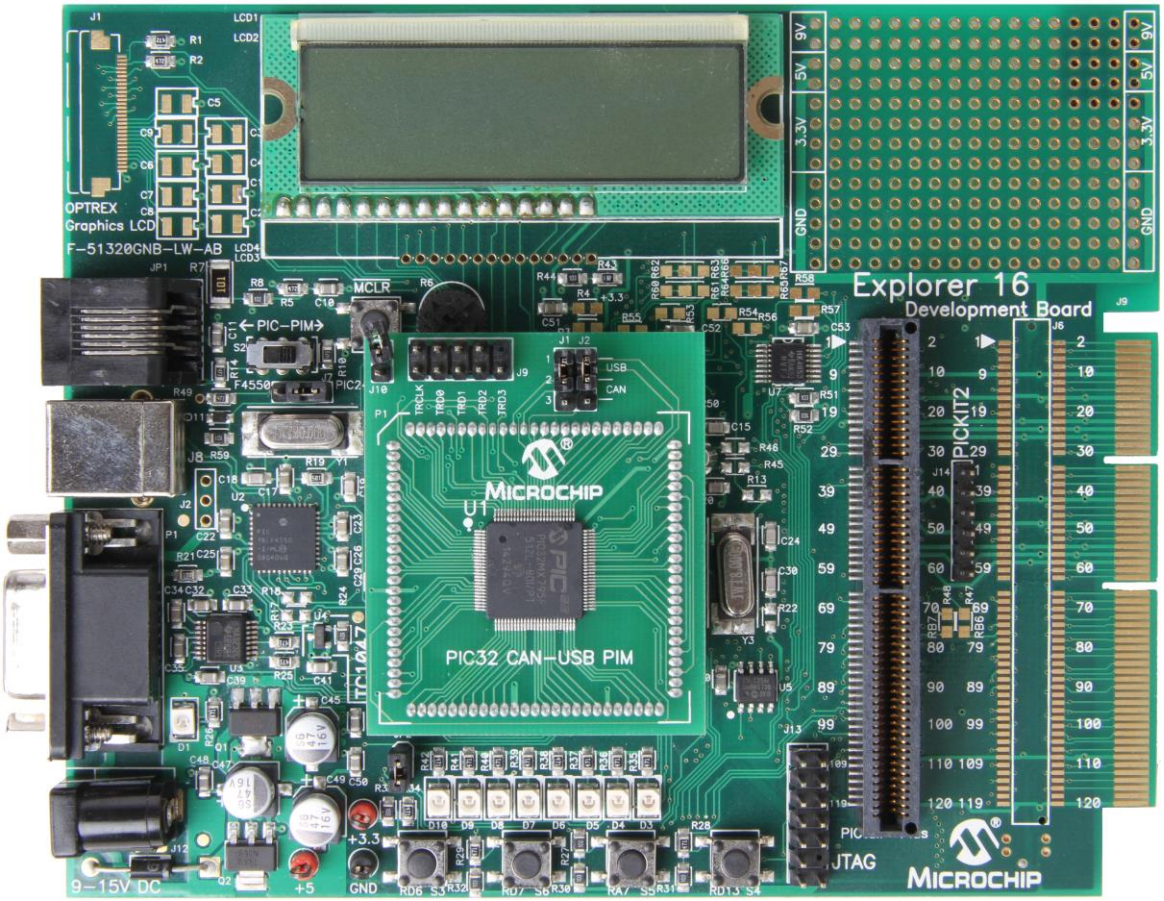
IoT Development Tools for PIC32



Explorer 16/32 Development Board

January 30, 2018

FRED EADY

Presented by:

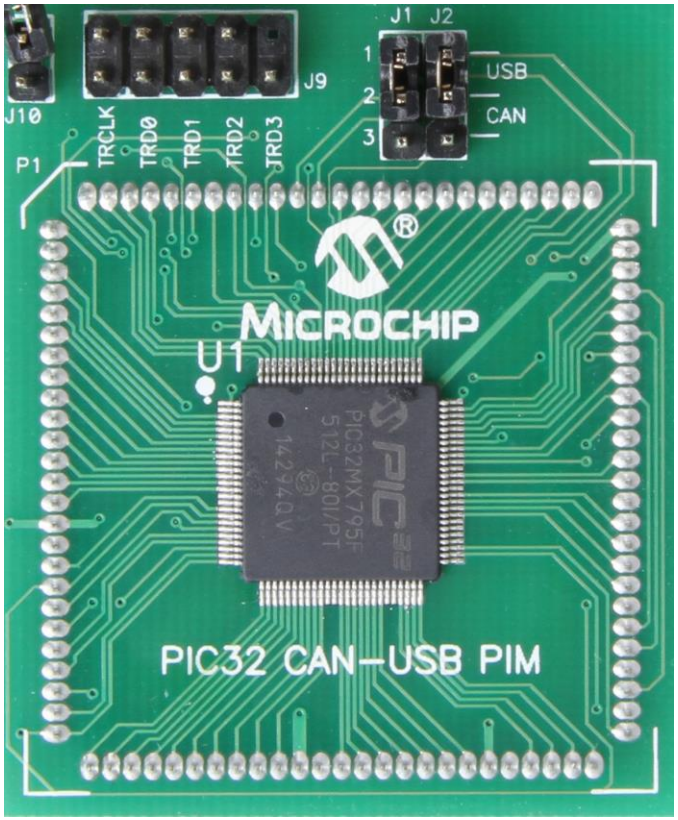
DesignNews

CEC CONTINUING EDUCATION CENTER

Digi-Key ELECTRONICS

AGENDA

- Explorer 16/32 Development Board Hardware
- GPS click Project
- Double click – Shake2Wake click Project
- Nos Vemos Mañana

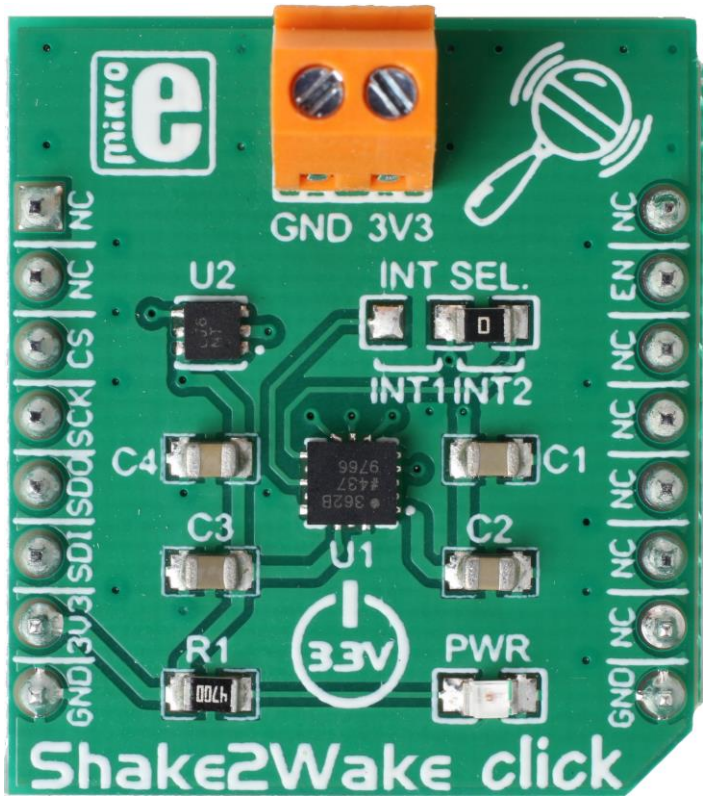


IoT Development Tools for PIC32

Explorer 16/32 Development Board Hardware – click Part Numbers

ANTENNA GPS 2M CABLE ACTIVE
MIKROE-363
1471-1196-ND

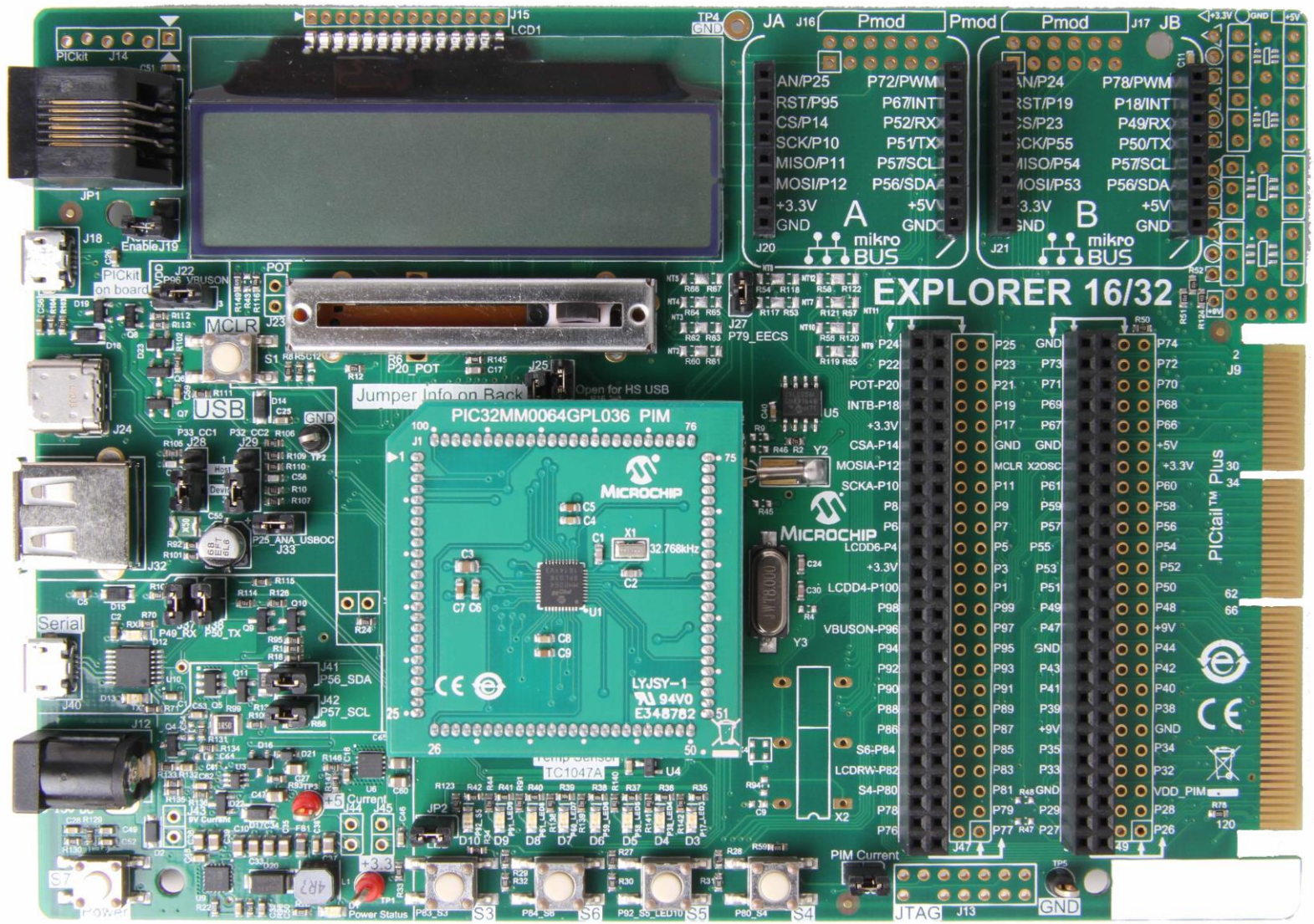
GPS CLICK UART/I2C
MIKROE-1032
1471-1009-ND



SHAKE2WAKE CLICK
MIKROE-1942
1471-1498-ND

IoT Development Tools for PIC32

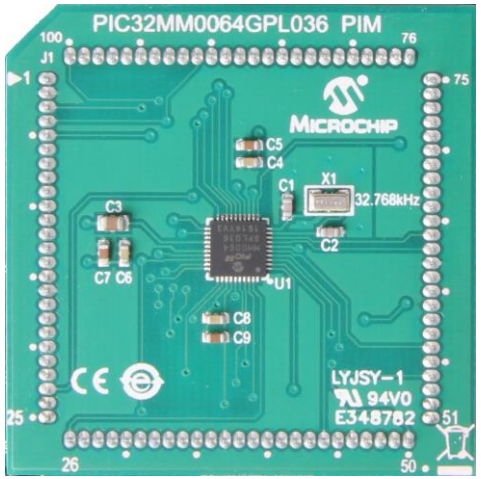
Explorer 16/32 Development Board Hardware

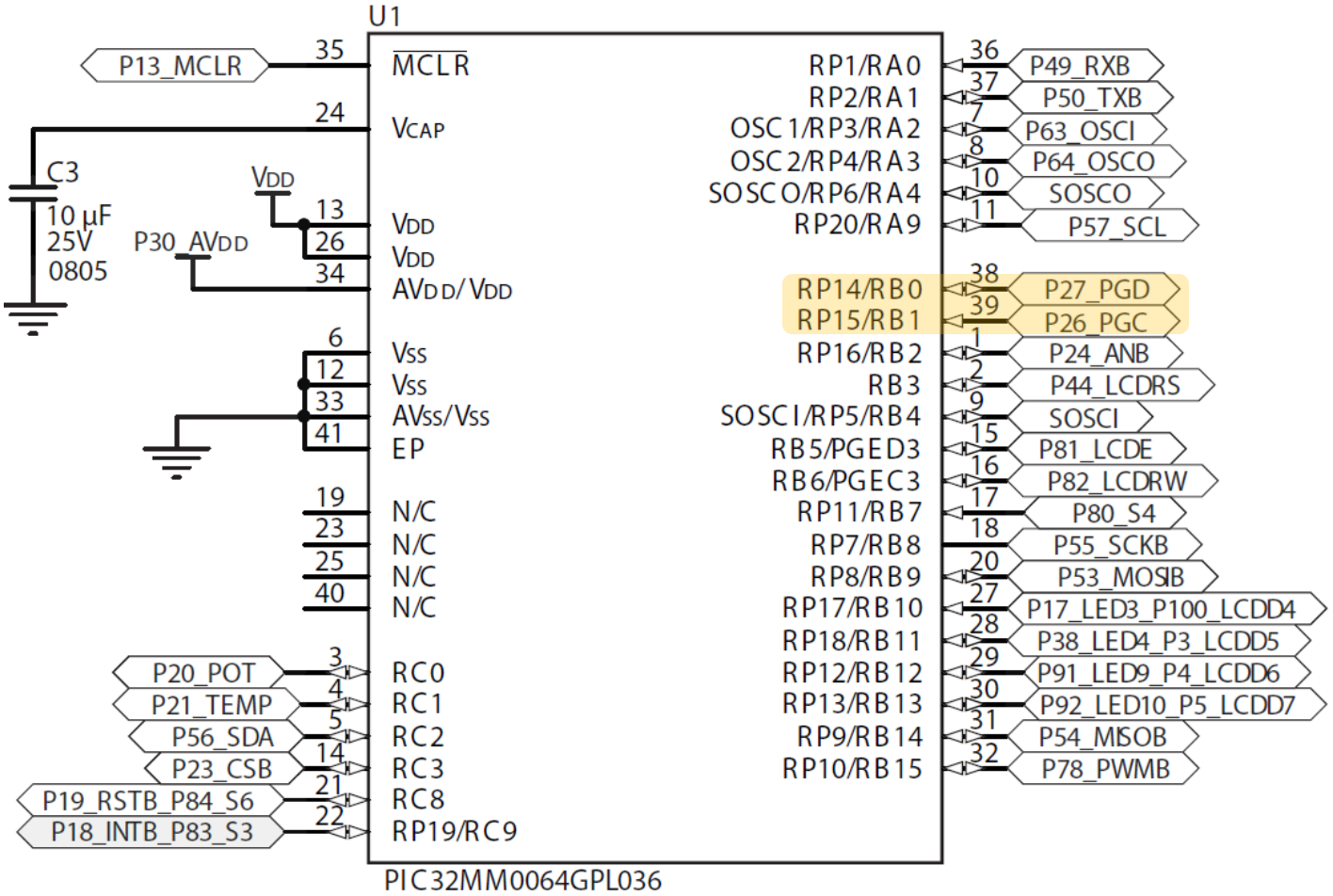


IoT Development Tools for PIC32

Explorer 16/32 Development Board Hardware

Locate Programming Pins

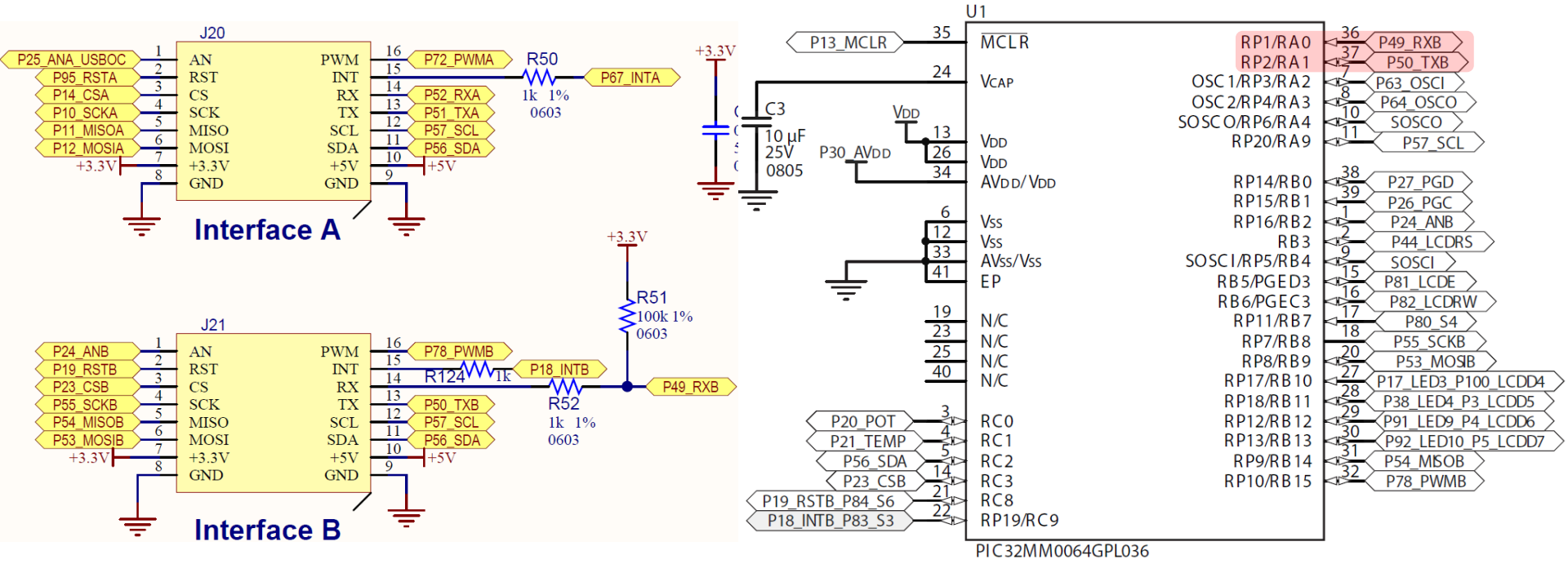




IoT Development Tools for PIC32

Explorer 16/32 Development Board Hardware

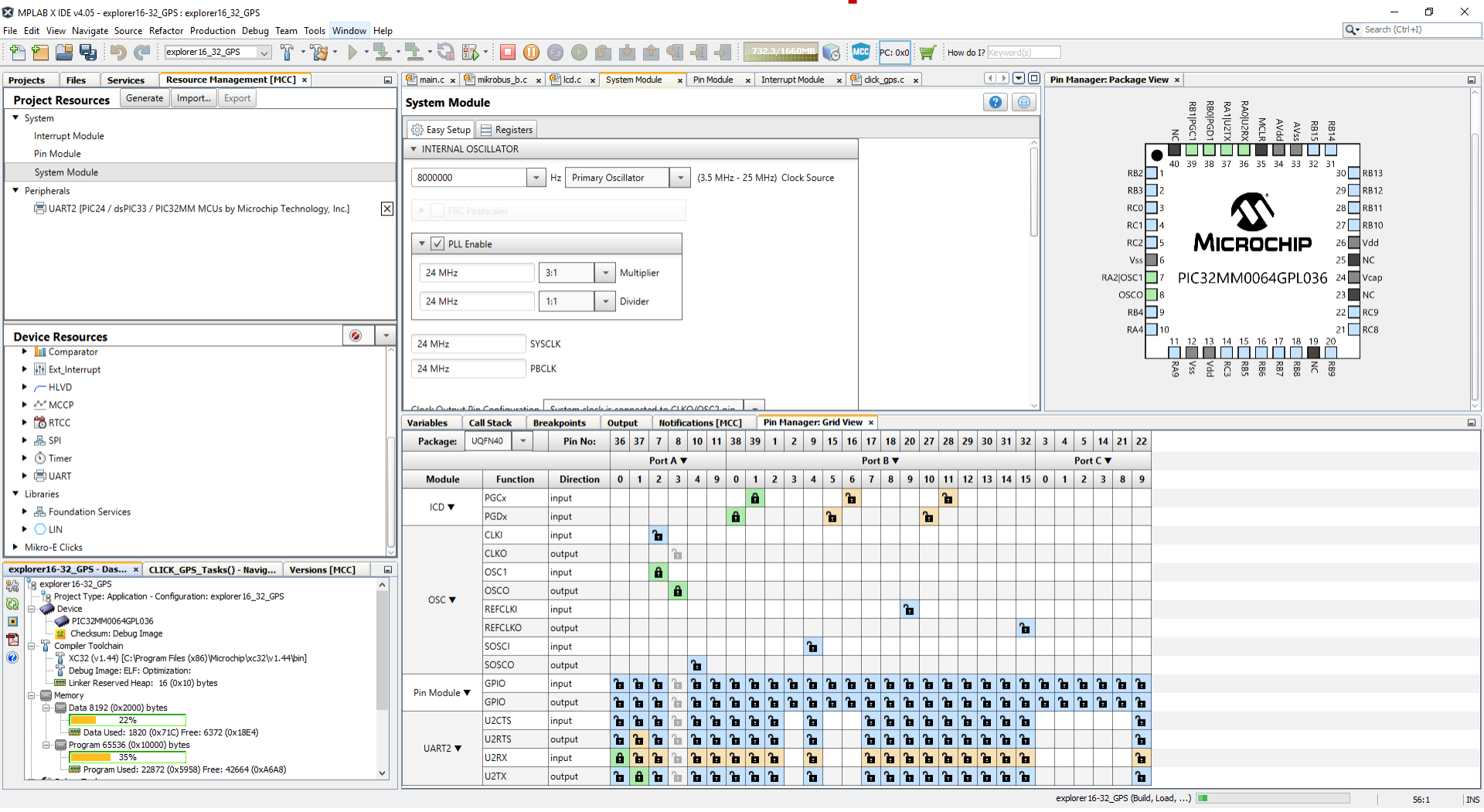
Locate UART Pins



IoT Development Tools for PIC32

Explorer 16/32 Development Board Hardware

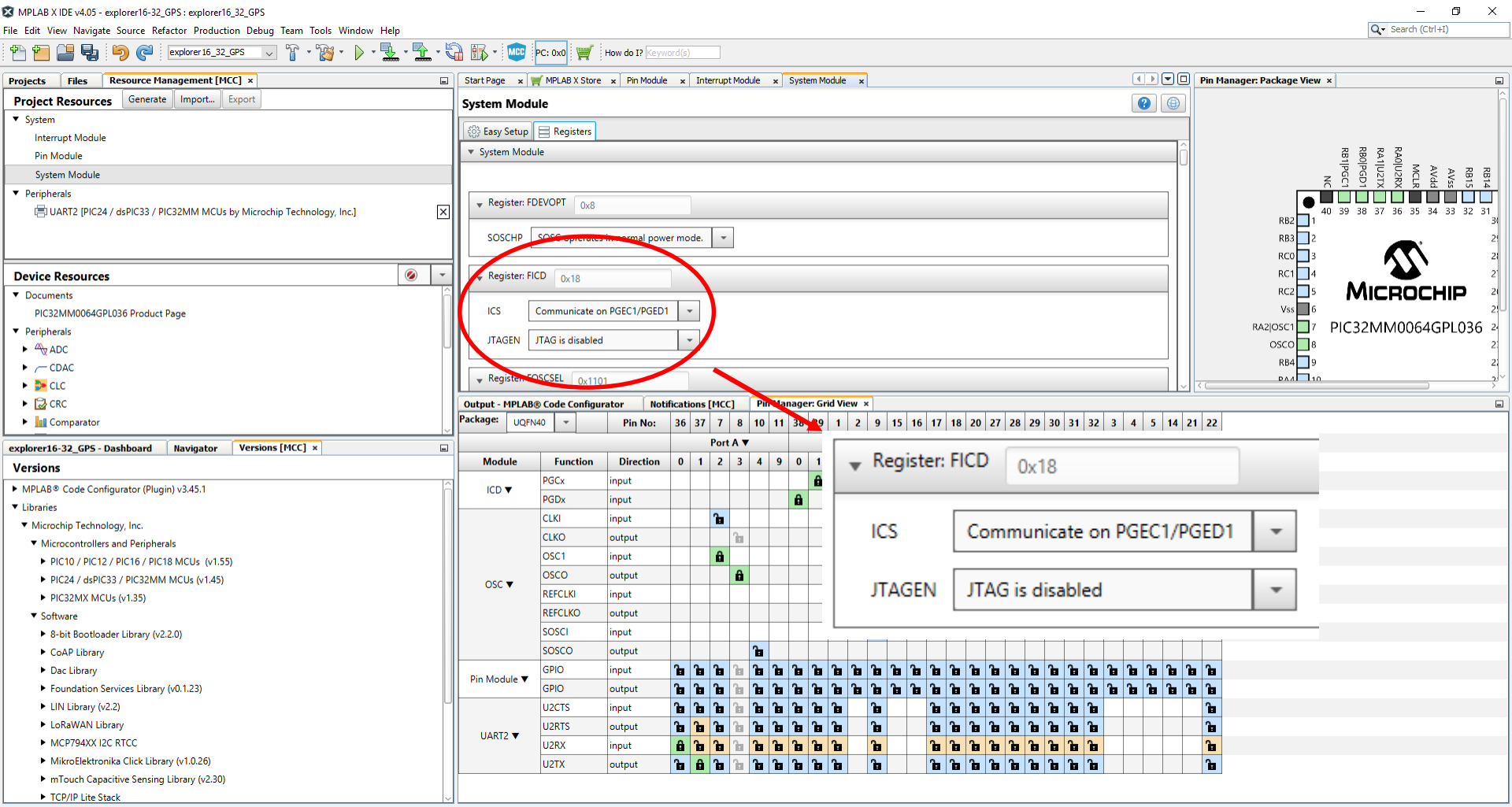
MCC Setup



IoT Development Tools for PIC32

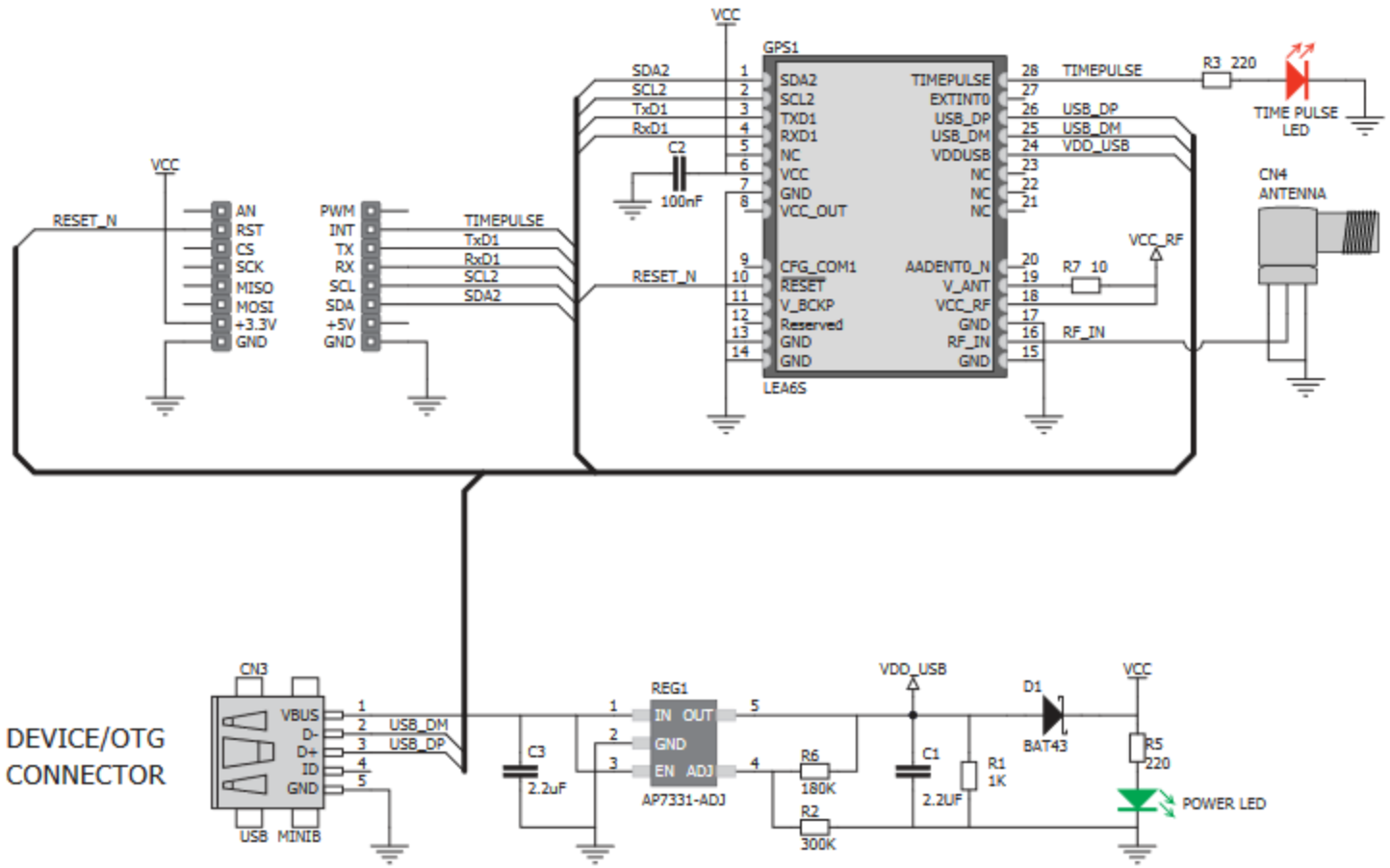
Explorer 16/32 Development Board Hardware

MCC Setup



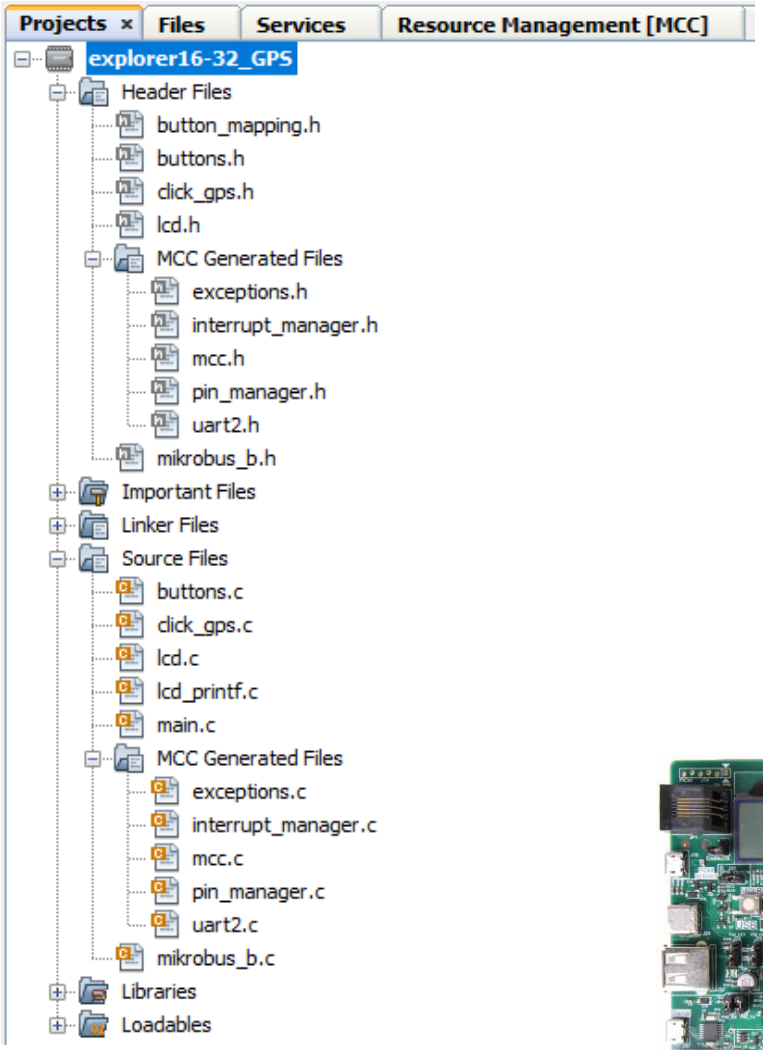
IoT Development Tools for PIC32

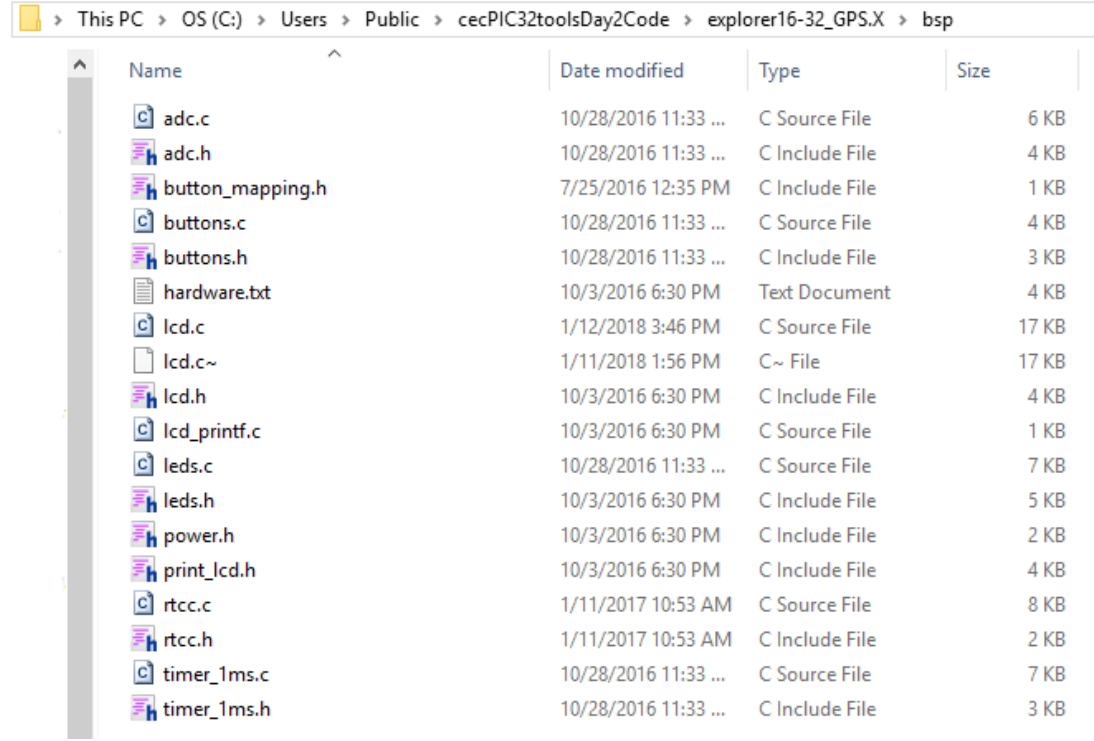
GPS click Project

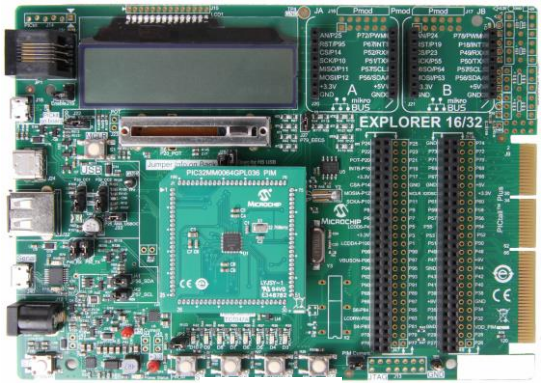


IoT Development Tools for PIC32

GPS click Project

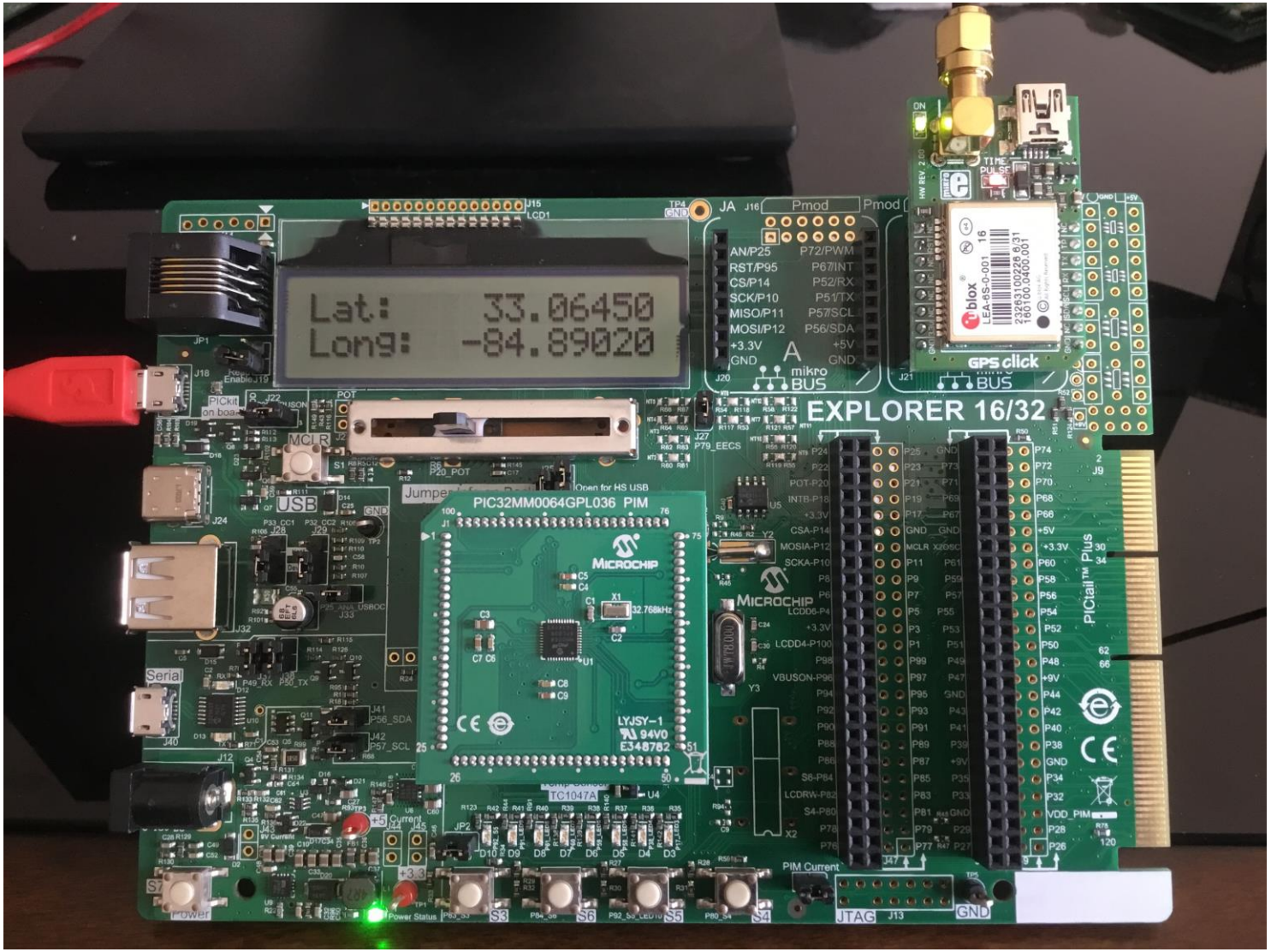






IoT Development Tools for PIC32

GPS click Project



IoT Development Tools for PIC32

Double click – Shake2Wake click Project

PIC32MX795F512L PIM (Plug-In Module) Table

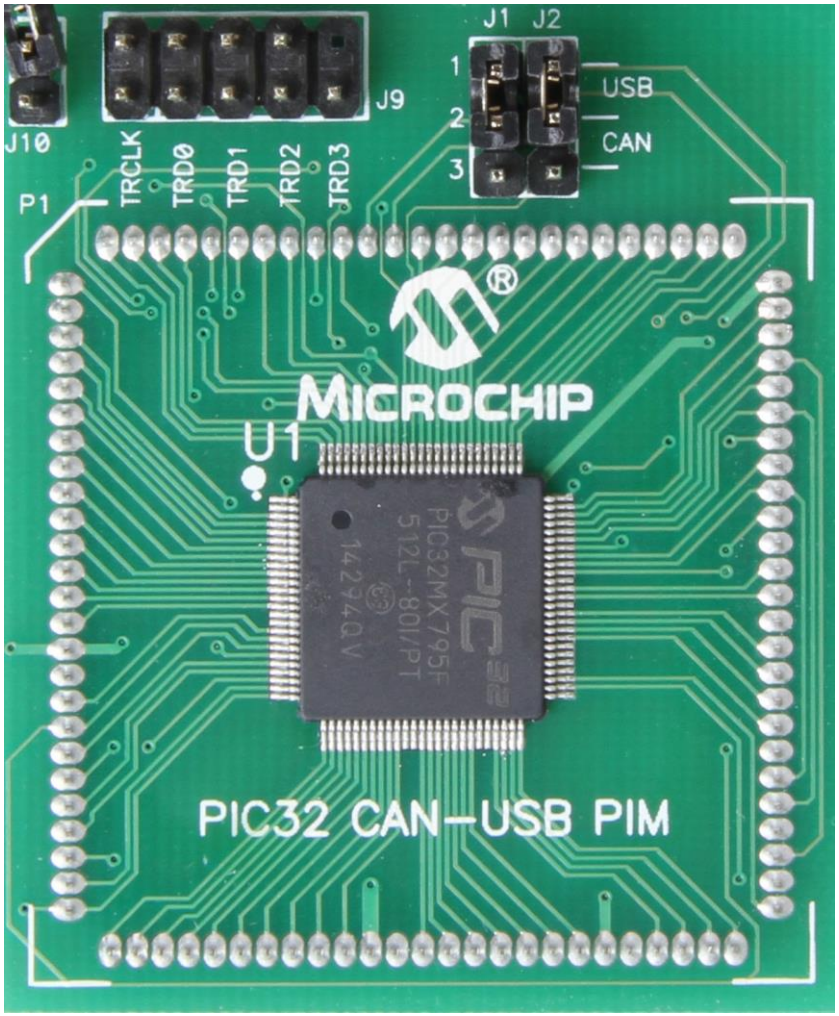


TABLE 1: 100-PIN TO 100-PIN PIM

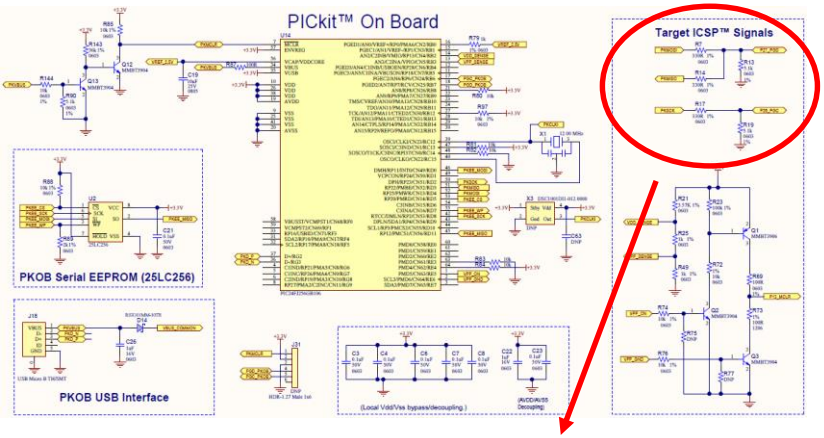
Device Pin #	PIC32MX795F512L Functional Description	PIM Pin #
1	AERXERR/RG15	69
2	VDD	2
3	PMD5/RE5	3
4	PMD6/RE6	4
5	PMD7/RE7	5
6	T2CK/RC1	6
7	T3CK/AC2TX/RC2	7
8	T4CK/AC2RX/RC3	8
9	T5CK/SDI1/RC4	9, 54
10	ECOL/SCK2/U6TX/U3RTS/PMA5/CN8/RG6	10
11	ECRS/SDA4/SDI2/U3RX/PMA4/CN9/RG7	11
12	ERXDV/AERXDV/ECRSDV/AECRSDV/SCL4/ SDO2/U3TX/PMA3/CN10/RG8	12
13	MCLR	13
14	ERXCLK/AERXCLK/EREFCLK/AEREFCLK/SS2/ U6RX/U3CTS/PMA2/CN11/RG9	14
15	VSS	15
16	VDD	16
17	TMS/RA0	17
18	AERXD0/INT1/RE8	18, 66
19	AERXD1/INT2/RE9	19
20	AN5/C1IN+/VBUSON/CN7/RB5	96
21	AN4/C1IN-/CN6/RB4	21
22	AN3/C2IN+/CN5/RB3	22
23	AN2/C2IN-/CN4/RB2	20
24	PGEC1/AN1/CN3/RB1	24
25	PGED1/AN0/CN2/RB0	25
26	PGEC2/AN6/OCFA/RB6	26
27	PGED2/AN7/RB7	27
28	VREF-/CVREF-/AERXD2/PMA7/RA9	28
29	VREF+/CVREF+/AERXD3/PMA6/RA10	29
30	AVDD	30
31	AVSS	31
32	AN8/C1OUT/RB8	32
33	AN9/C2OUT/RB9	33
34	AN10/CVREFOUT/PMA13/RB10	34

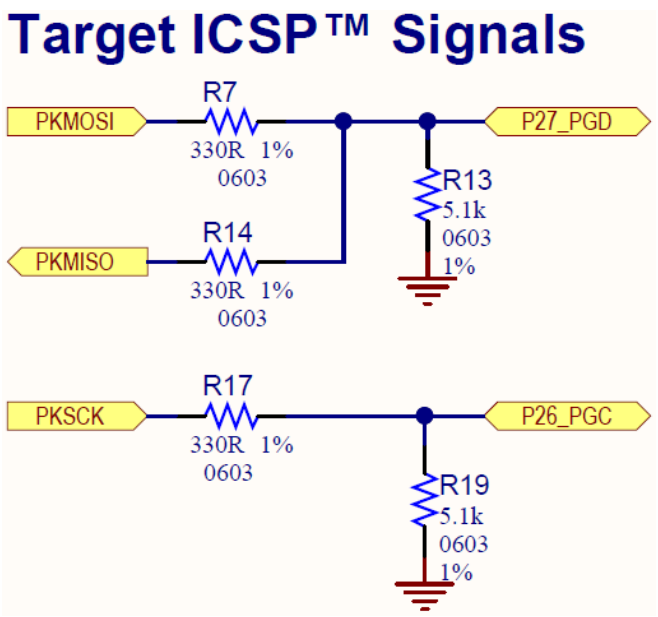
Device Pin #	PIC32MX795F512L Functional Description	PIM Pin #
35	AN11/ERXERR/AETXERR/PMA12/RB11	35
36	VSS	36
37	VDD	37
38	TCK/RA1	38
39	AC1TX/SCK4/U5TX/U2RTS/RF13	39
40	AC1RX/SS4/U5RX/U2CTS/RF12	40
41	AN12/ERXD0/AECRS/PMA11/RB12	41
42	AN13/ERXD1/AECOL/PMA10/RB13	42
43	AN14/ERXD2/AETXD3/PMALH/PMA1/RB14	43
44	AN15/ERXD3/AETXD2/OCFB/PMALL/PMA0/CN12/ RB15	44
45	VSS	45
46	VSS	46
47	AETXD0/SS3/U4RX/U1CTS/CN20/RD14	47
48	AETXD1/SCK3/U4TX/U1RTS/CN21/RD15	48
49	SDA5/SDI4/U2RX/PMA9/CN17/RF4	49
50	SCL5/SDO4/U2TX/PMA8/CN18/RF5	50
51	USBID/RF3	95
52	SDA3/SDI3/U1RX/RF2	52
53	SCL3/SDO3/U1TX/RF8	51
54	VBUS	1
55	VUSB	62
56	D-/RG3	89
57	D+/RG2	90
58	SCL2/RA2	58
59	SDA2/RA3	59
60	TDI/RA4	60
61	TDO/RA5	61
62	VDD	62
63	OSC1/CLKI/RC12	63
64	OSC2/CLKO/RC15	64
65	VSS	65
66	AETXCLK/SCL1/INT3/RA14	57
67	AETXEN/SDA1/INT4/RA15	56, 67
68	RTCC/EMDIO/AEMDIO/IC1/RD8	68

IoT Development Tools for PIC32

Double click – Shake2Wake click Project

Locate Programming Pins





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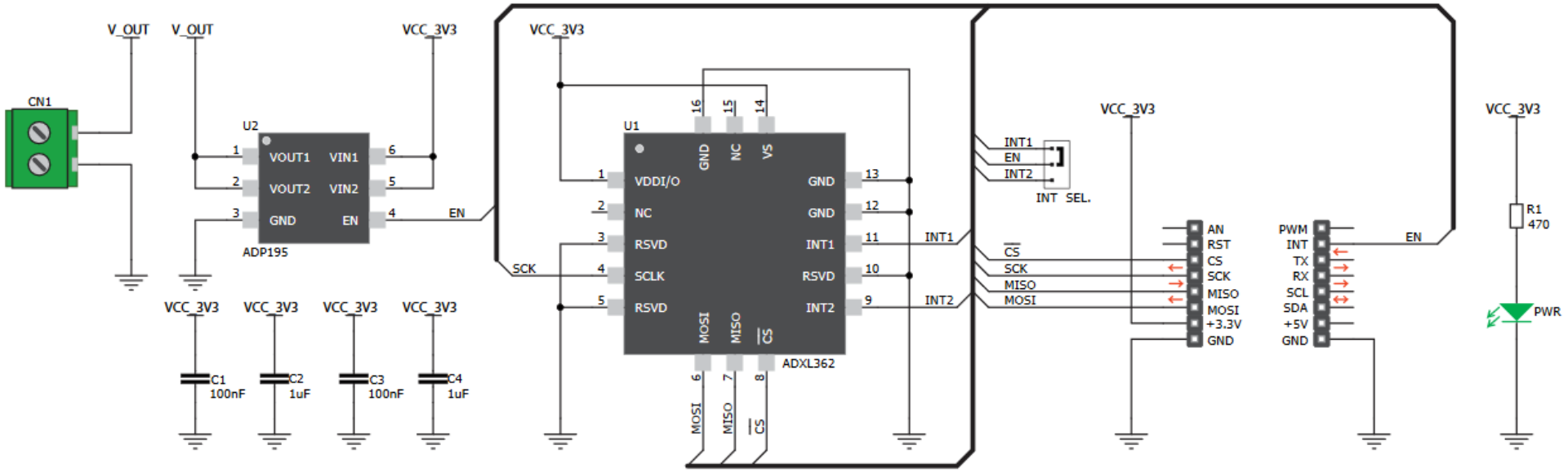
6	T2CK/RC1	6
7	T3CK/AC2TX/RC2	7
8	T4CK/AC2RX/RC3	8
9	T5CK/SDI1/RC4	9, 54
10	ECOL/SCK2/U6TX/U3RTS/PMA5/CN8/RG6	10
11	ECRS/SDA4/SDI2/U3RX/PMA4/CN9/RG7	11
12	ERXD/AERXDV/ECRSDV/AECRSDV/SCL4/SDO2/U3TX/PMA3/CN10/RG8	12
13	MCLR	13
14	ERXCLK/AERXCLK/EREFCLK/AEREFCLK/SS2/U6RX/U3CTS/PMA2/CN11/RG9	14
15	VSS	15
16	VDD	16
17	TMS/RA0	17
18	AERXD0/INT1/RE8	18, 66
19	AERXD1/INT2/RE9	19
20	AN5/C1IN+/VBUSON/CN7/RB5	96
21	AN4/C1IN-/CN6/RB4	21
22	AN3/C2IN+/CN5/RB3	22
23	AN2/C2IN-/CN4/RB2	20
24	PGEC1/AN1/CN3/RB1	24
25	PGED1/AN0/CN2/RB0	25
26	PGEC2/AN6/OCFA/RB6	26
27	PGED2/AN7/RB7	27
28	VREF-/CVREF-/AERXD2/PMA7/RA9	28
29	VREF+/CVREF+/AERXD3/PMA6/RA10	29
30	AVDD	30
31	AVSS	31
32	AN8/C1OUT/RB8	32
33	AN9/C2OUT/RB9	33
34	AN10/CVREFOUT/PMA13/RB10	34

Device Pin #	PIC32MX795F512L Functional Description	PIM Pin #
35	AN11/ERXERR/AETXERR/PMA12/RB11	35
36	VSS	36
37	VDD	37
38	TCK/RA1	38
39	AC1TX/SCK4/U5TX/U2RTS/RF13	39
40	AC1RX/SS4/U5RX/U2CTS/RF12	40
41	AN12/ERXD0/AECRS/PMA11/RB12	41
42	AN13/ERXD1/AECOL/PMA10/RB13	42
43	AN14/ERXD2/AETXD3/PMALH/PMA1/RB14	43
44	AN15/ERXD3/AETXD2/OCFB/PMALL/PMA0/CN12/RB15	44
45	VSS	45
46	VSS	46
47	AETXD0/SS3/U4RX/U1CTS/CN20/RD14	47
48	AETXD1/SCK3/U4TX/U1RTS/CN21/RD15	48
49	SDA5/SDI4/U2RX/PMA9/CN17/RF4	49
50	SCL5/SDO4/U2TX/PMA8/CN18/RF5	50
51	USBID/RF3	95
52	SDA3/SDI3/U1RX/RF2	52
53	SCL3/SDO3/U1TX/RF8	51
54	VBUS	1
55	VUSB	62
56	D-/RG3	89
57	D+/RG2	90
58	SCL2/RA2	58
59	SDA2/RA3	59
60	TDI/RA4	60
61	TDO/RA5	61
62	VDD	62
63	OSC1/CLKI/RC12	63
64	OSC2/CLKO/RC15	64
65	VSS	65
66	AETXCLK/SCL1/INT3/RA14	57
67	AETXEN/SDA1/INT4/RA15	56, 67
68	RTCC/EMDIO/AEMDIO/IC1/RD8	68

IoT Development Tools for PIC32

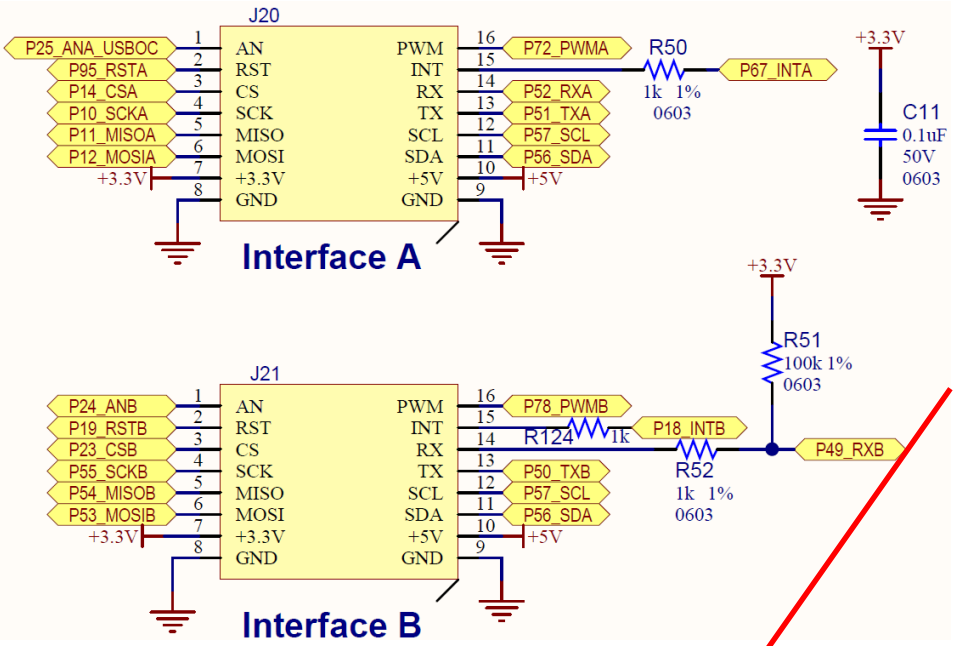
Double click – Shake2Wake click Project



IoT Development Tools for PIC32

Double click – Shake2Wake click Project

Locate SPI Pins



10	ECOL/SCK2/U6TX/U3RTS/PMA5/CN8/RG6	10
11	ECRS/SDA4/SDI2/U3RX/PMA4/CN9/RG7	11
12	ERXDV/AERXDV/ECRSDV/AECRSDV/SCL4/ SDO2/U3TX/PMA3/CN10/RG8	12

TABLE 1: 100-PIN TO 100-PIN PIM

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4	PMD6/RE6	4
5	PMD7/RE7	5
6	T2CK/RC1	6
7	T3CK/AC2TX/RC2	7
8	T4CK/AC2RX/RC3	8
9	T5CK/SDI1/RC4	9, 54
10	ECOL/SCK2/U6TX/U3RTS/PMA5/CN8/RG6	10
11	ECRS/SDA4/SDI2/U3RX/PMA4/CN9/RG7	11
12	ERXDV/AERXDV/ECRSDV/AECRSDV/SCL4/ SDO2/U3TX/PMA3/CN10/RG8	12
13	MCLR	13
14	ERXCLK/AERXCLK/EREFCLK/AEREFCLK/SS2/ U6RX/U3CTS/PMA2/CN11/RG9	14
15	VSS	15
16	VDD	16
17	TMS/RA0	17
18	AERXD0/INT1/RE8	18, 66
19	AERXD1/INT2/RE9	19
20	AN5/C1IN+/VBUSON/CN7/RB5	96
21	AN4/C1IN-/CN6/RB4	21
22	AN3/C2IN+/CN5/RB3	22
23	AN2/C2IN-/CN4/RB2	20
24	PGEC1/AN1/CN3/RB1	24
25	PGED1/AN0/CN2/RB0	25
26	PGEC2/AN6/OCFA/RB6	26
27	PGED2/AN7/RB7	27
28	VREF-/CVREF-/AERXD2/PMA7/RA9	28
29	VREF+/CVREF+/AERXD3/PMA6/RA10	29
30	AVDD	30
31	AVSS	31
32	AN8/C1OUT/RB8	32
33	AN9/C2OUT/RB9	33
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Device Pin #	PIC32MX795F512L Functional Description	PIM Pin #
35	AN11/ERXERR/AETXERR/PMA12/RB11	35
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37	VDD	37
38	TCK/RA1	38
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40	AC1RX/SS4/U5RX/U2CTS/RF12	40
41	AN12/ERXD0/AECRS/PMA11/RB12	41
42	AN13/ERXD1/AECOL/PMA10/RB13	42
43	AN14/ERXD2/AETXD3/PMALH/PMA1/RB14	43
44	AN15/ERXD3/AETXD2/OCFB/PMALL/PMA0/CN12/ RB15	44
45	VSS	45
46	VSS	46
47	AETXD0/SS3/U4RX/U1CTS/CN20/RD14	47
48	AETXD1/SCK3/U4TX/U1RTS/CN21/RD15	48
49	SDA5/SDI4/U2RX/PMA9/CN17/RF4	49
50	SCL5/SDO4/U2TX/PMA8/CN18/RF5	50
51	USBID/RF3	95
52	SDA3/SDI3/U1RX/RF2	52
53	SCL3/SDO3/U1TX/RF8	51
54	VBUS	1
55	VUSB	62
56	D-/RG3	89
57	D+/RG2	90
58	SCL2/RA2	58
59	SDA2/RA3	59
60	TDI/RA4	60
61	TDO/RA5	61
62	VDD	62
63	OSC1/CLKI/RC12	63
64	OSC2/CLKO/RC15	64
65	VSS	65
66	AETXCLK/SCL1/INT3/RA14	57
67	AETXEN/SDA1/INT4/RA15	56, 67
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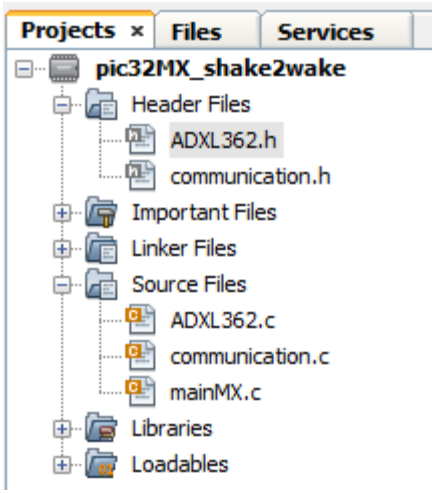
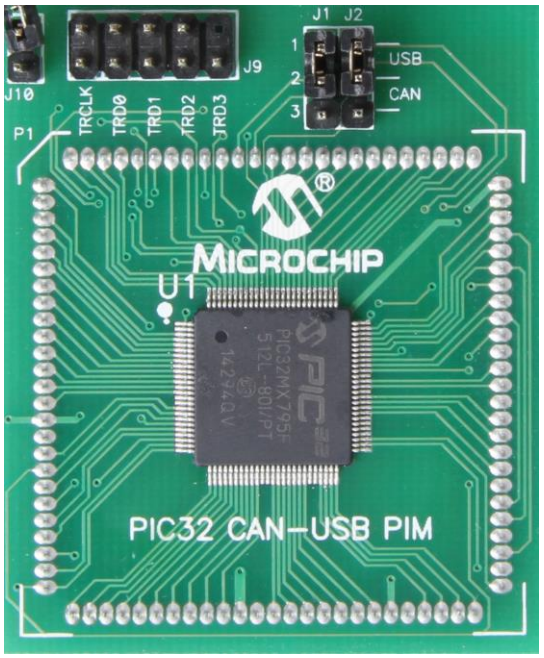
IoT Development Tools for PIC32

Double click – Shake2Wake click Project

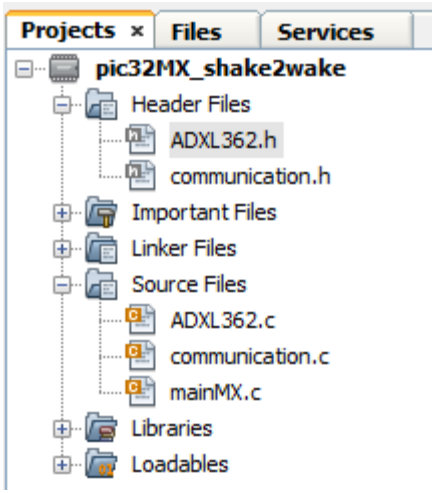


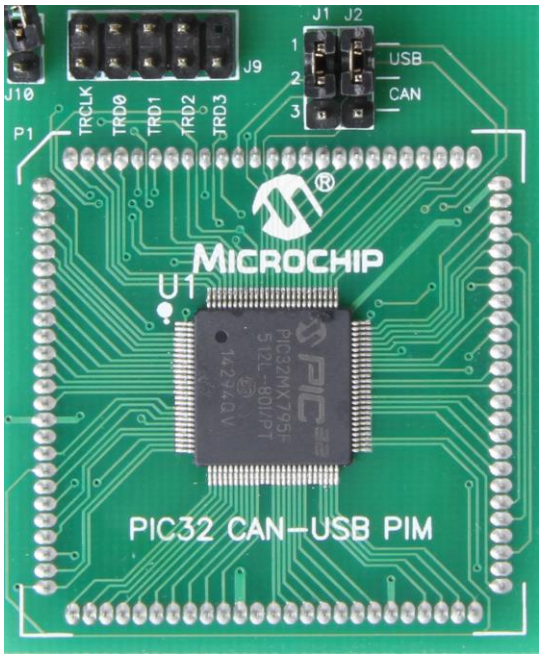



```
47 //*****************************************************************************
48 //* CLOCK MACROS
49 //*****************************************************************************
50 #define GetSystemClock()            80000000UL
51 #define GetPeripheralClock()        80000000UL
52 #define CoreTicksPerMs              (GetSystemClock() / 2000UL)
53 #define CoreTicksPeruS              (GetSystemClock() / 2000000UL)
54 //*****************************************************************************
55 //* mS DELAY
56 //*****************************************************************************
57 void ctDelayms(uint16_t ms)
58 {
59     uint32_t msDelayTime, currentTickCnt;
60     currentTickCnt = _CP0_GET_COUNT();
61     msDelayTime = (CoreTicksPerMs * ms) + currentTickCnt;
62     while((_CP0_GET_COUNT()) < msDelayTime);
63 }
64 //*****************************************************************************
65 //* uS DELAY
66 //*****************************************************************************
67 void ctDelayus(uint16_t us)
68 {
69     uint32_t usDelayTime, currentTickCnt;
70     currentTickCnt = _CP0_GET_COUNT();
71     usDelayTime = (CoreTicksPeruS * us) + currentTickCnt;
72     while((_CP0_GET_COUNT()) < usDelayTime);
73 }
```

IoT Development Tools for PIC32

Double click – Shake2Wake click Project

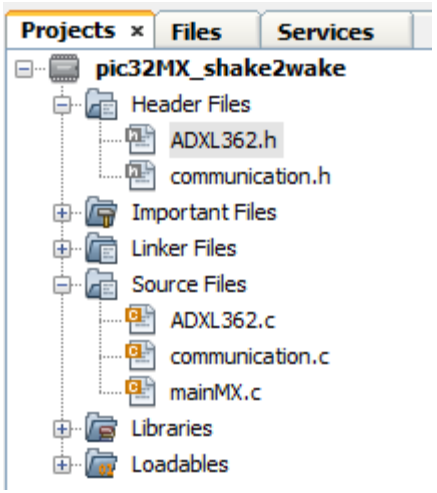


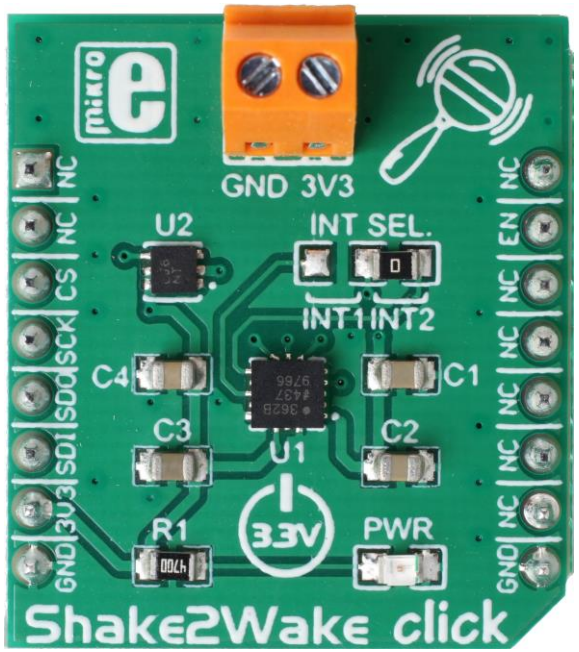



```
//*****************************************************************************
//* INITIALIZE FUNCTION
//*****************************************************************************
void initMX(void)
{
    WORD i;
    WORD timeoutms;
    // PIC32MX CPU Speed Optimizations (Cache/Wait States/Peripheral Bus Clks)
    // On reset, and after c-startup:
    // - Prefetch Buffer is disabled,
    // - I Cache is disabled,
    // - PFM wait States set to max setting (7 = too slow!!!)
    // - Data Memory SRAM wait states set to max setting (1 = too slow!!!)
    // PBCLK - already set to SYSCLK/1 via config settings
     __builtin_disable_interrupts();
    // Data Memory SRAM wait states: Default Setting = 1; set it to 0
    BMXCONbits.BMXWSDRM = 0;
   // Flash PM Wait States: MX Flash runs at 2 wait states @ 80 MHz
    CHECONbits.PFMWS = 2;
    // Prefetch-cache: Enable prefetch for cacheable PFM instructions
    CHECONbits.PREFEN = 1;
    // JTAG: Disable on PORTA
    DDPCONbits.JTAGEN = 0;

    TRISACLR = 0x0001;

     // Set Interrupt Controller for multi-vector machineMode
    INTCONSET = _INTCON_MVEC_MASK;

    // set the CP0 status IE bit high to turn on interrupts globally
    __builtin_enable_interrupts();
}
```

IoT Development Tools for PIC32

Double click – Shake2Wake click Project






```
107 //*****************************************************************************
108 //* MAIN FUNCTION
109 //*****************************************************************************
110 void main(void)
111 {
112     initMX();
113     rc = ADXL362_Init();
114     if(rc == 0)
115     {
116         //set activity threshold 250 mg
117         ADXL362_SetRegisterValue(0x00FA,0x20,1);
118         ADXL362_SetRegisterValue(0x0000,0x21,1);
119 
120         //set inactivity threshold 150 mg
121         ADXL362_SetRegisterValue(0x0096,0x23,1);
122         ADXL362_SetRegisterValue(0x0000,0x24,1);
123 
124         //set inactivity timer 30 samples
125         ADXL362_SetRegisterValue(0x001E,0x25,1);
126 
127         //configure motion detection in loop mode
128         //and enable referenced activity and inactivity
129         //detection
130         ADXL362_SetRegisterValue(0x003F,0x27,1);
131         //map the AWAKE bit to INT2
132         ADXL362_SetRegisterValue(0x0040,0x2B,1);
133 
134         //begin the measurement in wake-up mode
135         ADXL362_SetRegisterValue(0x000A,0x2D,1);
136         do
137         {
138           ADXL362_GetRegisterValue(&regVal,ADXL362_REG_STATUS,1);
139           if(regVal & ADXL362_STATUS_AWAKE)
140             {
141                 LATASET = 0x0001;
142             }
143             else
144             {
145                 LATACLR = 0x0001;
146             }
147         }while(1);
148     }
149 }
```

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Nos Vemos Mañana