AS7306

Small, High-Precision, Digital Isolated Delta-Sigma Modulators With High CMTI

Product Preview

Features

• Pin-Compatible Family Optimized for Shunt-Resistor-Based Current Measurements:
  - ±200mV Input Voltage Ranges (±320mV Full Scale Range)
  - Manchester Coded or Uncoded Bitstream Options
• Excellent DC Performance:
  - Offset Error: ±300 µV
  - Offset Drift: 1 µV/°C
  - Gain Error: ±1%
  - Gain Drift: ±60 ppm/°C
• Transient Immunity: 100 kV/µs (typ)
• System-Level Diagnostic Features
• Safety-Related Certifications:
  - 7000-V_{PEAK} Reinforced Isolation per DIN V VDE V 0884-11 (VDE V 0884-11): 2017-01
  - 5000-V_{RMS} Isolation for 1 Minute per UL1577
• Temperature Range: –40°C to +125°C

Typical Applications

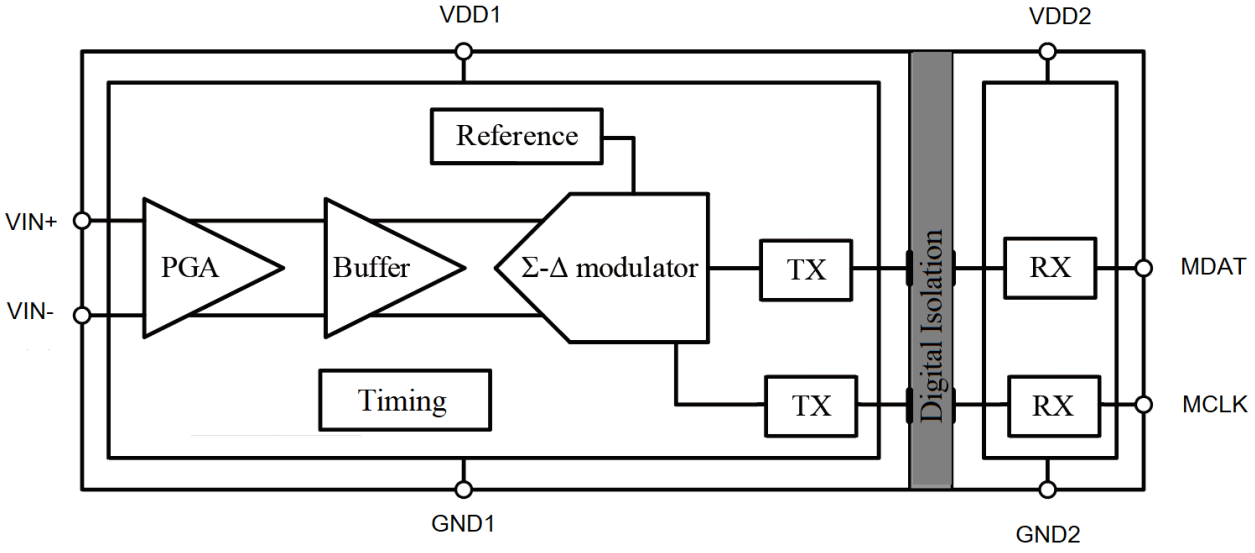
• Shunt-Resistor-Based Current Sensing and Isolated Voltage Measurements in:
  - Industrial Motor Drives
  - Photovoltaic Inverters
  - Uninterruptible Power Supplies

Overview

The AS7306 is a precision, delta-sigma (ΔΣ) modulator with the output separated from the input circuitry by a capacitive double isolation barrier that is highly resistant to magnetic interference. This barrier is certified to provide reinforced isolation of up to 7000 V_{PEAK} according to the DIN V VDE V 0884-11 and UL1577 standards. Used in conjunction with isolated power supplies, this isolated modulator separates parts of the system that operate on different common-mode voltage levels and protects lower-voltage parts from damage.

The input of the AS7306 is optimized for direct connection to shunt resistors or other low voltage level signal sources. The unique low input voltage range of the ±200mV device allows significant reduction of the power dissipation through the shunt and supports excellent ac and dc performance. The output bitstream of the AS7306 is Manchester coded or uncoded, depending on the derivate. By using an integrated digital circuit to decimate the bitstream, the device can achieve 16 bits of resolution.

The bitstream output of the Manchester coded AS7306Ex versions support single-wire data and clock transfer without having to consider the setup and hold time requirements of the receiving device.



Functional Chip Block Diagram

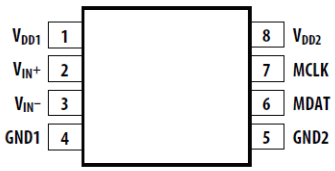
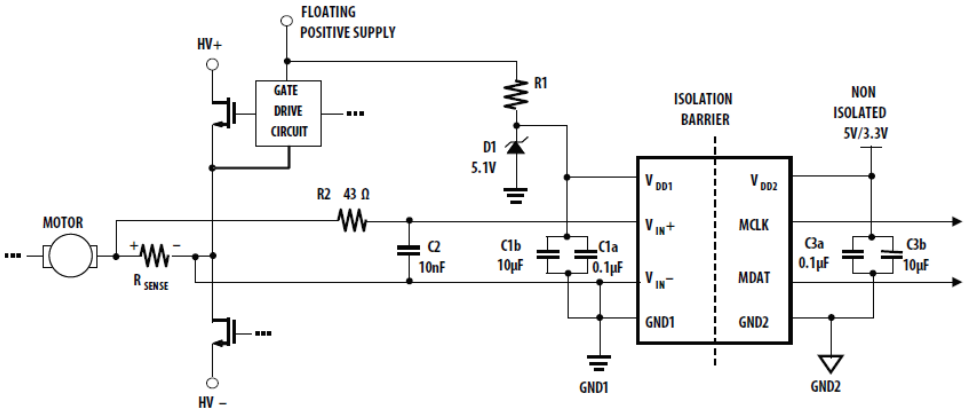


Table 1 Pin Descriptions

Pin No.	Symbol	Description
1	VDD1	Supply voltage for signal input side (analog side), relative to GND1
2	VIN+	Positive analog input, recommended input range ±200 mV
3	VIN-	Negative analog input, recommended input range ±200 mV (normally connected to GND1)
4	GND1	Supply ground for signal input side
5	GND2	Supply ground for data/clock output side (digital side)
6	MDAT	Modulator data output
7	MCLK	Modulator clock output
8	VDD2	Supply voltage for data output side, relative to GND2



Typical Application Circuit in Motor Phase Current Sensing

First draft of AMP + ⊿Σmodulator	Minimum	Typ	Maximum	Unit	Notes
POWER SUPPLY					
Supply Voltage, VDD1	4.5	5	5.5	V	
Supply Current		5.3		mA	Simulation supply SD ADC
STATIC CHARACTERISTICS					
Resolution		16		bit	
Effective Number of Bits (ENOB)		12.1		bit	From silicon evaluation
INL		3.5		LSB	From silicon evaluation
DNL		0.6		LSB	From silicon evaluation
Offset Error		0.1 (*2)		mV	Note (2): Selected by E-Fuse for ±80mV product
Offset Drift vs. Temperature		0.8 (*2)		uV/°C	Note (2): Selected by E-Fuse for ±80mV product
Reference Voltage Tolerance		0.18		%	6-bit binary trimming for bandgap voltage
Internal Reference Voltage(VREF)		320 (*1) 80 (*2)		mV	Note (1): Selected by E-Fuse for ±320mV product Note (2): Selected by E-Fuse for ±80mV product
VREF Drift vs. Temperature		16		ppm/°C	
ANALOG INPUTS					
Full-Scale Differential Voltage Input Range	-320 (*1) -80 (*2)		320 (*1) 80 (*2)	mV	Note (1): Selected by E-Fuse for ±320mV product Note (2): Selected by E-Fuse for ±80mV product
Input Bias Current		-160 (*1) -210 (*2)		uA	AINP = AINN = AGND, IIB = IIBP + IIBN
Input Resistance		2.5 (*1) 1.9 (*2)		kΩ	Across VIN+ or VIN- to GND1
Input Capacitance		8 (*3)		pF	Across VIN+ or VIN- to GND1. Note (3): Depends on IC package
CMRR		< -100		dB	AINP = AINN, fIN from 1KHz, -0.0V ≤ VIN ≤ 0.0V
DYNAMIC CHARACTERISTICS					
Clock Frequency		10		MHz	5-bit binary trimming for clock frequency. fIN = 1kHz
THD		78		dB	From silicon evaluation
SFDR		80		dB	From silicon evaluation
SNR		78		dB	From silicon evaluation
PSRR		68		dB	AINP = AINN = AGND, DC.
TEMPERATURE CHARACTERISTICS					
Operating Temperature	-40	25	125	°C	

First Draft of Digital Isolator Transmitter	Minimum	Type	Maximum	Unit	Notes
POWER SUPPLY					
Supply Voltage, VDD1	4.5	5	5.5	V	
Supply Current		1.5		mA	
STATIC CHARACTERISTICS					
Number of input channels		2			
DYNAMIC CHARACTERISTICS					
Input Signal Frequency	0.01	10	20	MHz	
Propagational delay			25	ns	
ISOLATION CHARACTERISTICS					
Withstand isolation voltage		5000		VRMS	Isolation for 1 Minute per UL1577
Common-mode transient immunity		100		KV/us	Simulation result without package mismatch
TEMPERATURE CHARACTERISTICS					
Operating Temperature	-40	25	125	°C	

First Draft of Digital Isolator Receiver	Minimum	Type	Maximum	Unit	Notes
POWER SUPPLY					
Supply Voltage, VDD2	2.5	5	5.5	V	
Supply Current		4.7		mA	CLOAD = 15pF
STATIC CHARACTERISTICS					
Number of input channels		2			
DYNAMIC CHARACTERISTICS					
Output Signal Frequency	0.01	10	20	MHz	
Propagational delay			25	ns	
Output Load Capacitance		15		pF	
High-level output voltage	VDD2-0.5			V	
Low-level output voltage			0.5	V	
ISOLATION CHARACTERISTICS					
Withstand isolation voltage		5000		VRMS	Isolation for 1 Minute per UL1577
Common-mode transient immunity		100		KV/us	Simulation result without package mismatch
TEMPERATURE CHARACTERISTICS					
Operating Temperature	-40	25	125	°C	