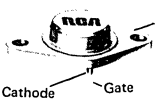
RCA Solid State Division

Thyristors

S3704, S3714 Series



S3704A,B,D,M,S

JEDEC TO-66 H-1340

JEDEC TO-66 S3714A,B,D,M,S
With Integral Heat Radiator H-1470A

5-A Silicon Controlled Rectifiers

For Inverter Applications

Features

- ■ Fast turn-off time-8 μs max.
- ▫ High di/dt and dv/dt capabilities
- ▫ Shorted-emitter gate-cathode construction . . .contains an internally diffused resistor between gate and cathode
- ▫ Center gate construction. . . .provides rapid uniform gate-current spreading for faster turn-on with substantially reduced heating effects

Package \ Voltage	100 V Types	200 V Types	400 V Types	600 V Types	700 V Types
TO-66	S3704A	S3704B	S3704D	S3704M	S3704S
TO-66 with Heat Radiator	S3714A	S3714B	S3714D	S3714M	S3714S

RCA-S3704 and S3714-series types are all-diffused, silicon controlled rectifiers (reverse-blocking triode thyristors) designed for inverter applications such as ultrasonics, choppers, regulated power supplies, induction heaters, cycloconverters, and fluorescent lighting. These types may be used at frequencies up to 25 kHz.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		S3704A S3714A	S3704B S3714B	S3704D S3714D	S3704M S3714M	S3704S S3714S	
NON-REPETITIVE PEAK REVERSE VOLTAGE:▫							
Gate Open	V_{RSOM}	150	300	500	700	800	V
NON-REPETITIVE PEAK OFF-STATE VOLTAGE:▫							
Gate Open	V_{DSOM}	150	300	500	700	800	V
REPETITIVE PEAK REVERSE VOLTAGE:▫							
Gate Open	V_{RROM}	100	200	400	600	700	V
REPETITIVE PEAK OFF-STATE VOLTAGE:▫							
Gate Open	V_{DROM}	100	200	400	600	700	V
ON-STATE CURRENT:							
T_C = 60°C, conduction angle = 180°:							
RMS	$I_{T(RMS)}$	5					A
Average	$I_{T(AV)}$	3.2					A
For other conditions		See Figs. 2, 3, 4					
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}						
For one full cycle of applied principal voltage, T_C = 60°C							
60 Hz (sinusoidal)		80					A
50 Hz (sinusoidal)		65					A
For more than one full cycle of applied principal voltage		See Fig. 5					
RATE OF CHANGE OF ON-STATE CURRENT							
$V_D = V_{DROM}$, I_{GT} = 50 mA, t_r = 0.1 μs (See Fig. 11)	di/dt	200					A/μs
FUSING CURRENT (for SCR protection):							
T_J = −40 to 100°C, t = 1 to 8.3 ms	I^2t	25					A
GATE POWER DISSIPATION:●							
Peak Forward (for 10 μs max., See Fig. 9)	P_{GM}	13					W
Peak Reverse (for 10 μs max., See Fig. 8)	P_{RGM}	13					W
Average (averaging time = 10 ms max.)	$P_{G(AV)}$	0.5					W
TEMPERATURE RANGE:▲							
Storage	T_{stg}	−40 to 150					°C
Operating (Case)	T_C	−40 to 100					°C
PIN TEMPERATURE (During soldering):							
At distances ⩾ 1/32 in. (0.8 mm) from seating plane for 10 s max.	T_P	225					°C

▫ These values do not apply if there is a positive gate signal. Gate must be open or negatively biased.

● Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted.

▲ For temperature measurement reference point, *see Dimensional Outline.*

ELECTRICAL CHARACTERISTICS

At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)

CHARACTERISTIC	SYMBOL	LIMITS FOR ALL TYPES Except as Specified			UNITS
		MIN.	TYP.	MAX.	
Peak Off-State Current: (Gate open, T_C = 100°C)					
Forward Current (I_{DOM}) at $V_D = V_{DROM}$	I_{DOM}	–	0.5	3	mA
Reverse Current (I_{ROM}) at $V_R = V_{RROM}$	I_{ROM}	–	0.3	1.5	mA
Instantaneous On-State Voltage:					
i_T = 30 A (peak), T_C = 25°C	v_T	–	2.2	3	V
For other conditions			See Fig. 7		
Instantaneous Holding Current:					
Gate open, T_C = 25°C	i_{HO}	–	20	50	mA
Critical Rate of Rise of Off-State Voltage (See Fig. 12):					
$V_D = V_{DROM}$, exponential voltage rise, Gate open, T_C = 80°C	dv/dt	100	250	–	V/μs
DC Gate Trigger Current:					
V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C	I_{GT}	–	15	40	mA
For other conditions			See Fig. 9		
DC Gate Trigger Voltage:					
V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C	V_{GT}	–	1.8	3.5	V
For other conditions			See Fig. 9		
Gate Controlled Turn-On Time: (Delay Time + Rise Time) For $V_{DX} = V_{DROM}$, I_{GT} = 300 mA, t_r = 0.1 μs, I_T = 2 A (peak), T_C = 25°C (See Fig. 10)	t_{gt}	–	0.7	–	μs
Circuit Commutated Turn-Off Time: $V_{DX} = V_{DROM}$, i_T = 2 A, pulse duration = 50 μs, dv/dt = 100 V/μs, –di/dt = –10 A/μs, I_{GT} = 100 mA, V_{GT} = 0 V (at turn-off), T_C = 80°C (See Fig. 13)	t_q	–	4	8	μs
Thermal Resistance:					
Junction-to-Case	$R_{\theta JC}$	–	4	8	°C/W
Junction-to-Ambient	$R_{\theta JA}$	–	–	40	°C/W

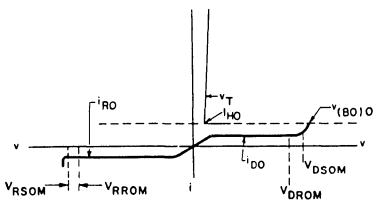


Fig. 1 – Principal voltage-current characteristic.

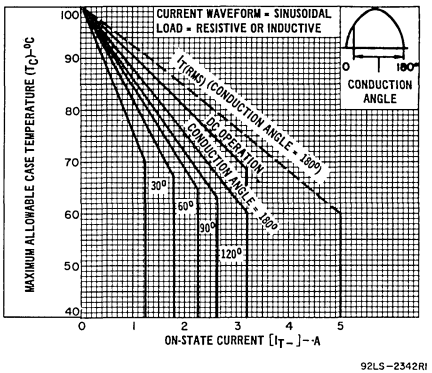


Fig. 2 — Maximum allowable case temperature vs. on-state current.

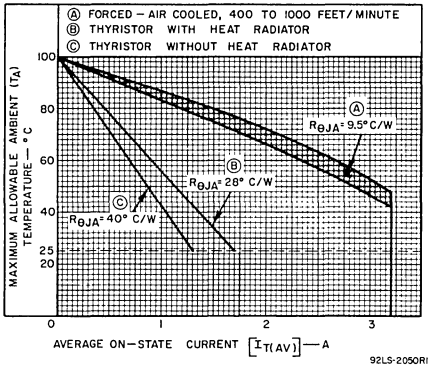


Fig. 3 — Maximum allowable ambient temperature vs. average on-state current.

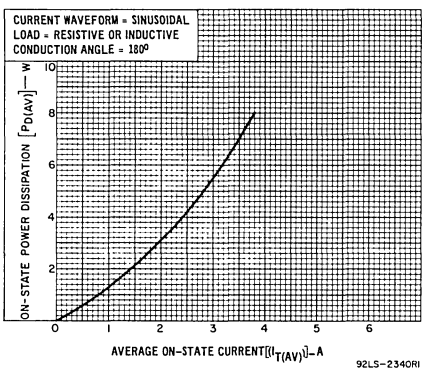


Fig. 4 — Power dissipation vs. average on-state current.

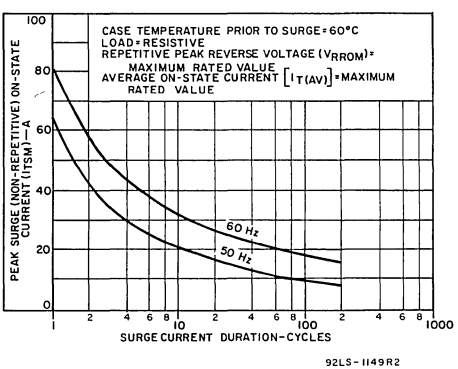


Fig. 5 — Peak surge on-state current vs. surge current duration.

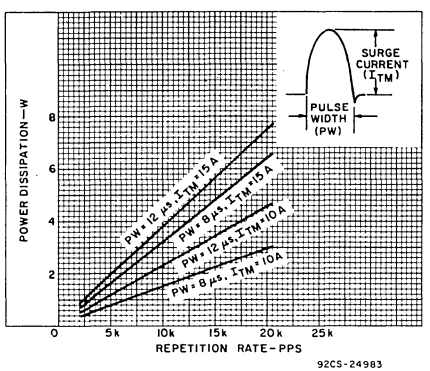


Fig. 6 — Dissipation vs. repetition rate

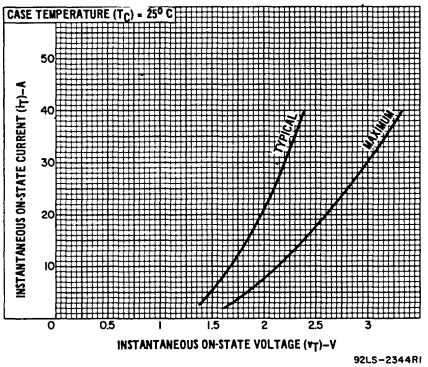


Fig. 7 — Instantaneous on-state current vs. on-state voltage.

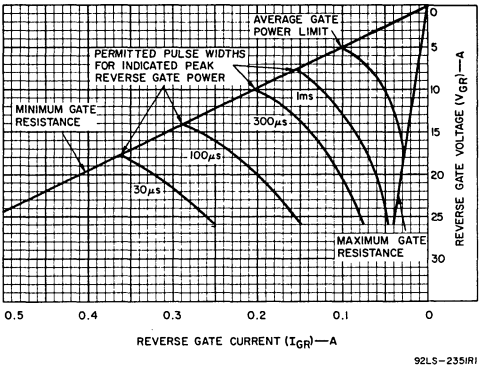


Fig. 8 — Reverse gate voltage vs. reverse gate current.

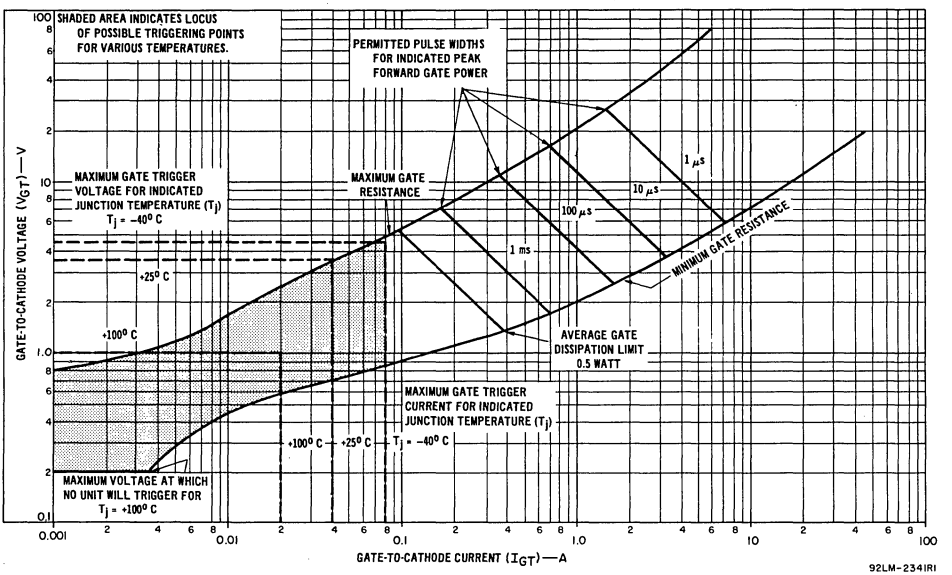


Fig. 9 — Gate trigger characteristics and limiting conditions for determination of permissible gate-trigger pulses.

TERMINAL CONNECTIONS

Pin 1 — Gate
Pin 2 — Cathode
Heat Rad., Case, Mtg. Flange — Anode

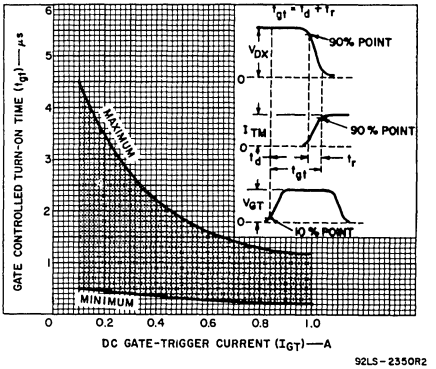


Fig. 10 — Turn-on time vs. gate-trigger current.

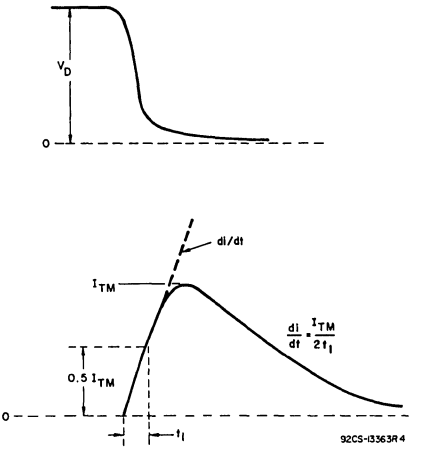


Fig. 11 — Rate-of-change of on-state current with time (defining di/dt).

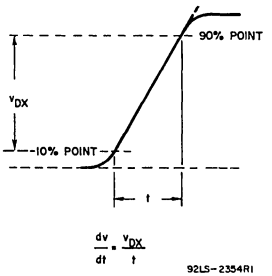


Fig. 12 — Rate-of-rise of off-state voltage with time (defining dv/dt).

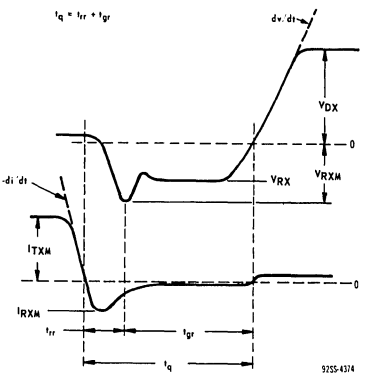


Fig. 13 — Relationship between off-state voltage, reverse voltage, on-state current, and reverse current showing reference points defining turn-off time (t_q).

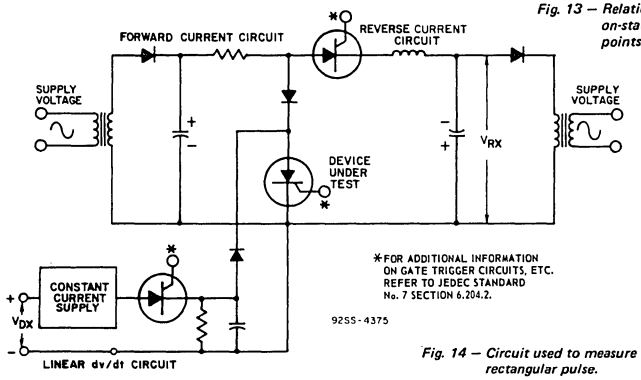
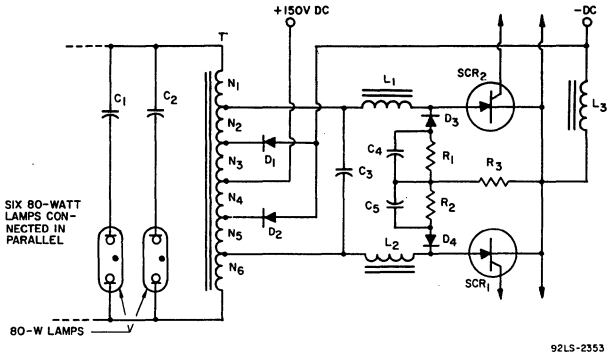


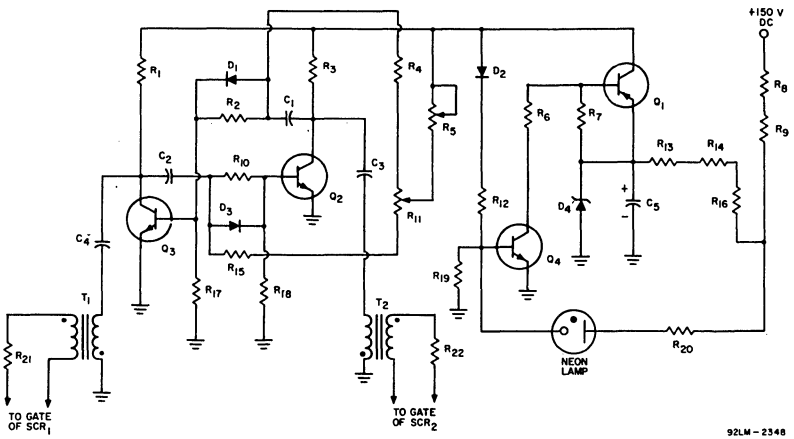
Fig. 14 — Circuit used to measure turn-off time (t_q), rectangular pulse.



C_1, C_2: 0.01 μF, 1200 V (Ballast Capacitors)
C_3: 0.01 μF, 600 V
C_4, C_5: 0.02 μF, 600 V
D_1, D_2: Fast-Recovery Diodes, 6 A, 600 V
D_3, D_4: 1N574
L_1, L_2: 32 μH
L_3: 131 Turns of No.15 Magnet Wire on Arnold Engineering Core No.A4-04117, or equivalent

R_1, R_2: 1.2 kΩ, 5 watt
R_3: 200 Ω, 10 watt
T: Core, 8 pieces of Indiana General No. CF-602 Material 05, or equivalent. Cross Section, 8 cm^2
N_1, N_6 – 30 Turns of No.18 Magnet Wire
N_2, N_5 – 13 Turns of No.18 Magnet Wire, 2 Strands
N_3, N_4 – 52 Turns of No.18 Magnet Wire, 2 Strands

Fig. 15 – Typical inverter circuit for 500-W, 8-kHz fluorescent-light control.



Q_1: RCA-40438
Q_2, Q_3, Q_4: RCA-2N3053
C_1, C_2: 0.003 μF, 100 V
C_3, C_4: 0.02 μF, 100 V
C_5: 25 μF, 25 V, electrolytic
D_1, D_2, D_3: Transitron type T1G, or equivalent
D_4: Motorola type 1M20Z10, or equivalent
Neon Lamp: GE type NE-83, or equivalent
R_1, R_3: 1 kΩ, 1/4 watt
R_2, R_{10}: 180 kΩ, 1/4 watt

R_4, R_{12}, R_{15}, R_{17}, R_{18}: 22 kΩ, 1/4 watt
R_5, R_{11}: 10 kΩ potentiometer
R_6: 10 kΩ, 1/4 watt
R_7: 1.5 kΩ, 1/4 watt
R_8, R_9, R_{13}, R_{14}, R_{16}: 680 Ω, 2 watts
R_{19}: 5.6 kΩ, 1/4 watt
R_{20}: 33 kΩ, 1/4 watt
R_{21}, R_{22}: 10 Ω, 1/4 watt
T_1, T_2: Sprague Pulse Transformer type 42Z109, or equivalent

Fig. 16 – Typical trigger-pulse generator for 500-W, 8-kHz fluorescent-light control inverter circuit.