

LM710 Voltage Comparator

General Description

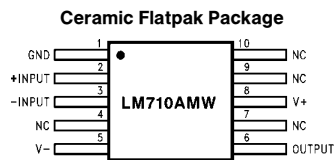
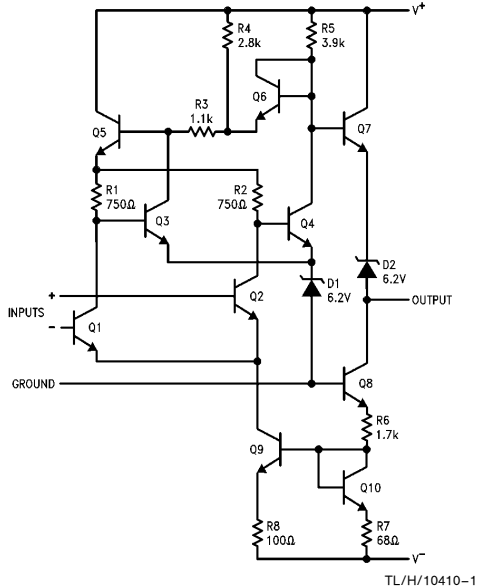
The LM710 series are high-speed voltage comparators intended for use as an accurate, low-level digital level sensor or as a replacement for operational amplifiers in comparator applications where speed is of prime importance. The circuit has a differential input and a single-ended output, with saturated output levels compatible with practically all types of integrated logic.

The device is built on a single silicon chip which insures low offset and thermal drift. The use of a minimum number of stages along with minority-carrier lifetime control (gold doping) makes the circuit much faster than operational amplifiers in saturating comparator applications. In fact, the low

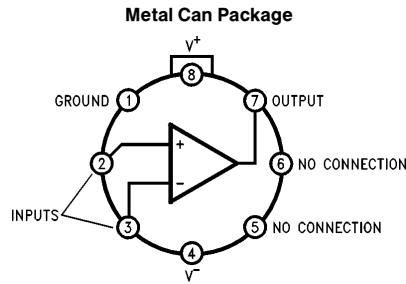
stray and wiring capacitances that can be realized with monolithic construction make the device difficult to duplicate with discrete components operating at equivalent power levels.

The LM710 series are useful as pulse height discriminators, voltage comparators in high-speed A/D converters or go, no-go detectors in automatic test equipment. They also have applications in digital systems as an adjustable-threshold line receiver or an interface between logic types. In addition, the low cost of the units suggests them for applications replacing relatively simple discrete component circuitry.

Schematic and Connection Diagrams

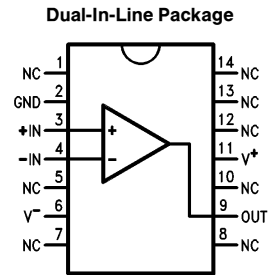


Order Number LM710AMW/883*
See NS Package Number W10A



Note: Pin 4 is connected to case.

**Order Number LM710AMH/883*, LM710H,
LM710H/883 or LM710CH**
See NS Package Number H08C



**Order Number
LM710AMJ/883* or LM710CN**
See NS Package Number N14A or J14A

*Also available per JM38510/10301

Absolute Maximum Ratings

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

| | |
|-------------------------------|------------|
| Positive Supply Voltage | +14V |
| Negative Supply Voltage | -7V |
| Peak Output Current | 10 mA |
| Output Short Circuit Duration | 10 seconds |
| Differential Input Voltage | ±5V |
| Input Voltage | ±7V |

| | |
|---------------------------------------|-----------------|
| Power Dissipation | |
| TO-99 (Note 1) | 700 mW |
| Plastic Dual-In-Line Package (Note 2) | 950 mW |
| Operating Temperature Range | |
| LM710 | -55°C to +125°C |
| LM710C | 0°C to +70°C |
| Storage Temperature Range | -65°C to +150°C |
| Lead Temperature (Soldering, 10 sec.) | 260°C |

Electrical Characteristics (Note 3)

| Parameter | Conditions | LM710 | | | LM710C | | | Units |
|---|---|------------|-------------|------------|--------|----------|------------|----------------------------------|
| | | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage | $R_S \leq 200\Omega$, $V_{CM} = 0V$, $T_A = 25^\circ C$ | | 0.6 | 2.0 | | 1.6 | 5.0 | mV |
| Input Offset Current | $V_{OUT} = 1.4V$, $T_A = 25^\circ C$ | | 0.75 | 3.0 | | 1.8 | 5.0 | μA |
| Input Bias Current | $T_A = 25^\circ C$ | | 13 | 20 | | 16 | 25 | μA |
| Voltage Gain | $T_A = 25^\circ C$ | 1250 | 1700 | | 1000 | 1500 | | |
| Output Resistance | $T_A = 25^\circ C$ | | 200 | | | 200 | | Ω |
| Output Sink Current | $V_{OUT} = 0$, $T_A = 25^\circ C$ $\Delta V_{IN} \geq 5 mV$ $\Delta V_{IN} \geq 10 mV$ | 2.0 | 2.5 | | 1.6 | 2.5 | | μA mA |
| Response Time | $T_A = 25^\circ C$ (Note 4) | | 40 | | | 40 | | ns |
| Input Offset Voltage | $R_S \leq 200\Omega$, $V_{CM} = 0V$ | | | 3.0 | | | 6.5 | mV |
| Average Temperature Coefficient of Input Offset Voltage | $T_{MIN} \leq T_A \leq T_{MAX}$ $R_S \leq 50\Omega$ | | 3.0 | 10 | | 5.0 | 20 | $\mu V/^\circ C$ |
| Input Offset Current | $T_A = T_{A MAX}$ $T_A = T_{A MIN}$ | | 0.25 1.8 | 3.0 7.0 | | | 7.5 7.5 | μA μA |
| Average Temperature Coefficient of Input Offset Current | $25^\circ C \leq T_A \leq T_{MAX}$ $T_{MIN} \leq T_A \leq 25^\circ C$ | | 5.0 15 | 25 75 | | 15 24 | 50 100 | nA/ $^\circ C$ nA/ $^\circ C$ |
| Input Bias Current | $T_A = T_{MIN}$ | | 27 | 45 | | 25 | 40 | μA |
| Input Voltage Range | $V^- = -7V$ | ±5.0 | | | ±5.0 | | | V |
| Common-Mode Rejection Ratio | $R_S \leq 200\Omega$ | 80 | 100 | | 70 | 98 | | dB |
| Differential Input Voltage Range | | ±5.0 | | | ±5.0 | | | V |
| Voltage Gain | | 1000 | | | 800 | | | V/V |
| Positive Output Level | $-5 mA \leq I_{OUT} \leq 0$ $V_{IN} \geq 5 mV$ $V_{IN} \geq 10 mV$ | 2.5 | 3.2 | 4.0 | 2.5 | 3.2 | 4.0 | V V |
| Negative Output Level | $V_{IN} \geq 5 mV$ $V_{IN} \geq 10 mV$ | -1.0 | -0.5 | 0 | -1.0 | -0.5 | 0 | V V |
| Output Sink Current | $V_{IN} \geq 5 mV$, $V_{OUT} = 0$ $T_A = 125^\circ C$ $T_A = -55^\circ C$ | 0.5 1.0 | 1.7 2.3 | | | | | μA mA |
| | $V_{IN} \geq 10 mV$, $V_{OUT} = 0$ $0^\circ C \leq T_A \leq +70^\circ C$ | | | | 0.5 | | | μA |

Electrical Characteristics (Note 3) (Continued)

| Parameter | Conditions | LM710 | | | LM710C | | | Units |
|-------------------------|-----------------------------|-------|-----|-----|--------|-----|-----|-------|
| | | Min | Typ | Max | Min | Typ | Max | |
| Positive Supply Current | $V_{IN} \geq 5 \text{ mV}$ | | 5.2 | 9.0 | | | | mA |
| | $V_{IN} \geq 10 \text{ mV}$ | | | | | 5.2 | 9.0 | mA |
| Negative Supply Current | $V_{IN} \geq 5 \text{ mV}$ | | 4.6 | 7.0 | | | | mA |
| | $V_{IN} \geq 10 \text{ mV}$ | | | | | 4.6 | 7.0 | mA |
| Power Consumption | $I_{OUT} = 0$ | | | | | | | mW |
| | $V_{IN} \geq 5 \text{ mV}$ | | 90 | 150 | | | | mW |
| | $V_{IN} \geq 10 \text{ mV}$ | | | | | | 150 | mW |

Note 1: Rating applies for ambient temperatures of 25°C; derate linearly at 5.6 mW/°C for ambient temperatures above 25°C.

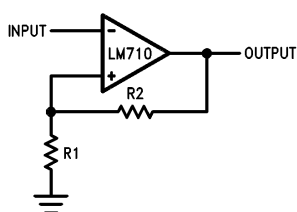
Note 2: Derate linearly at 9.5 mW/°C for ambient temperatures above 25°C.

Note 3: These specifications apply for $V^+ = 12\text{V}$, $V^- = -6\text{V}$, $-55^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$ for LM710 and $0^\circ\text{C} \leq T_A \leq +70^\circ\text{C}$ for LM710C unless otherwise specified: The input offset voltage and input offset current (see definitions) are specified for a logic threshold voltage of 1.8V at -55°C , 1.4V at 25°C , and 1V at 125°C for LM710 and 1.5V at 0°C , 1.4V at 25°C , and 1.2V at 70°C for LM710C.

Note 4: The response time specified (see definitions) is for a 100 mV input step with 5 mV overdrive (LM710) or a 10 mV overdrive (LM710C).

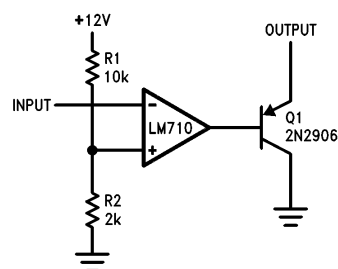
Typical Applications

Schmitt Trigger



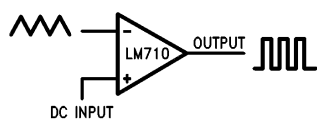
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Line Receive with Increased Output Sink Current



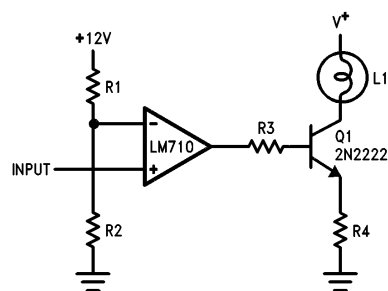
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Pulse Width Modulator



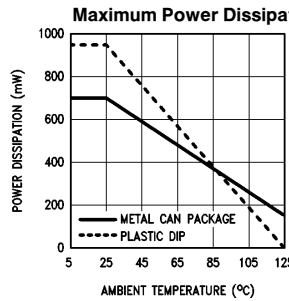
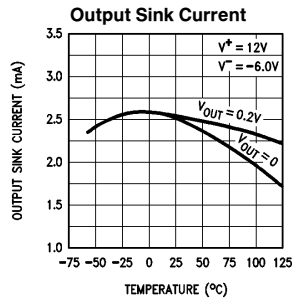
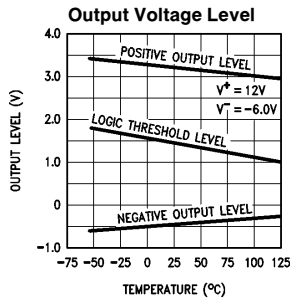
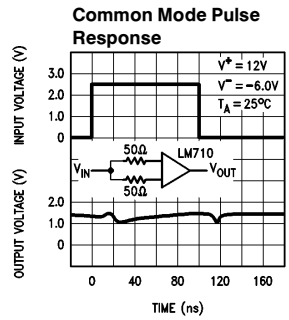
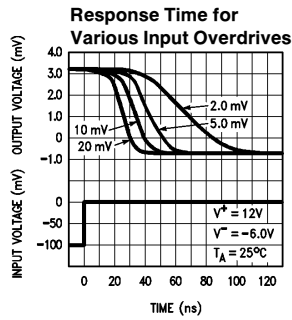
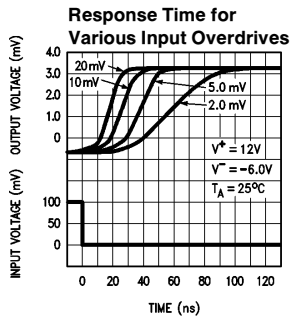
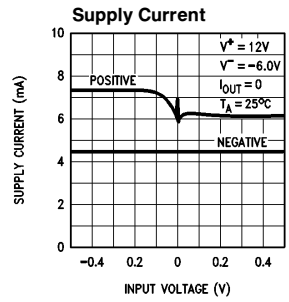
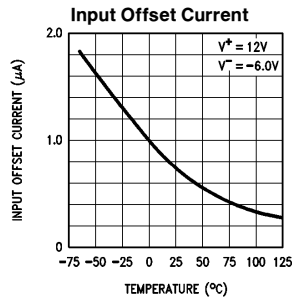
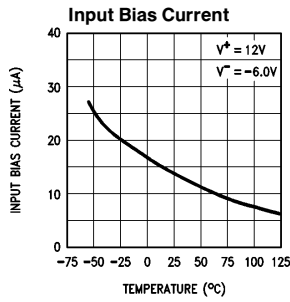
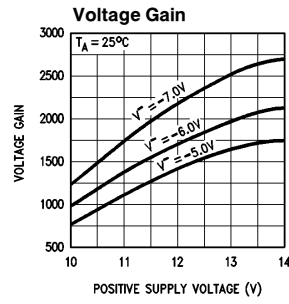
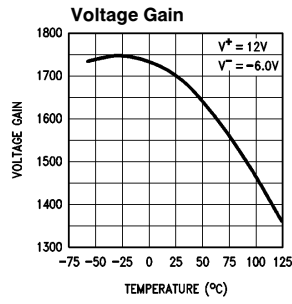
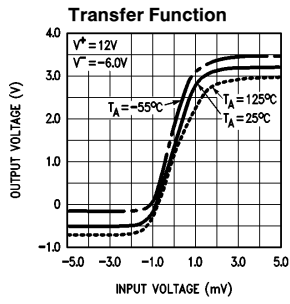
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Level Detector with Lamp Driver

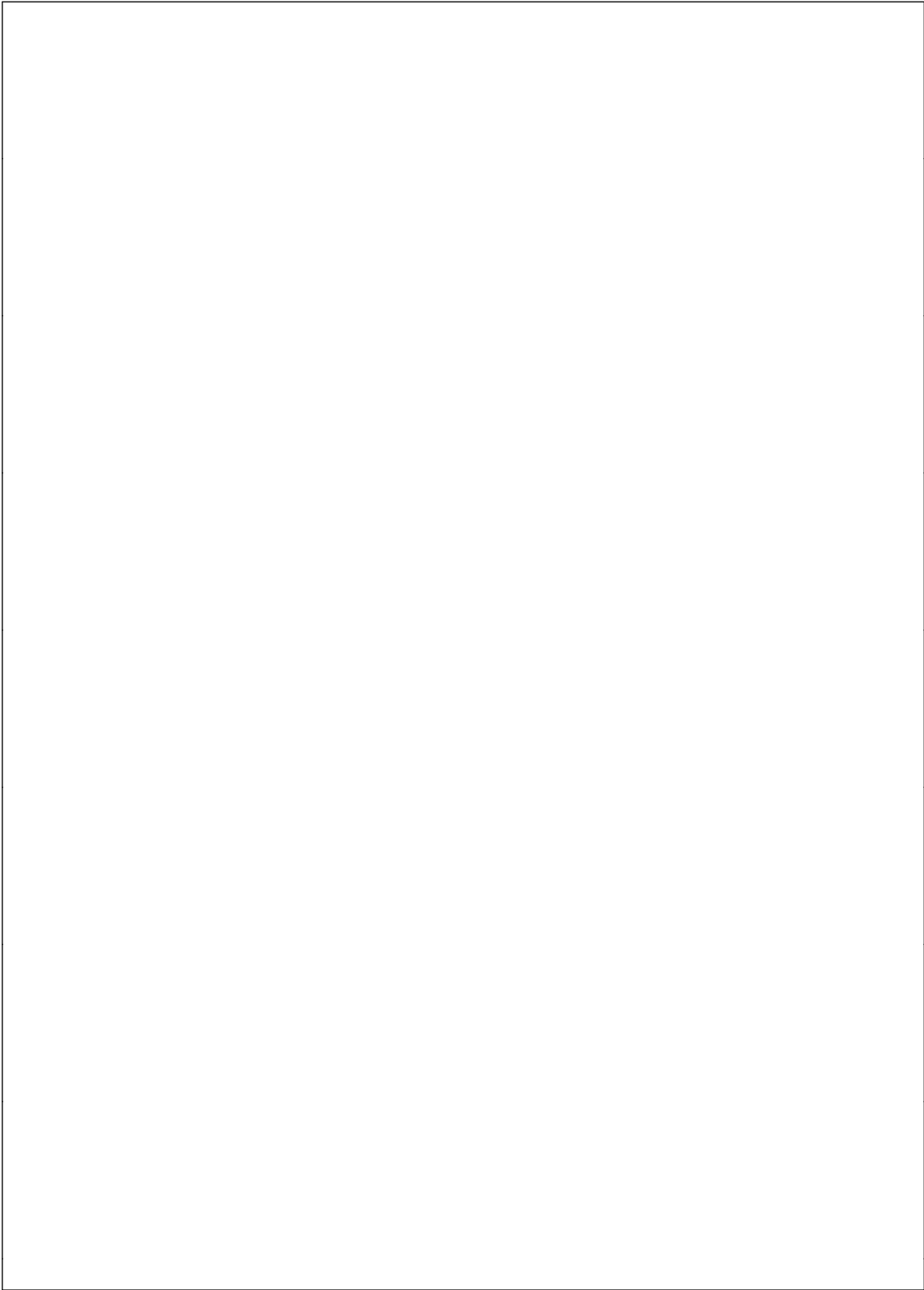


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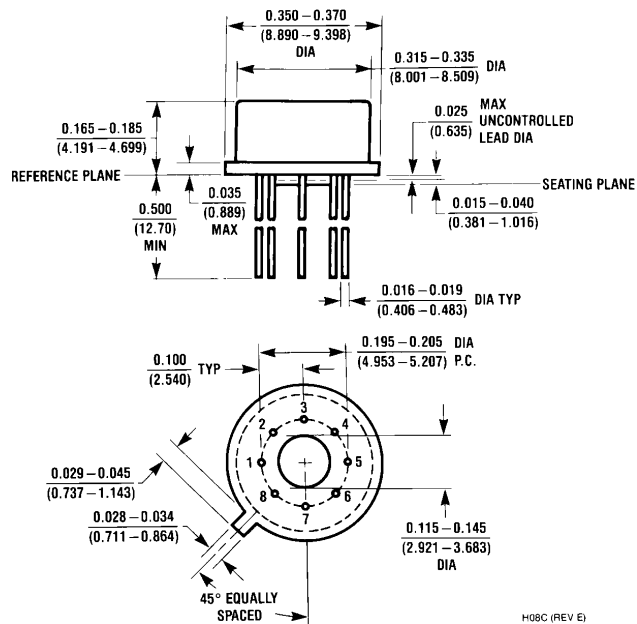
Typical Performance Characteristics



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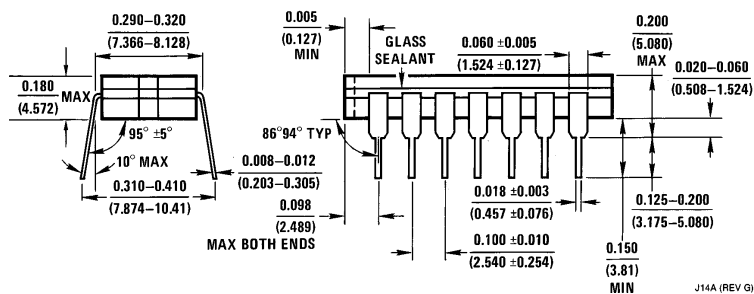
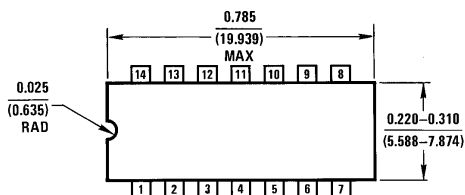


Physical Dimensions inches (millimeters)



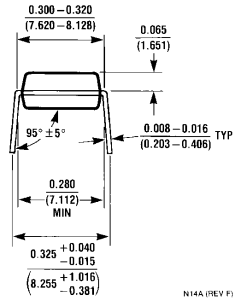
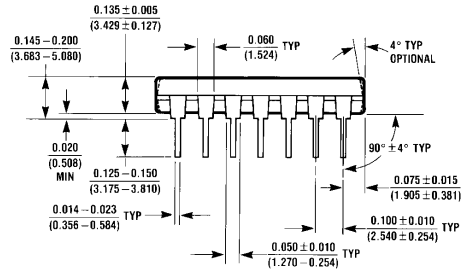
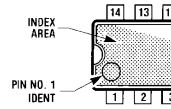
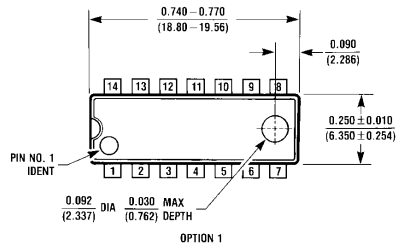
Metal Can Package

Order Number LM710AMH/883, LM710H, LM710H/883 or LM710CH
NS Package Number H08C



Ceramic Dual-In-Line Package
Order Number LM710AMJ/883
NS Package Number J14A

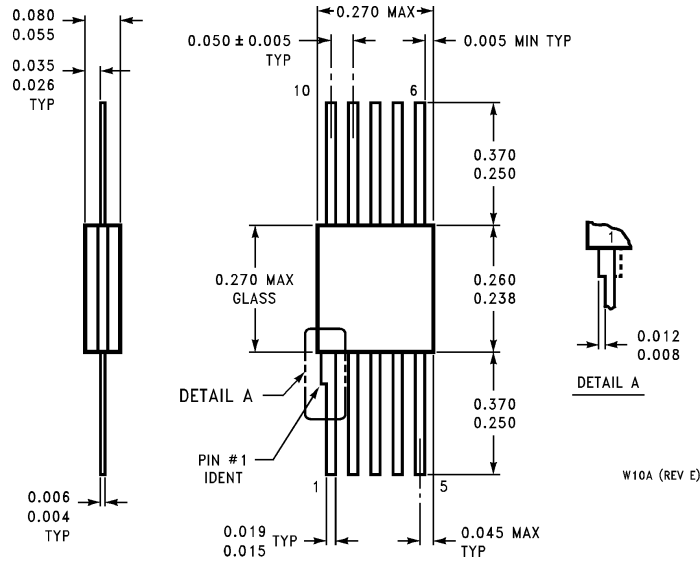
Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number LM710CN
NS Package Number N14A

N14A (REV F)

Physical Dimensions inches (millimeters) (Continued)



Ceramic Flatpak
Order Number LM710AMW/883
NS Package Number W10A

W10A (REV E)

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