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PIC16F913/914/916/917/946

Data Sheet

28/40/44/64-Pin Flash-Based,
8-Bit CMOS Microcontrollers with
LCD Driver and nanoWatt Technology

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MICROCHIP

PIC16F913/914/916/917/946

28/40/44/64-Pin Flash-Based, 8-Bit CMOS Microcontrollers with LCD Driver and 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
- Program Memory Read (PMR) capability
- Interrupt capability
- 8-level deep hardware stack
- Direct, Indirect and Relative Addressing modes

Special Microcontroller Features:

- Precision Internal Oscillator:
 - Factory calibrated to $\pm 1\%$, typical
 - Software selectable frequency range of 8 MHz to 125 kHz
 - Software tunable
 - Two-Speed Start-up mode
 - External Oscillator fail detect for critical applications
 - Clock mode switching during operation for power savings
- Software selectable 31 kHz internal oscillator
- 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 Reset (BOR) 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:
 - <100 nA @ 2.0V, typical
- Operating Current:
 - 11 μ A @ 32 kHz, 2.0V, typical
 - 220 μ A @ 4 MHz, 2.0V, typical
- Watchdog Timer Current:
 - 1 μ A @ 2.0V, typical

Peripheral Features:

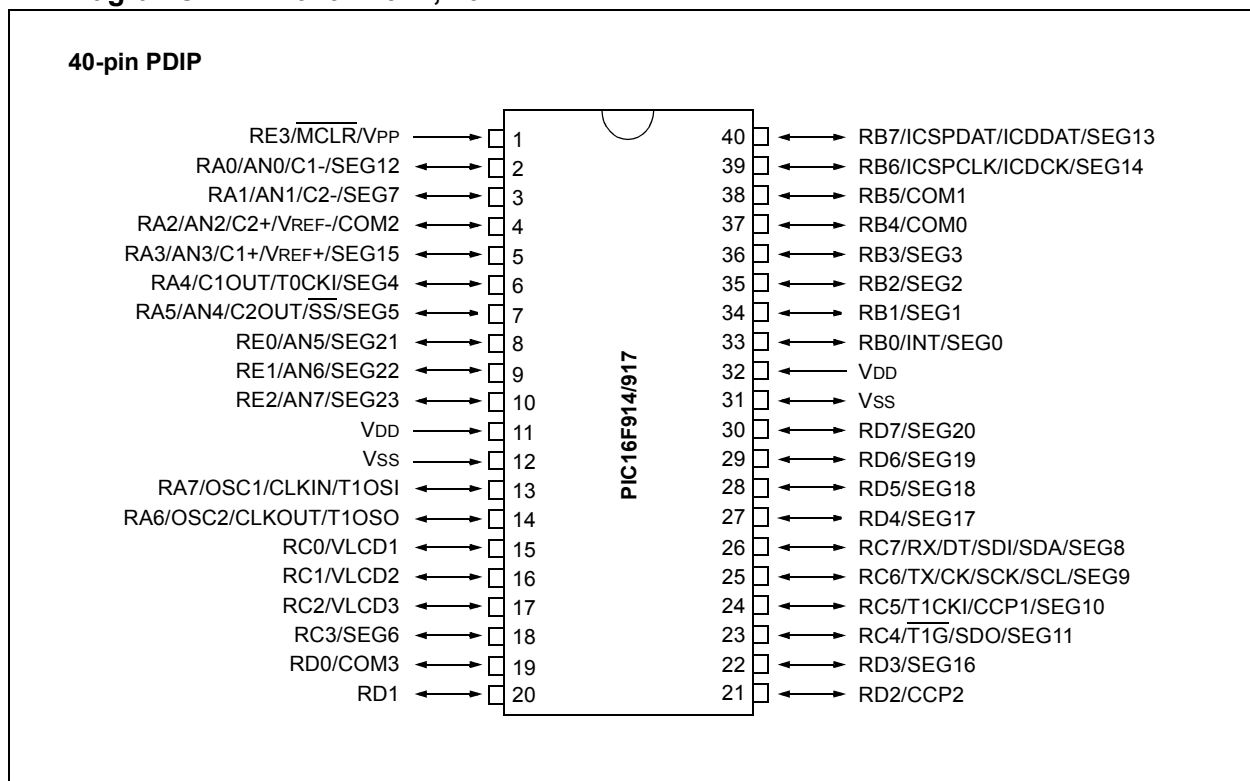
- Liquid Crystal Display module:
 - Up to 60/96/168 pixel drive capability on 28/40/64-pin devices, respectively
 - Four commons
- Up to 24/35/53 I/O pins and 1 input-only pin:
 - High-current source/sink for direct LED drive
 - Interrupt-on-change pin
 - Individually programmable weak pull-ups
- In-Circuit Serial Programming™ (ICSP™) via two pins
- 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 up to 8 channels
- Timer0: 8-bit timer/counter with 8-bit programmable prescaler
- Enhanced Timer1:
 - 16-bit timer/counter with prescaler
 - External Timer1 Gate (count enable)
 - Option to use OSC1 and OSC2 as Timer1 oscillator if INTOSCIO or LP mode is selected
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- Addressable Universal Synchronous Asynchronous Receiver Transmitter (AUSART)
- Up to 2 Capture, Compare, PWM modules:
 - 16-bit Capture, max. resolution 12.5 ns
 - 16-bit Compare, max. resolution 200 ns
 - 10-bit PWM, max. frequency 20 kHz
- Synchronous Serial Port (SSP) with I²C™

PIC16F913/914/916/917/946

Device	Program Memory	Data Memory		I/O	10-bit A/D (ch)	LCD (segment drivers)	CCP	Timers 8/16-bit
	Flash (words/bytes)	SRAM (bytes)	EEPROM (bytes)					
PIC16F913	4K/7K	256	256	24	5	16 ⁽¹⁾	1	2/1
PIC16F914	4K/7K	256	256	35	8	24	2	2/1
PIC16F916	8K/14K	352	256	24	5	16 ⁽¹⁾	1	2/1
PIC16F917	8K/14K	352	256	35	8	24	2	2/1
PIC16F946	8K/14K	336	256	53	8	42	2	2/1

Note 1: COM3 and SEG15 share the same physical pin on the PIC16F913/916, therefore SEG15 is not available when using 1/4 multiplex displays.

Pin Diagrams – PIC16F914/917, 40-Pin



PIC16F913/914/916/917/946

TABLE 1: PIC16F914/917 40-PIN SUMMARY

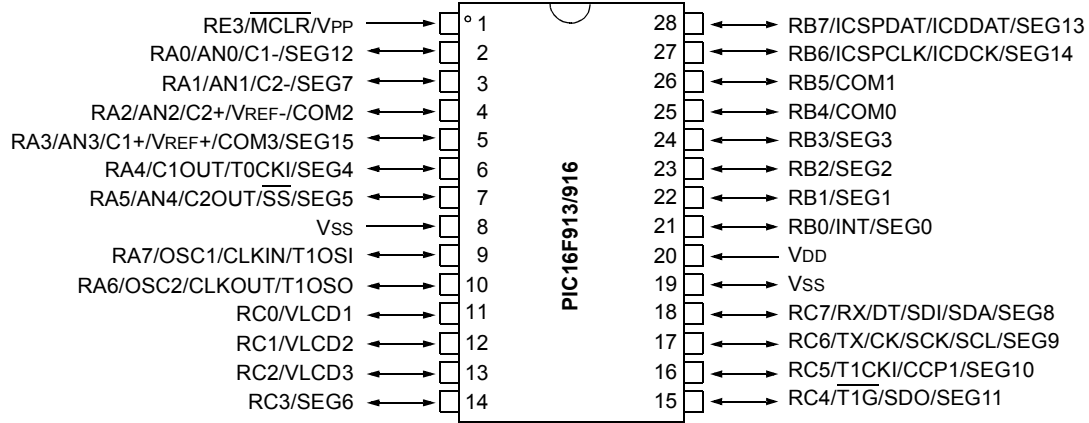
I/O	Pin	A/D	LCD	Comparators	Timers	CCP	AUSART	SSP	Interrupt	Pull-Up	Basic
RA0	2	AN0	SEG12	C1-	—	—	—	—	—	—	—
RA1	3	AN1	SEG7	C2-	—	—	—	—	—	—	—
RA2	4	AN2/VREF-	COM2	C2+	—	—	—	—	—	—	—
RA3	5	AN3/VREF+	SEG15	C1+	—	—	—	—	—	—	—
RA4	6	—	SEG4	C1OUT	T0CKI	—	—	—	—	—	—
RA5	7	AN4	SEG5	C2OUT	—	—	—	SS	—	—	—
RA6	14	—	—	—	T1OSO	—	—	—	—	—	OSC2/CLKOUT
RA7	13	—	—	—	T1OSI	—	—	—	—	—	OSC1/CLKIN
RB0	33	—	SEG0	—	—	—	—	—	INT	Y	—
RB1	34	—	SEG1	—	—	—	—	—	—	Y	—
RB2	35	—	SEG2	—	—	—	—	—	—	Y	—
RB3	36	—	SEG3	—	—	—	—	—	—	Y	—
RB4	37	—	COM0	—	—	—	—	—	IOC	Y	—
RB5	38	—	COM1	—	—	—	—	—	IOC	Y	—
RB6	39	—	SEG14	—	—	—	—	—	IOC	Y	ICSPCLK/ICDCK
RB7	40	—	SEG13	—	—	—	—	—	IOC	Y	ICSPDAT/ICDDAT
RC0	15	—	VLCD1	—	—	—	—	—	—	—	—
RC1	16	—	VLCD2	—	—	—	—	—	—	—	—
RC2	17	—	VLCD3	—	—	—	—	—	—	—	—
RC3	18	—	SEG6	—	—	—	—	—	—	—	—
RC4	23	—	SEG11	—	T1G	—	—	SDO	—	—	—
RC5	24	—	SEG10	—	T1CKI	CCP1	—	—	—	—	—
RC6	25	—	SEG9	—	—	—	TX/CK	SCK/SCL	—	—	—
RC7	26	—	SEG8	—	—	—	RX/DT	SDI/SDA	—	—	—
RD0	19	—	COM3	—	—	—	—	—	—	—	—
RD1	20	—	—	—	—	—	—	—	—	—	—
RD2	21	—	—	—	—	CCP2	—	—	—	—	—
RD3	22	—	SEG16	—	—	—	—	—	—	—	—
RD4	27	—	SEG17	—	—	—	—	—	—	—	—
RD5	28	—	SEG18	—	—	—	—	—	—	—	—
RD6	29	—	SEG19	—	—	—	—	—	—	—	—
RD7	30	—	SEG20	—	—	—	—	—	—	—	—
RE0	8	AN5	SEG21	—	—	—	—	—	—	—	—
RE1	9	AN6	SEG22	—	—	—	—	—	—	—	—
RE2	10	AN7	SEG23	—	—	—	—	—	—	—	—
RE3	1	—	—	—	—	—	—	—	—	Y ⁽¹⁾	MCLR/VPP
—	11	—	—	—	—	—	—	—	—	—	VDD
—	32	—	—	—	—	—	—	—	—	—	VDD
—	12	—	—	—	—	—	—	—	—	—	VSS
—	31	—	—	—	—	—	—	—	—	—	VSS

Note 1: Pull-up enabled only with external MCLR configuration.

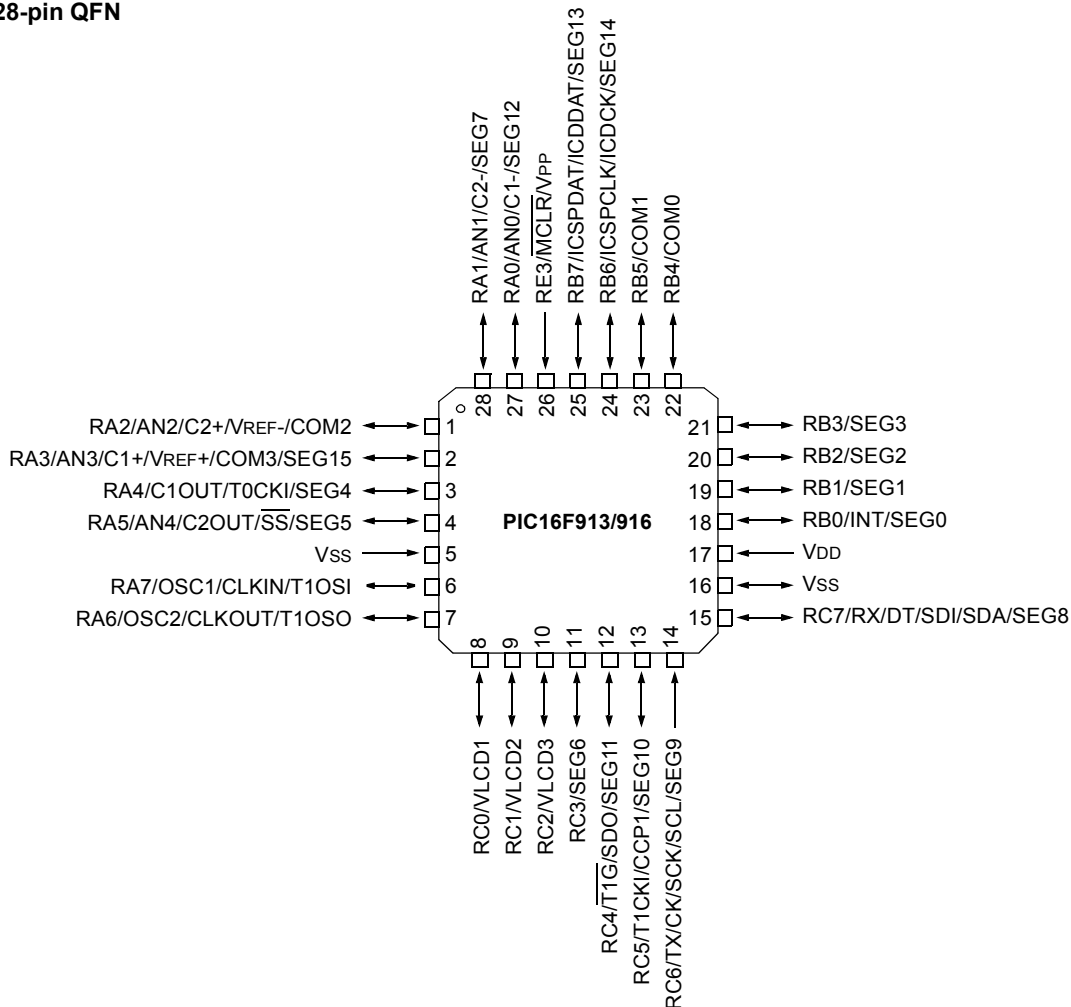
PIC16F913/914/916/917/946

Pin Diagrams – PIC16F913/916, 28-Pin

28-pin PDIP, SOIC, SSOP



28-pin QFN



PIC16F913/914/916/917/946

TABLE 2: PIC16F913/916 28-PIN (PDIP, SOIC, SSOP) SUMMARY

I/O	Pin	A/D	LCD	Comparators	Timers	CCP	AUSART	SSP	Interrupt	Pull-Up	Basic
RA0	2	AN0	SEG12	C1-	—	—	—	—	—	—	—
RA1	3	AN1	SEG7	C2-	—	—	—	—	—	—	—
RA2	4	AN2/VREF-	COM2	C2+	—	—	—	—	—	—	—
RA3	5	AN3/VREF+	SEG15/ COM3	C1+	—	—	—	—	—	—	—
RA4	6	—	SEG4	C1OUT	T0CKI	—	—	—	—	—	—
RA5	7	—	SEG5	C2OUT	—	—	—	SS	—	—	—
RA6	10	—	—	—	T1OSO	—	—	—	—	—	OSC2/CLKOUT
RA7	9	—	—	—	T1OSI	—	—	—	—	—	OSC1/CLKIN
RB0	21	—	SEG0	—	—	—	—	—	INT	Y	—
RB1	22	—	SEG1	—	—	—	—	—	—	Y	—
RB2	23	—	SEG2	—	—	—	—	—	—	Y	—
RB3	24	—	SEG3	—	—	—	—	—	—	Y	—
RB4	25	—	COM0	—	—	—	—	—	IOC	Y	—
RB5	26	—	COM1	—	—	—	—	—	IOC	Y	—
RB6	27	—	SEG14	—	—	—	—	—	IOC	Y	ICSPCLK/ICDCK
RB7	28	—	SEG13	—	—	—	—	—	IOC	Y	ICSPDAT/ICDDAT
RC0	11	—	VLCD1	—	—	—	—	—	—	—	—
RC1	12	—	VLCD2	—	—	—	—	—	—	—	—
RC2	13	—	VLCD3	—	—	—	—	—	—	—	—
RC3	14	—	SEG6	—	—	—	—	—	—	—	—
RC4	15	—	SEG11	—	T1G	—	—	SDO	—	—	—
RC5	16	—	SEG10	—	T1CKI	CCP1	—	—	—	—	—
RC6	17	—	SEG9	—	—	—	TX/CK	SCK/SCL	—	—	—
RC7	18	—	SEG8	—	—	—	RX/DT	SDI/SDA	—	—	—
RE3	1	—	—	—	—	—	—	—	—	Y ⁽¹⁾	MCLR/VPP
—	20	—	—	—	—	—	—	—	—	—	VDD
—	8	—	—	—	—	—	—	—	—	—	VSS
—	19	—	—	—	—	—	—	—	—	—	VSS

Note 1: Pull-up enabled only with external MCLR configuration.

PIC16F913/914/916/917/946

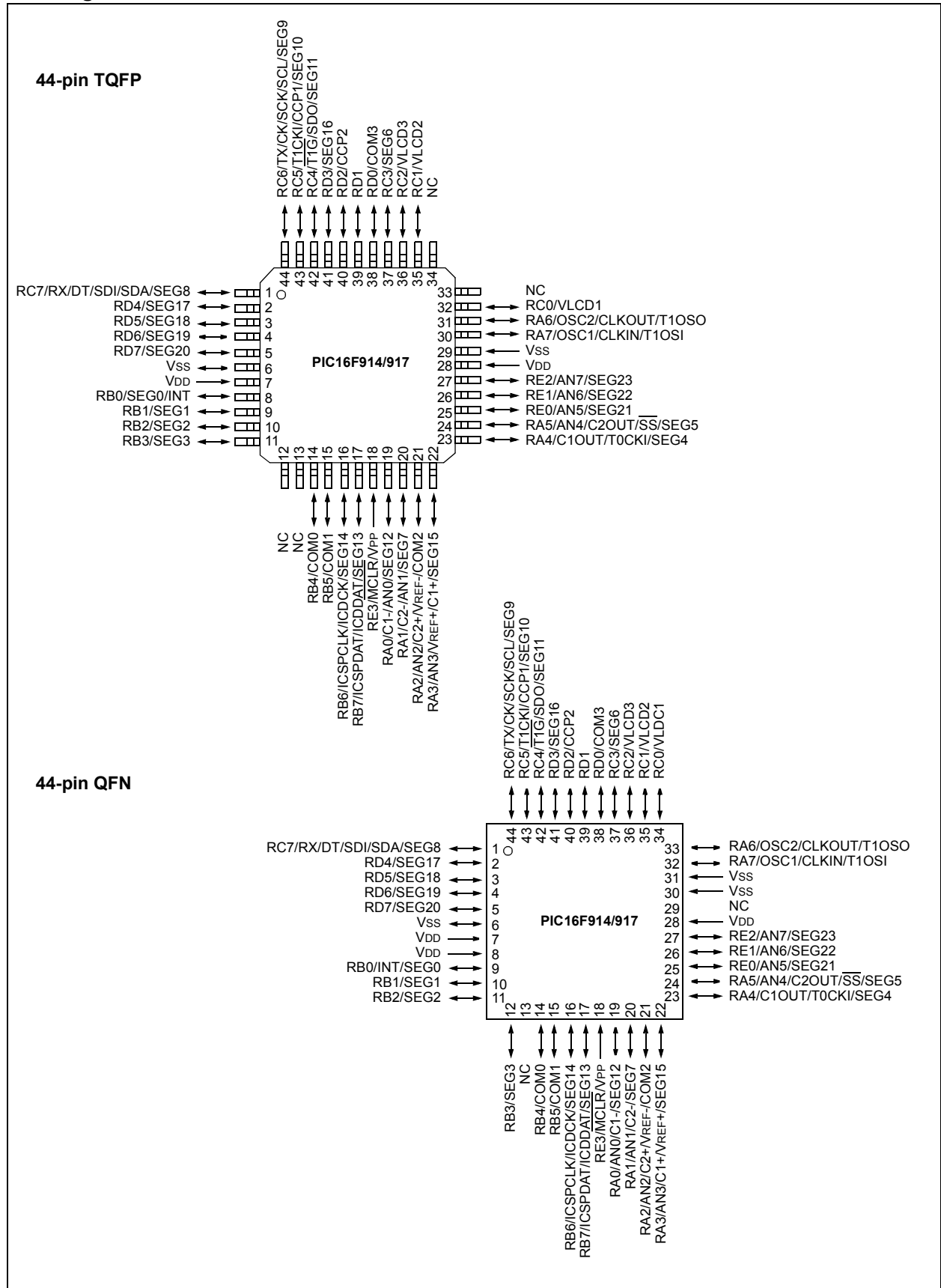
TABLE 3: PIC16F913/916 28-PIN (QFN) SUMMARY

I/O	Pin	A/D	LCD	Comparators	Timers	CCP	AUSART	SSP	Interrupt	Pull-Up	Basic
RA0	27	AN0	SEG12	C1-	—	—	—	—	—	—	—
RA1	28	AN1	SEG7	C2-	—	—	—	—	—	—	—
RA2	1	AN2/VREF-	COM2	C2+	—	—	—	—	—	—	—
RA3	2	AN3/VREF+	SEG15/ COM3	C1+	—	—	—	—	—	—	—
RA4	3	—	SEG4	C1OUT	T0CKI	—	—	—	—	—	—
RA5	4	AN4	SEG5	C2OUT	—	—	—	SS	—	—	—
RA6	7	—	—	—	T1OSO	—	—	—	—	—	OSC2/CLKOUT
RA7	6	—	—	—	T1OSI	—	—	—	—	—	OSC1/CLKIN
RB0	18	—	SEG0	—	—	—	—	—	INT	Y	—
RB1	19	—	SEG1	—	—	—	—	—	—	Y	—
RB2	20	—	SEG2	—	—	—	—	—	—	Y	—
RB3	21	—	SEG3	—	—	—	—	—	—	Y	—
RB4	22	—	COM0	—	—	—	—	—	IOC	Y	—
RB5	23	—	COM1	—	—	—	—	—	IOC	Y	—
RB6	24	—	SEG14	—	—	—	—	—	IOC	Y	ICSPCLK/ICDCK
RB7	25	—	SEG13	—	—	—	—	—	IOC	Y	ICSPDAT/ICDDAT
RC0	8	—	VLCD1	—	—	—	—	—	—	—	—
RC1	9	—	VLCD2	—	—	—	—	—	—	—	—
RC2	10	—	VLCD3	—	—	—	—	—	—	—	—
RC3	11	—	SEG6	—	—	—	—	—	—	—	—
RC4	12	—	SEG11	—	T1G	—	—	SDO	—	—	—
RC5	13	—	SEG10	—	T1CKI	CCP1	—	—	—	—	—
RC6	14	—	SEG9	—	—	—	TX/CK	SCK/SCL	—	—	—
RC7	15	—	SEG8	—	—	—	RX/DT	SDI/SDA	—	—	—
RE3	26	—	—	—	—	—	—	—	—	Y ⁽¹⁾	MCLR/VPP
—	17	—	—	—	—	—	—	—	—	—	VDD
—	5	—	—	—	—	—	—	—	—	—	VSS
—	16	—	—	—	—	—	—	—	—	—	VSS

Note 1: Pull-up enabled only with external MCLR configuration.

PIC16F913/914/916/917/946

Pin Diagrams – PIC16F914/917, 44-Pin



PIC16F913/914/916/917/946

TABLE 4: PIC16F914/917 44-PIN (TQFP) SUMMARY

I/O	Pin	A/D	LCD	Comparators	Timers	CCP	AUSART	SSP	Interrupt	Pull-Up	Basic
RA0	19	AN0	SEG12	C1-	—	—	—	—	—	—	—
RA1	20	AN1	SEG7	C2-	—	—	—	—	—	—	—
RA2	21	AN2/VREF-	COM2	C2+	—	—	—	—	—	—	—
RA3	22	AN3/VREF+	SEG15	C1+	—	—	—	—	—	—	—
RA4	23	—	SEG4	C1OUT	T0CKI	—	—	—	—	—	—
RA5	24	AN4	SEG5	C2OUT	—	—	—	SS	—	—	—
RA6	31	—	—	—	T1OSO	—	—	—	—	—	OSC2/CLKOUT
RA7	30	—	—	—	T1OSI	—	—	—	—	—	OSC1/CLKIN
RB0	8	—	SEG0	—	—	—	—	—	INT	Y	—
RB1	9	—	SEG1	—	—	—	—	—	—	Y	—
RB2	10	—	SEG2	—	—	—	—	—	—	Y	—
RB3	11	—	SEG3	—	—	—	—	—	—	Y	—
RB4	14	—	COM0	—	—	—	—	—	IOC	Y	—
RB5	15	—	COM1	—	—	—	—	—	IOC	Y	—
RB6	16	—	SEG14	—	—	—	—	—	IOC	Y	ICSPCLK/ICDCK
RB7	17	—	SEG13	—	—	—	—	—	IOC	Y	ICSPDAT/ICDDAT
RC0	32	—	VLCD1	—	—	—	—	—	—	—	—
RC1	35	—	VLCD2	—	—	—	—	—	—	—	—
RC2	36	—	VLCD3	—	—	—	—	—	—	—	—
RC3	37	—	SEG6	—	—	—	—	—	—	—	—
RC4	42	—	SEG11	—	T1G	—	—	SDO	—	—	—
RC5	43	—	SEG10	—	T1CKI	CCP1	—	—	—	—	—
RC6	44	—	SEG9	—	—	—	TX/CK	SCK/SCL	—	—	—
RC7	1	—	SEG8	—	—	—	RX/DT	SDI/SDA	—	—	—
RD0	38	—	COM3	—	—	—	—	—	—	—	—
RD1	39	—	—	—	—	—	—	—	—	—	—
RD2	40	—	—	—	—	CCP2	—	—	—	—	—
RD3	41	—	SEG16	—	—	—	—	—	—	—	—
RD4	2	—	SEG17	—	—	—	—	—	—	—	—
RD5	3	—	SEG18	—	—	—	—	—	—	—	—
RD6	4	—	SEG19	—	—	—	—	—	—	—	—
RD7	5	—	SEG20	—	—	—	—	—	—	—	—
RE0	25	AN5	SEG21	—	—	—	—	—	—	—	—
RE1	26	AN6	SEG22	—	—	—	—	—	—	—	—
RE2	27	AN7	SEG23	—	—	—	—	—	—	—	—
RE3	18	—	—	—	—	—	—	—	—	Y ⁽¹⁾	MCLR/VPP
—	7	—	—	—	—	—	—	—	—	—	VDD
—	28	—	—	—	—	—	—	—	—	—	VDD
—	6	—	—	—	—	—	—	—	—	—	VSS
—	29	—	—	—	—	—	—	—	—	—	VSS
—	12	—	—	—	—	—	—	—	—	—	NC
—	13	—	—	—	—	—	—	—	—	—	NC
—	33	—	—	—	—	—	—	—	—	—	NC
—	34	—	—	—	—	—	—	—	—	—	NC

Note 1: Pull-up enabled only with external MCLR configuration.

PIC16F913/914/916/917/946

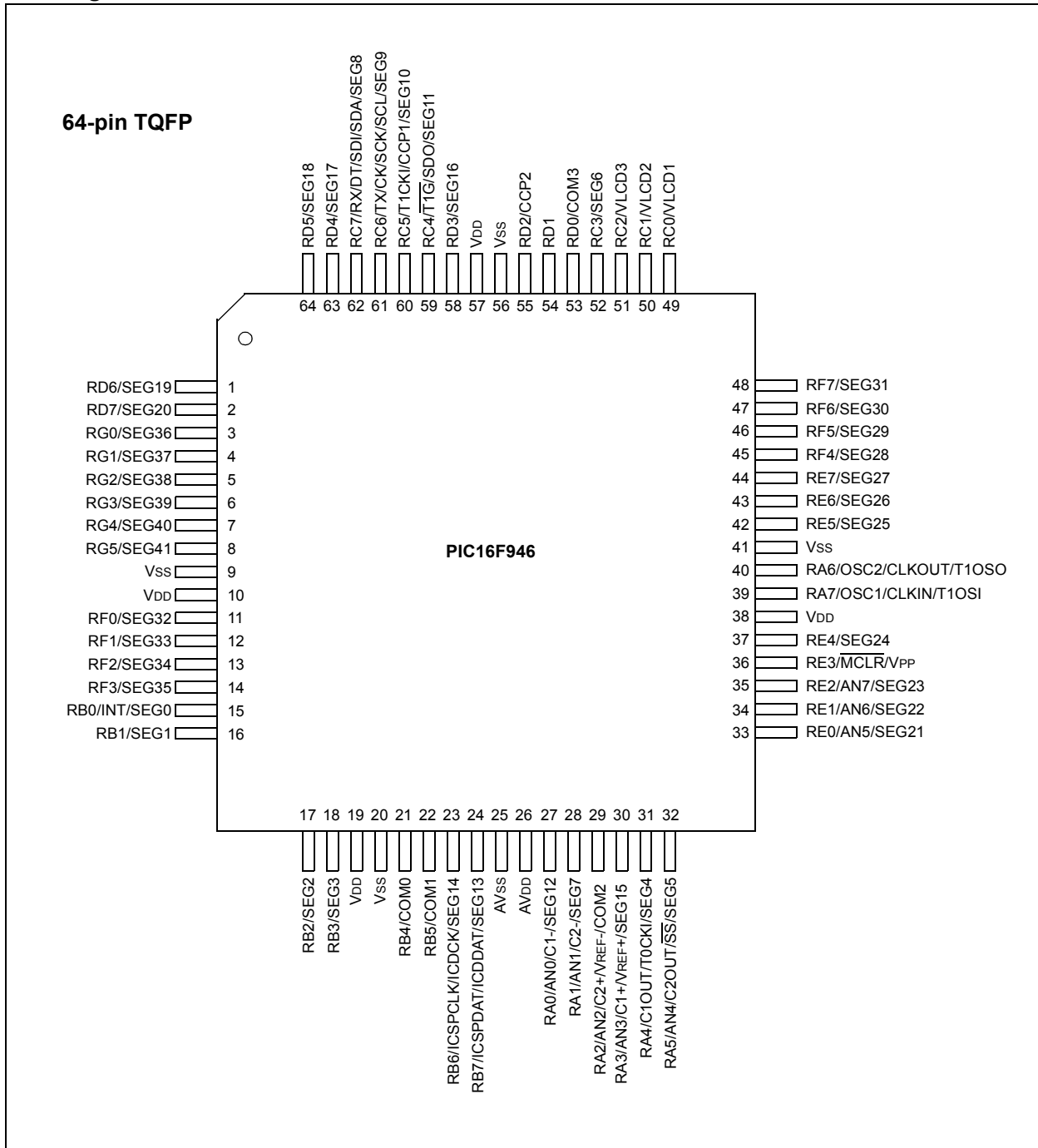
TABLE 5: PIC16F914/917 44-PIN (QFN) SUMMARY

I/O	Pin	A/D	LCD	Comparators	Timers	CCP	AUSART	SSP	Interrupt	Pull-Up	Basic
RA0	19	AN0	SEG12	C1-	—	—	—	—	—	—	—
RA1	20	AN1	SEG7	C2-	—	—	—	—	—	—	—
RA2	21	AN2/VREF-	COM2	C2+	—	—	—	—	—	—	—
RA3	22	AN3/VREF+	SEG15	C1+	—	—	—	—	—	—	—
RA4	23	—	SEG4	C1OUT	T0CKI	—	—	—	—	—	—
RA5	24	AN4	SEG5	C2OUT	—	—	—	SS	—	—	—
RA6	33	—	—	—	T1OSO	—	—	—	—	—	OSC2/CLKOUT
RA7	32	—	—	—	T1OSI	—	—	—	—	—	OSC1/CLKIN
RB0	9	—	SEG0	—	—	—	—	—	INT	Y	—
RB1	10	—	SEG1	—	—	—	—	—	—	Y	—
RB2	11	—	SEG2	—	—	—	—	—	—	Y	—
RB3	12	—	SEG3	—	—	—	—	—	—	Y	—
RB4	14	—	COM0	—	—	—	—	—	IOC	Y	—
RB5	15	—	COM1	—	—	—	—	—	IOC	Y	—
RB6	16	—	SEG14	—	—	—	—	—	IOC	Y	ICSPCLK/ICDCK
RB7	17	—	SEG13	—	—	—	—	—	IOC	Y	ICSPDAT/ICDDAT
RC0	34	—	VLCD1	—	—	—	—	—	—	—	—
RC1	35	—	VLCD2	—	—	—	—	—	—	—	—
RC2	36	—	VLCD3	—	—	—	—	—	—	—	—
RC3	37	—	SEG6	—	—	—	—	—	—	—	—
RC4	42	—	SEG11	—	T1G	—	—	SDO	—	—	—
RC5	43	—	SEG10	—	T1CKI	CCP1	—	—	—	—	—
RC6	44	—	SEG9	—	—	—	TX/CK	SCK/SCL	—	—	—
RC7	1	—	SEG8	—	—	—	RX/DT	SDI/SDA	—	—	—
RD0	38	—	COM3	—	—	—	—	—	—	—	—
RD1	39	—	—	—	—	—	—	—	—	—	—
RD2	40	—	—	—	—	CCP2	—	—	—	—	—
RD3	41	—	SEG16	—	—	—	—	—	—	—	—
RD4	2	—	SEG17	—	—	—	—	—	—	—	—
RD5	3	—	SEG18	—	—	—	—	—	—	—	—
RD6	4	—	SEG19	—	—	—	—	—	—	—	—
RD7	5	—	SEG20	—	—	—	—	—	—	—	—
RE0	25	AN5	SEG21	—	—	—	—	—	—	—	—
RE1	26	AN6	SEG22	—	—	—	—	—	—	—	—
RE2	27	AN7	SEG23	—	—	—	—	—	—	—	—
RE3	18	—	—	—	—	—	—	—	—	Y ⁽¹⁾	MCLR/VPP
—	7	—	—	—	—	—	—	—	—	—	VDD
—	8	—	—	—	—	—	—	—	—	—	VDD
—	28	—	—	—	—	—	—	—	—	—	VDD
—	6	—	—	—	—	—	—	—	—	—	VSS
—	30	—	—	—	—	—	—	—	—	—	VSS
—	13	—	—	—	—	—	—	—	—	—	NC
—	29	—	—	—	—	—	—	—	—	—	NC

Note 1: Pull-up enabled only with external MCLR configuration.

PIC16F913/914/916/917/946

Pin Diagram – PIC16F946



PIC16F913/914/916/917/946

TABLE 6: PIC16F946 64-PIN (TQFP) SUMMARY

I/O	Pin	A/D	LCD	Comparators	Timers	CCP	AUSART	SSP	Interrupt	Pull-Up	Basic
RA0	27	AN0	SEG12	C1-	—	—	—	—	—	—	—
RA1	28	AN1	SEG7	C2-	—	—	—	—	—	—	—
RA2	29	AN2/VREF-	COM2	C2+	—	—	—	—	—	—	—
RA3	30	AN3/VREF+	SEG15	C1+	—	—	—	—	—	—	—
RA4	31	—	SEG4	C1OUT	TOCKI	—	—	—	—	—	—
RA5	32	AN4	—	C2OUT	—	—	—	\overline{SS}	—	—	—
RA6	40	SEG5	—	—	T1OSO	—	—	—	—	—	OSC2/CLKOUT
RA7	39	—	—	—	T1OSI	—	—	—	—	—	OSC1/CLKIN
RB0	15	—	SEG0	—	—	—	—	—	INT	Y	—
RB1	16	—	SEG1	—	—	—	—	—	—	Y	—
RB2	17	—	SEG2	—	—	—	—	—	—	Y	—
RB3	18	—	SEG3	—	—	—	—	—	—	Y	—
RB4	21	—	COM0	—	—	—	—	—	IOC	Y	—
RB5	22	—	COM1	—	—	—	—	—	IOC	Y	—
RB6	23	—	SEG14	—	—	—	—	—	IOC	Y	ICSPCLK/ICDCK
RB7	24	—	SEG13	—	—	—	—	—	IOC	Y	ICSPDAT/ICDDAT
RC0	49	—	VLCD1	—	—	—	—	—	—	—	—
RC1	50	—	VLCD2	—	—	—	—	—	—	—	—
RC2	51	—	VLCD3	—	—	—	—	—	—	—	—
RC3	52	—	SEG6	—	—	—	—	—	—	—	—
RC4	59	—	SEG11	—	$\overline{T1G}$	—	—	SDO	—	—	—
RC5	60	—	SEG10	—	T1CKI	CCP1	—	—	—	—	—
RC6	61	—	SEG9	—	—	—	TX/CK	SCK/SCL	—	—	—
RC7	62	—	SEG8	—	—	—	RX/DT	SDI/SDA	—	—	—
RD0	53	—	COM3	—	—	—	—	—	—	—	—
RD1	54	—	—	—	—	—	—	—	—	—	—
RD2	55	—	—	—	—	CCP2	—	—	—	—	—
RD3	58	—	SEG16	—	—	—	—	—	—	—	—
RD4	63	—	SEG17	—	—	—	—	—	—	—	—
RD5	64	—	SEG18	—	—	—	—	—	—	—	—
RD6	1	—	SEG19	—	—	—	—	—	—	—	—
RD7	2	—	SEG20	—	—	—	—	—	—	—	—
RE0	33	AN5	SEG21	—	—	—	—	—	—	—	—
RE1	34	AN6	SEG22	—	—	—	—	—	—	—	—
RE2	35	AN7	SEG23	—	—	—	—	—	—	—	—
RE3	36	—	—	—	—	—	—	—	—	Y ⁽¹⁾	$\overline{MCLR/VPP}$
RE4	37	—	SEG24	—	—	—	—	—	—	—	—
RE5	42	—	SEG25	—	—	—	—	—	—	—	—
RE6	43	—	SEG26	—	—	—	—	—	—	—	—
RE7	44	—	SEG27	—	—	—	—	—	—	—	—
RF0	11	—	SEG32	—	—	—	—	—	—	—	—
RF1	12	—	SEG33	—	—	—	—	—	—	—	—
RF2	13	—	SEG34	—	—	—	—	—	—	—	—

Note 1: Pull-up enabled only with external \overline{MCLR} configuration.

PIC16F913/914/916/917/946

TABLE 6: PIC16F946 64-PIN (TQFP) SUMMARY (CONTINUED)

I/O	Pin	A/D	LCD	Comparators	Timers	CCP	AUSART	SSP	Interrupt	Pull-Up	Basic
RF3	14	—	SEG35	—	—	—	—	—	—	—	—
RF4	45	—	SEG28	—	—	—	—	—	—	—	—
RF5	46	—	SEG29	—	—	—	—	—	—	—	—
RF6	47	—	SEG30	—	—	—	—	—	—	—	—
RF7	48	—	SEG31	—	—	—	—	—	—	—	—
RG0	3	—	SEG36	—	—	—	—	—	—	—	—
RG1	4	—	SEG37	—	—	—	—	—	—	—	—
RG2	5	—	SEG38	—	—	—	—	—	—	—	—
RG3	6	—	SEG39	—	—	—	—	—	—	—	—
RG4	7	—	SEG40	—	—	—	—	—	—	—	—
RG5	8	—	SEG41	—	—	—	—	—	—	—	—
—	26	—	—	—	—	—	—	—	—	—	AVDD
—	25	—	—	—	—	—	—	—	—	—	AVSS
—	10	—	—	—	—	—	—	—	—	—	VDD
—	19	—	—	—	—	—	—	—	—	—	VDD
—	38	—	—	—	—	—	—	—	—	—	VDD
—	57	—	—	—	—	—	—	—	—	—	VDD
—	9	—	—	—	—	—	—	—	—	—	VSS
—	20	—	—	—	—	—	—	—	—	—	VSS
—	41	—	—	—	—	—	—	—	—	—	VSS
—	56	—	—	—	—	—	—	—	—	—	VSS

Note 1: Pull-up enabled only with external MCLR configuration.

PIC16F913/914/916/917/946

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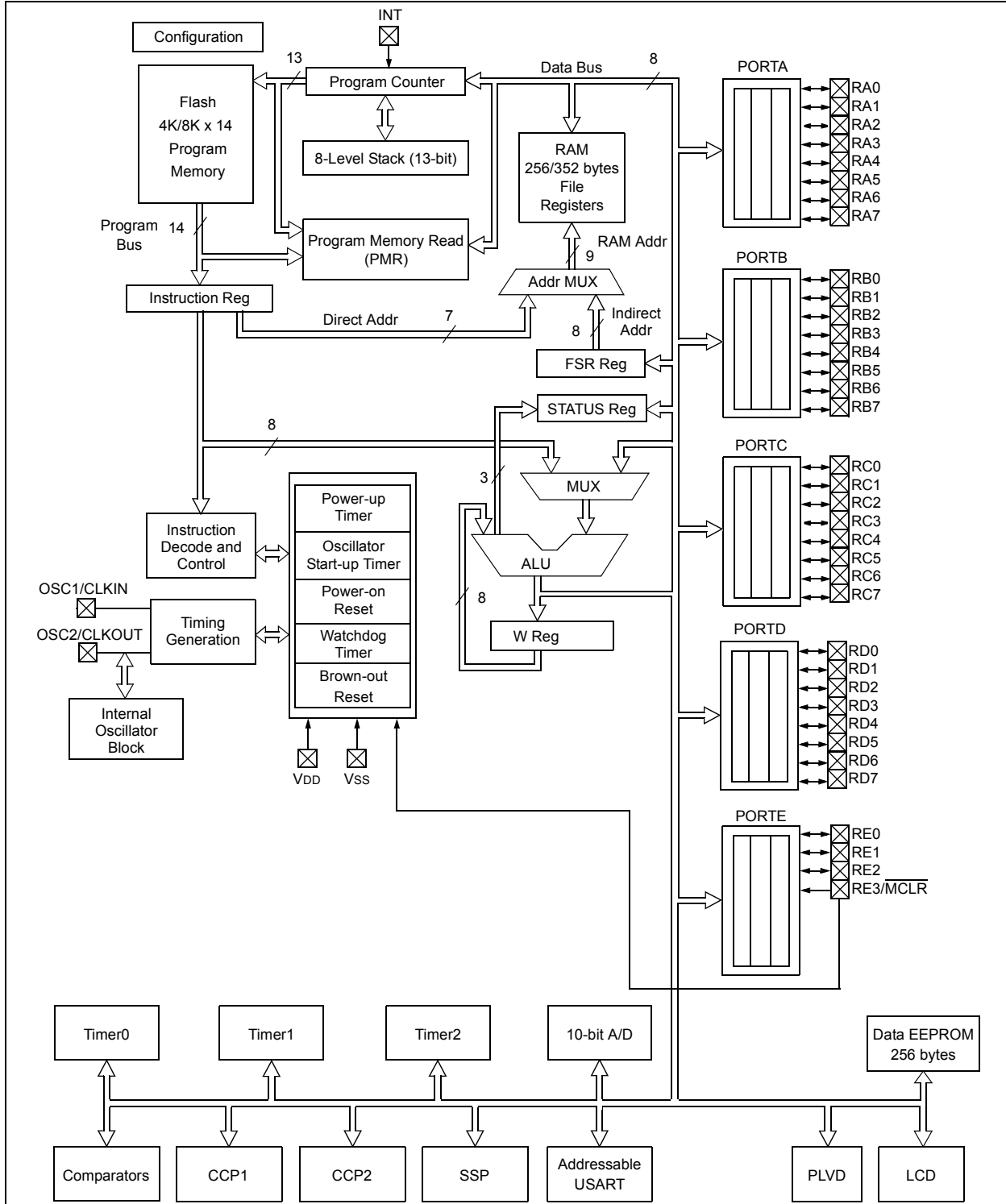
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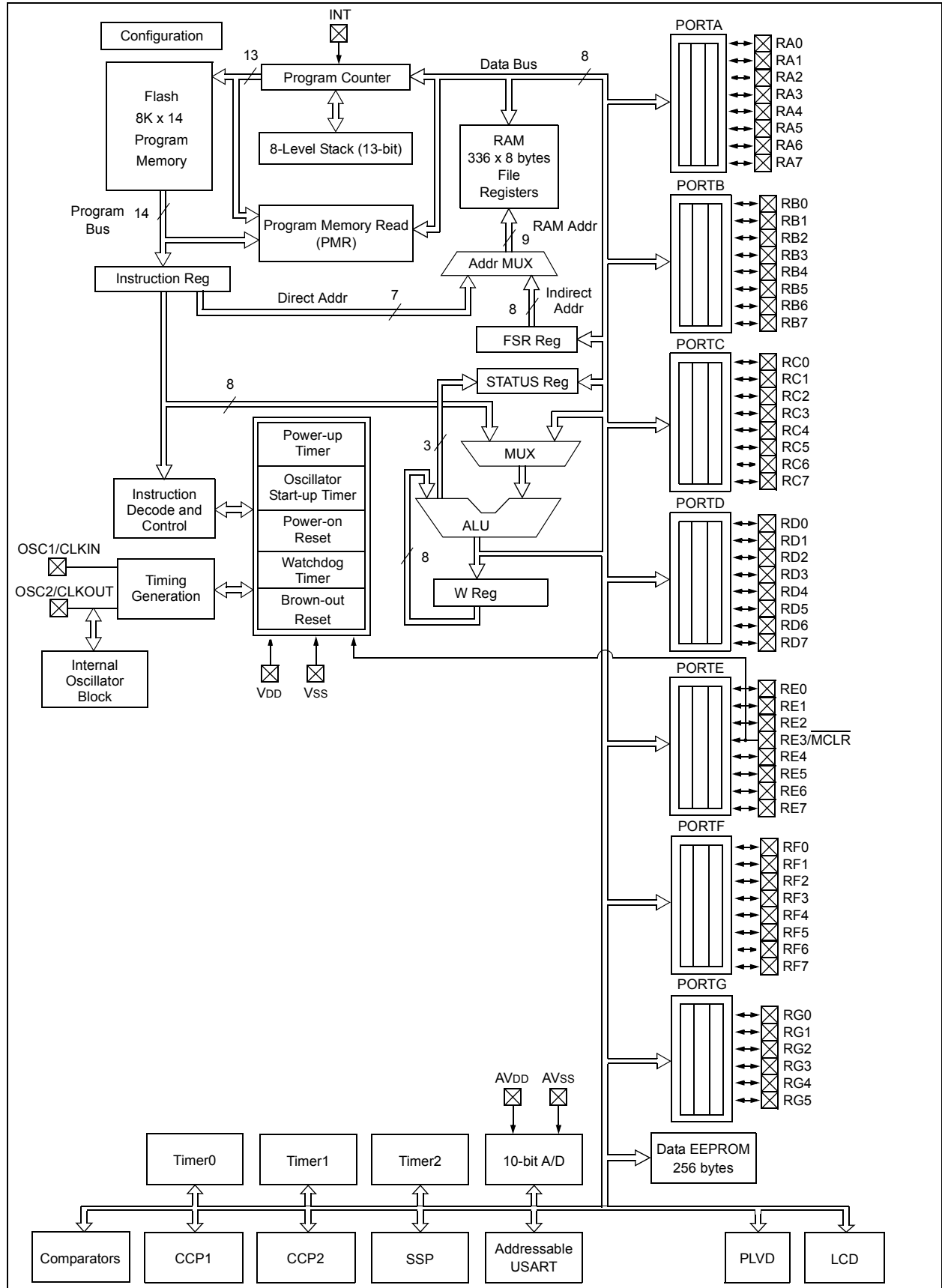
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FIGURE 1-2: PIC16F914/917 BLOCK DIAGRAM



PIC16F913/914/916/917/946

FIGURE 1-3: PIC16F946 BLOCK DIAGRAM



PIC16F913/914/916/917/946

TABLE 1-1: PIC16F91X/946 PINOUT DESCRIPTIONS

Name	Function	Input Type	Output Type	Description
RA0/AN0/C1-/SEG12	RA0	TTL	CMOS	General purpose I/O.
	AN0	AN	—	Analog input Channel 0.
	C1-	AN	—	Comparator 1 negative input.
	SEG12	—	AN	LCD analog output.
RA1/AN1/C2-/SEG7	RA1	TTL	CMOS	General purpose I/O.
	AN1	AN	—	Analog input Channel 1.
	C2-	AN	—	Comparator 2 negative input.
	SEG7	—	AN	LCD analog output.
RA2/AN2/C2+/VREF-/COM2	RA2	TTL	CMOS	General purpose I/O.
	AN2	AN	—	Analog input Channel 2.
	C2+	AN	—	Comparator 2 positive input.
	VREF-	AN	—	External A/D Voltage Reference – negative.
	COM2	—	AN	LCD analog output.
RA3/AN3/C1+/VREF+/COM3 ⁽¹⁾ /SEG15	RA3	TTL	CMOS	General purpose I/O.
	AN3	AN	—	Analog input Channel 3.
	C1+	AN	—	Comparator 1 positive input.
	VREF+	AN	—	External A/D Voltage Reference – positive.
	COM3 ⁽¹⁾	—	AN	LCD analog output.
	SEG15	—	AN	LCD analog output.
RA4/C1OUT/T0CKI/SEG4	RA4	TTL	CMOS	General purpose I/O.
	C1OUT	—	CMOS	Comparator 1 output.
	T0CKI	ST	—	Timer0 clock input.
	SEG4	—	AN	LCD analog output.
RA5/AN4/C2OUT/ \overline{SS} /SEG5	RA5	TTL	CMOS	General purpose I/O.
	AN4	AN	—	Analog input Channel 4.
	C2OUT	—	CMOS	Comparator 2 output.
	\overline{SS}	TTL	—	Slave select input.
	SEG5	—	AN	LCD analog output.
RA6/OSC2/CLKOUT/T1OSO	RA6	TTL	CMOS	General purpose I/O.
	OSC2	—	XTAL	Crystal/Resonator.
	CLKOUT	—	CMOS	Tosc/4 reference clock.
	T1OSO	—	XTAL	Timer1 oscillator output.
RA7/OSC1/CLKIN/T1OSI	RA7	TTL	CMOS	General purpose I/O.
	OSC1	XTAL	—	Crystal/Resonator.
	CLKIN	ST	—	Clock input.
	T1OSI	XTAL	—	Timer1 oscillator input.
RB0/INT/SEG0	RB0	TTL	CMOS	General purpose I/O. Individually enabled pull-up.
	INT	ST	—	External interrupt pin.
	SEG0	—	AN	LCD analog output.

Legend: AN = Analog input or output CMOS = CMOS compatible input or output OD = Open Drain
TTL = TTL compatible input ST = Schmitt Trigger input with CMOS levels P = Power
HV = High Voltage XTAL = Crystal

- Note 1:** COM3 is available on RA3 for the PIC16F913/916 and on RD0 for the PIC16F914/917 and PIC16F946.
Note 2: Pins available on PIC16F914/917 and PIC16F946 only.
Note 3: Pins available on PIC16F946 only.
Note 4: I²C Schmitt trigger inputs have special input levels.

PIC16F913/914/916/917/946

TABLE 1-1: PIC16F91X/946 PINOUT DESCRIPTIONS (CONTINUED)

Name	Function	Input Type	Output Type	Description
RB1/SEG1	RB1	TTL	CMOS	General purpose I/O. Individually enabled pull-up.
	SEG1	—	AN	LCD analog output.
RB2/SEG2	RB2	TTL	CMOS	General purpose I/O. Individually enabled pull-up.
	SEG2	—	AN	LCD analog output.
RB3/SEG3	RB3	TTL	CMOS	General purpose I/O. Individually enabled pull-up.
	SEG3	—	AN	LCD analog output.
RB4/COM0	RB4	TTL	CMOS	General purpose I/O. Individually controlled interrupt-on-change. Individually enabled pull-up.
	COM0	—	AN	LCD analog output.
RB5/COM1	RB5	TTL	CMOS	General purpose I/O. Individually controlled interrupt-on-change. Individually enabled pull-up.
	COM1	—	AN	LCD analog output.
RB6/ICSPCLK/ICDCK/SEG14	RB6	TTL	CMOS	General purpose I/O. Individually controlled interrupt-on-change. Individually enabled pull-up.
	ICSPCLK	ST	—	ICSP™ clock.
	ICDCK	ST	—	ICD clock.
	SEG14	—	AN	LCD analog output.
RB7/ICSPDAT/ICDDAT/SEG13	RB7	TTL	CMOS	General purpose I/O. Individually controlled interrupt-on-change. Individually enabled pull-up.
	ICSPDAT	ST	CMOS	ICSP Data I/O.
	ICDDAT	ST	CMOS	ICD Data I/O.
	SEG13	—	AN	LCD analog output.
RC0/VLCD1	RC0	ST	CMOS	General purpose I/O.
	VLCD1	AN	—	LCD analog input.
RC1/VLCD2	RC1	ST	CMOS	General purpose I/O.
	VLCD2	AN	—	LCD analog input.
RC2/VLCD3	RC2	ST	CMOS	General purpose I/O.
	VLCD3	AN	—	LCD analog input.
RC3/SEG6	RC3	ST	CMOS	General purpose I/O.
	SEG6	—	AN	LCD analog output.
RC4/ $\overline{T1G}$ /SDO/SEG11	RC4	ST	CMOS	General purpose I/O.
	$\overline{T1G}$	ST	—	Timer1 gate input.
	SDO	—	CMOS	Serial data output.
	SEG11	—	AN	LCD analog output.
RC5/T1CKI/CCP1/SEG10	RC5	ST	CMOS	General purpose I/O.
	T1CKI	ST	—	Timer1 clock input.
	CCP1	ST	CMOS	Capture 1 input/Compare 1 output/PWM 1 output.
	SEG10	—	AN	LCD analog output.

Legend: AN = Analog input or output CMOS = CMOS compatible input or output OD = Open Drain
TTL = TTL compatible input ST = Schmitt Trigger input with CMOS levels P = Power
HV = High Voltage XTAL = Crystal

- Note 1:** COM3 is available on RA3 for the PIC16F913/916 and on RD0 for the PIC16F914/917 and PIC16F946.
2: Pins available on PIC16F914/917 and PIC16F946 only.
3: Pins available on PIC16F946 only.
4: I²C Schmitt trigger inputs have special input levels.

PIC16F913/914/916/917/946

TABLE 1-1: PIC16F91X/946 PINOUT DESCRIPTIONS (CONTINUED)

Name	Function	Input Type	Output Type	Description
RC6/TX/CK/SCK/SCL/SEG9	RC6	ST	CMOS	General purpose I/O.
	TX	—	CMOS	USART asynchronous serial transmit.
	CK	ST	CMOS	USART synchronous serial clock.
	SCK	ST	CMOS	SPI clock.
	SCL	ST ⁽⁴⁾	OD	I ² C™ clock.
	SEG9	—	AN	LCD analog output.
RC7/RX/DT/SDI/SDA/SEG8	RC7	ST	CMOS	General purpose I/O.
	RX	ST	—	USART asynchronous serial receive.
	DT	ST	CMOS	USART synchronous serial data.
	SDI	ST	CMOS	SPI data input.
	SDA	ST ⁽⁴⁾	OD	I ² C™ data.
	SEG8	—	AN	LCD analog output.
RD0/COM3 ^(1, 2)	RD0	ST	CMOS	General purpose I/O.
	COM3	—	AN	LCD analog output.
RD1 ⁽²⁾	RD1	ST	CMOS	General purpose I/O.
RD2/CCP2 ⁽²⁾	RD2	ST	CMOS	General purpose I/O.
	CCP2	ST	CMOS	Capture 2 input/Compare 2 output/PWM 2 output.
RD3/SEG16 ⁽²⁾	RD3	ST	CMOS	General purpose I/O.
	SEG16	—	AN	LCD analog output.
RD4/SEG17 ⁽²⁾	RD4	ST	CMOS	General purpose I/O.
	SEG17	—	AN	LCD analog output.
RD5/SEG18 ⁽²⁾	RD5	ST	CMOS	General purpose I/O.
	SEG18	—	AN	LCD analog output.
RD6/SEG19 ⁽²⁾	RD6	ST	CMOS	General purpose I/O.
	SEG19	—	AN	LCD analog output.
RD7/SEG20 ⁽²⁾	RD7	ST	CMOS	General purpose I/O.
	SEG20	—	AN	LCD analog output.
RE0/AN5/SEG21 ⁽²⁾	RE0	ST	CMOS	General purpose I/O.
	AN5	AN	—	Analog input Channel 5.
	SEG21	—	AN	LCD analog output.
RE1/AN6/SEG22 ⁽²⁾	RE1	ST	CMOS	General purpose I/O.
	AN6	AN	—	Analog input Channel 6.
	SEG22	—	AN	LCD analog output.
RE2/AN7/SEG23 ⁽²⁾	RE2	ST	CMOS	General purpose I/O.
	AN7	AN	—	Analog input Channel 7.
	SEG23	—	AN	LCD analog output.
RE3/MCLR/VPP	RE3	ST	—	Digital input only.
	MCLR	ST	—	Master Clear with internal pull-up.
	VPP	HV	—	Programming voltage.

Legend: AN = Analog input or output CMOS = CMOS compatible input or output OD = Open Drain
TTL = TTL compatible input ST = Schmitt Trigger input with CMOS levels P = Power
HV = High Voltage XTAL = Crystal

- Note 1:** COM3 is available on RA3 for the PIC16F913/916 and on RD0 for the PIC16F914/917 and PIC16F946.
Note 2: Pins available on PIC16F914/917 and PIC16F946 only.
Note 3: Pins available on PIC16F946 only.
Note 4: I²C Schmitt trigger inputs have special input levels.

PIC16F913/914/916/917/946

TABLE 1-1: PIC16F91X/946 PINOUT DESCRIPTIONS (CONTINUED)

Name	Function	Input Type	Output Type	Description
RE4/SEG24 ⁽³⁾	RE4	ST	CMOS	General purpose I/O.
	SEG24	—	AN	LCD analog output.
RE5/SEG25 ⁽³⁾	RE5	ST	CMOS	General purpose I/O.
	SEG25	—	AN	LCD analog output.
RE6/SEG26 ⁽³⁾	RE6	ST	CMOS	General purpose I/O.
	SEG26	—	AN	LCD analog output.
RE7/SEG27 ⁽³⁾	RE7	ST	CMOS	General purpose I/O.
	SEG27	—	AN	LCD analog output.
RF0/SEG32 ⁽³⁾	RF0	ST	CMOS	General purpose I/O.
	SEG32	—	AN	LCD analog output.
RF1/SEG33 ⁽³⁾	RF1	ST	CMOS	General purpose I/O.
	SEG33	—	AN	LCD analog output.
RF2/SEG34 ⁽³⁾	RF2	ST	CMOS	General purpose I/O.
	SEG34	—	AN	LCD analog output.
RF3/SEG35 ⁽³⁾	RF3	ST	CMOS	General purpose I/O.
	SEG35	—	AN	LCD analog output.
RF4/SEG28 ⁽³⁾	RF4	ST	CMOS	General purpose I/O.
	SEG28	—	AN	LCD analog output.
RF5/SEG29 ⁽³⁾	RF5	ST	CMOS	General purpose I/O.
	SEG29	—	AN	LCD analog output.
RF6/SEG30 ⁽³⁾	RF6	ST	CMOS	General purpose I/O.
	SEG30	—	AN	LCD analog output.
RF7/SEG31 ⁽³⁾	RF7	ST	CMOS	General purpose I/O.
	SEG31	—	AN	LCD analog output.
RG0/SEG36 ⁽³⁾	RG0	ST	CMOS	General purpose I/O.
	SEG36	—	AN	LCD analog output.
RG1/SEG37 ⁽³⁾	RG1	ST	CMOS	General purpose I/O.
	SEG37	—	AN	LCD analog output.
RG2/SEG38 ⁽³⁾	RG2	ST	CMOS	General purpose I/O.
	SEG38	—	AN	LCD analog output.
RG3/SEG39 ⁽³⁾	RG3	ST	CMOS	General purpose I/O.
	SEG39	—	AN	LCD analog output.
RG4/SEG40 ⁽³⁾	RG4	ST	CMOS	General purpose I/O.
	SEG10	—	AN	LCD analog output.
RG5/SEG41 ⁽³⁾	RG5	ST	CMOS	General purpose I/O.
	SEG41	—	AN	LCD analog output.
AVDD ⁽³⁾	AVDD	P	—	Analog power supply for microcontroller.
AVSS ⁽³⁾	AVSS	P	—	Analog ground reference for microcontroller.
VDD	VDD	P	—	Power supply for microcontroller.

Legend: AN = Analog input or output CMOS = CMOS compatible input or output OD = Open Drain
TTL = TTL compatible input ST = Schmitt Trigger input with CMOS levels P = Power
HV = High Voltage XTAL = Crystal

- Note 1:** COM3 is available on RA3 for the PIC16F913/916 and on RD0 for the PIC16F914/917 and PIC16F946.
2: Pins available on PIC16F914/917 and PIC16F946 only.
3: Pins available on PIC16F946 only.
4: I²C Schmitt trigger inputs have special input levels.

PIC16F913/914/916/917/946

TABLE 1-1: PIC16F91X/946 PINOUT DESCRIPTIONS (CONTINUED)

Name	Function	Input Type	Output Type	Description
Vss	Vss	P	—	Ground reference for microcontroller.

Legend: AN = Analog input or output CMOS = CMOS compatible input or output OD = Open Drain
TTL = TTL compatible input ST = Schmitt Trigger input with CMOS levels P = Power
HV = High Voltage XTAL = Crystal

- Note 1:** COM3 is available on RA3 for the PIC16F913/916 and on RD0 for the PIC16F914/917 and PIC16F946.
2: Pins available on PIC16F914/917 and PIC16F946 only.
3: Pins available on PIC16F946 only.
4: I²C Schmitt trigger inputs have special input levels.

PIC16F913/914/916/917/946

2.0 MEMORY ORGANIZATION

2.1 Program Memory Organization

The PIC16F91X/946 has a 13-bit program counter capable of addressing a 4K x 14 program memory space for the PIC16F913/914 (0000h-0FFFh) and an 8K x 14 program memory space for the PIC16F916/917 and PIC16F946 (0000h-1FFFh). Accessing a location above the memory boundaries for the PIC16F913 and PIC16F914 will cause a wrap around within the first 4K x 14 space. The Reset vector is at 0000h and the interrupt vector is at 0004h.

FIGURE 2-1: PROGRAM MEMORY MAP AND STACK FOR THE PIC16F913/914

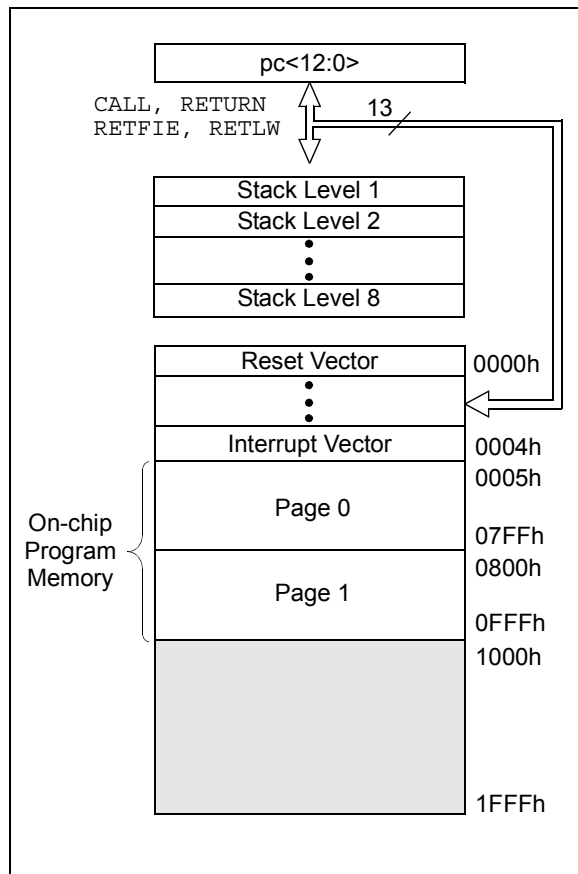


FIGURE 2-2: PROGRAM MEMORY MAP AND STACK FOR THE PIC16F916/917/PIC16F946

