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TDC-GP30

Operation with a single transducer for concentration measurement

ams Application Note [v1-00] 2016-Oct-13 Page 1 Document Feedback



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1 General Description

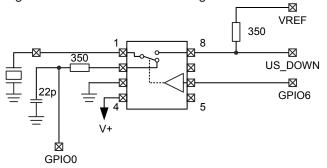
Concentration measurement targets an operation with a single transducer. The TDC-GP30 task management is dedicated to flow and therefore operation with a pair of transducers.

Thanks to the optional gas meter mode, it is possible to work with a single transducer.

2 Realization

This operation needs an external analog switch like Maxim MAX4659 as well as the external RC combination.

Figure 1: External circuit for a single transducer



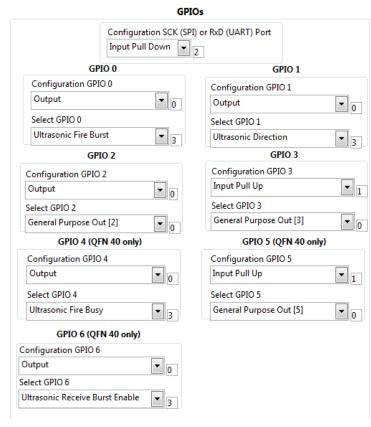
The TDC-GP30 runs in gas meter mode, sending only in one direction only. In gas meter mode the fire burst is sent at pin GPIO0. The external circuit switches the transducer between GPIO0 (fire) and US_DOWN (receive).

Figure	2:	Configuration
iguio	<u> </u>	Configuration

E GP30 Evaluation Software												
File Tools Firmware Help												
Measurements Ultrasonic Measurement Control	Temperature Measurement Control	General Control	Interfaces	Interrupt & Error Har	ndling a	icam		~				
Time of Flight: Sequence Control												
TOF Rate	Ultrasonic Pause Handling Pause between TOF Up and TOF Down					Start Fire at Buffer UP	- 0					
Zero Cross Calibration Rate	Only One Measurement per Cycle		Pause betwe	N/A ms	own	Time Of Flight Edge Mode	0					
Disabled 🔽 0	Univ One Measurement per Cycle	• • 0				Positive Edge of TOF Hit	- 0					
Fire Pulse Clock Divider Register Setting HS Clock Divisor	Number of Fire Pulses	Ν	Noise Mask Wi	ndow		Timeout TOF						
3 A	17	:	150 🖨	149,6 µs		4096 µs 💌 3						
Time Of Flight: Hit Control		Start Hit Mode										
No. of TOF Hits		Start Hit Mode Start Hit by First	Hit Detection	• 0		Hit Level Up						
8 Hits 8 TOF Hits Stored in Fr	ont End data Buffer	Selected Start Hit			35	÷ 50,0	First Hit Polarity					
No. of ignored Hits Sum of All TOF and	5. Hit First Hit Level Down Positive 0						=					
0 Hits V 0	first 8 TOF values	Start Hit Delay W	/indow		55	▼ 50,0						
		80900 🔄 632031 ns 🕼 Enable Pulse Width Detection										
Amplitude Measurement Control												
Amplitude Measurement Rate												
Every TOF Measurement		Amplitude Meas After 20, Hit	urement Peak									
Every 20th Amplitude Measurement	-	After 20. Hit		▼ 20								
	5											
Transducer Interface Options												
Transducer Interface Select No Fire Buffer & No Receive Path Selected	Z Enable Analog Switches in both US buffer					er						
	Enable Gas Meter Mode Enable Precharge Transistors in both US Buffer Enable Gas Meter Mode Enable Pull-Down Transistors in both US Buffer											
Enable External Receive Amplifier (QFN 40 or	nly)				Enable Bo	th Receive Path Transistors						
					- chable Bo	th Fire Buffer						



Figure 3: Configuration for GPIOs



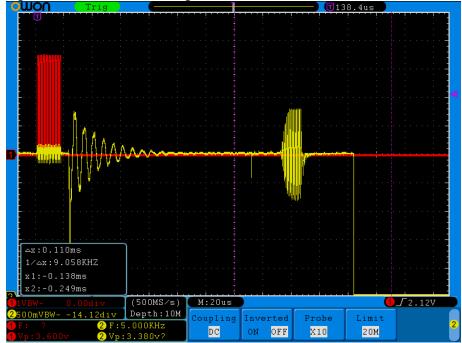
With this setup, the signals look like shown in following figures.



Figure 4: Send and Receive signals

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Figure 5: Send and Receive signals



It is obvious that the resonance of the transducers when switched to Vref for receive defines a minimum time-of-flight.

The resolution seen is in the order of 500ps rms with 10-fold average. Of course, the temperature affects the speed of sound and a drift is seen accordingly.

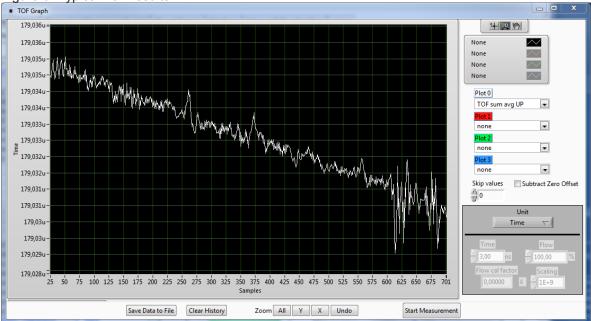


Figure 6: Typical ToF results



3 Conclusion

In principle, TDC-GP30 with an external analog switch can operate in a single transducer application. Of course, for a reasonable interpretation of the data an additional temperature measurement is necessary. Such a setup will be fine for concentration measurement. Level measurements will be hard to realize as the amplitude will vary dramatically with any waves on the reflecting surface so that first hit detection may not be applicable.



4 Contact Information

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6 Revision Information

Current revision 1-00 (2016-Oct-13)

Page

Initial version 1-00

Note: Page numbers for the previous version may differ from page numbers in the current revision. Correction of typographical errors is not explicitly mentioned.