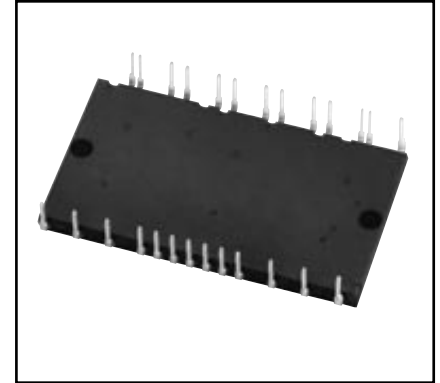
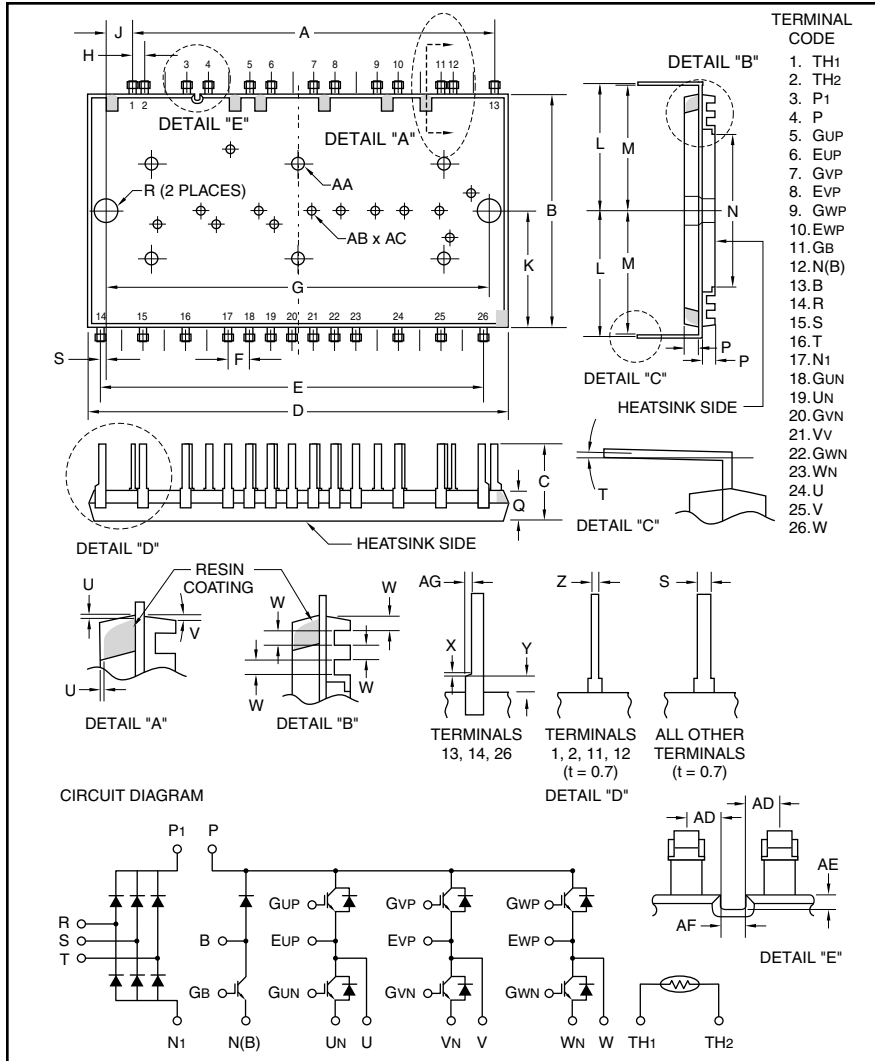


### DIP-CIB

3Ø Converter + 3Ø Inverter + Brake  
20 Amperes/600 Volts



#### Description:

DIP-CIBs are low profile, thermally efficient, transfer mold modules. Each module consists of a three-phase diode converter section, a three-phase inverter section and a brake circuit. Open emitters allow the designer to sense the current in each phase leg for accurate and low cost current sensing. A thermistor is included in the package for sensing the base-plate temperature. 5th Generation CSTBT chips yield low loss. The module is completely Pb-Free and hence RoHS compliant.

#### Features:

- Compact Package
- Only 5.7mm Thick
- One Package for Entire Family
- Thermistor
- Open Emitters

#### Applications:

- AC Motor Control
- Servo Motors
- Robotics
- HVAC Inverters

#### Ordering Information:

CP20TD1-12A is a 600 Volt, 20 Ampere DIP-CIB low profile, thermally efficient, transfer mold module.

#### Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	2.68	68.0
B	1.73	44.0
C	0.58±0.02	14.7±0.5
D	3.1	79.0
E	2.83	72.0
F	0.16±0.01	4.0±0.3
G	2.83±0.01	72.0±0.3
H	0.08±0.01	2.0±0.3
J	0.2±0.008	5.0±0.2
K	0.87	22.0
L	0.96±0.01	24.3±0.3
M	0.94±0.02	23.9±0.5
N	1.14	29.0
P	0.098	2.5
Q	0.22±0.02	5.7±0.5
R	0.18	4.5

Dimensions	Inches	Millimeters
S	0.04±0.008	1.0±0.2
T	0-5°	0-5°
U	0 Min.	0 Min.
V	8°	8°
W	0.04	1.1
X	0.02 Max.	0.5 Max.
Y	0.06	1.6
Z	0.023±0.008	0.6±0.2
AA	0.08 Dia.	2.0 Dia.
AB	0.1 Dia.	2.5 Dia.
AC	0.03 Deep	0.8 Deep
AD	0.057	1.45
AE	0.023	0.6
AF	0.04	1.1
AG	0.02±0.008	0.5±0.2

**CP20TD1-12A**

**DIP-CIB**

**3Ø Converter + 3Ø Inverter + Brake**

20 Amperes/600 Volts

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

Ratings	Symbol	CP20TD1-12A	Units
Junction Temperature*	$T_j$	-20 to 150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-40 to 125	$^\circ\text{C}$
Mounting Torque, M4 Mounting Screws	—	13	in-lb
Module Weight Typical	—	52	Grams
Isolation Voltage (60Hz, Sinusoidal, AC 1 Min., Applied Between Pins and Heatsink)	$V_{ISO}$	2500	Volts

**Inverter Part**

Collector-Emitter Voltage (G-E Short)	$V_{CES}$	600	Volts
Gate-Emitter Voltage (C-E Short)	$V_{GES}$	$\pm 20$	Volts
Collector Current** (DC, $T_C = 78^\circ\text{C}$ )	$I_C$	20	Amperes
Peak Collector Current*** (Pulse)	$I_{CM}$	40	Amperes
Maximum Collector Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_C$	96	Watts
Emitter Current* (DC, $T_C = 56^\circ\text{C}$ )	$I_E^{****}$	20	Amperes
Peak Emitter Current** (Pulse)	$I_{EM}^{****}$	40	Amperes

**Brake Part**

Collector-Emitter Voltage (G-E Short)	$V_{CES}$	600	Volts
Gate-Emitter Voltage (C-E Short)	$V_{GES}$	$\pm 20$	Volts
Collector Current* (DC, $T_C = 110^\circ\text{C}$ )	$I_C$	10	Amperes
Peak Collector Current** (Pulse)	$I_{CM}$	20	Amperes
Maximum Collector Dissipation ( $T_C = 25^\circ\text{C}$ , $T_j < 150^\circ\text{C}$ )	$P_C$	70	Watts
Repetitive Peak Reverse Voltage (Clamp Diode Part)	$V_{RRM}$	600	Volts
Forward Current (Clamp Diode Part, $T_j < 150^\circ\text{C}$ )	$I_{FM}$	10	Amperes

**Converter Part**

Repetitive Peak Reverse Voltage	$V_{RRM}$	800	Volts
Recommended AC Input Voltage	$E_a$	220	Volts
DC Output Current (Three-phase Rectifying Circuit)	$I_O$	20	Amperes
Surge Forward Current (1/2 Cycle at 60 Hz, Peak Value, Non-repetitive)	$I_{FSM}$	245	Amperes
$I^2t$ for Fusing (Value for 1 Cycle of Surge Current)	$I^2t$	252	$\text{A}^2\text{s}$

\*It is recommended to limit the average junction temperature below  $125^\circ\text{C}$  to ensure safe operation.

\*\* $T_C$  is measured just underneath the power chip.

\*\*\*Pulse width and repetition rate should be such that the device junction temperature ( $T_j$ ) does not exceed  $T_{j(max)}$  rating.

\*\*\*\* $I_E$ ,  $V_{EC}$ ,  $t_{rr}$ , and  $Q_{rr}$  represent characteristics of the anti-parallelled emitter-to-collector free-wheel diode (FWD).



Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272

CP20TD1-12A

DIP-CIB

3Ø Converter + 3Ø Inverter + Brake

20 Amperes/600 Volts

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>Inverter Part</b>						
Collector-Cutoff Current	$I_{CES}$	$V_{CE} = V_{CES}, V_{GE} = 0V$	—	—	1.0	mA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C = 2.0mA, V_{CE} = 10V$	5.0	6.0	7.0	Volts
Gate-Emitter Cutoff Current	$I_{GES}$	$V_{GE} = 20V, V_{CE} = 0V$	—	—	1.0	$\mu A$
Collector-Emitter	$V_{CE(sat)}$	$I_C = 20A, V_{GE} = 15V, T_j = 25^\circ\text{C}$	—	1.8	2.5	Volts
Saturation Voltage*		$I_C = 20A, V_{GE} = 15V, T_j = 125^\circ\text{C}$	—	1.9	—	Volts
Input Capacitance	$C_{ies}$		—	1.57	—	nF
Output Capacitance	$C_{oes}$	$V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$	—	0.24	—	nF
Reverse Transfer Capacitance	$C_{res}$		—	0.06	—	nF
Total Gate Charge	$Q_G$	$V_{CC} = 300V, I_C = 20A, V_{GE} = 15V$	—	65	—	nC
Turn-on Delay Time	$t_{d(on)}$		—	80	—	ns
Turn-on Rise Time	$t_r$	$V_{CC} = 300V, I_C = 20A,$	—	50	—	ns
Turn-off Delay Time	$t_{d(off)}$	$V_{GE} = \pm 15V, R_G = 33\Omega,$	—	200	—	ns
Turn-off Fall Time	$t_f$	$T_j = 25^\circ\text{C},$	—	400	—	ns
Reverse Recovery Time**	$t_{rr}$	Inductive Load	—	—	—	ns
Reverse Recovery Charge**	$Q_{rr}$		—	—	—	$\mu C$
Emitter-Collector Voltage**	$V_{EC}$	$I_E = 20A, V_{GE} = 0V$	—	1.7	2.4	Volts
External Gate Resistance	$R_g$	—	33	—	330	$\Omega$

### Brake Part

Collector-Cutoff Current	$I_{CES}$	$V_{CE} = V_{CES}, V_{GE} = 0V$	—	—	1.0	mA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C = 1.0mA, V_{CE} = 10V$	5.0	6.0	7.0	Volts
Gate-Emitter Cutoff Current	$I_{GES}$	$V_{GE} = 20V, V_{CE} = 0V$	—	—	1.0	$\mu A$
Collector-Emitter	$V_{CE(sat)}$	$I_C = 10A, V_{GE} = 15V, T_j = 25^\circ\text{C}$	—	1.8	2.5	Volts
Saturation Voltage*		$I_C = 10A, V_{GE} = 15V, T_j = 125^\circ\text{C}$	—	1.9	—	Volts
Input Capacitance	$C_{ies}$		—	0.8	—	nF
Output Capacitance	$C_{oes}$	$V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$	—	1.3	—	nF
Reverse Transfer Capacitance	$C_{res}$		—	0.03	—	nF
Total Gate Charge	$Q_G$	$V_{CC} = 300V, I_C = 10A, V_{GE} = 15V$	—	33	—	nC
Turn-on Delay Time	$t_{d(on)}$		—	80	—	ns
Turn-on Rise Time	$t_r$	$V_{CC} = 300V, I_C = 10A,$	—	50	—	ns
Turn-off Delay Time	$t_{d(off)}$	$V_{GE} = \pm 15V, R_G = 62\Omega,$	—	200	—	ns
Turn-off Fall Time	$t_f$	$T_j = 25^\circ\text{C},$	—	400	—	ns
Reverse Recovery Time	$t_{rr}$	Inductive Load	—	—	—	ns
Reverse Recovery Charge	$Q_{rr}$		—	—	—	$\mu C$
Forward Voltage Drop	$V_{FM}$	$I_F = 10A, \text{Clamp Diode Part}$	—	1.7	2.4	Volts
External Gate Resistance	$R_g$	—	62	—	620	$\Omega$

\*Pulse width and repetition rate should be such as to cause negligible temperature rise.

\*\* $T_C$  is measured just underneath the power chip.



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**CP20TD1-12A**  
**DIP-CIB**  
**3Ø Converter + 3Ø Inverter + Brake**  
 20 Amperes/600 Volts

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>Converter Part</b>						
Repetitive Reverse Current	I <sub>RRM</sub>	V <sub>R</sub> = V <sub>RRM</sub> , T <sub>j</sub> = 125°C	—	—	1.0	mA
Forward Voltage Drop	V <sub>FM</sub>	I <sub>F</sub> = 20A	—	—	1.4	Volts

**Thermal and Mechanical Characteristics, T<sub>j</sub> = 25 °C unless otherwise specified**

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>Common Rating</b>						
Contact Thermal Resistance	R <sub>th(c-f)</sub>	Case-to-Fin, Thermal Grease Applied	—	0.047	—	°C/W

**Inverter Part**

Thermal Resistance, Junction to Case	R <sub>th(j-c)Q</sub>	IGBT Part, Per 1/6 Module	—	—	1.3	°C/W
Thermal Resistance, Junction to Case	R <sub>th(j-c)D</sub>	FWDi Part, Per 1/6 Module	—	—	1.7	°C/W

**Brake Part**

Thermal Resistance, Junction to Case	R <sub>th(j-c)Q</sub>	IGBT Part	—	—	1.6	°C/W
Thermal Resistance, Junction to Case	R <sub>th(j-c)D</sub>	FWDi Part	—	—	2.1	°C/W

**Converter Part**

Thermal Resistance, Junction to Case	R <sub>th(j-c)</sub>	Per 1/6 Module	—	—	1.3	°C/W
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**NTC Thermistor Part**

Resistance	R <sub>th</sub>	T <sub>C</sub> = 25°C	9.5	10.0	10.5	kΩ
B Constant*	B(25/100)	Resistance at 25°C, 100°C	—	3450	—	K

\*Thermistor resistance R<sub>X</sub> at arbitrary temperature T<sub>X</sub>(K) can be calculated with the B constant formula

$$R_X = R_{25} \cdot \exp\left[B(25/100) \cdot \left(\frac{1}{T_X} - \frac{1}{T_{25}}\right)\right]$$

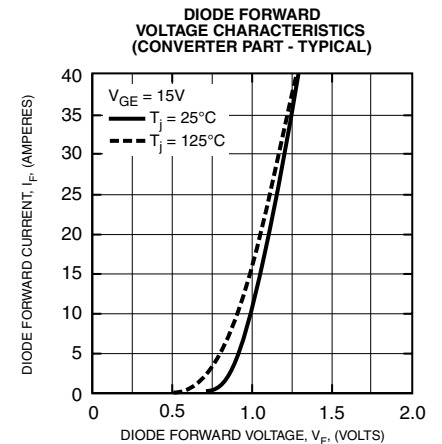
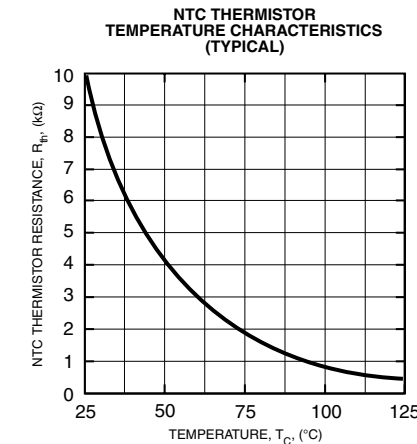
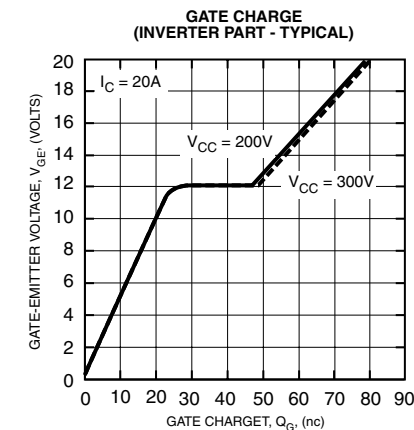
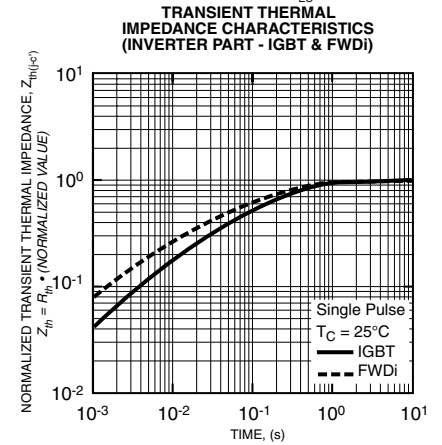
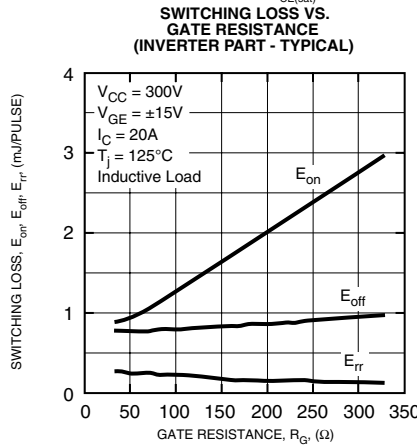
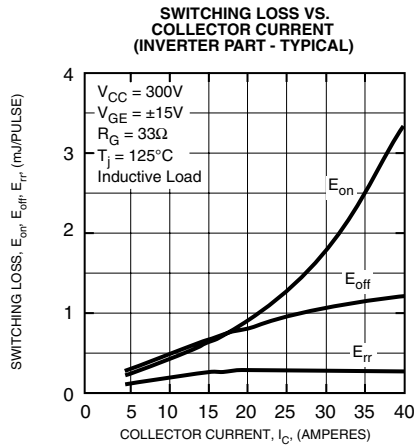
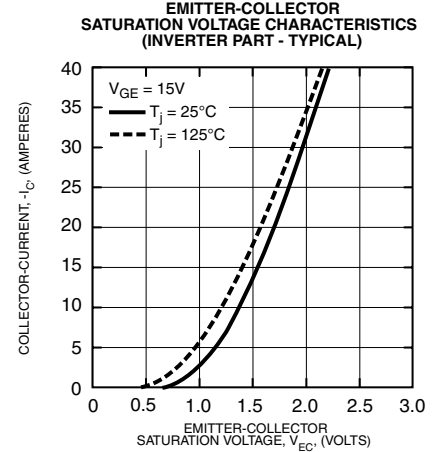
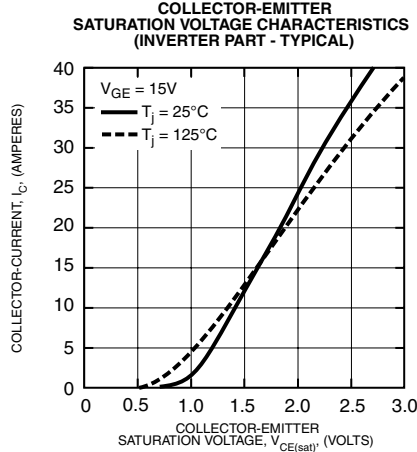
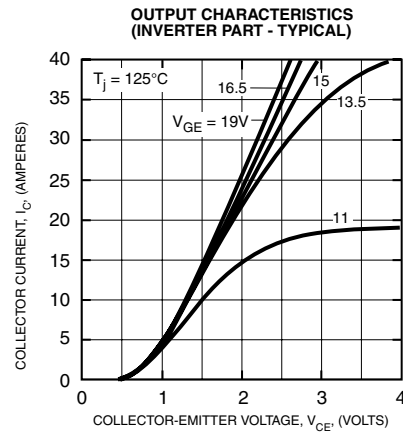
where R<sub>25</sub> is the resistance at T<sub>C</sub> = 25°C, T<sub>25</sub> = 298K.

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