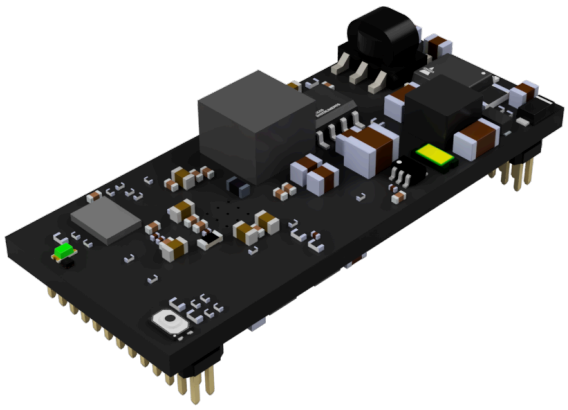
PowerNode Module

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 and is offered to OEMs designing drivers for the Domatic Bus. It comes as part of the Fixture Development Kit (FDK) that includes reference designs for carrier boards to host the PowerNode and an SDK that implements the Domatic protocol stack, allowing an OEM to focus their firmware efforts on their device's intended function.

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	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

Pin	Name	Net	Type	Function
11A	AT-PB4	CoProc_PWM1	TCA PWM	PWM1 / AIN9
12A	AT-PB0	SCL	I²C	I²C clock
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

Pin	Name	Net	Type	Function
21B	BCP-GA2	BCP_BOOT	Boot	BCP boot mode
22B	—	GND	Power	Ground
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

Part Number	Current Rating	I_{sat}	DCR	SRF
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