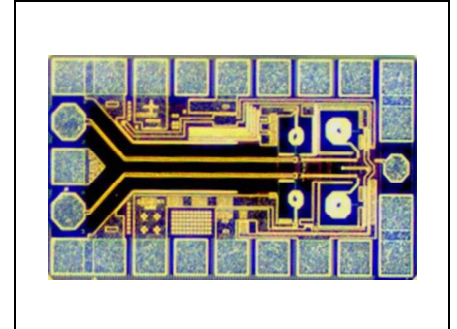


## VCSEL driver 56 Gbit/s NRZ



Sample image only. Actual product may vary

Product Code: A56-230C

Preliminary

### Product Description

The A56-230C is a high speed VCSEL driver IC designed for directly modulated VCSELs in fiber optic transmission systems.

The VCSEL driver IC is designed to directly modulate common-cathode VCSEL. The IC has differential input ( $V_{in+}$ ,  $V_{in-}$ ) and single-ended output to the VCSEL anode. A ground for the VCSEL common cathode is also provided by the IC. It is operated with a single 3.3 V supply typically dissipating less than 200 mW of DC power when no load (VCSEL) is connected at the output.

The driver is also equipped with various analog control pins ( $V_{xing}$ ,  $V_{mod}$ ,  $V_{bias}$ ). The zero-crossing can be adjusted with the  $V_{xing}$  pin. The VCSEL modulation current is controlled by varying the bias current swing with the  $V_{mod}$ , and the VCSEL bias current is controlled by  $V_{bias}$  pin.

### Features

- up to 56 Gbit/s Laser Diode Driver for VCSELs
- differential input 100  $\Omega$
- low power consumption
- small footprint

### Applications

- CEI-56G
- Fiber optics systems tests
- Research and development

Parameter	Typical	Notes
Data rate	Up to 56 Gbit/s	
Supply Voltage ( $V_{DD}$ )	3.3 V	
Power dissipation	200 mW	
Differential Input Resistance	100 $\Omega$	
Ambient Operating Temperature	-5 to +85°C	

All product specifications and descriptions are subject to change without notice.

### Simplified Block Diagram

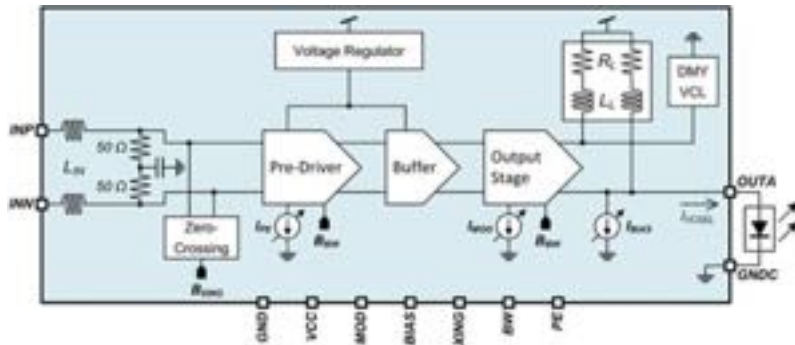


Figure 1. Simplified block diagram of the IC

The VCSEL driver IC is designed to directly modulate common-cathode VCSEL. The IC has differential input (INP, INN) and single-ended output (OUTA) to the VCSEL anode. A ground for the VCSEL common cathode (GNDC) is also provided by the IC. It is operated with a single 3.3 V supply (VCC and GND) and equipped with various analog control pins (MOD, BIAS, XING, BW, PE).

# Datasheet

## A56-230C VCSEL Driver



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### Pad Layout

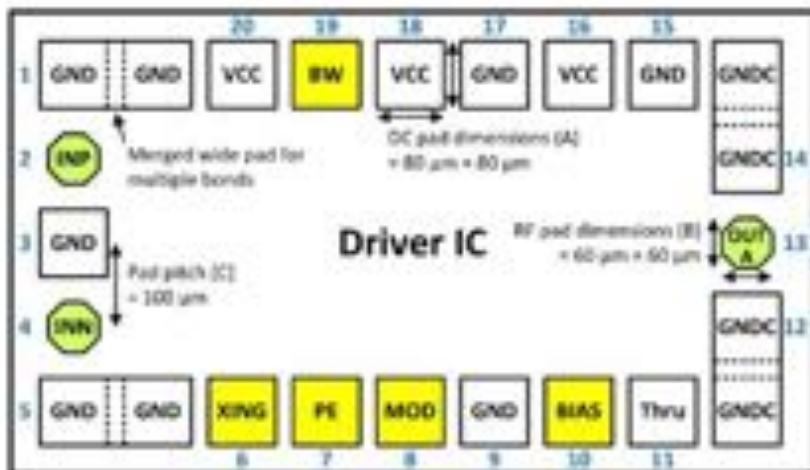


Figure 2. Pad layout of the IC

### Pad description

Name	Pin	Symbol	Description	Function
In+	2	INP	HF input (positive)	HF Input
In -	4	INN	HF input (negative)	HF Input
Vcc	16,18,20	VCC	3.3 V supply voltage.	Supply
V bias	10	BIAS	Control voltage of VCSEL bias current.	Input
V mod	8	MOD	Modulation current ( $I_{MOD}$ ) control	Input
V bw	19	BW	Analog control voltage of capacitive bandwidth extension.	Input
V xing	6	XING	Zero crossing control voltage	Input
V pe	7	PE	Analog control voltage of pre-emphasis level.	Input
V thru	11	Thru	Internal supply voltage monitoring.	Input
GND	1, 3, 5, 9, 15, 17	GND	Ground (0 V)	Ground
VCSEL cathode	12,14	GNDC	Ground to VCSEL cathode.	Output
VCSEL anode	13	OUTA	Output to VCSEL anode.	Output

All product specifications and descriptions are subject to change without notice.

### Control Voltages Description

#### Vcc

Power supply of the IC.

#### Vbias

Control voltage  $V_{bias}$  defines the bias current provided to the VCSEL. The values expected at different  $V_{mod}$  voltages are displayed on Fig. 3. (simulated with a VCSEL model)

#### Vmod

Control voltage  $V_{mod}$  defines the modulation current ( $I_{mod}$ ) provided to the VCSEL. The values expected at different  $V_{bias}$  voltages are displayed on Fig. 4 (simulated with a VCSEL model)

#### Vbw

Control voltage  $V_{bw}$  defines the use of capacitive bandwidth extension. Differential S21 parameter with and without  $V_{bw}$  control is displayed on Fig. 5 (measurement).

If this pin is left floating, the voltage is set to the typical value (0 V).

#### Vxing

Control voltage  $V_{xing}$  defines the position of the signal crossing point. If this pin is left floating, the voltage is set to the typical value (2.0 V).

#### Vpe

Control voltage  $V_{pe}$  defines the level of the pre-emphasis. If this pin is left floating, the voltage is set to the typical value (1.2 V).

#### Vthru

Control voltage  $V_{thru}$  is used for internal supply voltage monitoring.

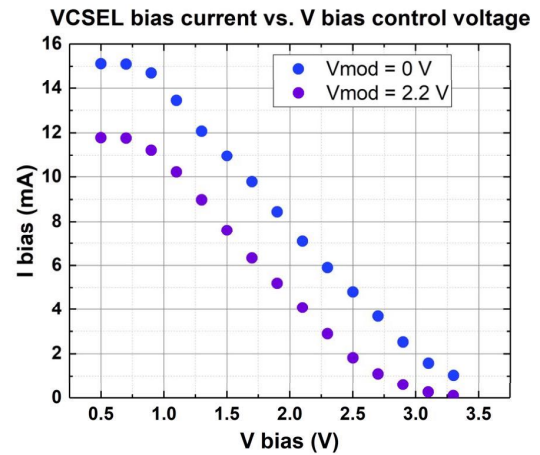


Figure 3. VCSEL bias current controlled by Vbias

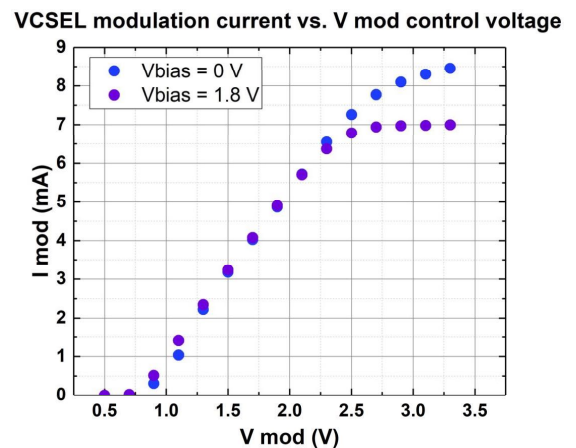


Figure 4. VCSEL modulation current controlled by Vmod

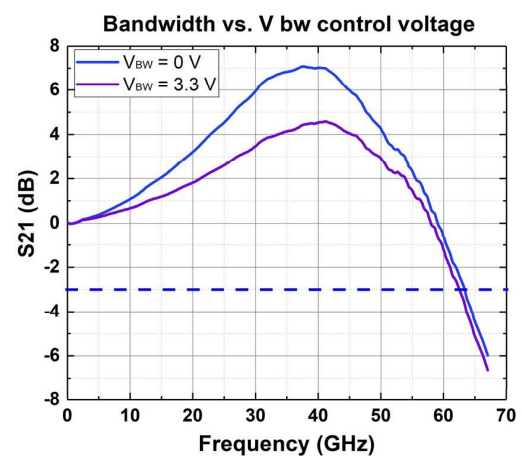


Figure 5. Measured Bandwidth controlled by Vbw

All product specifications and descriptions are subject to change without notice.

### Turn on conditions

Before Vcc is applied, provide a proper Vbias first in order to ensure that too much bias current, higher than the absolute maximum current of a VCSEL, is not supplied. If Vcc is applied with the floating Vbias, the maximum bias current is supplied to the VCSEL. Other control voltages can be applied simultaneously with or later than Vcc.

### Operating conditions

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Power supply voltage	V <sub>cc</sub>			3.3	3.4	V
Bias current control	V <sub>bias</sub>		0.7	1.8	3.3	V
Modulation current control	V <sub>mod</sub>			2.2	3.3	V
Crossing control	V <sub>xing</sub>			2.0	3.0	V
Peaking control voltage	V <sub>bw</sub>			0	3.3	V
Pre-emphasis control voltage	V <sub>pe</sub>			1.2	3.3	V
Bondwire inductance for signal pins				250	400	pH
Bondwire inductance for HF pins				62.5	100	pH
Bondwire length for signal pins				0.25	0.4	mm
Bondwire length for HF pins		multiple		4 x 62.5	4 x 100	um



**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features ESD protection, devices subjected to ESD stress may lose in performance and functionality.

### Test circuit

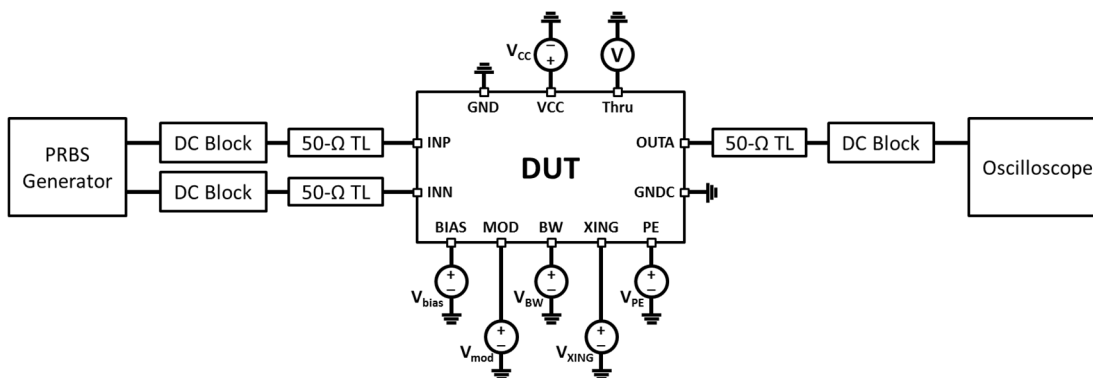


Figure 6. Test circuit

The functionality of the IC can be monitored and operated based on test circuit (Fig 6)  
300 pF external capacitor recommended to clean the Vcc DC signal.

All product specifications and descriptions are subject to change without notice.

# Datasheet

## A56-230C VCSEL Driver



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### Absolute Maximum Ratings

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Power Supply Voltage	$V_{cc}$	w/ respect to GND	0		3.4	V
Vxing, Vmod, Vbias	$V_{bias}$ $V_{xing}$ $V_{mod}$	w/ respect to GND	0		3.3	V
Differential Input	$V_{in+}$ $V_{in-}$	$V_{in+}$ to $V_{in-}$	0.4	0.6	1.0	V
Operating Temperature	$T_{OP}$		-5		+85	°C
Vcontrol current limits					2	mA

### Characteristics & output parameters

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Maximum data rate				56		Gbit/s
Bias current provided to VCSEL(sim)	$I_{BIAS}$		0	6	15	mA
Output modulation current provided to VCSEL (sim)	$I_{MOD}$		0	6	8	mA
S21 small-signal bandwidth		50Ω load		63		GHz
S11  input return loss		<40 GHz	15		7	dB
Rise / Fall time (sim)	$t_R / t_F$	(20-80%)		6.5/7		ps
Max. deterministic jitter	$J_D$	rms		0.7		ps
Crosspoint Adjust (CPA) Range			40	50	65	%
Supply current consumption	$I_{CC}$		50	60		mA
Power consumption			165	200	230	mW

*Simulated values are marked with (sim)*

All product specifications and descriptions are subject to change without notice.

### Performance

Electrical measurements were performed on a 50  $\Omega$  load. Improvement of the electrical characteristics is expected in assembly with a VCSEL chip. The performance of the assembly strongly depends on the model of the optoelectronic device and assembly scheme.

### Eye diagram at 56 Gbit/s

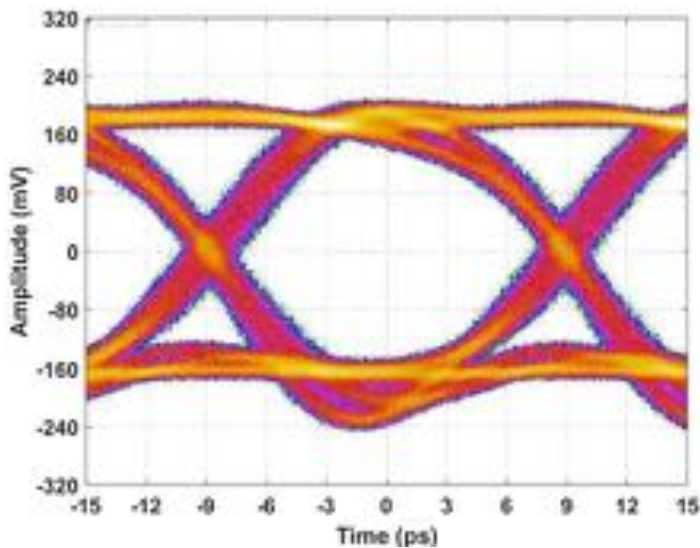


Figure 7. Electrical eye-diagram at 56 Gbit/s bit rate.  
Driving conditions:  $V_{bias} = 1.8$  V,  $V_{mod} = 3.0$  V,  $V_{bw} = 3.3$  V

### S-Parameters (measurement)

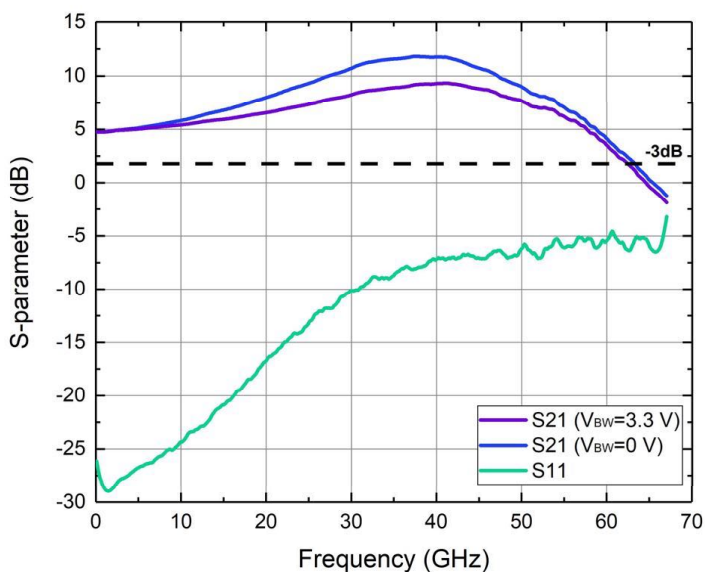


Figure 8.  $S_{21}$  and  $S_{11}$  parameters measured on the IC

All product specifications and descriptions are subject to change without notice.

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## A56-230C VCSEL Driver



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### Mechanical dimensions

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Die width	W			0.64		mm
Die length	L			1.04		mm
Die thickness	H			200		µm
DC square pad dimensions				80		µm
RF octagonal pad dimensions				60		µm
Pad pitch				100		µm

### Limited Qualification Notification

The A56-230C has been tested to meet specifications outlined in this data sheet at room temperature. However, it has not undergone full qualification testing or characterization and therefore may not meet the performance specifications over all extremes.



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