HARRIS

CA3165

OBSOLETE PRODUCT
NO RECOMMENDED REPLACEMENT
Call Central Applications 1-800-442-7747
or email: centapp@harris.com

May 1999

Electronic Switching Circuit

Features

- **Switching Initiated by Damping of Internal Oscillator**
- **Proximity Sensing of Rotational Motion**
- **Repeatable Timing of Switching States**
- **Five Outputs - Two Complementary Pairs and One Non-Inverting Output CA3165E1**
- **Two Outputs - One Complementary Pair CA3165E**

Part Number Information

PART NUMBER	TEMPERATURE	PACKAGE
CA3165E	-40°C to +85°C	8 Lead Plastic DIP
CA3165E1	-40°C to +85°C	14 Lead Plastic DIP

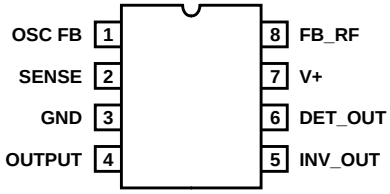
Description

The CA3165 is a single chip electronic switching circuit intended primarily for ignition applications. It includes an oscillator that is amplitude-modulated by the rotor teeth of a distributor, a detector that develops the positive going modulation envelope, a Schmitt trigger that eliminates switching uncertainties. Both types include two complementary high current switched outputs for driving power transistors requiring up to 120mA. The CA3165E also includes two complementary low current outputs that incorporate internal current limiting and a non-inverting output amplifier with uncommitted input capable of switching 27mA.

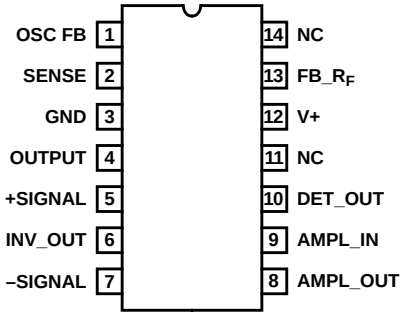
The CA3165 is supplied in the 8 lead dual-in-line plastic package (E suffix) and in the 14 lead dual-in-line plastic package (E1 suffix).

Pinouts

CA3165 (PDIP)
TOP VIEW



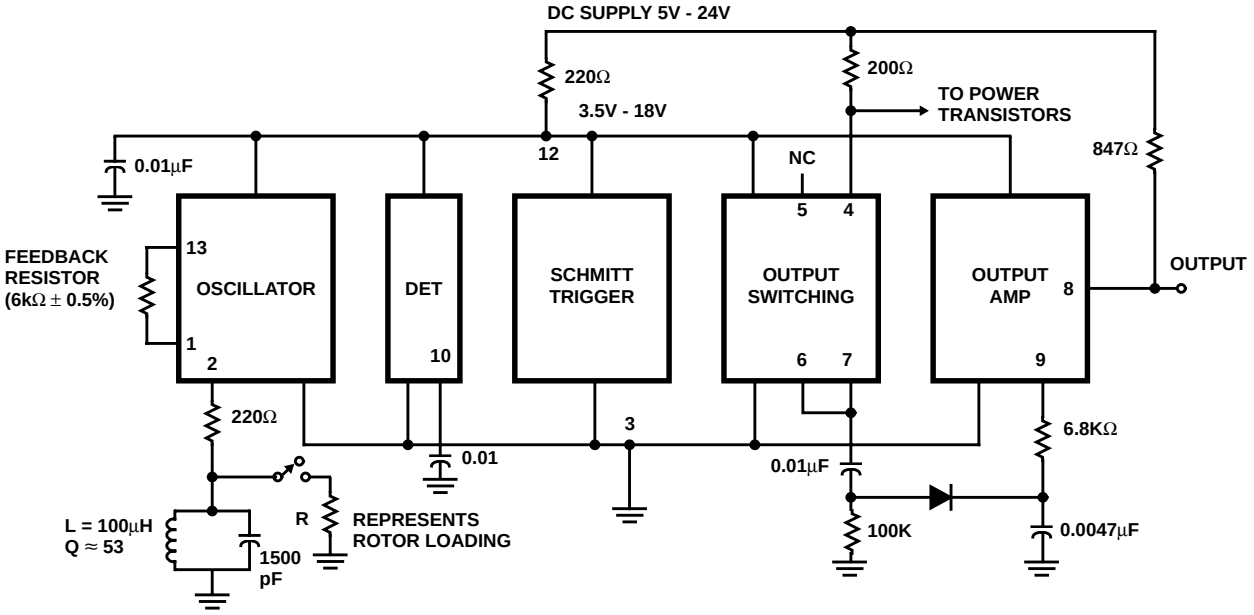
CA3165 (PDIP)
TOP VIEW



CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper I.C. Handling Procedures.

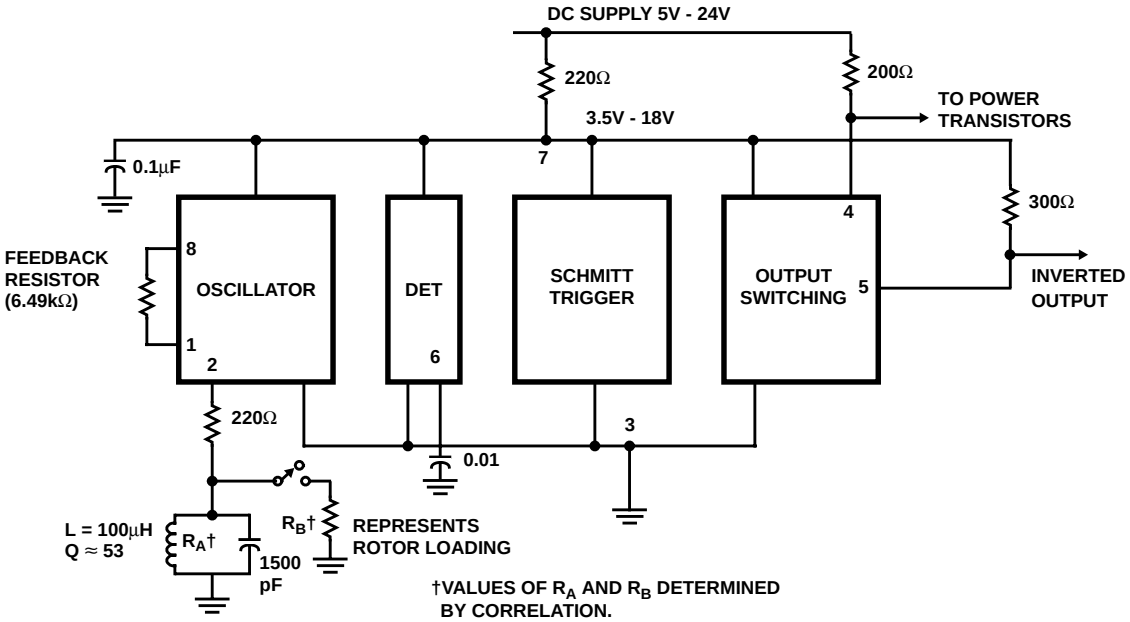
File Number **1278.3**

Functional Block Diagrams



OSCILLATOR CONDITION	TERMINAL 10	TERMINAL 4	TERMINAL 5	TERMINAL 6	TERMINAL 7	TERMINAL 8
Unloaded	Low	High	High	Low	Low	Low
Loaded	High	Low	Low	High	High	High

FIGURE 1. FUNCTIONAL BLOCK DIAGRAM FOR CA3165E1



OSCILLATOR CONDITION	TERMINAL 4	TERMINAL 5	TERMINAL 6
Unloaded	High	High	Low
Loaded	Low	Low	High

FIGURE 2. FUNCTIONAL BLOCK DIAGRAM FOR CA3165E

Absolute Maximum Ratings

DC Voltage (With Reference to Terminal 3)
- CA3165E1
  - Terminals 4, 6, 8 . . . . . 24V
  - Terminals 5, 7, 12 . . . . . 18V
  - Terminal 9 . . . . . 1.5V
- CA3165E
  - Terminals 4, 5 . . . . . 24V
  - Terminal 7 . . . . . 18V

Current (At Terminals Indicated)
- CA3165E1
  - Terminals 4, 6 . . . . . 120mA
  - Terminals 5, 7 . . . . . -0.1mA to 0.1mA
  - Terminal 8 . . . . . 30mA
- CA3165E
  - Terminals 4, 5 . . . . . 120mA

Thermal Information

Thermal Resistance θ_{JA}
- Plastic DIP Package 8 Lead . . . . . $150^oC/W$
- Plastic DIP Package 14 Lead . . . . . $100^oC/W$

Operating Temperature Range . . . . . -40^oC to $+85^oC$
Storage Temperature Range . . . . . -65^oC to $+150^oC$
Lead Temperature . . . . . $+265^oC$
- At Distance 1/16" ±1/32" (1.59 ±0.79mm) from Case for 10s Maximum

Device Dissipation Plastic DIP Package 8 Lead
- Up to $T_A = +55^oC$ 600mW
- Above $T_A = +55^oC$ . . . . . Derate Linearly at $6.67mW/^oC$

Device Dissipation Plastic DIP Package 14 Lead
- Up to $T_A = +55^oC$ 950mW
- Above $T_A = +55^oC$ . . . . . Derate Linearly at $10mW/^oC$

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Electrical Specifications

At $T_A = +25^oC$, V+ = 13V, Measured in the circuit of Figure 5 (CA3165E1) or Figure 6 (CA3165E)

PARAMETERS	SYMBOL	TEST CONDITIONS	CA3165E1			CA3165E			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Current at Term. (Note 1)	Δ	Dwell	-	18.4	-	-	18.4	-	mA
		Spark	-	17.5	-	-	17.5	-	mA
Output Voltage at Term. 4	V_4	Dwell	12.8	-	-	12.8	-	-	V
		Spark	-	-	0.5	-	-	0.5	V
Output Volatge at Term. 7	V_7	Dwell	-	-	1	-	-	-	V
Output Voltage at Term. 8	V_8	Dwell	-	-	0.9	-	-	-	V
		Portion of Spark	1.2	-	-	-	-	-	V
Oscillator Voltage at Term. 2	V_2	Dwell	-	4.4	-	-	4.4	-	Vp-p
		Spark	-	0.6	-	-	0.6	-	Vp-p

NOTE:

1. CA3165E at Term. 7 — Δ I7
   CA3165E1 at Term. 12 — I12

Schematic Diagrams

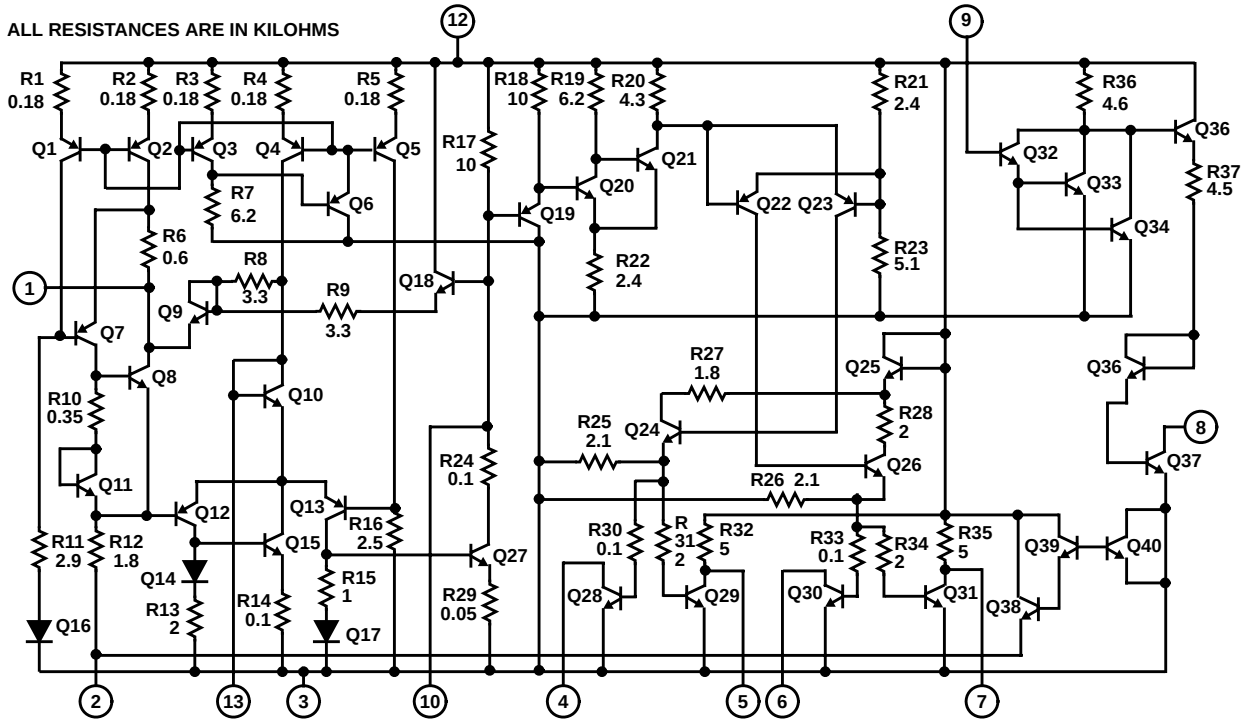


FIGURE 3. SCHEMATIC DIAGRAM FOR CA3165E1

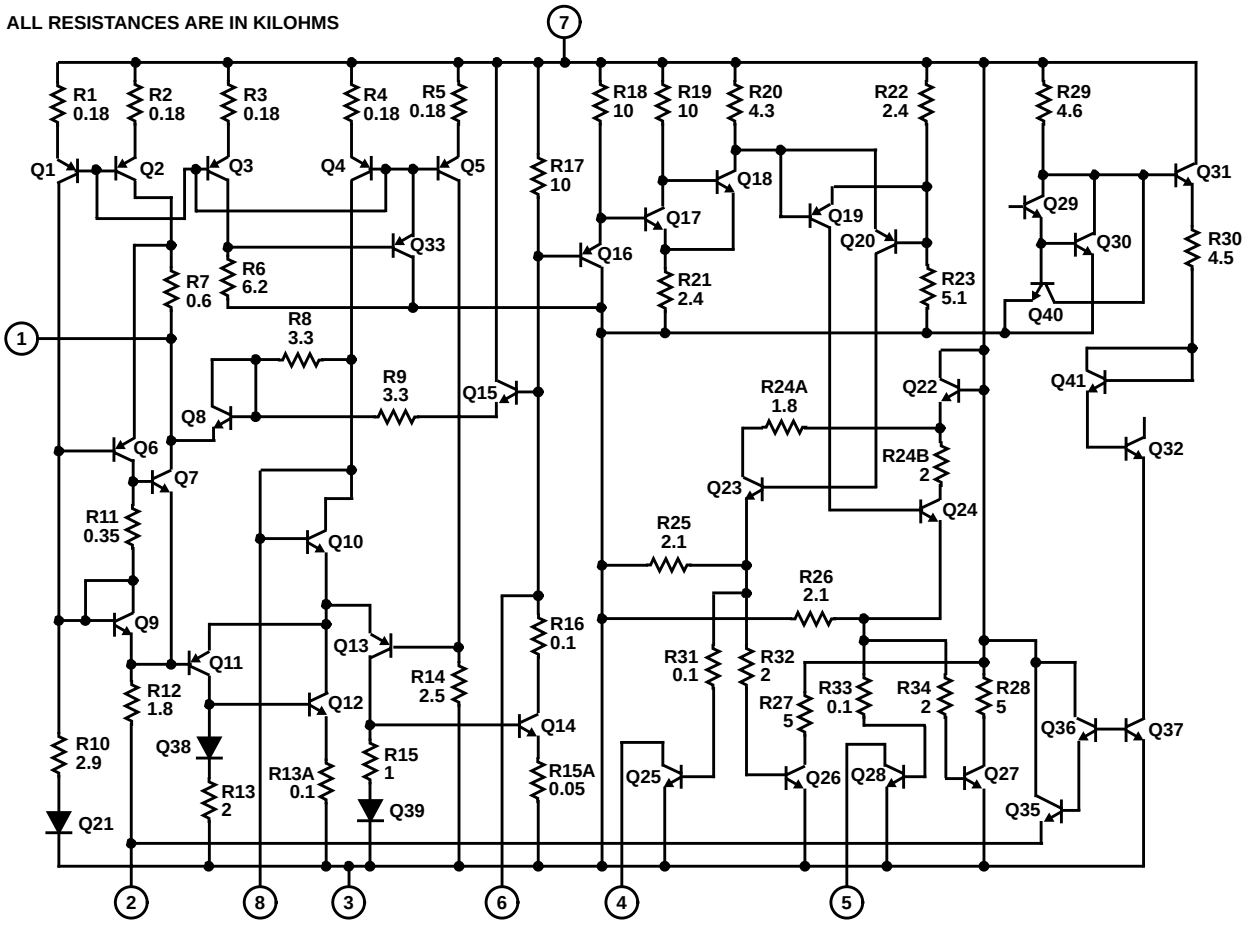


FIGURE 4. SCHEMATIC DIAGRAM FOR CA3165E

Application Information Figure 5 and Figure 6 show the application of the CA3165 in a typical ignition system.

TERMINAL DESCRIPTIONS		
TERMINAL		FUNCTION
CA3165E1	CA3165E	
1	1	Oscillator Feedback Resistor, R_F
2	2	220Ω Protective Resistor To Tank Circuit
3	3	Ground
4	4	Direct Output - R_7 load resistor 200Ω ± 5%, and R_8 to power Darlington 15Ω ± 10%
5	-	Direct Output - Low Current - Not Connected
6	5	Inverted High Current Output
7	-	Inverted Low Current Output Through C_1 (0.01µF) to D_3 and R_3 (100kΩ)
8	-	Output Amplifier Output - Through R_6 and R_5 (27Ω and 820Ω to Supply)
9	-	Output Amplifier Input - through R_4 (6800Ω) to D_3 and C_5 (0.0047µF)
10	6	Detector Output - C_2 to Ground (0.01µF)
11	-	No Connection
12	7	Circuit Supply Voltage Through R_1 (220Ω Protective Resistor) to Automotive Supply
13	8	Oscillator Feedback Resistor R_F to Terminal 1
14	-	No Connection

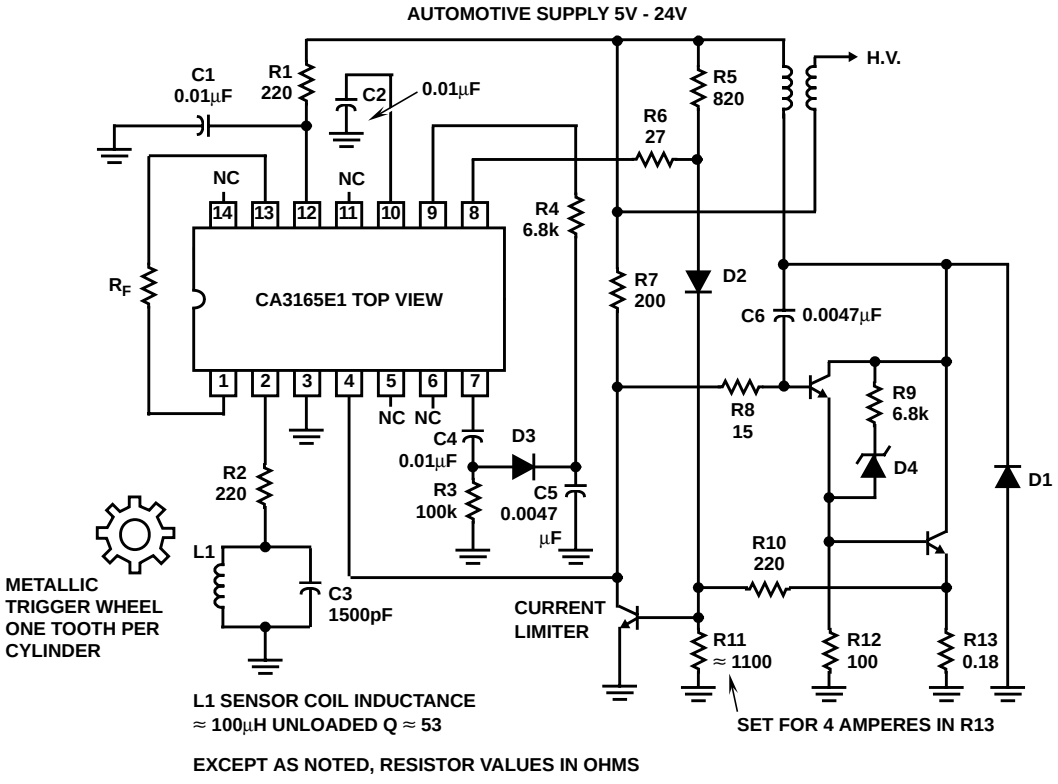


FIGURE 5. TYPICAL IGNITION SYSTEMS USING THE CA3165E1

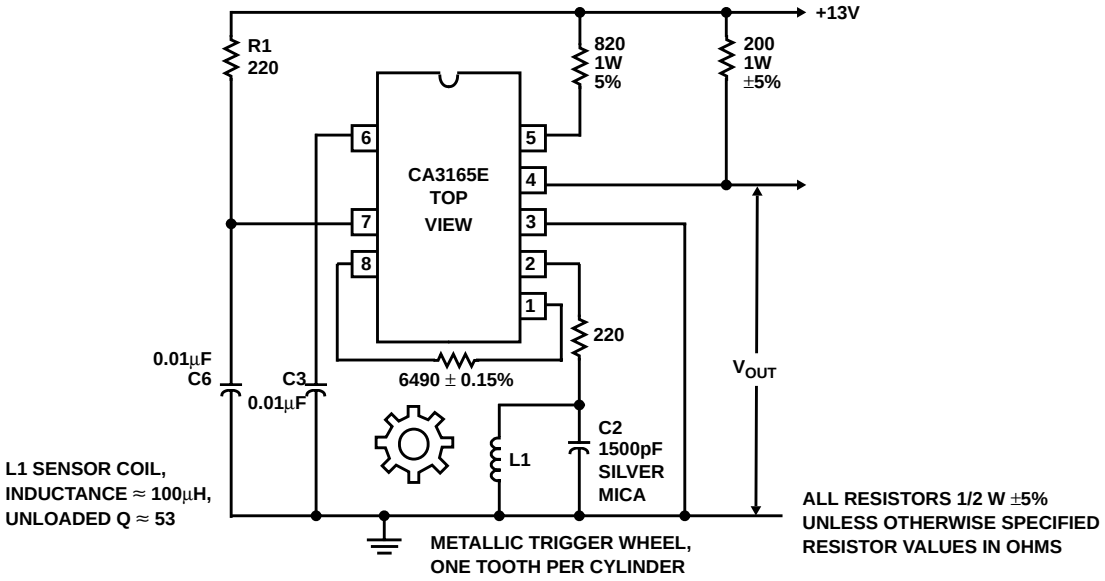


FIGURE 6. TYPICAL IGNITION SYSTEM USING THE CA3165E

Application Information

Figure 5 and Figure 6 show the application of the CA3165 in a typical ignition system. The oscillator on the chip operates at about 400kHz as determined by the tuned circuit L1, C2. The amplitude of the oscillation is detected on the chip and applied to a Schmitt trigger which sets the terminal voltage as shown in the chart in Figure 1 and Figure 2 for the unloaded condition of the oscillator. As a metallic tooth in the rotor passes the coil L1, eddy-current losses occur which reduce the Q of the resonant circuit and decrease the amplitude of the oscillations to a level below that of a reference in the detector circuit. The output terminals are then switched to states as shown in the chart in Figure 1 and Figure 2 for the loaded condition of the oscillator. The oscillation is maintained at this lower amplitude by switching in additional feedback in the oscillator circuit. The fact that the oscillator continues to operate at some minimum level during this dwell period eliminates timing variations which would occur if the oscillator had to be restarted by random noise.

Spark occurs as terminal 4 is switched from high to low. The output amplifier clamps terminal 4 low through the regulator during the duration of the spark.

The Dwell period represents the time that terminal 10 (CA3165E1) or terminal 6 (CA3165E) is high, terminal 4 is low, and the coil is charged.

The value of the oscillator feedback, resistor, R_F, is selected to set the dwell period. With a sintered-iron 8 f-tooth rotor, a typical value of R_F is 6500Ω for 28.5 degrees of dwell out of a 45 degree cycle. For a star-type rotor and a particular coil in a typical distributor, the feedback resistor would be larger (typically 8800Ω) depending on clearances, coil geometry and tooth shape.

For typical F-Tooth Rotor with Rod Sensor and 113μH of coil inductance, the Q and frequency with respect to rotor position was measured for the following positions

CENTER	46 at 377kHz
SLOT	6 at 390kHz
FIRE	15 at 381kHz

(Free air Q = 55.7 at 375kHz.)

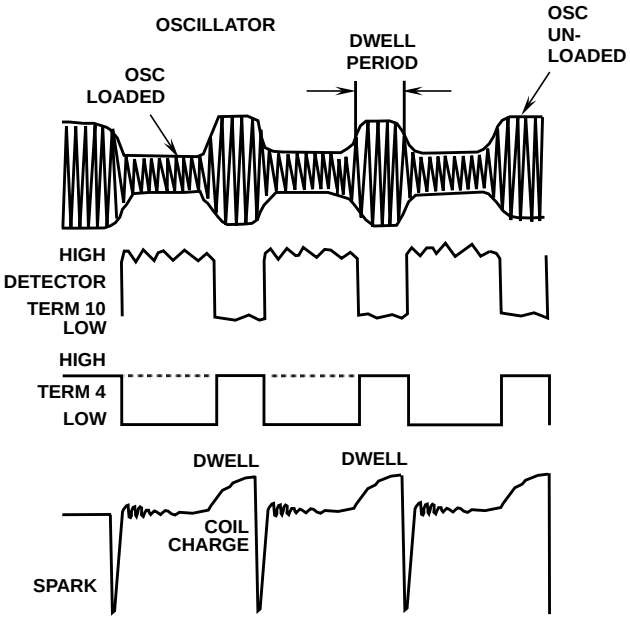


FIGURE 7. TIMING SEQUENCE