HOLT INTEGRATED CIRCUITS

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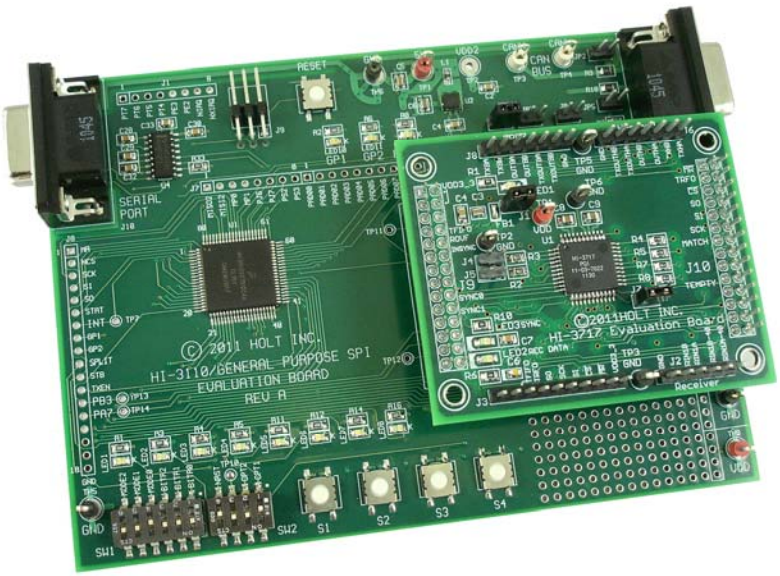
AN-170
HI-3717 Evaluation Board Users Guide

Introduction:

The Holt HI-3717 ARINC 717 Evaluation Board demonstrates most of the features of the HI-3717A ARINC 717 Protocol IC. ARINC 717 is a communication protocol used between the Digital Flight Data Acquisition Unit (DFDAU) and the Digital Flight Data Recorder (DFDR) used on most commercial aircraft.

The HI-3717A requires a single 3.3V power input. It features an on-chip DC-DC converter which generates both +5V and -5V to supply the bipolar differential voltage levels needed to meet the ARINC 717 Bipolar Return-to-Zero (BPRZ) Bus levels. A Freescale MC9S12XDT512 microcontroller communicates with the HI-3717A through the SPI interface. The main "General Purpose SPI Evaluation Board" includes switches and LEDs to navigate the operating modes and confirm data and status information. A Serial UART port on the MCU allows debug and data messages to be sent to a PC using any terminal program, such as Windows HyperTerminal. The HI-3717 Evaluation Board is a daughter card that plugs on to the General Purpose SPI board via two 26 pin connectors.

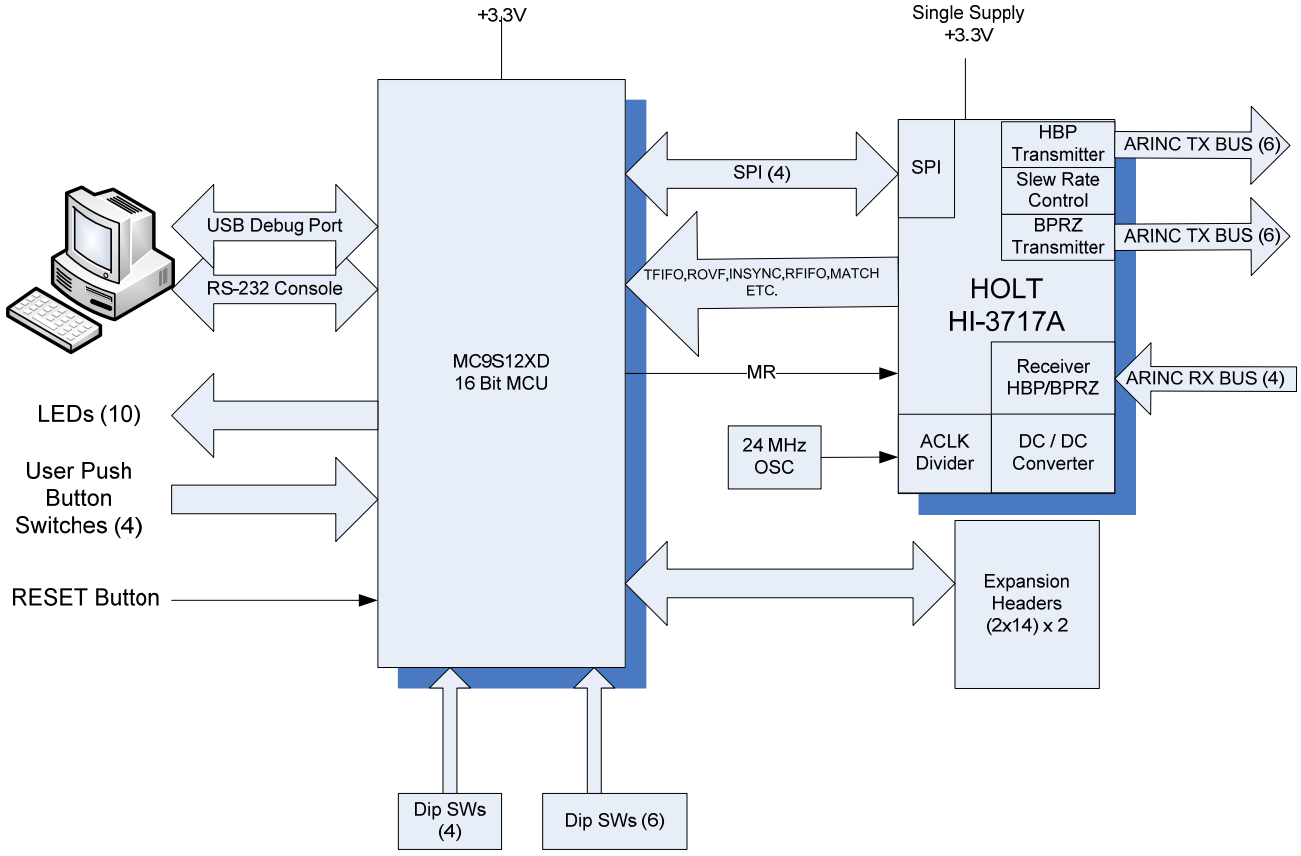
This guide summarizes how to get set up and running quickly. Additional support material and software are provided in the included CD-ROM. Since the demo code is pre-programmed into the flash in the microcontroller the demo is operational right out of the box. No software development tools are needed to run the demo.



KIT CONTENTS

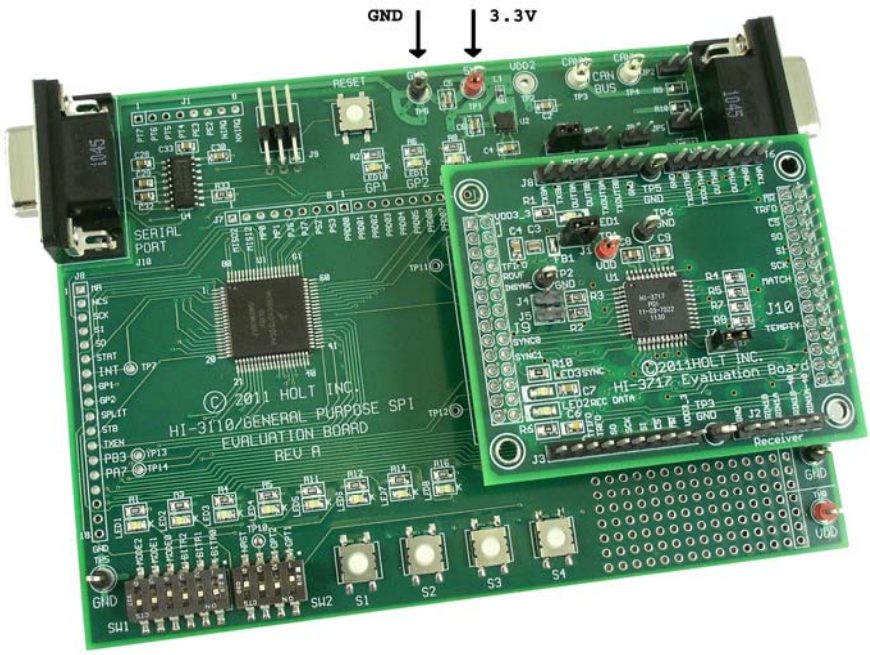
- This Quick Start Guide.
- General Purpose SPI Evaluation board and schematic.
- HI-3717A Evaluation Board (daughter card) and schematic.
- HI-3717A Data Sheet.
- RS-232 9 Pin Serial Cable.
- Demo Project compatible with Freescale™ CodeWarrior™.
- HI-3717A Users Guide.
- HI-3717A Application Note.
- CD-ROM containing all the documents and software.

Evaluation Board Diagram



Demonstration Board Set Up

1. Connect a +3.3V power supply to TP1 and ground to TP6. This is the only power supply needed by this demo; the HI-3717A includes an on-chip DC-DC converter which generates +5V and -5V to meet the ARINC transmit levels.



2. Connect the included RS-232 cable between the board and the PC Serial (COM) port. To view ARINC data, Control and Status Registers and enter optional commands, a terminal program may be used. Configure the communication for 115200 Baud, 8 bits, No Parity, No handshaking.

3. HI-3717 daughter card factory default jumper settings:

J1 - shorted	J4 - open
J7 - shorted	J5 - open

Board RESET

A RESET pushbutton is provided. A DIP switch is also provided to continuously assert processor RESET. For normal operation, ensure SW2 – 4 (MRST) is in the open position otherwise the MCU will be held in the reset state. The MRST DIP switch allows easy interfacing of an external MCU to the HI-3717A. Closing SW2-4 will keep the RESET pin low forcing the Freescale MCU GPIO pins into a high impedance state

Main Board Jumpers

Some jumpers do not apply to the HI-3717A so they will typically be shown as NA.

JP1 - NA, JP2 - NA
JP3 - VDD jumper to 3.3V.
JP4 - NA, JP5 - NA, JP7 - NA.

Demo Mode Selection

Mode2	Mode1	Mode0	MODE NUMBER	DEMO MODE
0	0	0	0	Board Test
0	0	1	1	Transmit Receive Mode
0	1	0	2	Transmit Receive Mode SELF-TEST
0	1	1	3	Transmit Special Mode
1	0	0	4	Receive Mode Compare Off
1	0	1	5	Receive Mode Compare On
1	1	0	6	Software Sync Mode
1	1	1	7	Serial Commands

(0=CLOSED, 1=OPEN)

OPT1 switch Receiver Mode

Open = BPRZ (Bipolar Return-to-Zero) Receive mode.
Closed = HBP (Harvard Bi-phase) Receive mode.

OPT2 switch 32 WPS

Open = 32 WPS (overrides all other rates).
Closed = Rate follows BitRate0, BitRate1 and Bitrate2 switch settings.

WPS Bit Rate DIP switches

BitR-2	BitR-1	BitR-0	WORD RATE	Slew Rate
0	0	0	64	7.5us
0	0	1	128	7.5us
0	1	0	256	7.5us
0	1	1	512	7.5us
1	0	0	1024	3.75us
1	0	1	2048	1.5us
1	1	0	4096	1.5us
1	1	1	8192	1.5us

WPS Bit Rate notes:

1. 0=CLOSED, 1=OPEN.
2. OPT2 must be closed to apply these rates, otherwise 32 WPS is selected.
3. The Slew Rate is automatically programmed, based on the setting.

Push Buttons SW1-SW4

Depending on the selected mode, these buttons perform specific tasks.

Daughter Card LED's

The Green LED when on indicates data in the Receive FIFO.
The Amber LED indicates power is applied to the board.
The Yellow LED turns on when the receiver is synchronized to the incoming data.

LED	FUNCTION	ACTION
LED1 - AMBER	3.3V POWER	ON
LED2 - GREEN	RECEIVE DATA	ON
LED3 - YELLOW	INSYNC	ON DURING SYNC

Main Board Status LEDs

LED	FUNCTION	ACTION	MODES
LED1	SNYC WORD TX FIFO LOADS	FLASHES	1,2,3
LED2	SYNC WORD PATTERN RECEIVED	FLASHES	1,2,4,5
LED3	SYNC WORD (PROPER) RECEIVED	FLASHES	1,2,4,5
LED4	MATCH COUNT INTERRUPT	FLASHES	1,2,4,5
LED5	RX FIFO FULL	ON	1,2,4,5
LED6	TX FIFO FULL	ON	1,2,4,5
LED7	PROCESSOR RUNNING	FLASHES 1HZ	ALL
LED8 (Red)	HI-3717A INTIALIZED/ DATA COMPARE FAIL	ON	ALL/1,2,5

DEMO MODE CONFIGURATION

Select the demo mode using the Mode-0, Mode-1 and Mode-2 DIP switches.

Set the Word Rate for 64 – 8192 WPS using BITR0, BITR1 and BIT2 DIP switches.

Set the WordRate for 32 WPS by opening OPT1. This overrides the BITRx switch settings.

Power cycle the board, or press the RESET button on the main board.

After a power-on reset, the program revision is displayed on the LEDs for two seconds in binary format, where LED1 is the LSB. After two seconds, the LEDs turn off, and then LED7 flashes every second as the main MCU “live” operating indicator.

A message is also sent to the Console Port. Some of the displayed information reflects the options selected by the DIP switches.

Mode- 0 Board Test:

This is a simple test program that cycles the LEDs 1 - 8 on briefly to verify operation. LED7 flashes every second, in addition to the normal flash. Pressing down S1 stops the sequence and turns on LED1. Pressing S2-4 turns on LEDs 2-4 respectively. This is a way to verify that the push buttons work.

The output on the console will be similar to:

```
Holt HI-3717 Demonstration Software Revision: x.x
Board Test
```

For the following examples, configure the DIP switches as follows:

```
Bit Rate DIP switches for 64 WPS.
32 WPS disabled (OPT2 closed).
Receiver set for BPRZ mode (OPT1 open).
```

Mode- 1 Transmit Receive Mode

This mode demonstrates both transmitting and receiving. The Word Rate and the receiver mode are configured according to the DIP switch settings. The transmitter transmits a SYNC word followed by an incrementing data word pattern from 1 to the maximum count. The value of the maximum word count depends on the Word Rate. A 64 Word Rate would count to 63 (0x3F). The data output sequence would be: SYNC, 1, 2, 3…63. The receiver displays the data in hex format and the SYNC words are marked with an asterisk. The console display below shows four sub-frames each with a SYNC word followed by the data word.

For the receiver to receive data, connect the transmitter to the receiver inputs by connecting two wires on the J2 and J6 terminal blocks:

J6-5 To J2-6
J6-4 To J2-5

The initial console screen looks similar to this, depending on the switch settings:

```
Holt HI-3717 Demonstration Software Revision: x.x

Transmit and Receive Mode

Initializing the HI-3717

Receiver Mode: BPRZ
Word Rate = 64 WPS
Slew Rate 7.5uS Selected
```

```
HI-3717 Initialized OK
Match Word Count Register set to = 0x0005

Press S1 to start
```

The HI-3717A has been successfully initialized and the program is waiting for the S1 push button to be pressed before transmitting and receiving begins. A check is performed when initializing the HI-3717A Control Register 0 by reading back the value; if the value read does not match the written value, an error message is displayed on the console; the Red LED turns on and the program enters a dead loop.

Once the S1 button is pressed, the "Transmitting" message is displayed on the console. The receiver fetches and displays the SYNC words and data as shown below:

```
Transmitting
247*001 002 003 004 005 006 007 008 009 00A 00B 00C 00D 00E 00F
010 011 012 013 014 015 016 017 018 019 01A 01B 01C 01D 01E 01F
020 021 022 023 024 025 026 027 028 029 02A 02B 02C 02D 02E 02F
030 031 032 033 034 035 036 037 038 039 03A 03B 03C 03D 03E 03F
5B8*001 002 003 004 005 006 007 008 009 00A 00B 00C 00D 00E 00F
010 011 012 013 014 015 016 017 018 019 01A 01B 01C 01D 01E 01F
020 021 022 023 024 025 026 027 028 029 02A 02B 02C 02D 02E 02F
030 031 032 033 034 035 036 037 038 039 03A 03B 03C 03D 03E 03F
A47*001 002 003 004 005 006 007 008 009 00A 00B 00C 00D 00E 00F
010 011 012 013 014 015 016 017 018 019 01A 01B 01C 01D 01E 01F
020 021 022 023 024 025 026 027 028 029 02A 02B 02C 02D 02E 02F
030 031 032 033 034 035 036 037 038 039 03A 03B 03C 03D 03E 03F
DB8*001 002 003 004 005 006 007 008 009 00A 00B 00C 00D 00E 00F
010 011 012 013 014 015 016 017 018 019 01A 01B 01C 01D 01E 01F
020 021 022 023 024 025 026 027 028 029 02A 02B 02C 02D 02E 02F
030 031 032 033 034 035 036 037 038 039 03A 03B 03C 03D 03E 03F
```

The receiver performs a compare on the incoming SYNC words and incremented data words. If either of these do not match with the expected values, the program stops and displays a "Data Fail" message. For example, if you remove one of the jumper wires while data is received the error message may look similar to this:

```
** Data Failed to Verify **
Expected = 0003

Data = FFE   Word Count = 0003
```

In this situation the received value 0xFFE did not match the expected value 003. Once Data Fail occurs, the program turns on the Red LED and enters a dead loop. Reset the board by pressing the RESET button to restart the program.

Pressing S1 or the space bar on the HyperTerminal program while the program is transmitting to stop the program and display the HI-3717A Control and Status Registers.

```
HI-3717 Status, Control Registers

Control Reg 0           0x01
Control Reg 1           0x01
FIFO Status Reg         0xE4
FIFO XMT Reg            0x00
REC FIFO Status Pin Reg 0x00
WORD Count Utility Reg  0x0028
REC FIFO Word and Count 0x0007 0x0043
Transmitting Paused

Press S4 or spacebar to continue
```

Press S4 on the board or press the space bar on the HyperTerminal program to resume transmitting and receiving data. When the program is resumed, a four second re-synchronizing delay occurs before data is displayed again on the console.

Mode – 2 Transmit Receive Mode SELF-TEST

Mode - 2 is nearly identical to Mode – 1 except the TEST bit is set in the Control Register 1 register to enable Test Mode. Test Mode disables the line drivers and receiver and digitally loops back the transmitted data to the receiver. The same data will be received as Mode -1 but without the need to provide jumpers on the terminal block.

The added prompt message will indicated Test Mode was selected:

```
SELF-TEST, Internal Digital Loop-back, No data is transmitted
externally
```

Mode – 3 Transmit Special Mode

Mode - 3 is a special transmit function which allows customized data patterns to be generated by combining predefined sets of sub-frames together. There are a few examples in the code which can be grouped together to create groups of sub-frames. Each sub-frame begins with a SNYC word and a number of data words determined by the WPS switch settings. Each sub-frame function is passed the desired SYNC word value; within the sub-frame module the data can be customized by adding additional CASE statements to transmit any data word pattern to the transmit function. The program default will repeatedly transmit four sub-frames. The first sub-frame contains all zeros, the second sub-frame will contains all ones, the 3rd sub-frame will contains all zeros again and finally the last sub-frame transmits an incrementing data word pattern.

Press a button on the board or entering a character on the console selects a different data word pattern on-the-fly.

Pressing S1 or the space bar on the HyperTerminal program while the program is transmitting causes the program to stop and display the HI-3717A Control and Status Registers. There may be a noticeable delay when a button or the space bar is pressed. When pressing a button on the board press and hold it down until you see the change take effect.

BUTTON	CONSOLE CHARACTER PRESSED	TRANSMIT PATTERN
S2	1	All Zeros
S3	2	All Ones
S4	3	Zeros, Ones, Zeros, Increment (default)

Modes – 4 & 5 Receive Mode

Receive Modes 4 & 5 are nearly identical to the Receive function used for Modes 1 and 2. Mode-5 receives the data without performing a compare on the data so it can be use to receive and display any data as long as the SYNC words remain in their proper sequence (0x0247, 0x05B8, 0x0A47, 0xDB8). Mode – 4 performs a compare on the expected SYNC word, Data Word and Word Count like Mode -1 or Mode- 2.

Mode – 6 Software Synchronization Mode

Mode 6 is similar to mode 1 in that it transmits and receives data but uses Software Synchronization (SFTSYNC) Mode. SFTSYNC is enabled when the SFTSYNC bit2 is set high in the Control Register 1. SFTSYNC mode speeds up the synchronization process and is useful during testing. SFTSYNC only requires two sequential order sync marks to establish synchronization; this shortens synchronization time from 4 – 8 seconds to 2-3 seconds.

In Flight Recorder Mode, (normal mode) SYNC0 and SYNC1 output pins and corresponding SYNC1:0 bits in the Receive FIFO Status Register reflect the subframe phase when INSYNC is “1”. These pins and status register bits are valid in Flight Recorder Mode (normal mode). In Software Synchronization mode (SFTSYNC bit2 =1 in the CTRL1 register) the SYNC0 and SYNC1 and status register bits will not match the true phase corresponding to the Barker codes. Mode 6 demonstrates how software can determine the true phase by examining the SYNC (Barker Code) words.

The example program examines the Barker Codes in the received data to determine the subframe phase, then outputs the true phase on two additional spare output pins PT4 and PT5 of the Freescale MCU on the lower board.

Select mode 6 on the mode DIP switches per the table shown on page 4. Connect the transmitter to the receiver using two clip leads to provide an external loopback connection.

J6-5 To J2-6
J6-4 To J2-5

Set Opt1 DIP switch closed to select Harvard mode. For this demo, select 4096 WPS using the DIP switch settings shown on page 5.

Press the RESET button on the base board. The console output should appear as follows:

```
Holt HI-3717 Demonstration Software Revision: 1.2

Transmit and Receive Mode

Initializing the HI-3717 - SOFTWARE SYNC MODE-6

Receiver Mode: HBP
Word Rate = 4096 WPS
Console ARINC data output disabled due to speed > 2048WPS
Slew Rate 1.5uS Selected
HI-3717 Initialized Software Sync mode OK
Match Word Count Register set to = 0x0005

Sync Barker codes 0x0247 0x05B8 0x0A47 0xDB8

Press S1 to start
```

After pressing S1, the console will start to update with just the Sync (Barker) codes shown below. To also see the data, select a word rate less than 4096 but for this test it is easier to see the Sync codes alone so a 4096 WPS is recommended. The new SYNC1:SYNC0 bits can be view on an oscilloscope on J1 -3 and J1-4 header connectors on the MCU board (bottom).

Sync (Barker) Code	SYNC1/PT5/J1-3	SYNC0/PT4/J1-4
0x0247	0	0
0x05B8	0	1
0x0A47	1	0
0x0DB8	1	1

Press S1 button to pause transmission and note the SYNC 1 and SYNC0 states will match the last Sync code on the console. Notice the first Sync code is 0x0A47 and not the expected 0x0247 value. This is because SFTSYNC mode only needs two consecutive sync marks to establish sync. The first 0x0247 in Flight mode is actually the fifth sync word. To continue transmitting, press S4 or the space bar on the PC keyboard.

```
Received data in SFTSYNC mode:
0A47 0DB8 0247 05B8 0A47 0DB8 0247 05B8

Received data in Flight mode would appear as:
0247 05B8 0A47 0DB8 0247 05B8 0A47 0DB8
```

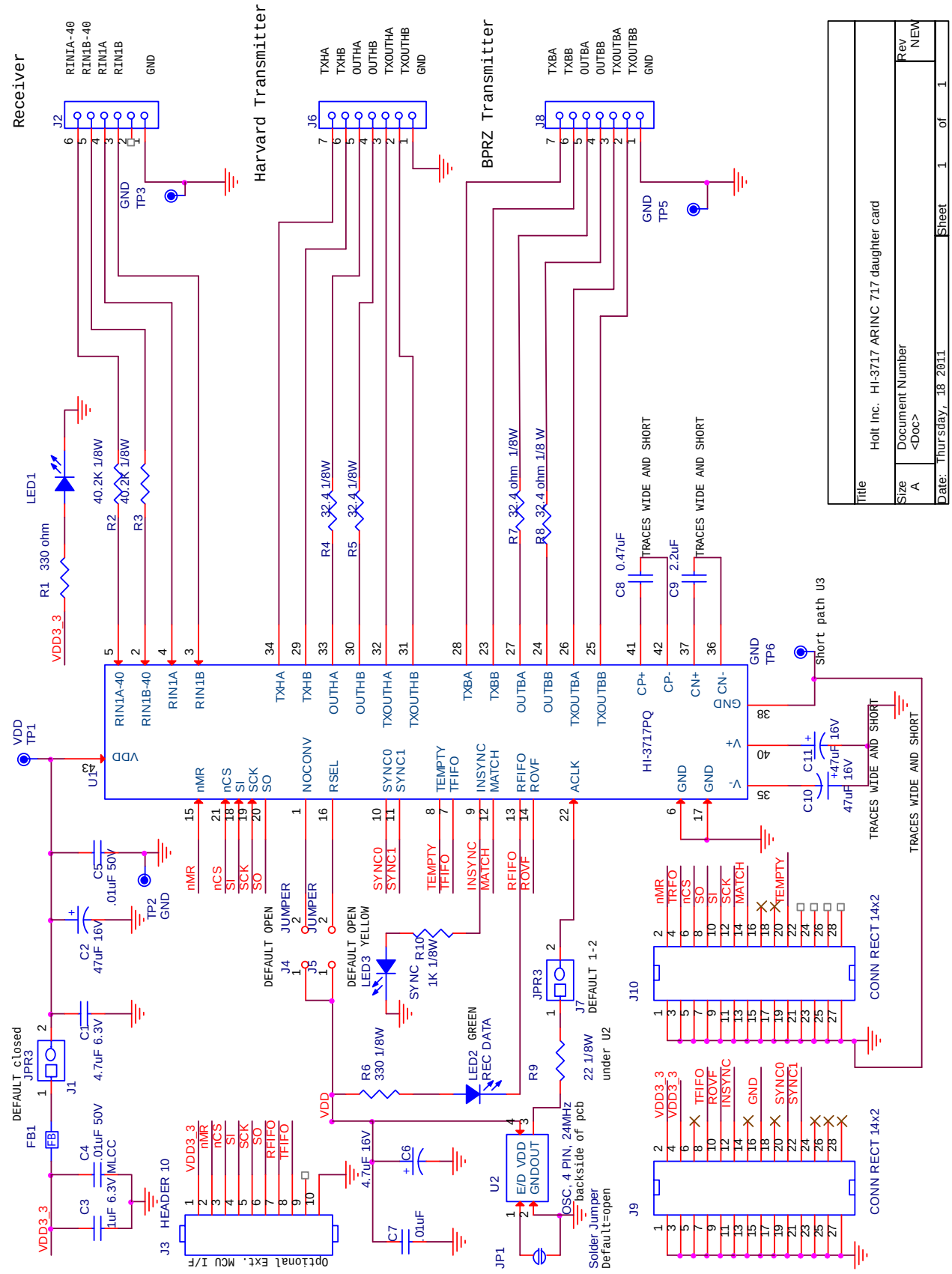
Note: All program console output references to HI-3717 apply to HI-3717A in this version.

HI- 3717A Daughter Card standalone use:

To use the Daughter Card in standalone mode without connection to the Holt General Purpose SPI main board, a 10 pin connector J3 is provided with the SPI signals needed to connect to an external MCU. Connectors J5 and J6 can provide some of the signals not preset on J10. Supply 3.3V to J3 – 1 and Ground to J3 – 10.

Summary

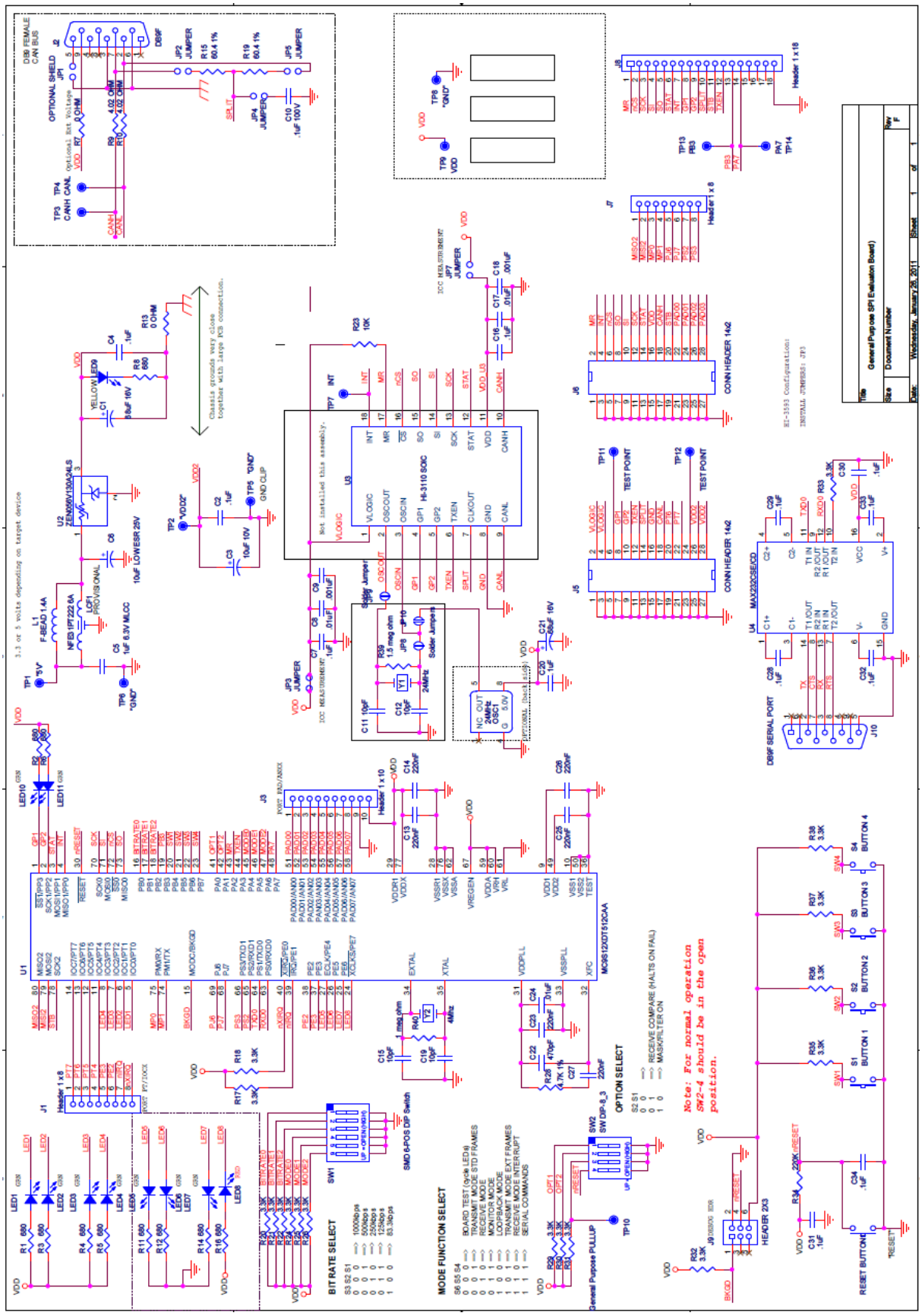
This Users Guide explains the capabilities of the HI-3717 demo software. To learn more about the demo software project and how to setup the Freescale Codewarrior IDE, refer to the AN-171 Software Application Note on the CD-ROM.


Receiver
Harvard Transmitter
BPRZ Transmitter
HI-3717PQ
Holt Inc. HI-3717 ARINC 717 daughter card
Optional Ext. MCU I/F
CONN RECT 14x2
TRACES WIDE AND SHORT
Short path U3
Solder Jumper Default=open
OSC, 4 PIN, 24MHz backside of pcb

Bill of Materials **HI-3717 Daughter Card NEW** **18-Aug-11**

Item	*Qty*	*Description*	*Reference*	*DigiKey*	*Mfr P/N*
1	1	PCB, Bare, Evaluation Board	N/A	--------	
2	1	HI-3717APQ	U1		Holt
3	1	24Mhz OSC, 4 - SMD 5x7mm	U2	CTX307LVCT-ND	CTS
4	2	Header, Female 2X14 0.1" Pitch	J9, J10	S7082-ND	Sullins
5	1	Header, Male 1x6, 0.1" Pitch	J2	S2012E-36-ND	Sullins
6	2	Header, Male 1x7, 0.1" Pitch	J6, J8	S2012E-36-ND	Sullins
7	1	Header, Male 1x10, 0.1" Pitch	J3	S2012E-36-ND	Sullins
8	4	Test Point, Black Insulator, 0.062" hole	TP3, TP4, TP5, TP6	5011K-KD	Keystone 5011
9	1	Test Point, Red Insulator, 0.062" hole	TP2	5010K-ND	Keystone 5010
10	1	Test Point, White	TP1	5012K-ND	Keystone 5012
11	1	Header, Male 1x2, 0.1" Pitch	J1, J4, J5, J7		
12	1	Ferrite Bead	FB1	490-5221-1-ND	Murata
13	2	Capacitor, Ceramic 10nF 10% 50V X7R 0805	C4, C5, C7	399-1158-1-ND	Kemet C0805C103K5RACTU
14	1	CER 1uF 6.3V MLCC 0805	C3	490-4354-1-ND	Murata LLL219R70J105MA01
15	1	CER 4.7uF 10% 6.3V Low ESR 0805	C1	587-1237-1-ND	Taiyo Yuden JWK212C6475KD-ND
16	1	4.7uF 16V TANT SMD 0805	C6	493-2939-1-ND	Nichicon F951C475MPAAQ2
17	1	Capacitor, CER 2.2uF 16V SMD 0805, **Low ESR**	C9	587-1431-1-ND	Yaiyo Yuden EMK212B7225KG-T
18	1	Capacitor, CER 0.47uF 16V SMD 0805, **Low ESR**	C8	587-1282-1-ND	Yaiyo Yuden EMK212B7474KD-T
19	1	Capacitor, Tant 47uF 16V 20% SMD 2917	C2	495-2251-6-ND	Kemet B45196H3476M409
20	2	Capacitor, Tant 47uF 16V 20% **Low ESR**, SMT 1210	C10, C11	587-1436-1-ND	Yaiyo Yuden EMK325BJ476MM-T
21	2	Resistor, 40.2K, 1/8W, 1%, SMT 0805	R2, R3	P40.2CCT-ND	Panasonic
22	2	Resistor, 32.4 ohm,1/8W, 1%, SMT 0805	R4, R5, R7, R8	P32.4CCT-ND	Panasonic
23	2	Resistor, 330 ohm, 5%, 1/8W 0805	R1, R6	P330ACT-ND	Panasonic
24	2	Resistor, 1K ohm, 5%, 1/8W 0805	R10	P1.0KACT-ND	Panasonic
25	1	LED Amber 0805	LED1	160-1177-1-ND	LiteOn LTST-C170AKT
26	1	LED Green 0805	LED2	160-1179-1-ND	LiteOn LTST-C170GKT
27	1	LED Yellow 0805	LED3	160-1175-1-ND	LiteOn LTST-C170YKT

Bill of Material	General Purpose SPI evalutation board			Revised: 2/11/2011
Item	*Qty*	*Description*	*Reference*	*DigiKey*	*Mfr P/N*
1	1	PCB, Bare, Evaluation Board	N/A	--------	
1					
2	1	RS-232 Serial Cable		AE1379-ND	AK131-2-R
3	4	Capacitor, Ceramic 10pF 5% NPO 50V 1206	C11,C12,C15,C19	311-1150-1-ND	YaegoCC1206JRNP09BN100
4	1	Capacitor, Ceramic 470pF 10% NPO 50V 1206	C22	311-1167-1-ND	Yaego CC1206KRX7R9BB471
5	6	Capacitor, Ceramic 220nF 10% 50V X7R 0805	C13,C14,C23,C25,C26, C27	399-3491-1-ND	Kemet C0805C224K5RACTU
6	2	Capacitor, Ceramic 0.001uF 20% 50V 7XR 0805	C9,C18	399-1146-1-ND	Kemet C0805C102M5RACTU
7	3	Capacitor, Ceramic 0.01uF 20% 50V 7XR 0805	C8,C17,C24	399-1160-1-ND	Kemet C0805C103M5RACTU
8	13	Capacitor, Ceramic 0.1uF 10% 100V X7R 0805	C2,C4,C7,C10,C16,C20, C28,C29,C30,C31,C32, C33,C34	399-5333-1-ND	Kemet C0805X104K1RACTU
9	1	Capacitor 10uF 10% 10V 1206	C3	399-3684-1-ND	Kemet T491A106K010AT. Alternate: 718-1121-1-ND
10	2	Capacitor 68uF ,20%, 16V Tantalum SMD Kemet	C1,C21	495-2254-1-ND	Kemet b45196h3686m409
11	2	Connector DB9F, Rt-Angle PCB Short Body	J2,J10	A35109-ND	NorComp 182-009-213R161
12	1	Resistor, 220k 5%	R34	P220KACT-ND	Panasonic ERJ-6GEYJ224V
13	2	Header, Male 1x8, 0.1" Pitch	J1,J7	S2012-18-ND **DO NOT STUFF**	Sullins
14	2	Header, Male 2X14, 0.1" Pitch	J5,J6	S1012-12-ND **DO NOT STUFF**	Sullins
15	0	Header, Male 1x18, 0.1" Pitch	J8	**DO NOT STUFF**	Sullins
16	1	Header, Male 0.1" Right Angle 2 x 3	J9	S2312E-ND	Sullins
17	9	LED Green 0805	LED1,LED2,LED3,LED4 ,LED5,LED6,LED7,LED 10,LED11	160-1179-1-ND	LiteOn LTST-C170GKT
18	1	LED Yellow 0805	LED9	160-1175-1-ND	LiteOn LTST-C170YKT
19	1	LED Red 0805	LED8	160-1176-1-ND	LiteOn LTST-C170CKT
20	1	Resistor , 1 meg 5% 0805	R40	P1.0MACT-ND	Panasonic ECG ERJ-6GEYJ105V
21	17	Resistor, 3.3K Ohm 5% 1/8W 0805	R17,R18,R20,R21,R22, R24,R25,R26,R29,R30, R31,R32,R33,R35,R36, R37,R38	311-3.3KARCT-ND	Alternate: 541-3.3KACT-ND
22	11	Resistor, 680 5% 1/8W 0805	R1,R2,R3,R4,R5,R6,R8, R11,R12,R14,R16	311-680ARCT-ND	Any
23	2	Resistor, 4.02 OHM 1% 1/8W 0805	R9,R10	541-4.02CCT-ND	CRCW08054R02FNEA OR OTHER
24	2	Resistor, 60.4 1% .5W	R15,R19	P60.4AACT-ND	Panasonic ERJ-14NF60R4U
25	2	Resistor, 0 ohm 5% 1/8W 0805	R7,R13	311-0.0ACT-ND	Any
26	1	Resistor, 1.5 meg 5%	R39	P1.5MACT-ND	Panasonic ECG ERJ-6GEYJ155V
27	1	Resistor, 4.7k 1% 1/10 W SMD	R28	RMCF1/104.7KFRCT-ND	Stackpole Electronics or other
28	1	DIP Switch 4-Pos Slide SMD	SW2	CT2194LPST-ND	CTS 219-4LPST
29	1	DIP Switch 6-Pos Slide SMD	SW1	CT2196LPST-ND	CTS 2196LPST. Alternate: CKN6121 ND
30	5	Push Button Switch	S1,S2,S3,S4,RESET BUTTON	P12948SCT-ND	Panasonic EVQ-Q2P02W
31		TVS 5.6V Diode	U2	Mouser: 650-ZEN056V130A24LS	Tyco ZEN056V130A24LS
32	2	Test Point, Red Insulator, 0.062" hole	TP1, TP9	5010K-ND	Keystone 5010
33	7	Test Point, Black Insulator, 0.062" hole	TP3,TP4,TP5,TP6,TP7, TP8,TP10	5011K-KD	Keystone 5011
34	1	IC, MC9S12XDT512CAA 80 QFP 16-Bit MCU, 512K Flash 0-70C	U1	Digikey: MC9S12XDT512CAA-ND	
35					
42	1	IC, MAX3232CSE Narrow 16-SOIC	U4	MAX232CSE+-ND	Texas Inst MAX3232CDR Maxim MAX3232CSE+-ND
43					
44					
45	1	Crystal 24.00MHz, SMD, 50ppm 20pF load cap	Y1	631-1020-1-ND	FOXSDLF/240F-20
46	1	Crystal 4.00MHz, SMD, 50ppm 20pF	Y2	XC564CT-ND	DIGIKEY
47	1	Crystal 24MHz,OSC MODULE - **OPTIONAL DO NOT INSTALL**	OSC1	DO NOT STUFF - ESCP85-AN-ND 24MHz	MFG: ECS ESCP85-AN-ND
47	4	Stand-off, #4-40 Female Thread, 1" long	-----	3482K-ND	
48	4	Machine Screw, #4-40 x 1/4"	-----	H343-ND	
49	4	Lock Washer, Int.Tooth #4-40	-----	H729-ND	
50	1	Ferrite Bead	L1	490-5221-1-ND	
51	1	1uF 6.3V MLCC	C5	490-4354-1-ND	Murata: LLL219R70J105MA01 (do not sub)
52	1	4.7uF 10% 6.3V Low ESL	C6	587-1237-1-ND	Taiyo Yuden JWK212C6475KD-ND
53	1	LC Filter 2200pF 1206	LCF1	490-2547-1-ND	Murata NFE31PT222
54	4	3M Bumpon		SJ5746-0-ND	3M: SJ61A1



REVISION HISTORY

P/N	Rev	Date	Description of Change
AN-170	NEW	08/18/11	Initial Release.
	A	9/18/13	Update jumper instructions on page 7.
	B	1/8/14	Added Mode 6, Software Sync Mode to demo software.
	C	3/12/15	Change 1024 slew rate to 3.75us and change some HI-3717 references to HI-3717A.