SERIES 671

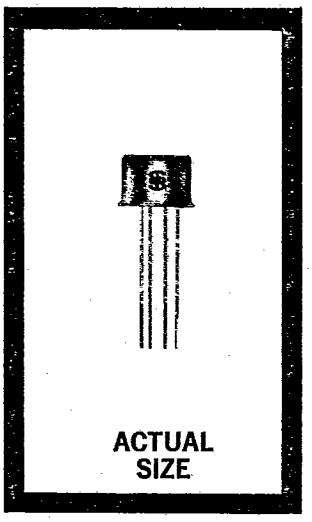
SOLID STATE SILICON LATCHING *RAYLAY

−65° C TO +125° C

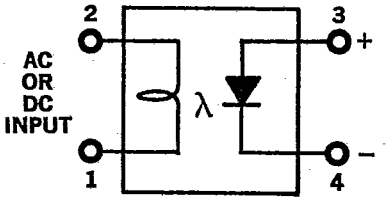
MICROMINIATURE • STABLE • UNIFORM • NONMECHANICAL • LONG LIFE

ARCLESS • RELIABLE • EFFICIENT • INERTIALESS • SHOCKPROOF

MODEL	MAX. APPLIED VOLTAGE AT OUTPUT TERMINALS (DC OR PEAK AC) (± VOLTS)
671-15	15
671-30	30
671-60	60
671-100	100



ACTUAL SIZE



EQUIVALENT CIRCUIT

FEATURES

100 VOLT, 350 MA CONTACT RATING
CONTACT 10 OHMS "ON", 1000 MEGOHMS "OFF"
1 VOLT, 15 MA, MINIMUM AC OR DC DRIVE
1000 MEGOHM ISOLATION
WITHSTANDS 5 AMP SURGES
WITHSTANDS INDUCTIVE LOADS
LOAD POWER TO 35 WATTS

APPLICATIONS

LATCHING RELAY
BINARY MEMORY
POWER CONTROL CIRCUITS
"AND" "OR" LOGIC CIRCUITS
TIME DELAY RELAY
INTERVAL TIMER
PULSE GENERATOR

DESCRIPTION

The Series 671 Latching Raylays are microminiature 4-terminal photoelectronic devices of completely solid state design and yet functionally equivalent to electromechanical latching relays. A major advantage of the Series 671 Solid State Latching Raylay is the complete electrical and mechanical isolation between the drive and the equivalent contacts. Energy transfer is accomplished by means of light radiation. The electrical drive can therefore be either AC or DC. Drive power is approximately 20 milliwatts. A very important feature to consider is that these units are very immune to drive transients and will withstand extremely high voltage and current for short periods of time if the average drive power is maintained below 50 milliwatts. Loads can vary between 0.2 to 350 milliamperes continuous DC or surge currents of 5 amperes at levels from 2 to 100 volts.

The equivalent output contacts can be unlatched by decreasing the voltage applied across the output terminals to a value below the maintaining level, or by disconnecting the applied voltage. The latching feature provides for binary memory applications in logic and control systems. The latching Raylay can replace electromechanical latching relays, mechanical switches, gas thyratrons and amplifiers for many uses. Advantages include exceptionally low drive power, reduced complexity, high reliability, long life, microminiature size and weight, tremendous resistance to shock and vibration and faster switching. Additional advantages realized include elimination of contact bounce, arcing, rf noise, wear, pitting and burning.

Latching Raylays can also be used as time delay relays. The delay time is a function of the drive voltage and can provide delays extending from 8 to 70 milliseconds. The circuit simplicity and reliability achieved can provide major performance improvement and cost reductions for many system applications. These units are recommended for industrial, military, missile, space vehicle and portable applications.

* Light-Controlled Relay

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TELEPHONE: AREA CODE (213) 894-2271 OR 785-4473

MODEL 671 LATCHING RA

OPERATION

The Model 671 Latching Raylay is a bistable photoelectronic switching device having an output that is completely isolated from the input. The bistable property of this device provides operation as a binary memory for logic and control systems. The drive to the unit need only be momentary. Once the output is switched "on", it is completely independent of the input. In order to turn the device "off" the output current must be reduced to zero.

Power delivered to a load can be as high as 35 watts at an efficiency of 99% while device dissipation is approximately 0.25 watts at 25°C. and 0.5 watts at 75°C.

The Latching Raylay can be used as a simple time delay relay with delays ranging from 8 to 70 milliseconds as the drive voltage is decreased from 3 to 1.2 volts. This is believed to be a unique application for so small a device.

ISOLATED CONTROL CIRCUITS

Figure 1 shows how the Latching Raylay is series-connected for switching a DC voltage across a resistive or inductive load. This is a "normally open" contact condition. AC or DC drive can be utilized to close the output terminals 3 and 4, thereby energizing the load. Since this is a "latching" device, removal of the drive will not de-energize the load. To "unlatch" or "reset", it is necessary to remove the load supply voltage by means of a series switch or to reduce the load supply current below its "hold" level of 40 microamperes. These are polarized devices and require a positive voltage at pin 3 relative to pin 4 in order to conduct.

As in Figure 2, an AC load supply can be used. However, conduction will only occur during that portion of the duty cycle where the voltage at pin 3 is positive with respect to pin 4. With an AC load supply a reset switch or signal is not required since the supply voltage returns to zero each cycle, which causes the Raylay to "unlatch" or de-energize.

A non-polarized switching operation can be obtained by connecting a pair of Latching Raylays as shown in Figure 3.

The foregoing applications utilize the 671 Raylays for "normally open" switching conditions. It is also possible to use the device in a shunt connection as shown in Figure 4 to provide a "normally closed" switching sense.

In Figure 5 a single Latching Raylay is used as a full-wave diode bridge control. This is an interesting application since either full-wave rectified DC power or full-wave AC power can be switched through a load.

HIGH POWER ISOLATED CONTROL CIRCUITS

The preceding basic circuits can be applied to the control

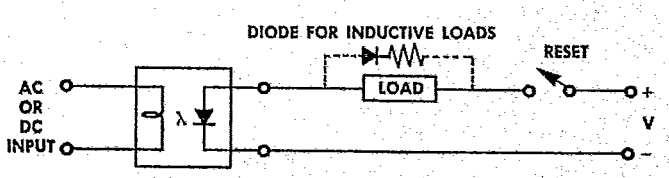


FIGURE 1. DC switching (normally open) (DC load supply).

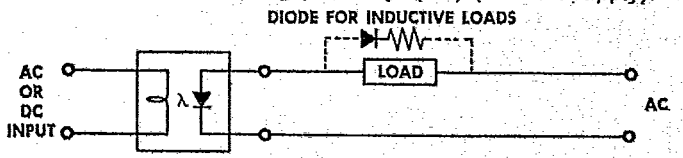


FIGURE 2. Half-wave AC switching (normally open) (AC load supply).

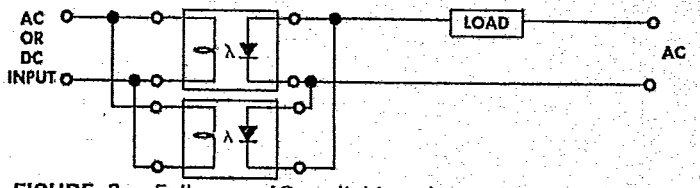


FIGURE 3. Full-wave AC switching (normally open) (AC load supply).

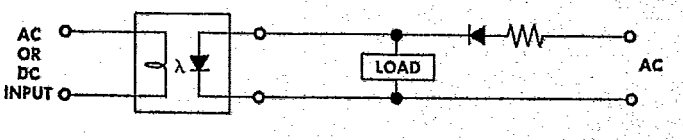


FIGURE 4. Half-wave AC switching (normally closed) (AC load supply).

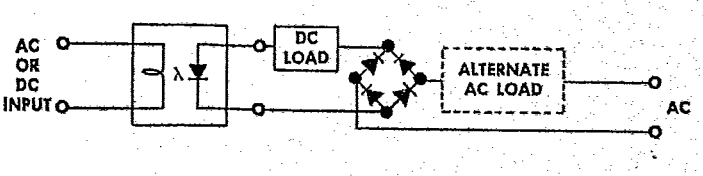


FIGURE 5. Full-wave AC or DC switching (normally open) (AC load supply).

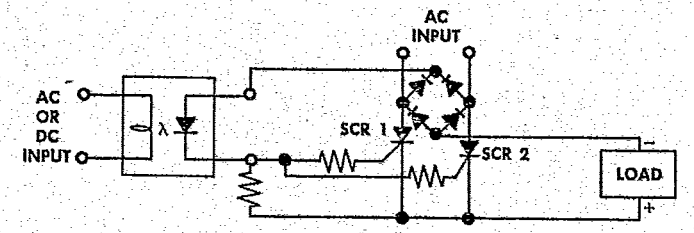


FIGURE 6. High power DC switching (normally open) (AC load supply).

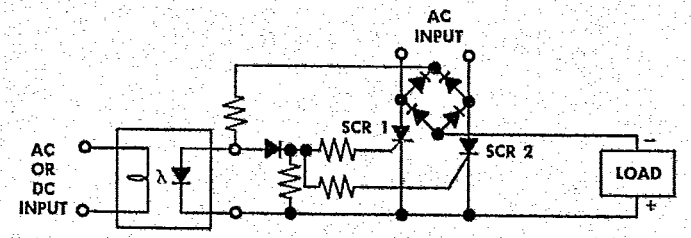


FIGURE 7. High power DC switching (normally closed) (AC load supply).

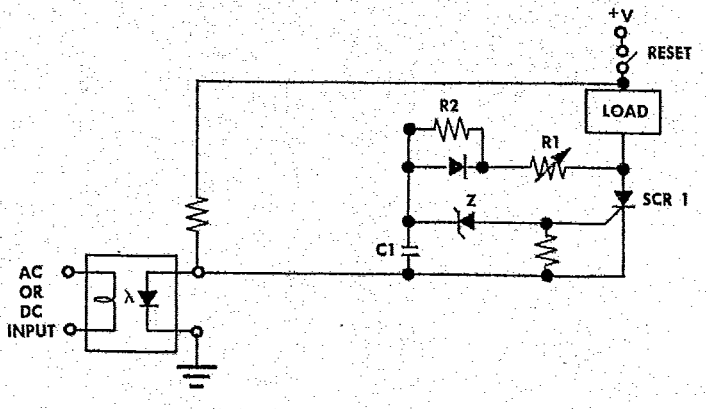


FIGURE 8. Time delayed high power DC switching (normally open) (DC load supply).

of relatively high power by suitable connections to silicon controlled rectifiers (SCR) having ratings exceeding 100 amperes and 30 kilowatts. Typical isolated control of AC power through a load are shown in Figures 6 and 7. A "normally off" condition is shown in Figure 6, where AC or DC drive must be applied at the Raylay input in order to energize the load. In Figure 7, a "normally on" condition prevails since the Raylay drive must be removed in order to de-energize the load.

Figure 8 shows an isolated time delayed power control circuit. R1, R2 and C1 can be adjusted to vary the time delay between the drive to the Raylay and the switching of DC power through the load. An interval timing application is shown in Figure 9 where DC power is applied to the load immediately after driving the Raylay. After a predetermined interval, power to the load will automatically be removed. The cycle can be repeated by interrupting and reapplying the drive to the Raylay. The time interval is determined by R1, R2, and C1.

ISOLATED LOGIC CONTROL CIRCUITS

The 671 Latching Raylay has a binary memory characteristic which can be utilized to provide many basic logic control functions. The number of logic functions can be increased indefinitely by adding Raylays as required. "OR" type logic control is shown in Figure 10 where either Raylay "A" or "B" can be activated to energize the load.

An interesting extension of the previous circuit to sequential "AND" logic control can be seen in Figure 12. It is not necessary that all Raylays be simultaneously activated. Each Raylay will "remember" being turned "on" and once all three have been activated in any sequence, the load will become energized.

The interconnection of two Latching Raylays as in Figure 13 provides a flip-flop or binary memory with isolated "SET" and "RESET" inputs. An AC or DC "SET" input will cause output "A" to assume a virtual ground potential while output "$\bar{A}$" will be at a potential +V. AC or DC applied to the "RESET" input will cause "A" to go to +V and "$\bar{A}$" to assume ground.

Latching Raylays can be used as isolated positive or negative pulse generators when connected as shown in Figures 14 and 15.

An isolated time delay relay application is shown in Figure 16. Timing is essentially controlled by R and C. Diode D acts to discharge C after the SCR fires in order to provide more precise timing with shorter recycling time.

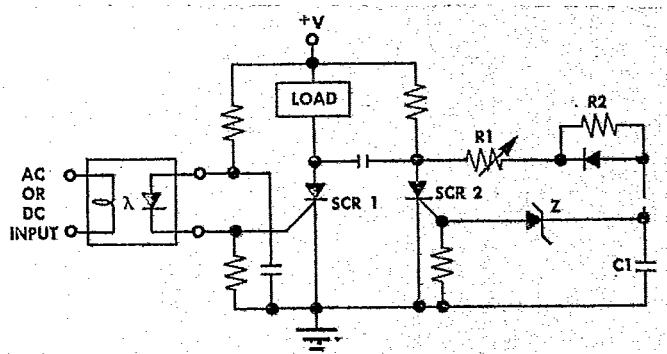


FIGURE 9. Time interval high power DC switching (normally open) (DC load supply).

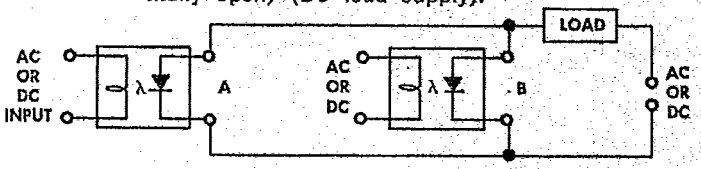


FIGURE 10. "OR" logic control (normally open) (AC or DC load supply).

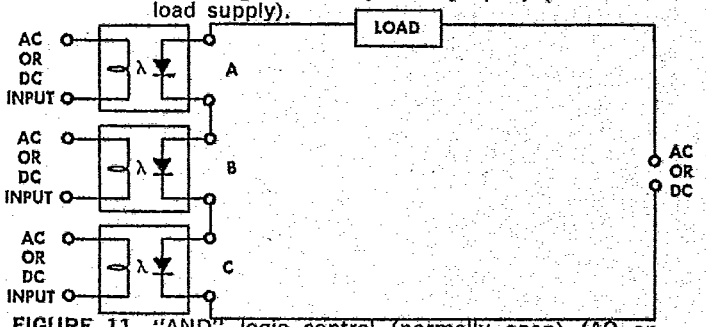


FIGURE 11. "AND" logic control (normally open) (AC or DC load supply).

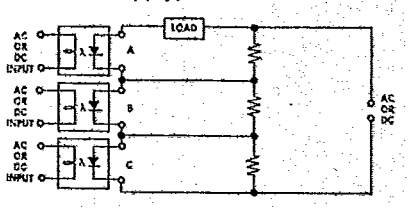


FIGURE 12. Sequential "AND" logic control (normally open) (AC or DC load supply).

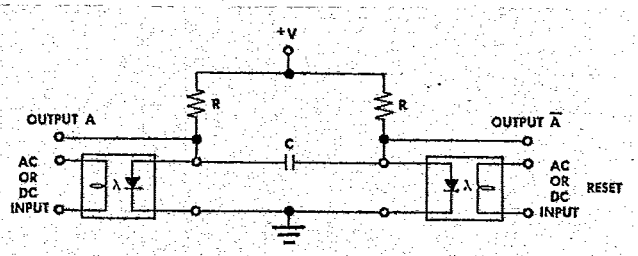


FIGURE 13. Control Flip-Flop (DC load supply).

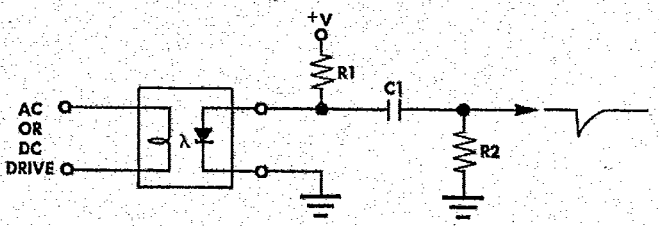


FIGURE 14. Negative pulse generator (DC load supply).

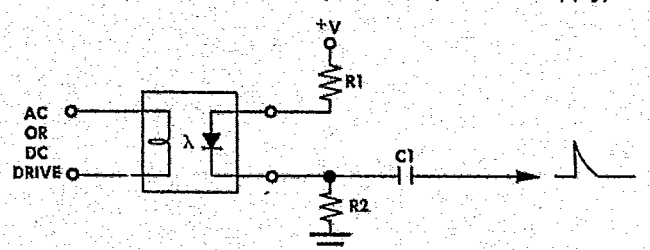


FIGURE 15. Positive pulse generator (DC load supply).

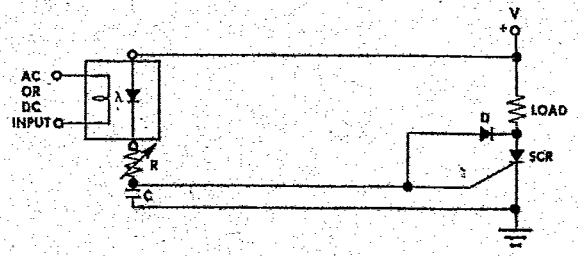


FIGURE 16. Isolated time delay relay (DC load supply).

DRIVE SPECIFICATIONS

(25° C. unless noted)

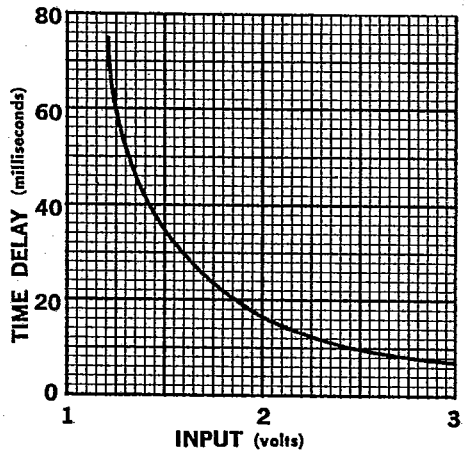
RATED CONTROL VOLTAGE:	1.0 to 1.5 volts AC or DC. (To 3 volts for 2000 hour life).
CONTROL CURRENT:	15 to 25 milliamperes
CONTROL POWER:	15 to 37.5 milliwatts
DRIVE-TO-OUTPUT ISOLATION:	1000 megohms

OUTPUT SPECIFICATIONS

(25° C. unless noted)

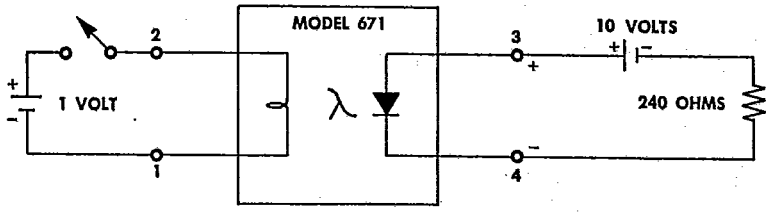
CONTINUOUS DC CURRENT:	0.5 to 350 milliamperes.
TERMINAL VOLTAGE (DC or peak AC):	Model 671-15, 15 volts. Model 671-30, 30 volts. Model 671-60, 60 volts. Model 671-100, 100 volts.
NOMINAL "ON" RESISTANCE:	Less than 10 ohms.
NOMINAL "OFF" RESISTANCE:	Greater than 1000 megohms.
POWER DISSIPITATION:	0.25 watts at 25° C. 0.5 watts at 75° C. case temperature.
POWER DELIVERED TO LOAD:	To 35 watts (350 milliamperes, 100 volts).
NOMINAL FORWARD "OFF" CURRENT:	2 nanoamperes typical; 0.2 microamperes maximum.
NOMINAL REVERSE "OFF" CURRENT:	2 nanoamperes typical; 0.2 microamperes maximum.
"ON" VOLTAGE DROP:	1.2 volts maximum.
HOLDING CURRENT:	40 microamperes typical; 200 microamperes maximum.
PEAK RECURRENT TRANSIENT CURRENT:	5 amperes.
SURGE CURRENT:	5 amperes (8 milliseconds; half sine wave).
NOMINAL "SWITCH ON" TIME:	8 milliseconds at rated 3 volt drive.
NOMINAL "SWITCH-OFF" TIME:	30 microseconds.
TIME DELAY RANGE:	Nominal 8 to 70 milliseconds as drive voltage is decreased from 3 to 1.2 volts (See graph).

TIME DELAY CHARACTERISTIC

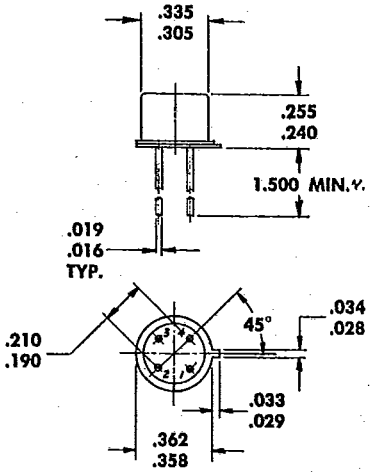


ENVIRONMENTAL SPECIFICATIONS

SHOCK:	1000 G's, 11 milliseconds.
VIBRATION:	100 G's, zero to 3000 cps.
ACCELERATION:	800 G's continuous.
TEMPERATURE:	−65° C. to +125° C., operating and storage.
LIFE:	50,000 hours.



TYPICAL TEST CIRCUIT



OUTLINE DIMENSIONS

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