M68EVB912DG128/D
January 1999

M68EVB912DG128
EVALUATION BOARD
USER'S MANUAL

3rd Edition

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* Cautionary Note *

EMC Information on M68EVB912DG128

This product conforms with the protection requirements of Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.

(Directive 89/336/EEC amended by Directives 91/263/EEC, 92/31/EEC, 93/68/EEC, 93/97/EEC)

1) **This is a Class A product.**

   In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

2) **Anti-static precautions must be adhered to when using this product.**

1. Introduction

This manual provides the necessary information for using the M68EVB912DG128 Evaluation Board (EVB), an evaluation and debugging tool for the MC68HC912DG128 Microcontroller Unit (MCU) device. The manual includes a general description of the EVB as well as configuration and set-up instructions

2. General Description and Features

The EVB can be used in conjunction with an appropriate debugger tool that uses the background debug mode, such as Motorola's (or Noral's) Serial Debug Interface (SDI), and compatible debug software such as Motorola's MCUez or P&E's SDBUG12.

The board consists of a 4 layer PCB which provides the interface and power connections to the MC68HC912DG128 microcontroller (MCU).

Hardware features include the following:

- Single 5 V dc power supply connector
- RS-232C Interface
- BDM In connector providing interface to Background Debug Mode
- 16 MHz oscillator module
- Prototype expansion area for customised interfacing with the MCU
- Low-voltage inhibit protection
- CAN Physical Interfaces
- Chargepump for the supply of the flash programming voltage
- Bargraph LED to assist with debugging
- 8 way DIP switch to assist with debugging

The EVB is factory configured to start in single chip or special single chip mode. It is supplied with the flash EEPROM unprogrammed and can be run with an appropriate debugger, via the Background Debug Mode (BDM) interface.

The EVB features a prototype area, which allows custom interfacing with the MCU's I/O and bus lines. The MCU pins can be accessed via header footprints immediately adjacent to the MCU.

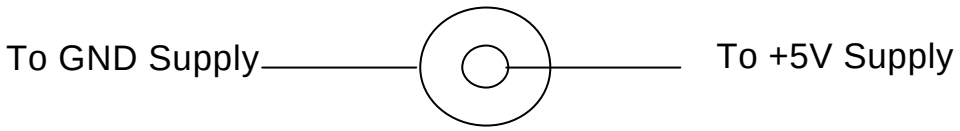
An on-board push-button switch, S2, allows the EVB hardware to be manually reset.

Two CAN physical interfaces are provided on the board. These comprise of Philips PCA82C250 CAN Interface controllers.

3. Hardware Reference

3.1 Power Supply

The EVB requires an external +5 volt power supply for operation. Ideally this should be current limited to 200mA. Power is supplied to the EVB via the power socket, P6. A 2.5mm power plug has been included in the M68EVB912DG128 kit to allow the user to power the EVB from a standard desktop power supply. To do this the user should solder insulated wires onto the two terminals of the power plug, and then connect the other ends of the wires up to their power supply. Great care should be taken to ensure that the 5 Volt supply is connected to the internal part of the power plug and the Gnd supply is connected to the external barrel of the power plug.



3.2 BDM In Connector

The EVB can be used in conjunction with a suitable Background Debug Mode (BDM) debugger interface, such as the SDI, and appropriate debugger software. The BDM input to the EVB is via jumper J16. Table 3-1 shows the pinout for J16.

3.3 MCU Operating Mode

Jumpers J24 and J25 allow the user to select which mode the MCU starts in after reset by controlling the state of the MODA and MODB pins. The default mode is to pull the MCU MODA and MODB pins to ground. This results in the MCU starting from reset in either Single Chip or Special Single Chip mode (dependant on the state of the BKGD pin).

The state of the MODA and MODB pins can also be set via the Noral SDI cable. When this option is used it is not necessary to install links on jumpers J24 and J25.

3.4 Clock

A 16 MHz oscillator module provides the clock signal to the MCU. Jumper J27 must be installed between pins 1 and 2 (factory default) to configure the clock signal correctly.

3.5 RS-232C Interface

An RS-232C interface is provided on the EVB through a 9 way D type connector, P1. Signal level translation between the MCU and P1 is provided by an MC145407 RS-232 interface IC (U3) . This is connected to the TxD and RxD pins of the Serial Communications Interface (SCI) on the MC68HC912DG128 via jumpers J11 (TxD) and J9 (RxD). As there are two serial communications interface modules supplied on the MCU, jumpers J9 and J11 can be used to select between them. The EVB has been configured to act as Data Circuit-terminating Equipment (DCE). Removing jumpers J8, J10 and J13 allows the user to disable this function if it is not required.

3.6 CAN Physical Interfaces

There are two CAN physical interfaces supplied on the M68EVB912DG128. The CAN0 physical interface comprises a Philips PCA82C250 CAN Interface controller (U1).The TXD and RXD pins on the PCA82C250 are

connected to the CANTX and CANRX pins, on the MC68HC912DG128, respectively. The CAN bus signals, CANH and CANL are available on jumper J1. Table 3-1 shows the pinout for J1.

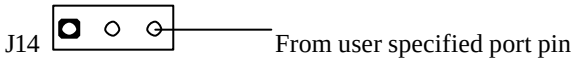
Similarly, the CAN1 physical interface also comprises a Philips PCA82C250 CAN interface controller (U2). The TXD and RXD pins on the PCA82C250 are connected to the PCAN3 and PCAN2 pins on the MC68HC912DG128, respectively. The CAN bus signals, CANH and CANL are available on jumper J2. Table 3-1 shows the pinout for J2.

3.7 Programming Operation

It is possible to configure the M68EVB912DG128 as a programming tool. To do this the relevant programming adapter board has to be purchased (contact Motorola for further details). To configure the EVB as a programming tool, the adapter board has to be connected to the header strips on the EVB (when doing this care should be taken to ensure that the adapter board is installed with the correct polarity as failure to do so could result in damage to the device being programmed). It is also necessary to install the jumpers on header P8 in the PGMR position.

There are two possible ways of supplying the flash EEPROM programming voltage V_{FP} to the MCU, either via the MAX662 chargepump I.C. (U5), or via the SDI cable. The source of the flash EEPROM programming voltage can be selected via jumper J17.

There is an option for controlling the operation of the chargepump I.C. (U5). If there is no jumper link installed on Jumper J14, then the V_{FP} supply will be held at the level of V_{DD}. If a jumper link is installed on Jumper J14 then 12V will be supplied to the V_{FP} pin of the MCU. In addition to this there is an option which allows the user to control the operation of the chargepump I.C. via a port pin of their choice. To do this the user must connect a wire between the pad situated to the right hand side of Jumper J14 and the pad of the port pin they want to use as the controller. When this option is chosen the user must remove the jumper link from jumper J14.



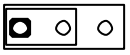
3.8 Jumper Configuration

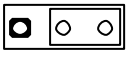
Table 3-1 summarises the jumper and header configurations for the EVB.

Key to Table 3-1

 2 pin header with no jumper installed

 2 pin header with jumper installed

 3 pin header with jumper installed between pins 1 and 2

 3 pin header with jumper installed between pins 2 and 3

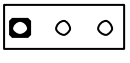
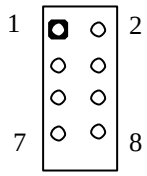
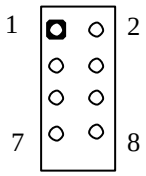
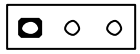
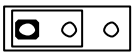
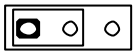
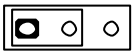
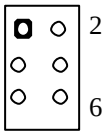
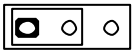
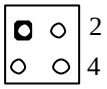
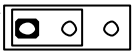
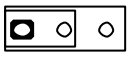
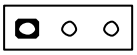
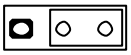
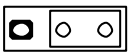
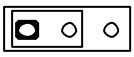
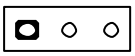
 3 pin header with no jumper installed

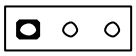
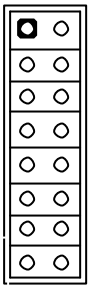
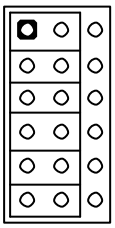
Table 3-1 - Jumper and Header Functions

(default Factory configurations shown as **bold type**)

Diagram	Pins	Description
J1 - CAN0 Physical Interface Connector		
	1 2 3 4 5 6 7 8	GND GND CANH CANH CANL CANL GND GND
J2 - CAN1 Physical Interface Connector		
	1 2 3 4 5 6 7 8	GND GND CANH CANH CANL CANL GND GND
J3 - VRH1 Voltage Select		
	**In**	**Connects VRH1 pin to VCC**
J4 - CAN1 Physical Interface 120 Ohm termination impedance		
	In	Connects 120 Ohm termination impedance to CAN1 bus
J5 - CAN0 Physical Interface 120 Ohm termination impedance		
	In	Connects 120 Ohm termination impedance to CAN0 bus
J6 - VRL1 Voltage Select		
	**In**	**Connects VRL1 pin to GND**
J7 - Port G - Pull Up/Down Select (D60 Only)		
	1 - 2 2 - 3	Port G pulled to VCC via 47K Port G pulled to GND via 47K

J8/J10/J13 - RS-232 Configuration (DCE)		
J13  J8  J10 	**In** **In** **In**	
J9 - SCI RxD Module Select		
PS0  PS2	**PS0** PS2	**Rxd0 connected to RS-232 Interface** Rxd1 connected to RS-232 Interface
J11 - SCI TxD Module Select		
PS1  PS3	**PS1** PS3	**Txd0 connected to RS-232 Interface** Txd1 connected to RS-232 Interface
J12 - VDDAD Supply		
ON  OFF	**ON** OFF	**VDDAD pin connected to VCC** VDDAD pin connected to GND
J14 - MAX662A Shutdown Voltage Source Select		
VFP ENABLE 	In **Out**	12V supplied to VFP pin **VFP pin held at VCC**
J15 – IDD Measurement		
	**In**	**For factory test purposes only**
J16 - BDM In		
1  2 5 6	1 2 3 4 5 6	BKGD GND No Connect *RESET EXTVPP VCC
J17 - VFP Source Select		
ICVPP  SDIVPP	**ICVPP** SDIVPP	**VFP supplied from chargepump I.C. (U5)** VFP supplied via Noral SDI cable
J18 - VRL0 Voltage Select		
	**In**	**Connects VRL0 pin to GND**

J19 - VRH0 Voltage Select		
	**In**	**Connects VRH0 pin to VCC**
J20 - Noral SDI Connector		
1  2 3 4	1 2 3 4	MODA MODB GND ECLK
J21 - VDDPLL Supply		
ON  OFF	**ON** OFF	**VDDPLL pin connected to VCC** VDDPLL pin connected to GND
J22 - D60 /DG128 Selection Jumper		
DG128  D60	**DG128** D60	**RAM standby voltage connected to VCC (DG128 only)** Port H pull up/pull down select (D60 only)
J23 - Port H - Pull Up/Down Select (D60 Only)		
1 	1 - 2 2 - 3	Port H pulled to VCC via 47K Port H pulled to GND via 47K
J24 - MODA Pull Up/Down Select		
1 	1 - 2 **2 - 3**	MODA pulled to VCC via 47K. **MODA pulled to GND via 47K.**
J25 - MODB Pull Up/Down Select		
1 	1 - 2 **2 - 3**	MODB pulled to VCC via 47K. **MODB pulled to GND via 47K.**
J26 - XTAL Select		
	Out	Connect external crystal circuit to XTAL pin
J27 - EXTAL - Clock source select		
FROM U6  FROM Y1	**1 - 2** 2 - 3	**Connect U6 (Osc. Module) output to EXTAL** Connect external crystal circuit to EXTAL
J29 – PAD0 – Pull Up/Down Select		
ON  OFF	ON OFF	PAD0 pulled to VCC via 15K PAD0 pulled to GND via 15K

J30 – PAD1– Pull Up/Down Select		
ON  OFF	ON OFF	PAD1 pulled to VCC via 15K PAD1 pulled to GND via 15K
P4 – Connection to Bargraph LED		
PB0  PB7	**IN** **IN** **IN** **IN** **IN** **IN** **IN** **IN**	**PB0 connected to LED** **PB1 connected to LED** **PB2 connected to LED** **PB3 connected to LED** **PB4 connected to LED** **PB5 connected to LED** **PB6 connected to LED** **PB7 connected to LED**
P8 – EVB/PGMR Selection Jumper		
EVB  PGMR	**EVB** **EVB** **EVB** **EVB** **EVB** **EVB**	