

3875081 G E SOLID STATE
Silicon Controlled Rectifiers

01E 17678 D T-2S-17

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

File Number 724

35-A Silicon Controlled Rectifiers

For Inverter Applications

Features:

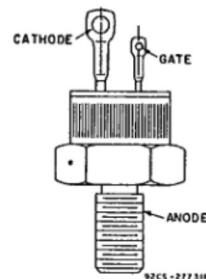
- Fast turn-off time — $10 \mu\text{s}$ max.
- High di/dt and dv/dt capability
- Low thermal resistance

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_{ASOM}^*	75	150	300	400	500	700	V
V_{DSOM}^{\dagger}	75	150	300	400	500	700	V
V_{AROM}^{\dagger}	50	100	200	300	400	600	V
V_{DROM}^{\dagger}	50	100	200	300	400	600	V
I_{TRMSI} ($T_c = 40^\circ\text{C}$, $\theta = 180^\circ$)			35				A
I_{TAVI} ($T_c = 40^\circ\text{C}$, $\theta = 180^\circ$)			25				A
I_{TSM} : For one full cycle of applied principal voltage 60-Hz (Rectangular wave-pw = 5 ms, $t_r = 50 \mu\text{s}$), $T_c = 40^\circ\text{C}$				180			A
di/dt : $V_o = V_{DROM}$, $I_{GT} = 200 \text{ mA}$, $t_r = 0.1 \mu\text{s}$ (See Fig. 15)			400				$\text{A}/\mu\text{s}$
$ I_2 $: $T_J = -65$ to 120°C , $t = 1$ to 8.3 ms			165				A2s
P_{GM} : Peak (forward or reverse) for $10\mu\text{s}$ maximum, See Fig. 7			40				W
P_{GAVG} : Averaging time = 10 ms maximum			1				W
T_{Jg}^*			-65 to 150				$^\circ\text{C}$
T_c^*			-65 to 120				$^\circ\text{C}$
T_r : During soldering for 10 s maximum (terminal and case)			225				$^\circ\text{C}$
T_s : Recommended			35				in-lbf
Maximum (DO NOT EXCEED)			0.4				kgl-m
			50				in-lbf
			0.57				kgl-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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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_{D0M} or I_{ROM} : $V_D = V_{DROM}$ or $V_R = V_{RROM}$, $T_C = 120^\circ C$ 2N3654, 2N3655, 2N3656, S7412M	—	2	6*	mA	
2N3657	—	2	5.5*		
2N3658	—	2	4*		
v_T : $i_T = 25 A$ (peak), $T_C = 25^\circ C$	—	1.5	2.05*	V	
i_{HO} : $T_C = 25^\circ C$	—	75	150	mA	
$T_C = -65^\circ C$	—	150	350*		
* dv/dt : $V_D = V_{DROM}$, exponential voltage rise, $T_C = 120^\circ C$ (See Fig. 16)	200	—	—	V/ μ s	
i_{GT} : $V_D = 6 V$ (dc), $R_L = 4 \Omega$, $T_C = 25^\circ C$	—	80	180	mA	
$V_D = 6 V$ (dc), $R_L = 2 \Omega$, $T_C = -65^\circ C$	—	150	500*		
V_{GT} : $V_D = 6 V$ (dc), $R_L = 4 \Omega$, $T_C = 25^\circ C$	—	1.5	3	V	
* $V_D = 6 V$ (dc), $R_L = 200 \Omega$, $T_C = 120^\circ C$	0.25	—	—		
$V_D = 6 V$ (dc), $R_L = 2 \Omega$, $T_C = -65^\circ C$	—	2	4.5*		
* t_q : Rectangular Pulse $V_{DX} = V_{DROM}$, $i_T = 10 A$, pulse duration = 50 μ s, $dv/dt = 200 V/\mu$ s, $-di/dt = 5 A/\mu$ s, $i_{GT} = 200 mA$ at turn-on, $V_{RX} = 15 V$ minimum, $V_{GK} = 0 V$ at turn-off, $T_C = 120^\circ C$ (See Figs. 17 & 18)	—	—	10	μ s	
Sinusoidal Pulse $V_{DX} = V_{DROM}$, $i_T = 100 A$, pulse duration = 2 μ s, $dv/dt = 200 V/\mu$ s, $V_{RX} = 30 V$ minimum, $V_{GK} = 0$ at turn-off, $T_C = 115^\circ C$ (See Figs. 19 & 20)	—	—	10		
$R_{\theta JC}$	—	0.85	1.7*	°C/W	

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

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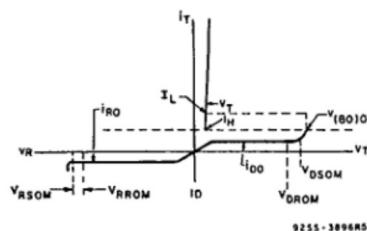


Fig. 1 - Principal voltage-current characteristic.

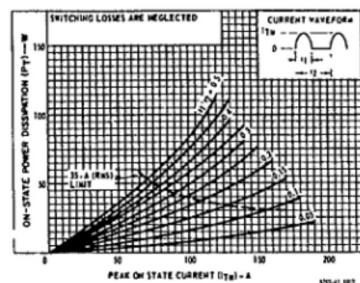


Fig. 2 - Power dissipation vs. peak on-state current.

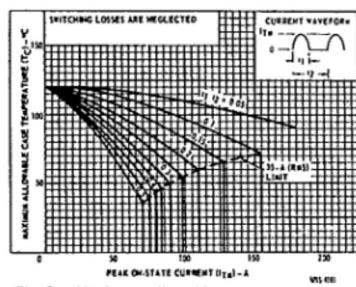


Fig. 3 - Maximum allowable case-temperature vs. peak on-state current.

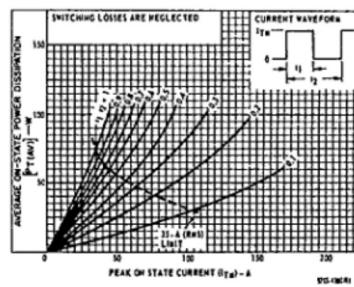


Fig. 4 - Power dissipation vs. peak on-state current.

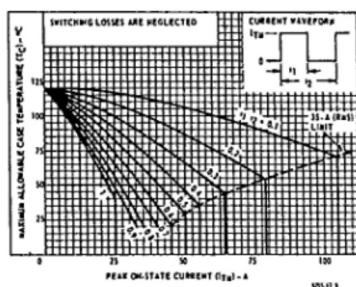


Fig. 5 - Maximum allowable case-temperature vs. peak on-state current.

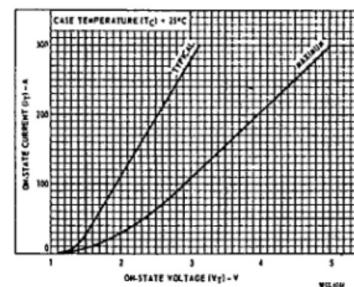


Fig. 6 - Variation of on-state with on-state voltage.

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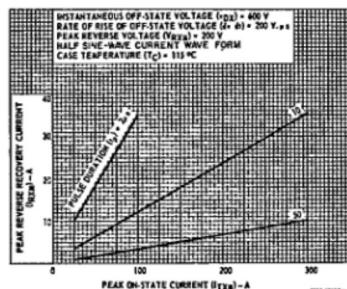


Fig. 7 — Typical variation of peak reverse-recovery current with peak on-state current (half-sine-wave pulse).

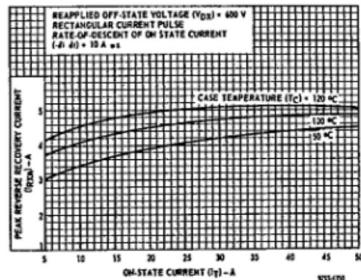


Fig. 8 — Typical variation of peak reverse-recovery current with on-state current (rectangular pulse).

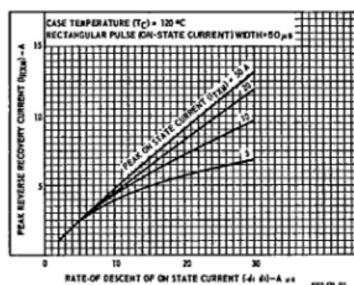


Fig. 9 — Typical variation of peak reverse-recovery current with rate-of-descent of on-state current (rectangular pulse).

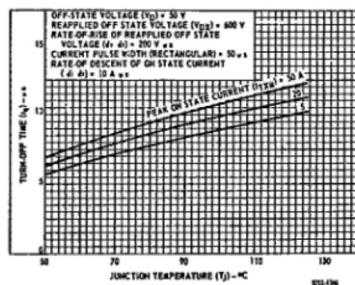


Fig. 10 — Typical variation of turn-off time with junction temperature (rectangular pulse).

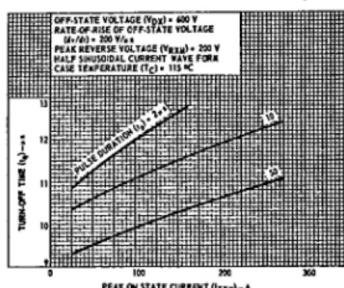


Fig. 11 — Typical variation of turn-off time with peak on-state current (half-sine-wave pulse).

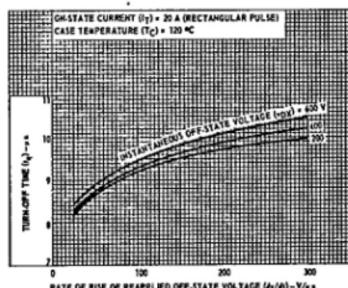
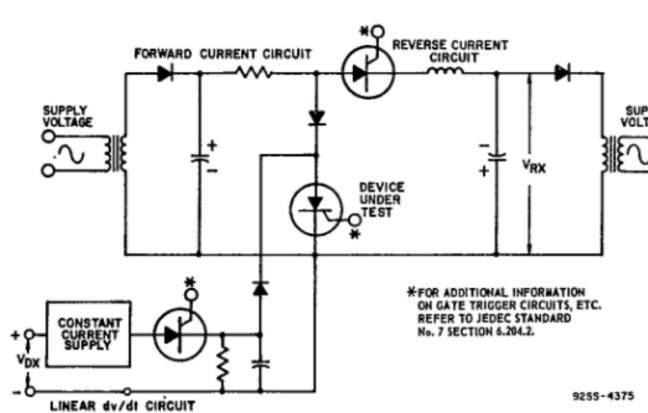
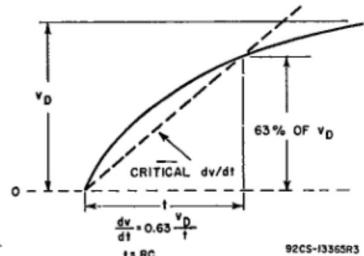
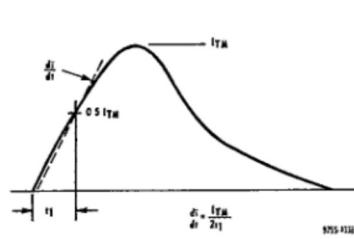
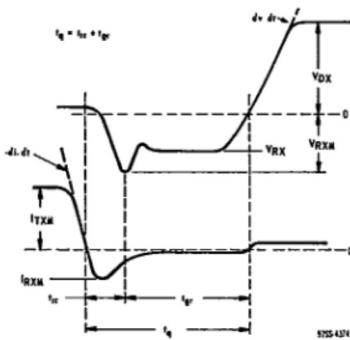
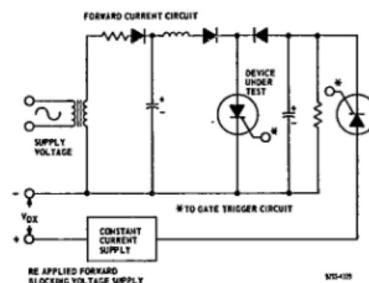


Fig. 12 — Typical variation of turn-off time with rate-of-rise of reapplied off-state voltage (rectangular pulse).

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Fig. 15 — Circuit used to measure turn-off time (t_0), 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_0), rectangular pulse.Fig. 17 — Circuit used to measure turn-off time (t_0), half-sine-wave pulse.

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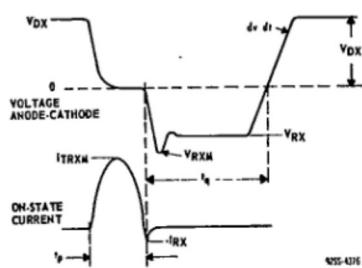


Fig. 18 — Relationship between off-state voltage, reverse voltage, on-state current, and reverse current showing reference points for specification of turn-off (t_a), half-sine-wave pulse.

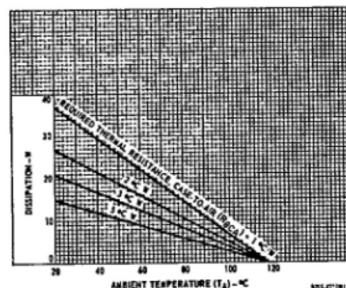


Fig. 19 — Heat sink guidance.