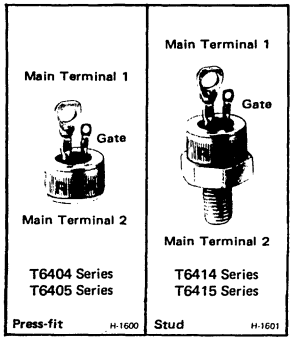
RCA
Solid State
Division

Thyristors
T6404 T6405
T6414 T6415
Series



400-Hz, 25 & 40-A Silicon Triacs

For Control-Systems Application in Airborne and Ground-Support Type Equipment

Features:

- RMS On-State Current — $I_{T(RMS)}$ = 25A: T6405 and T6415 Series; = 40A: T6404 and T6414 Series
- Shorted-Emitter Center-Gate Design
- di/dt Capability = 100 A/μs
- Commutating dv/dt Capability Characterized at 400 Hz

Voltage / Package	200 V Types	400 V Types
Press-fit	T6404B (40791)	T6404D (40792)
Press-fit	T6405B (40787)	T6405D (40788)
Stud	T6414B (40793)	T6414D (40794)
Stud	T6415B (40789)	T6415D (40790)

Numbers in parentheses are former RCA Type numbers.

These RCA triacs are gate-controlled full-wave silicon ac switches. They are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate triggering voltages.

They are intended for operation at 400 Hz with resistive or inductive loads and nominal line voltages of 115 and 208 V RMS sine wave and repetitive peak off-state voltages of 200 V and 400 V.

These triacs exhibit commutating voltage (dv/dt) capability at high commutating current (di/dt). They can also be used in 60-Hz applications where high commutating capability is required.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

For Operation with Sinusoidal Supply Voltage at 400 Hz and with Resistive or Inductive Load.

		T6404B T6405B T6414B T6415B	T6404D T6405D T6414D T6415D	
REPETITIVE PEAK OFF-STATE VOLTAGE:*	V_{DROM}			
Gate open, T_J = −50 to 110° C		200	400	V
RMS ON-STATE CURRENT (Conduction Angle = 360°):	$I_{T(RMS)}$			
Case temperature				
T_C = 85° C (T6405 Series)		25		A
80° C (T6415 Series)		25		A
70° C (T6404 Series)		40		A
65° C (T6414 Series)		40		A
For other conditions		*See Fig.3*		
PEAK SURGE (NON-REPETITIVE) ON-STATE CURRENT:	I_{TSM}			
For one cycle of applied principal voltage, T_C as above				
400 Hz (sinusoidal)		600		A
60 Hz (sinusoidal)		300		A
50 Hz (sinusoidal)		265		A
For more than one cycle of applied principal voltage		*See Fig.4*		
RATE-OF-CHANGE OF ON-STATE CURRENT:	di/dt			
V_{DM} = V_{DROM}, I_{GT} = 200 mA, t_r = 0.1 μs *(See Fig. 15)*		100		A/μs
FUSING CURRENT (for Triac Protection):	I^2t			
T_J = −50 to 110° C, t = 1.25 to 10 ms		270		A^2s
PEAK GATE-TRIGGER CURRENT:■	I_{GTM}			
For 1 μs max. *(See Fig. 7)*		12		A
GATE POWER DISSIPATION:				
Peak (For 10 μs max., $I_{GTM} \leq 4$ A (peak), *(See Fig. 7)*	P_{GM}	42		W
Average	$P_{G(AV)}$	0.75		W
TEMPERATURE RANGE:▲				
Storage	T_{stg}	−50 to 150		°C
Operating (Case)	T_C	−50 to 110		°C
TERMINAL TEMPERATURE (During soldering):	T_T			
For 10 s max. (terminals and case)		225		°C

* For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.
■ For either polarity of gate voltage (V_G) with reference to main terminal 1.
▲ For temperature measurement reference point, see Dimensional Outline.

MAXIMUM RATINGS, *Absolute-Maximum Values:* (Cont'd)

For Operation with Sinusoidal Supply Voltage at 400 Hz and with Resistive or Inductive Load.

		T6404B T6405B T6414B T6415B	T6404D T6405D T6414D T6415D	
STUD TORQUE:				
Recommended	τ_s		35	in.-lb
Maximum (DO NOT EXCEED)			50	in.-lb

ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC	SYMBOL	LIMITS Min.	LIMITS Typ.	LIMITS Max.	UNITS
Peak Off-State Current:♦					
Gate open, T_J = 110° C, V_{DROM} = Max. rated value	I_{DROM}	–	0.2	4	mA
Maximum On-State Voltage:♦					
For i_T = 100 A (peak), T_C = 25° C:	V_{TM}				V
T6405 & T6415 Series		–	1.7	2.5	
T6404 & T6414 Series		–	1.7	2	
DC Holding Current:♦					
Gate open, Initial principal current = 500 mA (DC), v_D = 12 V,					
T_C = 25° C	I_{HO}	–	30	90	mA
For other case temperatures			See Fig.6		
Critical Rate-of-Rise of Commutation Voltage:♦					
For v_D = V_{DROM}, $I_{T(RMS)}$ = rated value, gate unenergized, (See Figs.13 & 14):					
Commutating di/dt = 88 A/ms					
T_C = 85° C (T6405 Series)	dv/dt	2	–	–	V/μs
= 80° C (T6415 Series)		2	–	–	
Commutating di/dt = 141 A/ms					
T_C = 70° C (T6404 Series)		2	–	–	
= 65° C (T6414 Series)		2	–	–	
Critical Rate-of-Rise of Off-State Voltage:♦					
For v_D = V_{DROM}, exponential voltage rise, gate open, T_C = 110° C:	dv/dt				V/μs
T6405 & T6415 Series		30	150	–	
T6404 & T6414 Series		50	200	–	
DC Gate-Trigger Current:♦†					
For v_D = 12 V (DC), R_L = 30 Ω, T_C = 25° C	I_{GT}				mA
Mode I+ V_{MT2} positive V_G positive		–	20	80	
Mode III− V_{MT2} negative V_G negative		–	50	80	
Mode I− V_{MT2} positive V_G negative		--	80	120	
Mode III+ V_{MT2} negative V_G positive		–	80	120	
For other case temperatures			See Figs.8 & 9		
DC Gate-Trigger Voltage:♦†					
For v_D = 12 V(DC), R_L = 30 Ω, T_C = 25° C	V_{GT}	–	2	3	V
For other case temperatures			See Fig. 10		
For v_D = V_{DROM}, R_L = 125 Ω, T_C = 110° C		0.2	–	–	
Gate-Controlled Turn-On Time:					
(Delay Time + Rise Time)					
For v_D = V_{DROM}, I_{GT} = 150 mA, t_r = 0.1 μs,	t_{gt}				
i_T = 60 A (peak), T_C = 25° C (See Figs. 11 & 12)		–	1.6	2.5	μs
Thermal Resistance, Junction-to-Case:					
Steady-State					
Press-fit types	θ_{J-C}	–	–	0.8	°C/W
Stud		–	–	0.9	
Transient (Press-fit & stud types)			See Fig. 16		

♦ For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.

† For either polarity of gate voltage (V_G) with reference to main terminal 1.

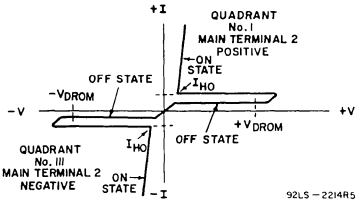


Fig. 1 – Principal voltage-current characteristic.

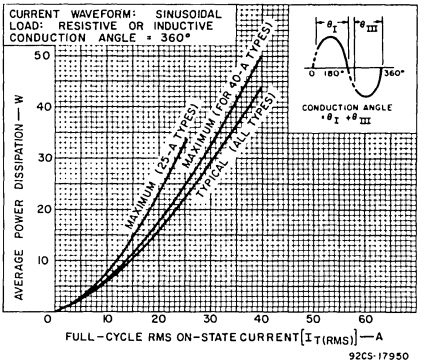


Fig. 2 – Power dissipation vs. on-state current.

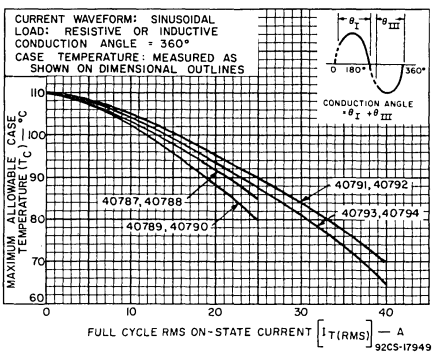


Fig. 3 – Maximum allowable case temperature vs. on-state current.

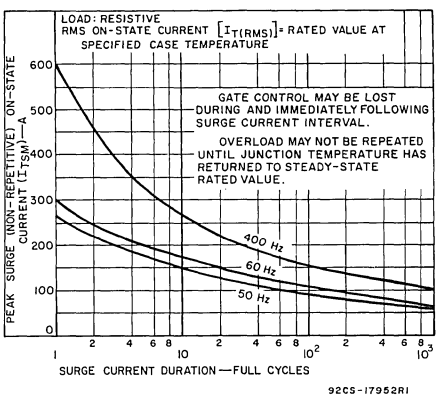


Fig. 4 – Peak surge on-state current vs. surge current duration.

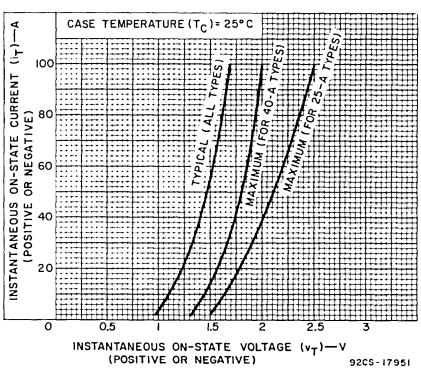


Fig. 5 – On-state current vs. on-state voltage.

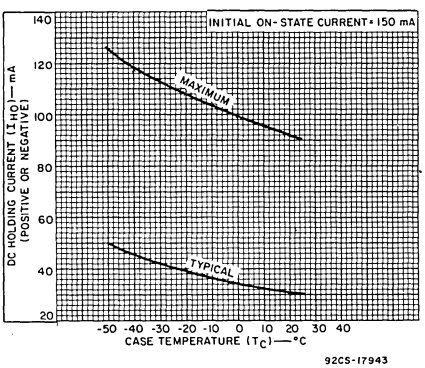


Fig. 6 – DC holding current vs. case temperature.

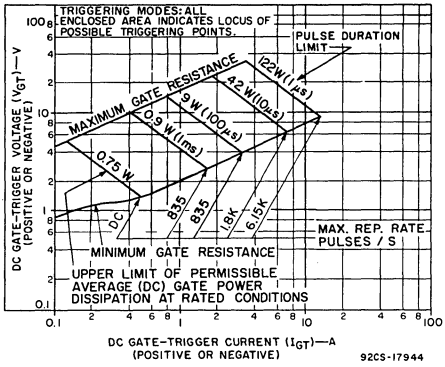


Fig. 7 — Gate-trigger characteristics and limiting conditions for determination of permissible gate-trigger pulses.

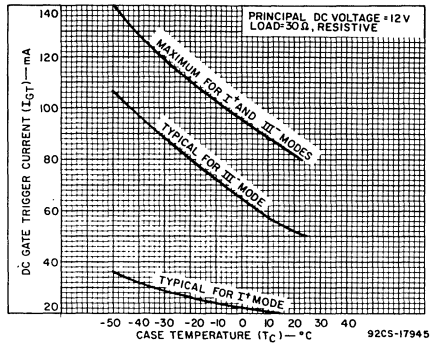


Fig. 8 — DC gate-trigger current vs. case temperature (I^+ & III^- modes).

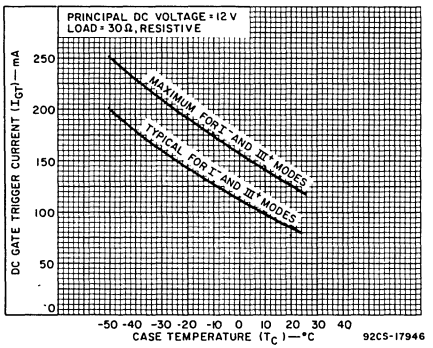


Fig. 9 — DC gate-trigger current vs. case temperature (I^- & III^+ modes).

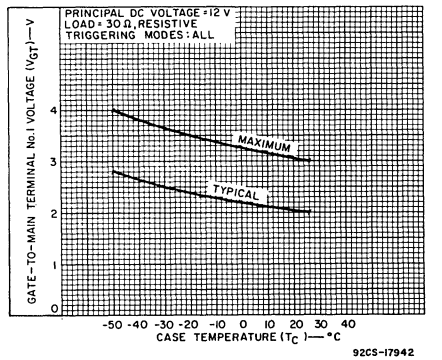


Fig. 10 — DC gate-trigger voltage vs. case temperature.

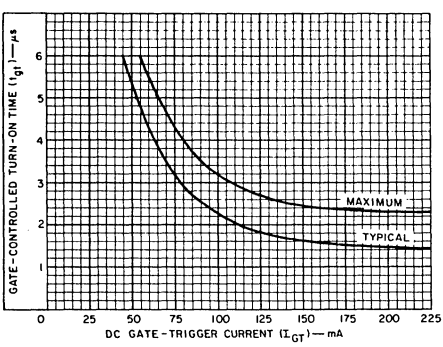


Fig. 11 — Turn-on time vs. gate trigger current.

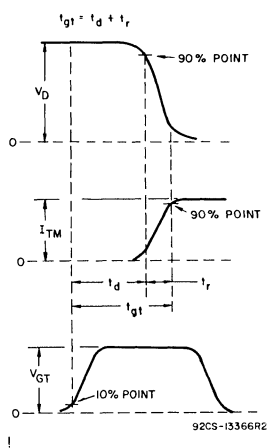


Fig. 12 — Relationship between off-state voltage, on-state current, and gate-trigger voltage showing reference points for definition of turn-on time (t_{gt}).

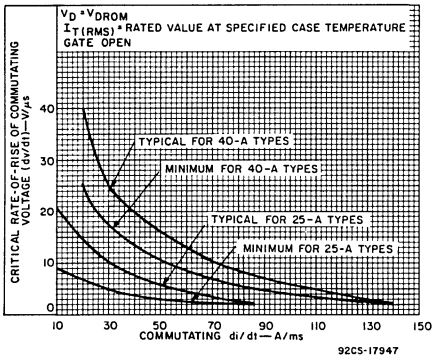


Fig. 13 – Commutating voltage vs. commutating current.

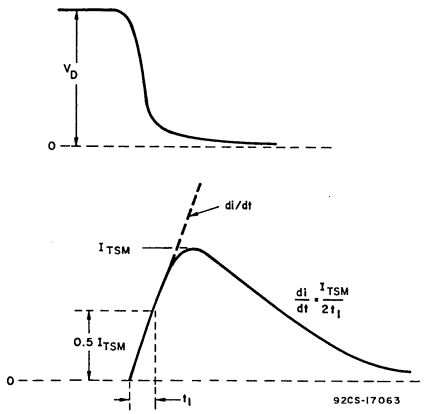


Fig. 15 – Rate of change of on-state current with time (defining di/dt).

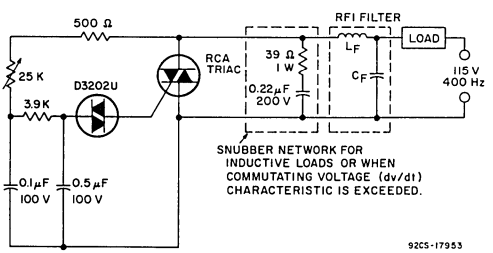


Fig. 17 – Typical phase-control circuit for operation at 400 Hz.

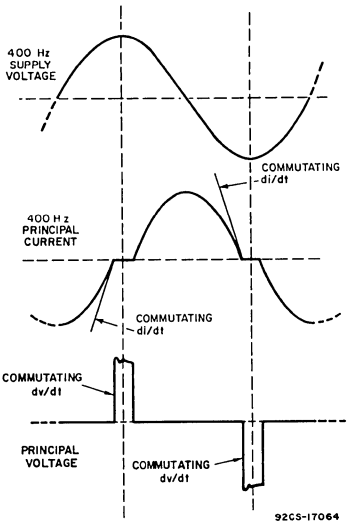


Fig. 14 – Relationship between supply voltage and principal current (inductive load) showing reference points for definition of commutating voltage (dv/dt).

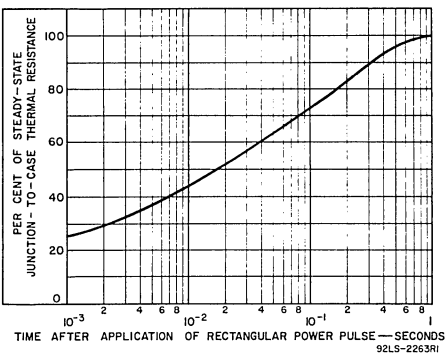


Fig. 16 – Transient junction-to-case thermal resistance vs. time.

WARNING:

The RCA isolated-stud package thyristors should be handled with care. The ceramic portion of these thyristors contains BERYLLIUM OXIDE as a major ingredient. Do not crush, grind, or abrade these portions of the thyristors because the dust resulting from such action may be hazardous if inhaled.

TERMINAL CONNECTIONS

No.1–Gate
No.2–Main Terminal 1
Case, No.3–Main Terminal 2