Mixed-Signal Products

UT30IBDAQ-16
16-Channel Sensor Data Acquisition Device with IntelliBus™ Network Interface

Data Sheet
June 2011

FEATURES

- ❑ 16 Differential Sensor Input Channels
- ❑ External Temperature Sensor Input
- ❑ On-Chip Temperature Sensor
- ❑ 3V(max) Programmable Bridge Driver
  - Optional Constant-Current Bridge Driver
- ❑ 17 On-Chip Sigma-Delta ADCs:
  - 16-Bit Resolution at 100Sa/s
  - Synchronous Data Collection
  - Input gain configurable (Av = 1, 5, 10 or 50)
  - Sample Rate Configurable to 4.4kSa/s at 12-bits
  - Dual 19-Word Input FIFO per Channel
- ❑ User-Programmable PLL (48 KHz to 24.576 MHz)
- ❑ SPI or I2C Peripheral Interface with 16-Word Input/Output FIFO
- ❑ IntelliBus Compliant Peripheral
  - Complies With Generation 3 Protocol
  - 7.5, 15 Or 30 Mb/s Data Rate
  - Internal Low-EMI MLVDS Transceiver
- ❑ 8KB RAM to Store EDS and Device Boot-Up
- ❑ External Serial Flash Interface
- ❑ Single 3.3V or Dual ± 1.65V Analog Supply
- ❑ Single 3.3V Digital Supply
- ❑ Available For Commercial, Industrial and Automotive Temperature
- ❑ 145-pin FBGA (8 x 8 x 0.9mm)

APPLICATIONS

- ❑ Avionics
- ❑ Industrial Automation & Control
- ❑ Automotive Sensors
- ❑ Security
- ❑ HVAC

OVERVIEW

The UT30IBDAQ is a 16 channel Plug & Sense℠ IntelliBus peripheral compliant with Generation 3 IntelliBus protocols. The device supports synchronous analog-to-digital conversion of 16 differential analog sensors and communication via a multi-drop, multi-cast capable IntelliBus network. Sample rate is user programmable from 100 samples per second (at 16-bit resolution) to 4,400 samples per second (at 12-bit resolution). The device also includes a configurable phase-locked loop (PLL) for clock generation and on-chip RAM for storing sensor calibration data and boot up instructions. An SPI/I2C peripheral interface allows connection to additional ADCs or DACs and digital I/O are available for basic control and sense applications.

INTELLIBUS INTERFACE

The UT30IBDAQ-16 uses the IntelliBus network protocol. IntelliBus is a multi-drop, multicast serial data bus communication standard designed to network sensors, actuators, and subsystems while providing:

- the simplicity necessary for miniature smart sensors,
- the low latency needed for flight controls,
- the time determinism required for data analysis, and
- the distance required for industrial control.

IntelliBus permits the integration of signal conditioning, analog-to-digital conversion, and digital interfacing into a low-cost package that can be installed in any sensor, actuator, interface module, or system.

IntelliBus has a low overhead that enables maximum data transmittal, accommodates both sensors and actuators for monitoring and control, and incorporates fault avoidance features. Additionally, IntelliBus accommodates a high sensor count per bus (over 500), allows synchronization between multiple busses, simultaneous sampling capability, and isochronous transmission with low jitter (+/- 500ps). IntelliBus is time deterministic and enables high data rates per bus (30, 15, and 7.5 Mbps) while maintaining a low cost per node.

EXTERNAL SERIAL FLASH INTERFACE

The UT30IBDAQ-16 contains a boot up algorithm to support a unique ID and unique self-configuration per port, offloading the IntelliBus Network Interface Controller from configuring the smart sensors. This boot up data is stored in external flash memory, and downloaded at power-up into 8K words of internal RAM via a serial interface. Electronic Data Sheet information is also stored in the external flash and is available for access by the IntelliBus Network Interface Controller after the boot up procedure downloads the data to on board RAM. The flash interface is implemented as a standard SPI interface.

PERIPHERAL INTERFACE (PORTS)

The Channel 1 SPI/I2C port contains three FIFOs for buffering the data flow. A 16-word Output FIFO stores network data before transferring to the peripheral when the proper (optionally isochronous) IntelliBus command is decoded. A 16-word Input Buffer and a second 16-word Input FIFO are provided to allow isochronous data collection at peripheral data rates, with previous-frame data output to the IntelliBus network at IntelliBus data rates.

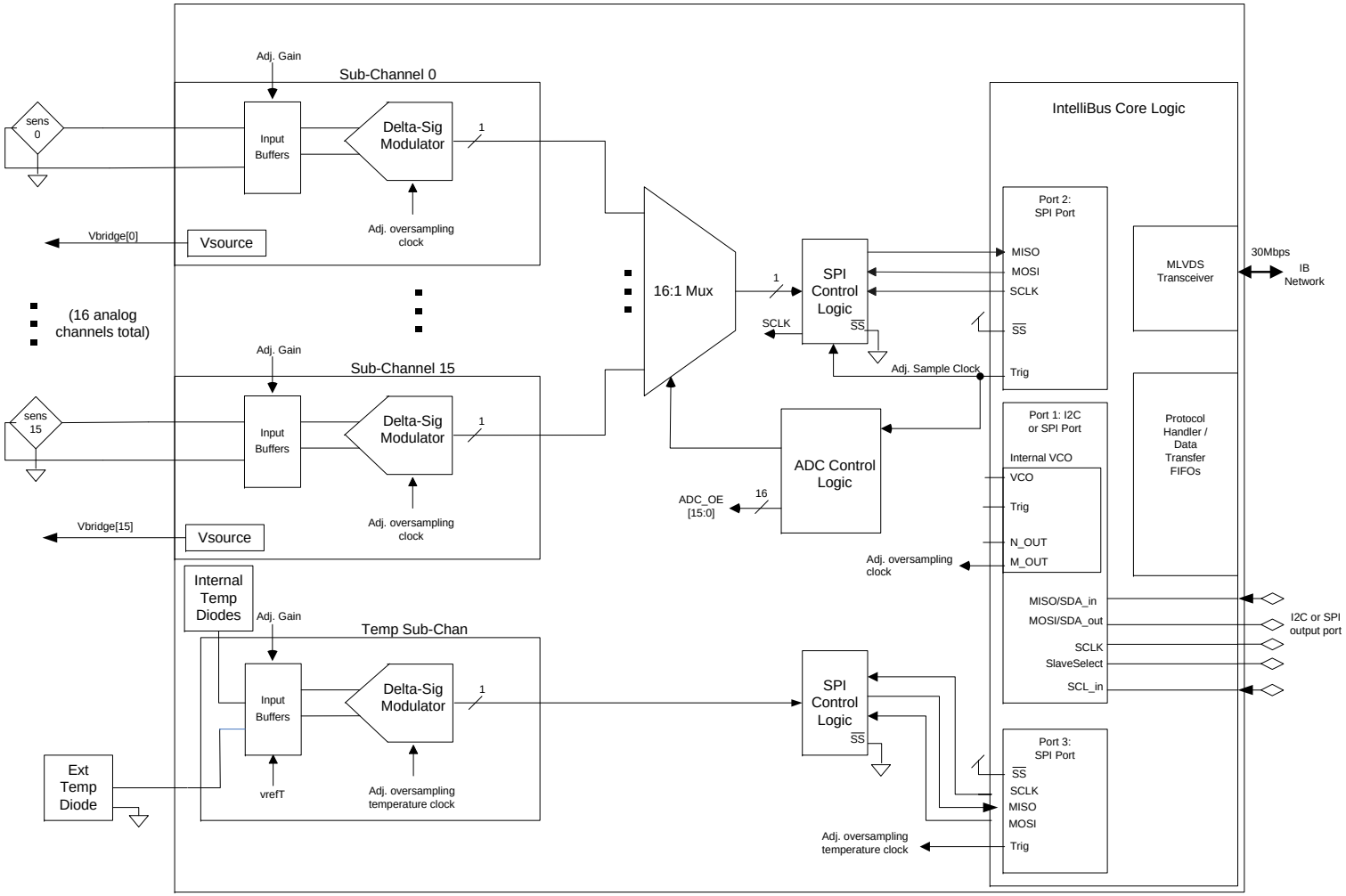
The PLL internal to the UT30IBDAQ provides peripheral clocking which is locked to the Trigger command.

DATA CONVERTERS

The UT30IBDAQ-16 contains 17 over-sampled sigma-delta analog to digital converters, all of which can be programmed to convert data synchronously (i.e. ADCs are not multiplexed). ADC resolution is user programmable from 16 bits at 100 samples per second to 12 bits at 4.4K samples per second. Gain control of the input amplifiers allows input voltage support up to $\pm$1.25V full scale. The converted sensor data for the first 16 channels is registered for transfer into the channel 2 and channel 3 FIFOs, which are then transferred onto the IntelliBus Network at data rates of up to 30Mbps. The 17^{th} ADC is used to sample an internal temperature sensor, an external temperature sensor or both.

REMOTE ID INPUTS

The UT30IBDAQ contains support for ID inputs which can be read by the IntelliBus Network Interface Controller to determine the physical location of each device located on the bus. These ID inputs are discrete inputs externally tied to either V_{dd} or Ground.


Adj. Gain
Sub-Channel 0
sens 0
Input Buffers
Delta-Sig Modulator
1
Adj. oversampling clock
Vbridge[0]
Vsource
(16 analog channels total)
Adj. Gain
Sub-Channel 15
sens 15
Input Buffers
Delta-Sig Modulator
1
Adj. oversampling clock
Vbridge[15]
Vsource
Internal Temp Diodes
Adj. Gain
Temp Sub-Chan
Input Buffers
Delta-Sig Modulator
1
vrefT
Adj. oversampling temperature clock
Ext Temp Diode
16:1 Mux
1
SCLK
SPI Control Logic
SS
ADC_OE [15:0]
16
ADC Control Logic
Adj. Sample Clock
Adj. oversampling clock
SPI Control Logic
SS
Adj. oversampling temperature clock
IntelliBus Core Logic
Port 2: SPI Port
MISO
MOSI
SCLK
SS
Trig
Port 1: I2C or SPI Port
Internal VCO
VCO
Trig
N_OUT
M_OUT
MISO/SDA_in
MOSI/SDA_out
SCLK
SlaveSelect
SCL_in
Port 3: SPI Port
SS
SCLK
MISO
MOSI
Trig
MLVDS Transceiver
30Mbps
IB Network
Protocol Handler / Data Transfer FIFOs
I2C or SPI output port

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