

# 2N5164 thru 2N5171 (SILICON)



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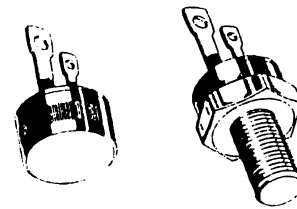
## THYRISTORS SILICON CONTROLLED RECTIFIERS

... designed for industrial and consumer applications such as power supplies, battery chargers, temperature, motor, light and welder controls.

- Supplied in Either Pressfit or Stud Package
- High Surge Current Rating –  $I_{TSM} = 240$  Amp
- Low On-State Voltage – 1.2 V (Typ) @  $I_{TM} = 20$  Amp
- Practical Level Triggering and Holding Characteristics – 10 mA (Typ) @  $T_C = 25^\circ\text{C}$

## THYRISTORS PNPN

50-600 VOLTS  
20 AMPERES RMS



### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
*Peak Reverse Blocking Voltage (1) 2N5164,2N5168 2N5165,2N5169 2N5166,2N5170 2N5167,2N5171	$V_{RRM}$	50 200 400 600	Volts
*Non-repetitive Peak Reverse Blocking Voltage 2N5164,2N5168 2N5165,2N5169 2N5166,2N5170 2N5167,2N5171	$V_{RSM}$	75 300 500 700	Volts
Forward Current RMS	$I_T(RMS)$	20	Amp
Circuit Fusing Considerations ( $T_J = -40$ to $+100^\circ\text{C}$ , $t \leq 8.3$ ms)	$I^2t$	235	$\text{A}^2\text{s}$
*Peak Forward Surge Current (One cycle, 60 Hz, $T_J = -40$ to $+100^\circ\text{C}$ )	$I_{TSM}$	240	Amp
*Peak Forward Gate Power	$P_{GFM}$	5.0	Watts
*Average Forward Gate Power	$P_{GF(AV)}$	0.5	Watt
*Peak Forward Gate Current	$I_{GFM}$	2.0	Amp
Peak Gate Voltage – Forward (2)	$V_{GFM}$	10	Volts
Reverse	$V_{GRM}$	10	Volts
*Operating Junction Temperature Range	$T_J$	-40 to +100	$^\circ\text{C}$
*Storage Temperature Range	$T_{stg}$	-40 to +150	$^\circ\text{C}$
Stud Torque (3)	2N5168-2N5171	30	in. lb.

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Typ	Max	Unit
*Thermal Resistance, Junction to Case 2N5164,65,66,67 2N5168,69,70,71	$\theta_{JC}$	1.0 1.1	1.5 1.6	$^\circ\text{C}/\text{W}$

\* Indicates JEDEC Registered Data.

- (1)  $V_{RRM}$  for all types can be applied on a continuous dc basis without incurring damage. Ratings apply for zero or negative gate voltage. Devices should not be tested for blocking capability in a manner such that the voltage applied exceeds the rated blocking voltage.
- (2) Devices should not be operated with a positive bias applied to the gate concurrent with a negative potential applied to the anode.
- (3) Reliable operation can be impaired if torque rating is exceeded, terminal tubes bent, or glass seal broken.

STYLE 1  
TERM 1 GATE  
2 CATHODE  
3 ANODE

2N5164  
2N5165  
2N5166  
2N5167

All JEDEC dimensions and notes apply

TO-203AA

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	12.726	12.827	0.501	0.505
B	11.811	12.065	0.465	0.475
C	8.39	9.65	0.330	0.380
E	2.54	-	0.100	-
F	0.89	1.72	0.035	0.066
J	2.04	2.46	0.080	0.097
K	-	20.32	-	0.800
N	-	12.95	-	0.510
O	1.66	2.28	0.065	0.090

STYLE 1  
TERM 1 CATHODE  
2 GATE  
3 STUD ANODE

2N5168  
2N5169  
2N5170  
2N5171

TO-48

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	15.34	15.50	0.604	0.614
B	14.00	14.20	0.551	0.559
C	20.70	24.13	0.815	0.950
F	1.40	1.65	0.055	0.065
H	2.29	REF	0.090	REF
J	10.67	11.56	0.420	0.455
K	9.78	10.54	0.385	0.415
L	8.99	7.75	0.275	0.305
O	2.03	2.41	0.080	0.095
R	1.55	REF	0.065	REF
T	12.70	12.83	0.500	0.505

# 2N5164 thru 2N5171

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

Characteristic	Symbol	Min	Max	Unit
*Peak Forward Blocking Voltage ( $T_J = 100^\circ\text{C}$ ) 2N5164, 2N5168 2N5165, 2N5169 2N5166, 2N5170 2N5167, 2N5171	$V_{DRM}(1)$	50 200 400 600	— — — —	Volts
*Peak Forward Blocking Current (Rated $V_{DRM}$ @ $T_J = 100^\circ\text{C}$ , gate open)	$I_{DRM}$	—	5.0	mA
Peak Reverse Blocking Current (Rated $V_{RRM}$ @ $T_J = 100^\circ\text{C}$ , gate open)	$I_{RRM}$	—	5.0	mA
Gate Trigger Current (Continuous dc) (Anode Voltage = 7.0 Vdc, $R_L = 100 \Omega$ ) *(Anode Voltage = 7.0 Vdc, $R_L = 100 \Omega$ , $T_C = -40^\circ\text{C}$ )	$I_{GT}(2)$	— —	40 75	mA
Gate Trigger Voltage (Continuous dc) (Anode Voltage = 7.0 Vdc, $R_L = 100 \Omega$ ) *(Anode Voltage = 7.0 Vdc, $R_L = 100 \Omega$ , $T_C = -40^\circ\text{C}$ ) *(Anode Voltage = Rated $V_{DRM}$ , $R_L = 100 \Omega$ , $T_J = 100^\circ\text{C}$ )	$V_{GT}$  $V_{GD}$	— — 0.2	1.5 2.5 —	Volts
Forward "ON" Voltage (pulsed, 1.0 ms max, duty cycle $\leq 1\%$ ) ( $I_{TM} = 20 \text{ A}$ ) ( $I_{TM} = 41 \text{ A}$ )	$V_{TM}$	— —	1.5 1.7	Volts
Holding Current (Anode Voltage = 7.0 Vdc, gate open) *(Anode Voltage = 7.0 Vdc, gate open, $T_C = -40^\circ\text{C}$ )	$I_H$	— —	50 90	mA
Turn-On Time ( $t_d + t_r$ ) ( $I_{TM} = 20 \text{ A}$ , $I_{GT} = 40 \text{ mAdc}$ )	$t_{on}$	TYPICAL 1.0		$\mu\text{s}$
Turn-Off Time ( $I_{TM} = 10 \text{ A}$ , $I_R = 10 \text{ A}$ ) ( $I_{TM} = 10 \text{ A}$ , $I_R = 10 \text{ A}$ , $T_J = 100^\circ\text{C}$ ) ( $V_{DRM} = \text{rated voltage}$ ) ( $dv/dt = 30 \text{ V}/\mu\text{s}$ )	$t_{off}$	20 30		$\mu\text{s}$
Forward Voltage Application Rate (Gate open, $T_J = 100^\circ\text{C}$ )	$dv/dt$	50		$\text{V}/\mu\text{s}$

\*Indicates JEDEC Registered Data.

(1)  $V_{DRM}$  for all types can be applied on a continuous dc basis without incurring damage. Ratings apply for zero or negative gate voltage. These devices should not be tested with a constant current source for forward or reverse blocking capability such that the voltage applied exceeds the rated blocking voltage.

(2) For optimum operation, i.e. faster turn-on, lower switching losses, best  $di/dt$  capability, recommended  $I_{GT} = 200 \text{ mA}$ .

## EFFECT OF TEMPERATURE UPON TYPICAL TRIGGER CHARACTERISTICS

FIGURE 1 – GATE TRIGGER CURRENT

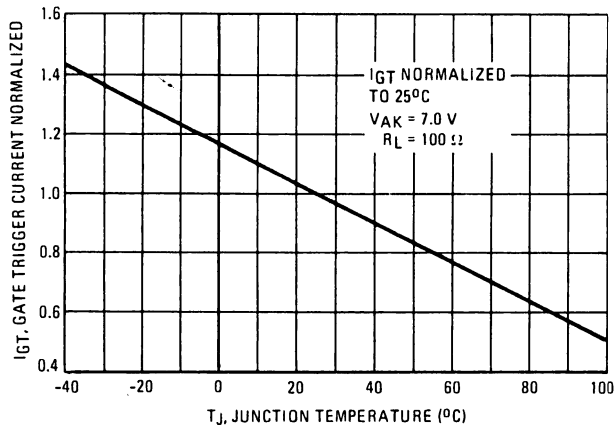
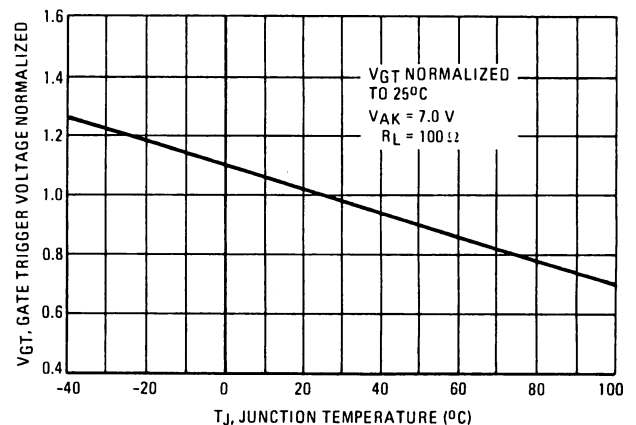


FIGURE 2 – GATE TRIGGER VOLTAGE



# 2N5164 thru 2N5171

## MAXIMUM ALLOWABLE NON-RECURRENT SURGE CURRENT

FIGURE 3 - 60 Hz SURGES

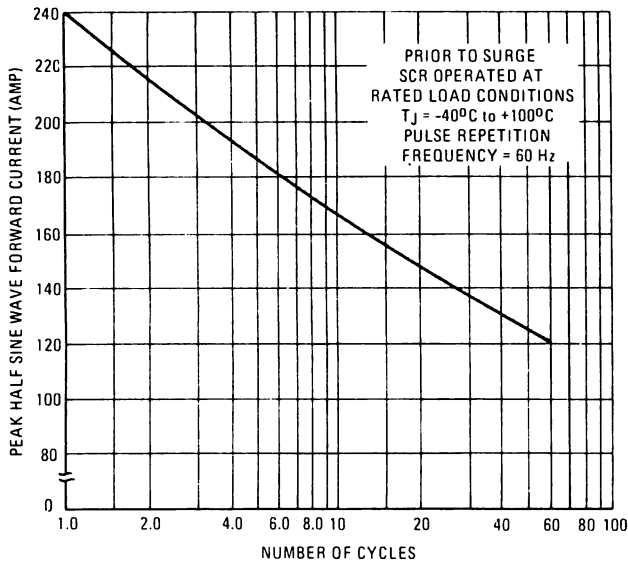


FIGURE 4 - SUB-CYCLE SURGES

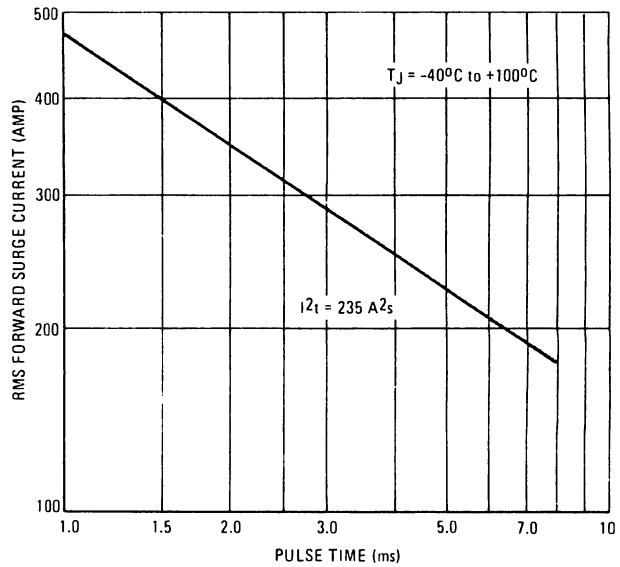


FIGURE 5 - GATE TRIGGER CHARACTERISTICS

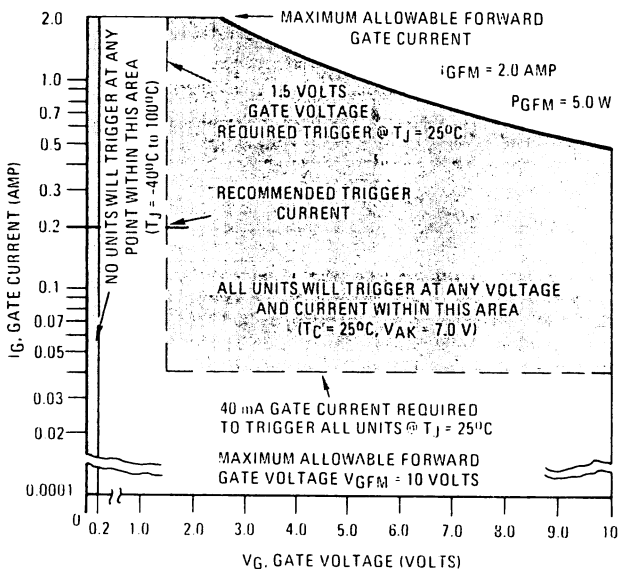
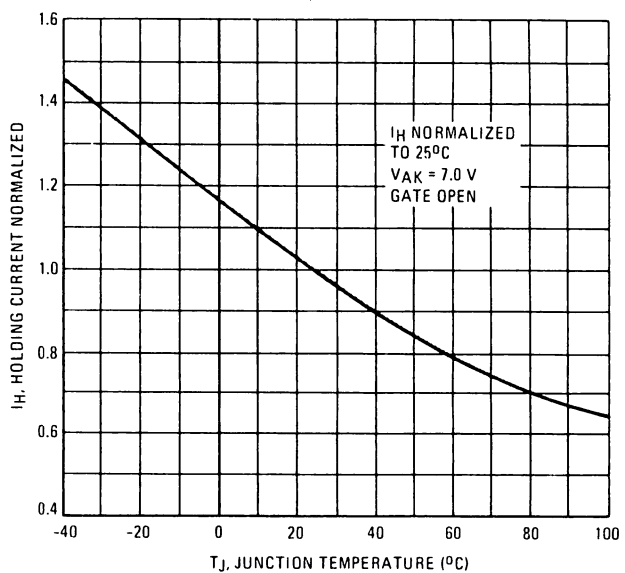


FIGURE 6 - EFFECT OF TEMPERATURE ON TYPICAL HOLDING CURRENT



DERATING AND DISSIPATION FOR RESISTIVE AND INDUCTIVE LOADS (f = 60 to 400 Hz, SINE WAVE)

FIGURE 7 - CURRENT DERATING<sup>(1)</sup>

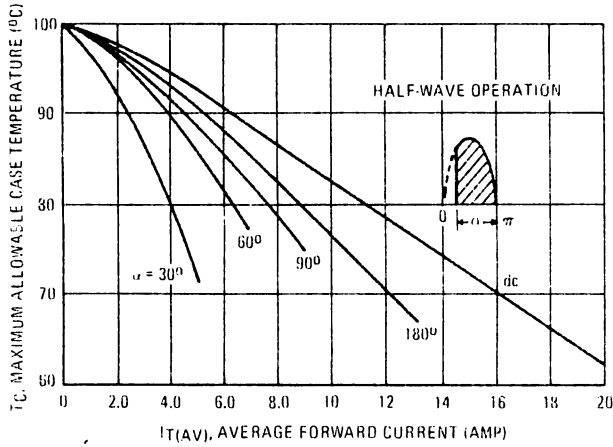


FIGURE 8 - FORWARD POWER DISSIPATION

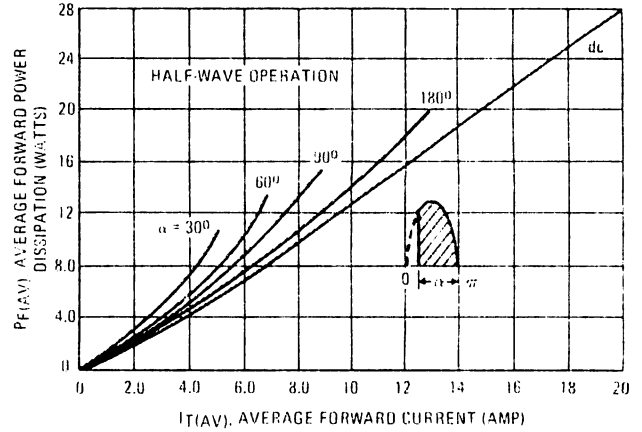


FIGURE 9 - FORWARD CONDUCTION CHARACTERISTICS

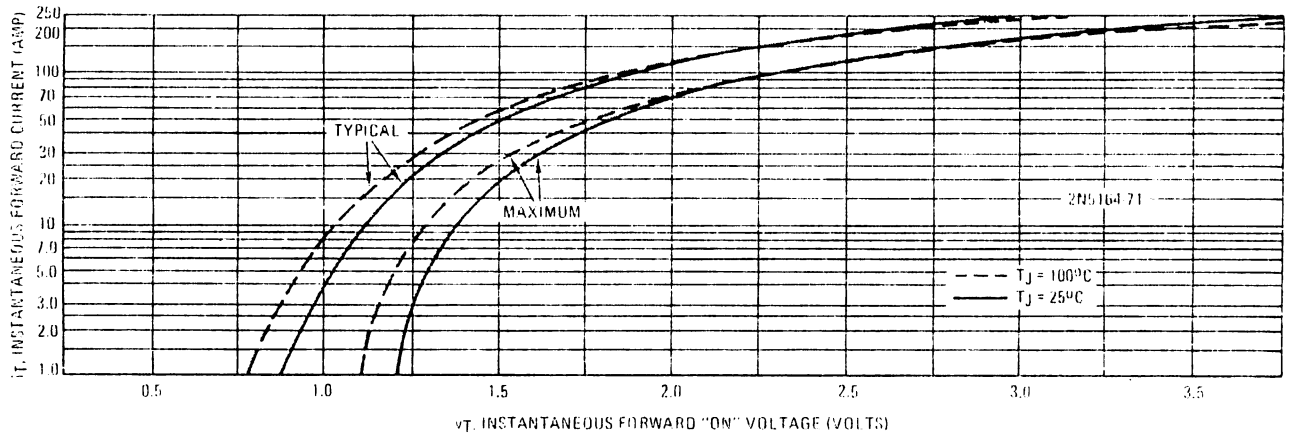
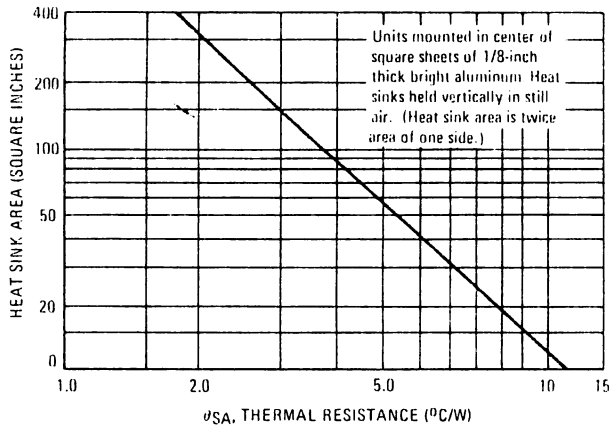


FIGURE 10 - TYPICAL THERMAL RESISTANCE OF PLATES



<sup>(1)</sup> Reverse polarity units must be derated an additional 10%, i.e., in Figure 7 the maximum allowable case temperature of the 2N5164 at 16 Adc is 70°C, a derating of 30°C below the maximum junction temperature.