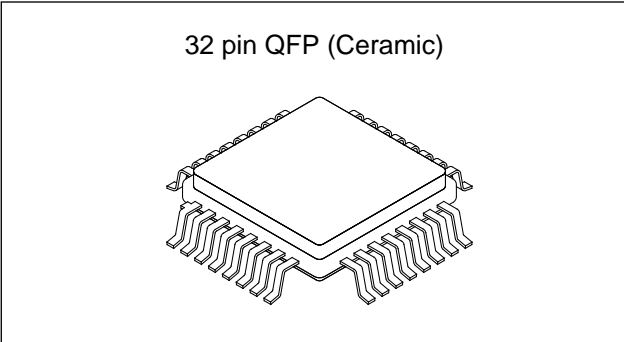


Laser Driver

Description

The CXB1548Q-Y is a high-speed monolithic Laser Driver/Current Switch with ECL input level. Open collector outputs are provided at the output pins (Q, \bar{Q}) and have the capability of driving modulation current of 60mApp at a max. data rate of 2.0Gbps (NRZ). DRIVADJ and SDRIV inputs control the modulation current amplitude, and BIASADJ, SBIAS inputs control the bias current. Modulation and bias current can be controlled by either voltage or current through these pins. This device includes three Operational Amplifiers and Laser Shutdown function.



Features

- Maximum data rate (NRZ): 2.0Gbps (Typ.)
- Differential Data input: ECL
- On chip three Operational Amplifiers
- Laser Shutdown Input: TTL

Applications

- SONET/SDH: 155,622Mb/s, 1.2Gb/s
- Fiber channel: 133,266,532Mb/s, 1.062Gb/s
- FDDI: 125Mb/s ESCON: 200Mb/s HDTV: 1.5Gb/s

Absolute Maximum Ratings

| | | | |
|-------------------------------|---------------------------|------------------|----|
| • Supply voltage | $V_{CC} - V_{EE}$ | -0.3 to +7.0 | V |
| • Input voltage | V_{IN} | V_{EE} to +0.5 | V |
| • Differential input voltage | $ V_{IN} - \bar{V}_{IN} $ | 0 to 2.5 | V |
| • Output current (Continuous) | I_Q, I_{BIAS} | 0 to 80 | mA |
| Input current (Continuous) | I_{DRVADJ} | 0 to 8 | mA |
| | $I_{BIASADJ}$ | 0 to 8 | mA |
| • Storage temperature | T_{stg} | -65 to +150 | °C |

Recommended Operating Conditions

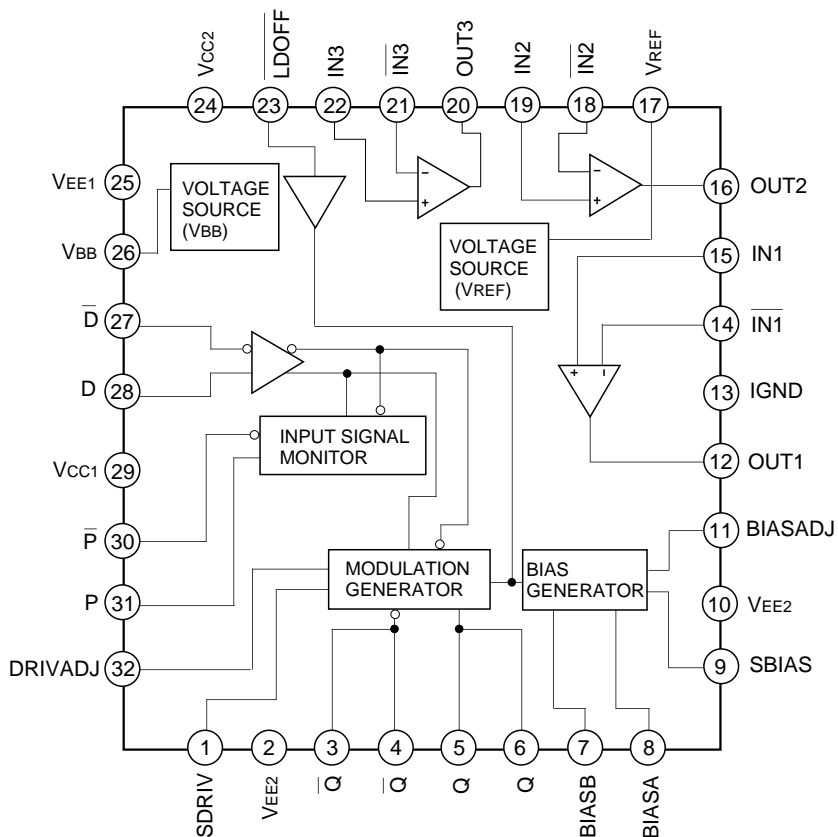
| | | | |
|------------------------------|-------------------|--------------|----|
| • DC power supply voltage | $V_{CC} - V_{EE}$ | 4.75 to 5.46 | V |
| • Operating case temperature | T_c | 0 to +85 | °C |

Structure

Bipolar silicon monolithic IC

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Block Diagram and Pin Assignment



Truth table

| \overline{LDOFF} | D | Q | P |
|--------------------|---|---|---|
| H | L | H | H |
| H | H | L | L |
| L | L | H | H |
| L | H | H | L |

* In a case of resistor load

Pin Description

| Pin No. | Symbol | Typical Voltage (V) | | Equivalent circuit | Description | |
|---------|-------------------|--|--------------------------------|--|--|---------------------------------|
| | | DC | AC | | | |
| 1 | SDRIV | 0mA to 8mA*1 0mA to 6mA*2 | — | | Modulation generator current monitor. | |
| 32 | DRIVADJ | V _{EE} to V _{EE} +2.5V | — | | Modulation generator current adjustment. | |
| 2, 10 | V _{EE} 2 | -5.2V | — | | Negative power supply pin. | |
| 3 | \bar{Q} | — | 0mA to 60mA*1 0mA to 40mA*2 | | Modulation generator current output. | |
| 4 | | | 0mA to 60mA*1 0mA to 40mA*2 | | | |
| 5 | Q | — | 0mA to 60mA*1 0mA to 40mA*2 | | | |
| 6 | | | 0mA to 60mA*1 0mA to 40mA*2 | | | |
| 7 | BIASB | 0mA to 30mA | — | | | Bias generator current output. |
| 8 | BIASA | | | | | Bias generator current monitor. |
| 9 | SBIAS | 0mA to 8mA | — | | Bias generator current monitor. | |
| 11 | BIASADJ | V _{EE} to V _{EE} +2.5V | — | | Bias generator current adjustment. | |
| 12 | OUT1 | V _{EE} +0.7V to -1.0V | — | | Output pin for OpAmp. | |
| 14 | $\bar{IN}1$ | | | | Input pins for OpAmp. | |
| 15 | IN1 | | | | Output pin for OpAmp. | |
| 16 | OUT2 | | | | Input pins for OpAmp. | |
| 18 | $\bar{IN}2$ | | | | Output pin for OpAmp. | |
| 19 | IN2 | | | | Input pins for OpAmp. | |
| 20 | OUT3 | | | | Output pin for OpAmp. | |
| 21 | $\bar{IN}3$ | | | | Input pins for OpAmp. | |
| 22 | IN3 | | | | | |
| 13 | IGND | open or V _{EE} | — | OpAmp switch pin IGND = V _{EE} : active IGND = OPEN: inactive | | |

*1 V_{EE} = -5.46V to -4.94V

*2 V_{EE} = -4.94V to -4.75V

| Pin No. | Symbol | Typical Voltage (V) | | Equivalent circuit | Description |
|---------|---------------------------|---------------------------|------------------|--------------------|---|
| | | DC | AC | | |
| 17 | V _{REF} | V _{EE} +2.5V | — | | Reference voltage (V _{REF} – V _{EE} : 2.5V) Max. drive current ±3mA |
| 23 | $\overline{\text{LDOFF}}$ | open or V _{EE} . | — | | <p>$\overline{\text{LDOFF}} = \text{L (V}_{\text{EE}})$: shut down</p> <p>$\overline{\text{LDOFF}} = \text{H (open)}$: Laser active</p> |
| 24 | V _{CC2} | 0V | — | | Positive Power supply pin. |
| 25 | V _{EE1} | –5.2V | — | | Negative Power supply pin. |
| 26 | V _{BB} | –1.3V | — | | Reference voltage (–1.3V) Use for the reference voltage in the case of single-phase input. Max. drive current ±200μA |
| 25 | V _{EE1} | –5.2V | — | | Negative power supply pin. |
| 27 | $\overline{\text{D}}$ | — | –1.84V to –0.81V | | Data signal input. |
| 28 | D | | | | |
| 29 | V _{CC1} | 0V | — | | Positive power supply pin. |

| Pin No. | Symbol | Typical Voltage (V) | | Equivalent circuit | Description |
|---------|-----------|---------------------|--------------|--------------------|------------------------------|
| | | DC | AC | | |
| 30 | \bar{P} | — | 0mA to 2.7mA | | Input signal monitor output. |
| 31 | P | — | | | |

Electrical Characteristics

• DC Electrical Characteristics

Laser Driver part

($V_{CC1} = V_{CC2} = \text{GND}$, $V_{EE1} = V_{EE2} = -5.46$ to -4.75V , $T_c = 0$ to $+85^\circ\text{C}$)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|-------------|--|----------------|-------|----------------|---------------|
| Power supply current | I_{EE} | $I_Q = 0\text{mA}$, $I_{BIAS} = 0\text{mA}$ | -99 | -69 | — | mA |
| | | $I_Q = 60\text{mA}$, $I_{BIAS} = 60\text{mA}$ | -240 | -203 | — | |
| Max. Modulation current | I_Q | $V_{EE} = -5.46$ to -4.94V | 60 | — | — | mA |
| | | $V_{EE} = -4.94$ to -4.75V | 40 | — | — | |
| Modulation output voltage range | V_Q | $T_c = 25^\circ\text{C}$ | -2.5 | — | +2.0 | V |
| Max. Bias current | I_{BIAS} | $I_{BIASA} + I_{BIASB}$ | 60 | — | — | mA |
| Bias output voltage range | V_{BIAS} | | -2.7 | — | 0 | V |
| Modulation current monitor output voltage range | V_{SQ} | | -2.7 | — | 0 | |
| Bias current monitor output voltage range | V_{SBIAS} | | -2.7 | — | 0 | |
| Input signal monitor current | I_P | | 1 | 1.7 | 2.7 | mA |
| Input signal monitor output voltage range | V_P | $T_c = 25^\circ\text{C}$ | -2.5 | — | +2.0 | V |
| ECL input High voltage | V_{EDH} | | -1.17 | — | -0.81 | |
| ECL input Low voltage | V_{EDL} | | -1.84 | — | -1.48 | |
| ECL input High current | I_{EDH} | | — | — | 20 | μA |
| TTL input High voltage | V_{TDH} | | $V_{EE} + 2.0$ | — | V_{CC} | V |
| TTL input Low voltage | V_{TDL} | | $V_{EE} - 0.5$ | — | $V_{EE} + 0.8$ | |
| TTL input High current | I_{TDH} | | — | — | 10 | μA |
| TTL input Low current | I_{TDL} | | -320 | — | — | |
| Reference bias voltage for OP Amp. | V_{REF} | $V_{REF} - V_{EE}$ | 2.25 | 2.5 | 2.75 | V |
| Reference bias voltage | V_{BB} | | -1.38 | -1.32 | -1.26 | |

Ratio of current setup

| Item | Symbol | Condition | Min. | Typ. | Max. |
|---|--------|--------------------------------|------|------|------|
| Modulation current vs. Modulation monitor current | S1 | at voltage control application | 9.0 | 11.4 | 12.0 |
| Modulation current vs. Modulation control current | S2 | at current control application | 6.5 | 8.6 | 10.5 |
| Bias current vs. Bias monitor current | S3 | at voltage control application | 11.0 | 12.0 | 13.0 |
| Bias current vs. Bias control current | S4 | at current control application | 7.4 | 9.8 | 12.0 |

• AC Electrical Characteristics

Laser Driver part

($V_{CC1} = V_{CC2} = \text{GND}$, $V_{EE1} = V_{EE2} = -5.46$ to -4.75V , $T_c = 0$ to $+85^\circ\text{C}$, $R_I = 25\Omega$ to GND)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------|-------------------|--------------------------------------|------|------|------|---------------|
| Max. Data rate | $f_{D\text{MAX}}$ | NRZ | 1.6 | 2.0 | — | Gbps |
| Shut Down Time | T_{SHUT} | | — | — | 30 | μs |
| Rise time | T_{TLH} | 20 to 80% | — | 170 | — | ps |
| Fall time | T_{THL} | $I_Q = 60\text{mA}$, $I_{BIAS} = 0$ | — | 150 | — | |

• AC & DC Electrical Characteristics

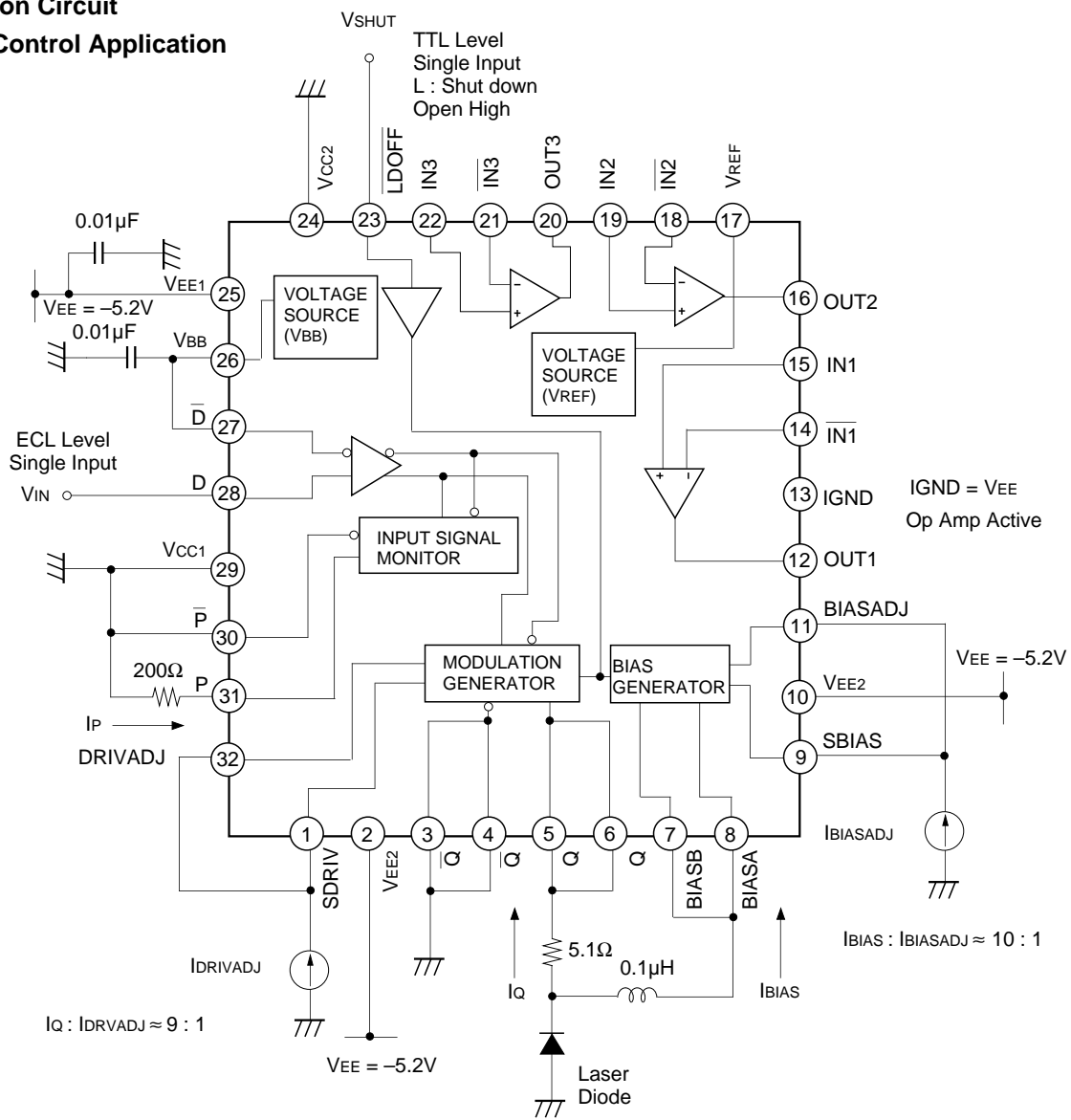
Operational Amplifier part

($V_{CC2} = GND$, $V_{EE1} = IGND = -5.46$ to $-4.75V$, $T_c = 0$ to $+85^\circ C$)

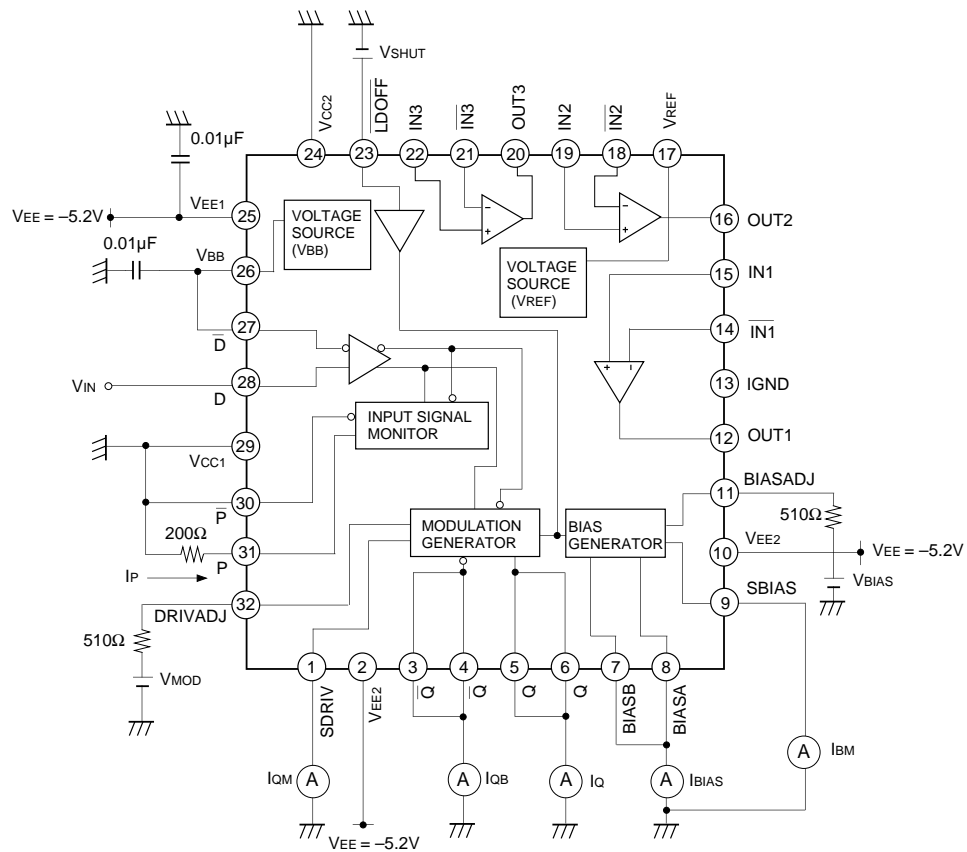
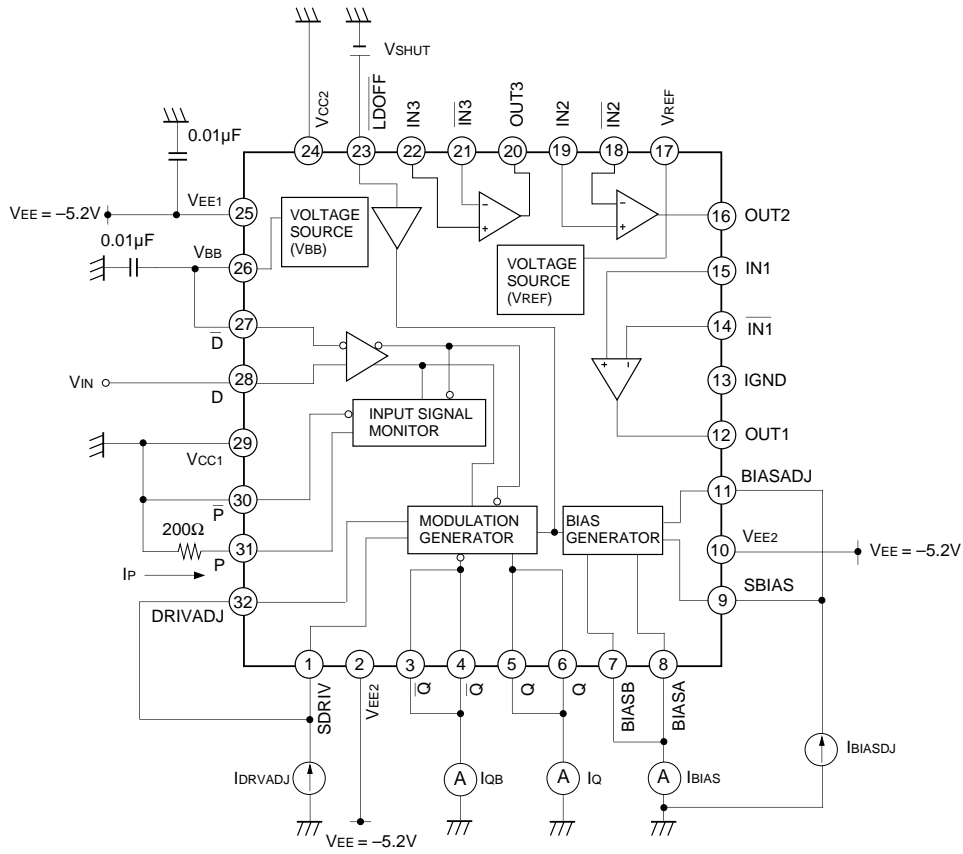
| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------|------------|-----------|----------------|------|------|-----------|
| Power supply current | I_{EE} | | — | -9.0 | — | mA |
| Input offset voltage | V_{off} | | — | 1.0 | — | mV |
| Input bias current | I_b | | — | -1.0 | — | μA |
| Input offset current | I_{off} | | — | 200 | — | nA |
| Input voltage range | V_{in} | | $V_{EE} + 0.7$ | — | -1.0 | V |
| Open Loop Gain | A_v | | — | 40 | — | dB |
| Output voltage range | V_o | | $V_{EE} + 0.7$ | — | -1.0 | V |
| Input Impedance | Z_{in} | | 1.0 | — | — | $M\Omega$ |
| Slew Rate | SR | | — | 18 | — | $V/\mu s$ |
| Unity Gain Band width | f_{unit} | | 30 | — | — | MHz |
| Output drive current range | I_o | | -3.0 | — | 3.0 | mA |

Application Circuit

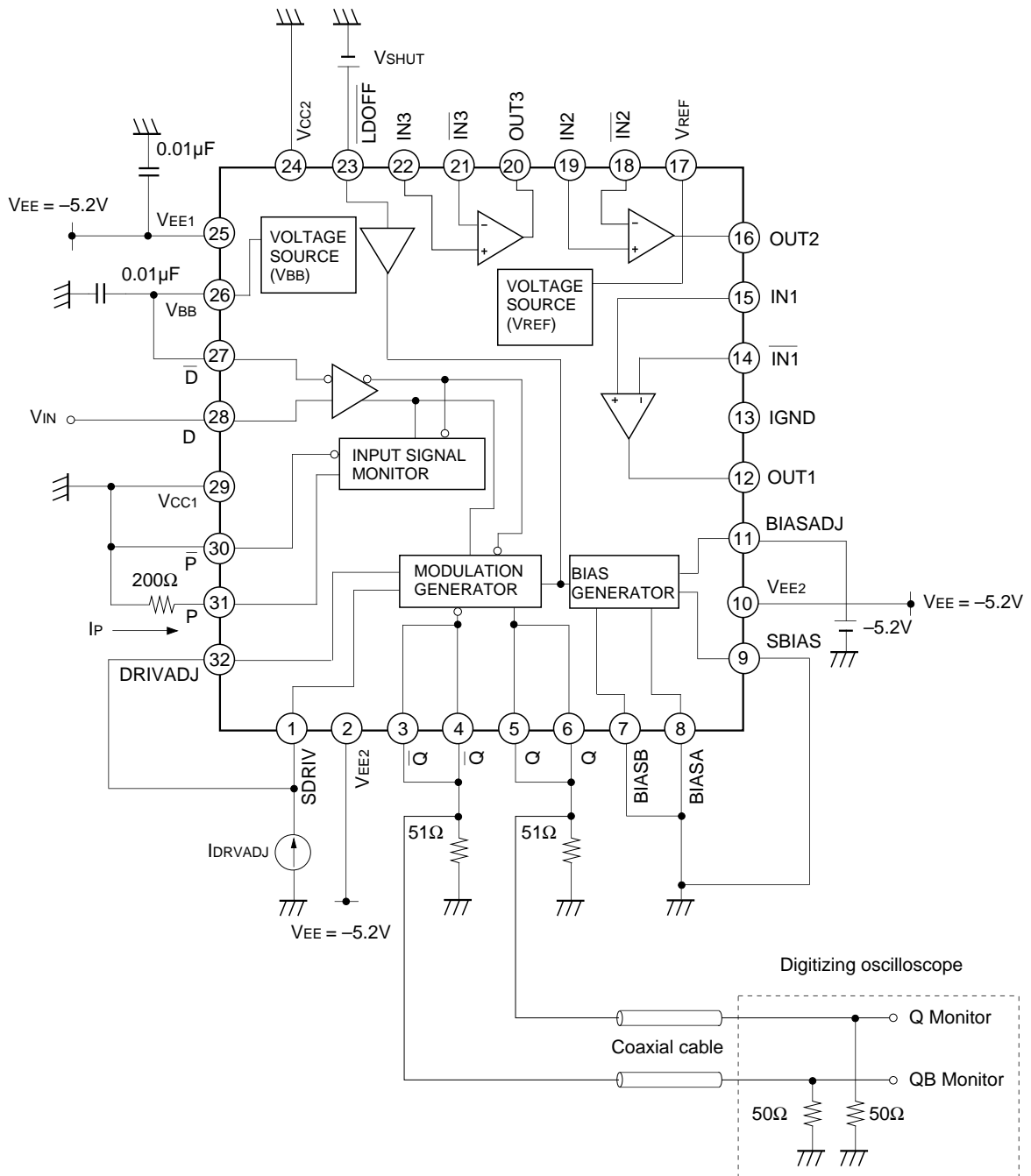
Current Control Application



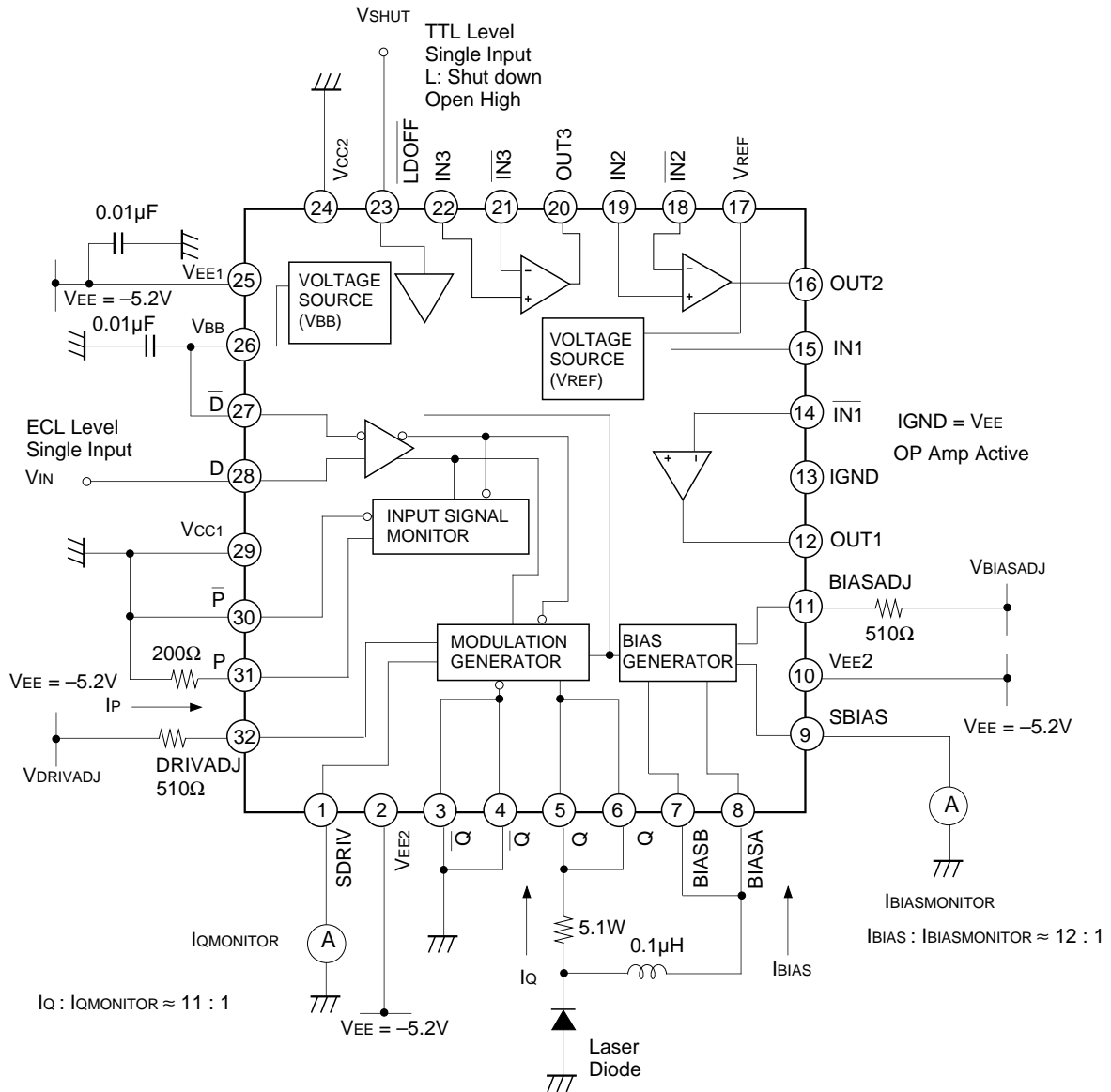
Measurement Circuit (DC)



Measurement Circuit (AC)



Voltage Control Application

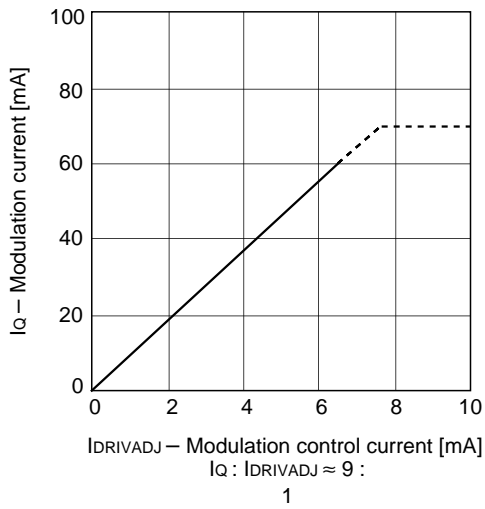


Cautions for Handling

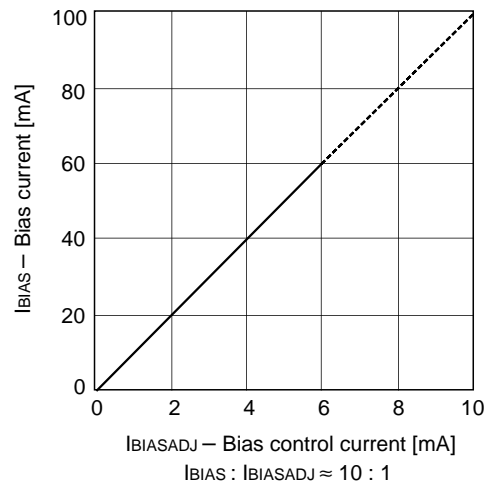
1. The outputs (Q, \bar{Q} , BIASA, BIASB, SDRIV, SBIAS, P and \bar{P}) on this IC are the open collector type. Therefore, when these pins are not being used, connect them to Vcc.
2. When the inputs (DRIVEADJ and BIASADJ) are not being used, connect them to VEE.
3. Do not apply voltage over VEE + 2.5V to DRIVEADJ pin and BIASADJ pin.
4. In voltage control Application, do not apply voltage over the output voltage range to SDRIV pin and SBIAS pin. (see DC Characteristics of Laser Part and Voltage Control Application Circuit.)
5. Maximum drive current of VBB pin is $\pm 200\mu\text{A}$.
6. Maximum input differential voltage is 2.5V. ($|D - \bar{D}|$)
7. Maximum drive current of VREF pin is $\pm 3\text{mA}$.
8. As the electronic breakdown level is weak, take care to handle.

Example of Representative Characteristics

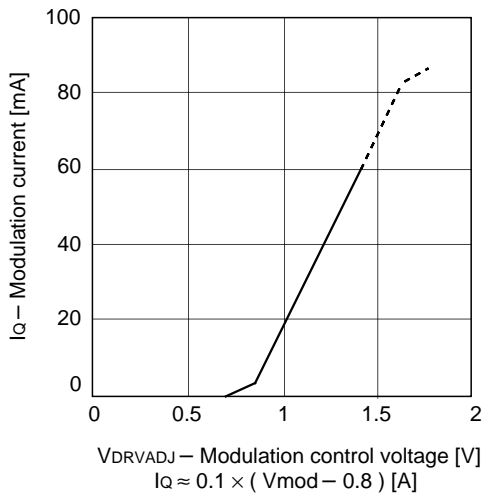
Modulation current vs. Modulation control current



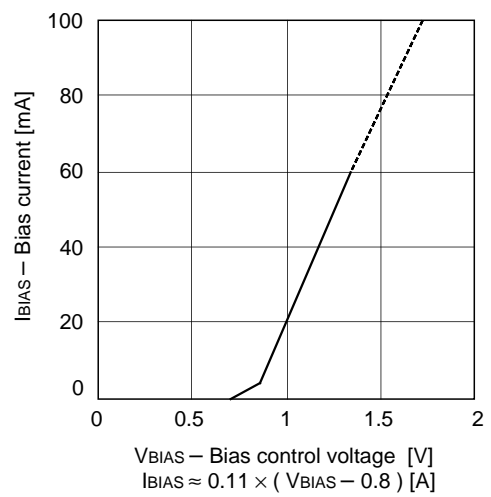
Bias current vs. Bias control current



Modulation current vs. Modulation control voltage



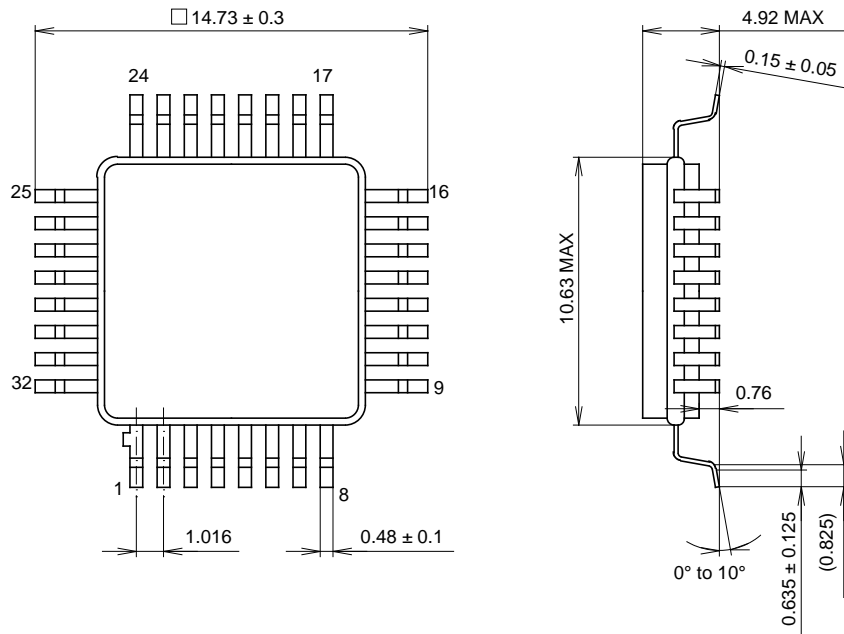
Bias current vs. Bias control voltage



Package Outline

Unit: mm

32PIN QFP (CERAMIC)



| | |
|------------|------------------|
| SONY CODE | QFP-32C-L01 |
| EIAJ CODE | XQFP023-G-0000-A |
| JEDEC CODE | _____ |

PACKAGE STRUCTURE

| | |
|------------------|-------------|
| PACKAGE MATERIAL | CERAMIC |
| LEAD TREATMENT | TIN PLATING |
| LEAD MATERIAL | 42 ALLOY |
| PACKAGE WEIGHT | 0.3g |