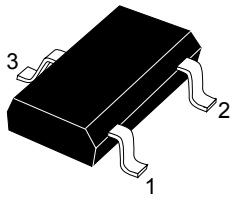
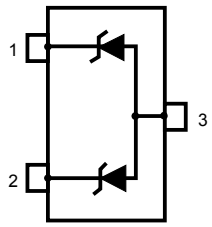
HSP181-2W3Y

Datasheet

Automotive grade 18 V dual-line high speed port protection



SOT323-3L
(Jedec TO-236)



Functional diagram

Product status link
HSP181-2W3Y

Product summary	
Order code	HSP181-2W3Y
Marking	H8Y
Package	SOT323-3L
Packing	Tape and reel

Features

- AEC-Q101 qualified
- Flow-through routing to keep signal integrity
- Large bandwidth: 1.7 GHz
- Ultra low capacitance: 2.1 pF
- Operating junction temperature range: -55 °C to 150 °C
- RoHS compliant and halogen free
- Complies with ISO ISO 10605 / IEC 61000-4-2 - C = 150 pF, R = 330 Ω exceeds level 4
  - ±12 kV (contact discharge)
  - ±30 kV (air discharge)
- Complies with ISO 10605 - C = 330 pF, R = 330 Ω
  - ±10 kV (contact discharge)
  - ±30 kV (air discharge)
- Complies with ISO 10605 - C = 330 pF, R = 2 kΩ
  - ±30 kV (contact discharge)
  - ±30 kV (air discharge)

Application

- USB 1.1 and USB2.0
- NFC
- Other high speed signals

Description

The HSP181-2W3Y is an ESD array designed for high-speed differential lines. The V_{RM} at 18 V makes it compatible with a short-to-battery hazard in vehicles.

The HSP181-2W3Y is also compatible with the maximum signal voltage (18 V) on the antenna of NFC readers and can thus efficiently protect NFC antenna I/O of NFC ICs.

The 2.1 pF low parasitic capacitance and the 1.7 GHz bandwidth provides enough room to preserve the signal integrity of USB 2.0 or NFC signals.

The HSP181-2W3Y is housed in SOT323-3L.

1 Characteristics

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

Symbol	Parameter		Value	Unit
V_{PP}	Peak pulse voltage	ISO10605 / IEC 61000-4-2 (C = 150 pF, R = 330 Ω) Contact discharge Air discharge	 12 30	kV
		ISO10605 (C = 330 pF, R = 330 Ω) Contact discharge Air discharge	 10 30	
		ISO10605 (C = 330 pF, R = 2 kΩ) Contact discharge Air discharge	 30 30	
P_{PP}	Peak pulse power dissipation (8/20 µs)		50	W
I_{PP}	Peak Pulse current (8/20 µs)		2	A
T_{stg}	Storage temperature range		-65 to +150	°C
T_j	Operating junction temperature range		-55 to +150	°C
T_L	Maximum lead temperature for soldering during 10 s		260	°C

Figure 1. Electrical characteristics - parameter definitions

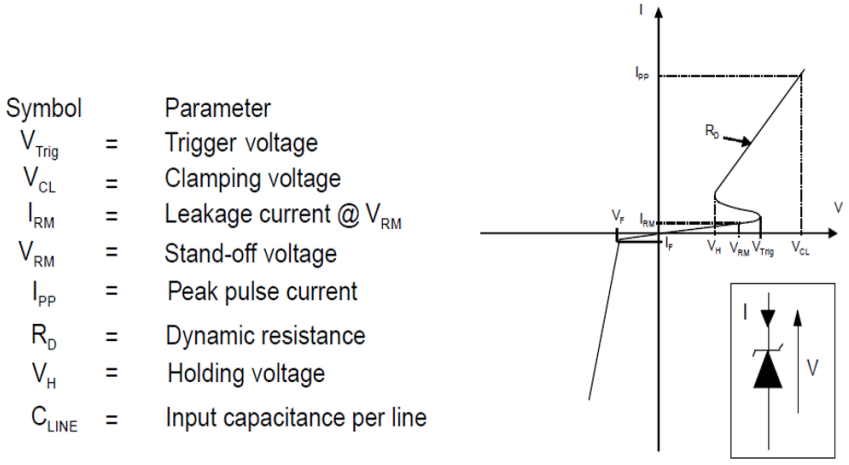


Table 2. Electrical characteristics (values) (T_{amb} = 25° C)

Symbol	Test conditions	Min.	Typ.	Max.	Unit
V_{TRIG}	Higher voltage than V_{TRIG} guarantees the protection turn-on	21.5		30	V
V_H	Lower voltage than V_H guarantees the protection turn-off	18			V
V_{RM}	Stand-off voltage			18	V
I_{RM}	V_{RM} = 18 V			50	nA
V_{CL}	TLP 100 ns, I_{PP} = 16 A		33		V
V_{CL}	8/20 µs waveform, I_{PP} = 2 A			29	V
C_{LINE}	V_{LINE} = 0 V, f = 1 MHz, V_{OSC} = 30 mV		2.1	2.5	pF
BW	Bandwidth S21 = -3dB		1.7		GHz
R_D	Pulse duration 100 ns		0.7		Ω

1.1 Characteristics (curves)

Figure 2. Leakage current versus junction temperature

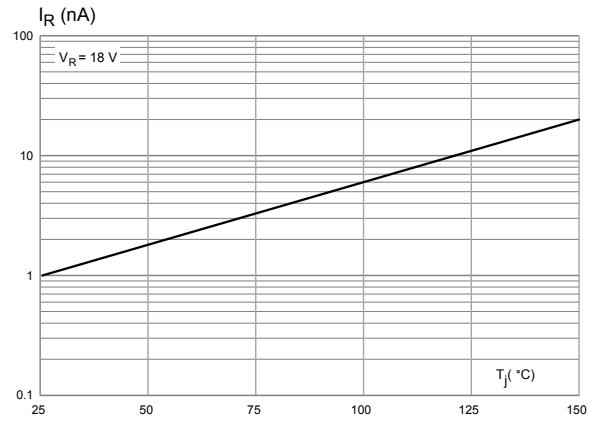


Figure 3. Junction capacitance versus reverse applied voltage

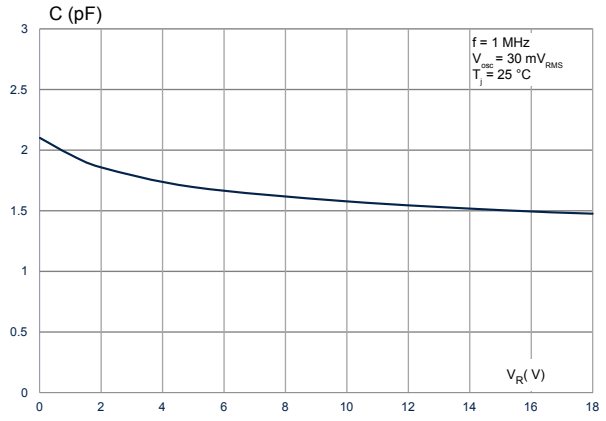


Figure 4. ESD response to ISO 10605 - C = 150 pF, R = 330 Ω (+8 kV contact discharge)

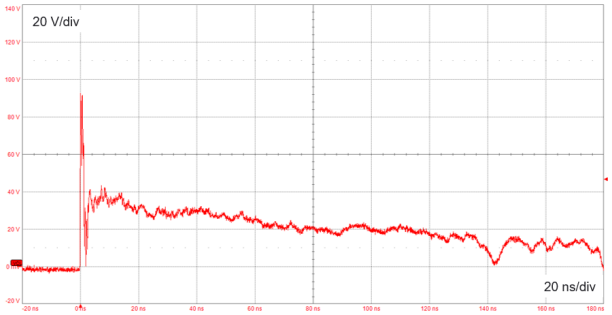


Figure 5. ESD response to ISO 10605 - C = 150 pF, R = 330 Ω (-8 kV contact discharge)

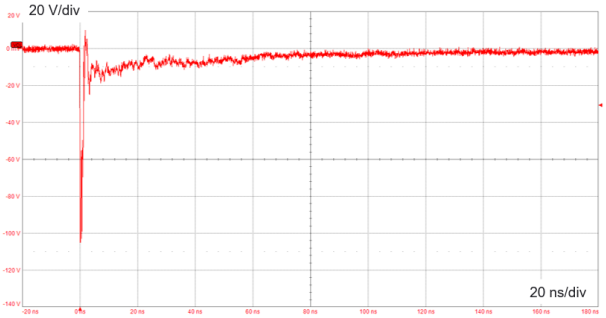


Figure 6. TLP

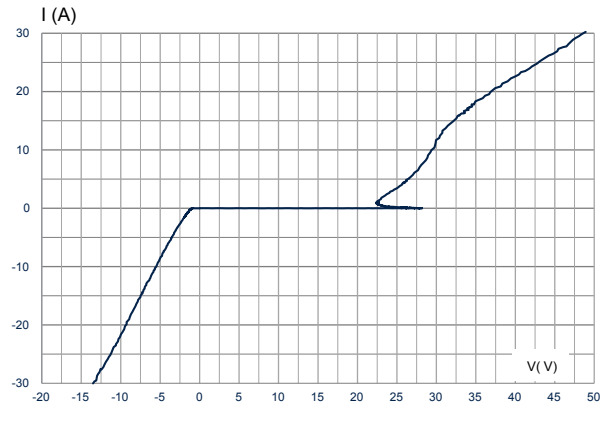


Figure 7. S21 attenuation

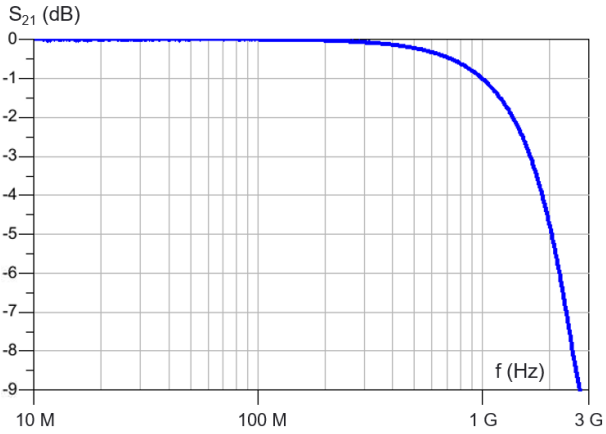


Figure 8. ISO7637-3, fast transient pulse 3a (Us = -150 V)

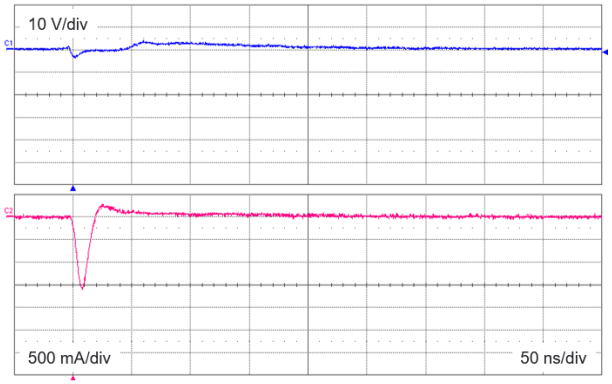


Figure 9. ISO7637-3, fast transient pulse 3b (Us = +150 V)

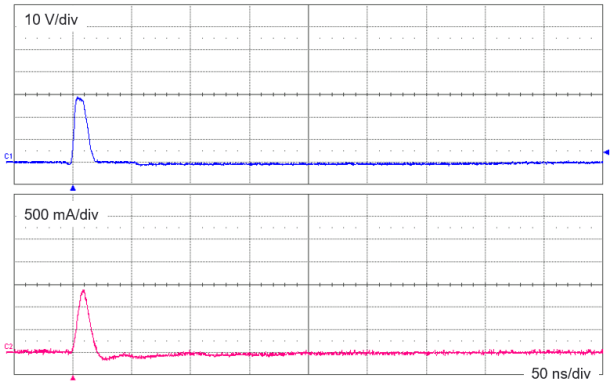


Figure 10. ISO7637-3, slow transient pulse - negative 2a (Us = -85 V)

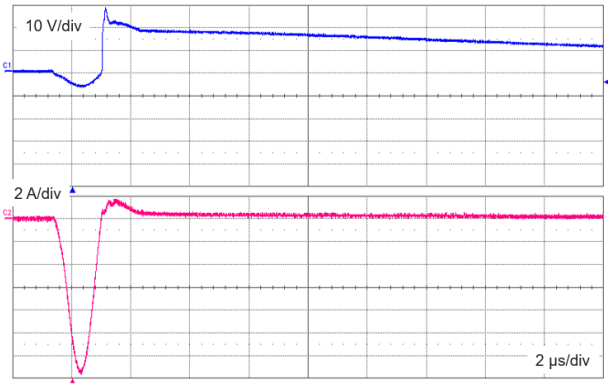


Figure 11. ISO7637-3, slow transient pulse - positive 2a (Us = +85 V)

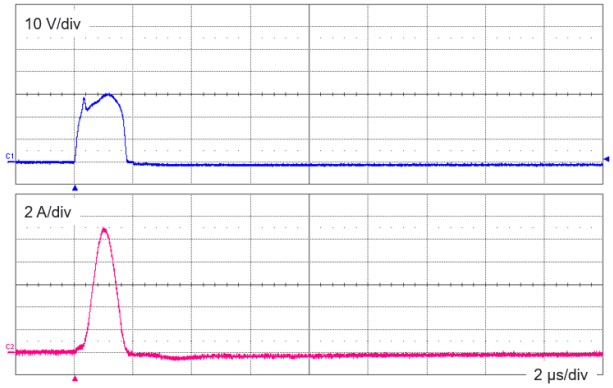


Figure 12. USB 2.0 high speed 480 Mbps eye diagram, template 1, without HSP181-2W3Y

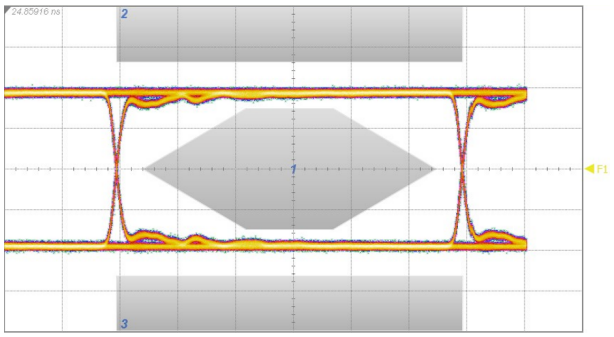
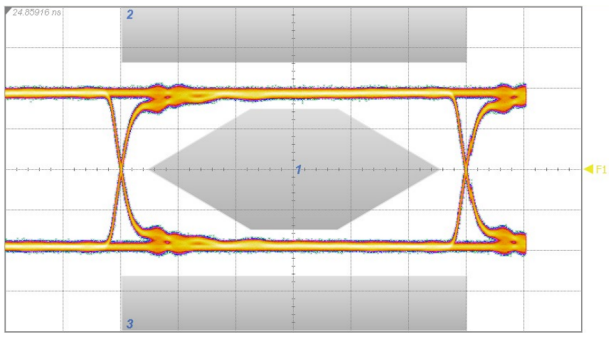


Figure 13. USB 2.0 high speed 480 Mbps eye diagram, template 1, with HSP181-2W3Y



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 SOT323-3L package information

- Epoxy meets UL 94,V0
- Lead-free package

Figure 14. SOT323-3L package outline

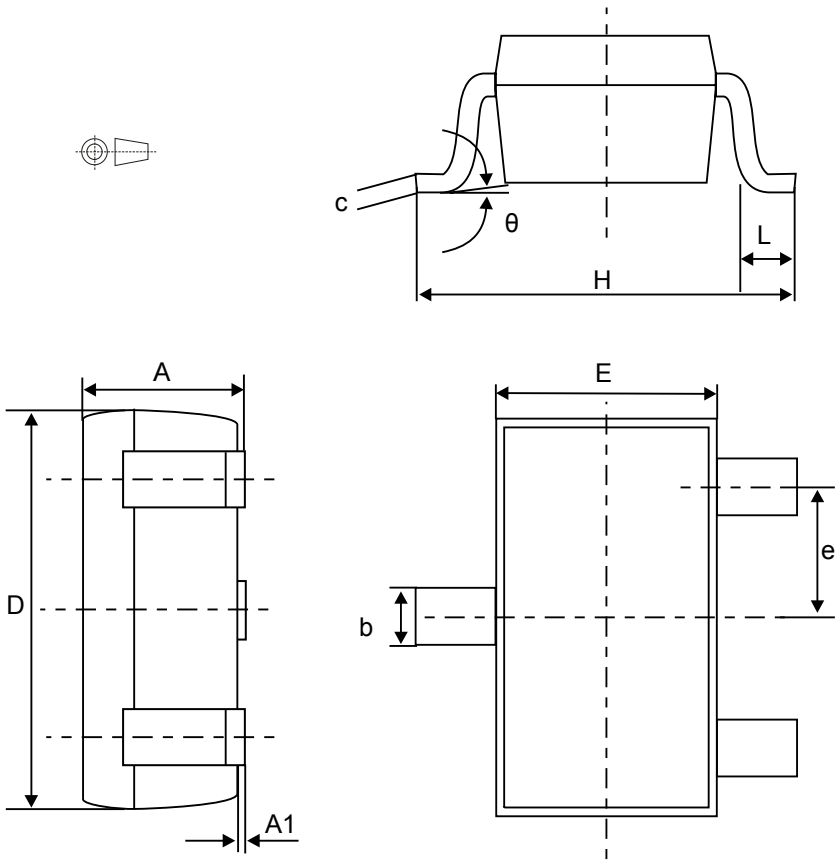


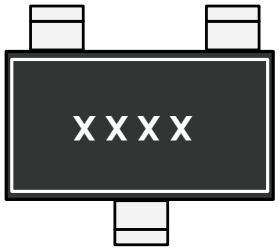
Table 3. SOT323-3L package mechanical data

Ref.	Dimensions					
	Millimeters			Inches[1]		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.80		1.10	0.031		0.043
A1	0.00		0.10	0.000		0.003
b	0.25		0.40	0.0098		0.0157
c	0.10		0.26	0.003		0.0102
D	1.80	2.00	2.20	0.070	0.078	0.086
E	1.15	1.25	1.35	0.0452	0.0492	0.0531
e	0.60	0.65	0.70	0.024	0.026	0.028
H	1.80	2.10	2.40	0.070	0.082	0.094
L	0.10	0.20	0.30	0.004	0.008	0.012
Θ		0	30°	0		30°

1. *Values in inches are converted from mm and rounded to 3 or 4 decimal digits.*

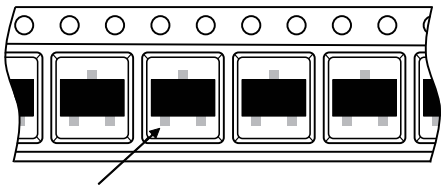
2.2 Packing and marking information

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



X X X X : Marking

Figure 16. Package orientation in reel



Pin 1 located according to EIA-481

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

Figure 17. Tape leader and trailer dimensions

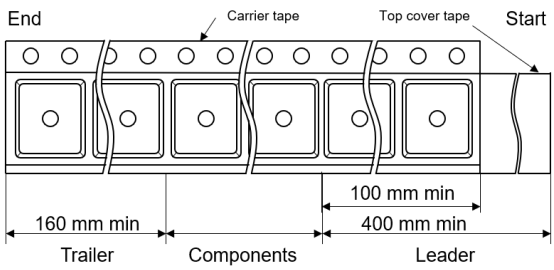


Figure 18. Tape and reel orientation

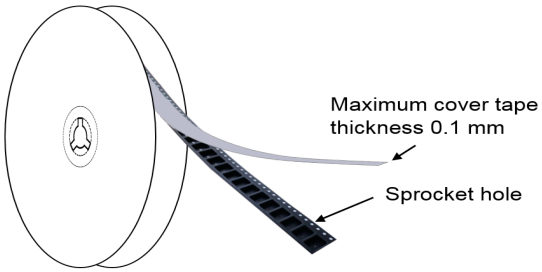


Figure 19. Reel dimensions (mm)

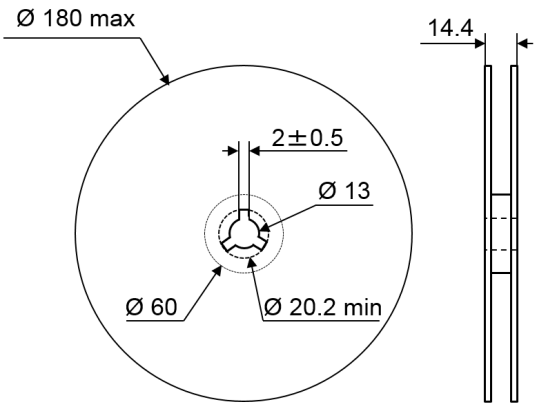


Figure 20. Inner box dimensions (mm)

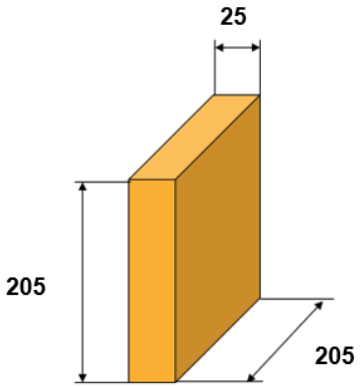
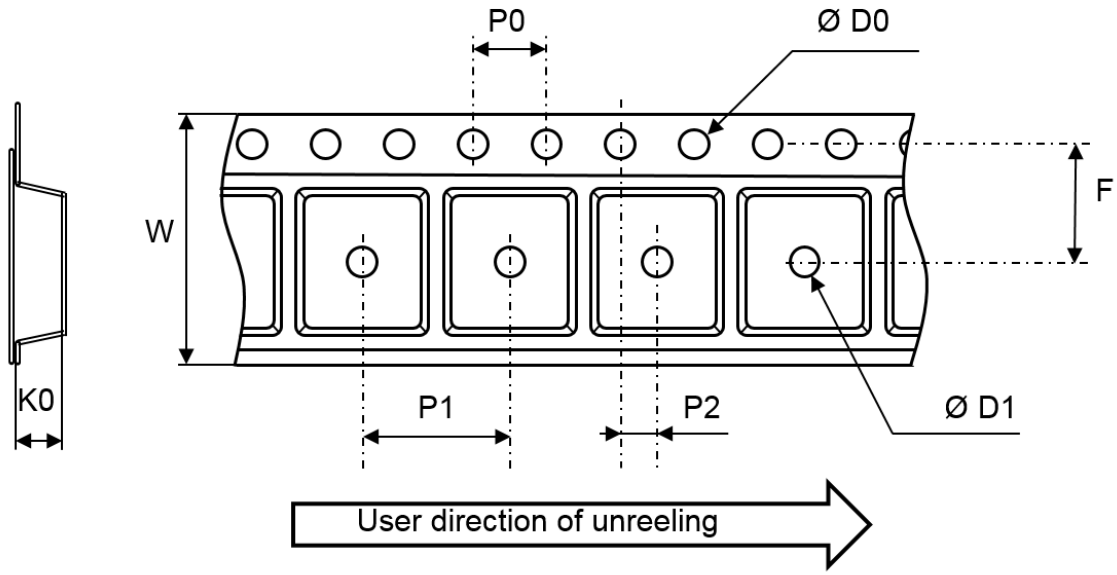


Figure 21. **Tape outline**



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

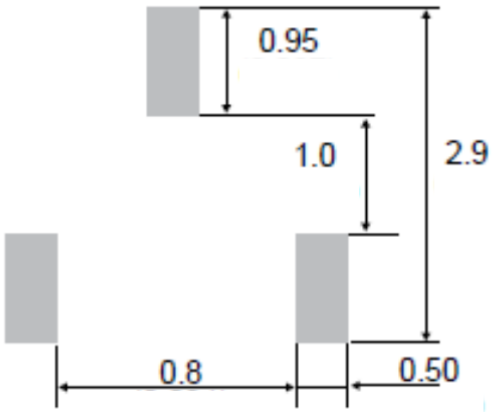
Table 4. **Tape and reel mechanical data**

Ref.	Dimensions		
	Millimeters		
	Min.	Typ.	Max.
D0	1.50		1.60
D1	0.90		
F	3.45	3.50	3.55
K0	1.10	1.20	1.30
P0	3.90	4.00	4.10
P1	3.90	4.00	4.10
P2	1.95	2.00	2.05
W	7.90	8.00	8.30

3 Recommendation on PCB assembly

3.1 Recommended footprint

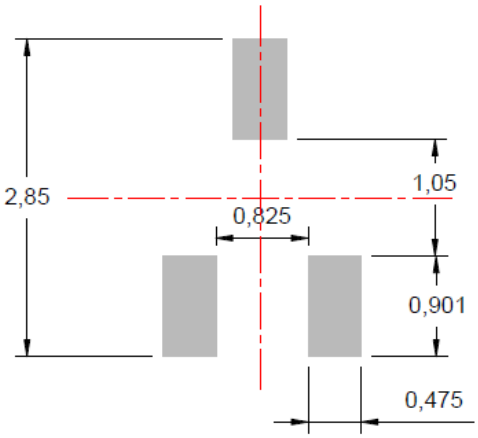
Figure 22. **Recommended footprint in mm**



3.2 Stencil opening design

Stencil opening thickness: 75 µm / 3 mils

Figure 23. **Stencil opening recommendations**



3.3 Solder paste

1. Halide-free flux, qualification ROL0 according to ANSI/J-STD-004.
2. “No clean” solder paste recommended.
3. Tack force high enough to resist component displacement during PCB movement.
4. Particles size 20-38 µm per IPCJ STD-005.

3.4 Placement

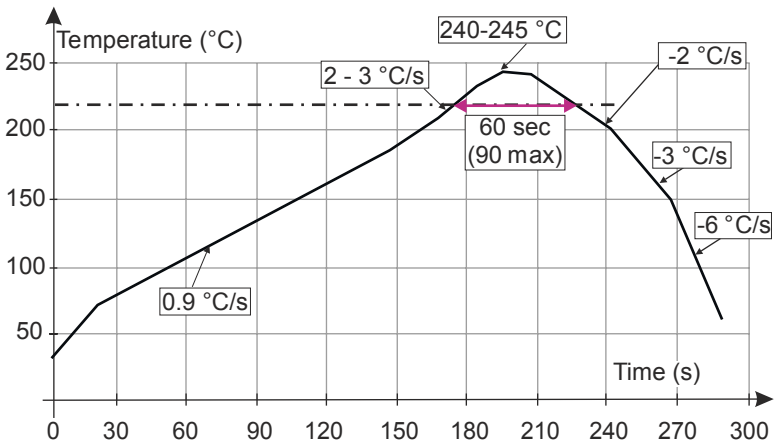
1. It is recommended to use leads recognition instead of package outline for accurate placement on footprint with adequate resolution tool.
2. Tolerance of ±50 µm is recommended.
3. 1.0 N placement force is recommended. Too much placement force can lead to squeezed out solder paste and cause solder joints 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.
4. 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 PCB design preference

1. Any via around or inside the footprint area must be closed to avoid solderpaste migration in the via.
2. Position and dimensions of the tracks should be well balanced. A symmetrical layout is recommended to prevent assembly troubles.

3.6 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.

4 Ordering information

Table 5. Ordering information

Order code	Marking[1]	Package	Weight	Base qty.	Delivery mode
HSP181-2W3Y	H8Y	SOT323-3L	6.46 mg	3000	Tape and reel

1. *The marking can be rotated by multiples of 90° to differentiate assembly location*

Revision history

Table 6. **Document revision history**

Date	Revision	Changes
29-Sep-2021	1	Initial release.
31-Jan-2022	2	Updated Section ■ Disclaimer Updated Section Application Updated Section Description
27-Jun-2022	3	Added Figure 12 and Figure 13.

IMPORTANT NOTICE – READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgment.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.