

## “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.

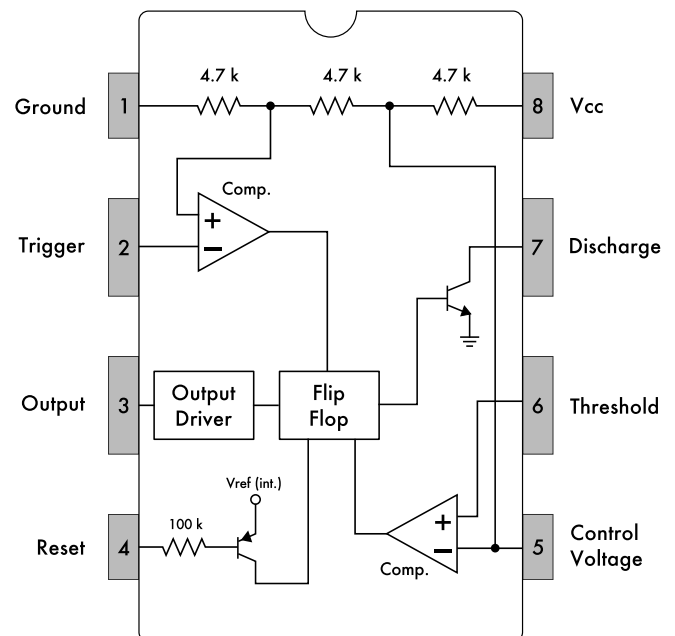
Design by Eric Schlaepfer ([tubetime.us](http://tubetime.us)), working in collaboration with Evil Mad Scientist Laboratories.

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

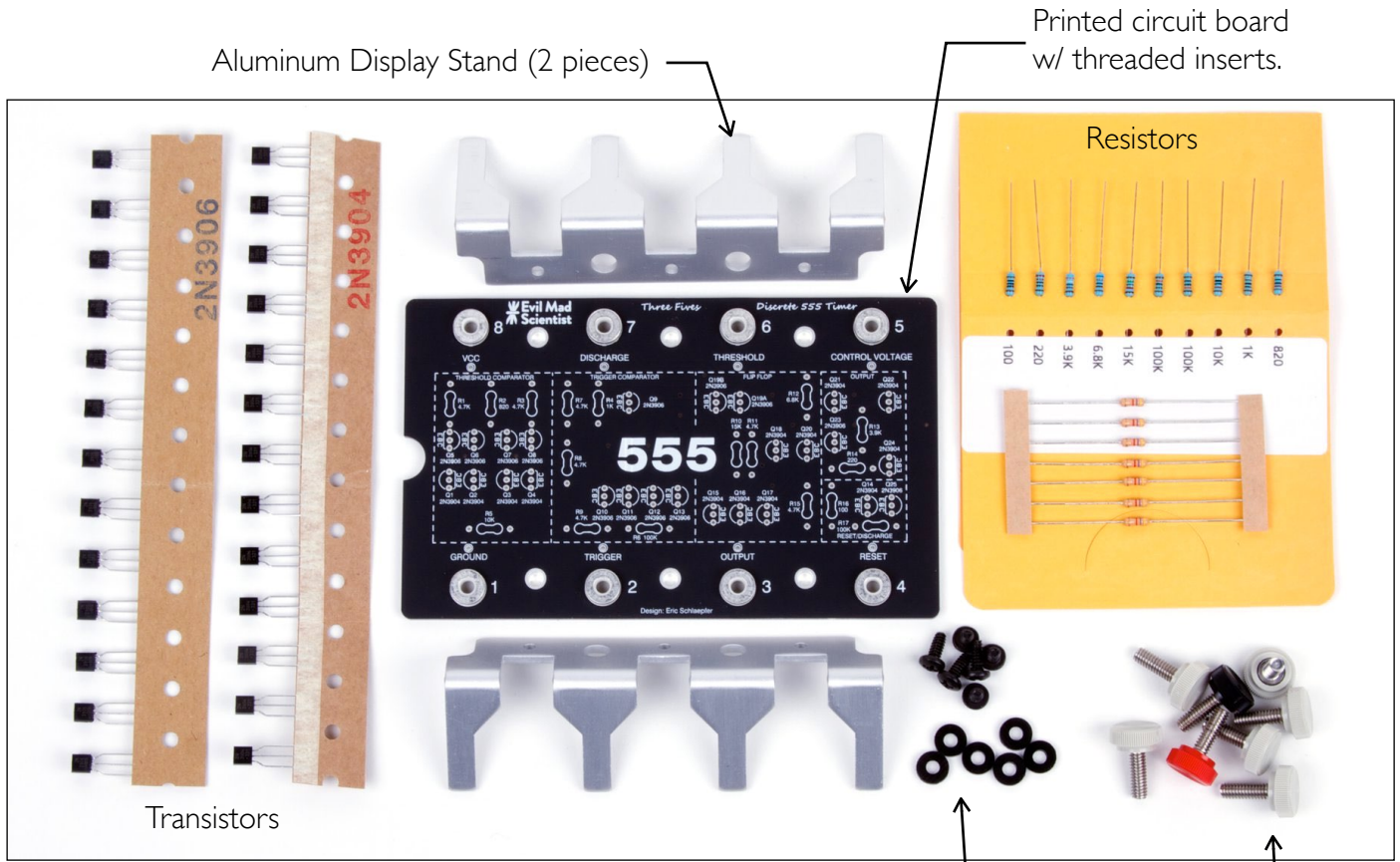
### Main Specifications

- 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

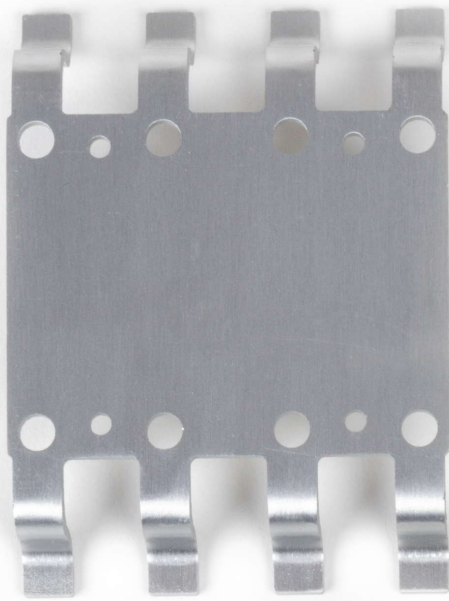
## Contents of the Three Fives through-hole soldering kit:

- 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)

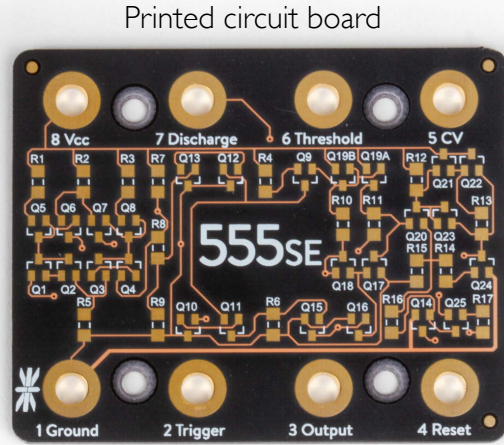
## Tools and materials required for assembly (not included with kit):

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

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

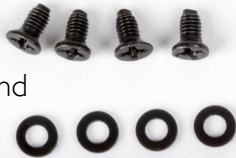


Aluminum Display Stand

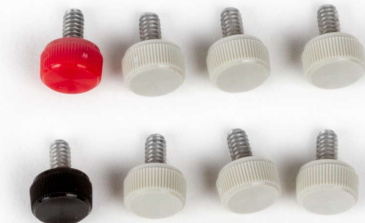


Printed circuit board

Screws and spacers for stand



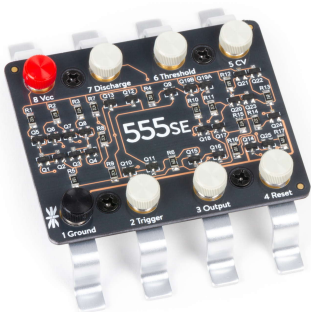
Threaded inserts for circuit board



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

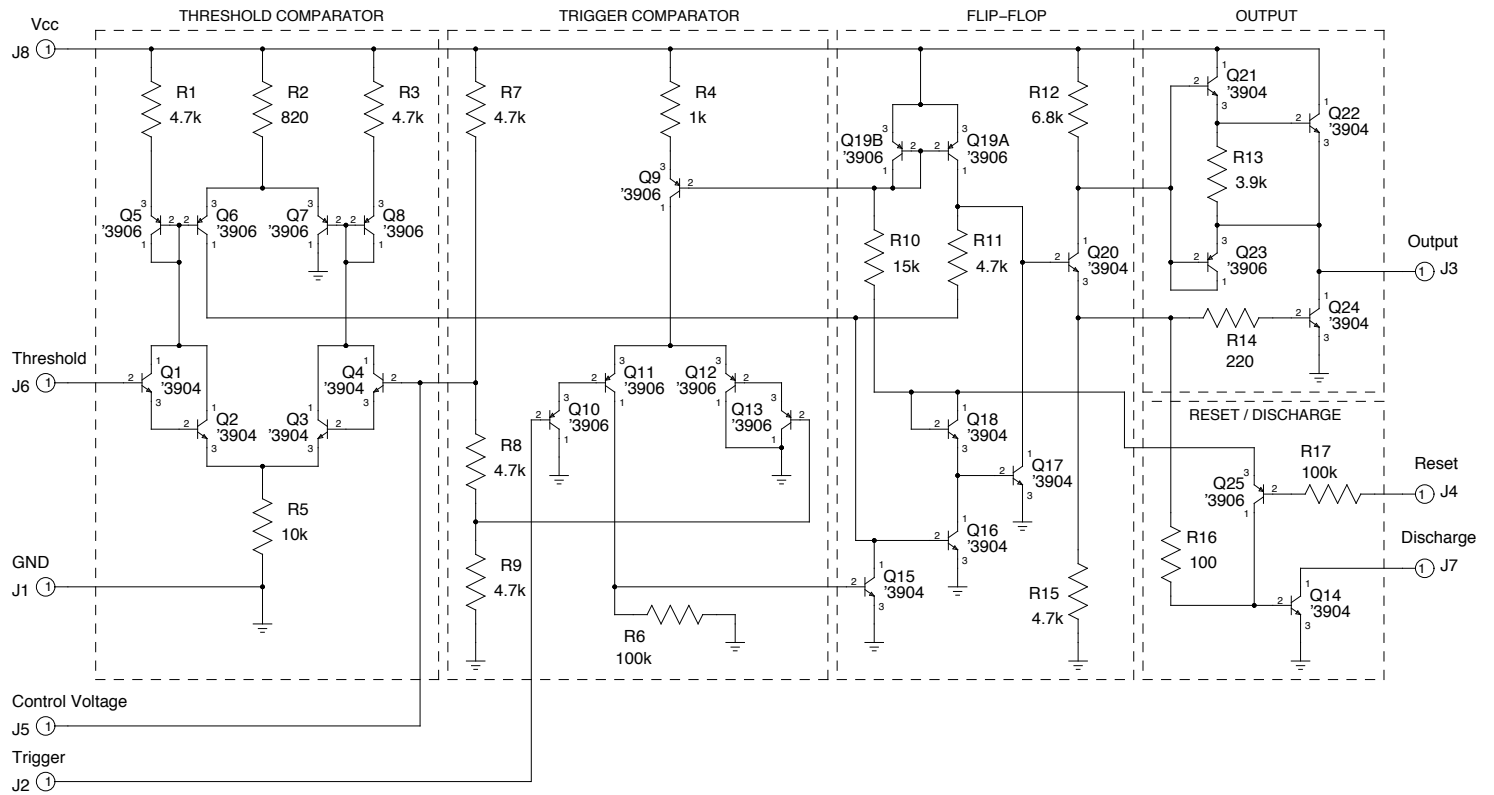
## Contents of the 555SE Surface-mount Soldering Kit:

- 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

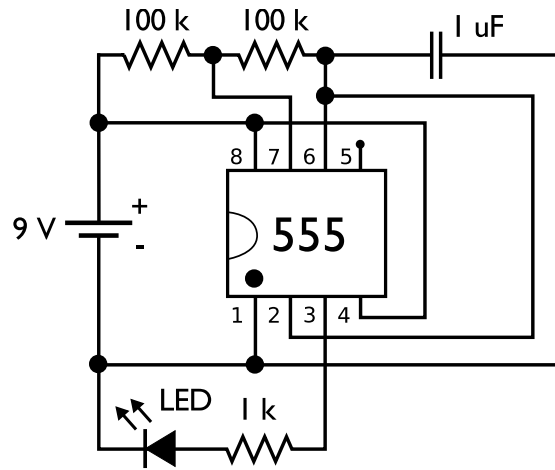
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	$V_{CC}$		4		18	V
Supply Current	$I_{CC}$	$V_{CC} = 5\text{ V}$ , Low state		3		mA
		$V_{CC} = 15\text{ V}$ , Low state		10		
Threshold Voltage	$V_{TH}$	$V_{CC} = 5\text{ V}$		3.3		V
		$V_{CC} = 15\text{ V}$		10		
Threshold Current	$I_{TH}$			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:

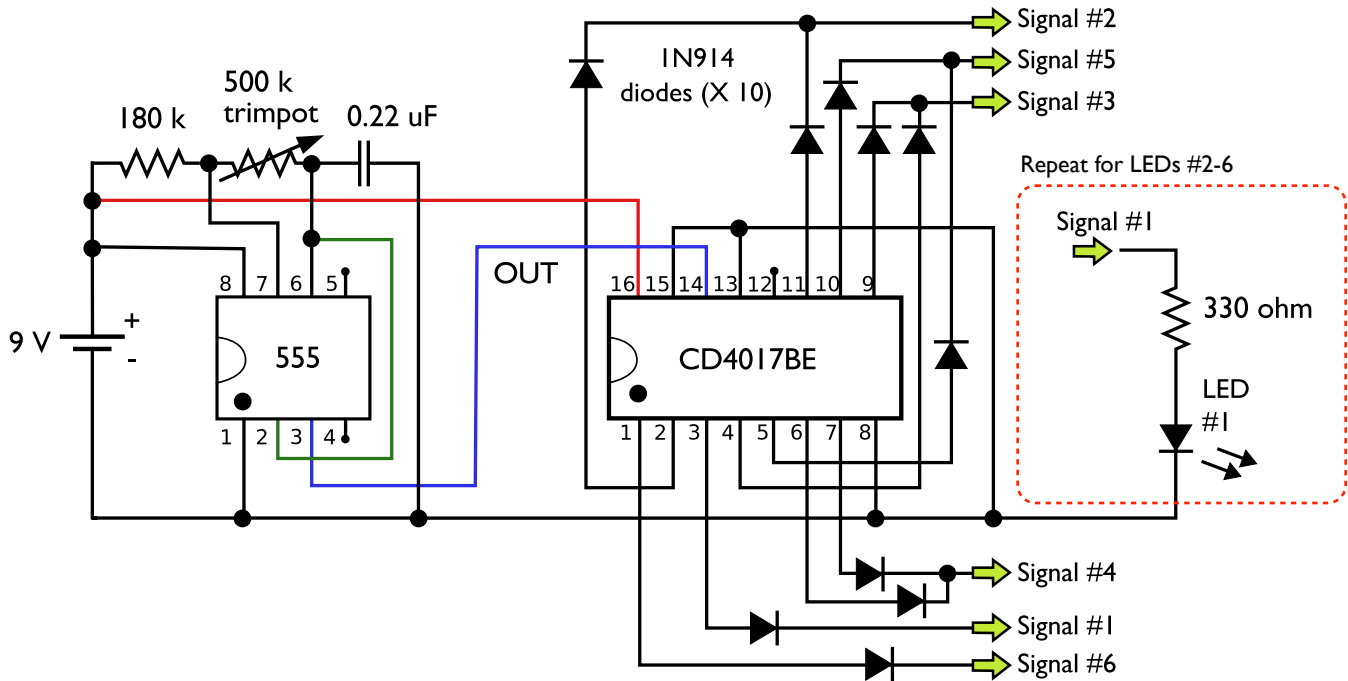
1. Specified with trigger input high.
2. For long term static operation, limit to 50 mA maximum.

# Example Circuits

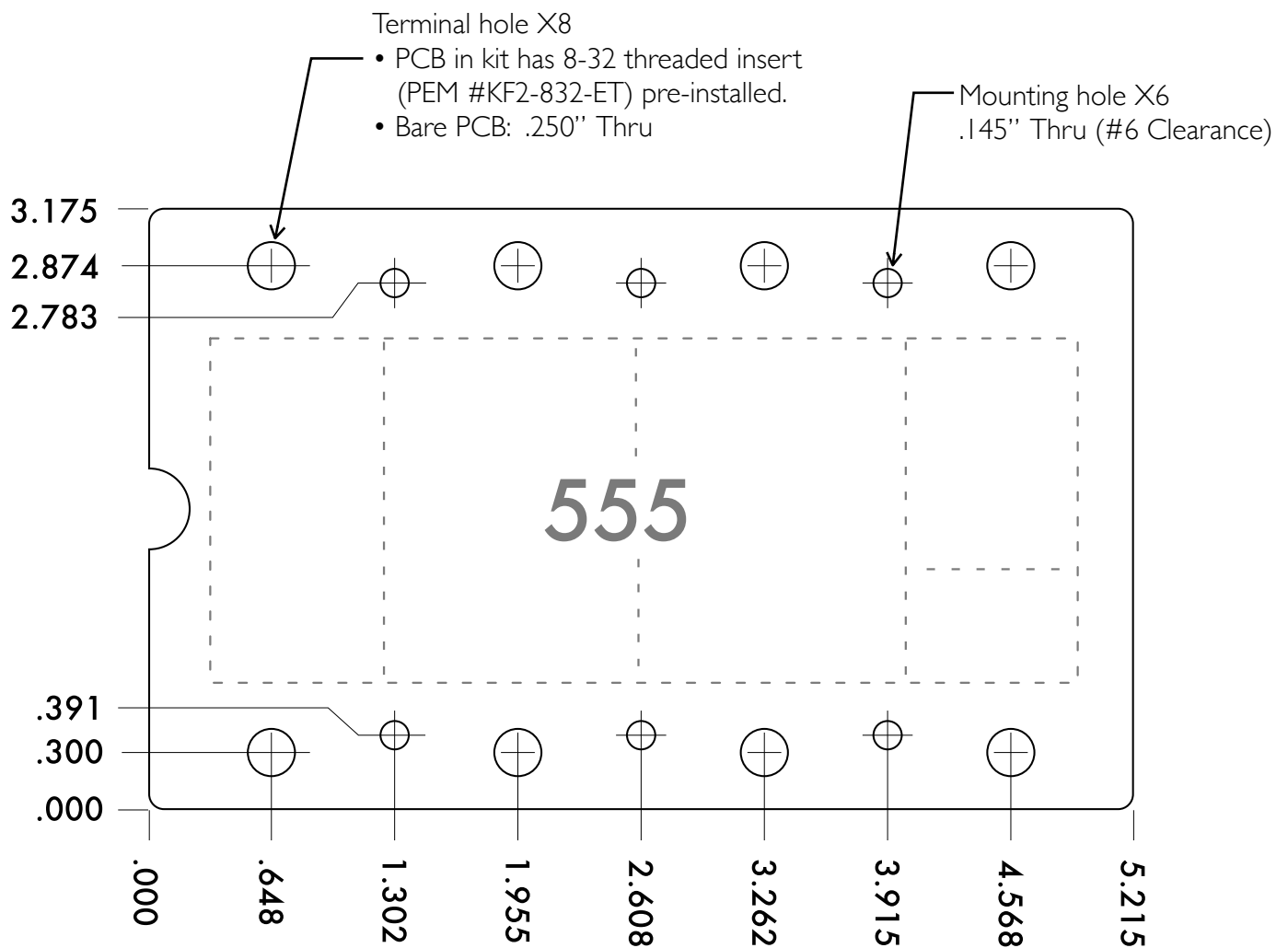
LED flasher:



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.