CSSV1500 SERIES

006007
Issue 3

Current Sensors Designed to Meet ASIL C Requirements

DESCRIPTION

The CSSV1500 Series Current Sensors are based on Honeywell's advanced multi-sensing scheme, a single power supply and an integrated CAN bus output. They are calibrated and temperature compensated using multi-point temperature characterization. This Honeywell's patented digital compensation technology enables a high degree of accuracy throughout the sensing range up to ±1500 A. The CSSV1500 Series is designed to meet Automotive Safety Integrity Level C (ASIL C) requirements for safety critical applications. These sensors have two independent sensing and data processing circuits for current sensing. The two processed data are checked for confidence. If they are within the set threshold range, the current data is outputted. If the threshold is exceeded, an alarm message is sent.

DIAGNOSTIC FUNCTIONALITY

The CAN output of the CSSV1500 Series offers fault detection and communication capability. Also, the digital CAN communication is nearly immune to electrical interference. Examples of sensor and host system faults include:

- Sensor fault
- Supply voltage over range
- Supply voltage under range

CUSTOMIZATION

The CSSV1500 Series may be customized to better meet application needs. Solutions may be tailored to exact specifications for improved time to market, lower total system costs and enhanced reliability.

DIFFERENTIATION

- **Accuracy:** Multi-point temperature characterization and calibration for improved accuracy over the temperature range
- **Magnetic immunity:** Sensing configuration and optimized magnetic circuit allow for enhanced performance in diverse magnetic environments
- **ASIL-C Compliance:** ASIL C for increased reliability in safety-critical applications

VALUE TO CUSTOMERS

- **Accurate:** Designed to enable precise battery state measurement for improved user experience
- **Ease of use:** Magnetic immunity allows for easy integration into different magnetic environments
- **Easy system integration:** CAN communication is transmitted using international road vehicle standard ISO 11898. CAN 2.0A is the default protocol

APPLICATIONS

- Current measurement for battery management systems in electrified vehicles (EV, HEV, PHEV, BEV)
- Current leakage detection and fault isolation in charging systems
- Current measurement in energy storage systems
- Fault detection in heavy industrial equipment

RoHS COMPLIANT

FEATURES

- Higher accuracy, lower temperature drift
- Enhanced EMC (Electromagnetic Compatibility) performance
- Designed to meet automotive Safety Integrity Level C (ASIL C) for the functional safety of road vehicle applications
- Reliable and stable CAN bus output
- Easy installation and software interface provide system integration convenience
- CE certification; REACH and RoHS compliant

PORTFOLIO

Honeywell offers a variety of current sensors for potential use in many applications. To view the entire product portfolio, click here.

Honeywell

TABLE 1. ABSOLUTE MAXIMUM RATINGS (not operating)

Characteristic	Symbol	Unit	Parameter	Condition
Load dump over voltage	V_S	V	35	400 ms
Over voltage	V_S	V V	24 20	10 min continuous
Reverse polarity	V_S	V	-24	10 min.
Supply voltage: minimum maximum	 V_S V_S	 V V	 6 18	 continuous continuous
CAN operation: supply voltage under range alarm, no measurement supply voltage over range alarm, no measurement	 V_S V_S	 V V	 5.5 to 5.9 18.5 to 24	 CAN continuous CAN continuous
Insulation resistance	R_{IS}	MΩ	2000	500 V at 1 min.
Creepage distance	d_{Cp}	mm	10	—
Clearance	d_{Cl}	mm	10	—
RMS voltage for ac isolation voltage	—	KV	5	50 Hz, 1 min.
Voltage for dc isolation voltage	—	KV	5	1 min.

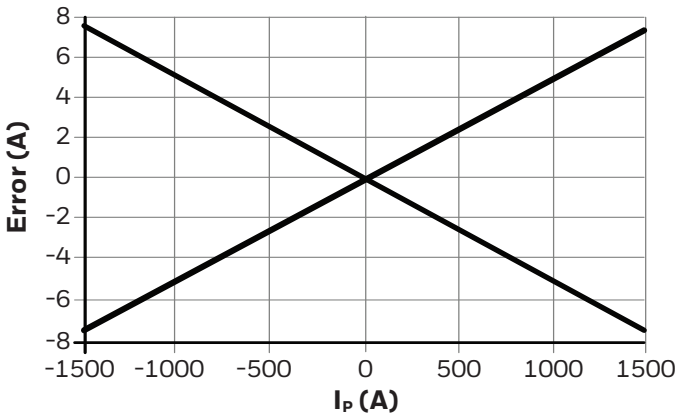
TABLE 2. OPERATING SPECIFICATIONS IN NOMINAL RANGE (I_{PN})

Characteristic	Symbol	Unit	Specification			Condition
			Min.	Typ.	Max.	
Primary current, nominal measuring range (dc)	I_{PN}	A	-1500	—	1500	—
Supply voltage	V_S	V	6	12	18	—
Supply voltage hysteresis: maximum minimum	 V_{UP} V_{UP} V_{LOW} V_{LOW}	 V V V V	 — — — —	 18.5 18.0 6.4 5.9	 — — — —	 when V_C increases when V_C decreases when V_C increases when V_C decreases
Current consumption	I_C	mA	40	—	200	V_S = 12 V, T = 25°C
Ambient operating temperature	T_A	°C [°F]	-40 [-40]	—	85 [185]	temperature range with accuracy guaranteed
High precision channel offset at I_P = 0 A	I_{OS}	A		±0.1		T = -40°C to 85°C, V_S = 9 V to 16 V, ±3 sigma
High precision channel total accuracy: high at I_P = 0 A to 20 A high at 20 A < I_P ≤ 1500 A	 I_{OS} X_G	 A —	 -0.1 —	 — ±0.5% of I_P	 +0.1 —	 T = -40°C to 85°C, V_S = 9 V to 16 V, ±3 sigma
Redundancy channel total accuracy: low at I_P = 0 A to 300 A low at I_P = 300 A to 1500 A	 I_{OS} X_G	 A —	 -15 —	 — ±5% of I_P	 +15 —	 T = -40°C to 85°C, V_S = 9 V to 16 V, ±3 sigma

TABLE 3. MECHANICAL SPECIFICATIONS	
Characteristic	**Parameter**
Housing material	PA66+GF25 (UL 94V - 0)
Mounting screws	M5, torque = 3,5 N m max. The installation bracket should have a flatness tolerance of ≤0,2 mm. The size tolerances of the installation bracket and nut, as well as the use of installation tools and fixtures, have an impact on the maximum installation torque of the product. If there are any relevant design or process changes, it is advisable to implement them after verification.
Mating electrical connector	TE MPN 1473672-1

TABLE 4. CERTIFICATIONS	
Characteristic	**Parameter**
Automotive Safety Integrity Level	ASIL C
Pollution degree	PD2

Figure 1. Error vs. I_p

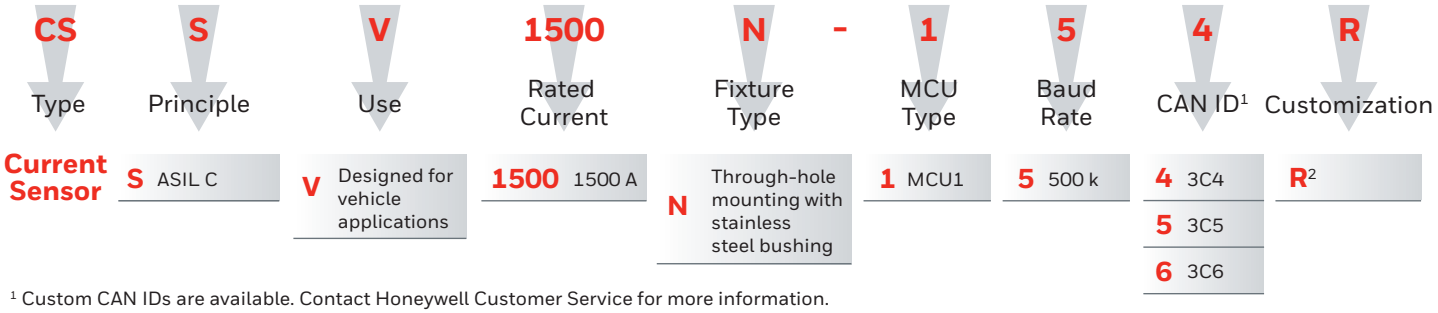


CSSV1500 SERIES
CURRENT SENSORS

TABLE 5. ORDER GUIDE

Catalog Listing	Description
CSSV1500N-154	CSSV1500N Series ASIL C current sensors, 1500 A, through-hole mounting with stainless steel bushing, 500 k baud rate, 3C4 CAN ID
CSSV1500N-155	CSSV1500N Series ASIL C current sensors, 1500 A, through-hole mounting with stainless steel bushing, 500 k baud rate, 3C5 CAN ID
CSSV1500N-156	CSSV1500N Series ASIL C current sensors, 1500 A, through-hole mounting with stainless steel bushing, 500 k baud rate, 3C6 CAN ID
CSSV1500N-154R	CSSV1500N Series ASIL C current sensors, 1500 A, through-hole mounting with stainless steel bushing, 500 k baud rate, 3C4 CAN ID, reverse current direction
CSSV1500N-155R	CSSV1500N Series ASIL C current sensors, 1500 A, through-hole mounting with stainless steel bushing, 500 k baud rate, 3C5 CAN ID, reverse current direction
CSSV1500N-156R	CSSV1500N Series ASIL C current sensors, 1500 A, through-hole mounting with stainless steel bushing, 500 k baud rate, 3C6 CAN ID, reverse current direction

Figure 2. Nomenclature



[1] Custom CAN IDs are available. Contact Honeywell Customer Service for more information.
[2] Customization selection "R" indicates reverse current direction.

TABLE 6. CAN BUS ELECTRICAL CHARACTERISTICS

Characteristic	Parameter
Speed	See Figure 2
Protocol	version 2.0A
Oscillator tolerance	0.3125%
Byte order	big endian (Motorola)

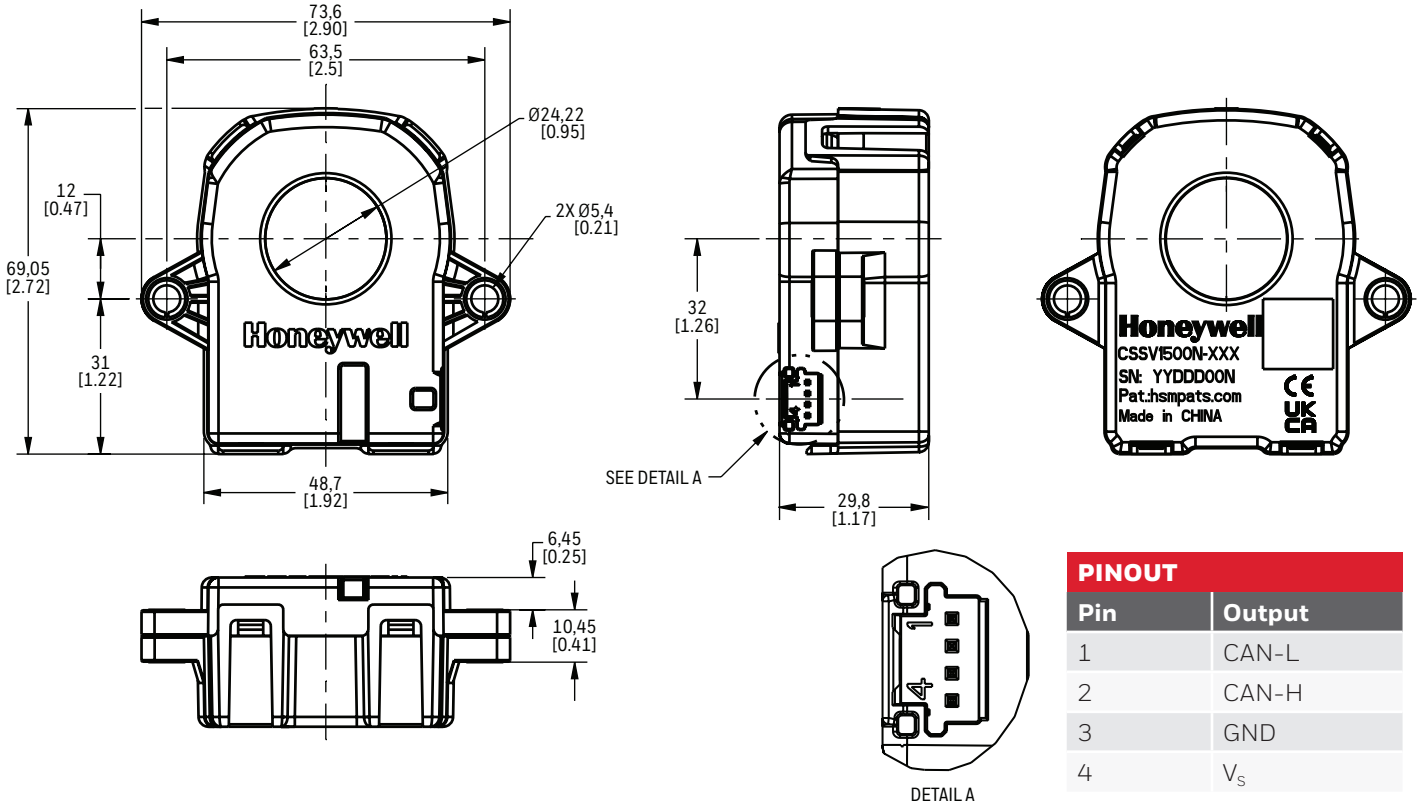
TABLE 7. CAN FRAME LAYOUT

Byte	SequenceCounterIP				Error Information		StatusOutOf RangeIndication	StatusCurrent ValueIndication
Standard CAN Frame								
0	7	6	5	4	3	2	1	0
High Precision Current Value								
1	15	14	13	12	11	10	9	8
2	23	22	21	20	19	18	17	16
3	31	30	29	28	27	26	25	24
Low Precision Current Value								
4	39	38	37	36	35	34	33	32
5	47	46	45	44	43	42	41	40
Software Build								
6	55	54	53	52	51	50	49	48
CRC_IP								
7	63	62	61	60	59	58	57	56

TABLE 8. SIGNAL DESCRIPTION

Signal Name	Description		
SequenceCounterIP	Initial value is 0, plus 1 every frame. Reset to 0 when the counter reaches 14.		
ErrorInformation	01: Power in Under Voltage, 10: Power in Over Voltage, 11: Internal Error, 10 state, Current Value Output 0xFFFFFF/0xFFFF 11 state, Output Current value		
StatusOutOfRange	0: Normal, 1: Out of Measure Range		
StatusCurrentValueInvalid	0: Current Value is valid, 1: Current Value is invalid		
High Precision Current Value	Unsigned number 24 bits, Unit: mA (offset 0x800000) When out of range occurs, becomes 0xFFFFFF, Ip_oc = 1550 A		
	$-1500 \le I_p \le +1500$	signal = I_p	accuracy = Spec
	$-Ip\_oc \le I_p < -1500$	signal = I_p	accuracy = ±2% (for reference)
	$+1500 < Ip \le I_p\_oc$	signal = I_p	accuracy = ±2% (for reference)
	$Ip < -Ip\_oc$	signal = 0xFFFFFF	accuracy = NA
	$Ip > Ip\_oc$	signal = 0xFFFFFF	accuracy = NA
Low Precision Current Value	Unsigned number 16 bits, Unit: A (offset 0x8000) When out of range occurs, becomes 0xFFFF, Ip_oc = 1550 A		
	$-1500 \le I_p \le +1500$	signal = I_p	accuracy = ±5%
	$-Ip\_oc \le I_p < -1500$	signal = I_p	accuracy = ±10% (for reference)
	$+1500 < I_p \le Ip\_oc$	signal = I_p	accuracy = ±10% (for reference)
	$Ip < -I_p\_oc$	signal = 0xFFFF	accuracy = NA
	$Ip > I_p\_oc$	signal = 0xFFFF	accuracy = NA
Software Build	Software version		
CRC_IP	8 bit SAE J1850 CRC/AUTOSAR profile 1 DataId = Same as CAN ID; DataIdMode = E2E_P01_DATAID_BOTH		

Figure 3. Dimensional Drawings (For reference only: mm/IN)



PINOUT	
Pin	**Output**
1	CAN-L
2	CAN-H
3	GND
4	V_S

Figure 4. Part Marking Details

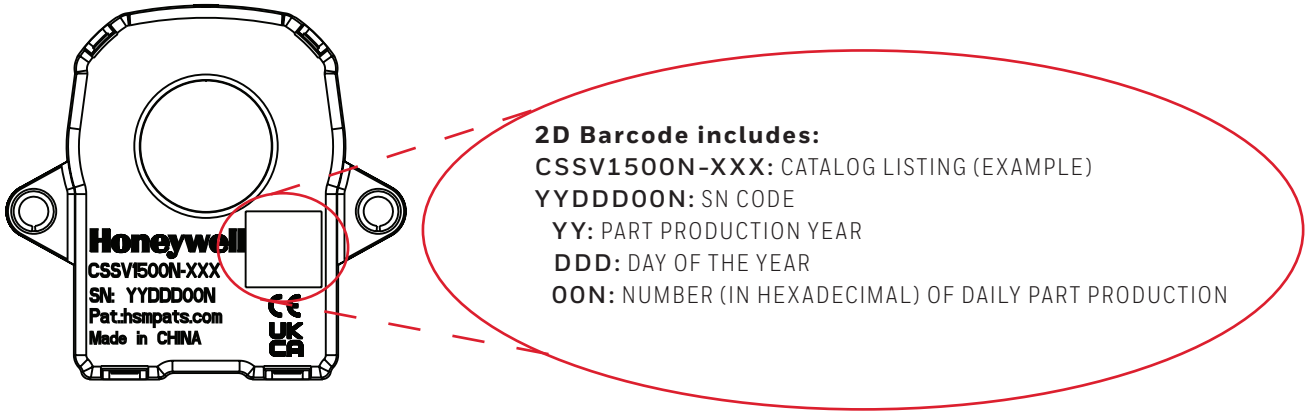


Figure 5. I_p Positive Primary Current Direction (Polarity)

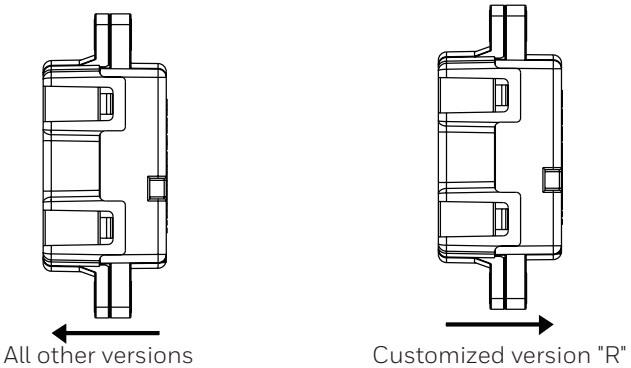


TABLE 9. EMC TEST SPECIFICATIONS

Test Name	Standard	Procedure
CISPR 25 Conducted RF Emissions - Voltage	CISPR25	According to CISPR 25:2008 Commission Form of Testing
CISPR 25 Conducted RF Emissions - Current	CISPR25	According to CISPR 25:2008 Commission Form of Testing
CISPR 25 Radiated Emissions - ALSE Method	CISPR25	According to CISPR 25:2008 Commission Form of Testing
Transient Conduction Emission	ISO 7637-2	According to ISO 7637-2
Low Frequency Magnetic Field Emission	SAE J551-5	According to SAE J551-5
Bulk Current Injection (BCI) Test	ISO 11452-4	According to ISO 11452-4
Rf Anti-Interference - ALSE Method	ISO 11452-2	According to ISO 11452-2
Transient Disturbances Conducted along Supply Lines	ISO 7637-2	According to ISO 7637-2
Transient Disturbances Conducted along I/O or Sensor Lines	ISO 7637-3	According to ISO 7637-3
Low Frequency Field Interference	ISO 11452-8	According to ISO 11452-8
Electrostatic Discharge	ISO 10605	Unpowered direct contact discharge: ±15 kV Unpowered air discharge: ±15 kV Powered-up direct contact discharge: ±8 kV Powered-up air discharge: ±15 kV
Portable Transmitter	ISO 11452-9	According to ISO 11452-9
Radio Frequency Electromagnetic Field	IEC 61000-4-3	10 V/m (80 MHz to 1 GHz), 3 V/m (1.4 GHz to 2 GHz), 1 V/m (2.0 GHz to 2.7 GHz)
Fast Transients Bursts Susceptibility Test	IEC 61000-4-4	2 kV Power port, 2 kV CAN signal and control port
Radio Frequency Continuous Conducted	IEC 61000-4-6	0.15 MHz to 80 MHz, 3 V 80% AM (1 kHz)
Radio Frequency Magnetic Field	IEC 61000-4-8	30 A/M
Radiated Disturbance (3M semi-anechoic chamber)	CISPR-11	Group 1, Class A

TABLE 10. ENVIRONMENTAL TEST SPECIFICATIONS

Test Name	Standard	Procedure
Low Temperature Storage	ISO16750-4	48 hr, 85°C power off. Performance test before and after test at 25°C and V_S nom.
High Temperature Storage	ISO16750-4	48 hr, -40°C power off. Performance test before and after test at 25°C and V_S nom.
Thermal Cycle Test	ISO16750-4	120 cycles: one cycle contains -40°C (120 min soak) and 85°C (120 min soak). Transition time = 120 min. Performance test before and after test at 25°C and V_S nom.
High Temperature and Humidity Endurance	ISO16750-4	1000 hr, 85°C, 85% humidity, power on. Performance after test, from –40°C to 85°C, notify XG ≤1 %
Vibration	IEC60068-2-64	5 Hz to 2000 Hz, 20 hr/axis, three axes with –40°C/85°C temperature cycle during test. Product power on. Performance test before and after test at 25°C and V_S nom.
Mechanical Shock	ISO16750-3	500 m/s, 2,20 each direction (60 total), half sine pulse. Product power on. Performance test before and after test at 25°C and V_S nom.
Package Drop	ISTA-1A or GB/T 4857.5	With final packaging, drop in direction at one corner, three edge, four face > total nine drops, one m on concrete floor. Performance test before and after test at 25°C and V_S nom.
Handling Drop	ISO 16750-3	First fall of each DUT at a different dimensional axis. Second fall with the given DUT at the same dimensional axis but on the opposite side of the housing, from 1 m on concrete floor. Performance test before and after test at 25°C and V_S nom.
Waterproof and Dust (and other Solid Intrusion)	ISO20653	IP category: 40

TABLE 11. ELECTRICAL TEST SPECIFICATIONS[1]

Test Name	Standard	Procedure
Long Time Overvoltage Test	ISO 16750-2	Power supply at 18 V for 60 min.
Superimposed Alternating Voltage	ISO 16750-2	Test voltage U_C max 16 V for 12 V systems; ac voltage (sinusoidal): Severity 2, UPP = 4 V
Slow Decrease Fast Increase of Supply Voltage	ISO 16750-2-4.5	According to ISO 16750-2-4.5 testing standard and Fig
Reset Behavior at Voltage Drop	ISO16750-2-4.6.2.2	See Fig. 6
Transient Overvoltage Test	ISO16750-2	Power supply at 24 V for 10 min.
Momentary Drop in Supply Voltage	ISO 16750-2-4.6.1	U_C min to 4.5 V. See Fig. 4
Load Dump	ISO 16750-2-4.6.4	Pulse described in Table 6. See Fig. 9
Reverse Voltage Test	ISO16750-2-4.7	Power supply at -24 V for 10 min.
Single Line Open Circuit Tests	ISO16750-2-4.9	Connect sensor to 12 V power supply and power on the sensor. Disconnect Us, GND, CAN-H, and CAN-L in sequence. Each open circuit time: 60 ±1 s
Connector Open Circuit Tests	ISO16750-2	Connect sensor to 12 V power supply and power on the sensor. Disconnect connector. Each open circuit time: 10 ±1 s
Insulation Resistance Test	ISO 16750-2-4.12	500 Vdc for 60 s; Resistance criteria: >500 MOhm
dc and ac Voltage Insulation Test	—	Test Voltage: 5000 Vdc and ac. Frequency: dc and 50~60 Hz. Test Duration: 60 s

[1] See the applicable standard for all table and figure references.

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The information contained in this document is preliminary and for reference only. Preliminary means that the product described has not been or is currently being formally tested. Specifications are subject to change without notice. Reliance on the information contained herein is at the reader's own risk.

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