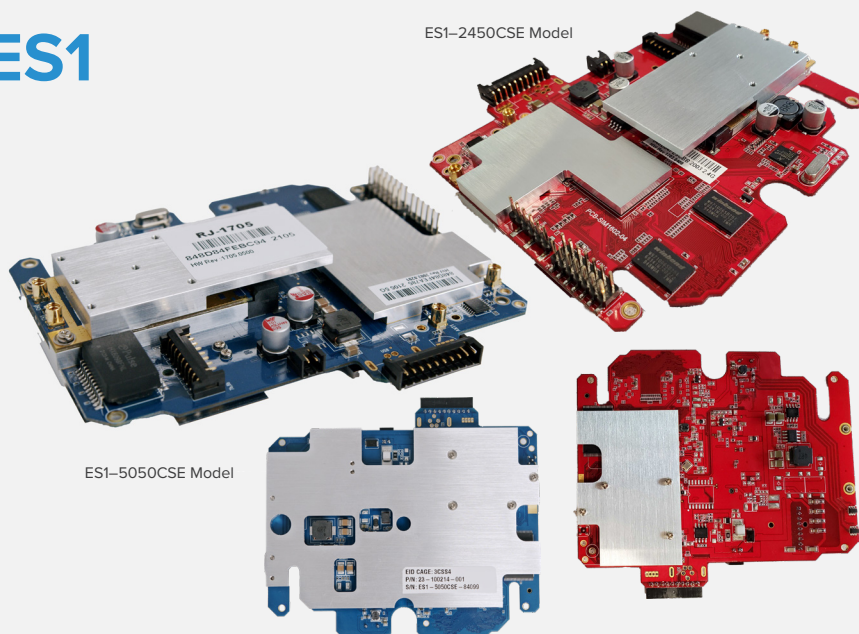# BreadCrumb® OEM ES1

Industrial, Dual-Transceiver, Kinetic Mesh Network Board

The OEM ES1 is a board intended for integration into industrial machines and robots. It enables a robust, mobile mesh network and allows for Machine-to-Machine (M2M) connectivity to extend communications range beyond the limitations of Wi-Fi access points.

The OEM ES1 provides high-performance, dual-concurrent 2x2 MIMO transceivers to avoid the hassle and cost associated with constantly adding new access points and antenna solutions. Applications include fully autonomous, tele-remote and manual robots, as well as industrial vehicles.
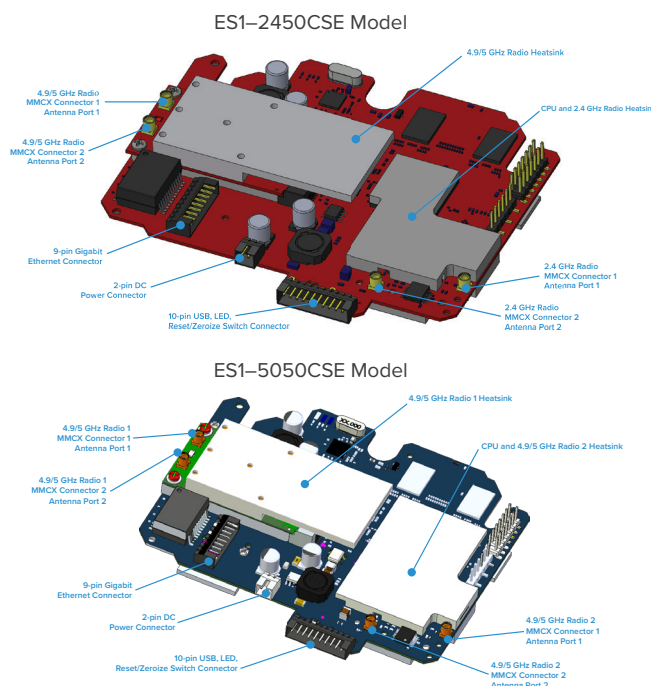
ES1–2450CSE Model

ES1–5050CSE Model

BreadCrumb OEM ES1: Ideal for Mobile Applications

The OEM ES1 is based on the popular ES1–2450R and ES1–5050CS models, which are packaged within an IP67 rated enclosure. The OEM ES1 maintains the industrial temperature and network performance characteristics of the ES1 family while removing the enclosure. It's designed with multiple features that simplify integration into industrial machines, robots and vehicles. It provides PCB mounted Hirose DF3 connectors for Ethernet, DC power, USB, LED, and reset/zeroize switch interfaces, and MMCX jack connectors for antenna ports. It replaces the internal, finned heatsinks of the ES1–2450R and ES1–5050CS with flat metal structures that can more easily interface with the system integrator's heat dissipation solution.

OEM ES1 Key Features:

- ES1–2450CSE contains one 2.4 GHz, 2x2 MIMO and one 4.9/5 GHz, 2x2 MIMO transceivers

- ES1–5050CSE contains two 4.9/5 GHz, 2x2 MIMO transceivers

- -40 °C to 85 °C (-40 °F to 185 °F) industrial operating temperature range

- Up to 29 dBm RF transmit power on the 2.4 GHz and 4.9/5 GHz transceivers for extended range

- Flat metal heatsink structures are provided to interface with the system integrator's thermal management solution. An internal temperature sensor allows for monitoring system conditions and the effectiveness of the thermal management solution.

- Includes PCB mounted connectors for gigabit Ethernet (9-pin), DC power (2-pin), and USB, LED, reset/zeroize switch (10-pin)
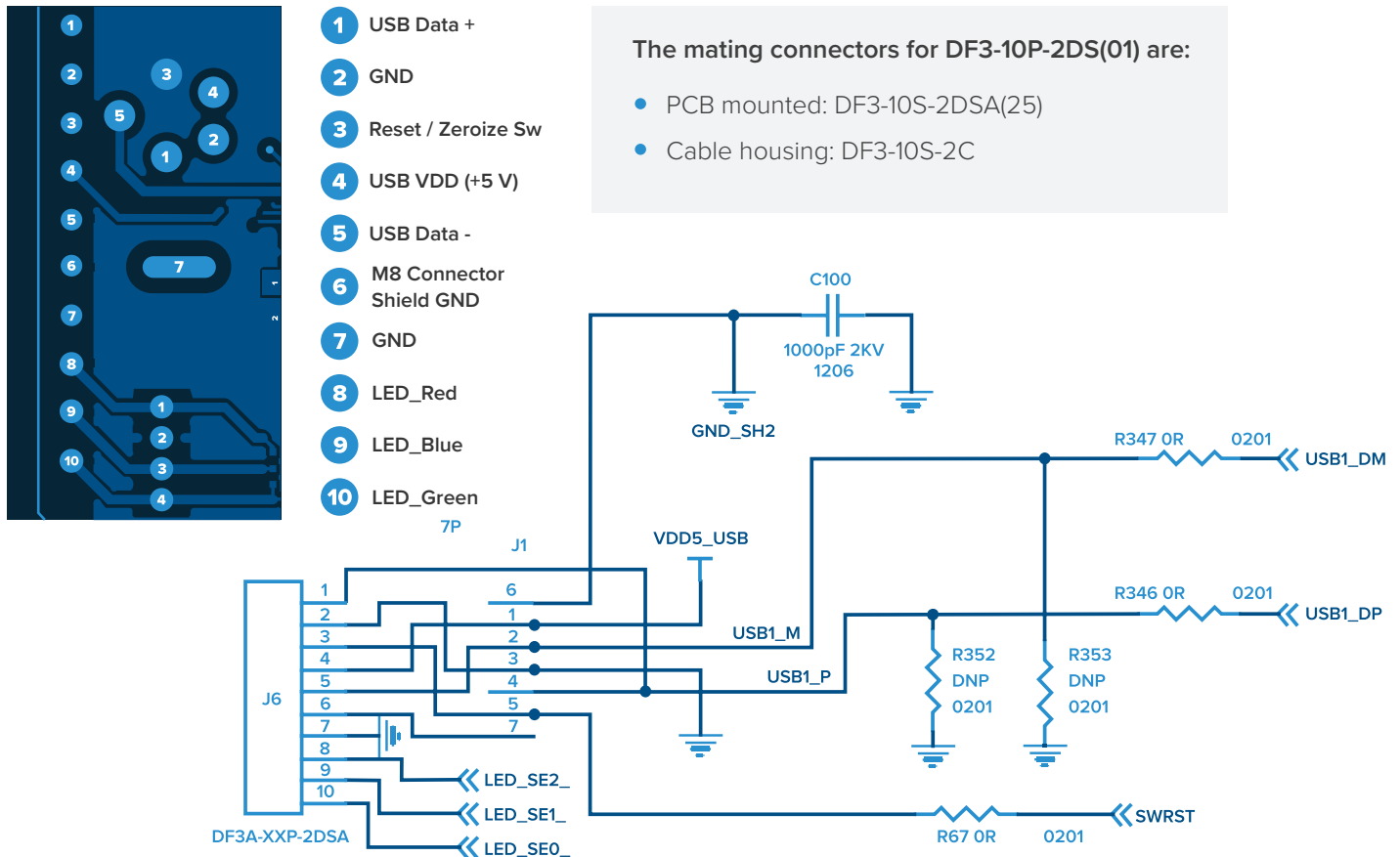
ES1–2450CSE Model

4.9/5 GHz Radio MMCX Connector 1 Antenna Port 1
4.9/5 GHz Radio MMCX Connector 2 Antenna Port 2
4.9/5 GHz Radio Heatsink
CPU and 2.4 GHz Radio Heatsink
9-pin Gigabit Ethernet Connector
2-pin DC Power Connector
10-pin USB, LED, Reset/Zeroize Switch Connector
2.4 GHz Radio MMCX Connector 1 Antenna Port 1
2.4 GHz Radio MMCX Connector 2 Antenna Port 2

ES1–5050CSE Model

4.9/5 GHz Radio 1 MMCX Connector 1 Antenna Port 1
4.9/5 GHz Radio 1 MMCX Connector 2 Antenna Port 2
4.9/5 GHz Radio 1 Heatsink
CPU and 4.9/5 GHz Radio 2 Heatsink
9-pin Gigabit Ethernet Connector
2-pin DC Power Connector
10-pin USB, LED, Reset/Zeroize Switch Connector
4.9/5 GHz Radio 2 MMCX Connector 1 Antenna Port 1
4.9/5 GHz Radio 2 MMCX Connector 2 Antenna Port 2

OEM ES1 Certification Considerations:

- ES1–2450CSE does not come with any wireless or safety-related certifications.

- ES1–5050CSE provides modular wireless certifications for FCC, IC and CE. It does not come with safety-related certifications.

- The system integrator bears the responsibility for obtaining and maintaining the certifications required for the system utilizing the OEM ES1.
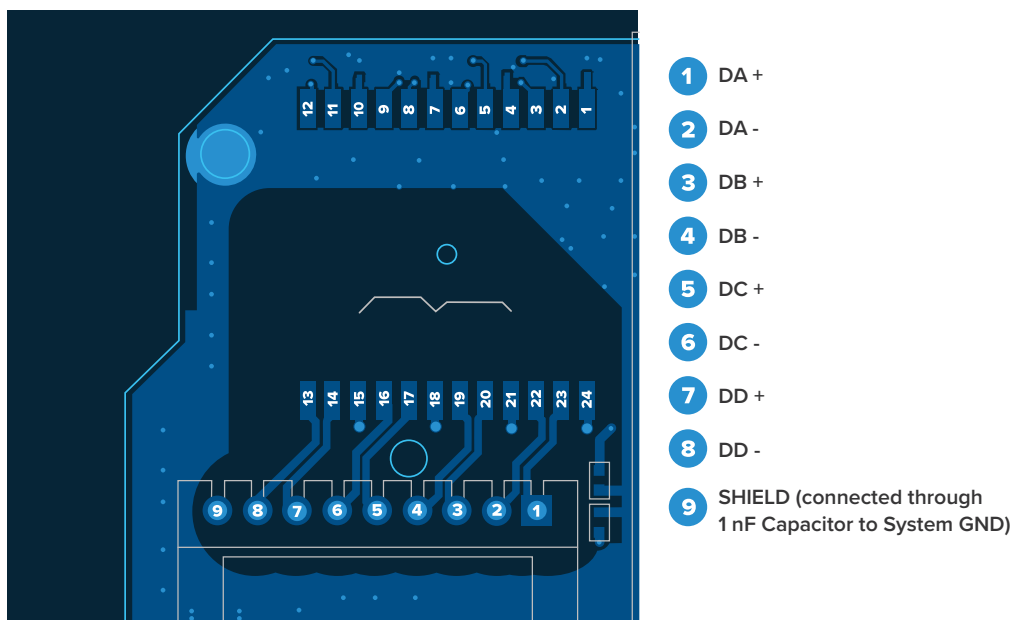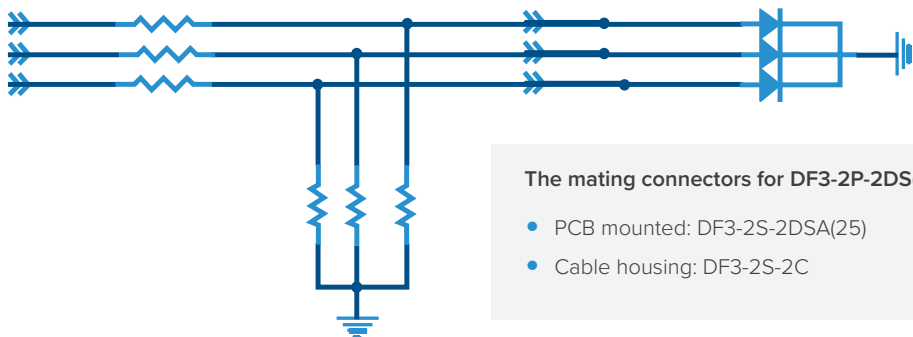
OEM ES1 Pinout and Mating Connectors

All OEM ES1 models use the same pinouts and connectors.

USB 2.0, LED and reset/zeroize switch interfaces are provided through a 10-pin Hirose DF3-10P-2DS(01) connector with the following pinout:

Pin	Signal
1	USB Data +
2	GND
3	Reset / Zeroize Sw
4	USB VDD (+5 V)
5	USB Data -
6	M8 Connector Shield GND
7	GND
8	LED_Red
9	LED_Blue
10	LED_Green

The mating connectors for DF3-10P-2DS(01) are:

- PCB mounted: DF3-10S-2DSA(25)
- Cable housing: DF3-10S-2C

A Gigabit Ethernet interface is provided through a 9-pin Hirose DF3-9P-2DS(01) connector with the following pinout:

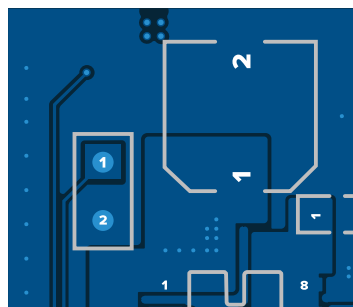| Pin	Signal
1	DA +
2	DA -
3	DB +
4	DB -
5	DC +
6	DC -
7	DD +
8	DD -
9	SHIELD (connected through 1 nF Capacitor to System GND)

The mating connectors for DF3-2P-2DS(01) are:

- PCB mounted: DF3-2S-2DSA(25)
- Cable housing: DF3-2S-2C

A DC power interface is provided through a 2-pin Hirose DF3-2P-2DS(01) connector with the following pinout:

The mating connectors for DF3-2P-2DS(01) are:

- PCB mounted: DF3-2S-2DSA(25)
- Cable housing: DF3-2S-2C

1 V +

2 V -

Model	Description
ES1–2450CSE	OEM ES1 with (1) 2.4 GHz, 2x2 MIMO, 300 Mbps and (1) 4.9/5 GHz, 2x2 MIMO, 300 Mbps transceivers
ES1–5050CSE	OEM ES1 with (2) 4.9/5 GHz, 2x2 MIMO, 300 Mbps transceivers
Power	
Input Voltage	9 — 30 VDC
Power Consumption	2.8 W (average, idle); 15 W (maximum, peak) @ 24 V
USB Port	Up to 2.5 W of additional power will be needed if a peripheral is being powered by USB (500 mA at 5 V is available at the USB port).
Physical	
Weight	ES1–2450CSE: 95 g (3.35 oz) ES1–5050CSE: 119 g (4.20 oz)
Dimensions	112 mm x 99 mm x 16 mm (4.41 in x 3.90 in x 0.63 in)
Certification	FCC (US), modular certification: ES1–5050CSE; IC (Canada), modular certification: ES1–5050CSE; CE mark (European Economic Area, Switzerland, and Turkey), modular certification: ES1–5050CSE; Electrostatic discharge (ESD) immunity testing compliant to EN 61000-4-2; Electrical fast transient (EFT) / burst immunity testing compliant to EN 61000-4-4; Surge immunity testing compliant to EN 61000-4-5

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