Ordering number : ENA0001A

SANYO Semiconductors
DATA SHEET

LV8051PL — Bi-CMOS IC For Digital Still Cameras 6-channel 1-chip Motor Driver IC

Overview

The LV8051PL is a digital still camera motor driver that integrates six channels on a single-chip.

Features

- Five PWM drive forward/reverse motor driver channels
- One constant current forward/reverse motor driver channel
- The states of all drivers can be set up over 8-bit serial data transfer
- Ability to set the constant current reference voltage via serial data

Examples of Actuator Applications

	Shutter	Iris	Focus	Zoom
Application 1	Constant current/VCM	Saturated/VCM	Saturated/STM	Saturated/STM
Application 2	Constant current/VCM	Saturated/VCM	Saturated/STM	Saturated/DCM

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage 1	VM max		6	V
Supply voltage 2	V_{CC} max		6	V
Output peak current	I_O peak	1ch/2ch/3ch/4ch/5ch/6ch Pulse width<10ms, Duty ≤20%	600	mA
Output continuous current	I_O max	1ch/2ch/3ch/4ch/5ch/6ch	400	mA
Allowable power dissipation 1	Pd max1	Independent IC	0.2	W
Allowable power dissipation 2	Pd max2	Mounted on a circuit board*	1.0	W
Operating temperature	Topr		-20 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

* Mounted on a specified board: 40mm×50mm×0.8mm, glass epoxy four-layer board.

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Allowable Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage range 1	VM		2.7 to 5.5	V
Supply voltage range 2	V_{CC}		2.7 to 5.5	V
Logic input voltage	V_{IN}		0 to V_{CC} +0.3	V
PWM frequency	fPWM	PWM1, PWM2, PWM3, PWM4, PWM5	Up to 100	kHz

Electrical Characteristics at Ta = 25ºC, VM = 5V, V_{CC} = 3.3V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Standby mode current drain	Istn	ST = low level			1.0	µA
Current drain 1	IM	ST= High level, PWM forward drive IN62= High level, No load		50	100	µA
Current drain 2	I_{CC}	ST= High level, PWM forward drive IN62= High level, No load		1.5	2.5	mA
V_{CC} low-voltage cut voltage	VthV_{CC}		2.1	2.35	2.6	V
Low-voltage hysteresis voltage	VthHIS		100	150	200	mV
Thermal shutdown temperature	TSD	Design guarantee*	150	170	190	°C
Thermal hysteresis width	ΔTSD	Design guarantee*	30	40	50	°C
PWM forward/reverse motor drivers (Channels 1, 2, 3, 4 and 5)						
Output on-resistance	Ronu1	I_O=400mA, upper side on-resistance		0.7	0.75	Ω
	Rond1	I_O=400mA, lower side on-resistance		0.5	0.6	Ω
Output leakage current	$I_O$leak1				1.0	µA
Diode forward voltage	VD1	ID= -400mA	0.8	1.0	1.2	V
Logic pin input current	I_{IN}L1	V_{IN}=0V (ST, PWM1, PWM2, PWM3, PWM4, PWM5)			1.0	µA
	I_{IN}H1	V_{IN}=3.3V (ST, PWM1, PWM2, PWM3, PWM4, PWM5)	20	33	50	µA
Logic input high-level voltage	V_{IN}H1	ST, PWM1, PWM2, PWM3, PWM4, PWM5	2.5			V
Logic input low-level voltage	V_{IN}L1	ST, PWM1, PWM2, PWM3, PWM4, PWM5			1.0	V
Constant current forward/reverse motor driver (channel 6)						
Output on-resistance	Ronu2	I_O=400mA, upper side on-resistance		0.7	0.75	Ω
	Rond2	I_O=400mA, lower side on-resistance		0.5	0.6	Ω
Output leakage current	$I_O$leak2				1.0	µA
Diode forward voltage	VD2	ID= -400mA	0.8	1.0	1.2	V
Logic pin input current	I_{IN}L2	V_{IN}=0V(IN61, IN62)			1.0	µA
	I_{IN}H2	V_{IN}=3.3V(IN61, IN62)	20	33	50	µA
Logic input high-level voltage	V_{IN}H2	IN61, IN62	2.5			V
Logic input low-level voltage	V_{IN}L2	IN61, IN62			1.0	V
Current selection reference voltage	VREF1	(D6,D5,D4,D3,D2)=(0,0,0,0,0)	0.190	0.200	0.210	V
	VREF2	(D6,D5,D4,D3,D2)=(0,0,0,0,1)	0.185	0.195	0.205	V
	VREF3	(D6,D5,D4,D3,D2)=(0,0,0,1,0)	0.181	0.190	0.200	V
	VREF4	(D6,D5,D4,D3,D2)=(0,0,0,1,1)	0.176	0.185	0.194	V
	VREF5	(D6,D5,D4,D3,D2)=(0,0,1,0,0)	0.171	0.180	0.189	V
	VREF6	(D6,D5,D4,D3,D2)=(0,0,1,0,1)	0.166	0.175	0.184	V
	VREF7	(D6,D5,D4,D3,D2)=(0,0,1,1,0)	0.162	0.170	0.179	V
	VREF8	(D6,D5,D4,D3,D2)=(0,0,1,1,1)	0.157	0.165	0.173	V
	VREF9	(D6,D5,D4,D3,D2)=(0,1,0,0,0)	0.152	0.160	0.168	V
	VREF10	(D6,D5,D4,D3,D2)=(0,1,0,0,1)	0.147	0.155	0.163	V
	VREF11	(D6,D5,D4,D3,D2)=(0,1,0,1,0)	0.143	0.150	0.158	V
	VREF12	(D6,D5,D4,D3,D2)=(0,1,0,1,1)	0.138	0.145	0.152	V
	VREF13	(D6,D5,D4,D3,D2)=(0,1,1,0,0)	0.133	0.140	0.147	V
	VREF14	(D6,D5,D4,D3,D2)=(0,1,1,0,1)	0.128	0.135	0.142	V
	VREF15	(D6,D5,D4,D3,D2)=(0,1,1,1,0)	0.124	0.130	0.137	V

*Design target value. No measurement made.

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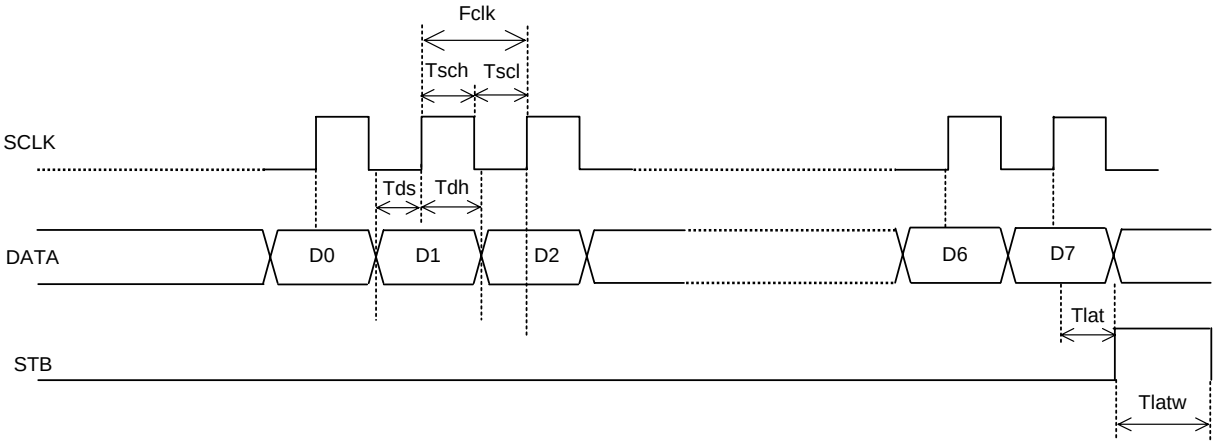
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current selection reference voltage	VREF16	(D6,D5,D4,D3,D2)=(0,1,1,1,1)	0.119	0.125	0.131	V
	VREF17	(D6,D5,D4,D3,D2)=(1,0,0,0,0)	0.114	0.120	0.126	V
	VREF18	(D6,D5,D4,D3,D2)=(1,0,0,0,1)	0.109	0.115	0.121	V
	VREF19	(D6,D5,D4,D3,D2)=(1,0,0,1,0)	0.105	0.110	0.116	V
	VREF20	(D6,D5,D4,D3,D2)=(1,0,0,1,1)	0.100	0.105	0.110	V
	VREF21	(D6,D5,D4,D3,D2)=(1,0,1,0,0)	0.094	0.100	0.106	V
	VREF22	(D6,D5,D4,D3,D2)=(1,0,1,0,1)	0.089	0.095	0.101	V
	VREF23	(D6,D5,D4,D3,D2)=(1,0,1,1,0)	0.084	0.090	0.096	V
	VREF24	(D6,D5,D4,D3,D2)=(1,0,1,1,1)	0.079	0.085	0.091	V
	VREF25	(D6,D5,D4,D3,D2)=(1,1,0,0,0)	0.074	0.080	0.086	V
	VREF26	(D6,D5,D4,D3,D2)=(1,1,0,0,1)	0.069	0.075	0.081	V
	VREF27	(D6,D5,D4,D3,D2)=(1,1,0,1,0)	0.064	0.070	0.076	V
	VREF28	(D6,D5,D4,D3,D2)=(1,1,0,1,1)	0.059	0.065	0.071	V
	VREF29	(D6,D5,D4,D3,D2)=(1,1,1,0,0)	0.054	0.060	0.066	V
	VREF30	(D6,D5,D4,D3,D2)=(1,1,1,0,1)	0.049	0.055	0.061	V
	VREF31	(D6,D5,D4,D3,D2)=(1,1,1,1,0)	0.044	0.050	0.056	V
	VREF32	(D6,D5,D4,D3,D2)=(1,1,1,1,1)	0.039	0.045	0.051	V
Output constant current	I_{OUT}	Rload=3Ω,RF=0.5Ω, Internal VREF = 0.2V	380	400	420	mA
FC6 rapid charge current	Irafc6		350	500	650	µA
FC6 steady-state charge current	Ichfc6		5	10	15	µA
FC6 steady-state discharge current	Idisfc6		5	10	15	µA
Serial data transfer pins						
Logic pin input current	$I_{IN}L3$	V_{IN}=0V(SCLK, DATA, STB)			1.0	µA
	$I_{IN}H3$	V_{IN}=3.3V(SCLK, DATA, STB)	20	33	50	µA
Logic input high-level voltage	$V_{IN}H3$	SCLK, DATA, STB	2.5			V
Logic input low-level voltage	$V_{IN}L3$	SCLK, DATA, STB			1.0	V
Minimum SCLK high-level pulse width	Tsch		0.125			µs
Minimum SCLK low-level pulse width	Tscl		0.125			µs
STB specified time	Tlat		0.125			µs
Minimum STB pulse width	Tlatw		0.125			µs
Data setup time	Tds		0.125			µs
Data hold time	Tdh		0.125			µs
Maximum SCLK frequency	Fclk				4	MHz



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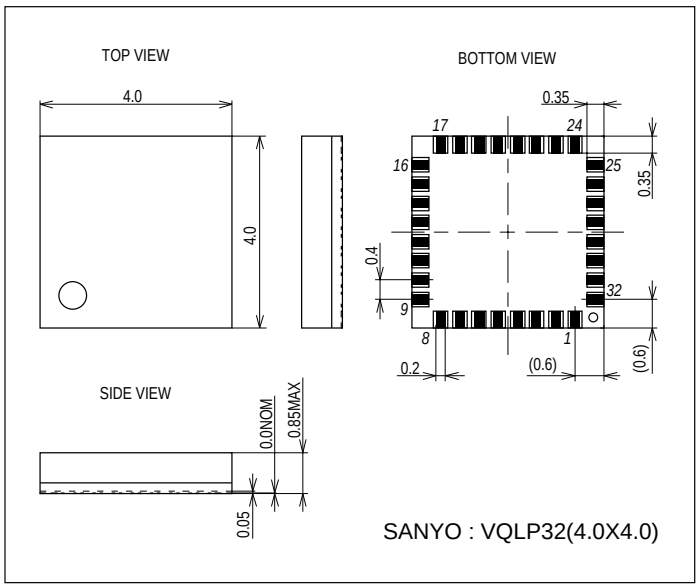
Package Dimensions

unit : mm (typ)

3331



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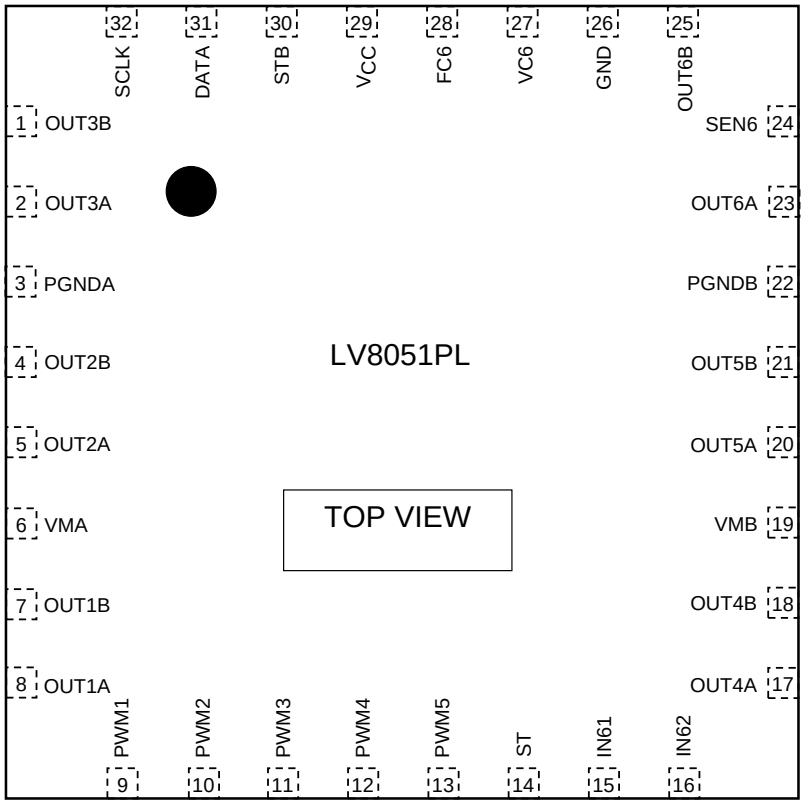
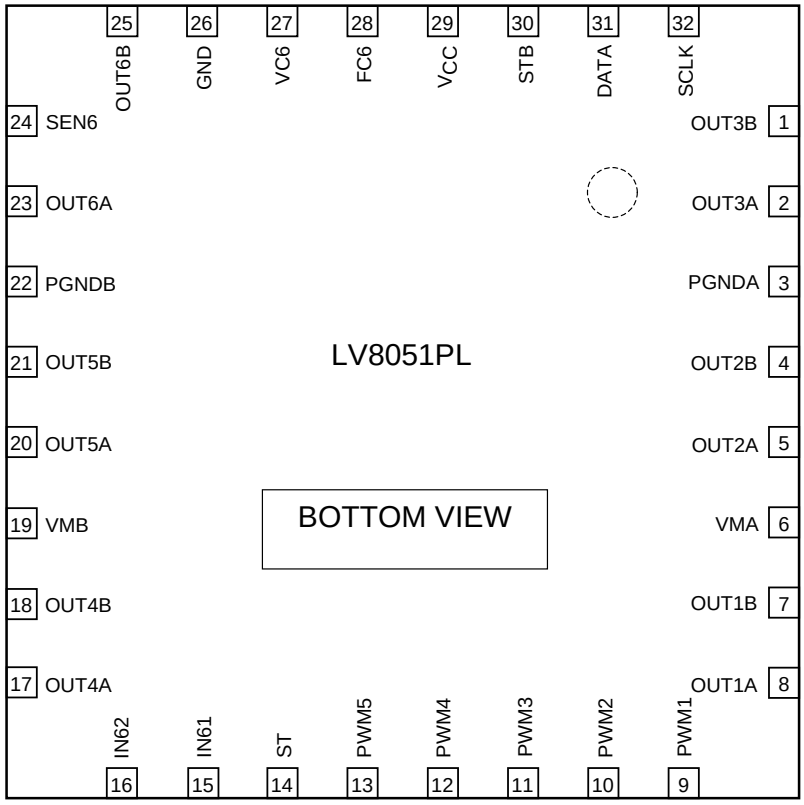
Pin Assignment / VQLP32





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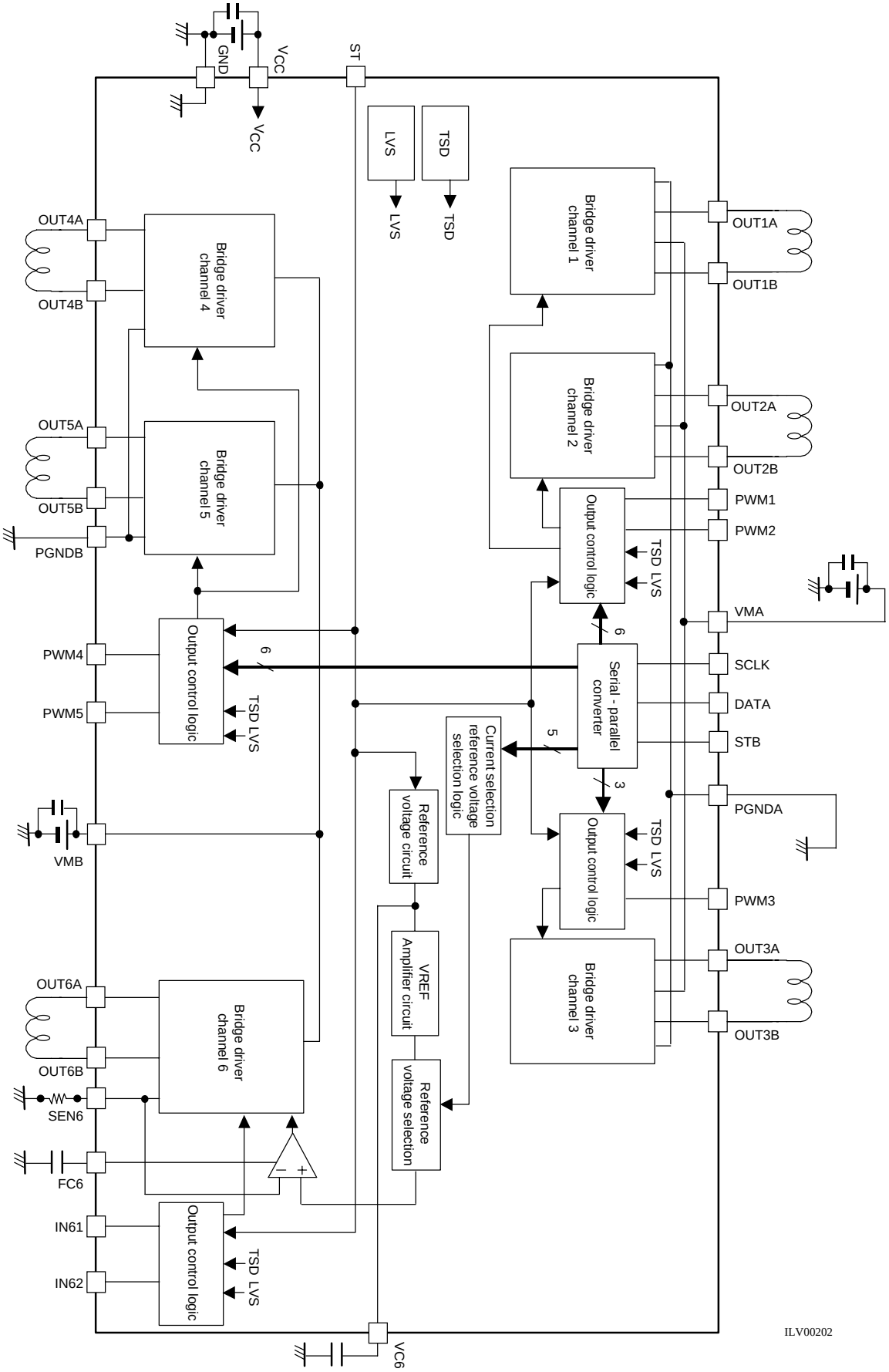
Block Diagram



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Pin Function

Pin No.	Pin name	Pin function
6	VMA	PWM: Channels 1, 2 and 3 motor power supply connection
8	OUT1A	PWM: Channel 1 OUTA output
7	OUT1B	PWM: Channel 1 OUTB output
9	PWM1	PWM: Channel 1 PWM signal input
5	OUT2A	PWM: Channel 2 OUTA output
4	OUT2B	PWM: Channel 2 OUTB output
10	PWM2	PWM: Channel 2 PWM signal input
2	OUT3A	PWM: Channel 3 OUTA output
1	OUT3B	PWM: Channel 3 OUTB output
11	PWM3	PWM: Channel 3 PWM signal input
3	PGNDA	PWM: Channels 1, 2 and 3 power ground
19	VMB	PWM: Channels 4, 5 constant current, Channel 6 motor power supply connection
17	OUT4A	PWM: Channel 4 OUTA output
18	OUT4B	PWM: Channel 4 OUTB output
12	PWM4	PWM: Channel 4 PWM signal input
20	OUT5A	PWM: Channel 5 OUTA output
21	OUT5B	PWM: Channel 5 OUTB output
13	PWM5	PWM: Channel 5 PWM signal input
22	PGNDB	PWM: Channels 4, 5 power ground
23	OUT6A	Constant current drive: Channel 6 OUTA output
25	OUT6B	Constant current drive: Channel 6 OUTB output
24	SEN6	Constant current drive: Channel 6 current sensing resistor connection
15	IN61	Constant current drive: Channel 6 logic input pin 1
16	IN62	Constant current drive: Channel 6 logic input pin 2
28	FC6	Constant current drive: Channel 6 phase compensation capacitor connection
27	VC6	Constant current drive: Channel 6 start-up correction capacitor connection
32	SCLK	Serial data transfer clock input
31	DATA	Serial data input
30	STB	Serial data latch pulse input
14	ST	Chip enable
29	V_{CC}	Logic system power connection
26	GND	Signal system ground

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Serial Data Input Specifications

Register (D1, D0): Data transfer Address register selections

D1	D0	Mode
0	0	PWM Channel 1 and 2 settings
0	1	PWM Channels 3 and 4 settings
1	0	PWM Channel 5 settings
1	1	Constant current channel 6 reference voltage/ PWM mode switch settings

Select the register for setting the state of each motor driver by setting the serial data (D1, D0) as shown above.

PWM Channel 1 and 2 settings

Register No.	Data	Symbol	Functions
D0	0	REG_SELECT1	Register selection 1
D1	0	REG_SELECT2	Register selection 2
D2	0 or 1	MODE1	Channel 1 input mode selection
D3	0 or 1	MODE2	Channel 2 input mode selection
D4	0 or 1	IN1A	Channel 1 input a
D5	0 or 1	IN1B	Channel 1 input b
D6	0 or 1	IN2A	Channel 2 input a
D7	0 or 1	IN2B	Channel 2 input b

PWM Channel 3 and 4 settings

Register No.	Data	Symbol	Functions
D0	1	REG_SELECT1	Register selection 1
D1	0	REG_SELECT2	Register selection 2
D2	0 or 1	MODE3	Channel 3 input mode selection
D3	0 or 1	MODE4	Channel 4 input mode selection
D4	0 or 1	IN3A	Channel 3 input a
D5	0 or 1	IN3B	Channel 3 input b
D6	0 or 1	IN4A	Channel 4 input a
D7	0 or 1	IN4B	Channel 4 input b

PWM Channel 5 settings

Register No.	Data	Symbol	Functions
D0	0	REG_SELECT1	Register selection 1
D1	1	REG_SELECT2	Register selection 2
D2	0 or 1	MODE5	Channel 5 input mode selection
D3	0 or 1	(DUMMY)	(Dummy data)
D4	0 or 1	IN5A	Channel 5 input a
D5	0 or 1	IN5B	Channel 5 input b
D6	0 or 1	(DUMMY)	(Dummy data)
D7	0 or 1	(DUMMY)	(Dummy data)

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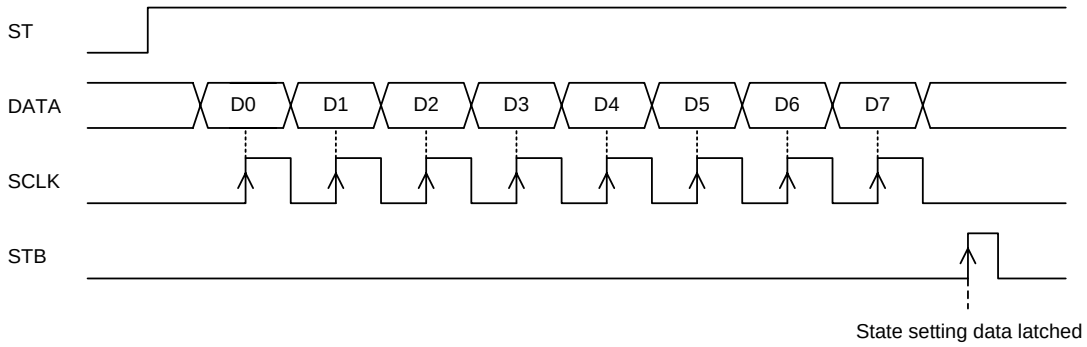
Constant Current Channel 6 Reference Voltage/ PWM Mode Switch Settings

Register No.	Data	Symbol	Functions
D0	1	REG_SELECT1	Register selection 1
D1	1	REG_SELECT2	Register selection 2
D2	0 or 1	VSEN1	Current control reference voltage selection 1
D3	0 or 1	VSEN2	Current control reference voltage selection 2
D4	0 or 1	VSEN3	Current control reference voltage selection 3
D5	0 or 1	VSEN4	Current control reference voltage selection 4
D6	0 or 1	VSEN5	Current control reference voltage selection 5
D7	0 or 1	PWMOFF	PWM control mode switch control

Serial Data Input Settings



Data is input in order from data bit 0 to data bit 7. Data is transferred on the rising edge of the clock signal and after all the data has been transferred, it is latched on the rising edge of the STB signal.
The data is reflected in the output simultaneously with the STB signal.

Note: When ST is low level and at the V_{CC} low-voltage cut voltage, all serial data is reset to 0.
(At initialization all register data is set to 0.)

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PWM Drive Forward/Reverse Drivers (Channels 1, 2, 3, 4 and 5)

PWM Control I/O Logic Truth Table

MODEx= “0”, PWMOFF= “0”

Input			Output		Operating Mode
INxA	INxB	PWMx	OUTxA	OUTxB	
0	0	*	OFF	OFF	Standby
0	1	L	L	H	Counterclockwise (reverse)
0	1	H	L	L	Short-circuit braking
1	0	L	H	L	Clockwise (forward)
1	0	H	L	L	Short-circuit braking
1	1	*	L	L	Short-circuit braking

MODEx= “0”, PWMOFF= “1”

Input			Output		Operating Mode
InxA	InxB	PWMx	OUTxA	OUTxB	
0	0	*	OFF	OFF	Standby
0	1	L	L	H	Counterclockwise (reverse)
0	1	H	OFF	OFF	Standby
1	0	L	H	L	Clockwise (forward)
1	0	H	OFF	OFF	Standby
1	1	*	L	L	Short-circuit braking

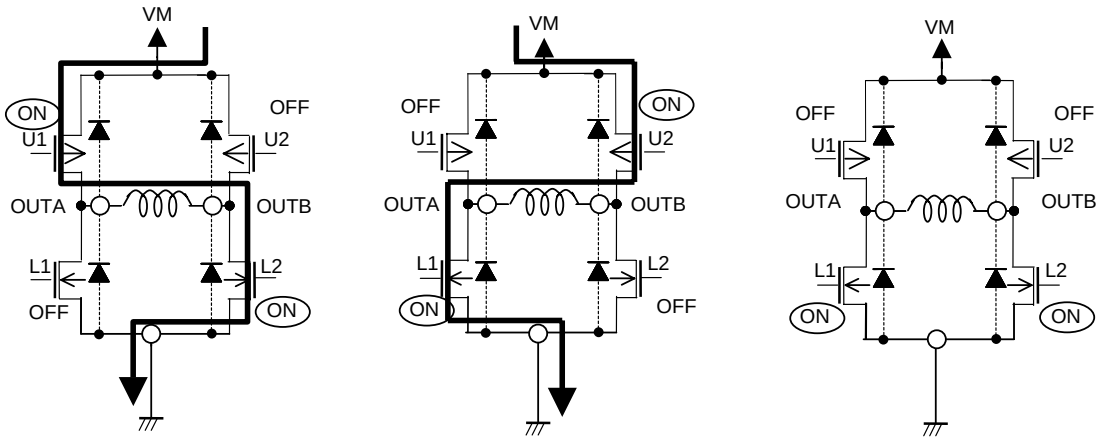
PWMOFF(D7): When in PWM control mode, it is possible to switch among Forward (Reverse) – Braking and Forward (Reverse) – Standby. However, it switches channels 1 through 5 at the same time.

MODEx= “1”, PWMOFF= “*”

Input			Output		Operating Mode
InxA	InxB	PWMx	OUTxA	OUTxB	
0	*	*	OFF	OFF	Standby
1	0	L	H	L	Clockwise (forward)
1	0	H	L	H	Counterclockwise (reverse)
1	1	*	L	L	Short-circuit braking

*: Don’t care x: Xch

Output stage transistor functions



(Forward) (Reverse) (Short-circuit braking)

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Constant Current Forward/Reverse Motor Driver (Channel 6)

Truth Table

Input		Output		Mode
IN61	IN62	OUT6A	OUT6B	
L	L	OFF	OFF	Standby
L	H	H	L	Clockwise (forward)
H	L	L	H	Counterclockwise (reverse)
H	H	L	L	Short-circuit braking

Reference Voltage Settings: 5 bits (D1,D0 = 1,1)

D6 (VSEN5)	D5 (VSEN4)	D4 (VSEN3)	D3 (VSEN2)	D2 (VSEN1)	Current setting reference voltage
0	0	0	0	0	0.200V
0	0	0	0	1	0.195V
0	0	0	1	0	0.190V
0	0	0	1	1	0.185V
0	0	1	0	0	0.180V
0	0	1	0	1	0.175V
0	0	1	1	0	0.170V
0	0	1	1	1	0.165V
0	1	0	0	0	0.160V
0	1	0	0	1	0.155V
0	1	0	1	0	0.150V
0	1	0	1	1	0.145V
0	1	1	0	0	0.140V
0	1	1	0	1	0.135V
0	1	1	1	0	0.130V
0	1	1	1	1	0.125V
1	0	0	0	0	0.120V
1	0	0	0	1	0.115V
1	0	0	1	0	0.110V
1	0	0	1	1	0.105V
1	0	1	0	0	0.100V
1	0	1	0	1	0.095V
1	0	1	1	0	0.090V
1	0	1	1	1	0.085V
1	1	0	0	0	0.080V
1	1	0	0	1	0.075V
1	1	0	1	0	0.070V
1	1	0	1	1	0.065V
1	1	1	0	0	0.060V
1	1	1	0	1	0.055V
1	1	1	1	0	0.050V
1	1	1	1	1	0.045V

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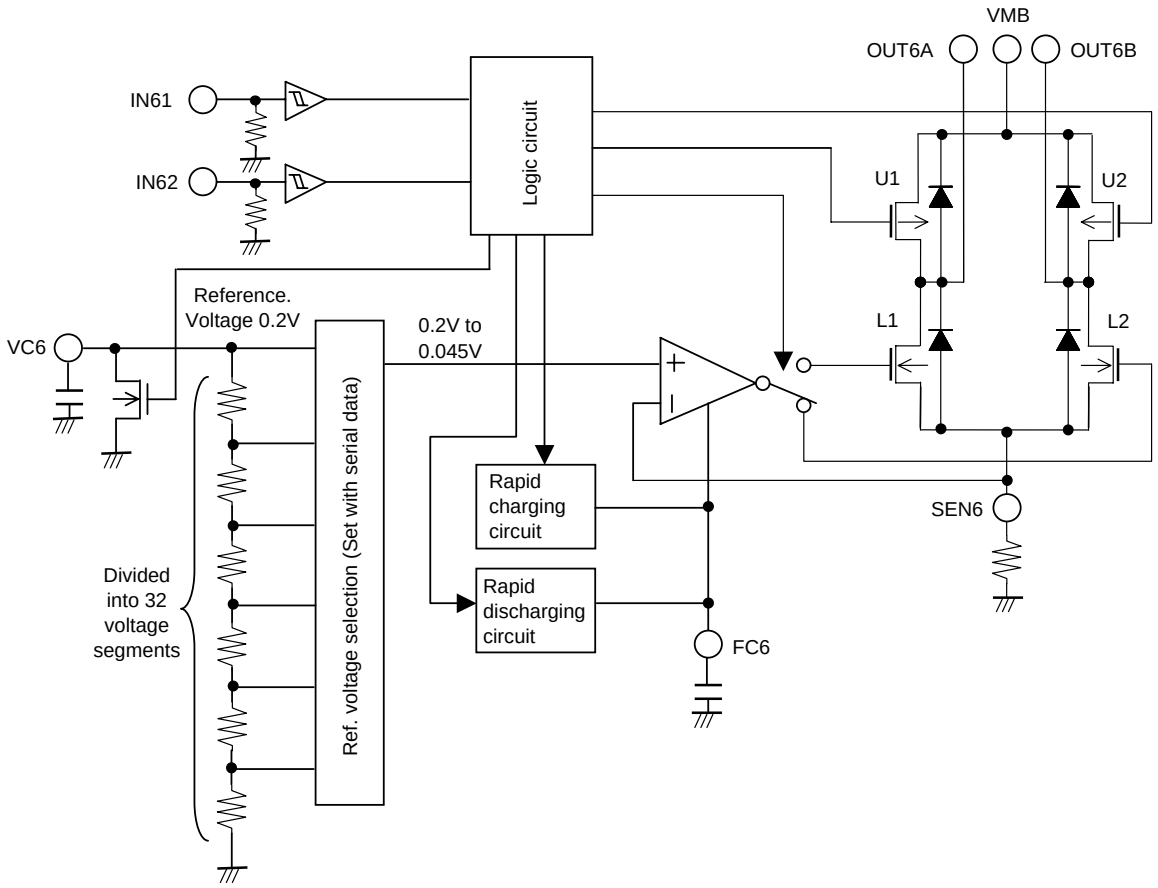

Start-up correction function (VC6)

A capacitor is connected to terminal VC6 and by controlling the rate at which the reference voltage rises, it corrects the start-up waveform of the coil. By doing this, stable shutter operation can be carried out with respect to the power supply variations.

For the start-up correction, check the coil current start-up wave for the VM reduced voltage when there is no VC6 capacitor and choose a capacitor so that the decay time constant is lower than this wave.

However, when power supply voltage is stable or the start-up correction function is not required, the start-up correction capacitor is not necessary.

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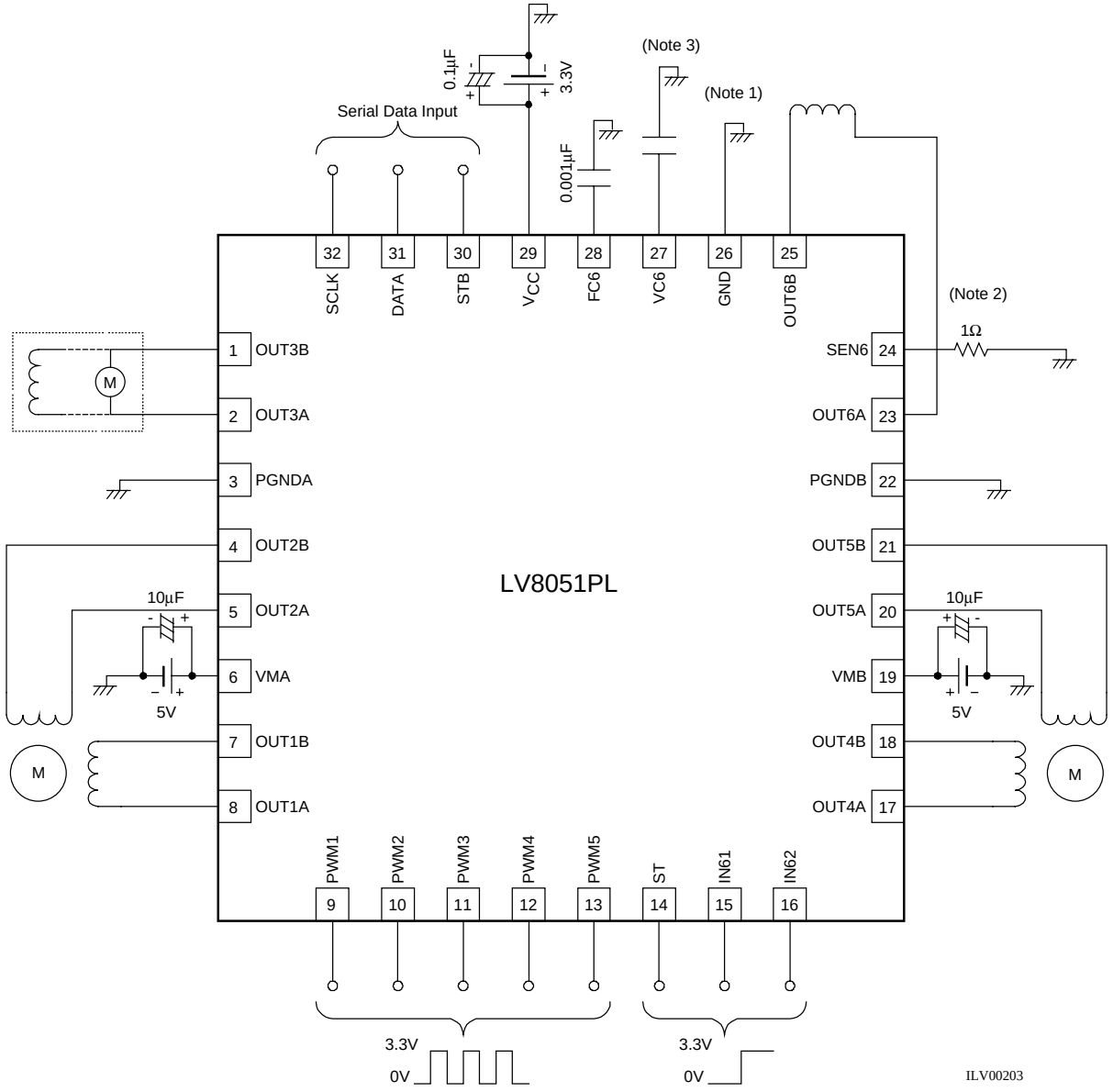
Recommended Application Circuit

The value at each pixel is a recommended value. Check the allowable operation range described previously for the values of each input condition.

1ch/2ch STM
3ch DCM/VCM
4ch/5ch STM
6ch VCM



Note 1: We recommend one-point grounding wherever possible.
Note 2: A 1Ω resistor is connected to the SEN6 pin. This gives an output current of 200mA when the reference voltage is set to 0.2V.
Note 3: The VC6 capacitor is optional. This pin must be held open when the capacitor is not to be used.

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