PoE+ 802.3at power budget per port - Official Technical Overview & Hardware Datasheet

EXECUTIVE SUMMARY

This document provides a comprehensive technical overview of the Power over Ethernet Plus (PoE+) capabilities as defined by IEEE 802.3at, with a specific focus on the per-port power budget architecture. Designed for enterprise access switches, campus edge deployments, and high-density surveillance or wireless infrastructure, the PoE+ implementation detailed herein delivers up to 30W per port while maintaining full compliance with backward power-sourcing interoperability standards (IEEE 802.3af). The system employs dynamic power allocation, port-level current limiting, and real-time power monitoring to ensure deterministic power delivery to Powered Devices (PDs) such as pan-tilt-zoom cameras, 802.11ac/ax access points, VoIP video consoles, and compact network switches.



HARDWARE ARCHITECTURE & SILICON

The PoE+ power sourcing equipment (PSE) subsystem is integrated directly onto the main switching ASIC companion power management controller, utilizing a per-port 4-pair forced-mode or Alt A + Alt B (Alternative A and Alternative B) power feed architecture. Each Gigabit Ethernet RJ45 interface is backed by a dedicated high-efficiency DC-DC converter with greater than 88% conversion efficiency at full load. The Power Management Integrated Circuit (PMIC) supports both Midspan and Endspan PSE configurations, enabling automatic detection and classification of PDs via resistive signature detection (25kΩ nominal) and IEEE 802.3at Layer 2 classification pulses (class 0–4).

KEY FEATURES & ROUTING LOGIC

- Per-Port Power Budget: Guaranteed 30W sustained output per port for all interfaces simultaneously under nominal system power headroom, with 34W peak short-duration burst support for PD inrush currents.

- Dynamic Power Allocation: The system applies both manual (administrator-assigned) and automatic power reservation modes, reallocating unused power from low-draw PDs to high-demand ports via real-time LLDP Power Negotiation (IEEE 802.3at Mode B).

- Prioritized Shutdown Logic: Four hardware-enforced power priority levels (Critical, High, Medium, Low) ensure that mission-critical PDs remain powered during system overload or primary PSU failure events.

- Overcurrent & Short-Circuit Protection: Independent per-port electronic circuit breaker with 350mA precision current sensing, latching shutdown at 33W, and auto-retry after 120 seconds.

- Cable Length Compensation: Active line resistance compensation for up to 100m of Category 5e/6/6a cabling, automatically increasing PSE output voltage up to 57V to maintain 48V at PD input.

COMPLIANCE & STANDARDS

- IEEE 802.3at-2009 (PoE+ Type 2) – Full compliance including two-event classification.

- IEEE 802.3af-2003 (PoE Type 1) – Backward compatibility.

- IEEE 802.3bt (partial) – Forward-compatible with 60W/90W detection handshake, but limited to 30W delivery.

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

- EN 55032 / CISPR 32 – Class A electromagnetic emissions.

- Energy Efficient Ethernet (IEEE 802.3az) – Reduces idle power on ports without active PDs.

TECHNICAL SPECIFICATIONS

PoE+ Power Budget per Port: 30W continuous, 34W peak (max 500ms)

Total PoE Power Budget (system): 740W (shared across 24 ports) or 370W (shared across 12 ports) depending on chassis configuration

Input Voltage Range: 100–240V AC (50/60Hz) or -48V DC redundant input

Output Voltage (PSE side): 50V–57V DC regulated

Maximum Cable Distance: 100 meters (328 ft) over solid copper 24-26 AWG

Supported PD Classes: Class 0 (15.4W), Class 1 (4W), Class 2 (7W), Class 3 (15.4W), Class 4 (30W)

Classification Method: Resistive signature + Hardware Layer 2 classification

Power Pinout: Alternative A (pins 1,2 / 3,6) + Alternative B (pins 4,5 / 7,8) – 4-pair forced mode

Efficiency at full load: >88% (per port)

MTBF (PoE subsystem): 850,000 hours (Telcordia SR-332, Ground Benign)

Parameter	Specification
Form Factor	1RU Standard 19-inch rack-mountable
Total PoE Power Budget (24-port model)	740W shared
Power Supply	Dual Hot-Swappable Redundant AC (1+1)
Per-Port Max Output Power	30W continuous (IEEE 802.3at compliant)
Peak Surge Support	34W for 500ms
Power Pin Configuration	4-pair Alt A + Alt B forced mode
Operating Temperature	-5°C to +50°C (derate above 40°C)
Power Efficiency	>88% at full load (per converter)


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SFP+ 1-4
SFP+ 1-4
SFP+ 1-4
10G-1-16
SFP+ 1-4
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