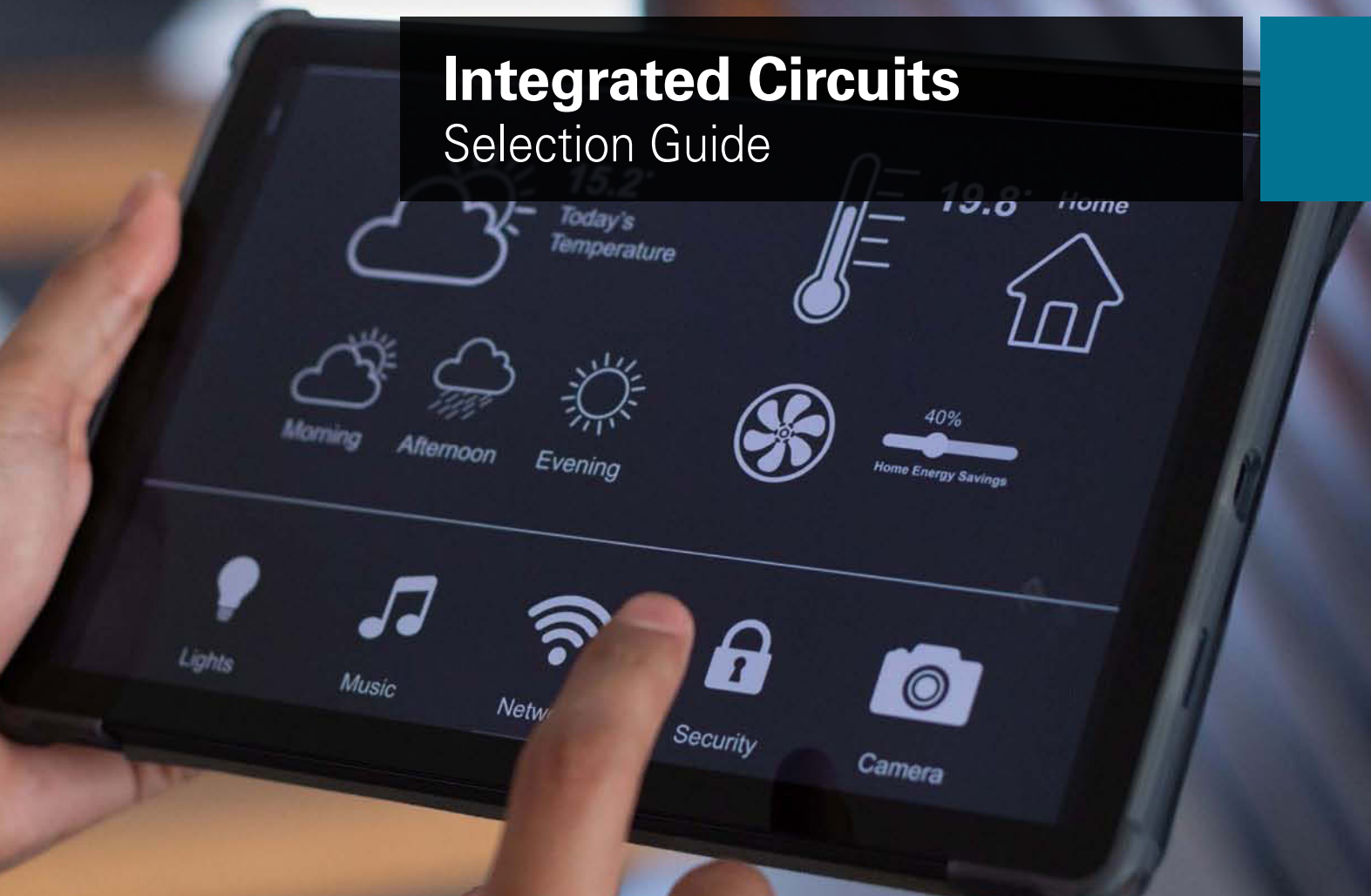
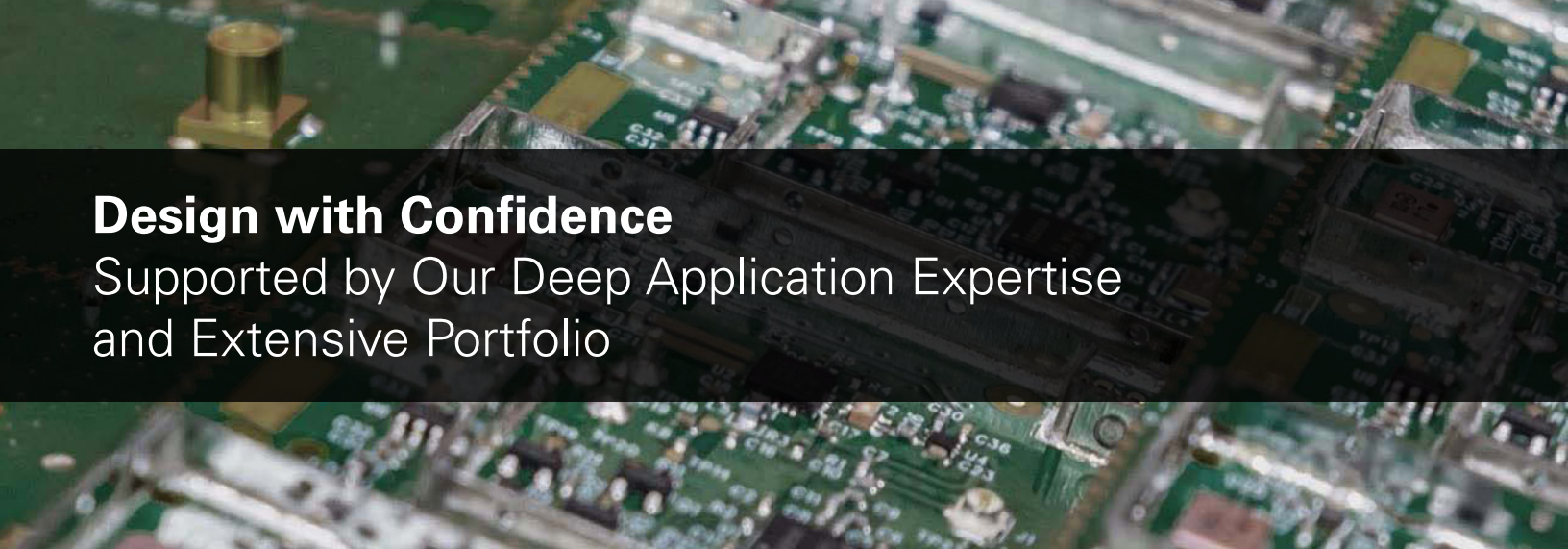


Integrated Circuits

Selection Guide



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



Design with Confidence

Supported by Our Deep Application Expertise and Extensive Portfolio

Littelfuse: Everywhere, Every Day

Founded in 1927, Littelfuse has become the world's most respected circuit protection brand, with well-established and growing platforms in power control and sensing technologies. Today, we are a global company, offering a diverse and extensive product portfolio—fuses, semiconductors, polymers, ceramics, relays, sensors, and more—serving the electronics, automotive, and industrial markets. Each is manufactured to exacting quality standards and backed by an unwavering commitment to technical support and customer service.

Our history of innovation, combined with our customer-first culture, drives us to collaborate with you to develop safer, more reliable products that are energy efficient and compliant with global regulations. We will partner with you to solve complex problems wherever electrical energy is used, bringing design, engineering, and technical expertise to deliver business results.

Why Choose Littelfuse

Littelfuse is the global leader in circuit protection solutions. We are the only company to offer all of the pertinent circuit protection technologies, with products that can be used in virtually everything that uses electrical energy. Complementing our wide portfolio of circuit protection products is a global network of design and technical support expertise. We offer decades of design experience to help you address application challenges and achieve regulatory compliance.

Your Single Source

Littelfuse offers an extensive circuit protection product line. We design forward-thinking, application-specific solutions to provide assurance that your most demanding requirements will be met. Our goal is to provide the most complete range of options so that you will not have to compromise.

Testing Support

Littelfuse can help ensure that your products will withstand most common threats repeatedly and will fail safely under extreme circumstances. We can serve as an independent source to provide assistance as you design by offering lab testing capabilities for customer applications. This testing includes industry-specific required power fault and Electrostatic Discharge (ESD) / Electrically Fast Transients (EFT) / lightning surge conditions.

Application Knowledge

For over 95 years, Littelfuse has maintained a focus on circuit protection, and we will continue to adapt as technologies evolve. Engineers and circuit designers around the world have come to rely on Littelfuse products and application knowledge to support their designs.

Global Support

Littelfuse stays close to customers. With manufacturing, lab, and design facilities located around the globe, application knowledge and technical support are locally available. Also, we offer a network of regional customer support offices and hundreds of independent authorized distributor contacts to assist you.

Visit [Littelfuse.com/contact-us](https://www.littelfuse.com/contact-us) to find local support near you.

Standards Compliance Expertise

Most Littelfuse products comply with a wide range of applicable industry and government guidelines as well as our own rigorous quality and reliability criteria. We continually look forward and adapt to changing requirements so that our products will comply with industry-specific national and international standards, such as CCC, CSA, IEC, IEEE, ISO, ITU, Meti, RoHS, Telcordia, TIA, and many more.

Operational Excellence

With our global manufacturing footprint, Littelfuse is firmly committed to manufacturing quality products at a competitive price. We build quality into our products and services, striving for zero defects in everything we do, thereby reducing cost and increasing your total satisfaction. We strive to exceed expectations every day.

Quality Assurance

Our global manufacturing facilities abide by strict quality assurance requirements and hold the following quality management system registrations:

- ISO 9001
- ISO14001
- IATF 16949

Table of Contents

About this guide

Littelfuse designs, manufactures, and markets a wide variety of semiconductor devices and is a major provider of optically isolated electronic components.

Littelfuse provides a 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.

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

Solid-state Relays (SSR)	4	Gate Driver ICs	24
1-Form-A Relays: Single-Pole	4	High-Side and Low-Side Gate Driver ICs	24
1-Form-A Relays: Dual Single-Pole	6	Half-Bridge Gate Driver ICs	25
1-Form-B Relays: Single-Pole	7	3-Phase Half-Bridge Gate Driver ICs	26
1-Form-B Relays: Dual Single-Pole	7	IX3407B Isolated Driver	27
1-Form-A & 1-Form-B Combination Relays	8	LEB-0022 Evaluation Board	27
1-Form-A Relays: Single-Pole, Unidirectional (DC-only)	8	Linear Optocouplers	28
2-Form-A Relays: Double-Pole, Single-Throw	8	Optocouplers	29
1-Form-C Relays: Common Input, Single-Pole, Double-Throw	8	Depletion Mode MOSFETs	30
Current Limiting SSRs with Voltage Triggered Shutdown & Thermal Management	9	RF MOSFETs	31
CPC2501M	10	Non-Volatile Digitally Programmable Capacitors	32
CPC1601M	11	High Voltage LED Drivers	34
1-Form-A Power Relays: Single-Pole, Bidirectional	12	Multifunction Products: SSR/Optocouplers	35
Optically Isolated AC Power Switches: $I_{LOAD} < 1\text{ A}$	13	Voltage Monitoring & Sensing IC	36
Optically-Isolated AC Power Switches: $I_{LOAD} > 1\text{ A}$	14	Central Office Line Card Access Switches	37
High Voltage Isolated Analog Switches	16	MCU & Cap-sense Touch	38
CPC7512: 320V Dual Shunt-Isolated High Voltage High Frequency Analog Switch	17	Part Number Alphanumeric Index	42
Gate Driver ICs	18		
Optically Isolated Load-Biased Gate Drivers	18		
Optically Isolated Photovoltaic Gate Drivers	19		
IGBT & MOSFET Drivers	20		
Low-Side Gate Drivers	20		
AEC-Q100-Qualified Low-Side Gate Drivers	21		
IGBT & MOSFET Drivers	22		
IX4351NE and IX4352NE Low-Side Gate Drivers	22		
Low-Side Driver With Charge Pump	23		
LEB-0023 IX4352NE Gate Driver Evaluation Board	23		

Solid-state Relays

Solid state relays by Littelfuse is one of the broadest in the industry. The devices use discrete semiconductor components and the patented OptoMOS® architecture to deliver fast, reliable, bounce-free switching in a compact design. Semiconductor relays are an ideal replacement for larger reed and electromechanical relays. Compared to these old electromagnetic technologies, our OptoMOS® relays offer significantly lower drive current, small package size, no susceptibility to magnetic interaction, and solid state reliability. All of these are key requirements for the design of today's complex, low-power, multi-channel products.

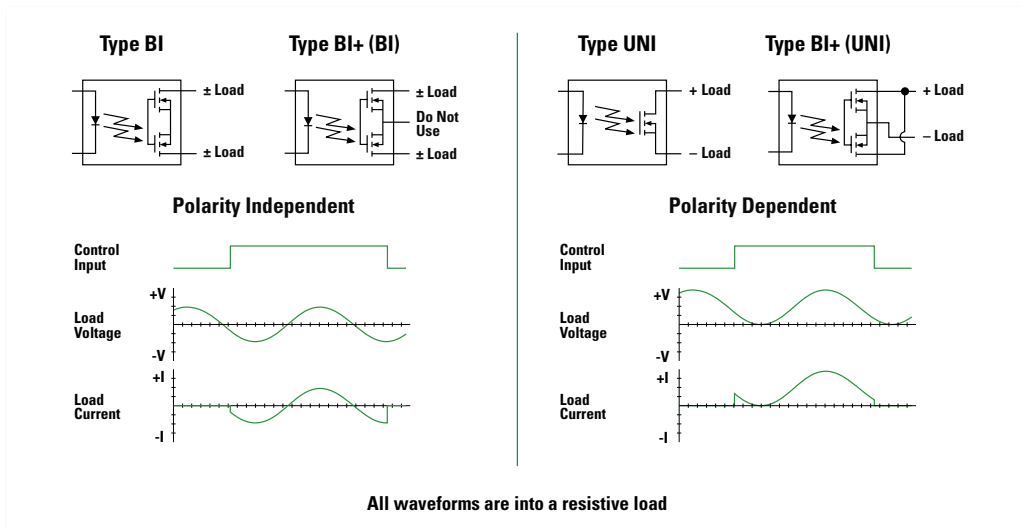
Features

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

Applications

- Telecommunications / data communications
- Instrumentation
- Multiplexers
- Data acquisition / electronic switching
- Meters (watt-hour, water, gas)
- Medical equipment (patient/equipment isolation)
- Security
- Industrial controls

Output Configurations



- 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 terminals only.
 - Type BI+** relays, in UNI configuration with output MOSFET 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.

1-Form-A Relays: Single-Pole



10
4-Pin SOP



21
8-Pin Flatpack



42
4-Pin DIP



12
6-Pin Surface Mount



22
8-Pin Surface Mount



43
4-Pin Surface Mount



14
6-Pin DIP



32
16-Pin SOIC



44
4-Pin V-DIP



20
8-Pin DIP

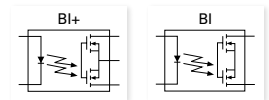


36
Power SIP



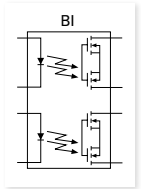
62
6-Pin Flatpack (8-Pin Body)

1-Form-A Relays: Single-Pole



Part Number	Relay Type	Blocking Voltage	Load Current	On Resistance	Input Control Current	Switching Speeds t_{on}/t_{off}	Isolation Voltage	Off-State Leakage	Package Type
		V_P	mA	Ω	mA	ms	V_{RMS}	μA	
CPC1006N	BI	60	75	10	0.5	10 / 10	1500	1	10
CPC1056N	BI	60	75	10	0.5	3 / 3	1500	1	10
CPC1008N	BI	100	150	8	2	2 / 1	1500	1	10
CPC1009N	BI	100	150	8	2	2 / 0.5	1500	0.02	10
CPC1010N	BI	250	170	11.5	2	3 / 3	1500	1	10
CPC1014N	BI	60	400	2	2	2 / 1	1500	1	10
CPC1016N	BI	100	100	16	2	2 / 1	1500	1	10
CPC1017N	BI	60	100	16	1	10 / 10	1500	1	10
CPC1018N	BI	60	600	0.8	1	3 / 2	1500	1	10
CPC1019N	BI	60	750	0.6	2	3 / 3	1500	1	10
CPC1020N	BI	30	1200	0.25	2	3 / 3	1500	1	10
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
CPC1230N	BI	350	120	30	2	2 / 1	1500	1	10
CPC1330	BI	350	120	30	2	2 / 1	5000	1	42, 43
CPC1335	BI	350	100	35	1	10 / 10	3750	1	21
CPC1390	BI	400	140	22	2	1 / 1	5000	1	42, 43, 44
CPC1393	BI	600	90	50	2	5 / 5	5000	1	42, 43, 44
CPC1394	BI	600	120	35	2	5 / 3	5000	1	42, 43, 44
CPC1510	BI+	250	200	15	2	2 / 2	3750	1	12, 14
CPC1511	BI	230	450	4	2.5	4 / 2	3750	1	36
CPC1540	BI+	350	120	25	2	2 / 2	3750	1	12, 14
CPC1560	BI+	60	300	5.6	1.1	0.1 / 0.4	3750	1	20, 22
CPC1561B	BI	60	1000	0.245	2.5	2.5 / 0.5	3750	1	32
CPC1563	BI+	600	120	35	2	2 / 2	3750	1	12, 14
CPC1593	BI+	600	120	35	2	2 / 2	3750	1	12, 14
LCA100	BI+	350	120	25	5	5 / 5	3750	1	12, 14
LCA100L	BI+	350	120	25	5	5 / 5	3750	1	12, 14
LCA110	BI+	350	120	35	2	3 / 3	3750	1	12, 14
LCA110L	BI+	350	120	35	2	3 / 3	3750	1	12, 14
LCA120	BI+	250	170	20	5	3 / 3	3750	1	12, 14
LCA120L	BI+	250	150	20	5	3 / 3	3750	1	12, 14
LCA125	BI+	300	170	16	5	5 / 5	3750	1	12, 14
LCA125L	BI+	300	170	20	5	5 / 5	3750	1	12, 14
LCA127	BI+	250	200	10	5	5 / 5	3750	1	12, 14
LCA127L	BI+	250	170	15	5	5 / 5	3750	1	12, 14
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
LCA701	BI+	100	1500	0.3	2	4 / 1	3750	1	12, 14
LCA710	BI+	60	1000	0.5	10	2.5 / 0.25	3750	1	12, 14
LCA712	BI+	60	1000	0.5	10	2.5 / 0.35	3750	0.01	12, 14
LCA715	BI+	60	2200	0.15	5	2.5 / 0.25	3750	1	12, 14
LCA717	BI+	30	2000	0.15	2	3 / 3	3750	1	12, 14
OMA160	BI+	250	50	100	10	0.125 / 0.125	3750	0.025	12, 14
PLA110	BI+	400	150	22	5	1 / 0.5	3750	1	12, 14
PLA110L	BI+	400	150	25	5	1 / 0.25	3750	1	12, 14
PLA132	BI+	60	600	1	2	5 / 2	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
PLA143	BI+	600	100	50	2	5 / 5	4000	1	12, 14
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
PLA170	BI+	800	100	50	5	5 / 5	3750	1	12, 14
PLA171	BI	800	100	50	2	5 / 5	5000	1	62
PLA172P	BI	800	100	50	2	5 / 5	5000	1	62
PLA190	BI+	400	150	22	5	1 / 0.5	5000	1	12, 14
PLA191	BI+	400	250	8	5	3 / 1	5000	1	12, 14
PLA192	BI+	600	150	22	5	5 / 5	5000	1	12, 14
PLA193	BI+	600	100	50	5	5 / 5	5000	1	12, 14
PLA194	BI+	600	130	35	2	3 / 2	5000	1	12, 14
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	Load Current	On Resistance	Input Control Current	Switching Speeds t_{on}/t_{off}	Isolation Voltage	Off-State Leakage	Package Type
		V_P	mA	Ω	mA	ms	V_{RMS}	μA	
CPC2014N	BI	60	400	2	2	2 / 1	1500	1	17
CPC2017N	BI	60	120	16	1	3 / 3	1500	1	17
CPC2025N	BI	400	120	30	2	2 / 1	1500	1	17
CPC2030N	BI	350	120	30	2	2 / 1	1500	1	17
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
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
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
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
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
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
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
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
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
PAA191	BI	400	250	8	5	3 / 1	5000	1	20, 22
PAA193	BI	600	100	50	5	5 / 5	5000	10	20, 22
XAA170	BI	350	100	50	5	5 / 5	3750	1	20, 21, 22



10
4-Pin SOP



20
8-Pin DIP



42
4-Pin DIP



12
6-Pin Surface Mount



21
8-Pin Flatpack



43
4-Pin Surface Mount



14
6-Pin DIP



22
8-Pin Surface Mount

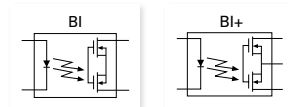


62
6-Pin Flatpack (8-Pin Body)



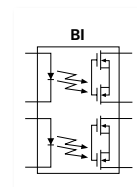
17
8-Pin SOP

1-Form-B Relays: Single-Pole



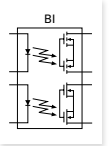
Part Number	Relay Type	Blocking Voltage	Load Current	On Resistance	Input Control Current	Switching Speeds t_{on}/t_{off}	Isolation Voltage	Off-State Leakage	Package Type
		V_P	mA	Ω	mA	ms	V_{RMS}	μA	
CPC1106N	BI	60	75	10	0.5	10 / 10	1500	1	10
CPC1114N	BI	60	400	2	2	2 / 5	1500	1	10
CPC1117N	BI	60	150	16	1	10 / 10	1500	1	10
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
CPC1333	BI	350	130	30	2	2 / 3	5000	1	42, 43
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
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
PLB150	BI+	250	250	7	5	1 / 2.5	3750	1	12, 14
PLB171	BI	800	80	55	2	5 / 5	5000	1	62
PLB190	BI+	400	130	25	2	1 / 2.5	5000	1	12, 14
XCB170	BI+	350	100	50	5	5 / 5	3750	1	12, 14

1-Form-B Relays: Dual Single-Pole



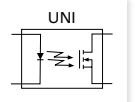
Part Number	Relay Type	Blocking Voltage	Load Current	On Resistance	Input Control Current	Switching Speeds t_{on}/t_{off}	Isolation Voltage	Off-State Leakage	Package Type
		V_P	mA	Ω	mA	ms	V_{RMS}	μA	
CPC2125N	BI	400	100	35	2	2 / 2	1500	5	17
LBB110	BI	350	120	35	5	3 / 3	3750	1	20, 21, 22
LBB120	BI	250	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

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



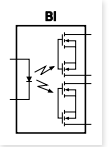
Part Number	Relay Type	Blocking Voltage	Load Current	On Resistance	Input Control Current	Switching Speeds t_{on}/t_{off}	Isolation Voltage	Off-State Leakage	Package Type
		V_P	mA	Ω	mA	ms	V_{RMS}	μA	
CPC2317N	BI	60	120	16	1	3 / 3	1500	1 / 1	17
CPC2330N	BI	350	120	30	2	3 / 3	1500	1 / 5	17
LBA110	BI	350	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
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
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
LBA710	BI	60	1000	0.6	2	5 / 5	3750	1 / 1	20, 22
LBA716	BI	60	1000	0.4	2	5 / 5	3750	1 / 1	20, 22
PBA150	BI	250	250	7	5	2.5 / 2.5	3750	1 / 1	20, 22

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



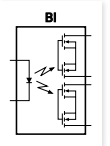
Part Number	Relay Type	Blocking Voltage	Load Current	On Resistance	Input Control Current	Switching Speeds t_{on}/t_{off}	Isolation Voltage	Off-State Leakage	Package Type
		V_P	mA	Ω	mA	ms	V_{RMS}	μA	
CPC1002N	UNI	60	700	0.55	2	5 / 2	1500	1 / 1	10
CPC1004N	UNI	100	300	4	2	3 / 1	1500	1 / 1	10

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



Part Number	Relay Type	Blocking Voltage	Load Current	On Resistance	Input Control Current	Switching Speeds t_{on}/t_{off}	Isolation Voltage	Off-State Leakage	Package Type
		V_P	mA	Ω	mA	ms	V_{RMS}	μA	
LCA210	BI	350	85	35	8	3 / 3	3750	1 / 1	20, 22
LCA210L	BI	350	85	35	8	4 / 4	3750	1 / 1	20, 22
LCA220	BI	250	120	20	10	5 / 5	3750	1 / 1	20, 22

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



Part Number	Relay Type	Blocking Voltage	Load Current	On Resistance	Input Control Current	Switching Speeds t_{on}/t_{off}	Isolation Voltage	Off-State Leakage	Package Type
		V_P	mA	Ω	mA	ms	V_{RMS}	μA	
LCC110	BI	350	120	35	8	4 / 4	3750	1 / 1	20, 21, 22
LCC120	BI	250	170	20	10	5 / 5	3750	1 / 1	20, 22

Current Limiting SSRs with Voltage Triggered Shutdown & Thermal Management

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 a traditional thermal management feature that deactivates the SSR outputs if 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.

Features & Benefits

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

Applications

- Telephony hook switches
- Electronic switching
- Security
- Industrial controls



10
4-Pin SOP



17
8-Pin SOP



22
8-Pin Surface Mount



12
6-Pin Surface Mount



20
8-Pin DIP



32
16-Pin SOIC



14
6-Pin DIP



21
8-Pin Flatpack



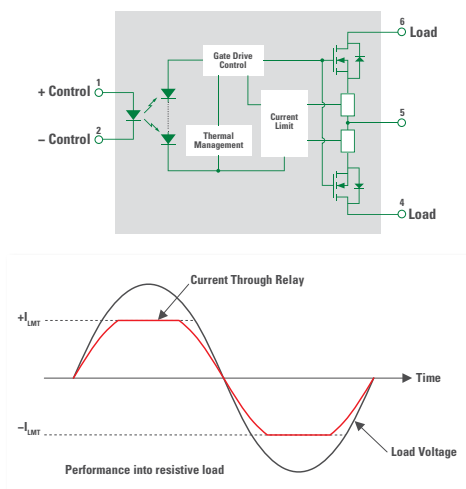
36
Power SIP

Part Number	Blocking Voltage (V _P)	Input Control Current (mA)	On-Resistance (Max)		Load Current (Max)		Current Limit (Max)		VTS ¹ Threshold (V _{TH}) (V)	Switching Speed t _{on} / t _{off} (ms)	Isolation Voltage (V _{RMS})	Package Type
			Configuration		Configuration		Configuration					
			DC	AC	DC	AC	DC	AC				
			(Ω)	(Ω)	(mA)	(mA)	(mA _P)	(mA _P)				
CPC1510	250	2	3.75	15	350	200	920	450	–	2 / 2	3750	12, 14
CPC1511	230	2.5	–	4	–	450	–	1400	–	4 / 2	3750	36
CPC1540	350	2	6.75	25	250	120	570	285	100 ¹	2 / 2	3750	12, 14
CPC1560	60	1.1	1.4	5.6	600	300	1500	900	–	0.1 / 0.4	3750	20, 22
CPC1561	60	2.5	–	0.245	–	1000 ²	–	3000	–	2.5 / 0.5	3750	32
CPC1563	600	2	11.75	35	250	120	570	285	100 ¹	2 / 2	3750	12, 14
CPC1593	600	2	11.75	35	250	120	570	285	175 ¹	2 / 2	3750	12, 14

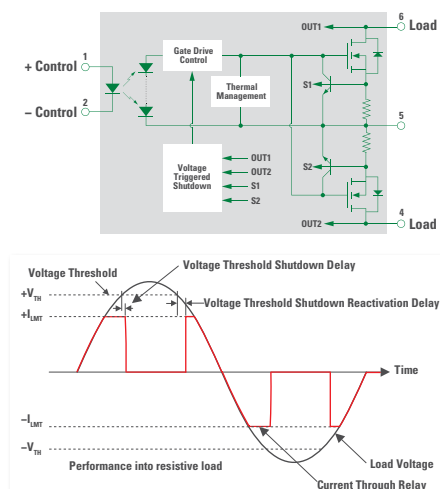
¹ Deactivates the switch when the load voltage exceeds the V_{TH} threshold while the switch is in current limit.

² Load current rating at up to 60 °C.

With I_{LIMIT} Without VTS



With I_{LIMIT} With VTS



CPC2501M

Self-Actuating, Normally Closed, 60 V, 1.84 A Solid-state Relay

The CPC2501M incorporates a normally closed (1-Form-B) solid-state relay switch with an integrated circuit specifically designed to control and manage the relay state based upon the applied voltage.

When configured for video doorbell applications, the CPC2501M becomes a self-actuating solid state relay to provide the ringing chime bypass function necessary to ensure proper video and chime operation. In addition to superior performance over traditional discrete video doorbell applications, the CPC2501M provides reduced BOM costs and printed circuit board real estate demands through integration.

Features & Benefits

- 1-Form-B (Normally closed) relay
- Internal control circuitry
 - Self actuating
 - Fault protection timer
- 600 mΩ Maximum On-resistance at 25 °C
- 60V peak AC or DC load voltage
- Load Current
 - 1.84 A_{RMS} Continuous
 - 5 A Peak
- Fast Turn-on: 170 μs maximum
- Small (6 × 6) mm thermally enhanced QFN package

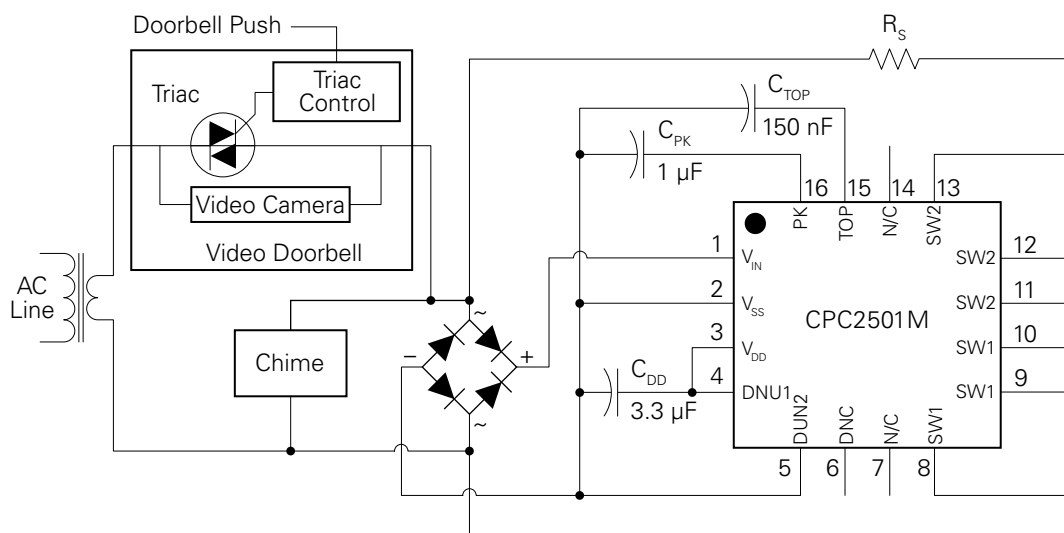
Applications

- Door chime bypass
 - Derives power from standard 2-wire chime supply.
 - System BOM savings and reduced PCB demands.
- Building Automation
- Internet of Things (IoT)
- Security
- Voltage controlled relay

Application Example: CPC2501M Typical Video Doorbell Application Circuit

Growing concerns about household safety and personal security fuel the popularity of video doorbell monitoring devices worldwide. CPC2501M is a self-actuating Voltage Controlled, Normally Closed, 60 V, 1.84 A_{RMS} Self-actuating Solid-state Relay IC which provides a bypass function to an installed doorbell chime to enable proper video and chime operation with the existing wire infrastructure. It derives its power from the standard 2-wire supply.

Since the CPC2501M is offered in a small (6 × 6) mm, 16-pin QFN package, it enables ultra-compact designs that can be easily integrated into numerous doorbell chimes with minimal design effort.



QFN-16

CPC1601M

Energy Harvesting, Normally Open, 60 V, 2 A Solid-state Latching Relay

The CPC1601M is a non-isolated, low operating current, 1-Form-A solid state latching relay, available in a small $3 \times 3 \text{ mm}^2$ DFN package. The relay can obtain operating power from the open-circuit load or system power supply. If powered from the load, the relay takes zero power from the system supply, thus helping to extend battery life. When power is supplied by the load, the relay opens periodically to obtain power via the open-circuit load voltage. In most applications this interruption is transparent to the load.

Additionally, the CPC1601M provides a power output pin that can supply external circuits with a maximum of 10 mW of power. The CPC1601M can sense whether it is powered by the load or by the system power supply automatically by monitoring the HV_{CC} input pin. The load-powered mode of operation applies to an AC source, such as a $24V_{AC}$ transformer secondary voltage.

Galvanic isolation can be achieved with the addition of a few passive components.

Problem/Solution

The CPC1601M is a non-isolated, low operating current, 1-Form-A solid state latching relay. The relay can obtain operating power from the open-circuit load or system power thus helping to extend battery life. The CPC1601M accepts system input supply voltage: 3 V–5.5 V and logic inputs are compatible with standard TTL and CMOS levels and can interface directly with many controlling devices.

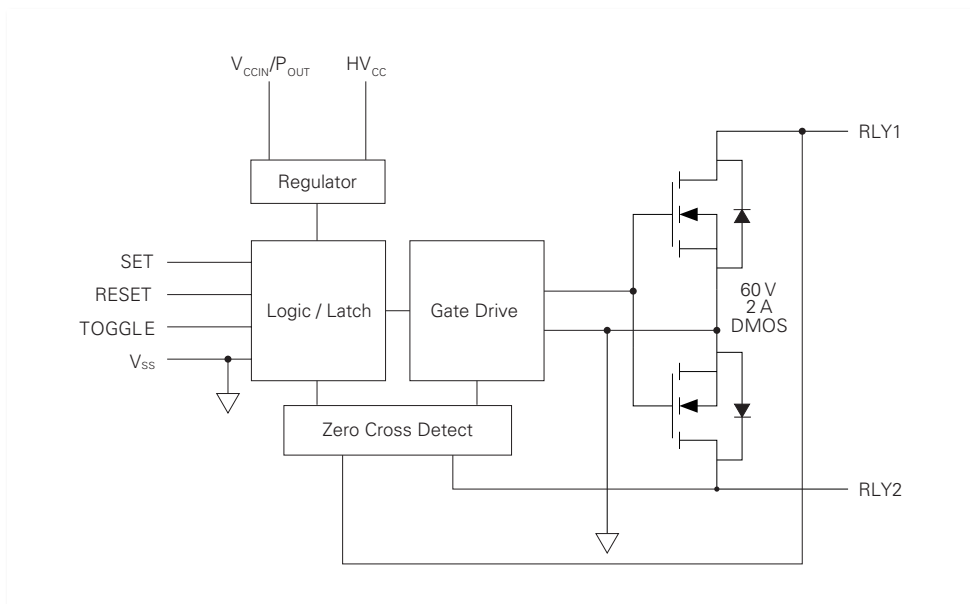
The CPC1601M is offered in DFN-8 package on tape and reel.

Features & Benefits

- Small $3 \times 3 \text{ mm}^2$ DFN package
- V_{CCIN}/P_{OUT} pin Input Current $< 1 \mu\text{A}$
- Single pulse operation On/Off
- Low on-resistance (308 mW typical)
- Load Connect RYL1 / RLY2: 60 VP AC or DC operation
- 2 A continuous load capability AC or DC
- Set/Reset or Toggle operation
- Latching Form-A switch output
- Supply Input Power voltage: 3 V–5.5 V
- Zero current from system power supply when load biased power mode (load-powered) is used
- Load-harvesting power pin for powering external circuitry up to 10 mW
- Zero Cross output load switching in load-powered mode
- No thermostat 'C' lead required
- External Galvanic Isolation capable
- Compatible with 24 Vac Transformers used in HVAC systems
- Can directly be controlled from microcontrollers
- Lower EMI emissions in zero cross load-power mode operation
- Excellent Power Handling Capability 2 Watts

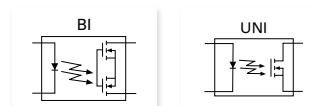
Applications

- Security systems
- Thermostats
- Fire alarm panels
- Electronic switching
- Data acquisition
- Metering
- Industrial controls
- Instrumentation
- Security
- Building automation



* An evaluation board is available upon request

1-Form-A Power Relays: Single-Pole, Bidirectional



Part Number	Relay Type	Blocking Voltage	Load Current			On Resistance	Input Control Current	Switching Speeds	Isolation Voltage	Off-State Leakage	Package Type
			Free Air	5 °C/W Heat Sink	T _C = 25 °C			t _{on} / t _{off}			
		V _P	A _{rms}	A _{rms}	A _{rms}	Ω	mA	ms	V _{RMS}	μA	
1-Form-A Power Relays: Single-Pole. Bidirectional											
CPC1906Y	BI	60	2	–	–	0.30	10	10 / 5	2500	1	36
CPC1907B	BI	60	6	–	–	0.06	5	5 / 1	5000	1	66
CPC1908J	BI	60	3.5	8.5	15	0.30	10	20 / 5	2500	1	29
CPC1909J	BI	60	6.5	15	15	0.10	10	25 / 10	2500	1	37
CPC1916Y	BI	100	2.5	–	–	0.34	10	5 / 3	2500	1	36
CPC1918J	BI	100	5.25	13	15	0.10	10	25 / 10	2500	1	37
CPC1926Y	BI	250	0.7	–	–	1.40	10	10 / 10	2500	1	36
CPC1927J	BI	250	2.7	6.7	15	0.20	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
CPC1973Y	BI	400	0.35	–	–	5.00	10	5 / 3	2500	1	36
CPC1977J	BI	600	1.25	3.1	8	1.00	10	20 / 5	2500	1	29
CPC1978J	BI	800	0.75	1.85	7.25	2.30	10	20 / 5	2500	1	29
CPC1979J	BI	600	1.4	3.5	14.5	0.75	10	25 / 5	2500	1	37
CPC1981Y	BI	1000	0.18	–	–	18.00	10	10 / 5	2500	1	36
CPC1983B	BI	600	0.5	–	–	6.00	5	5 / 2	5000	1	66
CPC1983Y	BI	600	0.5	–	–	6.00	5	5 / 2	2500	1	36
CPC1983YE	BI	600	0.5	–	–	6.00	5	5 / 2	4000	1	36
CPC1984Y	BI	600	1	–	–	0.66	5	10 / 2	4000	1	36
CPC1986J	BI	1000	0.65	1.6	6.5	3.00	10	20 / 5	2500	1	29
CPC1988J	BI	1000	0.9	2.25	9.4	2.50	10	20 / 5	2500	1	37
Dual 1-Form-A Power Relay: Bidirectional											
CPC2907B	BI	60	2	–	–	0.15	5	2.5 / 0.25	4000	1	66
1-Form-A Power Relays: Single-Pole. Unidirectional											
CPC1706Y	UNI	60	4	–	–	0.09	5	5 / 2	2500	1	36
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	0.08	10	20 / 5	2500	1	37
CPC1726Y	UNI	250	1	–	–	0.75	10	5 / 2	2500	1	36
CPC1727J	UNI	250	3.4	8.6	20	0.09	10	20 / 5	2500	1	37
CPC1777J	UNI	600	1.5	4.6	15	0.50	10	20 / 5	2500	1	29
CPC1779J	UNI	600	1.65	4.12	15	0.40	10	20 / 5	2500	1	37
CPC1786J	UNI	1000	0.65	1.75	6.9	2.00	10	20 / 5	2500	1	29
CPC1788J	UNI	1000	1	2.45	10.3	1.25	10	20 / 5	2500	1	37
1-Form-B Power Relay: Single-Pole. Unidirectional											
CPC1705Y	UNI	60	3.25	–	–	0.09	5	2 / 12	2500	1	36



29
i4-PAC



36
Power SIP



37
ISOPLUS-264



66
Power SOIC

What is Direct Copper Bonding (DCB)?

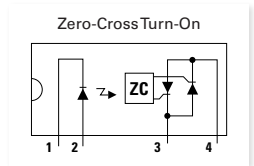
ISOPLUS-264™ and i4-PAC packages utilize DCB ceramic substrates instead of the usual copper lead frame. DCB stands for Direct Copper Bonding and denotes a process in which copper and a ceramic material are fused together, at high temperatures.

The design of these patented packages is revolutionary: The silicon chips are soft soldered onto the DCB ceramic substrate which provides both, high isolation capability of 2500V_{RMS} with an unbeatable low thermal resistance compared to conventional, externally mounted isolation materials.



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

The OptoMOS® line of power products uses dual power-SCR outputs to produce an alternative to optocoupler and TRIAC circuits. AC Power Switches provide a blocking voltage of up to 800V_p. In addition, tightly controlled zero-cross circuitry ensures the switching of AC loads while minimizing the generation of transients. The input and output circuits are optically coupled to provide 3750 V_{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 in which electromagnetic interference would disrupt the operation of electromechanical relays.



Part Number	Blocking Voltage	Load Current	Input Control Current	Operating Frequency Range	Isolation Voltage	Fig. No.
	V _p	A	mA	Hz	V _{RMS}	
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 ¹	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

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



2
4-Pin DIP (16-Pin Body)



15
6-Pin Power DIP



22
8-Pin Surface Mount



12
6-Pin Surface Mount



16
6-Pin Power DIP SMD



23
4-Pin SIP (8-Pin Body)



14
6-Pin DIP



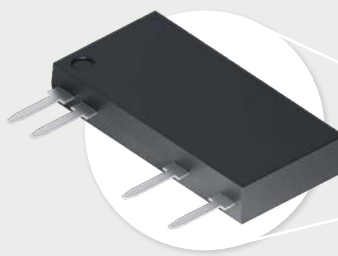
20
8-Pin DIP

How is the OptoMOS® AC Power Switch Used Here?

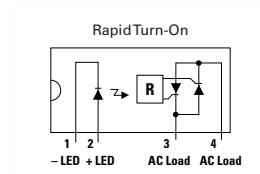
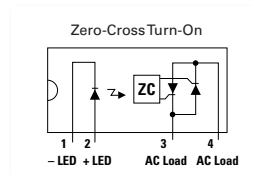
Smart Home

OptoMOS® AC Power Switches are ideal for switching smaller loads in all kind of applications including home automation or smart home. The input and output circuits are optically coupled to provide up to 5000V_{RMS} of galvanic isolation and noise immunity between control and load circuits. The product line includes devices with blocking voltages of up to 800V_{AC} peak.

Long life and environmental integrity make these power switches ideal for controlling a variety of AC load circuits.



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



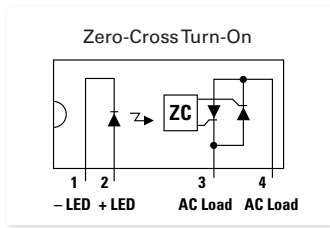
Part Number	Blocking Voltage	Load Current			Input Control Current	Operating Frequency Range	Isolation Voltage	Fig. No.
		No Heat Sink	with 5 °C/W Heat Sink	$T_C = 25^\circ\text{C}$				
	V_P	A_{rms}	A_{rms}	A_{rms}	mA	Hz	V_{RMS}	
CPC1964B	800	1.5	—	—	5	20 – 500	5000	66
CPC1964BX6 ¹	600	1.5	—	—	5	20 – 500	5000	66
CPC1966	600	3	—	—	5	20 – 500	3750	36
CPC1966B	800	3	—	—	5	20 – 500	5000	66
CPC1966YX6 ¹	600	3	—	—	5	20 – 500	3750	36
CPC1976	600	2	—	—	5	20 – 500	3750	36
CPC1976YX6 ¹	600	2	—	—	5	20 – 500	3750	36
CPC1998J	800	5	20	50	5	20 – 500	2500	29
CPC40055ST	800	5	20	40	5	20 – 500	2500	64

¹ Rapid turn-on (non-zero-cross)

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

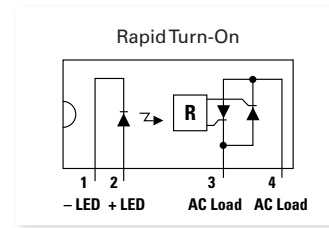
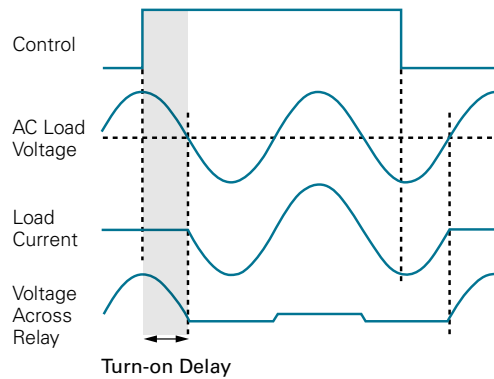


AC-Power Switches: Zero-Cross vs. Rapid Turn-on

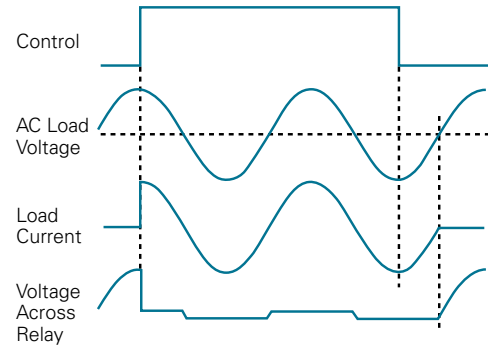


Turns the load on as soon as the ac load voltage crosses 0V

- Minimizes the turn-on switching transient



Turns the load rapidly on independent of load voltage phase angle



CPC7514: 320 V Quad High Voltage Isolated Analog Switch Array

The CPC7514 Quad High Voltage (HV) isolated Analog Switch Array builds upon our 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 economic package. Designed to provide flexible single-ended or differential access to high voltage networks, the CPC7514 high voltage array 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.

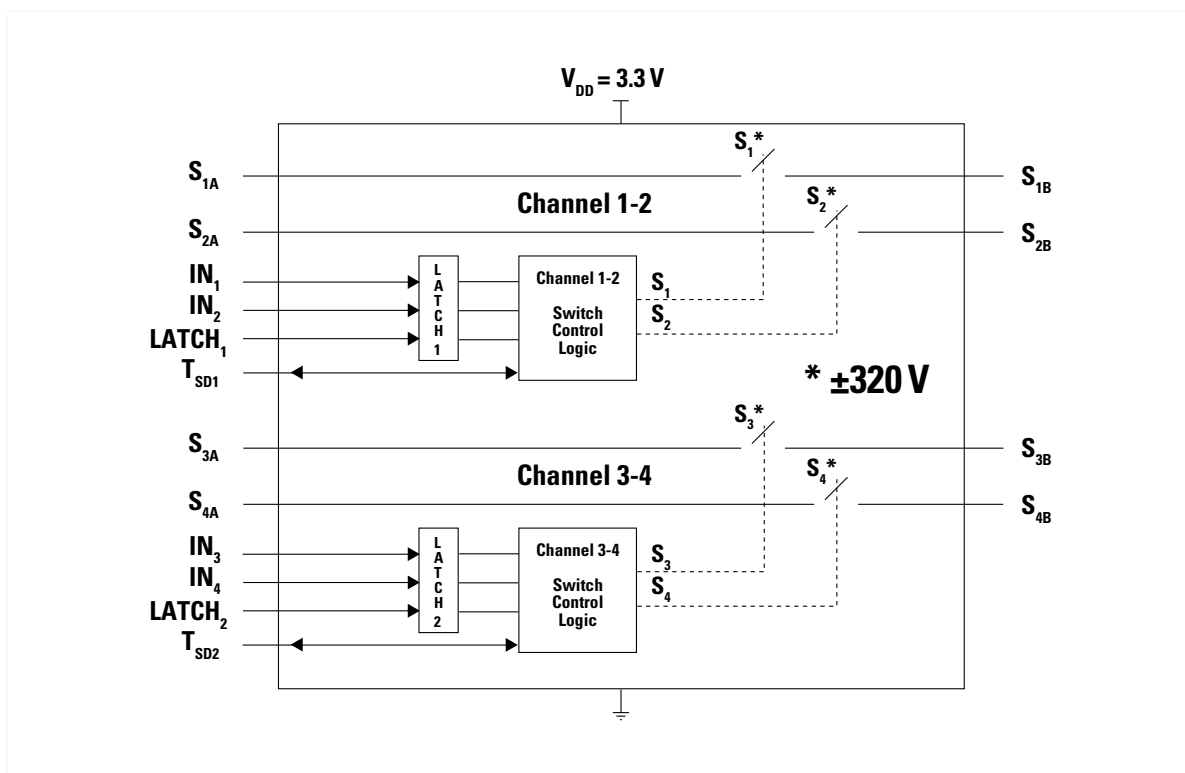
Features & Benefits

- Provides single-ended or differential access to high voltage networks
- Self-biasing – no external high-voltage supplies required
- Low, matched R_{ON}
- Switch voltage up to $\pm 320V_p$
- 320V logic-input-to-switch output isolation
- 110 dB switch-to-switch isolation at 5 kHz
- Flexible switch configurations
- Smart logic for power-up/hot-plug state control
- 3.3V operation with very low power consumption

Applications:

- Motor Controls / Drives
- Stepper Motor Drives
- DC/DC-Converters
- AC/DC-Inverters
- Robotics
- Cordless Power Tools
- Drones

CPC7514



20-Pin SOIC

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

The CPC7512 dual 1-Form-A high-voltage, high-frequency, shunt-isolated analog switch builds upon the design and fabrication expertise for industrial applications by Littelfuse. This monolithic solid state device provides the switching functionality of two normally open (1-Form-A) solid state relays for high frequency applications in one small economical package. Both switches incorporate shunt isolation by means of a T-switch compensation technique to minimize series capacitance through the open off-state switches for improved off-state isolation over frequency. Designed to provide flexible single-ended or differential access to high voltage networks, the CPC7512 is functionally configured as two independent logical switches.

The self-biasing switches do not require external high-voltage supplies for proper operation. An integrated thermal shutdown feature provides not only enhanced protection for devices connected to high voltage networks up to +320V, but also an external signal to indicate the device is shut down.

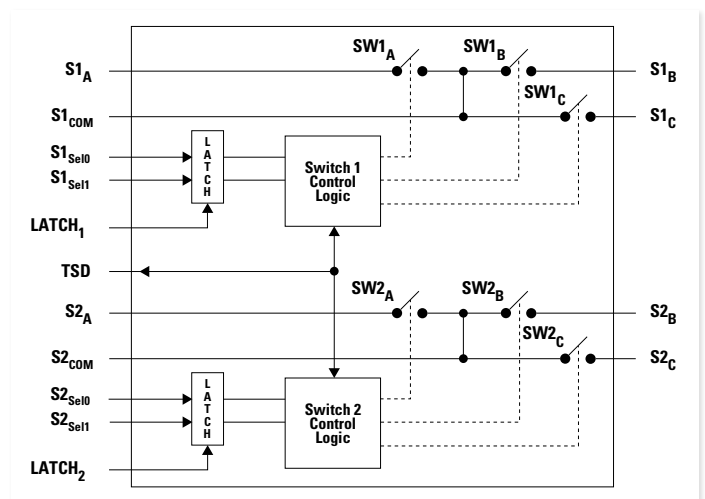
Features & Benefits

- Provides single-ended or differential access to high voltage networks
- Self-biasing: no external high voltage supplies required
- Low, matched R_{ON}
- Guaranteed break-before-make (BBM)
- Switch voltage up to $\pm 320V_P$
- 60 dB off-isolation at 1 MHz
- 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

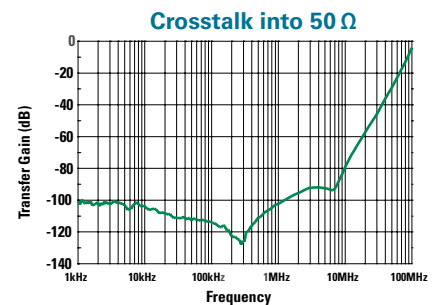
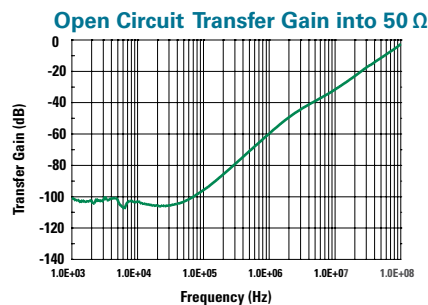
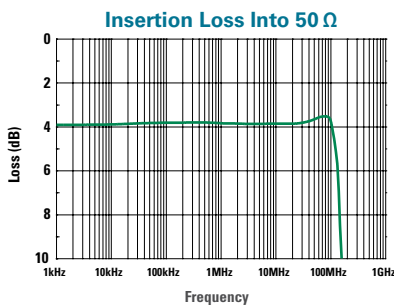
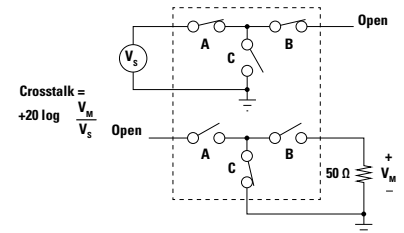
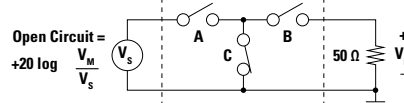
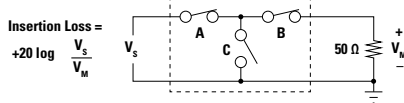
Applications:

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

CPC7512



Performance Data



20-Pin SOIC

The CPC1580 and CPC1590 devices are MOSFET Gate Drivers that require no external power supply: They regulate the input voltage drawn from the load (up to 65V or 200V, respectively), down to 12.2V for internal use. They are specifically designed for low duty cycle switching applications that drive up to 4 nF of gate capacitance.

Features & Benefits

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

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

Part Number	Input Control	Gate Voltage	Blocking Voltage	Regulated Capacitor Voltage	Switching Speeds	Isolation Voltage	Package Type
	Current	@ I _F = 5 mA		V _{CAP(max)}	t _{on} /t _{off}		
	mA	V _G	V _P	V	μs	V _{RMS}	
CPC1580	2.5	7.5 – 12	65	V _{DS} – 0.2	40 / 400	3750	21
CPC1590	2.5	7.5 – 12	200	16	40 / 400	3750	21



Optically Isolated Photovoltaic Gate Drivers

These single and dual optically isolated photodiode arrays, which can produce an open-circuit voltage of up to 13.3V, are well suited for use in discrete solid state relay designs. FDA117 is available in 4-pin DIP and 4-pin surface-mount packages, FDA215 and FDA217 are available in 8-pin DIP and 8-pin surface-mount packages.

Features

- Isolated 5.5V to 13.3V photovoltaic output
- Floating outputs for parallel or series configuration

Applications

- MOSFET drivers
- Isolated floating power sources

Part Number	Input Control Current	Nominal Open-Circuit Voltage V_{OC}	Nominal Short-Circuit Current I_{SC}	Switching Speeds t_{on}/t_{off}	Isolation Voltage V_{RMS}	Package Type
	mA	V	μA	ms		
FDA117	5	13.3	9.1	1 / 0.5	5000	42, 43
FDA215	5	5.5	2.5	5 / 5	3750	20, 22
FDA217	5	11.75	4.5	2 / 0.5	3750	20, 22



20
8-Pin DIP



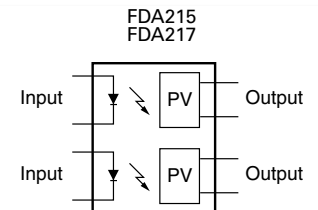
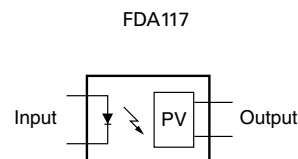
22
8-Pin Surface Mount



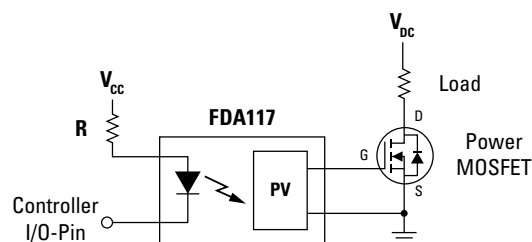
42
4-Pin DIP



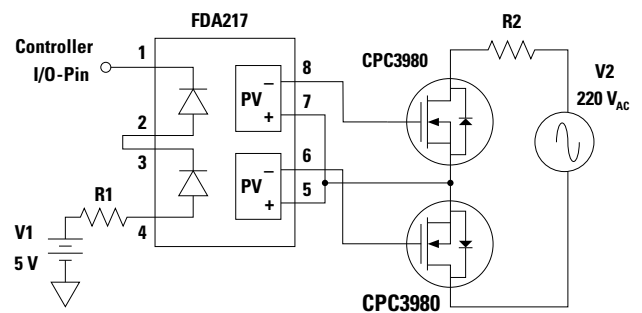
43
4-Pin Surface Mount



FDA117 drives one enhancement mode MOSFET to form a galvanically isolated, unidirectional, normally open switch



FDA217 used with CPC3980 MOSFETs to create Normally Closed Solid-state Relay



Low-Side Gate Drivers

Littelfuse offers powerful families of ultra-fast Low-Side Gate Drivers for MOSFETs and IGBTs, with a large mix of logic configurations, packaging, and drive current capabilities. Five of these devices are AEC-Q100 qualified.

Single-output and dual-output low-side driver ICs include selectable options for logic combinations. The range of current ratings offered is the broadest available, extending to 30A peak, which is the **LARGEST PEAK DRIVE CURRENT** capability for an integrated driver on the market.

In all series devices, internal circuitry eliminates cross conduction and current “shoot-through,” and the driver is virtually immune to latch up.

Features & Benefits

- 1.5A to 30A peak source sink drive current
- Wide operating voltage range up to 35V
- -40°C to +125°C extended operating temperature range
- Logic input withstands negative swing of up to -5V
- Dual drivers have matched rise and fall times
- Low propagation delay time

Applications

- Efficient power MOSFET and IGBT switching
- Switch mode power supplies
- Motor controls
- DC-to-DC converters
- Class-D switching amplifiers
- Pulse transformer driver

Part Number	Output Type	I_{PEAK} $T_C = 25^\circ C$	Output Resistance	Logic Configuration	Enable Function	Under-Voltage Lockout	Package Type
		A_P	Ω			V	
IX4426	DUAL	1.5	8	I	—	—	53, 54, 56
IX4427	DUAL	1.5	8	N	—	—	53, 54, 56
IX4428	DUAL	1.5	8	F	—	—	54, 56
IX4310T	SINGLE	2	3	D	—	$V_{CC} < 4.2$	52
IXD_602	DUAL	2	4	F, I, N	—	—	20, 53, 54, 56
IXD_604	DUAL	4	2.5	F, I, N, D	•	—	20, 53, 54, 56
IX4340	DUAL	5	1.5	D	•	$V_{CC} < 3.8$	53, 54, 92
IX4341	DUAL	5	1.5	G	•	3.8	54, 82, 92
IX4342	DUAL	5	1.5	H	•	3.8	54, 82, 92
IXD_609	SINGLE	9	1	I, N, D	•	—	20, 53, 54, 56, 57, 58
IXD_614	SINGLE	14	0.8	I, N, D	•	—	20, 53, 57, 58
IXD_630	SINGLE	30	0.4	I, N, D	•	$V_{CC} < 12.5$	57, 58
IXD_630M	SINGLE	30	0.4	I, N, D	•	$V_{CC} < 9$	57, 58



20
8-Pin DIP



54
8-Pin SOIC



58
5-Pin TO-263



52
SOT23-5



56
8-Pin DFN



92
8-Pin MSOP



53
8-Pin SOIC-EP



57
5-Pin TO-220

AEC-Q100-Qualified Low-Side Gate Drivers

Part Number	Output Type	$I_{PEAK} T_C = 25\text{ }^{\circ}\text{C}$	Output Resistance	Logic Configuration	Enable Function	Under-Voltage Lockout	Package Type
		A_P	Ω			V	
IXD_604SI	DUAL	4	2.5	F, I, N, D	•	–	53
IXD_604SIA	DUAL	4	2.5	F, I, N, D	•	–	54
IX4340NE	DUAL	5	1.5	D	•	$V_{CC} < 3.8$	53
IXD_609SI	SINGLE	9	1	I, N, D	•	–	53
IXD_614SI	SINGLE	14	0.8	I, N, D	•	–	53

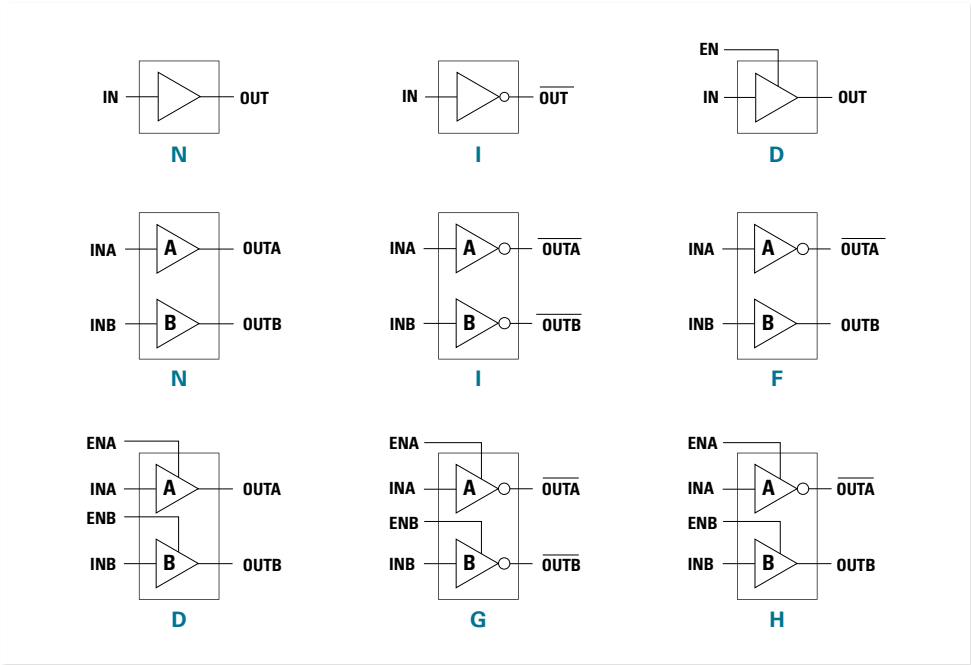


53
8-Pin SOIC-EP



54
8-Pin SOIC

Logic Configurations



How is the Gate Driver Used Here?

Off-board EV Charger

High speed Gate Driver ICs are efficiently driving Power-MOSFET or IGBT devices. The gate drivers convert the controller's PWM signals into gate-signals compatible to Si-/SiC-MOSFETs or IGBTs, providing an optimal power semiconductor control while minimizing power losses. Built-in protection features protect both, the gate driver as well as the power semiconductors.

Typical applications are all kind of chargers and power inverters including on-board and off-board chargers for electrical vehicles as shown in the illustration as one example out of many.



IX4351NE and IX4352NE Low-Side Gate Drivers

IX4351NE and IX4352NE are designed specifically to drive SiC MOSFETs and high-power IGBTs. Separate 9A source and sink outputs allow for tailored turn-on and turn-off timing while minimizing switching losses. An internal negative charge regulator provides a selectable negative gate drive bias for improved dV/dt immunity and faster turn-off.

Desaturation detection circuitry senses an overcurrent condition of the SiC MOSFET or IGBT and initiates a soft turn-off, thus preventing a potentially damaging dv/dt event. The non-inverting logic input, IN, is TTL and CMOS compatible; internal level shifters provide the necessary bias to accommodate negative gate drive bias voltages. Additional protection features include UVLO detection and thermal shutdown. An open drain FAULT output signals a fault condition to the microcontroller.

Both drivers are rated for an operational temperature range of -40°C to $+125^{\circ}\text{C}$ and are available in a thermally enhanced 16-pin narrow SOIC package.

The IX4351NE is available for existing designs while the IX4352NE should be used on all new designs.

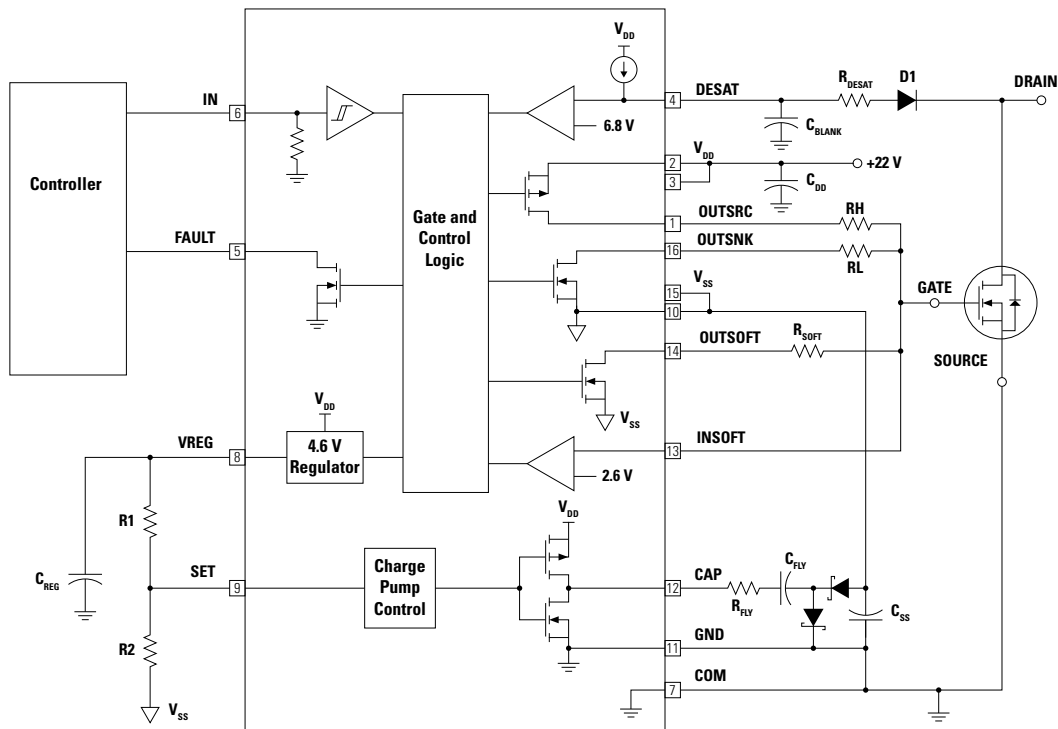
Features & Benefits

- Separate 9A peak source and sink outputs
- V_{DD} input supply voltage range: +13V to +25V
- Adjustable gate drive voltage range: -10V to +25V
- Internal logic level shifters
- Desaturation detection with soft shutdown sink driver
- Under Voltage Lockout (UVLO)
- Thermal shutdown
- Open drain FAULT output
- TTL and CMOS compatible input

Applications

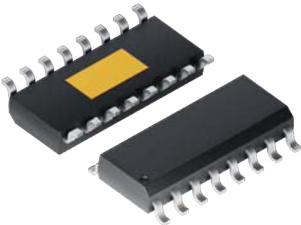
- Driving SiC MOSFETs and IGBTs
- On-board charger and DC charging station
- AC/DC and DC/DC converters
- Industrial power inverters
- Motor controllers
- Industrial power inverters
- AEC-Q100 qualified – IX4351NEAU

Typical IX4352NE Application Circuit



Low-Side Driver With Charge Pump

Part Number	Drive Current (A _{PEAK})	Maximum Output Resistance Source/Sink (Ω)	Logic Configurations	Enable Function	Under Voltage Lockout Maximum Threshold (V)	Internal Charge Pump Generates Selectable Negative Drive Voltage	Internal Logic Level Shifter	Separate Sink and Source Output Pins	Desaturation Detection with Soft Shutdown	Thermal Shutdown	Open-Drain Fault Output	AEC-Q100 Qualified
IX4352NE	9	2 / 1.5	Non-Inverting	No	10	•	•	•	•	•	•	
IX4352NEAU	9	2 / 1.5	Non-Inverting	No	10	•	•	•	•	•	•	•



IX4352NE and IX4352NEAU
16-Pin narrow SOIC exposed pad package

LEB-0023 IX4352NE Gate Driver Evaluation Board

The evaluation board is part of the Littelfuse gate driver evaluation platform for testing gate drivers with various power semiconductors. Pin headers enable easy integration into existing test setups LEB-0023 evaluation boards are intended to be evaluated using LEB-0025 gate driver evaluation main board, in low-side, high-side, or half-bridge configuration and are available on request.



High-Side and Low-Side Gate Driver ICs

High-side and low-side drivers control two N-Channel MOSFETs or IGBTs in fast switching applications. The gate driver converts PWM input signals into gate signals compatible with MOSFETs or IGBTs, providing a robust and efficient power semiconductor control. An integrated bootstrap circuit generates a floating voltage that enables the high-side driver to operate up to $600V_{DC}$.

The drivers accept wide V_{DD} supply voltage as well as wide logic input voltage ranges. Various built-in protection features ensure the safe operation of the driver and the driven power semiconductors.

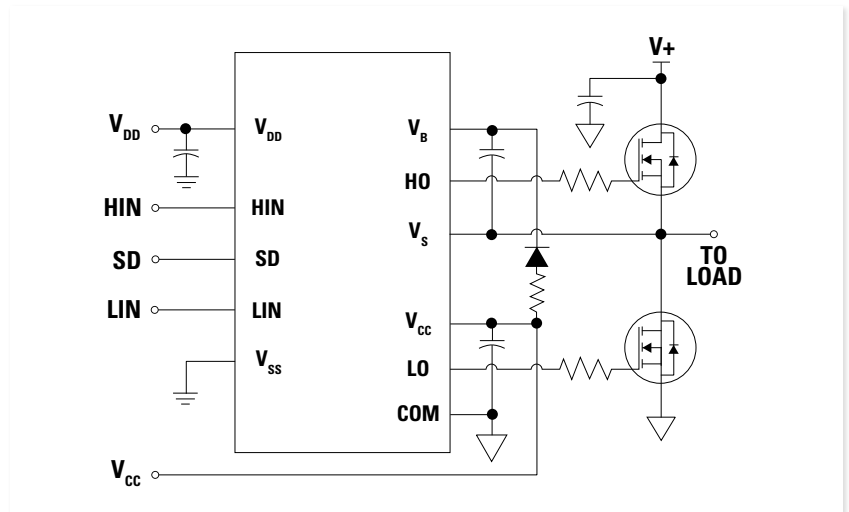
Features & Benefits

- High-side operation up to $600V_{DC}$
- Outputs tolerant to negative transients
- Supply voltage range: 10V to 20V
- Logic input voltage range: 3.3V to 20V
- Fixed or programmable deadtime
- Cycle-by-cycle edge-triggered shutdown circuitry
- Under Voltage Lockout (UVLO)
- Operating temperature range: $-40^{\circ}C$ to $+125^{\circ}C$

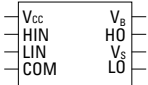
Applications

- DC-DC Converters
- AC-DC Inverters
- Motor Controls
 - Servo Motor Control
 - Pumps and Fans
- Class-D Power Amplifiers
- Uninterruptable Power Supplies (UPS)
- Welding
- Induction Cooking

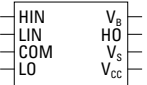
LF2110 and LF2113 Application Circuit



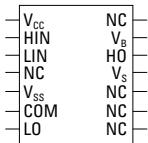
LF2101N
LF2106N



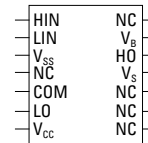
LF2181N
LF2190N



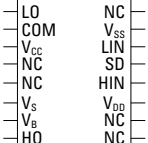
LF21064N



LF21814N
LF21904N



LF2110B
LF2113B



Part Number	Type / Description	Max. Offset Voltage	Typ. Sink/Source Peak Drive Current	Inputs	Deadtime	Propagation Delay t_{ON}/t_{OFF}	Rise/Fall Time t_r/t_f	Package
LF2101NTR	High-Side / Low-Side	600 V	600 mA / 290 mA	HIN / LIN	none	160 ns / 150 ns	70 ns / 35 ns	8-pin SOIC
LF2106NTR	High-Side / Low-Side	600 V	600 mA / 290 mA	HIN / LIN	none	220 ns / 200 ns	100 ns / 35 ns	8-pin SOIC
LF21064NTR	High-Side / Low-Side	600 V	600 mA / 290 mA	HIN / LIN	none	220 ns / 200 ns	100 ns / 35 ns	14-pin SOIC
LF2181NTR	High-Side / Low-Side	600 V	2.3 A / 1.9 A	HIN / LIN	none	180 ns / 220 ns	40 ns / 20 ns	8-pin SOIC
LF21814NTR	High-Side / Low-Side	600 V	2.3 A / 1.9 A	HIN / LIN	none	180 ns / 220 ns	40 ns / 20 ns	14-pin SOIC
LF2110BTR	High-Side / Low-Side	600 V	2.3 A / 1.9 A	HIN / LIN	none	105 ns / 94 ns	15 ns / 13 ns	16-pin SOIC
LF2113BTR	High-Side / Low-Side	600 V	2.3 A / 1.9 A	HIN / LIN	none	105 ns / 94 ns	15 ns / 13 ns	16-pin SOIC
LF2190NTR	High-Side / Low-Side	600 V	4.5 A / 4.5 A	HIN / LIN	none	140 ns / 140 ns	25 ns / 20 ns	8-pin SOIC
LF21904NTR	High-Side / Low-Side	600 V	4.5 A / 4.5 A	HIN / LIN	none	140 ns / 140 ns	25 ns / 20 ns	14-pin SOIC
IXD2012N	High-Side / Low-Side	200 V	1.9 A / 2.3 A	HIN / LIN	none	180 ns / 220 ns	30 ns / 20 ns	8-pin SOIC
IXD0579M	High-Side / Low-Side	100 V	1.5 A / 2.5 A	HIN / LIN / EN	none	65 ns / 58 ns	19 ns / 15 ns	10-pin TDFN



8-Pin SOIC



14-Pin SOIC



16-Pin SOIC

Half-Bridge Gate Driver ICs

Half-bridge gate drivers control two N-Channel MOSFETs or IGBTs in fast switching applications. The gate driver converts PWM input signals into gate-signals compatible to MOSFETs or IGBTs, providing a robust and efficient power semiconductor control. An integrated bootstrap circuit is generating a floating voltage with enables the high-side driver to operate up to 600V_{DC}.

The drivers accept wide V_{DD} supply voltage as well as wide logic input voltage ranges. Various built-in protection features ensure safe operation of the driver and the driven power semiconductors.

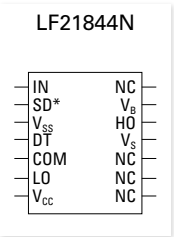
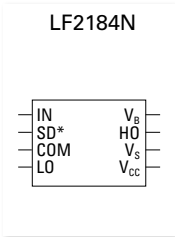
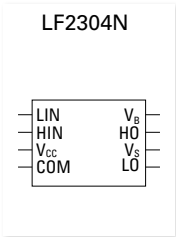
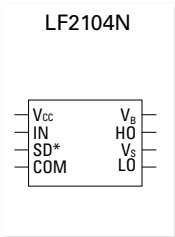
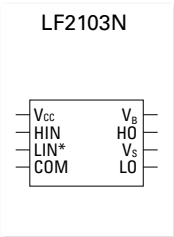
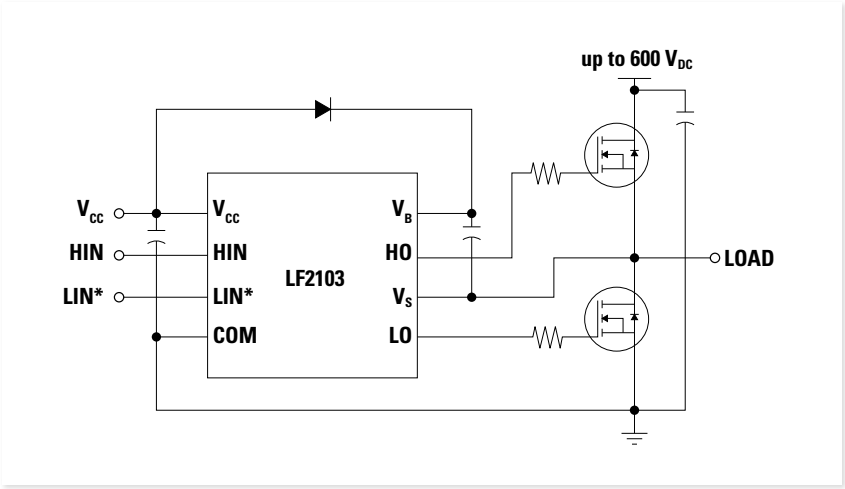
Features & Benefits

- High-side operation up to 600V_{DC}
- Outputs tolerant to negative transients
- Supply voltage range: 10V to 20V
- Logic input voltage range: 3.3V to 20V
- Fixed or programmable deadtime
- Cycle-by-cycle edge-triggered shutdown circuitry
- Under Voltage Lockout (UVLO)
- Operating temperature range: -40 °C to +125 °C

Applications:

- Motor Controls / Drives
- Stepper Motor Drives
- DC/DC-Converters
- AC/DC-Inverters
- Robotics
- Cordless Power Tools
- Drones

LF2103 Application Circuit



Part Number	Type / Description	Max. Offset Voltage	Typ. Sink/Source Peak Drive Current	Inputs	Deadtime	Propagation Delay t _{ON} /t _{OFF}	Rise/Fall Time t _r /t _f	Package
LF2103NTR	High-Side / Low-Side	600V	600 mA / 290 mA	HIN / LIN*	520 ns	680 ns / 150 ns	70 ns / 35 ns	8-pin SOIC
LF2104NTR	High-Side / Low-Side	600V	600 mA / 290 mA	IN / SD*	520 ns	680 ns / 150 ns	70 ns / 35 ns	8-pin SOIC
LF2304NTR	High-Side / Low-Side	600V	600 mA / 290 mA	HIN / LIN	100 ns	150 ns / 150 ns	70 ns / 35 ns	8-pin SOIC
LF2184NTR	High-Side / Low-Side	600V	2.3 A / 1.9 A	IN / SD*	400 ns	680 ns / 270 ns	40 ns / 20 ns	8-pin SOIC
LF21844NTR	High-Side / Low-Side	600V	2.3 A / 1.9 A	IN / SD*	400ns - 5µs	680 ns / 270 ns	40 ns / 20 ns	14-pin SOIC



8-Pin SOIC



14-Pin SOIC

3-Phase Half-Bridge Gate Driver ICs

Switching three pairs of N-Channel MOSFETs or IGBTs in 6-pack configurations is challenging in fast switching applications. 3-phase gate drivers convert PWM input signals into gate signals compatible to MOSFETs or IGBTs, providing robust and efficient power semiconductor control.

Integrated bootstrap circuits generate floating voltages, enabling the three high-side drivers to operate up to $600 V_{DC}$.

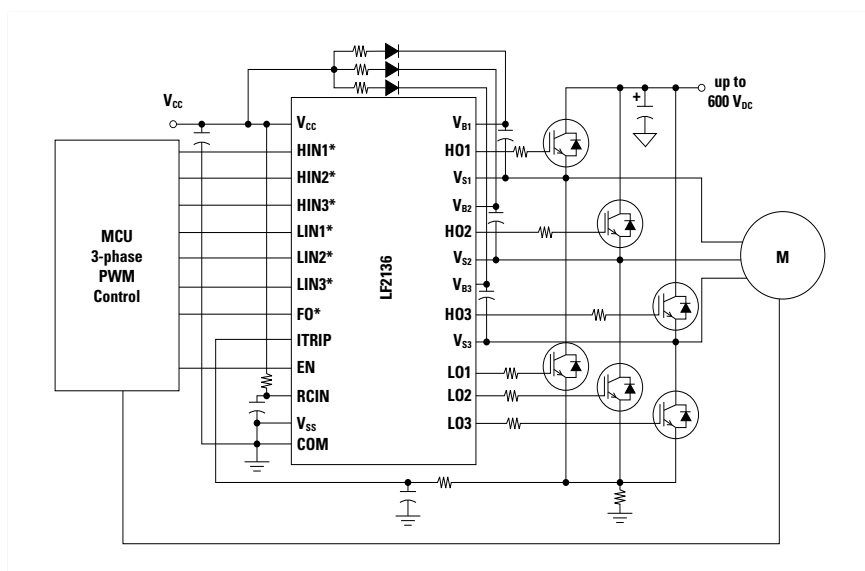
The drivers accept wide V_{DD} supply voltage as well as wide logic input voltage ranges. Various built-in protection features ensure the safe operation of the driver and the driven power semiconductors.

Features & Benefits

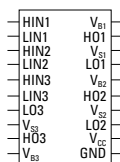
- High-side operation up to $600 V_{DC}$
- Outputs tolerant to negative transients
- Supply voltage range: 10 V to 20 V
- Logic input voltage range: 3.3 V to 20 V
- Cycle-by-cycle edge-triggered shutdown circuitry
- Under Voltage Lockout (UVLO)
- Matched propagation delay times
- Cross-conduction prevention logic
- Shoot-through protection logic
- Internal deadtime
- Operating temperature range: -40°C to $+125^{\circ}\text{C}$

Applications

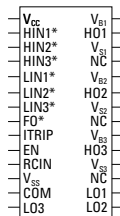
- 3-Phase Motor Drives
- White Goods
 - Pump Motors
 - Compressor Motors
- Fan Motors
- Air Conditioners
- Cordless Power Tools
- Robotics



LF2388B



LF2136B



Part Number	Max. Offset Voltage	Typ. Sink/Source Peak Drive Current	Inputs	Deadtime	Propagation Delay	Rise/Fall Time	Package
					t_{ON}/t_{OFF}	t_r/t_f	
LF2388BTR	600V	650 mA / 350 mA	HIN / LIN	270 ns	130 ns / 150 ns	50 ns / 35 ns	20-Pin SOIC
LF2136BTR	600V	350 mA / 200 mA	HIN* / LIN*	290 ns	330 ns / 330 ns	90 ns / 35 ns	28-Pin SOIC



20-Pin SOIC



28-Pin SOIC

IX3407B Isolated Driver

The IX3407B is a galvanically isolated, single-channel gate driver that provides a typical 7 A peak source and sink output current on separate output pins. Galvanic input to output isolation is provided by isolation technique where low voltage transmitter die and high voltage receiver die are isolated by integrated high voltage capacitors.

Logic inputs tolerant to input voltages up to V_{CC} employ TTL voltage thresholds to support a wide range of control logic devices powered by as low as 3.3 V.

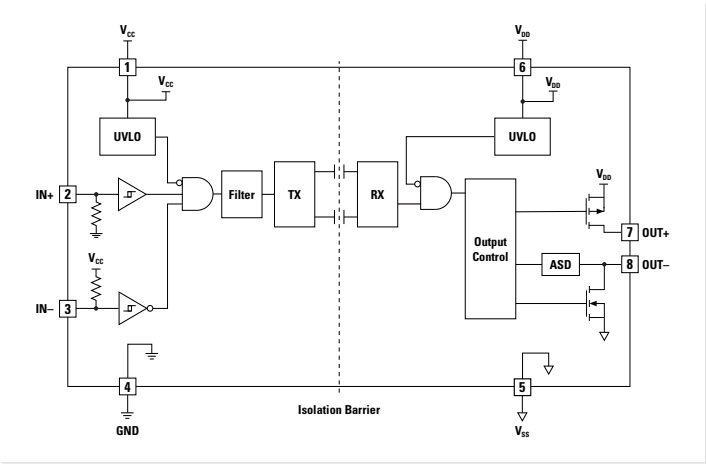
Protection is provided for both the input and output sides by Under Voltage Lockout (UVLO) circuitry. Additionally, an active shutdown feature protects the power transistor by pulling OUT– low in the event of an output side voltage supply loss.

Features

- Drives IGBTs, MOSFETs and SiC MOSFETs
- Separate Source and Sink Outputs
- Source and Sink typical 7 A peak Current
- 3.1 V to 17 V Input Side Operating Voltage Range
- 13 V to 35 V Output Side Operating Voltage Range
- Under Voltage Lockout (UVLO)
- 2500 V_{RMS} Input to Output Isolation

Applications

- AC and Brushless DC Motor Drives
- High Voltage DC/DC Converters and DC/AC Inverters
- Induction Heating Resonant Applications
- UPS Systems
- Welders
- Solar Inverters



Part Number	Max. Offset Voltage	Typ. Sink/Source Peak Drive Current	Inputs	Deadtime	Propagation Delay	Rise/Fall Time	Package
					T_{ON}/t_{OFF}	T_r/t_f	
IX3407B	17 V primary / 35 V secondary	7 A / 7 A typical peak	IN+ / IN–	N/A	154 ns typ T_{on} / 162 ns typ T_{off}	10 ns typ	SOIC-8
IX3407BTR	17 V primary / 35 V secondary	7 A / 7 A typical peak	IN+ / IN–	N/A	154 ns typ T_{on} / 162 ns typ T_{off}	10 ns typ	SOIC-8

Ordering Information

Part Number	Description
IX3407B	SOIC-8 (80/Tube)
IX3407BTR	SOIC-8 Tape and Reel (1000/Reel)



8-Pin SOIC

LEB-0022 Evaluation Board

The evaluation board is part of the Littelfuse gate driver evaluation platform for testing gate drivers with various power semiconductors. Pin headers enable easy integration into existing test setups. LEB-0022 evaluation boards are intended to be evaluated using LEB-0025 gate driver evaluation main board, in low-side, high-side, or half-bridge configuration and are available on request.



Linear Optocouplers

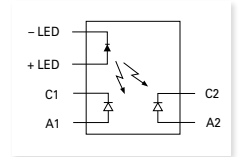
Littelfuse linear optocouplers feature an infrared LED optically coupled with two photodiodes. One feedback (input) photodiode is used to generate a control signal that provides a servomechanism to the LED drive current, thus compensating for the LED's nonlinear time and temperature characteristics. The other (output) photodiode provides an output signal that is linear with respect to the servo LED current. The devices feature wide bandwidth, high input-to-output isolation, and excellent servo linearity.

Features & Benefits

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

Applications

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



Part Number	Servo Gain $K1 = I_1/I_F$ Min/Max	Forward Gain $K2 = I_2/I_F$ Min/Max	Transfer Gain $K3 = K2/K1$ Min/Max	Input Control Current	Isolation Voltage	Package Type
				mA	V _{RMS}	
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



20
8-Pin DIP



21
8-Pin Flatpack



22
8-Pin
Surface Mount

Two Fundamental Operating Configurations

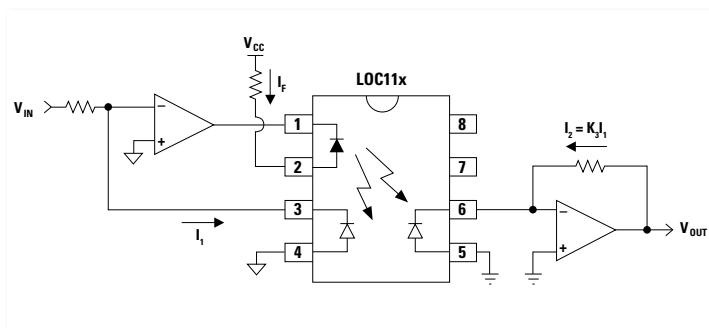
Photovoltaic Mode

- 14-bit linearity
- 40 kHz bandwidth

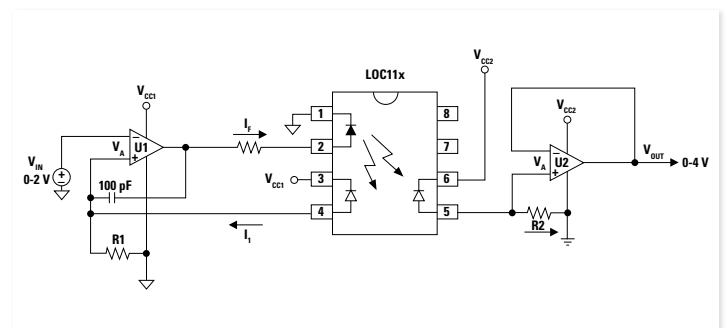
Photoconductive Mode

- 200 kHz bandwidth
- 8-bit linearity

Isolation Amplifier Photovoltaic Mode



Isolation Amplifier Photoconductive Mode



Optocouplers Series

Optocouplers provide an optically means of switching control circuits. Each package contains a phototransistor that is optically coupled with a LED. A shunt resistor can be used to adjust the threshold current required to activate the output circuitry.

Optocouplers are ideal for Telecom, Industrial Control and instrumentation circuits, where electrical isolation of control circuitry is crucial.

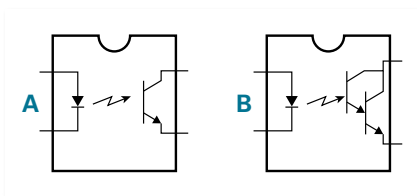
Features & Benefits

- Low Input Control Current
- High Current Transfer Ratio (CTR)
- Provides galvanic input to output isolation

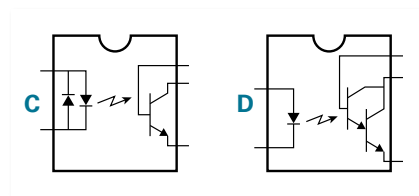
Applications

- Telecom Switching
- Industrial Control
- Instrumentation Circuits

4-Pin DIP and SOP



6-Pin DIP



Part Number	Minimum Breakdown Voltage BV_{CEO}	Typical Current Transfer Ratio	Maximum Saturation Voltage	Input Control Current	Input Characteristic	Isolation Voltage	Configuration	Package Type
	V	%	V	mA		V_{RMS}		
CPC1001N	30	330	0.3	0.2	unidirectional	1500	A	10
CPC1301	350	5500	1.2	1	unidirectional	5000	B	42, 43
CPC1303	30	1000	0.5	0.2	unidirectional	5000	A	42, 43
LDA100	30	300	0.5	1	bidirectional	3750	C	12, 14
LDA111	30	8500	1	1	unidirectional	3750	D	12, 14



10
4-Pin SOP



12
6-Pin
Surface Mount



14
6-Pin DIP



42
4-Pin DIP



43
4-Pin
Surface Mount

Littelfuse MOSFET and IGBT Devices



Discrete Packaged MOSFETs

The broad and deep Power MOSFETs portfolio from Littelfuse includes linear and depletion mode Power MOSFETs that set the industry standard for high-voltage, high-power discrete MOSFETs applications.



Scan to learn more



Discrete Packaged IGBTs

Littelfuse offers the largest selection of IGBT devices on the power semiconductor market. Benefits include low energy losses and exceptional device ruggedness while maintaining low on-state voltages.



Scan to learn more

Depletion Mode MOSFETs

N-Channel Depletion Mode FETs

Our N-channel depletion mode field effect transistors (FETs) utilize a proprietary third-generation vertical DMOS process. This third-generation process realizes world-class, high-voltage MOSFET performance in an economical silicon gate process. This process also yields a robust device for low-power applications with high input impedance. These highly reliable FET devices have been used extensively in our solid state relays for industrial and telecommunications applications. These “normally on” MOSFETs are well suited for low-cost, pre-regulator applications that are tolerant of high voltage drops and power dissipation between the power source and the output regulator stage.



SOT-23



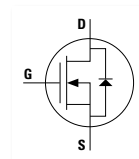
SOT-89



SOT-223

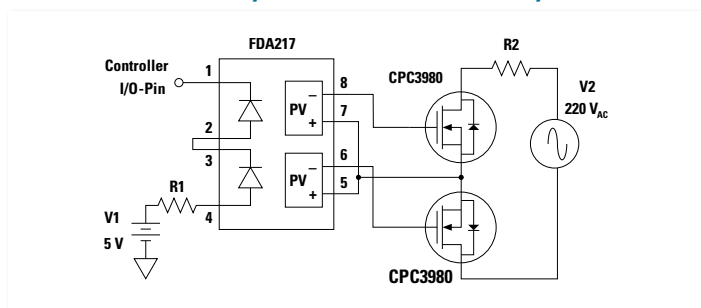


SOT-223-2L

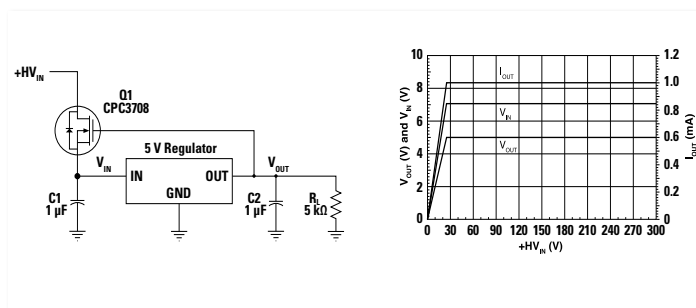


Part Number	$V_{(BR)DSX}$	$R_{DS(on)}$ max.	$V_{GS(off)}$ min.	$V_{GS(off)}$ max.	I_D min.	Package
	V	Ω	V	V	mA	
CPC3701	60	1	-1.4	-3.1	600	SOT-89
CPC3703	250	4	-1.6	-3.9	360	SOT-89
CPC3708	350	14	-2	-3.6	130	SOT-89 / SOT-223
CPC3710	250	10	-1.6	-3.9	220	SOT-89
CPC3714	350	14	-1.6	-3.9	240	SOT-89
CPC3720	350	22	-1.6	-3.9	130	SOT-89
CPC3730	350	35	-1.6	-3.9	140	SOT-89
CPC3902	250	2.5	-1.4	-3.1	400	SOT-89 / SOT-223
CPC3909	400	6	-1.4	-3.1	300	SOT-89 / SOT-223
CPC3960	600	44	-1.4	-3.1	100	SOT-223
CPC3980	800	45	-1.4	-3.1	100	SOT-223
CPC3981	800	45	-1.4	-3.1	100	SOT-223-2L
CPC3982	800	380	-1.4	-3.1	20	SOT-23
DE150-102N02A	1000	9.4	2.5	4.5	2	DE150
DE150-501N04A	500	1.5	2.5	4	4.5	DE150

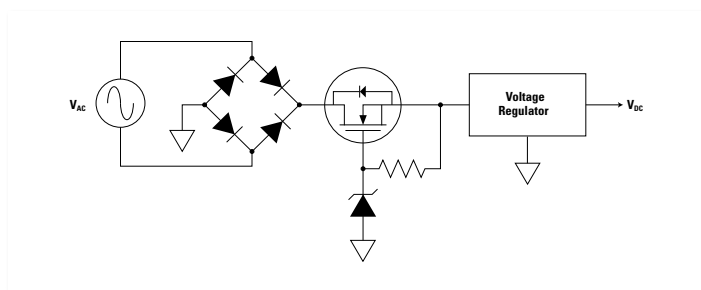
FDA217 used with CPC3980 MOSFETs to create Normally Closed Solid-state Relay



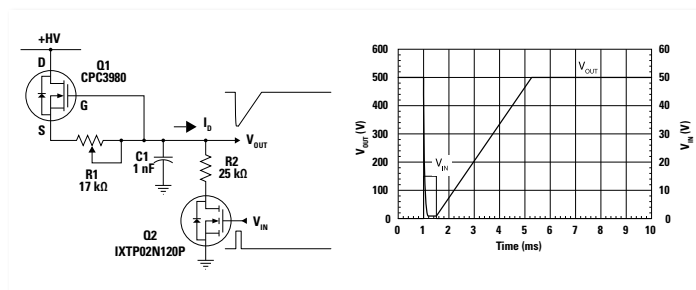
High Voltage Off-line Linear Voltage Regulator



N-Channel Depletion Mode MOSFET as Pre-Regulator



High Voltage Ramp Generator



RF MOSFETs

The DE150 MOSFET series consists of 500 V & 1000 V, N-channel, enhancement-mode MOSFET fabricated with Littelfuse's advanced low Q_g process.

With high input impedance and a low maximum on-resistance of 1.5 Ω and 9.4 Ω . The DE150 offers high power output in a small package with low-input drive requirements. Low-input capacitance and low-gate charge enable operation at full power up to 100 MHz.

The DE150 series MOSFETs are available in a flat, 6-lead SMD power package incorporates an electrically isolated bottom-side pad that enables efficient heat sinking.

Features

- 500 V and 1000 V breakdown voltages
- 1.5 Ω and 9.4 Ω maximum on-resistance
- V_{GS} : 2.5 V to 4.5 V
- $T_{vj(max)}$: 125 °C
- High input impedance
- Electrically isolated substrate
- High isolation voltage (> 2500 V)
 - Excellent thermal transfer
 - Increased temperature and power
 - Littelfuse advanced low Q_g process
 - Low gate charge and capacitances
 - Easier to drive
 - Faster switching
 - Very low insertion inductance (< 2 nH)

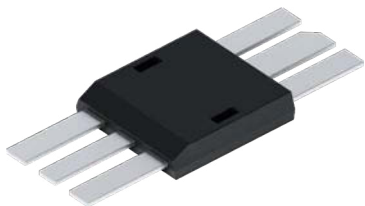
Benefits

- High speed switching at frequencies up to 10 MHz
- Easy to mount - no insulators necessary
- High-power density

Part Number	Max. Offset Voltage	Typ. Sink/Source Peak Drive Current	Inputs	Deadtime	Propagation Delay	Rise/Fall Time	Package
					T_{ON}/t_{OFF}	T_r/t_f	
DE150-500N04A	500 V	N/A	MOSFET Gate	N/A	N/A	N/A	6-lead SMD
DE150-102N02A	1000 V	N/A	MOSFET Gate	N/A	N/A	N/A	6-lead SMD

Ordering Information

Part Number	Description
DE150-500N04A	6-lead SMD (40/Tube)
DE150-102N02A	6-lead SMD (40/Tube)



DE150

Non-Volatile Digitally Programmable Capacitors

NCD2400M: Wide Capacitance Range, Non-volatile, Digital Programmable Capacitor

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 (I²C compatible) interface. The calibration value can be stored in the internal, re-programmable, non-volatile memory.

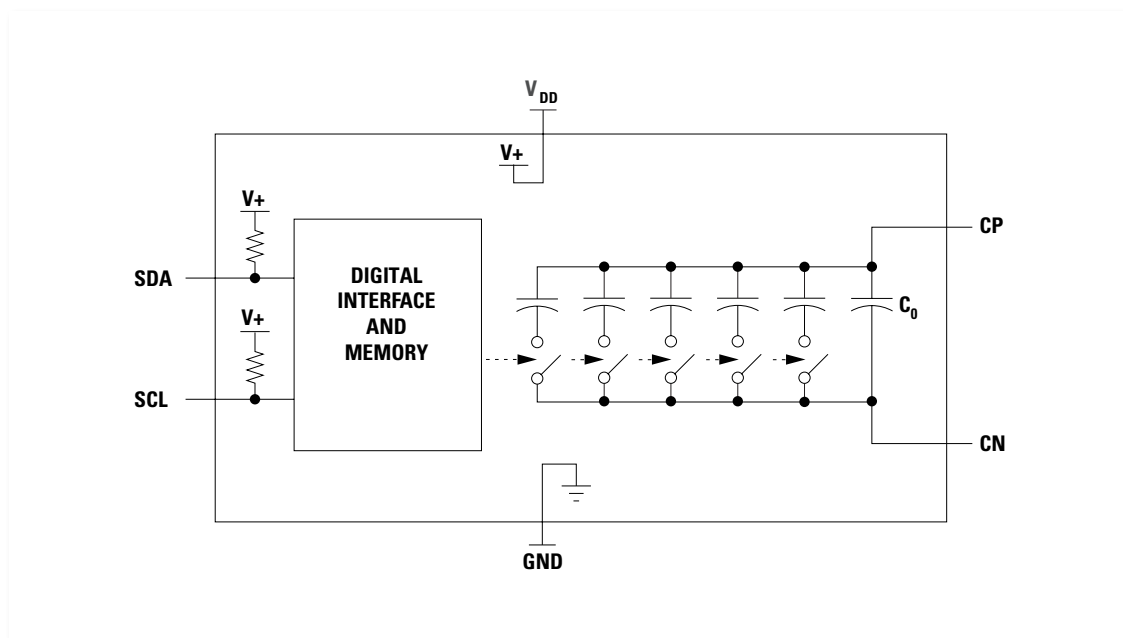
Features & Benefits

- Series and shunt configurations supported:
 - $C_{\text{shunt}} = 12.5 \text{ pF}$ to 194 pF in discrete 355 fF steps
 - $C_{\text{series}} = 1.7 \text{ pF}$ to 194 pF in discrete 376 fF steps
- 512-state digital programmable capacitor
- Operating frequency range of DC to 150 MHz
- Operation at 105 °C
- 2-wire (I²C compatible) serial interface
- EEPROM non-volatile memory
- 2.5V to 5.5V Input Supply voltage range
- (2 × 2) mm DFN-6

Applications

- VCXOs
- Crystal oscillators
- Tunable RF stages
- RFID tags
- Industrial wireless control
- Capacitor sensor trimming

NCD2400M



NCD2100: Non-Volatile Digital Programmable Capacitor

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 $+85^{\circ}\text{C}$.

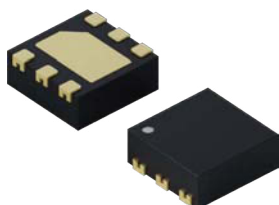
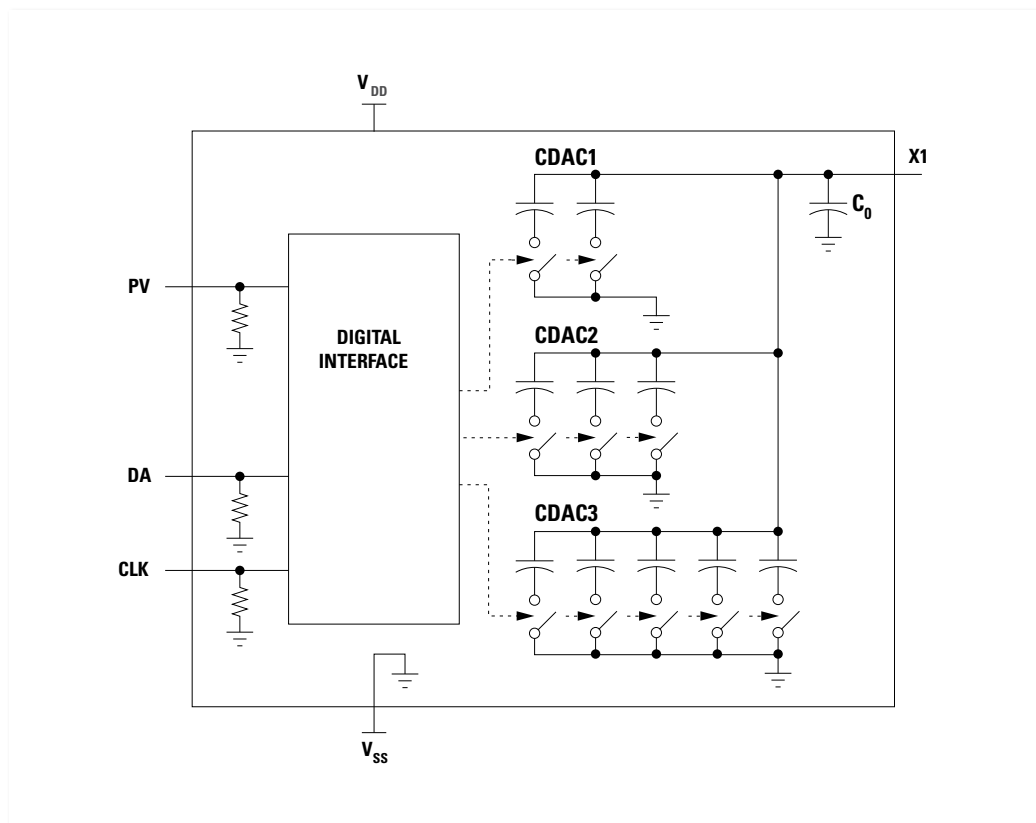
Features & Benefits

- Capacitance range
6.6 pF to 37.553 pF
- 1024 programmable capacitance values
- Operating frequency range
200 kHz to 250 MHz
- Smallest capacity step size: 63 fF
- (2 × 2) mm DFN-6

Applications

- VCXOs
- Crystal oscillators
- Tunable RF stages
- RFID tags
- Industrial wireless control
- Capacitor sensor trimming

NCD2100



DFN-6

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

The CPC9909 high-efficiency, high-brightness LED driver is manufactured in a high voltage BCDMOS on SOI process. The wide input operating voltage range from $8V_{DC}$ to $550V_{DC}$ enables the device to be used in a broad range of high-brightness LED applications. The device features pulse frequency modulation (PFM) with a constant peak-current control scheme. This regulation scheme is inherently stable, allowing the driver to be operated above 50 % duty cycle without open loop instability or sub-harmonic oscillations. LED dimming can be implemented by applying a small DC voltage to the LD pin, or by applying a low frequency PWM signal to the PWMD pin.

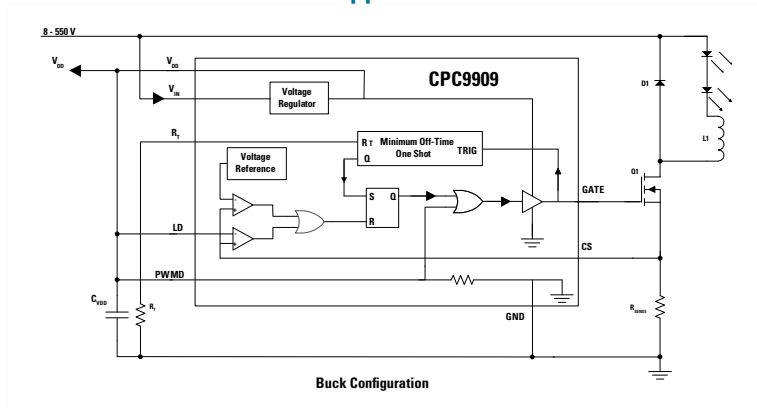
Features & Benefits

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

CPC9909 Application Circuit



MXHV9910: High Voltage, Mains-Powered LED Driver

The MXHV9910 high-efficiency, high-brightness LED driver is manufactured in a high voltage BCDMOS on SOI process. The wide input operating voltage range from $8V_{DC}$ to $450V_{DC}$ enables the device to be used in a broad range of high-brightness LED applications. The MXHV9910 features a fixed-frequency, peak-current control method, which provides an ideal solution for driving multiple LEDs in series and in parallel. LED dimming can be implemented by applying a small DC voltage to the LD pin, or by applying a low frequency PWM signal to the PWMD pin.

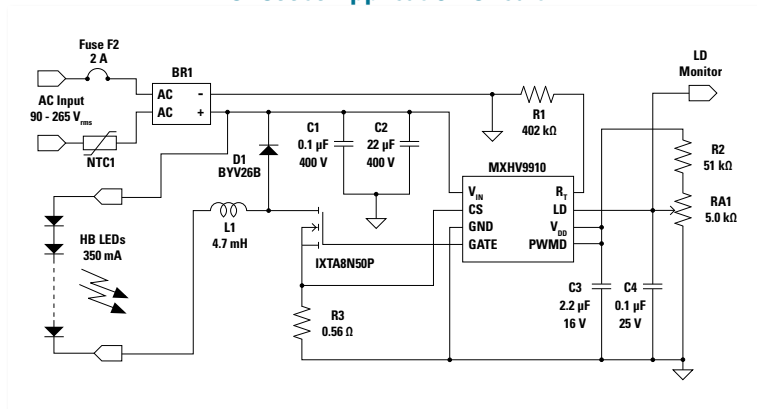
Features & Benefits

- 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

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

CPC9909 Application Circuit



8-Pin
SOIC-EP



8-Pin
SOIC

Multifunction Products: SSR/Optocouplers

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.

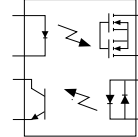
Features & Benefits

- 3750 V_{RMS} input-to-output isolation
- Multiple functionality in a single package
- Current limiting (part numbers with “L” suffix)

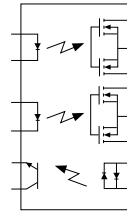
Applications

- Telecommunication/datacommunication
- Instrumentation
- I/O subsystems/electronic switching
- Medical equipment (patient/equipment isolation)
- Security

Available Multifunction Product Configurations



TS117(L)
TS117(L)S



IAA110P

Part Number	SSR Characteristics				Optocoupler Characteristics				Isolation Voltage	Features & Comments	Package
	Blocking Voltage	Load Current	On Resistance	Input Control Current	Breakdown Voltage	Current Transfer Ratio	Saturation Voltage	Input Control Current			
	V _P	mA	Ω	mA	V	%	V	mA			
IAA110P	350	100	35	5	20	33	0.5	6	3750	Two 1-Form-A relays, one optocoupler	32
TS117	350	120	35	2	20	33	0.5	6	3750	One 1-Form-A relay, one optocoupler	20
TS117L	350	120	35	2	20	33	0.5	6	3750	One current-limiting 1-Form-A relay, one optocoupler	20
TS117S	350	120	35	2	20	33	0.5	6	3750	One 1-Form-A relay, one optocoupler	22
TS117LS	350	120	35	2	20	33	0.5	6	3750	One 1-Form-A relay, one optocoupler	22



20
8-Pin DIP



22
8-Pin Surface Mount



32
16-Pin SOIC

Voltage Monitoring & Sensing IC

CPC5712

The CPC5712 is a special purpose Voltage 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 programmable signal level detects, polarity information, and a scaled representation of the phone line voltages. In use, the resistor divider and the high input impedance of the CPC5712 make the circuit practically undetectable on the line.

The CPC5712 can also be used in non-telephony applications including instrumentation and industrial controls. It is virtually undetectable in use.

Features & Benefits

- Derives two voltage level detects, polarity information, and a scaled, linear representation of the phone line voltages
- 2 independent, programmable level-detectors with programmable hysteresis
- Fixed-level polarity detector with hysteresis
- Differential linear output
- Common-Mode Rejection Ratio (CMRR) >55 dB
- 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)

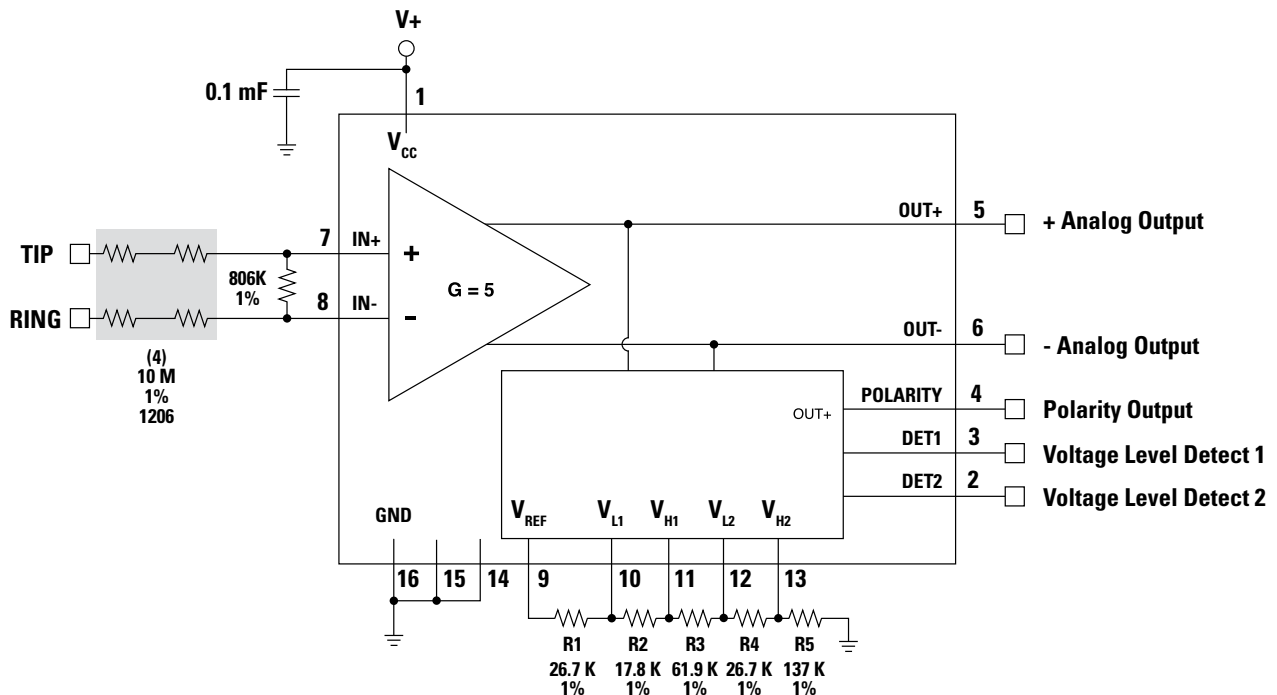
Applications

- Special-purpose “Voltage Monitor with Detectors” integrated circuit used in high voltage telephony applications
- VoIP gateways, IP-PBX, xDSL
- Non-telephony applications include instrumentation and industrial controls; virtually undetectable in use
- TIP/RING monitoring: polarity detection for caller ID, enhanced 911, line-in-use, battery detection, PSTN check



16-Pin SOIC

CPC5712 Application Circuit



Central Office Line Card Access Switches

Central Office Line Card Access Switch (LCAS)

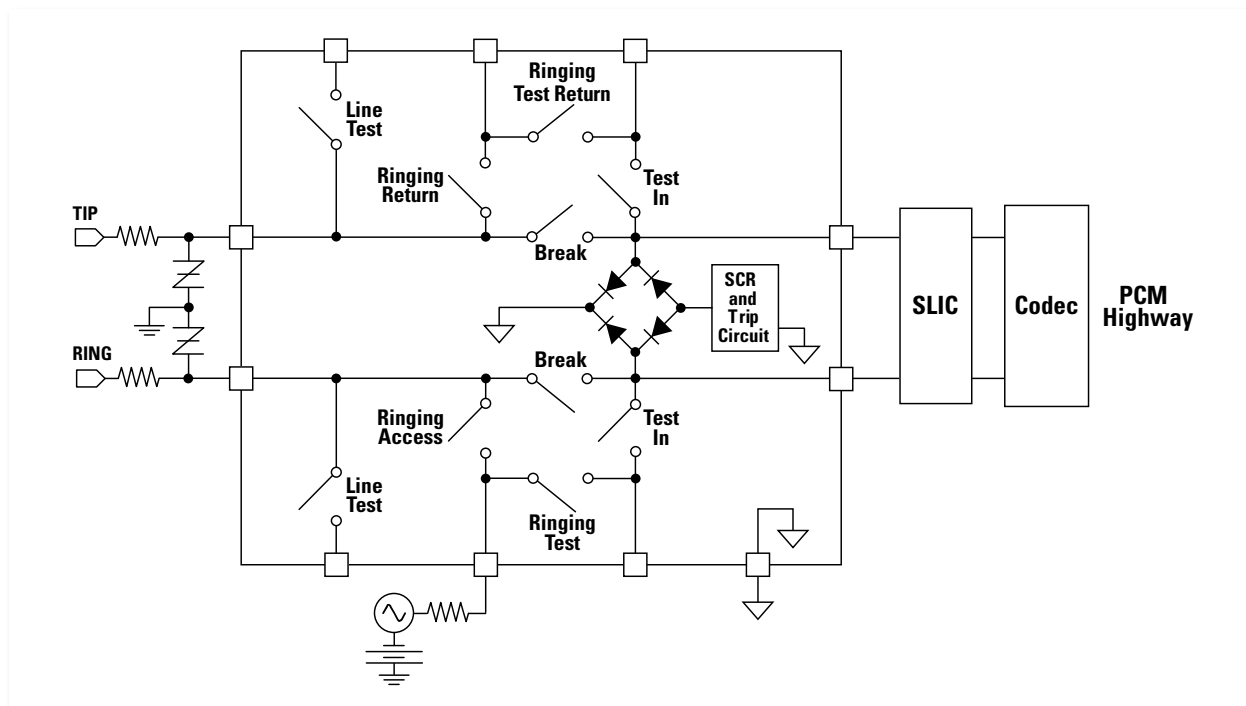
The CPC7695 is our third generation of Line Card Access Switches (LCAS). This monolithic 10-pole line card access switch is available in 20-pin and 28-pin SOIC packages. It provides the necessary functions to replace three 2-Form-C electromechanical relays on analog line card or combined voice and data line cards found in central office, access, and PBX equipment. The devices contain solid state switches for tip and ring line break, ringing injection, and test access. The CPC7695 requires only a +5V supply and provides stable start-up conditioning during system power-up and for hot-plug insertion. Once active, the inputs respond to traditional TTL logic levels, enabling the CPC7695 to be used with 3.3V logic.

Features & Benefits

- 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 <10.5 mW
- 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/ μ 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)		
CPC7695B	•	10	•	•	•	•	•	•	•	•	•	110	9	28-Pin SOIC
CPC7695Z	•	10	•	•	•	•	•	•	•	•	•	110	9	20-Pin SOIC



20-Pin SOIC



28-Pin SOIC

Zilog

Zilog is a trusted supplier of highly integrated microcontrollers and solutions for the industrial and consumer markets. Building on its legacy as an acclaimed architect in the microprocessor and microcontroller industry, Zilog has evolved its expertise beyond core silicon to include application specific solutions, industry leading tools and exceptional technical expertise. These capabilities enable embedded designers to achieve rapid time-to-market in areas like white goods, communications, environmental sensing, and motion detection. Zilog's long history is a testament to its quality centered philosophy focused on the design, manufacture, test and delivery of products ensuring total customer satisfaction.

MCU Products

S3

White Goods, Small Home Appliances, LCD control. Excellent noise immunity and low power.

Z8 Encore!

Industrial Control, power management, battery charging, sensing and control. Highly integrated analog with low power operation. (Fig. 2)

ZMotion™

Motion detection solutions for lighting control, security, IP cameras, video doorbells, HVAC. PIR sensors and lenses, MCU's, and application S/W. (Fig. 1)

eZ80

Ethernet and Internet Connectivity MCUs for embedded web servers. MCUs, TCP/IP stack, RTO.

Features & Benefits

- Lower Power consumption and Strong noise Immunity
- Up to 24 MHz High performance 8bit CPU
- Up to 64 KB Flash memory 10 K read/write endurance
- Up to 3.75 K RAM
- 128 Byte Non-Volatile Data Storage
- 10/12/14-bit ADC(Analog to Digital Converter) , internal/external reference Single-ended or differential inputs
- 12/8-bit Digital-to-Analog Converter (DAC)
- Integrated LCD driver with blinking and contrast control/Cap-bias mode
- 128-bit Advanced Encryption Standard (AES) encryption/decryption hardware accelerator according to FIPS PUB 197
- Real-Time Clock (RTC) supporting both Counter and Clock modes
- On-Chip Temperature Sensor
- on-chip analog comparators /on-chip, low-power operational amplifiers
- Event System provides communication between peripherals for autonomous triggering
- Full-Speed Universal Serial Bus (USB 2.0) device supporting eight endpoints with integrated USB-PHY
- Various communication interface
- UART supporting LIN/DALI/DMX, I2C,SPI
- Various Timer supporting capture/Compare/PWM
- High precision internal oscillator
- OCD(On-chip debugger)

Applications

- Applications
- Small Home Appliance
- White goods
- Thermostat
- PIR Motion sensing
- Environmental Sensor
 - CO, CO2, ambient light, pressure, temperature
- Proximity detectors
- Wired security panels
- DALI, DMX controller
- Electronic Locks
- Electrical energy usage monitoring
- BLDC motor control

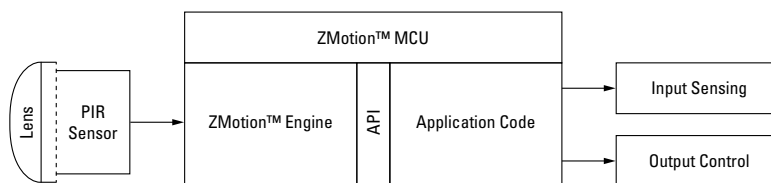


Fig. 1

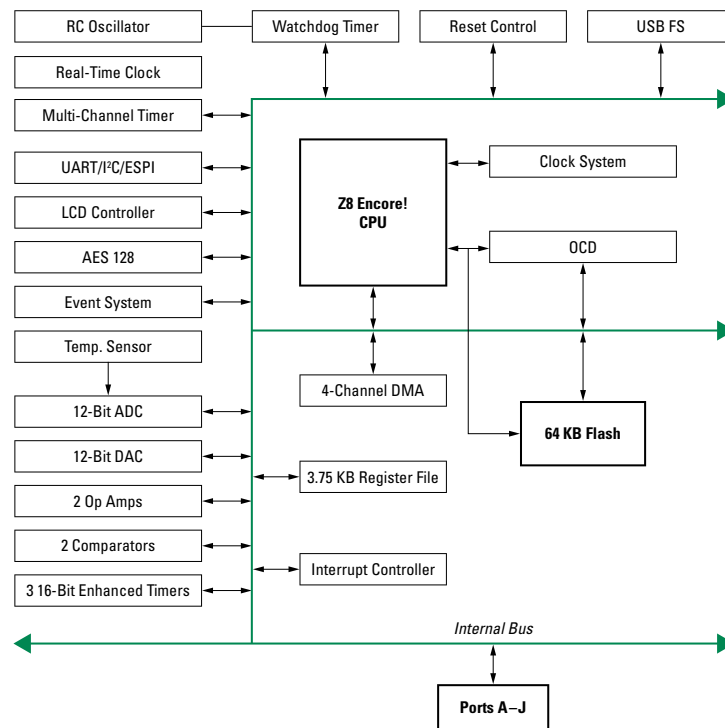
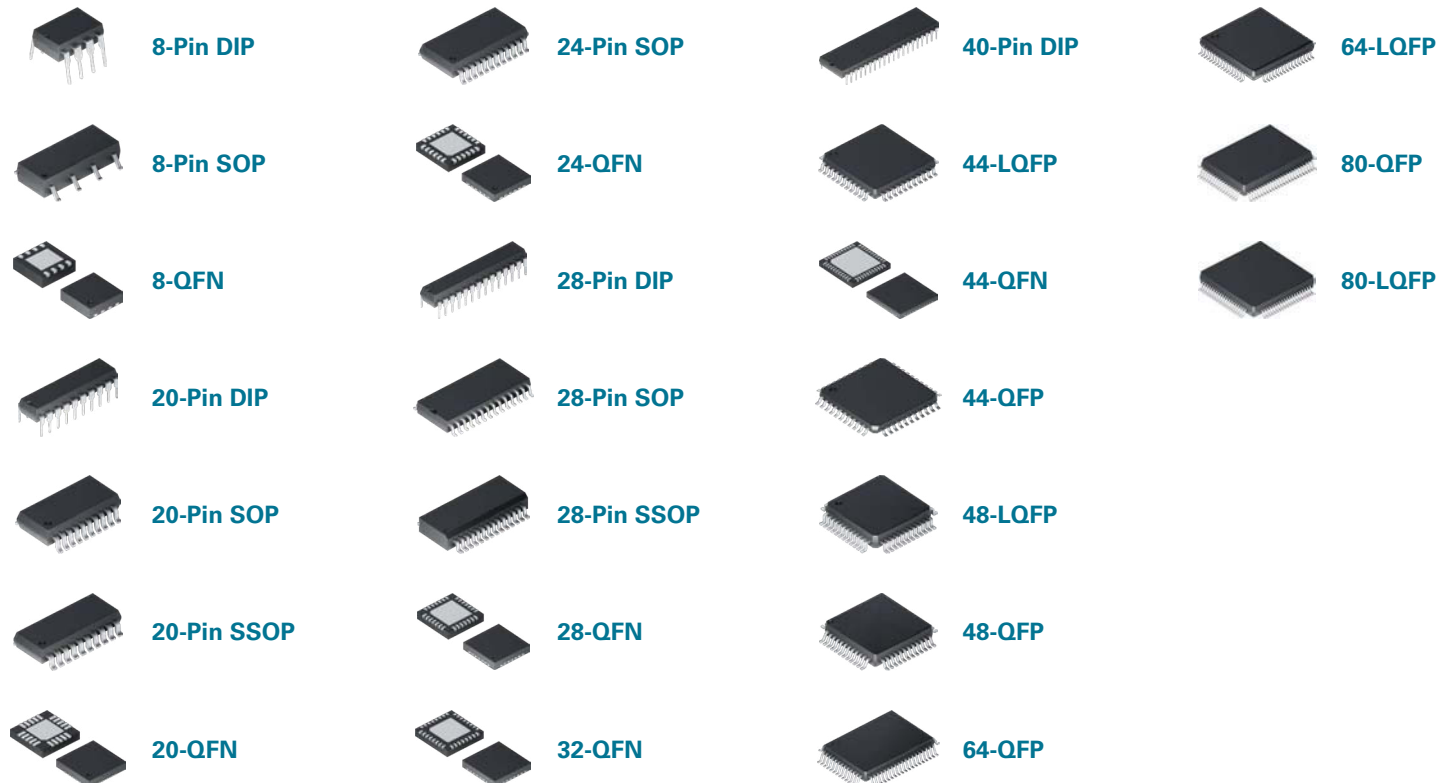


Fig. 2



MCU and Cap-sense Touch

Device Series	Part Number	Speed MHz	Flash KB	RAM	I/O	ADC Res. & Channels	Other Analog	Serial	Timers	V _{DD} (V)/ Temp (°C)	Packages	Additional Features
S3 Microcontrollers												
S3F94CX	S3F94C4EZZ	10	4	208 B	18	10-bit SAR 9CH	–	–	BT, 8TC, PWM: 1–14 bit	1.8–5.5 –40–85	20 DIP/ SOP/ SSOP	Internal RC Osc : 3.2/0.5 MHz ± 3% @ 25 °C Internal RC OSC temperature: –25 °C ~ +85 °C, External RC Osc, LVR
	S3F94C8EZZ		8	208 B	18							
S3F80PX	S3F80P5XZZ	8	18	1KB+272	19	–	–	–	BT, 8TCx1, 16TCx2, PWM: 1– 8bit	1.6–3.6 –25–85	24QFN, 24SOP, Pellet	Carrier Frequency Generator, LVR(1.65 V), 4 differebt LVD flag available, Executable 1KB RAM
	S3F80PBXZZ		63	1KB+272	26–38	–	–	–	BT, WT, 8TCx1, 16TCx2, PWM: 1–8 bit		44QFN, 32QFN, 32SOP, Pellet	
	S3F81RBXZZ		63	1KB+272	26–38	–	IR Transistor: min 200mA	–	BT, WT, 8TCx1, 16TCx2, PWM: 1–8bit			
SF8S2X	S3F8S28XZZ	10	8	272	18/22	12-bit SAR 13CH	–	1–UART 1–I ² C	BT, WT, 16T(8TCx2), 16TCx1 PWM: 2–14bit, 1–16bit	1.8–5.5 –40–85	20-SOP/SSOP, 24-SOP	LVR, LVR, Internal RC V _{DD} = 5V with 1% tolerance On-Chip Ring oscillator with 32 kHz frequency for free running Watchdog Timer.
S3F8S3X	S3F8S35XZZ	10	16	1KB	26	10-bit SAR 16CH	–	2–UART 1–SPI, 1 - I ² C	BT, SWT, WT, 8TCx1, 16TCx4 PWM: 2–8bit, 4–16bit		32 SOP/QFN/ LQFP	LVR, LVD Internal RC Osc: 8/4/1/0.5 MHz ± 1% @ 25 °C 32 KHz FRT for WDT
	S3F8S39XZZ		32	1KB								
S3F8S1X	S3F8S15XZZ	12	16	2KB	40	10-bit SAR 10CH	LCD 4comx20seg	2–UART 1–SPI, 1 - I ² C	BT, WT, SWT, 8TCx1, 16TCx4 PWM: 1–8bit, 3–16bit		48QFP/LQFP	LVR, LVD, Internal RC Osc: 8/4/1/0.5 MHz ± 1% @ 25 °C 32 KHz FRT for WDT, Cap-bias for LCD(Booster and regulator)
	S3F8S19XZZv		32	2KB								
S3F8S4S	S3F8S45XZZ	12	16	528B	38	10-bit SAR 9CH	LCD 4comx26seg	2–UART, 1–SPI	BT, WT, 8TCx3, 16TCx2 PWM: 3 – 8bit, 2–16bit		44QFP	LVR, LVD: 4 different level, Pattern Generator
S3F8S5A	S3F8S5AXZZ	12	48	1KB	36	10-bit SAR 8CH	LCD 4comx22seg	2–UART, 1–SPI	BT, WT, 8TCx3, 16TCx2 PWM: 2–8bit, 2–16bit, 1–10bit		44QFP	LVR, LVD: 4 different level, Pattern generator
S3F8S6B	S3F8S6BXZZ	12	64	2KB	54	10-bit SAR 8CH	–	2–UART, 1–SPI	BT, WT, 8TCx4, 16TCx2 PWM: 3–8bit, 2–16bit		64QFP/LQFP	LVR, Pattern Generator Cap-bias for LCD(Booster and regulator)
S3F8S7B	S3F8S7BXZZ	12	64	2KB	70	10-bit SAR 8CH	DAC (8bit)	2–UART, 1–SPI	BT, WT, 8TCx4, 16TCx2 PWM: 3–8bit, 2–16bit	80QFP/LQFP	LVR, Pattern Generator Cap-bias for LCD(Booster and regulator)	
S3F82NB	S3F82NBXZZ	12	64	4KB	83	10-bit SAR 8CH	LCD 16comx80seg 3 - Comparator	1–SPI	BT, WT, 8TC, 16TC PWM: 1–8bit, 1–16bit	128 Pellet	LVR, External RC Osc	
Z8 Encore Flash Microcontrollers												
Z8F0830/Z8F083A	Z8F0130	20	1	256B	17–23	10-bit SAR 7/8CH	1 - Comparator	–	2 – 16-bit Multi function timer (Cap/Comp/PWM)	2.7–3.6/ 0–70 –40~105	20/28-pin SOP, SSOP, QFN, DIP	5.54MHz IPO/20 MHz IPO 64 Bytes NVDS on 1KB, 2KB, 4KB and 8KB devices
	Z8F0131		1	256B								
	Z8F0230		2	256B								
	Z8F0231		2	256B								
	Z8F0430		4	256B								
	Z8F0431		4	256B								
	Z8F0830		8	256B								
	Z8F0831		8	256B								
	Z8F1232		12	256B								
	Z8F1233		12	256B								
	Z8F043A		4	256B								
	Z8F083A		8	256B								

Device Series	Part Number	Speed MHz	Flash KB	RAM	I/O	ADC Res. & Channels	Other Analog	Serial	Timers	V _{DD} (V)/ Temp (°C)	Packages	Additional Features
Z8 Encore Flash Microcontrollers												
Z8F082A	Z8F011A	20	1	256B	6~25	10-bit S/D 4/7/8CH	1 - Op Amp 1 - Comparator Temp Sense	1 – UART	2 – 16-bit Multi function timer (Cap/Comp/PWM)	2.7 ~ 3.6/ 0 ~ 70 –40 ~ 105	8-pin SOP, QFN, DIP 20, 28-pin SOP, SSOP, DIP	5.54 MHz IPO Up to 128 Bytes NVDS ADC has 14 bit resolution + sign
	Z8F012A		1	256B								
	Z8F021A		2	512B								
	Z8F022A		2	512B								
	Z8F041A		4	1KB								
	Z8F042A		4	1KB								
	Z8F081A		8	1KB								
Z8F082A	8	1KB										
Z8F1680	Z8F0880	20	8	2KB	17~37	10-bit SAR 7/8CH	1 - Op Amp 2 - Comparator Temp Sense	1 or 2 – UART 1 – I ² C (M/S) 1 – SPI*	3 – 16-bit Multi function timer (Cap/Comp/PWM) PWM: 4ch, 12-bit	1.8 ~ 3.6/ 0 ~ 70 –40 ~ 105	20, 28-pin SOP, SSOP, DIP 40-pin DIP 44-pin LQFP, QFN	11 MHz IPO 128 Bytes / 256 Bytes NVDS Executable RAM (IrDA)-compliant infrared encoder/decoder
	Z8F1680		16	3KB								
	Z8F2480		24	3KB								
Z8FMC	Z8FMC04	20	4	512B	17	10-bit SAR 8CH	1 - Op Amp 1 - Comparator	1 – UART 1 – I ² C (M/S) 1 – SPI	1 – 16-bit Multi function timer (Cap/Comp/PWM) PWM: 6ch single or 3ch diff, 12-bit	2.7 ~ 3.6/ 0 ~ 70 –40 ~ 105	32-pin QFN	Hardware PWM shutdown ADC/Timer/PWM inter-operation
	Z8FMC08		8	512B								
	Z8FMC16		16	512B								
Z8F6423	Z8F1621	20	16	2KB	29~60	10-bit S/D 8/12CH	–	2 – UART 1 – SPI 1 - I ² C (M)	4 – 16bit Multi function timer (Cap/Comp/PWM)	3.0 ~ 3.6/ 0 ~ 70 –40 ~ 85 –40 ~ 125	40-pin DIP 44, 68-pin PLCC 44, 64-pin LQFP 80-pin QFP	3 Channel DMA ADC Auto-Scan (IrDA)-compliant infrared encoder/ decoder
	Z8F1622		16	2KB								
	Z8F2421		24	2KB								
	Z8F2422		24	2KB								
	Z8F3221		32	2KB								
	Z8F3222		32	2KB								
	Z8F4821		48	4KB								
	Z8F4822		48	4KB								
	Z8F4823		48	4KB								
	Z8F6421		64	4KB								
	Z8F6422		64	4KB								
	Z8F6423		64	4KB								
Z8F6482	Z8F1681	24	16	2KB	26~67	12/14-bit SAR 8 to 12CH	LCD 4com x 24seg 2 - Op Amp 2 - Comparator Temp Sense DAC (12 bit)	1 or 2 – UART 1 or 2 – SPI 1 – I ² C (M/S) 0/1 – USB (FS)	3 – 16 bit Multi function timer (Cap/Comp/PWM) PWM: 4ch, 12-bit RTC	1.8 ~ 3.6/ –40 ~ 85	32-pin QFN 44, 64, 80-pin LQFP	128 Bytes NVDS Internal Programmable Voltage References AES128 Hardware Event System 4 - DMA
	Z8F1682		16	2KB								
	Z8F3281		32	3.7KB								
	Z8F3282		32	3.7KB								
	Z8F6081		60	3.7KB								
	Z8F6082		60	3.7KB								
	Z8F6481		64	3.7KB								
	Z8F6482		64	3.7KB								
Z8F3224	Z8F1624	20	16	3.7KB	14~36	12/14 Bit SAR 8 to 15ch	2 - Op Amp 2 - Comparator	1-UART 1-SPI 1-I ² C (M/S)	3 – 16bit 16bit Multi function timer (Cap/Comp/PWM) PWM: 4ch, 12bit 16bit Timer A	1.8~3.6/ –40~85	32-QFN 44-QFN	32 KHz IPO with FLL/DCO, Event System Programmable Voltage Reference System
	Z8F3224		32	3.7KB								
Z8F1625*	Z8F0825	8	8	1KB	18	*12 Bit SAR 6CH*	1 - Comparator	2-UART 1-I ² C (M/S)	3 – 16bit Multi function timer (Cap/Comp/PWM) 1 - 16bit Timer A, 1 - 16bit WDT	2.4~5.5/ –40~85	24-QFN/ 20-SSOP/SOIC	8 MHz IPO(HFRC)/32KHz IPO (LFRC) Event System Programmable Reference
	Z8F1625		16	1KB								
ZMotion™												
Z8FS021	Z8FS021	20	2	256B	17	10-bit S/D 7CH	1 - Op Amp 1 - Comparator	1 – UART	Cap/Comp/PWM: 2 - 16-bit	2.7~3.6/ 0~70/ –40~105	20 SSOP	5.54MHz IPO ADC has 14 bit resolution + sign 5V tolerance input
Z8FS040	Z8FS040	20	4	256B	6/17	10-bit S/D 4/7CH	1 - Op Amp 1 - Comparator	1 – UART	Cap/Comp/PWM: 2 - 16-bit	2.7~3.6/ 0~70 / –40~105	8SOP 20 SSOP	5.54MHz IPO ADC has 14 bit resolution + sign 5V tolerance input
Z8F1681	Z8F1681	24	16	2KB	26/36	12/14 bit SAR 8/12CH	2- Op Amp 2 - Comparator Temp Sense DAC (12 bit)	1 or 2 – UART 1 or 2 – SPI 1 – I ² C (M/S) 0/1 – USB (FS)	3 – 16 bit Multifunc- tion timer (Cap/Comp/PWM) PWM: 4ch, 12-bit RTC	1.8~3.6/ –40~85	32 pin QFN 44 pin QFN/ LQFP*	4comx24seg LCD, 128 NVDS AES128 Event System 4 - DMA*
Z8F6481	Z8F6481	24	64	3840B	36/67	12/14 bit SAR 8/12CH	2- Op Amp 2 - Comparator Temp Sense DAC (12 bit)	1 or 2 – UART 1 or 2 – SPI 1 – I ² C (M/S) 0/1 – USB (FS)	3 – 16 bit Multifunc- tion timer (Cap/Comp/PWM) PWM: 4ch, 12-bit RTC	1.8~3.6/ –40~85	44 pin QFN/ LQFP 80 LQFP	4comx24seg LCD, 128 NVDS AES128 Event System 4 - DMA

* Under development

Part Number Alphanumeric Index

C		CPC1393.....	5
CPC1002N.....	8	CPC1394.....	5
CPC1004N.....	8	CPC1510.....	5, 9
CPC1006N.....	5	CPC1511.....	5, 9
CPC1008N.....	5	CPC1540.....	5, 9
CPC1009N.....	5	CPC1560.....	5, 9
CPC1010N.....	5	CPC1561.....	5, 9
CPC1014N.....	5	CPC1563.....	5, 9
CPC1016N.....	5	CPC1580.....	18
CPC1017N.....	5	CPC1590.....	18
CPC1018N.....	5	CPC1593.....	5, 9
CPC1019N.....	5	CPC1705Y.....	12
CPC1020N.....	5	CPC1706Y.....	12
CPC1025N.....	5	CPC1708J.....	12
CPC1030N.....	5	CPC1709J.....	12
CPC1035N.....	5	CPC1718J.....	12
CPC1056N.....	5	CPC1726Y.....	12
CPC1106N.....	7	CPC1727J.....	12
CPC1114N.....	7	CPC1777J.....	12
CPC1117N.....	7	CPC1779J.....	12
CPC1125N.....	7	CPC1786J.....	12
CPC1130N.....	7	CPC1788J.....	12
CPC1135N.....	7	CPC1906Y.....	12
CPC1150N.....	7	CPC1907B.....	12
CPC1225N.....	5	CPC1908J.....	12
CPC1230N.....	5	CPC1909J.....	12
CPC1231N.....	7	CPC1916Y.....	12
CPC1330.....	5	CPC1918J.....	12
CPC1333.....	7	CPC1926Y.....	12
CPC1335.....	5	CPC1927J.....	12
CPC1390.....	5	CPC1943.....	13
		CPC1945G.....	13

CPC1945Y	13	CPC2317N.....	8
CPC1961	13	CPC2330N.....	8
CPC1963	13	CPC2907B	12
CPC1964B	14	CPC3701	30
CPC1964BX6.....	14	CPC3703.....	30
CPC1965G	13	CPC3708.....	30
CPC1965Y	13	CPC3710.....	30
CPC1966.....	14	CPC3714.....	30
CPC1966B	14	CPC3720.....	30
CPC1966YX6.....	14	CPC3730.....	30
CPC1967J	12	CPC3902.....	30
CPC1968J	12	CPC3909.....	30
CPC1972.....	13	CPC3960.....	30
CPC1973Y	12	CPC3980.....	30
CPC1976.....	14	CPC3981.....	30
CPC1976YX6.....	14	CPC3982.....	30
CPC1977J	12	CPC7695B	37
CPC1978J	12	CPC7695Z	37
CPC1979J	12	CPC40055ST	14
CPC1981Y	12	D	
CPC1983B	12	DE150-102N02A	30, 31
CPC1983Y	12	DE150-500N04A	31
CPC1983YE	12	DE150-501N04A	30
CPC1984Y	12	F	
CPC1986J	12	FDA117	19
CPC1988J	12	FDA215	19
CPC1998J	14	FDA217	19
CPC2014N	6	I	
CPC2017N	6	IAA110P	35
CPC2025N.....	6	IX3407B.....	27
CPC2030N.....	6	IX3407BTR.....	27
CPC2125N.....	7		

Part Number Alphanumeric Index

IX4310T	20	LAA125L	6
IX4340	20	LAA127	6
IX4340NE	21	LAA127L	6
IX4341	20	LAA710.....	6
IX4342	20	LBA110	8
IX4352NE	23	LBA110L	8
IX4352NEAU.....	23	LBA120.....	8
IX4426	20	LBA120L.....	8
IX4427	20	LBA127.....	8
IX4428	20	LBA127L.....	8
IXD0579M.....	24	LBA710.....	8
IXD_602.....	20	LBA716.....	8
IXD_604.....	20	LBB110	7
IXD_604SI	21	LBB120.....	7
IXD_604SIA.....	21	LBB126.....	7
IXD_609.....	20	LBB127.....	7
IXD_609SI	21	LCA100.....	5
IXD_614.....	20	LCA100L.....	5
IXD_614SI	21	LCA110	5
IXD_630.....	20	LCA110L	5
IXD_630M	20	LCA120.....	5
IXD2012N.....	24	LCA120L.....	5
L		LCA125.....	5
LAA100	6	LCA125L.....	5
LAA100L	6	LCA127.....	5
LAA108.....	6	LCA127L.....	5
LAA110	6	LCA129.....	5
LAA110L	6	LCA182.....	5
LAA120	6	LCA210.....	8
LAA120L	6	LCA210L.....	8
LAA125	6	LCA220.....	8
		LCA701.....	5

LCA710.....	5	LOC110	28
LCA712.....	5	LOC111	28
LCA715.....	5	LOC112.....	28
LCA717.....	5	LOC117	28
LCB110	7	O	
LCB111	7	OAA160.....	6
LCB120.....	7	OMA160.....	5
LCB126.....	7	P	
LCB127.....	7	PAA110	6
LCB710.....	7	PAA110L	6
LCB716.....	7	PAA132.....	6
LCB717.....	7	PAA140.....	6
LCC110	8	PAA140L.....	6
LCC120.....	8	PAA150.....	6
LEB-0022.....	27	PAA190.....	6
LEB-0023 IX4352NE	23	PAA191.....	6
LF2101NTR.....	24	PAA193.....	6
LF2103NTR	25	PBA150	8
LF2104NTR	25	PBB150.....	7
LF2106NTR	24	PBB190.....	7
LF2110BTR	24	PD1201	13
LF2113BTR	24	PD2401	13
LF2136BTR.....	26	PD2601	13
LF2181NTR	24	PLA110	5
LF2184NTR	25	PLA110L	5
LF2304NTR	25	PLA132.....	5
LF2388BTR.....	26	PLA140.....	5
LF21064NTR	24	PLA140L.....	5
LF21814NTR	24	PLA143.....	5
LF21844NTR	25	PLA150.....	5
LF21904NTR	24	PLA160.....	5
LFF2190NTR	24		

Part Number Alphanumeric Index

PLA170.....	5	S3F8S45.....	40
PLA171.....	5	S3F8S45XZZ.....	40
PLA172P.....	5	S3F80P5XZZ.....	40
PLA190.....	5	S3F80PBXZZ.....	40
PLA191.....	5	S3F80PX.....	40
PLA192.....	5	S3F81RBXZZ.....	40
PLA193.....	5	S3F82NB.....	40
PLA194.....	5	S3F94C4EZZ.....	40
PLB150.....	7	S3F94C8EZZ.....	40
PLB171.....	7	S3F94CX.....	40
PLB190.....	7	SF8S2X.....	40
PM1204.....	13	T	
PM1205.....	13	TS117.....	35
PM1206.....	13	TS117L.....	35
PS1201.....	13	TS117LS.....	35
PS2401.....	13	TS117S.....	35
PS2601.....	13	X	
S		XAA170.....	6
S3F8S1X.....	40	XBB170.....	7
S3F8S3X.....	40	XCA170.....	5
S3F8S5A.....	40	XCB170.....	7
S3F8S5AXZZ.....	40	Z	
S3F8S6B.....	40	Z8F011A.....	41
S3F8S6BXZZ.....	40	Z8F012A.....	41
S3F8S7B.....	40	Z8F021A.....	41
S3F8S7BXZZ.....	40	Z8F022A.....	41
S3F8S15XZZ.....	40	Z8F041A.....	41
S3F8S19XZZv.....	40	Z8F042A.....	41
S3F8S28XZZ.....	40	Z8F043A.....	40
S3F8S35XZZ.....	40	Z8F081A.....	41
S3F8S39XZZ.....	40	Z8F082A.....	41

Z8F083A.....	40	Z8F6082	41
Z8F0130.....	40	Z8F6421	41
Z8F0131.....	40	Z8F6422	41
Z8F0230	40	Z8F6423	41
Z8F0231	40	Z8F6481	41
Z8F0430	40	Z8F6482	41
Z8F0431	40	Z8FMC.....	41
Z8F0825	41	Z8FMC04.....	41
Z8F0830	40	Z8FMC08.....	41
Z8F0831	40	Z8FMC16.....	41
Z8F0880	41	Z8FS021	41
Z8F1232	40	Z8FS040.....	41
Z8F1233	40		
Z8F1621	41		
Z8F1622	41		
Z8F1624	41		
Z8F1625	41		
Z8F1680	41		
Z8F1681	41		
Z8F1682	41		
Z8F2421	41		
Z8F2422	41		
Z8F2480	41		
Z8F3221	41		
Z8F3222	41		
Z8F3224	41		
Z8F3281	41		
Z8F3282	41		
Z8F4821	41		
Z8F4822	41		
Z8F4823	41		
Z8F6081	41		

About Littelfuse

Littelfuse is a trusted partner to engineers worldwide who seek our technical expertise to accurately conduct tests and analyze the results.

Our global vision, team, and leadership collectively provide the strategic foundation to deliver innovations that help bolster businesses and align with global megatrends.

Littelfuse offers leading technologies in circuit protection, power control, and sensing. We continue to expand our broad and diverse portfolio of products into adjacent markets including Power Semiconductors, heavy-duty Switches, Magnetic, Optical, Electromechanical, and Temperature Sensors, and products that provide safe control and distribution of electrical power.

Overcurrent Protection

- Fuses
- Resettable Positive Temperature Coefficient (PTC) Devices

Overvoltage Suppression

- Gas Discharge Tubes (GDTs)
- TVS Diode Arrays
- PLED Series Open LED Protectors
- SIDACTor Protection Thyristors
- PulseGuard® ESD Suppressors
- Switching Thyristors
- TVS Diodes
- Varistors
- Power Control
- TRIAC Thyristors

Power Semiconductors

- Bipolar Devices
- IGBTs
- MOSFETs
- Silicon Carbide Technology
- High Power Devices
- Discrete and Module Solutions
- Bare Die Devices
- Fully Engineered Subsystems

Integrated Circuits and Solid-State Relays

- High-Voltage ICs
- Solid-State Relays
- Gate Drivers

Electromechanical Switches

- Tactile Switches
- Pushbutton Switches
- Keypress Switches
- Snap-Acting Switches
- Slide Switches
- Dip Switches
- Detect Switches
- Navigation Switches
- Toggle Switches
- Rocker Switches
- Switchlock Switches
- Rotary Switches

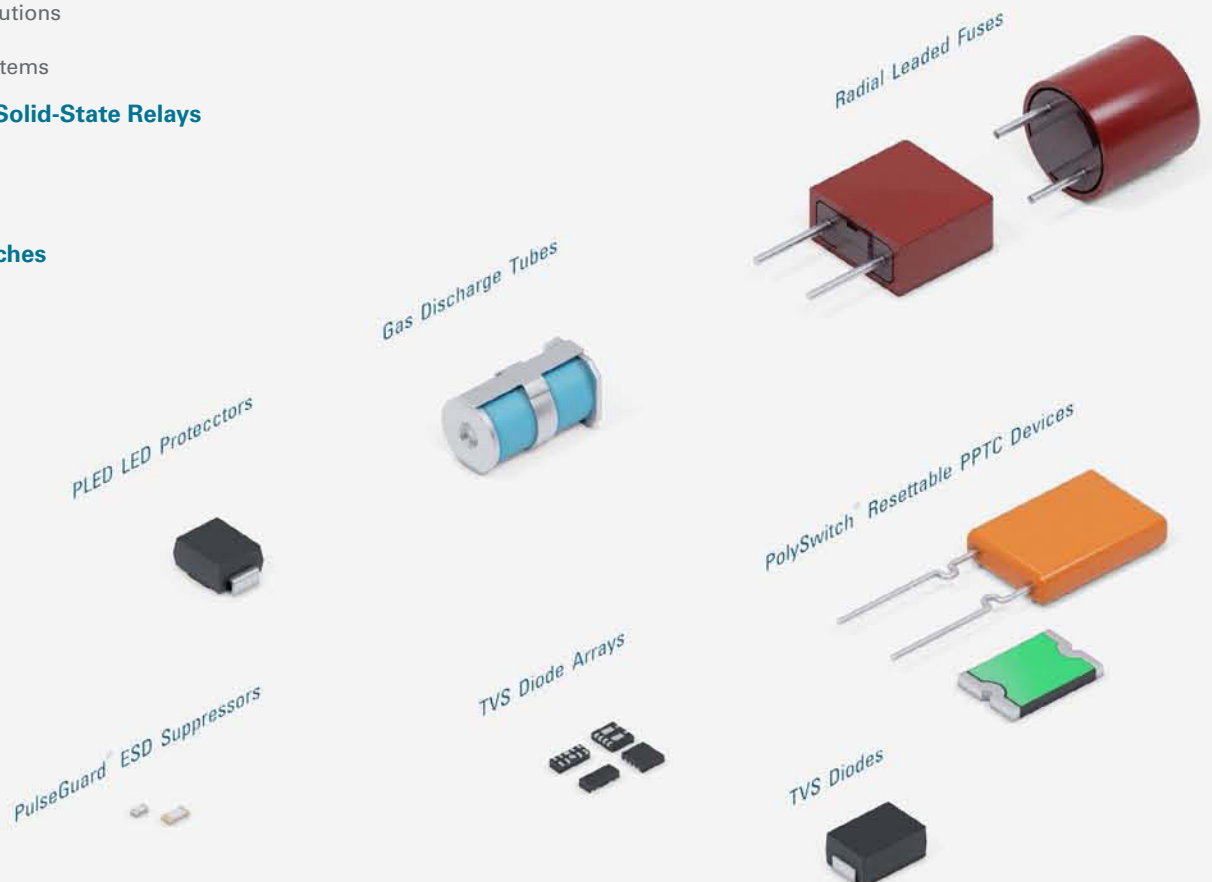
Global Footprint

At Littelfuse, our mission is to develop innovative circuit protection, power control, and sensing solutions that meet our customers' unique needs. This customer-focused philosophy has helped us become the top circuit protection brand in the world.

Our industry-leading product portfolio includes reliable circuit protection, power control, and sensing products that are designed for a variety of markets and applications. We have assembled unparalleled expertise and developed a global footprint that puts our facilities close to our customers and target markets. As our global manufacturing and R&D teams objectively recommend the best circuit protection, power control, or sensing solution for each customer application, they form partnerships that will lead to the development of the next generation of advanced products.

Littelfuse provides:

- application expertise
- global support
- operational excellence
- technology innovation
- collaboration
- customer focus



Additional Resources

Circuit Protection Products Selection Guide

This guide provides a summary of key circuit protection consideration factors, descriptions of the technologies Littelfuse offers, and product selection tables. It is designed to help you quickly find a protection solution appropriate to your application.

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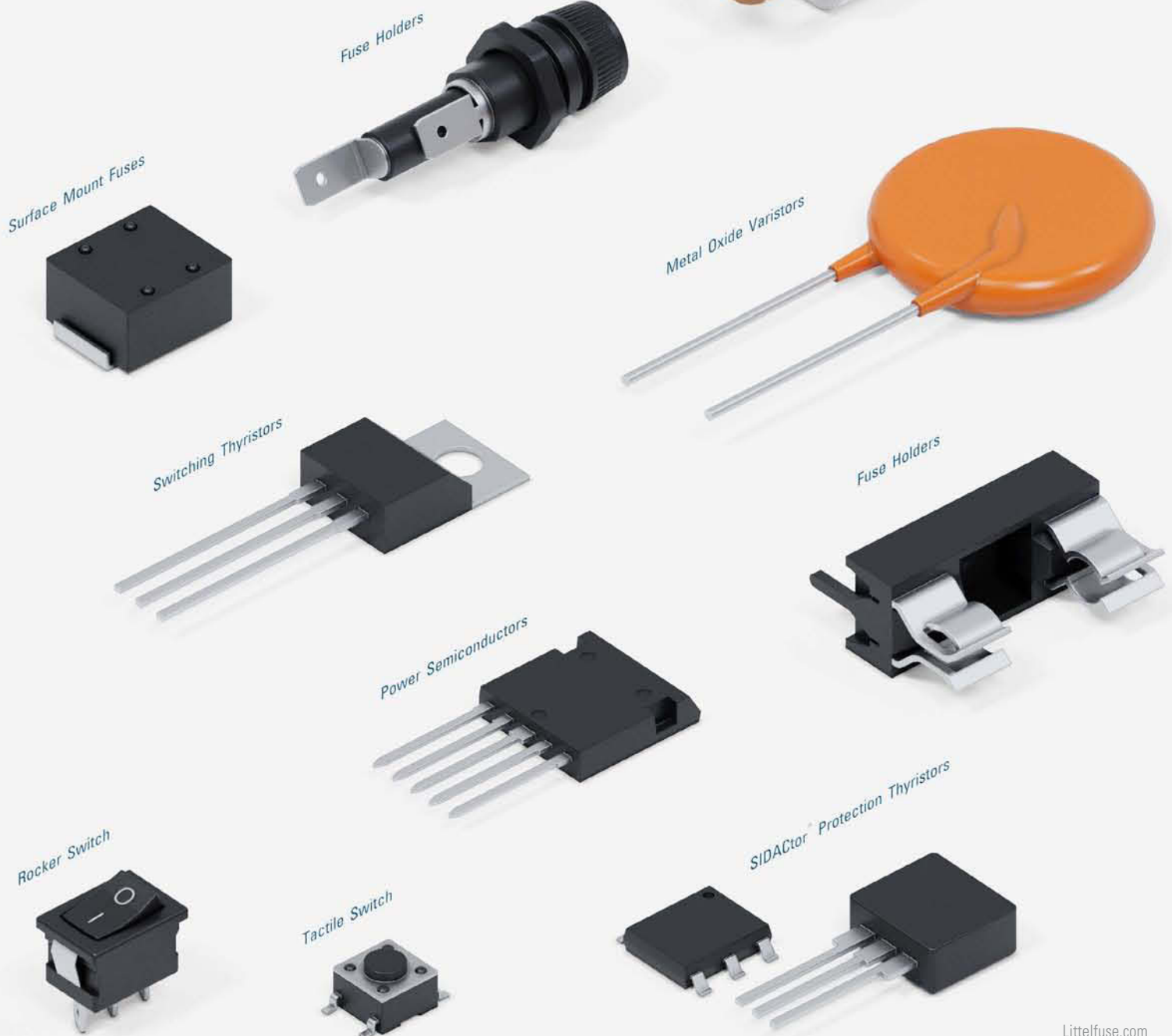
Data Center Solutions Application Guide

This guide provides an overview of the Littelfuse technologies used in various data center and cloud applications. It is designed to help you quickly find design solutions appropriate for your application.

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Technical Resources at Littelfuse.com

Technical information is only a click away. Littelfuse Technical Resources contains datasheets, product manuals, white papers, application guides, demos, on-line design tools, and more.



General Lab Capabilities



You need to be certain that your products live up to the highest standards for performance, reliability, safety, and regulatory compliance. Working with Littelfuse, you have access to dedicated application engineers who partner with you to provide expert design consultation, perform comprehensive tests simulating the harshest environments, and confidentially evaluate the results in consultation with you.

Testing Capabilities

Environmental

- Autoclave
- Dust
- H3TRB
- HAST
- High- & Low Temperature Storage
- High-Temperature Loading
- Ingress Protection (IP)
- HTGB
- HTRB
- Temperature & Humidity
- Temperature Cycling
- Thermal Shock
- Salt Fog

Physical-Mechanical Characteristics

- Acceleration
- Die Shear
- Leak Detection
- Mechanical Shock
- Resistance to Soldering Heat (Dip, Reflow, Wave)
- Resistance to Solvents
- Solderability
- Terminal Strength (Push, Pull, Bend)
- Vibration
- Wetting Balance
- Wire Pull

Electrical

- BCI
- Capacitance
- EFT
- ESD
- Impedance
- Insulation Resistance
- I-V
- Life
- Lightning Surge
- Overload
- Parametric Tests
- Power-Cross
- Power Cycling
- Ring Wave
- R-T
- S-Parameter Measurements (Insertion Loss, Isolation, Reflection)
- Short Circuit
- Step Current
- Surface Resistivity
- Surge
- TDR (Eye Diagram)
- Telecom
- Thermal Cut-Off
- Time-to-Trip
- TLP
- Transient
- Trip Cycle
- Trip Endurance
- Voltage Drop

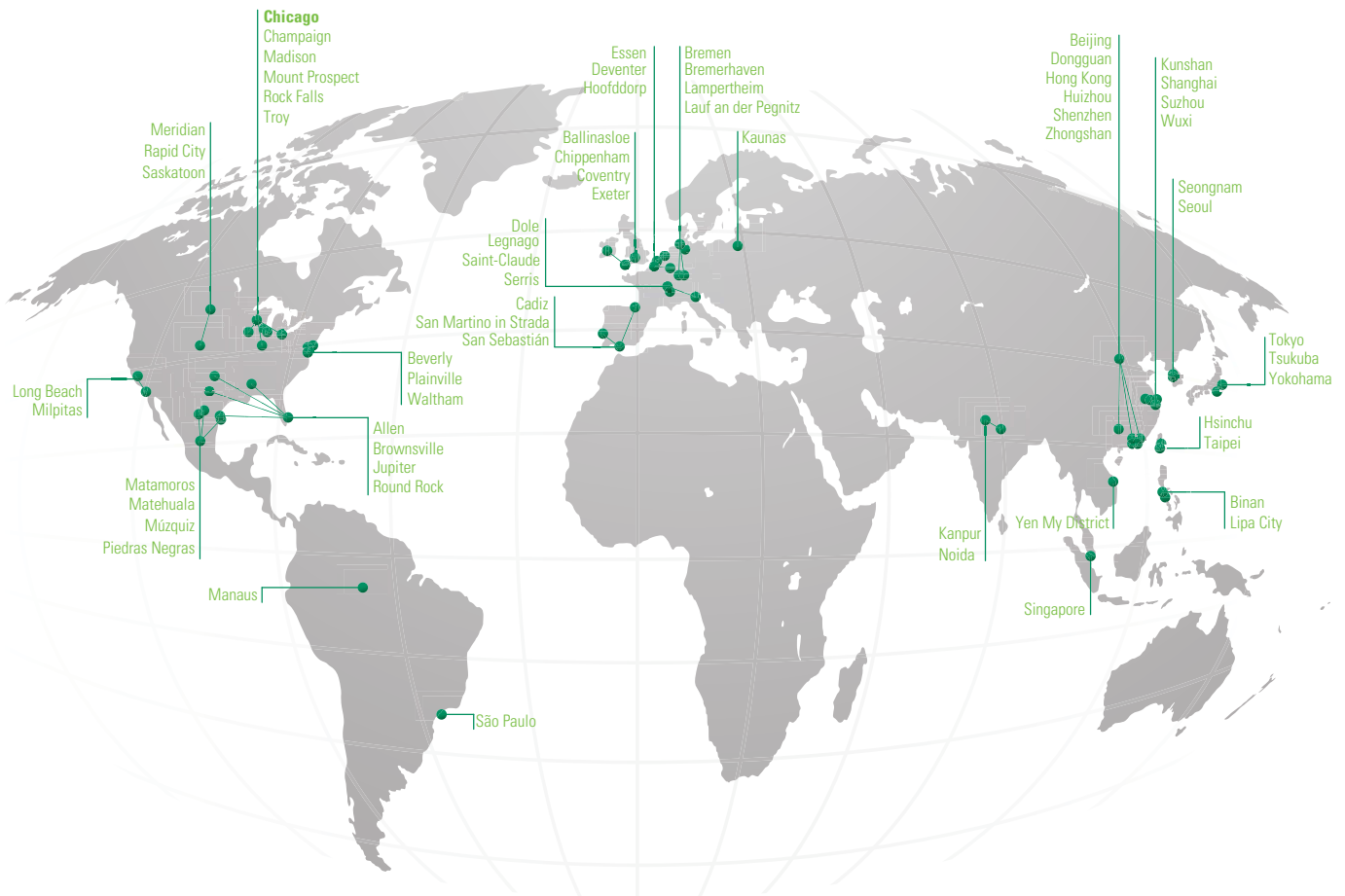


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