

### 2N6400



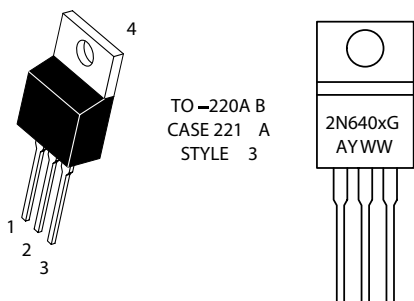
#### Description

Designed primarily for half-wave ac control applications, such as motor controls, heating controls and power supplies; or wherever half-wave silicon gate-controlled, solid-state devices are needed.

#### Features

- Glass Passivated Junctions 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

#### Pin Out



#### Functional Diagram



#### Additional Information



**Datasheet**



**Resources**



**Samples**

### Maximum Ratings † ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating                                                                                                                  | Part Number | Symbol                                 | Value       | Unit                 |
|-------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------|-------------|----------------------|
| Peak Repetitive Off-State Voltage (Note 1)<br>( $T_J = -40$ to $110^\circ\text{C}$ , Sine Wave, 50 to 60 Hz, Gate Open) | 2N6400      | $V_{\text{DRM}}$ ,<br>$V_{\text{RRM}}$ | 50          | V                    |
|                                                                                                                         | 2N6401      |                                        | 100         |                      |
|                                                                                                                         | 2N6402      |                                        | 200         |                      |
|                                                                                                                         | 2N6403      |                                        | 400         |                      |
|                                                                                                                         | 2N6404      |                                        | 600         |                      |
|                                                                                                                         | 2N6405      |                                        | 800         |                      |
| On-State RMS Current<br>( $180^\circ$ Conduction Angles; $T_C = 100^\circ\text{C}$ )                                    |             | $I_{\text{T (RMS)}}$                   | 16          | A                    |
| Average On-State RMS Current<br>( $180^\circ$ Conduction Angles; $T_C = 100^\circ\text{C}$ )                            |             | $I_{\text{T (AV)}}$                    | 10          | A                    |
| Peak Non-Repetitive Surge Current<br>(1/2 Cycle, Sine Wave, 60 Hz, $T_J = 90^\circ\text{C}$ )                           |             | $I_{\text{TSM}}$                       | 160         | A                    |
| Circuit Fusing Considerations ( $t = 8.3$ ms)                                                                           |             | $I^2t$                                 | 145         | $\text{A}^2\text{s}$ |
| Forward Peak Gate Power (Pulse Width $\leq 1.0$ $\mu\text{s}$ , $T_C = 100^\circ\text{C}$ )                             |             | $P_{\text{GM}}$                        | 20          | W                    |
| Forward Average Gate Power ( $t = 8.3$ ms, $T_C = 100^\circ\text{C}$ )                                                  |             | $P_{\text{G(AV)}}$                     | 0.5         | W                    |
| Forward Peak Gate Current (Pulse Width $\leq 1.0$ $\mu\text{s}$ , $T_C = 100^\circ\text{C}$ )                           |             | $I_{\text{GM}}$                        | 2.0         | A                    |
| Operating Junction Temperature Range                                                                                    |             | $T_J$                                  | -40 to +125 | $^\circ\text{C}$     |
| Storage Temperature Range                                                                                               |             | $T_{\text{stg}}$                       | -40 to +125 | $^\circ\text{C}$     |

† 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.  $V_{\text{DRM}}$  and  $V_{\text{RRM}}$  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.

### Maximum Ratings † ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating                                                                         | Symbol                | Value | Unit               |
|--------------------------------------------------------------------------------|-----------------------|-------|--------------------|
| Thermal Resistance, Junction-to-Case                                           | $R_{\theta\text{JC}}$ | 1.5   | $^\circ\text{C/W}$ |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | $T_L$                 | 260   | $^\circ\text{C}$   |

† Indicates JEDEC Registered Data

### Electrical Characteristics - OFF ( $T_c = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic                                                                   |                           | Symbol    | Min | Typ | Max | Unit          |
|----------------------------------------------------------------------------------|---------------------------|-----------|-----|-----|-----|---------------|
| †Peak Repetitive Blocking Current<br>( $V_{AK} = V_{DRM} = V_{RRM}$ ; Gate Open) | $T_J = 25^\circ\text{C}$  | $I_{DRM}$ | -   | -   | 1.0 | $\mu\text{A}$ |
|                                                                                  | $T_J = 125^\circ\text{C}$ | $I_{RRM}$ | -   | -   | 2.0 | mA            |

### Electrical Characteristics - ON

| Characteristic                                                                                                             |                            | Symbol   | Min | Typ | Max | Unit          |
|----------------------------------------------------------------------------------------------------------------------------|----------------------------|----------|-----|-----|-----|---------------|
| †Peak Forward On-State Voltage<br>( $I_{TM} = 32\text{ A Peak}$ , Pulse Width $\leq 1\text{ ms}$ , Duty Cycle $\leq 2\%$ ) |                            | $V_{TM}$ | -   | -   | 1.7 | V             |
| †Gate Trigger Voltage (Continuous DC), All Quadrants<br>(Continuous dc) ( $V_D = 12\text{ Vdc}$ , $R_L = 100\ \Omega$ )    | $T_c = 25^\circ\text{C}$   | $I_{GT}$ | -   | 9.0 | 30  | mA            |
|                                                                                                                            | $T_c = -40^\circ\text{C}$  |          | -   | -   | 60  |               |
| †Gate Trigger Voltage (Continuous dc) ( $V_D = 12\text{ Vdc}$ , $R_L = 100\ \Omega$ )                                      | $T_c = 25^\circ\text{C}$   | $V_{GT}$ | -   | 0.7 | 1.5 | V             |
|                                                                                                                            | $T_c = -40^\circ\text{C}$  |          | -   | -   | 2.5 |               |
| Gate Non-Trigger Voltage ( $V_D = 12\text{ Vdc}$ , $R_L = 100\ \Omega$ )                                                   | $T_c = +125^\circ\text{C}$ | $V_{GD}$ | 0.2 | -   | -   | V             |
| †Holding Current ( $V_D = 12\text{ Vdc}$ , Initiating Current = 200 mA, Gate Open)                                         | $T_c = 25^\circ\text{C}$   | $I_H$    | -   | 18  | 40  | mA            |
|                                                                                                                            | $T_c = -40^\circ\text{C}$  |          | -   | -   | 60  |               |
| Turn-On Time ( $I_{TM} = 12\text{ A}$ , $I_{GT} = 40\text{ mAdc}$ , $V_D = \text{Rated } V_{DRM}$ )                        |                            | $t_{gt}$ | -   | 1.0 | -   | $\mu\text{s}$ |
| Turn-Off Time ( $I_{TM} = 16\text{ A}$ , $I_R = 16\text{ A}$ , $V_D = \text{Rated } V_{DRM}$ )                             | $T_c = 25^\circ\text{C}$   | $t_q$    | -   | 15  | -   | $\mu\text{s}$ |
|                                                                                                                            | $T_J = +125^\circ\text{C}$ |          | -   | 35  | -   |               |

†Indicates JEDEC Registered Data

### Dynamic Characteristics

| Characteristic                                                                                        |                            | Symbol     | Min | Typ | Max | Unit             |
|-------------------------------------------------------------------------------------------------------|----------------------------|------------|-----|-----|-----|------------------|
| Critical Rate-of-Rise of Off-State Voltage<br>( $V_D = \text{Rated } V_{DRM}$ , Exponential Waveform) | $T_J = +125^\circ\text{C}$ | $dv/dt(c)$ | -   | 50  | -   | V/ $\mu\text{s}$ |

### Voltage Current Characteristic of SCR

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

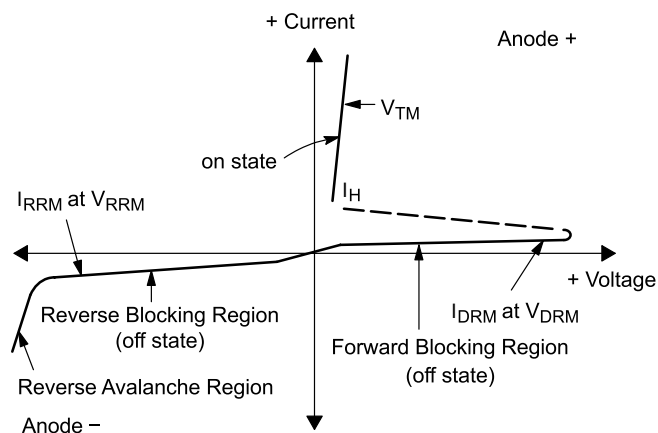


Figure 1. Current Derating

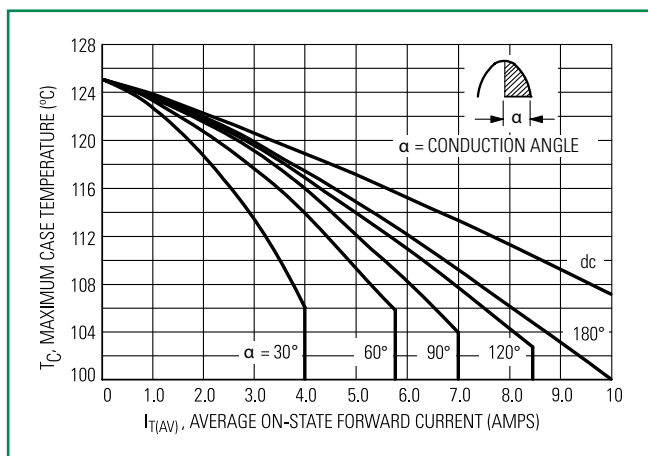
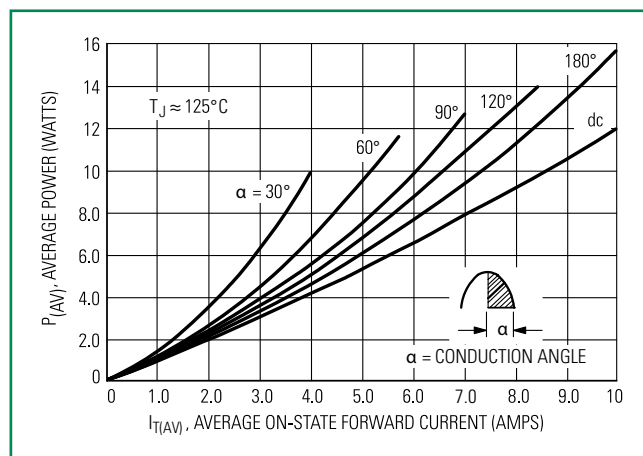
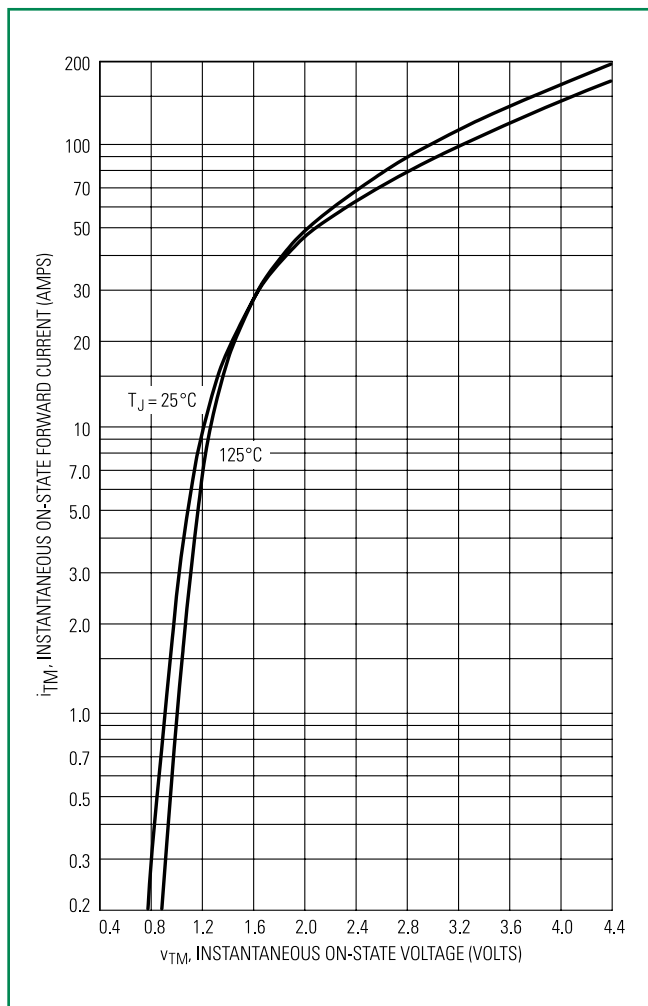


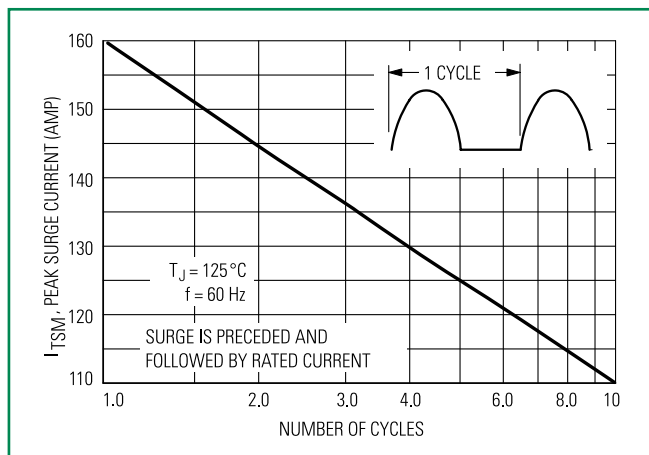
Figure 2. Maximum On-State Power Dissipation



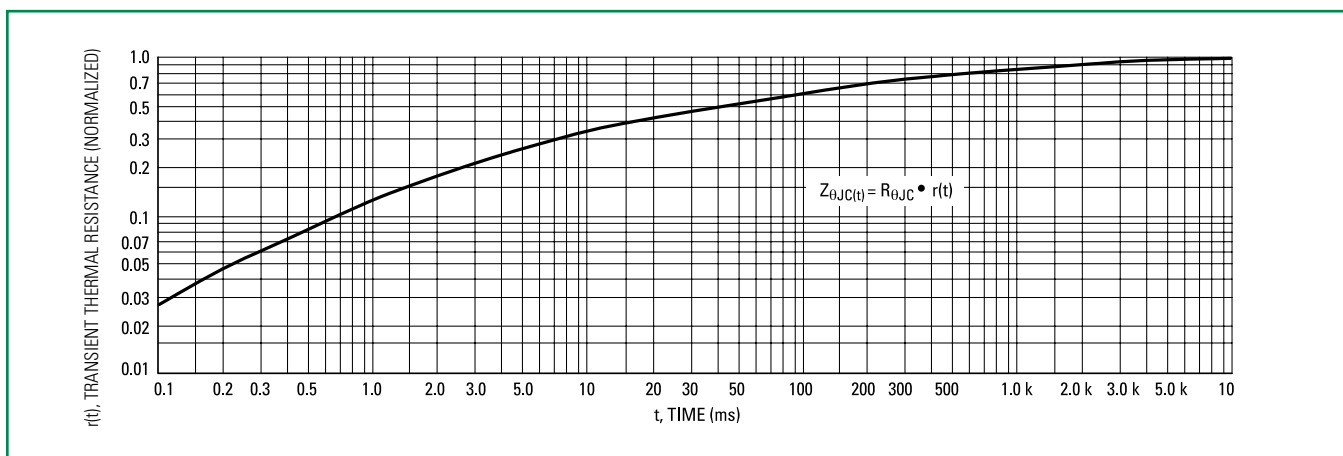
**Figure 3. On-State Characteristics**



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

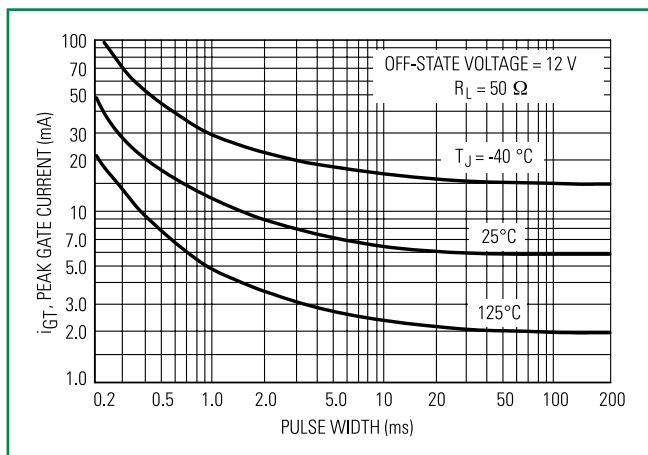


**Figure 5. Thermal Response**

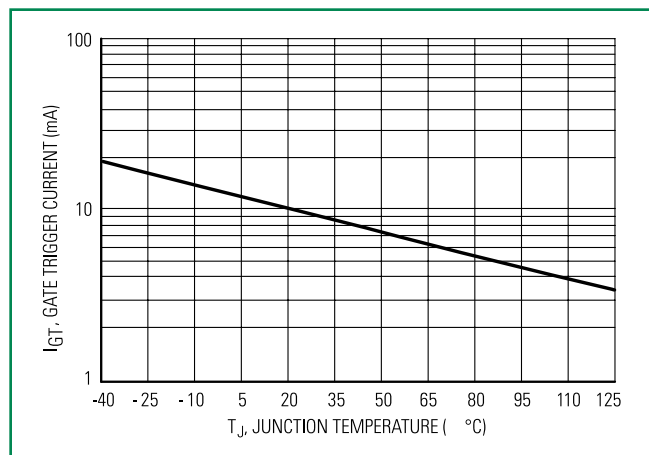


### Typical Characteristics

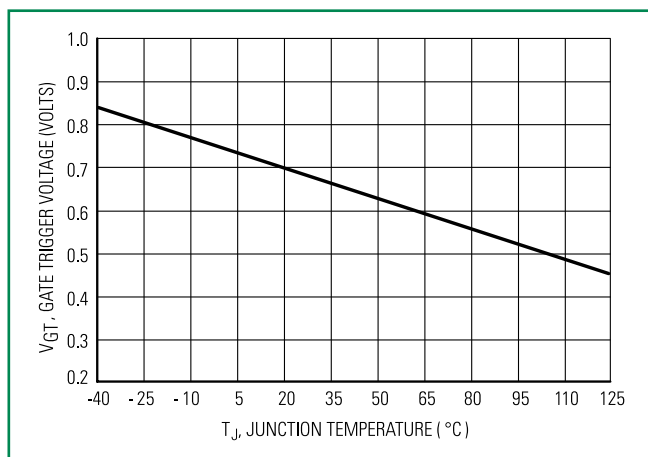
**Figure 6. Typical Gate Trigger Current vs. Pulse Width**



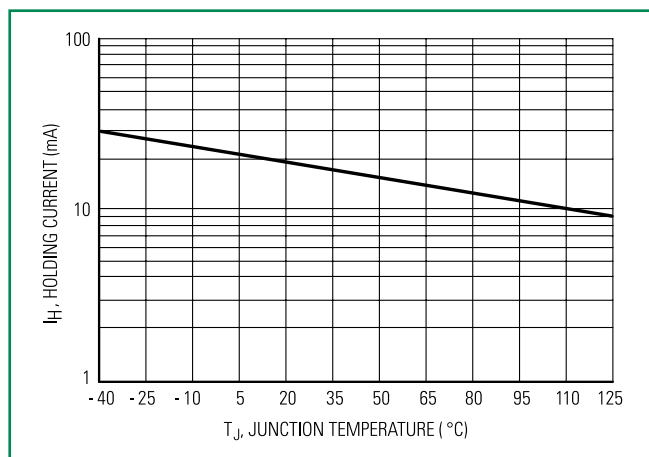
**Figure 7. Typical Gate Trigger Current vs. Junction Temperature**



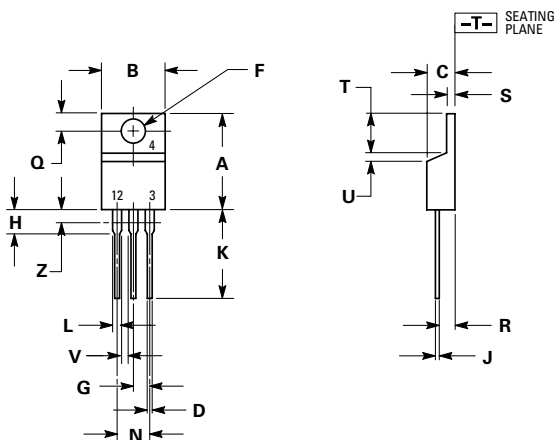
**Figure 8. Typical Gate Trigger Voltage vs. Junction Temperature**



**Figure 9. Typical Holding Current vs. Junction Temperature**



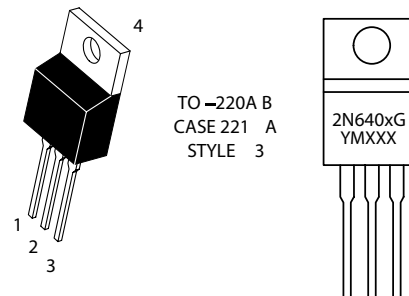
### Dimensions



| 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  |

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.

### Part Marking System



TO -220A B  
CASE 221 A  
STYLE 3

x= 0, 1, 2, 3, 4 or 5  
Y= Year  
M= Month  
XXX= Lot Trace Code  
G= Pb-Free Package

### Pin Assignment

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

### Ordering Information

| Device   | Package               | Shipping         |
|----------|-----------------------|------------------|
| 2N6400G  | TO-220AB<br>(Pb-Free) | 1000 Units / Box |
| 2N6401G  |                       |                  |
| 2N6402G  |                       |                  |
| 2N6403G  |                       | 50 Units / Tube  |
| 2N6403TG |                       |                  |
| 2N6404G  |                       | 1000 Units / Box |
| 2N6405G  |                       |                  |

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