



AiP2119

90V 3-Phase Bridge Driver

Product Specification

Specification Revision History:

Version	Date	Description
2021-08-A1	2021-08	New
2022-10-A2	2022-10	Modify the tube packing specifications of TSSOP24; add pin description, thermal resistance and power dissipation of QFN24
2023-05-B1	2023-05	Update the template
2023-11-B2	2023-11	Modify ordering information



Contents

1、General Description.....	3
2、Block Diagram And Pin Description	5
2.1、Block Diagram	5
2.2、Pin Configurations.....	6
2.3、Pin Description.....	7
3、Electrical Parameter	8
3.1、Absolute Maximum Ratings.....	8
3.2、Recommended Operating Conditions	8
3.3、Electrical Characteristics	9
3.3.1、DC Characteristics.....	9
3.3.2、AC Characteristics.....	10
4、AC Characteristics Waveforms.....	11
5、Typical Application Circuit And Application Note.....	12
5.1、Application Circuit.....	12
6、Package Information	13
6.1、TSSOP20.....	13
6.2、TSSOP24.....	14
6.3、QFN24.....	15
7、Statements And Notes	16
7.1、The name and content of Hazardous substances or Elements in the product.....	16
7.2、Notes	16



1、General Description

The AiP2119 is a high-speed 3-phase gate driver for power MOSFET and IGBT devices with three independent high and low side referenced output channels. Built-in dead time protection and shoot-through protection prevent damage to the half-bridge. The UVLO circuits prevent malfunction when V_{CC} and V_{BS} are lower than the specified threshold voltage. A novel high-voltage BCD process and common-mode noise canceling technique provide stable operation of high-side drivers under high dV/dt noise conditions while achieving excellent negative transient voltage tolerance. An enable pin (ENB) is included so that standby mode may be used to set the chip into a low quiescent current state to realize long battery lifetime.

Features:

- Integrated 90V half-bridge high side driver
- Built-in dead time protection
- Shoot-through protection
- Under voltage lockout for V_{CC} and V_{BS}
- 3.3V, 5V and 15V input logic compatible
- Enable pin (ENB) for low standby current
- I_{O+}/I_{O-} : 1200mA/2000mA
- Dead time: 0.5us (typical)
- Common-mode dV/dt noise cancellation circuit
- Tolerant of negative transient voltage
- Low dI/dt gate drive for better noise immunity
- Specified from -40°C to $+85^{\circ}\text{C}$
- Packaging information: TSSOP20/TSSOP24/QFN24

**Ordering Information:****Tube packing specifications:**

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
AiP2119TA20.TB	TSSOP20	AiP2119	70 PCS/tube	200 tube/box	14000 PCS/box	Dimensions of plastic enclosure: 6.5mm×4.4mm Pin spacing: 0.65mm
AiP2119TA24.TB	TSSOP24	AiP2119	62 PCS/tube	200 tube/box	12400 PCS/box	Dimensions of plastic enclosure: 7.8mm×4.4mm Pin spacing: 0.65mm
AiP2119QB24.TB	QFN24	AiP2119	490 PCS/plate	10 plate/box	4900 PCS/box	Dimensions of plastic enclosure: 4.0mm×4.0mm Pin spacing:0.5mm

Reel packing specifications:

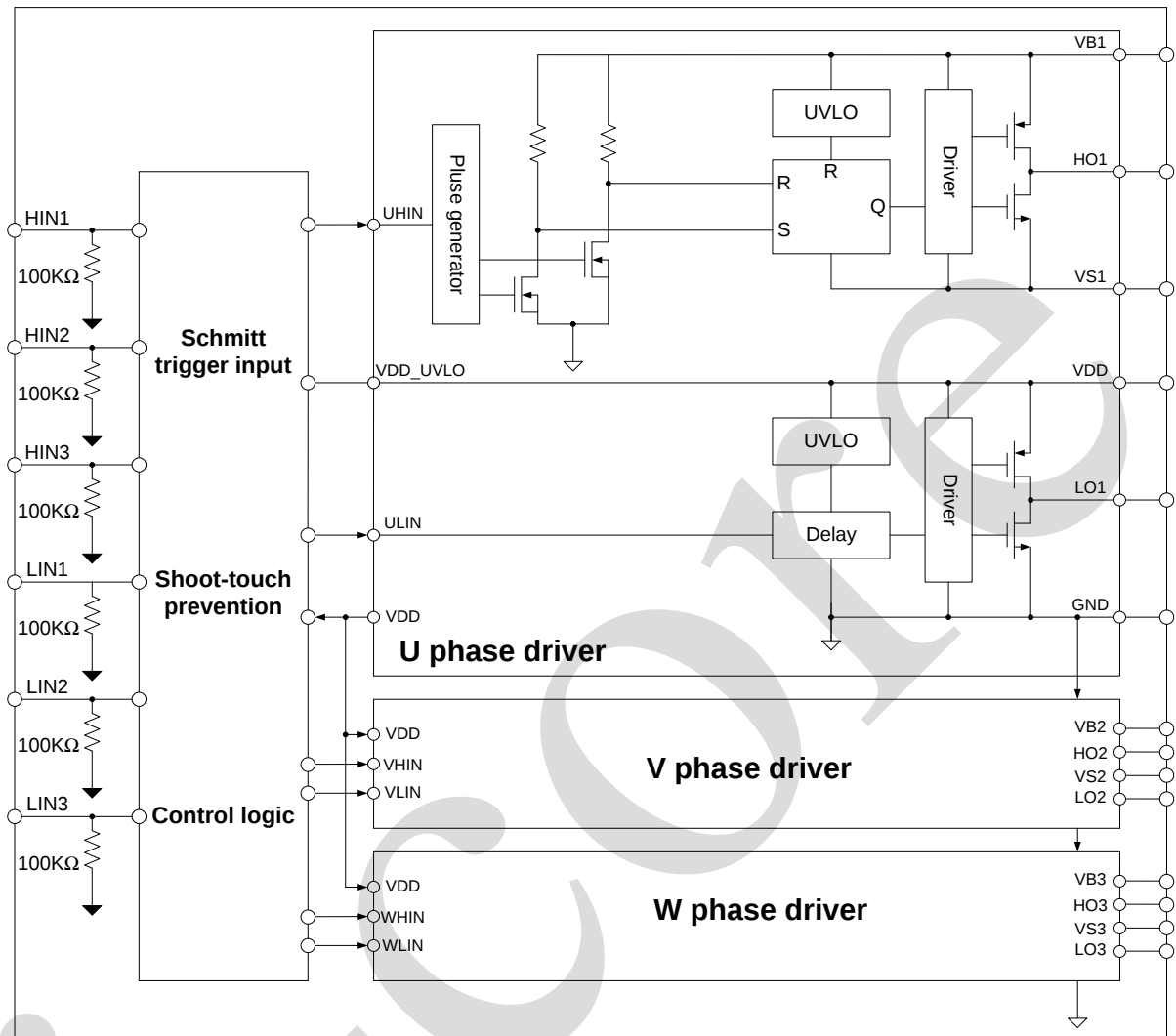
Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
AiP2119TA20.TR	TSSOP20	AiP2119	4000PCS/reel	8000PCS/box	Dimensions of plastic enclosure: 6.5mm×4.4mm Pin spacing:0.65mm
AiP2119TA24.TR	TSSOP24	AiP2119	4000PCS/reel	8000PCS/box	Dimensions of plastic enclosure: 7.8mm×4.4mm Pin spacing: 0.65mm
AiP2119QB24.TR	QFN24	AiP2119	1000PCS/reel	5000PCS/box	Dimensions of plastic enclosure: 4.0mm×4.0mm Pin spacing:0.5mm

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



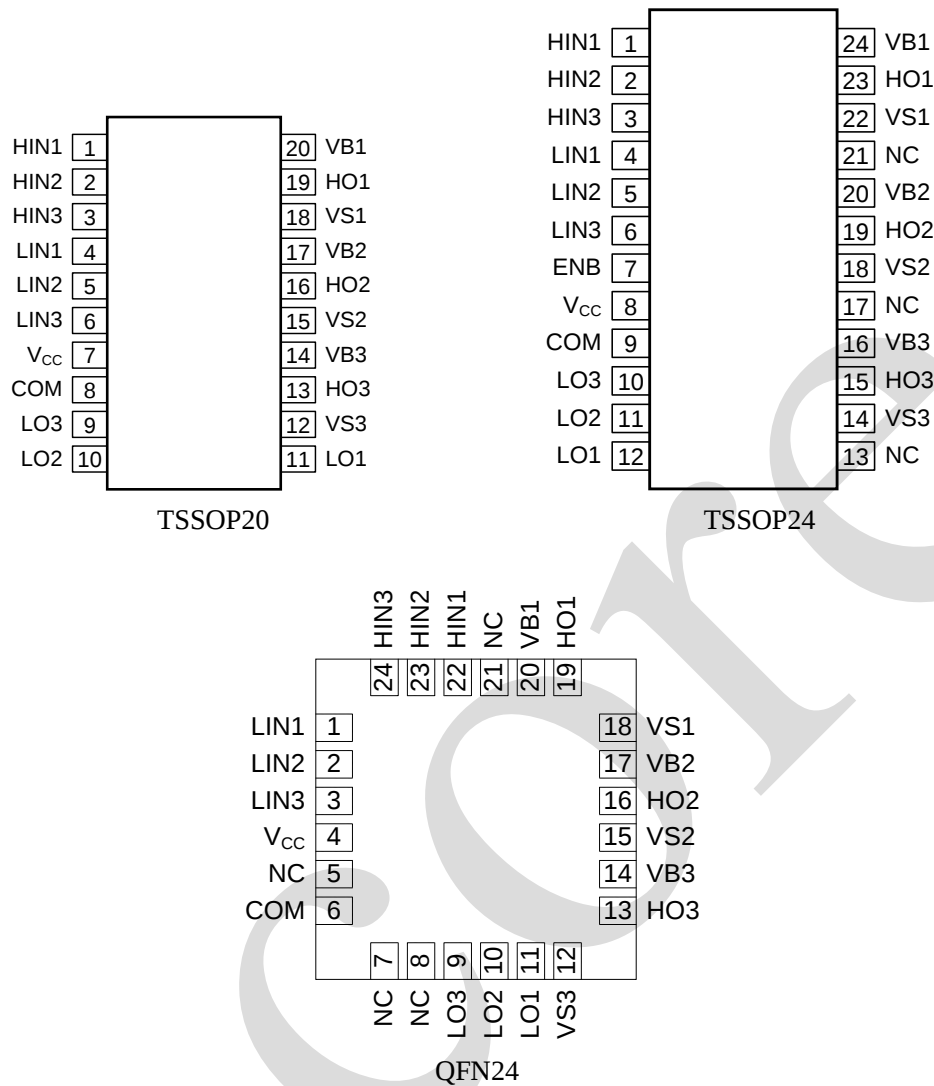
2、Block Diagram And Pin Description

2.1、Block Diagram





2.2、Pin Configurations





2.3、Pin Description

Pin No.			Pin Name	Description
TSSOP20	TSSOP24	QFN24		
1	1	22	HIN1	logic input for phase-1 high-side gate driver
2	2	23	HIN2	logic input for phase-2 high-side gate driver
3	3	24	HIN3	logic input for phase-3 high-side gate driver
4	4	1	LIN1	logic input for phase-1 low-side gate driver
5	5	2	LIN2	logic input for phase-2 low-side gate driver
6	6	3	LIN3	logic input for phase-3 low-side gate driver
-	7	-	ENB	standby mode enable control
7	8	4	V _{CC}	logic and low-side gate drivers power supply voltage
8	9	6	COM	logic ground and low-side gate drivers ground
9	10	9	LO3	phase-3 low-side gate driver output
10	11	10	LO2	phase-2 low-side gate driver output
11	12	11	LO1	phase-1 low-side gate driver output
12	14	12	VS3	phase-3 high-side driver floating supply offset voltage
13	15	13	HO3	phase-3 high-side driver output
14	16	14	VB3	phase-3 high-side driver floating supply
15	18	15	VS2	phase-2 high-side driver floating supply offset voltage
16	19	16	HO2	phase-2 high-side driver output
17	20	17	VB2	phase-2 high-side driver floating supply
18	22	18	VS1	phase-1 high-side driver floating supply offset voltage
19	23	19	HO1	phase-1 high-side driver output
20	24	20	VB1	phase-1 high-side driver floating supply
-	13, 17, 21	5, 7, 8, 21	NC	not connected



3、Electrical Parameter

3.1、Absolute Maximum Ratings

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

Characteristic	Symbol	Conditions	Min.	Max.	Unit
low-side supply voltage	V _{CC}	-	-0.3	18	V
high-side floating supply voltage	V _{B1,2,3}	-	-0.3	90	V
high-side floating supply offset voltage	V _{S1,2,3}	-	V _{B1,2,3} -20	V _{B1,2,3} +0.3	V
high-side gate driver output voltage	V _{HO1,2,3}	-	V _{S1,2,3} -0.3	V _{S1,2,3} +0.3	V
low-side gate driver output voltage	V _{LO1,2,3}	-	COM-0.3	V _{CC} +0.3	V
logic input voltage	V _{HIN1,2,3} V _{LIN1,2,3} ENB	-	-0.3	18	V
allowable offset voltage slew rate	dV/dt	-	-	50	V/ns
thermal resistance (junction to ambient)	R _{thJA}	TSSOP20	-	100	°C/W
		TSSOP24	-	94	°C/W
		QFN24	-	45	°C/W
power dissipation	P _D	TSSOP20	-	1.2	W
		TSSOP24	-	1.3	W
		QFN24	-	2.0	W
storage temperature	T _{stg}	-	-40	+150	°C
soldering temperature	T _L	10s	-	260	°C

Note: P_D and R_{thJA} are guaranteed by design.

3.2、Recommended Operating Conditions

Characteristic	Symbol	Min.	Typ.	Max.	Unit
low-side supply voltage	V _{CC}	5.5	-	16	V
high-side floating supply voltage	V _{B1,2,3}	V _{S1,2,3} +5.5	-	V _{B1,2,3} +16	V
high-side floating supply offset voltage	V _{S1,2,3}	COM-6	-	60	V
high-side gate driver output voltage	V _{HO1,2,3}	V _S	-	V _B	V
low-side gate driver output voltage	V _{LO1,2,3}	COM	-	V _{CC}	V
logic input voltage	V _{HIN1,2,3} V _{LIN1,2,3} ENB	0	-	5	V
operating temperature	T _{amb}	-40	-	+85	°C



3.3、Electrical Characteristics

3.3.1、DC Characteristics

($V_{CC}-COM$)=(V_B-V_S)=15V, $T_{amb}=25^{\circ}C$, unless otherwise specified. The $V_{IN,TH}$, V_I and I_{IN} parameters are referenced to COM and are applicable to all channels. The V_O and I_O parameters are referenced to COM and are applicable to the respective output leads. The V_{CCUV} parameters are referenced to, COM. The V_{BSUV} parameters are referenced to V_S .

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Low Side Power Supply Characteristics						
quiescent V_{CC} supply current	I_{QVCC1}	$V_{HIN1,2,3}=V_{LIN1,2,3}=0$ or 5V $V_{ENB}=0$	210	370	550	μA
quiescent V_{CC} supply current in standby mode	I_{QVCC2}	$V_{HIN1,2,3}=V_{LIN1,2,3}=0$ or 5V $V_{ENB}=5$	-	46	80	μA
operating V_{CC} supply current	I_{VCCOP}	$f_{LIN1,2,3}=20KHz$ $f_{HIN1,2,3}=20KHz$	-	1500	-	μA
V_{CC} supply under-voltage lockout positive going threshold voltage	V_{CCUV}	-	2.9	4.2	5.5	V
High Side Floating Power Supply Characteristics						
high side V_{BS} supply under-voltage lockout positive going threshold voltage	V_{BSUV}	-	2.5	3.8	5.5	V
high side quiescent V_{BS} supply current	I_{QBS}	$V_{BS}=15V$	15	45	75	μA
high side leakage current	I_{LK}	$V_B=V_S=100V$, $V_{CC}=0V$	-	-	10	μA
Logic Input Characteristics						
HIN1,2,3, LIN1,2,3 and ENB logic “1” voltage	V_{IH}	-	2.5	-	-	V
HIN1,2,3, LIN1,2,3 and ENB logic “0” voltage	V_{IL}	-	-	-	0.8	V
input positive threshold voltage	$V_{IN,TH+}$	-	-	1.9	-	V
input negative threshold voltage	$V_{IN,TH-}$	-	-	1.4	-	V
logic “1” input bias current	I_{IN+}	$V_{IN}=5V$	-	50	-	μA
logic “0” input bias current	I_{IN-}	$V_{IN}=0$	-	0	-	μA
Gate Driver Output Characteristics						
high side driver output HIGH short current	I_{HO+}	$V_{HO}=V_S=0$	-	1.2	-	A
high side driver output LOW short current	I_{HO-}	$V_{HO}=V_B=15V$	-	2.0	-	A
low side driver output HIGH short current	I_{LO+}	$V_{LO}=0$	-	1.2	-	A
low side driver output LOW short current	I_{LO-}	$V_{LO}=V_{CC}=15V$	-	2.0	-	A



allowable negative VS voltage for HIN signal propagation to HO	V_{SN}	$V_{BS}=15V$	-	-8	-	V
--	----------	--------------	---	----	---	---

3.3.2、AC Characteristics

($T_{amb}=25^{\circ}C$, $(V_{CC}-COM)=(V_B-V_S)=15V$, $V_{S1,2,3}=COM$, $C_{load}=1nF$, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
turn-on propagation delay	t_{on}	$V_{HIN1,2,3}$ or $V_{LIN1,2,3}=5V$, $V_{S1,2,3}=0$	-	120	200	ns
turn-off propagation delay	t_{off}	$V_{HIN1,2,3}$ or $V_{LIN1,2,3}=0$, $V_{S1,2,3}=0$	-	120	200	ns
turn-on rise time	t_r	$V_{HIN1,2,3}$ or $V_{LIN1,2,3}=5V$, $V_{S1,2,3}=0$	-	37	-	ns
turn-off fall time	t_f	$V_{HIN1,2,3}$ or $V_{LIN1,2,3}=0$, $V_{S1,2,3}=0$	-	30	-	ns
dead time	DT	$V_{HIN1,2,3}$ or $V_{LIN1,2,3}=0$ and 5V, without external dead time	300	500	700	ns
six channels dead time matching	MDT	without external dead time	-	-	50	ns
six channels delay matching	MT	external dead time>1000ns	-	-	50	ns
output pulse width matching	PM	external dead time>1000ns, $PW_{IN}=10\mu s$, $PM=PW_{OUT}-PW_{IN}$	-	-	50	ns
ENB input filter time	$t_{FLT,ENB}$	$V_{ENB}=0$ and 5V	-	450	-	ns
ENB input HIGH to HO/LO turn-off delay time	$t_{off,ENB}$	$V_{ENB}=5V$	-	0.55	-	us
ENB input LOW to HO/LO turn-on delay time	$t_{on,ENB}$	$V_{ENB}=0V$	-	6	-	us



4、AC Characteristics Waveforms

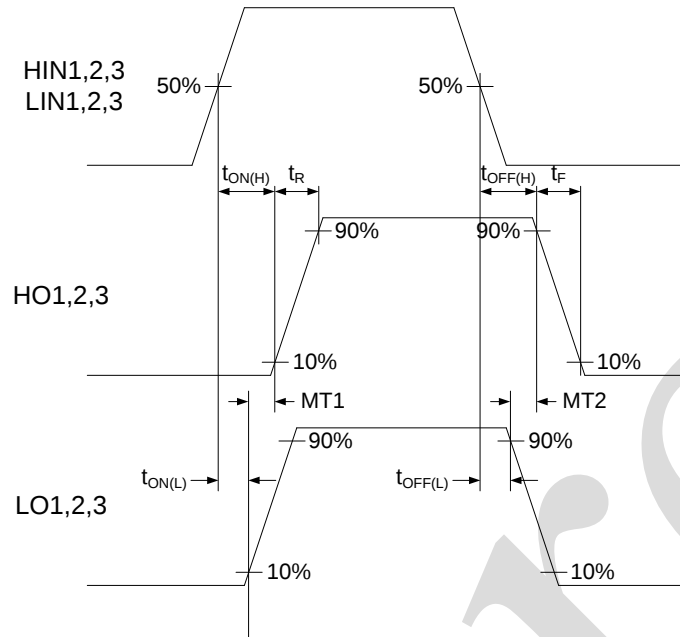


Figure 1. Switching time definition

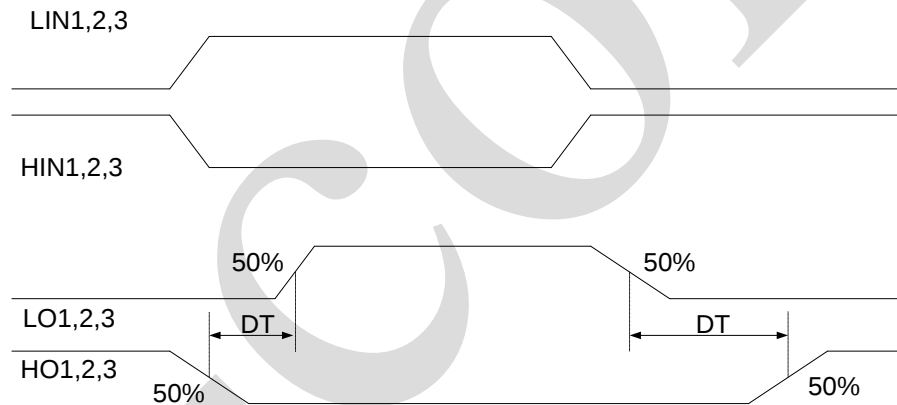


Figure 2. Dead time protection

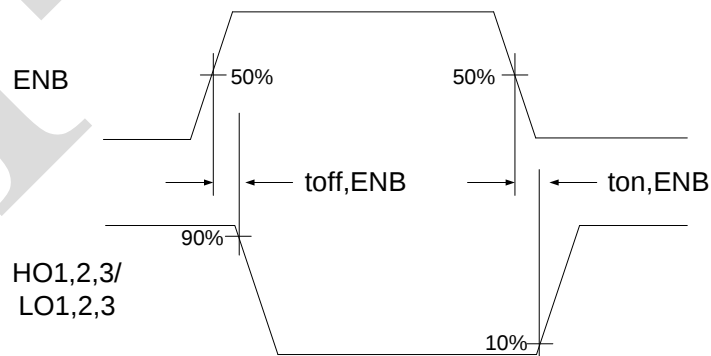
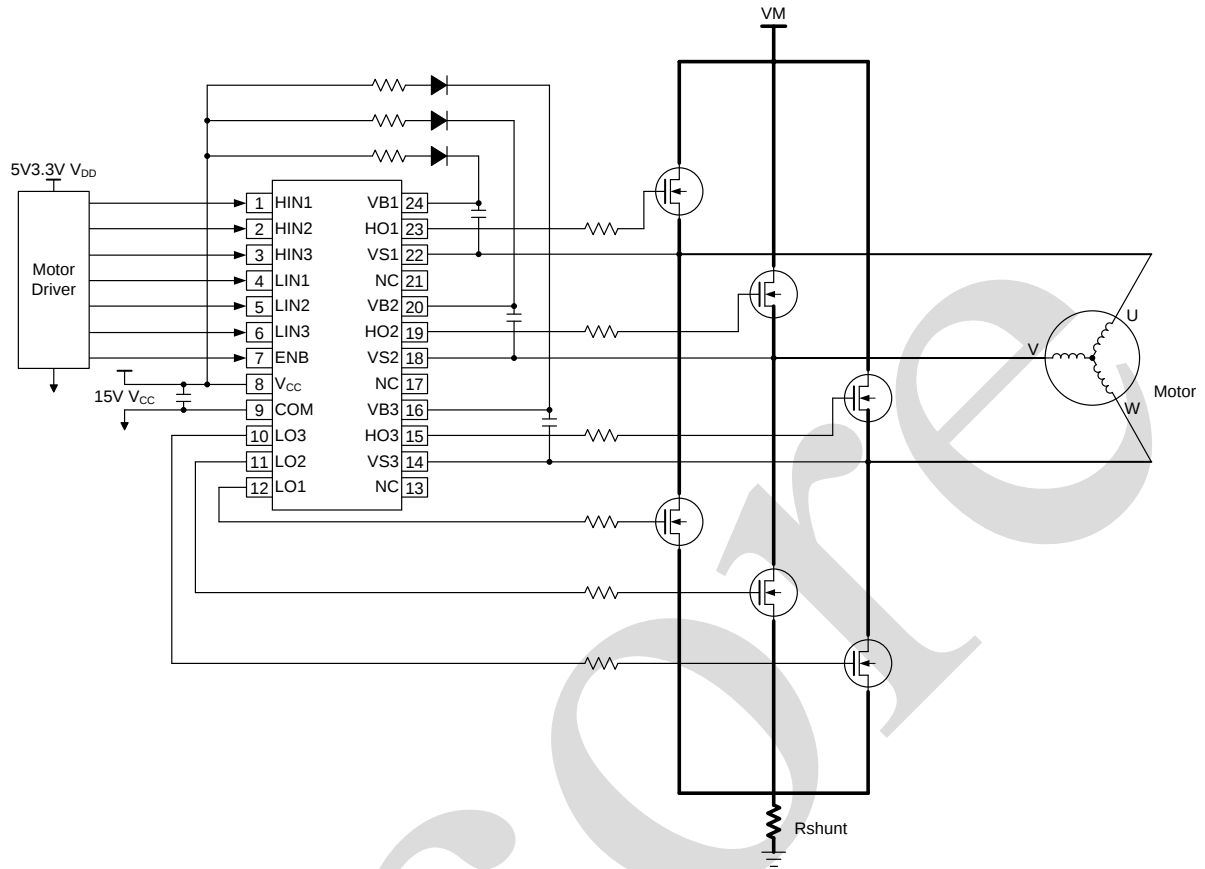


Figure 3. ENB ON/OFF waveform



5、Typical Application Circuit And Application Note

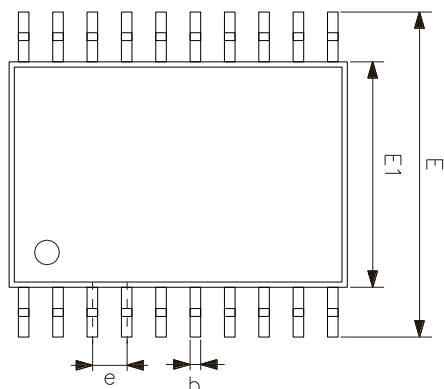
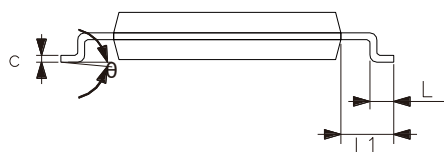
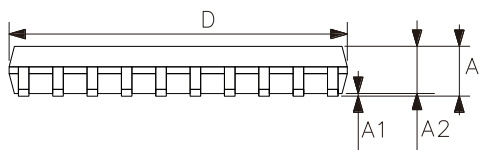
5.1、Application Circuit





6、Package Information

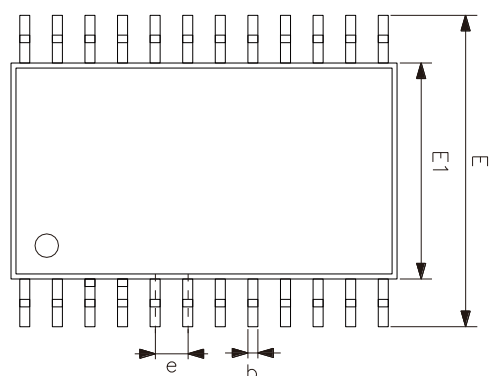
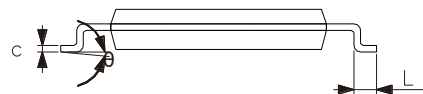
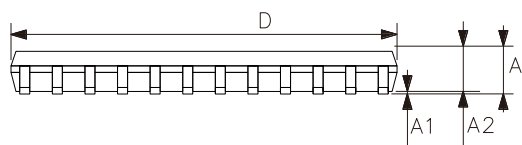
6.1、TSSOP20



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	6.40	6.60
E1	4.30	4.50
E	6.20	6.60
e	0.65	
L	0.45	0.75
L1	1.00	
θ	0°	8°



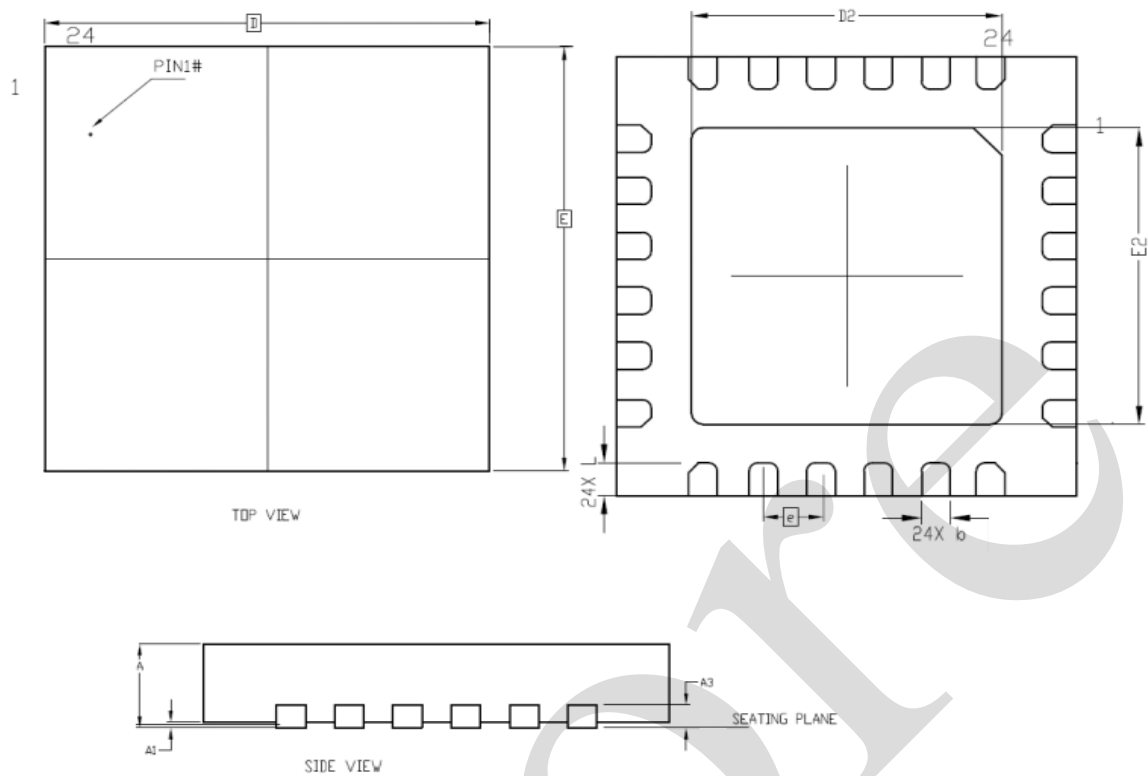
6.2、TSSOP24



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	7.70	7.90
E	6.20	6.60
E1	4.30	4.50
e	0.65	
L	0.45	0.75
θ	0°	8°



6.3、QFN24



Symbol	Dimensions (mm)	
	Min.	Max.
A	0.70	0.80
A1	0	0.05
A3	0.20	
b	0.20	0.30
D	4.00	
E	4.00	
D2	2.60	2.80
E2	2.60	2.80
e	0.50	
L	0.25	0.35



7、Statements And Notes

7.1、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.									

7.2、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 from 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.