

CL-711 Product Family Specification

PFS-CL711-A1

2/8/2016



INTELLIGENT VEHICLE CONTROLS



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USING THIS DOCUMENT

The specifications contained herein represent all possible configurations for this product family. The actual configurations available on each module may be a subset of this specification. Please refer to the module-specific datasheet for the connector pinout and configurations that are available.

USER LIABILITY

The OEM of a machine or vehicle in which HED® electronic controls are installed is fully responsible for all consequences that might occur. HED®, and any authorized distributor, has no responsibility for any consequences, direct or indirect, caused by failures or malfunctions. Failure or improper selection or improper use of HED® products can cause death, personal injury and property damage.

The OEM must analyze all aspects of their application and review the information concerning product or system in the current product documentation. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by HED® at any time without notice.

INPUT STB/STG/VTD (DEUTSCH PINS 11, 12, 17, 18)¹

INPUT STB/STG/VTD/FREQ/PWM/ENCODER (DEUTSCH PINS 15, 16)¹

INPUT STB/STG/VTD/FREQ/PWM/ENCODER/RTD (DEUTSCH PINS 9, 10)¹

Switch-to-Battery (STB) Mode

Input Resistance

- 1.4K Ω (typical)

Input Current

- 5.7mA at 8V (typical)
- 24.0mA at 32V (typical)

Positive Going Threshold

- > 5.9V

Negative Going Threshold

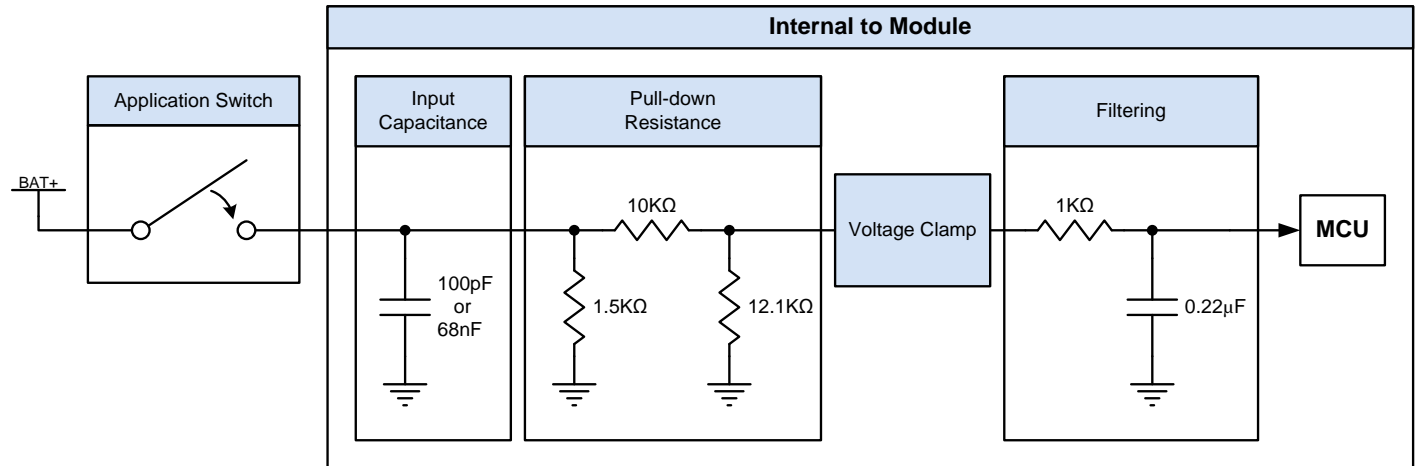
- < 3.2V

Parallel Resistance

- 2K Ω at 8V (minimum)
- 12K Ω at 32V (minimum)

Series Resistance

- 220 Ω (maximum)



Switch-to-Ground (STG) Mode

Pull-up Resistance

- 560 Ω (typical)

Input Current

- 7.6mA at 0V (typical)

Positive Going Threshold

- > 3.25V

Negative Going Threshold

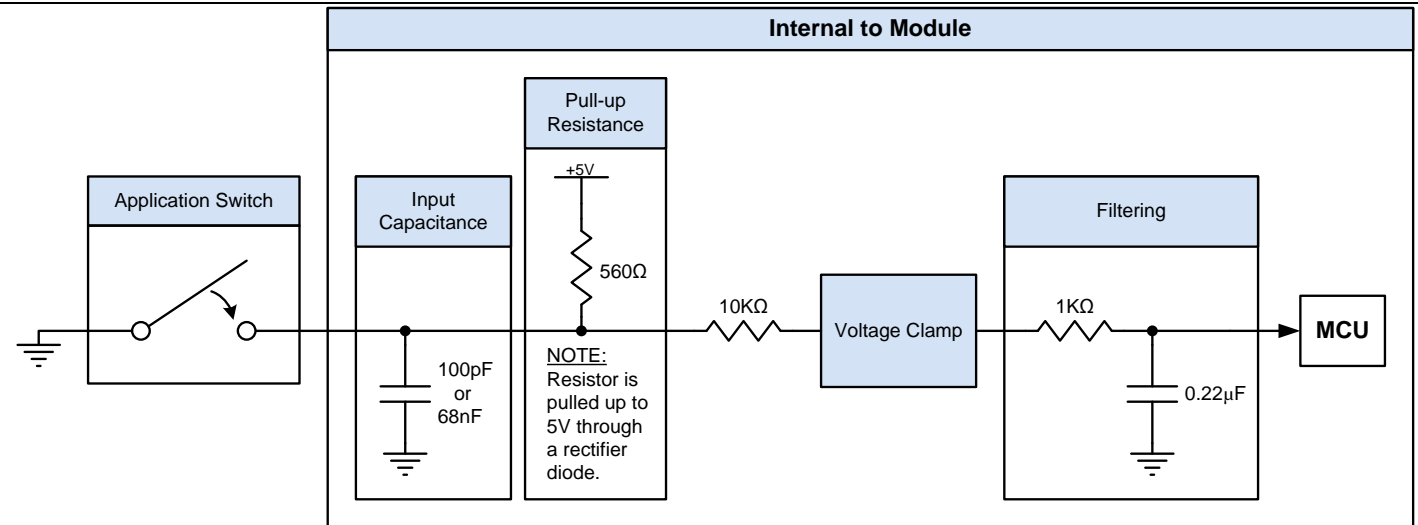
- < 1.75V

Parallel Resistance

- 2K Ω at 0V (minimum)

Series Resistance

- 220 Ω (maximum)



¹ Pins 9, 10, 15, and 16 have input capacitance of 100pF. Pins 11, 12, 17, and 18 have input capacitance of 68nF.

INPUT STB/STG/VTD (DEUTSCH PINS 11, 12, 17, 18)¹

INPUT STB/STG/VTD/FREQ/PWM/ENCODER (DEUTSCH PINS 15, 16)¹

INPUT STB/STG/VTD/FREQ/PWM/ENCODER/RTD (DEUTSCH PINS 9, 10)¹

**Voltage-to-Digital (VTD) Mode
(0 – 5.65VDC)**

Input Voltage Range

- 0V to 5.51V (minimum)
- 0V to 5.65V (typical)

Input Resistance

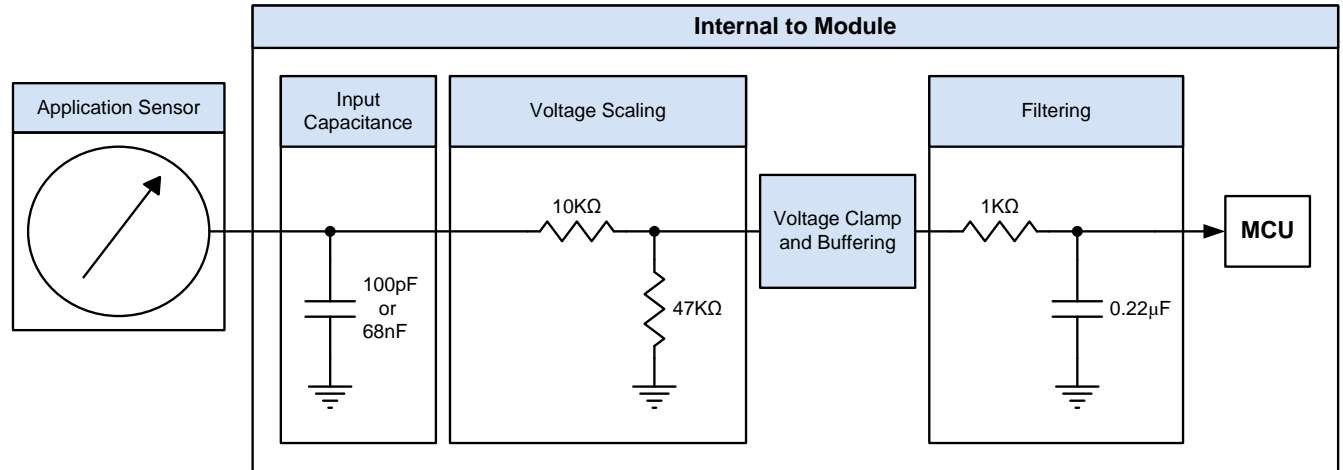
- 57KΩ (typical)

Resolution

- 12 Bits
- 1.38mV / count (typical)

Accuracy²

- ±1.0% and ±32mV (T_A = 25°C)
- ±2.5% and ±43mV (T_A = full)



**Voltage-to-Digital (VTD) Mode
(0 – 36.34VDC)**

Input Voltage Range

- 0V to 35.54V (minimum)
- 0V to 36.34V (typical)

Input Resistance

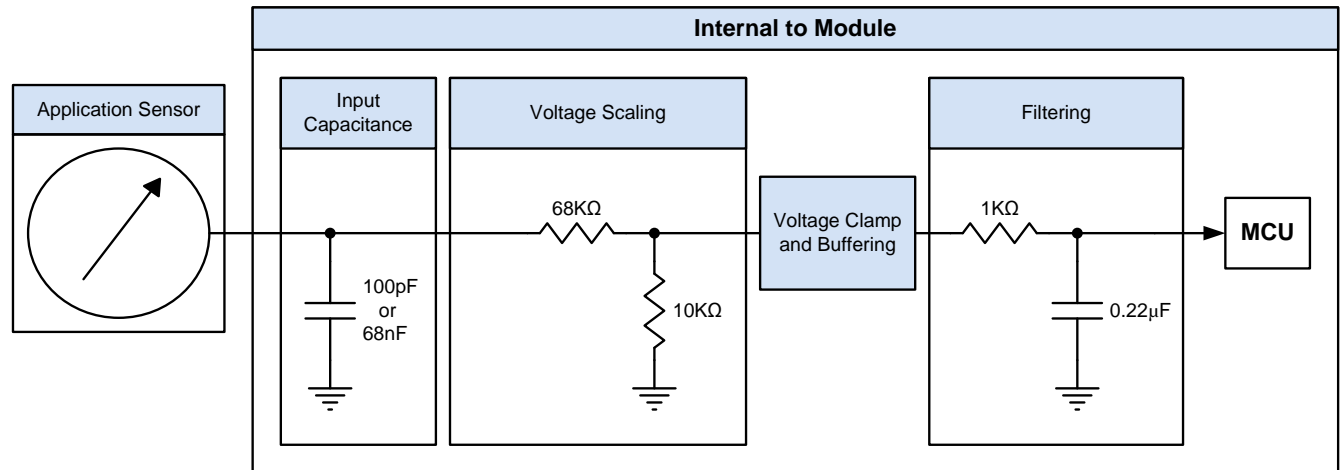
- 78KΩ (typical)

Resolution

- 12 Bits
- 8.87mV / count (typical)

Accuracy²

- ±1.0% and ±125mV (T_A = 25°C)
- ±2.5% and ±167mV (T_A = full)



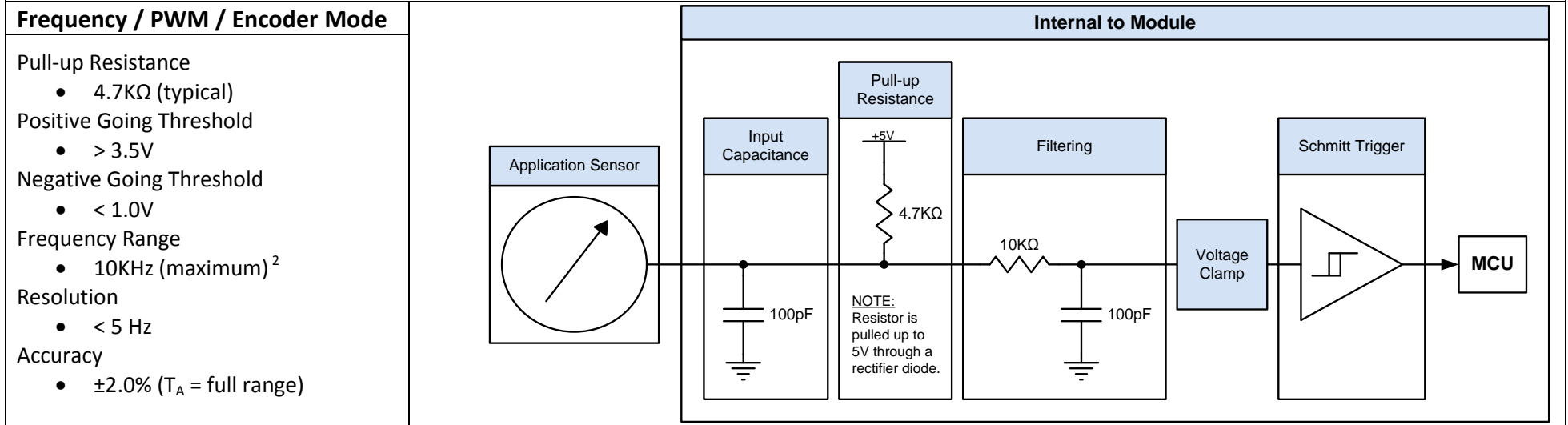
¹ Pins 9, 10, 15, and 16 have input capacitance of 100pF. Pins 11, 12, 17, and 18 have input capacitance of 68nF.

² VTD accuracy is estimated using datasheet maximums and a weighted average of worst-case and root-sum-square (RSS) methods. It is considered as a percentage of the input voltage range combined with an additional offset.

INPUT STB/STG/VTD (DEUTSCH PINS 11, 12, 17, 18)¹

INPUT STB/STG/VTD/FREQ/PWM/ENCODER (DEUTSCH PINS 15, 16)¹

INPUT STB/STG/VTD/FREQ/PWM/ENCODER/RTD (DEUTSCH PINS 9, 10)¹

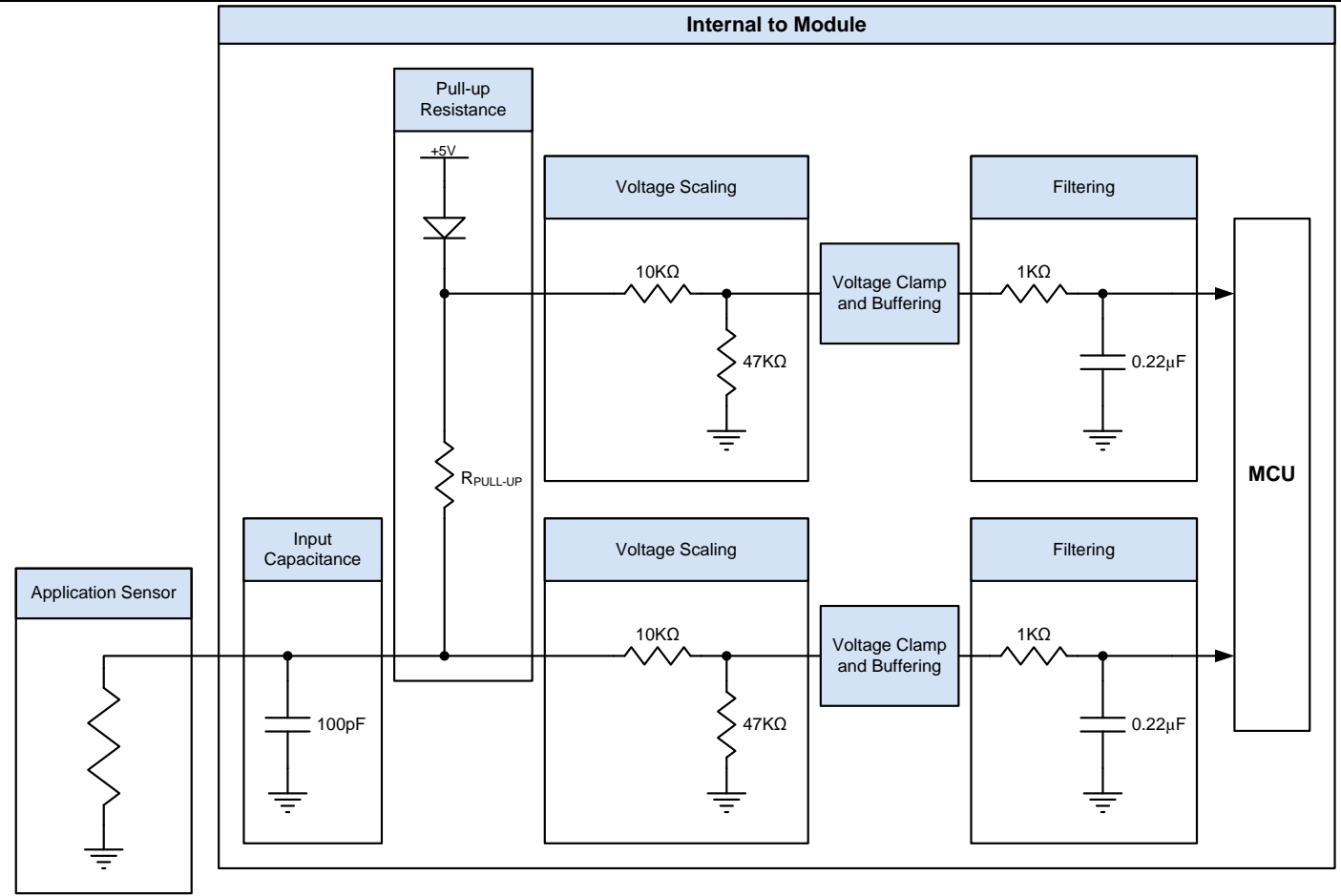


¹ Pins 9, 10, 15, and 16 have input capacitance of 100pF. Pins 11, 12, 17, and 18 have input capacitance of 68nF.

² Frequency range maximum assumes square wave, open-drain, sinking sensor at 50% duty cycle.

INPUT STB/STG/VTD (DEUTSCH PINS 11, 12, 17, 18)¹
INPUT STB/STG/VTD/FREQ/PWM/ENCODER (DEUTSCH PINS 15, 16)¹
INPUT STB/STG/VTD/FREQ/PWM/ENCODER/RTD (DEUTSCH PINS 9, 10)¹

Resistance-to-Digital (RTD) Mode (0 – 500Ω)
Pull-up Resistance ($R_{PULL-UP}$) <ul style="list-style-type: none"> • 499Ω (typical) Accuracy ² <ul style="list-style-type: none"> • ±1.0% and ±3.5% ($T_A = 25^\circ\text{C}$) • ±2.5% and ±5.0% ($T_A = \text{full}$)
Resistance-to-Digital (RTD) Mode (0 – 2KΩ)
Pull-up Resistance ($R_{PULL-UP}$) <ul style="list-style-type: none"> • 2KΩ (typical) Accuracy ² <ul style="list-style-type: none"> • ±1.0% and ±14.0Ω ($T_A = 25^\circ\text{C}$) • ±2.5% and ±19.5Ω ($T_A = \text{full}$)



¹ Pins 9, 10, 15, and 16 have input capacitance of 100pF. Pins 11, 12, 17, and 18 have input capacitance of 68nF.

² RTD accuracy is estimated using datasheet maximums and a weighted average of worst-case and root-sum-square (RSS) methods. It is considered as a percentage of the application sensor resistance range combined with an additional offset. Offset is estimated at an application sensor resistance of $\frac{1}{2}(R_{PULL-UP})$.

INPUT STB/STG/WAKE-UP (DEUTSCH PINS 11, 16, 17)

Switch-to-Battery (STB) Mode

See input section for Deutsch pins 11, 16, and 17 (STB mode)

Switch-to-Ground (STG) Mode

See input section for Deutsch pins 11, 16, and 17 (STG mode)

Wake-Up Mode

Wake-Up Source

- Software Configurable
- Use STB for active-high wake
- Use STG for active-low wake

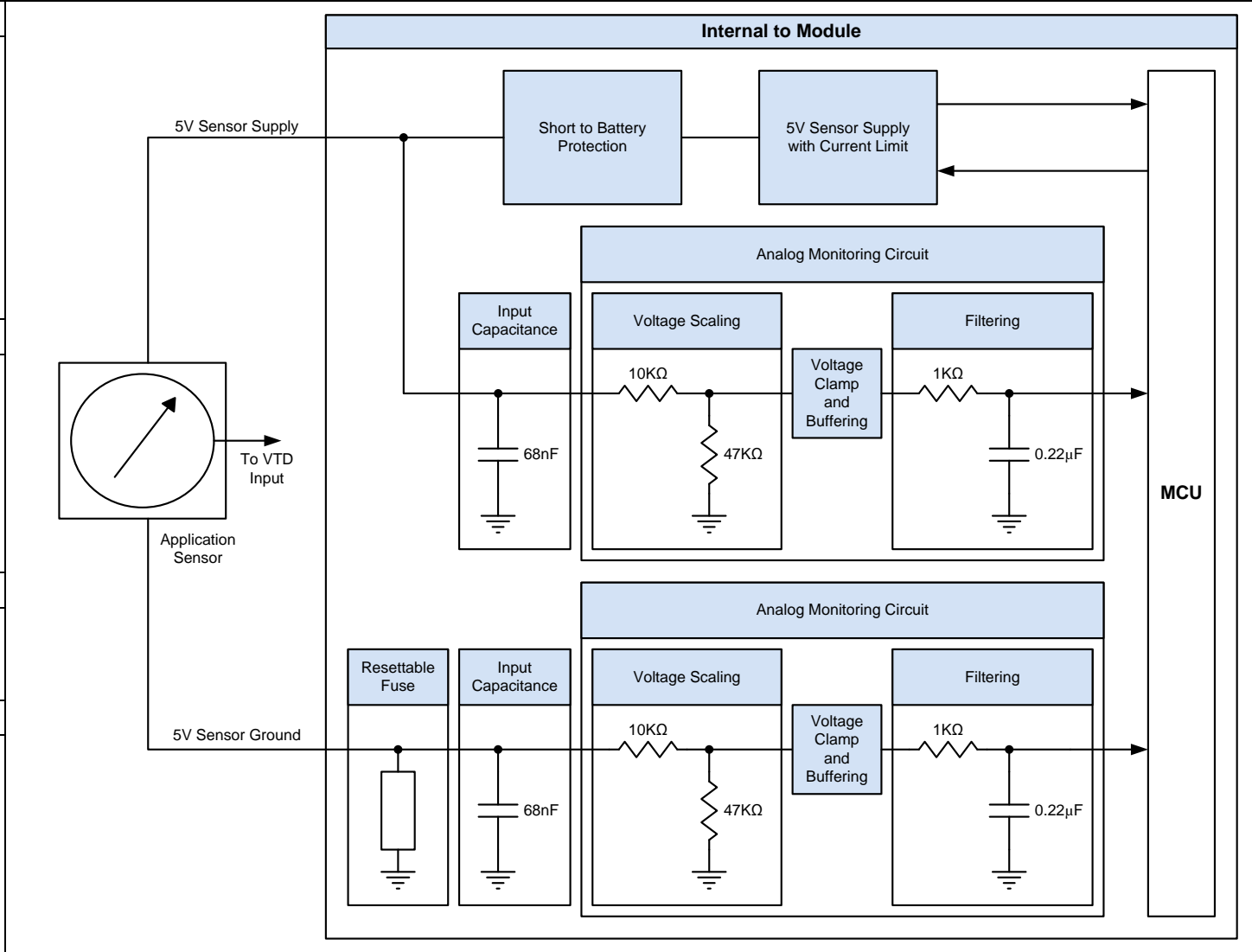
Wake-Up / Shutdown

- Input transition from inactive to active will wake module from low power / sleep mode
- Input transition from active to inactive will begin controlled shutdown sequence and place module in low power / sleep mode

See input section (STB / STG modes) for Deutsch pins 11, 16, and 17
Input capacitance is 68nF

5VDC SENSOR SUPPLY (DEUTSCH PIN 18) AND SENSOR GROUND (DEUTSCH PIN 17)

5VDC Sensor Supply Mode
Voltage Range <ul style="list-style-type: none"> • 5V ± 5% Current Rating <ul style="list-style-type: none"> • 250mA (typical) Current Limit <ul style="list-style-type: none"> • 231mA (minimum) • 266mA (typical) • 308mA (maximum)
Analog Monitoring Circuit
Resolution <ul style="list-style-type: none"> • 12 Bits • 1.38mV / count (typical) Accuracy <ul style="list-style-type: none"> • See Section Input – VTD Mode (0-5.65V Range)
5VDC Sensor Ground Mode
Current Rating <ul style="list-style-type: none"> • 250mA
Analog Monitoring Circuit
Resolution <ul style="list-style-type: none"> • 12 Bits • 1.38mV / count (typical) Accuracy <ul style="list-style-type: none"> • See Section Input – VTD Mode (0-5.65V Range)



CAN COMMUNICATION (DEUTSCH PINS 1/2, 7/8, 11/12, 13/14)

Baud Rate

- 40kbps to 500kbps

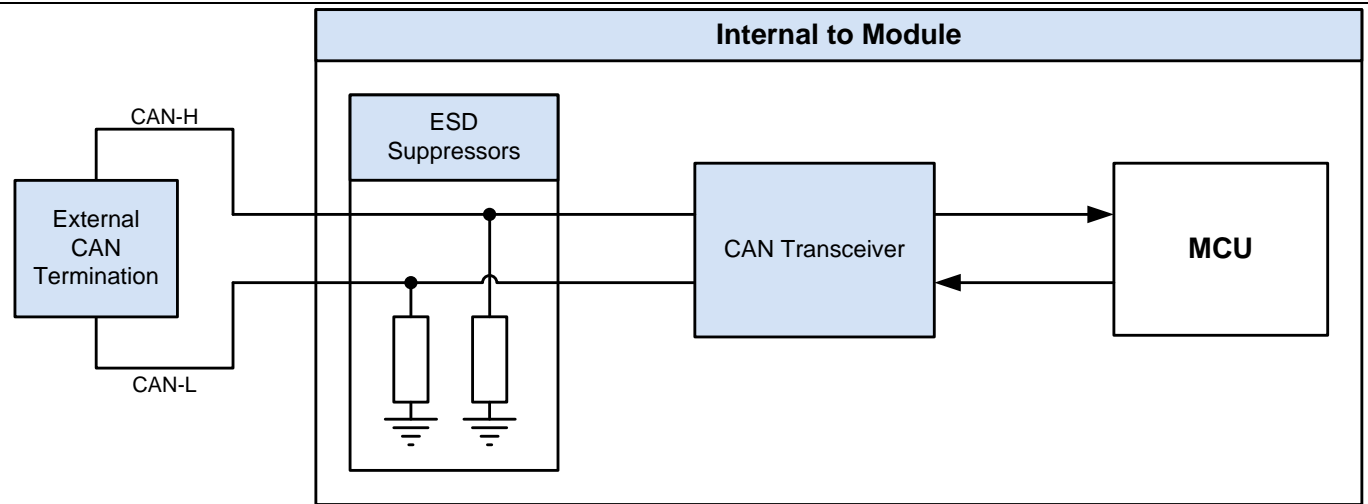
Maximum Allowable Voltage¹

- -27V to +40V

Input Capacitance (max)

- 26pF (common mode)

No Internal Termination



¹ Maximum allowable voltage defines the voltage extremes that the transceiver can tolerate. Exposure to these voltages for extended periods may affect device reliability.

INPUT STB/STG (DEUTSCH PINS 1 - 4)

Switch-to-Battery (STB) Mode

Input Resistance

- 1.4K Ω (typical)

Input Current

- 5.7mA at 8V (typical)
- 24.0mA at 32V (typical)

Positive Going Threshold

- > 5.9V

Negative Going Threshold

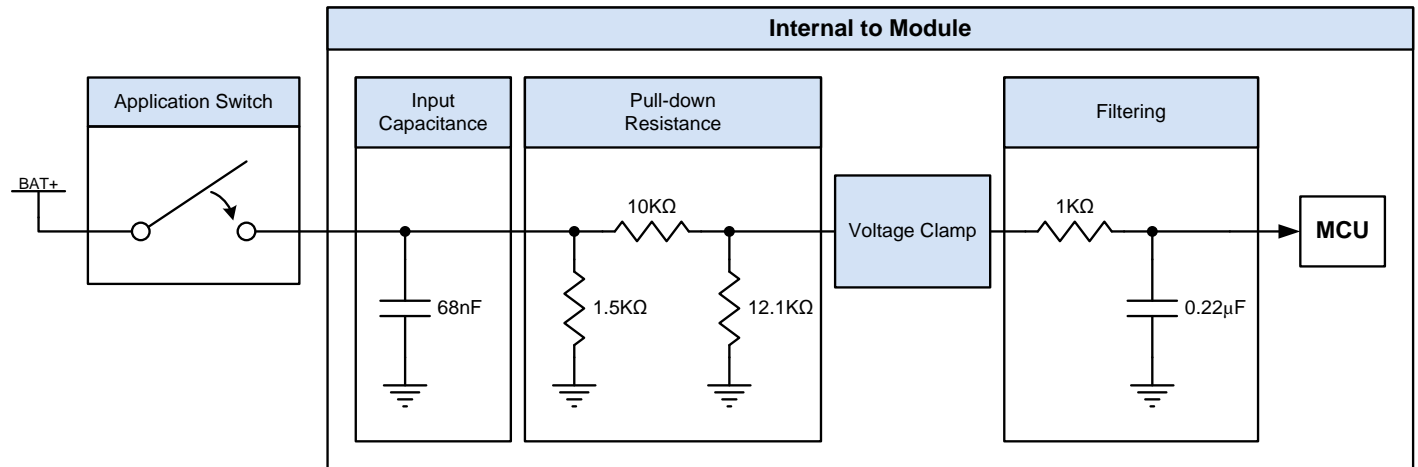
- < 3.2V

Parallel Resistance

- 2K Ω at 8V (minimum)
- 12K Ω at 32V (minimum)

Series Resistance

- 220 Ω (maximum)



Switch-to-Ground (STG) Mode

Pull-up Resistance

- 560 Ω (typical)

Input Current

- 7.6mA at 0V (typical)

Positive Going Threshold

- > 3.25V

Negative Going Threshold

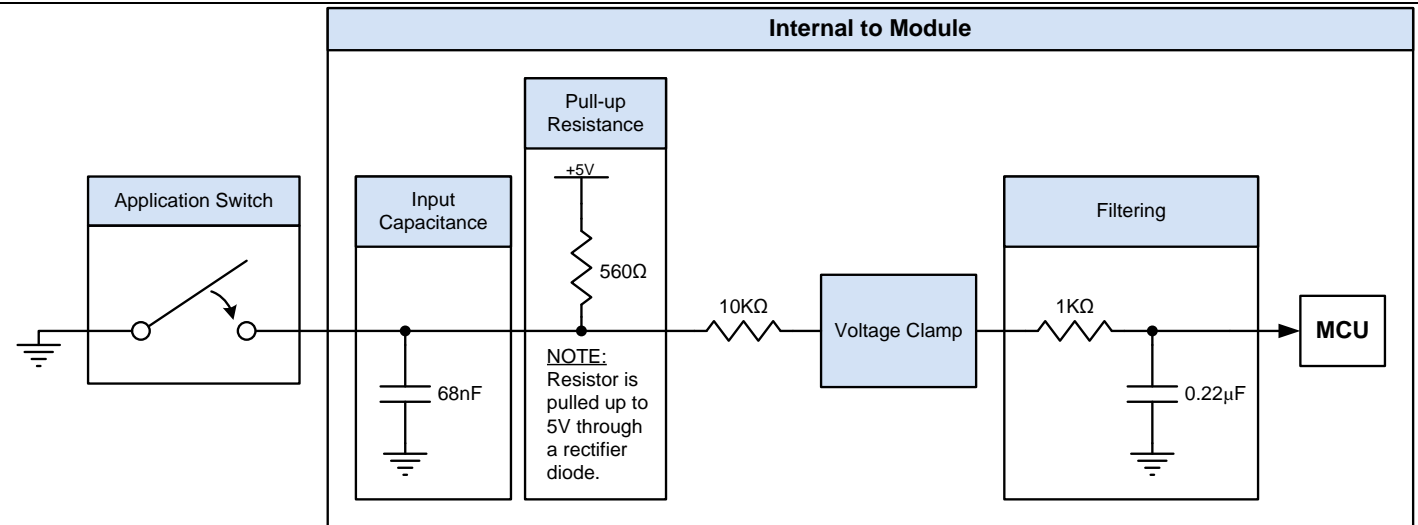
- < 1.75V

Parallel Resistance

- 2K Ω at 0V (minimum)

Series Resistance

- 220 Ω (maximum)



IMPORTANT NOTE: On modules where Input STB/STG and Output modes are software configurable and Input STB mode is chosen, the input voltage must remain at or below the main battery voltage on Pin 6 (or output battery voltage on Pin 12 or Pin 18, if populated) of the module. Otherwise, the input voltage can back feed through the output FET and may source current to the outputs from the STB input instead of Pin 6 (or Pin 12 / 18), potentially causing damage to the application switch and/or module.

OUTPUT DOUT(+)/PWM(+)/ECC(+) (DEUTSCH PINS 1 - 4)

Individual Output Current¹

- Digital Mode = 2.0A (maximum)
- PWM Mode = 2.0A (maximum)

Grouped Output Current^{2,3}

- Digital Mode = 2.0A (maximum)
- PWM Mode = 2.0A (maximum)

PWM Frequency⁴

- < 300 Hz (typical)
- < 1 KHz (maximum)

Output Diagnostics

- Short to Battery
- Short to Ground
- Overcurrent
- Open Circuit⁵

Current Sense Range

- Up to 4.1A (minimum)
- Up to 5.0A (typical)

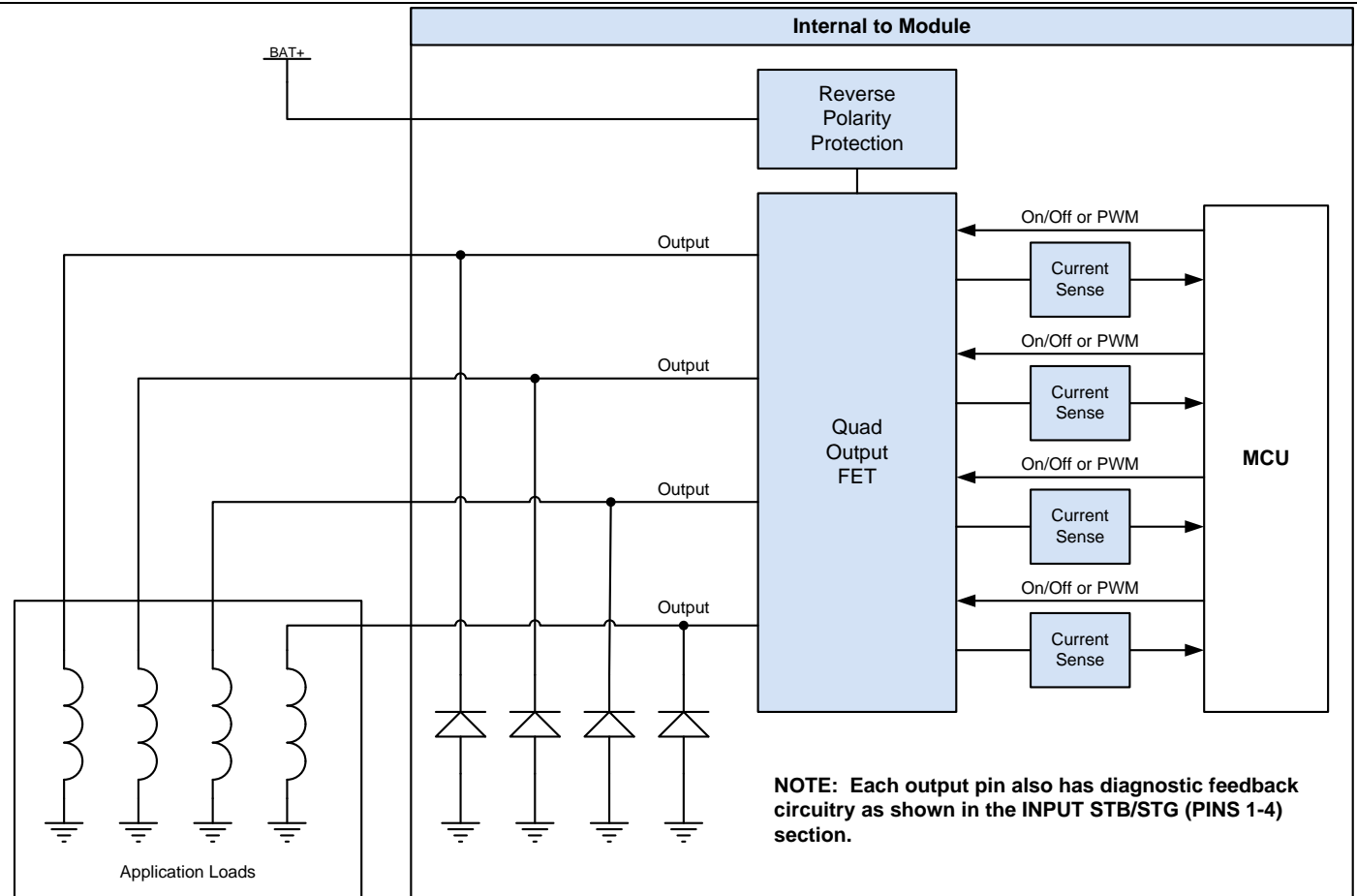
Current Sense Resolution

- 12 bits
- 1.2mA / count (typical)

Current Sense Accuracy (typical)

- < 50mA at 2A, T_A = 25°C

Internal Flyback Diodes



¹ Individual Output Current specifies the maximum current for an individual output channel. Additional restrictions regarding total output current, number of active channels, etc. will apply and are specified in the Grouped Output Current parameter. PWM outputs assume 250Hz frequency.

² Output current maximums assume all four channels are active simultaneously and the module is at maximum ambient temperature. PWM outputs assume 250Hz frequency. Output current may be increased per channel (up to the individual output current maximum) if not all channels are active simultaneously or other channels are at a reduced load current. Please contact HED® for further information.

³ Maximum total output current for Pins 1-4 is 8 Amps.

⁴ The output driver is best suited for PWM frequencies of 300 Hz or less. PWM frequencies of up to 1 KHz are possible, but at reduced output current and duty cycle range.

⁵ Open circuit can be detected when the output is active using current sense feedback for load currents of at least 250mA and duty cycles greater than 0%. Open circuit can be detected when the output is inactive using the pull-up resistor for loads that are not influenced by the associated pull-up current (see Input STG mode circuit diagram and parameters).

BATTERY (+) MODULE (DEUTSCH PIN 6)

BATTERY (+) OUTPUTS (DEUTSCH PIN 6 or PIN 12, 18)¹

Battery (+) (Pins 6, 12, 18)

Operating Voltage Range

- 6.5VDC – 32VDC

Maximum Continuous Voltage²

- 36VDC

Module Current Draw – Running

Battery Voltage	Current by LCD Type (typ)	
	400 nit ³	1000 nit ⁴
6.5V	913mA	1185mA
13.8V	440mA	536mA
28.0V	252mA	296mA
32.0V	227mA	270mA

Module Current Draw – Shutdown⁵

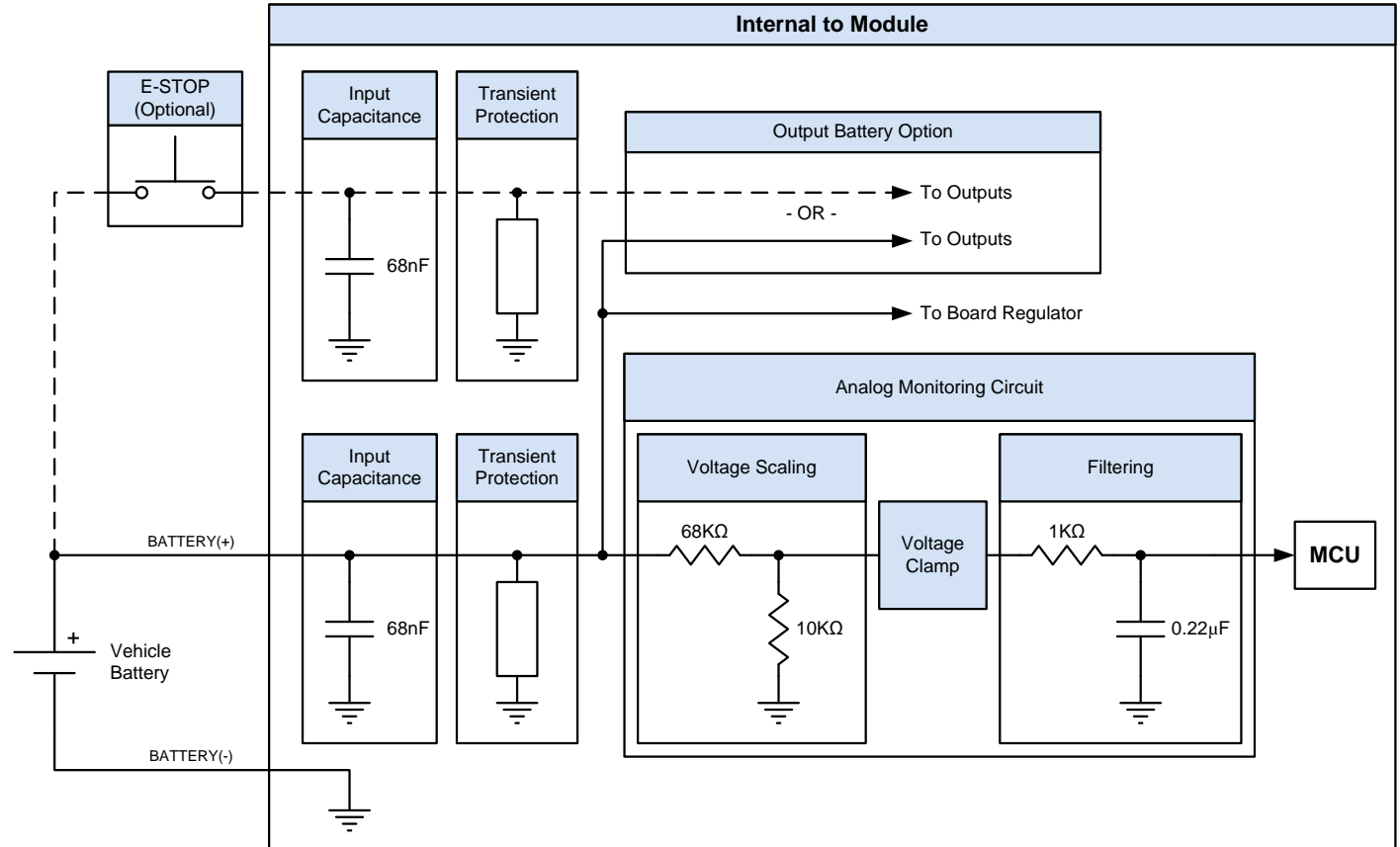
- 886µA at 6.5V (typical)
- 562µA at 13.8V (typical)
- 847µA at 28.0V (typical)
- 989µA at 32.0V (typical)

Maximum Total Output Current

- See Output Section for output current constraints

Analog Monitoring Circuit

See Section Input – VTD Mode (0-36.34V Range)



¹ Battery for outputs is typically powered from the main module battery pin (Pin 6); however, the outputs may optionally be powered by Pin 12 or Pin 18 in applications where it is desired to have module battery separate from output battery. This is a hardware-configurable option, so please see module-specific datasheet for pinout.

² Exposure to maximum voltages for extended periods may affect device reliability.

³ Module current draw was measured on a CL-711-101-10 with I/O inactive, no CAN communication, 5V sensor supply disabled, wake-up asserted, LCD backlight 100%, and simple application drawing text on-screen. Actual values will vary based on I/O configuration, CAN traffic, graphic rendering, and application.

⁴ Module current draw was measured on a CL-711-103-10 with I/O inactive, no CAN communication, 5V sensor supply disabled, wake-up asserted, LCD backlight 100%, and simple application drawing text on-screen. Actual values will vary based on I/O configuration, CAN traffic, graphic rendering, and application.

⁵ Module current draw is measured with inputs inactive and wake-up de-asserted. Actual values may vary based on specific display model.

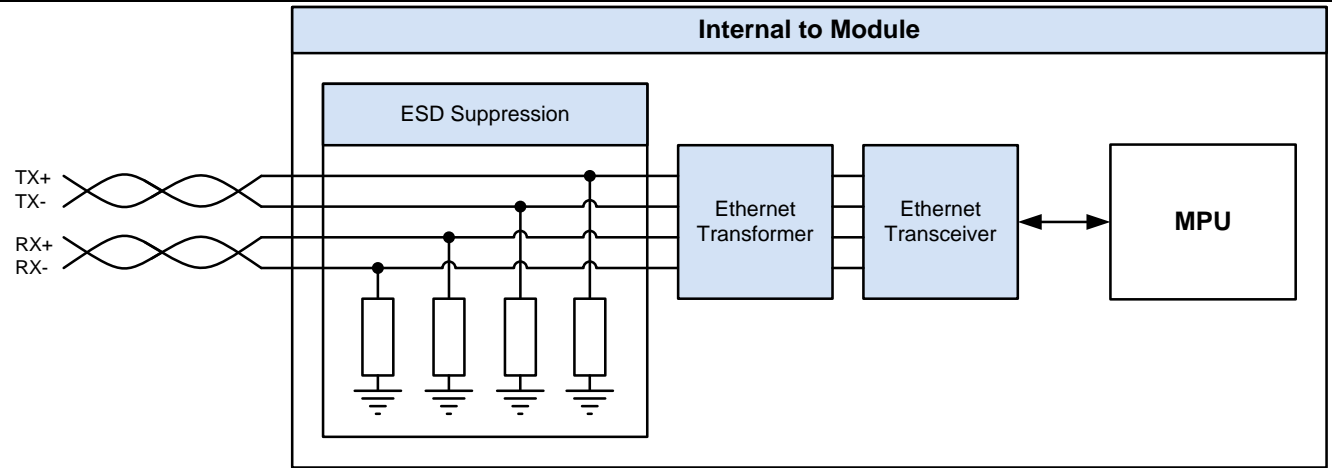
ETHERNET (CONNECTOR A)

Supported Modes

- 10Base-T
- 100Base-TX

ESD Suppression Capacitance (max)

- 1.0pF



AUDIO LINE IN / LINE OUT (CONNECTOR B)

Line-In Input Level

- 0.75 to 1.0 V_{RMS} (typical)

Line-In Input Impedance

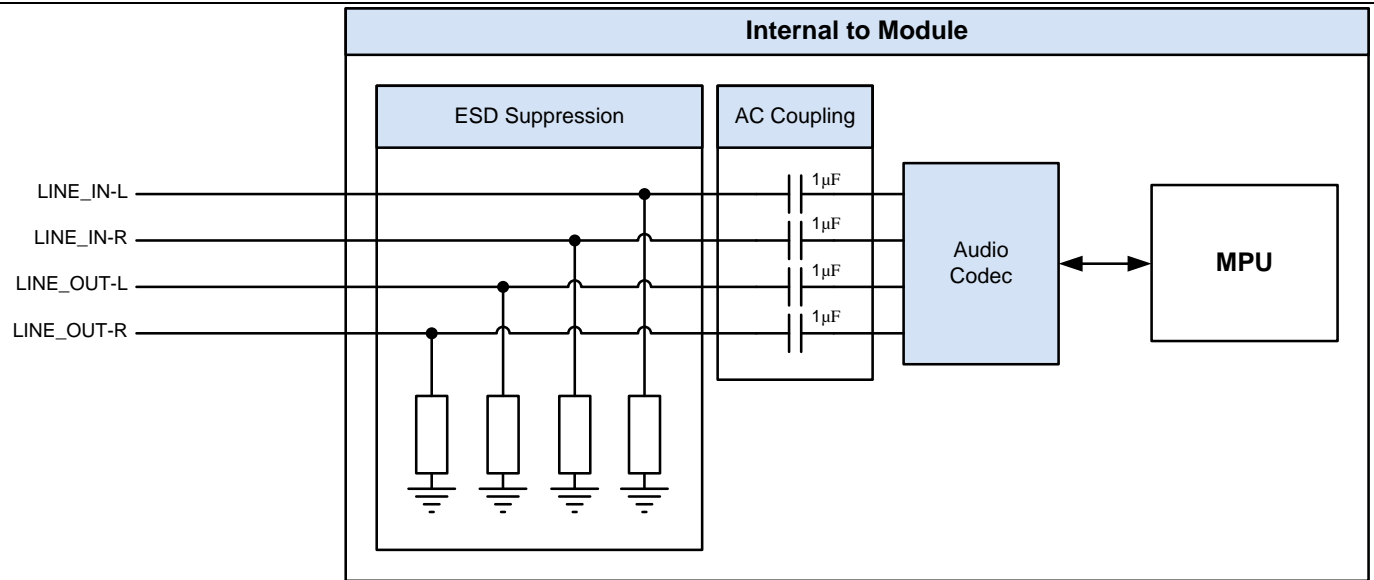
- 10K Ω (minimum)

Line-Out Load Impedance¹

- > 10K Ω

ESD Suppression Capacitance (max)

- 1.0pF



¹ Line-out should be connected to loads that have input impedances of 10K Ω or greater, such as the line-in of an amplifier, docking station, etc. Line-out is not intended to drive headphones or speakers directly. An external amplifier is required.

USB CLIENT (CONNECTOR C)

USB Standard

- USB 2.0

Connection Speeds

- Full – 12Mbps (maximum)
- High – 480Mbps (maximum)

V_{BUS} Input Voltage Range

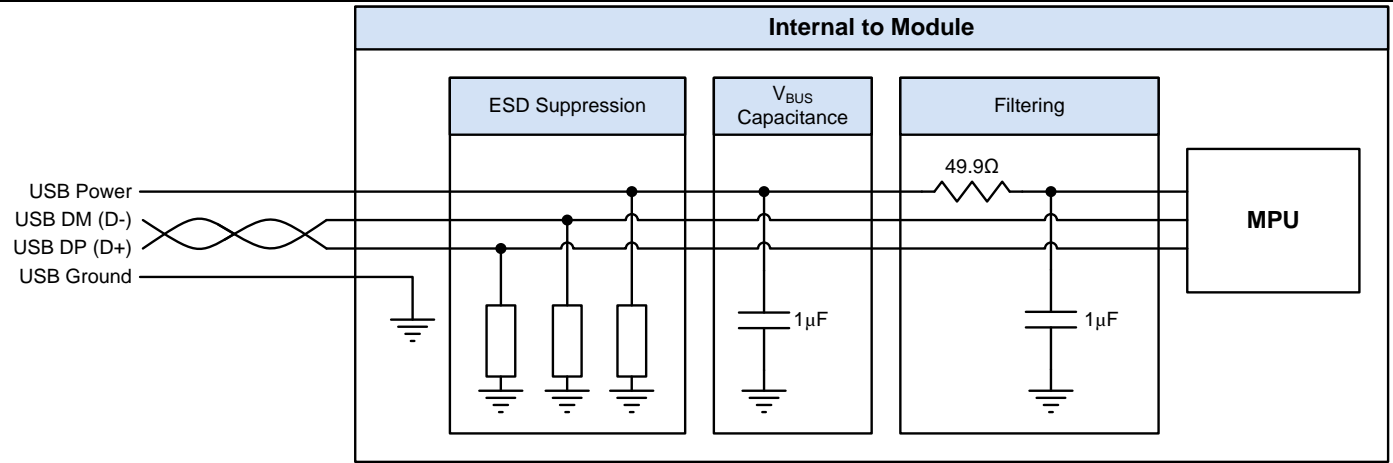
- $4.75V < V_{BUS} < 5.25V$

V_{BUS} Input Capacitance (typical)

- 1.0 μ F

ESD Suppression Capacitance (max)

- 1.0pF



USB HOST (CONNECTOR E)

USB Standard

- USB 2.0

Connection Speeds

- Full – 12Mbps (maximum)
- High – 480Mbps (maximum)

V_{BUS} Output Voltage Range

- $5V \pm 5\%$

V_{BUS} Input Capacitance (typical)

- 134 μ F

V_{BUS} Output Current Rating

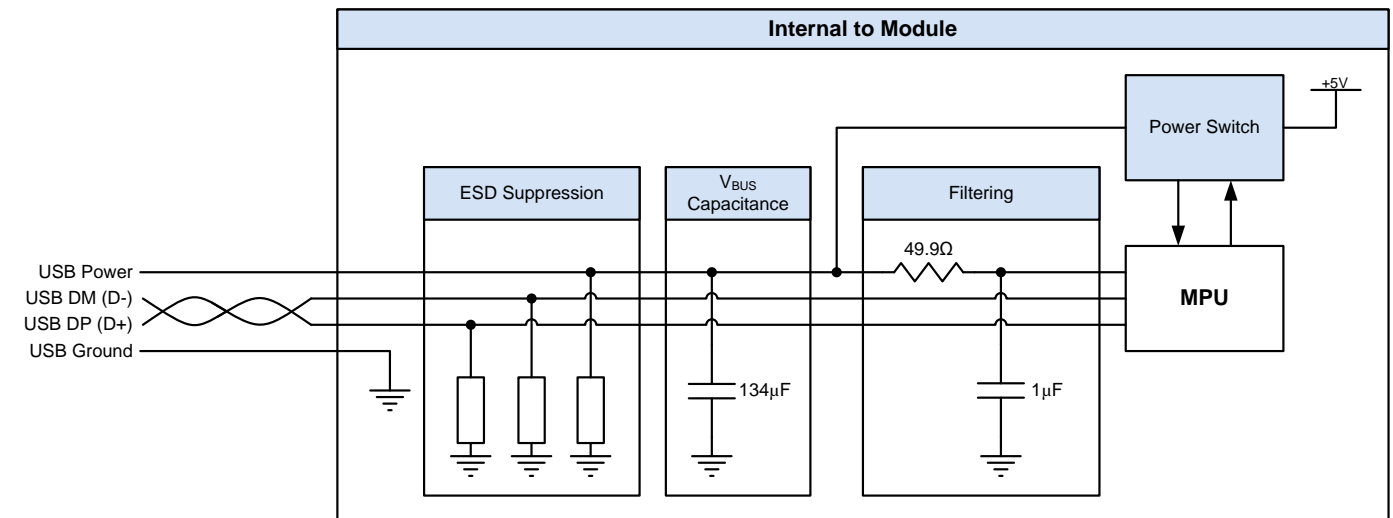
- 250mA

V_{BUS} Output Current Limit

- 255mA (minimum)
- 292mA (typical)
- 355mA (maximum)

ESD Suppression Capacitance (max)

- 1.0pF



VIDEO INPUTS - #1 AND #2 (CONNECTOR F) VIDEO INPUTS - #3 AND #4 (CONNECTOR G)

Video Standards

- NTSC
- PAL

Video Format (Standard Definition)

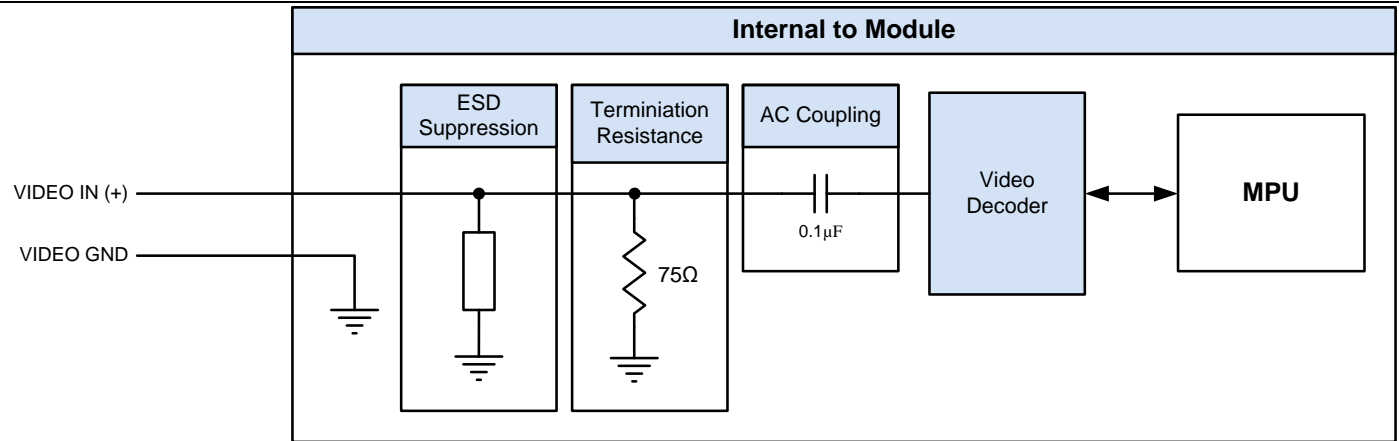
- Composite

Internal Termination Resistance

- 75Ω

ESD Suppression Capacitance (max)

- 1.0pF



ADDITIONAL NOTES

IMPORTANT: Module configurations that contain sourcing outputs with internal flyback diodes may continue to operate in the event of a loss of module ground. This event can result in a ground shift to the internal board reference (ground). The ground shift is a result of a remaining current path from internal board reference (ground), through internal flyback diode(s), and terminating through an external load to ground (assuming the load is of relatively low resistance). Depending on system configuration and load resistances, analog input accuracy can be affected, especially if the analog sensor is not referenced to the module sensor ground. Be sure to include this condition when conducting a system-level FMEA.

Please refer to the module-specific technical datasheet for information regarding internal peripherals such as flash memory, RAM memory, accelerometer, real-time clock, LCD, and touchscreen.

REVISION HISTORY

Revision	Date	EC #	Changes
A1	2/8/16	316-003	Initial Release