BULLETIN 603A

CRYDOM

SERIES T

Triac Output
Solid-State Relay

5 Thru 25 Amp
AC Output

Series T/Triac Output Solid-State, Photo-Isolated Power Relays (SPST*)

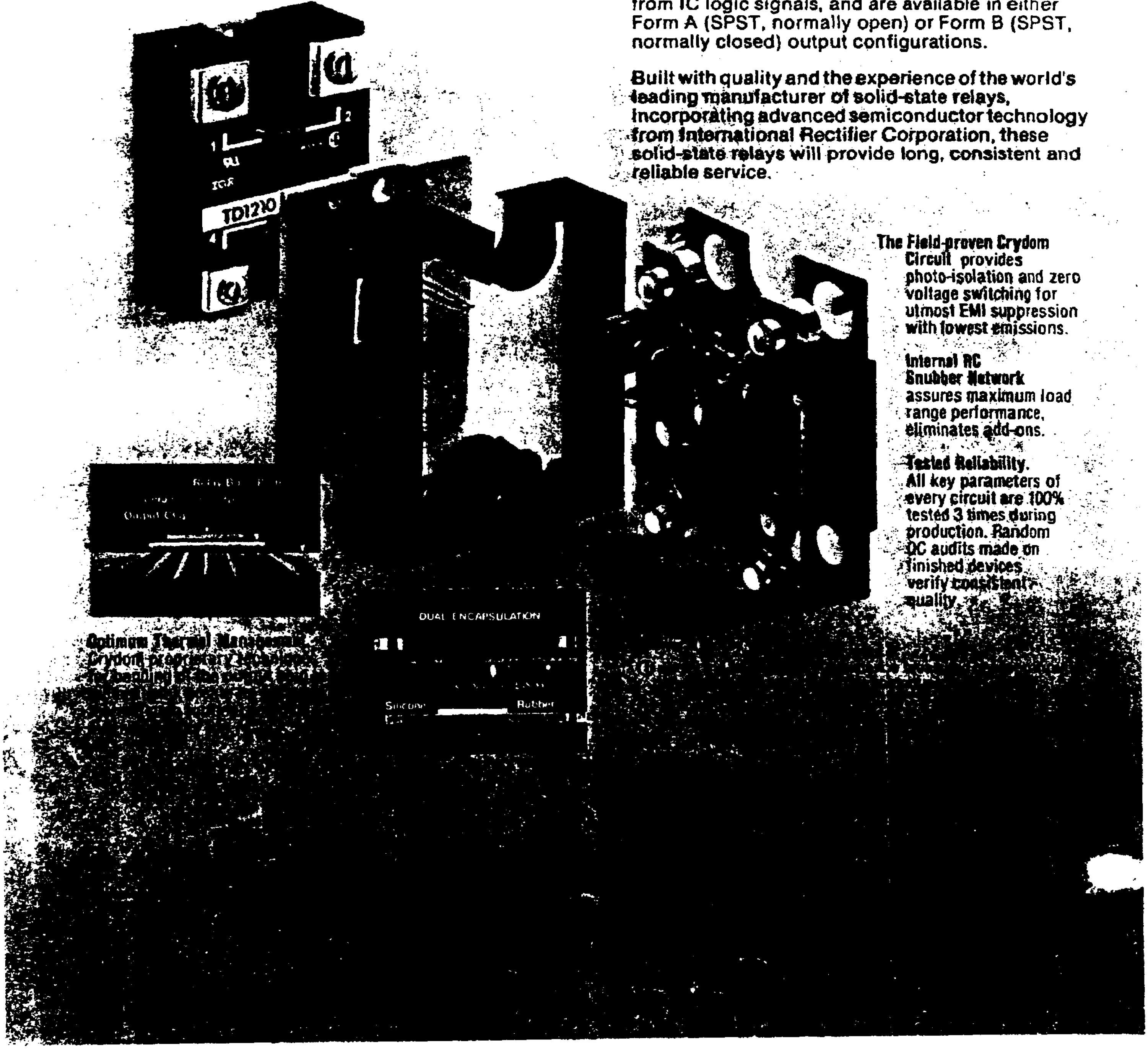
- **Low Cost**
- **Zero Voltage Switching**
- **U.L. Recognized, CSA Certified**
- **VDE Conformance**
- **AC and DC Control**
- ***Form A and B Output Switching**

General Description

The Series T Crydom solid-state power relays incorporate an economical TRIAC output device in the original standard Crydom package with the same highly reliable, noise-immune, drive circuitry used in most other Crydom photo-isolated relays. Snubbers are included for high dv/dt applications and inductive loads, together with zero-voltage switching to reduce high inrush currents and electrical noise.

The inherent zero-current turn-off characteristic of triacs and the total absence of arcing mechanical contacts, substantially reduces electro-magnetic interference and back EMF transients. AC input models can be controlled from a wide range of AC signal sources (90-280 VAC), and are available in Form A (normally open) configuration only. DC input versions will operate from IC logic signals, and are available in either Form A (SPST, normally open) or Form B (SPST, normally closed) output configurations.

Built with quality and the experience of the world's leading manufacturer of solid-state relays, incorporating advanced semiconductor technology from International Rectifier Corporation, these solid-state relays will provide long, consistent and reliable service.



Thermal Characteristics

A major consideration in the use of solid-state relays is the thermal design. It is essential that the user provide adequate heat sinking for the application.

The simplified thermal model (figure 1) indicates the basic elements to be considered in the thermal design. The values to be chosen or determined by the user are the case-to-heatsink interface thermal resistance ($R_{\theta CS}$) and the heatsink-to-ambient thermal resistance ($R_{\theta SA}$).

Referring to figures 4 thru 6, the left halves show power dissipation versus load current. The right halves are families of curves which are used in selecting the required heatsink to maintain a maximum case temperature for a given ambient. It is important to note that the thermal resistance values (°C/W) shown include both case-to-heatsink interface ($R_{\theta CS}$) as well as the heatsink-to-ambient thermal resistance ($R_{\theta SA}$). Thus, when selecting a heatsink, the value of $R_{\theta CS}$ must be subtracted from the number indicated by the curve in order to determine the required heatsink-to-ambient thermal resistance ($R_{\theta SA}$).

As a point of information, if the SSR is firmly mounted on a smooth heatsink surface using thermally conductive grease, the value of $R_{\theta CS}$ (case-to-heatsink interface) will typically be 0.1°C/W or less. Examples of how the curves are used are explained below in conjunction with figure 3.

Example 1.

If a TD1225 is mounted on a heatsink with a thermal resistance of 1°C/W (including $R_{\theta CS}$) and must operate in an ambient of 60°C, the allowable current of 18A may be determined by following the route A,B,C,D. Additional information of power dissipation and maximum allowable case temperature can be found by extending line C,B to points E and F where the values of 19W and 81°C are read.

Example 2.

If a current of 14A is required in an ambient of 50°C, the necessary heatsink, plus interface, thermal resistance of 2.7°C/W may be determined by following the route G,H,I,J. Additional information of power dissipation and case temperature can be found by extending line H,J to points L and K where the values of 14W and 87°C are read.

This information can be used in heatsink selection from manufacturer's dissipation versus thermal resistance curves such as those shown in figure 2. The thermal resistance of curve (a) at 14 watts is 2.5°C/W. This is better than the required 2.7°C/W in example 2, allowing 0.2°C/W for $R_{\theta CS}$, and is therefore suitable for this application.

Alternatively, heatsink (b) at 14 watts is 1.9°C/W. Adding 0.1°C/W for $R_{\theta CS}$ and returning to figure 3, it would allow operation at a maximum ambient of 58°C instead of 50°C.

Confirmation of proper heatsink selection can be achieved by actual temperature measurement under worst case conditions. The measurement can be taken on the metal baseplate in the area of the mounting screw, and should not exceed the maximum allowable case temperature shown in graphs.

Surge Characteristics

The curves in figures 7, 8 and 9 apply to a non-repetitive uniform amplitude surge of a given time and peak current, preceded and followed by any rated load condition. Also shown is the number of these surge occurrences that can be tolerated before device damage. For example, a life of 10^6 surge occurrences can be estimated for a 25 amp peak surge (figure 8) of 0.1 seconds duration. The junction temperature must be allowed to return to its steady-state value before reapplication of surge current.

Control of conduction may be momentarily lost if currents exceed the 10^4 curve values from initial junction temperatures greater than 40°C.

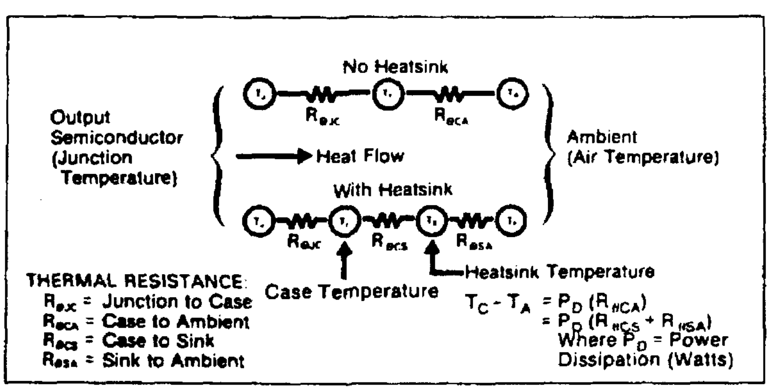


Figure 1. Simplified Thermal Model

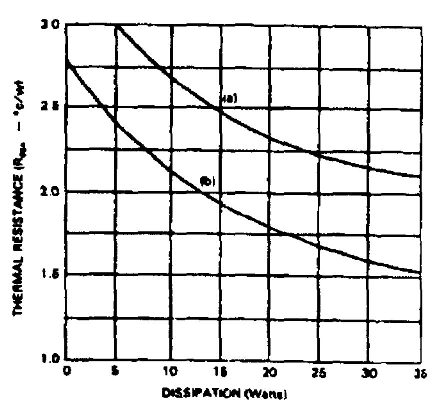


Figure 2. Typical Heat Sink Characteristics

> **NOTE:** Models TD1205, TD2405, TA1205 and TA2405 have been discontinued as of December 31, 1982.

Electrical Specifications (25°C unless otherwise specified)

OUTPUT CHARACTERISTICS		MODEL NUMBERS						UNITS
	AC Control	**TA1205**	**TA1210**	**TA1225**	**TA2405**	**TA2410**	**TA2425**	
	DC Control	**TD1205**	**TD1210**	**TD1225**	**TD2405**	**TD2410**	**TD2425**	
Operating Voltage Range 47-63 Hz ⑦		24-140			48-280			V RMS
Max. Load Current (See derating curves) ①		5	10	25	5	10	25	A RMS
Min. Load Current		50			50			mA RMS
Transient Overvoltage ③		300			500			V peak
Max. Surge Current (Non-Repetitive) 16.6 ms (see surge curves)		50	100	250	50	100	250	A peak
Max. Over Current (Non-Repetitive) 1 sec.		12	24	40	12	24	40	A RMS
Max. On State Voltage Drop @ Rated Current		1.6			1.6			V peak
Max. I^2T for Fusing (8.3 ms)		10	42	260	10	42	260	A^2sec
Thermal Resistance, Junction-to-Case, $R_{\theta JC}$ (T_J Max. = 105°C)		3.0	2.1	1.3	3.0	2.1	1.3	°C/W
Power Dissipation @ Max. Current (See dissipation curves)		7.0	14	31	7.0	14	31	Watts
Max. Zero Voltage Turn-on ④		15			35			V peak
Max. Peak Repetitive Turn-On Voltage		10			12			V peak
Max. Off-State Leakage Current @ Rated Voltage (-30°C ≤ T_A ≤ 80°C)		8			10			mA RMS
Min. Off-State dv/dt (Static) @ Max. Rated Voltage ⑤		200						V/μs

INPUT CHARACTERISTICS		DC INPUT MODELS (with "TD" Prefix)	AC INPUT MODELS (with "TA" Prefix)
Control Voltage Range		3 to 32 VDC	90 to 280 V RMS (47-63 Hz)
Max. Reverse Voltage		-32 VDC	—
Max. Turn-On Voltage (-30°C ≤ T_A ≤ 80°C)		3.0 VDC	90 V RMS
Min. Turn-Off Voltage (-30°C ≤ T_A ≤ 80°C)		1.0 VDC	10 V RMS
Min. Input Impedance		1500 Ohms	60K Ohms
Max. Input Current	5 VDC	4 mA DC	—
	28 VDC	20 mA DC	—
	120 VAC	—	2 mA RMS
	240 VAC	—	4 mA RMS
Max. Turn-On Time (@ 60 Hz)		8.3 msec	10 msec
Max. Turn-Off Time (@ 60 Hz)		8.3 msec	40 msec

GENERAL CHARACTERISTICS		ALL MODELS
Dielectric Strength ① ② 50/60 Hz		2500 V RMS
Insulation Resistance @ 500 VDC ①		10[illegible] Ohms
Max. Capacitance Input/Output		8 pf
Ambient Temperature Range	Operating	-30°C to 80°C
	Storage	-30°C to 100°C

Crydom Series T Solid-State Power Relays

Mechanical Specifications

Weight: 4 oz. Max.

Case Material: Fire retardant polyester

Encapsulant: Alumina filled epoxy

Case Color: Black

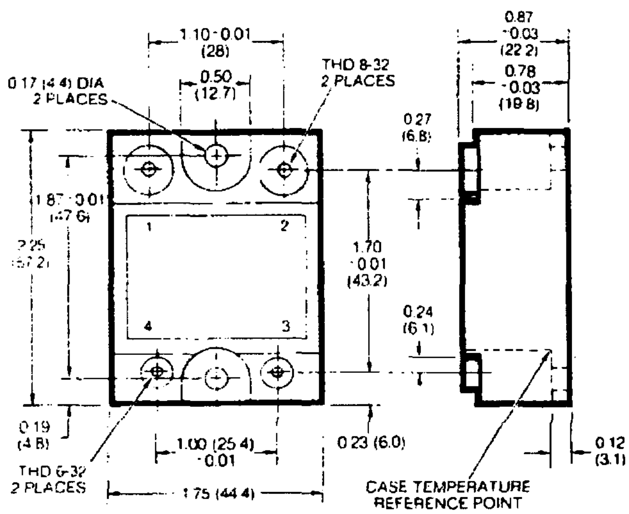
Base Plate Aluminum (Some models nickel-plated)

Terminals: Tin-plated Brass. Nickel-plated steel screws & saddle clamps supplied unmounted

Tolerances: ±0.02 (0.50) (unless otherwise noted)

Dimensions: Inches (mm)

Dimensional Drawing



Part Numbering

(Description does not represent an actual Crydom part number)

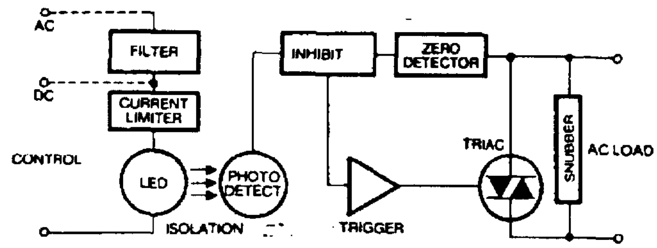
T A 12 10 B -13

- **T** — Triac
- **A** — Input: A = AC, D = DC
- **12** — Line Voltage: 12 = 120 VAC, 24 = 240 VAC
- **10** — Current Rating (Amps)
- **B** — B = Form B,* Normally Closed (Form A Normally Open, standard; no designation needed)
- **-13** — -13 = 600V Peak Blocking; -14 - 400V Peak Blocking

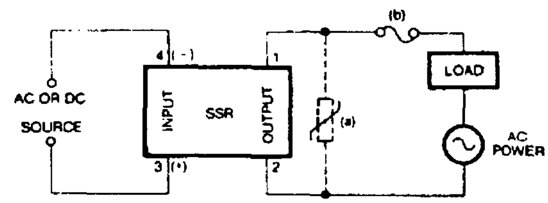
*Available with "D" prefix only (PC input). For phase control applications call factory.

Data and specifications subject to change without notice.

Block Diagram



Wiring Diagram



(a) Transient Protection
For transient and dv/dt protection, all models are fitted with an internal snubber. See table for details of additional transient overvoltage protection. If required, a Metal Oxide Varistor (MOV) may be connected across terminals 1 and 2 externally.

Max. Applied Line Voltage (VRMS)	Min. Transient Peak Rating of Relay (Vpeak)	Suggested IR MOV Part Number
130	400	Z10L221
250	600	Z10L441
	See Note ③	

(b) Fusing
Table shows suggested fuses suitable for most applications.

Max. Applied Line Voltage (VRMS)	Max. Current Rating of Relay (ARMS)	Suggested IR Fuse Part Number
130	10	SF13X10
130	25	SF13X25
250	10	SF25X10
250	25	SF25X20*

*Does not permit full rating of relay.

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Sales Offices, Agents and Distributors in Major Cities throughout the World

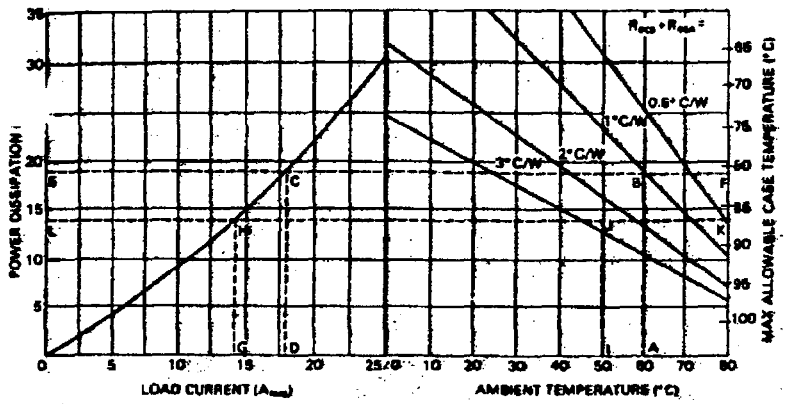

Figure 3. Use of Thermal Derating Curves (Examples)

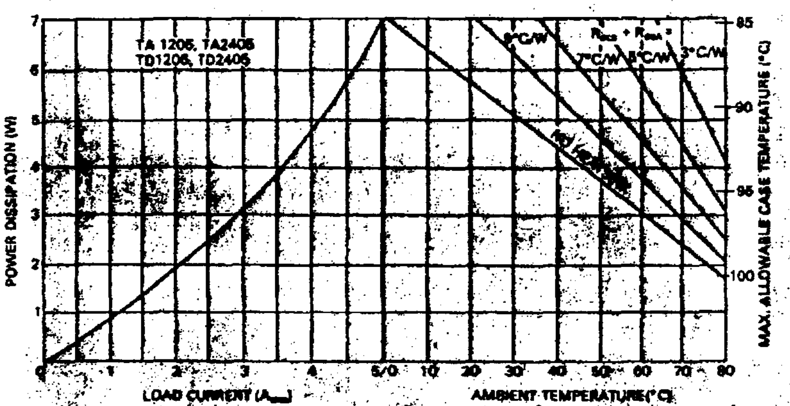

Figure 4. Thermal Derating Curves (5 Amp)

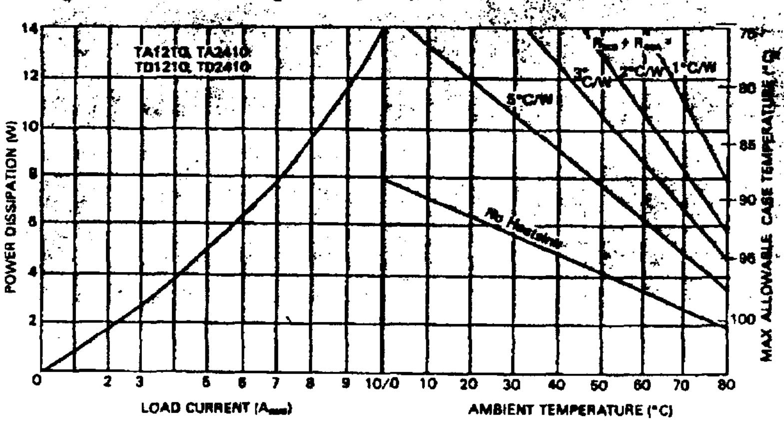

Figure 5. Thermal Derating Curves (10 Amp)

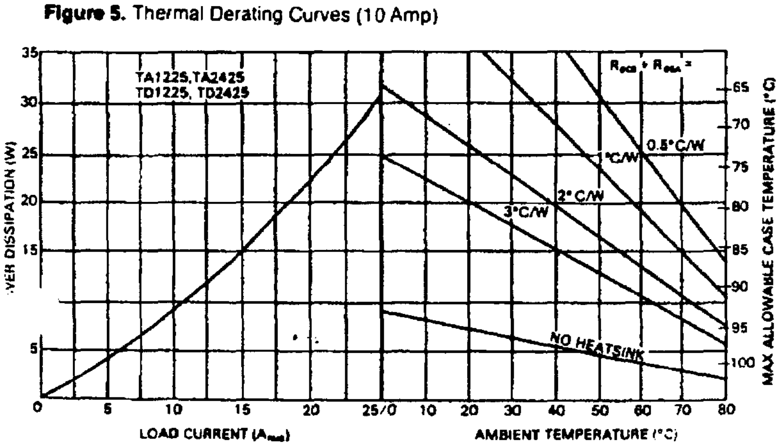

Figure 6. Thermal Derating Curves (25 Amp)

Surge Characteristics (see text)

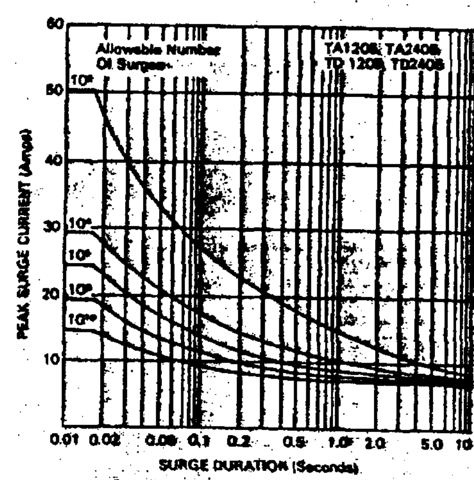

Figure 7. Peak Surge Current vs Duration (5 Amp)

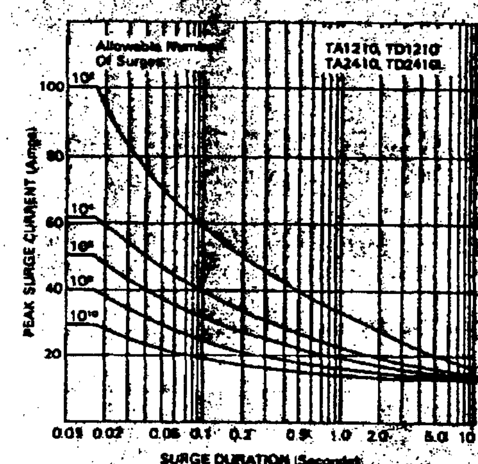

Figure 8. Peak Surge Current vs Duration (10 Amp)

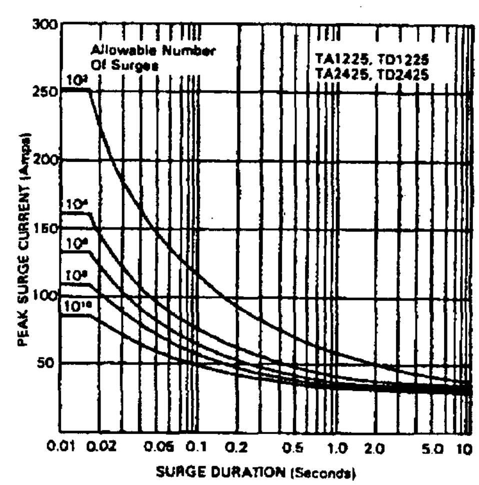

Figure 9. Peak Surge Current vs Duration (25 Amp)