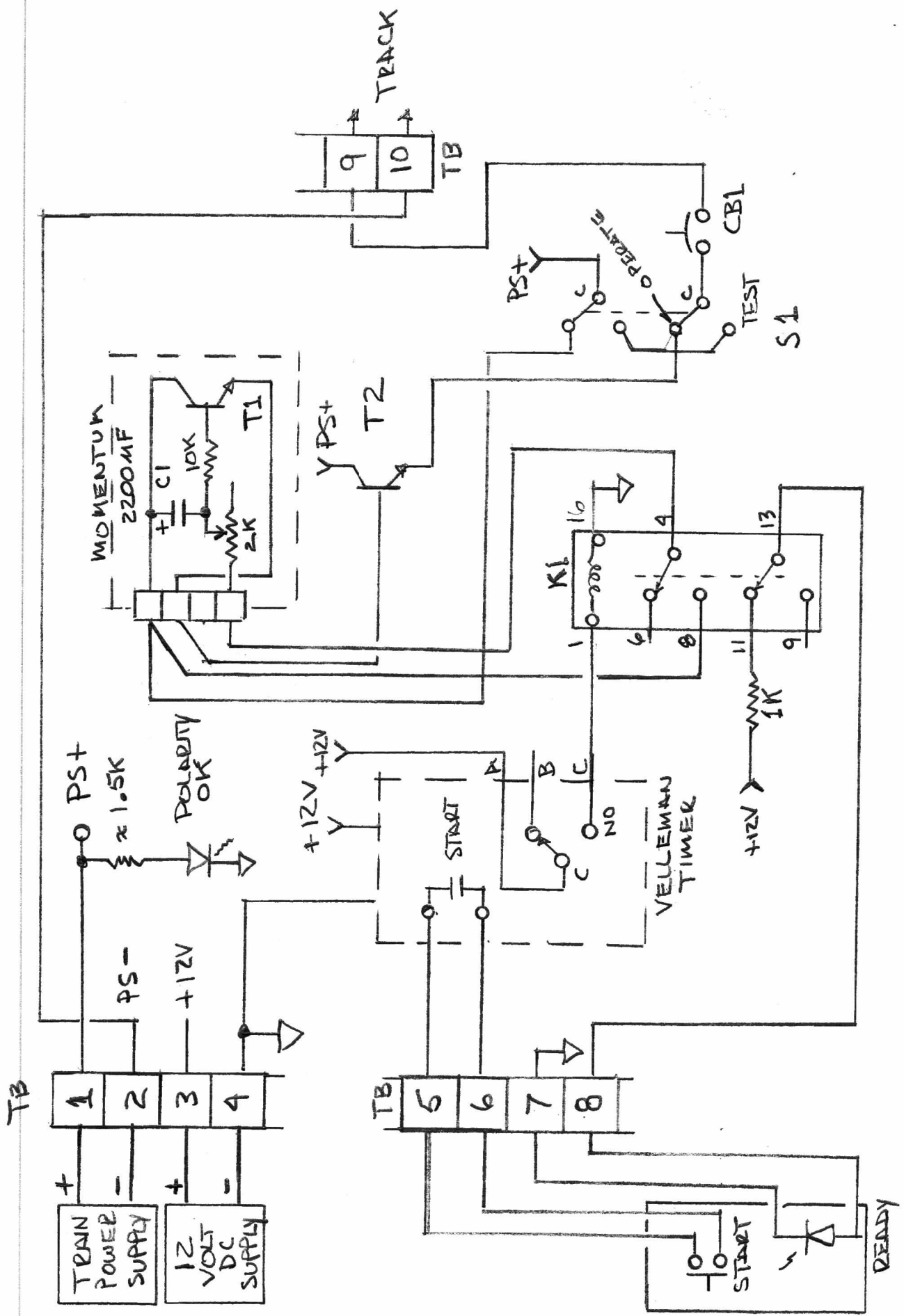


Tucson Garden Railway Society
Southern Arizona Transportation Museum
Train Control System

Date: ??

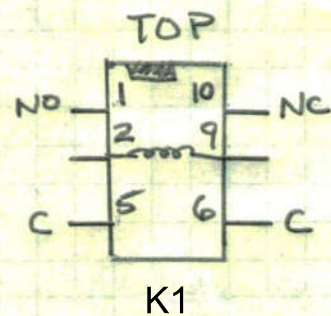
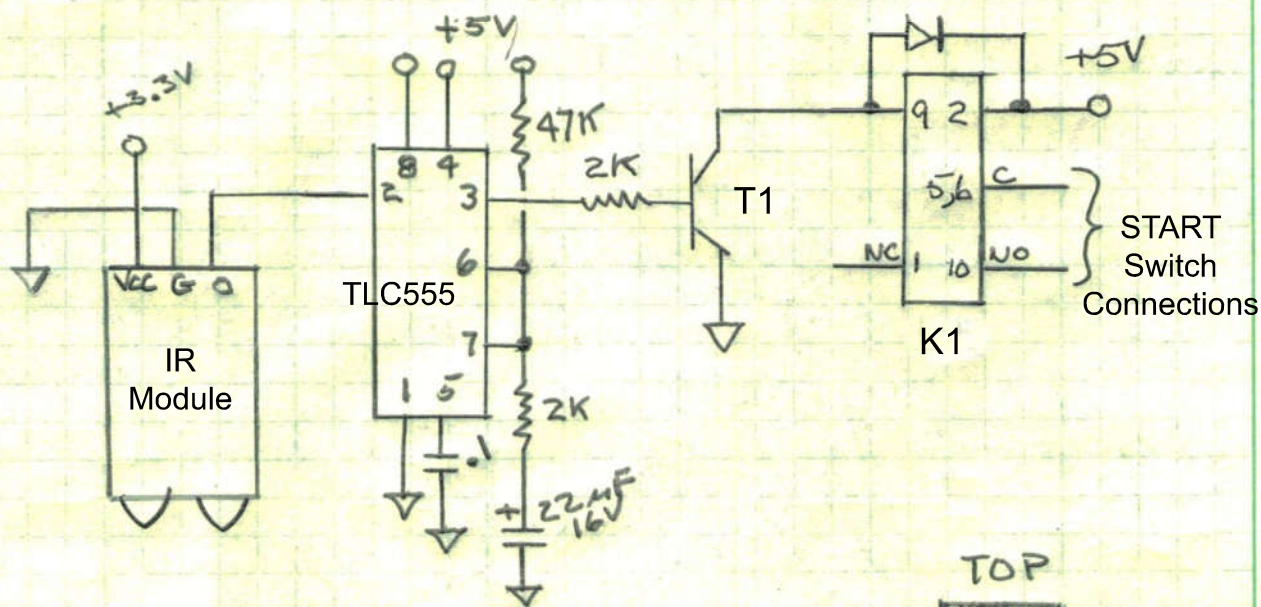
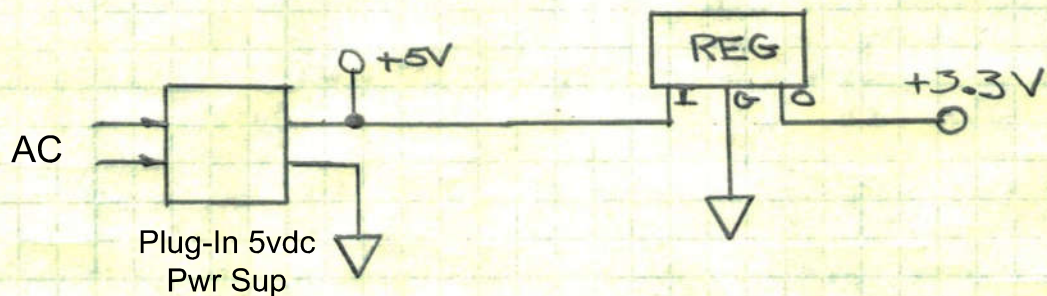
08/2020: Added Infrared START Switch circuit info

GEM 01/2020



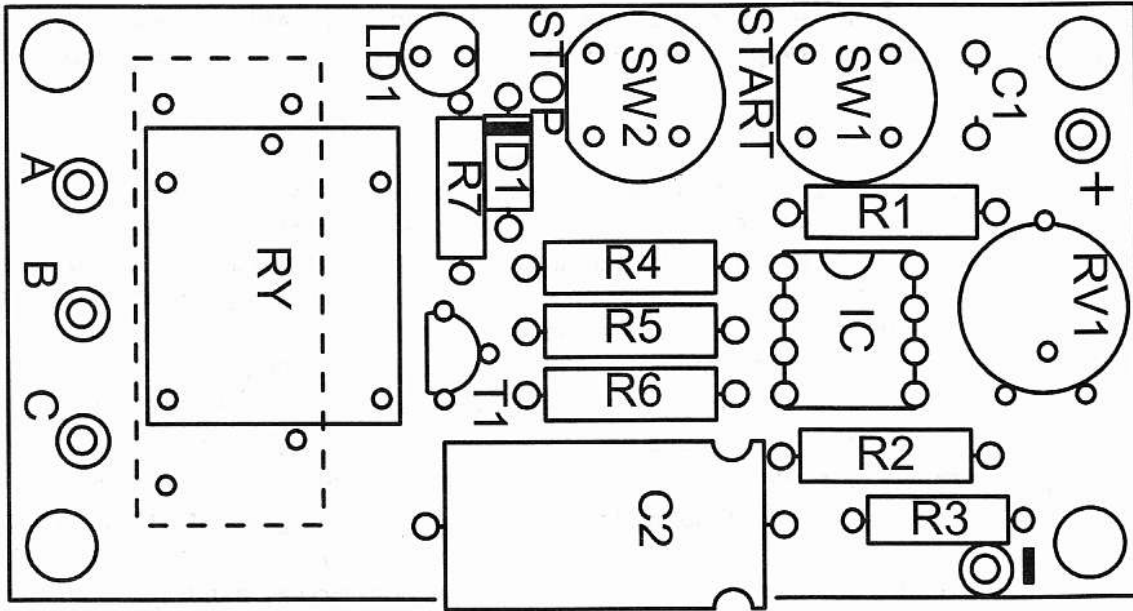
Southern Arizona Transportation Museum, Train Control

SATM Train Control



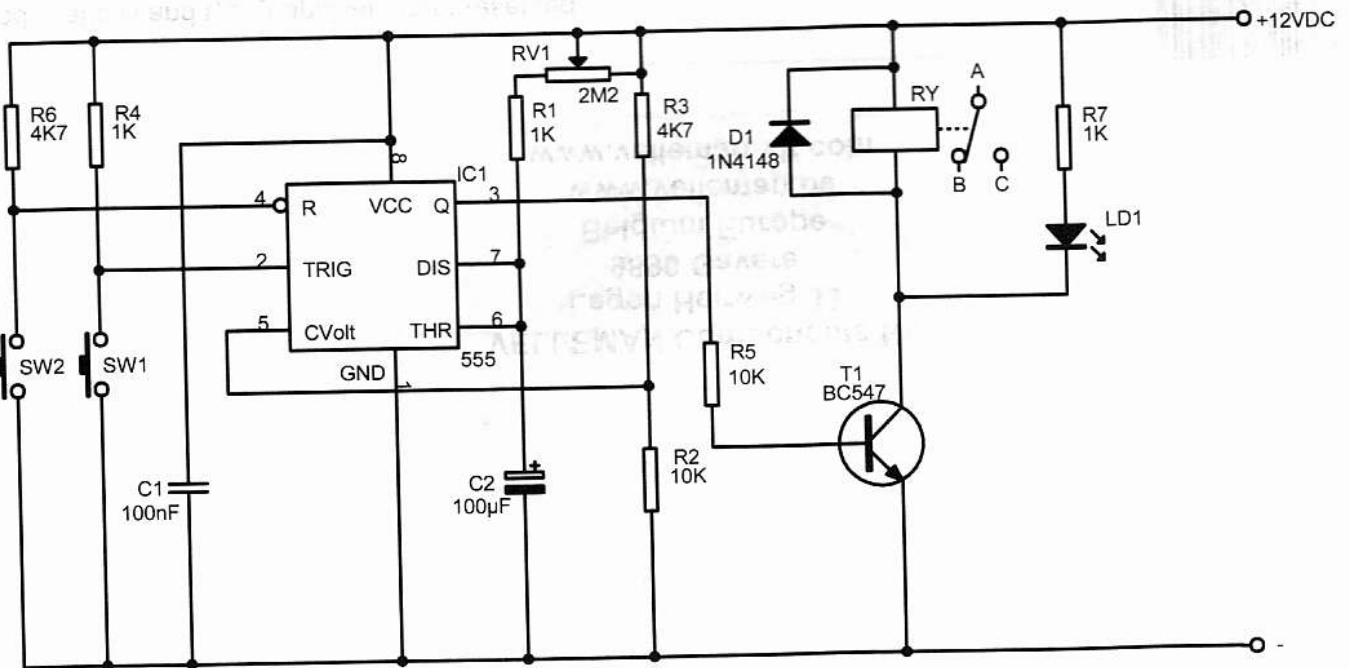
REF	Description	Part # or Designation	Company	Notes
	Train Power Supply			3 amps or more, DC output only (don't use PWM)
	12 volt dc plug-in supply			500 ma or more
TIMER	Start/Stop Timer Module	K2579	Velleman	assembled from kit
K1	Relay, 12vdc, DPDT	DS2Y-S-DC12V	Panasonic	DIP package
CB1	circuit breaker	??		approx 5 amp
S1	Switch, toggle, DPDT	??		
other	Resistors			1/4 watt, values per schematic
	<i>Momentum Circuit</i>			
C1	Capacitor, electrolytic, 2200 uf, 50v			
T1	Transistor	2N3053		to-39
T2	Transistor	2N3055		to-3
	Resistor, variable			approx. 2K ohms
	<i>IR START Switch</i>			
	5 volt dc plug-in supply			500 ma or more
Reg	3 - terminal regulator, 3.3v	LP2950	TI	
	IR Module		OSOYOO	item # LYSB0II57HIJO-ELECTRNCS
	timer IC	TLC555	TI	DIP
T1	transistor, NPN	2N3904		or equivalent
K1	relay, 5vdc, SPDT	G5V-1-DC5	Omron	
other	resistors, capacitors			values per schematic

14. PCB layout.



10

15. Diagram



TYPES

Contact arrangement	Nominal coil voltage	High sensitivity type		Standard type	
		Single side stable type	2 coil latching type	Single side stable type	2 coil latching type
		Part No.	Part No.	Part No.	Part No.
1 Form C	1.5 V DC	DS1E-S-DC1.5V	DS1E-SL2-DC1.5V	DS1E-M-DC1.5V	DS1E-ML2-DC1.5V
	3 V DC	DS1E-S-DC3V	DS1E-SL2-DC3V	DS1E-M-DC3V	DS1E-ML2-DC3V
	5 V DC	DS1E-S-DC5V	DS1E-SL2-DC5V	DS1E-M-DC5V	DS1E-ML2-DC5V
	6 V DC	DS1E-S-DC6V	DS1E-SL2-DC6V	DS1E-M-DC6V	DS1E-ML2-DC6V
	9 V DC	DS1E-S-DC9V	DS1E-SL2-DC9V	DS1E-M-DC9V	DS1E-ML2-DC9V
	12 V DC	DS1E-S-DC12V	DS1E-SL2-DC12V	DS1E-M-DC12V	DS1E-ML2-DC12V
	24 V DC	DS1E-S-DC24V	DS1E-SL2-DC24V	DS1E-M-DC24V	DS1E-ML2-DC24V
2 Form C	48 V DC	DS1E-S-DC48V	DS1E-SL2-DC48V	DS1E-M-DC48V	DS1E-ML2-DC48V
	3 V DC	DS2E-S-DC3V	DS2E-SL2-DC3V	—	—
	5 V DC	DS2E-S-DC5V	DS2E-SL2-DC5V	—	—
	6 V DC	DS2E-S-DC6V	DS2E-SL2-DC6V	—	—
	9 V DC	DS2E-S-DC9V	DS2E-SL2-DC9V	—	—
	12 V DC	DS2E-S-DC12V	DS2E-SL2-DC12V	—	—
	24 V DC	DS2E-S-DC24V	DS2E-SL2-DC24V	—	—
48 V DC	DS2E-S-DC48V	DS2E-SL2-DC48V	—	—	

Standard packing: Carton: 50 pcs.; Case: 500 pcs.

RATING

1. Coil data

• Operating characteristics such as 'Operate voltage' and 'Release voltage' are influenced by mounting conditions, ambient temperature, etc.

Therefore, please use the relay within $\pm 5\%$ of rated coil voltage.

• 'Initial' means the condition of products at the time of delivery.

1) Single side stable type

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [$\pm 10\%$] (at 20°C 68°F)	Coil resistance [$\pm 10\%$] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 50°C 122°F)
Standard (M) type	1.5 V DC	70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	266.7 mA	5.63 Ω	400 mW	1 Form C: 120%V of nominal voltage
	3 V DC			133.3 mA	22.5 Ω		
	5 V DC			80.0 mA	62.5 Ω		
	6 V DC			66.7 mA	90 Ω		
	9 V DC			44.4 mA	203 Ω		
	12 V DC			33.3 mA	360 Ω		
	24 V DC			16.7 mA	1,440 Ω		
High sensitivity (S) type	48 V DC	1 Form C: 80%V or less of nominal voltage 2 Form C: 70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	8.3 mA	5,760 Ω	200 mW	1 Form C: 160%V of nominal voltage 2 Form C: 220%V of nominal voltage
	1.5 V DC			133.3 mA	11.3 Ω		
	3 V DC			66.7 mA	45 Ω		
	5 V DC			40.0 mA	125 Ω		
	6 V DC			33.3 mA	180 Ω		
	9 V DC			22.2 mA	405 Ω		
	12 V DC			16.7 mA	720 Ω		
24 V DC	8.3 mA	2,880 Ω					
48 V DC	4.2 mA	11,520 Ω					

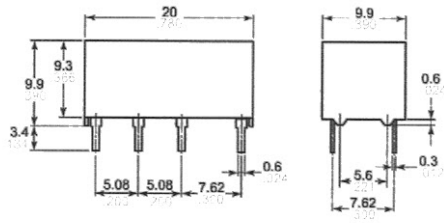
2) 2 coil latching type

Type	Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [$\pm 10\%$] (at 20°C 68°F)		Coil resistance [$\pm 10\%$] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 50°C 122°F)
				Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
Standard (M) type	1.5 V DC	70%V or less of nominal voltage (Initial)	70%V or less of nominal voltage (Initial)	240 mA	240 mA	6.25 Ω	6.25 Ω	360 mW	360 mW	1 Form C: 120%V of nominal voltage
	3 V DC			120 mA	120 mA	25 Ω	25 Ω			
	5 V DC			72 mA	72 mA	69.4 Ω	69.4 Ω			
	6 V DC			60 mA	60 mA	100 Ω	100 Ω			
	9 V DC			40 mA	40 mA	225 Ω	225 Ω			
	12 V DC			30 mA	30 mA	400 Ω	400 Ω			
	24 V DC			15 mA	15 mA	1,600 Ω	1,600 Ω			
High sensitivity (S) type	48 V DC	1 Form C: 80%V or less of nominal voltage 2 Form C: 70%V or less of nominal voltage (Initial)	1 Form C: 80%V or less of nominal voltage 2 Form C: 70%V or less of nominal voltage (Initial)	7.5 mA	7.5 mA	6,400 Ω	6,400 Ω	180 mW	180 mW	1 Form C: 160%V of nominal voltage 2 Form C: 220%V of nominal voltage
	1.5 V DC			120 mA	120 mA	12.5 Ω	12.5 Ω			
	3 V DC			60 mA	60 mA	50 Ω	50 Ω			
	5 V DC			36 mA	36 mA	139 Ω	139 Ω			
	6 V DC			30 mA	30 mA	200 Ω	200 Ω			
	9 V DC			20 mA	20 mA	450 Ω	450 Ω			
	12 V DC			15 mA	15 mA	800 Ω	800 Ω			
24 V DC	7.5 mA	7.5 mA	3,200 Ω	3,200 Ω						
48 V DC	3.75 mA	3.75 mA	12,800 Ω	12,800 Ω						

DS (2 Form C)
Single side stable

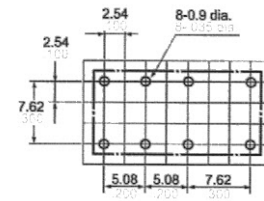
CAD Data

External dimensions

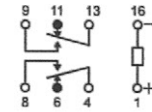


General tolerance: $\pm 0.3 \pm 0.12$

PC board pattern (Bottom view)



Schematic (Bottom view)



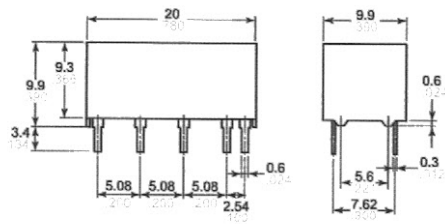
(Deenergized condition)

Tolerance: $\pm 0.1 \pm 0.04$

DS (2 Form C)
2 coil latching

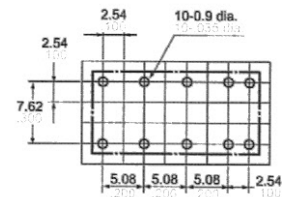
CAD Data

External dimensions

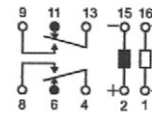


General tolerance: $\pm 0.3 \pm 0.12$

PC board pattern (Bottom view)



Schematic (Bottom view)



(Reset condition)

Tolerance: $\pm 0.1 \pm 0.04$

NOTES

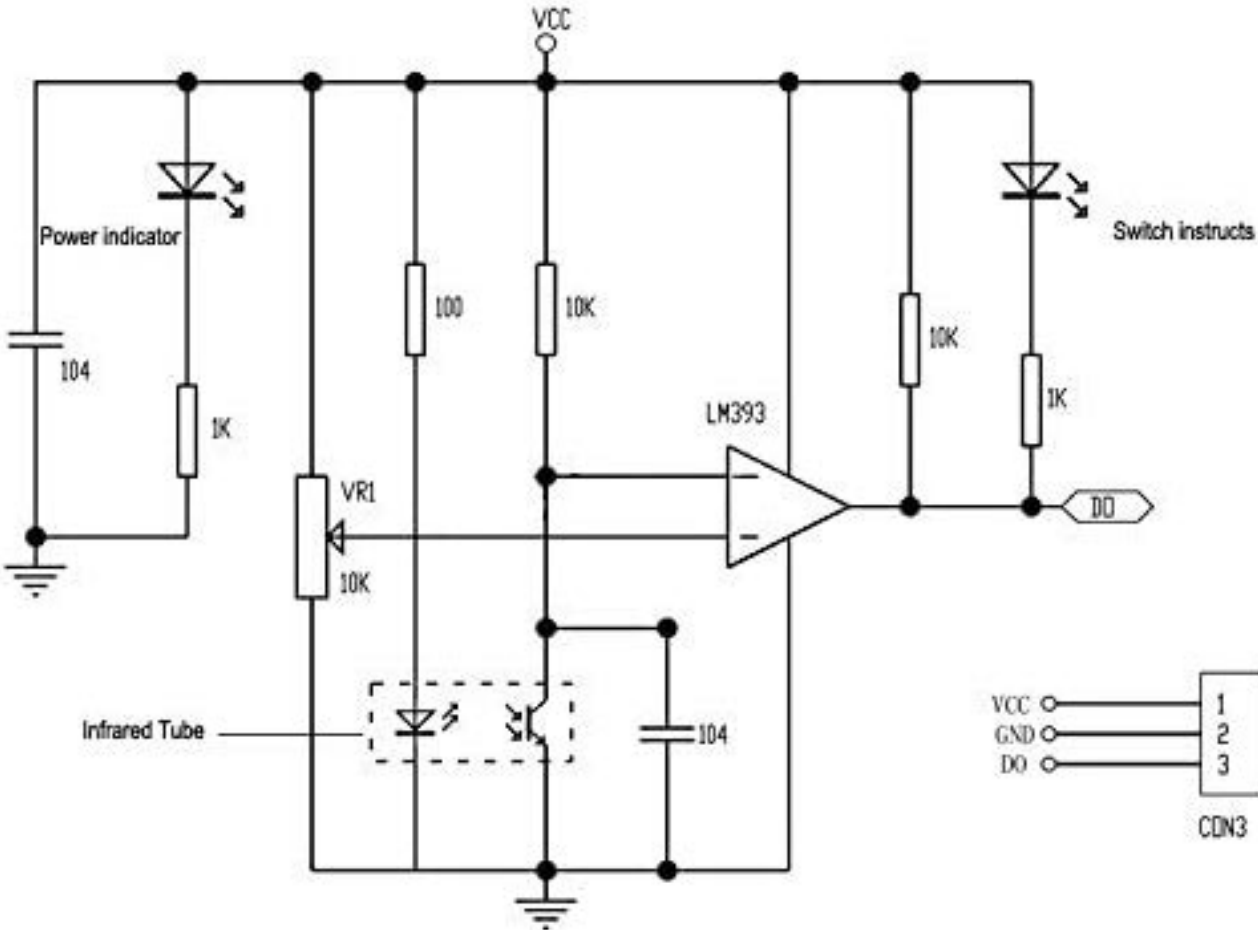
1. Coil connection

When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

Infrared Module

OSOY00

Item # LYSB01157HIJO - ELECTRNCS

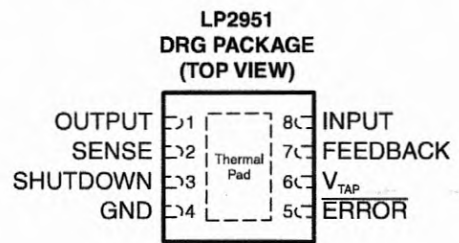
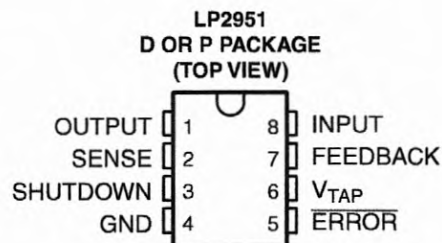
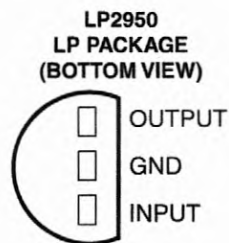


ADJUSTABLE MICROPOWER VOLTAGE REGULATORS WITH SHUTDOWN

Check for Samples: LP2950, LP2951

FEATURES

- **Wide Input Range: Up to 30 V**
- **Rated Output Current of 100 mA**
- **Low Dropout: 380 mV (Typ) at 100 mA**
- **Low Quiescent Current: 75 μ A (Typ)**
- **Tight Line Regulation: 0.03% (Typ)**
- **Tight Load Regulation: 0.04% (Typ)**
- **High V_O Accuracy**
 - 1.4% at 25°C
 - 2% Over Temperature
- **Can Be Used as a Regulator or Reference**
- **Stable With Low ESR (>12 m Ω) Capacitors**
- **Current- and Thermal-Limiting Features**
- **LP2950 Only (3-Pin Package)**
 - Fixed-Output Voltages of 5 V, 3.3 V, and 3 V
- **LP2951 Only (8-Pin Package)**
 - Fixed- or Adjustable-Output Voltages: 5 V/ADJ, 3.3 V/ADJ, and 3 V/ADJ
 - Low-Voltage Error Signal on Falling Output
 - Shutdown Capability
 - Remote Sense Capability for Optimal Output Regulation and Accuracy



DESCRIPTION/ORDERING INFORMATION

The LP2950 and LP2951 devices are bipolar, low-dropout voltage regulators that can accommodate a wide input supply-voltage range of up to 30 V. The easy-to-use, 3-pin LP2950 is available in fixed-output voltages of 5 V, 3.3 V, and 3 V. However, the 8-pin LP2951 is able to output either a fixed or adjustable output from the same device. By tying the OUTPUT and SENSE pins together, and the FEEDBACK and V_{TAP} pins together, the LP2951 outputs a fixed 5 V, 3.3 V, or 3 V (depending on the version). Alternatively, by leaving the SENSE and V_{TAP} pins open and connecting FEEDBACK to an external resistor divider, the output can be set to any value between 1.235 V to 30 V.

The 8-pin LP2951 also offers additional functionality that makes it particularly suitable for battery-powered applications. For example, a logic-compatible shutdown feature allows the regulator to be put in standby mode for power savings. In addition, there is a built-in supervisor reset function in which the ERROR output goes low when V_{OUT} drops by 6% of its nominal value for whatever reasons – due to a drop in V_{IN} , current limiting, or thermal shutdown.

The LP2950 and LP2951 are designed to minimize all error contributions to the output voltage. With a tight output tolerance (0.5% at 25°C), a very low output voltage temperature coefficient (20 ppm typical), extremely good line and load regulation (0.3% and 0.4% typical), and remote sensing capability, the parts can be used as either low-power voltage references or 100-mA regulators.



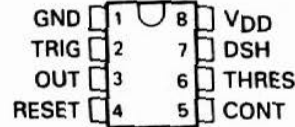
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

TLC555M, TLC555I, TLC555C LinCMOS™ TIMERS

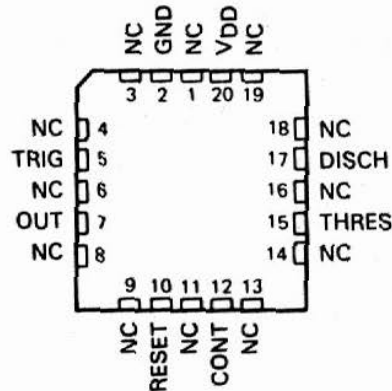
D2784, SEPTEMBER 1983—REVISED OCTOBER 1988

- **Very Low Power Consumption . . . 1 mW Typ at $V_{DD} = 5\text{ V}$**
- **Capable of Operation in Astable Mode**
- **CMOS Output Capable of Swinging Rail to Rail**
- **High Output-Current Capability**
 . . . Sink 100 mA Typ
 . . . Source 10 mA Typ
- **Output Fully Compatible with CMOS, TTL, and MOS**
- **Low Supply Current Reduces Spikes During Output Transitions**
- **High-Impedance Inputs . . . $10^{12}\ \Omega$ Typ**
- **Single-Supply Operation from 2 V to 18 V**
- **Functionally Interchangeable with the NE555; Has Same Pinout**

TLC555M . . . JG PACKAGE
 TLC555I, TLC555C . . . D OR P PACKAGE
 (TOP VIEW)



TLC555M . . . FK PACKAGE
 (TOP VIEW)



NC—No internal connection

description

The TLC555 is a monolithic timing circuit fabricated using TI's LinCMOS™ process, which provides full compatibility with CMOS, TTL, and MOS logic and operation at frequencies up to 2 MHz. Accurate time delays and oscillations are possible with smaller, less-expensive timing capacitors than the NE555 because of the high input impedance. Power consumption is low across the full range of power supply voltage.

Like the NE555, the TLC555 has a trigger level approximately one-third of the supply voltage and a threshold level approximately two-thirds of the supply voltage. These levels can be altered by use of the control voltage terminal. When the trigger input falls below the trigger level, the flip-flop is set and the output goes high. If the trigger input is above the trigger level and the threshold input is above the threshold level, the flip-flop is reset and the output is low. The reset input can override all other inputs and can be used to initiate a new timing cycle. If the reset input is low, the flip-flop is reset and the output is low. Whenever the output is low, a low-impedance path is provided between the discharge terminal and ground.

While the CMOS output is capable of sinking over 100 mA and sourcing over 10 mA, the TLC555 exhibits greatly reduced supply-current spikes during output transitions. This minimizes the need for the large decoupling capacitors required by the NE555.

These devices have internal electrostatic discharge (ESD) protection circuits that will prevent catastrophic failures at voltages up to 2000 V as tested under MIL-STD-883C, Method 3015. However, care should be exercised in handling these devices, as exposure to ESD may result in degradation of the device parametric performance.

All unused inputs should be tied to an appropriate logic level to prevent false triggering.

The TLC555M is characterized for operation over the full military temperature range of -55°C to 125°C . The TLC555I is characterized for operation from -40°C to 85°C . The TLC555C is characterized for operation from 0°C to 70°C .

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INSTRUMENTS

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4
Special Functions