

ACNT-H61L, ACNT-H343, ACNT-H313, ACNT-H50L, ACNT-H511, ACNT-H870, ACNT-H87A, ACNT-H87B, ACNT-H790, ACNT-H79A, ACNT-H79B

15-mm Wide ACNT Optocouplers for High Voltage Applications

Introduction

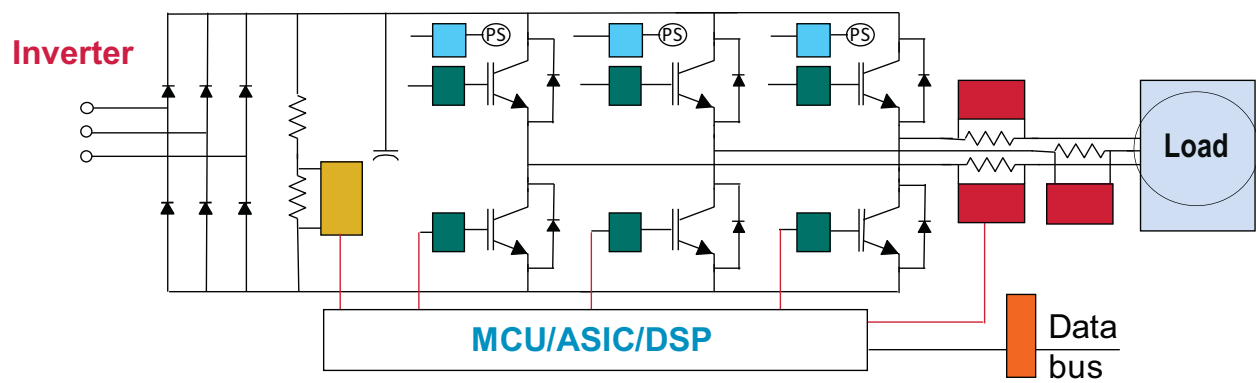
The Broadcom® ACNT family of optocouplers offers 15-mm creepage and 14.2-mm clearance for high voltage isolation applications. These optocouplers provide 2,262 V_{PEAK} working insulation voltage and 12,000 V_{PEAK} transient overvoltage in a compact stretched, surface-mount SO-8 package. The ACNT optocouplers consist of comprehensive product types to meet the different galvanic isolation requirements and features. They include following:


- ACNT-H343 gate drive optocoupler
- ACNT-H61L low-power 10 MBd digital optocoupler
- ACNT-H790/H79A/H79B high linearity isolation amplifier for current sensing
- ACNT-H870/H87A/H87B voltage sense optocoupler
- ACNT-H50L/H511 low speed analog optocoupler

For example, the three-phase inverter converts DC-AC power to a load (motor); [Figure 1](#) highlights the various isolation locations and the purpose of each ACNT optocoupler product type. The ACNT optocouplers are easy to use and are reliable.



Figure 1: ACNT Optocouplers for Various Isolation Needs in an Inverter

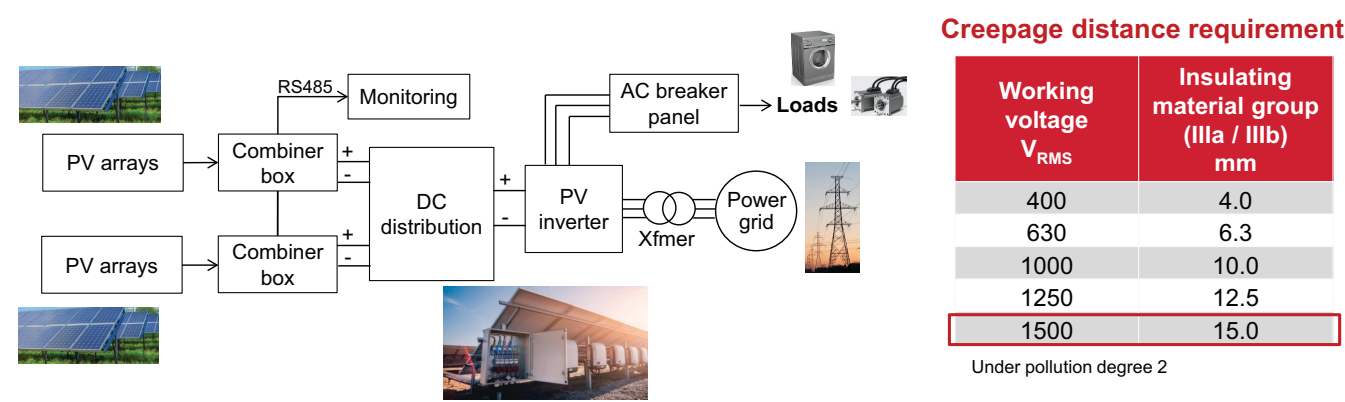


Isolation	Optocoupler	Purpose
	1) ACNT-H343 Gate Drive 	Drive IGBT/MOSFET
	2) ACNT-H61L 10MBd Low Power	LV-HV control interface (isolate MCU & HVIC gate driver)
	ACNT-H790/H79A/H79B Current Sense	Feedback current for system control
	ACNT-H870/H87A/H87B Voltage Sense	Voltage level control for system safety
	ACNT-H50L/H511 Low Speed Analog	Isolate power feedback, UVLO detect, fault feedback
	ACNT-H61L 10 MBd Low Power	Isolate data bus communication

High Voltage Trend and Requirements

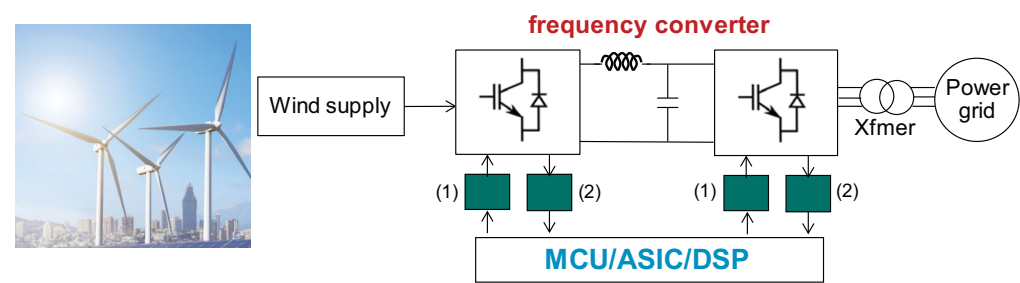
In the market segments of renewable (solar or wind) power, traction and healthcare systems, there is trend for a requirement for higher DC bus voltage or high transient voltage immunity. The new solar/PV systems have adopted 1500 VDC from 1000V. This upgrade has benefits in terms of higher energy efficiency and lower costs. One benefit is that more PV blocks per string (longer string of PV arrays) are able to form. Combiner boxes consolidate incoming power into one main feed. With long and lesser numbers of PV strings, fewer combiner boxes are required. Higher DC voltage of input also reduces wire (copper) power losses. As a whole, the 1500V system has fewer connections between the PV string arrays and inverters compared to 1000V or lower DC voltage systems. The higher power density and less equipment also reduces labor maintenance costs. One challenge of the 1500V system is the electrical safety and full range of certification standards for the components. The isolation between the control module and the power products must be able to withstand high voltage (steady and transient) and the relevant creepage distance (Figure 2). Broadcom's 15-mm wide ACNT optocouplers are able to meet these requirements.

Figure 2: PV Power Generation System – 1500V



In the wind solution of the renewable energy segment, the ACNT optocouplers have gained popularity in European countries as part of a national-level program of distribution grid renewal to replace nuclear power plants with renewable resources. In Figure 3, the frequency converter shows how the 15-mm wide ACNT-H61L 10 MBd low-power optocoupler isolates the control and fault feedback signals between low-voltage control and the high-voltage IGBTs. In another sub-segment of the electrical grid, metering for the low- or midrange-voltage distribution line becomes more advanced as part of the smart grid adoption. Wider creepage is required in the three-phase (> 400 VAC metering) for safety and high-voltage isolation of data communication. Security gains importance in the smart grid. The ACNT-H50L low-speed analog optocoupler's long-term reliability helps to secure isolated data communication.

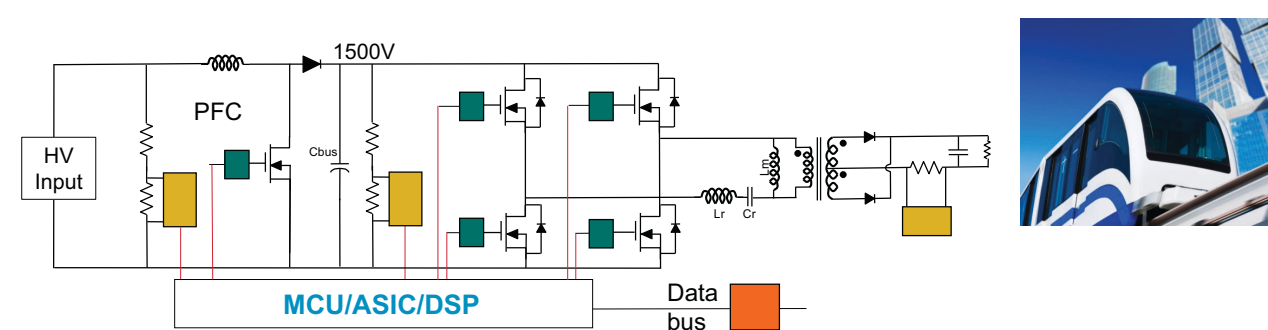
Figure 3: Renewable Energy – Frequency Converter of Wind Solutions



Isolation	Optocoupler	Purpose
	ACNT-H61L 10 MBd Low Power	(1) HV-LV control interface (isolate MCU & HVIC gate driver) (2) Fault feedback isolation

Another high-voltage application in the example of light rail or monorail (traction control) is that the ACNT optocouplers are used in DC-DC converters of 1500V. Figure 4 illustrates a monorail power converter with a 1500 VDC bus voltage. There are four digital optocouplers for the isolated high voltage-low voltage control interface. Two voltage sense isolation amplifiers are for isolated voltage level control, and the low-speed analog optocouplers are for isolated I/O communication. These optocouplers provide high-voltage insulation for reliability and robustness in a high-noise environment.

Figure 4: Power Converter in Traction Applications



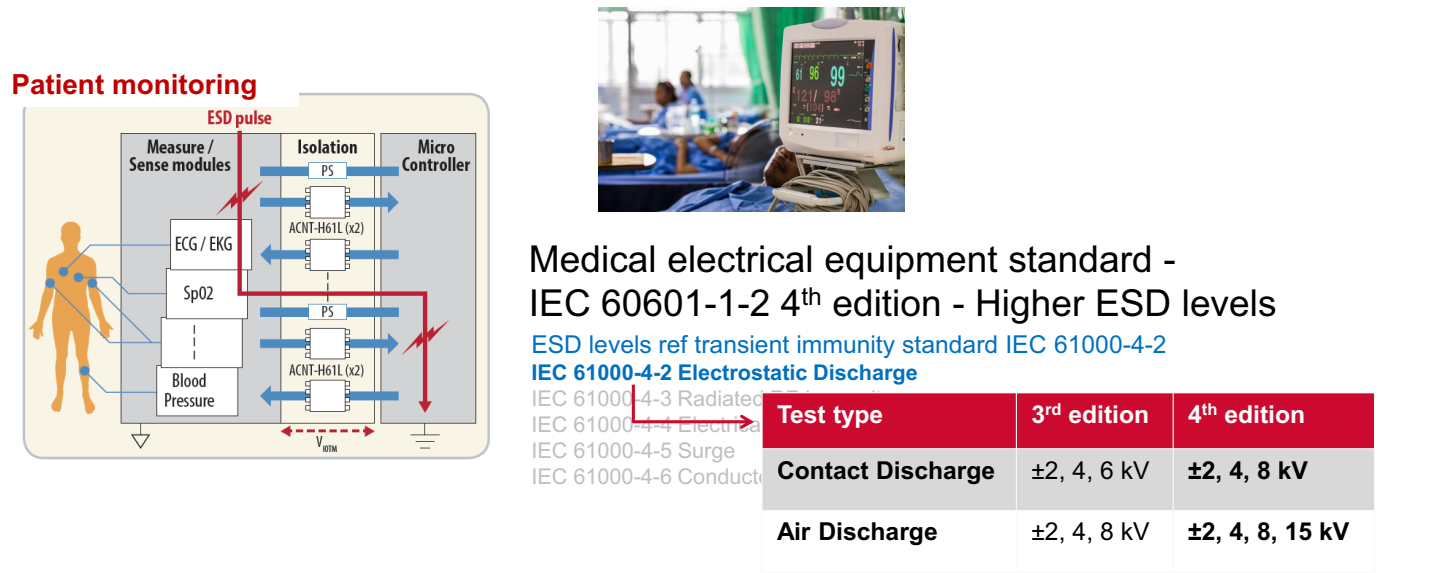
Isolation	Optocoupler	Purpose
	ACNT-H61L 10MBd Low Power	HV-LV control interface (isolate MCU & HVIC gate driver)
	ACNT-H870/H87A/H87B Voltage Sense	Voltage level control for system safety
	ACNT-H50L/H511 Low Speed Analog ACNT-H61L 10MBd Low Power	Isolate data bus communication

Revision in the Regulatory Standards

More stringent creepage and clearance requirements were defined during the harmonization of international standard bodies UL and IEC. Starting in 2016, UL 508C (power conversion equipment) transits to IEC 61800-5-1 (adjustable speed electrical power drive systems). A minimum 13.8-mm (wider) of creepage and clearance are required for reinforced insulation of a 690 VAC rating specification.

In the medical systems, the ACNT optocouplers provide benefits in addressing the high ESD immunity discharge transient overvoltage that is required across the isolation barrier. In patient monitoring applications, the ESD immunity-type test applies between the sensing circuitry (for example, blood pressure and ECG, where patient has direct contact) and the control board of the device. To address electromagnetic interference (EMI) threats of today for medical devices' increased use outside of hospitals, the fourth edition of the medical electrical equipment standard, IEC 60601-1-2, increases higher ESD immunity discharge level testing for medical devices (Figure 5). The ACNT-H61L used in patient-monitoring devices allows a transient overvoltage of 12,000 V_{PEAK} and its 15-mm wide creepage and clearance allow a wider isolating gap to minimize arcing.

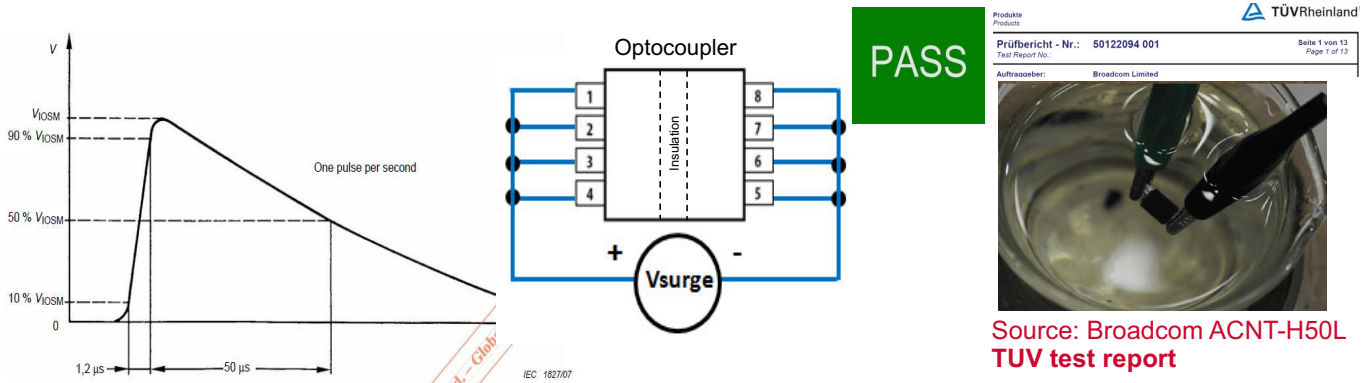
Figure 5: Meet High Insulation Voltage Needs in Medical Systems – ACNT-H61L



Broadcom ACNT Optocouplers

The Broadcom optocouplers' excellent performance withstands high-voltage surges (1.2- μ s/50- μ s voltage waveforms). As per the component safety standard IEC 60747-5-5, the Broadcom ACNT optocouplers pass a requirement of more than 25 kV. The pass criteria allows for no puncture or partial breakdown of the solid insulation at less than 5-pC partial discharge. As shown in Figure 6, the ACNT-H50L is tested under non-air conditions to remove electric arcing at high voltage surge (refer to the TUV test result report).

Figure 6: Broadcom Optocouplers Meet High Voltage Surges per IEC 60747-5-5



Source: Broadcom ACNT-H50L
TUV test report

The ACNT-H343 is a newly released 5A gate drive optocoupler. It resides in a 15-mm SSO-8 package designed for high-voltage and space-constrained industrial applications, including 690-VAC motor drives and 1500V solar inverters. The ACNT-H343 features common mode transient immunity (CMTI) greater than 100 kV/ μ s, which prevents erroneous gate driver failures in noisy environments. The device has minimal propagation delay and is three times faster than the previous generation devices, enabling high-frequency switching to improve efficiency in driving insulated-gate bipolar transistors (IGBTs) and SiC/GaN MOSFET.

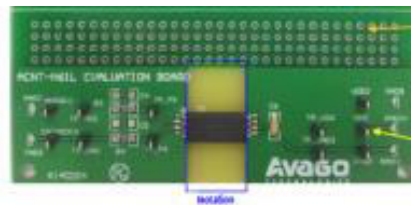
The ACNT-H61L is a 10 MBd low-power digital optocoupler that requires only a minimum of 4.5 mA of LED driving current, and the detector IC consumes a maximum of 2 mA I_{DD} across operating temperatures. The output of the detector IC is a CMOS output. The internal Faraday shield provides a guaranteed common-mode transient immunity specification of 20 kV/ μ s. The ACNT-H61L suits isolated logic interface communication and control in high-voltage or transient power-conversion systems.

The ACNT-H50L and ACNT-H511 are single-channel 1-MBd optocouplers with open collector transistor output. Separate connections for the photodiode bias and output transistor collector increase the speed up to 100 times over that of a conventional photo-transistor by reducing the base-collector capacitance. The ACNT-H50L and the ACNT-H511 are designed for a variety of applications, such as low-speed analog, isolated fault, or power control feedback.

The ACNT-H87B ($\pm 0.5\%$ gain tolerance), the ACNT-H87A ($\pm 1\%$ gain tolerance), and the ACNT-H870 ($\pm 3\%$ gain tolerance) voltage sensors are optical isolation amplifiers designed specifically for voltage sensing. Their 2V input range and high 1-G Ω input impedance meet the isolated voltage sensing requirements in electronic power converter applications. In a typical voltage sensing implementation, a resistive voltage divider scales the DC-link voltage to suit the input range of the voltage sensor. A differential output voltage, which is proportional to the input voltage, is created on the other side of the optical isolation barrier.

The ACNT-H79B ($\pm 0.5\%$ gain tolerance), the ACNT-H79A ($\pm 1\%$ gain tolerance), and the ACNT-H790 ($\pm 3\%$ gain tolerance) isolation amplifiers are designed for current and voltage sensing in electronic power converter applications. These optocouplers provide the precision and stability needed to accurately monitor motor current in high-noise motor control environments, providing for smoother control (less "torque ripple") in various types of motor control. Combined with superior optical coupling technology, the ACNT-H79B, the ACNT-H79A, and the ACNT-H790 uses sigma-delta ($\Sigma\text{-}\Delta$) analog-to-digital modulation, chopper stabilized amplifiers, and a fully differential circuit topology to provide unequalled isolation-mode noise rejection, low offset, high gain accuracy and stability.

Evaluation boards of the ACNT optocouplers are available. Contact Broadcom sales or its authorized distributors for your design needs.



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