

# 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	VDD	9	V
Predriver supply voltage	VG (2pin)	12	V
Driver output current	I <sub>O</sub> (CH1, CH3) I <sub>O</sub> (CH2, CH4)	500 300*1	mA
Power dissipation	P <sub>d</sub>	850*2	mW
Operating temperature	T <sub>opr</sub>	-30~85	°C
Storage temperature	T <sub>stg</sub>	-55~150	°C

\*1. 500 msec.

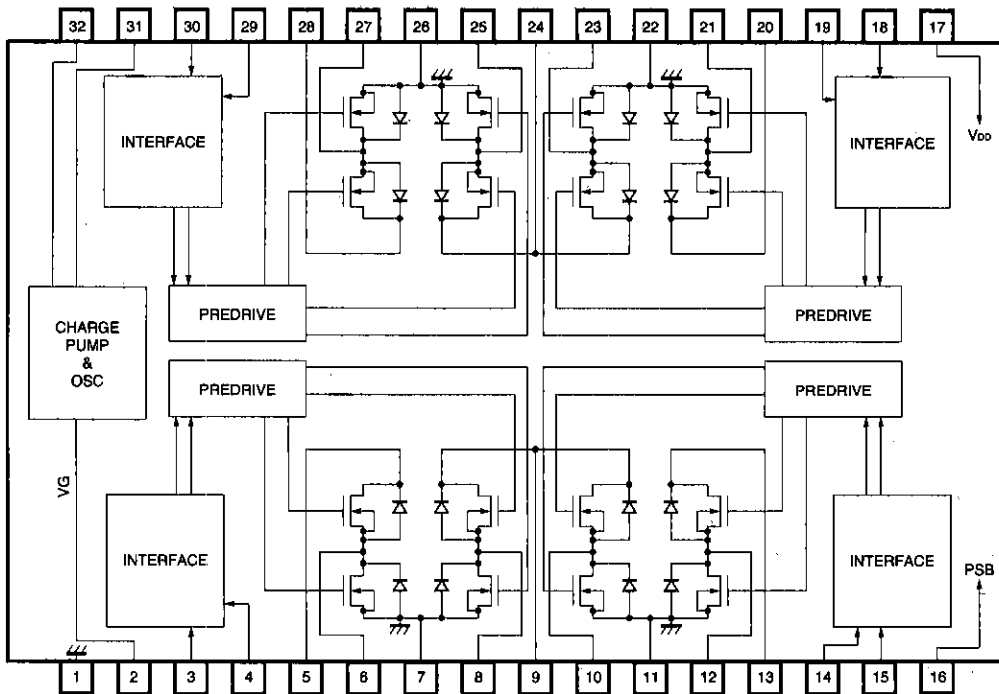
\*2. Reduced by 6.8 mW for each increase in Ta of 1°C over 25°C.

### ●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	VDD	2.7	3.0	5.5	V
Predriver supply voltage	VG (2pin)	VM+3.0	10	11.5	V
Ambient temperature	Ta	-35	25	85	°C
Pulse input frequency	f <sub>IN</sub>	—	176.4	200	kHz

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

●Block diagram



●Pin description

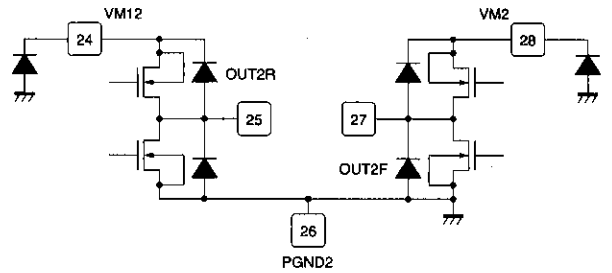
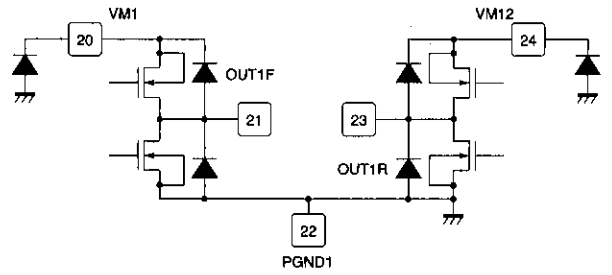
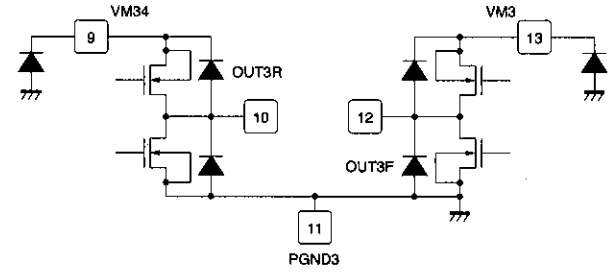
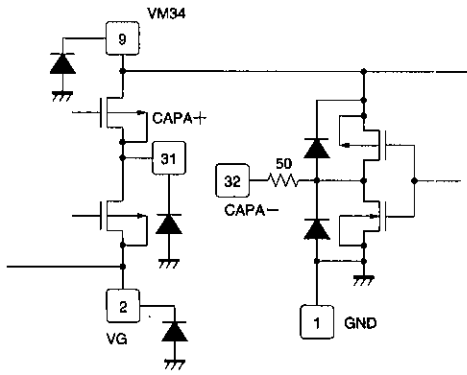
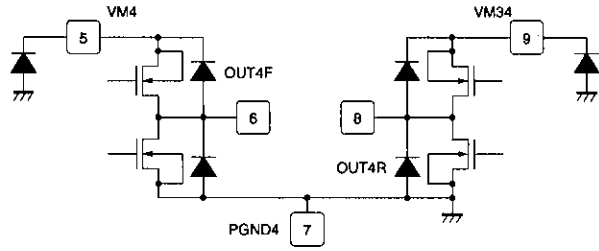
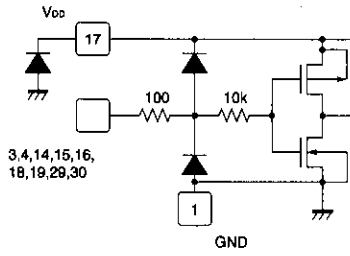
Pin No.	Pin name	Function
1	GND	Predrive ground
2	VG	Gate voltage supply
3	IN4R	Channel 4 reverse input
4	IN4F	Channel 4 forward input
5	VM4	Power supply
6	OUT4F	Channel 4 forward output
7	PGND4	Power ground
8	OUT4R	Channel 4 reverse output
9	VM34	Power supply
10	OUT3R	Channel 3 reverse output
11	PGND3	Power ground
12	OUT3F	Channel 3 forward output
13	VM3	Power supply
14	IN3F	Channel 3 forward input
15	IN3R	Channel 3 reverse input
16	PSB	Power cut

Pin No.	Pin name	Function
17	VDD	Predrive power supply
18	IN1R	Channel 1 reverse input
19	IN1F	Channel 1 forward input
20	VM1	Power supply
21	OUT1F	Channel 1 forward output
22	PGND1	Power ground
23	OUT1R	Channel 1 reverse outputd
24	VM12	Power supply
25	OUT2R	Channel 2 reverse output
26	PGND2	Power ground
27	OUT2F	Channel 2 forward output
28	VM2	Power supply
29	IN2F	Channel 2 forward input
30	IN2R	Channel 2 reverse input
31	CAPA+	Charge pump capacitor connection (positive)
32	CAPA-	Charge pump capacitor connection (negative)

CD/CD-ROM Drivers (4 channels)

For CDs/CD-ROMs

● Pin equivalent circuit diagrams



- Electrical characteristics (unless otherwise noted,  $T_a=25^\circ\text{C}$ ,  $V_M=5\text{V}$ ,  $V_{DD}=3\text{V}$ ,  $V_G$ =internal charge pump output,  $f_{IN}=176\text{kHz}$ ,  $R_L=8\ \Omega - 47\ \mu\text{H}$ )

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement Circuit
H-bridge supply current							
No input	IMST	—	320	380	$\mu\text{A}$	$V_{DD}=3\text{V}$ , $V_M=5\text{V}$	Fig.3
Control circuit supply current							
No input	IDD1	—	—	-1	$\mu\text{A}$		Fig.3
Operating	IDD2	—	6	70	$\mu\text{A}$	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 voltage, high level	VIH	$V_{DD}-0.6$	—	—	V		Fig.3
Input voltage, low level	VIL	—	—	0.6	V		Fig.3
Input current, high level	I <sub>IH</sub>	—	—	1	$\mu\text{A}$		Fig.3
Input current, low level	I <sub>IL</sub>	-1	—	—	$\mu\text{A}$		Fig.3
Output ON resistance	RON1, 3	—	0.8	1.2	$\Omega$	Sum of top and bottom ON resistance $V_M=2.5\text{V}$ , $V_{DC}=3\text{V}$ , $V_G=10\text{V}$ ( $V_G$ is supplied externally)	Fig.3
	RON2, 4	—	1.2	2.0			
Output delay time	t <sub>RISE</sub>	—	0.2	1	$\mu\text{sec}$		Fig.3
	t <sub>FALL</sub>	—	0.2	1	$\mu\text{sec}$		Fig.3
Minimum input pulse width	t <sub>min.</sub>	150	—	—	nsec	Output pulse width = 2/3 t <sub>min.</sub> (minimum)	Fig.3
Oscillator frequency	f <sub>osc</sub>	150	340	420	kHz	Pin 31 waveform monitor	Fig.3

○ Not designed for radiation resistance.

● Measurement circuit

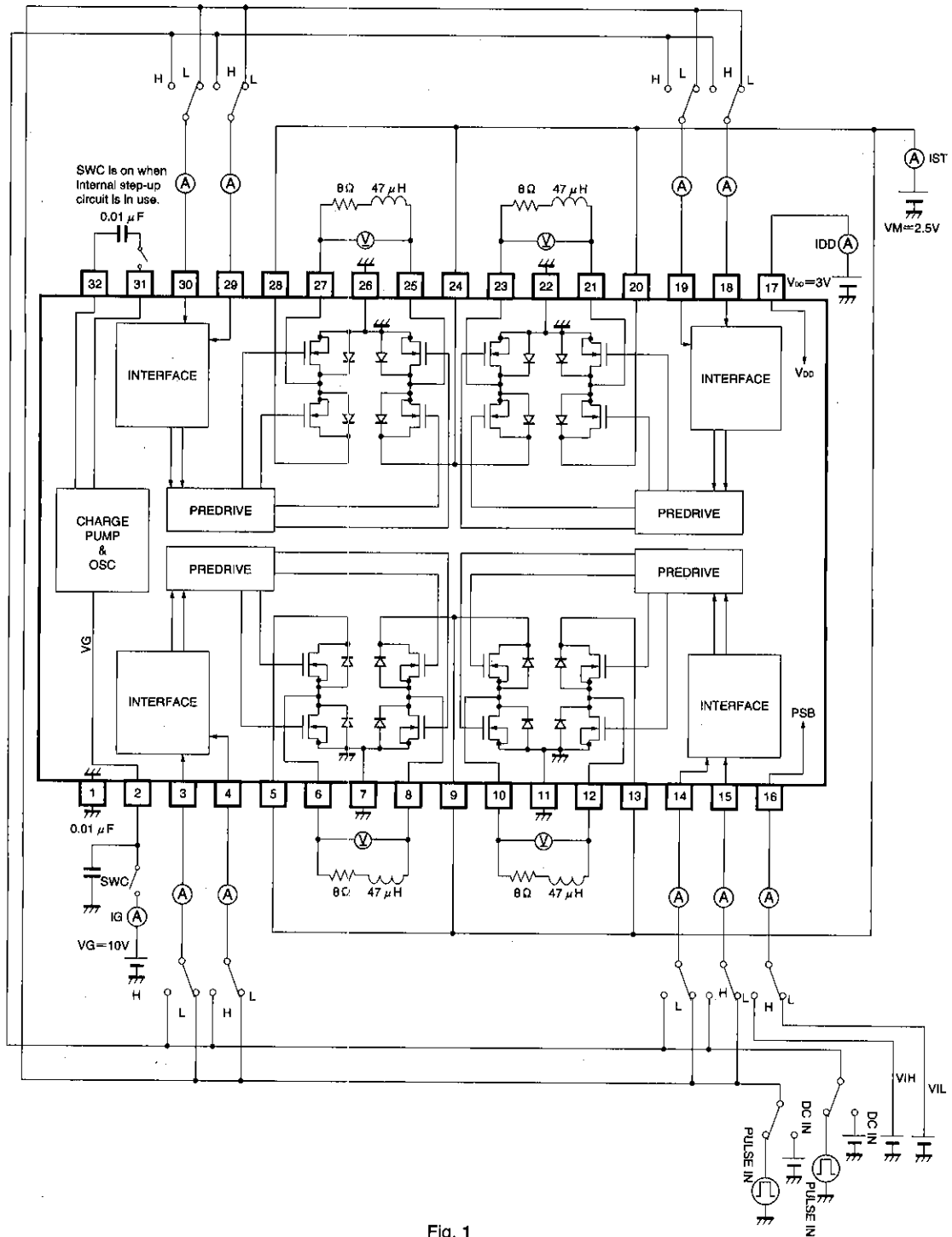


Fig. 1

## ● 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 MOS-FET.

- (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 0.1  $\mu$ F is recommended. Using one with a greater capacity will not significantly improve performance.

● Application example

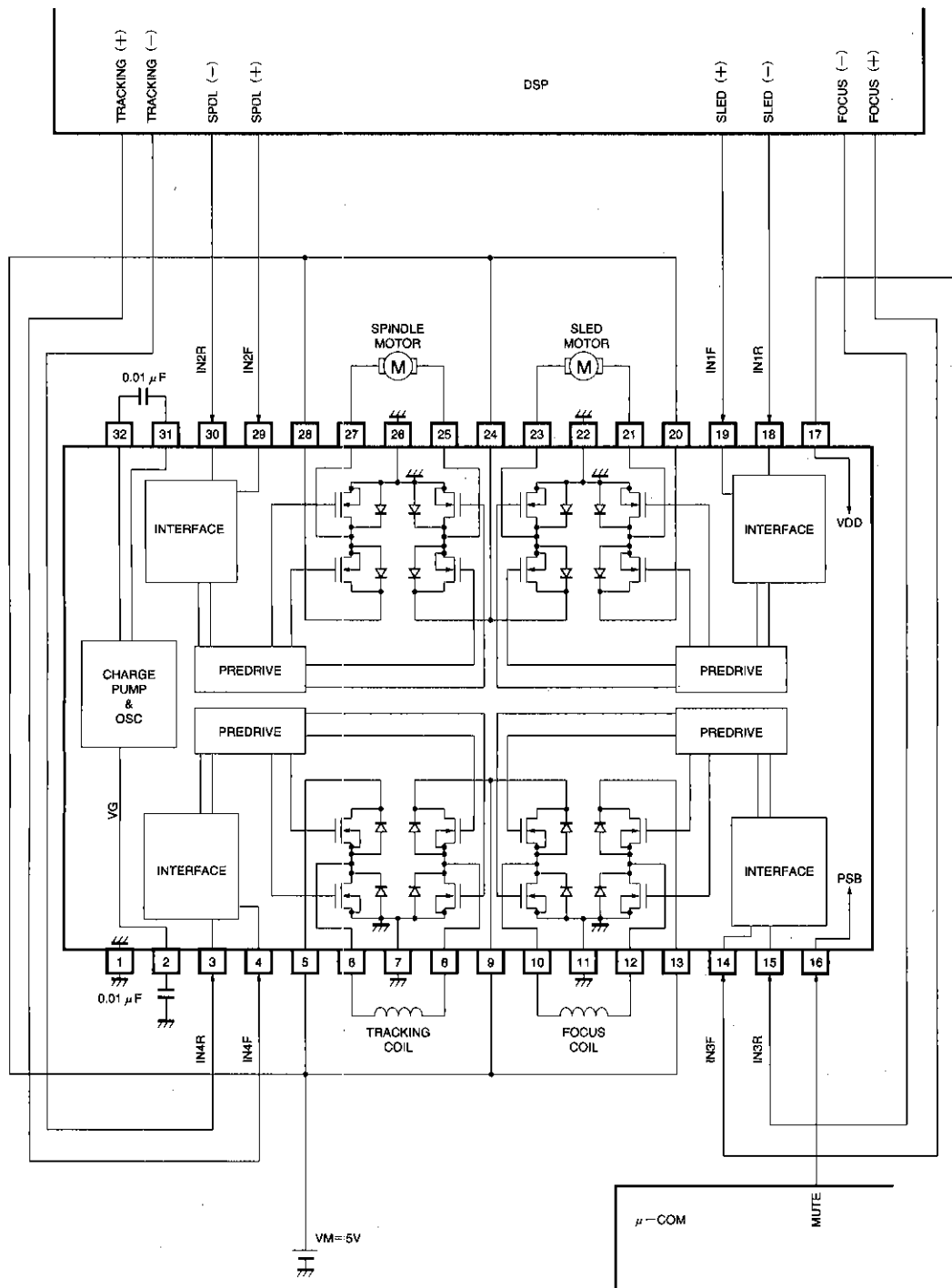


Fig. 2

● Electrical characteristic curves

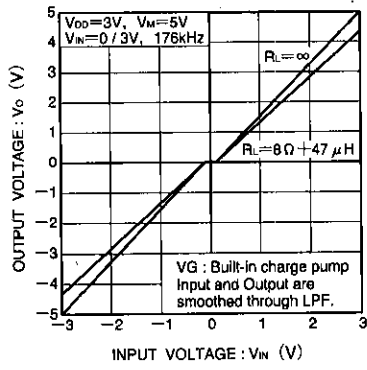


Fig. 3 I/O characteristics (CH1, CH3)

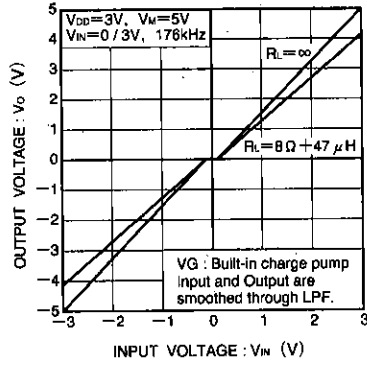


Fig. 4 I/O characteristics during ultralow input (CH2, CH4)

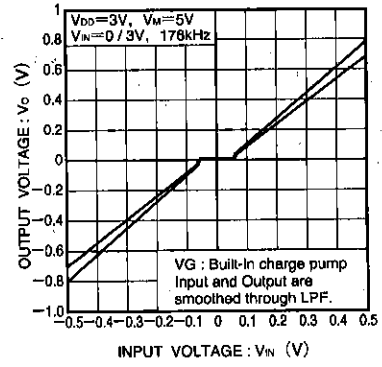


Fig. 5 I/O characteristics during ultralow input (CH1, CH3)

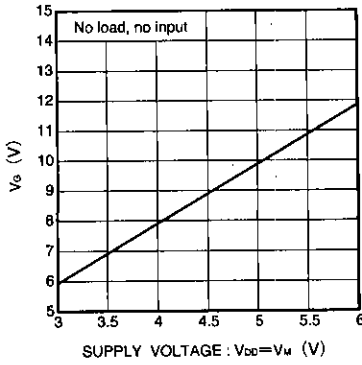
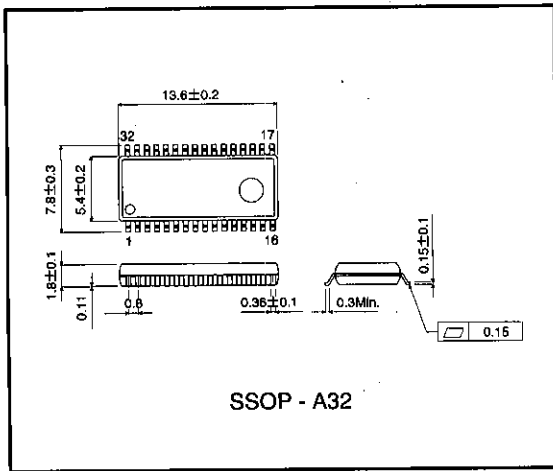


Fig. 6 Supply voltage vs. charge pump output

● External dimensions (Units: mm)



CD/CD-ROM Drivers (4 channels)

For CDs/CD-ROMs



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