



AU1564/2064 □
DATA SHEET

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一般規格:

AU1564, AU1564A, AU2064, AU2064A 乃一具有4-bit微處理器之單晶片語音合成器，它以LOGPCM之編碼方式，可合成15, 20秒之語音。此4-bit微處理器具有4-bit ALU (算術邏輯單元)、1K * 15 bits ROM、64 * 4bits RAM， I/O PORT、計時器、時脈產生器、LCD 驅動器等特性，且有78個指令供使用者程式用；其中 Halt function (暫停功能) 可減少功率消耗。

特性：

1. 單一工作電壓範圍為2.4 - 6 伏特。
2. 語音總長度可達15, 20秒, 且可分割成64語音段(section)。
(AU1564, AU1564A -->15秒； AU2064, AU2064A -->20秒)
3. 可由微處理器指令觸發語音訊號。
4. 可配電晶體驅動8歐姆之喇叭，或直接驅動蜂鳴器或64歐姆之喇叭。
5. 提供3x 24=72節(段)LCD驅動器，內裝HALVER電路。
6. 內含時脈產生器。
7. 內含ROM容量：1024 * 15bits。內含RAM容量：64 * 4bits。
8. 2個4 bits輸入埠。(其中 AU1564, AU1564A 無 S4 pad)
9. 2個4 bits輸入/出埠。
10. 一個4bits輸出埠。
11. 一個控制輸出接腳。
12. 78個指令。
13. 4個階層副式槽。
14. 2個外部中斷因素 (INT, S&M port)。
15. 2個內部中斷因素 (Timer, Divider)。
16. 3個電流輸出位準 1.5mA, 3mA, 4.5mA 由光罩選定。
(其中AU1564, AU1564A無 COUT 輸出功能)

General Description:

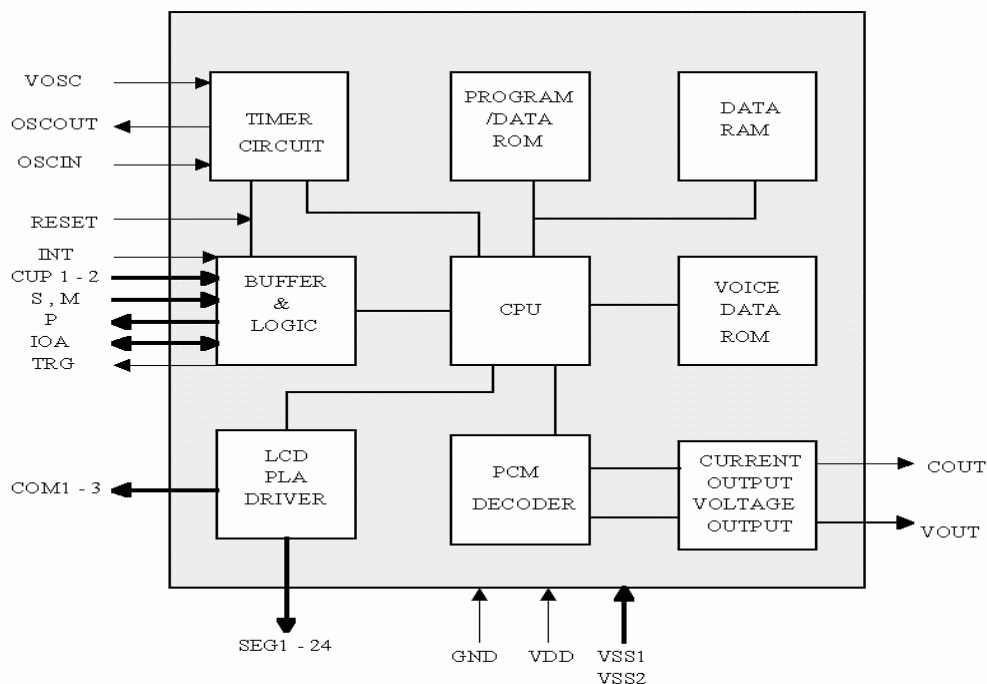
The **AU1564**, **AU1564A**, **AU2064**, **AU2064A** is a single chip voice synthesizer with 4-bit microprocessor. That can synthesize voice up to 15, 20 seconds by ALPHA qualified coding algorithm (LOGPCM).

The 4-bit microprocessor has various feature including 4-bit ALU, 1K×15 bits ROM, 64×4 bits RAM, I/O port, timer, clock generator, LCD driver, etc. The instruction set with 78 instructions. With the half function can minimize power dissipation.

Features:

1. Single power supply can operate from 2.4V through 6V
2. The total voice duration is about 15, 20 seconds could be partitioned up to 64 sections (AU1564, AU1564A -->15 seconds, AU2064, AU2064A -->20 seconds)
3. The voice can be triggered by microprocessor instructions
4. Current output could drive 8 ohm speaker with a transistor, VOUT could drive buzzer or 64 ohm directly.
5. LCD driver provided, up to 3× 24=72 segments. Build-in HALVER circuitry.
6. Build-in clock generator
7. Internal ROM: 1024×15 bits
Internal RAM: 64×4 bits
8. Two 4-bit input ports (AU1564, AU1564A has no S4 pad)
9. Two 4-bit I/O ports
10. One 4-bit output port
11. One control output pins
12. 78 instructions
13. 4-level subroutine nesting (also used for interrupt)
14. Two external factors (INT, S & M port) for interrupt
15. Two internal factors (Timer , Divider) for interrupt
16. Three current output level 1.5mA, 3mA, 4.5mA is mask option (full scale).
(AU1564, AU1564A has no COUT output function)

Block Diagram :



LCD Common Plate Usage:

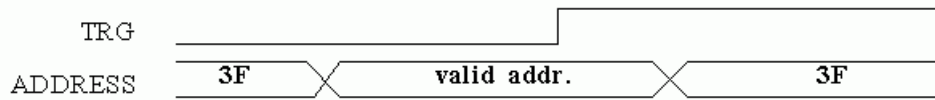
| | Static | 1/2 duty | 1/3 duty |
|-----------------------|--------|----------|----------|
| COM1 | Yes | Yes | Yes |
| COM2 | No | Yes | Yes |
| COM3 | No | No | Yes |
| Alternating frequency | 32Hz | 32Hz | 43Hz |

Voice Trigger:

The voice circuitry will be Triggered in the rising edge of TRG signal. The Voice section address must be placed on I/OA and I/OB port.

I/OB2 I/OB1 I/OA4 I/OA3 I/OA2 I/OA1
 (MSB) (LSB)

a) In power on state, TRG signal is reset to "LOW" level. TRG will stay at low level until the program set it to "HIGH" level.



b) Before triggering the voice circuitry, used the OIOA and OIOB instruction to place the voice section address on I/OA and I/OB port. The voice section address couldn't be changed until the rising edge of TRG signal.

c) After triggering voice, I/OA and I/OB ports must output 3F data or set to input mode. If not, there will be a standby current problem.

d) Example of playing voice subroutine:
Triggering the 26th(1Ah) section

```

LDS 3,1
LDS 4,A
OIOB 3 ; place voice section address to i/o port
OIOA 4
RF 4 ; trigger voice
SF 4
LDS 3,3
LDS 4,F
OIOA 4 ; output 3F data to I/O port
OIOB 3
  
```

Absolute Maximum Rating: (VDD=3V, VSS2=0V)

| Symbol | Rating | Unit |
|-----------|-----------|------|
| VSS1 | 1.2-1.8 | V |
| GND | 0-0.6 | V |
| CUP1 | VSS2-VSS1 | V |
| CUP2 | VSS1-VDD | V |
| OSCIN | GND-VDD | V |
| OSCOU | GND-VDD | V |
| S1-S4 | VSS2-VDD | V |
| M1-M4 | VSS2-VDD | V |
| IOA1-IOA4 | VSS2-VDD | V |
| IOB1-IOB4 | VSS2-VDD | V |
| INT/BUSY | VSS2-VDD | V |

| Symbol | Rating | Unit |
|--------------|----------|------|
| RESET | VSS2-VDD | V |
| TRG | VSS2-VDD | V |
| P1-P4 | VSS2-VDD | V |
| SEG1-24 | VSS2-VDD | V |
| COM1-3 | VSS2-VDD | V |
| VOU1-2 | VSS2-VDD | V |
| T(operating) | -10-+60 | °C |
| T(storage) | -55-+125 | °C |

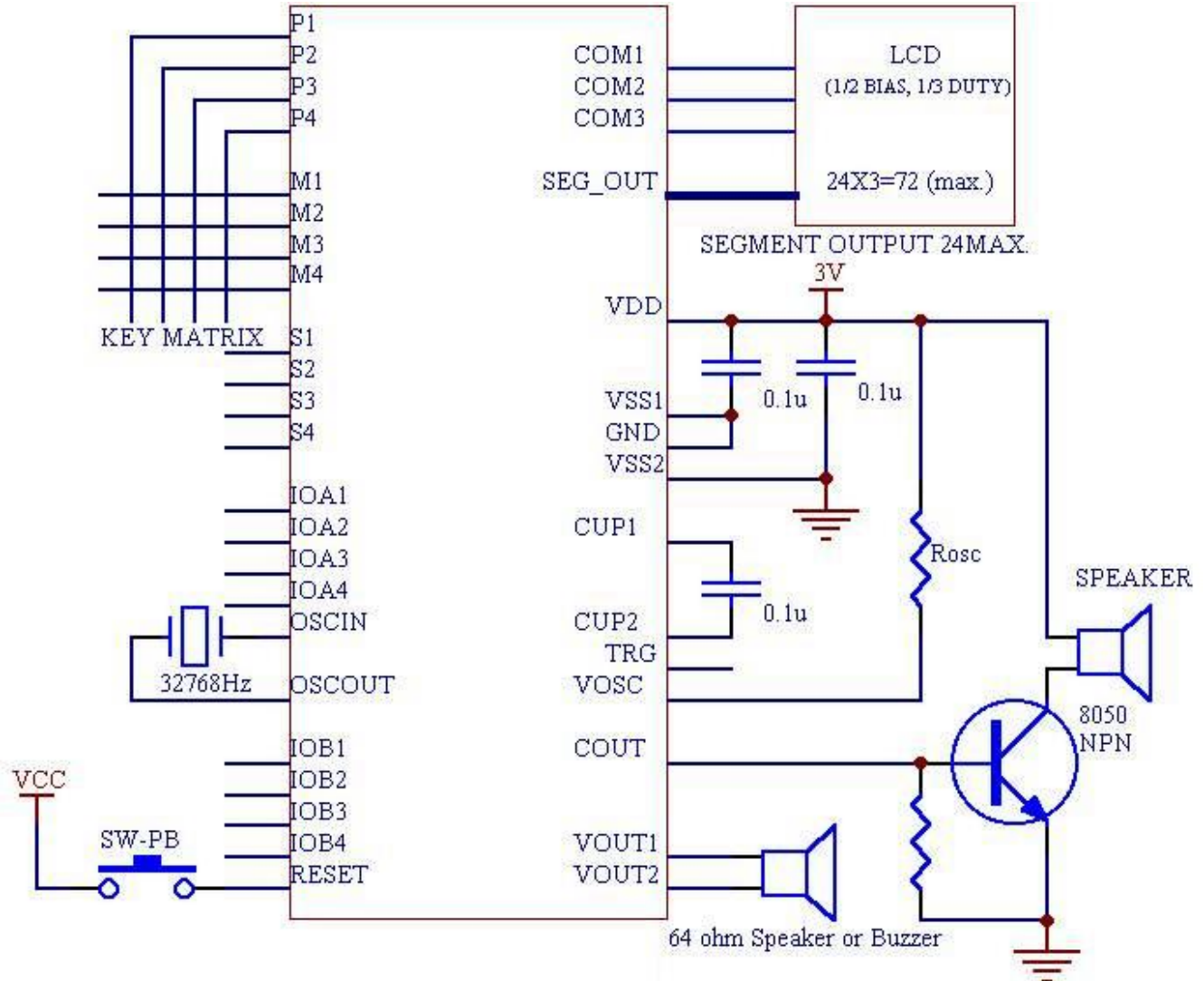
DC Characteristics :(VDD=3V, VSS=0V)

| Symbol | Parameter | Min. | Tpy. | Max. | Unit | Condition |
|--------|---|------|------|------|------|--|
| VDD | Operating Voltage | 2.4 | 3 | 6 | V | |
| ISB | Standby Current | | 1 | | uA | VDD=3V, no load |
| IOP | Operation Current | | | | uA | |
| VOH1 | Output High Voltage (IOA, IOB, P) | | 3 | | V | |
| VOL1 | Output Low Voltage (IOA, IOB, P) | | 0 | | V | |
| VOH2 | Output High Voltage (TRG) | | 3 | | V | |
| VOL2 | Output Low Voltage (TRG) | | 0 | | V | |
| RI1 | Input Resistance (S, M) | | 1.3 | | Mohm | "L"-level hold Tr.=OFF Pull-down Tr.=ON |
| R12 | Input Resistance (S, M) | | 230 | | Kohm | "L"-level hold Tr.=ON Pull-down Tr.=OFF |
| R13 | Input Resistance (INT/BUSY) | | | | Kohm | |
| R14 | Input Resistance (RESET) | | 16.8 | | Kohm | |
| IO1 | O/P Current VOUT1, VOUT2 | | | | | |
| ICO | O/P Current (COUT) | | -1.5 | | mA | full scale |
| | | | -3 | | | |
| | | | -4.5 | | | |
| △F/F | Crystal Oscillator Frequency Stability | | | | % | |
| △F/F | Voice Oscillator Frequency Variation | | | | % | |

Pad Description:

| Pad No. | Pad Name | I/O | Function Description |
|---------|-------------|------|---|
| 1 | VDD | P | Positive Power supply |
| 2-3 | CUP1-2 | I | Voltage Halver Capacitor |
| 4 | OSCIN | I | Crystal Oscillator Input, 32768Hz |
| 5 | OSCOUT | I | Crystal Oscillator Output, 32768Hz |
| 6 | COM1 | O | Common plate for LCD panel |
| 7-30 | SEG1-24 | O | 24 segment outputs for LCD panel |
| 31 | VDD | P | Positive Power supply |
| 32-33 | COM2-3 | O | Common plate for LCD panel |
| 34 | GND | G | Backup negative power supply |
| 35-36 | VSS1-2 | G | Negative power supply |
| 37-38 | S4-3 | I | Input port |
| 39 | TRG | I | Audio output enable signal. Latch voice Section address |
| 40-43 | IOA1-4/S0-3 | I/O | Voice section address. Internal pull-up |
| 44 | RESET | I | System reset |
| 45 | VOSC | I | Voice oscillator input |
| 46 | COUT | O | Audio signal current output |
| 47 | VOUT1 | O | Audio signal voltage output |
| 48 | VSS2 | G | Negative power supply |
| 49 | VOUT2 | O | Audio signal voltage output |
| 50-51 | IOB1-2/S4-5 | I/O | Voice section address. Internal pull-up. |
| 52-53 | IOB3-4 | I/O | I/O port, 2 bits |
| 54 | INT/BUSY | I/O | Voice busy status, CPU interrupt request |
| 55-58 | P1-4 | O | Output port |
| 59-62 | M1-4 | I | Input port |
| 63 | N.C. | N.C. | |
| 64-65 | S2-1 | I | Input port |

Typical Application :

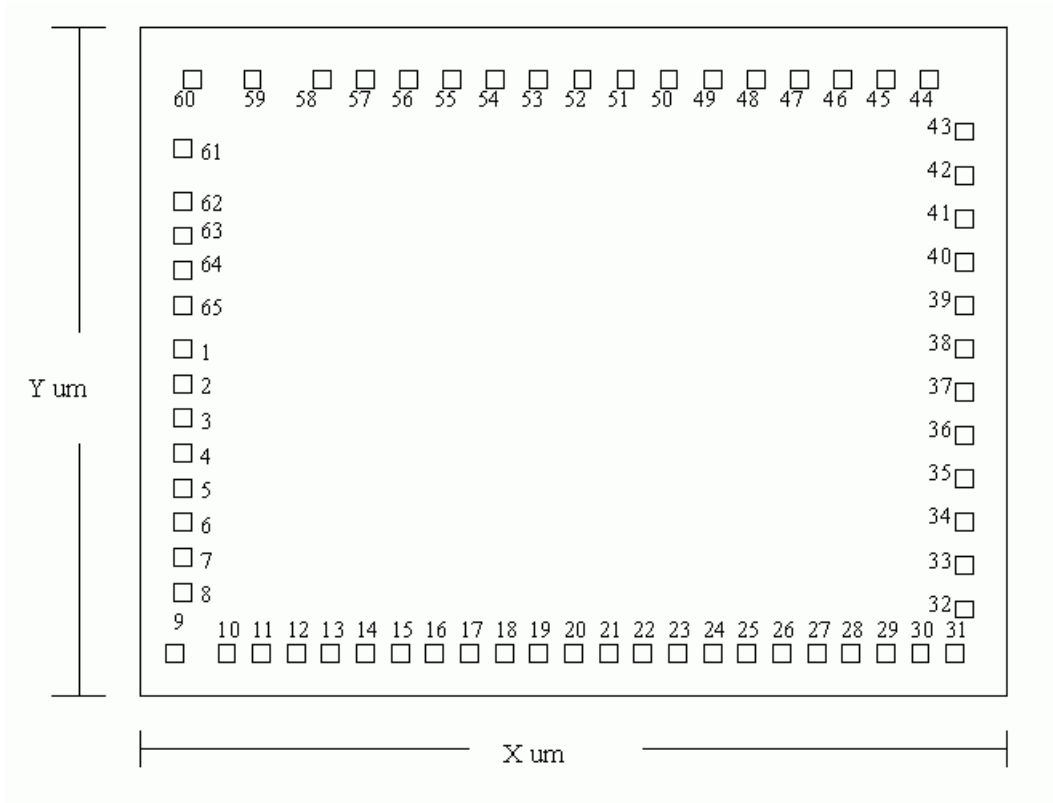


※ AU1564, AU1564A has no COUT output function

Bonding Diagram:

| PRODUCT | X | Y | PAD Size (μm^2) | Substrate | UNIT |
|---------------------------------|------|------|------------------------------|-----------|---------------|
| AU2064 AU2064A | 3530 | 2750 | 85 * 85 | VDD | μm |
| AU1564 AU1564A | 3050 | 2540 | 80 * 80 | VDD | μm |

FOR AU2064, AU2064A:

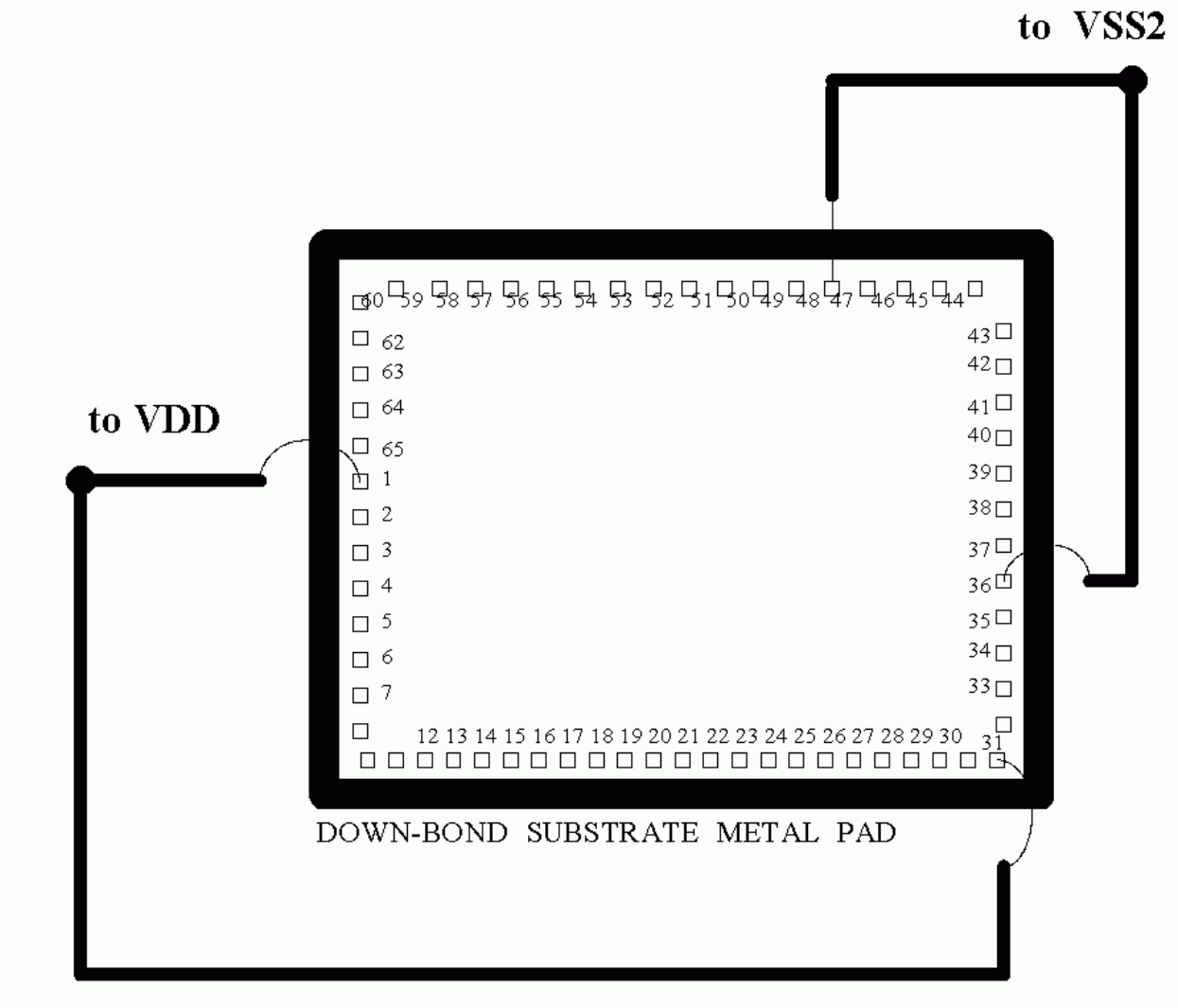


| AU2064, AU2064A pad location | | | | | | | |
|------------------------------|----------|---------|---------|---------|----------|---------|--------|
| Pad No. | Pad Name | X | Y | Pad No. | Pad Name | X | Y |
| 1 | VDD | -1614.2 | 174.6 | 34 | GND | 1595.4 | -455.1 |
| 2 | CUP1 | -1614.2 | 21.6 | 35 | VSS1 | 1601.8 | -302.1 |
| 3 | CUP2 | -1612.5 | -131.4 | 36 | VSS2 | 1618.1 | -149.1 |
| 4 | OSCIN | -1631.7 | -284.4 | 37 | S4 | 1631.7 | 3.9 |
| 5 | OSCOUT | -1632.6 | -530.2 | 38 | S3 | 1631.7 | 190.1 |
| 6 | CON1 | -1631.7 | -750.9 | 39 | TRG | 1631.7 | 343.1 |
| 7 | SEG1 | -1632.6 | -903.9 | 40 | IOA1 | 1631.7 | 496.1 |
| 8 | SEG2 | -1632.6 | -1056.9 | 41 | IOA2 | 1631.7 | 649.1 |
| 9 | SEG3 | -1632.6 | -1209.9 | 42 | IOA3 | 1631.7 | 802.1 |
| 10 | SEG4 | -1479.6 | -1209.9 | 43 | IOA4 | 1631.7 | 1070.2 |
| 11 | SEG5 | -1335.1 | -1209.9 | 44 | RESET | 1364.4 | 1216.2 |
| 12 | SEG6 | -1190.6 | -1209.9 | 45 | VOSC | 1146.8 | 1216.2 |
| 13 | SEG7 | -1046.1 | -1209.9 | 46 | COUT | 757.5 | 1216.2 |
| 14 | SEG8 | -901.6 | -1209.9 | 47 | VOUT1 | 510.7 | 1188.6 |
| 15 | SEG9 | -757.1 | -1209.9 | 48 | VSS2 | 339.1 | 1192.0 |
| 16 | SEG10 | -612.6 | -1209.9 | 49 | VOUT2 | 167.5 | 1188.6 |
| 17 | SEG11 | -468.1 | -1209.9 | 50 | IOB1 | -38.5 | 1216.2 |
| 18 | SEG12 | -323.6 | -1209.9 | 51 | IOB2 | -191.5 | 1216.2 |
| 19 | SEG13 | -179.1 | -1209.9 | 52 | IOB3 | -344.5 | 1216.2 |
| 20 | SEG14 | -34.6 | -1209.9 | 53 | IOB4 | -497.5 | 1216.2 |
| 21 | SEG15 | 109.9 | -1209.9 | 54 | INT | -667.5 | 1216.2 |
| 22 | SEG16 | 254.4 | -1209.9 | 55 | P1 | -820.5 | 1216.2 |
| 23 | SEG17 | 398.9 | -1209.9 | 56 | P2 | -973.5 | 1216.2 |
| 24 | SEG18 | 543.4 | -1209.9 | 57 | P3 | -1126.5 | 1216.2 |
| 25 | SEG19 | 687.9 | -1209.9 | 58 | P4 | -1279.5 | 1216.2 |
| 26 | SEG20 | 832.4 | -1209.9 | 59 | M1 | -1432.5 | 1216.2 |
| 27 | SEG21 | 976.9 | -1209.9 | 60 | M2 | -1603.4 | 1216.2 |
| 28 | SEG22 | 1121.4 | -1209.9 | 61 | M3 | -1631.7 | 972.7 |
| 29 | SEG23 | 1265.9 | -1209.9 | 62 | M4 | -1631.7 | 819.7 |
| 30 | SEG24 | 1410.4 | -1209.9 | 63 | TESTA | -1631.7 | 666.7 |
| 31 | VDD | 1554.9 | -1209.9 | 64 | S2 | -1631.7 | 513.7 |
| 32 | COM3 | 1631.7 | -1056.9 | 65 | S1 | -1631.7 | 327.6 |
| 33 | COM2 | 1631.7 | -608.1 | | | | |

| AU1564, AU1564A pad location | | | | | | | |
|-------------------------------------|-----------------|----------|----------|----------------|-----------------|----------|----------|
| Pad No. | Pad Name | X | Y | Pad No. | Pad Name | X | Y |
| 1 | VDD | -1380.6 | 164.3 | 33 | COM2 | 1397.16 | -232.64 |
| 2 | CUP1 | -1380.6 | 20.3 | 34 | GND | 1362.92 | -83.84 |
| 3 | CUP2 | -1379 | -123.7 | 35 | VSS1 | 1369 | 52.16 |
| 4 | OSCIN | -1397.16 | -267.7 | 36 | VSS2 | 1384.36 | 188.16 |
| 5 | OSCOUT | -1397.96 | -496.72 | 37 | S3 | 1397.16 | 357.76 |
| 6 | COM1 | -1397.16 | -695.92 | 38 | TRG | 1397.16 | 484.96 |
| 7 | SEG1 | -1397.96 | -830.32 | 39 | IOA1 | 1397.16 | 614.56 |
| 8 | SEG2 | -1397.96 | -968.72 | 40 | IOA2 | 1397.16 | 743.2 |
| 9 | SEG3 | -1397.96 | -1127.92 | 41 | IOA3 | 1397.16 | 872.8 |
| 10 | SEG4 | -1273.96 | -1138.72 | 42 | IOA4 | 1397.16 | 1012.8 |
| 11 | SEG5 | -1149.96 | -1138.72 | 43 | RESET | 1154.2 | 1144.6 |
| 12 | SEG6 | -1025.96 | -1138.72 | 44 | VOSC | 946.6 | 1144.6 |
| 13 | SEG7 | -901.96 | -1138.72 | 45 | VOUT1 | 692.28 | 1118.7 |
| 14 | SEG8 | -777.96 | -1138.72 | 46 | VSS2 | 530.76 | 1121.8 |
| 15 | SEG9 | -653.96 | -1138.72 | 47 | VOUT2 | 369.24 | 1118.7 |
| 16 | SEG10 | -529.96 | -1138.72 | 48 | IOB1 | 70.92 | 1144.6 |
| 17 | SEG11 | -405.96 | -1138.72 | 49 | IOB2 | -66.68 | 1144.6 |
| 18 | SEG12 | -281.96 | -1138.72 | 50 | IOB3 | -199.48 | 1144.6 |
| 19 | SEG13 | -157.96 | -1138.72 | 51 | IOB4 | -337.08 | 1144.6 |
| 20 | SEG14 | -33.96 | -1138.72 | 52 | INT | -491.48 | 1144.6 |
| 21 | SEG15 | 90.04 | -1138.72 | 53 | P1 | -635.48 | 1144.6 |
| 22 | SEG16 | 214.04 | -1138.72 | 54 | P2 | -779.48 | 1144.6 |
| 23 | SEG17 | 338.04 | -1138.72 | 55 | P3 | -923.48 | 1144.6 |
| 24 | SEG18 | 462.04 | -1138.72 | 56 | P4 | -1067.48 | 1144.6 |
| 25 | SEG19 | 586.04 | -1138.72 | 57 | M1 | -1211.48 | 1144.6 |
| 26 | SEG20 | 710.04 | -1138.72 | 58 | M2 | -1372.36 | 1144.6 |
| 27 | SEG21 | 834.04 | -1138.72 | 59 | M3 | -1397.16 | 915.5 |
| 28 | SEG22 | 958.04 | -1138.72 | 60 | M4 | -1397.16 | 771.5 |
| 29 | SEG23 | 1082.04 | -1138.72 | 61 | TESTA | -1397.16 | 627.5 |
| 30 | SEG24 | 1206.04 | -1138.72 | 62 | S2 | -1397.16 | 483.5 |
| 31 | VDD | 1330.04 | -1138.72 | 63 | S1 | -1397.16 | 308.3 |
| 32 | COM3 | 1397.16 | -645.44 | | | | |

PCB layout notice:

1. Use two lines to connect PAD1 and PAD31. The VDD line connected to PAD31 should be wider than another one. Because PAD31 must supply the higher current.
2. Use two VSS2 lines to connect PAD36 and PAD48 (for AU1564 and AU1564A, connect PAD 36 and PAD 46). The VSS2 line connected to PAD48 (for AU1564 and AU1564A, connect PAD 46) should be wider than another one. Because PAD48(for AU1564 and AU1564A, PAD 46) must sink the higher current.
3. Use the VDD line connected to PAD1 as the down-bond substrate.



***NOTE : all data and specification are subject to change without notice.**