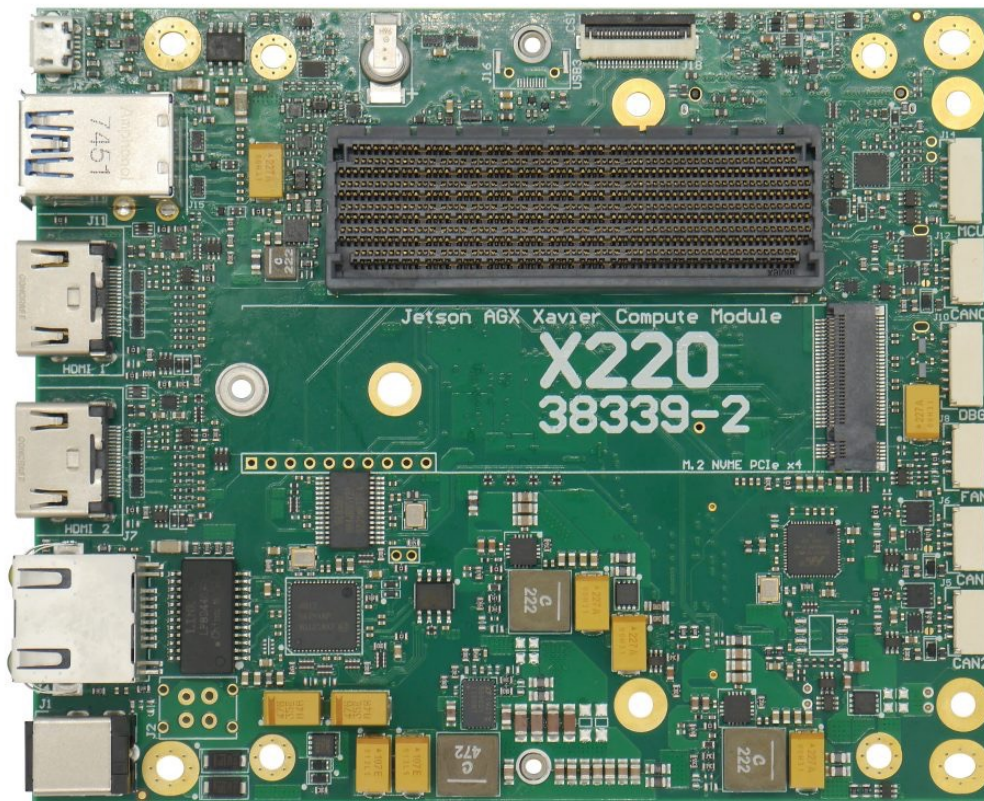


X220

technical reference manual

38339-X



Version 0.9

Preliminary

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Overview

X220 carrier board for the NVIDIA Jetson AGX Xavier

The X220 has been designed slightly larger than the dev kit version but with the maximum performance and full use of all the interfaces needed to serve your needs.

Technical details

- carrier board for one NVIDIA® Jetson™ AGX Xavier compute module (8GB or 32GB version)
- two USB 3.0 type A vertical
- RJ45 connector for 1000bT Ethernet (GbE)
- UART 0 (3.3V TTL) (6 pin) - console access
- fan connector (4 pin)
- two HDMI out
- M.2 key M 2280 NVME PCIe x4
- size: 125mm x 104,6mm (size of the PCB with all components)
- mounting: 4 holes with 3.2mm each
- model: 38339

Power

- power in: 12V

Features

Feature	X220	X220-LC
HDMI out	2x	1x
micro USB 2.0 OTG	✓	✓
USB 3.0 type A	✓	✓
10/100/1000 Ethernet (RJ45)	✓	✓
IMU MPU-9250 (optional 9 axis sensor)	✓	-
Components on both sides	✓	-
M.2 slot (NVME PCIe x4)	✓	✓
UART0 (3.3V TTL debug access)	1	1
CSI-2 (22 pin - 4 lanes)	extension port	-
fan connector	✓	✓
power in (5.5/2.5mm)	12V to 48V	12V

Auto flashing

Just connect a USB OTG cable from your host PC and power up the JN30/Nano. No need to press any switches. The MCU will detect this condition and control the switches appropriately.

Add-on modules

- U110 (38363): 4 port 100bT Ethernet with PoE PSE to connect to 4 network IP cameras
- U100 (38372): M.2 LTE and M.2 Wifi adapter
- U120 (38385): USB 2.0 to 4x USB 2.0 hub
- 38391: dev kit camera module and 2x GbE (i210 - JST-GH)
- 38392: dev kit camera module, 1x GbE (i210 - JST-GH) and mini UPS controller (supercaps)

X220

This new X220 carrier board turns the Jetson AGX Xavier compute module into a super mini computer.

Pinout description

12V - 48V power in (J1):

This is a 2 pin power jack for 5.5/2.5mm power plugs. The outside pin is “-“, the inside pin is “+”.

Pin	Function	Description
1	12V - 48V power in	center pin - positive supply pin
2	Ground	outside pin - negative supply pin

CAN2 (J5):

This is a 4 pin JST-GH connector with 1.25mm pitch.

Pin	Function	Description
1	5V	5V power for the CAN bus (500 mA)
2	CAN2_H	CAN data high (with 120 Ohm termination)
3	CAN2_L	CAN data low
4	GND	Ground

CAN1 (J6):

This is a 4 pin JST-GH connector with 1.25mm pitch.

Pin	Function	Description
1	5V	5V power for the CAN bus (500 mA)
2	CAN1_H	CAN data high (with 120 Ohm termination)
3	CAN1_L	CAN data low
4	GND	Ground

CAN0 (J12):

This is a 4 pin JST-GH connector with 1.25mm pitch.

Pin	Function	Description
1	5V	5V power for the CAN bus (500 mA)
2	CAN0_H	CAN data high (with 120 Ohm termination)
3	CAN0_L	CAN data low
4	GND	Ground

M.2 type M 2280 (J9)

This connector is powered by a 3.3V 3A power supply.

Form factor: 2242, 2260 or 2280 (22 x 80 mm)

Interface: four PCIe lanes for top performance (no SATA and SMBUS support).

USB 3.0 (J11)

This is a dual USB 3.0 type a connector. Pin 1-9 is the bottom connector and pin 10-18 is the top connector.

Pin	Function	Jetson Xavier	Description
1	5V		5V power controlled by USB2_EN_OC (A19) - max. 900 mA
2	USB2-D-		USB 2.0 data / USB2_D_N
3	USB2-D+		USB 2.0 data / USB2_D_P
4	GND		Ground
5	USB3_RX2-		USB 3.0 receive data / USBSS_RX_N
6	USB3_RX2+		USB 3.0 receive data / USBSS_RX_P
7	GND		Ground
8	USB3_TX2-		USB 3.0 transmit data / USBSS_TX_N
9	USB3_TX2+		USB 3.0 transmit data / USBSS_TX_P
10	5V		5V power controlled by USB2_EN_OC (A19) - max. 900 mA
11	USB1-D-		USB 2.0 data / USB1_D_N
12	USB1-D+		USB 2.0 data / USB1_D_P
13	GND		Ground
14	USB3_RX1-		USB 3.0 receive data / USBSS_RX_N
15	USB3_RX1+		USB 3.0 receive data / USBSS_RX_P
16	GND		Ground
17	USB3_TX1-		USB 3.0 transmit data / USBSS_TX_N
18	USB3_TX+		USB 3.0 transmit data / USBSS_TX_P

USB 2.0 (J2)

USB 2.0 port for firmware upgrades and for USB 2.0 devices like mouse and keyboard. New revisions feature a parallel connected JST-GH connector on the bottom side.

Pin	Function	Description
1	5V	5V power controlled by USB0_EN_OC* (A17) - max. 500 mA
2	USB0-D-	USB 2.0 data / USB2_D_N
3	USB0-D+	USB 2.0 data / USB2_D_P
5	GND	Ground

CSI-AB (J10)

This is a 22 pin 4 lane CSI-2 connector with 0.5mm pitch (Wuerth 687122149022). To open the connector and to release the cable just lift the brown lid upwards. This connector has the same pinout as the CSI-2 connector on the Raspberry Pi compute module carrier board. The contacts are on the bottom.

Pin	Function	Description
1	3.3V / 5V	3.3V power supply; 5V optional
2	CAM_I2C_SDA	3.3V level (converted from 1.8V of the Nano)
3	CAM_I2C_SCL	3.3V level (converted from 1.8V of the Nano)
4	GND	Ground
5	CAM1_MCLK	CAM1_MCLK (LC: 1.8V, non LC: 3.3V)
6	CAM1_PWDN	CAM1_PWDN (LC: 1.8V, non LC: 3.3V)
7	GND	Ground
8	CSI-B_D1+	CSI1_D1_P
9	CSI-B_D1-	CSI1_D1_N
10	GND	Ground
11	CSI-B_D0+	CSI1_D0_P
12	CSI-B_D0-	CSI1_D0_N
13	GND	Ground
14	CSI-A_CLK+	CSI0_CLK_P
15	CSI-A_CLK-	CSI0_CLK_N
16	GND	Ground
17	CSI-A_D1+	CSI0_D1_P
18	CSI-A_D1-	CSI0_D1_N
19	GND	Ground
20	CSI-A_D0+	CSI0_D0_P
21	CSI-A_D0-	CSI0_D0_N
22	GND	Ground

Ethernet (J1)

The X220 features an on-board RJ45 connector for 10/100/1000BT Ethernet with 2 LEDs.

LED	Function	Description
GBE0	GBE_LINK_ACT*	left LED
GBE1	GBE_LINK_100	right LED

HDMI (J7)

This is a 19 pin standard size HDMI connector.

Pin	Function	Description
1	HDMI_DP2_TXD0+	HDMI data lane 0
2	GND	Ground
3	HDMI_DP2_TXD0-	HDMI data lane 0
4	HDMI_DP2_TXD1+	HDMI data lane 1
5	GND	Ground
6	HDMI_DP2_TXD1-	HDMI data lane 1
7	HDMI_DP2_TXD2+	HDMI data lane 2
8	GND	Ground
9	HDMI_DP2_TXD2-	HDMI data lane 2
10	HDMI_DP2_TXD3+	HDMI data lane 3
11	GND	Ground
12	HDMI_DP2_TXD3-	HDMI data lane 3
13	HDMI_CEC	
14	RSVD	reserved pin
15	DP1_AUX_CH2+	
16	DP1_AUX_CH2-	
17	GND	Ground
18	PWR	5V power (max. 500 mA)
19	HPD	inverted and connected to DP1_HPDP

HDMI (J7)

This is a 19 pin standard size HDMI connector.

Pin	Function	Description
1	HDMI_DP2_TXD0+	HDMI data lane 0
2	GND	Ground
3	HDMI_DP2_TXD0-	HDMI data lane 0
4	HDMI_DP2_TXD1+	HDMI data lane 1
5	GND	Ground
6	HDMI_DP2_TXD1-	HDMI data lane 1
7	HDMI_DP2_TXD2+	HDMI data lane 2
8	GND	Ground
9	HDMI_DP2_TXD2-	HDMI data lane 2
10	HDMI_DP2_TXD3+	HDMI data lane 3
11	GND	Ground
12	HDMI_DP2_TXD3-	HDMI data lane 3
13	HDMI_CEC	
14	RSVD	reserved pin
15	DP1_AUX_CH2+	
16	DP1_AUX_CH2-	
17	GND	Ground
18	PWR	5V power (max. 500 mA)
19	HPD	inverted and connected to DP1_HPDP

UART 1/2 (J14)

This is a 6 pin connector with 1.25 mm pitch. Please connect to USB TTL serial converter (3.3V TTL level). Normally just connect TXD, RXD, and GND. Swap data lines. Default speed: 115200 bps.

Pin	Function	GPIO	Description
1	5V	-	5V power output
2	UART1_TXD	-	UART 1 console port (3.3V TTL level): transmit data output
3	UART1_RXD	-	UART 1 console port (3.3V TTL level): receive data input
4	UART2_TXD / SWCLK	-	UART 2 console port (3.3V TTL level): transmit data output / SWCLK (to flash the MCU)
5	UART2_RXD / SWDIO	-	UART 2 console port (3.3V TTL level): receive data input / SWDIO
6	GND	-	Ground

UART1 is optionally tunnelled through the micro controller (MCU). Default: hardware bypass.

UART3 (J10)

This is a 6 pin connector with 1.25 mm pitch.

Pin	Function	GPIO	Description
1	5.0V	-	5.0V power supply
2	UART3_TX_Debug	-	UART3_TXD_Debug 1.8V
3	UART3_RX_Debug	-	UART0_RXD_Debug 1.8V
4	GPIO13	-	GPIO13_out 3V3
5	GPIO04	-	GPIO4_IN 3V3
6	GND	-	Ground

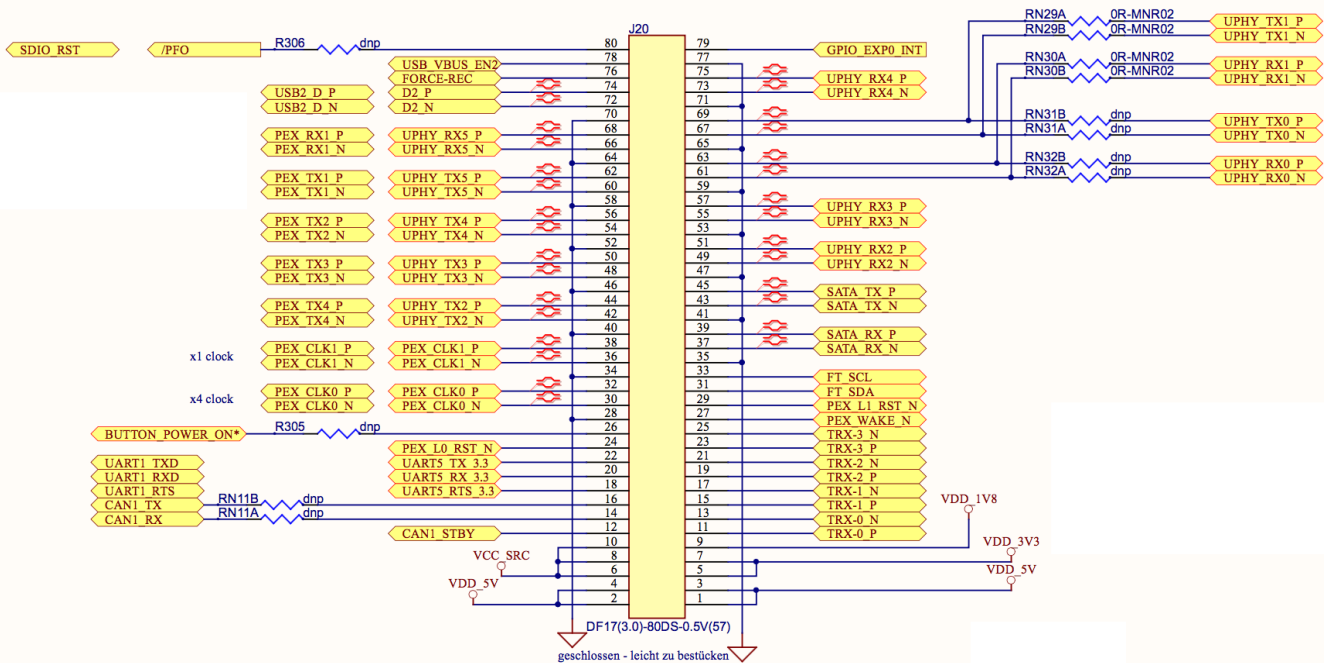
FAN (J8)

This is a 4 pin connector with 1.25 mm pitch.

Pin	Function	Description
1	GND	Ground
2	5V	5V power supply to the fan
3	FAN_TACH	tachometer from the fan (open drain input with 100k pull-up to 1.8V)
4	FAN_PWM	PWM control to the fan (open drain output: controlled by FAN_PWM and „disable fan“ with GPIO19 - F2)

Extension Port (J20)

This is a 80 pin board to board connector with 1.25 mm pitch. You need a extra add on module to use several features.

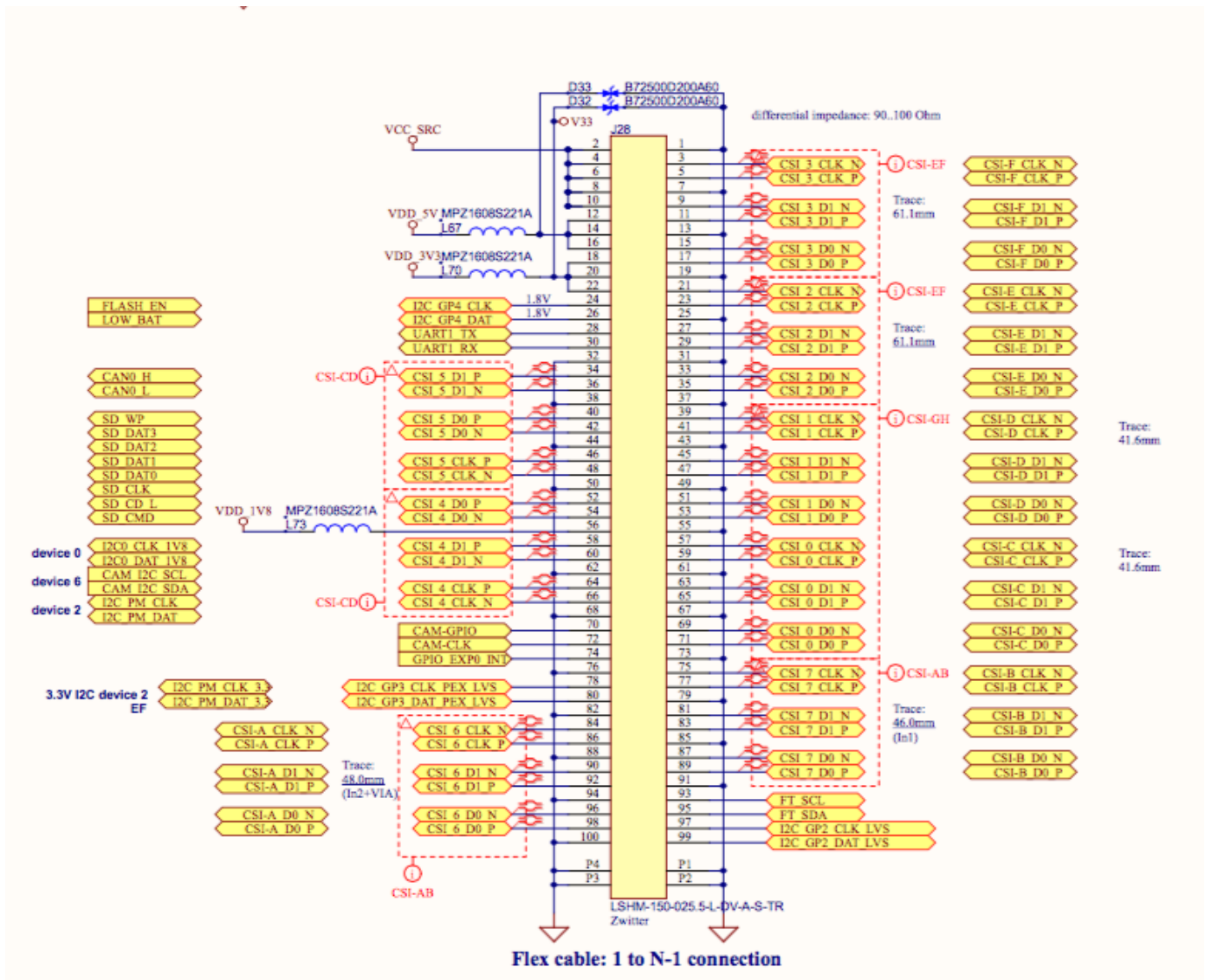


UART0 (J25)

This is a 6 pin connector with 1.25 mm pitch.

Pin	Function	GPIO	Description
1	5.0V	-	5.0V power supply
2	UART0_TXD	-	UART0_TXD 1.8V
3	UART0_RXD	-	UART0_RXD 1.8V
4	UART0_RTS	-	UART0_RTS 1.8V
5	UART0_CTS	-	UART0_CTS
6	GND	-	Ground

CSI-2 extension port (J28)



Power out (J31)

This is a 8 pin JST-GH connector with 1.25 mm pitch.

Pin	Function	GPIO	Description
1	Vdc	-	
2	Vdc	-	
3	12V	-	12V power out
4	12V	-	12V power out
5	12V	-	12V power out
6	GND	-	Ground
7	GND	-	Ground
8	GND	-	Ground

USB2 (J32)

This is a 4 pin JST-GH connector with 1.25 mm pitch.

Pin	Function	GPIO	Description
1	5V	-	5V power in
2	D4_N	-	data lane 4 -
3	D4_P	-	data lane 4 +
4	GND	-	Ground

USB2 (J33)

This is a 4 pin JST-GH connector with 1.25 mm pitch.

Pin	Function	GPIO	Description
1	5V	-	5V power in
2	D3_N	-	data lane 3-
3	D3_P	-	data lane 3 +
4	GND	-	Ground

USB2 (J34)

This is a 4 pin JST-GH connector with 1.25 mm pitch.

Pin	Function	GPIO	Description
1	5V	-	5V power in
2	D1_N	-	data lane 1 -
3	D1_P	-	data lane 1 +
4	GND	-	Ground

Power out (J32)

This is a 4 pin JST-GH connector with 1.25 mm pitch.

Pin	Function	GPIO	Description
1	5V	-	5V power out
2	5V	-	5V power out
3	GND	-	Ground
4	GND	-	Ground

DC in (J372)

This is a 4 pin JST-GH connector with 1.25 mm pitch.

Pin	Function	GPIO	Description
1	Vdc	-	
2	Vdc	-	
3	GND	-	Ground
4	GND	-	Ground

SATA (J30)

This is a 7 pin SATA connector.

Pin	Function	GPIO	Description
1	GND	-	Ground
2	SATA2_RX_P	-	SATA 2 receive +
3	SATA_RX_N	-	SATA 2 receive -
4	GND	-	Ground
5	SATA_TX_P	-	SATA transmit +
6	SATA_TX_N	-	SATA transmit -
7	GND	-	Ground

Buttons

There are 3 buttons on the bottom side of the JN30. These buttons are not populated with the LC version.

- Button 1 (J26) - Power on
- Button 2 (J25) - Force recovery
- Button 3 (J21) - Reset

M.2 type M 2280 (J15)

M.2 connector for NVMe cards.

Form factor: 2230, 2242, 2260 or 2280 (22 x 80 mm)

Interface: four PCIe lanes for top performance (no SATA support)

Recommended: Samsung EVO 960 and 970 modules.

X220 revisions

X220 Revision 1 (38339)

- first prototype of the X220

X220 Revision 2 (38339-2)

- add 12V/48V power connector
- add 5V power connector
- add 4 port USB 2.0 hub
- add 3 USB connectors

X220 Revision 3 (38339-3)

- remove USB3 connector J16
- add USB3 as an option (alternative to PCIe x1) to J20
- removed CSI-2 connector J18
- added 2 CSI-2 busses for a total of 16 lanes to J28
- added 4th I2C bus to J28 (1.8V)
- added PD circuit to front GbE RJ45 port
- added PoE PD

2230 or 2242 NVME card for the X220

https://www.sandisk.com/content/dam/sandisk-main/en_us/assets/resources/data-sheets/Western-Digital-PC-SN520-Commercial-Datasheet.pdf

FAQ

to be added.

Disclaimer

Thank you for reading this manual. If you have found any typos or errors in this document, please let us know. This is the preliminary version of this data sheet. Please treat all specifications with caution as there may be any typos or errors.

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