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

File Number **578**

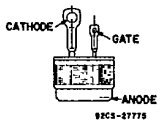
35-A Silicon Controlled Rectifiers

Features:

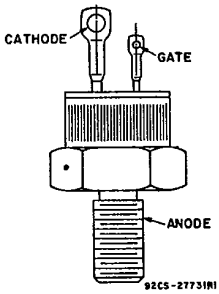
- *High di/dt and dv/dt capabilities*
- *Low on-state voltage at high current levels*
- *Low thermal resistance*

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

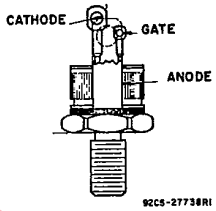
TERMINAL DESIGNATIONS



2N3870-73



2N3896-99



S6420 Series

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.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		2N3870 2N3896 S6420A	2N3871 2N3897 S6420B	2N3872 2N3898 S6420D	2N3873 22N3899 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°C†, conduction angle = 180°:						
RMS	$I_{T(RMS)}$		35			A
*Average	$I_{T(AV)}$		22			A
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT: For one full cycle of applied principal voltage	I_{TSM}					
*60 Hz (sinusoidal)			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 μs	di/dt		200			A/μs
FUSING CURRENT (for SCR protection): T_J = −40 to 100°C, t = 1 to 8.3 ms	I^2t		300			A^2s
GATE POWER DISSIPATION•: Peak Forward (for 10 μs 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			°C
Operating (Case)	T_C		−40 to 100			°C
TERMINAL TEMPERATURE (During soldering): For 10 s max. (terminals and case)	T_T		225			°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° 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.

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

ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC	SYMBOL	LIMITS (FOR ALL TYPES Unless Otherwise Specified) MIN.	TYP.	MAX.	UNITS
Peak Off-State Current: (Gate open, T_C = 100°C) Forward Current (I_{DOM}) at $V_D = V_{DROM}$ Reverse Current (I_{ROM}) at $V_R = V_{RROM}$	I_{DOM} or I_{ROM}				mA
2N3870, 2N3896, S6420A		–	0.2	2*	
2N3871, 2N3897, S6420B		–	0.25	2.5*	
2N3872, 2N3898, S6420D		–	0.3	3*	
2N3873, 2N3899, S6420M,					
Instantaneous On-State Voltage:	v_T				V
i_T = 69 A (peak), T_C = 25°C		–	–	1.85*	
i_T = 100 A (peak), T_C = 25°C		–	1.7	2.1	
DC Gate Trigger Voltage:	V_{GT}				V
V_D = 12 V (dc), R_L = 30 Ω, T_C = -40°C		–	1.5	3*	
V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C		–	1.1	2	
For other case temperatures			See Fig. 10		
DC Gate Trigger Current:	I_{GT}				mA
V_D = 12 V (dc), R_L = 30 Ω, T_C = -40°C		–	46	80*	
V_D = 12 V (dc), R_L = 30 Ω, T_C = 25°C		1	25	40	
For other case temperatures			See Fig. 9		
Instantaneous Holding Current: Gate open, T_C = 25°C	i_{HO}	0.5	30	70	mA
For other case temperatures			See. Fig. 6		
Gate Controlled Turn-On Time: (Delay Time + Rise Time) For $V_D = V_{DROM}$, I_G = 200 mA, t_r = 0.1 μs, I_T = 30 A (peak), T_C = 25°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 μs, dv/dt = 20 V/μs, -di/dt = -30 A/μs, I_G = 200 mA, T_C = 80°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°C (See Fig. 15)	dv/dt	10	100	–	V/μs
Thermal Resistance, Junction-to-Case: Steady-State	$R_{\theta JC}$				°C/W
Press-fit & stud types		–	–	0.9*	
Isolated-stud types		–	–	1	

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

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

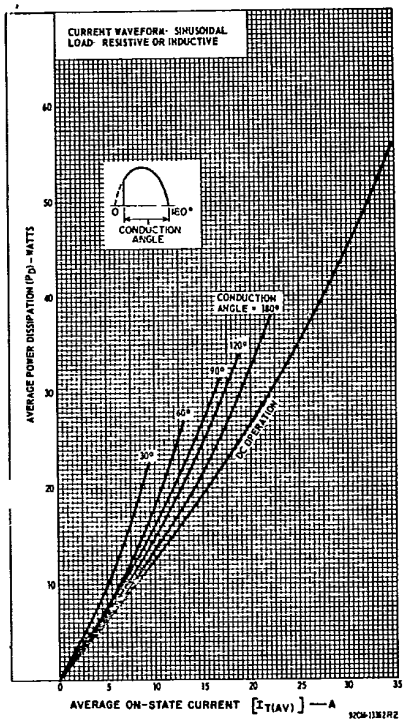


Fig. 1 — Power dissipation vs. on-state current.

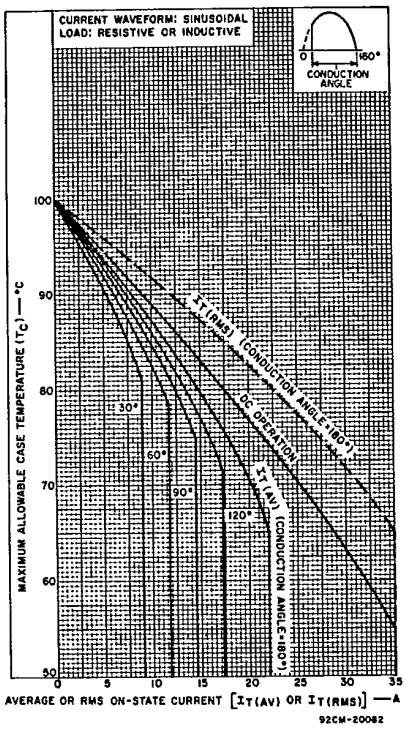


Fig. 2 — Maximum allowable case temperature vs. on-state current for press-fit and stud types.

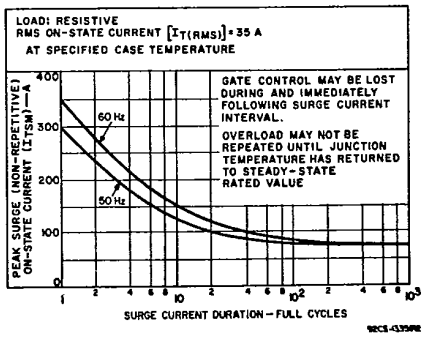


Fig. 3 — Peak surge on-state current vs. surge current duration.

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

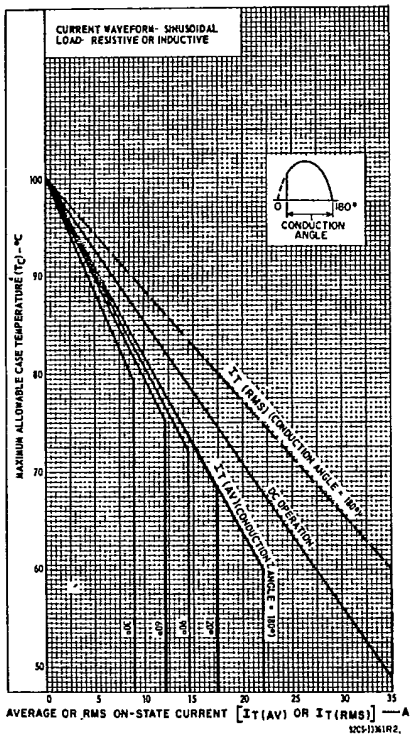


Fig. 4 — Maximum allowable case temperature vs. on-state current for isolated-stud types.

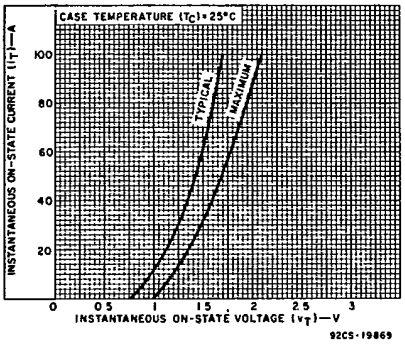


Fig. 5 — Instantaneous on-state current vs. on-state voltage.

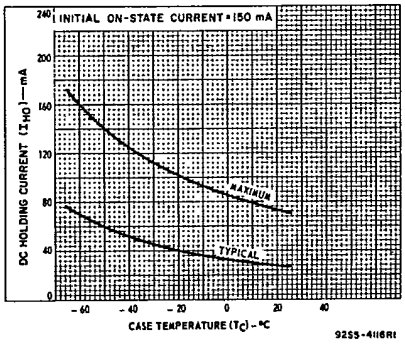


Fig. 6 — DC holding current vs. case temperature.

1234 D-11

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

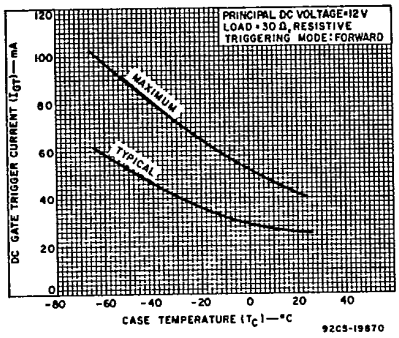


Fig. 7 — DC gate trigger current (forward) vs. case temperature.

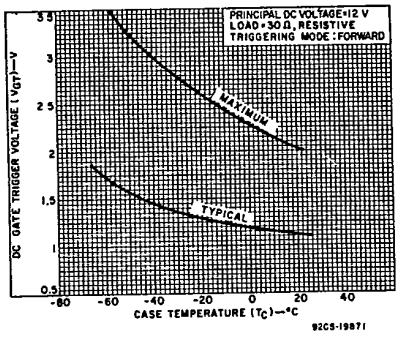


Fig. 8 — DC gate trigger voltage (forward) vs. case temperature.

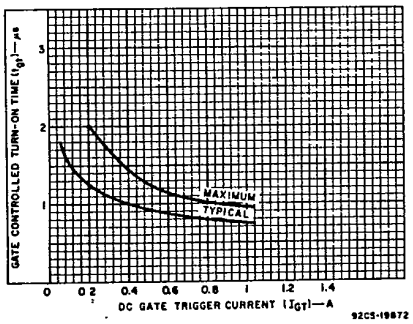


Fig. 9 — Gate-controlled turn-on time vs. gate trigger current.

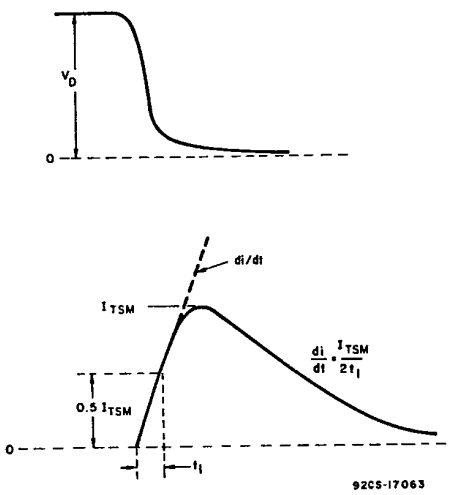


Fig. 10 — Rate of change of on-state current with time (defining di/dt).

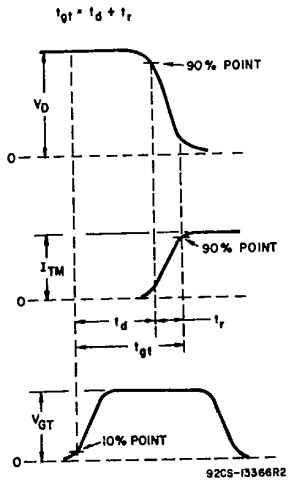


Fig. 11 — Relationship between off-state voltage, on-state current, and gate trigger voltage showing reference points for definition of turn-on time (t_{gt}).

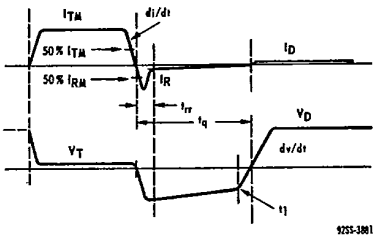


Fig. 12 — Relationship between instantaneous on-state current and voltage showing reference points for definition of circuit commutated turn-off time (t_q).

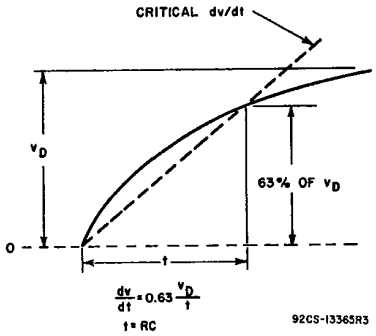


Fig. 13 — Rate of rise of off-state voltage with time (defining-critical dv/dt).