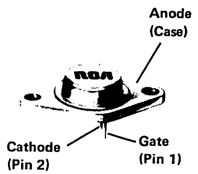
Solid State
Division

Thyristors

S3700 Series



JEDEC TO-66

H-1340

5-Ampere All-Diffused Silicon Controlled Rectifiers for Inverter Applications

Package \ Voltage	200 V Type	400 V Type	600 V Type
TO-66	S3700B (40553)	S3700D (40554)	S3700M (40555)

Numbers in parentheses are former RCA type numbers.

S3700B, S3700D, and S3700M* are all-diffused three-junction silicon controlled rectifiers intended for use in inverter applications such as ultrasonics and fluorescent lighting. They feature fast turn-off, high dv/dt, and high di/dt characteristics, and may be used at frequencies up to 25 kHz.

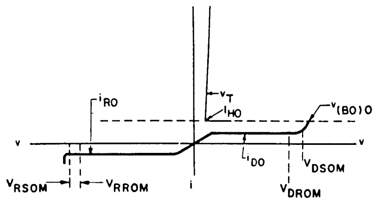
Each of these devices has an rms on-state current rating of 5 amperes at a case temperature of +60°C. The S3700B, S3700D, and S3700M have forward and reverse off-state voltage ratings of 200, 400, and 600 volts, respectively.

*Formerly Developmental Types TA2653, TA2654, and TA2655, respectively.

Features:

- RMS On-State Current –
  5 Amperes at T_C = + 60° C
- Fast Turn-Off Time –
  6 μs maximum
- High dv/dt Capability –
  100 V/μs minimum
- High di/dt Capability –
  200 A/μs
- Shorted-Emitter and Center-Gate Design –
  Removes restrictions on forward and reverse gate voltage and peak gate current

PRINCIPAL VOLTAGE-CURRENT CHARACTERISTIC



92SS-3896R2

Principal voltage is the voltage between the main terminals. Principal voltage is called positive, or forward, when the anode potential is higher than the cathode potential, and called negative when the anode potential is lower than the cathode potential.

Principal current is the current flowing between anode and cathode.

Absolute-Maximum Ratings, for Operation with Sinusoidal AC Supply Voltage At Low to Ultrasonic Frequencies, and with Resistive or Inductive Load

RATINGS	MAXIMUM VALUES			UNITS
	S3700B	S3700D	S3700M	
Non-Repetitive Peak Reverse Voltage, V_{RSOM}				
Gate Open	330	660	700	V
Repetitive Peak Reverse Voltage, V_{RROM}				
Gate Open	200	400	600	V
Repetitive Peak Off-State Voltage, V_{DROM}				
Gate Open	200	400	600	V
On-State Current:				
For case temperature of +60° C and 60 Hz				
Average DC value at a conduction angle of 180°, $I_{T(AV)}$	3.2	3.2	3.2	A
RMS value, $I_{T(RMS)}$	5	5	5	A
For other conditions		See *Fig.9*		
Peak Surge (Non-Repetitive) On-State Current, I_{TSM}				
For one cycle of applied voltage, T_C = 60°C				
60 Hz (sinusoidal)	80	80	80	A
50 Hz (sinusoidal)	65	65	65	A
For more than one cycle of applied voltage		See *Fig.11*		
Fusing Current (for SCR protection):				
T_J = –40 to 100°C, t = 1 to 8.3 ms, I^2t . .	25	25	25	A^2s
Critical Rate of Rise of On-State Current, Critical di/dt				
$V_{DX} = V_{(BO)O}$ rated value, I_{GT} = 50 mA, 0.1 μs rise time	200	200	200	A/μs
Gate Power Dissipation*				
Peak, Forward or Reverse, for 10 μs duration, P_{GM}	13	13	13	W
Average, $P_{G(AV)}$	0.5	0.5	0.5	W
Temperature:■				
Storage, T_{stg}	-40 to +150	-40 to +150	-40 to +150	°C
Operating (Case), T_C	-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 are permissible.

■For information on the reference point of temperature measurement, see *Dimensional Outline.*

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

CHARACTERISTICS	LIMITS									UNITS
	S3700B			S3700D			S3700M			
	Min.	*Typ.*	*Max.*	*Min.*	*Typ.*	*Max.*	*Min.*	*Typ.*	*Max.*	
Peak Repetitive Blocking Voltage, V_{DROM} Gate Open At T_C = +100° C	200	–	–	400	–	–	600	–	–	V
Peak Off-State Current: Gate Open At T_C = +100° C										
Forward, I_{DOM} $V_D = V_{DROM}$	–	0.5	3	–	0.5	3	–	0.5	3	mA
Reverse, I_{RROM} $V_{RO} = V_{RROM}$	–	0.3	1.5	–	0.3	1.5	–	0.3	1.5	mA
Instantaneous On-State Voltage, v_T For an on-state current of 30 A and T_C = +25° C (See *Fig.13*)	–	2.2	3	–	2.2	3	–	2.2	3	V
DC Gate Trigger Current, I_{GT} At T_C = +25° C (See *Fig.5*)	–	15	40	–	15	40	–	15	40	mA(dc)
DC Gate Trigger Voltage, V_{GT} At T_C = +25° C (See *Fig.5*)	–	1.8	3.5	–	1.8	3.5	–	1.8	3.5	V(dc)
Holding Current, I_H At T_C = +25° C	–	20	50	–	20	50	–	20	50	mA
Critical Rate of Rise of Off-State Voltage, Critical dv/dt $V_D = V_{DROM}$, linear rise, and T_C = +80°C (See waveshapes of *Fig.2*)	100	250	–	100	250	–	100	250	–	V/μs
Gate-Controlled Turn-On Time, t_{gt} (Delay Time + Rise Time) $V_{DX} = V_{DROM}$, I_{TM} = 2 A, I_{GT} = 300 mA, 0.1 μs rise time, and T_C = +25°C (See waveshapes of *Fig.3*)	–	0.7	–	–	0.7	–	–	0.7	–	μs
Circuit-Commutated Turn-Off Time, t_q (Reverse Recovery Time + Gate Recovery Time) $V_{DX} = V_{(BO)O}$ rated value, I_{TM} = 2 A, 50 μs min. pulse width, V_{RX} = 80 V min., rise time = 0.1 μs, dv/dt = 100 V/μs, di_R/dt = 10 A/μs, I_{GT} = 100 mA at turn-on, V_{GT} = 0 V at turn-off, and T_C = +80° C (See waveshapes of *Fig.4*)	–	4	6	–	4	6	–	4	6	μs
Thermal Resistance:										
Junction-to-case, $R_{\theta JC}$	–	–	8	–	–	8	–	–	8	°C/W
Junction-to-ambient, $R_{\theta JA}$	–	–	40	–	–	40	–	–	40	°C/W

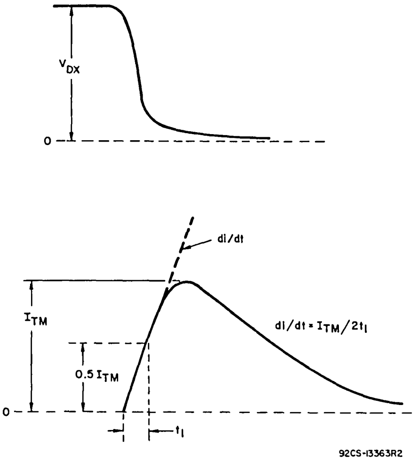


Fig. 1—Waveshape of di/dt rating test.

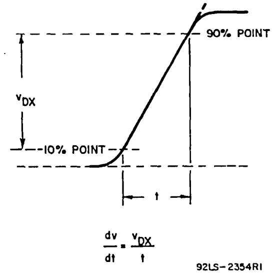


Fig. 2—Waveshape of critical dv/dt rating test (linear rise).

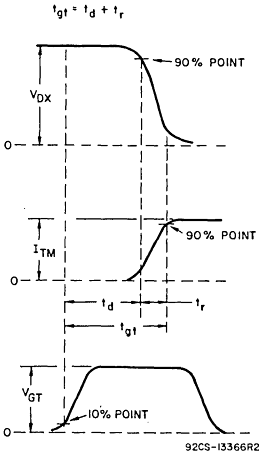


Fig. 3—Waveshape of t_{gt} rating test.

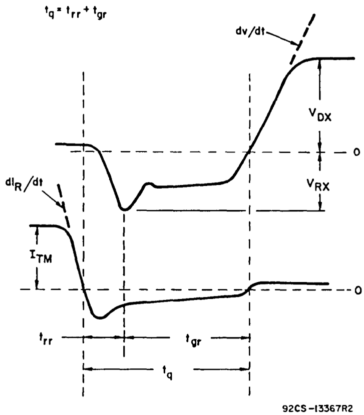


Fig. 4—Waveshape of t_q rating test.

TERMINAL CONNECTIONS

Pin 1 — Gate
Pin 2 — Cathode
Case, Mounting Flange — Anode

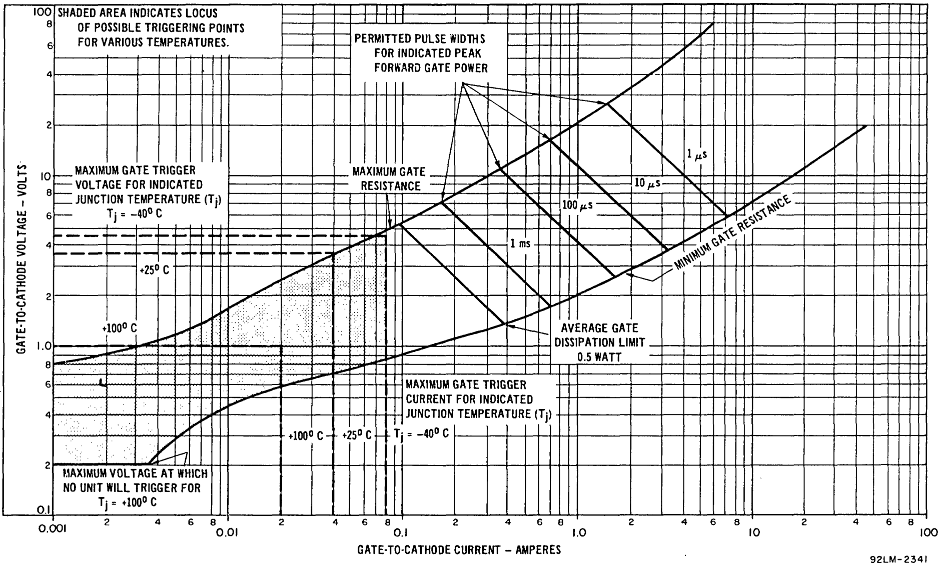


Fig. 5—Forward gate characteristics.

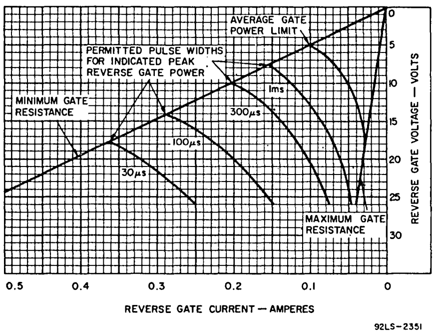


Fig. 6—Reverse gate characteristics.

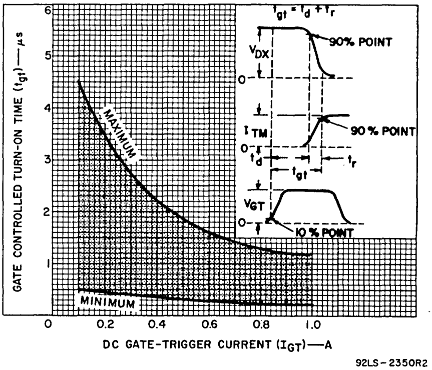


Fig. 7— Turn-on-time characteristics.

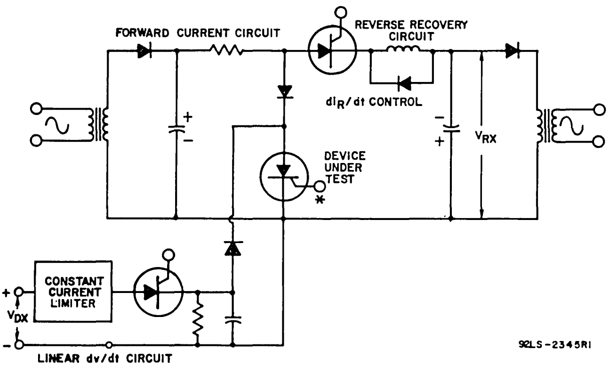


Fig. 8—Conventional turn-off-time test circuit.

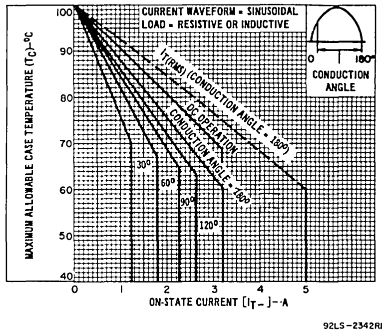


Fig. 9—Rating chart (case temperature).

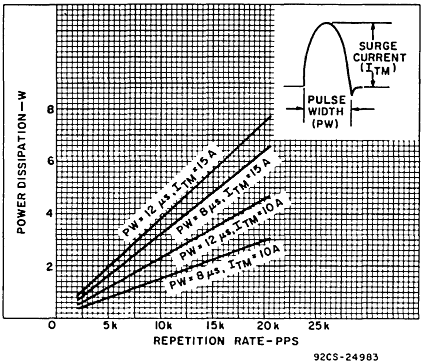


Fig. 10— Dissipation vs. repetition rate.

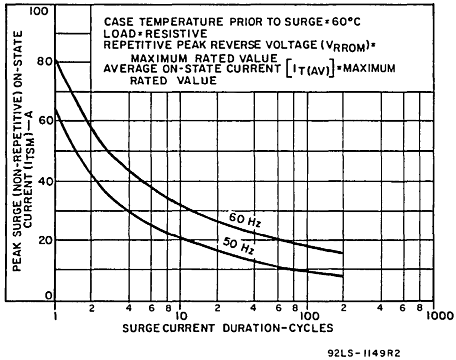


Fig. 11—Surge current rating.

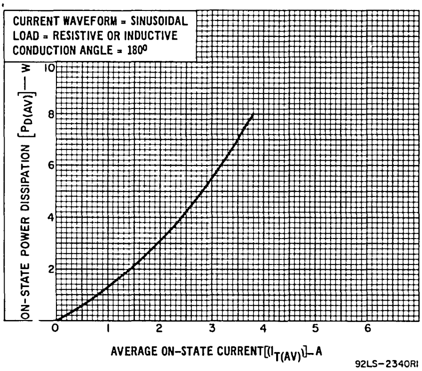


Fig. 12—Power dissipation versus average on-state current.

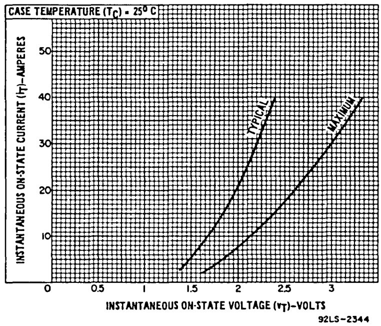
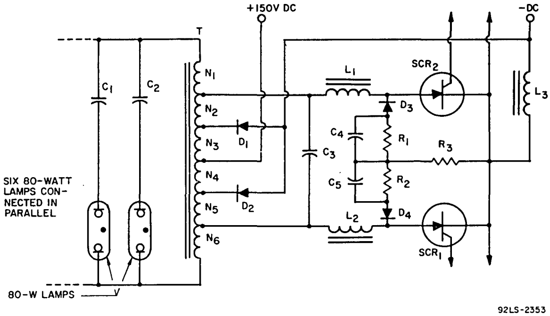


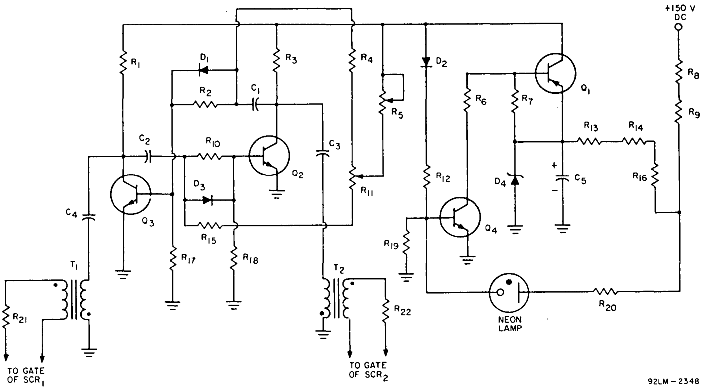
Fig. 13—On-state characteristics.



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 W
R_3: 200 Ω, 10 W
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. 14—Typical inverter circuit for 500-watt, 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. 15—Typical trigger pulse generator for 500-watt, 8-kHz fluorescent-light control inverter circuit.