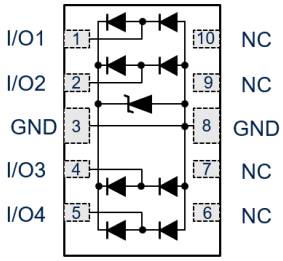
HSP061-4M10Y

Datasheet

Automotive 3 V 4-line high speed port protection in QFN-10L

QFN-10L 2.5 x 1 x 0.51 mm



NC = Internally not connected

Product status link
HSP061-4M10Y

Features

- Flow-through routing to keep signal integrity
- Large bandwidth: 8.7 GHz
- Ultra low capacitance: 0.3 pF
- Operating junction temperature range: -40 °C to 150 °C
- RoHS compliant and halogen free
- Complies with ISO 10605 / IEC 61000-4-2 - C = 150 pF, R = 330 Ω
  - ±8 kV (contact discharge)
  - ±15 kV (air discharge)
- Complies with ISO 10605 - C = 330 pF, R = 330 Ω
  - ±8 kV (contact discharge)
  - ±15 kV (air discharge)
- Complies with ISO 7637-3:
  - Pulse 3a/3b: +/-150 V
  - Pulse 2a: +/- 45 V

Applications

- USB 5Gbps
- USB 10Gbps
- HDMI2.1
- FPD-Llink III
- GMSL
- 1000BASE-T1
- APIX3

Description

The HSP061-4M10Y is a 4-line ultra-low capacitance TVS designed to protect high-speed interfaces with differential lines in automotive applications.

Electro-static discharge (ESD) capability is compliant with ISO 10605, and IEC 61000-4-2, which are system level ESD standards and then with the ESD component level standards with low energy such as human body model (HBM), and charge device model (CDM). The surge capability is compliant with ISO 7637-3.

The large bandwidth is compatible with USB 5Gbps, USB 10Gbps, HDMI2.1 - 12Gbps, FPD-Link III 4 - 16Gbps, GMSL 3 - 12Gbps, 1000BASE-T1, APIX3 6Gbps.

The Y suffix in the part number indicates an AEC-Q101 qualified device for automotive applications.

The device is packaged in a 10-pin QFN of 2.5 mm x 1.0 mm with a nominal height of 0.51 mm.

1 Characteristics

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

Symbol	Parameter		Value	Unit
V_{PP}	Peak pulse voltage	ISO 10605 / IEC 61000-4-2 (C = 150 pF, R = 330 Ω) Contact discharge Air discharge	 ±8 ±15	kV
		ISO 10605 (C = 330 pF, R = 330 Ω) Contact discharge Air discharge	 ±8 ±15	
T_{stg}	Storage temperature range		-65 to +150	°C
T_j	Operating junction temperature range		-40 to +150	
T_L	Maximum lead temperature for soldering during 10 s		260	

Table 2. Electrical characteristics (T_{amb} = 25 °C)

Symbol	Test conditions	Min.	Typ.	Max.	Unit
V_{BR}	Breakdown voltage at 1 mA	6			V
V_{RM}	Stand-off voltage			3	V
I_{RM}	V_{RM} = 3 V			70	nA
V_{CL}	I_{PP} = 1A, 8/20 µs			15	V
V_{CL}	ISO 10605- C = 150 pF, R = 330 Ω, +8 kV contact, measured at 30 ns		27		V
$C_{I/O - I/O}$	Capacitance I/O to I/O, $V_{I/O}$ = 0 V, f = 1 MHz, V_{OSC} = 30 mV		0.3	0.4	pF
$C_{I/O - GND}$	Capacitance I/O to ground, $V_{I/O}$ = 0 V, f = 1 MHz, V_{OSC} = 30 mV		0.6	0.8	pF
f_c	Cut-off frequency at - 3dB		8.7		GHz
Z_{Diff}	t_r = 200 ps (10 - 90%), Z0 Diff = 100 Ohm (HDMI specification)	85	100	115	Ω

1.1 Characteristics (curves)

Figure 1. Leakage current versus junction temperature

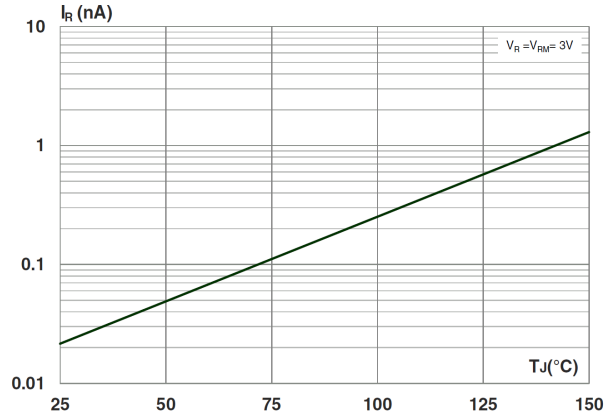


Figure 2. ESD response to IEC 61000-4-2 (+8 kV contact discharge)

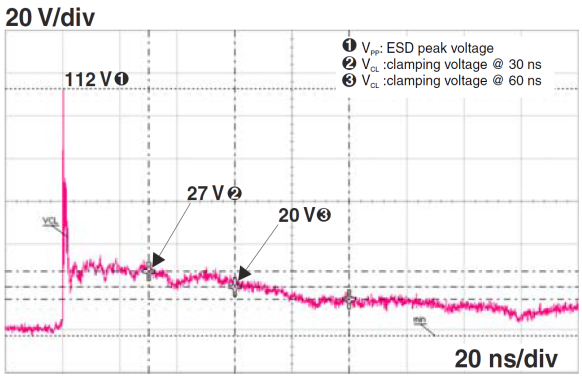


Figure 3. ESD response to IEC 61000-4-2 (-8 kV contact discharge)

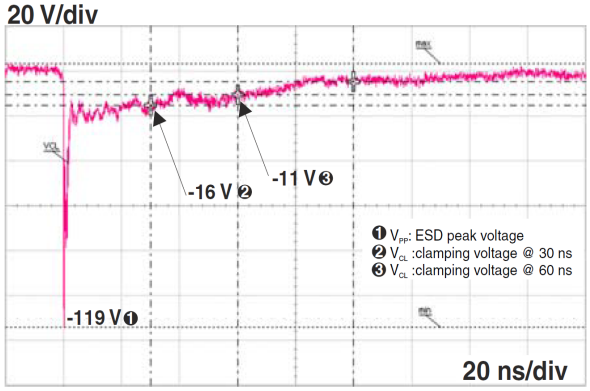


Figure 4. S_{21} attenuation

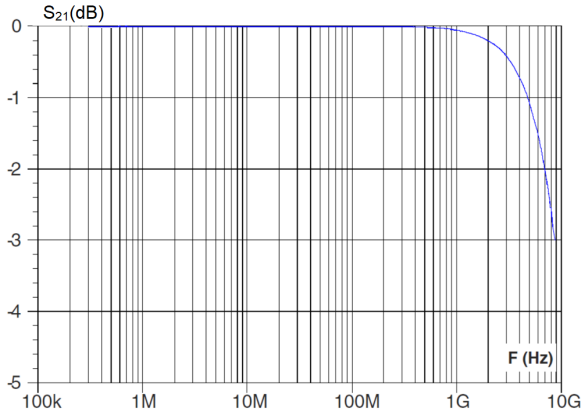


Figure 5. HDMI2.1 - 12 Gbps per channel without device (with worst cable model), 8dB CTLE and 25 mV DFE

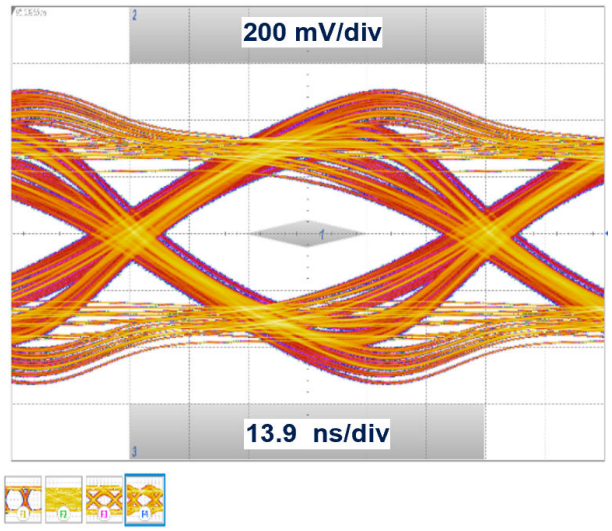


Figure 6. HDMI2.1 - 12 Gbps per channel with device (with worst cable model), 8dB CTLE and 25 mV DFE

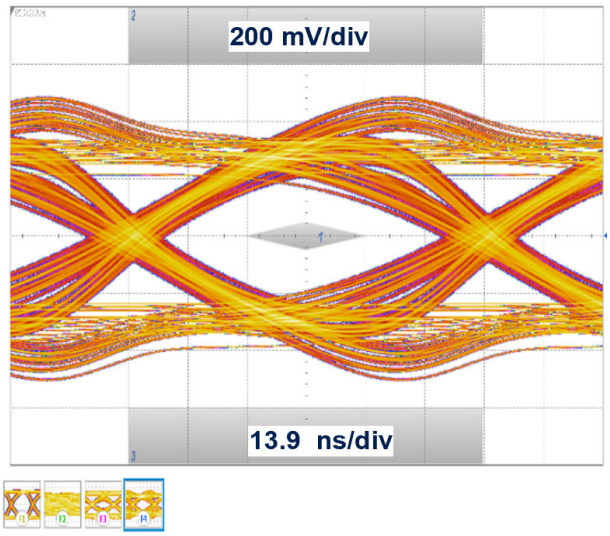


Figure 7. **USB 10 Gbps per channel without device, 0dB CTLE and DFE**

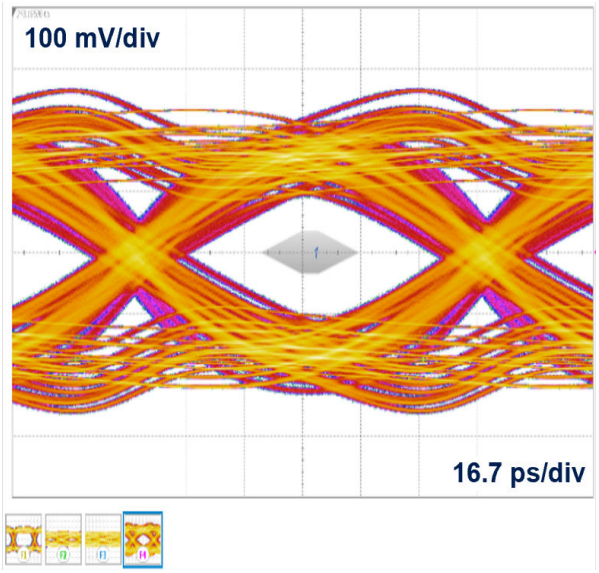


Figure 8. **USB 10 Gbps per channel with device, 0dB CTLE and DFE**

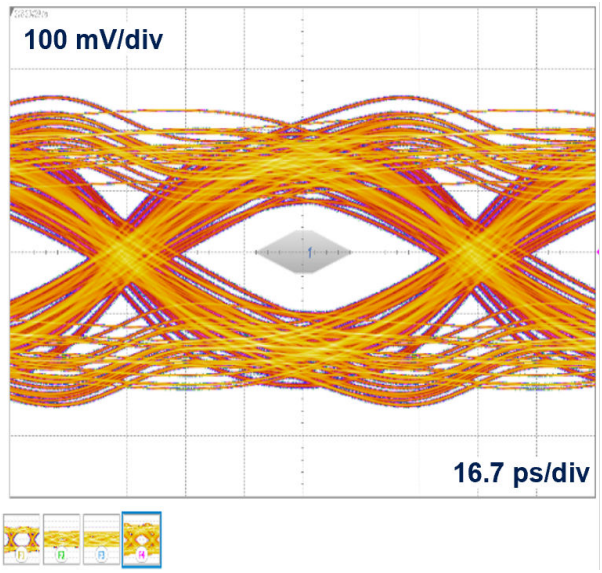


Figure 9. **Differential impedance (Zdiff)**

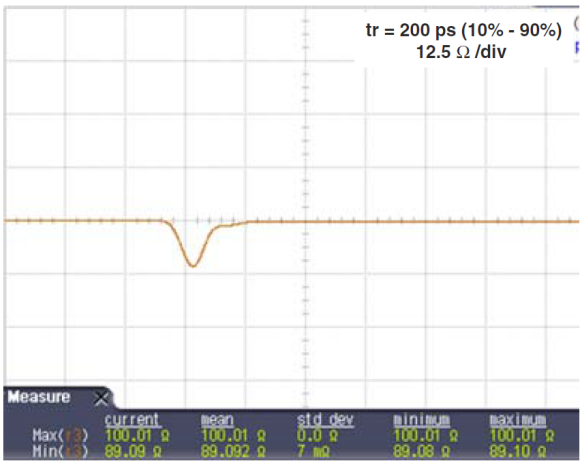


Figure 10. ISO 7637-3 Pulse 3a: -150 V

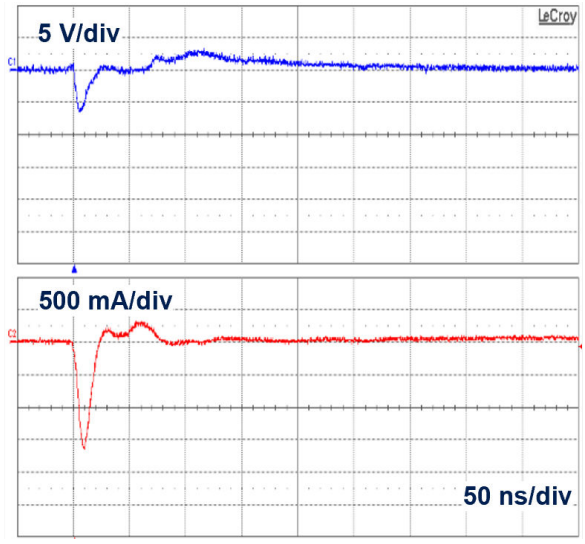


Figure 11. ISO 7637-3 Pulse 3b : +150 V

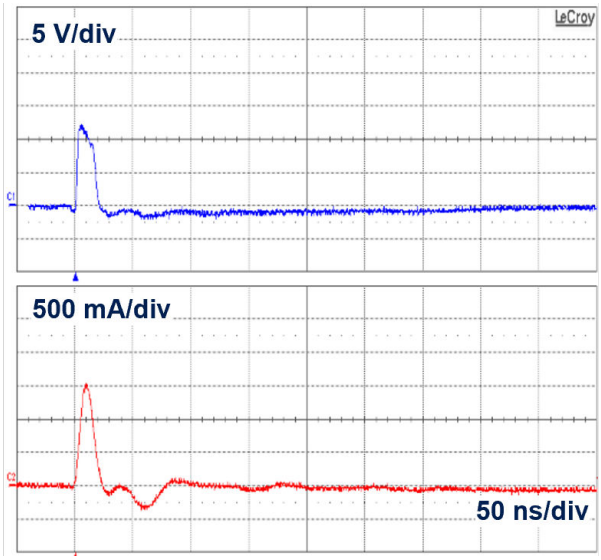


Figure 12. ISO 7637-3 Pulse 2a: -45 V

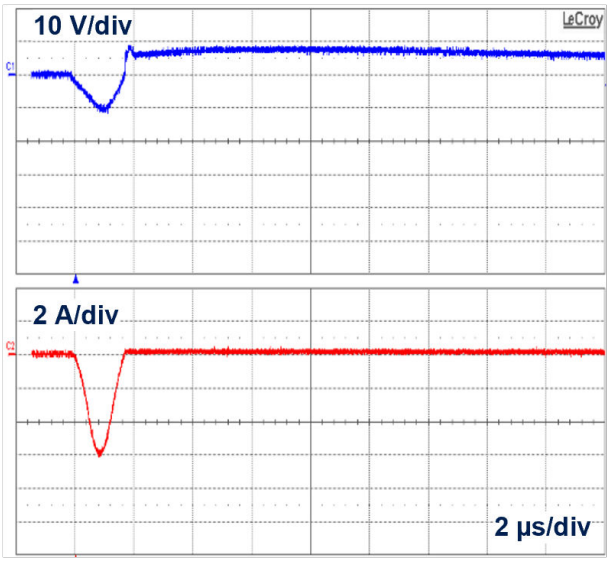
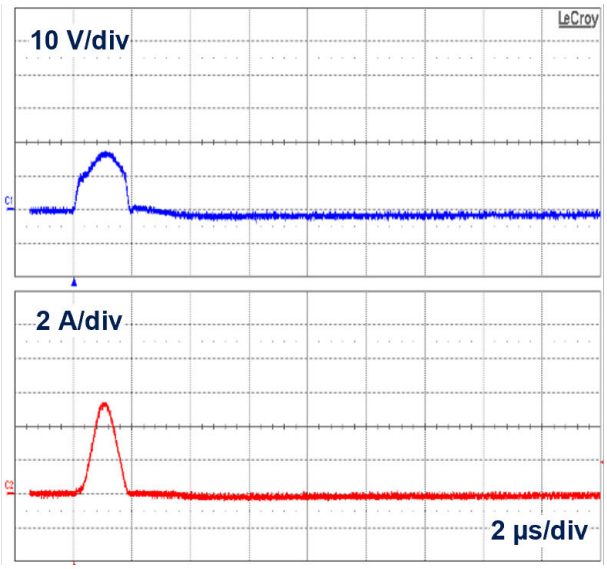


Figure 13. ISO 7637-3 Pulse 2a: +45 V



2 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. ECOPACK is an ST trademark.

2.1 QFN-10L package information

Figure 14. **QFN-10L package outline**

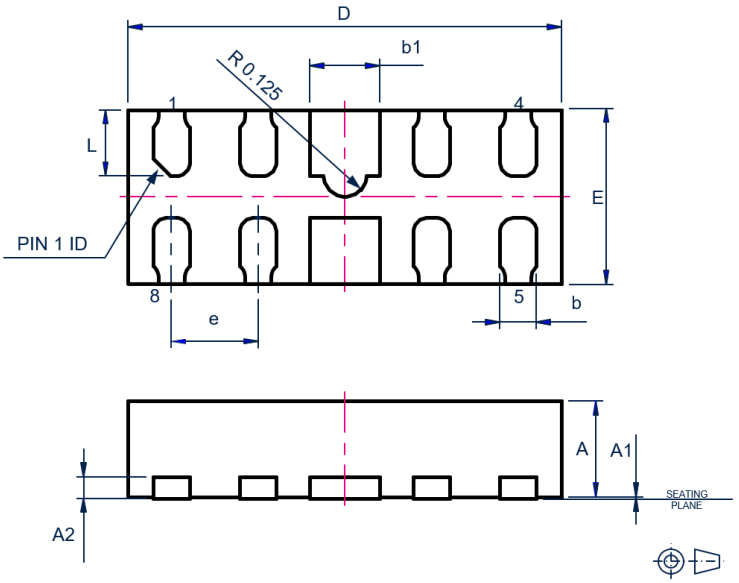


Table 3. **QFN-10L package mechanical data**

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.40	0.48	0.50	0.0157	0.0189	0.0197
A1	0.00	0.03	0.05	0.0000	0.0012	0.0020
A2		0.13			0.0049	
b	0.15	0.20	0.25	0.0059	0.0079	0.0099
b1	0.35	0.40	0.45	0.0137	0.0157	0.0178
D	2.40	2.50	2.60	0.0944	0.0984	0.1024
E	0.90	1.00	1.10	0.0354	0.0394	0.0434
e		0.50			0.0197	
L	0.30	0.38	0.43	0.0118	0.0150	0.0168

2.2 Packing and marking information

Figure 15. Marking layout (refer to ordering information table for marking)

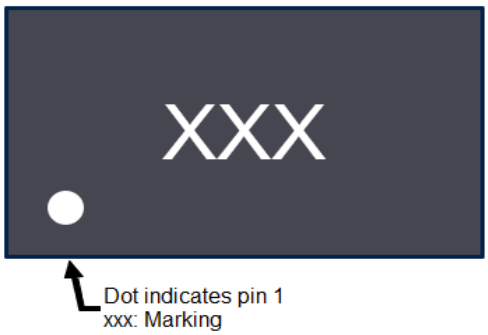
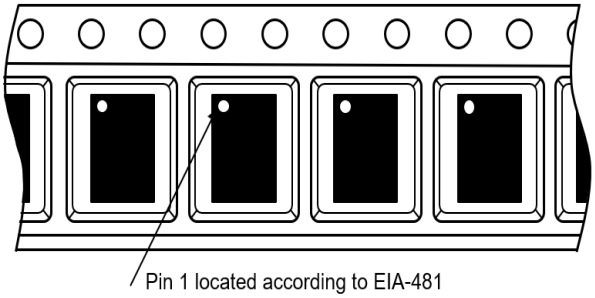


Figure 16. Package orientation in reel



Note: Pocket dimensions are not on scale
Pocket shape may vary depending on package

Figure 17. Tape leader and trailer dimensions

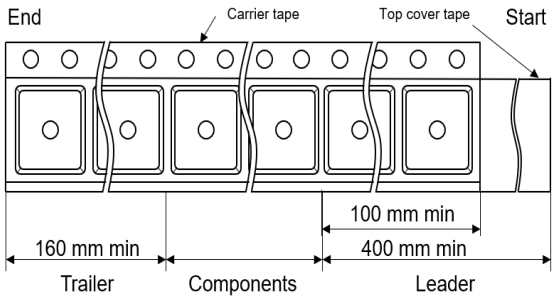


Figure 18. Tape and reel orientation

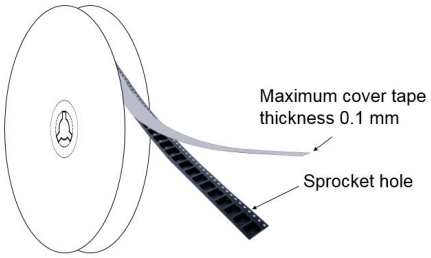


Figure 19. Reel dimensions (mm)

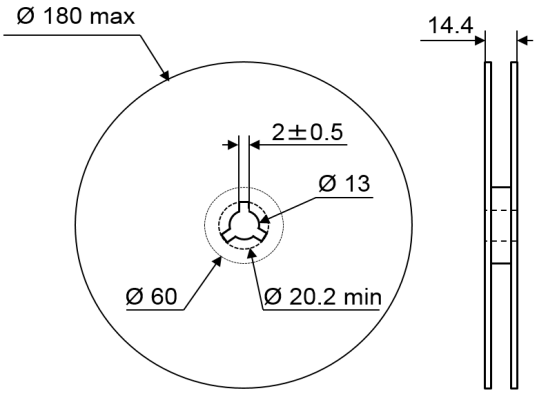


Figure 20. Inner box dimensions (mm)

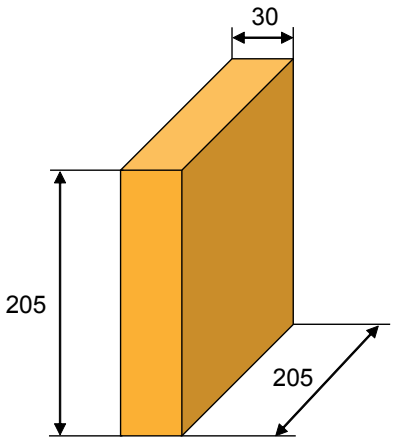
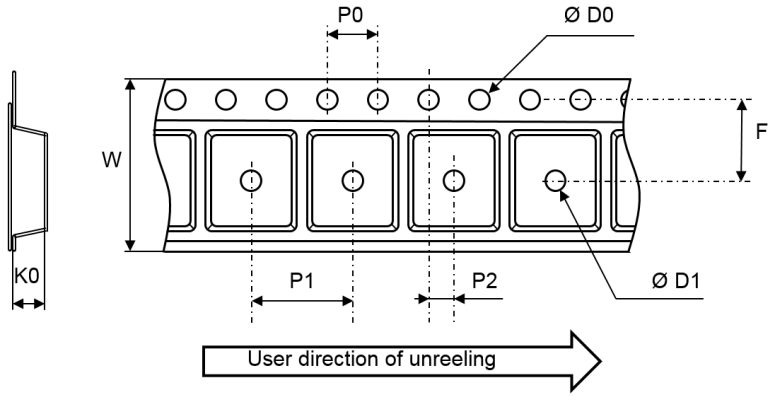


Figure 21. **Tape outline**



Note: Pocket dimensions are not on scale
Pocket shape may vary depending on package

Table 4. **Tape and reel mechanical data**

Ref.	Dimensions		
	Millimeters		
	Min.	Typ.	Max.
∅D0	1.50	1.55	1.60
∅D1	0.80		
F	3.45	3.50	3.55
K0	0.50	0.55	0.60
P0	3.90	4.00	4.10
P1	3.90	4.00	4.10
P2	1.95	2.00	2.05
W	7.70	8.00	8.30

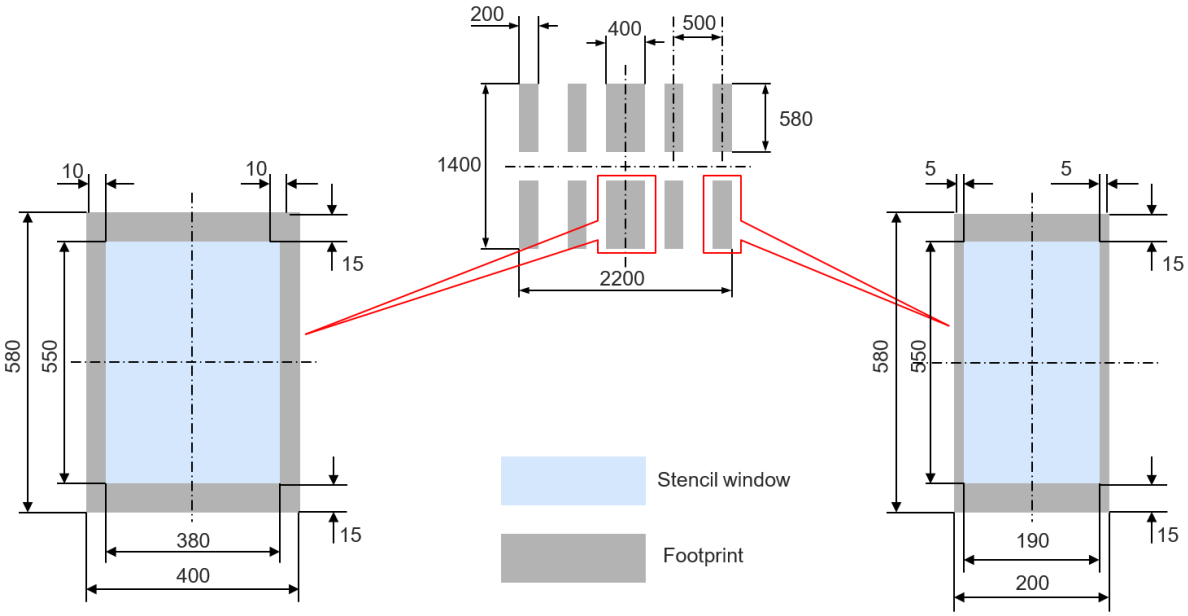
3 Recommendation on PCB assembly

3.1 Recommended footprint and stencil opening

Stencil opening thickness: 100 µm

Stencil opening ratio : 90 %

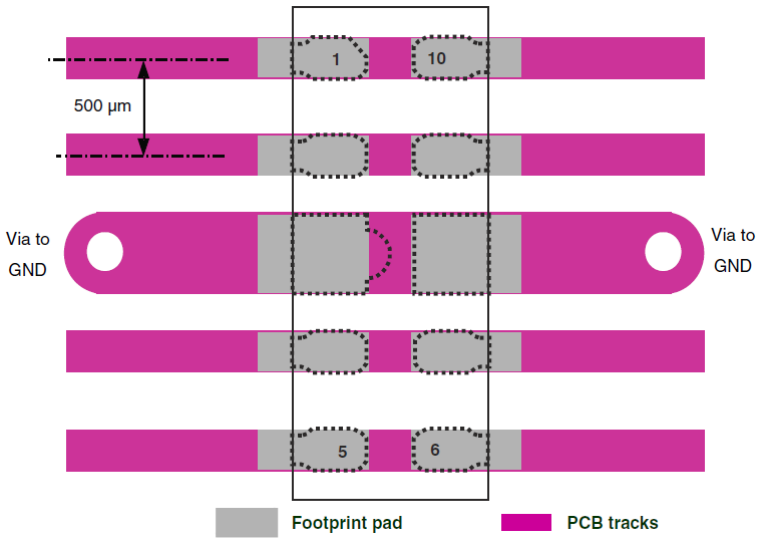
Figure 22. Recommended footprint and stencil opening (µm)



3.2 PCB design

1. To control the solder paste amount, closed vias are recommended instead of open vias.
2. A symmetrical layout is recommended.

Figure 23. Recommended printed circuit board layout



3.3 Solder paste

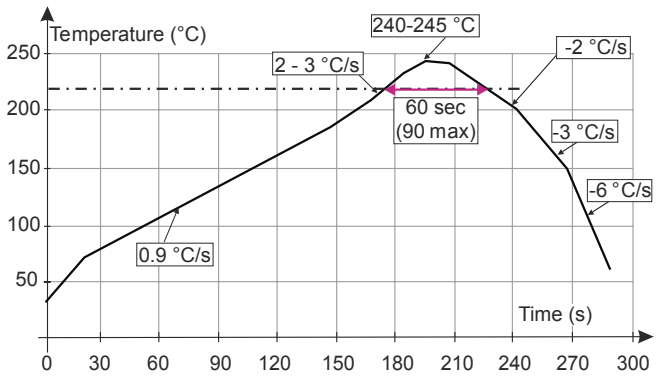
1. Halide-free flux qualification ROL0 according to ANSI/J-STD-004.
2. “No clean” solder paste is recommended.
3. Offers a high tack force to resist component movement during high speed.
4. Solder paste with fine particles: powder particle size is 20-38 µm.

3.4 Placement

1. Manual positioning is not recommended.
2. It is recommended to use the lead recognition capabilities of the placement system, not the outline centering
3. Standard tolerance of ±0.05 mm is recommended.
4. 1.0 N placement force is recommended. Too much placement force can lead to squeezed out solder paste and cause solder joints to short. Too low placement force can lead to insufficient contact between package and solder paste that could cause open solder joints or badly centered packages.
5. To improve the package placement accuracy, a bottom side optical control should be performed with a high resolution tool.
6. For assembly, a perfect supporting of the PCB (all the more on flexible PCB) is recommended during solder paste printing, pick and place and reflow soldering by using optimized tools.

3.5 Reflow profile

Figure 24. ST ECOPACK® recommended soldering reflow profile for PCB mounting



Note: Minimize air convection currents in the reflow oven to avoid component movement.

Note: Maximum soldering profile corresponds to the latest IPC/JEDEC J-STD-020.

4 Ordering information

Table 5. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
HSP061-4M10Y	H4Y	QFN-10L	3.27 mg	3000	Tape and reel

Revision history

Table 6. **Document revision history**

Date	Revision	Changes
9-Dec-2013	1	Initial release.
07-Dec-2023	2	Updated Figure 5, and Figure 6. Added Figure 7, Figure 8, Figure 10, Figure 11, Figure 12, and Figure 13. Minor text changes.

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