

## FEATURES

- Available as "HR" (high reliability) screened per MIL-PRF-19500, JANTX level. Add "HR" suffix to base part number.
- Available as non-RoHS (Sn/Pb plating), standard, and as RoHS by adding "-PBF" suffix.

## MAXIMUM RATINGS

Ratings	Symbol	2N3001	2N3002	2N3003	2N3004	Unit
Static Off-State Voltage <sup>(1)</sup>	$V_D$	30	60	100	200	V
Repetitive Peak Off-State Voltage <sup>(1)</sup>	$V_{DRM}$	30	60	100	200	V
Static Reverse Voltage <sup>(2)</sup>	$V_R$	30	60	100	200	V
Repetitive Peak Reverse Voltage <sup>(2)</sup>	$V_{RRM}$	30	60	100	200	V
Continuous or RMS On-State Current at (or below) 55°C Free Air Temperature <sup>(3)</sup>	$I_{T(RMS)}$	350				mA
Average On-State Current (180° Conduction Angle) at (or below) 55°C Free Air Temperature <sup>(4)</sup>	$I_{T(AV)}$	250				mA
Surge On-State Current <sup>(5)</sup>	$I_{TSM}$	6				A
Peak Reverse Gate Voltage	$V_{RGM}$	8				V
Peak Forward Gate Current ( $PW \leq 8ms$ )	$I_{FGM}$	250				mA
Average Gate Power Dissipation	PD	100				mW
Operating Free Air Temperature Range	$T_J$	-65 to +150				°C
Storage Temperature Range	$T_{stg}$	-65 to +175				°C
Lead Temperature 1/16" from Case for 10s	$T_L$	300				°C

Note 1: These values apply when the gate-cathode resistance  $R_{GK} \leq 1k\Omega$ .

Note 2: These values apply when the gate-cathode resistance  $R_{GK} \leq \infty$ .

Note 3: This value applies for continuous dc or single-phase, 60Hz, half-sine wave operation with resistive load. Above 55°C, derate according to Figure 1.

Note 4: This value may be applied continuously under single-phase, 60Hz, half-sine wave operation with resistive load. Above 55°C, derate according to Figure 1.

Note 5: This value applies for one 60 Hz half-sine wave when the device is operation at (or below) rated values of peak reverse voltage and on-state current. Surge may be repeated after the device has returned to original thermal equilibrium.

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ C$ unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit
<b>Static-Off-State Current</b> $V_D = \text{Rated } V_D, R_{GK} = 1k\Omega$ $V_D = \text{Rated } V_D, R_{GK} = 1k\Omega, T_A = 150^\circ C$	$I_D$	-	-	0.1 100	$\mu A$
<b>Static Reverse Current</b> $V_R = \text{Rated } V_R, R_{GK} = \infty$ $V_R = \text{Rated } V_R, R_{GK} = \infty, T_A = 150^\circ C$	$I_R$	-	-	0.1 100	$\mu A$
<b>Gate Current</b> $V_G = -5V, I_A = 0$	$I_G$	-	-	-5	$\mu A$
<b>Gate Trigger Current</b> $V_{AA} = 5V, R_L = 12\Omega, t_{p(g)} \geq 10\mu s$	$I_{GT}$	-	5	20	$\mu A$
<b>Gate Trigger Voltage</b> $V_{AA} = 5V, R_L = 12\Omega, t_{p(g)} \geq 10\mu s, T_A = -65^\circ C$ $V_{AA} = 5V, R_L = 12\Omega, t_{p(g)} \geq 10\mu s$ $V_{AA} = 5V, R_L = 12\Omega, t_{p(g)} \geq 10\mu s, T_A = 150^\circ C$	$V_{GT}$	- - 0.2	- 0.55 -	0.9 0.7 -	V
<b>Holding Current</b> $R_{GK} = 1k\Omega, R_L = 2k\Omega$ $R_{GK} = 1k\Omega, R_L = 2k\Omega, T_A = -65^\circ$	$I_H$	- -	1.2 -	3 4	mA
<b>On-State Voltage</b> <sup>(6)</sup> $I_T = 350mA, R_{GK} > 1k\Omega$	$V_T$	-	-	1.2	V
<b>Critical Rate of Rise of Off-State Voltage</b> $V_D = 1V$	$dv/dt$	-	400	-	V/ $\mu s$

# 2N3001-2N3004

SILICON REVERSE BLOCKING THYRISTORS

### SWITCHING CHARACTERISTICS (T<sub>J</sub> = 25°C)

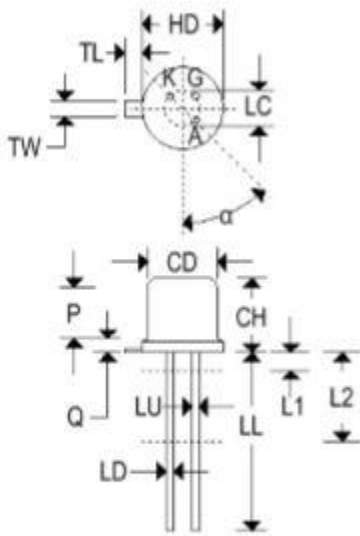
Parameter	Symbol	2N3004	Unit
Typical Gate Controlled Turn-On Time V <sub>AA</sub> = 200V, R <sub>L</sub> = 2.2kΩ, R <sub>G</sub> = 100Ω, V <sub>in</sub> = 3V	t <sub>gt</sub>	0.3	μs
Typical Circuit-Commutate Turn-Off Time V <sub>AA</sub> = 50V, R <sub>L</sub> = 140kΩ	t <sub>q</sub>	3.5	μs

### THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Junction-to-Case Thermal Resistance	R <sub>θJC</sub>	75	°C/W
Junction-to-Free-Air Thermal Resistance	R <sub>θJA</sub>	275	°C/W

### MECHANICAL CHARACTERISTICS

Case:	TO-18
Marking:	Alpha-Numeric
Polarity:	See Pin Out



Dim	TO-18			
	Inches		Millimeters	
	Min	Max	Min	Max
CD	0.178	0.195	4.520	4.950
CH	0.140	0.210	3.556	5.330
HD	0.209	0.230	5.310	5.840
LC	0.100 TP		2.540 TP	
LD	0.016	0.021	0.410	0.530
LL	0.500	0.750	12.700	19.050
LU	0.016	0.019	0.410	0.480
L <sub>1</sub>	-	0.050	-	1.270
L <sub>2</sub>	0.250	-	6.350	-
P	0.100	-	2.540	-
Q	-	0.040	-	1.020
TL	0.028	0.048	0.710	1.220
TW	0.036	0.046	0.910	1.170
α	45°TP		45°TP	

**ON-STATE CURRENT DERATING CURVES**

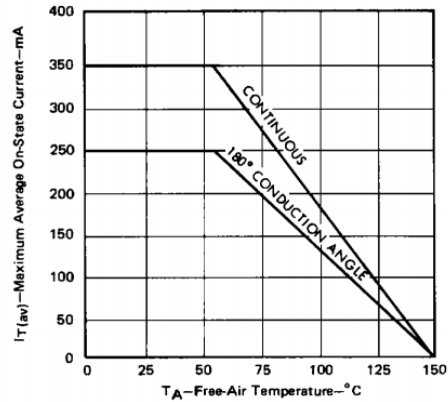


FIGURE 1

**STATIC OFF-STATE CURRENT  
vs  
FREE-AIR TEMPERATURE**

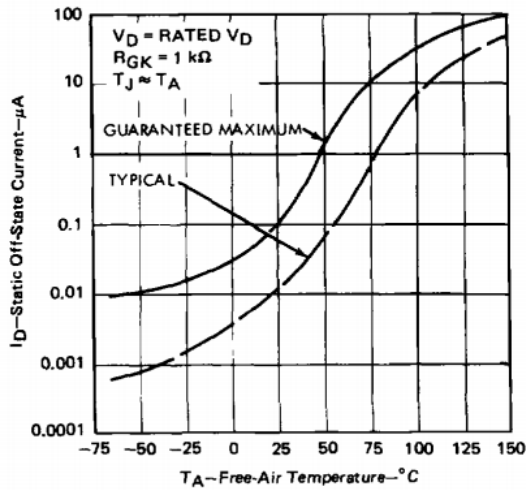


FIGURE 2

**STATIC REVERSE CURRENT  
vs  
FREE-AIR TEMPERATURE**

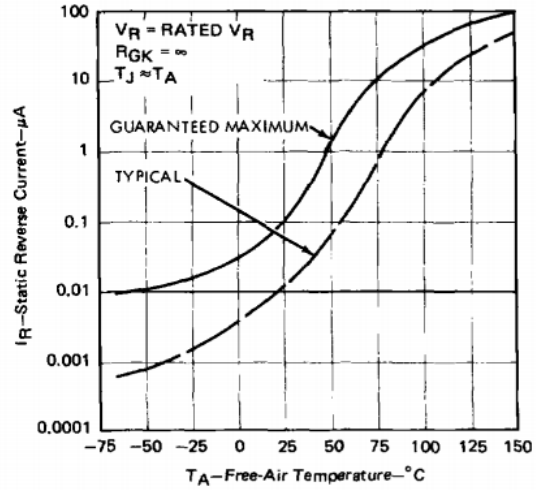


FIGURE 3

TYPICAL ON-STATE VOLTAGE  
vs  
ON-STATE CURRENT

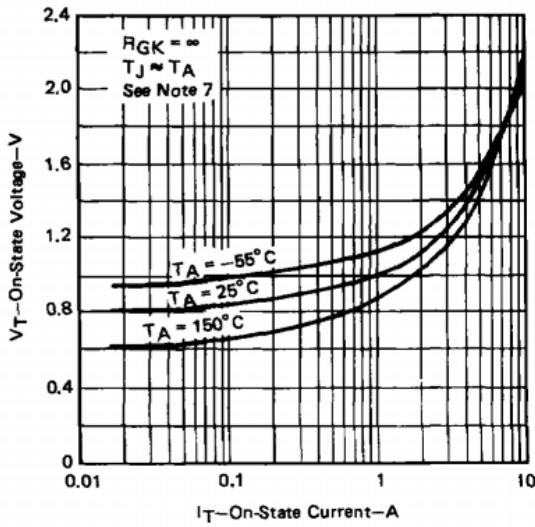


FIGURE 4

TYPICAL HOLDING CURRENT  
vs  
FREE-AIR TEMPERATURE

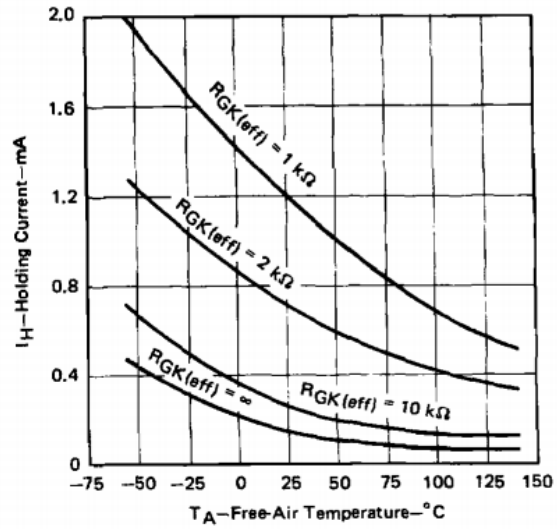


FIGURE 5

GATE TRIGGER CURRENT  
vs  
FREE-AIR TEMPERATURE

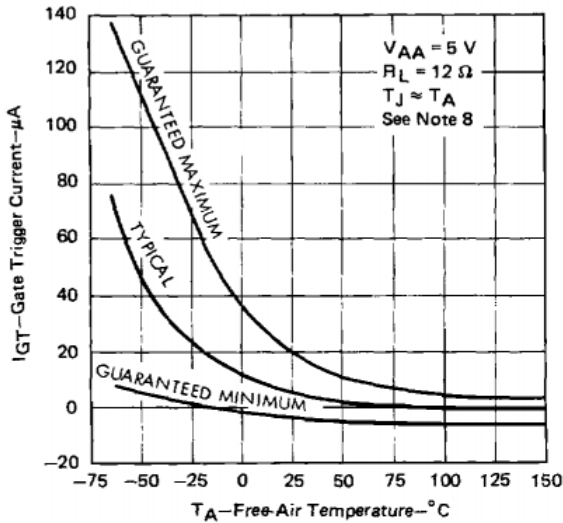


FIGURE 6

GATE TRIGGER VOLTAGE  
vs  
FREE-AIR TEMPERATURE

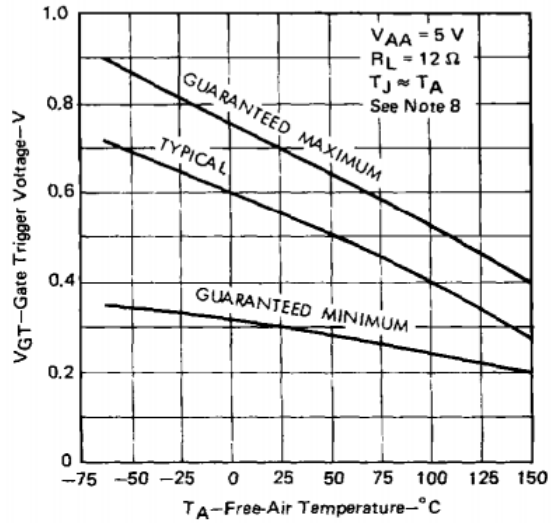


FIGURE 7

# 2N3001-2N3004

SILICON REVERSE BLOCKING THYRISTORS

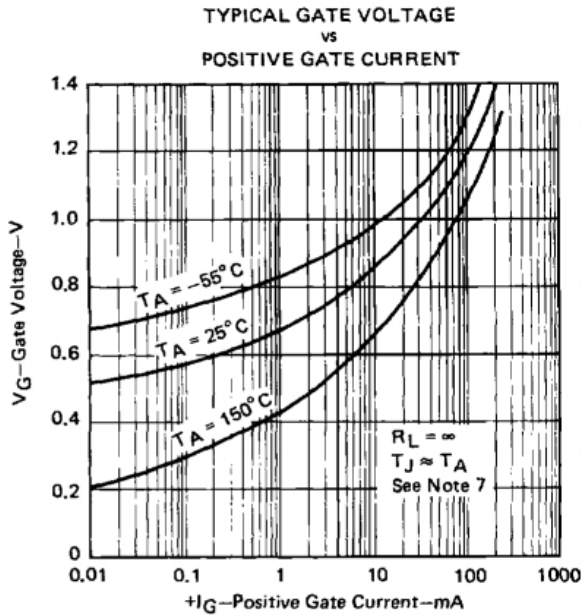


FIGURE 8

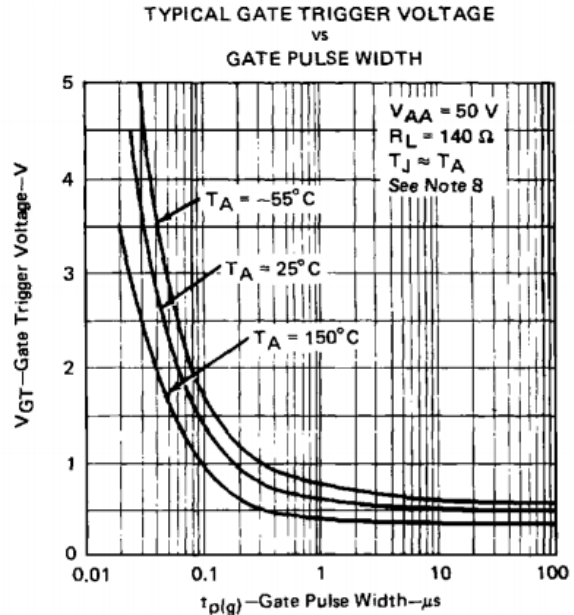


FIGURE 9

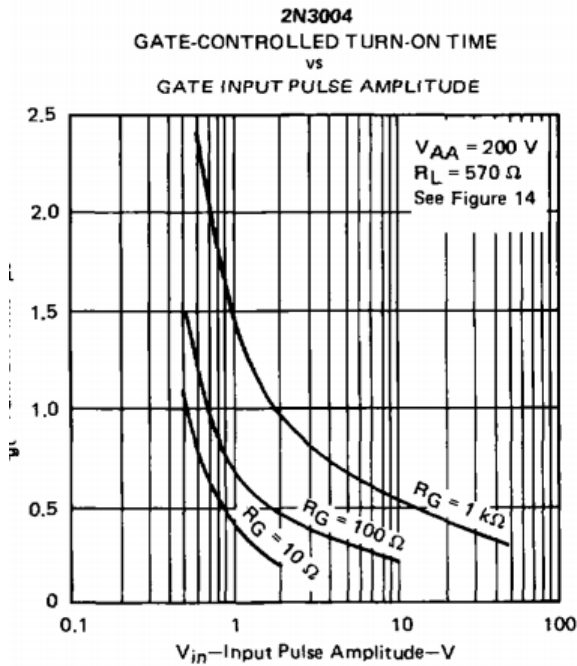


FIGURE 10

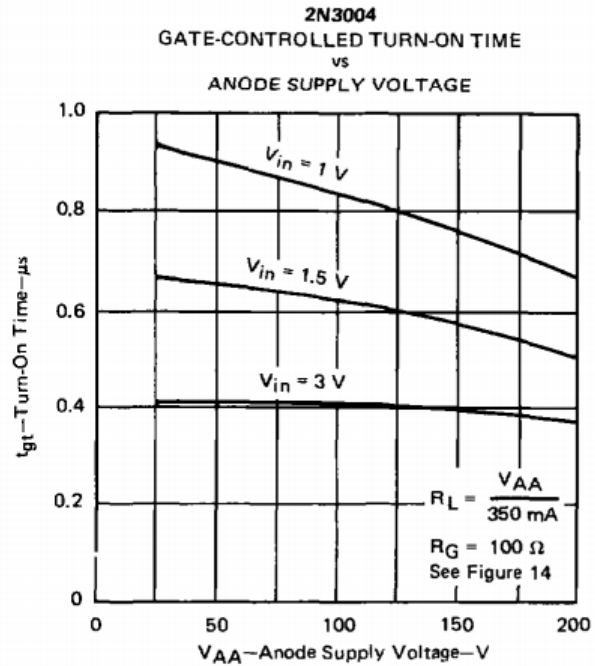


FIGURE 11

# 2N3001-2N3004

SILICON REVERSE BLOCKING THYRISTORS

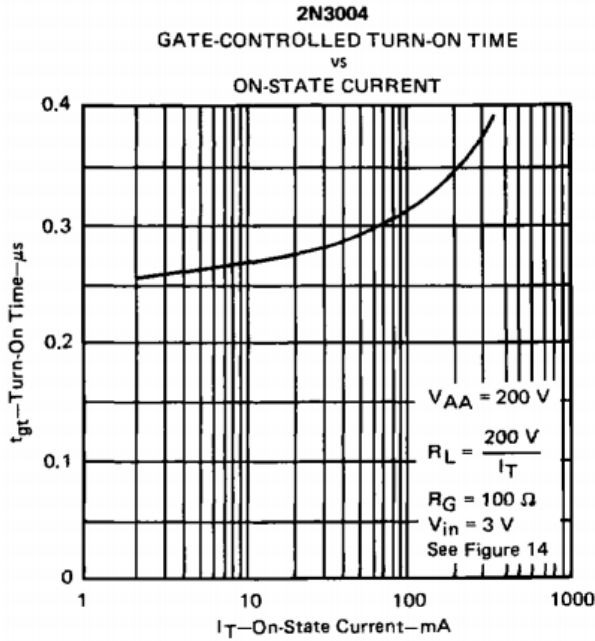


FIGURE 12

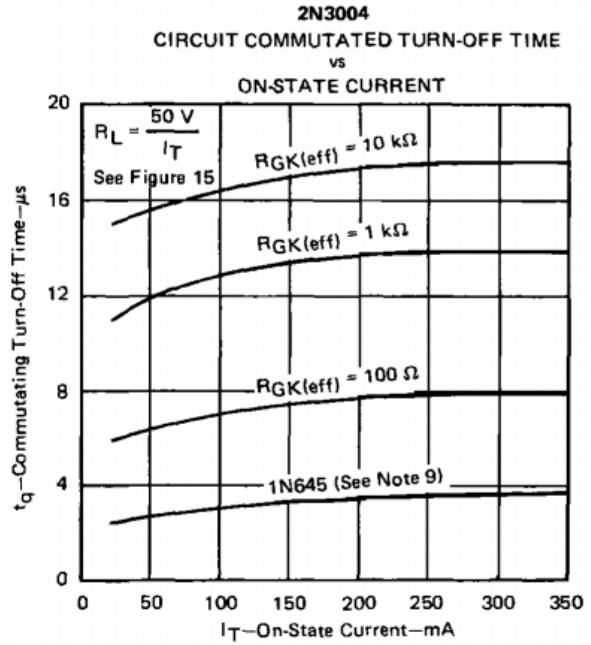
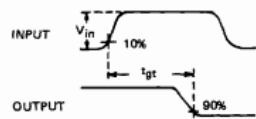
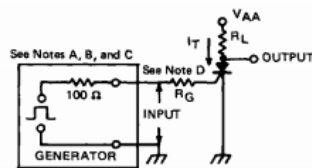


FIGURE 13

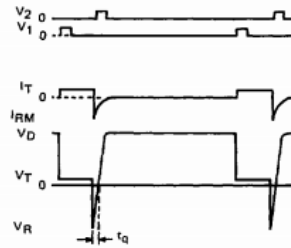


VOLTAGE WAVEFORMS

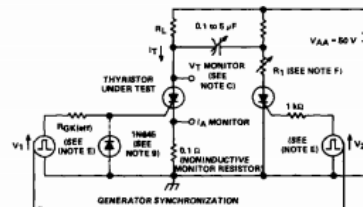


TEST CIRCUIT

FIGURE 14—TURN-ON TIME



WAVEFORMS



TEST CIRCUIT

FIGURE 15—COMMUTATING TURN-OFF TIME