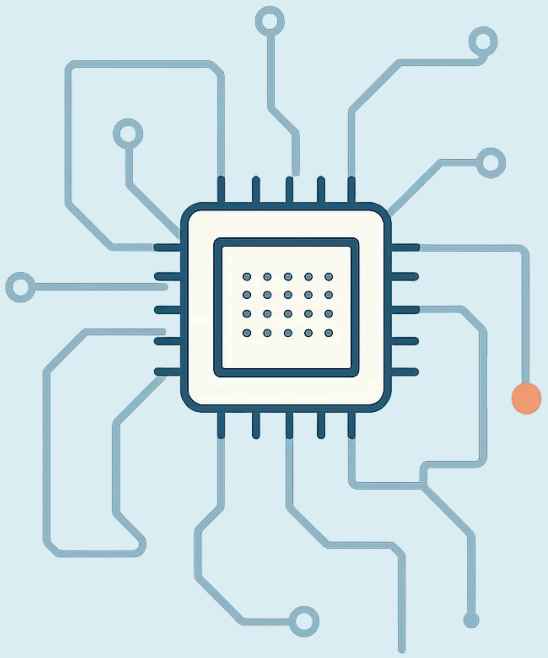


PureSwitch-22919 module

1.5-A, 5.5-V Ultra-Small Load Switch Module with Controlled Rise Time (based on TI's TPS22919 load switch)

Input Voltage

1.6 V to 5.5 V

Max Current

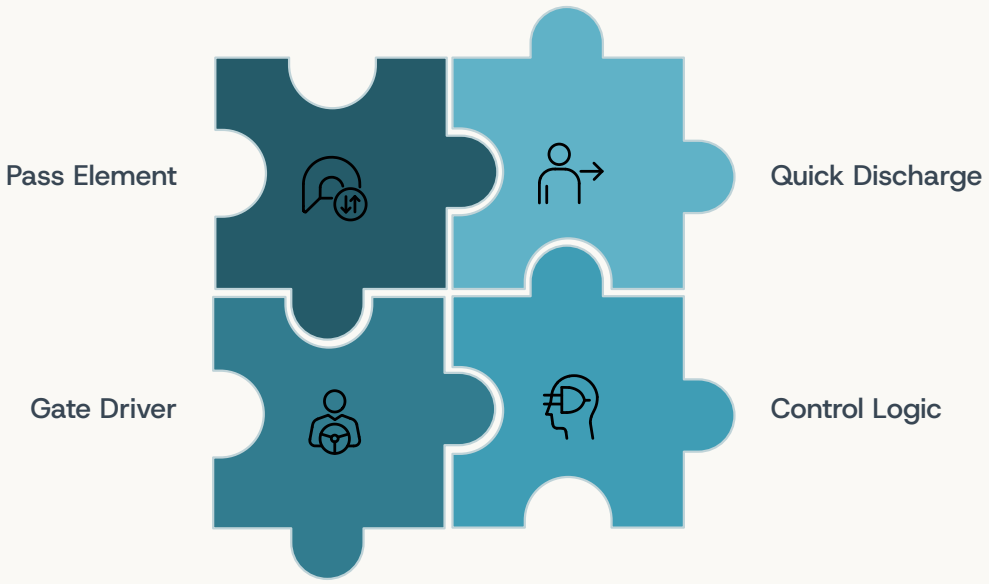
1.5 A continuous

RON

90 mΩ typical at 5 V

Shutdown Current

< 1 µA



Discrete MOSFET vs. Load Switch

The Problem: Discrete MOSFET

A standalone MOSFET turns on in nanoseconds. Large capacitors on loads like the ESP32 cause a massive **inrush current spike**, dropping battery voltage and triggering a microcontroller brown-out reset.

> ⚠ High inrush current can also burn PCB tracks and damage components.

The Solution: TPS22919

The integrated Gate Driver ramps voltage up over **~1 ms** instead of nanoseconds — a "Soft Start" that keeps your power rail stable.

- 5.0 V turn-on: 1.95 ms at 3.2 mV/µs
- 3.6 V turn-on: 1.75 ms at 2.7 mV/µs
- 1.8 V turn-on: 1.5 ms at 1.8 mV/µs

Feature	Discrete MOSFET	TPS22919
Switching Speed	Instant — dangerous for big loads	Controlled — safe for all loads
Logic Level	Often needs 5–10 V gate drive	Works with 1.2 V to 5 V directly
Protection	None — will burn if shorted	Thermal & short-circuit protection
OFF State	Load may float or stay charged	QOD pulls output instantly to 0 V
Leakage	High in cheap MOSFETs	Ultra-low: 2 nA typical

Use Cases

Battery-Powered IoT

2 nA shutdown leakage preserves battery for months. GPIO-compatible from 1.2 V to 5.5 V — no level shifters needed.

Power Sequencing

Stagger enable signals across multiple modules for precise power-up/down order. QOD prevents floating voltages and system hangs.

WiFi & USB Protection

Controlled rise time (~930 µs at 5 V) prevents inrush spikes. Self-protection limits current to 3 A and triggers thermal shutdown on a short.

Compact Integration

90 mΩ RON minimises voltage drop. Replaces MOSFETs, gate resistors, and discharge resistors in a single 13 × 19 mm footprint.

Enhanced Quick Output Discharge (QOD)

The **PureSwitch 22919** includes an onboard **180 Ohm (Plus internal 24 Ohm) external discharge resistor**. When the control signal (**Ctl**) is pulled LOW, the module doesn't just "stop" providing power; it actively pulls the **Vout** rail to Ground.

The Key advantages of QOD are:

- Reliable Power-Down Sequencing
- Elimination of "Ghost" Voltages and Residual Charge
- Managed Discharge even during Power Loss

Why This Matters:

- **Sensor "Hang":** Some sensors don't reset properly unless the voltage hits absolute **0V**.
- **Ghosting:** LEDs that stay dimly lit for seconds after power is cut.
- **Uncertain States:** Digital logic pins might stay at a "half-high" voltage, causing unpredictable behavior.

QOD Discharge: Internal 24 Ω + external 180 Ω = **204 Ω total RDIS**. A 10 µF capacitor bank discharges in approximately **4.5 ms**. Formula: $t_{\mathrm{FALL}} \approx 2.2 \times (R_{\mathrm{DIS}} \parallel R_L) \times C_L$

Summary of Advantages

Controlled Rise Time

Student: Stops resets when powering motors or WiFi.
Professional: Prevents power supply droop and EMI issues.

Quick Output Discharge

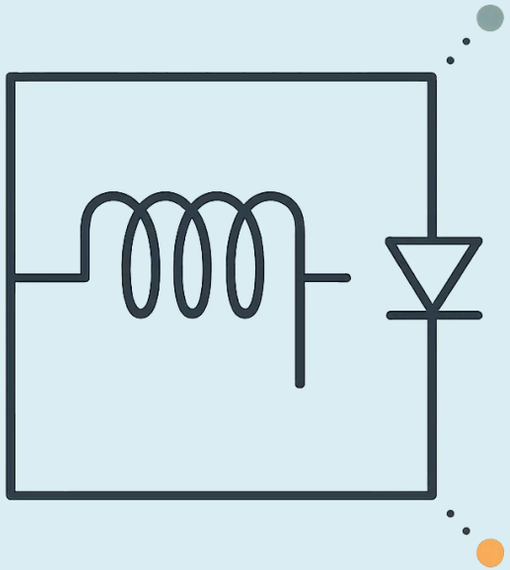
Student: Sensors truly turn off for a clean reset.
Professional: Critical for strict shutdown power sequencing.

Short-Circuit Protection

Student: Saves USB ports from wiring errors.
Professional: Protects expensive downstream modules.

Low Power Consumption

Student: Maximum battery life for set-and-forget projects.
Professional: High efficiency for energy-star rated electronics.



Integrated Inductive Load Protection

The RS-TMP6331-100K module includes a high-speed **Reverse Schottky Protection Diode (D1)** in the output stage — expanding its utility beyond sensing to direct inductive load control.

Back-EMF Suppression

When driving a relay or solenoid, the Schottky diode acts as a **Freewheeling (Flyback) Diode**, safely clamping high-voltage inductive spikes generated at switch-off — protecting your MCU or driving transistor.

Direct Relay Control

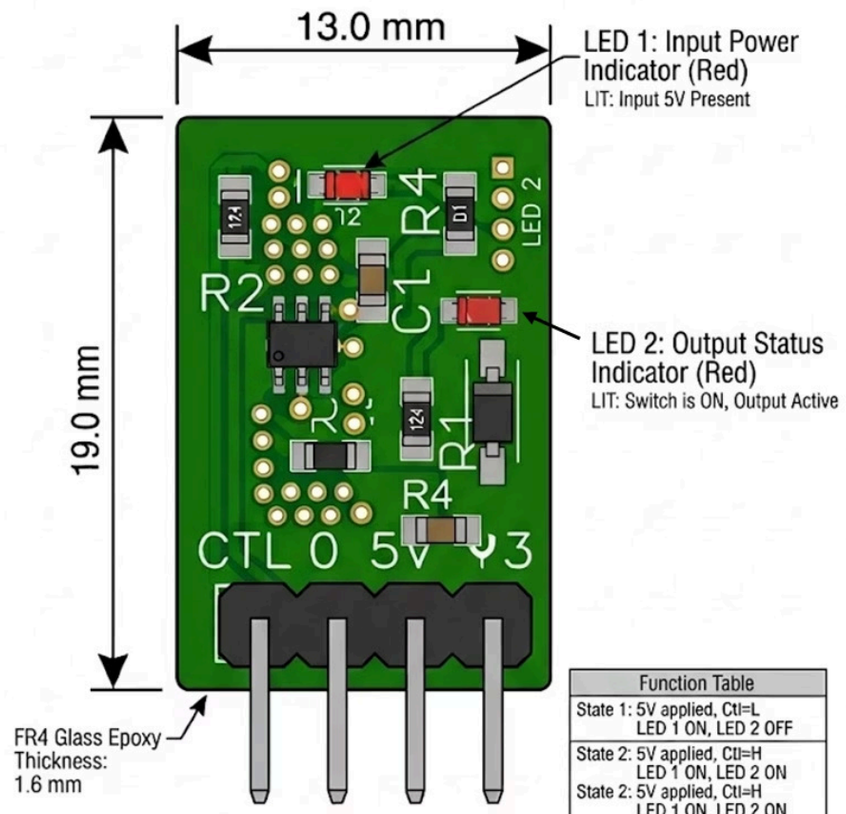
Built-in protection means the signal output can be directly integrated into **low-side switching circuits** for thermal-controlled relays — no external protection components required.

- on-board **Schottky freewheeling diode** integrated into the signal output. This allows the module to safely interface with inductive loads—such as relays or solenoids—by clamping high-voltage back-EMF spikes.

Ramanu Systems

PureSwitch 22919 Load Switch Module

Datasheet Revision 1.1



Function Table
State 1: 5V applied, Ctl=L LED 1 ON, LED 2 OFF
State 2: 5V applied, Ctl=H LED 1 ON, LED 2 ON
State 2: 5V applied, Ctl=H LED 1 ON, LED 2 ON

Pinout and Pin Definition			
Pin 1	Pin 2	Pin 3	Pin 4
Ctl	GND	5V	Vout
Control Input, Active High. Logic Level: 1.2V - 5V	Ground Connection	Input Voltage Rail (V_{IN})	Switched Power Output

Module Pinout and Outline