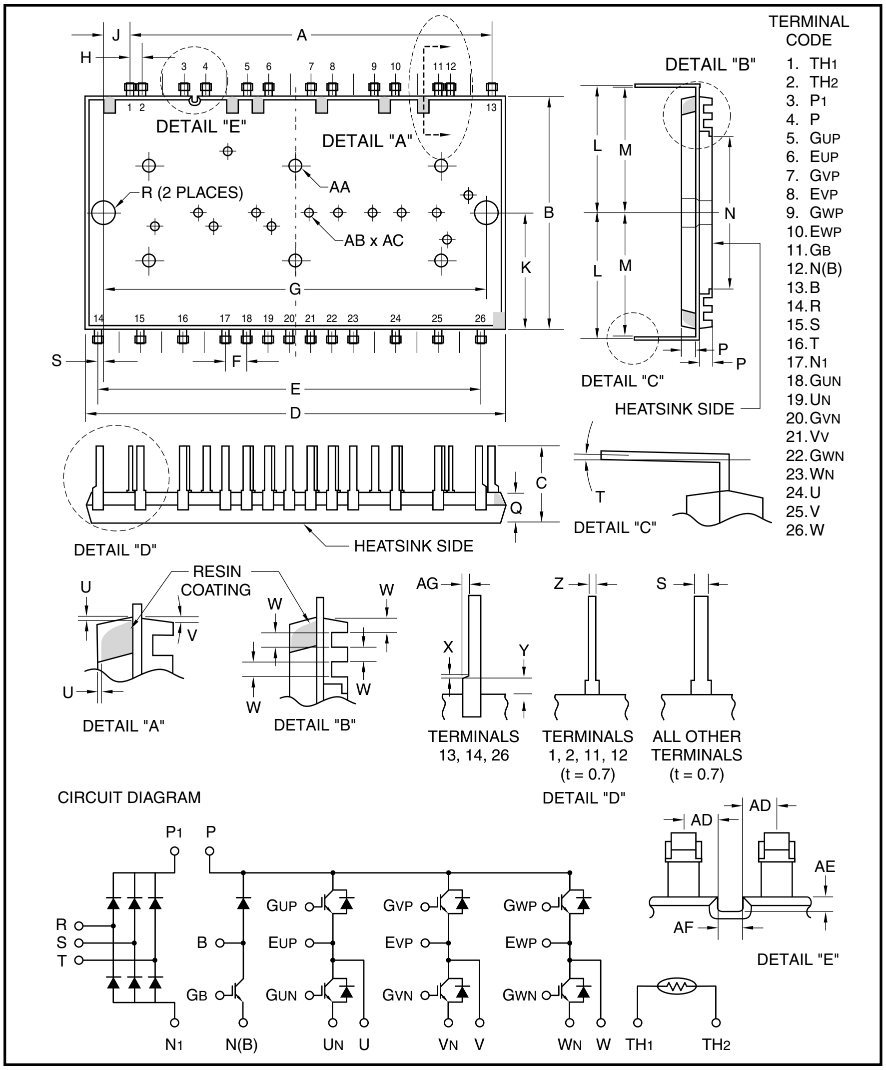
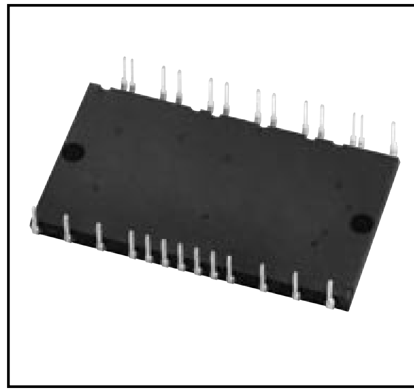
Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272

DIP-CIB

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





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

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.

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20 Amperes/600 Volts

Absolute Maximum Ratings, T_j = 25 °C unless otherwise specified

Ratings	Symbol	CP20TD1-12A	Units
Junction Temperature*	T_j	-20 to 150	°C
Storage Temperature	T_{stg}	-40 to 125	°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}	±20	Volts
Collector Current** (DC, T_C = 78°C)	I_C	20	Amperes
Peak Collector Current*** (Pulse)	I_{CM}	40	Amperes
Maximum Collector Dissipation (T_C = 25°C)	P_C	96	Watts
Emitter Current* (DC, T_C = 56°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}	±20	Volts
Collector Current* (DC, T_C = 110°C)	I_C	10	Amperes
Peak Collector Current** (Pulse)	I_{CM}	20	Amperes
Maximum Collector Dissipation (T_C = 25°C, T_j < 150°C)	P_C	70	Watts
Repetitive Peak Reverse Voltage (Clamp Diode Part)	V_{RRM}	600	Volts
Forward Current (Clamp Diode Part, T_j < 150°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	A^2s

*It is recommended to limit the average junction temperature below 125°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-paralleled emitter-to-collector free-wheel diode (FWDi).

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Inverter Part

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
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	µA
Collector-Emitter	$V_{CE(sat)}$	I_C = 20A, V_{GE} = 15V, T_j = 25°C	—	1.8	2.5	Volts
Saturation Voltage*		I_C = 20A, V_{GE} = 15V, T_j = 125°C	—	1.9	—	Volts
Input Capacitance	C_{ies}	V_{CE} = 10V, V_{GE} = 0V, f = 1MHz	—	1.57	—	nF
Output Capacitance	C_{oes}		—	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	$t_{d(on)}$	V_{CC} = 300V, I_C = 20A,	—	80	—	ns
Turn-on Rise Time	t_r	V_{GE} = ±15V, R_G = 33Ω,	—	50	—	ns
Turn-off Delay Time	$t_{d(off)}$	T_j = 25°C,	—	200	—	ns
Turn-off Fall Time	t_f	Inductive Load	—	400	—	ns
Reverse Recovery Time**	t_{rr}		—	—	—	ns
Reverse Recovery Charge**	Q_{rr}		—	—	—	µC
Emitter-Collector Voltage**	V_{EC}	I_E = 20A, V_{GE} = 0V	—	1.7	2.4	Volts
External Gate Resistance	R_g	—	33	—	330	Ω

Brake Part

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
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	µA
Collector-Emitter	$V_{CE(sat)}$	I_C = 10A, V_{GE} = 15V, T_j = 25°C	—	1.8	2.5	Volts
Saturation Voltage*		I_C = 10A, V_{GE} = 15V, T_j = 125°C	—	1.9	—	Volts
Input Capacitance	C_{ies}	V_{CE} = 10V, V_{GE} = 0V, f = 1MHz	—	0.8	—	nF
Output Capacitance	C_{oes}		—	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	$t_{d(on)}$	V_{CC} = 300V, I_C = 10A,	—	80	—	ns
Turn-on Rise Time	t_r	V_{GE} = ±15V, R_G = 62Ω,	—	50	—	ns
Turn-off Delay Time	$t_{d(off)}$	T_j = 25°C,	—	200	—	ns
Turn-off Fall Time	t_f	Inductive Load	—	400	—	ns
Reverse Recovery Time	t_{rr}		—	—	—	ns
Reverse Recovery Charge	Q_{rr}		—	—	—	µC
Forward Voltage Drop	V_{FM}	I_F = 10A, Clamp Diode Part	—	1.7	2.4	Volts
External Gate Resistance	R_g	—	62	—	620	Ω

*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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Electrical Characteristics, T_j = 25 °C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Converter Part						
Repetitive Reverse Current	I_{RRM}	$V_R = V_{RRM}$, T_j = 125°C	—	—	1.0	mA
Forward Voltage Drop	V_{FM}	I_F = 20A	—	—	1.4	Volts

Thermal and Mechanical Characteristics, T_j = 25 °C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Common Rating						
Contact Thermal Resistance	$R_{th(c-f)}$	Case-to-Fin, Thermal Grease Applied	—	0.047	—	°C/W
Inverter Part						
Thermal Resistance, Junction to Case	$R_{th(j-c)}Q$	IGBT Part, Per 1/6 Module	—	—	1.3	°C/W
Thermal Resistance, Junction to Case	$R_{th(j-c)}D$	FWDi Part, Per 1/6 Module	—	—	1.7	°C/W
Brake Part						
Thermal Resistance, Junction to Case	$R_{th(j-c)}Q$	IGBT Part	—	—	1.6	°C/W
Thermal Resistance, Junction to Case	$R_{th(j-c)}D$	FWDi Part	—	—	2.1	°C/W
Converter Part						
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	Per 1/6 Module	—	—	1.3	°C/W
NTC Thermistor Part						
Resistance	R_{th}	T_C = 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_X at arbitrary temperature T_X(K) can be calculated with the B constant formula

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

where R_{25} is the resistance at T_C = 25°C, T_{25} = 298K.

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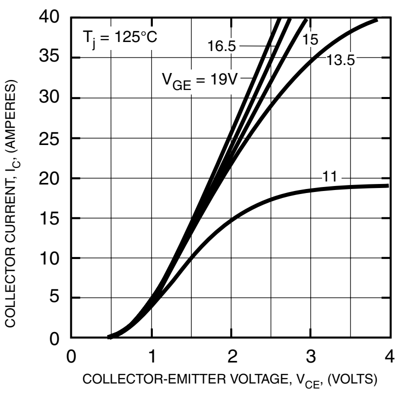
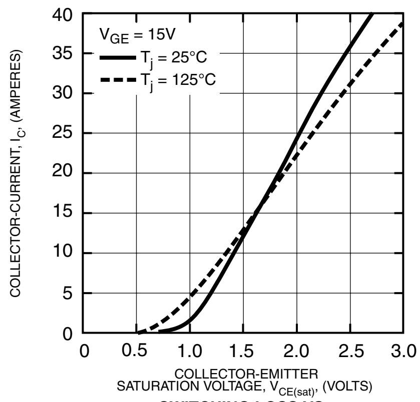
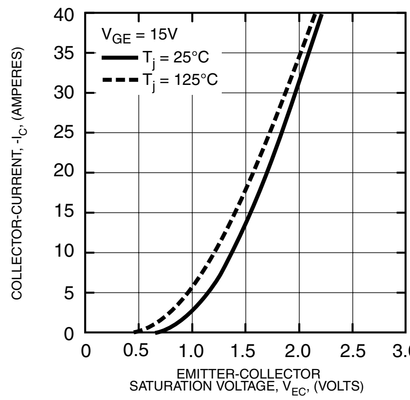
OUTPUT CHARACTERISTICS (INVERTER PART - TYPICAL)



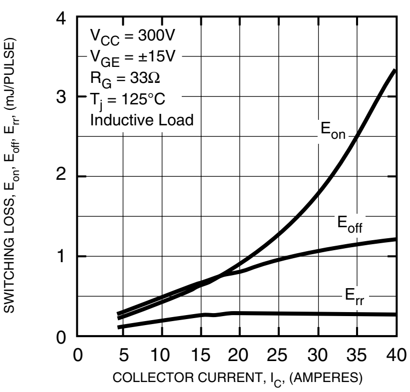
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (INVERTER PART - TYPICAL)



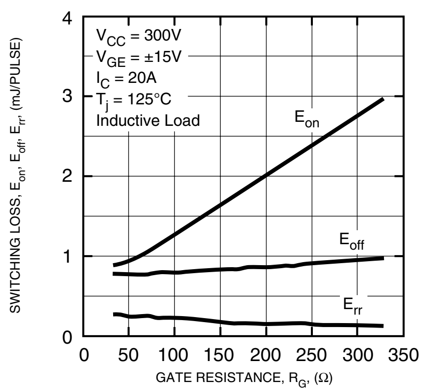
EMITTER-COLLECTOR SATURATION VOLTAGE CHARACTERISTICS (INVERTER PART - TYPICAL)



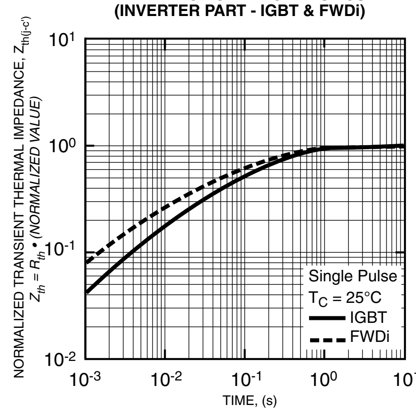
SWITCHING LOSS VS. COLLECTOR CURRENT (INVERTER PART - TYPICAL)



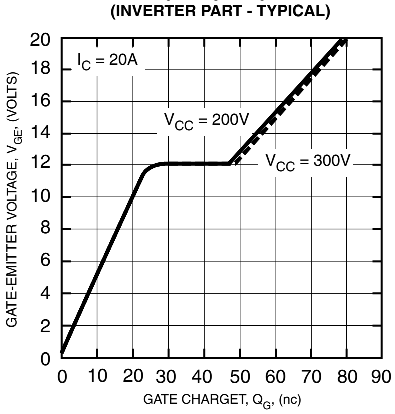
SWITCHING LOSS VS. GATE RESISTANCE (INVERTER PART - TYPICAL)



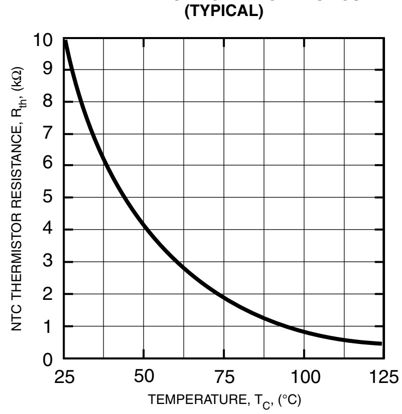
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (INVERTER PART - IGBT & FWDi)



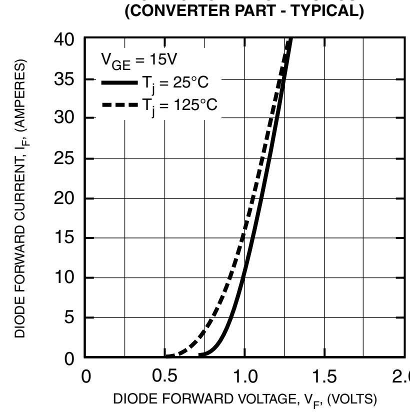
GATE CHARGE (INVERTER PART - TYPICAL)



NTC THERMISTOR TEMPERATURE CHARACTERISTICS (TYPICAL)



DIODE FORWARD VOLTAGE CHARACTERISTICS (CONVERTER PART - TYPICAL)



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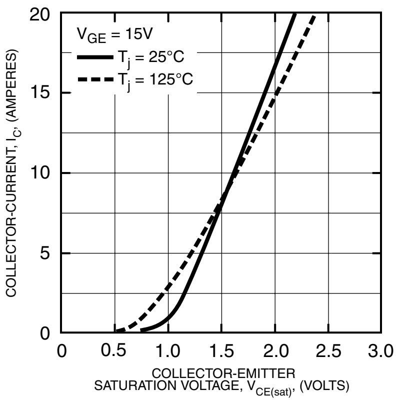
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (BRAKE PART - TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (BRAKE PART - TYPICAL)