



# FZ5 Card AI Accelerator Card Overview



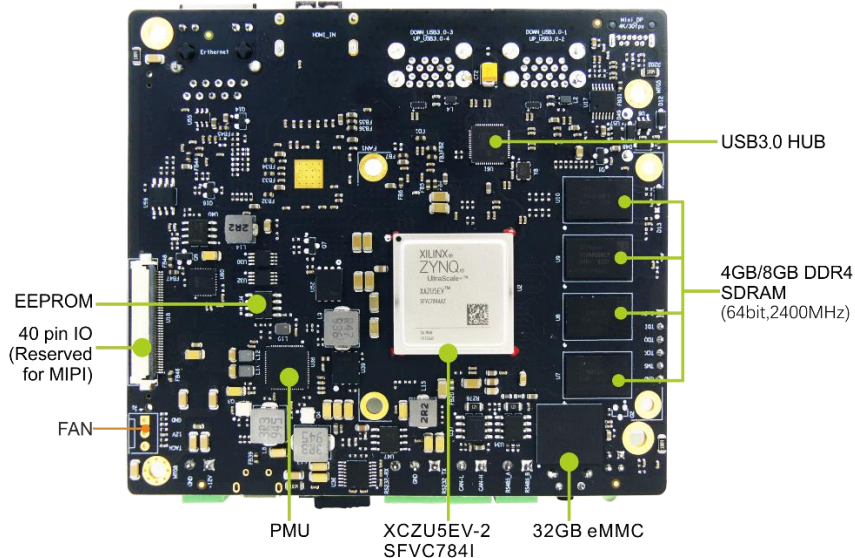
- ✓ Xilinx Zynq UltraScale+ ZU5EV MPSoC based on 1.5 GHz Quad Arm Cortex-A53 and 600MHz Dual Cortex-R5 Cores
- ✓ 8GB DDR4 SDRAM (64-bit, 2400MHz)
- ✓ 32GB eMMC Flash, 64MB QSPI Flash, 32KB EEPROM
- ✓ RS232, RS485, 4 x USB 3.0, Gigabit Ethernet, CAN, TF, DisplayPort (DP), HDMI, JTAG ...
- ✓ Computing Power up to 2.4TOPS, Runs at 55 FPS for ResNet-50
- ✓ Supports 8- to 16-channel Video Decoding and 4- to 8-channel Intelligent Analysis
- ✓ Supports Running PetaLinux
- ✓ Supports Baidu's PaddlePaddle AI Framework



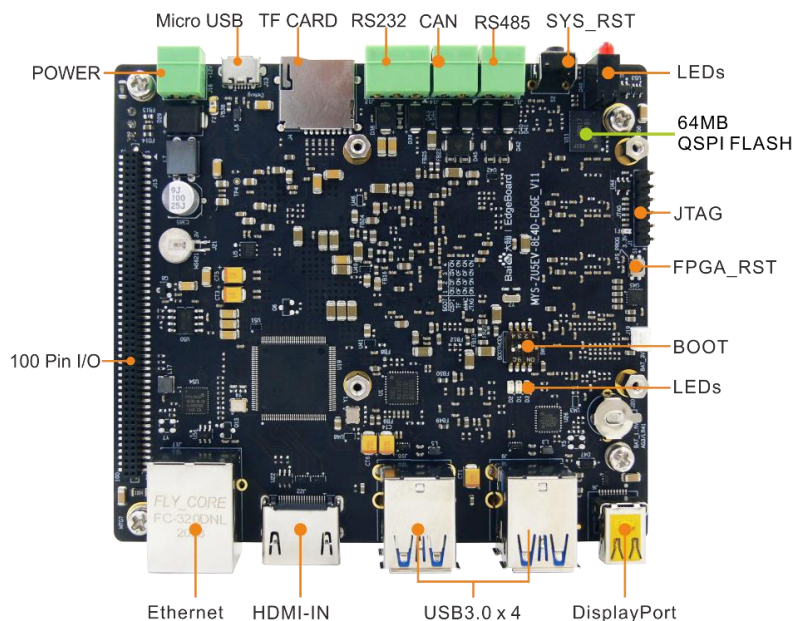
The **FZ5 Card** is an excellent Artificial Intelligence (AI) accelerator card based on [Xilinx Zynq UltraScale+ ZU5EV MPSoC](#) which features a 1.5 GHz quad-core ARM Cortex-A53 64-bit application processor, a 600MHz dual-core real-time ARM Cortex-R5 processor, a Mali400 embedded GPU, a H.264/H.265 Video Codec Unit (VCU) and rich FPGA fabric. It has computing power up to 2.4TOPS and can be seamlessly used with 55 FPS ResNet-50 backbone networks.

Besides, the **FZ5 Card** has integrated **8GB DDR4, 32GB eMMC, 64MB QSPI Flash and 32KB EEPROM** as well as many peripheral interfaces including **RS232, RS485, 4 x USB 3.0, Gigabit Ethernet, CAN, TF, DisplayPort (DP), HDMI-IN, USB-UART, JTAG, IO expansion interfaces, etc.** It is easy for your secondary development or used for your AI box or many other embedded designs.

The **FZ5 Card** is able to run **PetaLinux 2019.1** and provided with complete Linux BSP. It can also support [PaddlePaddle AI framework](#) which is fully compatible to use **Baidu Brain's AI development tools like EasyDL, AI Studio and EasyEdge** to enable developers and engineers to quickly leverage Baidu-proven technology or deploy self-defined models, enabling faster deployment.



*FZ5 Card Top-View (delivered with active heatsink by default)*



*FZ5 Card Bottom-View*



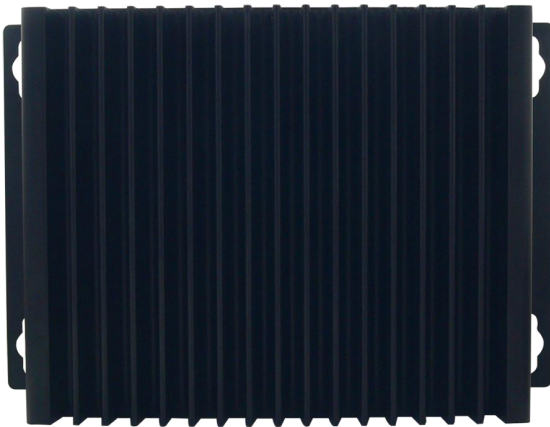
MYIR also offers an FZ5 EdgeBoard AI Box for the **FZ5 Card** which has a rugged and fanless enclosure to enable efficient development for many embedded vision applications such as multimedia, automotive ADAS, surveillance, industrial quality inspection, medical diagnosis, etc. The device can support -40 to 70 Celsius degree extended working temperature with small size and good stability. It has powerful AI capabilities to provide massive and iterative models to realize the image recognition of face, human body, animal, object, text, logo and various customized scenes.



Front View



Rear View



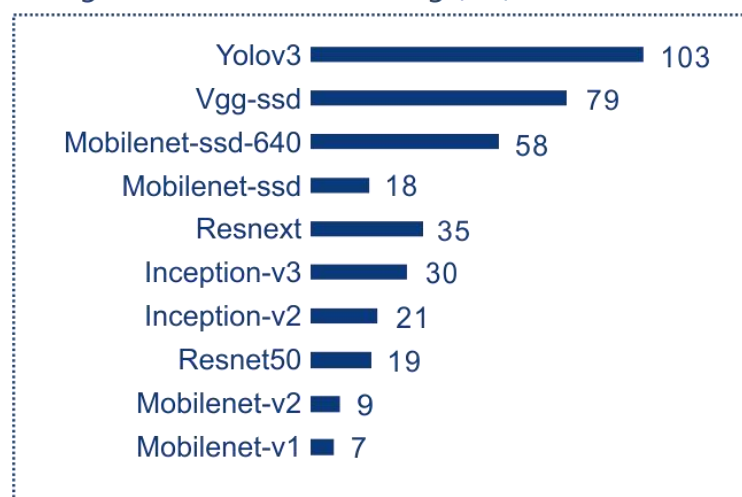
Top View



Bottom View

The FZ5 EdgeBoard AI Box has Computing Power up to 2.4TOPS and can run at 55 FPS for ResNet-50 in actual measurement. Power consumption is within 10W to 20W under typical working conditions. Measured data for some models are shown as below:

Single frame time-consuming (ms)



Measured Data for Reference

Hardware Specification

Zynq® UltraScale+™ MPSoC devices provide 64-bit processor scalability while combining real-time control with soft and hard engines for graphics, video, waveform, and packet processing. Built on a common real-time processor and programmable logic equipped platform, three distinct variants include dual application processor (CG) devices, quad application processor and GPU (EG) devices, and video codec (EV) devices.

	CG Devices	EG Devices	EV Devices
Application Processor	Dual-core ARM® Cortex™-A53 MPCore™ up to 1.3GHz	Quad-core ARM Cortex-A53 MPCore up to 1.5GHz	Quad-core ARM Cortex-A53 MPCore up to 1.5GHz
Real-Time Processor	Dual-core ARM Cortex-R5 MPCore up to 533MHz	Dual-core ARM Cortex-R5 MPCore up to 600MHz	Dual-core ARM Cortex-R5 MPCore up to 600MHz
Graphics Processor		Mali™-400 MP2	Mali™-400 MP2
Video Codec			H.264 / H.265
Programmable Logic	103K–600K System Logic Cells	103K–1143K System Logic Cells	192K–504K System Logic Cells
Applications	<ul style="list-style-type: none"> <li>• Sensor Processing &amp; Fusion</li> <li>• Motor Control</li> <li>• Low-cost Ultrasound</li> <li>• Traffic Engineering</li> </ul>	<ul style="list-style-type: none"> <li>• Flight Navigation</li> <li>• Missile &amp; Munitions</li> <li>• Military Construction</li> <li>• Secure Solutions</li> <li>• Networking</li> <li>• Cloud Computing Security</li> <li>• Data Center</li> <li>• Machine Vision</li> <li>• Medical Endoscopy</li> </ul>	<ul style="list-style-type: none"> <li>• Situational Awareness</li> <li>• Surveillance/Reconnaissance</li> <li>• Smart Vision</li> <li>• Image Manipulation</li> <li>• Graphic Overlay</li> <li>• Human Machine Interface</li> <li>• Automotive ADAS</li> <li>• Video Processing</li> <li>• Interactive Display</li> </ul>

Zynq UltraScale+ MPSoCs

The Zynq UltraScale+ family provides footprint compatibility to enable users to migrate designs from one device to another. Any two packages with the same footprint identifier code (last letter and number sequence) are footprint compatible. MYIR is using the **XCZU5EV-2SFVC784I** MPSoC for FZ5 CARD by default, the C784 package covers the widest footprint compatibilities that enable users to select devices among CG, EG and EV.

Pkg	mm	Zynq® UltraScale+™																											
		CG Devices								EG Devices								EV Devices											
		ZU2CG	ZU3CG	ZU4CG	ZU5CG	ZU6CG	ZU7CG	ZU9CG	ZU2EG	ZU3EG	ZU4EG	ZU5EG	ZU6EG	ZU7EG	ZU9EG	ZU11EG	ZU15EG	ZU17EG	ZU19EG	ZU4EV	ZU5EV	ZU7EV							
A484	19	■	■						■	■																			
A625	21	■	■						■	■																			
C784	23	■	■	■	■				■	■	■	■									■	■							
B900	31			■	■			■					■	■							■	■	■						
C900	31					■		■					■	■							■	■	■						
B1156	35					■		■					■	■							■	■	■						
C1156	35							■													■	■	■						■
B1517	40																				■	■	■						
F1517	40								■													■	■	■					■
C1760	42.5																				■	■	■						
D1760	42.5																					■	■	■					
E1924	45																					■	■	■					

Zynq® UltraScale+™ MPSoC Device Migration Table



The main features for the XCZU2CG, XCZU3CG, XCZU3EG, XCZU4EV and XCZU5EV MPSoC devices are summarized as below.

Device	XCZU2CG	XCZU3CG	XCZU3EG	XCZU4EV	XCZU5EV
Logic cells (k)	103	154	154	192	256
CLB Flip-Flops (K)	94	141	141	176	234
CLB LUTs (K)	47	71	71	88	117
Block RAM (Mb)	5.3	7.6	7.6	4.5	5.1
UltraRAM (Mb)	-	-	-	13.5	18.0
DSP Slices	240	360	360	728	1,248
GTX transceivers	PS-GTR4x (6Gb/s)	PS-GTR4x (6Gb/s)	PS-GTR4x (6Gb/s)	PS-GTR4x (6Gb/s), GTH4x (16.3Gb/s)	PS-GTR4x (6Gb/s), GTH4x (16.3Gb/s)
<b>Processor Units</b>					
Application Processor Unit	Dual-core ARM® Cortex™-A53 MPCore™ up to 1.3GHz		Quad-core ARM® Cortex™-A53 MPCore™ up to 1.5GHz		
Memory w/ECC	L1 Cache 32KB I / D per core, L2 Cache 1MB, on-chip Memory 256KB				
Real-Time Processor Unit	Dual-core ARM Cortex-R5 MPCore™ up to 600MHz				
Memory w/ECC	L1 Cache 32KB I / D per core, Tightly Coupled Memory 128KB per core				
Graphics Processing Unit	-	-	Mali™-400 MP2 up to 667MHz		
Video Codec	-	-	-	H.264 / H.265	
Memory L2 Cache	64KB				
<b>External Memory, Connectivity, Integrated Block Functionality</b>					
Dynamic Memory Interface	x32/x64: DDR4, LPDDR4, DDR3, DDR3L, LPDDR3 with ECC				
Static Memory Interfaces	NAND, 2x Quad-SPI				
High-Speed Connectivity	PCIe® Gen2 x4, 2x USB3.0, SATA 3.1, DisplayPort, 4x Tri-mode Gigabit Ethernet				
General Connectivity	2 x USB 2.0, 2 x SD/SDIO, 2 x UART, 2 x CAN 2.0B, 2 x I2C, 2 x SPI, 4 x 32b GPIO				
Power Management	Full / Low / PL / Battery Power Domains				
Security	RSA, AES, and SHA				
AMS - System Monitor	10-bit, 1MSPS – Temperature and Voltage Monitor				

*MPSoC device selection guide*



The **FZ5 AI Accelerator Card** takes full advantages of the Xilinx Zynq UltraScale+ ZU5EV MPSoC. The main features are listed in below table.

Item	Features
Dimensions	107mm x 96mm (14-layer PCB design)
Power supply	DC 12V/3A
Working Temp.	-40~85 Celsius
SoC	Xilinx Zynq UltraScale+ XCZU5EV-2SFVC784I (ZU5EV, 784 Pin Package) MPSoC - 1.5 GHz 64 bit Quad-core ARM® Cortex™-A53 Application Processing Unit - 600MHz Dual-core ARM® Cortex™-R5 Real-time Processing Unit - ARM Mali™-400 MP2 Graphics Processing Unit (GPU) - H.264 and H.265 Video Codec Unit (VCU) - 16nm FinFET+ FPGA fabric
Memory	8GB DDR4 (64bit, 2400MHz)
Storage	32GB eMMC 64MB QSPI Flash 32KB EEPROM 1 x Micro-SD Card Slot
Communications	1 x RS232 1 x RS485 1 x CAN Interface 1 x 10/100/1000Mbps Ethernet 4 x USB 3.0 Host 1 x USB-UART Debug Interface
Display	1 x HDMI Input port 1 x Mini DisplayPort (DP), 4K/30fps
RTC	1 x 3V Rechargeable RTC Battery Interface (battery is not soldered by default, Model MS621T is recommended) 1 x 1.5V Non-Rechargeable RTC Battery Holder (battery is not provided by default, Model AG3 or LR41 is recommended)
User I/O	1 x FPC_40PIN (Reserved for MIPI-CSI) 1 x 1.27mm pitch 2x50-pin IO Expansion Interface (5 x PS_MIO, 69 x PL_IO)
Others	1 x 2.54mm pitch 6-pin JTAG interface 2 x Buttons (1x FPGA Reset, 1 x System Reset) 5 x LEDs (Power LED: 1 x RED; Status LED: 2 x RED, 2 x Green)
Software	Supports Running PetaLinux Supports Baidu's PaddlePaddle AI Framework
Target Applications	Evaluation and Prototyping for XCZU5EV Zynq UltraScale+ MPSoC Intelligent Security Industrial Testing Medical Diagnosis UAV Inspection Scientific Research Consumer Electronics Driverless Technology

*Features of FZ5 Card*



**Software Features**

The **FZ5 Card** is able to run **PetaLinux 2019.1** and provided with complete Linux BSP. The features are as below:

Item	Features	Description	Source code provided
<b>Tool chains</b>	gcc8.2.0	gcc version 8.2.0	
	gcc 5.2.1	gcc version 5.2.1 (Linaro GCC 5.2)	
<b>Bootloader</b>	boot.bin	First boot program including FSBL and u-boot2019.01	Yes
<b>Linux Kernel</b>	Linux 4.19.0	Customized kernel for FZ5 Card	Yes
	USB2.0/3.0 Host	USB2.0/3.0 Host driver	Yes
	Ethernet	Gigabit Ethernet driver	Yes
	MMC/SD/TF	MMC/SD/TF card driver	Yes
	Qspi flash	Qspi flash driver	Yes
	CAN	CAN driver	Yes
	DP	DP driver	Yes
	I2C	I2C driver	Yes
	UART	UART driver	Yes
	Watchdog	Watchdog driver	Yes
	GPIO	GPIO driver	Yes
	LED	LED driver	Yes
	Button	Button driver	Yes
	RTC	RTC driver	Yes
	HDMI	HDMI IN driver	Yes
<b>Application</b>	HDMI	HDMI IN example	Yes
	CAN	CAN example	Yes
	Net	Socket example	Yes
<b>File system</b>	Ramdisk	Ramdisk System Image	
	Rootfs	Buildroot making including Qt	Yes
<b>Petalinux</b>	Petalinux2019.1	Supports Xilinx Petalinux2019.1 development tools. MYIR provides complete BSP for the FZ5 card.	

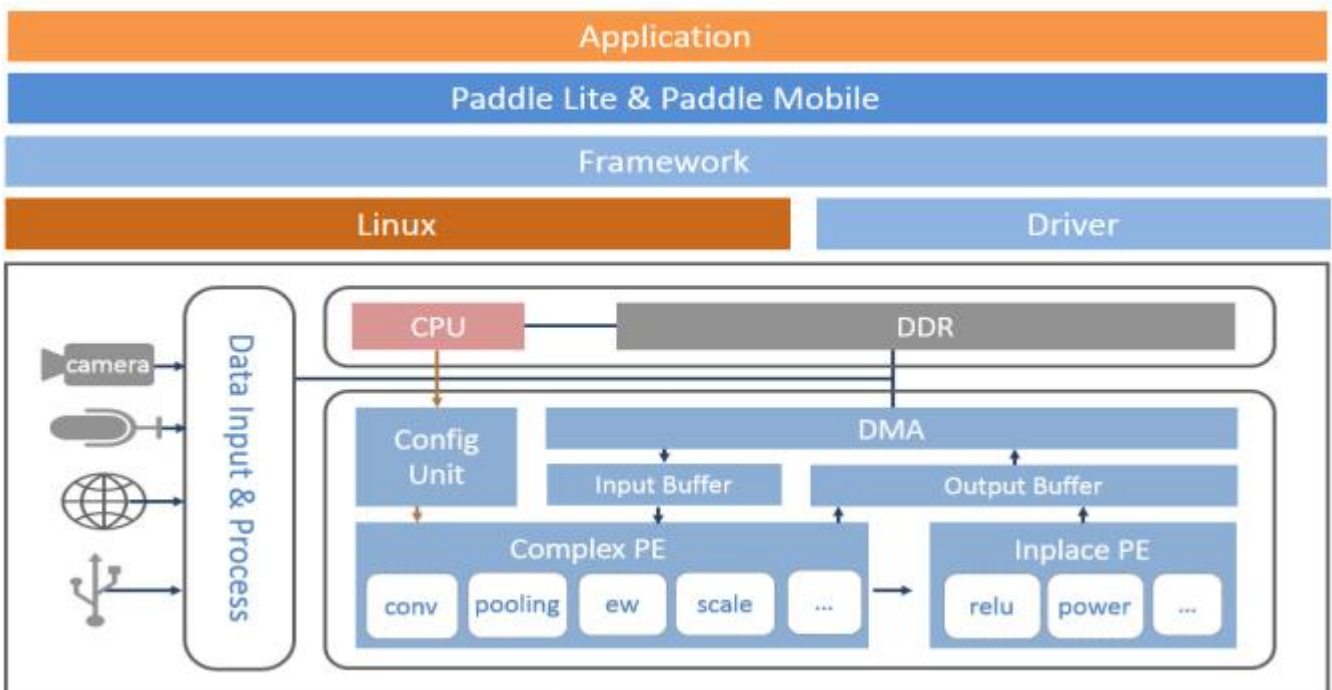
*Features of Linux BSP*



The FZ5 Card supports **PaddlePaddle AI framework** which is fully compatible to use **Baidu Brain's AI development tools like EasyDL, AI Studio and EasyEdge** to enable developers and engineers to quickly leverage Baidu-proven technology or deploy self-defined models, enabling faster deployment.



*Baidu Brain's AI Development Tools*

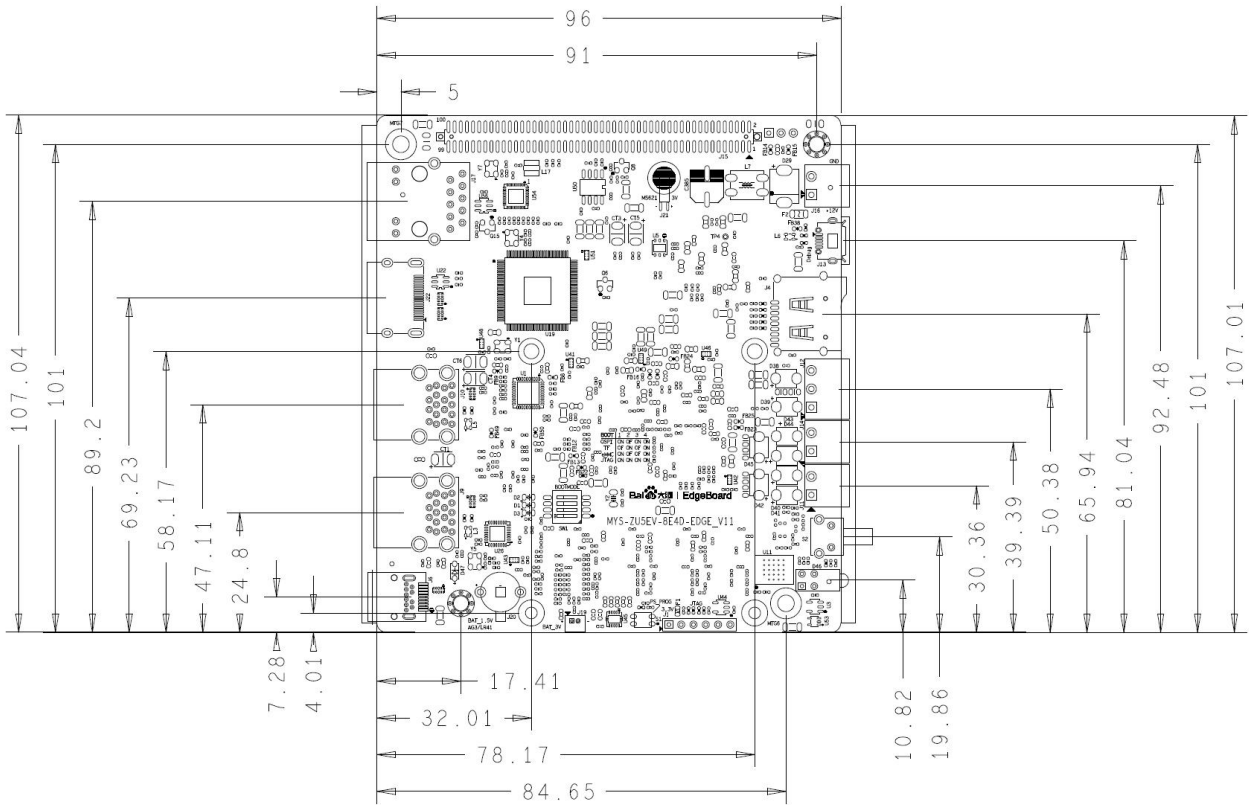


*Software Architecture of FZ5 Card*

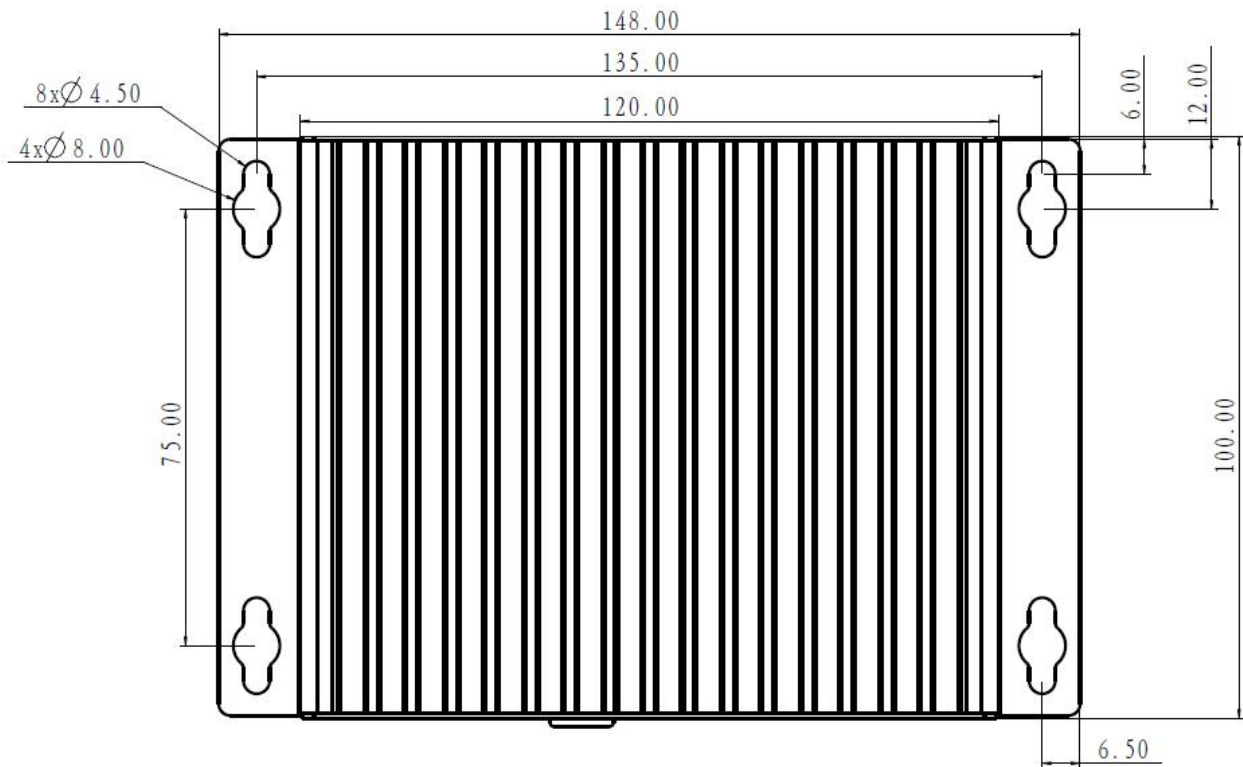




**Dimension Chart**



*Dimension Chart of FZ5 Card (Unit: mm)*



*Dimension Chart of FZ5 EDGE AI BOX (Unit: mm)*

**Order Information**

Item	Packing List
FZ5 Card (Part No.: MYS-ZU5EV-32E8D-EDGE-K1)	✓ One FZ5 Card (installed with active heat sink by default)
FZ5 EdgeBoard AI BOX (Part No.: MYS-ZU5EV-32E8D-EDGE-BOX)	✓ One FZ5 EdgeBoard AI BOX ✓ One 12V/3A Power Adapter ✓ One DC Power Adapter Cable ✓ One Mini USB Cable ✓ One 32GB TF Card
Note: Please contact MYIR to get development resources (including documentations and software BSP) download link after placing your order.	

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