250W AC/DC Switching Power Supply

Model: TG24-0250-01



FEATURES

- Universal 90 - 264VAC input voltage.
- Operating ambient temperature range: -20°C to +60°C.
- Built-in active PFC function.
- Output short circuit, over-current, over-voltage protection, over-temperature protection.
- High efficiency up to 91%.
- Remote On/Off Control.
- Operating altitude up to 5000m.
- Safety according to IEC62368-1.

Models & Ratings

Model No.	Output Power (W)	Output Voltage (V)	Output Current (A)	Efficiency at 230VAC (%) Typ.	External Cap. Load (μF)
TG24-0250-01	250	12	20.84	91 (1)	470 (2)

Notes：

1. Typical values are measured at 50% of maximum load and 230Vac/50Hz input voltage at 25°C.
2. An external 470μF capacitor is required to be added to the output during transient response testing.
3. The 250W +12V power supply supports standalone or 1+1 redundancy (pure backup mode, no current sharing). Please refer to the following input and output requirement tables for specific operating values.

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Voltage Range	AC input		90	100-240	264	VAC
Input Frequency	-		47	50-60	63	Hz
Input Current	115VAC & Maximum load		-	-	3	Arms
	230VAC & Maximum load		-	-	1.5	
Inrush Current	115VAC	At 25°C, Cold start	-	30	-	A peak
	230VAC		-	60	-	
Power Factor	115VAC & Maximum load		0.95	-	-	-
Leakage Current	264VAC/63Hz		-	-	3.5	mA

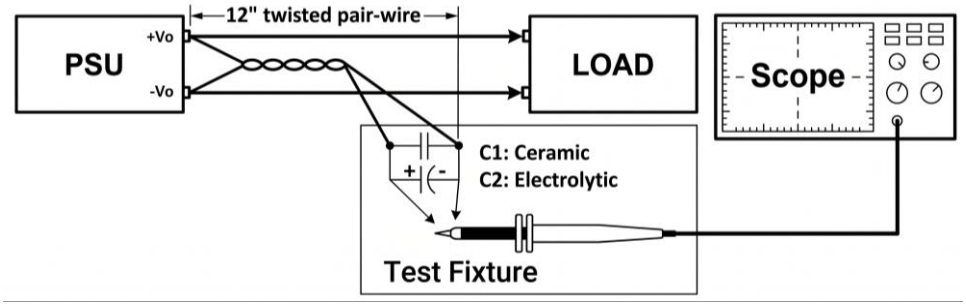
Notes:
4. The +12V return is isolated from the chassis ground by a bypass capacitor.

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Output Voltage	At any load and line condition		11.4	12	12.6	VDC
Initial Set Accuracy	50% of maximum load		11.95	12	12.05	VDC
Output Load	-		0	-	20.84	A
Line Regulation	90 - 264VAC, maximum load		-	±0.5	-	%
Load Regulation	Output from minimum load – maximum load		-	±1	-	%
Ripple & Noise (5)	Oscilloscope : Bandwidth : 20MHz		-	-	1	%
Regulation Transient Response (6)	Step load : 1.0 – 10.42A		-	±5	-	%
	Step load : 10.42 – 20.84A		-	±5	-	%
Overshoot	At power on, maximum load / no load		-	-	5	%
Time Sequence And Signal (7)	T1: Output turn-on delay time		-	-	2	S
	T2: Output Voltage Rise Time		1	-	100	ms
	T3: PG signal delay time		100	-	500	ms
	T4: PG signal rise time		-	-	1	ms
	T5: Hold-up time		16	-	-	ms
	T6: PG signal hold-up time		1	-	-	ms
Power Good (PG)	Logic Level Low	Sinking 3mA	-	-	0.8	V
	Logic Level High	Sourcing 400uA	2.0	-	3.6	ms
	PG Delay (T3)	12V stable to PG high	100	-	500	ms
	PG Hold-up (T6)	AC loss to PG low	1	-	-	ms
Alert Signal	Logic Level Low	OK (Normal)	-	-	0.8	V
	Logic Level High	Fault (OTP,OCP,OVP,Fan)	2.0	-	3.6	V
Over Current Protection	Output shut down and auto recovery		-	-	30.5	A
Over Voltage Protection	Output shut down and latch off manual reset (Re-power on or PSON reset)		-	-	16	V
Short Circuit Protection	Output shut down and auto recovery		-	-	-	-
Over Temperature Protection	Output shut down and latch off manual reset (Re-power on or PSON reset)		-	-	-	-

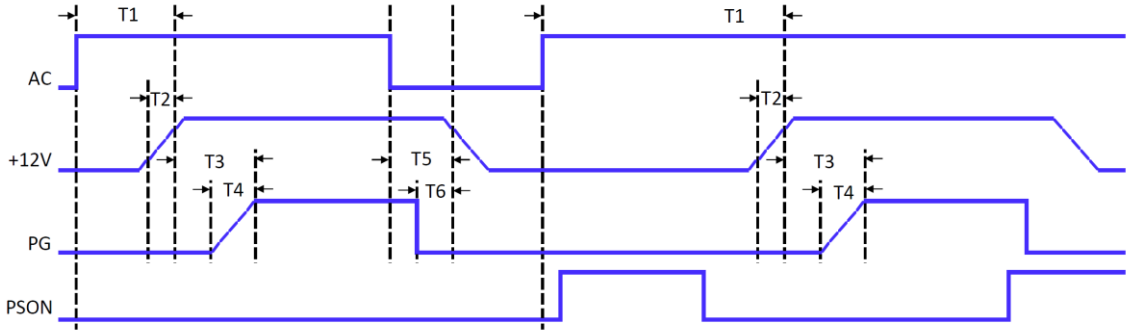
Notes:

5. The +12V output is decoupled with a 47μF low ESR aluminum electrolytic capacitor (C2) and a 0.1μF ceramic capacitor (C1).
   Measurement is made with a high impedance probe connected across the decoupling capacitance. Measurements shall be made with an oscilloscope with 20MHz bandwidth.



6. Step load change is 1A/us, at 50 Hz and 5KHz.
   The voltage setting should serve as the reference point for determining whether the output voltage is within ±5%.

7. **Time Sequence And Signal：**



   AC input 115Vac and 230Vac condition.

   ‣ **T1: Output turn-on delay time：**

   The output shall have a power-on time of 2 seconds maximum at 115Vac/60Hz condition.

   ‣ **T2: Output Voltage Rise Time：**

   The output shall rise from 10% to 90% of nominal to within the regulation ranges specified in rating load within 1ms to 100ms.

   ‣ **T5: Hold-up time：**

   When AC is removed, the +12V output below 10.8V for 16ms minimum that test with 80% of maximum load at 25°C.

8. **Output Fault Protection Isolation：**
   The power supply shall have an output isolation circuit (also known as OR-ing or paralleling circuit) in series with the positive output terminals for +12V rails.

9. **Hot Swap Description：**
   A power supply may be inserted or removed from a system chassis, which is already powered and live with other power supplies running or inactive with no power supplies running. During such actions (PSU insertion and removal), all the output (bus) voltages in the system back plane shall remain within their regulation limits when the system is active and shall not cause any damage to any power supplies in the system chassis.

10. **PSON Signal：**
    PSON is an active low input signal to the power supply. When this signal is low that turns on the +12V power rail. When this signal is not pulled low by the system, or left open, the output turn off.

11. **Redundancy Support：**
The power supply built in OR-ing for 1+1 redundant application. Two power supply must be same model use only for 1+1 redundant application and no current sharing function.

12. **Over Temperature Protection：**
The power supply shall have thermal protection against over temperature condition caused by loss of airflow or excessive ambient or hot spot temperature. The PSU should shut down and latch off when over temperature triggered.

13. **LED Indicator：**
The power supply uses a bi-color LED: Amber and green to identify different operating states of the power supply. Below table defines the characteristics of the LED indicator.

Power Supply Condition	**PG signal**	**Alert signal**	**bicolor LED status**
Power normal	High	Low	Solid green
Other Status(No AC Power, Ramp up)	Low	Low	Not lit
OCP, OVP, OTP, Fan fault	Low	High	Solid amber
Power supply warning events (OTP)	High	High	~1Hz Blink green

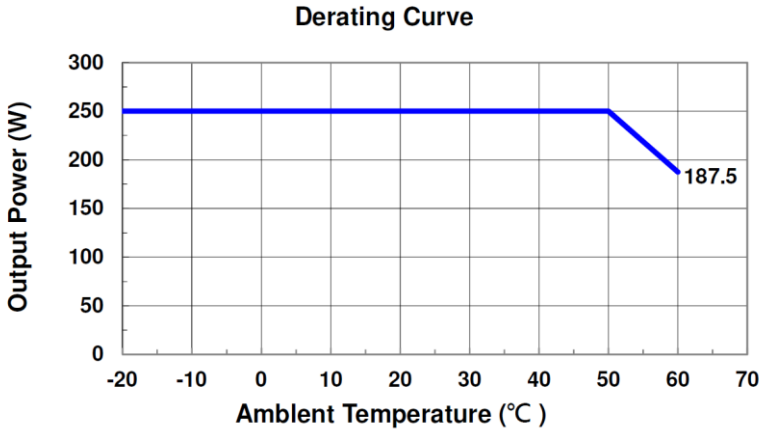
14. **PS Present：**
‣ This signal connects to +12V_return inside the power supply via 1KΩ resistor.
‣ PS Present is an active low output signal from the power supply used to indicate that the power supply is physically present. The power supply generates this signal by wiring the signal pin to ground internally. The power supply must not pull this signal up. The host system must pull this signal up to 3.3 or 5V.

General Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Operating Temperature	Refer to power derating curve (15)		-20	-	+60	°C
Storage Temperature	Non-operation		-40	-	+80	
Operating Humidity	Non-condensing		20	-	80	%
Storage Humidity			5	-	95	
Power Derating	+50°C to +60°C (Refer to the Derating Curve)		2.5	-	-	%/°C
Altitude (16)	Operating altitude		-	-	5,000	meter
Dielectric Strength	Input - Output	Electrical strength test for 1 minute, leakage current is less than 10mA.	3,000	-	-	VAC
	Input - FG		1,800	-	-	VAC
	Output - FG		500	-	-	VDC
Insulation Resistance	Input - Output	25±5°C, 70% RH, non-condensing testing voltage 500VDC.	100	-	-	MΩ
	Input - FG		100			MΩ
	Output - FG		100			MΩ
Mean Time Between Failure	At 230VAC/50HZ maximum load 25°C, Telcordia SR332, issue4.		300,000	-	-	Hrs.
Vibration	Operating：0.3G, 10-500Hz, 10 min/cycle, 30 min each axis (X, Y, Z)					
Shock	Non-operating (package)：20G, half-sine, 11 ms, 1 shock per direction per axis (X, Y, Z)					

Notes:

15. **Operation temperature：**
    - -20°C to 0°C, start up above 100Vac input voltage (It may not meet some specifications below 0°C)



16. **Altitude：**
    - Operation altitude of the power supply meet 5,000 meter.
    (The ambient operating temperature decreases by 1°C for every 305m increase in altitude.)
    - Storage altitude of the power supply meet 15,000 meter.

Safety Approvals

Safety Standard	Standard	UL/cUL 62368-1, 3rd Edition CB IEC 62368-1, 3rd Edition
Safety Class	-	Class I only

Electromagnetic Compatibility (EMC)

Emissions (17)	CE	EN 55032 (CISPR32) Class B, FCC Part 15 Class B	
	RE	EN 55032 (CISPR32) Class B, FCC Part 15 Class B	
	Harmonic Current	EN 61000-3-2 Class D	
	Flicker	EN 61000-3-3	
Immunity	ESD	EN 61000-4-2, level 4, Contact +/- 8KV; Air discharge +/- 15KV	Criteria A
	RS	EN 61000-4-3, level 3, 10V/m	Criteria A
	EFT	EN 61000-4-4, level 4, +/- 4KV	Criteria A
	Surge	EN 61000-4-5, level 4, Line to Line +/-2KV; Line to Earth +/- 4KV	Criteria A
	CS	EN 61000-4-6, level 2	Criteria A
	PFMF	EN 61000-4-8, level 3	Criteria A
	DIP	EN 61000-4-11	Criteria B

Note:

17. The power supply should be considered a part of the system component. All EMC tests conducted with the unit installed in a metal enclosure dummy system. The power supply needs to be confirmed for electromagnetic compatibility in conjunction with the terminal equipment.

PMBus Interface

Addressing：

The PMbus device address locations are shown below. For redundant systems there are up to 1 signals to set the address location of the power supply once it is install in the system: A0

System addressing A0	0	1
Power supply PMBus device address	60h	62h

Hardware：

The PMBus device in the power supply shall be compatible with both SMBus specification 2.0 for I2C Vdd based power and drive. This bus shall operate at 3.3V level.
Only system needs to have 4.7KΩ internal pull up to 3.3V on the SDA or SCL lines and operate with 3.3V nominal voltage level.

Data Speed：

The PMBus device in the power supply shall operate at the 100Kbps SMBus speed.

PMBus Command Summary：

PMBus commands are one byte command codes. As below listing is power supply can support of PMBus commands.

Command Code	Bytes	Write/Read	Command Name	Data Format	Default Value / Remark
03h	0	Write	Clear_Faults	N/A	No Data
19h	1	Read	Capability	Byte	90h
1Ah	1	Block Write – Block Read Process Call	Query	Byte	by command status
78h	1	Read	Status_Byte	Byte	00h
79h	2	Read	Status_Word	Word	0000h
7Ah	1	Read	Status_Vout	Byte	00h
7Bh	1	Read	Status_Iout	Byte	00h
7Dh	1	Read	Status_Temperature	Byte	00h
7Eh	1	Read	Status_CML	Byte	00h
81h	1	Read	Status_Fans	Byte	00h
8Bh	2	Read	Read_Vout	Linear	Variable
8Ch	2	Read	Read_Iout	Linear	Variable
8Dh	2	Read	Read_Temperature	Linear	Variable
90h	2	Read	Read_Fan speed Fan	Linear	Variable
96h	2	Read	Read_Pout	Linear	Variable
99h	9	Block Read	MFR_ID	String (ASCII)	“LEAD YEAR”
9Ah	12	Block Read	MFR_MODEL	String (ASCII)	“TG25-0250-01”
9Dh	4	Block Read	MFR_DATE	String (ASCII)	Variable
9Eh	15	Block Read	MFR_SERIAL	String (ASCII)	Variable

Read Command：

The READ commands allow the host to read temperature, current, voltage, power and energy parameters of the power supply.

PMBus command	Description	Data format
Read_Vout	Returns the output voltage in voltage.	Linear
Read_Iout	Returns the output current in amperes.	Linear
Read_Pout	Returns the output power in watts of the power supply.	Linear
Read_Temperature	Returns the temperature in °C of the airflow inside temperature.	Linear

Accuracy：

	Accuracy	Remark
Read_Vout	±5%	
Read_Iout	±0.5A	Iout tolerance is defined since every output load more than 20% of the maximum load.
Read_Pout	±10W	Pout tolerance is defined since both output load more than 20% of the maximum load.
Read_Temperature	±8°C	Ambient temperature, only page 00h
Read_Fan speed	18,000±1,800 rpm	Duty cycle at 100%

Capability (19h)：

This command provides a way for a host system to determine some key capabilities of a PMBus device. There is one data byte formatted as shown below.

Bits	Description	Value	Meaning
7	Packet Error Checking	0	Packet Error Checking not supported
		1	Packet Error Checking is supported
6:5	Maximum Bus Speed	00	Maximum supported bus speed is 100 kHz
4	SMBALERT#	0	The device does not have a SMBALERT# pin and does not support the SMBus Alert Response protocol
3:0	Reserved	xxxx	Reserved

Query (1Ah)：

This command is used to ask a PMBus device if it supports a given command. There is one data byte formatted as shown below.

Bits	Value	Meaning
7	1	Command is supported
	0	Command is not supported
6	1	Command is supported for write
	0	Command is not supported for write
5	1	Command is supported for read
	0	Command is not supported for read
4:2	000	Linear Data Format used
	001	16 bit signed number
	010	Reserved
	011	Direct Mode Format used
	100	8 bit unsigned number
	101	VID Mode Format used
	110	Manufacturer specific format used
	111	Command does not return numeric data. This is also used for commands that return blocks of data.
1:0	xx	Reserved for future use

Status _ Commands：

Status information is binary. A value of 1 indicates a fault or warning event has occurred and a value of 0 indicates that a fault or warning event has not occurred.

The Status _Byte message content is described as shown below.

Bits	Status Bit Name	Meaning
7	Busy	Not support, set to 0
6	Off	Not support, set to 0

5	Vout_OV_Fault	Output over voltage fault has occurred
4	Iout_OC_Fault	Output over current fault has occurred
3	Vin_UV_Fault	Not support, set to 0
2	Temperature	Temperature fault or warning has occurred
1	CML	A communications, memory or logic fault has occurred
0	None of the above	Not support, set to 0

The Status _Word message content is described as shown below：

Byte	Bits	Bit name	Meaning
Low	7	Busy	Not support, set to 0
	6	OFF	Not support, set to 0
	5	Vout_OV_Fault	Output over voltage fault has occurred
	4	Iout_OC_Fault	Output over current fault has occurred
	3	Vin_UV_Fault	Not support, set to 0
	2	Temperature	Temperature fault or warning has occurred
	1	CML	A communications, memory or logic fault has occurred
	0	None of above	Not support, set to 0
High	7	Vout	Output voltage fault or warning has occurred
	6	Iout	Output current fault or warning has occurred
	5	Input	Not support, set to 0
	4	Not use	Not support, set to 0
	3	Power_Good#	Not support, set to 0
	2	Fans	A fan or airflow fault or warning has occurred
	1	Other	Not support, set to 0
	0	Not use	Not support, set to 0

The Status_Vout command returns one data byte with contents as below：

Bits	Meaning
7	Output over voltage fault has occurred
6	Output over voltage warning has occurred
5	Output under voltage warning has occurred
4	Not support, set to 0
3	Not support, set to 0
2	Not support, set to 0
1	Not support, set to 0
0	Not support, set to 0

The Status_Iout command returns one data byte with contents as below：

Bits	Meaning
7	Output over current fault has occurred
6	Output over current fault and low voltage fault has occurred
5	Output over current warning has occurred
4	Not support, set to 0
3	Not support, set to 0
2	Not support, set to 0
1	Output over power fault has occurred
0	Output over power warning has occurred

Status_Temperature command returns one data byte with contents as below：

Bits	Meaning
7	Over temperature fault

6	Over temperature warning
5	Under temperature warning
4	Under temperature fault
3	Reserved
2	Reserved
1	Reserved
0	Reserved

Status_CML command returns one data byte with contents as below：

Bits	Meaning
7	Invalid or unsupported command received
6	Invalid or unsupported data received
5	Packet error check failed
4	Memory fault detected
3	Processor fault detected
2	Reserved
1	Other communication fault has occurred
0	Undetermined fault has occurred

The Status_Fans command reports on the status of fans installed in position：

Bits	Meaning
7	Fan speed less than 1,000 rpm during over 10 seconds If the fan control to stop condition will not set this bit
6	Not support, set to 0
5	Fan speed less than target 2,000 rpm, during over 5 seconds If the fan control target less than 1300 rpm, The warning and fault bit may be together setting.
4	Not support, set to 0
3	Not support, set to 0
2	Not support, set to 0
1	Not support, set to 0
0	Not support, set to 0

PMBus Linear Data Format：

The linear data format is typically used for commanding and reporting the parameters such as (but not only) the following:

- Input power and output power,
- Operating temperatures,
- Input current and output current,
- Input voltage,
- Fan speed RPM

The linear data format is a two bytes value with:

- An 11 bit, two's complement mantissa and
- A 5 bit, two's complement exponent (scaling factor).

The format of the two data bytes is illustrated in Figure 4.

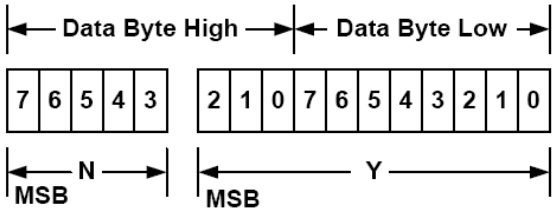


Figure 4. Linear Data Format Data Bytes

The relation between *Y*, *N* and the "real world" value is:

$X = Y \cdot 2^N$

Where, as described above:

X is the "real world" value; *Y* is an 11 bit, two's complement integer; and *N* is a 5 bit, two's complement integer.

Devices that use the linear format must accept and be able to process any value of *N*.

MFR_ID：

This command is used to read the manufacturer's name is "LEAD YEAR".

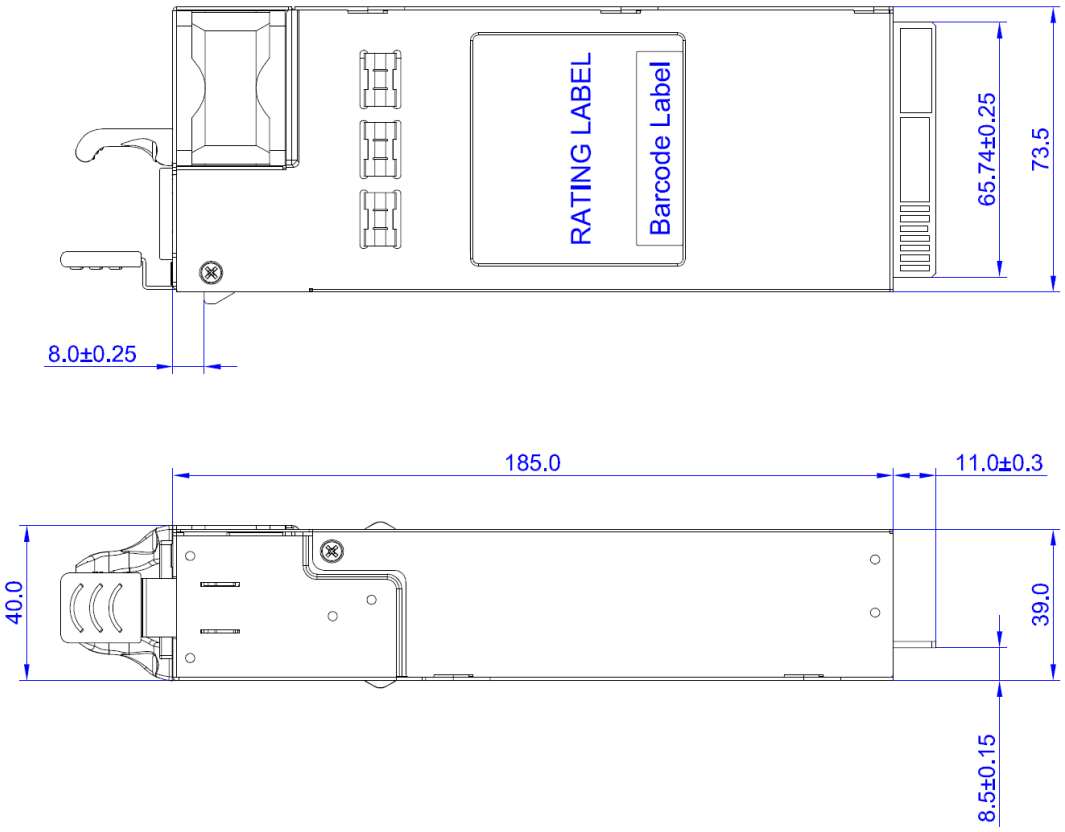
MFR_MODEL：

This command is used to read the model number is "TG24-0250-01".

Dimensions and Recommended Layout

Item	Value	Unit
Weight (Typ.)	660	g
Size (L x W x H)	185 x 73.5 x 40	mm

Outline Drawing：(Unit: mm, Tolerance: ±0.5 mm)

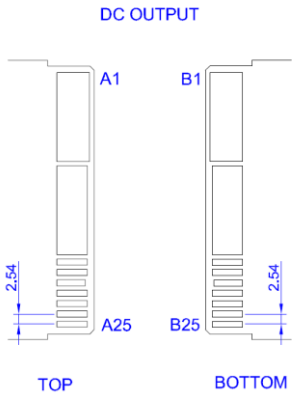


Input Connector

The AC input connector shall be IEC320 C14 or equivalent male connector.
The AC connector will be located on the opposite end as the DC output connector.

Output Connector：

The output gold finger connector connects the power as well as the signal to the system or power backplane board.
The model of connector mated with the golden finger is 9393-F2P50N11ACB30DA or equivalent part.



Pin	Name	Pin	Name
A1	GND	B1	GND
A2	GND	B2	GND
A3	GND	B3	GND
A4	GND	B4	GND
A5	GND	B5	GND
A6	GND	B6	GND
A7	GND	B7	GND
A8	GND	B8	GND
A9	GND	B9	GND
A10	+12V	B10	+12V
A11	+12V	B11	+12V
A12	+12V	B12	+12V
A13	+12V	B13	+12V
A14	+12V	B14	+12V
A15	+12V	B15	+12V
A16	+12V	B16	+12V
A17	+12V	B17	+12V
A18	+12V	B18	+12V
A19	SDA	B19	A0
A20	SCL	B20	NC
A21	PS ON	B21	NC
A22	NC	B22	Alert
A23	NC	B23	NC
A24	NC	B24	PS Present
A25	PWOK	B25	NC