Actions

MICROELECTRONICS Co., Ltd.

Actions-micro AM8360D Datasheet

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Revision History

Version	Date	Description	Author
1.0.0	11/10/2021	Initial Create	maweishuo

Terms and Acronyms

Terms and Acronyms	Definition
CF	Compact Flash
SM	Smart Media
XD	xD picture
SD	Secure Digital
Micro SD	Micro Secure Digital
MS	Memory Stick
MS Pro	Memory Stick Pro
MMC	Multimedia Card
SDRAM	Synchronous Dynamic Random Access Memory
MD	MicroDrive
TF	T Flash
LCD	Liquid Crystal Display
ICE	In-circuit emulation, or in-circuit emulator
JTAG	Joint Test Action Group(ANSI/ICEEE Std.11149.1-1990)
PQFP	Plastic Quad Flat Package
LQFP	Low-Profile Quad Flat Package
BGA	Ball Grid Array
PIP	Picture In Picture
TAP	TEST ACCESS PORT
RGB	Red-Green-Blue color space representation
TCON	Timing controller

General Conventions

Symbol	Description	Notes
Note		
H	In the notes column, an H indicates the pin is hidden behind the actual physical pin listed in the Alternate Functions column and is not included in the pin count. No H indicates the actual pin is listed in the Signal Name column and the Alternate Functions column lists the alternate signals present on the pin.	
Pad GP		
1	Pad group 1	
2	Pad group 2	
Dir/Pol (direction/polarity)		
I	Input	
O	Output	
B	Bidirectional	
Z	Three state output	
Pad Type		
A	Analog pad	
B	Bidirectional	
BS	Bidirectional with Schmitt trigger	
H	High-voltage(up to 3.0 V)tolerant digital input	
I	CMOS input	
IA	Analog input	
IS	Input with Schmitt trigger	
K	Contains an internal weak keeper device	
O	Output	
OA	Analog output	
OD	Open-drain	
PD	Contains an internal pull-down device	
PP[NP]	Can be programmed to non pull, pull down or pull up. The default value is no pull after reset.	
PP[PD]	Can be programmed to non pull, pull down or pull up. The default value is pull down after reset.	
PP[PU]	Can be programmed to non pull, pull down or pull up. The default value is pull up after reset.	
PU	Contains an internal pull-up device	
PWR	power	
Z	High-Z output	
Drive (mA)		
n	Variable drive strength pins.	

1 Introduction

1.1 Overview

The AM8360D processor from Actions-Micro is a highly integrated mix signal SoC target at multi-media applications. The AM8360D emmedded CPU is a high performance, low power 32bit RISC core with DSP instruction extension, which can run as fast as 700MHz.

The AM8360D processor features a hardwired multi-format video encoder, which supports a large variety of popular video formats including: H.264 at full HD resolution.

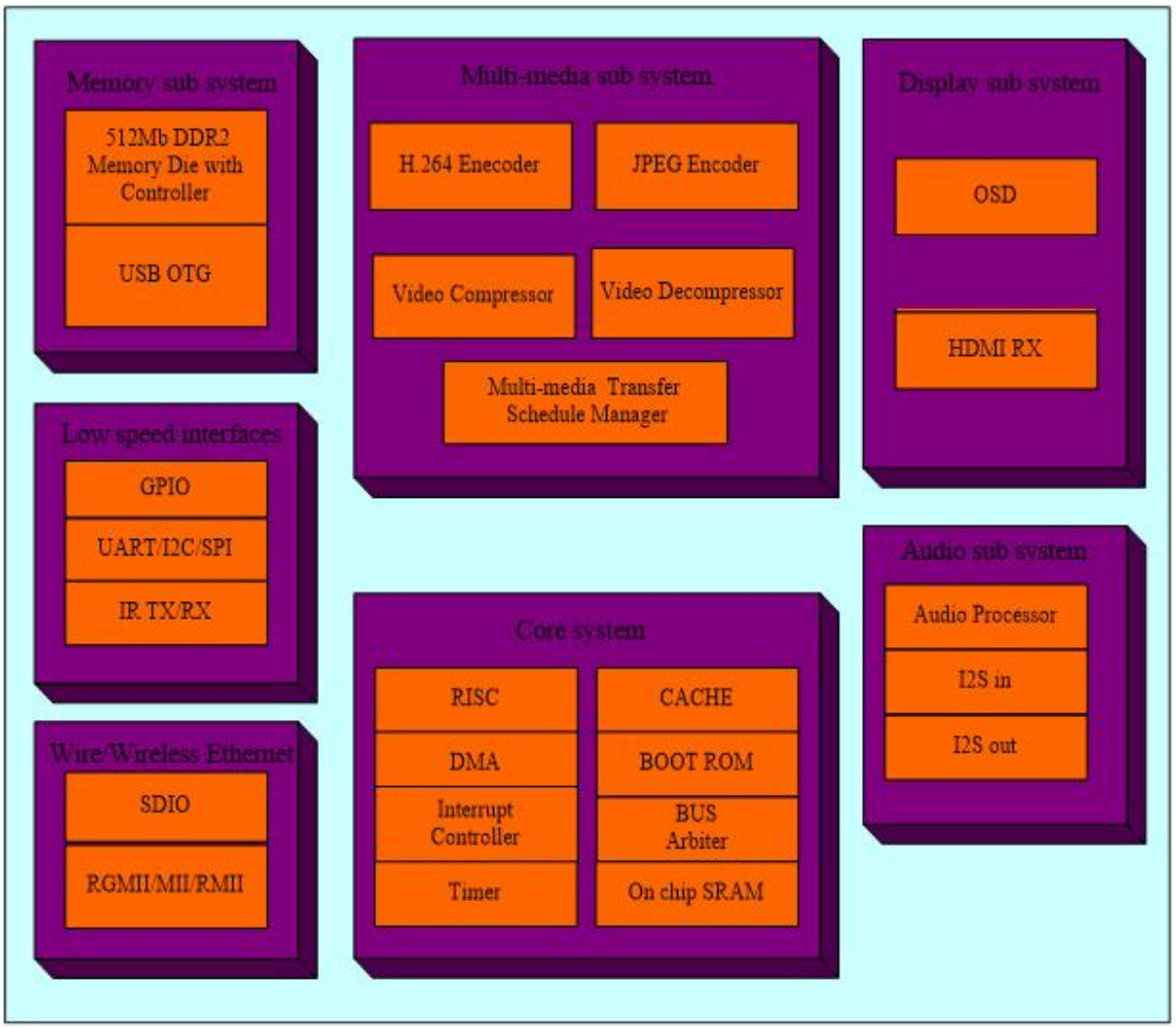
The AM8360D integrated lossless or near-lossless image/video compress and de-compress module which can transfer 1080P video with format RGB888 through 1Gbit/s Ethernet.

The AM8360D multi-media processor provided display solutions with the help of on chip HDMI transmitter and receiver interface.

AM8360D is also integrated with 1 USB OTG controllers, UART, I2C, SPI, etc.

There is a 512Mb DDR2 memory die integrated in AM8360D, so no need to hang a DDR2 memory on PCB.

Block Diagram



AM8360D BLOCK DIAGRAM

2 Feature

The AM8360D provides high level of system integration to support a wide variety of applications. The features of the AM8360D include:

✓ **32BIT RISC CORE**
- 32K byte instruction cache and data cache
- F/W can program from DC up to 800MHz transparently
- DSP instruction for multi-media acceleration
- Static design allows changing clock at run-time for power saving

✓ **VIDEO ENCODER**
- Support ISO/IEC 14496-10/YU-T Rec.H.264
- Base Profile,Level 1-5.1
  - Main Profile ,levels 1-5.1
  - High Profile ,levels 1-5.1
- Support JPEG ITU-T Rec.T81(09/92),Baseline interleaved/JFIF
- 60 frames per second at 1920x1080 resolution for video all format

✓ **IMAGE/VIDEO COMPRESSOR**
- Support upto 1080P Resolution
- Support 8bit YCbCr 4:2:2 & YCbYCr/RGB
- Adaptive compress ratio up to 1:6
- Lossless or Near-lossless compress

✓ **OSD**
- 1,2 OSD bitmap data width
- 256x128 size in 2 bit or 256x256 in 1 bit

✓ **DISPLAY INTERFACE**
- HDMI Tx support, industry standard compliance HDMI 1.2
- HDMI Rx support, industry standard compliance HDMI 1.3a

✓ **AUDIO**
- I2S IN & I2S OUT interface
- Support 32 levels volume control

✓ **Ethernet MAC**
- Support MII/RMII/RGMII up to 1Gbps rate
- Support SDIO interface for WIFI transfer

✓ **Transfer Schedule Manager**
- Transfer compressed video/audio data through Ethernet
- Receive compress video/audio data through Ethernet
- The transferred video upto 1920x1080 60fs

✓ **MEMORY Storage**
- Integrated with a 16x 512Mb DDR2 die which is up to 1066Mbps
- OTP ROM 64bit Chip ID

✓ **DMA CONTROLLER**
- 8 physical channels and 4 bus channels
- Stride mode support
- Software configurable priority

✓ **Boot ROM**
- On chip boot ROM with boot loader
- The system could be loaded from SPI Nor flash

✓ **USB 2.0 OTG**
- Complies with Universal Serial Bus Specification. Revision 2.0.
- Complies with On-The-Go Supplement to the USB2.0 Specification Revision 1.0a.
- Supports point-to-point communication with one low-speed, full-speed or high-speed device in Host mode.
- Supports full-speed or high-speed in peripheral mode.
- Supports USB Mass Storage Class Bulk-Only Transport Revision 1.0 as host or device.
- Supports Electronic still picture imaging Picture Transfer Protocol (PTP)
- Supports direct print function using pict-bridge
- Supports Universal Serial Bus Device Class Definition for Printing Devices Version 1.1 as host
- Supports Universal Serial Bus Still Image Capture Device Definition Revision 1.0 as host
- Configurable/programmable size of endpoints.
- Configurable/programmable single, double, triple or quad buffering.
- Programmable type of endpoints.
- Supports high-speed high-bandwidth Isochronous and Interrupt transfer.
- Supports suspend, resume and power managements function.
- Support USB wakeup

✓ **OTHER INTERFACE**
- UART/I2C/SPI
- 3 external interrupts
- 35 configurable GPIO shared with function pins

✓ **POWER**
- 1.3v for core

- 3.3v/2.5v/1.8/1.5v for mac io,3.3v for others
- Core PLL, LCD PLL,Audio PLL and DDR PLL support spread spectrum

✓ **PACKAGE**

- QFN 88pin (epad), 10x10mm

3 Power on Sequence

The power on sequence requirements of the AM7xxx and AM8xxx products are the same, which are shown in the following figure. VDD represents the power pins supplying power for the core. VCC represents the power pins supplying power for the general purpose pads. SVCC represents the power pins supplying power for the DDR2 or DDR3 SDRAM related pads. P_RESETB is the asynchronous reset pin. PWROK is an internal signal. It is low during the power-on phase to reset all the registers in the chip. The system boots at the moment when PWROK turns to high.

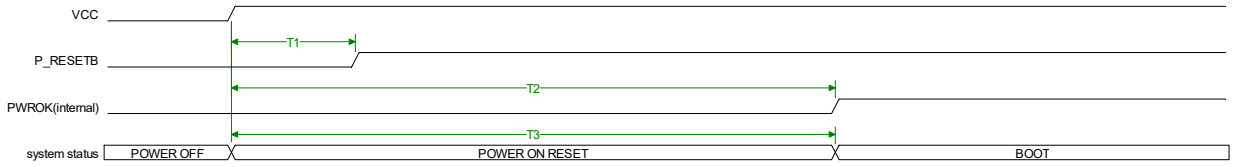


Figure 1 Power on Sequence Diagram

Timing Requirements:

1. $T1 \geq 20ms$
2. $T2 \approx 128ms$
3. $T3$ is equal to the greater one between $T1$ and $T2$
4. The power on sequence of VDD/VCC/SVCC is not cared

4 Pin Out Specification

Pin out table

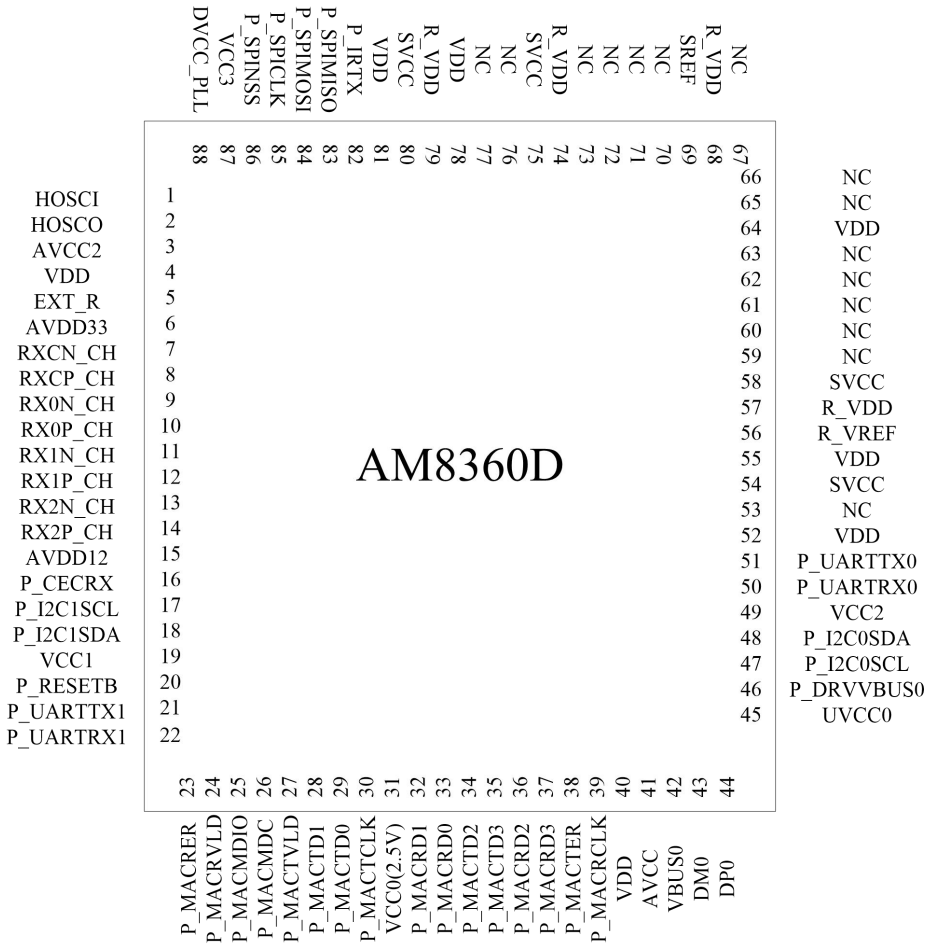
PIN NUM	PIN NAME	Function
1	HOSCI	HOSCI
2	HOSCO	HOSCO
3	AVCC2	AVCC2
4	VDD	VDD
5	EXT_R	EXT_R
6	AVDD33	AVDD33
7	RXCN_CH	RXCN_CH
8	RXCP_CH	RXCP_CH
9	RX0N_CH	RX0N_CH
10	RX0P_CH	RX0P_CH
11	RX1N_CH	RX1N_CH
12	RX1P_CH	RX1P_CH
13	RX2N_CH	RX2N_CH
14	RX2P_CH	RX2P_CH
15	AVDD12	AVDD12
16	P_CECRX	CEC_DAC
17	P_I2C1SCL	I2C1SCL
18	P_I2C1SDA	I2C1SDA
19	VCC1	VCC1
20	P_RESETB	RESETB
21	P_UARTTX1	UARTTX1
22	P_UARTRX1	UARTRX1
23	P_MACRER	GPIO1/RMII_RXER
24	P_MACRVLD	GPIO2//RMII_CRS_DV
25	P_MACMDIO	GPIO3/MACMDIO
26	P_MACMDC	GPIO4/MACMDC
27	P_MACTVLD	I2SSCK/RMII_TXEN
28	P_MACTD1	I2SSD/RMII_TXD1
29	P_MACTD0	I2SWS/RMII_TXD0
30	P_MACTCLK	GPIO8
31	VCC0(2.5V)	VCC0(2.5V)
32	P_MACRD1	I2C0SCL/RMII_RXD1
33	P_MACRD0	I2C0SDA/RMII_RXD0
34	P_MACTD2	SDD3/GPIO11
35	P_MACTD3	SDD2/GPIO12

36	P_MACRD2	SDD1/I2SSCK
37	P_MACRD3	SDD0/I2SSD
38	P_MACTER	SDCMD/I2SWS
39	P_MACRCLK	SDCLK/RMII_REFCLK
40	VDD	VDD
41	AVCC	AVCC
42	VBUS0	VBUS0
43	DM0	DM0
44	DP0	DP0
45	UVCC0	UVCC0
46	P_DRVVBUS0	DRVVBUS0
47	P_I2C0SCL	DDCSCL
48	P_I2C0SDA	DDCSDA
49	VCC2	VCC2
50	P_UARTRX0	UARTRX0
51	P_UARTTX0	UARTTX0
52	VDD	VDD
54	SVCC	SVCC
55	VDD	VDD
56	R_VREF	
57	R_VDD	
58	SVCC	SVCC
64	VDD	VDD
69	SREF	SREF
68	R_VDD	
75	SVCC	SVCCI
74	R_VDD	
78	VDD	VDD
79	R_VDD	
80	SVCC	SVCC
81	VDD	VDD
82	P_IRTX	IRTX
83	P_SPIMISO	SPI_MISO
84	P_SPIMOSI	SPI_MOSI
85	P_SPICLK	SPI_CLK
86	P_SPINSS	SPI_NSS
87	VCC3	VCC3
88	DVCC_PLL	AVCC_PLL2

PIN NUM	PIN NAME	TYPE	Function
1	HOSCI	A	HOSCI
2	HOSCO	A	HOSCO
3	AVCC2	PWR	AVCC2
4	VDD	PWR	VDD
5	EXT_R	A	EXT_R
6	AVDD33	PWR	AVDD33
7	RXCN_CH	A	RXCN_CH
8	RXCP_CH	A	RXCP_CH
9	RX0N_CH	A	RX0N_CH
10	RX0P_CH	A	RX0P_CH
11	RX1N_CH	A	RX1N_CH
12	RX1P_CH	A	RX1P_CH
13	RX2N_CH	A	RX2N_CH
14	RX2P_CH	A	RX2P_CH
15	AVDD12	PWR	AVDD12
16	P_CECRX	A	CEC_DAC
17	P_I2C1SCL	B	I2C1SCL
18	P_I2C1SDA	B	I2C1SDA
19	VCC1	PWR	VCC1
20	P_RESETB	B	RESETB
21	P_UARTTX1	B	UARTTX1
22	P_UARTRX1	B	UARTRX1
23	P_MACRER	B	GPIO1/RMII_RXER
24	P_MACRVLD	B	GPIO2//RMII_CRS_DV
25	P_MACMDIO	B	GPIO3/MACMDIO
26	P_MACMDC	B	GPIO4/MACMDC
27	P_MACTVLD	B	I2SSCK/RMII_TXEN
28	P_MACTD1	B	I2SSD/RMII_TXD1
29	P_MACTD0	B	I2SWS/RMII_TXD0
30	P_MACTCLK	B	GPIO8
31	VCC0(2.5V)	PWR	VCC0(2.5V)
32	P_MACRD1	B	I2C0SCL/RMII_RXD1
33	P_MACRD0	B	I2C0SDA/RMII_RXD0
34	P_MACTD2	B	SDD3/GPIO11
35	P_MACTD3	B	SDD2/GPIO12
36	P_MACRD2	B	SDD1/I2SSCK
37	P_MACRD3	B	SDD0/I2SSD
38	P_MACTER	B	SDCMD/I2SWS
39	P_MACRCLK	B	SDCLK/RMII_REFCLK
40	VDD	PWR	VDD

41	AVCC	PWR	AVCC
42	VBUS0	A	VBUS0
43	DM0	A	DM0
44	DP0	A	DP0
45	UVCC0	PWR	UVCC0
46	P_DRVVBUS0	B	DRVVBUS0
47	P_I2C0SCL	B	DDCSCL
48	P_I2C0SDA	B	DDCSDA
49	VCC2	PWR	VCC2
50	P_UARTRX0	B	UARTRX0
51	P_UARTTX0	B	UARTTX0
52	VDD	PWR	VDD
54	SVCC	PWR	SVCC
55	VDD	PWR	VDD
56	R_VREF	PWR	R_VREF
57	R_VDD	PWR	R_VDD
58	SVCC	PWR	SVCC
64	VDD	PWR	VDD
69	SREF	PWR	SREF
68	R_VDD	PWR	R_VDD
75	SVCC	PWR	SVCCI
74	R_VDD	PWR	R_VDD
78	VDD	PWR	VDD
79	R_VDD	PWR	R_VDD
80	SVCC	PWR	SVCC
81	VDD	PWR	VDD
82	P_IRTX	B	IRTX
83	P_SPIMISO	B	SPI_MISO
84	P_SPIMOSI	B	SPI_MOSI
85	P_SPICLK	B	SPI_CLK
86	P_SPINSS	B	SPI_NSS
87	VCC3	PWR	VCC3
88	DVCC_PLL	PWR	AVCC_PLL2

4.1 Pin out diagram



AM8360D PIN-OUT DIAGRAM

5 Operating Conditions

Absolute Maximum Ratings

SYMBOL	PARAMETER	RATING	UNITS
V_{CC}	Power Supply (3.3V)	3.8	V
Vsvcc	Power Supply (1.5V)	1.575	V
V_{dd}	Power Supply (1.35V)	1.4	V
V_{IN}	Input Voltage	-0.5~4.6	V
V_{OUT}	Output Voltage	-0.5~4.6	V
T_{STG}	Storage Temperature	0~75	℃
Tc	Operation Temperature (Case Surface)	0~70	℃
Ta	Ambient Temperature	0~60	℃

Recommended Operation Conditions

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
V_{CC}	Power Supply (3.3V)	3.0	3.3	3.6	V
Vsvcc	Power Supply (1.5V)	1.425	1.5	1.575	V
V_{dd}	Power Supply (1.35V)	1.3	1.35	1.4	V
T_a	Ambient Temperature	0	35	60	℃

DC Electrical Characteristics for 3.3 volts operation

(Under Recommended Operating Conditions and V_{CC} = 3.0V~3.6V, T_j = 0 to +70) ℃

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IL}	Input Low Voltage				0.8	V
V_{IH}	Input High Voltage		2.2			V
V_{T-}	Schmitt Input Low Voltage				0.9	V
V_{T+}	Schmitt Input High Voltage		1.9			V
V_{OL}	Output Low Voltage	4mA			0.4	V
V_{OH}	Output High Voltage	4mA	2.4			V

6 Crystal Requirements

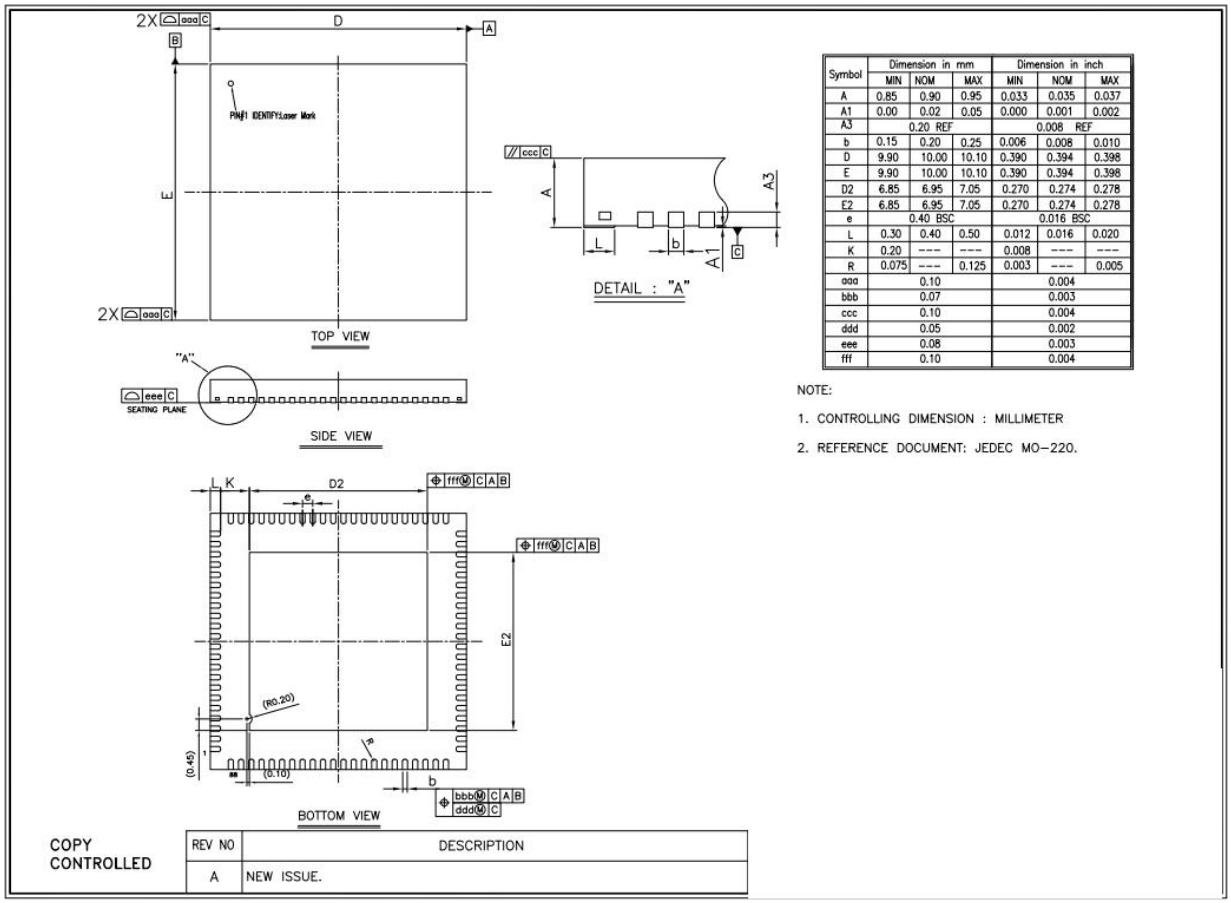
Requirements for 24MHz oscillator.

Description	Specification Requirement
Nominal Frequency	24MHz
Oscillation Mode	Fundamental
Frequency Tolerance at 25℃	±30ppm
Temperature Stability	±50ppm
Shunt Capacitance (Co)	7pF（max）
Load Capacitance (CL)	12pF~18pF
Equivalent Series Resistance (ESR)	50ohm（max）
Drive Level	500uW （max）
Aging (at 25℃)	±3ppm/year
Insulation Resistance	10meg
Net Weight	This will be various. No limitation.
Operating Temperature Range	-10~85℃
Storage Temperature Range	-45~125℃

Requirements for 32.768KHz oscillator.

Description	Specification Requirement
Nominal Frequency	32.768KHz
Oscillation Mode	Fundamental
Frequency Tolerance at 25℃	±30ppm
Temperature Stability	±50ppm
Shunt Capacitance (Co)	7pF（max）
Load Capacitance (CL)	12pF~18pF
Equivalent Series Resistance (ESR)	50ohm（max）
Drive Level	500uW （max）
Aging (at 25℃)	±3ppm/year
Insulation Resistance	10meg
Net Weight	This will be various. No limitation.
Operating Temperature Range	-10~85℃
Storage Temperature Range	-45~125℃

7 Mechanical Specification



Symbol	Dimension in mm			Dimension in inch		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.85	0.90	0.95	0.033	0.035	0.037
A1	0.00	0.02	0.05	0.000	0.001	0.002
A3	0.20 REF			0.008 REF		
b	0.15	0.20	0.25	0.006	0.008	0.010
D	9.90	10.00	10.10	0.390	0.394	0.398
E	9.90	10.00	10.10	0.390	0.394	0.398
D2	6.85	6.95	7.05	0.270	0.274	0.278
E2	6.85	6.95	7.05	0.270	0.274	0.278
e	0.40 BSC			0.016 BSC		
L	0.30	0.40	0.50	0.012	0.016	0.020
K	0.20	---	---	0.008	---	---
R	0.075	---	0.125	0.003	---	0.005
aaa	0.10			0.004		
bbb	0.07			0.003		
ccc	0.10			0.004		
ddd	0.05			0.002		
eee	0.08			0.003		
fff	0.10			0.004		