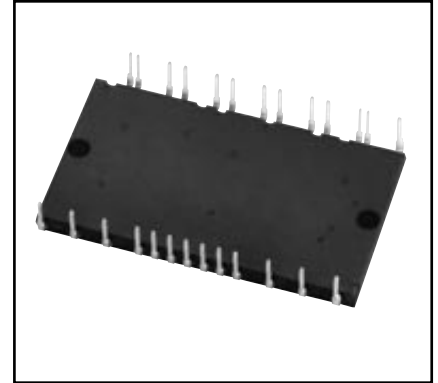
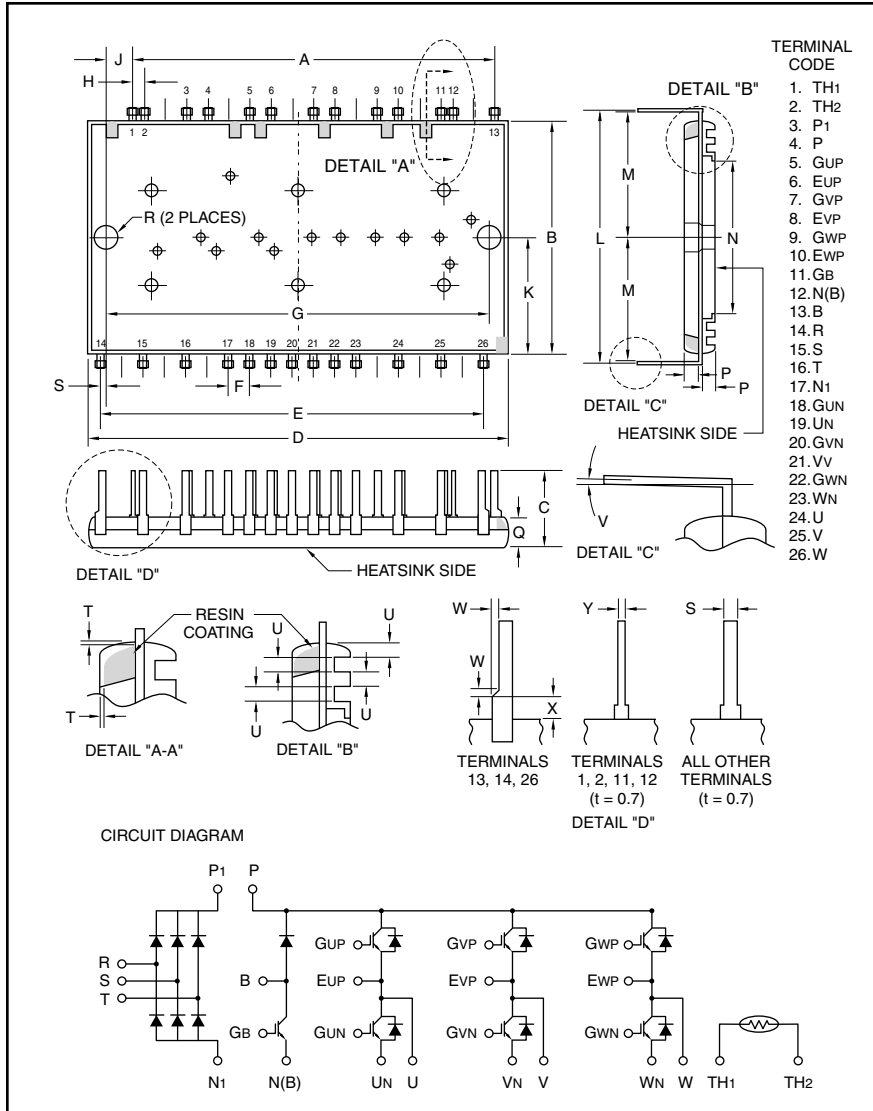


DIP-CIB

3Ø Converter + 3Ø Inverter + Brake
10 Amperes/1200 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:

CP10TD1-24A is a 1200 Volt, 10 Ampere DIP-CIB module.

Outline Drawing and Circuit Diagram

| Dimensions | Inches | Millimeters |
|------------|------------|-------------|
| A | 2.68±0.01 | 68.0±0.3 |
| B | 1.73±0.02 | 44.0±0.5 |
| C | 0.58±0.004 | 14.7±0.1 |
| D | 3.1±0.02 | 79.0±0.5 |
| E | 2.83 | 72.0 |
| F | 0.16±0.01 | 4.0±0.3 |
| G | 2.83±0.01 | 72.0±0.3 |
| H | 0.07 | 2.0 |
| J | 0.2±0.008 | 5.0±0.2 |
| K | 0.87 | 22.0 |
| L | 1.91±0.023 | 48.6±0.6 |
| M | 0.94±0.02 | 23.9±0.5 |

| Dimensions | Inches | Millimeters |
|------------|----------------|--------------|
| N | 1.14 | 29.0 |
| P | 0.098 | 2.5 |
| Q | 0.22±0.02 | 5.7±0.5 |
| R | 0.18±0.008Dia. | 4.5±0.2 Dia. |
| S | 0.04±0.008 | 1.0±0.2 |
| T | 0 Min. | 0 Min. |
| U | 0.04 | 1.1 |
| V | 0-5° | 0-5° |
| W | 0.02 Max. | 0.5 Max. |
| X | 0.06±0.02 | 1.6±0.5 |
| Y | 0.023±0.008 | 0.6±0.2 |



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CP10TD1-24A

DIP-CIB

3Ø Converter + 3Ø Inverter + Brake

10 Amperes/1200 Volts

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

| Ratings | Symbol | CP10TD1-24A | Units |
|--|-----------|-------------|------------------|
| Junction Temperature | T_j | -20 to 125 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | -20 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} | 1200 | Volts |
| Gate-Emitter Voltage (C-E Short) | V_{GES} | ± 20 | Volts |
| Collector Current* (DC, $T_C = 100^\circ\text{C}$) | I_C | 10 | Amperes |
| Peak Collector Current** (Pulse) | I_{CM} | 20 | 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^{***} | 10 | Amperes |
| Peak Emitter Current** (Pulse) | I_{EM}^{***} | 20 | Amperes |

Brake Part

| | | | |
|--|-----------|----------|---------|
| Collector-Emitter Voltage (G-E Short) | V_{CES} | 1200 | Volts |
| Gate-Emitter Voltage (C-E Short) | V_{GES} | ± 20 | Volts |
| Collector Current* (DC, $T_C = 100^\circ\text{C}$) | 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 | 104 | Watts |
| Repetitive Peak Reverse Voltage (Clamp Diode Part) | V_{RRM} | 1200 | Volts |
| Forward Current (Clamp Diode Part, $T_j < 150^\circ\text{C}$) | I_{FM} | 10 | Amperes |

Converter Part

| | | | |
|--|-----------|------|----------------------|
| Repetitive Peak Reverse Voltage | V_{RRM} | 1600 | Volts |
| Recommended AC Input Voltage | E_a | 440 | Volts |
| DC Output Current (Three-phase Rectifying Circuit) | I_O | 10 | Amperes |
| Surge Forward Current (1/2 Cycle at 60 Hz, Peak Value, Non-repetitive) | I_{FSM} | 200 | Amperes |
| I^2t for Fusing (Value for 1 Cycle of Surge Current) | I^2t | 168 | A^2s |

* 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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CP10TD1-24A

DIP-CIB

3Ø Converter + 3Ø Inverter + Brake

10 Amperes/1200 Volts

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

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------------------|---------------|--|------|------|------|----------|
| Inverter Part | | | | | | |
| Collector-Cutoff Current | I_{CES} | $V_{CE} = V_{CES}, V_{GE} = 0V$ | — | — | 1.0 | mA |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $I_C = 1.0mA, V_{CE} = 10V$ | 6.5 | 7.5 | 8.5 | Volts |
| Gate-Emitter Cutoff Current | I_{GES} | $V_{GE} = 20V, V_{CE} = 0V$ | — | — | 1.0 | μA |
| Collector-Emitter | $V_{CE(sat)}$ | $I_C = 10A, V_{GE} = 15V, T_j = 25^\circ C$ | — | 1.8 | 2.5 | Volts |
| Saturation Voltage* | | $I_C = 10A, V_{GE} = 15V, T_j = 125^\circ C$ | — | 2.0 | — | Volts |
| Input Capacitance | C_{ies} | | — | — | 2.04 | nF |
| Output Capacitance | C_{oes} | $V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$ | — | — | 0.16 | nF |
| Reverse Transfer Capacitance | C_{res} | | — | — | 0.04 | nF |
| Total Gate Charge | Q_G | $V_{CC} = 600V, I_C = 10A, V_{GE} = 15V$ | — | 67 | — | nC |
| Turn-on Delay Time | $t_{d(on)}$ | | — | — | 100 | ns |
| Turn-on Rise Time | t_r | $V_{CC} = 600V, I_C = 10A,$ | — | — | 75 | ns |
| Turn-off Delay Time | $t_{d(off)}$ | $V_{GE} = \pm 15V, R_G = 33\Omega,$ | — | — | 300 | ns |
| Turn-off Fall Time | t_f | $T_j = 25^\circ C,$ | — | — | 400 | ns |
| Reverse Recovery Time** | t_{rr} | Inductive Load | — | 200 | — | ns |
| Reverse Recovery Charge** | Q_{rr} | | — | 0.3 | — | μC |
| Emitter-Collector Voltage** | V_{EC} | $I_E = 10A, V_{GE} = 0V$ | — | 2.7 | 3.5 | Volts |
| External Gate Resistance | R_g | — | 33 | — | 330 | Ω |

Brake Part

| | | | | | | |
|--------------------------------|---------------|--|-----|-----|------|----------|
| Collector-Cutoff Current | I_{CES} | $V_{CE} = V_{CES}, V_{GE} = 0V$ | — | — | 1.0 | mA |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $I_C = 1.0mA, V_{CE} = 10V$ | 6.5 | 7.5 | 8.5 | Volts |
| Gate-Emitter Cutoff Current | I_{GES} | $V_{GE} = 20V, V_{CE} = 0V$ | — | — | 1.0 | μA |
| Collector-Emitter | $V_{CE(sat)}$ | $I_C = 10A, V_{GE} = 15V, T_j = 25^\circ C$ | — | 1.8 | 2.5 | Volts |
| Saturation Voltage* | | $I_C = 10A, V_{GE} = 15V, T_j = 125^\circ C$ | — | 2.0 | — | Volts |
| Input Capacitance | C_{ies} | | — | — | 2.16 | nF |
| Output Capacitance | C_{oes} | $V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$ | — | — | 0.15 | nF |
| Reverse Transfer Capacitance | C_{res} | | — | — | 0.04 | nF |
| Total Gate Charge | Q_G | $V_{CC} = 600V, I_C = 10A, V_{GE} = 15V$ | — | 67 | — | nC |
| Turn-on Delay Time | $t_{d(on)}$ | | — | — | 100 | ns |
| Turn-on Rise Time | t_r | $V_{CC} = 600V, I_C = 10A,$ | — | — | 75 | ns |
| Turn-off Delay Time | $t_{d(off)}$ | $V_{GE} = \pm 15V, R_G = 33\Omega,$ | — | — | 300 | ns |
| Turn-off Fall Time | t_f | $T_j = 25^\circ C,$ | — | — | 400 | ns |
| Reverse Recovery Time | t_{rr} | Inductive Load | — | 200 | — | ns |
| Reverse Recovery Charge | Q_{rr} | | — | 0.3 | — | μC |
| Forward Voltage Drop | V_{FM} | $I_F = 10A, \text{Clamp Diode Part}$ | — | 2.7 | 3.5 | Volts |
| External Gate Resistance | R_g | — | 33 | — | 330 | 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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CP10TD1-24A
DIP-CIB
3Ø Converter + 3Ø Inverter + Brake
10 Amperes/1200 Volts

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

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|----------------------------|-----------|--|------|------|------|-------|
| Converter Part | | | | | | |
| Repetitive Reverse Current | I_{RRM} | $V_R = V_{RRM}, T_j = 125^\circ\text{C}$ | — | — | 1.0 | mA |
| Forward Voltage Drop | V_{FM} | $I_F = 10\text{A}$ | — | 1.1 | 1.4 | Volts |

Thermal and Mechanical Characteristics, $T_j = 25\text{ }^\circ\text{C}$ 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 | — | $^\circ\text{C/W}$ |

Inverter Part

| | | | | | | |
|--------------------------------------|----------------|---------------------------|---|---|-----|--------------------|
| Thermal Resistance, Junction to Case | $R_{th(j-c)Q}$ | IGBT Part, Per 1/6 Module | — | — | 1.3 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction to Case | $R_{th(j-c)D}$ | FWDi Part, Per 1/6 Module | — | — | 2.0 | $^\circ\text{C/W}$ |

Brake Part

| | | | | | | |
|--------------------------------------|----------------|-----------|---|---|-----|--------------------|
| Thermal Resistance, Junction to Case | $R_{th(j-c)Q}$ | IGBT Part | — | — | 1.2 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction to Case | $R_{th(j-c)D}$ | FWDi Part | — | — | 1.7 | $^\circ\text{C/W}$ |

Converter Part

| | | | | | | |
|--------------------------------------|---------------|----------------|---|---|-----|--------------------|
| Thermal Resistance, Junction to Case | $R_{th(j-c)}$ | Per 1/6 Module | — | — | 1.3 | $^\circ\text{C/W}$ |
|--------------------------------------|---------------|----------------|---|---|-----|--------------------|

NTC Thermistor Part

| | | | | | | |
|-------------|-------------|---|-----|------|------|------------------|
| Resistance | R_{th} | $T_C = 25^\circ\text{C}$ | 9.5 | 10.0 | 10.5 | $\text{k}\Omega$ |
| B Constant* | $B(25/100)$ | Resistance at $25^\circ\text{C}, 100^\circ\text{C}$ | — | 3450 | — | K |

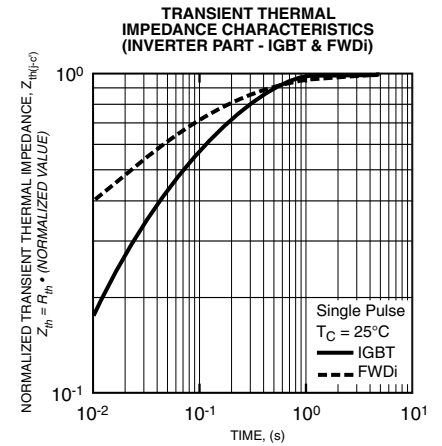
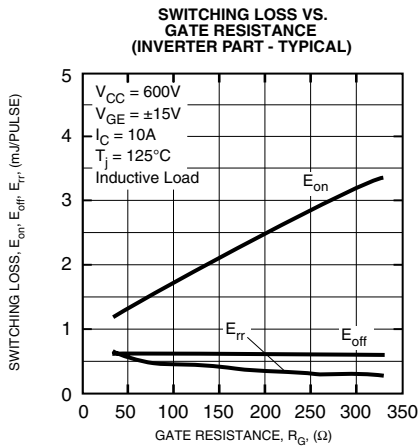
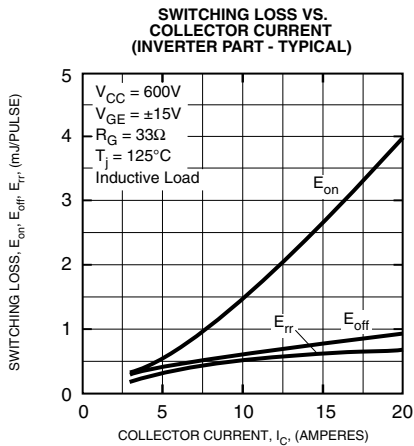
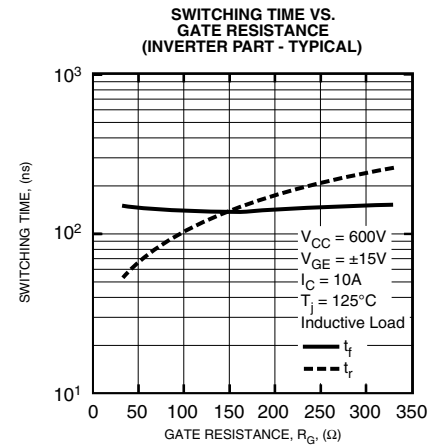
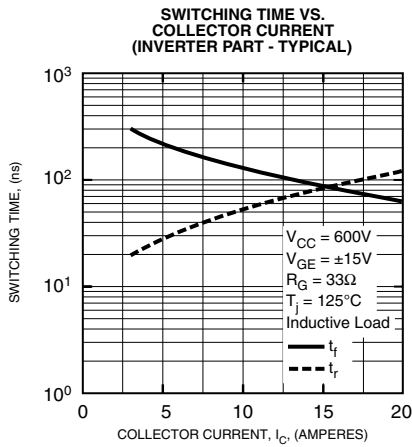
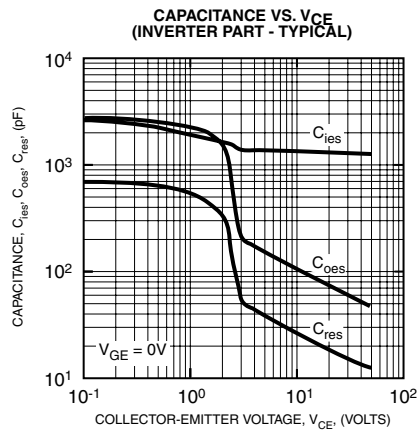
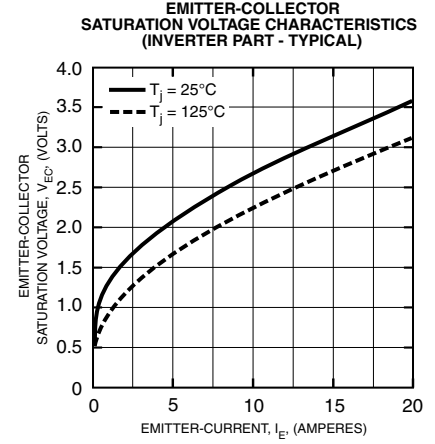
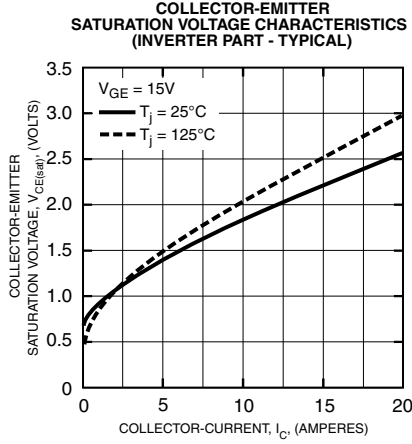
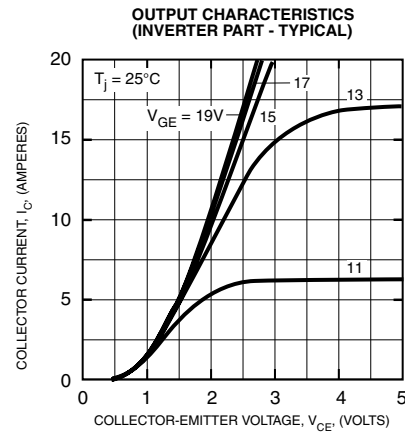
* $B = (\ln R_1 - \ln R_2) / (1/T_1 - 1/T_2)$ where R_1 is the resistance at $T_1(K)$, R_2 is the resistance at $T_2(K)$.

CP10TD1-24A

DIP-CIB

3Ø Converter + 3Ø Inverter + Brake

10 Amperes/1200 Volts



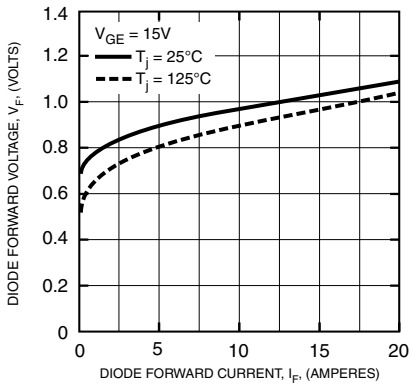
CP10TD1-24A

DIP-CIB

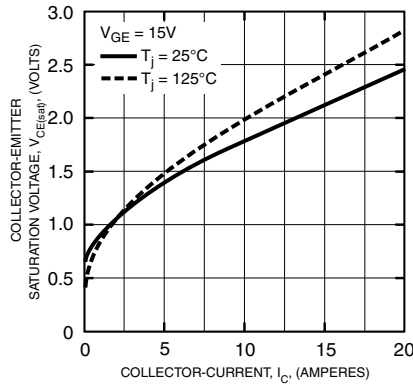
3Ø Converter + 3Ø Inverter + Brake

10 Amperes/1200 Volts

DIODE FORWARD VOLTAGE CHARACTERISTICS (CONVERTER PART - TYPICAL)



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



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

