HDMI® IPAD™ product presentation

HDMI signal conditioning

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Is this presentation suited for you?

Where do you stand with HDMI® interfacing?

Beginner?	Intermediate?	Advanced?
I am not familiar with this subject. I am in the discovery phase and would like an overview and a basic understanding of the technology.	I have a basic understanding of this subject. I would like to go deeper in details and tackle more aspects of this subject.	I am very familiar with this subject. I would like to deepen my knowledge and become an expert.
Click here to continue to next slide	Click here to open new presentation	Click here to open new presentation
Overview	**Basic**	**In depth**

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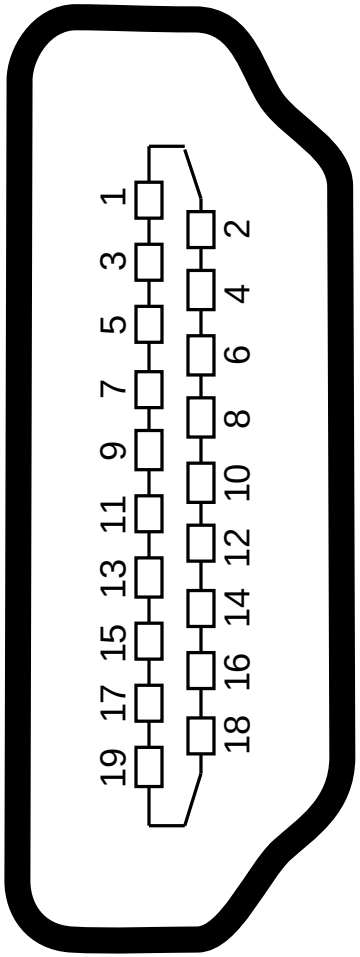
High-definition multimedia interface (HDMI) Ecosystem

HDMI®
HIGH-DEFINITION MULTIMEDIA INTERFACE

HDMI connectors address many applications

HDMI connector
ESD protection requirements

HDMI connector



Datalines

- High frequency
- Differential signaling

Control lines

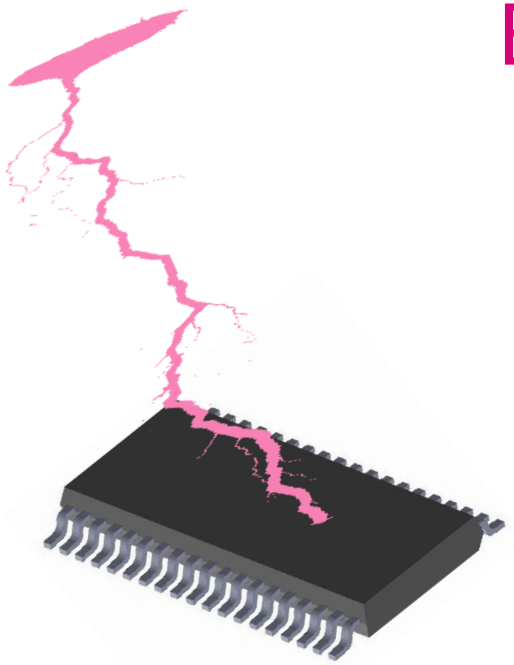
- Low frequency
- I²C bus must drive poor-quality cables

Power supply

- 5 V DC
- Requires current limiter

HDMI connector

ESD protection is needed for…



Core ICs such as microcontrollers, micro-processors, transceivers, etc.

- Advanced technology with very **thin lithography** and gate oxide highly vulnerable to ESD
- Integrated electronics systems with **PCBs having a high component density** facilitate ESD **coupling** and **propagation**
- IC manufacturers reluctant to make robust embedded ESD protection diodes that would require a **significant active area of their advanced and expensive technology.**

When the **application uses RF** (Wi-Fi or Bluetooth)**,** a **common-mode filter is required,** in addition to ESD protection, to avoid **RF performance decrease** due to the EMI generated by the high-speed link.

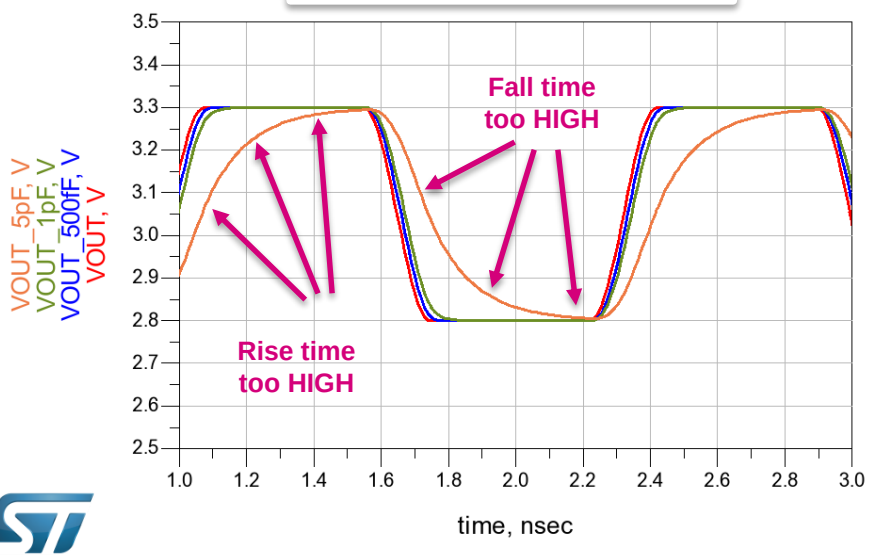
HDMI – Dataline ESD protection

Why ultra-low capacitance ?

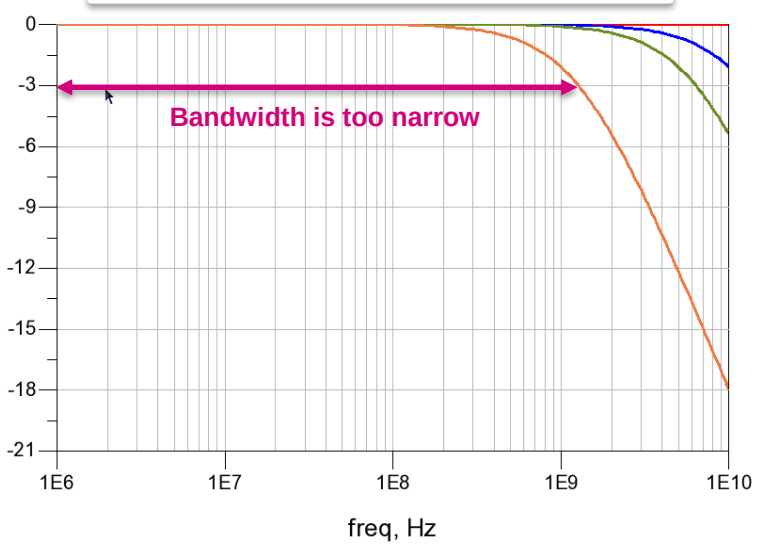
- The parasitic capacitance of ESD protection devices must be low enough to allow HDMI signals to be transmitted without degradation.
- A high parasitic capacitance of the ESD protection devices would increase too much the signal rise/fall time and prevent the communication.

Example of the impact of parasitic capacitance on an HDMI signal simulated with discrete capacitance

Time domain



Frequency domain



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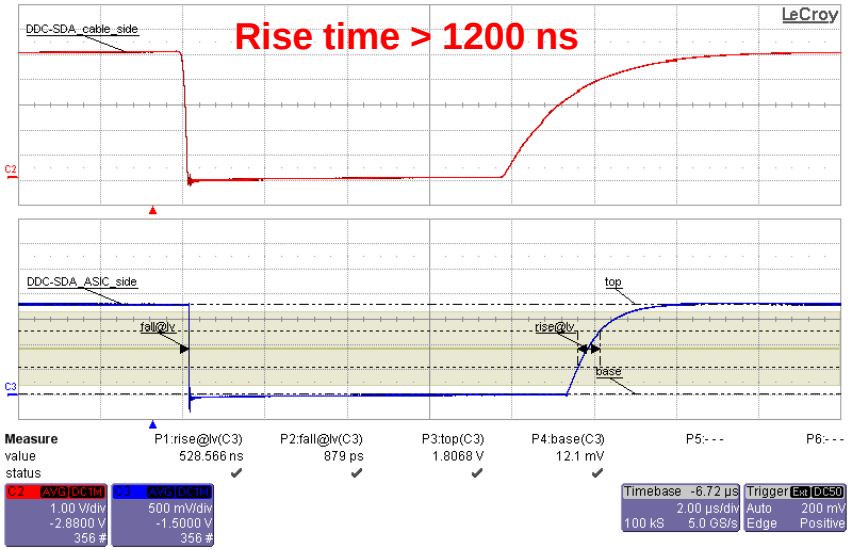
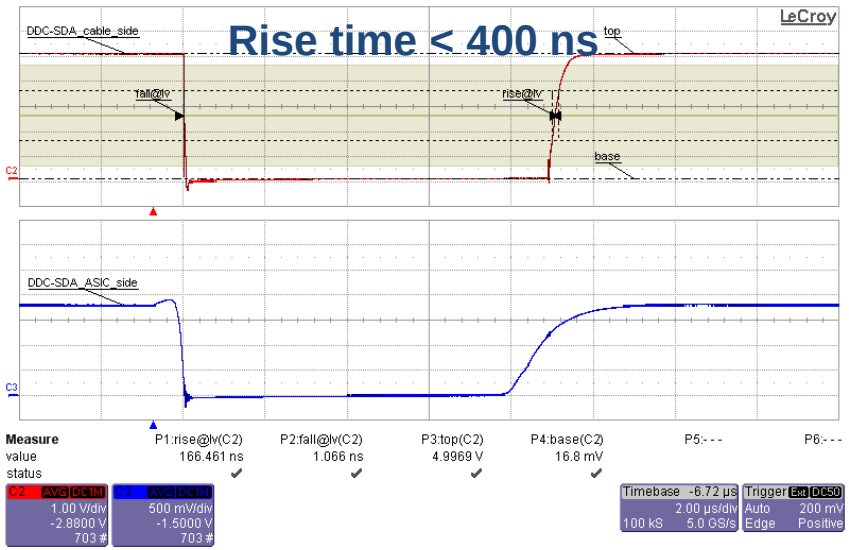
HDMI – Control lines: Why a specific I²C driver?

- The parasitic capacitance of poor quality or long cables increases the rise time of the I²C bus used by the High-bandwidth Digital Content Protection (HDCP) protocol.
- If this rise time exceeds the HDMI specification, a blue screen prevents the user from watching their video content.
- To mitigate this issue, an optimized I²C timing booster is needed.

Without optimized I²C booster



With ST's optimized I²C booster



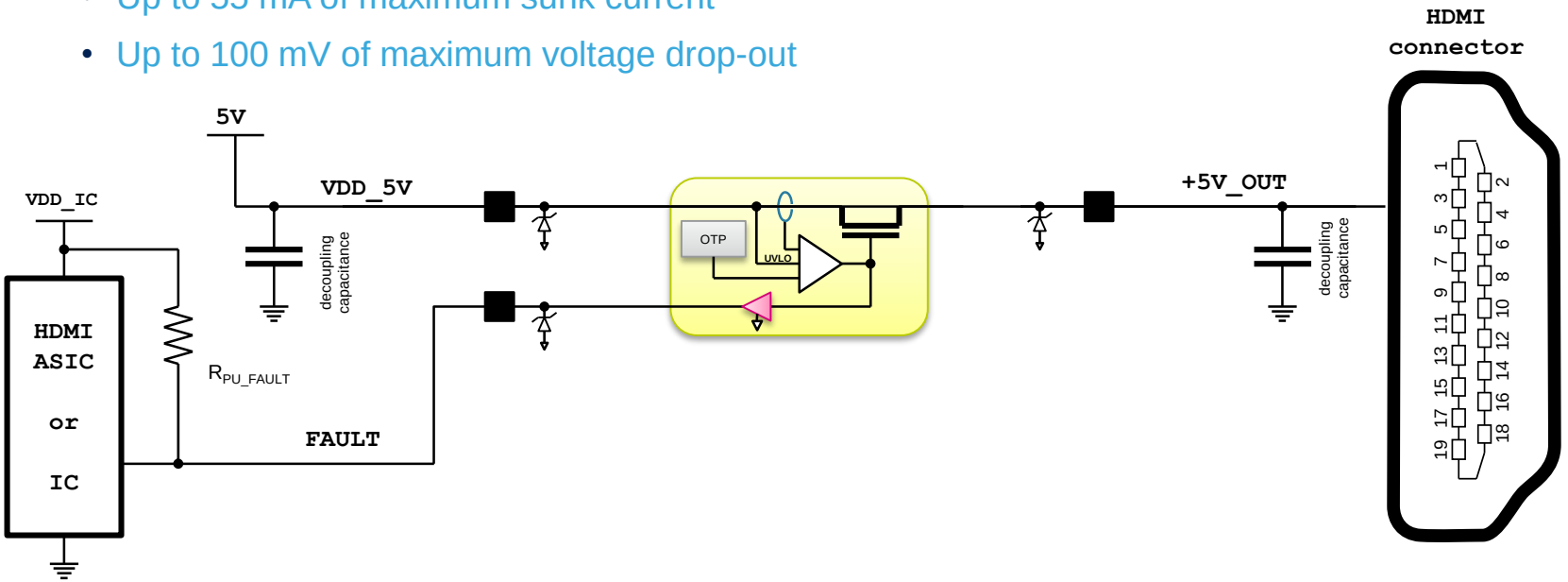
High risk of interoperability issue

I²C timing compliant with HDMI

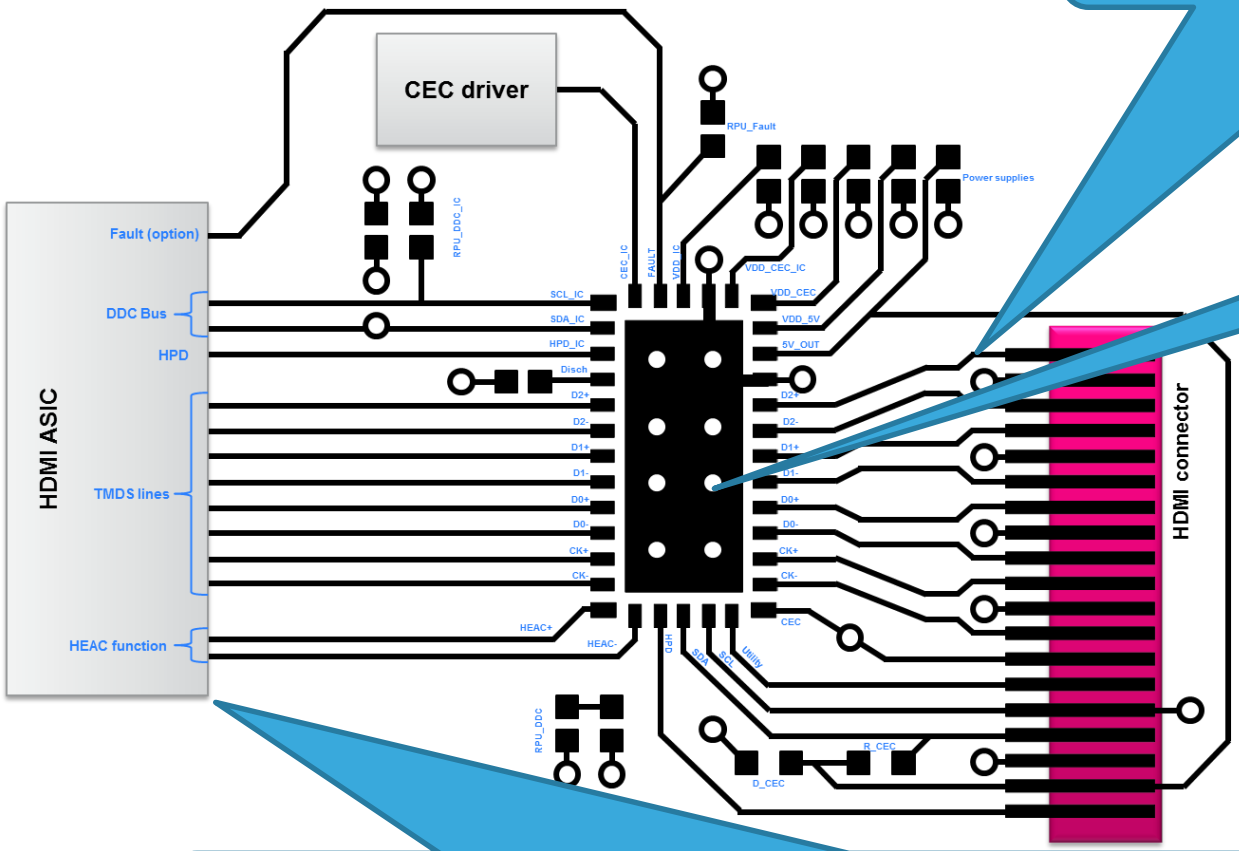
HDMI – Power supply

- The 5 V pin of the HDMI connector provides power to devices connected to the HDMI source.

- The HDMI specification allows:
  - Up to 500 mA of maximum output current from the source
  - Up to 55 mA of maximum sunk current
  - Up to 100 mV of maximum voltage drop-out



HDMI placement and layout - Tips



High-speed data

- Needs ESD protection close to HDMI connector
- Routing is impedance-controlled

Interface IC

- Single-chip interface is recommended for easier layout

HDMI chipset

- Cannot integrate system-level ESD protection (±8000 V) as per IEC 61000-4-2 Level 4 ➔ it requires an interface IC with system-level ESD protection
- Compliant with the basic HDMI specification, it will not handle optimized I²C booster

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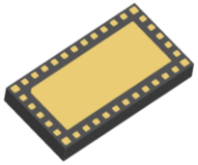
ST's HDMI product line-up

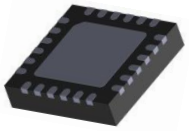
	Data lines	CONTROL LINES							
	TMDS ESD protection	ESD protection	I²C booster	HPD signal conditioning	CEC handling level shifter	HEAC signal	+5 V current limiter	5 V & I²C backdrive protection	ENABLE signal
Source	HDMI2C1-14HD								
Source	HDMI2C1-14HDS								
Source		HDMI2C1-6C1							
Sink	HDMI2C2-14HD								

HDMI2C1-14HD & HDMI2C2-14HD



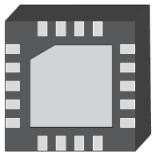
QFN 36L
500-µm pitch
6.5 x 3.5 mm

HDMI2C1-14HDS



QFN 24L
500-µm pitch
4 x 4 mm

HDMI2C1-6C1



QFN 18L
500-µm pitch
3.5 x 3.5 mm

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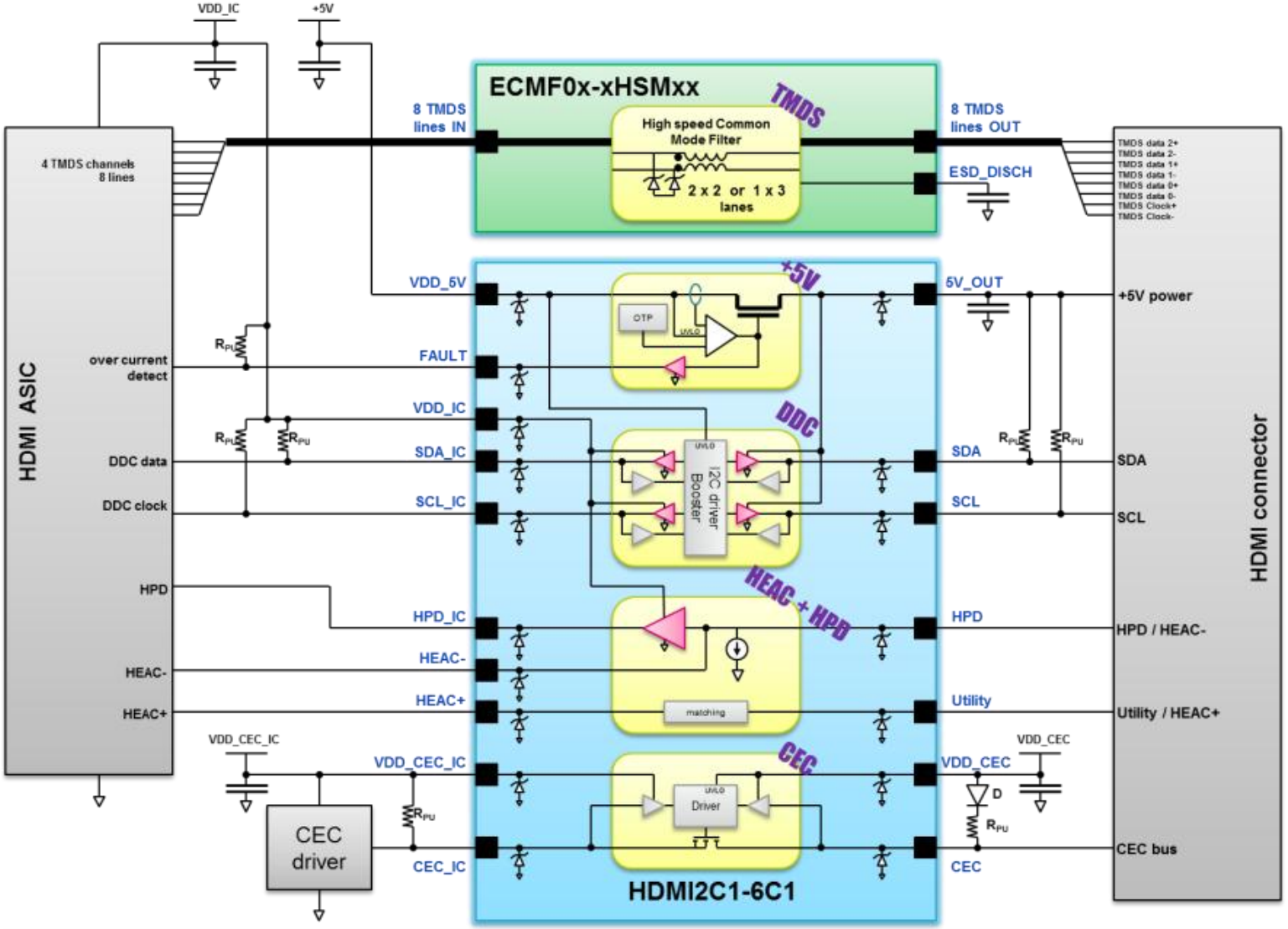
ST solution for HDMI interfaces w/ RF



HDMI application with RF

Requires ESD integrated common-mode filter on datalines with ST's ECMF series

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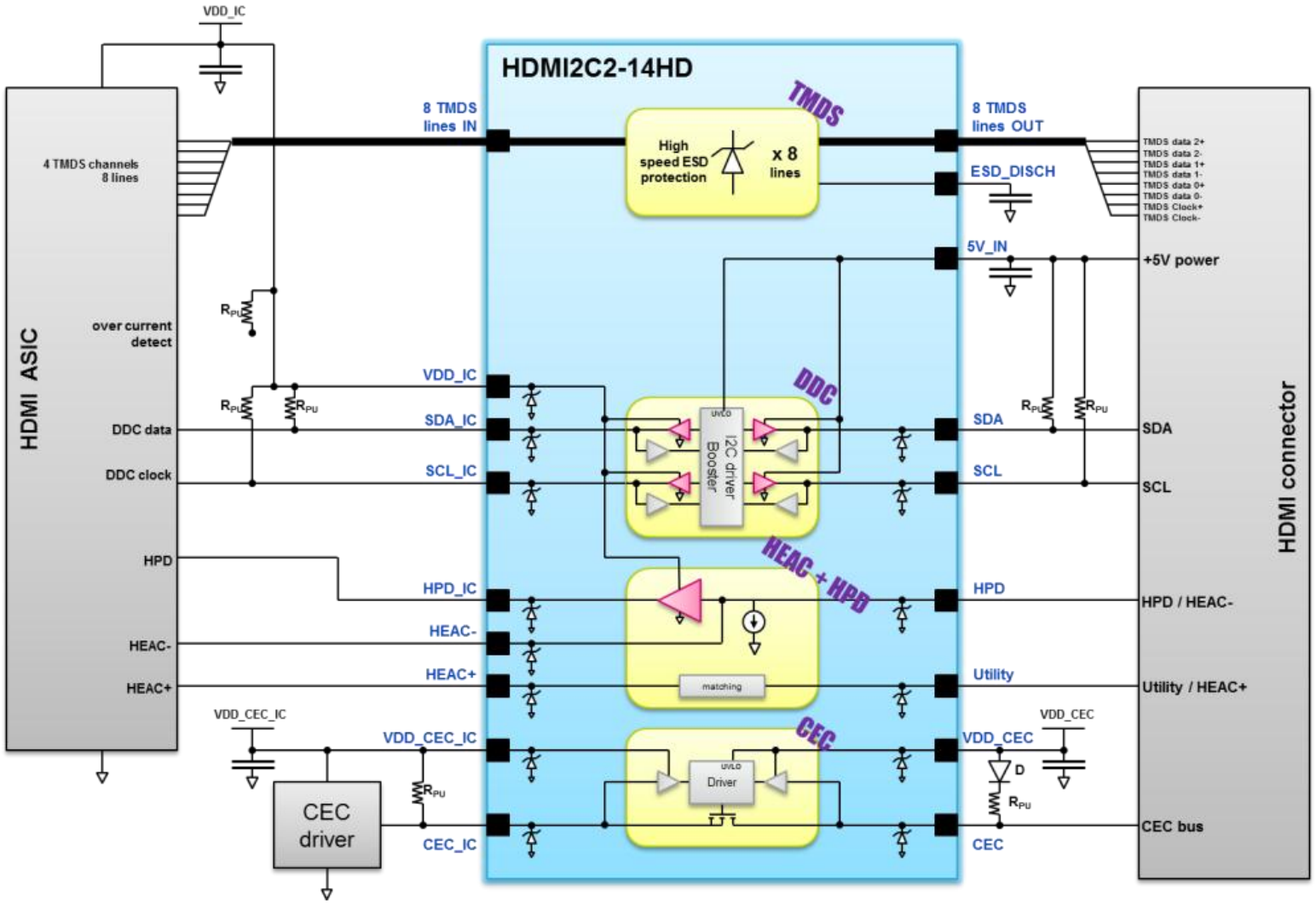
ST solution for HDMI interfaces w/o RF



HDMI application without RF

Requires single-chip HDMI interface IC such as HDMI2Cx-14HDx

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Let’s go further

Basic presentation

Intermediate product presentation soon available: ‘Understanding HDMI IPAD™ series specification’

In-depth information

Datasheets:

- HDMI2C1-14HD: ESD protection & signal conditioning for HDMI 2.0 source interface
- HDMI2C2-14HD: ESD protection & signal booster for HDMI™ 2.0 sink interface
- HDMI2C1-6C1: ESD protection and signal booster for HDMI™ Source control stage interface

Application Notes:

- TVS short-pulse dynamic resistance measurement ... (AN4022)
- IEC 61000-4-2 standard testing (AN3353)

Selection

- Selection guide *[pdf]*
- www.st.com/hdmi-ipad

Thank you