Kinetec MCDP5200 RD1 Evaluation Kit User Manual

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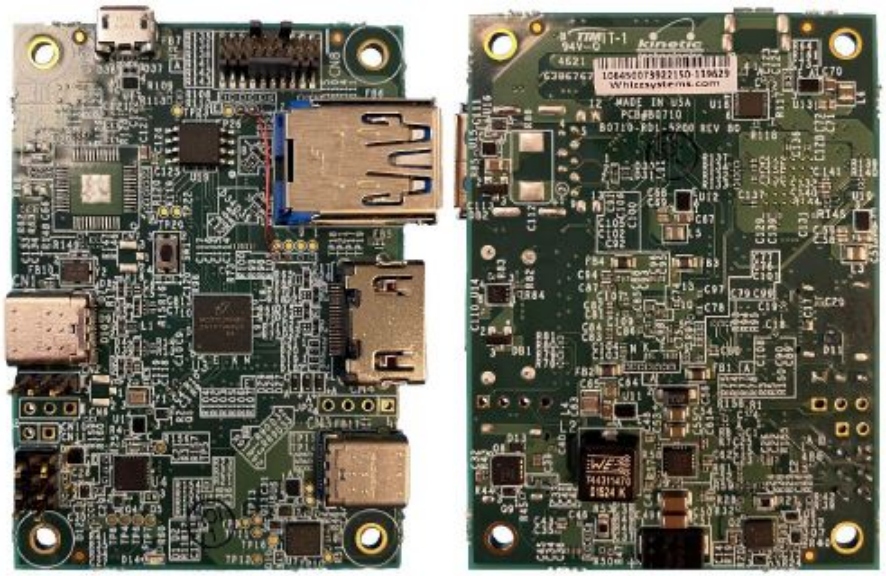
Kinetec MCDP5200 RD1 Evaluation Kit



General Description

The MCDP5200 is an advanced USB Type-C / DisplayPort1.4a to HDMI converter with an integrated USB type-C de-multiplexer, targeted primarily for Mobile Notebook accessory and display applications. This device functions as a DP to HDMI protocol converter with a HDCP1.x/ HDCP2.x repeater function.
The MCDP5200 has a USB Type C DP Alt mode Upstream Facing Port (UFP), supporting Billboard functionality. The four high speed lanes of UFP can receive DP1.4a MST audio-video and USB3.1 Gen2 data streams simultaneously. The input lane mapping is flexible and meets the USB Type-C connector flip orientation requirements. The incoming DP and USB signals are de-multiplexed, retimed, and transmitted on the Downstream Facing Ports (DFP). The MCDP5200 consists of a USB DFP port with USB3.1 TX and RX pair and an audio-video DFP port configured as DC coupled HDMI/DVI port, each with four high-speed lanes.

Ordering Information

Part Number	Description	IC Package
RD1-5200	MCDP5200 RD1 Evaluation Kit	LFBGA77-169

Detailed functionality of the IC is described in the MCDP5200 datasheet. Included in the kit are the following items:

Item #	Description	Quantity
1	Fully assembled printed circuit board	1
1	Reference Design Evaluation kit manual	1

Evaluation Board Features

Design Features

- **DUT**: MCDP5200
- **Board Name:** RD1-5200
- Power Supply
    - DC5V Input = Barrel Jack, USB Type-C (5V/3A mode) in alternative use, with over voltage protection (trip voltage 6.2~7.0V)

- **Interfaces**
  - Input: USB Type-C Alt mode support
    - Display Port: 1.62 / 2.74 / 5.4 / 8.1 Gbps, 1 /2 / 4 lane configuration
    - USB3.2 : 5Gbps, 10Gbps x1 operation
    - USB2: (bypassed to DFP)
  - Output: HDMI2.0b with HDMI Type-A Connector as DFP
    - If UFP port is configured as 4L DP mode, then 600 MHz(max) TMDS character clock, 6Gbps(max) can be supported
    - If UFP port is configured as USB3 + 2L DP mode, then up to 540MHz TMDS character clock can be supported. 4k2k60Hz resolution can be achieved in either reduced blanking, YUV420 or with the DSC functionality
  - Output: USB3.2 SSPx1 operation with USB Type-A Connector as DFP
    - 5Gbps/10Gbps
  - CPU Reset: 1x Push switch
  - Charging Port: USB type-C Receptacle
    - Handling voltage can be up to 20VDC as Power Delivery specification.
    - USB PD: Through UFP USB C and DFP USB C (up to 65W) Dual Role
    - Components
  - MCDP9000 (USB PD3.0 Type-C Port Controller)
  - Small crystal operation: 25MHz with 2016 size (metric)
  - 16Mbit SPI Flash: MX25R1635FM2IH2 (default) or compatibles1.
  - Protection Circuit2
    - ESD Diodes on
- RX: High Speed Line and AUX/HPD
- TX1(HDMI): High Speed Line and DDC
- TX0(USB3 SSP): High Speed Line
- Pin header of G-Probe Interface (debug use)
    - Over current protection
- 1.5A@VBUS: USB Type-A(DFP)
- 0.3A@Trip of poly-fuse (resettable fuse): HDMI +5V power supply
- 1.0A@Trip of poly-fuse: for external G-Probe card
  - External reference resistor: 5.36kΩ ± 1% ohm
- VRM Block (Power Distribution Network)
  - Lower cost components and smaller space
  - DCDC converter circuit compliant with noise requirement (<20mVpp)
  - The self-contained over-current protection circuit
  - Discharging load capacitors
- Interfaces for debug:
  - 1x G-Probe Interface on USB Micro-B connector (UART signals can be bypassed to external GProbe card)
  - 1x JTAG(SWD) interface with J-Link 19pin
  - Trace pins of JTAGE interface are option
  - 1x HDMI DDC pins (DC coupled) on DFP

- 1x Reference clock output with u-coax connector (Hirose U.FL)
- 1x Reference clock input path with u-coax connector (Hirose U.FL)
- 1x 6pin connector for TEST mode and VPP(6V) Power Supply
- 1x Bootstrap pin header

System Overview

Functional Block Diagram

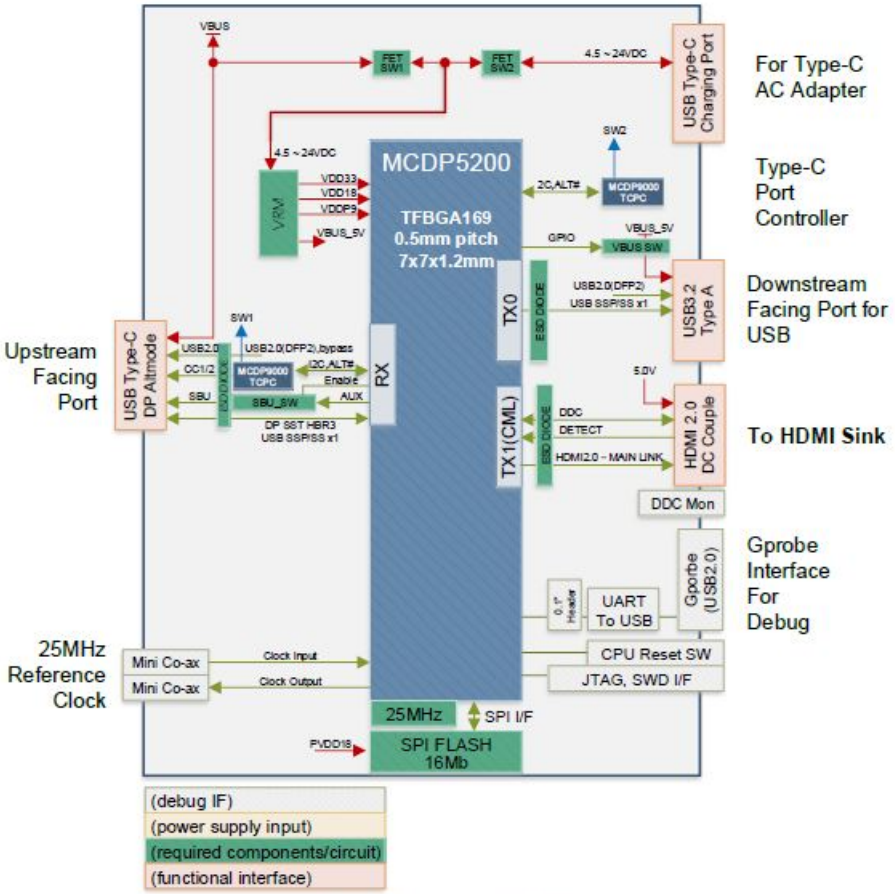


Figure 1. Functional Block Diagram

Connection Setup

1. Connect USB Type C cable
2. Connect HDMI Cable
3. [optional] Connect USB Type C Charging port: MCDP5200 RD1 USB PD (through UFP USB C and DFP USB C Dual Role)
4. [optional]: USB3.2 Type A: Downstream Facing Port for USB supports (USB2.0, USB3.x Gen1/Gen2).
5. USB Type A-to-C cable can also be used to connect to USBC 2.0 / 3.x Gen1/Gen2 devices.

Figure 2. Connection Setup

Diagnosis

If the image does not come up, follow the steps below for diagnosis.
Note: The diagnosis requires the Kinetics' GProbe software3.

1. Install the GProbe diagnostic tool on a computer and set the baud rate to 115,200.
2. Connect a micro-USB cable to the CN5 connector as shown in figure2-3 (the board has a USB-UART for Gprobe Interface
3. Install the necessary driver FTDI drivers (USB to UART) and connect to the computer with the Gprobe software
4. Hit the Reset button on the board. You will see the firmware version and date of firmware in the GProbe window. This indicates the DP receiver IC is functional. If the message does not appear, contact Kinetic for further assistance.

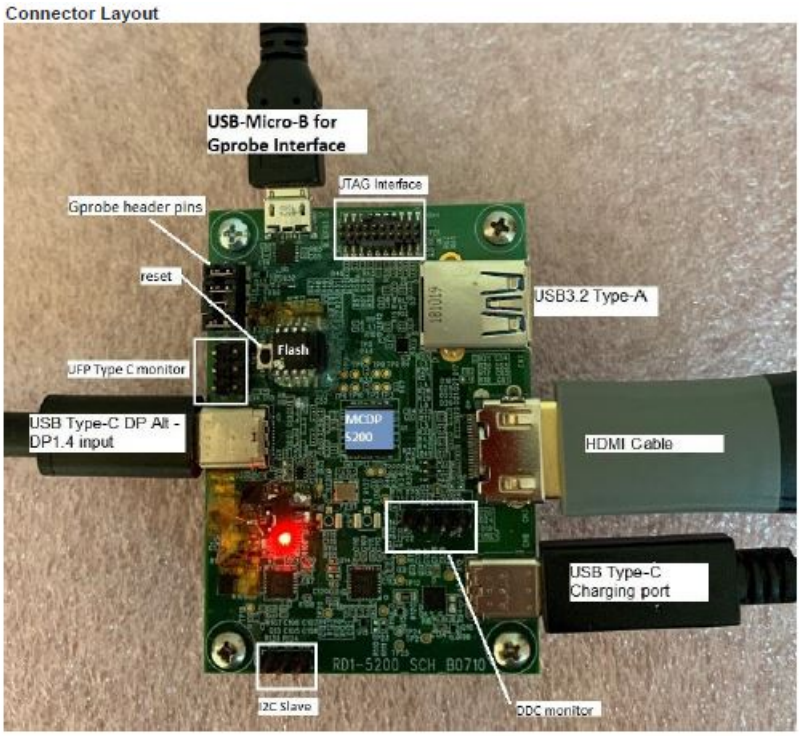
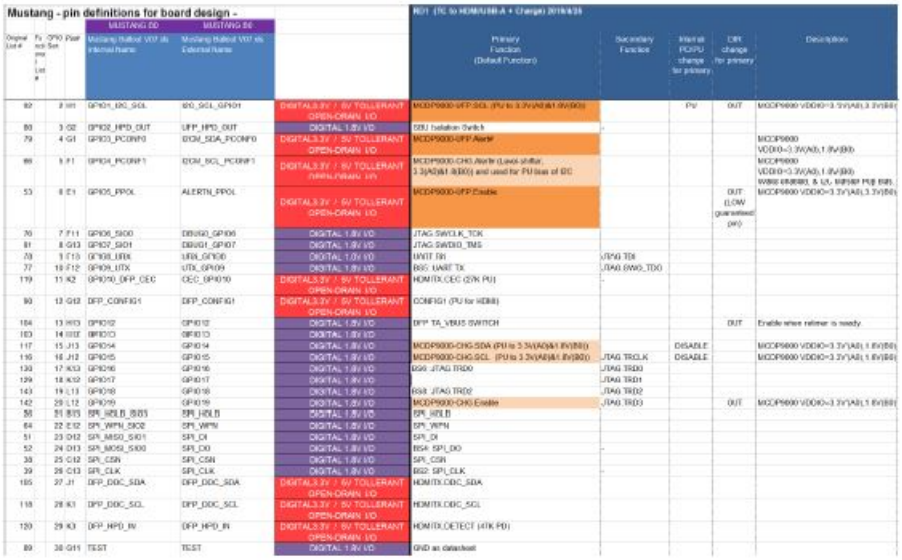


Figure 3. Connector Layout

MFP Pin Assignment



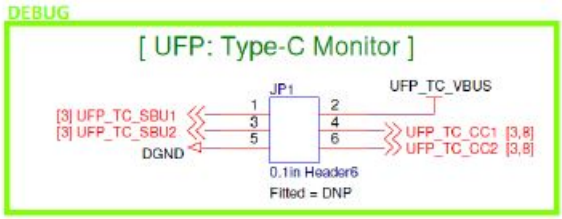
Mustang - pin definitions for board design -

Original List #	Fx ncti on s List #	GPIO Num	Pad	MUSTANG DD Mustang Ballout V07 xls Internal Name	MUSTANG DE Mustang Ballout V07 xls External Name		RD1 (TE to HDMI/USB-A + Charge) 2018/4/24 Primary Function (Default Function)	Secondary Function	Internal PD/PU change for primary	DIR change for primary	Description
82		0	M1	GPIO0_I2C_SCL	I2C_SCL_GPIO0	DIGITAL 3.3V / 5V TOLLERANT OPEN-DRAIN I/O	MCDP6000-DFP SCL (PU to 3.3V(A0)&1.8V(B0))		PU	OUT	MCDP6000 VDDIO=3.3V(A0),3.3V(B0)
80		3	G2	GPIO2_HPD_OUT	UFP_HPD_OUT	DIGITAL 1.8V I/O	DBU Isolation Switch				
79		4	G1	GPIO3_PCONF0	I2CM_SDA_PCONF0	DIGITAL 3.3V / 5V TOLLERANT OPEN-DRAIN I/O	MCDP6000-DFP Alert#				MCDP6000 VDDIO=3.3V(A0),1.8V(B0)
86		5	F1	GPIO4_PCONF1	I2CM_SCL_PCONF1	DIGITAL 3.3V / 5V TOLLERANT OPEN-DRAIN I/O	MCDP6000-CH0 Alert# (Level-shifter, 3.3V(A0)&1.8V(B0)) and used for PU bias of I2C				MCDP6000 VDDIO=3.3V(A0),1.8V(B0) Within MCDP6000, 5.1k, MCDP6000 PU to 3V3_A0
53		8	E1	GPIO5_PPOL	ALERTN_PPOL	DIGITAL 3.3V / 5V TOLLERANT OPEN-DRAIN I/O	MCDP6000-DFP Enable			OUT (LOW guaranteed on)	MCDP6000 VDDIO=3.3V(A0),3.3V(B0)
70		7	F11	GPIO6_SIO0	DBUG0_GPIO6	DIGITAL 1.8V I/O	JTAG SWCLK_TCK				
81		8	G13	GPIO7_SIO1	DBUG1_GPIO7	DIGITAL 1.8V I/O	JTAG SWDIO_TMS				
78		9	F13	GPIO8_UTX	UTX_GPIO8	DIGITAL 1.0V I/O	UART TX	JTAG TDI			
77		10	F12	GPIO9_URX	UTX_GPIO9	DIGITAL 1.8V I/O	BSS: UART TX	JTAG SWO_TDO			
119		11	K2	GPIO10_DFP_CEC	CEC_GPIO10	DIGITAL 3.3V / 5V TOLLERANT OPEN-DRAIN I/O	HDMITX.CEC (23K PU)	-			
90		12	G12	DFP_CONFIG1	DFP_CONFIG1	DIGITAL 3.3V / 5V TOLLERANT OPEN-DRAIN I/O	CONFIG1 (PU for HDMI)				
104		13	H13	GPIO12	GPIO12	DIGITAL 1.8V I/O	DFP TA_VBUS SWITCH			OUT	Enable when retimer is ready
103		14	G12	GPIO13	GPIO13	DIGITAL 1.8V I/O					
117		15	J13	GPIO14	GPIO14	DIGITAL 1.8V I/O	MCDP6000-CH0 SDA (PU to 3.3V(A0)&1.8V(B0))		DISABLE		MCDP6000 VDDIO=3.3V(A0),1.8V(B0)
116		16	J12	GPIO15	GPIO15	DIGITAL 1.8V I/O	MCDP6000-CH0 SCL (PU to 3.3V(A0)&1.8V(B0))	JTAG TRCLK	DISABLE		MCDP6000 VDDIO=3.3V(A0),1.8V(B0)
139		17	K13	GPIO16	GPIO16	DIGITAL 1.8V I/O	BSS: JTAG TRD0	JTAG TRD0			
129		18	K12	GPIO17	GPIO17	DIGITAL 1.8V I/O		JTAG TRD1			
143		19	L13	GPIO18	GPIO18	DIGITAL 1.8V I/O	BS8: JTAG TRD2	JTAG TRD2			
142		20	L12	GPIO19	GPIO19	DIGITAL 1.8V I/O	MCDP6000-CH0 Enable	JTAG TRD3		OUT	MCDP6000 VDDIO=3.3V(A0),1.8V(B0)
58		51	B15	SPI_HOLD_B15	SPI_HOLD	DIGITAL 1.8V I/O	SPI_HOLD				
64		22	E12	SPI_WPN_SIO2	SPI_WPN	DIGITAL 1.8V I/O	SPI_WPN				
51		23	D12	SPI_MISO_SIO1	SPI_DI	DIGITAL 1.8V I/O	SPI_DI				
52		24	D13	SPI_MOSI_SIO0	SPI_DO	DIGITAL 1.8V I/O	BS4: SPI_DO	-			
38		25	C12	SPI_CSN	SPI_CSN	DIGITAL 1.8V I/O	SPI_CSN				
39		26	C13	SPI_CLK	SPI_CLK	DIGITAL 1.8V I/O	BS2: SPI_CLK	-			
105		27	J1	DFP_DDC_SDA	DFP_DDC_SDA	DIGITAL 3.3V / 5V TOLLERANT OPEN-DRAIN I/O	HDMITX.DDC_SDA				
118		28	K1	DFP_DDC_SCL	DFP_DDC_SCL	DIGITAL 3.3V / 5V TOLLERANT OPEN-DRAIN I/O	HDMITX.DDC_SCL				
120		29	K3	DFP_HPD_IN	DFP_HPD_IN	DIGITAL 3.3V / 5V TOLLERANT OPEN-DRAIN I/O	HDMITX.DETECT (4TK PD)				
89		30	G11	TEST	TEST	DIGITAL 1.8V I/O	GND as datasheet				

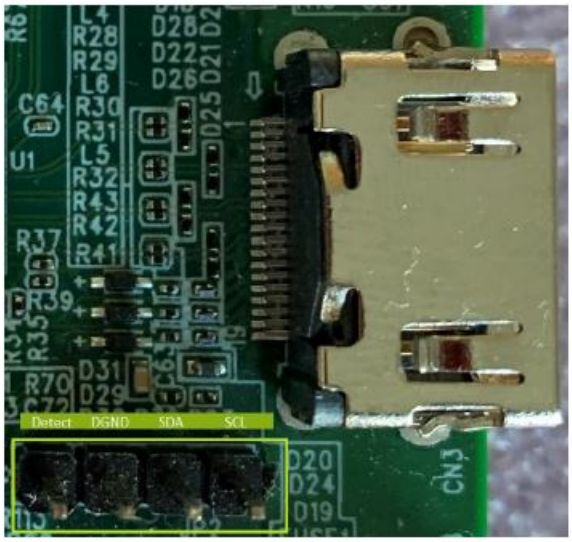
Figure 4. MFP Pin Assignment on the Board Except for High Speed Signal

Selected Pin Usage and Assignment

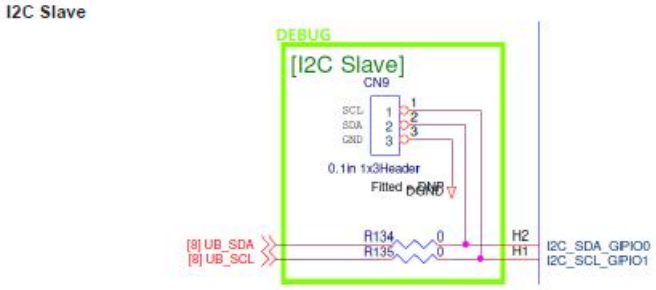
UFP Type-C Monitor

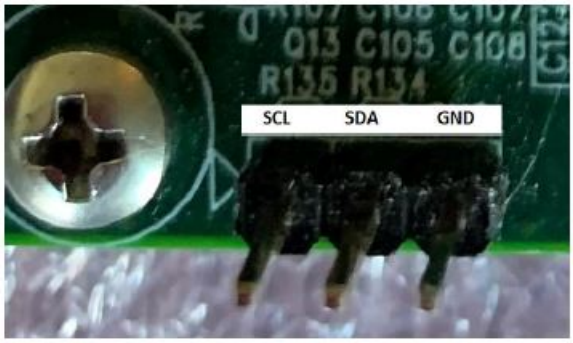


DDC Monitor for HDMI TX

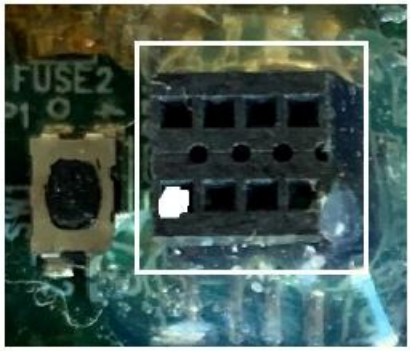

Detect
DGND
SDA
SCL
CN3

I2C Slave

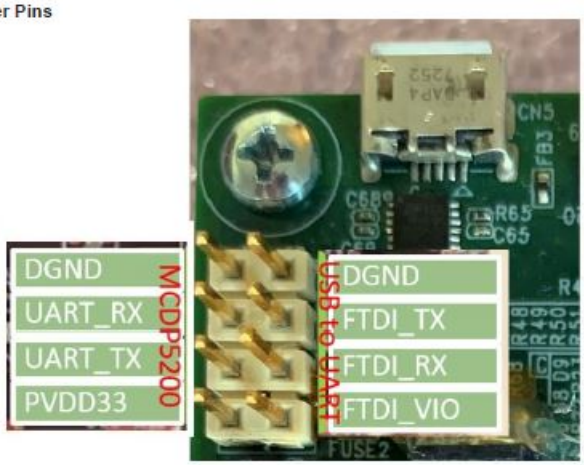

I2C Slave
DEBUG
[I2C Slave]
CN9
SCL
SDA
GND
1
2
3
0.1in 1x3Header
Fitted
DGND
[8] UB_SDA
[8] UB_SCL
R134
R135
0
0
H2
H1
I2C_SDA_GPIO0
I2C_SCL_GPIO1


SCL
SDA
GND

SPI Flash & Reset[4]



Gprobe Header Pins



Recommended Accessories

AC Adapters

This list is a list for your convenience.
Table 1.Recommended AC Adapter List

Application	Manufacturer	Model	Description	Where to Buy
DC5V Input Barrel Plug	CUI Inc	SMI36-5-V-P5	5V/5A 25W AC/DC External Wall Mount Adapter Multi-Blade (Included) Input	https://goo.gl/2VEPF1
USB Type-C Power Adapter	Qualtek	QFWC-60-20-USCR	5V, 9V, 12V, 15V, 20V 60W AC/DC External Wall Mount (Class II) Adapter Fixed Blade Input	https://www.digikey.com/short/z4jndz

Cables

This is a list for your convenience.
As of 2018/9/24, we have confirmed highest data rate with these cables. Table 2. Recommended Cable List

Application	Manufacturer	Model	Description	Where to Buy
DP Alt mode	StarTech.com	CDP2DPMM1MB	USB-C to DisplayPort 4K 60Hz Cable – 1m (3.3 ft.)	https://goo.gl/KqGoQZ
	Plugable	USBC-DP	USB-C to DisplayPort Cable – 1.8m (6.0 ft.)	https://goo.gl/Vxta53
	Cable Matters	201036	USB-C to DisplayPort 4K 60Hz Cable, 1m (3.3 ft.)	https://goo.gl/mK9bwi

Application	Manufacturer	Model	Description	Where to Buy
USB3.1Gen2	StarTech.com	USB31AC1M	USB-A to USB-C Cable - USB-IF Certified USB 3.1 (10Gbps) 1m (3ft)	https://goo.gl/2nXNgG
		USB31C5C1M	USB-C Cable with Power Delivery (5A) - M/M - USB-IF Certified USB 3.1 (10Gbps) 1m (3ft)	https://goo.gl/2nXNgG
		USB31CC1M	USB-C Cable - M/M - USB 3.1 (10Gbps) - USB-IF Certified 1m (3ft)	https://goo.gl/2nXNgG
		USB31CUB50CM	USB-C to Micro-B Cable - M/M - USB 3.1 (10Gbps) 0.5m (1.6ft)	https://goo.gl/2nXNgG

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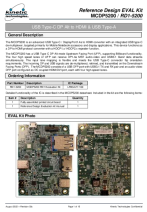
SUBSTANCE COMPLIANCE

Kinetic Technologies IC products are compliant with RoHS, formally known as Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. However, this evaluation kit does not fall within the scope of the EU directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and may not meet the requirements of these or related directives. To the best of our knowledge the information is true and correct as of the date of the original publication of the information. Kinetic Technologies bears no responsibility to update such a statement.

Documents / Resources

	[Kinetec MCDP5200 RD1 Evaluation Kit](#) [pdf] User Manual MCDP5200, RD1-5200, USB Type C DP Alt to HDMI and USB Type A Converter, MCDP5200 USB Type C DP Alt to HDMI and USB Type A Converter, RD1 Evaluation Kit, MCDP5200 RD1 Evaluation Kit

References

- StarTech.com | IT Pro's Trusted Source for Connectivity Accessories
- Kinetic Technologies - Analog & Mixed-Signal Semiconductors
- USB-C Cables
- SMI36-5-V-P5 CUI Inc. | Power Supplies - External/Internal (Off-Board) | DigiKey
- 3ft USB C to DisplayPort 1.2 Cable 4K60 - USB-C™ Video Adapters | Japan
- USB-C to DisplayPort Cable - 8K Ready
- Plugable USB 3.1 Type-C to DisplayPort Adapter Cable – Plugable Technologies
- QFWC-60-20-USCR Qualtek | Power Supplies - External/Internal (Off-Board) | DigiKey

Manuals+.