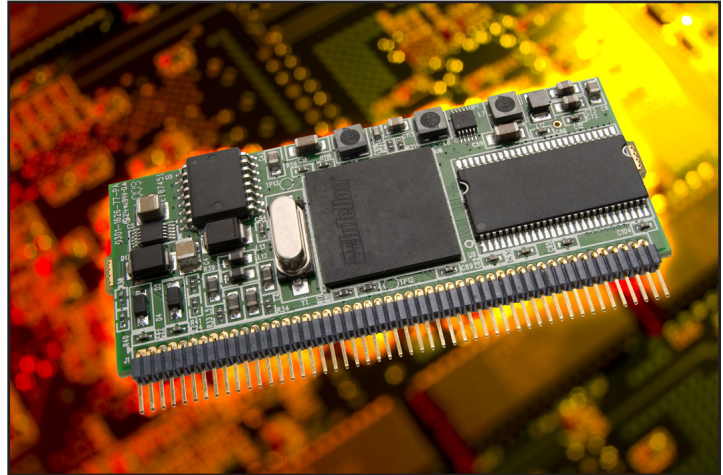


# POWERLINE MODULES

Low Power Embedded HomePlug® AV Modules

## FEATURES

- Supports HomePlug® AV Standard with data rates of 200Mbps
- Based on Intellon INT6400/INT1400 chipset
- MII (Host & PHY) interface
- Supports 1024/256/64/16/8-QAM, QPSK, BPSK and ROBO modulation schemes
- 128-bit AES Link Encryption with key management for secure power line communications
- Windowed OFDM with noise mitigation based on patented line synchronization techniques improves data integrity in noisy conditions
- Dynamic channel adaptation and channel estimation maximizes throughput in harsh channel conditions
- Advanced turbo code forward error correction
- ToS, CoS and IP port number packet classifiers
- Supports IGMP managed multicast sessions
- Green standard (ROHS) compliant
- GPIO second function as general data lines
- Compact vertical or horizontal mounting configuration using standard 1.27mm pin header
- Integrates all components necessary to add HomePlug AV functionality to any embedded system at low cost



Part Number	Description
0804-5000-17	Vertical Mounting
0804-5000-18	Horizontal Mounting



The Bel 0804-5000-17 and 0804-5000-18 Single In-line Package (SIP) modules are HomePlug AV, open-standard-based MAC/PHY/AFE Powerline Communications (PLC) transceiver modules. The modules combine the Intellon INT6400, and the INT1400 chip set to offer a high performance, low power HomePlug AV-based communications solution.

The Bel 0804-5000-17 and 0804-5000-18 modules enable the development of HD-grade communication bridges, to and from the powerline. They also serve as translators between the digital and analog worlds. On the digital side are host interfaces that include: Ethernet as MII Host or PHY. The digital data provided by these interfaces is translated by the INT6400 into a very complex analog signal which rides over the AC wiring. The INT6400 also accomplishes the reverse – powerline to host interface, analog back to digital.

### APPLICATIONS

The 0804-5000-17 and 0804-5000-18 modules are the key element that enables reliable, HD-grade performance over inherently noisy AC wiring. Robust and reliable connectivity is absolutely essential for the successful consumer adoption of new networked media-access products, systems and services. Market segments, opened up by the Bel powerline modules include but are not limited to:

- Over-the-Top Video
- Retail Adapters
- Telco / IPTV
- Smart Grid
- Ethernet-over-Coax (EoC) and Multi-Dwelling Unit (MDU) applications

The market strategy involved here is very simple – consumers want to enjoy their media content at any and all locations throughout their offices or homes. The days of depending on installed cabling, jacks and the limitations that are associated with these, are passing and being replaced with an elegant, transparent and ubiquitous solution – HomePlug AV. Using the AC power grid, present in all buildings, be it home or office alike. With the HomePlug AV technology, and a new wave of products and services, consumers are now able to fully enjoy media and information on demand, without the requirement to install cabling and access points. The Bel 0804-5000-17 and 0804-5000-18 modules open the market to designers to take advantage of the HomePlug AV technology.

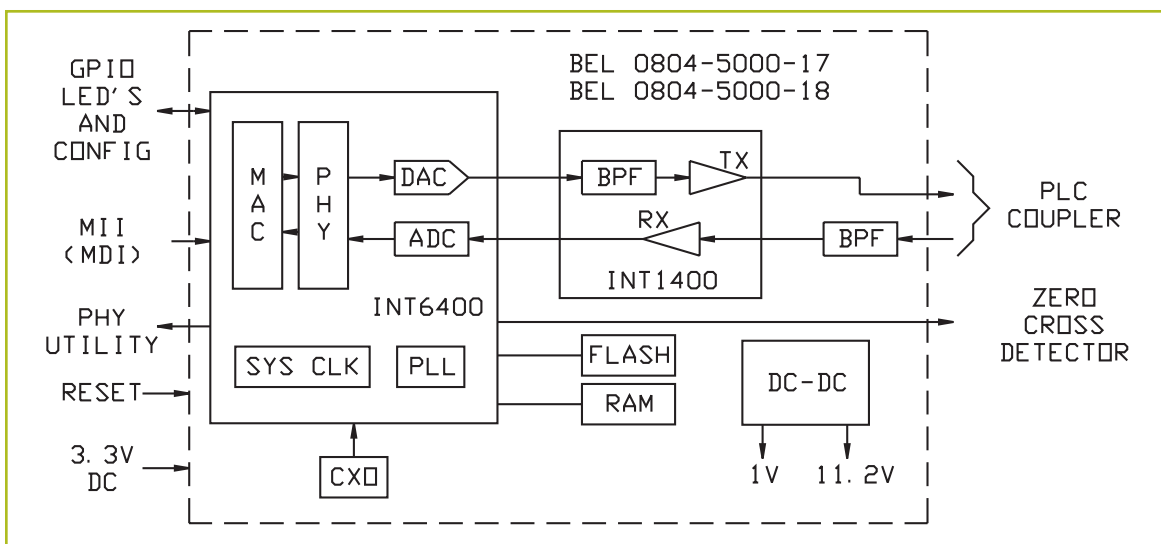
### 200 Mbps Powerline Standards for Home Networking

The Bel 0804-5000-17 and 0804-5000-18 modules are based on the Intellon INT6400/INT1400 chipset, which is fully compliant with HomePlug AV standard, to reliably deliver 200 Mbps PHY rate over the power line wiring.

### Everything Required to Move into Production

The Bel 0804-5000-17 and 0804-5000-18 modules design provides everything required to move quickly into production of Powerline adapters. The designs have been thoroughly validated, to provide an advanced foundation for manufacturers, seeking to minimize their time-to-market. The design has been developed to minimize cost, as well as to reduce the format and component count to an absolute minimum.

### MODULE BLOCK DIAGRAM



## POWERLINE MODULES

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### TECHNICAL DESCRIPTION

Within the INT6400, the HomePlug-AV MAC function is carried out by firmware running on an embedded ARM926EJ-S CPU (central processing unit), supported by DMA (direct memory access) hardware, two dedicated CRC (cyclic redundancy check) engines, and a large off-chip SDRAM data-store. The HomePlug-AV MAC firmware running on the CPU oversees operation of the integrated HomePlug-AV PHY via an interface that carries control/status information as well as transmits and receives data packets. General-purpose I/O pins are available to drive LEDs directly to indicate link status, as well as to indicate user reset or network-attach events. An on-chip PLL (phase locked loop) and built-in crystal oscillator driver permit generation of system clocks from a single external 37.5 MHz crystal.

In addition to the processor, the MAC also contains numerous peripherals that are essential for running an advanced Real-Time Operating System (RTOS). The MAC contains a reset/clock controller, numerous timers, a vector interrupt controller, a synchronous and an asynchronous UART (universal asynchronous receiver transmitter), GPIO (general purpose input output) support, and a complex self-diagnostic module. These peripherals allow the RTOS and MAC software to respond to system interrupts, and control the operation of the software.

Numerous on-chip busses allow unimpeded access to critical system resources – most notably, the SDRAM interface and the small on-chip SRAM (Static Random Access Memory). The on-chip SRAM is used for storing time-critical descriptor chains, while the off-chip SDRAM is used for storing the majority of the descriptor information, as well as the packet data. The descriptor engine is responsible for moving data to and from memory (either on-chip SRAM or off-chip SDRAM), for merging packets together, and for providing status and interrupt information back to the processor. A key factor here is to reduce the number of interrupts that the processor must respond to – with the high data rates that are achievable through the HomePlug-AV PHY, it is essential that a large proportion of the DMA processing is off-loaded to these descriptor engines.

Within the INT1400 is the TX filter, programmable-gain line driver and the programmable-gain RX amplifier. The lowpass filter has a cutoff of 30 MHz. The RX PGA provides 60 dB of gain control range, in 2 dB increments. The TX PG Line Driver provides 30 dB of gain control range, in 2 dB increments.

### MODULE INTERFACES

Type	Description
<b>MII (Ethernet)</b>	Host or PHY, IEEE 802.3u Media Independent Interface
<b>GPIO</b>	Status LEDs, module configuration options, and general use I/O
<b>POWERLINE</b>	TX and RX pairs of Powerline signal for connection to coupling transformer

### TECHNOLOGIES

Type	Description
<b>Windowed OFDM</b>	Windowed Orthogonal Frequency Division Multiplexing – provides over 1,000 narrow-band carriers each of which can be independently turned off (30-dB notch) or modulated up to 1024 QAM for optimal performance
<b>TDMA Channel Access</b>	Time Division Multiple Access – a means of accommodating more than one service on the channel by assigning time slots – useful for ensuring Quality of Service (QoS) for video streams
<b>CSMA/CA Channel Access</b>	Carrier-Sense Multiple Access/Collision Avoidance – a means of sensing the presence of a carrier before transmission is attempted to avoid network collisions or contention

### PERFORMANCE

Type	Value	Description
<b>Maximum PHY Rate</b>	200 Mbps	Maximum PHY rate including payload and overhead
<b>Modulation</b>	1024/256/64/16/8 QAM, QPSK, BPSK, ROBO	Each OFDM sub-carrier can be independently modulated to optimize throughput for operating conditions
<b>Encryption</b>	128 bit AES	Matches industry standard Advanced Encryption System

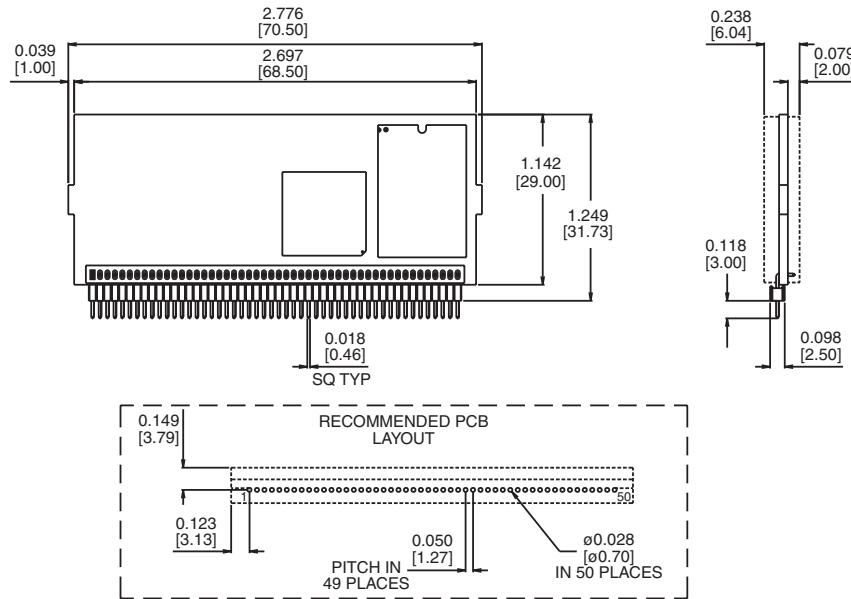


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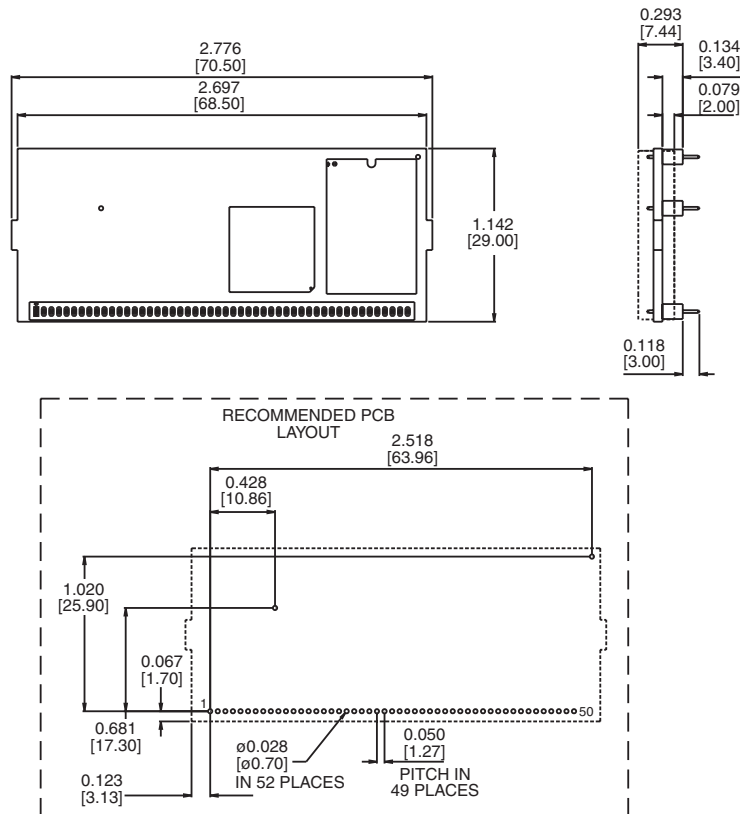
## Low Power Embedded HomePlug® AV Modules

### MECHANICAL

**0804-5000-17**  
Vertical Mount



**0804-5000-18**  
Horizontal Mount



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