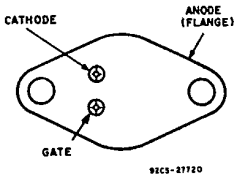
12.5-A Silicon Controlled Rectifiers

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 2N3668	2N3669	2N3670	2N4103	UNITS
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
Forward Current:					
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)					
Peak Surge Current, i_{FM} (surge):					
For one cycle of applied voltage	200	200	200	200	amperes
For one cycle of applied principal voltage					
60 Hz (sinusoidal), T_C = 80°C	200	200	200	200	amperes
50 Hz (sinusoidal), T_C = 80°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	
Fusing Current (for SCR protection):					
T_J = -40 to 100°C, t = 1 to 8.3 ms, I^2t	170	170	170	170	ampere² second
Rate of Change of Forward Current, di/dt	200	200	200	200	amperes/ microsecond
$V_{FB} = V_{BOO}$ (min. value)					
I_{GT} = 200 mA, 0.5 ns rise time					
Gate Power*:					
Peak, Forward or Reverse, for 10 ns duration, P_{GM} (See Figs. 7 and 9)	40	40	40	40	watts
Average, P_{GAV}	0.5	0.5	0.5	0.5	watt
Temperature:					
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_{DROM} At T_C = +100°C	100	—	—	200	—	—	400	—	—	600	—	—	volts
Peak Blocking Current, at T_C = +100°C: Forward, I_{DOM}	—	0.2	2	—	0.25	2.5	—	0.3	3	—	0.35	4	mA
$V_D = V_{DROM}$ 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°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°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°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°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 V_{FB}=V_{BOO}(min. value), exponential rise, T_C = +100°C	10	100	—	10	100	—	10	100	—	10	100	—	volts/ micro-second
Turn-On Time, t_{on} (Delay Time + Rise Time) $V_D = V_{DROM}$ i_T = 8 amperes, I_G = 200 mA, 0.1 μs rise time, T_C = +25°C	—	1.25	—	—	1.25	—	—	1.25	—	—	1.25	—	micro-seconds
Turn-Off Time, t_{off}, (Reverse Recovery Time + Gate Recovery Time) I_F = 8 amperes, 50 ns pulse width, dv_{FB}/dt = 20 v/μs, di_r/dt = 30 A/μs, I_{GT} = 200 mA, T_C = +80°C	—	20	50	—	20	50	—	20	50	—	20	50	micro-seconds
Thermal Resistance, Junction-to-Case	—	—	1.7	—	—	1.7	—	—	1.7	—	—	1.7	°C/W

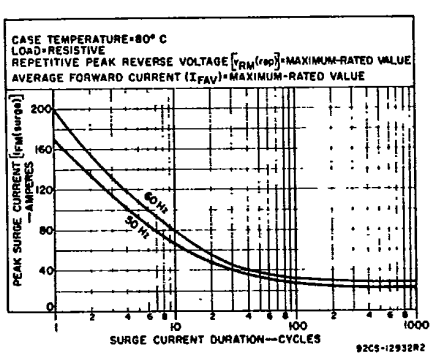


Fig. 1 — Peak surge current vs. surge current duration.

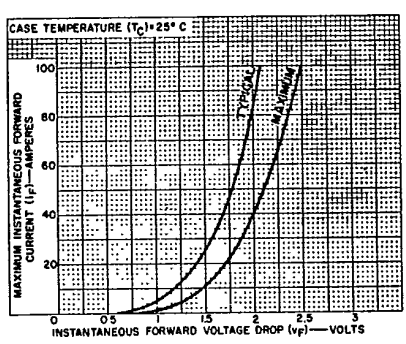


Fig. 2 — Instantaneous forward current vs. instantaneous forward voltage drop.

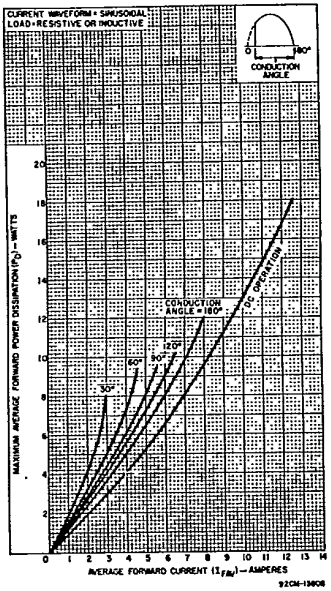


Fig. 3 — Power dissipation vs. forward current.

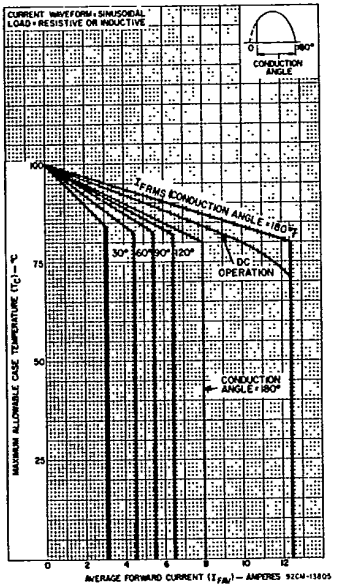


Fig. 4 — Maximum allowable case temperature vs. average forward current.

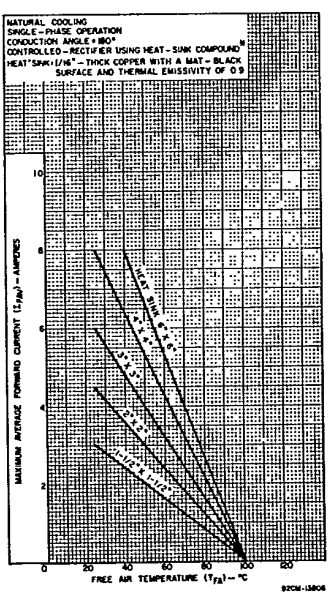


Fig. 5 — Natural-cooling operation guidance chart.

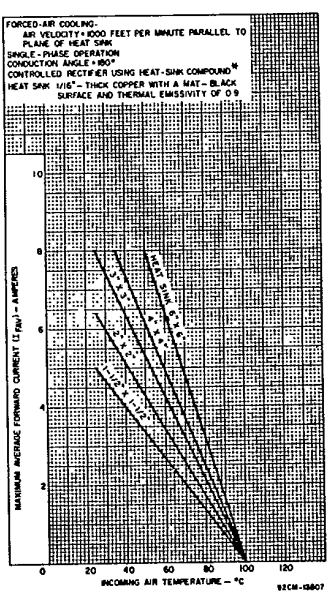


Fig. 6 — Forced-air cooling operation guidance chart.

*Dow Corning 340 Silicon Heat Sink Compound, or Equivalent.

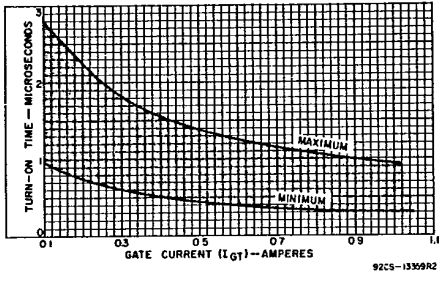


Fig. 7 — Turn-on time vs. gate current.