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Light Control Network

DATA SHEET

LN1003 LINET NETWORK NODE

FEATURES:

- DOWNWARDS COMPATIBLE WITH LIN02 FAMILY OF NODES
- COMPLETE ULTRA LOW POWER NETWORK NODE
- MINIMUM EXTERNAL COMPONENTS
- POLARITY AND TOPOLOGY FREE BUS CONNECTION
- ON/OFF INPUT AND OUTPUT
- PHASE ANGLE / PWM CONTROL OUTPUT
- INTERNAL 12-BIT A/D-CONVERTER
- SLOW SERIAL DATA TRANSMISSION

APPLICATIONS:

- LIGHTING CONTROL SYSTEMS
- REMOTE CONTROL SYSTEMS
- HOME AUTOMATION
- ETC.

1. DESCRIPTION

Linet - Light Control Network is an easy and inexpensive local operational network used to control simple devices - relays, heaters, sensors, etc. - in small control and slow data networks.

A Linet network consists of a controller and up to 200 nodes. The controller and nodes share a single, two wire network interconnection. The network is totally topology and polarity free, and no terminating resistors are required. This network provides for power (for all of the nodes) as well as bi-directional data transmission between the nodes and the controller. A shaped, 20kHz 'AC' waveform is impressed on these two wires (NETA and NETB) by the controller.

A small EEPROM is included for the node to store its identification (an integer between 1 and 200). Addtional 3 bits are available for the user as programmable outputs PO1...PO3.

The node incorporates ready-made control interfaces, which are:

- the switch input and output,
- the pwm output (with synchronising option),
- the analog input, and
- the serial data input/output.

The node is available in a 28-pin SSOP package and as an assembly ('the hybrid') containing the node and its external co-components in a DIL20W package, fitting with through-hole circuit boards or 'wide' IC sockets.

2. THE NODE

A shaped, 20kHz 'AC' waveform carrier is impressed by the controller on the two wire network to pins NETA and NETB. 'Power supplying' and 'data-transmitting' half-cycles are alternated. An (external) bridge rectifier at each node converts this to single polarity, allowing interchange of the wiring without effect on the system function. Via the Linet data protocol each of the nodes connected to the controller are assigned a particular time slot where they will communicate.

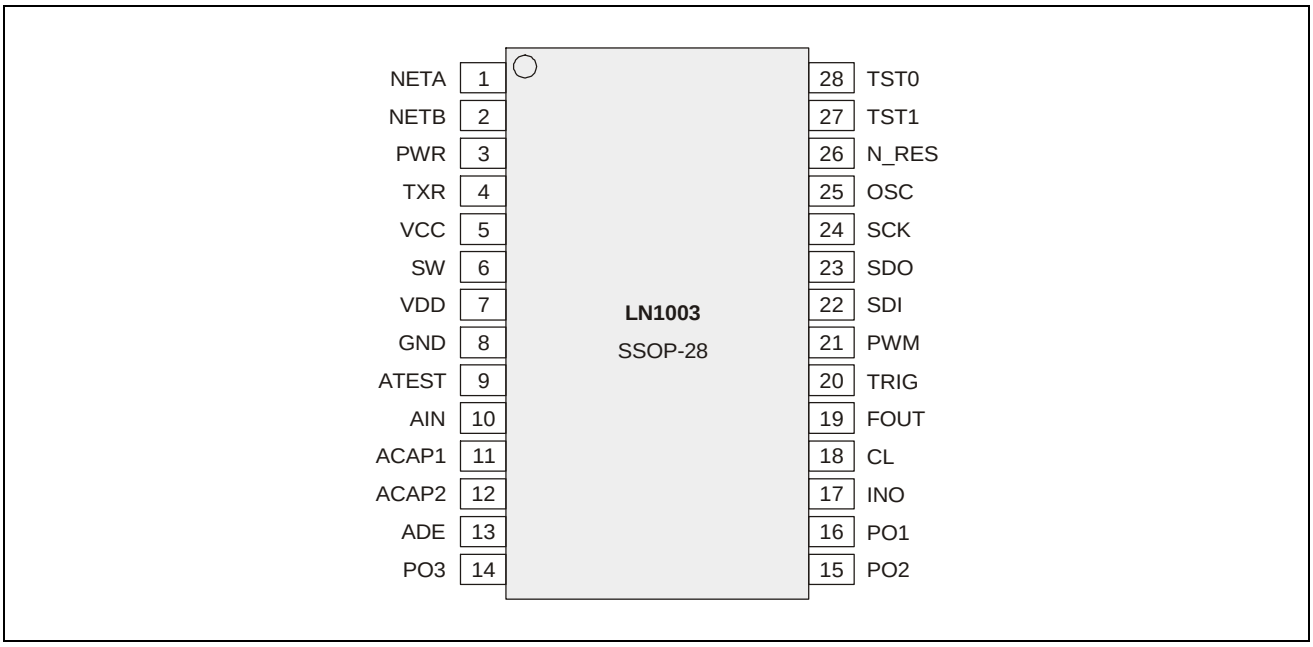


FIGURE 1. THE-NODE

TABLE 1. THE NODE PIN DESCRIPTIONS

NAME	PIN	TYPE	DESCRIPTION
ACAP1	11	ANAL. OUTPUT	A/D-converter - integrator output
ACAP2	12	ANAL. INPUT	A/D-converter - integrator summing junction
ADE	13	DIGIT. INPUT	A/D-converter - conversion enable
AIN	10	ANAL. INPUT	A/D-converter - input voltage
ATEST	9	ANAL. OUTPUT	Multiplexed analog test point output
FOUT	19	DIGIT. OUTPUT	Filtered data out ("1" = LED on)
CL	18	DIGIT. OUTPUT	Control Light output (current sinking only)
INO	17	DIGIT. INPUT	NO switch input
NETA	1	HV ANAL. IN/OUT	Linet network
NETB	2	HV ANAL. IN/OUT	Linet network
N_RES	26	DIGIT. OUT	Reset output
OSC	25	DIGIT. OUTPUT	Internal 1MHz oscillator output
PO1	16	DIGIT. OUTPUT	Programmable output 1
PO2	15	DIGIT. OUTPUT	Programmable output 2
PO3	14	DIGIT. OUTPUT	Programmable output 2
PWM	21	DIGIT. OUTPUT	Pulse width modulator output
PWR	3	HV ANAL. INPUT	Raw HV input (internal)
SCK	24	DIGIT. IN/OUT	Serial data clock
SDI	22	DIGIT. INPUT	Serial data input
SDO	23	DIGIT. OUTPUT	Serial data output
SW	6	HV ANAL.	Switching power supply MOSFET drain (internal)
TRIG	20	DIGIT. INPUT	Zero-crossing detector signal
TST0	28	DIGIT. INPUT	Test input (internal)
TST1	27	DIGIT. INPUT	Test input (internal)
TXR	4	HV ANAL.	Transmit data MOSFET drain (internal)
VCC	5	HV ANAL.	Filtered HV supply terminal (internal)
VDD	7	POWER	3,3V supply terminal
GND	8	POWER	Device ground

3. THE HYBRID

The 'hybrid' includes the Linet node, it's external components, a pushbutton switch for configuration and an indicator LED in a DIL20W package.

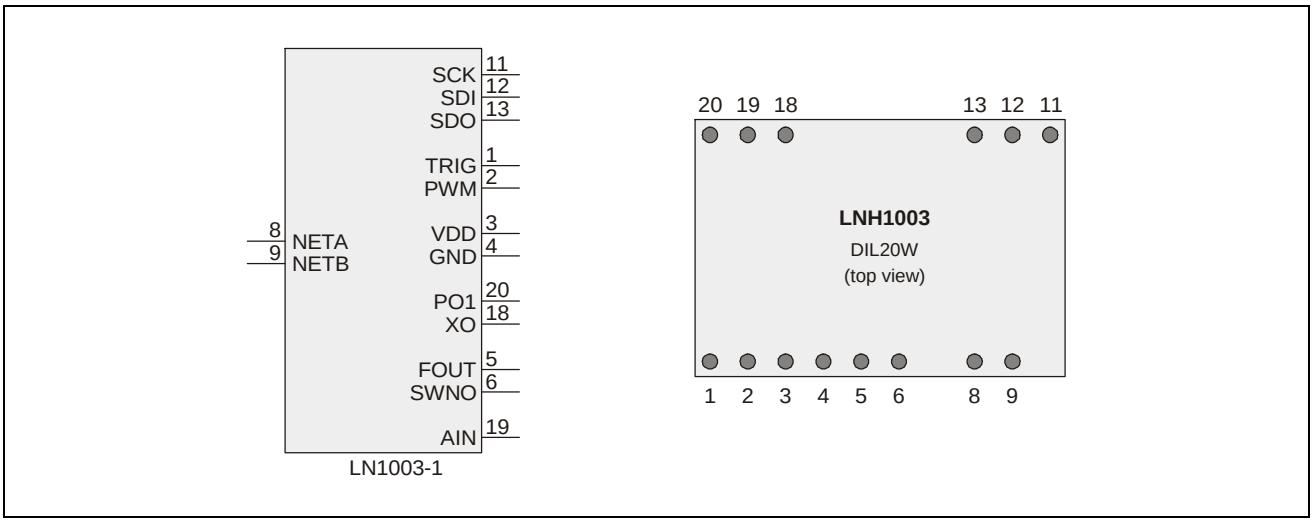


FIGURE 2. THE HYBRID SYMBOL AND PINOUT

TABLE 2. THE HYBRID PIN DESCRIPTIONS

NAME	PIN	TYPE	DESCRIPTION
NETA	8	IN/OUT	Linet network connection
NETB	9	IN/OUT	Linet network connection
SDO	13	OUTPUT	Serial data output
SDI	12	INPUT	Serial data input
SCK	11	OUTPUT	Serial data synchronisation
PWM	2	OUTPUT	Pulse width modulation output
TRIG	1	INPUT	Trigger input for phase angle control
VDD	3	-	Positive voltage source
GND	4	-	Ground
FOUT	5	OUTPUT	Switch output
SWNO	6	INPUT	Switch input
XO	18	OUTPUT	Clock output
PO1	20	OUTPUT	Slow non volatile output
AIN	19	INPUT	Analogue input

NETA and NETB are to connect the Linet two wire network to the node. Note that the connection is polarity free. Nothing else but the network should be connected to these pins.

SDO, SDI and SCK are for inputting and outputting serial data between a microcontroller and the node.

PWM is the pulse width modulation output that is used in power (voltage) controller applications. TRIG is used to synchronise this output with AC mains.

VDD and GND provide supply for the circuitry connected to the node.

FOUT and SWNO are the switch output and switch input pins. The input is typically connected to a pushbutton switch or relay contacts, the output e.g. to a solid-state relay. Note that the on-board pushbutton switch is in parallel with an external switch connected to SWNO.

XO is a clock output.

PO1 is a non-volatile configuration output.

AIN is the A/D-converter voltage input.

4. HYBRID SCHEMATICS

Schematics of the hybrid are presented in figure 3. This schema also displays the external co-components required by the node.

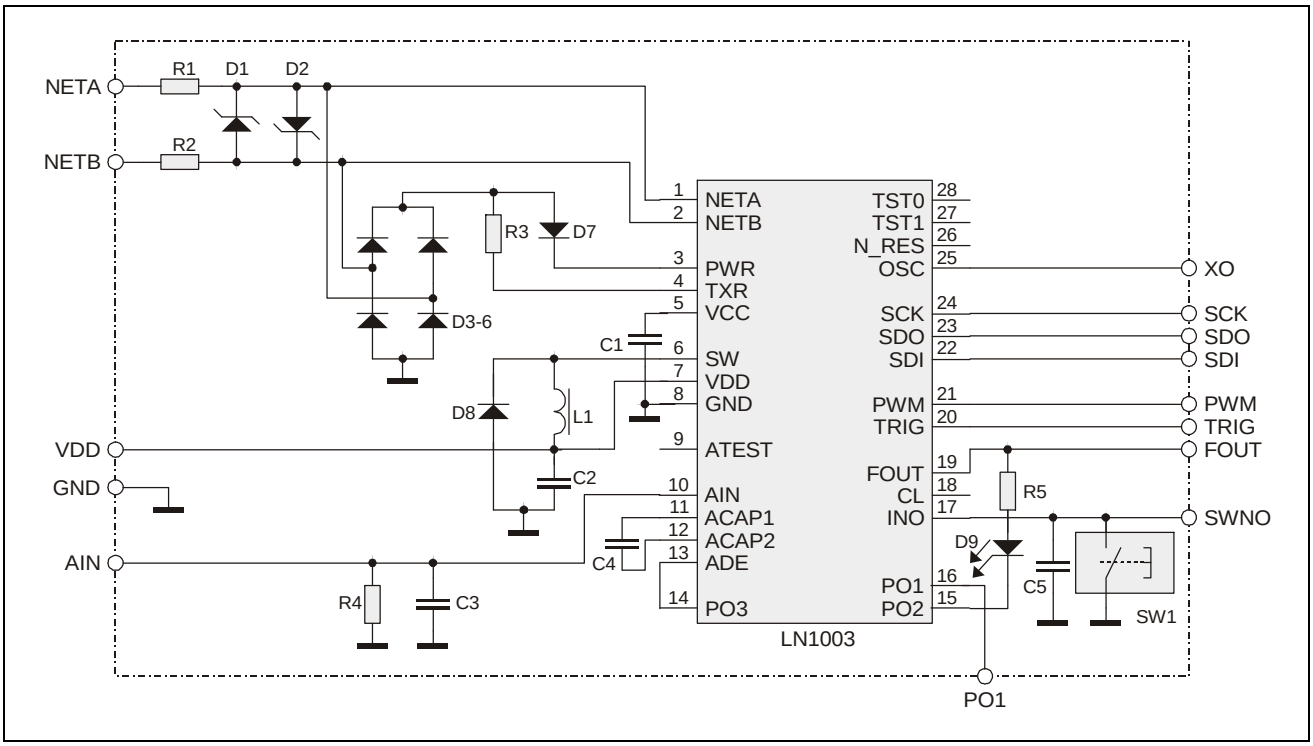


FIGURE 3. CONNECTIONS FOR THE EXTERNAL COMPONENTS

TABLE 3. DESCRIPTION FOR COMPONENTS IN FIGURE 3

ITEM	DESCRIPTION	NOTES
IC1	LN1003	Linet network node
D1,2	24V TRANSIENT SUPPRESSOR	Use low capacitance type, e.g. SL24 from Semtech
D3-8	SMALL SIGNAL SCHOTTKY DIODE	
D9	LIGHT EMITTING DIODE	Use ultrabright type
R1,2	10R RESISTOR	
R3	390R RESISTOR	
R4(1	1M RESISTOR	
R5	1k6 RESISTOR	
C1	470n CERCAP 25V	
C2	2u2 CERCAP	
C3(1	100n CERCAP	
C4(1	2n2 CERCAP	
C5	10n CERCAP	
L1	1000uH INDUCTOR	
SW1	PUSHBUTTON SWITCH	

Notes: 1) These components (R4,C3,C4) are used by the A/D-converter, and may be omitted in applications where the converter is not used. In such design, short-circuit pins 11 and 12 and connect pin 10 to GND.

5. SPECIFICATIONS

TABLE 4. SPECIFICATIONS

PARAMETER	TYP.	UNITS
General parameters		
Network voltage	22	Vpp (max.)
DC test voltage	22	VDC (max)
Average power consumption	3,5	mW
IC current output capacity, sum of all output pins	3	mA (max.)
Output voltage	3,3	V
Frequency on XO pin	1	MHz (approx.)
Operating temperature range, the node	-40…+85	°C
Operating temperature range, the hybrid	-40…+85	°C
Toggle groups		
Signal propagation delay	50 / 25 / 12,5	msec. (max.)
PWM groups		
Number of steps	32	
Signal propagation delay, step-up and step-down signal	62,5 / 31,25 / 15,625	msec. (max.)
Signal propagation delay, on and off signal	50 / 25 / 12,5	msec. (max.)
PWM output frequency (no triggering)	100	Hz
Data groups		
Serial full duplex data capacity	80 / 160 / 320	bits/sec.
A/D-converter		
Resolution	12	bits
Input voltage range	0...+1.25	V
Linearity	0,5	%
Non-calibrated accuracy	2	%
Temperature coefficiency	85	ppm/K

Design guidelines:
- Single twisted pair is used as a network cable. Nothing else but a Linet controller and 1 to 200 nodes should be in electrical connection to the cable.
- Overloading the node is not recommended. Even though it might work well when the number of nodes in the network is low, problems may appear when the network containing overloaded nodes is expanded.
- Note that the node is not isolated. When the node is interfaced to externally powered systems or connected to large conducting areas, galvanic isolation between the node and the application should be used.

6. APPLICATION EXAMPLES

6.1. TOGGLE GROUPS

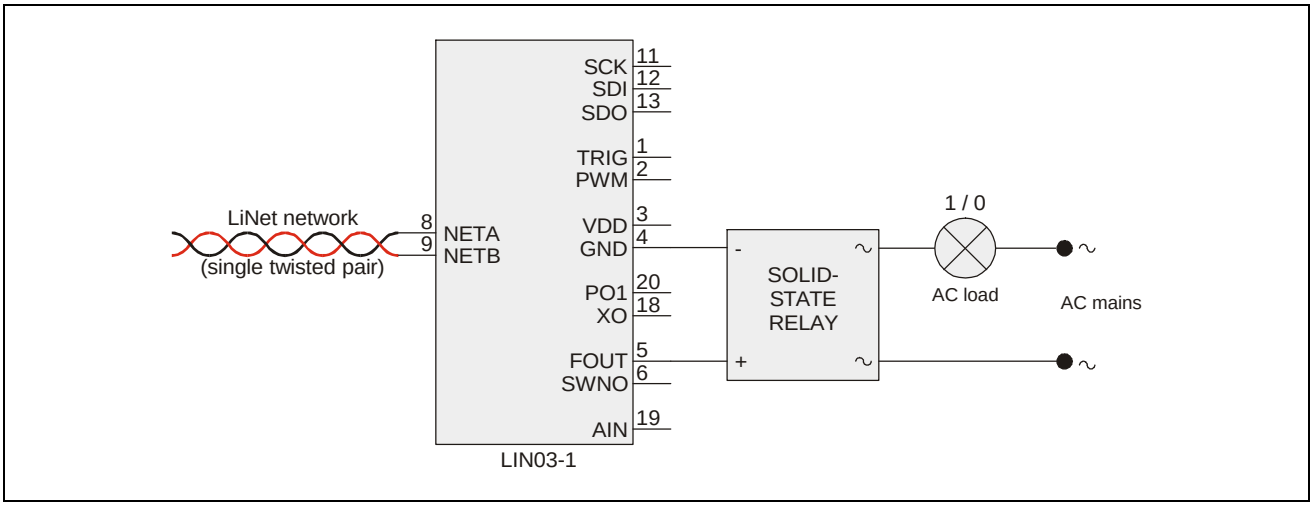


FIGURE 4. TOGGLE GROUP

The nodes can be interfaced to power lines e.g. with readily available solid state relays. FOUT output can drive directly the LED of the SSR. Note that the node can control any voltage or current, when the SSR is selected according to the load ratings.

6.2. PWM GROUPS

DC loads can be controller with the built-in pulse width modulation output (PWM). Without external triggering, the frequency of the PWM signal is 100 Hz.

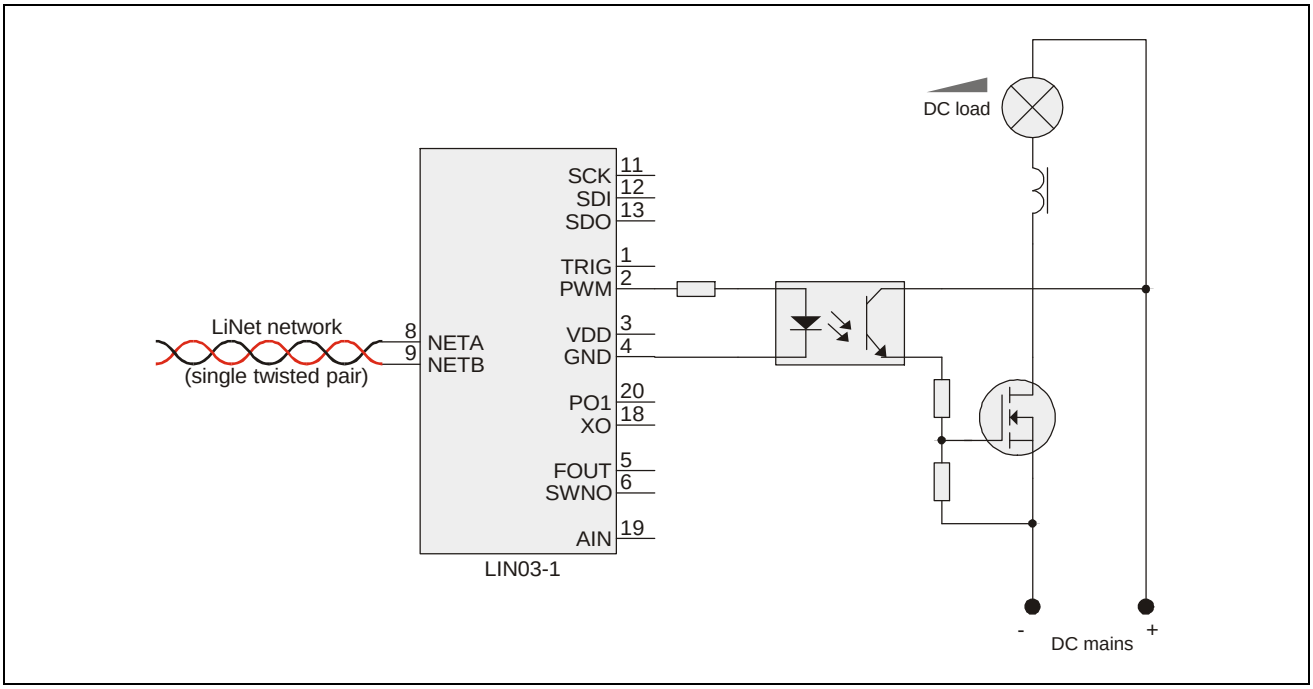


FIGURE 5. DC PWM GROUP

The power of AC loads can be easily controlled using the phase-angle control. The node contains built-in logic for this. PWM output pin can drive an external TRIAC or SCR driver. The synchronization is achieved by sensing the AC line with an optoisolator.

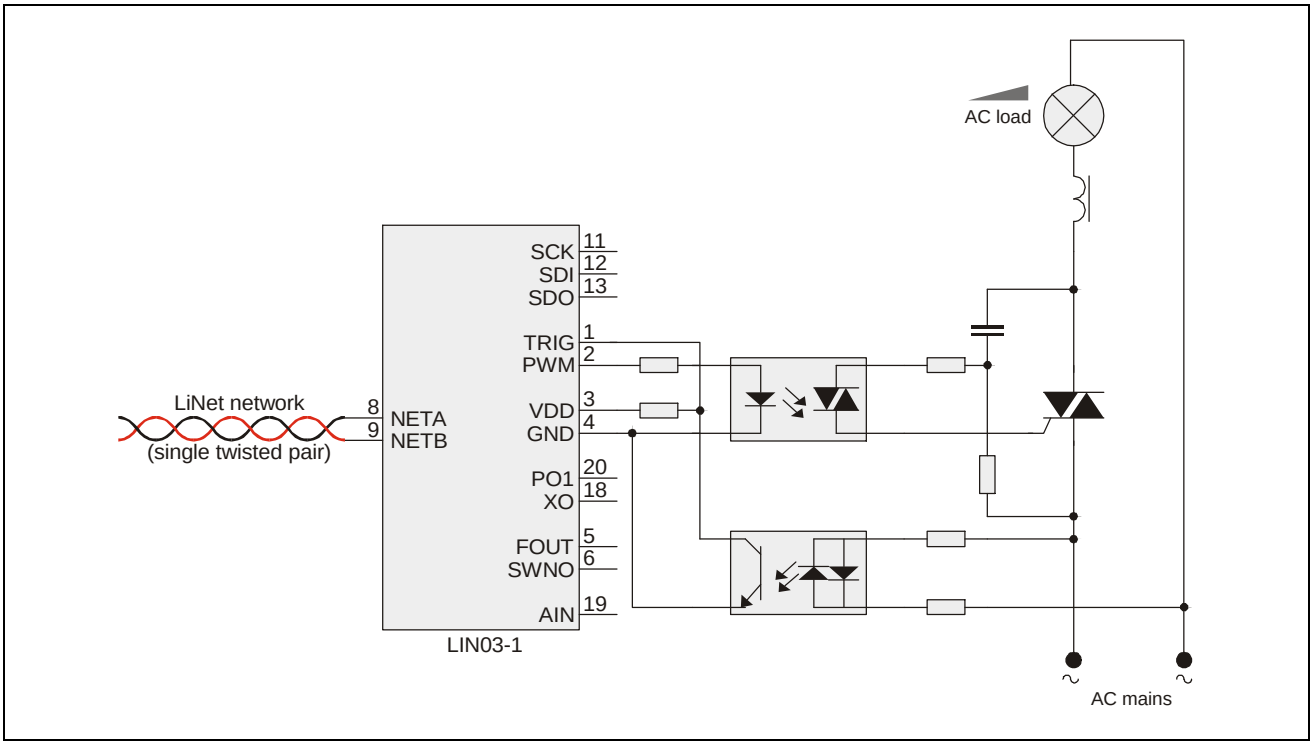


FIGURE 6. AC PWM GROUP

6.3. ANALOG INPUT

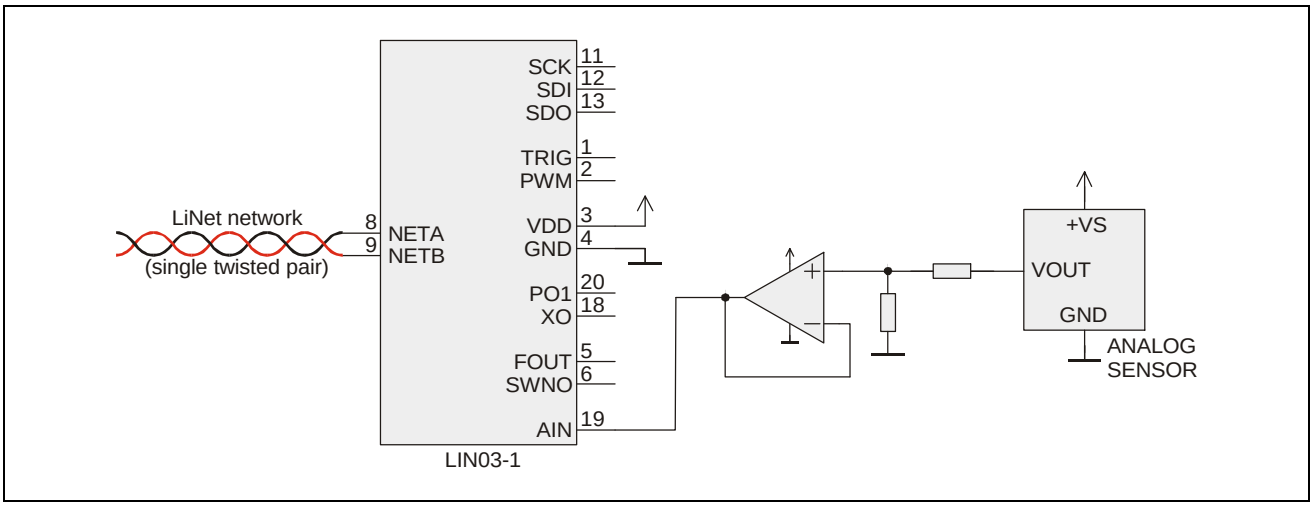


FIGURE 7. ANALOG INPUT

Analog input voltages can be converted to digital data with the internad A/D converter. The data will be transmitted in serial format to another network node, or to the network controller.

6.4. DATA GROUPS

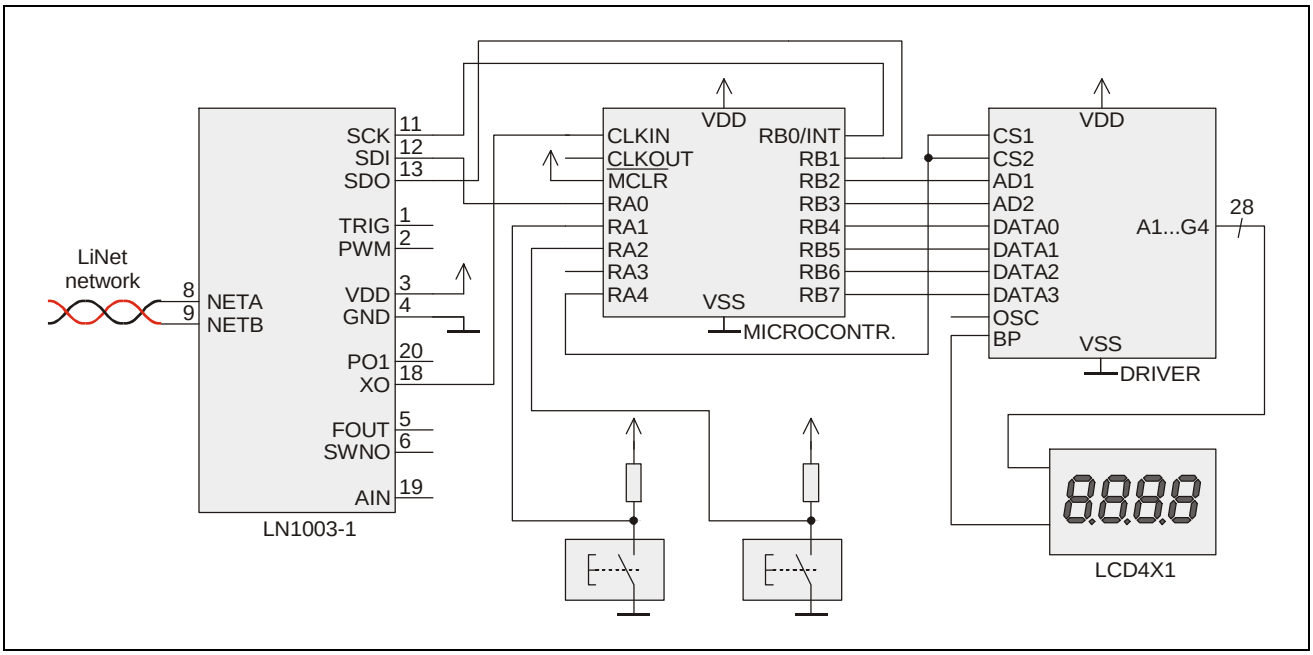


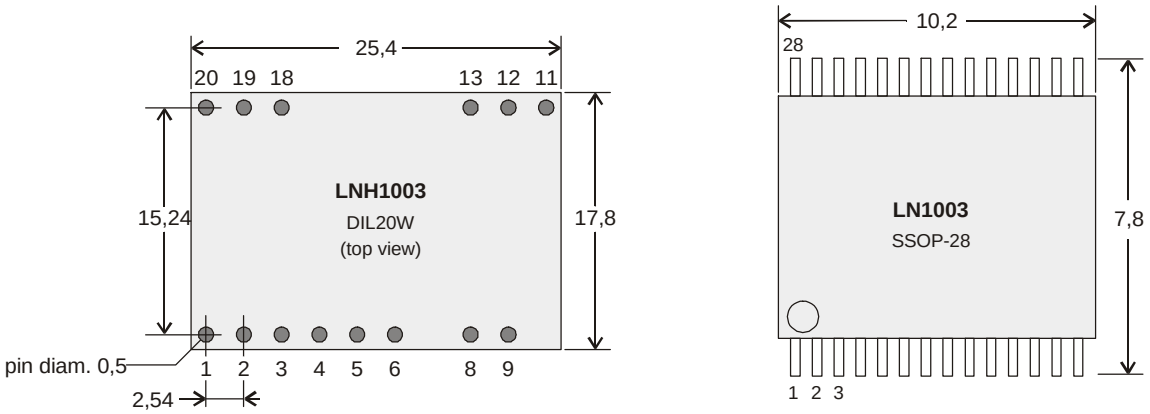
FIGURE 8. DATA INPUT/OUTPUT

Digital data can be transmitted in serial mode between two nodes, or between a node and a controller. In fig. 8. the received data is interpreted by a microcontroller that drives an LCD display. In addition to the serial clock and data input and output, the node also provides the power supply and clock for the external microcontroller.

7. CONFIGURATION BITS

The node has three peripheral outputs PO1...PO3. These pins are affected by the configuration register bits Rb4...Rb1. The configuration bits are stored into node's EEPROM memory, and can be altered during network configuration.

8. MECHANICAL DIMENSIONS



Not to scale. Dimensions in millimetres.

FIGURE 9. MECHANICAL DIMENSIONS

9. CHANGE DATA

The LN1003 family of nodes is downwards compatible with LIN02 and LIN01 nodes. A Linet network may contain any mix of these nodes. Major changes between LN1003 and the earlier families of nodes are:

- VDD output changed to 3,3 V.
- Number of external components reduced.
- No external EEPROM required.
- SSOP28 package (the hybrid is pin compatible with LIN02).
- The node reaches industrial temperature range.

10. ORDERING INFORMATION

TABLE 5. ORDERING INFORMATION

PART NUMBER	DESCRIPTION
LN1003	Linet network node, SSOP-28
LNH1003	Linet network hybrid, DIL-20W

Linet products are not suitable for use as safety critical components (a) in life support devices, (b) in or on an aircraft, (c) in a nuclear plant, without the written approval of Linet Oy.