CL-713_CL-714 Product Family Specification

PFS-CL713_CL714-A2

5/17/2024

CL-713

CL-714

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

Switch-to-Battery (STB) Mode

Input Resistance
- 1.4KΩ (typical)

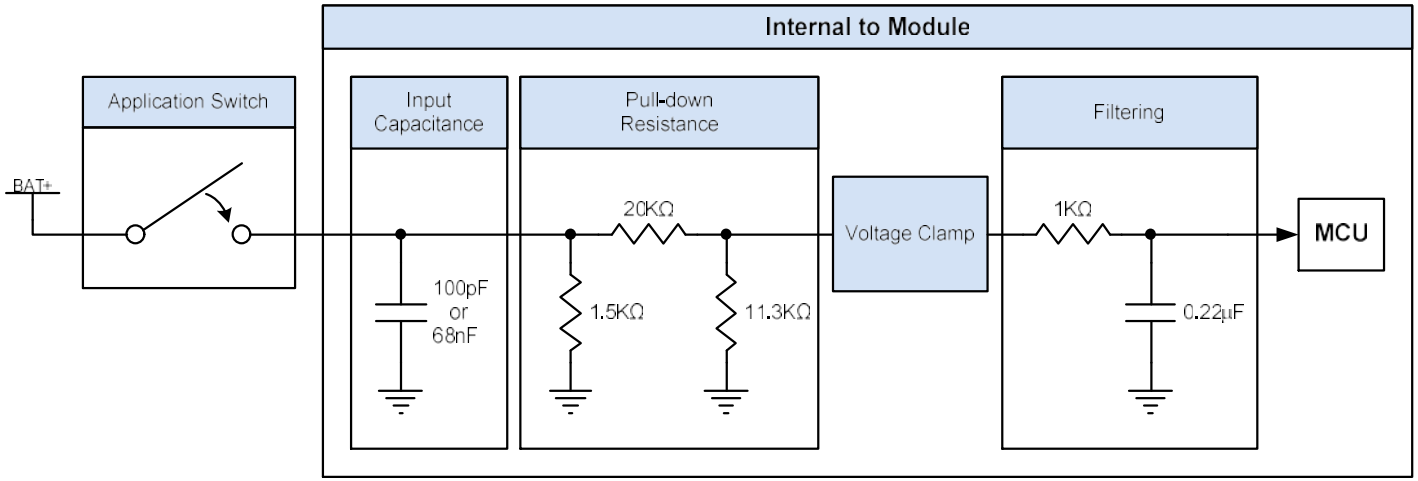
Input Current
- 5.7mA at 8V (typical)
- 24.0mA at 32V (typical)

Positive Going Threshold
- > 6.5V

Negative Going Threshold
- < 2.7V

Parallel Resistance
- 3.4KΩ at 8V (minimum)
- 18KΩ at 32V (minimum)

Series Resistance
- 220Ω (maximum)



Switch-to-Ground (STG) Mode

Pull-up Resistance
- 330Ω (typical)

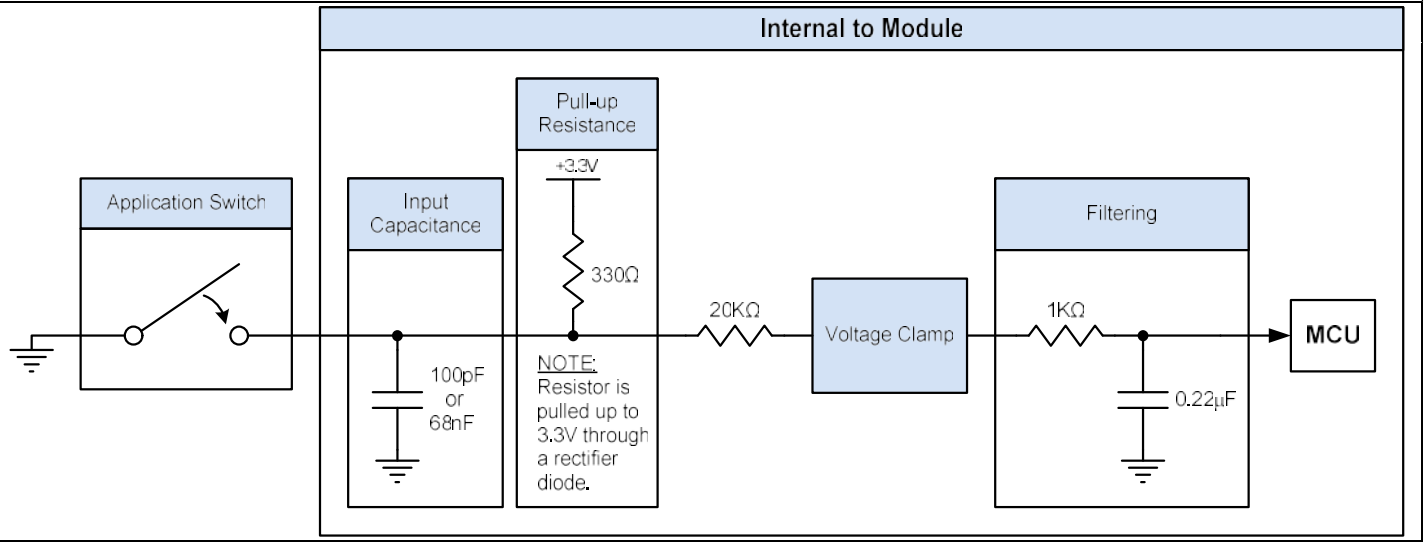
Input Current
- 9.2mA at 0V (typical)

Positive Going Threshold
- > 2.3V

Negative Going Threshold
- < 1.0V

Parallel Resistance
- 2KΩ at 0V (minimum)

Series Resistance
- 140Ω (maximum)



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

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

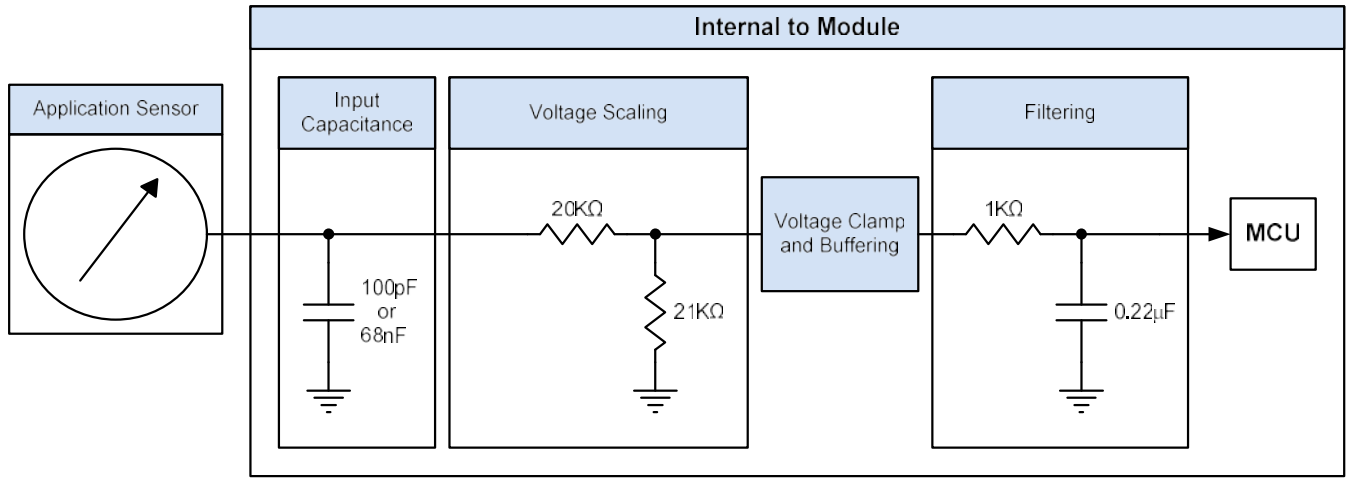
Voltage-to-Digital (VTD) Mode (0 – 5.86VDC)

Input Voltage Range
- 0V to 5.80V (minimum)
- 0V to 5.86V (typical)

Input Resistance
- 41KΩ (typical)

Resolution
- 12 Bits
- 1.43mV / count (typical)

Accuracy[2]
- ±1.0% and ±20mV (T_A = 25°C)
- ±2.5% and ±40mV (T_A = full)



[1] Pins 9, 10, 15, and 16 have input capacitance of 100pF. Pin 17 has 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.

**When Pin 18 is configured as an input, the sensor supply is turned off. The extra circuitry for the sensor supply will create an offset voltage of 0.65V which will be read when configured as a VTD. Unless the connected sensor can sink current, the reading will not drop below 0.65V. If the sensor is driving a voltage above 0.65V, then it will have no affect.

INPUT STB/STG/VTD (DEUTSCH PIN 18)

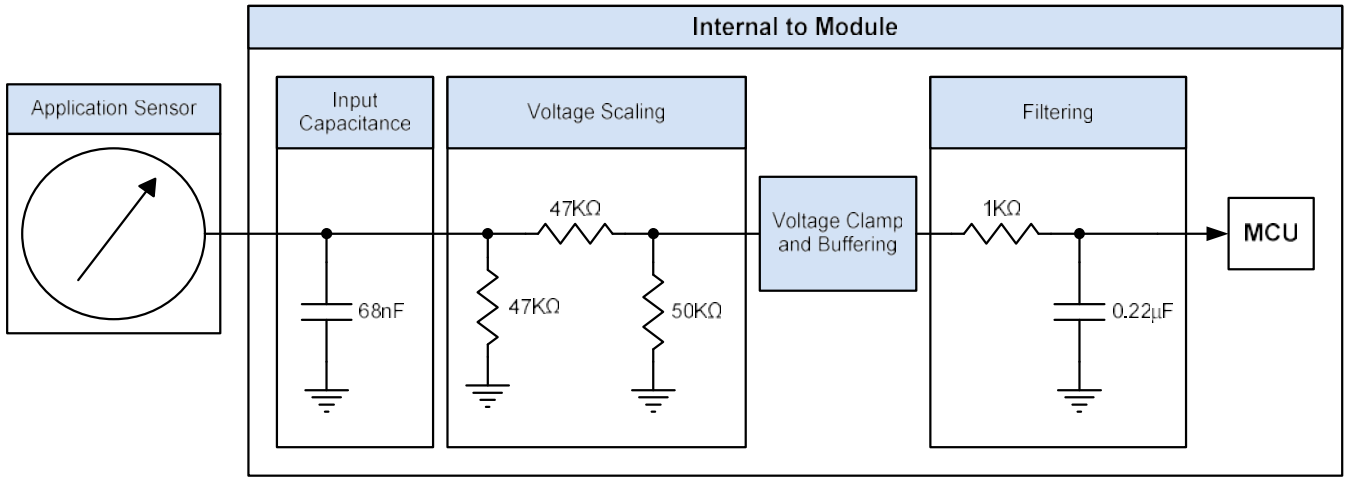
Voltage-to-Digital (VTD) Mode (0 – 5.83VDC)

Input Voltage Range
- 0V to 5.80V (minimum)
- 0V to 5.83V (typical)

Input Resistance
- 32KΩ (typical)

Resolution
- 12 Bits
- 1.42mV / count (typical)

Accuracy[1]
- ±1.0% and ±20mV (T_A = 25°C)
- ±2.5% and ±40mV (T_A = full)



INPUT STB/STG/VTD (DEUTSCH PIN 12)[1]

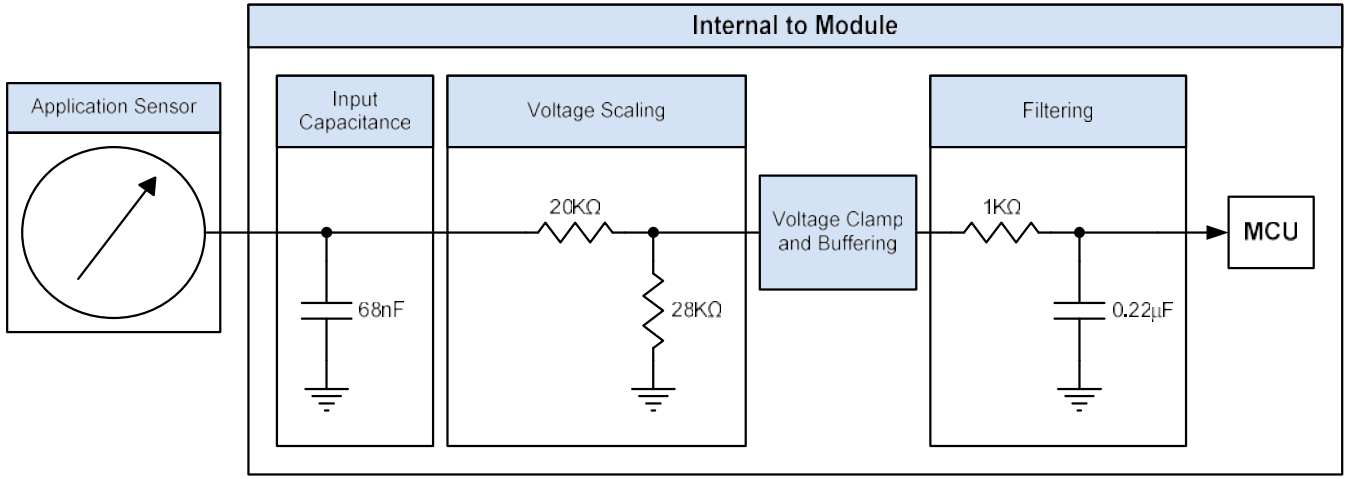
Voltage-to-Digital (VTD) Mode (0 – 5.66VDC)

Input Voltage Range
- 0V to 5.30V (minimum)
- 0V to 5.66V (typical)

Input Resistance
- 48KΩ (typical)

Resolution
- 12 Bits
- 1.38mV / count (typical)

Accuracy[1]
- ±1.0% and ±25mV (T_A = 25°C)
- ±3.0% and ±50mV (T_A = full)



[1] 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/FREQ/PWM/ENCODER/RTD (DEUTSCH PINS 9, 10, 15, 16)[1]

Frequency / PWM / Encoder Mode

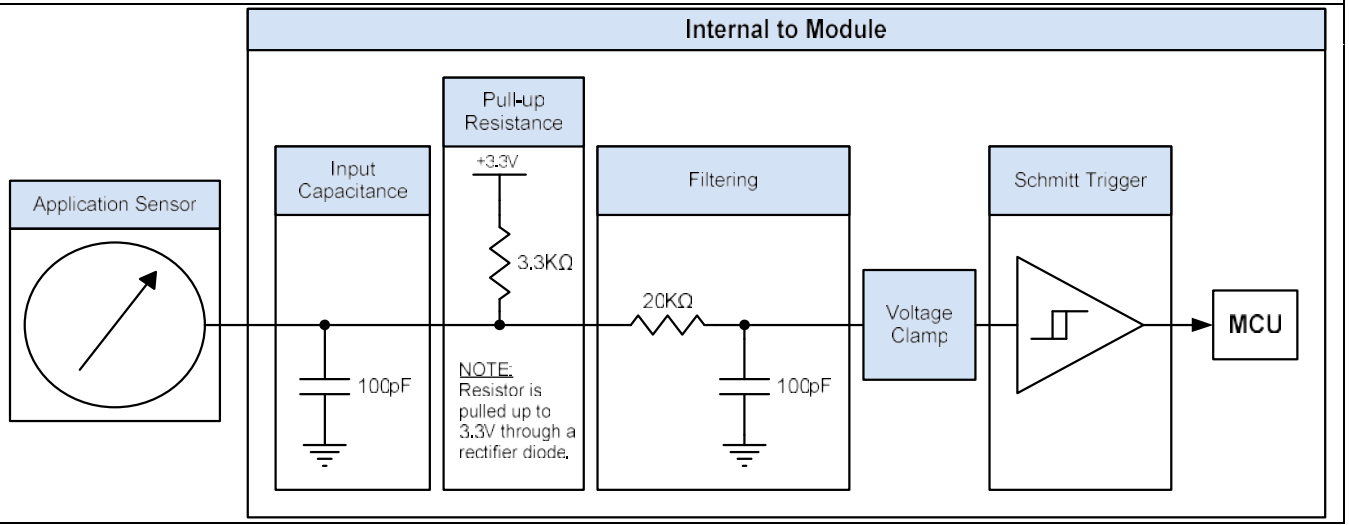
Pull-up Resistance
- 3.3KΩ (typical)

Positive Going Threshold
- > 2.3V

Negative Going Threshold
- < 1.0V

Frequency Range
- 10KHz (maximum)[2]

Accuracy
- ±2.0%[3] (T_A = full range)



[1] Pins 9, 10, 15, and 16 have input capacitance of 100pF.

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

[3] PWM inputs tolerance is within 2% up to 1 kHz. HED recommends not using PWM mode above 1 kHz. If used above 1 kHz the value will be outside of tolerance.

INPUT STB/STG/VTD/FREQ/PWM/ENCODER/RTD (DEUTSCH PINS 9, 10, 15, 16)

Resistance-to-Digital (RTD) Mode (0 – 500Ω)

Pull-up Resistance ($R_{PULL-UP}$)

- 499Ω (typical)

Accuracy[1]

- ±1.0% and ±5.0Ω (T_A = 25°C)
- ±2.5% and ±10.0Ω (T_A = full)

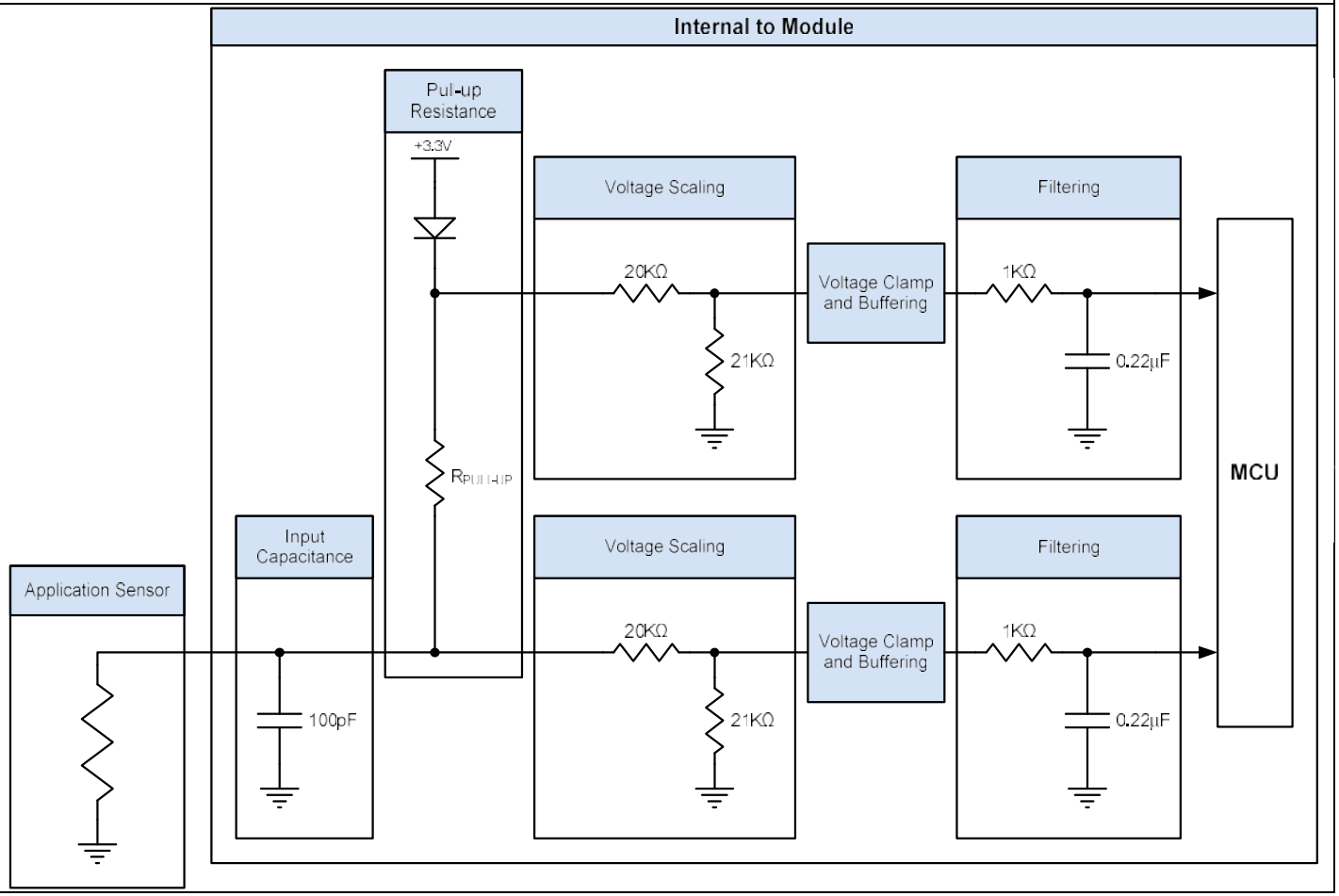
Resistance-to-Digital (RTD) Mode (0 – 2KΩ)

Pull-up Resistance ($R_{PULL-UP}$)

- 2KΩ (typical)

Accuracy[1]

- ±1.0% and ±20.0Ω (T_A = 25°C)
- ±2.5% and ±40.0Ω (T_A = full)



[1] 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 ½($R_{PULL-UP}$).

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

5VDC Sensor Supply Mode

Voltage Range
- 5V ± 5%

Current Rating
- 250mA (typical)

Current Limit
- 262mA (minimum)
- 292mA (typical)
- 325mA (maximum)

Analog Monitoring Circuit

Resolution
- 12 Bits
- 1.42mV / count (typical)

Accuracy
- See Section Input – VTD Mode (0-5.83V Range)

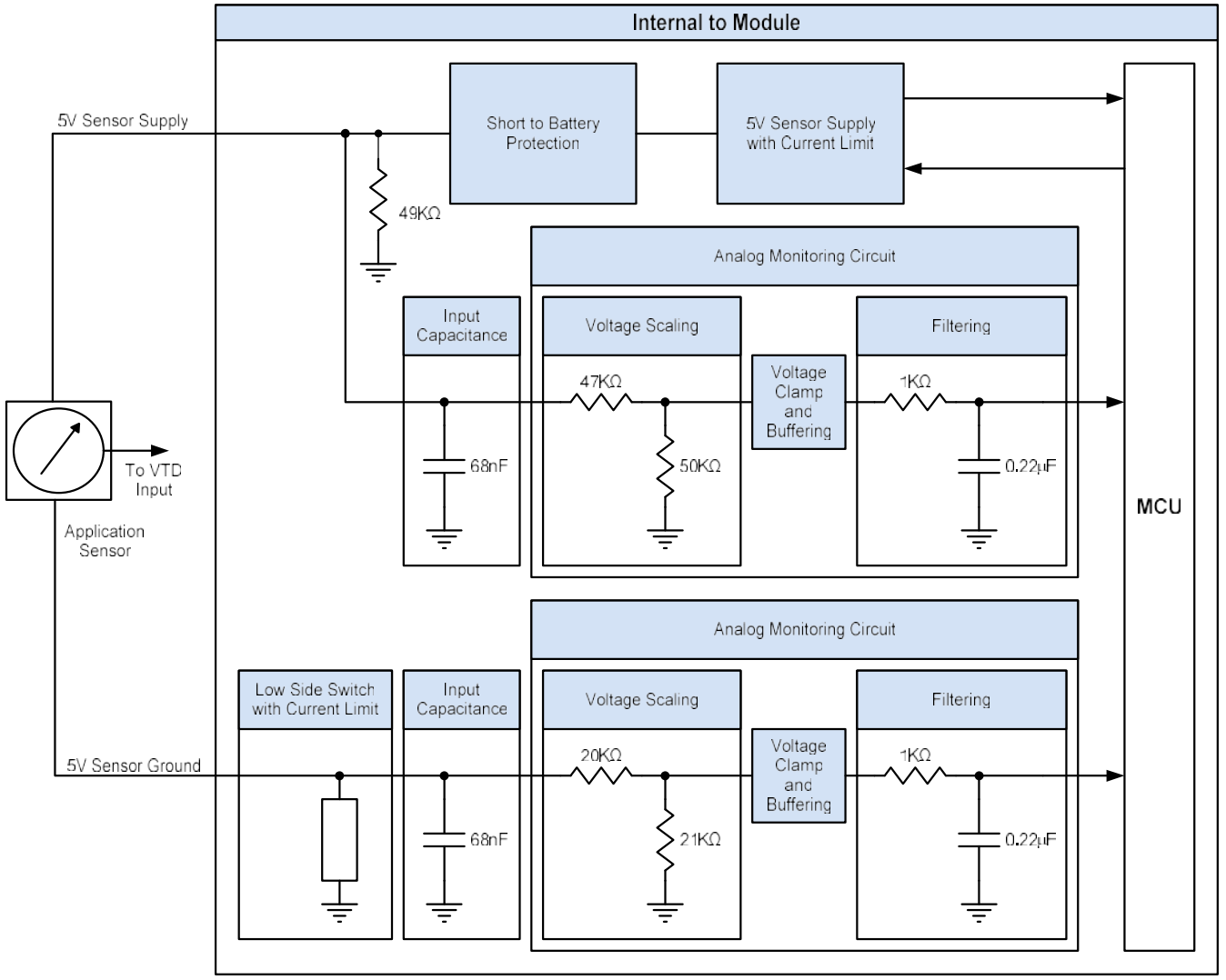
5VDC Sensor Ground Mode

Current Rating
- 250mA

Analog Monitoring Circuit

Resolution
- 12 Bits
- 1.43mV / count (typical)

Accuracy
- See Section Input – VTD Mode (0-5.86V Range)



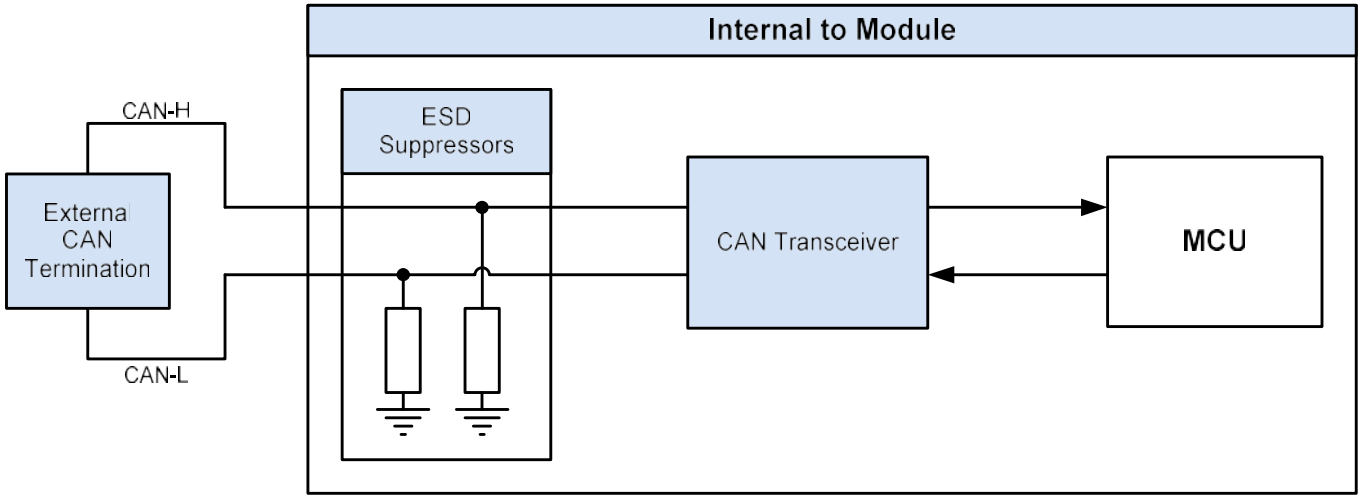
CAN COMMUNICATION (DEUTSCH PINS 7/8, 13/14)

Baud Rate
- 40kbps to 500kbps

Maximum Allowable Voltage[1]
- -27V to +40V

Input Capacitance (max)
- 37pF (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
- 1.4KΩ (typical)

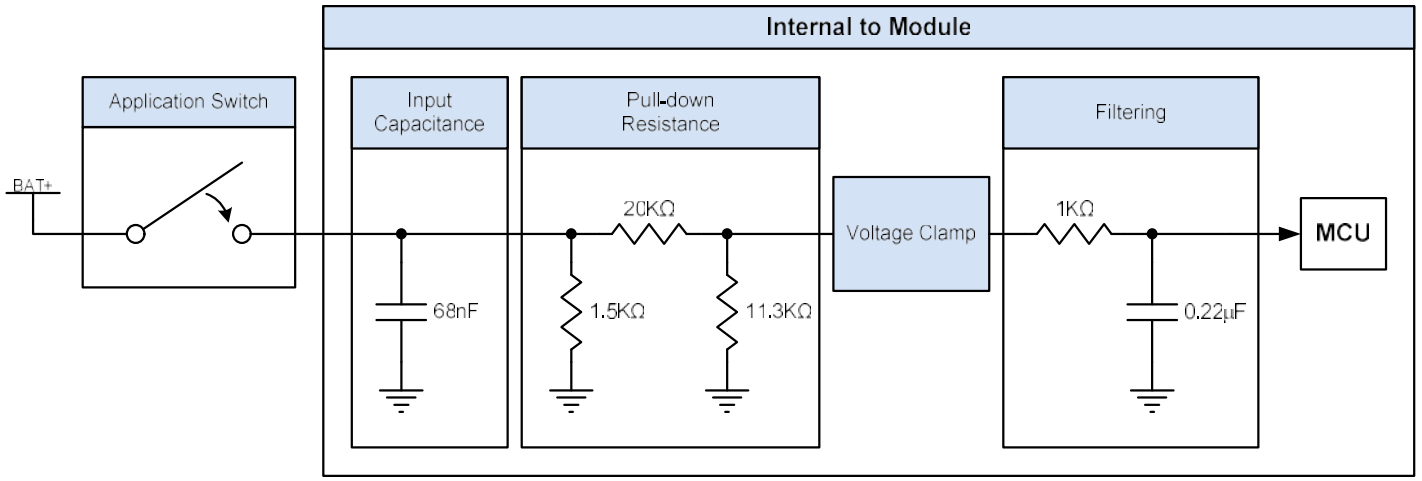
Input Current
- 5.7mA at 8V (typical)
- 24.0mA at 32V (typical)

Positive Going Threshold
- > 6.5V

Negative Going Threshold
- < 2.7V

Parallel Resistance
- 3.4KΩ at 8V (minimum)
- 18KΩ at 32V (minimum)

Series Resistance
- 220Ω (maximum)



Switch-to-Ground (STG) Mode

Pull-up Resistance
- 330Ω (typical)

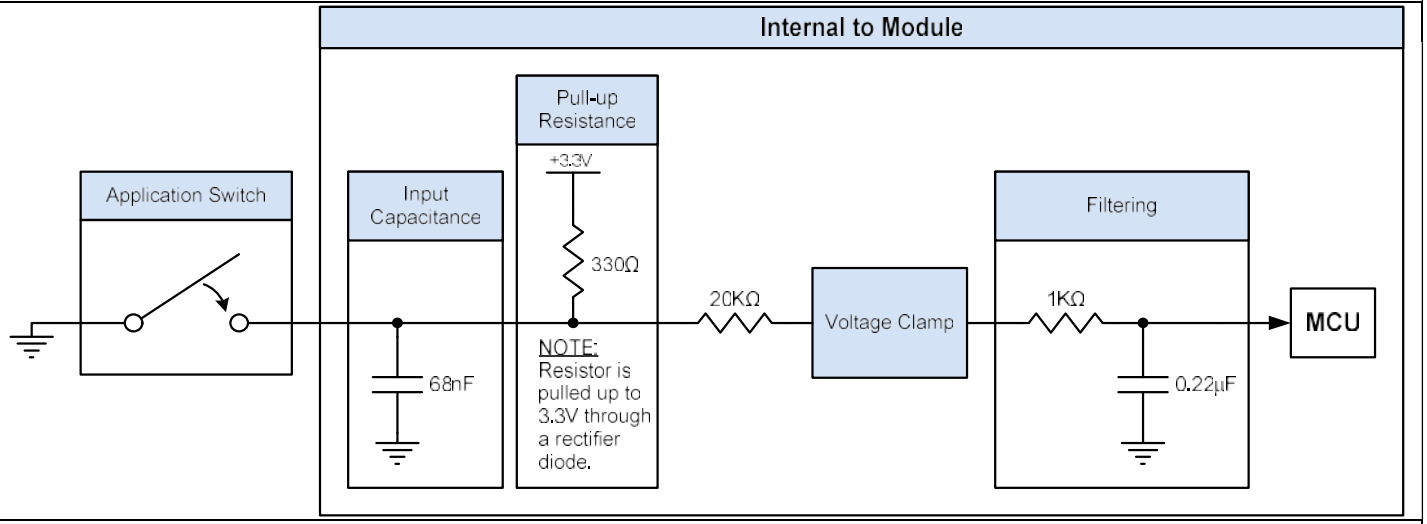
Input Current
- 9.2mA at 0V (typical)

Positive Going Threshold
- > 2.3V

Negative Going Threshold
- < 1.0V

Parallel Resistance
- 2KΩ at 0V (minimum)

Series Resistance
- 220Ω (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 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, potentially causing damage to the application switch and/or module. In addition this can cause the module to remain powered and active after removal of voltage on Pin 6.

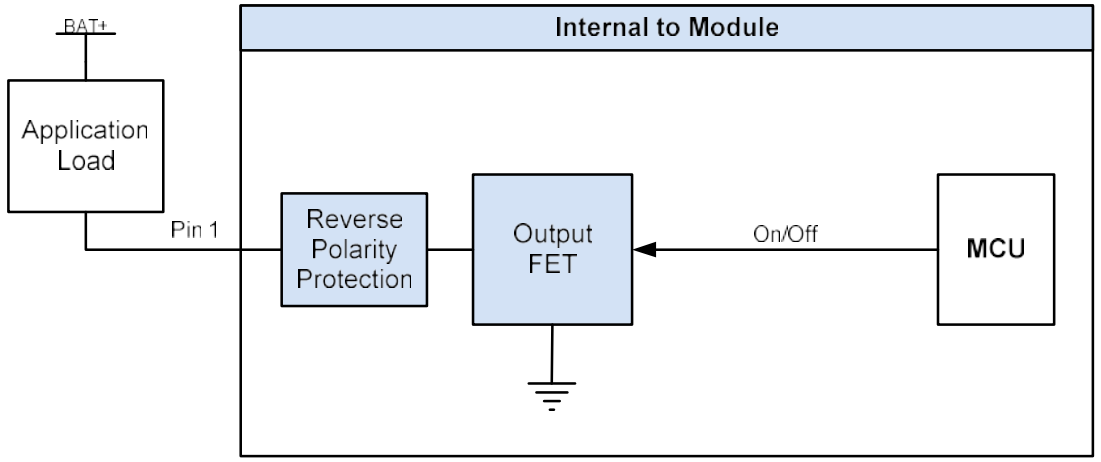
OUTPUT DOUT(-) (PIN 1)

Output Current
- 150mA (maximum)

Output Protection
- Short Circuit
- Over Temperature
- Over-Voltage (Transient)[1]

Output Diagnostics
- None

Hardware Current Limit
- 1.0A (minimum)
- 1.5A (typical)



[1] Transient over-voltage protection is limited to a single pulse inductive energy 550mJ (typical).

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

Individual Output Current[1]
- 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 Frequency[4]
- < 300 Hz (typical)
- < 1 KHz (maximum)

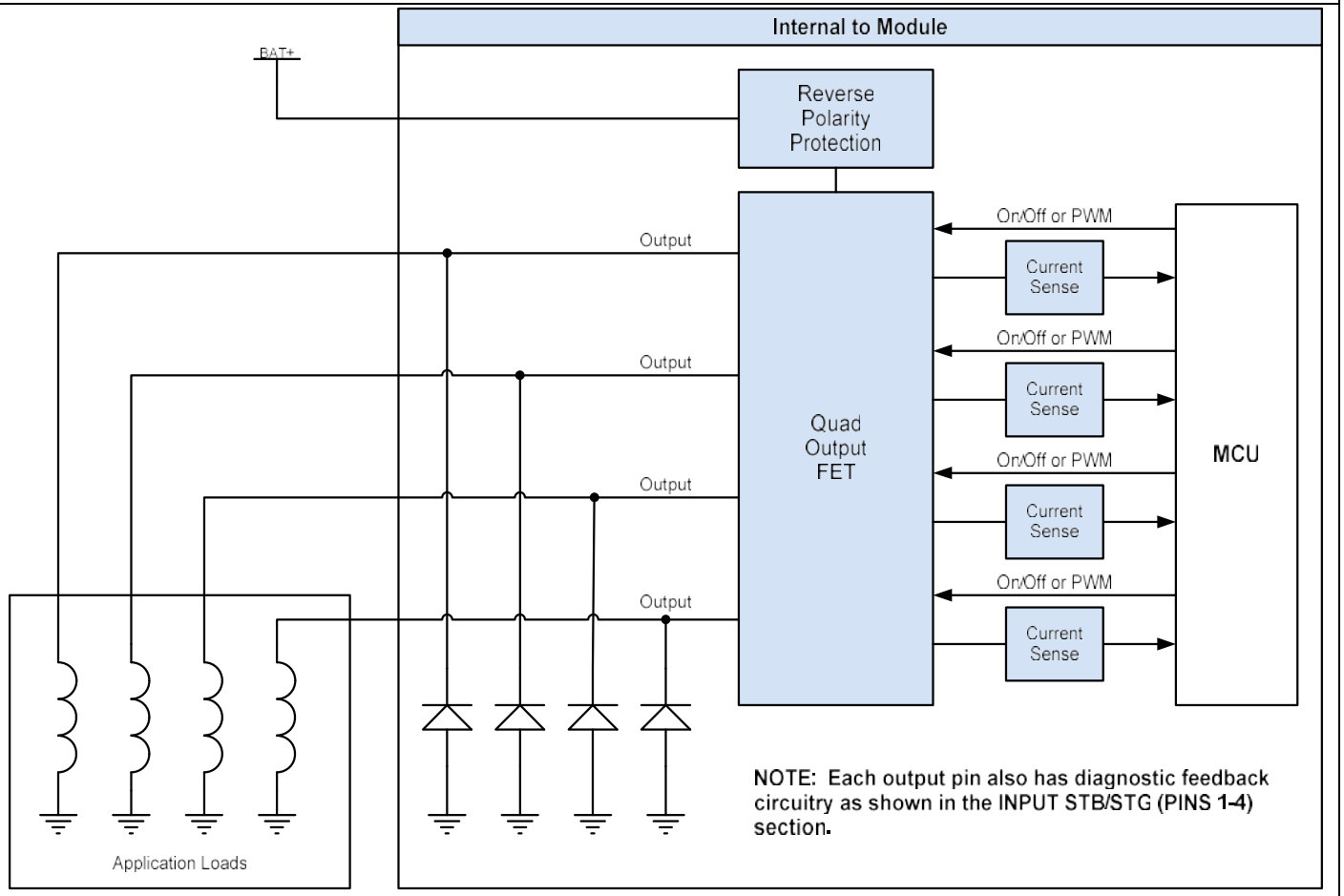
Output Diagnostics
- Short to Battery
- Short to Ground
- Overcurrent
- Open Circuit[5]

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).

SWITCHED BATTERY (+) / KEYSWITCH (PIN 11)[1]

Switched Battery (+)

Operating Voltage Range
- 6.5VDC – 32VDC

Maximum Continuous Voltage[1]
- 36VDC

Keyswitch Function
- Input transition from inactive to active will activate module
- Input transition from active to inactive will begin controlled shutdown sequence (if applicable) and de-activate module

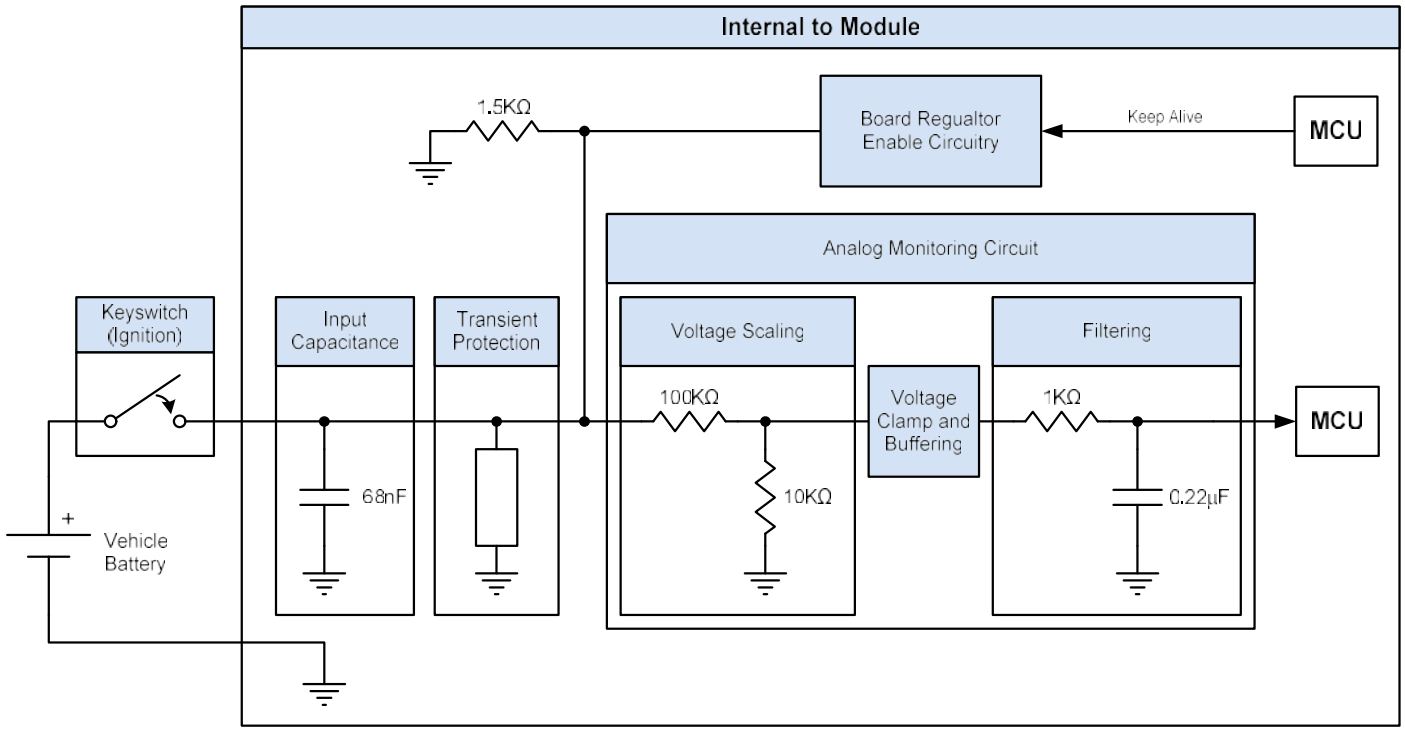
Analog Monitoring Circuit

Input Voltage Range
- 0V to 35.2V (minimum)
- 0V to 36.3V (typical)

Input Resistance
- 110KΩ (typical)

Resolution
- 12 Bits
- 8.86mV / count (typical)

Accuracy[2]
- ±1.1% and ±100mV (T_A = 25°C)
- ±3.2% and ±200mV (T_A = full)



**The VTD input values on pin 6 and 11 will have spikes in the reported value that are not present on the signal going into the display. The spikes can be up to 10% of the signals value. For example, if pin 11 has 4 volts on the connector pin, it could momentarily report 4.4 volts. If this will cause an issue in your application HED suggests that you implement a trimmed mean filter to remove the spikes from the value. Contact HED for additional information or sample code if required.

[1] Exposure to maximum voltages for extended periods may affect device reliability.

[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.

CL-713 BATTERY (+) MODULE (DEUTSCH PIN 6)
BATTERY (+) OUTPUTS (DEUTSCH PIN 6) (1)

Battery (+) (Pins 6)

Operating Voltage Range

- 6.5VDC – 32VDC

Maximum Continuous Voltage(2)1

- 36VDC

Module Current Draw – Running

Battery Voltage	No I/O or CAN active(3)
6.5V	439mA
13.8V	213mA
28.0V	125mA
32.0V	117mA

Module Current Draw – Shutdown(4)2

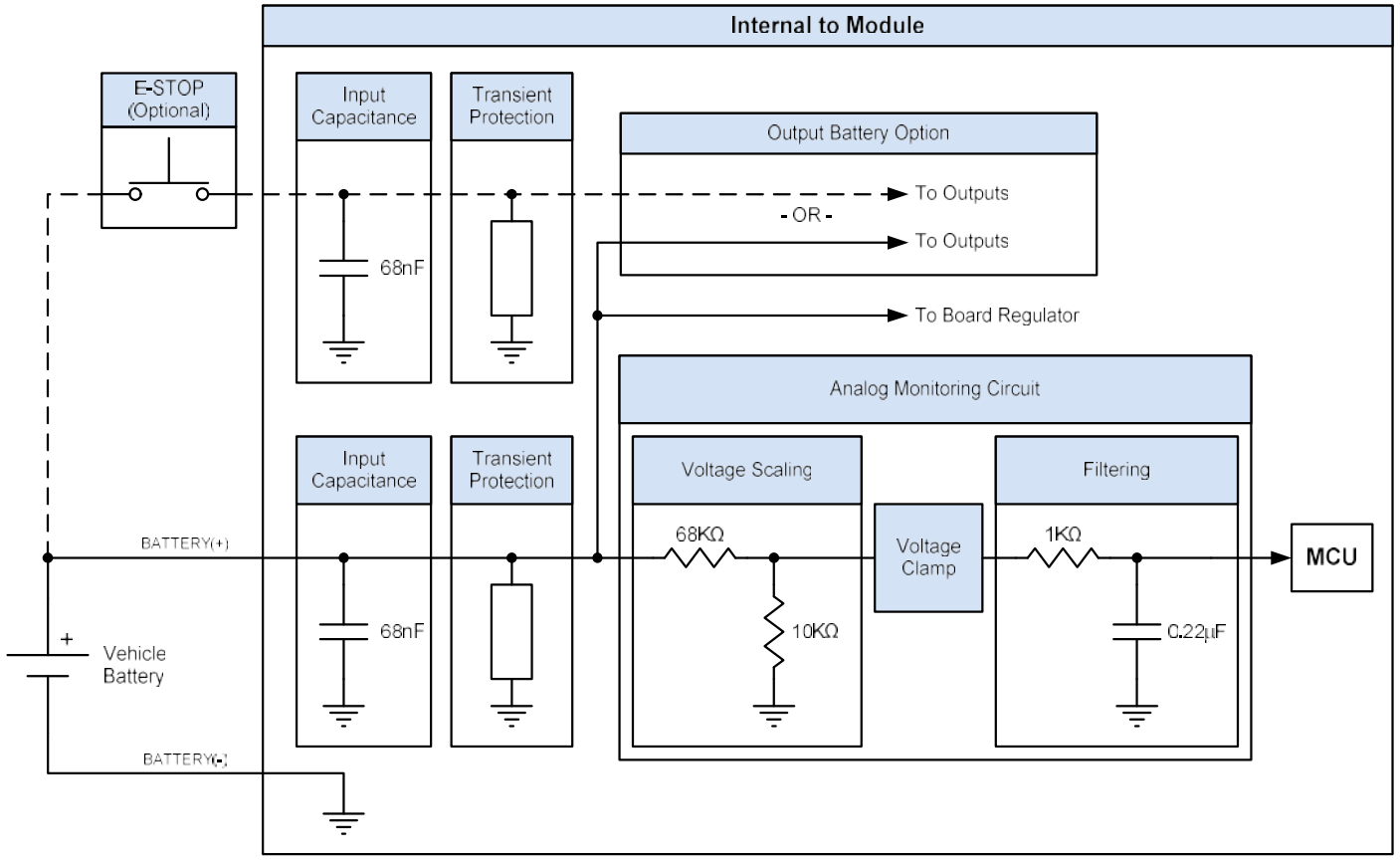
- 470µA at 6.5V (typical)
- 620µA at 13.8V (typical)
- 1100µA at 28.0V (typical)
- 1260µA at 32.0V (typical)

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 Voltage for outputs is typically powered from the main module battery pin (Pin 6).
(2) Exposure to maximum voltages for extended periods may affect device reliability.
(3) Module current draw was measured on a CL-713 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 is measured with inputs inactive and wake-up de-asserted. Actual values may vary based on specific display model.

**The VTD input values on pin 6 and 11 will have spikes in the reported value that are not present on the signal going into the display. The spikes can be up to 10% of the signals value. For example, if pin 11 has 4 volts on the connector pin, it could momentarily report 4.4 volts. If this will cause an issue in your application HED suggests that you implement a trimmed mean filter to remove the spikes from the value. Contact HED for additional information or sample code if required.

CL-714 BATTERY (+) MODULE (DEUTSCH PIN 6)
BATTERY (+) OUTPUTS (DEUTSCH PIN 6)(1)

Battery (+) (Pins 6)

Operating Voltage Range

- 6.5VDC – 32VDC

Maximum Continuous Voltage(2)

- 36VDC

Module Current Draw – Running

Battery Voltage	No I/O or CAN active(3)
6.5V	1320 mA
13.8V	560 mA
28.0V	350 mA
32.0V	270 mA

Module Current Draw – Shutdown(4)

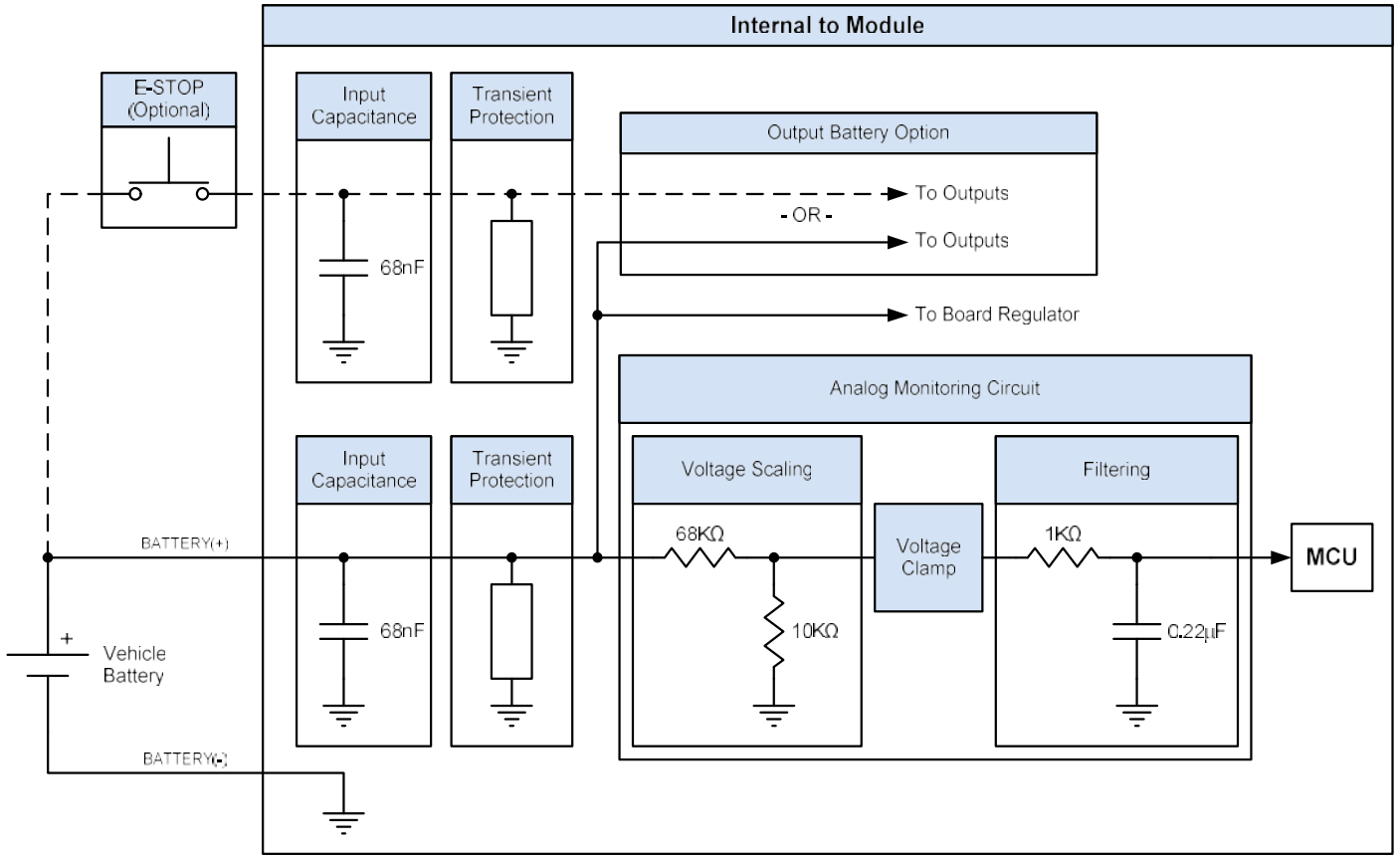
- 510µA at 6.5V (typical)
- 660µA at 13.8V (typical)
- 1200µA at 28.0V (typical)
- 1380µA at 32.0V (typical)

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).
(2) Exposure to maximum voltages for extended periods may affect device reliability.
(3) Module current draw was measured on a CL-714 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 is measured with inputs inactive and wake-up de-asserted. Actual values may vary based on specific display model.

**The VTD input values on pin 6 and 11 will have spikes in the reported value that are not present on the signal going into the display. The spikes can be up to 10% of the signals value. For example, if pin 11 has 4 volts on the connector pin, it could momentarily report 4.4 volts. If this will cause an issue in your application HED suggests that you implement a trimmed mean filter to remove the spikes from the value. Contact HED for additional information or sample code if required.

REAL-TIME CLOCK – BATTERY BACKUP

Battery Chemistry

- High-Temperature Lithium Primary (Non-Rechargeable)

Nominal Capacity

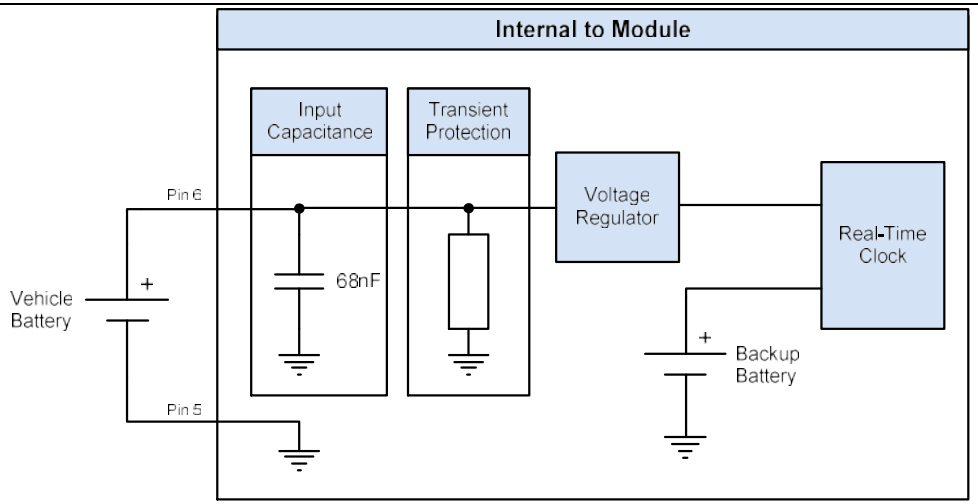
- 120mAh at > 25˚C
- 60mAh at -10˚C (estimate)

Function

- Switchover to backup battery occurs when Pin 6 of the module is disconnected or unpowered

Estimated Battery Life[1]

- 10 years



[1] Battery life is estimated with the following assumptions: one year of storage prior to vehicle install at 25˚C, 3 months disconnection from Pin 6 per year at -10˚C, and 25% self-discharge during a 10 year period.

USB HOST / CLIENT (CONNECTOR A)[1]

USB Standard
- USB 2.0

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

V_{BUS} Output Voltage Range
- 5V ± 5%

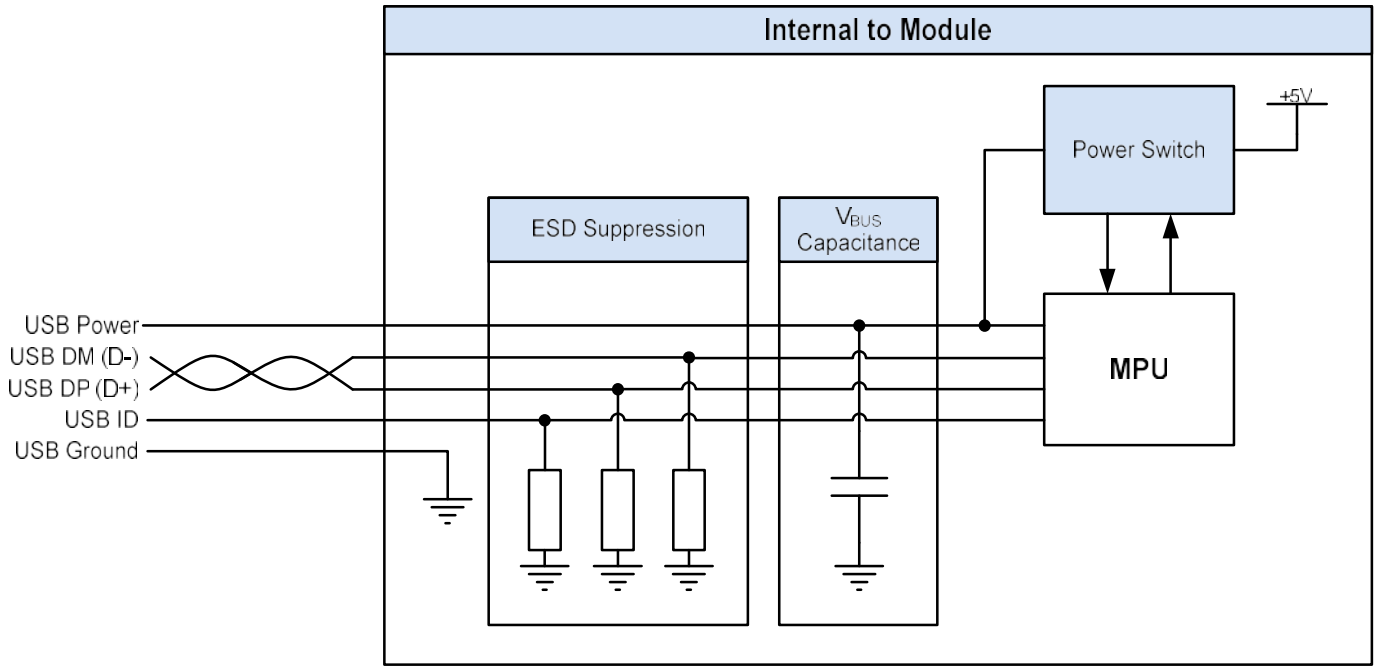
V_{BUS} Input Capacitance (typical)
- 134µF (Host)
- 2µF (Client)

V_{BUS} Output Current Rating
- 500mA

V_{BUS} Output Current Limit[2]
- 510mA (minimum)
- 564mA (typical)
- 615mA (maximum)

ID Pin Connection and Mode
- Connect to USB Ground = Host
- Leave Unconnected = Client

ESD Suppression Capacitance
- USB DP / DM: 0.3pF (typ)
- USB ID: 68nF (typ)



[1] USB power, ground, and signal pins are not protected against shorts to vehicle battery or other signals above typical USB voltage levels. The USB transceiver, per USB 2.0 standards, is required to withstand continuous short circuit of D+ and/or D- to GND, other data line, or cable shield for 24 hours (does not include shorts to USB power). Care must be taken to ensure wiring errors and shorts to higher voltage levels do not occur in the application.

[2] In host mode, USB bus voltage (VBUS) is used to power an external device as well as the MPU. MPU current draw can be up to 50mA; therefore, output current limit for the external device could reduce by up to 50mA from the values listed.

Warning: When in USB host mode, USB ID (PIN 5 of Connector J2) must be connected only to the module USB Ground (PIN 4 of connector J2). Connecting to vehicle ground or other signals may result in damage to the module.

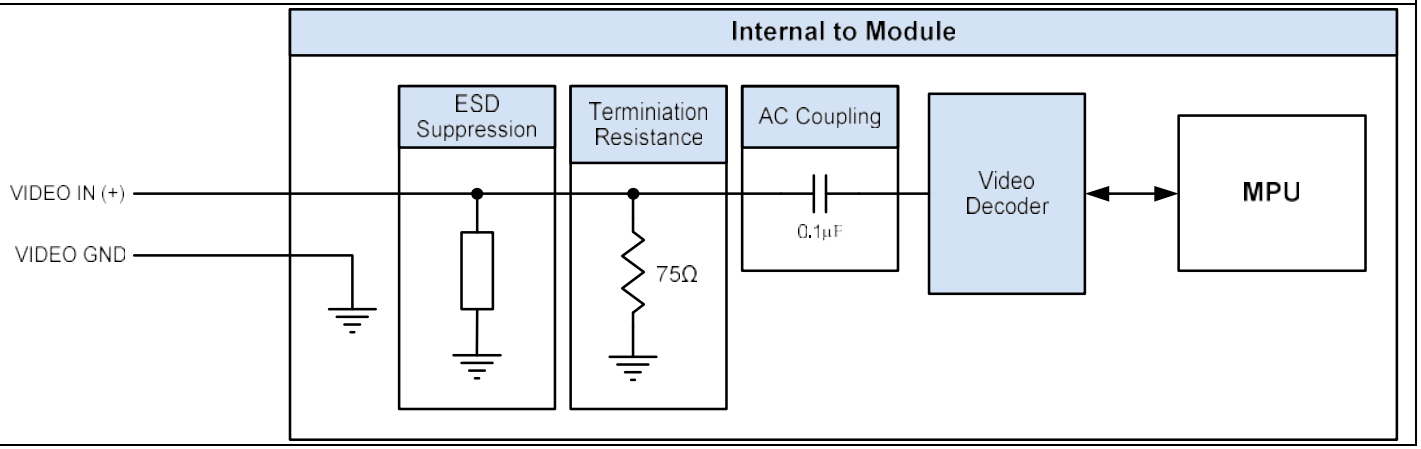
VIDEO INPUTS – #1 (CONNECTOR B)
VIDEO INPUTS – #2 (CONNECTOR C)

Video Standards
- NTSC
- PAL

Video Format (Standard Definition)
- Composite

Internal Termination Resistance
- 75Ω

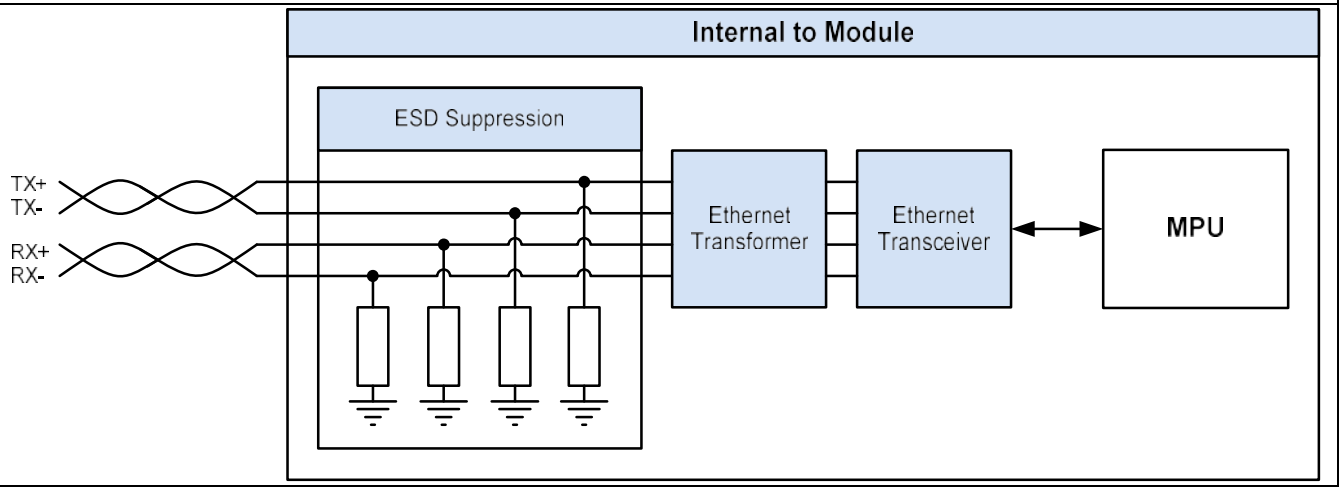
ESD Suppression Capacitance (max)
- 0.4pF



ETHERNET (CONNECTOR D)

Supported Modes
- 10Base-T
- 100Base-TX

ESD Suppression Capacitance (typ)
- 0.3pF



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	11/7/23	323-249	Initial Release
A2	5/15/24	324-130	Pages 13, 14, 15. Added Note for VTD accuracy " **The VTD input values on pin…" Page 10 Revised Note for STB inputs. "In addition this can cause the module to remain powered and active after removal of voltage on Pin 6."