TOSHIBA
Leading Innovation »»»

INTELLIGENT PHASE CONTROL
Eliminates Phase Shift

Toshiba has developed Intelligent Phase Control technology (InPAC), the latest Toshiba control technology, that automatically adjusts phases of motor voltage and motor current. Using automatic phase adjustment, the optimal efficiency is achieved simply by initial setting in the used rotation range. The adjustment burden for optimization is reduced, which normally incurs at every rotation speed with the conventional technology. Accordingly customers' development time can be shortened.

Intelligent PhAse Control

APPLICATIONS

- Cooling fans for servers and industrial motors

- Fans for home appliances (air cleaners, hot water supply machines, ventilation fans, electrical fans)

FEATURES | ADVANTAGES

FEATURES	ADVANTAGES
Auto lead angle control	Automatically adjusting brushless motors' current and voltage phases by comparing them
	Eliminating consumption current generated from the phase difference that depends on the rotation speed and the current value
Sine-wave drive	Smooth current waveform

BENEFITS

- Eliminating adjustment and evaluation procedure
- Achieving highly efficient drive
- Contributing to motor-operation noise and vibration lower than for square-wave drive
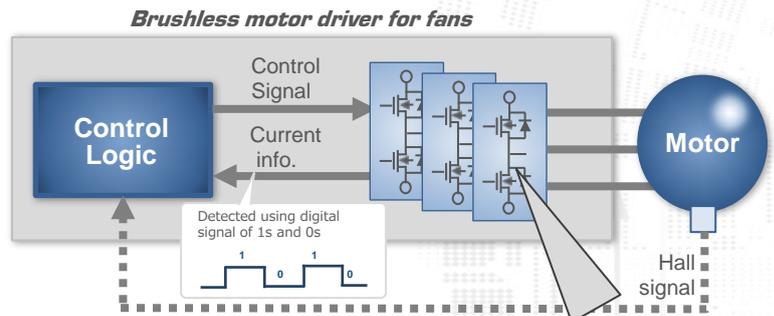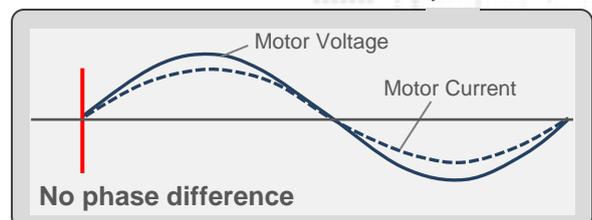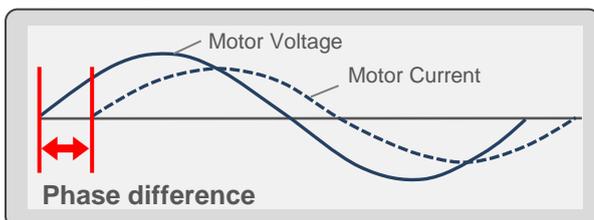
REALIZING HIGHLY EFFICIENT DRIVE

A conventional brushless DC motor driver feeds back and controls the rotor position by hall signal. Phase difference is generated between motor voltage and motor current since motor speed changes because of motor impedance etc. Phase difference decreases driving efficiency. Adjustment is required to eliminate the difference and increase the efficiency.

Toshiba's InPAC technology compares phase of motor current (current information) and phase of motor voltage (hall signal) and the result is fed back to motor current control (control signal). Phase difference between motor voltage and motor current is adjusted automatically. This is the optimal system for achieving highly efficient drive.
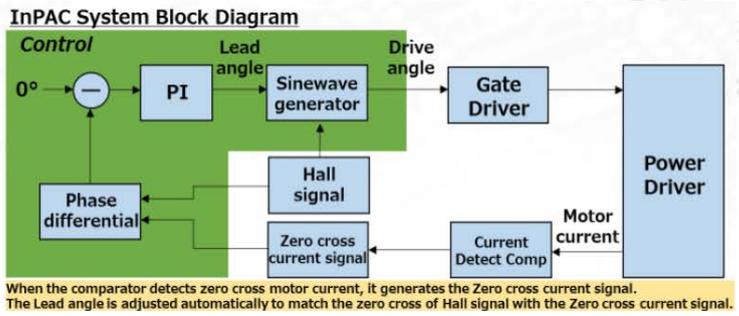
Brushless motor driver for fans

Control Signal

Current info.

Control Logic

Motor

Detected using digital signal of 1s and 0s

| 1 | 0 | 1 | 0 |

Hall signal

Conventional

Motor Voltage

Motor Current

Phase difference

Motor Voltage

Motor Current

No phase difference

InPAC technology automatically adjusts current and voltage phases.
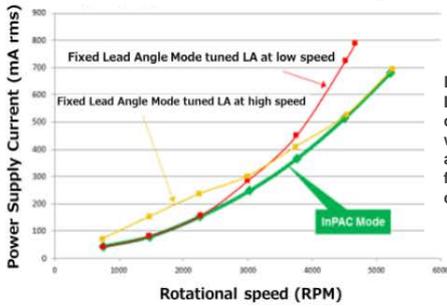
Depending on RPM, InPAC reduces motor current significantly when comparing the approach of using a fixed lead angle control mode.

InPAC System Block Diagram

When the comparator detects zero cross motor current, it generates the Zero cross current signal.
The Lead angle is adjusted automatically to match the zero cross of Hall signal with the Zero cross current signal.

REDUCING DEVELOPMENT BURDEN

With conventional technology, repeated adjustments of differences between motor voltage and motor current for optimization are required in the rotation range to achieve the optimal efficient characteristics. Therefore, customers have been burdened with a complicated development process. Toshiba's InPAC technology allows optimization throughout the rotation range simply by initial setting, because phase difference between motor voltage and motor current is adjusted automatically. It reduces customers' development burdens.

Conventional
Repeated adjustment at each point for optimization

NEW InPAC
Optimization through automatic phase difference adjustment simply by initial setting
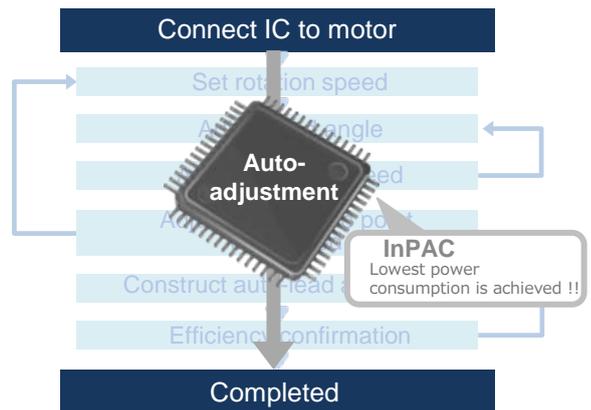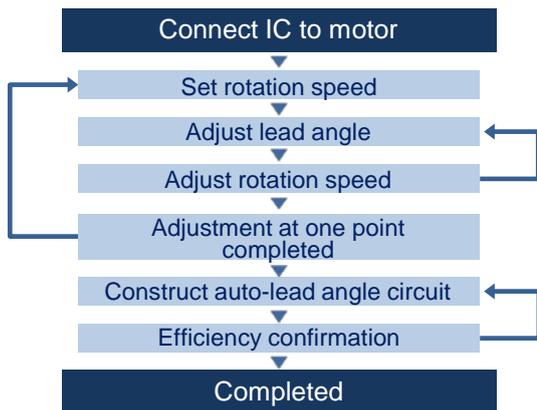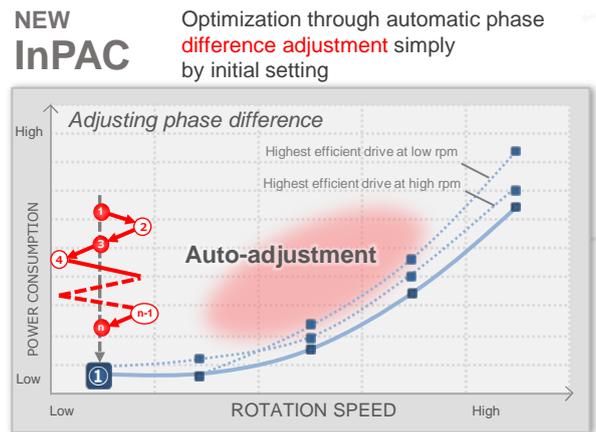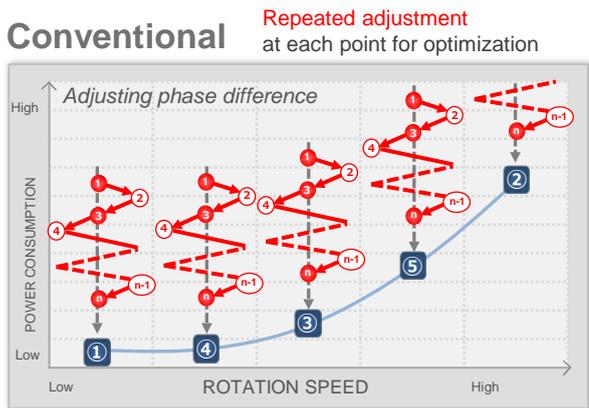
	Efficiency	
- Low except at adjusted point		+ Optimized automatically
- Necessary many times	Need for adjustment	+ Unnecessary

PRODUCT LINEUP

Product number	Supply voltage range	Output current	Drive method	Package	Other features
TC78B016FTG	6~30 V	3.0 A	Sine-wave drive	WQFN36 (5x5 mm)	Auto lead angle (voltage and current: optimized phase control) Support for hall devices and hall ICs Speed control inputs: PWM inputs or analog voltage inputs Abnormal detection functions: Thermal shutdown, overcurrent detection, motor lock detection
TC78B025FTG	5.5~16V	3.5 A	Sine-wave drive	VQFN24 (4x4 mm)	