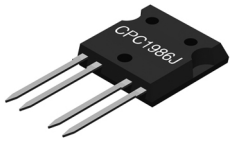
IXYS
INTEGRATED CIRCUITS DIVISION




# CPC1986
## i4-PAC™ Power Relay

## Characteristics

| Parameter | Rating | Units |
|---|---|---|
| Blocking Voltage | 1000 | $V_P$ |
| Load Current, $T_A$=25°C: | | |
| With 5°C/W Heat Sink | 1.6 | $A_{rms}$ |
| No Heat Sink | 0.65 | |
| On-Resistance (max) | 3 | Ω |
| $R_{\theta JC}$ | 0.35 | °C/W |

## Features

- 1.6$A_{rms}$ Load Current with 5°C/W Heat Sink
- Low 3Ω On-Resistance
- 1000$V_P$ Blocking Voltage
- 2500$V_{rms}$ Input/Output Isolation
- Low Thermal Resistance (0.35 °C/W)
- Electrically Non-conductive Thermal Pad for Heat Sink Applications
- Low Drive Power Requirements
- Arc-Free With No Snubbing Circuits
- No EMI/RFI Generation
- Machine Insertable, Wave Solderable

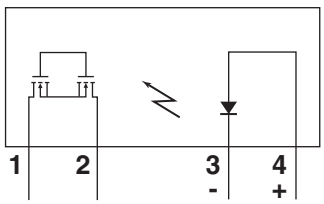
## Applications

- 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

## Approvals

- UL 508 Certified Component: File E69938

## Pin Configuration




RoHS e3

## Description

IXYS Integrated Circuits Division 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 family, the CPC1986 single-pole, normally open (1-Form-A) Solid State Power Relay is rated for up to 1.6$A_{rms}$ continuous load current with a 5°C/W heat sink.

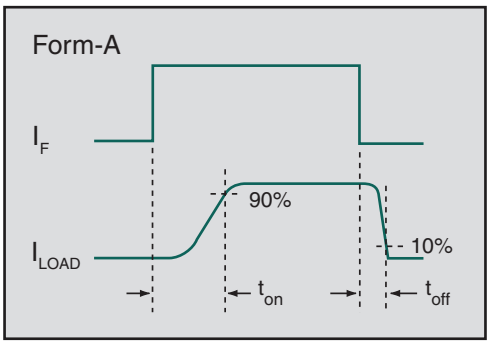
The CPC1986 employs optically coupled MOSFET technology to provide 2500$V_{rms}$ of input to output isolation. The optically coupled outputs, that use patented OptoMOS architecture, are controlled by a highly efficient GaAlAs infrared LED. The combination of low on-resistance and high load current handling capability makes this relay suitable for a variety of high performance switching applications.

The unique i4-PAC package pioneered by IXYS enables 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 2500$V_{rms}$ isolation but also very low thermal resistance (0.35 °C/W).

## Ordering Information

| Part | Description |
|---|---|
| CPC1986J | i4-PAC Package (25 per tube) |

## Switching Characteristics






ПРОМЭЛЕКТРОНИКА / sales@prom-elec.com

# 1 Specifications

## 1.1 Absolute Maximum Ratings @ 25°C

| Symbol | Ratings | Units |
|---|---|---|
| Blocking Voltage | 1000 | $V_P$ |
| Reverse Input Voltage | 5 | V |
| Input Control Current | 100 | mA |
| Peak (10ms) | 1 | A |
| 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 |

*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 [1] | | | | | | |
| Peak | t≤10ms | $I_L$ | - | - | 10 | $A_P$ |
| Continuous | No Heat Sink | $I_L$ | - | - | 0.65 | $A_{rms}$ |
| Continuous | $T_C$=25°C | $I_L$ | - | - | 6.5 | $A_{rms}$ |
| Continuous | $T_C$=99°C | $I_{L(99)}$ | - | - | 0.75 | $A_{rms}$ |
| On-Resistance [2] | $I_F$=10mA, $I_L$=1A | $R_{ON}$ | - | 2.4 | 3 | Ω |
| Off-State Leakage Current | $V_L$=1000$V_P$ | $I_{LEAK}$ | - | - | 1 | µA |
| Switching Speeds | | | | | | |
| Turn-On | $I_F$=20mA, $V_L$=10V | $t_{on}$ | - | - | 20 | ms |
| Turn-Off | $I_F$=20mA, $V_L$=10V | $t_{off}$ | - | - | 5 | ms |
| Output Capacitance | $V_L$=25V, f=1MHz | $C_{out}$ | - | 330 | - | pF |
| **Input Characteristics** | | | | | | |
| Input Control Current to Activate [3] | $I_L$=120mA | $I_F$ | - | - | 10 | mA |
| Input Control Current to Deactivate | - | $I_F$ | 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 |
| **Input/Output Characteristics** | | | | | | |
| Capacitance, Input-to-Output | - | $C_{I/O}$ | - | 1 | - | pF |

[1] Higher load currents possible with proper heat sinking.
[2] Measurement taken within 1 second of on-time.
[3] For applications requiring high temperature operation ($T_C$ > 60ºC) a LED drive current of 20mA is recommended.

## 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 | - | 100 | °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.

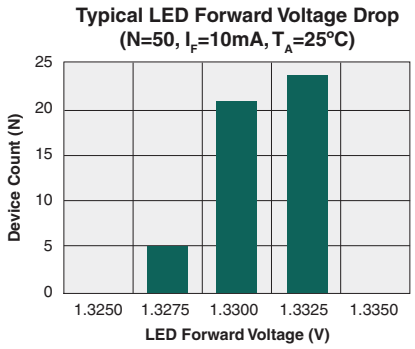
**Heat Sink Rating**

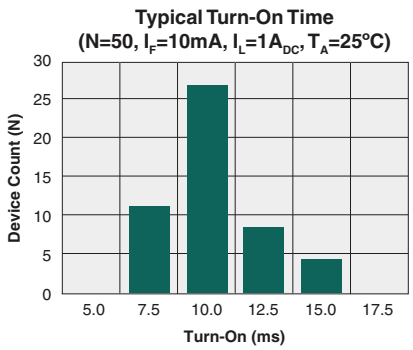
$$R_{\theta CA} = \frac{(T_J - T_A)\, I_{L(99)}^2}{I_L^2 \bullet P_{D(99)}} - R_{\theta JC}$$

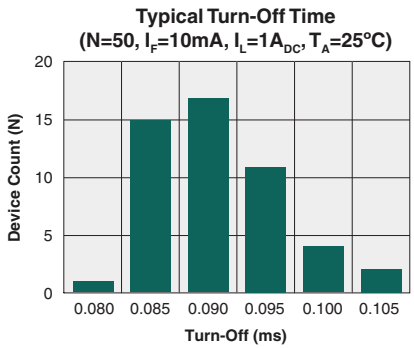
$T_J$ = Junction Temperature (°C), $T_J \leq 100°C$ *
$T_A$ = Ambient Temperature (°C)
$I_{L(99)}$ = Load Current with Case Temperature @ 99°C ($A_{DC}$)
$I_L$ = Desired Operating Load Current ($A_{DC}$), $I_L \leq I_{L(MAX)}$
$R_{\theta JC}$ = Thermal Resistance, Junction to Case (°C/W) = 0.35°C/W
$R_{\theta CA}$ = Thermal Resistance of Heat Sink & Thermal Interface Material , Case to Ambient (°C/W)
$P_{D(99)}$ = Maximum power dissipation with case temperature held at 99ºC = 2.86W

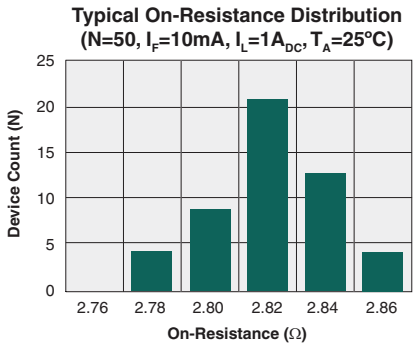
* Elevated junction temperature reduces semiconductor lifetime.

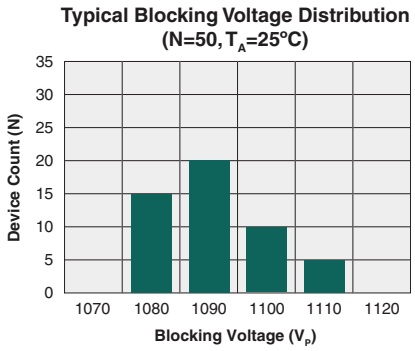
## 3 Performance Data

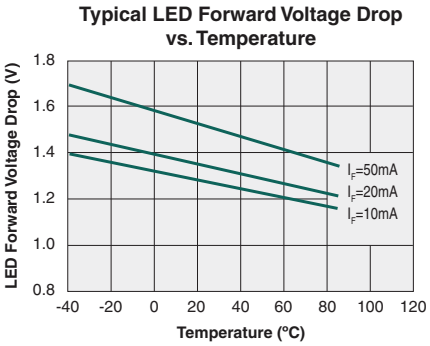


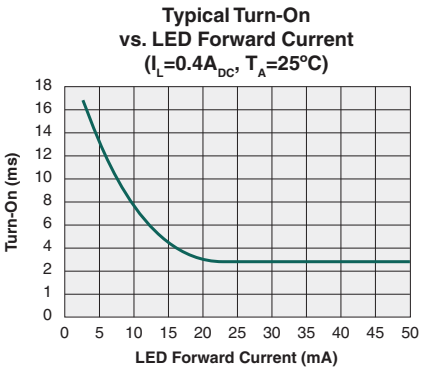



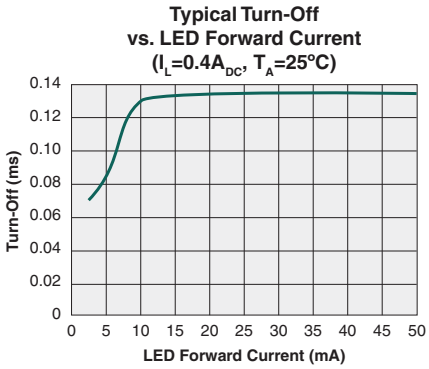



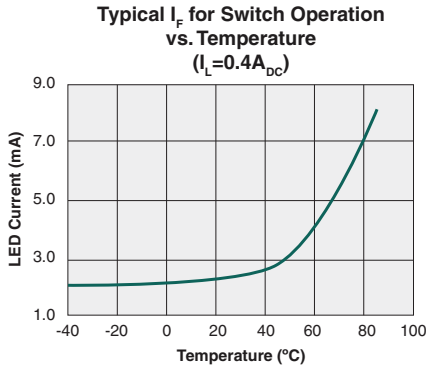



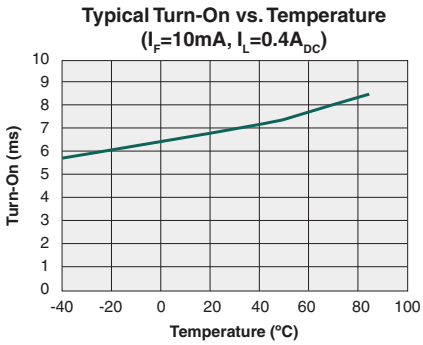



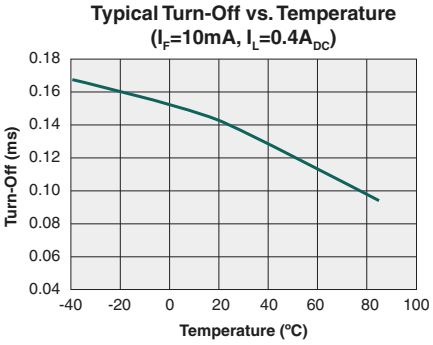



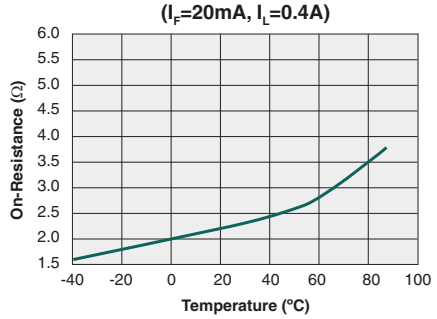



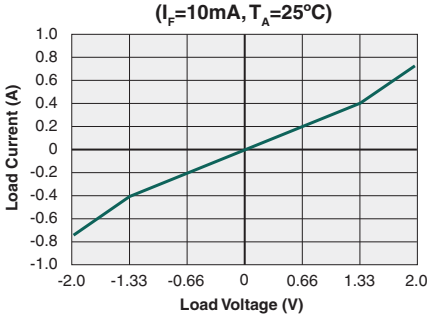

Unless otherwise specified, all performance data was acquired without the use of a heat sink.

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.

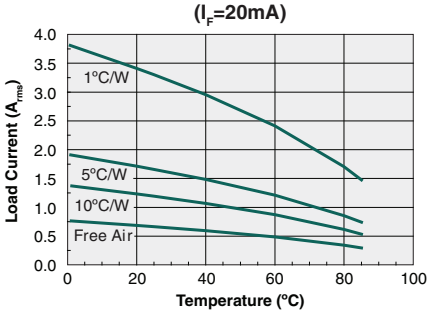
**Typical On-Resistance vs. Temperature ($I_F$=20mA, $I_L$=0.4A)**



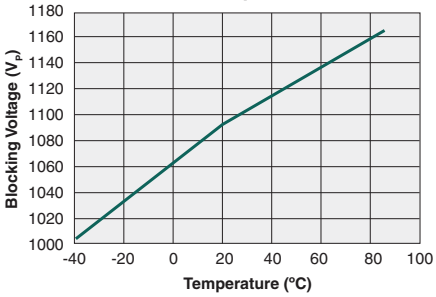

**Typical Load Current vs. Load Voltage ($I_F$=10mA, $T_A$=25°C)**



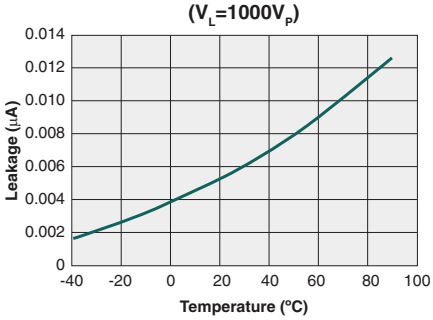

**Maximum Load Current vs. Temperature with Heat Sink ($I_F$=20mA)**



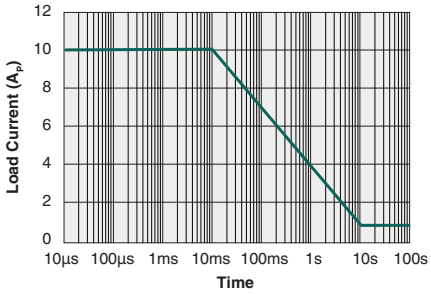

**Typical Blocking Voltage vs. Temperature**




**Typical Leakage vs. Temperature Measured Across Pins 1&2 ($V_L$=1000$V_P$)**




**Energy Rating Curve Free Air, No Heat Sink**




Unless otherwise specified, all performance data was acquired without the use of a heat sink.

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.

# 4 Manufacturing Information

## 4.1 Moisture Sensitivity

All plastic encapsulated semiconductor packages are susceptible to moisture ingression. IXYS Integrated Circuits Division 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 |
|---|---|
| CPC1986J | 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

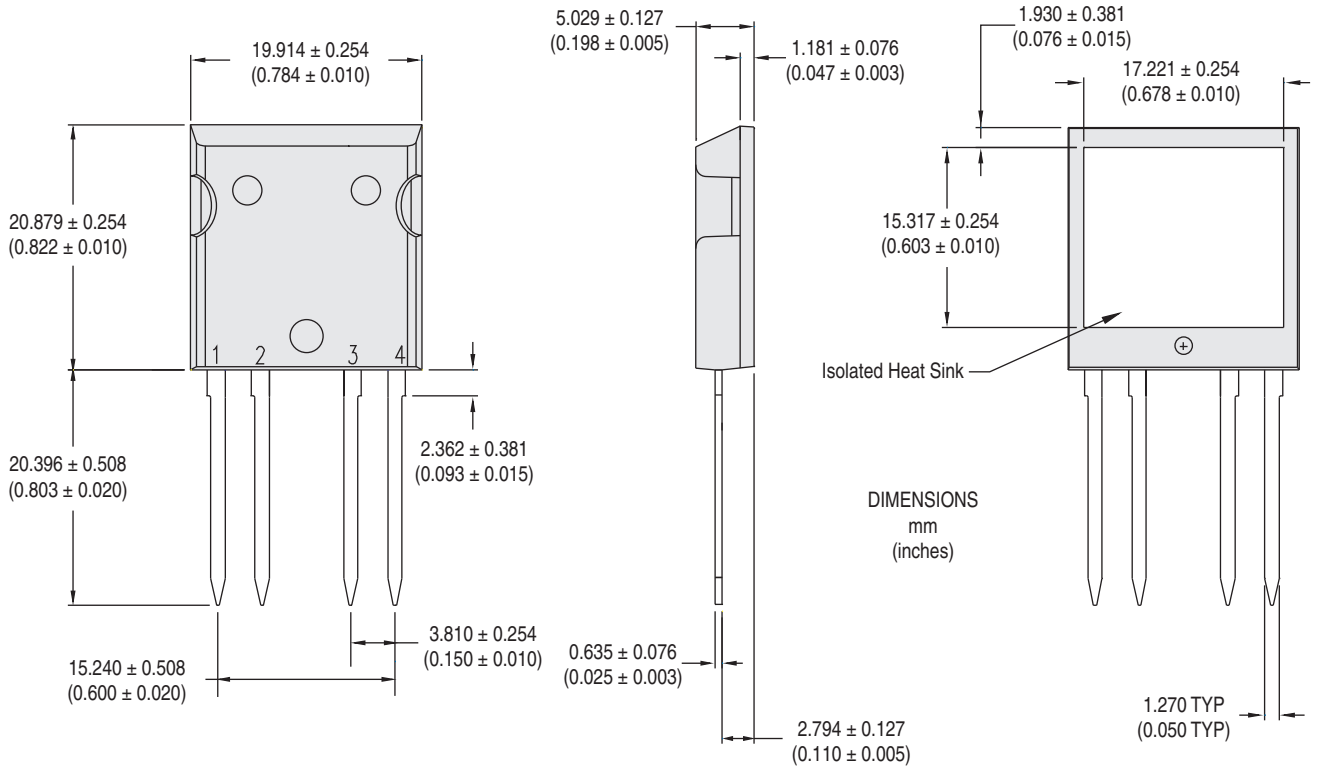
This product has a maximum body temperature and time rating as shown below. All other guidelines of **J-STD-020** must be observed.

| Device | Maximum Temperature x Time |
|---|---|
| CPC1986J | 245°C for 30 seconds |

## 4.4 Board Wash

IXYS Integrated Circuits Division recommends the use of no-clean flux formulations. However, board washing to remove flux residue is acceptable. Since IXYS Integrated Circuits Division employs the use of silicone coating as an optical waveguide in many of its optically isolated products, the use of a short drying bake may 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 2500$V_{rms}$ isolation to the pins.

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

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12/17/2012

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