CONTROL SYSTEM SOLUTIONS

ECM196

Automotive Grade Engine Control Module

P/N: ECM-1793-196-1503

The ECM196 is an up to 8 cylinder engine control module. The module has 3 CAN buses and 1 LIN bus. The dual processors make this module suitable for safety critical applications where redundant processing is required.

The ECM196 is part of a family of rugged, automotive-grade production controllers that use a software development process based on MATLAB/Simulink, known as Raptor-Dev. Raptor-Dev significantly speeds up algorithm development by using automatic code generation. In addition, developers can quickly test application software on their PCs with a built-in onscreen PC simulation. See the next page for more details.

- MATLAB Simulink Programmable
- Processor
  - Infineon Tricore TC1793
  - 200/260MHz
- Memory
  - 4MB Flash
  - 96KB EEPROM
  - 256 KB Internal RAM
- 50 Inputs
  - 39 Analog Inputs
  - 8 Digital Inputs
  - 10 Frequency Inputs
- 84 Outputs
  - 48 Low Side Drivers
  - 6 Half-Bridges or (3 Full-Bridges)
  - 1 High Side Driver
  - 1 Main Power Relay Driver
- 6-16 V Operating Voltage
- Communication
  - 3 CAN 2.0B
  - 1 LIN
- Environmental
  - -40°C to +105°C Operating
  - IP6k9k Compliant
- Required Compiler
  - Hitech Compiler v3.4.5.11
- Aluminum Construction

What is a Raptor Control Module?

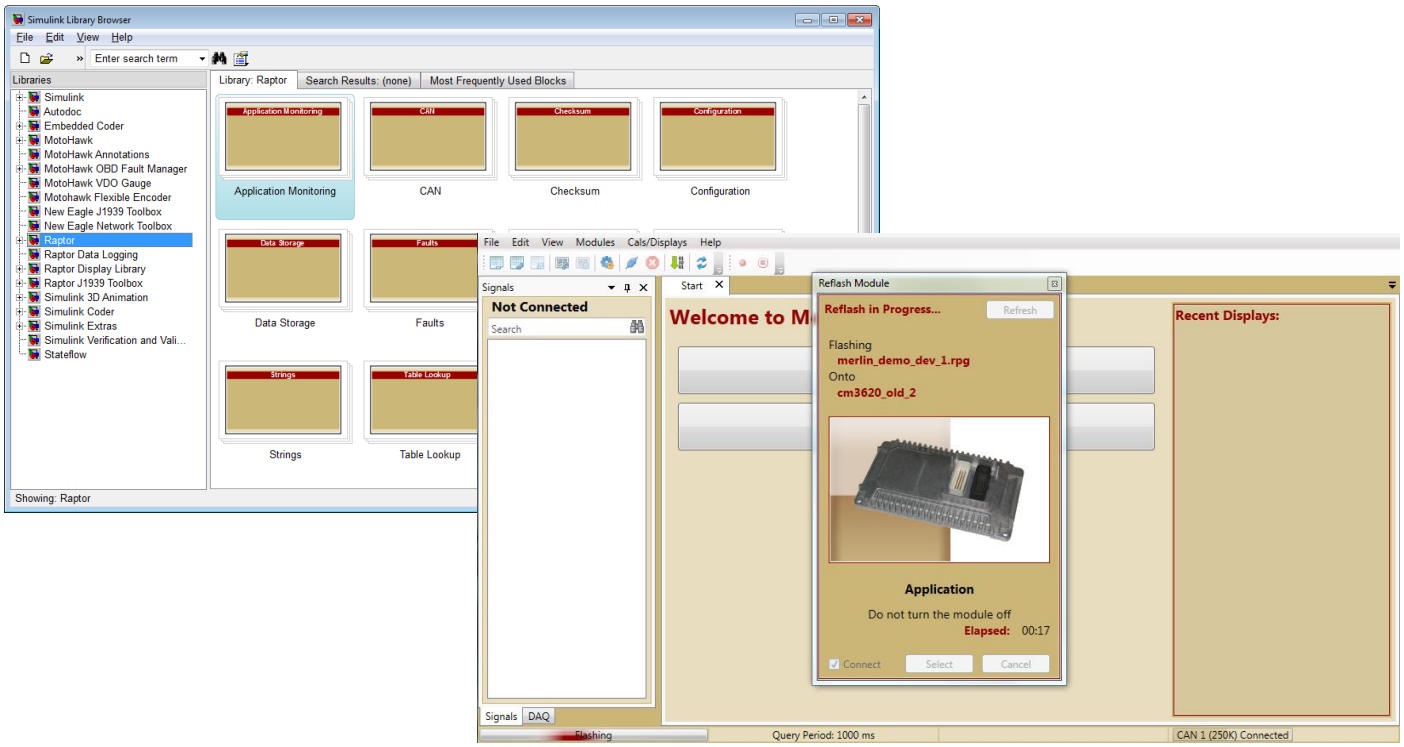
Nearly all complex electro-mechincal systems—especially those in automotive applications—such as internal combustion engines, hydraulic systems, or hybrid electric powertrains require complex control algorithms. Hand-coding such complicated control logic in traditional programming languages like C, C++, or Java can amount to hundreds of thousands of lines of code. Writing and debugging code in this manner can be time consuming, tedious, and labor intensive.

Raptor
Model-Based Development Tool

New Eagle's line of Raptor-compatible controllers and complimentary Raptor-Dev software offer an alternative approach to the traditional programming languages: These controllers allow developers to leverage the graphical programming environment of MATLAB Simulink to quickly and easily create, edit, and debug application software. But what exactly is Raptor-Dev software and how does it allow developers to create software in Simulink for control modules?

Raptor-Dev is a library of customizable Simulink blocks that allows developers to quickly create custom software for Raptor-compatible controllers. Developers work directly in the Simulink environment with Raptor-Dev blocks as well as native Simulink blocks and features. The Raptor-Dev library blocks facilitate interaction between Simulink and all of the input, outputs, and communication channels of the control module hardware. For example, the Raptor-Dev library includes blocks to read analog inputs or actuate low side drive outputs. The Raptor-Dev library also contains other useful block-sets for many applications, such as OBD fault management and data logging. Even J1939 or Modbus Raptor library blocks are available. Common to all of the Raptor library blocks is that they are easy and intuitive to use. The Raptor-dev libraries vastly reduce software complexity, speed-up development, and they eliminate the need to understand low-level logic necessary to manage controller hardware.

Once an application is ready for programming, code can be directly compiled from Simulink into an application file which can then be programmed onto the Raptor-compatible module though the windows-based Raptor-Cal software and a USB-to-CAN hardware interface. Raptor-Cal also allows users to calibrate application parameters in real-time.



Hardware

Microprocessor	Infineon Tricore TC1793
Clock Speed	200/260MHz
Environmental	IP6k9k Compliant
Operating Temp	-40°C to +105°C

Memory Segments

Memory Segment	Size
FLASH CB	63 KB
FLASH ASW0	1919 KB
FLASH ASW1	1535 KB
FLASH DATA	495 KB
EEPROM	71 KB
INTERNAL RAM1	128 KB
INTERNAL RAM2	128 KB

Communication Channels

Channel	Functions	Options
CAN1	CAN	125k 250k 500k 1000k
CAN2	CAN	125k 250k 500k 1000k
CAN3	CAN	125k 250k 500k 1000k

Inputs

Resourse	Functions	Voltage Ranges	Pull-Downs/Ups	Note
WAKE_INPUT1	digital_in	0 - 5 V	2.9k PD	Key Switch, Pin K050
INPUT2	analog_in	0 - 5 V	2.15k PU	Pin A016, Pullup to 5V
INPUT3	analog_in	0 - 5 V	2.15k PU	Pin A017, Pullup to 5V
INPUT4	analog_in	0 - 5 V	422k PD	Pin A018
INPUT5	analog_in	0 - 5 V	681k PU	Pin A019, Pullup to 5V
INPUT6	analog_in	0 - 5 V	681k PU	Pin A037, Pullup to 5V
INPUT7	analog_in	0 - 5 V	681k PU	Pin A038, Pullup to 5V
INPUT8	analog_in	0 - 5 V	4.64k PU	Pin A040, Pullup to 5V
INPUT9	analog_in	0 - 5 V	681k PU	Pin A041, Pullup to 5V
INPUT10	analog_in	0 - 5 V	681k PU	Pin A042, Pullup to 5V
INPUT11	analog_in	0 - 5 V	681k PU	Pin A055, Pullup to 5V
INPUT12	analog_in	0 - 5 V	422k PD	Pin A059
INPUT13	analog_in	0 - 5 V	2.15k PU, 31.6k PD	Pin A062, Pullup to 5V
INPUT14	analog_in	0 - 5 V	681k PU	Pin A082, Pullup to 5V
INPUT15	analog_in	0 - 5 V	2.15k PU, 31.6k PD	Pin A084, Pullup to 5V
INPUT16	analog_in	0 - 5 V	4.64k PU	Pin A097, Pullup to 5V
INPUT17	analog_in	0 - 5 V	422k PD	Pin A102
INPUT18	analog_in	0 - 5 V	422k PD	Pin A103
INPUT19	analog_in	0 - 5 V	2.15k PU	Pin A105, Pullup to 5V
INPUT20	analog_in	0 - 5 V	681k PU	Pin K011, Pullup to 5V
INPUT21	analog_in	0 - 5 V	2.15k PU	Pin K013, Pullup to 5V
INPUT22	analog_in	0 - 5 V	2.15k PU	Pin K030, Pullup to 5V

Inputs (continued)

Resourse	Functions	Voltage Ranges	Pull-Downs/Ups	Note
INPUT23	analog_in	0 - 5 V	56.7k PD	Pin K034
INPUT24	analog_in	0 - 5 V	56.7k PD	Pin K035
INPUT25	analog_in	0 - 5 V	2.15k PU	Pin K042, Pullup to 5V
INPUT26	analog_in	0 - 5 V	681k PU	Pin K045, Pullup to 5V
INPUT27	analog_in	0 - 5 V	2.15k PU	Pin K051, Pullup to 5V
INPUT28	analog_in	0 - 5 V	2.15k PU	Pin K058, Pullup to 5V
INPUT29	analog_in	0 - 5 V	215k PD	Pin K065
INPUT30	analog_in	0 - 5 V	215k PD	Pin K082
INPUT31	analog_in	0 - 5 V	None	Pin K041
INPUT32	analog_in	0 - 5 V	None	Pin K075
INPUT33	digital_in		1.3k PD	Pin A057
INPUT34	digital_in		1.3k PD	Pin K047
INPUT35	digital_in		1.3k PD	Pin K049
INPUT36	digital_in		2.6k PU	Pin K014, Pullup to 5V
INPUT37	digital_in		1.3k PU	Pin K016, Pullup to 5V
INPUT38	digital_in		1.18k PU	Pin K017, Pullup to 5V
INPUT39	digital_in		1.3k PU	Pin K028, Pullup to 5V
INPUT40	digital_in		1.3k PU	Pin K033
INPUT41	freq_in		2.61k PU 46.4k PD	Pin A035, Max Frequency 300 Hz, Pullup to 5V
INPUT42	freq_in		1.47k	Pin K018, Max Frequency 33 kHz, Pullup to 5V
INPUT43	freq_in		1.3k PD 46.4k PD	Pin K029, Max Frequency 300 Hz
INPUT44	freq_in		2.61k PU 23.7k PD	Pin K048, Max Frequency 15 kHz, Pullup to 5V
INPUT45	freq_in		1.47k PU	Pin K052
INPUT46	cam_in		3.16k PU	Pin A013
INPUT47	cam_in		3.16k PU	Pin A034

Inputs (continued)

Resourse	Functions	Voltage Ranges	Pull-Downs/Ups	Note
INPUT48	cam_in		3.16k PU	Pin A053
INPUT49	cam_in		3.16k PU	Pin A074
INPUT50	crank_in		1.07k PU	Pin A095
INPUT51	knock_in			Pin A079, Knock 1A
INPUT52	knock_in			Pin A100, Knock 1B
INPUT53	knock_in			Pin A101, Knock 2A
INPUT54	knock_in			Pin A080, Knock 2B
INPUT55	knock_in			Pin A099, Knock 3A
INPUT56	knock_in			Pin A078, Knock 3B
INPUT57	knock_in			Pin A098, Knock 4A
INPUT58	knock_in			Pin A077, Knock 4B

Note: All analog inputs are 12 bit.

Outputs

Resource	Functions	Driver Types	Note
OUTPUT1	digital_out pwm_out output_status	Low Side	Pin A010, 2.2A(4A) Max
OUTPUT2	digital_out pwm_out output_status	Low Side	Pin A023, 3A(6A) Max
OUTPUT3	digital_out pwm_out output_status	Low Side	Pin A024, 2.2A(4A) Max
OUTPUT4	digital_out pwm_out output_status	Low Side	Pin A046, 2.2A(4A) Max
OUTPUT5	digital_out pwm_out output_status	Low Side	Pin A054, 2.2A(4A) Max

Outputs (continued)

Resource	Functions	Driver Types	Note
OUTPUT6	digital_out pwm_out output_status	Low Side	Pin A093, 3A(6A) Max
OUTPUT7	digital_out pwm_out output_status	Low Side	Pin K084, 2.2A(4A) Max
OUTPUT8	digital_out pwm_out output_status	Low Side	Pin K088, 2.2A(4A) Max
OUTPUT9	digital_out pwm_out output_status	Low Side	Pin A003, 4A(10A) Max,(O2 Heater - WB Sensor 2) Frequency 100 Hz
OUTPUT10	digital_out pwm_out output_status	Low Side	Pin A045, 3A(6A) Max (O2 Heater)
OUTPUT11	digital_out pwm_out output_status	Low Side	Pin K057, 3A(6A) Max (O2 Heater)
OUTPUT12	digital_out pwm_out output_status	Low Side	Pin A022, 4A(10A) Max, (O2 Heater - WB Sensor 1) Frequency 100 Hz
OUTPUT13	injector_out	Low Side	Pin K022, 4A(10A) Max
OUTPUT14	injector_out	Low Side	Pin K090, 3A(6A) Max
OUTPUT15	injector_out	Low Side	Pin K023, 4A(10A) Max
OUTPUT16	injector_out	Low Side	Pin K074, 3A(6A) Max
OUTPUT17	injector_out	Low Side	Pin K040, 2.2A(4A) Max
OUTPUT18	injector_out	Low Side	Pin K091, 4A(10A) Max
OUTPUT19	injector_out	Low Side	Pin A030, 2.2A(4A) Max
OUTPUT20	injector_out	Low Side	Pin A032, 2.2A(4A) Max
OUTPUT21	digital_out output_status	Low Side	Pin A004, 3A(8A) Max
OUTPUT22	digital_out output_status	Low Side	Pin A031, 2.2A Max
OUTPUT23	digital_out output_status	Low Side	Pin K037, 2.2A(4A) Max
OUTPUT24	digital_out output_status	Low Side	Pin K073, 2.2A(4A) Max
OUTPUT25	digital_out output_status	Low Side	Pin A001, 2.2A(4A) Max

Outputs (continued)

Resource	Functions	Driver Types	Note
OUTPUT26	digital_out output_status	Low Side	Pin A002, 2.2A(4A) Max
OUTPUT27	digital_out output_status	Low Side	Pin A009, 2.2A(4A) Max
OUTPUT28	digital_out output_status	Low Side	Pin A011, 2.2A(4A) Max
OUTPUT29	digital_out output_status	Low Side	Pin A025, 2.2A(4A) Max
OUTPUT30	digital_out output_status	Low Side	Pin A033, 2.2A(4A) Max
OUTPUT31	digital_out output_status	Low Side	Pin A075, 2.2A(4A) Max
OUTPUT32	digital_out output_status	Low Side	Pin A094, 2.2A(4A) Max
OUTPUT33	digital_out output_status	Low Side	Pin K012, 2.2A(4A) Max
OUTPUT34	digital_out	Low Side	Pin K019, 0.6A(1.4A) Max
OUTPUT35	digital_out output_status	Low Side	Pin K020, 2.2A(4A) Max
OUTPUT36	digital_out output_status	Low Side	Pin K021, 0.5A Max
OUTPUT37	digital_out output_status	Low Side	Pin K036, 2.2A(4A) Max
OUTPUT38	digital_out output_status	Low Side	Pin K038, 2.2A(4A) Max
OUTPUT39	digital_out output_status	Low Side	Pin K039, 2.2A(4A) Max
OUTPUT40	digital_out output_status	Low Side	Pin K054, 0.6A(1.4A) Max
OUTPUT41	digital_out output_status	Low Side	Pin K055, 2.2A(4A) Max
OUTPUT42	digital_out output_status	Low Side	Pin K056, 2.2A(4A) Max
OUTPUT43	digital_out output_status	Low Side	Pin K059, 0.6A(1.4A) Max
OUTPUT44	digital_out output_status	Low Side	Pin K069, 0.6A(1.4A) Max
OUTPUT45	digital_out output_status	Low Side	Pin K070, 0.6A(1.4A) Max

Outputs (continued)

Resource	Functions	Driver Types	Note
OUTPUT46	digital_out output_status	Low Side	Pin K071, 2.2A(4A) Max
OUTPUT47	digital_out output_status	Low Side	Pin K072, 2.2A(4A) Max
OUTPUT48	digital_out output_status	High Side	Pin K089, 0.4A(2A) Max
OUTPUT49	digital_out	High Side	Pin K053, 0.4A(2A) Max, Activated only w/ INPUT38 (K017) to GND.
OUTPUT50_51	hbridge_out output_status	H-Bridge	Pin A066 and A067, 2.5A(6.7A) Max, 300-25kHz
OUTPUT52_53	hbridge_out output_status	H-Bridge	Pin A064 and A065, 2.5A(6.7A) Max, 300-25kHz
OUTPUT54_55	hbridge_out output_status	H-Bridge	Pin A043 and A044, 2.5A(6.7A) Max
OUTPUT56	ignition_coil	EST	Pin A051, TTL
OUTPUT57	ignition_coil	EST	Pin A072, TTL
OUTPUT58	ignition_coil	EST	Pin A052, TTL
OUTPUT59	ignition_coil	EST	Pin A073, TTL
OUTPUT60	ignition_coil	EST	Pin A049, TTL
OUTPUT61	ignition_coil	EST	Pin A070, TTL
OUTPUT62	ignition_coil	EST	Pin A050, TTL
OUTPUT63	ignition_coil	EST	Pin A071, TTL
OUTPUT80	rpm_out	Low Side	Pin A014, 30mA(200mA) Max
POWER_HOLD	digital_out	(None)	

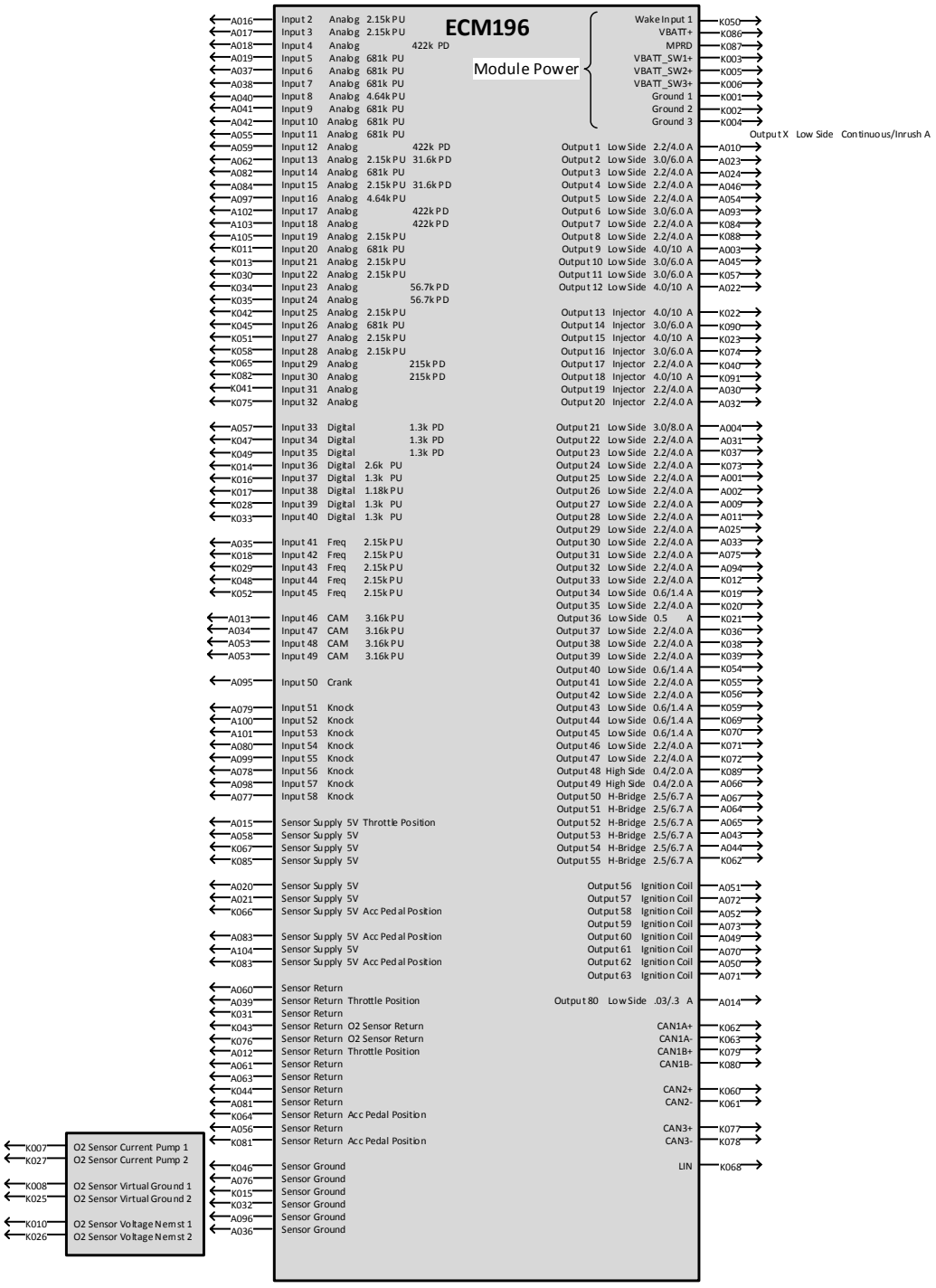
Internal Measurements

Name	Units	Note
IGNITION_COUNT	Count	Ignition count
INJECTION_COUNT	Count	Injection count
ENGINE_SPEED	RPM	Engine Speed crank synchronous
ENGINE_SPEED_10ms	RPM	Engine Speed calculated every 10ms
ENGINE_SPEED_GRADIENT	RPM	Engine Speed gradient over crankshaft segment
ENGINE_SPEED_GRADIENT_CYCL	RPM	Engine Speed gradient calculated over one working cycle
ENCODER_CYLINDER_COUNT	Count	Software cylinder counter

Internal Measurements (continued)

Name	Units	Note
ENCODER_STATUS	Enum	Indicates the status of the Engine Position Monitoring driver.
ENCODER_SYNC_STATE	Enum	Indicates the sync state of the Engine Position Monitoring driver.
ENCODER_CRANK_ANGLE	Deg	Current Crank Angle
ENCODER_CRANK_ERROR	bool	Indicates if there is a crank sensor error present (limp home mode).
BATTERY_VOLTAGE	V	Voltage measured at MPR ECU supply pins – K003,K005,K006

Example System Wiring Diagram



Programming

Note: The ECU must be power cycled after programming to enable CAN 2 and CAN 3.

Power

Note: The ECU must be connected to Constant Battery Power, Switched Battery Power (typically via a main power relay), Key Switch, and Power Ground in order to establish communication. The CAN transceiver is powered off of Switched Battery power, as are the outputs.

Constant Battery Power (Pin Name: VBATT+)

Constant Battery Power is used for powering internal components, such as the microprocessor, logic circuitry, RAM, etc.

	Min	Nom	Max	Units
Input Voltage: Normal Operation	6		16	V
Overvoltage Protection			38.5	V
Reverse Battery Protection			13.5	V
Current Draw: Off-State Current			70	uA

Switched Battery Power (Pin Name: VBATT_SW1+, VBATT_SW2+, VBATT_SW3+)

Switched Battery Power is used for powering high-side outputs, half-bridges, etc.

	Min	Nom	Max	Units
Input Voltage: Normal Operation	6		16	V
Overvoltage Protection			38.5	V
Reverse Battery Protection			13.5	V
Current Draw: Off-State Current			8.42	mA

Key Switch (Pin Name: WAKE_INPUT1)

To power up the module, the microprocessor must detect a voltage (on the WAKE_INPUT1 pin) greater than the Power-on voltage threshold. Likewise, the module will power down once this voltage falls below the Power-down voltage threshold.

	Min	Nom	Max	Units
High Switch Input	4.13			V
Low Switch Input			3.61	V

The Raptor-Dev application software template, which can be generated used the *raptor_create_project('ProjectName')* command in the MATLAB Command Window, contains default shutdown logic that stores non-volatile memory after the key switch signal goes low, but before the module actually

powers itself down. Note that this default shutdown logic can be modified to include the execution of any additional shutdown routines once key switch goes low.

Sensor Power

Sensor power is used for powering external components outside of the GCM196, such as analog sensors on the vehicle. There are 10 Sensor Power pins.

	Min	Nom	Max	Units
Output Voltage	4.9	5	5.1	V
Output current*			150	mA

*Each Sensor Power output is rated to continuously source 150mA of current; however, in some applications, the rating must be reduced, or de-rated, to less than 150 mA. To determine the amount, you must look at sensor supply pins in groups, because output current is provided from the same circuitry for each groups of senor supply pins. Sensor supply 1, 2, and 3 share the same circuitry as do 3, 4, and 5 and 6, 7, 8, and 9 form the final group. For example, if output 1 and output 2 are sourcing 30 mA and 50mA, respectively, then output 3 should be de-rated to less than 70 mA.

Analog Ground

Analog grounds are low current ground paths intended to be used for grounding analog sensors. Using Analog Grounds helps reduce noise and improve accuracy.

Digital Grounds (Pin Name: DIGITAL_GROUND1 - DIGITAL_GROUND6)

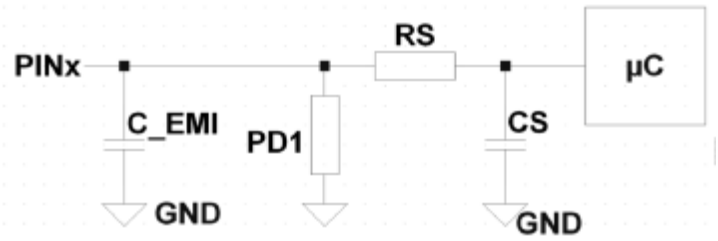
Digital grounds are low current ground paths intended to be used for grounding digital sensors that are connected to digital inputs or frequency inputs.

Analog Inputs

All analog inputs have the following properties:

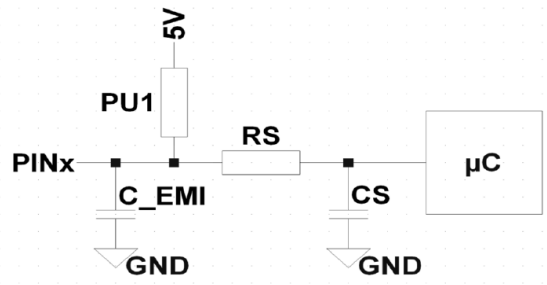
	Min	Nom	Max	Units
Input voltage range	0		5	V
Resolution			12	bits
Overvoltage			?	V
C_EMI	3.76		5.64	nF

Analog Inputs (Inputs 9-11, 40, 44-47)



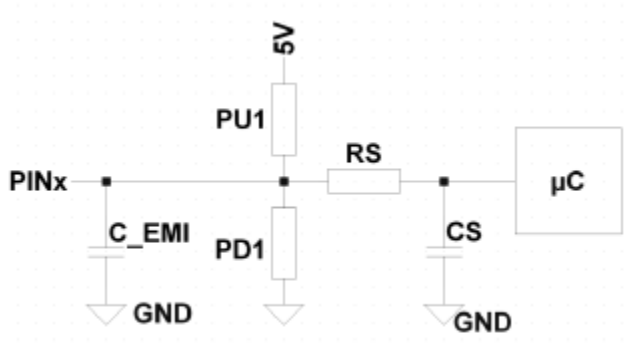
	Min	Nom	Max	Units
Cutoff frequency, Input 10, 44, 45, 46, 47	0.820		1.269	kHz
Cutoff frequency, Input 9, 40	1.188		1.838	kHz
Cutoff frequency, Input 11	.805		1.244	kHz

Analog Inputs (Inputs 16-21, 38, 39, 41, 42)



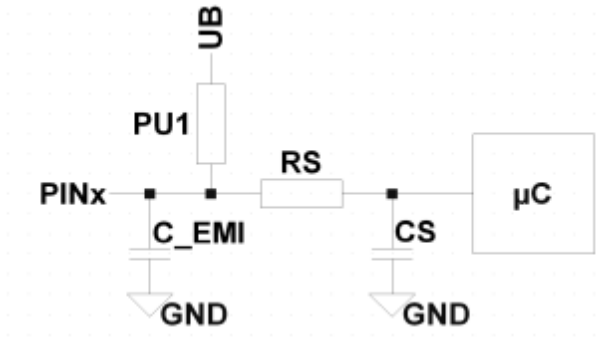
	Min	Nom	Max	Units
Cutoff frequency	1.188		1.838	kHz

Analog Inputs (Inputs 15, 36)



	Min	Nom	Max	Units
Cutoff frequency	1.188		1.838	kHz

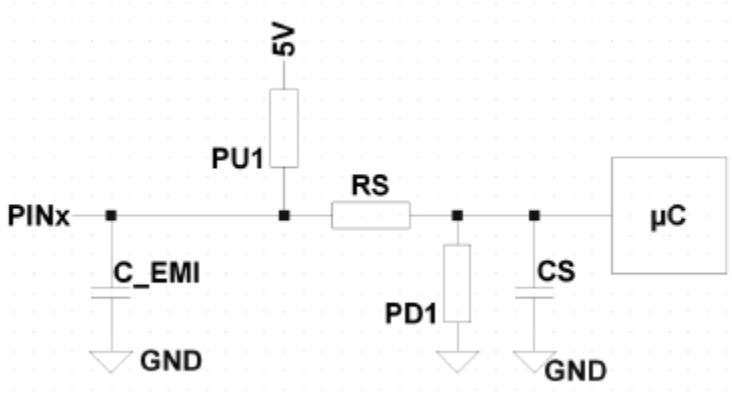
Analog Inputs (Inputs 12, 13, 14, 22, 23, 34, 35, 37, 43)



	Min	Nom	Max	Units
Cutoff frequency	1.188		1.838	kHz

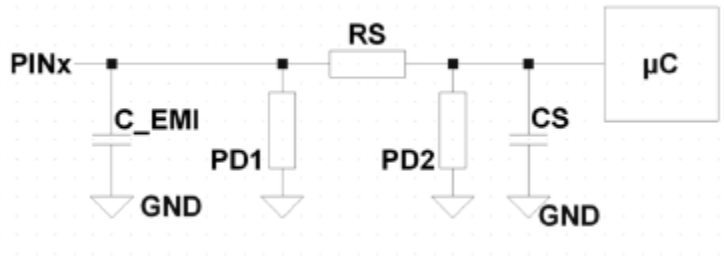
Digital Inputs

Pull-up Digital Inputs (Inputs 2)



	Min	Nom	Max	Units
Low logic threshold			1.76	V
High logic threshold	3.43			V
Cutoff frequency	210		265	kHz

Digital Inputs (Inputs 4, 7)



Input 7

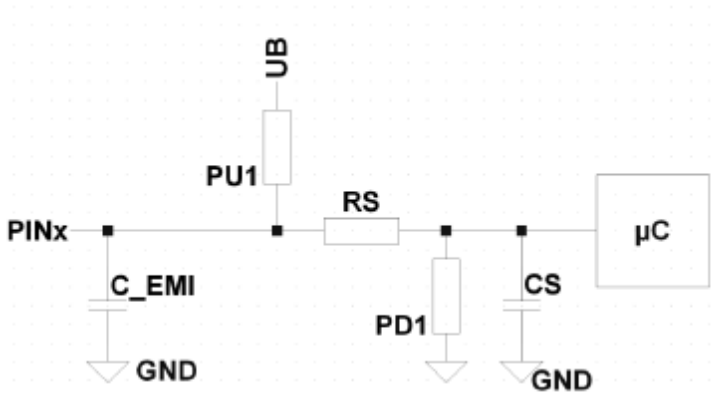
	Min	Nom	Max	Units
Low logic threshold			2	V
High logic threshold	4.42			V
Cutoff frequency	.753		1.164	kHz

Input 4

	Min	Nom	Max	Units

Low logic threshold			2.22	V
High logic threshold	4.19			V
Cutoff frequency	.753		1.164	kHz

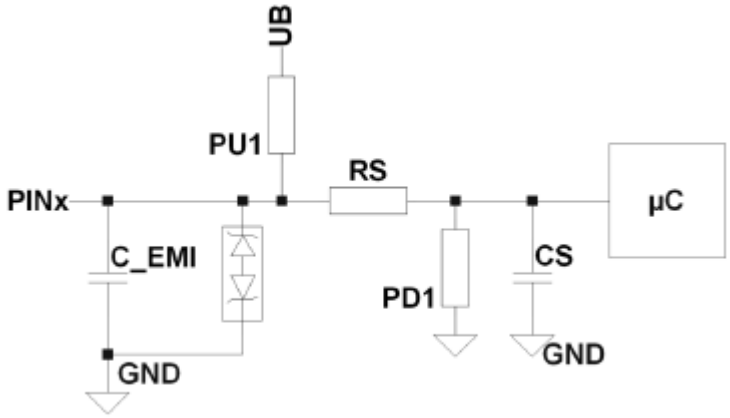
Pull-up Digital Inputs (Inputs 1, 3)



	Min	Nom	Max	Units
Low logic threshold			2.25	V
High logic threshold	4.17			V
Cutoff frequency	.753		1.164	kHz

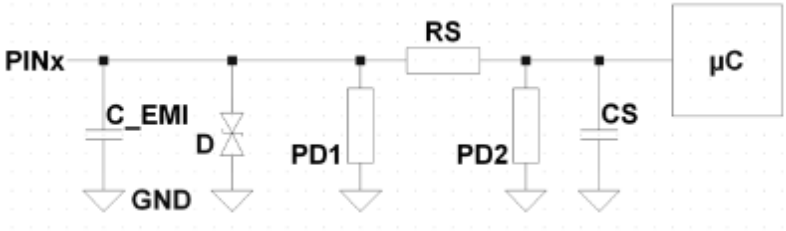
Pull-up Digital Inputs (Inputs 55)

These digital inputs use a pull-up resistor to battery and a single-pole low-pass filter.



	Min	Nom	Max	Units
Low logic threshold			2	V
High logic threshold	4.42			V
Cutoff frequency	.753		1.164	kHz

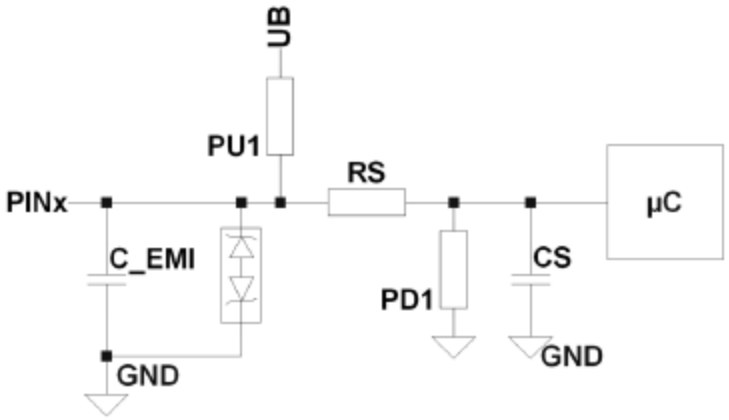
Pull-up Digital Inputs (Inputs 8).



	Min	Nom	Max	Units
Low logic threshold			2.25	V
High logic threshold	4.17			V
Cutoff frequency	.753		1.164	kHz

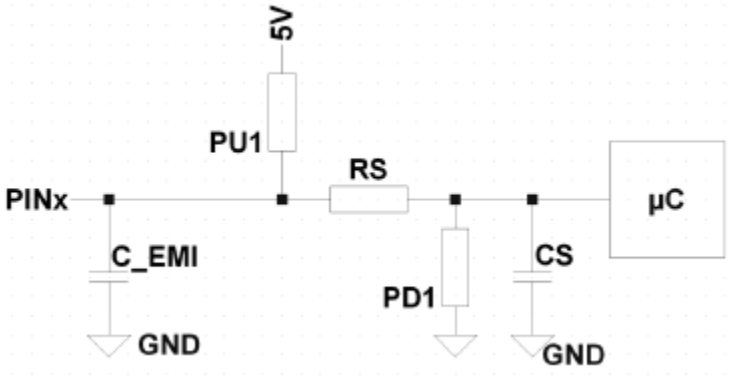
Frequency Inputs

Pull-up Frequency Inputs (Inputs 48, 49)



	Min	Nom	Max	Units
Low logic threshold			1.15	V
High logic threshold	2.04			V
Cutoff frequency	610		769	kHz

Pull-up Frequency Inputs (50- 54, 57)



Input51, 53, 54,

	Min	Nom	Max	Units
Low logic threshold			1.84	V

High logic threshold	3.35			V
Cutoff frequency	210		265	kHz

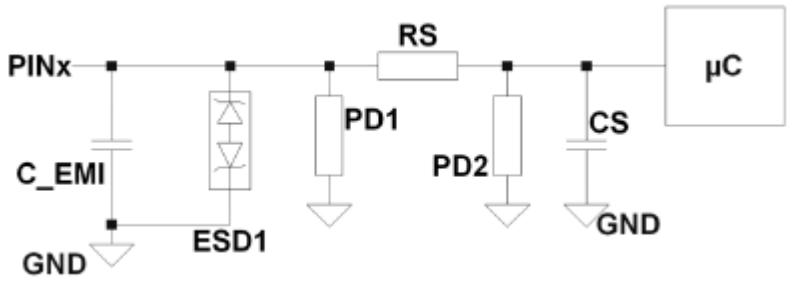
Input50,

	Min	Nom	Max	Units
Low logic threshold			1.1	V
High logic threshold	2.1			V
Cutoff frequency	?		?	kHz

Input 57

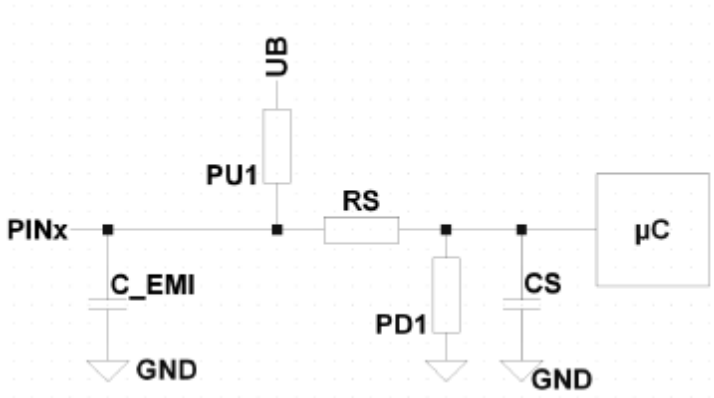
	Min	Nom	Max	Units
Low logic threshold			1.76	V
High logic threshold	3.43			V
Cutoff frequency	210		265	kHz

Pull Down Frequency Inputs (Inputs 56)



	Min	Nom	Max	Units
Low logic threshold			2.25	V
High logic threshold	4.17			V
Cutoff frequency	.753		1.164	kHz

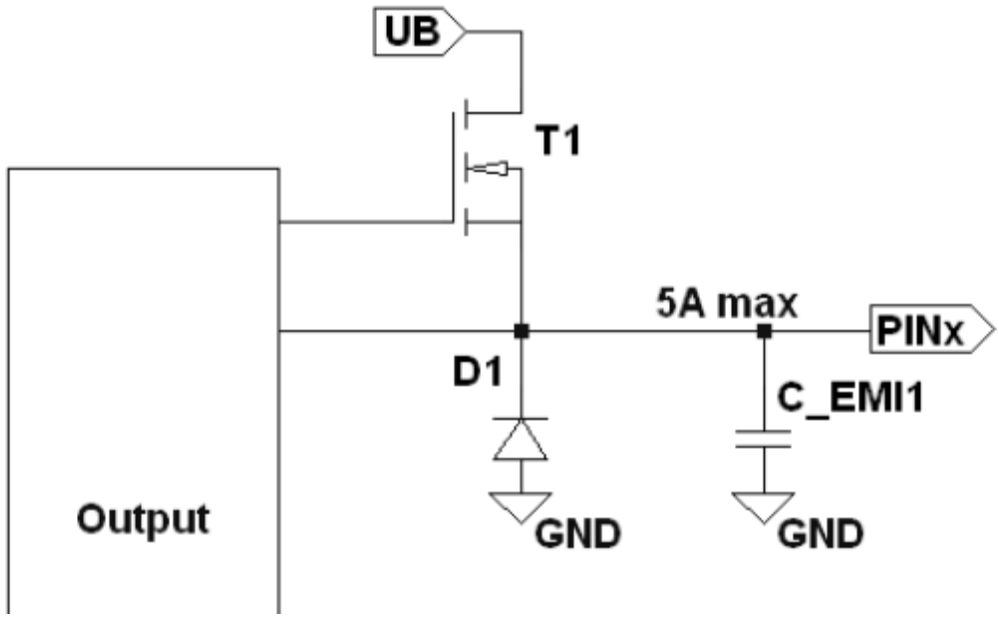
Pull-up Frequency Inputs (Inputs 58)



	Min	Nom	Max	Units
Low logic threshold			2.25	V
High logic threshold	4.17			V
Cutoff frequency	.753		1.164	kHz

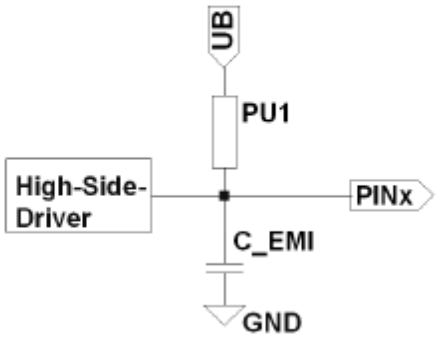
High Side Drives

High Side Drives (Outputs 1, 2)



	Min	Nom	Max	Units
Pickup Current			10	A
Hold Current			4.5	A

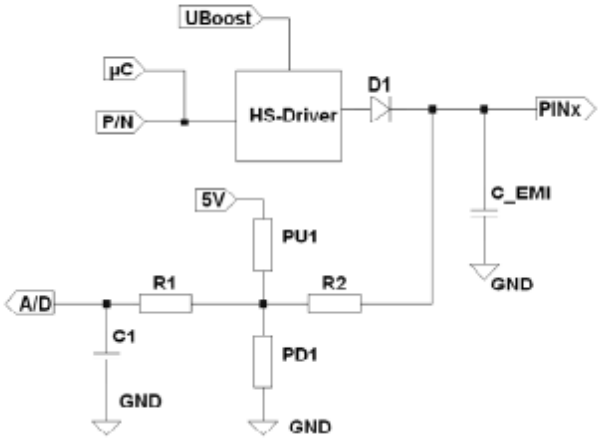
High Side Drives (Outputs 3)



	Min	Nom	Max	Units

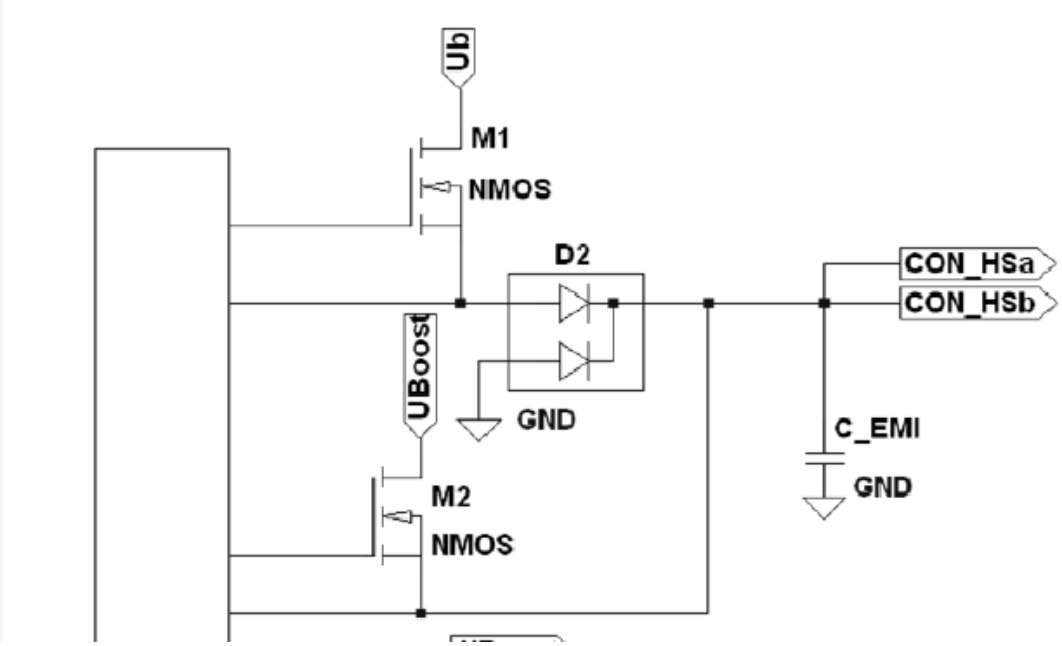
Output Current	0		400	mA
Short Circuit Detection Current Threshold			2	A

High Side Drives (Outputs 4)



	Min	Nom	Max	Units
Output Current	0		400	mA
Short Circuit Detection Current Threshold			2	A

High Side Drives (Outputs 5-12)



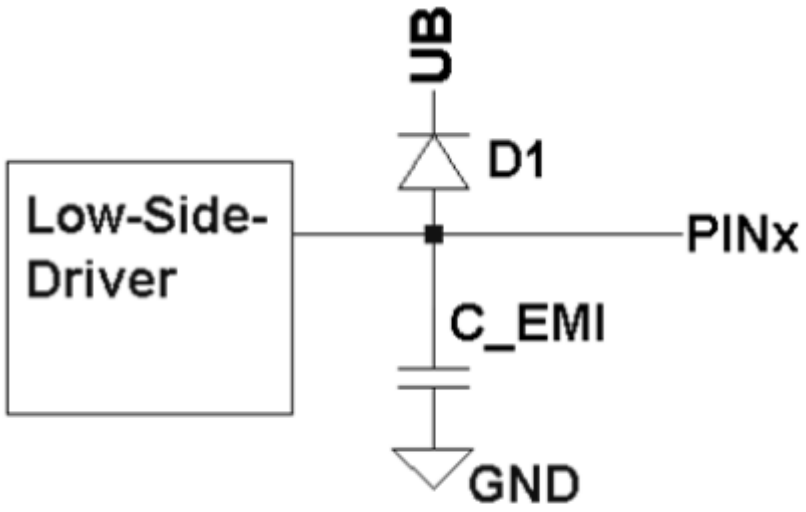
	Min	Nom	Max	Units
Boost Current			15*	A
Pickup Current			10*	A
Hold Current			4.5*	A

*Table shows sum of maximum allowed currents on outputs 5 thru 8 and 9 thru 12.

Low Side Drives

PWM-capable low side drives have a frequency range of 38Hz to 20kHz.

Low Side Drives (24, 25, 26, 34, 35, 41-44, 47-51, 53, 58, 61-63, 65-68, 71)



Outputs 26, 34, 35, 51, 65, 66, 71

	Min	Nom	Max	Units
Output Current	0		2.2	A
Short Circuit Detection Current Threshold			4	A

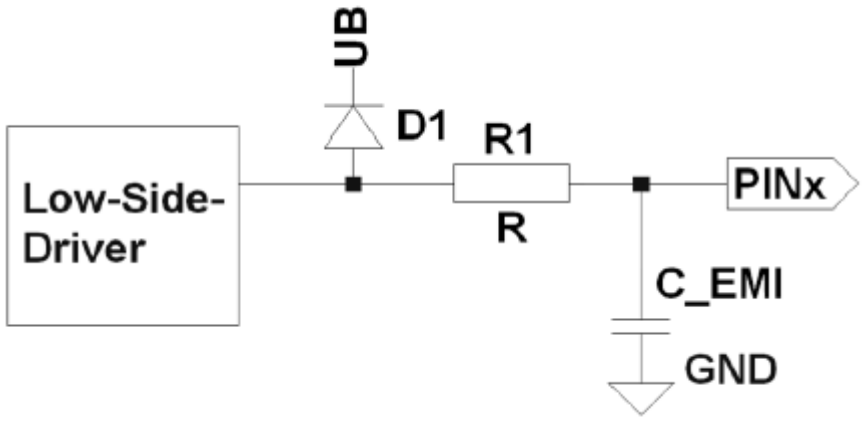
Outputs 25, 41, 44, 42, 47, 48, 50, 58, 61, 63, 67, 68

	Min	Nom	Max	Units
Output Current	0		4	A
Short Circuit Detection Current Threshold			10	A

Outputs 43, 49, 62, 53

	Min	Nom	Max	Units
Output Current	0		3	A
Short Circuit Detection Current Threshold			6	A

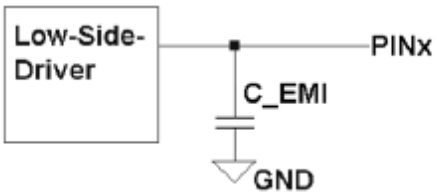
Low Side Drive (Output 64)



	Min	Nom	Max	Units
Output Current	0		4	A
Short Circuit Detection Current Threshold			20	A

Low Side Drive (23, 28, 29-33, 36-38, 40, 45, 46, 52, 54-57, 59, 60, 70)

The following low side drives have integrated short circuit detection.



Outputs 23, 29, 30, 31, 38, 40, 45, 46, 59, 60, 70

	Min	Nom	Max	Units
Output Current	0		2.2	A
Short Circuit Detection Current Threshold			4	A

Outputs 28, 32, 33, 36, 37

	Min	Nom	Max	Units
Output Current	0		600	mA

Short Circuit Detection Current Threshold			1.4	A

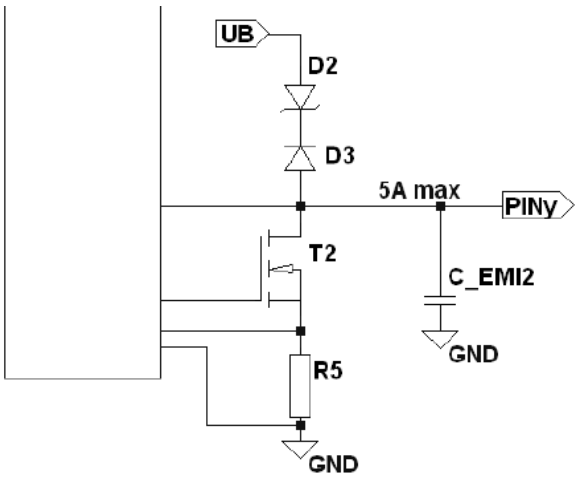
Outputs 52, 56, 57

	Min	Nom	Max	Units
Output Current	0		4	A
Short Circuit Detection Current Threshold			10	A

Output 54, 55

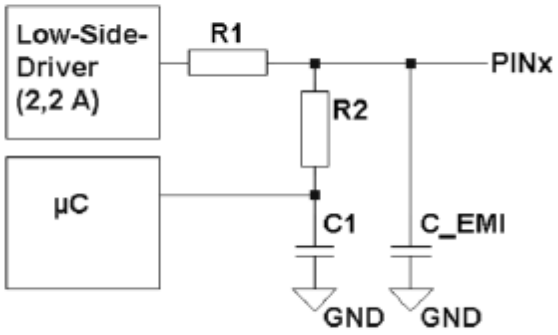
	Min	Nom	Max	Units
Output Current	0		3	A
Short Circuit Detection Current Threshold			6	A

Low Side Drive (21, 22)



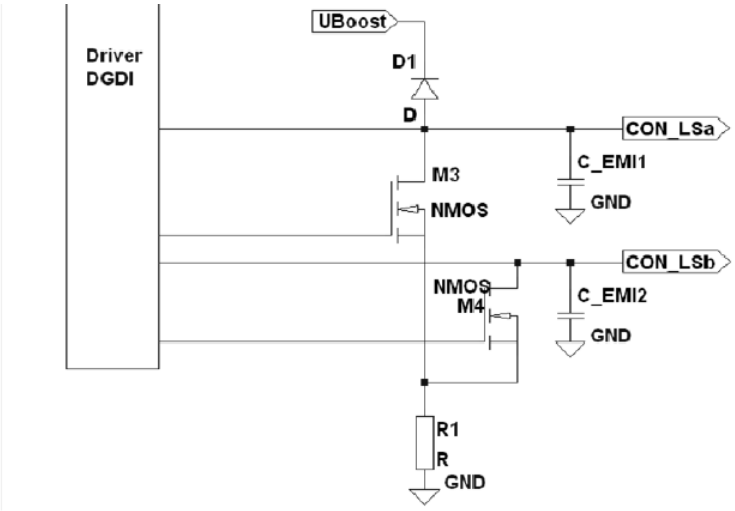
	Min	Nom	Max	Units
Pickup Current			10	A
Hold Current			4.5	A

Low Side Drive (39)



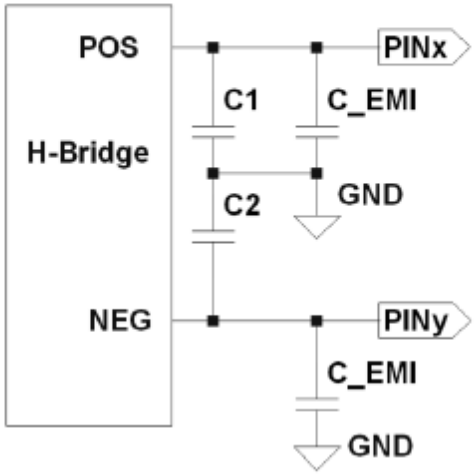
	Min	Nom	Max	Units
Output Current	0		477	mA
Short Circuit Detection Current Threshold			477	A

Low Side Drive (13-20)



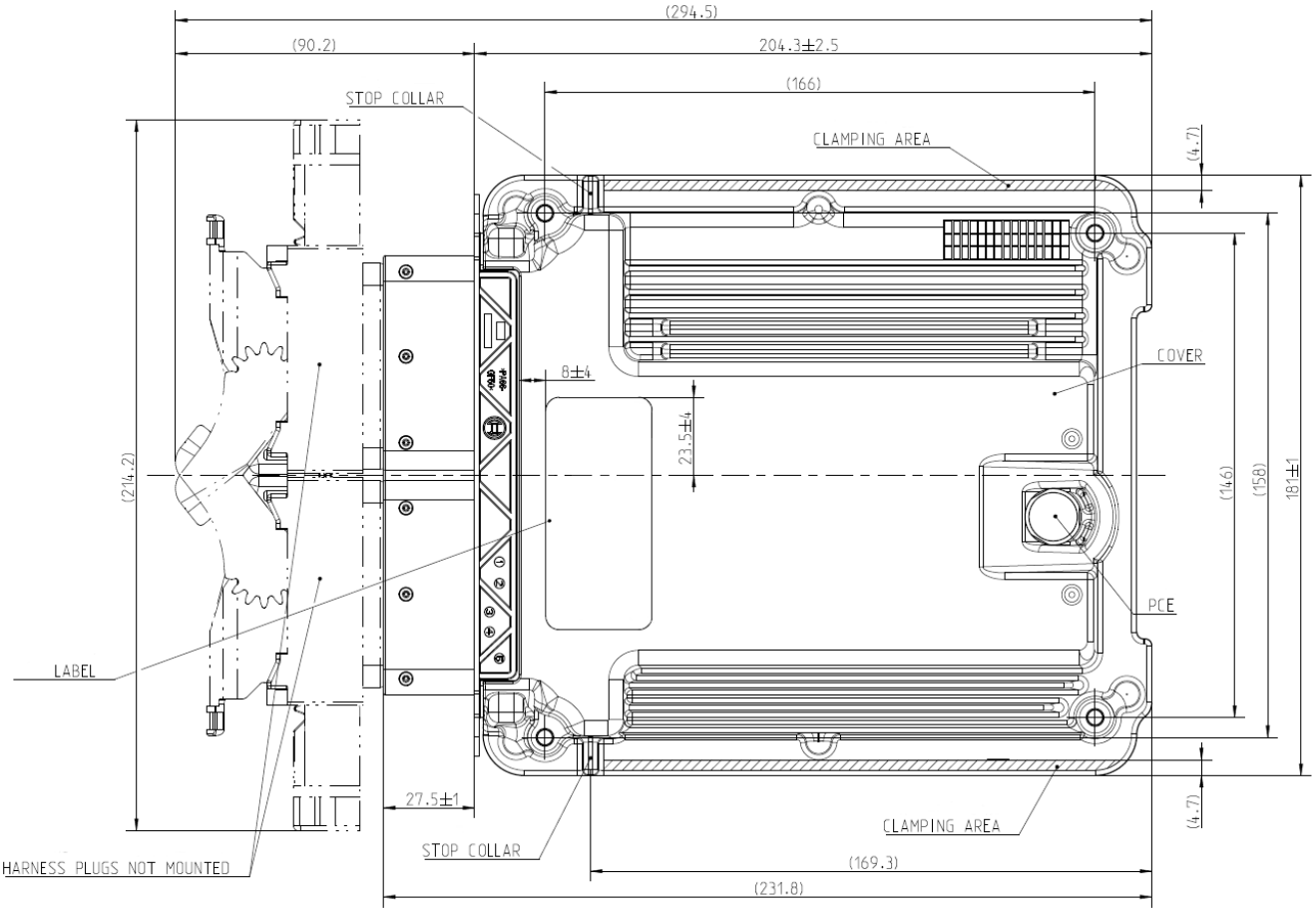
	Min	Nom	Max	Units
Boost Current			15	A
Pickup Current			10	A
Hold Current			4.5	A

Half Bridges (Outputs 72 & 73, 74 & 75, 76 & 77)



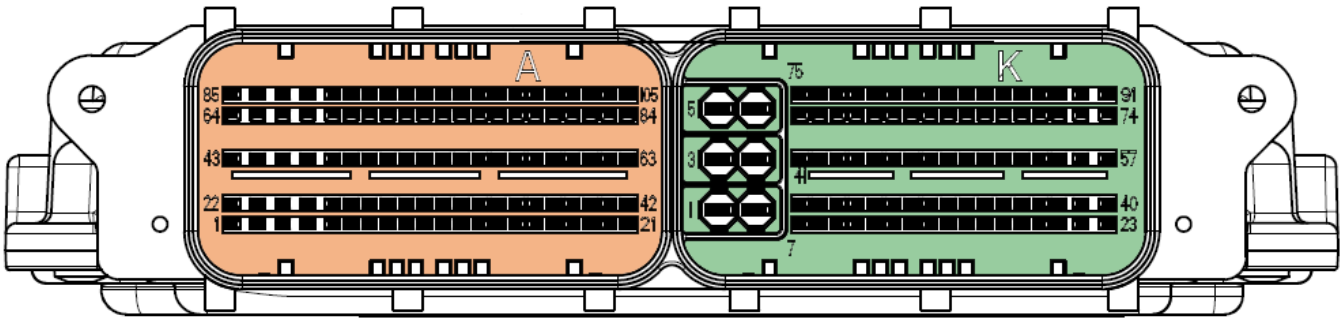
	Min	Nom	Max	Units
Output Current (RMS)	-2.5		2.5	Arms
Output Current (DC)	-7.6		7.6	A
Short Circuit Detection Current Threshold	-11.1		11.1	A

Dimensions



Connections

The connector is split into two chambers, 105 pins for connector A and 91 pins for connector K. Contact New Eagle Distribution (NED) to purchase a connector kit quotes@neweagle.net



Connector A					
Pin	Function	Pin	Function	Pin	Function
1	OUTPUT25	36	SENSOR GROUND	71	OUTPUT63
2	OUTPUT26	37	INPUT6	72	OUTPUT57
3	OUTPUT09	38	INPUT7	73	OUTPUT59
4	OUTPUT21	39	SENSOR RETURN	74	INPUT45
5	Not Connected	40	INPUT8	75	OUTPUT31
6	Not Connected	41	INPUT9	76	SENSOR GROUND
7	Not Connected	42	INPUT10	77	INPUT58
8	Not Connected	43	OUTPUT54	78	INPUT56
9	OUTPUT27	44	OUTPUT55	79	INPUT51
10	OUTPUT1	45	OUTPUT10	80	INPUT54
11	OUTPUT28	46	OUTPUT4	81	SENSOR RETURN
12	SENSOR RETURN	47	Not Connected	82	INPUT14
13	INPUT41	48	Not Connected	83	SENSOR SUPPLY
14	OUTPUT80	49	OUTPUT60	84	INPUT15
15	SENSOR SUPPLY	50	OUTPUT62	85	Not Connected
16	INPUT2	51	OUTPUT56	86	Not Connected
17	INPUT3	52	OUTPUT58	87	Not Connected
18	INPUT4	53	INPUT44	88	Not Connected
19	INPUT5	54	OUTPUT54	89	Not Connected
20	SENSOR SUPPLY	55	INPUT11	90	OUTPUT75
21	SENSOR SUPPLY	56	SENSOR RETURN	91	Not Connected
22	OUTPUT12	57	INPUT33	92	Not Connected
23	OUTPUT2	58	INPUT58	93	OUTPUT6
24	OUTPUT3	59	INPUT12	94	OUTPUT32
25	OUTPUT29	60	SENSOR RETURN	95	INPUT50
26	Not Connected	61	SENSOR RETURN	96	SENSOR GROUND
27	Not Connected	62	INPUT13	97	INPUT16
28	Not Connected	63	SENSOR RETURN	98	INPUT57
29	Not Connected	64	OUTPUT52	99	INPUT55
30	OUTPUT19	65	OUTPUT53	100	INPUT52
31	OUTPUT22	66	OUTPUT50	101	INPUT53
32	OUTPUT20	67	OUTPUT51	102	INPUT17
33	OUTPUT30	68	Not Connected	103	INPUT18
34	INPUT42	69	Not Connected	104	SENSOR SUPPLY
35	INPUT43	70	OUTPUT61	105	INPUT19

Connector K					
Pin	Function	Pin	Function	Pin	Function
1	BATTERY -	36	OUTPUT37	71	OUTPUT46
2	BATTERY -	37	OUTPUT23	72	OUTPUT47
3	BATTERY +	38	OUTPUT38	73	OUTPUT24
4	BATTERY -	39	OUTPUT39	74	OUTPUT16
5	BATTERY +	40	OUTPUT17	75	INPUT32
6	BATTERY +	41	INPUT31	76	SENSOR RETURN
7	O2 Current Pump 1	42	INPUT25	77	CAN3
8	O2 Virtual Ground 1	43	SENSOR RETURN	78	CAN3
9	Not Connected	44	SENSOR RETURN	79	CAN1B
10	O2 Voltage Nernst 1	45	INPUT26	80	CAN1B
11	INPUT20	46	SENSOR GROUND	81	SENSOR RETURN
12	OUTPUT33	47	INPUT34	82	INPUT30
13	INPUT21	48	INPUT48	83	SENSOR SUPPLY
14	INPUT36	49	INPUT35	84	OUTPUT7
15	SENSOR GROUND	50	WAKE_INPUT1	85	SENSOR SUPPLY
16	INPUT37	51	INPUT27	86	BATTERY +
17	INPUT38	52	INPUT49	87	MPRD
18	INPUT46	53	OUTPUT49	88	OUTPUT88
19	OUTPUT34	54	OUTPUT40	89	OUTPUT48
20	OUTPUT35	55	OUTPUT41	90	OUTPUT14
21	OUTPUT36	56	OUTPUT42	91	OUTPUT18
22	OUTPUT13	57	OUTPUT11		
23	OUTPUT15	58	INPUT28		
24	Not Connected	59	OUTPUT43		
25	O2 Virtual Ground 2	60	CAN2		
26	O2 Voltage Nernst 2	61	CAN2		
27	O2 Current Pump 2	62	CAN1		
28	INPUT39	63	CAN2		
29	INPUT47	64	SENSOR RETURN		
30	INPUT22	65	INPUT29		
31	SENSOR RETURN	66	SENSOR SUPPLY		
32	SENSOR GROUND	67	SENSOR SUPPLY		
33	INPUT40	68	LIN		
34	INPUT23	69	OUTPUT44		
35	INPUT24	70	OUTPUT45		

Minimum Programming Harness

Connector K					
Pin	Function	Pin	Function	Pin	Function
1	GND1	60	CAN2_HI	77	CAN3_HI
5	VBATT_SW2+	61	CAN2_LO	78	CAN3_LO
15	SENSOR_GND	62	CAN1A_HI		
50	WAKE_INPUT1	63	CAN1A_LO		