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DEMO MANUAL DC2507A

Input Protected Universal Temperature Measurement System on a Chip

DESCRIPTION

Demonstration circuit DC2507A is a resistive protection network designed to interface the LTC®2986 demonstration boards (DC2508 for LTC2986 or DC2618 for LTC2986-1). The LTC2986 is a pin and software compatible 10-channel version of the 20-channel LTC2983. The LTC2986 includes several new modes enabling external protection/ filtering resistors for 2-/3-/4-wire RTDs, thermistors, and thermocouples. The DC2507A includes a universal input 4-input terminal block, front end protection/filtering resistors, and a interface for connecting to the DC2508/DC2618 demonstration circuit.

The 4-input terminal block (J1) can directly interface to a single 2-/3-/4-wire RTD, or a thermistor, or a thermocouple (with 4 options for cold junction compensation). A single hardware design is shared between all sensor types. Switching between sensors simply requires a change in software (channel assignment programming). All LTC2986

input channels are isolated from the terminal block by a $2.4k\Omega$, 1W protection resistor, while the complementing DC2508 contains 100pF filtering capacitors. As a reference, the DC2507A includes a top level hookup diagram for each sensor type, see Figure 1.

The DC2507A requires a DC2531 or DC2608 kit. These kits contain the LTC2986 motherboard (DC2508 or DC2618) and a Linduino[®] One (DC2026) USB interface board. Additionally, QuikEvalTM software is used to program the LTC2986 channel assignment data and display the temperature results.

Design files for this circuit board are available at http://www.linear.com/demo/DC2507A

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Figure 1. DC2507A Demonstration Board



Global Parameters Setup

In order to run the LTC2986 in the universally protected mode, all 3 kelvin mode global variables need to be set, see Figure 2. Note, these variables are not available with the LTC2983 and LTC2984. The LTC2986 will automatically determine the current mode based on the sensor type and/or the number of sensor wires.

Global parameters	
Temperature unit	Deg C 🔽
Rejection frequency	50/60 Hz 🖌
Enable Kelvin 3-Wire RTD Mode?	Yes 💙
Enable Kelvin 2-Wire RTD Mode?	Yes 👻
Enable Kelvin Thermistor Mode?	Yes 💙
Disable -999?	No 💌
Extra delay between conversions (hundreds of us)	0
OK Cancel	

Figure 2. Setting Global Kelvin Mode



Sense Resistor Setup

The DC2508 includes a precision $2k\Omega$ sense resistor. This Sense resistor is assigned to CH2 for all RTDs and Thermistors (see Figure 3).

Built-In Configurations

The LTC2986 demonstration software includes stored configurations for each of the sensor type used for the DC2507A demonstration board. These can be loaded by selecting the menu function: Configuration > Demo Board > DC2507A. (see Figure 4). These configurations will automatically load all the channel assignment data and global variables for each sensor.



Figure 3. Sense Resistor Channel Assignment

LTC2986 Demo	Carde Car	Kana Usla					
nfiguration Evaluate New Open Load from daughter board Load example Save as Set global parameters Quit	C code Set	tings Help DC2210_EXPERIMEN DC2211_THERMOCC DC2211_IRTD DC2211_INTERMOCC DC2211_INTERMOCC DC2212_THERMOCC DC2212_INTERMOCC DC2313_DEDICATEL DC2213_DEDICATEL DC2507A_MULT_SE DC2507A_MULT_SE DC2507A_MULT_SE DC2507A_MULT_SE DC2507A_MULT_SE	ITTERAD VIER_BOARD SUPLE _TEMPERATURE_MEASUREMENT_BC VIER_BOARD > TO BOARD > THE MISTOR_BOARD > THE MISTOR_BOARD NOOR_BOARD_Q.WIRE_RTD NOOR_BOARD_Q.WIRE_RTD NOOR_BOARD_VIER.TD NOOR_BOARD_THERMOCOURLE_10 NOOR_BOARD_THERMOCOURLE_10 NOOR_BOARD_THERMOCOURLE_10 NOOR_BOARD_THERMOCOURLE_10 NOOR_BOARD_THERMOCOURLE_10	LTC2 DARD K_THERMISTOR_CJ 100_C3	(Peg C)	Status byte	
	م م اللہ اللہ م	9 - 10 - 1					





2-Wire RTD

Connect the 2-wire RTD to between terminals 1 and 2 on terminal block J1, see Figure 5.



Figure 5. 2-Wire RTD Connection

The 2-wire RTD is assigned to CH4 (see Figure 6) and can be automatically loaded using the configuration file DC2507A_MULTI_SENSOR_BOARD_2_WIRE_RTD or manually entered using the LTC2986 demonstration software.

D LTC2986 Demo - DC2507A_MULTI_SENSOR_BO	ARD_2_WIRE_RTD.cfg*		
Configuration Evaluate C code Settings	Help		
[[[LTC2986 TESTBE	NCH
	TECHNOLOGY	a) Orth (Base C) Status but	_
	- Eak Out (uv, onin	i) Out (beg c) Status byte	e
Ch 2	Sense Resistor		
ch 3			
€ Ch4 ☑	RTD PT-100		
Ch 5			
Ch 6	Ch 4 RTD Configuration		
Ch 7	Value	Change to	Accept Changes
Ch 8	rtd - rsense channel	Ch 2 Ch 2	Cancel
с н 9	rtd - num wires	2-Wire 2-Wire	✓
Ch 10	rtd - excitation mode No r	rotation/sharing No rotation/sharing	✓
сом	rtd - excitation current	50uA 50uA 💙	
	rtd - standard	American 🖌	
	Channel assignment	011000001000010100010000000000000000000	

Figure 6. 2-Wire RTD Configuration



3-Wire RTD

Connect the 3-wire RTD to between terminals 1, 2 and 3 on terminal block J1, see Figure 7.



Figure 7. 3-Wire RTD Connection

The 3-wire RTD is assigned to CH6 (see Figure 8) and can be automatically loaded using the configuration file DC2507A_MULTI_SENSOR_BOARD_3_WIRE_RTD or manually entered using the LTC2986 demonstration software.

LTC2986 Demo - DC2507A_MULTI_SENSOR	_BOARD_3_WIRE_RTD.cfg*			🛛
		LTC2	2986 TESTBENCH	
61 62 63 64 65 66 66 67	TECHNOLOGY Use Sensor - Sense Resistor - - - - - - - - - - - - - - Ch 6 RTD Configu	Edit Out (uV, ohm) 0 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2 V 2	Dut (Deg C) Status byte	
		Value rtd - rsense channel rtd - num wires rtd - excitation mode No ro rtd - excitation current rtd - standard . Channel assignment	Change to Ch 2 Ch 2 V 3-Wire V south South American American American South South Change C	Cancel

Figure 8. 3-Wire RTD Configuration



4-Wire RTD

Connect the 4-wire RTD to between terminals 1, 2, 3 and 4 on terminal block J1, see Figure 9.



DC2507A_MULTI_SENSOR_BOARD_4_WIRE_RTD or manually entered using the LTC2986 demonstration software. In the universal protected mode, 4-wire RTDs have rotation and sharing turned off, the DC2507 includes a protected ground connection for the 4-wire RTD.

The 4-wire RTD is assigned to CH6 (see Figure 10) and

can be automatically loaded using the configuration file

Figure 9. 4-Wire RTD Connection

LTC2986 Demo - DC2507A_MULTI_S	SENSOR_BOARD_4_WIRE_RTD.cfg*			
Inguradon Evaluate C. Coos		LT	C2986 TESTBE	NCH
	Use Sensor	Edit Out (uV, ohm)	Out (Deg C) Status by	te
5.				
	HCh 3			
	- Ch 5 -			
^{≶2} ≵⊡	Ch 6 🗹 RTD PT-100			
Ē	H ch 7 -			
₽	H ^{Ch 8} - 📶 Ch 6 RTD Configur	ration		
B	HCh9 -	Value	Change to	Accept Changes
	- Ch 10 -	rtd - rsense channel	Ch 2 Ch 2	Cancel
ξ L		rtd - num wires	4-Wire 4-Wire	
		rtd - excitation mode No re	otation/no sharir No rotation/no sh	haring 🔽
		rtd - excitation current	50uA 🗸	
		rtd - standard	American American	
		Channel assignment	0110000010100001000100000000	0000

Figure 10. 4-Wire RTD Configuration



Thermistor

Connect the thermistor between terminals 1 and 2 on terminal block J1, see Figure 11.



Figure 11. Thermistor Connection

The thermistor is assigned to CH4 (see Figure 12) and can be automatically loaded using the configuration file DC2507A_MULTI_SENSOR_BOARD_10K_THERMISTOR or manually entered using the LTC2986 demonstration software.



Figure 12. Thermistor Configuration



Thermocouple

Connect the thermocouple between terminals 3 and 4 on terminal block J1, see Figure 13. 1 of 4 sensors can be used for the cold junction compensation.



Figure 13. Thermocouple and Cold Junction Connection

CJ Option 1: Active analog temperature sensor (U1) tied to CH10.

CJ Option 2: Diode (Q1) tied to CH9.

CJ Option 3: 2-wire RTD connected between terminals 1 and 2 on terminal block J1 and assigned to CH4.

CJ Option 4: Thermistor connected between terminals 1 and 2 on terminal block J1 and assigned to CH4.

See pages 63-65 in the LTC2986 data sheet for more information.

The thermocouple is assigned to CH6 (see Figure 14) and can be automatically loaded using the configuration file DC2507A_MULTI_SENSOR_BOARD_ THERMICOUPLE_10K_THERMISTOR_CJ or DC2507A_ MULTI_SENSOR_BOARD_THERMICOUPLE_PT100_CJ or manually entered using the LTC2986 demonstration software.

LTC2986 Demo - DC2507A_MUL Configuration Evaluate C code	TI_SENSOR_BO Settings	ARD_THERMOCOUPLE_10K	(_THERMISTOR_CJ.cfg			- • ×
┃ ┃ 日 日 ∨ ❷ ❷	•) L	ГС2986 ТЕ	STBENCH	
	Use	Sensor	Edit Out (uV, ohm)	Out (Deg C)	Status byte	
5	-Ch 1	-				
<u> </u>		Sense Resistor				
Ļ	-Ch 3	-				
SE.	61 − Ch4 🗹	Thermistor 44006 10K@25C				
	Ch 5	-				
		Type K Thermocouple				
Ch 9 💙 👅	Ch7	-				
	□ − Ch8	-				
<u>-</u>	- Ch 9 🗹	Off-Chip Diode				
	-Ch 10 🗹	Active Analog				
ę	сом	11 Ch 6 Th	nermocouple Configuratio	n		
Ĩ				Value	Change to	Accept
			tc - cold ju	nction ch Ch 9	Ch 9 🗸	Changes
			tc - diff	erential? No	No v	Cancel
			tc - open ck	detect? Ver	Var	
			tr - open skt deter	current to t		
			c. open ck detec	10uA	10UA M	
			Channel as	ignment 0001001	001110000000000000000000000000000000000	

Figure 14. Thermocouple and Cold Junction Configuration

dc2507at

PCB LAYOUT

Top Silkscreen





PCB LAYOUT



Top Layer





PCB LAYOUT



Bottom Layer



PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	2	C1, C2	CAP, 0.1µF, X7R, 16V, 10%, 0603	AVX 0603YC104KAT2A
2	1	J1	CONN., TERMINAL BLOCK, 4 POS, 5.08mm, THT, 13.5A, GREEN	PHOENIX 1869237
3	1	J2	CONN., RCPT., 40 POS., 1.27mm, R/A, THT	HIROSE FX2-40S-1.27DS(71)
4	1	LB1	LABEL SPEC, DEMO BOARD SERIAL NUMBER	BRADY THT-96-717-10
5	4	MP1-MP4	STANDOFF, NYLON, SNAP-ON, 0.250"	KEYSTONE 8831
6	1	PCB1	PCB, DC2507A	MAO BANG 600-DC2507A
7	1	Q1	XSTR., NPN, 40V, 200mA, TO-92 3L, THT	FAIRCHILD SEMI 2N3904TF
8	1	R1	RES., 2kΩ, 0.1%, 1/8W, THT	VISHAY PTF562K0000BYEB
9	8	R2-R9	RES., 2.4kΩ, 2%, 1W, AXIAL LEADED	VISHAY CMF202K4000GNEK
10	3	R10-R12	RES., 4.99kΩ, 1%, 1/10W, 0603	NIC NRC06F4991TRF
11	1	R13	RES., 1kΩ, 5%, 1/10W, 0603	VISHAY CRCW06031K00JNEA
12	1	U1	IC, REMOTE INTERNAL TEMP SENSOR, 6-PIN DFN 2mm × 3mm	LINEAR TECHNOLOGY LTC2997IDCB#TRMPBF
13	1	U2	IC, MEMORY, EEPROM, 2K-BIT, 400kHz, TSSOP-8	MICROCHIP 24LC025-I/ST





DEMO MANUAL DC2507A

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