Semiconductor
Product Catalog
Clare Overview

Clare is a wholly owned subsidiary of IXYS Corporation, and is conveniently located close to Boston, Massachusetts, USA. Clare designs, manufactures, and markets a wide variety of semiconductor devices, and is a major designer and manufacturer of optically isolated electronic products. Clare manufactures one of the industry’s broadest lines of Solid State Relays (SSR), featuring galvanic input-to-output electrical isolation from $1500\text{V}_{\text{rms}}$ up to $5000\text{V}_{\text{rms}}$; a wide selection of optocouplers and linear optocouplers; and optically isolated AC Power Switches.

Clare SSR products are rapidly replacing electromechanical relays in many applications, making it a leading supplier to the Telecommunications, Medical, Security, Utility Metering, and Industrial Control industries. Replacing electromechanical relays with smaller, more-reliable optically isolated SSRs improves safety and lowers costs, while minimizing equipment size and enhancing overall system performance. With no moving parts, no coils, and no contacts, Solid State Relays are ideally suited for use in flammable surroundings, and in environments with high electrical and magnetic noise.

For the Telecommunications Industry, Clare manufactures a broad range of products that includes phone-line interface and monitoring devices, DC Termination devices for xDSL and ISDN applications, and Central Office products. Clare’s newest entries into the Central Office market include several new Line Card Access Switch devices with high transient immunity: $1500\text{V}/\mu\text{s}$. These robust devices have led to the development of monolithic high voltage switching ICs, powered from 3.3V digital supplies, that interface to industrial controls, instrumentation, automatic test equipment, and medical applications (see the new CPC7514).

Clare’s expertise in high-voltage and power devices supports a growing line of standard devices. Power SSRs, SCR-based AC power switches, Field Effect transistors (FET), and IGBT and MOSFET gate drivers, both optically isolated and standard, round out a broad offering in the power market. The high-speed IXD_600 series of low-side IGBT and MOSFET gate drivers, with gate-drive currents of up to 30A, have rapidly become one of Clare’s most successful power products.

In the display market, Clare offers drivers for LED lighting. The new CPC9909 answers the growing need in the illumination industry for a cost-effective, off-line, high-brightness LED driver. Clare also manufactures a line of display drivers for electronic paper devices.

Clare Hi-Reliability Program

Building on 20 years of experience supplying Hi-Rel parts to the aerospace industry, Clare now offers a line of high-reliability Solid State Relays and Optocouplers.

- Full Product Traceability
- Extremely Low PPM Failure Rates
- Guaranteed Operation from -40°C to +85°C, and up to 105°C Upon Request
- 100% Burn-In (HTRB) 48 Hours Minimum
- 100% Post Burn-In Electrical Tests at Room Temperature and at 85°C
- Thermal Cycle (By Sample or 100% for 20 Cycles)

Any Clare Solid State Relay (SSR) or Optocoupler offered in this catalog can be provided as a Hi-Rel device based on extensive additional environmental stressing and screening performed on standard commercial parts. Please see www.clare.com/Products/HiRelProgram.htm for full details.

Clare Custom, High-Voltage Semiconductor Design Services

Clare offers design services to the industry for the custom development of high-voltage semiconductor devices. Clare’s wafer fabrication facility features a 600V BCDMOS process on a bonded-wafer, silicon-on-insulator, trench-isolated technology for IC development. Monolithic silicon with high-voltage vertical DMOSFETs along with CMOS logic and bipolar transistors from Clare address many applications requiring a high voltage interface. In addition, Clare’s techniques for optical isolation for relays and signal processing offer high voltage isolation between the load side and the system controller.

Bring your high-voltage semiconductor component design challenges to Clare.
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Solid State Relays

The OptoMOS® line of Solid State Relays (SSR) uses discrete semiconductor components and Clare’s patented OptoMOS architecture to provide fast, reliable, bounce-free switching in a compact design. From one of the world’s smallest single pole, high voltage, 4-pin relays to multi-pole and multifunction devices, OptoMOS products are an ideal replacement for larger reed and electromechanical relays. Compared to older electromagnetic technologies, Clare OptoMOS relays offer significantly lower drive current, smaller package size, no susceptibility to magnetic interference, and solid state reliability. All of these are key requirements for the design of today’s complex low-power, multichannel products.

Clare SSRs are provided in three main types: Unidirectional (UNI), Bidirectional (BI), and Bidirectional Plus (BI+). A UNI relay conducts load current in only one direction, a BI relay conducts load current in both directions, and a BI+ relay has a provision for connecting the output MOSFETs in such a way that the relay in UNI configuration conducts significantly more load current than when it is wired in BI configuration (see the diagram on this page). The accompanying tables reference these three types for all devices listed.

These three main types are available in a variety of configurations: normally open (1-Form-A), normally closed (1-Form-B), dual 1-Form-A, dual 1-Form-B, 1-Form-A and 1-Form-B in the same package, 1-Form-A and 1-Form-B voltage-controlled relays, 2-Form-A, and 1-Form-C.

Drawings of all the available packages are shown below. For exact physical dimensions of any package, download the data sheet for the product that you are interested in from Clare’s web site page, a link to which is referenced in the note at the bottom of the page. The packages are referred to by number in the accompanying tables.

**Features:**
- Low Drive Current
- High Reliability
- No EMI/RFI Generation
- Arc-Free with No Snubbing Circuits
- AC or DC Switching
- Current Limiting (Available)
- FCC Compatible
- Low Off-State Leakage

**Applications:**
- Telecommunications / Datacommunications
- Instrumentation
- Multiplexers
- Data Acquisition / Electronic Switching
- I/O Subsystems
- Meters (Watt-Hour, Water, Gas)
- Medical Equipment (Patient / Equipment Isolation)
- Security
- Aerospace
- Industrial Controls

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For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)
# 1-Form-A Relays: Single-Pole, Normally Open

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For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)

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### 1-Form-A Relays: Single-Pole, Normally Open (Continued)

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<th>Load Current $(I)$ (mA)</th>
<th>On Resistance $(R)$ (Ω)</th>
<th>Input Control Current $(I_{cc})$ (mA)</th>
<th>Switching Speeds $t_{on}$/$t_{off}$ (µs)</th>
<th>Isolation Voltage $(V_{iso})$ (V)</th>
<th>Off-State Leakage $(I_{leak})$ (µA)</th>
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### 1-Form-A Relays: Quad Single-Pole, Normally Open

**NEW!** See Page 30 for full details. The CPC7514 Quad High Voltage Isolated Analog Switch Array provides the switching functionality of four independent 1-Form-A relays in a single small economical package. Designed to provide flexible single-ended or differential access to high voltage networks, up to 320V, the CPC7514 is configured as two sets of matched-pair switches. The CPC7514 is self-biasing, and requires no external power supply. Shown to the right is one 2-switch channel.
1-Form-A Relays: Dual Single-Pole, Normally Open

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<th>On Resistance (Ω)</th>
<th>Input Control Current (mA)</th>
<th>Switching Speeds (ms)</th>
<th>Isolation Voltage (V&lt;sub&gt;rms&lt;/sub&gt;)</th>
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Features and Comments:
- EN50130-4
- Low I<sub>leak</sub>, EN50130-4
- Current Limiting
- Current Limiting
- Current Limiting
- Current Limiting
- Current Limiting
- Current Limiting
- Current Limiting
- Very Low I<sub>leak</sub>, Fast Switching Times
- Very Low I<sub>leak</sub>, Fast Switching Times
- Current Limiting
- Current Limiting
- Enhanced Isolation Voltage
- Enhanced Isolation Voltage
- Enhanced Isolation Voltage
- Low I<sub>leak</sub>

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### 1-Form-B Relays: Single-Pole, Normally Closed

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Relay Type</th>
<th>Blocking Voltage $(V_p)$ (mA)</th>
<th>Load Current $(I)$ (mA)</th>
<th>On Resistance $(R)$ (Ω)</th>
<th>Input Control Current $(I_{CC})$ (mA)</th>
<th>Switching Speeds $(t_{on}/t_{off})$ (μs)</th>
<th>Isolation Voltage $(V_{iso})$ (V)</th>
<th>Off-State Leakage $(I_{off})$ (μA)</th>
<th>Package Type</th>
<th>Features and Comments</th>
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<td>10</td>
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<tr>
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**NEW!**

### 1-Form-B Relays: Dual Single-Pole, Normally Closed

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<th>Load Current $(I)$ (mA)</th>
<th>On Resistance $(R)$ (Ω)</th>
<th>Input Control Current $(I_{CC})$ (mA)</th>
<th>Switching Speeds $(t_{on}/t_{off})$ (μs)</th>
<th>Isolation Voltage $(V_{iso})$ (V)</th>
<th>Off-State Leakage $(I_{off})$ (μA)</th>
<th>Package Type</th>
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<td>5</td>
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**NEW!**

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### 1-Form-A & 1-Form-B Relays: Combination Form-A & Form-B

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<th>On Resistance (Ω)</th>
<th>Input Control Current (mA)</th>
<th>Switching Speeds (t_on / t_off) (ms)</th>
<th>Isolation Voltage (V_recent) (μA)</th>
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### 1-Form-A Relays: Single-Pole, Normally Open, Unidirectional (DC-Only)

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<tr>
<th>Part Number</th>
<th>Relay Type</th>
<th>Blocking Voltage (V_p)</th>
<th>Load Current (mA)</th>
<th>On Resistance (Ω)</th>
<th>Input Control Voltage (V)</th>
<th>Switching Speeds (t_on / t_off) (ms)</th>
<th>Isolation Voltage (V_recent) (μA)</th>
<th>Features and Comments</th>
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<td>Extended Operating Temperature Range: -40ºC to +110ºC</td>
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### 1-Form-A Relays: Single-Pole, Normally Open, Voltage-Controlled

<table>
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<th>Relay Type</th>
<th>Blocking Voltage $(V_p)$ (mV)</th>
<th>Load Current $(I)$ (mA)</th>
<th>On Resistance $(R)$ (Ω)</th>
<th>Input Control Voltage $(V_i)$ (V)</th>
<th>Switching Speeds $t_{on} / t_{off}$ (ms)</th>
<th>Isolation Voltage $(V_{iso})$ (V)</th>
<th>Off-State Leakage $(I_{off})$ (μA)</th>
<th>Package Type</th>
<th>Features and Comments</th>
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<td>EN50130-4, Direct drop-in reed relay replacement</td>
</tr>
</tbody>
</table>

### 1-Form-B Relays: Single-Pole, Normally Closed, Voltage-Controlled

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Relay Type</th>
<th>Blocking Voltage $(V_p)$ (mV)</th>
<th>Load Current $(I)$ (mA)</th>
<th>On Resistance $(R)$ (Ω)</th>
<th>Input Control Voltage $(V_i)$ (V)</th>
<th>Switching Speeds $t_{on} / t_{off}$ (ms)</th>
<th>Isolation Voltage $(V_{iso})$ (V)</th>
<th>Off-State Leakage $(I_{off})$ (μA)</th>
<th>Package Type</th>
<th>Features and Comments</th>
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<tr>
<td>CPC1219</td>
<td>BI</td>
<td>60</td>
<td>200</td>
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<td>5V - 12V</td>
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### 2-Form-A Relays: Common Input, Dual-Pole, Normally Open

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<th>On Resistance $(R)$ (Ω)</th>
<th>Input Control Voltage $(V_i)$ (V)</th>
<th>Switching Speeds $t_{on} / t_{off}$ (ms)</th>
<th>Isolation Voltage $(V_{iso})$ (V)</th>
<th>Off-State Leakage $(I_{off})$ (μA)</th>
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<th>Features and Comments</th>
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<tr>
<td>LCA210</td>
<td>BI</td>
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<td>85</td>
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<td>LCA210L</td>
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<td>100</td>
<td>35</td>
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<tr>
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<tr>
<td>LCA220</td>
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<td>Current Limiting</td>
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### 1-Form-C Relays: Common Input

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<th>Load Current $(I)$ (mA)</th>
<th>On Resistance $(R)$ (Ω)</th>
<th>Input Control Voltage $(V_i)$ (V)</th>
<th>Switching Speeds $t_{on} / t_{off}$ (ms)</th>
<th>Isolation Voltage $(V_{iso})$ (V)</th>
<th>Off-State Leakage $(I_{off})$ (μA)</th>
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<th>Features and Comments</th>
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<td>LCC120</td>
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<td>20, 22</td>
<td>EN50130-4, Direct drop-in reed relay replacement</td>
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For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)
Multifunction Products

The OptoMOS line of Multifunction products combines optically isolated discrete component functions into a single package. These products mix and match solid state relays, optocouplers, and Darlington transistors to create highly functional circuits in a single, small package. Multifunction devices allow designers to consolidate circuit functions into a single device, freeing up valuable board space and reducing component count.

Features:
- 3750Vrms Input to Output Isolation
- Multiple Functionality in a Single Package
- Current Limiting (Part Numbers with “L” Suffix)
- Machine Insertable, Wave Solderable
- TTL and CMOS Compatible

Applications:
- Telecommunication / Datacommunication
- Instrumentation
- I/O Subsystems / Electronic Switching
- Medical Equipment (Patient / Equipment Isolation)
- Security
- Aerospace
- Industrial Controls

<table>
<thead>
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<th>Part Number</th>
<th>Style</th>
<th>Relay Characteristics</th>
<th>Optocoupler Characteristics</th>
<th>Features and Comments</th>
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<td></td>
<td></td>
<td>Blocking Voltage (Vp)</td>
<td>Input Control Current (mA)</td>
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<td></td>
<td></td>
<td>Current Handling (mA)</td>
<td>On Resistance (Ω)</td>
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<td>Isolation Voltage (Vrms)</td>
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<td></td>
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<td>Breakdown Voltage (V)</td>
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<td>TTL and CMOS Compatible</td>
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<td></td>
<td>Machine Insertable, Wave Solderable</td>
<td>Current-Limiting (Part Numbers with “L” Suffix)</td>
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<td>One 1-Form-A Relay, One 1-Form-B Relay, One Optocoupler</td>
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<td></td>
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<td>One 1-Form-A Relay, Two Optocouplers</td>
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<tr>
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<td></td>
<td>One 1-Form-A Relay, One Optocoupler</td>
<td>One 1-Form-A Relay, One Darlington Optocoupler</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>One Current-Limiting 1-Form-A Relay, One Optocoupler</td>
<td>One Current-Limiting 1-Form-A Relay, One Darlington Optocoupler</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>One 1-Form-A Relay, One Optocoupler</td>
<td>One 1-Form-A Relay, One Optocoupler</td>
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</tr>
<tr>
<td></td>
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<td>One 1-Form-A Relay, One Darlington Optocoupler</td>
<td>One 1-Form-A Relay, One Optocoupler</td>
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<tr>
<td></td>
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<td>One Current-Limiting 1-Form-A Relay, One Optocoupler</td>
<td>One Current-Limiting 1-Form-A Relay, One Optocoupler</td>
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<td>One 1-Form-A Relay, One Optocoupler</td>
<td>One 1-Form-A Relay, One Optocoupler</td>
<td></td>
</tr>
</tbody>
</table>

For ordering information, go to www.clare.com/Products/ProdList.htm

+1 978 524 6700, +1 978 524 4700 – Customer Service +1 978 524 6768, +1 978 524 4900
Telecom Multifunction Products

The OptoMOS line of Multifunction Products combines optically isolated discrete component functions into a single package. These products mix and match solid state relays, optocouplers, bridge rectifiers, Darlington transistors, and Zener diodes to create highly functional circuits in a single, small package. Multifunction devices allow designers to consolidate circuit functions into a single device, freeing up valuable board space and reducing component count. Designed specifically for the telecommunications industry, the Integrated Telecom Circuit (ITC) series is well suited for voice telephony and modem applications, providing most of the major functions required when designing DAA (Data Access Arrangement) or voice (FXO) line interface circuits. Available in a 16-pin SOIC package.

Features:
- 3750\(V_{rms}\) Input to Output Isolation
- Multiple Functionality in a Single Package
- Current Limiting (Part Numbers with “L” Suffix)
- Machine Insertable, Wave Solderable
- TTL and CMOS Compatible
- Security
- Aerospace
- Industrial Controls

Applications:
- Telecommunication / Datacommunication
- Instrumentation
- I/O Subsystems
- Electronic Switching
- Medical Equipment (Patient / Equipment Isolation)
- Telecommunication / Datacommunication
- Instrumentation
- I/O Subsystems
- Electronic Switching
- Medical Equipment (Patient / Equipment Isolation)
- Security
- Aerospace
- Industrial Controls

For ordering information, go to www.clare.com/Products/ProdList.htm
Discrete Components

N-Channel Depletion Mode FETs

Clare's N-channel depletion mode Field Effect Transistors (FETs) utilize a proprietary third generation vertical DMOS process. The third generation process realizes world class, high-voltage MOSFET performance in an economical silicon gate process. The vertical DMOS process yields a robust device for low-power applications with high input impedance. These highly reliable FET devices have been used extensively in Clare’s solid state relays for industrial and telecommunications applications.

The normally-on MOSFETs are well suited for low cost, pre-regulator applications that are tolerant of high voltage drop and power dissipation between the power source and the output regulator stage. The pre-regulator is particularly effective as an inexpensive solution for filtering AC line voltage variations in non-isolated DC power supplies as compared to switch-mode power supplies or step-down transformers.

### NEW!

**Diode Bridges**

The CPC7556N integrated diode bridge offers protection from high voltage transients by means of an adjustable voltage clamp. The clamp performs two actions, first to limit the voltage across the diode bridge rectified outputs to a value determined by external resistors and the gate voltage, and second to fully discharge the V+ to V− outputs when the gate’s trigger threshold is exceeded during the voltage limiting function. The rectified outputs are discharged as a result of the voltage fold-back function of the OVP device. Voltage fold-back of the OVP circuit will continue until the current through the protector falls below the hold current threshold.

The CPC7557N is an integrated diode bridge built on Clare’s High Voltage SOI technology. Very small in size, this integrated diode bridge device offers a space saving method for inclusion of a highly reliable, monolithic, full-wave bridge rectifier into today’s miniature circuit designs.

#### Features:
- Monolithic Construction
- Surface Mount Package

#### Applications:
- Telecommunications Protection Clamp
- High Voltage Multiplexer / Switch
- High Voltage ESD Clamp

### Diode Bridge Specifications

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Reverse Voltage (V)</th>
<th>Forward Current (mA_rms)</th>
<th>Diode V_F Drop (V)</th>
<th>Thyristor Current (mA)</th>
<th>Reverse Leakage I_LEAK (mA)</th>
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<tbody>
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<td>CPC7556</td>
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<td>0.95</td>
<td>120</td>
<td>1</td>
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<tr>
<td>CPC7557</td>
<td>100</td>
<td>240</td>
<td>0.95</td>
<td>120</td>
<td>1</td>
</tr>
</tbody>
</table>

For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)
Power Relays

Clare and IXYS have joined forces to bring OptoMOS technology, reliability, and compact size to the Power SIP, i4-PAC™ and ISOPLUS™-264 series of power solid state relays. Development of these products was founded on the blending of Clare’s traditional strengths in the design and manufacture of photovoltaic integrated circuits (ICs), leadframe design, and multi-chip packaging with IXYS’ expertise in power MOSFETs, power packages, and substrate technology.

Clare Power Relays are now offered in three package types, all of which offer 2500V\textsubscript{rms} of input to output isolation: the Power SIP, the i4-PAC, and the ISOPLUS-264. The Power SIP package offers pin-to-pin compatibility with other solid state relays providing an easy upgrade path for existing designs, and compatibility for new designs. The i4-PAC and the ISOPLUS-264 packages feature a unique assembly process whereby the silicon is soft soldered onto a Direct Copper Bond (DCB) substrate rather than traditional bonding onto an epoxy encapsulated copper frame. This structure allows for a substantially lower junction-to-case thermal impedance when compared to conventionally assembled power relays. The i4-PAC thermal resistance is 0.35°C/W while the ISOPLUS-264 has an even lower thermal impedance of 0.30°C/W.

Clare Power SSRs are provided in two types: Unidirectional (UNI) and Bidirectional (BI). The polarity independent BI relay conducts load current in both directions, while the polarity dependent UNI relay conducts load current in only one direction. The accompanying tables reference these two types for all devices listed.

On the back of these packages, the electrically non-conductive surface of the DCB ceramic substrate provides 2500V\textsubscript{rms} of isolation to the package’s electrically conductive power switching and control leads. The combination of an electrically isolated, non-conductive exterior and low thermal impedance makes the new i4-PAC and ISOPLUS-264 power relays an ideal solution for power applications preferring a non-biased heat sink with superior thermal management properties.

**Features:**
- Handles Loads up to 32A
- Voltage Ratings up to 1000V\textsubscript{p}
- Low On-Resistance
- Electrically Non-Conductive Thermal Pad for Heat Sink Applications
- Industry Standard 4-Pin SIP Package
- Low Input Control Current
- Low Thermal Impedances:
  - 0.30°C/W - ISOPLUS-264
  - 0.35°C/W - i4-PAC
  - 1.50°C/W - Power SIP

**Applications:**
- Robotics
- Medical Equipment
- Railroad / Traffic Controls
- Consumer Appliances
- Industrial Control
- Test and Measurement Equipment

For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)
### 1-Form-A Power Relays: Single-Pole, Bidirectional

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Relay Type</th>
<th>Blocking Voltage</th>
<th>Load Current</th>
<th>On Resistance</th>
<th>Input Control Current</th>
<th>Switching Speeds</th>
<th>Isolation Voltage</th>
<th>Off-State Leakage</th>
<th>Package Type</th>
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<td>10 / 5</td>
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<td>15</td>
<td>0.3</td>
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<td>20 / 5</td>
<td>2500</td>
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<td>0.1</td>
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### 1-Form-A Power Relays: Single-Pole, Unidirectional

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<th>Relay Type</th>
<th>Blocking Voltage</th>
<th>Load Current</th>
<th>On Resistance</th>
<th>Input Control Current</th>
<th>Switching Speeds</th>
<th>Isolation Voltage</th>
<th>Off-State Leakage</th>
<th>Package Type</th>
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<td>9</td>
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<td>2500</td>
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For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)
Optically Isolated AC Power Switches

Optically Isolated AC Power Switches: $I_{\text{LOAD}} \leq 1\text{A}$

The OptoMOS line of power products uses dual power-SCR outputs to produce an alternative to optocoupler and Triac circuits. These AC Power Switches provide a blocking voltage of up to $800\text{V}_p$. In addition, tightly controlled zero-cross circuitry ensures switching of AC loads while minimizing the generation of transients. The input and output circuits are optically coupled to provide $3750\text{V}_{\text{rms}}$ of isolation and noise immunity between control and load circuits. Long life and environmental integrity make these power switches ideal for controlling a variety of AC circuits in industrial environments where electromagnetic interference would disrupt the operation of electromechanical relays.

Features:
- Load Current up to $1A_{\text{rms}}$
- Blocking Voltage up to $800\text{V}_p$
- 5mA Sensitivity
- Zero-Crossing Turn-On
- DC Control, AC Switching
- Optically Isolated
- TTL and CMOS Compatible
- Low EMI and RFI Generation
- High Noise Immunity
- VDE Compatible
- Machine Insertable, Wave Solderable
- Switching Speed < 0.5 Cycle

Applications:
- Programmable Controls
- Process Control
- Power Control Panels
- Remote Switching
- Gas Pump Electronics
- Contactors
- Large Relay Control Circuits
- Solenoids
- Motor Controls
- Heater Controls

<table>
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<th>Blocking Voltage ($V_p$)</th>
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<th>Input Control Current (mA)</th>
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For ordering information, go to www.clare.com/Products/ProdList.htm
Optically Isolated AC Power Switches: \( I_{\text{LOAD}} > 1 \text{A} \)

Clare introduces new solid-state AC Power Switches that are capable of handling very high load currents. With blocking voltages up to 800V\(_p\) and tightly controlled zero-cross circuitry (ensuring switching of AC loads while minimizing the generation of transients), these robust AC Power Switches enable simpler power switching designs.

Optically coupled input and output circuits provide up to 3750V\(_{\text{rms}}\) of isolation and noise immunity between control and load circuits. These arc-free, heavy-duty AC power switches are ideal for controlling a variety of AC circuits in industrial environments where electromagnetic interference would disrupt the operation of electromechanical relays or where explosive atmospheres exist.

Features:
- Load Current up to 50A\(_{\text{rms}}\)
- Blocking Voltage up to 800V\(_p\)
- 5mA Sensitivity
- Zero-Crossing Turn-On
- DC Control, AC Switching
- Optically Isolated I/O
- TTL and CMOS Compatible
- Low EMI and RFI Generation
- High Noise Immunity
- VDE Compatible
- Machine Insertable, Wave Solderable
- Switching Speed < 0.5 Cycle

Applications:
- Programmable Controls
- Process Control
- Power Control Panels
- Remote Switching
- Gas Pump Electronics
- Contactors
- Large Relay Control Circuits
- Solenoids
- Motor Controls
- Heater Controls

<table>
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<th>Input Control Current (\text{(mA)})</th>
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For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)

☎ +1 978 524 6700, ☎ +1 978 524 4700 – Customer Service ☎ +1 978 524 6768, ☎ +1 978 524 4900
Optocouplers

Single & Dual Optocouplers

Single and dual OptoMOS optocouplers provide an optically isolated means of current detection or control of switching circuits. Devices offer a single or dual anti-parallel LED input stage for unidirectional or bidirectional signal control to the optically coupled output. The output can be either a single transistor or, for greater gain, a Darlington transistor. These optocouplers are ideal for use in circuits where electrical isolation of control circuitry or voltage detection is crucial.

### Features:
- AC and DC Compatible Inputs
- 1500V\(_{\text{rms}}\), 3750V\(_{\text{rms}}\), 5000V\(_{\text{rms}}\) I/O Isolation
- Machine Insertable, Wave Solderable

### Applications:
- Voltage Detection
- Tip/Ring Circuits
- Modem Switching (Laptops, Notebooks, PDAs)
- Loop Detection
- Ringing Detection
- Current Sensing
- Telecom Switching

### Part Number Specifications

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<th>Nominal Current Transfer Ratio (%)</th>
<th>Maximum Saturation Voltage (V)</th>
<th>Maximum Input Control Current (mA)</th>
<th>Minimum Isolation Voltage (V(_{\text{rms}}))</th>
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### Configurations

- A
- B
- C
- D
- E
- F
- G
- H
- I
- J
- K
- L
- M
- N

For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)
Linear Optocouplers

OptoMOS Linear Optocouplers feature an infrared LED optically coupled to a pair of photodiodes. One feedback (input) photodiode is used to generate a feedback signal that provides a servomechanism to the LED drive current thus compensating for the LED’s nonlinear time and temperature characteristics. The output photodiode provides an isolated output signal that is linear with respect to the servo LED current.

Features:
- Couples Analog & Digital Signals
- 3750\(V_{rms}\) Input / Output Isolation
- Wide Bandwidth (>200kHz)
- High Gain Stability
- Low Input / Output Capacitance
- Low Power Consumption
- 0.01% Servo Linearity
- THD 87dB Typical
- VDE Compatible
- Machine Insertable, Wave Solderable

Applications:
- Modern Transformer Replacement with No Insertion Loss
- Digital Telephone Isolation
- Power Supply Feedback Voltage / Current
- Medical Sensor Interfacing
- Isolation of Process Control Transducers

Optically Isolated Error Amplifiers

Optically Isolated Linear Error Amplifiers combine Clare’s optical technology with an industry standard 431-type precision programmable shunt regulator to provide linear isolated feedback for power supply designs. The LIA120 features matched photodiodes for linear high-gain response with excellent temperature stability for a total gain error of less than 2dB. These devices are well suited for isolated high-gain feedback amplifiers that require excellent linearity and low temperature variation such as power supply feedback stages, modem and audio transformer replacements, industrial control signals, and sensor feedback. Available in 8-pin DIP or 8-pin surface mount packages.

Features:
- 70dB Linearity Typical
- Optocoupler, Precision Reference, and Error Amplifier in a Single Package
- Low Voltage Operation: 2.7V

Applications:
- Power Supply Feedback
- Telecom Central Office Supply
- Telecom Bricks
- Modern Transformer Replacement

For ordering information, go to www.clare.com/Products/ProdList.htm
Gate Drivers

Clare’s line of ultra-fast, high current MOSFET and IGBT gate drivers are optimized for high efficiency performance in motor drive and power conversion applications. With output current ratings of 2A to 30A, they are designed to switch the largest MOSFETs and IGBTs with minimum switching times and at frequencies up to 10MHz. Depending on the output current rating, these gate drivers are offered in DFN, SOIC, Power SOIC, DIP, TO-220, and TO-263 packages.

The 30A IXD_630 features an undervoltage lockout (UVLO) that keeps the output LOW until a sufficient level of $V_{cc}$ is present.

**IXD_600 Series Low-Side Gate Drivers - NEW!**

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<th>Undervoltage Lockout (V)</th>
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<td>C</td>
<td>$V_{cc} \leq 9V$</td>
<td>57, 58</td>
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**Features:**
- 2A to 30A Peak Source/Sink Drive Current
- Wide Operating Voltage Range: 4.5V to 35V
- -40°C to +125°C Extended Operating Temperature Range
- Logic Input Withstands Negative Swing of up to 5V
- Matched Rise and Fall Times
- Low Propagation Delay Time
- Low 10μA Supply Current
- Low Output Impedance

**Applications:**
- Efficient Power MOSFET and IGBT Switching
- Switch Mode Power Supplies
- Motor Controls
- DC to DC Converters
- Class-D Switching Amplifiers
- Pulse Transformer Driver

For ordering information, go to www.clare.com/Products/ProdList.htm
IX2127 600V High-Side MOSFET and IGBT Driver

The IX2127 is a high-voltage, high-speed power MOSFET and IGBT driver. The device’s high-voltage level-shift technique enables it to operate at up to 600V. Clare’s proprietary common-mode design techniques provide stable operation in high dV/dt noise environments.

The IX2127 detects an over-current condition in the driven MOSFET or IGBT device, and shuts down drive to that device. An open-drain output, FAULT, indicates that an over-current shutdown has occurred. The gate driver output typically can source 250mA and sink 500mA, which is suitable for fluorescent lamp ballast, motor control, SMPS, and other converter drive topologies. Available in 8-pin DIP and 8-pin SOIC packages.

Features:
- Internal High Voltage Level Shift Function
- Tolerant to Negative Transient Voltages; dV/dt Immune
- Undervoltage Lockout
- 3.3V, 5V, and 12V Input Logic Compatible
- Open-Drain FAULT Indicator Pin Shows Over-Current Shutdown
- Output in Phase with the Input

Applications:
- High Speed Gate Driver
- Motor Drive Inverter
- Automotive

MX6895 -550V Full Bridge Gate Driver

Built on Clare’s high voltage integrated circuit (HVIC) technology, the MX6895 combines high-side and low-side N-channel power MOSFET drivers in a full bridge configuration. The circuit is optimally configured to be used as a commutator for High Intensity Discharge (HID) lamps. This device is provided in a 16-pin SOIC package.

Features:
- Internal High Voltage Level Shift Function
- Negative 550V Lamp Supply Voltage
- 3V to 12V CMOS Logic Compatible
- 8V to 12V Input Supply Voltage
- No External Bootstrap Capacitors Needed

Applications:
- Commutator for High Intensity Discharge Lamps
- Vehicle Xenon Head Lamps
- Outdoor/Street Lighting
- Multimedia Projectors
- Retail Accent Lighting
- Warehouse Lighting

For ordering information, go to www.clare.com/Products/ProdList.htm
Optically Isolated Gate Drivers

The CPC1580 and CPC1590 are high speed, optically isolated Gate Driver ICs. On-chip circuitry charges an external capacitor from the load voltage which eliminates the need for an external IC power supply. These Gate Drivers are ideal for low duty cycle switching applications. Both devices are provided in Clare’s 8-pin flatpack package.

**Features:**
- No External IC Power Supply
- Low Drive Power Requirements (TTL/CMOS Compatible)
- Load Voltages up to 200V
- Fast Switching Times - On: 20 μsec / Off: 400 μsec

**Applications:**
- Instrumentation
- Multiplexers
- I/O Subsystems
- Meters (Watt-Hour, Water, Gas)
- Medical Equipment (Patient/Equipment Isolation)
- Security
- Aerospace
- Industrial Controls

![CPC1580 and CPC1590 Schematic](image)

**Optically Isolated Dual MOSFET Gate Driver**

The FDA215 is a Dual Optically Isolated Photodiode Array. The light-activated array produces an open-circuit voltage of up to 8V. This device is suited for use in discrete solid state relay designs. The FDA215 is provided in either an 8-pin DIP package or in an 8-pin surface-mount package.

![FDA215 Schematic](image)

**Features:**
- Isolated 5V Photovoltaic Output
- Floating Outputs for Parallel or Series Configuration

**Applications:**
- MOSFET Driver
- Isolated Floating Power Source

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<thead>
<tr>
<th>Part Number</th>
<th>Input Control Current (mA)</th>
<th>Gate Voltage @ I&lt;sub&gt;G&lt;/sub&gt;=5mA (V&lt;sub&gt;G&lt;/sub&gt;)</th>
<th>Blocking Voltage (V&lt;sub&gt;P&lt;/sub&gt;)</th>
<th>Regulated Capacitor Voltage (V&lt;sub&gt;CAP-MAX&lt;/sub&gt;)</th>
<th>Nominal Switching Speeds t&lt;sub&gt;on&lt;/sub&gt; / t&lt;sub&gt;off&lt;/sub&gt; (ms)</th>
<th>Isolation Voltage (V&lt;sub&gt;rms&lt;/sub&gt;)</th>
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<th>Nominal Short-Circuit Current I&lt;sub&gt;SC&lt;/sub&gt; (μA)</th>
<th>Switching Speeds t&lt;sub&gt;on&lt;/sub&gt; / t&lt;sub&gt;off&lt;/sub&gt; (ms)</th>
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<td>8-Pin DIP, 8-Pin Surface Mount</td>
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High Voltage Analog Switches

Clare’s high-voltage analog switches are low charge injection 8 & 16-channel, high-voltage analog switch integrated circuits for use in applications requiring high voltage switching. Control of the high voltage switching is via low voltage, TTL logic level compatible inputs for direct connectivity to the system controller. Switch manipulation is managed by serial to parallel shift registers whose outputs are buffered and stored by a transparent latch. Level shifters buffer the latch outputs, and operate the high voltage switches. Construction of the switches using Clare’s reliable BCDMOS process technology on SOI (Silicon On Insulator) enables the switches to be organized as solid state switches with direct gate drive.

Features:
• Flexible High Voltage Supplies up to $V_{PP} - V_{NN} = 200V$
• Output Switch On-Resistance Typically 20Ω
• Low Charge Injection, Low Capacitance Analog Switches

Applications:
• Piezoelectric Transducer Drivers
• Ultrasound Imaging
• Printers
• Industrial Controls and Measurement

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<th>Part Number</th>
<th>Number of Channels</th>
<th>Channel On-Resistance (Ω)</th>
<th>Bleed Resistors (kΩ)</th>
<th>Clock Frequency (MHz)</th>
<th>Turn-On Time (μs)</th>
<th>Turn-Off Time (μs)</th>
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</table>

For ordering information, go to www.clare.com/Products/ProdList.htm
Display Products

MXEI2300 300-Output ePaper Gate Driver

MXEI2300 is a 300 bit serial shift register, level translator, and high voltage buffered driver. MXEI2300 is an excellent choice for driving the displays of eBooks and eReaders, mobile phones and other portable hand-held devices, smart cards, and other electronic display devices. MXEI2300 output switching modes are: one pulse, continuous two pulse, jumping two pulse, or no pulse pattern. MXEI2300 can be cascaded up to a maximum of four devices. MXEI2300 is available as gold bumped die in wafer form or waffle pack.

Features:
- CMOS Technology
- Drives Segment or Active Matrix Displays
- 16V to 47V Output Drive ($V_{DD}$ to $V_{EE}$)
- Selectable Output Shift Direction and Polarity

MXEI2240 240-Output ePaper Gate Driver

MXEI2240 is a 240 bit serial shift register, level translator, and high voltage buffered driver. MXEI2240 is an excellent choice for driving the displays of eBooks and eReaders, mobile phones and other portable hand-held devices, smart cards, and other electronic display devices. MXEI2240 output switching modes are: one pulse, continuous two pulse, jumping two pulse, or no pulse pattern. MXEI2240 can be cascaded up to a maximum of four devices. MXEI2240 is available as gold bumped die in wafer form or waffle pack.

Features:
- CMOS Technology
- Drives Segment or Active Matrix Displays
- 16V to 57V Output Drive ($V_{DD}$ to $V_{EE}$)
- Selectable Output Shift Direction and Polarity

MXEI1480 ±15V ePaper Source Driver

Clare’s MXEI1480 is a selectable 400 or 480 bit long, 2-bit wide, serial-input, parallel-output digital shift register with level conversion on each parallel output, which convert the 2 digital bits into $V_{POS}$, $V_{SS}$, or $V_{NEG}$ analog output voltages. An 8-bit input bus simultaneously inputs 4 groups of 2 bits each. MXEI1480 is available as gold-bumped die in waffle pack and gold-bumped die in wafer form.

Features:
- CMOS Technology
- ±15V Output Driver Supply Voltage
- Drives Segment or Active Matrix Displays
- 4-Level Gray Scale
- 25MHz Clock Frequency
- Bidirectional Data Transfer
- Selectable Register Length
- 2.7V to 5.5V Logic Supply Voltage
- Cascadable
**MX860 ±15V ePaper Source Driver**

Clare's MX860 is a selectable 240, 256, or 268 bit long 2-bit wide serial-input, parallel-output digital shift register with level conversion on each parallel output, which convert the 2 digital bits into \( V_{\text{POS}} \), \( V_{\text{SS}} \) or \( V_{\text{NEG}} \) analog output voltages. An 8-bit input bus simultaneously inputs 4 groups of 2 bits each. MX860 is available as gold-bumped die in wafer pack and gold-bumped die in wafer form.

**Features:**
- CMOS Technology
- ±15V Output Driver Supply Voltage
- Drives Segment or Active Matrix Displays
- 4-Level Gray Scale
- 25MHz Clock Frequency
- Bidirectional Data Transfer
- Selectable Register Length
- 2.7V to 5.5V Logic Supply Voltage
- Cascadable

**CPC9909 High Efficiency, High Brightness Off-Line LED Driver**

The CPC9909 is a low-cost, high-efficiency, off-line, high-brightness (HB) LED driver manufactured using Clare’s high voltage BCDMOS on SOI process. It has an internal regulator that allows it to operate from \( 8V_{\text{DC}} \) to \( 550V_{\text{DC}} \). This wide input operating voltage range enables the driver to be used in a broad range of HB LED applications.

**Features:**
- 8V to 550V Input Voltage Range
- >90% Efficiency
- Stable Operation at >50% Duty Cycle
- Drives Multiple LEDs in Series/Parallel
- Regulated LED Current
- Linear or PWM Brightness Control Inputs
- Resistor-Programmable Minimum Off-Time
- Buck or Boost Configuration
- Available in 8-Pin SOIC and Power SOIC Packages

**MXHV9910 High Voltage, Off-Line LED Driver**

The MXHV9910 features a fixed-frequency, peak-current control method, which provides an ideal solution for driving multiple LEDs in series and in parallel. Internal circuitry allows it to operate from a universal AC line, or from \( 8V_{\text{DC}} \) to \( 450V_{\text{DC}} \). This highly versatile input operating voltage enables this IC to be used in a broad range of HB LED applications. In addition, LED dimming can be implemented by applying a small DC voltage to the LD pin, or by applying a low-frequency digital PWM signal to the PWMD pin. Applications include flat-panel display RGB backlighting, signage, decorative LED lighting, and DC & AC/DC LED driver applications.

**Features:**
- 8V to 450V Input Voltage Range
- >90% Efficiency
- Drives Multiple LEDs in Series/Parallel Combinations
- Regulated LED Drive Current
- Linear or PWM Brightness Control Inputs
- Resistor-Programmable Oscillator Frequency
- Available in 8-Pin SOIC and Power SOIC Packages

For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)
Telecommunications Products

Line Card Access Switches - LCAS

The LCAS product family consists of monolithic ICs that contain high-voltage switches for tip and ring line break, power ringing, line test access, test in access, and ringing generator testing. They provide the necessary functions to replace all 2-Form-C electromechanical relays found on both traditional voice and integrated voice and data (IVD) line cards found in Central Office, Digital Loop Carriers, and Channel Banks. LCAS ICs enable low-power, high-density line cards.

New features include: (1) TTL compatible inputs, (2) Smart logic for safe power up and hot plug state control, and (3) Increased dV/dt immunity.

Features:
• Small Surface Mount SOIC or DFN Packages
• Monolithic IC Reliability
• Low, Matched On-Resistance
• Built-in Zero-Cross Switching
• Impulse Noise Reduction
• Current Limiting, Thermal Shutdown, and SLIC Protection
• Robust Power Cross and Lightning Surge Performance
• Ultra-Low Power Consumption of <10.5mW

Applications:
• VOIP Gateways
• Central Offices (CO)
• Digital Loop Carriers (DLC)
• Digitally Added Main Line (DAML)
• Hybrid Fiber Coax (HFC)
• Fiber in the Loop (FITL)
• Pair Gain Systems
• Channel Banks
• PBX Systems

Note: Packages refer to devices in the table on the next page.

For ordering information, go to www.clare.com/Products/ProdList.htm
**LCAS Devices**

<table>
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<tr>
<th>Part Number</th>
<th>Minimum 1500V/μs dV/dt</th>
<th># Switches</th>
<th>Switch Pairs</th>
<th>Test Out</th>
<th>Test In</th>
<th>Ringing Test</th>
<th>Zero-Cross Switching</th>
<th>Current Limit</th>
<th>Diode Bridge</th>
<th>Protection SCR</th>
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**Dual LCAS: 6-Pole CPC75282**

The CPC75282 Dual Line Card Access Switch (LCAS), a member of Clare’s next generation Line Card Access Switch family, is a monolithic solid state device that provides the switching functionality of four 2-Form-C relays in a single, small, economical package.

The CPC75282 Dual LCAS device is designed to provide ringing and test access to the telephone loop in Central Office, Digitally Added Main Line, Private Branch Exchange, Digital Loop Carrier, and Hybrid Fiber Coax/Fiber-In-The-Loop analog line card applications. Test access switches provide access to the telephone loop for line (drop) test or message waiting in the PBX application. Available in a 44-pin TQFP package.

**Features:**
- Improved Switch dV/dt Immunity of 1500V/μs
- Smart Logic for Power-Up/Hot-Plug State Control
- Low, Matched $R_{ON}$
- Eliminates the Need for Zero-Cross Switching
- Flexible Switch Timing to Transition from Ringing Mode to Talk Mode
- Tertiary Protection Consisting of Integrated Current Limiting, Voltage Clamping, and Thermal Shutdown for SLIC Protection
- 5V Operation with Very Low Power Consumption
- Intelligent Battery Monitor
- Latched Logic-Level Inputs, No External Drive Circuitry Required

**Applications:**
- VoIP Gateways
- Central Office (CO)
- Digital Loop Carrier (DLC)
- PBX Systems
- Digitally Added Main Line (DAML)
- Hybrid Fiber Coax (HFC)
- Fiber In The Loop (FITL)
- Pair Gain System
- Channel Banks

For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)

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LCAS for Ringing SLIC: CPC7508

The CPC7508 is a member of Clare’s next generation Line Card Access Switch family. Used with ringing SLICs, it provides the necessary functions to replace the two 2-Form-C electromechanical test relays used in contemporary Fiber To The Home (FTTH) and Optical Network Unit (ONU) deployments as well as Voice over IP (VoIP) telephony terminals. Solid state switches provide the mechanism for tip and ring line break, drop test, and channel test while requiring only a single +12V supply for operation. Interface compatibility with 3.3V or 5V logic for switch state control is provided by the TTL logic-level inputs. The CPC7508 is designed for fiber access units where EMR’s are used for test access and line monitoring functions but solid-state switches are desired due to reduced operating noise, lower power consumption and longer lifetimes. Available in a 16-pin SOIC package.

Features:
- TTL Logic-Level Inputs for 3.3V Logic Interfaces
- Smart Logic for Power-Up / Hot Plug State Control
- Monolithic IC Reliability
- Low, Matched $R_{ON}$
- Clean, Bounce-Free Switching
- Tertiary Protection Consisting of Integrated Current Limiting and Thermal Shutdown for SLIC Protection

Applications:
- Fiber to the Home (FTTH)
- Fiber in the Loop (FITL)
- VoIP Gateways
- PBX Systems
- Digitally Added Main Line (DAML)
- Hybrid Fiber Coax (HFC)

Quad High Voltage Isolated Analog Switch Array: CPC7514 (NEW!)

The CPC7514 Quad High Voltage (HV) isolated Analog Switch Array builds upon Clare’s Line Card Access Switch (LCAS) design and fabrication expertise for telecom and non-telecom applications. This monolithic solid state device provides the switching functionality of four normally open (1-Form-A) relays in one small economical package. Designed to provide flexible single-ended or differential access to high voltage networks, the CPC7514 High Voltage Array (HVA) is configured as two sets of matched, paired switches for improved differential performance. Additionally, sensitive differential applications will benefit from the matched pairs excellent pair-to-pair isolation. The self-biasing switches do not require external high-voltage supplies for proper operation. Independent switch current limiting and switch-pair thermal shutdown features provide enhanced protection for devices connected to high voltage networks up to +320V.

Features:
- Low, Matched $R_{ON}$
- Switch Voltage up to 320V
- 320V Logic Input to Switch Output Isolation
- 110dB Switch-to-Switch Isolation at 5kHz
- Flexible Switch Configurations
- Smart Logic for Power-Up / Hot-Plug State Control
- 3.3V Operation with Very Low Power Consumption
- Switch Current Limiting Protects Against Fault Conditions
- Thermal Shutdown Protects Against Fault Conditions
- Latched TTL Logic-Level Inputs
- Clean, Bounce-Free Switching
- Monolithic IC Reliability

Applications:
- Instrumentation
- Industrial Controls and Monitoring
- Automatic Test Equipment (ATE)
- Battery Charging Circuits
- Telephony
- VoIP Gateways
- Central Office (CO) and Remote Terminal (RT)
  - Concentrators
  - PBX Systems
- Optical Network Terminals (ONT) and Optical Network Units (ONU)
- Hybrid Fiber Coax (HFC)
LITELINK™ Silicon DAA, Phone Line Interface

The LITELINK phone line interface is the industry’s only single package silicon Data Access Arrangement, featuring a 32-pin, small outline, low profile, surface mount package. It is ideal for both voice and data (V.22bis to V.90/V.92) and applications in particularly dense circuit environments. The internal optical isolation barrier eliminates high-cost transformer or capacitive isolation circuits. This solution saves cost relative to competitive circuits through reduced passive component count and smaller printed circuit board space.

The 3kV rms internal isolation barrier exceeds all worldwide regulatory requirements. The optical isolation barrier yields low distortion performance necessary for high speed communications. In addition, the LITELINK application circuit is capable of surviving 6kV (10μsec x 700μsec) lightning surge waveforms making it the most robust silicon DAA on the market.

LITELINK offers the lowest operational phone line quiescent current. The device easily interfaces to commonly available standard single-ended or differential voice and modem codecs on the market. Contact Clare for information on codec reference designs that offer programmable AC termination impedance for global applications. LITELINK complies with international PSTN agency requirements.

The newest device is the CPC5622, which is part of the LITELINK III product family. It offers continuous Caller-ID (CID) signal buffering which is ideal for telephony applications in countries where CID information is present before the ringing signal. The CPC5622 also offers both full-wave and half-wave ringing signal detection allowing the designer to choose the appropriate interface to the codec/DSP block.

**Features:**
- Voice and Data Applications
- Modem DAA for Speeds up to V.92
- Half-Wave or Full-Wave Ringing Detection
- Worldwide Telephone Network Compatibility
- Caller-ID Reception
- Line Side Powered from Telephone Line
- 3.3V to 5V Power Supply
- Easy Interface with Modem ICs and Voice Codecs
- High Power Transmit Option for Voice Applications (>3dBm)
- Small 32-Pin SOIC Package

**Applications:**
- Computer Telephony
- VoIP Gateways
- PBXs
- Satellite Set-Top Box
- V.92 Modems
- Fax Machines
- Voice Mail Systems
- Embedded Modems
- Vending Machines
- Automated Banking
- Remote Metering
- Surveillance
- Security Systems

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<td>CPC5608</td>
<td>Low-Power Transistor Array (see page 38)</td>
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For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)
Phone Line Monitor Devices

Clare's CPC5712 is a special-purpose “Phone Line Monitor with Detectors” integrated circuit that is used in various high-voltage telephony applications such as VoIP gateways and IP-PBXs. The device monitors the TIP/RING potential through a high-impedance divider (resistor isolation) to derive two resistor-programmable signal level detects, polarity information, and a scaled, linear representation of the phone line voltages.

Clare’s CPC5710N is a versatile building block for designing telephone line monitoring circuits. The device has two outputs: a scaled, linear representation of the input TIP/RING voltage, and a switchable, internally set comparator output. The comparator output provides a ringing detect signal, the level of which is set by the resistor values selected for the input network. A formula for selecting these input resistors is given in the CPC5710 Data Sheet that is available at Clare’s web site. The Data Sheet also includes an application circuit that derives Line-in-Use (LIU) and line polarity information from the scaled output signal. This high-impedance, resistive-barrier application circuit is fully compliant to the EN60950 safety standard, and meets the ITU-T K.21 over-voltage and over-current specifications.

In use, the resistor divider and the high input impedance of both the CPC5710 and the CPC5712 make the circuits practically undetectable on the line.

CPC5712 Features:
- Two Independent, Programmable Level Detectors with Programmable Hysteresis
- Fixed-Level Polarity Detector with Hysteresis
- Differential Linear Output
- Excellent Common-Mode Rejection Ratio (CMRR)
- 16-Pin SOP Package
- Worldwide Telephone Network Compatibility
- Minimum External Components
- High Differential Input Impedance, Very Low Common-Mode Input Impedance
- Fixed Gain
- 3V to 5.5V Operation
- Low Power Consumption
- CMOS Logic-Level Output (TTL Compatible)

CPC5712 Applications:
- VoIP Gateways, IP-PBX, xDSL
- TIP/RING Monitoring: Polarity Detection for Caller ID, Enhanced 911, Line-in-Use, Battery Detection, PSTN Check
- Non-Telephony Voltage Level Detection Applications: Instrumentation and Industrial Control

CPC5710 Features:
- Differential or Single-Ended Linear Output
- Full-Wave Ringing Level Detector Comparator with Internal Threshold, Large Hysteresis, and TTL Logic-Level Output
- High Common-Mode Rejection Ratio (CMRR)
- 8-Pin SOIC Package
- Worldwide Telephone Network Compatibility
- High Differential Input Impedance, Very Low Common-Mode Input Impedance
- Fixed Gain
- 3V to 5.5V Operation
- CMOS Logic-Level Output (TTL Compatible)

CPC5710 Applications:
- Display Feature (Caller ID) Signal Buffering
- Line-in-Use Detection (Another Phone-Off-Hook)
- Ringing Signal Detection
- Battery Presence Monitoring
- TIP/RING Voltage Monitoring
- Line Polarity
**DC Termination IC: CPC1465 SHDSL/ISDN**

The CPC1465 provides a polarity-insensitive DC termination for wetting (sealing) current on the CPE side conforming to ITU-T G.991.2 to eliminate corrosion on G.SHDSL/ISDN lines. The CPC1465 has excellent linearity (70dB typ.) to minimize harmonic distortion, and well-controlled turn-on and turn-off characteristics to minimize injecting impulse noise with in-band signal energy into the G.SHDSL channel. This DC termination IC, which interfaces with the tip/ring pair, is rated at 300V, and is able to handle power cross and lightning transients with appropriate protection. Manufactured in Clare’s proven 320V Silicon-On-Insulator (SOI) process, the CPC1465 is packaged as a 16-pin SOIC or as a 16-pin DFN.

**Features:**
- Meets Wetting (Sealing) Current Requirements Per ITU-T G.991.2
- Integrated Bridge Rectifier for Polarity Correction
- Uses Inexpensive Optocoupler for DC Signaling
- Electronic Inductor, Breakover, and Latch Circuits
- Current Limiting and Excess Power Protection Circuits
- ANSI SHDSL and ISDN Compatible
- MLT and SARTS Compatible
- Excellent Linearity (70dB typ.)

**Applications:**
- G.SHDSL
- ISDN
- Router and Bridge Customer Premises Equipment
- Leased Line Equipment
- T1/E1 Network Line Cards and Repeaters
- Network Termination 1 (NT1) Equipment
- Mechanized Loop Test (MLT) Networks
- Switched Access Remote Test System (SARTS) Networks

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**DC Termination IC: CPC1466 Broadband ADSL/VDSL**

The CPC1466 is a DC Termination IC for broadband ADSL/VDSL applications. The high-voltage, monolithic device provides a path for DC wetting (sealing) current in customer premises equipment (CPE) to eliminate phone line corrosion on DSL twisted-pair copper lines without telephone voice services (i.e. broadband-only services).

**Features:**
- Meets Wetting (Sealing) Current Requirements Per ITU-T G.992.3
- Integrated Bridge Rectifier for Polarity Correction
- Uses Inexpensive Optocoupler for DC Sealing Current Monitoring
- Electronic Inductor, Breakover, and Latch Circuits
- Current Limiting and Excess Power Protection Circuits
- ADSL/VDSL Compatible with Low-Pass Filter Network
- MLT and SARTS Compatible
- Compatible with Portable Test Sets
- Small 16-Pin SOIC and 16-Pin DFN Packages

**Applications:**
- ADSL/VDSL Broadband Modems
- Router and Bridge Customer Premises Equipment
- Leased Line Equipment
- Mechanized Loop Test (MLT) Networks
- Switched Access Remote Test Systems (SARTS) Networks

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For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)
Cybergate™ Data Access Arrangement (DAA) Modules

The Cybergate family is Clare’s turnkey modular DAA solution. The V.34 family provides the circuitry required in a single, completely functional DAA circuit in a 1.07” x 1.07” x 0.4” plastic module. This plug-and-play design allows the user to choose the necessary options to minimize costs, and in turn maximize value. Standard features include surge protection, transient protection Zeners, ringing detection, hook switch circuitry, gyrator circuitry (impedance balancing), and a transformer. Caller-ID (CID) and loop current detection are also available as options.

**Features:**
- 28.8kbps (Except for CYG2911 at 9.6kbps)
- Optional Caller ID and Loop Current Sense
- Ringing Detection
- Low Power Hook Switch
- Surge Protection
- Low THD
- Gyrator Circuitry
- Meets Most Regulatory Agency Requirements

**Applications:**
- Modems
- Remote Data Acquisition
- Fax Machines
- Security / Metering
- Computer Telephony
- PBX
- Voice Mail Systems

**Features:**
- 28.8kbps (Except for CYG2911 at 9.6kbps)
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- Surge Protection
- Low THD
- Gyrator Circuitry
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**Applications:**
- Modems
- Remote Data Acquisition
- Fax Machines
- Security / Metering
- Computer Telephony
- PBX
- Voice Mail Systems

### Part Number | Region | Hook Switch Resistance | DC Loop Current | Return Loss (Min) | Insertion Loss (Max) | Ringing Voltage Detection Range | Isolation Voltage (Vrms) | FEATURES
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For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)
Call Progress Tone Detectors & Generators

Clare’s Call Progress Detectors and Generators provide an inexpensive method of detecting and generating common call progress tones including busy tone, dial tone, call waiting tones, and others. The family includes both an inexpensive band detector and precise call tone detectors that detect individual tones. Detectors are available in both DIP and SOIC packages, and operate on a 3V to 5V supply. The call progress generator allows for a simple method of providing dial tone, busy tone, and other call progress tones in applications where a POTS interface is required such as VoIP or other network gateways.

**Features:**
- Receive and Generate Common Call Progress Tones
- Detectors Operate with a Single 3-5 Volt Supply
- Linear Input (Detectors) and Output (Generator)
- Inexpensive Band Detector with Wide Dynamic Range (>38dB)
- Low Power Consumption
- Common Call Progress and SIT Detection
- Available in both DIP and SOIC packages

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Function</th>
<th>Detection Frequencies</th>
<th>Package Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-980-02</td>
<td>Detector</td>
<td>Band (315 - 640Hz), Dial Tone (350 - 440Hz), Audible Ringing (440 - 480Hz), Busy Tone (480 - 620Hz)</td>
<td>102, 103</td>
</tr>
<tr>
<td>M-991</td>
<td>Generator</td>
<td></td>
<td>100, 102</td>
</tr>
</tbody>
</table>

**Applications:**
- PBX Circuits
- Billing Systems
- Test Equipment
- Point-of-Sale Terminals
- Pay Telephones

**M-980-02**
- Bandpass Filter
- Level Sensitive
- Digital Control
- Clock Gen
- Detect

**M-991**
- CO PBX Switching Equipment
- Strobe
- Off-hook

**Line Sense Relay**

**M-949-11 Balanced Dual Coil Telephone Line Current Sensing Relay**
- Senses Telephone Line Current From 15mA to 200mA
- Used by Control Circuitry for
  - On-Hook/Off-Hook Monitoring
  - Switch Hook Flash Detection
  - Rotary Dial Pulse
- Meets High Isolation Voltage Requirement of 4000V
- Meets UL and British Standard Specifications
- Includes 1-Form-A Relay Contact

Note: These relays are not polarity sensitive. The Positive and Negative indicators show the series-aiding coil configuration.

For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)
Embedded Modem Module: CPC2400E

The Embedded Modem Module (EMM) combines a datapump and microcontroller with the Data Access Arrangement (DAA) to deliver an all-in-one solution for V.22bis modem transaction-oriented applications. This plug-and-play module provides a total solution complete with transferable FCC registration. It supports a standard serial V.24 TTL interface to the DTE equipment. The CPC2400E features a quick handshake time of 1.6 seconds. This offers a clear advantage for short connection sessions when compared to V.34 and V.90 modems which have a data handshake period greater than 10 seconds.

Features:
- Easy Integration and Installation
- Small Footprint of 1.00” x 2.50”
- Low Power Consumption
- 5V Power Supply Operation
- Supports V.22bis, V.22, V.23
- FCC Part 15B Compliant
- FCC Part 68 User Transferable Registration
- UL Approved

Applications:
- Point-of-Sale (POS)
- Gaming Equipment
- Utility Metering
- Lock Boxes
- Remote Monitoring
- Embedded Applications
- Medical Appliances
Other Semiconductor Products

Hall Effect Switches

The MX887D and MX887P integrated Hall-Effect switches target the requirements of low-power portable devices with battery operating voltages from 2.5V to 5.5V. On-chip power management circuitry reduces the effective average current to just 5μA at 3V supply voltage.

Both devices turn on when either a north or south magnetic pole is applied, and turn off when the magnetic field is removed. The MX887D switches between GND and high-impedance state, while the output of the MX887P switches between the supply voltage and GND.

MX887D and MX887P are ideal reed relay replacements, especially in low-power portable device applications. Available in a TSOT-23 package.

Solar Cells

Clare’s Solar Cells address the diverse needs of the growing number of micro-solar-power applications. Clare’s SOI process, which also creates isolation trenches on the die, produces multiple solar cells on a single, monolithic piece of monocrystalline silicon. These isolated solar cells can then be interconnected to give a useful level of voltage from a small, SOIC package that can be easily installed in an automated process. Ideal for use in applications where high current is not needed, but voltages higher than those provided by single solar cells is required.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Open-Circuit Voltage (V)</th>
<th>Short-Circuit Current (μA)</th>
<th>Package Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPC1822</td>
<td>4</td>
<td>50</td>
<td>8-Pin SOIC</td>
</tr>
<tr>
<td>CPC1824</td>
<td>4</td>
<td>100</td>
<td>16-Pin SOIC</td>
</tr>
<tr>
<td>CPC1831</td>
<td>8</td>
<td>25</td>
<td>8-Pin SOIC</td>
</tr>
<tr>
<td>CPC1832</td>
<td>8</td>
<td>50</td>
<td>16-Pin SOIC</td>
</tr>
</tbody>
</table>

Features:
- Provides True Wireless Power
- Triggers with Natural Sunlight or Artificial Light
- Semiconductor Miniature Size and Reliability

Applications:
- Solar Tracking
- μ-Power Wireless Sensors
- Portable Electronics
- Solar Battery Chargers
- Battery Operated Equipment
- Consumer Electronics
- Sunlight / Light / Flame Detection

For ordering information, go to www.clare.com/Products/ProdList.htm
Load Drivers: MX877 & MX879 (8-Channel, 60V, with Serial Interface)

These devices are 8-channel, high-voltage switches with 8-bit parallel or serial input control. The 3-wire serial interface connects directly to a microprocessor using an industry standard protocol. These devices are designed to operate over a temperature range of -40°C to +85°C, and are available in a 28-pin QFN package.

MX877, with push-pull output configuration, can drive up to 60 volts at 80mA. Outputs can be paralleled for increased drive current up to a device total of 400mA sink or source.

MX879, with open-drain pullup output configuration, can drive up to 60 volts at 120mA. Outputs can be paralleled for increased drive current up to a device total of 600mA source.

Features:
- 6V to 60V Drive Supply Voltage
- 2.7V to 5.5V Logic Supply Range
- 3-Wire Serial Interface Plus Chip Select
- Captures Serial and Parallel Input Data
- Outputs Can Be Paralleled
- Small 28-Pin QFN Package

Applications:
- White Goods
- Automatic Test Equipment (ATE)
- Industrial Equipment
- Automotive Relay Control

Low Power Transistor Array: CPC5608

Clare’s CPC5608 is a 5-channel, low-power transistor array IC with a simple 2-state logic control input. A logic-low input turns on switches OUT1, OUT2, and OUT3; a logic high turns on switches OUT4 and OUT5. Output transistors are capable of sinking 50mA in low output voltage (<7V) circuits. The IC features a low supply voltage range of 2.5V to 5.5V and no static supply bias current draw making it ideal for portable battery and on-hook telephone applications. In addition, output transistor leakage is a low 1μA maximum current.

The device has a low input threshold. It can also be used with a standard optocoupler interface for isolation applications. The CPC5608 is used with the Clare LITELINK silicon DAA (CPC56xx) family for selecting programmable phone-line AC terminations for worldwide compliance. Please call Clare Customer Service for more information.

Features:
- No Static Current Draw from Power Supply (CMOS Control)
- Two-State Control
- Low-Voltage Operation \((V_{cc} = 2.5V)\)
- Low Output Transistor Leakage
- 8-Pin, 150mil SONB Package

Applications:
- Portable Battery Equipment
- Telephony
- Instrumentation

For ordering information, go to [www.clare.com/Products/ProdList.htm](http://www.clare.com/Products/ProdList.htm)
Application Notes

The following application notes can be downloaded from our web site at www.clare.com

General
• AN-131 Handling MOS Devices

Solid State Relays
• AN-145 Advantages of Solid State Relays Over Electromechanical Relays (English, Espanol, Deutsch, Francais)

High Voltage LED Drivers
• AN-300 MXHV9910 Design Considerations
• AN-301 CPC9909 Design Considerations

Gate Drivers
• AN-201 Using the CPC1580 Isolated Gate Driver IC
• AN-202 CPC1590 Application Technical Information

Optoisolators
• AN-107 LOCxx Series - Isolated Amplifier Design Principals
• AN-109 LOC1110 - Variable Speed Motor Controller Design
• AN-111 Isolated 0-10V to 4-20mA Converter Application
• AN-118 Detecting Line Polarity Reversal

Multifunction Products
• AN-112 Ground-Start Supervision Circuit Using Clare’s IAA110
• AN-114 ITC117P Integrated Telecom Circuit
• AN-151 FXO/DAA Design Using Clare OptoMOS Components

Line Interface Products
Line Card Access Switch
• AN-100 Design Surge and Power Fault Protection for Subscriber Line Interfaces
• AN-144 Impulse Noise Benefits of Line Card Access Switches
• AN-154 LCAS Longitudinal Balance Calculator Excel Spreadsheet for Line Card Applications

LITELINK Silicon DAA
• AN-102 Loop Current Detection for LITELINK
• AN-146 Guidelines for Effective LITELINK Designs
• AN-150 Ground-Start Supervision Circuit Using Clare’s IAA110
• AN-157 Increased LITELINK Transmit Power
• AN-158 LITELINKIII Application Circuit Calculations

Tone Signaling Products
• AN-125 M-986 - Configuring the M-986 MF Trunk Signaling
• AN-128 M-980 - Algorithm for Call Progress Signal Detection
• AN-129 M-991 - Call Progress Tone Generator
• AN-130 Call Progress Tone Standards
• AN-138 M-980 - Call Progress Tone Detector Applications
• AN-142 M-949 - Loop Current Sensing and Ring Chatter
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