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Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

# Technical Information

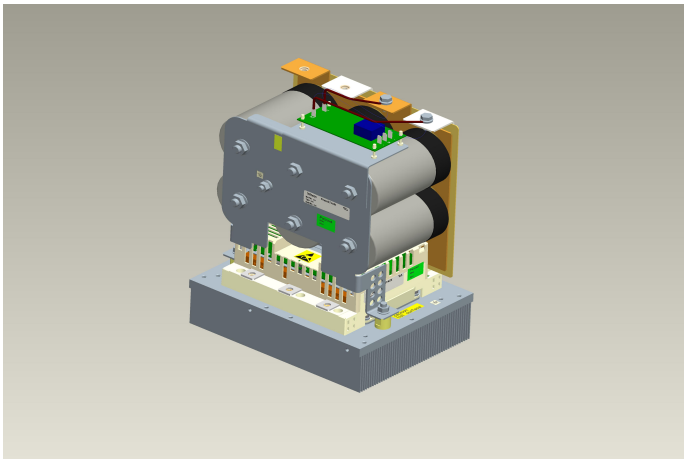
PrimeSTACK™ 6PS04512E43G37986

**Preliminary data**

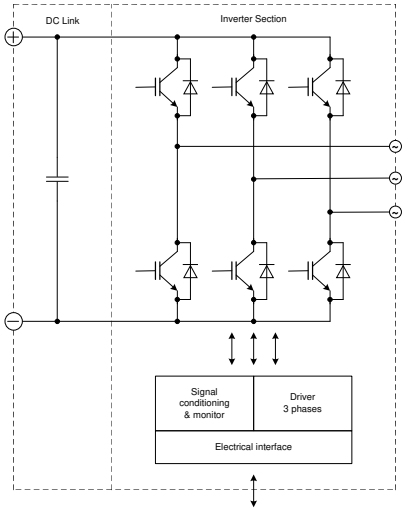
## General information

### IGBT STACK for typical voltage of up to 400V
### Rated output current 217A

- Solar power
- Motor drivers
- 62mm IGBT power module
· Trenchstop™IGBT 4



| | |
|---|---|
| Topology | B6I |
| Application | Inverter |
| Load type | Resistive, inductive |
| Semiconductor (Inverter Section) | 3 x FF450R12KE4 |
| DC Link | 2.4 mF |
| Heatsink | Forced air colled (fan not included) |
| Implemented sensors | Current,voltage, temperature |
| Driver signals IGBT | Electrical |
| Design standards | EN 50178 |
| Sales - name | 6PS04512E43G37986 |
| SP - No. | SP001046792 |

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## Absolute maximum rated values

| | | | | |
|---|---|---|---|---|
| Collector-emitter voltage | IGBT; $T_{vj}$ = 25°C | $V_{CES}$ | 1200 | V |
| Repetitive peak reverse voltage | Diode; $T_{vj}$ = 25°C | $V_{RRM}$ | 1200 | V |
| DC link voltage | IGBT not swtiching | $V_{DC}$ | 900 | V |
| Insulation management | according to installation height of 2000 m | $V_{line}$ | 500 | $V_{RMS}$ |
| Insulation test voltage | according to EN 50178, f = 50 Hz, t = 1 s | $V_{ISOL}$ | 2 | $kV_{RMS}$ |
| Repetitive peak collector current inverter section (IGBT) | $t_p$ = 1 ms | $I_{CRM2}$ | 900 | A |
| Repetitive peak forward current inverter section (Diode) | $t_p$ = 1 ms | $I_{FRM2}$ | 900 | A |
| Continuous current inverter section | | $I_{AC2}$ | 270 | $A_{RMS}$ |
| Junction temperature | under switching conditions | $T_{vjop}$ | 150 | °C |
| Switching frequency inverter section | | $f_{sw2}$ | 14 | kHz |

Notes
Further maximun ratings are specified in the following dedicated sections

## Characteristic values

### DC Link

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Rated voltage | | $V_{DC}$ | | 600 | 850 | V |
| Over voltage shutdown | within 1000 µs | | | 850 | | V |
| Capacitor | 1 s, 6 p | $C_{DC}$ | | 2.4 | | mF |
| Maximum ripple current | per device, $T_{amb}$ = 55 °C | $I_{ripple}$ | | 49 | | $A_{RMS}$ |
| Balance or discharge resistor | per DC link unit | $R_b$ | | 164 | | kΩ |

### Inverter Section

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Rated continuous current | $V_{DC}$ = 600 V, $V_{AC}$ = 400 $V_{RMS}$, cos(φ) = 0.85, $f_{AC\ sine}$ = 50 Hz, $f_{sw}$ = 5000 Hz, $T_{inlet}$ = 40°C, $T_j \leq$ 125 °C | $I_{AC}$ | | 265 | | $A_{RMS}$ |
| Over current shutdown | within 15 µs | $I_{AC\ OC}$ | | 626 | | $A_{peak}$ |
| Power losses | $I_{AC}$ = 265 A, $V_{DC}$ = 600 V, $V_{AC}$ = 400 $V_{RMS}$, cos(φ) = 0.85, $f_{AC\ sine}$ = 50 Hz, $f_{sw}$ = 5000 Hz, $T_{inlet}$ = 40 °C, $T_j \leq$ 125 °C | $P_{loss}$ | | 2275 | | W |

### Inverter Section (specific condition)

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Specific continuous current | $V_{DC}$ = 750 V, $V_{AC}$ = 400 $V_{RMS}$, cos(φ) = 0.8, $f_{AC\ sine}$ = 50 Hz, $f_{sw}$ = 5000 Hz, $T_{inlet}$ = 40 °C, $T_j \leq$ 125 °C | $I_{ACsp}$ | | 217 | | $A_{RMS}$ |
| Continuous current at low frequency | $V_{DC}$ = 750 V, $V_{AC}$ = 400 $V_{RMS}$, cos(φ) = 0.8, $f_{AC\ sine}$ = 0 Hz, $f_{sw}$ = 5000 Hz, $T_{inlet}$ = 40 °C, $T_j \leq$ 125 °C | $I_{ACsp}$ | | 105 | | $A_{RMS}$ |
| Specific continuous current for 150% overload capability | $I_{AC\ 150\%}$ = 263 $A_{RMS}$, $t_{on\ over}$ = 3 s, $T_j \leq$ 125 °C | $I_{ACsp\ over1}$ | | 175 | | $A_{RMS}$ |
| Specific continuous current for 150% overload capability | $I_{AC\ 150\%}$ = 229 $A_{RMS}$, $t_{on\ over}$ = 60 s, $T_j \leq$ 125 °C | $I_{ACsp\ over2}$ | | 152 | | $A_{RMS}$ |
| Power losses | $I_{AC}$ = 217 A, $V_{DC}$ = 750 V, $V_{AC}$ = 400 $V_{RMS}$, cos(φ) = 0.8, $f_{AC\ sine}$ = 50 Hz, $f_{sw}$ = 5000 Hz, $T_{inlet}$ = 40 °C, $T_j \leq$ 125 °C | $P_{loss}$ | | 1975 | | W |

Notes
Maximum junction temperature limited to 125°C under all operating conditions

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## Controller interface

| Driver and interface board | ref. to separate Application Note | | | DR210 | | |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| Auxiliary voltage | | $V_{aux}$ | 18 | 24 | 30 | V |
| Auxiliary power requirement | $V_{aux}$ = 24 V | $P_{aux}$ | | | 40 | W |
| Digital input level | resistor to GND 10 kΩ, capacitor to GND 1 nF, logic high = on | $V_{in\ low}$ | 0 | | 1.5 | V |
| | | $V_{in\ high}$ | 11 | | 15 | V |
| Digital output level | open collector, logic low = no fault, max. 15 mA | $V_{out\ low}$ | 0 | | 1.5 | V |
| | | $V_{out\ high}$ | | 15 | | V |
| Analog current sensor output inverter section | load max 5 mA, @ 217 $A_{RMS}$ | $V_{IU\ ana2}$ $V_{IV\ ana2}$ $V_{IW\ ana2}$ | 3.3 | 3.5 | 3.7 | V |
| Analog DC link voltage sensor output | load max 5 mA, @ 850 V | $V_{DC\ ana}$ | 8.3 | 8.5 | 8.7 | V |
| Analog temperature sensor output unit 1 (NTC) | load max 5 mA, @$T_{NTC}$ = 85 °C, corresponds to $T_j$ = 115 °C at rated conditions | $V_{Theta\ NTC1}$ | 10.7 | 10.9 | 11.1 | V |
| Over temperature shutdown inverter section | load max 5 mA, @$T_{NTC}$ = 87 °C | $V_{Error\ OT2}$ | | 11 | | V |

## System data

| | | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|---|
| EMC robustness | according to EN 61800-3 at named interfaces | power | $V_{Burst}$ | | 2 | | kV |
| | | control | $V_{Burst}$ | | 1 | | kV |
| | | aux (24V) | $V_{surge}$ | | 1 | | kV |
| Storage temperature | | | $T_{stor}$ | -40 | | 80 | °C |
| Operational ambient temperature | PCB, DC link capacitor, bus bar, excluding cooling medium | | $T_{op\ amb}$ | -25 | | 55 | °C |
| Cooling air velocity | PCB, DC link capacitor, bus bar, standard atmosphere | | $V_{air}$ | 2 | | | m/s |
| Humidity | no condensation | | Rel. F | 0 | | 85 | % |
| Vibration | according to IEC 60721 | | | | | 5 | m/s² |
| Shock | according to IEC 60721 | | | | | 40 | m/s² |
| Protection degree | | | | | IP00 | | |
| Pollution degree | | | | | 2 | | |
| Dimensions | width x depth x height | | | 216 | 335 | 376 | mm |
| Weight | | | | | 18 | | kg |

Notes
Dimension "depth" does not include the data cables

## Heatsink air cooled

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Air flow | $T_{air}$ = 25 °C, $P_{air}$ = 1013 hPa, dry and dust free, measured at the side of the heat sink according to DIN 41882 | ΔV/Δt | | 500 | | m³/h |
| Air pressure drop | at min. air flow | Δp | | 190 | | Pa |
| Air inlet temperature | | $T_{inlet}$ | -40 | | 55 | °C |



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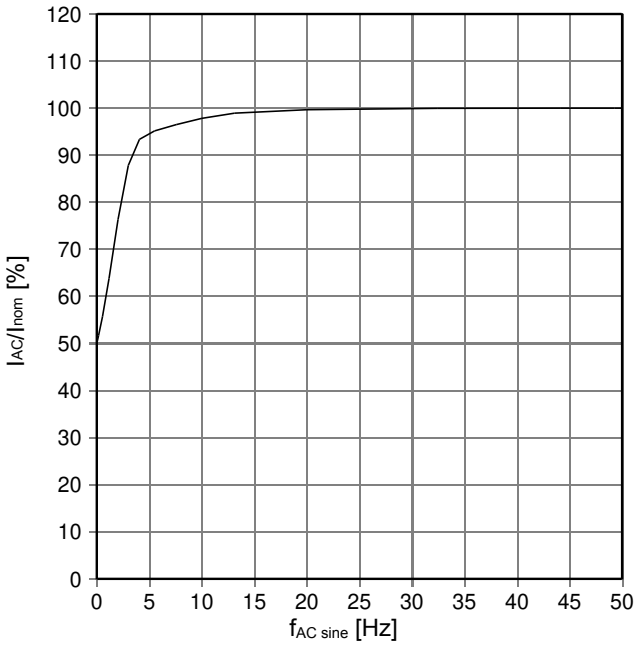
## Overview of optional components

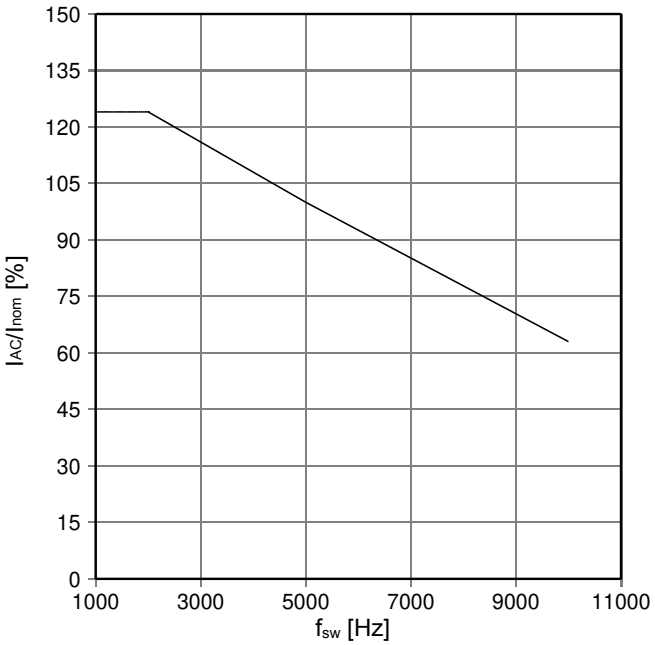
| | Unit 1 | Inverter Section | Unit 3 |
|---|---|---|---|
| Parallel interface board | | | |
| Optical interface board | | | |
| Chopper controller | | | |
| Voltage sensor | | × | |
| Current sensor | | × | |
| Temperature sensor | | × | |
| Temperature simulation | | | |
| DC link capacitors | | × | |
| Data cable for control signals | | | |
| Fan | | | |
| Collector-emitter Active Clamping | | × | |

Notes
Setting of Active Clamping TVS-Diodes: $V_Z$ = 824 V

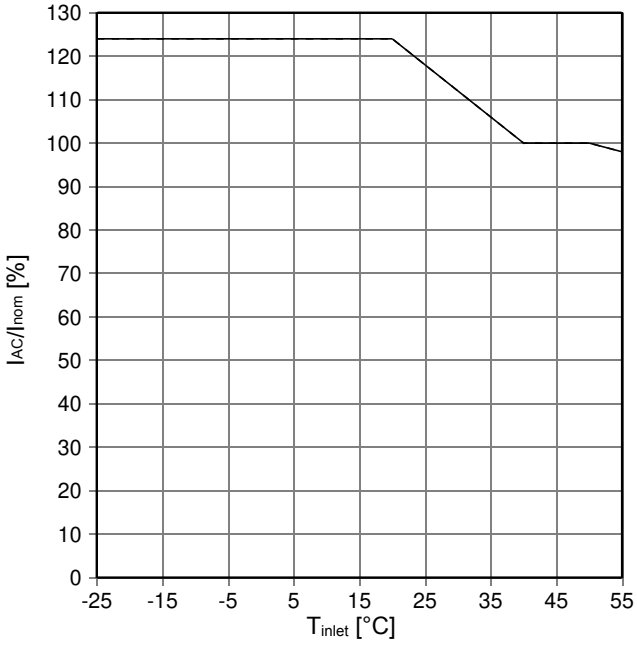
$f_{AC\ sine}$ - derating curve IGBT (motor), Diode (generator)
$V_{DC}$ = 750 V, $V_{AC}$ = 400 $V_{RMS}$, $f_{sw}$ = 5 kHz, cosφ = ±0.8,
$T_{inlet}$ = 40 °C and nom. cooling conditions



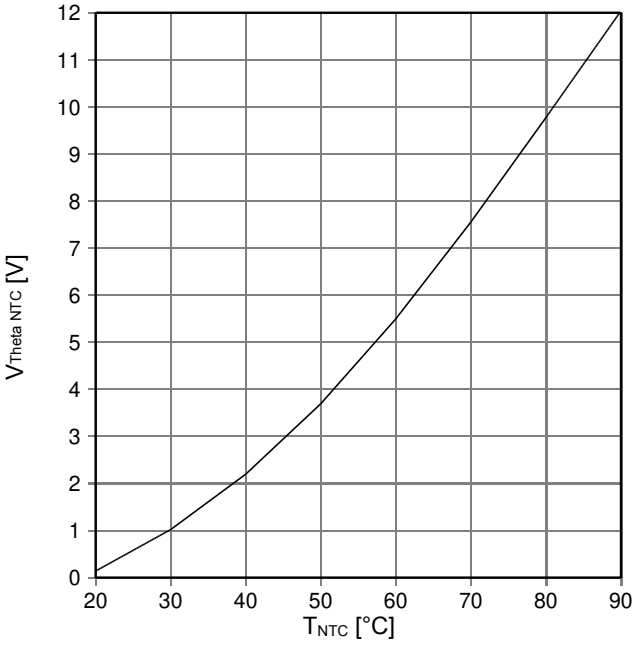

$f_{sw}$ - derating curve IGBT (motor), Diode (generator)
$V_{DC}$ = 750 V, $V_{AC}$ = 400 $V_{RMS}$, $f_{AC\ sine}$ = 50 Hz, cosφ = ±0.8,
$T_{inlet}$ = 40 °C and nom. cooling conditions




$T_{inlet}$ - derating curve IGBT (motor), Diode (generator)
$V_{DC}$ = 750 V, $V_{AC}$ = 400 $V_{RMS}$, $f_{sw}$ = 5 kHz, $f_{AC\ sine}$ = 50 Hz,
cosφ = ±0.8 and nom. cooling conditions




Analog temperature sensor output $V_{Theta\ NTC}$
Sensing NTC of heatsink

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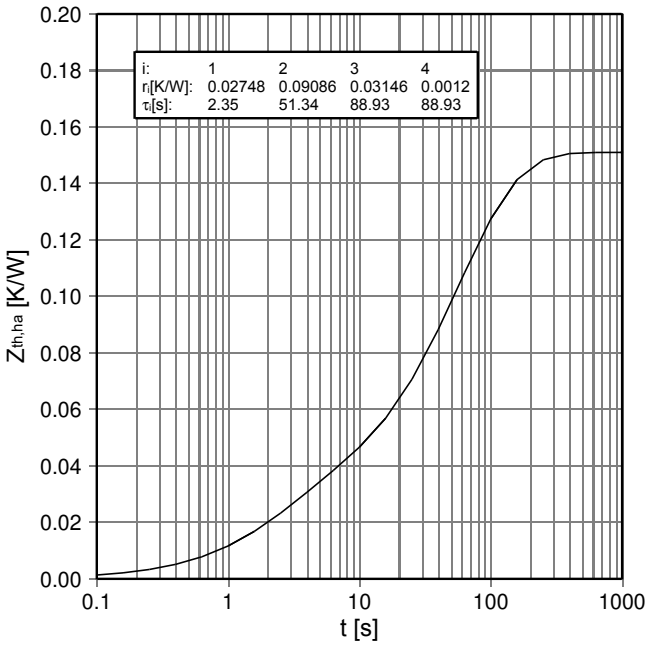
$Z_{th,ha}$ - thermal impedance heatsink to ambient per switch
nom. cooling conditions

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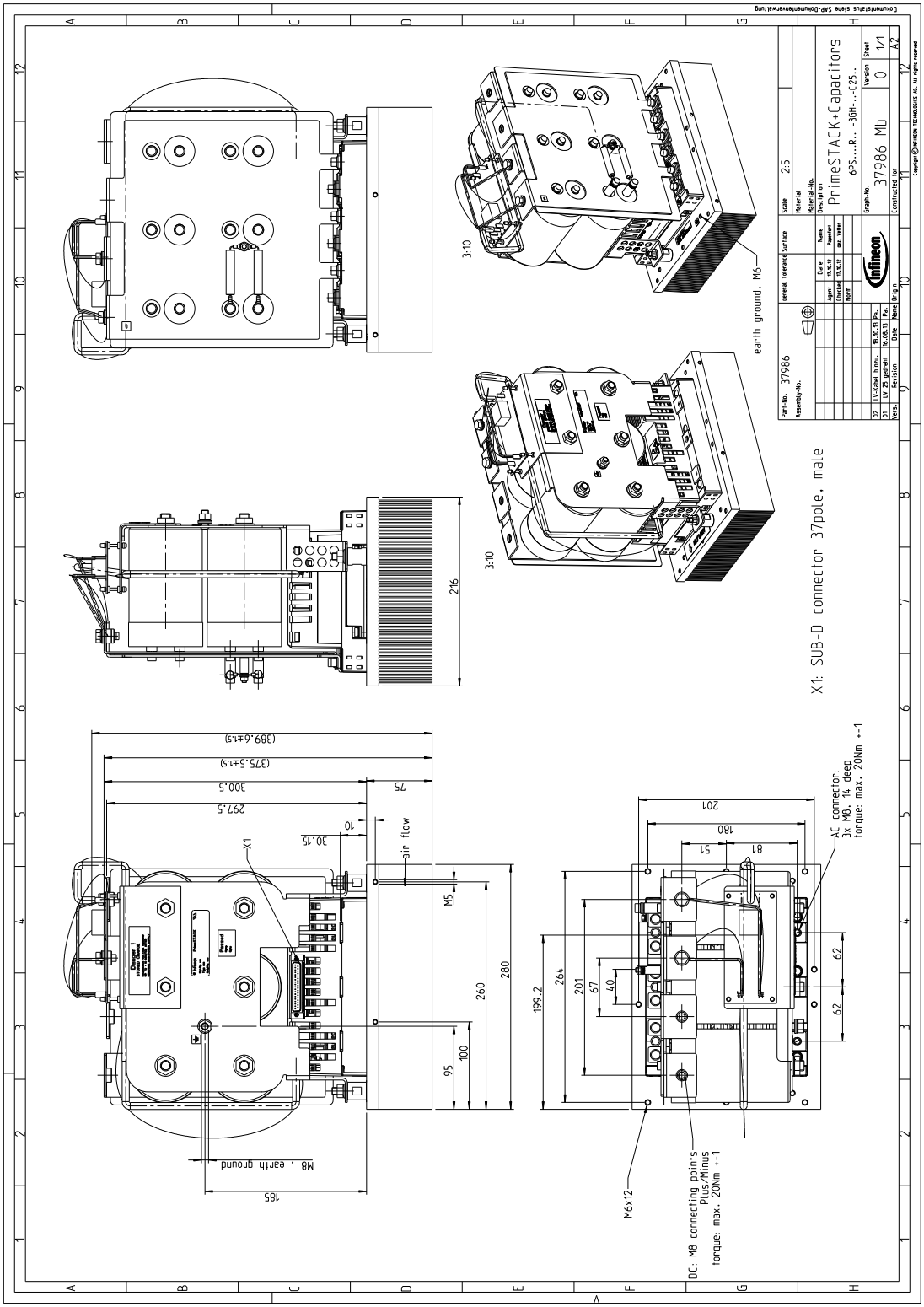
## Mechanical drawing

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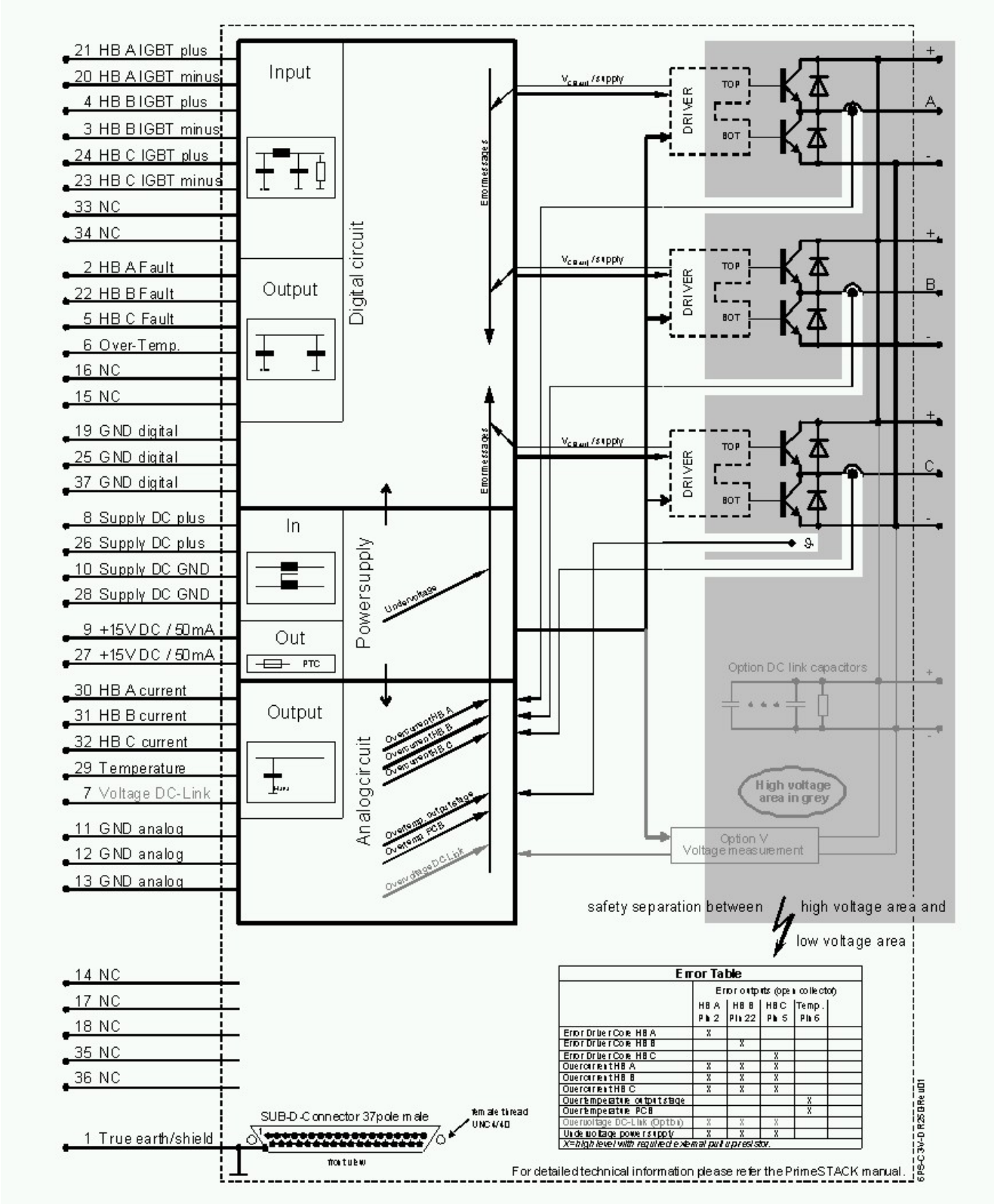
## Circuit diagram




**Error Table**

| | Error outputs (open collector) | | | | |
|---|---|---|---|---|---|
| | HB A Pin 2 | HB B Pin 22 | HB C Pin 5 | Temp. Pin 6 | |
| Error Driver Core HB A | X | | | | |
| Error Driver Core HB B | | X | | | |
| Error Driver Core HB C | | | X | | |
| Overcurrent HB A | X | X | X | | |
| Overcurrent HB B | X | X | X | | |
| Overcurrent HB C | X | X | X | | |
| Overtemperature output stage | | | | X | |
| Overtemperature PCB | | | | X | |
| Overvoltage DC-Link (Optbl) | X | X | X | | |
| Undervoltage power supply | X | X | X | | |

*X= high level with required external pull up resistor.*

6PS-C 3V-D R25 0 Rev101

| | |
|---|---|
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