Hardware Description

Ninja Digital Instrumentation Display (Ninja DIDy)

By:

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Introduction
The EX500R Digital Instrumentation Display (Ninja DIDy) is a digital instrumentation display for the Kawasaki Ninja EX500R motorcycle. The device will display key performance data, such as engine rotation speed (rotations per minute or RPM), vehicle travel speed (miles per hour or MPH), operating temperature, odometer (total distance traveled through the life of the vehicle) and trip odometer (distance traveled, which can be reset by the user). The device will also indicate the use of blinkers, high-beams and neutral gear engagement.

Power Supply
The LP2957 is a 5-volt low-dropout linear regulator which will provide power for all active devices of the Ninja DIDy. This device will protect against negative voltage spikes while accurately maintaining the output voltage at 5-volts. The input of the power supply will be the vehicle’s 12-volt battery.

PSoC CY8C29466
The PSoC provides modules that can be programmed to function as various analog and digital devices such as counters, timers, LCD driver and digital to analog converters. The PSoC also features an 8-bit microcontroller which interfaces with the various modules.

One 16-bit counter and a 16-bit timer will sample pulses from the hall effect sensor mounted at the wheel of the EX500R. As the bike travels, the pulses will be converted to current speed and distance traveled for the speedometer and odometer of the vehicle. The odometer data will be stored via EEPROM user module. A second 16-bit timer will read the ignition pulses from the vehicle’s ignition control unit to provide the current engine rotation speed for the tachometer.

An analog to digital converter module within the PSoC will be used to detect the voltage of the vehicle’s temperature sensor, providing the operating temperature of the vehicle. A second analog to digital converter will monitor the battery power of the system to detect shutdown of the vehicle, in which case the 1000uF shunt capacitor of the PSoC’s input pin will allow enough power for specific vehicle data to be stored via EEPROM module.

As a background debug module is not available for this part, a header is available to access the In System Serial Programming (ISSP) pins (ISSP CLK and ISSP DATA) to reprogram the part as necessary. The same pins are used for a 32.768 KHz crystal which is connected to the PSoC to allowing greater clock accuracy.

LCD Display
The CFAH1604B is a 16 X 4 LCD module, driven by the PSoC. The vehicle’s speed, tachometer, temperature, odometer and various indicator signals will be displayed on the LCD module. The back light of the LCD will be switched on and off by the PSoC via MOSFET. The contrast of the LCD will be controlled by a digital to analog converter module of the PSoC. The LCD will operate in four-bit mode and will be operated by the PSoC’s LCD driver module.

Hall Effect Sensor
The AH182 hall effect sensor is mounted on the front fork of the vehicle. A magnet, opposing the sensor, will be mounted on vehicle’s wheel, triggering the device with each rotation. The output of the sensor will be connected to the PSoC for speedometer and odometer data.
**Voltage Dividers**
A voltage divider is used to reduce all vehicle signals (used by the original analog instrumentation) to an acceptable level for the PSoC. These consist of a series resistor to the PSoC, as well as a shunt resistor and capacitor, providing a resistive divider to step down the vehicle’s battery voltage and a low pass filter to guard against noise spikes. A diode provides protection against negative voltages. A series resistor is not used for the tachometer signal (PSoC P01), as the signal has a source resistance 6.4 kilohms.

**Push Button**
A COL-918702BP momentary-on push button switch, connected between the PSoC and the regulated 5-volt supply will allow for user input. Pressing the button will drive the PSoC pin high, allowing the user to switch between screens, as well as reset the trip-odometer and switch the backlight.