CPC1979

600V Single-Pole, Normally Open Power Relay

INTEGRATED CIRCUITS DIVISION

Characteristics

Parameter	Rating	Units
Blocking Voltage	600	V_P
Load Current, T_A=25°C:		
With 5°C/W Heat Sink	3.5	A_{rms} / A_{DC}
No Heat Sink	1.4	
On-Resistance (max)	0.75	Ω
Thermal Impedance, Junction-to-Case, θ_{JC}	0.3	°C/W

Features

- 3.5A_{rms} Load Current with 5°C/W Heat Sink
- Low 0.75Ω On-Resistance
- 600V_P Blocking Voltage
- 2500V_{rms} Input/Output Isolation
- Low Thermal Impedance: 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
- Flammability Rating UL 94 V-0

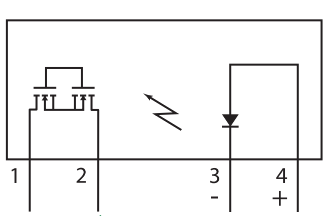
Applications

- 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 Recognized Component: File E69938

Pin Configuration



Description

IXYS Integrated Circuits brings OptoMOS® technology, reliability and compact size to a new family of high-power Solid State Relays.

As part of this family, the CPC1979 single-pole normally open (1-Form-A) Solid State Power Relay is rated for up to 3.5A_{rms} continuous load current with a 5°C/W heat sink.

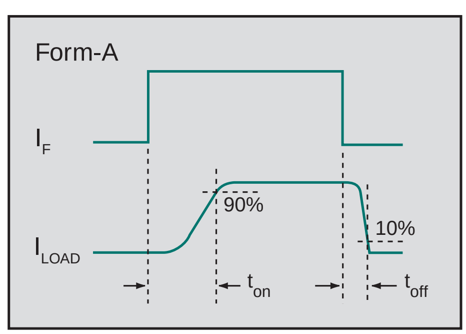
The CPC1979 employs optically coupled MOSFET technology to provide 2500V_{rms} of input to output isolation. The optically coupled outputs, that use patented OptoMOS architecture, are controlled by a highly efficient infrared LED. The combination of low on-resistance and high load current handling capability makes this relay suitable for a variety of high performance 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 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 junction-to-case thermal impedance (0.3 °C/W).

Ordering Information

Part	Description
CPC1979J	ISOPLUS-264 Package (25 per tube)

Switching Characteristics



1 Specifications

1.1 Absolute Maximum Ratings @ 25°C

Symbol	Ratings	Units
Blocking Voltage	600	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.

Typical values are characteristic of the device at +25°C, and are the result of engineering evaluations. They are provided for information purposes only, and are not part of the manufacturing testing requirements.

1.2 Electrical Characteristics @ 25°C

Parameter	Conditions	Symbol	Minimum	Typical	Maximum	Units
Output Characteristics						
Load Current [1]						
Peak	$t \leq 10ms$	I_L	-	-	20	A_P
Continuous	No Heat Sink	I_L	-	-	1.4	A_{rms} / A_{DC}
Continuous	T_C=25°C	I_L	-	-	14.5	A_{rms} / A_{DC}
Continuous	T_C=99°C	$I_{L(99)}$	-	-	1.7	A_{rms} / A_{DC}
On-Resistance [2]	I_F=10mA, I_L=1A	R_{ON}	-	0.59	0.75	Ω
Off-State Leakage Current	V_L=600V_P	I_{LEAK}	-	-	1	μA
Switching Speeds						
Turn-On	I_F=20mA, V_L=10V	t_{on}	-	8	25	ms
Turn-Off	I_F=20mA, V_L=10V	t_{off}	-	0.2	5	ms
Output Capacitance	I_F=0mA, V_L=25V, f=1MHz	C_{out}	-	700	-	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=10mA	V_F	0.9	1.35	1.56	V
Reverse Input Current	V_R=5V	I_R	-	-	10	μA
Input/Output Characteristics						
Capacitance, Input-to-Output	V_{IO}=0V, f=1MHz	C_{IO}	-	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 minimum LED drive current of 20mA is recommended.

2 Thermal Characteristics

Parameter	Conditions	Symbol	Rating	Units
Thermal Impedance (Junction to Case)	-	θ_{JC}	0.3	°C/W
Thermal Impedance (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 impedance of 12.5°C/W.

2.2 Heat Sink Calculation

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

Heat Sink Rating

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

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 Impedance, Junction to Case (°C/W) = 0.3°C/W
θ_{CA} = Thermal Impedance 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

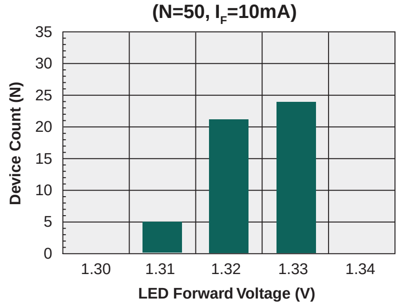
* Elevated junction temperature reduces semiconductor lifetime.

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

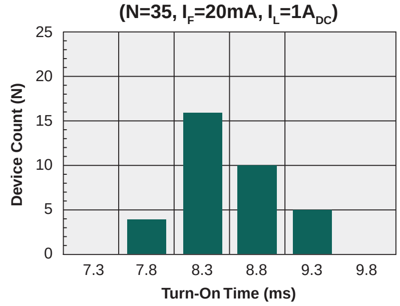
3 Performance Data*

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

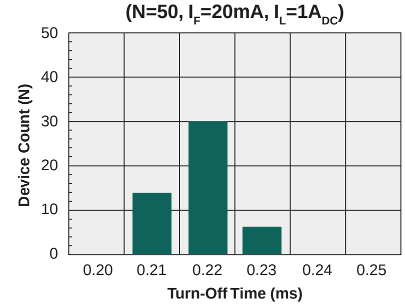
Typical LED Forward Voltage Drop (N=50, I_F=10mA)



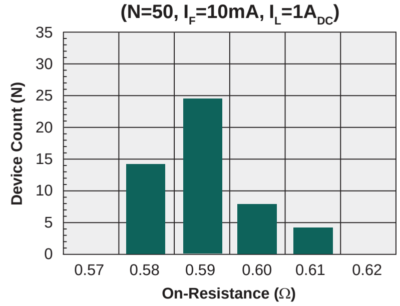
Typical Turn-On Time (N=35, I_F=20mA, I_L=1A$_{DC}$)



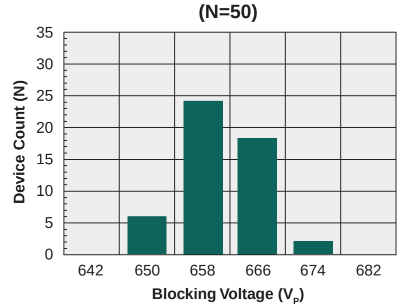
Typical Turn-Off Time (N=50, I_F=20mA, I_L=1A$_{DC}$)



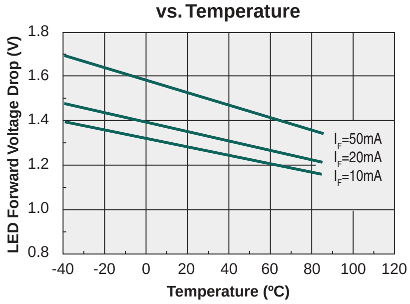
Typical On-Resistance Distribution (N=50, I_F=10mA, I_L=1A$_{DC}$)



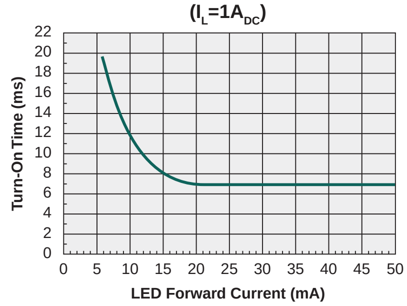
Typical Blocking Voltage Distribution (N=50)



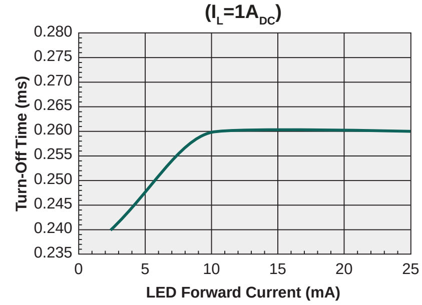
Typical LED Forward Voltage Drop vs. Temperature



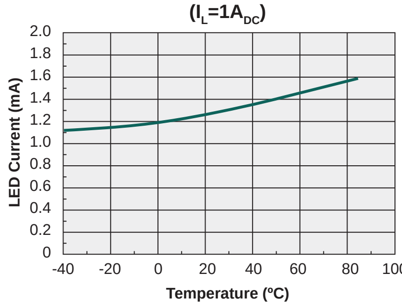
Typical Turn-On Time vs. LED Forward Current (I_L=1A$_{DC}$)



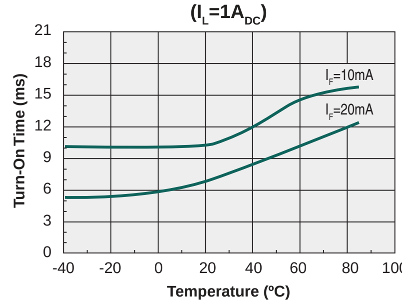
Typical Turn-Off Time vs. LED Forward Current (I_L=1A$_{DC}$)



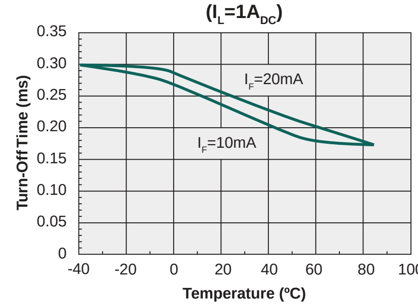
Typical I_F for Switch Operation vs. Temperature (I_L=1A$_{DC}$)



Typical Turn-On Time vs. Temperature (I_L=1A$_{DC}$)

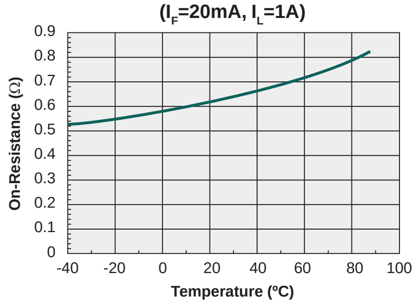


Typical Turn-Off Time vs. Temperature (I_L=1A$_{DC}$)

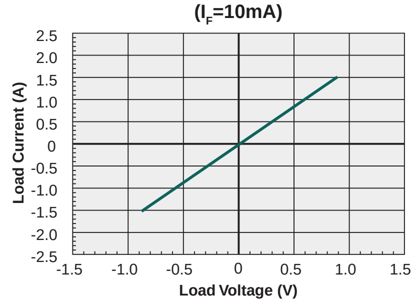


*Unless otherwise noted, data presented in these graphs is typical of device operation at 25ºC.
For guaranteed parameters not indicated in the written specifications, please contact our application department.

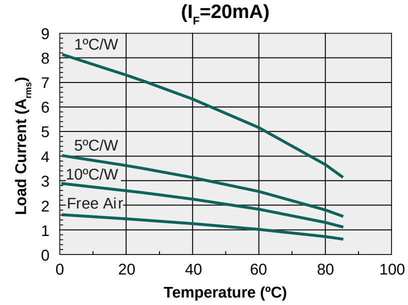
Typical On-Resistance vs. Temperature (I_F=20mA, I_L=1A)



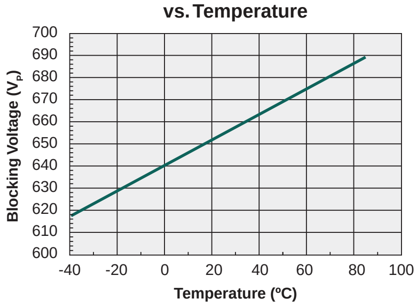
Typical Load Current vs. Load Voltage (I_F=10mA)



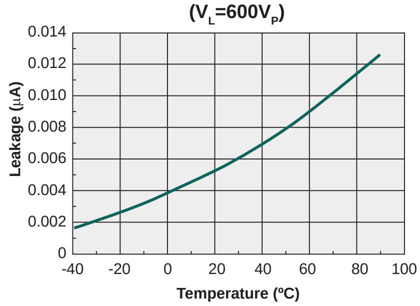
Maximum Load Current vs. Temperature with Heat Sink (I_F=20mA)



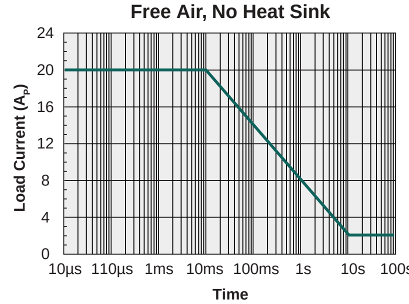
Typical Blocking Voltage vs. Temperature



Typical Leakage vs. Temperature Measured Across Pins 1&2 (V_L=600V_P)



Energy Rating Curve Free Air, No Heat Sink



*Unless otherwise noted, data presented in these graphs is typical of device operation at 25ºC.
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 classifies 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)** classification 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) Classification
CPC1979J	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

Provided in the table below is the Classification Temperature (T_C) of this product and the maximum dwell time the body temperature of this device may be (T_C - 5)ºC or greater. The classification temperature sets the Maximum Body Temperature allowed for this device during lead-free reflow processes. For through-hole devices, and any other processes, the guidelines of **J-STD-020** must be observed.

Device	Classification Temperature (T_C)	Dwell Time (t_p)	Max Reflow Cycles
CPC1979J	245°C	30 seconds	1

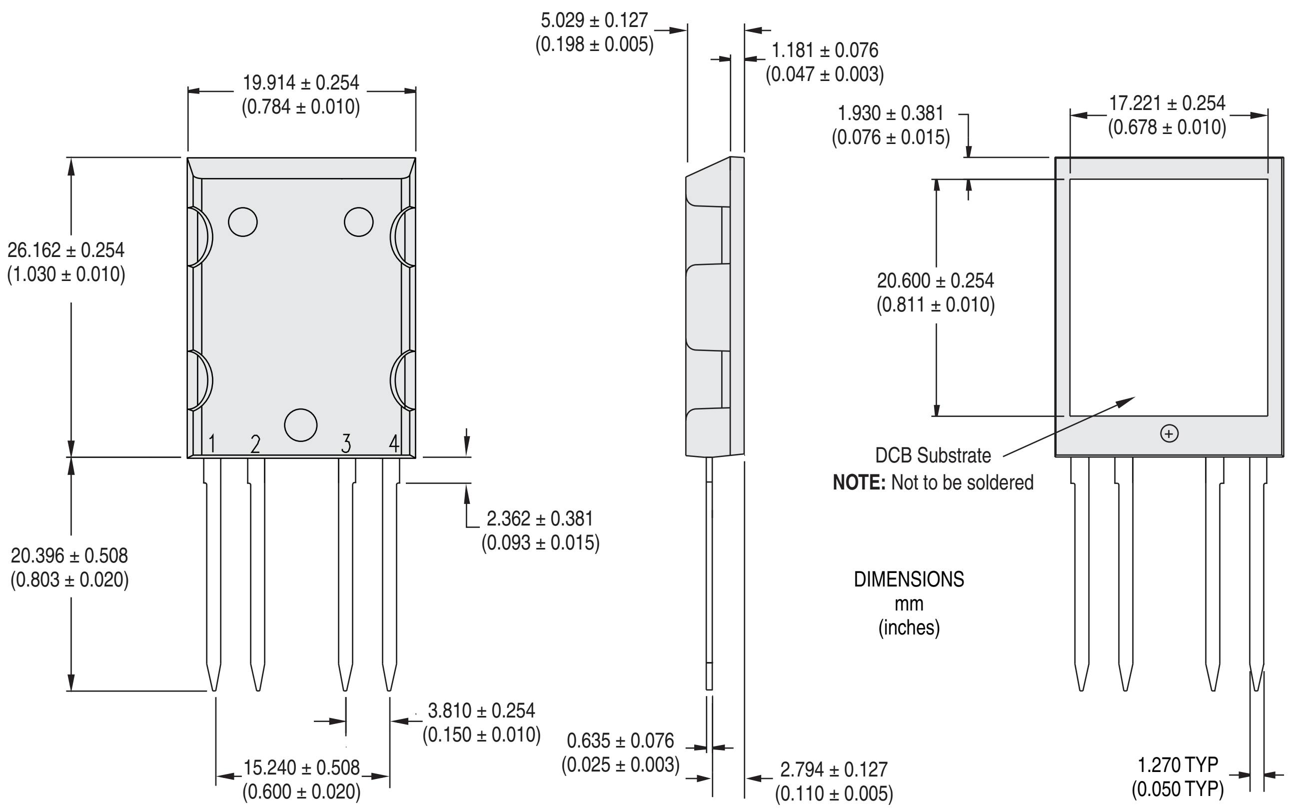
NOTE: The exposed surface of the DCB substrate is not to be soldered.

4.4 Board Wash

IXYS Integrated Circuits recommends the use of no-clean flux formulations. Board washing to reduce or remove flux residue following the solder reflow process is acceptable provided proper precautions are taken to prevent damage to the device. These precautions include but are not limited to: using a low pressure wash and providing a follow up bake cycle sufficient to remove any moisture trapped within the device due to the washing process. Due to the variability of the wash parameters used to clean the board, determination of the bake temperature and duration necessary to remove the moisture trapped within the package is the responsibility of the user (assembler). Cleaning or drying methods that employ ultrasonic energy may damage the device and should not be used. Additionally, the device must not be exposed to flux or solvents that are Chlorine- or Fluorine-based.

RoHS e3

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

Specification: DS-CPC1979-R10

6/21/2018