

5+1CH serial input motor driver IC for DSC

Features

- Built-in 4 full-swing/constant voltage drivers switched by serial control with brake function
- Built-in 2 constant current drivers for shutter or IRIS
- Low on-resistance (1.2Ω , sum of on-resistance of up side and bottom side)
- Output current : $I_{OUT} \leq 0.8A(\text{max.})$ for each channel
- Built-in thermal shutdown (TSD, 150°C)
- Built-in CC mode weak excitation
- CH1/2 corresponds to STM control of 2-2 phase or 1-2 phase
- Built-in exclusive control mode: CH13/23 → the combination control mode of 6CH is set
- All power supply systems (VCC, VM12, VM3, VM45) can be set up with an independent power supply
- Power save mode corresponds by serial control setup
- PI (photo interrupter drive) 3 channel built-in.
- Small 32TQFN (4×4mm) is adopted

Applications

Stepping motor driver/ DC motor driver for DSC

General Description

G2028 is a 5+1-channel H-Bridge motor drivers IC for the digital camera and so on. It has four full-swing/constant voltage drivers and two full-swing/constant current drivers. G2028 can be operated in serial control mode or partial exterior control mode. When operating in partial exterior control mode, the mode of each CH is fixed by initial serial control setting. When operating in serial control mode, the mode of each driver can be setting by serial control.

Ordering Information

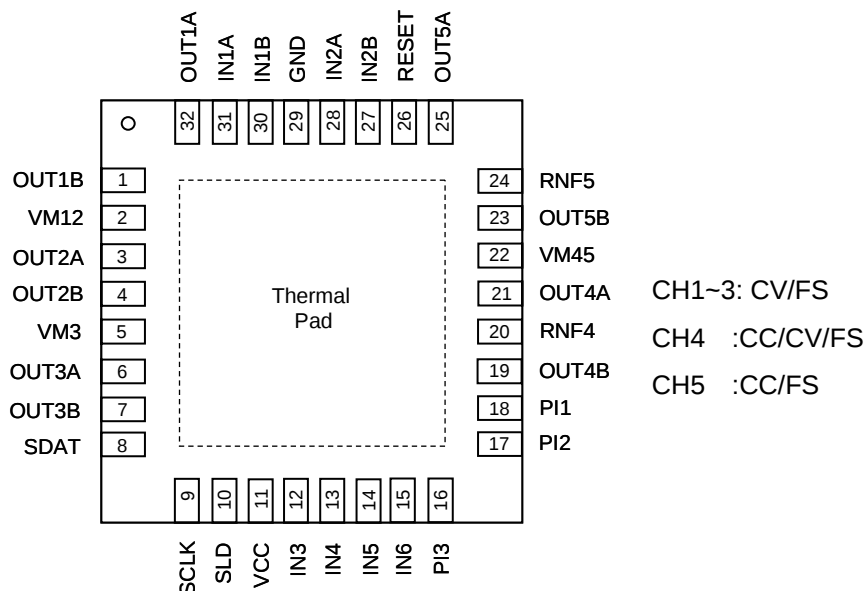
ORDER NUMBER	MARKING	TEMP. RANGE	PACKAGE (Green)
G2028K11U	2028	-20°C to $+85^\circ\text{C}$	TQFN4X4-32

Note: K1: TQFN4X4-32

1: Bonding Code

U: Tape & Reel

Pin Configurations



G2028 TQFN4X4-32

Note: Recommend connecting the Thermal Pad to the Ground for excellent power dissipation.

Absolute Maximum Ratings

Supply Voltage VCC.(VCC) -0.5V to 6.5V
 Supply Voltage VM12, VM3, VM45 (VM) . . -0.5V to 6.5V
 H-Bridge Output Voltage (VOUT) 6.5V
 Control Input Voltage (VIN) -0.5V to VCC
 Direct Current (Iod) 600mA/CH
 Instantaneous Output Current (Iop) 800mA/CH
 Thermal Resistance Junction to Ambient, (θ_{JA})*
 TQFN4X4-32. 54°C/W
 Continuous Power Dissipation ($T_A=25^{\circ}\text{C}$)*
 TQFN4X4-32 2.3W
 Operating Temperature (Topr) -20°C to +85°C
 Junction Temperature (Tj) +150°C

Storage Temperature range (Tstg) -55°C to +150°C
 Minimum ESD Rating (Human Body Model) (V_{ESD}) . 2kV

Recommended Operating Conditions

Supply Voltage VCC (VCC) +2.5V to +6.0V
 Supply Voltage VM12, VM3, VM45 (VM)+2.9V to +6.0V
 Control Input Voltage (VIN) 0V to VCC
 H-Bridge Output Current (IOUT) . . -400mA to +400mA
 H-Bridge Output Voltage (VOUT) 6.0V
 Logic Input Frequency (Fin) 0kHz to 100kHz

* Please refer to Minimum Footprint PCB Layout Section.

1. Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
2. Device is ESD sensitive. Handling precaution recommended. The Human Body model is a 100pF capacitor discharged through a 1.5K Ω resistor into each pin.
3. Supply voltage VCC, VM12, VM3, and VM45 at 6.0V~6.5V may have EOS possibility.

Electrical Characteristics

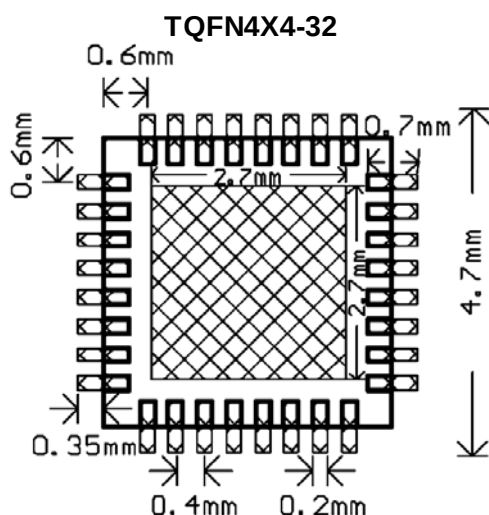
($T_A=+25^{\circ}\text{C}$, VCC = 3.3V, VM=5.0.)

The device is not guaranteed to function outside its operating conditions. Parameters with MIN and/or MAX limits are 100% tested at +25°C, unless otherwise specified.

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Power Supply Current						
VCC Stand by Current	ICCST	RESET=L, PS=L, all input pin open	---	0	5.0	μA
VM Stand by Current	IMST	RESET=L, PS=L (VM12+VM3+VM45)	---	0	5.0	μA
Operate Circuit Current	ICC	RESET=H, PS=H, all CH driver operate	---	0.6	2.0	mA
	IM	ON, PI1~PI3 ON, all input pin open, no load	---	0.6	2.0	mA
Serial Input PIN: SLD, SCLK, SDAT						
H Level Input Voltage	VSIH		2.0	---	---	V
L Level Input Voltage	VSIL		---	---	0.8	V
H Level Input Current	ISIH		---	5	20	μA
Pull-down Resistance	RIN		---	1	---	M Ω
Control Input PIN: IN1A, IN1B, IN2A, IN2B, IN3, IN4, IN5, IN6, RESET						
H Level Input voltage	VINH		2.0	---	---	V
L Level Input voltage	VINL		---	---	0.8	V
H Level Input current	INH		---	5	20	μA
Pull-down Resistance	RIN		---	1	---	M Ω
Low-Voltage Detection						
VCC UVLO	UVLO	falling	1.8	2.0	2.2	V

Electrical Characteristics (continued)

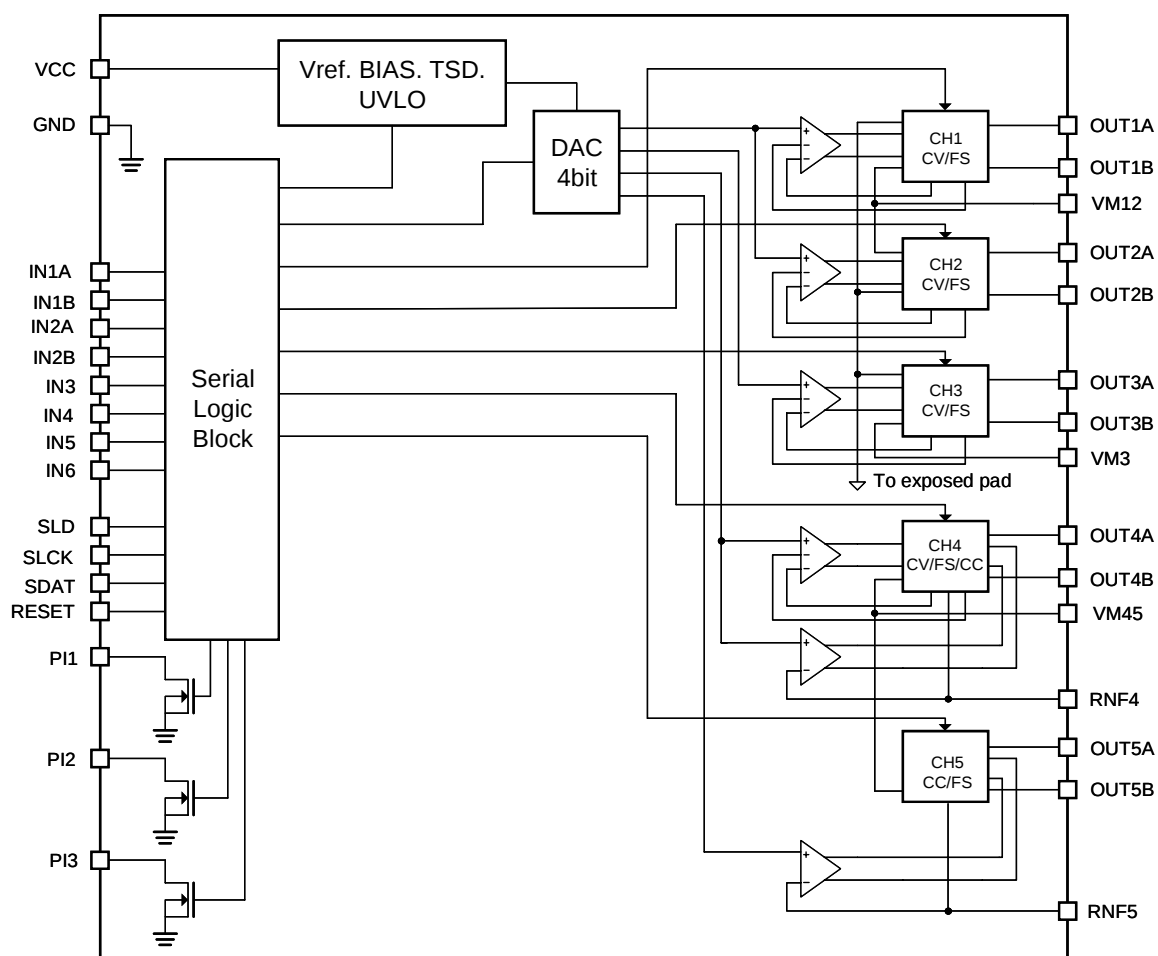
PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
CH1-CH4						
Output ON Resistance 1	RON1	At VM=5V, I _{OUT} =100mA, Sum of on-resistance	---	1.2	1.6	Ω
Output ON Resistance 2	RON2	At VM=3V, I _{OUT} =100mA, Sum of on-resistance	---	1.5	2.0	Ω
Output Constant Voltage	VOUT	DAC accuracy with no load between output and GND	-5.0	0	5.0	%
Constant Current Driver CH4, CH5						
Output ON Resistance 1	RON1	I _{OUT} =100mA, RNF=0V, VM=5V	---	1.2	1.6	Ω
Output ON Resistance 2	RON2	I _{OUT} =100mA, RNF=0V, VM=3V	---	1.5	2.0	Ω
Constant current precision	IOUT	RNF=1Ω, RM=5Ω, DAC=200mV	190	200	210	mA
RNF Output Voltage 1	VRNF1	RNF=1Ω DAC accuracy 300mV	-5.0	0	5.0	%
RNF Output Voltage 2	VRNF2	RNF=1Ω DAC accuracy 150mV	-6.6	0	6.6	%
Serial Control						
SCLK Frequency	fsclk		---	5.0	6.2	MHz
SLD Setup Time	Tsets		200	---	---	nS
SLD Hold Time	Tholds		100	---	---	nS
SLD Negate Time	Tnegs		200	---	---	nS
SDAT Setup Time	Tsetd		60	---	---	nS
SDAT Hold Time	Thold		20	---	---	nS
PI Driver						
On Voltage	VPION	I _{OUT} =30mA	---	0.2	0.4	V
Leakage current when OFF	Ioff	VCC ≥ P _I OUT	-2.0	0	2.0	μA
TSD						
Thermal Shut Down Temperature	TTSD	Tip temperature in case H-bridge output turns OFF	---	150	---	°C
Note: Temperature Hysteresis 30°C						

Minimum Footprint PCB Layout Section


Pin Description

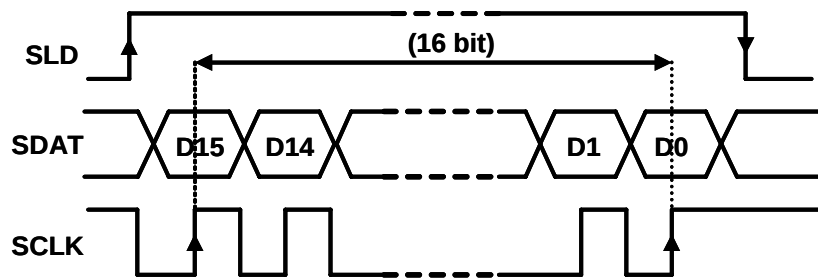
Pin NO.	Symbol	I/O	Description
1	OUT1B	O	CH1 H-bridge output terminal 1B of CV/FS
2	VM12	Power	Power supply for CH1/2
3	OUT2A	O	CH2 H-bridge output terminal 2A of CV/FS
4	OUT2B	O	CH2 H-bridge output terminal 2B of CV/FS
5	VM3	Power	Power supply for CH3
6	OUT3A	O	CH3 H-bridge output terminal 3A of CV/FS
7	OUT3B	O	CH3 H-bridge output terminal 3B of CV/FS
8	SDAT	I	Serial control signal for data input
9	SCLK	I	Serial control signal for clock input
10	SLD	I	Serial control signal for latch data control
11	VCC	Power	Control power supply
12	IN3	I	Control input pin for Motor
13	IN4	I	Control input pin for Motor
14	IN5	I	Control input pin for Motor
15	IN6	I	Control input pin for Motor
16	PI3	O	PI3 driver output
17	PI2	O	PI2 driver output
18	PI1	O	PI1 driver output
19	OUT4B	O	CH4 H-bridge output terminal 4B of CV/FS/CC
20	RNF4	I/O	CH4 current detect terminal for CC or CV/FS ground
21	OUT4A	O	CH4 H-bridge output terminal 4A of CV/FS/CC
22	VM45	Power	Power supply for CH4/5
23	OUT5B	O	CH5 H-bridge output terminal 5B of CC/FS
24	RNF5	I/O	CH5 current detect terminal for CC or FS ground
25	OUT5A	O	CH5 H-bridge output terminal 5A of CC/FS
26	RESET	I	Logic reset
27	IN2B	I	Control input pin for Motor
28	IN2A	I	Control input pin for Motor
29	GND	GND	Ground
30	IN1B	I	Control input pin for Motor
31	IN1A	I	Control input pin for Motor
32	OUT1A	O	CH1 H-bridge output terminal 1A of CV/FS
EP	PGND_	GND	This pad is internally connected to all CH power ground, meaning there are internal bond wires physically connecting the EP pad to the PGND_ of the all CH. The EP pad must be connected to the power and analog ground plane.

Block Diagram

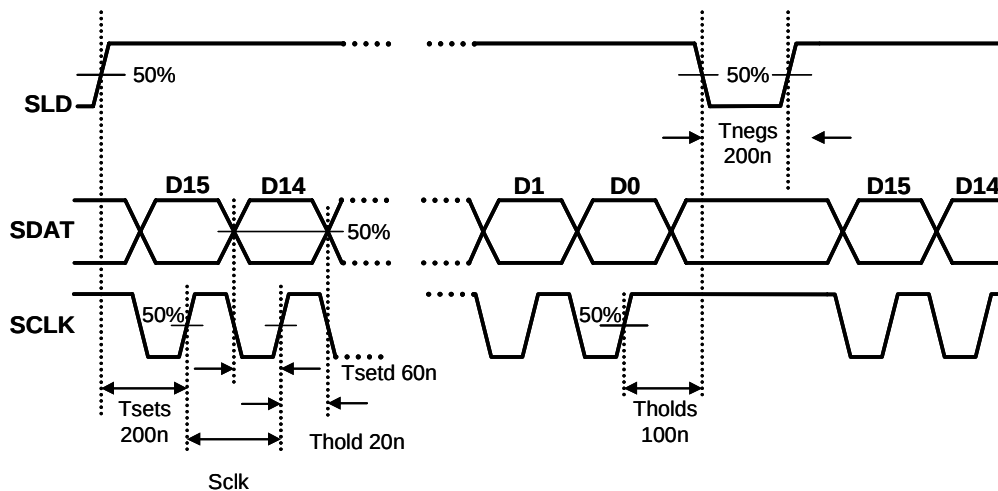


FS: Full-swing; CV: Constant Voltage; CC: Constant Current

Serial timing chart for G2028



Serial Port Write Timing



Serial Control Map

No ·	Address		Data													
	b1 5	b1 4	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
A0	0	0	CH1/2 mode setup			CH3 mode setup			CH4 mode setup			CH5 mode setup			CH1/2/3 exclusive control	
A1	0	1	CH1/2 DAC				CH3 DAC				CH1/2 CV/FS	CH3 CV/FS	CC weak excitati on	Input pin control		
A2	1	0	CH4 DAC				CH5 DAC				CH4 CC/CV/FS		CH5 CC/FS	PI1 control	PI2 control	PI3 control
A3	1	1	CH1/2, CH13/23 serial control input				CH3 serial control input		CH4 serial control input		CH5 serial control input		PS	CH1/2 disable	CH1/2 brake selection	SW Reset
			C1S1	C1S2	C2S1	C2S2	C3S1	C3S2	C4S1	C4S2	C5S1	C5S2				

* FS: Full Swing CV: Constant Voltage CC: Constant Current

Power On RESET (POR)	Software RESET	Internal Logic
RESET(Pin 26)	S/W RESET bit	
L	x	
H	0	
H	1	Initial Clear (Software RESET)*

* Initializes the register area except PS bit.

Serial control function table

No.	Address		Data													
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
A0	0	0	CH1/2 mode setup			CH3 mode setup			CH4 mode setup			CH5 mode setup			CH1/2/3 exclusive control	

Description

Data bit	Bit name	Function
b13-b11	CH1/2 mode setup	CH1/2 input control mode 000: Table 1 001: Table 2 010: Table 3 011: Table 4 100: Serial mode 101: Parallel mode 110: CH1/2 3 lines control (STM 1-2 phase drive) 111: CH1/2 2 lines control (STM 2-2 phase drive)
b10-b8	CH3 mode setup	CH3 input control mode 000: Table 1 001: Table 2 010: Table 3 011: Table 4 100: Serial mode 101: Parallel mode 110: Prohibition 111: Prohibition
b7-b5	CH4 mode setup	CH4 input control mode 000: Table 1 001: Table 2 010: Table 3 011: Table 4 100: Serial mode 101: Parallel mode 110: CH4/5 3 lines control (CC/FS 2 phase drive) 111: Prohibition
b4-b2	CH5 mode setup	CH5 input control mode 000: Table 1 001: Table 2 010: Table 3 011: Table 4 100: Serial mode 101: Parallel mode 110: Prohibition 111: Prohibition
b1-b0	CH1/2/3 exclusive control	00: Normal mode 01: CH13 Exclusive control mode 10: CH23 Exclusive control mode 11: CH13/23 Exclusive control mode

No.	Address		Data													
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
A1	0	1	CH1/2 DAC				CH3 DAC				CH1/2 CV/FS	CH3 CV/FS	CC weak excitati on	Input pin control		

Description

Data bit	Bit name	Function	
b13-b10	CH1/2 constant voltage value setup 1.80~4.80V, 0.2V/bit	0000: 4.80V 0001: 4.60V 0010: 4.40V 0011: 4.20V 0100: 4.00V 0101: 3.80V 0110: 3.60V 0111: 3.40V	1000: 3.20V 1001: 3.00V 1010: 2.80V 1011: 2.60V 1100: 2.40V 1101: 2.20V 1110: 2.00V 1111: 1.80V
b9-b6	CH3 constant voltage value setup 1.80~4.80V, 0.2V/bit	0000: 4.80V 0001: 4.60V 0010: 4.40V 0011: 4.20V 0100: 4.00V 0101: 3.80V 0110: 3.60V 0111: 3.40V	1000: 3.20V 1001: 3.00V 1010: 2.80V 1011: 2.60V 1100: 2.40V 1101: 2.20V 1110: 2.00V 1111: 1.80V
b5	CH1/2 CV/FS drive mode change	CH1/2 drive mode setup 0: Constant voltage 1: Full swing	
b4	CH3 CV/FS drive mode change	CH3 drive mode setup 0: Constant voltage 1: Full swing	
b3	CH4/5 CC weak excitation ON (DAC value 1/2 set)	0: CH4/5 CC weak excitation OFF (Normal) 1: CH4/5 CC weak excitation ON (DAC value 1/2 set)	
b2-b0	Input PIN setup IN3, IN4, IN5, IN6 terminal	Define by selection table	

Input terminal Selection Table

Serial Data bit			Input Pin			
b2	b1	b0	IN3	IN4	IN5	IN6
0	0	0	CH3	CH4	IN5A	IN5B
0	0	1	CH3	CH5	IN4A	IN4B
0	1	0	IN3A	IN3B	CH4	CH5
0	1	1	IN3A	IN3B	IN4A	IN4B
1	0	0	IN3A	IN3B	IN5A	IN5B
1	0	1	IN4A	IN4B	IN5A	IN5B

No.	Address		Data													
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
A2	1	0	CH4 DAC				CH5 DAC				CH4 CC/CV/FS		CH5 CC/FS	PI1 control	PI2 control	PI3 control

Description

Data bit	Bit name	Function	
b13-b10	CH4 constant voltage value setup 1.80~4.80V, 0.2V/bit	0000: 4.80V 0001: 4.60V 0010: 4.40V 0011: 4.20V 0100: 4.00V 0101: 3.80V 0110: 3.60V 0111: 3.40V	1000: 3.20V 1001: 3.00V 1010: 2.80V 1011: 2.60V 1100: 2.40V 1101: 2.20V 1110: 2.00V 1111: 1.80V
	CH4 constant current value setup (RNF4 voltage) 150mV~300mV, 10mV/bit	0000: 300mV 0001: 290mV 0010: 280mV 0011: 270mV 0100: 260mV 0101: 250mV 0110: 240mV 0111: 230mV	1000: 220mV 1001: 210mV 1010: 200mV 1011: 190mV 1100: 180mV 1101: 170mV 1110: 160mV 1111: 150mV
b9-b6	CH5 constant current value setup (RNF5 voltage) 150mV~300mV, 10mV/bit	0000: 300mV 0001: 290mV 0010: 280mV 0011: 270mV 0100: 260mV 0101: 250mV 0110: 240mV 0111: 230mV	1000: 220mV 1001: 210mV 1010: 200mV 1011: 190mV 1100: 180mV 1101: 170mV 1110: 160mV 1111: 150mV
b5-b4	CH4 CC/CV/FS drive mode change	CH4 drive mode setup 00: Constant current 01: Constant current 10: Constant voltage 11: Full swing	
b3	CH5 CC/FS drive mode change	CH5 drive mode setup 0: Constant current 1: Full swing	
b2	PI1 control	0: Output Hi-Z 1: Output ON "L"	
b1	PI2 control	0: Output Hi-Z 1: Output ON "L"	
b0	PI3 control	0: Output Hi-Z 1: Output ON "L"	

*When CH4/5 3 lines control is selected, the CC/FS mode select stand on [A2:b5].

[A2:b5]="0" is the CC mode. [A2:b5]="1" is the FS mode.

No.	Address		Data													
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
A3	1	1	CH1/2, CH13/23 serial control input				CH3 serial control input		CH4 serial control input		CH5 serial control input		PS	CH1/2 disable	CH1/2 brake selectio n	S/W Reset
			C1S1	C1S2	C2S1	C2S2	C3S1	C3S2	C4S1	C4S2	C5S1	C5S2				

Description

Data bit	Bit name	Function
b13-b10	Channel 1/2 serial input	b13: C1S1 b12: C1S2 b11: C2S1 b10: C2S2
b9-b8	Channel 3 serial input	b9: C3S1 b8: C3S2
b7-b6	Channel 4 serial input	b7: C4S1 b6: C4S2
b5-b4	Channel 5 serial input	b7: C5S1 b6: C5S2
b3	Power save (PS)	0: Power OFF (Standby=Power save) 1: Power ON (Active)
b2	CH1/2 disable setting (and CH1/2 mode setup=110,111)	CH1/2 disable setting 0: Disable 1: Enable
b1	CH1/2 brake selection	0: Off 1: Brake
b0	S/W RESET	0: Nothing is done 1: The register area is initialized

CH1/2 I/O Truth Table

X: Channel number(X=1,2); - : Don't care; H: High level; L: Low level; Z: High impedance

Table 1

Serial control input		Input terminal	Output terminal		MODE
CXS1	CXS2	INXA	OUTXA	OUTXB	
0	0	-	Z	Z	OFF
0	1	L	L	L	Brake
0	1	H	H	L	Forward
1	0	L	L	L	Brake
1	0	H	L	H	Reverse
1	1	-	L	L	Brake

Table 2

Serial control input		Input terminal	Output terminal		MODE
CXS1	CXS2	INXA	OUTXA	OUTXB	
0	0	-	Z	Z	OFF
0	1	L	H	L	Forward
0	1	H	L	L	Brake
1	0	L	L	H	Reverse
1	0	H	L	L	Brake
1	1	-	L	L	Brake

Table 3

Serial control input		Input terminal	Output terminal		MODE
CXS1	CXS2	INXA	OUTXA	OUTXB	
-	0	-	Z	Z	OFF
0	1	L	L	H	Reverse
0	1	H	H	L	Forward
1	1	-	L	L	Brake

Table 4

Serial control input		Input terminal	Output terminal		MODE
CXS1	CXS2	INXA	OUTXA	OUTXB	
-	0	-	Z	Z	OFF
0	1	L	H	L	Forward
0	1	H	L	H	Reverse
1	1	-	L	L	Brake

Serial mode

Serial control input		Output terminal		MODE
CXS1	CXS2	OUTXA	OUTXB	
0	0	Z	Z	OFF
0	1	H	L	Forward
1	0	L	H	Reverse
1	1	L	L	Brake

Parallel mode
[A3 :b1]=0

Input terminal		Output terminal		MODE
INXA	INXB	OUTXA	OUTXB	
L	L	Z	Z	OFF
H	L	H	L	Forward
L	H	L	H	Reverse
H	H	L	L	Brake

[A3 :b1]=1

Input terminal		Output terminal		MODE
INXA	INXB	OUTXA	OUTXB	
L	L	L	L	Brake
H	L	H	L	Forward
L	H	L	H	Reverse
H	H	L	L	Brake

CH1/2 3 lines control (STM 1-2 phase drive)
[A3 :b2]=1; [A3 :b1]=0

Input terminal			Output terminal				MODE	
IN1A	IN1B	IN2A	OUT1A	OUT1B	OUT2A	OUT2B	CH1	CH2
H	H	L	H	L	H	L	Forward	Forward
L	H	H	Z	Z	H	L	OFF	Forward
L	H	L	L	H	H	L	Reverse	Forward
L	L	H	L	H	Z	Z	Reverse	OFF
L	L	L	L	H	L	H	Reverse	Reverse
H	L	H	Z	Z	L	H	OFF	Reverse
H	L	L	H	L	L	H	Forward	Reverse
H	H	H	H	L	Z	Z	Forward	OFF

[A3 :b2]=1; [A3 :b1]=1

Input terminal			Output terminal				MODE	
IN1A	IN1B	IN2A	OUT1A	OUT1B	OUT2A	OUT2B	CH1	CH2
H	H	L	H	L	H	L	Forward	Forward
L	H	H	L	L	H	L	Brake	Forward
L	H	L	L	H	H	L	Reverse	Forward
L	L	H	L	H	L	L	Reverse	Brake
L	L	L	L	H	L	H	Reverse	Reverse
H	L	H	L	L	L	H	Brake	Reverse
H	L	L	H	L	L	H	Forward	Reverse
H	H	H	H	L	L	L	Forward	Brake

CH1/2 2 lines control (STM 2-2 phase drive)
[A3 :b2]=1

Input terminal		Output terminal				MODE	
IN1A	IN1B	OUT1A	OUT1B	OUT2A	OUT2B	CH1	CH2
H	H	H	L	H	L	Forward	Forward
L	H	L	H	H	L	Reverse	Forward
L	L	L	H	L	H	Reverse	Reverse
H	L	H	L	L	H	Forward	Reverse

CH1/2 more control mode of stepping motor

Input terminal PWM control (STM 1-2 phase drive)

CH1/2 mode setup=000: Table 1

Serial control input bit				Input terminal		Output terminal				MODE	
C1S1	C1S2	C2S1	C2S2	IN1A	IN2A	OUT1A	OUT1B	OUT2A	OUT2B	CH1	CH2
0	0	0	0	-	-	Z	Z	Z	Z	OFF	OFF
0	1	0	1	H	H	H	L	H	L	Forward	Forward
0	0	0	1	-	H	Z	Z	H	L	OFF	Forward
1	0	0	1	H	H	L	H	H	L	Reverse	Forward
1	0	0	0	H	-	L	H	Z	Z	Reverse	OFF
1	0	1	0	H	H	L	H	L	H	Reverse	Reverse
0	0	1	0	-	H	Z	Z	L	H	OFF	Reverse
0	1	1	0	H	H	H	L	L	H	Forward	Reverse
0	1	0	0	H	-	H	L	Z	Z	Forward	OFF
0	1	0	1	L	L	L	L	L	L	Brake	Brake
0	0	0	1	-	L	Z	Z	L	L	OFF	Brake
1	0	0	1	L	L	L	L	L	L	Brake	Brake
1	0	0	0	L	-	L	L	Z	Z	Brake	OFF
1	0	1	0	L	L	L	L	L	L	Brake	Brake
0	0	1	0	-	L	Z	Z	L	L	OFF	Brake
0	1	1	0	L	L	L	L	L	L	Brake	Brake
0	1	0	0	L	-	L	L	Z	Z	Brake	OFF

Input terminal PWM control(STM 2-2 phase drive)

CH1/2 mode setup=000: Table 1

Serial control input bit				Input terminal		Output terminal				MODE	
C1S1	C1S2	C2S1	C2S2	IN1A	IN2A	OUT1A	OUT1B	OUT2A	OUT2B	CH1	CH2
0	0	0	0	-	-	Z	Z	Z	Z	OFF	OFF
0	1	0	1	H	H	H	L	H	L	Forward	Forward
1	0	0	1	H	H	L	H	H	L	Reverse	Forward
1	0	1	0	H	H	L	H	L	H	Reverse	Reverse
0	1	1	0	H	H	H	L	L	H	Forward	Reverse
0	1	0	1	L	L	L	L	L	L	Brake	Brake
1	0	0	1	L	L	L	L	L	L	Brake	Brake
1	0	1	0	L	L	L	L	L	L	Brake	Brake
0	1	1	0	L	L	L	L	L	L	Brake	Brake

Input terminal Forward/Reverse control(STM 2-2 phase drive)

CH1/2 mode setup=010: Table 3

Serial control input bit				Input terminal		Output terminal				MODE	
C1S1	C1S2	C2S1	C2S2	IN1A	IN2A	OUT1A	OUT1B	OUT2A	OUT2B	CH1	CH2
0	0	0	0	-	-	Z	Z	Z	Z	OFF	OFF
0	1	0	1	H	H	H	L	H	L	Forward	Forward
0	1	0	1	L	H	L	H	H	L	Reverse	Forward
0	1	0	1	L	L	L	H	L	H	Reverse	Reverse
0	1	0	1	H	L	H	L	L	H	Forward	Reverse

CH1/2/3 Exclusive control I/O Truth Table

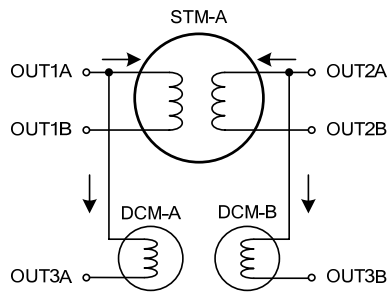


Figure 1

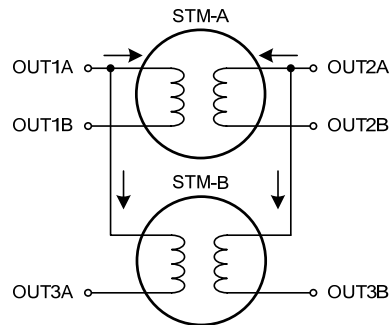


Figure 2

Note:

1. CH13 show H-Bridge OUT1A → OUT3A
2. CH23 show H-Bridge OUT2A → OUT3B

Fig1: CH13/23 DCM control , DCM-A : OUT1A ↔ OUT3A , DCM-B : OUT2A ↔ OUT3B 。

CH13 exclusive control mode
Table 1

Serial control input		Input terminal	Output terminal		MODE
C1S1	C1S2	IN1A	OUT1A	OUT3A	
0	0	-	Z	Z	OFF
0	1	L	L	L	Brake
0	1	H	H	L	Forward
1	0	L	L	L	Brake
1	0	H	L	H	Reverse
1	1	-	L	L	Brake

Table 2

Serial control input		Input terminal	Output terminal		MODE
C1S1	C1S2	IN1A	OUT1A	OUT3A	
0	0	-	Z	Z	OFF
0	1	L	H	L	Forward
0	1	H	L	L	Brake
1	0	L	L	H	Reverse
1	0	H	L	L	Brake
1	1	-	L	L	Brake

Table 3

Serial control input		Input terminal	Output terminal		MODE
C1S1	C1S2	IN1A	OUT1A	OUT3A	
-	0	-	Z	Z	OFF
0	1	L	L	H	Reverse
0	1	H	H	L	Forward
1	1	-	L	L	Brake

Table 4

Serial control input		Input terminal	Output terminal		MODE
C1S1	C1S2	IN1A	OUT1A	OUT3A	
-	0	-	Z	Z	OFF
0	1	L	H	L	Forward
0	1	H	L	H	Reverse
1	1	-	L	L	Brake

Serial mode

Serial control input		Output terminal		MODE
C1S1	C1S2	OUT1A	OUT3A	
0	0	Z	Z	OFF
0	1	H	L	Forward
1	0	L	H	Reverse
1	1	L	L	Brake

Parallel mode
[A3 :b1]=0

Input terminal		Output terminal		MODE
IN1A	IN1B	OUT1A	OUT3A	
L	L	Z	Z	OFF
H	L	H	L	Forward
L	H	L	H	Reverse
H	H	L	L	Brake

[A3 :b1]=1

Input terminal		Output terminal		MODE
IN1A	IN1B	OUT1A	OUT3A	
L	L	L	L	Brake
H	L	H	L	Forward
L	H	L	H	Reverse
H	H	L	L	Brake

CH23 exclusive control mode
Table 1

Serial control input		Input terminal	Output terminal		MODE
C2S1	C2S2	IN2A	OUT2A	OUT3B	
0	0	-	Z	Z	OFF
0	1	L	L	L	Brake
0	1	H	H	L	Forward
1	0	L	L	L	Brake
1	0	H	L	H	Reverse
1	1	-	L	L	Brake

Table 2

Serial control input		Input terminal	Output terminal		MODE
C2S1	C2S2	IN2A	OUT2A	OUT3B	
0	0	-	Z	Z	OFF
0	1	L	H	L	Forward
0	1	H	L	L	Brake
1	0	L	L	H	Reverse
1	0	H	L	L	Brake
1	1	-	L	L	Brake

Table 3

Serial control input		Input terminal	Output terminal		MODE
C2S1	C2S2	IN2A	OUT2A	OUT3B	
-	0	-	Z	Z	OFF
0	1	L	L	H	Reverse
0	1	H	H	L	Forward
1	1	-	L	L	Brake

Table 4

Serial control input		Input terminal	Output terminal		MODE
C2S1	C2S2	IN2A	OUT2A	OUT3B	
-	0	-	Z	Z	OFF
0	1	L	H	L	Forward
0	1	H	L	H	Reverse
1	1	-	L	L	Brake

Serial mode

Serial control input		Output terminal		MODE
C2S1	C2S2	OUT2A	OUT3B	
0	0	Z	Z	OFF
0	1	H	L	Forward
1	0	L	H	Reverse
1	1	L	L	Brake

Parallel mode
[A3 :b1]=0

Input terminal		Output terminal		MODE
IN2A	IN2B	OUT2A	OUT3B	
L	L	Z	Z	OFF
H	L	H	L	Forward
L	H	L	H	Reverse
H	H	L	L	Brake

[A3 :b1]=1

Input terminal		Output terminal		MODE
IN2A	IN2B	OUT2A	OUT3B	
L	L	L	L	Brake
H	L	H	L	Forward
L	H	L	H	Reverse
H	H	L	L	Brake

CH13/23 exclusive control mode
CH13/23 3 lines control (STM 1-2 phase drive)
[A3 :b2]=1; [A3 :b1]=0

Input terminal			Output terminal				MODE	
IN1A	IN1B	IN2A	OUT1A	OUT3A	OUT2A	OUT3B	CH13	CH23
H	H	L	H	L	H	L	Forward	Forward
L	H	H	Z	Z	H	L	OFF	Forward
L	H	L	L	H	H	L	Reverse	Forward
L	L	H	L	H	Z	Z	Reverse	OFF
L	L	L	L	H	L	H	Reverse	Reverse
H	L	H	Z	Z	L	H	OFF	Reverse
H	L	L	H	L	L	H	Forward	Reverse
H	H	H	H	L	Z	Z	Forward	OFF

[A3 :b2]=1; [A3 :b1]=1

Input terminal			Output terminal				MODE	
IN1A	IN1B	IN2A	OUT1A	OUT3A	OUT2A	OUT3B	CH13	CH23
H	H	L	H	L	H	L	Forward	Forward
L	H	H	L	L	H	L	Brake	Forward
L	H	L	L	H	H	L	Reverse	Forward
L	L	H	L	H	L	L	Reverse	Brake
L	L	L	L	H	L	H	Reverse	Reverse
H	L	H	L	L	L	H	Brake	Reverse
H	L	L	H	L	L	H	Forward	Reverse
H	H	H	H	L	L	L	Forward	Brake

CH13/23 2 lines control (STM 2-2 phase drive)

[A3 :b2]=1

Input terminal		Output terminal				MODE	
IN1A	IN1B	OUT1A	OUT3A	OUT2A	OUT3B	CH13	CH23
H	H	H	L	H	L	Forward	Forward
L	H	L	H	H	L	Reverse	Forward
L	L	L	H	L	H	Reverse	Reverse
H	L	H	L	L	H	Forward	Reverse

More control mode of stepping motor

Input terminal PWM control(STM 1-2 phase drive)

CH1/2 mode setup=000: Table 1

Serial control input bit				Input terminal		Output terminal				MODE	
C1S1	C1S2	C2S1	C2S2	IN1A	IN2A	OUT1A	OUT3A	OUT2A	OUT3B	CH13	CH23
0	0	0	0	-	-	Z	Z	Z	Z	OFF	OFF
0	1	0	1	H	H	H	L	H	L	Forward	Forward
0	0	0	1	-	H	Z	Z	H	L	OFF	Forward
1	0	0	1	H	H	L	H	H	L	Reverse	Forward
1	0	0	0	H	-	L	H	Z	Z	Reverse	OFF
1	0	1	0	H	H	L	H	L	H	Reverse	Reverse
0	0	1	0	-	H	Z	Z	L	H	OFF	Reverse
0	1	1	0	H	H	H	L	L	H	Forward	Reverse
0	1	0	0	H	-	H	L	Z	Z	Forward	OFF
0	1	0	1	L	L	L	L	L	L	Brake	Brake
0	0	0	1	-	L	Z	Z	L	L	OFF	Brake
1	0	0	1	L	L	L	L	L	L	Brake	Brake
1	0	0	0	L	-	L	L	Z	Z	Brake	OFF
1	0	1	0	L	L	L	L	L	L	Brake	Brake
0	0	1	0	-	L	Z	Z	L	L	OFF	Brake
0	1	1	0	L	L	L	L	L	L	Brake	Brake
0	1	0	0	L	-	L	L	Z	Z	Brake	OFF

Input terminal PWM control(STM 2-2 phase drive)

CH1/2 mode setup=000: Table 1

Serial control input bit				Input terminal		Output terminal				MODE	
C1S1	C1S2	C2S1	C2S2	IN1A	IN2A	OUT1A	OUT3A	OUT2A	OUT3B	CH13	CH23
0	0	0	0	-	-	Z	Z	Z	Z	OFF	OFF
0	1	0	1	H	H	H	L	H	L	Forward	Forward
1	0	0	1	H	H	L	H	H	L	Reverse	Forward
1	0	1	0	H	H	L	H	L	H	Reverse	Reverse
0	1	1	0	H	H	H	L	L	H	Forward	Reverse
0	1	0	1	L	L	L	L	L	L	Brake	Brake
1	0	0	1	L	L	L	L	L	L	Brake	Brake
1	0	1	0	L	L	L	L	L	L	Brake	Brake
0	1	1	0	L	L	L	L	L	L	Brake	Brake

Input terminal Forward/Reverse control(STM 2-2 phase drive)

CH1/2 mode setup=010: Table 3

Serial control input bit				Input terminal		Output terminal				MODE	
C1S1	C1S2	C2S1	C2S2	IN1A	IN2A	OUT1A	OUT3A	OUT2A	OUT3B	CH13	CH23
0	0	0	0	-	-	Z	Z	Z	Z	OFF	OFF
0	1	0	1	H	H	H	L	H	L	Forward	Forward
0	1	0	1	L	H	L	H	H	L	Reverse	Forward
0	1	0	1	L	L	L	H	L	H	Reverse	Reverse
0	1	0	1	H	L	H	L	L	H	Forward	Reverse

CH3/4/5 I/O Truth Table

X: Channel number(X=3,4,5); - : Don't care; H: High level; L: Low level; Z: High impedance

Y: Define by Input terminal selection table(Y=3,4,5,6)

Table 1

Serial control input		Input terminal	Output terminal		MODE
CXS1	CXS2	INY	OUTXA	OUTXB	
0	0	-	Z	Z	OFF
0	1	L	L	L	Brake
0	1	H	H	L	Forward
1	0	L	L	L	Brake
1	0	H	L	H	Reverse
1	1	-	L	L	Brake

Table 2

Serial control input		Input terminal	Output terminal		MODE
CXS1	CXS2	INY	OUTXA	OUTXB	
0	0	-	Z	Z	OFF
0	1	L	H	L	Forward
0	1	H	L	L	Brake
1	0	L	L	H	Reverse
1	0	H	L	L	Brake
1	1	-	L	L	Brake

Table 3

Serial control input		Input terminal	Output terminal		MODE
CXS1	CXS2	INY	OUTXA	OUTXB	
-	0	-	Z	Z	OFF
0	1	L	L	H	Reverse
0	1	H	H	L	Forward
1	1	-	L	L	Brake

Table 4

Serial control input		Input terminal	Output terminal		MODE
CXS1	CXS2	INY	OUTXA	OUTXB	
-	0	-	Z	Z	OFF
0	1	L	H	L	Forward
0	1	H	L	H	Reverse
1	1	-	L	L	Brake

Serial mode

Serial control input		Output terminal		MODE
CXS1	CXS2	OUTXA	OUTXB	
0	0	Z	Z	OFF
0	1	H	L	Forward
1	0	L	H	Reverse
1	1	L	L	Brake

Parallel mode

Input terminal		Output terminal		MODE
INY	INY	OUTXA	OUTXB	
L	L	Z	Z	OFF
H	L	H	L	Forward
L	H	L	H	Reverse
H	H	L	L	Brake

CH4/5 3 lines control (CC/FS 2 phase simultaneous drive)

[A1:b2,b1,b0]=101

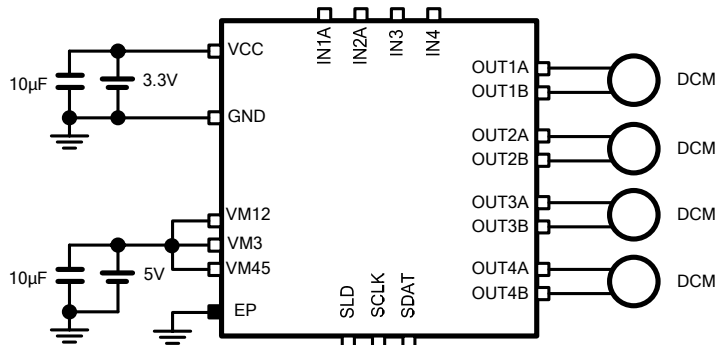
Input terminal			Output terminal				MODE	
IN3	IN4	IN5	OUT4A	OUT4B	OUT5A	OUT5B	CH4	CH5
L	-	-	Z	Z	Z	Z	OFF	OFF
H	L	L	H	L	H	L	Forward	Forward
H	L	H	H	L	L	H	Forward	Reverse
H	H	L	L	H	H	L	Reverse	Forward
H	H	H	L	H	L	H	Reverse	Reverse

Application Circuits

Address =A0		Mode	Application circuit X
b1	b0		
0	0	Normal	Application circuit 1~7
0	1	CH13 Exclusive	Application circuit 8
1	0	CH23 Exclusive	
1	1	CH13/23 Exclusive	Application circuit 9

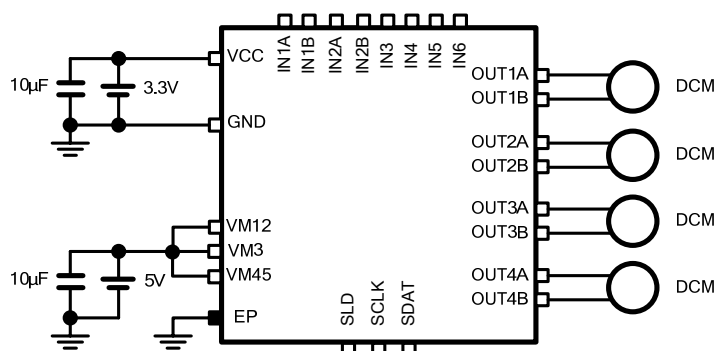
Application circuit 1 : CH1, CH2, CH3, CH4

[A1:b2,b1,b0]=000
Table1~Table4 or serial mode control for DCM



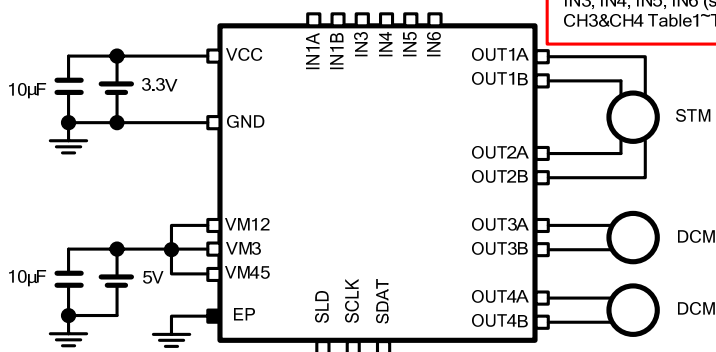
Application circuit 2 : CH1, CH2, CH3, CH4

[A1:b2,b1,b0]=011
parallel mode control for DCM

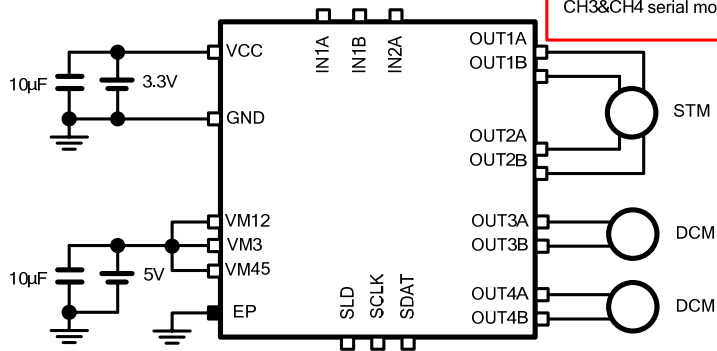


Application circuit 3 : CH1, CH2, CH3, CH4

CH1&CH2 2 lines control for STM(STM 2-2 phase drive)
IN3, IN4, IN5, IN6 (select by "input terminal selection table")
CH3&CH4 Table1~Table4, serial or parallel mode control for DCM

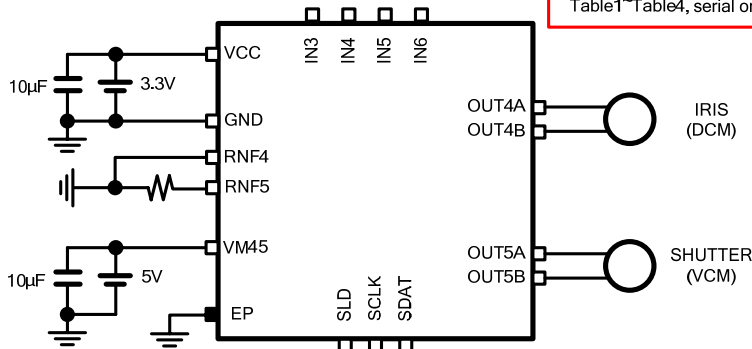


Application circuit 4 : CH1, CH2, CH3, CH4



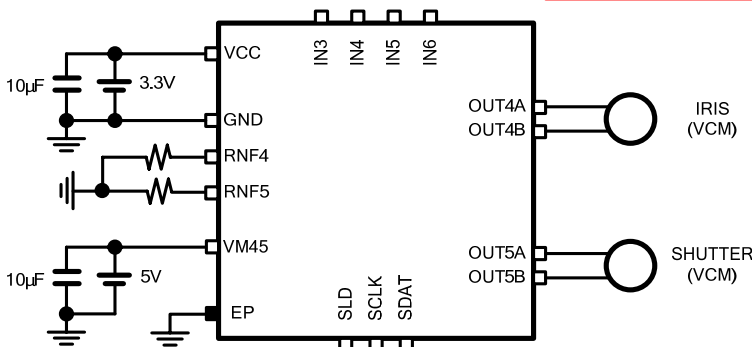
CH1&CH2 3 lines control for STM(STM 1-2 phase drive)
CH3&CH4 serial mode control for DCM

Application circuit 5 : CH4, CH5



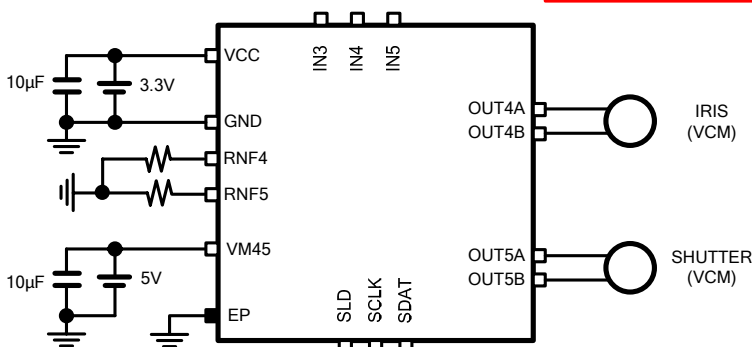
IN3, IN4, IN5, IN6 (select by "input terminal selection table")
Table1~Table4, serial or parallel mode control for VCM, DCM

Application circuit 6 : CH4, CH5



[A1:b2,b1,b0]=101
parallel mode control for VCM

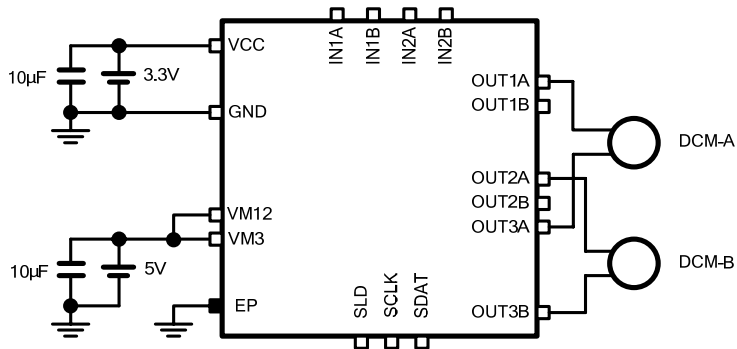
Application circuit 7 : CH4, CH5



[A1:b2,b1,b0]=101
3 lines control for VCM (CC 2 phase simultaneous drive)

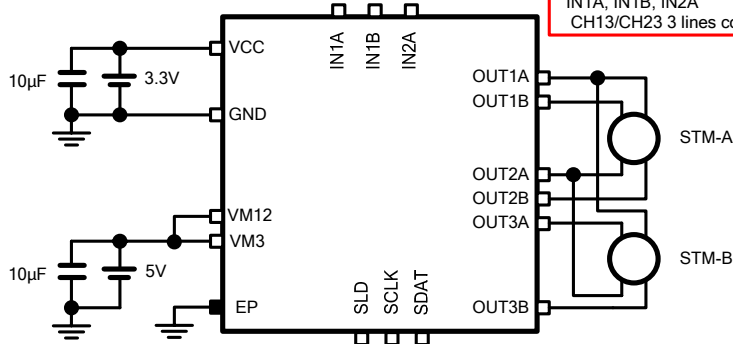
Application circuit 8 : CH1, CH2, CH3

CH13/CH23 Table1~Table4, serial or parallel mode control for DCM

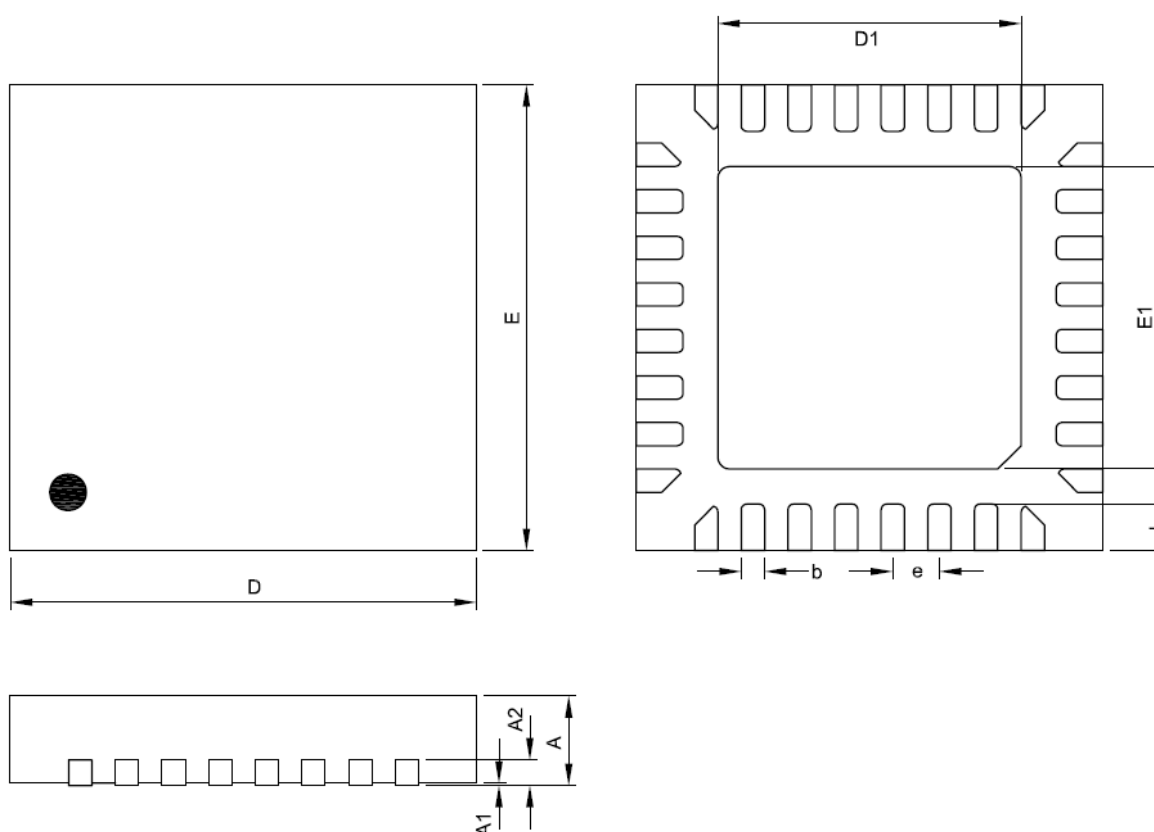


Application circuit 9 : CH1, CH2, CH3

IN1A, IN1B
CH13/CH23 2 lines control for STM(STM 2-2 phase drive)
IN1A, IN1B, IN2A
CH13/CH23 3 lines control for STM(STM 1-2 phase drive)



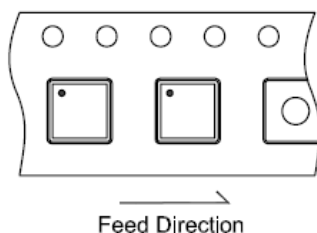
Package Information



TQFN4X4-32 Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.0276	0.0295	0.0315
A1	0.00	---	0.05	0.0000	---	0.0020
A2	0.19	0.20	0.21	0.0075	0.0079	0.0083
D	3.95	4.00	4.05	0.1555	0.1575	0.1594
E	3.95	4.00	4.05	0.1555	0.1575	0.1594
D1	2.65	2.70	2.75	0.1043	0.1063	0.1083
E1	2.65	2.70	2.75	0.1043	0.1063	0.1083
b	0.15	0.20	0.25	0.0059	0.0079	0.0098
e	0.40 BSC			0.0157 BSC		
L	0.35	0.40	0.45	0.0138	0.0157	0.0177

Taping Specification



PACKAGE	Q'TY/REEL
TQFN4X4-32	3,000 ea

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