TMU3112MS

USB Full Speed Controller (Preliminary)

Data Sheet

AMENDMENT HISTORY

Version	Date	Description
V1.0	Aug, 2008	New release
V1.1	Oct, 2008	Modified module SPIA to SPIB.
V1.2	Aug, 2009	Omit SPI interface for master/slave mode.
V1.3	Oct, 2009	Add VBAT grounding in SINGLE MODE.
V1.4	JAN,2012	Add Ordering Information table.

CONTENTS

1. General Description

The TMU3112MS is a 12T 8051 embedded device tailored to the USB full speed general purpose application. TMU3112MS was designed for connecting PC or operating at stand-alone (non-PC) mode.

2. Features

(1). Operation Frequency

- FAST mode: 24MHz crystal oscillation with internal 48MHz PLL at 5.0V for USB mode
- SLOW mode: Adjustable ext. R/C, RC oscillator at 2.0V~3.6V for battery system (optional)
- STOP mode

(2). On-Chip Memory

- 16k x 8 internal MASK ROM
- Internal RAM 256bytes and external XRAM up to 384bytes

(3). USB interface

- Compliance with the Universal Serial Bus specification v2.0 Full Speed
- Built-in USB Transceiver, 3.3V regulator
- Support USB Suspend /Resume and Remote Wakeup function
- Endpoint 0: Control SETUP/IN/OUT transfer (each 8 bytes)
- Endpoint 1: BULK-IN transfer with Pin-Pong feature (2*64 bytes)
- Endpoint 2: BULK-OUT transfer with Pin-Pong feature (2*64 bytes)
- Endpoint 3: BULK-IN transfer (64 bytes)
- Endpoint 4: BULK-OUT transfer (64 bytes)
- Endpoint 5: INTERRUPT IN transfer (8 bytes)

(5). PWM

- Support 2 channels of Pulse Width Modulation (PWM) function with 8-bit resolution

(6). Reset Controller

- Power On Reset, Low Voltage Reset, Watch-Dog Timer, USB Plug-out Reset

(7). SPI interface

- Support Mode0, 1, 2, 3
- 1x Master (Tx FIFO 8 bytes, Rx FIFO 8 bytes)

- Clock rate up to 6Mbps

(8). Support 32768Hz Crystal pin for Accuracy timing in low power mode (optional)

(9). Keep SRAM data when USB un-plug (need battery)

(10). I/O Ports

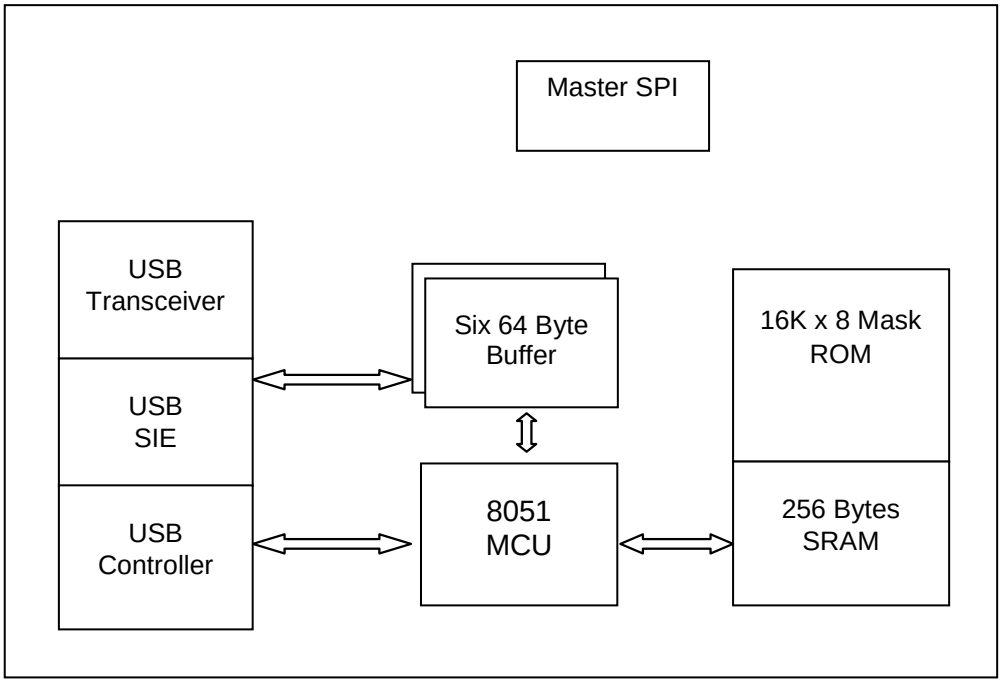
- 4 external Interrupts with wakeup function

(11). LQFP48/Die Form

(12). Application

- USB full speed general purpose
- USB to Serial adapter

3. Functional Block Diagram

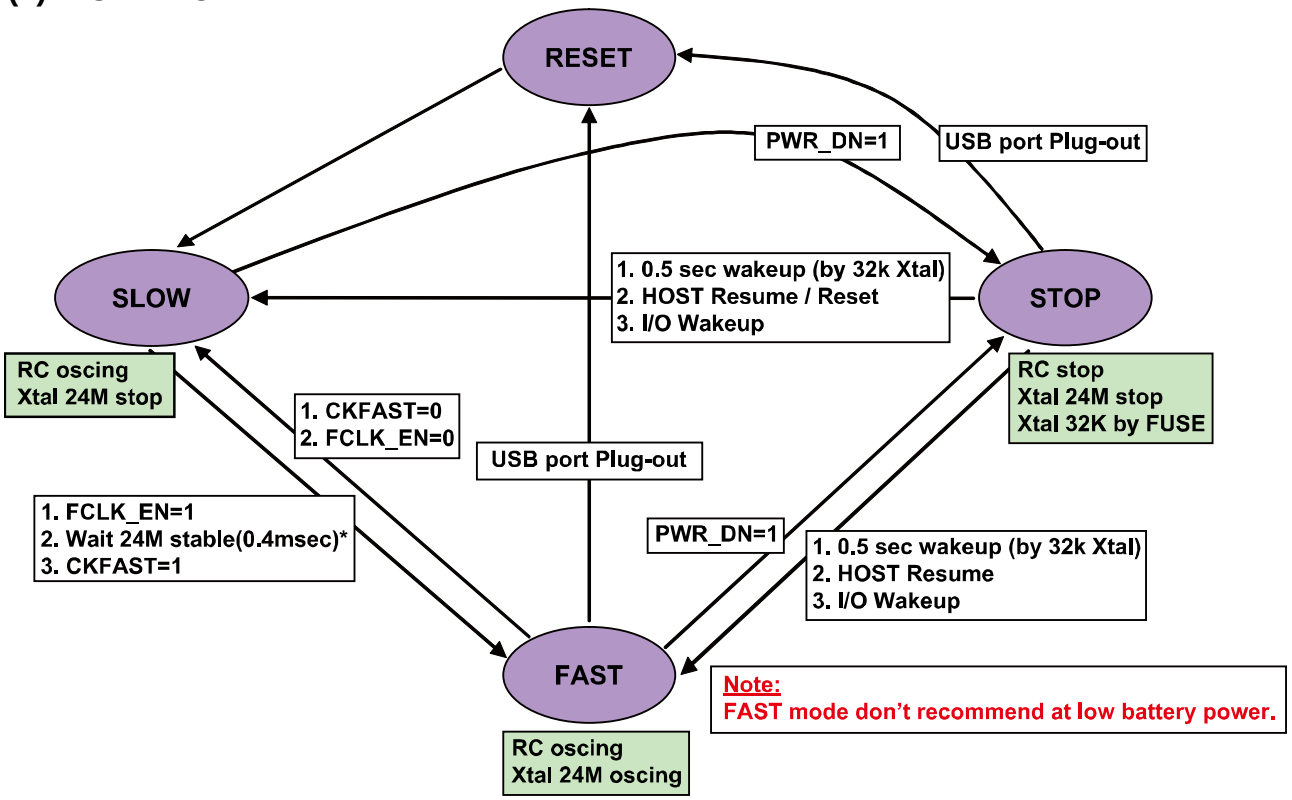


4. Pin Description

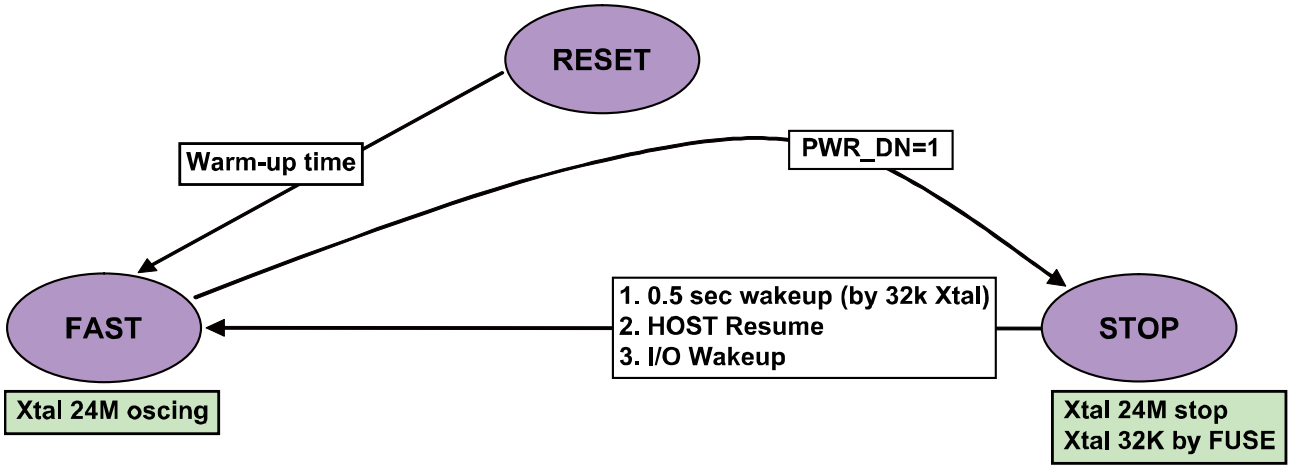
Name	I/O	Description
VDD	P	5V Power from USB cable
VSS	P	Ground
VBAT	P	Battery power
FX1	I	Crystal in (24MHz)
FX2	O	Crystal out
LX1	I	Crystal in (32KHz)
LX2	O	Crystal out
OSCI	I	RC clock, external capacitor and resistor
RESETn	I	Chip reset pin
TESTn	I	Test Mode control
V33	O	3.3V regulator output
DP	I/O	USB positive data signal
DM	I/O	USB negative data signal
P1[7:0]	I/O	8051's Port1
P3[1:0]	I/O	8051's Port3[1:0]
P3.5/T0	I/O	8051's Port3.5 / Timer 0
P3.4/T1	I/O	8051's Port3.4 / Timer 1
PA[7:0]	I/O	GPIO
PB[0]	I/O	GPIO
PB[1]	I/O	GPIO
PB[2]	I/O	GPIO
PB[3]	I/O	GPIO
PB[4]	I/O	GPIO or SPIB serial clock out
PB[5]	I/O	GPIO or SPIB serial data out
PB[6]	I/O	GPIO or SPIB serial data input
PB[7]	I/O	GPIO
PC[0]	I/O	GPIO with Wake-up interrupt
PC[1]	I/O	GPIO with Wake-up interrupt
PC[2]	I/O	GPIO with Wake-up interrupt
PC[3]	I/O	GPIO with Wake-up interrupt
PC[4]	I/O	GPIO or PWMB output
PC[5]	I/O	GPIO or PWMA output
PC[6]	I/O	GPIO
PC[7]	I/O	GPIO

All I/O ports are pseudo-open drain type.

(1). DUAL MODE



(2). SINGLE MODE



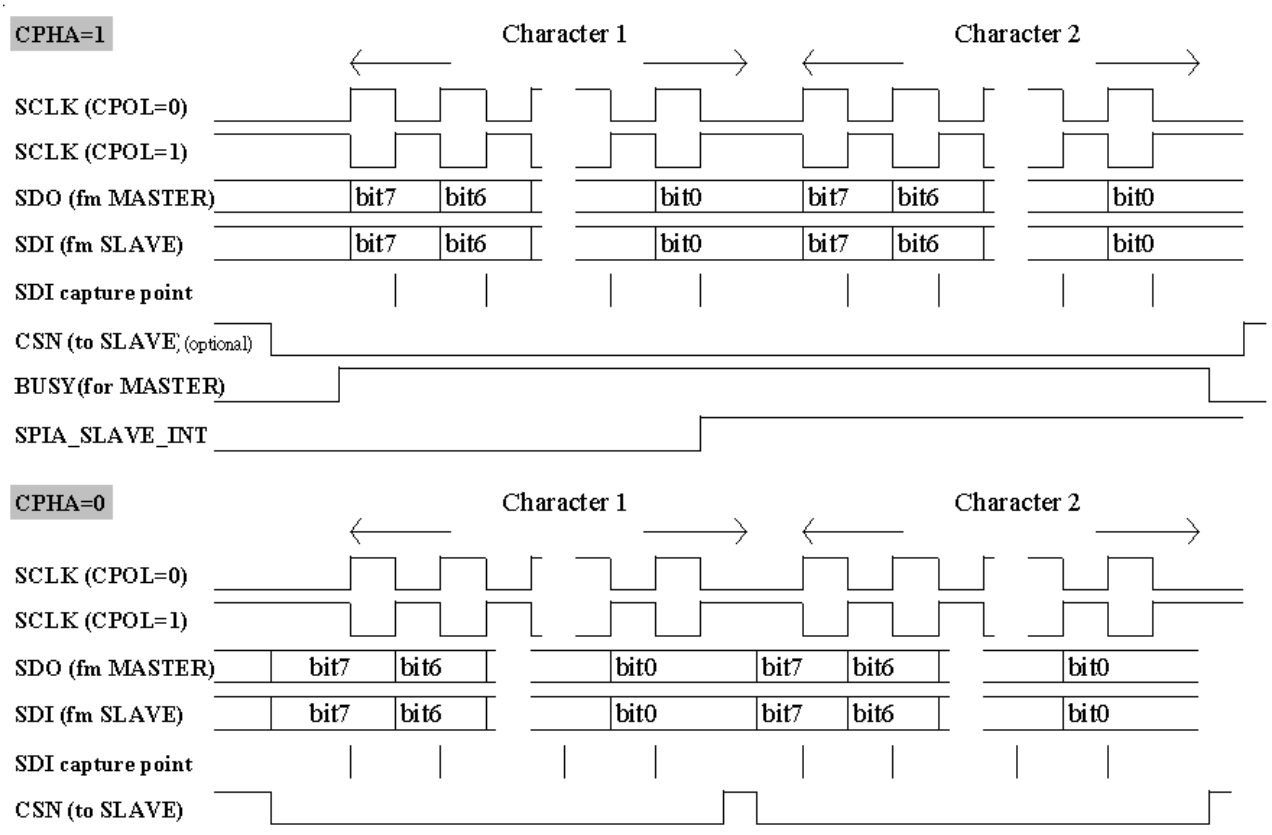
The VBAT pin should tie to power ground, while mask option is selected in SINGLE MODE.

(3). CPU Operation Mode V.S. Peripheral Clock:

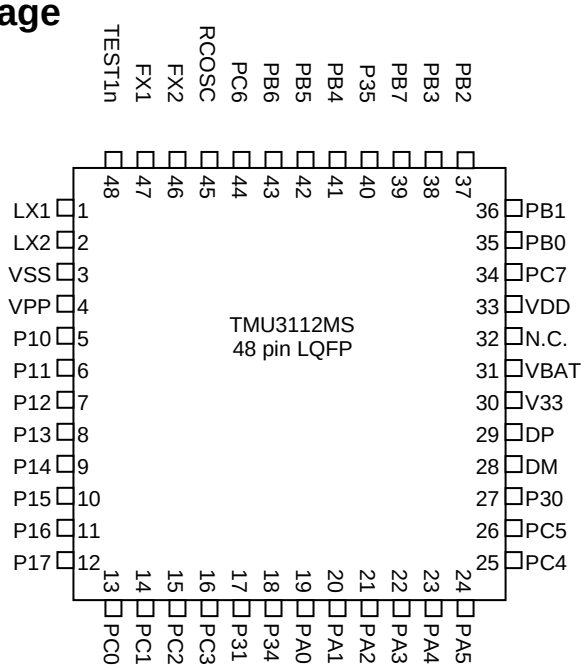
	DUAL MODE (Note-1)		SINGLE MODE (Note-1)	NOTE
	SLOW (Note-2)	FAST (Note-2)		
CPUCLK(CPU51)	RC osc	24MHz	24MHz	
USB function	N/A	48MHz	48MHz	
SPI	CPUCLK	CPUCLK	CPUCLK	
WDT	CPUCLK	CPUCLK	CPUCLK	
PWM	CPUCLK	CPUCLK	CPUCLK	
0.5sec timer wakeup Interrupt	0.5sec	0.5sec	0.5sec	If 32KHz Xtal (Note-3) is available

Note: 1. & 3. function enable/disable control by mask options.
2. CPU clock mode switching control by firmware.

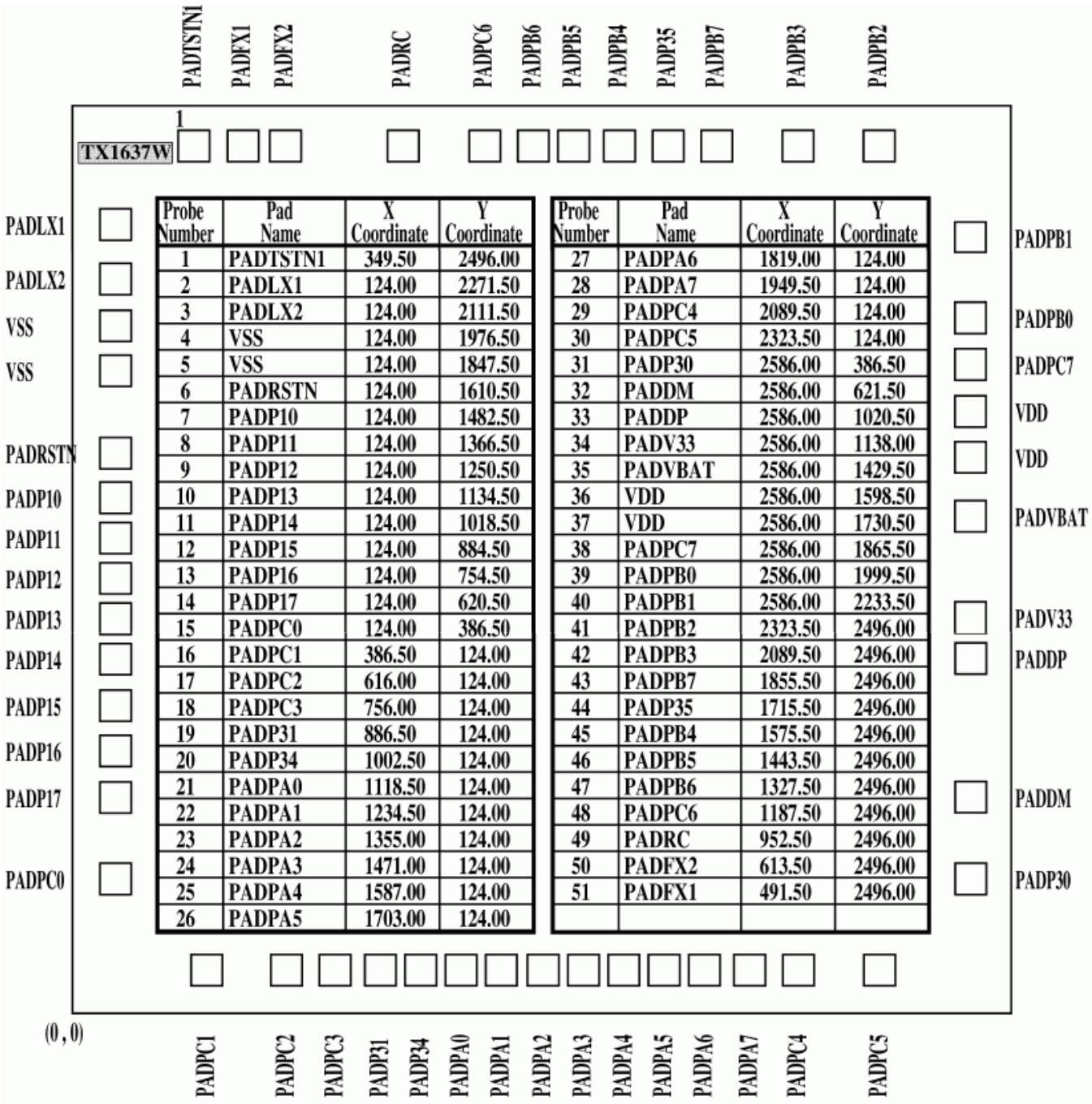
(4). SPI Timing:



5. Package


TEST1n
FX1
FX2
RCOSC
PC6
PB6
PB5
PB4
P35
PB7
PB3
PB2
48
47
46
45
44
43
42
41
40
39
38
37
LX1 1
LX2 2
VSS 3
VPP 4
P10 5
P11 6
P12 7
P13 8
P14 9
P15 10
P16 11
P17 12
36 PB1
35 PB0
34 PC7
33 VDD
32 N.C.
31 VBAT
30 V33
29 DP
28 DM
27 P30
26 PC5
25 PC4
TMU3112MS
48 pin LQFP
13
14
15
16
17
18
19
20
21
22
23
24
PC0
PC1
PC2
PC3
P31
P34
PA0
PA1
PA2
PA3
PA4
PA5

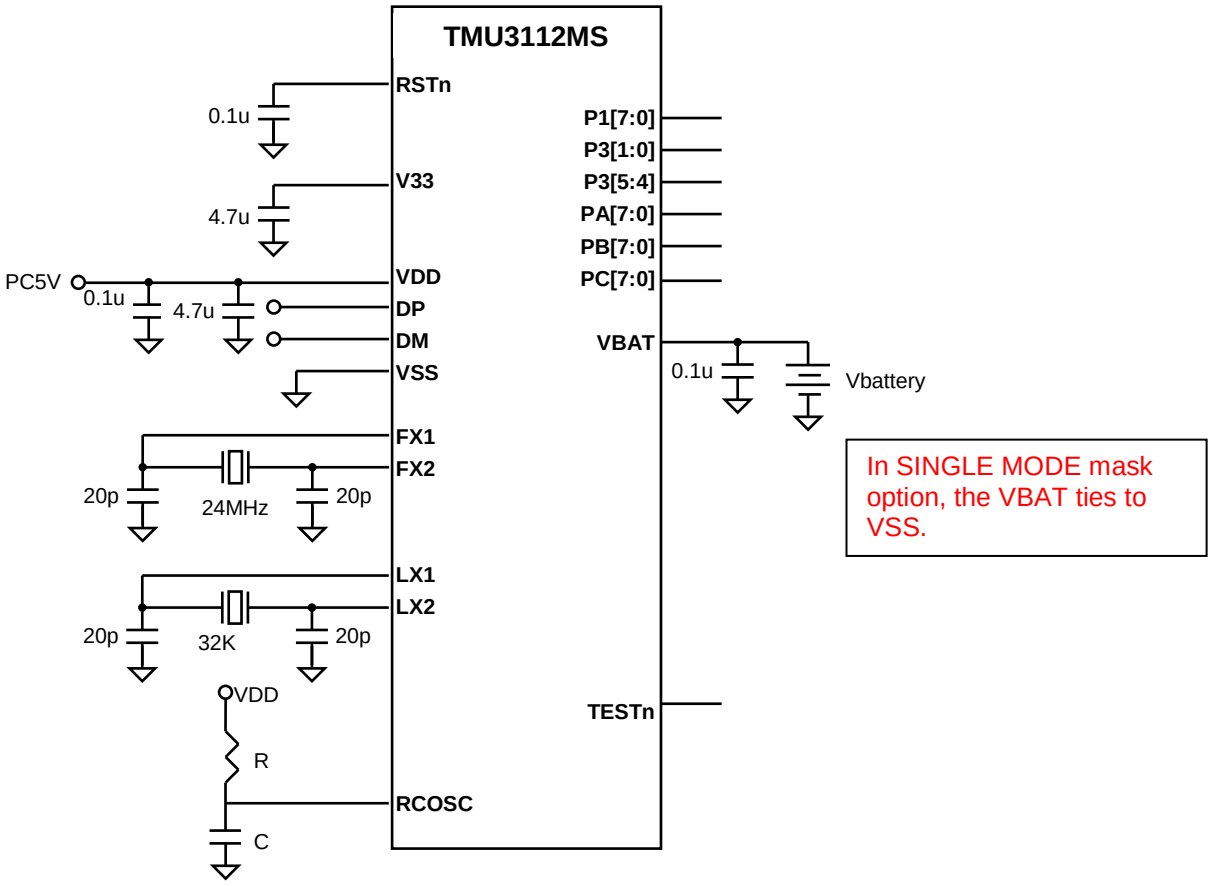
6. Pad List



Probe Number	Pad Name	X Coordinate	Y Coordinate
1	PADTSTN1	349.50	2496.00
2	PADLX1	124.00	2271.50
3	PADLX2	124.00	2111.50
4	VSS	124.00	1976.50
5	VSS	124.00	1847.50
6	PADRSTN	124.00	1610.50
7	PADP10	124.00	1482.50
8	PADP11	124.00	1366.50
9	PADP12	124.00	1250.50
10	PADP13	124.00	1134.50
11	PADP14	124.00	1018.50
12	PADP15	124.00	884.50
13	PADP16	124.00	754.50
14	PADP17	124.00	620.50
15	PADPC0	124.00	386.50
16	PADPC1	386.50	124.00
17	PADPC2	616.00	124.00
18	PADPC3	756.00	124.00
19	PADP31	886.50	124.00
20	PADP34	1002.50	124.00
21	PADPA0	1118.50	124.00
22	PADPA1	1234.50	124.00
23	PADPA2	1355.00	124.00
24	PADPA3	1471.00	124.00
25	PADPA4	1587.00	124.00
26	PADPA5	1703.00	124.00

Probe Number	Pad Name	X Coordinate	Y Coordinate
27	PADPA6	1819.00	124.00
28	PADPA7	1949.50	124.00
29	PADPC4	2089.50	124.00
30	PADPC5	2323.50	124.00
31	PADP30	2586.00	386.50
32	PADDM	2586.00	621.50
33	PADDP	2586.00	1020.50
34	PADV33	2586.00	1138.00
35	PADVBAT	2586.00	1429.50
36	VDD	2586.00	1598.50
37	VDD	2586.00	1730.50
38	PADPC7	2586.00	1865.50
39	PADPB0	2586.00	1999.50
40	PADPB1	2586.00	2233.50
41	PADPB2	2323.50	2496.00
42	PADPB3	2089.50	2496.00
43	PADPB7	1855.50	2496.00
44	PADP35	1715.50	2496.00
45	PADPB4	1575.50	2496.00
46	PADPB5	1443.50	2496.00
47	PADPB6	1327.50	2496.00
48	PADPC6	1187.50	2496.00
49	PADRC	952.50	2496.00
50	PADFX2	613.50	2496.00
51	PADFX1	491.50	2496.00

7. Application Circuit



8. Electrical Characteristics

(1). ABSOLOUTE MAXIMUM RATINGS (GND= 0V)

Name	Symbol	Range	Unit
Maximum Supply Voltage	VDD	-0.3 to 5.5	V
Maximum Input Voltage	Vin	-0.3 to VDD+0.3	V
Maximum output Voltage	Vout	-0.3 to VDD+0.3	V
Maximum Operating Temperature	Topg	-5 to +70	℃
Maximum Storage Temperature	Tstg	-25 to +125	℃

(2). RECOMMEND OPERATING CONDITION (at Ta=-20℃ to 70℃,GND= 0V)

Name	Symb.	Min.	Max.	Unit
Supply Voltage(USB mode)	VDD	4.5	5.5	V
Battery Voltage(battery mode)	Vbat	2.1	4.1	V
Chip I/O Voltage	Vio	Vbat	5.5	V
Input “L” Voltage	Vil1	0	0.3xVport	V

(3). DC CHARACTERISTICS (at Ta=25 ℃,VDD=5.0V, VSS= 0V, Fosc=24MHz)

Name	Symb.	Min.	Typ.	Max.	Unit	Condition	Note
FAST clock	fclk		24		MHz		
SLOW clock	sclk	-30%	850	+30%	MHz	VBAT=3.0V, VDD=NC ExtC=750pF, ExtR=1K	
Threshold voltage of USB detection	Vdet		Vbat+0.2		V		
Operating current	Icc1	-	12	-	mA	Fosc=24MHz	No load
	Icc2		1.2		mA	24MHz off, Fosc=850k VBAT=3.0V, VDD=N.C.	No load
Suspend current	Isus	-	300	500	uA	USB mode	No load
Power down current	Ipd1		3	5	uA	32KHz Off, Vbat=3.0V, VDD=N.C.	No load
	Ipd2		5	8	uA	32KHz On, Vbat=3.0V, VDD=N.C, 0.5sec Wakeup	No load
Port Output High Current	Ioh1	5			mA	Voh=2.9v, Vport=3.3V	One clk time
	Ioh2	6			uA		
Port Output Low Current	Iol1	9			mA	Vol=VSS+0.2V, Vport=3.3V	
Port Voltage	Vport		3.3		V	VDD>Vbat+0.2	
			Vbat-0.1		V	VDD=N.C.	
V33 pin voltage	V33	3.0			V	I=150mA(max)	
		3.2	3.3	3.4	V	No Load	
Port Input High Voltage	Vih	0.6x Vport			V	Schmitt trigger	
Port Pull-Hi Resistor	Rup		125		Kohm	Vport=3.3v	
Low Voltage Reset	Vrst		2.2		V		

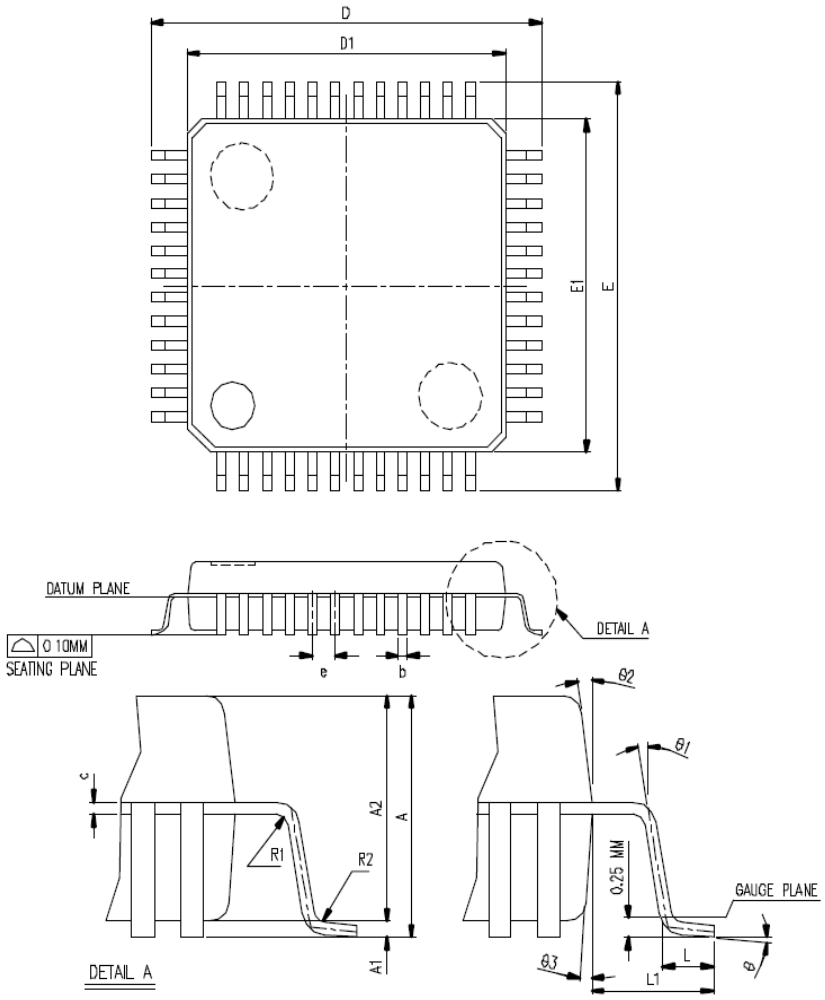
(4). AC CHARACTERISTICS (at Ta=25 ℃,VDD5V=5.0V, VSS= 0V, Fosc=24MHz)

Name	Symb.	Min.	Typ.	Max.	Unit	Note
DP/DM rising time	Trise	4		20	ns	
DP/DM falling time	Tfall	4		20	ns	
DP,DM cross point	Vx	1.3		2.0	V	
V33 output voltage	Vreg	3.2	3.3	3.4	V	

Note: All USB transceiver characteristics can meet USB1.1 spec.

9. Package Information

(1). LQFP48:



SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM	MAX.	MIN	NOM	MAX
A			1.60			0.063
A1	0.05		0.15	0.001		0.006
A2	1.35	1.40	1.45	0.053	0.055	0.057
⚠ b	0.17	0.22	0.27	0.007	0.009	0.011
⚠ c	0.09		0.20	0.004		0.008
e	0.50 BASIC			0.020 BASIC		
D	9.00 BASIC			0.354 BASIC		
D1	7.00 BASIC			0.276 BASIC		
E	9.00 BASIC			0.354 BASIC		
E1	7.00 BASIC			0.276 BASIC		
L	0.45	0.60	0.75	0.018	0.024	0.030
L1	1.00 REF.			0.039 REF.		
R1	0.08			0.003		
R2	0.08		0.20	0.003		0.008
θ	0°	3.5°	7°	0°	3.5°	7°
θ1	0°			0°		
θ2	11°	12°	13°	11°	12°	13°
θ3	11°	12°	13°	11°	12°	13°
JEDEC	MS-026 (BBC)					

*NOTES : DIMENSIONS " D1 " AND " E1 " DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 mm PER SIDE. " D1 " AND " E1 " ARE MAXIMUM PLASTIC BODY SIZE DIMENSIONS INCLUDING MOLD MISMATCH.

Ordering Information

The ordering information:

Ordering number	Package
TMU3112MS-COD	Wafer / Dice