Introduction

The TES 1381/1383 timer controller modules provide a simple way to extend the operating life for battery powered nixie clocks based on the SmartNixie family while providing an entertaining hands free display capability. A very low power micro-processor on these modules supports three modes of operation:

1. Pressing an enable button immediately powers a connected clock to display the time.
2. The processor counts time to operate the clock at various specific intervals.
3. The connected clock can be set to display continuously.

When a connected clock is powered on, the timer module acts as an I^2C slave on the clock communication bus to which the clock master, the 10s of hours module, updates along with the other display modules the current time. When the timer module prepares to power down the clock, it uses the last updated time information to compute the delay until the next display interval. The timer counts down this delay using a very low power oscillator... current consumption of the entire timer module in this "Waiting" mode is less than 50uA at 9V input.

Since the maximum time between wakeups is no more than one hour (The maximum interval in the automatic display mode), the accuracy of the timer clock only has to be trimmed close enough so as to not loose more than 1/2 second per hour.

A SmartNixie RTC is used to count the real-time displayed on the clock and so it is trimmed for long term accuracy. The RTC has its own battery to maintain the correct time which is charged when ever the clock is turned on... So long as the time is displayed periodically, the RTC battery will remain charged indefinitely since this battery charges much-much faster than it discharges.

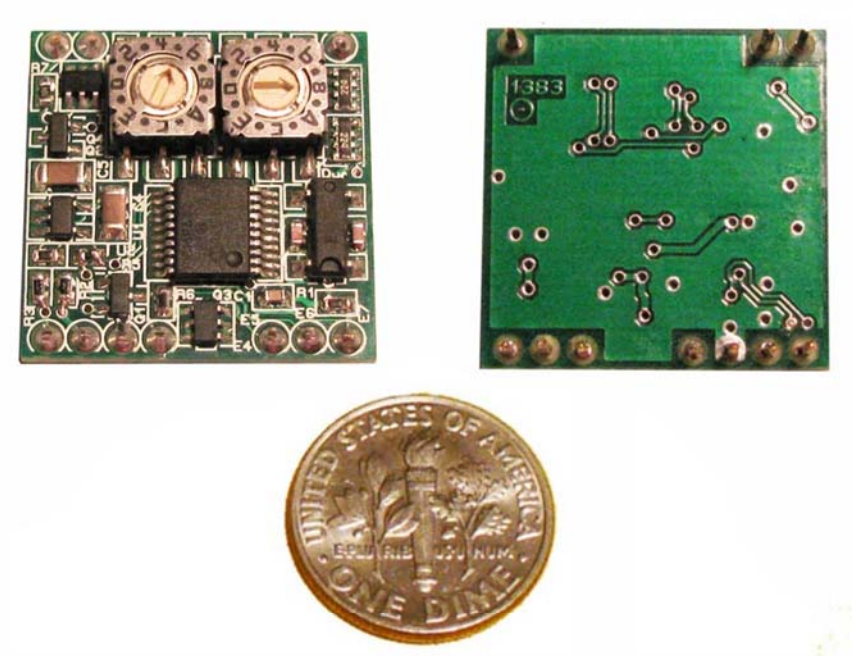


Fig 1: 1383 Horizontal timer module

Specifications: 1381/1383 Clock Timer Controller

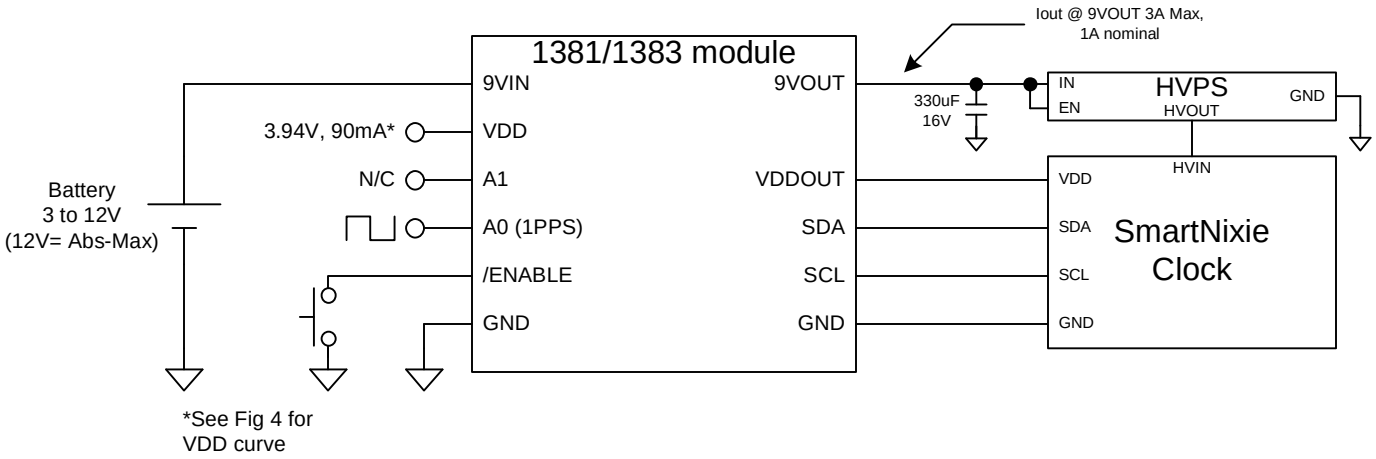
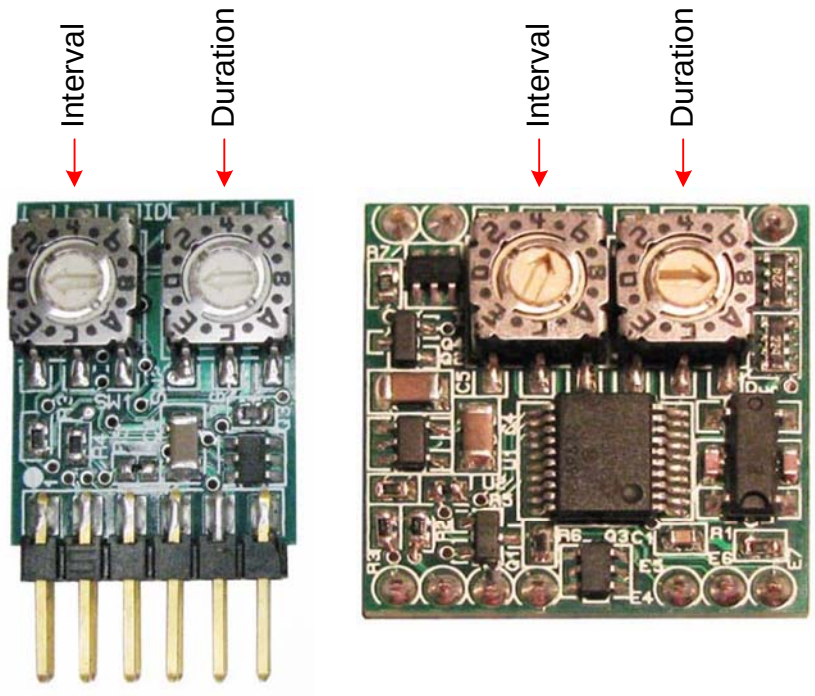


Fig 2: Application schematic

Table 1: Interval switch settings

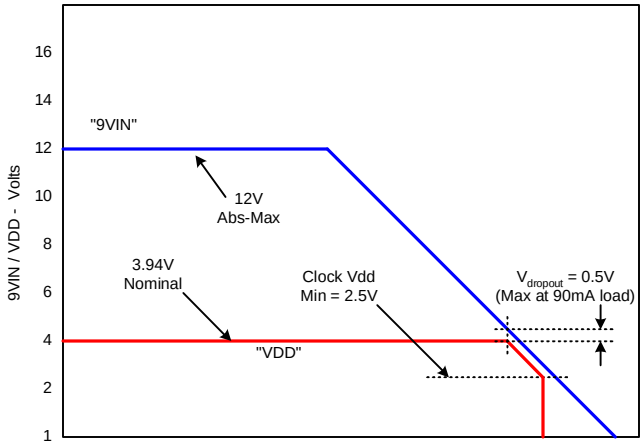
Interval Select Switch		
Setting	Display Behavior	
0	On when button pressed	
1	Interval	45 seconds
2		1 minute
3		90 seconds
4		2 minutes
5		3 minutes
6		4 minutes
7		5 minutes
8		6 minutes
9		10 minutes
A		12 minutes
B		15 minutes
C		20 minutes
D		30 minutes
E		60 minutes
F	Always on	



1381: Vertical timer module

1383: Horizontal timer module

Fig 3: Module switch locations



The regulator in the timer module has a dropout of 200mV with no external load and 500mV max when an external load of 90mA (Maximum allowed) is connected and is specified as the sum of the current from both the static VDD and switched VDDOUT terminals.

Do not apply more than 1uF of external capacitance to the VDDOUT pin without matching that amount x10 at the VDD pin to prevent the VDDOUT load capacitance from browning out the VDD rail when VDDOUT is switched on.

The regulator power limit is approximately 0.6W at 25C derated to 0.0W at 125C and ultimately determines the maximum allowable load current at any particular input voltage or ambient temperature.

Fig 4: VDD regulator transfer function

The following applies for interval selections from 1 to E (1 to 14): The hour is split into even units based on the selected interval switch setting and the display will be turned on such that the center of the "Duration" period will be exactly aligned. If for instance a duration of 5 and an interval of C is selected, the display will turn on 5 seconds before 12:20 and remain on until 5 seconds after 12:20. The display will turn on again just before 12:40, just before 1:00 and so on. Pressing the enable button (On the user PWB) displays the current time immediately and turns the display off as soon as the button is released. Manual display of the time will not alter the next programmed display period, i.e. the display will come on automatically in the example below at 12:40 even if the enable button was pressed at 12:31.

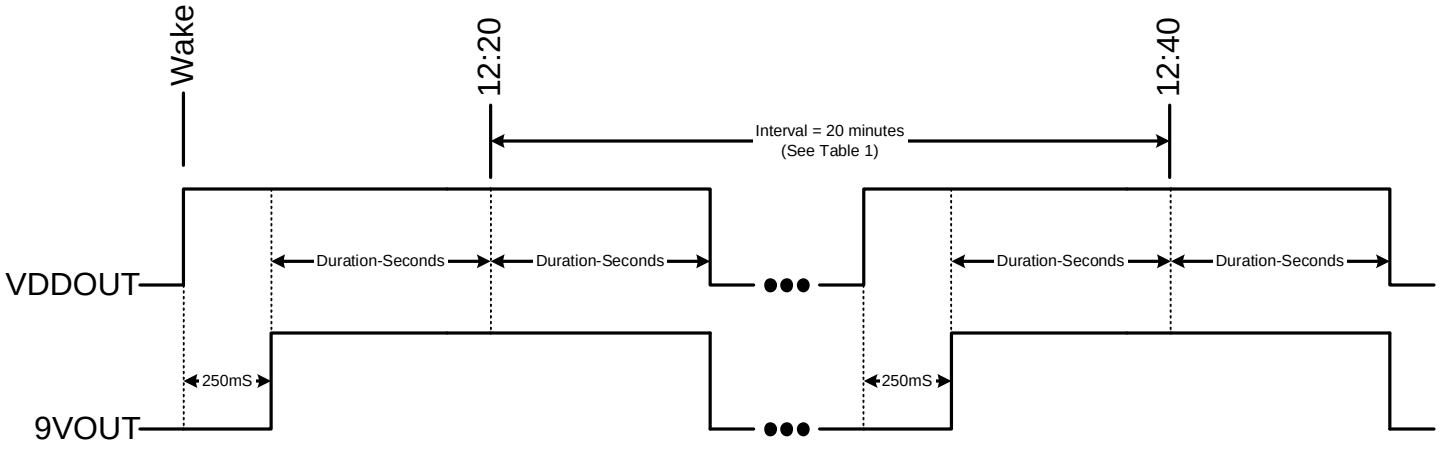


Fig 5: Interval timing diagram (Interval Setting "C" example)

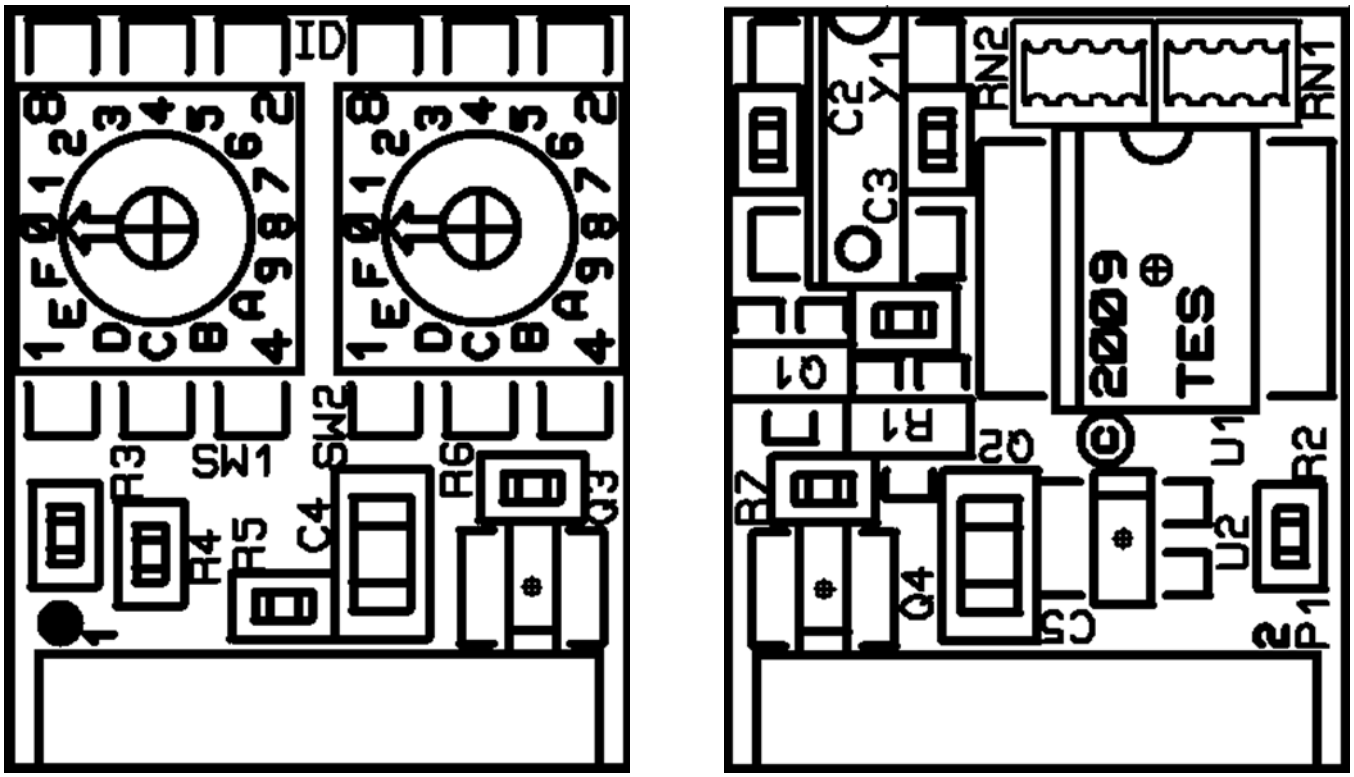


Fig 6: 1381 Vertical timer module parts placement

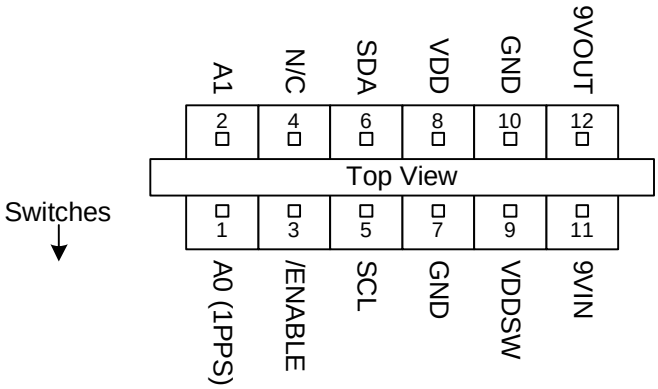


Fig 7: 1381 Connector signal names

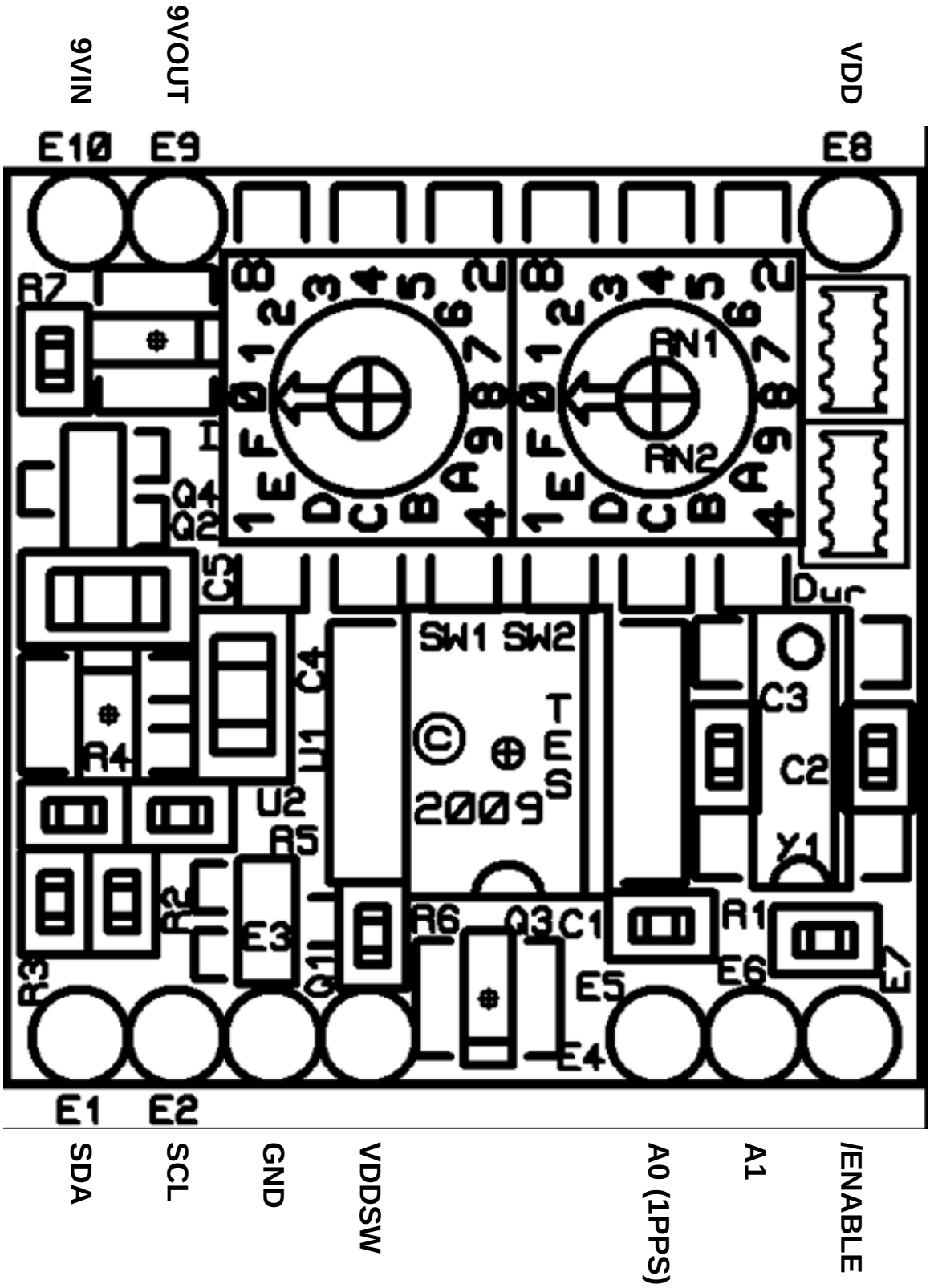


Fig 8: 1383 Horizontal module parts placement and connector signal names

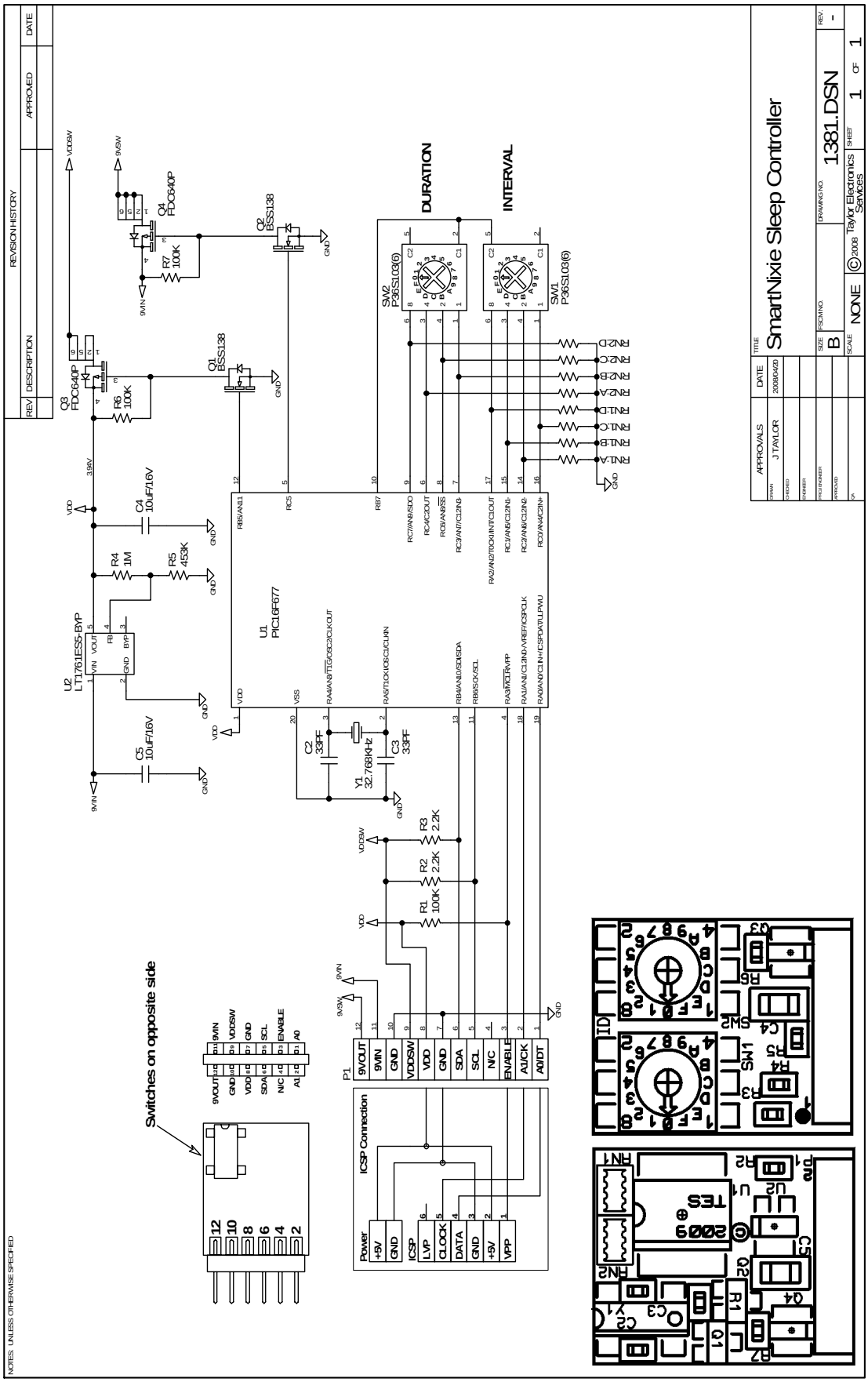


Fig 9: 1381 Vertical module schematic (References except for the connector are the same for both versions)

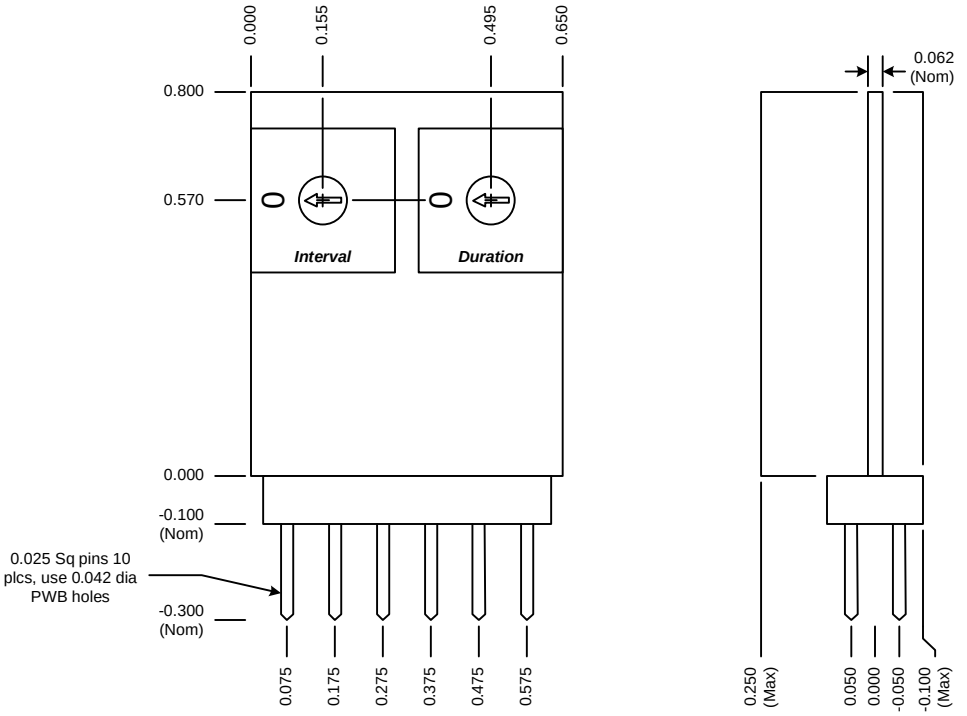


Fig 10: 1381 Mechanical outline (Inches)

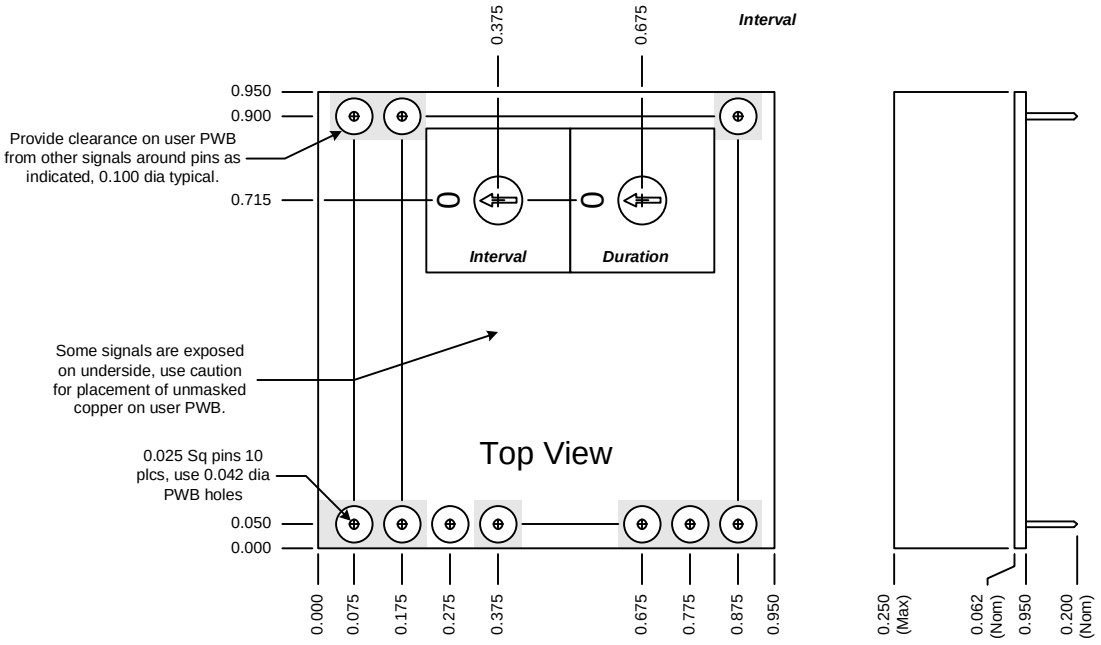


Fig 11: 1383 Mechanical outline (Inches)