TWR-56F8257
User Manual

Microcontroller Solutions Group
Rev. 0.02

Contents

Overview

The MC56F8257 Tower MCU module (TWR-56F8257) is a cost-effective evaluation, demonstration and development board. The TWR-56F8257 can operate stand-alone or as the main control board in a Tower System with peripheral modules. It can also be used as the main control board with an APMOTOR56F8000E motor control board.

The following list summarizes the features of the TWR-56F8257:

- Tower-compatible microcontroller module
- Selectable power sources:
  - USB
  - Barrel connector
  - Motor control board
  - Tower elevator board
- Filtered power for VDDA and VSSA on the MC56F8257DSC
- MC56F8257 digital signal controller (DSC) in an 64 LQFP package
- Optional 8 MHz crystal circuit for the MC56F8257 DSC
- Nine LEDs controlled by the MC56F8257 DSC
- Motor control board connector for the APMOTOR56F8000E motor control board
- Auxiliary signal connector
- Four thermistors for single-ended or differential analog inputs to the MC56F8257 DSC
- CAN transceiver, header and termination
- Two push buttons for user input or interrupts to the MC56F8257 DSC
- Reset push button for the MC56F8257 DSC
- JTAG header for the MC56F8257 DSC with header to disconnect from OSBDM
- Headers to connect SCI signals to either USB bridge or elevator board
- Expansion via primary elevator connector
- MC9S08JM60 MCU with a 4 MHz crystal provides:
  - Open source debug (OSBDM) circuit
  - USB to SCI bridge
  - Header to select between OSBDM and USB to SCI bridge functions
  - Bootloader enable header
  - BDM header for the MC9S08JM60 MCU
  - Status and target power indicator LEDs
  - Control of semiconductor switch to enable power to board from USB
  - Voltage translators between 5V MC9S08JM60 MCU chip and 3.3V MC56F8257 DSC chip

1.1 Block Diagram

TWR-56F8257 Block Diagram
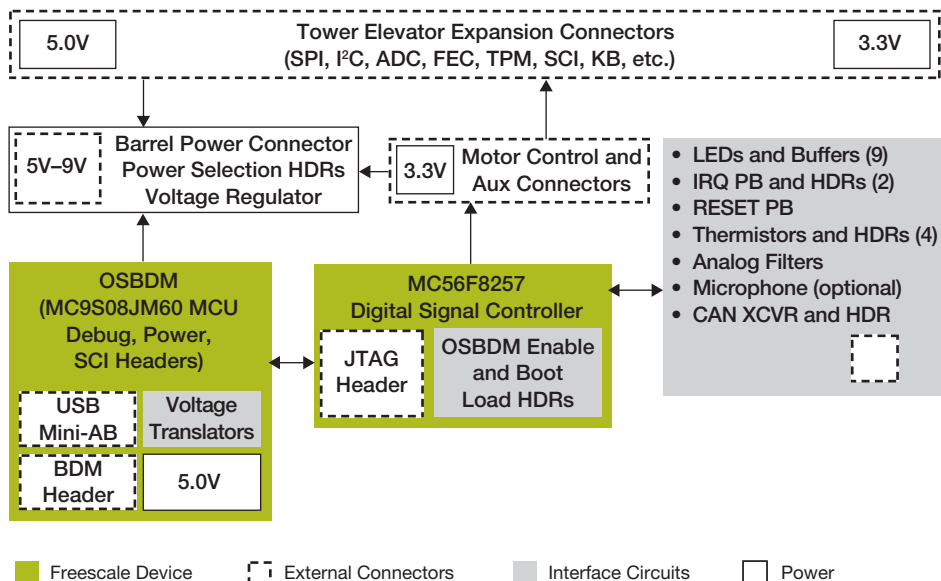
Figure 1. TWR-56F8257 Block Diagram

1.2 Reference Documents

The documents listed below should be referenced for more information on the Freescale Tower System and the TWR-56F8257. Refer to freesale.com/Tower for the latest Tower documentation.

- Freescale Tower Electromechanical Specification
- TWR-56F8257 Quick Start Guide
- TWR-56F8257 Lab Tutorials
- MC56F825X Reference Manual
- MC56F825X Data Sheet
- MC56F825X Chip Errata
- AN3561, USB Bootloader for the MC9S08JM60
- Serial Bootloader for MC56F825x User Guide
- APMOTOR56F8000e Motor Control Demonstration System User Manual

Hardware Features

This section provides details about the features and functionality of the TWR-56F8257. Figure 2 illustrates the primary features of the TWR-56F8257. (Not seen are the buffer, multiplexor, inverters, USB power switch, and the CAN transceiver ICs as well as the motor control and auxiliary connectors which are on the back of the board.) Each feature is discussed below.
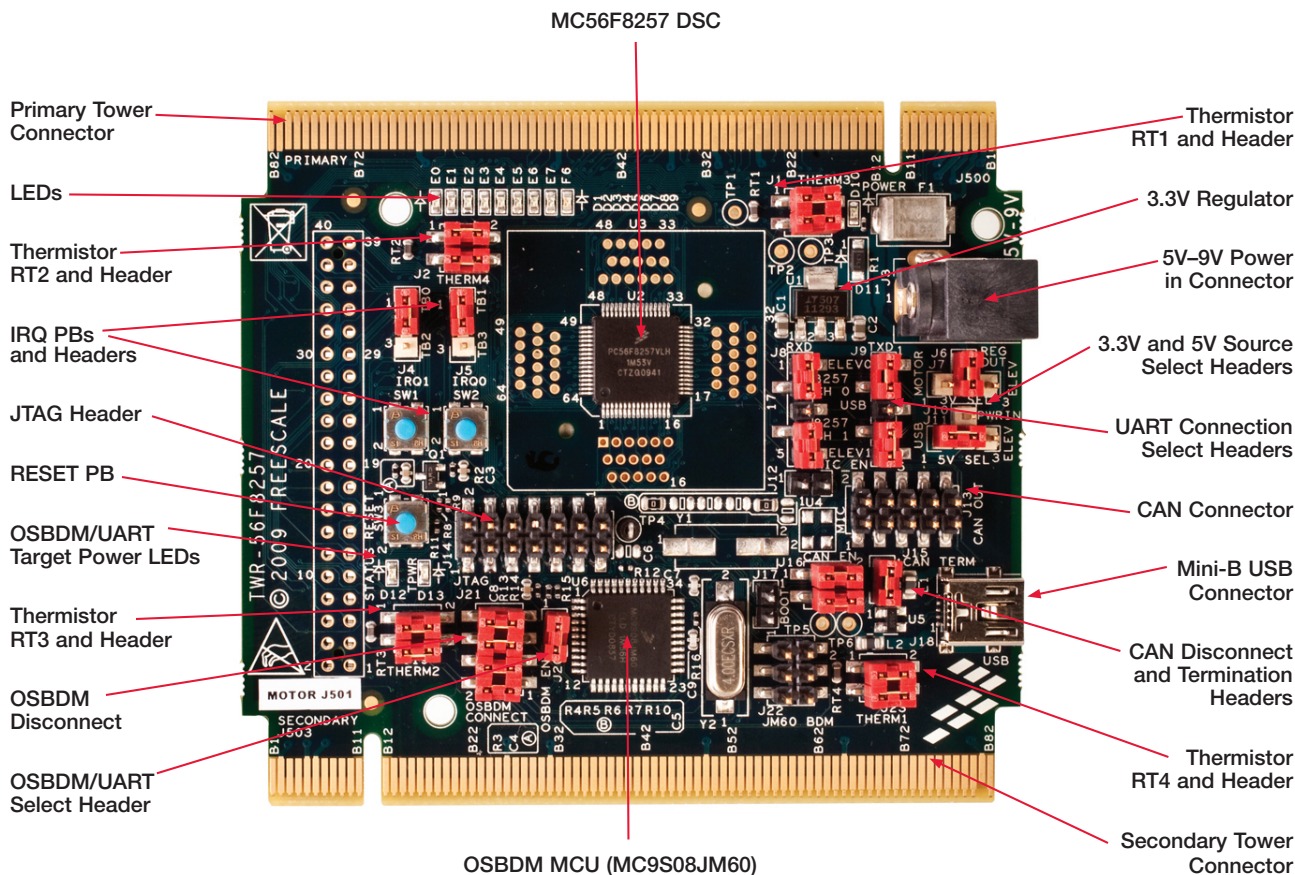
Figure 2. TWR-56F8257 Board

2.1 Tower MCU Module

The TWR-56F8257 board is an MCU module designed for use with a Freescale Tower System and complies with the electrical and mechanical specification as described in Freescale Tower Electromechanical Specification. Connection to the Tower System is enabled through two expansion card edge connectors that interface to the elevator boards in a Tower System: the primary and secondary elevator connectors. The primary elevator connector, comprised of sides A and B, is utilized by the TWR-56F8257, while the secondary elevator connector only makes connections to ground (GND). On sheet 7 of the schematic, the J500A and J500B symbols have names assigned to the card edge fingers that correspond with the normal Tower pin assignments. The pin out details for the TWR-56F8257 can be found in the TWR-56F8257 Module Pin out document.

2.2 System Power

The TWR-56F8257 board contains three power rails: P5V_USB, P3_3V and P3_3V/5V. They are sourced and used as follows:

2.2.1 P5V_USB

The P5V_USB power rail is derived from the Mini-B USB connector at J18 and the inductor at L2. It is used to power the on-board OSBDM/serial bridge circuit. This consists of the OSBDM MCU at U6, several pull-up resistors at R13, R14, R15, R527 and R528, the USB power switch at U501, and the STATUS and TPWR LEDs at D12 and D13. If there is no USB cable connected to J18 there is no power on this rail and these circuits are all powered down.

2.2.2 P3_3V

The P3_3V power rail is derived from a) the P3_3V_MOTOR power net from the motor control board connector at J501, b) the P3_3V_ELEV power net from the Tower connector at J500A, or c) the on-board 3.3V regulator at U1. The selection of the source is made with a shunt at J6 and J7. Table 6 shows the operation of the different shunt positions. The selection of power into the regulator is made with a shunt at J10 and J11 which selects from a) the P5V_TRG_USB power net out of the USB switch at U501, b) the P5V_ELEV power net from the elevator connection at J500A pins A1 and B1, or c) the PWR_IN power net from the 2 mm barrel jack at J3 through resettable fuse F1. Table 6 shows the operation of the different shunt positions. The barrel jack input is protected from reverse voltage inputs by diode D11. The input to the barrel jack may be from a 5V to 9V source and must be center positive.

The P3_3V power rail provides power to the majority of the circuits on the board including the MC56F8257 (including the analog power pins through L500 and L501), inverters at U500 and U502, a multiplexor at U505, the on-board LEDs at D1-D9, the thermistor divider circuits at RT1-RT4, and the pull-up resistors at R2, R3, R11, R565, R570 and R562.

2.2.3 P3_3V/5V

The P3_3V/5V power rail is derived from the diode OR (using D500 and D501) of a) the P5V_ELEV power net from the elevator connection (J500A pins A1 and B1), b) the P5V output of the USB power switch at U501, or c) the P3_3V power rail from J7. When there is a USB cable connected or when the Tower elevator boards are connected this power rail will be a Schottky diode drop (about 0.3V) below the 5V power nets. When there is no 5V source this power rail will be a Schottky diode drop below the P3.3V power rail. This allows the inputs of the ICs powered by this rail to stay in a high impedance state instead of loading down the inputs through the input protection diodes as would happen if there were no power supplied to the buffers.

2.2.4 Default Power Configuration

The TWR-56F8257 board default power configuration uses the OSBDM USB port for all power. As soon as the OSBDM firmware has started it negotiates with the host PC USB port for full USB power. Once approved it enables the 5V USB power switch (U501) which provides 5V to the P3_3V/5V power rail and to the 3.3V regulator (U1) through headers J10 and J11. Likewise, the on-board voltage regulator provides 3.3V to the P3_3V power rail through headers J6 and J7. The 3.3V regulator is able to provide up to 700 mA subject to the power dissipation and temperature limits of the device.

2.3 MC56F8257 DSC

The primary circuits on the board are related to the MC56F8257 DSC. This part is supplied in a surface-mounted, 64-pin LQFP package at U2. Although the board was laid out to allow a ZIF socket at U3 in parallel to the chip at U2, the TWR-56F8257 is only available with the surface mounted chip.

2.3.1 Clock Sources for the MC56F8257 DSC

Three options are provided for clocking the MC56F8257 device:
1. Oscillator internal to the MC56F8257 chip: approximately 8 MHz
2. 8 MHz crystal
3. External clock input from primary Tower connector or the AUX connector

The internal oscillator is used to clock the MC56F8257 immediately following reset. This is the default operation. In this mode the zero ohm resistors at R4 and R10 allow the GPIOC0 and GPIOC1 pins of the MC56F8257 (pins 3 and 4) to be used as inputs or outputs.

To use an external crystal with the MC56F8257, zero ohm resistors R4 and R10 must be removed and placed in the R5 and R7 positions. The desired crystal, load capacitors and parallel resistor (if needed) must be soldered to the board at Y1, C5, C6 and R6. (These components are not provided with the TWR-56F8257 kit.) Following reset, reconfigure the GPIOC0 and GPIOC1 pins to the XTAL and EXTAL functions to allow the use of an external crystal.

To use an external clock for the MC56F8257, make sure the zero ohm resistors are installed at R4 and R10 and removed from R5 and R7. Provide a clock signal on either the primary Tower connector J500A, pin B24 (the pin designated as CLOCKIN0) or on the AUX connector J502, pin 8. Following reset, configure the GPIOC0 pin to the CLKIN input function. In this mode the zero ohm resistor at R10 allows the GPIOC1 pin of the MC56F8257 (pin 10) to be used as an input or output.

2.3.2 Serial I/O Source Select Headers

The TWR-56F8257 board allows the UART functions of the MC56F8257 DSC to be connected to a serial interface at the primary Tower connector J500A or through a USB bridge to the host PC using the OSBDM MCU (U6). The selection of the RXD connections is done with the header at J8 as shown in Table 1. The selection of the TXD connections is done with the header at J9 as shown in Table 2.

Table 1. J8 – RXD Source Select Header

J8 – RXD Source Select Header		
Pin #	Connected Signal	Description
1	ELEV_RXD0 at J500A pin A41	Shunt pins 1 and 2 together to connect the DSC RXDO pin to the primary Tower connector RXD0 pin. (This is a default position.)
2	GPIOF8/RXD0/TB1 from the 56F8257 DSC – pin 6 (RXD0 function)	
3	RXD_SEL from the USB bridge function on the OSBDM MCU	Shunt pins 2 and 3 together to connect the DSC RXD0 pin to the USB serial bridge function. Shunt pins 3 and 4 together to connect the DSC RXD1 pin to the USB serial bridge function.
4	GPIOF5/RXD1/XB_OUT5 from the 56F8257 DSC – pin 42 (RXD1 function)	
5	ELEV_RXD1 at J500A pin A43	Shunt pins 4 and 5 together to connect the DSC RXD1 pin to the primary Tower connector RXD1 pin. (This is a default position.)

Table 2. J9 – TXD Source Select Header

J9 – RXD Source Select Header		
Pin #	Connected Signal	Description
1	ELEV_TXD0 at J500A pin A42	Shunt pins 1 and 2 together to connect the DSC TXDO pin to the primary Tower connector TXD0 pin. (This is a default position.)
2	GPIOC2/TXD0/TB0/XB_IN2/CLKO from the 56F8257 DSC – pin 5 (TXD0 function)	
3	TXD_SEL to the USB bridge function on the OSBDM MCU	Shunt pins 2 and 3 together to connect the DSC TXD0 pin to the USB serial bridge function. Shunt pins 3 and 4 together to connect the DSC TXD1 pin to the USB serial bridge function.
4	GPIOF4/TXD1/XB_OUT4 from the 56F8257 DSC – pin 41 (TXD1 function)	
5	ELEV_TXD1 at J500A pin A44	Shunt pins 4 and 5 together to connect the DSC TXD1 pin to the primary Tower Connector TXD1 pin. (This is a default position.)

As noted in Tables 1 and 2, the 56F8257 DSC serial signals may be connected to either the Tower serial signals or to the USB bridge chip however, only one channel may be connected to the USB bridge chip. If the associated 56F8257 DSC serial pins are not being used for the serial functions the shunts should be removed for those pins. For more information on the USB serial bridge function see section 2.4.2 USB serial bridge interface.

2.3.3 LEDs Controlled by the MC56F8257 DSC

There are nine LEDs with buffers connected to the MC56F8257 DSC. Inverting buffers (U500A-F and U502D-F) isolate the LEDs from the DSC pins by providing high impedance inputs. The LEDs are powered by the P3_3V rail and draw about 5 mA each. Table 3 shows the DSC pin names associated with each LED.

Table 3. LEDs Controlled by the MC56F8257 DSC

LEDs Controlled by the MC56F8257 DSC				
MC56F8257 DSC Pin Name	MC56F8257 Pin Number	LED Reference	LED Label	LED Color
GPIOE0/PWM0B	45	D1	E0	Green
GPIOE1/PWM0A	46	D2	E1	Yellow
GPIOE2/PWM1B	47	D3	E2	Green
GPIOE3/PWM1A	48	D4	E3	Yellow
GPIOE4/PWM2B/XB_IN2	51	D5	E4	Green
GPIOE5/PWM2A/XB_IN3	52	D6	E5	Yellow
GPIOE6/PWM3B/XB_IN4	53	D7	E6	Green
GPIOE7/PWM3A/XB_IN5	54	D8	E7	Yellow
GPIOF6/TB2/PWM3X	58	D9	F6	Amber

2.3.4 Motor Control Connector

The TWR-56F8257 board may be connected to a motor control board such as the APMOTOR56F8000E. The motor control connector (J501) is on the bottom of the board to provide a convenient connection to the motor control board. For convenience, the pins of the motor control connector may be probed from the top of the board.

Many of the MC56F8257 DSC pins are connected to the motor control connector. Those pins associated with analog inputs have 100 ohm resistors in series to provide some ESD protection for the analog inputs of the DSC. Those pins providing analog signals from the motor control board have 2200 pf caps with the resistors to provide a low pass filter. The connector pin out is shown in Table 4.

Table 4. Motor Control Connector Pin Out 2.2.5 Auxiliary Connector

Motor Control Connector J501 Pin Out			
Pin #	MC56F8257 DSC Signal	Pin #	MC56F8257 DSC Signal
1	P3_3V_MOTOR	2	GPIOB7/ANB7&CMPB_M2 (With 100 ohms in series)
3	GND	4	GPIOD4/RESET_B (With 0 ohms in series. Remove to isolate)
5	GPIOF4/TXD1/XB_OUT4	6	GPIOA3/ANA3&CMPA_M2 (With 100 ohms in series)
7	GPIOF3/SDA1/XB_OUT3	8	GND
9	GPIOE1/PWM0A	10	GPIOA0/ANA0&VREFHA&CMPA_P2/CMPC_O (With 100 ohm, 2200 pf low pass filter)
11	GPIOE0/PWM0B	12	GPIOA1/ANA1&VREFLA&CMPA_M0 (With 100 ohm, 2200 pf low pass filter)
13	GPIOC3/GC3 TA0/CMPA_O/RXD0	14	GPIOA2/ANA2&CMPA_M1 (With 100 ohm, 2200 pf low pass filter)
15	GPIOC13/TA3/XB_IN6	16	GND
17	GPIOC4/TA1/CMPB_O	18	GPIOB0/ANB0&VERFHB&CMPB_P2 (With 100 ohm, 2200 pf low pass filter)
19	GPIOC6/TA2/XB_IN3/CMP_REF	20	GPIOB1/ANB1&VERFLB&CMPB_M0 (With 100 ohm, 2200 pf low pass filter)
21	GPIOC15/SCL0/XB_OUT1	22	GPIOB2/ANB2&CMPC_P2 (With 100 ohm, 2200 pf low pass filter)
23	GPIOC14/SDA0/XB_OUT0	24	GND
25	GPIOD0/TDI	26	GPIOE7/PWM3A/XB_IN5
27	GPIOD1/TDO	28	GPIOE6/PWM3B/XB_IN4
29	GPIOD2/TCK	30	GPIOE3/PWM1A
31	GPIOD3/TMS	32	GPIOE2/PWM1B
33	GPIOB3/ANB3&CMPC_M0 (With 100 ohms in series)	34	GPIOE5/PWM2A/XB_IN3
35	GPIOB4/ANB4&CMPC_M1 (With 100 ohms in series)	36	GPIOE4/PWM2B/XB_IN2
37	GPIOB5/ANB5&CMPC_M2 (With 100 ohms in series)	38	GPIOA4/ANA4 (With 100 ohms in series)
39	GPIOB6/ANB6&CMPB_M1 (With 100 ohms in series)	40	GPIOA5/ANA5 (With 100 ohms in series)

2.3.5 Auxiliary Connector

In addition to the motor control connector, the TWR-56F8257 board also provides an auxiliary connector (J502) on the bottom of the board. This connector provides access to the MC56F8257 DSC signals that are not covered by the motor control connector. Those pins associated with analog inputs have 100 ohm resistors in series to provide some ESD protection for the analog inputs of the DSC. The connector pin out is shown in Table 5.

Table 5. Auxiliary Connector J502 Pin Out

Auxilliary Connector J502 Pin Out			
Pin #	MC56F8257 DSC Signal	Pin #	MC56F8257 DSC Signal
1	GPIOF0/XB_IN6	2	GPIOA6/ANA6 (With 100 ohms in series)
3	GPIOF1/CLKO/XB_IN7	4	GPIOA7/ANA7 (With 100 ohms in series)
5	GPIOF2/SCL1/XB_OUT2	6	GND
7	GPIOF5/RXD1/XB_OUT5	8	GPIOC0/XTAL&CLKIN
9	GPIOF6/TB2/PWM3X	10	GPIOC1/EXTAL
11	GPIOF7/TB3	12	GPIOC2/TXD0/TB0/XB_IN2/CLKO
13	GPIOF8/RXD0/TB1	14	GPIOC5/DACO/XB_IN7
15	GPIOC11/CANTX/SCL1/TXD1	16	GPIOC7/SS_B/TXD0
17	GPIOC12/CANRX/SDA1/RXD1	18	GPIOC8/MISO/RXD0
19	GND	20	GPIOC9/SCK/XB_IN4
21	No Connection	22	GPIOC10/MOSI/XB_IN5/MISO
23	No Connection	24	No Connection
25	No Connection	26	No Connection

2.3.6 Tower Elevator Connectors

The TWR-56F8257 board features two expansion card edge connectors that interface to elevator boards in a Tower System: the primary and secondary elevator connectors. The primary elevator connector, comprised of sides A and B, is utilized by the TWR-56F8257 board, while the secondary elevator connector only makes connections to ground (GND). Table 7 in Appendix A: Tower Elevator Connector Pin Functions, lists the pin functions for the primary elevator connector.

2.3.7 Thermistors as Analog Inputs

The TWR-56F8257 board provides four thermistors (RT1-4) near the corners of the board that can be used as single ended or differential analog inputs to the MC56F8257 DSC as can be seen on sheet 6 of the schematic. In addition to each thermistor there is a resistor between the thermistor and P3_3V and another resistor between the thermistor and ground. The thermistors are all 10K ohm parts but the associated divider chain uses different resistors. This may increase or decrease the voltage across the thermistor and provides the ability to try the different gain settings on the analog channels. All four thermistor circuits are designed to provide useable differential inputs over the temperature range of -20°C to +90°C. RT2 and RT4 both give a differential voltage of ~1.65V at 25°C. RT1 gives a differential voltage of 0.10V and RT3 gives a differential voltage of 0.28V at 25°C.

In addition to the thermistor voltage divider chain, each thermistor has a 0.1 uF capacitor in parallel. Each thermistor circuit also has a header that allows the thermistor to be disconnected from the analog inputs to the DSC. If a user wishes to apply an external analog value, these headers may be removed and the external analog signal attached to the DSC side of the headers. Finally, each analog input to the DSC has a 100 ohm series resistor and a 2200 pF capacitor as a low pass filter. This helps protect the DSC from electrostatic discharges and lowers the impedance of the analog signal so that it can be sampled with less noise.

2.3.8 CAN Transceiver

The TWR-56F8257 board has a CAN transceiver circuit that may be connected to the CAN pins of the DSC. The CAN transceiver (U503) can be connected to the GPIOC11/CANTX/SCL1/TXD and GPIOC12/CANRX/SDA1/RXD1 pins of the DSC through the header at J16. Installing a shunt from pin 1 to pin 2 connects the TXD nets and installing a shunt from pin 3 to pin 4 connects the RXD nets. Note that the GPIOC11/CANTX/SCL1/TXD and GPIOC12/CANRX/SDA1/RXD1 nets also go to the primary elevator edge connector (J500A) pins B41 and B42 and to the auxiliary connector (J502) pins 15 and 17. When using these nets for CAN communications care must be taken that these nets are not driven from these other connectors.

The transceiver is capable of running from 3.3V and is powered by the P3_3V/5V power rail. The transceiver output is connected to header J13 with CANH connected to pin 4 and CANL connected to pin 3. A 120 ohm parallel termination resistor may be connected between these nets by installing a shunt on header J15.

2.3.9 IRQ or Input Pushbuttons

The TWR-56F8257 board has two push buttons (SW1 and SW2) that can be used to provide inputs or interrupts to the DSC. Each has a 10K ohm pull up resistor to P3_3V and a 0.1 uF capacitor to ground to minimize bounce on the output.

Push button SW1 is connected to header J4 where the switch output can be connected to either DSC pin GPIOC2/TXD0/TB0/XB_IN2/CLKO (default) or GPIOF6/TB2/PWM3X depending on the position of the shunt on the header (pin 1 to pin 2 is the default). Similarly, push button SW2 is connected to header J5 where the switch output can be connected to either DSC pin GPIOF8/RXD0/TB1 (default) or GPIOF7/TB3 depending on the position of the shunt on the header (pin 1 to pin 2 is the default).

If the push button switches are not being used as an interrupt or other it is best to remove the shunt to the DSC so that the 0.1 uF capacitor is not loading down the DSC pins.

2.3.10 RESET

The GPIOD4/RESET_B pin of the DSC is connected to the motor control connector and the Tower connector but also to a push button (SW3) and through buffers to the OSBDM chip. It is pulled to P3_3V by a 10K ohm resistor. It may be pulled low by the push button or by Q1 in response to a high output from the OSBDM chip (pin 1) on the TRESET_OUT net. The state of the GPIOD4/RESET_B signal is provided to the OSBDM chip through a voltage translator (U504B). This buffer is powered by the P3_3V/5V power rail so that its input will remain high impedance when there is no USB cable connected. The buffered RESET signal is provided to pin 33 of the OSBDM chip and is used by the OSBDM program in that chip.

2.3.11 JTAG Header and OSBDM Disconnect Header

The TWR-56F8257 board includes an OSBDM circuit as a debug interface to the MC56F8257 DSC for normal purposes. If the user desires to use a different debugger header J14 provides a connection point for an external JTAG based debugger. If an external debugger is connected to the JTAG header the shunts at J21 (pins 1 to 2, 3 to 4, 5 to 6 and 7 to 8) which connect the OSBDM circuit to the JTAG signals should be removed.

The TWR-56F8257 board provides a 2.2K ohm pull up resistor to 3.3V on the TMS line. If an external JTAG debugger also has a pull up on this line the external debugger may not be able to pull the TMS line low. If this occurs, remove one of the pull up resistors on the TMS line.

2.4 OSBDM

2.4.1 Debug Interface

An on-board MC9S08JM60 based OSBDM circuit provides a debug interface to the MC56F8257. A standard USB A male to Mini-B male cable (supplied) can be used for debugging via the USB connector, J18.

2.4.2 USB Serial Bridge Interface

The on-board MC9S08JM60 can also be used as a USB to serial bridge interface for the UART signals from the MC56F8257 DSC. This bridge circuit is described in detail in section 2.3.2 Serial I/O Source Select Headers.

The RXD_SEL signal goes to the MC56F8257 DSC. The USB bridge chip is powered by 5V so its output is a 5V output. The multiplexor (U505) is able to accept the 5V signal from the USB bridge chip (T_TXD1) and converts it to the 3.3V signal (RXD_SEL) for the DSC. The multiplexor output is enabled by an inverted RTS signal (TXD_RXD_EN_B) from the USB bridge chip. If there is no USB connection to the Tower board the RTS signal is not driven and the 3.3V powered inverter (U502C) input is biased low disabling the output of the multiplexor.

Similarly, TXD_SEL is a 3.3V signal from the MC56F8257 DSC. The USB bridge chip is expecting a 5V input on T_RXD1. The buffer between these two signals (U504C) is powered by P3_3V/5V. It will accept the 3.3V input from the DSC and convert it to the 5V signal needed by the USB bridge chip. The buffer output is enabled by the same inverted RTS signal (TXD_RXD_EN_B) discussed above. If there is no USB connection to the TWR board the RTS signal is not driven and the 5V powered buffer disabled so nothing is driving the powered down USB bridge chip.

The USB serial bridge interface is enabled by removing the shunt on J20 before applying power to the board. The serial interface signals from the MC56F8257 DSC are routed to the MC9S08JM60 serial interface. In the USB serial bridge mode the MC9S08JM60 will convert the serial interface data into USB packets and send them to the host PC.

2.4.3 Clocking the OSBDM MCU (MC9S08JM60)

The MC9S08JM60 MCU uses an on-board 4 MHz external crystal circuit (Y2, R16, C7, and C9) for its clock. There are no user options for clocking the MC9S08JM60.

2.4.4 OSBDM/UART Function Select Header

Header J20 selects whether the on-board MC9S08JM60 MCU operates as an OSBDM debug interface or as a USB serial bridge interface. Leaving the shunt on the header enables the OSBDM debug interface. Removing the shunt on header J20 enables the USB serial bridge interface.

2.4.5 Bootloader Enable

In addition to the OSBDM debug interface and the USB serial bridge interface the MC9S08JM60 device used in the OSBDM circuit is pre-programmed with a USB bootloader. The USB bootloader will run following a power-on reset if a shunt is installed on header J17. This allows in-circuit reprogramming of the JM60 flash memory via USB. This enables the OSBDM firmware to be upgraded by the user when upgrades become available. In normal OSBDM or USB serial bridge operation this shunt must be left off. For details on the USB bootloader, refer to application note AN3561at freescale.com.

The USB bootloader communicates with a GUI application running on a host PC. The GUI application can be found at freescale.com: search keyword "JM60 GUI." Refer to section 2.5 and 3.3 of AN3561 for details on installing and running the application.

Note: The JM60 GUI installer should be run before connecting the OSBDM in Bootloader Mode to a host USB port. Otherwise, the JM60 USB device will not be recognized and the proper drivers will not be loaded.

2.4.6 BDM Header

The BDM header at J22 is used for initial programming of the MC9S08JM60 MCU or if re-programming with the bootloader fails. An external 9S08 BDM debugger would be connected to J22 and used to program the MCU. This is not expected to be a normal user interface.

2.4.7 OSBDM Status LEDs

The MC9S08JM60 OSBDM MCU controls two status LEDs at D12 and D13. Refer to the OSBDM instructions for the meaning of the LEDs.

2.4.8 OSBDM Voltage Translation

Since the OSBDM MCU runs from 5V and the 56F8257 DSC runs from 3.3V there must be voltage translation between the two circuits. This is done through U505, U504A and U502B. U505 has 5V tolerant inputs and provides 3.3V signals (TCK, TDI, and TMS) to the DSC's JTAG pins through the shunts on header J21. U504A is powered by the P3_3V/5V rail and translates the 3.3V TDO signal from the DSC to a 5V signal for the OSBDM MCU. The outputs of both of these translators are high impedance if the signal OUT_EN_B goes high. This happens if the OSBDM circuit looses power (no power to the USB connector). In that case, the OUT_EN signal from the OSBDM MCU (pin 15) is biased low by R12. The inverter at U502B then drives OUT_EN_B high in response. Additional information is included in section 2.4.2.

Jumper Table

There are several headers provided for isolation, configuration and feature selection. Refer to Table 6 for details. The default shunt positions are shown in bold.

Table 6. TWR-56F8257 Jumper Table

Jumper	Function	Shunts	Description
J1	Thermistor RT1 Connect	**1-2, 3-4**	Connect RT1 circuit to the MC56F827 DSC
		none	Disconnect RT1 circuit from the MC56F8257 DSC
J2	Thermistor RT2 Connect	**1-2, 3-4**	Connect RT2 circuit to the MC56F827 DSC
		none	Disconnect RT2 circuit from the MC56F8257 DSC
J4	IRQ1 Select	**1-2**	Connect SW1 to MC56F8257 DSC pin GPIOC2/TXD0/TB0/XB_IN2/CLKO
		3-4	Connect SW1 to MC56F8257 DSC pin GPIOF6/TB2/PWM3X
		none	Disconnect SW1 from the MC56F8257 DSC
J5	IRQ0 Select	**1-2**	Connect SW2 to MC56F8257 DSC pin GPIOF8/RXD0/TB1
		3-4	Connect SW2 to MC56F8257 DSC pin GPIOF7/TB3
		none	Disconnect SW2 from the MC56F8257 DSC
J6 and J7	3.3V Source Select	**J6-1 to J7-2**	Connect the on-board voltage regulator to the P3_3V power rail
		J7-1 to J7-2	Connect P3_3V_MOTOR to the P3_3V power rail (Power the 3.3V rail from the motor control connector)
		J7-2 to J7-3	Connect P3_3V_ELEV to the P3_3V power rail (Power the 3.3V rail from the tower connector)
		J7-2 open	Disconnect the P3_3V power rail: no power
J8	RXD Source Select (Only one connection can be made to pin 3 at a time)	**1-2**	Connect ELEV_RXD0 from the Tower connector to MC56F8257 DSC pin GPIOF8/RXD0/TB1
		2-3	Connect RXD_SEL from the USB serial bridge to MC56F8257 DSC pin GPIOF8/RXD0/TB1
		Pin 2 open	Disconnect MC56F8257 DSC pin GPIOF8/RXD0/TB1
		3-4	Connect RXD_SEL from the USB serial bridge to MC56F8257 DSC pin GPIOF5/RXD1/XB_OUT5
		4-5	Connect ELEV_RXD1 from the Tower connector to MC56F8257 DSC pin GPIOF5/RXD1/XB_OUT5
		Pin 4 open	Disconnect MC56F8257 DSC pin GPIOF5/RXD1/XB_OUT5
J9	TXD Source Select (Only one connection can be made to pin 3 at a time)	**1-2**	Connect ELEV_TXD0 from the Tower connector to MC56F8257 DSC pin GPIOC2/TXD0/TB0/XB_IN2/CLKO
		2-3	Connect TXD_SEL from the USB serial bridge to MC56F8257 DSC pin GPIOC2/TXD0/TB0/XB_IN2/CLKO
		Pin 2 open	Disconnect MC56F8257 DSC pin GPIOC2/TXD0/TB0/XB_IN2/CLKO
		3-4	Connect TXD_SEL from the USB serial bridge to MC56F8257 DSC pin GPIOF4/TXD1/XB_OUT4
		4-5	Connect ELEV_TXD1 from the Tower connector to MC56F8257 DSC pin GPIOF4/TXD1/XB_OUT4
		Pin 4 open	Disconnect MC56F8257 DSC pin GPIOF4/TXD1/XB_OUT4
J10 and J11	5V Source Select	**J10-1 to J11-2**	Connect the power in barrel connector (Through fuse F1) to the input of the 3.3V voltage regulator
		J11-1 to J11-2	Connect P5V_TRG_USB (The switched USB 5V) to the input of the 3.3V voltage regulator
		J11-2 to J11-3	Connect P5V_ELEV to the input of the 3.3V voltage regulator
		J11-2 open	Disconnect the input of the 3.3V voltage regulator
J12	Unused	open	Unused
J15	CAN Termination Enable	1-2	Connect the 120 ohm CAN termination resistor
		open	No CAN termination
J16	CAN Enable	1-2, 3-4	Connect the CAN transceiver TXD and RXD to MC56F8257 DSC pins GPIOC11/CANTX/SCL1/TXD1 and GPIOC12/CANRX/SDA1/RXD1
		open	Disconnect the CAN transceiver
J17	MC9S08JM60 Bootload Enable	1-2	Enable USB bootloading of the MCU flash memory
		open	Disable bootloading
J19	Thermistor RT3 Connect	**1-2, 3-4**	Connect RT3 circuit to the MC56F827 DSC
		none	Disconnect RT3 circuit from the MC56F8257 DSC
J20	OSBDM Enable	**1-2**	Enable OSBDM function
		none	Enable USB serial bridge function
J21	OSBDM Connect to JTAG	**1-2, 3-4, 5-6, 7-8**	Connect the OSBDM debug signals (JTAG) to the MC56F8257 DSC JTAG pins
		none	Disconnect OSBDM from the MC56F8257 DSC
J23	Thermistor RT4 Connect	**1-2, 3-4**	Connect RT4 circuit to the MC56F827 DSC
		none	Disconnect RT4 circuit from the MC56F8257 DSC

Appendix A: Tower Elevator Connector Pin Functions

Table 7 provides the pin out for the primary elevator connector. An "X" in the "Used" column indicated that there is a connection from the TWR-56F8257 board to that pin on the elevator connector. An "X" in the "Jmp" column indicates that a jumper is available that can isolate the on-board circuitry from the elevator connector. An "X" in the "Jmp" column indicates that a jumper is available that can isolate part of the on-board circuitry from the elevator connector.

The function listed in the "Usage" column is the function(s) that the pin is expected to be programmed to provide when used with the Tower system. All of the MC56F8257 pins (except power) have multiple functions. Not all of the possible functions are shown.

Note that all analog pins (ANAn or ANBn) have a low pass filter to ground consisting of a 100 ohm resistor and a 2200 pf capacitor. This is to protect the analog inputs of the DSC from a static discharge at one of the connectors. See schematic sheets 6 and 7 in Appendix B: TWR-56F8257 Board Schematic.

*Table 7. TWR-56F8257 Primary Elevator Connector Pin Out*

TWR-56F8257 Primary Connector										
Pin	Name	Usage	Used	Jmp	Pin	Name	Usage	Used	Jmp
B1	5V	5V Power	X	X	A1	5V	5V Power	X	X
B2	GND	Ground	X		A2	GND	Ground	X	
B3	3.3V	3.3V Power	X	X	A3	3.3V	3.3V Power	X	X
B4	ELE_PS_SENSE	3.3V Power	X	X	A4	3.3V	3.3V Power	X	X
B5	GND	Ground	X		A5	GND	Ground	X	
B6	GND	Ground	X		A6	GND	Ground	X	
B7	SDHC_CLK / SPI1_CLK	SCK (See also pin B48)	X		A7	SCL0	SCL0	X	
B8	SDHC_D3 / SPI1_CS1_b				A8	SDA0	SDA0	X	
B9	SDHC_D3 / SPI1_CS0_b	SS_B (See also pin B46)	X		A9	GPIO9 / CTS1	GPIOA4/ANA4	X	X
B10	SDHC_CMD / SPI1_MOSI	MOSI (See also pin B45)	X		A10	GPIO8 / SDHC_D2	GPIOA5/ANA5	X	X
B11	SDHC_D0 / SPI1_MISO	MISO (See also pin B44)	X		A11	GPIO7 / SD_WP_DET	GPIOA6/ANA6	X	X
B12	ETH_COL				A12	ETH_CRS			
B13	ETH_RXER				A13	ETH_MDC			
B14	ETH_TXCLK				A14	ETH_MDIO			
B15	ETH_TXEN				A15	ETH_RXCLK			
B16	ETH_TXER				A16	ETH_RXDV			
B17	ETH_TXD3				A17	ETH_RXD3			
B18	ETH_TXD2				A18	ETH_RXD2			
B19	ETH_TXD1				A19	ETH_RXD1			
B20	ETH_TXD0				A20	ETH_RXD0			
B21	GPIO1 / RTS1	GPIOB4/ANB4&CMPC_M1	X	X	A21	SSI_MCLK			
B22	GPIO2 / SDHC_D1	GPIOB5/ANB5&CMPC_M2	X	X	A22	SSI_BCLK			
B23	GPIO3	GPIOB6/ANB6&CMPB_M1	X	X	A23	SSI_FS			
B24	CLKIN0	XTAL&CLKIN	X	X	A24	SSI_RXD			
B25	CLKOUT1				A25	SSI_TXD			
B26	GND	Ground	X		A26	GND	Ground	X	
B27	AN7	ANB3&CMPC_M0	X		A27	AN3	ANA3&CMPA_M2	X	X
B28	AN6	ANB2&CMPC_P2	X		A28	AN2	ANA2&CMPA_M1	X	
B29	AN5	ANB1&VERFLB&CMPB_M0	X		A29	AN1	ANA1&VREFLA&CMPA_M0	X	
B30	AN4	ANB0&VERFHB&CMPB_P2	X		A30	AN0	ANA0&VREFHA&CMPA_P2/CMPC_O	X	
B31	GND	Ground	X		A31	GND	Ground	X	
B32	DAC1				A32	DAC0	DAC0	X	
B33	TMR3	TA3	X		A33	TMR1	TA1	X	

Pin	Name	Usage	Used	Jmp	Pin	Name	Usage	Used	Jmp
B34	TMR2	TA2	X		A34	TMR0	TA0	X	
B35	GPIO4	GPIOB7/ANB7&CMPB_M2	X	X	A35	GPIO6	GPIOA7/ANA7	X	X
B36	3.3V	3.3V Power	X	X	A36	3.3V	3.3V Power	X	X
B37	PWM7	PWM3B	X		A37	PWM3	PWM1B	X	
B38	PWM6	PWM3A	X		A38	PWM2	PWM1A	X	
B39	PWM5	PWM2B	X		A39	PWM1	PWM0B	X	
B40	PWM4	PWM2A	X		A40	PWM0	PWM0A	X	
B41	CANRX0	CANRX	X	X	A41	RXD0	ELEV_RXD0 (See also pin B61)	X	X
B42	CANTX0	CANTX	X	X	A42	TXD0	ELEV_TXD0 (See also pin B62)	X	X
B43	1WIRE				A43	RXD1	ELEV_RXD1	X	X
B44	SPI0_MISO/IO1	MISO (See also pin B11)	X		A44	TXD1	ELEV_TXD1	X	X
B45	SPI0_MOSI/IO0	MOSI (See also pin B10)	X		A45	VSSA	VSSA		
B46	SPI0_CS0_b	SS_B (See also pin B9)	X		A46	VDDA	VDDA		
B47	SPI0_CS1_b				A47	VREFA1	Test Point 7 (TP7)		
B48	SPI0_CLK	SCK (See also pin B7)	X		A48	VREFA2	Test Point 8 (TP8)		
B49	GND	Ground	X		A49	GND	Ground	X	
B50	SCL1	SCL1	X		A50	GPIO14			
B51	SDA1	SDA1	X		A51	GPIO15			
B52	GPIO5/SPIO_HOLD/IO3	GPIOF0	X		A52	GPIO16			
B53	USB0_DP_PDOWN				A53	GPIO17			
B54	USB0_DM_PDOWN				A54	USB0_DM			
B55	IRQ_H				A55	USB0_DP			
B56	IRQ_G				A56	USB0_ID			
B57	IRQ_F				A57	USB0_VBUS			
B58	IRQ_E				A58	TMR7	TB3	X	X
B59	IRQ_D				A59	TMR6	TB2	X	X
B60	IRQ_C				A60	TMR5			
B61	IRQ_B	TB1 (See also pin A41)	X	X	A61	TMR4			
B62	IRQ_A	TB0 (See also pin A42)	X	X	A62	RSTIN_b	RESET_B	X	
B63	EBI_ALE / EBI_CS1_b				A63	RSTOUT_b	RESET_B	X	
B64	EBI_CS0_b				A64	CLKOUT0	CLKO	X	
B65	GND	Ground	X		A65	GND	Ground	X	
B66	EBI_AD15				A66	EBI_AD14			
B67	EBI_AD16				A67	EBI_AD13			
B68	EBI_AD17				A68	EBI_AD12			
B69	EBI_AD18				A69	EBI_AD11			
B70	EBI_AD19				A70	EBI_AD10			
B71	EBI_R/W_b				A71	EBI_AD9			
B72	EBI_OE_b				A72	EBI_AD8			
B73	EBI_D7				A73	EBI_AD7			
B74	EBI_D6				A74	EBI_AD6			
B75	EBI_D5				A75	EBI_AD5			
B76	EBI_D4				A76	EBI_AD4			
B77	EBI_D3				A77	EBI_AD3			
B78	EBI_D2				A78	EBI_AD2			
B79	EBI_D1				A79	EBI_AD1			
B80	EBI_D0				A80	EBI_AD0			
B81	GND	Ground	X		A81	GND	Ground	X	
B82	3.3V	3.3V Power	X	X	A82	3.3V	3.3V Power	X	X
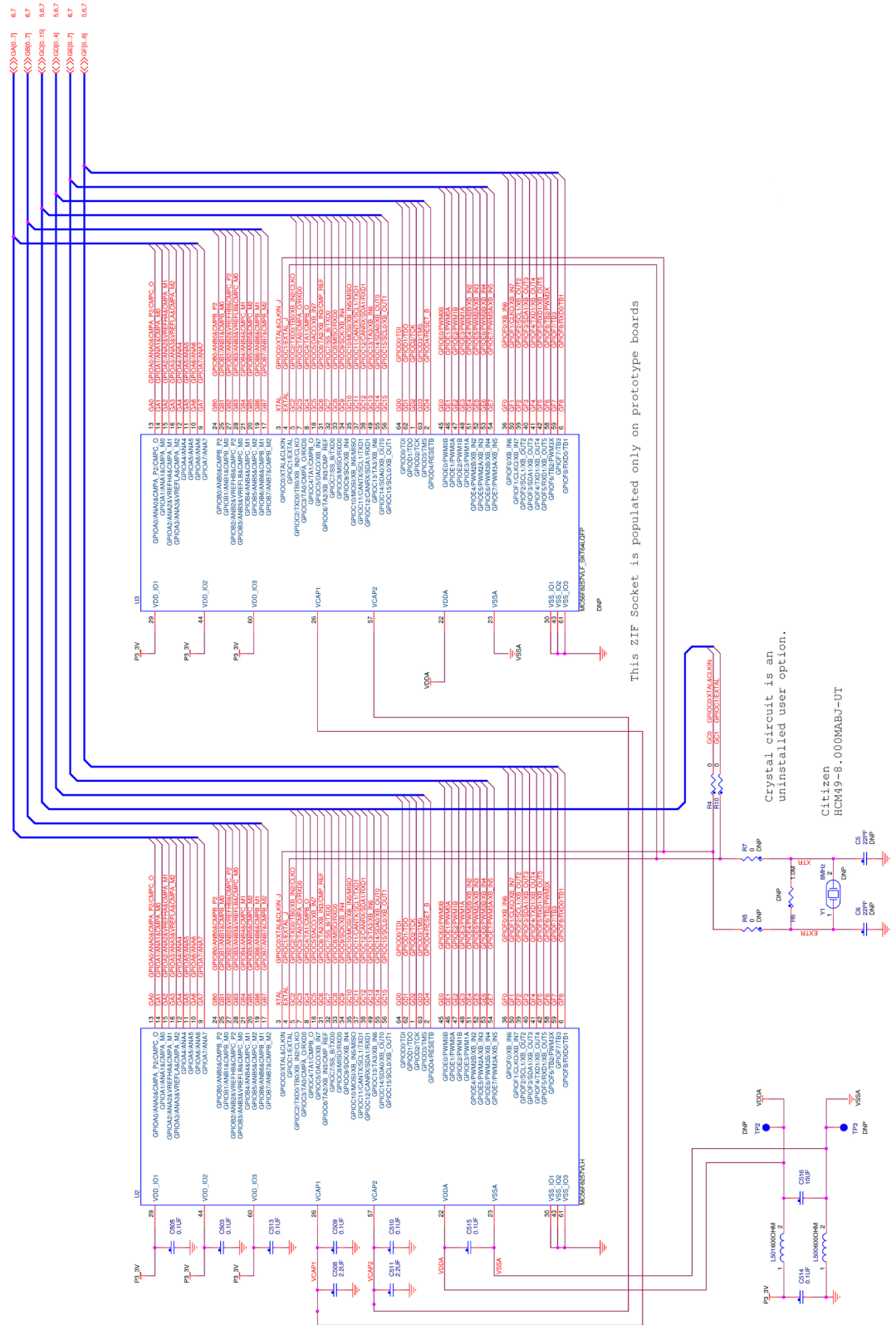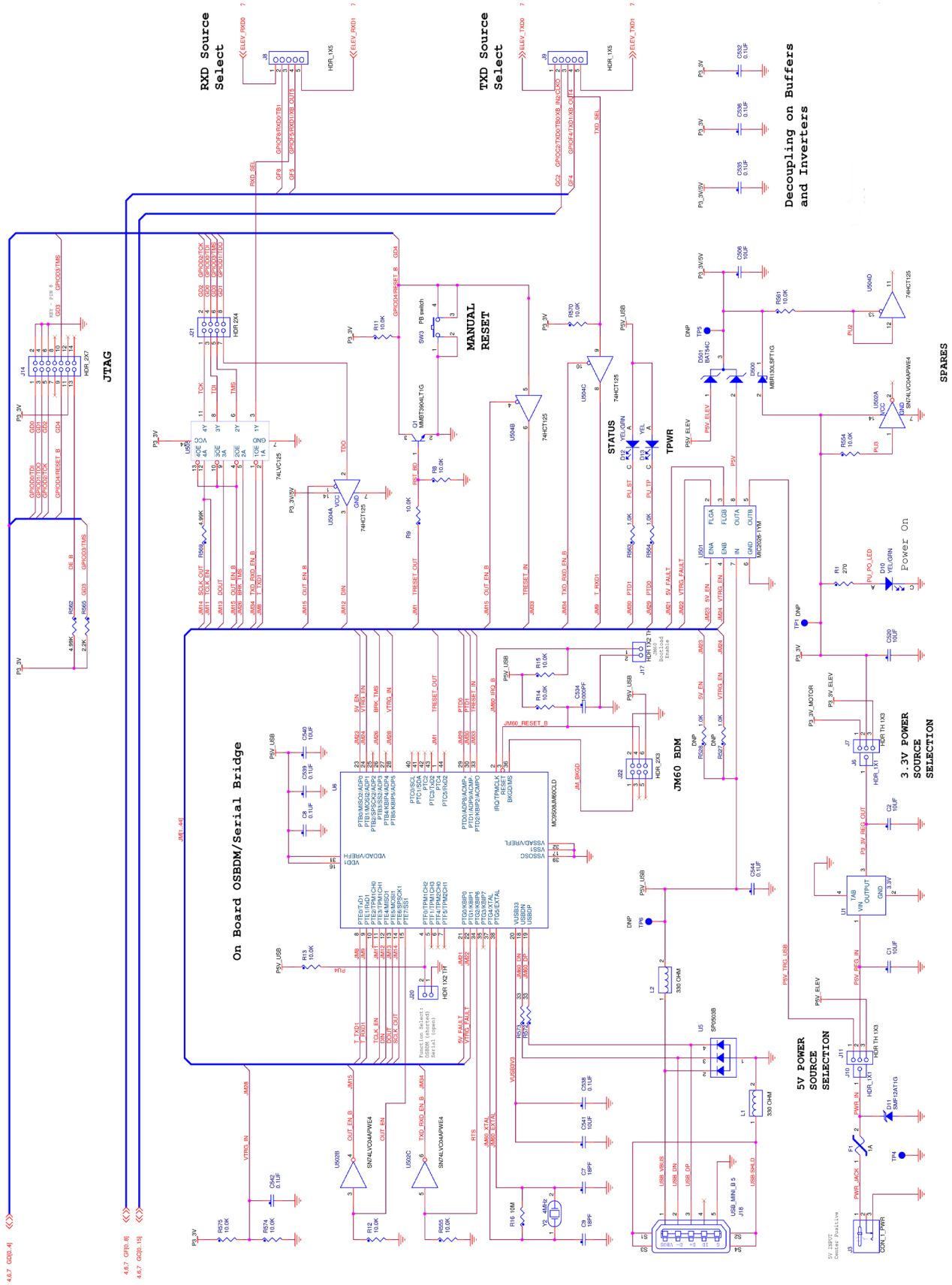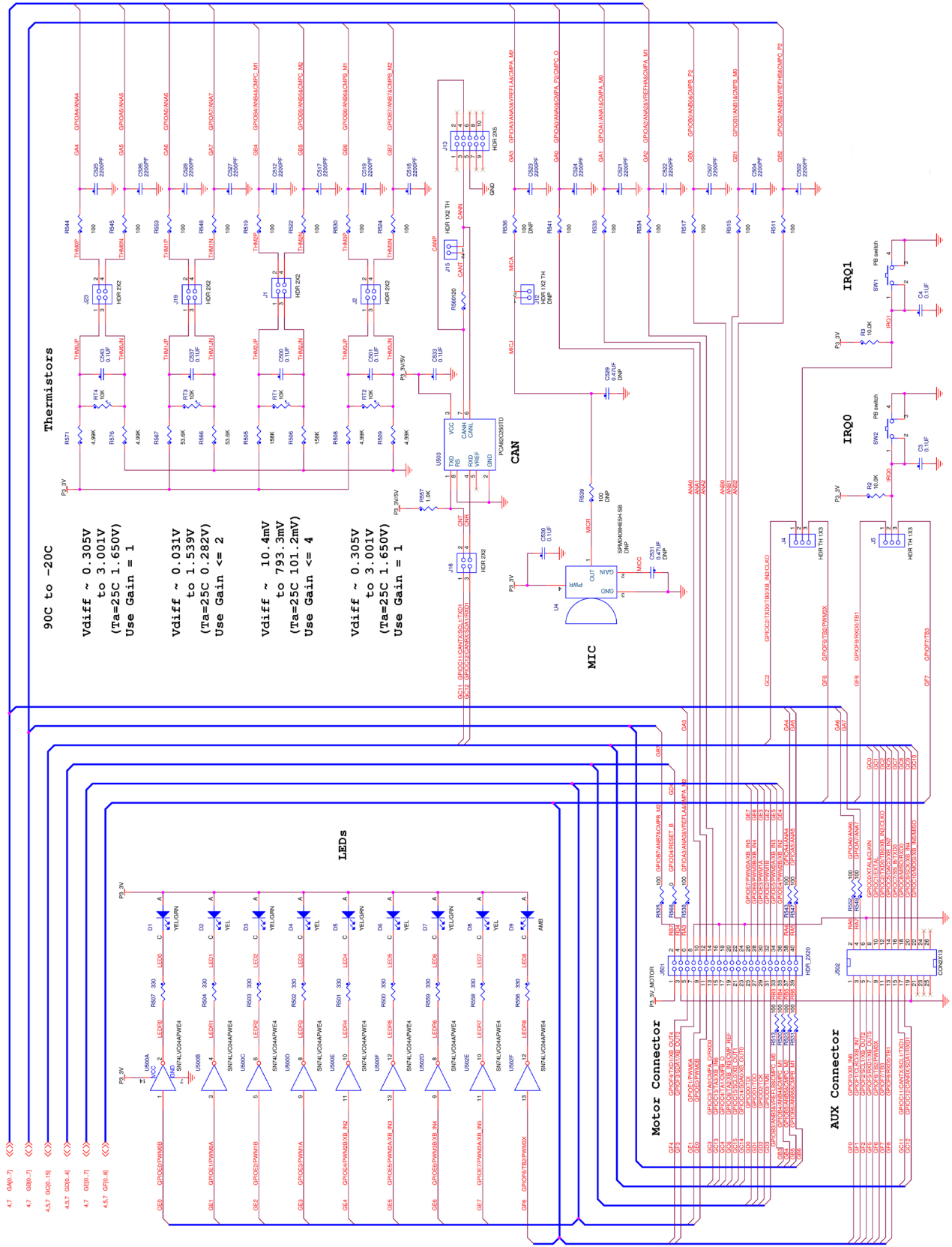
Appendix C: TWR-56F8257 Board BOM

Manufacturer BOM Report

Item Number	750-26034 Rev B Manufacturers BOM
Description	SUB ASSEMBLY, SCHEMATIC PARTS,700-26034,TWR-56F8257
Item Revision	A ECO28529
Sites	5150~Freescale Dev-Tech~DEVTOOL
Date and Time	13-Oct-2010 04:23:41 PM CDT

Subclass	Number	Description	Qty	Ref Des
Manufacturer Name	Manufacturer Part Number	Preferred Status		
CADPart	150-30253	CAP CER 2.2UF 10V 10% X5R 0603	2	C508, C511
TDK	C1608X5R1A225K	Preferred		
VENKEL COMPANY	C0603X5R100-225KNE	Alternate		
MURATA	GRM188R61A225KE34D	Alternate		
CADPart	150-75016	CAP CER 0.10UF 25V 10% X7R 0603	23	C3, C4, C8, C500, C501, C503, C505, C509, C510, C513, C514, C515, C530, C532, C533, C535, C536, C537, C538, C539, C542, C543, C544
Yageo	CC0603KRX7R8BB104	Alternate		
WALSIN TECHNOLOGY CORP.	0603B104K250CT	Alternate		
VENKEL COMPANY	C0603X7R250-104KNE	Alternate		
MURATA	GRM188R71E104KA01	Alternate		
AVX	06033C104KAT2A	Alternate		
KEMET	C0603C104K3RAC	Preferred		
CADPart	150-75116	CAP CER 18PF 50V 5% C0G 0603	2	C7, C9
YAGEO AMERICA	CC0603JRNPO9BN180	Preferred		
SKYMOS	0603CG180J500NT	Alternate		
VENKEL COMPANY	C0603C0G500-180JNE	Alternate		
WALSIN TECHNOLOGY CORP.	0603N180J500LT	Alternate		
KEMET	C0603C180J5GAC	Alternate		
AVX	06035A180JAT2A	Alternate		
MURATA	GRM1885C1H180JA01J	Alternate		
CADPart	150-75283	CAP CER 10UF 16V 10% X5R 0805	7	C1, C2, C506, C516, C520, C540, C541
WALSIN TECHNOLOGY CORP.	0805X106K160CT	Alternate		
AVX	0805YD106KAT2A	Preferred		
KEMET	C0805C106K4PAC	Alternate		
MURATA	GRM21BR61C106KE15L	Alternate		
YAGEO AMERICA	CC0805KKX5R7BB106	Alternate		
CADPart	150-75600	CAP CER 2200PF 50V 10% X7R 0402	15	C502, C504, C507, C512, C517, C518, C519, C521, C522, C523, C524, C525, C526, C527, C528
SMEC	MCCE222K0NRTF	Preferred		
WALSIN TECHNOLOGY CORP.	0402B222K500CT	Alternate		
CADPart	150-78519	CAP CER 1000PF 50V 5% C0G 0603	1	C534
WALSIN TECHNOLOGY CORP.	0603N102J500LT	Preferred		
CADPart	180-30021	IND FER BEAD 330 ohm @ 100 MHz 2.5A -- SMT	2	L1, L2
TDK	MPZ2012S331A	Preferred		
CADPart	180-75046	IND 600 ohm @ 100 MHz 0.2A 25% 0603 SMT	2	L500, L501
MURATA	BLM18BD601SN1D	Preferred		

Subclass	Number	Description	Qty	Ref Des
Manufacturer Name	Manufacturer Part Number	Preferred Status		
CADPart	210-75683	TEST POINT BLACK 40 MIL DRILL 180 MIL TH	1	TP4
COMPONENTS CORPORATION	TP-105-01-00	Preferred		
KEYSTONE ELECTRONICS	5001	Alternate		
KOBICONN	151-203-RC	Alternate		
CADPart	210-75818	CON 1 PWR PLUG RA TH 1A -- 430H NI	1	J3
WIN WIN PRECISION INDUSTRIAL CO. LTD	DC0005E-2.0	Alternate		
SWITCHCRAFT	RAPC722X	Preferred		
ANYTRONIC CORPORATION LIMITED	4004201N0-16LF	Alternate		
CADPart	211-75177	CON 2X20 SMT SKT 100MIL CTR 307H AU	1	J501
FCI	89898-320ALF	Alternate		
ANYTRONIC CORPORATION LIMITED	08026M32015#6T-10LF	Alternate		
SAMTEC	SSM-120-L-DV-BE	Preferred		
CADPart	211-75905	CON 2X13 SKT SMT 100MIL CTR 300H AU	1	J502
SAMTEC	SSM-113-L-DV-TR	Preferred		
CADPart	211-78723	CON 1X5 USB MINI-B RA SHLD SKT SMT 0.8 mm SP 159H AU	1	J18
WIN WIN PRECISION INDUSTRIAL CO. LTD	MUBF-5S-TSROBTC	Preferred		
CADPart	230-76633	XTAL 4 MHz -- SMT	1	Y2
ECS INC. INTERNATIONAL	ECS-40-20-5PX-TR	Preferred		
CADPart	312-75336	IC GATE HEX INV -- TSSOP14	2	U500, U502
TEXAS INSTRUMENTS	SN74LVC04APWE4_	Preferred		
CADPart	312-75936	IC LIN SW PWR ACTIVE HIGH DUAL 2.7V–5.5V 0.5A SOIC8	1	U501
MICREL	MIC2026-1YM	Preferred		
CADPart	312-77275	IC MCU 8-bit 60K FLASH 48 MHz 2.7–5.5V LQFP44	1	U6
FREESCALE SEMICONDUCTOR	MC9S08JM60CLD	Preferred		
CADPart	312-77298	IC BUF QUAD TS 1.65–3.6V TSSOP14	1	U505
NXP SEMICONDUCTORS	74LVC125APW	Alternate		
TEXAS INSTRUMENTS	SN74LVC125APWG4	Preferred		
CADPart	312-79576	IC DSC 16-bit 60 MHz 3.0–3.6V LQFP64	1	U2
FREESCALE SEMICONDUCTOR	PC56F8257VLH	Preferred		
CADPart	312-79586	IC BUF QUAD TS 4.5–5.5V SOIC14	1	U504
TEXAS INSTRUMENTS	SN74HCT125D	Preferred		
CADPart	315-30028	IC XCVR CAN 1MBAUD 5V S08	1	U503
PHILIPS SEMICONDUCTOR	PCA82C250T/N4	Preferred		
PHILIPS SEMICONDUCTOR	PCA82C250TD	Preferred		
PHILIPS SEMICONDUCTOR	PCA82C250TD-G	Preferred		
CADPart	315-76506	IC VREG LDO 3.3V 0.7A 4.3–20V SOT-223	1	U1
LINEAR TECHNOLOGY	LT1129CST-3.3#PBF	Preferred		
CADPart	370-76470	LED AMB SGL 30MA 0603	1	D9
Bright Led Electronics Corp	BL-HJF36D-AV-TRB	Alternate		
Bright Led Electronics Corp	BL-HJF36D-TRB	Preferred		
CADPart	370-76471	LED YEL SGL 30MA 0603	5	D2, D4, D6, D8, D13
Bright Led Electronics Corp	BL-HKC36D-TRB	Preferred		

Subclass	Number	Description	Qty	Ref Des
Manufacturer Name	**Manufacturer Part Number**	**Preferred Status**		
CADPart	370-76472	LED YEL GRN SGL 30MA 0603	6	D1, D3, D5, D7, D10, D12
Bright Led Electronics Corp	BL-HGE36D-TRB	Preferred		
CADPart	470-30149	RES MF 120 ohm 1/16W 1% 0402	1	R560
WALSIN TECHNOLOGY CORP.	WR04X1200FTL	Alternate		
VISHAY INTERTECHNOLOGY	CRCW0402120RFKED	Preferred		
THYE MING TECH CO LTD	CR02FL6-120R	Alternate		
CADPart	470-30454	RES MF 100 ohm 1/16W 1% 0402	40	R510, R511, R512, R513, R514, R515, R516, R517, R518, R519, R520, R521, R522, R523, R524, R525, R526, R529, R530, R531, R532, R533, R534, R535, R537, R538, R540, R541, R542, R543, R544, R545, R546, R547, R548, R549, R550, R551, R552, R553
VISHAY INTERTECHNOLOGY	CRCW0402100RFKED	Alternate		
VENKEL COMPANY	CR0402-16W-1000FT	Alternate		
THYE MING TECH CO LTD	CR-02FL6--100R	Preferred		
WALSIN TECHNOLOGY CORP.	WR04X1000FTL	Alternate		
CADPart	470-30782	RES MF 270 ohm 1/16W 1% 0402	1	R1
WALSIN TECHNOLOGY CORP.	WR04X2700FTL	Alternate		
KOA SPEER	RK73H1ETTP2700F	Preferred		
CADPart	470-30913	RES MF 4.99K 1/16W 1% 0402	6	R508, R509, R562, R569, R571, R576
KOA SPEER	RK73H1ETTP4991F	Preferred		
WALSIN TECHNOLOGY CORP.	WR04X4991FTL	Alternate		
CADPart	470-31081	RES MF 158K 1/16W 1% 0402	2	R505, R506
WALSIN TECHNOLOGY CORP.	WR04X1583FTL	Alternate		
KOA SPEER	RK73H1ETTP1583F	Preferred		
CADPart	470-75416	RES MF 10.0K 1/16W 1% 0402	15	R2, R3, R8, R9, R11, R12, R13, R14, R15, R554, R555, R561, R570, R574, R575
WALSIN TECHNOLOGY CORP.	WR04X1002FTL	Alternate		
VISHAY INTERTECHNOLOGY	CRCW040210K0FKED	Alternate		
SKYMOS	SCR-0402-K-103-F-T	Alternate		
VIKING COMPONENTS	CR-02FL6---10K	Alternate		
SMEC	RC73A2Z1002FTF	Alternate		
YAGEO AMERICA	9C04021A1002FLPF3	Alternate		
KOA SPEER	RK73H1ETTP1002F	Preferred		
VENKEL COMPANY	CR0402-16W-1002FT	Alternate		
BOURNS	CR0402-FX-1002GLF	Alternate		
VENKEL COMPANY	CR0402-16W-1002FSNT	Alternate		
CADPart	470-75442	RES MF ZERO ohm 1/8W -- 0805	3	R4, R10, R568
YAGEO AMERICA	RC0805JR-070RL	Alternate		
SMEC	RC73JP2DTF	Alternate		
BOURNS	CR0805-J/-000ELF	Preferred		
VENKEL COMPANY	CR0805-8W-000T	Alternate		
VISHAY INTERTECHNOLOGY	CRCW0805000RJNEA	Alternate		
KOA SPEER	RK73Z2ATTD	Alternate		
PANASONIC	ERJ6GEY0R00V	Alternate		
ROHM	MCR10EZPJ000	Alternate		
TMTEC	CR-05JL7----0R	Alternate		

Subclass	Number	Description	Qty	Ref Des
Manufacturer Name	Manufacturer Part Number	Preferred Status		
CADPart	470-75790	RES MF 33.0 ohm 1/16W 1% 0402	2	R572, R573
BOURNS	CR0402FX33R0GLF	Alternate		
THYE MING TECH CO LTD	CR-02FL6---33R	Preferred		
YAGEO AMERICA	RC0402FR-0733RL	Alternate		
WALSIN TECHNOLOGY CORP.	WR04X33R0FTL	Alternate		
CADPart	470-76037	RES MF 1.0K 1/16W 1% 0402	3	R557, R563, R564
BOURNS	CR0402-FX-1001GLF	Alternate		
VISHAY INTERTECHNOLOGY	CRCW-0402-1K00-FK-E3	Alternate		
KOA SPEER	RK73H1ETTP1001F	Preferred		
THYE MING TECH CO LTD	CR-02FL6----1K	Alternate		
PANASONIC	ERJ-2RKF1001X	Alternate		
YAGEO AMERICA	RC0402FR-071KL	Alternate		
CADPart	470-76235	RES MF 53.6K 1/16W 1% 0402	2	R566, R567
SMEC	RC73A2Z5362FTF	Alternate		
KOA SPEER	RK73H1ETTP5362F	Preferred		
WALSIN TECHNOLOGY CORP.	WR04X5362FTL	Alternate		
CADPart	470-76465	RES MF 330 ohm 1/16W 1% 0402	9	R500, R501, R502, R503, R504, R507, R556, R558, R559
WALSIN TECHNOLOGY CORP.	WR04X3300FTL	Alternate		
THYE MING TECH CO LTD	CR-02FL6--330R	Alternate		
VISHAY INTERTECHNOLOGY	CRCW0402330RFK	Preferred		
CADPart	470-76481	RES MF 10M 1/16W 1% 0402	1	R16
WALSIN TECHNOLOGY CORP.	WR04X1005FTL	Alternate		
THYE MING TECH CO LTD	CR02FL6--10M	Preferred		
CADPart	470-78359	RES MF 2.2K 1/16W 1% 0402	1	R565
VISHAY INTERTECHNOLOGY	CRCW04022K20FKED	Alternate		
KOA SPEER	RK73H1ETTP2201F	Preferred		
CADPart	470-80022	THERMISTOR 10K 1/10W 1% 0603	4	RT1, RT2, RT3, RT4
MURATA	NCP18XH103F03RB	Preferred		
CADPart	480-30005	DIODE SCH PWR RECT 1A 30V SOD-123	1	D500
ON SEMICONDUCTOR	MBR130LSFT1G	Preferred		
CADPart	480-75173	TRAN NPN GEN 200MA 40V SOT-23	1	Q1
PHILIPS SEMICONDUCTOR	MMBT3904	Alternate		
MICRO COMMERCIAL COMPONENTS CORP	MMBT3904-TP	Alternate		
ON SEMICONDUCTOR	MMBT3904LT1G	Preferred		
CADPart	480-76886	DIODE TVS ARRAY 3-ch. -- 5V 0.225W SOT143	1	U5
LITTELFUSE	SP0503BAHTG	Preferred		
CADPart	480-77944	DIODE SCH DUAL CC 200MA 30V SOT23	1	D501
FAIRCHILD	BAT54C	Preferred		
CADPart	510-75078	SW SMT 4 MM FMS 0.1A MAX 16V MAX ROHS COMPLIANT	3	SW1, SW2, SW3
BOURNS	7914J-1-000E	Preferred		
CADPart	510-75080	FUSE PLYSW 1.1A 0.48 ohm SMT	1	F1
TYCO ELECTRONICS	SMD100F-2	Preferred		

Subclass	Number	Description	Qty	Ref Des
Manufacturer Name	Manufacturer Part Number	Preferred Status		
CADPart	150-75202	CAP CER 22PF 50V 5% C0G 0805	0	C5, C6
KEMET	C0805C220J5GAC	Preferred		
AVX	08055A220JAT2A	Alternate		
KOA SPEER	NPO0805HTTD220J	Alternate		
VENKEL COMPANY	C0805C0G500-220JNE	Alternate		
CADPart	210-75439	HDR 1X2 TH 100MIL SP 339H AU 98L	3	J15, J17, J20
SAMTEC	HTSW-102-07-G-S	Alternate		
ANYTRONIC CORPORATION LIMITED	090021S02015-2LF	Alternate		
SAMTEC	TSW-102-07-S-S	Alternate		
FCI	77311-801-02LF	Alternate		
SAMTEC	HTSW-102-07-SM-S	Alternate		
ANYTRONIC CORPORATION LIMITED	090021S02018-2LF	Alternate		
SAMTEC	TSW-102-07-G-S	Preferred		
3M	929647-01-02-EU	Alternate		
CADPart	210-75726	HDR 1X3 TH 100MIL SP 339H AU 100L	4	J4, J5, J7, J11
FCI	77311-801-03LF	Alternate		
SAMTEC	TSW-103-07-S-S	Alternate		
SAMTEC	TSW-103-07-G-S	Preferred		
ANYTRONIC CORPORATION LIMITED	090021S03015-2LF	Alternate		
CADPart	210-79790	HDR 1X1 TH -- 350H AU 100L	2	J6, J10
SAMTEC	TSW-101-07-L-S	Preferred		
ANYTRONIC CORPORATION LIMITED	090021S01015-2LF	Alternate		
FRAMATOME CONNECTORS INTERNATIONAL	68000-201HLF	Alternate		
CADPart	211-78844	CON DUAL 2X82 Edge PCI Express SMT 1MM SP 591H for Tower System Not an Orderable Part	1	J500A/B
CADPart	211-78931	HDR 2X4 SMT 100MIL CTR 400H AU	1	J21
FCI	98401-801A08LF	Alternate		
ANYTRONIC CORPORATION LIMITED	090092H04015N6T-2LF	Alternate		
FCI	98401-101A08LF	Alternate		
SAMTEC	TSM-104-01-L-DV-A-P-TR	Preferred		
CADPart	211-78932	HDR 2X5 SMT 100MIL CTR 400H AU	1	J13
ANYTRONIC CORPORATION LIMITED	090092H05015N6T-2LF	Alternate		
FCI	98401-801A10LF	Alternate		
FCI	98401-101A10LF	Alternate		
SAMTEC	TSM-105-01-L-DV-A-P-TR	Preferred		
CADPart	211-78936	HDR 2X2 SMT 100MIL CTR 400H AU	5	J1, J2, J16, J19, J23
FCI	95278-101A04LF	Alternate		
SAMTEC	TSM-102-01-L-DV-P-TR	Preferred		
ANYTRONIC CORPORATION LIMITED	090092M02015N6T-2LF	Alternate		
FCI	95278-801A04LF	Alternate		
CADPart	211-78942	HDR 2X3 SMT 100MIL CTR 414H AU	1	J22
FCI	95278-801A06LF	Alternate		
FCI	95278-101A06LF	Alternate		
ANYTRONIC CORPORATION LIMITED	090092M03015N6T-2LF	Alternate		
SAMTEC	TSM-103-01-L-DV-P-TR	Preferred		

Subclass	Number	Description	Qty	Ref Des
Manufacturer Name	Manufacturer Part Number	Preferred Status		
CADPart	211-78959	HDR 1X5 SMT 100MIL SP 380H AU	2	J8, J9
FCI	54201-G0805ALF	Alternate		
SAMTEC	TSM-105-01-L-SV-P-TR	Preferred		
FCI	54201-S0805ALF	Alternate		
CADPart	211-78966	HDR 2X7 SMT 2.54MM SP 397H AU	1	J14
FCI	95278-801A14LF	Alternate		
ANYTRONIC CORPORATION LIMITED	090092M07015N6T-2LF	Alternate		
FCI	95278-101A14LF	Alternate		
SAMTEC	TSM-107-01-L-DV-P-TR	Preferred		
CADPart	480-78141	DIODE ZNR 200W 12V SOD-123	1	D11
ON SEMICONDUCTOR	SMF12AT1G	Preferred		
CADPart	150-75214	CAP CER 0.47UF 25V 10% X7R 0805	0	C529, C531
VENKEL COMPANY	C0805X7R250-474KNE	Preferred		
AVX	08053C474KAT2A	Alternate		
KEMET	C0805C474K3RAC	Alternate		
WALSIN TECHNOLOGY CORP.	0805B474K250CT	Alternate		
CADPart	210-75439	HDR 1X2 TH 100MIL SP 339H AU 98L	0	J12
SAMTEC	HTSW-102-07-G-S	Alternate		
ANYTRONIC CORPORATION LIMITED	090021S02015-2LF	Alternate		
SAMTEC	TSW-102-07-S-S	Alternate		
FCI	77311-801-02LF	Alternate		
SAMTEC	HTSW-102-07-SM-S	Alternate		
ANYTRONIC CORPORATION LIMITED	090021S02018-2LF	Alternate		
SAMTEC	TSW-102-07-G-S	Preferred		
3M	929647-01-02-EU	Alternate		
CADPart	210-75683	TEST POINT BLACK 40 MIL DRILL 180 MIL TH	0	TP1, TP2, TP3, TP5, TP6, TP7, TP8
COMPONENTS CORPORATION	TP-105-01-00	Preferred		
KEYSTONE ELECTRONICS	5001	Alternate		
KOBICONN	151-203-RC	Alternate		
CADPart	230-30033	XTAL 8 MHz SER SMT	0	Y1
CITIZEN	HCM49-8.000MABJ-UT	Preferred		
CTS	ATS08ASM-T	Alternate		
ECS INC. INTERNATIONAL	ECS-80-18-5PX	Alternate		
CADPart	470-30454	RES MF 100 ohm 1/16W 1% 0402	0	R536
VISHAY INTERTECHNOLOGY	CRCW0402100RFKED	Alternate		
VENKEL COMPANY	CR0402-16W-1000FT	Alternate		
THYE MING TECH CO LTD	CR-02FL6--100R	Preferred		
WALSIN TECHNOLOGY CORP.	WR04X1000FTL	Alternate		
CADPart	470-75442	RES MF ZERO ohm 1/8W -- 0805	0	R5, R7
YAGEO AMERICA	RC0805JR-070RL	Alternate		
SMEC	RC73JP2DTF	Alternate		
BOURNS	CR0805-J/-000ELF	Preferred		
VENKEL COMPANY	CR0805-8W-000T	Alternate		
VISHAY INTERTECHNOLOGY	CRCW0805000RJNEA	Alternate		
KOA SPEER	RK73Z2ATTD	Alternate		
PANASONIC	ERJ6GEY0R00V	Alternate		
ROHM	MCR10EZPJ000	Alternate		
TMTEC	CR-05JL7----0R	Alternate		

Subclass	Number	Description	Qty	Ref Des
Manufacturer Name	Manufacturer Part Number	Preferred Status		
CADPart	470-75458	RES MF 100 ohm 1/8W 1% 0805	0	R539
PANASONIC	ERJ6ENF1000V	Alternate		
YAGEO AMERICA	RC0805FR-07100RL	Alternate		
ROHM	MCR10EZPF1000	Alternate		
KOA SPEER	RK73H2ATTD1000F	Alternate		
VENKEL COMPANY	CR0805-8W-1000FT	Preferred		
VISHAY INTERTECHNOLOGY	CRCW0805100RFKEA	Alternate		
BOURNS	CR0805-FX-1000ELF	Alternate		
CADPart	470-75952	RES MF 1.0M 1/8W 1% 0805	0	R6
BOURNS	CR0805-FX-1004ELF	Alternate		
KOA SPEER	RK73H2ATTD1004F	Alternate		
VENKEL COMPANY	CR0805-8W-1004FSNT	Preferred		
ROHM	MCR10EZPF1004	Alternate		
VISHAY INTERTECHNOLOGY	CRCW08051M00FKEA	Alternate		
PANASONIC	ERJ6ENF1004V	Alternate		
CADPart	470-76037	RES MF 1.0K 1/16W 1% 0402	0	R527, R528
BOURNS	CR0402-FX-1001GLF	Alternate		
VISHAY INTERTECHNOLOGY	CRCW-0402-1K00-FK-E3	Alternate		
KOA SPEER	RK73H1ETTP1001F	Preferred		
THYE MING TECH CO LTD	CR-02FL6----1K	Alternate		
PANASONIC	ERJ-2RKF1001X	Alternate		
YAGEO AMERICA	RC0402FR-071KL	Alternate		
CADPart	510-77681	MICROPHONE MINI SISONIC 300 ohm 59DB 1.5–3.6V SMT	0	U4
KNOWLES ACOUSTICS	SPM0408HE5H-SB	Preferred		
CADPart	750-77085	SKT 64 QFP TH 0.5 mm 630MIL AU 87L + IC DSC MC56F8257VLF 3.0–3.6V LQFP64	0	U3
CADPart	210-78980	SKT 64 QFP TH 0.5 mm SP 630H AU 87L	1	
YAMAICHI ELECTRONICS	IC234-0644-122P-1	Preferred		
CADPart	312-79576	IC DSC 16-bit 60MHZ 3.0–3.6V LQFP64	1	
FREESCALE SEMICONDUCTOR	PC56F8257VLH	Preferred		

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Document Number: TWR56F8257UM
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