# Replacing AT84AS003/004 ADC with EV10AS150 ADC

## Application Note

## 1. Introduction

This application note aims at providing you with a device comparison and board level recommendations to migrate a design using the AT84AS003TP series (e2v 10-bit 1.5 Gsps ADC & DMUX combined device) or the AT84AS004TP series (e2v 10-bit 2 Gsps ADC & DMUX combined device) to the EV10AS150ATP series (e2v 10-bit 2.5 Gsps ADC & DMUX combined device).

The main improvements (vs earlier 003/004 ADCs) include:

- Full Power Input BW: from 3.3 GHz to 5 GHz (–3dB)
- Data conversion rate: now guaranteed up to 2.5 Gsps
- ENOB: 7.9 bit and SFDR = –57 dBc (at 2.5 Gsps, 2.5 GHz) vs previous ENOB: 7.5 bit and SFDR = –54 dBc (at 2 Gsps, 2 GHz) for AT84AS004TP
- New addition of 3WSI (3 Wire Serial Interface) that includes gain, offset and sampling delay adjust for interleaving 2 individual chips (5 Gsps equivalent performance).

It first compares the two versions including:

- Power supplies
- Analog and digital controls

It also describes board modifications to migrate from the existing versions to the EV10AS150 Series ADC.

This document applies to the following devices:

- AT84AS003CTP(Y)
- AT84AS003VTP(Y)
- AT84AS004CTP(Y)
- AT84AS004VTP(Y)

## 2. Comparing AT84AS003/004 and EV10AS150 10-bit 2.5 Gsps ADC Devices

The EV10AS150ATP is delivered in the same package as AT84AS003/004TP, with same footprint, same mechanical and thermal characteristics. The following sections discuss the similarities and differences between AT84AS003/004TP and EV10AS150ATP.





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## 2.1 AT84AS003/004 versus EV10AS150

Highlights of the differences between the two devices:

- Analog and clock input positions:
  - reversal of analog and clock input positioning on package pin-out.
- Power supply assignments positive voltage:
  - analog power supply: VEE, becomes a VCCA3 positive voltage,
  - analog power supply: VCCA, becomes a VCCA5 positive voltage,
  - digital power supply: VMINUSD, becomes a DGND.
- Three-digital control input pins active-level change (default mode is unchanged)

The following table describes similarities and differences between AT84AS003/004TP and EV15AS150 Series. Functional improvements are Highlighted **in bold**.

**Table 2-1.** Main Differences Between AT84AS003/004 and EV10AS150 Devices

| Function | AT84AS003/004TP Series | | EV10AS150 Series | |
|---|---|---|---|---|
| | **Symbol** | **Value/Comments** | **Symbol** | **Comments** |
| Analog power supplies | VEE<br>VCCA | –5V<br>3.3V | VCCA3<br>VCCA5 | 3.3V (**positive voltage)**<br>5.2V |
| Digital power supplies | VCCD<br>VPLUSD<br>VMINUSD | 3.3V<br>2.5V<br>–2.2V | VCCD<br>VPLUSD<br>DGND | 3.3V (**positive voltage)**<br>2.5V<br>**0V** |
| Output buffer | A9-A0 / B9-B0 / C9-C0 / D9-D0 | LVDS | A9-A0 / B9-B0 / C9-C0 / D9-D0 | LVDS |
| Analog input | VIN<br>VINN | Common mode = 0V | VIN<br>VINN | Positive common mode<br>**(AC coupling)** |
| Clock input | CLK<br>CLKN | Common mode = 0V | CLK<br>CLKN | Positive common mode<br>**(AC coupling)** |
| Digital controls inputs | SLEEP<br>STAGG<br>DRTYPE<br>RS<br>BIST<br>CLKDACTRL | GND or 3.3V | SLEEP<br>STAGG<br>DRTYPE<br>RS<br>BIST<br>CLKDACTRL | GND or 3.3V |
| | CLKTYPE<br>DACTRL<br>DAEN<br>DAI, DAIN, DAO, DAON | GND or 3.3V<br>Differential input and output | | **(No More exists)** |
| | B/GB,<br>PGEB,<br>SDAEN<br>SDA,<br>GA | GND or VEE<br>–0.5 to 0.5V | ADC function controls by 3 Wire Serial Link (SDATA – SLDN, SCLK, Reset) | **(Add 3WSI software)** |
| Temp | Diode | I = 1 mA | Diode | No change |
| Reset controls inputs | ASYNCRST<br>DRRB | GND or 3.3V | ASYNCRST<br>DRR | No change<br>**(GND or 3.3V depending on 3WSI programming)** |

## 2.2 Pinout Differences Summary

Table 2-2 is a description of the pin differences between AT84AS003/004 and EV10AS150

Table 2-2 Includes recommendation for forward compatibility. For more details, pleas e refer to

“EV10AS150 Pinout (Bottom View, Balls Side)” on page 5.

Table 2-2 is a description of the pin reassignments necessary between AT84AS003/004TP and EV10AS150 Series **(in bold)**.

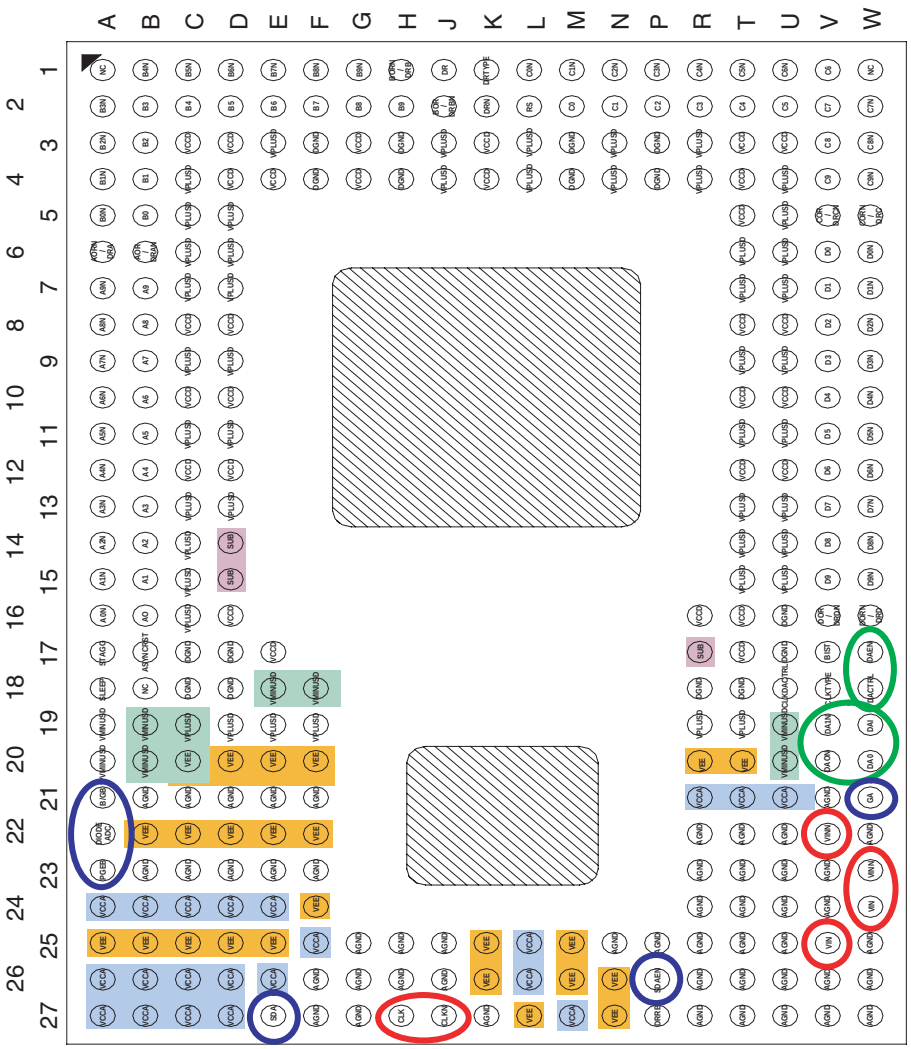
**Table 2-2.** Pin Differences

| Pin | AT84AS003/004TP | EV10AS150 series |
|---|---|---|
| A24, A26, A27, B24, B26, B27, C24, C26, C27, D24, D26, D27, E24, E26, F25, L25, L26, M27, R21, T21, U21 | VCCA<br>3.3V | VCCA5<br>**5.2V** |
| B21, B23, C21, C23, D21, D23, E21, E23, F21, F23, F26, F27, G25, G26, G27, H25, H26, J25, J26, K27, N25, P25, R22, R23, R24, R25, R26, R27, T22, T23, T24, T25, T26, T27, U22, U23, U24, U25, U26, U27, V21, V23, V24, V26, V27, W22, W25, W26, W27 | AGND | AGND |
| C17, C18, D17, D18, F3, F4, H3, H4, M3, M4, P3, P4, R18, T18, U16, U17 | DGND | DGND |
| A25, B22, B25, C20, C22, C25, D20, D22, D25, E20; E22, E25, F20, F22, F24, K25, K26, L27, M25, M26, N26, N27, R20, T20 | VEE<br>–5V | VCCA3<br>**3.3V** |
| D14, D15, R17 | SUB (connected to VEE) | SUB **(connected to GND)** |
| C4, C5, C6, C7, C9, C11, C13, C14, C15, C16, C19, D5, D6, D7, D9, D11, D13, D19, E3, E19, F19, J3, J4, L3, L4, N3, N4, R3, R4, R19, T6, T7, T9, T11, T13, T14, T15, T19, U4, U5, U6, U7, U9, U11, U13, U14, U15 | VPLUSD | VPLUSD |
| C3, C8, C10, C12, D3, D4, D8, D10, D12, D16, E4, E17, G3, G4, K3, K4, R16, T3, T4, T5, T8, T10, T12, T16, T17, U3, U8, U10, U12 | VCCD | VCCD |
| A19, A20, B19, B20, E18, F18, U19, U20 | VMINUSD<br>–2.2V | DGND<br>**(connected to GND)** |
| W24 | VIN | **CLK** |
| W23 | VINN | **CLKN** |
| H27 | CLK | **VIN** |
| J27 | CLKN | **VINN** |
| V25, V22 | VIN, VINN | **No connect** |
| B16, B15, B14, B13, B12, B11, B10, B9, B8, B7 | A0…A9 | A0…A9 |
| A16, A15, A14, A13, A12, A11, A10, A9, A8, A7 | A0N…A9N | A0N…A9N |
| B6, A6 | AOR/DRAN, AORN/DRA | AOR/DRAN, AORN/DRA |
| B5, B4, B3, B2, C2, D2, E2, F2, G2, H2 | B0…B9 | B0…B9 |
| A5, A4, A3, A2, B1, C1, D1, E1, F1, G1 | B0N…B9N | B0N…B9N |
| J2, H1 | BOR/DRBN, BORN/DRB | BOR/DRBN, BORN/DRB |
| M2, N2, P2, R2, T2, U2, V1, V2, V3, V4 | C0…C9 | C0…C9 |
| L1, M1, N1, P1, R1, T1, U1, W2, W3, W4 | C0N…C9N | C0N…C9N |
| V5, W5 | COR/DRCN, CORN/DRC | COR/DRCN, CORN/DRC |
| V6, V7, V8, V9, V10, V11, V12, V13, V14, V15 | D0…D9 | D0…D9 |
| W6, W7, W8, W9, W10, W11, W12, W13, W14, W15 | D0N…D9N | D0N…D9N |
| V16, W16 | DOR/DRDN, DORN/DRD | DOR/DRDN, DORN/DRD |

**Table 2-2.** Pin Differences (Continued)

| Pin | AT84AS003/004TP | EV10AS150 series |
|---|---|---|
| J1, K2 | DR, DRN | DR, DRN |
| B17 | ASYNCRST | ASYNCRST |
| V18 | CLKTYPE | **No connect** |
| A18 | SLEEP | SLEEP |
| A17 | STAGG | STAGG |
| K1 | DRTYPE | DRTYPE |
| L2 | RS | RS |
| V17 | BIST | BIST |
| U18 | CLKDACTRL | CLKDACTRL |
| W18 | DACTRL | **No connect** |
| W17 | DAEN | **No connect** |
| W19, V19 | DAI, DAIN, DAO, DAON | **No connect** |
| A21 | B/GB | **SLDN (3WSI)** |
| A22 | Diode ADC | **SCLK (3WSI)** |
| A23 | PGEB | **SDATA (3WSI)** |
| P27 | DRRB | **DRR** |
| W21 | GA | **Diode** |
| E27 | SDA | **RESET (3WSI)** |
| P26 | SDAEN | **No connect** |
| B18 | Do Not connect | Do not connect |
| A1, V18, V20, W1, W20 | No Connect | No connect |

**Figure 2-1.** AT84AS003/004 Pinout



Analog power supply

$V_{EE}$ plane: -5V → VCCA3 +3.3V
$V_{CCA}$ plane: +3.3V → VCCA5 +5.2V
AGND plane: → No change

Digital power supply

$V_{CCD}$ plane: → No change
$V_{PLUSD}$: → No change
$V_{MINUSD}$: -2.2V → GROUND
DGND plane: → No change

Substrate

SUB (VEE) → GROUND

**Digital control inputs pins**

4 pins: 3-Wire Interface
(before: Diode, B/GB, PGEB, SDA)

SDAEN: → No Connect
GA: → Diode pin
(Gain, SDA, phase adjust., BIST etc… now with 3-Wire Interface

**Analog & Clock input pins**

VIN – VINB: → CLK – CLKB (balls for back termination becomes NC)
CLK – CLKB: → VIN – VINB

Dropped pins from DEMUX section (Delay line)
DAI, DAIN, DAO, DAON, DAEN, DACTRL → NC

# 3. AT84AS003/004 to EV10AS150: Application Information

This section discusses the board implementation of changes described above.

## 3.1 Analog and Digital Power Supplies

**Table 3-1.** Power Supplies

| Power Supplies | | AT84AS003/004 | EV10AS150 | Recommendations |
|---|---|---|---|---|
| Analog power supplies | $V_{EE}$ | –5V | 3.3V | Change regulator |
| Analog power supplies | $V_{CCA}$ | 3.3V | 5.2V | Change regulator |
| Digital power supplies | Output buffers VMINUSD | –2.2V | 0V | To be connected to digital ground plane |
| SUB | SUB | –5V | 0V | To be connected to digital ground plane |

## 3.2 Analog and Clock input signal

Permutation of VIN and CLK input signal.

**Table 3-2.** Analog and CLK

| Analog and Clock Input Signal | | AT84AS003/004 | EV10AS150 | Recommendations |
|---|---|---|---|---|
| Analog input signal | W24 | VIN | CLK | Change VIN position |
| Analog input signal | W23 | VINN | CLKN | Change VINN position |
| Analog input signal | V25 | VIN | No connect | Not connected & remove external 50Ω resistor |
| Analog input signal | V22 | VINN | No connect | Not connected & remove external 50Ω resistor |
| Clock input signal | H27 | CLK | VIN | Change CLK position |
| Clock input signal | J27 | CLKN | VINN | Change CLKN position |

## 3.3 DMUX Digital Control Inputs (CLKTYPE, DACTRL, DAEN, DAI, DAIN, DAO, DAON)

Remove some DMUX Digital control input.

**Table 3-3.** DMUX Digital Control

| DMUX Digital control input | | AT84AS003/004 | EV10AS150 | Recommendations |
|---|---|---|---|---|
| CLKTYPE | V18 | Vccd or no connect | No connect | Not connected |
| DACTRL | W18 | Potentiometer | No connect | Not connected & remove potentiometer resistor |
| DAEN | W17 | Jumper | No connect | Not connected & remove jumper |
| DAI, DAIN, DAO, DAON | W19, V19, W20, V20 | External delay cell | No connect | Not connected |

## 3.4 ADC Control Inputs (B/GB, Diode ADC, PGEB, GA, SDA)

Remove some ADC control input.

Note: These functions are now available via a 3WSI interface.

**Table 3-4.** ADC Control Input

| ADC Control Input | | AT84AS003/004 | EV10AS150 | Recommendations |
|---|---|---|---|---|
| B/GB | A21 | Binary to Gray function | SLDN<br>3WSI input | Connect to a FPGA or microcontroller |
| Diode ADC | A22 | Temperature diode function | SCLK<br>3WSI input | Connect to a FPGA or microcontroller |
| PGEB | A23 | Pattern Generator function | SDATA<br>3WSI input | Connect to a FPGA or microcontroller |
| SDA | E27 | Sampling delay adjustment function | RESET<br>3WSI input | Connect to a FPGA or microcontroller |
| SDAEN | P26 | Sampling delay<br>Enable function | No connect | Not connected & remove jumper |
| GA | W121 | Gain<br>function | DIODE | Connect to a temperature sensor and remove potentiometer |

## 3.5 ADC RESET Inputs

Remove some ADC control input.

**Table 3-5.** ADC Reset

| ADC control input | | AT84AS003/004 | EV10AS150 | Recommendations |
|---|---|---|---|---|
| ADC RESET | P27 | ADC RESET<br>Function<br>Active level low<br><br>Name: DRRB | ADC RESET<br>Function<br>Active level low or high depends on 3WSI programming<br><br>Name DRR | |

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