CORRESPONDANCE BETWEEN TTL AND DARLINTON PADS.

Regardless of TTL direction, the Darlington output always follows the state of the corresponding TTL pin with the following logic:

- when TTL signal is logic 1 (above 2.0v), the corresponding Darlington become conducting (the pin is forced to GND)
- when TTL signal is logic 0 (below 0.8v), the corresponding Darlington is not conducting (the pin is in high impedance)

TTL PAD	TTL function	DARLINGTON	Power function	Max current
OUT	OUT/ PWM4 Output only	OUT	Normal output or PWM4 output	1000mA (paired darlington outputs)
CNT	Counter input Open drain output	OUT2	Normal output	500mA
PWM1	PMW1 output	PWM1	Normal output or PWM1 output	1000mA (paired darlington outputs)
ADC	Adc input, PMW2 output	PWM2	Normal output or PWM2 output	500mA
PIO	Input/output, PWM3 output	PIO	Normal output or PWM3 output	500mA

COMPARISON OF CAPABILITIES BETWEEN TTL SIGNALS AND TRANSISTOR OUTPUT (DARLINGTON)

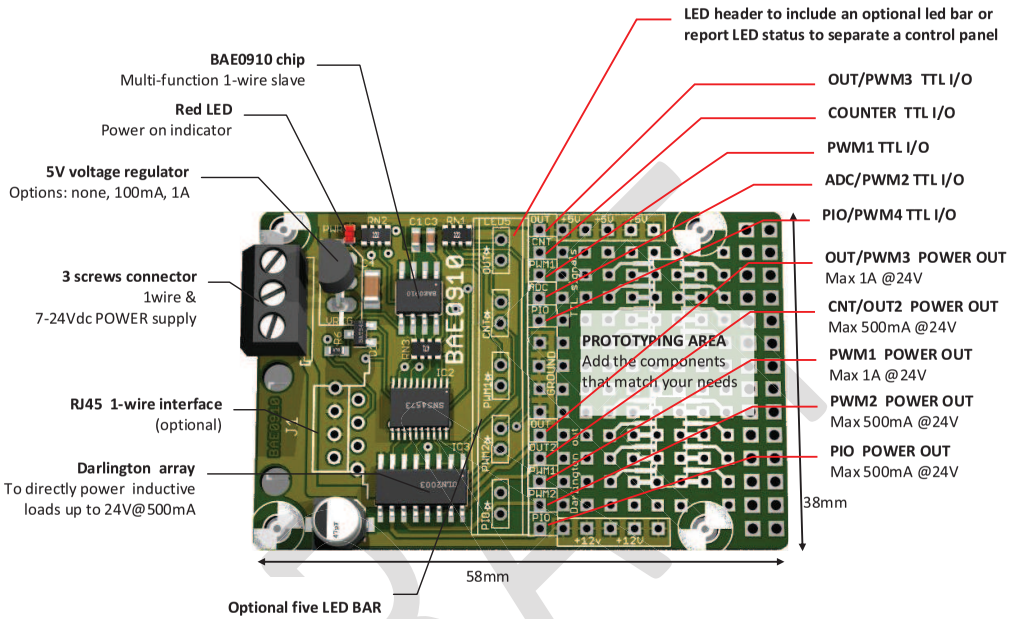
Description	TTL SIGNAL	DARLINGTON
voltage range	0 to 5V	0 to 24v
sink current max	16mA	500mA (1000mA for OUT and PWM1)
source current max	16mA	n/a (*NPN Darlington don't source current)*
Direction	Input and output	Output only
Analog input	Yes on ADC	No, but output turns on/off when crossing a fixed analog threshold
PWM (output)	yes, capable to dim led, produce variable tone on piezo, etc	Yes, allows to drive loads at variable power
Resistance to spikes and shorts.	ESD immunity. In case of short, the current is limited by a 330Ω resistor installed in series.	Good. The integrated freewheeling diodes protect the outputs.
Utilization	Leds, piezo, servo, transistors, sensors, switches, potentiometer, optocouplers, opto-triacs, analog signals	DC motors, relays, steppers motors, incandescent lights, power leds, speakers, sirens, solenoids, heaters, etc

Capabilities of TTL's and Darlington's

See the ULN2003 datasheet for complete capabilities of the Darlington outputs

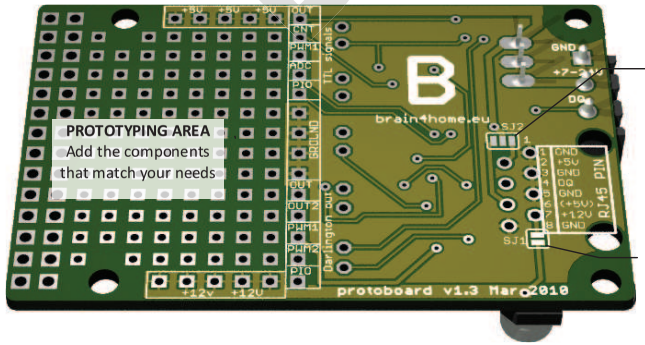
GENERAL PRESENTATION

TOP SIDE



The prototyping area allows a versatile utilization of the BAE0910 chip while keeping a compact 60x40mm form factor.

BOTTOM SIDE



SJ2: onboard 5V to/from RJ45
Open: 5v onboard is isolated from network
1-2 : onboard 5V is connected to rj45 pin 2
2-3: onboard 5V is connected to rj45 pin6

SJ1: 12V supply source
Short: board is powered by RJ45 cable
Open: board need power from screw terminal

CONNECTOR'S PINOUTS:

1-WIRE INTERFACES:

RJ45 connector:

1	2	3	4	5	6	7	8
GND power	+5v DC	GND power	1Wire data	GND data	opt. +5v DC	+12v DC	GND power
white green	green	white orange	Blue	white blue	orange	white brown	Brown

The board could be connected via RJ45 socket or via the 3 screw terminal. When using the RJ45, both 5V and 12v supply are provided from the network cable and no onboard voltage regulator is required.

The RJ45 wiring follows the standard proposed by 1-wire.org. Wirings using RJ11/RJ12 cables with 2, 4 or 6 wires are also allowed but care should be taken to correctly centre the smaller connector within the socket.

The optional pin 6 could be used for stronger 5V supply. (close 2-3 on jumper SJ2 to enable)

3 SCREW TERMINAL

1	Ground
2	12V (7 to 24V)
3	1-Wire (DQ)

The 3 screw terminal could be used instead of or in conjunction of the RJ45.
This allows supplying higher current than cat5 cable. This board requires unregulated 7 to 24V input DC voltage (12V typical). The board itself consume less than 50mA. However up to 3A may be consumed depending on peripherals connected to the board.
If the 5 volt is not supplied by the RJ45 connector, the voltage regulator has to be installed.

SOLDER JUMPER SJ1: UNREGULATED 12V SUPPLY SOURCE

Short: board is powered by RJ45
Open(default): board has to be powered from screw terminal

Close this jumper to power the board with 12V from network cable (white-brown pin 7),

Leave open when powering the board from screw terminal jack (if closed, the board will inject the 12Volts from screw terminal to the corresponding RJ45 wire)

☛ *Remember that CAT5 cables are not designed to handle high currents. (500mA is a safe limit for a single wire)*

SOLDER JUMPER SJ2: ONBOARD 5V TO RJ45

Leave open to isolate onboard 5v from network cable. (default setting)
1-2 : 5V is connected to rj45 pin 2
2-3: 5V is connected to rj45 pin 6

This jumper allows providing 5V to the board without requiring the onboard voltage regulator. To power the board with 5V from network cable (green wire + optional orange wire), close the relevant part of the jumper

Leave open when VREG is installed onboard. Closing this jumper while voltage regulator is present will inject 5Volts on the corresponding wires.

☛ *Remember that CAT5 cables are not designed to handle high currents, never go beyond 1A for a single wire (500mA is a safe limit)*

PROTOTYPING AREA

The prototyping area of 12 x 10 copper holes at 0.1" spacing is available for user components. This allows all sorts of applications.

Pads are available on this area:

- **Ground**: four holes are identified on the center of the area
- **5V**: five holes are identified on the top of the area. The 5V may be provided by the onboard VREG or by the RJ45 connector. Maximal power depends from option selected: cable: up to 1A; vreg: 100mA or 1A.
- **12V**: The pads marked as 12V on the bottom area are not regulated and are directly connected from the 12V input connector. The actual voltage may range from to 7-24V based on the power supply provided. Maximum 3A could be drawn with adequate supply.
- **TTL I/O**: the five holes are connected to the BAE0910 pins through a 330Ω resistors:
  - COUNTER: pulled up with as 1,5K resistor, this is an input for switches or other sensors. This one could be used as opendrain output for dual function usage. ie. connected to the doorbell push button, it know when someone rings at the door but also allows to control the bell.
  - OUT: output only TTL for servos, leds or optocoupler. This signal is bufferized and is no more limited to opendrain usage as in the tinyboard
  - PWM1: output only TTL for servos, leds, optocouplers, etc...,
  - ADC: input when ADC mode selected, or TTL output for PWM2.
  - PIO: software selectable TTL input/output.
- **Darlington out**: transistor output paired with the equivalent TTL pins. The installed ULN2003 device is an array of seven open drains supporting sinking up to 500mA per pin. To drive a device from these Darlington output, connect the load between 12v pad and the Darlington pad. When the BAE0910 pin is low (register=zero), the corresponding Darlington output is in hi-impedance state and the connected device is not powered. When BAE0910 pin is high the corresponding Darlington output is forced to ground and the connected device is powered. The ULN2003 has integrated protection diode that allows driving inductive loads like motors and relays, door latches etc...
  - OUT: two coupled outputs allows 1A loads to be driven
  - OUT2 (counter): max 500mA load
  - PWM1: two coupled outputs allows max 1A loads to be driven, the PWM feature allows load regulation
  - PWM2: max 500mA load, the PWM feature allows load regulation
  - PIO: max 500mA load.
- **SOIC16 footprints**: two soic-16 footprints allow installing standard surface mount components on the prototyping area without the need of an additional adaptor.

PRINCIPLE OF A DARLINGTON TRANSISTOR

A Darlington transistor is in fact an arrangement of two paired transistors allowing higher gain.
The prototyping board has a Darlington output for each corresponding TTL pin allowing to drive higher loads such as relays, motors, sirens, etc,...
The onboard Darlington's are NPN models. NPN transistors don't source current to the load; they only sink the current to the ground. A correct connection is shown below: