

FUNCTIONAL FEATURES

The SY88702 features:

- Up to 622Mbps operation
- Modulation current to 25mA
- PECL output enable
- Differential PECL inputs
- Single 5V power supply
- Available in a tiny 10-pin (3mm x 3mm) MSOP

The SY88702 evaluation board features:

- User adjustable potentiometer to adjust modulation current
- 50Ω equivalent input network termination
- Unloaded open-collector outputs allow flexibility for evaluating various output loads
- AC-coupled inputs with SMA connectors
- DC-coupled outputs with SMA connectors

AVAILABLE MEASUREMENTS

- Frequency performance
- Output eye pattern generation
- Mark testing
- Jitter
- Output rise/fall time
- BER testing

EVALUATION BOARD

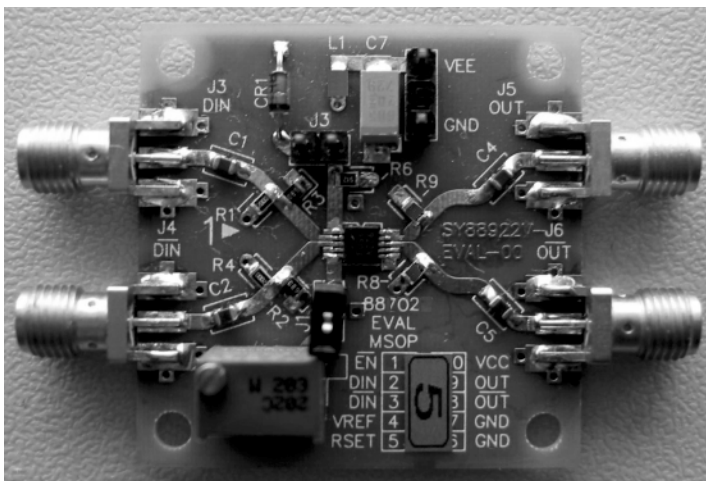


Figure 1. SY88702 Evaluation Board

DESCRIPTION

The SY88702 is a high-speed current switch for driving a semiconductor laser diode in optical transmission applications. The modulation current (I_{OUT}) is controlled by the current (I_{RSET}) through the external resistor R_{SET} . The output OUT is HIGH and no current flows through OUT when output enable is HIGH.

The device incorporates complementary open collector outputs with 25mA maximum current driving capability. The external resistor R_{EXT} must be placed between /OUT and V_{CC} to dissipate the worst case power. R_{SER} is recommended to compensate for laser diode matching issues.

This manual provides information on the SY88702 evaluation board. It should be used in conjunction with the SY88702 data sheet, which contains full specifications of the SY88702.

The SY88702 evaluation board enables fast and thorough electrical evaluation of the SY88702 622Mbps laser diode driver with output enable. The board is an easy-to-use, single-layer high-speed microstrip design. It is designed to be driven by a high-speed 622Mbps pattern generator and provides onboard 50Ω equivalent terminations for the generator's outputs. The input termination network also provides the required input bias of $V_{CC} - 1.3V$ for the SY88702.

The board is intended to be terminated to a 50Ω scope and provides for adjustability of the modulation current through the adjustment of an on-board potentiometer. With the amplitude of the voltage waveform displayed on the scope, a user can verify the desired modulation current through the equation: $I_{mod}(mA) = V_{amp}(V) / 0.050k\Omega$. The voltage waveform data also helps in evaluating various parameters of the SY88702, as listed in the "Available Measurements" section of this document.

All data sheets and support documentation can be found on Micrel's web site at www.micrel.com.

MEASUREMENT SETUP

Equipment used for measurements:

1. Agilent 83752A Synthesized Sweeper
2. Agilent 70004A Display
3. Agilent 70843B Error Performance Analyzer
4. Agilent 86100A Wide-Bandwidth Oscilloscope

5. Two (2) MCL BW S15W2 6dB attenuators
6. Agilent E3620A DC Power Supply
7. Matched high-speed cables w/SMA connectors

Note. Items 1 through 3 constitute the BERT stack.

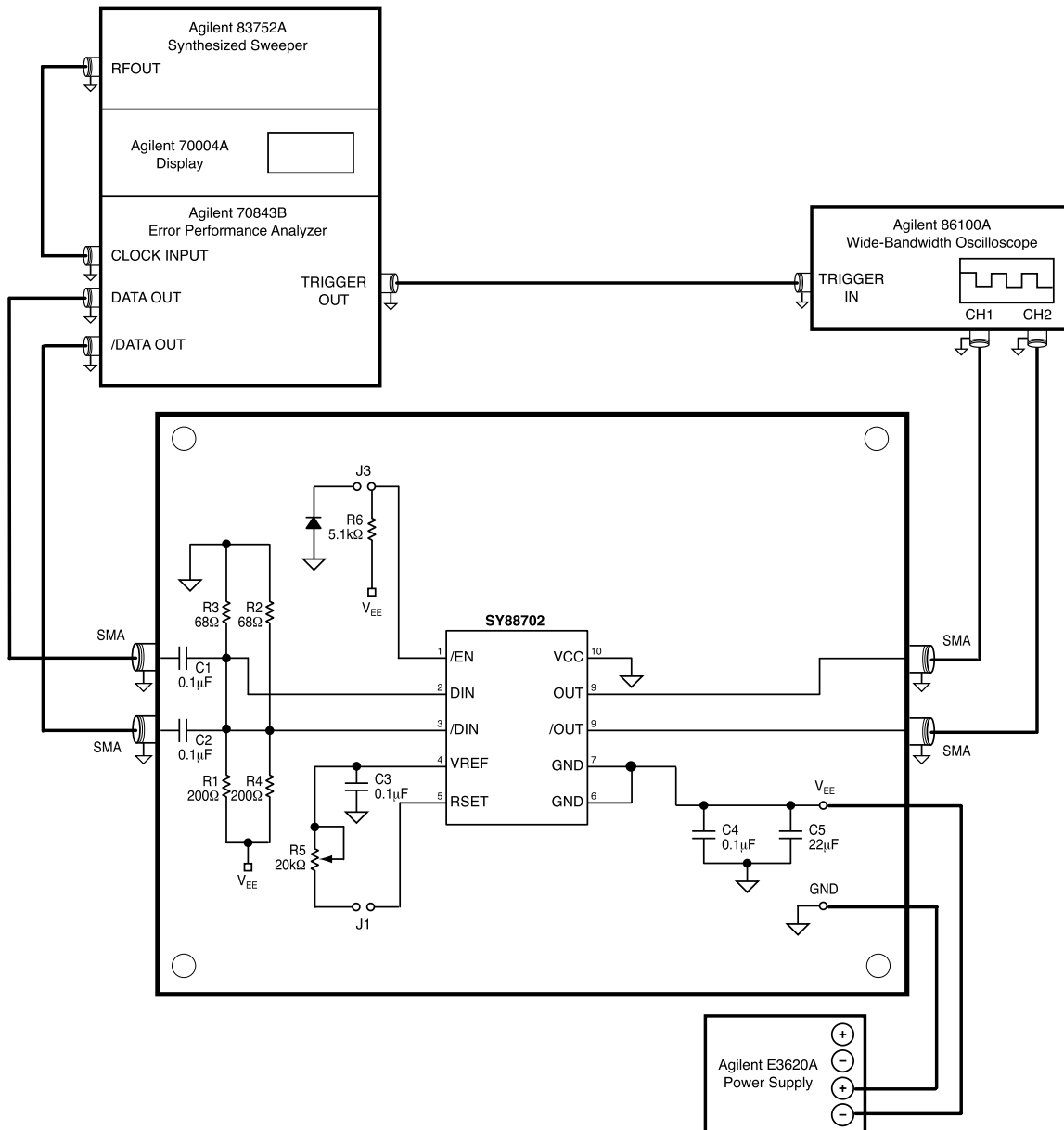


Figure 2. Setup for Measurements

SETUP FOR MEASUREMENTS

This section explains how to connect and setup the SY88702 evaluation board per Figure 2. Ensure proper ESD precautionary measures are taken before handling sensitive electronic equipment, including the SY88702 evaluation board.

1. Set E3620A to output 5V and then turn off E3620A. Connect E3620A's positive lead to GND post and negative lead to V_{EE} post. Note that the board uses a negative supply; ensure that the power supply polarity is correct.
2. Configure Agilent BERT stack:
 - a) Set the 83752A synthesized sweeper to 622MHz
 - b) From the 70004A's pattern menu, choose the PRBS $2^{31}-1$ pattern
 - c) From the 70004A's trigger menu:
 - i. Choose clock as trigger output
 - ii. Choose CLK/8 for divider
 - d) From the 70004A's data menu:
 - i. External termination = DC termination 0V
 - ii. Amplitude = 800mV ($1600mV_{pp}$)
 - iii. Hi-Level = 0V
 - iv. Tracking = ON
 - v. Attenuation = 0dB
 - vi. Data output = ON
 - vii. Polarity = NORMAL
 - viii. Crossing = 0
3. Connect 70843V's trigger output to 86100A's trigger input
4. Short J1; open J3 on SY88702 evaluation board
5. Connect DIN and /DIN on SY88702 evaluation board to 70843V's data outputs
6. Connect OUT and /OUT on SY88702 evaluation board to 86100A's inputs
7. Turn on E3620A. Typical power supply current should be ~53mA, including the SY88702's current and current through the on-board 50Ω equivalent termination network. Excessive current usually means the power supply leads have been connected backwards. Be careful of this!
8. Configure 86100A oscilloscope:
 - a) Verify a trigger signal is present by checking that the trigger source button is lit
 - i. Depress this button to choose external source if necessary
 - ii. Adjust trigger level if necessary
 - b) Press Eye/Mask mode on front panel
 - c) Choose NRZ eye measurements from on-screen display
 - d) Choose RMS Jitter, Rise Time, Fall Time and Eye Amplitude measurements from on-screen selection list
 - e) Attach 6dB attenuators to oscilloscope's inputs. 6dB attenuators are required since the scope can only display $2V_{pp}$ maximum amplitude waveforms, and the SY88702 evaluation board can output larger swings than this ($25mA \times 50\Omega = 1.25V = 2.5V_{pp}$)
 - i. To configure scope to account for external 6dB attenuation, choose Setup -> Channel X (X = 1 to 4) -> Advanced -> Attenuator factor = 6dB

MEASUREMENTS

The SY88702 evaluation board assumes the use of a 50Ω scope to terminate the SY88702. The current passing through this load creates a voltage swing used to measure various performance parameters of the SY88702. The current is adjustable through the use of potentiometer R5. The following sections detail various measurements that can be performed with the SY88702 evaluation board:

1. Eye pattern generation output including jitter, rise/fall times and modulation current verification:
 - a) Adjust R5 to give 1.25V ($2.5V_{pp}$) output amplitude ($I_{mod} = 25mA = 1.25V/0.050k\Omega$). R5 should be approximately $1k\Omega$. The power supply needs to be turned off to get a correct reading of the potentiometer's resistance.
 - b) Press Autoscale on oscilloscope. The eye pattern should automatically display on the scope. If not, verify the steps listed in the "Setup for Measurements" section are completed. Sometimes the waveform needs to be manually adjusted to fit the display. Use the Time Scale and Voltage Scale knobs on the front panel of the scope to adjust this.
 - c) Observe measurements on scope's display. The rise and fall times should be less than 400ps, amplitude around 1.25V and jitter around $10ps_{rms}$.
 - d) Adjust R5 to give 250mV ($500mV_{pp}$) output amplitude ($I_{mod} = 5mA = 0.250V/0.050\Omega$) and repeat above. R5 should be around $8k\Omega$.

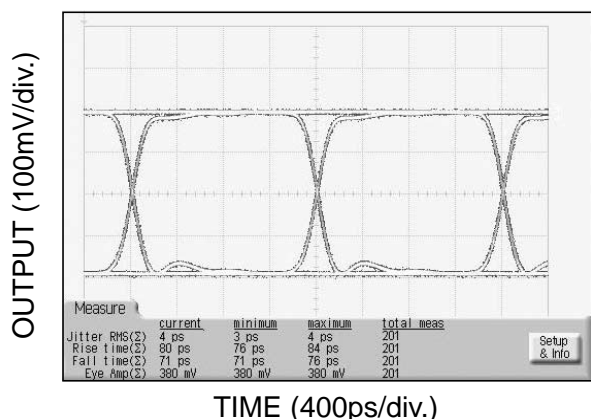


Figure 3. Typical SY88702 Eye Diagram

2. Mask testing:
 - a) Press eye/mask mode on front panel of scope
 - b) Choose mask testing from on-screen display
 - c) Choose open mask from on-screen selection list
 - i. Select and open the OC-12 mask
 - d) Choose Start Mask Testing from on-screen selection list. Waveform should automatically display with appropriate mask regions and testing will start. If not, verify the steps listed in the "Setup for Measurements" section are completed.
3. BER testing:
 - a) Since the SY88702 is designed to drive a laser, where an optical HIGH means the laser is conducting, the SY88702 will electrically be LOW. Hence, the output polarity is opposite of the input polarity. Since this is the case, it is recommended to feedback the SY88702 evaluation board's /OUT output to the 70843B's BERT data input. The alternative is to feedback the SY88702 evaluation board's OUT output to the 70843V's BERT data input, but to select inverted polarity from the 70004A's data menu.
 - b) Feedback the 70843V's clock output to the 70843V's BERT clock input
 - c) Set the 87702's modulation current to a desired value using R5 as described in Section 1 of this page. Remember, $I_{mod}(mA) = V_{amp}(V)/0.050k\Omega$.
 - d) From the 70004A's Gating menu:
 - i. Choose a gate condition. The options are: gate by time, errors or bits. Choose bits, but this is of no relevance because there should be no errors, and the test will run forever until manually interrupted if gate by errors is chosen.
 - ii. Choose single gating period
 - iii. Choose run gating
 - iv. 70004A will reset error count and synchronize SY88702's transmitted bitstream to generated 70843V's bitstream. If synchronization does not occur, it is sometimes due to cable length. Try using different length cables to achieve synchronization. If this is unavailable, another trick is to adjust the 83752A's frequency to a slightly higher or lower value.
 - v. At end of gating period, there should be no errors.

FREQUENTLY ASKED QUESTIONS

I just got my SY88702 evaluation board and I cannot get anything to work. What should I check first?

First, check the power supplies. Remember, the board is V_{CC} referenced, and hence uses a negative supply. Typical power supply current should be $\sim 53\text{mA}$, including the SY88702's current and current through the on-board 50Ω equivalent termination network. Excessive current usually means the power supply leads have been connected backwards. Please be aware of this!

Next, ensure the input amplitude is large enough to drive the SY88702. PECL amplitudes are typically 800mV (1600mV_{pp}). This is a good starting point, and you can reduce or enlarge the swing from here, depending on your application. Another not so obvious setting is the modulation current. Ensure that you've set it to output a current! If the SY88702 is disabled (by shorting J3) or RSET is too large (make sure to short J1), then you will not get an output on the scope.

If amplitude and modulation current are fine and there is still no display on the scope, then there is most likely a trigger setup issue with the scope. Look on the scope's front panel and verify that the instrument is triggered. The Trigger Source button should be lit if a trigger signal is present. If not, press the button until the external trigger is selected. Also, try adjusting the level until a signal is found. If this does not work, verify that the 70004A is set to output a CLK/8 trigger signal as described in the "Setup for Measurements" section of this document.

Why is the OUT output LOW when I set the Data input HIGH?

The SY88702 is a laser driver and is meant to conduct current through the laser diode during the high state. This means that, with a resistive load, the output will be LOW when the input is HIGH. But optically, the output will be HIGH when the input is HIGH.

Can you suggest a bypass/decoupling scheme?

Figure 2 shows the power supply decoupling scheme used for the SY88702 evaluation board. The "Bill of Materials" section at the end of this document lists the supplier and component values. We have found this arrangement to be an excellent starting point.

What layout tips do you have?

1. Establish controlled impedance stripline, microstrip or coplanar construction techniques for high-speed signal paths.
2. All differential paths are critical timing paths and skew should be matched to within $\pm 10\text{ps}$.
3. Signal trace impedance should not vary more than $\pm 5\%$. If in doubt, perform Time Domain Reflectometry (TDR) analysis of signal traces.
4. Place power supply decoupling capacitors as close as possible to the device's power pins.

What is Time Domain Reflectometry (TDR)?

TDR is used to verify impedance continuity along a signal path. Many interconnects, such as SMA, if not launched correctly onto the PCB, will exhibit inductive-like resonance with an abrupt capacitive discontinuity. This discontinuity will subtract signal from the inputs and outputs, effectively closing the resulting data eye. The 86100A allows TDR testing and is a useful tool to help evaluate your PCB.

I still have questions. Who should I contact?

Micrel's HBW Applications helpline is available to assist you. Please call (408) 955-1690 or e-mail hbwhelp@micrel.com for assistance.

BILL OF MATERIALS

Item	Part Number	Manufacturer	Description	Qty
C1, C2, C3, C4	PCC1762CT-ND	Panasonic ⁽¹⁾	0.1 μ F surface mount capacitor, size 0603	4
C5	P11317CT-ND	Panasonic ⁽¹⁾	22 μ F surface mount capacitor, size C	1
J1, J3	TSW-103-07-S-S	Samtec ⁽²⁾	0.1mil center through hole terminal strip	3
R1, R4	P200GCT-ND	Panasonic ⁽¹⁾	200 Ω surface mount resistor, size 0603	2
R2, R3	P68LCT-ND	Panasonic ⁽¹⁾	68 Ω surface mount resistor, size 0603	2
R5	3269W-1-203G	Bourns ⁽³⁾	20k Ω trimmer	1
R6	P5.1KGCT-ND	Panasonic ⁽¹⁾	5.1k Ω surface mount resistor, size 0603	1
S1, S2, S3, S4	142-0701-851	Johnson ⁽⁴⁾	end launch SMA	4
U1	SY88702	Micrel, Inc. ⁽⁵⁾	622Mbps laser diode driver	1

Notes:

1. Panasonic tel: 800-344-2112
2. Samtec tel: 800-726-8329
3. Bourns tel: 877-426-8767
4. Johnson tel: 800-247-8256
5. **Micrel, Inc.** tel: 408-944-0800

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