TOSHIBA Transistor Inverter

High-performance Inverter TOSVERT™

VF-AS1
Flexible for you

I need the most suitable inverter for my application, which has low noise, low harmonics, minimal parameter setting, high torque and control.

We meet all your requirements with VF-AS1.

It has outstanding Performance, including high torque, fast response, high accuracy and excellent environmental compatibility with easy operation.

The VF-AS1 is an advanced inverter evolved to satisfy all your needs in one comprehensive product.

High-performance Inverter TOSVERT™

VF-AS1

For your Commercial facilities, offices and factories

- Feature: Reduce high-frequency noise*1, Reduce harmonics*1
- Applications: Washing machines, Treadmill, Showcase refrigerators, Medical equipment, stage equipment

For machinery that requires simple function

- Feature: EASY key, 8 basic parameters
- Applications: Drilling machines, Handling machines, Conveyors, Semiconductor production Equipment, Cutting machines, Woodworking machinery

For machinery that requires high torque and a large capacity

- Feature: Starting torque of 0.3Hz-200%*2, Up to 500kw for a 400V class
- Applications: Cranes, Mining machinery, refrigerator, Presses, Compressers, Crushing machine

For system devices that requires flexibility

- Feature: My function, High-precision and high-speed torque control with or without sensors
- Applications: Process lines, Printing machines, Coilers/uncoilers

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</table>

*1 Depends on the voltage and capacity range
*2 When a TOSHIBA standard 3-phase, 0.4 to 3.7kw 4-pole motor are driven

Compatible with the World’s Main Standards

(CE marking, UL, CSA, C-tick)

UL and CSA compliancy conditions partially differ from the standard specifications. Consult us separately for details.

Approval pending

Coming soon

High voltage class (input/rated output)

Voltage Class

Applicable Motor Output (kW)

<table>
<thead>
<tr>
<th>Voltage Class</th>
<th>Up to 5.5kw, 3-phase 200V class can be applied to 1-phase input power supply by using 1 size-up rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Ø200V/3Ø200V</td>
<td>0.4 0.75 1.5 2.2 3.7 5.5 7.5 11 16 18 22 28 30 37 45 55 75 90 110 132 160 200 220 280 355 500 500</td>
</tr>
</tbody>
</table>

For machinery that requires expansion

For inverter users

Peripheral devices

High performance inverter designed for the world's major standards (CE marking, UL, CSA, C-tick)

UL and CSA compliancy conditions partially differ from the standard specifications. Consult us separately for details.

Approval pending

Coming soon

Up to 5.5kw, 3-phase 200V class can be applied to 1-phase input power supply by using 1 size-up rating
For your commercial facilities, offices and factories

This makes the inverter ideal for your electronic applications such as washing machines treadmill, showcase refrigerators for stores, medical equipment, and stage equipment where attention must be paid to peripheral devices.

*1: Photos of machinery are for illustrative purposes only.

Harmonics Reduction, Power Factor Improvement

- A compact, space-saving new type of DC reactor is built into 200 V class 11 to 45 kW and 400 V 18.5 to 75 kW models.

In addition to reducing harmonics, this reactor limits the input current to 110% of the rated output current, and it has been designed to be compatible with power supply systems containing transformers, molded-case circuit breakers, and power lines.

Adding on the optional DC reactor enables compliance with IEC harmonics standards.

High-frequency Noise Reduction

- High-frequency noise is drastically reduced on models with built-in noise filters. Built-in noise filters are ideal for sites from commercial facilities and offices through to factories where attention must be paid to peripheral devices.

Compared with filter not integrated models, space and wiring savings have been achieved by incorporating the filter in the panel. Also, models with built-in EMC noise filter comply with the European EMC Directive as individual inverter units.


For machinery that requires simple function

This makes the inverter ideal for drilling machines, handling machines, conveyors, semiconductor production equipment, cutting machines, and woodworking machinery that require simple function.

*1: Photos of machinery are for illustrative purposes only.

Simple Setup by EASY Key

- In the Quick mode, pressing the EASY key on the panel allows you to operate the inverter by eight basic parameters. When setting each of the functions, press the EASY key to move to the standard mode by one-touch operation. In this mode, you can access all parameters.

- You can customize the Quick mode display, maximum of 32 target parameters are displayed to suit your specific setup requirements.

- You can also use the EASY key as a panel/remote key to switch between panel and remote operation, and as a shortcut key to directly access any specific setup or display screen.

Easy Installation, Easy commissioning, and Easy maintenance

- Side-by-side installation of inverters is possible up to the inverter’s total capacity. This allows effective utilization of space inside control panels. Heat sink can be installed outside of the panel as an option.

- A removable terminal board is used. This allows you to use the control wiring when replacing the inverter, which also makes maintenance easier.

ON/OFF control of cooling fan

- Temperature-based ON/OFF control reduces noise while the inverter is being stopped, saves energy and extends the cooling fan’s life.

Monitoring of serviceable parts/alarm output

- The expected replacement cycle of main circuit capacitors, capacitors on control board, and cooling fan is monitored, and an alarm is output when the cycle is reached.
For machinery that requires high torque and a large capacity

This makes it ideal for cranes, mining machinery, refrigerators, presses, compressors, crushing machines, and other machinery that require a high torque and large capacity.

*1: Photos of machinery are for illustrative purposes only.

Excellent Motor Control Performance

- Motor constants required for vector control can be easily set by auto-tuning to enable 1:120 speed control. Moreover, the VF-AS1 also features a robust structure that is unlikely to be influenced by motor temperature.
- On inverters provided with a sensor, high-torque operation of 200%*2 from zero velocity is possible, achieving a speed control range of 1:1000.
- High-speed response frequencies of 40 Hz without sensor and 50 Hz with sensor are achieved respectively, to maintain fixed speed in response to sudden changes in load.
- Modifying software enables high-frequency output up to 1000 Hz, which is ideal for spindle rotation of woodworking and metalworking machinery.

*2: When a TOSHIBA standard 3-phase, 200 V - 2.2 kW 4-pole motor is driven. (Note, however, that torque differs according to voltage and capacity.)

Dedicated Functions Ideal for Lifting Applications

- Braking sequence/light-load, high-speed functions
  - The inverter has two built-in functions: brake sequence function and light-load high-speed function, as standard. The brake sequence function measures the timing with braking by an external motor to achieve smooth operation at start and stop of braking operation. The light-load, high-speed function automatically increases the speed when operating at low load according to the lifting load to improve conveyance efficiency. A learning function for setting and storing in memory required parameters while performing actual operations is also provided to facilitate adjustments.
- Built-in transistor for dynamic braking
  - The VF-AS1 has a built-in transistor for dynamic braking up to 160 kW, which makes it ideal for lifting applications.

For system devices that require flexibility

This makes the inverter ideal for process lines, printing machines, coilers/uncoilers.

*1: Photos of machinery are for illustrative purposes only.

Customizing by “My Function”

- With “My function”, you can create programs containing up to 28 steps. This achieves logic operations and internal data operations. Parameters can also be set according to analog input and minimum-peak hold of analog outputs.
- For example:
  - (Ex.1) Inverter is automatically switched to commercial operation without the external sequence when the inverter is tripped.
  - (Ex.2) A signal is output when torque reaches 120% and frequency is 5 Hz.
  - (Ex.3) “Forward rotation operation,” “preset-speed operation frequency 3” and “No.2 acceleration/deceleration” are simultaneously turned ON by input on a single terminal.
  - (Ex.4) The acceleration/deceleration time is changed dynamically by a voltage within the range 0 to 10 V.

Communications and Network

- RS-485 communications
  - RS-485 communications is equipped as standard, and Modbus-RTU protocol is supported in addition to TOSHIBA protocol.
- Network options
  - Use of communication options enables support of DeviceNet®, PROFIBUS and CC-Link and other main fieldbuses.
- Data tracing
  - The PCM001Z communications software allows you to edit, monitor, and trace parameter data on a PC, enabling easier data management from inverter startup through to maintenance.

*2: DeviceNet® is a registered trademark of ODVA (Open DeviceNet Vendor Association).
For machinery that requires expansion

## Outstanding Lineup of Options

### LCD Extension Panel Option

This panel is an 23-character x 8-line display, and can be used for simple setup and monitoring by selection of parameters using the jog dial. The display language can be switched between English and Japanese. (German, Italian, Spanish, and Chinese will be available soon.)

*Type: RKP004Z*

### LED Extension Panel Option

Our customers require a “display that is easily visible from a long way away.” In response to this need, we developed this panel using 20 mm LEDs, the largest in its class in the market, to ensure outstanding visibility. It has also been designed to be fitted into panels for use as an extension panel or display. In addition, it can be used as a parameter copy and is capable of storing parameters for up to three models.

*Type: RKP002Z*

### Expanded Terminal Block Option

This I/O terminal block can be added on to enhance your system for extra compatibility with a wide range of systems:

- Contact inputs (4)
- Contact outputs (2)
- Analog inputs (2)
- Analog outputs (2)
- PTC input (1)
- Relay output (1 circuit)
- Pulse train input (1)

Main fieldbuses are supported to enable connection to a host controller to achieve savings in space and centralized control of systems.

- DeviceNet*1
- PROFIBUS
- CC-Link

*Type: ETB003Z, ETB004Z*

### Encoder Feedback Option

Three encoder feedback options are provided to match output for support of vector control with a sensor.

- Line driver output (RS-422), *Type: VEC007Z*
- Open collector/complimentary output (12 V), *Type: VEC004Z*
- Open collector/complimentary output (15 V), *Type: VEC005Z*

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### Wide Range of Applications

#### Safety Environmental Compatibility

- **Ambient temperature 60°C**
  - The VF-AS1 can be used at a rating up to an ambient temperature of 50°C and in environments up to 60°C at a derating current.

- **Eco Design**
  - 88% of materials used on the VF-AS1 are recyclable, which design more than meets of the European WEEE (Waste Electrical and Electronic Equipment) Directive of 70%.

#### Various Drive Performance

- **Permanent Magnet Motor (PM) Drive**
  - The PM is driven efficiently by a TOSHIBA oriented control algorithm to achieve savings in energy and space.

- **High-frequency 1000 Hz Output**
  - Software modification increases output up to a high frequency of 1000 Hz, making it ideal for woodworking and metalworking machinery.

- **New DC Braking**
  - A newly developed DC braking function allows the stop time to a quarter of that on conventional models.

#### A Further Enhanced of Functions

- **Multi-PID Control**
  - As well as process-type PID control (e.g. temperature, pressure, flow rate), the VF-AS1 incorporates speed-type PID control that is compatible with speed feedback, for example, in follow-up operation or winding, for line compatibility with line control.

  - Traverse
  - Power interruption synchronized control
  - Drooping
  - Speed gain switching
  - Zero speed lock
  - Dwell

- **Drooping**
  - Distributes the load of 2-shaft drive on conveyance machinery, for example. Speed gain switching enables adaptation to changes in inertia during operation. Zero speed is hold when the inverter is stopped. And dwell controls acceleration/deceleration, for example, when conveying heavy loads.

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*1 DeviceNet is a registered trademark of ODVA (Open DeviceNet Vendor Association).
Basic functions

Each “setup item” that determines the control characteristics of the inverter is called a “parameter.” For example, to change the acceleration time, you must set the acceleration time parameter (called “RCC”).

Quick mode (EASY)

To enter the Quick mode, press the EASY key on the panel. In this mode, you can set eight of the basic parameters.

Standard mode

In this mode, you can set all parameters. For details of parameters, refer to the Instruction Manual.

### Basic parameters

<table>
<thead>
<tr>
<th>Title</th>
<th>Function</th>
<th>Adjustment Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Capacity</td>
<td>200 V class - 0.4 to 45 kW, 400 V class -0.75 to 75 kW model</td>
<td>0.4 - 45 kW, 0.75 - 75 kW</td>
</tr>
<tr>
<td>Form</td>
<td>Protection</td>
<td>Built-in</td>
<td>Built-in</td>
</tr>
<tr>
<td>Voltage/frequency</td>
<td>3-phase, 200 V – 50/60 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable Fluctuation</td>
<td>Voltage ±10% (Note 3: Frequency ±5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protective method</td>
<td>IP20 enclosed type (JEM1030)</td>
<td>IP00 enclosed type (JEM1030)</td>
<td></td>
</tr>
<tr>
<td>Cooling method</td>
<td>Forced air cooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>RAL7016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Builtin Filter</td>
<td>EMI noise filter (note 5)</td>
<td>Basic noise filter (note 6)</td>
<td></td>
</tr>
<tr>
<td>DC Reactor</td>
<td>External option</td>
<td>Built-in</td>
<td></td>
</tr>
</tbody>
</table>

### Standard specifications

#### Standard specifications (200 V class - 0.4 to 45 kW, 400 V class -0.75 to 75 kW model)

<table>
<thead>
<tr>
<th>200 V class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable Motor (kW)</td>
</tr>
<tr>
<td>Output Voltage</td>
</tr>
<tr>
<td>Overload Current Rating</td>
</tr>
<tr>
<td>Dynamic Braking Circuit</td>
</tr>
<tr>
<td>Dynamic Braking Resistor</td>
</tr>
<tr>
<td>Voltage/frequency</td>
</tr>
<tr>
<td>Allowable Fluctuation</td>
</tr>
<tr>
<td>Protective method</td>
</tr>
<tr>
<td>Cooling method</td>
</tr>
<tr>
<td>Color</td>
</tr>
<tr>
<td>Builtin Filter</td>
</tr>
<tr>
<td>DC Reactor</td>
</tr>
</tbody>
</table>

#### 400 V class

<table>
<thead>
<tr>
<th>400 V class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable Motor (kW)</td>
</tr>
<tr>
<td>Output Voltage</td>
</tr>
<tr>
<td>Overload Current Rating</td>
</tr>
<tr>
<td>Dynamic Braking Circuit</td>
</tr>
<tr>
<td>Dynamic Braking Resistor</td>
</tr>
<tr>
<td>Voltage/frequency</td>
</tr>
<tr>
<td>Allowable Fluctuation</td>
</tr>
<tr>
<td>Protective method</td>
</tr>
<tr>
<td>Cooling method</td>
</tr>
<tr>
<td>Color</td>
</tr>
<tr>
<td>Builtin Filter</td>
</tr>
<tr>
<td>DC Reactor</td>
</tr>
</tbody>
</table>

### Extended parameters

About 500 extended parameters are available. For details on extended parameters, please visit our web site (http://www.inverter.co.jp).
# Standard specifications (200 V class -55 to 75 kW, 400 V class -90 to 500 kW model)

## 400 V class

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable Motor (kW)</td>
<td>90</td>
</tr>
<tr>
<td>Type</td>
<td>VFA50PC</td>
</tr>
<tr>
<td>Form</td>
<td>4900PC</td>
</tr>
<tr>
<td>Capacity (kW)</td>
<td>136</td>
</tr>
<tr>
<td>Output Current (A)</td>
<td>215</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>380 to 480 V</td>
</tr>
<tr>
<td>Dynamic braking circuit</td>
<td>Built-in</td>
</tr>
<tr>
<td>Dynamic braking resistance</td>
<td>Compatible with external options</td>
</tr>
<tr>
<td>Voltage/frequency</td>
<td>3-phase, 380 to 440 V – 50 Hz</td>
</tr>
<tr>
<td>Allowable fluctuation</td>
<td>+10% – 15% (use ±15% for higher frequency)</td>
</tr>
<tr>
<td>Protective function</td>
<td>IP20 enclosed type (UJEM1030) (note 4)</td>
</tr>
<tr>
<td>Cooling method</td>
<td>Forced air cooling</td>
</tr>
<tr>
<td>Color</td>
<td>RAL7016</td>
</tr>
<tr>
<td>Built-in filter</td>
<td>EMI noise filter (note 7)</td>
</tr>
<tr>
<td>DC reactor</td>
<td>Attached DC reactor (note 5)</td>
</tr>
</tbody>
</table>

## 200 V class

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable Motor (kW)</td>
<td>55</td>
</tr>
<tr>
<td>Type</td>
<td>VFA50PC</td>
</tr>
<tr>
<td>Form</td>
<td>2500P</td>
</tr>
<tr>
<td>Capacity (kW)</td>
<td>84</td>
</tr>
<tr>
<td>Output Current (A)</td>
<td>221</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>3-phase, 200 to 240 V (The maximum output voltage is the same as the input voltage.)</td>
</tr>
<tr>
<td>Dynamic braking circuit</td>
<td>Built-in</td>
</tr>
<tr>
<td>Dynamic braking resistance</td>
<td>Compatible with external options</td>
</tr>
<tr>
<td>Voltage/frequency</td>
<td>3-phase, 200 to 240 V – 50/60 Hz</td>
</tr>
<tr>
<td>Allowable fluctuation</td>
<td>Voltage +10% – 15% (use ±15% for higher frequency)</td>
</tr>
<tr>
<td>Protective function</td>
<td>IP20 enclosed type (UJEM1030) (note 4)</td>
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<tr>
<td>DC reactor</td>
<td>Attached DC reactor (note 5)</td>
</tr>
</tbody>
</table>

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**Note 1:** Capacity is calculated at 220V for the 200V models and at 440V for the 400V models.

**Note 2:** Indicates the value when the PWM carrier frequency (parameter F0-2) is 2.5 kHz or less.

**Note 3:** 10% when the motor is used continuously (load of 100%)

**Note 4:** Inverters, 18.5kW or greater, do not have wiring port covers. They have large openings, but there is no space to bend the external cables inside the unit. If they are fitted external to the cabinet, please use an optional wiring port cover.

**Note 5:** For 200V 55kW, 400V 55kW or larger models, it is not necessary to install DC reactor. However, this is unnecessary for DC input specifications.

**Note 6:** Three-phase 380~480V-50/60Hz for 4900PC

**Note 7:** Complies with the European EMC Directive 89/336/EEC, EMI noise filter (note 7)
**External dimensions**

- **200 V class - 0.4 to 45 kW, 400 V class - 0.75 to 75 kW model**

### Input Voltage (Vf)

#### 200 V class - 0.4 to 45 kW

<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions (mm)</th>
<th>0.75</th>
<th>2.2</th>
<th>5.5</th>
<th>7.5</th>
<th>15</th>
<th>18.5</th>
<th>22</th>
<th>32</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75</td>
<td>VPAS1-020PL</td>
<td>130</td>
<td>230</td>
<td>152</td>
<td>114</td>
<td>220</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>VPAS1-050PL</td>
<td>155</td>
<td>260</td>
<td>164</td>
<td>138</td>
<td>249</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>VPAS1-100PL</td>
<td>175</td>
<td>295</td>
<td>164</td>
<td>158</td>
<td>283</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>VPAS1-200PL</td>
<td>210</td>
<td>295</td>
<td>191</td>
<td>190</td>
<td>283</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>VPAS1-250PL</td>
<td>230</td>
<td>400</td>
<td>191</td>
<td>210</td>
<td>386</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>VPAS1-2100PM</td>
<td>240</td>
<td>420</td>
<td>212</td>
<td>205</td>
<td>403</td>
<td>F</td>
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<td></td>
<td></td>
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<tr>
<td>18.5</td>
<td>VPAS1-2200PM</td>
<td>320</td>
<td>550</td>
<td>240</td>
<td>280</td>
<td>525</td>
<td>G</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>VPAS1-3000PM</td>
<td>320</td>
<td>550</td>
<td>240</td>
<td>280</td>
<td>525</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>VPAS1-3500PM</td>
<td>320</td>
<td>550</td>
<td>240</td>
<td>280</td>
<td>525</td>
<td>I</td>
<td></td>
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</tr>
</tbody>
</table>

#### 400 V class - 0.75 to 75 kW

<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions (mm)</th>
<th>0.75</th>
<th>2.2</th>
<th>5.5</th>
<th>7.5</th>
<th>15</th>
<th>18.5</th>
<th>22</th>
<th>32</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
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<td>130</td>
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<td></td>
</tr>
<tr>
<td>5.5</td>
<td>VPAS1-200PL</td>
<td>210</td>
<td>295</td>
<td>191</td>
<td>190</td>
<td>283</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>VPAS1-250PL</td>
<td>230</td>
<td>400</td>
<td>191</td>
<td>210</td>
<td>386</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>VPAS1-2100PM</td>
<td>240</td>
<td>420</td>
<td>212</td>
<td>205</td>
<td>403</td>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.5</td>
<td>VPAS1-2200PM</td>
<td>320</td>
<td>550</td>
<td>240</td>
<td>280</td>
<td>525</td>
<td>G</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>VPAS1-3000PM</td>
<td>320</td>
<td>550</td>
<td>240</td>
<td>280</td>
<td>525</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>VPAS1-3500PM</td>
<td>320</td>
<td>550</td>
<td>240</td>
<td>280</td>
<td>525</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Approx. Weight (kg)

- **3000 PM**
  - A: 3
  - B: 4
  - C: 5.5
  - D: 7
  - E: 9
  - F: 21
  - G: 28
  - H: 39
  - I: 47.5
## External dimensions

### 200 V class - 55 to 75 kW, 400 V class - 90 to 500 kW model

<table>
<thead>
<tr>
<th>Inverter Type</th>
<th>Dimensions (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VFAS1-2550P</td>
<td>310 560 260 320 75 150 30</td>
<td>84 (59)</td>
</tr>
<tr>
<td>VFAS1-2750P</td>
<td>350 580 260 360 72 150 30</td>
<td>106 (72)</td>
</tr>
<tr>
<td>VFAS1-4900PC</td>
<td>310 660 260 320 75 150 30</td>
<td>106 (72)</td>
</tr>
<tr>
<td>VFAS1-4110KPC</td>
<td>330 660 260 360 72 150 30</td>
<td>106 (72)</td>
</tr>
<tr>
<td>VFAS1-4132KPC</td>
<td>330 680 260 360 72 150 30</td>
<td>106 (72)</td>
</tr>
<tr>
<td>VFAS1-4160KPC</td>
<td>350 700 260 360 72 150 30</td>
<td>106 (72)</td>
</tr>
<tr>
<td>VFAS1-4200KPC</td>
<td>370 720 280 400 75 150 30</td>
<td>106 (72)</td>
</tr>
<tr>
<td>VFAS1-4220KPC</td>
<td>370 720 280 400 75 150 30</td>
<td>106 (72)</td>
</tr>
<tr>
<td>VFAS1-4280KPC</td>
<td>370 720 280 400 75 150 30</td>
<td>106 (72)</td>
</tr>
<tr>
<td>VFAS1-4355KPC</td>
<td>370 720 280 400 75 150 30</td>
<td>106 (72)</td>
</tr>
<tr>
<td>VFAS1-4400KPC</td>
<td>370 720 280 400 75 150 30</td>
<td>106 (72)</td>
</tr>
<tr>
<td>VFAS1-4500KPC</td>
<td>370 720 280 400 75 150 30</td>
<td>106 (72)</td>
</tr>
</tbody>
</table>

**Note:** Values in ( ) are not DC reactor attached.

---

**Figure J**

**Figure K**

**Figure L**

**Figure M**

**Figure N**

**Figure J’**

**Figure K’**

**Figure L’**

**Figure M’**

**Figure N’**

---

**External dimensions**

- **200 V class - 55 to 75 kW, 400 V class - 90 to 500 kW model**

---

**Input Voltage**  
**Class**  
**Applicable Motor (kW)**  
**Approx. Weight (kg)**

---

**Coming soon**
Standard connection diagrams

Terminal functions

Main circuit terminal

Control circuit terminal

Control circuit terminal

Ammeter or voltmeter

External potentiometer (or voltage signal across RR/S4-CCA terminals: 0 to 10 V input)

Voltage signal: -10 to +10 V

Voltage signal: 0 to 10 V or current signal: 4 (0) to 20 mA

<table>
<thead>
<tr>
<th>Terminal Symbol</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F Input</td>
<td>Shunting across F-CC causes forward rotation, open causes deceleration stop.</td>
</tr>
<tr>
<td>R Input</td>
<td>Shunting across R-CC causes reverse rotation, open causes deceleration stop.</td>
</tr>
<tr>
<td>ST Input</td>
<td>The ST terminal is on standby whether ST and CC are connected. This terminal can be used for interlocking.</td>
</tr>
<tr>
<td>SI Input</td>
<td>The motor is on standby while ST and CC are connected. It coasts to a stop if this connection is broken. This terminal can be used for interlocking.</td>
</tr>
<tr>
<td>RES Input</td>
<td>Shorting and then opening RES-CC cancels the status held by an inverter protective circuit. When the inverter is operating normally, shorting and then opening RES-CC produces no effect.</td>
</tr>
<tr>
<td>P24/PLC Input</td>
<td>24Vdc-20mA power input (when SW1 is in any position other than PLC)</td>
</tr>
<tr>
<td>PW4/PLC Input</td>
<td>Digital signal equipment (5Vdc terminal) for the control circuit and equipotential (0V) terminal for the optional control power supply backup.</td>
</tr>
<tr>
<td>PP Input</td>
<td>Analog input signal output power.</td>
</tr>
<tr>
<td>SW4 Input</td>
<td>24Vdc Multifunction programmable analog input terminal when SW4 is in the S4 position. Standard default setting: 0-10Vdc input and 0~60Hz frequency.</td>
</tr>
<tr>
<td>SW1 Input</td>
<td>Internal power input and 0<del>60Hz frequency. This terminal can also be used as a 4</del>20mAdc (0~20mAdc) input terminal, if the parameter 7 is set to 1.</td>
</tr>
<tr>
<td>R Input</td>
<td>Multifunction programmable analog input. Standard default setting: 0-10Vdc input and 0~60Hz frequency.</td>
</tr>
<tr>
<td>FM Input</td>
<td>Multifunction programmable analog output. Standard default setting: 0-10Vdc input and 0~60Hz frequency.</td>
</tr>
<tr>
<td>AM Input</td>
<td>Multifunction programmable analog output. Standard default setting: 0-10Vdc input and 0~60Hz frequency.</td>
</tr>
<tr>
<td>OUT1 Output</td>
<td>Open collector output. Use this terminal to output a 4~20mAdc input signal when the output low speed threshold has been reached. Depending on the SW4 setting, pulses are output with frequencies of 1.0kHz to 43.2kHz. Standard default setting 3kHz.</td>
</tr>
<tr>
<td>OUT2 Output</td>
<td>Multifunction programmable open collector output. By default, it is set to output a signal indicating the completion of acceleration.</td>
</tr>
<tr>
<td>NO Output</td>
<td>Digital output signal equipment (5Vdc terminal) for the control circuit. It is inversed from the CC terminal.</td>
</tr>
<tr>
<td>SW4 Input</td>
<td>Digital signal equipment (5Vdc terminal) for the control circuit.</td>
</tr>
</tbody>
</table>

Ammeter or voltmeter

External potentiometer (or voltage signal across RR/S4-CCA terminals: 0 to 10 V input)

Voltage signal: -10 to +10 V

Voltage signal: 0 to 10 V or current signal: 4 (0) to 20 mA

1: The inverter is shipped with the terminals PO and PA/+ shorted with a bar (200V-45kW or smaller, 400V-75kW or smaller).

2: The DC react is built-in for models 200V-115V-50/60Hz and 400V-115V-50/60Hz.

3: The noise filter is a built-in model 200V-45kW or smaller and all of 400V.

4: External braking resistor (optional), Dynamic braking drive circuit breaker (GTR7S) as standard for models 160kW or smaller.

5: Power generation braking Unit (option). When the external braking resistor (optional) is used on 200 kW or more models, the separate power braking unit (optional) is required.

6: To supply a DC power, connect the cables to the P24/PLC and PW4/PLC terminals.

7: If you use a DC power supply to operate the inverter (200V: 115V-50/60Hz or more, 400V: 230V-50/60Hz or more), be sure to contact your supplier customer support center, because an inverter’s cooling power input terminals. When using a DC power supply, connect three-phase power cables. This terminal can also be used as a 4-20mAdc (0-20mAdc) input terminal, if the parameter 7 is set to 1.

8: For models 200V-115V and 400V-115V as targets, three-phase power input is necessary to drive the fan if you want to use a DC power supply.

9: The functions assigned to terminals OUT1, VI/VII and RR/S4 can be switched by changing parameter settings.

10: To supply control power from an external power supply for backing up the control power supplied from the inverter, an optional control power backup device (CPS002Z) is required. In this case, the backup device is used at the same time with the internal power supply of the inverter.

* The optional control power backup unit can be used with both 200V and 400V models.

*1: Although the CC terminal and the CCA terminal are not insulated, they should be used separately, one for the logic circuit and the other for the analog circuit.
For inverter users

### Notes

**Leakage current**

This inverter uses high-voltage switching devices for PWM control. When a relatively large (say 100mA) current is supplied to an inverter, current may leak from the cable or the motor to the ground because of its capacitance, adversely affecting peripheral equipment. The intensity of such a leakage current depends on the PWM carrier frequency, the lengths of the input and output cables, etc, of the inverter. To prevent current leakage, it is recommended to take the following measures.

#### Effects of leakage current

Leakage current which increases when an inverter is used may pass through the following routes:

1. Leakage due to the capacitance between the ground and the motor circuit (Route (1)).
2. Leakage due to the capacitance between the ground and the cable connecting the inverter and the power source (Route (2)).
3. Leakage due to the capacitance between the ground and the cable connecting the inverter and the load (Route (3)).
4. Leakage due to the capacitance of the cable connecting the motor and an inverter (Route (4)).

This means that it is necessary to take measures to reduce the leakage current. The leakage current may be greatly reduced if the following measures are taken:

- **Installation of input AC rectors and electronic systems.**
- **Use of radio-frequency interference-proof ELCBs (manufactured by Toshiba.)**
- **Noise filter.**
- **Metallic conduit, and shielded cables.**

The leakage current that may pass through the above routes may cause the following troubles.

- **Malfunction of a leakage circuit breaker in the same or another power distribution line.**
- **Malfunction of a grounding relay installed in the same or another power distribution line.**
- **Noise produced at the output of an electronic device in another power distribution line.**
- **Noise produced at the wiring end of the inverter.**
- **High current sensitivity or reduce the number of inverters connected to the ELCB.**
- **Ground fault**

Before beginning operation, thoroughly check the wiring between the motor and the inverter for the following direct circuits. Do not ground the neutral point of any inter-connected motor.

#### Ground fault

Before beginning operation, thoroughly check the wiring between the motor and the inverter for the following direct circuits. Do not ground the neutral point of any inter-connected motor.

#### Radio interference

**[Noise produced by inverters]**

Since this inverter is a PWM control, it produces noises and sometimes affects nearby instrumental devices, electrical and electronic systems, etc. The effects of noise greatly vary with the noise resistance of each individual device, its wiring condition, the distance between it and the inverter, etc.

According to the route through which noise is transmitted, the noises produced by the inverter are classified into the following types:

- **[Examples of protective measures]**
  - Separate the power line from other lines, such as weak-current lines and signal lines, and install them apart from each other.
  - Use shielded twisted pair wires for wiring of the weak-current and signal circuits, and always ground one pair of each wire.
  - Install a noise filter at each inverter. It is effective for noise prevention to install noise filters in other devices as well, and use shielded cables and buses with metallic conduits, and cover electronic systems with metallic gable cases.
  - Separate the power distribution line of the inverter from that of other devices and systems.
  - Install the input and output cables of the inverter apart from each other.
  - Use shielded twisted pair wires for wiring of the weak-current and signal circuits, and always ground one pair of each wire.
  - Ground the inverter with wiring as long as short as possible, separately from other devices and systems.

On 200V 0.4 to 7.5kW and 400V 0.75 to 75kW models, noise can be greatly reduced as they have a built-in EMI noise filter on their input side.

#### Power factor improvement capacitors

Do not install a power factor improvement capacitor on the input or output side of the inverter.

Installing a power factor improvement capacitor on the input or output side causes current containing harmonic components to flow into the inverter, adversely affecting the capacitor itself or causing the inverter to trip. To improve the power factor, install an input AC reactor or a DC reactor (optional) on the primary side of the inverter.

#### Installation of input AC reactors

These devices are used to improve the input power factor and suppress high harmonic currents and voltage. Install an input AC reactor when using the inverter under the following conditions:

- When the input power source is 50Hz or more, and when it is 10 times or more greater than the inverter capacity.
- When the inverter is connected to the same power distribution system as that of distorted wave-producing systems, such as arc furnaces and large-capacity inverters.

#### Measurement of input AC currents

When using the shortest possible cable to connect the inverter to the motor.

- (5) When the inverter has a high-attenuation EMI filter, turn off the grounding capacitor discharge switch to reduce the leakage current. Note that doing so leads to a reduction in the noise attenuating effect.

- Note that if the inverter is used, the PWM carrier frequency cannot be increased to 1MHz. However, that should not be set to less than 3kHz during vector control.

- Describing the same frequency range in an inverter shows that the harmonic components are concentrated.

- **[Measures against effects of leakage current]**

The measures to be considered against the above leakage current are as follows:

1. Measures to prevent the malfunction of leakage circuit breakers
   - [Decrease the PWM carrier frequency of the inverter.]
2. Measures to prevent the radio-frequency interference-proof ELCBs (manufactured by Toshiba, Schneider Electric, and Mitsubishi Electric) from malfunctioning
   - [Install the wires 30 cm or more apart from each other. When the wires are installed in the same duct, separate the weak-current line and the strong-current line with a metallic separator. Use twisted wires for weak-current lines.
   - [Shield cables and buses with metallic conduits, and cover electronic systems with metallic gable cases.
   - [Separate the power distribution line of the inverter from that of other devices and systems.
   - [Install the input and output cables of the inverter apart from each other.
   - [Use shielded twisted pair wires for wiring of the weak-current and signal circuits, and always ground one pair of each wire.
   - [Ground the inverter with wiring as long as short as possible, separately from other devices and systems.

3. Measures to prevent the malfunction of ground-fault relay
   - [Decrease the PWM carrier frequency of the inverter.]
2. Measures to prevent the malfunction of external thermal relay
   - [Install a magnetic contactor or an overload relay matching the motor.
   - [To turn on/off the motor frequently, close/break the control terminals F (or R) and G (or H) of the PWM carrier frequency of the inverter.
3. Measures to prevent the malfunction of protective devices
   - [Install a noise filter at each inverter. It is effective for noise prevention to install noise filters in other devices as well, and use shielded cables and buses with metallic conduits, and cover electronic systems with metallic gable cases.
   - [Separate the power distribution line of the inverter from that of other devices and systems.
   - [Install the input and output cables of the inverter apart from each other.
   - [Use shielded twisted pair wires for wiring of the weak-current and signal circuits, and always ground one pair of each wire.
   - [Ground the inverter with wiring as long as short as possible, separately from other devices and systems.

4. Measures to prevent the malfunction of protective devices
   - [Install an input AC reactor or a DC reactor (optional) on the primary side of the inverter.

#### When wiring the inverter

**Wiring precautions**

1. **Installing a molded-case circuit breaker (MCCB)**
   - (1) Install a molded-case circuit breaker (MCCB) on the inverter's power supply input to protect the wiring.
   - (2) Avoid turning the molded-case circuit breaker on and off frequently to turn off the MCCB.
   - (3) To turn off the MCCB frequently, disconnect the break control terminals F (or R) and G (or H).

2. **Installing a magneticcontactor (MC) [primary side]**
   - (1) To prevent an automatic restart after the power interruption or overload relay has tripped, or actuation of the protective circuit, install an electromechanical contact in the power supply.
   - (2) The inverter is provided with a failure detection relay (FL), so that, if its contacts are connected to the operation circuit of the magnetic contactor on the primary side, the magnetic contactor will be open when the protective circuit of the inverter is activated.
   - (3) The inverter can be used without a magnetic contactor. In this case, use an MCCB (equipped with a voltage trippping device) for opening the primary circuit when the protective circuit of the inverter is activated.
   - (4) Avoid turning the magnetic contactor on and off frequently to turn off the MCCB.
   - (5) To turn off the MCCB frequently, disconnect the break control terminals F (or R) and G (or H).

3. **Installing a magnetic contactor (MC) [secondary side]**
   - (1) As a rule, if a magnetic contactor is installed between the inverter and the motor, do not turn OFF/ON while running. (If the secondary-side contactor is turned OFF/ON while running, a large current may flow in the inverter, causing inverter damage and failure.)
   - (2) A magnetic contactor may be installed to change the motor or change the start-up and stop circuit of the motor. Always use an interlock with the magnetic contactor in this situation so that the commercial power supply is not applied to the inverter's output terminals.

#### Application to standard motors

**Vibration**

When a motor is operated with an industrial inverter, it experiences more vibrations than when it is operated by the commercial power supply. The vibration can be reduced to a negligible level by securing the motor and machine to the base firmly. If the base vibration is low, the motor may increase at a light load due to resonance with the mechanical system.

**Reduction gear, belt, chain**

Note that the lubrication capability of a reducer or a converter used as the interface of the motor and the load machine may affect its life. When operating at a frequencies exceeding 60 Hz or higher, power transmission mechanisms such as reduction gear, belts and chains, may cause problems such as production of noise, a reduction in strength, or shortening of service life.

**Frequency**

Before setting the maximum frequency to 60 Hz or higher, confirm that the opening range is acceptable for the motor.

**Application to special motors**

**Braking motor**

When using a braking motor, if the braking circuit is directly connected to the inverter's output terminals, the brake cannot be released because of the lowered starting voltage. Therefore, when using a braking motor, connect the braking circuit to the inverter's power supply side, as shown on the below. Usually, braking motors produce larger noise in low speed ranges.

**Gear motor**

When using an industrial inverter to drive a gear motor, inquirers of the motor manufacturer about its continuous operation range, since low-speed operation of a gear motor may cause insufficient lubrication.

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Note that high-current (100A or more) AC motors, which may be used for fans, have higher rated current than 4-pole motors.

The current ratings of multipole motors are relatively high. So, when selecting an inverter, you must pay special attention to its current rating so that the current rating of the motor is below that of the inverter.

Note that high-pole count motors (8 or more poles), which may be used for fans, etc., have higher rated current than 4-pole motors. Therefore, when selecting a motor, you must pay special attention to its current rating so that the current rating of the motor is below that of the inverter.
For inverter users

■ Selecting peripheral and wiring sizes devices

| Voltage Class | Inverter Type | Option Code | Sensor output type | Motor output type | Control connection type | Power cable (mm²) | Control connection cable (mm²) | Enclosure \n|---------------|---------------|-------------|-------------------|-------------------|-----------------------|----------------|--------------------------------|-------|
| 1.0 | 0.3-0.4 | VFB1-0040PL | Terminal block | Nema | Nema | 8.0 M5 | 2.0 M5 | IP20 |
| 2.0 | 0.3-0.4 | VFB1-0040PL | Terminal block | Nema | Nema | 8.0 M5 | 2.0 M5 | IP20 |
| 3.0 | 0.3-0.4 | VFB1-0040PL | Terminal block | Nema | Nema | 8.0 M5 | 2.0 M5 | IP20 |

Note 1) Includes the recommended encoder NO. of, feed control by Feedback Encoder Block (LED).
Note 2) Directions for the type of the Terminal block standard model with sensor output of 100% power Net.
Note 3) Choose the MCB according to the power supply capacity.
Note 4) The enclosure is a metal enclosure for standard model and a plastic enclosure for the optional small-size model.

■ Selecting the Capacity (model) of the Inverter

| Voltage Class | Inverter Type | Option Code | Sensor output type | Motor output type | Control connection type | Power cable (mm²) | Control connection cable (mm²) | Enclosure \n|---------------|---------------|-------------|-------------------|-------------------|-----------------------|----------------|--------------------------------|-------|
| 1.0 | 0.3-0.4 | VFB1-0040PL | Terminal block | Nema | Nema | 8.0 M5 | 2.0 M5 | IP20 |
| 2.0 | 0.3-0.4 | VFB1-0040PL | Terminal block | Nema | Nema | 8.0 M5 | 2.0 M5 | IP20 |
| 3.0 | 0.3-0.4 | VFB1-0040PL | Terminal block | Nema | Nema | 8.0 M5 | 2.0 M5 | IP20 |

Note 1) Includes the recommended encoder NO. of, feed control by Feedback Encoder Block (LED).
Note 2) Directions for the type of the Terminal block standard model with sensor output of 100% power Net.
Note 3) Choose the MCB according to the power supply capacity.
Note 4) The enclosure is a metal enclosure for standard model and a plastic enclosure for the optional small-size model.

■ Peripheral devices

Harmonic current and influence to power supply

Harmonics are defined as sinusoidal waves that is multiple frequency of commercial power (base frequency: 50Hz or 60Hz). Commercial power including harmonics has a distorted waveform. Some electrical and electronic devices produce distorted waves in their rectifying and smoothing circuits on the input side. Harmonics produced by a device influence other electrical equipment and facilities in some cases (for example, overheating of phase advancing capacitors and reactors).

Measures for suppressing harmonics

1. Connecting reactor
2. Connecting a higher-frequency suppressing reactor
3. Connecting an additional phase advancing capacitor
4. Connecting an additional phase advancing capacitor
5. Connecting a higher-frequency suppressing reactor
6. Connecting an additional phase advancing capacitor

■ External option

Power supply

Molded case circuit breaker MCCB

Magnetic contactor MC

Input AC reactor

High-voltage transformer (HVT) Type : VEA0000

Control power supply backup unit

Power supply

Molded case circuit breaker MCCB

Magnetic contactor MC

Input AC reactor

High-voltage transformer (HVT) Type : VEA0000

Control power supply backup unit

■ Bulitin options

External option

Power supply

Molded case circuit breaker MCCB

Magnetic contactor MC

Input AC reactor

High-voltage transformer (HVT) Type : VEA0000

Control power supply backup unit

■ Bulitin options

External option

Power supply

Molded case circuit breaker MCCB

Magnetic contactor MC

Input AC reactor

High-voltage transformer (HVT) Type : VEA0000

Control power supply backup unit

■ Bulitin options

External option

Power supply

Molded case circuit breaker MCCB

Magnetic contactor MC

Input AC reactor

High-voltage transformer (HVT) Type : VEA0000

Control power supply backup unit

■ Bulitin options

External option

Power supply

Molded case circuit breaker MCCB

Magnetic contactor MC

Input AC reactor

High-voltage transformer (HVT) Type : VEA0000

Control power supply backup unit

■ Bulitin options

External option

Power supply

Molded case circuit breaker MCCB

Magnetic contactor MC

Input AC reactor

High-voltage transformer (HVT) Type : VEA0000

Control power supply backup unit

■ Bulitin options

External option

Power supply

Molded case circuit breaker MCCB

Magnetic contactor MC

Input AC reactor

High-voltage transformer (HVT) Type : VEA0000

Control power supply backup unit
To users of our inverters: Our inverters are designed to control the speeds of three-phase induction motors for general industry.

⚠️ Precautions

* Read the instruction manual before installing or operating the inverter unit and store it in a safe place for reference.
* When using our inverters for equipment such as nuclear power control, aviation and space flight control, traffic, and safety, and there is a risk that any failure or malfunction of the inverter could directly endanger human life or cause injury, please contact our headquarters, branch, or office printed on the front and back covers of this catalogue. Special precautions must be taken and such applications must be studied carefully.
* When using our inverters for critical equipment, even though the inverters are manufactured under strict quality control always fit your equipment with safety devices to prevent serious accident or loss should the inverter fail (such as issuing an inverter failure signal).
* Do not use our inverters for any load other than three-phase induction motors.
* None of Toshiba, its subsidiaries, affiliates or agents, shall be liable for any physical damages, including, without limitation, malfunction, anomaly, breakdown or any other problem that may occur to any apparatus in which the Toshiba inverter is incorporated or to any equipment that is used in combination with the Toshiba inverter. Nor shall Toshiba, its subsidiaries, affiliates or agents be liable for any compensatory damages resulting from such utilization, including compensation for special, indirect, incidental, consequential, punitive or exemplary damages, or for loss of profit, income or data, even if the user has been advised or apprised of the likelihood of the occurrence of such loss or damages.

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