

TI Designs: TIDA-00152

Automotive Acoustic Knock Sensor Interface



System Description

This reference design utilizes a dual-channel, signal processing IC for detection of premature detonation in combustion (gasoline) engines. The heart of this design is the TPIC8101 that serves as an interface between acoustical sensors or accelerometers and automobile engine management systems. Programmable features on this device include the selection of engine knock detection sensitivity, engine resonance frequency, and sampling rate control of on-board ADC and DAC in signal processing chain. These features allow the TPIC8101 to be a flexible interface that can adapt to cost and/or processing time constraints of the customer.

Featured Applications

- Engine Knock Detector Signal Processing

Design Resources

- Block Diagram and Schematic
- Test Data
- Design and Software Files
- Bill of Materials
- Wiki Page

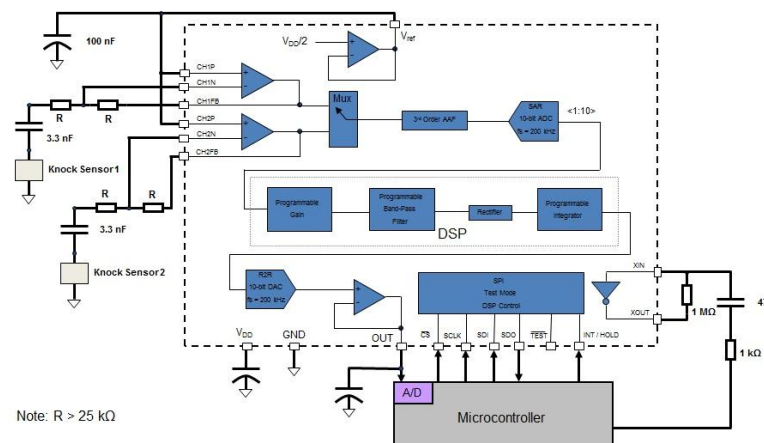
Design Features

- 2 channel device
 - Cars usually has two knock sensors
- Programmable features
 - Gain
 - BPF Center Frequency
 - Input Frequency Pre-Scalar
- Broad uC selection
 - Nine selectable external clock frequencies
- Full SoC
 - Can be used for general analog signal processing
- Xtal-less solution
 - Providing there is a clock from MCU
- AEC-Q100 qualified parts



Design Photo

Block Diagram



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 Comprehensive designs include schematics or block diagrams, BOMs, design files and test reports by experts with deep system and product knowledge. Designs span TI's portfolio of analog, embedded processor and connectivity products and supports a board range of applications including industrial, automotive, medical, consumer, and more. To explore the designs, go to <http://www.ti.com/tidesigns>

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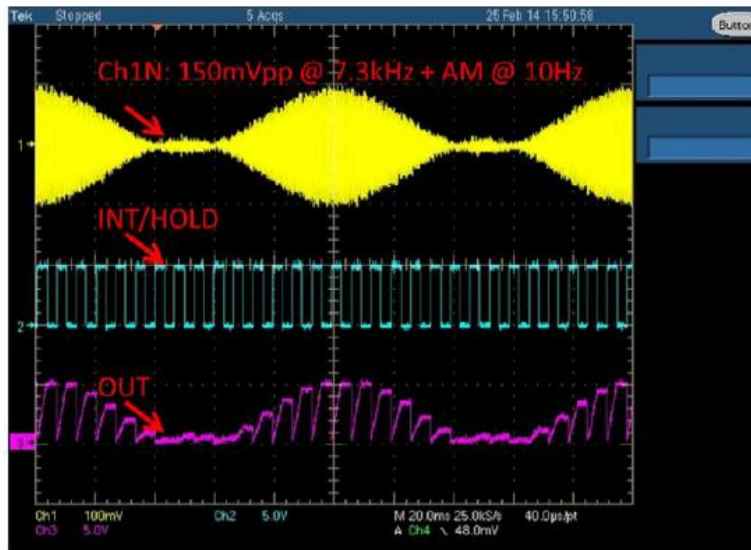


Associated Part Numbers

<u>Part Number</u>	<u>Part Description</u>	<u>EVM Link</u>
TPIC8101	Knock Sensor Interface	

Design Considerations and Test Data:

- Knock sense elements are piezoelectric transducers
 - Detects vibrations (engine knocking) and sends a voltage signal to the engine control module
 - Module interrupts the knock signal to control timing and improve engine efficiency
 - Mounted in the engine block
- Knock sensors meet OBDII emission control requirements
- Two types of Knock Sensors:
 - Conventional (resonant)
 - Consists of a built-in vibration plate, which has the same resonance point as the knocking frequency that can detect the vibration in the this band
 - Flat Type (non –resonant)
 - Can detect vibration in a wider frequency band
 - Can detect knocking even when the engine knocking frequency is changed
- TPIC8101-Q1 is designed for conventional (resonant) knock sensors but can be used with flat type (non-resonant) sensors.



- INT/HOLD is the integration window and is set for 3ms (through the GUI).
- OUT is the integration of the input signal's amplitude. OUT is integrated while
- INT/HOLD is high. OUT is then held while INT/HOLD is low and is reset when
- INT/HOLD goes high again.
- In the figure below, the input amplitude is not constant because the signal is amplitude modulated. As a result, the OUT signal's amplitude also varies

Ch1N on TPIC8101-Q1 EVM is connected to function generator. Function generator settings are: 150mVpp @ 7.3kHz sine wave; amplitude modulation @ 10 Hz.



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