

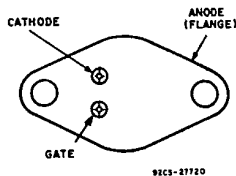
# 12.5-A Silicon Controlled Rectifiers

For Low-Cost Power-Control and Power-Switching Applications

**Features:**

- Low switching losses
- High di/dt and dv/dt capabilities
- Low leakage currents, both forward and reverse
- Low forward voltage drop at high current levels
- Low thermal resistance

**TERMINAL DESIGNATIONS**



**JEDEC TO-204AA**

RCA 2N3668\*, 2N3669\*, 2N3670\*, and 2N4103\* are all-diffused, three-junction, silicon controlled-rectifiers (SCR's). They are intended for use in power-control and power-switching applications requiring a blocking-voltage capability of up to 600 volts and a forward-current capability of 12.5 amperes (rms value) or 8 amperes (average value) at a case temperature of 80°C.

The 2N3668 is designed for low-voltage power supplies, the 2N3669 for direct operation from 120-volt line supplies, the 2N3670 for direct operation from 240-volt line supplies, and the 2N4103 for high-voltage power supplies.

The 2N3668, 2N3669, 2N3670 and 2N4103 SCR's employ the hermetic JEDEC TO-204AA package.

\*Formerly Dev. Types TA2621, TA2598, TA2618, and TA2775, respectively.

**Absolute-Maximum Ratings, for Operation with Sinusoidal AC Supply Voltage at a Frequency between 50 and 400 Hz, and with Resistive or Inductive Load RATINGS**

	CONTROLLED-RECTIFIER TYPES				UNITS
	2N3668	2N3669	2N3670	2N4103	
Transient Peak Reverse Voltage (Non-Repetitive), $V_{RM}(non-rep)$ .....	150	330	660	700	volts
Peak Reverse Voltage (Repetitive), $V_{RM}(rep)$ .....	100	200	400	600	volts
Peak Forward Blocking Voltage (Repetitive), $V_{FBOM}(rep)$ .....	100	200	400	600	volts
<b>Forward Current:</b>					
For case temperature ( $T_C$ ) of +80°C					
Average DC value at a conduction angle of 180°, $I_{FAV}$ .....	8	8	8	8	amperes
RMS value, $I_{FRMS}$ .....	12.5	12.5	12.5	12.5	amperes
For other conditions, (See Fig. 4)					
<b>Peak Surge Current, <math>I_{FM}</math> (surge):</b>					
For one cycle of applied voltage .....	200	200	200	200	amperes
For one cycle of applied principal voltage					
60 Hz (sinusoidal), $T_C = 80^\circ C$ .....	200	200	200	200	amperes
50 Hz (sinusoidal), $T_C = 80^\circ C$ .....	170	170	170	170	amperes
For more than one cycle of applied voltage .....	See Fig. 1	See Fig. 1	See Fig. 1	See Fig. 1	
<b>Fusing Current (for SCR protection):</b>					
$T_J = -40$ to $100^\circ C$ , $t = 1$ to 8.3 ms, $I^2t$ .....	170	170	170	170	ampere <sup>2</sup> second/microsecond
<b>Rate of Change of Forward Current, di/dt .....</b>					
$V_{FB} = V_{B00}$ (min. value)	200	200	200	200	
$I_{GT} = 200$ mA, 0.5 ns rise time					
<b>Gate Power*:</b>					
Peak, Forward or Reverse, for 10 ns duration, $P_{GM}$ .....	40	40	40	40	watts
(See Figs. 7 and 9)					
Average, $P_{CAV}$ .....	0.5	0.5	0.5	0.5	watt
<b>Temperature:</b>					
Storage, $T_{stg}$ * .....	-40 to +125	-40 to +125	-40 to +125	-40 to +125	°C
Operating (Case), $T_C$ .....	-40 to +100	-40 to +100	-40 to +100	-40 to +100	°C

\*Any values of peak gate current or peak gate voltage to give the maximum gate power is permissible.

\*Temperature reference point is within 1/8 in. (3.17 mm) of the center of the underside of unit.

**ELECTRICAL CHARACTERISTICS**

Characteristics at Maximum Ratings (unless otherwise specified), and at Indicated Case Temperature ( $T_c$ )

CHARACTERISTICS	CONTROLLED-RECTIFIER TYPES												UNITS
	2N3668			2N3669			2N3670			2N4103			
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Peak Repetitive Blocking Voltage, $V_{DRM}$ At $T_c = +100^\circ\text{C}$ .....	100	—	—	200	—	—	400	—	—	600	—	—	volts
Peak Blocking Current, at $T_c = +100^\circ\text{C}$ : Forward, $I_{BOM}$ .....	—	0.2	2	—	0.25	2.5	—	0.3	3	—	0.35	4	mA
$V_D = V_{DRM}$ Reverse, $I_{ROM}$ .....	—	0.05	1	—	0.1	1.25	—	0.2	1.5	—	0.3	3	mA
$V_R = V_{RROM}$ Forward Voltage Drop, $v_f$ At a Forward Current of 25 amperes and a $T_c = +25^\circ\text{C}$ (See Fig. 2) .....	—	1.5	1.8	—	1.5	1.8	—	1.5	1.8	—	1.5	1.8	volts
DC Gate-Trigger Current, $I_{GT}$ : At $T_c = +25^\circ\text{C}$ (See Fig. 9) .....	1	20	40	1	20	40	1	20	40	1	20	40	mA (dc)
Gate-Trigger Voltage, $V_{GT}$ : At $T_c = +25^\circ\text{C}$ (See Fig. 9) .....	—	1.5	2	—	1.5	2	—	1.5	2	—	1.5	2	volts (dc)
Holding Current, $I_{HO}$ : At $T_c = +25^\circ\text{C}$ .....	0.5	25	50	0.5	25	50	0.5	25	50	0.5	25	50	mA
Critical Rate of Applied Forward Voltage, Critical $dv/dt$ .....	10	100	—	10	100	—	10	100	—	10	100	—	volts/ micro- second
$V_{FB} = V_{BOO}$ (min. value), exponential rise,  $T_c = +100^\circ\text{C}$ Turn-On Time, $t_{on}$ (Delay Time + Rise Time) .....	—	1.25	—	—	1.25	—	—	1.25	—	—	1.25	—	micro- seconds
$V_D = V_{DRM}$ $i_T = 8$ amperes, $I_G = 200$ mA, $0.1 \mu\text{s}$ rise time, $T_c = +25^\circ\text{C}$ Turn-Off Time, $t_{off}$ , (Reverse Recovery Time + Gate Recovery Time) .....	—	20	50	—	20	50	—	20	50	—	20	50	micro- seconds
$I_F = 8$ amperes, 50 ns pulse width, $dv_{FB}/dt = 20$ v/ $\mu\text{s}$ , $di/dt = 30$ A/ $\mu\text{s}$ , $I_{GT} = 200$ mA, $T_c = +80^\circ\text{C}$ Thermal Resistance, Junction-to-Case .....	—	—	1.7	—	—	1.7	—	—	1.7	—	—	1.7	$^\circ\text{C}/\text{W}$

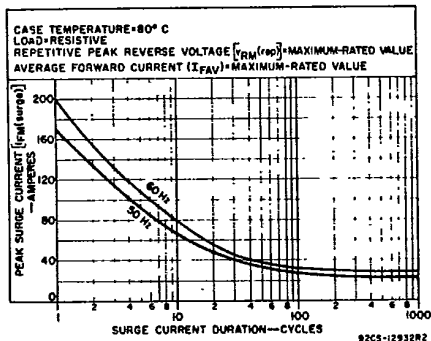


Fig. 1 — Peak surge current vs. surge current duration.

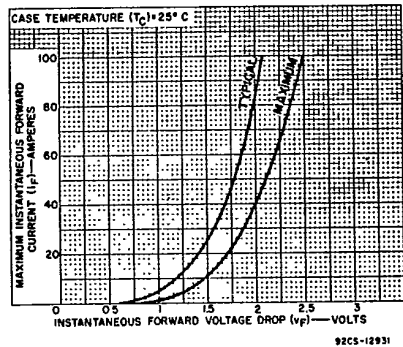


Fig. 2 — Instantaneous forward current vs. instantaneous forward voltage drop.

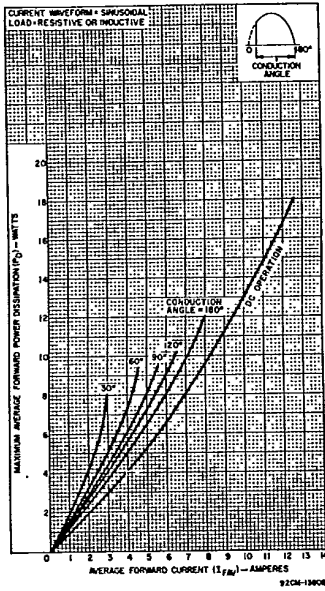


Fig. 3 — Power dissipation vs. forward current.

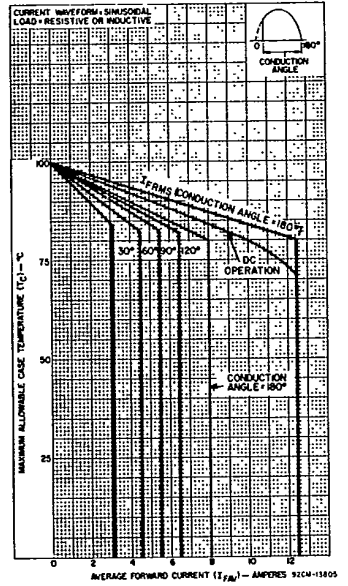


Fig. 4 — Maximum allowable case temperature vs. average forward current.

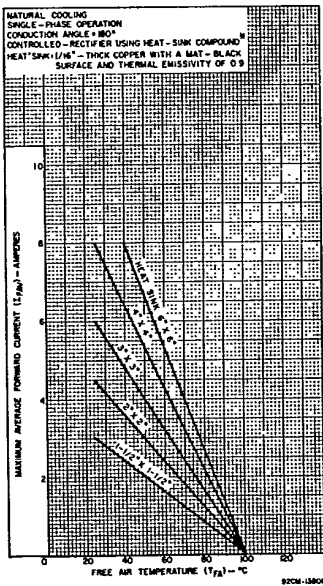


Fig. 5 — Natural-cooling operation guidance chart.

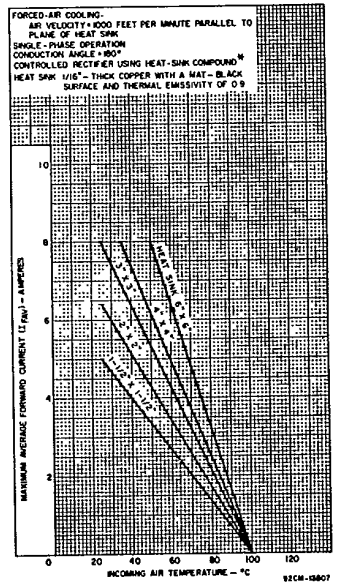


Fig. 6 — Forced-air cooling operation guidance chart.

\*Dow Corning 340 Silicone Heat Sink Compound, or Equivalent.

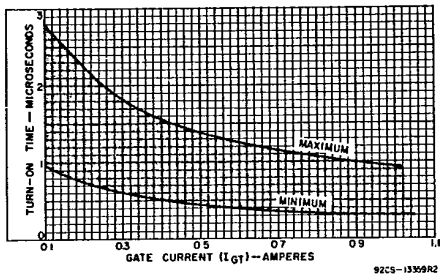


Fig. 7 — Turn-on time vs. gate current.