

LM1815

Adaptive Variable Reluctance Sensor Amplifier

General Description

The LM1815 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

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage 12V
Power Dissipation (Note 2) 1250 mW

Operating Temperature Range $-40^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$
Storage Temperature Range $-65^{\circ}\text{C} \leq T_J \leq +150^{\circ}\text{C}$
Junction Temperature $+150^{\circ}\text{C}$
Input Current $\pm 30\text{ mA}$
Lead Temperature (Soldering, 10 sec.) 260°C

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 | $f_{IN} = 1\text{ Hz to } 2\text{ kHz}$, $R = 150\text{ k}\Omega$, $C = 0.00\mu\text{F}$ | 70 | 100 | 130 | μs |
| Logic Input Bias Current | $V_{IN} = 2\text{V}$, (Pin 9 and Pin 11) | | | 5 | μA |
| Signal Input Bias Current | $V_{IN} = 0\text{V dc}$, (Pin 3) | | 200 | | nA |
| Input Impedance | $V_{IN} = 5\text{ Vrms}$, (Note 3) | 12 | 20 | 28 | $\text{k}\Omega$ |
| Zero Crossing Threshold | $V_{IN} = 100\text{ mV}_{P-P}$, (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 | $I_{SINK} = 0.1\text{ mA}$, (Pin 10) | | 0.3 | 0.4 | V |
| Input Arming Threshold | Pin 5 Open, $V_{IN} = 135\text{ mV}_{P-P}$ (Mode 1) | 30 | 45 | 60 | mV |
| | Pin 5 Open, $V_{IN} \geq 230\text{ mV}_{P-P}$ (Mode 1) | 40 | 80 | 90 | % of $V_3 + P_K$ |
| | Pin 5 to V^+ , $V_{IN} \geq 1\text{V}_{P-P}$ (Mode 2) | 200 | 300 | 450 | mV |
| | Pin 5 to Gnd, $V_{IN} \geq 100\text{mV}_{P-P}$ (Mode 3) | -25 | 0 | 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: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" specifies conditions of device operation.

Note 2: For operation at elevated temperatures, the device must be derated based on a 150°C maximum junction temperature and a thermal resistance of 80°C/W (DIP), 120°C/W (SO-14) junction to ambient.

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

Truth Table

| Signal Input Pin 3 | RC Timing Pin 14 | Input Select Pin 11 | Timing Input Pin 9 | Gated Output Pin 10 |
|--------------------|------------------|---------------------|--------------------|---------------------|
| \pm Pulses | RC | L | X | Pulses = RC |
| X | X | H | H | H |
| X | X | H | L | L |
| \pm Pulses | L | L | L | Zero Crossing |

Truth Table (Continued)

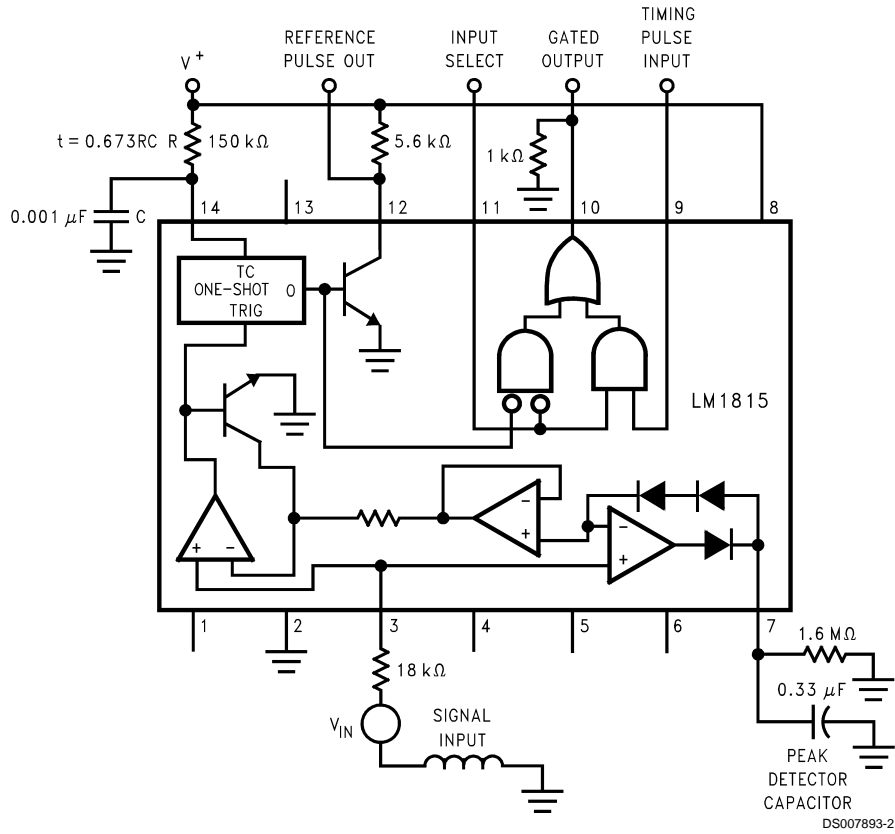
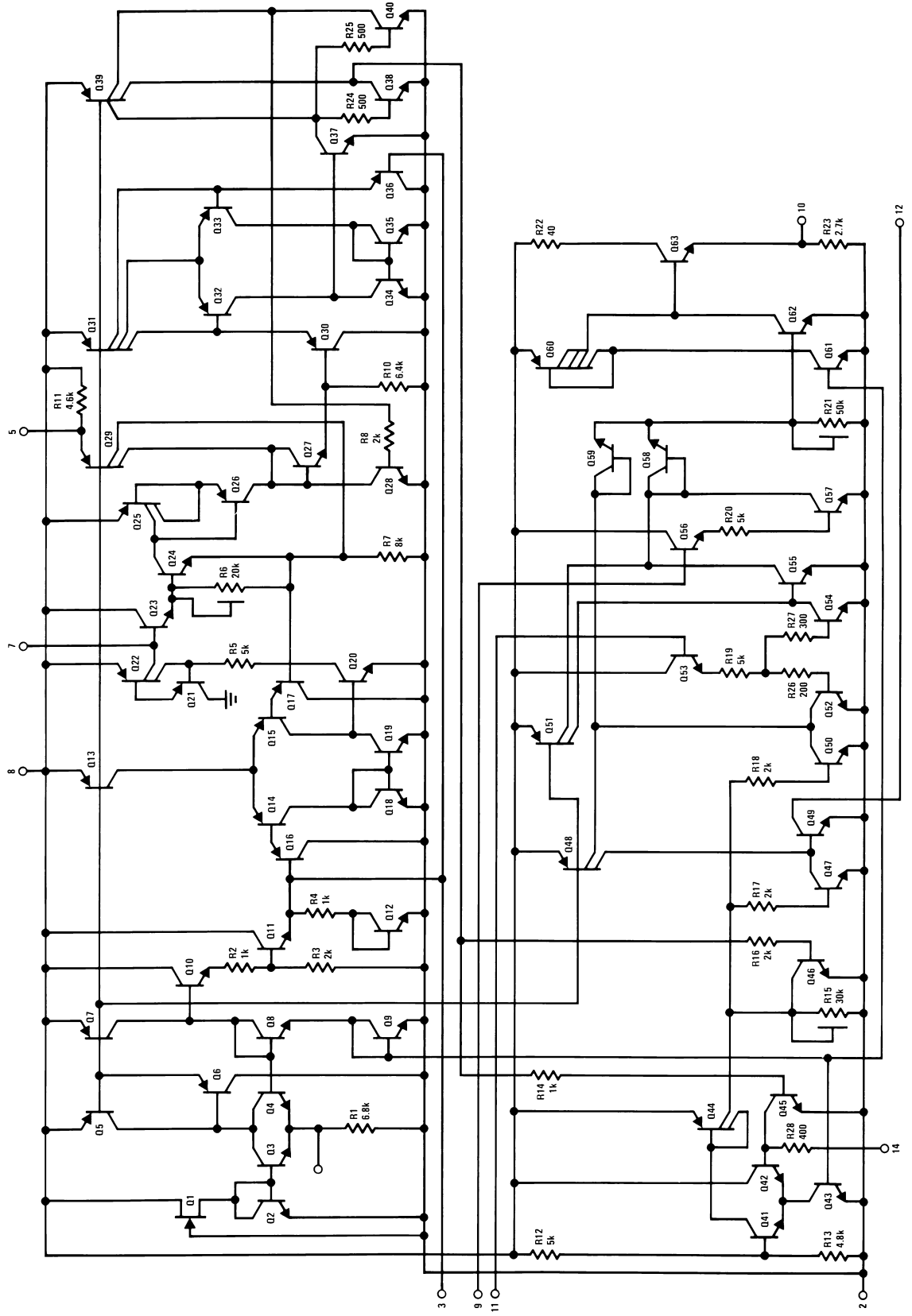


FIGURE 1. LM1815 Adaptive Sense Amplifier

Schematic Diagram



DS007893-4

Application Hints (Continued)

no output for signals of less than ± 200 mV (i.e. 400mVp-p) and triggers on the next negative-going zero crossing when the arming threshold is has been exceeded.

MODE 3, Pin 5 grounded.

With pin 5 grounded, the input arming threshold is set to 0V, ± 25 mV maximum. Positive-going zero crossings arm the chip, and the next negative-going zero crossing triggers it. This is the very basic form of zero-crossing detection.

One Shot Timing

The one shot timing is set by a resistor and capacitor connected to pin 14. The recommended maximum resistor value is 150kohms. The capacitor value can be changed as needed, as long as the capacitor type does not present any significant leakage that would adversely affect the RC time constant.

The output pulse width is:

$$\text{pulse width} = 0.673 \times R \times C \quad (1)$$

For a given One Shot pulse width, the recommended maximum input signal frequency is:

$$F_{in(max)} = 1/(1.346 \times R \times C) \quad (2)$$

In the application example shown in figure 1 ($R=150$ kohms, $C=0.001\mu$ F) the recommended maximum input frequency will typically be 5kHz. Operating with input frequencies above the recommended $F_{in(max)}$ value may result in unreliable performance of the One Shot circuitry. For those applications where the One Shot circuit is not required, device pin 14 can be tied directly to Ground.

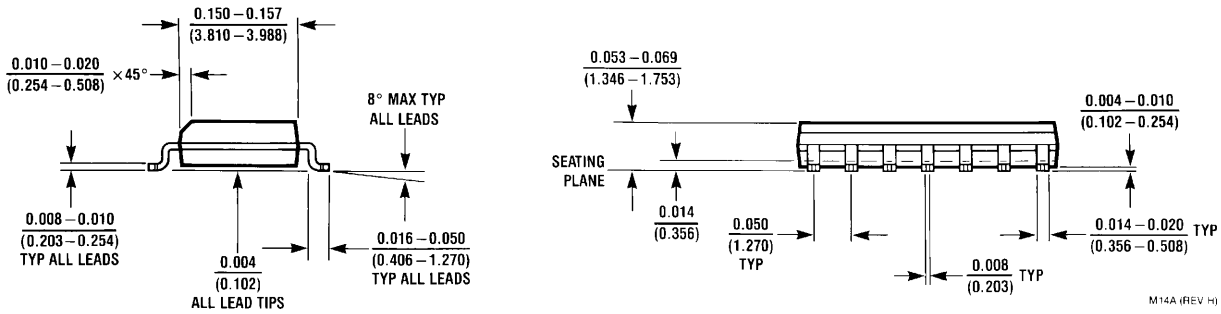
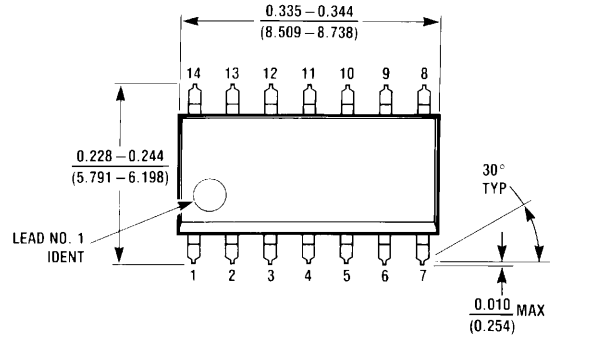
Logic Inputs

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.

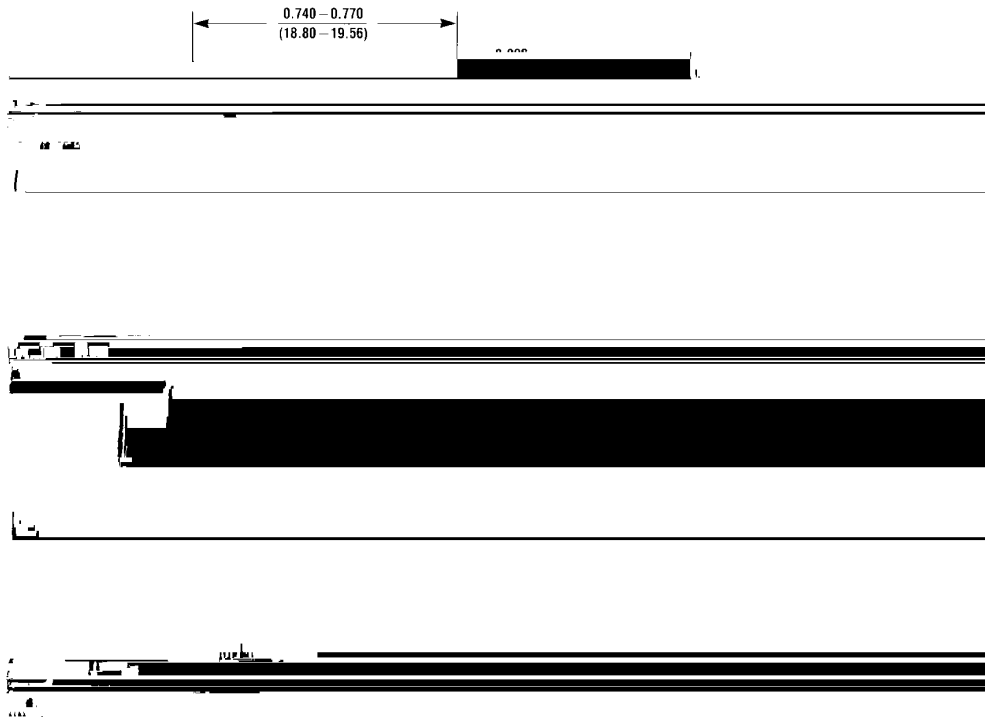
Input/output pins 9, 11, 10, and 12 are all CMOS logic compatible. In addition, pins 9, 11, and 12 are TTL compatible. Pin 10 is not guaranteed to drive a TTL load.

Pins 1, 4, 6 and 13 have no internal connections and can be grounded.

Physical Dimensions inches (millimeters) unless otherwise noted



14-Lead Small Outline Circuit (M)
Order Number LM1815M
NS Package Number M14A



Molded Dual-In-Line Package (N)
Order Number LM1815N
NS Package Number N14A

Notes

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