4-channel PWM driver for CD and MD players

BH6511FS

The BH6511FS is an IC designed for CD and MD player motors and actuators, and has an internal 4-channel PWM driver, and a charge pump circuit that supplies the gate drive for the output stage power MOSFET. The power MOSFET in the output stage assures low power consumption for applications.

●Applications

CD and MD players

●Features

1) Internal 4-channel power MOS H-bridge.
2) Adaptable for PWM input.
3) Internal charge pump circuit to raise VG voltage.
4) Low ON resistance.
5) Low power consumption.
6) 32-pin SSOP-A compact package.

●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
H-bridge supply voltage	VM	9	V
Control circuit supply voltage	V_{DD}	9	V
Predriver supply voltage	VG (pin2)	12	V
Driver output current	Io (ch1, ch3) Io (ch2, ch4)	500 300*1	mA
Power dissipation	Pd	850*2	mW
Operating temperature	Topr	−30～+85	℃
Storage temperature	Tstg	−55～+150	℃

*1. 500 ms.

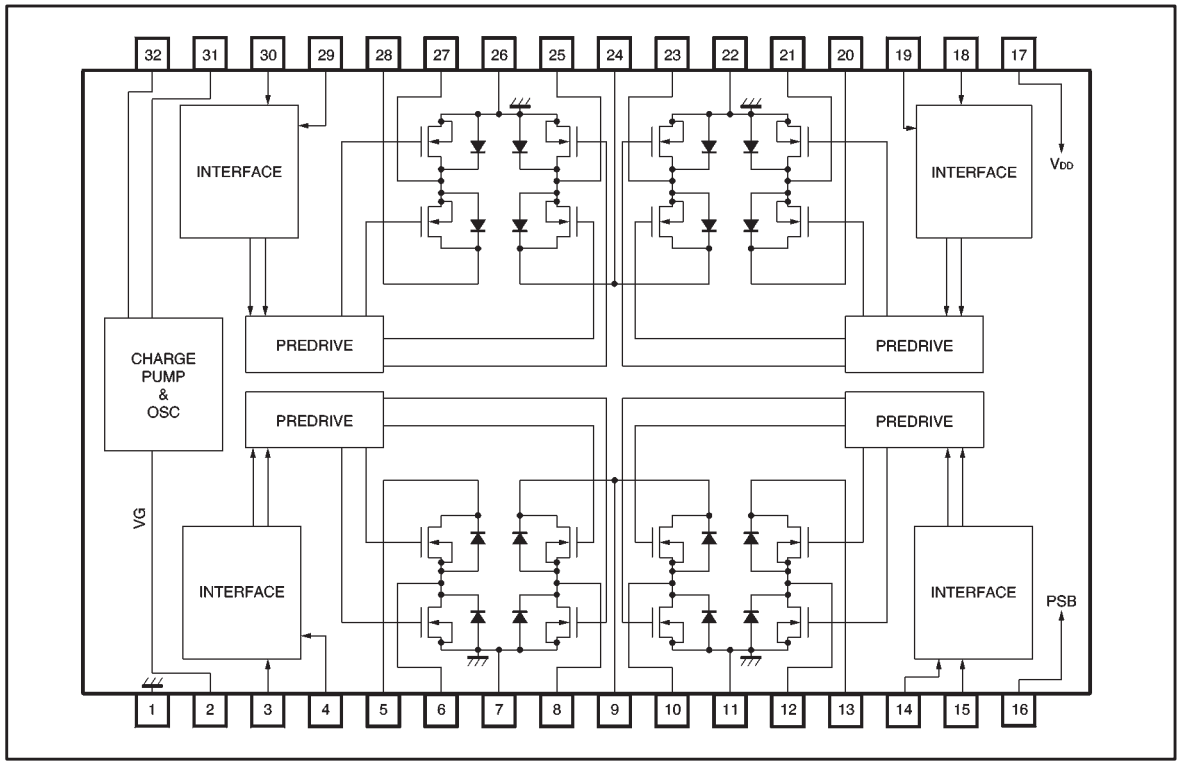
*2. Reduced by 6.8 mW for each increase in Ta of 1℃ over 25℃.

●Recommended operating conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
H-bridge supply voltage	VM*	1.6	5.0	5.5	V
Control circuit supply voltage	V_{DD}	2.7	3.0	5.5	V
Predriver supply voltage	VG(pin2)	VM+3.0	10	11.5	V
Ambient temperature	Ta	−35	25	85	℃
Pulse input frequency	f_{IN}	−	176.4	200	kHz

*Internal charge pump not used. When used, H-bridge supply voltage = 2.7-5.5 V.

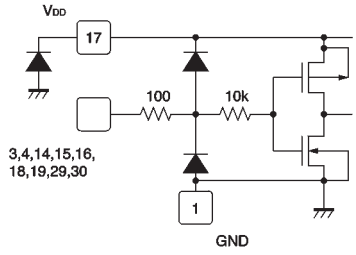
●Block diagram

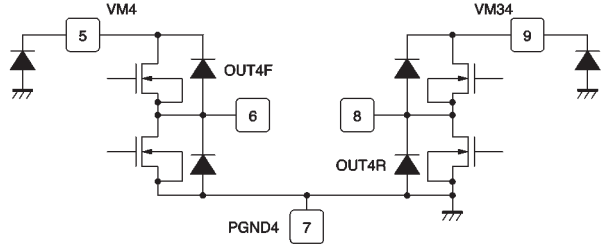


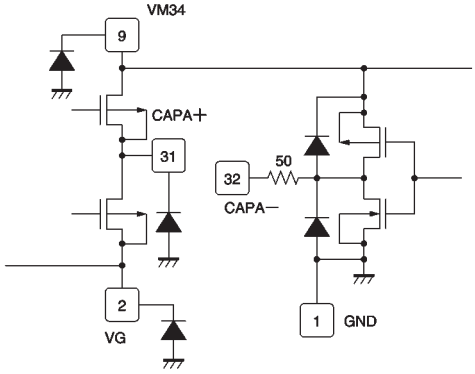
●Pin descriptions

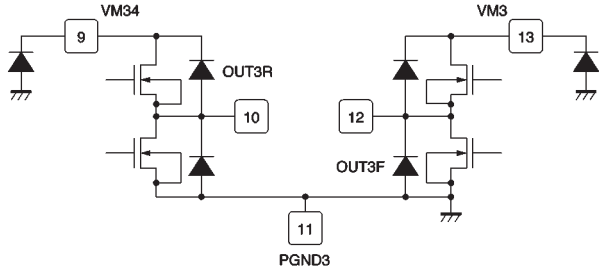
Pin No.	Pin name	Function	Pin No.	Pin name	Function
1	GND	Predrive ground	17	V_{DD}	Predrive power supply
2	VG	Gate voltage supply	18	IN1R	Channel 1 reverse input
3	IN4R	Channel 4 reverse input	19	IN1F	Channel 1 forward input
4	IN4F	Channel 4 forward input	20	VM1	Power supply
5	VM4	Power supply	21	OUT1F	Channel 1 forward output
6	OUT4F	Channel 4 forward output	22	PGND1	Power ground
7	PGND4	Power ground	23	OUT1R	Channel 1 reverse output
8	OUT4R	Channel 4 reverse output	24	VM12	Power supply
9	VM34	Power supply	25	OUT2R	Channel 2 reverse output
10	OUT3R	Channel 3 reverse output	26	PGND2	Power ground
11	PGND3	Power ground	27	OUT2F	Channel 2 forward output
12	OUT3F	Channel 3 forward output	28	VM2	Power supply
13	VM3	Power supply	29	IN2F	Channel 2 forward input
14	IN3F	Channel 3 forward input	30	IN2R	Channel 2 reverse input
15	IN3R	Channel 3 reverse input	31	CAPA+	Charge pump capacitor connection (positive)
16	PSB	Power cut	32	CAPA−	Charge pump capacitor connection (negative)

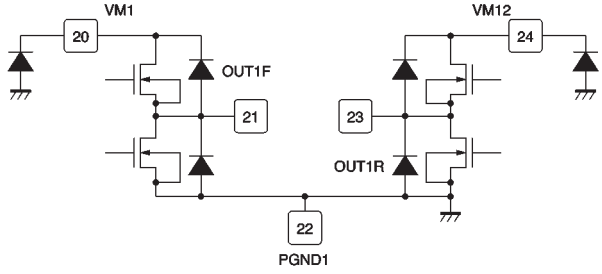
●Pin equivalent circuit diagrams

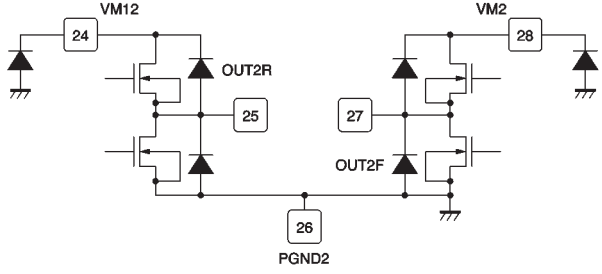












●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_M = 5V, V_{DD} = 3V, VG = internal charge pump output, f_{IN} = 176kHz, R_L = 8Ω –47μH)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement Circuit
〈H-bridge supply current〉							
No input	IMST	—	320	380	μA	V_{DD}=3V, VM=5V	Fig.3
〈Control circuit supply current〉							
No input	I_{DD1}	—	—	−1	μA		Fig.3
Operating	I_{DD2}	—	6	70	μA	IDD1 / 4-channel simultaneous drive	Fig.3
〈Predriver supply voltage〉 (charge pump output)							
No input	VGST	8.8	9.95	12	V		Fig.3
Operating	VGA	7.9	8.5	11	V	4-channel simultaneous drive	Fig.3
〈Logic input characteristics〉							
Input high level voltage	V_{IH}	V_{DD}−0.6	—	—	V		Fig.3
Input low level voltage	V_{IL}	—	—	0.6	V		Fig.3
Input high level current	I_{IH}	—	—	1	μA		Fig.3
Input low level current	I_{IL}	−1	—	—	μA		Fig.3
Output ON resistance	RON1, 3	—	0.8	1.2	Ω	Sum of top and bottom ON resistance VM=2.5V, V_{DD}=3V, VG=10V (VG is supplied externally)	Fig.3
	RON2, 4	—	1.2	2.0			
Output delay time	t_{RISE}	—	0.2	1	μsec		Fig.3
	t_{FALL}	—	0.2	1	μsec		Fig.3
Minimum input pulse width	$t_{Min.}$	150	—	—	nsec	Output pulse width = 2 / 3 tMin. (minimum)	Fig.3
Oscillator frequency	f_{OSC}	150	370	520	kHz	Pin 31 waveform monitor	Fig.3

◎ Not designed for radiation resistance.

●Measurement circuit

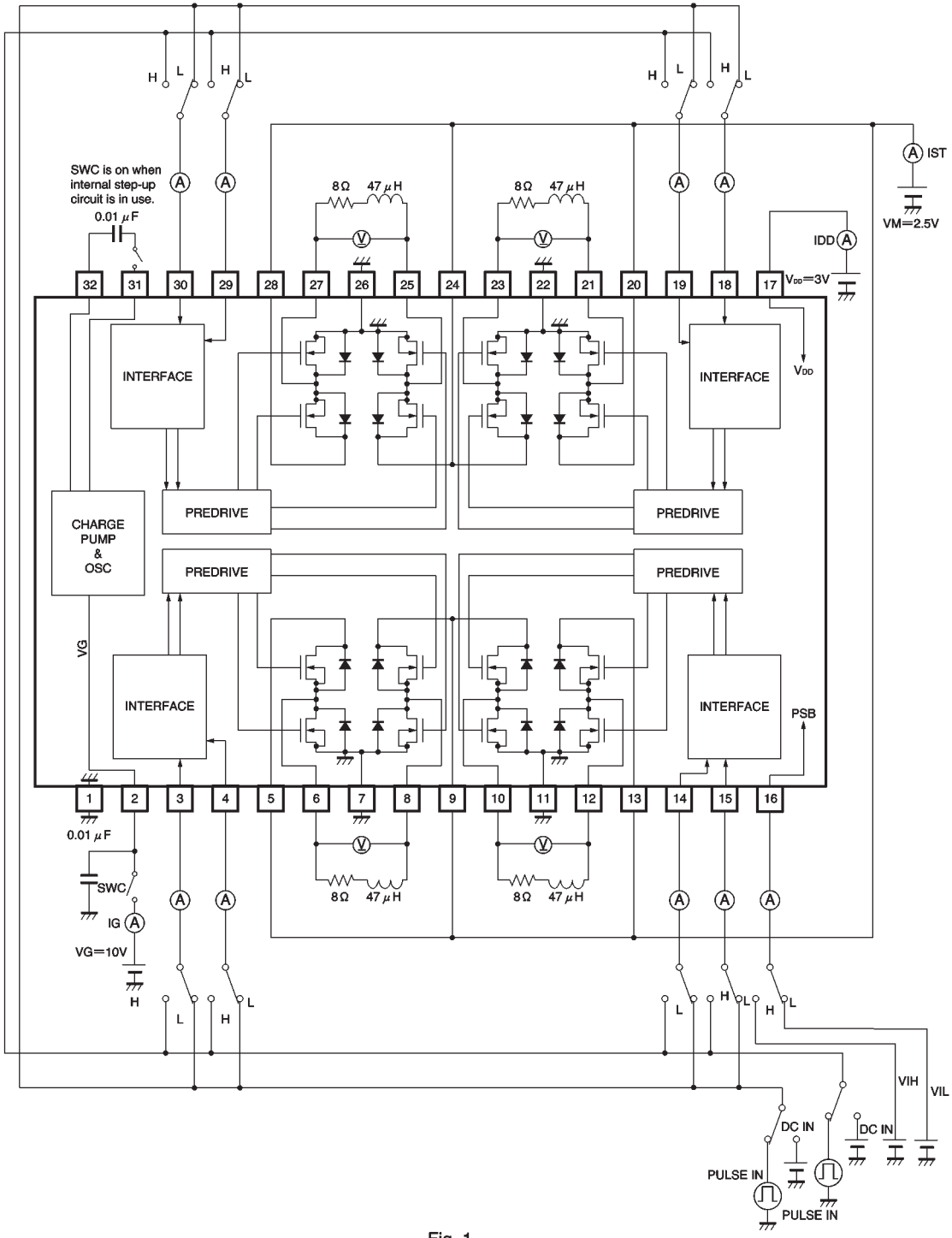


Fig. 1

●Circuit operation

(1) PWM driver

The output stage is an H-bridge driver with four N-type FET circuits. Output PWM duty is changed according to input PWM duty. This pulse drives the load (direct PWM).

Driver truth table

PSB*	IN1～4F	IN1～4R	OUT1～3F	OUT1～3R	OUT4F	OUT4R
H	L	L	L	L	L	L
H	L	H	L	H	L	H
H	H	L	H	L	L	L
H	H	H	L	L	H	L
L	X	X	L	L	L	L

* All outputs are L,L in the PSB mode, regardless of inputs. Even in this state, however, the charge pump circuit does not stop free-run oscillation.

(2) Charge pump

A dedicated charge pump that supplies the drive voltage to the output stage H-bridge power MOSFET.

(3) Because the charge pump circuit doubles the voltage using pin 9 voltage as its reference, VG is not output unless VM is impressed on pin 9. Also, be sure to set the VM voltage to keep the charge pump voltage under the absolute maximum rating.

(4) When supplying VG directly from an external source, rather than using the internal charge pump circuit, disconnect the capacitor between pins 31 and 32.

(5) A charge pump capacitor between 0.01 and 0.1μF is recommended. Using one with a greater capacity will not significantly improve performance.

●Application example

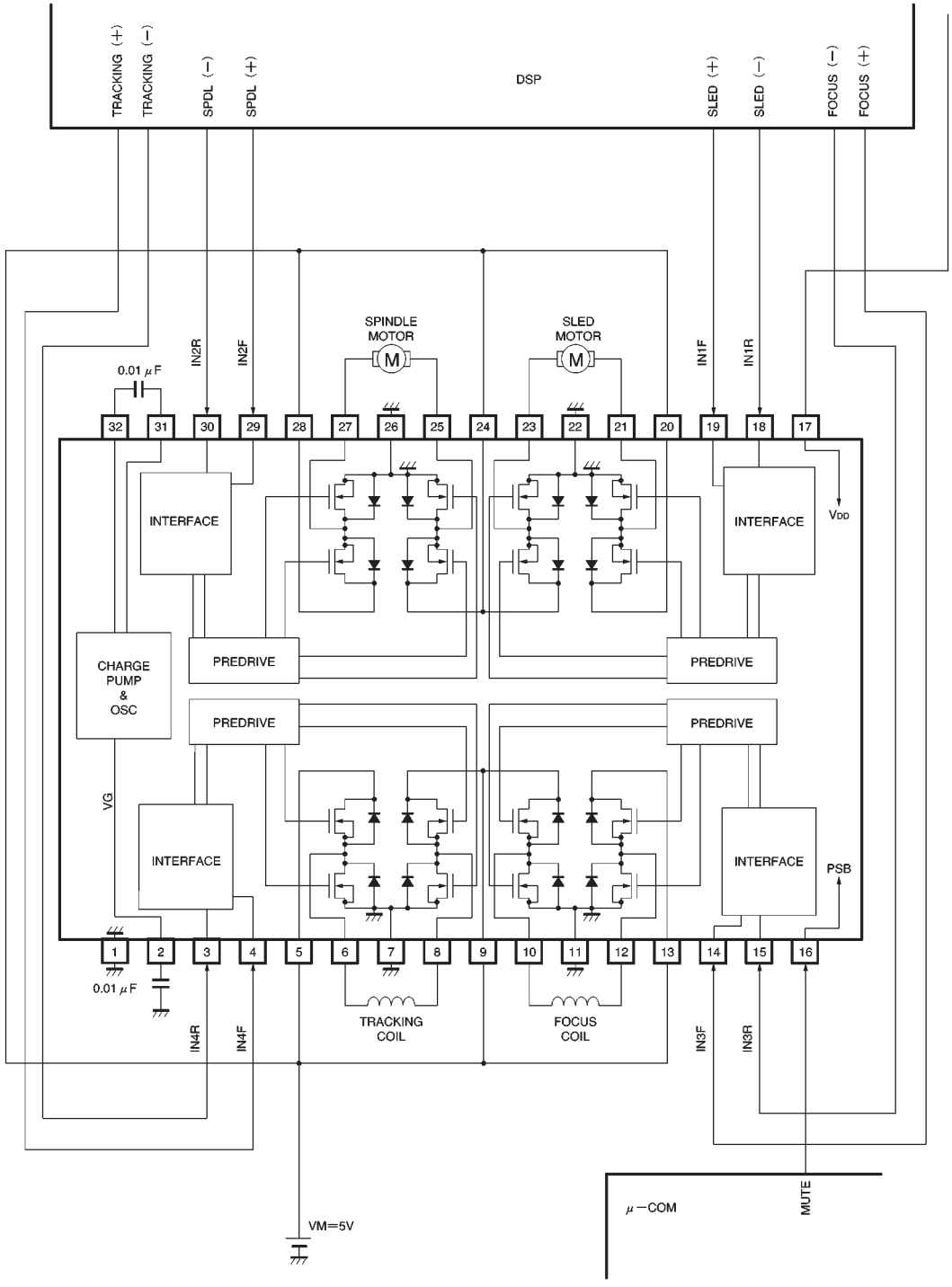


Fig. 2

●Electrical characteristic curves

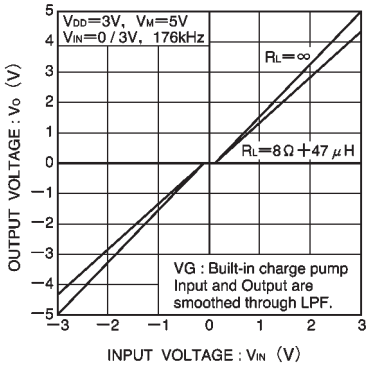


Fig. 3 I / O characteristics (CH1, CH3)

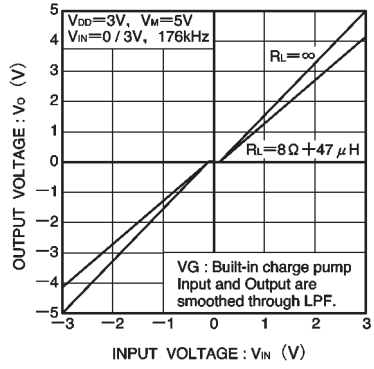


Fig. 4 I / O characteristics (CH2, CH4)

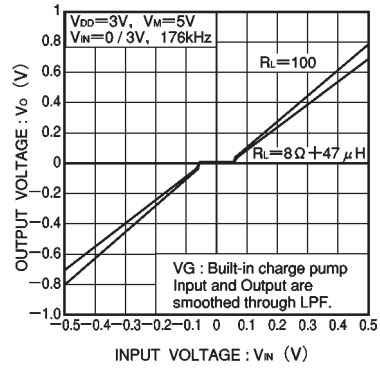


Fig. 5 I / O characteristics during ultralow input (CH1, CH3)

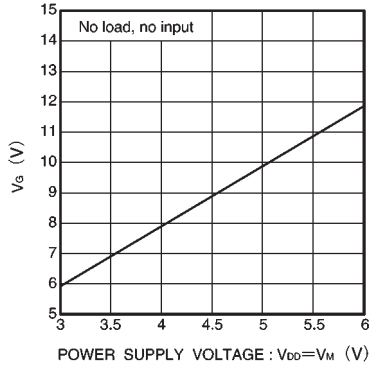


Fig. 6 Power supply voltage vs. charge pump output

●Extermal dimensions (Units: mm)