Chirp-IoT™ Long-range Wireless Transceiver Module

SPECIFICATION

Model No.: DL-PAN3029-S

Version: V1.0

DL-PAN3029-S
433/868/915MHz

Before using this module, please pay attention to the following important matters:

This module is an electrostatic sensitive product. Please operate it on an anti-static workbench during installation and testing.

This DL-PAN3029-S module uses an external antenna by default, which is intended to be embedded in your product or application, and does not provide a casing itself. The antenna can be a wire antenna or a standard UHF antenna. You can choose a specific antenna according to the actual situation.

Metal objects and wires should be kept away from the antenna as much as possible. If the product uses a metal shell, be sure to install the antenna outside the metal shell. Otherwise, the RF signal will be seriously attenuated, which will affect the effective distance.

Disclaimer:

This specification is just for your information, all the charts and pictures used in this specification are for reference only. The actual test shall prevail for details. We do not assume any responsibility for personal injury or property loss caused by user's improper operation.

This specification is subject to change due to the continuous improvement and upgrading of the product version, and the latest version specification shall prevail. DREAMLNK reserves the right of final interpretation and modification of all contents in this specification.

Date	Version	Formulation / Revision of Contents	Approved by
2024-1-17	V1.0	DL-PAN3029-S Standard RF Module	Fagan Xu

1. Module Introduction

1.1 Brief Introduction

DL-PAN3029-S is a wireless module designed based on **PANCHIP**'s radio frequency chip **PAN3029**. The power supply of this module adopts a chip integrated DCDC working mode, which can greatly reduce power consumption in various modes. It is equipped with a built-in temperature compensation crystal, which can effectively reduce temperature drift and ensuring more stable transmission. This Wireless Module is compact in size, and has the characteristics of ultra-low receiving power consumption, strong anti-interference ability, and longer transmission distance.

Moreover, DL-PAN3029-S RF module adopts the new generation Chirp IoT ™ Modulation technology, which has strong anti-interference ability and long communication range. The TX power can be configured through software, and the maximum TX power can reach +20dBm. It also has a high sensitivity of -141dBm and a receiving current of less than 5.9mA, when it works as a receiver. The frame structure of this RF chip has added MAPM function, allowing data frames received from addresses other than their own to be directly discarded and enter sleep mode, which can further optimize the device power consumption at the receiver end.

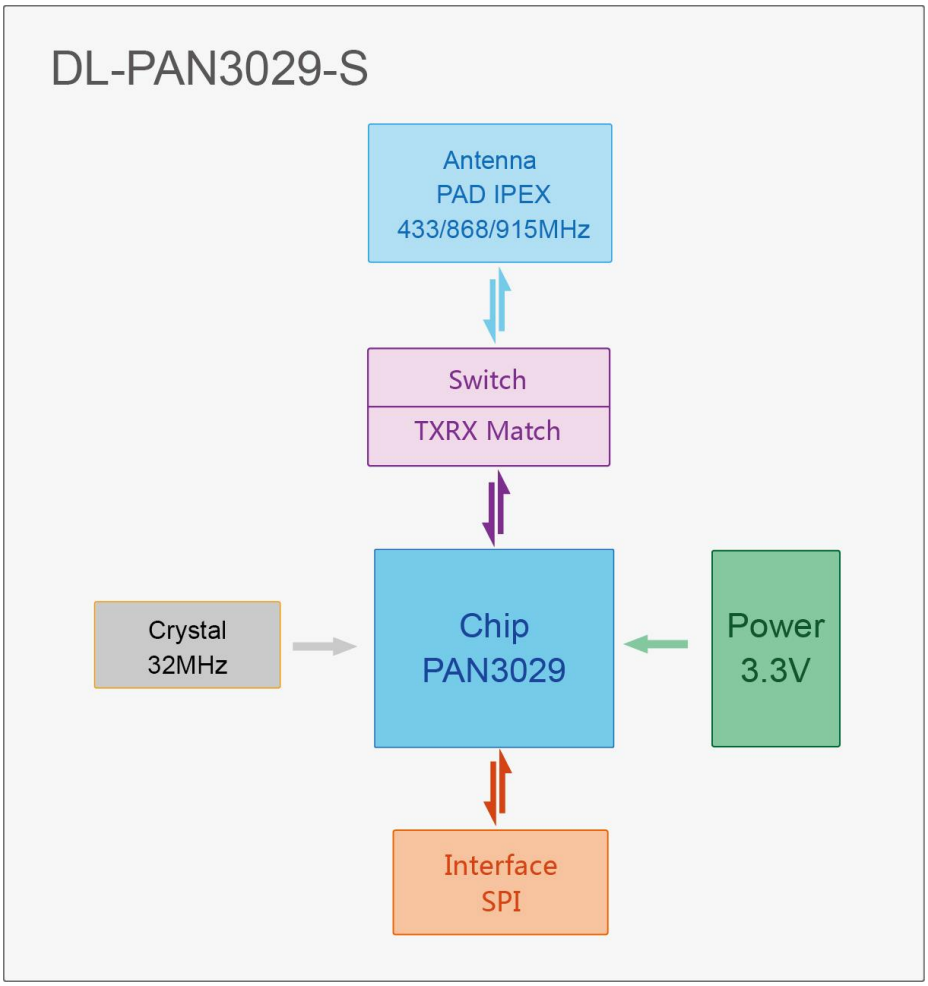
Compared with traditional modulation technology, Chirp-IoT ™ Modulation technology has obvious advantages in adjustable bandwidth, spread spectrum factor and error correction rate, which solves the problem of distance, anti-interference and power consumption that traditional design schemes cannot take into account at the same time. It can be widely used in various wireless communication fields of the IoT industry, especially battery powered applications, as well as long-distance communication projects.

1.2 Features

- Chirp-IoT ™ modulation technology;
- It supports frequency range of 408~565MHz; 816~1080MHz;
- Designed frequency (use recommended frequency to achieve the best RF performance): 408~565MHz --> 433M module; 816~1080MHz --> 868/915M module;
- The working voltage is 2.0~3.6V, use stable voltage (≥2.4V) to maximum output power;
- Supported bandwidth: 62.5KHz, 125KHz, 250KHz, 500KHz;
- Supported spreading factor: SF5/SF6/SF7/SF8/SF9/SF10/SF11/SF12;
- Supported Bit Rates: 4/5, 4/6, 4/7, 4/8;

- Supports fast Channel Activity Detection (CAD);
- Supports low-rate mode;
- Optional passive/temperature compensated crystals;
- Supports 3/4-line SPI configuration interface;
- Operating temperature: -40~85 C;

1.3 Circuit Schematic Diagram



Circuit Schematic Diagram (DL-PAN3029-S)

1.4 Typical Application

- Wireless automatic meter reading (water meter, electric meter, gas meter)
- Ultra-long range data communication
- Smart home system
- Intelligent security monitoring
- Smart building

- Industrial controllers, sensors
- Agricultural automation solutions
- Intelligent parking system
- Automotive industry applications
- Supply chain logistics

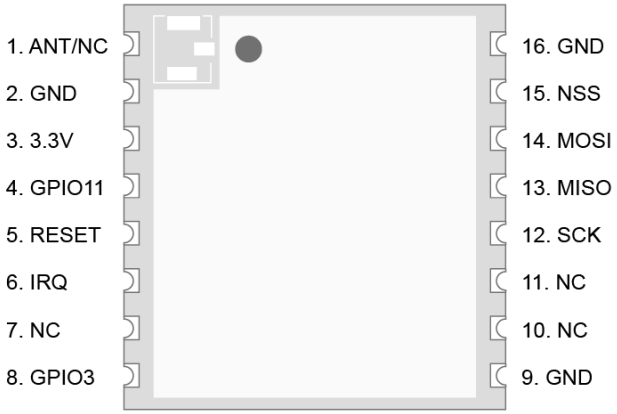
2. Technical Parameter

Parameter	Min.	Typical	Max.	Unit	Remarks
Operating conditions					
Working Voltage (VDD)	2.0	3.3	3.6	V	@DCDC mode 2V~3.6V, to ensure maximum chip power, stable voltage should ≥2.4V
Communication Level Range	-0.3		VDD	V	Exceeding this range will damage the chip
Working Temperature Range	-40	25	85	℃	The larger the temperature difference, the greater the bandwidth required for communication
Current consumption					
Receiving Current	5	5.6	5.9	mA	@DCDC @ Active crystal (default)
	4	4.7	4.9	mA	@DCDC @ Passive crystal
Transmission Current	115	125	145	mA	@433MHz @DCDC @ANT TX 20dbm
	95	110	135	mA	@868MHz @DCDC @ANT 50-ohm impedance; TX 18dbm
	95	110	135	mA	@915MHz @DCDC @ANT 50-ohm impedance; TX 18dbm
Sleep Current	0.1	0.5	0.7	uA	Save via register
RF parameters					
Recommended Frequency (For best performance)	420	433/470	490	MHz	@433MHz RF module
	840	868/915	930	MHz	@868MHz/915Mhz RF module
Transmit Power Range	-30	20	20	dBm	Software configurable
Receiving Sensitivity		-141		dBm	@BW=62.5KHz, SF=12
Payload Rate Range	0.15		62.5	Kb/s	L: BW:62.5, SF:12, CR:4/5 H: BW:500, SF:5, CR:4/5

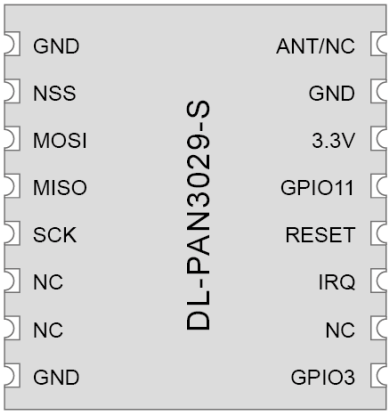
Communication Rate Range	0.04	0.04	0.04	Kb/s	@BW:62.5, SF:12, CR:4/5 (Min. Rate) Payload: 10byte Preamble: 8byte
	59.33	59.33	59.33	Kb/s	@BW:500, SF:5, CR:4/5 (Max. Rate) Payload: 255byte Preamble: 8byte

Table 1: Technical Parameter

3. Pin Diagram



Front Side



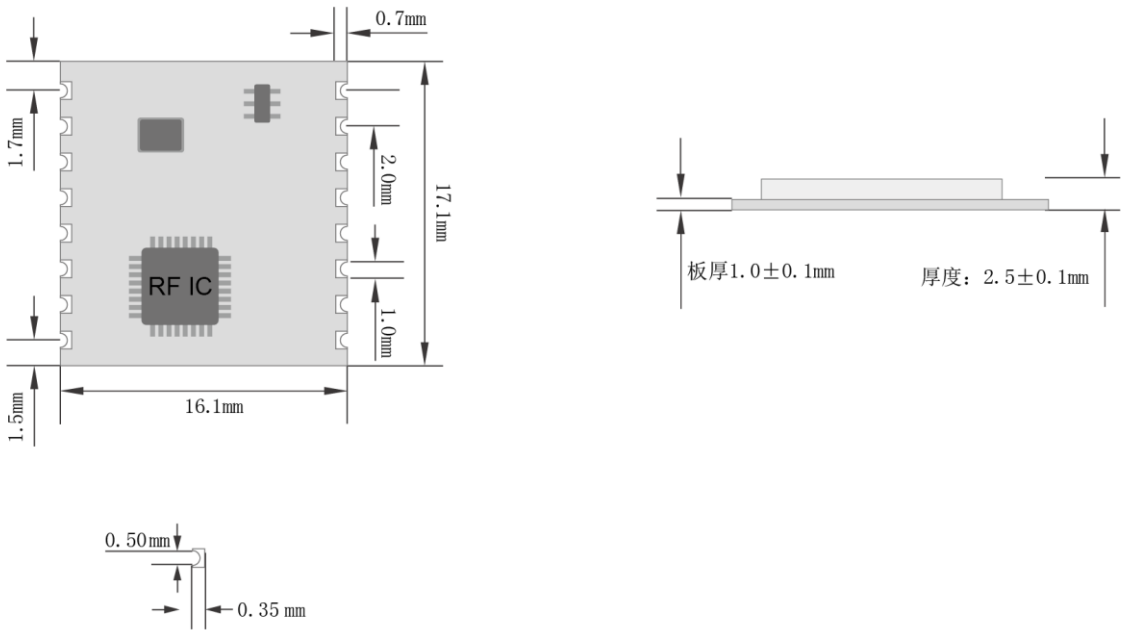
Back Side

No	Definitions	Type	Description
1	ANT/NC	AI/AO	RF signal input/output port, π-matching circuit must be reserved; Adopt 50Ω impedance matching for RF routing, route the ground and add via holes around it
2	GND	PWR	Reliable grounding
3	3.3V	PWR	Power
4	GPIO11	I/O	Digital I/O port
5	RESET	I	Reset pin, effective at low level
6	IRQ	O	Interrupt Request Pin, high level active
7	NC		No connection
8	GPIO3	I/O	Digital I/O port
9	GND	PWR	Reliable grounding
10	NC		No connection
11	NC		No connection

12	SCK	I	SPI Serial Clock Input
13	MISO	O	SPI Master Input Slave Output
14	MOSI	I	SPI Master Output Slave Input
15	NSS	I	SPI Chip Select Input
16	GND	PWR	Reliable grounding

Table 2: Pin Definitions

4. Module Size & SMT



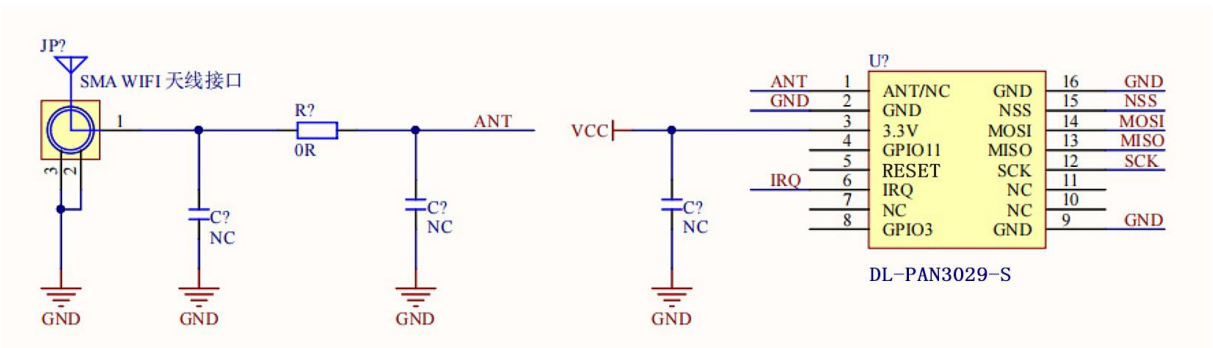
Please apply for module packaging from our technical support: SMT patch package (refer to schematic diagram)

Package files format description:

* .ASC format can be opened with Protel99se;
* .DXF format can be opened with CAD;
* .PCB format can be opened with PADS software;

Module packaging: SMT placement (steel mesh thickness ≥1.2mm)

5. Application Connection Diagram



Note: This schematic diagram is for your reference only, it shows the minimum communication connection. The 4-line SPI and IRQ pins need to be connected to the I/O port of the MCU. If you have any question, please contact us for more help.

5.1 I/O design

● When doing the hardware design, for the data packet mode (SPI transmission), the general SPI interface, and IRQ interfaces should be connected to the GPIO of the MCU;

● The software obtains the interrupt event of the chip by polling IRQ; IRQ pin is valid at high level; Interrupt type: send/receive completion interrupt, CRC error interrupt, etc., please refer to <PAN3029-PAN3060 product manual.pdf> 8.4 IRQ Interrupt to know more.

● Regarding the electronic switch of the transceiver mode:

The chips GPIO10(RXEN) and GPIO0(TXEN) are designed as the switch control of antenna switching by hardware, and the antenna switching is automatically completed inside the module;

● CAD mode is a must, if you want to achieve low power consumption. By default, the SDK sets GPIO11 as the channel status indication signal.

6. Circuit Design

6.1 Power Supply Design

● Please pay attention to the power supply voltage of the device, exceeding the recommended voltage range may cause function abnormally and permanently damage;

● Try to use a DC stabilized power supply, and the power ripple coefficient should be as small as possible; the power load when transmitting the maximum power needs to be also considered;

● The module needs to be grounded reliably, and a good grounding can achieve better performance output and reduce the impact of RF on other sensitive devices.

6.2 RF Routing Design

● The module should be far away from RF interference sources, such as high-frequency circuit transformer, and please do not directly route at the lower layer of the RF module. Otherwise, the receiving sensitivity may be affected;

● When using the on-board antenna, the antenna needs to be clear on both sides, and the ground should not be too close to the antenna at the same time, otherwise it will absorb the radiated energy;

● Route 50Ω impedance line, lay the ground and add more via holes around it

● If there is enough space on your PCBA, please reserve a π-type matching circuit, and it needs to be placed as close to the chip end as possible, please make it grounded and add via holes around it. Do remember to connect it through a 0R resistor, otherwise the antenna will open circuit; SMA ANT circular through-hole requires clearance treatment

6.3 Antenna Design

● There are many types of antennas, please choose the appropriate antenna according to your needs;

● Choose a suitable position to place the antenna, according to the antenna polarity. And it is recommended to be vertically upward;

● There should be no metal objects in the antenna radiation path, otherwise the transmission distance will be affected (such as a closed metal casing).

6.4 Wireless interference

For high-power wireless transmission, wireless interference may occur, which may affect the functions of some sensitive circuits, such as amplifiers, ADCs, RESETs, and data pins with low driving force. This situation has a significant impact on high-power transmission at 20dbm and above. The interference mainly comes from the antenna power being amplified and coupled to longer lines or devices through conduction or radiation. Therefore, when making the hardware design, the signal routing should be as short as possible; when using high power, try to use external antennas as much as possible, stay away from PCB sensitive devices, and add 100pF ground capacitance in sensitive device circuits to filter out high-frequency interference in low-speed signals to reduce wireless interference in other circuits.

7. Software Debugging Process

7.1 The SDK is transplanted according to the demo program, and you can connect the HAL interface according to the MCU you use;

7.2 Make two verification PCB boards to complete the communication verification (both transmitting and receiving), according to the Demo Program;

7.3 After communication normally set up, you need to optimize the modulation parameters, and change the spreading factor, bandwidth and other parameters according to your needs to control the code transmission time (related to the symbol time) and communication distance;

Modulation Bandwidth (BW_L)	The higher the BW, the faster the modulation rate, but the larger the signal bandwidth will reduce the sensitivity of the receiver
Spreading Factor (SF)	The higher SF can increase the sensitivity of demodulation and increase the distance, the disadvantage is that it will greatly increase the transmission time
The Coding Rate (CR)	In the case of severe interference, it can increase the anti-interference, but the disadvantage is that the coding efficiency will be reduced and the baud rate will slow down. Under normal circumstances, the default CR = 4/5 can be used.

Table 3: Commonly Used Debugging Parameters

7.4 The maximum transmit power can be +20dbm, to ensure the largest link budget;

7.5 If low power consumption is required, you can use the API interface of the Demo

7.6 In Chirp-IoT™ mode, the corresponding table between the symbol time sent by the spreading factor and the bit rate of the actual payload is as follows:

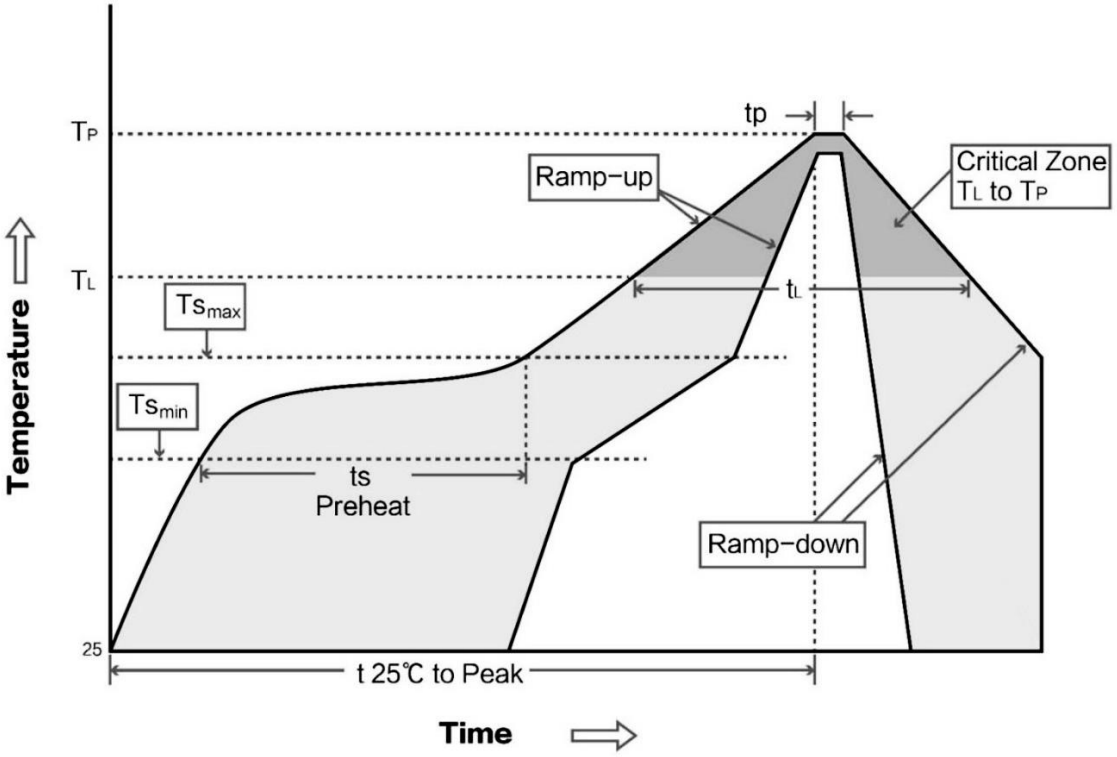
BW / SF	62.5		125		250		500	
	Symbol tim (ms)	Rate (kbps)	Symbol tim (ms)	Rate (kbps)	Symbol tim (ms)	Rate (kbps)	Symbol tim (ms)	Rate (kbps)
5	0.51	7.81	0.26	15.63	0.13	31.25	0.06	62.50
6	1.02	4.69	0.51	9.38	0.26	18.75	0.13	37.50
7	2.05	2.73	1.02	5.47	0.51	10.94	0.26	21.88
8	4.10	1.56	2.05	3.13	1.02	6.25	0.51	12.50
9	8.19	0.88	4.10	1.76	2.05	3.52	1.02	7.03
10	16.38	0.49	8.19	0.98	4.10	1.95	2.05	3.91
11	32.77	0.27	16.38	0.54	8.19	1.07	4.10	2.15
12	65.54	0.15	32.77	0.29	16.38	0.59	8.19	1.17

Table 4: Symbol time and bit rate

Note: The payload data refers to the data you actually transmit, but the actual transmission time includes not only the payload, but also the preamble, the header, its encoding rate, and the check digit of the payload. The actual data rate can be calculated by the PAN3029 calculator.

8. Welding Operation Guidance

8.1 Reflow Soldering Curve Chart



8.2 Reflow Soldering Temperature

IPC/JEDEC J-STD-020B the condition for lead-free reflow soldering	Big size components (thickness ≥ 2.5 mm）
The ramp-up rate (Tl to Tp)	**3℃/s (max.)**
Preheat Temperature	
- Temperature Minimum (Tsmin)	150℃
- Temperature Maximum (Tsmax)	200℃
- Preheat Time (ts)	60~180s
Average ramp-up rate (Tsmax to Tp)	**3℃/s (Max.)**
- Liquidous temperature (TL)	217℃
- Time at liquidous(tL)	60~150 second
Peak Temperature (Tp)	**245+/-5℃**

9. Notice for module application

(1) This module is an electrostatic sensitive product. Please operate on an anti-static workbench during installation and testing;
(2) When installing the module, make sure that nearby objects keep a sufficient safe distance from the module to prevent short-circuit damage;
(3) Liquid substance is not allowed to come into contact with this module, and this module should be used in a dry environment;
(4) Please use an independent voltage stabilizing circuit to supply power to this module, and avoid sharing with other circuits. The tolerance of the power supply should not be less than 5%.
(5) The indicators of this module are accord to commonly used international standard. If special certifications needed, we can adjust certain indicators according to your needs.

10. Model Selection Table:

Model No.	Picture	Feature	Frequency
DL-PAN3029-S-433S		With Metal Shield	433MHz
DL-PAN3029-S-868S		With Metal Shield	868MHz
DL-PAN3029-S-915S		With Metal Shield	915MHz

11. Contact us

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★ Data collection, Smart home, Internet of Things applications, Wireless remote control technology, Remote active RFID, Antennas ★

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