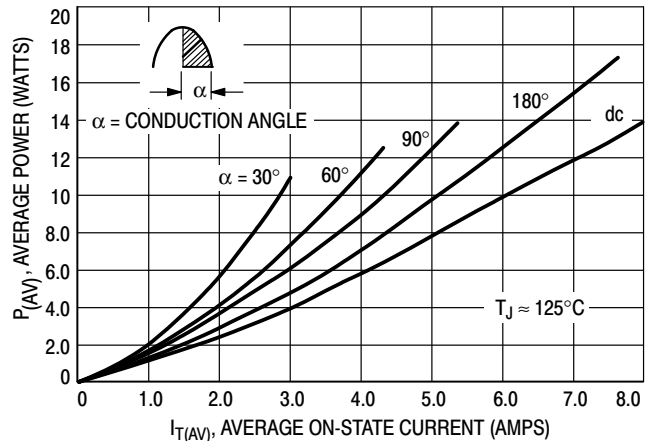
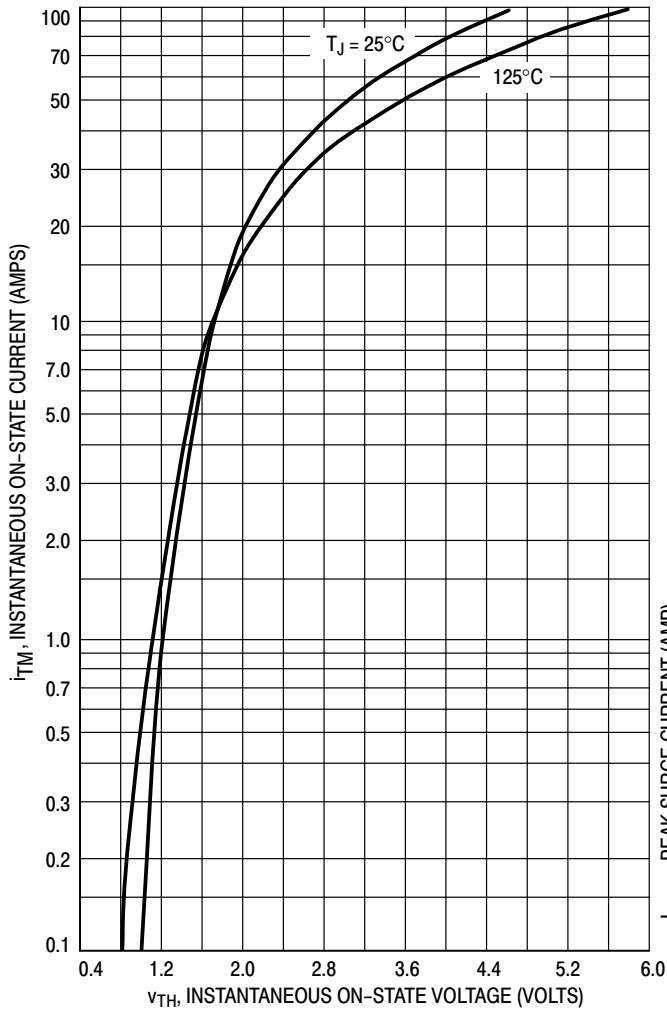
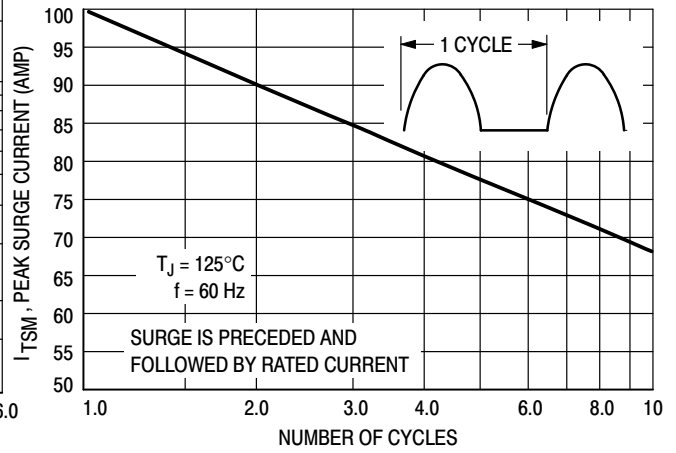


Figure 2. Maximum On-State Power Dissipation

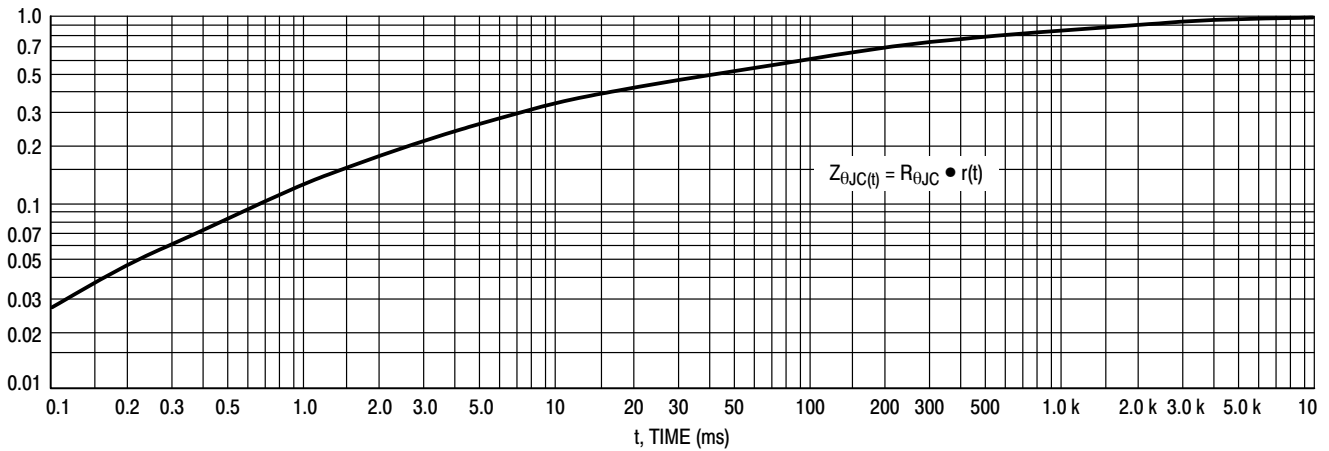
# 2N6394 Series



**Figure 3. On-State Characteristics**



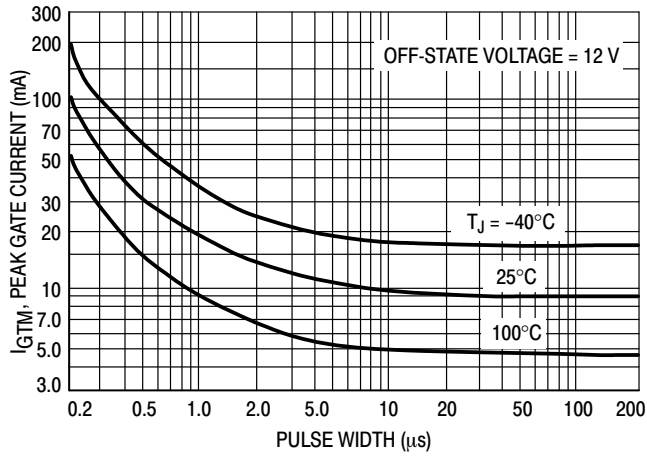
**Figure 4. Maximum Non-Repetitive Surge Current**



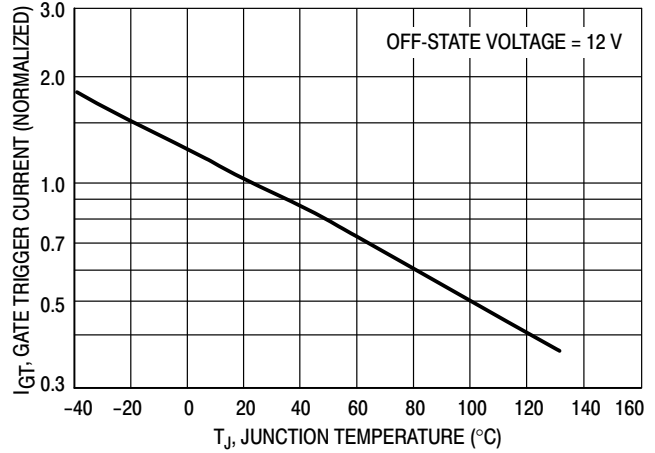
**Figure 5. Thermal Response**

# 2N6394 Series

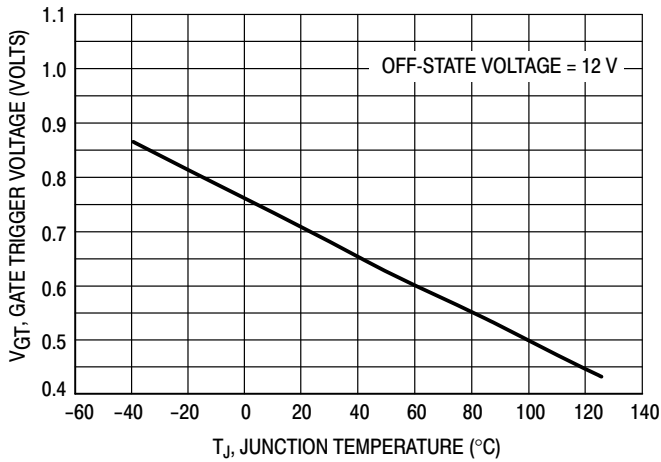
## TYPICAL CHARACTERISTICS



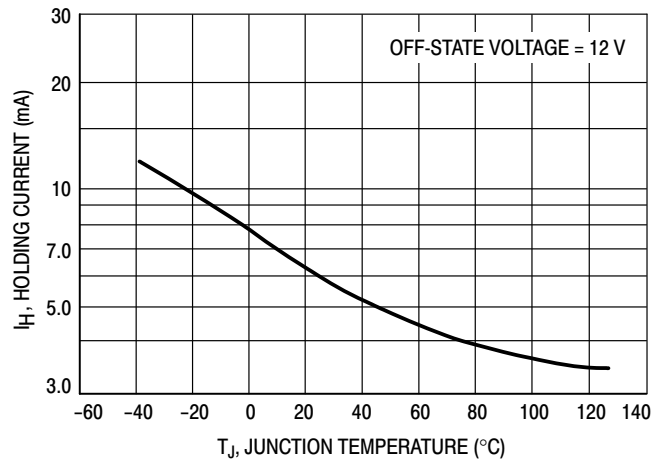
**Figure 6. Typical Gate Trigger Current versus Pulse Width**



**Figure 7. Typical Gate Trigger Current versus Temperature**



**Figure 8. Typical Gate Trigger Voltage versus Temperature**



**Figure 9. Typical Holding Current versus Temperature**

## ORDERING INFORMATION

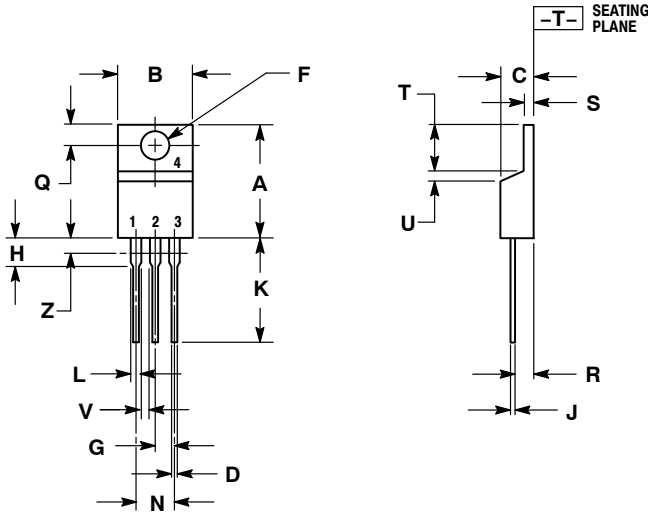
| Device   | Package               | Shipping**       |
|----------|-----------------------|------------------|
| 2N6394G  | TO-220AB<br>(Pb-Free) | 500 Units / Bulk |
| 2N6394TG |                       | 50 Units / Rail  |
| 2N6395G  |                       | 500 Units / Bulk |
| 2N6397G  |                       | 500 Units / Bulk |
| 2N6397TG |                       | 50 Units / Rail  |
| 2N6399G  |                       | 500 Units / Bulk |
| 2N6399TG |                       | 50 Units / Rail  |

\*\*For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# 2N6394 Series

## PACKAGE DIMENSIONS

TO-220AB  
CASE 221A-07  
ISSUE AA



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.570  | 0.620 | 14.48       | 15.75 |
| B   | 0.380  | 0.405 | 9.66        | 10.28 |
| C   | 0.160  | 0.190 | 4.07        | 4.82  |
| D   | 0.025  | 0.035 | 0.64        | 0.88  |
| F   | 0.142  | 0.147 | 3.61        | 3.73  |
| G   | 0.095  | 0.105 | 2.42        | 2.66  |
| H   | 0.110  | 0.155 | 2.80        | 3.93  |
| J   | 0.014  | 0.022 | 0.36        | 0.55  |
| K   | 0.500  | 0.562 | 12.70       | 14.27 |
| L   | 0.045  | 0.060 | 1.15        | 1.52  |
| N   | 0.190  | 0.210 | 4.83        | 5.33  |
| Q   | 0.100  | 0.120 | 2.54        | 3.04  |
| R   | 0.080  | 0.110 | 2.04        | 2.79  |
| S   | 0.045  | 0.055 | 1.15        | 1.39  |
| T   | 0.235  | 0.255 | 5.97        | 6.47  |
| U   | 0.000  | 0.050 | 0.00        | 1.27  |
| V   | 0.045  | ---   | 1.15        | ---   |
| Z   | ---    | 0.080 | ---         | 2.04  |

STYLE 3:

- PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

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