M21328/M21428/M21518/M21528 3G/HD/SD-SDI Cable Driver Performance Comparison & Pin Compatibility

Application Note

Products Affected: M21328, M21428, M21518, M21528, M23428 and MACD-23528

Scope

To compare the performance of MACOM's 3G cable driver to competitors and to facilitate its use as a drop-in compatible replacement option. This application note offers detailed pin-by-pin descriptions for the devices that are pin compatible. Table 5 lists the various options:

Table 1. 3G Cable Driver Competitive Parts

MACOM 3G Cable Driver Part	TI 3G Cable Driver Part	Semtech 3G Cable Driver Part
M21328	LMH0302	GS2978
M21428		
M21518	LMH0303	GS2988
M21528	LMH0307	GS2989

Table 2. M21328 vs. LMH0302 and GS2978 3G Cable Driver Performance Comparison

Parameter	MACOM's M21328	TI's LMH0302	Semtech's GS2978
Power Supply	3.3V	3.3V	3.3V
Power Consumption	144mW	125mW	168mW
Package Size	16-pin, 4 x 4mm MLF	16-pin, 4 x 4mm WQFN	16-pin, 4 x 4mm QFN
Typical Additive Output Jitter @ 3G	20ps	20ps	22ps
Outputs	Single Differential	Single Differential	Single Differential
Pin Compatible	LMH0302/GS2978	M21328/GS2978	M21328/LMH0302
Max. Output Voltage Swing	1600mVpp	880mVpp	1040mVpp
Operating Temperature Range	-10°C to 85°C	-40°C to 85°C	0°C to 70°C

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Table 3. M21428 vs. LMH0303 and GS2988 3G Cable Driver Performance Comparison

Parameter	MACOM's M21428	TI's LMH0303	Semtech's GS2988
Power Supply	2.5V/3.3V	3.3V	2.5V/3.3V
Power Consumption	122mW	155mW	110mW
Package Size	16-pin, 3 x 3mm MLF	16-pin, 4 x 4mm WQFN	16-pin, 4 x 4mm QFN
Typical Additive Output Jitter @ 3G	20ps	20ps	10ps
Max. Rise/Fall Time @ 3G	135ps	130ps	135ps
Max. Input Equalization	-	-	3dB
Output Drivers	Dual	Single	Single
50ohm output driver	No	No	No

Table 4. M21518/M21528 vs. LMH0307 and GS2989 3G Cable Driver Performance Comparison

Parameter	MACOM's M21518	MACOM's M21528	TI's LMH0307	Semtech's GS2989
Power Supply	1.8V/2.5V/3.3V	1.2V/1.8V/2.5V/3.3V	3.3V	2.5V/3.3V
Power Consumption	52mW	40mW	275mW	110mW
Package Size	24-pin, 4 x 4mm QFN	24-pin, 4 x 4mm QFN	16-pin, 4 x 4mm WQFN	16-pin, 4 x 4mm QFN
Typical Additive Output Jitter @ 3G	12ps	12ps	20ps	10ps
Max. Rise/Fall Time @ 3G	90ps	90ps	130ps	135ps
Max. Input Equalization	6dB	6dB	-	3dB
Output Drivers	Single Channel	Dual Channel	Single Channel	Dual Channel
50ohm output driver	Configurable	Configurable	No	No

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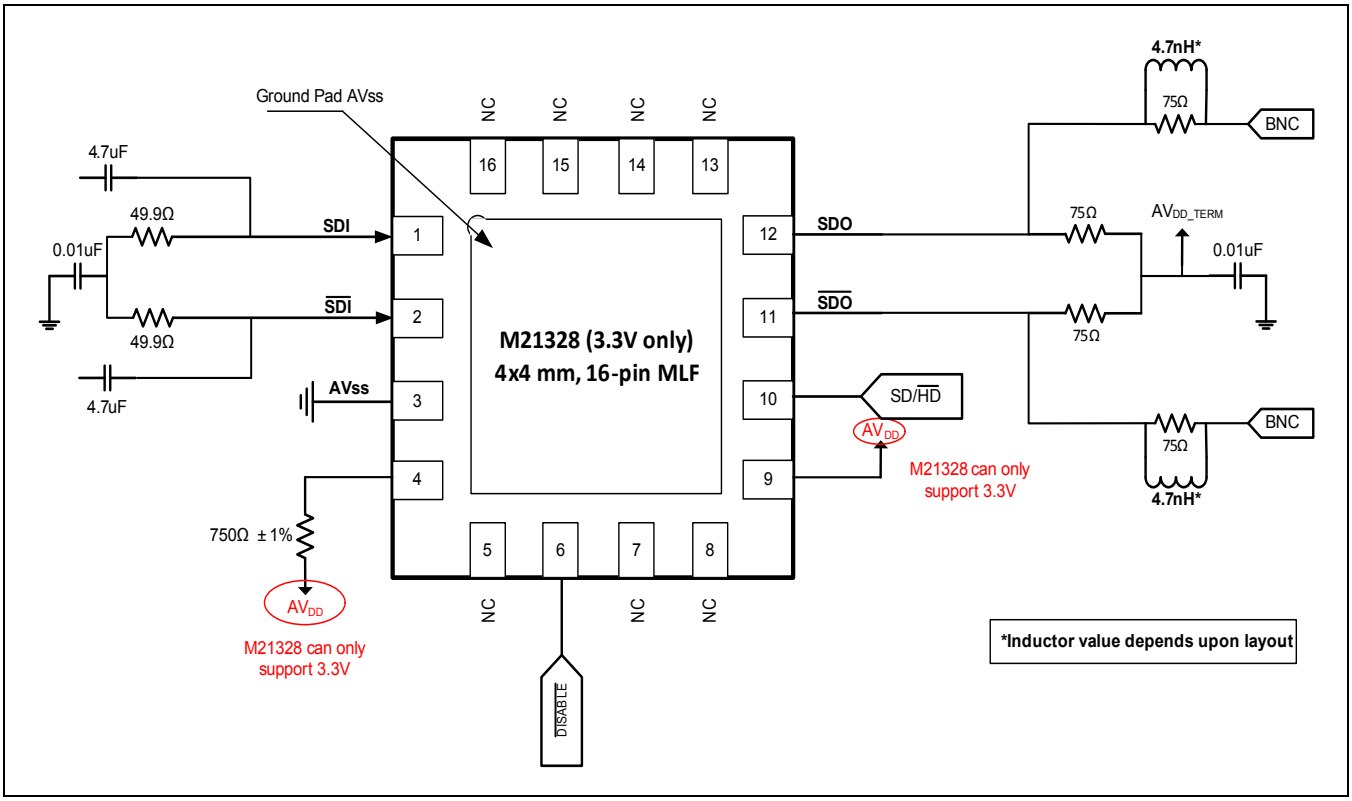
Pin Compatibility

Table 5. 3G Cable Driver Compatibility List

MACOM 3G Cable Driver Part	Pin Compatibility	Description
M21328	GS2978/GS1578A/GS1678/LMH0302/LMH0002SQ	Single Output CD, 16-pin QFN, 4x4 mm
M21428	M23428/MACD-23528	Dual Output, 16-pin QFN, 3x3 mm

M21328 compatible to GS2978/GS1578A/GS1678/LMH0302/LMH0002SQ

Figure 1. Typical M21328 Implementation



Pin Number	M21328	GS2978	GS1578A	GS1678	LMH0302	LMH0002SQ	Functional Difference
3, Ground Pad	AV_{SS}	V_{EE}	V_{EE}	V_{EE}	V_{EE}	V_{EE}	None
9	AV_{DD}	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}	M21328: Only supports 3.3V

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M21328/M21428/M21518/M21528 3G/HD/SD-SDI Cable Driver Performance Comparison & Pin Compatibility Rev -

Pin Number	M21328	GS2978	GS1578A	GS1678	LMH0302	LMH0002SQ	Functional Difference
1, 2	SDI/$\overline{SDI}$	DDI/$\overline{DDI}$	SDI/$\overline{SDI}$	DDI/$\overline{DDI}$	SDI/$\overline{SDI}$	SDI/$\overline{SDI}$	None
12, 11	SDO/$\overline{SDO}$	SDO/$\overline{SDO}$	SDO/$\overline{SDO}$	SDO/$\overline{SDO}$	SDO/$\overline{SDO}$	SDO/$\overline{SDO}$	
4	RSET	RSET	RSET	RSET	R_{REF}	R_{REF}	
5, 7, 8, 13, 14, 15, 16	NC	NC	NC	NC	NC	NC	
6	$\overline{DISABLE}$	$\overline{DISABLE}$	NC	$\overline{DISABLE}$	ENABLE	NC	
10	SD/$\overline{HD}$	RSVD	SD/$\overline{HD}$	SD/$\overline{HD}$	SD/$\overline{HD}$	SD/$\overline{HD}$	

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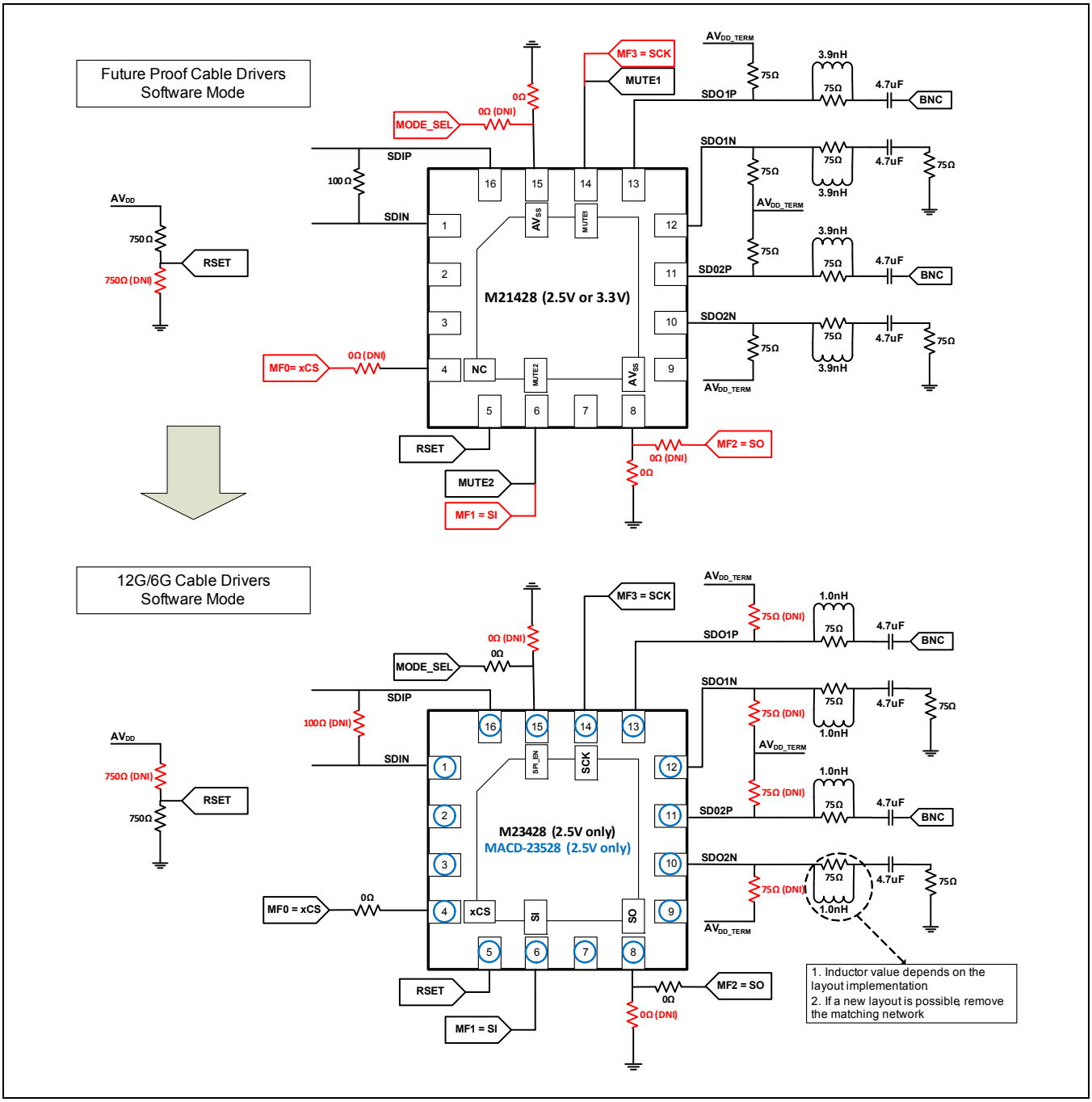
M21428 compatible to M23428/MACD-23528 (12G-SDI Cable Driver) - Software Mode

Figure 2. Typical M21428 Implementation



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Pin Number	M21428	M23428	MACD-23528	Functional Difference
3, Ground Pad	AV_{SS}	AV_{SS}	AV_{SS}	None
8	AV_{SS}	MF2	MF2	M21428: Ground. M23428/ MACD-23528: SW Mode - 4-wire Serial Output.
15	AV_{SS}	MODE_SEL	MODE_SEL	M21428: Ground. M23428/ MACD-23528: High - Software Mode (4-wire).
2, 7	AV_{DD}	AV_{DD}	AV_{DD}	M23428/ MACD-23528: Only supports 2.5V.
16, 1	SDI/$\overline{SDI}$	SDIP/SDIN	SDIP/SDIN	None
13, 12	SDO1/$\overline{SDO1}$	SDO1P/SDO1N	SDO1P/SDO1N	
11, 10	SDO2/$\overline{SDO2}$	SDO2P/SDO2N	SDO2P/SDO2N	
4	NC	MF0	MF0	M21428: No Connect. M23428/ MACD-23528: SW Mode - 4-wire Serial Input.
5	RSET	RSET	RSET	None
6	MUTE2	MF1	MF1	M21428: High - Mute SDO2 output. Low - Enable SDO2 output. M23428/ MACD-23528: SW Mode - 4-wire Chip Select.
9	SD/$\overline{HD}$	SD_xHD	SD_xHD	None
14	MUTE1	MF3	MF3	M21428: High - Mute SDO1 output. Low - Enable SDO1 output. M23428/ MACD-23528: SW Mode - 4-wire Serial Clock.

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NOTE: It is strongly recommended to set the device to software mode to select optimum operational conditions, see the M23428 and MACD-23528 data sheets for more details.

The following changes need to be implemented on the legacy systems to be future proof to the M23428 or MACD-23528 (Software Mode):

1. The supply voltage to the cable driver needs to have option to supply 2.5V, the M23428 and MACD-23528 cable drivers power supply supports only 2.5V.
2. Add a 750 ohm resistor connecting pin5 to ground. For the new cable drivers, RSET is referenced to ground instead of $AV_{DD.}$
3. Add a 0 ohm resistor connecting pin4 to a digital control signal. For the M23428 and MACD-23528, pin4 functions as the SPI interface chip select (xCS).
4. For the M23428 and MACD-23528, pin 6 functions as the SPI interface Serial Input (SI). The system must be able to control this digital pin dynamically.
5. Add two 0 ohm resistors to pin 8 to select between ground and a digital output signal. For the M23428 and MACD-23528, pin 8 functions as the SPI interface Serial Output (SO).
6. For the M23428 and MACD-23528, pin 14 functions as the SPI interface Serial Clock (SCK). The system must be able to control this digital input pin dynamically.
7. Add two 0 ohm resistors to pin 15 to select between ground and a digital input signal. For the M23428 and MACD-23528, pin 15 enables SPI interface.

Once the new M23428 or MACD-23528 cable driver is installed in the legacy system, the following steps should be taken:

1. Remove the 100 ohm resistor connecting the high speed inputs SDIP and SDIN, this resistor is now integrated inside the cable driver.
2. Remove the 750 ohm resistor to AV_{DD} and install the 750 ohm resistor to ground on RSET.
3. Remove the 75 ohm pull-up resistors at the SDI outputs, these resistances are now integrated inside the cable driver.
4. Remove the two 0 ohm resistors grounding pins 8 and 15.

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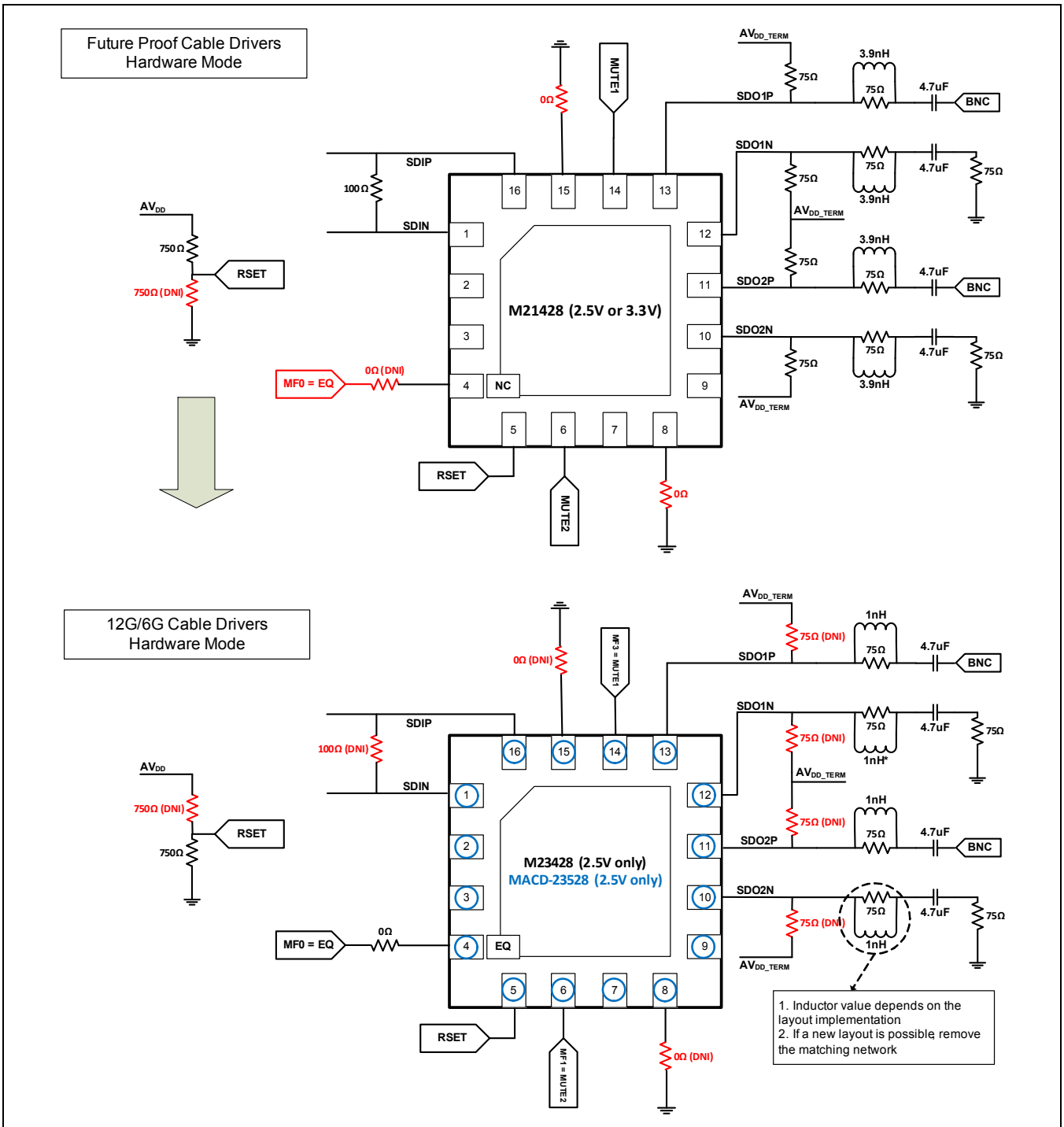
M21428 compatible to M23428/MACD-23528 (12G-SDI Cable Driver) - Hardware Mode

Figure 3. Typical M21428 Implementation



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Pin Number	M21428	M23428	MACD-23528	Functional Difference
3, Ground Pad	AV_{SS}	AV_{SS}	AV_{SS}	None
8	AV_{SS}	MF2	MF2	M21428: Ground. M23428/ MACD-23528: HW Mode - No Function.
15	AV_{SS}	MODE_SEL	MODE_SEL	M21428: Ground. M23428/ MACD-23528: Low - Hardware Mode.
2, 7	AV_{DD}	AV_{DD}	AV_{DD}	M23428/ MACD-23528: Only supports 2.5V.
16, 1	SDI/$\overline{SDI}$	SDIP/SDIN	SDIP/SDIN	None
13, 12	SDO1/$\overline{SDO1}$	SDO1P/SDO1N	SDO1P/SDO1N	
11, 10	SDO2/$\overline{SDO2}$	SDO2P/SDO2N	SDO2P/SDO2N	
4	NC	MF0	MF0	M21428: No Connect. M23428/ MACD-23528: HW Mode - Input Equalization High - 6dB input EQ. Floating - No input EQ. Low - 4dB input EQ.
5	RSET	RSET	RSET	None
6	MUTE2	MF1	MF1	M21428: High - Mute SDO2 output. Low - Enable SDO2 output. M23428/ MACD-23528: HW Mode - MUTE2 High - SDO2 powered down, logic forced to zero. Low - SDO2 enabled.
9	SD/$\overline{HD}$	SD_xHD	SD_xHD	None
14	MUTE1	MF3	MF3	M21428: High - Mute SDO1 output. Low - Enable SDO1 output. M23428/ MACD-23528: HW Mode - MUTE2 High - SDO1 powered down, logic forced to zero. Low - SDO1 enabled.

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The following changes need to be implemented on the legacy systems to be future proof to the M23428 or MACD-23528 (Hardware Mode):

1. The supply voltage to the cable driver needs to have option to supply 2.5V, the M23428 and MACD-23528 cable drivers power supply supports only 2.5V.
2. Add a 750 ohm resistor connecting pin5 to ground. For the new cable drivers, RSET is referenced to ground instead of AV_{DD}.
3. Add a 0 ohm resistor connecting pin4 to a equalization control signal (that should be driven high for 6dB input equalization, low for 4dB input equalization and floating for no input equalization). For the M23428 and MACD-23528, pin4 functions as the input equalization control.
4. Add a 0 ohm resistor to pin 8 to ground. For the M23428 and MACD-23528, pin 8 has no function.
5. Add a 0 ohm resistor to pin 15 to ground. For the M23428 and MACD-23528, pin 15 configures Hardware/Software mode.

Once the new M23428 or MACD-23528 cable driver is installed in the legacy system, the following steps should be taken:

1. Remove the 100 ohm resistor connecting the high speed inputs SDIP and SDIN, this resistor is now integrated inside the cable driver.
2. Remove the 750 ohm resistor to AV_{DD} and install the 750 ohm resistor to ground on RSET.
3. Remove the 75 ohm pull-up resistors at the SDI outputs, these resistances are now integrated inside the cable driver.
4. Remove the two 0 ohm resistors grounding pins 8 and 15.

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