十速科技股份有限公司
tenx technology inc.

Advance Information

TMU3111

USB Full Speed Controller

Data Sheet

Tenx reserves the right to change or discontinue this product without notice.

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CONTENTS

1. GENERAL DESCRIPTION

The TMU3111 is an 8051-based embedded device tailored to general USB full speed application. TMU3111 is designed for connecting PC or operating in stand-alone (non-PC) mode. It also supports the powerful functions and interfaces, such as 10-bit A/D converter for data acquisition and micro-phone recording, speech PWM output, master/slave SPI and external parallel bus (NOR, NAND interface).

2. FEATURES

(1). Dual Power System

- USB 5V and/or battery-in dual power systems

(2). Operation Frequency

- FAST mode
  - 6MHz crystal oscillator for PLL clock source, PLL generate 48MHz for USB data transaction and 24MHz/6MHz for CPU clock
- SLOW mode
  - External resistor, RC oscillator at 2.0V~3.6V for battery system (optional)
  - 32KHz crystal oscillator for CPU clock and accuracy timing in low power mode (optional)
- STOP mode

(3). On-Chip Memory

- 32k x 8 internal program OTP-ROM
- Internal RAM 256 bytes and external XRAM up to 320 bytes

(4). USB interface

- Compliance with Universal Serial Bus specification v2.0 Full Speed
- Built-in USB Transceiver, 3.3V regulator
- Software Control USB pull-up resister
- Support USB Suspend /Resume and Remote Wakeup function
- Endpoint 0: Control SETUP transfer (8 bytes)
- Endpoint 0: Control IN/OUT transfer (64 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: INTERRUPT IN transfer (8 bytes)

(5). ADC (Analog to Digital Converter)

- 20 analog input channels
- 10-bit SAR A/D converter

(6). Recording Function

- 8KHz sampling rate for voice recording
- Recorder AC Couple Out
- Recorder AC Couple In
- Built-in Microphone Booster (Pre_Amp)

(7). Speech PWM Out

- 8-bit unsigned PCM format
- 8KHz sampling rate for Audio Playback
- Class-D Amplify for Speaker Out

(8). NOR Interface

- Data transfer for all of External XRAMs
- H/W handle NOR command procedure
- Read DMA (up to 64 bytes per time)
- Write DMA (up to 64 bytes per time)

(9). NAND Interface

- Data transfer for all of External XRAMs
- Write DMA (up to 64 bytes per time)
- Read DMA (up to 64 bytes per time)
- Compatible with 8-bit parallel interface

(10). SPI Interface

- Mode0, 1, 2, 3
- Master or Slave mode
- Clock Rate up to 12Mbps
- Read DMA (up to 64 bytes per time)
- Write DMA (up to 64 bytes per time)

(11). PWM

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

(12). Reset Controller

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

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

(14). I/O Ports

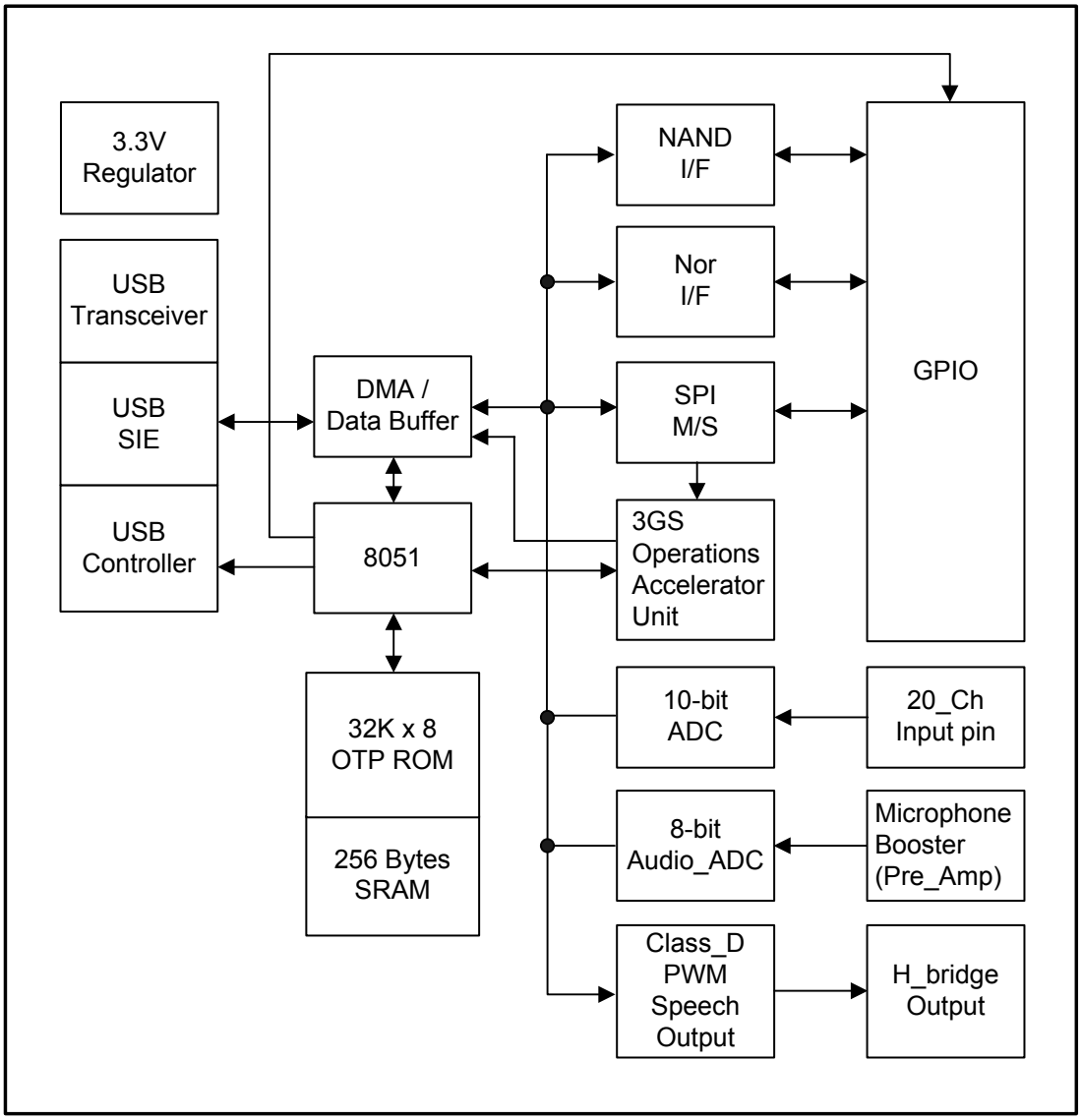
- Max. 50 GPIOs to flexible application
- 4 external Interrupts with wakeup function

(15). LQFP80 / Die Form / Customer Request

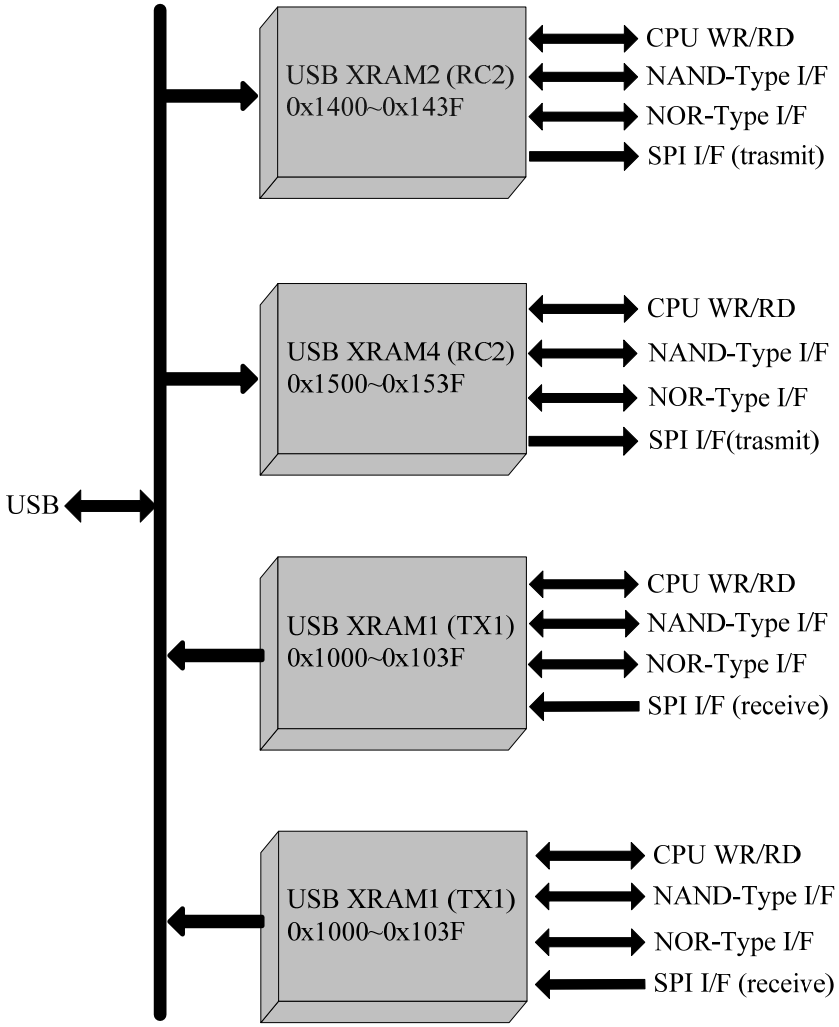
(16). Application

- USB full speed general purpose
- Portable picture viewer equipment (Digital Portable Framer)
- Voice Interactive Toy
- Voice Recording Toy
- Downloadable voice / storage application via Internet

3. Functional Block Diagram



4. XRAM Data Path



5. Pin Description

Name	I/O	Description				
DVDD	P	5V Power from USB cable				
DGND	P	Ground				
PC5VDET	I	USB 5V detection pin, should connect to USB power				
VBAT	P	Battery power in				
V33	O	3.3V regulator output				
DP	I/O	USB positive data signal				
DM	I/O	USB negative data signal				
VPP/RESETn	I	OTP programming power/Chip reset pin (internal pull-up)				
TESTn[1:0]	I	Test Mode control (internal pull-up)				
FX1	I	Crystal in (6MHz)				
FX2	O	Crystal out				
VDDX	P	PLL power				
FLTC	I	PLL filter				
VSSX	P	PLL ground				
LX1	I	Crystal in (32KHz)				
LX2	O	Crystal out				
VR	I	RCLK clock, external resistor				
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]		GPIO (b)	ADC_CH[07:00] (i)	NOR_FA[7:0] (o)		
PB[3:0]		GPIO (b)		NOR_FD[3:0] (b)	NAND_DIO[3:0] (b)	
PB[7:4]		GPIO (b)	ADC_CH[19:16] (i)	NOR_FD[7:4] (b)	NAND_DIO[7:4] (b)	
PC[0]		GPIO with wake-up interrupt (b)		NOR_WRN (o)	NAND_WRN (o)	
PC[1]		GPIO with wake-up interrupt (b)		NOR_RDN (o)	NAND_RDN (o)	
PC[2]		GPIO with wake-up interrupt (b)				
PC[3]		GPIO with wake-up interrupt (b)				
PC[4]		GPIO (b)				PWMB out (o)
PC[5]		GPIO (b)				PWMA out (o)
PC[6]		GPIO (b)				SPICLK M(o), S(i)
PC[7]		GPIO (b)				SPI DOUT (o)
PE[7:0]		GPIO (b)	ADC_CH[15:8] (i)			ICE pins
PF[3:0]		GPIO (b)		NOR_FA[11:8] (o)		
PF[4]		GPIO				SPI DIN (i)
PF[5]		GPIO				SPI CSN (i)
ADC:						
AVDD	P	Analog Power				
AGND	P	Analog Ground				
MICP	I	Micro-phone MIC IN+ input				
MICN	I	Micro-phone MIC IN- input				
VREF	I	External reference voltage				
ANAI	I	AC couple in				
ANAO	O	AC couple out				
Speech PWM:						
VDDW	P	PWM Power				
PWMP	O	Speech PWMP output				
PWMN	O	Speech PWMN output				
VSSW	P	PWM Ground				

All I/O ports are pseudo-open drain types, unless otherwise specified function.

6. CPU Operation Mode V.S. Peripheral Clock

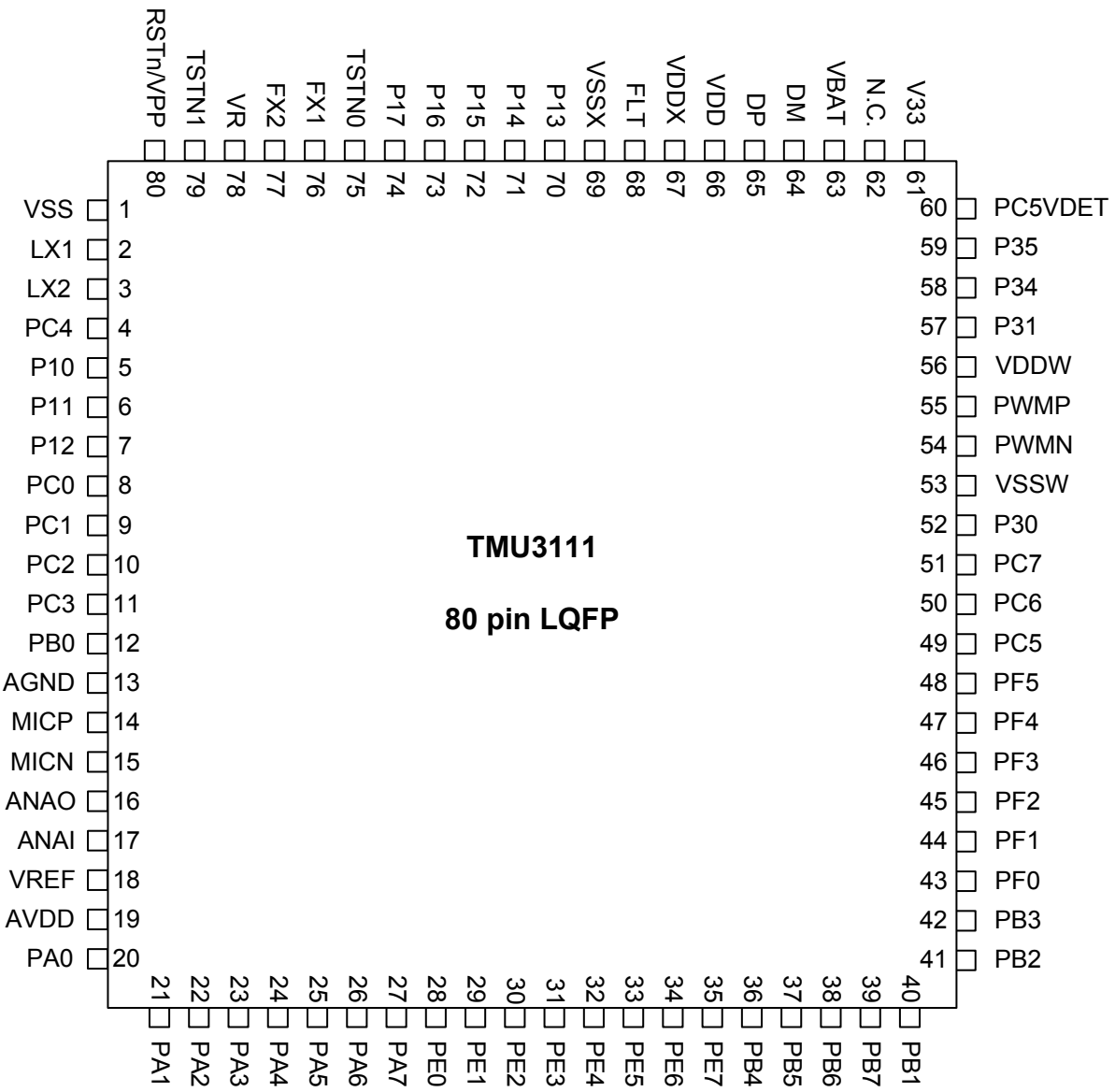
	DUAL MODE[1]		SIGNLE MODE[1]	NOTE
	SLOW [2]	FAST [2]		
CPUCLK(CPU51)	RCLK/32KHz	6M/24MHz	6M/24MHz	
USB function	N/A	48MHz	48MHz	
NAND DMA	N/A	6MHz	6MHz	XTAL_EN = 1
NOR DMA	N/A	6MHz	6MHz	
A/D converter	N/A	6MHz	6MHz	
Recording	N/A	6MHz	6MHz	
Speech PWM	N/A	6MHz	6MHz	
SPI	CPUCLK	CPUCLK	CPUCLK	
WDT	CPUCLK	CPUCLK	CPUCLK	
PWMA/B	CPUCLK	CPUCLK	CPUCLK	
0.5sec timer wakeup Interrupt	0.5sec	0.5sec	0.5sec	If 32KHz Xtal[3] is available

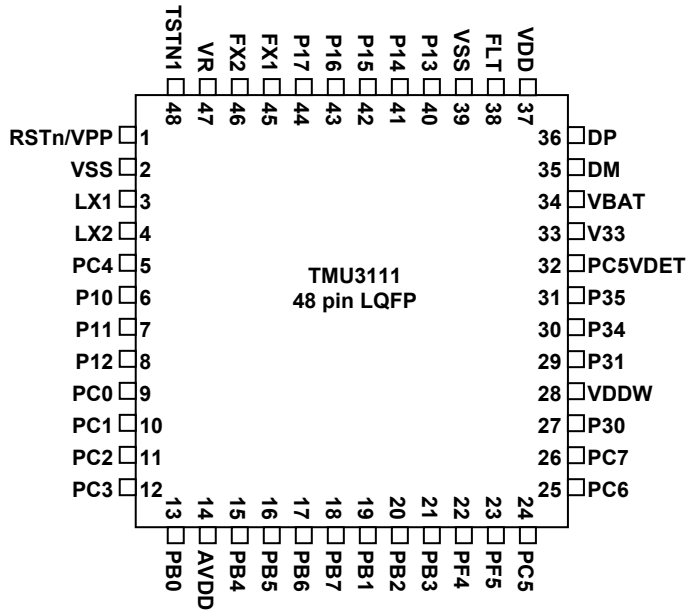
Notes:

(1) & (3) Function enable/disable control by FUSE option.

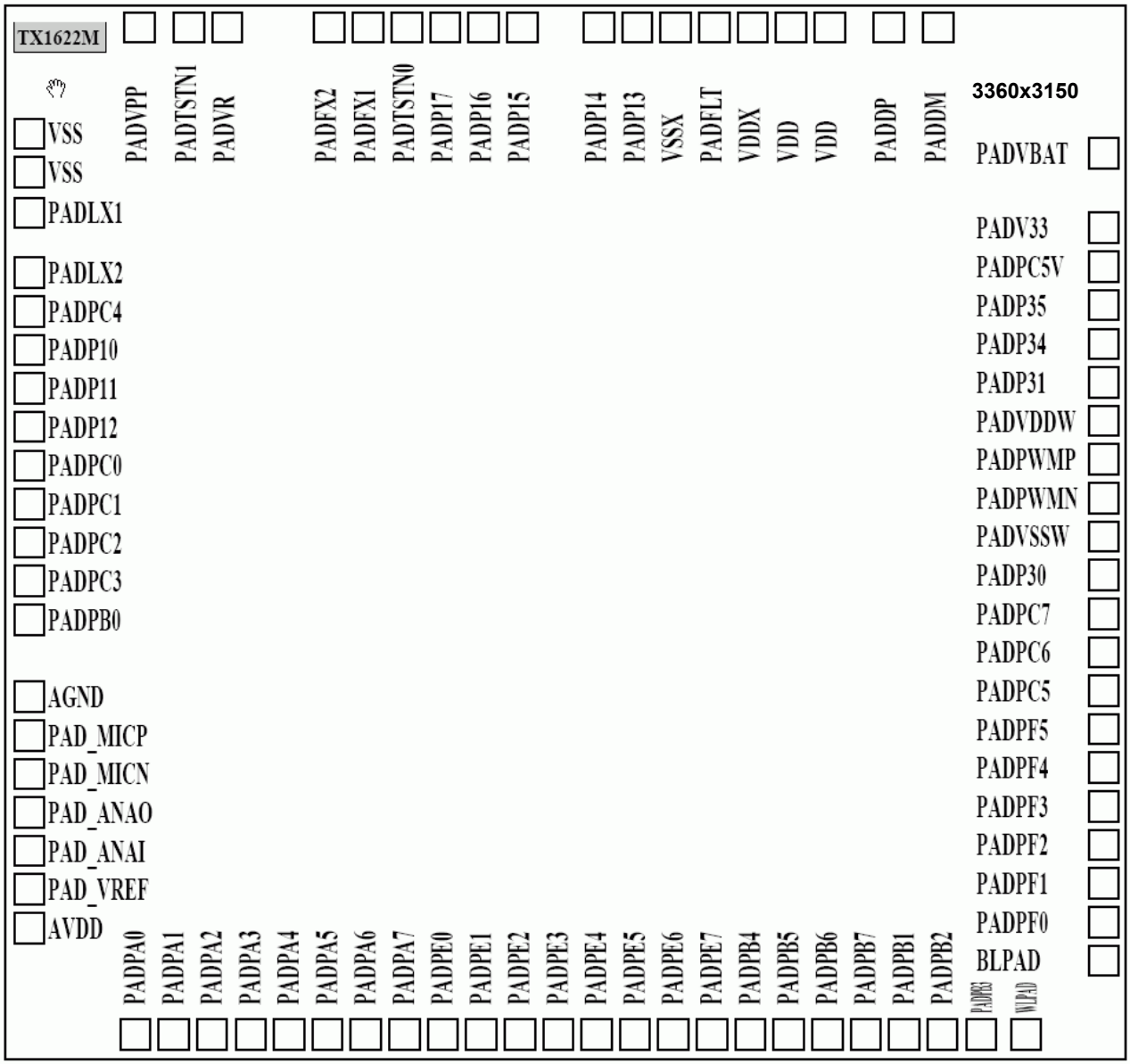
(2) CPU clock mode switching control by firmware.

7. Package


TMU3111
80 pin LQFP
1 VSS
2 LX1
3 LX2
4 PC4
5 P10
6 P11
7 P12
8 PC0
9 PC1
10 PC2
11 PC3
12 PB0
13 AGND
14 MICP
15 MICN
16 ANAO
17 ANAI
18 VREF
19 AVDD
20 PA0
21 PA1
22 PA2
23 PA3
24 PA4
25 PA5
26 PA6
27 PA7
28 PE0
29 PE1
30 PE2
31 PE3
32 PE4
33 PE5
34 PE6
35 PE7
36 PB4
37 PB5
38 PB6
39 PB7
40 PB1
41 PB2
42 PB3
43 PF0
44 PF1
45 PF2
46 PF3
47 PF4
48 PF5
49 PC5
50 PC6
51 PC7
52 P30
53 VSSW
54 PWMN
55 PWMP
56 VDDW
57 P31
58 P34
59 P35
60 PC5VDET
61 V33
62 N.C.
63 VBAT
64 DM
65 DP
66 VDD
67 VDDX
68 FLT
69 VSSX
70 P13
71 P14
72 P15
73 P16
74 P17
75 TSTN0
76 FX1
77 FX2
78 VR
79 TSTN1
80 RSTn/VPP


TMU3111
48 pin LQFP
RSTn/VPP 1
VSS 2
LX1 3
LX2 4
PC4 5
P10 6
P11 7
P12 8
PC0 9
PC1 10
PC2 11
PC3 12
36 DP
35 DM
34 VBAT
33 V33
32 PC5VDET
31 P35
30 P34
29 P31
28 VDDW
27 P30
26 PC7
25 PC6
TSTN1 48
VR 47
FX2 46
FX1 45
P17 44
P16 43
P15 42
P14 41
P13 40
VSS 39
FLT 38
VDD 37
PB0 13
AVDD 14
PB4 15
PB5 16
PB6 17
PB7 18
PB1 19
PB2 20
PB3 21
PF4 22
PF5 23
PC5 24

8. PAD List


TX1622M
3360x3150
PADVPP
PADTSTN1
PADVR
PADFX2
PADFX1
PADTSTN0
PADPI7
PADPI6
PADPI5
PADPI4
PADPI3
VSSX
PADFLT
VDDX
VDD
VDD
PADDP
PADDM
VSS
VSS
PADLX1
PADLX2
PADPC4
PADP10
PADP11
PADP12
PADPC0
PADPC1
PADPC2
PADPC3
PADPB0
AGND
PAD_MICP
PAD_MICN
PAD_ANAO
PAD_ANAI
PAD_VREF
AVDD
PADVBAT
PADV33
PADPC5V
PADP35
PADP34
PADP31
PADVDDW
PADPWMP
PADPWMN
PADVSSW
PADP30
PADPC7
PADPC6
PADPC5
PADPF5
PADPF4
PADPF3
PADPF2
PADPF1
PADPF0
BLPAD
PADPA0
PADPA1
PADPA2
PADPA3
PADPA4
PADPA5
PADPA6
PADPA7
PADPE0
PADPE1
PADPE2
PADPE3
PADPE4
PADPE5
PADPE6
PADPE7
PADPB4
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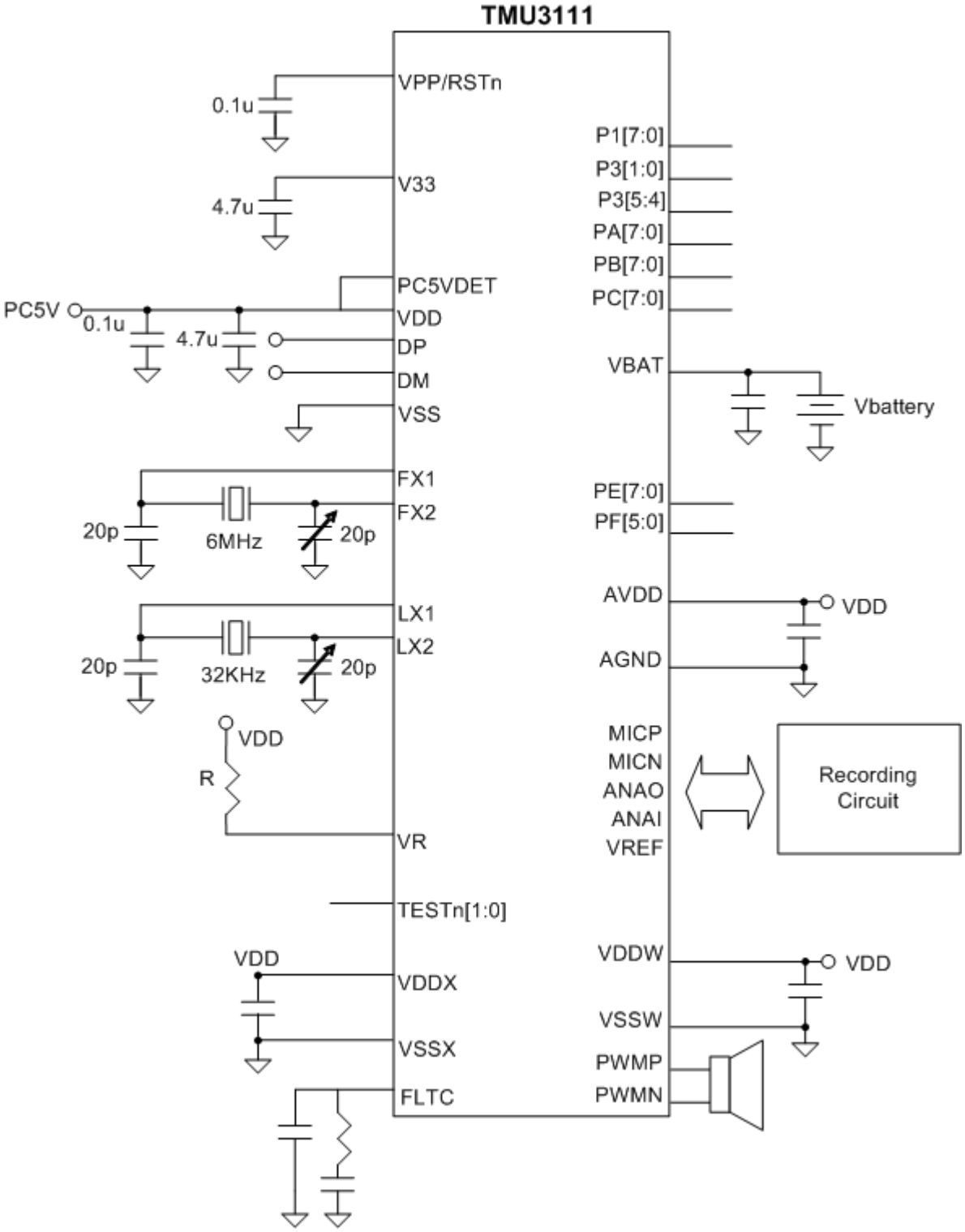
PADPB6
PADPB7
PADPB1
PADPB2
PADDM3
WLPAD

9. Application Circuit



10. 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	-10 to + 70	℃
Maximum Storage Temperature	Tstg	-25 to + 125	℃

(2). RECOMMEND OPERATING CONDITION (at Ta = -10℃ to 70℃, GND = 0V)

Name	Symb.	Min.	Max.	Unit
Supply Voltage	VDD	2.2	5.5	V
Battery Voltage, if apply	Vbat	2.2	4.2	V
Input “H” Voltage	Vih	0.9 x VDD	VDD	V
Input “L” Voltage	Vil	0	0.1 x VDD	V

(3). DC CHARACTERISTICS

(at Ta = 25℃, VDD = 5.0V, VSS = 0V, unless otherwise specify)

Name	Symb.	Min.	Typ.	Max.	Unit	Condition	Note
FAST clock	fclk1		24		MHz	XT6MHz On, PLL enable	
	fclk2		6		MHz	XT6MHz On	
SLOW clock	sclk1	0.1		10	MHz	VBAT = 3.0V, VDD = N.C.	
	sclk2		32		KHz	XT32KHz On	
Operating current	Icc1		10		mA	fclk1 = 24MHz, XT6MHz On	No load
	Icc2		0.8		mA	XT6MHz Off, RCLK = 3MHz VBAT = 3.0V, VDD = N.C.	No load
Suspend current	Isus		360	500	uA	USB mode	No load
Power down current	Ipd1		3	5	uA	VDD = 3.0v, XT32KHz Off	No load
Output high current	Ioh1	2.5	3.8	-	mA	Voh = 3.0v, Vbat = 3.3v, VDD = N.C.	One clk time
	Ioh2	4	6	-	uA		
	Ioh3	2.5	3.8	-	mA		PWMA/B
	Ioh4	60	70	-	mA	VDD = 3.3V, Voh = VDD/2	Sph. PWM
Output low current	Iol1	10	15	-	mA	Vol = VSS + 0.4v,	GPIO
	Iol2	20	25	-	mA	Vol = VSS + 0.4v	PWMA/B
Input high voltage	Vih1	1.6		VDD	V	VDD = 3.2V, Vio = V33 = 3.2V PC5V = 0, Schmitt trigger	GPIO
	Vih2	1.7		VDD	V	VDD = 5.0V, Vio = V33 = 3.3V, PC5V > Vih3, Schmitt trigger	GPIO
	Vih3	2.8		VDD	V	Schmitt trigger	PC5V
Input low voltage	Vil1			1.3	V	VDD = 3.2V, Vio = V33 = 3.2V PC5V = 0, Schmitt trigger	GPIO
	Vil2			1.4	V	VDD = 5.0V, Vio = V33 = 3.3V PC5V > Vih3, Schmitt trigger	GPIO
	Vil3			1.4	V	Schmitt trigger	PC5V

Pull up resistance	Rup1	5	10	15	KΩ	VDD = 3.3 or 5V	VPP/RSTn
	Rup2	40	50	60	KΩ	VDD = 5V	TEST pin
Pull down resistance	Rdn1	50	100	150	KΩ	PC5V	
V33 pin voltage	V33	3.0	3.3	3.6	V	130mA, PC5V > Vih3	

(4). A/D conversion

(at Ta = 25℃, VDD = AVDD = 5.0V, VSS = AGND = 0V, unless otherwise specify)

Name	Symb.	Min.	Typ.	Max.	Unit	Condition	Note
Resolution		-	10	-	Bits		
Conversion time	Tadc		24		us	Fadc=1.5MHz	
Differential linearity	DL		±2.5	±4	LSB		
Linearity	IL		±3.2	±5	LSB		
Total error	ERR		±4	±6	LSB		

(5). USB AC CHARACTERISTICS

(at Ta = 25℃, VDD = AVDD = 5.0V, VSS = AGND = 0V)

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 the USB transceiver characteristics meet USB1.1 spec.