

## SEES - Smart Embedded Ethernet Switch



## **Quick Hardware Reference Guide**

Rev01 – February 2022



## **SEES Description**

Designed for quick integration with minimal engineering effort, the small SEES - Smart Embedded Ethernet Switch provides simplicity and flexibility making it the easiest and fastest networking-enabling module on the market.

The SEES is a highly-integrated, Layer 2 managed, five-port switch with numerous features designed to reduce system cost. The SEES is Automotive qualified (AEC-Q100) and was designed to be used in embedded 10/100Mbps five-port switch systems with low power requirements. The SEES supports high-performance memory bandwidth and shared memory-based switch fabric with non-blocking configuration.

The SEES, if paired with an external MCU or Linux CPU, also includes an extensive feature set, including: power management, programmable rate limit and priority ratio, tag/port-based VLAN, packets filtering, four queue QoS prioritization, management interfaces, and MIB counters. All registers of MACs and PHYs units can be managed by the SPI or the SMI interface. MIIM registers can be accessed through the MDC/ MDIO interface.



## **SEES Main Features**

#### The SEES provides the following features:

- 5x 10/100 Ethernet Ports
- Connect two boards to create a 8-port switch
- Molex Picoblade or Milli-Grid/Harwin M22 Ethernet/LED connectors
- IEEE 802.1q VLAN support for up to 128 active VLAN groups
- New generation switch with five MACs and five PHYs that are fully compliant with the IEEE 802.3u standard
- Serial management interface (MDC/MDIO) to all PHYs registers and SMI interface (MDC/ MDIO) to all registers
- High-speed SPI (up to 25MHz) and I2C master Interface to all internal registers
- Non-blocking switch fabric assures fast packet delivery by utilizing a 1K MAC address lookup table and a store-and-forward architecture
- DIP switch to program selective registers in unmanaged switch mode
- Extended Temperature: -40° to +85° C
- Switch Monitoring Features
- Low-Power Dissipation
- Size 60 x 60 x 12 mm



## **SEES Operational Requirements**

The following table provides the facilities requirements that must be met for the SEEG.

Туре	Requirements	
Electrical	<ul> <li>Primary DC input: 5-14 VDC</li> <li>Current Consumption: &lt;0.5W</li> </ul>	
Thermal	• Ambient air temperature not exceeding -40 to +85 ° C while the SEEG is operating	
Installation	<ul> <li>Can be strapdown installed using 4x M2 screws.</li> <li>Can be installed in vertical or horizontal position</li> <li>Can be installed upside down</li> </ul>	



## **SEES Board Mechanical Specs**

The top view of the SEEG shows all available connectors and pin header available on the top side of board. There are other connectors or pin headers on the bottom side of the board.



<- 60 mm ->

Max height: 10 mm Weight: 25g



## SEEG Connectors, Buttons and LEDs

Туре	Function	
Power	PWR: 5-14 VDC-In	
Ethernet Ports	P1-P5: RX-/Rx+/TX-/TX+ J8: RX-/Rx+/TX-/TX+ J10: LEDs	
RMII	RMII: RMII Signals (See Table)	
SPI	SPI: SPI Signals (See Table)	
Buttons	RESET	
Activity LED	Power, Ethernet	
DIP Switch	Boot Mode	



### **SEEG Connectors**



**Top View** 



**Bottom View** 



## **PWR: DC Power Input Connector**

Pin	Signal	Function
1	VDC_IN	5-14 VDC positive power input
2	VDC_GND	VDC negative power input



**PWR Top View** 

- Manufacturer: Molex
- Part Name: PicoBlade Receptable Crimp Housing, 2 Circuits
- Mfg. Part Number: 510210200
- Pre-Crimped Lead 150 mm: 797580006
- Pre-Crimped Lead 300 mm: 797580014



## P1-P5: Ethernet Ports

Pin	Signal	Function
1	RX-	Physical Received Signal - (differential)
2	RX+	Physical Received Signal + (differential)
3	TX-	Physical Transmit Signal - (differential)
4	TX+	Physical Transmit Signal + (differential)



P1-P5 Top View

- Manufacturer: Molex
- Part Name: PicoBlade Receptable Crimp Housing, 4 Circuits
- Mfg. Part Number: 510210400
- Pre-Crimped Lead 150 mm: 797580006
- Pre-Crimped Lead 300 mm: 797580014



## SPI: External MCU Management

Pin	Signal	Function
1	SPIQ	SPI serial data output in SPI slave mode
2	SPIC/SCL	<ul><li>(1) Input clock up to 25 MHz in SPI slave mode,</li><li>(2) Output clock at 61 kHz in I<sub>2</sub>C master mode.</li></ul>
3	SPID/SDA	<ul><li>(1) Serial data input in SPI slave mode;</li><li>(2) Serial data input/output in I<sub>2</sub>C master mode.</li></ul>
4	SPIS N	SPI data transfer start in SPI slave mode
5	GNDD	Digital Ground



**SPI Front View** 

- Manufacturer: Molex
- Part Name: PicoBlade Receptable Crimp Housing, 5 Circuits
- Mfg. Part Number: 510210500
- Pre-Crimped Lead 150 mm: 797580006
- Pre-Crimped Lead 300 mm: 797580014



## **RMII: SOM Connectivity**

Pin	Signal	Function
1	GNDD	Digital Ground
2	SMTXEN	Port 5 Switch MII/RMII transmit enable
3	SMTXD1	Port 5 Switch MII/RMII transmit bit 1
4	SMTXD0	Port 5 Switch MII/RMII transmit bit 0
5	SMTXER	Port 5 Switch MII transmit error
6	SMREFCLK	Port 5 Switch MII transmit clock
7	SMRXC	Port 5 Switch MII receive clock
8	SMCRSDV	MAC5 RMII Carrier Sense/Receive Data Valid Output
9	SMRXD1	Port 5 Switch MII receive bit 1
10	SMRXD0	Port 5 Switch MII receive bit 0
11	MDC	PHYs MII management data clock
12	MDIO	PHYs MII management data I/O



#### **RMII Front View**

- Manufacturer: Molex
- Part Name: PicoBlade Receptable Crimp Housing, 12 Circuits
- Mfg. Part Number: 510211200
- Pre-Crimped Lead 150 mm: 797580006
- Pre-Crimped Lead 300 mm: 797580014



## J8: Ethernet Board Connectivity

Pin	Signal	Function
1	P1_RX -	P1 Physical Received Signal - (differential)
2	P1_RX +	P1 Physical Received Signal + (differential)
3	P1_TX -	P1 Physical Transmit Signal - (differential)
4	P1_TX +	P1 Physical Transmit Signal + (differential)
5	P2_RX -	P2 Physical Received Signal - (differential)
6	P2_RX +	P2 Physical Received Signal + (differential)
7	P2_TX -	P2 Physical Transmit Signal - (differential)
8	P2_TX +	P2 Physical Transmit Signal + (differential)
9	P3_RX -	P3 Physical Received Signal - (differential)
10	P3_RX +	P3 Physical Received Signal + (differential)
11	P3_TX -	P3 Physical Transmit Signal - (differential)
12	P3_TX +	P3 Physical Transmit Signal + (differential)
13	P4_RX -	P4 Physical Received Signal - (differential)
14	P4_RX +	P4 Physical Received Signal + (differential)
15	P4_TX -	P4 Physical Transmit Signal - (differential)
16	P4_TX +	P4 Physical Transmit Signal + (differential)



J8: ETH EXP-Board Front View

- Manufacturer: Harwin
- Part Name: 8+8 Male DIL Horizontal SMT Conn. (T+R);
   2.00mm Pitch
- Mfg. Part Number: M22-2540805



## J10: LED Board Connectivity

Pin	Signal	Function
1	P1_EXT_LED1-2	P1 LED Indicator Link/Activity
2	P1_EXT_LED1-0	P1 LED Indicator Speed
3	P2_EXT_LED1-2	P2 LED Indicator Link/Activity
4	P2_EXT_LED1-0	P2 LED Indicator Speed
5	P3_EXT_LED1-2	P3 LED Indicator Link/Activity
6	P3_EXT_LED1-0	P3 LED Indicator Speed
7	P4_EXT_LED1-2	P4 LED Indicator Link/Activity
8	P4_EXT_LED1-0	P4 LED Indicator Speed
9	GND	LED Ground
10	3V3_ETH	LED Power Supply (needs resistor)



J10: LED EXP-Board Front View

- Manufacturer: Harwin
- Part Name: 5+5 Pos. Male DIL Horizontal SMT Conn. (T+R); 2.00mm Pitch
- Mfg. Part Number: M22-2540505R



## **DIP: Board Configuration**

DIP Switch Position		Function
P1=0	P0=0	I2C Master Mode for EEPROM (Default)
P1=0	P0=1	SMI Interface Mode
P1=1	P0=0	SPI Slave Mode for CPU Interface
P1=1	P0=1	Factory Test Mode (BIST)
SCONF1=0	SCONF0=0	Disable RMII (Default)
SCONF1=0	SCONF0=1	PHY Mode RMII
SCONF1=1	SCONF0=0	MAC Mode RMII
SCONF1=1	SCONF0=1	PHY Mode SNI



**DIP Top View** 



## J6: UART\_1 to PixHawk

Pin	Signal	Function	Pixhawk TELEM 1 & 2
1	5 VDC_IN	5V positive power input	5 VDC_OUT
2	TXD1	UART_1 transmitting pin	TX1 -> Must be connected to J6:3
3	RXD1	UART_1 receiving pin	RX1 -> Must be connected to J6:2
4	RTS1	UART_1 Request to Send flow control	RTS1
5	CTS1	UART_1 Clear to Send flow control	CTS1
6	GND	5V negative power input	GND



PX4 Top View



## **Board Add-Ons**



Molex PicoBlade to RJ45 Adapter



Board to Board RJ45 Adapter



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