an Intel company

10 Gbit/s Modulator Driver GD19901

Preliminary

General Description

The GD19901 is a high-speed amplifier, which provides a high power output drive suitable to feed an optical modulator at 10 Gbit/s.

GD19901 provides single-ended or differential output drive to an external modulator. The outputs must be externally AC coupled and on-chip termination is provided to minimize reflections.

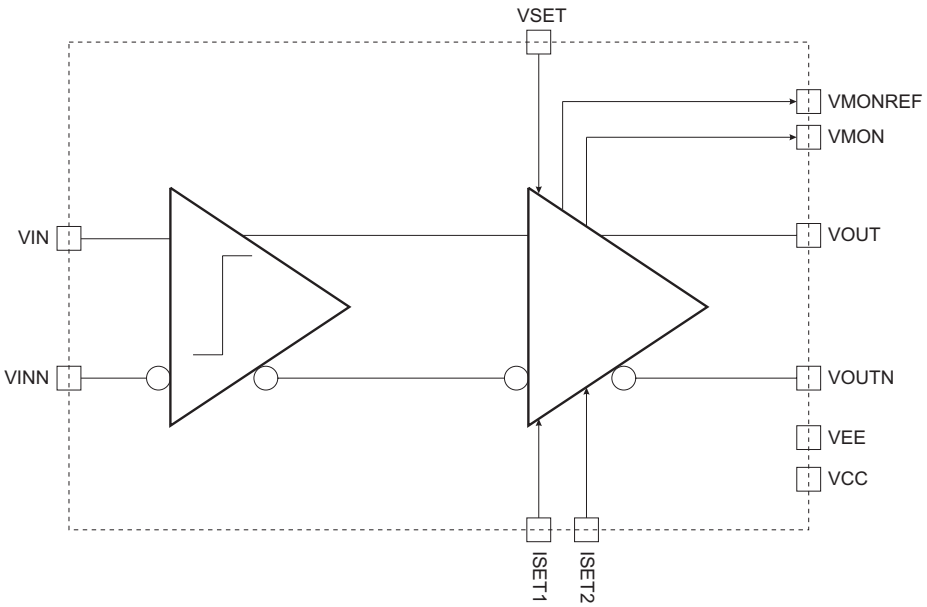
The output amplitude can be adjusted to the required value by sourcing a DC current into a control terminal of the device.

The data outputs can be shut down by setting the amplitude control currents to 0. When shut down, the residual output data amplitude will be less than 1.5 % of maximum amplitude.

The GD19901 modulator driver provides *Amplitude Modulation* (AM) control of the outputs of the modulator driver for control of the modulation in Mach-Zehnder modulators. The AM will be controlled by inserting a dither current at up to 10 kHz with AM amplitude of up to 10 % of the data amplitude.

An analogue monitor output is provided to indicate peak-peak output voltage swing.

The GD19901 modulator driver is delivered in a 68 pin ceramic package with 50 Ω transmissions lines.



Features

- Fully differential, 6 V_{PP} differential drive capability.
- CML inputs.
- Limiting input stage.
- Output peak-peak monitor.
- Data outputs can be turned off.
- Capability to AM modulate output.
- Power supply: -6.5 V and +5 V
- No external choke required.
- Rise/fall time of maximum 45 ps (20 – 80 %).
- Power dissipation: 3.2 W (typical) at maximum output swing.
- Package: 68 pin MLC

Applications

- Telecommunications transmission systems:
  - SDH STM-64
  - SONET OC-192
- WDM applications.
- 10 Gbit/s optical transmission.

Functional Details

General

The GD19901 modulator driver incorporates a limiting amplifier and provides a high power output.

The device performs the following functions:

1. High output drive capability, sufficient to modulate an external optical EA laser or to drive III-V modulator at 9.952 Gbit/s data rate.

2. On chip termination (50 Ω to ground) on the differential CML inputs. Outputs must be externally AC coupled and on-chip termination is provided to minimize reflections.

3. The output amplitude is adjusted between maximum and minimum values over a wide temperature and operating range.
   The amplitude is controlled by a DC current.
   The output regulation can be disabled, i.e., a fixed maximum output is obtained (if required) by grounding VSET and disconnecting the ISET terminals.

4. Output data is shutdown when the amplitude control current and AM control current are set to 0. The residual output data amplitude rms should be within 1.5 % of full amplitude.

Functionality

The GD19901 can be driven with a single ended or a differential input. The unused input does not need to be terminated, but a 50 Ω resistor AC coupled to GND is recommended. The inputs can be DC coupled, but then the applied circuit must not alter the quiescent input voltage. The DC level at the output vary with the output voltage swing and therefore AC coupling is recommended. When used to drive a single ended load, the unused output shall be 50 Ω terminated via an AC coupling capacitor. (See Figure 1)

The amplifier output voltage swing is controlled through the current flowing into the pins ISET1 and ISET2. It is recommended that the two pins are tied together giving a common impedance of typical 45 Ω. Figure 2 shows a typical measurement of VOUT vs. ISET = ISET1 + ISET2. The slope is 0.12 V/mA.

If the two ISET pins are both left open and the Vset pin is connected to GND maximum output voltage swing is achieved. This setting is only recommended for test purposes and VSET input shall normally be left open with a capacitor to GND. Shutting the outputs off can be obtained by tying both ISET1 and ISET2 to VEE.

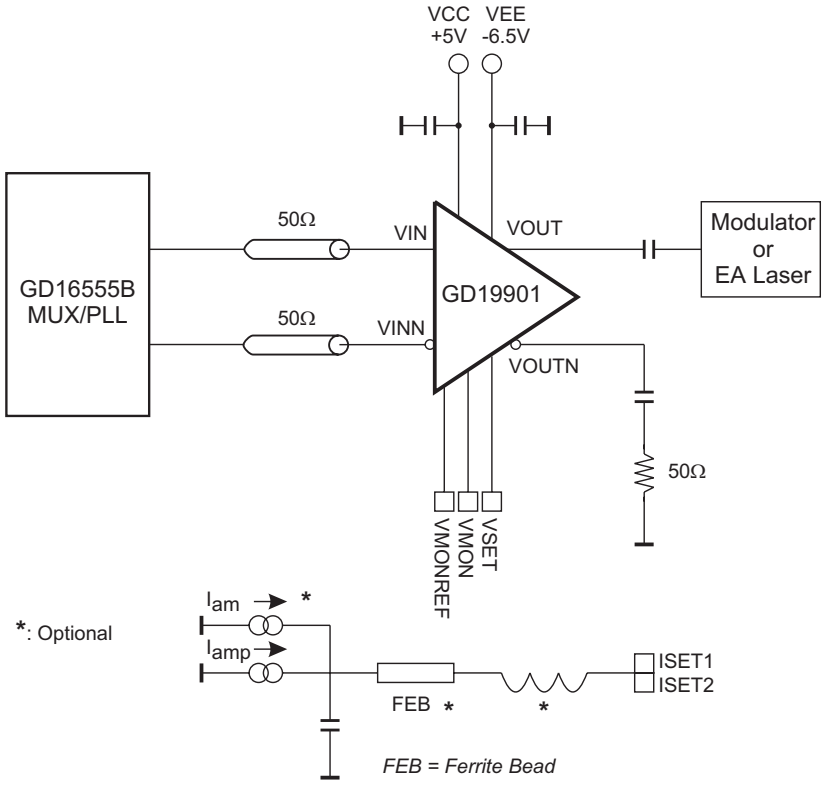


Figure 1. *Application Diagram*

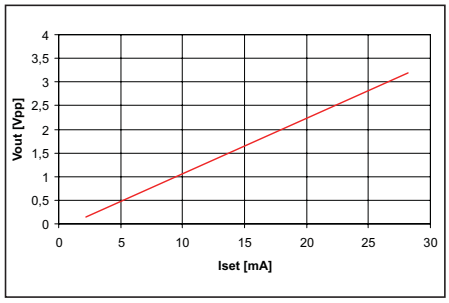


Figure 2. *VOUT vs. ISET (Typical).*

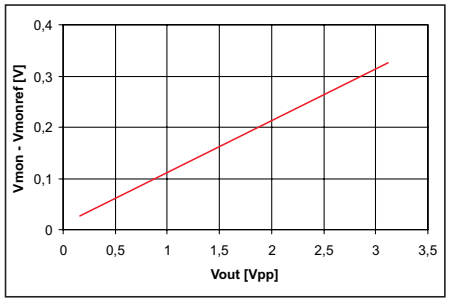


Figure 3. *VMON - VMONREF vs. VOUT (Typical).*

The voltage difference between Vmon and Vmonref is a measure of the driver output level with a slope of 0.11 V/V. Please observe that this relation is only valid with input signals levels within the specified range. Figure 3 shows a typical measurement of VMON – VMONREF vs. VOUT.

Special Precautions

When the GD19901 is used to drive a single-ended load, the unused output shall be terminated (AC coupled) to 50 Ω.

Inputs VIN/VINN are open circuit and short circuit (to ground) protected.

Outputs VOUT/VOUTN are open circuit protected only. AC short circuit is allowed.

Note: DC short circuit to ground will cause permanent damage to the device.

Pin List

Mnemonic:	Pin No.:	Pin Type:	Description:
VIN, VINN	27, 25	CML	Data input, differential 10 Gbit/s.
VOUT, VOUTN	61, 59	AC	Data output, differential 10 Gbit/s.
VMONREF	40	DC	Modulation current monitor reference.
VMON	42	DC	Modulation current monitor.
ISET1, ISET2	41, 13	DC	Current input for output AGC and AM control.
VSET	12	DC	Voltage input for overide of output AGC and AM. For test purpose.
GND	1, 4, 9, 14, 17, 19, 20, 21, 22, 23, 24, 26, 28, 29, 30, 31, 32, 33, 38, 43, 48, 51, 53, 54, 55, 56, 57, 58, 60, 62, 63, 64, 65, 66, 67, 68	PWR	Ground, 0V.
VEE	18, 35	PWR	-6.5 V negative supply voltage.
VCC	34, 52	PWR	+5 V positive supply voltage.
NC	2, 3, 5, 6, 7, 8, 10, 11, 15, 16, 36, 37, 39, 44, 45, 46, 47, 49, 50		Not Connected

Package Pinout

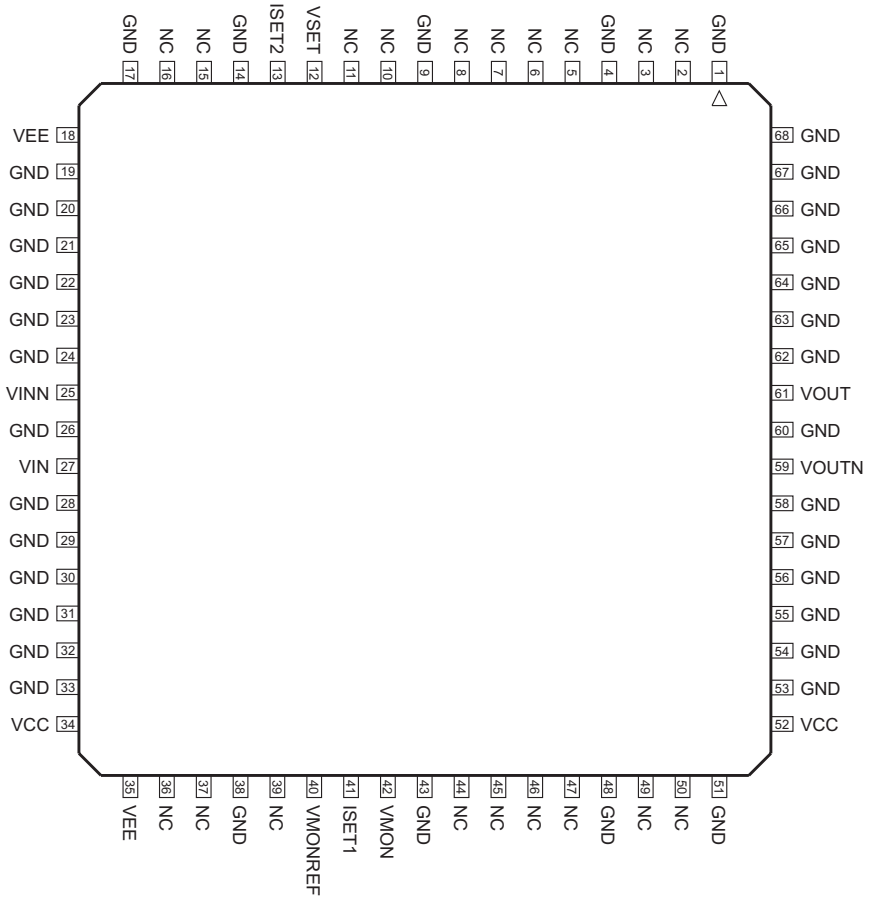


Figure 4. *Package 68 pin CML, Top View*

Maximum Ratings

These are the limits beyond which the component may be damaged.
All voltages in the table are referred to GND.
All currents in the table are defined positive out of the pin.

Symbol:	Characteristic:	Conditions:	MIN.:	TYP.:	MAX.:	UNIT:
V_{CC}	Positive Supply		GND		6.0	V
V_{EE}	Negative Supply		-7.5		GND	V
$V_{I\ VIN,VINN}$	CML Input Voltage		-3.5		0.5	V
V_{VSET}	VSET Voltage Level		V_{EE}		GND	V
V_{ISET}	Voltage @ ISET pin	Note 1	V_{EE}		V_{EE} +3.8	V
I_{SET}	Amplitude Control Current Level	Note 3	0		-30	mA
T_0	Operating Temperature	Note 2	0		70	°C
T_S	Storage Temperature		-65		125	°C

Note 1: I_{SET} pins are intended for current drive only. Voltage forcing into I_{SET} pins that exceeds maximum ratings will cause permanent damage to the device.
Note 2: Hot-spot temperature 150 °C @ 70 °C T_{CASE}.
Note 3: ISET = ISET1 + ISET2

DC Characteristics

T_{CASE} = 0 °C to 70 °C, VCC = +5.0 V ±5 %, VEE = -6.5 V ±5 %.

All voltages in the table are referenced to GND.

Symbol:	Characteristic:	Conditions:	MIN.:	TYP.:	MAX.:	UNIT:
V_{CC}	Positive Supply		4.75	5	5.25	V
V_{EE}	Negative Supply		-6.8	-6.5	-6.2	V
I_{CC}	Positive Supply Current				150	mA
I_{EE}	Negative Supply Current				-500	mA
Pdiss	Power Dissipation			3.2	4.2	W

AC Characteristics

T_{CASE} = 0 °C to 70 °C, VCC = +5.0 V ±5 %, VEE = -6.5 V ±5 %.

Symbol:	Characteristic:	Conditions:	MIN.:	TYP.:	MAX.:	UNIT:
$V_{VOUT,VOUTN}$	Output Data Amplitude per Output			3.0		V_{PP}
$V_{VIN,VINN}$	Input Data Amplitude per Input		300	400	500	mV_{PP}
t_{RISE} /t_{FALL} *IN*	Input Data Rise/Fall Time, 20 – 80 %				40	ps
t_{RISE} /t_{FALL} *OUT*	Output Data Rise/Fall Time, 20 – 80 %	t_{RISE} /t_{FALL} *IN*		45		ps
S11	0 - 6 GHz 6 - 10 GHz	Note 1		-7 -5		dB dB
S22	0 - 6 GHz 6 - 10 GHz	Note 1		-7 -5		dB dB

Note 1: Measured on GD19901-68BA (gullwings) on FR4 PCB, GD99901.

Package Outline

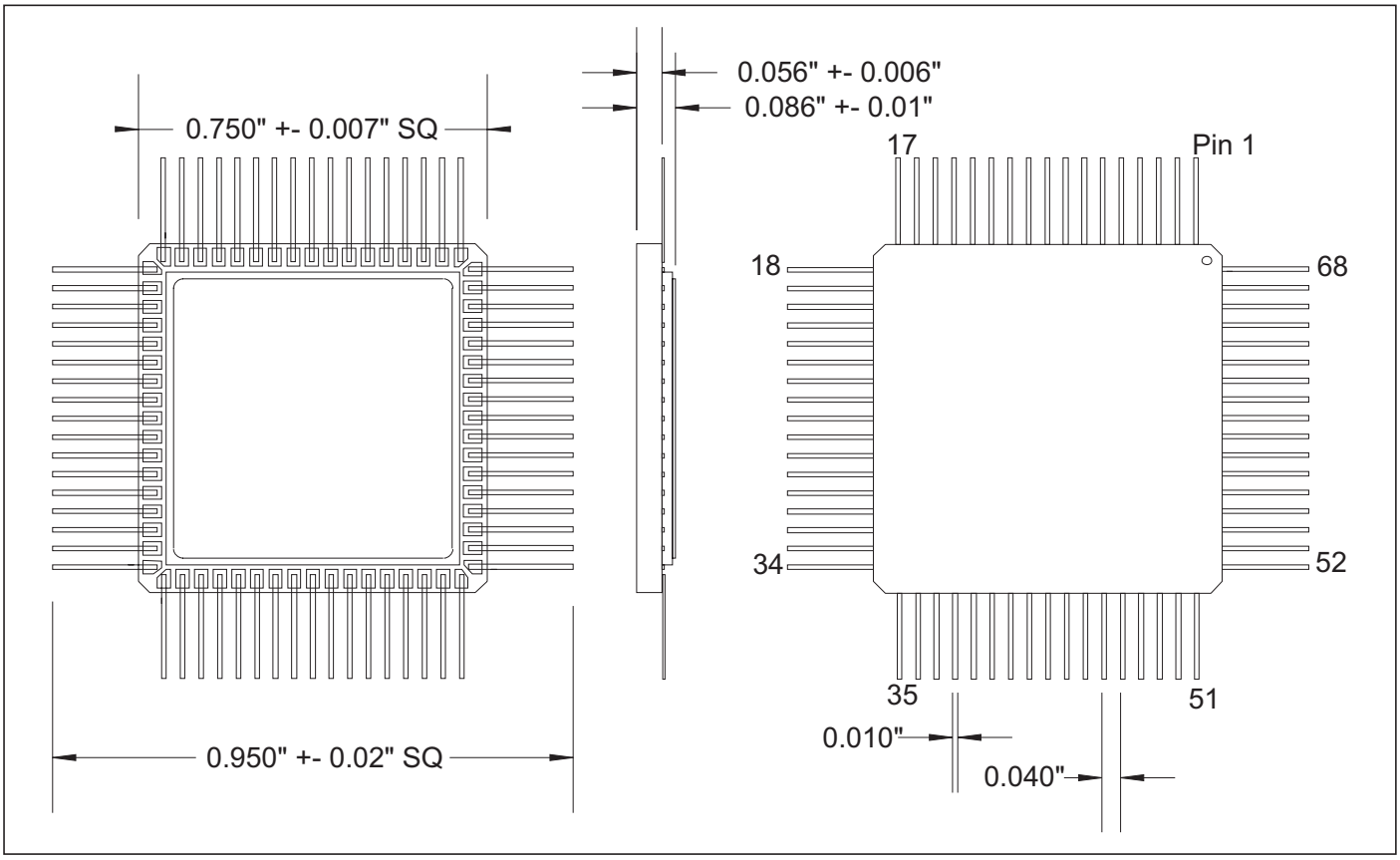


Figure 5. *Package 68 pin MLC, Straight Leads (68AB). All Dimensions are in inch*

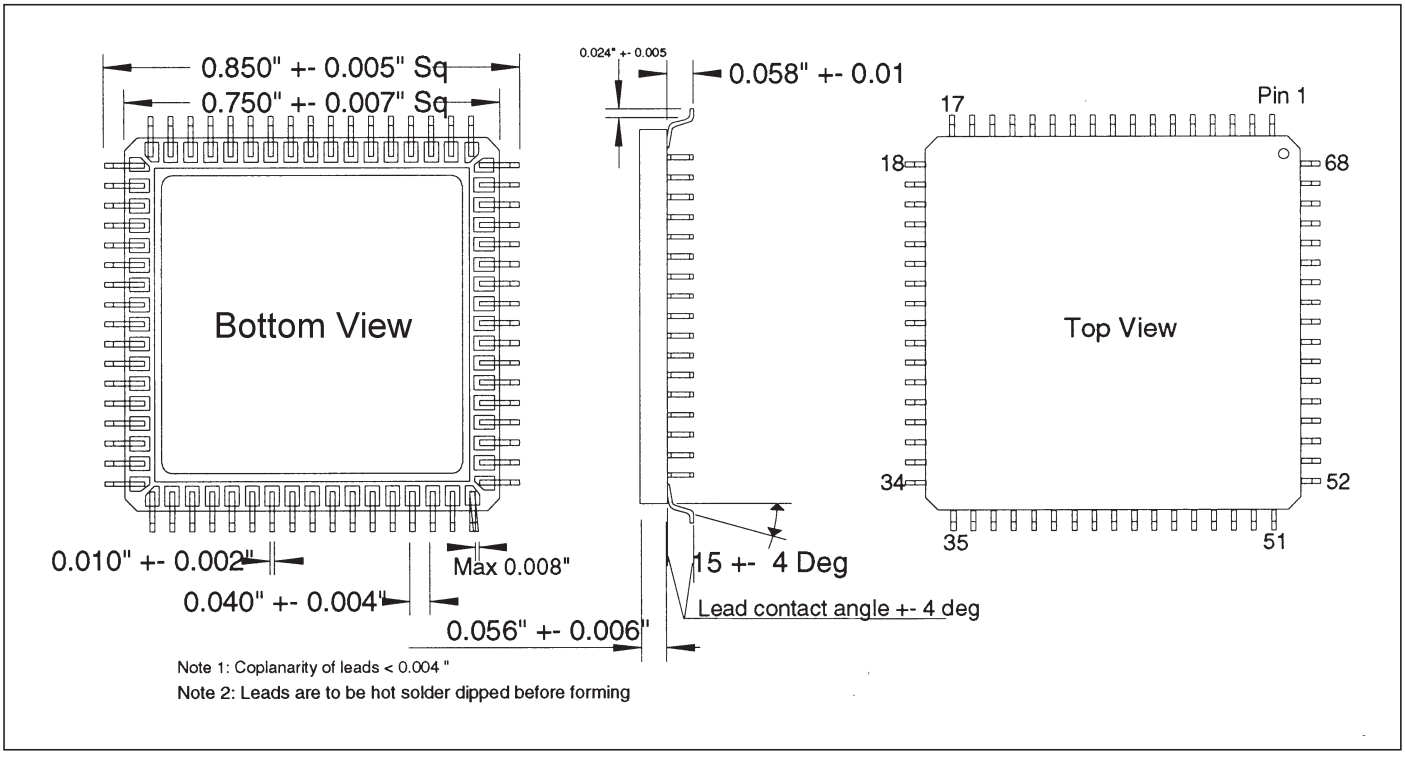


Figure 6. *Package 68 pin MLC, Gullwings (68BA). All Dimensions are in inch.*

Device Marking

Figure 7. *Device Marking. Top View*

Ordering Information

To order, please specify as below:

Product Name:	**Intel Order Number**:	**Package Type:**	**Case Temperature Range:**
GD19901-IS	**QGD19901IS** MM#: 835983	**68 pin Straight Leads,** Multi Layer Ceramic	0..70 °C
GD19901-IG	**QGD19901IG** MM#: 835982	**68 pin Gullwings,** Multi Layer Ceramic	0..70 °C

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