



# MICROCHIP SAMRH707 100-Pin Motor Control Plug-In Module User Guide

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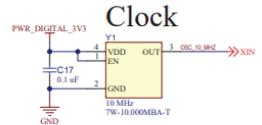
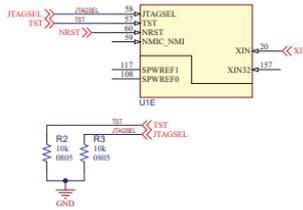
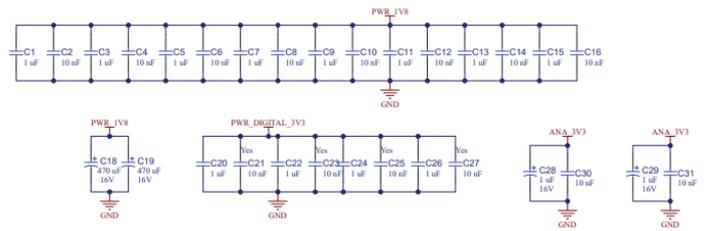
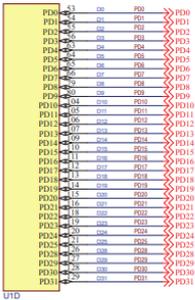
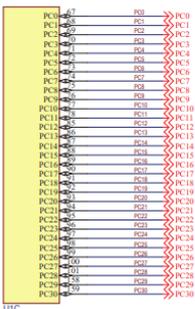
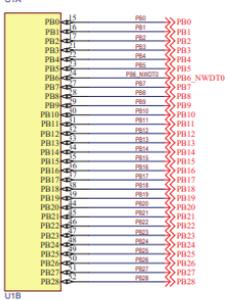
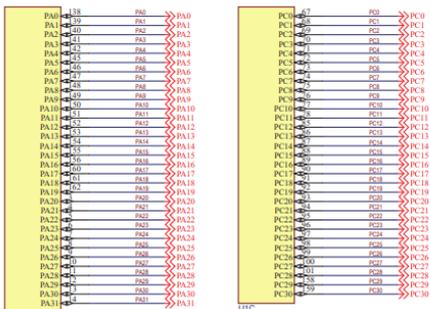
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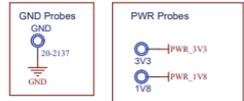
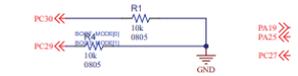
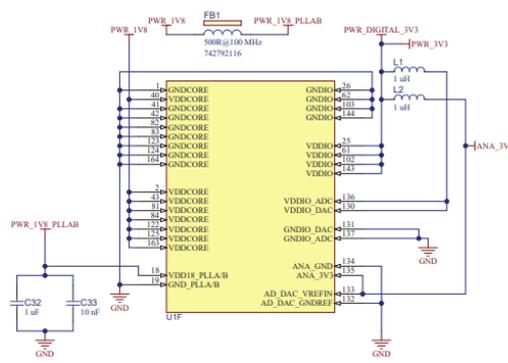
**SAMRH707 100-Pin Motor Control Plug-In Module**

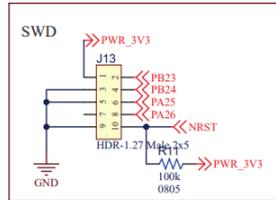
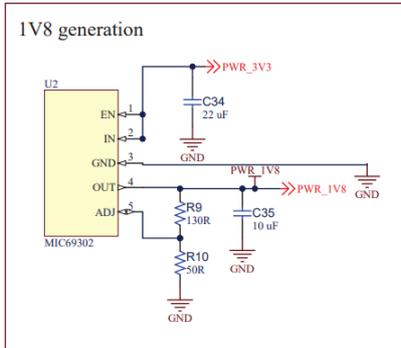
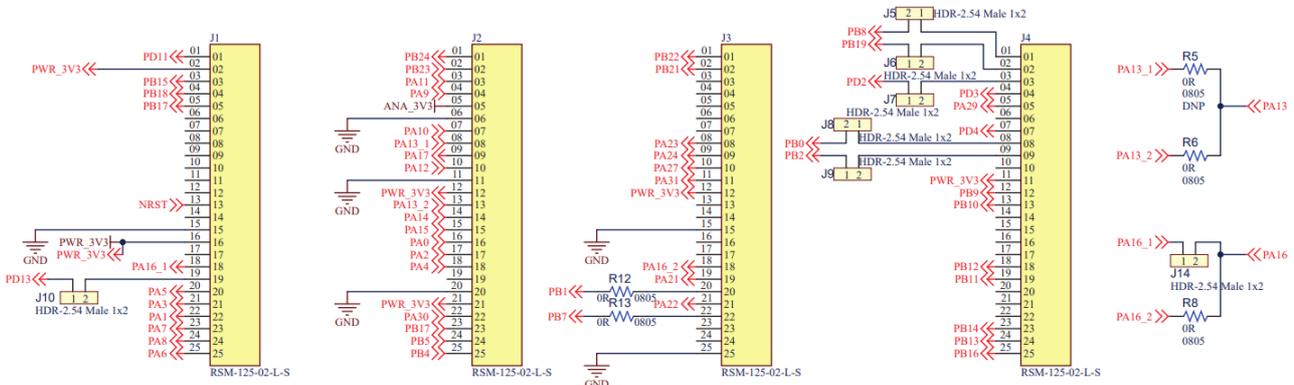


## WIRING DIAGRAMS



### Boot on internal Flash only





PIM CONF	MCLV2	MCHV3	MCSM
J14 (PA16_1)	CLOSE	CLOSE	OPEN
J5 (PB8)	-	CLOSE	-
J6 (PB19)	-	CLOSE	OPEN
J7 (PD2)	-	CLOSE	OPEN
J8 (PB0)	CLOSE	-	-
J9 (PB2)	CLOSE	-	-
J10 (PD13)	-	CLOSE	OPEN

## Product Information

### SAMRH707 100-Pin Motor Control Plug-In Module

The SAMRH707 100-Pin Motor Control Plug-In Module is designed to demonstrate the capabilities of the SAMRH707 164-pin Motor Control devices. It is equipped with jumpers that can be configured to work on MCLV-2 Board PMSM Motors, MCHV-3 Board PMSM Motors, or MCSM Board Stepper Motors. The PIM to MCU mapping table provides the static mapping between the 100-pin PIM pins and the 164-pin device pins. The module also comes with a warning regarding the use of non-isolated oscilloscope probes while using the PIM with the dsPICDEM MCHV-3 development boards.

### Product Usage Instructions

1. Identify the application board to be used with the module: MCLV-2 Board PMSM Motors, MCHV-3 Board PMSM Motors, or MCSM Board Stepper Motors.
2. Configure the jumpers according to Table 1-1. Jumpers Configuration for the identified application board.
3. Refer to Table 2-1. PIM to MCU Mapping for the static mapping between the 100-pin PIM pins and the 164-pin device pins.
4. Follow the product manual for the identified application board to connect the module properly.
5. While using the PIM with the dsPICDEM MCHV-3 development boards, use a high-voltage differential probe, rated in excess of 600 VRMS (Common mode). Do not connect non-isolated oscilloscope probes to probe any traces.

### Introduction

The SAMRH707 100-pin Motor Control Plug-in Module (PIM), SAMRH707F18-PIM, is designed to demonstrate the capabilities of the SAMRH707 164-pin Motor Control devices with the following hardware:

- The dsPICDEM™ MCLV-2 development board (DM330021-2) (using external op amps)
- The dsPICDEM™ MCHV-3 development board (DM330023-3) (using external op amps)
- The dsPICDEM™ MCSM development board (DM330022)

All development boards support 100-pin PIM interfaces. The SAMRH707 100-pin Motor Control PIM is designed to use on board external op amps for signal conditioning of analog feedback inputs when used with MCLV-2 or MCHV-3.

For the dsPICDEM™ MCLV-2 development board, insert the external op amp configuration board (included with the development board) at header J14.

For the dsPICDEM™ MCHV-3 development board, insert the PFC-EXT-OPAMP configuration board (included with the development board) at header J4.

The following figures show the op amp configuration board for the dsPICDEM™ MCLV-2 and dsPICDEM™ MCHV-3 development boards.

Op amp Configuration Board for dsPICDEM™ MCLV-2



Op amp Configuration Board for dsPICDEM™ MCHV-3



**WARNING:** Do not connect non-isolated oscilloscope probes to probe any traces while using the PIM with the dsPICDEM MCHV-3 development boards. Instead, use a high-voltage differential probe, rated in excess of 600 VRMS (Common mode). Failure to heed this warning could result in hardware damage.

## Jumpers Configuration

The SAMRH707 100-pin Motor Control PIM can be used on the following boards:

- The dsPICDEM™ MCLV-2 development board (DM330021-2)
- The dsPICDEM™ MCHV-3 development board (DM330023-3)
- The dsPICDEM™ MCSM development board (DM330022)

For that, the jumpers are configured as follows:

**Table 1-1. Jumpers Configuration**

MCLV-2 Board PMSM Motors		MCHV-3 Board PMSM Motors		MCSM Board Steppers Motors	
J14	CLOSE	J14	CLOSE	J14	OPEN
J5	OPEN/CLOSE	J5	CLOSE	J5	OPEN
J6	OPEN/CLOSE	J6	CLOSE	J6	OPEN
J7	OPEN/CLOSE	J7	CLOSE	J7	OPEN
J8	CLOSE	J8	OPEN/CLOSE	J8	OPEN
J9	CLOSE	J9	OPEN/CLOSE	J9	OPEN
J10	OPEN/CLOSE	J10	CLOSE	J10	OPEN

## PIM to MCU Mapping

The following table provides the static mapping between the 100-pin PIM pins and the 164-pin device pins.

**Table 2-1. PIM to MCU Mapping**

PIM Connector PIN	MCLV2 100-pin connection		MCHV3 100-pin connection		100-pin connector signal name	MCSM Development Board		SAMRH707 MCU Pin	SAMRH707 Pin Number
	Pin Name	Functionality	Pin Name	Functionality		Pin Name	Functionality		
1	DBG_LED2	Debug_LED_2	DBG_LED1	Debug_LED_1	LED2	—	NC	PD11	105
2	VDD	NC	VDD	NC	VDD	VDD	Digital Supply	VDDIO	25
3	PWM1H3	PWM Output – 3H	PWM1H3	PWM Output – 3H	PWM1H3	PWM1H3	PWM Output	PB15_PWMC0_PWMH2	35
4	NC	NC	NC	NC	NC	PWM2L1	PWM Output	PB18_PWMC0_PWML3	38

5	NC	NC	NC	NC	NC	PWM2 H1	PWM Output	PB17_ PWMC0_ PWMH3_ TIO B1	37
6	NC	NC	NC	NC	NC	—	NC	—	—
7	NC	NC	NC	NC	NC	—	NC	—	—
8	NC	NC	NC	NC	NC	—	NC	—	—
9	NC	NC	NC	NC	NC	—	NC	—	—
10	NC	NC	NC	NC	NC	—	NC	—	—
11	NC	NC	NC	NC	NC	—	NC	—	—
12	NC	NC	NC	NC	NC	—	NC	—	—
13	MCLR	Device Mas ter Clear	MCLR	Device Mas ter Clear	NRST	{MCLR}	Device Master Clea r	NRST	60
14	NC	NC	NC	NC	NC	—	NC	—	—
15	VSS	NC	VSS	NC	VSS	VSS	Digital Supply Gro und	GNDIO	26
16	VDD	NC	VDD	NC	VDD	VDD	Digital Supply	VDDIO	25
17	NC	NC	NC	NC	NC	—	NC	—	—
18	FAULT	DC bus Cur rent Fault (a ctive-low lo gic)	FAULT	DC bus Cur rent Fault (a ctive-low lo gic)	FAULT _PWM	PWM2 H1	PWM Output	PA16_ PWMC0_ _PWMF12	156
19	NC	NC	PFC_FL T	IPFC Fault ( overvoltage or overcurre nt)	PFC_ EN_FL T	PWM2L 1	PWM Output	PD13	107
20	PIM_V_ M3	Voltage fee dback signa l	PIM_IN DX/POT / V_M3	Hall Sensor/Curr ent Sense/ Voltage Fee dback signa l	NC	POT	Potentiomet er signal	PA05_AD5	145
21	PIM_V_ M2	Voltage fee dback signa l	PIM_Q EB/IB/V _M2	Hall Sensor/Curr ent Sense/ Voltage Fee dback signa l	NC	—	NC	PA03_AD3	141

22	PIM_V_M1	Voltage feedback signal	PIM_QEA/IA/V_M1	Hall Sensor/Current Sense/Voltage Feedback signal	NC	POT	Potentiometer signal	PA01_AD1	139
23	PIM_IMOTOR_SUM	DC bus current signal	PIM_IBUS/VBUS	DC bus Voltage (downscaled)	VBUS2	DC_REF	DC Bus Voltage (downscaled)	PA07_AD7	147
24	PIM_IMOTOR2	Phase current signal	PIM_IB/POT	AC Input Zero Cross/AC Input Voltage (downscaled)/ Potentiometer	NC	IMOTOR2	Phase 1 Current signal	PA08_AD8	148
25	PIM_IMOTOR1	Phase current signal	PIM_IA/IPFC	PFC Current (buffered)	NC	IMOTOR1	Phase 2 Current signal	PA06_AD6	146
26	PGC	Device programming clock line	PGC	Device programming clock line	NC	PGC	Device programming clock line	PB24_TCK_SWCLK	48
27	PGD	Device programming data line	PGD	Device programming data line	NC	PGD	Device programming data line	PB23_TMS_SWDIO	47
28	VREF	Reference voltage (half of AVDD voltage)	AVDD/2	Reference voltage (half of AVDD voltage)	VREF	—	NC	PA11_AD11	151
29	PIM_REC_NEUTR	Reconstructed motor neutral line voltage	PIM_REC_NEUTR	Reconstructed motor neutral line voltage	NEUTR	—	NC	PA09_AD9	149
30	AVDD	Analog supply	AVDD	Analog supply	AVDD	AVDD	Analog Supply	ANA_3V3	135
31	AVSS	Analog supply	AVSS	Analog supply	GND	AVSS	Analog Supply Ground	ANA_GND	134
32	PIM_POT	Potentiometer signal	PIM_POT	Potentiometer signal	POT	—	NC	PA10_AD10	150
33	NC	NC	PIM_POT	Potentiometer signal	NC	—	NC	PA13_AD13	153
34	PIM_GEN2	General I/O	PIM_GEN2	General I/O	NC	—	NC	PA17	160

35	PIM_VBUS	DC bus voltage (downscaled)	PIM_VBUS	DC bus voltage (downscaled)	VBUS1	DC_RE F	DC Bus Voltage (downscaled)	PA12_AD12	152
36	VSS	NC	VSS	NC	VSS	VSS	Digital Supply Ground	GNDIO	26
37	VDD	NC	VDD	NC	VDD	VDD	Digital Supply	VDDIO	25
38	NC	NC	PIM_VAC_VOL2	AC input voltage (unbuffered)	NC	—	NC	PA13_AD13	153
39	NC	NC	PB00_AFE0_CH10_BEMF_W_ADC	PFC shunt signal	NC	—	NC	PA14_AD14	154
40	NC	NC	PIM_PFC_L	PFC shunt signal	NC	—	NC	PA15_AD15	155

PIM Connector PIN	MCLV2 100-pin connection		MCHV3 100-pin connection		100-pin connector signal name	MCSM Development Board		SAMRH707 MCU Pin	SAMRH707 Pin Number
	Pin Name	Functionality	Pin Name	Functionality		Pin Name	Functionality		
41	PIM_MONITOR_1	Hall sensor/ current sense/ voltage feedback signal	PIM_VM1/POT	Hall sensor/ current sense/ voltage feedback signal	Ph_Cur_1	POT	Potentiometer signal	PA00_AD0	138
42	PIM_MONITOR_2	Hall sensor/ current sense/ voltage feedback signal	PIM_VM2	Hall sensor/ current sense/ voltage feedback signal	Ph_Cur_2	—	NC	PA02_AD2	140
43	PIM_MONITOR_3	Hall sensor/ current sense/ voltage feedback signal	PIM_VM3/IBUS	Hall sensor/ current sense/ voltage feedback signal	I_Shunt	—	NC	PA04_AD4	142
44	NC	NC	NC	NC	NC	—	NC	—	—
45	VSS	NC	VSS	NC	VSS	VSS	Digital Supply Ground	GNDIO	26

46	VDD	NC	VDD	NC	VDD	VDD	Digital Supply	VDDIO	25
47	HALLB	Hall sensor/ QEI input	HB/QE B	Hall sensor/ QEI input	HALLB _QEB	—	NC	PA30_TIOB0	13
48	HALLC	Hall sensor/ QEI input	HC/IND X	Hall sensor/ QEI input	HALL C_QIN DX	—	NC	PB17_PWM C0_PWMH3_ TIO B1	37
49	RX	UART Rece ive	RX	UART Rece ive	PA09_ URXD 0	USB_R X	UART Receive	PB05_FLEX COM1_IO1	23
50	TX	UART Trans mit	TX	UART Trans mit	PA10_ UTXD 0	USB_T X	UART Trans mit	PB04_FLEX COM1_IO0	22
51	USB_T X	UART Trans mit (connected directly to U 7)	NC	NC	NC	USB_T X	UART Trans mit	PB22_FLEC XOM3_IO0	46
52	USB_R X	UART Rece ive (connect ed directly t o U7)	NC	NC	NC	USB_R X	UART Receive	PB21_FLEX COM3_IO1	45
53	NC	NC	NC	NC	NC	—	NC	—	—
54	NC	NC	NC	NC	NC	USB_V BUS	USB VBUS	—	—
55	NC	NC	NC	NC	NC	USB_3. 3V	NC	—	—
56	NC	NC	NC	NC	NC	USB_D- -	USB Data -	—	—
57	NC	NC	NC	NC	NC	USB_D +	USB Data +	—	—
58	PIM_FL T_OUT 2	General I/O	PIM_FL T_OUT 2 (VAC ZC)	General I/O	PFC_ VACZ C	—	NC	PA23	6
59	PIM_FL T_OUT 1	General I/O	PIM_FL T_OUT 1 (IPFC )	General I/O	PFC_I	—	NC	PA24	7
60	DBG_L ED1	Debug LED 1	DBG_L ED2	Debug LED 2	LED1	—	NC	PA27	10

61	HOME	Home signal for QE1	HOME	Home signal for QE1	NC	—	NC	PA31	14
62	VDD	NC	VDD	NC	VDD	VDD	Digital Supply	VDDIO	25
63	OSC1/CLKO	Crystal osc in	OSCI	Crystal osc in	NC	OSCI	Crystal Oscillator In	—	—
64	OSC2/CLKI	Crystal osc out	OSCO	Crystal osc out	NC	OSCO	Crystal Oscillator Out	—	—
65	VSS	NC	VSS	NC	VSS	VSS	Digital Supply Ground	GNDIO	26
66	PIM_IB US+	BUS current shunt signal	PIM_IB US+	BUS current shunt signal	NC	—	NC	—	—
67	PIM_IB US-	BUS current shunt signal	PIM_IB US-	BUS current shunt signal	NC	—	NC	—	—
68	LIN_CS	LIN chip select signal	BTN	Push button	NC	FAULT_1	Fault signal	PA16_PWM C0_PWMF12	156
69	LIN_FAULT	LIN fault signal	NC	NC	NC	—	NC	PA21	4
70	NC	NC	NC	NC	NC	BTN_1	Push Button S1 Input	PB01_PWM C0_PWMEX TRG 1	16
71	NC	NC	PIM_PFC_PWM	PFC PWM output	NC	—	NC	PA22	5
72	NC	NC	HA/QEA	Hall Sensor/QEI Input	NC	—	NC	PB07_TIOA3	27
73	PIM_IB +	IMOTOR1 shunt signal	PIM_IB +	IB shunt signal	NC	—	NC	—	—
74	PIM_IA +	IMOTOR2 shunt signal	PIM_IA +	IA shunt signal	NC	—	NC	—	—
75	VSS	NC	VSS	NC	VSS	VSS	Digital Supply Ground	GNDIO	26
76	NC	NC	HB/QEB	Hall Sensor/QEI Input	NC	USB_TX	USB TX	PB08_TIOB3	28

77	NC	NC	PIM_H ALLC/ NDX/ S TP_PW M	Hall Sensor/QEI Input	NC	PWM2 H1	PWM Outpu t	PB19	39
78	NC	NC	PIM_PFC C_PW M	PFC PWM output	PFC_ PWM	PWM2L 1	PWM Outpu t	PD02	55
79	NC	NC	VACZX	AC Input ze ro crossing	NC	—	NC	PD03	56
80	HALLA	Hall Sensor/QEI Input	HA/QE A	Hall Sensor/QEI Input	HALLA _QEA	—	NC	PA29_TIOA0	12
81	NC	NC	NC	NC	NC	—	NC	—	—
82	PIM_G EN1	General I/O	PIM_G EN1	General I/O	NC	—	NC	PD04	63
83	BTN_1	Push-button S2 input	NC	NC	BTN1	USB_T X	USB TX	PB00	15
84	BTN_2	Push-button S3 input	NC	NC	BTN2	USB_R X	USB RX	PB02	17
85	NC	NC	NC	NC	NC	—	NC	—	—
86	VDD	NC	VDD	NC	VDD	VDD	Digital Supp ly	VDDIO	25
87	CAN_R X	CAN receiv e	NC	NC	NC	—	NC	PB09_CANR X1	29
88	CAN_T X	CAN transmit	NC	NC	NC	—	NC	PB10_CANT X1	30
89	NC	NC	NC	NC	NC	—	NC	—	—
90	NC	NC	NC	NC	NC	—	NC	—	—
91	NC	NC	NC	NC	NC	—	NC	—	—
92	NC	NC	NC	NC	NC	—	NC	—	—

PIM Connector PIN	MCLV2 100-pin connection		MCHV3 100-pin connection		100-pin connector signal name	MCSM Development Board		SAMRH707 MCU Pin	SAMRH707 Pin Number
	Pin Name	Functionality	Pin Name	Functionality		Pin Name	Functionality		
93	PWM1L1	PWM Output – 1L	PWM1L1	PWM Output – 1L	PWM1L1	PWM1L1	PWM Output	PB12_PWMCO_PWML0	32
94	PWM1H1	PWM Output – 1H	PWM1H1	PWM Output – 1H	PWM1H1	PWM1H1	PWM Output	PB11_PWMCO_PWML0	31
95	NC	NC	NC	NC	NC	—	NC	—	—
96	NC	NC	NC	NC	NC	—	NC	—	—
97	NC	NC	NC	NC	NC	—	NC	—	—
98	PWM1L2	PWM Output – 2L	PWM1L2	PWM Output – 2L	PWM1L2	PWM1L2	PWM Output	PB14_PWMCO_PWML1_TIO B4	34
99	PWM1H2	PWM Output – 2H	PWM1H2	PWM Output – 2H	PWM1H2	PWM1H2	PWM Output	PB13_PWMCO_PWML1	33
100	PWM1L3	PWM Output – 3L	PWM1L3	PWM Output – 3L	PWM1L3	PWM1L3	PWM Output	PB16_PWMCO_PWML2	36

The following figures show the SAMRH707 Motor Control PIM schematic diagrams.

## Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Revision	Date	Description
A	10/2022	Initial Revision

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