
**ATSAME54 100-Pin Motor Control Plug-In Module
Information Sheet**

Introduction

The ATSAME54 100-Pin Motor Control Plug-in Module (PIM), MA320207, is designed to demonstrate the capabilities of the ATSAME54 128-pin Motor Control devices using external op amps with the following hardware:

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

Both development boards support 100-pin PIM interfaces. The ATSAME54 Motor Control PIM is designed to use on board external op amps for signal conditioning of analog feedback inputs.

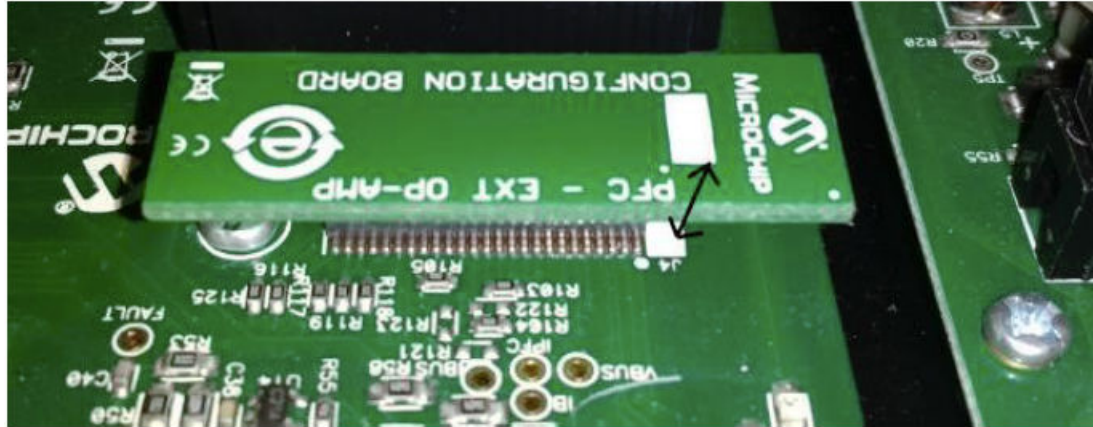
For the dsPICDEM™ MCLV-2 development board, insert the external op amp configuration board (included with the development board) at header J14.

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

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



Figure 2. Op amp Configuration Board for dsPICDEM™ MCHV-3



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 and Debugging:

Use the following options to program and debug software on the ATSAME54 Motor Control PIM:

1. In-Circuit Debugger : The ATSAME54 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 ATSAME54 Motor Control PIM. This daughter board is compatible with the dsPICDEM™ 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 128-pin device pins.

Table 1-1. PIM to MCU Mapping

PIM Connector PIN	MCLV2 100-pin connection		MCHV3 100-pin connection			SAME54 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	PB26_LED	102
2	VDD	NC	VDD	NC	VDD	-	32,37,46,54, 65,79,91, 97,107,118
3	PWM1H3	PWM Output - 3H	PWM1H3	PWM Output - 3H	PWM1H3	PA10_TCC0_WH	35
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	nRESET	nRESET	114
14	NC	NC	NC	NC	NC	-	-
15	VSS	NC	VSS	NC	VSS	-	5,31,38,45, 53,64,78,90, 96,106,116
16	VDD	NC	VDD	NC	VDD	-	32,37,46,54, 65,79,91, 97,107,118
17	NC	NC	NC	NC	NC	-	-
18	FAULT	DC bus Current Fault (active low logic)	FAULT	DC bus Current Fault (active low logic)	FAULT_PWM	PB02_EXT2_FAULT_PWM	127
19	TX	UART Transmit	PFC_FLT	IPFC Fault (overvoltage or overcurrent)	PFC_EN_FLT	PB03_EXT3_PFCFLT_PFCEN	128
20	PIM_V_M3	Voltage feedback signal	PIM_INDX/POT/V_M3	Hall Sensor/Current Sense/Voltage Feedback Signal	NA	-	-
21	PIM_V_M2	Voltage feedback signal	PIM_QEB/IB/V_M2	Hall Sensor/Current Sense/Voltage Feedback Signal	NA	-	-
22	PIM_V_M1	Voltage feedback signal	PIM_QEA/IA/V_M1	Hall Sensor/Current Sense/Voltage Feedback Signal	NA	-	-
23	PIM_IMOTOR_SUM	DC bus current signal	PIM_IBUS/VBUS	DC Bus Voltage (downscaled)	VDCBUS2	PA07_ADC0_CH7_VDC_ISHUNT	24
24	PIM_IMOTOR2	Phase current signal	PIM_IB/POT	AC Input Zero Cross/AC Input Voltage (downscaled)/ Potentiometer	NA	-	-

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PIM to MCU Mapping

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PIM Connector PIN	MCLV2 100-pin connection		MCHV3 100-pin connection			SAME54 MCU Pin	MCU Pin
	Pin Name	Functionality	Pin Name	Functionality	100-pin connector signal name		
25	PIM_IMOTOR1	Phase current signal	PIM_IA/IPFC	PFC Current (buffered)	NA	-	-
26	PGC	Device programming clock line	PGC	Device programming clock line	SWCLK	PA30_SWCLK	119
27	PGD	Device programming data line	PGD	Device programming data line	SWDIO	PA31_SWDIO	120
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	PA05_ADC0_CH5_REC_NEUTR	22
30	AVDD	Analog supply	AVDD	Analog supply	AVDD	VDDANA	6,15,26
31	AVSS	Analog supply	AVSS	Analog supply	GND	GNDANA	14,25
32	PIM_POT	Potentiometer signal	PIM_POT	Potentiometer signal	PIM_POT	PA06_ADC0_CH6_PIM_POT	23
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	PB01_ADC0_CH13_VBUS PD00_ADC1_CH14_VBUS	126, 13
36	VSS	NC	VSS	NC	VSS	-	5,31,38,45, 53,64,78, 90,96,106,116
37	VDD	NC	VDD	NC	VDD	-	32,37,46,54, 65,79,91, 97,107,118
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	PIM_MONITOR_1	PA02_ADC0_CH0_UpH	9
42	PIM_MONITOR_2	Hall Sensor/Current Sense/Voltage Feedback Signal	PIM_V_M2	Hall Sensor/Current Sense/Voltage Feedback Signal	PIM_MONITOR_2	PB08_ADC0_CH2_ADC1_CH0_VPh	19
43	PIM_MONITOR_3	Hall Sensor/Current Sense/Voltage Feedback Signal	PIM_V_M3/IBUS	Hall Sensor/Current Sense/Voltage Feedback Signal	PIM_MONITOR_3	PB09_ADC0_CH3_ADC1_CH1_ISHUNT; PC03_ADC1_CH5_ISHUNT	20, 8
44	NC	NC	NC	NC	NC	-	-
45	VSS	NC	VSS	NC	VSS	-	5,31,38,45, 53,64,78, 90,96,106,116
46	VDD	NC	VDD	NC	VDD	-	32,37,46,54, 65,79,91, 97,107,118
47	HALLB	Hall sensor /QEI input	HB/QEB	Hall sensor /QEI input	HALLB_QEB	PC17_PDEC_QD1_HALL_ENCB	71

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PIM to MCU Mapping

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PIM Connector PIN	MCLV2 100-pin connection		MCHV3 100-pin connection			SAME54 MCU Pin	MCU Pin
	Pin Name	Functionality	Pin Name	Functionality	100-pin connector signal name		
48	HALLC	Hall sensor /QEI input	HC/INDX	Hall sensor /QEI input	HALLC_QINDX	PC18_PDEC_QDI2_HALL_ENCZ	72
49	RX	UART Receive	RX	UART Receive	URXD0	PA13_URXD0_SER2_PAD1	61
50	TX	UART Transmit	TX	UART Transmit	UTXD0	PA12_UTXD0_SER2_PAD0	60
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	-	-
58	PIM_FLT_OUT2	General I/O	PIM_FLT_OUT2 (VACZC)	General I/O	PFC_VACZC	PA11_ADC0_CH11_PFCVACZC_IA; PB05_ADC1_CH7_PFCVACZC_IA	36, 12
59	PIM_FLT_OUT1	General I/O	PIM_FLT_OUT1 (IPFC)	General I/O	PFC_I	PB00_ADC0_CH12_IPFC_IB; PC30_ADC1_CH12_IPFC_IB	125, 123
60	DBG_LED1	Debug LED 1	DBG_LED2	Debug LED 2	LED1	PB27_LED	103
61	HOME	Home signal for QEI	HOME	Home signal for QEI	NC	-	-
62	VDD	NC	VDD	NC	VDD	-	32,37,46,54, 65,79,91, 97,107,118
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	-	5,31,38,45, 53,64,78,90, 96,106,116
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	BTN	PD08_BTN	47
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	-	-

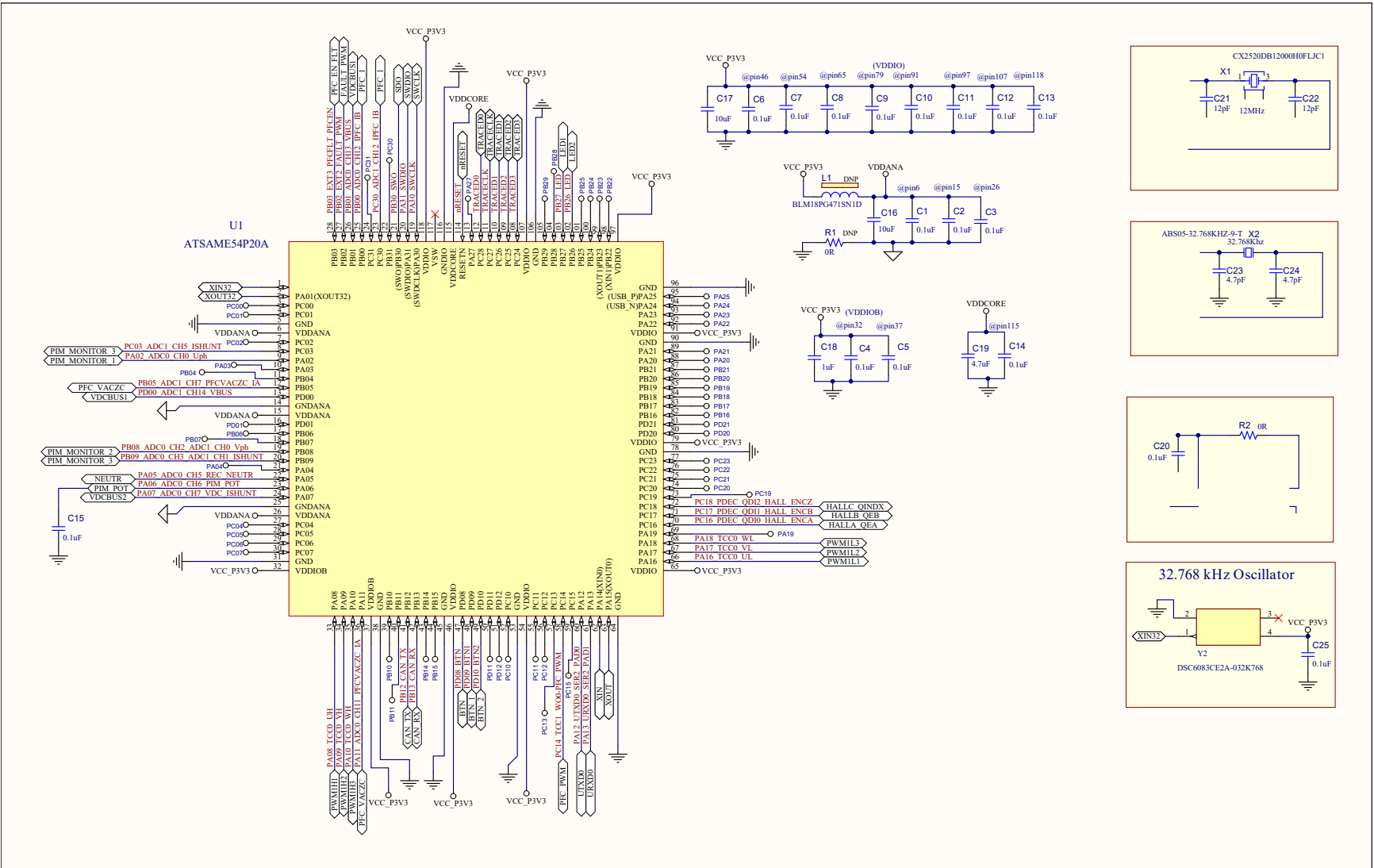
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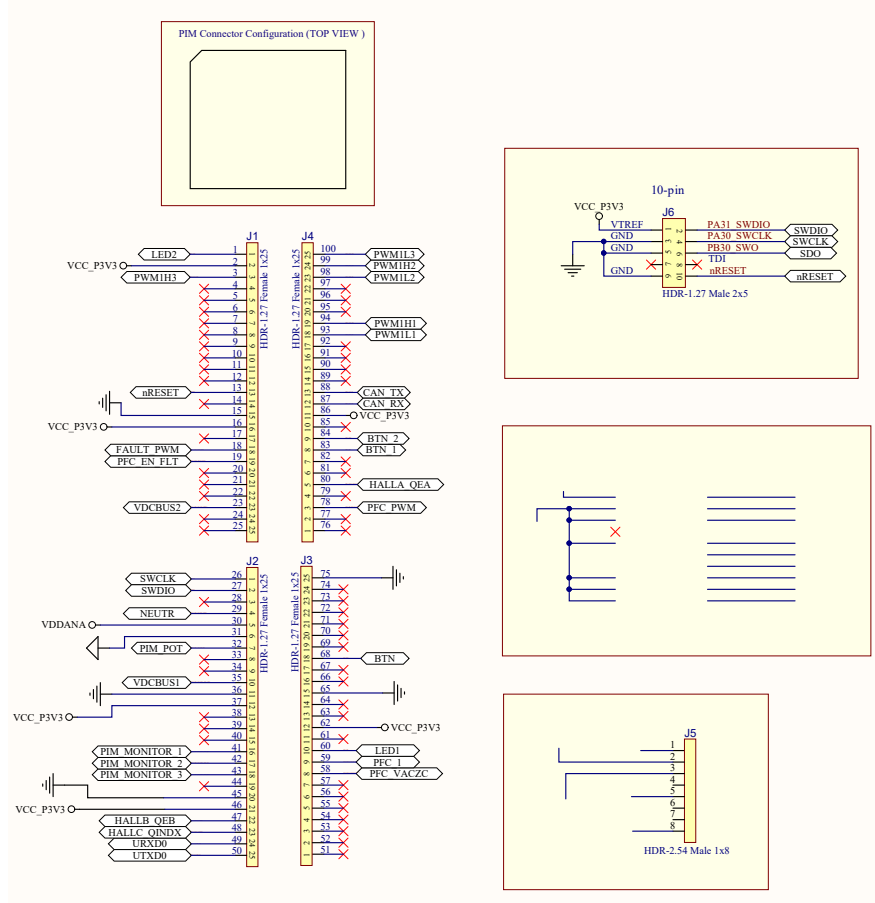
PIM to MCU Mapping

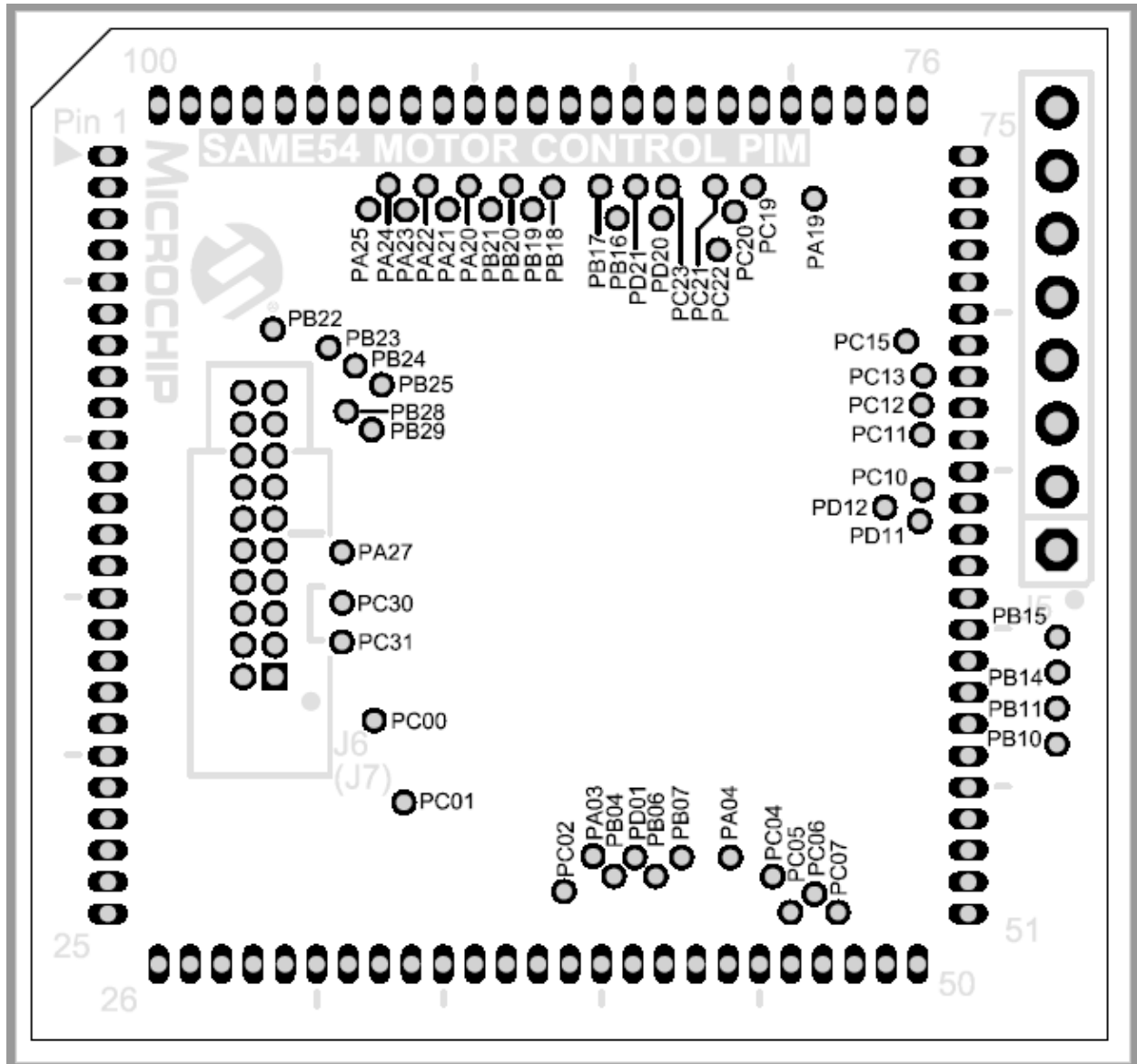
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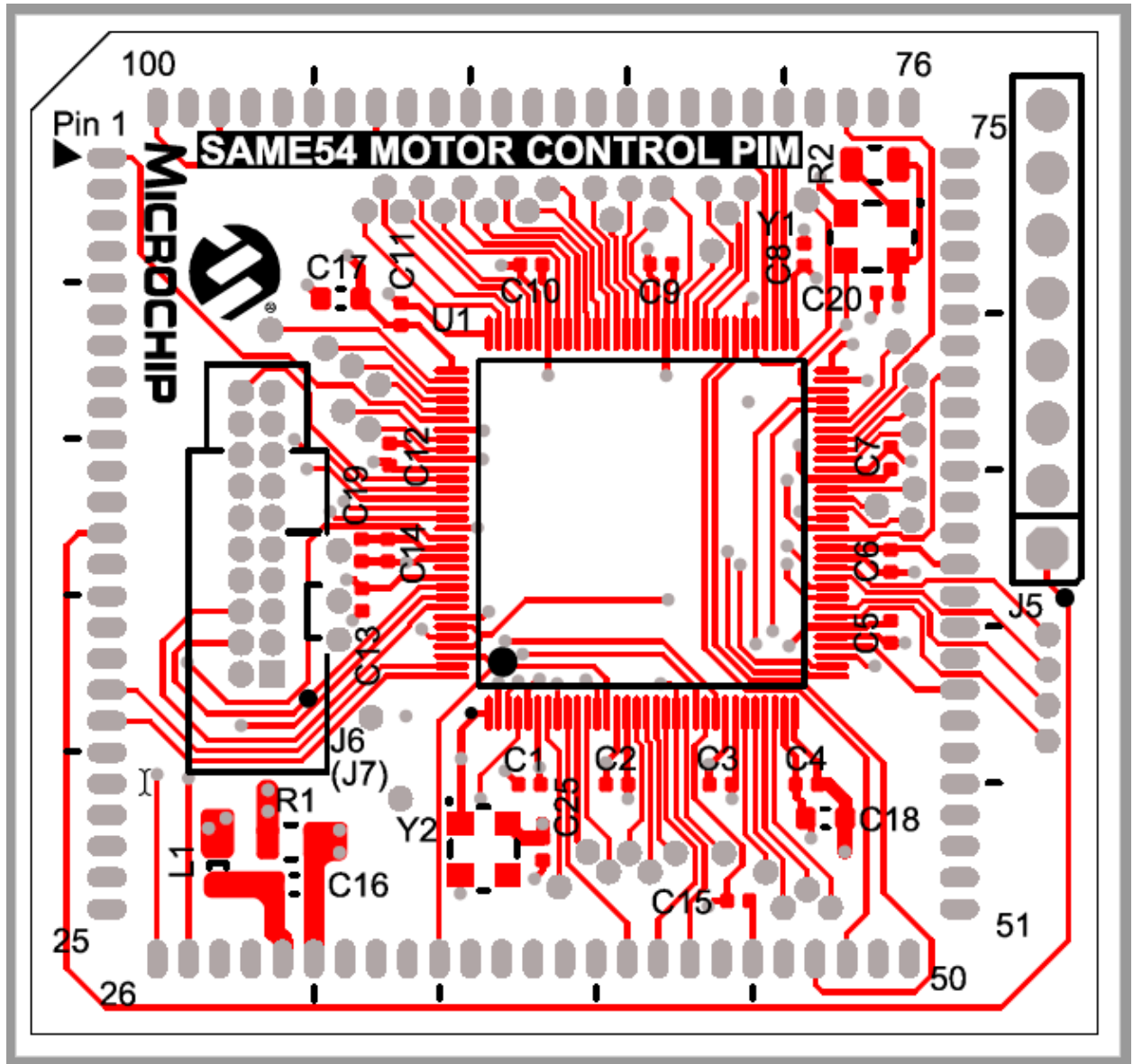
PIM Connector PIN	MCLV2 100-pin connection		MCHV3 100-pin connection			SAME54 MCU Pin	MCU Pin
	Pin Name	Functionality	Pin Name	Functionality	100-pin connector signal name		
75	VSS	NC	VSS	NC	VSS	-	5,31,38, 45,53,64,78, 90,96,106,116
76	USB_TX	UART Transmit (connected directly to U7)	HB/QEB	Hall Sensor /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	PC14_TCC1_WO0_PFC_PWM	58
79	NC	NC	VACZX	AC Input Zero Cross	NC	-	-
80	HALLA	Hall sensor /QEI input	HA/QEA	Hall Sensor /QEI Input	HALLA_QEA	PC16_PDEC_QDIO_HALL_ENCA	70
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	PD09_BTN1	48
84	BTN_2	Push-button S3 input	TX	UART Transmit	BTN2	PD10_BTN2	49
85	NC	NC	NC	NC	NC	-	-
86	VDD	NC	VDD	NC	VDD	-	32,37,46,54, 65,79,91, 97,107,118
87	CAN_RX	CAN Receive	NC	NC	CAN_RX	PB13_CAN_RX	42
88	CAN_TX	CAN Transmit	NC	NC	CAN_TX	PB12_CAN_TX	41
89	NC	NC	NC	NC	NC	-	-
90	NC	NC	NC	NC	NC	-	-
91	NC	NC	NC	NC	NC	-	-
92	NC	NC	NC	NC	NC	-	-
93	PWM1L1	PWM Output - 1L	PWM1L1	PWM Output - 1L	PWM1L1	PA16_TCC0_UL	66
94	PWM1H1	PWM Output - 1H	PWM1H1	PWM Output - 1H	PWM1H1	PA08_TCC0_UH	33
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	PA17_TCC0_VL	67
99	PWM1H2	PWM Output - 2H	PWM1H2	PWM Output - 2H	PWM1H2	PA09_TCC0_VH	34
100	PWM1L3	PWM Output - 3L	PWM1L3	PWM Output - 3L	PWM1L3	PA18_TCC0_WL	68

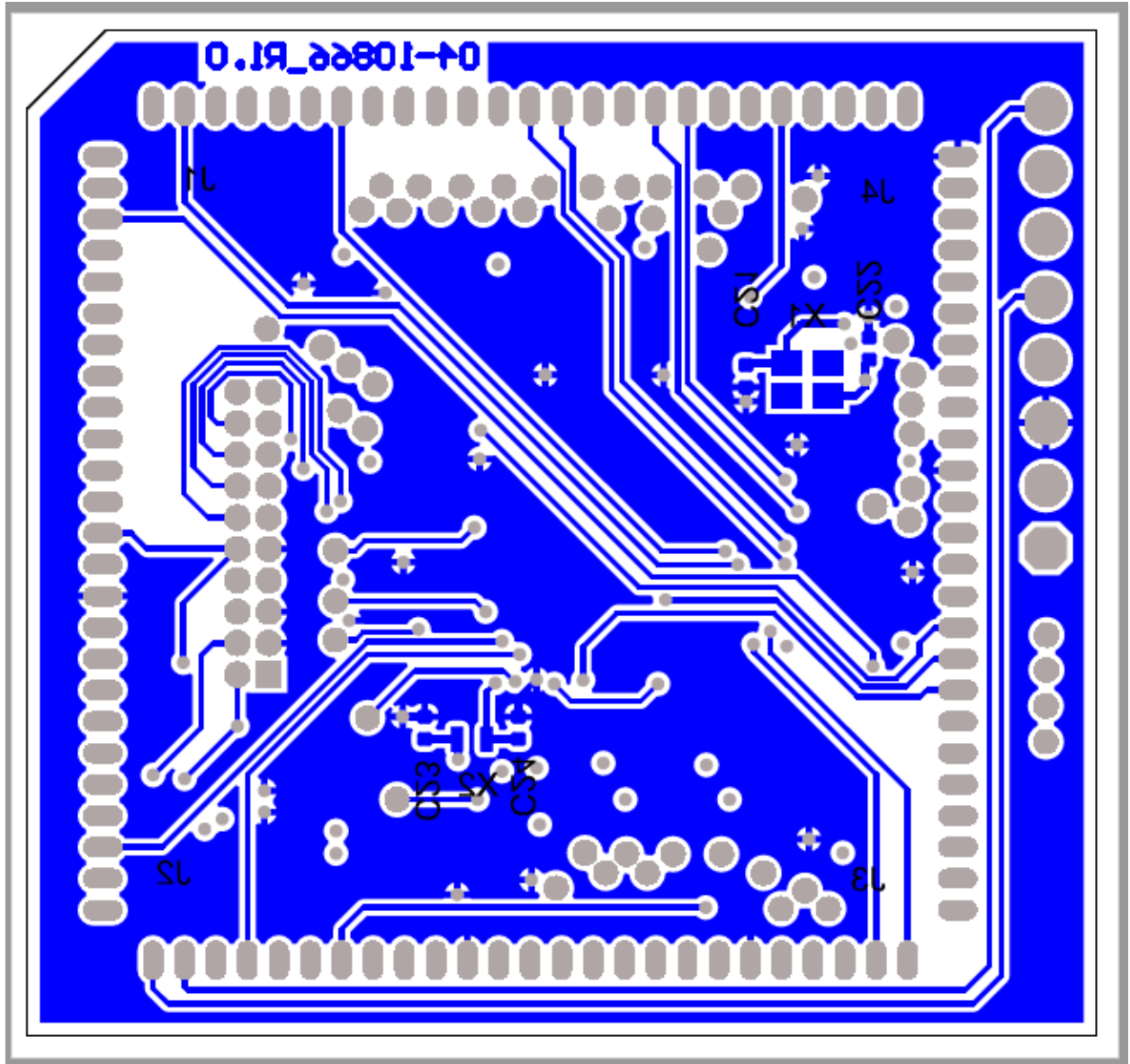
Figure 1-1. ATSAME54 Motor Control PIM Schematic











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