

3875081 G E SOLID STATE
Silicon Controlled Rectifiers

01E 17678 D T-25-17

2N3654, 2N3655, 2N3656, 2N3657, 2N3658, S7412M

File Number 724

35-A Silicon Controlled Rectifiers

For Inverter Applications

Features:

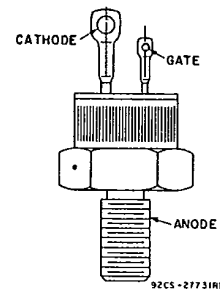
- Fast turn-off time — 10 μ s max.
- High di/dt and dv/dt capability
- Low thermal resistance

RCA-2N3654 to 2N3658, inclusive, and the S7412M* are all-diffused silicon controlled rectifiers (reverse-blocking triode thyristors) intended for high-speed switching applications such as power inverters, switching regulators, and high-current pulse applications. They feature fast turn-off, high dv/dt, and high di/dt characteristics and may be used at frequencies up to 25 kHz.

The 2N3654 to 2N3658 have forward and reverse off-state voltage ratings of 50, 100, 200, 300, and 400 volts, respectively. Type S7412M has a forward and reverse off-state voltage rating of 600 volts.

These SCR's employ a hermetic JEDEC TO-208AA package.

*Formerly RCA Type No. S7432M.

TERMINAL DESIGNATIONS

JEDEC TO-208AA

MAXIMUM RATINGS, Absolute-Maximum Values:

	2N3654	2N3655	2N3656	2N3657	2N3658	S7412M	
*V _{RSOM} †	75	150	300	400	500	700	V
V _{DSOM} †	75	150	300	400	500	700	V
*V _{RRM} †	50	100	200	300	400	600	V
*V _{DRM} †	50	100	200	300	400	600	V
I _{T(RMS)} (T _C = 40°C, θ = 180°)				35			A
*I _{TA(V)} (T _C = 40°C, θ = 180°)				25			A
*I _{TSM} : For one full cycle of applied principal voltage 60-Hz (Rectangular wave-pw = 5 ms, t _r = 50 μ s), T _C = 40°C				180			A
*di/dt:							A
V _D = V _{DRM} , I _{GT} = 200 mA, t _r = 0.1 μ s (See Fig. 15)				400			A/ μ s
I _{2t} :				165			A2s
T _J = -65 to 120°C, t = 1 to 8.3 ms							
*P _{GM} ‡:							W
Peak (forward or reverse) for 10 μ s maximum, See Fig. 7)				40			W
*P _{GM(V)} ‡:							W
Averaging time = 10 ms maximum				1			W
*T _{stg} *				-65 to 150			°C
*T _C *				-65 to 120			°C
T _r :							°C
During soldering for 10 s maximum (terminal and case)				225			°C
r _s :							
Recommended				35			in-lbf
				0.4			kgf-m
Maximum (DO NOT EXCEED)				50			in-lbf
				0.57			kgf-m

* 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.

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Silicon Controlled Rectifiers

2N3654, 2N3655, 2N3656, 2N3657, 2N3658, S7412M**ELECTRICAL CHARACTERISTICS**At Maximum Ratings Unless Otherwise Specified and at Indicated Case Temperature (T_C)

CHARACTERISTIC	LIMITS			UNITS
	FOR ALL TYPES Except as Specified			
	MIN.	TYP.	MAX.	
I_{DOM} or I_{ROM} : $V_D = V_{DROM}$ or $V_R = V_{RROM}$, $T_C = 120^\circ\text{C}$ 2N3654, 2N3655, 2N3656, S7412M 2N3657 2N3658	— — —	2 2 2	6* 5.5* 4*	mA
v_T : $i_T = 25\text{ A (peak)}$, $T_C = 25^\circ\text{C}$	—	1.5	2.05*	V
i_{HO} : $T_C = 25^\circ\text{C}$ $T_C = -65^\circ\text{C}$	— —	75 150	150 350*	mA
* dv/dt : $V_D = V_{DROM}$, exponential voltage rise, $T_C = 120^\circ\text{C}$ (See Fig. 16)	200	—	—	V/ μs
I_{GT} : $V_D = 6\text{ V (dc)}$, $R_L = 4\ \Omega$, $T_C = 25^\circ\text{C}$ $V_D = 6\text{ V (dc)}$, $R_L = 2\ \Omega$, $T_C = -65^\circ\text{C}$	— —	80 150	180 500*	mA
* V_{GT} : $V_D = 6\text{ V (dc)}$, $R_L = 4\ \Omega$, $T_C = 25^\circ\text{C}$ $V_D = 6\text{ V (dc)}$, $R_L = 200\ \Omega$, $T_C = 120^\circ\text{C}$ $V_D = 6\text{ V (dc)}$, $R_L = 2\ \Omega$, $T_C = -65^\circ\text{C}$	— 0.25 —	1.5 — 2	3 — 4.5*	V
* t_q : Rectangular Pulse $V_{DX} = V_{DROM}$, $i_T = 10\text{ A}$, pulse duration = $50\ \mu\text{s}$, $dv/dt = 200\text{ V}/\mu\text{s}$, $-di/dt = 5\text{ A}/\mu\text{s}$, $I_{GT} = 200\text{ mA}$ at turn-on, $V_{RX} = 15\text{ V}$ minimum, $V_{GK} = 0\text{ V}$ at turn-off, $T_C = 120^\circ\text{C}$ (See Figs. 17 & 18) Sinusoidal Pulse $V_{DX} = V_{DROM}$, $i_T = 100\text{ A}$, pulse duration = $2\ \mu\text{s}$, $dv/dt = 200\text{ V}/\mu\text{s}$, $V_{RX} = 30\text{ V}$ minimum, $V_{GK} = 0$ at turn-off, $T_C = 115^\circ\text{C}$ (See Figs. 19 & 20)	— — —	— — —	10 10	μs
$R_{\theta JC}$	—	0.85	1.7*	$^\circ\text{C}/\text{W}$

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

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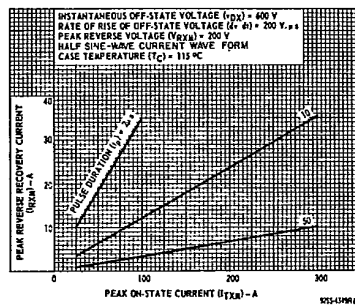


Fig. 7 — Typical variation of peak reverse-recovery current with peak on-state current (half-sine-wave pulse).

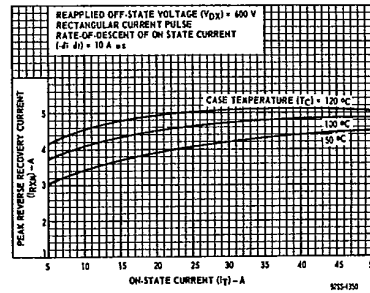


Fig. 8 — Typical variation of peak reverse-recovery current with on-state current (rectangular pulse).

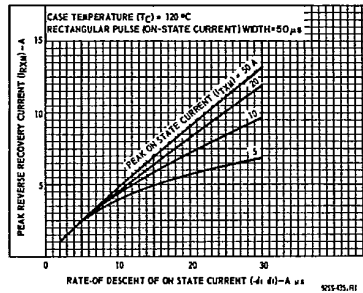


Fig. 9 — Typical variation of peak reverse-recovery current with rate-of-descent of on-state current (rectangular pulse).

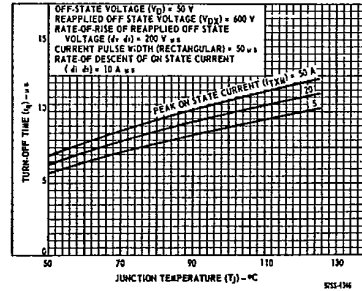


Fig. 10 — Typical variation of turn-off time with junction temperature (rectangular pulse).

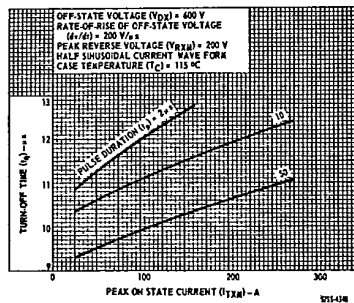


Fig. 11 — Typical variation of turn-off time with peak on-state current (half-sine-wave pulse).

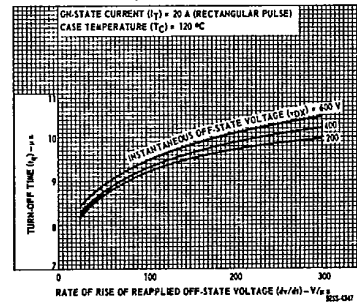


Fig. 12 — Typical variation of turn-off time with rate-of-rise of reapplied off-state voltage (rectangular pulse).

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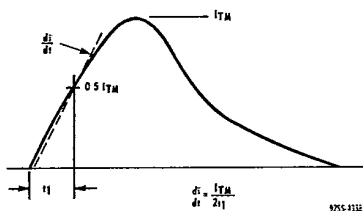


Fig. 13 — Rate-of-change of on-state current with time (defining di/dt).

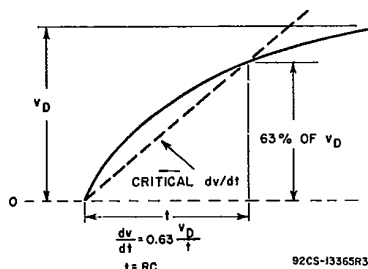


Fig. 14 — Rate-of-rise of off-state voltage with time (defining dv/dt).

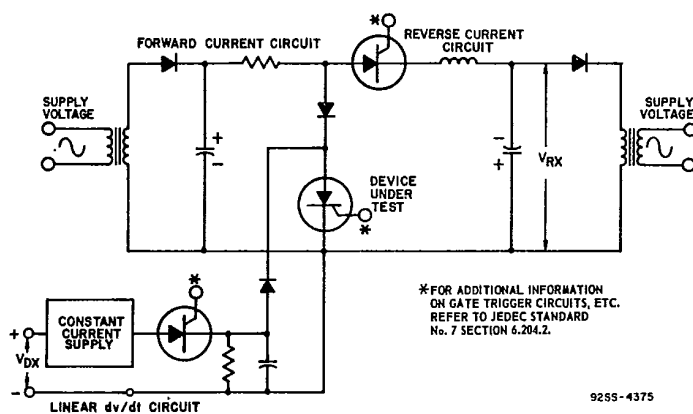


Fig. 15 — Circuit used to measure turn-off time (t_o), rectangular pulse.

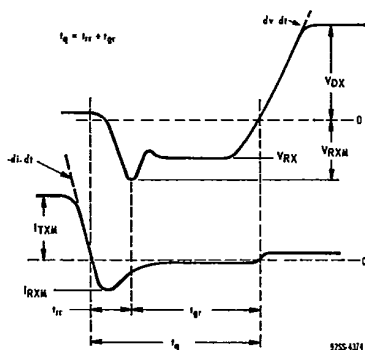


Fig. 16 — Relationship between off-state voltage, reverse voltage, on-state current, and reverse current showing reference points defining turn-off time (t_a), rectangular pulse.

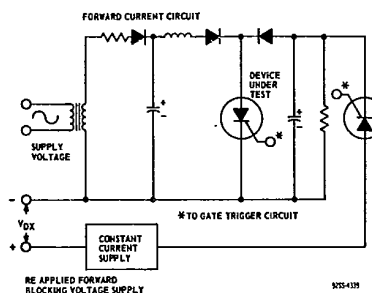


Fig. 17 — Circuit used to measure turn-off time (t_0), half-sine-wave pulse.

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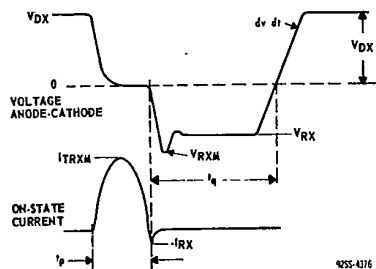


Fig. 18 — Relationship between off-state voltage, reverse voltage, on-state current, and reverse current showing reference points for specification of turn-off (t_0), half-sine-wave pulse.

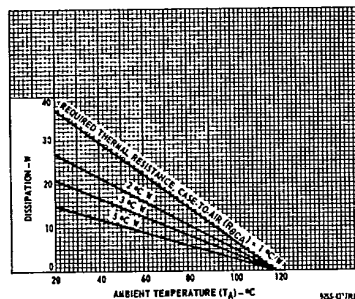


Fig. 19 — Heat sink guidance.