Interface Circuits

HDMI ™

HIGH-DEFINITION MULTIMEDIA INTERFACE

Optional Presentation
Instructor: Dr. Fos'hati
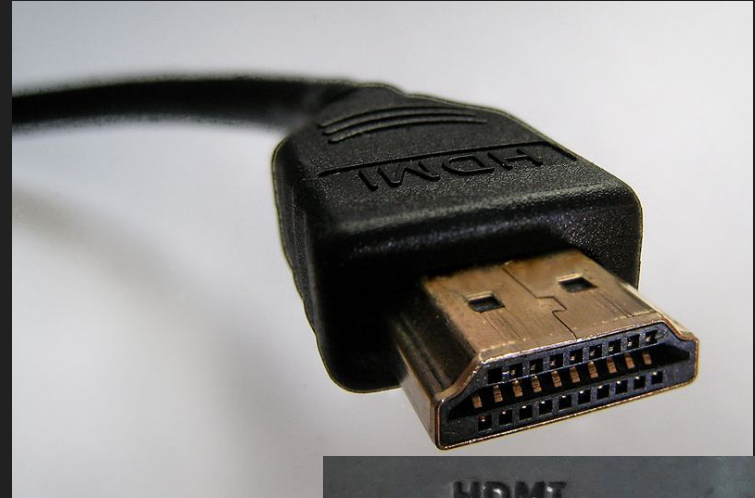**Student: Ali Safarafard**

Introduction

What is HDMI

- High Definition Multimedia Interface

- Developed in 2002

- Replaced AV Connectors

- Hitachi, Panasonic, Philips, Silicon Image, Sony,...

Motivation

- Need for a Single Digital Connection

- High-Quality Digital Transmission

- Content Protection for Digital Media

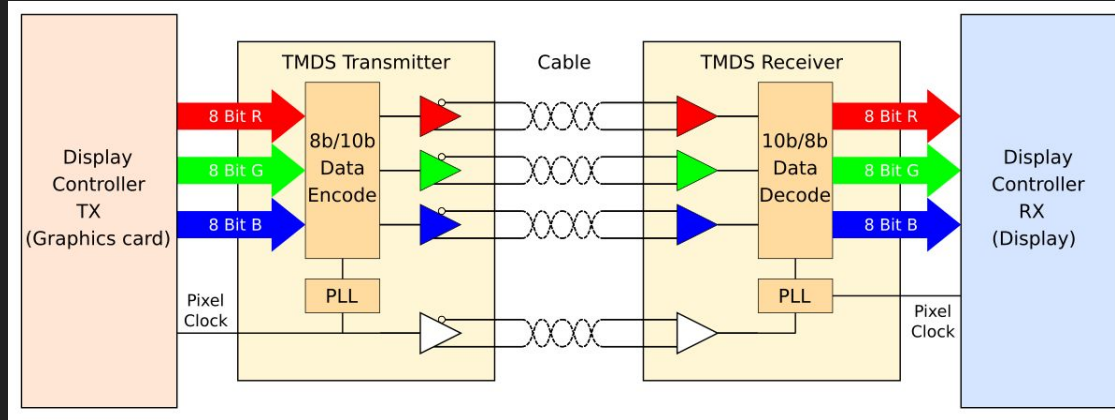- Future-Proofing for Higher Resolutions & Audio Standards

How HDMI Encodes Data?

TMDS

- Transition-Minimized Differential Signaling
  - reduces electromagnetic interference (EMI)
  - reliable high-speed data transfer.

- Two-Step Encoding Process:
  - Step 1: XOR/XNOR Encoding
  - Step 2: Differential Signaling

TMDS

- Three Data Channels (One Per Color!)
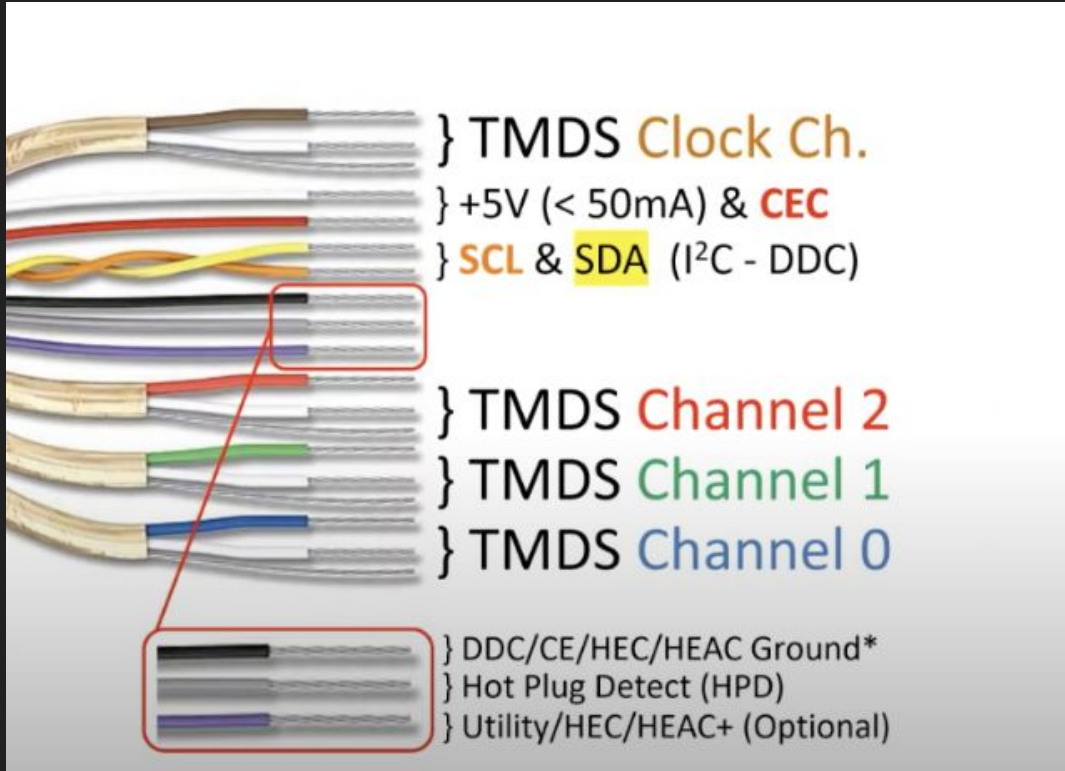- One Clock Channel

TMDS

HDMI Respects Copyright

HDCP

- A digital rights management
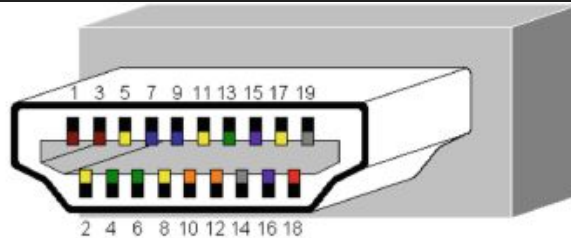- High-Bandwidth Digital Content Protection

How HDCP Works:

- Authentication (Handshake)
- Encryption:
  - key exchange
  - Data is transmitted in an encrypted format
- Ongoing Key Renewal

HDMI Wiring

Port/Cable Pinout
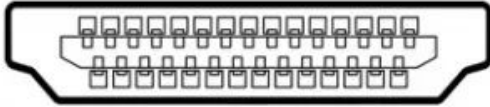
Port/Cable Pinout

HDMI Pinout While Looking into Plug

1 TMDS Data2+	3 TMDS Data2-	5 TMDS Data1 Shield	7 TMDS Data0+	9 TMDS Data0-	11 TMDS Clock Shield	13 CEC	15 SCL	17 DDC / CEC / HEC Ground	19 Hot Plug Detect
	2 TMDS Data2 Shield	4 TMDS Data1+	6 TMDS Data1-	8 TMDS Data0 Shield	10 TMDS Clock+	12 TMDS Clock-	14 reserved	16 SDA	18 +5V power, 50 mA max	

Different Port Types
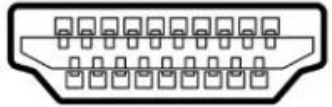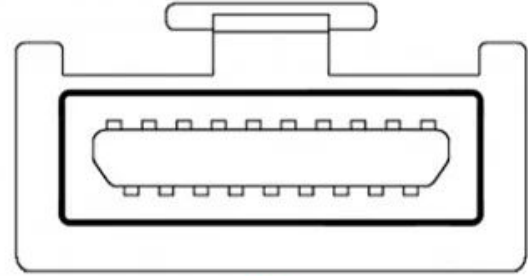
A	B	C	D	E
Standard	Dual-Link	Mini	Micro	Automotive Connection System

HDMI Versions

HDMI VERSION	1.0	1.1	1.2	1.3	1.4	2.0
Date initially released	12/9/02	5/20/04	8/22/05	6/22/06	6/5/09	9/4/13
Maximum Bandwidth (Gbps)	4.95	4.95	4.95	10.2	10.2	18
Maximum Resolution	1600×1200p60	1600×1200p60	1600×1200p60	2048×1536p75	4096×2160p24	4096×2160p60
Maximum LPCM Audio Channels	8 Channels	8 Channels	8 Channels	8 Channels	8 Channels	32 Channels
Maximum Audio Sampling Rate	768kHz	768kHz	768kHz	768kHz	768kHz	1536kHz

HDMI 2.1

Thank You