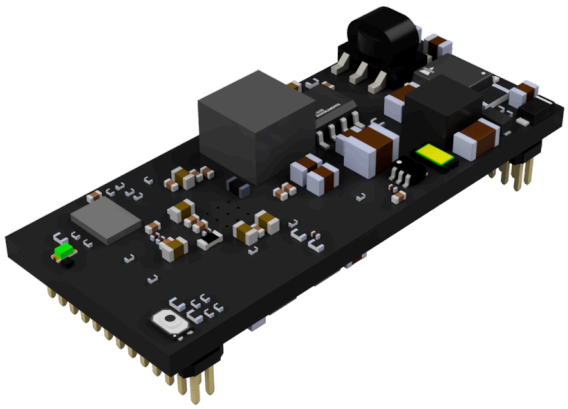
PowerNode Module

OEM Module for Domatic Bus-compliant devices | 24–59 VDC | 100W pass-through



PowerNode Module lets manufacturers create **Domatic Bus-compliant devices**. The Domatic Bus carries class-2 low-voltage DC power and IP networking on a single 2-wire pair — dramatically reducing copper compared to traditional Romex and simplifying installation compared to PoE. Under the hood, the bus uses IEEE 1901 HD-PLC to create the Ethernet framing that supports the IP stack and Domatic protocols.

PowerNode is the building block inside Domatic-built drivers — the Sensor Driver, LED Driver, and PoE Adapter — and is offered to OEMs designing carrier boards for the Domatic Bus.

Key Features

- ✓ Native Domatic Bus interface: power and data on a single 2-wire pair (IEEE 1901 HD-PLC)
- ✓ Multihop mode up to 320 Mbps · 1024 nodes; Streamer mode up to 500 Mbps · 128 nodes
- ✓ Selectable frequency bands for tuned throughput vs. range
- ✓ Soft-start circuit supports hot-plug carrier boards (≤ 400 µF input capacitance)
- ✓ On-board I/O expander: 5× 12-bit ADC, 3× PWM, I²C host
- ✓ Real-time output current and voltage monitoring
- ✓ 3.3V auxiliary rail for carrier-board logic (0.5 A max)
- ✓ Compact 40 × 17 mm footprint, 8 mm tall soldered (12 mm on headers)

Electrical Specifications

Parameter	*Value*	*Parameter*	*Value*
Input Voltage	24 – 59 VDC (48 V nominal)	Aux Output Rail	3.3 V, 0.5 A
Input Current	2.5 A max	Module Power Use	1 W avg, 2 W max
Pass-through Power	100 W max	Operating Temp	−40 °C to +85 °C
Power Source	Domatic PowerHub (100 W per port, current-limited)	Carrier Hot-plug Cap	≤ 400 µF input

Onboard Silicon

Host Processor	Megachips MLKHN-based — RISC-V, 125 MHz, AES-128, 4 MB external program flash
I/O Expander	Microchip ATTiny-based — 8-bit AVR, 5× 12-bit ADC + 3× dedicated ADCs, 3× PWM, I²C host
Monitoring	Output current sense, output voltage sense, carrier-board version ID, on-board temperature

PLC Front-end	TX/RX analog circuitry on-module

HD-PLC Communication

Mode	*Max Throughput*	*Max Nodes*	*Notes*
Multihop	320 Mbps	1024	Mesh-style topology
Streamer	500 Mbps	128	Optimized for streaming

Measured Performance — multihop, x-1 algorithm, 50 m of 18/2 wire

TCP Throughput	55 – 72 Mbps
UDP Throughput	50 Mbps with <0.1 % packet loss

Mechanical Specifications

Footprint	40 mm × 17 mm
Height — soldered	8 mm
Height — on headers	12 mm
Mating Header A	2 × 12, 1.27 mm pitch
Mating Header B	2 × 13, 1.27 mm pitch

Module Pin Assignment — v10x (rev 5)

The PowerNode module exposes two 1.27 mm-pitch headers — Side A (24 pins, 2 × 12) and Side B (26 pins, 2 × 13). MCU-connected pins are prefixed **AT-** (ATTINY1626 I/O expander) or **BCP-** (BCP2 host processor). Pins marked with ⚠️ require special handling — see **Pin Notes** below.

Side A header (2 × 12)

Pin	*Name*	*Net*	*Type*	*Function*
1A	—	WIRE_P	—	PLC data +
2A	—	+3V3	Power	3.3 V auxiliary supply
3A	—	WIRE_N	—	PLC data −
4A	—	GND	Power	Ground
5A	—	GND	Power	Ground
6A	AT-PA3	PA3	GPIO	GPIO / AIN3
7A	AT-PB2	PB2	GPIO	GPIO / TXD0 / EVOUTB
8A	AT-PC2	PC2	GPIO	GPIO / AIN14 / EVOUTC
9A	AT-PB3	CoProc_PWM0	TCA PWM	PWM0 / RXD0
10A	AT-PC3	PC3	GPIO	GPIO / AIN15
11A	AT-PB4	CoProc_PWM1	TCA PWM	PWM1 / AIN9
12A	AT-PB0	SCL	I²C	I²C clock

Pin	Name	Net	Type	Function
13A	AT-PB5	CoProc_PWM2	TCA PWM	PWM2 / AIN8
14A	AT-PB1	SDA	I²C	I²C data
15A	—	GND	Power	Ground
16A	—	GND	Power	Ground
17A	—	PRE_SS	Power	48 V soft-start input
18A	—	GND	Power	Ground
19A	—	PRE_SS	Power	48 V soft-start input
20A	AT-PA6	I_OUT_P	Analog In	Output current sense
21A	—	+48V	Power	48 V pass-through
22A	AT-PA7	V_OUT	Analog In	Output voltage sense
23A	—	+48V	Power	48 V pass-through
24A	AT-PC1	CARRIER_VERS	Analog In	Carrier-board version ID

Side B header (2 × 13)

Pin	Name	Net	Type	Function
1B	—	GND	Power	Ground
2B	—	GND	Power	Ground
3B	BCP-GB2	BCP_SCK	SPI	SPI clock
4B	BCP-GE7	PHYCLK	Ethernet	RMII PHY clock
⚠ 5B	BCP-GB4	BCP_CS	SPI	SPI chip select — flash CS
⚠ 6B	BCP-GE6	MDC	Ethernet / Rev	MDC / board-revision sense
7B	BCP-GB3	BCP_MISO	SPI	SPI MISO
8B	BCP-GE5	RXD1	Ethernet	RMII RXD1
9B	BCP-GB1	BCP_MOSI	SPI	SPI MOSI
10B	BCP-GE4	RXD0	Ethernet	RMII RXD0
11B	—	GND	Power	Ground
12B	—	GND	Power	Ground
13B	BCP-GC0	BCP_RXD	UART	BCP UART RX
14B	BCP-GE3	RXDV	Ethernet	RMII RXDV
15B	BCP-GC1	BCP_TXD	UART	BCP UART TX
16B	BCP-GE2	TXEN	Ethernet	RMII TXEN
⚠ 17B	BCP-GA1	JTAG_SEL	JTAG strap	JTAG select — must be low at reset
18B	BCP-GE1	MDIO/TXD0	Ethernet	MDIO / RMII TXD0
19B	BCP-NRESET	BCP_RESETn	Reset	BCP reset
20B	BCP-GE0	TXD1	Ethernet	RMII TXD1
21B	BCP-GA2	BCP_BOOT	Boot	BCP boot mode
22B	—	GND	Power	Ground

Pin	Name	Net	Type	Function
23B	BCP-GD3	TDO	JTAG	JTAG TDO
24B	BCP-GD5	LINK	Ethernet	Link status
25B	BCP-GD2	TCK	JTAG / Ethernet	JTAG TCK / LAN_R
⚠ 26B	BCP-GD4	ETHRST	Ethernet / Rev	Ethernet reset / board-revision sense

Pin Notes

Caution **Pin 5B — SPI Chip Select for the 4 MB program flash.** This pin has an internal 10 kΩ pull-up. It should only be driven on the carrier board if you specifically need to write to the MLKHN2501DM SPI flash directly; otherwise, leave it floating.

Caution **Pins 6B and 26B — connected to internal board-revision sense.** If an external pull-up or pull-down is required on the carrier board, use a tristate device so the carrier circuitry does not interfere with the module's revision-pin state at reset.

Caution **Pin 17B — JTAG-select strap on the MLKHN2501DM.** Internally pulled low at reset; pulling it high during reset puts the chip in JTAG mode. For normal operation this pin must not be high at reset. An external pull-down is fine; if a pull-up is required at reset, use a tristate device.

Carrier Board Design Guide

ISN inductors

The carrier board provides the two ISN (Impedance Stabilization Network) inductors that AC-couple the PLC data onto the power pair. Required: **47 µH**, SRF > 2 MHz, current rating sized for the carrier-board power draw with ≥ 20% headroom.

Part Number	Current Rating	I_{sat}	DCR	SRF
Coilcraft XAL8080-473	4.7 A	4.1 A	71.8 mΩ	5.9 MHz
TDK SPM10065VT-470M-D	4.0 A	5.9 A	79.8 mΩ	~5 MHz
Bourns SRR1210-470M	3.8 A	3.1 A	72 mΩ	4.5 MHz
Coilcraft XGL6060-473	3.7 A	3.2 A	107 mΩ	6 MHz
YJYCOIN YPRH1209-470M	3.6 A	—	63 mΩ	—
Taiyo Yuden NS12575T470MN	2.95 A	3.76 A	61.8 mΩ	6.5 MHz
Taiyo Yuden NS12575T470MNV	2.95 A	3.6 A	61.8 mΩ	6.5 MHz
Taiyo Yuden LCRNJ12575GL470MN	2.95 A	3.6 A	51.5 mΩ	—
Würth Elektronik 7447714470	2.2 A	2.5 A	99 mΩ	8.8 MHz
Bourns SRN6045TA-470M	1.6 A	2.0 A	200 mΩ	12 MHz
cjiang FNR5040S470MT	1.15 A	1.2 A	354 mΩ	7 MHz
TDK VLS5045EX-470M	1.0 A	1.3 A	390 mΩ	~4.5 MHz
cjiang FNR4030S470MT	0.8 A	1.0 A	579 mΩ	8.4 MHz
Murata LQW32FT470M0HL	100 mA	300 mA	900 mΩ	30 MHz

ESD / surge protection — varistors

Part Number	Max DC	V_{var} (Min)	V_{var} (Typ)	V_{var} (Max)	V_{clamp} Max	Surge	C	Size
MLVC12V060C180	60 V	68.4 V	76 V	83.6 V	134 V	120 A	180 pF @ 1 MHz	1206
RL1812A760K	60 V	72 V	—	90 V	198 V	800 A	—	1812

ESD / surge protection — TVS diodes

Part Number	Reverse Standoff	Breakdown	Clamping (Max)	I_{pp}	P_{pp}
Littelfuse SMDJ58CA	58 V	64.4 V	93.6 V	32.1 A	3 kW
Littelfuse SZSMF4L58CAT3G	58 V	64.4 V	93.6 V	4.3 A	400 W

PLC routing

Route the PLC data pair (WIRE_P / WIRE_N) differentially. Impedance is not critical — keep the pair short, away from switching nodes, and avoid splitting the return path.

Mounting Options

PowerNode can be soldered directly to a carrier board or mounted on standard 1.27 mm-pitch female headers. Recommended parts below.

Through-hole headers

Position	HCTL	Amphenol
Header A — 2 × 12	PM127-2-12-Z-4.3-G0	20021311-00024T4LF
Header B — 2 × 13	PM127-2-13-Z-4.3-G0	20021311-00026T4LF

Surface-mount headers

Position	HCTL	Amphenol
Header A — 2 × 12	PM127-2-12-S-4.3	20021321-00024T4LF
Header B — 2 × 13	PM127-2-13-S-4.3	20021321-00026T4LF

Important Notes

Caution **No reverse-polarity protection.** An internal unidirectional TVS diode forces a dead short when reverse voltage is applied. PowerNode must only be powered from the Domatic PowerHub, which provides 100 W power-limited ports that safely tolerate this short during a wiring fault.

Note **Carrier hot-plug.** The on-module soft-start circuit allows hot-plugging carrier boards without inrush damage. Carrier-board input capacitance must not exceed 400 µF.

Ordering Information

Model Number	Description
DOM-M-1	HD-PLC OEM module — 24–59 VDC, 100 W pass-through, IEEE 1901