

# MPC5606S-DEMO-V2 User Guide

by: Joseph Martinez  
Freescale Applications Engineer  
Tlaquepaque, Jalisco

## 1 Overview

The MPC56xxS family is the latest generation of 32-bit Power Architecture microcontrollers (MCUs) that address color thin-film transistor (TFT) displays in automotive instrument cluster applications. It offers a cost-effective entry-level instrument cluster solution with the ability to scale your designs to fit your performance needs.

### 1.1 Specific MPC5606S Key Features

- e200 32-bit Book E compliant CPU core complex built on Power Architecture technology
- Display Control Unit (DCU) for direct drive of TFT displays up to WQVGA resolution
- Stepper motor drivers (for driving up to six instrumentation gauges)
- 40 x 4 segment LCD display driver

### Contents

1	Overview	1
2	Power	3
3	Video	4
4	Input/Output	5
5	Memory	7
6	Communications	7
7	Debug	9
8	Sound	9
9	Initialization Code	9

## Overview

- 1 MB on-chip flash with separate 64 k Data Flash for the EEPROM Emulation
- 48 KB on-chip SRAM with ECC
- 160 KB on-chip graphics SRAM (no ECC)
- Parallel Data Interface (PDI) for digital video input
- Sound generation and playback using PWM channels and DMA
- QuadSPI Serial Flash Controller

The MPC5606S-DEMO-V2 allows testing most of the MPC5606S MCUs features, especially graphics. The following block diagram shows the functionality and architecture of the board.

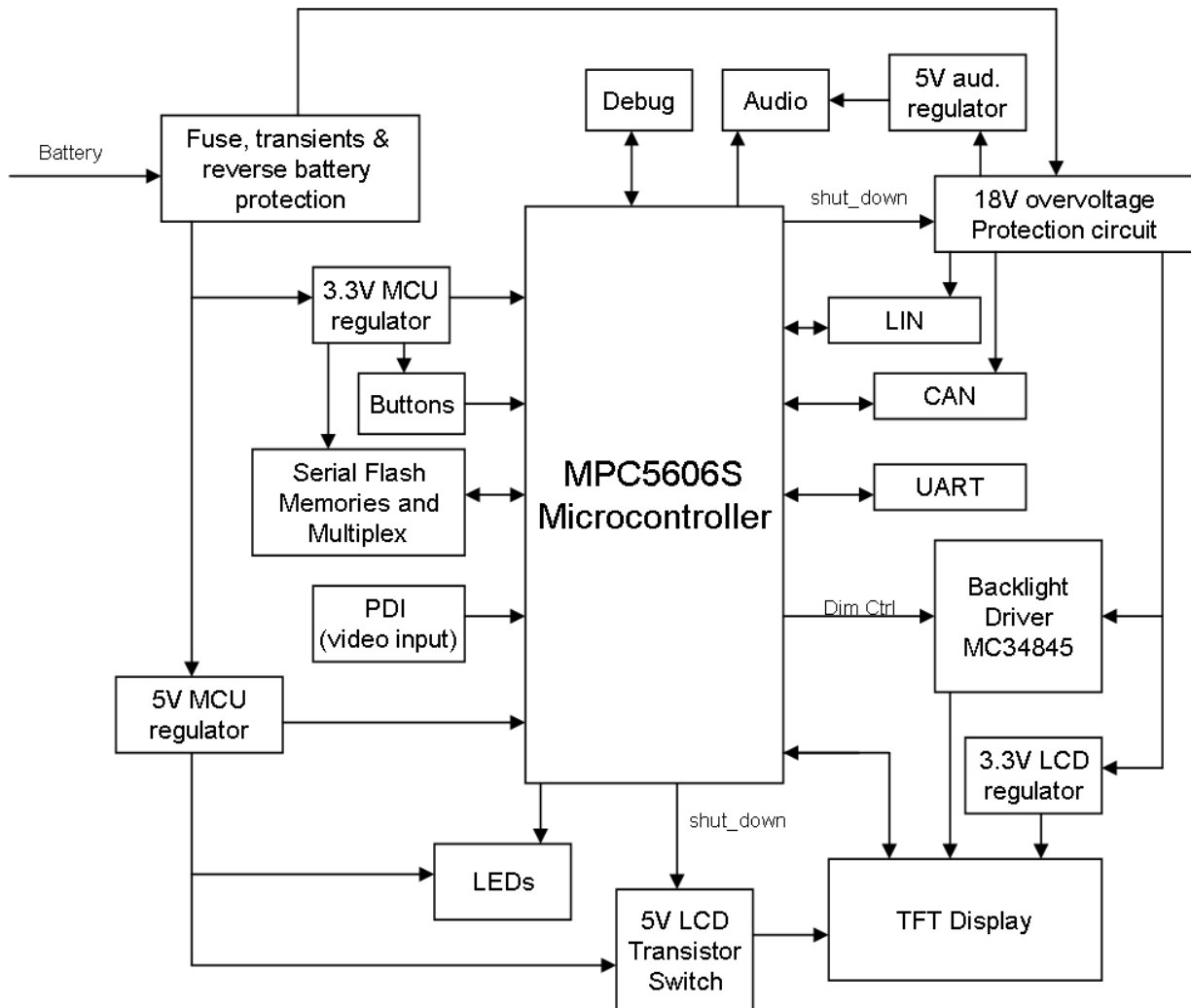


Figure 1-1. MPC5606S-DEMO-V2 block diagram

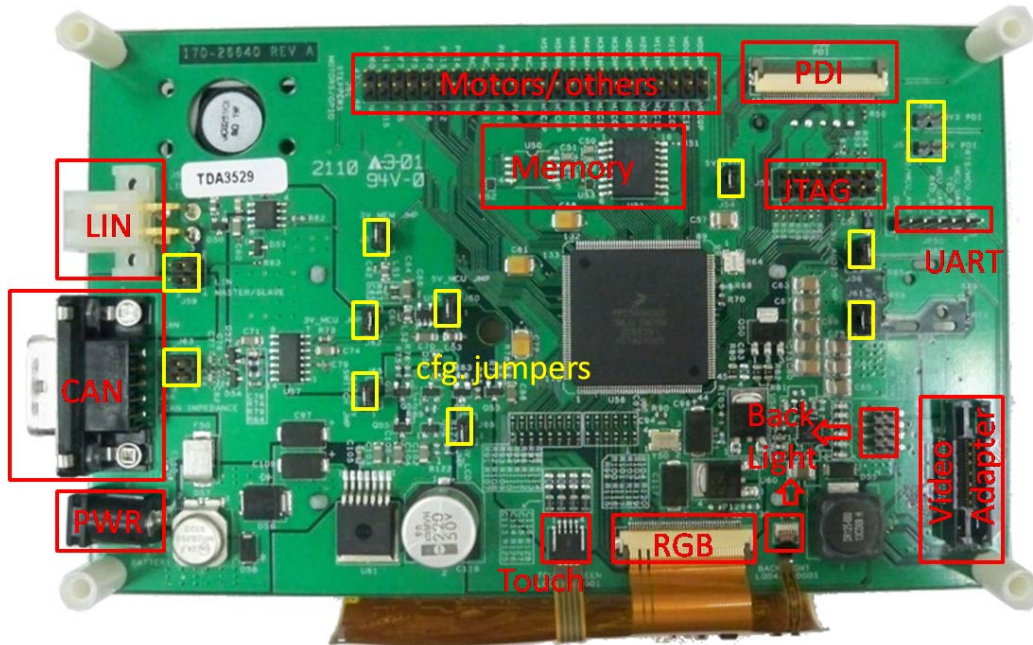


Figure 1-2. MPC5606S-DEMO-V2 functional blocks

## 2 Power

Power to the MPC5606S-DEMO-V2 is applied through a 2.1 mm center-positive barrel jack marked J69. It includes a resettable poly-fuse F50 that provides protection from excessive current. A Transient Voltage Suppression (TVS) device provides input protection from excessive voltage. [Table 2-1](#) shows the input voltages accepted by the board.

Table 2-1. Accepted voltage ranges

Voltage Mode	Voltage range
Nominal	7.0V to 18.0V
Over voltage	18.0V to 21.0V

Nominal voltage mode — Is when the board operates normally without any risk of damage. All the devices operate according to their specification.

Over voltage mode — Is a voltage level where the power bus “battery switch” needs to be turned off by the microcontroller and by setting low the pin PC13. The MCU can continuously sense the battery voltage. When the voltage range is again nominal it is safe to turn on the battery switch.

The EVB includes a set of power buses that correctly distribute power to all the devices on the board. [Table 2-2](#) shows the different buses and the jumpers that enable and disable them.

**Table 2-2. Power buses**

Power Bus	Jumper	Comments
5V_MCU	J60	5V to certain power pins in the MCU.
3_MCU	J62	3.3V to certain power pins in the MCU.
5V_LED	J54	5V to the LEDs in the board.
Battery Switch	J65	Battery power branch without any regulation
3V_MEM	J57	3.3V to the serial flash memories installed.
5V_Audio	J58	5V to the audio circuit.
3V3_LCD	J61	3.3V digital power to the TFT display
5V_LCD	J66	5V analog power to the TFT display

The MCU requires both 5 V and 3.3 V because it is connected to the TFT display logic which is 3.3V. The stepper motor module requires 5 V. Always install both J60 and J62 when using the MCU.

The 5V\_Audio and 3V3\_LCD require the battery switch J65 to be enabled in order to work.

The 5V\_LCD requires that pin PC12 be set on high to turn on the voltage branch.

## 3 Video

The MPC5606S has the capability to drive TFT Displays directly using the DCU module interface.

### 3.1 Display

The display is powered by three buses: 3.3 V, 5 V, and the backlight voltage which is 28 V. The specification of the display requires the power to be supplied in the following order:

1. 5 Volts for analog power (enabled with pin PC12)
2. 3.3 V for digital power (enabled with the battery switch bus with pin PC13)
3. Backlight (not mandatory, enable backlight circuit using pin PG12)

The display also includes a Resistive Touch Interface connected on J71 through the ADC channels from the MCU.

The MPC5606S-DEMO-V2 provides a port for a custom adapter board for different display connectivity, that is a 38 pin MICTOR on J68 with all the RGB, clocks, power, and touch interface signals.

For more details about the specification of the display read the LQ043T1DG01 datasheet.

### 3.2 Backlight Circuitry

The MPC5606S-DEMO-V2 has a Freescale MC34845 which is an analog device to drive LED strings. In this case, the display included has a 9 LED string for the backlight. The circuit is designed to be supplied from 7 V to 18 V and provide a stable 20 mA current to either eight or nine LEDs in a string.

The MC34845 can handle up to six strings. The anodes and cathodes can be accessed from J67. When building an adapter to drive a different kind of display requiring more LED strings, J67 can be accessed for that functionality.

The MC34845 is controlled using the MPC5606S MCU as shown in the table below:

**Table 3-3. Control signals for the MC34845**

Signal	Functionality
Battery Switch (PC13)	Provides power to the chip, must be turned off when the system is not in nominal voltage
PWM_WAKE_BACKLIGHT (PG12)	PWM for controlling the intensity of the backlight

The PWM frequency has to be below 100 KHz but preferably above 20 KHz to avoid an audible vibration from the components. If dimming is not needed then pin PG12 can be set to high and to low to turn on and off the backlight.

For more details refer to the MC34845 datasheet.

### 3.3 Parallel Data Input (PDI)

The MPC5606S can receive digital video as input. The J50 connector is provided matching signals to the J72 connector. The J72 is an output port to the display. This allows performing simple interface testing by connecting the output of one MPC5606S-DEMO-V2 board (J72) into another MPC5606S-DEMO-V2 board (J50).

It is possible to provide power to the J50 connector by setting jumpers on the J52 and J53. Never set the jumpers if the other board already has them installed. They can only act as power sources but not as power sinks.

## 4 Input and Output

The MPC5606S-DEMO-V2 provides some basic controls for interfacing, switch buttons, LEDs, and a two row pin header with the remaining signals of the unused modules from the microcontroller.

There are five general input switch buttons and one reset button as shown in Table 4-4.

**Table 4-4. Switch buttons**

Name	MCU PIN
DOWN (SW5)	PF8
RIGHT (SW4)	PF3
LEFT (SW3)	PF9
TOP (SW2)	PF4
ENTER (SW6)	PF1
Reset (SW7)	RESET

## Input and Output

The board has three LEDs which are powered with the 5 V\_LED bus. The signals driving the LEDs are in the following table.

**Table 4-5. LEDs signal connections**

Name	MCU PIN/signal
LED1 (red)	PK10
LED2 (red)	PK11
LED3 (green)	GND

The connector J51 is a two-row standard 100 mm pin header where all the unused pins from the microcontroller are routed to. The following table shows the pin assignment of the J51 connector.

**Table 4-6. Connector J51 pin assignment**

Pin Number	MCU Signal	Pin Number	MCU Signal
1	PD0	2	PD1
3	PD2	4	PD3
5	PD4	6	PD5
7	PD6	8	PD7
9	PD8	10	PD9
11	PD10	12	PD11
13	PD12	14	PD13
15	PD14	16	PD15
17	PE0	18	PE1
19	PE2	20	PE3
21	PE4	22	PE5
23	PE6	24	PE7
25	NC	26	NC
27	PB4	28	PB6
29	PB10	30	PB11
31	NC	32	PC11
33	NC	34	NC
35	PC14	36	NC
37	PC15	38	PF2
39	PF0	40	PF6
41	PF5	42	NC
43	PF7	44	PH5
45	PJ14	46	PJ15
47	PK0	48	NC

It is then possible to use the stepper motor control functionality by getting the signals from the J51 connector.

## 5 Memory

The MPC5606S-DEMO-V2 has an external serial flash memory that connects to the microcontroller using a quad serial peripheral interface (QSPI) at high clock speeds (max 52 MHz). By using a multiplexer that selects between the memories using a GPIO pin from the microcontroller it is possible to have two QSPI memories installed on the board and to be able to access independently.

**Table 5-7. QSPI select multiplexer**

Signal	Device
PC2 logic 1	U51 (S25FL064P0XMFV001)
PC2 logic 0	U50 (Not populated)

## 6 Communications

The MPC5606S-DEMO-V2 implements CAN, LIN, and TTL-UART physical interfaces.

### 6.1 CAN

The EVB uses the Freescale MC33902 high speed (from 40 kbps to 1 Mbps) CAN physical interface transceiver that can be directly connected to the battery line. The J64 male DB-9 connector provides the physical connectivity. The table below shows the connector pin mapping.

**Table 6-8. J64 CAN connector pin mapping**

Signal	Pins
CANH	7
CANL	2
GND	6, 3, 5, M1, M2
NC	9, 4, 8, 1

The CAN bus termination is specified to be 60 ohms. If the MPC5606S-DEMO-V2 is going to be used as the node with the 60 ohm CAN bus termination on J63 shunt pins 1 and 2 and shunt pins 3 and 4.

The CAN transceiver is connected to the MCU via the pins shown in [Table 6-9](#).

**Table 6-9. MC33902 pin connection to the MCU**

MC33902	MCU pins
TXD	PB0
RXD	PB1
NERR	PB7
EN	PB8
STBY	PB9

## 6.2 LIN

The physical LIN interface for the MPC5606S-DEMO-V2 is implemented with a Freescale MC33661 LIN transceiver. The physical connectivity is provided by a four slot mini-fit Molex connector. The table below shows the connections on the J56 connector.

**Table 6-10. J56 LIN connector pin mapping**

Signal	Pins
LIN Power	3
GND	1
LIN signal	4
NC	2

Providing or receiving power through a LIN cable is optional with the configuration jumper J59. Be careful when configuring:

Close J59 1 and 3 to either provide or receive power. If receiving power, the power input at J69 must be disconnected.

Close J59 2 and 4 for Master mode. When it is open the device works as a slave.

Connections from the MC33661 to the MCU are as follows:

**Table 6-11. MC33661 pin connection to MCU**

MC33902	MCU pins
TXD	PB2
RXD	PB3
EN	PC8



## 6.3 UART

UART connectivity is provided through JP50 directly from the microcontroller at the 5 V level. The pin connections on the JP50 are as follows:

**Table 6-12. JP50 UART pin mapping**

Signal	JP50 pin	MCU pins
TXD	5	PB13
RXD	4	PB12
CTS	2	PC0
RTS	6	PC1
GND	1	N/A
NC	3	N/A

## 7 Debug

The MPC5606S-DEMO-V2 supports both the JTAG and Nexus for application development and debug for the MPC5606S.

The JTAG connector is located in the back (bottom layer) of the board at J55. Be careful with the pin numbering because connecting it wrongly may cause damage to the board (J55 Pin 1 must match Pin 1 from the debugging tool). The Nexus port J1 is located in front with a MICTOR 38 connector.

## 8 Sound

The MPC5606S-DEMO-V2 provides a loud-speaker with an amplifier that allows to generate sounds with the microcontroller.

The potentiometer R10 allows to control the gain in the amplifier. The input sound signal comes from MCU pin PC10. The audio amplifier is fed with a separate regulator because the current consumption of the circuit on some cases can be high. The circuit can deliver up to 1 W of power to the loud-speaker.

## 9 Initialization Code

The hardware architecture on the MPC5606S-DEMO-V2 allows independent power on different modules of the board. The following code listing provides the C code necessary to power the peripherals included on the board.

## Revision History

### Code List 1—Initialization code:

```
// Init of Ext. peripheral on MPC5606S-DEMO-V2

// Set data output pins to 0 first
SIU.GPDO[PC13].R = 0;
SIU.GPDO[PC12].R = 0;
SIU.GPDO[PG12].R = 0;

// Configure pins as outputs
SIU.PCR[PC13].R = 0x0200;
SIU.PCR[PC12].R = 0x0200;
SIU.PCR[PG12].R = 0x0200;
SIU.GPDO[PC13].R = 1;           // Enable battery switch branch
SIU.GPDO[PC12].R = 1;         // Enable 5V lcd analog supply
SIU.GPDO[PG12].R = 1;         // Enable Backlight

// QSPI Memory Mux
SIU.GPDO[PC2].R = 0;           // 0 for U51, (set to 1 for U50)
SIU.PCR[PC2].R = 0x0200;      // EN QSPI Mux select pin

// CAN transceiver activation
SIU.GPDO[PB8].R = 1;           // Enable CAN_EN signal
SIU.PCR[PB8].R = 0x0200;      // Set CAN_EN pin as output
SIU.GPDO[PB9].R = 1;           // Enable CAN_STBY signal */
SIU.PCR[PB9].R = 0x0200;      // Set CAN_STBY pin as output

// LIN transceiver activation
SIU.GPDO[PC8].R = 1;           // Enable LIN_ENABLE signal
SIU.PCR[PC8].R = 0x0200;      // Set LIN_ENABLE pin as output
```

## 10 Revision History

Revision Number	Revision Date	Description of Changes
0	October 2010	Initial Version Added MPC5606S information on <ul style="list-style-type: none"> <li>• overview section</li> <li>• initialization code</li> <li>• index</li> </ul>



**How to Reach Us:****Home Page:**

[www.freescale.com](http://www.freescale.com)

**Web Support:**

<http://www.freescale.com/support>

**USA/Europe or Locations Not Listed:**

Freescale Semiconductor, Inc.  
Technical Information Center, EL516  
2100 East Elliot Road  
Tempe, Arizona 85284  
+1-800-521-6274 or +1-480-768-2130  
[www.freescale.com/support](http://www.freescale.com/support)

**Europe, Middle East, and Africa:**

Freescale Halbleiter Deutschland GmbH  
Technical Information Center  
Schatzbogen 7  
81829 Muenchen, Germany  
+44 1296 380 456 (English)  
+46 8 52200080 (English)  
+49 89 92103 559 (German)  
+33 1 69 35 48 48 (French)  
[www.freescale.com/support](http://www.freescale.com/support)

**Japan:**

Freescale Semiconductor Japan Ltd.  
Headquarters  
ARCO Tower 15F  
1-8-1, Shimo-Meguro, Meguro-ku,  
Tokyo 153-0064  
Japan  
0120 191014 or +81 3 5437 9125  
[support.japan@freescale.com](mailto:support.japan@freescale.com)

**Asia/Pacific:**

Freescale Semiconductor China Ltd.  
Exchange Building 23F  
No. 118 Jianguo Road  
Chaoyang District  
Beijing 100022  
China  
+86 10 5879 8000  
[support.asia@freescale.com](mailto:support.asia@freescale.com)

**For Literature Requests Only:**

Freescale Semiconductor Literature Distribution Center  
1-800-441-2447 or 303-675-2140  
Fax: 303-675-2150  
[LDCForFreescaleSemiconductor@hibbertgroup.com](mailto:LDCForFreescaleSemiconductor@hibbertgroup.com)

Information in this document is provided solely to enable system and software implementers to use Freescale Semiconductor products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

Freescale Semiconductor reserves the right to make changes without further notice to any products herein. Freescale Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Freescale Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in Freescale Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals", must be validated for each customer application by customer's technical experts. Freescale Semiconductor does not convey any license under its patent rights nor the rights of others. Freescale Semiconductor products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Freescale Semiconductor product could create a situation where personal injury or death may occur. Should Buyer purchase or use Freescale Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold Freescale Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Freescale Semiconductor was negligent regarding the design or manufacture of the part.

RoHS-compliant and/or Pb-free versions of Freescale products have the functionality and electrical characteristics as their non-RoHS-compliant and/or non-Pb-free counterparts. For further information, see <http://www.freescale.com> or contact your Freescale sales representative.

For information on Freescale's Environmental Products program, go to <http://www.freescale.com/epp>.

Freescale™ and the Freescale logo are trademarks of Freescale Semiconductor, Inc. All other product or service names are the property of their respective owners.  
© Freescale Semiconductor, Inc. 2010. All rights reserved.

Document Number: MPC5606SDEMOUG  
Rev. 0  
10/2010