2N5164 thru 2N5171 (SILICON)
2N5164R thru 2N5171R

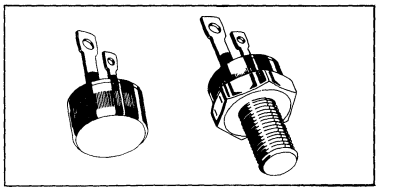
THYRISTORS
SILICON CONTROLLED RECTIFIERS

. . . 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°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°C, t ≤ 8.3 ms)	I^2t	235	A^2s
*Peak Forward Surge Current (One cycle, 60 Hz, T_J = -40 to +100°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) Reverse	V_{GFM} V_{GRM}	10 10	Volts
*Operating Junction Temperature Range	T_J	-40 to +100	°C
*Storage Temperature Range	T_{stg}	-40 to +150	°C
Stud Torque (3) 2N5168-2N5171		30	in. lb.

THERMAL CHARACTERISTICS

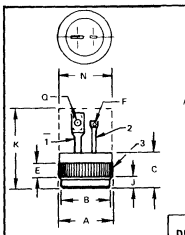
Characteristic	Symbol	Typ	Max	Unit
*Thermal Resistance, Junction to Case 2N5164,65,66,67 2N5168,69,70,71	θ_{JC}	 1.0 1.1	 1.5 1.6	°C/W

*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.



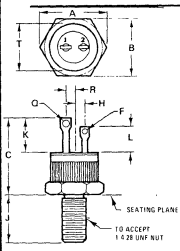
2N5164
2N5165
2N5166
2N5167

All JEDEC dimensions and notes apply

CASE 174-02
TO-203AA

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES 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	0.068
J	2.04	2.46	0.080	0.097
K	–	20.32	–	0.800
N	–	12.95	–	0.510
Q	1.66	2.28	0.065	0.090

STYLE 1
TERM. 1. GATE
2. CATHODE
3 ANODE



2N5168
2N5169
2N5170
2N5171

CASE 175

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	15.34	15.60	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	6.99	7.75	0.275	0.305
Q	2.03	2.41	0.080	0.095
R	1.65 REF		0.065 REF	
T	12.70	12.83	0.500	0.505

STYLE 1:
TERM 1. CATHODE
2. GATE
STUD : ANODE

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

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

*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 mA.

EFFECT OF TEMPERATURE UPON TYPICAL TRIGGER CHARACTERISTICS

FIGURE 1 – GATE TRIGGER CURRENT

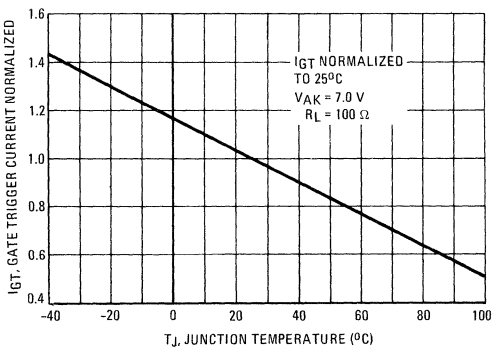
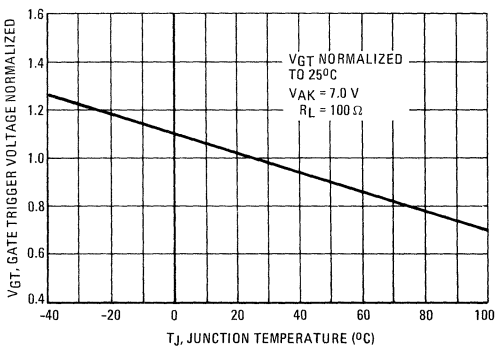


FIGURE 2 – GATE TRIGGER VOLTAGE



MAXIMUM ALLOWABLE NON-RECURRENT SURGE CURRENT

FIGURE 3 – 60 Hz SURGES

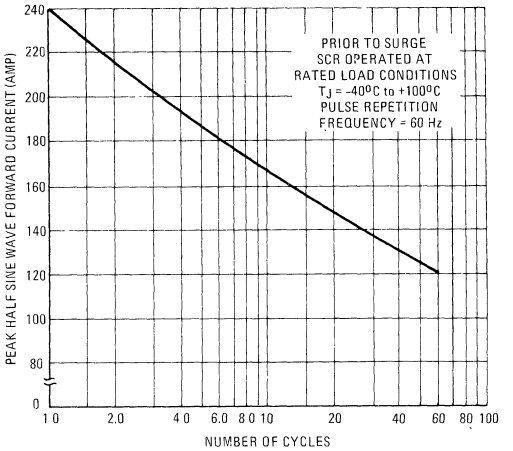


FIGURE 4 – SUB-CYCLE SURGES

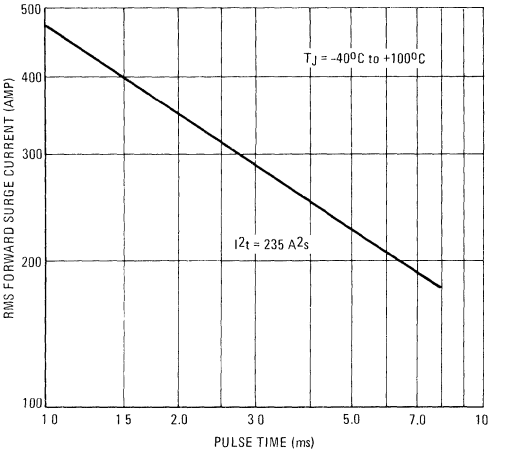


FIGURE 5 - GATE TRIGGER CHARACTERISTICS

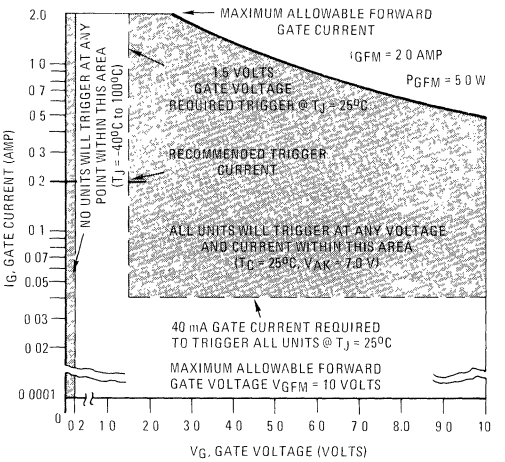
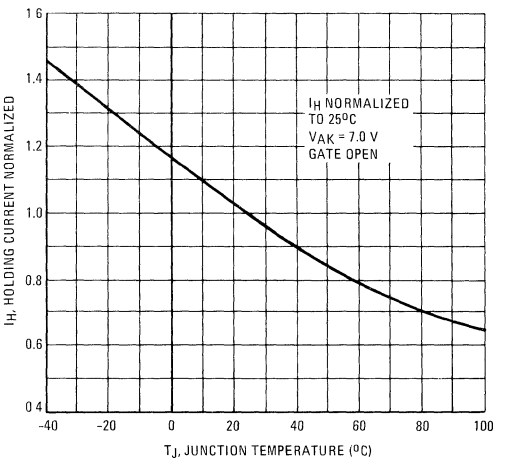


FIGURE 6 – EFFECT OF TEMPERATURE ON TYPICAL HOLDING CURRENT



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

FIGURE 7 – CURRENT DERATING(1)

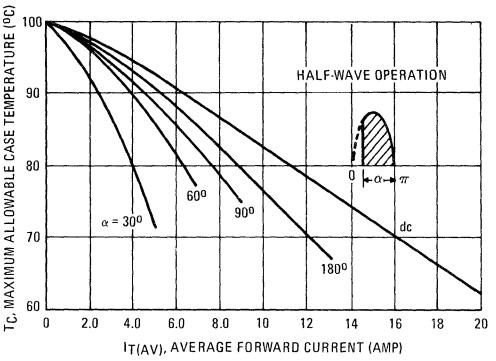


FIGURE 8 – FORWARD POWER DISSIPATION

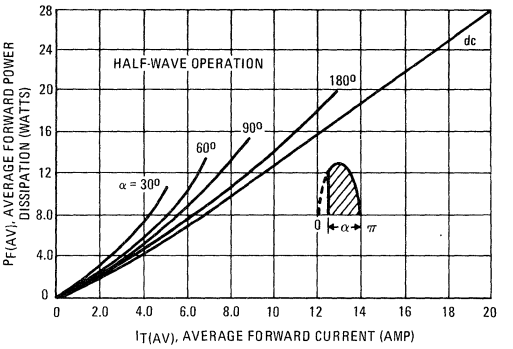


FIGURE 9 – FORWARD CONDUCTION CHARACTERISTICS

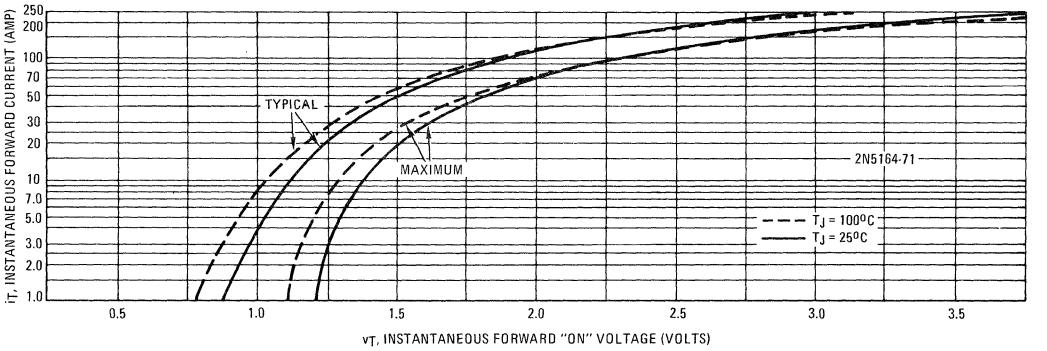
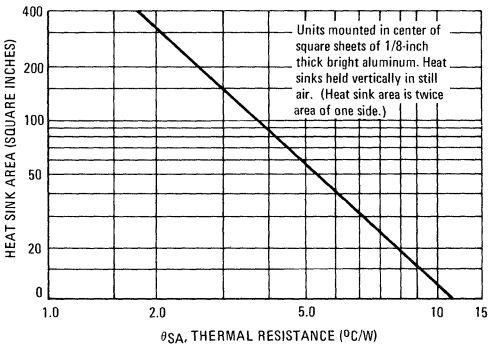


FIGURE 10 – TYPICAL THERMAL RESISTANCE OF PLATES



(1) 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. For the 2N5164R the derating would be an additional 10% or 3.0°C, making the allowable case temperature 67°C.

For additional mounting information, refer to the Motorola brochure "Mounting Techniques for Pressfit Silicon Rectifiers and Silicon Controlled Rectifiers".