

IAP150T060H SixPac™ Three Phase Inverter



Shown with optional blower

Features:

- High performance IGBT inverter bridge
- Integrated gate drive board with fault monitoring and protection
- System status / troubleshooting LEDs to verify or monitor proper operation
- Isolated, low level (100:1), analog feedback of DC bus voltage
- Isolated gate drive power supplies
- Low inductance laminated bus
- Output current measurement and feedback
- Superior short circuit protection and shoot through prevention

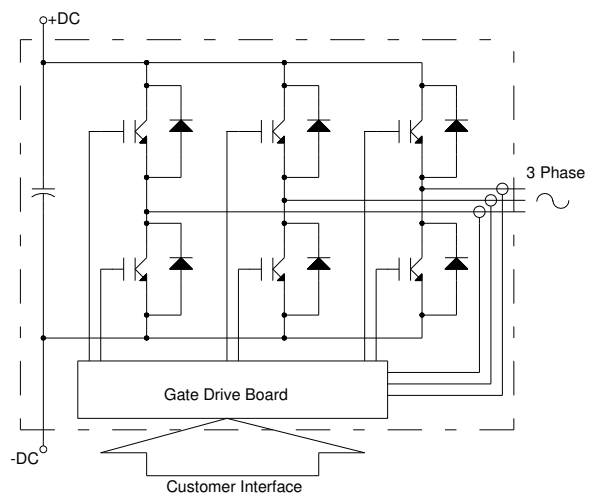
Description:

The SixPac™ from Applied Power Systems is a configurable IGBT based power stage that may be used as a converter, chopper, half or full bridge, or three phase bridge inverter for motor control, power supply, UPS or other power conversion applications.

The IGBTs for the power assembly are mounted on a high efficiency forced air-cooled heatsink. The switching devices interface with a capacitor bank via a low inductance laminated bus. The gate drive board provides a simple user interface along with protection features including: overvoltage, overcurrent, undervoltage lockout, overtemperature, and short circuit protection.

Depending on application characteristics, the SixPac™ is suitable for operation with DC bus voltages up to 400 VDC and switching frequencies to above 20 KHz.

Schematic:



SIXPAC INVERTER IAP150T060H

Absolute Maximum Ratings, $T_j = 25^\circ\text{C}$ unless otherwise specified

General	Symbol		Units
IGBT Junction Temperature	T_j	-40 to +150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-40 to +150	$^\circ\text{C}$
Operating Temperature	T_{op}	-25 to +85	$^\circ\text{C}$
Voltage Applied to DC terminals	V_{cc}	450	Volts
Isolation Voltage, AC 1 minute, 60 Hz sinusoidal	V_{iso}	2500	Volts
IGBT Inverter*			
Collector Current ($T_c = 25^\circ\text{C}$)	I_c	150	Amps
Peak Collector Current ($T_j < 150^\circ\text{C}$)	I_{CM}	300	Amps
Emitter Current	I_E	150	Amps
Peak Emitter Current	I_{EM}	300	Amps
Maximum Collector Dissipation ($T_j < 150^\circ\text{C}$)	P_c	600	Watts
Gate Drive Board			
Unregulated +24V Power Supply		30	Volts
Regulated +15V Power Supply		15.5	Volts
PWM Signal Input Voltage		20	Volts
Fault Signal Output Supply Voltage		30	Volts
Fault Signal Output Current		50	mA

* These parameters are for each IGBT. There are two IGBTs in parallel.

IGBT Inverter Electrical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

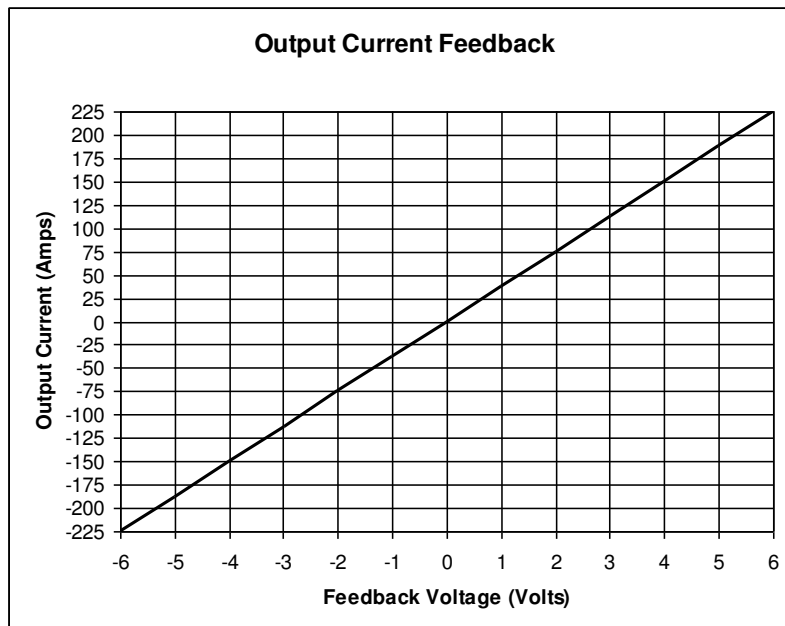
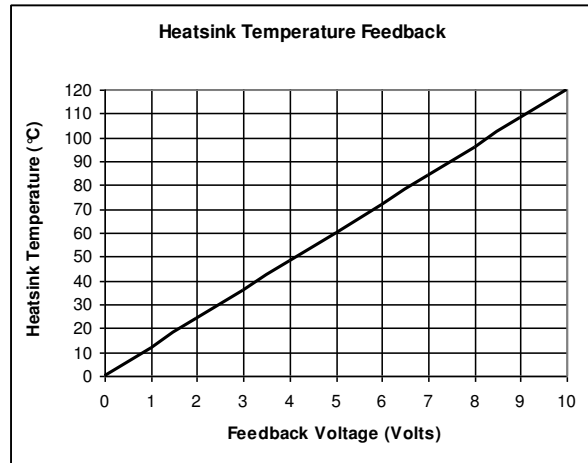
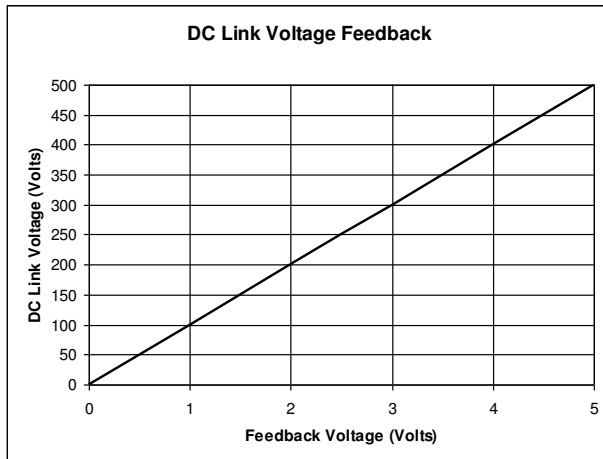
Characteristics	Symbol	Test Conditions	Min	Typ	Max	Units
Collector Cutoff Current	I_{CES}	$V_{\text{CE}}=V_{\text{CES}}, V_{\text{GE}}=0\text{V}$	-	-	1	mA
Collector-Emitter Saturation Voltage	$V_{\text{CE(SAT)}}$	$I_c=150\text{A}, T_j=25^\circ\text{C}$	-	1.8	2.4	Volts
		$I_c=150\text{A}, T_j=125^\circ\text{C}$	-	1.9	-	Volts
Emitter-Collector Voltage	V_{EC}	$I_E=150\text{A}$	-	-	3.2	Volts
	$t_{\text{d(on)}}$		-	-	150	ηS
Inductive Load Switching Times	t_r	$V_{\text{CC}}=300\text{V}$	-	-	80	ηS
	$t_{\text{d(off)}}$	$I_c=150\text{A}$	-	-	450	ηS
	t_f	$V_{\text{GE}}=15\text{V}$	-	-	300	ηS
Diode Reverse Recovery Time	t_{rr}	$R_G=2.1$	-	-	150	ηS
Diode Reverse Recovery Charge	Q_{rr}		-	6.0	-	μC
DC Link Capacitance				4950		μF

Thermal and Mechanical Characteristics

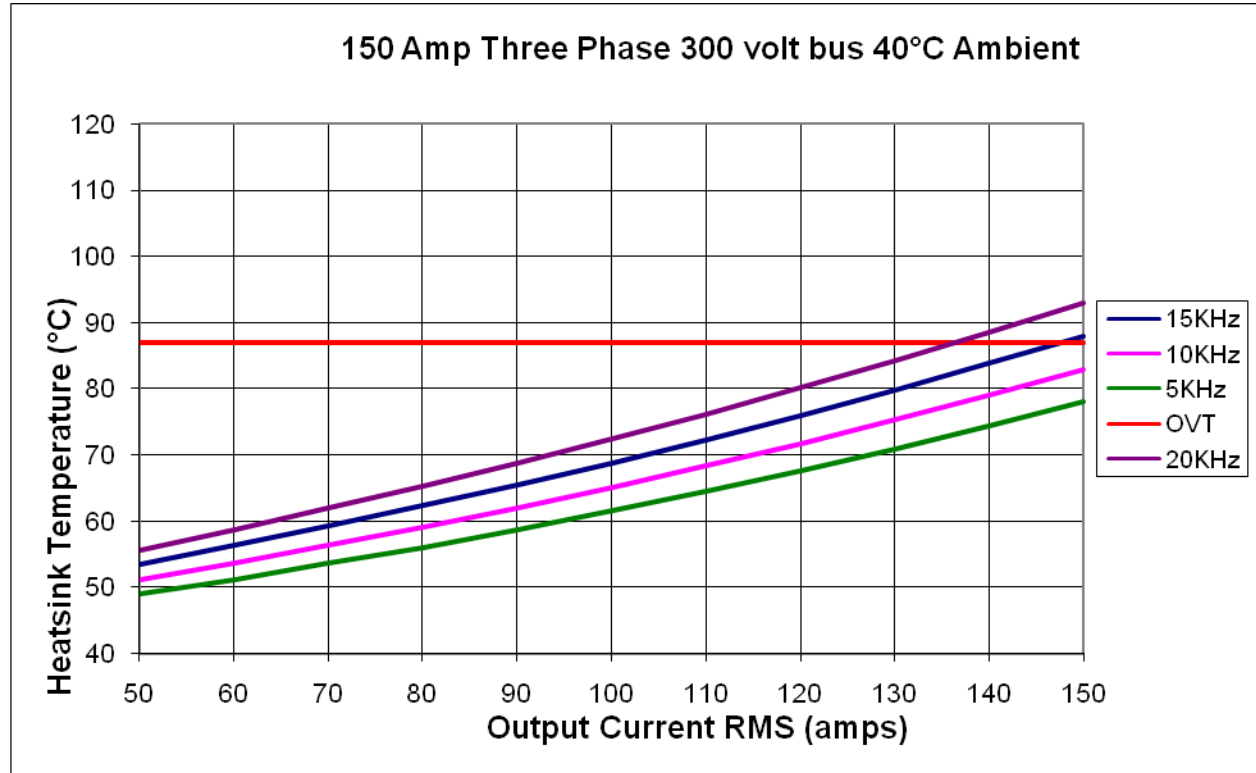
Characteristics	Symbol	Test Conditions	Min	Typ	Max	Units
IGBT Thermal Resistance, Junction to Case	$R_{\text{th(j-c)Q}}$	Per IGBT 1/2 module	-	-	.21	$^\circ\text{C/W}$
FWD Thermal Resistance, Junction to Case	$R_{\text{th(j-c)D}}$	Per FWD 1/2 module	-	-	.24	$^\circ\text{C/W}$
Contact Thermal Resistance	$R_{\text{th(c-f)}}$		-	.02		$^\circ\text{C/W}$
Heatsink Thermal Resistance	$R_{\text{th(f-a)}}$	2500 LFM		.028		$^\circ\text{C/W}$
Mounting Torque, AC Terminals				75	90	In-lb
Mounting Torque, DC Terminals				130	150	In-lb
Mounting Torque, Mounting plate				130	150	In-lb
Weight					30	lb

Gate Drive Board Electrical Characteristics

Characteristics	Min	Typ	Max	Units
Unregulated +24V Power Supply	20	24	30	Volts
Regulated +15V Power Supply	14.4	15	15.6	Volts
PWM Input On Threshold	12	15		Volts
PWM Input Off Threshold		0	2	Volts
Output Overcurrent Trip	215	225	235	Amps
Overtemperature Trip	77	79	81	°C
Overvoltage Trip	450	475	500	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



Condition	Symbol	Value	Units
Ambient Temperature	T_A	40	°C
DC Bus Voltage	V_{CC}	300	Volts
Load Power Factor	$\cos \phi$	0.8	
IGBT Saturation Voltage	$V_{CE(SAT)}$	Typical @ $T_J = 125^\circ\text{C}$	Volts
IGBT Switching Loss	E_{SW}	Typical @ $T_J = 125^\circ\text{C}$	mJ
Airflow	-	2500	LFM

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

Gate Drive Board Interface Connector Signal Definitions

J1

Pin	Signal Name	Description
1	Shield	Low resistance connection to ground
2	PWM A-	0 – 15V signal controlling the duty cycle of A- IGBT
3	Phase A Error ¹	Open collector output, external pull-up resistor required LOW = No Error; Floating = Phase A overcurrent or short circuit
4	PWM A+	0 – 15V signal controlling the duty cycle of A+ IGBT
5	PWM B-	0 – 15V signal controlling the duty cycle of B- IGBT
6	Phase B Error ¹	Open collector output, external pull-up resistor required LOW = No Error; Floating = Phase B overcurrent or short circuit
7	PWM B+	0 – 15V signal controlling the duty cycle of B+ IGBT
8	PWM C-	0 – 15V signal controlling the duty cycle of C- IGBT
9	Phase C Error ¹	Open collector output, external pull-up resistor required LOW = No Error; Floating = Phase C overcurrent or short circuit
10	PWM C+	0 – 15V signal controlling the duty cycle of C+ IGBT
11	Overtemperature, UVLO, or Overvoltage ¹	Open collector output, external pull-up resistor required LOW = No Error; Floating = Heatsink overtemp, UVLO fault, or DC bus overvoltage
12	Not Connected	
13	DC Bus Voltage	Analog voltage representation of DC bus voltage
14	24 VDC Input Power ²	20 – 30 VDC input voltage range
15	24 VDC Input Power ²	20 – 30 VDC input voltage range
16	15 VDC Input Power ²	14.4 - 15 VDC input voltage range
17	15 VDC Input Power ²	14.4 - 15 VDC input voltage range
18	GND	Ground reference for 15 and 24 VDC inputs
19	GND	Ground reference for 15 and 24 VDC inputs
20	Heatsink Temperature	Analog voltage representation of heatsink temperature
21	GND ³	Tied to pins 18 and 19 on gate drive board
22	I _{out} Phase A	Analog voltage representation of Phase A output current
23	GND ³	Tied to pins 18 and 19 on gate drive board
24	I _{out} Phase B	Analog voltage representation of Phase B output current
25	GND ³	
26	I _{out} Phase C	Analog voltage representation of Phase C output current

Notes:

1. Open collectors can be pulled up to 30 V max and sink up to 50mA continuous.
2. Do not connect a 15 VDC and 24 VDC 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_{out} Phase A.

Gate Drive Board Interface Connector

Description	Symbol	Type	Manufacturer
Gate Drive Board Interface Header	J1	0.100" x 0.100" latching header, 16 pin	3M# 3408-6002 or equivalent
Recommended Mating Socket	-	0.100" x 0.100" IDC socket, 16 pin	3M# 3452-7600 or equivalent
Recommended Strain Relief	-	Plastic strain relief	3M# 3448-3016 or equivalent

