What Does PoE Power Budget Mean - Official Technical Overview & Hardware Datasheet

EXECUTIVE SUMMARY

Power over Ethernet (PoE) has revolutionized network endpoint deployment by eliminating the need for separate AC power outlets. However, the single most critical engineering parameter defining a PoE switch’ s real-world capability is its PoE Power Budget. This document defines the PoE power budget as the total amount of DC power (in Watts) that the switch’ s internal power supply unit (PSU) can simultaneously deliver to all connected Powered Devices (PDs) via their Ethernet ports.

Unlike per-port power limits (e.g., 30W per IEEE 802.3at port), the aggregate power budget represents a system-level constraint. Exceeding this budget triggers port shutdown or priority-based power shedding. For enterprise and carrier-grade deployments, accurate power budget planning is non-negotiable for IP cameras, VoIP phones, wireless APs, and IoT gateways.

ARCHITECTURE & CHASSIS DESIGN

The PoE power delivery architecture integrates three hierarchical subsystems:

1. Internal PSU Stage: Converts AC mains (100-240V~) or DC backup (-48V) into a system DC bus (typically 54V-57V to compensate for cable loss). The maximum output rating of this stage defines the raw system power.
2. PoE Power Management Controller: A dedicated hardware ASIC that monitors per-port real-time current draw, class detection (Class 0-8 per IEEE 802.3bt), and allocates power from a dynamic budget pool.
3. Ethernet Magnetic & PD Interface: Isolates data pairs while injecting DC voltage onto the Ethernet cable (Alternative A or B, or 4-pair for Type 4).

Two primary architectural models exist:

- Fixed Budget (Entry-level): Shared budget across all ports, non-expandable.

- Modular/Redundant Budget (Carrier-grade): Multiple hot-swappable PSUs (e.g., 1+1 or N+1) allow for budget aggregation or failover. With 1+1 redundancy, the total PoE budget equals a single PSU’ s PoE capacity, not both.

HARDWARE FEATURES

- Per-Port Power Limit: Software-configurable from 1W to 90W (IEEE 802.3bt Type 4).

- Power Budget Allocation Modes: Static allocation (reserved upon link up) or Dynamic allocation (consumption-based, over-subscription allowed).

- Priority Shutdown Policies: User-defined port priority (Critical, High, Low). When budget is exceeded, low-priority ports are depowered first.

- Real-time Telemetry: SNMP traps and CLI show power state, providing per-port milliwatt accuracy for capacity planning.

- Fast PoE (Legacy Detection): Compatible with pre-standard AF/AT devices via resistive signature detection.

COMPLIANCE & STANDARDS

- IEEE 802.3af (Type 1): Up to 15.4W per port (12.95W guaranteed at PD after cable loss).

- IEEE 802.3at (Type 2, PoE+): Up to 30W per port (25.5W guaranteed).

- IEEE 802.3bt (Type 3, 4PPoE): Up to 60W per port (51W guaranteed).

- IEEE 802.3bt (Type 4, High Power PoE): Up to 90W per port (71.3W guaranteed).

- UL 60950-1 / IEC 62368-1: Safety extra-low voltage (SELV) compliance.

- Energy Efficient Ethernet (IEEE 802.3az): Reduces idle power, which indirectly preserves PoE budget for active devices.

TECHNICAL SPECIFICATIONS

All specifications are based on a 48-port Gigabit PoE+ switch with dual hot-swappable PSUs (reference model). Actual values vary per product family.

Total PoE Power Budget (1+1 redundant PSUs): 740W (max per single PSU capacity).

Total PoE Power Budget (non-redundant, both PSUs active): 1480W.

Per-port maximum: 30W (IEEE 802.3at), 60W/90W (bt Type 3/4 on selected ports).

Power allocation granularity: 1W steps.

Standby power consumption (no PDs attached): 45W.

Peak inrush current protection: 350mA per port, 15ms duration.

Operating voltage range: 100V AC to 240V AC (50/60Hz) or -36V DC to -72V DC

for telecom models.

Power budget measurement accuracy: +/- 3% of full scale.

Thermal derating: Budget reduces by 10% from 40°C to 50°C ambient.

Parameter	**Specification**
Form Factor	1RU / 2RU Rack-mountable Chassis
Total PoE Power Budget (Redundant Mode)	740W (1+1 PSU)
Total PoE Power Budget (Non-Redundant)	1480W (dual active PSU)
Per-port max (802.3af/at/bt)	15.4W / 30W / 90W
Power Supply Configuration	Dual Hot-swappable (AC or DC)
Power Management Resolution	1W per port
Overload Protection	Port-based current limiting + global budget monitor

ORDERING OPTIONS

Select SKUs based on required aggregated PoE power for your endpoint density.

PWR-BASE-150: 150W total budget (4-8 ports, 802.3af cameras/VoIP). Ideal for small office edge.

PWR-BASE-370: 370W total budget (12-24 ports, 802.3at APs & PTZ cameras). Standard enterprise access layer.

PWR-BASE-740: 740W total budget (24-48 ports mixed at/bt). Includes 1+1 PSU ready.

PWR-BASE-1440: 1440W total budget (48 ports full bt Type 4, 90W per port). High-power industrial IoT.

PWR-EXT-MOD: Expansion power module that adds 400W to base budget (field-upgradeable).

All SKUs include per-port power priority firmware and SNMP MIB support for power monitoring. For carrier-grade deployments requiring zero-port shutdown during PSU failure, always size the budget to operate from a single PSU (N+1 redundancy rule).