APPLICATION NOTE · AN-TXFLASH-01

Automotive Transmitter Triggered by a Headlight Pulse

Battery-free gate-opener module — powered by the vehicle high beam — 433.92 MHz RF transmitter with EETX433A

Application guide for an in-vehicle transmitter that opens gates and barriers with a flash of the high beam. Powered directly from the high-beam lamp (12/24 V), it needs no battery and never leaves the vehicle.

FREQUENCY	RF POWER
433.92 MHz	13 dBm

POWER	BATTERY
Headlight 12 / 24 V	None

VERSION	BASED ON IC	DEVELOPED BY	DATE
v1.0	EETX433A	Engeletron Engenharia	2026-07-04

Introduction

This application note describes how to build an **automotive gate-opener transmitter** triggered by a **high-beam pulse**, using the **EETX433A** multifunction transmitter. Instead of a battery-powered handheld remote, the module is wired to the high-beam lamp circuit and powered by the same voltage that lights the lamp. A flash of the high beam near the gate transmits the RF code and opens it.

The EETX433A integrates a 433.92 MHz PLL oscillator, OOK/ASK modulator, power amplifier and the encoding logic in a single SOP-8 package. An input stage (rectifier bridge + 3.3 V LDO regulator) adapts the vehicle voltage (12 V in cars and motorcycles, 24 V in trucks), tolerates either connection polarity and dispenses with internal batteries.

The product goal is a transmitter that **never leaves the vehicle** and **never needs a battery change**. The IC electrical details (pinout, absolute ratings, operating conditions, RF frame format and code mapping) are given in the EETX433A datasheet and referenced throughout this document.

Operating Principle

The module input is wired to the high-beam circuit: the **positive** wire to the high-beam feed (fuse/positive of the headlight) and the **negative** wire to the vehicle chassis ground. When the driver flashes the high beam, the lamp voltage appears at the input, powers the module and triggers the transmission.

The input stage makes the circuit robust in the automotive environment: the **rectifier bridge** makes the module immune to connection polarity and rectifies the pulse; the **3.3 V LDO regulator** converts the 12/24 V from the headlight into the EETX433A operating voltage, with filter capacitors against spikes and noise from the vehicle electrical system. The presence of the high-beam voltage generates a rising edge (0→1) on the **SENIN** pin, which triggers the RF code (the same trigger mechanism used by the magnetic sensor modes).

A brief flash (recommended to hold for **≥ 2 s**) guarantees the complete transmission: wake-up (~50 ms) + PLL settling (~0.2 ms) + the RF packets. If the high beam is left **on continuously** (e.g. night driving), transmission is **automatically cut after ~5 s**, avoiding continuous emission; to transmit again, turn the high beam off and flash again. With the headlight off, the module is completely unpowered — **zero drain** on the vehicle battery.

Wiring Scheme

The module is wired in parallel with the high-beam lamp and powered by it. The input stage protects the EETX433A and adapts the vehicle voltage:

- **Input (J1):** two wires — the positive goes to the high-beam circuit (fuse/positive of the headlight) and the negative to the chassis ground.
- **Rectifier bridge:** lets the module work regardless of connection polarity and rectifies the headlight pulse.
- **3.3 V LDO regulator:** converts the 12/24 V from the headlight into the EETX433A operating voltage, with filter capacitors for spikes and noise from the vehicle electrical system.
- **Trigger:** the presence of the high-beam voltage drives the SENIN pin high (0→1 edge), triggering transmission of the code.

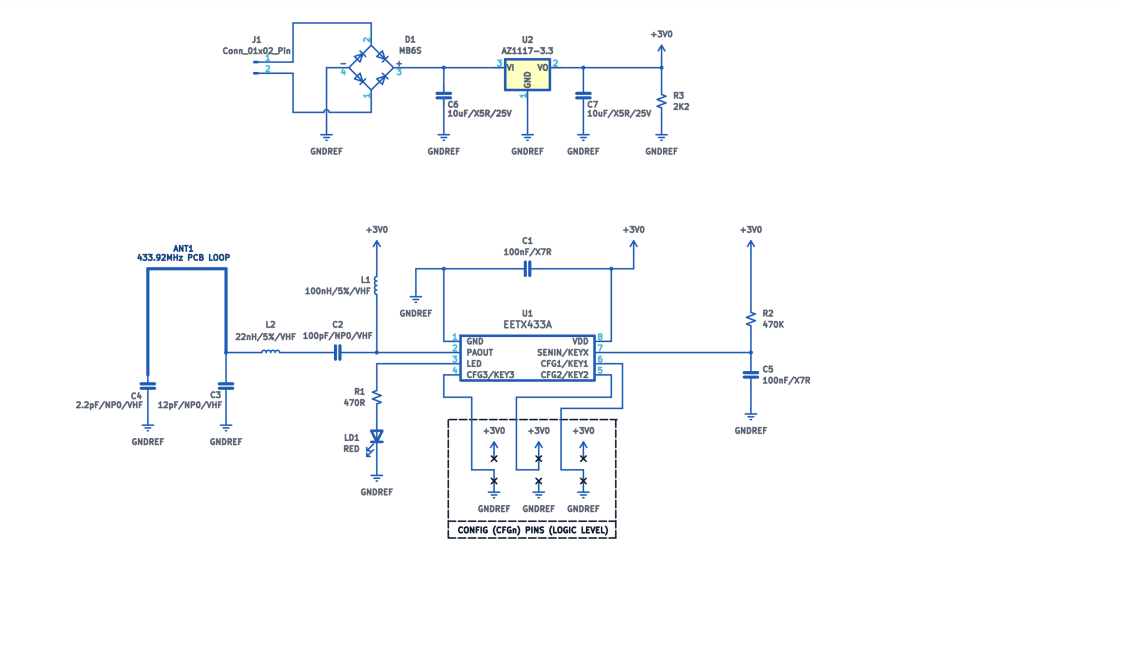

Figure 1: Transmitter powered by the high beam — rectifier bridge + 3.3 V LDO + EETX433A (433.92 MHz PCB antenna)

Configuration (CFG Pins)

The transmitter uses the same configuration as a magnetic sensor: the CFG pins select the code and the SENIN pin is the trigger input (here, the presence of the high beam). Since there is a single event — the trigger — the Smart mode (open/close) is not used; only the violation modes:

MODE	FUNCTION	CFG3	CFG2	CFG1	SENIN
1	Trigger (Violation)	0	0	1	Trigger
2	Trigger (Violation)	0	1	0	Trigger
6	Trigger (Violation)	1	1	0	Trigger

> The CFG pins are sampled only at power-up (at each flash, when the module is energized). The code is set at the factory. Mode 3 (Smart open/close) and low-battery signaling do not apply — the module is vehicle-powered and has no battery.

Transmitted Events and Codes

At each flash, the 4-bit data field (D3D2D1D0) transmits the trigger code according to the configured mode:

MODE	FUNCTION	Event (flash)	Code (4 bits)
1	Violation	Trigger	0001 (1)
2	Violation	Trigger	0011 (3)
6	Violation	Trigger	0010 (2)

The code differs between modes, allowing distinct units to be pre-programmed to trigger different receivers/gates. The unique 20-bit address identifies each module at the receiver. There is no closing event and no low-battery event in this application.

Operating Sequence

The sequence starts when the high beam is switched on and the module is powered. The LED indicates transmission. There is no need to hold the high beam on — one pulse is enough.

Phase	Condition	Behavior	LED
Idle	High beam off	Module unpowered — zero drain on the vehicle battery	Off
Power-up	High-beam flash	Bridge + LDO supply 3.3 V; wake-up ~50 ms + PLL ~0.2 ms	—
Transmission	High beam present · SENIN 0→1	Sends the trigger code; hold the flash ≥ 2 s for the full packet	Blinks on transmit
Auto cutoff	High beam continuous	Transmission stops after ~5 s to avoid continuous emission	Off after cutoff
Re-arm	Turn off and flash again	Switch the high beam off and flash again to transmit once more	—

PRACTICAL USE

As you approach the gate, flash the high beam (~2 s) to trigger — a single pulse is enough. If you drive with the high beam continuously on, the module cuts transmission after ~5 s, so the transmitter is not emitting while you drive. For a new trigger, turn off and flash again.

Transmitted RF Signal

Transmission follows the EETX433A packet format: pulse-width OOK encoding at 433.92 MHz, basic time unit λ = 500 µs (each bit takes 3λ = 1.5 ms). Each packet carries pilot, start, 20 bits of programmable address (factory-unique), 4 bits of data and 4 bits of fixed anti-code, totaling 108λ ≈ 54 ms, repeated while the trigger is active, up to the ~5 s limit.

In the headlight trigger, the 4-bit data field carries the trigger code of the configured mode (see Events and Codes). The 20-bit address identifies the module at the gate receiver. See the EETX433A datasheet for the full frame structure and code mapping.

Technical Characteristics

Values for the complete transmitter module (EETX433A IC + input stage). Power comes from the high-beam lamp; there is no battery.

Parameter	Value
Operating frequency	433.92 MHz
Channels	1
Modulation	OOK / ASK
RF power (typ.)	13 dBm
Input power	High beam 12 V (cars/motorcycles) / 24 V (trucks)
Polarity immunity	Rectifier bridge (any polarity)
Internal regulation	3.3 V LDO
Battery	None — powered by the headlight
Idle consumption	Zero (unpowered with the headlight off)
Transmit current	12 mA @ 3.3 V
Trigger	Presence of the high beam (0→1 edge on SENIN)
Recommended flash	≥ 2 s (full transmission)
Transmission cutoff	≈ 5 s (continuous high beam)
Available modes	1, 2, 6 (violation)
IC package	SOP-8

IC RF per the EETX433A datasheet (13 dBm). The input stage (bridge + LDO) adapts the headlight voltage and protects the EETX433A against reverse polarity and transients from the vehicle electrical system.

Soldering and Reflow

Excess temperature can damage the EETX433A, causing thermal deformation of the package and a shift of the 433.92 MHz frequency. Therefore, use **low-temperature solder-paste alloys** and limit the peak to **≤ 210 °C for ≤ 10 s**.

The lead-free alloy **SnBi — Sn42Bi57Ag1** (180 °C peak, RoHS) is recommended. The **SnPb — Sn63Pb37** alloy (210 °C peak) is only the **absolute maximum limit** reference — never exceed 210 °C.

> **CRITICAL TEMPERATURE LIMIT**
>
> NEVER exceed a **210 °C** peak or **10 s** at peak. Above 210 °C the SOP-8 suffers thermal deformation and frequency drift. Always prefer the low-temperature alloy (SnBi).

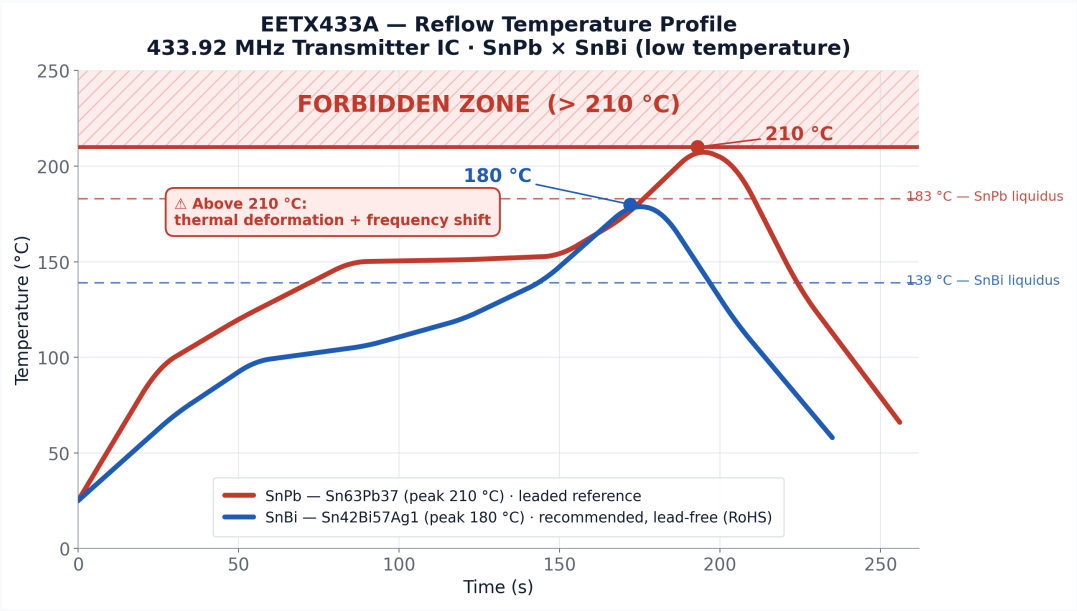

Figure: Reflow temperature profile — SnBi (recommended) × SnPb (max. limit 210 °C)

Soldering and Reflow

Phase	SnPb · t (s)	SnPb · T (°C)	SnBi · t (s)	SnBi · T (°C)
Ramp-up	0–90	25→150	0–60	25→100
Preheat (soak)	90–150	~150	60–120	100→120
Ramp to peak	150–190	150→210	120–170	120→180
Peak (reflow)	190–200	210 (≤10 s)	170–180	180
Cooling	200–255	210→70	180–235	180→60

SnBi (Sn42Bi57Ag1, lead-free, RoHS) — recommended. SnPb (Sn63Pb37) is the leaded reference; 210 °C is the absolute maximum limit. Ramp-up ~1.2–1.4 °C/s · cooling ≤ 3–4 °C/s · max. 2 reflow cycles. Hand soldering (samples): tip ≤ 300 °C, contact ≤ 5 s.

Installation and Guidelines

- **Electrical connection:** connect the module's positive wire to the high-beam circuit (fuse/positive of the headlight) and the negative wire to the chassis ground, as close as possible. A high-beam flash should power the module.
- **Fuse and safety:** respect the vehicle headlight wiring and fuse and do not overload the circuit. Installation must follow the vehicle manufacturer's electrical rules.
- **Maintenance-free:** the module has no battery and stays in the vehicle — it never needs recharging or a battery change.
- **Coding:** each module has a factory-unique address; learn it into the gate receiver. The same module can be enrolled in more than one gate (compatible receivers on the same frequency).
- **Operation:** approach the gate and flash the high beam. Avoid driving with the high beam continuously on near the gate; transmission is cut after ~5 s.
- **Antenna:** use the printed 433.92 MHz loop antenna per the reference schematic and the datasheet; position the module avoiding large metal masses over the antenna.

To learn more about the EETX433A and obtain the full datasheet, visit: **engeletron.com.br**