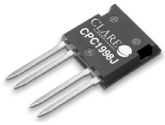
CPC1998
AC Power Switch



Characteristics

Parameter	Rating	Units
AC Operating Voltage	20-240	V_{rms}
Load Current		
With 5°C/W Heat Sink	20	A_{rms}
No Heat Sink	5	
On-State Voltage Drop	1.1	V_P (at I_L=2A_P)
Blocking Voltage	800	V_P
$R_{\theta JC}$	0.35	°C/W

Features

- Load Current up to 20A_{rms} with 5°C/W Heat Sink
- 800V_P Blocking Voltage
- 5mA Control Current
- Zero-Cross Switching
- 2500V_{rms} Isolation, Input to Output
- DC Control, AC Output
- Optically Isolated
- TTL and CMOS Compatible
- Low EMI and RFI Generation
- High Noise Immunity
- Machine Insertable, Wave Solderable

Applications

- Programmable Control
- Process Control
- Power Control Panels
- Remote Switching
- Gas Pump Electronics
- Contactors
- Large Relays
- Solenoids
- Motors
- Heaters

Approvals

- UL 508 Recognized Component: File E69938

Description

CPC1998J is an AC Solid State Switch utilizing dual power SCR outputs. This device also includes zero-cross turn-on circuitry and is specified with an 800V_P blocking voltage.

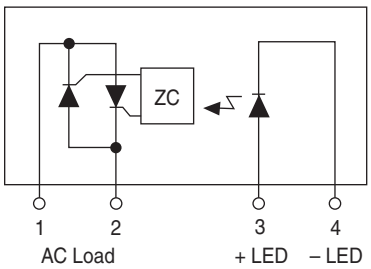
Tightly controlled zero-cross circuitry ensures low noise switching of AC loads by minimizing the generation of transients. The optically coupled input and output circuits provide exceptional noise immunity and 2500V_{rms} of isolation between the control and the output. As a result, the CPC1998 is well suited for industrial environments where electromagnetic interference would disrupt the operation of plant facility communications and control systems.

The unique i4-PAC package pioneered by IXYS allows Solid State Relays to achieve the highest load current and power ratings. This package features a unique IXYS process in which the silicon chips are soft soldered onto the Direct Copper Bond (DCB) substrate instead of the traditional copper leadframe. The DCB ceramic, the same substrate used in high power modules, not only provides 2500V_{rms} isolation but also very low thermal resistance (0.35 °C/W).

Ordering Information

Part	Description
CPC1998J	i4-PAC Package (25 per tube)

Pin Configuration



RoHS 2002/95/EC e3

1 .Specifications

1.1 Absolute Maximum Ratings @ 25°C

Symbol	Min	Max	Units
Blocking Voltage	-	800	V_P
Reverse Input Voltage	-	5	V
Input Control Current	-	50	mA
Peak (10ms)	-	1	A
Input Power Dissipation [1]	-	150	mW
Total Power Dissipation [2]	-	3.5	W
I^2t for Fusing (1/2 Sine Wave, 60Hz)	-	200	A^2s
Isolation Voltage, Input to Output	-	2500	V_{rms}
ESD, Human Body Model	-	8	kV
Operational Temperature	- 40	+85	°C
Storage Temperature	- 40	+125	°C

[1] Derate linearly 1.33mW / °C.

[2] Free air, no heat sink.

Absolute maximum ratings are stress ratings. Stresses in excess of these ratings can cause permanent damage to the device. Functional operation of the device at conditions beyond those indicated in the operational sections of this data sheet is not implied.

1.2 Electrical Characteristics @ 25°C

Parameter	Conditions	Symbol	Minimum	Typical	Maximum	Units
Output Characteristics						
Load Current						
Continuous	No Heat Sink, V_L=20-240V_{rms}	I_L	0.1	-	5	A_{rms}
Continuous	T_C=25°C		0.1	-	50	
Maximum Surge Current	1/2 Sine Wave, 60Hz	I_P	-	-	150	A
Off-State Leakage Current	V_L=800V	I_{LEAK}	-	-	100	μA_P
On-State Voltage Drop [1]	I_L=2A_P	-	-	0.85	1.1	V_P
Off-State dV/dt	I_F=0mA	dV/dt	1000	-	-	V/µs
Switching Speeds						
Turn-On	I_F=5mA	t_{on}	-	-	0.5	cycles
Turn-Off		t_{off}	-	-	0.5	
Zero-Cross Turn-On Voltage	1st half-cycle	-	-	5	20	V
	subsequent half-cycle		-	-	5	
Holding Current	-	I_H	-	44	50	mA
Latching Current	-	I_L	-	48	75	mA
Operating Frequency [2]	-	-	20	-	500	Hz
Load Power Factor for Guaranteed Turn-On [3]	f=60Hz	PF	0.25	-	-	-
Input Characteristics						
Input Control Current [4]	I_L=1A Resistive, f=60Hz	I_F	-	-	5	mA
Input Dropout Voltage	-	-	0.8	-	-	V
Input Voltage Drop	I_F=5mA	V_F	0.9	1.2	1.4	V
Reverse Input Current	V_R=5V	I_R	-	-	10	µA
Input/Output Characteristics						
Capacitance, Input-to-Output	-	$C_{I/O}$	-	-	3	pF

[1] Tested at a peak value equivalent.
[2] Zero-cross first half-cycle @ < 100Hz.
[3] Snubber circuits may be required at low power factors.
[4] For high-noise environments, or high-frequency operation (>60Hz), or for applications with a high inductive load, use $I_F \geq$ 10mA.

2 Thermal Characteristics

Parameter	Conditions	Symbol	Minimum	Typical	Maximum	Units
Thermal Resistance (Junction to Case)	-	$R_{\theta JC}$	-	-	0.35	°C/W
Thermal Resistance (Junction to Ambient)	Free Air	$R_{\theta JA}$	-	33	-	°C/W
Junction Temperature (Operating)	-	T_J	-40	-	125	°C

2.1 Thermal Management

Device high current characterization was performed using Kunze heat sink KU 1-159, phase change thermal interface material KU-ALC 5, and transistor clip KU 4-499/1. This combination provided an approximate junction-to-ambient thermal resistance of 12.5°C/W.

2.2 Heat Sink Calculation

Higher load currents are possible by using lower thermal resistance heat sink combinations.

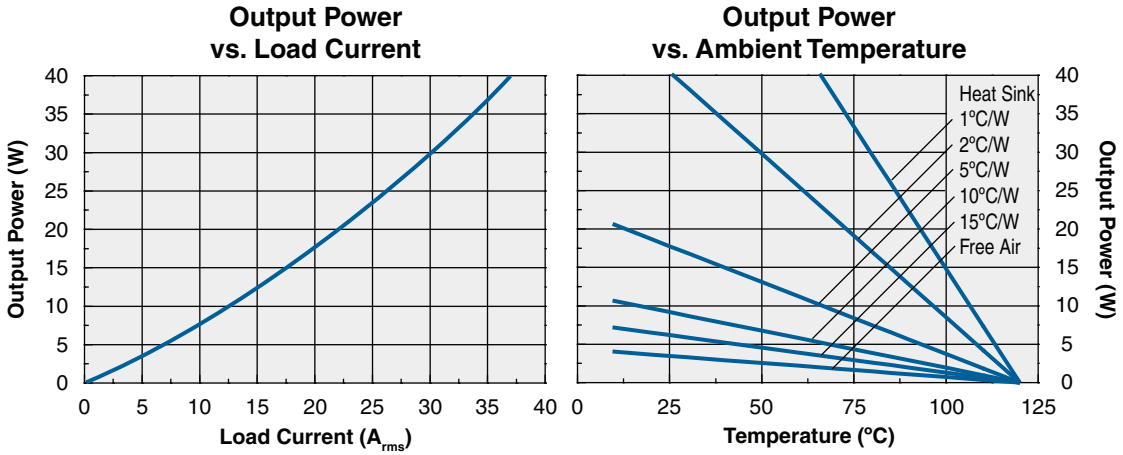
Heat Sink Rating

$$R_{\theta CA} = \frac{(T_J - T_A)}{P_D} - R_{\theta JC}$$

T_J = Junction Temperature (°C), $T_J \leq 125°C$ *
T_A = Ambient Temperature (°C)
$R_{\theta JC}$ = Thermal Resistance, Junction to Case (°C/W) = 0.35°C/W
$R_{\theta CA}$ = Thermal Resistance of Heat Sink & Thermal Interface Material , Case to Ambient (°C/W)
P_D = On-State Voltage (V_{rms}) • Load Current (A_{rms})

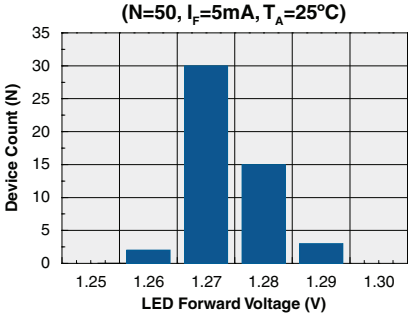
* Elevated junction temperature reduces semiconductor lifetime.

2.3 Thermal Performance Data

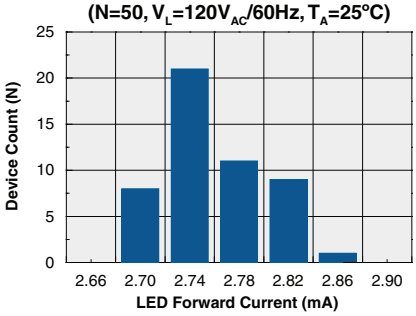


3 Performance Data*

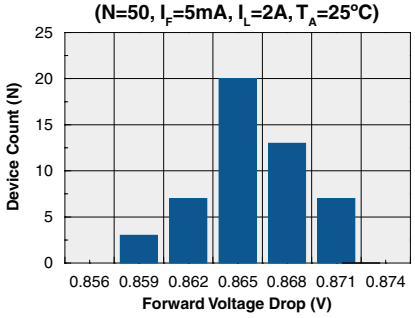
Typical LED Forward Voltage Drop
(N=50, I_F=5mA, T_A=25°C)



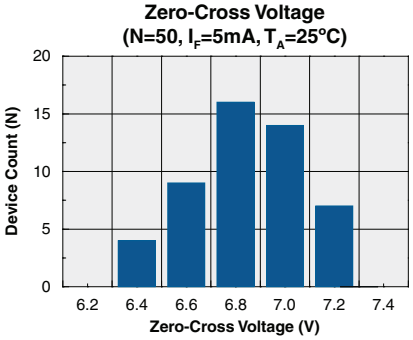
Typical I_F for Switch Operation
with 1A Resistive Load
(N=50, V_L=120V_{AC}/60Hz, T_A=25°C)



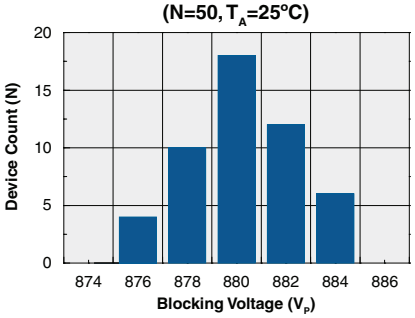
Forward Voltage Drop Distribution
(N=50, I_F=5mA, I_L=2A, T_A=25°C)



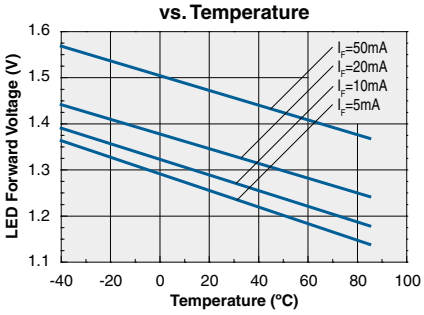
Zero-Cross Voltage
(N=50, I_F=5mA, T_A=25°C)



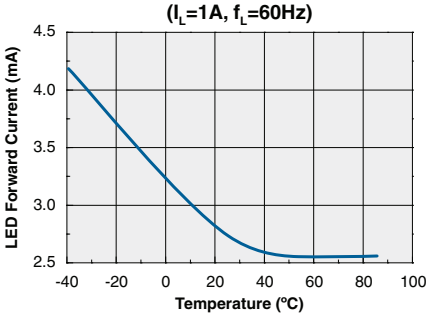
Typical Blocking Voltage Distribution
(N=50, T_A=25°C)



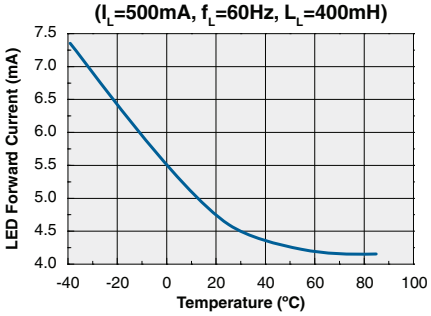
Typical LED Forward Voltage Drop
vs. Temperature



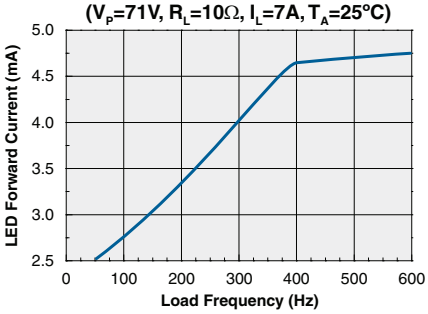
LED Forward Current to Operate
vs. Temperature - Resistive Load
(I_L=1A, f_L=60Hz)



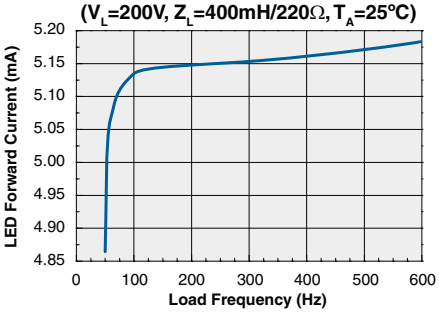
LED Forward Current to Operate
vs. Temperature - Inductive Load
(I_L=500mA, f_L=60Hz, L_L=400mH)



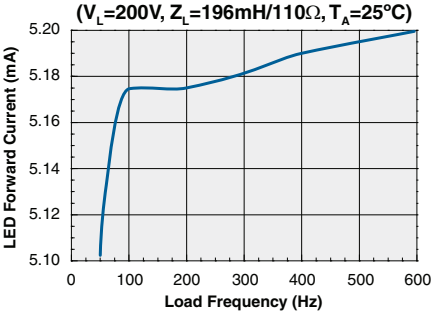
LED Current to Operate
vs. Load Frequency - Resistive Load
(V_P=71V, R_L=10Ω, I_L=7A, T_A=25°C)



LED Current to Operate
vs. Load Frequency - Inductive Load
(V_L=200V, Z_L=400mH/220Ω, T_A=25°C)

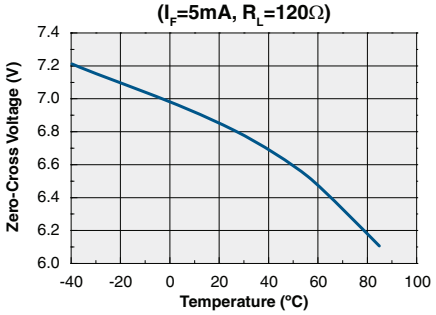


LED Current to Operate
vs. Load Frequency- Inductive Load
(V_L=200V, Z_L=196mH/110Ω, T_A=25°C)

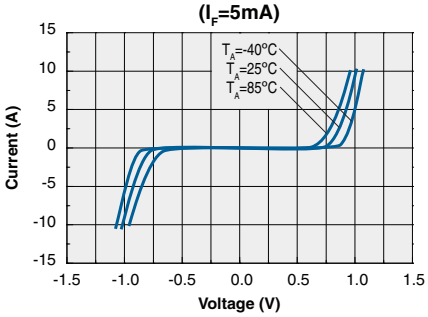


* The Performance data shown in the graphs above is typical of device performance. For guaranteed parameters not indicated in the written specifications, please contact our application department.

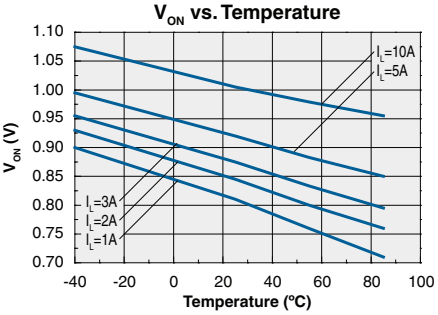
Zero-Cross Voltage vs. Temperature
(I_F=5mA, R_L=120Ω)



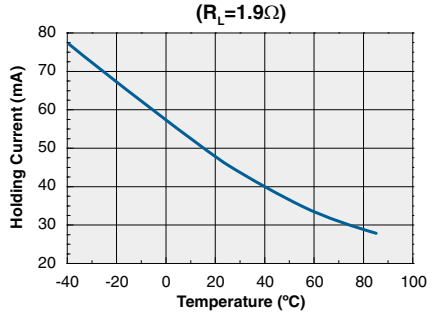
Output Voltage vs. Output Current
(I_F=5mA)



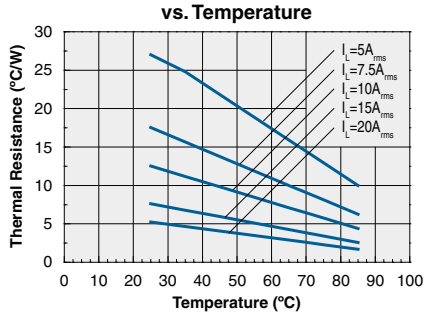
V_{ON} vs. Temperature



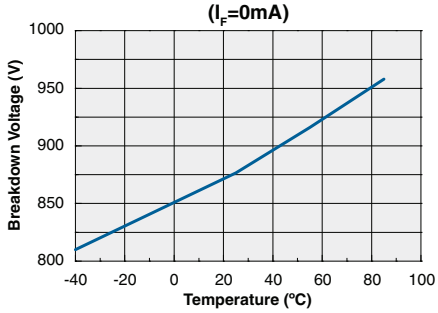
Holding Current vs. Temperature
(R_L=1.9Ω)



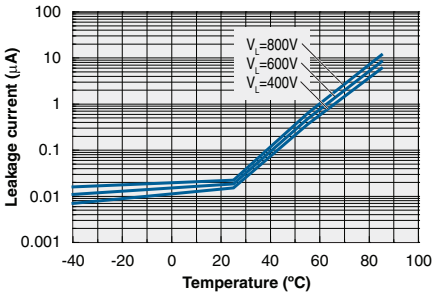
Total Heat Sinking Required
vs. Temperature



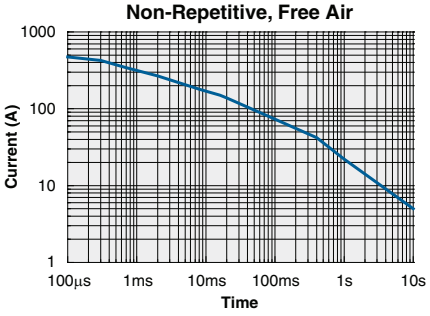
Breakdown Voltage vs. Temperature
(I_F=0mA)



Leakage Current vs. Temperature
Measured Across Pins 1&2



Maximum Surge Current
Non-Repetitive, Free Air



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4 Manufacturing Information

4.1 Moisture Sensitivity

All plastic encapsulated semiconductor packages are susceptible to moisture ingression. Clare classified all of its plastic encapsulated devices for moisture sensitivity according to the latest version of the joint industry standard, **IPC/JEDEC J-STD-020**, in force at the time of product evaluation. We test all of our products to the maximum conditions set forth in the standard, and guarantee proper operation of our devices when handled according to the limitations and information in that standard as well as to any limitations set forth in the information or standards referenced below.

Failure to adhere to the warnings or limitations as established by the listed specifications could result in reduced product performance, reduction of operable life, and/or reduction of overall reliability.

This product carries a **Moisture Sensitivity Level (MSL) rating** as shown below, and should be handled according to the requirements of the latest version of the joint industry standard **IPC/JEDEC J-STD-033**.

Device	Moisture Sensitivity Level (MSL) Rating
CPC1998J	MSL 1

4.2 ESD Sensitivity

This product is **ESD Sensitive**, and should be handled according to the industry standard **JESD-625**.

4.3 Reflow Profile

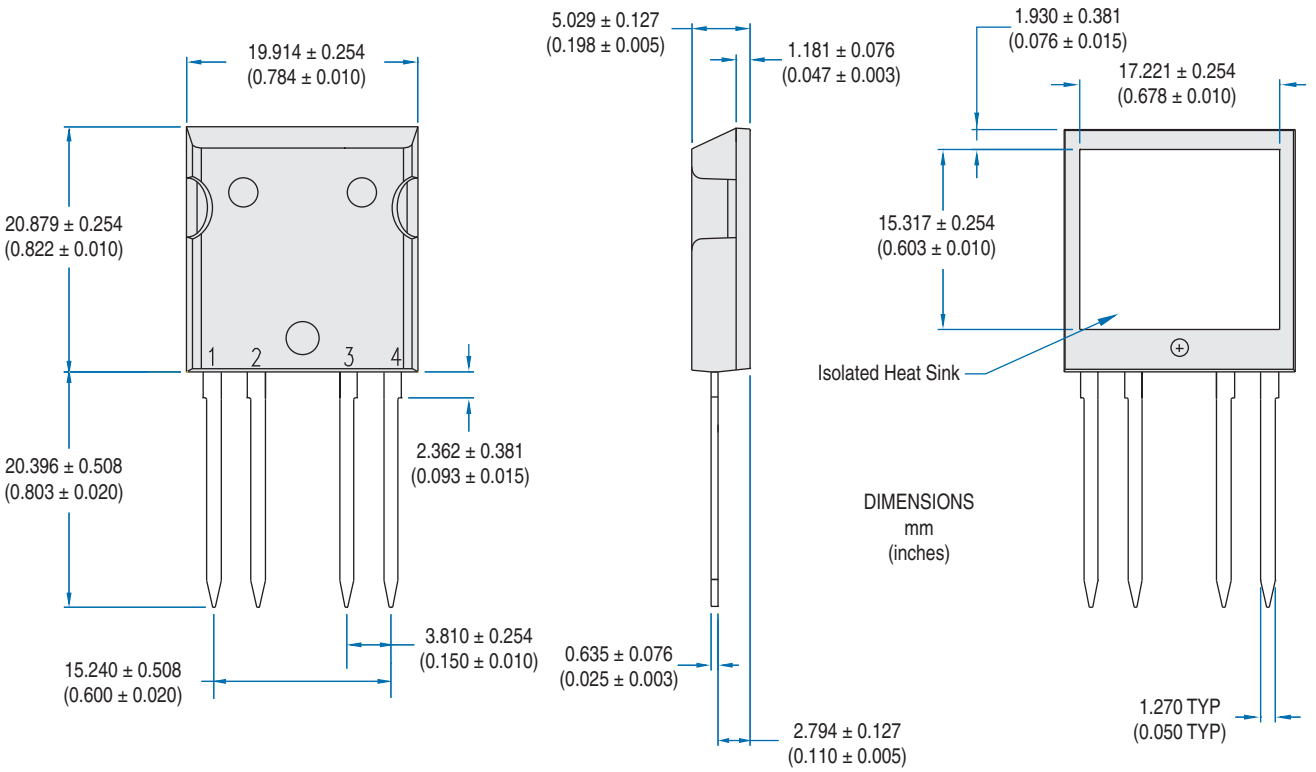
This product has a maximum body temperature and time rating as shown below. All other guidelines of **J-STD-020** must be observed.

Device	Maximum Temperature x Time
CPC1998J	245°C for 30 seconds

4.4 Board Wash

Clare recommends the use of no-clean flux formulations. However, board washing to remove flux residue is acceptable. Since Clare employs the use of silicone coating as an optical waveguide in many of its optically isolated products, the use of a short drying bake could be necessary if a wash is used after solder reflow processes. Chlorine-based or Fluorine-based solvents or fluxes should not be used. Cleaning methods that employ ultrasonic energy should not be used.

4.5 Mechanical Dimensions



NOTE: Back-side heat sink meets 2500V_{rms} isolation to the pins.

For additional information please visit our website at: www.clare.com

Specification: DS-CPC1998-R01

11/30/2010