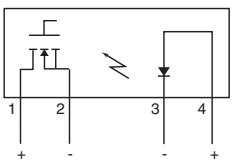
# CPC1788
# ISOPLUS™-264 DC Power Relay

| Parameter | Rating | Units |
|---|---|---|
| Blocking Voltage | 1000 | $V_P$ |
| Load Current | | |
| With 5°C/W Heat Sink | 2.45 | $A_{DC}$ |
| No Heat Sink | 1.0 | |
| On-resistance (Max) | 1.25 | Ω |
| $R_{\theta JC}$ | 0.3 | °C/W |

## Features
- 100% Solid State
- Compact ISOPLUS-264 Power Package
- Low Thermal Resistance (0.3°C/W)
- 2.45$A_{DC}$ Load Current with 5°C/W Heat Sink
- Electrically Non-conductive Thermal Pad for Heat Sink Applications
- Low Drive Power Requirements
- Arc-Free With No Snubbing Circuits
- 2500$V_{rms}$ Input/Output Isolation
- No EMI/RFI Generation
- Machine Insertable, Wave Solderable

## Applications
- Industrial Controls
- Motor Control
- Robotics
- Medical Equipment—Patient/Equipment Isolation
- Instrumentation
  - Multiplexers
  - Data Acquisition
  - Electronic Switching
  - I/O Subsystems
  - Meters (Watt-Hour, Water, Gas)
- Transportation Equipment
- Aerospace/Defense

## Pin Configuration




## Description
Clare and IXYS have combined to bring OptoMOS® technology, reliability and compact size to a new family of High Power Solid State Relays. As part of this new family, the CPC1788 single-pole, normally open (1-Form-A) DC Solid State Relay employs optically coupled MOSFET technology to provide 2500$V_{rms}$ of input to output isolation.

The output is constructed with an efficient MOSFET switch and photovoltaic die that uses Clare's patented OptoMOS architecture while the input GaAlAs infrared LED provides the optically coupled control. The combination of low on-resistance and high load current handling capability makes this relay suitable for a variety of high performance DC switching applications.

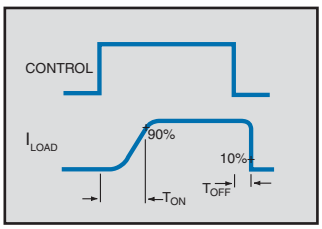
The unique ISOPLUS-264 package pioneered by IXYS allows solid state relays to achieve the highest load current and power ratings. This package features an IXYS unique process where the silicon chips are soft soldered onto the Direct Copper Bond (DCB) substrate instead of the usual copper leadframe. The DCB ceramic, the same substrate used in high power modules, not only provides 2500$V_{rms}$ isolation but also very low thermal resistance (0.3°C/W).

## Approvals
- UL 508 Recognized Component: File # E69938

## Ordering Information

| Part Number | Description |
|---|---|
| CPC1788J | ISOPLUS-264 (25 per tube) |

**Switching Characteristics of Normally Open (Form A) Devices**

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## Absolute Maximum Ratings

| Parameter | Ratings | Units |
|---|---|---|
| Blocking Voltage | 1000 | $V_P$ |
| Reverse Input Voltage | 5 | V |
| Input Control Current | 100 | mA |
| Peak (10ms) | 1 | $A_{DC}$ |
| Input Power Dissipation | 150 | mW |
| Isolation voltage, Input to Output | 2500 | $V_{rms}$ |
| Operational Temperature | -40 to +85 | °C |
| Storage Temperature | -40 to +125 | °C |

Electrical absolute maximum ratings are at 25°C

*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.*

## Electrical Characteristics

| Parameter | Conditions | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Output Characteristics** | **$T_A$=25°C** | | | | | |
| Load Current [1] | | | | | | |
| Peak | t ≤ 10ms | $I_L$ | - | - | 12 | $A_P$ |
| Continuous | No Heat Sink | | | | 1 | $A_{DC}$ |
| Continuous | $T_C$=25°C | | | | 10.3 | |
| Continuous | $T_C$=99°C | $I_{L(99)}$ | | | 1.2 | |
| On-Resistance [2] | $I_F$=10mA, $I_L$=1A | $R_{ON}$ | - | 1.0 | 1.25 | Ω |
| Off-State Leakage Current | $V_L$=1000$V_P$ | $I_{LEAK}$ | - | - | 1 | µA |
| Switching Speeds | | | | | | |
| Turn-On | $I_F$=20mA, $V_L$=10V | $T_{ON}$ | - | 2.85 | 20 | ms |
| Turn-Off | | $T_{OFF}$ | - | 0.11 | 5 | |
| Output Capacitance | V=25V, f=1MHz | $C_{OUT}$ | - | 640 | - | pF |
| **Input Characteristics** | **$T_A$=25°C** | | | | | |
| Input Control Current [3] | $I_L$=1A | $I_F$ | - | - | 10 | mA |
| Input Dropout Current | - | $I_F$ | 0.6 | - | - | mA |
| 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 |
| **Common Characteristics** | **$T_A$=25°C** | | | | | |
| Capacitance Input to Output | - | $C_{I/O}$ | - | 1 | - | pF |

[1] Higher load currents possible with proper heatsinking.
[2] Measurement taken within 1 second of on time.
[3] For applications requiring high temperature operation (greater than 60ºC) an LED drive current of 20mA is recommended.

## Thermal Characteristics

| Parameter | Conditions | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Thermal Resistance (junction to case) | - | $R_{\theta JC}$ | - | - | 0.3 | °C/W |
| Thermal Resistance (junction to ambient) | Free air | $R_{\theta JA}$ | - | 33 | - | °C/W |
| Junction Temperature (operation) | - | $T_J$ | -40 | - | 100 | °C |

## 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.

## Heat Sink Calculation

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

**Heat Sink Rating**

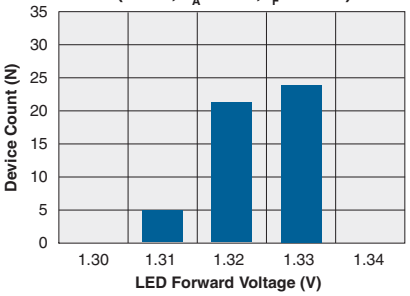
$$R_{\theta CA} = \frac{(T_J - T_A)\, I_{L(99)}^{\,2}}{I_L^{\,2} \bullet P_{D(99)}} - R_{\theta JC}$$

$T_J$ = Junction Temperature (°C), $T_J \leq 100°C$ *
$T_A$ = Ambient Temperature (°C)
$I_{L(99)}$ = Load Current with Case Temperature @ 99°C ($A_{DC}$)
$I_L$ = Desired Operating Load Current ($A_{DC}$), $I_L \leq I_{L(MAX)}$
$R_{\theta JC}$ = Thermal Resistance, Junction to Case (°C/W) = 0.3°C/W
$R_{\theta CA}$ = Thermal Resistance of Heat Sink & Thermal Interface Material , Case to Ambient (°C/W)
$P_{D(99)}$ = Maximum power dissipation with case temperature held at 99°C = 3.33W

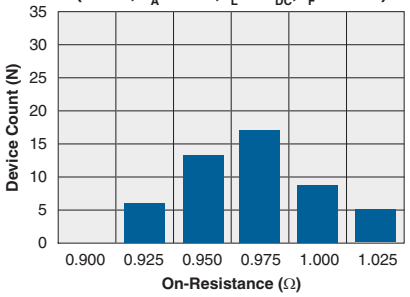
* Elevated junction temperature reduces semiconductor lifetime.

## PERFORMANCE DATA*

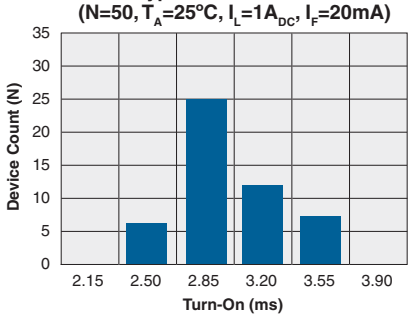
**CPC1788**
**Typical LED Forward Voltage Drop**
**(N=50, $T_A$=25°C, $I_F$=10mA)**



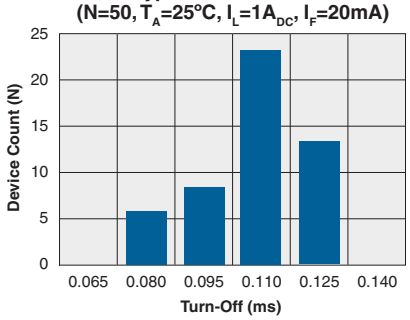

**CPC1788**
**Typical On-Resistance Distribution**
**(N=50, $T_A$=25°C, $I_L$=1$A_{DC}$, $I_F$=10mA)**



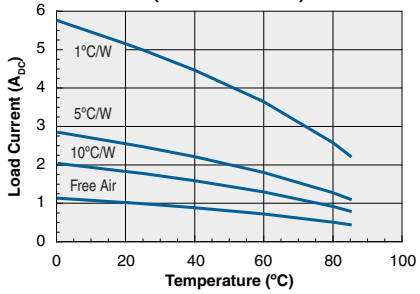

**CPC1788**
**Typical Turn-On Time**
**(N=50, $T_A$=25°C, $I_L$=1$A_{DC}$, $I_F$=20mA)**



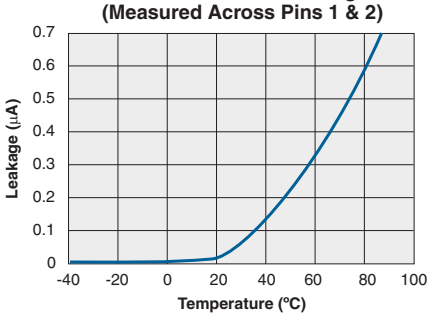

**CPC1788**
**Typical Turn-Off Time**
**(N=50, $T_A$=25°C, $I_L$=1$A_{DC}$, $I_F$=20mA)**



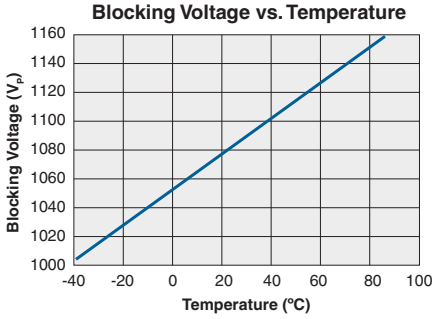

**CPC1788**
**Maximum Load Current vs. Temperature**
**(With Heat Sink)**



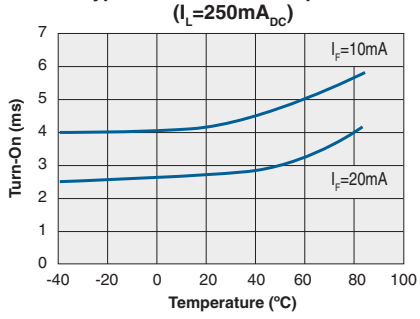

**CPC1788**
**Typical Leakage vs. Temperature**
**at Maximum Rated Voltage**
**(Measured Across Pins 1 & 2)**



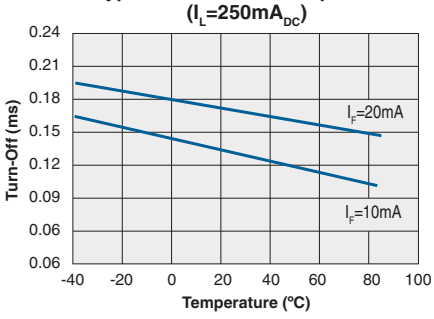

**CPC1788**
**Blocking Voltage vs. Temperature**



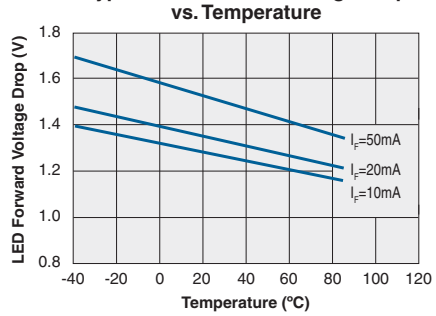

**CPC1788**
**Typical Turn-On vs. Temperature**
**($I_L$=250m$A_{DC}$)**



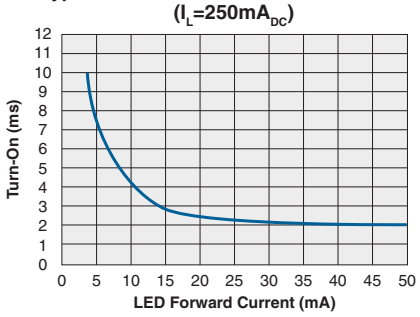

**CPC1788**
**Typical Turn-Off vs. Temperature**
**($I_L$=250m$A_{DC}$)**



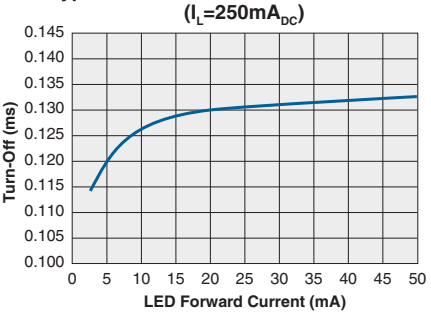

**CPC1788**
**Typical LED Forward Voltage Drop**
**vs. Temperature**




**CPC1788**
**Typical Turn-On vs. LED Forward Current**
**($I_L$=250m$A_{DC}$)**



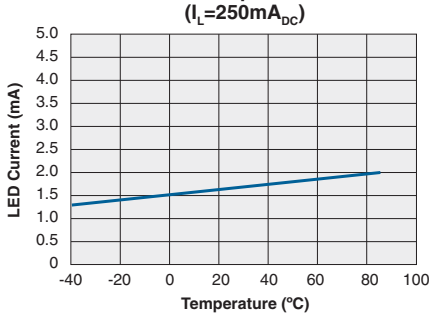

**CPC1788**
**Typical Turn-Off vs. LED Forward Current**
**($I_L$=250m$A_{DC}$)**



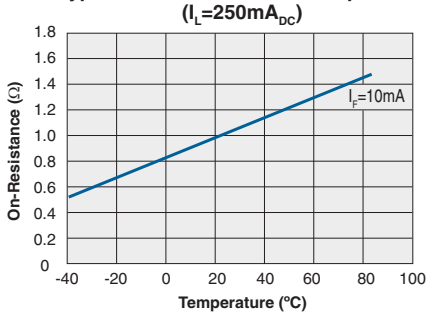

*The Performance data shown in the graphs above is typical of device performance. For guaranteed parameters not indicated in the written specifications, please contact our application department.

## PERFORMANCE DATA*

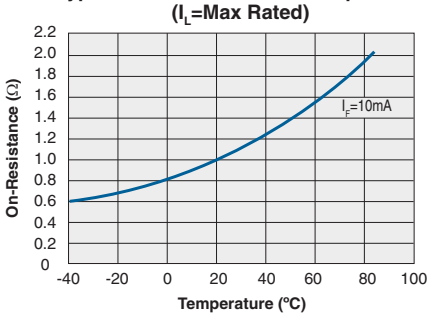
**CPC1788**
**Typical $I_F$ for Switch Operation vs. Temperature ($I_L$=250mA$_{DC}$)**



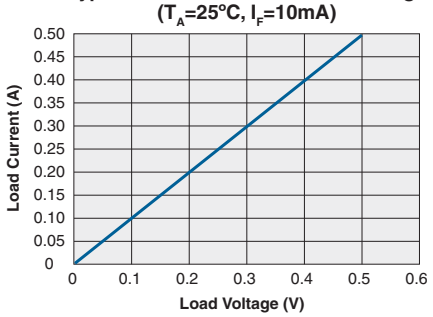

**CPC1788**
**Typical On-Resistance vs. Temperature ($I_L$=250mA$_{DC}$)**



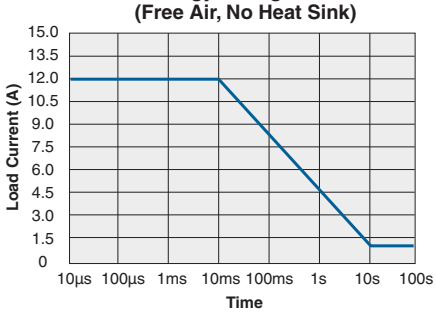

**CPC1788**
**Typical On-Resistance vs. Temperature ($I_L$=Max Rated)**




**CPC1788**
**Typical Load Current vs. Load Voltage ($T_A$=25°C, $I_F$=10mA)**




**CPC1788**
**Energy Rating Curve (Free Air, No Heat Sink)**

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## MANUFACTURING INFORMATION

### Soldering

For proper assembly, the component must be processed in accordance with the current revision of IPC/JEDEC standard J-STD-020. Failure to follow the recommended guidelines may cause permanent damage to the device resulting in impaired performance and/or a reduced lifetime expectancy.

### Washing

Clare does not recommend ultrasonic cleaning or the use of chlorinated solvents.

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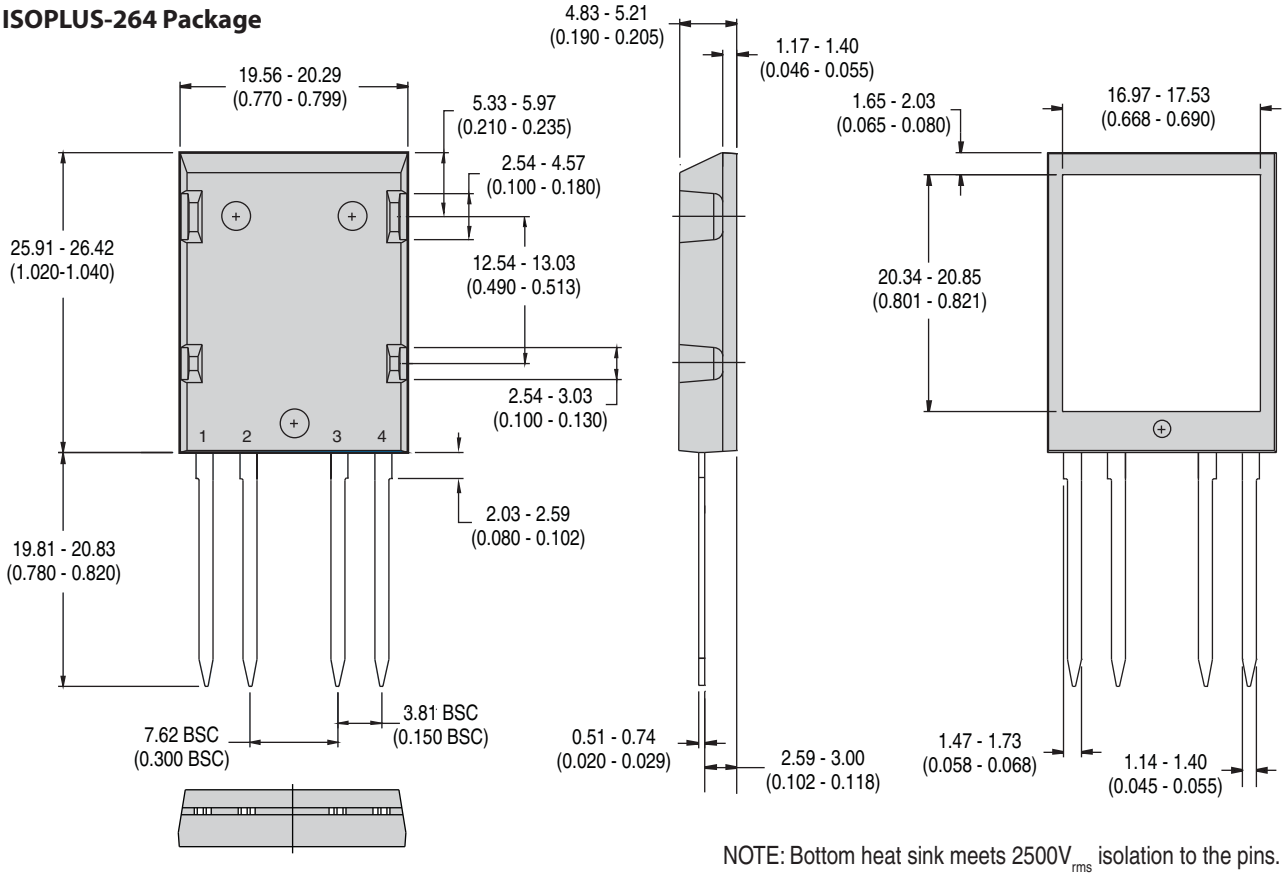
## MECHANICAL DIMENSIONS:

**ISOPLUS-264 Package**




NOTE: Bottom heat sink meets 2500$V_{rms}$ isolation to the pins.

DIMENSIONS
MIN - MAX mm
(MIN - MAX inches)

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





DS-CPC1788-R02

7/18/08