

ESD5374D

Low Capacitance Transient Voltage Suppressors Array

Descriptions

The ESD5374D is a low capacitance TVS (Transient Voltage Suppressor) array designed to protect high speed data interfaces. It incorporates 3 lines low capacitance TVS diodes and 1 line high surge capability TVS diode in one package, it is suitable to replace multiple discrete components in portable electronics.

The ESD5374D is specifically designed to protect USB port. 3 lines of low capacitance TVS diodes are used to protect USB data (DP, DM) and USB ID pins operating up to 5V. 1 line of TVS diode with higher surge capability of 90A (8/20 μ s) is used to protect USB voltage bus pin operating up to 12V.

The ESD5374D may be used to provide ESD protection up to ± 20 kV (DP, DM, ID Pins) and ± 30 kV (VBus Pin) according to IEC61000-4-2 contact discharge, and withstand peak pulse current up to 4A (DP, DM, ID Pins) and 90A (VBus Pin) according to IEC61000-4-5 (8/20 μ s).

The ESD5374D is available in DFN1820-6L package. Standard products are Pb-free and Halogen-free.

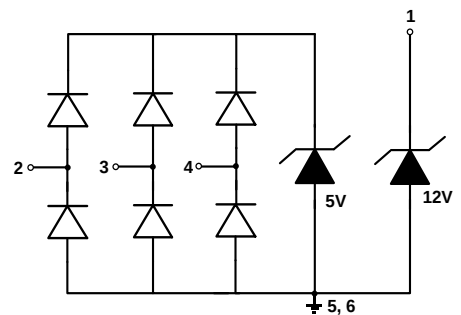
Features

- Reverse stand-off voltage: 5V max. (DP, DM, ID Pins)
12V max. (VBus Pin)
- ESD protection according to IEC61000-4-2
Contact & Air discharge: ± 20 kV (DP, DM, ID Pins)
 ± 30 kV (VBus Pin)
- Surge protection according to IEC61000-4-5
8/20 μ s waveform: 4A (DP, DM, ID Pins)
90A (VBus Pin)
- Low capacitance: $C_j = 0.40$ pF typ. (DP, DM, ID Pins)
- Low clamping voltage
- Solid-state silicon technology

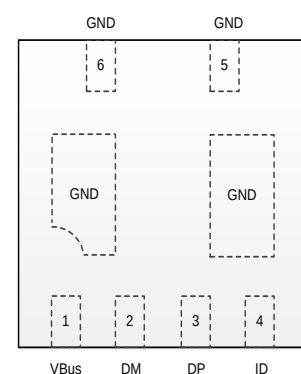
Applications

- USB 2.0
- USB OTG

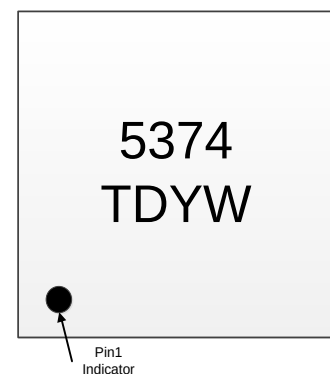
<http://www.sh-willsemi.com>



Circuit diagram



Pin configuration (Top View)



5374 = Device code
TD = Fixed code
YW = Date code

Marking

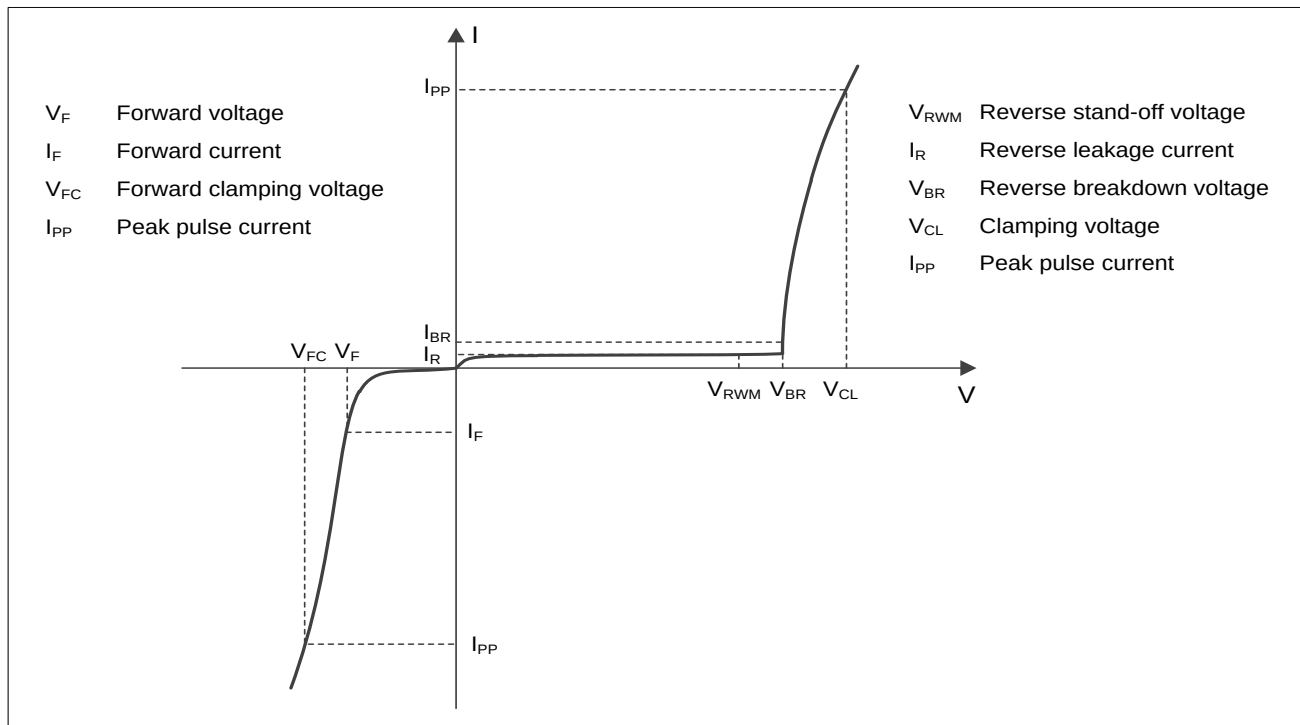
Order information

Device	Package	Shipping
ESD5374D-6/TR	DFN1820-6L	3000/Tape&Reel

Absolute maximum ratings

Parameter	Symbol	Rating	Unit
USB DP, DM, ID TVS			
Peak pulse power ($t_p = 8/20\mu s$)	P_{pk}	56	W
Peak pulse current ($t_p = 8/20\mu s$)	I_{pp}	4	A
ESD according to IEC61000-4-2 air discharge	V_{ESD}	± 20	kV
ESD according to IEC61000-4-2 contact discharge		± 20	
Operation junction temperature	T_J	125	$^{\circ}C$
Lead temperature	T_L	260	$^{\circ}C$
Storage temperature	T_{STG}	-55~150	$^{\circ}C$
VBus TVS			
Peak pulse power ($t_p = 8/20\mu s$)	P_{pk}	2700	W
Peak pulse current ($t_p = 8/20\mu s$)	I_{pp}	90	A
ESD according to IEC61000-4-2 air discharge	V_{ESD}	± 30	kV
ESD according to IEC61000-4-2 contact discharge		± 30	
Junction temperature	T_J	125	$^{\circ}C$
Operating temperature	T_{OP}	-40~85	$^{\circ}C$
Lead temperature	T_L	260	$^{\circ}C$
Storage temperature	T_{STG}	-55~150	$^{\circ}C$

Electrical characteristics ($T_A = 25^{\circ}C$, unless otherwise noted)



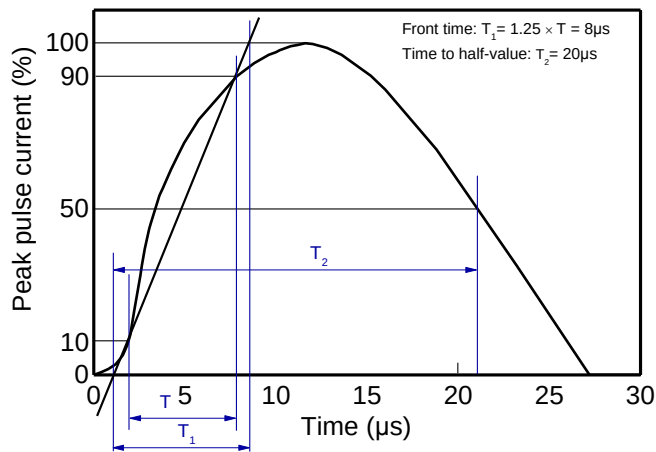
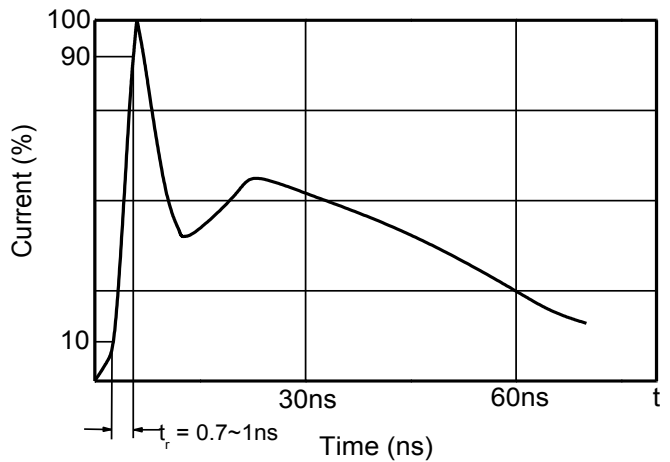
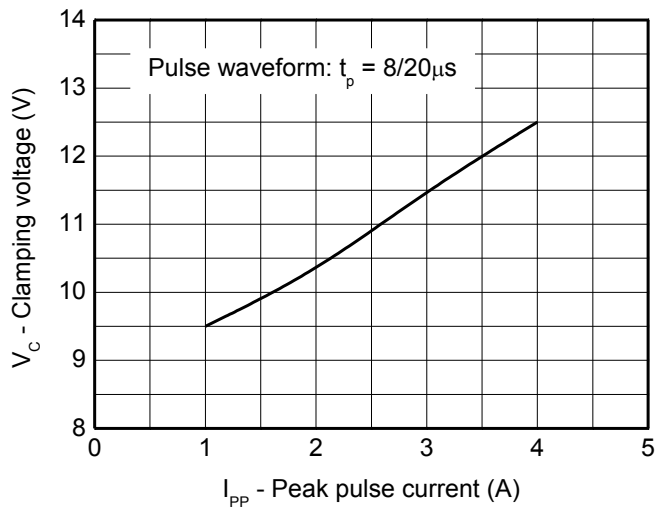
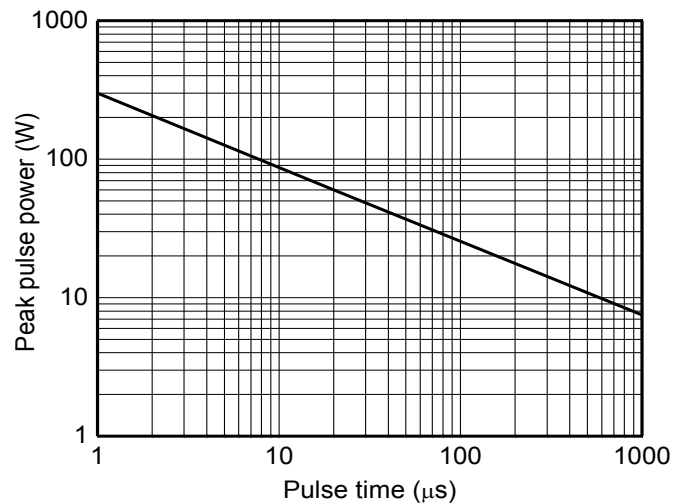
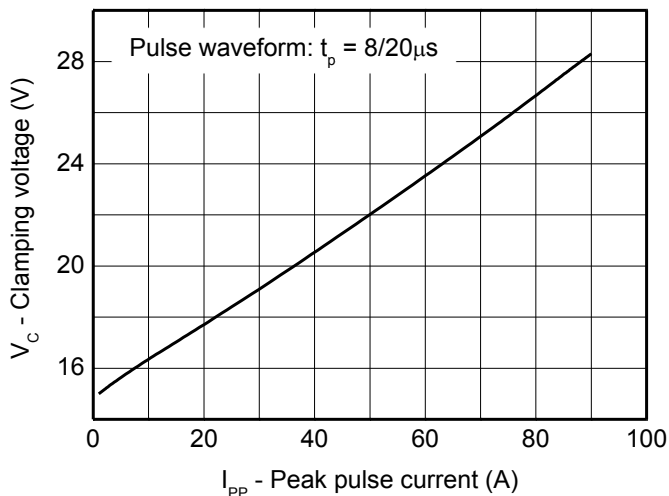
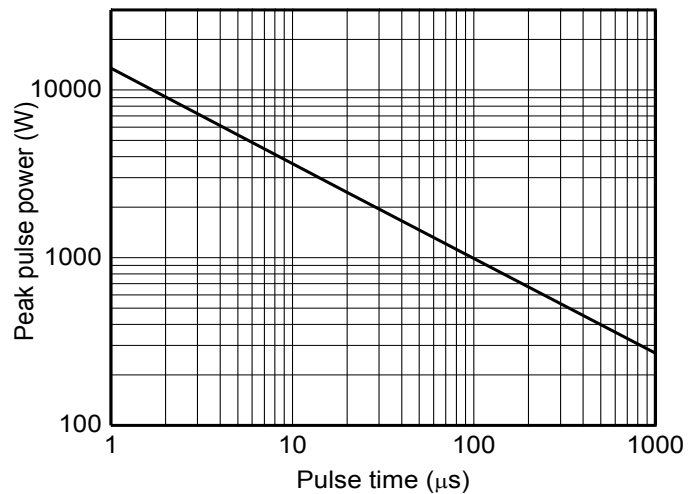
Definitions of electrical characteristics

Electrical characteristics ($T_A = 25^\circ\text{C}$, unless otherwise noted)

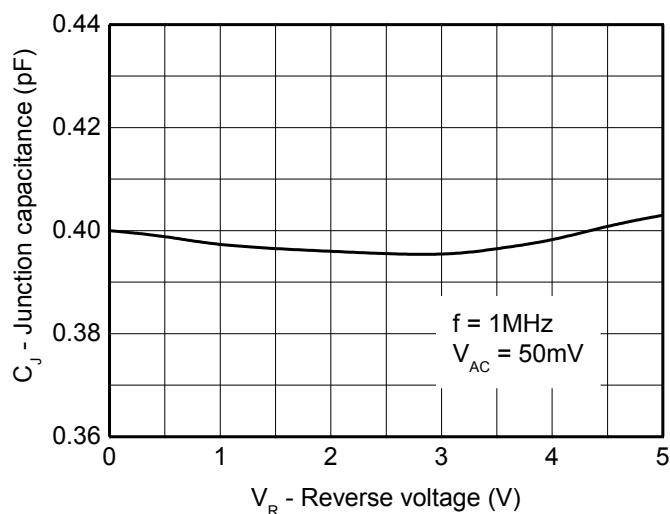
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
USB DP, DM, ID TVS						
Reverse stand-off voltage	V _{RWM}				5.0	V
Reverse leakage current	I _R	V _{RWM} = 5V		<1	100	nA
Reverse breakdown voltage	V _{BR}	I _{BR} = 1mA	7.0	8.0	9.0	V
Forward voltage	V _F	I _F = 10mA	0.6	0.9	1.2	V
Clamping voltage ¹⁾	V _{CL}	I _{PP} = 16A, t _p = 100ns		17.5		V
Clamping voltage ²⁾	V _{CL}	V _{ESD} = +8kV		17.5		V
Clamping voltage ³⁾	V _{CL}	I _{PP} = 1A, t _p = 8/20μs			11	V
		I _{PP} = 4A, t _p = 8/20μs			14	V
Dynamic resistance ¹⁾	R _{DYN}			0.55		Ω
Junction capacitance	C _J	V _R = 0V, f = 1MHz, Pin2, 3, 4 to GND		0.40	0.65	pF
		V _R = 0V, f = 1MHz, Between Pin2, 3, 4		0.25	0.40	pF
VBus TVS						
Reverse stand-off voltage	V _{RWM}				12	V
Reverse leakage current	I _R	V _{RWM} = 12V			500	nA
Reverse breakdown voltage	V _{BR}	I _{BR} = 1mA	13.5	15.0	16.5	V
Forward voltage	V _F	I _F = 10mA	0.4	0.7	1.0	V
Clamping voltage ³⁾	V _{CL}	I _{PP} = 30A, t _p = 8/20μs			22	V
		I _{PP} = 90A, t _p = 8/20μs			30	V
Junction capacitance	C _J	V _R = 0V, f = 1MHz, Pin1 to GND		800	1200	pF

Notes:

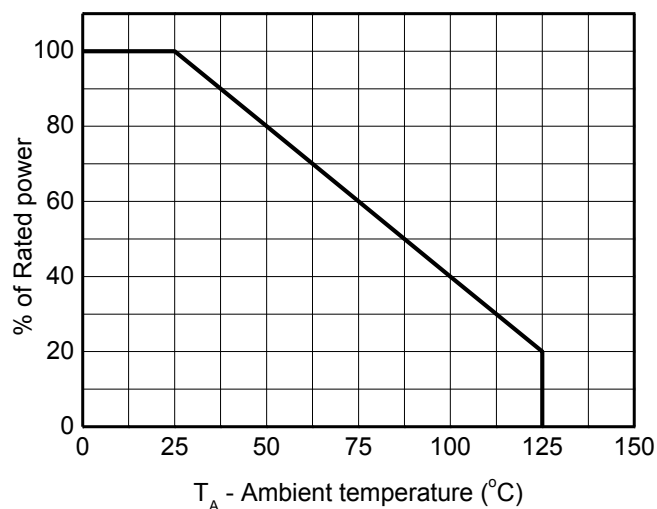
- 1) TLP parameter: $Z_0 = 50\Omega$, $t_p = 100\text{ns}$, $t_r = 2\text{ns}$, averaging window from 60ns to 80ns. R_{DYN} is calculated from 4A to 16A.
- 2) Contact discharge mode, according to IEC61000-4-2.
- 3) Non-repetitive current pulse, according to IEC61000-4-5.

Typical characteristics ($T_A = 25^\circ\text{C}$, unless otherwise noted)

8/20 μs waveform per IEC61000-4-5

Contact discharge current waveform per IEC61000-4-2

**Clamping voltage vs. Peak pulse current
(DP, DM, ID Pins)**

**Non-repetitive peak pulse power vs. Pulse time
(DP, DM, ID Pins)**

**Clamping voltage vs. Peak pulse current
(VBus Pin)**

**Non-repetitive peak pulse power vs. Pulse time
(VBus Pin)**

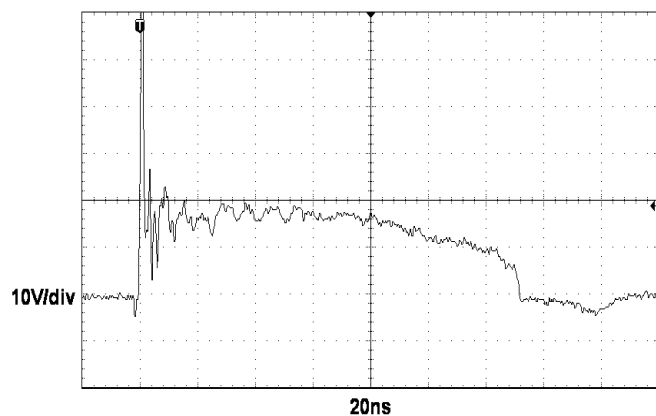
Typical characteristics ($T_A = 25^\circ\text{C}$, unless otherwise noted)



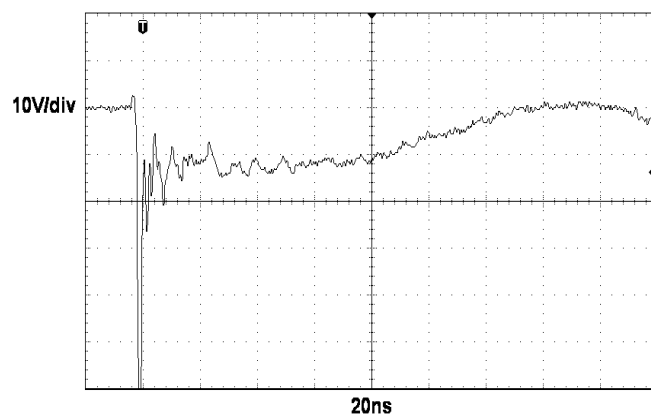
Capacitance vs. Reverse voltage
(DP, DM, ID Pins)



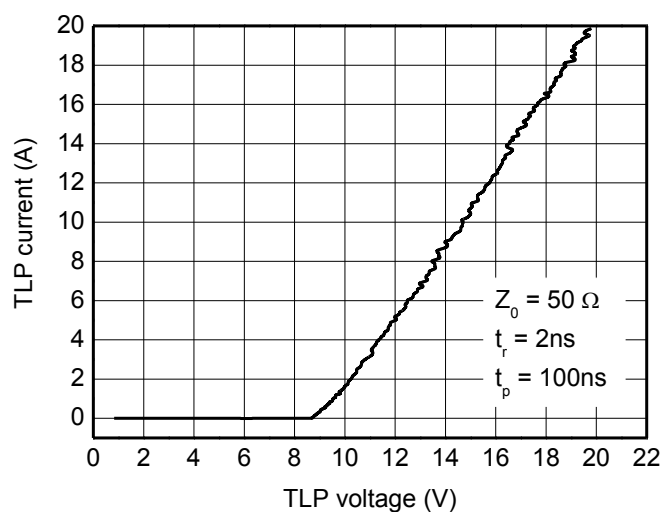
Power derating vs. Ambient temperature



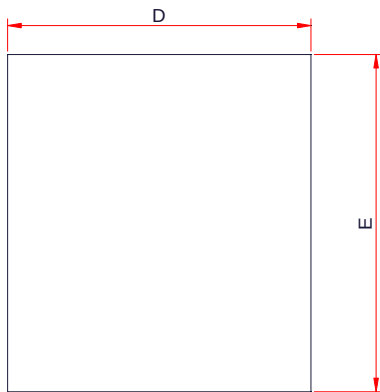
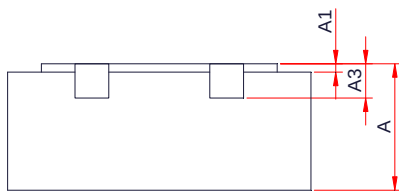
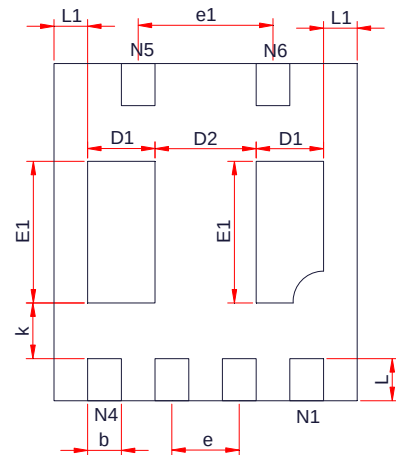
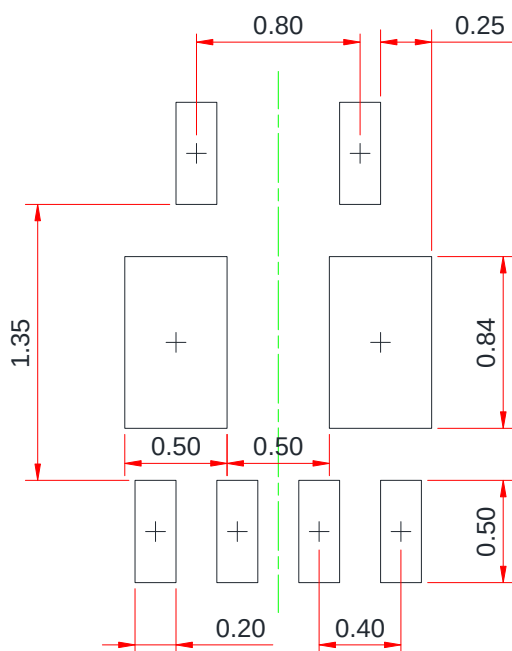
ESD clamping +8kV contact discharge
(DP, DM, ID Pins)



ESD clamping -8kV contact discharge
(DP, DM, ID Pins)



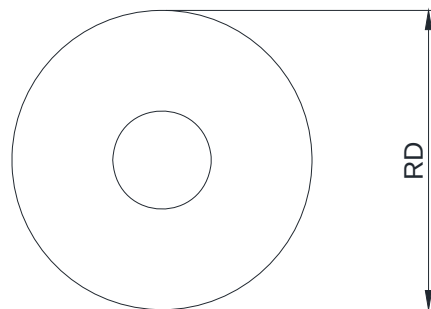
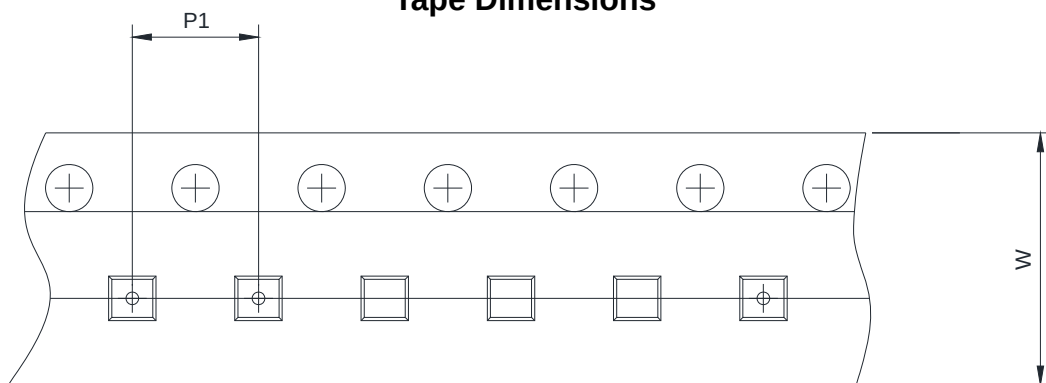
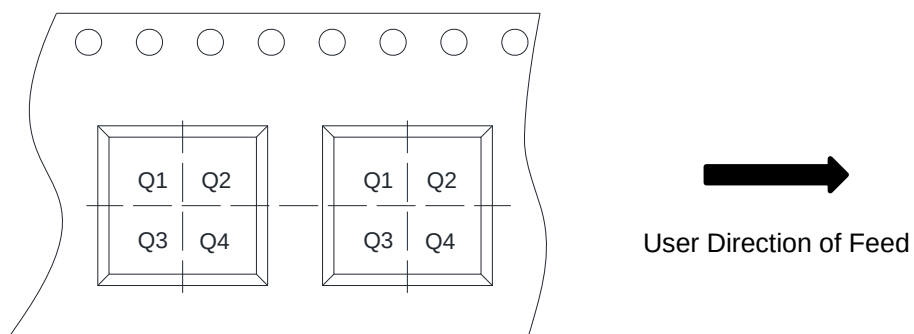
TLP Measurement
(DP, DM, ID Pins)

PACKAGE OUTLINE DIMENSIONS
DFN1820-6L

TOP VIEW

SIDE VIEW

BOTTOM VIEW
Recommended land pattern (Unit: mm)


Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	0.70	0.75	0.80
A1	0.00	0.03	0.05
A3	0.20Ref		
D	1.70	1.80	1.90
E	1.90	2.00	2.10
D1	0.30	0.40	0.50
E1	0.74	0.84	0.94
D2	0.50	0.60	0.70
b	0.15	0.20	0.25
e	0.30	0.40	0.50
e1	0.70	0.80	0.90
k	0.20	—	—
L	0.17	—	0.33
L1	0.15	0.20	0.25

Notes:

This recommended land pattern is for reference purposes only. Please consult your manufacturing group to ensure your PCB design guidelines are met.

TAPE AND REEL INFORMATION
Reel Dimensions

Tape Dimensions

Quadrant Assignments For PIN1 Orientation In Tape


RD	Reel Dimension	☒ 7inch	☐ 13inch
W	Overall width of the carrier tape	☒ 8mm	☐ 12mm ☐ 16mm
P1	Pitch between successive cavity centers	☐ 2mm	☒ 4mm ☐ 8mm
Pin1	Pin1 Quadrant	☒ Q1	☐ Q2 ☐ Q3 ☐ Q4