

# 100m 1.25G SFP Copper Transceiver

## Copper Transceivers

### Overview

ARIA's Copper Small Form Pluggable (SFP) transceivers are a high performance, cost effective module compliant with the Gigabit Ethernet and 1000BASE-T standards as specified in IEEE 802.3-2002 and IEEE 802.3ab.

These modules support a data-rate of 1000Mbps up to 100 meters over unshielded twisted-pair category 5 cable.

The module supports 1000 Mbps full duplex data-links with 5-level Pulse Amplitude Modulation (PAM) signals.

The module provides standard serial ID information compliant with SFP MSA, which can be accessed with address of A0h via the 2-wire serial CMOS EEPROM protocol. The physical IC can also be accessed via 2-wire serial bus at address ACh.



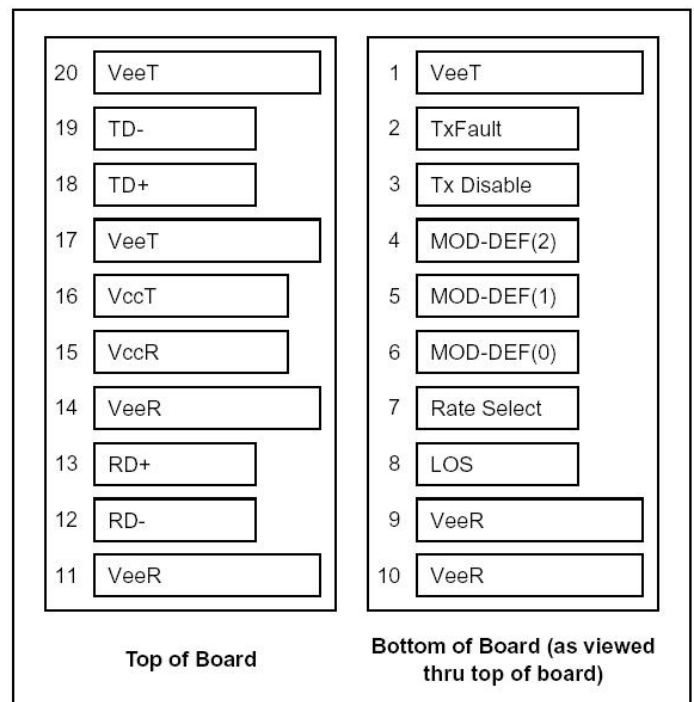
### Features

- Up to 1.25Gb/s bi-directional data links
- Hot-pluggable SFP footprint
- TX Disable and RX Los/without Los function
- Fully metallic enclosure for low EMI
- +3.3V single power supply
- Low power dissipation (1.05 W typical)
- Compact RJ-45 connector assembly
- Access to physical layer IC via 2-wire serial bus
- 1000 BASE-T operation in host systems with SERDES interface
- 10/100/1000Mbps compliant in host systems with SGMII interface
- Operating case temperature range of -40°C to +85°C

### Applications

- 1.25 Gigabit Ethernet over Cat 5 cable

### Pin Diagram



# 100m 1.25G SFP Copper Transceiver

## Copper Transceivers

### Pin Descriptions

| Pin | Signal Name | Description                  | Plug Seq. | Notes |
|-----|-------------|------------------------------|-----------|-------|
| 1   | VEET        | Transmitter Ground           | 1         |       |
| 2   | TX FAULT    | Transmitter Fault Indication | 3         | Note1 |
| 3   | TX DISABLE  | Transmitter Disable          | 3         | Note2 |
| 4   | MOD_DEF(2)  | SDA Serial Data Signal       | 3         | Note3 |
| 5   | MOD_DEF(1)  | SCL Serial Clock Signal      | 3         | Note3 |
| 6   | MOD_DEF(0)  | TTL Low                      | 3         | Note3 |
| 7   | Rate Select | Not Connected                | 3         |       |
| 8   | LOS         | Loss of Signal               | 3         | Note4 |
| 9   | VEER        | Receiver ground              | 1         |       |
| 10  | VEER        | Receiver Ground              | 1         |       |
| 11  | VEER        | Receiver Ground              | 1         |       |
| 12  | RX-         | Inv. Received Data Out       | 3         | Note5 |
| 13  | RX+         | Received Data Out            | 3         | Note5 |
| 14  | VEER        | Receiver ground              | 1         |       |
| 15  | VCCR        | Receiver Power Supply        | 2         |       |
| 16  | VCCT        | Transmitter Power Supply     | 2         |       |
| 17  | VEET        | Transmitter Ground           | 1         |       |
| 18  | TX+         | Transmit Data In             | 3         | Note6 |
| 19  | TX-         | Inv. Transmit Data In        | 3         | Note6 |
| 20  | VEET        | Transmitter Ground           | 1         |       |

#### Notes:

- 1) TX Fault is not supported and is always connected to ground.
- 2) TX disable, an input used to reset the transceiver module, This pin is pulled up within the module with a 4.7 K $\Omega$  resistor.  
Low (0–0.8 V): Transceiver on. Between (0.8 V and 2.0 V): Undefined. High (2.0–3.465 V): Transceiver in reset state.  
Open: Transceiver in reset state
- 3) Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7K~10K resistor on the host board. The pull-up voltage shall be VccT or VccR. Mod-Def 0 is grounded by the module to indicate that the module is present. Mod-Def 1 is the clock line of two wire serial interface for serial ID. Mod-Def 2 is the data line of two wire serial interface for serial ID
- 4) RX\_LOS (Loss of Signal): LVTTTL compatible with a maximum voltage of Host\_Vcc. RX\_LOS can be enabled or disabled (Refer to Ordering information),RX\_LOS is not used and is always tied to ground via a 100-ohm resistor.
- 5) RD-/+: These are the differential receiver outputs. They are AC coupled 100 differential lines which should be terminated with 100 (differential) at the user SERDES.
- 6) TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 differential termination inside the module.
- 7) Plug Seq.: Pin engagement sequence during hot plugging.

# 100m 1.25G SFP Copper Transceiver

## Copper Transceivers

### +3.3V Volt Electrical Power Interface

| Parameter              | Symbol           | Min  | Typ | Max  | Unit | Notes/Conditions   |
|------------------------|------------------|------|-----|------|------|--|
| <b>Supply Current</b>  | I <sub>s</sub>   | N/A  | 320 | 375  | mA   | 1.2W max power over full range of voltage and temperature.<br>See caution note below |
| <b>Input Voltage</b>   | V <sub>cc</sub>  | 3.13 | 3.3 | 3.47 | V    | Referenced to GND  |
| <b>Maximum Voltage</b> | V <sub>max</sub> | N/A  | N/A | 3.6  | V    |  |

### Low-Speed Signals, Electronic Characteristics

| Parameter              | Symbol | Min            | Max            | Unit | Notes/Conditions  |
|------------------------|--------|----------------|----------------|------|---|
| <b>SFP Output LOW</b>  | VOL    | 0              | 0.5            | V    | 4.7k to 10k pull-up to host_Vcc, measured at host side of connector |
| <b>SFP Output HIGH</b> | VOH    | host_Vcc - 0.5 | host_Vcc + 0.3 | V    | 4.7k to 10k pull-up to host_Vcc, measured at host side of connector |
| <b>SFP Input LOW</b>   | VIL    | 0              | 0.8            | V    | 4.7k to 10k pull-up to Vcc, measured at SFP side of connector       |
| <b>SFP Input HIGH</b>  | VIH    | 2              | Vcc + 0.3      | V    | 4.7k to 10k pull-up to Vcc, measured at SFP side of connector       |

### High-Speed Electrical Interface Transmission Line-SFP

| Parameter                  | Symbol              | Min | Typ | Max | Unit | Notes/Conditions  |
|----------------------------|---------------------|-----|-----|-----|------|---|
| <b>Line Frequency</b>      | f <sub>L</sub>      | N/A | 125 | N/A | MHz  | 5-level encoding, per IEEE 802.3                          |
| <b>Tx Output Impedance</b> | Z <sub>out,TX</sub> | N/A | 100 | N/A | Ohm  | Differential, for all Frequencies between 1MHz and 125MHz |
| <b>Rx Input Impedance</b>  | Z <sub>in,RX</sub>  | N/A | 100 | N/A | Ohm  | Differential, for all Frequencies between 1MHz and 125MHz |

### High-Speed Electrical Interface, Host-SFP

| Parameter                             | Symbol               | Min | Typ | Max  | Unit | Notes/Conditions |
|---------------------------------------|----------------------|-----|-----|------|------|------------------|
| <b>Single ended data input swing</b>  | V <sub>insing</sub>  | 250 | N/A | 1200 | mV   | Single ended     |
| <b>Single ended data output swing</b> | V <sub>outsing</sub> | 350 | N/A | 800  | mV   | Single ended     |
| <b>Rise/Fall Time</b>                 | Tr,Tf                | N/A | 175 | N/A  | psec | 20%-80%          |
| <b>Tx Input Impedance</b>             | Z <sub>in</sub>      | N/A | 50  | N/A  | Ohm  | Single ended     |
| <b>Rx Output Impedance</b>            | Z <sub>out</sub>     | N/A | 50  | N/A  | Ohm  | Single ended     |

### General Specifications

| Parameter           | Symbol | Min | Typ | Max  | Unit   | Notes/Conditions                                      |
|---------------------|--------|-----|-----|------|--------|---|
| <b>Data Rate</b>    | BR     | 10  | N/A | 1000 | Mb/sec | IEEE 802.3 compatible.<br>See Notes 2 through 4 below |
| <b>Cable Length</b> | L      | N/A | N/A | 100  | m      | Category 5 UTP. BER <10 <sup>-12</sup>                |

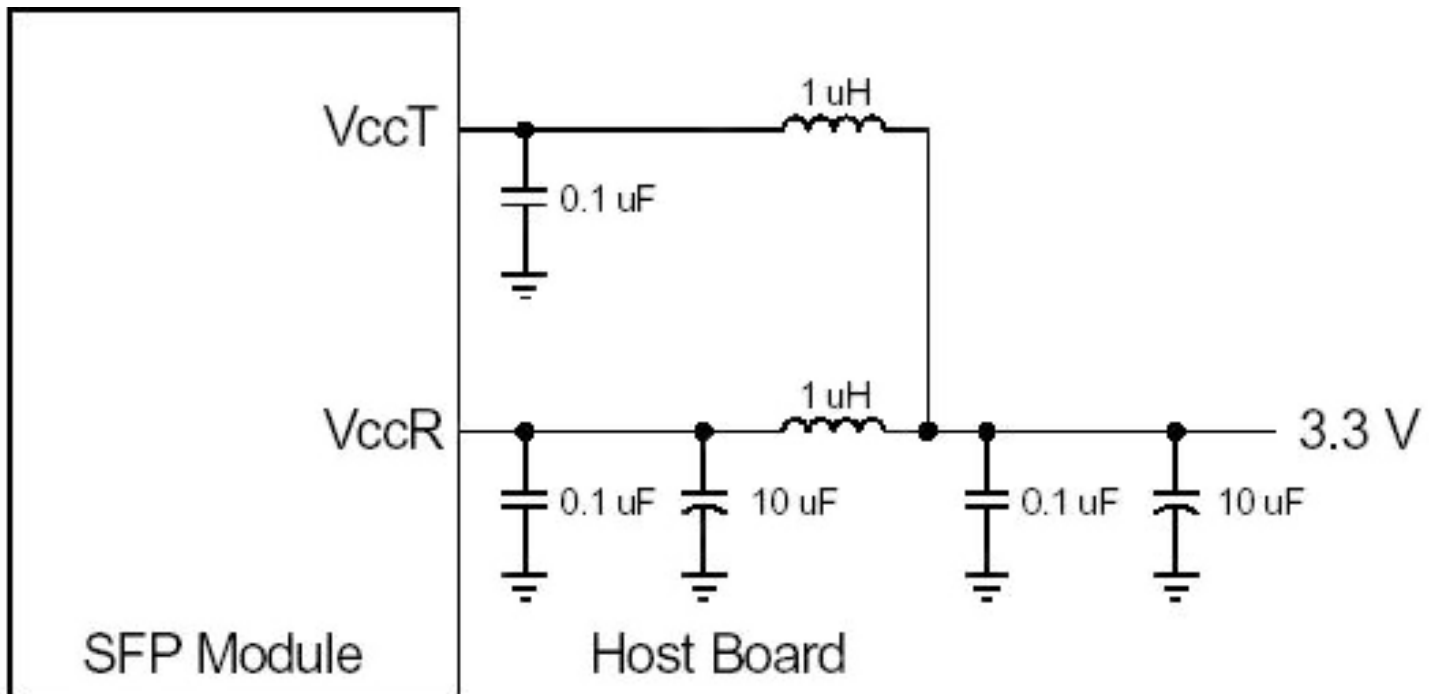
Notes:

1. Clock tolerance is +/- 50 ppm
2. By default, the module is a full duplex device in preferred master mode
3. Automatic crossover detection is enabled. External crossover cable is not required

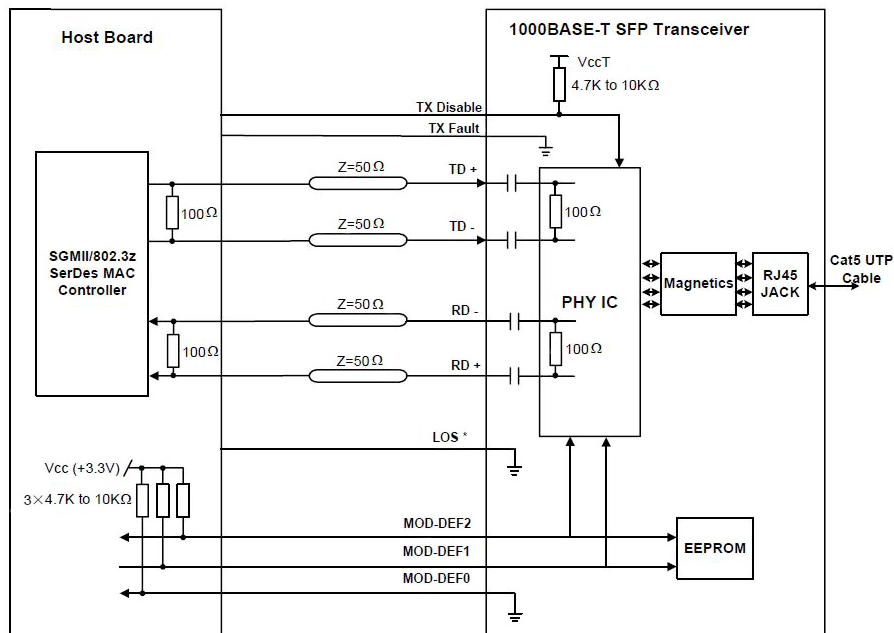
### Environmental Specifications

| Parameter                         | Symbol | Min | Typ | Max | Unit |
|-----------------------------------|--------|-----|-----|-----|------|
| <b>Operating Case Temperature</b> | Tc     | -40 | N/A | +85 | °C   |
| <b>Storage Temperature</b>        | N/A    | -40 | N/A | +85 | °C   |

### Recommended Host Board Power Supply Circuit

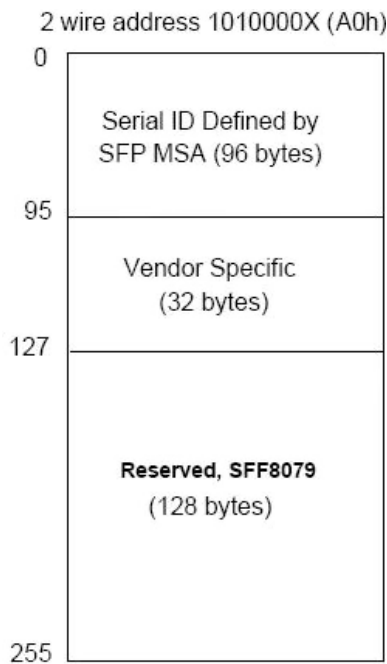


### Recommended Interface Circuit



NOTE: The consumer can choose whether the module has los signal or not, please refer to the Pin Descriptions and the Ordering Information.

### 2-Wire Serial Memory Map



# 100m 1.25G SFP Copper Transceiver

## Copper Transceivers

### Physical Layer IC Register List

|                  |    | Page Address   |                                 |
|------------------|----|--|---------------------------------|
|                  |    | Page 0 (Copper)  | Page 1 (Fiber)                  |
| Register Address | 0  | Control Register   | Control Register                |
|                  | 1  | Status Register  | Status Register                 |
|                  | 2  | PHY Identifier   |                                 |
|                  | 3  | PHY Identifier   |                                 |
|                  | 4  | Auto-Neg Advertisement Register  | Auto-Neg Advertisement Register |
|                  | 5  | Link Partner Ability Register  | Link Partner Ability Register   |
|                  | 6  | Auto-Neg Expansion Register  | Auto-Neg Expansion Register     |
|                  | 7  | Next Page Transmit Register  | Next Page Transmit Register     |
|                  | 8  | Link Partner Next Page Register  | Link Partner Next Page Register |
|                  | 9  | 1000BASE-T Control Register  |                                 |
|                  | 10 | 1000BASE-T Status Register   |                                 |
|                  | 15 | Extended Status Register   |                                 |
|                  | 16 | PHY Specific Control Register  |                                 |
|                  | 17 | PHY Specific Status Register   | PHY Specific Status Register    |
|                  | 18 | Interrupt Enable Register  | Interrupt Enable Register       |
|                  | 19 | Interrupt Status Register  | Interrupt Status Register       |
|                  | 20 | Extended PHY Specific Control Register   |                                 |
|                  | 21 | Receive Error Counter Register   |                                 |
|                  | 22 | Extended Address Register  |                                 |
|                  | 23 | Global Status Register   |                                 |
|                  | 24 | LED Control Register   |                                 |
|                  | 25 | Manual LED Override Register   |                                 |
|                  | 26 | Extended PHY Specific Control 2 Register   |                                 |
|                  | 27 | Extended PHY Specific Status Register  |                                 |
|                  | 28 | MDI[0:3] Virtual Cable Tester™ Status (Pages 0-3); 1000BASE-T Pair Skew (Page 4); 100BASE-T Pair, 1000BASE-T Pair Swap and Polarity (Page 5)                           |                                 |
|                  | 29 | Extended Address   |                                 |
|                  | 30 | Calibration Override (Page 3); Force Gigabit (Page 7); Class A (Page 11); CRC Checker result (Page 12); Test Enable Control (Page 16); Miscellaneous Control (Page 18) |                                 |

### How to enable the module to work at 10/100/1000BASE-T

The physical IC can also be accessed via 2wire serial bus at address Ach. This module supports 1000Mbps full duplex SerDes interface default. But it also can operate with SGMII (without clocks) interface by software configuration when HOST is SGMII interface.

Please refer the following steps to configure:

Step 1: Access the PHY at 0xAC via two-wire serial interface.

Step 2: Configure 0xAC as below table

#### PHY Address: 0xAC

| Register Address | Write data | Description                                     |
|------------------|------------|---|
| 0x1Bh            | 0x9084h    | Enable SGMII mode                               |
| 0x00h            | 0x9140h    | Software reset to allow changes to take effect  |
| 0x16h            | 0x0000h    | Select page 0                                   |
| 0x09h            | 0x0F00h    | Advertise 1000BASE-T Full Duplex/ Half Duplex   |
| 0x04h            | 0x0DE1h    | Advertise 100/10BASE-T Full Duplex/ Half Duplex |
| 0x00h            | 0x9140h    | Software reset to allow changes to take effect  |

### How to disable Auto-negotiation on the module

This module works in the “Auto-negotiation enable” mode by default. It also can operate with “Auto-negotiation disable ”.

Please refer the following steps to configure it:

Step 1: Access the PHY at 0xAC via two-wire serial interface.

Step 2: Configure 0xAC as below table

#### PHY Address: 0xAC

| Register Address | Write data | Description              |
|------------------|------------|--------------------------|
| 0x16h            | 0x0001h    | Select page 1            |
| 0x00h            | 0x8140h    | Disable Auto-negotiation |
| 0x16h            | 0x0000h    | Select page 0            |

### Mechanical Specifications

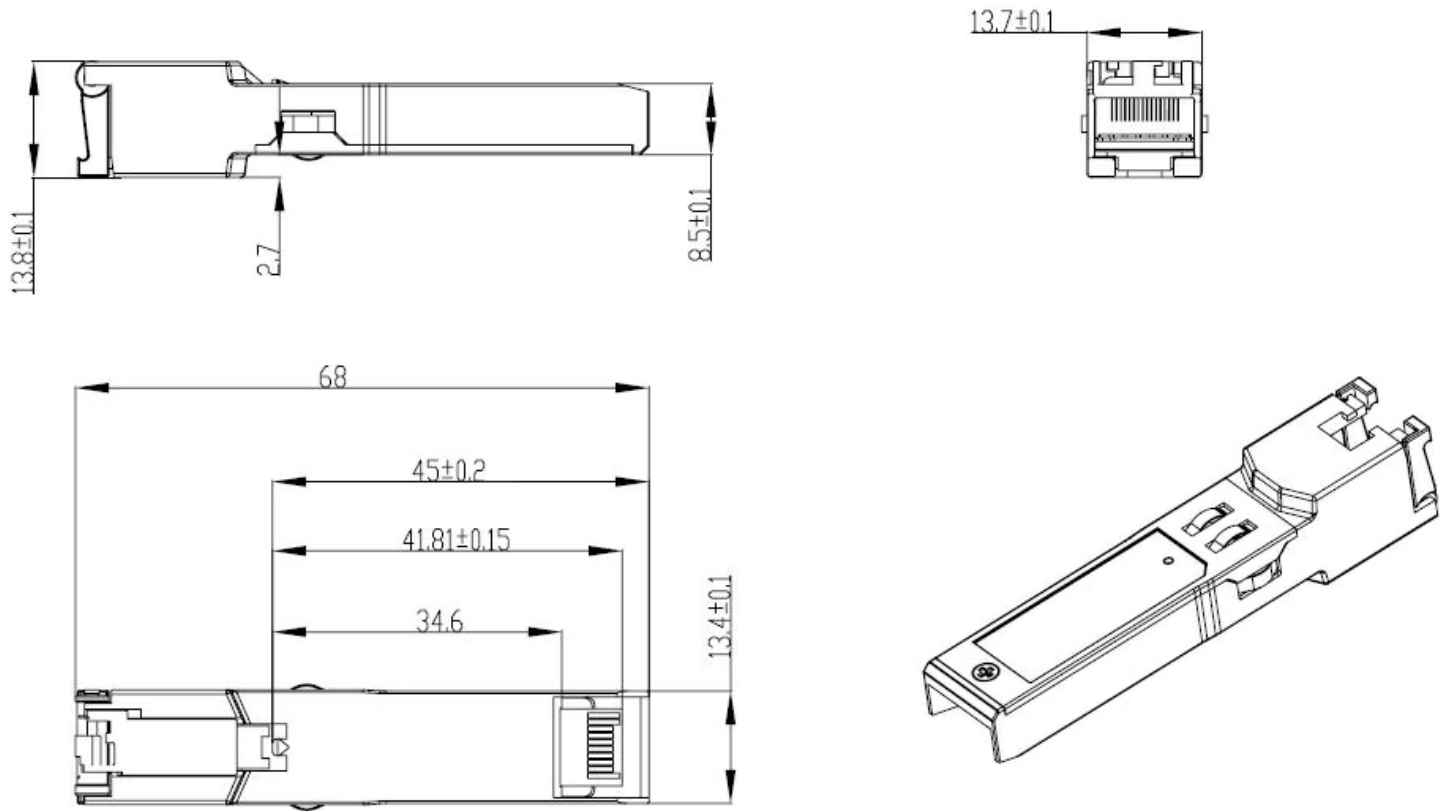
The host-side of the module conforms to the mechanical specifications outlined in the SFP MSA1. The front portion of the SFP (part extending beyond the face plate of the host) is larger to accommodate the RJ-45 connector



# 100m 1.25G SFP Copper Transceiver

## Copper Transceivers

### Mechanical Dimensions



### Regulatory Compliance

| Feature                  | Agency | Standard                  |
|--------------------------|--------|---------------------------|
| Environmental protection | SGS    | RoHS Directive 2011/65/EU |

### Ordering Information

| Feature        | Agency          | Standard | Standard | Standard | Standard  |
|----------------|-----------------|----------|----------|----------|-----------|
| ATM-GB-P1RT-E  | 10/100/1000Mbps | SGMII    | Yes      | Yes      | -40~85 °C |
| ATM-GB-P3RT-E  | 1000Mbps        | SERDES   | Yes      | Yes      | -40~85 °C |
| ATM-GB-P3RT-C5 | 1000Mbps        | SERDES   | No       | No       | -40~85 °C |