

## “Three Fives” and 555SE Discrete 555 Timers

*Re-create one of the most classic, popular, and all-around useful chips of all time.*

The “Three Fives” and 555SE Discrete 555 Timers are faithful and functional transistor-scale replicas of the classic NE555 timer integrated circuit.

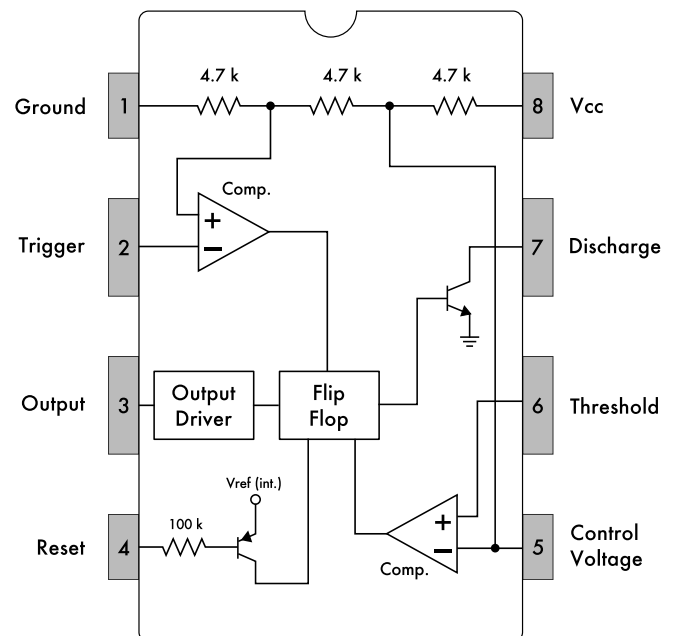
Design by Eric Schlaepfer (tubetime.us), working in collaboration with Evil Mad Scientist Laboratories.

The latest version of this document and additional resources about 555 timers are available at: <https://wiki.evilmadscientist.com/555>

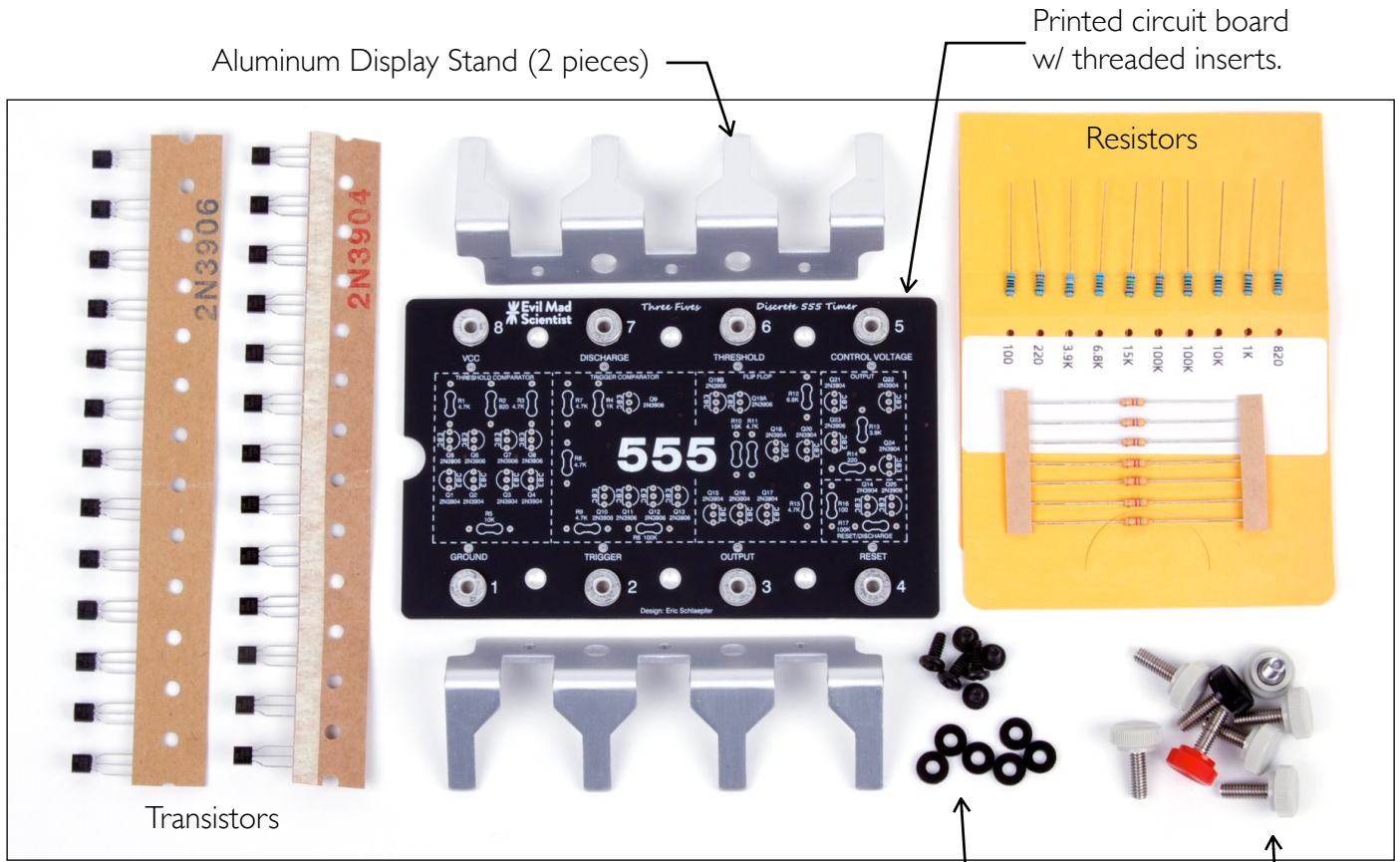
### Main Specifications

- Kit type: Through-hole soldering kit (Three Fives) or Surface-mount soldering kit (555SE)
- Assembly instructions: Printed, included with kit
- Function: Equivalent circuit to NE555 timer IC. Some performance characteristics differ; Refer to Abs. Maximum ratings and Electrical Characteristics
- RoHS compliance: All kit components are RoHS compliant (lead free)
- Connection methods: Terminal posts (bare wire, lug, or alligator clip) or solder

### Block Diagram / Pinout



# Kit Contents: “Three Fives” — Through Hole soldering kit



Completed kit

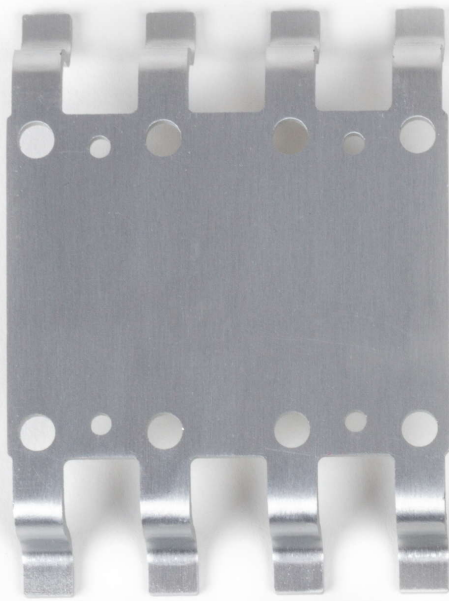
## Contents of the Three Fives through-hole soldering kit:

- The Three Fives printed circuit board (extra thick 0.100”), pre-fitted with eight 8-32 threaded inserts
- The transistors and resistors required to assemble the kit
- Eight thumbscrews (terminal posts) with color-coded cap
- Two-piece “IC Legs” stand, anodized aluminum
- Mounting screws and spacers for attaching the “IC Legs” stand
- Printed assembly instructions (not shown)

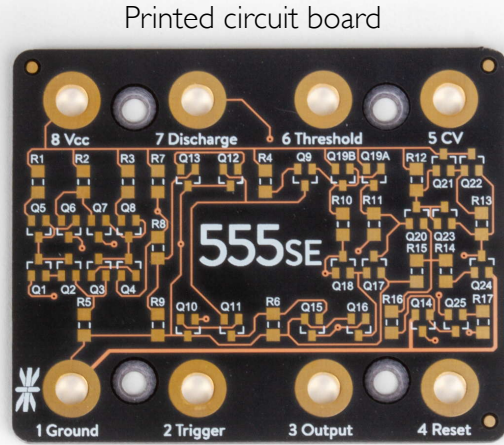
## Tools and materials required for assembly (not included with kit):

- Soldering iron
- Solder
- Wire clippers
- Phillips head screwdriver (#2 size recommended).

# Kit Contents: “555SE” — Surface mount soldering kit



Aluminum Display Stand

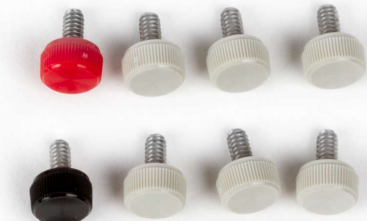


Printed circuit board

Screws and spacers for stand



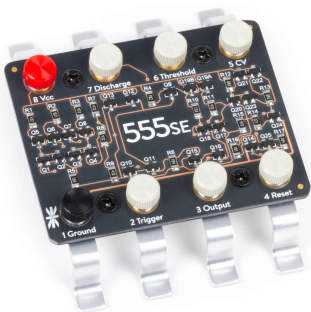
Threaded inserts for circuit board



Thumbscrew terminal posts:  
6 gray, 1 red, 1 black



Surface mount components: Resistors (1206 size) and transistors (SOT-23 size). (Example parts, shown enlarged)



Completed kit

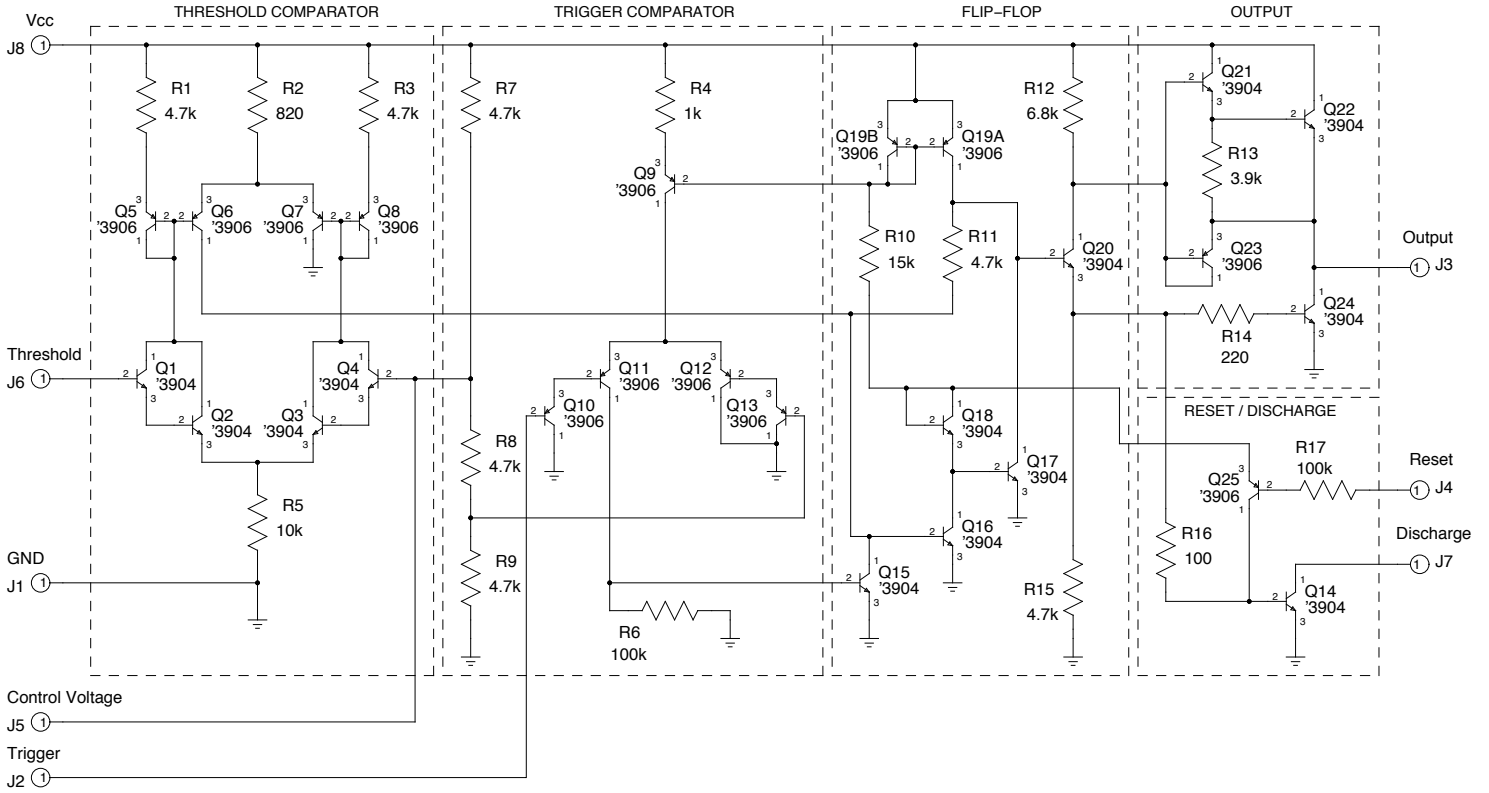
## Contents of the 555SE Surface-mount Soldering Kit:

- The 555SE printed circuit board (black with clear mask and visible traces)
- Surface mount threaded inserts
- The transistors and resistors required to assemble the kit
- Eight thumbscrews (terminal posts) with color-coded caps
- Single-piece “SOIC Legs” stand, anodized aluminum
- Mounting screws and spacers for attaching the stand
- Printed assembly instructions (not shown)

## Tools and materials required for assembly (not included with kit):

- Solder (paste or wire)
- Soldering iron (or other surface mount soldering equipment)
- Fine-point metal tweezers
- Phillips head screwdriver (#1 size recommended).

# Schematic Diagram



# Electrical Components

Reference	Qty	Type	Value Three Fives Kit	Value 555SE Kit
Q1-4, Q14-18, Q20-22, Q24	13	NPN Transistor	2N3904	MMBT3904
Q5-13, Q19A, Q19B, Q23, Q25	13	PNP Transistor	2N3906	MMBT3906
R1, R3, R7, R8, R9, R11, R15	7	Resistor	4.7 k	4.7 k
R2	1	Resistor	820	820
R4	1	Resistor	1 k	1 k
R5	1	Resistor	10 k	10 k
R6, R17	1	Resistor	100 k	100 k
R10	1	Resistor	15 k	15 k
R12	1	Resistor	6.8 k	6.8 k
R13	1	Resistor	3.9 k	3.9 k
R14	1	Resistor	220	220
R16	1	Resistor	100	100

## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage	$V_{CC}$	18	V
Output current	$I_O$	$\pm 100$	mA
Input voltage (Control Voltage, Threshold, Trigger, Reset pins)	$V_{IN}$	$V_{CC}^1$	

### Notes:

- Exception for Three Fives kit version 1.0 (without R17) only:  
Input voltage at reset pin ( $V_{RST}$ ) should be kept to lesser of  $V_{CC}$  or 6.6 V.  
For  $V_{CC} > 6.6$  V, Reset pin may be pulled up to  $V_{CC}$  through a 100 kilohm resistor.

## Electrical Characteristics

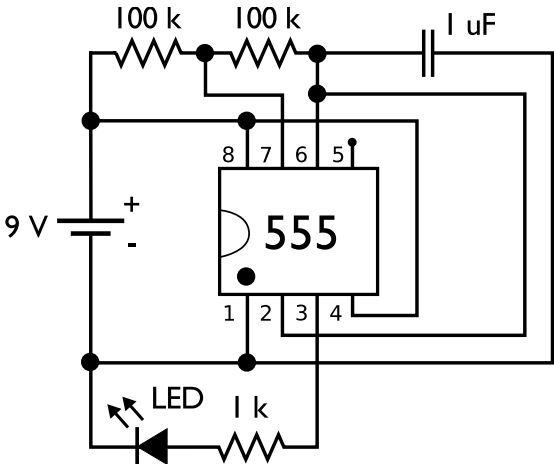
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	$V_{CC}$		4		18	V
Supply Current	$I_{CC}$	$V_{CC} = 5\text{ V}$ , Low state		3		mA
		$V_{CC} = 15\text{ V}$ , Low state		10		
Threshold Voltage	$V_{TH}$	$V_{CC} = 5\text{ V}$		3.3		V
		$V_{CC} = 15\text{ V}$		10		
Threshold Current	$I_{TH}$			10		nA
Trigger Voltage	$V_{TR}$	$V_{CC} = 5\text{ V}$		1.67		V
		$V_{CC} = 15\text{ V}$		5		
Trigger Current	$I_{TR}$	TRIG at 0 V		10		nA
Reset Voltage <sup>1</sup>	$V_{RST}$			0.4		V
Reset Current	$I_{RST}$			0.2		mA
Control Voltage Level	$V_C$	$V_{CC} = 5\text{ V}$		3.33		V
Discharge Pin Leakage	$I_{LKG}$			1		nA
Discharge Pin Output Voltage Low	$V_{DL}$	$V_{CC} = 5\text{ V}$ , $I_O = -5\text{ mA}$		50		mV
Output Pin Voltage High <sup>2</sup>	$V_{OH}$	$V_{CC} = 5\text{ V}$ , No load		4.5		V
		$V_{CC} = 5\text{ V}$ , $I_O = 100\text{ mA}$		3.3		V
		$V_{CC} = 15\text{ V}$ , $I_O = 100\text{ mA}$		13.3		V
Output Pin Voltage Low <sup>2</sup>	$V_{OL}$	$V_{CC} = 5\text{ V}$ , $I_O = -5\text{ mA}$		50		mV
		$V_{CC} = 5\text{ V}$ , $I_O = -8\text{ mA}$		100		mV
		$V_{CC} = 15\text{ V}$ , $I_O = -10\text{ mA}$		0.1		V
		$V_{CC} = 15\text{ V}$ , $I_O = -50\text{ mA}$		0.4		V
		$V_{CC} = 15\text{ V}$ , $I_O = -100\text{ mA}$		2		V

### Notes:

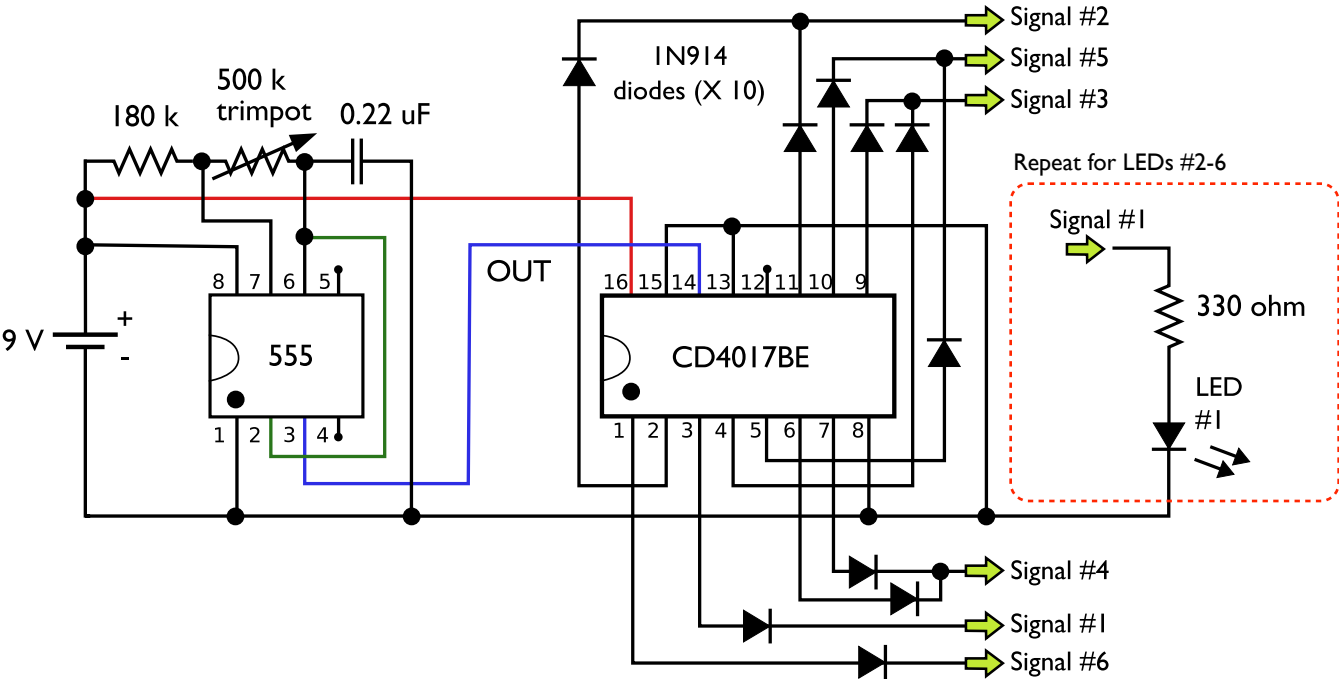
1. Specified with trigger input high.
2. For long term static operation, limit to 50 mA maximum.

# Example Circuits

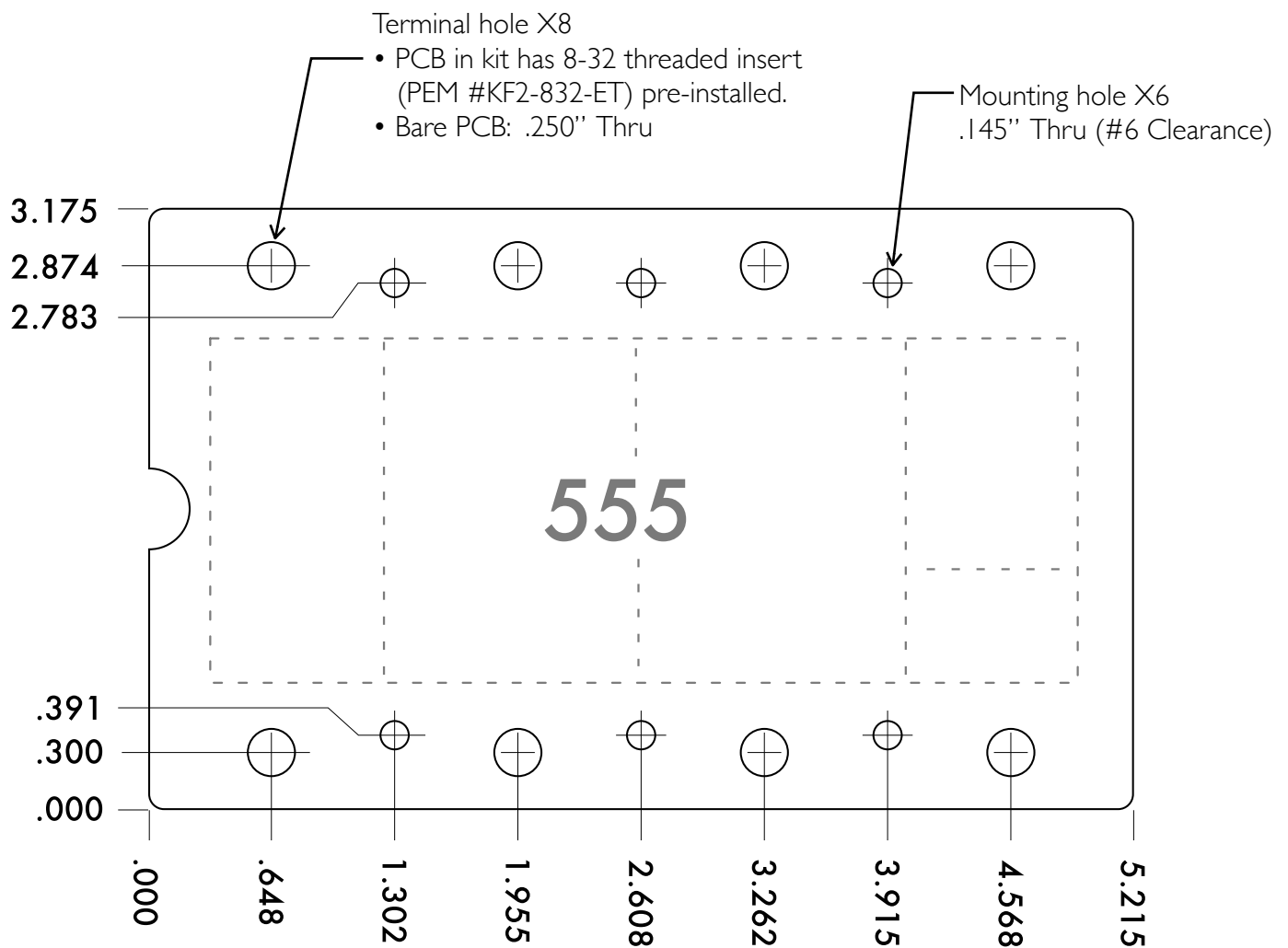
LED flasher:



Variable-speed Larson Scanner



## “Three Fives” Package information: Circuit board physical layout and mounting holes



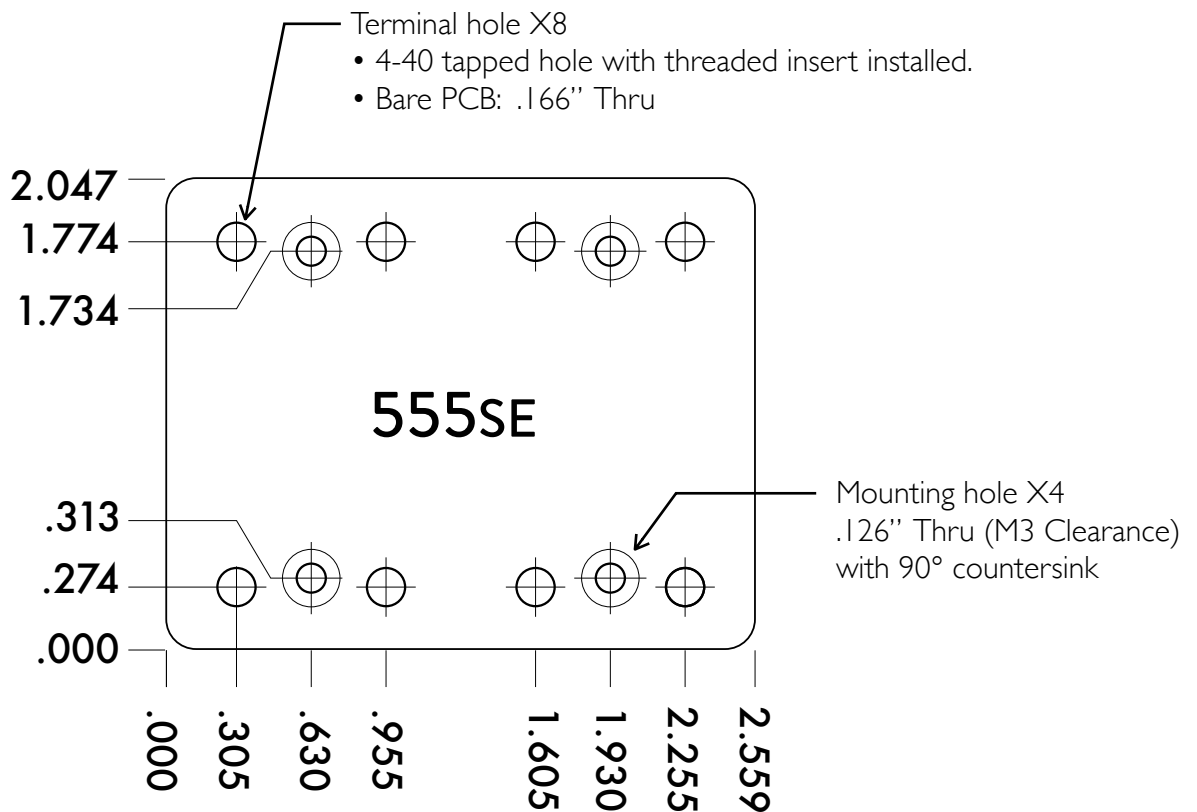
Note: All dimensions are in INCHES.

### Additional physical specifications:

- Printed Circuit Board size: 5.215 X 3.175 inches (13.25 X 8.06 cm) wide
- PCB thickness: 0.100" (2.54 mm) nominal, not including threaded inserts
- PCB thickness: 0.196" (4.98 mm) nominal, including threaded inserts
- Overall thickness: Allow 0.5" min. clearance above and below circuit board
- Mounting holes: Six #6 clearance holes provided. See drawing for locations.
- Height of “DIP IC legs” stand: 1.25 inches (3.175 cm) nominal , not including spacers
- Height of “DIP IC legs” stand: 1.31 inches (3.33 cm) nominal , including spacers, to bottom of PCB.



## 555SE Package information: Circuit board physical layout and mounting holes



Note: All dimensions are in INCHES.

### Additional physical specifications:

- Printed Circuit Board size: 2.559 X 2.047 inches (6.50 X 5.20 cm) wide
- PCB thickness: 0.062" (1.6 mm) nominal, not including threaded inserts
- PCB thickness: 0.125" (3.2 mm) nominal, including threaded inserts
- Overall thickness: Allow 0.25" min. clearance above circuit board for thumbscrews (if installed)
- Mounting holes: Four M3 countersunk clearance holes provided. See drawing for locations.
- Height of "SOIC legs" stand: 0.433 inches (11 mm) nominal, not including spacers
- Overall height: 0.80 inches (20.2 mm), from bottom of base to top of thumbscrews