RCA
Solid State
Division

Thyristors

2N3654 2N3655
2N3656 2N3657
2N3658 S7432M

JEDEC TO-48 H-1601

35-A Silicon Controlled Rectifiers

For Inverter Applications

Features:

- Fast turn-off time — 10 μs max.
- High di/dt and dv/dt capabilities
- Shorted-emitter gate-cathode construction . . . contains an internally diffused resistor between gate and cathode
- Low thermal resistance
- Center gate construction . . . provides rapid uniform gate-current spreading for faster turn-on with substantially reduced heating effects

These RCA types are all-diffused, silicon controlled rectifiers designed for high-frequency power-switching applications such as inverters, switching regulators, and high-current pulse applications. These types may be used at frequencies up to 25 kHz.

		2N3654	2N3655	2N3656	2N3657	2N3658	S7432M	
MAXIMUM RATINGS, *Absolute-Maximum Values:*								
***NON-REPETITIVE PEAK REVERSE VOLTAGE:**●								
Gate Open	V_{RSOM}	75	150	300	400	500	700	V
NON-REPETITIVE PEAK OFF-STATE VOLTAGE:●								
Gate Open	V_{DSOM}	75	150	300	400	500	700	V
***REPETITIVE PEAK REVERSE VOLTAGE:**●								
Gate Open	V_{RROM}	50	100	200	300	400	600	V
***REPETITIVE PEAK OFF-STATE VOLTAGE:**●								
Gate Open	V_{DROM}	50	100	200	300	400	600	V
ON-STATE CURRENT:								
T_C = 40°C, conduction angle = 180°:								
RMS	$I_{T(RMS)}$				35			A
* Average	$I_{T(AV)}$				25			A
***PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:** For one full cycle of applied principal voltage 60 Hz (sinusoidal)	I_{TSM}				180			A
***RATE OF CHANGE OF ON-STATE CURRENT:** $V_D = V_{DROM}$, I_{GT} = 200 mA, t_r = 0.1 μs (See Fig. 15)	di/dt				400			A/μs
FUSING CURRENT (for SCR protection): T_J = −65 to 120°C, t = 1 to 8.3 ms	I^2t				165			A^2s
***GATE POWER DISSIPATION:**■								
Peak Forward (for 10 μs max., See Fig. 7)	P_{GM}				40			W
Average (averaging time = 10 ms max.)	$P_{G(AV)}$				1			W
***TEMPERATURE RANGE:**▲								
Storage	T_{stg}				−65 to 150			°C
Operating (Case)	T_C				−65 to 120			°C
TERMINAL TEMPERATURE (During soldering): For 10 s max. (terminals and case)	T_T				225			°C
STUD TORQUE:	τ_s							
Recommended					35			in-lb
Maximum (DO NOT EXCEED)					50			in-lb

* In accordance with JEDEC registration data format (JS-14, RDF-1) filed for the JEDEC (2N series) types.

● 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 = 120°C) Forward Current (I_{DOM}) at $V_D = V_{DROM}$ Reverse Current (I_{ROM}) at $V_R = V_{RROM}$	I_{DOM} or I_{ROM}				mA
	2N3654, 2N3655, 2N3656, S7432M		–	–	6	
	2N3657		–	–	5.5	
	2N3658		–	–	4	
*	Instantaneous On-State Voltage: i_T = 25 A (peak), T_C = 25°C	v_T	–	–	2.05	V
	Instantaneous Holding Current: Gate open, T_C = 25°C	i_{HO}	–	75	150	mA
	T_C = –65°C		–	150	350*	
*	Critical Rate of Rise of Off-State Voltage: $V_D = V_{DROM}$, exponential voltage rise, Gate open, T_C = 120°C (See Fig. 16)	dv/dt	200	–	–	V/μs
	DC Gate Trigger Current: V_D = 6 V (dc), R_L = 4 Ω, T_C = 25°C	I_{GT}	–	80	180	mA
	V_D = 6 V (dc), R_L = 2 Ω, T_C = –65°C		–	150	500*	
	DC Gate Trigger Voltage: V_D = 6 V (dc), R_L = 4 Ω, T_C = 25°C	V_{GT}	–	1.5	3	V
	$V_D = V_{DROM}$, R_L = 200 Ω, T_C = 120°C		0.25*	–	–	
	V_D = 6 V (dc), R_L = 2 Ω, T_C = –65°C		–	2	4.5*	
*	Circuit Commutated Turn-Off Time: (Rectangular Pulse) $V_{DX} = V_{DROM}$, i_T = 10 A, pulse duration = 50 μs, dv/dt = 200 V/μs, – di/dt = –5 A/μs, I_{GT} = 200 mA, V_{RX} = 15 V min., V_{GK} = 0 V (at turn-off), T_C = 120°C (See Figs. 19 & 20)	t_q	–	–	10	μs
*	Circuit Commutated Turn-Off Time: (Sinusoidal Pulse) $V_{DX} = V_{DROM}$, i_T = 100 A, pulse duration = 2 μs, dv/dt = 200 V/μs, V_{RX} = 30 V min., V_{GK} = 0 V (at turn-off) T_C = 115°C (See Figs. 17 & 18)	t_q	–		10	μs
*	Thermal Resistance Junction-to-Case: Steady-State	$R_{\theta\text{-JC}}$	–	–	1.7	°C/W

* In accordance with JEDEC registration data format (JS-14, RDF-1) filed for the JEDEC (2N-series) types.

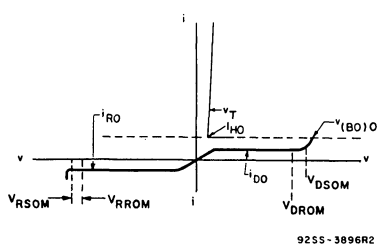

Fig. 1 – Principal voltage-current characteristic.

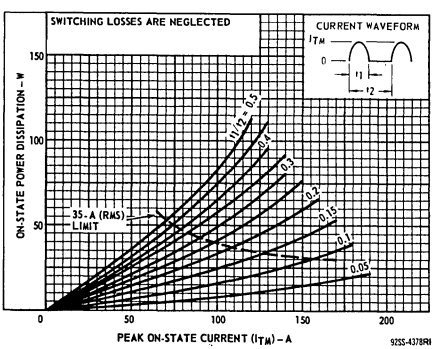

Fig. 2 – Power dissipation vs. peak on-state current.

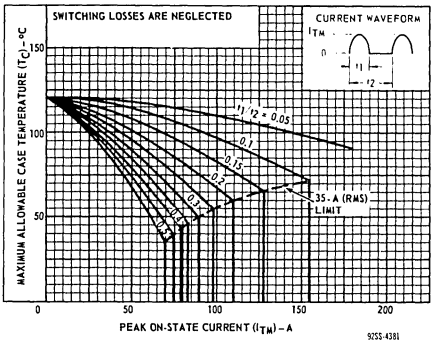

Fig. 3 – Maximum allowable case-temperature vs. peak on-state current.

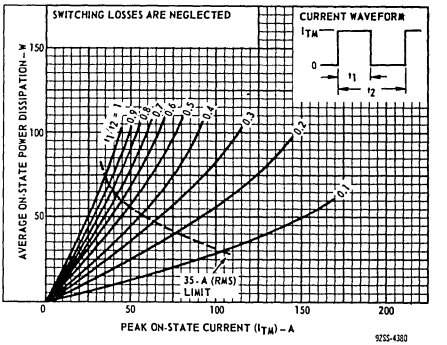

Fig. 4 – Power dissipation vs. peak on-state current.

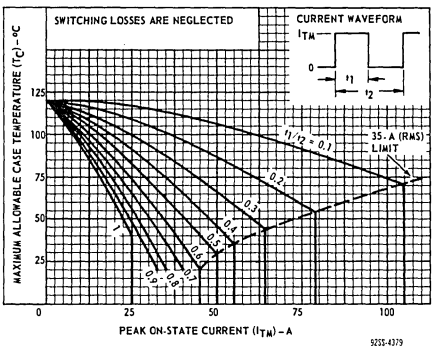

Fig. 5 – Maximum allowable case-temperature vs. peak on-state current.

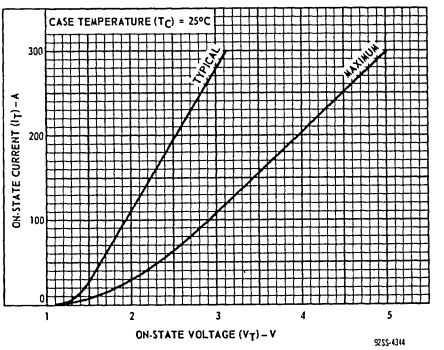

Fig. 6 – Variation of on-state current with on-state voltage.

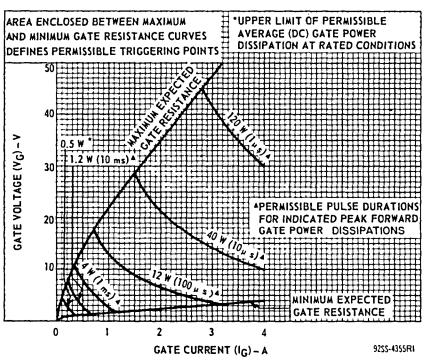

Fig. 7 – Typical forward-biased gate characteristics.

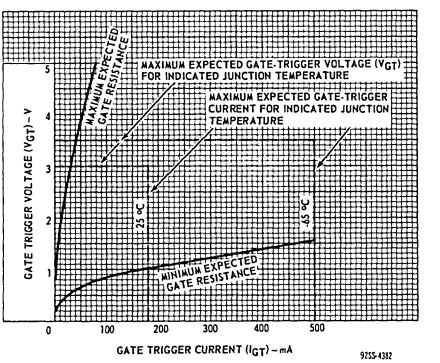

Fig. 8 – Typical gate-trigger characteristics.

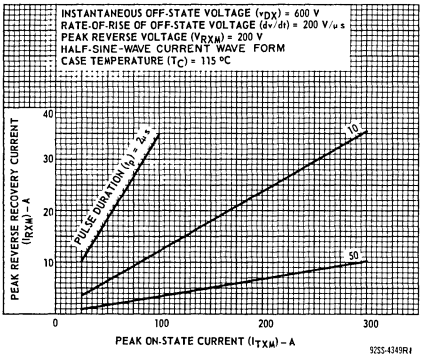

Fig. 9 — Typical variation of peak reverse-recovery current with peak on-state current (half-sine-wave pulse).

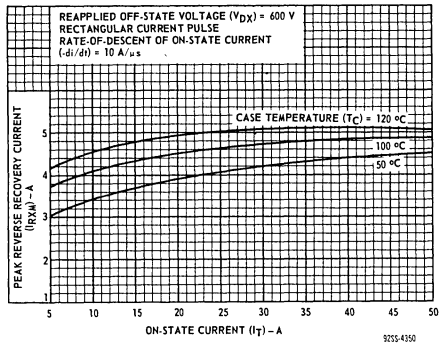

Fig. 10 — Typical variation of peak reverse-recovery current with on-state current (rectangular pulse).

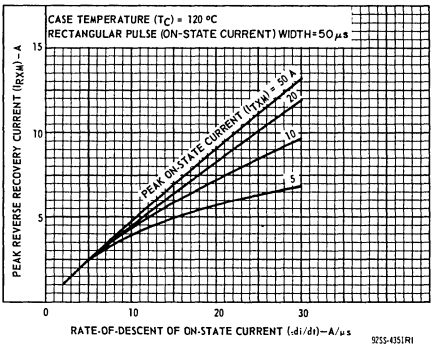

Fig. 11 — Typical variation of peak reverse-recovery current with rate-of-descent of on-state current (rectangular pulse).

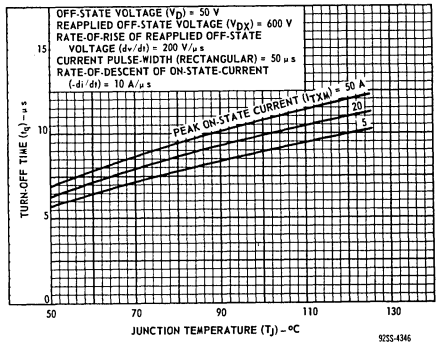

Fig. 12 — Typical variation of turn-off time with junction temperature (rectangular pulse).

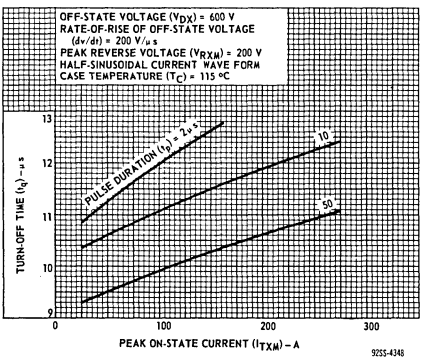

Fig. 13 — Typical variation of turn-off time with peak on-state current (half-sine-wave pulse).

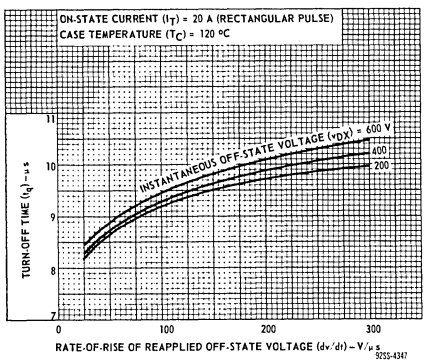

Fig. 14 — Typical variation of turn-off time with rate-of-rise of reapplied off-state voltage (rectangular pulse).

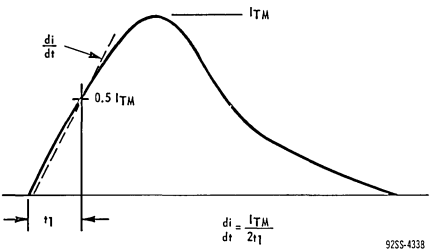

Fig. 15 – Rate-of-change of on-state current with time (defining di/dt).

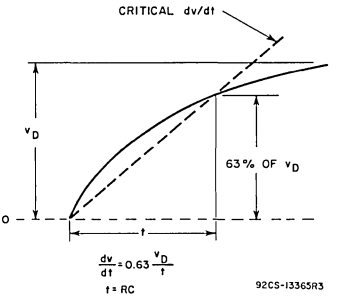

Fig. 16 – Rate-of-rise of off-state voltage with time (defining dv/dt).

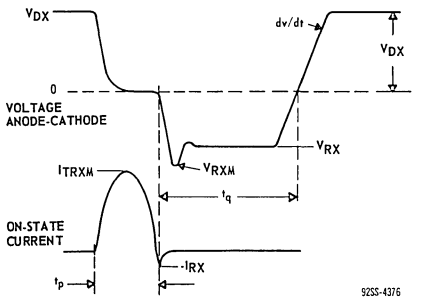

Fig. 17 – Relationship between off-state voltage, reverse voltage, on-state current, and reverse current showing reference points for specification of turn-off time (t_q), half-sine-wave pulse.

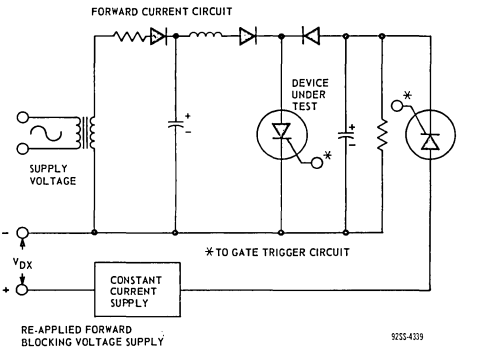

Fig. 18 – Circuit used to measure turn-off time (t_q), half-sine-wave pulse.

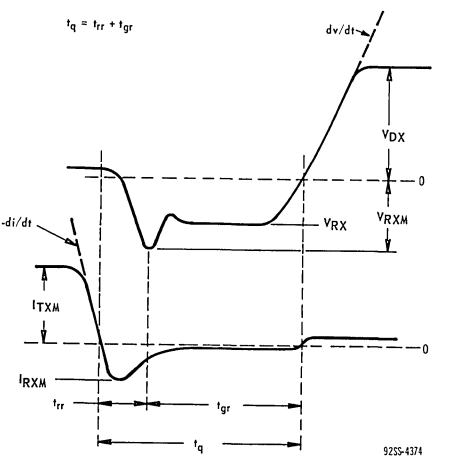

Fig. 19 – Relationship between off-state voltage, reverse voltage, on-state current, and reverse current showing reference points defining turn-off time (t_q), rectangular pulse.

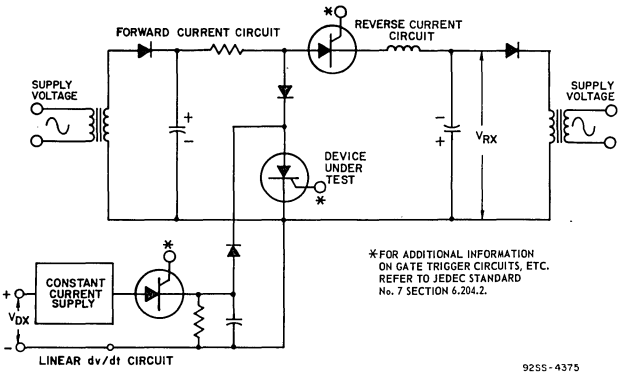

Fig. 20–Circuit used to measure turn-off time (t_q), rectangular pulse.

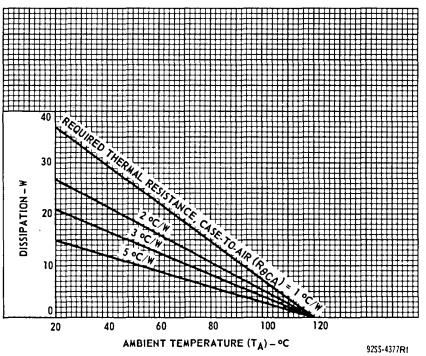

Fig. 21 – Heat sink guidance.

TERMINAL CONNECTIONS

No. 1 – Gate
No. 2 – Cathode
Case, No. 3 – Anode