

3875081 G E SOLID STATE
Silicon Controlled Rectifiers

01E 17688 D T-25-17

2N3870-2N3873, 2N3896-2N3899, S6420 Series

File Number 578

35-A Silicon Controlled Rectifiers

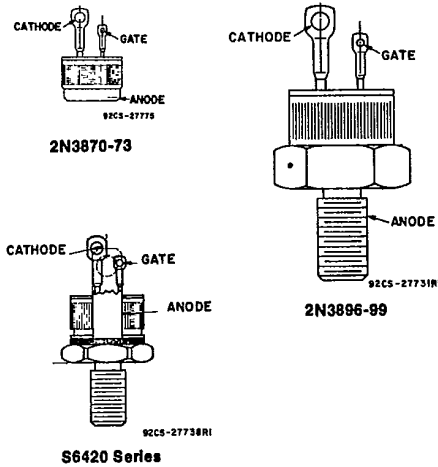
Features:

- High di/dt and dv/dt capabilities
- Low on-state voltage at high current levels
- Low thermal resistance

Voltage Package	100 V Types	200 V Types	400 V Types	600 V Types
Press-Fit	2N3870	2N3871	2N3872	2N3873
Stud	2N3896	2N3897	2N3898	2N3899
Isolated-Stud	S6420A	S6420B	S6420D	S6420M

These RCA types are all-diffused, silicon controlled rectifiers (reverse-blocking triode thyristors) designed for power switching, power control, and voltage regulator applications and for heating, lighting, and motor speed-control circuits.

TERMINAL DESIGNATIONS



MAXIMUM RATINGS, Absolute-Maximum Values:

	2N3870 2N3896 S6420A	2N3871 2N3897 S6420B	2N3872 2N3898 S6420D	2N3873 2N3899 S6420M	
*NON-REPETITIVE PEAK REVERSE VOLTAGE‡					
Gate Open..... V_{RSOM}	150	330	660	700	V
*REPETITIVE PEAK REVERSE VOLTAGE‡					
Gate Open..... V_{RROM}	100	200	400	600	V
*REPETITIVE PEAK OFF-STATE VOLTAGE‡					
Gate Open..... V_{DROM}	100	200	400	600	V
ON-STATE CURRENT:					
$T_c = 65^\circ C$ †, conduction angle = 180°:					
RMS..... I_{TRMS}		35			A
*Average..... $I_{T(AV)}$		22			A
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:					
For one full cycle of applied principal voltage					
60 Hz (sinusoidal)..... I_{TSM}		350			A
50 Hz (sinusoidal).....		300			A
RATE OF CHANGE OF ON-STATE CURRENT					
$V_D = V_{DROM}$, $I_{GT} = 200$ mA, $t_r = 0.5$ μ s..... di/dt		200			A/ μ s
FUSING CURRENT (for SCR protection):					
$T_j = -40$ to $100^\circ C$, $t = 1$ to 8.3 ms..... I_{2t}		300			A ² s
GATE POWER DISSIPATION*:					
Peak Forward (for 10 μ s max., See Fig. 7)..... P_{GM}		40			W
Peak Reverse..... P_{RGM}		See Fig. 8			
Average (averaging time = 10 ms max.)..... $P_{G(AV)}$		0.5			W
*TEMPERATURE RANGE#:					
Storage..... T_{stg}		-40 to 125			$^\circ C$
Operating (Case)..... T_c		-40 to 100			$^\circ C$
TERMINAL TEMPERATURE (During soldering):					
For 10 s max. (terminals and case)..... T_r		225			$^\circ C$

*In accordance with JEDEC registration data 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.
 † $T_c = 60^\circ$ for isolated-stud package types.
 * Any product of gate current and gate voltage which results in a gate power less than the maximum is permitted.
 # Temperature measurement point is shown on the DIMENSIONAL OUTLINE.

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ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC	SYMBOL	LIMITS			UNITS
		FOR ALL TYPES Unless Otherwise Specified			
		MIN.	TYP.	MAX.	
Peak Off-State Current: (Gate open, $T_C = 100^\circ\text{C}$) Forward Current (I_{DOM}) at $V_D = V_{DROM}$ Reverse Current (I_{ROM}) at $V_R = V_{RROM}$ 2N3870, 2N3896, S6420A 2N3871, 2N3897, S6420B 2N3872, 2N3898, S6420D 2N3873, 2N3899, S6420M,	I_{DOM} or I_{ROM}	— — —	0.2 0.25 0.3	2* 2.5* 3*	mA
Instantaneous On-State Voltage: $i_T = 69$ A (peak), $T_C = 25^\circ\text{C}$ $i_T = 100$ A (peak), $T_C = 25^\circ\text{C}$	v_T	— —	— 1.7	1.85* 2.1	V
DC Gate Trigger Voltage: $V_D = 12$ V (dc), $R_L = 30 \Omega$, $T_C = -40^\circ\text{C}$ $V_D = 12$ V (dc), $R_L = 30 \Omega$, $T_C = 25^\circ\text{C}$ For other case temperatures	V_{GT}	— —	1.5 1.1 See Fig. 10	3* 2	V
DC Gate Trigger Current: $V_D = 12$ V (dc), $R_L = 30 \Omega$, $T_C = -40^\circ\text{C}$ $V_D = 12$ V (dc), $R_L = 30 \Omega$, $T_C = 25^\circ\text{C}$ For other case temperatures	I_{GT}	— 1	46 25 See Fig. 9	80* 40	mA
Instantaneous Holding Current: Gate open, $T_C = 25^\circ\text{C}$ For other case temperatures	i_{HO}	0.5	30	70	mA
Gate Controlled Turn-On Time: (Delay Time + Rise Time) For $V_D = V_{DROM}$, $I_G = 200$ mA, $t_r = 0.1 \mu\text{s}$, $I_T = 30$ A (peak), $T_C = 25^\circ\text{C}$ (See Fig. 11 & 13)	t_{gt}	—	1.25	2	μs
Circuit Commutated Turn-Off Time: $V_D = V_{DROM}$, $i_T = 18$ A, pulse duration $= 50 \mu\text{s}$, $dv/dt = 20$ V/ μs , $-di/dt$ $= -30$ A/ μs , $I_G = 200$ mA, $T_C = 80^\circ\text{C}$ (See Fig. 14)	t_q	—	20	40	μs
Critical Rate of Rise of Off-State Voltage: $V_D = V_{DROM}$, exponential voltage rise, Gate open, $T_C = 100^\circ\text{C}$ (See Fig. 15)	dv/dt	10	100	—	V/ μs
Thermal Resistance, Junction-to-Case: Steady-State Press-fit & stud types Isolated-stud types	$R_{\theta JC}$	—	—	0.9* 1	$^\circ\text{C/W}$

*In accordance with JEDEC registration data filed for the JEDEC (2N-series) types.

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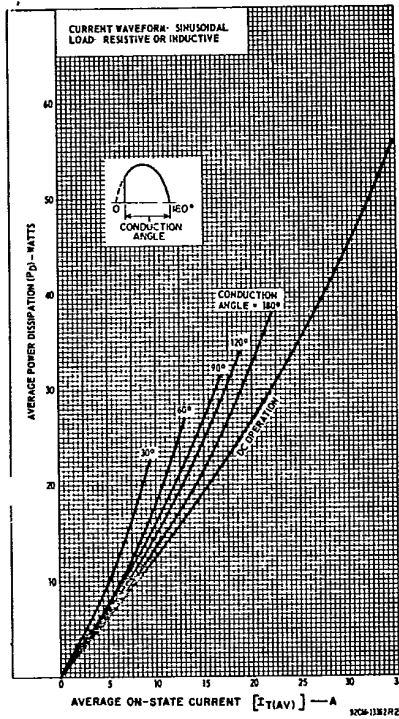


Fig. 1 — Power dissipation vs. on-state current.

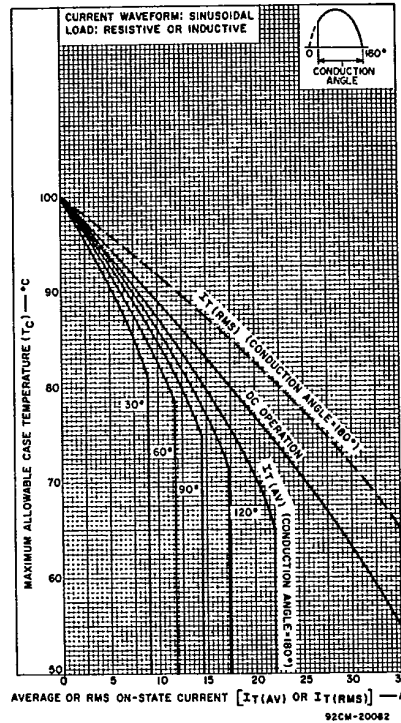


Fig. 2 — Maximum allowable case temperature vs. on-state current for press-fit and stud types.

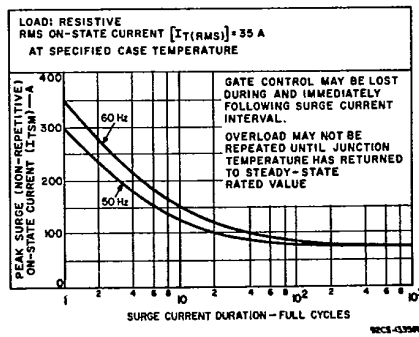


Fig. 3 — Peak surge on-state current vs. surge current duration.

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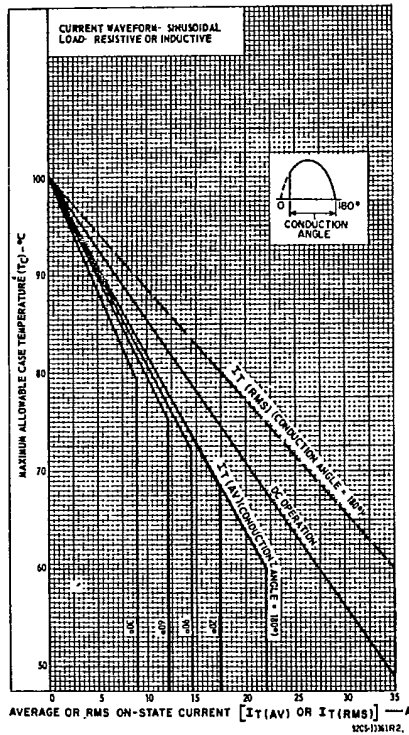


Fig. 4 — Maximum allowable case temperature vs. on-state current for isolated-stud types.

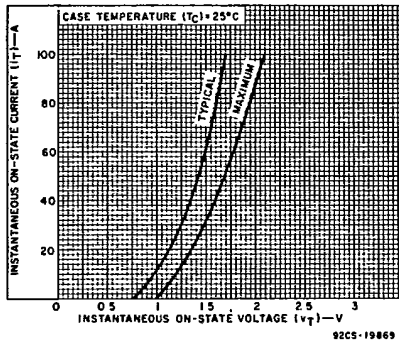


Fig. 5 — Instantaneous on-state current vs. on-state voltage.

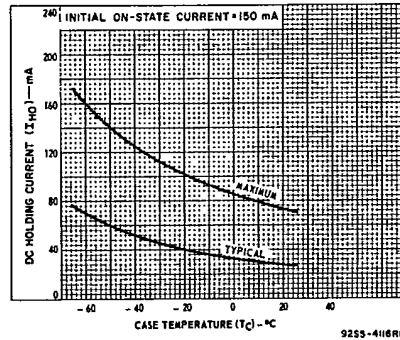


Fig. 6 — DC holding current vs. case temperature.

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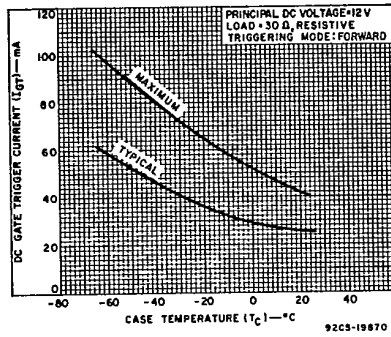


Fig. 7 — DC gate trigger current (forward) vs. case temperature.

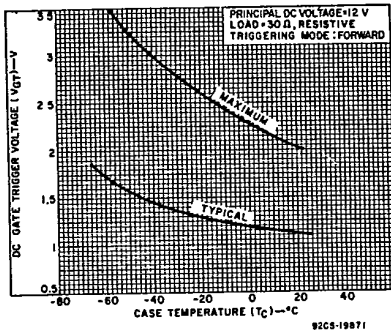


Fig. 8 — DC gate trigger voltage (forward) vs. case temperature.

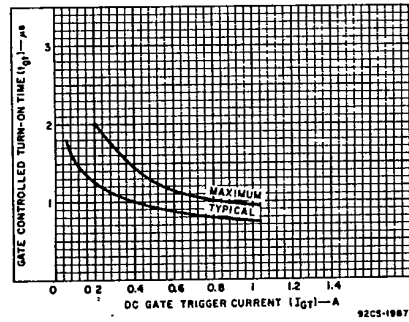


Fig. 9 — Gate-controlled turn-on time vs. gate trigger current.

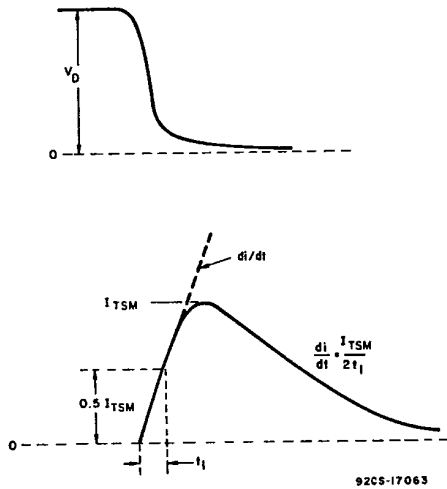


Fig. 10 — Rate of change of on-state current with time (defining di/dt).

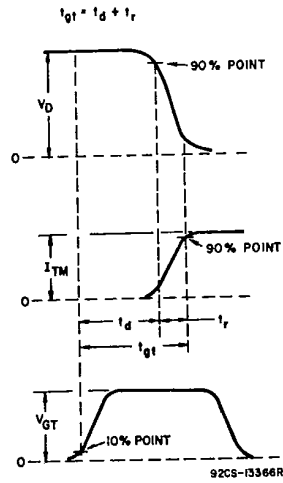


Fig. 11 — Relationship between off-state voltage, on-state current, and gate trigger voltage showing reference points for definition of turn-on time (t_{GT}).

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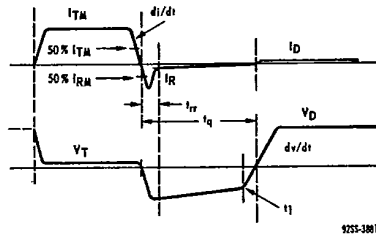


Fig. 12 — Relationship between instantaneous on-state current and voltage showing reference points for definition of circuit commutated turn-off time (t_q).

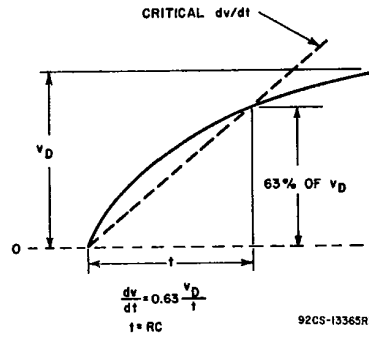


Fig. 13 — Rate of rise of off-state voltage with time (defining-critical dv/dt).