

## Common mode filter with ESD protection for high speed serial interface

Datasheet - production data

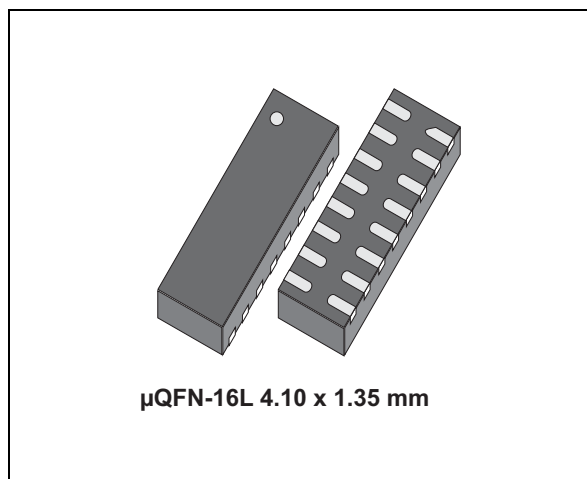
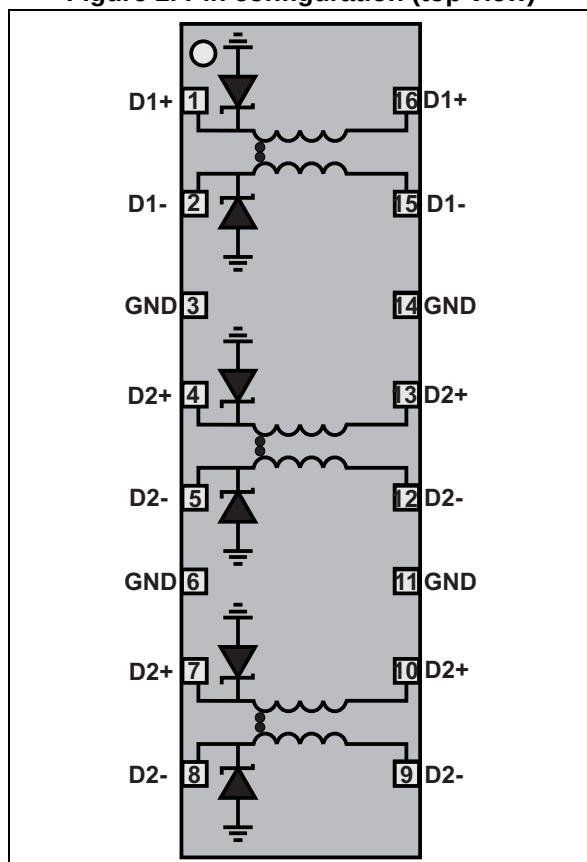


Figure 1. Pin configuration (top view)



### Features

- Very large differential bandwidth to comply with HDMI Full HD, MIPI, USB2.0, USB3.0, Display Port and other high speed serial interfaces
- Provides -20 dB attenuation at 700 MHz in LTE bands
- High common mode attenuation: -25 dB between 800 MHz - 900 MHz
- Very low PCB space consumption
- Thin package: 0.55 mm max.
- Lead-free package
- High reduction of parasitic elements through integration.

### Complies with the following standards:

- IEC 61000-4-2 level 4:
  - ±15 kV (air discharge)
  - ±8 kV (contact discharge)

### Applications

- Mobile phones
- Notebook, laptop
- Portable devices
- PND

### Description

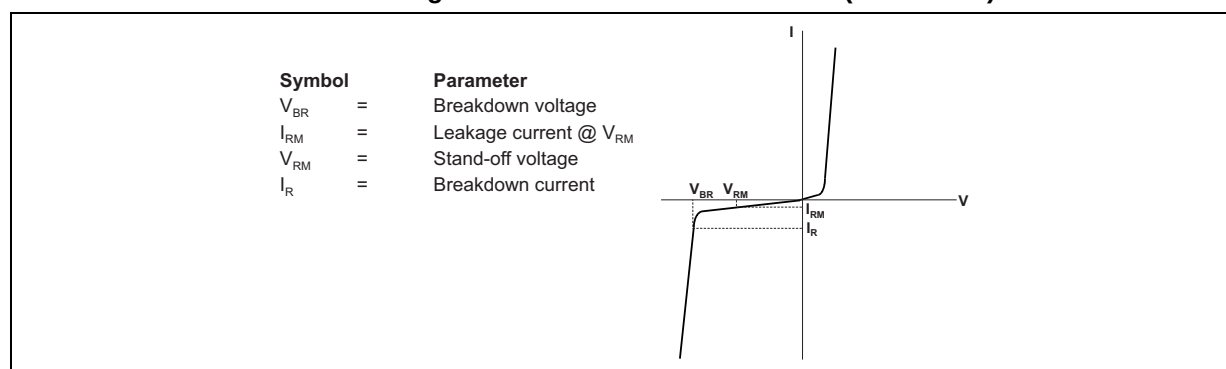
This device is a highly integrated common mode filter designed to suppress EMI/RFI common mode noise on high speed differential serial buses like HDMI Full HD, MIPI, Display Port and other high speed serial interfaces. The device has a very large differential bandwidth to comply with these standards. The device can protect and filter 3 differential lanes.

# 1 Characteristics

**Table 1. Absolute maximum ratings ( $T_{amb} = 25\text{ °C}$ )**

| Symbol    | Parameter                    |                                                                                       | Value        | Unit |
|-----------|------------------------------|---------------------------------------------------------------------------------------|--------------|------|
| $V_{PP}$  | Peak pulse voltage           | IEC 61000-4-2<br>Contact discharge (connector side)<br>Air discharge (connector side) | 8<br>16      | kV   |
| $I_{DC}$  | Maximum DC current           |                                                                                       | 100          | mA   |
| $T_{op}$  | Operating temperature range  |                                                                                       | -40 to +85   | °C   |
| $T_j$     | Maximum junction temperature |                                                                                       | 125          | °C   |
| $T_{stg}$ | Storage temperature range    |                                                                                       | - 55 to +150 | °C   |

**Figure 2. Electrical characteristics (definitions)**



**Table 2. Electrical characteristics ( $T_{amb} = 25\text{ °C}$ )**

| Symbol   | Test conditions                | Min. | Typ. | Max. | Unit     |
|----------|--------------------------------|------|------|------|----------|
| $V_{BR}$ | $I_R = 1\text{ mA}$            | 6    |      |      | V        |
| $I_{RM}$ | $V_{RM} = 3\text{ V per line}$ |      |      | 100  | nA       |
| $R_{DC}$ | DC serial resistance           |      | 5    |      | $\Omega$ |

**Table 3. Pin description**

| Pin number | Description      | Pin number | Description      | Pin number | Description | Pin number | Description |
|------------|------------------|------------|------------------|------------|-------------|------------|-------------|
| 1          | D1+ to connector | 5          | D2- to connector | 9          | D3- to IC   | 13         | D2+ to IC   |
| 2          | D1- to connector | 6          | GND              | 10         | D3+ to IC   | 14         | GND         |
| 3          | GND              | 7          | D3+ to connector | 11         | GND         | 15         | D1- to IC   |
| 4          | D2+ to connector | 8          | D3- to connector | 12         | D2- to IC   | 16         | D1+ to IC   |

Figure 3. Differential attenuation versus frequency ( $Z_{0\text{ diff}} = 100\ \Omega$ )

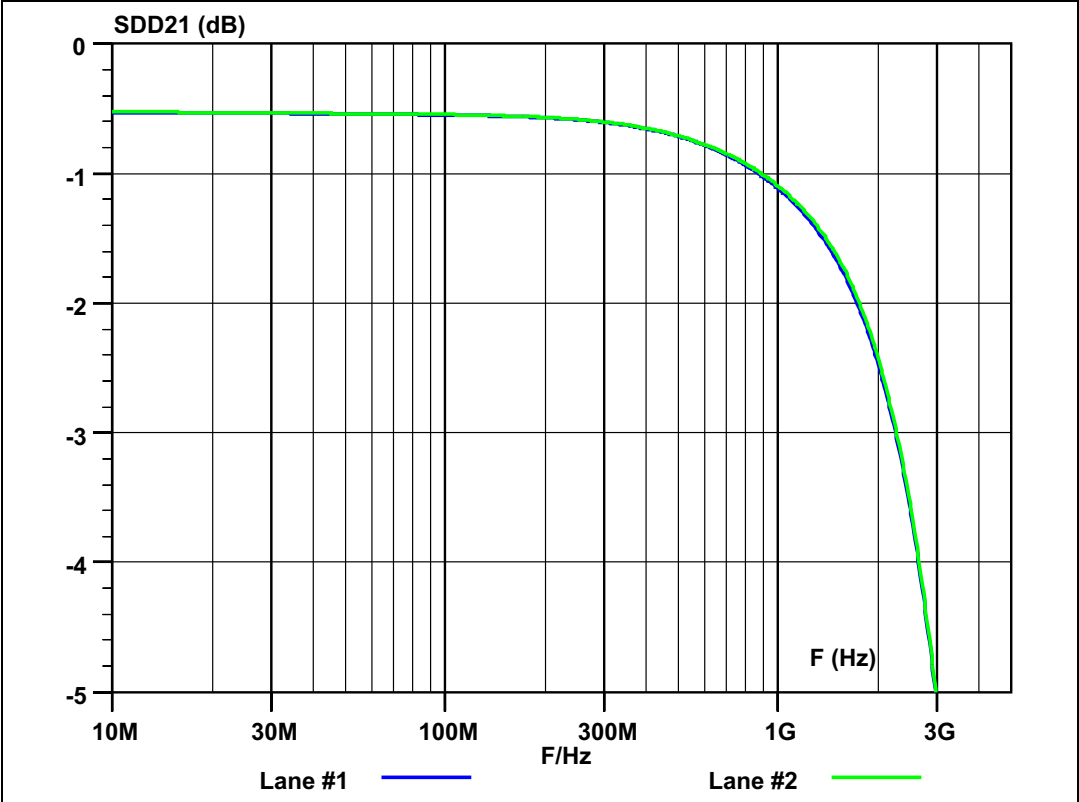


Figure 4. Common mode attenuation versus frequency ( $Z_{0\text{ com}} = 50\ \Omega$ )

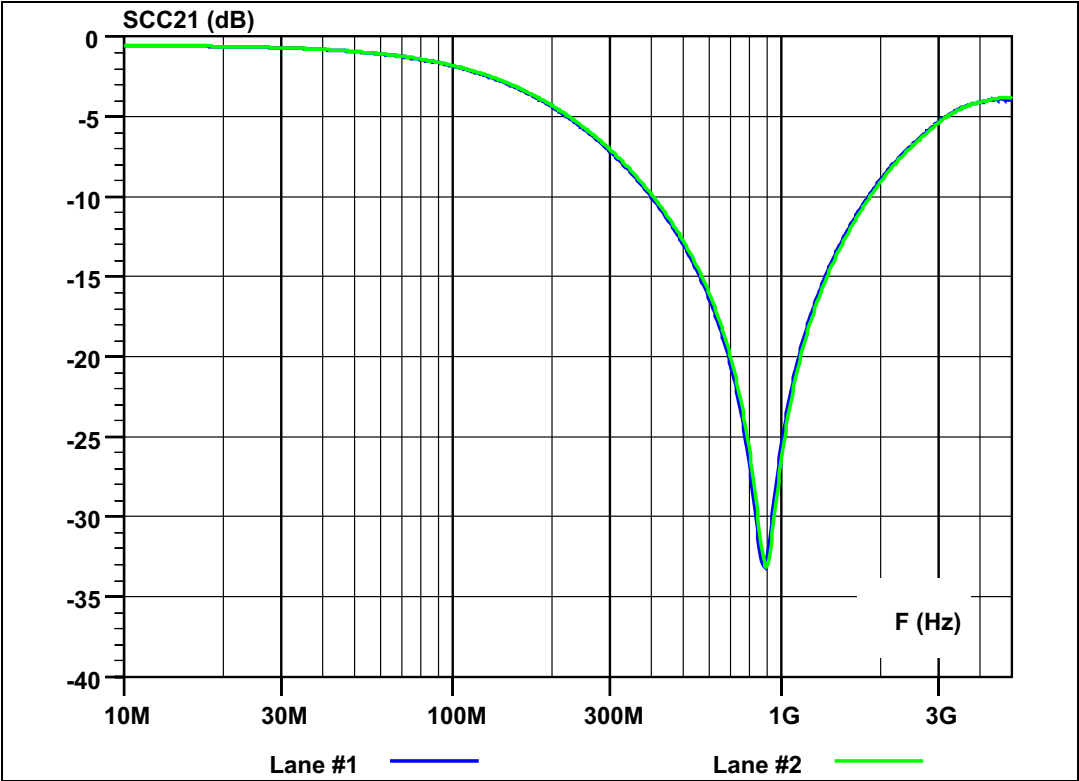


Figure 5. Differential ( $Z_{DD21}$ ) and common mode ( $Z_{CC21}$ ) impedance versus frequency

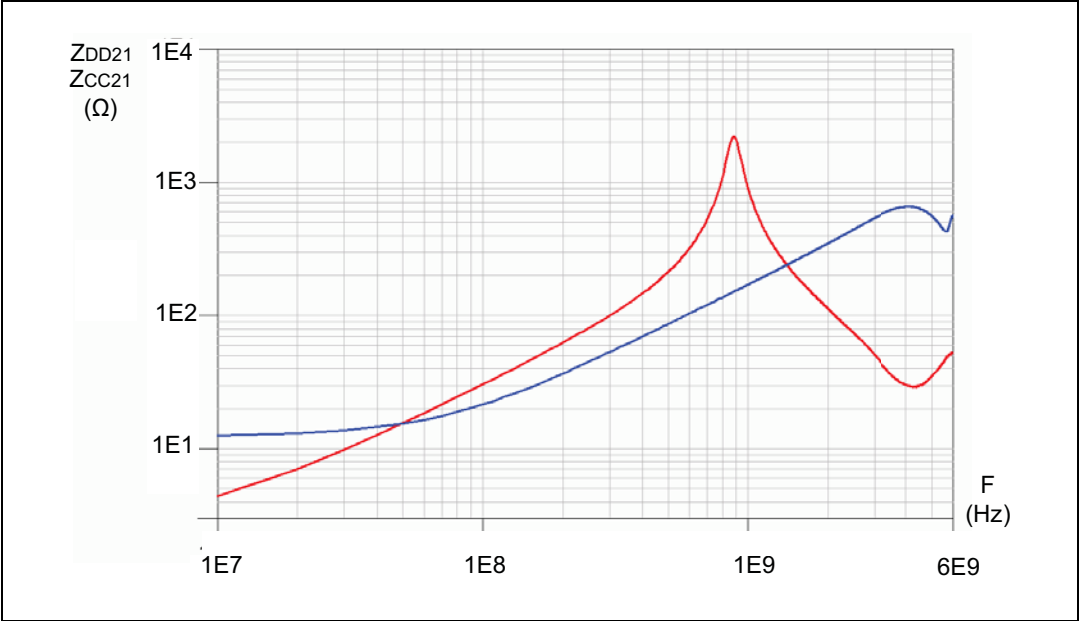


Figure 6. ESD response to IEC61000-4-2 (+8 kV contact discharge)

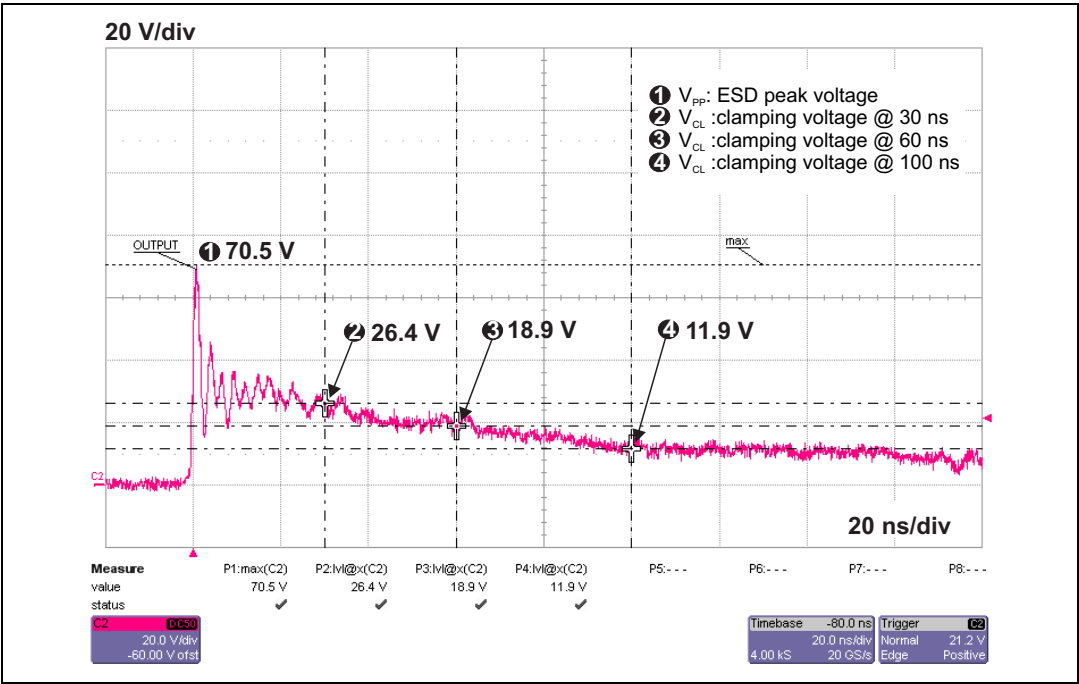


Figure 7. ESD response to IEC61000-4-2 (-8 kV contact discharge)

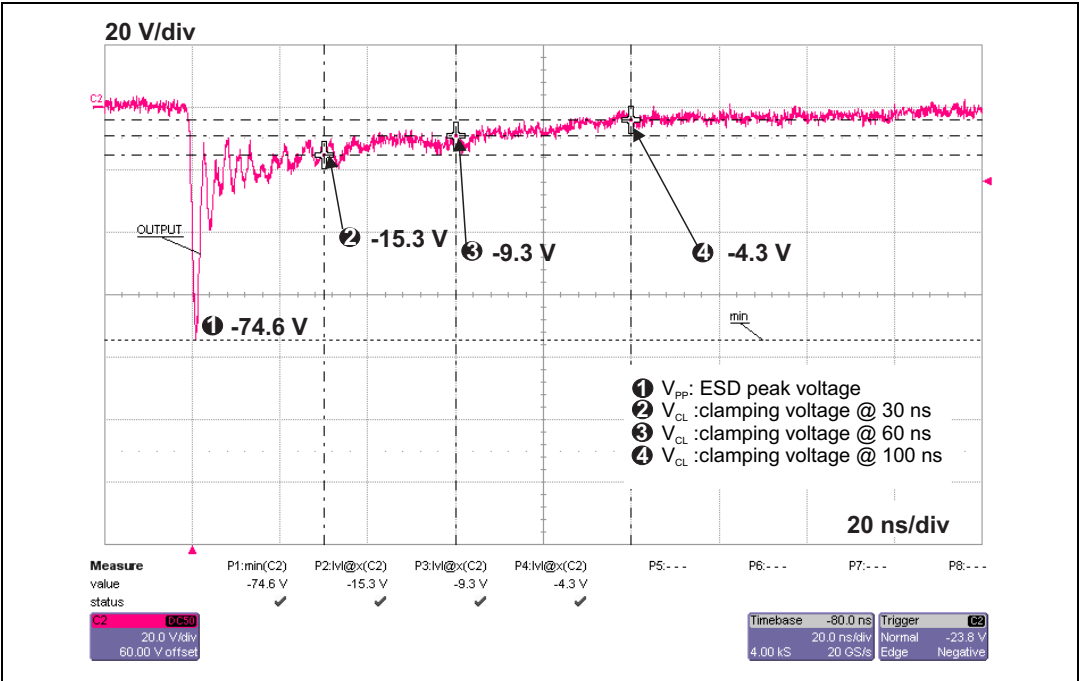


Figure 8. USB2.0 480 Mbps eye diagram without device

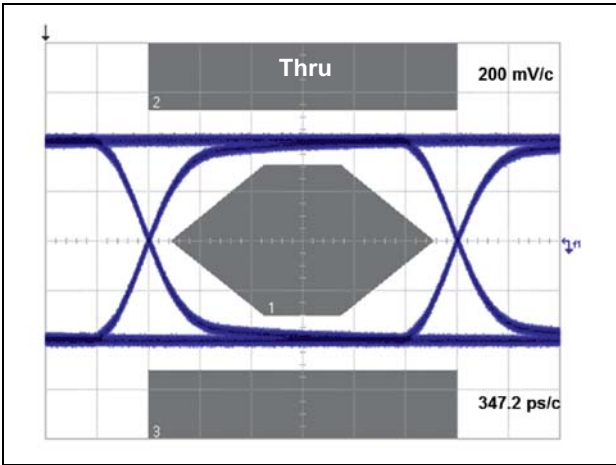


Figure 9. USB2.0 480 Mbps eye diagram with device

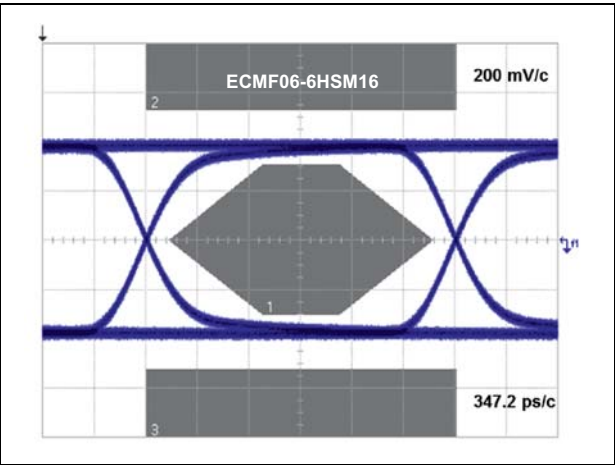


Figure 10. USB3.0 5 Gbps eye diagram without device

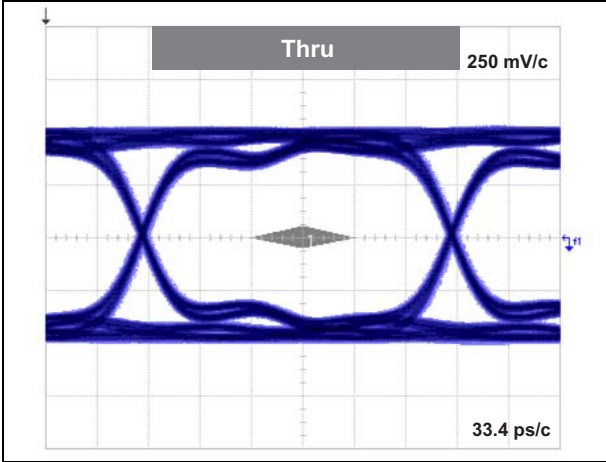


Figure 11. USB3.0 5 Gbps eye diagram with device

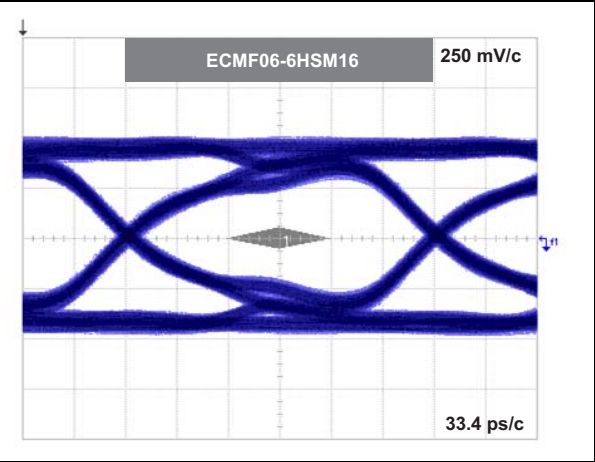


Figure 12. HDMI 3.35 Gbps eye diagram without device

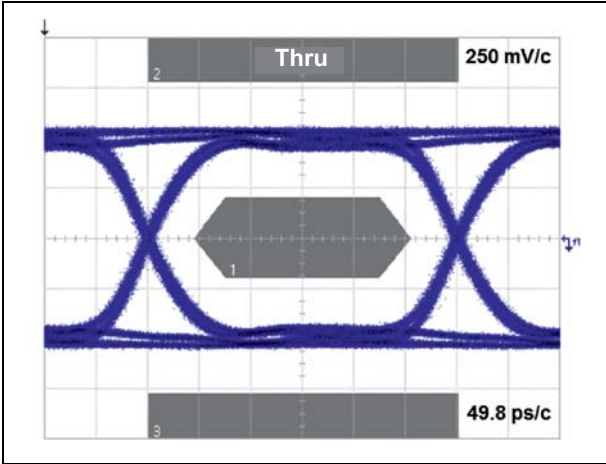


Figure 13. HDMI 3.35 Gbps eye diagram with device

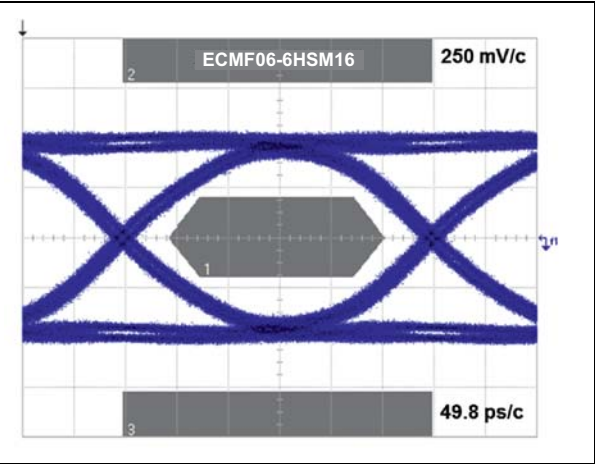
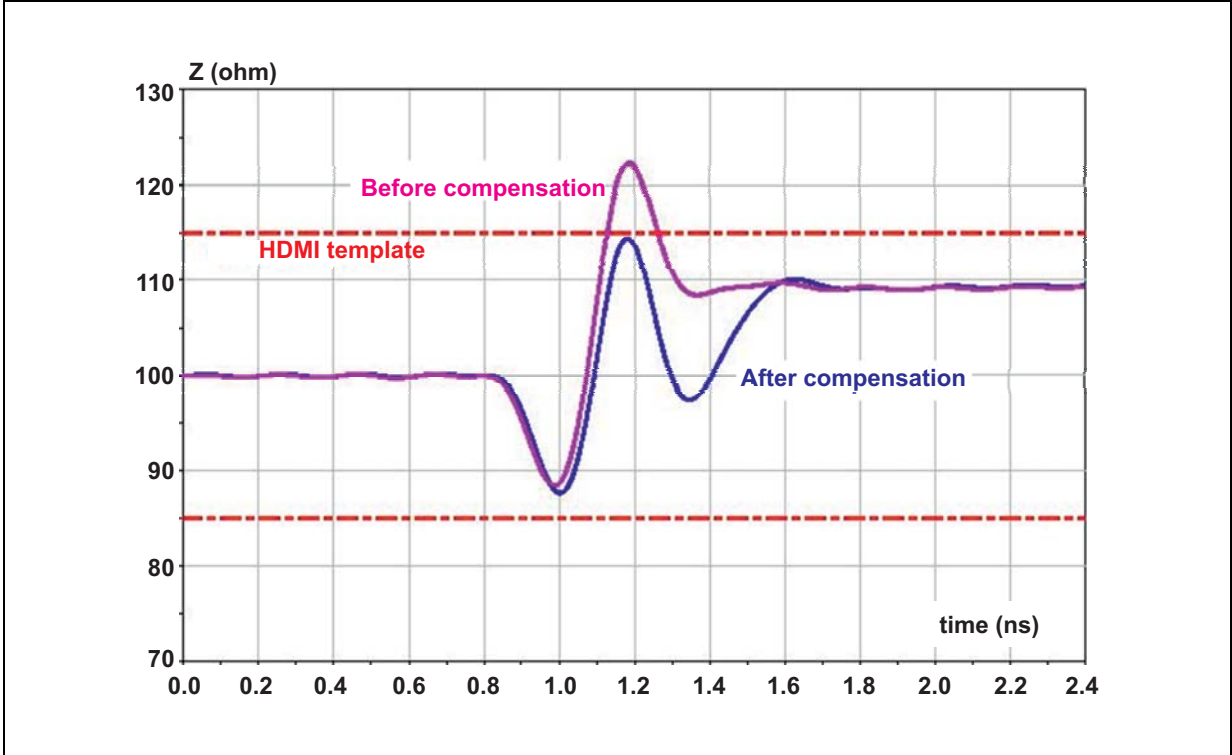
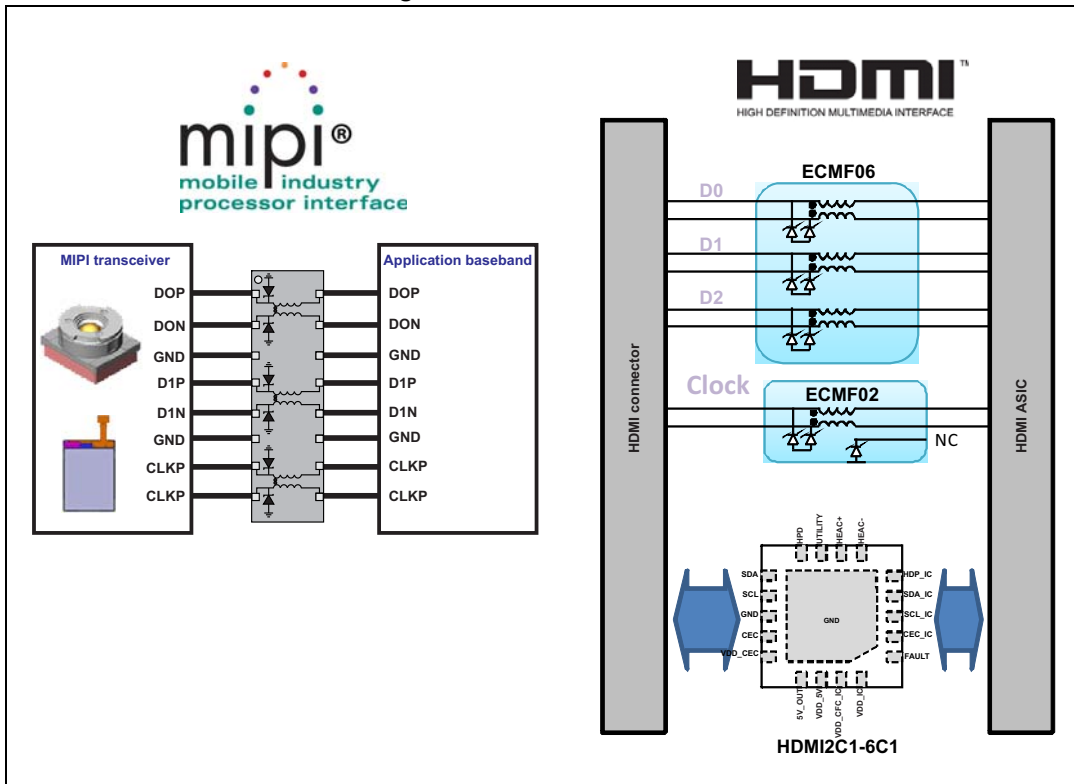


Figure 14. TDR



## 2 Application information

### Figure 15. HDMI schematic



More application information available in following AN:

- Application Note AN4356: "Antenna desense on handheld equipment"
- Application Note AN4511: "Common Mode filters"
- Application Note AN4540: "MHL link filtering and protection"

3 PCB layout recommendations

Figure 16. PCB layout recommendations

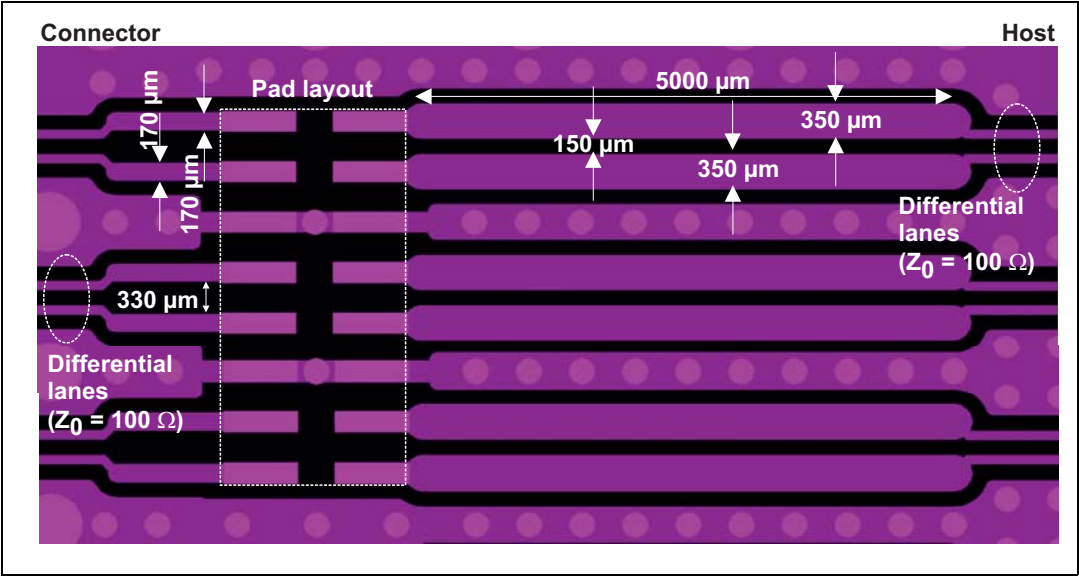
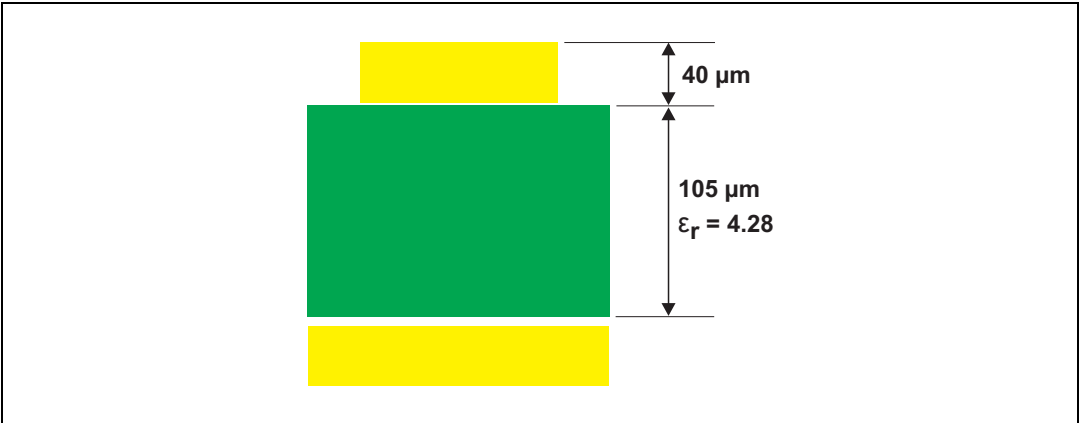


Figure 17. PCB stack dimensions



## 4 Package information

- Epoxy meets UL94, V0
- Lead-free package

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

Figure 18.  $\mu$ QFN-16L dimension definitions

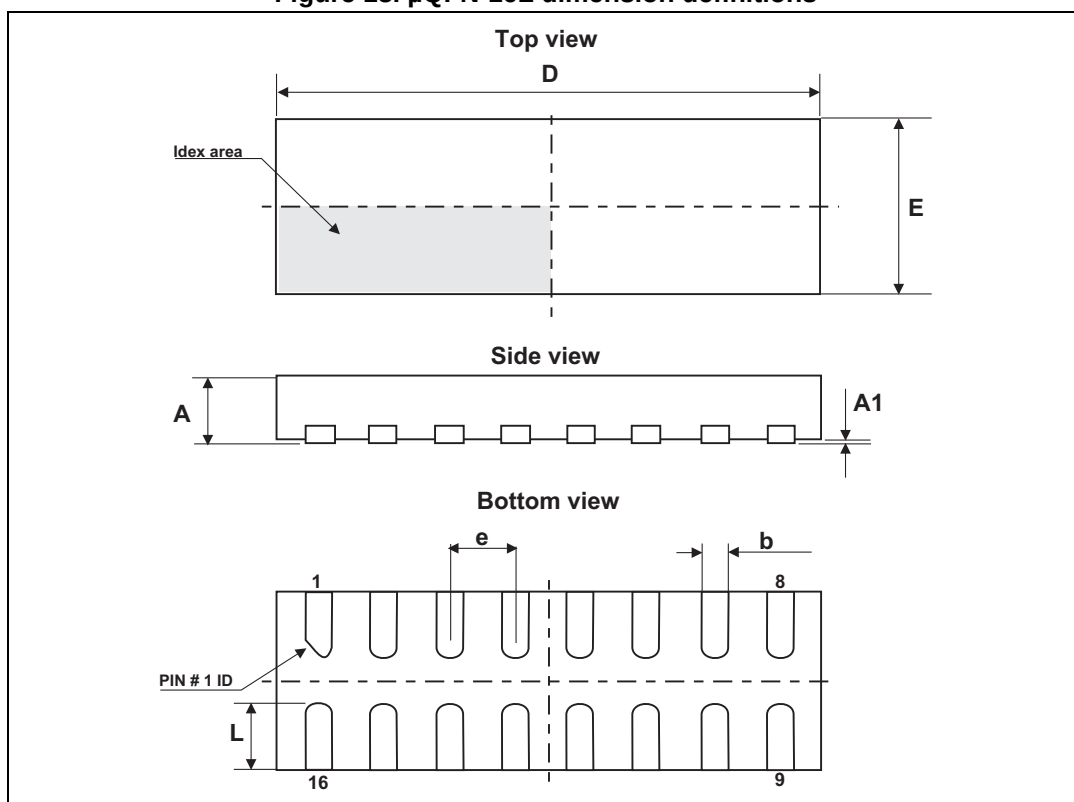
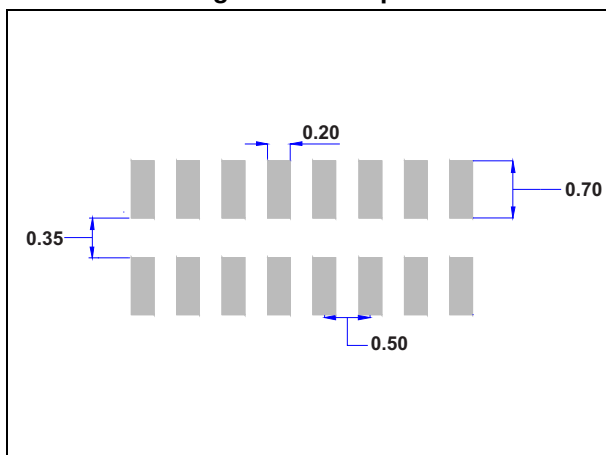


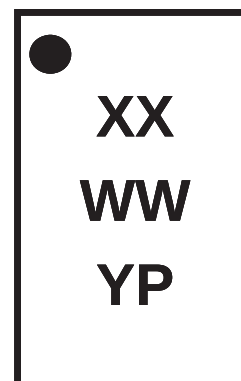
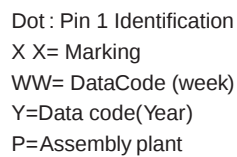
Table 4.  $\mu$ QFN-16L dimension values

| Ref. | Dimensions  |      |      |        |        |       |
|------|-------------|------|------|--------|--------|-------|
|      | Millimeters |      |      | Inches |        |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.   | Max.  |
| A    | 0.45        | 0.50 | 0.55 | 0.018  | 0.020  | 0.022 |
| A1   | 0.00        | 0.02 | 0.05 | 0.00   | 0.0008 | 0.002 |
| b    | 0.15        | 0.20 | 0.25 | 0.006  | 0.008  | 0.010 |
| D    |             | 4.10 |      |        | 0.161  |       |
| E    |             | 1.35 |      |        | 0.053  |       |
| e    |             | 0.50 |      |        | 0.020  |       |
| L    | 0.40        | 0.50 | 0.60 | 0.016  | 0.020  | 0.024 |

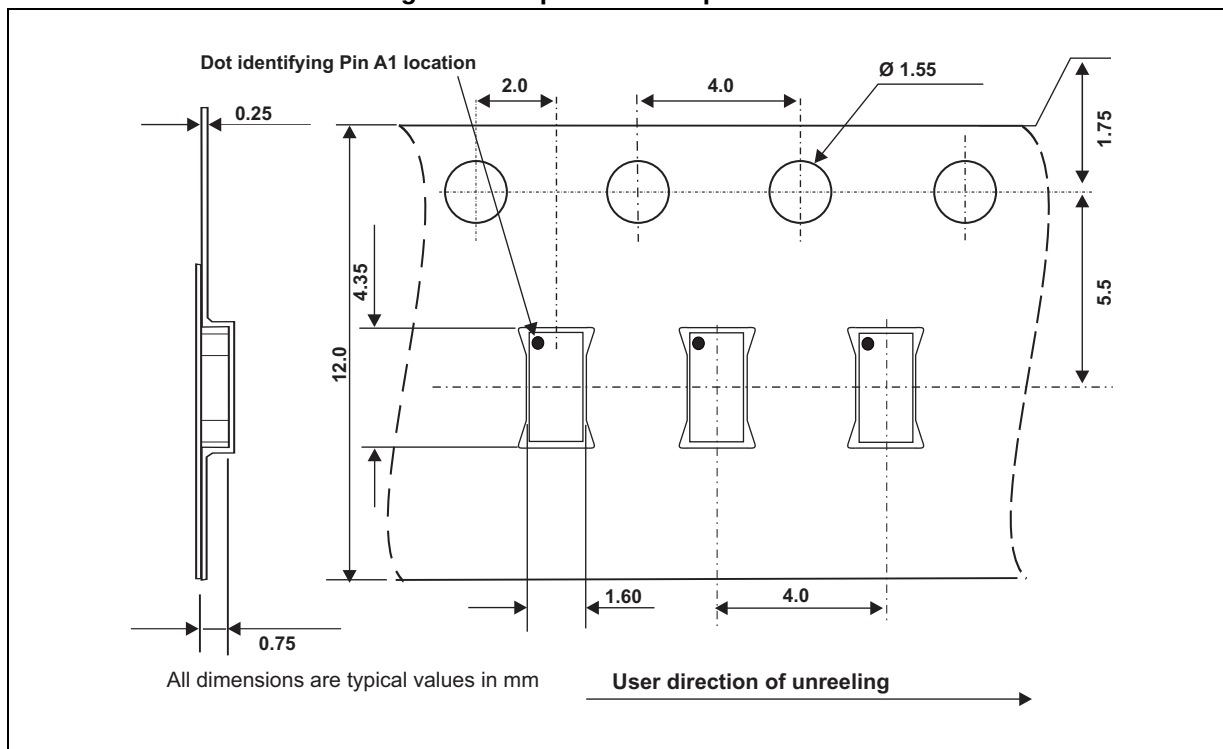
### Figure 19. Footprint



### Figure 20. Marking



### Figure 21. Tape and reel specifications



# 5 Ordering information

Figure 22. Ordering information scheme

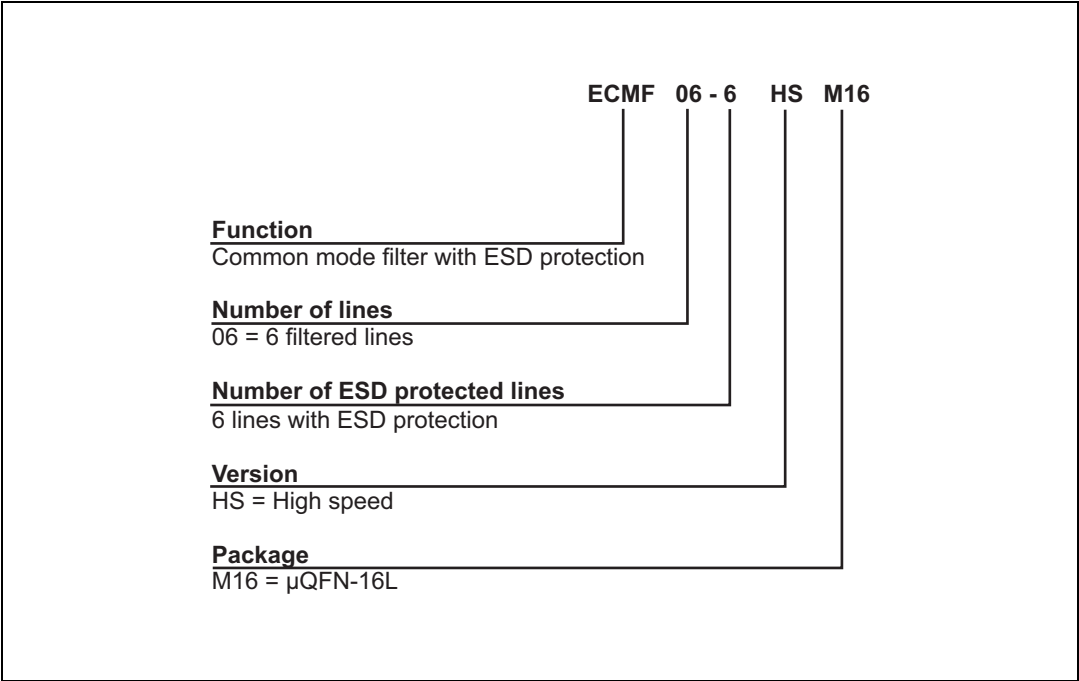


Table 5. Ordering information

| Order code    | Marking | Package  | Weight  | Base qty | Delivery mode |
|---------------|---------|----------|---------|----------|---------------|
| ECMF06-6HSM16 | KL      | μQFN-16L | 7.76 mg | 3000     | Tape and reel |

# 6 Revision history

Table 6. Document revision history

| Date        | Revision | Changes                                                                                                  |
|-------------|----------|----------------------------------------------------------------------------------------------------------|
| 03-Oct-2013 | 1        | Initial release.                                                                                         |
| 25-Aug-2014 | 2        | Added <a href="#">Figure 5: Differential (ZDD21) and common mode (ZCC21) impedance versus frequency.</a> |

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