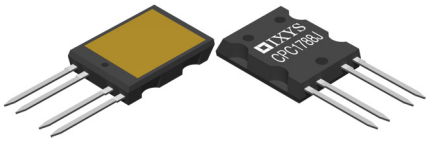
CPC1788

1000V Single-Pole, Normally Open DC-Only Power Relay



Characteristics

Parameter	Rating	Units
Blocking Voltage	1000	V_P
Load Current, T_A=25°C:		
With 5°C/W Heat Sink	2.45	A_{DC}
No Heat Sink	1	
On-Resistance (max)	1.25	Ω
Thermal Resistance, Junction-to-Case, θ_{JC}	0.3	°C/W

Features

- 2.45A_{DC} Load Current with 5°C/W Heat Sink
- Low 1.25Ω On-Resistance
- 1000V_P Blocking Voltage
- 2500V_{rms} Input/Output Isolation
- Low Thermal Resistance: θ_{JC} = 0.3 °C/W
- Isolated, Low Thermal Impedance Ceramic Pad for Heat Sink Applications
- Low Drive Power Requirements
- Arc-Free With No Snubbing Circuits
- No EMI/RFI Generation
- Machine Insertable, Wave Solderable

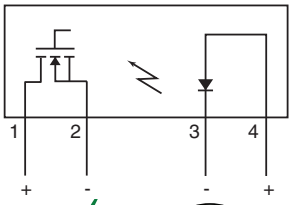
Applications

- 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 new family, the CPC1788 single-pole normally open (1-Form-A) DC Solid State Power Relay employs optically coupled MOSFET technology to provide 2500V_{rms} of input to output isolation.

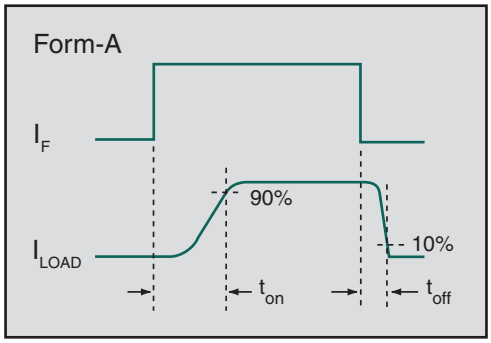
The optically coupled outputs, that use patented OptoMOS architecture, are controlled by a highly efficient infrared LED. The combination of low on-resistance and high load current handling capability makes this relay suitable for a variety of high performance DC switching applications.

The unique ISOPLUS-264 package pioneered by IXYS enables Solid State Relays to achieve the highest load current and power ratings. This package features a unique IXYS process where 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 junction-to-case thermal resistance (0.3 °C/W).

Ordering Information

Part	Description
CPC1788J	ISOPLUS-264 Package (25 per tube)

Switching Characteristics



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_{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

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	-	-	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	1.25	Ω
Off-State Leakage Current	V_L=1000V_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_L=25V, f=1MHz	C_{out}	-	640	-	pF
Input Characteristics						
Input Control Current to Activate [3]	I_L=1A	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 > 60°C) an LED drive current of 20mA is recommended.

2 Thermal Characteristics

Parameter	Conditions	Symbol	Rating	Units
Thermal Resistance (Junction to Case)	-	θ_{JC}	0.3	°C/W
Thermal Resistance (Junction to Ambient)	Free Air	θ_{JA}	33	°C/W
Junction Temperature (Operating)	-	T_J	-40 to +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

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

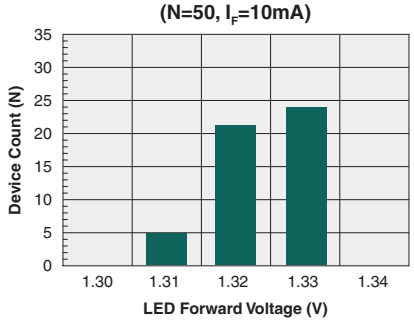
T_J = Junction Temperature (°C), $T_J \leq 100°C$ *
T_A = Ambient Temperature (°C)
$I_{L(99)}$ = Load Current with Case Temperature @ 99°C (A_{DC})
I_L = Desired Operating Load Current (A_{DC}), $I_L \leq I_{L(MAX)}$
θ_{JC} = Thermal Resistance, Junction to Case (°C/W) = 0.3°C/W
θ_{CA} = Thermal Resistance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

* Elevated junction temperature reduces semiconductor lifetime.

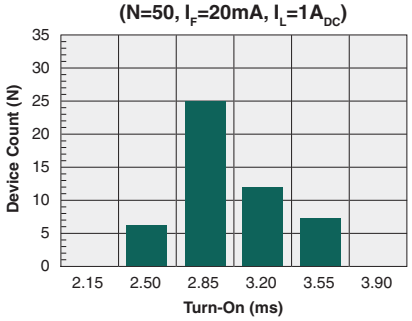
NOTE: The exposed surface of the DCB substrate is not to be soldered.

3 Performance Data @ 25°C (Unless Otherwise Noted)

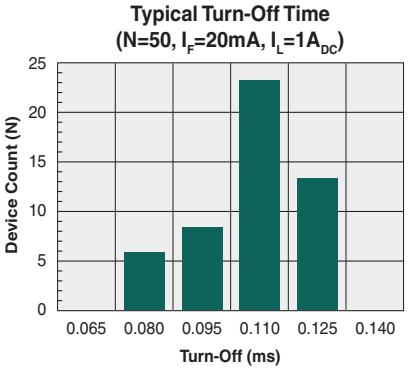
Typical LED Forward Voltage Drop
(N=50, I_F=10mA)



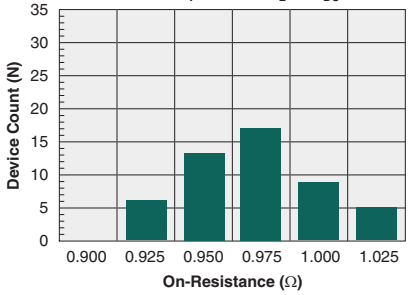
Typical Turn-On Time
(N=50, I_F=20mA, I_L=1A_{DC})



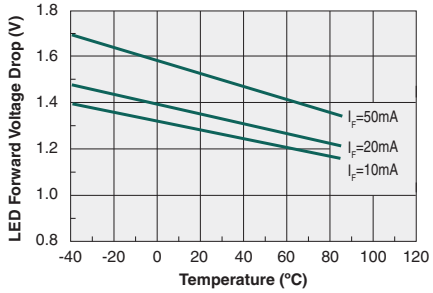
Typical Turn-Off Time
(N=50, I_F=20mA, I_L=1A_{DC})



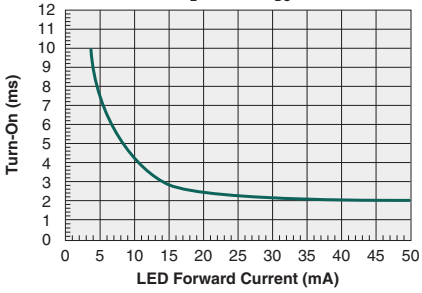
Typical On-Resistance Distribution
(N=50, I_F=10mA, I_L=1A_{DC})



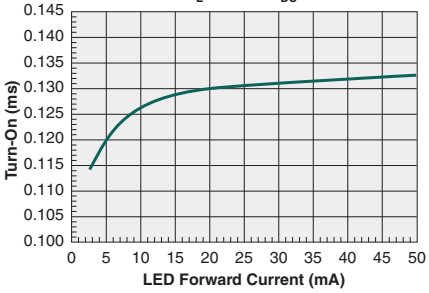
Typical LED Forward Voltage Drop
vs. Temperature



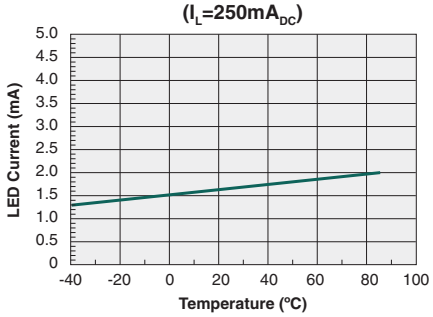
Typical Turn-On Time
vs. LED Forward Current
(I_L=250mA_{DC})



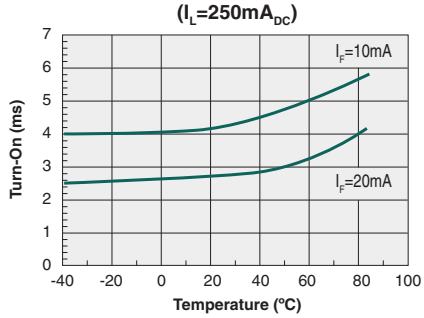
Typical Turn-Off Time
vs. LED Forward Current
(I_L=250mA_{DC})



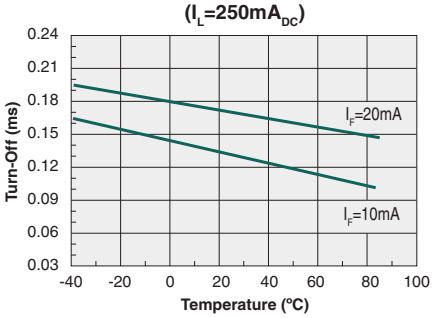
Typical I_F for Switch Operation
vs. Temperature
(I_L=250mA_{DC})



Typical Turn-On Time vs. Temperature
(I_L=250mA_{DC})



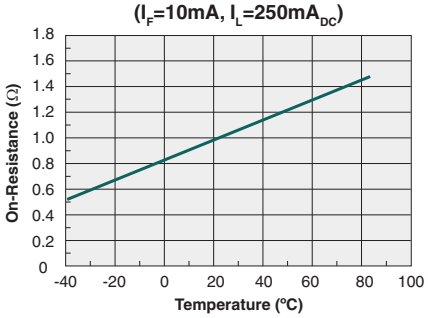
Typical Turn-Off Time vs. Temperature
(I_L=250mA_{DC})



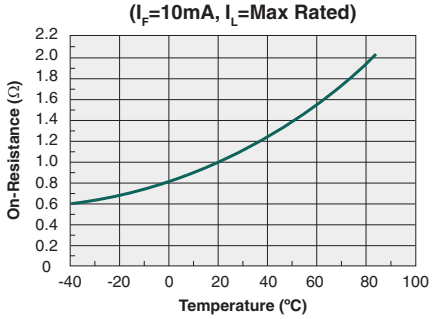
Unless otherwise specified, all performance data was acquired without the use of a heat sink.

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.

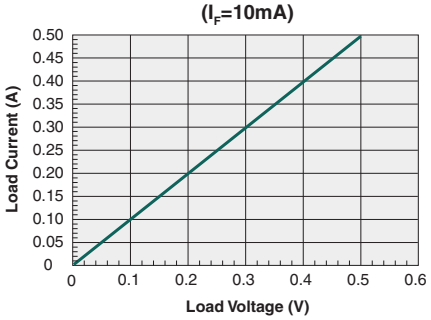
Typical On-Resistance vs. Temperature (I_F=10mA, I_L=250mA$_{DC}$)



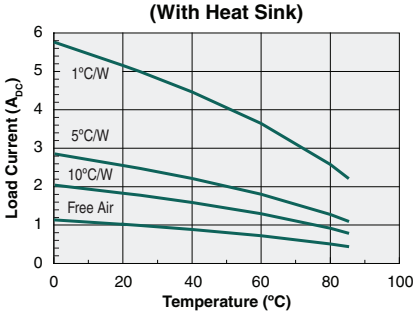
Typical On-Resistance vs. Temperature (I_F=10mA, I_L=Max Rated)



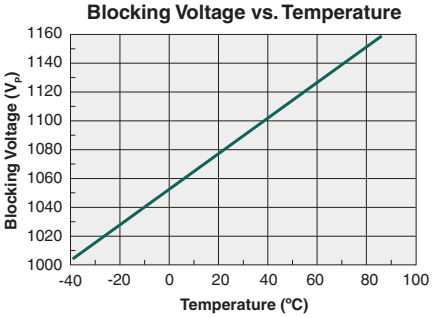
Typical Load Current vs. Load Voltage (I_F=10mA)



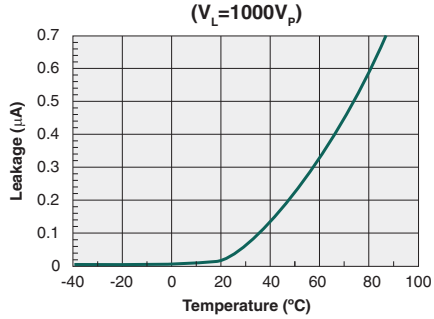
Maximum Load Current vs. Temperature (With Heat Sink)



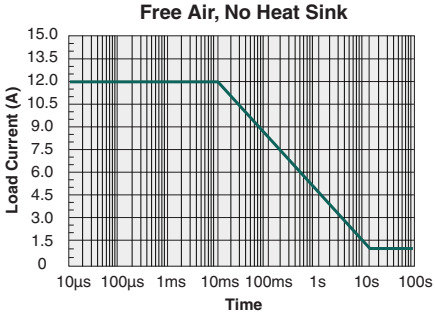
Blocking Voltage vs. Temperature



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



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
CPC1788J	MSL 1

4.2 ESD Sensitivity



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

4.3 Soldering 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
CPC1788J	245°C for 30 seconds

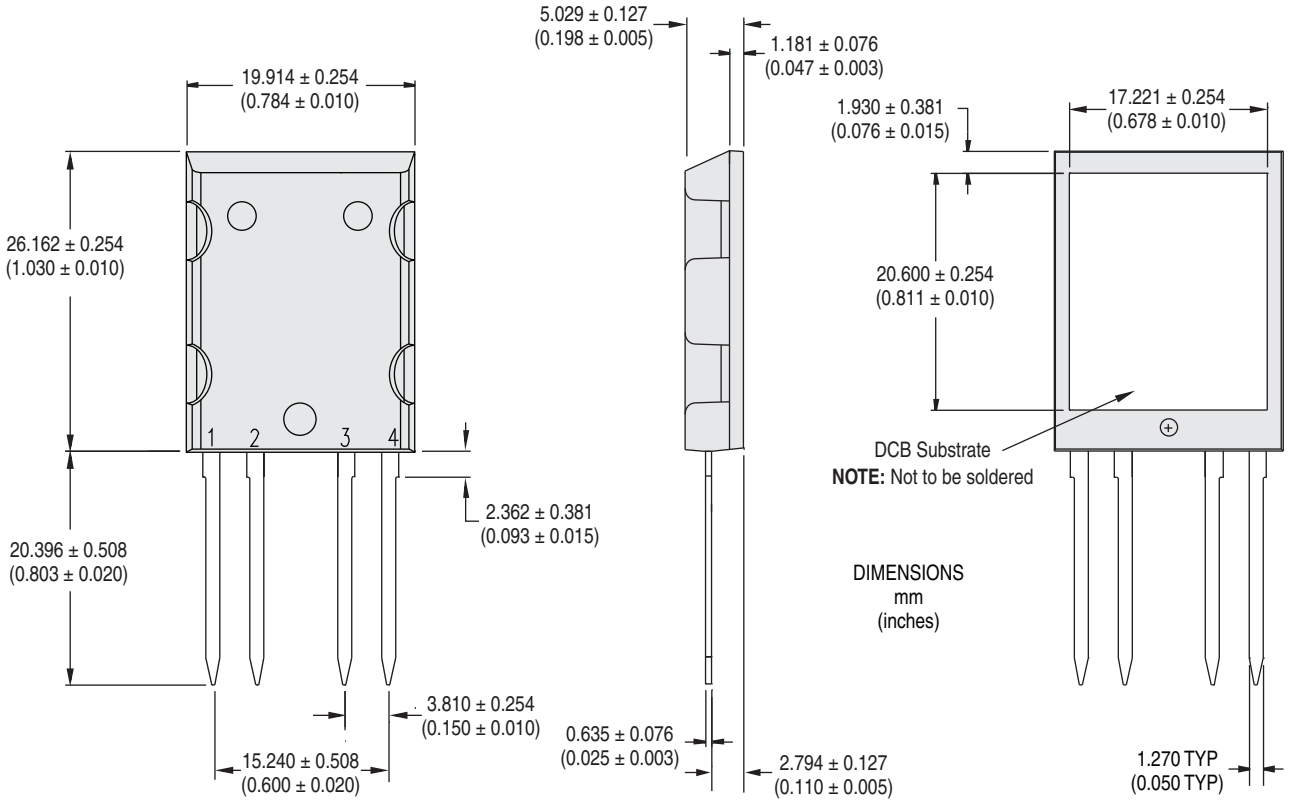
NOTE: The exposed surface of the DCB substrate is not to be soldered.

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: Metallized external surface of DCB substrate maintains 2500V_{rms} isolation to device internal structure and all external pins.

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

IXYS Integrated Circuits Division makes no representations or warranties with respect to the accuracy or completeness of the contents of this publication and reserves the right to make changes to specifications and product descriptions at any time without notice. Neither circuit patent licenses nor indemnity are expressed or implied. Except as set forth in IXYS Integrated Circuits Division's Standard Terms and Conditions of Sale, IXYS Integrated Circuits Division assumes no liability whatsoever, and disclaims any express or implied warranty, relating to its products including, but not limited to, the implied warranty of merchantability, fitness for a particular purpose, or infringement of any intellectual property right.

The products described in this document are not designed, intended, authorized or warranted for use as components in systems intended for surgical implant into the body, or in other applications intended to support or sustain life, or where malfunction of IXYS Integrated Circuits Division's product may result in direct physical harm, injury, or death to a person or severe property or environmental damage. IXYS Integrated Circuits Division reserves the right to discontinue or make changes to its products at any time without notice.

Specification: DS-CPC1788-R06
©Copyright 2015, IXYS Integrated Circuits Division
All rights reserved. Printed in USA.
3/9/2015