佑 華 微 電 子 股 份 有 限 公 司

AM4EG Series

DATA SHEET

佑華微電子股份有限公司

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Rev 1.6 2004/7/1

1.0 General Description

The AM4EG series are very low cost voice and melody synthesizer with 4-bits CPU. They have various features including 4-bits ALU, ROM, RAM, I/O ports, timers, clock generator, voice and melody synthesizer, and PWM (Direct drive) or D/A current outputs, etc. The audio synthesizer contains one voice-channel and two melody-channels. Furthermore, they consist of 27 instructions in these devices. With CMOS technology and halt function can minimize power dissipation. Their architectures are similar to RISC, with two stages of instruction pipeline. They allow all instructions to be executed in a single cycle, except for program branches and data table read instructions (which need two instruction cycles).

2.0 Features

(1) Single power supply can operate from 2.2~5.5V at 4MHz or 3.6~5.5V at 8MHz.

(2) Program ROM: 64k x 10 bits

(3) 1 set of 16-bits DPR can access up to 64k x 10 bits melody data memory space, and 1 set of 20-bits VPR can access up to 1024k x 10 bits voice data memory space.

Product	Voice Duration (sec)	Voice Pointer (VPR)	ROM Size (10-bits)
AM4EG127x	127	19-bits	384k
AM4EG170x	170	19-bits	512k
AM4EG255x	255	20-bits	768k
AM4EG340x	340	20-bits	1024k

(4) Data Registers:

a). 128 x 4-bits data RAM (00-7Fh)

b). Unbanked special function registers (SFR) range: 00h-2Fh

(5) I/O Ports:

a). PRA: 4-bits I/O Port A (10h) can be programmed to input/output individually. (Register control)

b). PRB: 4-bits I/O Port B (13h) can be configured to input/output individually. (Mask option)

c). PRC: 4-bits I/O Port C (14h) can be programmed to input/output individually. (Register control)

d). PRD: 4-bits I/O Port D (15h) can be programmed to input/output individually. (Register control)

e). PRE: 4-bits I/O Port E (17h) can be programmed to input/output individually. (Register control)

f). PRF: 4-bits I/O Port F (18h) can be programmed to input/output individually. (Register control)

(6) On-chip clock generator: Resistive Clock Drive ***(RM)*** or Crystal oscillator ***(HM)***

(7) Timer: 1-set Voice Interrupt (Timer0: a 9-bits auto-reload timer/counter).

(8) Stack: 2-level subroutine nesting.

(9) Built-in 4-level Volume Control can be programmed.

(10) Built-in 8-level DAC Current Control can be configured. (Mask option)

(11) Built-in IR Carrier Output: Port B[1] can be configured as IR pin by 38k / 56kHz. (Mask option)

(12) External Reset: Port B[3] can be configured as reset pin. (Mask opton)

(13) HALT and Release from HALT function to reduce power consumption

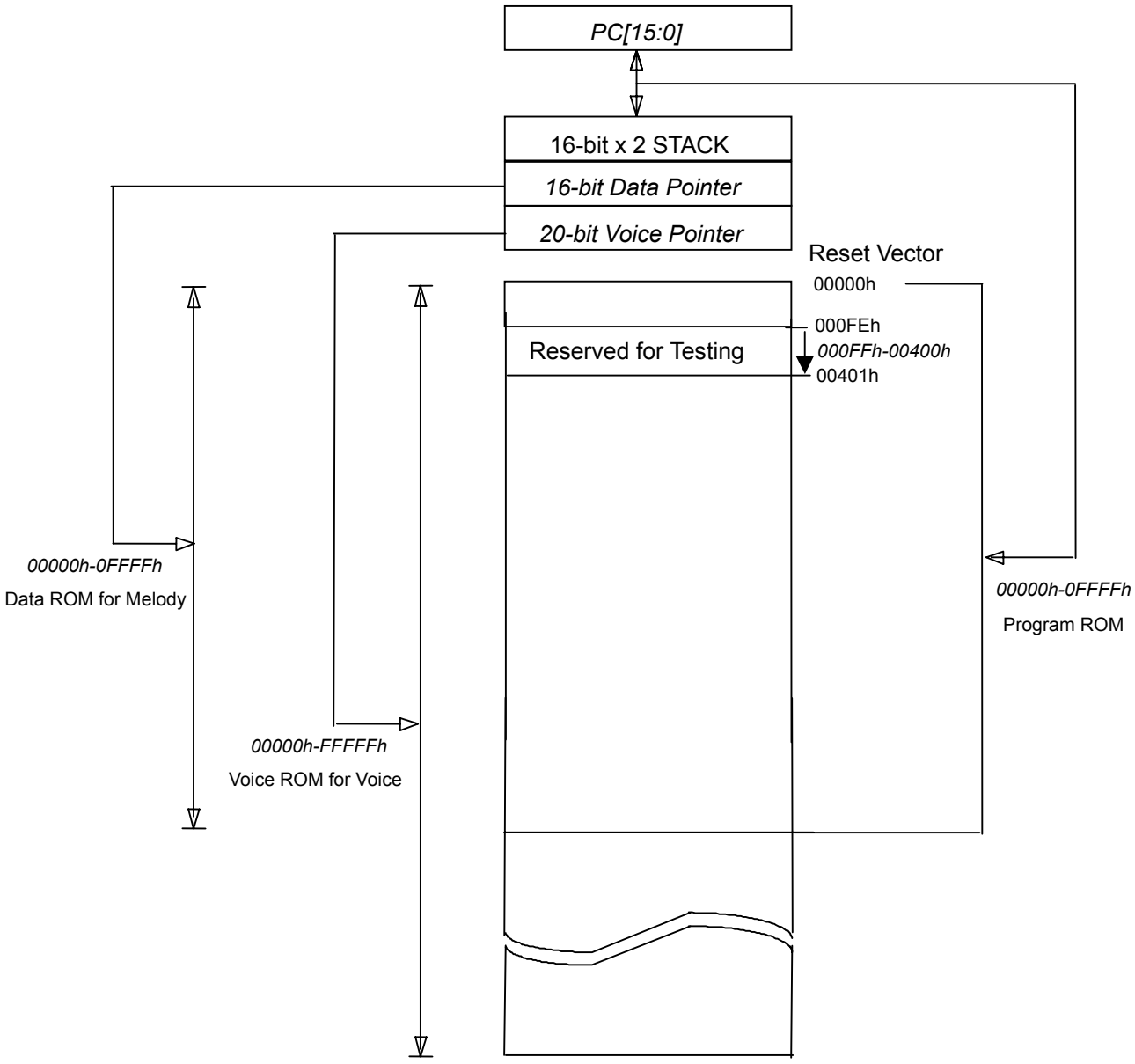
(14) Watch Dog Timer (***WDT***)

(15) Instruction: 1-cycle instruction except for table read and program branches which are 2-cycles

(16) Number of instruction: 27

(17) DAC: 1 channel voice and dual tone melody synthesizer (One 9-bits Cout or 8-bits PWM output).

FIGURE 1 : ROM Map of AM4EG Series



3.0 Pin Description

Pad Name	Pin Attr.	Description
PWM2/Cout	O	PWM2 output, or Current Output of Audio.
PWM1	O	PWM1 output.
Vdd1~3	Power	Power supply during operation.
PRA0~3 **PRC0~3** **PRD0~3** **PRE0~3** **PRF0~3**	I/O	I/O port can be programmed to input/output individually. Input type with weak pull-low or fix-input-floating capability. Buffer Output type.
PRB0 / OSC2	I/O	I/O port can be configured to input/output individually or **HM** OSC pad. Input type with weak pull-low or fix-input-floating capability. Buffer Output type.
PRB1 / IR	I/O	I/O port can be configured to input/output individually. Input type with weak pull-low or fix-input-floating capability. Buffer Output type. *Mask option selected as an IR Carrier Output with 38k / 56kHz*
PRB2	I/O	I/O port can be configured to input/output individually. Input type with weak pull-low or fix-input-floating capability. Buffer Output type.
PRB3 / Reset	I/O	I/O port can be configured to input/output individually. Input type with weak pull-low or fix-input-floating capability. Buffer Output type. *Mask option selected as an external RESET pin with weak pull-low capability.*
OSC1	I	RM/HM mode Oscillator input
GND1~4	Power	Ground Potential

4.0 ABSOLUTE MAXIMUM RATING:

Symbol	Rating	Unit
V_{dd}~V_{ss}	-0.5 ~ +7.0	V
V_{in}	V_{ss}-0.3 < V_{in} < V_{dd}+0.3	V
V_{out}	GND < V_{out} < V_{dd}	V
T_{op} (operating)	0 ~ +70	ºC
T_{st} (storage)	-25 ~ +85	ºC

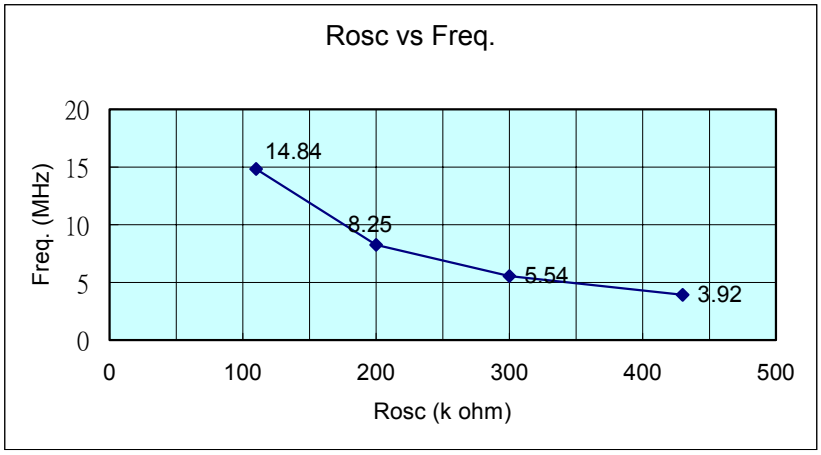
5.0 DC Characteristics

Symbol	Parameter		Vdd	Min.	Typ.	Max.	Unit	Condition
V_{dd}	Operating voltage			2.2	3	5.5	V	F_{osc}=4MHz
I_{sb}	Supply current	Standby	3			1	uA	4MHz, RM, HALT Mode
			4.5			1		
I_{op}		Operating	3		1		mA	4MHz, RM, no load
			4.5		2.5			
I_{ih}	Input current (Internal pull low)		3		3		uA	Input ports with weak pull-low
			4.5		10			

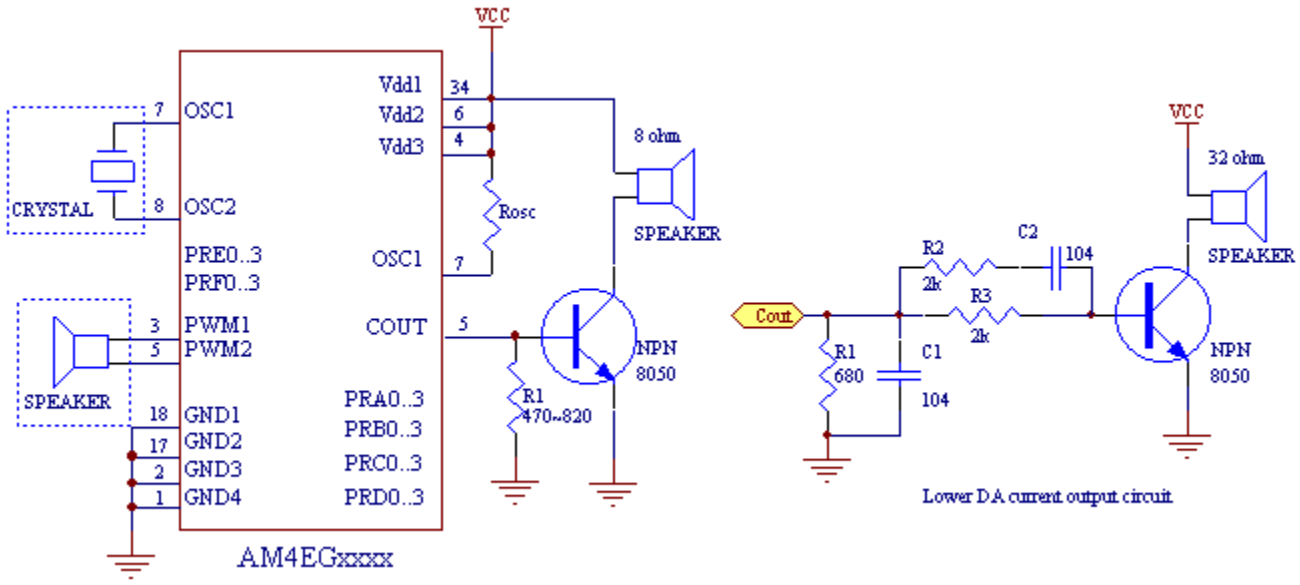
Ioh	Output-high current	3		-4		mA	Voh=0.4V
		4.5		-10			Voh=1.0V
Iol	Output-low current	3		8.5		mA	Vol=2.0V
		4.5		19			Vol=2.6V
Ioh	PWM output current	3		-25		mA	Vdd=3V, Voh=2.4V
Iol		3		25			Vdd=3V, Vol=0.6V
Cout	DAC output current (8-level option)	3	0.8 ~ 4.8			mA	4MHz, RM (Full scale)
		4.5	0.9 ~ 6.5				
dF/F	Frequency stability		-5		5	dF/F	Fosc(3v- 2.4v) / Fosc (3v)
dF/F	Fosc lot variation		-10		10	dF/F	Vdd=3V, Rosc=430k, (~4MHz)

FIGURE 2 : Frequency vs. Rosc (at 3V)

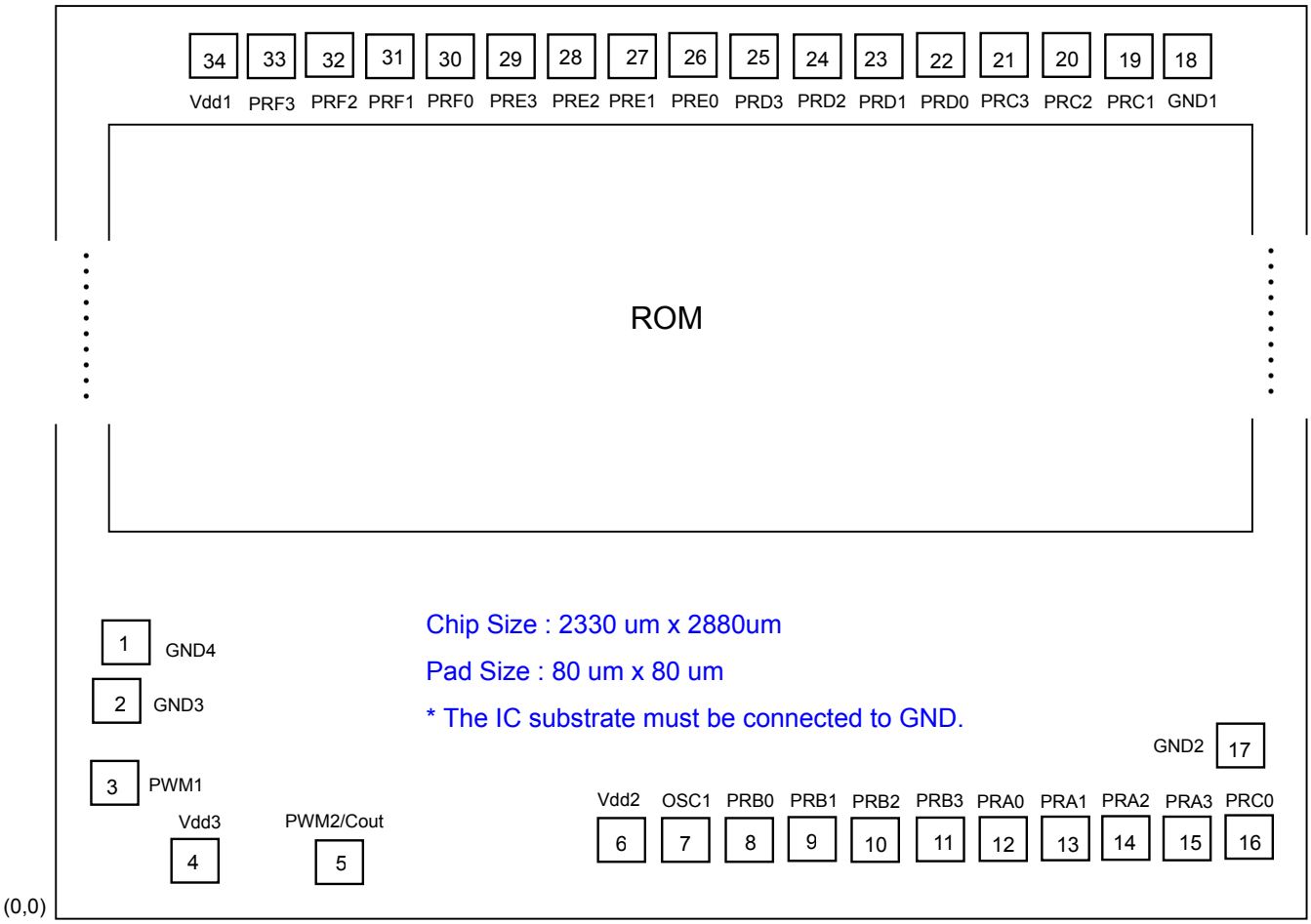
Resistor (Rosc ohms)	110k	200k	300k	430k
Frequency (MHz)	14.84	8.25	5.54	3.92



6.0 Application Circuit

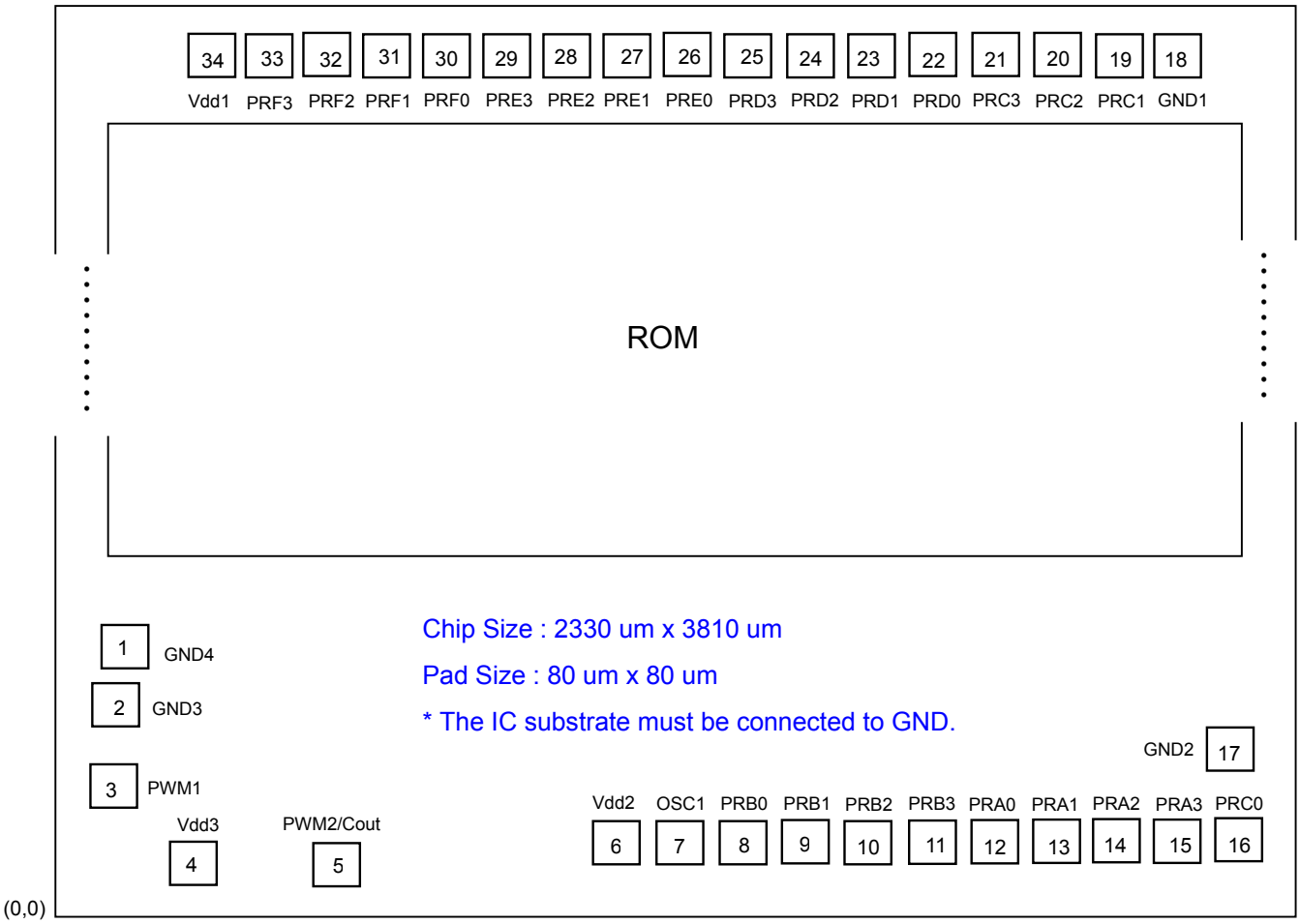


7.0 Bonding Diagram of AM4EG1277/AM4EG1707



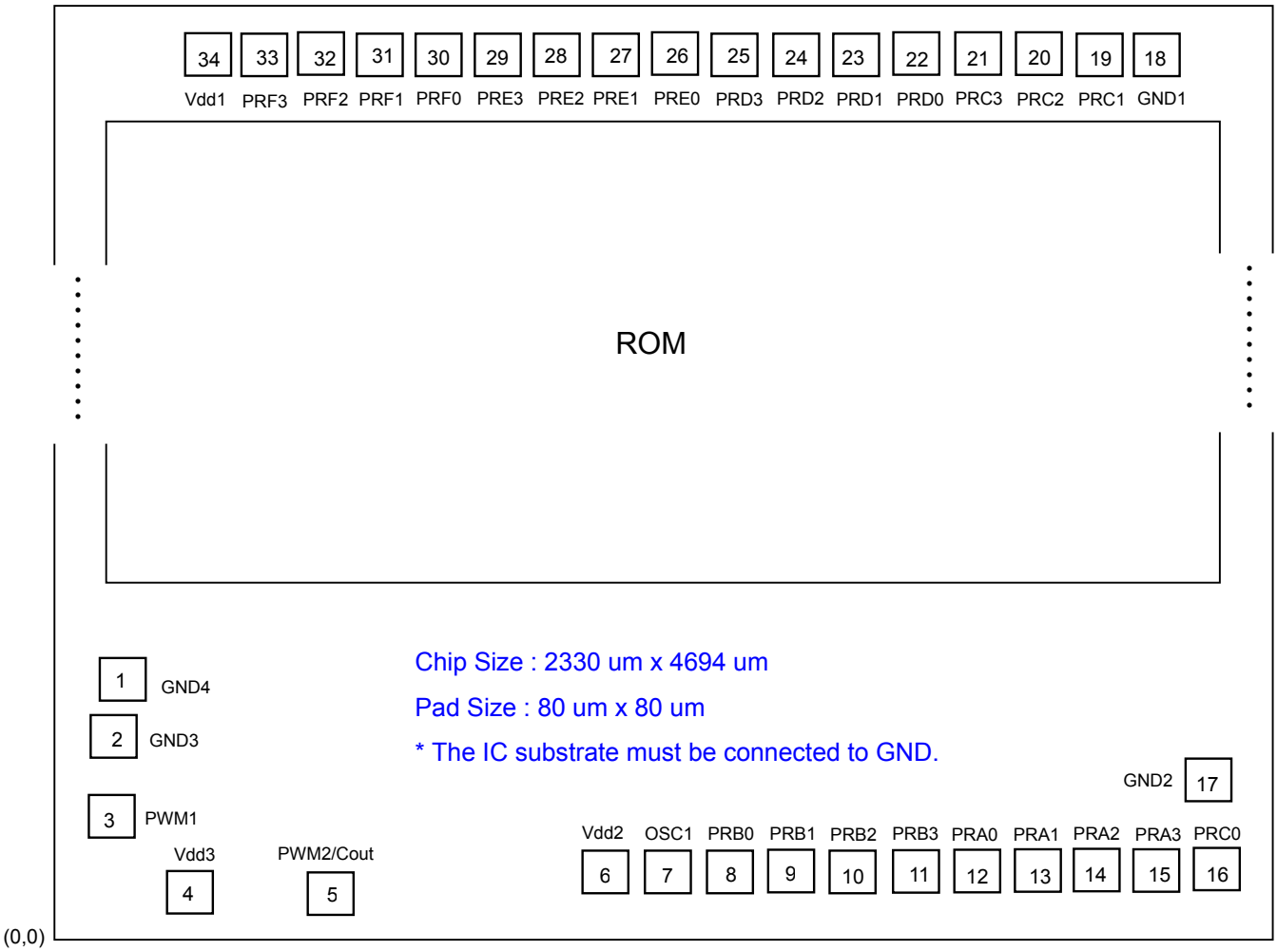
Pad #	Pad Name	X	Y	Pad #	Pad Name	X	Y
1	GND4	75	404	**18**	GND1	2033	2703
2	GND3	57	293	**19**	PRC1	1920	2703
3	PWM1	56	145	**20**	PRC2	1807	2703
4	Vdd3	183	60	**21**	PRC3	1694	2703
5	PWM2/Cout	467	58	**22**	PRD0	1581	2703
6	Vdd2	988	86	**23**	PRD1	1468	2703
7	OSC1	1106	86	**24**	PRD2	1355	2703
8	PRB0/OSC2	1224	86	**25**	PRD3	1242	2703
9	PRB1/IR	1342	86	**26**	PRE0	1129	2703
10	PRB2	1460	86	**27**	PRE1	1016	2703
11	PRB3/Reset	1578	86	**28**	PRE2	903	2703
12	PRA0	1696	86	**29**	PRE3	790	2703
13	PRA1	1814	86	**30**	PRF0	676	2703
14	PRA2	1932	86	**31**	PRF1	563	2703
15	PRA3	2050	86	**32**	PRF2	450	2703
16	PRC0	2168	86	**33**	PRF3	337	2703
17	GND2	2160	230	**34**	Vdd1	223	2703

7.1 Bonding Diagram of AM4EG255D



Pad #	Pad Name	X	Y	Pad #	Pad Name	X	Y
1	GND4	75	404	**18**	GND1	2033	3641
2	GND3	58	293	**19**	PRC1	1920	3641
3	PWM1	56	145	**20**	PRC2	1807	3641
4	Vdd3	183	60	**21**	PRC3	1694	3641
5	PWM2/Cout	467	58	**22**	PRD0	1581	3641
6	Vdd2	988	86	**23**	PRD1	1468	3641
7	OSC1	1106	86	**24**	PRD2	1355	3641
8	PRB0/OSC2	1224	86	**25**	PRD3	1242	3641
9	PRB1/IR	1342	86	**26**	PRE0	1129	3641
10	PRB2	1460	86	**27**	PRE1	1016	3641
11	PRB3/Reset	1578	86	**28**	PRE2	903	3641
12	PRA0	1696	86	**29**	PRE3	790	3641
13	PRA1	1814	86	**30**	PRF0	676	3641
14	PRA2	1932	86	**31**	PRF1	563	3641
15	PRA3	2050	86	**32**	PRF2	450	3641
16	PRC0	2168	86	**33**	PRF3	337	3641
17	GND2	2160	230	**34**	Vdd1	223	3641

7.2 Bonding Diagram of AM4EG2557/AM4EG3407



Pad #	Pad Name	X	Y	Pad #	Pad Name	X	Y
1	GND4	75	404	**18**	GND1	2033	4525
2	GND3	58	293	**19**	PRC1	1920	4525
3	PWM1	56	145	**20**	PRC2	1807	4525
4	Vdd3	183	60	**21**	PRC3	1694	4525
5	PWM2/Cout	467	58	**22**	PRD0	1581	4525
6	Vdd2	988	86	**23**	PRD1	1468	4525
7	OSC1	1106	86	**24**	PRD2	1355	4525
8	PRB0/OSC2	1224	86	**25**	PRD3	1242	4525
9	PRB1/IR	1342	86	**26**	PRE0	1129	4525
10	PRB2	1460	86	**27**	PRE1	1016	4525
11	PRB3/Reset	1578	86	**28**	PRE2	903	4525
12	PRA0	1696	86	**29**	PRE3	790	4525
13	PRA1	1814	86	**30**	PRF0	676	4525
14	PRA2	1932	86	**31**	PRF1	563	4525
15	PRA3	2050	86	**32**	PRF2	450	4525
16	PRC0	2168	86	**33**	PRF3	337	4525
17	GND2	2160	230	**34**	Vdd1	223	4525