AN2357
Application note

Connecting ST10F252 evaluation board to the airbag eva board

Introduction

The aim of this document is to provide the necessary information to implement the modifications to connect the ST airbag eva board (MB467) to the ST10F252 evaluation board (MB449).

A very brief application overview is followed by an explanation on how to manage the signals involved. Finally, hints on how to supply the entire system are provided.

Contents

1   Application overview

An airbag safety system interprets decelerations monitored by satellite sensors, identifies crash situations and actuates the squibs to inflate the balloons (see *Figure 1*).

Figure 1.   Airbag system
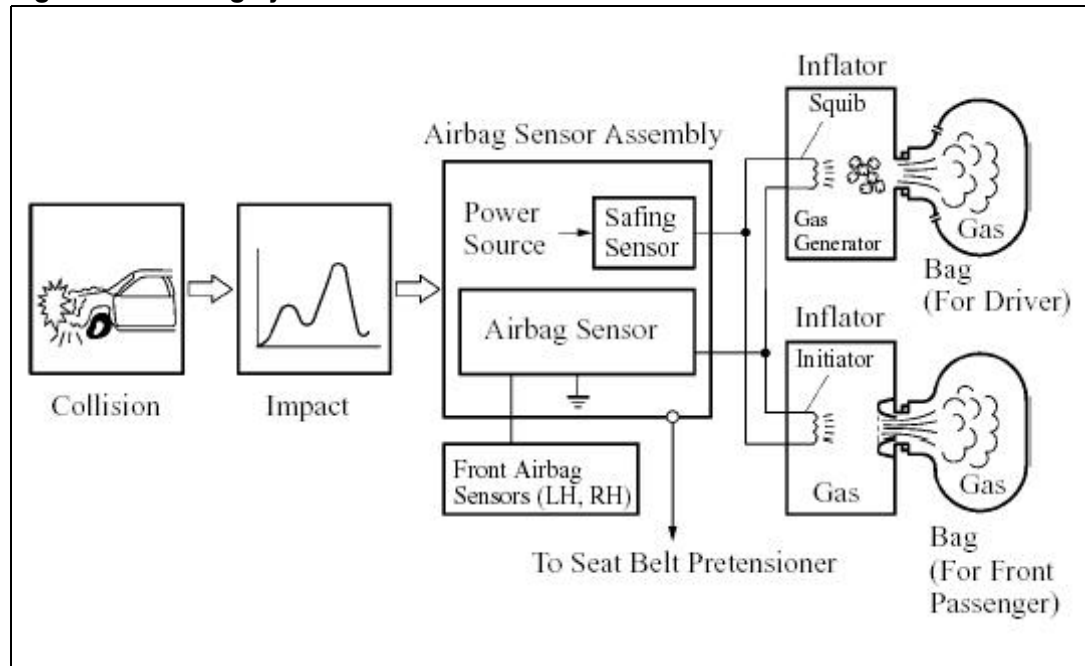
From a technical point of view, a typical airbag system comprises no less than:

● a microcontroller

● a squib driver, satellite/sensor interface

● satellites/sensors

● squibs

● a safety power regulator

STMicroelectronics offers a complete solution for the development of airbag systems, from microcontrollers, to squib and satellite drivers, to power regulators (see *Figure 2: Airbag system block diagram on page 4*).

Figure 2.   Airbag system block diagram
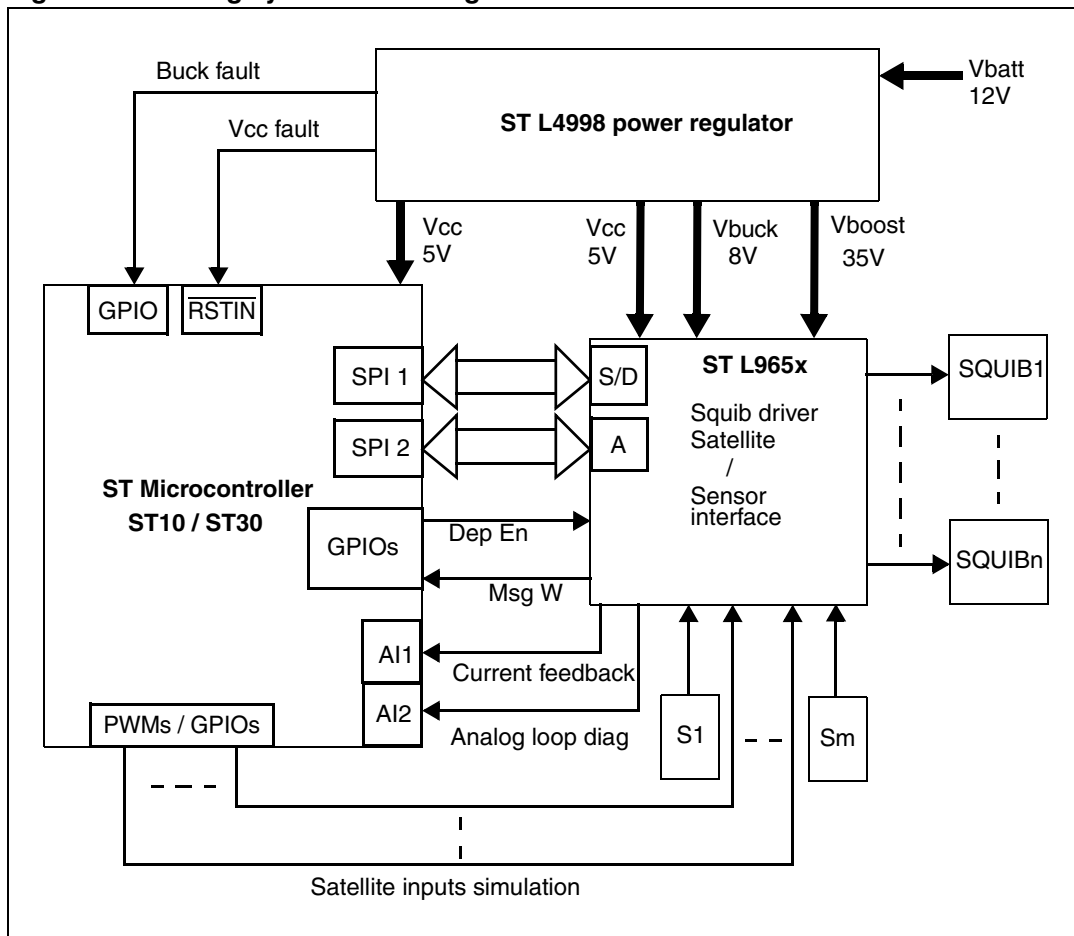
1.1   MB449 board

The MB449 ST10F25x Eva board is a standalone evaluation board for the ST10F252 and ST10F251 devices.

Main components:

● socket for ST10F25x microcontroller (TQFP100)

● 256Kx16 bit High Speed Static RAM

● L9616 CAN transceiver

● ST232ABDR RS232 transceiver

● standardized CPU board connector providing access to off-board I/O, PWM, SSC and power supply

Features:

● Support for the following interfaces:

– CAN

– RS232 serial port

● User buttons and LEDs

● Main power supply 5V

Please refer to the *MB449 User Manual* (UM0186) for more details about the board and to the *ST10F25x User Manual* for more details about the microcontroller functionalities.

1.2   MB467 board

The MB467 Airbag Eva board is a complete demonstrator of an airbag system based on STMicroelectronics devices. The board implements a flexible and open design demonstrating the capability of the STMicroelectronics 16-/32-bit microcontrollers and safing devices for airbag applications.

The MB467 Airbag Eva board mounts two safing devices with squib drivers and satellite sensor interfaces L9654 and L9658 plus a safety power regulator L4998. The board has open connectivity to ST CPU boards, squibs and to the external power supply. A prototyping area allows users to extend the board's functionality with specific circuitry.

Main components:

● L9658 octal squib driver and quad sensor interface ASIC for safety application
● L9654 quad squib driver and dual sensor interface ASIC for safety application
● L4998 safety power regulator
● standardized CPU board connector providing access to off-board I/O, PWM, SPI and power supply
● connector for squibs
● connector for satellites
● connector for Hall sensors

Features:

● Supports the ST30F7xx and ST10Fxxx Eva boards
● Support for up to 6 satellites or 4 satellites and 2 Hall sensors, real or simulated
● Support for up to 12 squibs, real or simulated
● Diagnostic testing and validation of safing functionality:
    – SPI arming and deployment
    – squibs and deployment drivers
    – loss of ground and short circuit
    – satellites communication
● On board standard 100 mils prototyping area
● Main power supply 12V

Please refer to the board *MB467 User Manual* (UM0178) for more details.

2 Interconnection organization: ST10F252 point of view

ST10F25x is a derivative of the STMicroelectronics ST10 family of 16-bit single chip CMOS microcontrollers. Unlike the other members of the family, ST10F25x is a 100-pin package. Due to this pin count limitation, some pin alternate functionalities have been either remapped on other pins or completely removed.

The airbag evaluation board has been designed to be coupled directly with the ST30F7xx boards, however with some minor modifications, this board can be adapted for use with ST10F25x board. In the remainder of the chapter all the signals involved will be examined in order to underline the differences and to provide the necessary modifications. *Figure 2: Airbag system block diagram on page 4* summarizes all the connections required.

2.1 Reset signal

The microcontroller reset signal ($\overline{RSTIN}$, pin A12 in the connector) is driven by the L4998 Safety Power Regulator (SPR); no other connection is necessary.

The SPR also provides an indication of the buck voltage (BCKFLT). This signal has been directed to an ST10F252 GPIO: Pin P2.3 (pin D18 on the connector), which can also be used as a CAPTURE input. No other connection is needed.

2.2 SPI (SSC) and CS signals

The ST10F25x and L965x communicate through two SPI interfaces: The first is dedicated to the deployment and the satellite communication (S/D in *Figure 2 on page 4*) and the other is used for the arming (A in *Figure 2*). In addition three chip select signals per device (total of six) are necessary to address each interface separately (satellite/sensor, deployment and arming).

The arming interface has been mapped on the standard ST10F252 SSC interface: MTSR0 pin P3.9, MRST0 pin P3.8, SCLK0 pin P3.13 (C26, D26, D25 respectively in the connector). Pin P3.0 and pin 3.7 (D30 and C27 in connector) have been designed to be used as CS for L9658 and L9654 respectively. No extra connection needed.

The satellite/sensor - deployment interface has been mapped on the other SSC interface, ST10F252 XSSC. In the ST10F252 XBUS peripherals use port P1. In detail MTSR1 is mapped on P1H.2 (A7), MRST1 pin P1H.1 (B6) and SCLK1 pin P1H.3 (B7). For this reason an external connection using dedicated wires between these pins of the connector are necessary:

● A7 <-> A16
● B6 <-> B16
● B7 <-> B15

No ST10F252 pin is linked to A16, B16 or B15 of the standard connector.

Moreover, two CS signals are used to address the satellite/sensor and deployment interface per each device (total of four). Some pins have been identified: Pin 3.6 (D27) as CS_S2

(L9654) does not need any other connection. The other pins chosen have no direct connection with ST10F252, therefore three output pins must be designed, for instance:

   – CS_S1 (L9658) can be connected to P1H.4 (A8)
   – CS_D1 (L9658) can be connected to P1H.5 (B8)
   – CS_D2 (L9654) can be connected to P1H.6 (A9)

In this case the following external connections are required:

● A8 <-> A25
● B8 <-> B25
● A9 <-> C29

Remember to free up port P1 from the address generation, using only multiplexed modes (external RAM present on the ST10F25x evaluation board cannot be used).

2.3 Analog inputs

The L9658 provides two analog outputs (IF3/IF4) reporting signals coming from Hall sensors plus an analog output (AOUT) for loop diagnostics.

The L9654 provides only an analog output (AOUT) signal.

Analog inputs port P5.0, port P5.1, port P5.2 and port P5.3 have been chosen. No other connections are needed.

2.4 Satellite inputs simulation

Satellite inputs to L965x can be emulated by the microcontroller for testing purposes. The L9658 supports up to four satellites whereas L9654 supports up to two satellites. For this reason up to six ST10F252 outputs must be dedicated to the satellite inputs simulation (either PWMs or GPIOs).

DICH1 and DICH2 (L9658) are linked to port P2.4 and port P2.5 respectively (GPIOs or COMPARE outputs). DICH5 and DICH6 are linked to port P4.2 and port P4.3 respectively (PWMs). Remember to set SW4.2 = OFF and SW4.3 = ON to disable segment address lines.

There is no direct correspondence for the remaining signals, DICH3 and DICH4. These two signals should be linked to other PWM outputs, for instance:

   – DICH3 can be connected to XPWM0, P1L.0 (A2)
   – DICH4 can be connected to XPWM1, P1L.1 (B2)

In this case the following external connections are required:

● A2 <-> A18
● B2 <-> B18

2.5 Message waiting signals management

There is another very important signal coming from L965x: Message Waiting (MSG). MSG can be configured active HIGH or active LOW. MSG is used only to notify that a satellite message is present in the satellite FIFO. The MSG signal related to L9658 is linked to port

P3.2. This pin is used as CAPIN (capture input) in the ST10 microcontroller; an interrupt is also linked to this event.

Since the MSG signal related to L9654 has no direct correspondence, an external connection is needed. An ST10F252 capture input can be used, for instance P1H.4 (B9), therefore:

● B9 <-> D17

2.6 Deployment enable signals

DEPEN (Deployment Enable) is the last signal used to start the deployment.

L9654 DEPEN has been designed to be connected to ST10F252 P4.0 (used as GPIO) whereas L9658 DEPEN is linked to P3.1 (used as GPIO as well). No extra connection is needed.

Table 1.   Connection table

External connection	Pin	Name	Description
none	A12	RESETB	Reset
A7	A16	MOSI	Satellite/Deployment: Data in
A2	A18	DICH3	Channel 3 Satellite/Sensor input simulation for L9658
none	A22	DEPEN2	Deployment enable input for L9654
none	A23	DICH5	Channel 1 Satellite input simulation for L9654
A8	A25	CS_S1	Chip select for Satellite Interface of L9658
none	A26	IF3	Current Feedback for channel 3 raw or data output for channel 3 of the L9658
none	A27	AOUT	Analog output for loop diagnostic for L9658
B7	B15	SCLK	Satellite/Deployment SPI: Clock
B6	B16	MISO	Satellite/Deployment SPI: Data Output
B2	B18	DICH4	Channel 4 Satellite/Sensor input simulation for L9658
none	B23	DICH6	Channel 2 Satellite input simulation for L9654
B8	B25	CS_D1	Chip select for Deployment Driver of L9658
none	B26	IF4	Current Feedback for channel 4 raw or data output for channel 4 of the L9658
none	B27	AOUT2	Analog output for loop diagnostic for L9654
none	C19	DICH1	Channel 1 Satellite input simulation for L9658
none	C26	MOSI_A	Arming SPI: Data In
none	C27	CS_A2	Chip select for Arming Interface of L9654
A9	C29	CS_D2	Chip select for Deployment Driver of L9654
none	C30	DEPEN1	Deployment enable input for L9658
B9	D17	MSG2	Message waiting for L9654

Table 1.   **Connection table (continued)**

External connection	Pin	Name	Description
none	D18	BCKFLT	Buck fault output
none	D19	DICH2	Channel 2 Satellite input simulation for L9658
none	D25	SCLK_A	Arming SPI: Clock
none	D26	MISO_A	Arming SPI: Data Out
none	D27	CS_S2	Chip select for Satellite Interface of L9654
none	D29	MSG	Message waiting for L9658
none	D30	CS_A1	Chip select for Arming Interface of L9658

3 How to supply the boards

Once coupled, both the boards can be supplied through only one power supply: 12V applied to the airbag eva board (airbag eva board jumpers J48 - J50 closed).

4   Revision history

Table 2.   Document revision history

Date	Revision	Changes
26-Jun-2006	1	Initial release

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