# HL5897 Ultra-Broadband Linear Amplifier (63 GHz)

## PRODUCT SUMMARY

The HL5897 is an ultra-broadband, linear amplifier that demonstrates exceptional gain flatness over a typical bandwidth of 48 kHz to 63 GHz.

This amplifier is optimized as a data driver to amplify signals with a minimum amount of eye distortion. This is ideal for use as a linear gain block in applications such as fiber optic receiver channels or 112 Gbps PAM4 signaling.

Only a single 6 V supply is needed for operation.

## APPLICATIONS

Optical Communications
Satellite Communications
Data Signaling
High-Speed Pulses
Analog Signals
Antenna Measurements
Research & Development

## S-PARAMETERS

S-parameters files are available on our website.

## AVAILABLE OPTIONS

The following options and configurations are available for this product:

- ***-10***, 1.0 mm connectors
- ***-18***, 1.85 mm connectors

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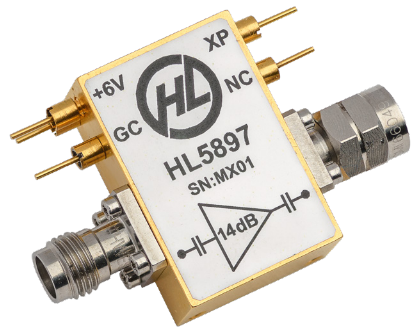
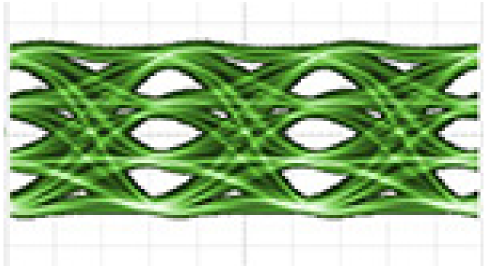
- ***-PP***, plug in & out
- ***-PJ***, plug in, jack out
- ***-JJ***, jack in & out
- ***-JP***, jack in, plug out

## Key Features and Technical Specifications

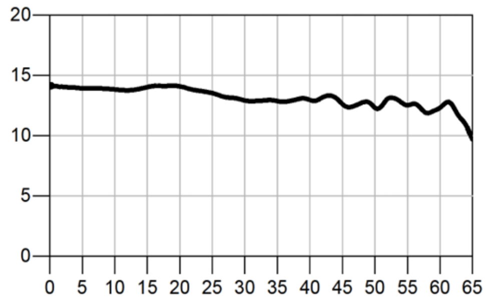
| | |
|---|---|
| Bandwidth (3 dB) | 48 kHz to 63 GHz |
| Small Signal Gain | 14 dB |
| Return Loss | 10 dB, input<br>10 dB, output |
| $P_{in\ max}$ | 15 dBm (damage threshold) |
| P1dB<br>(24 GHz)) | 16.5 dBm |
| Power Supply | +6 V @ 0.18 A |
| Power Consumption | 1.1 W typical |
| Dimensions<br>(L x H x D) | 41.5 x 27.0 x 10.0 mm (opt. -18-JP)<br>1.63” x 1.06” x 0.40” |
| Weight | 25 g (0.88 oz) |
| Operating Temp.<br>Storage Temp. | 0° to +50° C, case temp<br>-40° to +50° C, case temp |
| RoHS Compliant | Yes, assembled with lead-free solder |
| REACH Compliant | Yes |
| Warranty | 1 year, see website |




*HL5897, option -18-JP drawing shown*



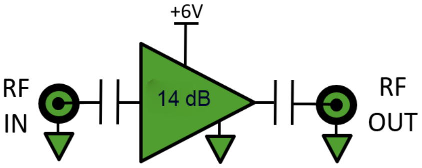
*Eye diagram of HL5987 driving 9.5" coaxial cable at 112 Gbps*




*Typical Small Signal Gain of HL5897*

### DEVICE PORT ASSIGNMENTS

For the purposes of this datasheet, the below port assignments are used.



## HL5897 Full Specifications

| Parameter | Conditions | Minimum | Typical | Maximum | Comments |
|---|---|---|---|---|---|
| Upper 3 dB Frequency | | | 63 GHz | | 3 dB roll-off point, relative to avg. gain from 35 MHz to 210 MHz |
| Lower 3 dB Frequency | | | 48 kHz | | 3 dB roll-off point, relative to avg. gain from 35 MHz to 210 MHz |
| Small Signal Gain | $P_{in}$ = -10 dBm | 13 dB | 14 dB | | Avg from 35 MHz to 210 MHz |
| Return Loss, Input | | | 10 dB | | 35 MHz < f < 65 GHz |
| Return Loss, Output | | | 10 dB | | 35 MHz < f < 65 GHz |
| Group Delay | | | 0.19 ns | | |
| Input Referred Noise Voltage | | | 0.15 mV | | Integrated DC to 20 GHz broadband measurement |
| Max RF Input | | | | 15 dBm | Damage threshold |
| Max Power Out | 1 dB gain compression | | 16.5 dBm | | 24 GHz |
| *See note(1)* | 2 dB gain compression | | 17.5 dBm | | 24 GHz |
| | 3 dB gain compression | | 18.3 dBm | | 24 GHz |
| Impedance | | | 50 Ω | | Input and output |
| Polarity | Inverting | | | | |
| Coupling | AC, input and output | | | | |
| Supply Voltage (+) | | +5.8 $V_{DC}$ | +6 $V_{DC}$ | +7 $V_{DC}$ | |
| Supply Current (+) | | | 180 mA | 200 mA | Do not exceed 200 mA operating limit max |
| Power Dissipation | | | 1.1 W | | |
| Gain Control Voltage | | -10 V | +2 V | +3 V | Pin floats to +2 V |
| XP Control | | -1V | +1.2 V | +6 V | Pin floats to +1.2 V |

***Table 1: Output Compression Table***
***All output in dBm***

| Compression | 100 MHz | 6 GHz | 12 GHz | 24 GHz |
|---|---|---|---|---|
| 1 dB | 14.3 | 15.9 | 16.2 | 16.5 |
| 2 dB | 15.7 | 17.0 | 17.9 | 17.5 |
| 3 dB | 16.4 | 17.6 | 18.9 | 18.3 |

*Note(1): Compression measurements made using Keysight U2002A Average Power Sensor*

## HL5897 Typical Performance Characteristics

The data presented in Figures 1 through 6 were obtained using a MICRAM DAC4 signal source and LeCroy SDA 100G Sampling Oscilloscope with 70GHz (SE-70) remote sampling module.

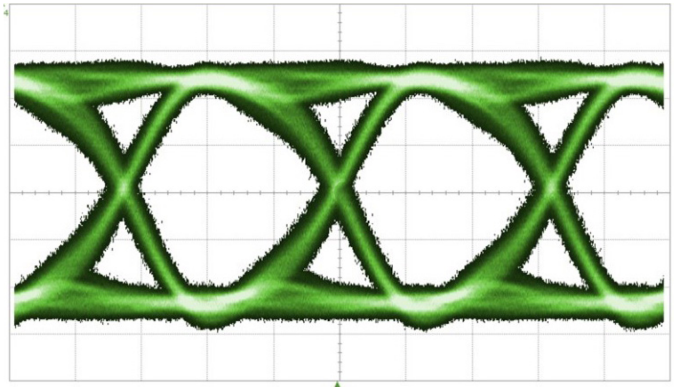


*Fig. 1: 56 Gbps PRBS11 pattern on RF In. 60 mv/div*

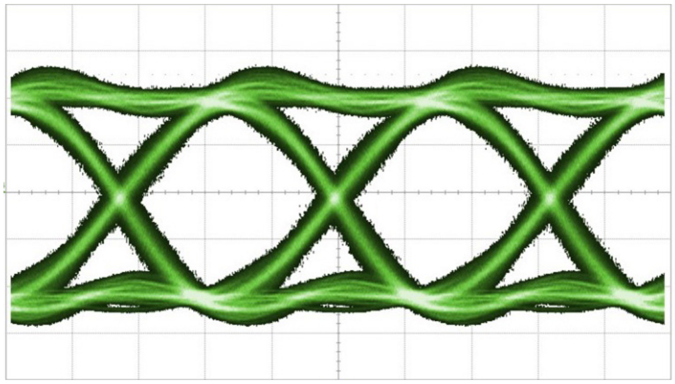


*Fig. 2: 56 Gbps PRBS11 pattern on RF Out. 325 mv/div*

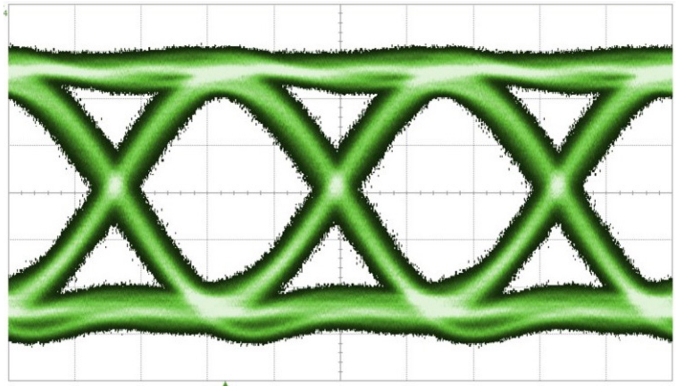


*Fig. 3: 80 Gbps PRBS7 pattern on RF In. 53 mv/div*

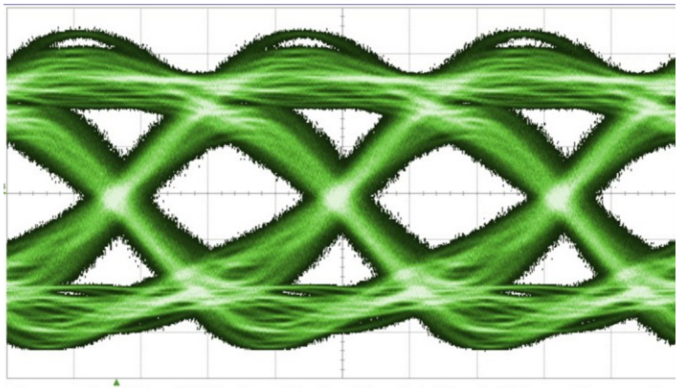


*Fig. 4: 80 Gbps PRBS7 pattern on RF Out. 280 mv/div*

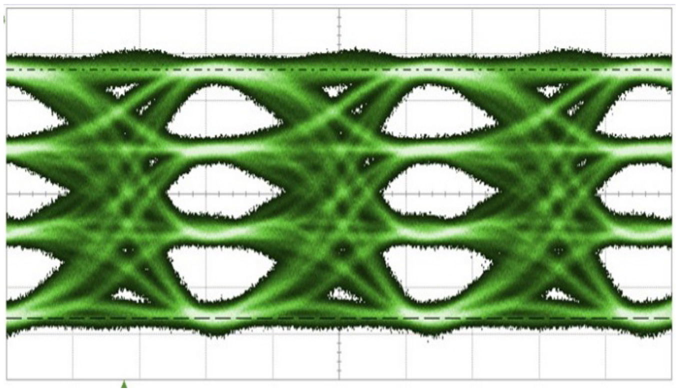


*Fig. 5: 112 Gbps PAM4 pattern on RF In. 50 mv/div*

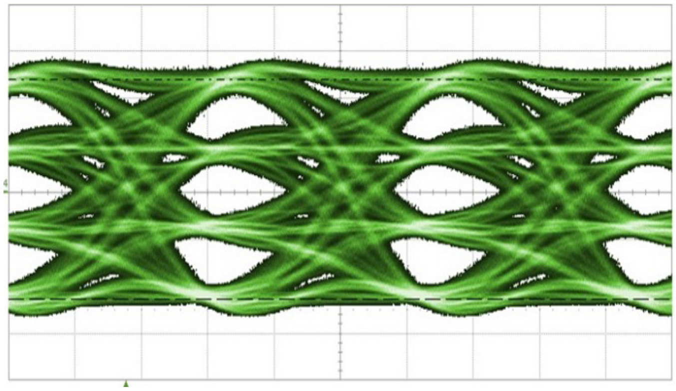


*Fig. 6: 112 Gbps PAM4 pattern on RF out. 280 mv/div*

## HL5897 Typical Performance Characteristics

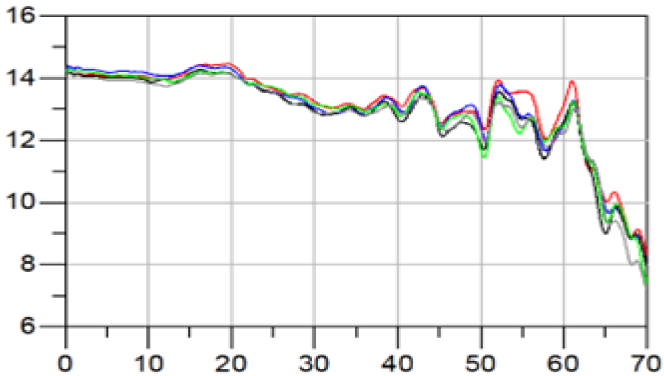



*Fig. 7: Typical Gain (dB) vs Linear Frequency (GHz)*

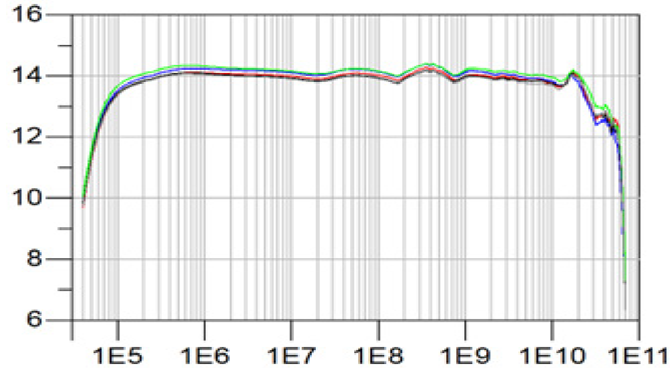



*Fig. 8: Typical Gain (dB) vs Log Frequency (Hz)*

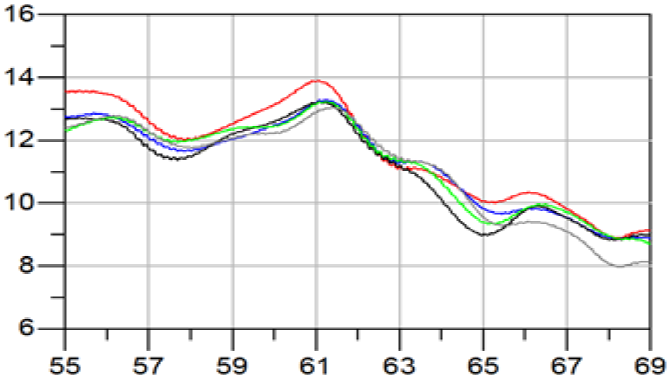



*Fig. 9: Typical Gain (dB) High-Frequency Cut-off Region (GHz)*

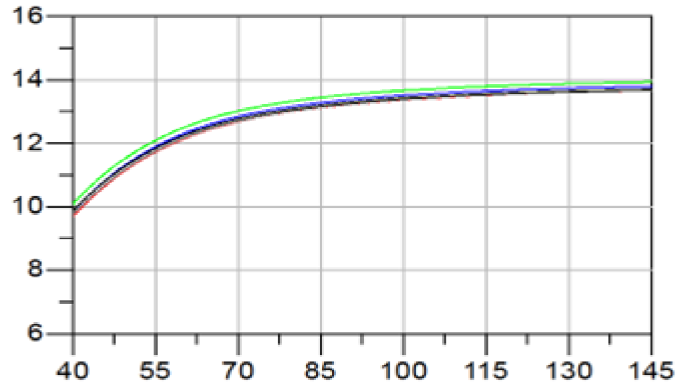



*Fig. 10: Typical Gain (dB) Low-Frequency Cut-off Region (kHz)*

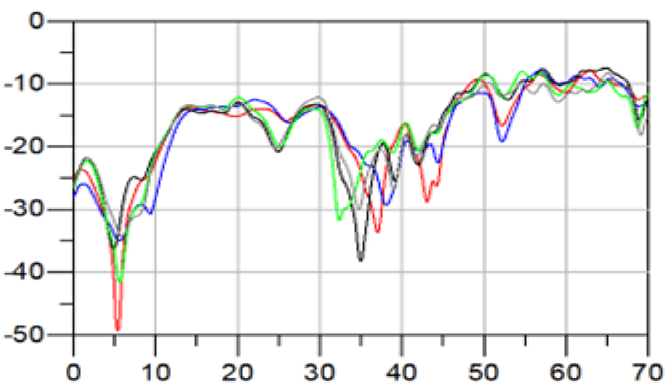



*Fig. 11: Typical Input Return Loss (dB) vs Frequency (GHz)*

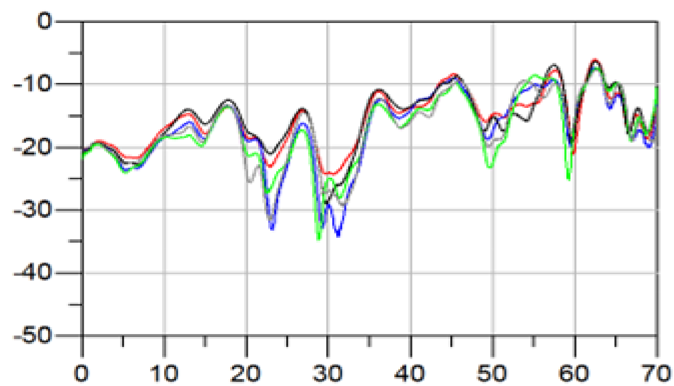



*Fig. 12: Typical Output Return Loss (dB) vs Frequency (GHz)*

## HL5897 Typical Gain Control and Crossing Point (XP) Control Functions

The data presented in Figures 13 through 18 were obtained using a MICRAM DAC4 signal source and LeCroy SDA 100G Sampling Oscilloscope with 50GHz (SE-50) remote sampling module. All measurements were made at 270mV input eye amplitude and 51% input eye crossing point. Gain control and crossing control functions are dependent on input amplitude. Adjust both controls interactively to control output amplitude while maintaining 50% crossing point as shown in Figures 15 through 18.

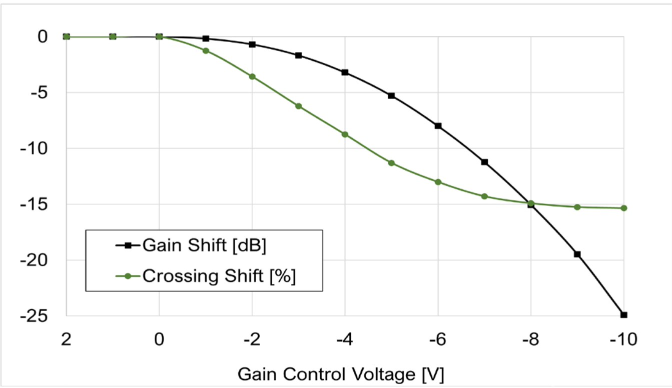



*Fig. 13: Gain Control Function with Crossing Control pin floating*

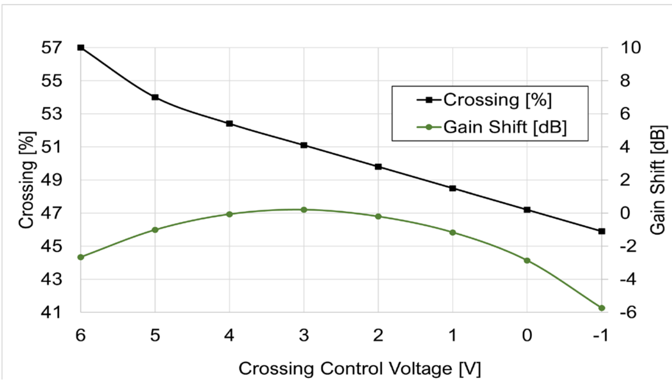



*Fig.14: Crossing Control Function with Gain Control pin floating*

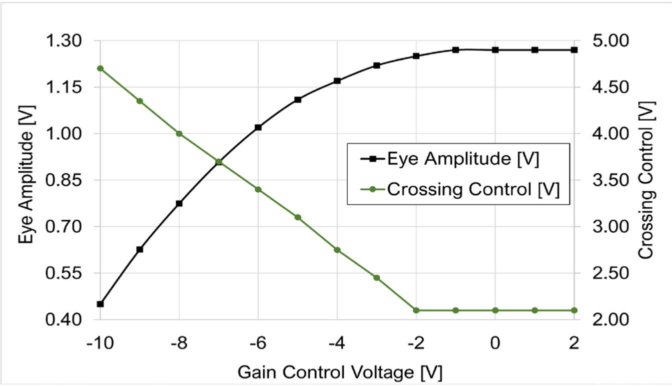



*Fig. 15: Interactive Control Example with constant 50% Crossing Pt*

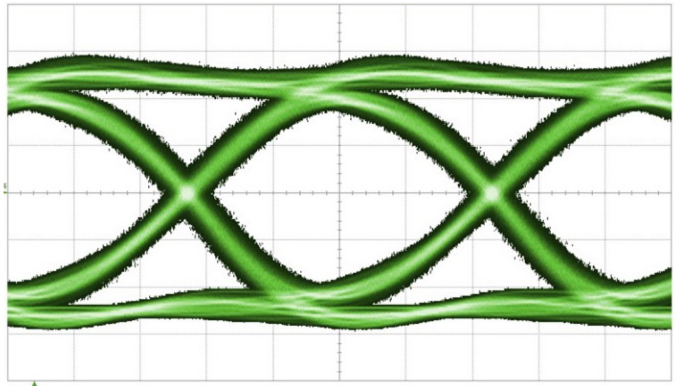


*Fig. 16: Vgc=2V, Vxp=2.1V, XP=50%, Eye Amplitude=1.27V*

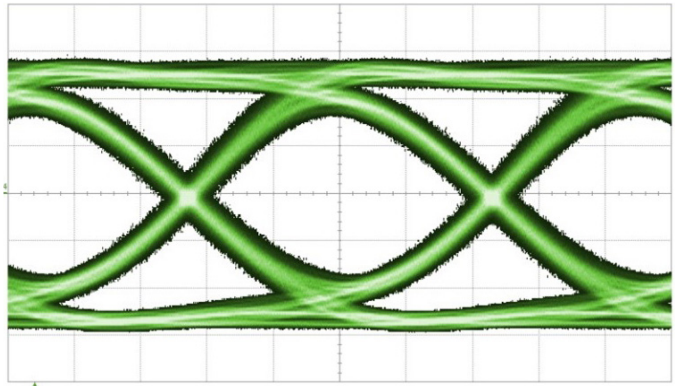


*Fig. 17: Vgc=-7V, Vxp=3.7V, XP=50%, Eye Amplitude = 0.91V*

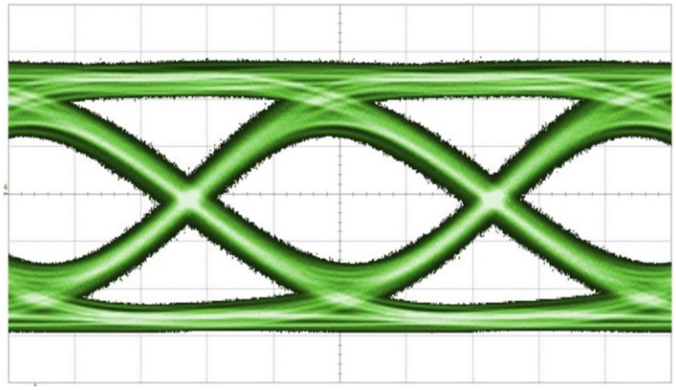
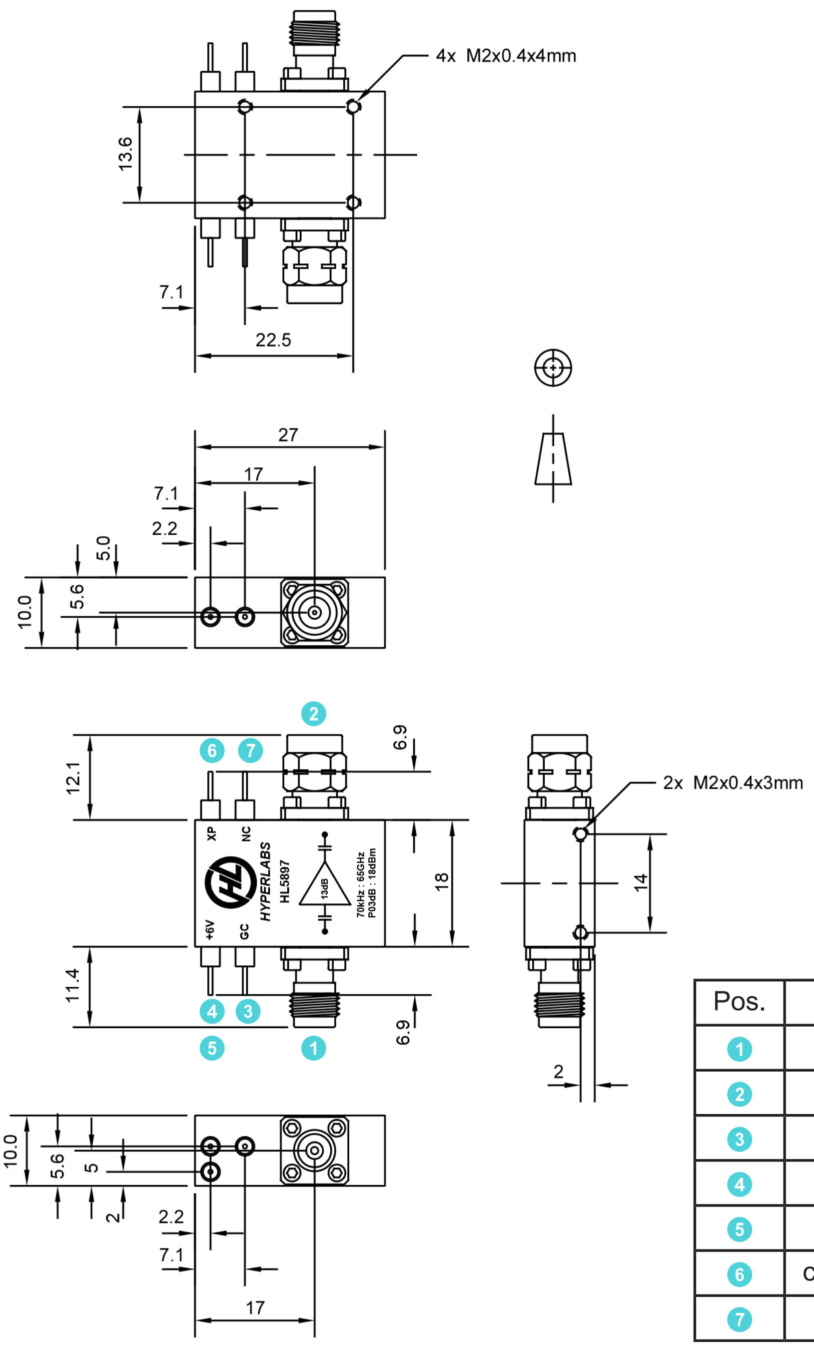


*Fig. 18: Vgc=-10V, Vxp=4.7V, XP=50%, Eye Amplitude = 0.46V*

## HL5897 Dimensional Drawing

Figure 1 shows a mechanical drawing of an HL5897, option -18-JP. Unless otherwise noted, all units are in mm.




| Pos. | Connector |
|---|---|
| 1 | Input |
| 2 | Output |
| 3 | Gain control |
| 4 | +6 V / 0.2 A |
| 5 | GND |
| 6 | crossing control |
| 7 | nc (optional) |

*Figure 1: HL5897 mechnical drawing (opt. -18-JP), mm*