

Absolute Maximum Ratings (Note 1)

| | |
|---------------------------------------|------------------------|
| Supply Voltage | -0.5V to 3.6V |
| Input Voltage (all inputs) | -0.3V to $V_{CC}+0.3V$ |
| Storage Temperature Range | -65°C to +150°C |
| Junction Temperature | +150°C |
| Lead Temperature (Soldering 4 Sec) | +260°C |
| Package Thermal Resistance | |
| θ_{JA} 16-pin SOIC | +115°C/W |
| θ_{JC} 16-pin SOIC | +105°C/W |
| ESD Rating (HBM) | 8kV |
| ESD Rating (MM) | 250V |

Recommended Operating Conditions

| | |
|--|----------------|
| Supply Voltage ($V_{CC} - V_{EE}$) | 3.3V \pm 5% |
| Input Coupling Capacitance | 1.0 μ F |
| AEC Capacitor (Connected between AEC+ and AEC-) | 1.0 μ F |
| Operating Free Air Temperature (T_A) | -40°C to +85°C |

DC Electrical Characteristics

Over Supply Voltage and Operating Temperature ranges, unless otherwise specified (Notes 2, 3).

| Symbol | Parameter | Conditions | Reference | Min | Typ | Max | Units |
|-------------|----------------------------|--------------------------------|-----------------------|-----|----------------------|-----|-------------------|
| V_{CMIN} | Input Common Mode Voltage | | SDI, \overline{SDI} | | 1.9 | | V |
| V_{SDI} | Input Voltage Swing | At LMH0024 input, (Notes 4, 6) | | 720 | 800 | 950 | mV _{P-P} |
| V_{CMOUT} | Output Common Mode Voltage | | SDO, \overline{SDO} | | $V_{CC} - V_{SDO}/2$ | | V |
| V_{SDO} | Output Voltage Swing | 50 Ω load, differential | | | 750 | | mV _{P-P} |
| | CLI DC Voltage | 0m cable | CLI | | 2.5 | | V |
| | | no signal | | | 1.2 | | V |
| | MUTE Input Voltage | Min to mute outputs | MUTE | 3.0 | | | V |
| | | Max to force outputs active | | | | 2.0 | V |
| I_{CC} | Supply Current | (Note 7) | | | 60 | 77 | mA |

AC Electrical Characteristics

Over Supply Voltage and Operating Temperature ranges, unless otherwise specified (Note 3).

| Symbol | Parameter | Conditions | Reference | Min | Typ | Max | Units |
|------------|--|---|-----------------------|-----|-------|-----|-----------|
| BR_{SDI} | Input Data Rate | | SDI, \overline{SDI} | 143 | | 540 | Mbps |
| | Maximum Equalized Cable Length (with equalizer pathological) | 270 Mbps, Belden 1694A, 0.2UI output jitter, (Note 4) | | | 350 | | m |
| | | 270 Mbps, Belden 8281, 0.2UI output jitter, (Note 4) | | | 280 | | m |
| | | 540 Mbps, Belden 1694A, 0.2UI output jitter, (Note 4) | | | 250 | | m |
| | | 540 Mbps, Belden 8281, 0.2UI output jitter, (Note 4) | | | 180 | | m |
| t_r, t_f | Output Rise Time, Fall Time | 20% – 80%, (Note 4) | SDO, \overline{SDO} | | 100 | 220 | ps |
| | Mismatch in Rise/Fall Time | (Note 4) | | | 2 | 15 | ps |
| t_{OS} | Output Overshoot | (Note 4) | | | 1 | 5 | % |
| R_{OUT} | Output Resistance | single-ended, (Note 5) | | | 50 | | Ω |
| RL_{IN} | Input Return Loss | (Note 8) | SDI, \overline{SDI} | 15 | 18-20 | | dB |
| R_{IN} | Input Resistance | single-ended | | | 1.3 | | $k\Omega$ |
| C_{IN} | Input Capacitance | single-ended, (Note 5) | | | 1 | | pF |

Note 1: "Absolute Maximum Ratings" are those parameter values beyond which the life and operation of the device cannot be guaranteed. The stating herein of these maximums shall not be construed to imply that the device can or should be operated at or beyond these values. The table of "Electrical Characteristics" specifies acceptable device operating conditions.

Note 2: Current flow into device pins is defined as positive. Current flow out of device pins is defined as negative. All voltages are stated referenced to $V_{EE} = 0$ Volts.

Note 3: Typical values are stated for $V_{CC} = +3.3V$ and $T_A = +25^\circ C$.

Note 4: Specification is guaranteed by characterization.

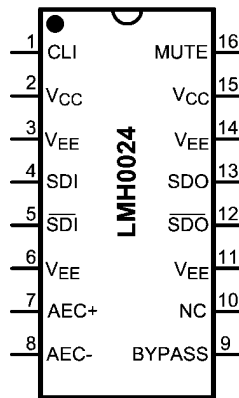
Note 5: Specification is guaranteed by design.

Note 6: The maximum input voltage swing assumes a nonstressing, DC-balance signal; specifically, the SMPTE-recommended color bar test signal. Pathological or other stressing signals may not be used. This specification is for 0m cable only.

Note 7: Supply current depends on the amount of cable being equalized. The current is highest for short cable and decreases as the cable length is increased. Refer to *Figure 1*.

Note 8: Input return loss is dependent on board design. The LMH0024 meets this specification on the SD024 evaluation board from 5MHz to 1.5GHz.

Connection Diagram

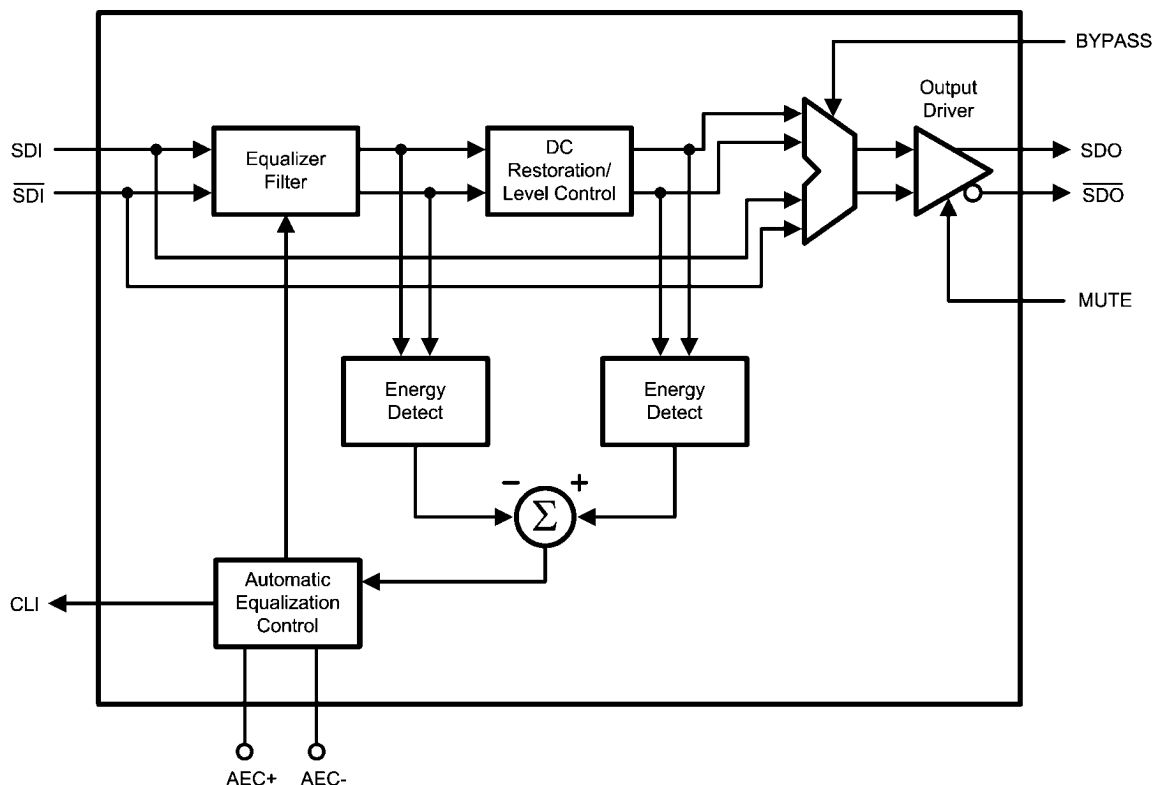


20172503
16-Pin SOIC
Order Number LMH0024MA
See NS Package Number M16A

Pin Descriptions

| Pin # | Name | Description |
|-------|-------------------------|---|
| 1 | CLI | Cable length indicator. Provides a voltage inversely proportional to the cable length being equalized. |
| 2 | V _{CC} | Positive power supply (+3.3V). |
| 3 | V _{EE} | Negative power supply (ground). |
| 4 | SDI | Serial data true input. |
| 5 | $\overline{\text{SDI}}$ | Serial data complement input. |
| 6 | V _{EE} | Negative power supply (ground). |
| 7 | AEC+ | AEC loop filter external capacitor (1 μ F) positive connection. |
| 8 | AEC- | AEC loop filter external capacitor (1 μ F) negative connection. |
| 9 | BYPASS | Bypasses equalization and DC restoration when high. No equalization occurs in this mode. |
| 10 | NC | No connect. |
| 11 | V _{EE} | Negative power supply (ground). |
| 12 | $\overline{\text{SDO}}$ | Serial data complement output. |
| 13 | SDO | Serial data true output. |
| 14 | V _{EE} | Negative power supply (ground). |
| 15 | V _{CC} | Positive power supply (+3.3V). |
| 16 | MUTE | Output mute. To force SDO and $\overline{\text{SDO}}$ to mute, tie to V _{CC} . To disable MUTE, tie to GND. Typical application is MUTE tied to GND to enable the outputs. MUTE must be tied either high or low; it may not be left unconnected. |

Block Diagram



20172502

Device Operation

BLOCK DESCRIPTION

The **Equalizer Filter** block is a multi-stage adaptive filter. If Bypass is high, the equalizer filter is disabled.

The **DC Restoration / Level Control** block receives the differential signals from the equalizer filter block. This block incorporates a self-biasing DC restoration circuit to fully DC restore the signals. If Bypass is high, this function is disabled.

The signals before and after the DC Restoration / Level Control block are used to generate the **Automatic Equalization Control (AEC)** signal. This control signal sets the gain and bandwidth of the equalizer filter. The loop response in the AEC block is controlled by an external $1\mu\text{F}$ capacitor placed across the AEC+ and AEC- pins. **Cable Length Indicator (CLI)** is derived from this block.

The **Output Driver** produces SDO and $\overline{\text{SDO}}$. SDO and $\overline{\text{SDO}}$ may be forced to mute by activating **MUTE**.

CABLE LENGTH INDICATOR (CLI)

The cable length indicator provides a voltage to indicate the length of cable being equalized. The CLI voltage decreases as the cable length increases.

MUTE

MUTE can be used to manually mute or enable the LMH0024 outputs. MUTE must be tied to a low-level input or ground for SDO and $\overline{\text{SDO}}$ to be active. Applying a high input to MUTE will mute the LMH0024 outputs.

INPUT INTERFACING

The LMH0024 accepts either differential or single-ended input. The input must be AC coupled. Transformer coupling is not supported.

The LMH0024 correctly handles equalizer pathological signals for standard definition serial digital video, as described in SMPTE RP 178.

OUTPUT INTERFACING

The SDO and $\overline{\text{SDO}}$ outputs are internally loaded with 50Ω . They produce a $750\text{ mV}_{\text{P-P}}$ differential output, or a $375\text{ mV}_{\text{P-P}}$ single-ended output.

Application Information

PCB LAYOUT RECOMMENDATIONS

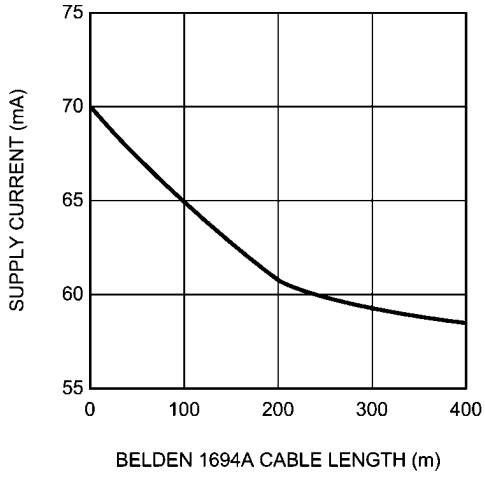
Please refer to the following Application Note for the CLC034 on National's website: **AN-1372, "LMH0034 PCB Layout Techniques."** The PCB layout techniques in this application note apply to the LMH0024 as well.

REPLACING THE GENNUM GS9064

The LMH0024 is footprint compatible with the Gennum GS9064. Pin 16 (MUTE) of the LMH0024 must be connect to ground for correct operation.

SUPPLY CURRENT VS. CABLE LENGTH

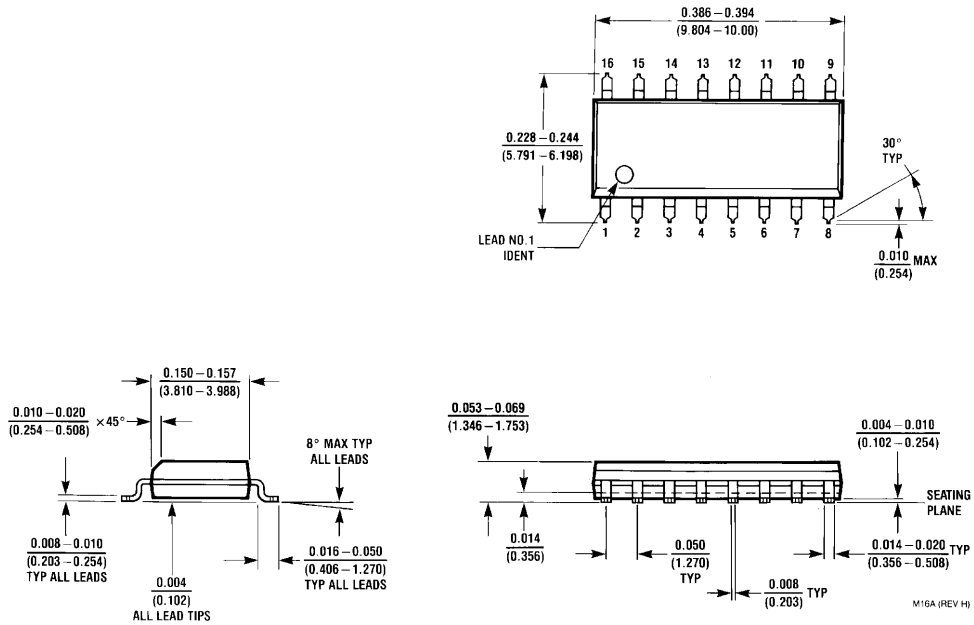
The supply current (I_{CC}) depends on the amount of cable being equalized. The current is highest for short cable and decreases as the cable length is increased. *Figure 1* shows supply current vs. Belden 1694A cable length for 270 Mbps data.



20172515

FIGURE 1. Supply Current vs. Belden 1694A Cable Length, 270 Mbps

Physical Dimensions inches (millimeters) unless otherwise noted



16-Pin SOIC
Order Number LMH0024MA
NS Package Number M16A

Notes

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