

## Motor Drivers

### > InPAC Intelligent Phase Control Technology

Energy saving is increasingly promoted and higher power efficiency is required for home appliances and industrial equipment. Therefore, higher efficiency for incorporated fan motor controllers is essential. However, with the fan motor control system, the ideal efficient characteristics cannot be obtained and complicated adjustment is required for optimization because phase difference between motor voltage and motor current is generated because of motor impedance. To solve this problem, we have developed "InPAC" technology. InPAC, our latest control technology, automatically adjusts phases of motor voltage and motor current. Using automatic phase adjustment, the optimal efficiency is achieved simply by initial setting in the usage rotation range. The adjustment burden for optimization, which is incurred at every rotation speed with the conventional technology, is reduced. And customers' development time can be shortened.



### > APPLICATIONS

- Cooling fans for servers and game machines
- Fans for home appliances (air conditioners, air cleaners, hot-water supply machines, ventilation fans, electric fans)

### > FEATURES

Auto lead angle control

Sine-wave drive

### > ADVANTAGES

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

Smooth current waveform

### > BENEFITS

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

### > PRODUCT LINEUP

Product number	Supply voltage range	Output current	Drive method	Package	Other features
TC78B016FTG	6~30 V	3 A	Sine-wave drive	WQFN36 (5x5mm)	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

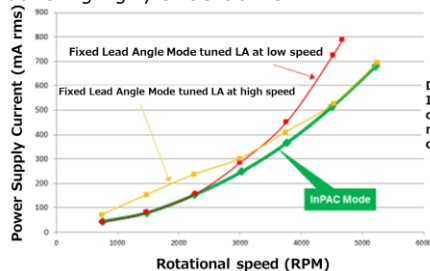
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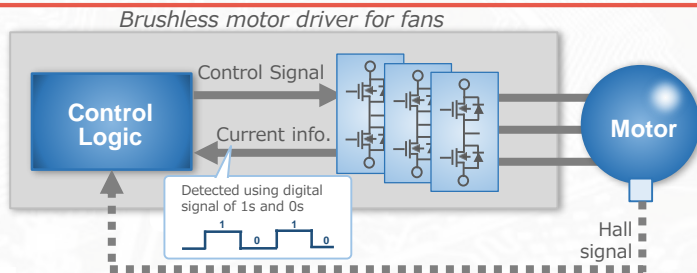
## > ADVANTAGE: Realizing highly efficient drive *automatically adjusting current and voltage phases*

A conventional brushless 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.

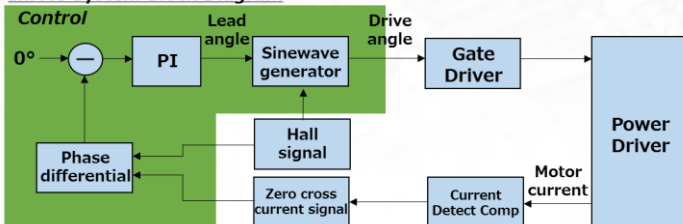
Our InPAC technology compares phase of motor current (current information) and phase of motor voltage (Hall signal). And the result is fed back to motor current control (control signal). Phase difference between motor voltage and motor current is adjusted automatically. This is the optimal system for achieving highly efficient drive.



Depends on RPM, in general InPAC reduces supply current significantly with respect to Fixed lead angle control mode approaches

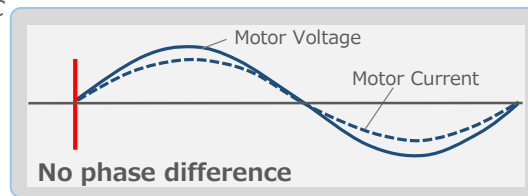
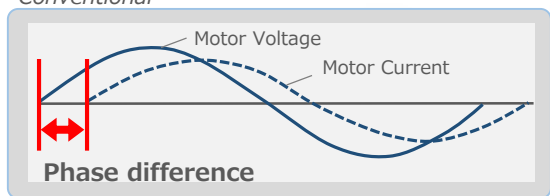


### InPAC System Block Diagram



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.

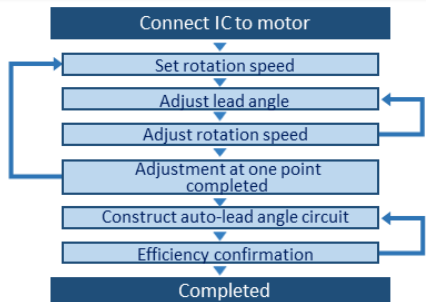
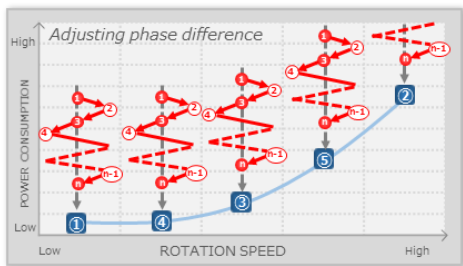
### InPAC



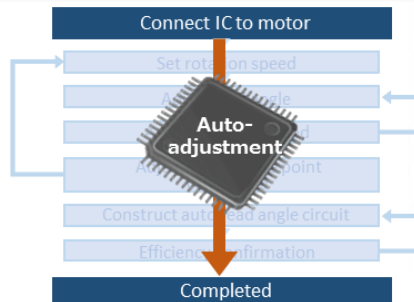
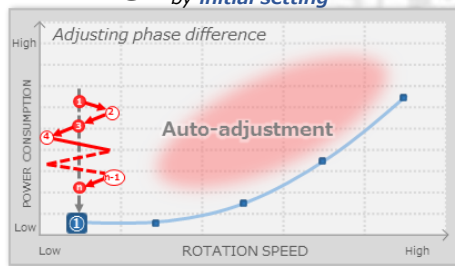
## > ADVANTAGE: Reducing development burden

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. Our 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*



	Motor Efficiency	Easily setting	Easy-deployed motor model	Parts count	Cons
Fixed Lead Angle Control	×	×	×	△	· Cannot obtain optimized efficiency across the entire speed range · Need to set lead angle for each motor
Traditional Auto Lead Angle Control	△	△	△	×	
InPAC	✓	✓	✓	✓	None