QSG-8430

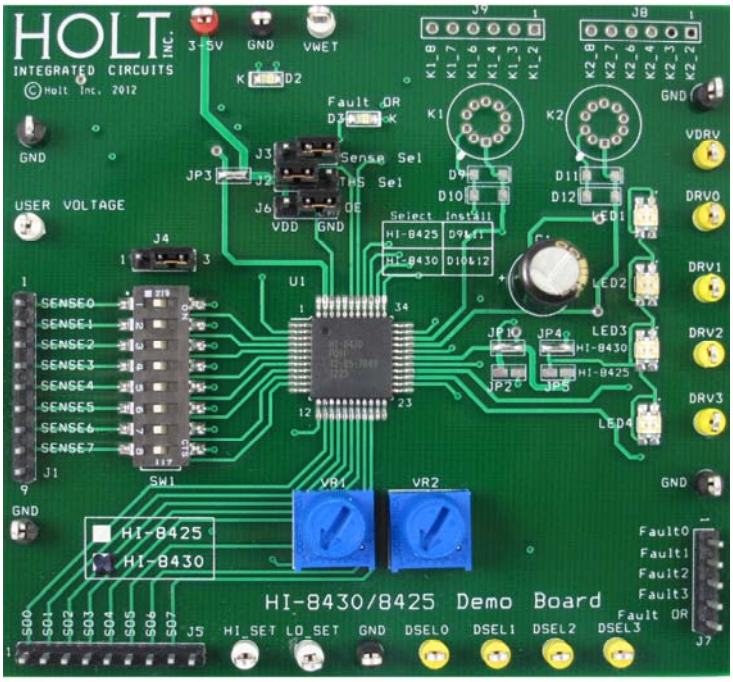
HI-8430, HI-8425 Discrete Digital I/O Evaluation Board

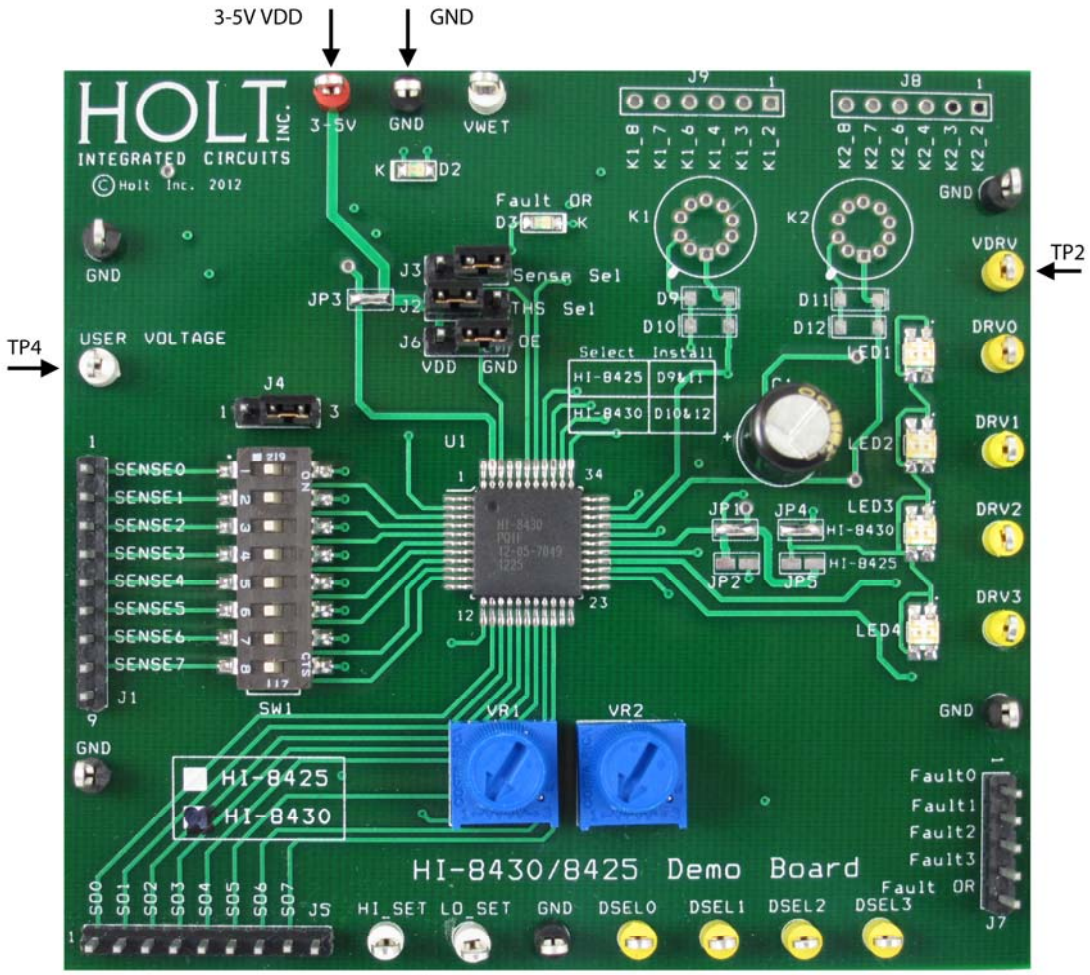
March 2, 2015

Introduction

The HI-8430/8425 Evaluation Board allows the user to evaluate the HI-8425 or HI-8430 Avionics Discrete to Digital IC. Both the HI-8430 and HI-8425 include eight sensor input channels and four output drivers. The eight input channels are configurable for either Ground/Open or Supply/Open depending on the state of the SNSE_SEL pin. The HI-8430 provides four high-side drivers while the HI-8425 has four low-side drivers. The board features jumpers, DIP switches, test points, LED's and two potentiometers to facilitate IC testing and evaluation.

Discrete-to-Digital input sensors are used in avionics systems to monitor signals between +28VDC, ground and floating states. The four channel 200 mA driver outputs can be used to drive LED's, relays and other loads. Some types of incandescent bulbs can be driven with a modified input signal (explained further into the document).





Power Supply Setup

1. Connect a 3.3V or 5V power supply to TP1 VDD and connect the power supply ground connection to the GND TP.
2. To demonstrate the input sensors connect a 0-20 VDC adjustable power supply to TP4 USER VOLTAGE.
3. To demonstrate the output drivers connect a 5.0V – 28V supply to TP2 (VDRV).

Discrete Input Sensors Setup Configuration

The eight input sensors on both the HI-8425 and HI-8430 are configurable for either Ground/Open or Supply/Open sensors depending on the state of the SNSE_SEL pin. If SNSE_SEL is low, the inputs are configured for Ground/Open sensing. If the SNSE_SEL is high, the inputs are configured for Supply/Open sensing.

Configuration Steps

1. Choose the type of sensor desired Ground/Open or Supply/Open and configure the board jumpers according to the table below.

2. If using external thresholds (J2 1-2) adjust the desired high (upper) threshold voltage at TP18 using VR1 potentiometer. Adjust the low threshold voltage at TP19 using VR2. Turning the potentiometers clockwise increases the voltages on both. The actual threshold voltages will be approximately 10x the voltages on the LO_SET and HI_SET pins.

3. To apply a common input voltage to all eight sensor inputs in parallel, connect the input signal to TP4, close the eight DIP switches, and span the J4 jumper between pins 2 and 3. To apply a common ground to all the inputs set the J4 jumper between pins 1 and 2.

4. To apply individual input signals, open the corresponding DIP switch at SW1 and connect the desired input signal to J1. J1-1 connects to SENSE0, J1-2 to SENSE1 etc. See the schematic for the remaining connections. The sense outputs SO_0 through SO_7 are available on J5 header pins 1 though pin 8. These outputs can be used to monitor the sensor outputs.

5. Enable the SO_x outputs by grounding the /OE input by setting J6 jumper between pins 1 and 2 (right side).

Ground/Open Input Sensing demonstration

Configure the jumpers for Ground/Open sensing and internal thresholds using the following table.

Mode	Thresholds	J2 (threshold select)	J3 (Sense Select)	J6 /OE
Gnd/Open Sense	Internal*	2-3(right side)	2-3 (right side)	1-2 (GND)
Gnd/Open Sense	External	1-2(left side)	2-3(right side)	1-2(GND)

Note * - When internal thresholds are used, the HI-Set and LO-Set inputs should ideally be grounded. For the demo board, turn both VR1 and VR2 potentiometers fully CCW.

Apply a variable power supply voltage on TP4. The input to output behavior will follow this truth table:

Sense_n TP4 Voltage	SO_n Output	Comment
Open or > 2.0V	**Low**	**High sense**
< 1.6V	**High**	**Low sense**
1.6- 2.0V	**No change**	**Hysteresis**

Supply/Open Input Sensing demonstration

Configure the jumpers for Supply/Open sensing and internal thresholds using the following table.

Mode	Thresholds	J2 (threshold select)	J3 (Sense Select)	J6 /OE
Supply/Open Sense	Internal*	2-3(right side)	1-2(left side)	1-2(GND)
Supply/Open Sense	External	1-2(left side)	1-2(left side)	1-2(GND)

Note * - When internal thresholds are used, the HI-Set and LO-Set inputs should ideally be grounded. For the demo board turn both VR1 and VR2 potentiometers fully CCW.

Apply a variable power supply voltage on TP4. The input to output behavior will follow this truth table:

Sense_n TP4 Voltage	SO_n Output	Comment
Open or < 12V	**High**	**Low sense**
> 14V	**Low**	**High sense**
12 - 14V	**No change**	**Hysteresis**

Discrete Output Driver Setup and Demonstration

The HI-8430 features four high-side output drivers each capable of sourcing 200 mA. In the HI-8425, the outputs are low-side drivers capable of sinking 200 mA. The DRV_0 – DRV_3 outputs are driven to the active state by applying a logic high on the DSEL0 - DSEL3 inputs. THE DSELX inputs to the IC include internal 30K ohm pull-down resistors to keep the outputs off (low) when there are no connections on these pins.

Jumper Settings

On the HI-8430, pin 28 is the VDRV voltage source pin. On the HI-8425 pin 28 is grounded.

Four bi-color LEDs (LED1-LED4) are used to provide visual status of the four outputs. For the HI-8430, JP4 is closed and JP5 is open. The corresponding yellow LED is on when the output is high. For the HI-8425, JP4 is open and JP5 is closed. With the HI-8425 the green LEDs will be on when the corresponding outputs are driven low.

The table below shows the jumper settings for the two possible board configurations.

	JP1	JP2	JP3	JP4	JP5	LEDs
HI-8430	Closed	Open	Closed	Closed	Open	Yellow
HI-8425	Open	Closed	Closed	Open	Closed	Green

HI-8430 Demo

To demonstrate the output drivers, make the power supply connections listed in the “Power Supply Setup” section. Apply a logic one state to any of the DSELx inputs (TP8 – TP12) using a clip lead to the VDD TP1 or to any other logic one source. The corresponding LED will turn on when the DRV_x output is driven High. The VDR_x output voltage can be monitored with an oscilloscope or a multimeter on TP13 – TP16.

HI-8425 Demo

To demonstrate the output drivers make the power supply connections listed in the “Power Supply Setup” section. Apply a logic one state to any of the DSELx inputs (TP8 – TP12) using a clip lead to the VDD TP1 or to any other logic one source. The corresponding LED will turn on when the DRV_x output is driven Low. The VDR_x output voltage can be monitored with an oscilloscope or a multimeter on TP13 – TP16.

Additional loads can be connected to the DRV_x outputs on TP13, TP14, TP15 and TP16. When the only output load is the on-board LEDs, a slow decaying waveform may be seen with a oscilloscope when the driver is switched off. This is caused by the LED capacitance when the driver voltage falls below the forward voltage drop of the LED.

Over-Current Faults

The HI-8430 and HI-8425 provides independent over-current fault protection on each output. Each output automatically shuts off if excessive current is detected. A channel FAULTx signal will be driven high corresponding to the faulted channel. FAULT_OR will go active high for any faulted channel which will turn on the Red Fault LED D3. To clear a fault condition, first remove the excessive load and return the corresponding DSELx input low again before attempting to turn on the output driver again. All four FAULTx output indicator outputs of the IC are available on CONN 5 including the FAULT_OR signal.

Incandescent Bulbs

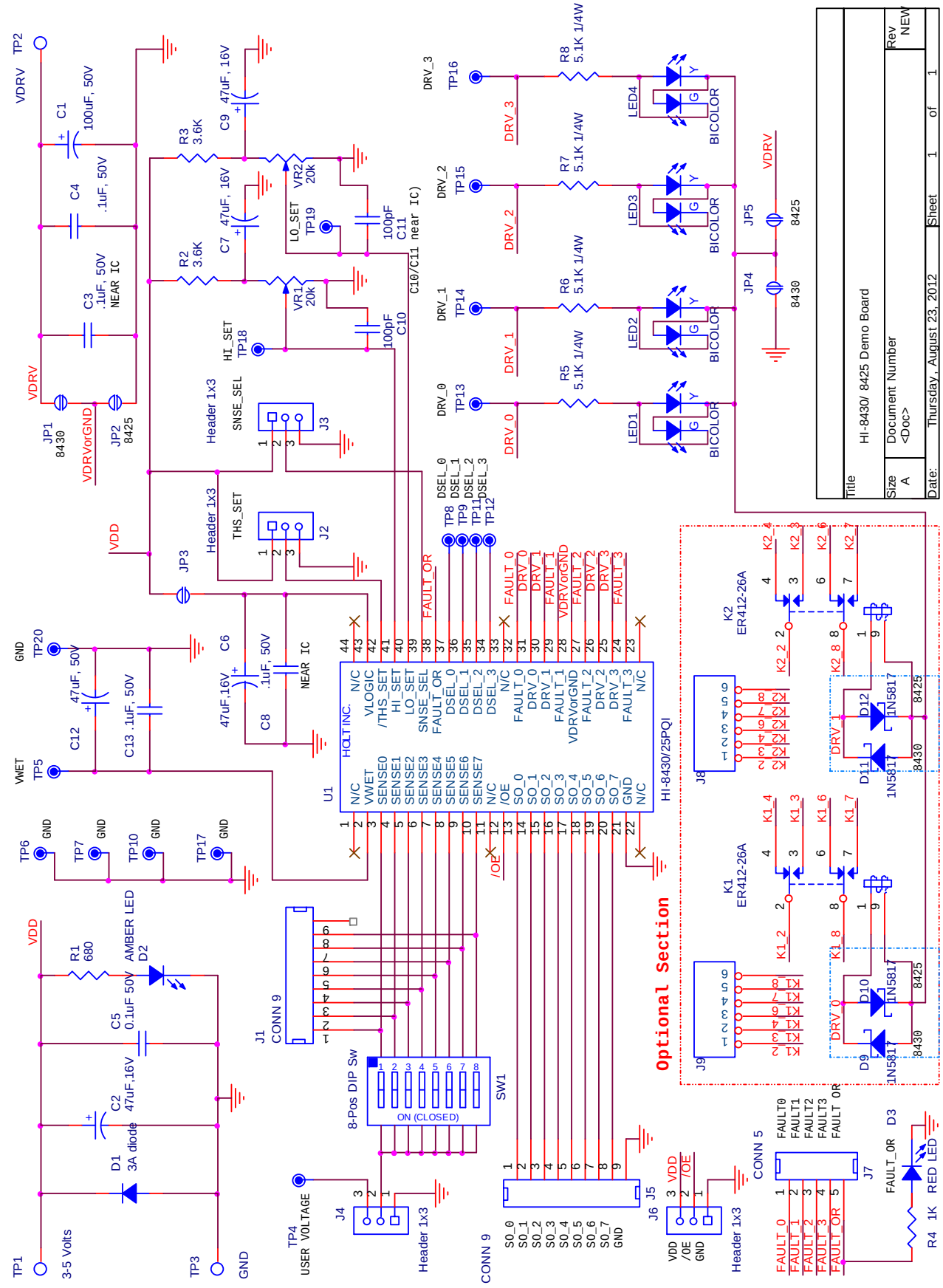
When bulb filaments are cold (off), incandescent bulbs typically exhibit high initial inrush currents 10 to 12 times the normal operating current. This typically causes the output protection circuit to detect over-current fault and shut off. One remedy is to modulate the leading edge of the DRV_x drive input with a 20 to 30KHz clock signal. The accumulated energy of the pulses eventually warms the filament and after a period of time the pulses can be removed and the DRV_x signal can be left in the on state (high) for the desired duration. For bulbs near 200 mA, two outputs in parallel may be needed. The amount of pulse modulation warm up time needed is dependent on the bulb type, voltage and current requirements but may be in the range of 50 – 200 ms. For additional applications assistance please contact applications engineers at Holt Integrated Circuits.

Relays

The board includes an optional area on the PCB for testing relays. The PCB layout is for Teledyne ER412-26A relays but these relays are NOT included on the demo board. The relays contacts are routed to two 6-pin header areas where header pins could be soldered in for access to the relay pins.

Conclusion:

The Holt HI-8430/25 Evaluation Board demonstrates the features and capabilities of the HI-8430 or HI-8425 Discrete to Digital Avionics IC.


Optional Section
HI-8430/25PQI
HI-8430/ 8425 Demo Board
Document Number
<Doc>
Thursday, August 23, 2012
Header 1x3
8-Pos DIP Sw
ON (CLOSED)
CONN 9
CONN 5
ER412-26A
1N5817
BICOLOR
AMBER LED
RED LED
3A diode
3-5 Volts
USER VOLTAGE

Bill of Materials: HI-8430 / HI-8425 Evaluation Board

Item	Qty	Description	Reference	DigiKey	Mfr P/N
1	1	PCB, Bare, Evaluation Board	N/A	--------	
2	1	Capacitor Alum 100uF, 50V 20% Radial	C1	P12392-ND	Panasonic EEU-FM1H101
3	2	Capacitor, Ceramic 100pF 5% NPO 50V 0805	C10,C11	311-1111-1-ND	Yaego CC0805JRNPO9BN101
4	5	Capacitor, Ceramic 0.1uF 10% 50V X7R 0805	C3,C4,C5,C8,C13	311-1140-1-ND	Yageo CC0805KRX7R9BB104
5	5	Capacitor 47uF 10% 16V Tantalum SMD EIA 6032	C2,C6,C7,C9,C12	495-2247-1-ND	Kemet T491C476K016ZT
6	2	Header, Male 1x9, 0.1" Pitch	J1,J5	S1012E-9-ND	Sullins PEC36SAAN
7	4	Header, Male 1x3, 0.1" Pitch	J2,J3,J4,J6	S1012E-3-ND	Sullins PEC36SAAN
8	5	Solder Jumper	JP1,JP2,JP3,JP4,JP5	Solder Jump	
9	4	Shunt, 2-pin, 0.1" pitch	JP2,3,4,6	A26228-ND	TE 382811-8
10	4	LED Bicolor Green/Yellow	LED1,LED2,LED3, LED4	160-1171-1-ND	LiteOn LTST-C155GYKT
11	1	Diode GPP 3A 600V SMC	D1	S3JFSCT-ND	Fairchild S3J
12	1	LED Yellow 0805	D2	160-1416-1-ND	LiteOn LTST-C170KSKT
13	1	LED Red 0805	D3	160-1176-1-ND	LiteOn LTST-C170CKT
14	1	Resistor, 680 Ohm 5% 1/8W 0805	R1	311-680ARCT-ND	Yageo RC0805JR-07680RL
15	2	Resistor, 3.6K 5% 1/8W 0805	R2,R3	311-3.6KARCT-ND	Yageo RC0805JR-073K6L
16	1	Resistor, 1K 5% 1/8W 0805	R4	311-1.0KARCT-ND	Yageo RC0805JR-071KL
17	4	Resistor, 5.1K 5% 1/4W 1206	R5,R6,R7,R8	311-5.1KERCT-ND	Yageo RC1206JR-075K1L
18	2	Trim Pot 20K - 3/4 Turn w/ Knob	VR1,VR2	3386P-203TLF-ND	Bourns 3386P-1-203TLF
19	1	DIP Switch 8-Pos Slide SMD	SW1	CT2198MST-ND	CTS 219-8MST
20	1	Test Point, Red Insulator, 0.062" hole	3-5VDC	5010K-ND	Keystone 5010
21	6	Test Point, Black Insulator, 0.062" hole	GND	5011K-ND	Keystone 5011
23	9	Test Point, Yellow Insulator, 0.062" hole	VDRV, DRV0-DRV3, DSEL0-DSEL3	5014K-ND	Keystone 5014
24	4	Test Point, White Insulator, 0.062" hole	VWET, USER Volt, HI_ SET, LO_SET	5012K-ND	Keystone 5012
25	1	IC, HI-8430/25 44-PQFP	U1	HI-8430/25PQI	Holt Inc.
26	4	Rubber Foot, Bumpon Cylindrical .312X.200 BLK	4 Corners	SJ5746-0-ND	3M SJ61A1
27	4	Diode Schtky 1N5817 1A 20V	D9,D10,D11,D12	SM5817PL-TPMSCT-ND	Micro CC SM5817PL-TP
28	2	Relay DPDT 26V T0-5	K1,K2 Optional	Mouser 881-ER412-26A	Teledyne ER412-26A
29	2	Header, Male 1x6, 0.1" Pitch	J8,J9 Optional	S1012E-6-ND	Sullins PEC36SAAN

REVISION HISTORY

P/N	Rev	Date	Description of Change
QSG-8430	NEW	10/02/12	Initial Release
QSG-8430	A	03/02/15	Added BOM