LTC2986 and LTC2986-1
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 2.4kΩ, 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, QuikEval™ 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
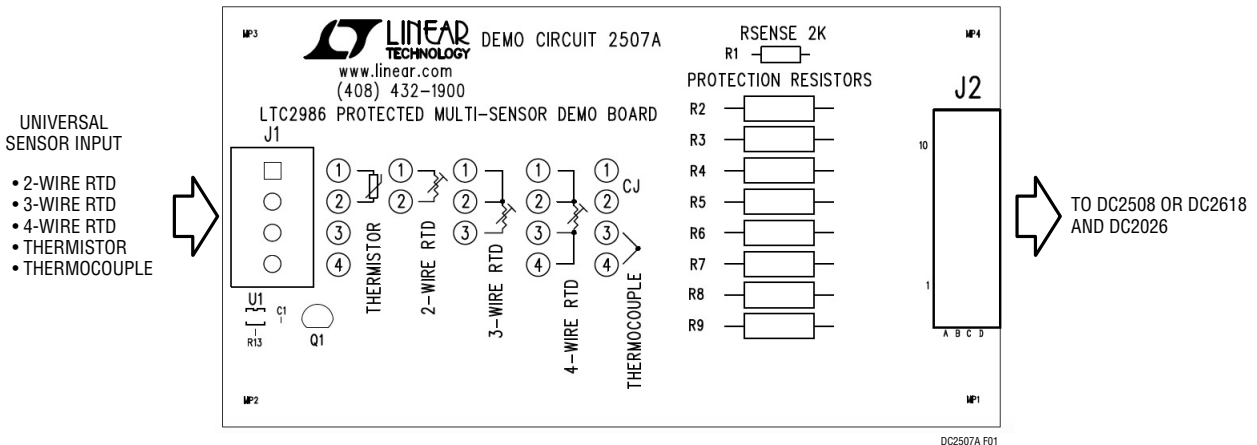
Figure 1. DC2507A Demonstration Board

SETUP

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.
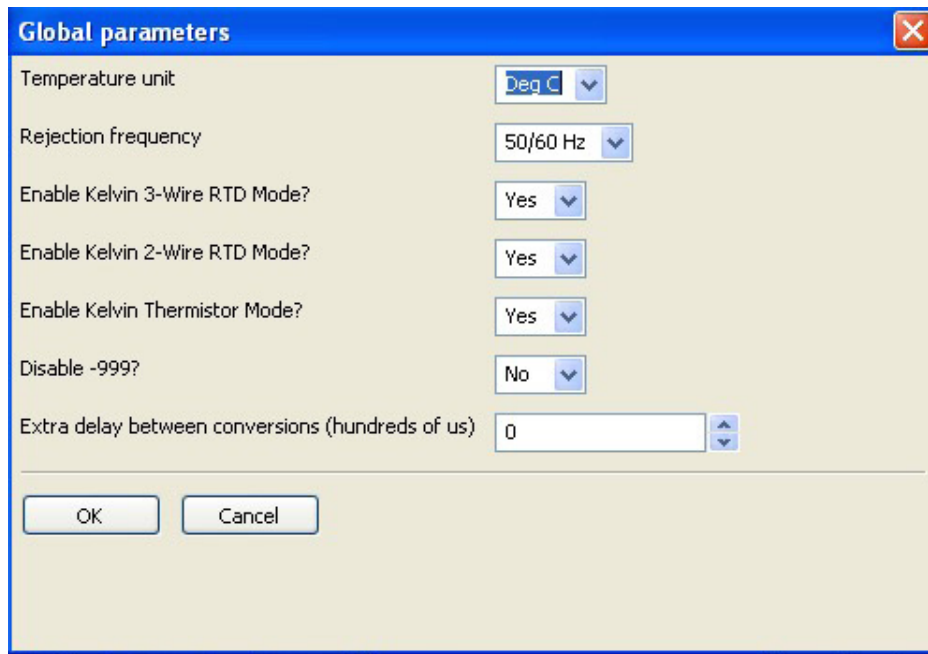

Figure 2. Setting Global Kelvin Mode

SETUP

Sense Resistor Setup

The DC2508 includes a precision 2kΩ 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.
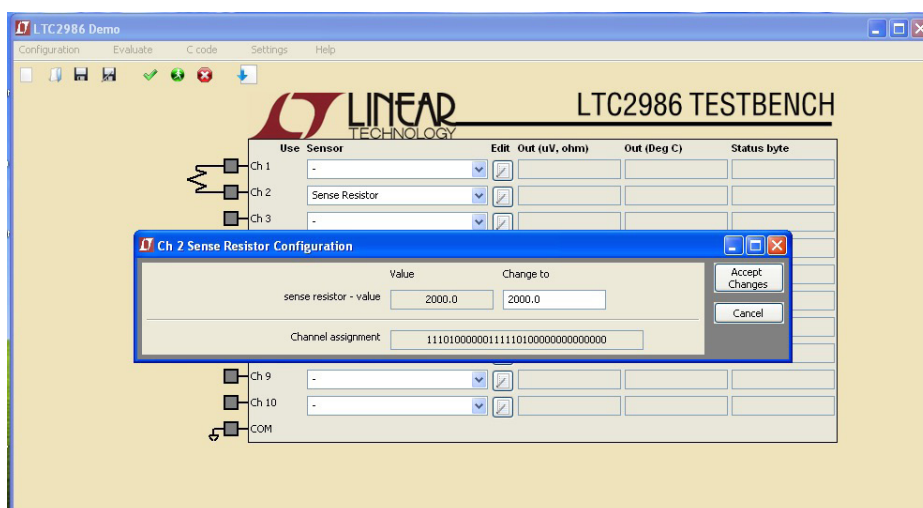
Figure 3. Sense Resistor Channel Assignment
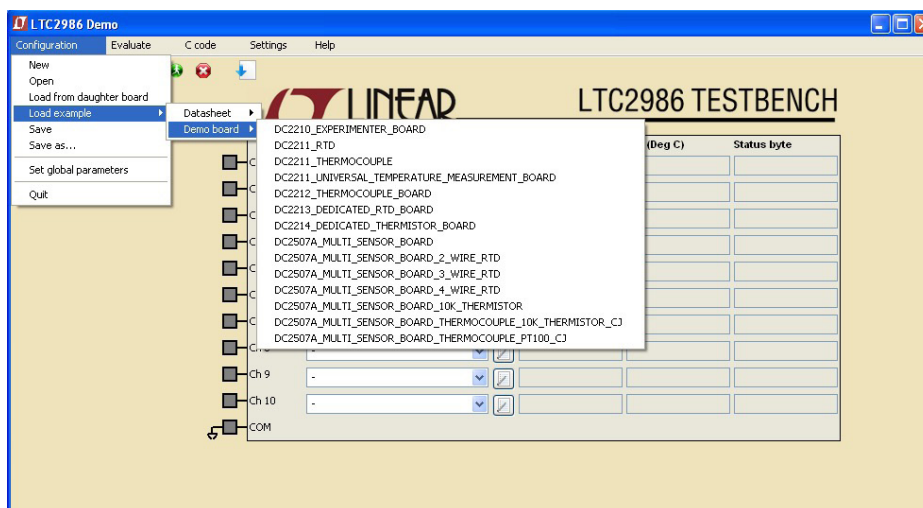
Figure 4. Loading Pre-Programmed Sensor Configurations

SETUP

2-Wire RTD

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

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.
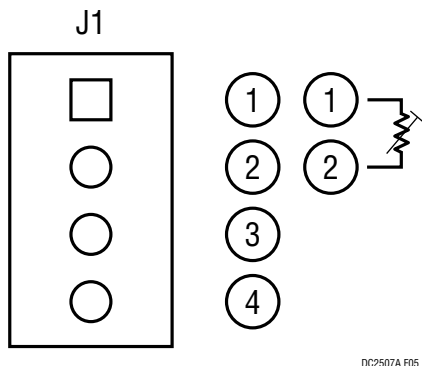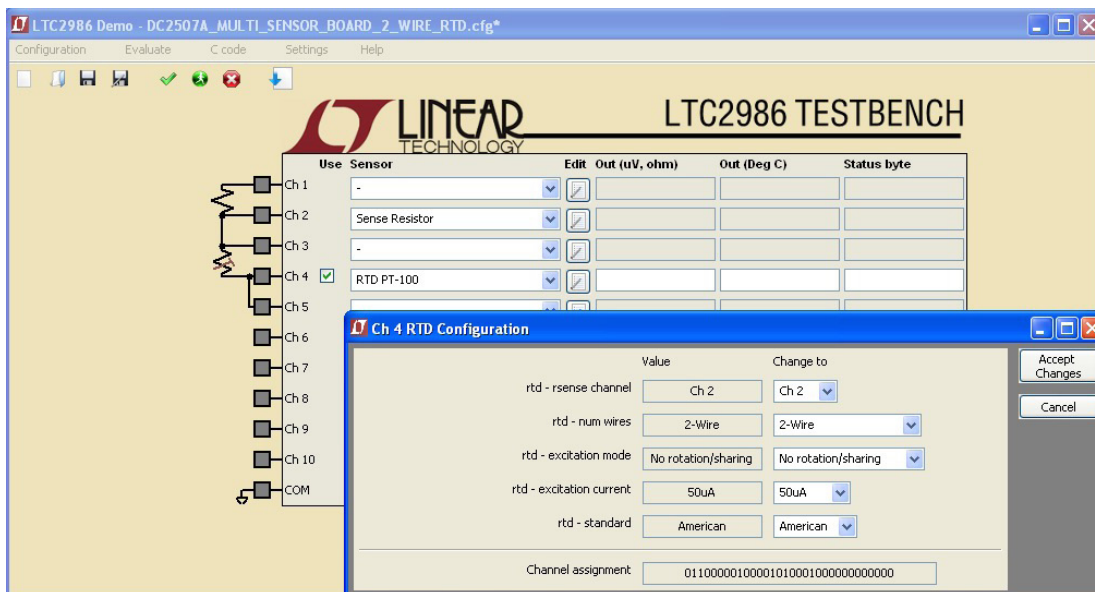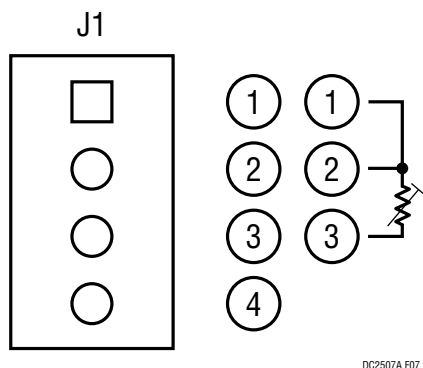

Figure 5. 2-Wire RTD Connection

Figure 6. 2-Wire RTD Configuration

SETUP

3-Wire RTD

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

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.

Figure 7. 3-Wire RTD Connection

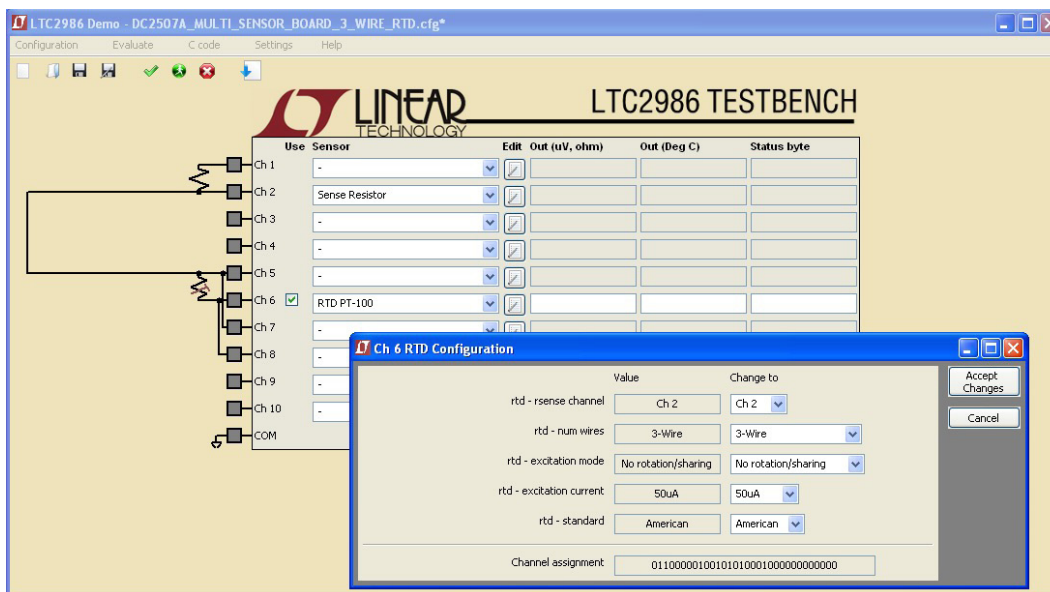Figure 8. 3-Wire RTD Configuration

SETUP

4-Wire RTD

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

The 4-wire RTD is assigned to CH6 (see Figure 10) and can be automatically loaded using the configuration file 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.
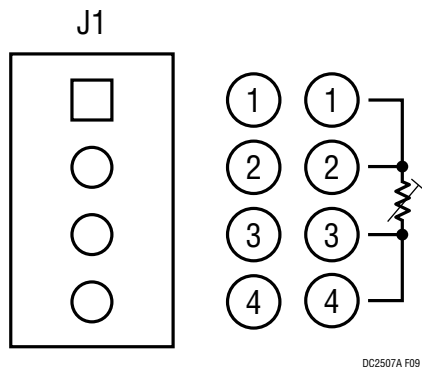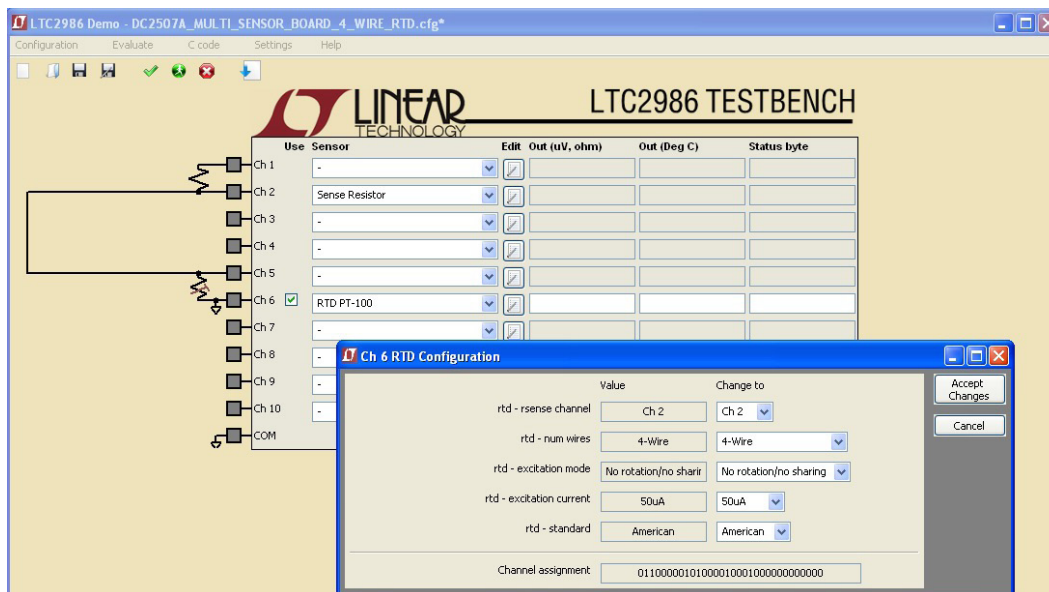

DC2507A F09

Figure 9. 4-Wire RTD Connection

Figure 10. 4-Wire RTD Configuration

SETUP

Thermistor

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

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.
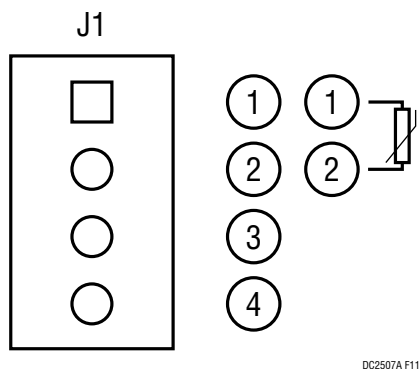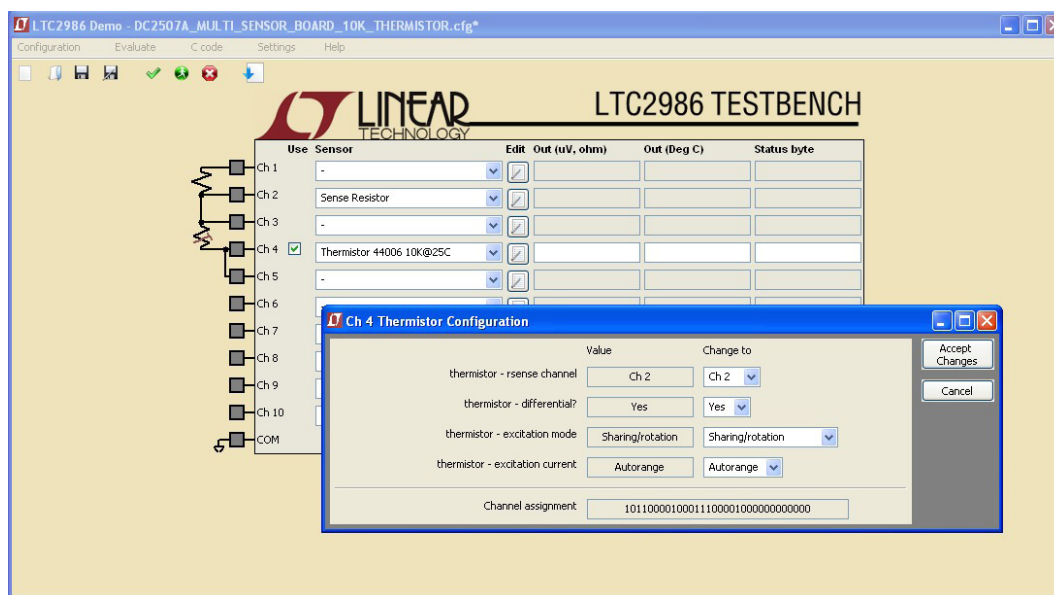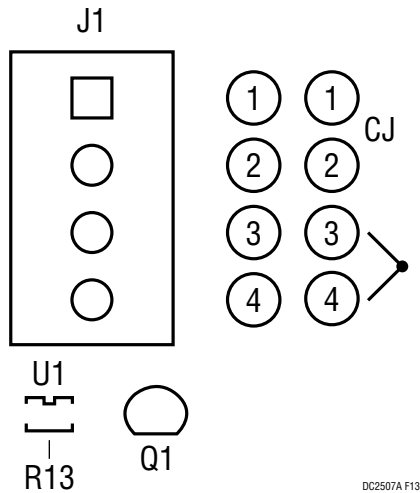

Figure 11. Thermistor Connection

Figure 12. Thermistor Configuration

SETUP

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.
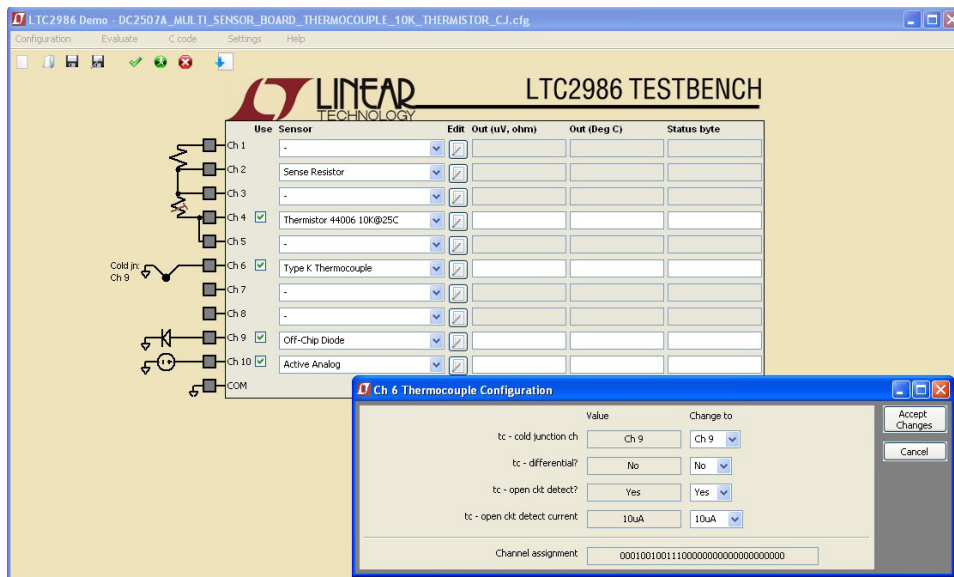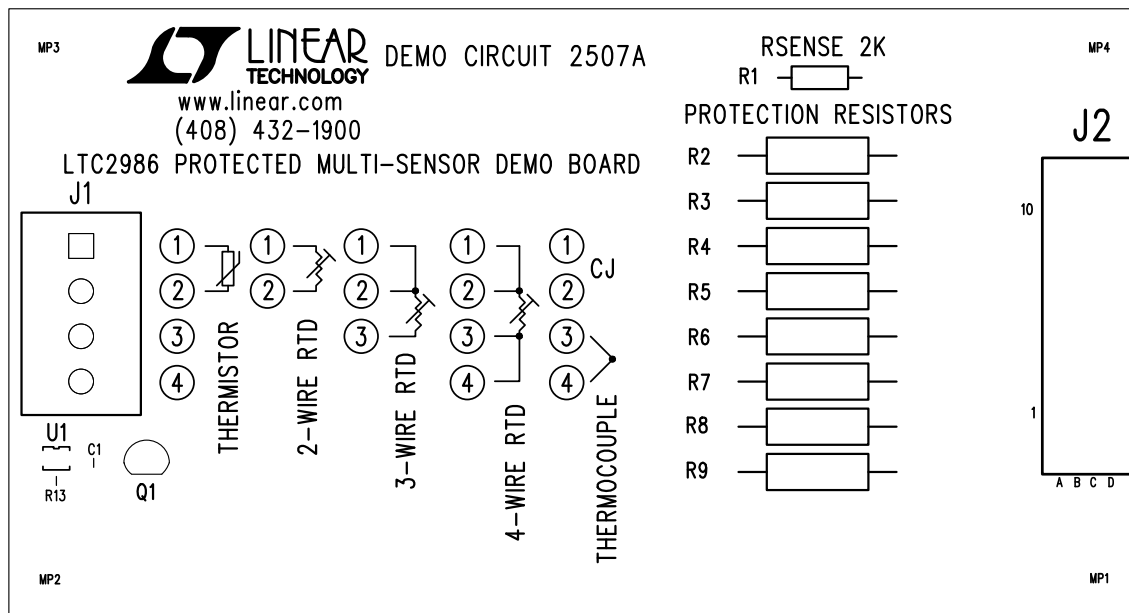

Figure 14. Thermocouple and Cold Junction Configuration

PCB LAYOUT

Top Silkscreen

PCB LAYOUT

Top Layer
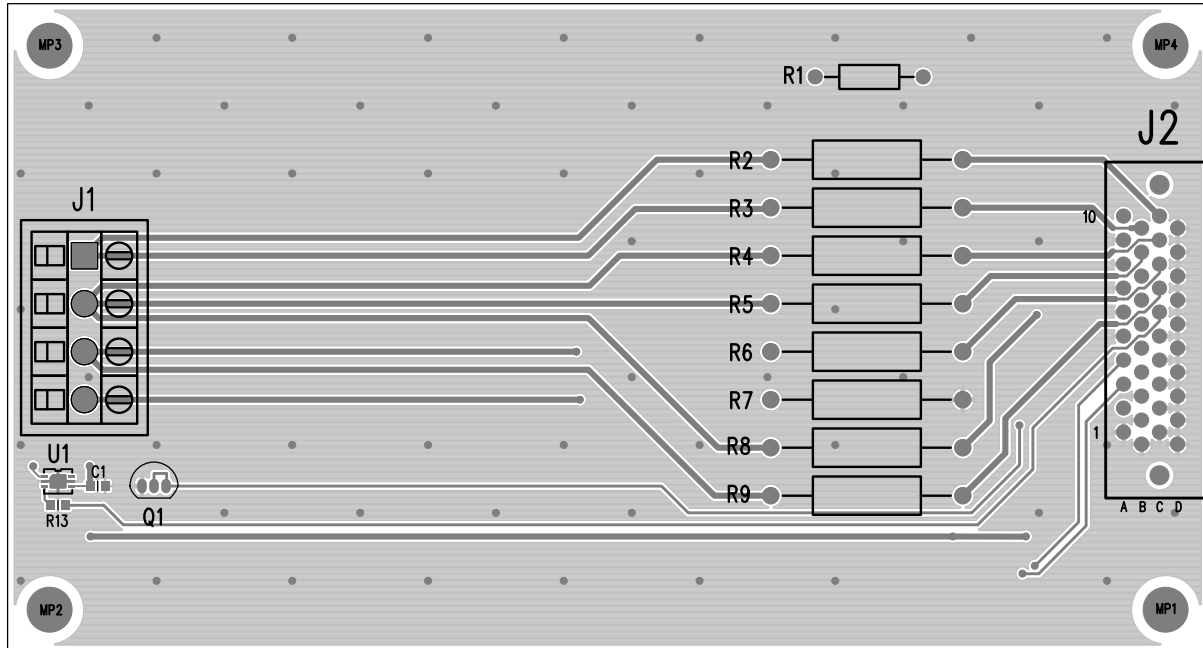
dc2507af

PCB LAYOUT

Bottom Layer
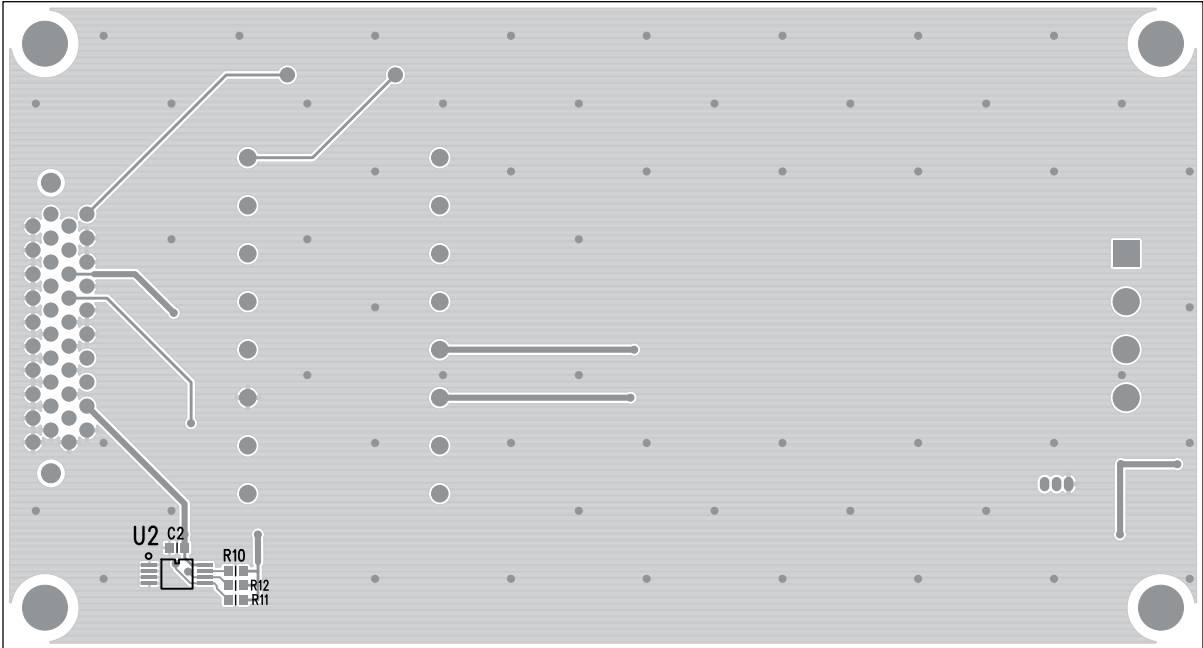
PARTS LIST

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

SCHEMATIC DIAGRAM

NOTES:
1. R1-R9 ARE AXIAL LEAD THRU-HOLE TYPE.
2. R10-R13, C1-C2 ARE SMD SIZE 0603.

HIROSE FX2-40S-1.27DS(71)
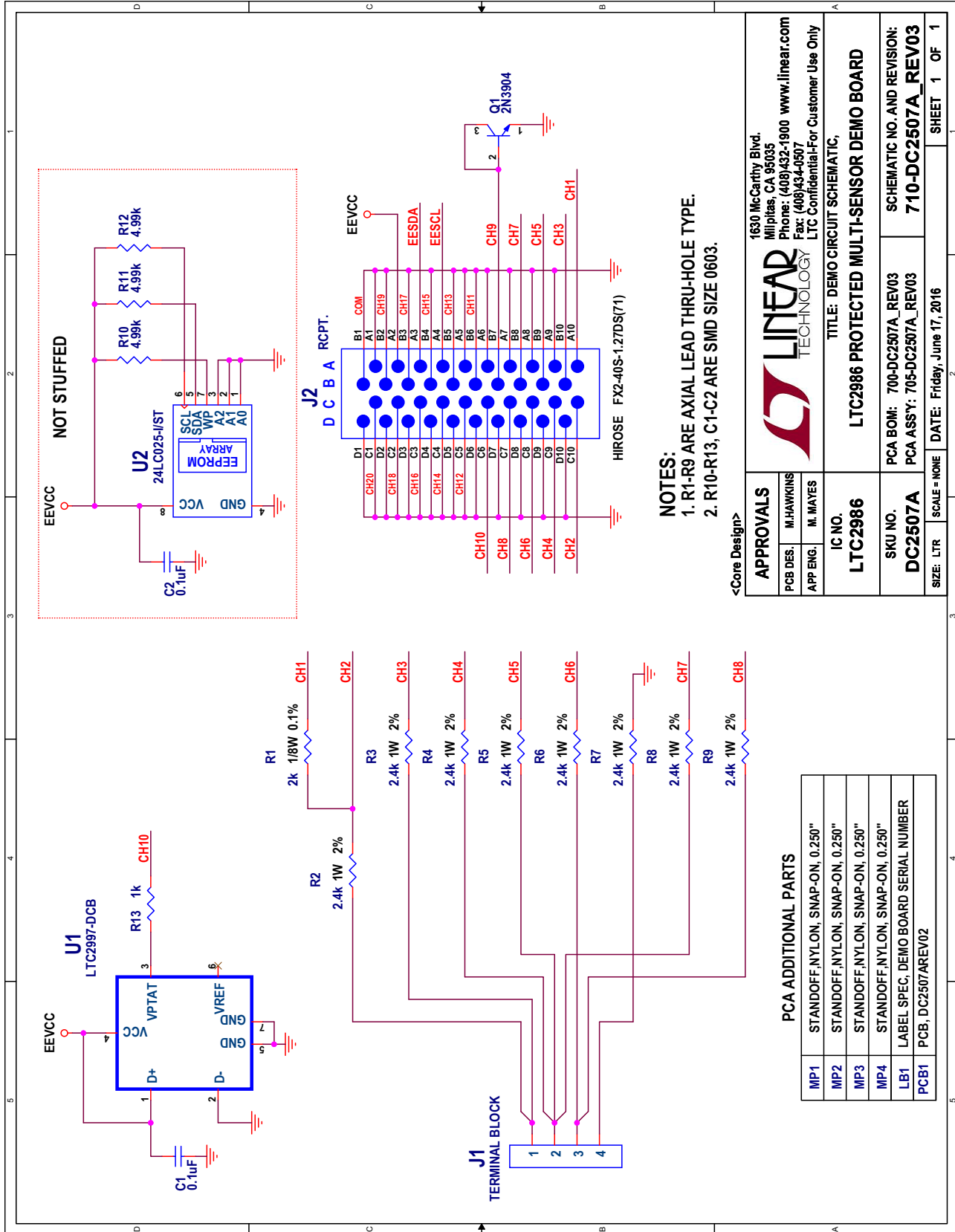
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<Core Design>

APPROVALS	
PCB DES.	M.HAWKINS
APP ENG.	M. MAYES

IC NO.
LTC2986

SKU NO.
DC2507A

TITLE: DEMO CIRCUIT SCHEMATIC,
LTC2986 PROTECTED MULTI-SENSOR DEMO BOARD

PCA BOM: 700-DC2507A_REV03
PCA ASS'Y: 705-DC2507A_REV03

SCHEMATIC NO. AND REVISION:
710-DC2507A_REV03

DATE: Friday, June 17, 2016

SIZE: LTR   SCALE = NONE   SHEET   1   OF   1

PCA ADDITIONAL PARTS

MP1	STANDOFF,NYLON, SNAP-ON, 0.250"
MP2	STANDOFF,NYLON, SNAP-ON, 0.250"
MP3	STANDOFF,NYLON, SNAP-ON, 0.250"
MP4	STANDOFF,NYLON, SNAP-ON, 0.250"
LB1	LABEL SPEC, DEMO BOARD SERIAL NUMBER
PCB1	PCB, DC2507AREV02

dc2507af

dc2507af

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