Motor Drivers Vol.12.0

ROHM Co.,Ltd.

Motor Drivers

Four characteristics are required for motor drivers

High Reliability

ROHM is further strengthening the internal protection capabilities of its motor drivers, such as by integrating functions that prevent malfunctions due to voltage drop and protecting the IC from abnormal voltages and currents. We are also implementing a current limiting function that controls the motor current at startup, during forced stops, and when locked. In addition, function pins are provided that output fault conditions to an external host processor, ensuring a greater level of safety.

Silent Operation / Low Vibration

Regarding optimization of the drive waveforms with respect to noise and vibration during motor operation, ROHM will continue to propose commutation drive technologies optimized for the wide range of magnetic circuits of motors in various applications and fields, for example by utilizing current attenuation methods (decay technology) in stepper motor drivers, fan motor driver soft start technology, and commutation width technology (120°/150°/sine wave) ideal for brushless

Low Power Consumption / High Efficiency

To reduce motor power consumption, we continue to develop eco drive technologies and energy efficient power devices. One example is the use of an automatic angle adjustment function that achieves high efficiency and low power consumption across a wide range of rotational speeds, from high to low.

Control / Convenience

ROHM will continue to offer solutions that maximize the hardware implementation of high efficiency drive control algorithms for motors that make it easy for engineers to use. For example, there is high precision positioning control technology required for actuators and digital motor rotation control technology based on FFL (speed control) and PLL (phase control). Also, taking into account the compatibility of our product lineups, we are working to improve convenience by considering package pin designs that eliminate the need to change the pattern of the motor drive control substrate even when the load specifications change during motor development.

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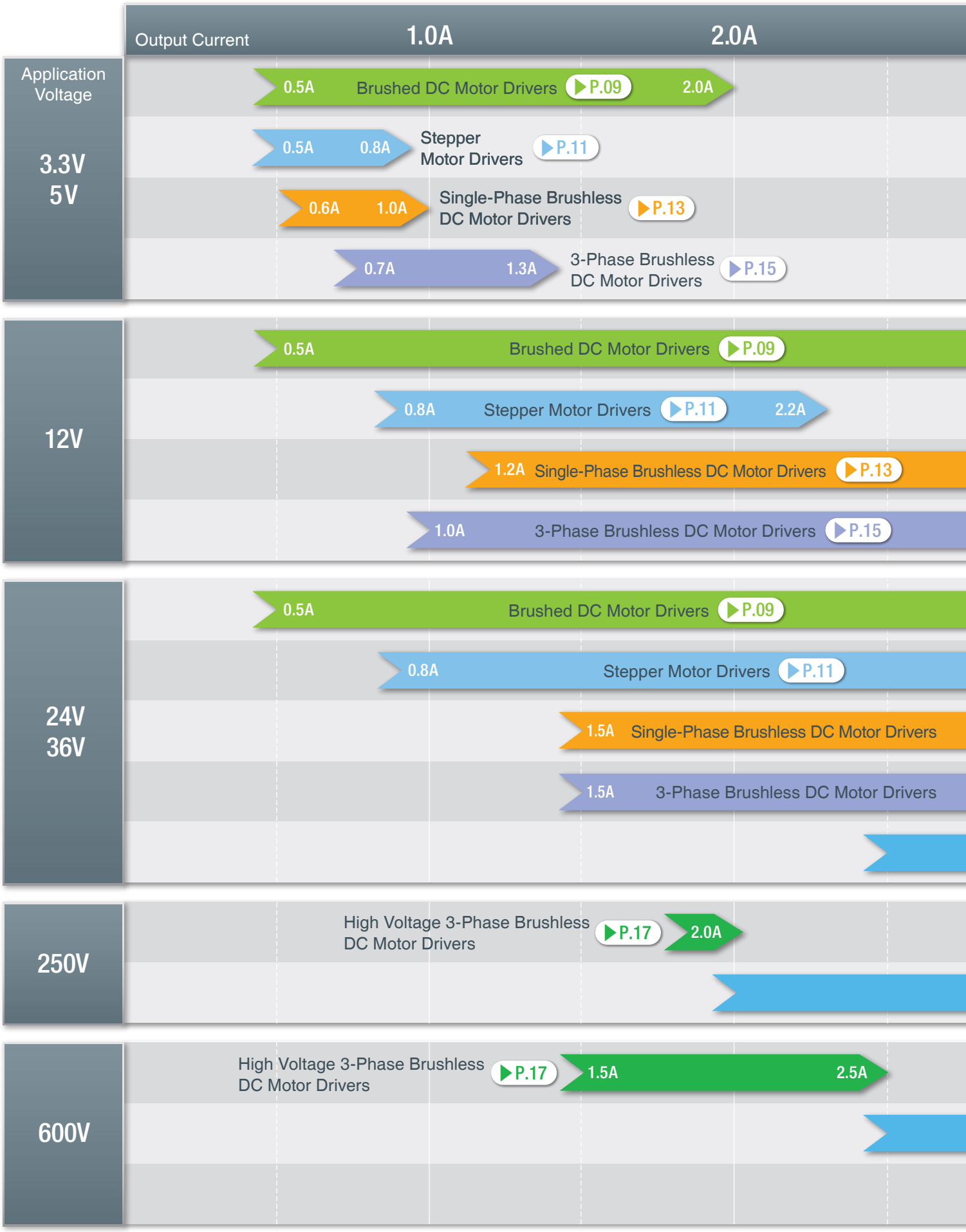
Motor Driver Selection Map

(Refer to P.21 for automotive products)




3.0A
4.0A
5.0A
30.0A
5.0A
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Non-Isolated Gate Driver+Power Device
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30A

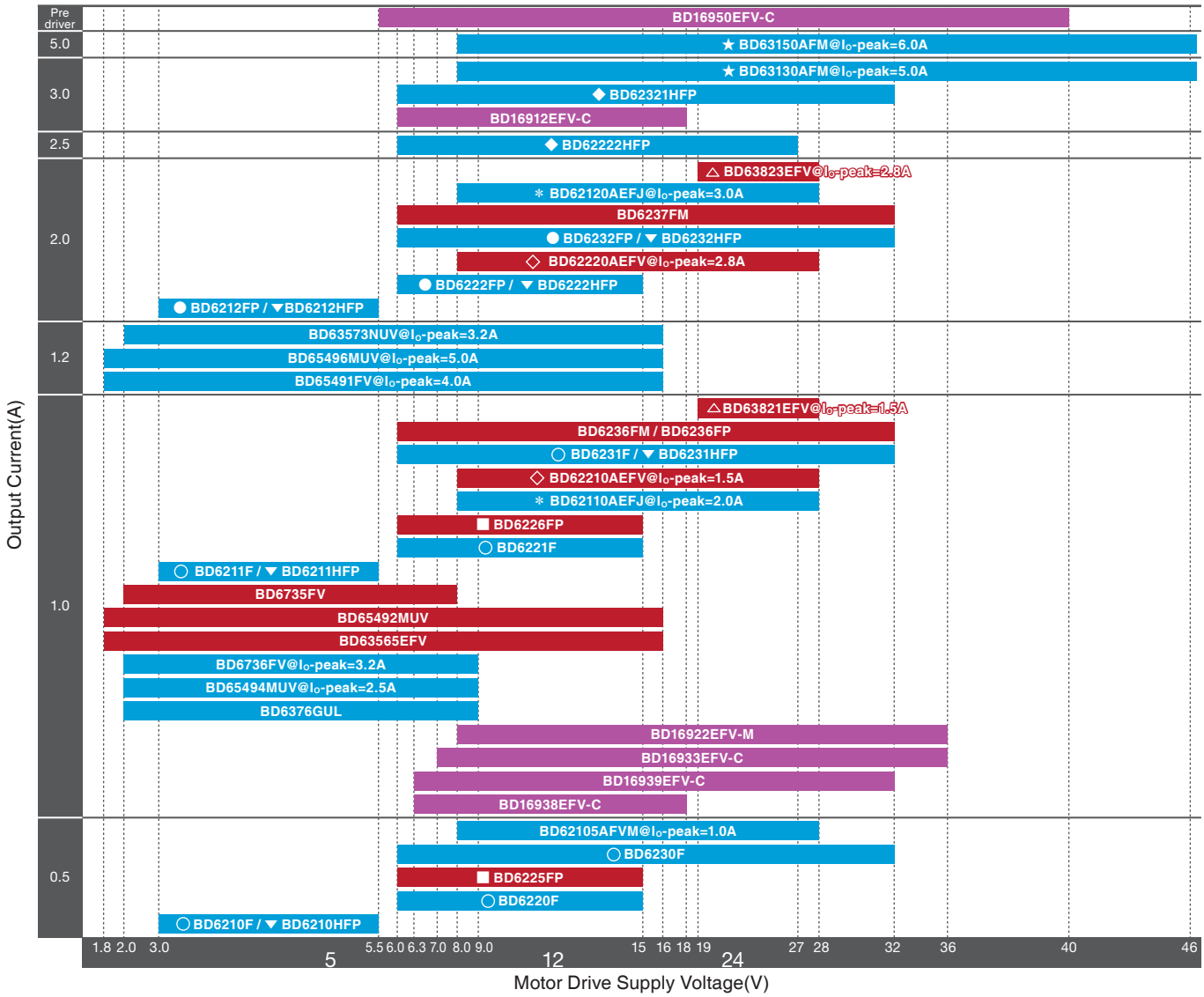
Motor Driver Quick Search

Brushed DC Motor Drivers

▶P.09 ▶P.21 (Automotive Products)

1ch Brushed Motor Drivers **2ch Brushed Motor Drivers** **Automotive Brushed Motor Drivers**

The same type of symbol in front of part numbers indicate pin-compatible products.

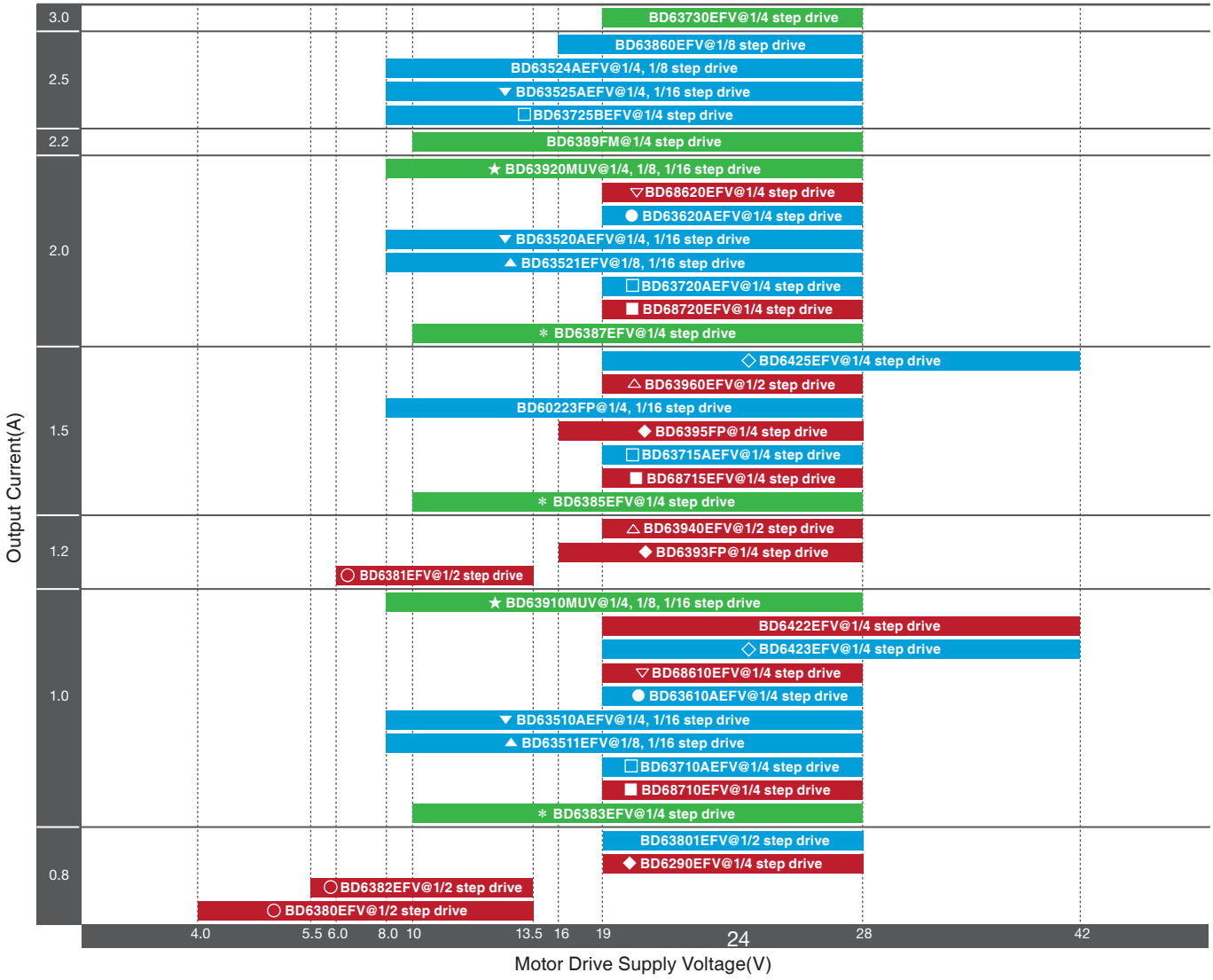


Stepper Motor Drivers

P.11

CLK-IN | PARA-IN | Selectable CLK-IN/PARA-IN

After the @ mark indicates the drive method. The same type of symbol in front of part numbers indicate function-compatible products.

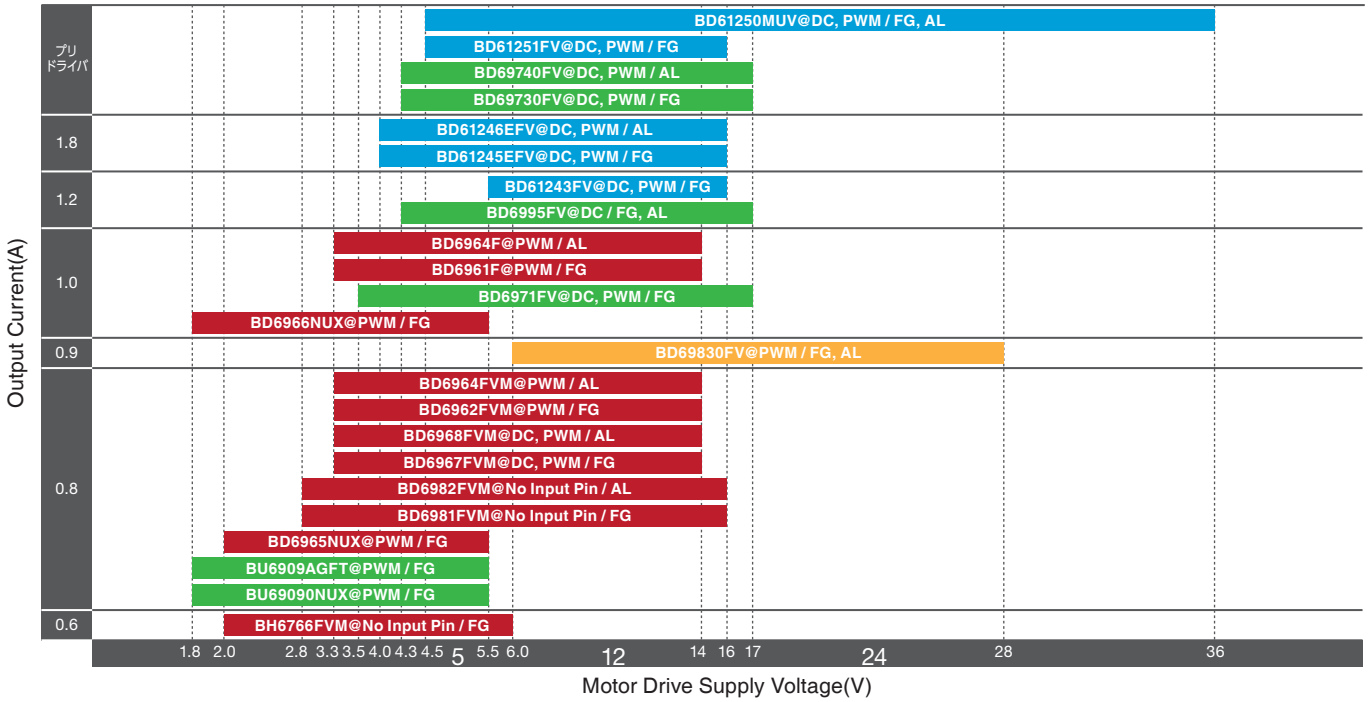


Single-Phase Brushless DC Motor Drivers

P.13

Sine Wave | BTL | PWM Soft Switching | Switching

After the @ mark shows ① The speed control input signal (DC, PWM, No Terminal (No speed control terminal)), and ② The external output signal pin (FG, AL). (@① / ②)



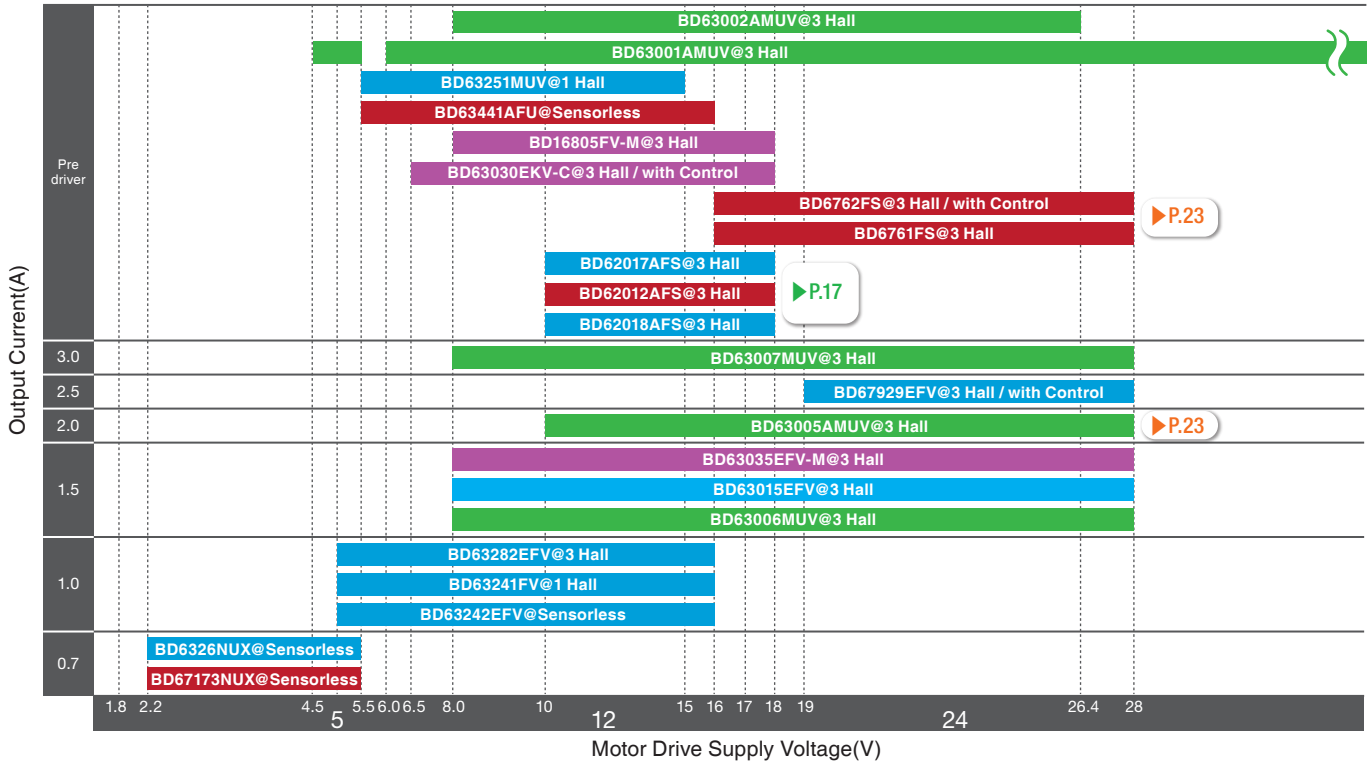
Motor Driver Quick Search

3-Phase Brushless DC Motor Drivers

▶P.15 ▶P.21(Automotive Products)

Sine Wave | 150° | 120° | Automotive Products

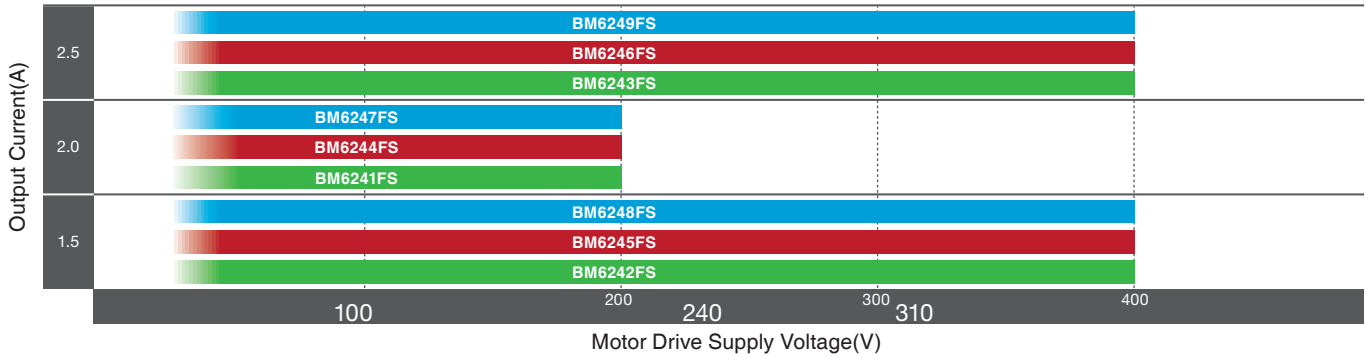
After the @ mark indicates ① Hall sensor type, and ② Presence/absence of control (no notation if no control).



High Voltage 3-Phase Brushless DC Motor Drivers

▶P.17

Sine Wave | 120°/150° Commutation Selectable | 6-Input



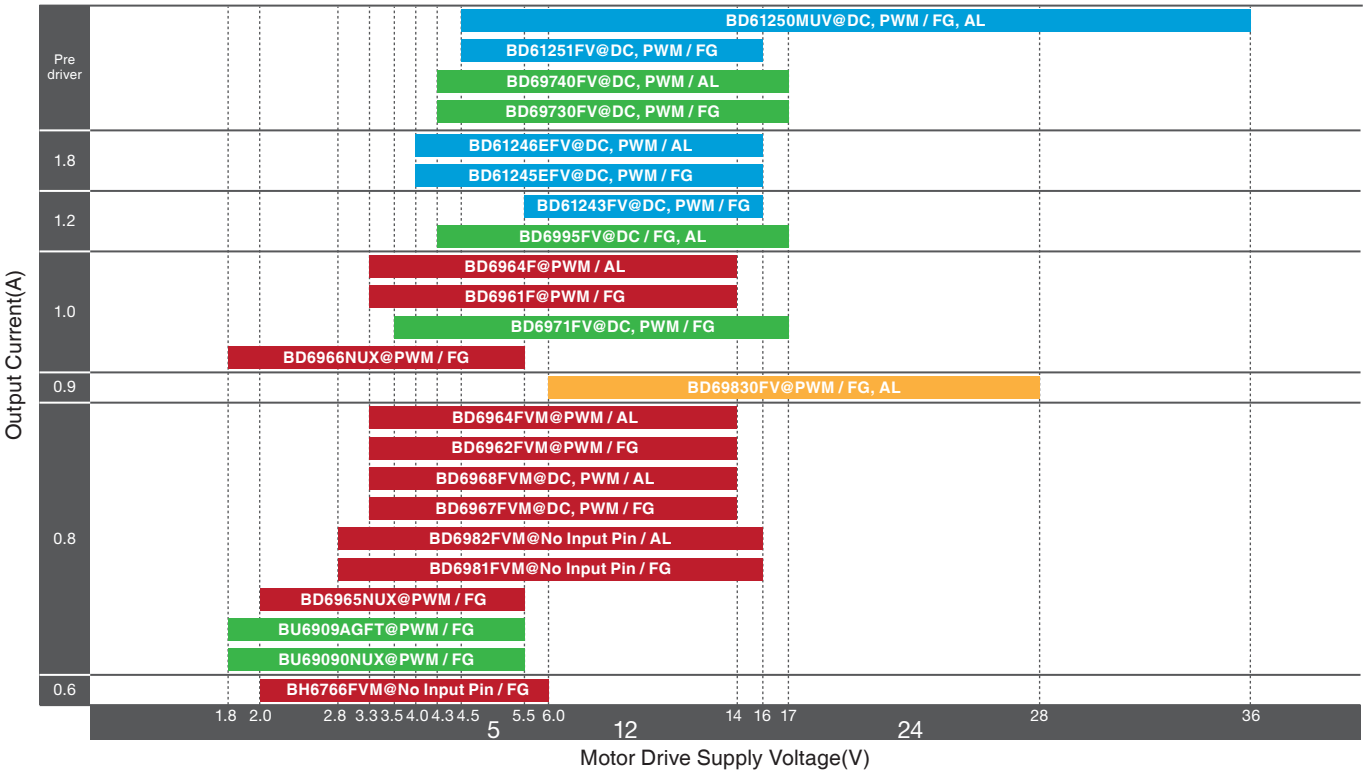
Fan Motor Drivers

Single-Phase Brushless DC Motor Drivers

▶P.13

Sine Wave | BTL | PWM Soft Switching | Switching

After the @ mark shows ① The speed control input signal (DC, PWM, No Terminal (No speed control terminal)), and ② The external output signal pin (FG, AL). (@① / ②)

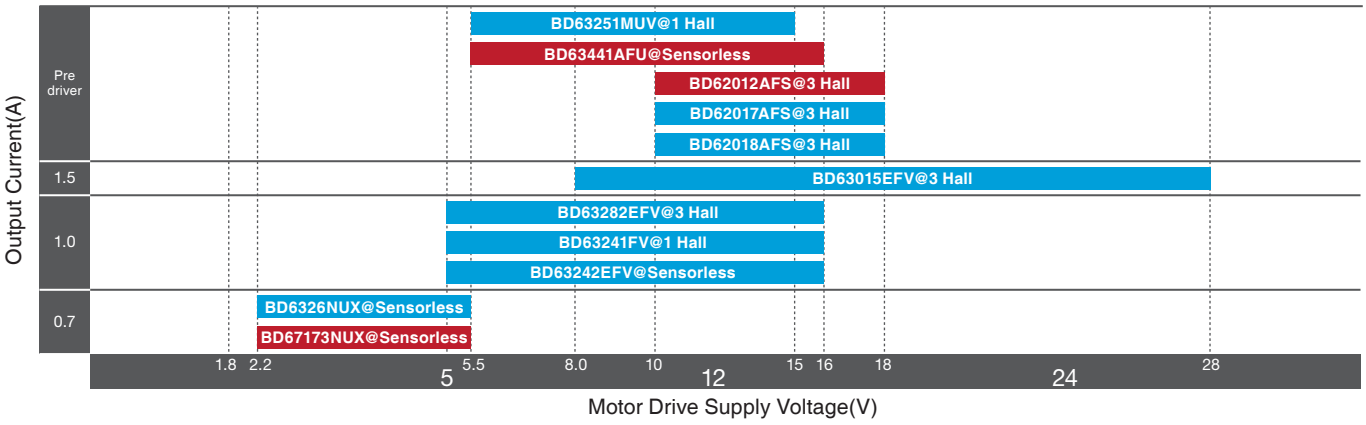


3-Phase Brushless DC Motor Drivers

▶P.15

Sine Wave | 150° | 120°

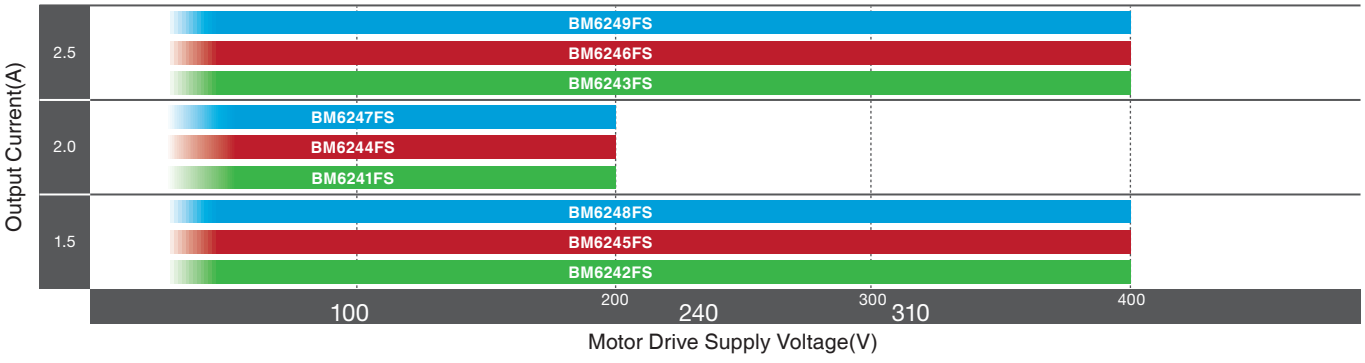
After the @ mark indicates the Hall sensor type.



High Voltage 3-Phase Brushless DC Motor Drivers

▶P.17

Sine Wave | 120°/150° Commutation Selectable | 6-Input



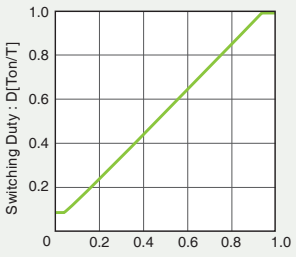
Brushed DC Motor Drivers (Refer to P.21 for automotive products)

ROHM brush DC motor drivers are reversible drivers equipped with functions such as PWM, brake, and forward/reverse modes and drive brush motors using an H bridge circuit. These high efficiency, high reliability motor drivers are offered in a range of voltages, currents, and package types - including pin-compatible models.

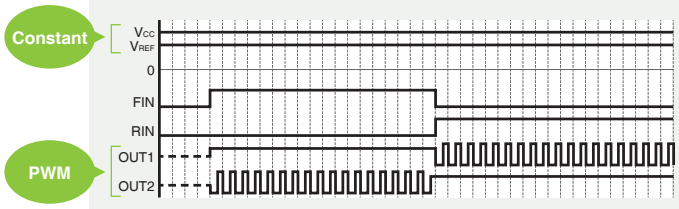
High Efficiency

V_{REF} Control Function

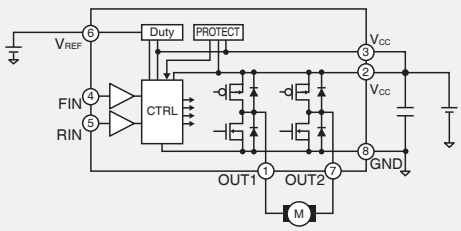
PWM drive at the output stage is enabled by supplying a DC voltage to the V_{REF} pin. Changing the PWM ON duty based on the supplied DC voltage value makes it possible to control motor speed. This method (PWM duty control) results in lower power consumption compared with controlling the voltage supplied to the motor. The relationship between the V_{REF} pin supplied voltage and output switching duty is shown in the graph at right. During switching operation, the L side output performs switching based on duty. ("L"⇔"Hi-Z")



Input Voltage : V_{REF}/V_{CC}[V]
V_{REF}-Duty Characteristics
(V_{CC}=24V)



V_{REF} Control Mode(Timing Chart)

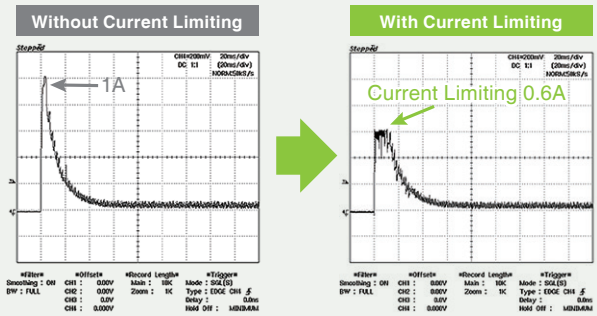


High Reliability

Current Limiting Function

A current limiting function is built in that limits inrush current during startup. (The current is set by the voltage supplied to the output current detection resistor and V_{REF} terminal.) This function also allows use as a constant current control stepper motor driver.

Output Current Waveforms During Startup



Control

Supports High-Speed Drive

BD65491FV, BD65496MUV, BD65494MUV, BD65492MUV, etc.

In these products, shortening the turn ON and turn OFF times increases the maximum operating frequency at the output stage, making it ideal for applications requiring high-speed drive.

	Logic Input Frequency (kHz)(Max.)	Turn ON (ns)(Typ.)	Turn OFF (ns)(Typ.)	Comments
BD65491FV	500	150	50	Turn ON/OFF time can be switched in 4 steps
BD65496MUV	500	150	50	Turn ON/OFF time can be switched in 4 steps
BD65494MUV	200	200	60	3mm×3mm package(VQFN016V3030)
BD65492MUV	500	200	80	2ch

Brushed DC Motor Driver Lineup

3.3V/5V Applications

Part No.	Supply Voltage(V)	Output Current(A) [Peak Current(A)]	ch	V_{REF} PWM	Current Limiting Function	Supports High-Speed Drive	Output ON Resistance(Ω)/ Output Saturation Voltage(V)Typ.	Package
BD6210F	3.0 to 5.5	0.5	1	✓	–	–	1.0Ω	SOP8
BD6210HFP	3.0 to 5.5	0.5	1	✓	–	–	1.0Ω	HRP7
BD6211F	3.0 to 5.5	1.0	1	✓	–	–	1.0Ω	SOP8
BD6211HFP	3.0 to 5.5	1.0	1	✓	–	–	1.0Ω	HRP7
BD65494MUV	2.0 to 9.0	1.0[2.5*1]	1	–	–	✓	0.55Ω	VQFN016V3030
BD6376GUL	2.0 to 9.0	1.0	1	–	–	✓	0.45Ω	VCSP50L1
BD6736FV	2.0 to 9.0	1.0[3.2*2]	1	–	–	–	0.35Ω	SSOP-B20
BD6735FV	2.0 to 8.0	1.0	2	–	–	–	1.0Ω	SSOP-B20
BD65492MUV	1.8 to 16.0	1.0	2	–	–	✓	0.9Ω	VQFN024V4040
BD63565EFV	1.8 to 16.0	1.0	2	–	–	✓	0.9Ω	HTSSOP-B20
BD65491FV	2.0 to 16.0	1.2[4.0*3]	1	–	–	✓	0.35Ω	SSOP-B16
BD65496MUV	1.8 to 16.0	1.2[5.0*3]	1	–	–	✓	0.35Ω	VQFN024V4040
BD63573NUV	2.0 to 16.0	1.2[3.2*4]	1	–	–	✓	0.38Ω	VSON010V3030
BD6212FP	3.0 to 5.5	2.0	1	✓	–	–	0.5Ω	HSOP25
BD6212HFP	3.0 to 5.5	2.0	1	✓	–	–	0.5Ω	HRP7

∗1 : Pulse width tw=100ms, Duty≦10% of pulse ∗2 : Pulse width tw=100ms ∗3 : Pulse width tw=10ms, Duty≦5% of pulse ∗4 : Pulse width tw=100ms, Duty≦20% of pulse

12V Application

Part No.	Supply Voltage(V)	Output Current(A) [Peak Current(A)]	ch	V_{REF} PWM	Current Limiting Function	Supports High-Speed Drive	Output ON Resistance(Ω)/ Output Saturation Voltage(V)Typ.	Package
BD6220F	6.0 to 15.0	0.5	1	✓	–	–	1.5Ω	SOP8
BD6230F	6.0 to 32.0	0.5	1	✓	–	–	1.5Ω	SOP8
BD6225FP	6.0 to 15.0	0.5	2	✓	–	–	1.5Ω	HSOP25
BD6221F	6.0 to 15.0	1.0	1	✓	–	–	1.5Ω	SOP8
BD6231F	6.0 to 32.0	1.0	1	✓	–	–	1.5Ω	SOP8
BD6231HFP	6.0 to 32.0	1.0	1	✓	–	–	1.5Ω	HRP7
BD63565EFV	1.8 to 16.0	1.0	2	–	–	✓	0.9Ω	HTSSOP-B20
BD65492MUV	1.8 to 16.0	1.0	2	–	–	✓	0.9Ω	VQFN024V4040
BD6226FP	6.0 to 15.0	1.0	2	✓	–	–	1.5Ω	HSOP25
BD6236FP	6.0 to 32.0	1.0	2	✓	–	–	1.5Ω	HSOP25
BD6236FM	6.0 to 32.0	1.0	2	✓	–	–	1.5Ω	HSOP-M28
BD62210AEFV	8.0 to 28.0	1.0[1.5*1]	2	–	✓	–	1.9Ω	HTSSOP-B28
New BD63573NUV	2.0 to 16.0	1.2[3.2*3]	1	–	–	✓	0.38Ω	VSON010V3030
BD65491FV	1.8 to 16.0	1.2[4.0*2]	1	–	–	✓	0.35Ω	SSOP-B16
BD65496MUV	1.8 to 16.0	1.2[5.0*2]	1	–	–	✓	0.35Ω	VQFN024V4040
BD6222FP	6.0 to 15.0	2.0	1	✓	–	–	1.0Ω	HSOP25
BD6222HFP	6.0 to 15.0	2.0	1	✓	–	–	1.0Ω	HRP7
BD6232FP	6.0 to 32.0	2.0	1	✓	–	–	1.0Ω	HSOP25
BD6232HFP	6.0 to 32.0	2.0	1	✓	–	–	1.0Ω	HRP7
BD6237FM	6.0 to 32.0	2.0	2	✓	–	–	1.0Ω	HSOP-M28
BD62220AEFV	8.0 to 28.0	2.0[2.8*1]	2	–	✓	–	0.65Ω	HTSSOP-B28
BD62222HFP	6.0 to 27.0	2.5	1	–	–	–	1.0Ω	HRP7
BD62321HFP	6.0 to 32.0	3.0	1	–	–	–	1.0Ω	HRP7

∗1 : Pulse width tw≦ 1ms, Duty20% of pulse ∗2 : Pulse width tw=10ms, Duty≦5% of pulse ∗3 : Pulse width tw=100ms, Duty≦20% of pulse

24V Applications

Part No.	Supply Voltage(V)	Output Current(A) [Peak Current(A)]	ch	V_{REF} PWM	Current Limiting Function	Supports High-Speed Drive	Output ON Resistance(Ω)/ Output Saturation Voltage(V)Typ.	Package
BD6230F	6.0 to 32.0	0.5	1	✓	–	–	1.5Ω	SOP8
New BD62105AFVM	8.0 to 28.0	0.5[1.0*2]	1	–	–	–	1.8Ω	MSOP8
BD6231F	6.0 to 32.0	1.0	1	✓	–	–	1.5Ω	SOP8
BD6231HFP	6.0 to 32.0	1.0	1	✓	–	–	1.5Ω	HRP7
BD63821EFV	19.0 to 28.0	1.0[1.5*1]	2	–	✓	–	1.9Ω	HTSSOP-B28
BD6236FP	6.0 to 32.0	1.0	2	✓	–	–	1.5Ω	HSOP25
BD6236FM	6.0 to 32.0	1.0	2	✓	–	–	1.5Ω	HSOP-M28
BD62210AEFV	8.0 to 28.0	1.0[1.5*2]	2	–	✓	–	1.9Ω	HTSSOP-B28
New BD62110AEFJ	8.0 to 28.0	1.0[2.0*2]	1	–	–	–	1.8Ω	HTSOP-J8
BD6232FP	6.0 to 32.0	2.0	1	✓	–	–	1.0Ω	HSOP25
BD6232HFP	6.0 to 32.0	2.0	1	✓	–	–	1.0Ω	HRP7
BD63823EFV	19.0 to 28.0	2.0[2.8*1]	2	–	✓	–	0.65Ω	HTSSOP-B28
BD6237FM	6.0 to 32.0	2.0	2	✓	–	–	1.0Ω	HSOP-M28
BD62220AEFV	8.0 to 28.0	2.0[2.8*2]	2	–	✓	–	0.65Ω	HTSSOP-B28
New BD62120AEFJ	8.0 to 28.0	2.0[3.0*2]	1	–	–	–	0.65Ω	HTSOP-J8
BD62222HFP	6.0 to 27.0	2.5	1	–	–	–	1.0Ω	HRP7
BD62321HFP	6.0 to 32.0	3.0	1	–	–	–	1.0Ω	HRP7

∗1 : Pulse width tw≦ 20ms of pulse ∗2 : Pulse width tw≦ 1ms, Duty20% of pulse

36V Applications

Part No.	Supply Voltage(V)	Output Current(A) [Peak Current(A)]	ch	V_{REF} PWM	Current Limiting Function	Supports High-Speed Drive	Output ON Resistance(Ω)/ Output Saturation Voltage(V)Typ.	Package
New BD63130AFM	8.0 to 46.2	3.0[5.0]	1	–	✓	–	0.55Ω	HSOP-M36
New BD63150AFM	8.0 to 46.2	5.0[6.0*1]	1	–	✓	–	0.3Ω	HSOP-M36

∗1 : Pulse width tw≦ 1ms, Duty20% of pulse

Stepper Motor Drivers

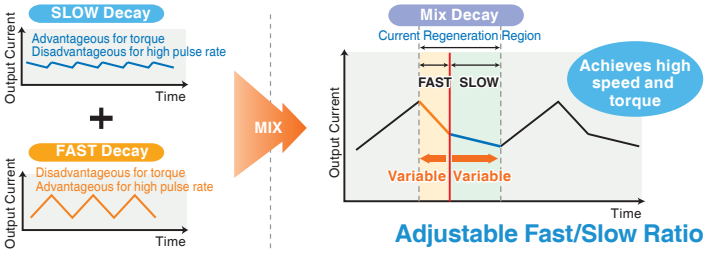
ROHM's high efficiency, high reliability CLK-/PARA-IN stepper motor drivers are available in a range of interfaces, voltages, currents. Pin-compatible models are offered as well.

Silence

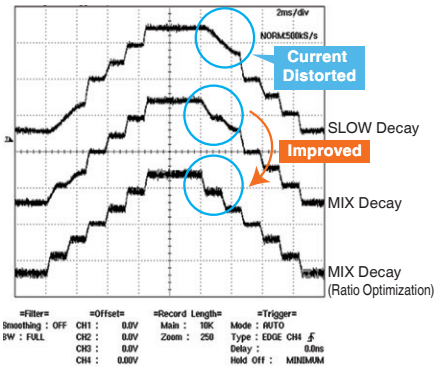
Mix Decay Function

When the motor current decays, the followability of the current will worsen depending on the current regeneration mode (Slow/Fast Decay), causing vibration and noise. As a countermeasure, a Mix Decay function is built in that externally adjusts the ratio of Slow Decay and Fast Decay during current attenuation.

Current Attenuation Method Switching



Adjustable Fast/Slow Ratio



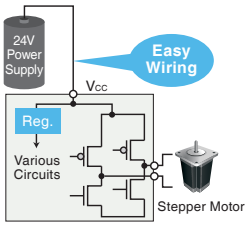
Motor current waveforms

Control

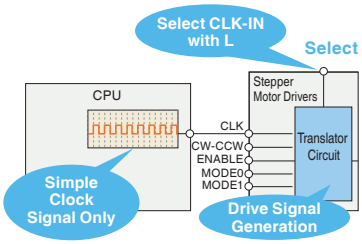
Single Power Supply/Easy CLK-IN Control

- Regarding power supply systems, 2 power sources are typically needed, a normal control system (5V) and drive system (12V/24V). However, ROHM products integrate a control system power supply, requiring just a single drive system power supply for operation.
- Supports both CLK-IN and PARA-IN control signals.

Single Power Supply



Easy CLK-IN Control

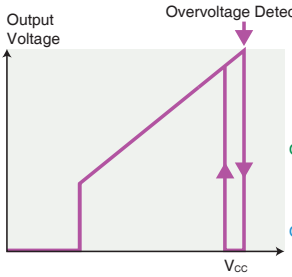


High Reliability

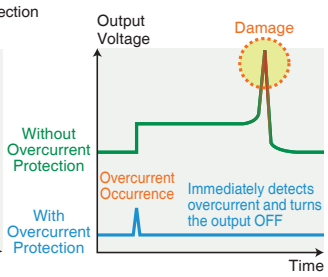
Multiple Protection Circuits

- When overvoltage is supplied to the power supply pin the output stage is turned OFF to prevent breakdown. (Overvoltage protection)
- Output fault tolerance (overcurrent protection) Prevents damage even when the output pin is shorted to the power supply or ground.

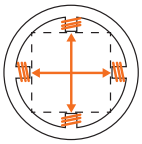
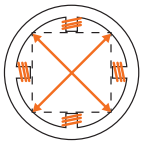
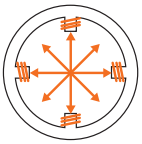
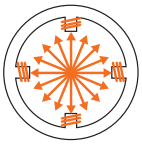
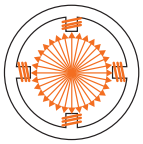
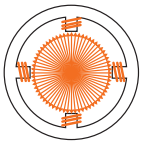
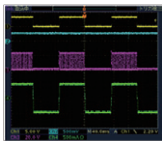
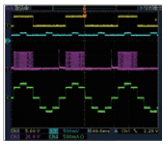
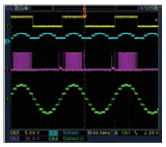
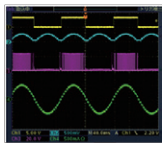
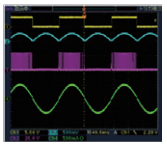
Overvoltage Protection



Overcurrent Protection



Stepper Motor Driver - Drive Methods

Excitation Method	Single Phase Excitation	2-Phase Excitation Full Step	1-2Phase Excitation Half Step	W1-2 Phase Excitation Quarter Step	2W1-2 Phase Excitation Eighth Step	4W1-2 Phase Excitation Sixteenth Step
Structural Overview Excitation Overview						
Features	・Small torque ・Long vibration convergence time ・Normally not used	・Large torque ・Short vibration convergence time	・1/2 step angle ・Requires output current control	・1/4 step angle ・Requires output current control	・1/8 step angle ・Requires output current control	・1/16 step angle ・Requires output current control
Waveforms INA V_{REF} V_{OUT} I_{OUT}						

Stepper Motor Driver Lineup

3.3V/5V Applications

Part No.	Supply Voltage(V)		Output Current (A)	Control Input Signal	Drive	Decay	Function Capability	Single Power Supply	Output ON Resistance(Ω)	Package
	Control Block	Output Block								
BD6380EFV	2.5 to 5.5	4.0 to 13.5	0.8	PARA	1/2	–	–	–	1.2	HTSSOP-B24

12V Applications

Part No.	Supply Voltage(V)		Output Current (A)	Control Input Signal	Drive	Decay	Function Capability*	Single Power Supply	Output ON Resistance(Ω)	Package
	Control Block	Output Block								
BD6382EFV	3.0 to 5.5	5.5 to 13.5	0.8	PARA	1/2	–	–	–	1.2	HTSSOP-B24
BD6380EFV	2.5 to 5.5	4.0 to 13.5	0.8	PARA	1/2	–	–	–	1.2	HTSSOP-B24
BD6383EFV	–	10.0 to 28.0	1.0	CLK/PARA	1/4	✓	✻	✓	1.5	HTSSOP-B40
BD6381EFV	2.5 to 5.5	6.0 to 13.5	1.2	PARA	1/2	–	–	–	1.0	HTSSOP-B24
BD6385EFV	–	10.0 to 28.0	1.5	CLK/PARA	1/4	✓	✻	✓	1.0	HTSSOP-B40
BD6387EFV	–	10.0 to 28.0	2.0	CLK/PARA	1/4	✓	✻	✓	0.8	HTSSOP-B40
BD6389FM	–	10.0 to 28.0	2.2	CLK/PARA	1/4	✓	✻	✓	0.7	HSOP-M36

*Models with the same symbol are function compatible

12V Applications

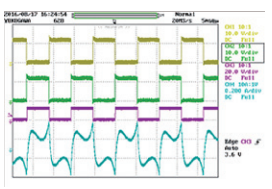
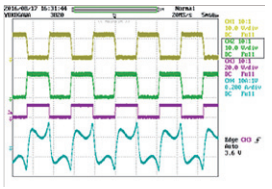
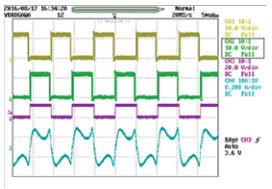
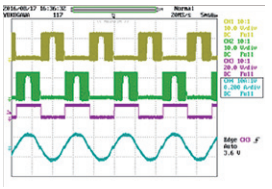
Part No.	Supply Voltage (V)	Output Current (A)	Control Input Signal	Drive	Decay	Function Capability*	Single Power Supply	Output ON Resistance(Ω)	Package
BD6290EFV	19.0 to 28.0	0.8	PARA	1/4	–	◆	✓	2.8	HTSSOP-B24
BD63801EFV	19.0 to 28.0	0.8	CLK	1/2	–	–	✓	2.8	HTSSOP-B24
BD63510AEFV	8.0 to 28.0	1.0	CLK	1/16	✓	▼	✓	1.75	HTSSOP-B28
BD63511EFV	8.0 to 28.0	1.0	CLK	1/16	✓	▲	✓	1.75	HTSSOP-B28
BD63910MUV	8.0 to 28.0	1.0	CLK/PARA	1/16	✓	★	✓	1.3	VQFN028V5050
BD6383EFV	10.0 to 28.0	1.0	CLK/PARA	1/4	✓	✻	✓	1.5	HTSSOP-B40
BD68610EFV	19.0 to 28.0	1.0	PARA	1/4	–	▽	✓	1.8	HTSSOP-B20
BD68710EFV	19.0 to 28.0	1.0	PARA	1/4	✓	■	✓	1.2	HTSSOP-B28
BD63610AEFV	19.0 to 28.0	1.0	CLK	1/4	–	●	✓	1.8	HTSSOP-B20
BD63710AEFV	19.0 to 28.0	1.0	CLK	1/4	✓	□	✓	1.2	HTSSOP-B28
BD6423EFV	19.0 to 42.0	1.0	CLK	1/4	✓	◇	✓	2.0	HTSSOP-B24
BD6422EFV	19.0 to 42.0	1.0	PARA	1/4	✓	–	✓	2.0	HTSSOP-B24
BD6393FP	16.0 to 28.0	1.2	PARA	1/4	–	◆	✓	1.5	HSOP25
BD63940EFV	19.0 to 28.0	1.2	PARA	1/2	–	△	✓	1.4	HTSSOP-B24
BD60223FP	8.0 to 28.0	1.5	CLK	1/16	✓	–	✓	0.55	HSOP25
BD6385EFV	10.0 to 28.0	1.5	CLK/PARA	1/4	✓	✻	✓	1.0	HTSSOP-B40
BD68715EFV	19.0 to 28.0	1.5	PARA	1/4	✓	■	✓	0.95	HTSSOP-B28
BD63715AEFV	19.0 to 28.0	1.5	CLK	1/4	✓	□	✓	0.95	HTSSOP-B28
BD6395FP	16.0 to 28.0	1.5	PARA	1/4	–	◆	✓	1.2	HSOP25
BD63960EFV	19.0 to 28.0	1.5	PARA	1/2	–	△	✓	1.1	HTSSOP-B24
BD6425EFV	19.0 to 42.0	1.5	CLK	1/4	✓	◇	✓	1.1	HTSSOP-B28
BD63520AEFV	8.0 to 28.0	2.0	CLK	1/16	✓	▼	✓	0.65	HTSSOP-B28
BD63521EFV	8.0 to 28.0	2.0	CLK	1/16	✓	▲	✓	0.65	HTSSOP-B28
BD63920MUV	8.0 to 28.0	2.0	CLK/PARA	1/16	✓	★	✓	0.49	VQFN028V5050
BD6387EFV	10.0 to 28.0	2.0	CLK/PARA	1/4	✓	✻	✓	0.8	HTSSOP-B40
BD68620EFV	19.0 to 28.0	2.0	PARA	1/4	–	▽	✓	0.95	HTSSOP-B24
BD68720EFV	19.0 to 28.0	2.0	PARA	1/4	✓	■	✓	0.65	HTSSOP-B28
BD63620AEFV	19.0 to 28.0	2.0	CLK	1/4	–	●	✓	0.95	HTSSOP-B24
BD63720AEFV	19.0 to 28.0	2.0	CLK	1/4	✓	□	✓	0.65	HTSSOP-B28
BD6389FM	10.0 to 28.0	2.2	CLK/PARA	1/4	✓	(✻)	✓	0.7	HSOP-M36
BD63725BEFV	8.0 to 28.0	2.5	CLK	1/4	✓	□	✓	0.35	HTSSOP-B28
BD63525AEFV	8.0 to 28.0	2.5	CLK	1/16	✓	▼	✓	0.35	HTSSOP-B28
BD63524AEFV	8.0 to 28.0	2.5	CLK	1/8	✓	–	✓	0.35	HTSSOP-B28
BD63860EFV	16.0 to 28.0	2.5	CLK	1/8	✓	–	✓	0.8	HTSSOP-B28
BD63730EFV	19.0 to 28.0	3.0	CLK/PARA	1/4	✓	–	✓	0.4	HTSSOP-B54

*Models with the same symbol are function compatible

Single-Phase Brushless DC Motor Drivers

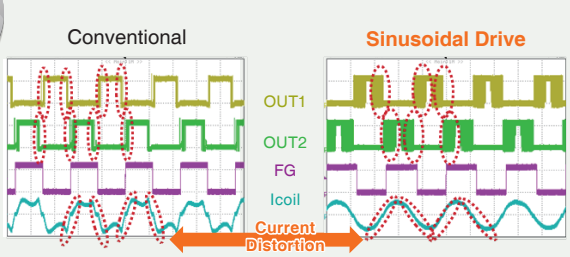
ROHM's single-phase brushless DC motor drivers support control technologies and various drive methods required for silent, high efficiency operation, making them ideal for fan motors. A broad lineup is offered in a range of voltages and currents.

Operating Waveform Comparison of Different Drive Methods

	Switching Drive	BTL Drive	PWM Soft Switching Drive	Sinusoidal Drive
Drive Waveforms				
Motor Efficiency	Better	Good	Better	Better
Low Noise	Good	Better	Better	Excellent

Sinusoidal Drive

Silence

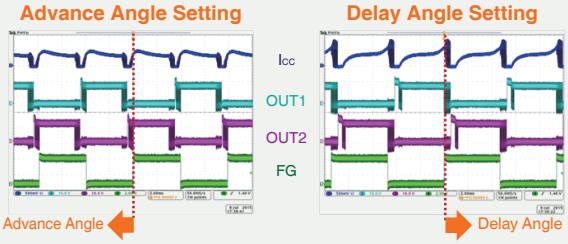


Hall signals are used to generate PWM soft switching waveforms.
The PWM soft switching interval cannot be freely adjusted due to the effects of the temperature characteristics of the Hall signal. In addition, the coil signal will become distorted and noise will increase.

The coil current waveform can be adjusted by the voltage supplied to the PWM soft switching interval setting terminal. This helps to minimize current distortion and noise.

Advance/Delay Angle Control Drive

High Efficiency

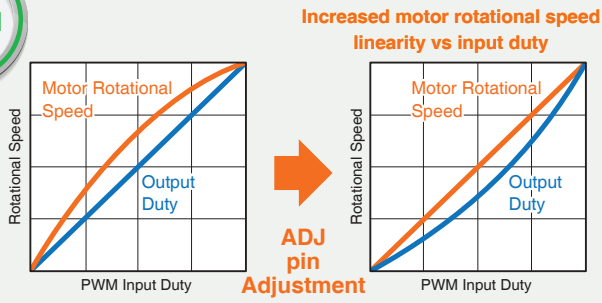


To obtain the maximum torque, the phase of the driver output signal with respect to the Hall signal should be adjusted so that the phases of the magnet (rotor) and coil current are at 90°. (can be set from 22.5° on the advance angle side to 22.5° on the delay angle side)

Wind Loss Correction

BD61250MUV, BD6995FV

Control

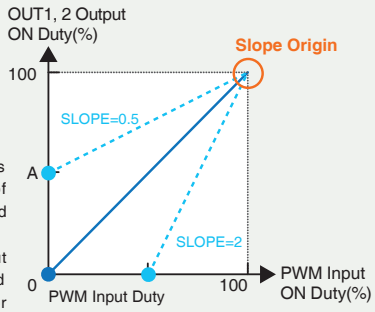


Optimizing the setting of the ADJ pin makes it possible to improve the linearity of motor rotational speed (vs. PWM input duty) and increase speed setting accuracy.

I/O Slope Setting

BD61243FV, BD61250MUV

Control

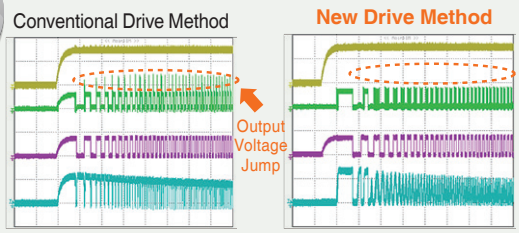


This function enables convenient adjustment of the motor rotational speed and PWM input duty.
The slope of the IC output duty and PWM speed control signal to the motor can be varied between 0.5 and 2.0.

Improved Back Electromotive Force Jump

BD6995FV, BD61243FV

Control



Output voltage jumps that occur during rotational speed changes are minimized, such as when the forward/reverse idle power supply is turned ON, the torque input suddenly changes, or during lock detection/recovery.

Standby Function

High Efficiency

This function reduces standby power consumption when the motor is stopped. Switch the IC to standby mode by setting the PWM signal duty to 0%.

Single Phase Brushed DC Motor Driver Lineup

3.3V/5V(Driver)

Part No.	Supply Voltage (V)	Output Current (A)	Drive Method				Speed Control		Min. Speed Setting	Advance/Delay Angle Setting	Standby Function	Current Control Function	FG/AL*	Hall Bias (V)	Package
			Switching	BTL	PWM Sof SW	Sine Wave	DC	PWM							
BH6766FVM	2.0 to 6.0	0.6	–	✓	–	–	–	–	–	–	–	–	FG	1.3	MSOP8
BU6909AGFT	1.8 to 5.5	0.8	–	–	✓	–	–	✓	–	–	✓	–	FG	Built-in	TSSOF6
New BU69090NUX	1.8 to 5.5	0.8	–	–	✓	–	–	✓	–	–	✓	–	FG	Built-in	VSON008X2030
BD6965NUX	2.0 to 5.5	0.8	–	✓	–	–	–	✓	–	–	✓	–	FG	–	VSON008X2030
BD6966NUX	1.8 to 5.5	1.0	–	✓	–	–	–	✓	–	–	✓	–	FG	1.0	VSON010X3030
☆BD69060GFT	1.8 to 5.5	1.0	–	–	✓	–	–	✓	–	–	✓	–	FG	Built-in	TSSOF6

＊ : FG : Rotational speed output terminal

☆ : Under Development

12V/24V(Driver)

Part No.	Supply Voltage (V)	Output Current (A)	Drive Method				Speed Control		Min. Speed Setting	Advance/Delay Angle Setting	Standby Function	Current Control Function	FG/AL*	Hall Bias (V)	Package
			Switching	BTL	PWM Sof SW	Sine Wave	DC	PWM							
BD6981FVM	2.8 to 16.0	0.8	–	✓	–	–	–	–	–	–	–	–	FG	1.2	MSOP8
BD6982FVM	2.8 to 16.0	0.8	–	✓	–	–	–	–	–	–	–	–	AL	1.2	MSOP8
BD6967FVM	3.3 to 14.0	0.8	–	✓	–	–	✓	✓	–	–	–	–	FG	1.2	MSOP10
BD6968FVM	3.3 to 14.0	0.8	–	✓	–	–	✓	✓	–	–	–	–	AL	1.2	MSOP10
BD6962FVM	3.3 to 14.0	0.8	–	✓	–	–	–	✓	–	–	–	–	FG	–	MSOP8
BD6964FVM	3.3 to 14.0	0.8	–	✓	–	–	–	✓	–	–	–	–	AL	–	MSOP8
BD6971FV	3.5 to 17.0	1.0	–	–	✓	–	✓	✓	✓	–	–	✓	FG	1.3	SSOP-B14
BD6961F	3.3 to 14.0	1.0	–	✓	–	–	–	✓	–	–	–	–	FG	–	SOP8
BD6964F	3.3 to 14.0	1.0	–	✓	–	–	–	✓	–	–	–	–	AL	–	SOP8
BD6995FV	4.3 to 17.0	1.2	–	–	✓	–	✓	–	✓	–	✓	✓	FG/AL	1.25	SSOP-B16
BD61243FV	5.5 to 16.0	1.2	–	–	–	✓	✓	✓	✓	–	–	✓	FG	–	SSOP-B14
New BD61245EFV	4.0 to 16.0	1.8	–	–	–	✓	✓	✓	✓	–	–	✓	FG	–	HTSSOP-B16
New BD61246EFV	4.0 to 16.0	1.8	–	–	–	✓	✓	✓	✓	–	–	✓	AL	–	HTSSOP-B16
BD69830FV	6.0 to 28.0	0.9	✓	–	–	–	–	✓	–	–	–	–	FG/AL	1.2	SSOP-B14

＊ : FG : Rotational speed output terminal, AL : Alarm signal output ter

12V/24V(Predriver)

Part No.	Supply Voltage (V)	Output Current (A)	Drive Method				Speed Control		Min. Speed Setting	Advance/Delay Angle Setting	Standby Function	Current Control Function	FG/AL*	Hall Bias (V)	Package
			Switching	BTL	PWM Sof SW	Sine Wave	DC	PWM							
BD69730FV	4.3 to 17.0	–	–	–	✓	–	✓	✓	✓	–	–	✓	FG	1.26	SSOP-B16
BD69740FV	4.3 to 17.0	–	–	–	✓	–	✓	✓	✓	–	–	✓	AL	1.26	SSOP-B16
New BD61251FV	4.5 to 16.0	–	–	–	–	✓	✓	✓	–	–	✓	✓	FG	–	SSOP-B16
BD61250MUV	4.5 to 36.0	–	–	–	–	✓	✓	✓	✓	✓	✓	✓	FG/AL	–	VQFN024V4040

＊ : FG : Rotational speed output terminal, AL : Alarm signal output ter

MOSFET Lineup(When Using a Predriver)

Polarity (ch)	Part No.	V_{DSS}(V)		I_D(A)		$R_{DS(on)}$ Typ.(mΩ) V_{GS}=10		$R_{DS(on)}$ Typ.(mΩ) V_{GS}=4.5		Package	Size (mm)	P_D (W)
		Nch	Pch	Nch	Pch	Nch	Pch	Nch	Pch			
N+P	New HP8M51	100	−100	4.5	−4.5	120	210	130	230	(HSOP8 Symmetry Dual)	5.0×6.0×1.0	7*3
	SH8M51	100	−100	3	−2.5	120	210	130	230	(SOP8)	5.0×6.0×1.75	2
	QS8M51	100	−100	2	−1.5	240	350	250	380	(TSMT8)	2.8×3.0×0.85	1.5
	SH8M41	80	−80	3.4	−2.6	90	165	110	220	(SOP8)	5.0×6.0×1.75	2
	New HP8M31	60	−60	8.5	−8.5	46	50	52	55	(HSOP8 Symmetry Dual)	5.0×6.0×1.0	7*3
	New SH8M31	60	−60	4.5	−4.5	46	50	52	55	(SOP8)	5.0×6.0×1.75	2
	QS8M31	60	−60	3	−2	80	150	93	180	(TSMT8)	2.8×3.0×0.85	1.5
	SH8M24	45	−45	6	−6	33	45	41	60	(SOP8)	5.0×6.0×1.75	2
	QH8M22	40	−40	4.5*2	−2*2	34.6	130	43.9	180	(TSMT8)	2.8×3.0×0.85	1.5*2
	HP8MA2	30	−30	18*3	−15*3	7.5	13.2	11.7	21	(HSOP8 Symmetry Dual)	5.0×6.0×1.0	7*3
	New SH8MA4	30	−30	9	−8.5	16.5	23	22.2	32	(SOP8)	5.0×6.0×1.75	2
	QH8MA4	30	−30	9*1	−8*1	12.3	22	18.2	31	(TSMT8)	2.8×3.0×0.85	2.6*1
	New SH8MA3	30	−30	7	−6	23	40	42	60	(SOP8)	5.0×6.0×1.75	2
	QH8MA3	30	−30	7*1	−5.5*1	22	37	35	55	(TSMT8)	2.8×3.0×0.85	2.5*1
	New SH8MA2	30	−30	4.5	−4.5	57	63	88	89	(SOP8)	5.0×6.0×1.75	2
	QH8MA2	30	−30	4.5	−3	25	55	40	80	(TSMT8)	2.8×3.0×0.85	1.5
	UT6MA2	30	−30	4	−4	37	55	59	80	DFN2020-8D (HUML2020L8 Dual)	2.0×2.0×0.6	2
	UT6MA3	20	−20	5.5	−5	—	—	30	42			2

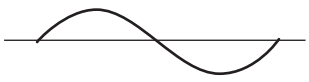
＊1 : Pw≦1s ＊2 : Pw=5s ＊3 : Pw<1s

Package indicates JEDEC code. ( ) denotes ROHM package type.

3-Phase Brushless DC Motor Drivers (Refer to P.21 for automotive products)

ROHM's 3-phase brushless DC motor drivers are compatible with sensorless motors and motors equipped with Hall sensors. These high efficiency, high reliability drivers are offered in different commutation angles, including 120°, 150°, and sine wave.

120°/150°/Sine Wave Commutation Drive

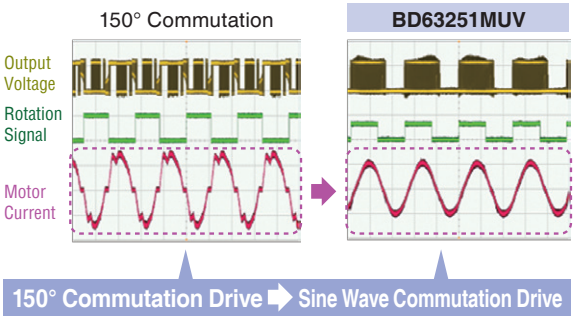
	120° Commutation Drive	150° Commutation Drive	Sine Wave Commutation Drive
Current Waveform			
Motor Efficiency			Good
Switching Efficiency	Good		
Control Characteristics	Easy		
Noise			Good
Torque Ripple			Good

Silence

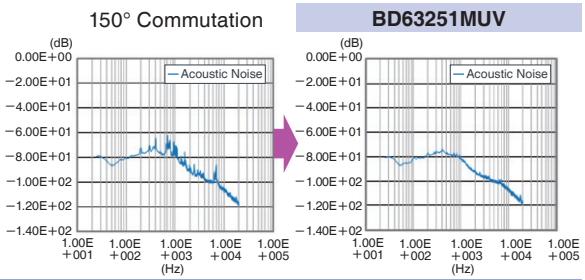
Sine Wave Commutation Drive IC Lineup

ROHM 3-phase brushless DC motor drivers utilize sine wave commutation drive and are offered in 1-Hall and 3-Hall sensor types. Adopting sinusoidal commutation ensures low noise and vibration.

Low Noise/Low Vibration Technologies



Relative Noise Level Comparison at Low Speed(1,000rpm)



Noise level : −10dB (ROHM measured value in the audible band)

Control

Sensor Lineup

ROHM 3-phase brushless DC motor driver lineup includes conventional 3-Hall sensor types along with sensorless and 1-Hall sensor models that offer superior space savings by reducing the number of external parts. This makes it possible to select the ideal product based on application requirements.

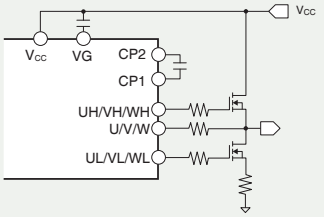
Control

Predriver＋Power Element Supports a Wide Drive Voltage Range

The BD63001AMUV and BD63002AMUV utilize predriver specifications to drive external MOSFETs. The BD63001AMUV can be used with the V_M voltage raised with respect to the Vcc voltage and supports a wide drive voltage range.
Also, when using V_{CC}=V_M, the number of external parts can be reduced by setting the logic of the UH/VH/WH pin that drives the external high side element through the HL SW pin.

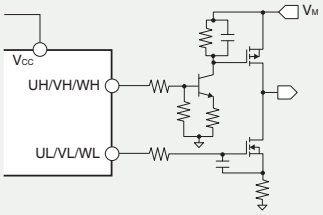
BD63002AMUV

External Element(H/L)=Nch/Nch



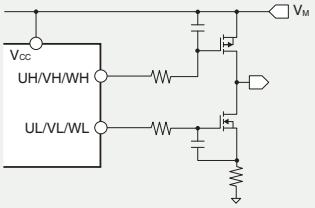
BD63001AMUV

When HLSW=H or Open
External Element(H/L)=Pch/Nch



BD63001AMUV

When HLSW=L
External Element(H/L)=Pch/Nch



3-Phase Brushless DC Motor Driver Lineup

3.3V/5V(Driver)

Part No.	Supply Voltage (V)	Output Current (A)	Energization Method	Sensor type	Advance Angle Setting	FG Signal Output	Hall Bias	Motor Lock Protection	Speed Control Input Signal	Current Limting Function	Package
BD67173NUX	2.2 to 5.5	0.7	150	Sensorless	–	✓	–	✓	DirectPWM	–	VSON010X3030
BD6326NUX	2.2 to 5.5	0.7	Sine Wave	Sensorless	–	✓	–	✓	DirectPWM	–	VSON010X3030

12V(Driver)

Part No.	Supply Voltage (V)	Output Current (A)	Energization Method	Sensor type	Advance Angle Setting	FG Signal Output	Hall Bias	Motor Lock Protection	Speed Control Input Signal	Current Limting Function	Package
BD63282EFV	5.0 to 16.0	1.0	Sine Wave	3 Hall	✓	✓	–	✓	DC/DirectPWM	✓	HTSSOP-B20
BD63241FV	5.0 to 16.0	1.0	Sine Wave	1 Hall	✓	✓	1.25V element used	✓	DirectPWM	✓	SSOP-B16
BD63242EFV	5.0 to 16.0	1.0	Sine Wave	Sensorless	✓	✓	–	✓	DC/DirectPWM	✓	HTSSOP-B16
BD63006MUV	8.0 to 28.0	1.5	120	3 Hall	–	✓	5V element used	✓	DirectPWM	✓	VQFN024V4040
New BD63015EFV	8.0 to 28.0	1.5	Sine Wave	3 Hall	–	✓	5V element used	✓	DC	✓	HTSSOP-B20
BD63005AMUV	10.0 to 28.0	2.0	120	3 Hall	–	✓	5V element used	✓	DirectPWM	✓	VQFN040V6060
New BD63007MUV	10.0 to 28.0	3.0	120	3 Hall	–	✓	5V element used	✓	DirectPWM	✓	VQFN040V6060

24V(Driver)

Part No.	Supply Voltage (V)	Output Current (A)	Energization Method	Sensor type	Advance Angle Setting	FG Signal Output	Hall Bias	Motor Lock Protection	Speed Control Input Signal	Current Limting Function	Package
BD63006MUV	8.0 to 28.0	1.5	120	3 Hall	–	✓	5V element used	✓	DirectPWM	✓	VQFN024V4040
New BD63015EFV	8.0 to 28.0	1.5	Sine Wave	3 Hall	–	✓	5V element used	✓	DC	✓	HTSSOP-B20
BD63005AMUV	10.0 to 28.0	2.0	120	3 Hall	–	✓	5V element used	✓	DirectPWM	✓	VQFN040V6060
New BD63007MUV	10.0 to 28.0	3.0	120	3 Hall	–	✓	5V element used	✓	DirectPWM	✓	VQFN040V6060

12V(Predriver)

Part No.	Supply Voltage (V)	Output Current (A)	Energization Method	Sensor type	Advance Angle Setting	FG Signal Output	Hall Bias	Motor Lock Protection	Speed Control Input Signal	Current Limting Function	External FET	Package
BD63441AFU	5.5 to 16.0	–	150	Sensorless	–	✓	–	✓	DC	✓	N+P	SSOP-C20
BD63251MUV	5.5 to 15.0	–	Sine Wave	1 Hall	✓	✓	1.25V element used	✓	DC/DirectPWM	✓	N+P	VQFN024V4040
BD63001AMUV	6.0 to 28.0	–	120	3 Hall	–	✓	5V element used	✓	DC/DirectPWM	✓	N+P	VQFN024V4040
BD63002AMUV	8.0 to 26.4	–	120	3 Hall	–	✓	5V element used	✓	DirectPWM	✓	N+N	VQFN028V5050

24V(Predriver)

Part No.	Supply Voltage (V)	Output Current (A)	Energization Method	Sensor type	Advance Angle Setting	FG Signal Output	Hall Bias	Motor Lock Protection	Speed Control Input Signal	Current Limting Function	External FET	Package
BD63001AMUV	6.0 to 28.0	–	120	3 Hall	–	✓	5V element used	✓	DC/DirectPWM	✓	N+P	VQFN024V4040
BD63002AMUV	8.0 to 26.4	–	120	3 Hall	–	✓	5V element used	✓	DirectPWM	✓	N+N	VQFN028V5050

MOSFET Lineup(When Using The Predriver)

Polarity (ch)	Part No.	V_{DSS} (V)	I_D (A)	$R_{DS(on)}$ Typ.(mΩ) V_{GS}=10	$R_{DS(on)}$ Typ.(mΩ) V_{GS}=4.5	Package	Size (mm)	P_D (W)
N+N	SH8K52	100	3	120	130	(SOP8)	5.0×6.0×1.75	2
	SH8K41	80	3.4	90	110			2
	New SH8K39	60	8	15	20			2
	New SH8K37	60	5.5	33	44			2
	SH8K32	60	4.5	46	52			2
	UT6K30	60	3	111	162	DFN2020-8D(HUML2020L8 Dual)	2.0×2.0×0.6	2
	SH8K26	40	6*1	27	35	(SOP8)	5.0×6.0×1.75	2*1
	SH8K25	40	5.2*1	60	80			3
	SH8KA7	30	15*1	7.1	8.3			2*1
	SH8KA4	30	9*1	16.5	22.2			2.8*1
	SH8KA2	30	8*1	23	34			3*1
	SH8KA1	30	4.5*1	57	88			2.7
	UT6K3	30	5.5	—	30	DFN2020-8D(HUML2020L8 Dual)	2.0×2.0×0.6	2
	QH8KA2	30	4.5	25	40	(TSMT8)	2.8×3.0×0.85	1.5
	QH8KA1	30	4.5*1	56	86			2.4*1

Polarity (ch)	Part No.	V_{DSS}(V) Nch	V_{DSS}(V) Pch	I_D(A) Nch	I_D(A) Pch	$R_{DS(on)}$ Typ.(mΩ) V_{GS}=10 Nch	$R_{DS(on)}$ Typ.(mΩ) V_{GS}=10 Pch	$R_{DS(on)}$ Typ.(mΩ) V_{GS}=4.5 Nch	$R_{DS(on)}$ Typ.(mΩ) V_{GS}=4.5 Pch	Package	Size (mm)	P_D (W)
N+P	New HP8M51	100	−100	4.5	−4.5	120	210	130	230	(HSOP8 Symmetry Dual)	5.0×6.0×1.0	7*3
	SH8M51	100	−100	3	−2.5	120	210	130	230	(SOP8)	5.0×6.0×1.75	2
	QS8M51	100	−100	2	−1.5	240	350	250	380	(TSMT8)	2.8×3.0×0.85	1.5
	SH8M41	80	−80	3.4	−2.6	90	165	110	220	(SOP8)	5.0×6.0×1.75	2
	New HP8M31	60	−60	8.5	−8.5	46	50	52	55	(HSOP8 Symmetry Dual)	5.0×6.0×1.0	7*3
	New SH8M31	60	−60	4.5	−4.5	46	50	52	55	(SOP8)	5.0×6.0×1.75	2
	QS8M31	60	−60	3	−2	80	150	93	180	(TSMT8)	2.8×3.0×0.85	1.5
	SH8M24	45	−45	6	−6	33	45	41	60	(SOP8)	5.0×6.0×1.75	2
	QH8M22	40	−40	4.5*2	−2*2	34.6	130	43.9	180	(TSMT8)	2.8×3.0×0.85	1.5*2
	HP8MA2	30	−30	18*3	−15*3	7.5	13.2	11.7	21	(HSOP8 Symmetry Dual)	5.0×6.0×1.0	7*3
	New SH8MA4	30	−30	9	−8.5	16.5	23	22.2	32	(SOP8)	5.0×6.0×1.75	2
	QH8MA4	30	−30	9*1	−8*1	12.3	22	18.2	31	(TSMT8)	2.8×3.0×0.85	2.6*1
	New SH8MA3	30	−30	7	−6	23	40	42	60	(SOP8)	5.0×6.0×1.75	2
	QH8MA3	30	−30	7*1	−5.5*1	22	37	35	55	(TSMT8)	2.8×3.0×0.85	2.5*1
	New SH8MA2	30	−30	4.5	−4.5	57	63	88	89	(SOP8)	5.0×6.0×1.75	2
	QH8MA2	30	−30	4.5	−3	25	55	40	80	(TSMT8)	2.8×3.0×0.85	1.5
	UT6MA2	30	−30	4	−4	37	55	59	80	DFN2020-8D (HUML2020L8 Dual)	2.0×2.0×0.6	2
	UT6MA3	20	−20	5.5	−5	—	—	30	42			2

*1 : Pw≦1s *2 : Pw=5s *3 : Pw<1s
Package indicates JEDEC code. ( ) denotes ROHM package type.

High Voltage 3-Phase Brushless DC Motor Drivers

ROHM high voltage 3-phase brushless DC motor drivers are compatible with motors equipped with Hall sensors.
The broad lineup supports different voltages (250V/600V withstand), commutation angles (120°/150°/180°(sine wave)), and currents (1.5A to 2.5A). Ideal for home appliances such as air conditioners/purifiers and fan motors.

Control

Pin Compatibility

These high voltage 3-phase brushless DC motor drivers, offered in a variety of output currents and drive methods, feature pin-compatible specifications. This makes it possible to use the same board, eliminating the need to design and create boards for different motor specifications. The following 3 series are pin-compatible.

Controllers — SSOP-A24

150° Commutation	BD62012AFS
Sine Wave Commutation	BD62017AFS BD62018AFS

Drivers — SSOP-A54_23

	6-Input type
250V/2.0A	BM6241FS
600V/1.5A	BM6242FS
600V/2.5A	BM6243FS

Motor Drivers — SSOP-A54_36

	120°/150° Commutation Selectable type	Sine Wave Commutation type
250V/2.0A	BM6244FS	BM6247FS
600V/1.5A	BM6245FS	BM6248FS
600V/2.5A	BM6246FS	BM6249FS

High Reliability

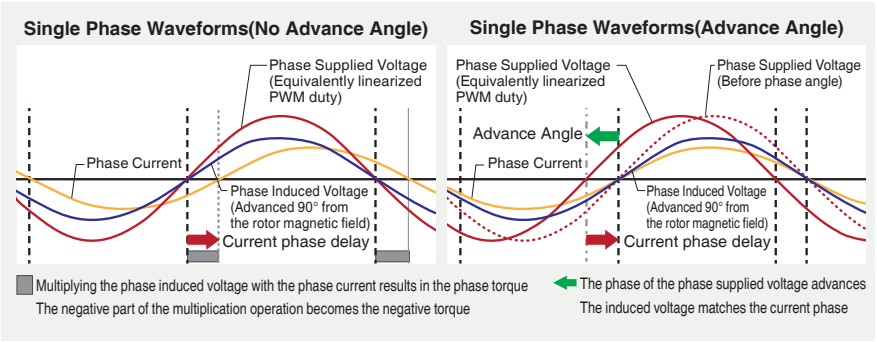
Multiple Protection Functions

UVLO(Under Voltage Lock Out)	Built-into the high side power supply, V_{CC} line, and internal REG. Prevents malfunctions due to supply voltage drops.
TSD(Thermal Shutdown)	Monitors controller chip temperature and operates when it exceeds a threshold value.
CL(Current Limting Function)	Monitors the PGND pin voltage so that it does not exceed the constant current.
OCP(Over Current Protection)	Monitors the PGND pin voltage and turns all outputs (upper/lower arms) OFF when the constant current is exceeded.
MLP(Motor Lockout Protection)	Sets all outputs (upper/lower arms) to L when it detects that the motor has locked up for a certain amount of time.
Hall Input Abnormality Detection Function	Switches all outputs (upper/lower arms) to L when all Hall input signals are set to L or H.
Fault Output	Changes the FOB pin to L when either TSD or OCP is detected.

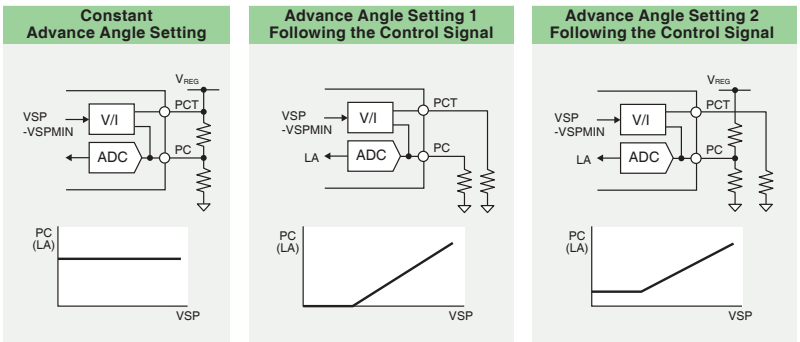
High Efficiency

Advance Angle Control Function

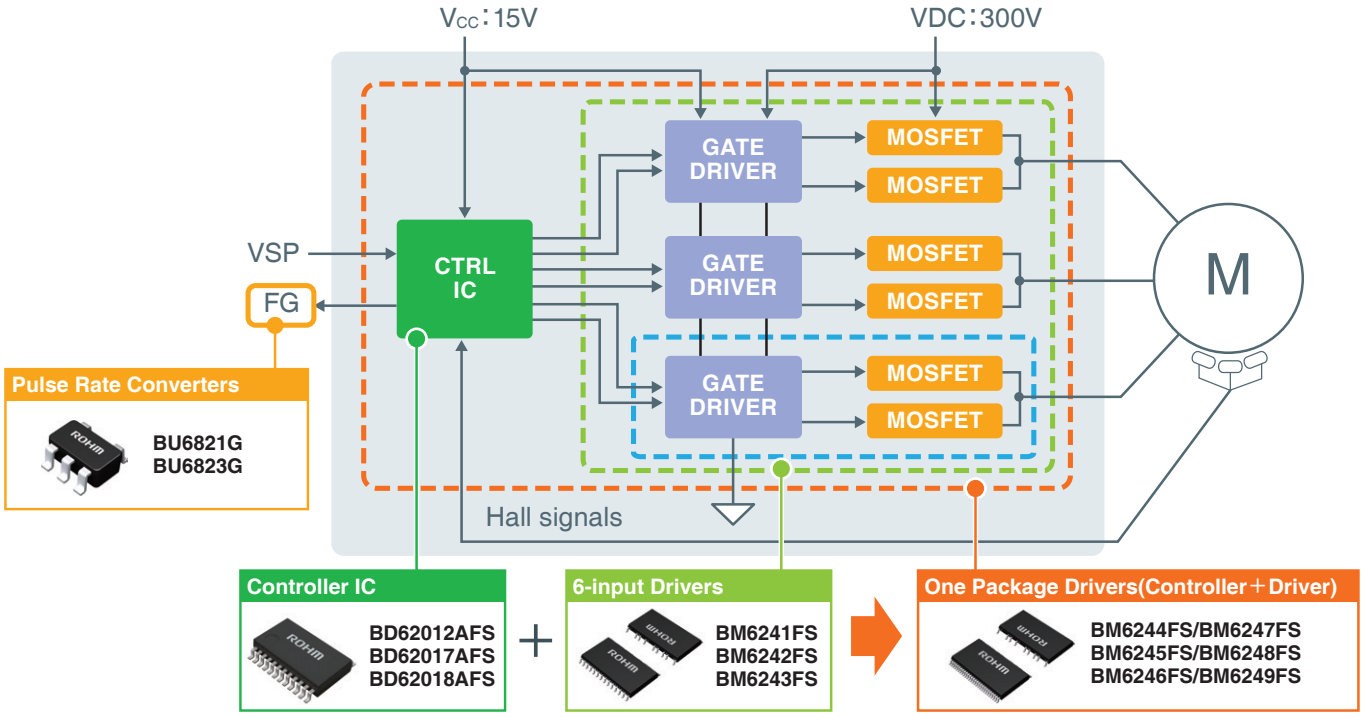
To maximize motor efficiency it is necessary to obtain maximum torque by setting the phases of the magnetic fields of the magnet (rotor) and coil (winding) to 90°. This enables control of the phase of the driver output signal relative to the Hall signal.



The optimum advance angle value will vary depending on the motor characteristics, the number of revolutions, and load torque (current value). It is necessary to set an appropriate value based on usage conditions. Set the advance angle value to obtain maximum efficiency. (BM6244FS/45FS/46FS : 0 to +30°, BM6247FS/48FS/49FS : 0 to +40°)



Brushless DC Motor : Block Diagram



High Voltage 3-Phase Brushless DC Motor Driver Lineup

High Voltage 3-Phase Brushless DC Motor Drivers 6-Input Control type

Part No.	Control Method	Withstand Voltage(V)	Output Current (A)	Output ON Resistance (Ω)(Typ.)	Diode Forward Voltage (V)	Package
BM6241FS	6-Input	250	2.0	0.9	0.9	SSOP-A54_23
BM6242FS	6-Input	600	1.5	2.7	1.1	SSOP-A54_23
BM6243FS	6-Input	600	2.5	1.7	1.1	SSOP-A54_23

High Voltage 3-Phase Brushless DC Motor Drivers 120°/150° Commutation Selectable type

Part No.	Commutation Method	Withstand Voltage(V)	Output Current (A)	Output ON Resistance (Ω)(Typ.)	Diode Forward Voltage (V)	Phase Control Range (deg.)	Package
BM6244FS	120°/150° Commutation	250	2.0	0.9	0.9	0 to +30°	SSOP-A54_36
BM6245FS	120°/150° Commutation	600	1.5	2.7	1.1	0 to +30°	SSOP-A54_36
BM6246FS	120°/150° Commutation	600	2.5	1.7	1.1	0 to +30°	SSOP-A54_36

High Voltage 3-Phase Brushless DC Motor Drivers Sine Wave Commutation type

Part No.	Commutation Method	Withstand Voltage(V)	Output Current (A)	Output ON Resistance (Ω)(Typ.)	Diode Forward Voltage (V)	Phase Control Range (deg.)	Package
BM6247FS	Sine Wave Commutation	250	2.0	0.9	0.9	0 to +40°	SSOP-A54_36
BM6248FS	Sine Wave Commutation	600	1.5	2.7	1.1	0 to +40°	SSOP-A54_36
BM6249FS	Sine Wave Commutation	600	2.5	1.7	1.1	0 to +40°	SSOP-A54_36

3-Phase Brushless DC Motor Controllers

Part No.	Commutation Method	Supply Voltage (V)	Control Voltage Input Range(V)	Phase Control Range* (deg.)	No. of FG Output Pulses (Pulse/rev)	FG Signal Conversion Ratio	Package
BD62012AFS	150° Commutation	10.0 to 18.0	2.1 to 5.4	0 to +30	4 or 12	12 : 12	SSOP-A24
BD62017AFS	Sine Wave Commutation	10.0 to 18.0	2.1 to 5.4	0 to +40	4 or 12	15 : 12	SSOP-A24
BD62018AFS	Sine Wave Commutation	10.0 to 18.0	2.1 to 5.4	0 to +40	4 or 12	12 : 12	SSOP-A24

*In the case of 8-pole motors

Pulse Rate Converters

Part No.	Supply Voltage (V)	Circuit Current (mA)	Input Frequency Range (kHz)	Conversion Ratio (Input : Output)	Package
New BU6821G	4.5 to 5.5	0.5	0.005 to 5	15 : 12	SSOP5
New BU6823G	4.5 to 5.5	0.5	0.005 to 5	21 : 12	SSOP5

IPMs(Intelligent Power Modules)

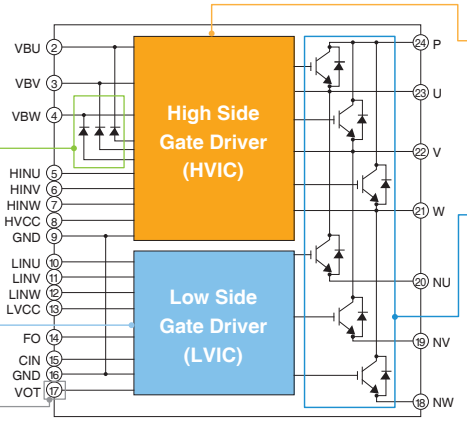
ROHM IPMs integrate a high efficiency control circuit in original high voltage low loss power devices to maximize performance. A wide lineup of IGBTs and MOSFETs are available.

Module Configuration(IGBT IPM)

Bootstrap Diodes
- Fast Recovery Diodes

LVIC (Low-side Gate Driver)
- UVLO, SCP, TSD, VOT
- Fault signal output

- Analog temperature output function specifications: VOT (BM6356xS, BM6396xS)
- TSD specifications : NC(No Connection) (BM6336xS, BM6376xS)



HVIC (High-side Gate Driver)
- Bootstrap diode current limiting function
- Floating power supply UVLO

Inverter Part (IGBT and FWD)
- Low Loss Field Stop Trench IGBT
- Ultra-Low V_F Fast Recovery Diode

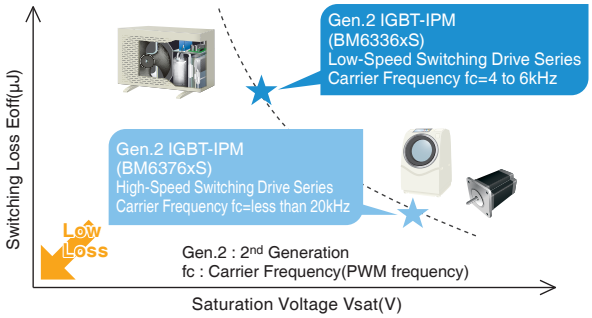
Protection Circuits
UVLO : Under Voltage Lock Out
SCP : Short Circuit Protection
TSD : Thermal Shut Down
VOT : Analog Temperature Output

High Efficiency

High Efficiency Technology

High efficiency drive is achieved by optimizing IGBT and gate constant settings based on application requirements.

High efficiency drive with settings optimized according to the application



Non-Isolated Gate Driver+Power Device

ROHM non-isolated gate drivers are high side/low side gate drivers that utilize the bootstrap method. ROHM power devices such as IGBTs and MOSFETs contribute to greater energy savings and higher efficiency.

High Reliability

HVICs Adopting Latch Up Free SOI Processes

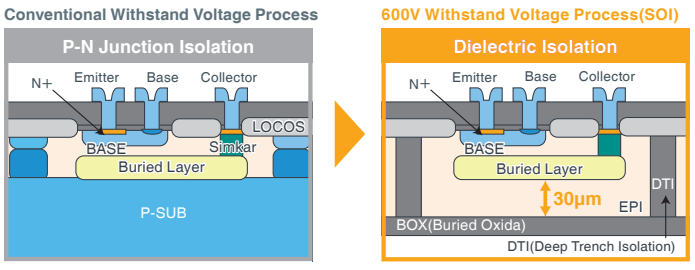
High Withstand Voltage Process Higher voltages achieved utilizing a perfect dielectric separation method with SOI substrate

Conventional Process

The latch up tolerance will vary based on usage conditions, element layout, and process capability, with the difference in tolerance depending on the product. Please note that in some cases malfunctions and even damage may occur due to negative voltage supplied during abnormality testing (i.e. surge tests).

ROHM's SOI Process

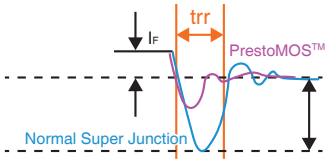
Adopting a process structure that makes it difficult for latch up to occur prevents malfunctions and damage due to negative voltage.



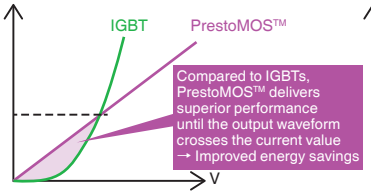
High Efficiency

Increased Energy Savings by Switching from IGBT

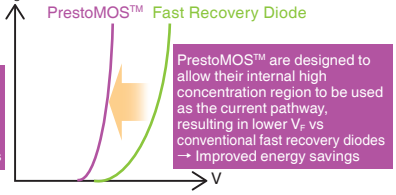
ROHM PrestoMOS™ features improved reverse recovery characteristics of the internal diode - a major drawback of super junction MOSFETs.



Drain(Collector) Current vs Voltage Drop



Diode(Regenerative) Current vs Voltage Drop



PrestoMOS™ is a trademark of ROHM.

IPMs(Intelligent Power Module) Lineup

IGBT-IPM

Part No.	V_{CES}(V)	I_C(A)	$V_{CE(sat)}$(V)	PWM Input Frequency(kHz)	Isolation Voltage*1(Vrms)	Temperature Protection Function*2	Package
BM63363S-VA/-VC	600	10	1.5	less than 6	1,500	TSD	HSDIP25/HSDIP25VC
BM63563S-VA/-VC	600	10	1.5	less than 6	1,500	VOT	HSDIP25/HSDIP25VC
BM63763S-VA/-VC	600	10	1.7	less than 20	1,500	TSD	HSDIP25/HSDIP25VC
BM63963S-VA/-VC	600	10	1.7	less than 20	1,500	VOT	HSDIP25/HSDIP25VC
BM63364S-VA/-VC	600	15	1.5	less than 6	1,500	TSD	HSDIP25/HSDIP25VC
BM63564S-VA/-VC	600	15	1.5	less than 6	1,500	VOT	HSDIP25/HSDIP25VC
BM63764S-VA/-VC	600	15	1.7	less than 20	1,500	TSD	HSDIP25/HSDIP25VC
BM63964S-VA/-VC	600	15	1.7	less than 20	1,500	VOT	HSDIP25/HSDIP25VC
BM63767S-VA/-VC	600	30	1.7	less than 20	1,500	TSD	HSDIP25/HSDIP25VC
BM63967S-VA/-VC	600	30	1.7	less than 20	1,500	VOT	HSDIP25/HSDIP25VC

MOS-IPM

Part No.	V_{DSS}(V)	I_D(A)	Ron(mΩ)	Recommended Switching Frequency(kHz)	Isolation Voltage*1(Vrms)	Temperature Protection Function*2	Package
BM65364S-VA	600	15	120	less than 20	1,500	TSD	HSDIP25
BM65364S-VC	600	15	120	less than 20	1,500	TSD	HSDIP25VC

*1 : Supports 2,500Vrms when using convex heat sink at AC60Hz for 1min *2 : TSD(Thermal Shutdown), VOT(Analog Temperature Output)

Non-Isolated Gate Driver/ Power Device Lineup

IGBT/MOSFET High Side/Low Side Gate Drivers

Part No.	ch	V_{CC} (V)	High Side Floating Voltage(V)	I_O (mA)	OCP	High Side Floating Voltage(V)	Boot Diode	Operating Temperature (°C)	Package
BS2101F	2	10 to 18	600	60/−130	−	−	−	−40 to +125	SOP8
BS2103F	2	10 to 18	600	60/−130	−	160	−	−40 to +125	SOP8
BS2114F	2	10 to 20	600	500/−500	−	160	−	−40 to +125	SOP8
BS2130F-G	6	11.5 to 20	600	200/−350	External setting(5% detection accuracy)	300	−	−40 to +125	SOP28
New BS2132F	6	11.5 to 20	600	200/−350	External setting(5% detection accuracy)	300	✓	−40 to +125	SOP28

IGBT RGT series/RGS series

Part No.	V_{CES} (V)	I_C(A)		$V_{CE(sat)}$(V)		tf(ns)		Cies(pF)		Cres(pF)		FRD				Package
												V_F(V)		trr(ns)		
		25℃	100℃	Typ.	I_C(A)	Typ.	I_C(A)	Typ.	V_{CE}(V)	Typ.	I_F(A)	Typ.	I_F(A)	Typ.	I_F(A)	
RGT8BM65D	650	8	4	1.65	4	71	4	220	30	4.5	30	1.45	4	40	4	TO-252〔DPAK〕
RGT16BM65D	650	16	8	1.65	8	95	8	450		8		1.4	8	42	8	
RGT8NS65D	650	8	4	1.65	4	71	4	220	30	4.5	30	1.45	4	40	4	TO-263S (LPDS)〔D2PAK〕/ TO-262/ TO-263L qualified
RGT16NS65D	650	16	8	1.65	8	95	8	450		8		1.4	8	42	8	
RGT30NS65D	650	30	15	1.65	15	75	15	780		13		1.5	15	55	15	
RGT40NS65D	650	40	20	1.65	20	60	20	1070		18		1.45	20	58	20	
RGT50NS65D	650	48	25	1.65	25	65	25	1400		22		1.45	20	58	20	
RGT8TM65D	650	9	5	1.65	8	71	4	220	30	4.5	30	1.45	4	40	4	TO-220NFM
RGT16TM65D	650	9	5	1.65	8	95	8	450		8		1.4	8	42	8	
RGT30TM65D	650	14	8	1.65	15	75	15	780		13		1.5	15	55	15	
RGT40TM65D	650	17	10	1.65	20	60	20	1070		18		1.45	20	58	20	
RGT50TM65D	650	21	13	1.65	25	65	25	1400		22		1.45	20	58	20	
RGT40TS65D	650	40	20	1.65	20	60	20	1070	30	18	30	1.45	20	58	20	TO-247N
RGT50TS65D	650	48	25	1.65	25	65	25	1400		22		1.45	20	58	20	
RGT60TS65D	650	55	30	1.65	30	60	30	1730		29		1.35	20	58	20	
RGT80TS65D	650	70	40	1.65	40	55	40	2210		36		1.35	20	58	20	
RGT00TS65D	650	85	50	1.65	50	62	50	2770		43		1.45	30	54	30	
RGS60TS65D	650	56	30	1.65	30	101	30	980	30	13	30	1.45	30	98	30	TO-247N
RGS80TS65D	650	73	40	1.65	40	96	40	1240		16		1.45	30	98	30	
RGS00TS65D	650	88	50	1.65	50	91	50	1570		23		1.45	30	98	30	
RGS00TS65E	650	88	50	1.65	50	91	50	1570		23		1.45	50	113	50	
☆RGS30TSX2D	1200	30	15	1.7	15	TBD	15	TBD		TBD		1.65	15	TBD	15	
☆RGS50TSX2D	1200	50	25	1.7	25	205	25	1930		18		1.65	25	195	25	
☆RGS80TSX2D	1200	80	40	1.75	40	227	40	2820		25		1.75	40	280	40	

Package indicates JEDEC code. ( ) : ROHM Package, [ ] : JEITA Code, 〔 〕: GENERAL Code. ☆ : Under Development

Fast Recovery PrestoMOS™ Super Junction MOSFET R60xxJNx series

Part No.	V_{DSS} (V)	I_D (A)	$R_{DS(on)}$(Ω) V_{GS}=15V	Qg(nC) V_{GS}=15V	trr (ns)	Package
New R6004JND3	600	4	1.10	10.5	45	TO-252 [DPAK]
New R6006JND3		6	0.72	15.5	58	
New R6007JND3		7	0.60	17.5	60	
New R6009JND3		9	0.45	22	65	
★R6014JND3		14	0.30	32	75	
New R6004JNJ	600	4	1.10	10.5	45	TO-263S (LPTS) [SC-83] [D2PAK]
New R6006JNJ		6	0.72	15.5	58	
New R6007JNJ		7	0.60	17.5	60	
New R6009JNJ		9	0.45	22	65	
☆R6012JNJ		12	0.30	28	70	
☆R6018JNJ		18	0.22	42	80	
☆R6020JNJ		20	0.18	45	85	
☆R6020JNZ	600	20	0.18	45	85	TO-3PF
☆R6025JNZ		25	0.14	57	90	
☆R6030JNZ		30	0.11	74	100	
★R6050JNZ		50	0.064	120	120	

Part No.	V_{DSS} (V)	I_D (A)	$R_{DS(on)}$(Ω) V_{GS}=15V	Qg(nC) V_{GS}=15V	trr (ns)	Package
New R6004JNX	600	4	1.10	10.5	45	TO-220FM
New R6006JNX		6	0.72	15.5	58	
New R6007JNX		7	0.60	17.5	60	
New R6009JNX		9	0.45	22	65	
New R6012JNX		12	0.30	28	70	
New R6018JNX		18	0.22	42	80	
☆R6020JNX		20	0.18	45	85	
☆R6025JNX		25	0.14	57	90	
★R6030JNX		30	0.11	74	100	
☆R6020JNZ4	600	20	0.18	45	85	TO-247
☆R6025JNZ4		25	0.14	57	90	
☆R6030JNZ4		30	0.11	74	100	
☆R6042JNZ4		42	0.08	100	110	
★R6050JNZ4		50	0.064	120	120	
★R6070JNZ4		70	0.045	165	135	

Package indicates JEDEC code. ( ) : ROHM Package, [ ] : JEITA Code, 〔 〕: GENERAL Code.

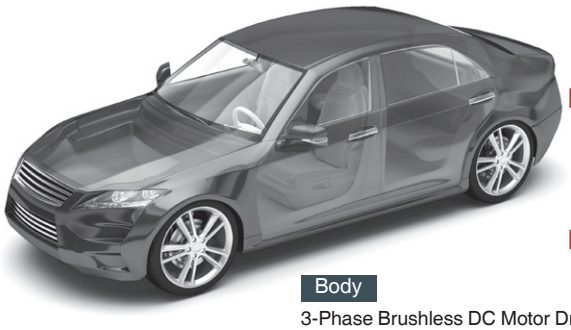
☆ : Under Development
★ : Development Under Consideration

Automotive Motor Drivers

ROHM's automotive motor drivers are specifically designed for brushed DC motors and brushless motors with 3-phase Hall sensors. Each includes a driver and predriver, enabling support for a range of drive currents, from small to large.
In addition, the products are qualified under AEC-Q100 Grade 1/Grade 2.

Body
3-Phase Brushless DC Motor Drivers
HVAC Blower & Battery Cooling Fan
- **BD16805FV-M**(Predriver)
- New **BD63030EKV-C**(Predriver)

Body
Brushed DC Motor Drivers
HVAC Damper & Door Mirror
- **BD16922EFV-M**(2ch Full)
- **BD16933EFV-C**(3ch Half+SPI)
- New **BD16939EFV-C**(6ch Half+SPI)
- New **BD16938EFV-C**(8ch Half+SPI)
- New **BD16912EFV-C**(1ch Full)



Body
Brushed DC Motor Predriver
Power Window, Power Seat, Sunroof, Rear-gate
- New **BD16950EFV-C**(Predriver)

Infotainment System
Brushed DC Motor Drivers
HUD Combiner, LD Projector, etc
- New **BD16912EFV-C**(1ch Full)

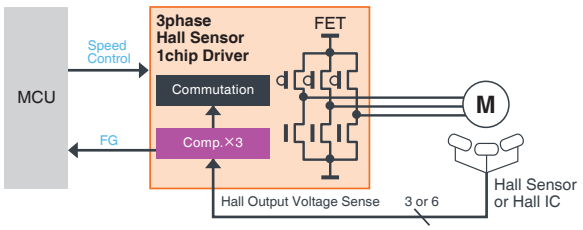
Body
3-Phase Brushless DC Motor Drivers
Seat Fan
- **BD63035EFV-M**(Driver)

Drive System
Brushed DC Motor Drivers
4-Wheel Torque Distribution System
- New **BD16950EFV-C**(Predriver)

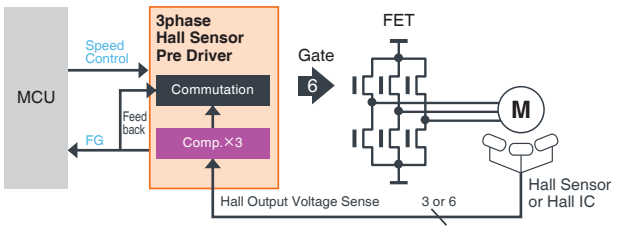
3-Phase Brushless DC Motor Driver/Predriver BD63035EFV-M, BD63030EKV-C

These 3-phase brushless DC motor predriver and motor driver are 3-Hall sensor types that adopt the sine wave drive commutation method to achieve low noise and low vibration. The BD63030EVK-C utilize predriver specifications to drive external Nch(upper/lower) MOSFETs.

3-Phase Full-Wave 1chip Driver
(BD63035EFV-M)



3-Phase Full-Wave Predriver
(BD63030EKV-C)



Features

- Built-in speed command signal link type lead angle control function(30deg. Max.) enables high efficiency drive(BD63030EKV-C)
- Rotational feedback control minimizes air volume variations due to external pressure fluctuations(BD63030EKV-C)
- Integrated sinusoidal commutation logic ensures ultra-quiet operation(BD63035EFV-M, BD63030EKV-C)

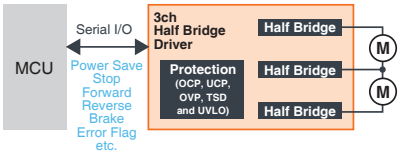
Brush DC Motor Driver(H-Bridge type) Usage Method BD16933EFV-C, BD16939EFV-C, BD16938EFV-C

Multichannel brush motor drivers(H-bridge type) are products that drive motors by controlling multiple drivers using only one control signal(SPI communication). This makes it possible to reduce the number of signal lines along with the external parts.

Part No.	Output Channels	No. of Drivable Motors							Drive Restrictions Marked by the ○ Symbol (◎ indicates no drive restrictions)	Application Examples
		1	2	3	4	5	6	7		
BD16933EFV-C	1.5ch(Half 3ch)	◎	○						○ Do not drive 2 motors simultaneously	Door mirror angle adjustment, etc.
BD16939EFV-C	3ch(Half 6ch)			◎	○	○			○ Do not drive more than 4 motors simultaneously	AC damper open/close, etc.
BD16938EFV-C	4ch(Half 8ch)				◎	○	○	○	○ Do not drive more than 5 motors simultaneously	AC damper open/close, etc.

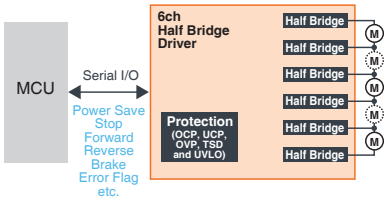
1.5ch(Half 3ch) Usage Example
(BD16933EFV-C)

Below is an example of a 1.5ch(half 3ch) application.
Two motors can be driven, but not at the same time.
(Application example: Door mirror angle adjustment, etc.)



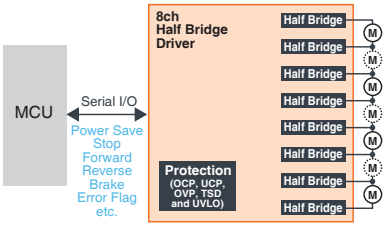
3ch(Half 6ch) Usage Example
(BD16939EFV-C)

Below is an example of a 3ch(half 6ch) application.
4 to 5 motors can be driven, provided that 3 are not driven at the same time.
(Application example: AC damper open/close, etc.)



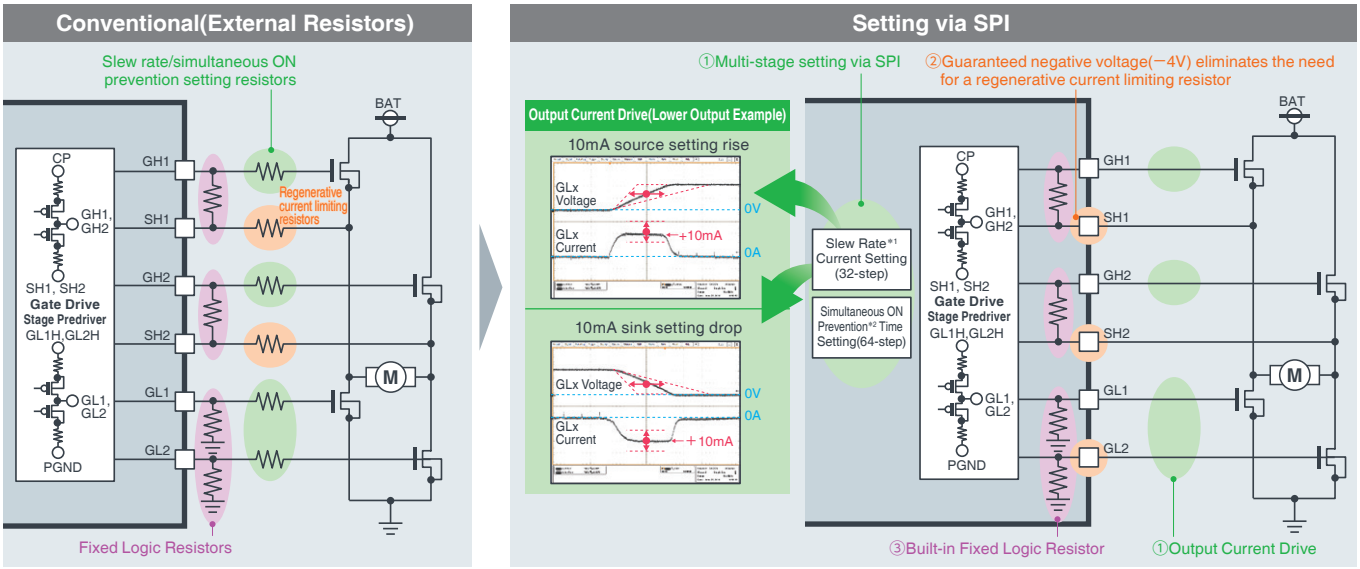
4ch(Half 8ch) Usage Example
(BD16938EFV-C)

Below is an example of a 4ch(half 8ch) application.
4 to 7 motors can be driven with 1 driver, provided that more than 5 are not driven at the same time.
(Application example: AC damper open/close, etc.)



Set the predriver output current and simultaneous ON prevention time in multiple stages via SPI communication BD16950EFV-C

Optimization and efficiency of EMI characteristics can be adjusted via SPI communication(vs conventional methods using external resistors), contributing to improved design efficiency and ECU miniaturization by reducing the number of parts required.

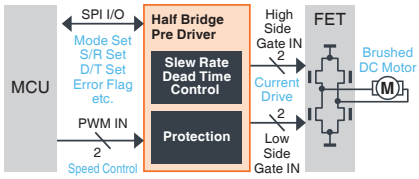


∗1 : 31-step output slew rate setting: 1mA to 31mA output current(in 1mA steps) ∗2 : 64-step simultaneous ON prevention time setting: 0.25us to 92us prevention time

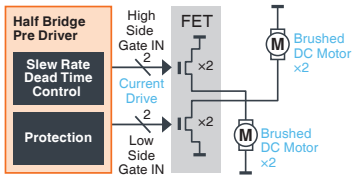
Independently control up to 4 motors and/or solenoids BD16950EFV-C

Independent control supports a variety of drive systems.

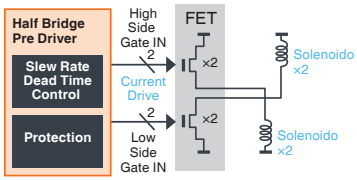
Bi-Directional Brushed Motor DC Drive



Uni-Directional Brushed Motor DC Drive



Solenoid Drive



Brushed DC Motor Drivers

Drivers

Part No.	Output Channels (ch)	Withstand Voltage(V)	Supply Voltage(V)	Output Current(A)	FWD/REV/ BRK/Hi-Z	Protection Functions*	Error Flag	Automotive Grade AEC-Q100 Qualified	Operating Temperature(°C)	Package
BD16922EFV-M	2	60	8.0 to 36.0	1	Parallel 2 Inputs	OCP, OVP, TSD	OCP	Grade 2	−40 to +110	HTSSOP-B24
BD16933EFV-C	1.5(Half 3ch)	60	7.0 to 36.0	1	SPI	OCP, UCP, OVP, TSD, UVLO	✓	Grade 1	−40 to +125	HTSSOP-B20
New **BD16939EFV-C**	3(Half 6ch)	40	6.3 to 32.0	1	SPI	OCP, UCP, OVP, TSD, UVLO, TW	✓	Grade 1	−40 to +125	HTSSOP-B28
New **BD16938EFV-C**	4(Half 8ch)	40	6.3 to 18.0	1	SPI	OCP, UCP, OVP, TSD, UVLO, TW	✓	Grade 1	−40 to +125	HTSSOP-B20
New **BD16912EFV-C**	1	40	6.0 to 18.0	3	Parallel 2 Inputs	OCP, OVP, TSD, UVLO, TW	OCP, OVP, TW	Grade 1	−40 to +125	HTSSOP-B20

∗ : OCP : Over Current Protection, UCP : Under Current Protection, OVP : Over Valtage Protection, TSD : Thermal Shutdown, UVLO : Under Voltage Lock Out, TW : Thermal Warning

Predrivers

Part No.	Output Channels(ch)	Withstand Voltage(V)	Supply Voltage(V)	FWD/REV/ BRK/Hi-Z	Speed Control Input Signal	Protection Functions*	Error Flag	Automotive Grade AEC-Q100 Qualified	Operating Temperature(°C)	Package
New **BD16950EFV-C**	1(Half 2ch)	40	5.5 to 40.0	SPI	Direct PWM	OCP, OVP, TSD, UVLO, TW, UVP	OCP, OVP, TSD, UVLO, TW, UVP	Grade 1	−40 to +125	HTSSOP-B24

∗ : OCP : Over Current Protection, OVP:Over Valtage Protection, TSD : Thermal Shutdown, UVLO : Under Voltage Lock Out, TW : Thermal Warning, UVP : Under Voltage Protection of Drain Terminal

3-Phase Brushless DC Motor Drivers

Drivers

Part No.	Withstand Voltage(V)	Supply Voltage(V)	Output Current(A)	Commutation Method	Sensor type	FG/ AL*1	Hall Bias (V)	Motor Lock Protection	Speed Control Input Signal	Current Control Function	Automotive Grade AEC-Q100 Qualified	Operating Temperature(°C)	Package
BD63035EFV-M	36	8.0 to 28.0	1.5 (2.0A)*3	Sine Wave	3 Hall*2	FG	5V Element Used	✓	DC	✓	Grade 2	−40 to +105	HTSSOP-B20

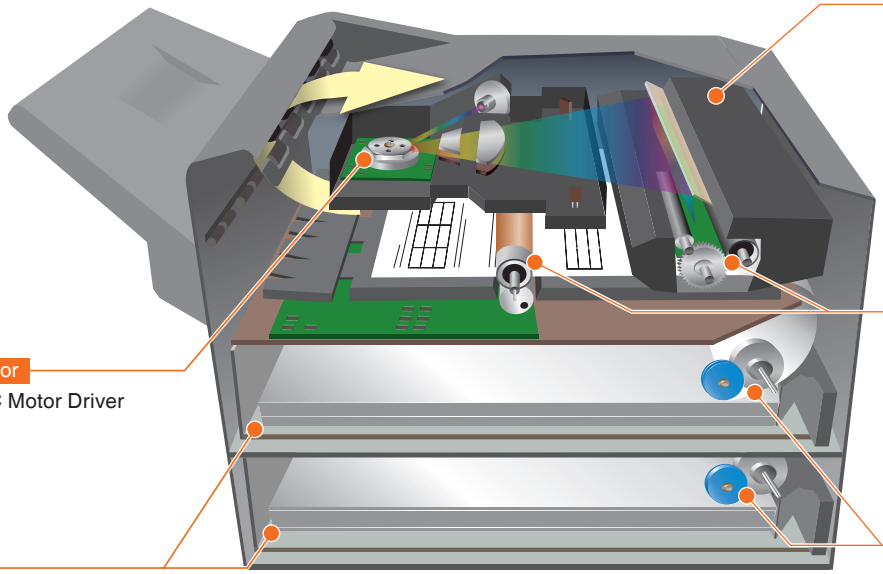
∗1 : FG : Rotational speed output terminal, AL: Alarm signal output termina ∗2 : Supports Hall elements and Hall ICs ∗3 : Pulse width tw≦1ms, Duty 20% of pulse

Predrivers

Part No.	Withstand Voltage(V)	Supply Voltage(V)	Commutation Method	Sensor type	Advance Angle Setting	FG/ AL*3	Hall Bias (V)	Motor Lock Protection	Speed Control Input Signal	Automotive Grade AEC-Q100 Qualified	Operating Temperature(°C)	Package
BD16805FV-M	60	8.0 to 18.0	Sine Wave	3 Hall*1	Fixed from 0 to 30°	FG/ AL	5.5	✓	DC/Dierect PWM	Grade 2	−40 to +110	SSOP-B40
New **BD63030EKV-C**	50	6.5 to 18.0	Sine Wave	3 Hall*2	Linked to speed command from 0 to 30°	FG/ AL*4	5.0	✓	DC/Direct PWM (with rotational speed feedback control)	Grade 1	−40 to +125	HTQFP64AV

∗1 : Supports only Hall elements ∗2 : Supports Hall elements and Hall ICs ∗3 : FG : Rotational speed output terminal, AL : Alarm signal output terminal
∗4 : Normally the FG signal is output, but during abnormalities the AL signal is output(at 1 output)

Printer Drivers



Printer Drivers

Polygon Mirror 3-Phase Brushless DC Motor Drivers — For LBP, PPC

Part No.	Supply Voltage(V)	Output Current (A)	Circuit Current (mA)	Input Threshold Voltage		Current Limiting Voltage*1(V)	ON Resistance (Ω)	Motor Stop Circuit Current(mA)	Package
				H Level(V)	L Level(V)				
BD67929EFV	19 to 28	2.5	4.0	3.0	1.5	0.5	1.35(at 1A)	1.0	HTSSOP-B28
BD6415AEFV	18 to 28	2.5	5.0	2.0	0.8	0.4	0.6(at 1A)	4.5	HTSSOP-B30

∗1 : The output current limiting value is obtained by dividing the current limiting voltage by the external output current detection resistance (RNF resistance).

Brushed DC Motor Drivers for Printers

Part No.	Supply Voltage(V)	Output Current(A) [Peak Current(A)]	ch	Current Limiting Function	ON Resistance (Ω)	Package
BD62110AEFJ	8.0 to 28.0	1.0[2.0*1]	1	–	1.8	HTSOP-J8
BD62120AEFJ	8.0 to 28.0	2.0[3.0*1]	1	–	0.65	HTSOP-J8
BD62210AEFV	8.0 to 28.0	1.0[1.5*1]	2	✓	1.9	HTSSOP-B28
BD62220AEFV	8.0 to 28.0	2.0[2.8*1]	2	✓	0.65	HTSSOP-B28

∗1 : Pulse width tw≦ 1ms, Duty 20% of pulse
The BD62110AEFJ and BD62120AEFJ are pin-compatible. The BD62210AEFV and BD62220AEFV are pin-compatible.

Bipolar Stepper Motor Drivers for Paper Transport or Carriage — For LBP, PPC, Scanners, Photo Printers, Fax, IJP

Part No.	Supply Voltage(V)	Output Current (A)	Control Input Signal	Drive	Decay	Single PowerSupply	ON Resistance (Ω)	Package
BD63510AEFV	8.0 to 28.0	1.0	CLK	1/16	✓	✓	1.75	HTSSOP-B28
BD63520AEFV	8.0 to 28.0	2.0	CLK	1/16	✓	✓	0.65	HTSSOP-B28
BD63525AEFV	8.0 to 28.0	2.5	CLK	1/16	✓	✓	0.35	HTSSOP-B28

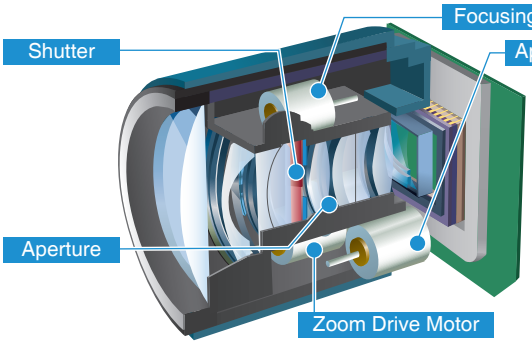
3-Phase Brushless DC Motor Predrivers for Paper Transport — For LBP, PPC

Part No.	Withstand Voltage(V)	Supply Voltage(V)	Circuit Current (mA)	Input Threshold Voltage		External FET Drive Voltage		PWM Frequency(kHz)	Package
				H Level(V)	L Level(V)	Upper Side(V)	Lower Side(V)		
BD6761FS	36	16 to 28	15.0	2.2	0.8	V_{CC}+6	10.5	15	SSOP-A32
BD6762FV	36	16 to 28	17.0	2.2	0.8	V_{CC}+6.8	10.8	16	SSOP-B40

Printer Driver for Inkjet Printers

Part No.	Supply Voltage(V)	H Bridge Output Current(A)	SW REG Output Current(A)	H Bridge 1 ON Resistance(Ω)	H Bridge 2 ON Resistance(Ω)	SW REG ON Resistance(Ω)	SW REG Output Voltage(V)	Series REG Output Voltage(V)	Package
BD64538EFV	9 to 45	1.5	1.5	1.75(at 1A)	1.75(at 1A)	0.75(at 1A)	3 to V_{BB}×0.6 (Max. 5.5V)	1.0 to 2.5	HTSSOP-B28

Camera Lens Drivers



Camera Drivers

5ch Camera System Lens Drivers

Part No.	Supply Voltage(V)	Max. Driver Output Current(A)	Actuator-Specific Drive Examples(Drive Motor, Drive System, Output ON Resistance(Ω))					Input I/F	Reference Voltage Output for Output Setting Current(V)	Package (mm)
				AF	Zoom	Iris	Shutter			
BD6758MWV	2.5 to 5.5	0.8	ex.	STM(1, 2ch) FULL ON 1.2	DCM(3ch) FULL ON 1.2	DCM or VCM(4ch) FULL ON 1.2	VCM(5ch) Constant Current 1.0	Parallel	1.2 (±3%)	UQFN036V5050 (5.0×5.0)H=1.0Max.
BD6758KN	2.5 to 5.5	0.8	ex.	STM(1, 2ch) FULL ON 1.2	DCM(3ch) FULL ON 1.2	DCM or VCM(4ch) FULL ON 1.2	VCM(5ch) Constant Current 1.0	Parallel	1.2 (±3%)	VQFN36 (6.2×6.2)H=0.95Max.

6ch Camera System Lens Drivers

Part No.	Supply Voltage(V)	Max. Driver Output Current(A)	Actuator-Specific Drive Examples(Drive Motor, Drive System, Output ON Resistance(Ω))						Input I/F	Reference Voltage Output for Output Setting Current(V)	Package (mm)
				AF	Zoom	Iris	Shutter	Barrier			
BD6373GW	2.5 to 5.5	0.8	ex.	STM(1, 2ch) FULL ON 1.2	STM(3, 4ch) FULL ON 1.2	DCM or VCM(5ch) FULL ON 1.2	VCM(6ch) FULL ON 1.2	–	Parallel	–	UCSP75M2 (2.6×2.6) H=0.85Max.
BD6753KV	4.5 to 10.5(1, 2ch) 2.0 to 10.5(3 to 6ch)	0.8	ex.	STM(1, 2ch) FULL ON 1.2	STM(3, 4ch) FULL ON 1.2	DCM or VCM(5ch) PWM(±3%) 1.2	VCM(6ch) PWM(±3%) 1.2	–	Parallel + Serial	0.9 (±10%)	VQFP48C (9.0×9.0) H=1.60Max.

1ch/2ch Camera Lens Drivers

Part No.	No. of Channel(ch)	Supply Voltage(V)	Max. Driver Output Current(A)	Actuator-Specific Drive Examples(Drive Motor, Drive System, Output ON Resistance(Ω))						Turn ON Time	Turn OFF Time(ns)	Control Input Frequency	Package (mm)
					Cleaner	AF	Zoom	Iris	Shutter				
BD65492MUV	2	1.8 to 16.0	1.0	ex.	–	FULL ON 0.9	FULL ON 0.9	FULL ON 0.9	–	200ns(includes 80ns through-current prevention OFF time)	80	500kHz (Max.)	VQFN024V4040 (4.0×4.0)H=1.0Max.
BD63565EFV	2	1.8 to 16.0	1.0	ex.	–	FULL ON 0.9	FULL ON 0.9	FULL ON 0.9	FULL ON 0.9	200ns(includes 80ns through-current prevention OFF time)	80	500kHz (Max.)	HTSSOP-B20 (6.5×6.4)H=1.0Max.
BD6735FV	2	2.0 to 8.0	1.0	ex.	–	FULL ON 1.0	FULL ON 1.0	FULL ON 1.0	–	300ns(includes 90ns through-current prevention OFF time)	100	100kHz (Max.)	SSOP-B20 (6.5×6.4)H=1.25Max.
BD6376GUL	1	2.0 to 9.0	1.0	ex.	–	FULL ON 0.45	FULL ON 0.45	FULL ON 0.45	FULL ON 0.45	200ns(includes 80ns through-current prevention OFF time)	60	200kHz (Max.)	VCSP50L1 (1.6×1.6)H=0.55Max.
BD65491FV	1	1.8 to 16.0	1.2 Peak 4.0	ex.	–	FULL ON 0.35	FULL ON 0.35	FULL ON 0.35	FULL ON 0.35	150ns(includes 80ns through-current prevention OFF time)	50	500kHz (Max.)	SSOP-B16 (6.5×5.0)H=1.25Max.
BD6736FV	1	2.0 to 9.0	1.0 Peak 3.2	ex.	–	FULL ON 0.35	FULL ON 0.35	FULL ON 0.35	FULL ON 0.35	1000ns(includes 800ns through-current prevention OFF time)	100	100kHz (Max.)	SSOP-B20 (6.5×6.4)H=1.25Max.
BD65499MUV	1	4.0 to 27.0	0.5 Peak 2.0	ex.	Piezo(1ch) FULL ON 0.6	–	–	–	–	150ns(includes 80ns through-current prevention OFF time)	50	300kHz (Max.)	VQFN028V5050 (5.0×5.0)H=1.0Max.
BD65494MUV	1	2.0 to 9.0	1.0 Peak 2.5	ex.	–	FULL ON 0.55	FULL ON 0.55	FULL ON 0.55	FULL ON 0.55	200ns(includes 80ns through-current prevention OFF time)	60	200kHz (Max.)	VQFN016V3030 (3.0×3.0)H=1.0Max.
BD65496MUV	1	1.8 to 16.0	1.2 Peak 5.0	ex.	–	FULL ON 0.35	FULL ON 0.35	FULL ON 0.35	FULL ON 0.35	150ns(includes 80ns through-current prevention OFF time)	50	500kHz (Max.)	VQFN024V4040 (4.0×4.0)H=1.0Max.
New BD63573NUV	1	2.0 to 16.0	1.2 Peak 3.2	ex.	–	FULL ON 0.35	FULL ON 0.35	FULL ON 0.35	FULL ON 0.35	250ns(includes 80ns through-current prevention OFF time)	80	500kHz (Max.)	VSON010V3030 (3.0×3.0)H=1.0Max.

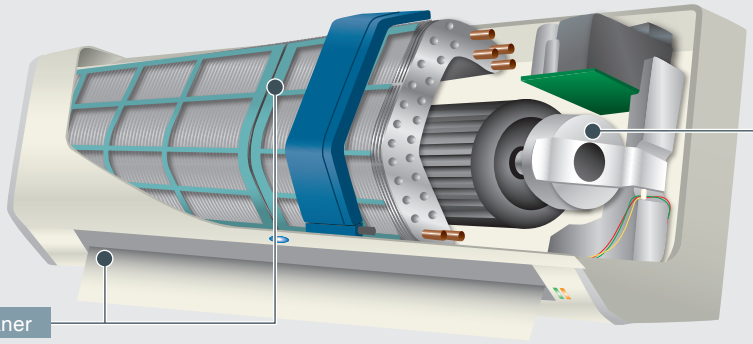
μ-Step Compatible Camera System Lens Drivers

Part No.	Supply Voltage(V)	Max. Driver Output Current(A)	Actuator-Specific Drive Examples(Drive Motor, Drive System, Output ON Resistance(Ω))						Package (mm)
				AF	Zoom	Iris	Shutter	Other	
BU24020GU	2.7 to 3.6(Logic) 2.7 to 5.5(Driver)	0.5	ex. 1	STM(1, 2ch) μ-step(Class D) 1.5	STM(3, 4ch) μ-step(Class D) 1.5	–	–	–	VCSP85H2 (2.6×2.6) H=1.0Max.
			ex. 2	STM(1, 2ch) μ-step(Class D) 1.5	DCM(3ch) FULL ON(PWM) 1.5	VCM(4ch) FULL ON(PWM) 1.5	–	–	
BU24031GW	1.62 to 3.6(I_O) 2.7 to 3.6(Logic) 2.7 to 5.5(Driver)	0.5	ex.	STM(1, 2ch) μ-step(Class D) 2.0	DCM(4ch) FULL ON(PWM+Speed Control) 2.0	VCM(3ch) FULL ON(PWM) 2.0	VCM(5ch) Constant Current 1.0	–	UCSP75M2 (2.5×2.5) H=0.85Max.
BU24033GW	1.62 to 3.6(I_O) 2.7 to 3.6(Logic) 2.7 to 5.5(Driver)	0.5/0.6	ex. 1	STM(1, 2ch) μ-step(Class D) 1.5	STM(3, 4ch) μ-step(Class D) 1.5	VCM(5ch) FULL ON(PWM) 1.0	VCM(6ch) Constant Current 1.0	–	UCSP75M3 (3.0×3.0) H=0.85Max.
			ex. 2	STM(1, 2ch) μ-step(Class D) 1.5	DCM(5ch) FULL ON(PWM+Speed Control) 1.0	VCM(3ch) FULL ON(PWM) 1.5	VCM(6ch) Constant Current 1.0	DCM(4ch) FULL ON(PWM) 1.5	
BU24035GW	2.7 to 3.6(Logic) 2.7 to 5.5(Driver)	0.5/0.6	ex. 1	STM(1, 2ch) μ-step(Class D) 1.5	DCM(5ch) FULL ON(PWM+Speed Control) 1.0	STM(3, 4ch) μ-step(Class D) 1.5	VCM(6ch) Constant Current 1.0	–	UCSP75M3 (3.1×3.1) H=0.85Max.
			ex. 2	STM(1, 2ch) μ-step(Class D) 1.5	DCM(3ch) FULL ON(PWM+Speed Control) 1.5	VCM(5ch) FULL ON(PWM)/Constant Current 1.0	VCM(6ch) Constant Current 1.0	VCM(4ch) FULL ON(PWM) 1.5	
BU24036MWV	2.7 to 3.6(Logic) 2.7 to 5.5(Driver)	0.5/0.6	ex. 1	STM(1, 2ch) μ-step(Class D) 2.0	DCM(5ch) FULL ON(PWM+Speed Control) 1.0	STM(3, 4ch) μ-step(Class D) 1.5	VCM(6ch) Constant Current 1.0	–	UQFN040V5050 (5.0×5.0) H=1.00Max.
			ex. 2	STM(1, 2ch) μ-step(Class D) 2.0	DCM(3ch) FULL ON(PWM+Speed Control) 1.5	VCM(5ch) FULL ON(PWM)/Constant Current 1.0	VCM(6ch) Constant Current 1.0	VCM(4ch) FULL ON(PWM) 1.5	
BU24038GW	2.7 to 3.6(Logic) 2.7 to 5.5(Driver)	0.5	ex. 1	STM(1, 2ch) μ-step(Class D) 1.5	STM(3, 4ch) μ-step(Class D) 1.5 / STM(5, 6ch) μ-step(Class D) 1.5	VCM(8ch) FULL ON(PWM) 1.5	VCM(9ch) Constant Current 1.0	DCM(7ch) FULL ON(PWM) 1.5	UCSP75M3 (3.8×3.8) H=0.85Max.
			ex. 2	STM(1, 2ch) μ-step(Class D) 1.5	STM(5, 6ch) μ-step(Class D) 1.5	VCM(3ch) FULL ON(PWM) 1.5 / VCM(4ch) FULL ON(PWM) 1.5	VCM(9ch) Constant Current 1.0	DCM(7ch) FULL ON(PWM) 1.5	

STM : Stepper Motor, DCM : DC Motor, VCM : Voice Coil Motor(These actuator-specific drive examples are typical examples, and usage in other applications can be considered.)
Input I/F : 3-wire serial, μ-step resolution : 1024

Applications

AC



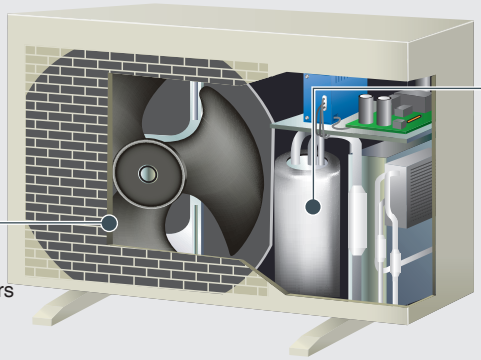
Indoor Fan

High Voltage 3-Phase
Brushless DC Motor Drivers
P.17

Louver/Filter Cleaner

Brushed DC Motor Drivers
P.09

Stepper Motor Drivers
P.11



Compressor

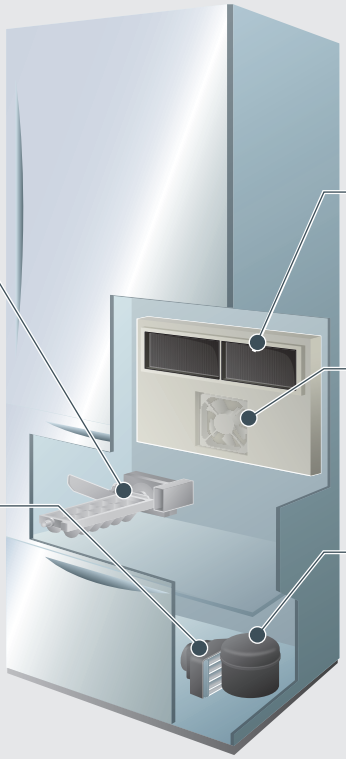
IPM Intelligent
Power Modules
P.19

Non-Isolated Gate Driver
+Power Device
P.19

Outdoor Fan

High Voltage 3-Phase
Brushless DC Motor Drivers
P.17

Refrigerators



Automatic Ice Maker

Brushed DC Motor Drivers
P.09

Stepper Motor Drivers
P.11

Damper

Brushed DC Motor Drivers
P.09

Stepper Motor Drivers
P.11

Fan

Single-Phase Brushless
DC Motor Drivers
P.13

3-Phase Brushless DC Motor Drivers
P.15

Fan

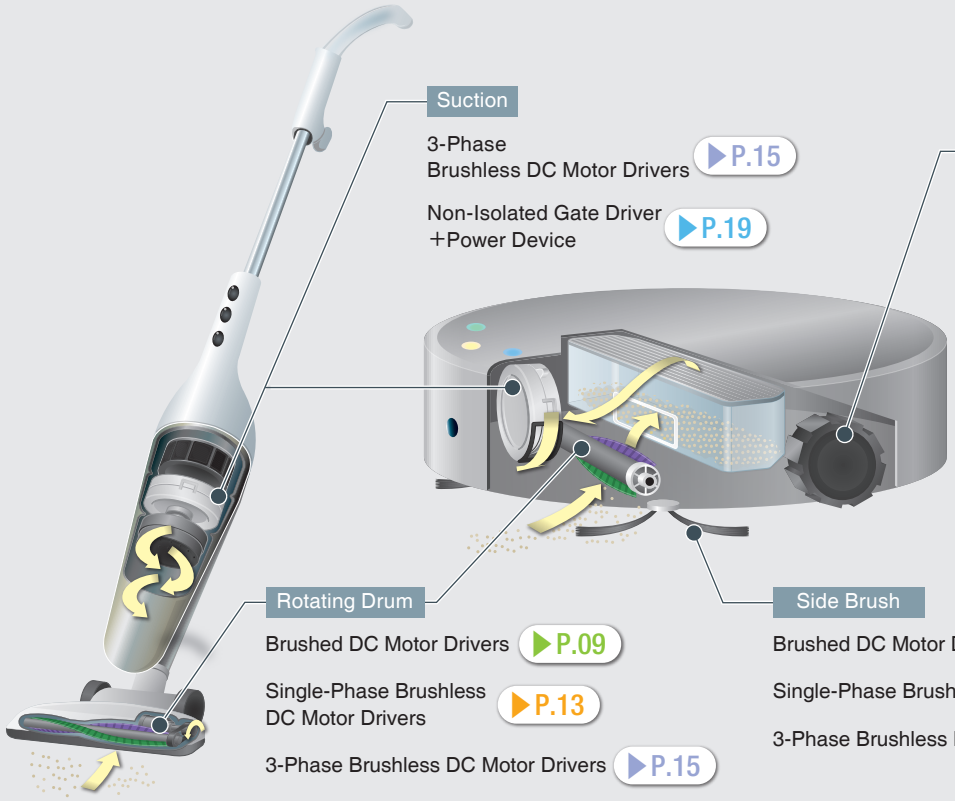
Single-Phase Brushless DC Motor Drivers
P.13

3-Phase Brushless DC Motor Drivers
P.15

Compressor

Non-Isolated Gate Driver
+Power Device
P.19

Vacuum Cleaners



Suction

3-Phase Brushless DC Motor Drivers ▶P.15

Non-Isolated Gate Driver +Power Device ▶P.19

Rolling

3-Phase Brushless DC Motor Drivers ▶P.15

Rotating Drum

Brushed DC Motor Drivers ▶P.09

Single-Phase Brushless DC Motor Drivers ▶P.13

3-Phase Brushless DC Motor Drivers ▶P.15

Side Brush

Brushed DC Motor Drivers ▶P.09

Single-Phase Brushless DC Motor Drivers ▶P.13

3-Phase Brushless DC Motor Drivers ▶P.15

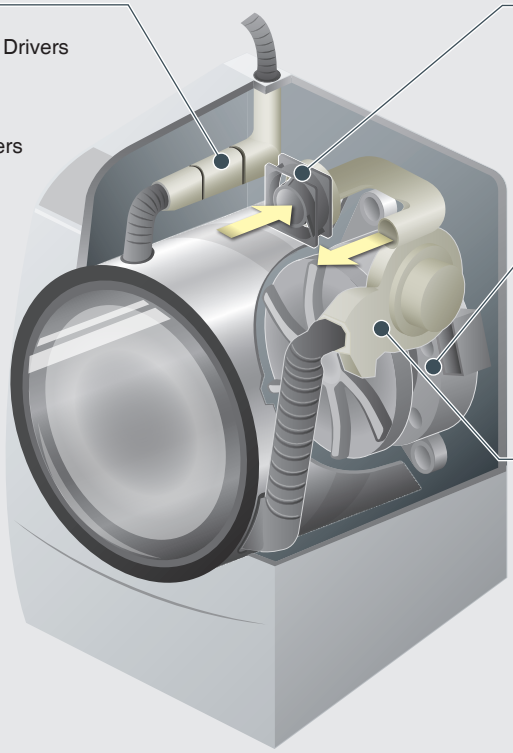
Washing Machines

Water Pump

Single-Phase Brushless DC Motor Drivers ▶P.13

3-Phase Brushless DC Motor Drivers ▶P.15

High Voltage 3-Phase Brushless DC Motor Drivers ▶P.17



Dryer Fan

High Voltage 3-Phase Brushless DC Motor Drivers ▶P.17

Non-Isolated Gate Driver +Power Device ▶P.19

Rotating Drum

IPM Intelligent Power Modules ▶P.19

Non-Isolated Gate Driver +Power Device ▶P.19

Circulation Pump

Single-Phase Brushless DC Motor Drivers ▶P.13

3-Phase Brushless DC Motor Drivers ▶P.15

High Voltage 3-Phase Brushless DC Motor Drivers ▶P.17

MOSFET Quick Search

Low-Voltage type

External MOSFET Quick Reference Table when using a predriver.

	Supply Voltage	Polarity (ch)	Motor Voltage (V_M)	Package Size (mm)	Motor Power(W) 10 20 30 40 50 60 70 80 90 100 150 200 — MOSFET Part No. / Product Page
Single Phase Driver	12V / 24V	N+P	5	2.0×2.0	UT6MA2 / P.14 UT6MA3 / P.14
				3.0×2.8	QH8MA2 / P.14 QH8MA3 / P.14 QH8MA4 / P.14
				5.0×6.0	SH8MA2 / P.14 SH8MA3 / P.14 SH8MA4 / P.14 HP8MA2 / P.14
			12	2.0×2.0	UT6MA2 / P.14
				3.0×2.8	QH8MA2 / P.14 QH8MA3 / P.14 QH8M22(40V) / P.14
				5.0×6.0	SH8MA2 / P.14 SH8MA3 / P.14 SH8MA4 / P.14 HP8MA2 / P.14
			24	3.0×2.8	QS8M31 / P.14
				5.0×6.0	SH8M31 / P.14 HP8M31 / P.14
			48	3.0×2.8	QS8M51 / P.14
				5.0×6.0	SH8M51 / P.14 HP8M51 / P.14
3-Phase Driver	12V / 24V	N+P	5	2.0×2.0	UT6MA2 / P.16 UT6MA3 / P.16
				3.0×2.8	QH8MA2 / P.16 QH8MA3 / P.16 QH8MA4 / P.16
				5.0×6.0	SH8MA2 / P.14 SH8MA3 / P.14 SH8MA4 / P.14 HP8MA2 / P.16
			12	2.0×2.0	UT6MA2 / P.16
				3.0×2.8	QH8MA2 / P.16 QH8MA3 / P.16 QH8M22(40V) / P.16
				5.0×6.0	SH8MA2 / P.14 SH8MA3 / P.14 SH8MA4 / P.14 HP8MA2 / P.16
			24	3.0×2.8	QS8M31 / P.16
				5.0×6.0	SH8M31 / P.16 HP8M31 / P.16
			48	3.0×2.8	QS8M51 / P.16
				5.0×6.0	SH8M51 / P.16 HP8M51 / P.16
		N+N	12	2.0×2.0	UT6K3 / P.16
				3.0×2.8	QH8KA1 / P.16 QH8KA2 / P.16
				5.0×6.0	SH8KA1 / P.16 SH8KA2 / P.16 SH8KA4 / P.16 SH8KA7 / P.16
			24	2.0×2.0	UT6K30 / P.16
				5.0×6.0	SH8K32 / P.16 SH8K37 / P.16 SH8K39 / P.16

( ) denotes ROHM package type.

High-Voltage type

Quick Reference Table when configuring a controller + gate driver + MOSFET.

	IC Output Voltage Range (Supply Voltage)	Motor Voltage (V_M)	V_{DSS}	Package	Series	ON Resistance(Ω) 2,000 to 1,000	1,000 to 900	900 to 800	800 to 600	700 to 600	600 to 500	500 to 400	400 to 300	300 to 250	250 to 200	200 to 150	150 to 100	100 to 50	50 to
						MOSFET Part No. / Product Page													
3-Phase Driver	11.5V to 20V	DC140V (AC 100V / 200V)	250	TO-220FM	—	RCX051N25 / P.20		RCX080N25 / P.20					RCX100N25 / P.20			RCX120N25 / P.20	RCX220N25 / P.20	RCX330N25 / P.20	RCX510N25 / P.20
				TO-263S (LPTS) [SC-83] 〔D2PAK〕	—	RCJ050N25 / P.20		RCJ080N25 / P.20					RCJ100N25 / P.20			RCJ120N25 / P.20	RCJ220N25 / P.20	RCJ330N25 / P.20	RCJ510N25 / P.20
		DC280V (AC 100V / 200V)	600	TO-220FM	JNX	R6004JNX / P.20		R6006JNX / P.20			R6007JNX / P.20	R6009JNX / P.20	R6012JNX / P.20	R6018JNX / P.20		R6020JNX / P.20	R6025JNX / P.20 R6030JNX / P.20		
				TO-263S (LPTS) [SC-83] 〔D2PAK〕	JNJ	R6004JNJ / P.20		R6006JNJ / P.20			R6007JNJ / P.20	R6009JNJ / P.20	R6012JNJ / P.20	R6018JNJ / P.20		R6020JNJ / P.20			
				TO-252 〔DPAK〕	JND3	R6004JND3 / P.20		R6006JND3 / P.20			R6007JND3 / P.20	R6009JND3 / P.20	R6014JND3 / P.20						
				TO-247	JNZ4											R6020JNZ4 / P.20	R6025JNZ4 / P.20 R6030JNZ4 / P.20	R6042JNZ4 / P.20 R6050JNZ4 / P.20	R6070JNZ4 / P.20
				TO-3PF	JNZ											R6020JNZ / P.20	R6025JNZ / P.20 R6030JNZ / P.20	R6050JNZ / P.20	

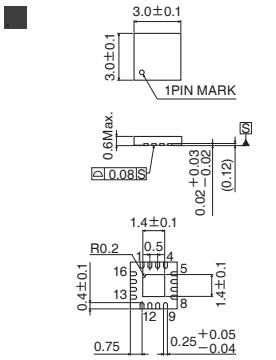
Package indicates JEDEC code. ( ) : ROHM Package, [ ] : JEITA Code, 〔 〕: GENERAL Code.

Package List (Unit : mm)

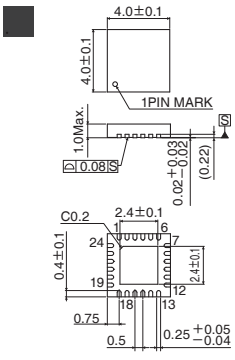
It show in actual size under the package name.

VQFN Packages

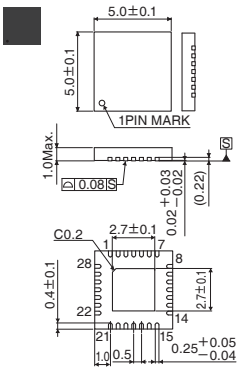
VQFN016V3030



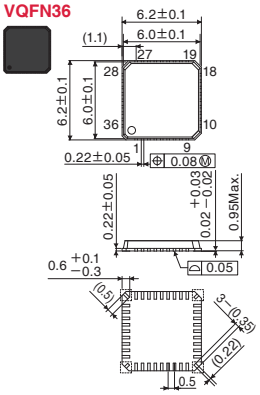
VQFN024V4040



VQFN028V5050



VQFN36



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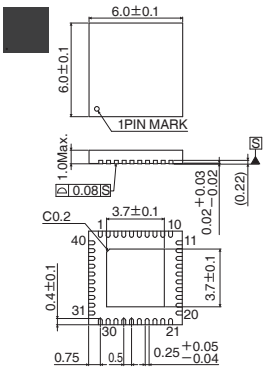
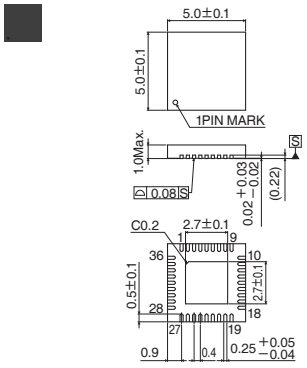


UQFN Packages

UQFN036V5050



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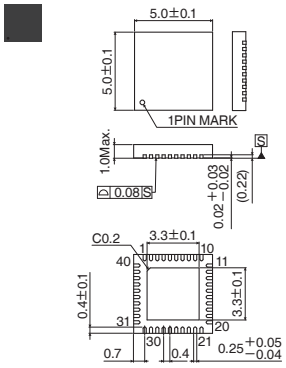
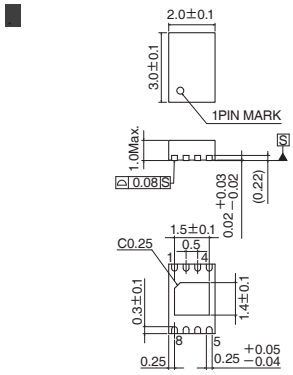
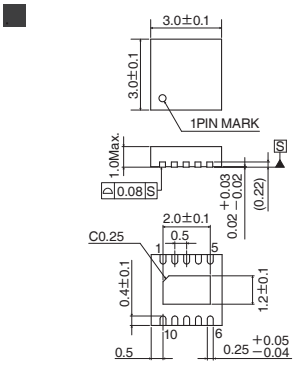


VSON Packages

VSON008V2030

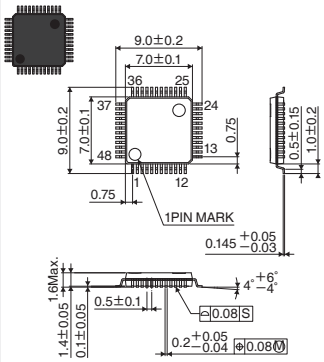


VSON010V3030



QFP Packages

VQFP48C



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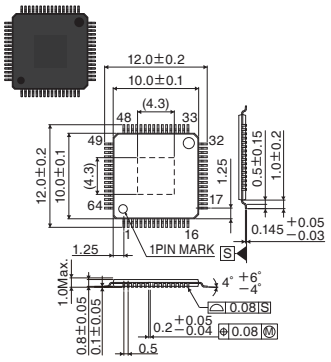
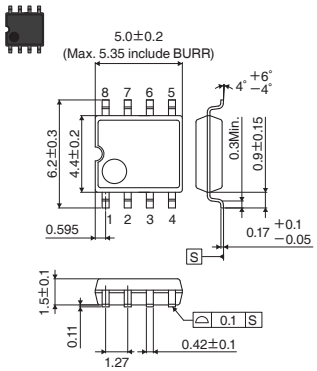
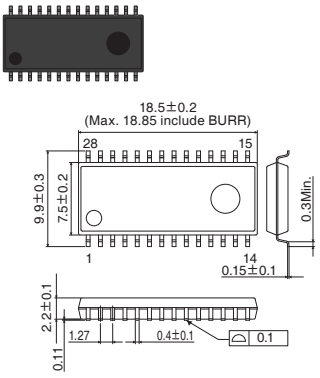


SOP Packages

SOP8



SOP28



SOP Packages

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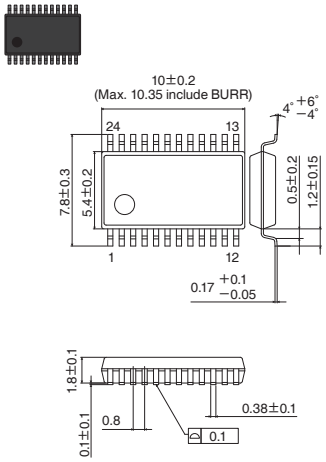

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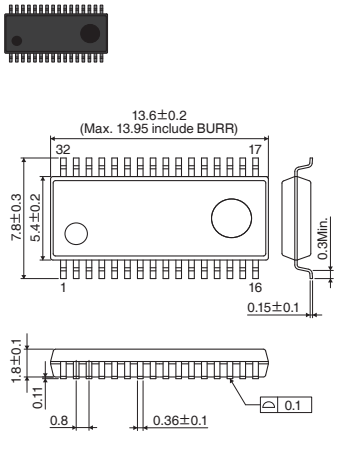

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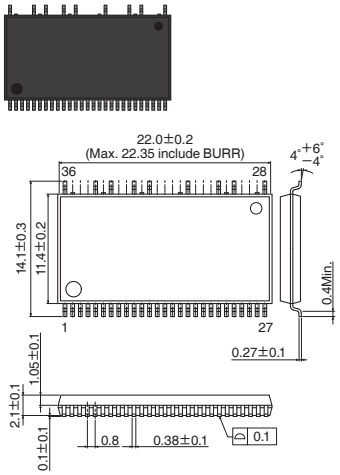

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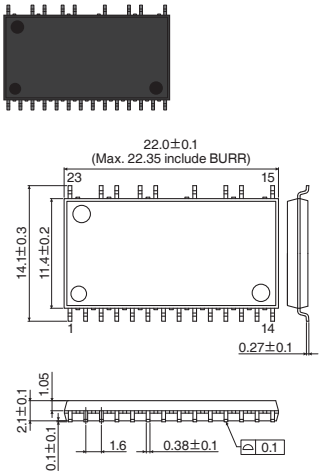

SOP Packages

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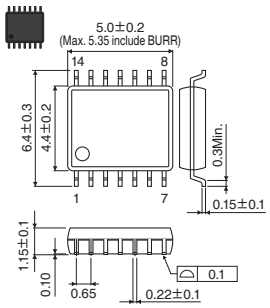

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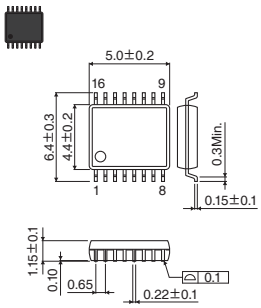

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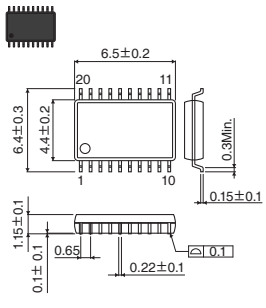

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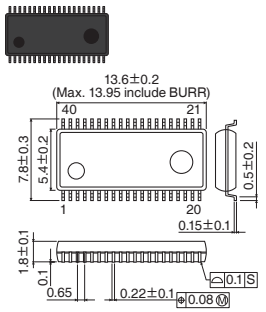

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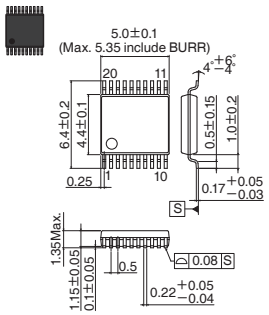

SOP Packages

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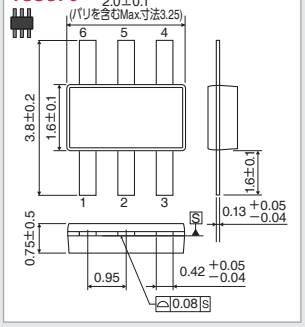

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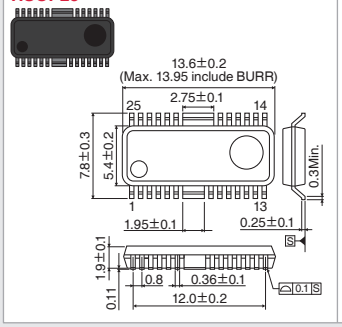

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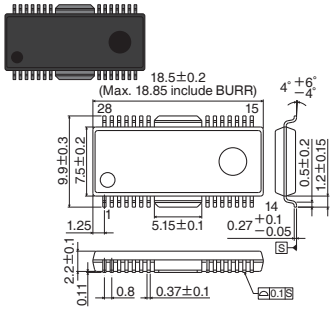

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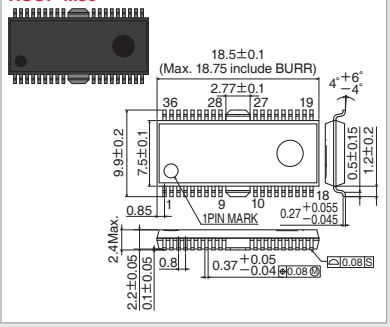

HSOP Packages

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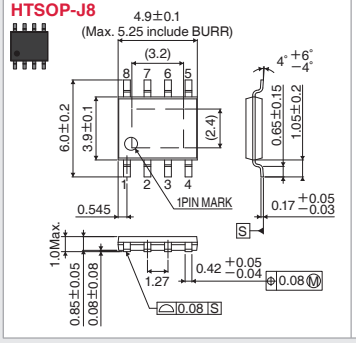

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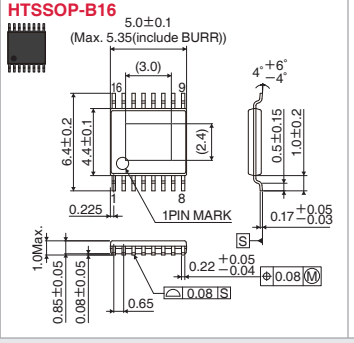

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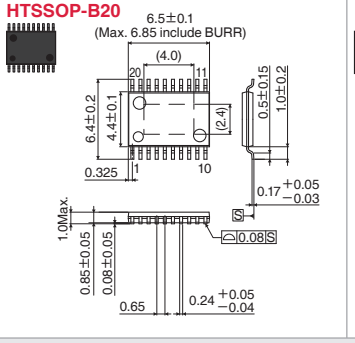

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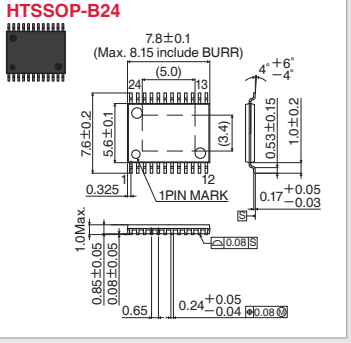

HSOP Packages

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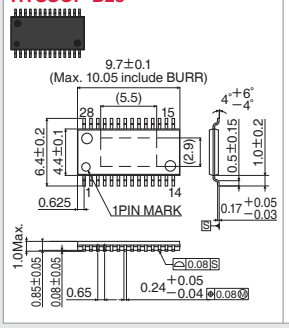

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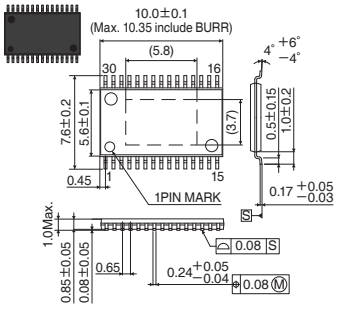

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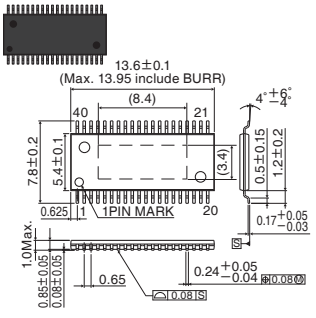

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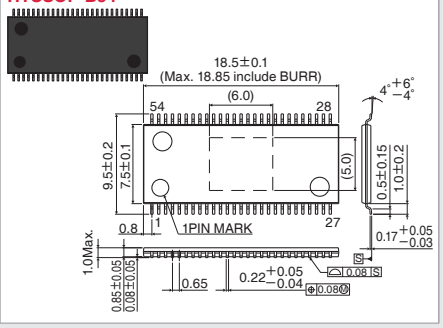

Small Packages

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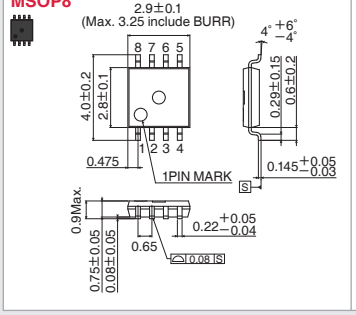

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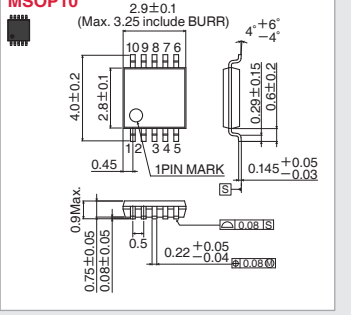

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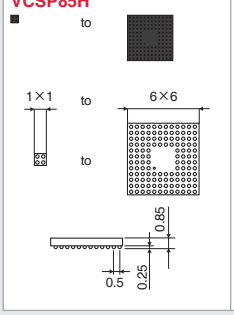

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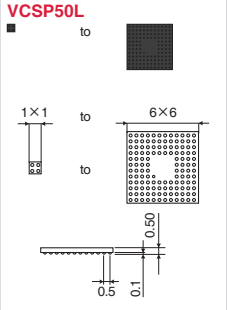

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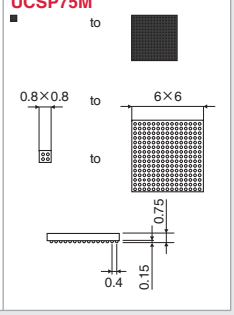


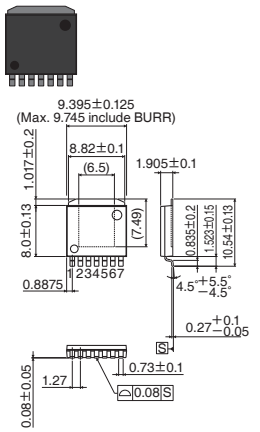
Package List

Package List (Unit : mm)

It show in actual size under the package name.

Power Package

HRP7



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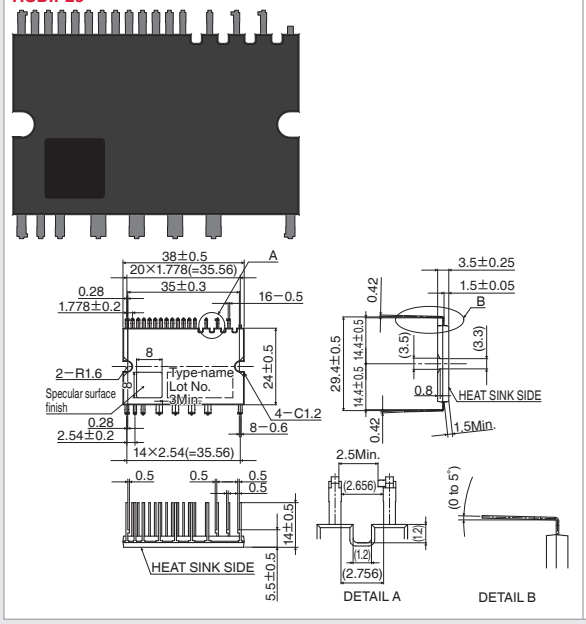

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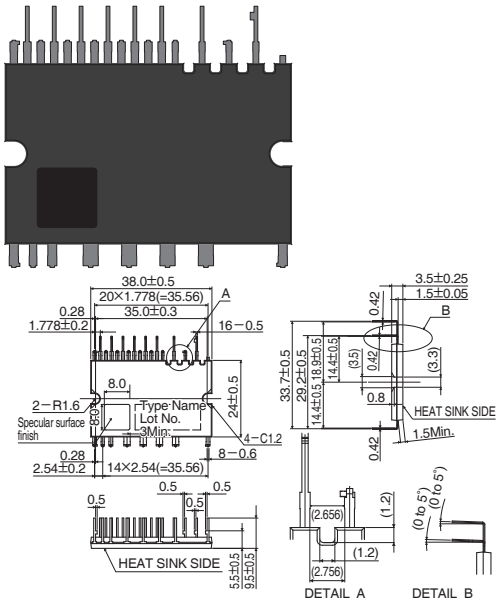
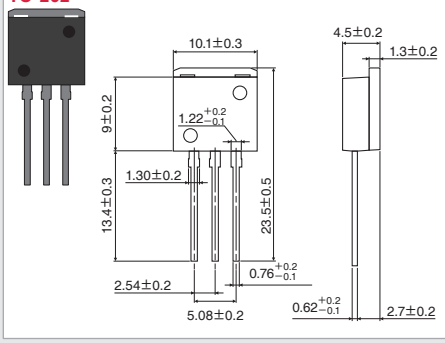


IGBT/MOSFET Packages

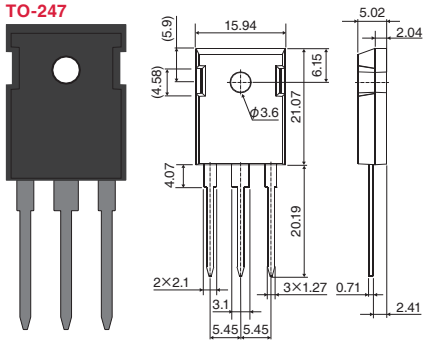
Package indicates JEDEC code. ( ) : ROHM Package, [ ] : JEITA Code, 〔 〕: GENERAL Code.

IGBT/MOSFET Packages

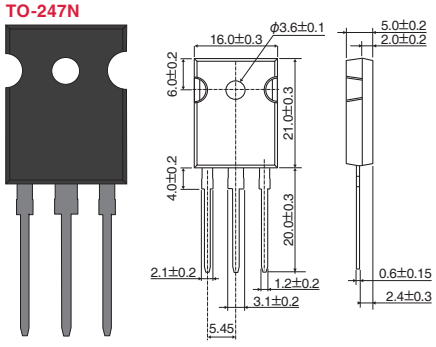
TO-262



TO-247



TO-247N



IGBT/MOSFET Packages

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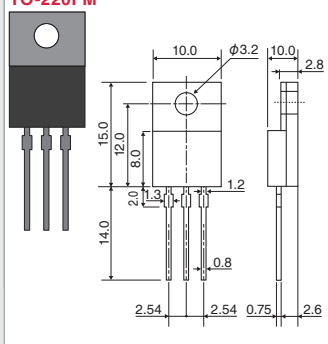
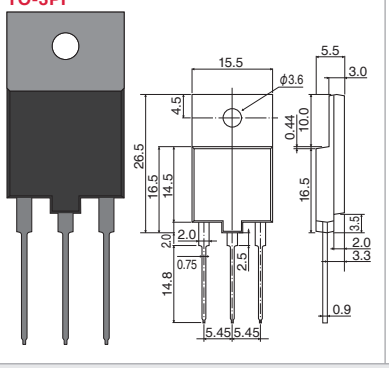
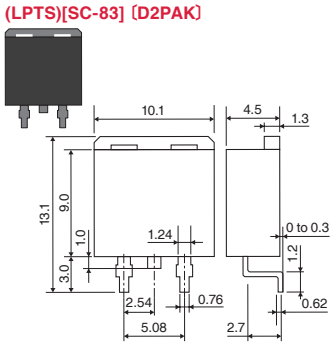


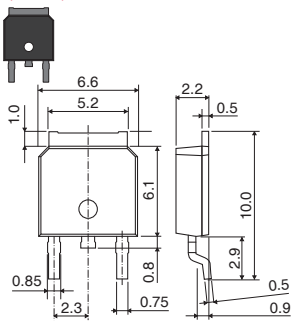
TO-3PF



TO-263S (LPTS)[SC-83] 〔D2PAK〕



TO-252 〔DPAK〕



IGBT/MOSFET Packages

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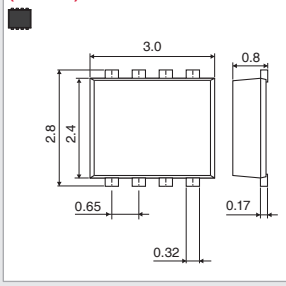
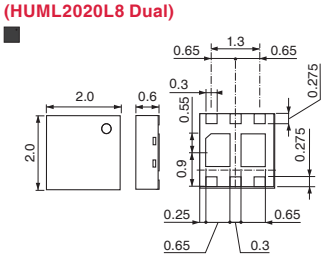


DFN2020-8D (HUML2020L8 Dual)



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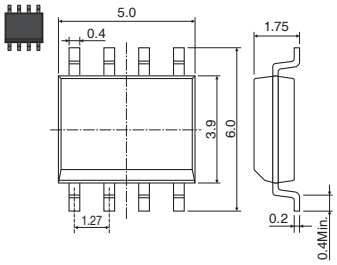

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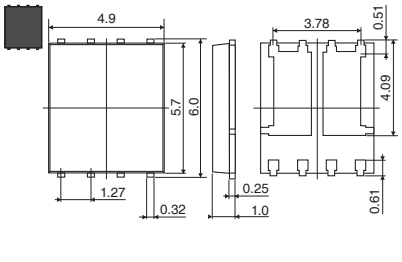

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ROHM Group Locations

ROHM Group Locations (Japan)

Sales Offices

Kyoto	Nagoya	Matsumoto	Sendai
Tokyo	Fukuoka	Mito	Takasaki
Yokohama		Nishi-Tokyo	Utsunomiya

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ROHM Hamamatsu Co., Ltd.
ROHM Wako Co., Ltd.
ROHM Apollo Co., Ltd.
ROHM Mechatech Co., Ltd.
LAPIS Semiconductor Miyagi Co., Ltd.
LAPIS Semiconductor Miyazaki Co., Ltd.

Design Centers

Kyoto Technology Center (Head Office)
Kyoto Technology Center (Kyoto Ekimae)
Yokohama Technology Center
LAPIS Semiconductor Co., Ltd.(Shin-Yokohama)
LAPIS Semiconductor Miyazaki Design Center

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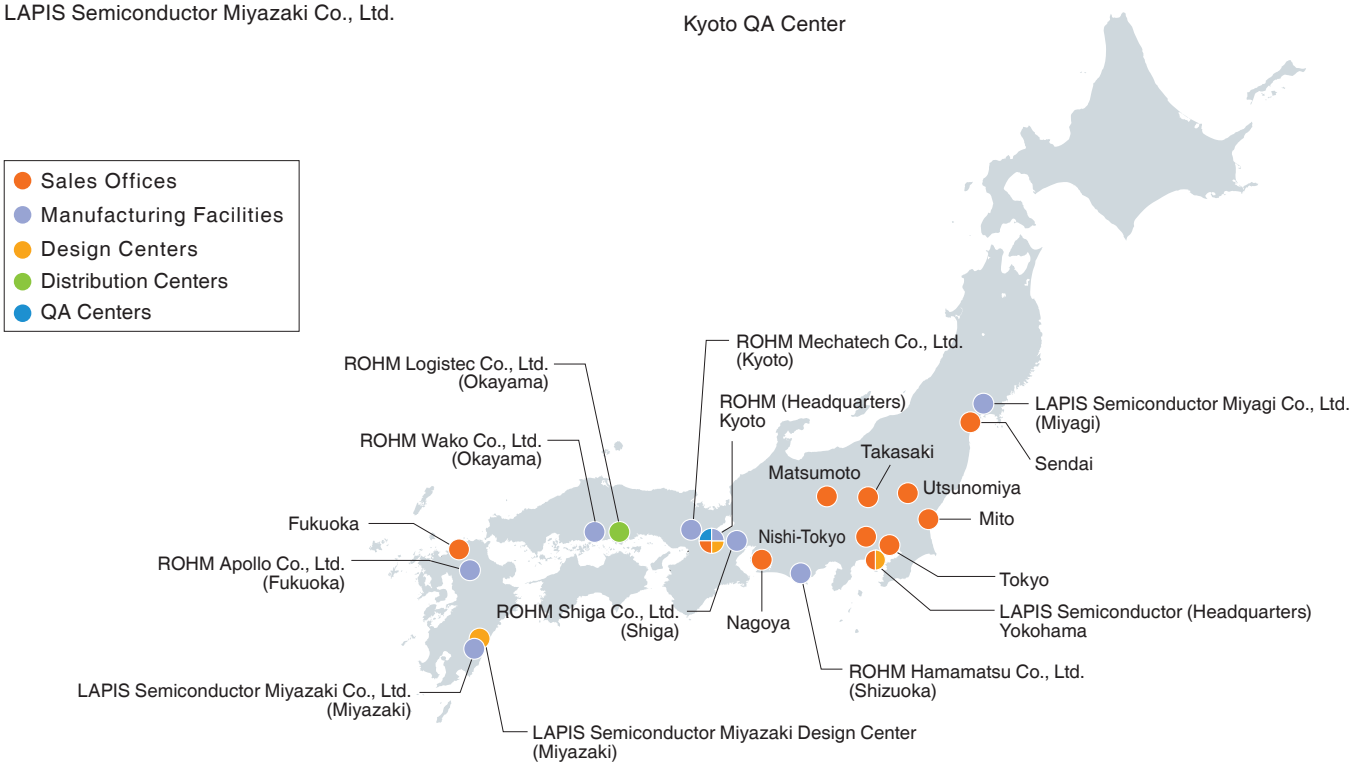
ROHM Logistec Co., Ltd.

QA Centers

Kyoto QA Center




Kyoto HQ


Kyoto Technology Center

Yokohama Technology Center


LAPIS Semiconductor Miyagi


LAPIS Semiconductor Miyazaki

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	ROHM Semiconductor (Shenzhen) Co., Ltd.
	ROHM Semiconductor Hong Kong Co., Ltd.
	ROHM Semiconductor Taiwan Co., Ltd.
	ROHM Semiconductor Singapore Pte. Ltd.
	ROHM Semiconductor Philippines Corporation
	ROHM Semiconductor (Thailand) Co., Ltd.
	ROHM Semiconductor Malaysia Sdn. Bhd.
	ROHM Semiconductor India Pvt. Ltd.
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	ROHM Semiconductor do Brasil Ltda.
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	Shenzhen Design Center
	Taiwan Design Center
	India Design Center
AMERICA	America Design Center (Santa Clara)
EUROPE	Europe Design Center
	Finland Software Development Center
	ROHM POWERVATION Ltd.

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	ROHM-Wako Electronics (Malaysia) Sdn. Bhd.
	ROHM Mechatech Philippines, Inc.
	ROHM Mechatech (Thailand) Co., Ltd.
AMERICA	Kionix, Inc.
EUROPE	SiCrystal GmbH

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	Shanghai QA Center
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	Thailand QA Center
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EUROPE	Europe QA Center

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