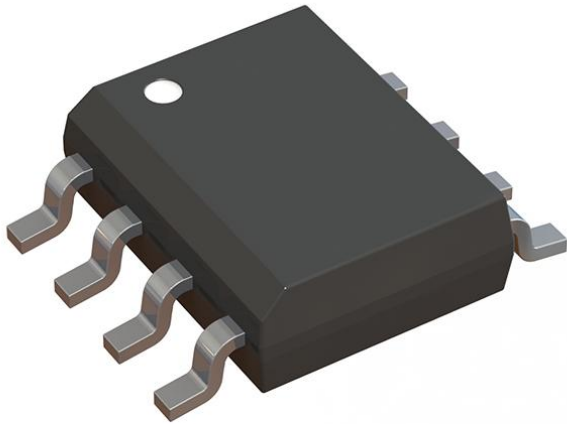


[www.digi-electronics.com](http://www.digi-electronics.com)



# 423N Datasheet

DiGi Electronics Part Number	IX4423N-DG
Manufacturer	<a href="#">IXYS Integrated Circuits Division</a>
Manufacturer Product Number	IX4423N
Description	IC GATE DRVR LOW-SIDE 8SOIC

<https://www.DiGi-Electronics.com>

**Detailed Description**      Low-Side Gate Driver IC Inverting 8-SOIC

This model IX4423N is available at DiGi Electronics.

DiGi Electronics offers a global database of semiconductor and electronic component datasheets. We welcome your inquiries regarding pricing, lead time, or other product-related questions.

 [Request a Quote](#)

 [Datasheet Search](#)

Tel: +00 852-30501935

RFQ Email: [Info@DiGi-Electronics.com](mailto:Info@DiGi-Electronics.com)

DiGi is a global authorized distributor of electronic components.

## Purchase and inquiry

Manufacturer Product Number:

IX4423N

Series:

-

DiGi-Electronics Programmable:

Not Verified

Channel Type:

Independent

Gate Type:

N-Channel, P-Channel MOSFET

Logic Voltage - VIL, VIH:

0.8V, 3V

Input Type:

Inverting

Operating Temperature:

-55°C ~ 150°C (TJ)

Package / Case:

8-SOIC (0.154", 3.90mm Width)

Base Product Number:

IX4423

Manufacturer:

IXYS Integrated Circuits Division

Product Status:

Obsolete

Driven Configuration:

Low-Side

Number of Drivers:

2

Voltage - Supply:

4.5V ~ 30V

Current - Peak Output (Source, Sink):

3A, 3A

Rise / Fall Time (Typ):

18ns, 18ns

Mounting Type:

Surface Mount

Supplier Device Package:

8-SOIC

## Environmental & Export classification

RoHS Status:

DiGi is a global authorized distributor of electronic components.

Moisture Sensitivity Level (MSL):

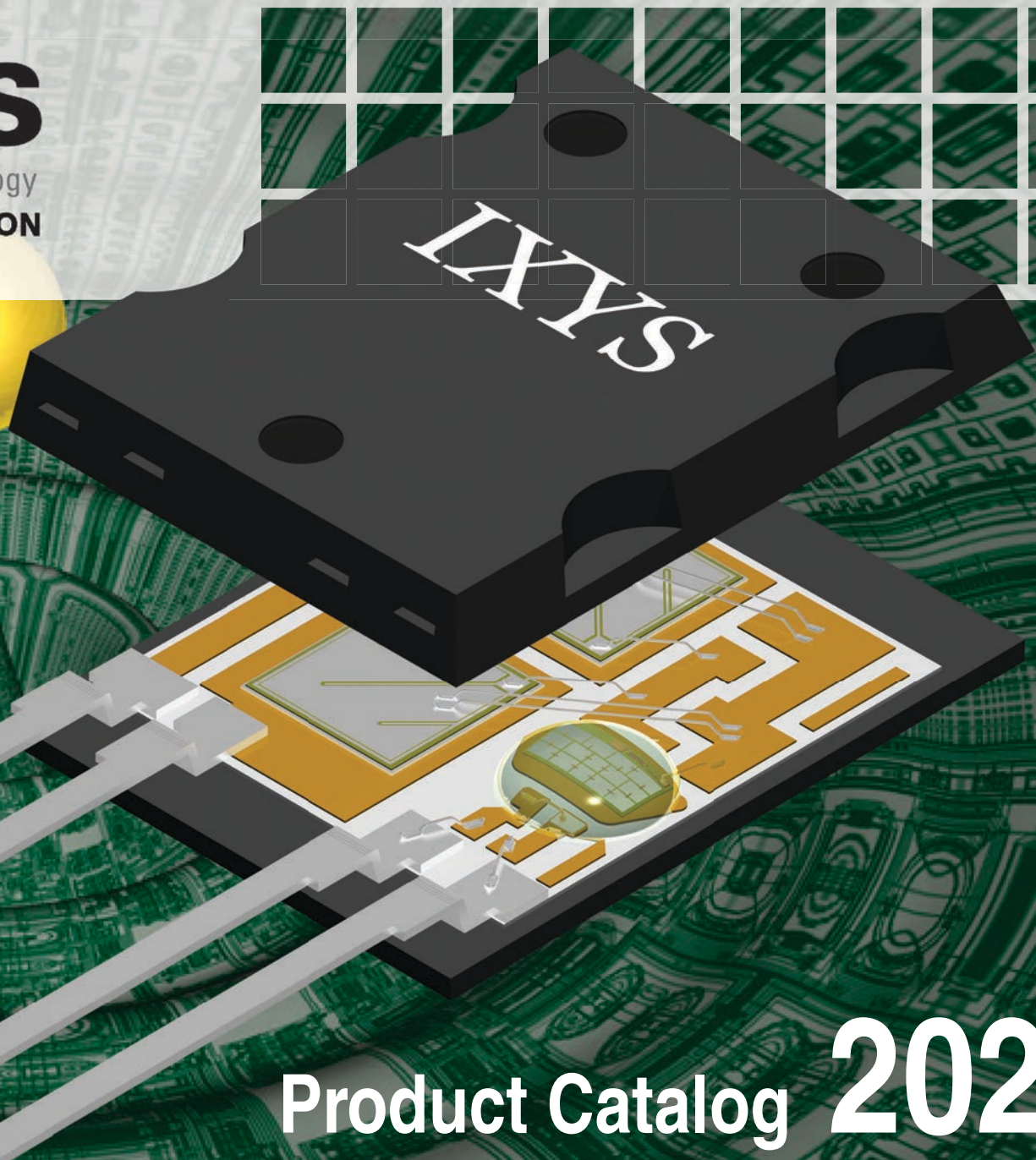
1 (Unlimited)



# IXYS

A Littelfuse Technology

INTEGRATED CIRCUITS DIVISION



# Product Catalog 2021

High Voltage, Analog & Mixed Signal ICs, Optically Isolated Devices



## IXYS Integrated Circuits

IXYS Integrated Circuits, formerly a wholly owned subsidiary of IXYS Corporation, is now part of Littelfuse, Inc. IXYS Integrated Circuits designs, manufactures, and markets a wide variety of semiconductor devices and is a major provider of optically isolated electronic components.

IXYS Integrated Circuits' unique mix of high voltage wafer fabrication, isolation barrier expertise, multi-chip packaging experience, and expertise in analog, mixed signal, and power design, points the way to greater functionality in a smaller footprint at lower cost for your designs.

### Products and Markets

- **IGBT and MOSFET Drivers:** High voltage, low-side, and optically isolated IGBT and MOSFET drivers, many of which are AEC-Q100 qualified.
- **Solid State Relays (SSR):** One of the industry's broadest lines of optically isolated SSRs, available in a wide selection of configurations, blocking voltages, and load currents.
- **Power Market:** Power solid state relays; SCR-based AC power switches (zero-cross & rapid turn-on); and N-channel, depletion-mode, field effect transistors (FET).
- **Lighting Market:** High voltage LED drivers.
- **HV Switch Arrays:** High voltage isolated analog switch arrays
- **High Speed Digital Optical Isolators:** High speed optically coupled isolators that pass DC signals, require no refresh clocking, and provide 3750V<sub>RMS</sub> of galvanic isolation.
- **I<sup>2</sup>C Optically Isolated Bus Repeaters:** New high speed repeaters that buffer both I<sup>2</sup>C signals, require no refresh clocking, and provide 3750V<sub>RMS</sub> of galvanic isolation.
- **Non-volatile Digitally Programmable Capacitors:** Provide capacitive offset trimming for capacitance sensitive circuits.
- **Telecommunications Market:**
  - LITELINK<sup>®</sup>: Galvanically isolated, single IC, analogue phone line interface
  - Phone-line interface and monitoring devices
  - LCAS: Line Card Access Switch products

OptoMOS<sup>®</sup> is a registered trademark of IXYS Integrated Circuits

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**Note:** Drawings and photographs of IXYS Integrated Circuits products shown in this catalog are for illustrative purposes only and do not necessarily portray accurate physical details, marking, or branding. They exist solely to provide additional useful information.

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For data sheets, go to: <https://www.ixysic.com/Products/ProdList.htm>

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# SOLID STATE RELAYS

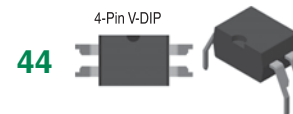
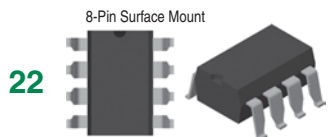
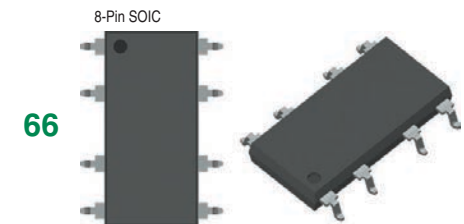
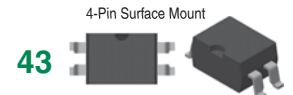
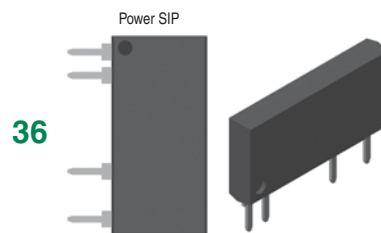
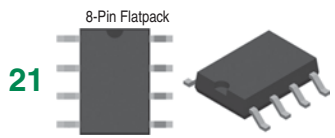
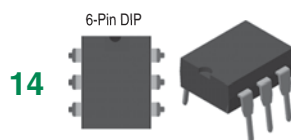
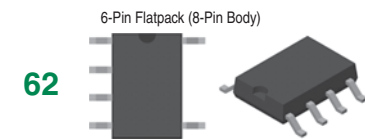
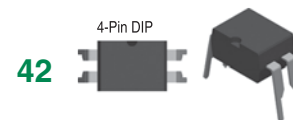
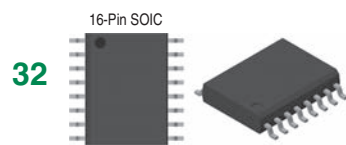
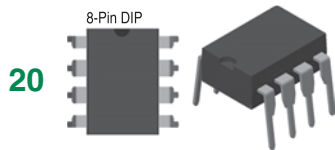
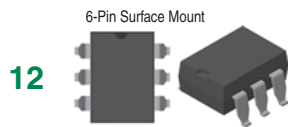
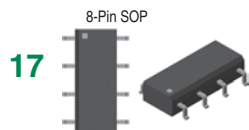
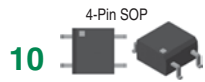
- **Replace electromechanical relays**
- **Replace mechanical switches**
- **Implement computer control of electromechanical circuits**

## Features:

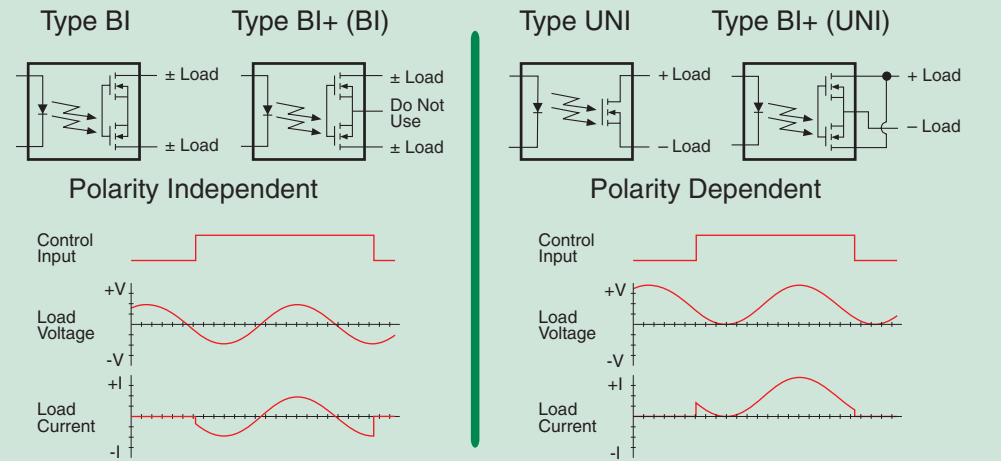
- Low drive current
- High reliability
- No EMI/RFI generation
- Arc-free with no snubbing circuits
- AC or DC switching
- Current limiting devices available
- FCC compatible
- Low off-state leakage

## Applications:

- Instrumentation
- Multiplexers
- Data acquisition/electronic switching
- Meters (Watt-hour, water, gas)
- Medical equipment (patient/equipment isolation)
- Security
- Industrial controls
- Telecomm / datacomm



Packages are referenced by number in the following Solid State Relay selection tables



**Type BI** relays conduct load current in both directions.

**Type BI+** relays, in BI configuration, conduct load current in both directions.

**Type UNI** relays conduct load current from the positive terminal to the negative terminal only.

**Type BI+** relays, in UNI configuration with output MOSFETs wired in parallel, enable higher load current from positive terminal to negative terminal only.

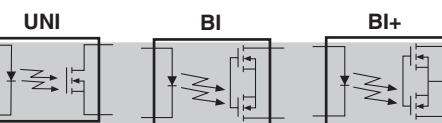
The accompanying SSR tables reference these types (BI, BI+, & UNI) for all devices listed.

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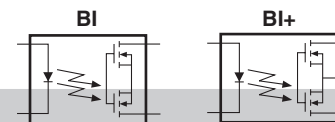
## • 1-FORM-A RELAYS (NORMALLY OPEN)

### 1-Form-A Relays: Single-Pole

Part Number	Relay Type	Blocking Voltage	Load Current	On Resistance	Input Control Current	Switching Speeds	Isolation Voltage	Off-State Leakage	Package Type (Page 6)	Features and Comments
		(V <sub>P</sub> )	(mA)	(Ω)	(mA)	t <sub>on</sub> / t <sub>off</sub> (ms)	(V <sub>RMS</sub> )	(μA)		
CPC1006N	BI	60	75	10	0.5	10 / 10	1500	1	10	Low I <sub>F</sub> , EN 50130-4
CPC1008N	BI	100	150	8	2	2 / 1	1500	1	10	
CPC1009N	BI	100	150	8	2	2 / 0.5	1500	0.02	10	Very low off-state I <sub>LEAK</sub> ≤ 20nA
CPC1010N	BI	250	170	11.5	2	3 / 3	1500	1	10	
CPC1014N	BI	60	400	2	2	2 / 1	1500	1	10	EN 50130-4
CPC1016N	BI	100	100	16	2	2 / 1	1500	1	10	
CPC1017N	BI	60	100	16	1	10 / 10	1500	1	10	Low I <sub>F</sub> , EN 50130-4
CPC1018N	BI	60	600	0.8	1	3 / 2	1500	1	10	Low I <sub>F</sub> , EN 50130-4
CPC1019N	BI	60	750	0.6	2	3 / 3	1500	1	10	
CPC1020N	BI	30	1200	0.25	2	3 / 3	1500	1	10	High load current, very low on-resistance
CPC1025N	BI	400	120	30	2	2 / 1	1500	1	10	
CPC1030N	BI	350	120	30	2	2 / 1	1500	1	10	
CPC1035N	BI	350	100	35	2	2 / 1	1500	1	10	
CPC1225N	BI	400	120	30	2	2 / 1	1500	1	10	IEC/EN/UL 62368-1 Supplementary Insulation (0.4mm distance through insulation)
CPC1230N	BI	350	120	30	2	2 / 1	1500	1	10	IEC/EN/UL 62368-1 Supplementary Insulation (0.4mm distance through insulation)
CPC1330	BI	350	120	30	2	2 / 1	5000	1	42, 43	Enhanced isolation voltage
CPC1335	BI	350	100	35	1	10 / 10	3750	1	21	Low I <sub>F</sub> , EN 50130-4 (installation class 3), transient voltage suppression (TVS)
CPC1390	BI	400	140	22	2	1 / 1	5000	1	42, 43, 44	Enhanced isolation voltage
CPC1393	BI	600	90	50	2	5 / 5	5000	1	42, 43, 44	Enhanced isolation voltage
CPC1394	BI	600	120	35	2	5 / 3	5000	1	42, 43, 44	Enhanced isolation voltage
CPC1510	BI+	250	200	15	2	2 / 2	3750	1	12, 14	Current limiting with thermal management - see page 12
CPC1511	BI	230	450	4	2.5	4 / 2	3750	1	36	Current limiting with thermal management - see page 12
CPC1540	BI+	350	120	25	2	2 / 2	3750	1	12, 14	Current limiting, thermal management, voltage triggered shutdown - see page 12
CPC1560	BI+	60	300	5.6	1.1	0.1 / 0.4	3750	1	20, 22	Current limiting with thermal management - see page 12
CPC1561B	BI	60	1000	0.245	2.5	2.5 / 0.5	3750	1	32	Current limiting with thermal management - see page 12
CPC1563	BI+	600	120	35	2	2 / 2	3750	1	12, 14	Current limiting, thermal management, voltage triggered shutdown - see page 12
CPC1593	BI+	600	120	35	2	2 / 2	3750	1	12, 14	Current limiting, thermal management, voltage triggered shutdown - see page 12
CPC1706Y	UNI	60	4000	0.09	5	5 / 2	2500	1	36	
CPC1726Y	UNI	250	1000	0.75	10	5 / 2	2500	1	36	
CPC1906Y	BI	60	2000	0.3	10	10 / 5	2500	1	36	
CPC1907B	BI	60	6000	0.06	5	5 / 1	5000	1	66	
CPC1916Y	BI	100	2500	0.34	10	5 / 3	2500	1	36	
CPC1926Y	BI	250	700	1.4	10	10 / 10	2500	1	36	
CPC1973Y	BI	400	350	5	10	5 / 3	2500	1	36	
CPC1981Y	BI	1000	180	18	10	10 / 5	2500	1	36	
CPC1983B	BI	600	500	6	5	5 / 2	5000	1	66	
CPC1983Y	BI	600	500	6	5	5 / 2	2500	1	36	

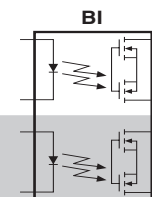


## 1-Form-A Relays: Single-Pole (continued)



Part Number	Relay Type	Blocking Voltage (V <sub>p</sub> )	Load Current (mA)	On Resistance (Ω)	Input Control Current (mA)	Switching Speeds t <sub>on</sub> / t <sub>off</sub> (ms)	Isolation Voltage (V <sub>RMS</sub> )	Off-State Leakage (μA)	Package Type (Page 6)	Features and Comments
CPC1983YE	BI	600	500	6	5	5 / 2	4000	1	36	
CPC1984Y	BI	600	1000	0.66	5	10 / 2	4000	1	36	
LCA100	BI+	350	120	25	5	5 / 5	3750	1	12, 14	
LCA100L	BI+	350	120	25	5	5 / 5	3750	1	12, 14	Current limiting
LCA110	BI+	350	120	35	2	3 / 3	3750	1	12, 14	
LCA110L	BI+	350	120	35	2	3 / 3	3750	1	12, 14	Current limiting
LCA120	BI+	250	170	20	5	3 / 3	3750	1	12, 14	
LCA120L	BI+	250	150	20	5	3 / 3	3750	1	12, 14	Current limiting
LCA125	BI+	300	170	16	5	5 / 5	3750	1	12, 14	
LCA125L	BI+	300	170	20	5	5 / 5	3750	1	12, 14	Current limiting
LCA127	BI+	250	200	10	5	5 / 5	3750	1	12, 14	
LCA127L	BI+	250	170	15	5	5 / 5	3750	1	12, 14	Current limiting
LCA129	BI+	250	170	20	2	8 / 8	3750	1	12, 14	
LCA182	BI+	350	120	35	0.25	3 / 3	3750	1	12, 14	Very low I <sub>F</sub>
LCA701	BI+	100	1500	0.3	2	4 / 1	3750	1	12, 14	High load current
LCA710	BI+	60	1000	0.5	10	2.5 / 0.25	3750	1	12, 14	High load current
LCA712	BI+	60	1000	0.5	10	2.5 / 0.35	3750	0.01	12, 14	High load current, low I <sub>LEAK</sub>
LCA715	BI+	60	2200	0.15	5	2.5 / 0.25	3750	1	12, 14	High load current
LCA717	BI+	30	2000	0.15	2	3 / 3	3750	1	12, 14	High load current
OMA160	BI+	250	50	100	10	0.125 / 0.125	3750	0.025	12, 14	Low I <sub>LEAK</sub> , fast switching speeds
PLA110	BI+	400	150	22	5	1 / 0.5	3750	1	12, 14	
PLA110L	BI+	400	150	25	5	1 / 0.5	3750	1	12, 14	Current limiting
PLA132	BI+	60	600	1	2	5 / 2	3750	1	12, 14	
PLA134	BI+	100	350	3	5	5 / 5	3750	1	12, 14	
PLA140	BI+	400	250	8	5	3 / 1	3750	1	12, 14	
PLA140L	BI+	400	200	13	5	5 / 3	3750	1	12, 14	Current limiting
PLA143	BI+	600	100	50	2	5 / 5	4000	1	12, 14	Enhanced isolation voltage
PLA150	BI+	250	250	7	5	2.5 / 0.5	3750	1	12, 14	
PLA160	BI+	300	50	100	10	0.05 / 0.05	3750	0.025	12, 14	Low I <sub>LEAK</sub> , fast switching speed
PLA170	BI+	800	100	50	5	5 / 5	3750	1	12, 14	
PLA171	BI	800	100	50	2	5 / 5	5000	1	62	Enhanced isolation voltage, high blocking voltage (output pins 7mm separation)
PLA172P	BI	800	100	50	2	5 / 5	5000	1	62	-40°C to +105°C Operational Temperature Range
PLA190	BI+	400	150	22	5	1 / 0.5	5000	1	12, 14	Enhanced isolation voltage
PLA191	BI+	400	250	8	5	3 / 1	5000	1	12, 14	Enhanced isolation voltage
PLA192	BI+	600	150	22	5	5 / 5	5000	1	12, 14	Enhanced isolation voltage
PLA193	BI+	600	100	50	5	5 / 5	5000	1	12, 14	Enhanced isolation voltage
PLA194	BI+	600	130	35	2	3 / 2	5000	1	12, 14	Enhanced isolation voltage
XCA170	BI+	350	100	50	5	5 / 5	3750	1	12, 14	

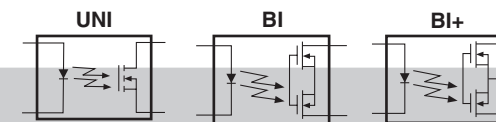
## 1-Form-A Relays: Dual Single-Pole



Part Number	Relay Type	Blocking Voltage (V <sub>P</sub> )	Load Current (mA)	On Resistance (Ω)	Input Control Current (mA)	Switching Speeds t <sub>on</sub> / t <sub>off</sub> (ms)	Isolation Voltage (V <sub>RMS</sub> )	Off-State Leakage (μA)	Package Type (Page 6)	Features and Comments
CPC2014N	BI	60	400	2	2	2 / 1	1500	1	17	EN 50130-4
CPC2017N	BI	60	120	16	1	3 / 3	1500	1	17	Low I <sub>F</sub> , EN 50130-4
CPC2025N	BI	400	120	30	2	2 / 1	1500	1	17	
CPC2030N	BI	350	120	30	2	2 / 1	1500	1	17	
CPC2907B	BI	60	2000	0.15	5	2.5 / 0.25	4000	1	66	DUAL: two independent relays in one package
LAA100	BI	350	120	25	5	5 / 5	3750	1	20, 21, 22	
LAA100L	BI	350	120	25	5	5 / 5	3750	1	20, 21, 22	Current limiting
LAA108	BI	100	300	8	2	3 / 3	3750	1	20, 21, 22	
LAA110	BI	350	120	35	5	3 / 3	3750	1	20, 21, 22	
LAA110L	BI	350	120	35	5	3 / 3	3750	1	20, 21, 22	Current limiting
LAA120	BI	250	170	20	5	5 / 5	3750	1	20, 21, 22	
LAA120L	BI	250	150	25	5	5 / 5	3750	1	20, 21, 22	Current limiting
LAA125	BI	350	170	16	5	5 / 5	3750	1	20, 21, 22	
LAA125L	BI	350	150	18	5	5 / 5	3750	1	20, 21, 22	Current limiting
LAA127	BI	250	200	10	5	5 / 5	3750	1	20, 21, 22	
LAA127L	BI	250	170	10	5	5 / 5	3750	1	20, 21, 22	Current limiting
LAA710	BI	60	1000	0.5	10	2.5 / 0.25	3750	1	20, 22	
OAA160	BI	250	50	100	6	0.125 / 0.125	3750	0.025	20, 21, 22	Very low I <sub>LEAK</sub> , fast switching speeds
PAA110	BI	400	150	22	5	1 / 0.25	3750	1	20, 21, 22	
PAA110L	BI	400	150	25	5	1 / 0.5	3750	1	20, 21, 22	Current limiting
PAA127	BI	280	200	10	3	0.5 / 0.5	3750	0.025	20, 21, 22	Very low I <sub>LEAK</sub> , fast switching speeds
PAA132	BI	60	600	1	2	5 / 2	3750	1	20, 22	
PAA140	BI	400	250	8	5	3 / 1	3750	1	20, 21, 22	
PAA140L	BI	400	200	13	5	5 / 3	3750	1	20, 22	Current limiting
PAA150	BI	250	250	7	5	2.5 / 0.5	3750	1	20, 21, 22	
PAA190	BI	400	150	22	5	1 / 0.5	5000	1	20, 22	Enhanced isolation voltage
PAA191	BI	400	250	8	5	3 / 1	5000	1	20, 22	Enhanced isolation voltage
PAA193	BI	600	100	50	5	5 / 5	5000	10	20, 22	Enhanced isolation voltage
XAA117	BI	60	150	16	1	5 / 5	3750	1	20, 21, 22	Low I <sub>F</sub>
XAA170	BI	350	100	50	5	5 / 5	3750	1	20, 21, 22	

## • 1-FORM-B RELAYS (NORMALLY CLOSED)

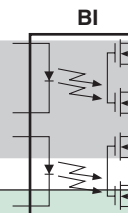
### 1-Form-B Relays: Single-Pole



Part Number	Relay Type	Blocking Voltage (V <sub>p</sub> )	Load Current (mA)	On Resistance (Ω)	Input Control Current (mA)	Switching Speeds t <sub>on</sub> / t <sub>off</sub> (ms)	Isolation Voltage (V <sub>RMS</sub> )	Off-State Leakage (μA)	Package Type (Page 6)	Features and Comments
CPC1106N	BI	60	75	10	0.5	10 / 10	1500	1	10	Low I <sub>E</sub> , EN 50130-4
CPC1114N	BI	60	400	2	2	2 / 5	1500	1	10	
CPC1117N	BI	60	150	16	1	10 / 10	1500	1	10	Low I <sub>E</sub> , EN 50130-4
CPC1125N	BI	400	100	35	2	2 / 2	1500	5	10	
CPC1130N	BI	350	120	30	2	2 / 2	1500	5	10	
CPC1135N	BI	350	120	35	2	2 / 2	1500	5	10	
CPC1150N	BI	350	120	50	2	1 / 2	1500	5	10	
CPC1231N	BI	350	120	30	2	2 / 2	1500	5	10	IEC/EN/UL 62368-1 Supplementary Insulation (0.4mm distance through insulation)
CPC1333	BI	350	130	30	2	2 / 3	5000	1	42, 43	Enhanced isolation voltage
CPC1705Y	UNI	60	3250	0.09	5	2 / 12	2500	1	36	
LCB110	BI+	350	120	35	5	3 / 3	3750	1	12, 14	
LCB111	BI+	350	120	35	2	5 / 5	3750	1	12, 14	
LCB120	BI+	250	170	20	5	5 / 5	3750	1	12, 14	
LCB126	BI+	250	170	15	5	5 / 5	3750	1	12, 14	
LCB127	BI+	250	200	10	5	5 / 5	3750	1	12, 14	
LCB710	BI+	60	1000	0.6	2	3 / 3	3750	1	12, 14	High load current
LCB716	BI+	60	500	2	2	3 / 3	3750	1	12, 14	
LCB717	BI+	30	1500	0.3	2	2 / 5	3750	1	12, 14	High load current
PLB150	BI+	250	250	7	5	1 / 2.5	3750	1	12, 14	
PLB171	BI	800	80	55	2	5 / 5	5000	1	62	Enhanced isolation voltage, high blocking voltage (output pins 7mm separation)
PLB190	BI+	400	130	25	2	1 / 2.5	5000	1	12, 14	Enhanced isolation voltage
XCB170	BI+	350	100	50	5	5 / 5	3750	1	12, 14	

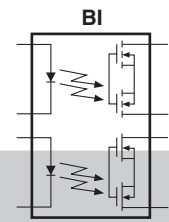
### 1-Form-B Relays: Dual Single-Pole

Part Number	Relay Type	Blocking Voltage (V <sub>p</sub> )	Load Current (mA)	On Resistance (Ω)	Input Control Current (mA)	Switching Speeds t <sub>on</sub> / t <sub>off</sub> (ms)	Isolation Voltage (V <sub>RMS</sub> )	Off-State Leakage (μA)	Package Type (Page 6)	Features and Comments
CPC2125N	BI	400	100	35	2	2 / 2	1500	5	17	
LBB110	BI	350	120	35	5	3 / 3	3750	1	20, 21, 22	
LBB120	BI	250	170	20	5	5 / 5	3750	1	20, 22	
LBB126	BI	250	170	15	5	5 / 5	3750	1	20, 21, 22	
LBB127	BI	250	200	10	5	5 / 5	3750	1	20, 21, 22	
PBB150	BI	250	250	7	5	2.5 / 2.5	3750	1	20, 21, 22	
PBB190	BI	400	130	25	2	1 / 2.5	5000	1	20, 22	
XBB170	BI	350	100	50	5	5 / 5	3750	1	20, 21, 22	



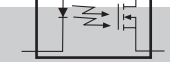
## • MISCELLANEOUS RELAYS

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



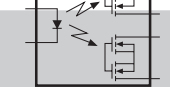
Part Number	Relay Type	Blocking Voltage	Load Current (mA)	On Resistance ( $\Omega$ )	Input Control Current (mA)	Switching Speeds $t_{on} / t_{off}$ (ms)	Isolation Voltage ( $V_{RMS}$ )	Off-State Leakage A/B ( $\mu A$ )	Package Type (Page 6)	Features and Comments
		( $V_p$ )								
CPC2317N	BI	60	120	16	1	3 / 3	1500	1 / 1	17	Low $I_F$
CPC2330N	BI	350	120	30	2	3 / 3	1500	1 / 5	17	
LBA110	BI	350	120	35	2	3 / 3	3750	1 / 1	20, 21, 22	
LBA110L	BI	350	120	35	5	3 / 3	3750	1 / 1	20, 21, 22	Current limiting
LBA120	BI	250	170	20	5	5 / 5	3750	1 / 1	20, 21, 22	
LBA120L	BI	250	150	25	5	5 / 5	3750	1 / 1	20, 22	Current limiting
LBA127	BI	250	200	10	5	5 / 5	3750	1 / 1	20, 21, 22	
LBA127L	BI	250	150	15	5	5 / 5	3750	1 / 1	20, 22	Current limiting
LBA710	BI	60	1000	0.6	2	5 / 5	3750	1 / 1	20, 22	High load current
LBA716	BI	60	1000	0.4	2	5 / 5	3750	1 / 1	20, 22	High load current (Normally closed pole load current = 500mA)
PBA150	BI	250	250	7	5	2.5 / 2.5	3750	1 / 1	20, 22	

### 1-Form-A Relays: Single-Pole, Unidirectional (DC-only)



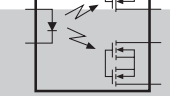
Part Number	Relay Type	Blocking Voltage	Load Current (mA)	On Resistance ( $\Omega$ )	Input Control Current (mA)	Switching Speeds $t_{on} / t_{off}$ (ms)	Isolation Voltage ( $V_{RMS}$ )	Off-State Leakage ( $\mu A$ )	Package Type (Page 6)	Features and Comments
		( $V_p$ )								
CPC1002N	UNI	60	700	0.55	2	5 / 2	1500	1	10	EN 50130-4
CPC1004N	UNI	100	300	4	2	3 / 1	1500	1	10	Extended operating temperature range: $-40^{\circ}C$ to $+110^{\circ}C$

### 2-Form-A Relays: Double-Pole, Single-Throw



Part Number	Relay Type	Blocking Voltage	Load Current (mA)	On Resistance ( $\Omega$ )	Input Control Current (mA)	Switching Speeds $t_{on} / t_{off}$ (ms)	Isolation Voltage ( $V_{RMS}$ )	Off-State Leakage ( $\mu A$ )	Package Type (Page 6)	Features and Comments
		( $V_p$ )								
LCA210	BI	350	85	35	8	3 / 3	3750	1	20, 22	
LCA210L	BI	350	85	35	8	4 / 4	3750	1	20, 22	Current limiting
LCA220	BI	250	120	20	10	5 / 5	3750	1	20, 22	

### 1-Form-C Relays: Common Input, Single-Pole, Double-Throw



Part Number	Relay Type	Blocking Voltage	Load Current (mA)	On Resistance ( $\Omega$ )	Input Control Current (mA)	Switching Speeds $t_{on} / t_{off}$ (ms)	Isolation Voltage ( $V_{RMS}$ )	Off-State Leakage ( $\mu A$ )	Package Type (Page 6)	Features and Comments
		( $V_p$ )								
LCC110	BI	350	120	35	8	4 / 4	3750	1	20, 21, 22	
LCC120	BI	250	170	20	10	5 / 5	3750	1	20, 22	

For data sheets, go to: <https://www.ixysic.com/Products/ProdList.htm>

# FAULT PROTECTED SOLID STATE RELAYS

## • ACTIVE CURRENT LIMITING SSRs WITH VOLTAGE TRIGGERED SHUTDOWN & THERMAL MANAGEMENT

- Provide excellent power-cross immunity
- Resumes normal operation after fault is removed
- Ideal for use in electromagnetically noisy environments

All of the Fault Protected Solid State Relays (SSR) listed below feature Active Current Limiting and Thermal Management while the CPC1540, CPC1563, and CPC1593 additionally feature Voltage Triggered Shutdown, or VTS.

Fault Protected SSRs can directly replace footprint-compatible standard SSRs in existing designs to improve end-product survivability.

These Fault Protected relays resume normal operation upon removal of the fault condition or upon cycling the input control current. Should the fault condition repeat or persist, the fault protection will immediately resume.

**Active Current Limiting:** All Fault Protected SSRs limit load current to protect both the load and the SSR.

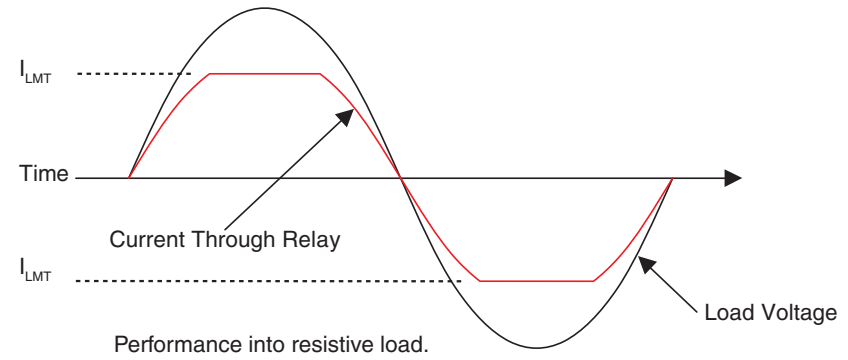
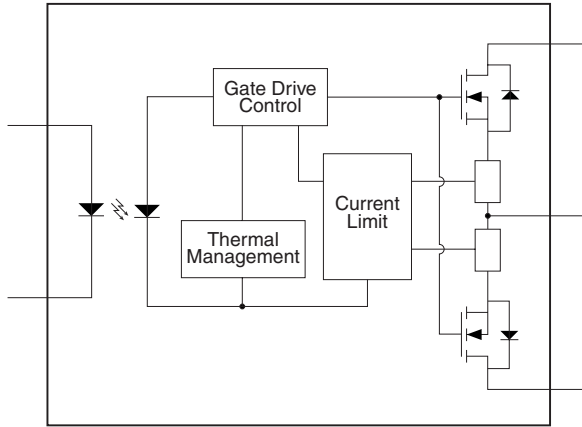
**Voltage Triggered Shutdown:** CPC1540, CPC1563, and CPC1593 incorporate a third protection feature called Voltage Triggered Shutdown (VTS). During a current limiting event this advanced thermal management protection feature reduces the relay current to  $<100\mu\text{A}$  whenever the voltage drop across the relay exceeds a non-adjustable predetermined threshold thereby preventing excessive heating of the SSR.

**Thermal Management:** All Fault Protected relays include the traditional thermal management feature that deactivates the SSR outputs anytime the die temperature exceeds a safe limit regardless of the Active Current Limiting state and when equipped, the Voltage Triggered Shutdown state. This feature provides excellent power cross immunity.

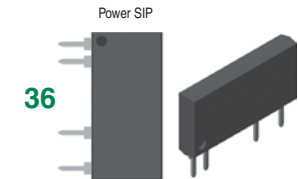
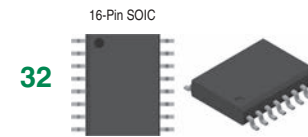
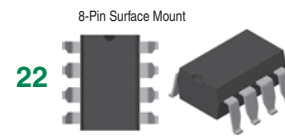
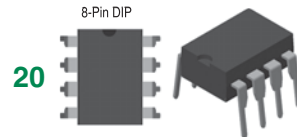
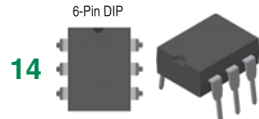
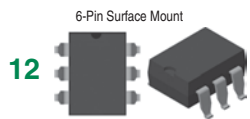
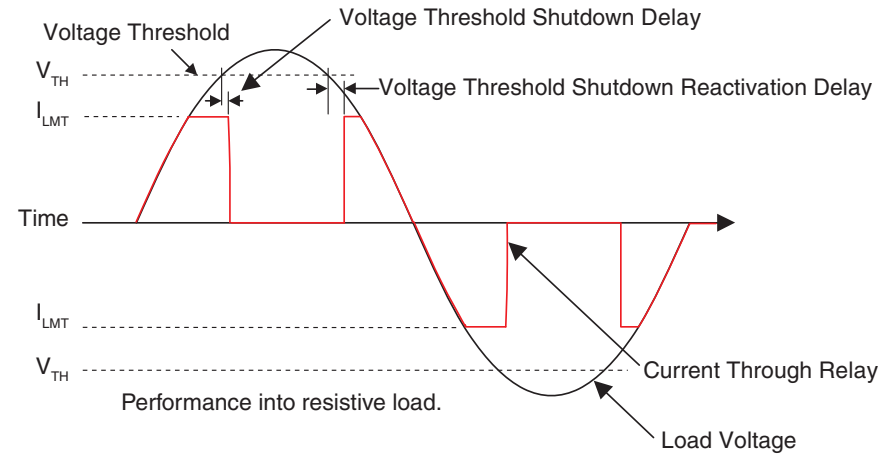
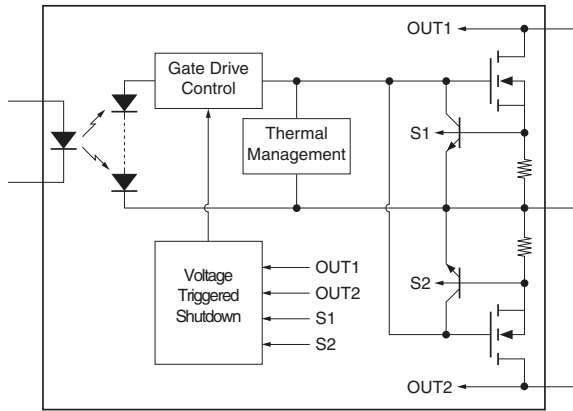
Part Number	Blocking Voltage ( $V_p$ )	Input Control Current (mA)	On-Resistance (Maximum)		Load Current (Maximum)		Current Limit (Maximum)		* VTS Threshold ( $V_{TH}$ ) (V)	Switching Speed ( $t_{on} / t_{off}$ ) (ms)	Isolation Voltage ( $V_{RMS}$ )	Package Type	Features & Comments
			DC-Only ( $\Omega$ )	AC ( $\Omega$ )	DC-Only (mA)	AC (mA)	DC-Only ( $\text{mA}_p$ )	AC ( $\text{mA}_p$ )					
CPC1510	250	2	3.75	15	350	200	920	450	-	2 / 2	3750	12, 14	Industrial applications
CPC1511	230	2.5	-	4	-	450	-	1400	-	4 / 2	3750	36	Industrial applications
CPC1540	350	2	6.75	25	250	120	570	285	100	2 / 2	3750	12, 14	PSTN hook switch applications
CPC1560	60	1.1	1.4	5.6	600	300	1500	900	-	0.1 / 0.4	3750	20, 22	Fast switching speeds
CPC1561B	60	2.5	-	0.245	-	1000	-	3000	-	2.5 / 0.5	3750	32	1A Load current rating to 60°C
CPC1563	600	2	11.75	35	250	120	570	285	100	2 / 2	3750	12, 14	High blocking voltage
CPC1593	600	2	11.75	35	250	120	570	285	21	2 / 2	3750	12, 14	Power supply start-up

\* Load current is reduced to approximately  $100\mu\text{A}$  or less whenever the voltage across the switches exceeds the threshold  $V_{TH}$  while the relay is in current limit.

With  $I_{LIMIT}$   
Without VTS



With  $I_{LIMIT}$   
With VTS



# OPTICALLY ISOLATED POWER RELAYS

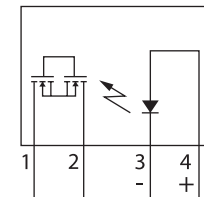
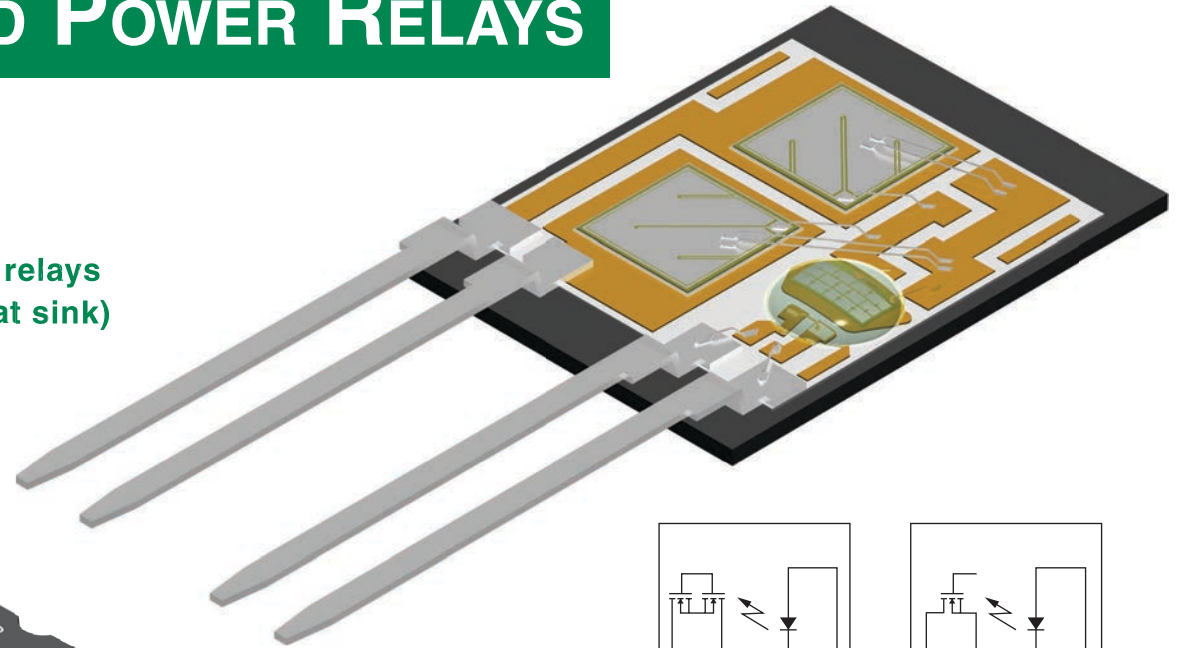
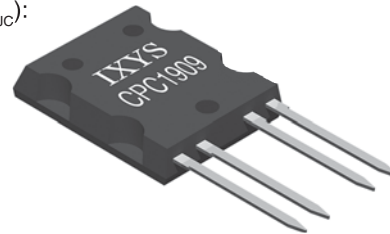
- Blocking voltage up to  $1000V_P$
- On-resistance as low as 0.05 Ohms
- On/off times from 5ms to 25ms
- MOSFET-based AC/DC and DC-only power relays
- Load current up to  $22.8A_{DC}$  (with  $5^\circ C/W$  heat sink)
- $2500V_{RMS}$  isolation from input to output and to the ceramic substrate

## Features:

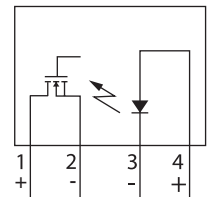
- Isolated, low thermal impedance pad for heat sink applications
- Low input control current
- Low thermal impedances, junction to case ( $\theta_{JC}$ ):
  - 0.30°C/W - ISOPLUS-264
  - 0.35°C/W - i4-PAC
  - 1.50°C/W - Power SIP
  - 1.50°C/W - Power SOIC

## Applications:

- Medical equipment
- Railroad/traffic controls
- Industrial control
- Test and measurement equipment

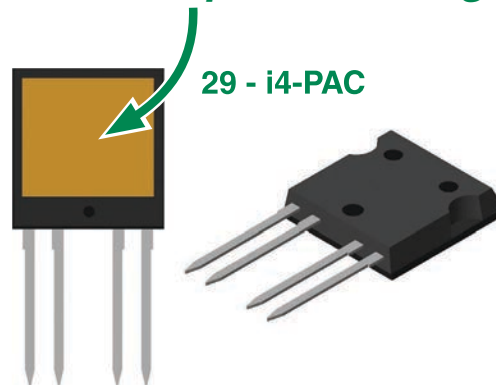


1-Form-A  
Bidirectional

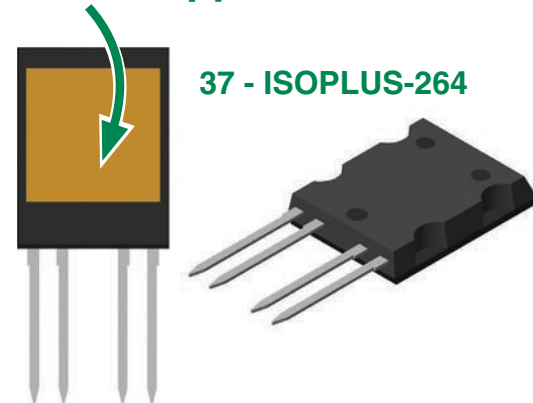


1-Form-A  
Unidirectional

**Heat dissipating, isolating substrate is heat-sink compatible for higher current applications**



29 - i4-PAC

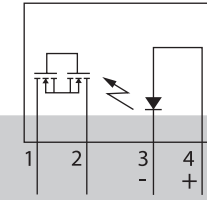


37 - ISOPLUS-264

For data sheets, go to: <https://www.ixysic.com/Products/ProdList.htm>

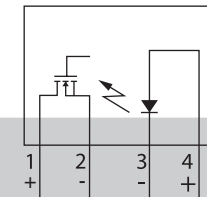
### • 1-FORM-A POWER RELAYS: SINGLE-POLE - BIDIRECTIONAL

Part Number	Relay Type	Blocking Voltage (V <sub>P</sub> )	Load Current (A <sub>RMS</sub> )			On Resistance (Ω)	Input Control Current (mA)	Switching Speeds t <sub>on</sub> / t <sub>off</sub> (ms)	Isolation Voltage (V <sub>RMS</sub> )	Off-State Leakage (μA)	Package Type (Page 14)	Features & Comments
			Without Heat Sink	5°C/W Heat Sink	T <sub>c</sub> =25°C							
CPC1908J	BI	60	3.5	8.5	15	0.3	10	20 / 5	2500	1	29	
CPC1909J	BI	60	6.5	15	15	0.1	10	25 / 10	2500	1	37	
CPC1918J	BI	100	5.25	13	15	0.1	10	25 / 10	2500	1	37	
CPC1927J	BI	250	2.7	6.7	15	0.2	10	25 / 10	2500	1	37	
CPC1967J	BI	400	1.35	3.35	13.15	0.85	10	20 / 5	2500	1	29	
CPC1968J	BI	500	2	5	15	0.35	10	20 / 5	2500	1	37	
CPC1977J	BI	600	1.25	3.1	12.25	1	10	20 / 5	2500	1	29	
CPC1978J	BI	800	0.75	1.85	7.25	2.3	10	20 / 5	2500	1	29	
CPC1979J	BI	600	1.4	3.5	14.5	0.75	10	25 / 5	2500	1	37	
CPC1986J	BI	1000	0.65	1.6	6.5	3	10	20 / 5	2500	1	29	
CPC1988J	BI	1000	0.9	2.25	9.4	2.5	10	20 / 5	2500	1	37	



### • 1-FORM-A POWER RELAYS: SINGLE-POLE - UNIDIRECTIONAL

Part Number	Relay Type	Blocking Voltage (V <sub>P</sub> )	Load Current (A)			On Resistance (Ω)	Input Control Current (mA)	Switching Speeds t <sub>on</sub> / t <sub>off</sub> (ms)	Isolation Voltage (V <sub>RMS</sub> )	Off-State Leakage (μA)	Package Type (Page 14)	Features & Comments
			Without Heat Sink	5°C/W Heat Sink	T <sub>c</sub> =25°C							
CPC1708J	UNI	60	4	11.85	24	0.08	10	20 / 5	2500	1	29	
CPC1709J	UNI	60	9	22.8	32	0.05	10	20 / 5	2500	1	37	
CPC1718J	UNI	100	6.75	17.5	32	0.075	10	20 / 5	2500	1	37	
CPC1727J	UNI	250	3.4	8.6	20	0.09	10	20 / 5	2500	1	37	
CPC1777J	UNI	600	1.5	4.6	15	0.5	10	20 / 5	2500	1	29	
CPC1779J	UNI	600	1.65	4.12	15	0.4	10	20 / 5	2500	1	37	
CPC1786J	UNI	1000	0.65	1.75	6.9	2	10	20 / 5	2500	1	29	
CPC1788J	UNI	1000	1	2.45	10.3	1.25	10	20 / 5	2500	1	37	



# OPTICALLY ISOLATED AC POWER SWITCHES

## • OPTICALLY ISOLATED AC POWER SWITCHES: LOAD CURRENT $\leq 1A$

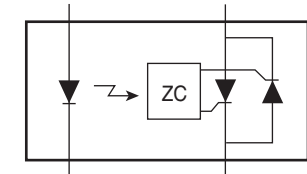
- Blocking voltage from 400V<sub>p</sub> to 800V<sub>p</sub>
- SCR-based AC power switches
- Maximum load current up to 1A<sub>RMS</sub>

### Features:

- 5mA input sensitivity
- Zero-cross turn on  $\leq \frac{1}{2}$  Cycle
- Low EMI and RFI generation
- DC control, AC switching
- Optically isolated
- TTL and CMOS compatible
- High noise immunity
- Machine insertable, wave solderable

### Applications:

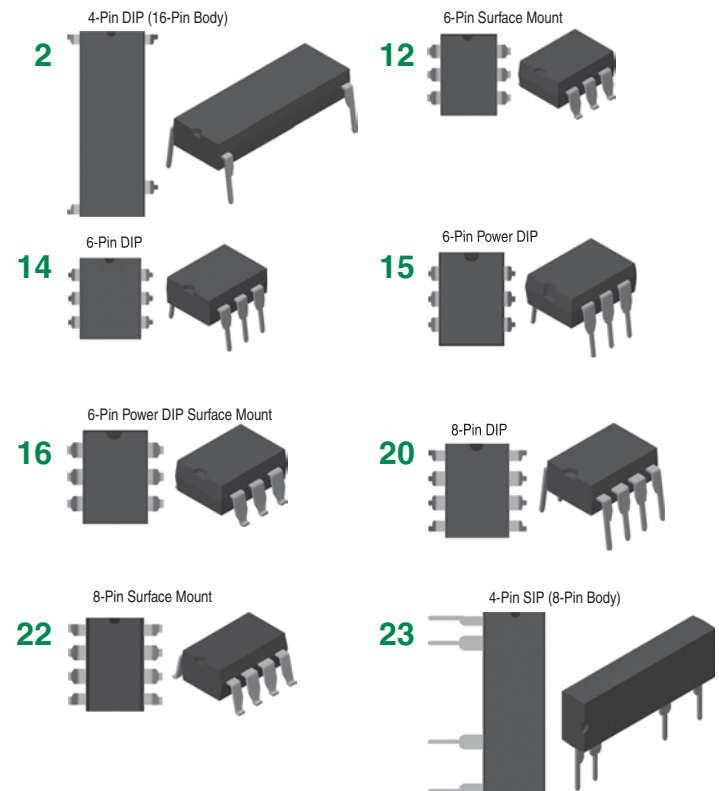
- Programmable controls
- Process control
- Power control panels
- Remote switching
- Gas pump electronics
- Contactors
- Solenoids
- Motor controls
- Heater controls



Zero-Cross Turn-On

Part Number	Blocking Voltage (V <sub>p</sub> )	Load Current (A <sub>RMS</sub> )	Input Control Current (mA)	Operating Frequency Min / Max (Hz)	Isolation Voltage (V <sub>RMS</sub> )	Package Type
CPC1943	400	0.5	5	20 - 500	3750	15, 16
CPC1945G	400	1	5	20 - 400	3750	2
CPC1945Y	400	1	5	20 - 400	3750	23
CPC1961 Dual	600	0.25 <sup>1</sup>	5	20 - 500	3750	20, 22
CPC1963	600	0.5	5	20 - 500	3750	15, 16
CPC1965G	600	1	5	20 - 400	3750	2
CPC1965Y	600	1	5	20 - 400	3750	23
CPC1972	800	0.25	5	20 - 500	3750	12, 14
PD1201	400	1	5	20 - 500	3750	2
PD2401	500	1	5	20 - 500	3750	2
PD2601	600	1	5	20 - 500	3750	2
PM1204	400	0.5	5	20 - 500	3750	15, 16
PM1205	500	0.5	5	20 - 500	3750	15, 16
PM1206	600	0.5	5	20 - 500	3750	15, 16
PS1201	400	1	5	20 - 500	3750	23
PS2401	500	1	5	20 - 500	3750	23
PS2601	600	1	5	20 - 500	3750	23

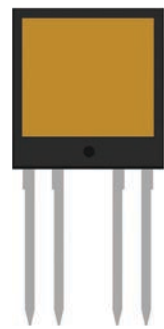
<sup>1</sup> Maximum continuous load current of a single pole or the sum of the load currents with both poles operating simultaneously.



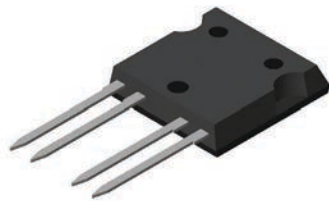
## • OPTICALLY ISOLATED AC POWER SWITCHES: LOAD CURRENT >1A

- Blocking voltages of 600V<sub>p</sub> and 800V<sub>p</sub>
- SCR-based AC power switches
- Zero-cross and Rapid turn-on (non-zero-cross) versions

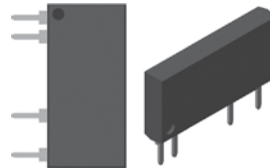
*Heat dissipating, isolating substrate is heat-sink compatible for higher current applications*



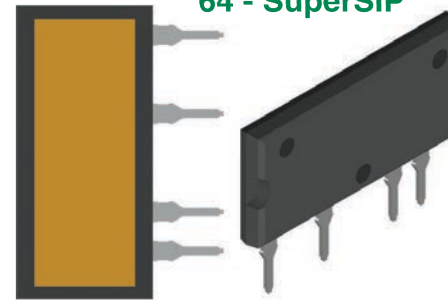
29 - i4-PAC



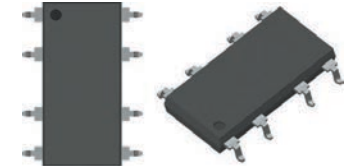
36 - Power SIP



64 - SuperSIP



66 - Power SOIC



### \* Rapid turn-on (non-zero-cross)

Rapid turn-on devices turn on when the control input goes true regardless of the load voltage phase, and turn off when the load current crosses zero.

Part Number	Blocking Voltage (V <sub>p</sub> )	Load Current			Input Control Current (mA)	Input Control Voltage (V)	Operating Frequency Min / Max (Hz)	Turn-On: Zero-Cross or Rapid	Switching Speed t <sub>on</sub> / t <sub>off</sub> (max)	Isolation Voltage (V <sub>RMS</sub> )	Package Type	Features
		Without Heat Sink (A <sub>RMS</sub> )	5°C/W Heat Sink (A <sub>RMS</sub> )	T <sub>c</sub> =25°C (A <sub>RMS</sub> )								
CPC1964B	800	1.5	-	-	5	-	20 - 500	Zero-cross	½ Cycle	5000	66	Enhanced isolation voltage, 12.5mm creepage
CPC1964BX6	600	1.5	-	-	5	-	20 - 500	* Rapid	500µs / ½ Cycle	5000	66	Rapid turn-on, enhanced isolation voltage
CPC1966Y	600	3	-	-	5	-	20 - 500	Zero-cross	½ Cycle	3750	36	
CPC1966B	800	3	-	-	5	-	20 - 500	Zero-cross	½ Cycle	5000	66	Enhanced isolation voltage, 12.5mm creepage
CPC1966BX8	800	3	-	-	5	-	20 - 500	* Rapid	**45µs / ½ Cycle	5000	66	Rapid turn-on, 12.5mm creepage
CPC1966YX6	600	3	-	-	5	-	20 - 500	* Rapid	500µs / ½ Cycle	3750	36	Rapid turn-on
CPC1966YX8	800	3	-	-	5	-	20 - 500	* Rapid	**45µs / ½ Cycle	3750	36	Rapid turn-on
CPC1976	600	2	-	-	5	-	20 - 500	Zero-cross	½ Cycle	3750	36	
CPC1976YX6	600	2	-	-	5	-	20 - 500	* Rapid	500µs / ½ Cycle	3750	36	Rapid turn-on
CPC1998J	800	5	20	50	5	-	20 - 500	Zero-cross	½ Cycle	2500	29	High load current
CPC40055ST	800	5	20	40	5	-	20 - 500	Zero-cross	½ Cycle	2500	64	High load current, 8.788mm creepage

\*\* Typical turn-on values.

For data sheets, go to: <https://www.ixysic.com/Products/ProdList.htm>

# IGBT & MOSFET GATE DRIVERS

**AEC-Q100 qualified:**

**IXD\_604SI & SIA**

**IXD\_609SI**

**IXD\_614SI**

**IX4340NE**

## • LOW-SIDE GATE DRIVERS

Part Number	Output Type	$I_{PEAK}$ $T_C=25^\circ\text{C}$ ( $A_P$ )	Output Resistance ( $\Omega$ )	Available Logic Configurations	Enable Function	Under-voltage Lockout (V)	Package Type
IX4426	DUAL	1.5	8	I	-	-	56, 81
IX4427	DUAL	1.5	8	N	-	-	56, 81
IX4428	DUAL	1.5	8	F	-	-	56, 81
IX4310T	SINGLE	2	3	N	-	$V_{CC} \leq 4.2$	99
IXD_602	DUAL	2	4	F, I, N	-	-	20, 56, 81, 82
IXD_604	DUAL	4	2.5	F, I, N, D	•	-	20, 56, 81, 82
IX4340	DUAL	5	1.5	D	•	$V_{CC} \leq 3.8$	81, 82, 92
IXD_609	SINGLE	9	1	I, N, D	•	-	20, 56, 57, 58, 81, 82
IXD_614	SINGLE	14	0.8	I, N, D	•	-	20, 57, 58, 82
IXD_630	SINGLE	30	0.4	I, N, D	•	$V_{CC} \leq 12.5$	57, 58
IXD_630M	SINGLE	30	0.4	I, N, D	•	$V_{CC} \leq 9$	57, 58

### Features:

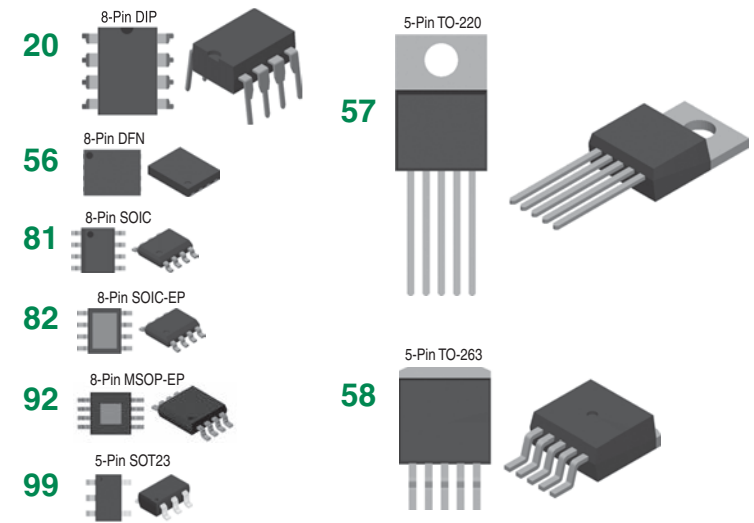
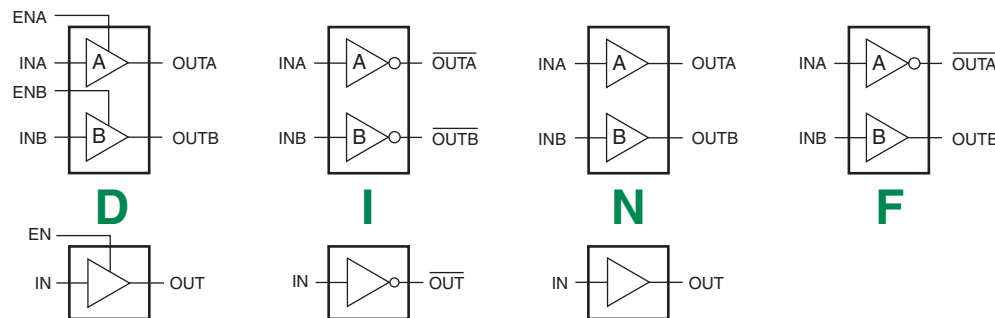
- 1.5A to 30A peak source/sink drive current
- Wide operating voltage range
- $-40^\circ\text{C}$  to  $+125^\circ\text{C}$  extended operating temperature range
- Logic input withstands negative swing of up to  $-5\text{V}$
- Dual drivers have matched rise and fall times
- Low propagation delay time
- 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

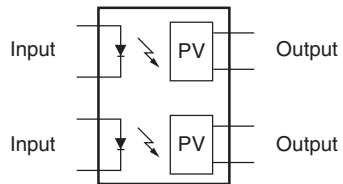
## AEC-Q100 Qualified Low-Side Gate Drivers

Part Number	Output Type	$I_{PEAK}$ $T_C=25^\circ\text{C}$ ( $A_P$ )	Output Resistance ( $\Omega$ )	Available Logic Configurations	Enable Function	Package Type
IXD_604SI	DUAL	4	2.5	D, I, N, F	•	82
IXD_604SIA	DUAL	4	2.5	D, I, N, F	•	81
IX4340NE	DUAL	5	1.5	D	•	82
IXD_609SI	SINGLE	9	1	D, I, N	•	82
IXD_614SI	SINGLE	14	0.8	D, I, N	•	82



## • OPTICALLY ISOLATED PHOTOVOLTAIC GATE DRIVERS

- Dual optically isolated photovoltaic devices
- Well suited for use in discrete solid state relay designs

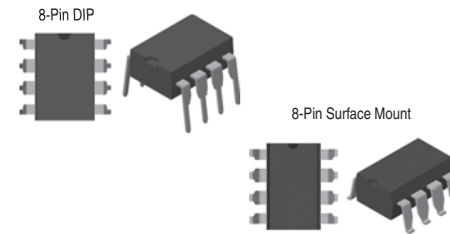


### Features:

- Isolated 5.5V and 12V photovoltaic output
- Floating outputs for parallel or series configuration

### Applications:

- MOSFET driver
- Isolated floating power source

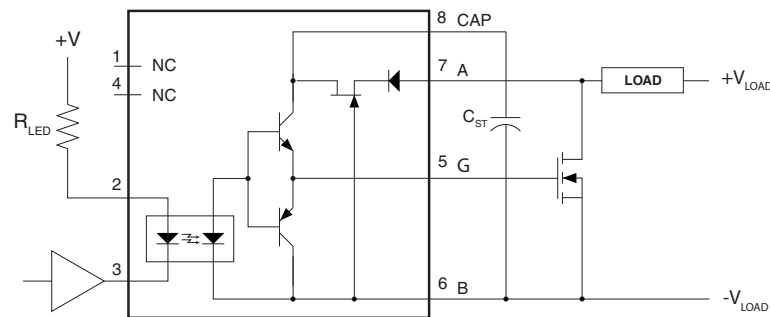


Part Number	Input Control Current (mA)	Nominal Open-Circuit Voltage $V_{OC}$ (V)	Nominal Short-Circuit Current $I_{SC}$ ( $\mu$ A)	Switching Speeds $t_{on} / t_{off}$ (ms)	Isolation Voltage ( $V_{RMS}$ )	Package Type
FDA215	5	5.5	2.5	5 / 5	3750	8-pin DIP, 8-pin surface mount
FDA217	5	11.75	4.5	2 / 0.5	3750	8-pin DIP, 8-pin surface mount

## • OPTICALLY ISOLATED LOAD-BIASED GATE DRIVERS

- High speed, optically isolated gate driver ICs
- Output driver powered from load voltage; no external power supply required
- On-chip circuitry charges an external capacitor whose charge enables fast turn-on

CPC1590 Application Diagram

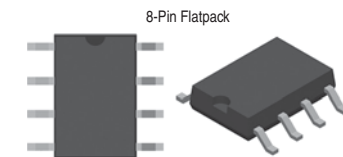


### Features:

- No external IC power supply required
- Low drive power requirements (TTL/CMOS compatible)
- Load voltages up to 200V
- Fast switching speeds: 40 $\mu$ s on, 400 $\mu$ s off

### Applications:

- Instrumentation
- Multiplexers
- I/O subsystems
- Meters (Watt-Hour, water, gas)
- Medical equipment (patient/equipment isolation)
- Security
- Industrial controls



Part Number	Input Control Current (mA)	Gate Voltage @ $I_F=5$ mA ( $V_G$ )	Blocking Voltage ( $V_P$ )	Regulated Capacitor Voltage ( $V_{CAP-MAX}$ )	Switching Speeds $t_{on} / t_{off}$ ( $\mu$ s)	Isolation Voltage ( $V_{RMS}$ )
CPC1580	2.5	7.5 - 12	65	$V_{DS} - 0.2V$	40 / 400	3750
CPC1590	2.5	7.5 - 12	200	16	40 / 400	3750

## • CPC1596: 570V OPTICALLY ISOLATED LOAD-BIASED GATE DRIVER

The CPC1596 is an optically isolated, load-biased Gate Driver that requires no additional power supply to bias the external MOSFET gates; in the off-state it regulates the voltage drawn from the load (up to 570V) down to 12.2V for internal use. It is specifically designed for low duty cycle switching applications such as an optically isolated DC relay using a single MOSFET or an AC relay with two MOSFETs.

The CPC1596 accomplishes very fast MOSFET turn-on by supplying charge stored in an external capacitor to the MOSFET gate when input control current is applied to the device's LED. After the MOSFET is turned on, photocurrent from the internal optocoupler keeps the MOSFET active for as long as sufficient input control current is applied assuring very low-frequency operation. When the MOSFET is turned off, the storage capacitor charges from the load voltage via the regulated internal voltage in preparation for the next turn-on.

Provided in a small, 8-pin package and requiring no separate power supply, the CPC1596 provides a flexible design solution that minimizes PCB real estate.

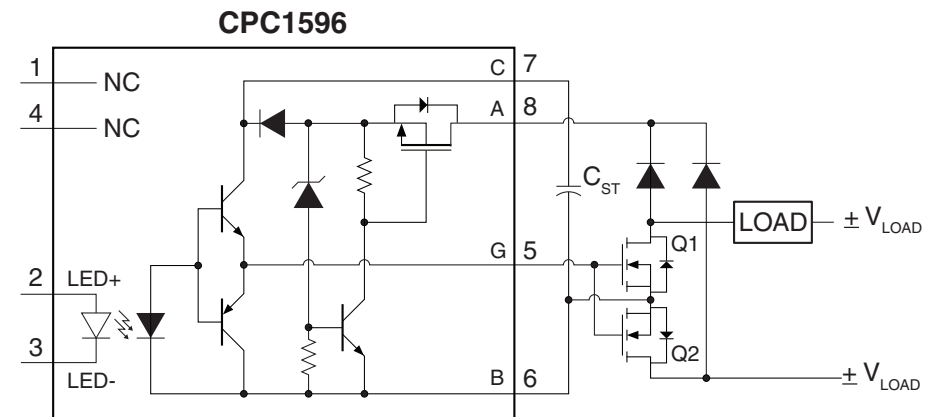
### Features:

- Requires No Load-side Power Supply
- Drives External Power MOSFET
- Only 2.5mA Input LED Current to Drive External MOSFET
- 3750V<sub>RMS</sub> Input-to-Output Isolation

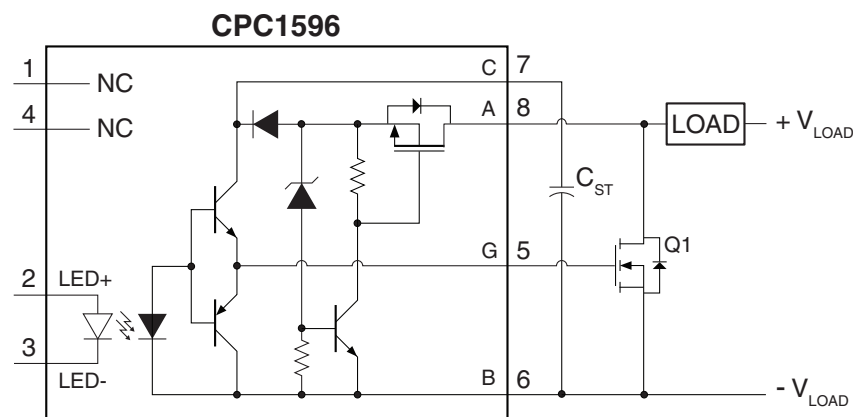
### Applications:

Optically Isolated AC or DC Relays for:

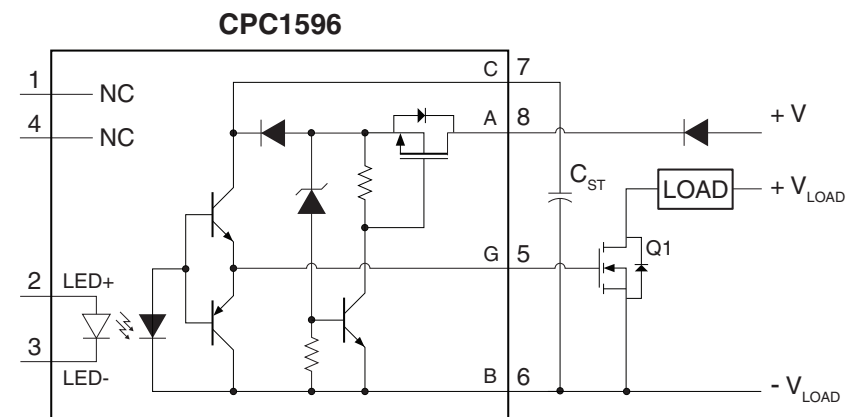
- Industrial Controls
- Instrumentation
- Medical Equipment Isolation
- Electronic Switching
- I/O Subsystems
- Appliances



CPC1596 AC Application Circuit



CPC1596 DC Application Circuit #1



CPC1596 DC Application Circuit #2



# High Voltage Isolated Analog Switches

## • CPC7524: 600V Quad High Voltage Isolated Analog Switch Array

- Provides flexible single-ended or differential access to high voltage networks
- Configured as two sets of matched, paired switches for improved differential performance

### Features:

- Switch voltage up to 600V<sub>p</sub>
- 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 and thermal shutdown protect against fault conditions
- TTL logic-level inputs
- Input latch
- Matched R<sub>ON</sub>
- Clean, bounce-free switching
- Monolithic IC reliability
- 28-pin SOIC package

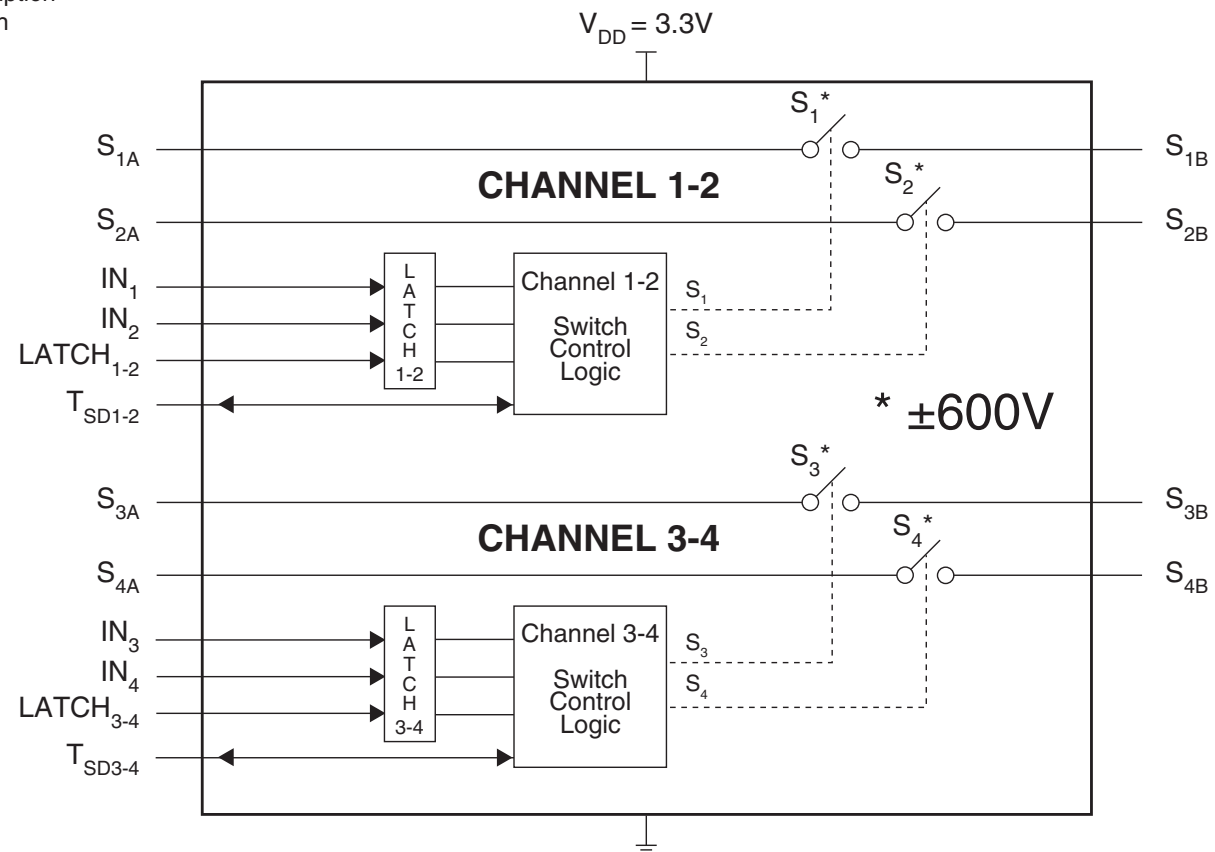
### Applications:

- Instrumentation
- Industrial controls and monitoring
- Automatic test equipment (ATE)
- Battery monitoring and charging circuits
- Worldwide AC mains monitor

28-Pin SOIC



## CPC7524



## • CPC7514: 320V Quad High Voltage Isolated Analog Switch Array

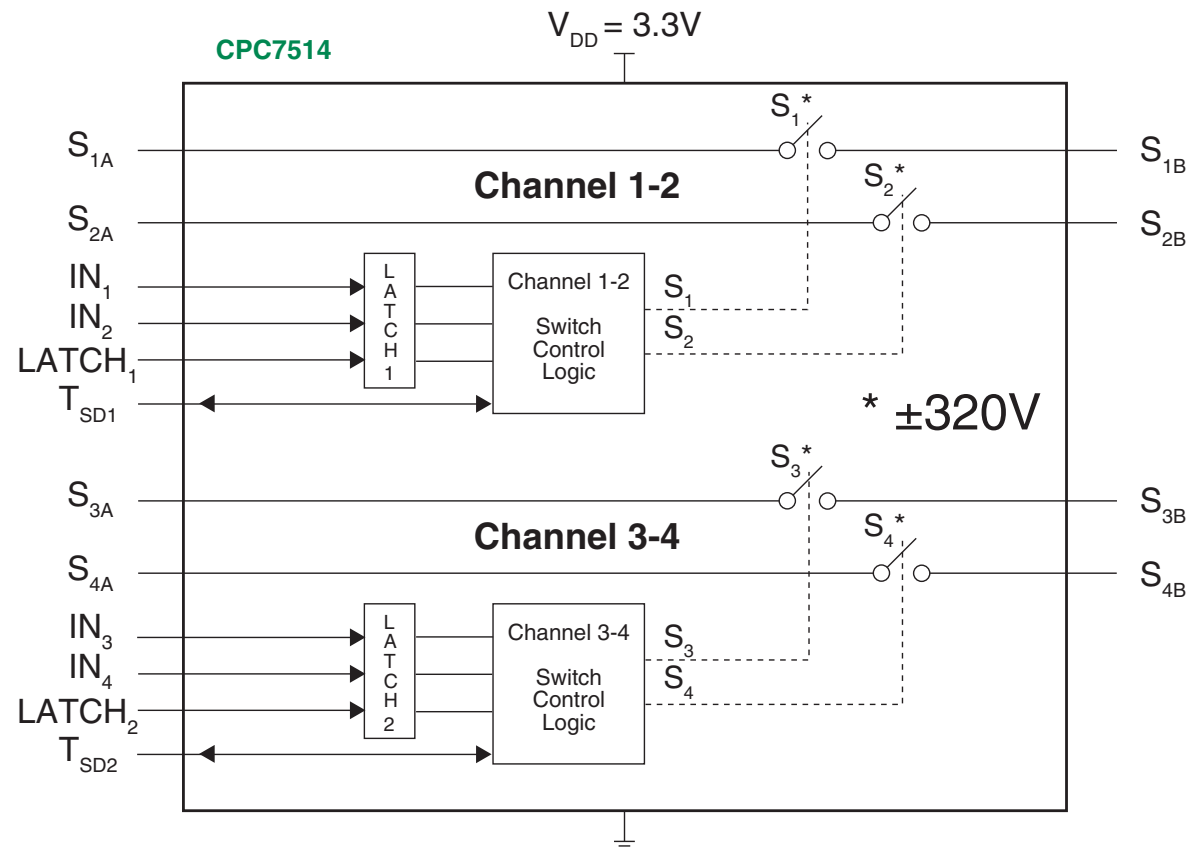
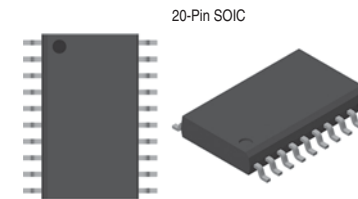
- Provides single-ended or differential access to high voltage networks
- Self-biasing - no external high-voltage supplies required

### Features:

- Low, matched  $R_{ON}$
- Switch voltage up to  $\pm 320V_P$
- 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)
  - Optical network units (ONU)
  - Hybrid fiber coax (HFC)



**• CPC7512: 320V Dual Shunt-Isolated High Voltage High Frequency Analog Switch**

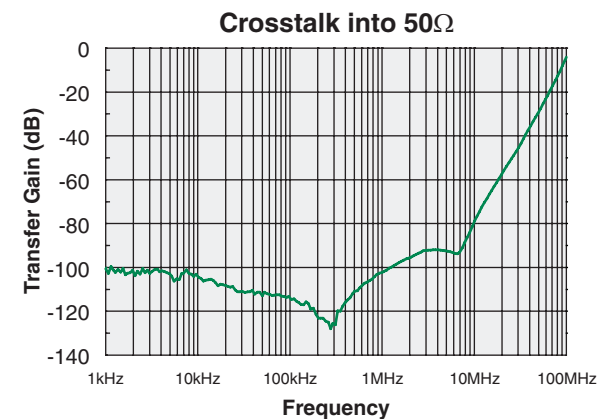
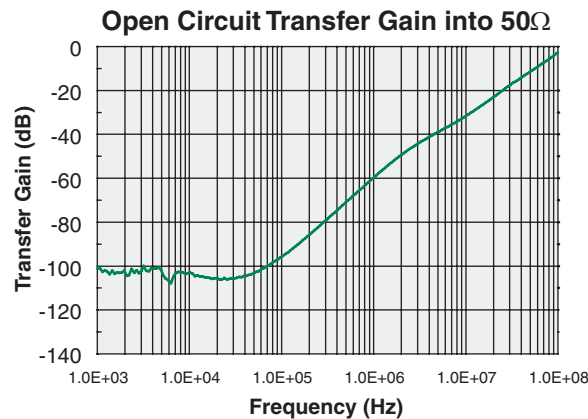
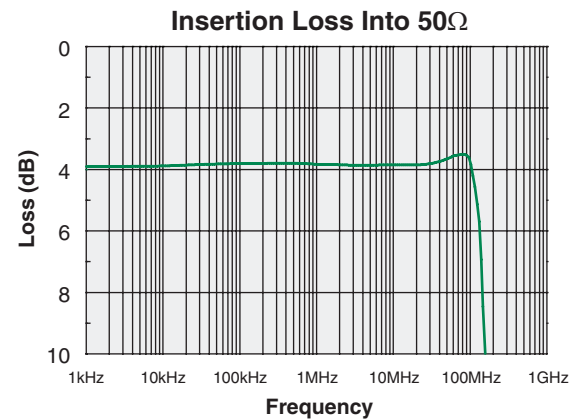
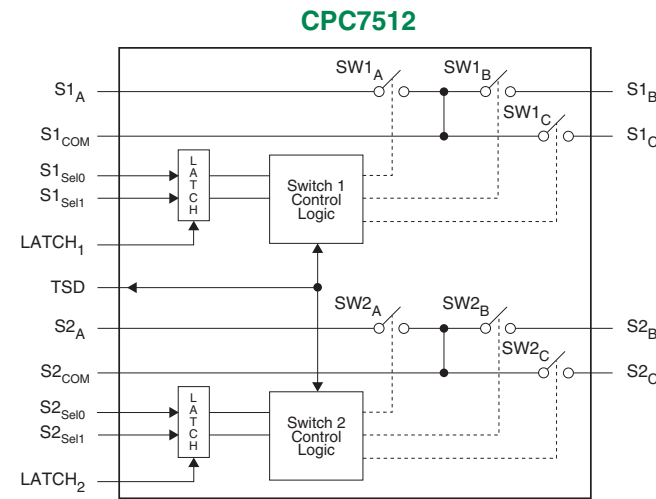
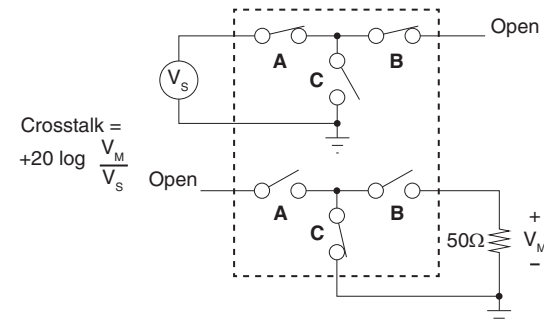
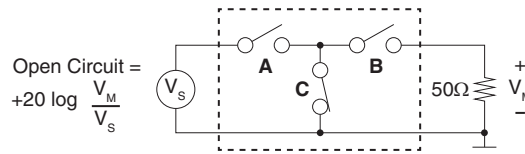
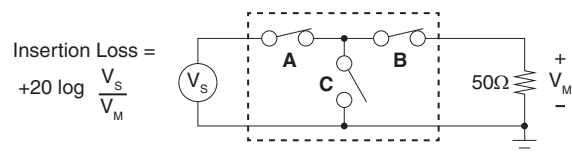
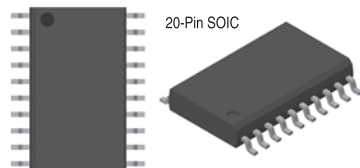
- Provides single-ended or differential access to high voltage networks
- Self-biasing: no external high-voltage supplies required

**Features:**

- Low, matched  $R_{ON}$
- Guaranteed break-before-make (BBM)
- Switch voltage up to  $\pm 320V_P$
- 60dB off-isolation at 1MHz
- Smart logic for power-up/hot-plug state control
- 5V operation with very low power consumption
- Thermal shutdown protects against fault conditions
- Latched TTL logic level inputs

**Applications:**

- Instrumentation
- Industrial controls and monitoring
- Multiplexed ultrasonic transducer switching
- Automatic test equipment (ATE)
- Battery monitoring and charging



# OPTOCOUPERS

## • LINEAR OPTOCOUPERS

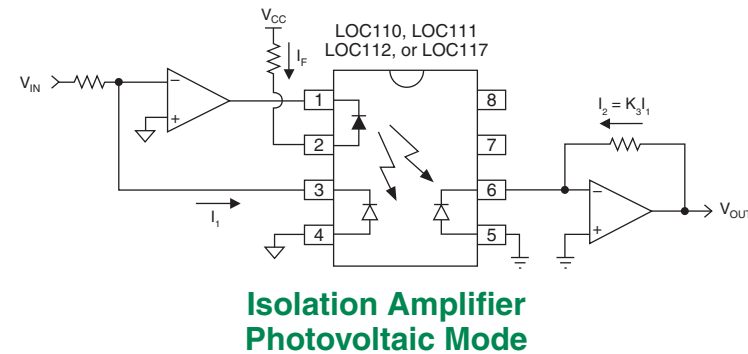
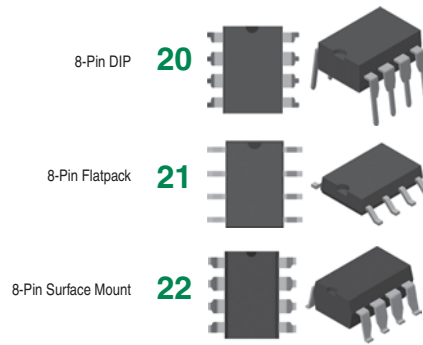
Two fundamental operating configurations:

### Photovoltaic Mode:

- 14-bit linearity
- 40kHz bandwidth

### Photoconductive Mode:

- 200kHz bandwidth
- 8-bit linearity



- Input LED drives two photodiodes: (1) feedback to correct for the input LED's non-linearity (2) isolated output

### Features:

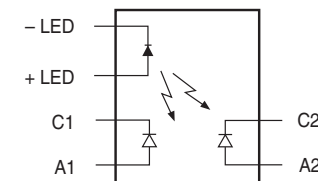
- Couples analog & digital signals
- 3750V<sub>RMS</sub> input-to-output isolation
- 200kHz bandwidth in photoconductive mode
- 40kHz bandwidth in photovoltaic mode
- High gain stability
- Low input-to-output capacitance
- Low power consumption
- 0.01% servo linearity
- THD 87dB typical

### Applications:

- Power supply feedback voltage/current
- Industrial and medical sensors
- Isolation of process control transducers
- Isolated 4-20mA converters

Part Number	Servo Gain K1=I <sub>1</sub> /I <sub>F</sub> (Min - Max)	Forward Gain K2=I <sub>2</sub> /I <sub>F</sub> (Min - Max)	Transfer Gain K3=K <sub>2</sub> /K <sub>1</sub> (Min - Max)	Input Control Current (mA)	Isolation Voltage (V <sub>RMS</sub> )	Package Type
LOC110	0.004 - 0.03	0.004 - 0.03	0.668 - 1.179	2 - 10	3750	20, 21, 22
LOC111	0.008 - 0.03	0.006 - 0.03	0.733 - 1.072	2 - 10	3750	20, 21, 22
LOC112	0.004 - 0.03	0.004 - 0.03	0.733 - 1.072	2 - 10	3750	20, 21, 22
LOC117	0.008 - 0.03	0.006 - 0.03	0.887 - 1.072	2 - 10	3750	20, 21, 22

### LOC11x



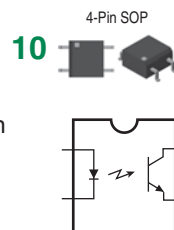
## • SINGLE OPTOCOUPLER

### Features:

- 100mA continuous load rating
- Breakdown voltage: 30V
- Minimum current transfer ratio: 100%
- 1500V<sub>RMS</sub> Input/Output isolation
- 4-pin SOP package

### Applications:

- Logic signal isolation
- Sensor circuitry
- Instrumentation
- Industrial control



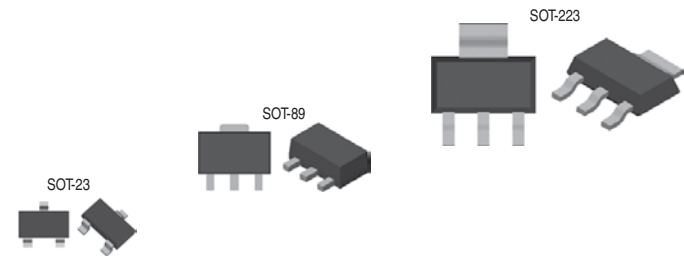
Part Number	Minimum Breakdown Voltage (BV <sub>CEO</sub> )	Typical Current Transfer Ratio (%)	Maximum Saturation Voltage (V)	Input Control Current (mA)	Minimum Isolation Voltage (V <sub>RMS</sub> )	Package Type
CPC1001N	30	330	0.3	0.2	1500	10

For data sheets, go to: <https://www.ixysic.com/Products/ProdList.htm>

# MOSFETs

## • N-CHANNEL DEPLETION MODE MOSFETs

- Depletion mode MOSFETs are normally closed
- Ideal for security applications
- LED drivers



Part Number	$V_{(BR)DSX}$ (V)	$I_D$ Min (mA)	$R_{DS(on)}$ Max ( $\Omega$ )	$V_{GS(off)}$ Min (V)	$V_{GS(off)}$ Max (V)	Package Type	Features & Comments
CPC3701	60	600	1	-1.4	-3.1	SOT-89	
CPC3703	250	360	4	-1.6	-3.9	SOT-89	
CPC3708	350	130	14	-2	-3.6	SOT-89, SOT-223	
CPC3710	250	220	10	-1.6	-3.9	SOT-89	
CPC3714	350	240	14	-1.6	-3.9	SOT-89	
CPC3720	350	130	22	-1.6	-3.9	SOT-89	
CPC3730	350	140	35	-1.6	-3.9	SOT-89	
CPC3902	250	400	2.5	-1.4	-3.1	SOT-223	
CPC3909	400	300	6	-1.4	-3.1	SOT-89, SOT-223	
CPC3960	600	100	44	-1.4	-3.1	SOT-223	
CPC3980	800	100	45	-1.4	-3.1	SOT-223	
CPC3982	800	20	380	-1.4	-3.1	SOT-23	Very small package
CPC5602	350	130	14	-2	-3.6	SOT-223	Designed for use with LITELINK applications
CPC5603	415	130	14	-2	-3.6	SOT-223	Designed for use with LITELINK applications

### Features:

- Normally closed depletion mode devices offer low  $R_{DS(on)}$  at cold temperatures
- High input impedance
- Low input capacitance
- Fast switching speeds
- Low input and output leakage

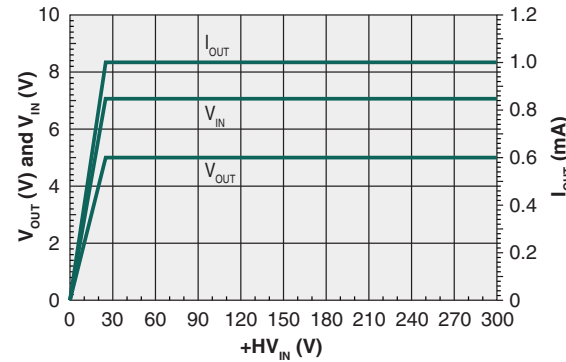
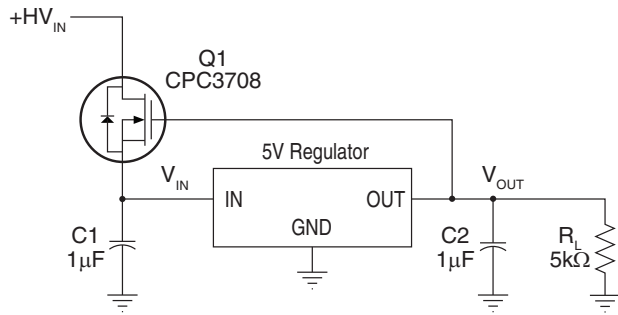
### Applications:

- Power fail switches
- Discrete normally closed relays
- Constant current, high brightness LED drivers
- High voltage pre-regulators
- Power inverters
- Power supplies

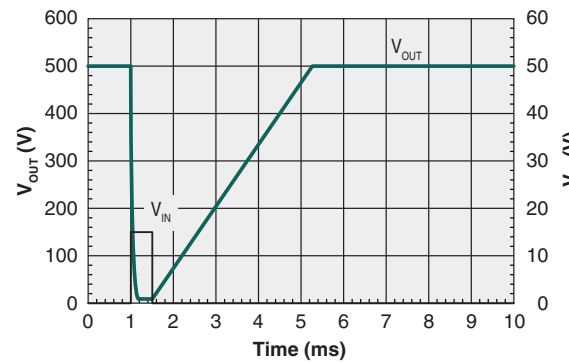
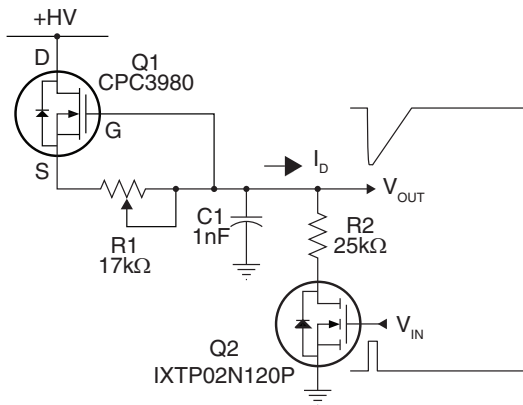
See IXYS IC Application Note AN-500

## “Depletion-Mode Power MOSFETs and Applications”

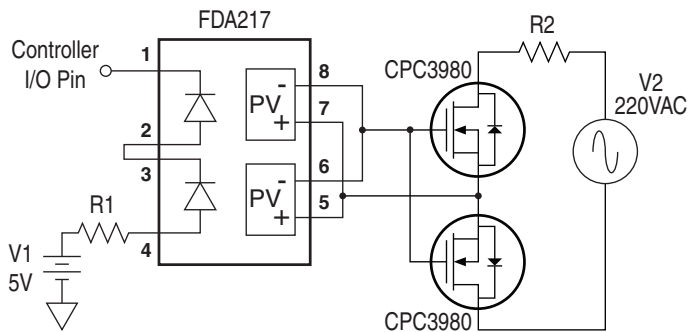
for descriptions and analyses of  
the following applications



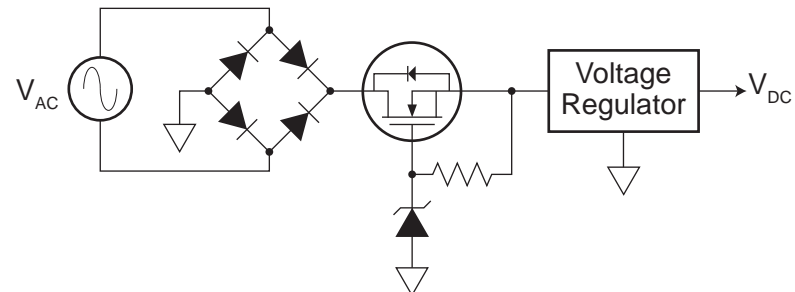
**High Voltage Off-line Linear Voltage Regulator**



**High Voltage Ramp Generator with Depletion-Mode and Enhancement-Mode N-Channel MOSFETs**



**FDA217 (see page 19) used with CPC3980 MOSFETs to create Normally Closed Solid State Relay**

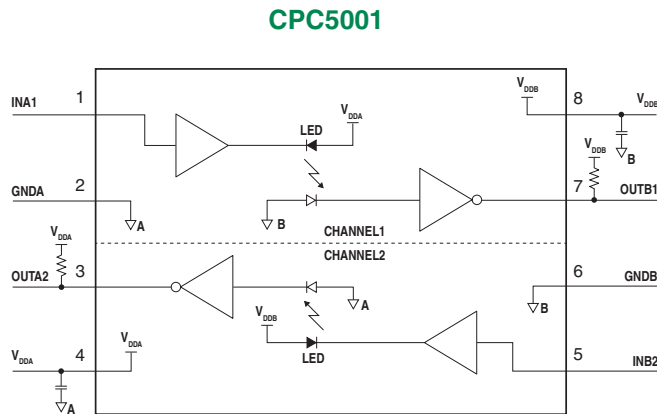


**N-Channel Depletion Mode MOSFET as Pre-Regulator**

# High Speed Digital Optical Isolators

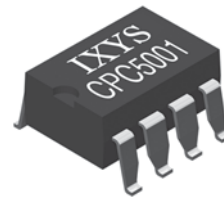
## • SINGLE-CHANNEL EACH DIRECTION DIGITAL OPTICAL ISOLATOR: CPC5001

- Logic level translation for levels as low as 2.7V or as high as 5.5V
- Passes DC signals - no refresh clock needed



### Features:

- Isolates one signal in each direction
- Operates from 2.7V to 5.5V
- Buffered inputs - no external LED drive required
- Hysteresis at inputs for noise rejection
- Slew-limited drivers reduce EMI
- 3750V<sub>RMS</sub> galvanic isolation from input to output
- Power down to Hi-Z does not load outputs
- 5 Mbd data rate



### Applications:

- Isolated signal monitoring and control
- Power-over-Ethernet, POE
- Power supply high-side interface
- Logic level translation
- Microprocessor system interface
- Inter integrated circuit (I<sup>2</sup>C) interface
- Serial peripheral interface
- Full duplex communication
- Isolated line receiver
- Isolated data acquisition systems

## • DUAL HIGH SPEED DIGITAL OPTICAL ISOLATOR: CPC5002

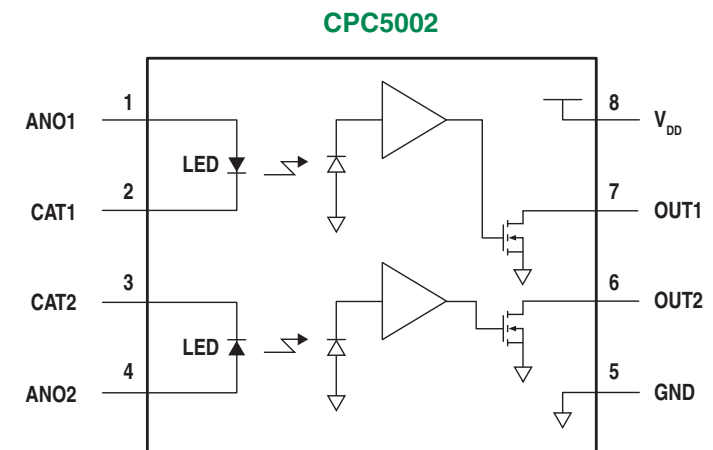
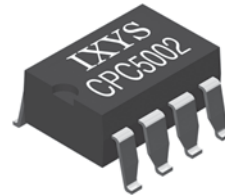
- 3750V<sub>RMS</sub> galvanic isolation from input to output
- Passes DC signals - no refresh clock needed

### Features:

- Dual optics isolate two signals
- 10 Mbd data rate
- Operates over  $2.7V \leq V_{DD} \leq 5.5V$
- Power down to Hi-Z does not load outputs
- Low-power CMOS reduces supply current
- LED drive current only 1.5mA
- High speed: 10 Mbd typical

### Applications:

- Isolated line receiver
- Ground loop elimination
- ADC/DAC digital noise isolation
- I<sup>2</sup>C bus isolation



## • BIDIRECTIONAL, OPTICALLY ISOLATED I<sup>2</sup>C BUS REPEATERS: CPC5902 & CPC5904

- CPC5902 Side B Fast-mode compliant (400kbit/s):  $V_{DDB} \geq 4.5V$
- CPC5904 Side B Fast-mode Plus compliant (1000kbit/s):  $V_{DDB} \geq 2.7V$
- Logic level translation for levels as low as 2.7V or as high as 5.5V
- Passes DC signals - no refresh clock needed

CPC5902 and CPC5904 are dual, optically isolated, bidirectional logic-bus repeaters. They galvanically isolate two open-drain logic signals, and provide a galvanic isolation of 3750V<sub>RMS</sub>. When the two sides' supply voltages are configured with different voltages, the CPC5902 and CPC5904 also function as logic level translators for levels as low as 2.7V or as high as 5.5V. Unlike transformer or capacitive isolators, these isolated repeaters pass DC signals and do not need to be clocked periodically to sustain the logic states. Buffered signals will always return to their proper value after a transient interruption on either side.

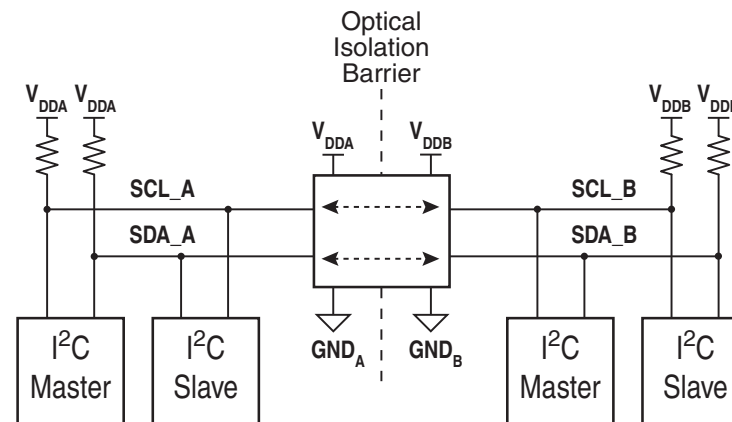
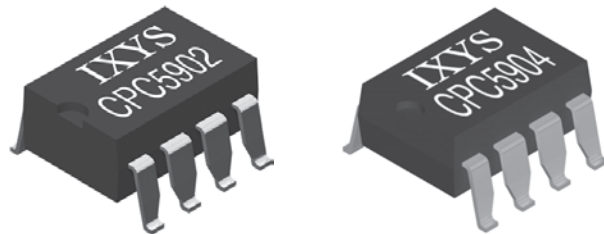
### Features:

- Bidirectionally buffers both I<sup>2</sup>C signals
- Extends and isolates I<sup>2</sup>C interfaces
- Supports I<sup>2</sup>C clock stretching
- No internal clock - low EM & RF generation
- Operates on 2.7V to 5.5V
- Supports DC logic level buffering without refresh
- Glitch-free operation
- Power down to Hi-Z does not load I<sup>2</sup>C bus
- Slew-limited drivers reduce EMI
- Immune to external EMI & RF emissions
- High voltage isolation

### Applications:

- Isolated Signal Monitoring and Control
- Power-over-Ethernet
- Power Supply High Side Interface
- I<sup>2</sup>C Bus Length Extenders
- I<sup>2</sup>C Logic Level Translation

See Technical Brief TB-101  
 "Optically Isolating an I<sup>2</sup>C Interface"



CPC5902 & CPC5904 Application Block Diagram

## • OPTICALLY ISOLATED I<sup>2</sup>C BUS REPEATER: CPC5903

- CPC5903 bidirectionally buffers data signal, unidirectionally buffers clock signal
- Logic level translation for levels as low as 2.7V or as high as 5.5V
- Passes DC signals - no refresh clock needed - no clock noise generated

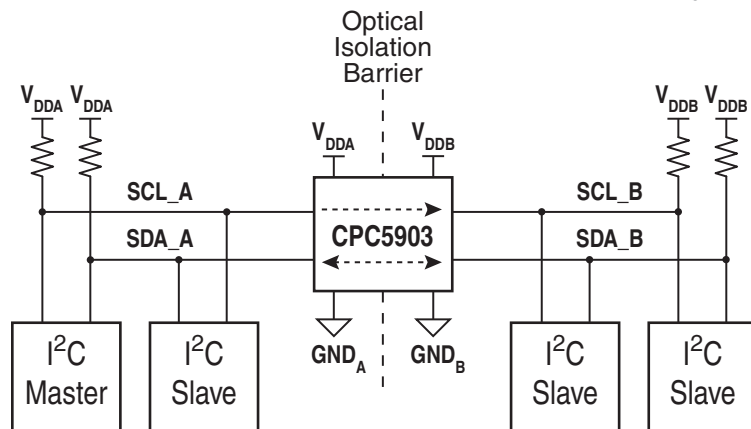
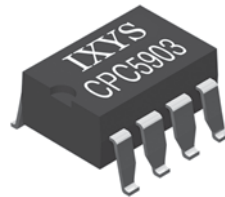
The CPC5903 is a dual, optically isolated, logic-bus repeater. It isolates two open-drain logic signals while providing 3750V<sub>RMS</sub> of galvanic isolation. When the two sides are powered by different supply voltages, it also functions as a logic level translator for levels as low as 2.7V or as high as 5.5V. Because the CPC5903 provides an isolated bidirectional buffer for the I<sup>2</sup>C data signal and a unidirectional buffer for the I<sup>2</sup>C clock signal, it is best suited for applications where clock stretching is not required. This configuration also requires the I<sup>2</sup>C bus master to be on the Side A bus. Unlike transformer or capacitive isolators, optical isolation passes DC signals and does not require continuous high frequency modulation to transmit clock and logic signals across the galvanic isolation barrier. The CPC5903 always returns the buffered signals to their proper state after transient interruptions on either side.

### CPC5903 Features:

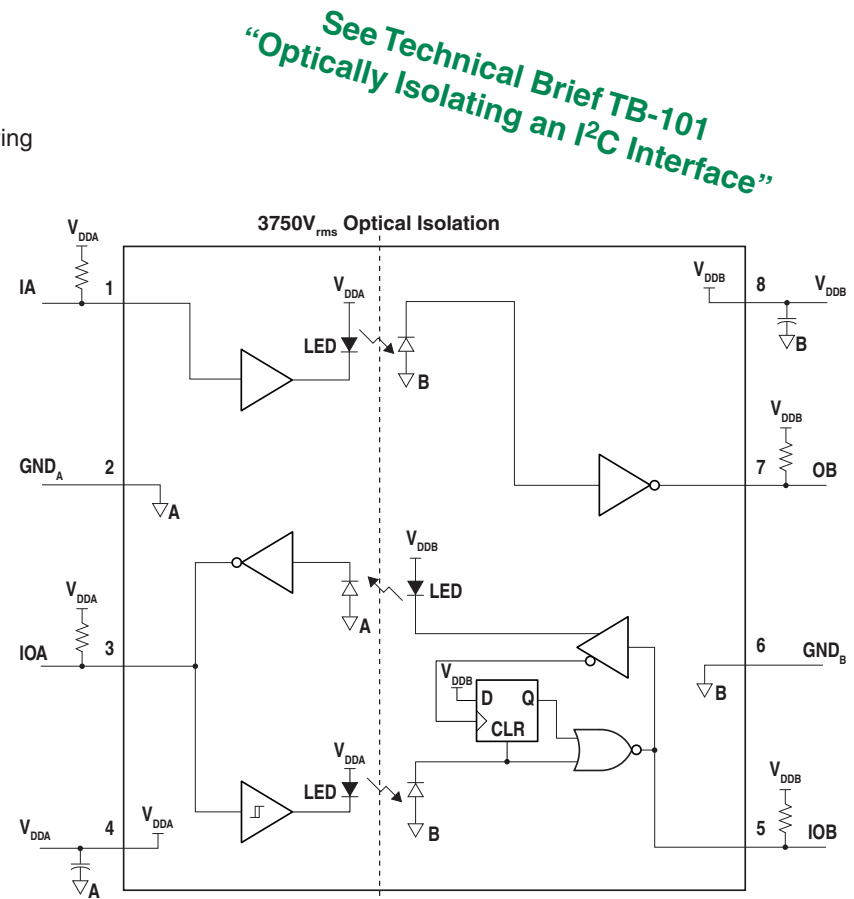
- Minimum I<sup>2</sup>C clock frequency: 500kHz
- Bidirectionally buffers SDA I<sup>2</sup>C signal
- Side A extends and isolates I<sup>2</sup>C interfaces
- Standard-mode and Fast-mode I<sup>2</sup>C
- Side B fast-mode compliant: V<sub>DDB</sub> ≥ 4.5V
- No internal clock - low EM & RF generation
- Operates on 2.7V to 5.5V
- Voltage level translation
- Slew-limited drivers reduce EMI
- Power down to Hi-Z does not load I<sup>2</sup>C bus
- 3750V<sub>RMS</sub> galvanic isolation
- Immune to external EMI & RF emissions

### Applications:

- Power-over-Ethernet (POE)
- I<sup>2</sup>C bus length extender
- Isolated control and signal monitoring
- Power supply high-side interface
- I<sup>2</sup>C logic level translation



CPC5903 Application Block Diagram



CPC5903 Block Diagram

See Technical Brief TB-101  
"Optically Isolating an I<sup>2</sup>C Interface"

# NON-VOLATILE DIGITALLY PROGRAMMABLE CAPACITORS

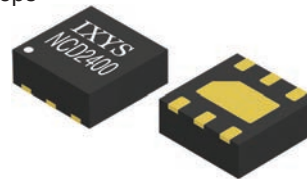
**APPLICATIONS:** • VCXOs • Crystal oscillators • Tunable RF stages • RFID tags • Industrial wireless control • Capacitor sensor trimming

## • WIDE CAPACITANCE RANGE, NON-VOLATILE, DIGITAL PROGRAMMABLE CAPACITOR: NCD2400M

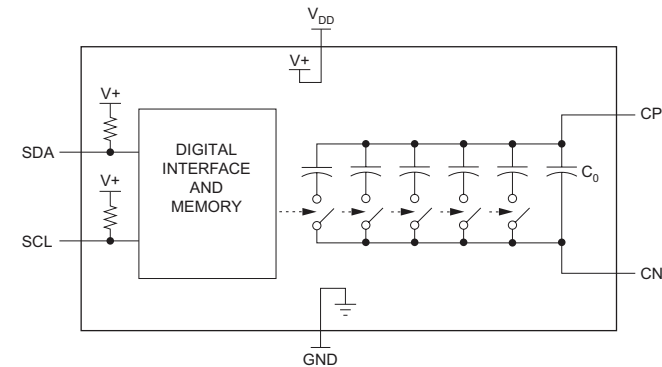
The NCD2400M is a dedicated electronic calibrator for oscillators, with reliable performance at 105°C as required by OCXO applications. This product can be used in series or shunt configuration, to support a wide variety of tuning circuit topologies. Digitally controlled capacitance trimming information is communicated via a 2-wire (I<sup>2</sup>C compatible) interface. The calibration value can be stored in the internal, re-programmable, non-volatile memory.

### Features:

- Series and shunt configurations supported:
  - $C_{\text{shunt}} = 12.5\text{pF to }194\text{pF}$  (15.6:1 tuning ratio) in discrete 355fF steps
  - $C_{\text{series}} = 1.7\text{pF to }194\text{pF}$  in discrete 376fF steps
- 512-state digital programmable capacitor
- Operating frequency range of DC to 150MHz
- Operation at 105°C
- 2-wire (I<sup>2</sup>C compatible) serial interface
- EEPROM non-volatile memory
- Wide power supply range (2.5V to 5.5V)
- 2mm x 2mm x 0.65mm 6-pin DFN package, MSL 1



DFN-EP package: 2mm x 2mm

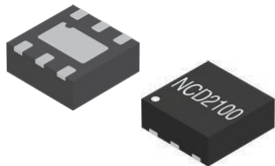


## • NON-VOLATILE DIGITAL PROGRAMMABLE CAPACITOR: NCD2100

The NCD2100 is an EEPROM-based digitally programmable variable capacitor that provides capacitive offset trimming for capacitance sensitive circuits. Programming the non-volatile EEPROM register value or implementing on demand capacitance value changes are easily accomplished by means of the simple two-wire serial bus. To ensure interoperability over a broad array of design environments, the device is rated for operation with supply voltages of 2.5V to 5.5V across the temperature range of -40°C to +85°C.

### Features:

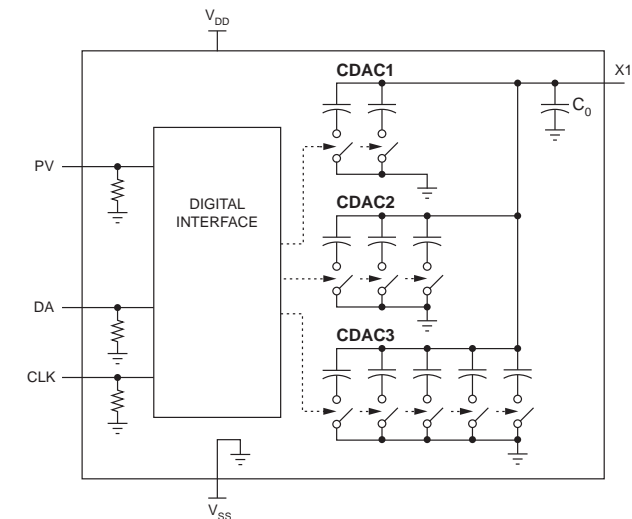
- Capacitance range 6.6pF to 37.553pF
- 1024 programmable capacitance values
- Operating frequency range 200kHz to 250MHz
- Very small CDAC3 capacitance step size: 63fF
- Device size: 2mm x 2mm (DFN-6), 2.9mm x 2.8mm (TSOT-6)



DFN-EP package: 2mm x 2mm



TSOT package: 2.8mm x 2.9mm



# High Voltage LED DRIVERS

## • CPC9909: High Efficiency, High Brightness Mains-Powered LED Driver

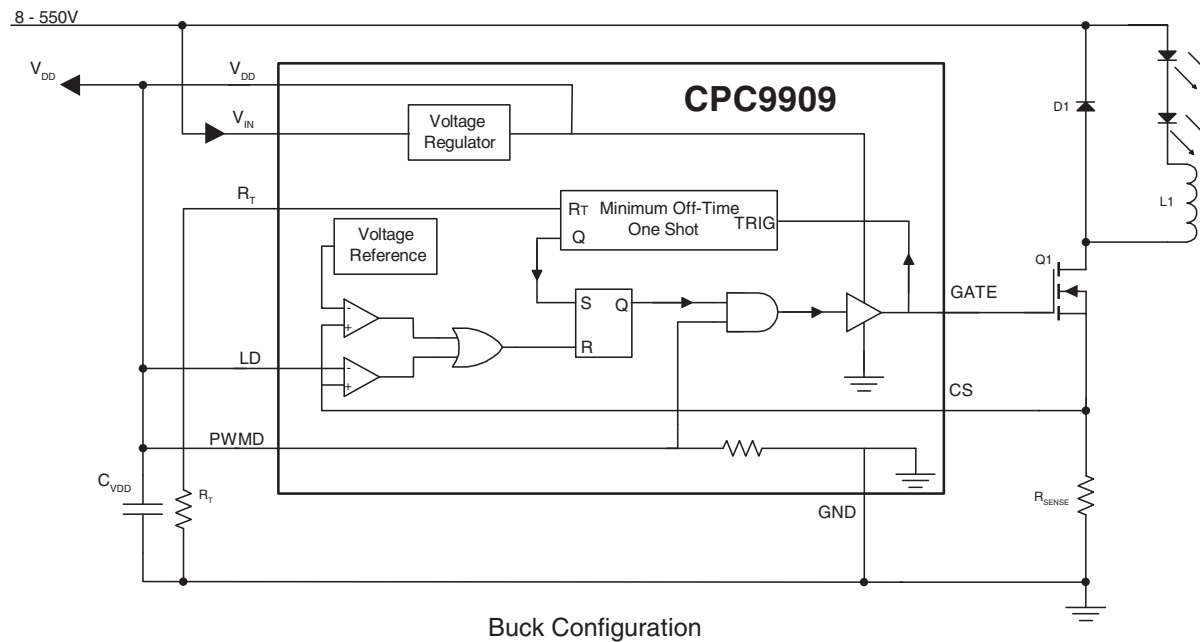
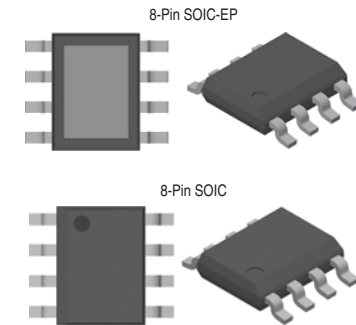
- 8V to 550V input voltage range
- Linear or PWM brightness control inputs
- Drives multiple LEDs in series/parallel

### Features:

- >90% efficiency
- Stable operation at >50% duty cycle
- Regulated LED current
- Resistor-programmable minimum off-time
- Drives external power MOSFET, enabling high LED output current applications
- Buck or boost configuration

### Applications:

- Flat-Panel Display RGB Backlighting
- Signage and Decorative LED Lighting
- DC/DC or AC/DC LED Driver Applications



Buck Configuration

CPC9909 Application Diagram

## • MXHV9910: High Voltage, Mains-Powered LED Driver

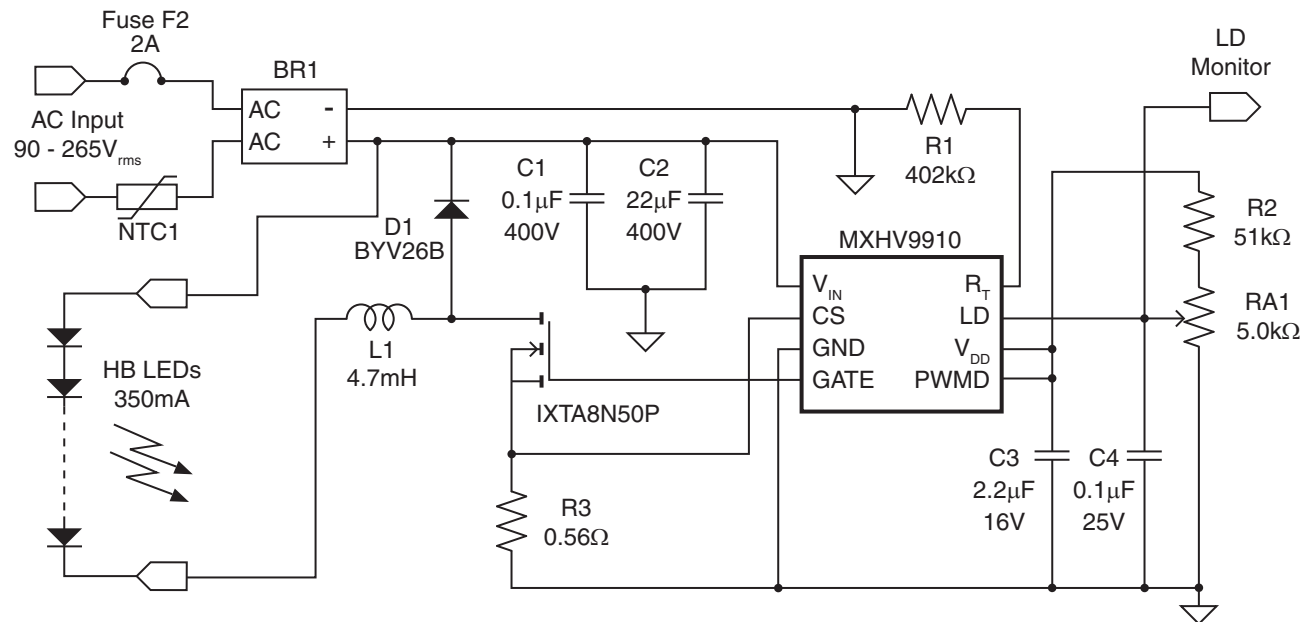
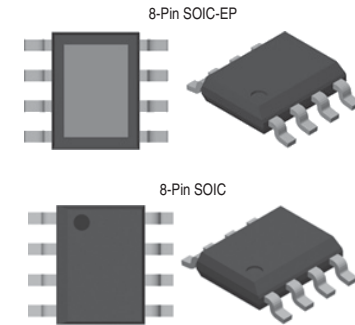
- Signage, decorative LED lighting
- Flat-panel display RGB backlighting
- DC & AC/DC LED driver applications

### 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

### Applications:

- Flat-Panel Display RGB Backlighting
- Signage and Decorative LED Lighting
- DC/DC or AC/DC LED Driver Applications



**MXHV9910 Application Diagram**

# MULTIFUNCTION PRODUCTS: SSR/OPTOCOUPLEDERS

## • GENERAL PURPOSE MULTIFUNCTION PRODUCTS

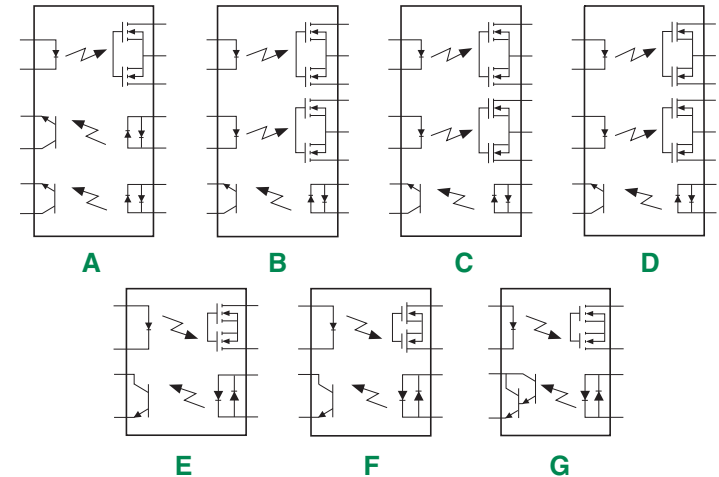
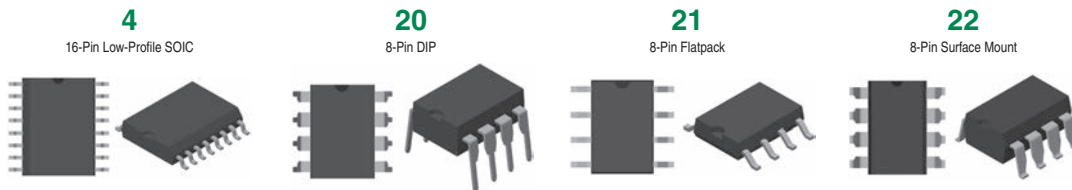
The OptoMOS line of Multifunction Products combines a number of discrete, optically isolated functions into a single package. These products mix and match solid state relays, optocouplers, and Darlington transistors to create highly functional circuits in a single, small package. Multifunction devices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

### Features:

- 3750V<sub>RMS</sub> 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
- Industrial controls

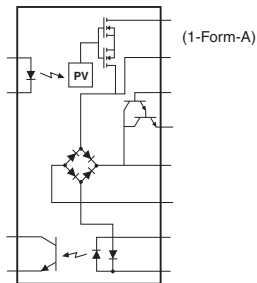


Part Number	Style	SSR Characteristics				Optocoupler Characteristics				Isolation Voltage (V <sub>RMS</sub> )	Package Type	Features and Comments
		Blocking Voltage (V <sub>p</sub> )	Load Current (mA)	On Resistance (Ω)	Input Control Current (mA)	Breakdown Voltage (V)	Current Transfer Ratio (%)	Saturation Voltage (V)	Input Control Current (mA)			
IAA110	B	350	100	35	5	20	33	0.5	6	3750	4	Two 1-Form-A relays, one optocoupler
IAB110	C	350	100	35	5	20	33	0.5	6	3750	4	One 1-Form-A relay, one 1-Form-B relay, one optocoupler
IAD110	A	350	100	35	5	20	33	0.5	6	3750	4	One 1-Form-A relay, two optocouplers
IBB110	D	350	100	35	5	20	33	0.5	6	3750	4	Two 1-Form-B relays, one optocoupler
TS117	E	350	120	35	2	20	33	0.5	6	3750	20, 21, 22	One 1-Form-A relay, one optocoupler
TS117L	E	350	120	35	2	20	33	0.5	6	3750	20, 21, 22	One current-limiting 1-Form-A relay, one optocoupler
TS118	F	350	120	35	5	20	33	0.5	6	3750	20, 21, 22	One 1-Form-B relay, one optocoupler
TS120	G	350	120	35	5	20	300	0.8	2	3750	20, 21, 22	One 1-Form-A relay, one Darlington optocoupler
TS190	E	400	150	22	5	20	33	0.5	6	3750	20, 21, 22	One 1-Form-A relay, one optocoupler
TS190L	E	400	150	25	5	20	33	0.5	6	3750	21	One current-limiting 1-Form-A relay, one optocoupler
XS170	E	350	100	50	2	20	33	0.5	6	3750	20, 22	One 1-Form-A relay, one optocoupler

## • TELECOMMUNICATIONS MULTIFUNCTION PRODUCTS

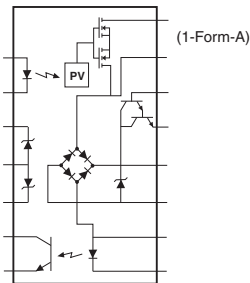
Multifunction devices allow designers to consolidate circuit functions into a single device, freeing up valuable board space and reducing component count. Designed specifically for the telecommunications industry, the Integrated Telecom Circuit (ITC) series is well suited for voice telephony and modem 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.

No Zener Protection  
Bidirectional Opto-Input



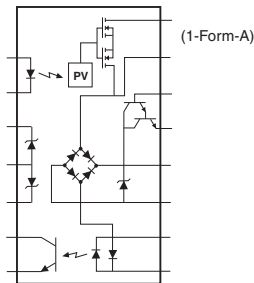
**ITC117(L)**

Zener Protection  
Unidirectional Opto-Input



**ITC135**

Zener Protection  
Bidirectional Opto-Input



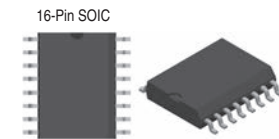
**ITC137**

### Features:

- 3750V<sub>RMS</sub> 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
- Industrial controls



Part Number	Relay Parameters				Optocoupler Parameters				Isolation Voltage (V <sub>RMS</sub> )	Package Type	Features
	Blocking Voltage (V <sub>p</sub> )	Load Current (mA)	On Resistance (Ω)	Input Control Current (mA)	Breakdown Voltage (V)	Current Transfer Ratio (%)	Saturation Voltage (V)	Input Control Current (mA)			
ITC117P	350	120	15	5	20	33	0.5	6	3750	16-pin SOIC	Full-wave ringing detect
ITC117PL	350	120	20	5	20	33	0.5	6	3750	16-pin SOIC	Full-wave ringing detect, current limiting
ITC135P	350	120	15	5	20	33	0.5	6	3750	16-pin SOIC	Half-wave ringing detect
ITC137P	350	120	15	5	20	33	0.5	6	3750	16-pin SOIC	Full-wave ringing detect

For data sheets, go to: <https://www.ixysic.com/Products/ProdList.htm>

# TELECOMMUNICATIONS PRODUCTS

## • LITELINK™ GALVANICALLY ISOLATED PHONE LINE INTERFACE

- Industry's only single-package phone line interface
- Ideal for both voice and data (V.22bis to V.90/V.92) applications in particularly dense circuit environments
- Internal optical isolation barrier eliminates high-cost transformer or capacitive isolation circuits
- Saves cost through reduced passive component count and smaller printed circuit board space

The  $3kV_{RMS}$  internal isolation barrier exceeds all worldwide regulatory requirements. The LITELINK application circuit is capable of surviving 6kV ( $10\mu s \times 700\mu s$ ) lightning surge waveforms making it the most robust phone line interface IC 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 IXYS Integrated Circuits for information on codec reference designs that offer programmable AC termination impedance for global applications. LITELINK complies with international PSTN agency requirements.

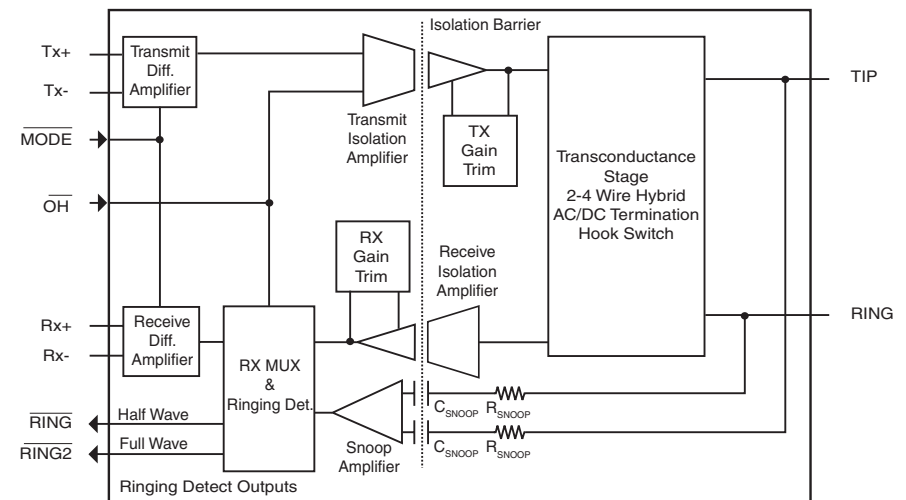
### Features:

- Voice and data applications
- Modem DAA for speeds up to V.92
- Half-wave or full-wave ringing detection
- World-wide 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

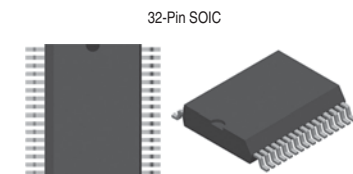
### Applications:

- 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

CPC5622



Part Number	Isolation Voltage ( $V_{RMS}$ )	Power Supply (V)	Caller ID	Ringing Detect
CPC5622	3000	3.3 - 5	Continuous	Half-wave & full-wave
CPC5621	3000	3.3 - 5	Selectable ( $\overline{CID}=0$ )	Full-wave ( $\overline{CID}=1$ )
CPC5620	3000	3.3 - 5	Selectable ( $\overline{CID}=0$ )	Half-wave ( $\overline{CID}=1$ )

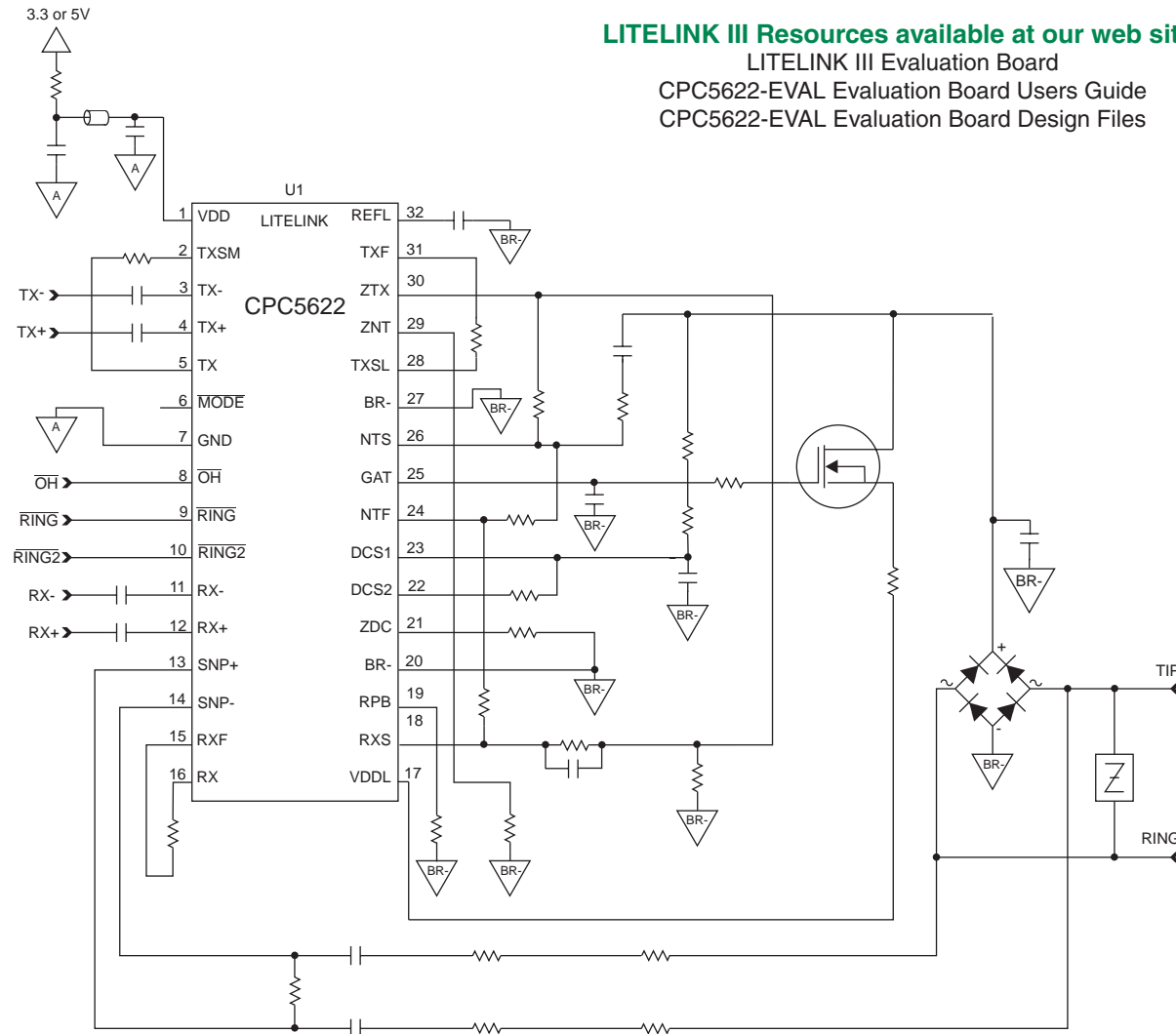


32-Pin SOIC

## LITELINK: Resistive Termination Application Circuit Schematic

LITELINK can be used with telephone networks worldwide. Some public telephone networks, notably in North America and Japan require a resistive line termination. Other telephone networks, such as in Europe, China and elsewhere, require a reactive line termination.

The application circuit shown here is typical of an application requiring a resistive termination. An example of a reactive-termination application is available in the data sheets at our web site.



For data sheets, go to: <https://www.ixysic.com/Products/ProdList.htm>

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

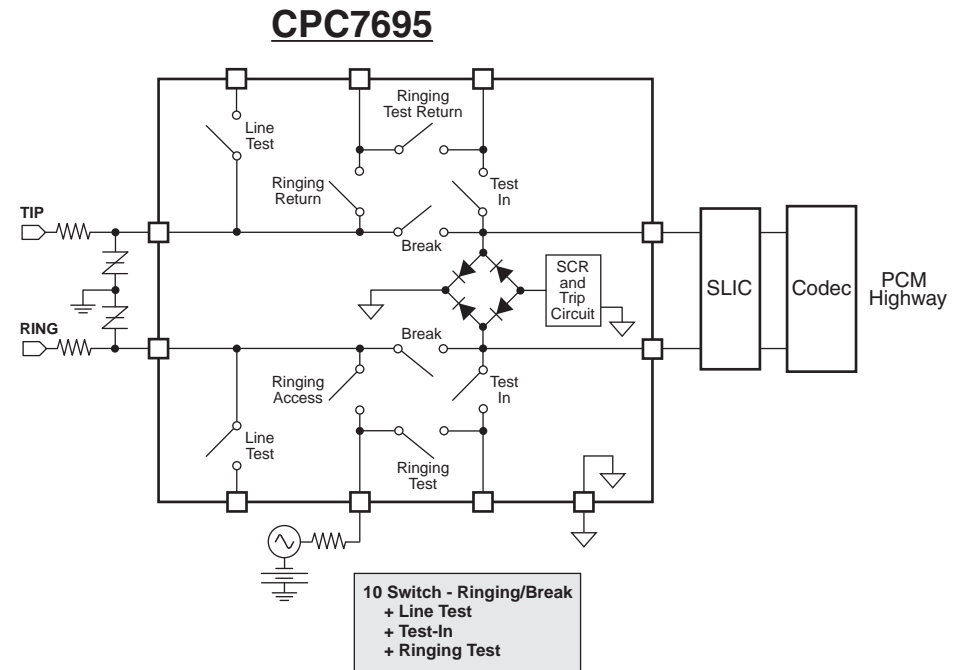
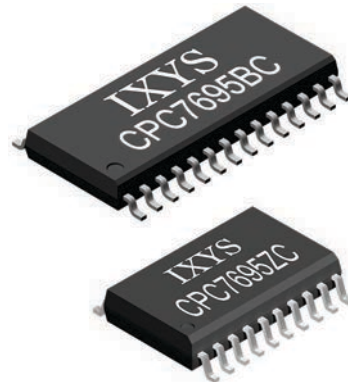
## • LINE CARD ACCESS SWITCH (LCAS)

### Features:

- Monolithic IC reliability
- Impulse noise reduction
- Low, matched on-resistance
- Built-in ringing zero-cross switching
- Small surface mount SOIC packages
- Ultra-low power consumption of <10.5mW
- Robust power-cross and lightning surge performance
- Current limiting, thermal shutdown, and SLIC protection

### Applications:

- PBX systems
- VoIP gateways
- Channel banks
- Pair gain systems
- Central offices (CO)
- Fiber in the loop (FITL)
- Hybrid fiber coax (HFC)
- Digital loop carriers (DLC)
- Digitally added main line (DAML)



Part Number	Minimum 1500V/ $\mu$ s dV/dt	Switch Pairs						Zero-Cross Switching	Protection Features				Logic States	Package Type
		# Switches	Break	Ringing	Line Test	Test In	Ringing Test		Current Limit	Diode Bridge	Protection SCR	Minimum Hold Current (mA)		
CPC7695BC	•	10	•	•	•	•	•	•	•	•	•	110	9	SOIC-28
CPC7695ZC	•	10	•	•	•	•	•	•	•	•	•	110	9	SOIC-20

# VOLTAGE MONITORING & SENSING IC

## CPC5712

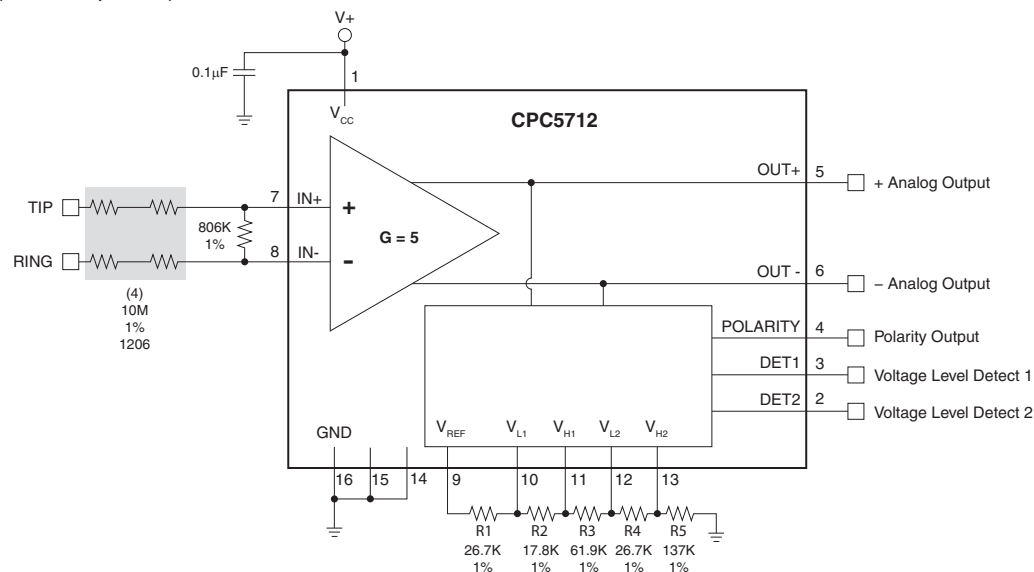
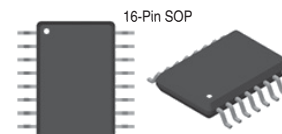
- Special-purpose “Voltage Monitor with Detectors” integrated circuit used in high voltage telephony applications
- Derives two voltage level detects, polarity information, and a scaled, linear representation of the phone line voltages
- Non-telephony applications include instrumentation and industrial controls; virtually undetectable in use

### Features:

- 2 independent, programmable level-detectors with programmable hysteresis
- Fixed-level polarity detector with hysteresis
- Differential linear output
- Excellent common-mode rejection ratio (CMRR)
- 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)

### Applications:

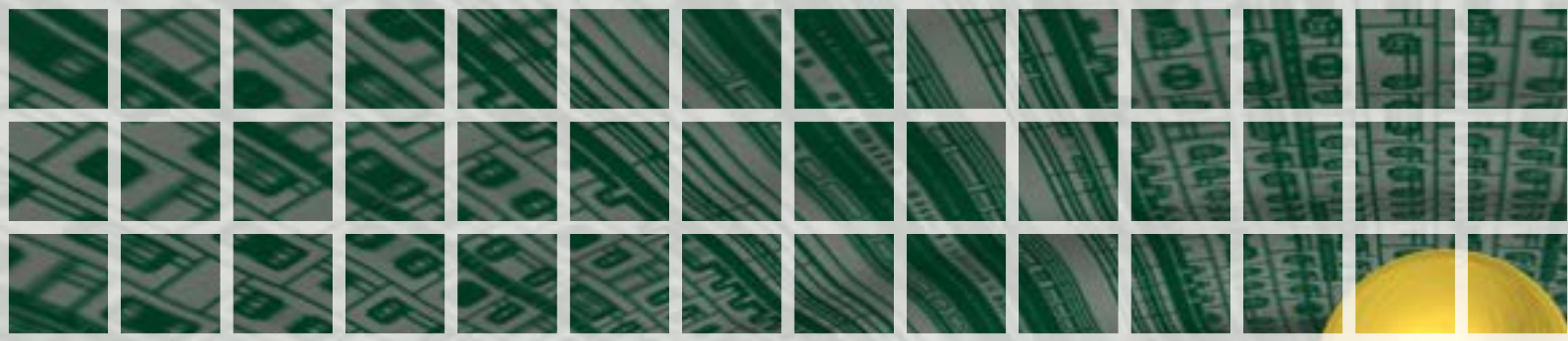
- VoIP gateways, IP-PBX, xDSL
- TIP/RING monitoring: polarity detection for caller ID, enhanced 911, line-in-use, battery detection, PSTN check



Resistors set the Voltage Level Detect Thresholds

### CPC5712 Application Circuit

For data sheets, go to: <https://www.ixysic.com/Products/ProdList.htm>



**For information on technical or sales support or our authorized distributors:  
<https://www.littelfuse.com/contactus.aspx>**

**IXYS Integrated Circuits**

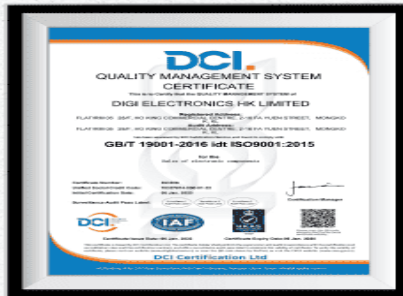
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**<https://www.ixysic.com>**

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