



Angle Toggle



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A Motorola Low-Level Driver Component

The Angle Toggle driver executes in conjunction with the Engine Position driver to produce a pin toggle referenced to a tooth on the crankshaft. The pin toggle is continually repeated throughout the engine cycle, with a constant number of teeth between each transition. The end result is a pattern of evenly spaced pulses matched to the position of the engine, regardless of engine speed. The driver may be initialized on multiple TPU channels, each channel running independently of the others.

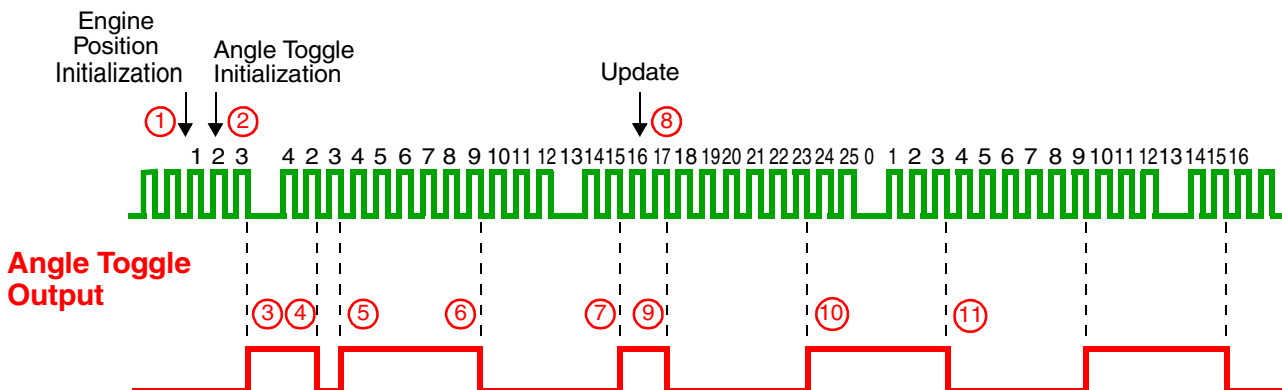
At each pin transition, the driver also measures and updates the time span since the last transition, and requests an interrupt from the CPU. Because each pin transition occurs at a specific tooth on the crankshaft, the driver essentially accumulates crank tooth periods over a defined span of teeth. The driver also calculates and returns the difference between the two most recent accumulated period measurements.

The driver associates a pin polarity with each transition. This prevents the output signal from switching phase upon synchronization to the missing tooth or to the camshaft. Every time the crankshaft tooth count unexpectedly changes, the Angle Toggle driver automatically resynchronizes to the new tooth number and adjusts its pin level to match the desired phase.

The application may force a pin toggle at any time. In this case, the driver toggles the pin at the requested tooth number and repeats the new pin toggle pattern until the end of the engine cycle when it reverts back to the values given at initialization.

The diagram below illustrates the normal operation for the Angle Toggle driver. The example shows a 13-tooth wheel with one missing tooth. The circled numbers represent actions or events this example illustrates, and are described in the table on the back of this datasheet

Crankshaft Input



①	The Crank and Cam functions are initialized.
②	The Angle Toggle driver is initialized to transition the pin high at tooth 3, remain high for 6 teeth, and then toggle the pin low. At initialization, the driver determines the initial pin state based on the current tooth count and the desired polarity and tooth number of the first transition. In the example diagram, the driver determines that the pin should be low.
③	When the tooth count increments to 3, the driver sets the pin high.
④	After the first missing tooth, the Engine Position driver adjusts the tooth count to the correct value, in this case 2. The Angle Toggle driver responds to the change in tooth count by recalculating the pin state polarity as it did in initialization. Here, it drives the pin low.
⑤	At tooth 3, the driver sets the pin high, as it was initialized to do.
⑥	Six teeth later, the driver toggles the pin.
⑦	Six teeth later, the driver toggles the pin.
⑧	The application requests a pin toggle at tooth 17.
⑨	The driver toggles the pin as requested.
⑩	Six teeth later, the driver toggles the pin.
⑪	At the beginning of the next engine cycle, the driver reverts back to the original values from initialization.

The Low Level Driver System

The Low Level Driver system includes a set of drivers with an API that interfaces to and controls the hardware for a microcontroller unit (such as the Motorola MPC555)

Engine Position

Tracks the angular position in the engine cycle based on input from an automobile's crankshaft and camshaft sensors

Spark & DTS

Generates pulses defined by duration and end angle; can be used to time the firing of spark plugs

Fuel

Generates pulses immediately upon request or defined by duration and end angle; can be used to control fuel injection duration and frequency

Speed Measurement

Determines the speed of a rotating shaft

Synchronous PWM

Synchronizes an output pulse width modulation (PWM) signal to an input PWM signal

Synchronous Output

Transmits a clock signal and serial data, following a specific protocol

Angle Toggle

Toggles an output pin and generates interrupts on selected crank angles

QADC Trigger

Generates pulses defined by a start angle and duration

Knock Window

Generates pulses defined by a start and end angle

Discrete Input/Output (DIO)

Operates as a general-purpose digital input or output pin



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