

2N6504 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 supply crowbar circuits.

- Glass Passivated Junctions with Center Gate Fire for Greater Parameter Uniformity and Stability
- Small, Rugged, Thermowatt Constructed for Low Thermal Resistance, High Heat Dissipation and Durability
- Blocking Voltage to 800 Volts
- 300 A Surge Current Capability
- Device Marking: Logo, Device Type, e.g., 2N6504, Date Code

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

| Rating | Symbol | Value | Unit |
|---|--------------------------|----------------|------------------|
| *Peak Repetitive Off-State Voltage (Note 1.) (Gate Open, Sine Wave 50 to 60 Hz, $T_J = 25$ to 125°C) | V_{DRM} , V_{RRM} | | Volts |
| 2N6504 | | 50 | |
| 2N6505 | | 100 | |
| 2N6507 | | 400 | |
| 2N6508 | | 600 | |
| 2N6509 | | 800 | |
| On-State RMS Current (180° Conduction Angles; $T_C = 85^\circ\text{C}$) | $I_{T(RMS)}$ | 25 | A |
| Average On-State Current (180° Conduction Angles; $T_C = 85^\circ\text{C}$) | $I_{T(AV)}$ | 16 | A |
| Peak Non-repetitive Surge Current (1/2 Cycle, Sine Wave 60 Hz, $T_J = 100^\circ\text{C}$) | I_{TSM} | 250 | A |
| Forward Peak Gate Power (Pulse Width $\leq 1.0 \mu\text{s}$, $T_C = 85^\circ\text{C}$) | P_{GM} | 20 | Watts |
| Forward Average Gate Power ($t = 8.3 \text{ ms}$, $T_C = 85^\circ\text{C}$) | $P_{G(AV)}$ | 0.5 | Watts |
| Forward Peak Gate Current (Pulse Width $\leq 1.0 \mu\text{s}$, $T_C = 85^\circ\text{C}$) | 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

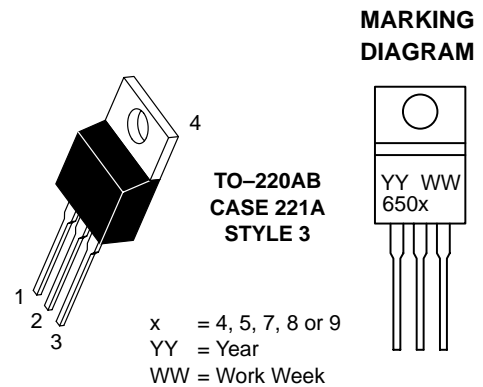
1. V_{DRM} and V_{RRM} for all types can be applied on a continuous basis. Ratings apply for zero or negative gate voltage; however, positive gate voltage shall not be applied concurrent with negative potential on the anode. Blocking voltages shall not be tested with a constant current source such that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



ON Semiconductor™

<http://onsemi.com>

SCRs
25 AMPERES RMS
50 thru 800 VOLTS



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

ORDERING INFORMATION

| Device | Package | Shipping |
|--------|---------|----------|
| 2N6504 | TO220AB | 500/Box |
| 2N6505 | TO220AB | 500/Box |
| 2N6507 | TO220AB | 500/Box |
| 2N6508 | TO220AB | 500/Box |
| 2N6509 | TO220AB | 500/Box |

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

2N6504 Series

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*THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|-----------------|-----|---------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.5 | $^{\circ}C/W$ |
| 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 ($V_{AK} = \text{Rated } V_{DRM} \text{ or } V_{RRM}, \text{ Gate Open}$) | I_{DRM}, I_{RRM} | $T_J = 25^{\circ}C$ | – | – | 10 | μA |
| | | $T_J = 125^{\circ}C$ | – | – | 2.0 | mA |

ON CHARACTERISTICS

| | | | | | | |
|--|----------|----------------------|-----|-----|---------|---------|
| *Forward On-State Voltage (Note 2.) ($I_{TM} = 50 \text{ A}$) | V_{TM} | – | – | 1.8 | Volts | |
| *Gate Trigger Current (Continuous dc) ($V_{AK} = 12 \text{ Vdc}, R_L = 100 \text{ Ohms}$) | I_{GT} | $T_C = 25^{\circ}C$ | – | 9.0 | 30 | mA |
| | | $T_C = -40^{\circ}C$ | – | – | 75 | |
| *Gate Trigger Voltage (Continuous dc) ($V_{AK} = 12 \text{ Vdc}, R_L = 100 \text{ Ohms}, T_C = -40^{\circ}C$) | V_{GT} | – | 1.0 | 1.5 | Volts | |
| Gate Non-Trigger Voltage ($V_{AK} = 12 \text{ Vdc}, R_L = 100 \text{ Ohms}, T_J = 125^{\circ}C$) | V_{GD} | 0.2 | – | – | Volts | |
| *Holding Current ($V_{AK} = 12 \text{ Vdc}, \text{ Initiating Current} = 200 \text{ mA}, \text{ Gate Open}$) | I_H | $T_C = 25^{\circ}C$ | – | 18 | 40 | mA |
| | | $T_C = -40^{\circ}C$ | – | – | 80 | |
| *Turn-On Time ($I_{TM} = 25 \text{ A}, I_{GT} = 50 \text{ mAdc}$) | t_{gt} | – | 1.5 | 2.0 | μs | |
| Turn-Off Time ($V_{DRM} = \text{rated voltage}$) ($I_{TM} = 25 \text{ A}, I_R = 25 \text{ A}$) ($I_{TM} = 25 \text{ A}, I_R = 25 \text{ A}, T_J = 125^{\circ}C$) | t_q | | – | 15 | – | μs |
| | | | – | 35 | – | |

DYNAMIC CHARACTERISTICS

| | | | | | |
|---|---------|---|----|---|-----------|
| Critical Rate of Rise of Off-State Voltage (Gate Open, Rated V_{DRM} , Exponential Waveform) | dv/dt | – | 50 | – | $V/\mu s$ |
|---|---------|---|----|---|-----------|

*Indicates JEDEC Registered Data.

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

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 |

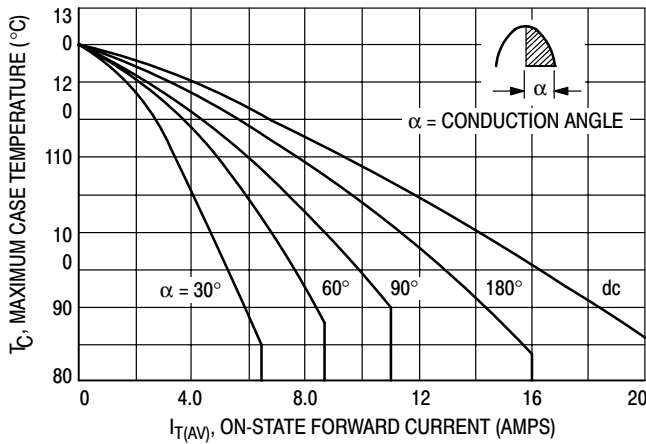
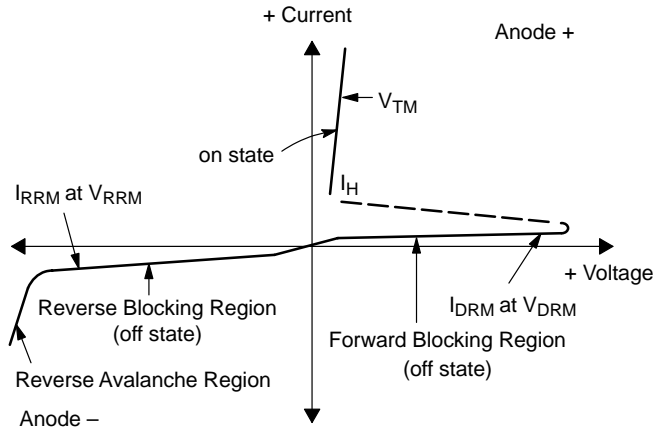


Figure 1. Average Current Derating

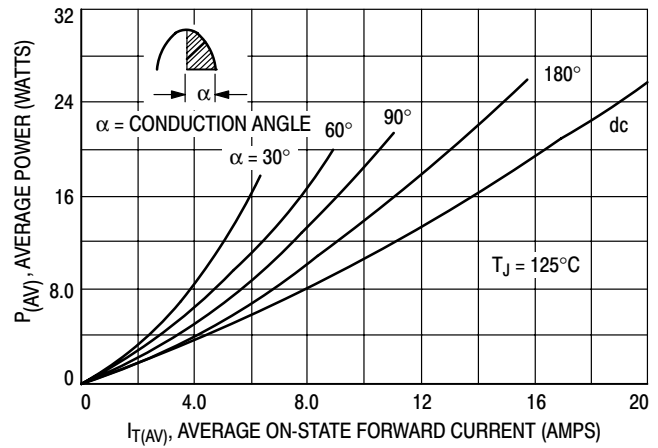


Figure 2. Maximum On-State Power Dissipation

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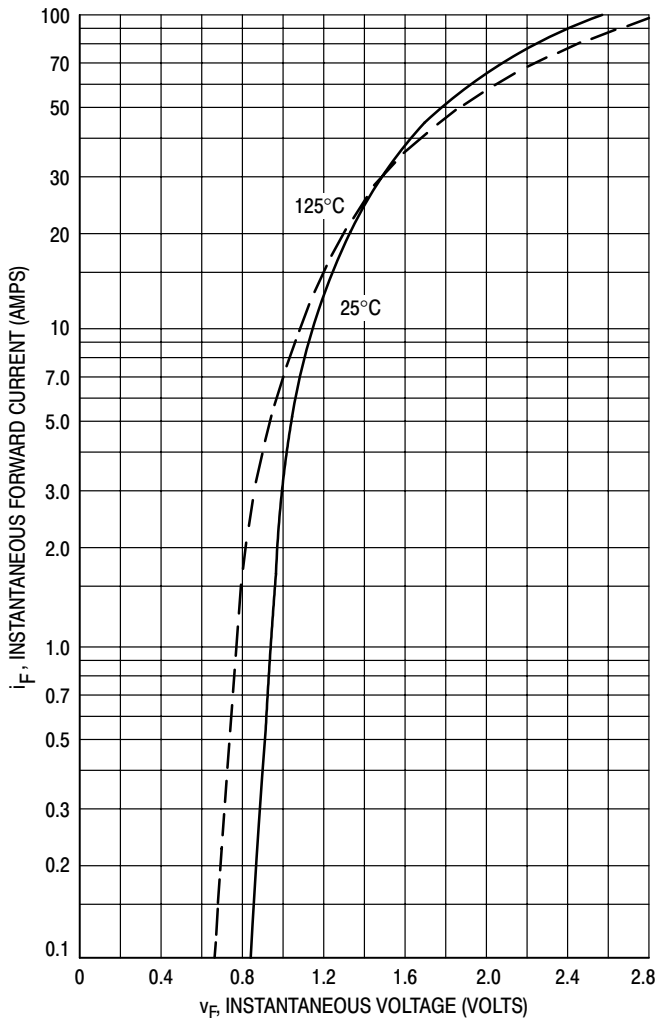


Figure 3. Typical On-State Characteristics

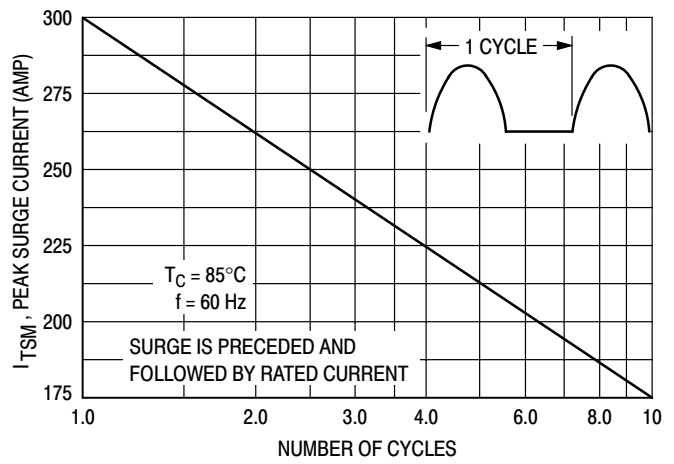


Figure 4. Maximum Non-Repetitive Surge Current

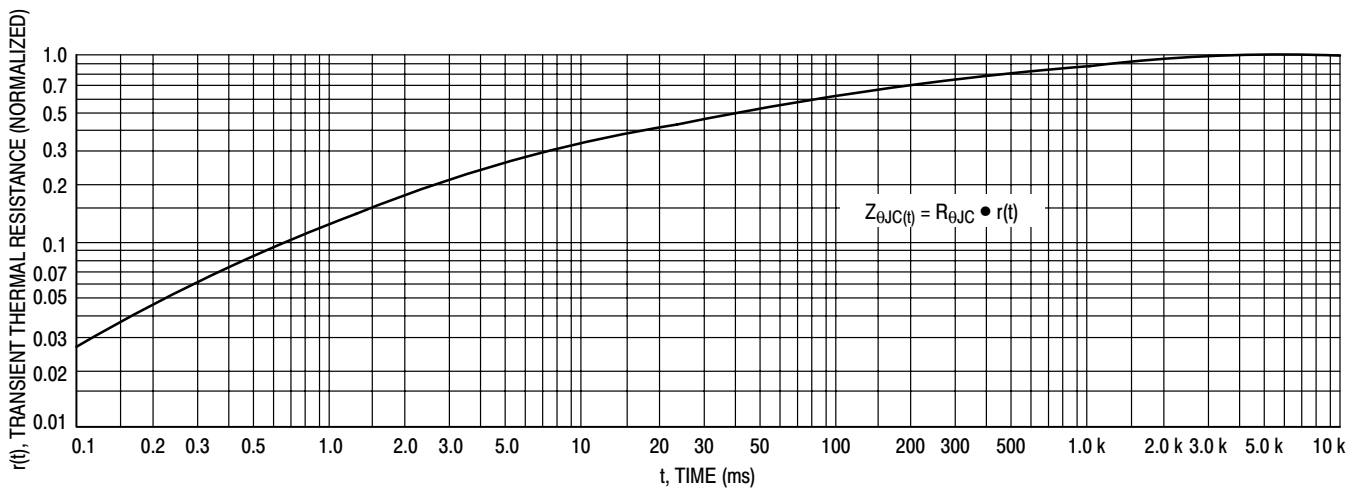


Figure 5. Thermal Response

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TYPICAL TRIGGER CHARACTERISTICS

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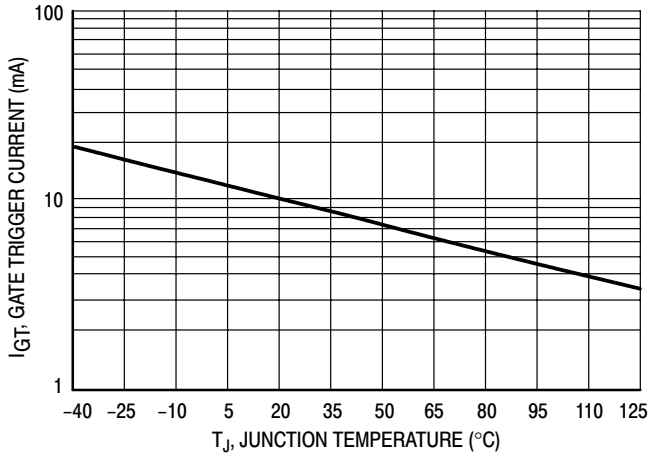


Figure 6. Typical Gate Trigger Current versus Junction Temperature

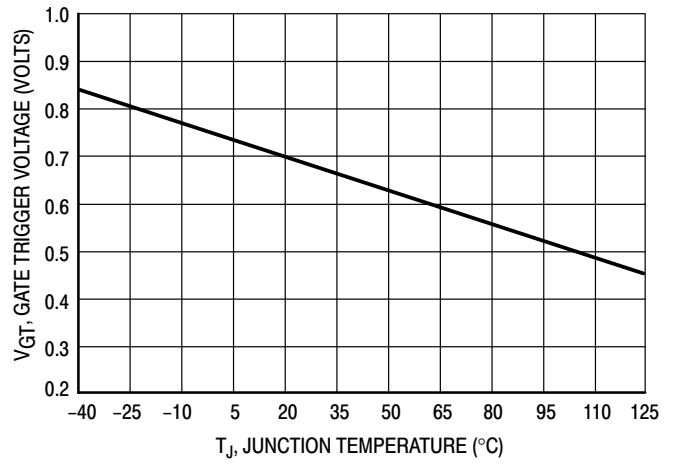


Figure 7. Typical Gate Trigger Voltage versus Junction Temperature

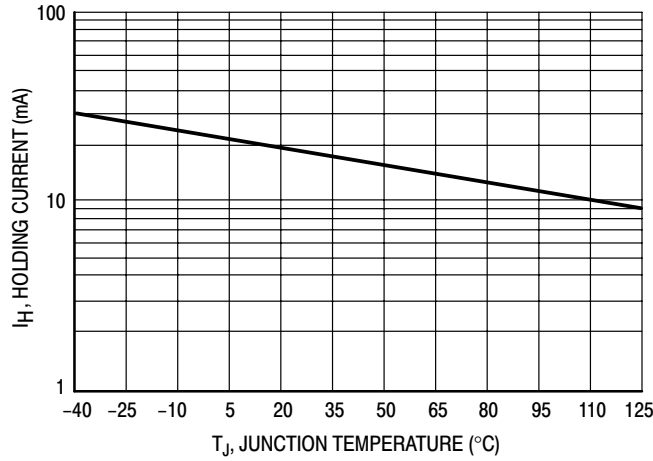


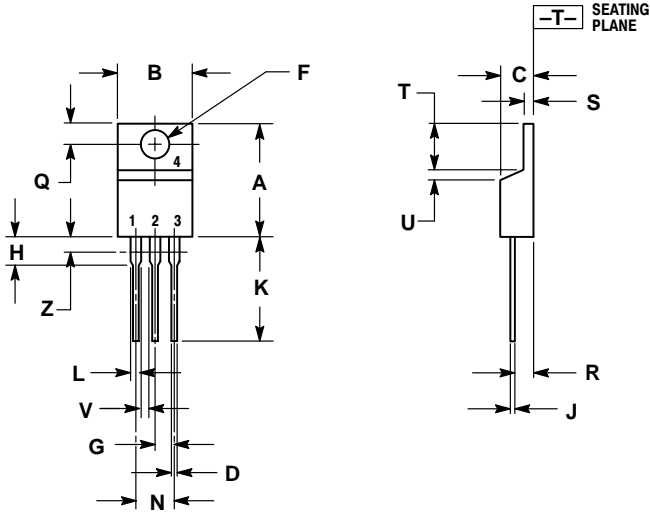
Figure 8. Typical Holding Current versus Junction Temperature

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PACKAGE DIMENSIONS

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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

Notes

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