



# PIC16F684

## 14-Pin Flash-Based, 8-Bit CMOS Microcontrollers with nanoWatt Technology

### High-Performance RISC CPU:

- Only 35 instructions to learn:
  - All single-cycle instructions except branches
- Operating speed:
  - DC – 20 MHz oscillator/clock input
  - DC – 200 ns instruction cycle
- Interrupt capability
- 8-level deep hardware stack
- Direct, Indirect and Relative Addressing modes

### Special Microcontroller Features:

- Precision Internal Oscillator:
  - Factory calibrated to  $\pm 1\%$
  - Software selectable frequency range of 8 MHz to 31 kHz
  - Software tunable
  - Two-speed Start-up mode
  - Crystal fail detect for critical applications
  - Clock mode switching during operation for power savings
- Power-saving Sleep mode
- Wide operating voltage range (2.0V-5.5V)
- Industrial and Extended Temperature range
- Power-on Reset (POR)
- Power-up Timer (PWRT) and Oscillator Start-up Timer (OST)
- Brown-out Detect (BOD) with software control option
- Enhanced low-current Watchdog Timer (WDT) with on-chip oscillator (software selectable nominal 268 seconds with full prescaler) with software enable
- Multiplexed Master Clear with pull-up/input pin
- Programmable code protection
- High Endurance Flash/EEPROM cell:
  - 100,000 write Flash endurance
  - 1,000,000 write EEPROM endurance
  - Flash/Data EEPROM retention: > 40 years

### Low-Power Features:

- Standby Current:
  - 1 nA @ 2.0V, typical
- Operating Current:
  - 8.5  $\mu$ A @ 32 kHz, 2.0V, typical
  - 100  $\mu$ A @ 1 MHz, 2.0V, typical
- Watchdog Timer Current:
  - 1  $\mu$ A @ 2.0V, typical

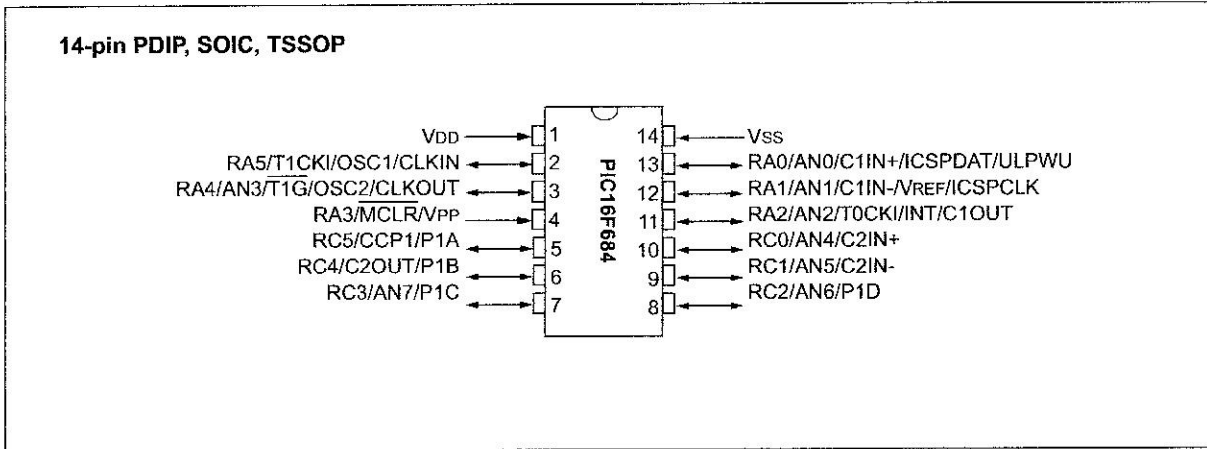
### Peripheral Features:

- 12 I/O pins with individual direction control:
  - High current source/sink for direct LED drive
  - Interrupt-on-pin change
  - Individually programmable weak pull-ups
  - Ultra Low-power Wake-up (ULPWU)
- Analog comparator module with:
  - Two analog comparators
  - Programmable on-chip voltage reference (CVREF) module (% of VDD)
  - Comparator inputs and outputs externally accessible
- A/D Converter:
  - 10-bit resolution and 8 channels
- Timer0: 8-bit timer/counter with 8-bit programmable prescaler
- Enhanced Timer1:
  - 16-bit timer/counter with prescaler
  - External Gate Input mode
  - Option to use OSC1 and OSC2 in LP mode as Timer1 oscillator if INTOSC mode selected
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- Enhanced Capture, Compare, PWM module:
  - 16-bit Capture, max resolution 12.5 ns
  - Compare, max resolution 200 ns
  - 10-bit PWM with 1, 2 or 4 output channels, programmable "dead time", max frequency 20 kHz
- In-Circuit Serial Programming™ (ICSP™) via two pins

Device	Program Memory	Data Memory		I/O	10-bit A/D (ch)	Comparators	Timers 8/16-bit
	Flash (words)	SRAM (bytes)	EEPROM (bytes)				
PIC16F684	2048	128	256	12	8	2	2/1

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## Pin Diagram



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**TABLE 1-1: PIC16F684 PINOUT DESCRIPTION**

Name	Function	Input Type	Output Type	Description
RA0/AN0/C1IN+/ICSPDAT/ULPWU	RA0	TTL	CMOS	PORTA I/O w/programmable pull-up and interrupt-on-change
	AN0	AN	—	A/D Channel 0 input
	C1IN+	AN	—	Comparator 1 input
	ICSPDAT	TTL	CMOS	Serial Programming Data I/O
	ULPWU	AN	—	Ultra Low-power Wake-up input
RA1/AN1/C1IN-/VREF/ICSPCLK	RA1	TTL	CMOS	PORTA I/O w/programmable pull-up and interrupt-on-change
	AN1	AN	—	A/D Channel 1 input
	C1IN-	AN	—	Comparator 1 input
	VREF	AN	—	External Voltage Reference for A/D
	ICSPCLK	ST	—	Serial Programming Clock
RA2/AN2/T0CKI/INT/C1OUT	RA2	ST	CMOS	PORTA I/O w/programmable pull-up and interrupt-on-change
	AN2	AN	—	A/D Channel 2 input
	T0CKI	ST	—	Timer0 clock input
	INT	ST	—	External Interrupt
	C1OUT	—	CMOS	Comparator 1 output
RA3/MCLR/VPP	RA3	TTL	—	PORTA input with interrupt-on-change
	MCLR	ST	—	Master Clear w/internal pull-up
	VPP	HV	—	Programming voltage
RA4/AN3/T1G/OSC2/CLKOUT	RA4	TTL	CMOS	PORTA I/O w/programmable pull-up and interrupt-on-change
	AN3	AN	—	A/D Channel 3 input
	T1G	ST	—	Timer1 gate
	OSC2	—	XTAL	Crystal/Resonator
	CLKOUT	—	CMOS	Fosc/4 output
RA5/T1CKI/OSC1/CLKIN	RA5	TTL	CMOS	PORTA I/O w/programmable pull-up and interrupt-on-change
	T1CKI	ST	—	Timer1 clock
	OSC1	XTAL	—	Crystal/Resonator
	CLKIN	ST	—	External clock input/RC oscillator connection
RC0/AN4/C2IN+	RC0	TTL	CMOS	PORTC I/O
	AN4	AN	—	A/D Channel 4 input
	C2IN+	AN	—	Comparator 2 input
RC1/AN5/C2IN-	RC1	TTL	CMOS	PORTC I/O
	AN5	AN	—	A/D Channel 5 input
	C2IN-	AN	—	Comparator 2 input
RC2/AN6/P1D	RC2	TTL	CMOS	PORTC I/O
	AN6	AN	—	A/D Channel 6 input
	P1D	—	CMOS	PWM output
RC3/AN7/P1C	RC3	TTL	CMOS	PORTC I/O
	AN7	AN	—	A/D Channel 7 input
	P1C	—	CMOS	PWM output
RC4/C2OUT/P1B	RC4	TTL	CMOS	PORTC I/O
	C2OUT	—	CMOS	Comparator 2 output
	P1B	—	CMOS	PWM output
RC5/CCP1/P1A	RC5	TTL	CMOS	PORTC I/O
	CCP1	ST	CMOS	Capture input/Compare output
	P1A	—	CMOS	PWM output
Vss	Vss	Power	—	Ground reference
VDD	VDD	Power	—	Positive supply

**Legend:** TTL = TTL input buffer, ST = Schmitt Trigger input buffer, AN = Analog input