ATSAMC21 100-pin Motor Control Plug-In Module (PIM) Information Sheet

Introduction

The ATSAMC21 100-Pin Motor Control Plug-in Module (PIM), MA320206, is designed to demonstrate the capabilities of ATSAMC21 64-pin Motor Control devices using external op amps with the following hardware:

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

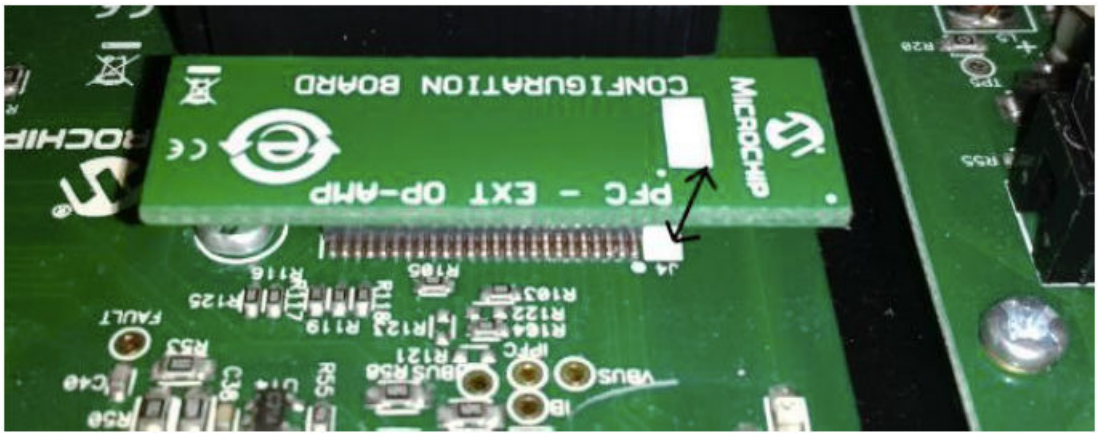
Both development boards support 100-pin PIM interfaces. ATSAMC21 Motor Control PIM is designed to utilize on board external op amps for signal conditioning of analog feedback inputs.

For the dsPICDEM™ MCLV-2 development board, insert 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.

Figure 1. Op amp Configuration Board for dsPICDEM™ MCLV-2

Figure 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.

Programming or Debugging:

Use the following two methods to program and debug software on ATSAMC21 Motor Control PIM:

1. In-Circuit Debugger: ATSAMC21 Motor Control PIM can be programmed and debugged using the following debugging tools which are connected to the board using a CoreSight 10 connector:
   1.1. MPLAB ICD4 In-Circuit Debugger
   1.2. ATMEL ICE
   1.3. SAM ICE
2. Isolated EDBG Interface (AC320202): This daughter board provides an isolated programming and debugging interface for the ATSAMC21 Motor Control PIM. This daughter board is compatible with dsPICDEMTM MCHV-2/ MCHV-3 boards. Refer to the Information Sheet of this daughter board for additional information.

1. PIM to MCU Mapping

The following table provides the static mapping between the 100-pin PIM pins and the 64-pin device pins.

Table 1-1.

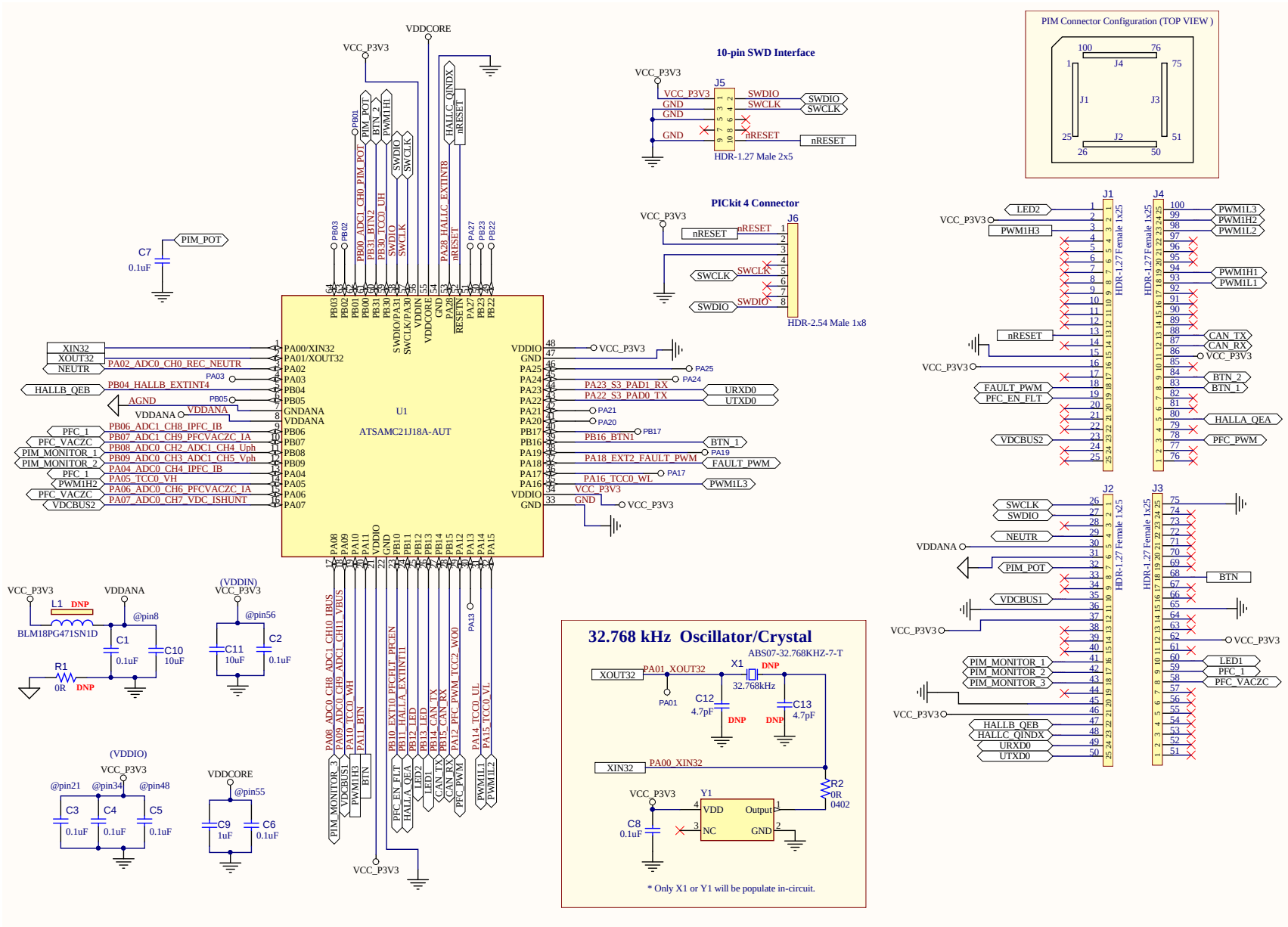
PIM Connector PIN	MCLV2 100-pin connection		MCHV3 100-pin connection			SAMC21 MCU Pin	MCU Pin
	Pin Name	Functionality	Pin Name	Functionality	100-pin connector signal name		
1	DBG_LED2	Debug LED 2	DBG_LED1	Debug LED 1	LED2	PB12_LED	25
2	VDD	NC	VDD	NC	VDD	-	21,34,48,56
3	PWM1H3	PWM Output - 3H	PWM1H3	PWM Output - 3H	PWM1H3	PA10_TCC0_WH	19
4	NC	NC	NC	NC	NC	-	-
5	NC	NC	NC	NC	NC	-	-
6	NC	NC	NC	NC	NC	-	-
7	NC	NC	NC	NC	NC	-	-
8	NC	NC	NC	NC	NC	-	-
9	NC	NC	NC	NC	NC	-	-
10	NC	NC	NC	NC	NC	-	-
11	NC	NC	NC	NC	NC	-	-
12	NC	NC	NC	NC	NC	-	-
13	MCLR	Device Master Clear	MCLR	Device Master Clear	NRST	nRESET	52
14	NC	NC	NC	NC	NC	-	-
15	VSS	NC	VSS	NC	VSS	-	22,33,47,54
16	VDD	NC	VDD	NC	VDD	-	21,34,48,56
17	NC	NC	NC	NC	NC	-	-
18	FAULT	DC Bus Current Fault (active-low logic)	FAULT	DC Bus Current Fault (activ- low logic)	FAULT_PWM	PA18_EXT2_FAULT_PWM	37
19	TX	UART Transmit	PFC_FLT	IPFC Fault (overvoltage or overcurrent)	PFC_EN_FLT	PB10_EXT10_PFCFLT_PFCEN	23
20	PIM_V_M3	Voltage feedback signal	PIM_INDX/POT/ V_M3	Hall Sensor/ Current Sense/ Voltage Feedback Signal	NC	-	-
21	PIM_V_M2	Voltage feedback signal	PIM_QEB/IB/V_M2	Hall Sensor/ Current Sense/ Voltage Feedback Signal	NC	-	-
22	PIM_V_M1	Voltage feedback signal	PIM_QEA/IA/V_M1	Hall Sensor/ Current Sense/ Voltage Feedback Signal	NC	-	-
23	PIM_IMOTOR_SUM	DC Bus current signal	PIM_IBUS/VBUS	DC Bus Voltage (downscaled)	VDCBUS2	PA07_ADC0_CH7_VDC_ISHUNT	16
24	PIM_IMOTOR2	Phase current signal	PIM_IB/POT	AC Input Zero Cross/AC Input Voltage (downscaled)/ Potentiometer	NC	-	-
25	PIM_IMOTOR1	Phase current signal	PIM_IA/IPFC	PFC Current (buffered)	NC	-	-
26	PGC	Device programming clock line	PGC	Device programming clock line	NC	PA30_SWCLK	57

PIM Connector PIN	MCLV2 100-pin connection		MCHV3 100-pin connection			SAMC21 MCU Pin	MCU Pin
	Pin Name	Functionality	Pin Name	Functionality	100-pin connector signal name		
27	PGD	Device programming data line	PGD	Device programming data line	NC	PA31_SWDIO	58
28	VREF	Reference voltage (half of AVDD voltage)	AVDD/2	Reference voltage (half of AVDD voltage)	VREF	-	-
29	PIM_REC_NEUTR	Reconstructed motor neutral line voltage	PIM_REC_NEUTR	Reconstructed motor neutral line voltage	NEUTR	PA02_ADC0_CH0_REC_NEUTR	3
30	AVDD	Analog supply	AVDD	Analog supply	AVDD	VDDANA	8
31	AVSS	Analog supply	AVSS	Analog supply	GND	GNDANA	7
32	PIM_POT	Potentiometer signal	PIM_POT	Potentiometer signal	POT	PB00_ADC1_CH0_PIM_POT	61
33	NC	NC	PIM_POT	Potentiometer signal	NC	-	-
34	PIM_GEN2	General I/O	PIM_GEN2	General I/O	NC	-	-
35	PIM_VBUS	DC Bus voltage (downscaled)	PIM_VBUS	DC Bus voltage (downscaled)	VDCBUS1	PA09_ADC0_CH9_ADC1_CH11_VBUS	18
36	VSS	NC	VSS	NC	VSS	-	22,33,47,54
37	VDD	NC	VDD	NC	VDD	-	21,34,48,56
38	NC	NC	PIM_VAC_VOL2	AC Input Voltage (unbuffered)	NC	-	-
39	NC	NC		PFC Shunt Signal	NC	-	-
40	NC	NC	PIM_PFC_L	PFC Shunt Signal	NC	-	-
41	PIM_MONITOR_1	Hall sensor/ Current sense/ Voltage feedback signal	PIM_V_M1/POT	Hall Sensor/ Current Sense/ Voltage Feedback Signal	Ph_Cur_1	PB08_ADC0_CH2_ADC1_CH4_Uph	11
42	PIM_MONITOR_2	Hall sensor/ Current sense/ Voltage feedback signal	PIM_V_M2	Hall Sensor/ Current Sense/ Voltage Feedback Signal	Ph_Cur_2	PB09_ADC0_CH3_ADC1_CH5_Vph	12
43	PIM_MONITOR_3	Hall sensor/ Current sense/ Voltage feedback signal	PIM_V_M3/IBUS	Hall Sensor/ Current Sense/ Voltage Feedback Signal	I_Shunt	PA08_ADC0_CH8_ADC1_CH10_IBUS	17
44	NC	NC	NC	NC	NC	-	-
45	VSS	NC	VSS	NC	VSS	-	22,33,47,54
46	VDD	NC	VDD	NC	VDD	-	21,34,48,56
47	HALLB	Hall sensor/QEI input	HB/QEB	Hall sensor/QEI input	HALLB_QEB	PB04_HALLB_EXTINT4	5
48	HALLC	Hall sensor/QEI input	HC/INDX	Hall sensor/QEI input	HALLC_QINDX	PA28_HALLC_EXTINT8	53
49	RX	UART Receive	RX	UART Receive	URXD0	PA23_S3_PAD1_RX	44
50	TX	UART Transmit	TX	UART Transmit	UTXD0	PA22_S3_PAD0_TX	43
51	USB_TX	UART Transmit (connected directly to U7)	NC	NC	NC	-	-
52	USB_RX	UART Receive (connected directly to U7)	NC	NC	NC	-	-
53	NC	NC	NC	NC	NC	-	-
54	NC	NC	NC	NC	NC	-	-
55	NC	NC	NC	NC	NC	-	-
56	NC	NC	NC	NC	NC	-	-
57	NC	NC	NC	NC	NC	-	-

PIM Connector PIN	MCLV2 100-pin connection		MCHV3 100-pin connection			SAMC21 MCU Pin	MCU Pin
	Pin Name	Functionality	Pin Name	Functionality	100-pin connector signal name		
58	PIM_FLT_OUT2	General I/O	PIM_FLT_OUT2 (VACZC)	General I/O	PFC_VACZC	PA06_ADC0_CH6_PFCVACZC_IA; PB07_ADC1_CH9_PFCVACZC_IA	15 10
59	PIM_FLT_OUT1	General I/O	PIM_FLT_OUT1 (IPFC)	General I/O	PFC_I	PA04_ADC0_CH4_IPFC_IB; PB06_ADC1_CH8_IPFC_IB	13 9
60	DBG_LED1	Debug LED 1	DBG_LED2	Debug LED 2	LED1	PB13_LED	26
61	HOME	Home signal for QEI	HOME	Home signal for QEI	NC	-	-
62	VDD	NC	VDD	NC	VDD	-	21,34,48,56
63	OSC1/CLKO	Crystal oscillator in	OSCI	Crystal oscillator in	NC	-	-
64	OSC2/CLKI	Crystal oscillator out	OSCO	Crystal oscillator out	NC	-	-
65	VSS	NC	VSS	NC	VSS	-	22,33,47,54
66	PIM_IBUS+	Bus current shunt signal	PIM_IBUS+	Bus current shunt signal	NC	-	-
67	PIM_IBUS-	Bus current shunt signal	PIM_IBUS-	BUS current shunt signal	NC	-	-
68	LIN_CS	LIN Chip Select signal	BTN	Push Button	NC	PA11_BTN	20
69	LIN_FAULT	LIN Fault signal	NC	NC	NC	-	-
70	RX	UART Receive	RX	UART Receive	NC	-	-
71	NC	NC	PIM_PFC_PWM	PFC PWM Output	NC	-	-
72	USB_RX	UART Receive (connected directly to U7)	HA/QEA	Hall Sensor/QEI Input	NC	-	-
73	PIM_IB+	IMOTOR1 shunt signal	PIM_IB+	IB Shunt Signal	NC	-	-
74	PIM_IA+	IMOTOR2 shunt signal	PIM_IA+	IA Shunt Signal	NC	-	-
75	VSS	NC	VSS	NC	VSS	-	22,33,47,54
76	USB_TX	UART Transmit (connected directly to U7)	HB/QEB	Hall Sensor/QEI Input	NC	-	-
77	CAN_TX	CAN Transmit	PIM_HALLC/INDX/ STP_PWM	Hall Sensor/QEI Input	NC	-	-
78	CAN_RX	CAN Receive	PIM_PFC_PWM	PFC PWM Output	PFC_PWM	PA12_PFC_PWM_TCC2_WO0	29
79	NC	NC	VACZX	AC Input Zero Cross	NC	-	-
80	HALLA	Hall sensor/QEI input	HA/QEA	Hall Sensor/QEI Input	HALLA_QEA	PB11_HALLA_EXTINT11	24
81	NC	NC	NC	NC	NC	-	-
82	PIM_GEN1	General I/O	PIM_GEN1	General I/O	NC	-	-
83	BTN_1	Push-button S2 input	NC	NC	BTN1	PB16_BTN1	39
84	BTN_2	Push-button S3 input	TX	UART Transmit	BTN2	PB31_BTN2	60
85	NC	NC	NC	NC	NC	-	-
86	VDD	NC	VDD	NC	VDD	-	21,34,48,56
87	CAN_RX	CAN Receive	NC	NC	NC	PB15_CAN_RX	28
88	CAN_TX	CAN Transmit	NC	NC	NC	PB14_CAN_TX	27
89	NC	NC	NC	NC	NC	-	-
90	NC	NC	NC	NC	NC	-	-
91	NC	NC	NC	NC	NC	-	-
92	NC	NC	NC	NC	NC	-	-

PIM Connector PIN	MCLV2 100-pin connection		MCHV3 100-pin connection			SAMC21 MCU Pin	MCU Pin
	Pin Name	Functionality	Pin Name	Functionality	100-pin connector signal name		
93	PWM1L1	PWM Output - 1L	PWM1L1	PWM Output - 1L	PWM1L1	PA14_TCC0_UL	31
94	PWM1H1	PWM Output - 1H	PWM1H1	PWM Output - 1H	PWM1H1	PB30_TCC0_UH	59
95	NC	NC	NC	NC	NC	-	-
96	NC	NC	NC	NC	NC	-	-
97	NC	NC	NC	NC	NC	-	-
98	PWM1L2	PWM Output - 2L	PWM1L2	PWM Output - 2L	PWM1L2	PA15_TCC0_VL	32
99	PWM1H2	PWM Output - 2H	PWM1H2	PWM Output - 2H	PWM1H2	PA05_TCC0_VH	14
100	PWM1L3	PWM Output - 3L	PWM1L3	PWM Output - 3L	PWM1L3	PA16_TCC0_WL	35

Figure 1-1. ATSAMC21 Motor Control PIM Schematic



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