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	
On-resistance	0.5	Ω
$R_{\theta JC}$	0.35	°C/W

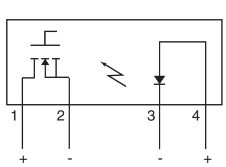
Features

- 100% Solid State
- Compact i4-PAC Power Package
- Low Thermal Resistance (0.35°C/W)
- 4.6A_{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
- 2500V_{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
  - Utility Meters (gas, oil, electric and water)
- 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 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 output is constructed with an efficient MOSFET switch and photovoltaic die that uses Clare's patented OptoMOS architecture while the input GaAIAs 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 i4-PAC 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 2500V_{rms} isolation but also very low thermal resistance (0.35°C/W).

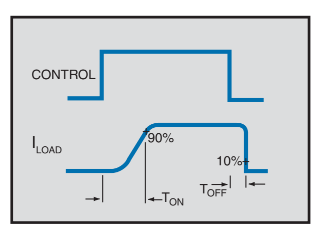
Approvals

- UL 508 Recognized Component: File # E69938

Ordering Information

Part Number	Description
CPC1777J	i4-PAC (25 per tube)

Switching Characteristics of Normally Open (Form A) Devices



Absolute Maximum Ratings

Parameter	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

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	-	-	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	$I_{L(99)}$	-	-	2.0	A_{DC}
On-Resistance [2]	I_L=1A, I_F=10mA	R_{ON}	-	0.35	0.5	Ω
Off-State Leakage Current	V_L=600V	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=25V, f=1MHz	C_{OUT}	-	3500	-	pF
Input Characteristics	T_A=25°C					
Input Control Current [3]	I_L=1.0A	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 heat sinking.
[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)	-	$R_{\theta JC}$	-	-	0.35	°C/W
Thermal Resistance (junction to ambient)	Free air	$R_{\theta JA}$	-	40	-	°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

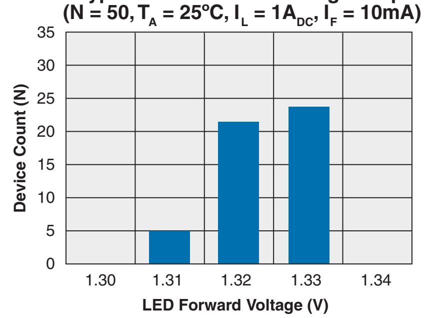
$$R_{\theta CA} = \frac{(T_J - T_A)\, I_{L(99)}^2}{I_L^2 \bullet P_{D(99)}} - R_{\theta JC}$$

T_J = Junction Temperature (°C), $T_J \le 100°C$ *
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}), $I_L \le I_{L(MAX)}$
$R_{\theta JC}$ = 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

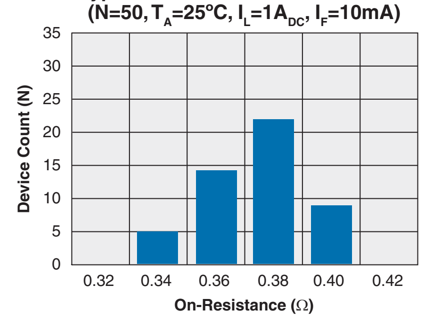
* Elevated junction temperature reduces semiconductor lifetime.

PERFORMANCE DATA*

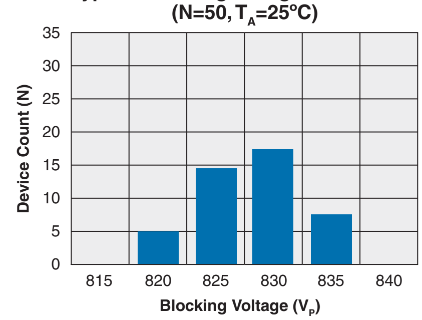
CPC1777
Typical LED Forward Voltage Drop
($N = 50, T_A = 25°C, I_L = 1A_{DC}, I_F = 10mA$)



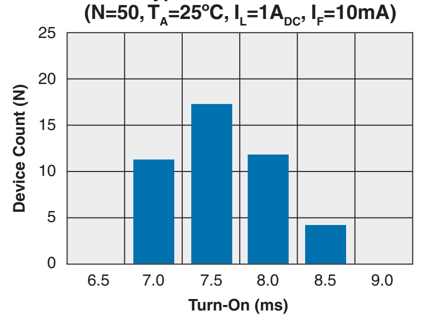
CP1777
Typical On-Resistance Distribution
($N=50, T_A=25°C, I_L=1A_{DC}, I_F=10mA$)



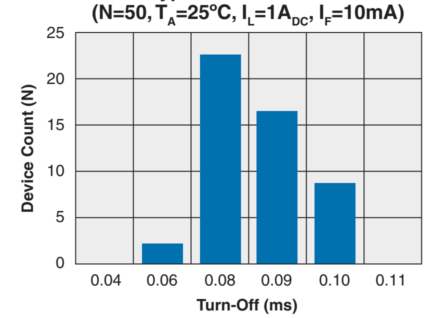
CPC1777
Typical Blocking Voltage Distribution
($N=50, T_A=25°C$)



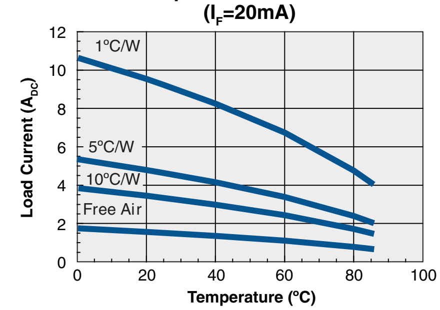
CPC1777
Typical Turn-On Time
($N=50, T_A=25°C, I_L=1A_{DC}, I_F=10mA$)



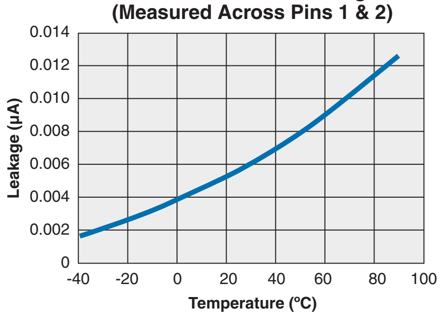
CPC1777
Typical Turn-Off Time
($N=50, T_A=25°C, I_L=1A_{DC}, I_F=10mA$)



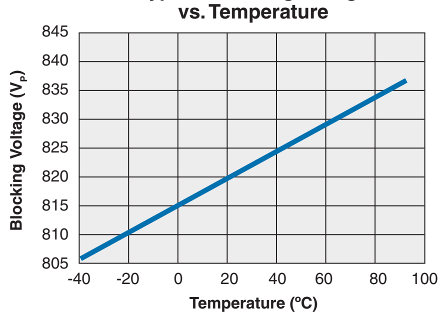
CPC1777
Maximum Load Current
vs. Temperature with Heat Sink
($I_F=20mA$)



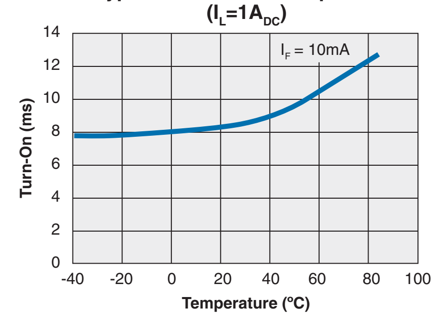
CPC1777
Typical Leakage vs. Temperature
at Maximum Rated Voltage
(Measured Across Pins 1 & 2)



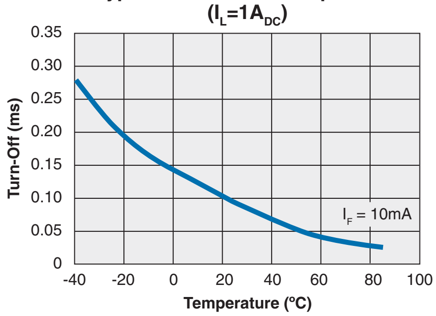
CPC1777
Typical Blocking Voltage
vs. Temperature



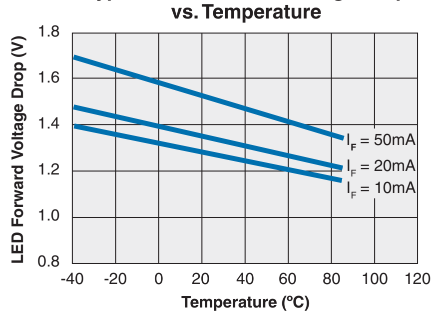
CPC1777
Typical Turn-On vs. Temperature
($I_L=1A_{DC}$)



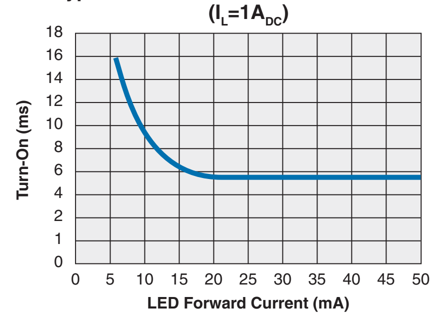
CPC1777
Typical Turn-Off vs. Temperature
($I_L=1A_{DC}$)



CPC1777
Typical LED Forward Voltage Drop
vs. Temperature



CPC1777
Typical Turn-On vs. LED Forward Current
($I_L=1A_{DC}$)

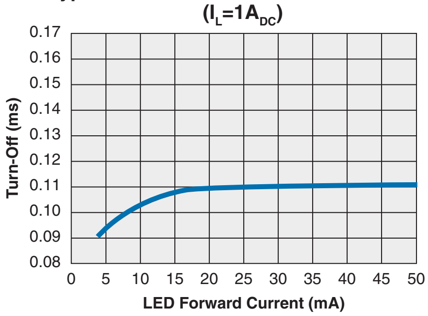


Unless otherwise specified, all performance data was acquired without the use of a heat sink.

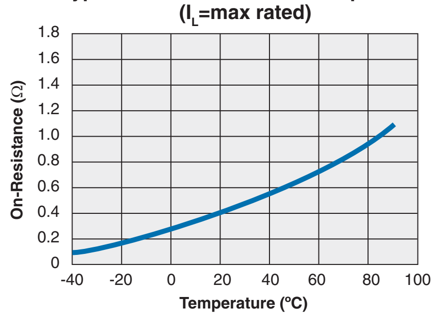
*The Performance data shown in the graphs above is typical of device performance. For guaranteed parameters not indicated in the written specifications, please contact our application department.

PERFORMANCE DATA*

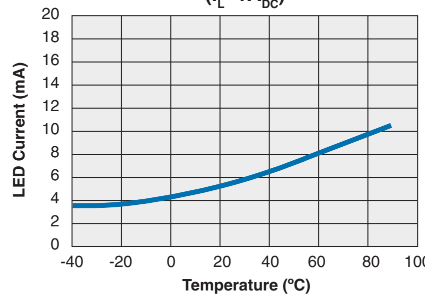
CPC1777
Typical Turn-Off vs. LED Forward Current
(I_L=1A_{DC})



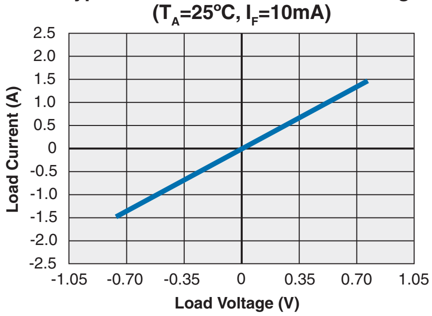
CPC1777
Typical On-Resistance vs. Temperature
(I_L=max rated)



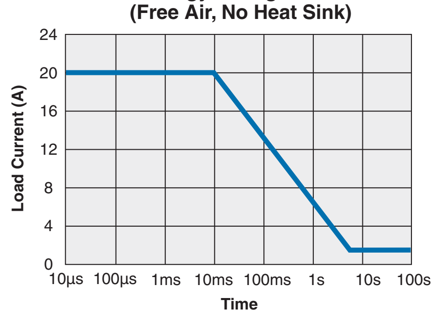
CPC1777
Typical I_F for Switch Operation vs. Temperature
(I_L=1A_{DC})



CPC1777
Typical Load Current vs. Load Voltage
(T_A=25ºC, I_F=10mA)



CPC1777
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.

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

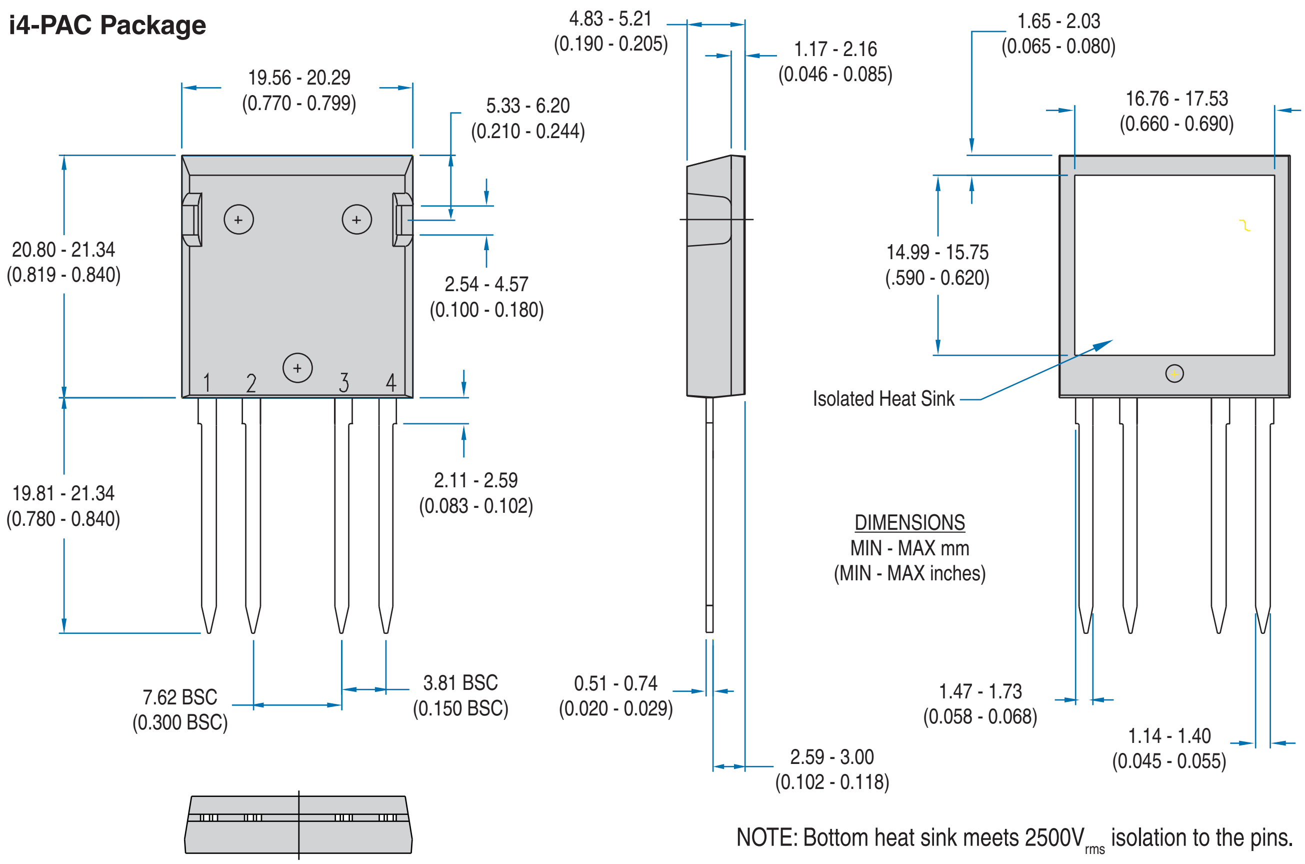
Clare does not recommend ultrasonic cleaning or the use of chlorinated solvents.

RoHS 2002/95/EC

e3

MECHANICAL DIMENSIONS:

i4-PAC Package



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

Specification: DS-CPC1777-R04

7/18/08