KETEREX

AN1101
Application Note

Economical Implementation of Variable Spark Advance for Small Gasoline Engines

INTRODUCTION

A small engine ignition system with variable spark advance holds several significant benefits over a fixed-timing implementation. It can make starting easier, eliminate starter kick-back, and provide better low RPM performance without compromising performance at high RPM.

This application note describes how to use the KX1130 Ignition Controller to add variable timing to small gasoline engine ignition systems without using an expensive microcontroller and without the associated expense and risk of software development.

KX1130 DESCRIPTION

The KX1130 is an inexpensive integrated circuit in an eight-pin SOIC footprint designed to provide variable spark advance timing in ignition systems for small gasoline engines. It runs from a 2.7V to 5.5V power supply and works equally well in self-powered (magneto-based) or battery-powered ignition systems.

The KX1130 produces three discrete advance timing delays (advance angles) as shown in Figure 1.

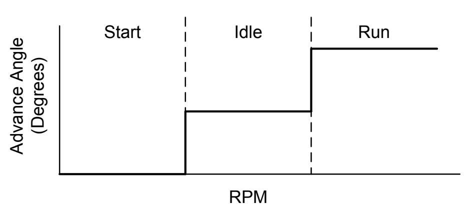

Figure 1. KX1130 Spark Advance Timing

Both the amount of delay (degrees of advance angle) for each step and the RPM values at which the advance angle transitions between steps are configurable. The ignition output is disabled if the RPM exceeds a preset limit.

For small engines such as those used in outdoor power equipment and small two or three-wheeled vehicles, these three discrete advance steps for start, idle and run are usually adequate. A fully-continuous slope advance scheme, as is frequently implemented in microcontroller-based solutions, is not required and is more complex and costly than necessary.

OPERATION

The KX1130 will work in either inductive or capacitive discharge ignition systems. The KX1130 detects pulses from the magneto or pulser coil, which are used as a timing reference and to determine the engine's RPM. Based on the RPM, it calculates the appropriate delay required to position the ignition pulse for the desired advance angle. At the end of this delay, it generates an output signal to trigger the discharge switch used to create the fast rising flux in the system's high-tension transformer core.

The example shown in Figure 2 is a self-powered, capacitive discharge ignition using the KX1130. In this self-powered system, the output of the magneto's charging coil is rectified to power the KX1130. Note that only a few low-cost, passive components are required for the power circuit and for conditioning the input to the KX1130. In battery-powered configurations, the components in the power circuit may be reduced even further.

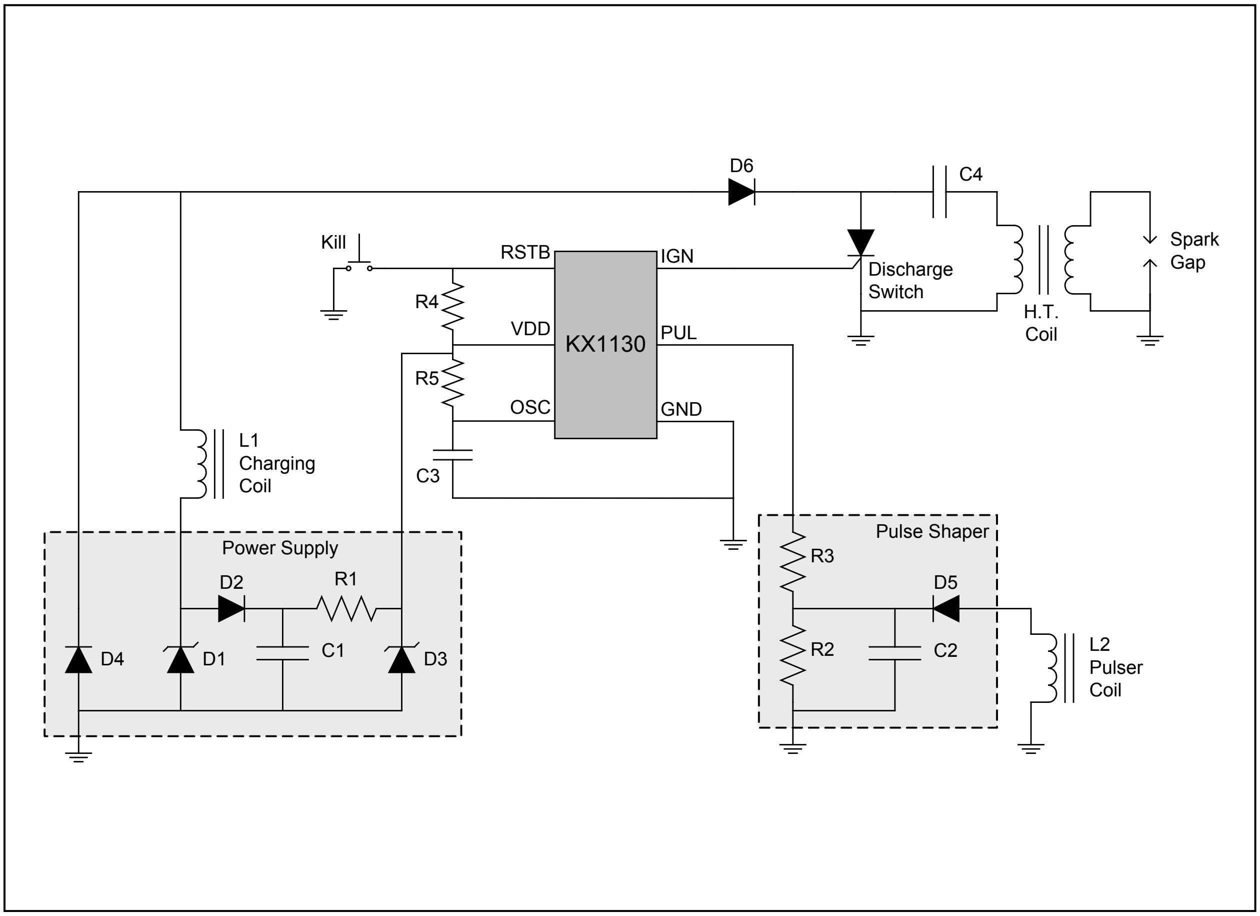

Figure 2. Self-Powered Capacitive Discharge Ignition System with Variable Spark Advance

POWER SUPPLY CIRCUIT

In a self-powered application, a simple half-bridge rectifier circuit driven by the negative phase of the charging coil is all that is required to power KX1130. In the example rectifier circuit shown in Figure 3, diode D1 ensures the voltage level at the base of the charging coil (L1) is sufficient to forward bias the rectifying diode D2. The Zener voltage for D1 must be high enough to compensate for the voltage drop across D2 and R1 but should be as low as possible to minimize its power dissipation requirements.

Diode D3 is a 5V Zener used as a voltage regulator across the power pins of the KX1130. The resistance and capacitance values required for R1 and C1, respectively, will depend on the properties of the magneto, charging coil, and expected minimum RPM during engine start. Typical power requirements for the KX1130 are 1.1mA at 5 volts.

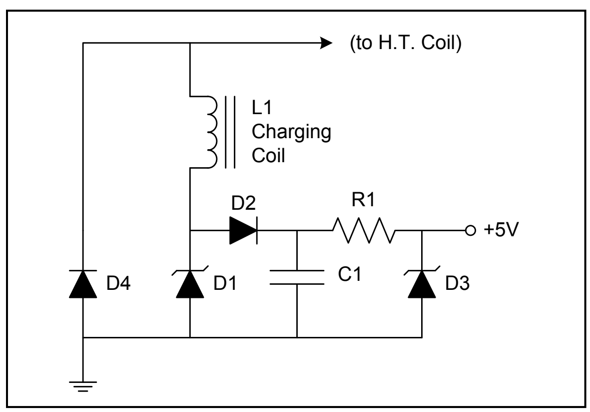

Figure 3. Power Circuit for KX1130

In battery powered applications, R1, D3 and a small bypass capacitor is all that is required.

INPUT CONDITIONING

The timing signals coming from the magneto or pulser coil need to be modified into positive pulses with at least the minimum required duration (pulse width). The pulse's minimum width is dependent on the manner in which the KX1130 is configured for a specific application. Refer to the KX1130 datasheet for more information.

The KX1130 employs a Schmitt Trigger structure on its input to provide noise immunity and simplify the conditioning requirements for the signal from the pulser coil. The simple pulse shaping circuit from the above example, and shown again in Figure 4, is usually sufficient.

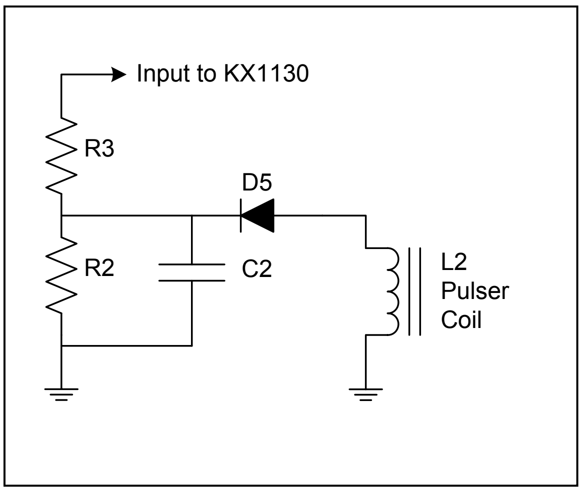

Figure 4. Pulse Shaping Circuit

The signal from the pulser coil (L2) is rectified into a positive pulse by diode D5. R3 limits the current into the input pin of the KX1130. Its resistance value is determined by the maximum amplitude generated by the pulser coil. R2 and C2 ensure a return to zero-level after the minimum required pulse width.

CONCLUSION

This application note has discussed a cost-effective means of implementing variable spark advance timing for small gasoline engine ignition systems by using the Keterex KX1130 Ignition Controller. The KX1130 IC can be utilized in either self-powered or battery powered ignition systems with the addition of only a few low-cost, passive components.

It has been necessary to discuss some design aspects in a general manner since actual implementation will depend significantly on the characteristics of the electro-mechanical properties of the system. Please contact Keterex technical support for assistance with designing for a specific application.

ADDITIONAL DOCUMENTATION

A Product Brief and Datasheet for the KX1130 are also available from Keterex. Please visit the Keterex website or contact your local Keterex representative for more information.

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