



SPARK



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A Motorola Low-Level Driver Component

Overview

The Spark driver, one of the low-level driver components, is designed to generate spark timing output pulses, which are used to charge an ignition coil and ignite a spark plug. The timing of these output pulses is dependent upon engine position information measured from the crank and cam sensors.

The Engine Position driver provides the data used, which consists of three reference points:

- The period between the last two crankshaft teeth
- The latest tooth number
- The timestamp of the last crank tooth

The end-of-dwell is specified as an angular position referenced to the position of the crankshaft. The start-of-dwell is specified as a programmable dwell time prior to the end-of-dwell.

A “restrike” feature allows for a series of short pulses to occur following the end-of-dwell of a normal pulse.

The Spark driver comprises both C code and TPU microcode. The driver is configured at runtime using initialization calls; the driver's

operation can be altered during normal runtime by mode and parameter update calls made via the API.

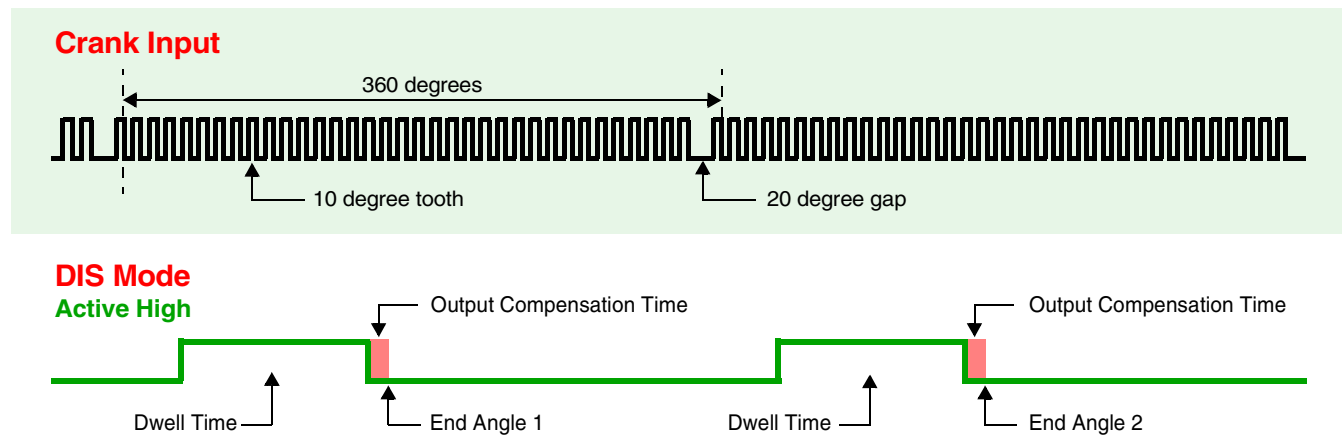
Optional Dwell Time Shutdown

The Spark driver may work in conjunction with an optional Dwell Time Shutdown (DTS) feature, which measures the elapsed time between the spark start-of-dwell and the specified DTS edge.

Multiple non-overlapping spark outputs may use a single DTS channel. The DTS driver supports two modes: sense mode, which allows adaptive dwell algorithms to be implemented, as well as detects an open circuit condition, and error mode which detects a short circuit condition.

Example Showing DIS Mode

The diagram below shows the relationship between the crank input and the spark pulse when the Spark driver is operating in DIS mode with the active edge as high.



Driver Highlights

- Supports four to ten cylinder configurations
- Operates with multiple ignition systems – coil-on-plug (COP) and distributor-less ignition system (DIS)
- Maximized accuracy by rescheduling end-of-dwell on every Crank tooth
- Programmable minimum and maximum dwell times to ensure proper coil charging
- Configurable number of restrike pulses that allow several small pulses after the main pulse to guarantee total combustion
- Automatic shutdown feature may be enabled to trap open/shorted coils (utilizing the DTS feature)
- Ability to measure charging times (utilizing the DTS feature) for adaptive dwell calculations
- Software shutdown feature allows coil to be disabled programatically at any time
- Assemble-time dwell time configuration (low/high)
- Programmable dwell time up to 32.64 ms
- Spark position specified to an accuracy of 0.039° for 10° tooth spacing and 0.023° for 6° tooth spacing
- Programmable offtime up to 4.080 ms to ensure no pulses start for a user-specified time after end-of-dwell
- Automatic synchronization with the Engine Position driver functions
- Drop Dead Angle to ensure pulse will not extend past specified angle (overrides minimum dwell and end-of-dwell)
- Flexibility to enable/inhibit individual sparks

Configuration Details

- Runs on a TPU 2 or TPU 3
- Runs in conjunction with compatible Engine Position driver function
- Needs two spark functions on consecutive TPU channels for storage of global parameters
- Sparks run on the same TPU

Spark Driver Operating Modes

The Spark driver may operate in one of four modes:

- COP – active high or active low
- DIS – active high or active low

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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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For more information, contact your local Motorola sales representative or:

Motorola, Inc.
Advanced Vehicle Systems Division
Attention Software Operations
6501 William Cannon Drive West, Mail Drop OE-39
Austin, TX 78735-8589