2N3654, 2N3655, 2N3656, 2N3657, 2N3658, S7412M File Number **724**

35-A Silicon Controlled Rectifiers

For Inverter Applications

Features:
- *Fast turn-off time — 10 μs max.*
- *High di/dt and dv/dt capability*
- *Low thermal resistance*

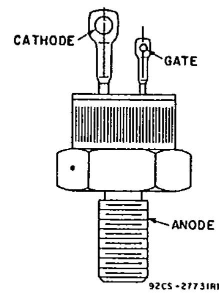
RCA-2N3654 to 2N3658, inclusive, and the S7412M* are all-diffused silicon controlled rectifiers (reverse-blocking triode thyristors) intended for high-speed switching applications such as power inverters, switching regulators, and high-current pulse applications. They feature fast turn-off, high dv/dt, 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_{RROM}†	50	100	200	300	400	600	V
*V_{DROM}†	50	100	200	300	400	600	V
$I_{T(RMS)}$ (T_C = 40°C, θ = 180°)	35						A
*$I_{T(AV)}$ (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 μs), T_C = 40°C	180						A
*di/dt: V_D = V_{DROM}, I_{GT} = 200 mA, t_r = 0.1 μs (See Fig. 15)	400						A/μs
I^2t: T_J = -65 to 120°C, t = 1 to 8.3 ms	165						A2s
*P_{GM}■: Peak (forward or reverse) for 10μs maximum, See Fig. 7)	40						W
*$P_{G(AV)}$■: Averaging time = 10 ms maximum	1						W
*T_{stg}•	-65 to 150						°C
*T_C•	-65 to 120						°C
T_T: During soldering for 10 s maximum (terminal and case)	225						°C
τ_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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ELECTRICAL CHARACTERISTICS

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

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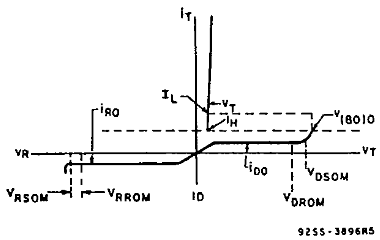

Fig. 1 – Principal voltage-current characteristic.

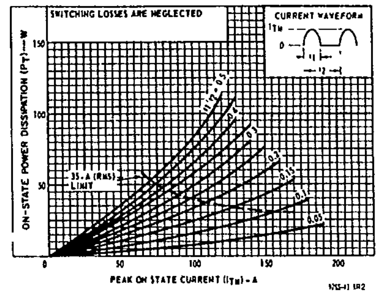

Fig. 2 – Power dissipation vs. peak on-state current.

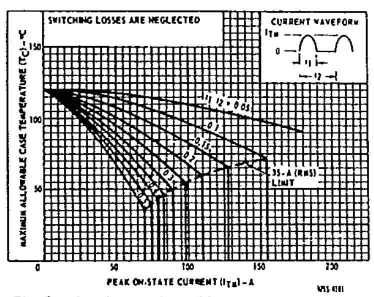

Fig. 3 – Maximum allowable case-temperature vs. peak on-state current.

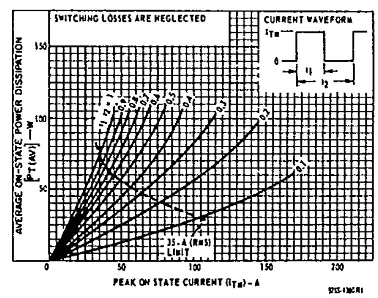

Fig. 4 – Power dissipation vs. peak on-state current.

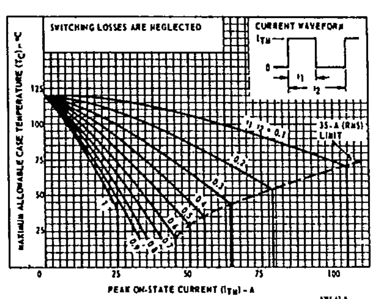

Fig. 5 – Maximum allowable case-temperature vs. peak on-state current.

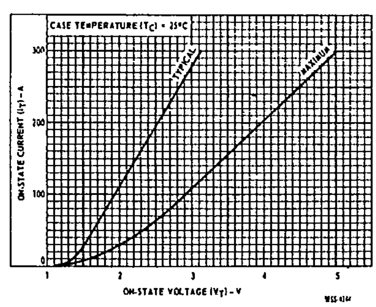

Fig. 6 – Variation of on-state with on-state voltage.

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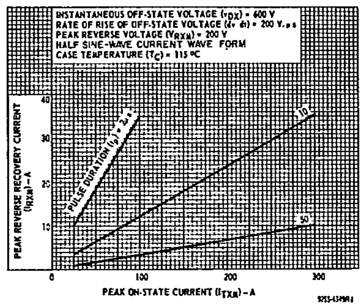

Fig. 7 — Typical variation of peak reverse-recovery current with peak on-state current (half-sine-wave pulse).

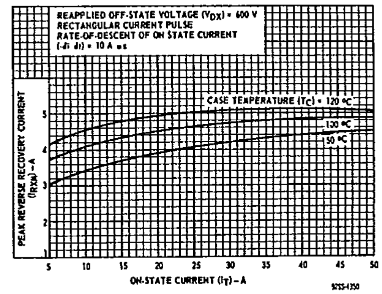

Fig. 8 — Typical variation of peak reverse-recovery current with on-state current (rectangular pulse).

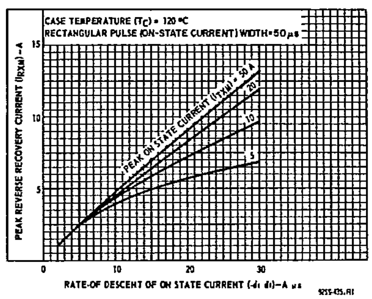

Fig. 9 — Typical variation of peak reverse-recovery current with rate-of-descent of on-state current (rectangular pulse).

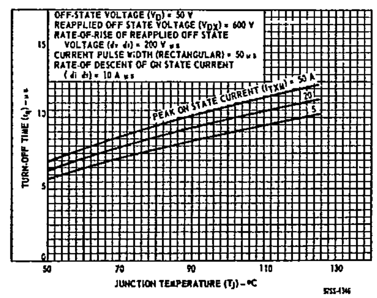

Fig. 10 — Typical variation of turn-off time with junction temperature (rectangular pulse).

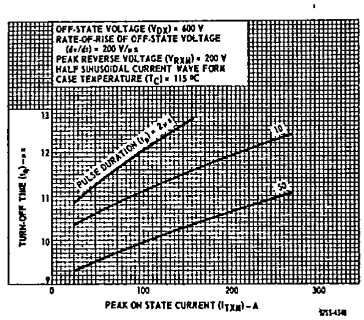

Fig. 11 — Typical variation of turn-off time with peak on-state current (half-sine-wave pulse).

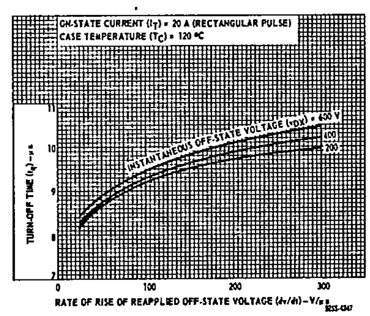

Fig. 12 — Typical variation of turn-off time with rate-of-rise of reapplied off-state voltage (rectangular pulse).

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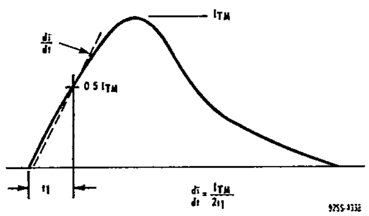

Fig. 13 — Rate-of-change of on-state current with time (defining di/dt).

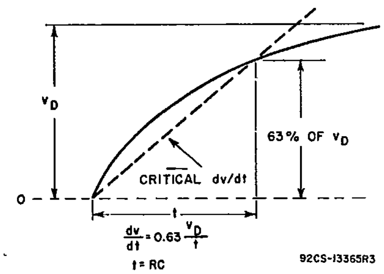

Fig. 14 — Rate-of-rise of off-state voltage with time (defining dv/dt).

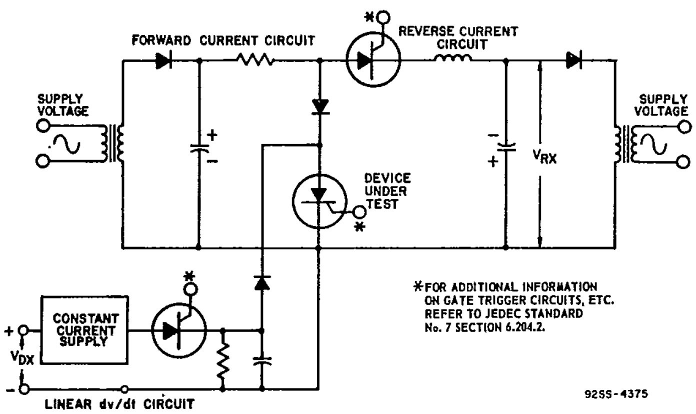

Fig. 15 — Circuit used to measure turn-off time (t_q), rectangular pulse.

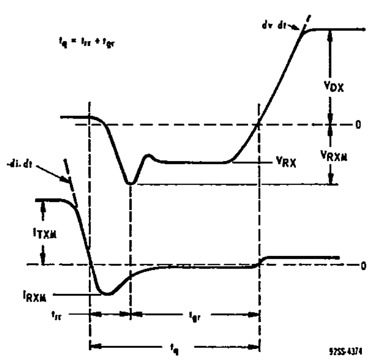

Fig. 16 — Relationship between off-state voltage, reverse voltage, on-state current, and reverse current showing reference points defining turn-off time (t_q), rectangular pulse.

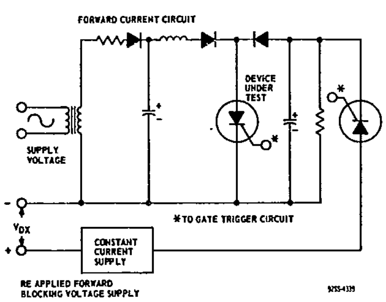

Fig. 17 — Circuit used to measure turn-off time (t_q), half-sine-wave pulse.

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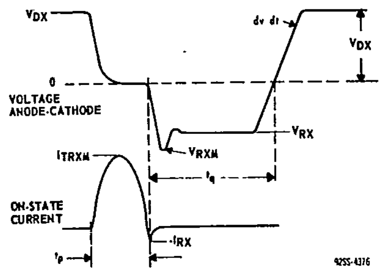

Fig. 18 — Relationship between off-state voltage, reverse voltage, on-state current, and reverse current showing reference points for specification of turn-off (t_q), half-sine-wave pulse.

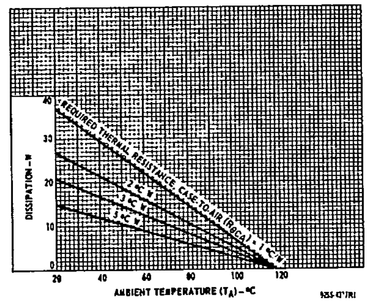

Fig. 19 — Heat sink guidance.