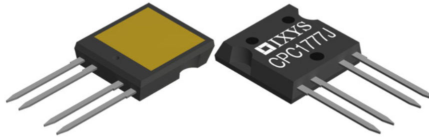
IXYS
INTEGRATED CIRCUITS DIVISION



CPC1777
600V Single-Pole, Normally Open DC-Only Power Relay

Characteristics

Parameter	Rating	Units
Blocking Voltage	600	V_P
Load Current, T_A=25°C:		
With 5°C/W Heat Sink	4.6	A_{DC}
No Heat Sink	1.5	A_{DC}
On-Resistance (max)	0.5	Ω
Thermal Resistance, Junction-to-Case, θ_{JC}	0.35	°C/W

Features

- $4.6A_{DC}$ Load Current with 5°C/W Heat Sink
- Low 0.5Ω On-Resistance
- $600V_P$ Blocking Voltage
- $2500V_{rms}$ Input/Output Isolation
- Low Thermal Resistance: θ_{JC} = 0.35 °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

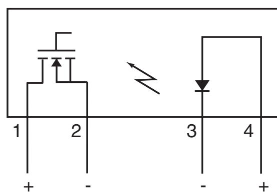
Applications

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

Approvals

- UL 508 Certified Component: File E69938

Pin Configuration



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 CPC1777 single-pole normally open (1-Form-A) DC Solid State Relay employs optically coupled MOSFET technology to provide $2500V_{rms}$ of input to output isolation.

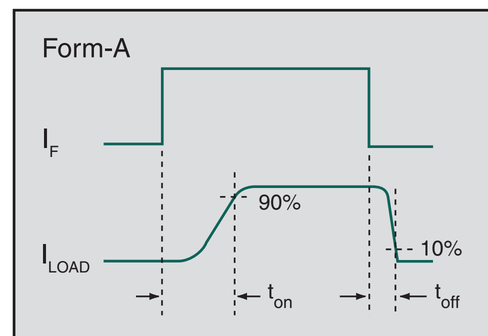
The optically coupled outputs, that use patented OptoMOS architecture, are controlled by a highly efficient infrared LED. The combination of low on-resistance and high load current handling capability makes this relay suitable for a variety of high performance DC switching applications.

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

Ordering Information

Part	Description
CPC1777J	i4-PAC 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	50	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	-	-	20	A_P
Continuous	No Heat Sink	I_L	-	-	1.5	A_{DC}
Continuous	T_C=25°C	I_L	-	-	15	A_{DC}
Continuous	T_C=99°C	$I_{L(99)}$	-	-	2	A_{DC}
On-Resistance [2]	I_F=10mA, I_L=1A	R_{ON}	-	0.35	0.5	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	20	ms
Turn-Off	I_F=20mA, V_L=10V	t_{off}	-	0.15	5	ms
Output Capacitance	V_L=25V, f=1MHz	C_{out}	-	3500	-	pF
Input Characteristics						
Input Control Current to Activate [3]	I_L=1A	I_F	-	-	10	mA
Input Dropout 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) an LED drive current of 20mA is recommended.

2 Thermal Characteristics

Parameter	Conditions	Symbol	Rating	Units
Thermal Resistance (Junction to Case)	-	θ_{JC}	0.35	°C/W
Thermal Resistance (Junction to Ambient)	Free Air	θ_{JA}	40	°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

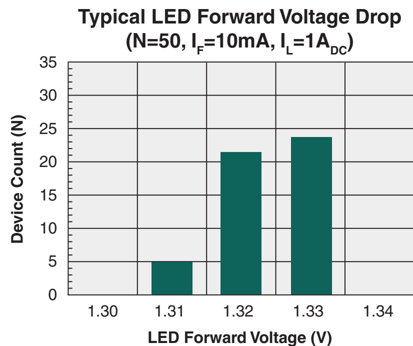
$$\theta_{CA} = \frac{(T_J - T_A)\, I_{L(99)}^2}{I_L^2 \cdot P_{D(99)}} - \theta_{JC}$$

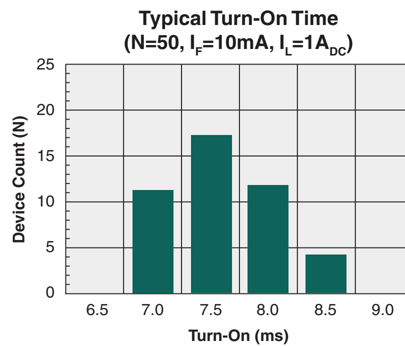
T_J = Junction Temperature (°C), $T_J \leq 100$°C *
T_A = Ambient Temperature (°C)
$I_{L(99)}$ = Load Current with Case Temperature @ 99°C (A_{DC})
I_L = Desired Operating Load Current (A_{DC}), $I_L \leq I_{L(MAX)}$
θ_{JC} = Thermal Resistance, Junction to Case (°C/W) = 0.35°C/W
θ_{CA} = Thermal Resistance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

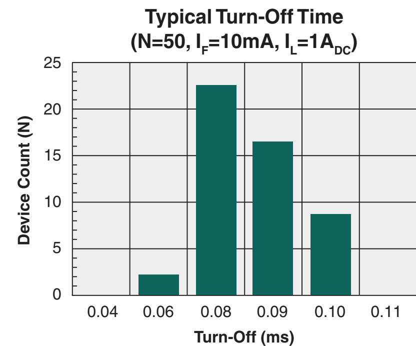
* Elevated junction temperature reduces semiconductor lifetime.

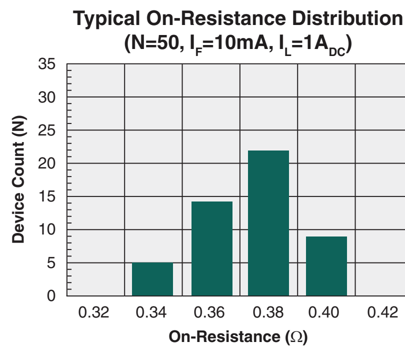
NOTE: The exposed surface of the DCB substrate is not to be soldered.

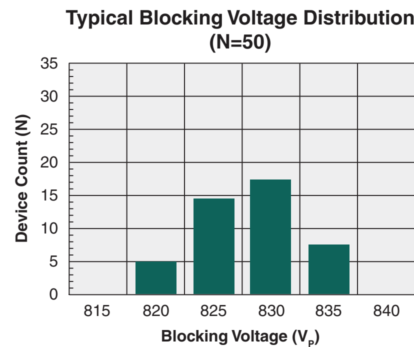
3 Performance Data @25°C (Unless Otherwise Noted)

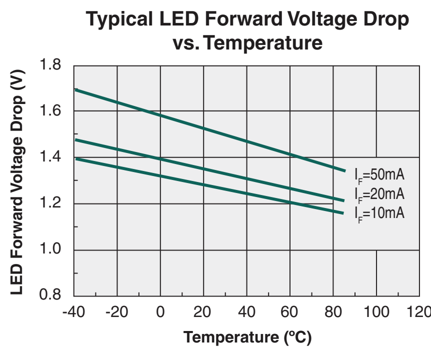


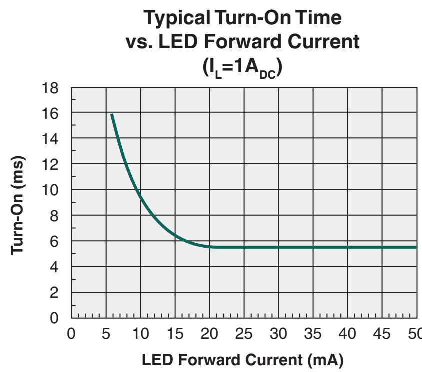


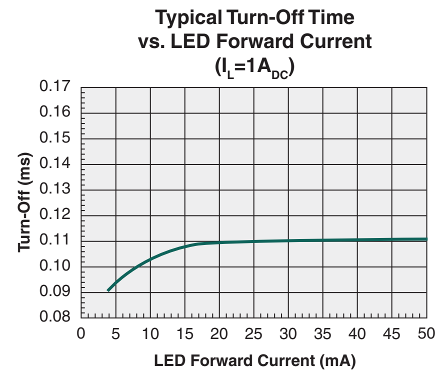


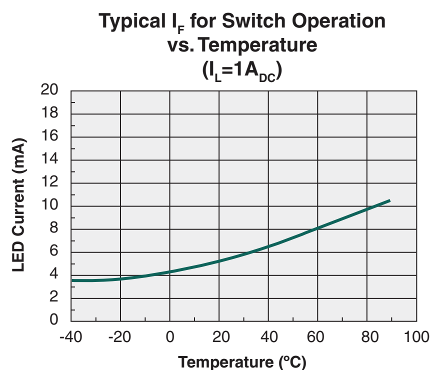


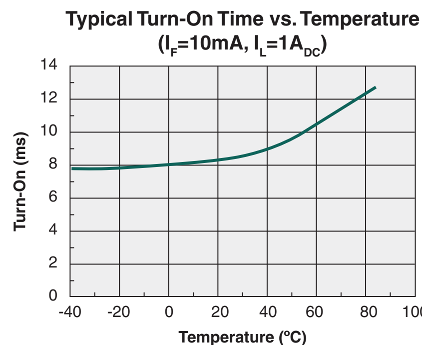


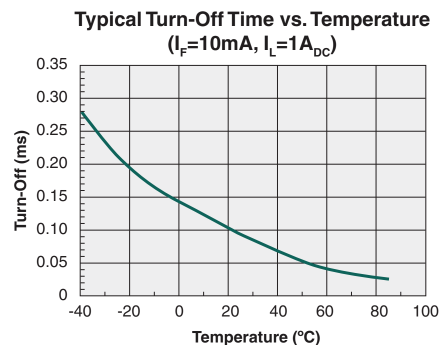






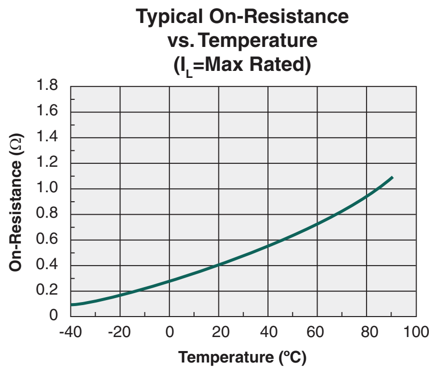


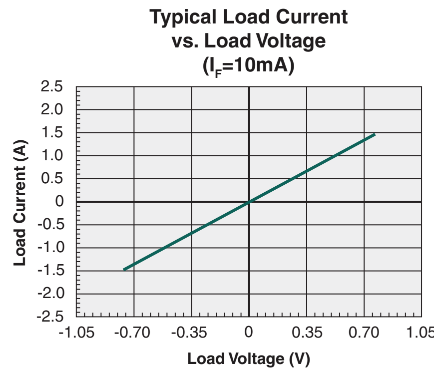


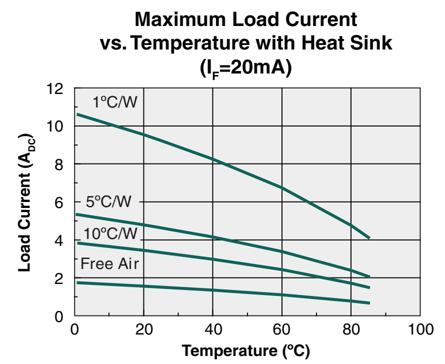


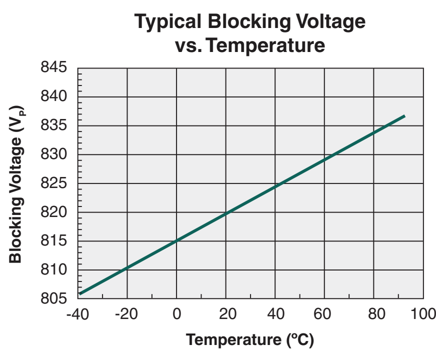
Unless otherwise specified, all performance data was acquired without the use of a heat sink.

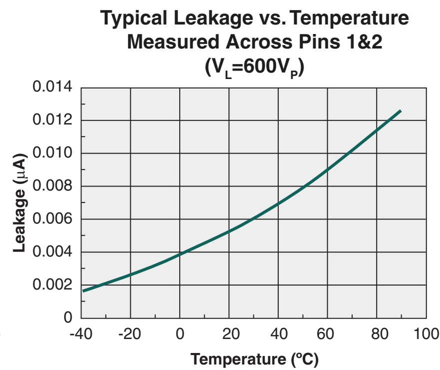
The Performance data shown in the graphs above is typical of device performance. For guaranteed parameters not indicated in the written specifications, please contact our application department.

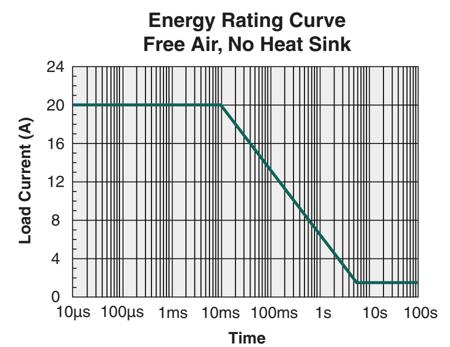












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The Performance data shown in the graphs above is typical of device performance. For guaranteed parameters not indicated in the written specifications, please contact our application department.

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
CPC1777J	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
CPC1777J	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

19.914 ± 0.254 (0.784 ± 0.010)
20.879 ± 0.254 (0.822 ± 0.010)
20.396 ± 0.508 (0.803 ± 0.020)
2.362 ± 0.381 (0.093 ± 0.015)
3.810 ± 0.254 (0.150 ± 0.010)
15.240 ± 0.508 (0.600 ± 0.020)
5.029 ± 0.127 (0.198 ± 0.005)
1.181 ± 0.076 (0.047 ± 0.003)
0.635 ± 0.076 (0.025 ± 0.003)
2.794 ± 0.127 (0.110 ± 0.005)
1.930 ± 0.381 (0.076 ± 0.015)
17.221 ± 0.254 (0.678 ± 0.010)
15.317 ± 0.254 (0.603 ± 0.010)
DCB Substrate
NOTE: Not to be soldered
1.270 TYP (0.050 TYP)

DIMENSIONS mm (inches)

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

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