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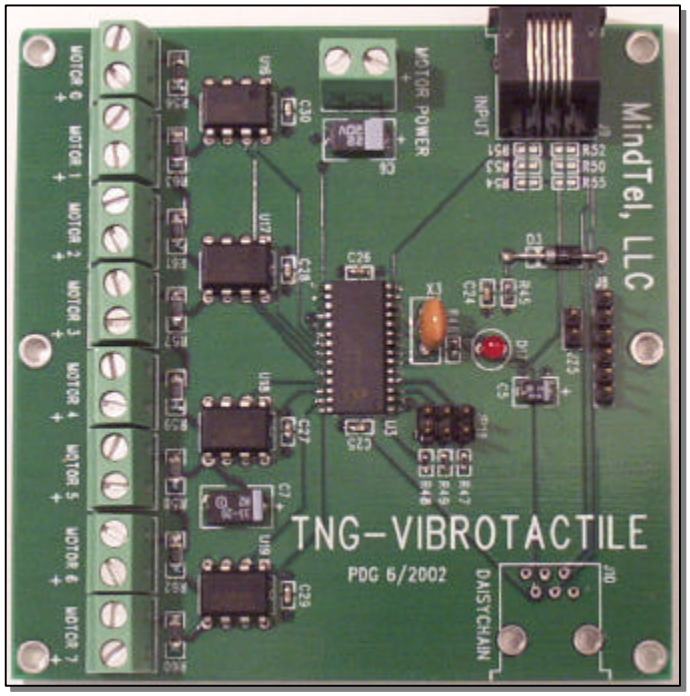
TNG Vibrotactile Array Driver Board



The TNG vibrotactile array driver board will drive from 1 to 8 motors or solenoids in pulse-width modulated (PWM) mode. The PWM technique allows the apparent intensity of the vibratory motors to be controlled over a 0-100% range in 1% steps by changing the ratio of on-time to off-time.

PWM works with more than just motors. LEDs and lamps, for example, can be varied in apparent intensity using this technique.

Since 0 and 100% are allowed, an attached device can be always off or always on. This means that the state of solenoids, relays, and lamps can be controlled.

Control of the motors is delivered through the SPI port of TNG4. Each board can assume one of eight board addresses. This allows up to eight uniquely addressed boards to be daisy chained together. The boards do not have to be of the same type. The LED flashes when the board detects a properly addressed message.

Pads are provided for terminating the SPI lines if required.

The motor power source, the board, and the host device must share a ground return. The mounting holes are connected to the ground plane of the board. Motor power is applied only to the outputs and to the peripheral driver ICs.

The board is 3.5” (8.89 cm) square. The printed circuit board is 0.62” (1.57 mm) thick and is made from FR4. The mounting holes are 0.125” (3.175 mm) diameter, and are located 0.125” in from the edges of the board. The two middle holes are placed 0.125” from the edge at the midpoint.

The motor operating voltage should not exceed 60 VDC. (When operating at motor voltages above 18 VDC, the capacitors C6 and C7 have to be removed or replaced with capacitors tolerant of the working voltage of the motors.) Each motor can draw up to 350 milliamps of current.

The SN75477 peripheral driver ICs drop about 0.5 volts. That is, the motor power should be about 0.5 V more than the motor requires. A 1.3 VDC motor, for example, would need a 1.8 VDC power supply.

The motors or solenoids are connected to the board through eight 2-position screw terminals. The terminals designated “+” are connected to the collector of the corresponding section of a SN75477 peripheral driver IC. The other terminal is power for the motor, if required. The resistor associated with each screw terminal connector allows current limiting. Without some value of resistor installed, no power is available on that screw terminal.

The duty period depends on the motor. It's assumed that all the motors attached to any one board will have the same duty period. An 8500 RPM device has a duty period of 7.06ms. A 7500 RPM motor has a duty period of 8ms. A 7000 RPM has a duty period of 8.6ms. A 4500 RPM motor has a duty period of 13.3 ms.

The first task is to assign the correct duty period. The intensity of the motor can then be varied over a 0-100% range in 1% increments. The duty period setting is 1/100th the entire duty period in microseconds.

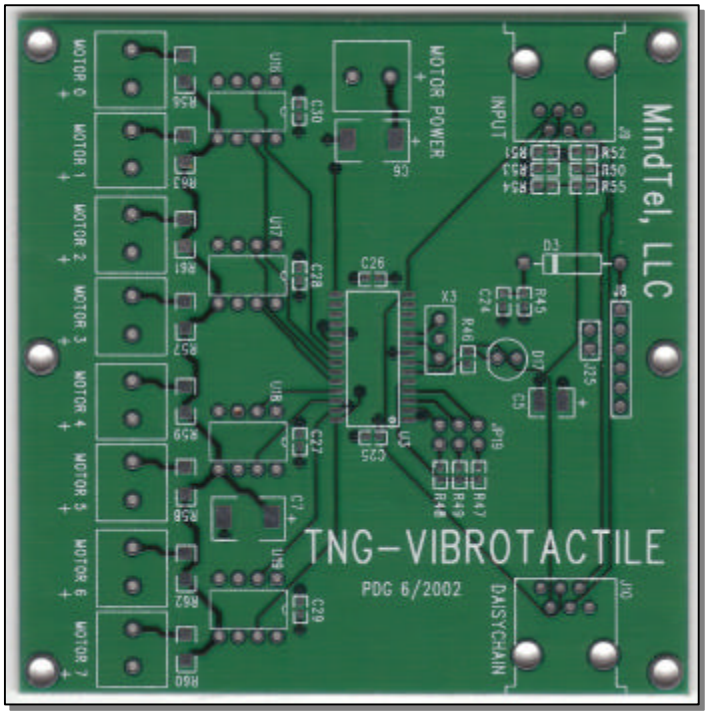
The communications protocol is as follows:

1. Sync Byte: (FFh[255])
2. Address Byte.
   form: xybbbmmm where
   - x = 1 when setting duty period high byte (mmm ignored)
   - y = 1 when setting duty period low byte (mmm ignored).
   - bbb = board base address (0-7). This byte must equal the base address selector lines.

   and mmm = motor number (0-7).

3. 0-100 for motor intensity; 0-255 when setting duty period. A zero setting means that the motor is completely off. An intensity setting of 100 (or more) turns the motor on continuously.

Unpopulated board:



Vibrotactile array driver board along with relay board used to control a massage unit.