JANUARY 2013
Avago Current & Voltage Sensing Optocouplers

AVAGO TECHNOLOGIES

Target Market Segments & Applications

INDUSTRIAL DRIVES

- Industrial Networking
- Motor Control
- PLC Input/Output Isolation
- Power Distribution Systems
- Switch Mode Power Supplies

RENEWABLE ENERGIES

- DC/AC Inverters for PV systems
- Wind Turbine Supplies

RAILWAY

- Locomotive DC/DC /Inverters
- Railway Signalling

MEDICAL

- ECG/EKG
- Endoscopes
- Defibrillators
- Magnetic Resonance Imaging
- Patient Monitoring

AUTOMOTIVE

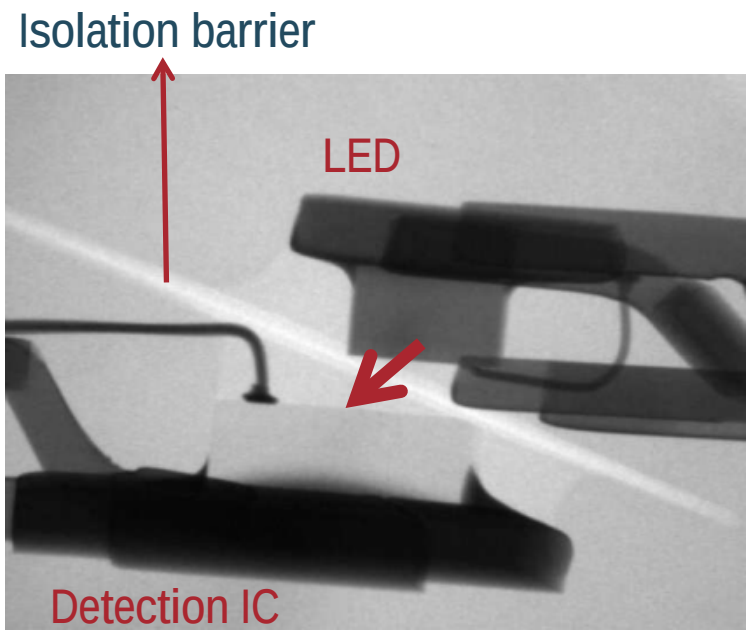
- Powertrain
- Motor Inverter Control
- Automotive CANBus System Interface
- Battery System

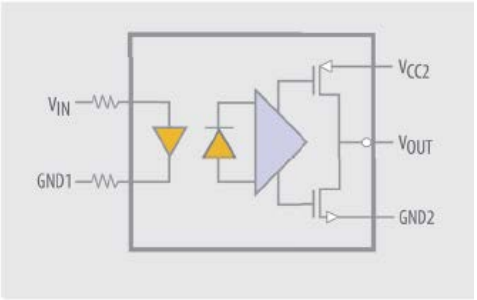
MILITARY/AEROSPACE

- Environmental Controls
- Generator Controls
- Guidance Systems
- Ordnance Fire Control
- Radar Systems
- Reaction Wheel Assemblies
- Signal Tracking Systems
- Vehicle Communications Systems

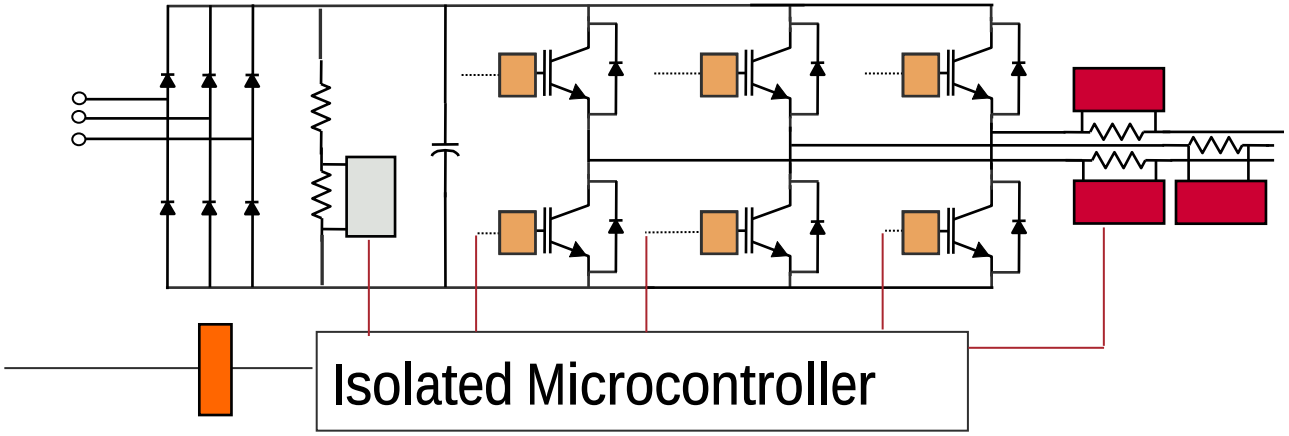
Value Proposition Optical Isolation. Galvanic. Failsafe.

- ✓ True Galvanic Isolation
- ✓ Re inforced = failsafe Isolation (IEC 60747-5-2/-5-5 Safety Approval)
- ✓Excellent Signal Immunity
- ✓Low impedance LED input (Ohm) = rejection of conducted & inducted EMI
- ✓Very low inherent capacitance (pF) = no Common Mode Noise failure through leakage currents caused by Transients
- ✓No Inductance
- ✓Very Low Power Consumption (mWatt)
- ✓Fast reaction times & endurance





An Isolation Product for All Sockets...



- Gate Drive Optocouplers - to drive MOSFETs/IGBTs + protect
- Current Sense Optocoupler - feedback loop for system control
- Voltage Sense Optocoupler - voltage level control for system safety
- Fieldbus / User Interface - to communicate data, not noise !

Product Families & Strategy. Your Requirements.

Gate Drive Optocouplers

Rail to rail output for better efficiency

Smaller footprint for compact designs

Lower deadtime for faster switching

Current/Voltage Sense

Outstanding accuracy for higher measurement precision

Digital output for direct FPGA/DSP processing

Digital Optocouplers

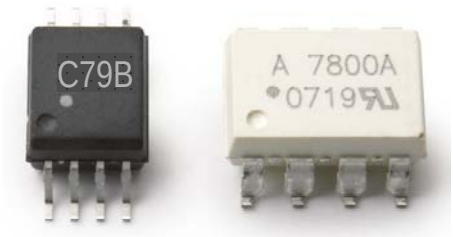
Low Power to reduce System Consumption

1 MBd family with wide supply voltage for 12/24V rails

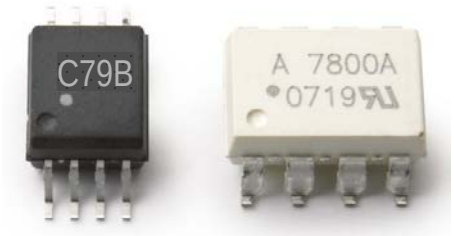
10 MBd family with 3.3/5V compatibility for Fieldbus

Wide package range for different needs

Optocouplers for Current/Voltage Sensing



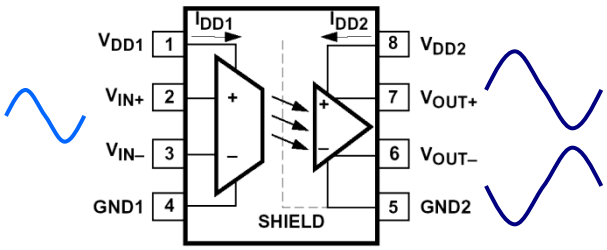
Current/Voltage Sense Optocouplers – High Precision & Compact Solution against Hall Effect



Target Applications

- Motor Phase and Rail Current/Voltage Sensing
- Inverter Current Sensing
- Switching Power Supply Signal Isolation
- General Purpose Current Sensing and Monitoring
- General Purpose Analog Signal Isolation

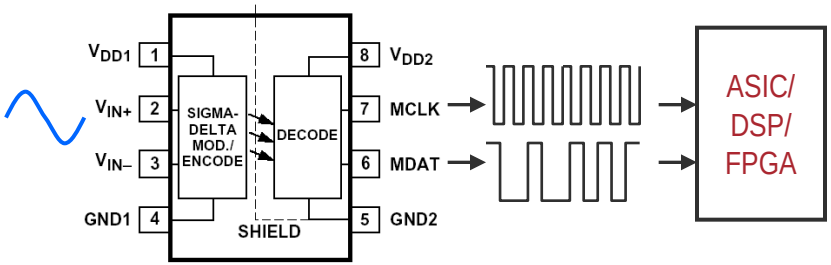
Current/Voltage Sense Optocouplers



ACPL-790B/790A/7900
ACPL-C79B/C79A/C790
ACPL-C78A/C780/C784
HCPL-7800A/7800/7840

Analog Output

- 3V/5V compatible
- High CMR (15 kV/μs at V_{CM} = 1000 V)
- 1.6μs fast response, 60dB SNR
- 8 mm Creepage and Clearance
- IEC/EN/DIN EN 60747-5-5: V_{IORM} = 1230 Vpeak, UL 1577: 5000 Vrms/1 min



ACPL-C797
HCPL-7860/7560

Digital Output

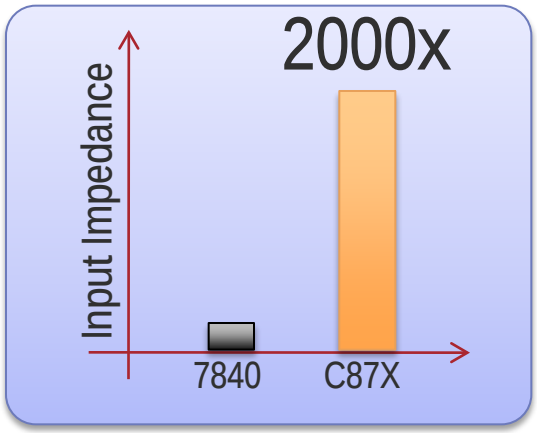
Sigma Delta Modulator with 16-bit resolution

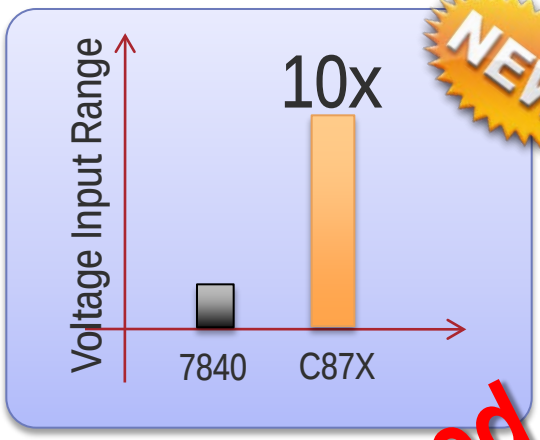
- High CMR (15 kV/μs at V_{CM} = 1000 V)
- VREF error @ 25° C max: ±0.5%
- Accurate internal clock frequency

ACPL-C870/A/B – Precision Isolated Voltage Sensor

Features

- *Input Linear Range : 0 - 2V*
- *Input Impedence : 1GΩ*
- Gain : 1V/V
- Gain Tolerance : 3% (0), 1% (A), 0.5% (B)
- *Gain Drift : -35ppm/°C*
- Supply Voltage Vcc1 : 4.5 – 5.5V
- Supply Voltage Vcc2 : 3.3 – 5.5V
- *Nonlinearity : 0.1% Max*
- Differential Output
- Low power standby or shutdown pin
- High CMR : 15 kV/**µs** at V_{CM} = 1500 V
- Bandwidth : 100KHz
- Package : SSO8
- Operating Temp: - 40°C – 105°C
- Reinforced Optical Insulation with Worldwide Safety Approval (Pending):
  - UL Recognized 5kV_{RMS} for 1 min Viorm = 1230Vpeak (1414V optional)
  - IEC 60747-5-5
  - CSA File Notice #5





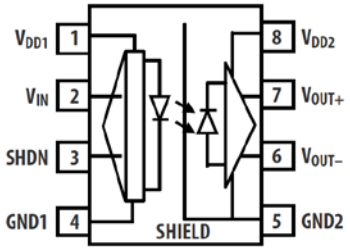
Released

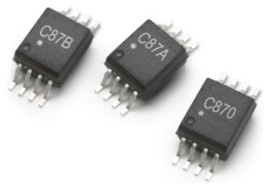
Key Benefits

- ✓Low Gain Drift and Non-Linearity for Enhanced Accuracy.
- ✓High Input Impedence and Wider Input Range for lower Power Dissipation
- ✓Superior Optical Isolation for Reinforced Safety Insulation and Isolation.

Applications

- Isolated Voltage Sensing in AC and Servo Motor Drives
- Isolated DC-Bus Voltage Sensing in Solar Inverters,
- Isolated Sensor Interfaces
- Signal Isolation in Data Acquisition Systems
- General Purpose Voltage Isolation





TECHNOLOGIES

New Current/Voltage Sensors for Your Upgrade

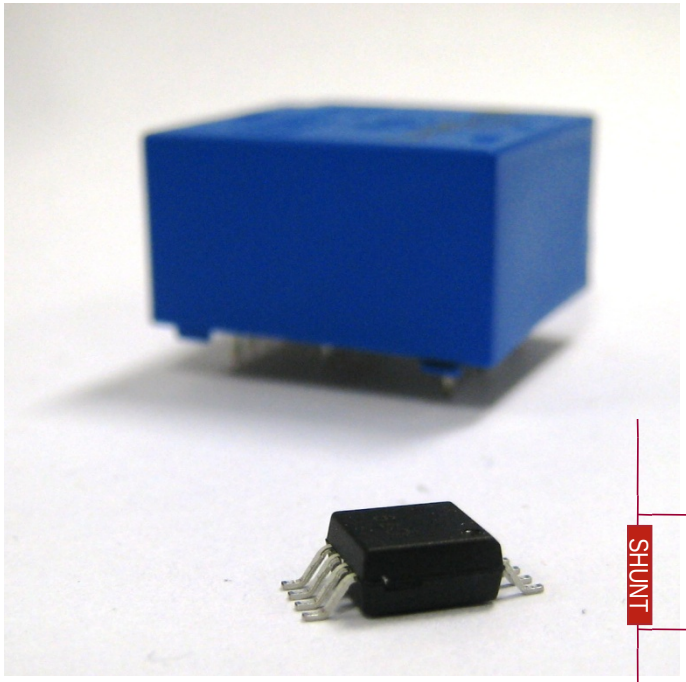
Avago Cross	1st Gen Upgrade	Focus/Upgrade Products	Value Propositions
HCPL-786J HCPL-7860		ACPL-C797 (on board clock !)	▪Clock output over temp: $9MHz_{min}$, $10MHz_{max}$ ▪ENOB: 12 bits ▪SNR over temp min: 74dB
		ACPL-796J (external clock)	▪External Clock Input: 5 MHz to 20 MHz ▪Synchronize system with multiple converters ▪ENOB: 12 bits ▪SNR over temp min: 74dB
HCPL-7800A HCPL-7800 HCPL-7840	ACPL-C78A ACPL-C780 ACPL-C784	ACPL-C79B ACPL-C79A ACPL-C790	▪Signal delay over temp max: 3.3µs ▪SNR over temp min: 60dB ▪Gain error@25ºC max: ±0.5%, ±1%, ±3% ▪Non-linearly over temp max: 0.2% ▪Bandwidth typ: 200 kHz
HCPL-37xx	HCPL-0370	ACPL-K376 (Low input current) ACPL-K370	▪Thresholds guaranteed over temperature ▪Thresholds independent of LED optical parameters ▪3.3V and 5V Vcc specifications characterized ▪AC or DC input ▪Programmable sense voltage with Hysteresis ▪Logic compatible output

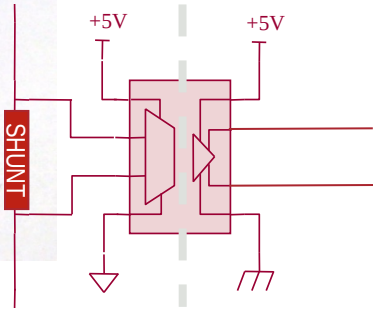
Hall Effect Sensors versus AVAGO Solution?

Shunt+Iso Amp. versus Hall Effect Sensor ?

- Advantages of Avago Solution are:
- Lower Temperature Drift
- Smaller Size
- Simple SMD Assembly
- Lower Cost

- Trend: IGBT module manufacturers starting to integrate shunts





Isolation Amplifier

ACCURACY

	Avago	Typical CL Hall Effect	Typical OLHall Effect
Part number	ACPL-C79B	Closed-Loop Transducer	Open-Loop Transducer
Output configuration	Analog Differential	Analog Single-ended	Analog Single-ended
Accuracy at 25° C (%)	1.5	1.4	3
Temperature Drift Error (%)	0.8	1.6	8
Uncalibrated accuracy across operating temperature (%)	2.3	3	11
Calibrated accuracy [-40 to 105°C] (%)	0.8	1.7	10
Bandwidth (kHz)	200	200	50

Evaluation Boards for Isolation Amplifiers

ACPL-C79X/790x eval board
Supports ACPL-C79B/C79A/C790

ACPL-C78X eval board
Supports ACPL-C780A/C780/C784

HCPL-78XX eval board
Supports HCPL-7800A/7800/7840 and ACPL-782T

HCPL-788J eval board

HCPL-7510/7520 eval board

AVAGO TECHNOLOGIES

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Thank You.