



PIC16(L)F1764/5/8/9

14/20-Pin, 8-Bit Flash Microcontroller Product Brief

Description:

PIC16(L)F176X microcontrollers combine intelligent analog integration with digital peripherals to suit a variety of functions and end equipment. These 14/20-pin devices provide features like 10-bit A/D, op amps, zero-cross detect, high current I/Os, communication, peripheral pin select and other key peripherals that make this family appealing in applications looking for design flexibility.

Core Features:

- C Compiler Optimized RISC Architecture
- Only 49 Instructions
- Operating Speed:
 - DC – 32 MHz clock input
 - 125 ns minimum instruction cycle
- Interrupt Capability
- 16-Level Deep Hardware Stack
- Up to Four 8-Bit Timers
- Up to Three 16-Bit Timers
- Power-on Reset (POR)
- Configurable Power-up Timer (PWRT)
- Brown-out Reset (BOR) with Selectable Trip Point
- Extended Watchdog Timer (EWDT):
 - Low-power 31 kHz WDT
 - Software-selectable prescaler
 - Software-selectable enable

Memory:

- Up to 14 KB Flash Program Memory
- Up to 1024 Bytes Data RAM Memory
- Direct, Indirect and Relative Addressing modes
- High Endurance Flash (HEF)
 - 128B of nonvolatile data storage
 - 100K Erase/Write cycles

Operating Characteristics:

- Operating Voltage Range:
 - 1.8V to 3.6V (PIC16LF176X)
 - 2.3V to 5.5V (PIC16F176X)
- Temperature Range:
 - Industrial: -40°C to 85°C
 - Extended: -40°C to 125°C

eXtreme Low-Power (XLP) Features:

- Sleep mode: 50 nA @ 1.8V, typical
- Watchdog Timer: 500 nA @ 1.8V, typical
- Secondary Oscillator 500 nA @ 32 kHz
- Operating Current:
 - 8 uA @ 32 kHz, 1.8V, typical
 - 32 uA/MHz @ 1.8V, typical
- Low-Power BOR (LPBOR):
 - 200 nA in Sleep

Digital Peripherals:

- Configurable Logic Cell (CLC):
 - Up to three CLCs; up to four selected inputs
 - Integrated combinational and state logic
- Up to Two Complementary Output Generators (COG):
 - Push-Pull, Full-Bridge and Steering modes
- Up to Two Capture/Compare/PWM (CCP) modules
- Pulse-Width Modulators (PWM):
 - Up to two 10-bit PWMs
 - Up to two 16-bit PWMs
- Peripheral Pin Select (PPS):
 - Configure any digital pin to output
- Serial Communications:
 - Enhanced USART (EUSART)
 - SPI, I²C™, RS-232, RS-485, LIN compatible
 - Auto-Baud Detect, auto-wake-up on start
- Up to 18 I/O Pins:
 - Individually programmable pull-ups
 - Slew rate control
 - Interrupt-on-change with edge-select
- Up to Two Data Signal Modulators (DSM)

Intelligent Analog Peripherals:

- 10-Bit Analog-to-Digital Converter (ADC):
 - Up to 12 external channels
 - Conversion available during Sleep
- Up to Two Operational Amplifiers (OPA):
 - Selectable internal and external channels
 - High and low GBWP operating modes
- Up to Four Fast Comparators (COMP):
 - Low-Power/High-Speed mode
 - Up to five external inverting inputs
 - Up to eight external non-inverting inputs
 - Fixed Voltage Reference at non-inverting input(s)
 - Comparator outputs externally accessible
- Digital-to-Analog Converters (DAC):
 - Up to two 10-bit resolution DACs
 - Up to two 5-bit resolution DACs

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- Voltage Reference:
 - Fixed Voltage Reference (FVR): 1.024V, 2.048V and 4.096V output levels
- Zero-Cross Detector (ZCD):
 - Detect high voltage AC signal
- Programmable Ramp Generator (PRG)
 - Slope compensation
 - Ramp generation
- High Current Drive I/Os:
 - 100 mA capacity
 - Low voltage

Clocking Structure:

- 16 MHz Internal Oscillator:
 - $\pm 1\%$ at calibration
 - Selectable frequency range 32 MHz to 31 kHz
- 31 kHz Low-Power Internal Oscillator
- 4x Phase-Locked Loop (PLL):
 - For up to 32 MHz internal operation
- External Oscillator Block with:
 - Three external clock modes up to 32 MHz

TABLE 1: PIC16(L)F1764/5/8/9 FAMILY TYPES

Device	Data Sheet Index	Program Memory Flash (words)	High-Endurance Flash (B)	Data SRAM (bytes)	I/O Pins	8/16-bit Timer	Comparator	10-bit ADC (ch)	5/10-bit DAC	CCP	10/16-bit PWM	COG	DSM	CLC	Op Amp	Zero-Cross Detect	Programmable Ramp Gen	High Current I/Os	Peripheral Pin Select	EUSART	I ² C™/SPI	Debug ⁽¹⁾
PIC16(L)F1764	(A)	4096	128	512	12	4/3	2	8	1/1	1	1/1	1	1	3	1	1	1	2	Y	1	1	I/H
PIC16(L)F1765	(A)	8192	128	1024	12	4/3	2	8	1/1	1	1/1	1	1	3	1	1	1	2	Y	1	1	I/H
PIC16(L)F1768	(B)	4096	128	512	18	4/3	4	12	2/2	2	2/2	2	2	3	2	1	2	2	Y	1	1	I/H
PIC16(L)F1769	(B)	8192	128	1024	18	4/3	4	12	2/2	2	2/2	2	2	3	2	1	2	2	Y	1	1	I/H

Note 1: Debugging Methods: (I) – Integrated on Chip; (H) – via ICD header; E – Emulation Product.

Data Sheet Index:

- A. Future Release [PIC16\(L\)F1764/5 Data Sheet, 14-Pin, 8-bit Flash Microcontrollers.](#)
- B. Future Release [PIC16\(L\)F1768/9 Data Sheet, 20-Pin, 8-bit Flash Microcontrollers.](#)

Note: For other small form-factor package availability and marking information, please visit <http://www.microchip.com/packaging> or contact your local sales office.

TABLE 2: PACKAGES

Packages	PDIP	SOIC	TSSOP	QFN	SSOP
PIC16(L)F1764	X	X	X	X	
PIC16(L)F1765	X	X	X	X	
PIC16(L)F1768	X	X		X	X
PIC16(L)F1769	X	X		X	X

Note: Pin details are subject to change.

PIN DIAGRAMS

FIGURE 1: 14-PIN PDIP, SOIC, TSSOP

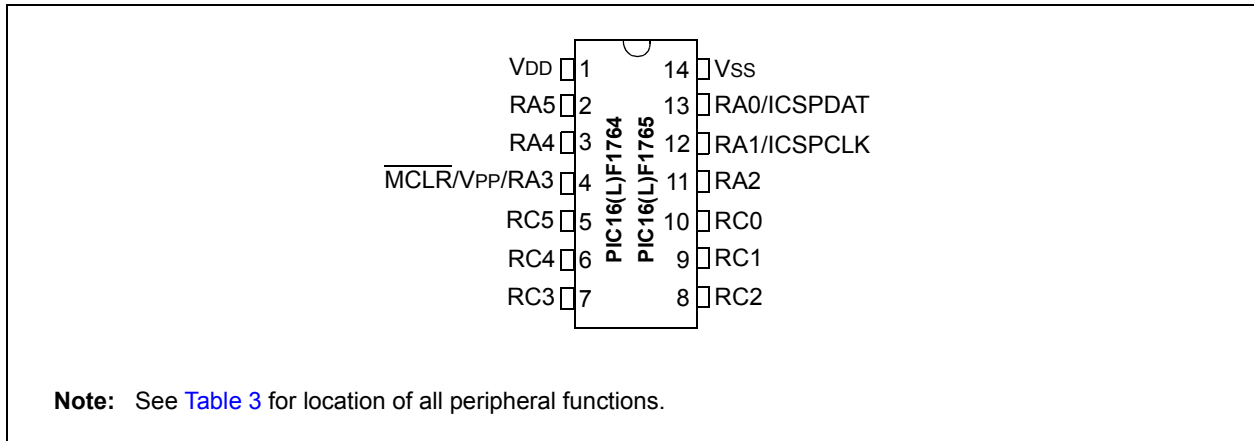
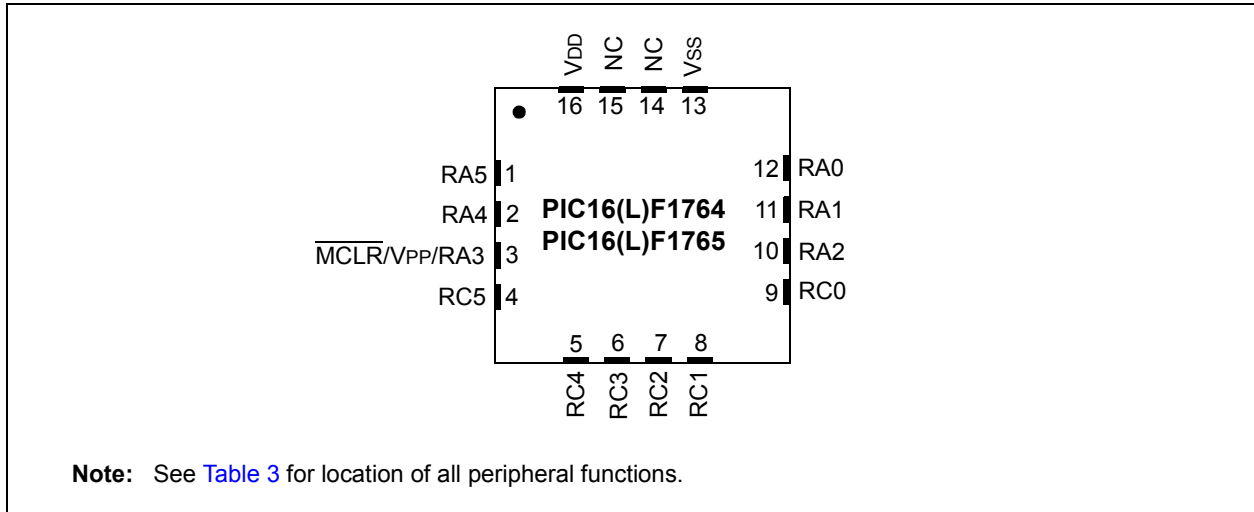


FIGURE 2: 16-PIN QFN (4x4)



PIC16(L)F1764/5/8/9

FIGURE 3: 20-PIN PDIP, SOIC, SSOP

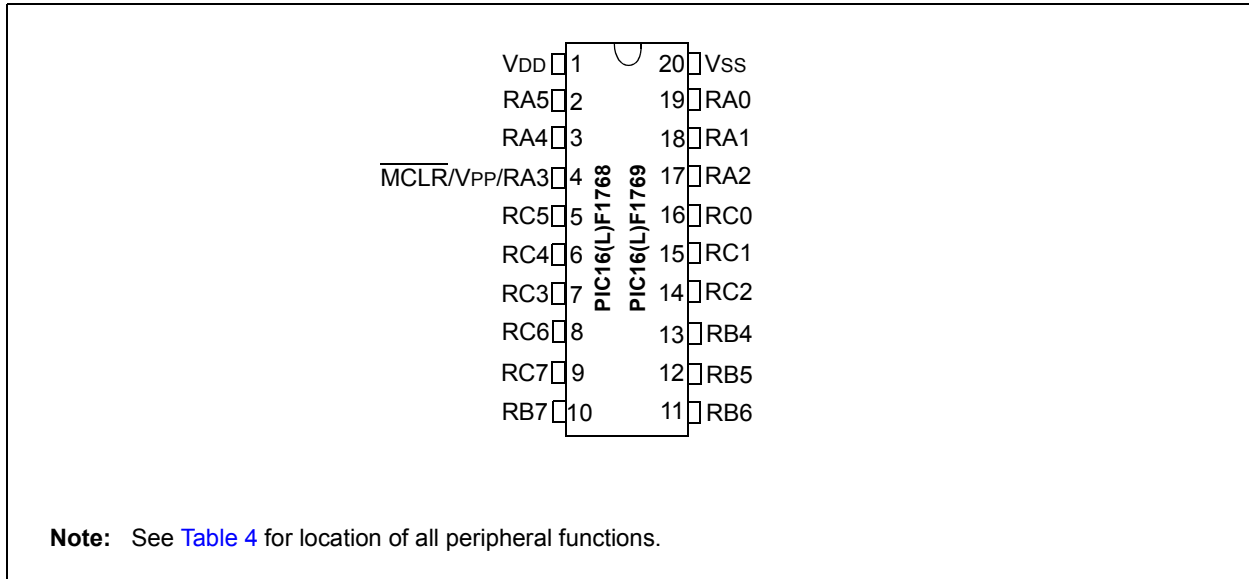
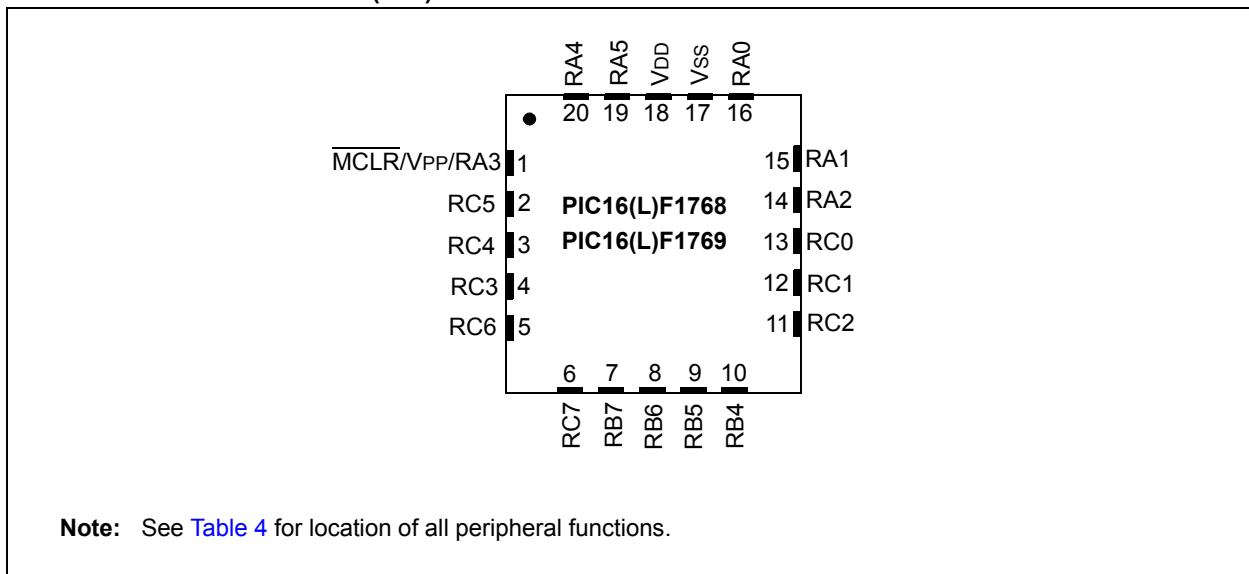


FIGURE 4: 20-PIN QFN (4x4)



PIN ALLOCATION TABLES

TABLE 3: 14-PIN AND 16-PIN ALLOCATION TABLE (PIC16(L)F1764 AND PIC16(L)F1765)

I/O	14-Pin PDI/PSOC/TSSOP	16-Pin QFN	ADC	Reference	DAC	Op Amp	Comparator	Zero Cross	Ramp Generator	Timers	PWM	CCP	COG	CLC	DSM	EUSART	MSSP	Interrupts	Pull-ups	Hi Current	Basic
RA0	13	12	AN0	VREF- DAC1REF- DAC2REF-	DAC1OUT1 DAC2OUT1	—	C1IN0+ C2IN0+	—	—	—	—	—	—	—	—	—	—	IOC	Y	—	ICSPDAT
RA1	12	11	AN1	VREF+ DAC1REF+ DAC2REF+	—	—	C1IN0- C2IN0-	—	—	—	—	—	—	—	—	—	—	IOC	Y	—	ICSPCLK
RA2	11	10	AN2	—	—	—	—	ZCD	—	T0CKI ⁽¹⁾	—	—	COG1IN ⁽¹⁾	—	—	—	—	INT ⁽¹⁾ IOC	Y	—	—
RA3	4	3	—	—	—	—	—	—	—	T6CKI ⁽¹⁾	—	—	—	—	DSM1CH ⁽¹⁾	—	—	IOC	Y	—	V _{PP} MCLR ICD
RA4	3	2	AN3	—	—	—	—	—	—	T1G ⁽¹⁾ SOSCO	—	—	—	—	DSM1CL ⁽¹⁾	—	—	IOC	Y	—	OSC2 CLKOUT
RA5	2	1	—	—	—	—	—	—	—	T1CKI ⁽¹⁾ T2CKI ⁽¹⁾ SOSCI	—	—	—	CLCIN3 ⁽¹⁾	DSM1MOD ⁽¹⁾	—	—	IOC	Y	—	OSC1 CLKIN
RC0	10	9	AN4	—	—	OPA1IN+	C2IN0+	—	—	T5CKI ⁽¹⁾	—	—	—	—	—	—	SCL ⁽¹⁾ SCK ^(1,3)	IOC	Y	—	—
RC1	9	8	AN5	—	—	OPA1IN-	C1IN1- C2IN1-	—	—	T4CKI ⁽¹⁾	—	—	—	CLCIN2 ⁽¹⁾	—	—	SDI ⁽¹⁾ SDA ^(1,3)	IOC	Y	—	—
RC2	8	7	AN6	—	—	OPA1OUT	C1IN2- C2IN2-	—	RG1IN0	—	—	—	—	—	—	—	—	IOC	Y	—	—
RC3	7	6	AN7	—	—	—	C1IN3- C2IN3-	—	—	T5G ⁽¹⁾	—	—	—	CLCIN0 ⁽¹⁾	—	—	SS ⁽¹⁾	IOC	Y	—	—
RC4	6	5	—	—	—	—	—	—	RG1R ⁽¹⁾	T3G ⁽¹⁾	—	—	—	CLCIN1 ⁽¹⁾	—	CK ⁽¹⁾	—	IOC	Y	Y	—
RC5	5	4	—	—	—	—	—	—	RG1F ⁽¹⁾	T3CKI ⁽¹⁾	—	CCP1 ⁽¹⁾	—	—	—	RX ^(1,3)	—	IOC	Y	Y	—
V _{DD}	1	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	V _{DD}
V _{SS}	14	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	V _{SS}
OUT ⁽²⁾	—	—	—	—	—	—	C1OUT	—	—	—	PWM3OUT	CCP1	COG1A	CLC1OUT	DSM1OUT	DT ⁽³⁾	SDO	INT	—	—	—
	—	—	—	—	—	—	C2OUT	—	—	—	—	—	COG1B	CLC2OUT	—	TX	SDA ⁽³⁾	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	COG1C	CLC3OUT	—	CK	SCK ⁽³⁾	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	COG1D	—	—	—	SCL	—	—	—	—

- Note**
- 1: Default peripheral input. Input can be moved to any other pin with the PPS input selection register.
 - 2: All pin outputs default to PORT latch data. Any pin can be selected as a digital peripheral output with the PPS output selection registers.
 - 3: These peripheral functions are bidirectional. The output pin selections must be the same as the input pin selections.

TABLE 4: 20-PIN ALLOCATION TABLE (PIC16(L)F1768 AND PIC16(L)F1769)

I/O	20-Pin PDIP/SOIC/SSOP	20-Pin QFN	ADC	Reference	DAC	Op Amp	Comparator	Zero Cross	Ramp Generator	Timers	PWM	CCP	COG	CLC	DSM	EUSART	MSSP	Interrupts	Pull-ups	Hi Current	Basic
RA0	19	16	AN0	VREF- DAC1REF- DAC2REF- DAC3REF- DAC4REF-	DAC1OUT1 DAC2OUT1 DAC3OUT1 DAC4OUT1	—	C1IN0+ C3IN0+	—	—	—	—	—	—	—	—	—	—	IO	Y	—	ICSPDAT
RA1	18	15	AN1	VREF+ DAC1REF+ DAC2REF+ DAC3REF+ DAC4REF+	—	—	C1IN0- C2IN0- C3IN0- C4IN0-	—	—	—	—	—	—	—	—	—	—	IO	Y	—	ICSPCLK
RA2	17	14	AN2	—	—	—	—	ZCD	—	T0CKI ⁽¹⁾	—	—	COG1IN ⁽¹⁾ COG2IN ⁽¹⁾	—	—	—	—	INT ⁽¹⁾ IO	Y	—	—
RA3	4	1	—	—	—	—	—	—	—	T6CKI ⁽¹⁾	—	—	—	—	DSM1CH ⁽¹⁾ DSM2CH ⁽¹⁾	—	—	IO	Y	—	VPP MCLR ICD
RA4	3	20	AN3	—	—	—	—	—	—	T1G ⁽¹⁾ SOSCO	—	—	—	—	DSM1CL ⁽¹⁾ DSM2CL ⁽¹⁾	—	—	IO	Y	—	OSC2 CLKOUT
RA5	2	19	—	—	—	—	—	—	—	T1CKI ⁽¹⁾ T2CKI ⁽¹⁾ SOSCI	—	—	—	CLCIN3 ⁽¹⁾	DSM1MOD ⁽¹⁾ DSM2MOD ⁽¹⁾	—	—	IO	Y	—	OSC1 CLKIN
RB4	13	10	AN10	—	—	OPA1IN0-	—	—	—	—	—	—	—	—	—	—	SDI ⁽¹⁾ SDA ^(1,3)	IO	Y	—	—
RB5	12	9	AN11	—	—	OPA1IN0+	—	—	—	—	—	—	—	—	—	RX ^(1,3)	—	IO	Y	—	—
RB6	11	8	—	—	—	—	C1IN1+ C3IN1+	—	—	—	—	—	—	—	—	—	SCL ⁽¹⁾ SCK ^(1,3)	IO	Y	—	—
RB7	10	7	—	—	—	—	C2IN1- C4IN1+	—	—	—	—	—	—	—	—	CK ⁽¹⁾	—	IO	Y	—	—
RC0	16	13	AN4	—	—	—	C2IN0- C4IN0+	—	—	T5CKI ⁽¹⁾	—	—	—	—	—	—	—	IO	Y	—	—
RC1	15	12	AN5	—	—	—	C1IN1- C2IN1- C3IN1- C4IN1-	—	—	T4CKI ⁽¹⁾	—	—	—	CLCIN2 ⁽¹⁾	—	—	—	IO	Y	—	—
RC2	14	11	AN6	—	—	OPA1OUT OPA2IN1- OPA2IN1+	C1IN2- C2IN2-	—	RG1IN0 RG2IN1	—	—	—	—	—	—	—	—	IO	Y	—	—

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RC3	7	4	AN7	—	—	OPA2OUT OPA1IN1- OPA1IN1+	C1IN3- C2IN3- C3IN3- C4IN3-	—	RG2IN0 RG1IN1	T5G ⁽¹⁾	—	CCP2 ⁽¹⁾	—	CLCIN0 ⁽¹⁾	—	—	—	IOC	Y	—	—	
RC4	6	3	—	—	—	—	—	—	RG1R ⁽¹⁾ RG2R ⁽¹⁾	T3G ⁽¹⁾	—	—	—	CLCIN1 ⁽¹⁾	—	—	—	IOC	Y	Y	—	
RC5	5	2	—	—	—	—	—	—	RG1F ⁽¹⁾ RG2F ⁽¹⁾	T3CKI ⁽¹⁾	—	CCP1 ⁽¹⁾	—	—	—	—	—	IOC	Y	Y	—	
RC6	8	5	AN8	—	—	OPA2IN0-	—	—	—	—	—	—	—	—	—	—	SS ⁽¹⁾	IOC	Y	—	—	
RC7	9	6	AN9	—	—	OPA2IN0+	—	—	—	—	—	—	—	—	—	—	—	IOC	Y	—	—	
VDD	1	18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
VSS	20	17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
OUT ⁽²⁾	—	—	—	—	—	—	C1OUT	—	—	—	PWM3OUT	CCP1	COG1A	CLC1OUT	DSM1OUT	DT ⁽³⁾	SDO	—	—	—	—	
	—	—	—	—	—	—	C2OUT	—	—	—	PWM4OUT	CCP2	COG1B	CLC2OUT	DSM2OUT	TX	SDA ⁽³⁾	—	—	—	—	
	—	—	—	—	—	—	C3OUT	—	—	—	PWM5OUT	—	COG1C	CLC3OUT	—	CK	SCK ⁽³⁾	—	—	—	—	
	—	—	—	—	—	—	C4OUT	—	—	—	PWM6OUT	—	COG1D	—	—	—	SCL	—	—	—	—	
	—	—	—	—	—	—	—	—	—	—	—	—	COG2A	—	—	—	—	—	—	—	—	
	—	—	—	—	—	—	—	—	—	—	—	—	COG2B	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	COG2C	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	COG2D	—	—	—	—	—	—	—	—	—

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Fax: 91-80-3090-4123

India - New Delhi
Tel: 91-11-4160-8631
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India - Pune
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Japan - Osaka
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Japan - Tokyo
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Fax: 81-3-6880-3771

Korea - Daegu
Tel: 82-53-744-4301
Fax: 82-53-744-4302

Korea - Seoul
Tel: 82-2-554-7200
Fax: 82-2-558-5932 or
82-2-558-5934

Malaysia - Kuala Lumpur
Tel: 60-3-6201-9857
Fax: 60-3-6201-9859

Malaysia - Penang
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Philippines - Manila
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Fax: 63-2-634-9069

Singapore
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Taiwan - Hsin Chu
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Taiwan - Kaohsiung
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Taiwan - Taipei
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