

# 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<sub>J</sub> = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
*Peak Repetitive Off-State Voltage (Note 1.) (Gate Open, Sine Wave 50 to 60 Hz, T <sub>J</sub> = 25 to 125°C)	V <sub>DRM</sub> , V <sub>RRM</sub>		Volts
2N6504		50	
2N6505		100	
2N6507		400	
2N6508		600	
2N6509		800	
On-State RMS Current (180° Conduction Angles; T <sub>C</sub> = 85°C)	I <sub>T(RMS)</sub>	25	A
Average On-State Current (180° Conduction Angles; T <sub>C</sub> = 85°C)	I <sub>T(AV)</sub>	16	A
Peak Non-repetitive Surge Current (1/2 Cycle, Sine Wave 60 Hz, T <sub>J</sub> = 100°C)	I <sub>TSM</sub>	250	A
Forward Peak Gate Power (Pulse Width ≤ 1.0 μs, T <sub>C</sub> = 85°C)	P <sub>GM</sub>	20	Watts
Forward Average Gate Power (t = 8.3 ms, T <sub>C</sub> = 85°C)	P <sub>G(AV)</sub>	0.5	Watts
Forward Peak Gate Current (Pulse Width ≤ 1.0 μs, T <sub>C</sub> = 85°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

\*Indicates JEDEC Registered Data

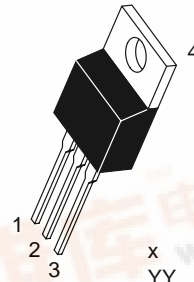
1. V<sub>DRM</sub> and V<sub>RRM</sub> for all types can be applied on a continuous basis. Ratings apply for zero or negative gate voltage; however, positive gate voltage shall not be applied concurrent with negative potential on the anode. Blocking voltages shall not be tested with a constant current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



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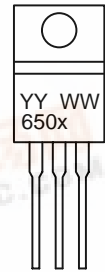
**SCRs**  
**25 AMPERES RMS**  
**50 thru 800 VOLTS**



TO-220AB  
CASE 221A  
STYLE 3

x = 4, 5, 7, 8 or 9  
YY = Year  
WW = Work Week

### MARKING DIAGRAM



### PIN ASSIGNMENT

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

### \*THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.5	$^{\circ}\text{C}/\text{W}$
Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 Seconds	$T_L$	260	$^{\circ}\text{C}$

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

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

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

### ON CHARACTERISTICS

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

### DYNAMIC CHARACTERISTICS

Critical Rate of Rise of Off-State Voltage (Gate Open, Rated $V_{DRM}$ , Exponential Waveform)	$dv/dt$	–	50	–	$\text{V}/\mu\text{s}$
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\*Indicates JEDEC Registered Data.

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

# 2N6504 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

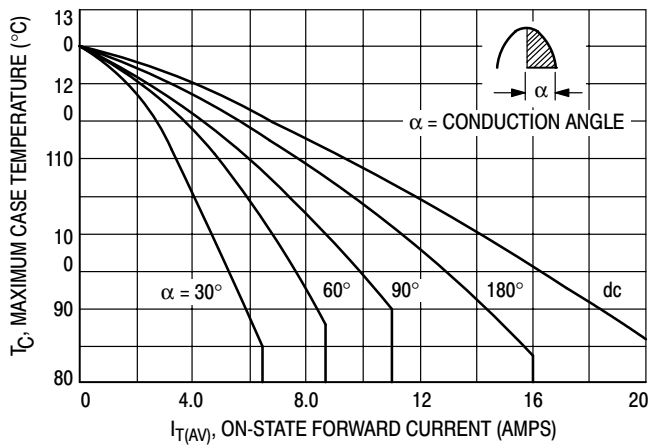
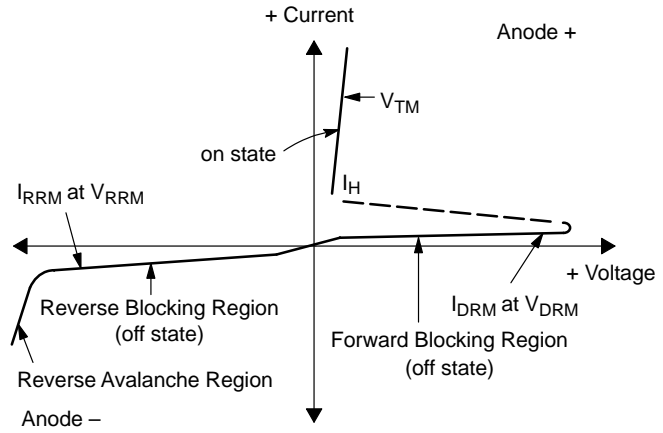


Figure 1. Average Current Derating

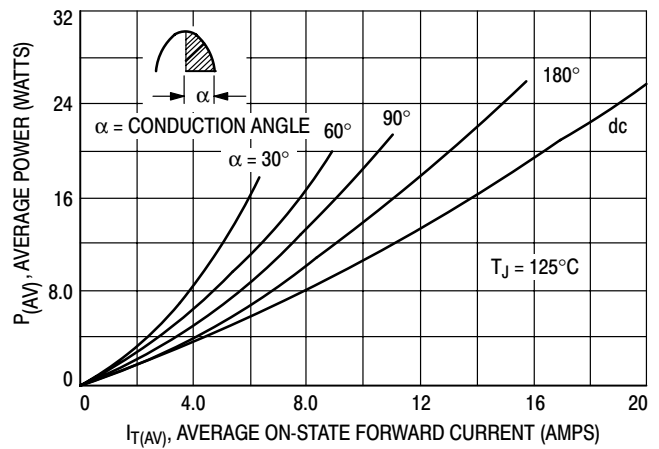


Figure 2. Maximum On-State Power Dissipation

## 2N6504 Series

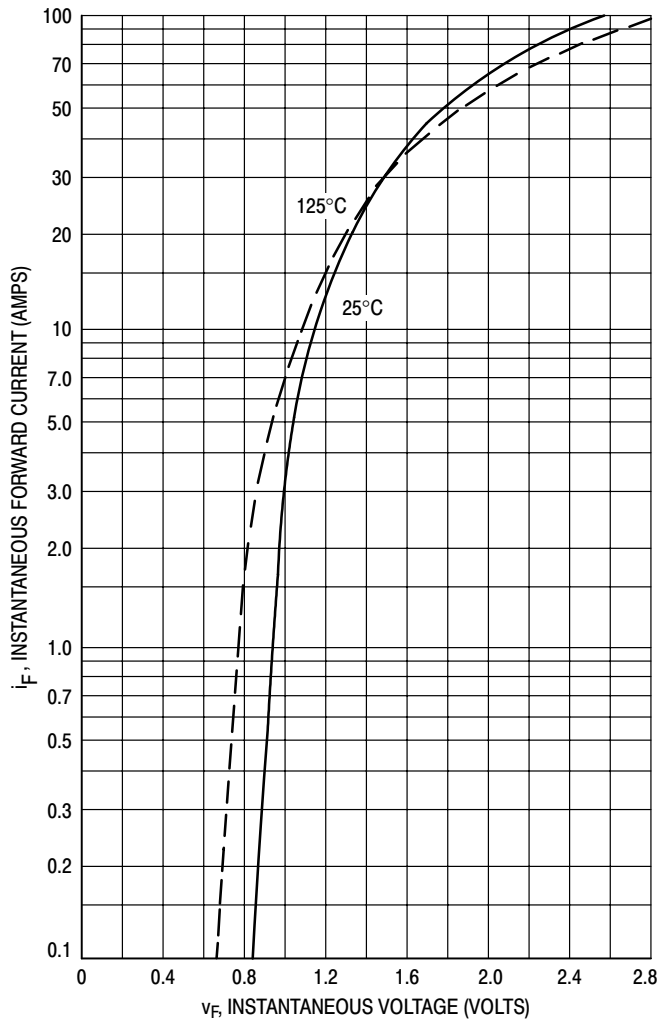


Figure 3. Typical On-State Characteristics

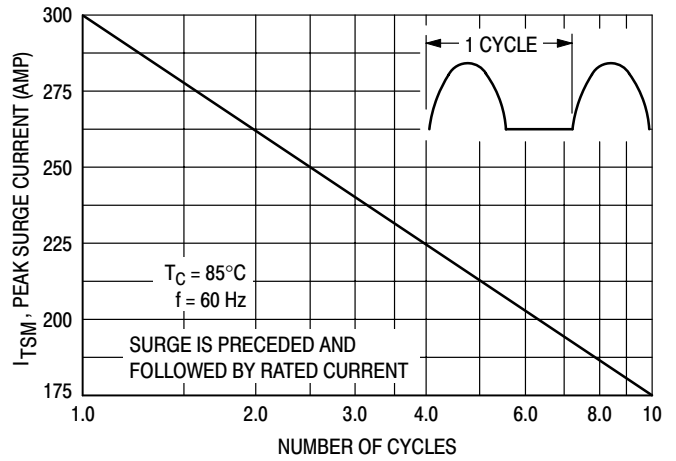


Figure 4. Maximum Non-Repetitive Surge Current

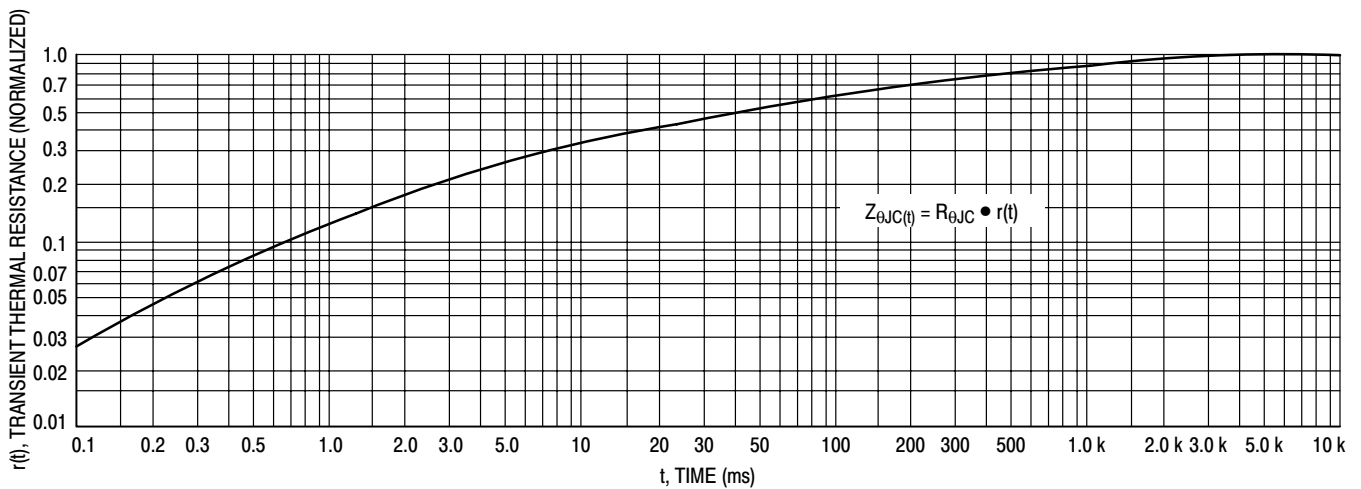


Figure 5. Thermal Response

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## TYPICAL TRIGGER CHARACTERISTICS

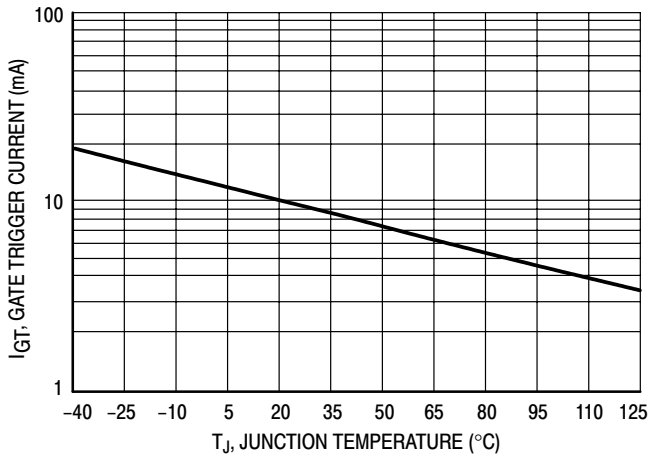


Figure 6. Typical Gate Trigger Current versus Junction Temperature

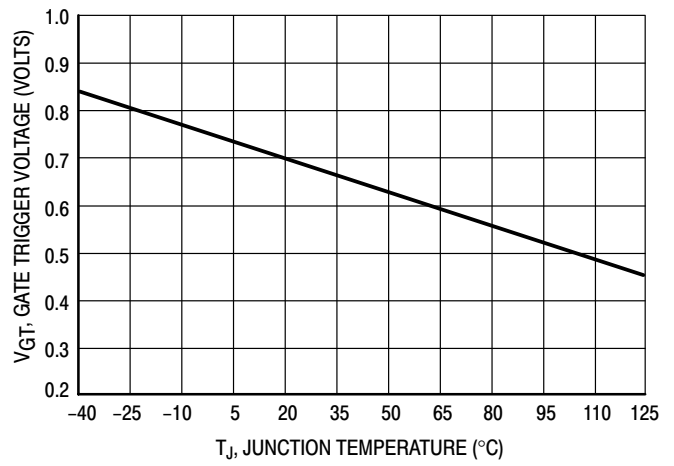


Figure 7. Typical Gate Trigger Voltage versus Junction Temperature

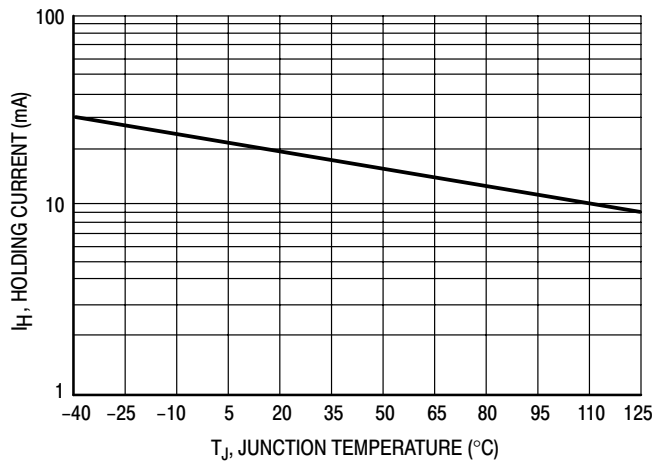
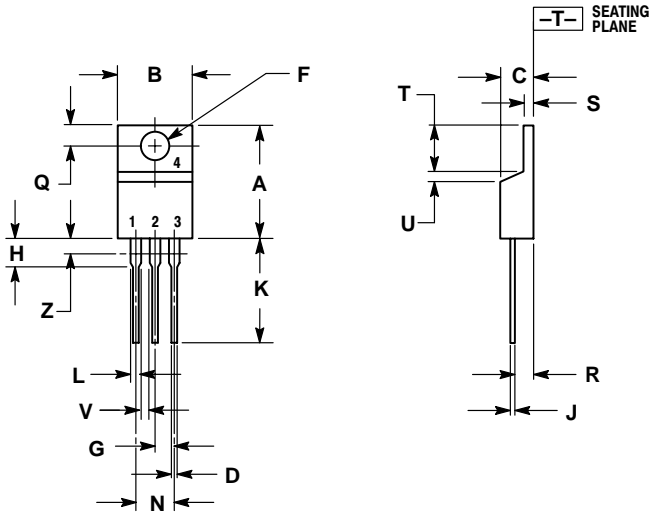


Figure 8. Typical Holding Current versus Junction Temperature

# 2N6504 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

## 2N6504 Series

### Notes

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