

# 2N6394 Series

Preferred Device

## 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 Volts
- Pb-Free Packages are Available\*

#### MAXIMUM RATINGS\* ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating   | Symbol                   | Value           | Unit                 |
|--|--------------------------|-----------------|----------------------|
| Peak Repetitive Off-State Voltage (Note 1)<br>( $T_J = -40$ to $125^\circ\text{C}$ , Sine Wave,<br>50 to 60 Hz, Gate Open) | $V_{DRM}$ ,<br>$V_{RRM}$ |                 | V                    |
| 2N6394   |                          | 50              |                      |
| 2N6395   |                          | 100             |                      |
| 2N6397   |                          | 400             |                      |
| 2N6399   |                          | 800             |                      |
| On-State RMS Current<br>( $180^\circ$ Conduction Angles; $T_C = 90^\circ\text{C}$ )  | $I_{T(RMS)}$             | 12              | A                    |
| Peak Non-Repetitive Surge Current<br>(1/2 Cycle, Sine Wave, 60 Hz, $T_J = 90^\circ\text{C}$ )                              | $I_{TSM}$                | 100             | A                    |
| Circuit Fusing ( $t = 8.3$ ms)   | $I^2t$                   | 40              | $\text{A}^2\text{s}$ |
| Forward Peak Gate Power<br>(Pulse Width $\leq 1.0$ $\mu\text{s}$ , $T_C = 90^\circ\text{C}$ )                              | $P_{GM}$                 | 20              | W                    |
| Forward Average Gate Power<br>( $t = 8.3$ ms, $T_C = 90^\circ\text{C}$ )   | $P_{G(AV)}$              | 0.5             | W                    |
| Forward Peak Gate Current<br>(Pulse Width $\leq 1.0$ $\mu\text{s}$ , $T_C = 90^\circ\text{C}$ )                            | $I_{GM}$                 | 2.0             | A                    |
| Operating Junction Temperature Range   | $T_J$                    | $-40$ to $+125$ | $^\circ\text{C}$     |
| Storage Temperature Range  | $T_{stg}$                | $-40$ to $+150$ | $^\circ\text{C}$     |

\*Indicates JEDEC Registered Data

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1.  $V_{DRM}$  and  $V_{RRM}$  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.

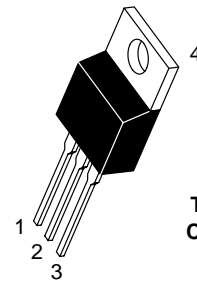
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



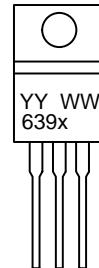
ON Semiconductor®

<http://onsemi.com>

SCRs  
12 AMPERES RMS  
50 thru 800 VOLTS



#### MARKING DIAGRAM



TO-220AB  
CASE 221A  
STYLE 3

x = 4, 5, 7 or 9  
YY = Year  
WW = Work Week

#### 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 2 of this data sheet.

**Preferred** devices are recommended choices for future use and best overall value.

## 2N6394 Series

### THERMAL CHARACTERISTICS

| Characteristic  | Symbol          | Max | Unit          |
|---|-----------------|-----|---------------|
| Thermal Resistance, Junction-to-Case  | $R_{\theta JC}$ | 2.0 | $^{\circ}C/W$ |
| Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 Seconds | $T_L$           | 260 | $^{\circ}C$   |

### ELECTRICAL CHARACTERISTICS ( $T_C = 25^{\circ}C$ unless otherwise noted.)

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

### OFF CHARACTERISTICS

|  |                    |   |   |     |         |
|--|--------------------|---|---|-----|---------|
| * Peak Repetitive Forward or Reverse Blocking Current<br>( $V_{AK} = \text{Rated } V_{DRM} \text{ or } V_{RRM}$ , Gate Open) | $I_{DRM}, I_{RRM}$ | – | – | 10  | $\mu A$ |
| $T_J = 25^{\circ}C$  |                    | – | – | 2.0 | mA      |
| $T_J = 125^{\circ}C$   |                    | – | – |     |         |

### ON CHARACTERISTICS

|  |          |     |     |     |         |
|--|----------|-----|-----|-----|---------|
| * Peak Forward On-State Voltage (Note 2)<br>( $I_{TM} = 24 \text{ A Peak}$ )   | $V_{TM}$ | –   | 1.7 | 2.2 | V       |
| * Gate Trigger Current (Continuous dc)<br>( $V_D = 12 \text{ Vdc}$ , $R_L = 100 \text{ Ohms}$ )  | $I_{GT}$ | –   | 5.0 | 30  | mA      |
| * Gate Trigger Voltage (Continuous dc)<br>( $V_D = 12 \text{ Vdc}$ , $R_L = 100 \text{ Ohms}$ )  | $V_{GT}$ | –   | 0.7 | 1.5 | V       |
| Gate Non-Trigger Voltage<br>( $V_D = 12 \text{ Vdc}$ , $R_L = 100 \text{ Ohms}$ , $T_J = 125^{\circ}C$ )   | $V_{GD}$ | 0.2 | –   | –   | V       |
| * Holding Current<br>( $V_D = 12 \text{ Vdc}$ , Initiating Current = 200 mA, Gate Open)  | $I_H$    | –   | 6.0 | 50  | mA      |
| Turn-On Time<br>( $I_{TM} = 12 \text{ A}$ , $I_{GT} = 40 \text{ mAdc}$ , $V_D = \text{Rated } V_{DRM}$ )   | $t_{gt}$ | –   | 1.0 | 2.0 | $\mu s$ |
| Turn-Off Time ( $V_D = \text{Rated } V_{DRM}$ )<br>( $I_{TM} = 12 \text{ A}$ , $I_R = 12 \text{ A}$ )<br>( $I_{TM} = 12 \text{ A}$ , $I_R = 12 \text{ A}$ , $T_J = 125^{\circ}C$ ) | $t_q$    | –   | 15  | –   | $\mu s$ |
|  |          | –   | 35  | –   |         |

### DYNAMIC CHARACTERISTICS

|  |         |   |    |   |           |
|--|---------|---|----|---|-----------|
| Critical Rate-of-Rise of Off-State Voltage Exponential<br>( $V_D = \text{Rated } V_{DRM}$ , $T_J = 125^{\circ}C$ ) | $dv/dt$ | – | 50 | – | $V/\mu s$ |
|--|---------|---|----|---|-----------|

\*Indicates JEDEC Registered Data

2. Pulse Test: Pulse Width  $\leq 300 \mu s$ , Duty Cycle  $\leq 2\%$ .

### ORDERING INFORMATION

| Device  | Package               | Shipping†       |
|---------|-----------------------|-----------------|
| 2N6394  | TO-220AB              | 500 Units / Box |
| 2N6394G | TO-220AB<br>(Pb-Free) | 500 Units / Box |
| 2N6395  | TO-220AB              | 500 Units / Box |
| 2N6395G | TO-220AB<br>(Pb-Free) | 500 Units / Box |
| 2N6397  | TO-220AB              | 500 Units / Box |
| 2N6397G | TO-220AB<br>(Pb-Free) | 500 Units / Box |
| 2N6399  | TO-220AB              | 500 Units / Box |
| 2N6399G | TO-220AB<br>(Pb-Free) | 500 Units / Box |

†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

## Voltage Current Characteristic of SCR

| Symbol    | Parameter                                 |
|-----------|---|
| $V_{DRM}$ | Peak Repetitive Off State Forward Voltage |
| $I_{DRM}$ | Peak Forward Blocking Current             |
| $V_{RRM}$ | Peak Repetitive Off State Reverse Voltage |
| $I_{RRM}$ | Peak Reverse Blocking Current             |
| $V_{TM}$  | Peak On State Voltage                     |
| $I_H$     | Holding Current                           |

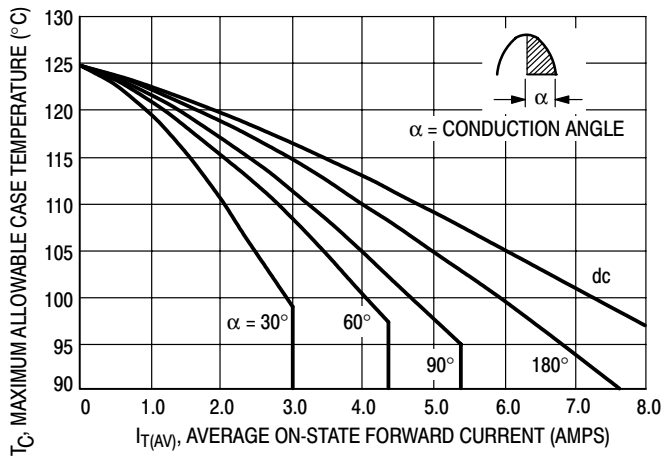
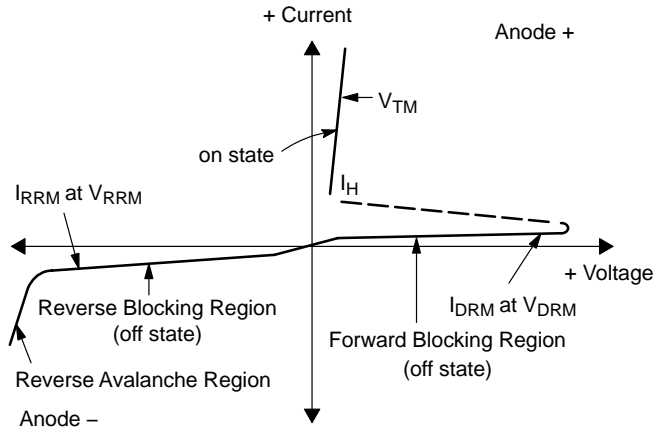


Figure 1. Current Derating

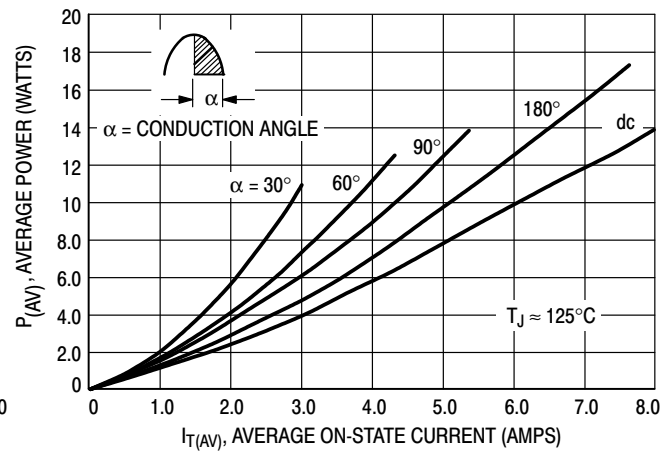


Figure 2. Maximum On-State Power Dissipation

# 2N6394 Series

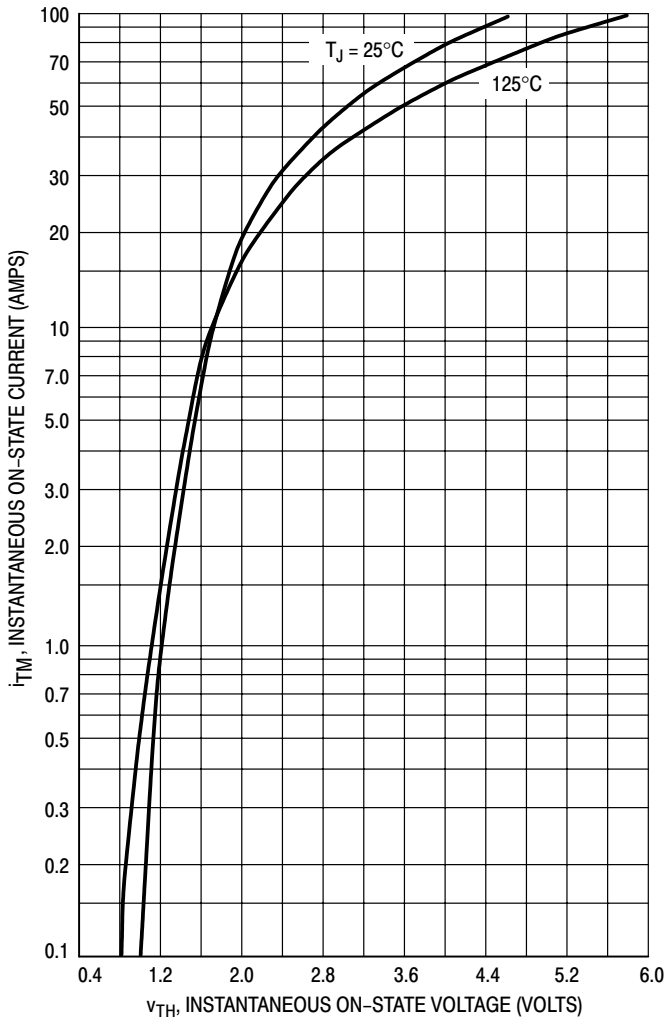


Figure 3. On-State Characteristics

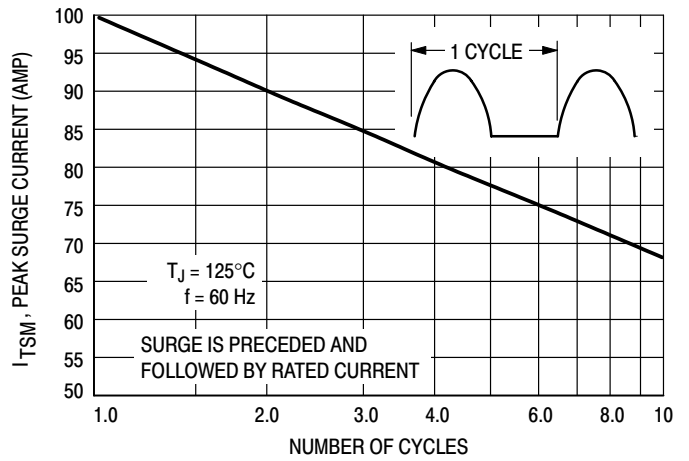


Figure 4. Maximum Non-Repetitive Surge Current

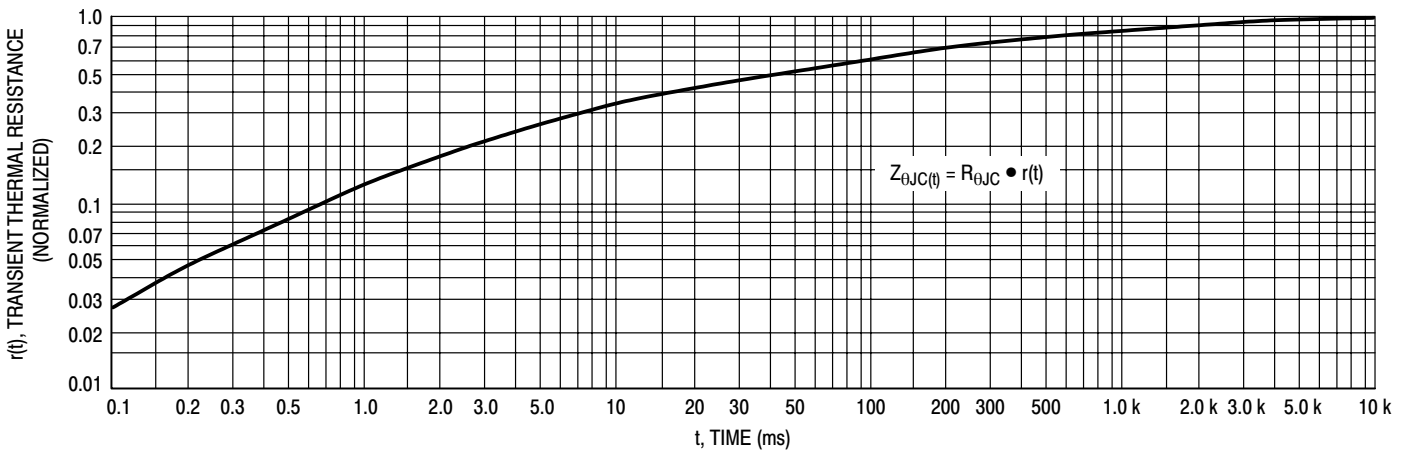


Figure 5. Thermal Response

# 2N6394 Series

## TYPICAL CHARACTERISTICS

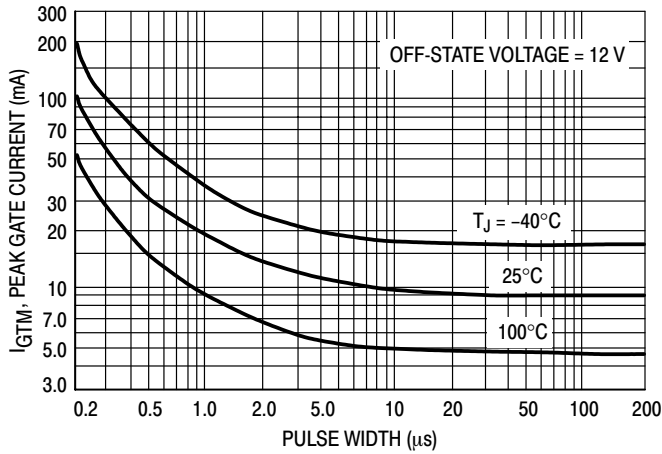


Figure 6. Typical Gate Trigger Current versus Pulse Width

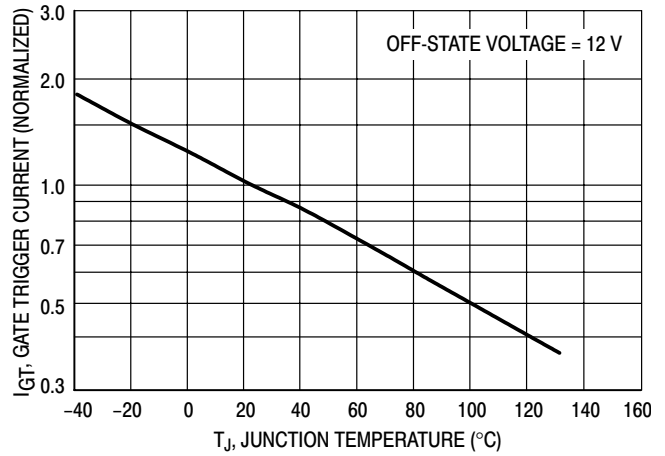


Figure 7. Typical Gate Trigger Current versus Temperature

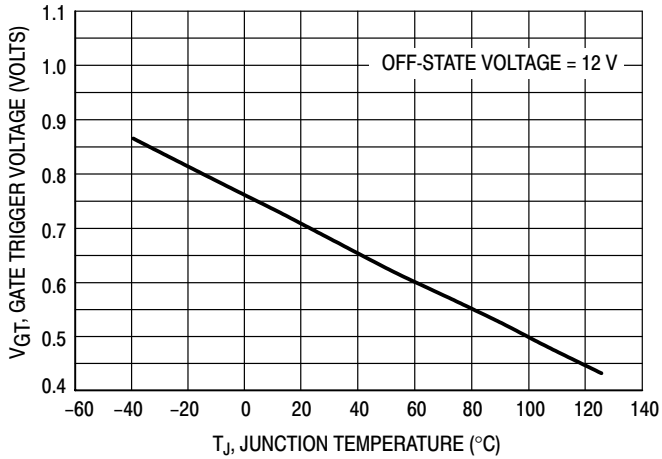


Figure 8. Typical Gate Trigger Voltage versus Temperature

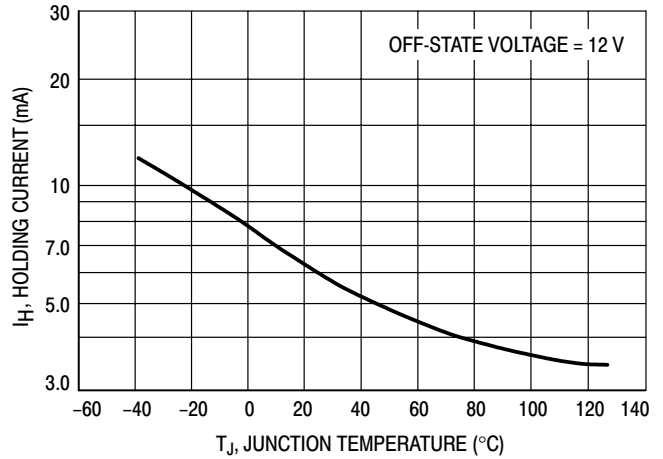
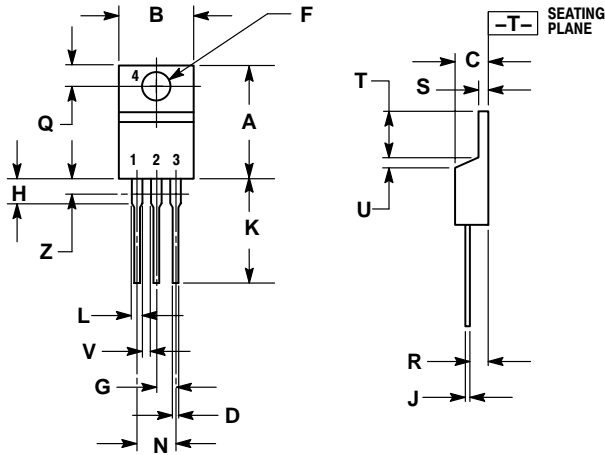


Figure 9. Typical Holding Current versus Temperature

# 2N6394 Series

## PACKAGE DIMENSIONS

TO-220AB  
CASE 221A-09  
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   | 0.018  | 0.025 | 0.46        | 0.64  |
| 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:**

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

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