



Thyristors

2N3654 2N3655
2N3656 2N3657
2N3658 S7432M

35-A Silicon Controlled Rectifiers

For Inverter Applications



JEDEC TO-48

H-1601

Features:

- Fast turn-off time — 10 μ s 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.

MAXIMUM RATINGS, Absolute-Maximum Values:

NON-REPETITIVE PEAK REVERSE VOLTAGE:

Gate Open	V_{RSOM}	75	150	300	400	500	700	V
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NON-REPETITIVE PEAK OFF-STATE VOLTAGE:*

Gate Open	V_{DSOM}	75	150	300	400	500	700	V
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REPETITIVE PEAK REVERSE VOLTAGE:

Gate Open	V_{RROM}	50	100	200	300	400	600	V
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REPETITIVE PEAK OFF-STATE VOLTAGE:

Gate Open	V_{DROM}	50	100	200	300	400	600	V
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ON-STATE CURRENT:

$T_C = 40^\circ\text{C}$, conduction angle = 180° :

RMS	$I_T(\text{RMS})$		35					A
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* Average	$I_T(\text{AV})$		25					A
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*PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:

For one full cycle of applied principal voltage	I_{TSM}			180				A
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60 Hz (sinusoidal)

*RATE OF CHANGE OF ON-STATE CURRENT:

$V_D = V_{DROM}$, $I_{GT} = 200$ mA, $t_r = 0.1$ μ s (See Fig. 15)	di/dt		400					A/ μ s
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FUSING CURRENT (for SCR protection):

$T_J = -65$ to 120°C , $t = 1$ to 8.3 ms	I^2t		165					A ² s
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GATE POWER DISSIPATION:

Peak Forward (for 10 μ s max., See Fig. 7)	P_{GM}		40					W
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Average (averaging time = 10 ms max.)	$P_{G(\text{AV})}$		1					W
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TEMPERATURE RANGE:

Storage	T_{stg}		-65 to 150					$^\circ\text{C}$
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Operating (Case)	T_C		-65 to 120					$^\circ\text{C}$
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TERMINAL TEMPERATURE (During soldering):

For 10 s max. (terminals and case)	T_T		225					$^\circ\text{C}$
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STUD TORQUE:

Recommended	τ_s		35					in-lb
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Maximum (DO NOT EXCEED)			50					in-lb
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* 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			UNITS
		FOR ALL TYPES Except as Specified			
		MIN.	TYP.	MAX.	
* Peak Off-State Current: (Gate open, $T_C = 120^{\circ}\text{C}$) Forward Current (I_{DOM}) at $V_D = V_{\text{DROM}}$ Reverse Current (I_{ROM}) at $V_R = V_{\text{RROM}}$ 2N3654, 2N3655, 2N3656, S7432M 2N3657 2N3658	I_{DOM} or I_{ROM}	— — —	— — —	6 5.5 4	mA
* Instantaneous On-State Voltage: $i_T = 25\text{ A (peak)}$, $T_C = 25^{\circ}\text{C}$	v_T	—	—	2.05	V
Instantaneous Holding Current: Gate open, $T_C = 25^{\circ}\text{C}$ $T_C = -65^{\circ}\text{C}$	i_{HO}	— —	75 150	150 350*	mA
* Critical Rate of Rise of Off-State Voltage: $V_D = V_{\text{DROM}}$, exponential voltage rise, Gate open, $T_C = 120^{\circ}\text{C}$ (See Fig. 16)	dv/dt	200	—	—	V/ μs
DC Gate Trigger Current: $V_D = 6\text{ V (dc)}$, $R_L = 4\ \Omega$, $T_C = 25^{\circ}\text{C}$ $V_D = 6\text{ V (dc)}$, $R_L = 2\ \Omega$, $T_C = -65^{\circ}\text{C}$	I_{GT}	— —	80 150	180 500*	mA
DC Gate Trigger Voltage: $V_D = 6\text{ V (dc)}$, $R_L = 4\ \Omega$, $T_C = 25^{\circ}\text{C}$ $V_D = V_{\text{DROM}}$, $R_L = 200\ \Omega$, $T_C = 120^{\circ}\text{C}$ $V_D = 6\text{ V (dc)}$, $R_L = 2\ \Omega$, $T_C = -65^{\circ}\text{C}$	V_{GT}	— 0.25* —	1.5 — 2	3 — 4.5*	V
* Circuit Commutated Turn-Off Time: (Rectangular Pulse) $V_{\text{DX}} = V_{\text{DROM}}$, $i_T = 10\text{ A}$, pulse duration = $50\ \mu\text{s}$, $dv/dt = 200\text{ V}/\mu\text{s}$, $-di/dt = -5\text{ A}/\mu\text{s}$, $I_{\text{GT}} = 200\text{ mA}$, $V_{\text{RX}} = 15\text{ V min.}$, $V_{\text{GK}} = 0\text{ V}$ (at turn-off), $T_C = 120^{\circ}\text{C}$ (See Figs. 19 & 20).	t_q	—	—	10	μs
* Circuit Commutated Turn-Off Time: (Sinusoidal Pulse) $V_{\text{DX}} = V_{\text{DROM}}$, $i_T = 100\text{ A}$, pulse duration = $2\ \mu\text{s}$, $dv/dt = 200\text{ V}/\mu\text{s}$, $V_{\text{RX}} = 30\text{ V min.}$, $V_{\text{GK}} = 0\text{ V}$ (at turn-off) $T_C = 115^{\circ}\text{C}$ (See Figs. 17 & 18)	t_q	—	—	10	μs
* Thermal Resistance Junction-to-Case: Steady-State	$R_{\theta\text{-JC}}$	—	—	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.

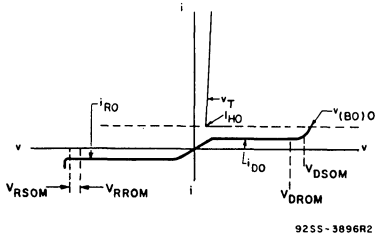


Fig. 1 — Principal voltage-current characteristic.

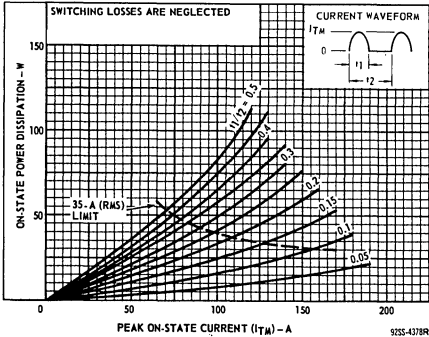


Fig. 2 — Power dissipation vs. peak on-state current.

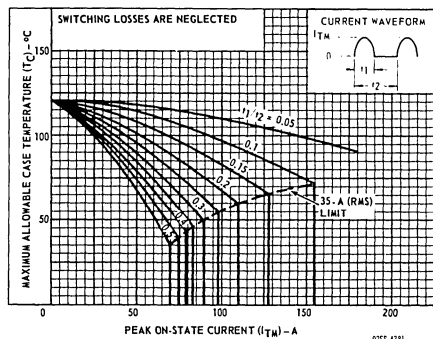


Fig. 3 - Maximum allowable case-temperature vs. peak on-state current.

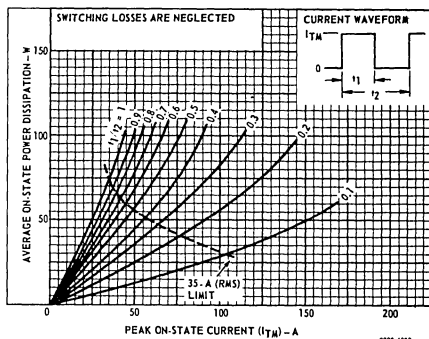


Fig. 4 - Power dissipation vs. peak on-state current.

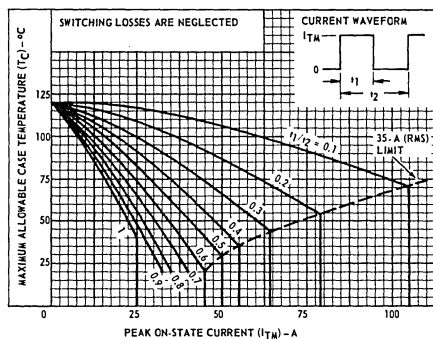


Fig. 5 - Maximum allowable case-temperature vs. peak on-state current.

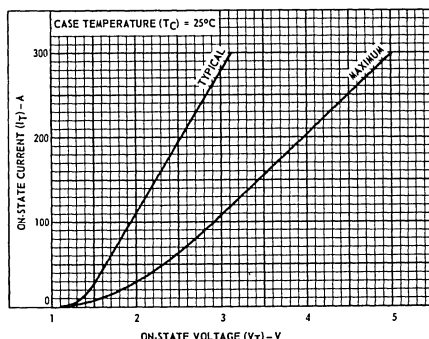


Fig. 6 - Variation of on-state current with on-state voltage.

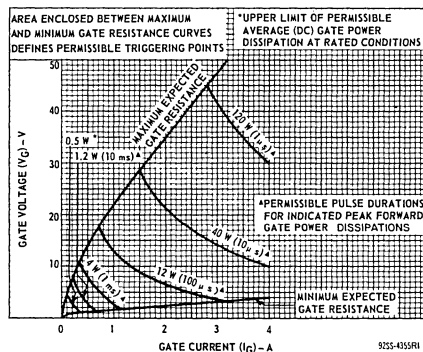


Fig. 7 - Typical forward-biased gate characteristics.

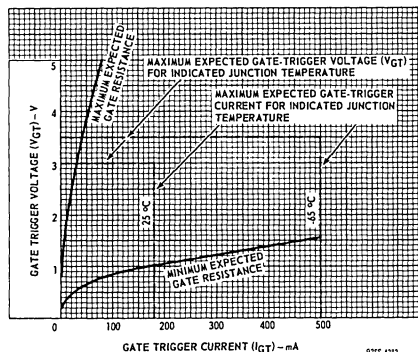


Fig. 8 - Typical gate-trigger characteristics.

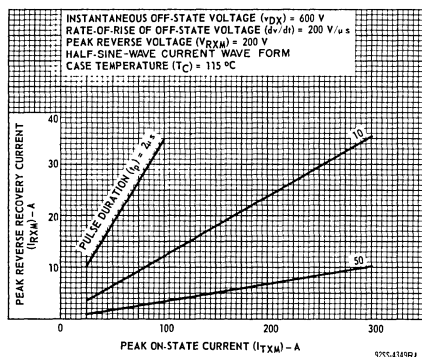


Fig. 9 - Typical variation of peak reverse-recovery current with peak on-state current (half-sine-wave pulse).

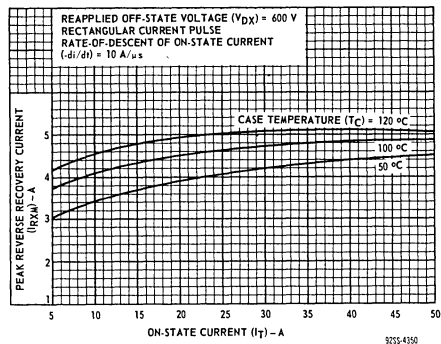


Fig. 10 - Typical variation of peak reverse-recovery current with on-state current (rectangular pulse).

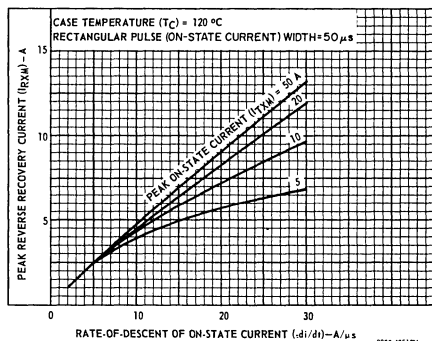


Fig. 11 - Typical variation of peak reverse-recovery current with rate-of-descent of on-state current (rectangular pulse).

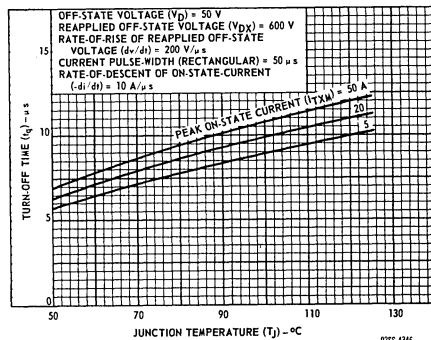


Fig. 12 - Typical variation of turn-off time with junction temperature (rectangular pulse).

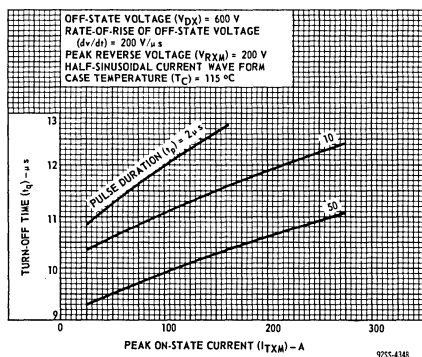


Fig. 13 - Typical variation of turn-off time with peak on-state current (half-sine-wave pulse).

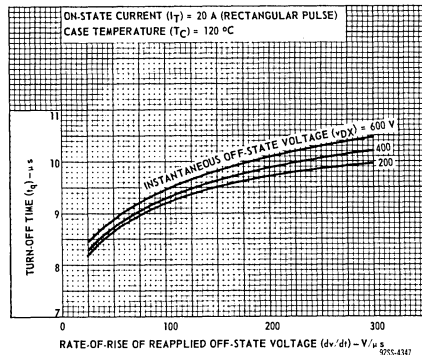


Fig. 14 - Typical variation of turn-off time with rate-of-rise of reapplied off-state voltage (rectangular pulse).

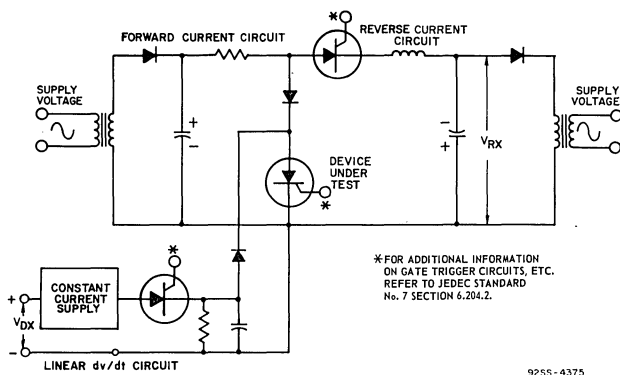


Fig. 20—Circuit used to measure turn-off time (t_q), rectangular pulse.

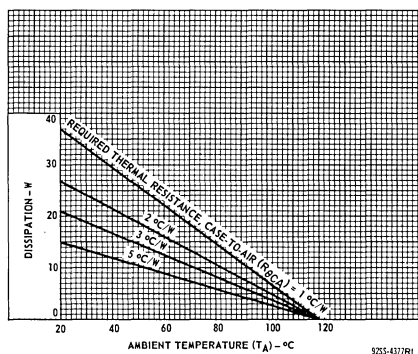


Fig. 21 — Heat sink guidance.

TERMINAL CONNECTIONS

No. 1 — Gate

No. 2 — Cathode

Case, No. 3 – Anode