AiP2003
7CH Darlington Arrays

Product Specification

Specification Revision History：

Version	Data	Description
2018-11-A0	2018-11	New
2023-11-A1	2023-11	Parameter modification
2024-09-A2	2024-09	Modify the content

Contents

1、General Description

AiP2003 is high voltage, high current darlington arrays each containing seven open collector darlington pairs with common emitters.

Suppression diodes are included for inductive load driving and the inputs are pinned opposite the outputs to simplify board layout. These versatile devices are useful for driving a wide range of loads including solenoids, relays DC motors, LED displays filament lamps, stepper motor drive and high power buffers. Each channel rated at 500mA,The Darlington tube can be connected in parallel to achieve higher output current capability.

Each Darlington tube in AiP2003 is connected with a 2.7K base resistance in series. It can be directly connected with TTL/CMOS circuit at 5V working voltage, and can directly process data that originally required standard logic buffer to process.

Features:

- Output current 500mA per driver
- Output voltage 50V
- TTL/CMOS compatible inputs
- Packaging form: DIP16/SOP16/TSSOP16

Ordering Information：

Tube packing specifications:

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
AiP2003DA16.TB	DIP16	AiP2003	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
AiP2003SA16.TB	SOP16	AiP2003	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing: 1.27mm
AiP2003TA16.TB	TSSOP16	AiP2003	96 PCS/tube	200 tube/box	19200 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm

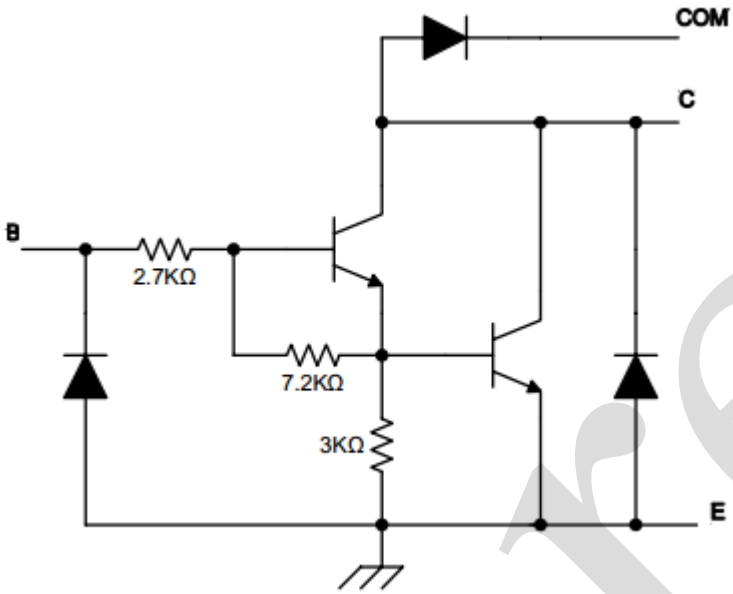
Reel packing specifications:

Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
AiP2003SA16.TR	SOP16	AiP2003	4000PCS/reel	8000PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
AiP2003TA16.TR	TSSOP16	AiP2003	5000PCS/reel	10000PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm

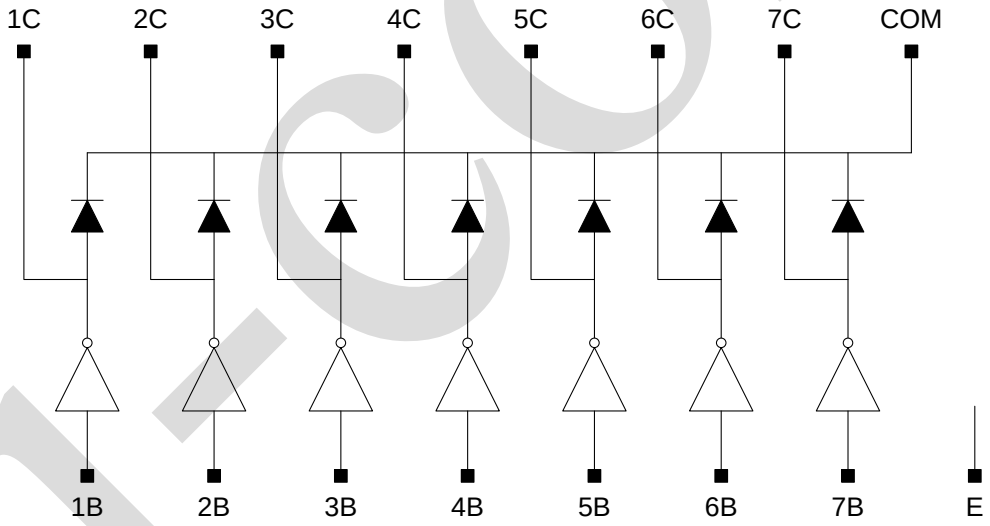
Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.

2、Block Diagram And Pin Description

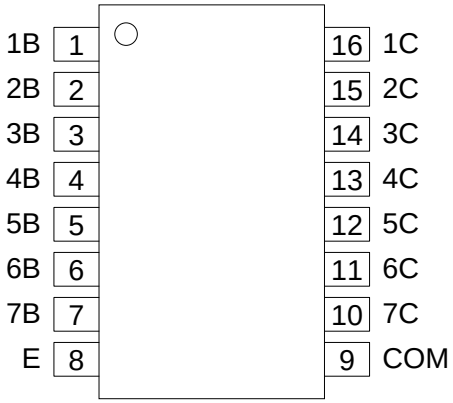
2.1、Block Diagram



Single channel



2.2、Pin Configurations



2.3、Pin Description

Pin No.	Pin Name	Description
1	1B	INPUT1
2	2B	INPUT2
3	3B	INPUT3
4	4B	INPUT4
5	5B	INPUT5
6	6B	INPUT6
7	7B	INPUT7
8	E	Ground
9	COM	Common Free Wheeling Diodes
10	7C	OUTPUT7
11	6C	OUTPUT6
12	5C	OUTPUT5
13	4C	OUTPUT4
14	3C	OUTPUT3
15	2C	OUTPUT2
16	1C	OUTPUT1

3、**Electrical** Parameter

3.1、Absolute Maximum Ratings

(T_{amb}=25℃, All voltage referenced to E, unless otherwise specified)

Characteristic		Symbol	Conditions		Value	Unit
collector-emitter voltage (1C～7C)		V_{CE}	-		-0.5 to 50	V
COM voltage		V_{COM}	-		50	V
input voltage		V_I	-		-0.5 to 30	V
collector peak current		I_{CP}	-		500	mA/ch
forward peak current of output clamp diode		I_{OK}	-		500	mA
Maximum working junction temperature (Note 2)		T_J	-		150	℃
storage temperature		T_{stg}	-		-65 to 150	℃
Thermal resistance	T	θ_{JA}	-		90	℃/W
	SOP16		-		115	
	TSSOP16		-		155	
soldering temperature		T_L	10s	DIP	245	℃
				SOP/TSSOP	260	

Note:

1、the maximum power consumption can be calculated according to the following relationship.

$$P_D = (T_j - T_A)/\theta_{JA}$$

3.2、Recommended Operating Conditions

(T_{amb}=25℃, unless otherwise specified)

Characteristic		Symbol	Conditions		Min.	Typ.	Max.	Unit
collector-emitter voltage		V_{CE}	—		0	—	50	V
COM voltage		V_{COM}	—		0	—	50	V
input voltage (1B~7B)		V_{IN}	—		0	—	24	V
output current	DIP16	I_{OUT}	T_{PW}=25ms 7 channel T_{amb}=85℃ T_J=120℃	Duty=10%	0	—	350	mA
				Duty=50%	0	—	100	
	SOP16			Duty=10%	0	—	300	
				Duty=50%	0	—	90	
	TSSOP16			Duty=10%	0	—	200	
				Duty=50%	0	—	60	
clamp diode reverse voltage		V_R	—		—	—	50	V
clamp diode forward current		I_F	—		—	—	350	mA
working temperature range		T_{amb}	—		-40	—	85	℃

3.3、Electrical characteristics

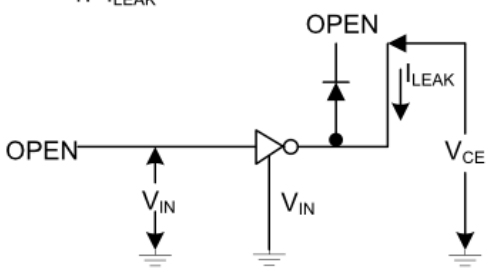
(T_{amb}=25℃, unless otherwise specified)

Parameter	Symbol	Test Circuit	Test Conditions		Min.	Typ.	Max.	Unit
collector turn off leakage current	I_{LEAK}	Circuit 1	V_{CE}=50V， V_{IN}=0V		—	—	50	uA
			V_{CE}=50V，V_{IN}=0V，T_{amb}=85℃		—	—	100	
collector Emitter Saturation Voltage	$V_{CEO(SAT)}$	Circuit2	I_{OUT}=350mA， I_{IN}=500uA		—	1.3	1.6	V
			I_{OUT}=200mA， I_{IN}=350uA		—	1.1	1.3	
			I_{OUT}=100mA， I_{IN}=250uA		—	0.9	1.1	
DC forward current Gain	h_{FE}		V_{CE}=2V, I_{OUT}=350mA		1000	-	-	-
input current	$I_{IN(ON)}$	Circuit 3	V_{IN}=2.4V， I_{OUT}=350mA		—	0.4	0.7	mA
input current	$I_{IN(OFF)}$	Circuit 4	I_{OUT}=500uA, T_{amb}=85℃		50	65	-	uA
input voltage	$V_{IN(ON)}$	Circuit 5	V_{CE}=2V	I_{OUT}=350mA	—	—	2.4	V
				I_{OUT}=200mA	—	—	2.0	
clamp diode leakage current	I_R	Circuit 6	V_R=50V, T_{amb}=25℃		-	-	50	uA
clamp diode forward voltage	V_F	Circuit 7	I_R=350mA		-	-	2.0	V
input capacitance	C_{IN}	-	-		-	15	-	pF
opening delay	t_{ON}	Circuit 8	V_{OUT}=50V, R_L=125Ω, C_L=15pF		-	100	-	ns
turn off delay	t_{OFF}		V_{OUT}=50V, R_L=125Ω, C_L=15pF		-	200	-	

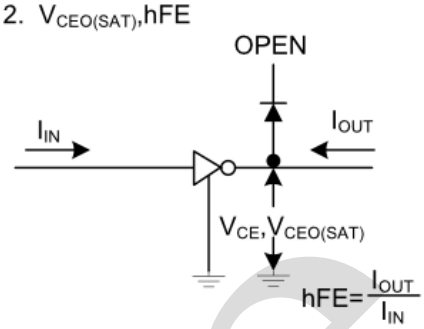
4、Testing Circuit

4.1、DC Testing Circuit

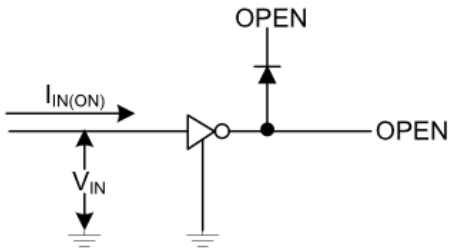
1. I_{LEAK}



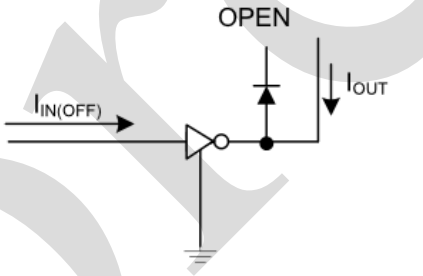
2. $V_{CEO(SAT)}$,hFE



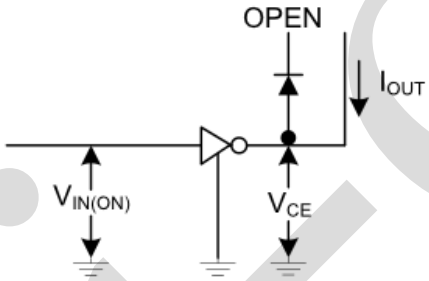
3. $I_{IN(ON)}$



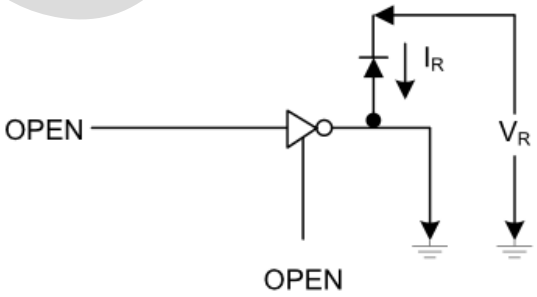
4. $I_{IN(OFF)}$



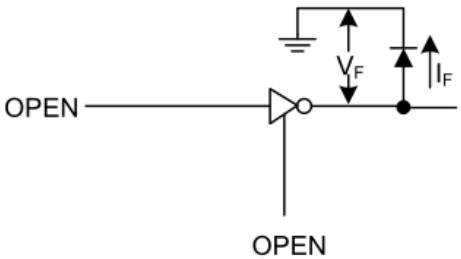
5. $V_{IN(ON)}$



6. I_R

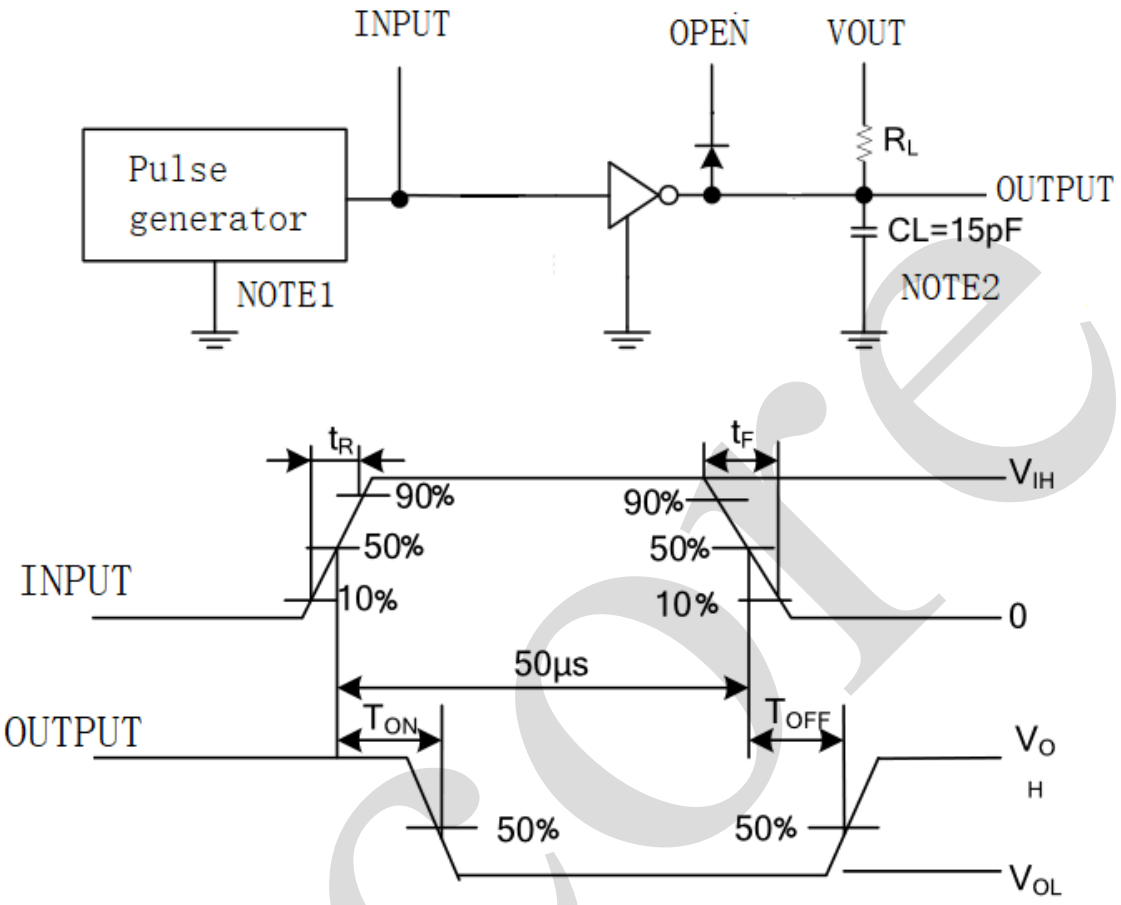


7. V_F



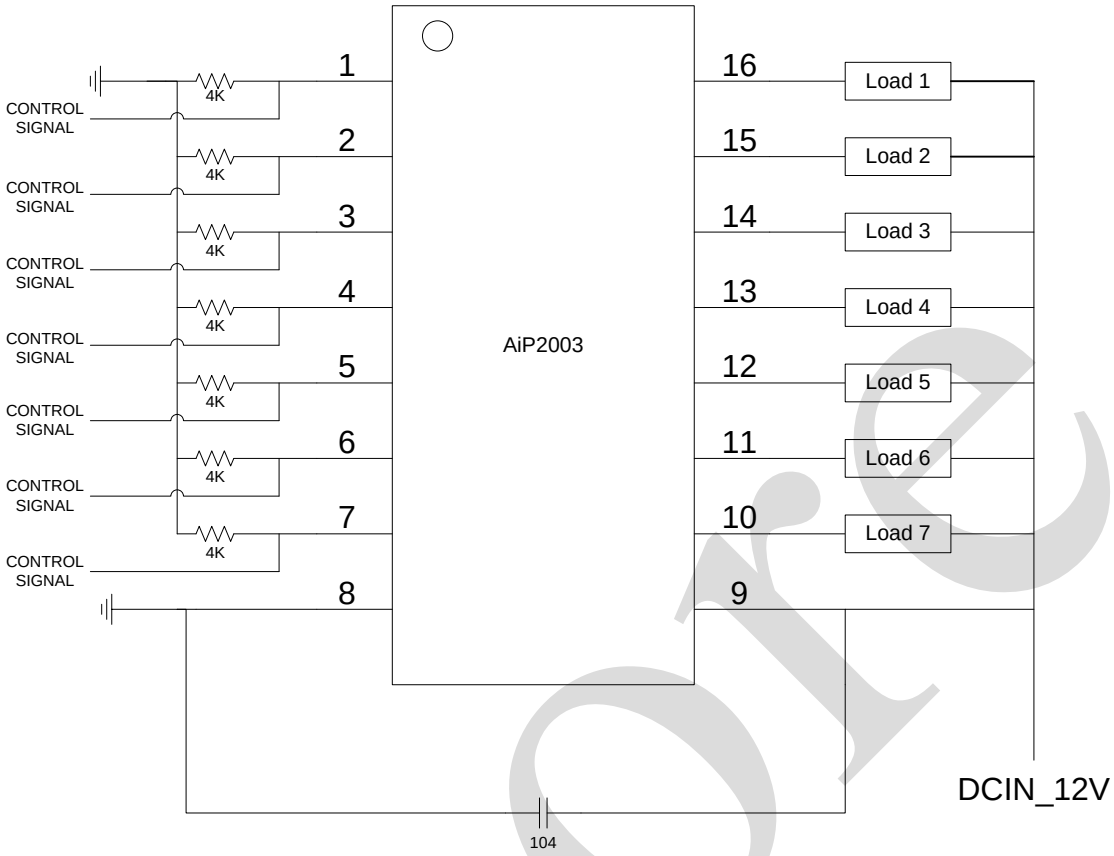
4.2、AC Testing Circuit

8. t_{ON}, t_{OFF}



Note 1: pulse width 50uS, duty cycle 10%, output impedance 50 ohm, t_R<=5ns, t_F<=10ns input voltage 3V
Note 2: C_L includes probes and capacitors on the fixture.

5、Typical Application Circuit



6、Application Note

Note1:There is no overcurrent and overvoltage protection inside the circuit.

if the applied situation includes overcurrent、overvoltage,AiP2003 may bedestroyed.

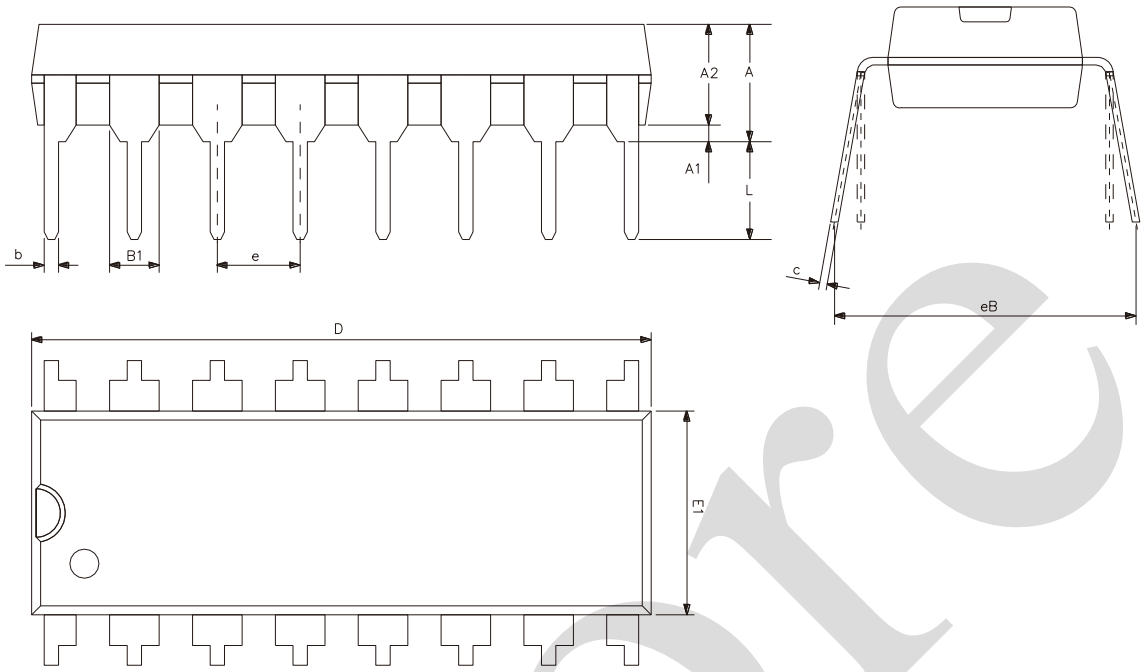
So we should take care of the application with this IC.

Note2:When it is applied with a general logic circuit such as TTL or COMS, pull-down resistors should be connected in series to avoid misoperation.

Note3:The COM pin should be shorted to the power supply to protect the IC from extra swing voltage.

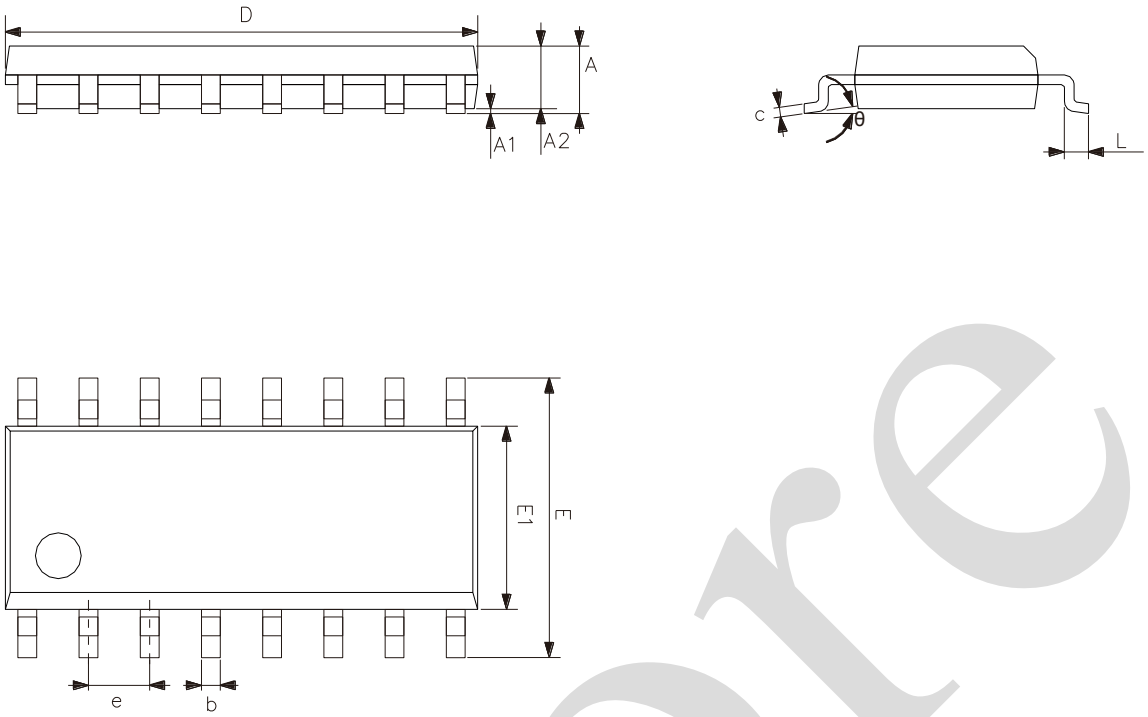
7、Package Information

7.1、DIP16



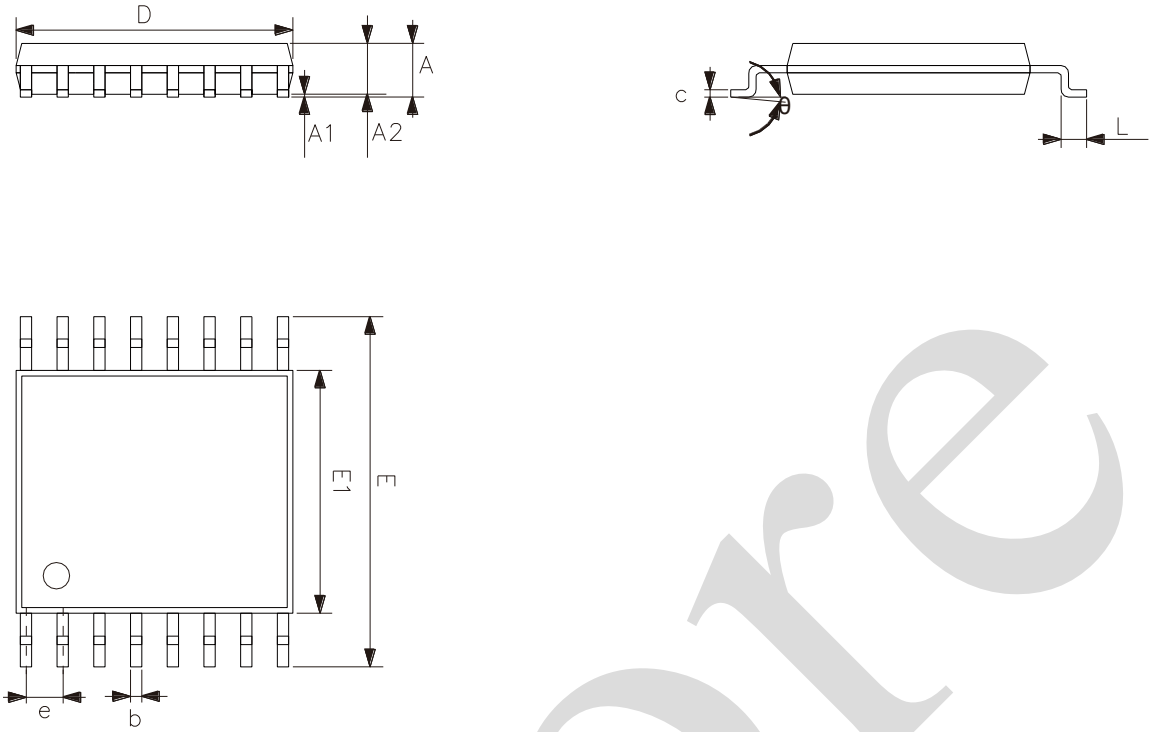
Symbol	Dimensions (mm)	
	Min.	Max.
A2	3.20	3.60
A1	0.51	—
A	3.60	5.33
L	3.00	—
b	0.36	0.56
B1	1.52	
D	18.80	19.94
E1	6.20	6.60
e	2.54	
c	0.20	0.36
eB	7.62	9.30

7.2、SOP16



Symbol	Dimensions (mm)	
	Min.	Max.
A	1.35	1.80
A1	0.10	0.25
A2	1.25	1.55
b	0.33	0.51
c	0.19	0.25
D	9.50	10.10
E	5.80	6.30
E1	3.70	4.10
e	1.27	
L	0.35	0.89
θ	0°	8°

7.3、TSSOP16



Symbol	Dimensions (mm)	
	Min.	Max.
A	—	1.20
A1	0.05	0.15
A2	0.80	1.05
b	0.19	0.30
c	0.09	0.20
D	4.90	5.10
E1	4.30	4.50
E	6.20	6.60
e	0.65	
L	0.45	0.75
θ	0°	8°

8、Statements And Notes

8.1、The name and content of Hazardous substances or Elements in the product

Part name	Hazardous substances or Elements									
	Lead and lead compounds	Mercury and mercury compounds	Cadmium and cadmium compounds	Hexavalent chromium compounds	Polybrominated biphenyls	Polybrominated biphenyl ethers	Dibutyl phthalate	Butylbenzyl phthalate	Di-2-ethylhexyl phthalate	Diisobutyl phthalate
Lead frame	○	○	○	○	○	○	○	○	○	○
Plastic resin	○	○	○	○	○	○	○	○	○	○
Chip	○	○	○	○	○	○	○	○	○	○
The lead	○	○	○	○	○	○	○	○	○	○
Plastic sheet installed	○	○	○	○	○	○	○	○	○	○
explanation	○：Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard. ×：Indicates that the content of hazardous substances or elements exceeding the SJ/T11363-2006 Standard limit requirements.									

8.2、Notes

We recommend you to read this chapter carefully before using this product.

The information in this chapter is provided for reference only and i-Core disclaims any express or implied warranties, including but not limited to applicability, special application or non-infringement of third party rights.

This product is not suitable for critical equipment such as life-saving, life-sustaining or safety equipment. It is also not suitable for applications that may result in personal injury, death, or serious property or environmental damage due to product malfunction or failure. I-Core will not be liable for any damages incurred by the customers at their own risk for such applications.

The customer is responsible for conducting all necessary tests i-Core's application to avoid failure in the application or the application of the customer' s third party users. I-Core does not accept any liability.

The Company reserves the right to change or improve the information published in this chapter at any time. The information in this chapter are subject to change without notice. We recommend the customer to consult our sales staff before purchasing.

Please obtain related materials form i-Core's regular channels and we are not responsible for its content if it is provided by sources other than our company.

In case of any conflict between the Chinese and English version, the version is subject to the Chinese one.