

ESD73004D

4-Lines, Uni-directional, Ultra-low Capacitance Transient Voltage Suppressors

Descriptions

The ESD73004D is an ultra-low capacitance TVS (Transient Voltage Suppressor) array designed to protect high speed data interfaces. It has been specifically designed to protect sensitive electronic components which are connected to data and transmission lines from over-stress caused by ESD (Electrostatic Discharge).

The ESD73004D incorporates four pairs of ultra-low capacitance steering diodes plus a TVS diode.

The ESD73004D may be used to provide ESD protection up to $\pm 20\text{kV}$ (contact discharge) according to IEC61000-4-2, and withstand peak pulse current up to 5.5A (8/20 μs) according to IEC61000-4-5.

The ESD73004D is available in DFN2510-10L package. Standard products are Pb-free and Halogen-free.

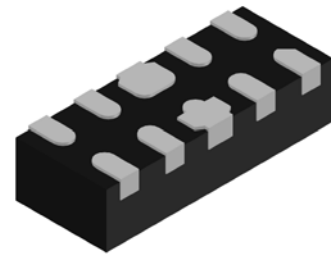
Features

- Stand-off voltage: 3.3V Max.
- Transient protection for each line according to IEC61000-4-2 (ESD): $\pm 20\text{kV}$ (contact discharge)
IEC61000-4-4 (EFT): 40A (5/50ns)
IEC61000-4-5 (surge): 5.5A (8/20 μs)
- Ultra-low capacitance: $C_J = 0.65\text{pF}$ typ.(I/O to GND)
- Ultra-low leakage current: $I_R < 1\text{nA}$ typ.
- Low clamping voltage: $V_{CL} = 8\text{V}$ typ. @ $I_{PP} = 16\text{A}$ (TLP)
- Solid-state silicon technology

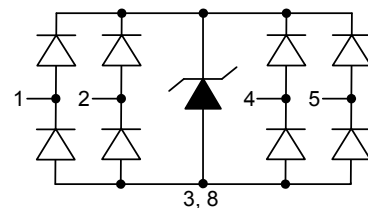
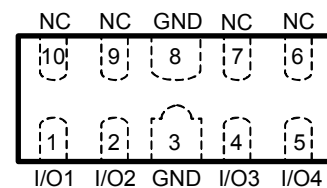
Applications

- USB 2.0 and USB 3.1
- HDMI 1.3, HDMI 1.4 and HDMI 2.0
- SATA and eSATA
- DVI
- Portable Electronics and Notebooks

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



DFN2510-10L (Bottom view)



Pin configuration (Top view)



TC = Device code

YW = Date code

Marking(Top View)

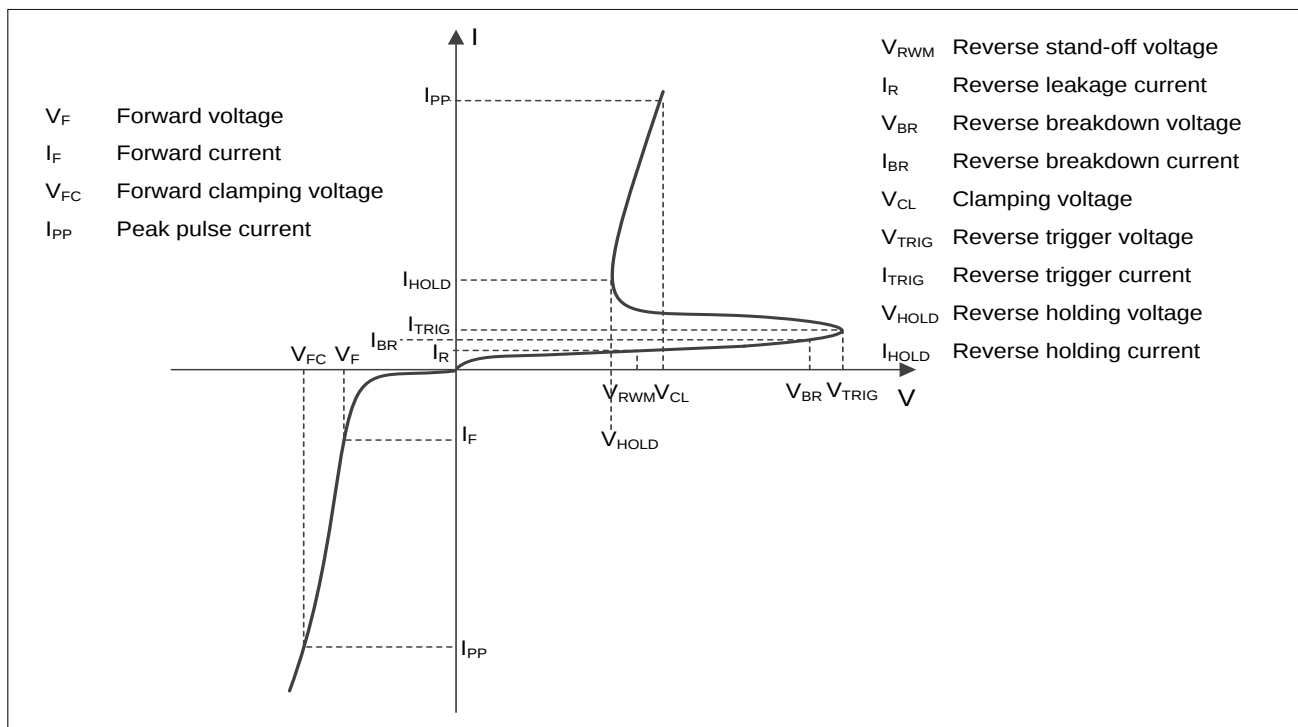
Order information

Device	Package	Shipping
ESD73004D-10/TR	DFN2510-10L	3000/Tape&Reel

Absolute maximum ratings

Parameter	Symbol	Rating	Unit
Peak pulse power ($t_p = 8/20\mu s$)	P_{pk}	40	W
Peak pulse current ($t_p = 8/20\mu s$)	I_{PP}	5.5	A
ESD according to IEC61000-4-2 air discharge	V_{ESD}	± 20	kV
ESD according to IEC61000-4-2 contact discharge		± 20	
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

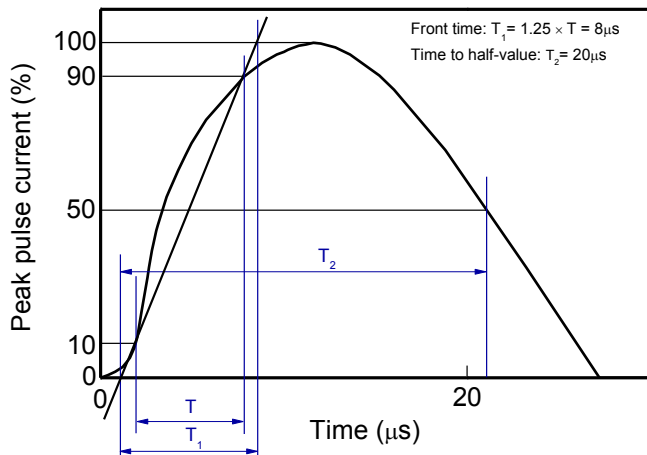
Electrical characteristics ($T_A = 25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Reverse maximum working voltage	V_{RWM}				3.3	V
Reverse leakage current	I_R	$V_{RWM} = 3.3\text{V}$		<1	50	nA
Reverse breakdown voltage	V_{BR}	$I_T = 1\text{mA}$	6.5			V
Forward voltage	V_F	$I_T = 20\text{mA}$	0.6	0.9	1.2	V
Clamping voltage ¹⁾	V_{CL}	$I_{PP} = 16\text{A}$, $t_p = 100\text{ns}$		8.0		V
Dynamic resistance ¹⁾	R_{DYN}			0.30		Ω
Clamping voltage ²⁾	V_{CL}	$V_{ESD} = 8\text{kV}$		8.0		V
Clamping voltage ³⁾	V_{CL}	$I_{PP} = 1\text{A}$, $t_p = 8/20\mu\text{s}$			4.5	V
		$I_{PP} = 5.5\text{A}$, $t_p = 8/20\mu\text{s}$			7.0	V
Junction capacitance	C_J	$V_R = 0\text{V}$, $f = 1\text{MHz}$ Any I/O pin to GND		0.65	0.80	pF
		$V_R = 0\text{V}$, $f = 1\text{MHz}$ Between any I/O pin		0.35	0.45	pF

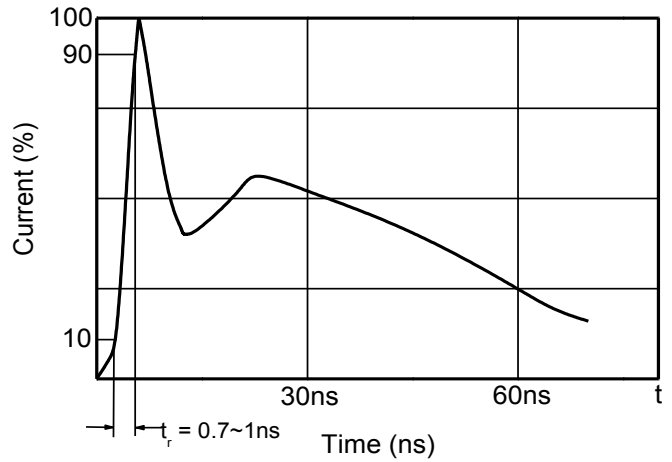
Notes:

- 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.

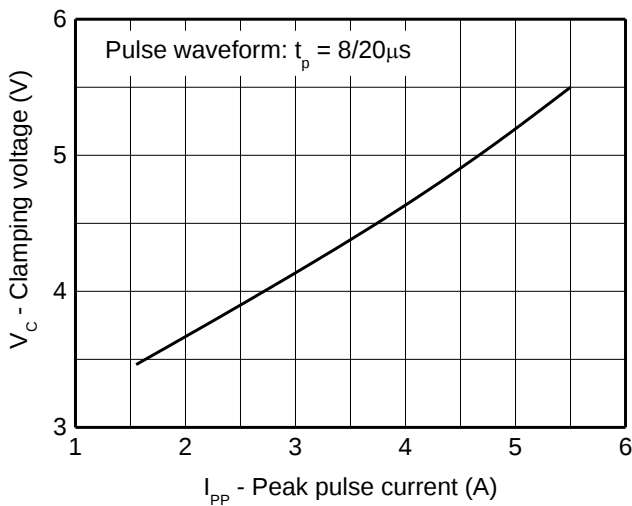
Typical characteristics ($T_A = 25^\circ\text{C}$, unless otherwise noted)



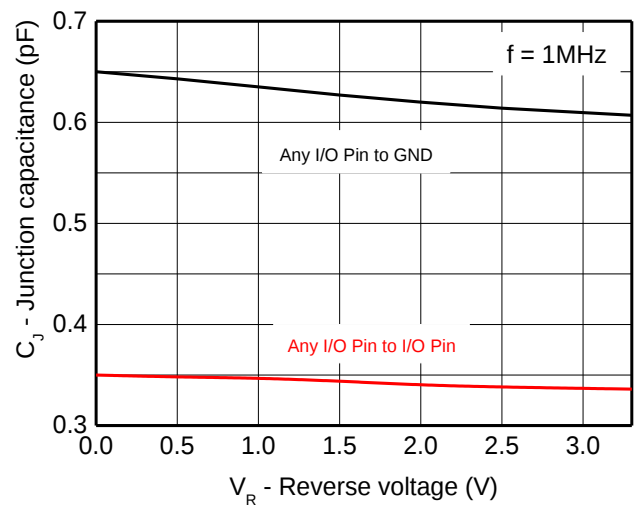
8/20 μs waveform per IEC61000-4-5



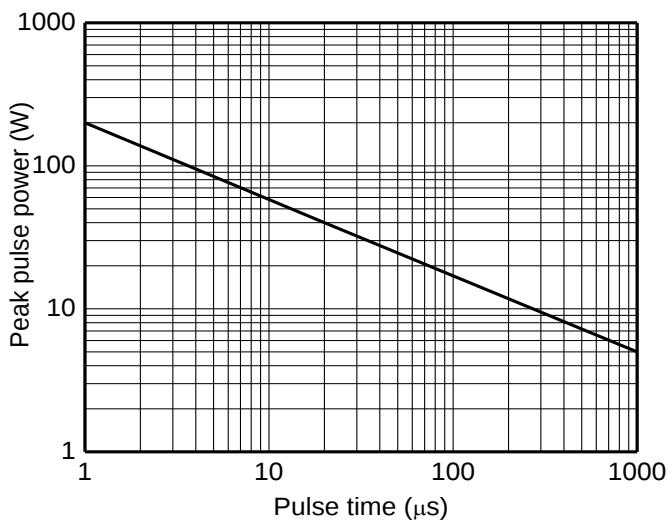
Contact discharge current waveform per IEC61000-4-2



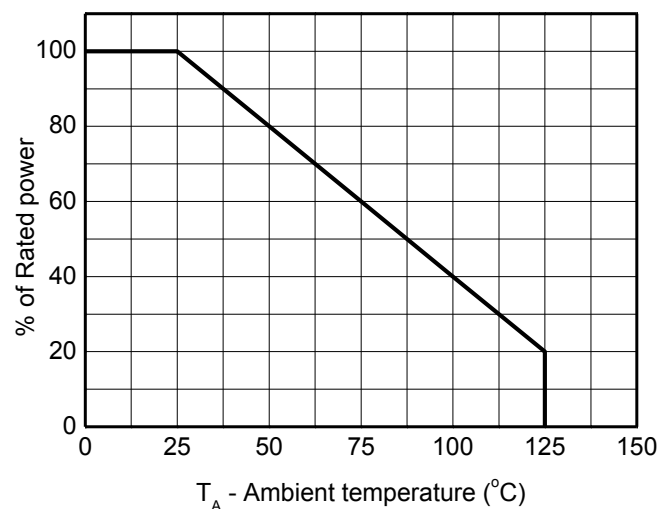
Clamping voltage vs. Peak pulse current



Capacitance vs. Reverse voltage

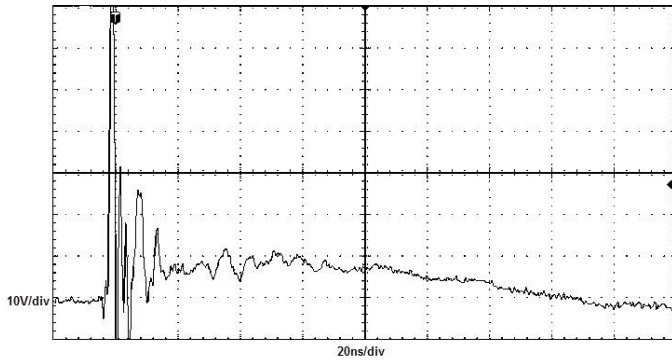


Non-repetitive peak pulse power vs. Pulse time

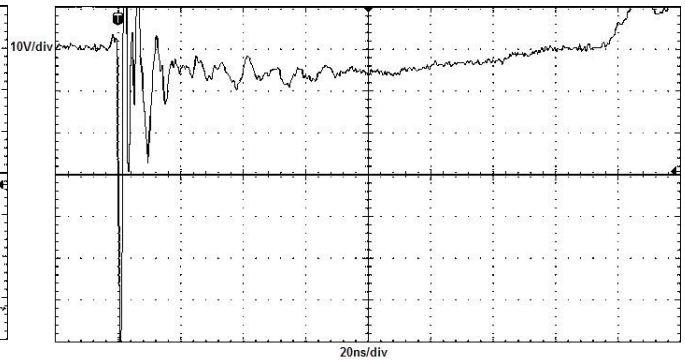


Power derating vs. Ambient temperature

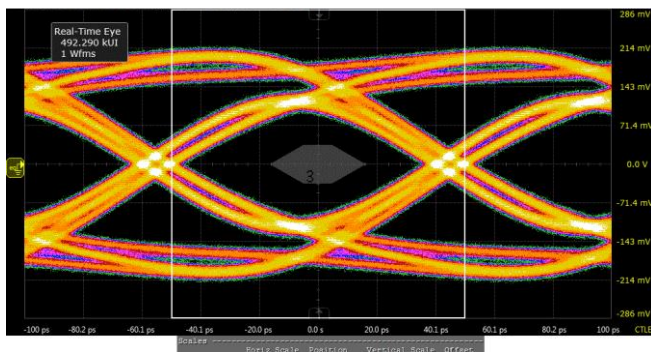
Typical characteristics ($T_A = 25^\circ\text{C}$, unless otherwise noted)



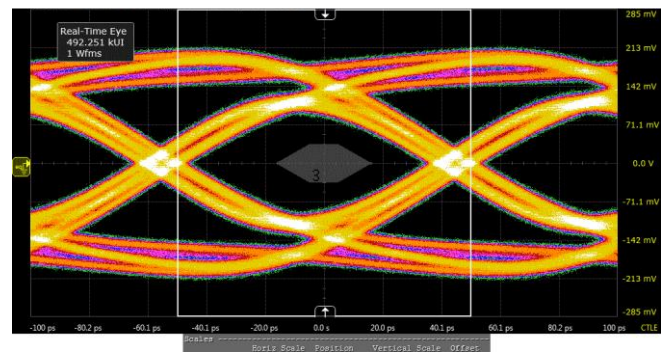
ESD clamping
(+8kV contact discharge per IEC61000-4-2)



ESD clamping
(-8kV contact discharge per IEC61000-4-2)

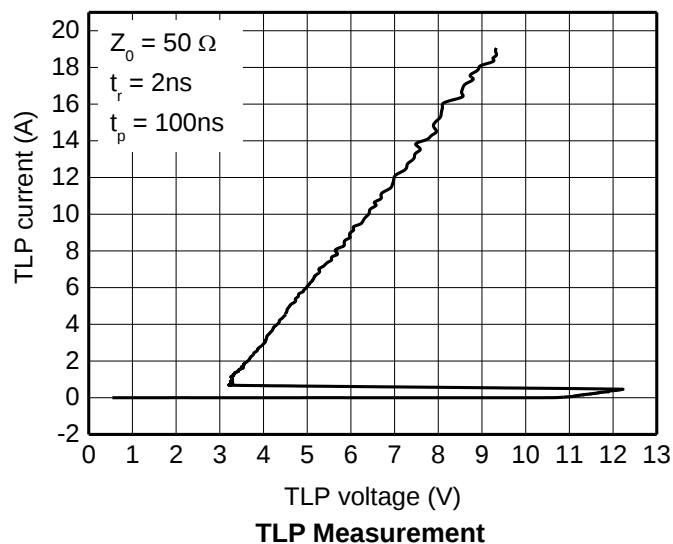


Without ESD73004D



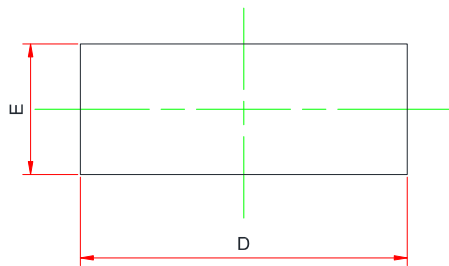
With ESD73004D

USB3.1 Eye Diagram with and without ESD73004D 10Gb/s

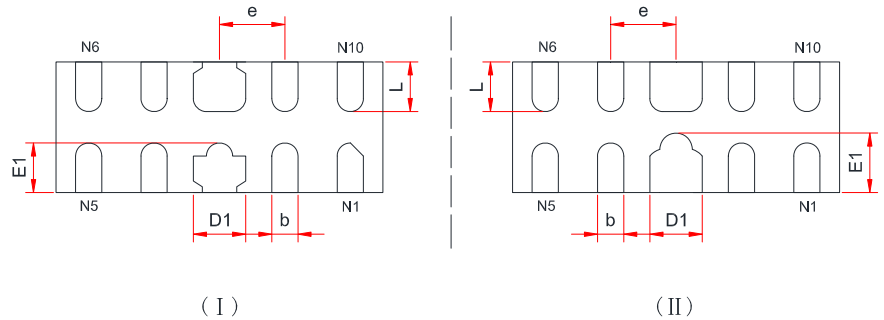


PACKAGE OUTLINE DIMENSIONS

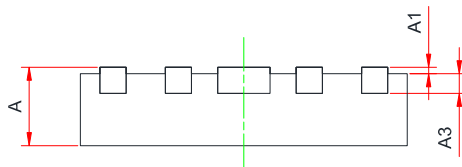
DFN2510-10L



Top View



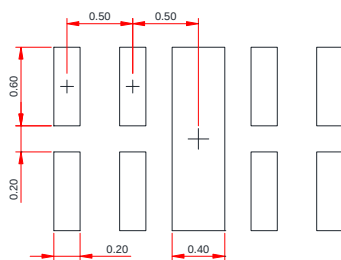
Bottom View



Side View

Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	0.500	0.575	0.650
A1	0.000	-	0.050
A3	0.150 Ref.		
D	2.400	2.500	2.600
E	0.900	1.000	1.100
D1	0.300	0.400	0.500
E1	0.300	0.455	0.610
b	0.130	0.190	0.250
e	0.500 BSC		
L	0.280	0.390	0.500

Recommend land pattern (Unit: mm)

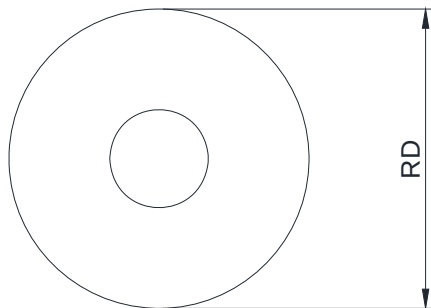


Notes:

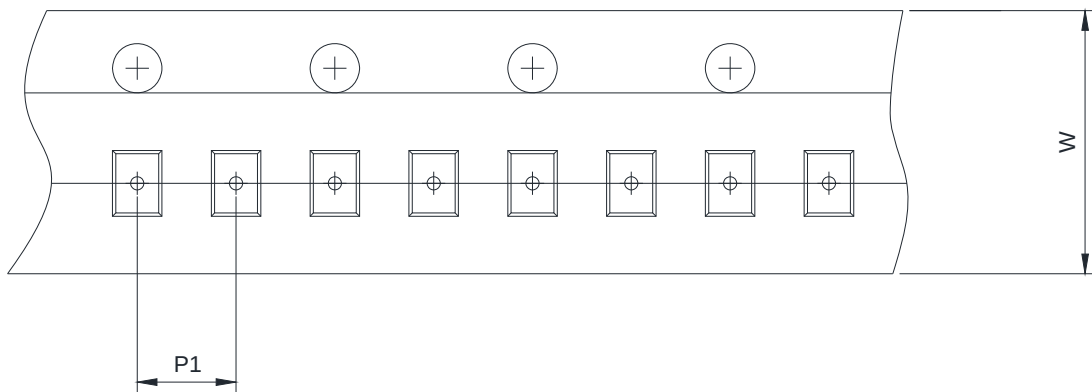
This recommended land pattern is for reference purposes only. Please consult your manufacturing group to ensure your PCB design guidelines are met.

TAPE AND REEL INFORMATION

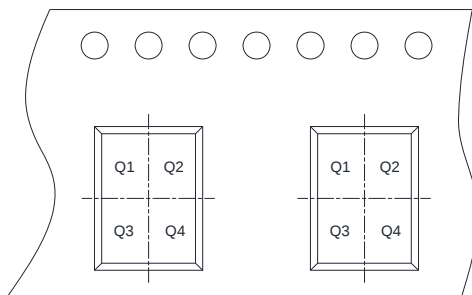
Reel Dimensions



Tape Dimensions



Quadrant Assignments For PIN1 Orientation In Tape



 User Direction of Feed

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