

**IAP400T120 SixPac™ FEATURES INCLUDE**



- Multi-Function Power Assembly
- Compact Size – 8.50” H X 23.62” W X 17.64” D
- DC Bus Voltages to 800VDC
- Snubber-less operation to 650VDC
- Switching frequencies to up to 20kHz
- Protective circuitry with fail-safe opto-isolated fault annunciation, including:
  - OverCurrent
  - OverVoltage
  - OverTemperature
  - Short circuit
  - P.S. UnderVoltage
- Opto-isolated or fiber-optic gate drive and fault signal output for electrical isolation and noise immunity
- Integrated cooling with temperature sensors and feedback
- Many options - Available with IGBTs from 75A to 1400A

**Configurable Power**

The IAP400T120 SixPac™ is a flexible, highly integrated IGBT based power assembly with a wide range of applications. These include inverters for motor controls, switch mode power supplies (SMPS), UPS, welders, etc. The IAP400T120 SixPac™ can be operated at frequencies up to 20kHz. The IAP300T120 SixPac™ is configured as a three-phase bridge inverter mounted on an air-cooled or liquid-cooled heat sink. Configurations include options for (full, half or no control) converter input circuitry, inverter output circuitry, cooling and a wide variety of drivers and safety features for the converter front end and IGBT inverter output stage.

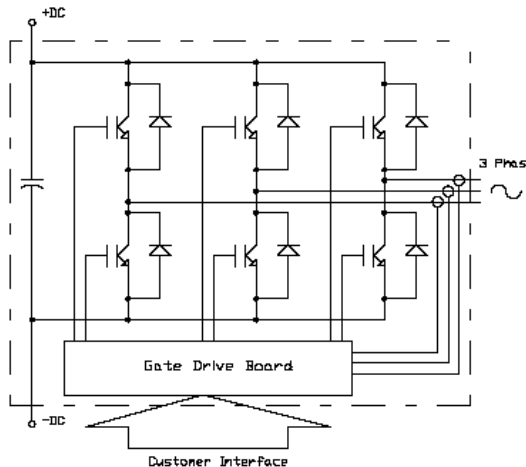
To operate at high switching frequencies, the IAP400T120 SixPac™ utilizes a low inductance laminated bus structure, optically isolated or fiber optically coupled gate drive interfaces, isolated gate power supplies and a DC-link capacitor bank.

The IAP400T120 SixPac™ provides built in protection features including: OverVoltage, UnderVoltage lockout, OverCurrent, OverTemperature, short circuit and optional airflow or liquid flow indicators.

Flexibility is a key feature of the IAP400T120 SixPac™. Options include: a choice of converter front ends, rectifier, half or full SCR control, with or without SCR gate firing boards and soft-start circuitry. A choice of cooling methods, forced air or liquid is also available. Customer provided PWM is optically coupled or a fiber optic link can be provided to the IGBT interface. Current feedback is provided by Hall effect current transducers.

The IAP400T120 SixPac™ is rated to maximum input voltages up to 800 VDC, switching frequencies up to 20kHz, includes many safety features to protect the IGBTs and output circuitry and can be configured to meet your application.

**Schematic:**



**SixPac™ IAP400T120**

<b>Absolute Maximum Ratings – T<sub>J</sub>=25°C unless otherwise specified</b>			
<b>General</b>	<b>Symbol</b>	<b>Value</b>	<b>Units</b>
IGBT Junction Temperature	T <sub>J</sub>	-40 to +150	°C
Storage Temperature	T <sub>STG</sub>	-40 to +125	°C
Operating Temperature	T <sub>OP</sub>	-25 to +85	°C
Voltage applied to DC terminals	V <sub>CC</sub>	800	Volts
Isolation voltage, AC 1 minute, 60Hz sinusoidal	V <sub>ISO</sub>	2500	Volts
<b>IGBT Inverter</b>			
Collector Current (T <sub>C</sub> =25°C)	I <sub>C</sub>	400	Amperes
Peak Collector Current (T <sub>J</sub> <150°C)	I <sub>CM</sub>	800	Amperes
Emitter Current	I <sub>E</sub>	400	Amperes
Peak Emitter Current	I <sub>EM</sub>	800	Amperes
Maximum Collector Dissipation (T <sub>J</sub> <150°C)	P <sub>CD</sub>	1660	Watts
<b>Gate Drive Board</b>			
Unregulated +24V Power Supply		30	Volts
Regulated +15V Power Supply		18	Volts
PWM Signal Input Voltage		20	Volts
Fault Output Supply Voltage		30	Volts
Fault Output Current		50	mA

**IGBT Inverter Electrical Characteristics, T<sub>J</sub>=25°C unless otherwise specified**

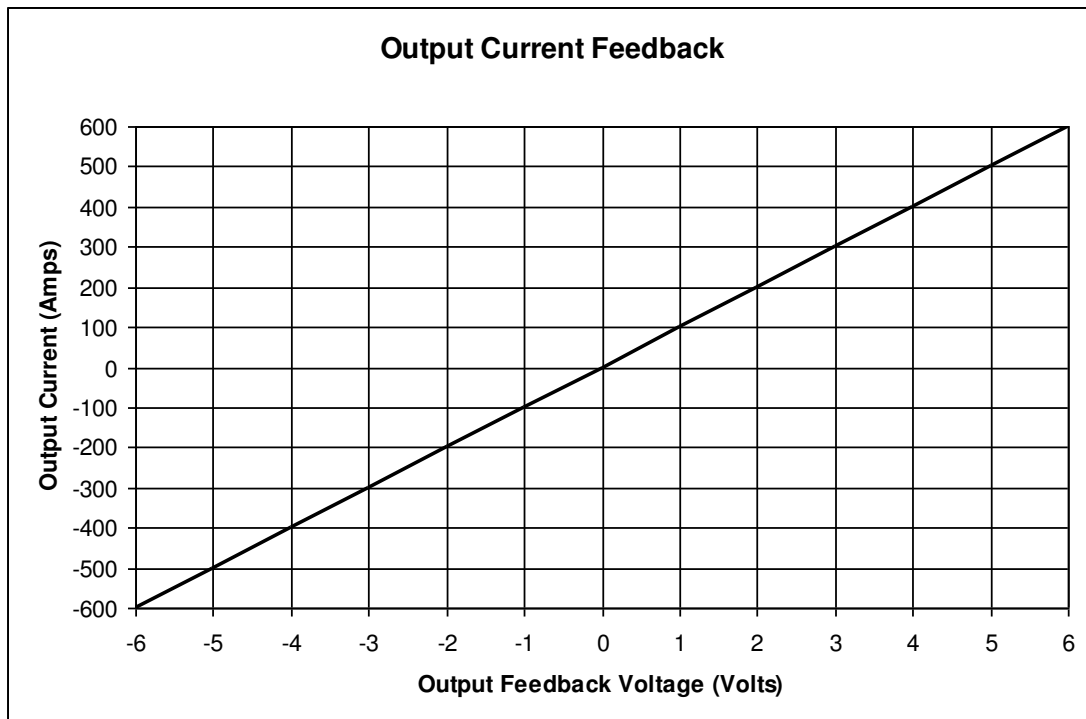
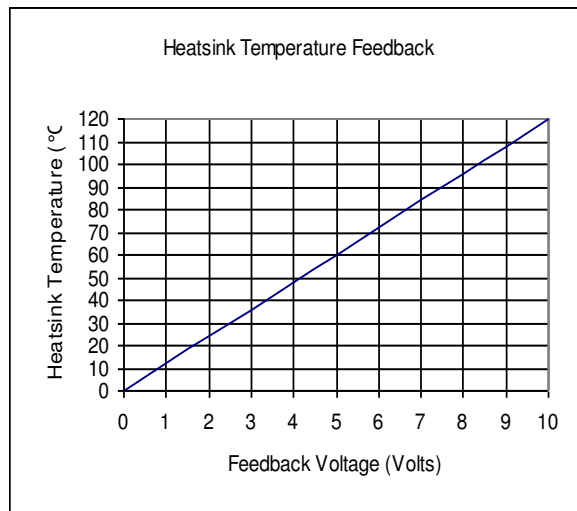
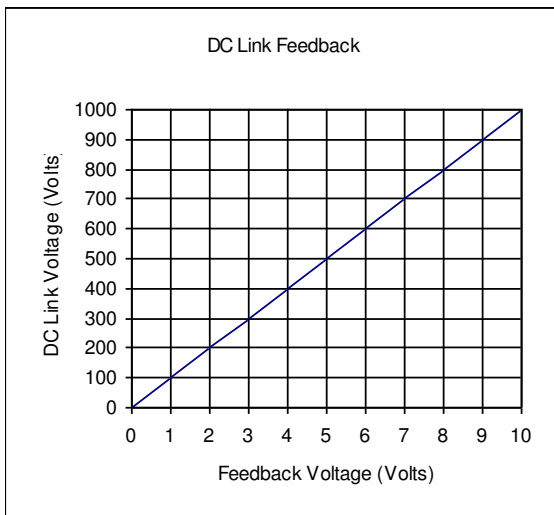
<b>Parameter</b>	<b>Symbol</b>	<b>Test Conditions</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Units</b>
Collector Cutoff Current	I <sub>CES</sub>	V <sub>CE</sub> =V <sub>CES</sub> , V <sub>GE</sub> =0V	-	-	1	mA
Collector-Emitter Saturation Voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> =400A, T <sub>J</sub> =25°C	-	1.8	2.4	Volts
		I <sub>C</sub> =400A, T <sub>J</sub> =125°C	-	1.9	-	Volts
Emitter-Collector Voltage	V <sub>EC</sub>	I <sub>E</sub> =400A	-	-	3.2	Volts
Inductive Load Switching Times	t <sub>d(on)</sub>	V <sub>CC</sub> =600V I <sub>C</sub> =400A V <sub>GE</sub> =15V R <sub>G</sub> =1.6Ω	-	-	300	ns
	t <sub>r</sub>		-	-	80	ns
	t <sub>d(off)</sub>		-	-	500	ns
	t <sub>r</sub>		-	-	300	ns
Diode Reverse Recovery Time	t <sub>rr</sub>		-	-	200	ns
Diode Reverse Recovery Charge	Q <sub>rr</sub>		-	24.4	-	μC
DC Link Capacitance			-	9,900	-	μF

**Thermal and Mechanical Parameters**

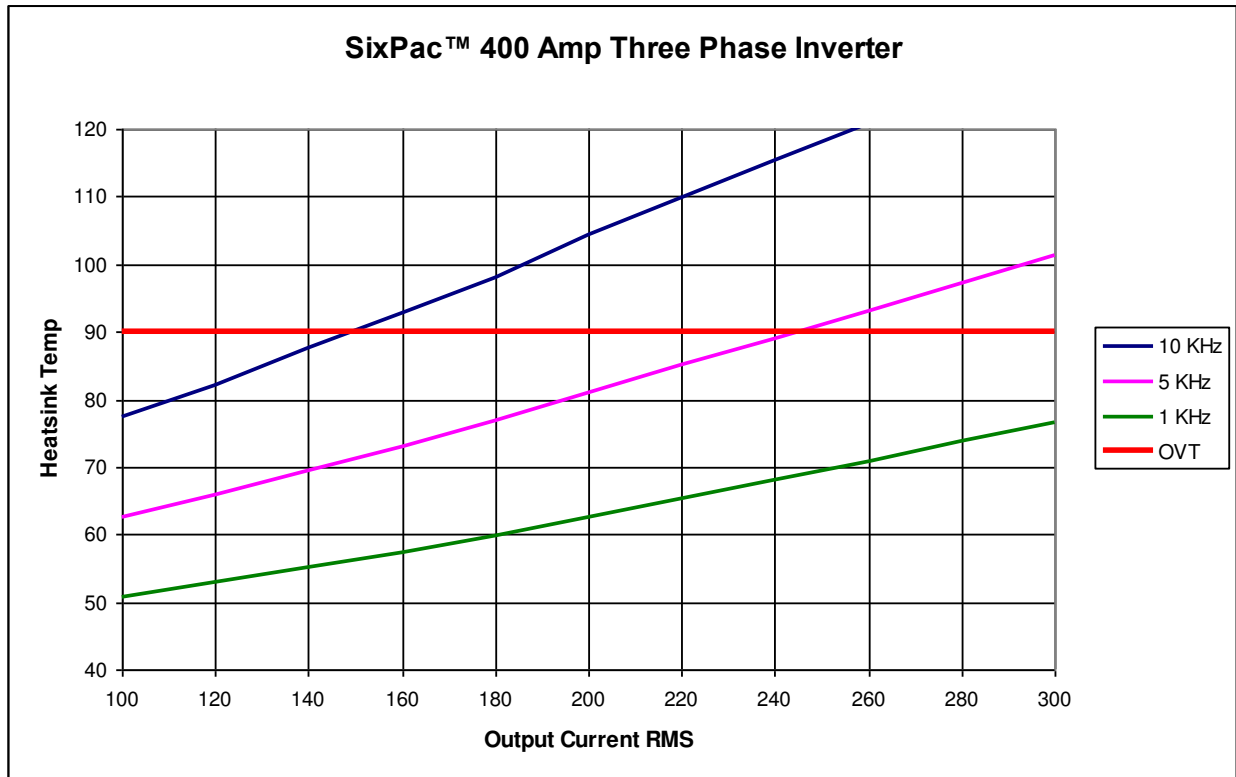
<b>Parameter</b>	<b>Symbol</b>	<b>Test Conditions</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Units</b>
IGBT Thermal Resistance, Junction to Case	R <sub>Θ(j-c)</sub>	Per IGBT ½ module	-	-	0.15	°C/W
FWD Thermal Resistance, Junction to Case	R <sub>Θ(j-c)</sub>	Per FWD ½ module	-	-	0.18	°C/W
Heatsink Thermal Resistance	R <sub>Θ(s-a)</sub>	1500 LFM airflow	-	.045	-	°C/W
Mounting Torque, AC terminals			-	75	90	In-lb
Mounting Torque, DC terminals			-	130	150	In-lb
Mounting Torque, case mounting			-	130	150	In-lb
Weight			-	70	-	lb

**Gate Drive Board Electrical Characteristics**

Parameter	Min	Typ	Max	Units
Unregulated +24V Power Supply	20	24	30	Volts
Regulated +15V Power Supply	14.4	15	18	Volts
PWM Input On Threshold	12	15	-	Volts
PWM Input Off Threshold	-	0	2	Volts
Output OverCurrent Trip	-	600	-	Amperes
OverTemperature Trip	88	90	92	°C
OverVoltage Trip	-	900	-	Volts
DC Link Voltage Feedback	See Figure Below			Volts
Heatsink Temperature Feedback	See Figure Below			Volts
Output Current Feedback	See Figure Below			Volts



## Performance Curves



Conditions	Symbol	Value	Units
Ambient Temperature	$T_A$	40	°C
DC Bus Voltage	$V_{CC}$	600	Volts
Load Power Factor	$\text{COS } \Phi$	0.8	
Airflow	-	1500	LFM
Switching Conditions	3-phase PWM, 60Hz sinusoidal output		

### Options for the BAP300T120-XX

Option	Option Number								
	01	02	03	04	05	06	07	08	09
Blower	X		X		X		X		X
Half-Control SCR Converter		X	X						
Full Control SCR Converter				X	X				
Diode Converter						X	X		
Dual Inverter								X	X

**Interface**

Pin	Signal Name	Description
1	Shield	Connected to circuit ground
2	Lo Side Switch (PWM-)	0 – 15V signal controlling the duty cycle of Lo Side Switch IGBT
3	Phase Error <sup>1</sup>	Open collector output, external pull-up resistor required LOW = No Error; Floating = Phase A overcurrent or short circuit
4	High Side Switch (PWM+)	0 – 15V signal controlling the duty cycle of High Side Switch IGBT
5	Overtmp <sup>1,4</sup>	Open collector output, external pull-up resistor required LOW = No Error; Floating = heatsink overtemp
6	24 VDC input power <sup>2</sup>	20 – 30 VDC input voltage range
7	24 VDC input power <sup>2</sup>	20 – 30 VDC input voltage range
8	15 VDC input power <sup>2</sup>	14.4 – 18 VDC input voltage range
9	15 VDC input power <sup>2</sup>	14.4 – 18 VDC input voltage range
10	GND	Ground reference for 15 and 24 VDC inputs
11	GND	Ground reference for 15 and 24 VDC inputs
12	Heatsink Temperature <sup>5</sup>	Analog voltage representation of heatsink temperature
13	GND <sup>3</sup>	Ground reference for analog signals
14	I <sub>OUT</sub>	Analog voltage representation of output current
15	GND <sup>3</sup>	Ground reference for 15 and 24 VDC inputs
16	DC Link Voltage	Analog representation of DC Link voltage; 0V represents 0V on the DC Link, 9V represents 900V on DC Link

**NOTES:**

1. Open collectors can be pulled up to 30VDC Max and sink 50mA continuous.
2. **DO NOT** connect a 15VDC and 24VDC source to the unit at the same time. Use one or the other.
3. GND signals to be used for analog feedback signals, i.e. twisted pair with I<sub>OUT</sub> Phase A.
4. The error signal on pin 5 is the ORed output of the OverVoltage, OverTemp and UVLO fault signals. An LED will illuminate on the board to differentiate specific faults.
5. The gate drive board can be configured with a 14 pin connector, providing **either** heatsink temperature or DC Link Voltage at pin 12.

**Gate Drive Interface Connector**

Description	Symbol	Type	Manufacturer
Gate Drive Interface Header	J1	0.100" x 0.100" latching header, 26 pin	3M #3429-6002 or equivalent
Recommending Mating Socket	-	0.100" x 0.100" IDC socket, 26 pin	3M #3399-7600 or equivalent
Recommended Strain Relief	-	Plastic strain relief	3M #3448-3026 or equivalent

**Mechanical Information**

