Application Report
SNLA283–September 2017

3G-SDI Cable Equalizer Compatibility Guide – TI / Semtech

ABSTRACT

To facilitate design with TI's 3G-SDI portfolio, this guide provides a detailed description about cable equalizer devices that are drop-in compatible and functional equivalent replacements for similar Semtech cable equalizers. In addition, this guide provides details about 3G-SDI cable equalizer part selection for new designs to enable improved performance and an easy future upgrade path from 3G to 12G.

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Trademarks

1 Introduction

TI offers a diverse 3G-SDI portfolio that includes cable equalizers, reclockers, and cable drivers. Many of these 3G-SDI devices are pin-compatible or functional equivalent replacement options with devices offered by other SDI IC vendors. This guide serves as a pin-by-pin reference with a detailed comparison of TI's 3G cable equalizers and similar cable equalizer devices offered by Semtech.

2 Cable Equalizer Compatibility Overview

These TI devices are pin-compatible with the following Semtech cable equalizers:

TI CABLE EQ	PIN-COMPATIBLE WITH...	DEVICE DETAILS
LMH0384 LMH0344	GS2964, GS2974A, GS2984, GS2994, GS3440	Single Output EQ 16-Pin QFN 4 mm × 4 mm
LMH0394	GS2994, GS3440	Single Output EQ 16-Pin QFN 4 mm × 4 mm

The TI device below is functionally equivalent, but not pin-compatible, with the following Semtech cable equalizers:

TI CABLE EQ	FUNCTIONALLY COMPATIBLE WITH...	DEVICE DETAILS
LMH0395	GS2993, GS3441	Dual Output EQ 24-Pin QFN 4 mm × 4 mm

3 LMH0384, LMH0344 Pin Compatibility With GS2964, GS2974A, GS2984

3.1 Key Schematic Differences

Figure 1 highlights key schematic differences between TI and Semtech drop-in compatible solutions in **blue**. For a detailed comparison of device pin functionality, refer to Section 3.2.

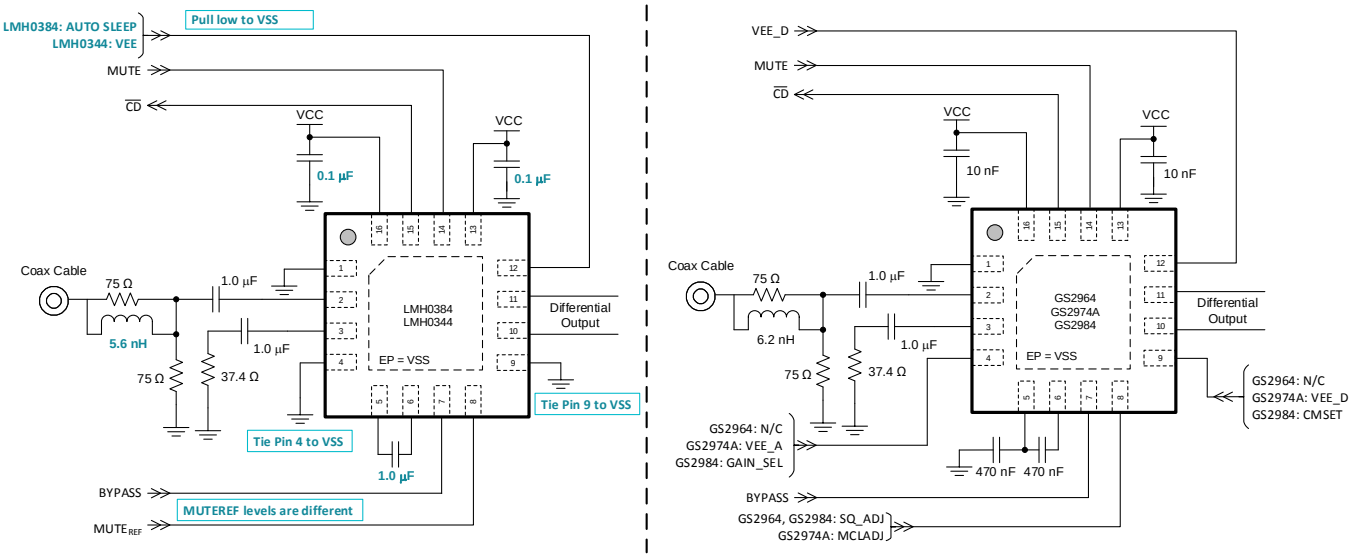

Figure 1. LMH0384, LMH0344 Pin Compatibility With GS2964, GS2974A, GS2984

3.2 Pin-By-Pin Comparison

PIN NO.	LMH0384[1] LMH0344	GS2964 GS2974A GS2984	FUNCTIONAL DIFFERENCES AND NOTES
1, DAP	V_{EE}	VEE_A	None
2, 3	SDI, $\overline{SDI}$	SDI, $\overline{SDI}$	None
4	LMH0384: SPI_EN LMH0344: V_{EE}	GS2964: N/C GS2974A: VEE_A GS2984: GAIN_SEL	LMH0384: Pull to V_{EE} for compatibility. Ensure launch amplitude before LMH0384 is 800 mVpp to comply with SMPTE standards. GS2984: 6-dB flat attenuation compensation. Tie to VEE when interfacing with SMPTE compliant launch amplitude of 800 mVpp.
5, 6	AEC+, AEC–	AGC, $\overline{AGC}$	LMH0384/44: 1-µF integration cap required GS2964/74A/84: 2 × 470-nF capacitors required
7	BYPASS	BYPASS	LMH0344: External pulldown required to disable bypass function.
8	$MUTE_{REF}$	GS2964/84: SQ_ADJ GS2974A: MCLADJ	LMH0384/44: Leave as no connect for maximum cable reach. See LMH0384/LMH0344 data sheet for specific threshold levels.
9	V_{EE}	GS2964: N/C GS2974A: VEE_D GS2984: CMSET	GS2984: CMSET sets the common mode logic level to 3.3 V (tie high) or 2.5 V (tie low). For interface flexibility, a 4.7-µF, AC-coupling cap can be used, with CMSET tied low.
10, 11	$\overline{SDO}$, SDO	$\overline{SDO}$, SDO	None
12	LMH0384: AUTO SLEEP LMH0344: V_{EE}	VEE_D	LMH0384: Automatic Power Down in case of carrier loss. For compatibility, pull this pin low to disable automatic power down.
13	V_{CC}	VCC_D	None. 3.3-V Supply
14	MUTE	MUTE	None
15	$\overline{CD}$	$\overline{CD}$	None
16	V_{CC}	VCC_A	None. 3.3-V Supply

(1) LMH0384 pin descriptions in this table are shown for Pin Mode only. Although the TI LMH0384 also supports a programmable SPI Mode, the Semtech GS2964/GS2974A/GS2984 only supports Pin Mode operation.

3.3 External Component Differences

To replace the GS2964/GS2974A/GS2984, the following external component changes should be observed regarding the LMH0384/LMH0344:

COMPONENT(S)	CHANGE FROM...	CHANGE TO...
$MUTE_{REF}$ Resistor Network	Leave as no connect for maximum cable reach. See LMH0384/LMH0344 data sheet for specific threshold levels.	
External Integration Capacitor	2 × 470 nF	1 µF
Return Loss Inductor	6.2 nH	5.6 nH

4 LMH0394, LMH0384, LMH0344 Pin Compatibility With GS2994, GS3440

- When only a 3.3-V power supply is available, TI recommends the LMH0384 or LMH0344. Alternatively, the LMH0394 can be used with a TLV117125DCYR (2.5-V LDO) to provide the 2.5-V supply.
- When a 2.5-V power supply is available, TI recommends the LMH0394. Using a 2.5-V power supply significantly reduces the power dissipation compared with the GS2994 and GS3440.

4.1 Key Schematic Differences

Figure 2 and Figure 3 highlight key schematic differences between TI and Semtech drop-in compatible solutions in **blue**. For a detailed comparison of device pin functionality, refer to Section 4.2.

4.1.1 LMH0394 vs. GS2994, GS3440

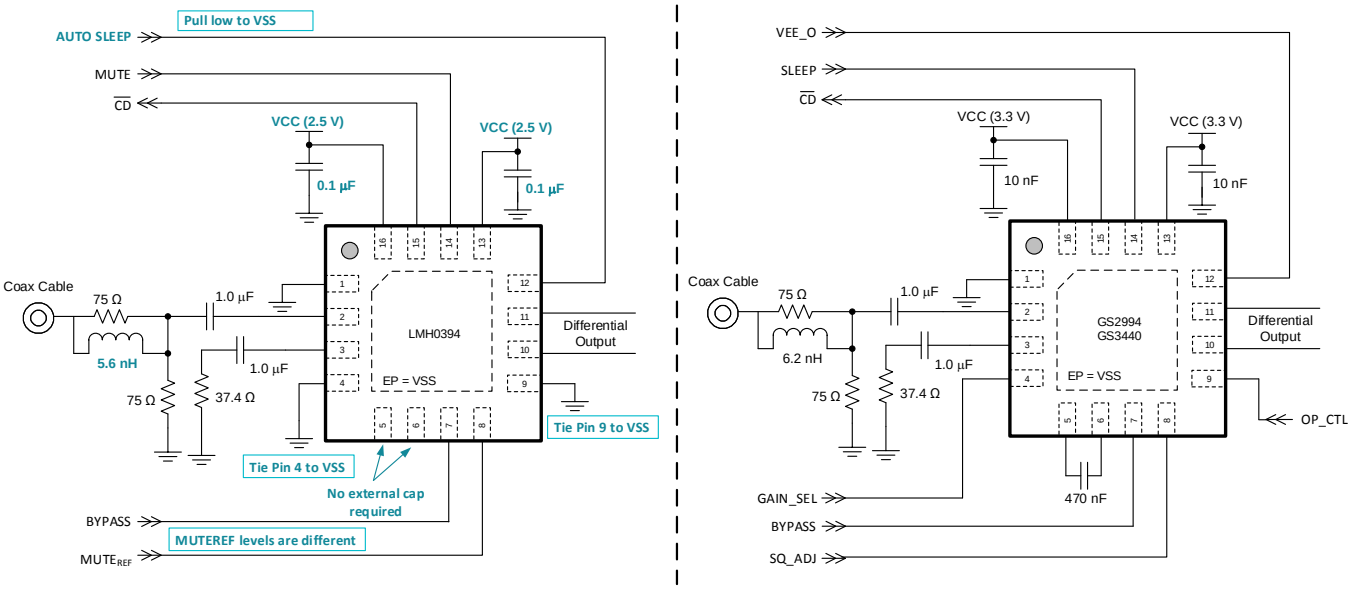

Figure 2. LMH0394 Pin Compatibility With GS2994, GS3440

4.1.2 LMH0384, LMH0344 vs. GS2994, GS3440

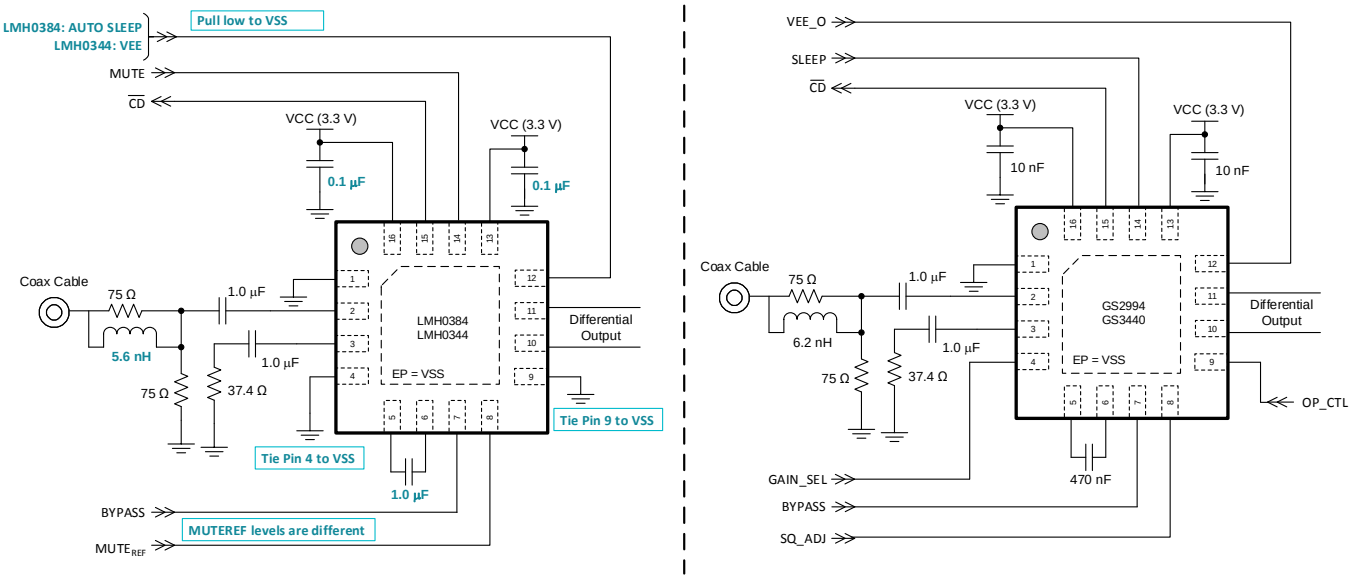

Figure 3. LMH0384, LMH0344 Pin Compatibility With GS2994, GS3440

4.2 Pin-by-Pin Comparison

PIN NO.	LMH0394[1] LMH0384[1] LMH0344	GS2994 GS3440	FUNCTIONAL DIFFERENCES AND NOTES
1, DAP	V_{EE}	VEE_A	None
2, 3	SDI, $\overline{SDI}$	SDI, $\overline{SDI}$	None
4	LMH0394/84: SPI_EN LMH0344: V_{EE}	GAIN_SEL	LMH0394/84: Pull to VEE for compatibility. Ensure launch amplitude before LMH0394/84 is 800 mVpp to comply with SMPTE standards. GS2994/3440: 6-dB flat attenuation compensation. Tie to VEE when interfacing with SMPTE compliant launch amplitude of 800 mVpp.
5, 6	AEC+, AEC–	AGC, $\overline{AGC}$	LMH0394: Optional 1-µF integration capacitor (not required) LMH0384/44: 1-µF integration cap required GS2294/3440: 470-nF cap required.
7	BYPASS	BYPASS	LMH0344: External pulldown required to disable bypass function.
8	$MUTE_{REF}$	SQ_ADJ	LMH0394/84/44: Leave as no connect for maximum cable reach. See LMH0394/LMH0384/LMH0344 data sheet for specific threshold levels.
9	V_{EE}	OP_CTL	GS2994/3440: OP_CTL sets the output swing and de-emphasis settings. Tie low VEE to output 800 mVpp with no de-emphasis.
10, 11	$\overline{SDO}$, SDO	$\overline{DDO}$, DDO	None
12	LMH0394/84: AUTO SLEEP LMH0344: V_{EE}	VEE_O	LMH0394/84: Automatic Power Down in case of carrier loss. For compatibility, pull this pin low to disable automatic power down
13	V_{CC}	VCC_O	LMH0394: 2.5-V Supply LMH0384/44 and GS2994/3440: 3.3-V Supply
14	MUTE	SLEEP	None
15	$\overline{CD}$	$\overline{CD}$	None
16	V_{CC}	VCC_A	LMH0394: 2.5-V Supply LMH0384/44 and GS2994/3440: 3.3-V Supply

(1) LMH0394/LMH0384 pin descriptions in this table are shown for Pin Mode only. Although the TI LMH0394/LMH0384 also supports a programmable SPI Mode, the Semtech GS2994/GS3440 only supports Pin Mode operation.

4.3 External Component Differences

To replace the GS2994/GS3440, the following external component changes should be observed regarding the LMH0394/LMH0384/LMH0344:

COMPONENT(S)	CHANGE FROM...	CHANGE TO...
$MUTE_{REF}$ Resistor Network	Leave as no connect for maximum cable reach. See LMH0394/LMH0384/LMH0344 data sheet for specific threshold levels.	
External Integration Capacitor	470 nF	LMH0394: No external cap required. LMH0384/44: 1 µF
Return Loss Inductor	6.2 nH	5.6 nH

5 LMH0395 Functional Equivalent With GS2993, GS3441

While TI does not have a pin-compatible equivalent to Semtech's GS2993 and GS3441 3G-SDI dual output cable equalizers, the LMH0395 can be used as a functional equivalent. The LMH0395 supports dual outputs in either Pin Mode or SPI Mode.

NOTE: The LMH0395 requires a 2.5-V supply compared to a 3.3-V supply for the GS2993 and GS3441. This lower supply voltage results in lower power dissipation.

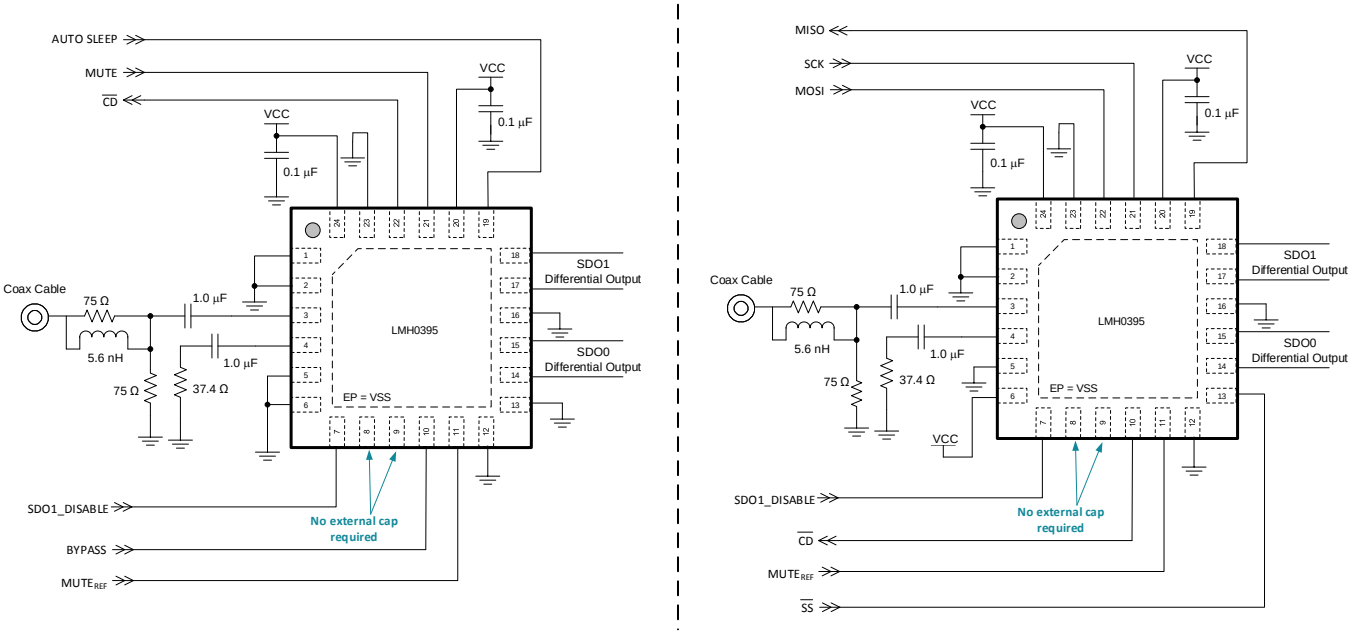

Figure 4. LMH0395 Dual Output Cable EQ Schematic in Pin Mode (Left) and SPI Mode (Right)

Table 1. LMH0395 Performance Comparison vs. GS2993, GS3441

FEATURES	LMH0395	GS2993	GS3441
3G Cable Reach, B1694A (m)	200	140	200
Power Consumption, Typical (mW)	140	165	210
6-dB Splitter Mode (Input Gain)	Yes	Yes	Yes
Cable Length Indicator	Yes	Yes	Yes
Supply Voltage (V)	2.5	3.3	3.3
Pin Control	Yes	Yes	Yes
Software Control (SPI)	Yes	No	No
Operating Temperature Range	–40 to 85ºC	–40 to 85ºC	–40 to 85ºC
Package	24-Pin QFN 4 mm × 4 mm	24-Pin QFN 4 mm × 4 mm	24-Pin QFN 4 mm × 4 mm

6 LMH0324 3G-SDI Cable Equalizer for New Designs

For new 3G-SDI designs in the component-selection phase, TI recommends designing with the LMH0324. Using the LMH0324 enables an easy upgrade path to the LMH1219, a pin-compatible 12G-SDI cable equalizer with integrated reclocker. In addition, the LMH0324 offers lower power dissipation and improved cable reach compared to previous generation 3G-SDI cable equalizers, as shown in Table 2.

Table 2. Belden 1694A Cable Reach Performance Comparison

FEATURES	LMH0324	LMH0395	GS3441
3G Cable Reach, B1694A (m)	**200**	200	200
HD Cable Reach, B1694A (m)	**280**	220	250
SD Cable Reach, B1694A (m)	**600**	400	500

NOTE: The LMH0324 is *not* pin-compatible with the previously mentioned 3G-SDI devices (LMH0344, LMH0384, LMH0394, LMH0395).

Other advantages of the LMH0324 include the following:

- Lowest Power: 78 mW Typical
- Integrated Input and Output Terminations
- Integrated Return Loss Network
- Dual Output PCB Trace Drivers
- SMBus or SPI Control Programmability

For more information, visit the LMH0324 product folder to request access to the full data sheet and other design documents.

7 Summary

TI offers a wide SDI portfolio with pin-compatible alternatives to Semtech 3G-SDI cable equalizer devices. With a few simple component changes to an existing SDI design and board layout, a Semtech 3G-SDI single output cable equalizer can be replaced and improved with TI's pin-compatible 3G-SDI cable equalizers. For Semtech's 3G-SDI dual output cable equalizers, the LMH0395 can be used as a functionally compatible replacement. For new 3G designs that are in the component selection phase, TI recommends the LMH0324 for improved performance and easy upgrade path to 12G.

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