



## HDMI05-CL02F3

### 5-line IPAD™, HDMI™ control line ESD protection

#### Features

- Low line capacitance: 12 pF max.
- High efficiency in ESD protection
- Lead-free package
- Very thin package
- High reliability offered by monolithic integration
- High reduction of parasitic elements through integration and wafer level packaging

#### Complies with the standards:

- IEC 61000-4-2 Level 4
  - ± 15 kV (air discharge)
  - ± 8 kV (contact discharge)
- IEC 61000-4-2 Level 1
  - ± 2 kV (air discharge)
  - ± 2 kV (contact discharge)

#### Application

Where ESD protection for HDMI control lines (CEC, HPD, SCL and SDA) is required:

- Mobile phones and communication systems
- Portable multimedia players
- Camcorder, digital still cameras

#### Description

The HDMI05-CL02F3 chip is a low capacitance ESD protection for HDMI control pins. It also integrates pull-up resistor for I<sup>2</sup>C bus and pull-down resistor for hot plug detect and pull-up resistor for CEC line.

The ESD protection circuitry prevents damage to the protected device when subjected to ESD surges up to 15 kV.

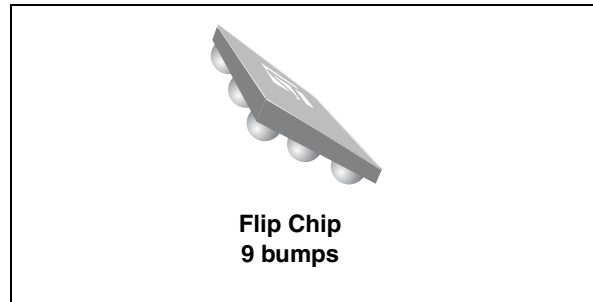


Figure 1. Pin configuration (bump side)

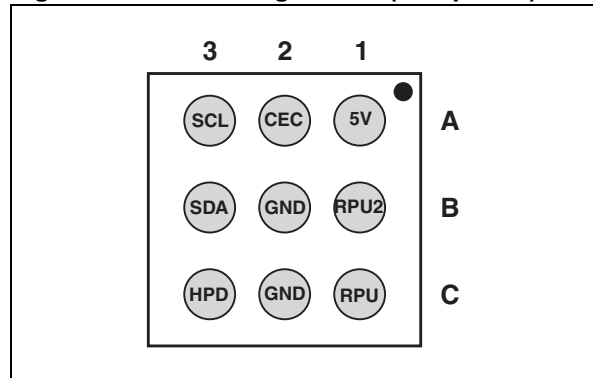


Figure 2. Schematic

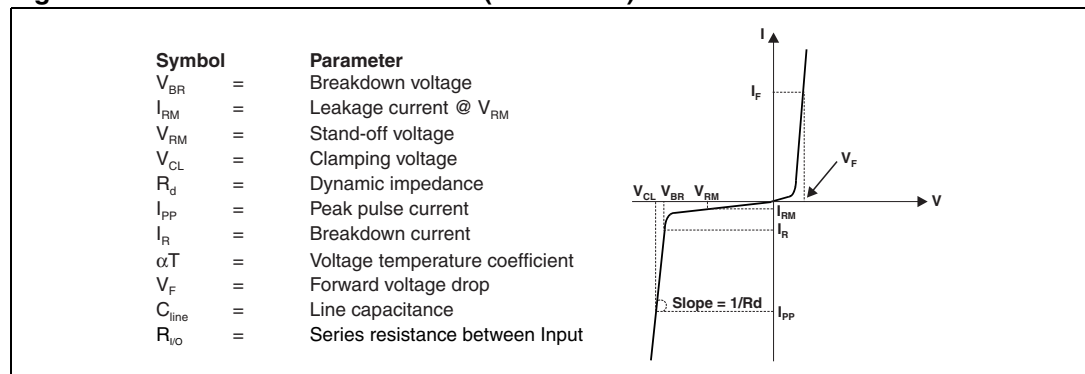
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# 1 Characteristics

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

| Symbol    | Parameter                                                         | Value        | Unit               |
|-----------|-------------------------------------------------------------------|--------------|--------------------|
| $V_{PP}$  | External pins (A1, A2, A3, B3 and C3):                            |              |                    |
|           | ESD IEC 61000-4-2, level 4 - air discharge                        | 15           |                    |
|           | ESD IEC 61000-4-2, level 4 - contact discharge                    | 8            |                    |
|           | Internal pins (B1, C1):                                           |              |                    |
|           | ESD IEC 61000-4-2, level 1 - air discharge                        | 2            |                    |
|           | ESD IEC 61000-4-2, level 1 - contact discharge                    | 2            | kV                 |
| $P_d$     | Line resistance power dissipation at $70\text{ }^{\circ}\text{C}$ | 60           | mW                 |
| $T_{op}$  | Operating temperature range                                       | -30 to + 85  | $^{\circ}\text{C}$ |
| $T_{stg}$ | Storage temperature range                                         | -55 to + 150 | $^{\circ}\text{C}$ |

**Figure 3. Electrical characteristics (definitions)**



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

| Symbol           | Test condition                                                                                                                                                                                                 | Min. | Typ.     | Max.     | Unit       |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|----------|------------|
| $V_{BR}$         | $I_R = 1\text{ mA}$                                                                                                                                                                                            | 6    |          | 20       | V          |
| $I_{RM}$         | $V_{RM} = 3\text{ V per line}$                                                                                                                                                                                 |      | 50       | 200      | nA         |
| $R_1, R_2$       |                                                                                                                                                                                                                | 1575 | 1750     | 1925     | $\Omega$   |
| $R_3$            |                                                                                                                                                                                                                | 80   | 100      | 120      | k $\Omega$ |
| $R_4$            |                                                                                                                                                                                                                | 22   | 27       | 32       | k $\Omega$ |
| $C_{line}$       | $V_{line} = 0\text{ V}$ , $V_{osc} = 30\text{ mV}$ , $F = 1\text{ MHz}$<br>CEC to GND with $R_{PU2}$ not connected<br>SCL and SDA to GND with $R_{PU}$ not connected<br>(measured under zero light conditions) |      | 14<br>24 | 17<br>29 | pF         |
| $C_{line}^{(1)}$ | $V_{line} = 0\text{ V}$ , $V_{osc} = 30\text{ mV}$ , $F = 1\text{ MHz}$<br>CEC, SCL and SDA to GND with $R_{PU}$ and $R_{PU2}$ grounded<br>(measured under zero light conditions)                              |      | 10       | 12       | pF         |

1. This is the line capacitance seen by the data signals in the application conditions

Figure 4. S21(dB) versus frequency

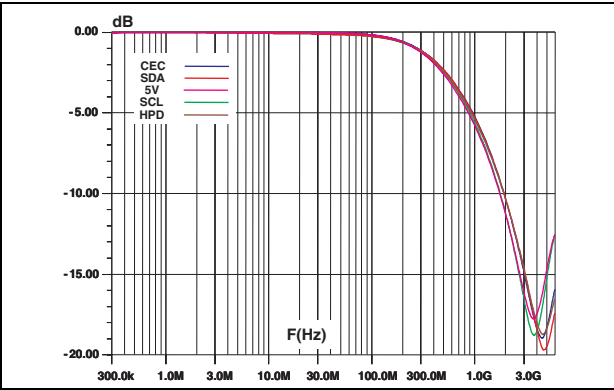


Figure 5. Analog crosstalk measurements

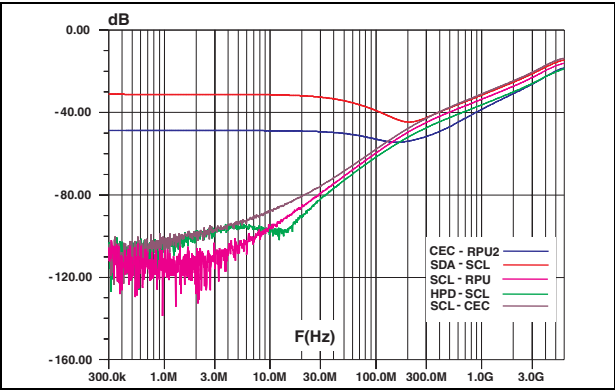


Figure 6. ESD response to IEC 61000-4-2 (+8 kV contact discharge) on CEC line

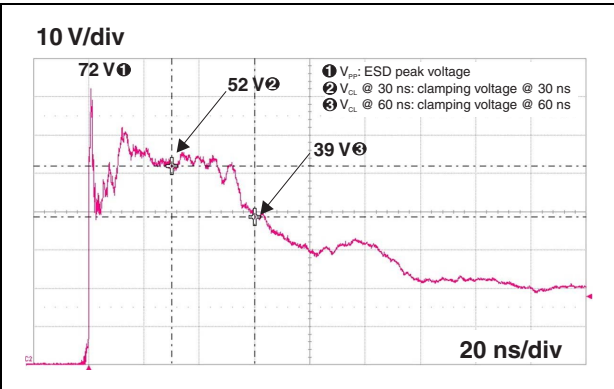


Figure 7. ESD response to IEC 61000-4-2 (-8 kV contact discharge) on CEC line

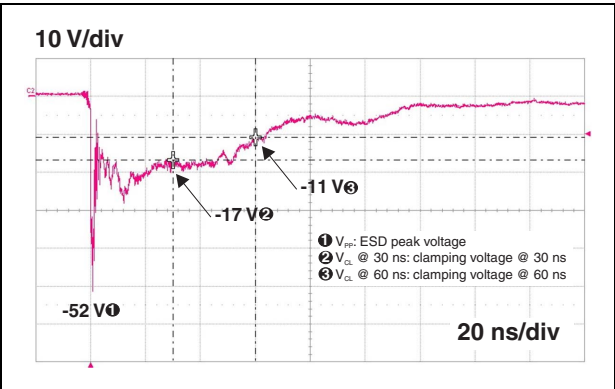


Figure 8. ESD response to IEC 61000-4-2 (+8 kV contact discharge) on SCL line

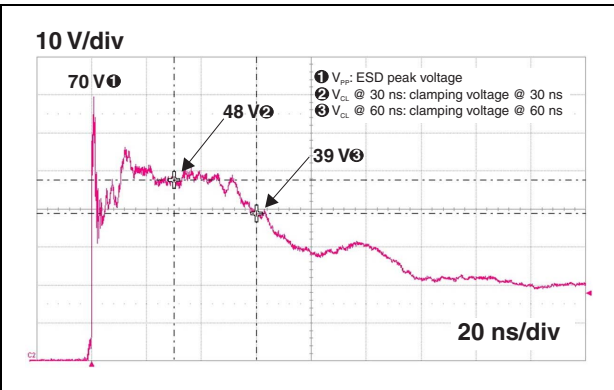
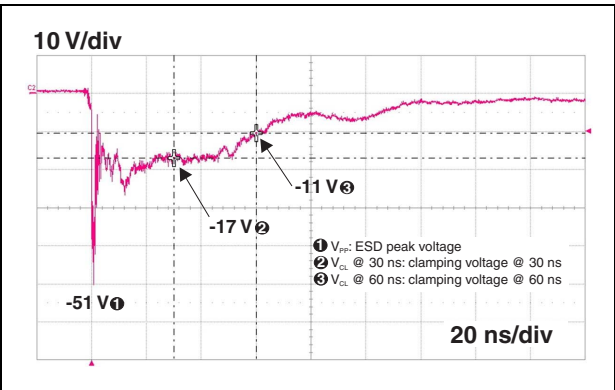
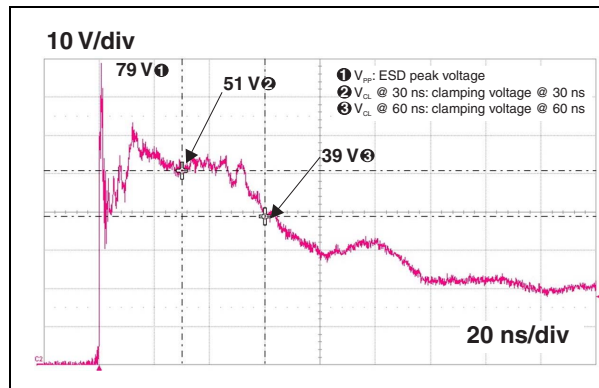


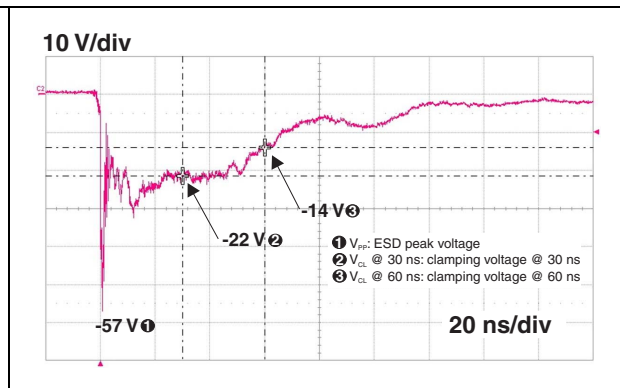
Figure 9. ESD response to IEC 61000-4-2 (-8 kV contact discharge) on SCL line



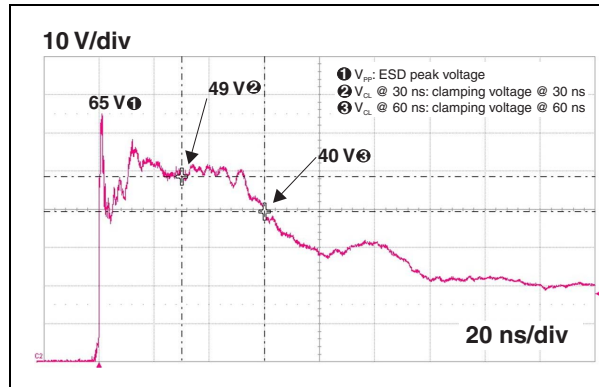
**Figure 10. ESD response to IEC 61000-4-2  
(+8 kV contact discharge)  
on SDA line**



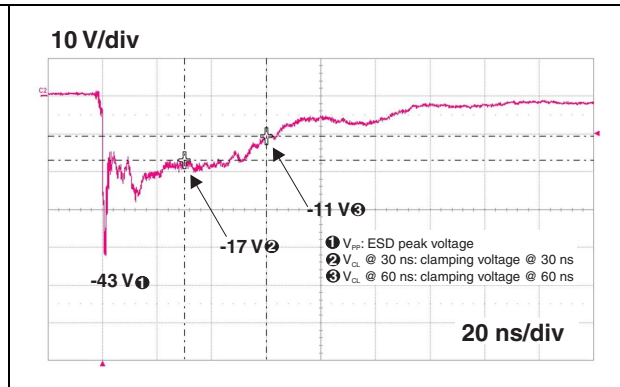
**Figure 11. ESD response to IEC 61000-4-2  
(-8 kV contact discharge)  
on SDA line**



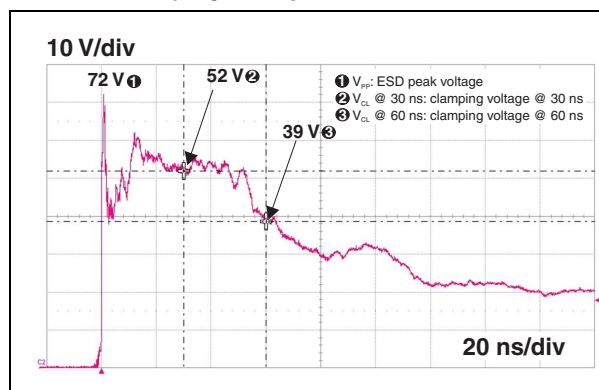
**Figure 12. ESD response to IEC 61000-4-2  
(+8 kV contact discharge)  
on HPD line**



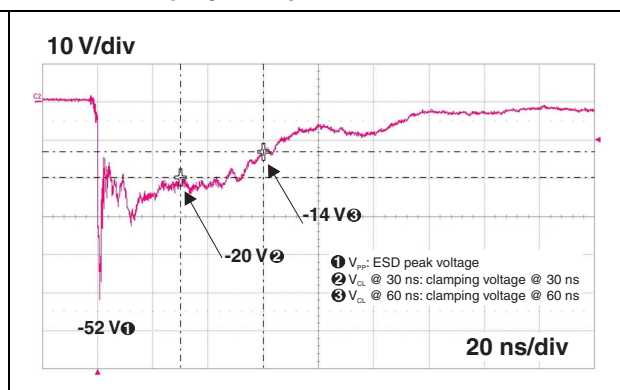
**Figure 13. ESD response to IEC 61000-4-2  
(-8 kV contact discharge)  
on HPD line**



**Figure 14. ESD response to IEC 61000-4-2  
(+8 kV contact discharge)  
on 5 V line**

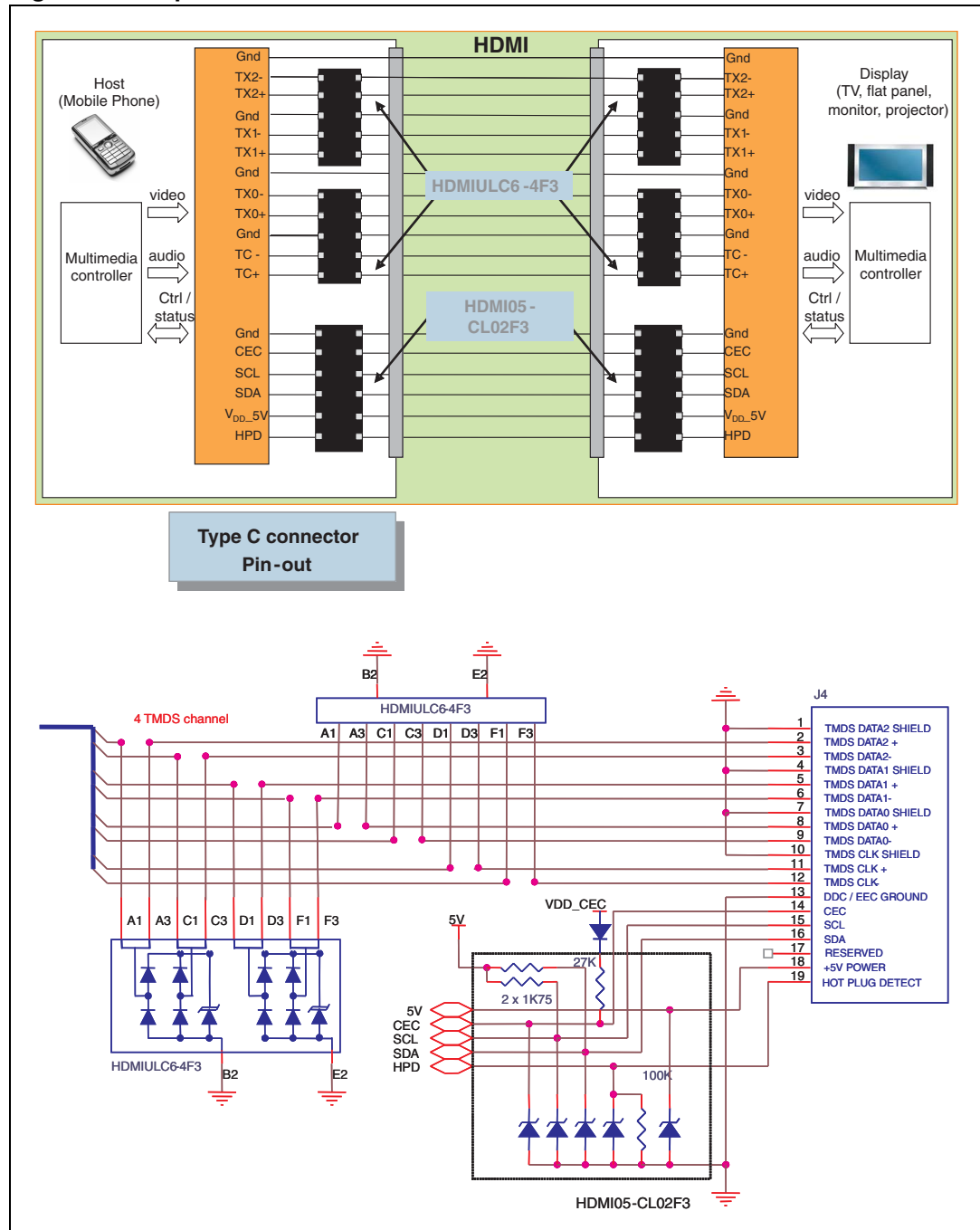


**Figure 15. ESD response to IEC 61000-4-2  
(-8 kV contact discharge)  
on 5 V line**



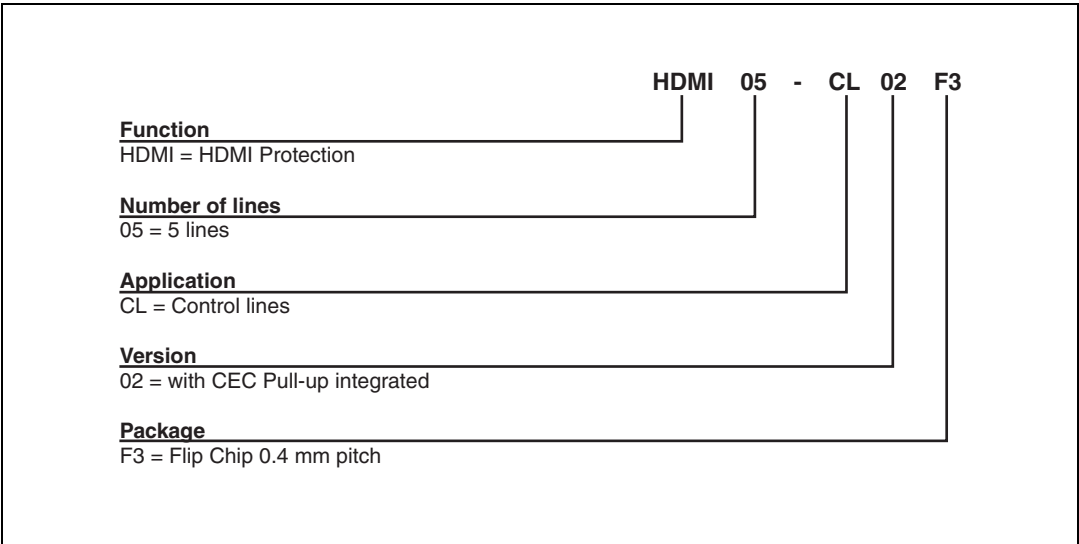
## 2 Typical application schematic

Figure 16. Implementation with HDMI



### 3 Ordering information scheme

Figure 17. Ordering information scheme



### 4 Package information

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

Figure 18. Flip Chip dimensions

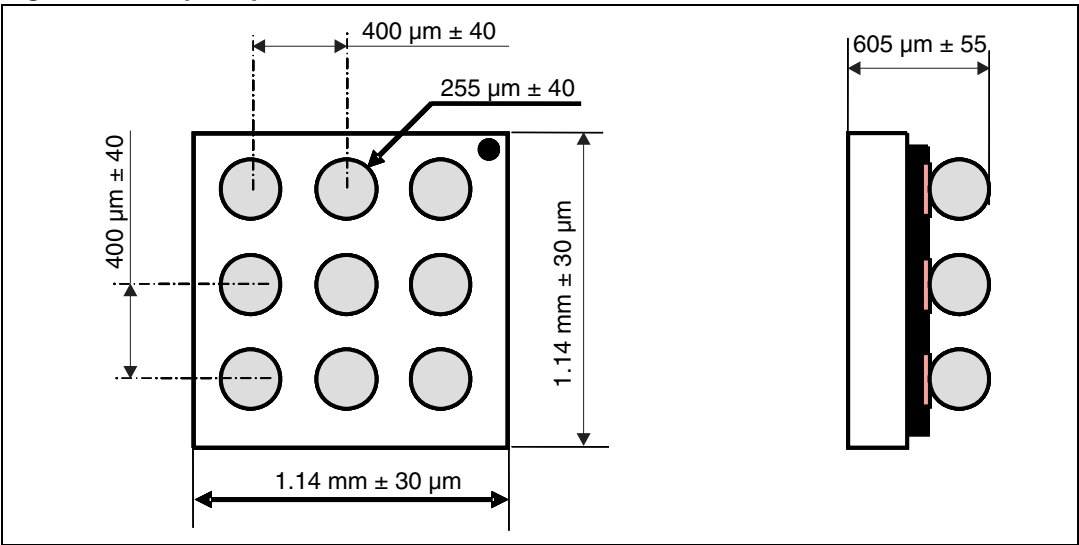


Figure 19. Footprint

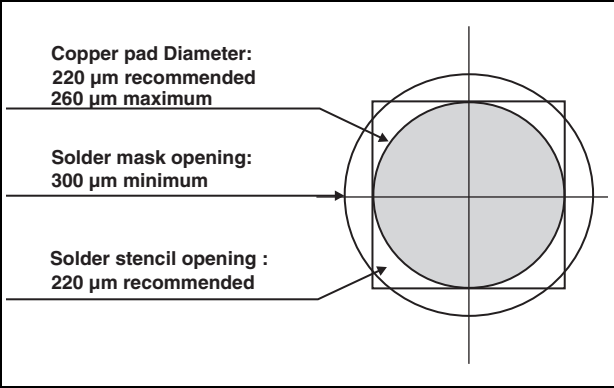


Figure 20. Marking

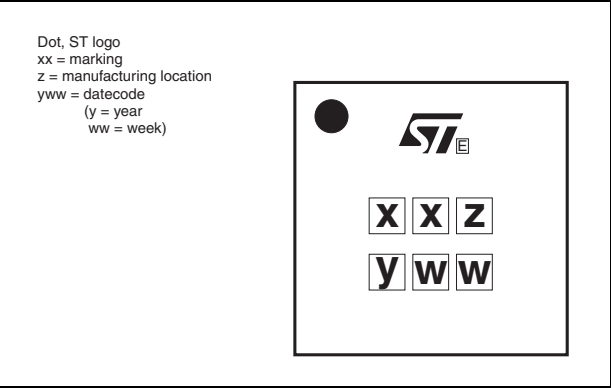
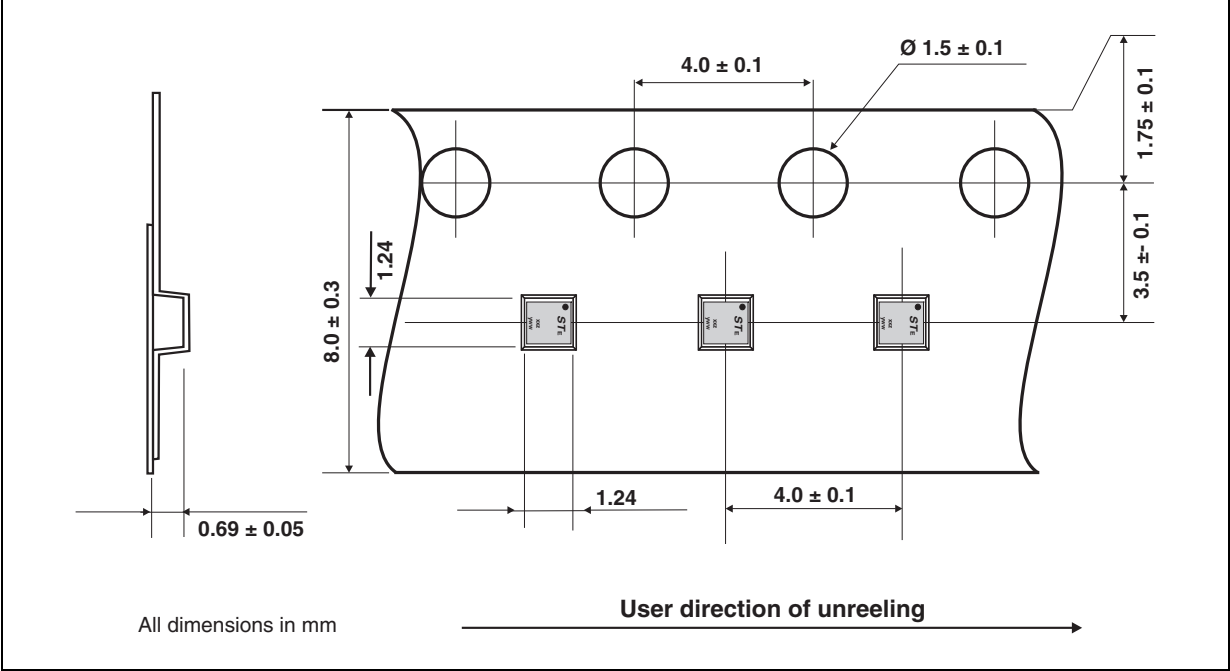


Figure 21. Flip Chip tape and reel specification



## 5 Ordering information

**Table 3. Ordering information**

| Order code    | Marking | Package   | Weight  | Base qty | Delivery mode      |
|---------------|---------|-----------|---------|----------|--------------------|
| HDMI05-CL02F3 | JG      | Flip Chip | 1.76 mg | 5000     | Tape and reel (7") |

## 6 Revision history

**Table 4. Document revision history**

| Date        | Revision | Changes                             |
|-------------|----------|-------------------------------------|
| 24-Mar-2009 | 1        | First issue.                        |
| 07-Apr-2010 | 2        | Updated <a href="#">Figure 18</a> . |



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