



We are the link  
between the real and  
the digital world.

# Air-Con ODU Dual Motor and HPFC Control Solution

Infineon's virtual show 2020



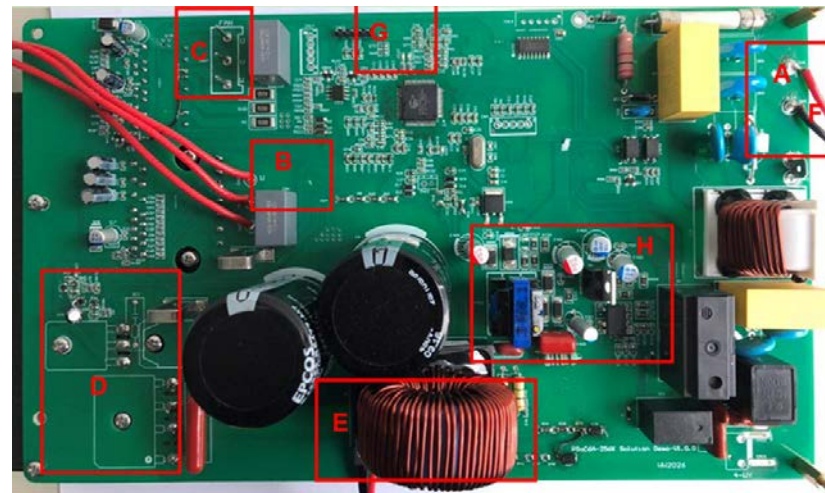
# Air-Con ODU Dual Motor and HPFC Control Solution

## Board View

- › This demo board is based on the latest PSOC4500H for air-conditioner outdoor unit (ODU), it implements the solution of dual-motor control including compressor and fan motor, as well as HPFC(high frequency power factor correction ) motor control.
- › All the power module ICs on board(part B\C\D\H) are from Infineon.
- › The module circuits on the board are shown in following table:

**PSoC4500H Motor Control Solution Demo View**

No.	Part	Description
A	AC input	The AC input for the board, AC voltage is 165v~ 220v~ 275v
B	Motor output	The U\W of the motor
C	Fan motor output	The U\W of the fan motor
D	PFC chopper	High PFC chopping circuit
E	PFC inductance	High frequency PFC inductance with 40KHz carrier, 400uH/10A
F	PFC test line	AC line can be used to test the PFC current for the evaluation
G	SWD Debugger	Online debug the code through Segger J-link on IAR 8.3
H	Switch power	Power module of 3.3v\15v\12v to each part on board



# Air-Con ODU Dual Motor and HPFC Control Solution

## Solution Feature

Dual Sensor-less motor control method based on FOC technology, PFC carrier frequency  $\geq 40\text{KHz}$

### Compressor

- Optimized SVPWM runs faster (4us)
- 1-shunt with Compressor and 2-Shunt with Fan control
- Over modulation increases the DC voltage usage rate
- 2-phases modulation decreases system switching loss
- Field weakening runs motor to higher speed
- Smart torque compensator gets the compensation angle and amplitude automatically, then to eliminates machine vibration
- PFC increases the power factor (0.99)
- Dead-time compensation eliminates dead-time effect
- Harmonic suppression reduces THD and makes current more sinusoidal
- Ultra-low speed running lets compressor could run at 3Hz stably
- Full scale protection: over/under voltage, over current (phase current and AC input), IPM over temperature, sample hardware fault, phase loss, rotor lock
- Pre-heat enables compressor run at very low temperature

### FAN

- Compatible fan solution all features and performance
- Dedusting functions for air conditioner system

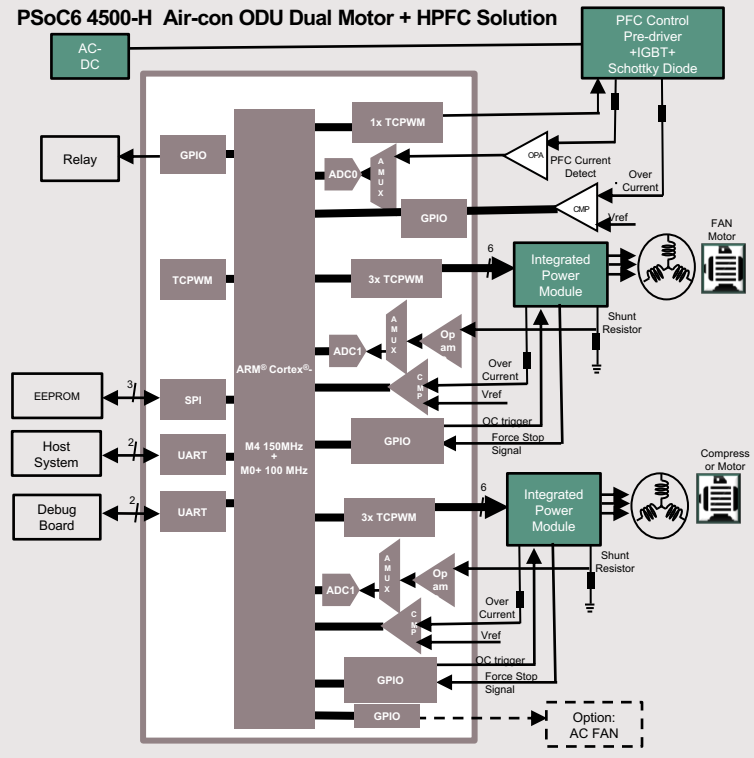
## Chip Feature

### Primary features of PSoC6 4500-H for the Dual Motor and HPFC Control Solution

	PSoC6 4500-H
Dual Core	150-MHz M4 and 100-MHz M0+
A/D	2x 12bit-ADCs, 16 channels, 2MSPS
Analog	2x Opamps, 2x Lp Comp
Operation Voltage	1.7-V to 3.6-V, Type 3.3V
Other Peripherals	6x SCB, 12x TCPWM, DMA, 256k Flash, 128K RAM
Package	LQFP64/80

## Block Diagram

### PSoC6 4500-H Air-con ODU Dual Motor + HPFC Solution



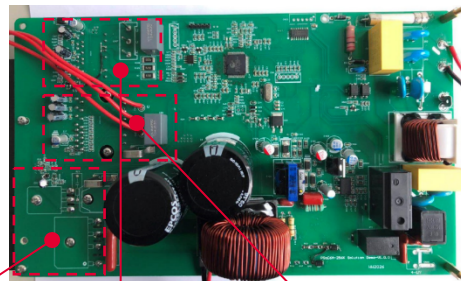
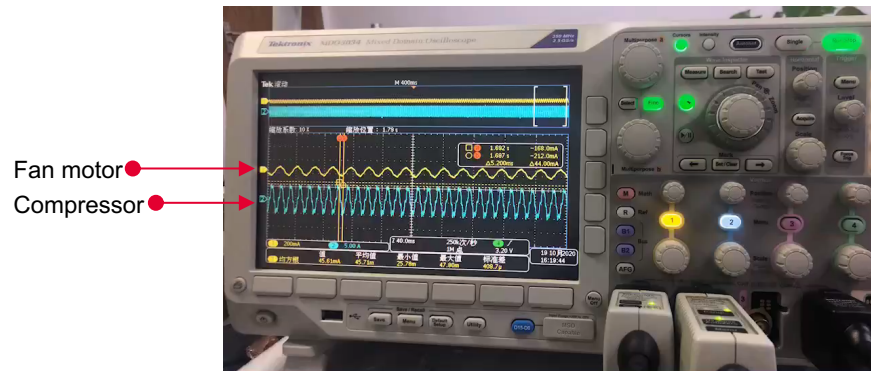
# Air-Con ODU Dual Motor and HPFC Control Solution

## System View

This solution demo is to implement a dual motor control board with 5kHz carrier inverter of sensor-less single shunt solution, 15KHz carrier fan motor and 40kHz high-frequency PFC.

## Infineon Products on Board

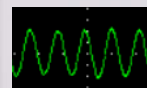
Function	MPN	Quantity
Controller	CY8C4588AZI-H676	1
Aux power	ICE5AR4770BZS	1
IPM for fan motor	IM231-M6T2B	1
IPM for Compressor	IKCM15L60GA	1
pre-driver for IGBT in HPFC	1ED44175N01B	1
IGBT for HPFC	IKW30N65WR5	1
PFC Diodes	IDW30C65D1	1



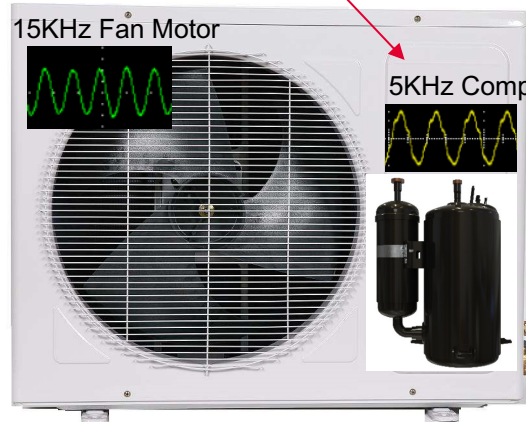
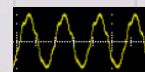
40KHz HPFC



15KHz Fan Motor



5KHz Compressor



For more information, please visit our web site <https://www.infineon.com/>



Part of your life. Part of tomorrow.