

16路LED驱动器和GPIO控制器

16-CHANNEL LED DRIVER AND GPIO CONTROLLER

■ FEATURES

- Power supply range : 2.5V~5.5V
- 16 multifunctional IOs, capable of LED driving (current-source dimming) or GPIO
- 256 steps linear dimming in LED mode
- Any IO can be configured as an input or an output independently
- Interrupt function, 8 μ s deglitch, active low
- Standard I²C interface, 4 programmable device addresses
- 1.8V/3.3V logic input (SDA, SCL, RSTN, IO)
- Shutdown function, active low
- Support 2 intelligent breathing mode: blinking and fading, breathing time is adjustable
- Pb-free Packages, QFN4 \times 4-24L
- 供电范围: 2.5V~5.5V
- 16个多功能IO, 支持LED驱动或GPIO (电流源调光)
- LED模式下具有256阶线性调光
- 任意IO可配置为独立的输入或输出
- 中断功能, 8 μ s防抖, 低电平有效
- 标准I²C接口, 4个I²C器件地址可选
- 支持1.8V/3.3V逻辑电平(SDA, SCL, RSTN, IO)
- 具有关断功能, 低电平有效
- 支持两种智能呼吸模式: Blinking模式和Fading模式, 呼吸时间可调, 智能呼吸模式节省主控芯片功耗
- QFN4 \times 4-24L, 无铅封装

■ APPLICATIONS

- Cell Phone
- Speakers
- Other Consumer electronics
- 手机
- 音箱
- 其他消费类电子产品

■ DESCRIPTION

HTR3316 is a 16 multifunctional LED driver and GPIO controller with 2.5V~5.5V power supply. Any of the 16 IOs can be configured as LED mode or GPIO mode. Meanwhile, any GPIO can be configured as an input or an output independently.

After power on, all the 16 IOs are configured as GPIO output as default, and their default states are decided by AD0 and AD1. When the IOs are configured as inputs, they are continuously monitored for state changes with 8 μ s deglitch. State changes are indicated at the INTN output. Once the GPIO state are read through the I²C interface, the INTN output is cleared.

When the IOs are configured as LED mode, the LED driver's current, divided by 256 steps linear dimming, can be set between 0~I_{MAX} by I²C interface. The default maximum current (I_{MAX}) is 37mA, and I_{MAX} can be changed in GloCTL register.

HTR3316 supports breathing function to implement different lighting effects in an much easier way with two modes: blinking mode and fading mode.

HTR3316 is available in QFN4 \times 4-24L package.

HTR3316是一款16路多功能LED驱动器和GPIO控制器, 2.5V~5.5V电源供电。16个IO端口中的任何一个都可以配置为LED模式或GPIO模式。此外, 任何GPIO都可以单独配置为输入或输出。

通电后, 16个IO端口配置默认为GPIO输出, 默认状态根据AD0和AD1决定。所有配置为输入的IO端口都会持续监控状态变化, 并具有8 μ s的防抖动时间, IO口的变化由INTN输出指示。当GPIO状态通过I²C接口被读取时, INTN输出被清除。

当IO端口配置为LED模式时, 可以通过I²C接口将LED驱动器的电流设置在0~I_{MAX}之间, 并可以以该值除以256步进行线性调光。默认最大电流(I_{MAX})为37mA, 可在全局在控制寄存器中更改I_{MAX}。

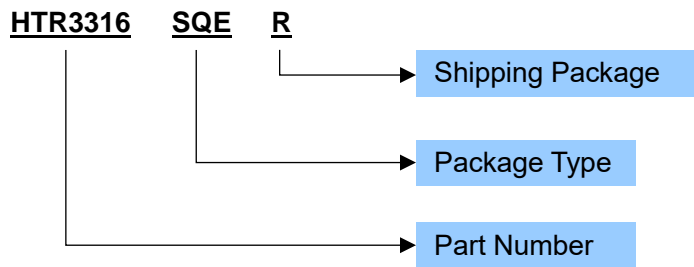
HTR3316支持breathing功能, 使其实现灯效变得更为容易, 其有两种模式:blinking模式和fading模式。

HTR3316提供QFN4 \times 4-24L封装。

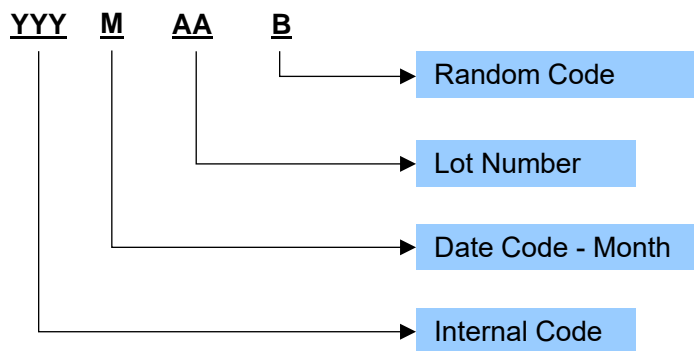
ORDERING INFORMATION

Ordering Number	Package Type	Marking	Operating Temperature Range	Shipping Package / MOQ
HTR3316SQER	QFN4x4-24L (SQE)	HTR3316 YYMAAB ¹	-40°C~85°C	Tape and Reel (R) 5000PCS

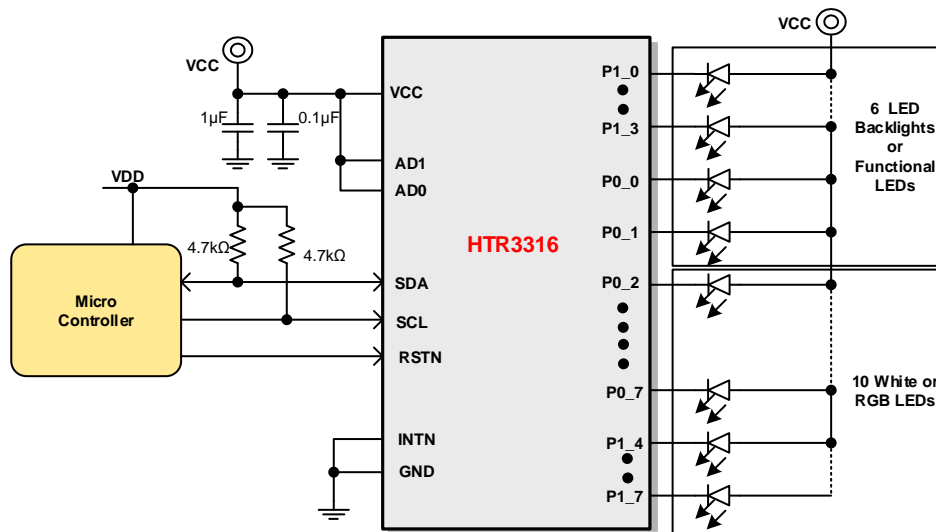
Ordering Number



Production Tracking Code



■ TYPICAL APPLICATION



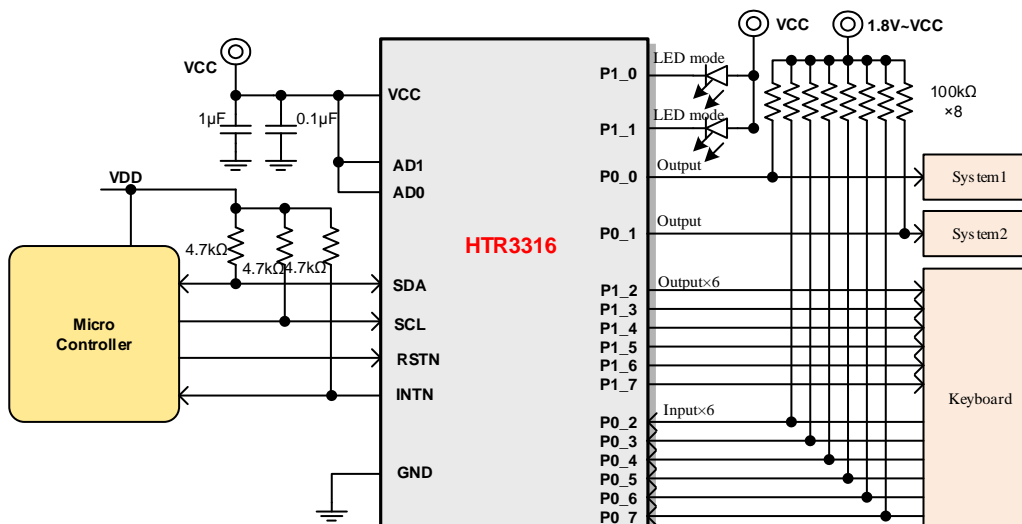
16 functional LED drivers, with 6 capable of driving LED backlights

Once the LED anode is pulled to VCC, AD1 and AD0 terminals must be pulled to VCC to ensure that the default value of GPIO after POWER ON is High or Hi-Z so that the LEDs are not working unexpectedly. The default value of GPIO after POWER ON is decided by AD1 and AD0 terminals (see table 1).

The Dropout performance of the 6 LED Ports (P1_0~P1_3, P0_0~P0_1) is optimized, so that they are capable of driving LED backlights.

当LED的阳极接VCC时，需将芯片的AD1/AD0接VCC，确保GPIO的上电默认状态为高或高阻，从而LED不会意外工作。GPIO的上电默认状态由AD1/AD0的电平决定，具体参看表1。

P1_0~P1_3, P0_0~P0_1这6路的驱动能力做了优化，在驱动LED背光时建议选取这几路。



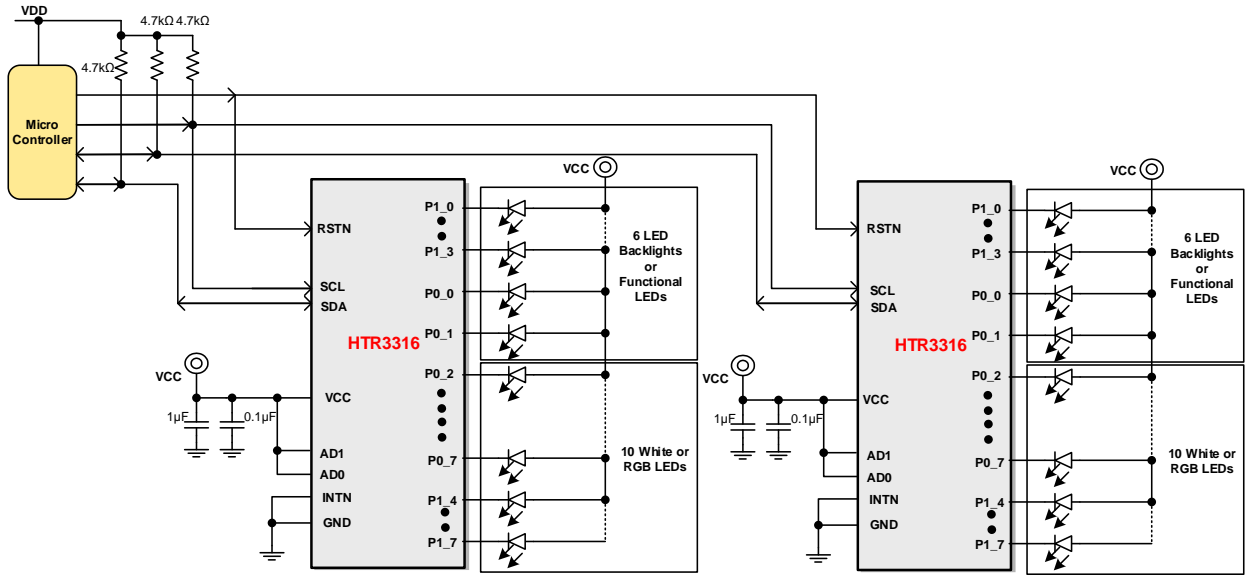
Functional LED drivers, IO and Keyboard expander

Once the LED anode is pulled to VCC, AD1 and AD0 terminals must be pulled to VCC to ensure that the default value of GPIO after POWER ON is High or Hi-Z so that the LEDs are not working unexpectedly. The default value of GPIO after POWER ON is decided by AD1 and AD0 terminals (see table 1).

Any of the 16 IOs can be configured as LED mode or GPIO mode. In the above schematic, P1_0 and P1_1 are configured as LED mode, P0_0 and P0_1 is configured as GPIO output to control other systems, P1_2~P1_7 are configured as GPIO output to drive the row line of keyboard, and P0_2~P0_7 are configured as GPIO input to drive the column line of keyboard

当LED的阳极接VCC时，需将芯片的AD1/AD0接VCC，确保GPIO的上电默认状态为高或高阻，从而LED不会意外工作。GPIO的上电默认状态由AD1/AD0的电平决定，具体参看表1。

16路IO均可配置为GPIO或LED模式。在上图中，P1_0和P1_1配置为LED模式，P0_0和P0_1配置为GPIO输出模式用来控制其他系统，P1_2~P1_7配置为GPIO输出用来驱动键盘的行，P0_2~P0_7配置为GPIO输入用来驱动键盘的列。



Functional LED drivers with 2 HTR3316

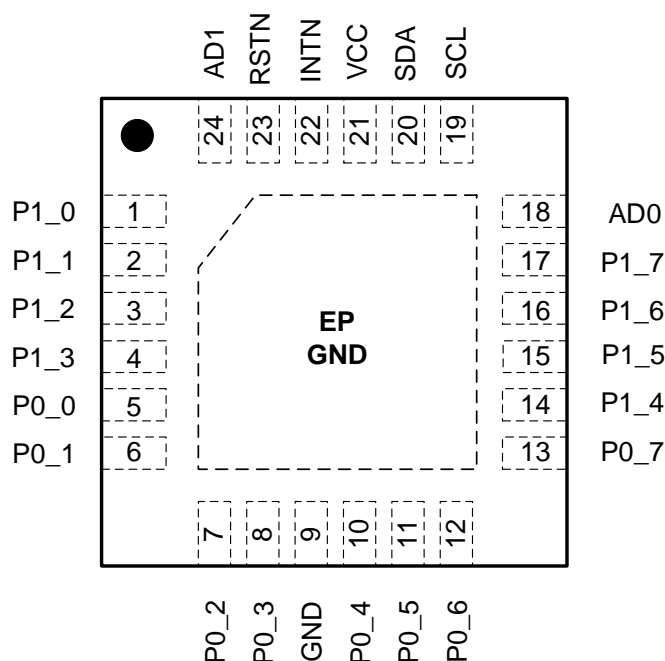
Once the LED anode is pulled to VCC, AD1 and AD0 terminals must be pulled to VCC to ensure that the default value of GPIO after POWER ON is High or Hi-Z so that the LEDs are not working unexpectedly. The default value of GPIO after POWER ON is decided by AD1 and AD0 terminals (see table 1).

The 2 HTR3316 can share reset line RSTN and clock line SCL, but the data line SDA need to be separated.

当LED的阳极接VCC时，需将芯片的AD1/AD0接VCC，确保GPIO的上电默认状态为高或高阻，从而LED不会意外工作。GPIO的上电默认状态由AD1/AD0的电平决定，具体参看表1。

两颗HTR3316可复用复位线RSTN和时钟线SCL，数据线SDA需分开。

■ TERMINAL CONFIGURATION



■ TERMINAL FUNCTION

Terminal No.	Name	Description
1~4	P1_0~P1_3	GPIO mode default, input or output (push-pull), the state after power on is decided by AD1 and AD0 terminals. Can be configured as LED mode. 默认GPIO模式，输入或输出（推挽结构），上电默认状态由AD1和AD0决定。可设置为LED模式。
5~8	P0_0~P0_3	GPIO mode default, input or output (open-drain (default) or push-pull), the state after power on is decided by AD1 and AD0 terminals. Can be configured as LED mode. 默认GPIO模式，输入或输出（开漏结构（默认）或推挽结构），上电默认状态由AD1和AD0决定。可设置为LED模式。
9	GND	Ground. 地
10~13	P0_4~P0_7	GPIO mode default, input or output (open-drain (default) or push-pull), the state after power on is decided by AD1 and AD0 terminals. Can be configured as LED mode. 默认GPIO，输入或输出（开漏结构（默认）或推挽结构），上电默认状态由AD1和AD0决定。可设置为LED模式。
14~17	P1_4~P1_7	GPIO mode default, input or output (push-pull), the state after power on is decided by AD1 and AD0 terminals. Can be configured as LED mode. 默认GPIO，输入或输出(推挽结构)，，上电默认状态由AD1和AD0决定。可设置为LED模式。
18	AD0	I ² C device address, connect to VCC or GND, and control the default state of GPIOs (see table 1). I ² C器件地址选择，接VCC或GND，并设置GPIO状态（见表1）。
19	SCL	I ² C serial clock. I ² C时钟
20	SDA	I ² C serial data. I ² C数据
21	VCC	Power supply. 电源输入端.
22	INTN	Interrupt output pin, open-drain, need external pull-up resistor; active low. 中断输出，开漏结构，需外部上拉电阻；低有效
23	RSTN	Hardware reset pin, active low; internal 100 kΩ (typical) pull-down

		resistor. 硬件复位，低为复位；内部下拉100 k Ω （典型值）电阻
24	AD1	I ² C device address, connect to VCC or GND, and control the default state of GPIO (see table 1). I ² C器件地址选择，接VCC或GND，并设置GPIO状态（见表1）。
EP	GND	Provides both electrical and thermal connection from the device to the board. Connect to the system ground. 接地。

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