

IL1815 Adaptive Variable Reluctance Sensor Amplifier

Features

- Adaptive hysteresis
- Single supply operation
- Ground referenced input
- True zero crossing timing reference
- Operates from 2V to 12V supply voltage
- Handles inputs from 100 mV to over 120V with external resistor
- CMOS compatible logic

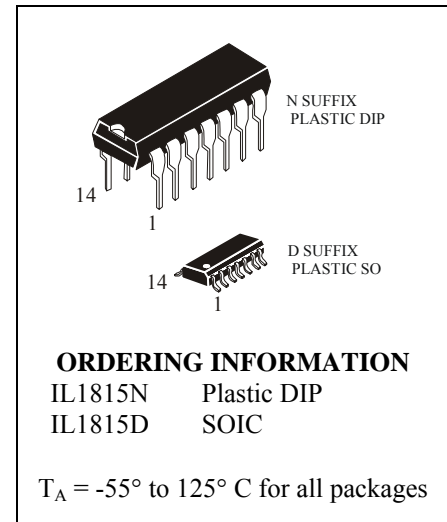
Applications

- Position sensing with notched wheels
- Zero crossing switch
- Motor speed control
- Tachometer
- Engine testing

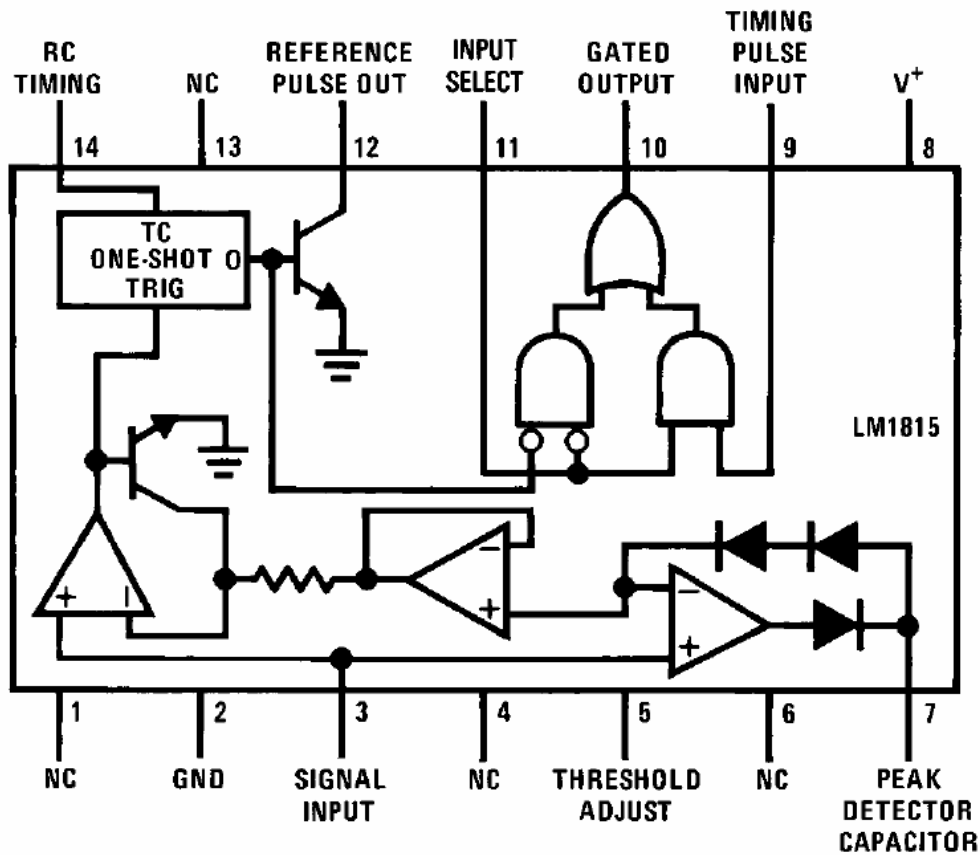
General Description

The IL1815 is an adaptive sense amplifier and default gating circuit for motor control applications. The sense amplifier provides a one-shot pulse output whose leading edge coincides with the negative-going zero crossing of a ground referenced input signal such as from a variable reluctance magnetic pick-up coil. In normal operation, this timing reference signal is processed (delayed) externally and returned to the IL1815. A logic input is then able to select either the timing reference or the processed signal for transmission to the output driver stage. The adaptive sense amplifier operates with a positive-going threshold which is derived by peak detecting the incoming signal and dividing this down. Thus the input hysteresis varies with input signal amplitude. This enables the circuit to sense in situations where the high speed noise is greater than the low speed signal amplitude. Minimum input signal is 100 mVp-p.

IL1815



Connection Diagram



Top View

Truth Table

Signal Input	Timing Gated	Input Select	Input Output
Pulses	L	X	Pulses
X	H	Pulses	Pulses

Absolute Maximum Ratings

Supply Voltage 12V
 Power Dissipation (Note 1) 1250 mW
 Operating Temperature Range -40°C to +125°C
 Storage Temperature Range -65°C to +150°C
 Junction Temperature (Note 2) +125°C
 Input Current ±30 mA

Electrical Characteristics ($T_A = 25^{\circ}\text{C}$, $V_{CC} = 10\text{V}$, unless otherwise specified, see Figure 1)

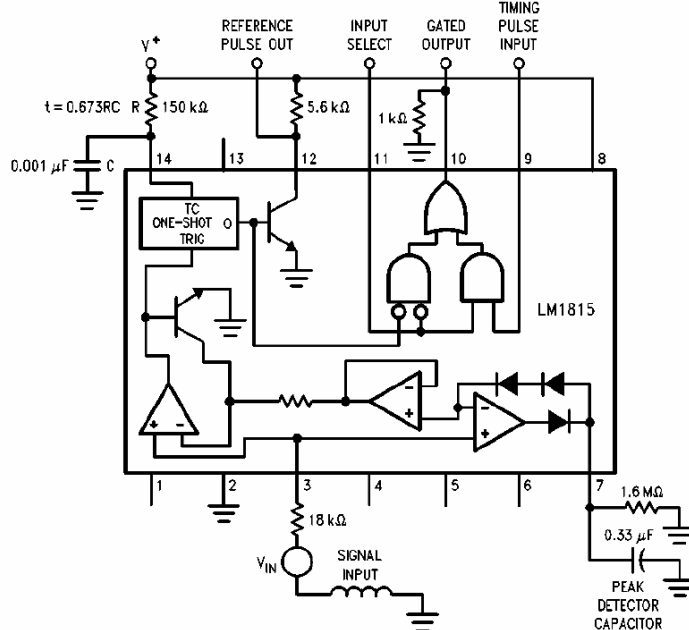
Parameter	Conditions	Min	Typ	Max	Units
Operating Supply Voltage		2.5	10	12	V
Supply Current	$f_{IN} = 500\text{ Hz}$, Pin 9 = 2V, Pin 11 = 0.8V		3.6	6	mA
Reference Pulse Width	$f_{IN} = 1\text{ Hz to } 2\text{ kHz}$	70	100	130	μs
Input Bias Current	$V_{IN} = 2\text{ V}$, (Pin 9 and Pin 11)			5	μA
Input Bias Current	$V_{IN} = 0\text{ V dc}$, (Pin 3)		200		nA
Input Impedance	$V_{IN} = 5\text{ V}_{\text{rms}}$, (Note 3)	12	20	28	k Ω
Zero Crossing Threshold	$V_{IN} = 100\text{ mVp-p}$, (Pin 3)			25	mV
Logic Threshold	(Pin 9 and Pin 11)	0.8	1.1	2.0	V
V_{OUT} High	$R_L = 1\text{ k}\Omega$, (Pin 10)	7.5	8.6		V
V_{OUT} Low	$I_{\text{SINK}} = 0.1\text{ mA}$, (Pin 10)		0.3	0.4	V
Input Arming Threshold	Pin 5 Open, $V_{IN} \leq 135\text{ mVp-p}$	30	45	60	mV
	Pin 5 Open, $V_{IN} \geq 230\text{ mVp-p}$	40	80	90	%of V_3 Pk
	Pin 5 to V_+	200			mV
	Pin 5 to Gnd	-25		25	mV
Output Leakage Pin 12	$V_{12} = 11\text{ V}$		0.01	10	μA
Saturation Voltage P12	$I_{12} = 2\text{ mA}$		0.2	0.4	V

Note 1: For operation at elevated temperatures, the device must be derated based on a 125°C maximum junction temperature and a thermal resistance of 80°C/W (DIP), 120°C/W (SO-14) junction to ambient.

Note 2: Temporary excursions to 150°C can be tolerated.

Note 3: Measured at input to external $18\text{ k}\Omega$ resistor. IC contains $1\text{ k}\Omega$ in series with a diode to attenuate the input signal.

FIGURE 1. IL1815 Adaptive Sense Amplifier



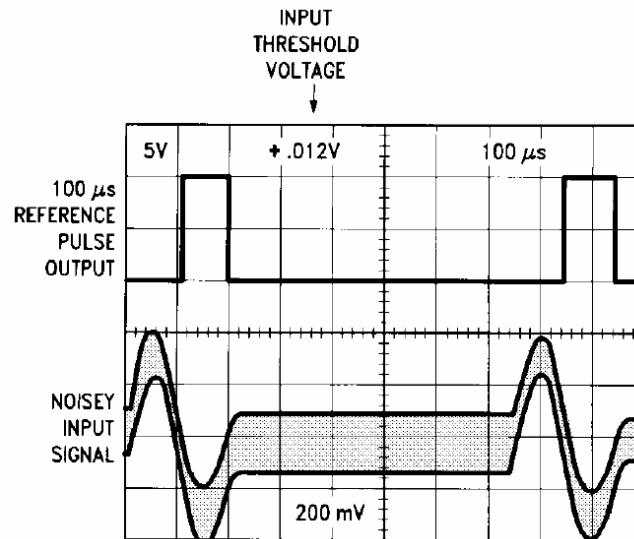


FIGURE 2. IL1815 Oscilloscopes

Application Hints

Input Clamp

The signal input at pin 3 is internally clamped. Current limit is provided by an external resistor which should be selected to allow a peak current of 3 mA in normal operation. Positive inputs are clamped by a 1 k Ω resistor and series diode, while an active clamp limits pin 3 to -350 mV for negative inputs (see R4, Q12, Q11 in internal schematic diagram).

Operation of Zero Crossing Detector

The IL1815 is designed to operate as a zero crossing detector, triggering an internal one shot on the negative-going edge of the input signal. Unlike other zero crossing detectors, the IL1815 cannot be triggered until the input signal has crossed an "arming" threshold on the positive-going portion of the waveform. The arming circuit is reset when the chip is triggered, and subsequent zero crossings are ignored until the arming threshold is exceeded again. This threshold varies depending on the connection at pin 5. Three different modes of operation are possible:

MODE 1, Pin 5 open. The adaptive mode is selected by leaving pin 5 open circuit. For input signals of less than 135 mVp-p, the input arming threshold is typically 45 mV. Under these conditions the input signal must first cross the 45 mV threshold in the positive direction to arm the zero crossing detector, and then cross zero in the negative direction to trigger it. If the signal is less than 30 mV peak (minimum rating in Electrical Characteristics), the one shot is guaranteed to not trigger.

Input signals of greater than 230 mVp-p cause the arming threshold to track at 80% of the peak input voltage. A peak detector (pin 7) stores a value relative to the positive input peaks to establish the arming threshold. Input signals must exceed this threshold in the positive direction to arm the zero crossing detector, which can then be triggered by a negative-going zero crossing. The peak detector tracks rapidly as the input signal amplitude increases, and decays by virtue of the resistor connected externally at pin 7 to track decreases in the input signal.

Note that since the input is clamped, the waveform observed at pin 3 is not identical to the waveform observed at the variable reluctance sensor. Similarly, the voltage stored at pin 7 is not identical to the peak voltage appearing at pin 3.

MODE 2, Pin 5 connected to Va. The input arming threshold is fixed at 200 mV minimum when pin 5 is connected to the positive supply. The chip has no output for signals of less than 200 mV peak, and triggers on the next negativegoing zero crossing when the threshold is exceeded.

MODE 3, Pin 5 grounded. With pin 5 grounded, the input arming threshold is set to 0V (± 25 mV maximum). Positivegoing zero crossings arm the chip, and the next negative zero crossing triggers it.

The one shot timing is set by a resistor and capacitor connected to pin 14. The output pulse width is

$$\text{pulse width} = 0.673 RC \quad (1)$$

In some systems it is necessary to externally generate pulses, such as during stall conditions when the variable reluctance sensor has no output. External pulse inputs at pin 9 are gated through to pin 10 when Input Select (pin 11) is pulled high. Pin 12 is a direct output for the one shot and is unaffected by the status of pin 11. Input/output pins 9, 11, 10 and 12 are all CMOS logic compatible. In addition, pins 9, 11 and 12 are TTL compatible. Pin 10 is not guaranteed to drive a TTL load. Pins 1, 4, 6 and 13 have no internal connections and can be grounded.