

dsPIC33EV256GM106 5V Motor Control Plug-In Module (PIM) Information Sheet

The dsPIC33EV256GM106 5V Motor Control PIM is designed to demonstrate the capabilities of the dsPIC33EV256GM106 motor control device, using both internal and external op amps with the Low-Voltage Motor Control Development Bundle (DV330100), by using its 105-pin interface.

The dsPIC33EV256GM106 device is a high-performance, 16-bit Digital Signal Controller (DSC) in a 64-pin TQFP package. This PIM is designed to take advantage of all the features of the device, such as the four internal op amps/comparators, the additional dedicated comparator, the ADC Converter and the dedicated motor control PWM unit (3 PWM generators).

The dsPIC33EV256GM106 5V Motor Control PIM takes advantage of these analog peripherals, configured using on-board passive components (resistors and capacitors) to support motor control applications. The PIM is designed to enable driving one motor with both internal and external op amps.

In order to operate this device with the Low-Voltage Motor Control Development Bundle, please insert the dsPIC33EV256GM106 5V Motor Control PIM on the dsPIC® DSC Signal Board. [Table 1](#) provides information on the hardware versions of the motor control boards that are compatible with this PIM. Refer to the user's guide for the specific motor control board for hardware version identification information.

Connector J1 interacts with the Signal Board to have the correct power supply voltage generated. The Signal Board is, in fact, capable of generating both 3.3V and 5V. For a correct voltage to be supplied to the dsPIC33EV256GM106, resistors R33 and R34 must always be populated with 0 Ohm value resistors.

Four different voltage references, from PIM:101 to PIM:104 are used to bias each of the four op amps present on the device. Each op amp reference voltage is independent from the others, allowing a large versatility in the hardware configuration.

FIGURE 1: dsPIC33EV256GM106 5V MOTOR CONTROL PIM

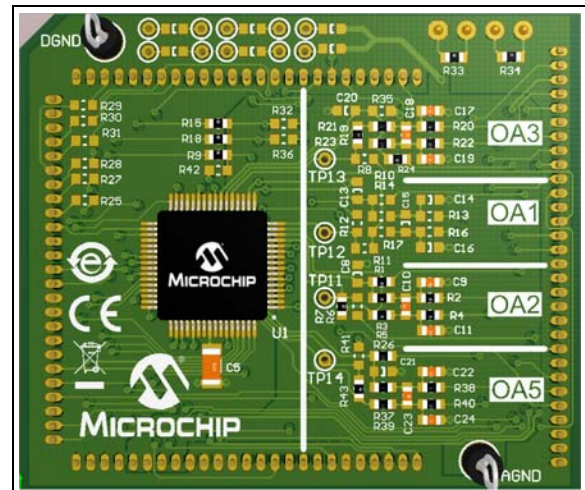


TABLE 1: HARDWARE COMPATIBILITY

Development Board	Part Number	Compatible Hardware Version(s)
dsPICDEM™ MCHV Development Board	DM330023	Not Compatible
dsPICDEM™ MCLV Development Board	DM330021	Not Compatible
dsPICDEM™ MCSM Development Board	DM330022	Not Compatible
dsPICDEM™ MCHV-2 Development Board	DM330023-2	Not Compatible
dsPICDEM™ MCLV-2 Development Board	DM330021-2	Not Compatible
Low-Voltage Motor Control Development Bundle	DV330100	All Revisions

dsPIC33EV256GM106

Table 2 provides the mapping between the 64-pin device pinout and the 105-pin PIM.

TABLE 2: DEVICE TO PIM MAPPING (SORTED BY PIM PIN NUMBER)

Connector	PIM Pin #	PIM Functional Description on Low-Voltage Motor Control Development Bundle	Device Pin #	dsPIC33EV256GM106 Device Functional Description
U2A-1	PIM:01	Direct Connection	64	AN56/RA10
U2A-2	PIM:02	Digital Power (DVDD)	10, 26, 38, 57	VDD
U2A-3	PIM:03	Direct Connection	60	RP42/PWM1H3/RB10
U2A-4	PIM:04	Linked to PIM:94	2 ⁽¹⁾	RPI46/PWM1H1/T3CK/RB14
U2A-5	PIM:05	Linked to PIM:93	3 ⁽¹⁾	RPI47/PWM1L1/T5CK/RB15
U2A-6	PIM:06	Linked to PIM:98	63 ⁽¹⁾	RPI45/PWM1L2/CTPLS/RB13
U2A-7	PIM:07	Linked to PIM:99	62 ⁽¹⁾	RPI44/PWM1H2/RB12
U2A-8	PIM:08	Linked to PIM:100	61 ⁽¹⁾	RP43/PWM1L3/RB11
U2A-9	PIM:09	Linked to PIM:03	60 ⁽¹⁾	RP42/PWM1H3/RB10
U2A-10	PIM:10	Direct Connection	34	AN28/SDI1/RPI25/RA9
U2A-11	PIM:11	Not Connected		
U2A-12	PIM:12	Not Connected		
U2A-13	PIM:13	MCLR	7	MCLR
U2A-14	PIM:14	OA1OUT	16 ⁽²⁾	PGEC3/OA1OUT/AN3/C1IN4-/C4IN2-/RPI33/CTED1/RB1
U2A-15	PIM:15	Digital Ground (DGND)	9, 25, 41	Vss
U2A-16	PIM:16	Digital Power (DVDD)	10, 26, 38, 57	Vdd
U2A-17	PIM:17	OA1IN+	17 ⁽²⁾	PGEC1/OA1IN+/AN4/C1IN3-/C1IN1+/C2IN3-/RPI34/RB2
U2A-18	PIM:18	Direct Connection	32	FLT32/RP36/RB4
U2A-19	PIM:19	OA1_OUT	16 ⁽¹⁾	PGEC3/OA1OUT/AN3/C1IN4-/C4IN2-/RPI33/CTED1/RB1
U2A-20	PIM:20	Direct Connection	8	AN16/RPI121/RG9
U2A-21	PIM:21	Direct Connection	30	AN15/RPI95/FLT8/RE15
U2A-22	PIM:22	Direct Connection	29	AN14/RPI94/FLT7/RE14
U2A-23	PIM:23	Not Connected		
U2A-24	PIM:24	Direct Connection	24	AN11/C1IN2-/U1CTS/FLT4/RC11
U2A-25	PIM:25	OA1IN-	18 ⁽²⁾	PGED1/OA1IN-/AN5/C1IN1-/ (CTMUC)/RP35/RB3
U2B-1	PIM:26	Direct Connection	44	PGEC2/SCL1/RP38/RB6
U2B-2	PIM:27	Direct Connection	43	PGED2/SDA1/RP37/RB5
U2B-3	PIM:28	Not Connected		
U2B-4	PIM:29	Not Connected		
U2B-5	PIM:30	Analog Power (AVDD)	19	AVDD
U2B-6	PIM:31	Analog Ground (AGND)	20	AVSS
U2B-7	PIM:32	Direct Connection	28	AN13/C3IN2-/U2CTS/FLT6/RE13
U2B-8	PIM:33	Not Connected		
U2B-9	PIM:34	Not Connected		
U2B-10	PIM:35	Direct Connection	11	AN10/RPI28/RA12
U2B-11	PIM:36	Digital Ground (DGND)	9, 25, 41	Vss
U2B-12	PIM:37	Digital Power (DVDD)	10, 26, 38, 57	VDD

- Note 1:** The device pin is connected to the PIM pin through a passive network. A direct connection can be implemented by removing some components and/or replacing some with 0 Ohm resistors.
- 2:** The device pin is connected to the PIM pin through a 0 Ohm resistor, which can be removed if desired.

TABLE 2: DEVICE TO PIM MAPPING (SORTED BY PIM PIN NUMBER) (CONTINUED)

Connector	PIM Pin #	PIM Functional Description on Low-Voltage Motor Control Development Bundle	Device Pin #	dsPIC33EV256GM106 Device Functional Description
U2B-13	PIM:38	OA1IN+	17 ⁽¹⁾	PGEC1/OA1IN+/AN4/C1IN3-/C1IN1+/C2IN3-/RPI34/RB2
U2B-14	PIM:39	OA1IN-	18 ⁽¹⁾	PGED1/OA1IN-/AN5/C1IN1-/CTMUC/RP35/RB3
U2B-15	PIM:40	Direct Connection	48	AN26/CVREF10/ASCL1/RP40/T4CK/RB8
U2B-16	PIM:41	Direct Connection	35	AN29/SCK1/RPI51/RC3
U2B-17	PIM:42	Not Connected		
U2B-18	PIM:43	Direct Connection	12	AN9/RPI27/RA11
U2B-19	PIM:44	Direct Connection	27	AN12/C2IN2-/C5IN2-/U2RTS/BCLK2/FLT5/RE12
U2B-20	PIM:45	Digital Ground (DGND)	9, 25, 4	Vss
U2B-21	PIM:46	Digital Power (DVDD)	10, 26, 38, 57	VDD
U2B-22	PIM:47	Direct Connection	50	AN53/RP54/RC6
U2B-23	PIM:48	Direct Connection	58	RPI96/RF0
U2B-24	PIM:49	Direct Connection	37	AN31/RPI53/RC5
U2B-25	PIM:50	Direct Connection	59	RP97/RF1
U2E-1	PIM:51	Not Connected		
U2E-2	PIM:52	Not Connected		
U2E-3	PIM:53	Not Connected		
U2E-4	PIM:54	Direct Connection	54	RP70/RD6
U2E-5	PIM:55	OA1OUT	16 ⁽¹⁾	PGEC3/OA1OUT/AN3/C1IN4-/C4IN2-/RPI33/CTED1/RB1
U2E-6	PIM:56	OA1IN+	17 ⁽¹⁾	PGEC1/OA1IN+/AN4/C1IN3-/C1IN1+/C2IN3-/RPI34/RB2
U2E-7	PIM:57	OA1IN-	18 ⁽¹⁾	PGED1/OA1IN-/AN5/C1IN1-/CTMUC/RP35/RB3
U2E-8	PIM:58	Not Connected		
U2E-9	PIM:59	Direct Connection	42	RPI72/RD8
U2E-10	PIM:60	Direct Connection	53	RP69/RD5
U2E-11	PIM:61	Direct Connection	45	AN48/CVREF20/RPI58/RC10
U2E-12	PIM:62	Digital Power (DVDD)	10, 26, 38, 57	VDD
U2E-13	PIM:63	Direct Connection	39	OSC1/CLKI/AN49/RPI60/RC12
U2E-14	PIM:64	Direct Connection	40	OSC2/CLKO/RPI63/RC15
U2E-15	PIM:65	Digital Ground (DGND)	9, 25, 41	Vss
U2E-16	PIM:66	OA3IN+	23 ⁽¹⁾	OA3IN+/AN8/C3IN3-/C3IN1+/RPI50/U1RTS/BCLK1/FLT3/RC2
U2E-17	PIM:67	OA3IN-	22 ⁽¹⁾	OA3IN-/AN7/C3IN1-/C4IN1-/RP49/RC1
U2E-18	PIM:68	OA3OUT	21 ⁽¹⁾	OA3OUT/AN6/C3IN4-/C4IN4-/C4IN1+/RP48/RC0
U2E-19	PIM:69	Direct Connection	36	AN30/CVREF+/RPI52/RC4
U2E-20	PIM:70	Direct Connection	51	AN52/RP55/RC7
U2E-21	PIM:71	OA2IN-	15 ⁽¹⁾	PGED3/OA2IN-/AN2/C2IN1-/SS1/RPI32/CTED2/RB0
U2E-22	PIM:72	OA2OUT	13 ⁽¹⁾	OA2OUT/AN0/C2IN4-/C4IN3-/RPI16/RA0
U2E-23	PIM:73	OA2IN+	14 ⁽¹⁾	OA2IN+/AN1/C2IN1+/RPI17/RA1
U2E-24	PIM:74	OA5IN+	33 ⁽¹⁾	OA5IN+/AN24/C5IN3-/C5IN1+/SDO1/RP20/T1CK/RA4
U2E-25	PIM:75	Digital Ground (DGND)	9, 25, 41	Vss
U2D-1	PIM:76	Direct Connection	6	AN17/RP120/RG8

- Note 1:** The device pin is connected to the PIM pin through a passive network. A direct connection can be implemented by removing some components and/or replacing some with 0 Ohm resistors.
- 2:** The device pin is connected to the PIM pin through a 0 Ohm resistor, which can be removed if desired.

dsPIC33EV256GM106

TABLE 2: DEVICE TO PIM MAPPING (SORTED BY PIM PIN NUMBER) (CONTINUED)

Connector	PIM Pin #	PIM Functional Description on Low-Voltage Motor Control Development Bundle	Device Pin #	dsPIC33EV256GM106 Device Functional Description
U2D-2	PIM:77	OA5OUT	46 ⁽¹⁾	OA5OUT/AN25/C5IN4-/RP39/INT0/RB7
U2D-3	PIM:78	Not Connected		
U2D-4	PIM:79	Not Connected		
U2D-5	PIM:80	Direct Connection	31	RPI24/RA8
U2D-6	PIM:81	OA5IN-	49 ⁽¹⁾	OA5IN-/AN27/C5IN1-/ASDA1/RP41/RB9
U2D-7	PIM:82	Direct Connection	47	RPI61/RC13
U2D-8	PIM:83	Direct Connection	5	AN18/RPI119/RG7
U2D-9	PIM:84	Direct Connection	4	AN19/RP118/RG6
U2D-10	PIM:85	Not Connected		
U2D-11	PIM:86	Digital Power (DVDD)	10, 26, 38, 57	Vdd
U2D-12	PIM:87	Direct Connection	55	AN54/RP57/RC9
U2D-13	PIM:88	Direct Connection	52	AN51/RP56/RC8
U2D-14	PIM:89	Not Connected		
U2D-15	PIM:90	Direct Connection	1	AN55/RA7
U2D-16	PIM:91	Not Connected		
U2D-17	PIM:92	Not Connected		
U2D-18	PIM:93	Direct Connection	3	RPI47/PWM1L1/T5CK/RB15
U2D-19	PIM:94	Direct Connection	2	RPI46/PWM1H1/T3CK/RB14
U2D-20	PIM:95	Not Connected		
U2D-21	PIM:96	Not Connected		
U2D-22	PIM:97	Not Connected		
U2D-23	PIM:98	Direct Connection	63	RPI45/PWM1L2/CTPLS/RB13
U2D-24	PIM:99	Direct Connection	62	RPI44/PWM1H2/RB12
U2D-25	PIM:100	Direct Connection	61	RP43/PWM1L3/RB11
U2E-26	PIM:101	OA1_REF; OA1IN+	17 ⁽¹⁾	PGEC1/OA1IN+/AN4/C1IN3-/C1IN1+/C2IN3-/RPI34/RB2
U2E-27	PIM:102	OA2_REF; OA2IN+	14 ⁽¹⁾	OA2IN+/AN1/C2IN1+/RPI17/RA1
U2E-28	PIM:103	OA3_REF; OA3IN+	23 ⁽¹⁾	OA3IN+/AN8/C3IN3-/C3IN1+/RPI50/U1RTS/BCLK1/FLT3/RC2
U2E-29	PIM:104	OA5_REF; OA5IN+	33 ⁽¹⁾	OA5IN+/AN24/C5IN3-/C5IN1+/SDO1/RP20/T1CK/RA4
U2E-30	PIM:105	Not Connected		
			56	VCAP

- Note 1:** The device pin is connected to the PIM pin through a passive network. A direct connection can be implemented by removing some components and/or replacing some with 0 Ohm resistors.
- Note 2:** The device pin is connected to the PIM pin through a 0 Ohm resistor, which can be removed if desired.

Table 3 provides the static mapping between the device pins and the 105-pin PIM pins.

TABLE 3: DEVICE TO PIN PIM MAPPING (SORTED BY DEVICE PIN NUMBER)

Connector	PIM Pin #	PIM Functional Description on Low-Voltage Motor Control Development Bundle	Device Pin #	dsPIC33EV256GM106 Device Functional Description
U2D-15	PIM:90	Direct Connection	1	AN55/RA7
U2D-19	PIM:94	Direct Connection	2	RPI46/PWM1H1/T3CK/RB14
U2A-4	PIM:04	Linked to PIM:94	2 ⁽¹⁾	RPI46/PWM1H1/T3CK/RB14
U2D-18	PIM:93	Direct Connection	3	RPI47/PWM1L1/T5CK/RB15
U2A-5	PIM:05	Linked to PIM:93	3 ⁽¹⁾	RPI47/PWM1L1/T5CK/RB15
U2D-9	PIM:84	Direct Connection	4	AN19/RP118/RG6
U2D-8	PIM:83	Direct Connection	5	AN18/RPI119/RG7
U2D-1	PIM:76	Direct Connection	6	AN17/RP120/RG8
U2A-13	PIM:13	MCLR	7	MCLR
U2A-20	PIM:20	Direct Connection	8	AN16/RPI121/RG9
(Note 3)	(Note 3)	Digital Ground (DGND)	9	Vss
(Note 4)	(Note 4)	Digital Power (DVDD)	10	VDD
U2B-10	PIM:35	Direct Connection	11	AN10/RPI28/RA12
U2B-18	PIM:43	Direct Connection	12	AN9/RPI27/RA11
U2E-22	PIM:72	OA2OUT	13 ⁽¹⁾	OA2OUT/AN0/C2IN4-/C4IN3-/RPI16/RA0
U2E-23	PIM:73	OA2IN+	14 ⁽¹⁾	OA2IN+/AN1/C2IN1+/RPI17/RA1
U2E-27	PIM:102	OA2_REF; OA2IN+	14 ⁽¹⁾	OA2IN+/AN1/C2IN1+/RPI17/RA1
U2E-21	PIM:71	OA2IN-	15 ⁽¹⁾	PGED3/OA2IN-/AN2/C2IN1-/SS1/RPI32/CTED2/RB0
U2A-19	PIM:19	OA1_OUT	16 ⁽¹⁾	PGEC3/OA1OUT/AN3/C1IN4-/C4IN2-/RPI33/CTED1/RB1
U2E-5	PIM:55	OA1OUT	16 ⁽¹⁾	PGEC3/OA1OUT/AN3/C1IN4-/C4IN2-/RPI33/CTED1/RB1
U2A-14	PIM:14	OA1OUT	16 ⁽²⁾	PGEC3/OA1OUT/AN3/C1IN4-/C4IN2-/RPI33/CTED1/RB1
U2B-13	PIM:38	OA1IN+	17 ⁽¹⁾	PGEC1/OA1IN+/AN4/C1IN3-/C1IN1+/C2IN3-/RPI34/RB2
U2E-6	PIM:56	OA1IN+	17 ⁽¹⁾	PGEC1/OA1IN+/AN4/C1IN3-/C1IN1+/C2IN3-/RPI34/RB2
U2E-26	PIM:101	OA1_REF; OA1IN+	17 ⁽¹⁾	PGEC1/OA1IN+/AN4/C1IN3-/C1IN1+/C2IN3-/RPI34/RB2
U2A-17	PIM:17	OA1IN+	17 ⁽²⁾	PGEC1/OA1IN+/AN4/C1IN3-/C1IN1+/C2IN3-/RPI34/RB2
U2B-14	PIM:39	OA1IN-	18 ⁽¹⁾	PGED1/OA1IN-/AN5/C1IN1-/CTMUC/RP35/RB3
U2E-7	PIM:57	OA1IN-	18 ⁽¹⁾	PGED1/OA1IN-/AN5/C1IN1-/CTMUC/RP35/RB3
U2A-25	PIM:25	OA1IN-	18 ⁽²⁾	PGED1/OA1IN-/AN5/C1IN1-/CTMUC/RP35/RB3
U2B-5	PIM:30	Analog Power (AVDD)	19	AVDD
U2B-6	PIM:31	Analog Ground (AGND)	20	AVSS
U2E-18	PIM:68	OA3OUT	21 ⁽¹⁾	OA3OUT/AN6/C3IN4-/C4IN1-/RP48/RC0
U2E-17	PIM:67	OA3IN-	22 ⁽¹⁾	OA3IN-/AN7/C3IN1-/C4IN1-/RP49/RC1
U2E-16	PIM:66	OA3IN+	23 ⁽¹⁾	OA3IN+/AN8/C3IN3-/C3IN1+/RPI50/U1RTS/BCLK1/FLT3/RC2
U2E-28	PIM:103	OA3_REF; OA3IN+	23 ⁽¹⁾	OA3IN+/AN8/C3IN3-/C3IN1+/RPI50/U1RTS/BCLK1/FLT3/RC2
U2A-24	PIM:24	Direct Connection	24	AN11/C1IN2-/U1CTS/FLT4/RC11

- Note 1:** The device pin is connected to the PIM pin through a passive network. A direct connection can be implemented by removing some components and/or replacing some with 0 Ohm resistors.
- 2:** The device pin is connected to the PIM pin through a 0 Ohm resistor, which can be removed if desired.
- 3:** Digital Ground (DGND) connects to PIM pins 15, 36, 45, 65 and 75, which are connector pins U2A-15, U2B-11, U2B-20, U2E-15 and U2E-25.
- 4:** Digital Power (DVDD) connects to PIM pins 2, 16, 37, 46, 62 and 86, which are connector pins U2A-2, U2A-16, U2B-12, U2B-21, U2E-12 and U2D-11.

dsPIC33EV256GM106

TABLE 3: DEVICE TO PIN PIM MAPPING (SORTED BY DEVICE PIN NUMBER) (CONTINUED)

Connector	PIM Pin #	PIM Functional Description on Low-Voltage Motor Control Development Bundle	Device Pin #	dsPIC33EV256GM106 Device Functional Description
(Note 3)	(Note 3)	Digital Ground (DGND)	25	Vss
(Note 4)	(Note 4)	Digital Power (DVDD)	26	VDD
U2B-19	PIM:44	Direct Connection	27	AN12/C2IN2-/C5IN2-/U2RTS/BCLK2/FLT5/RE12
U2B-7	PIM:32	Direct Connection	28	AN13/C3IN2-/U2CTS/FLT6/RE13
U2A-22	PIM:22	Direct Connection	29	AN14/RPI94/FLT7/RE14
U2A-21	PIM:21	Direct Connection	30	AN15/RPI95/FLT8/RE15
U2D-5	PIM:80	Direct Connection	31	RPI24/RA8
U2A-18	PIM:18	Direct Connection	32	FLT32/RP36/RB4
U2E-24	PIM:74	OA5IN+	33 ⁽¹⁾	OA5IN+/AN24/C5IN3-/C5IN1+/SDO1/RP20/T1CK/RA4
U2E-29	PIM:104	OA5_REF; OA5IN+	33 ⁽¹⁾	OA5IN+/AN24/C5IN3-/C5IN1+/SDO1/RP20/T1CK/RA4
U2A-10	PIM:10	Direct Connection	34	AN28/SDI1/RPI25/RA9
U2B-16	PIM:41	Direct Connection	35	AN29/SCK1/RPI51/RC3
U2E-19	PIM:69	Direct Connection	36	AN30/CVREF+/RPI52/RC4
U2B-24	PIM:49	Direct Connection	37	AN31/RPI53/RC5
(Note 4)	(Note 4)	Digital Power (DVDD)	38	VDD
U2E-13	PIM:63	Direct Connection	39	OSC1/CLKI/AN49/RPI60/RC12
U2E-14	PIM:64	Direct Connection	40	OSC2/CLKO/RPI63/RC15
(Note 3)	(Note 3)	Digital Ground (DGND)	41	Vss
U2E-9	PIM:59	Direct Connection	42	RPI72/RD8
U2B-2	PIM:27	Direct Connection	43	PGED2/SDA1/RP37/RB5
U2B-1	PIM:26	Direct Connection	44	PGEC2/SCL1/RP38/RB6
U2E-11	PIM:61	Direct Connection	45	AN48/CVREF20/RPI58/RC10
U2D-2	PIM:77	OA5OUT	46 ⁽¹⁾	OA5OUT/AN25/C5IN4-/RP39/INT0/RB7
U2D-7	PIM:82	Direct Connection	47	RPI61/RC13
U2B-15	PIM:40	Direct Connection	48	AN26/CVREF10/ASCL1/RP40/T4CK/RB8
U2D-6	PIM:81	OA5IN-	49 ⁽¹⁾	OA5IN-/AN27/C5IN1-/ASDA1/RP41/RB9
U2B-22	PIM:47	Direct Connection	50	AN53/RP54/RC6
U2E-20	PIM:70	Direct Connection	51	AN52/RP55/RC7
U2D-13	PIM:88	Direct Connection	52	AN51/RP56/RC8
U2E-10	PIM:60	Direct Connection	53	RP69/RD5
U2E-4	PIM:54	Direct Connection	54	RP70/RD6
U2D-12	PIM:87	Direct Connection	55	AN54/RP57/RC9
			56	VCAP
(Note 4)	(Note 4)	Digital Power (DVDD)	57	VDD
U2B-23	PIM:48	Direct Connection	58	RPI96/RF0
U2B-25	PIM:50	Direct Connection	59	RP97/RF1
U2A-3	PIM:03	Direct Connection	60	RP42/PWM1H3/RB10
U2A-9	PIM:09	Linked to PIM:03	60 ⁽¹⁾	RP42/PWM1H3/RB10
U2D-25	PIM:100	Direct Connection	61	RP43/PWM1L3/RB11
U2A-8	PIM:08	Linked to PIM:100	61 ⁽¹⁾	RP43/PWM1L3/RB11
U2D-24	PIM:99	Direct Connection	62	RPI44/PWM1H2/RB12
U2A-7	PIM:07	Linked to PIM:99	62 ⁽¹⁾	RPI44/PWM1H2/RB12
U2D-23	PIM:98	Direct Connection	63	RPI45/PWM1L2/CTPLS/RB13

- Note 1:** The device pin is connected to the PIM pin through a passive network. A direct connection can be implemented by removing some components and/or replacing some with 0 Ohm resistors.
- 2:** The device pin is connected to the PIM pin through a 0 Ohm resistor, which can be removed if desired.
- 3:** Digital Ground (DGND) connects to PIM pins 15, 36, 45, 65 and 75, which are connector pins U2A-15, U2B-11, U2B-20, U2E-15 and U2E-25.
- 4:** Digital Power (DVDD) connects to PIM pins 2, 16, 37, 46, 62 and 86, which are connector pins U2A-2, U2A-16, U2B-12, U2B-21, U2E-12 and U2D-11.

TABLE 3: DEVICE TO PIN PIM MAPPING (SORTED BY DEVICE PIN NUMBER) (CONTINUED)

Connector	PIM Pin #	PIM Functional Description on Low-Voltage Motor Control Development Bundle	Device Pin #	dsPIC33EV256GM106 Device Functional Description
U2A-6	PIM:06	Linked to PIM:98	63 ⁽¹⁾	RPI45/PWM1L2/CTPLS/RB13
U2A-1	PIM:01	Direct Connection	64	AN56/RA10
U2A-11	PIM:11	Not Connected		
U2A-12	PIM:12	Not Connected		
U2A-23	PIM:23	Not Connected		
U2B-3	PIM:28	Not Connected		
U2B-4	PIM:29	Not Connected		
U2B-8	PIM:33	Not Connected		
U2B-9	PIM:34	Not Connected		
U2B-17	PIM:42	Not Connected		
U2E-1	PIM:51	Not Connected		
U2E-2	PIM:52	Not Connected		
U2E-3	PIM:53	Not Connected		
U2E-8	PIM:58	Not Connected		
U2D-3	PIM:78	Not Connected		
U2D-4	PIM:79	Not Connected		
U2D-10	PIM:85	Not Connected		
U2D-14	PIM:89	Not Connected		
U2D-16	PIM:91	Not Connected		
U2D-17	PIM:92	Not Connected		
U2D-20	PIM:95	Not Connected		
U2D-21	PIM:96	Not Connected		
U2D-22	PIM:97	Not Connected		
U2E-30	PIM:105	Not Connected		

- Note 1:** The device pin is connected to the PIM pin through a passive network. A direct connection can be implemented by removing some components and/or replacing some with 0 Ohm resistors.
- 2:** The device pin is connected to the PIM pin through a 0 Ohm resistor, which can be removed if desired.
- 3:** Digital Ground (DGND) connects to PIM pins 15, 36, 45, 65 and 75, which are connector pins U2A-15, U2B-11, U2B-20, U2E-15 and U2E-25.
- 4:** Digital Power (DVDD) connects to PIM pins 2, 16, 37, 46, 62 and 86, which are connector pins U2A-2, U2A-16, U2B-12, U2B-21, U2E-12 and U2D-11.

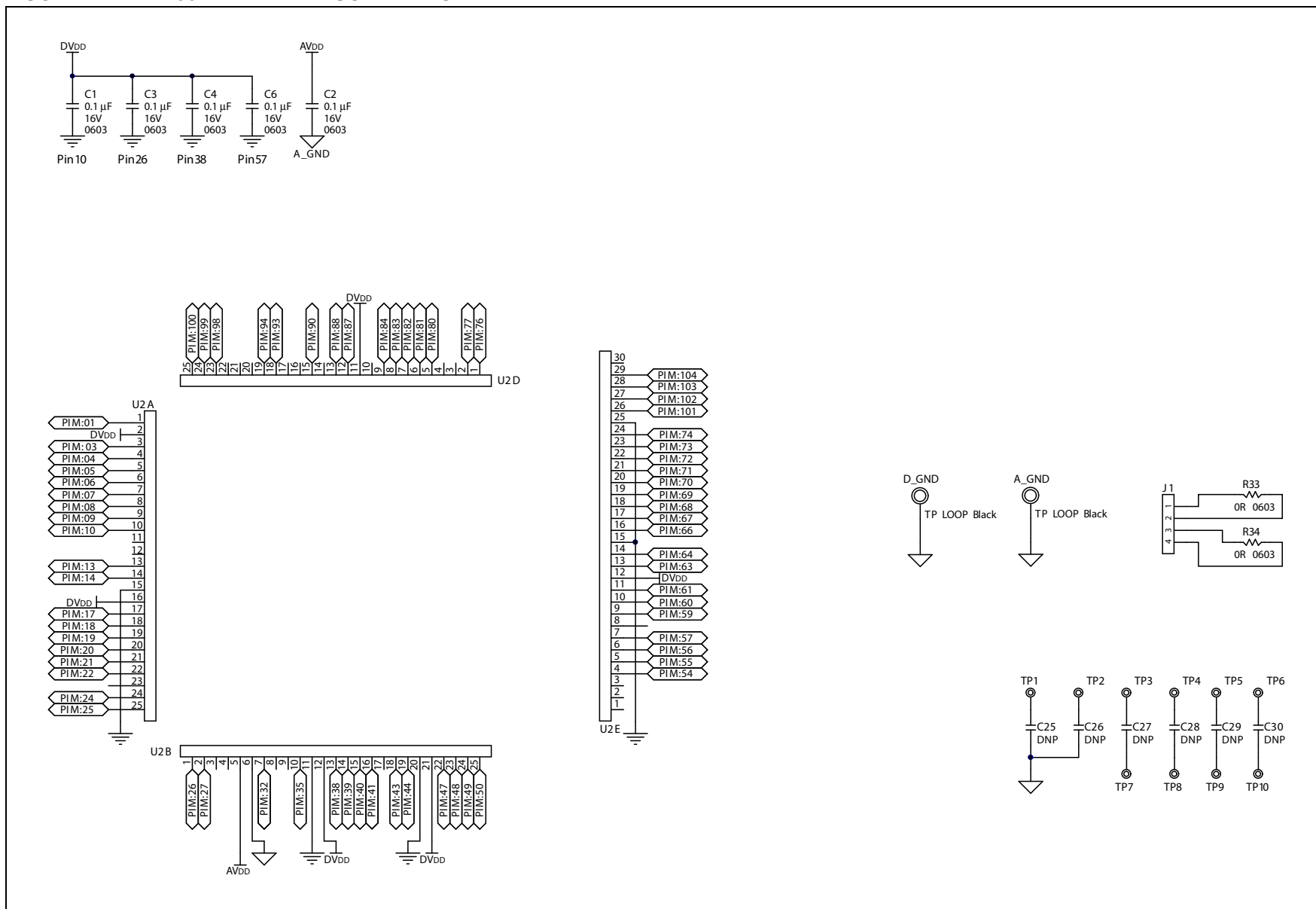
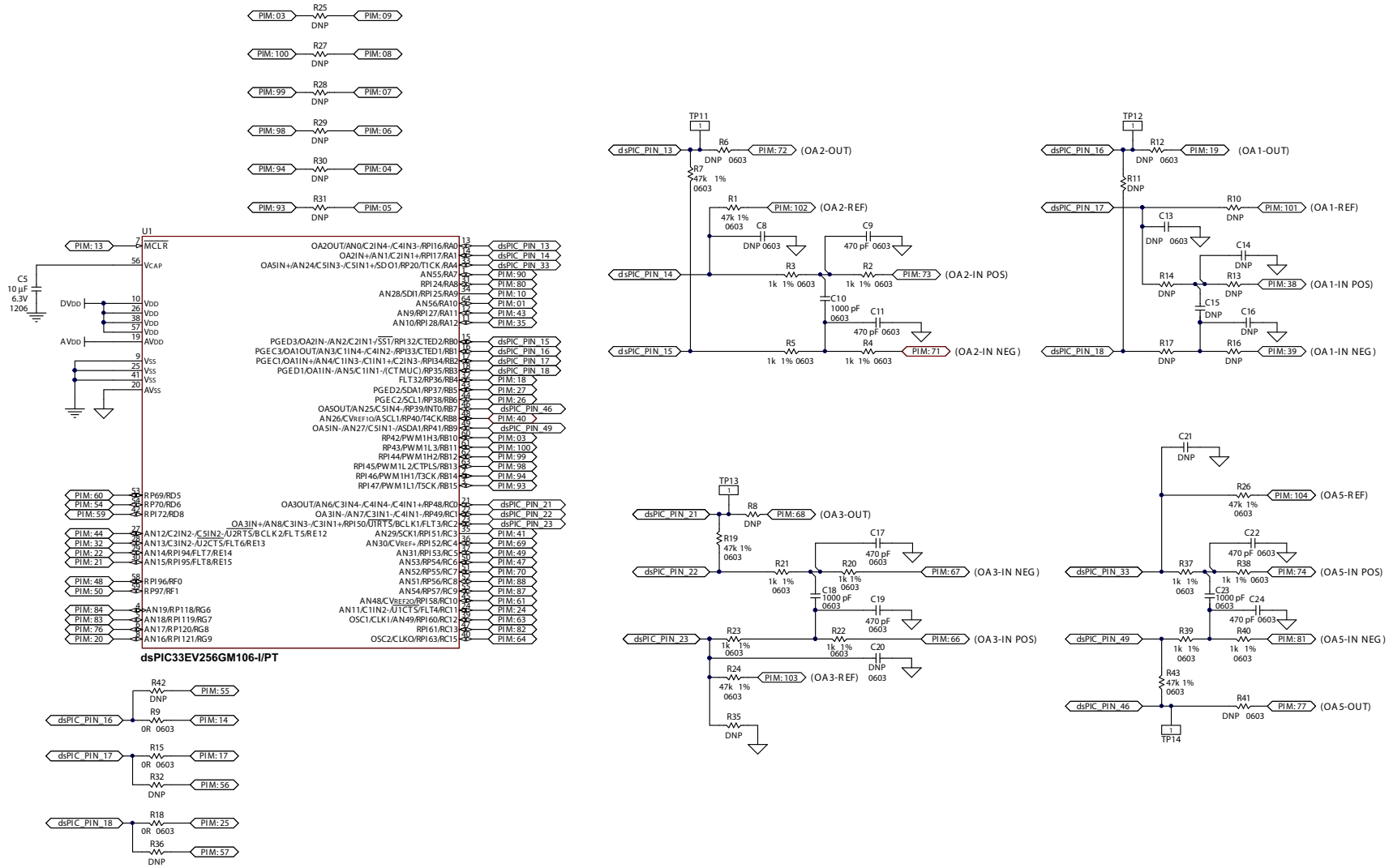
FIGURE 2: 100-PIN HEADER SCHEMATIC**dSPIC33EV256GM106**

FIGURE 3: 64-PIN DEVICE SCHEMATIC

dsPIC33EV256GM106

Table 4 classifies the passive components according to their functionalities and also presents the design equations applicable in each case.

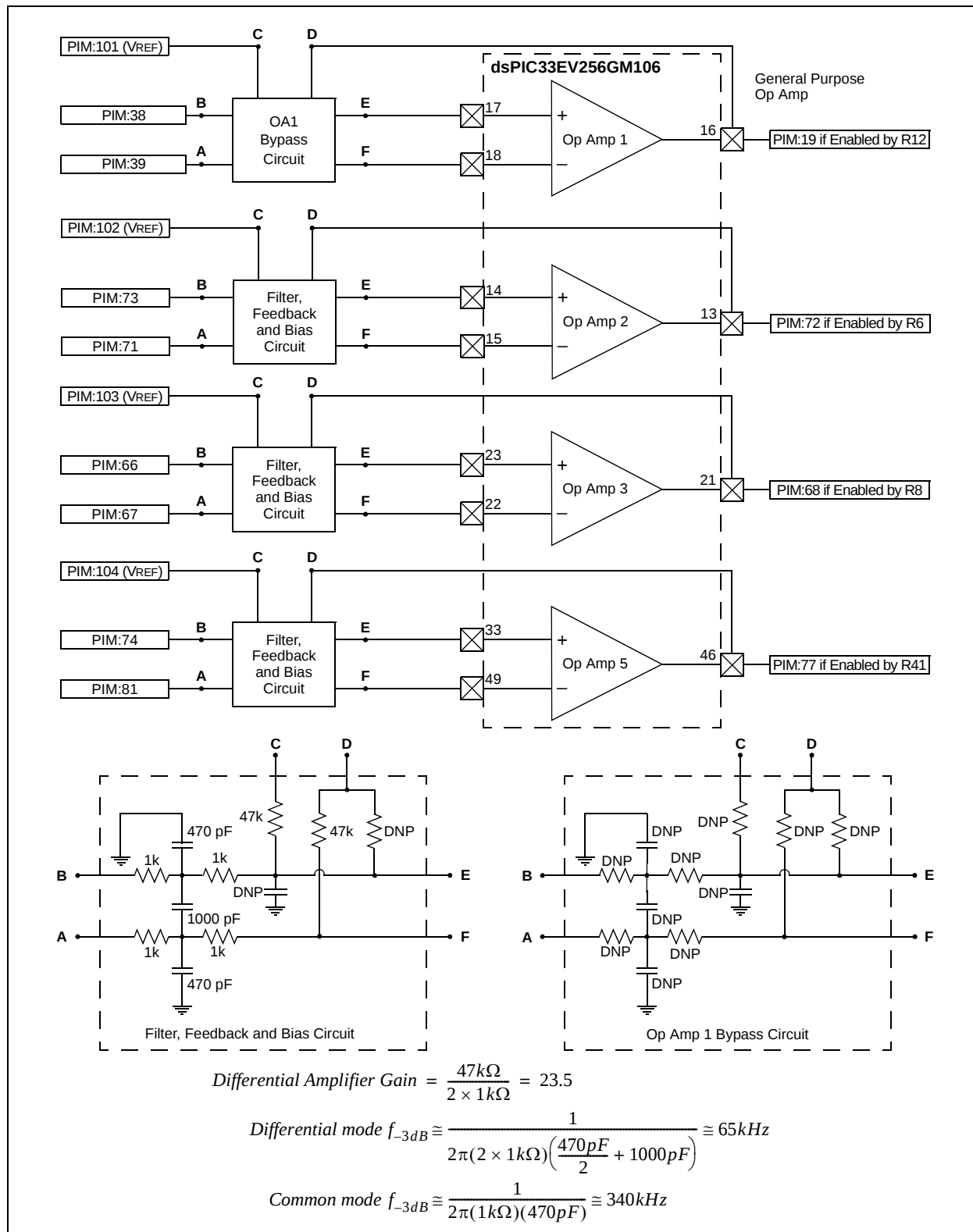
TABLE 4: ANALOG FUNCTIONALITY LISTING

Op Amp #	Analog Function	Passive Components	Design Equations
1	Low-Pass Filter	R13, R14, R16, R17, C14, C15, C16	$R13 = R14 = R16 = R17 = R$ $C14 = C16 = C$ $R10 = R11$ $Common-mode f_{-3dB} \cong \frac{1}{2\pi RC}$ $Differential mode f_{-3dB} \cong \frac{1}{2\pi(2R)\left(\frac{C}{2} + C_{15}\right)}$ $DifferentialAmplifierGain = \frac{R_{11}}{2R}$
	Reference Voltage Bias	R10, R11	
	Differential Amplifier Input	R13, R14, R16, R17	
	Differential Amplifier Feedback	R11	
2	Low-Pass Filter	R2, R3, R4, R5, C9, C10, C11	$R2 = R3 = R4 = R5 = R$ $C9 = C11 = C$ $R1 = R7$ $Common-mode f_{-3dB} \cong \frac{1}{2\pi RC}$ $Differential mode f_{-3dB} \cong \frac{1}{2\pi(2R)\left(\frac{C}{2} + C_{10}\right)}$ $DifferentialAmplifierGain = \frac{R_7}{2R}$
	Reference Voltage Bias	R1, R7	
	Differential Amplifier Input	R2, R3, R4, R5	
	Differential Amplifier Feedback	R7	
3	Low-Pass Filter	R20, R21, R22, R23, C17, C18, C19	$R20 = R21 = R22 = R23 = R$ $C17 = C19 = C$ $R24 = R19$ $Common-mode f_{-3dB} \cong \frac{1}{2\pi RC}$ $Differential mode f_{-3dB} \cong \frac{1}{2\pi(2R)\left(\frac{C}{2} + C_{18}\right)}$ $DifferentialAmplifierGain = \frac{R_{19}}{2R}$
	Reference Voltage Bias	R19, R24	
	Differential Amplifier Input	R20, R21, R22, R23	
	Differential Amplifier Feedback	R19	
5	Low-Pass Filter	R37, R38, R39, R40, C22, C23, C24	$R37 = R38 = R39 = R40 = R$ $C22 = C24 = C$ $R26 = R43$ $Common-mode f_{-3dB} \cong \frac{1}{2\pi RC}$ $Differential mode f_{-3dB} \cong \frac{1}{2\pi(2R)\left(\frac{C}{2} + C_{23}\right)}$ $DifferentialAmplifierGain = \frac{R_{43}}{2R}$
	Reference Voltage Bias	R26, R43	
	Differential Amplifier Input	R37, R38, R39, R40	
	Differential Amplifier Feedback	R43	

Op Amp 1, as seen in Figure 4, is not used by default. This means that if the filter, bias and feedback circuit will be populated and configured by software, it can be used as a general purpose op amp. The positive input will be

PIM:38, the negative input is PIM:39 and the output is PIM:19. All of these three signals are routed to Connector C on the Signal Board for easy prototyping.

FIGURE 4: INTERNAL OP AMP CONFIGURATION



dsPIC33EV256GM106

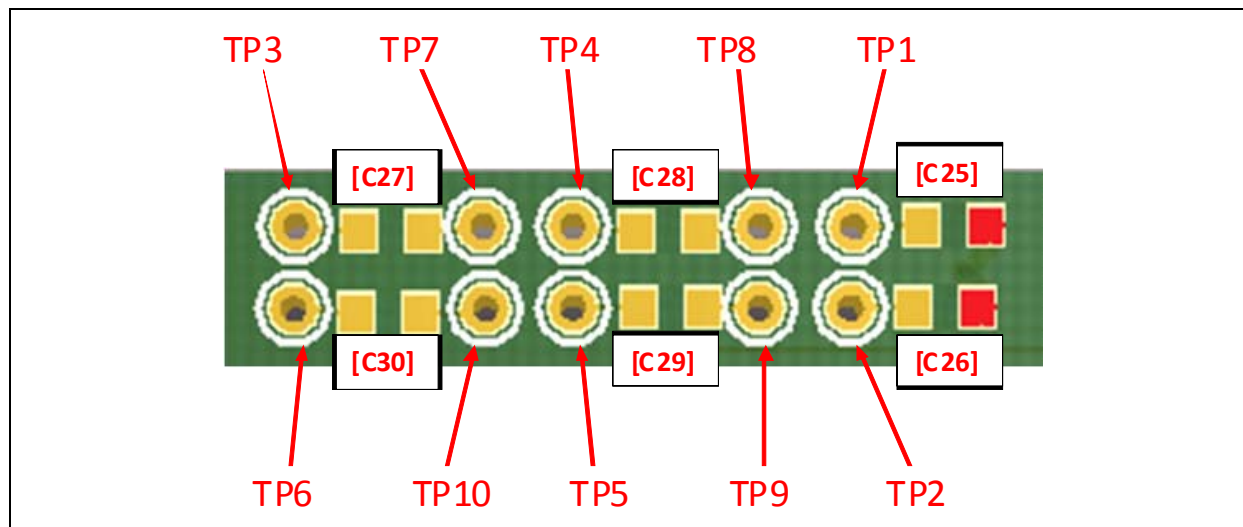
Prototyping Area

This area is located on the upper side of the dsPIC33EV256GM106 5V Motor Control PIM (see [Figure 5](#)).

TP1 to TP10 and C25 to C30 are pads and holes available for further enhancement and prototyping directly on the PIM. The right pads (marked with red) are internally

connected to Analog Ground (AGND). The rest of the pads are connected only to the nearest test point. With this configuration, extra SMD resistors or capacitors can be added to the circuit by soldering them on the pads, and then soldering wires from the test points to the place on the PIM where the added components are needed.

FIGURE 5: PROTOTYPING AREA



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