

!DEDICATED INFRARED RECEIVER

FEATURES

- **Highly Integrated Device with No External Components except PIN Diode**
- **High Sensitivity due to Adaptive Gain Control**
- **High Immunity Against Interference from Ambient Light**
- **Improved Immunity against 2.4GHz and 5GHz Wi-Fi Noise**
- **Available for Carrier Frequencies of 33kHz, 36kHz, 38kHz, 40kHz, 56kHz**
- **Wide Supply Voltage Range: 2.7V to 5.5V**
- **Compatible with Popular IR Coding Protocol such as: RCMM Compatible**
- **TS3116L Support Long Burst Length Code**

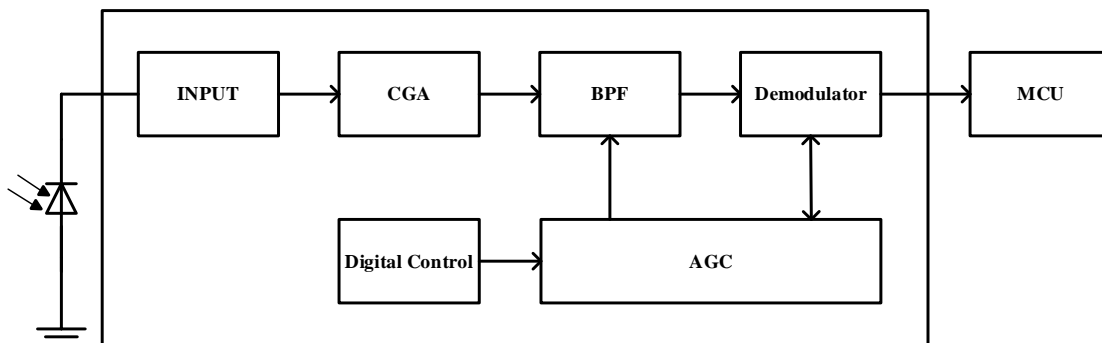
APPLICATIONS

- **Home Entertainment Applications**
- **Remote Control Equipment**
- **Home Appliances**

PRODUCT DESCRIPTION

TS3116 is a complete IR receiver for using in carrier-frequency-modulated transmission applications. The IC combines small size with high sensitivity as well as high suppression of interference from daylight and lamps. TS3116 operates in a supply voltage range of 2.7V to 5.5V, and is available with standard frequencies (33, 36, 38, 40, 56kHz). The function of TS3116 is described using the block diagram of Figure 1. The IC contains input stage IV conversion circuit, variable gain VGA, bandpass filter BPF, integral demodulation circuit and output stage circuit. The input stage has two main functions: first, it provides a suitable bias voltage for the PIN diode; second, the pulsed photo current signals are transformed into a voltage.

The signals have to pass a Controlled Gain Amplifier (CGA), and then pass a bandpass filter (BPF) with a center frequency, which is equal to the carrier frequency. The demodulator converts the input burst signal to a digital envelope output pulse. The output stage provides a certain drive capability. The analog control loop circuit and the Controlled Gain Amplifier can realize that the chip can always keep the most sensitive state in any case, which means the chip always stays above the noise state. Once the signal is sent, it will be immediately received and demodulated.



ORDERING INFORMATION

| Product Model | Period | Carrier Frequency | Ecology Plan | Package Type |
|---------------|------------|-------------------|--------------|--------------|
| TS3116-36 | Production | 36kHz | RoHS | Dice |

ABSOLUTE MAXIMUM RATINGS

Over operating free-air temperature range (unless otherwise noted) ⁽¹⁾

| Parameter | Minimum | Maximum | Unit |
|-----------------------|---------|----------------|------|
| Supply Voltage | -0.3 | 6 | V |
| Output Voltage | -0.3 | V _s | V |
| Output Current | 8 | | mA |
| Operating Temperature | -25 | 85 | °C |
| Storage Temperature | -40 | 125 | °C |
| ESD HBM | | ±8000 | V |

- (1) Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ESD CAUTION



ESD (electrostatic discharge) sensitive device.
Charged devices and circuit boards can discharge without detection.
Although this product features patented or proprietary protection circuitry, damage may occur on devices subjects to high energy ESD.
Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

ELECTRICAL CHARACTERISTICS

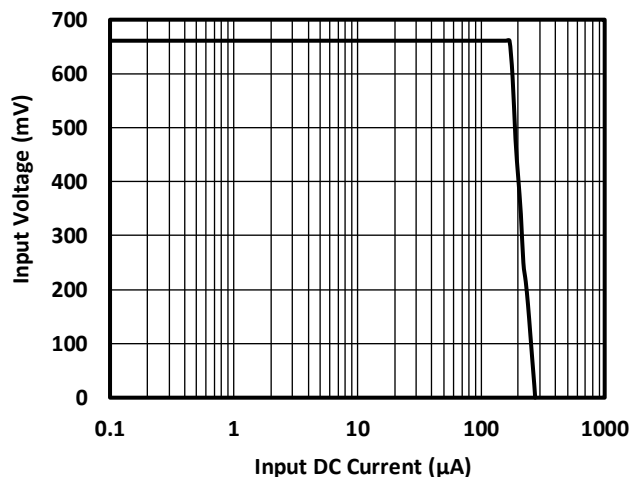
$T_A = -25^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_S = 2.7\text{V}$ to 5.5V (unless otherwise specified)

| Parameters | | Test Conditions | Min | Typ | Max | Unit |
|--|--|---|-------------|-------|-------|------------------|
| Supply | | | | | | |
| V_S | Supply-Voltage Range | | 2.7 | | 5.5 | V |
| I_S | Supply Current | $I_{IN} = 0^{\circ}\text{C}$ | | 400 | 500 | μA |
| Output | | | | | | |
| R_{PU} | Internal Pull-Up Resistor | $T_A = 25^{\circ}\text{C}$ | | 39 | | $\text{k}\Omega$ |
| V_{OL} | Output Voltage Low | external pull-up resistor is $1.4\text{k}\Omega$ | | | 125 | mV |
| V_{OH} | Output Voltage High | | $V_S - 125$ | | V_S | mV |
| I_{OCL} | Output Current Clamping | $V_{OUT} = V_S$, $V_S = 5\text{V}$ | | 6 | | mA |
| Input | | | | | | |
| I_{IN_DCMAX} | Input DC Current | $V_{IN} = 0$, $T_A = 25^{\circ}\text{C}$ | | 330 | | μA |
| I_{Eemin} | Minimum Detection Threshold Current | $I_{IN_DC} = 0.1\mu\text{A}$, $T_A = 25^{\circ}\text{C}$, burst $N = 16$, $f = f_0$ | | 0.42 | | nA |
| | Minimum Detection Threshold Current with AC Current Disturbance $I_{IN_AC100} = 1\mu\text{A}$ at 50Hz | | | 0.7 | | nA |
| I_{Eemax} | Maximum Detection Threshold Current | $V_{IN} > 0\text{V}$, $I_{IN_DC} = 1\mu\text{A}$, $T_A = 25^{\circ}\text{C}$, burst $N = 16$, $f = f_0$ | | 100 | | μA |
| Controlled Amplifier and Filter | | | | | | |
| G_{VARMAX} | Maximum Value of Variable Gain (CGA) | $T_A = 25^{\circ}\text{C}$ | | 70 | | dB |
| G_{VARMIN} | Minimum Value of Variable Gain (CGA) | $T_A = 25^{\circ}\text{C}$ | | -10 | | dB |
| G_{MAX} | Total Internal Amplification (VGA + BPF) | $T_A = 25^{\circ}\text{C}$ | | 85 | | dB |
| f_{03V_FUSE} | Center Frequency Fusing Accuracy of Bandpass | $T_A = 25^{\circ}\text{C}$, 0.5% accuracy | -2.5 | f_0 | 2.5 | % |
| f_{03V} | Overall Accuracy Center Frequency of Bandpass | | -4.3 | f_0 | 3.2 | % |
| BW | BPF Bandwidth | -3dB, $f_0 = 36\text{kHz}$ | | 4 | | kHz |

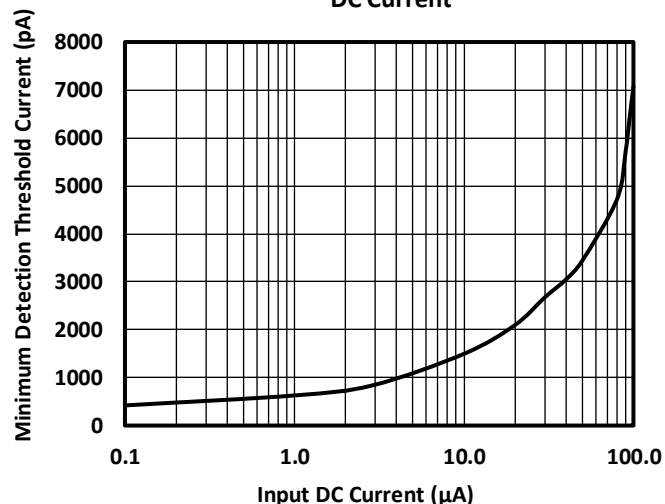
TYPICAL ELECTRICAL CURVES

At $T_A = +25^\circ\text{C}$, $V_S = 3\text{V}$ (unless otherwise noted)

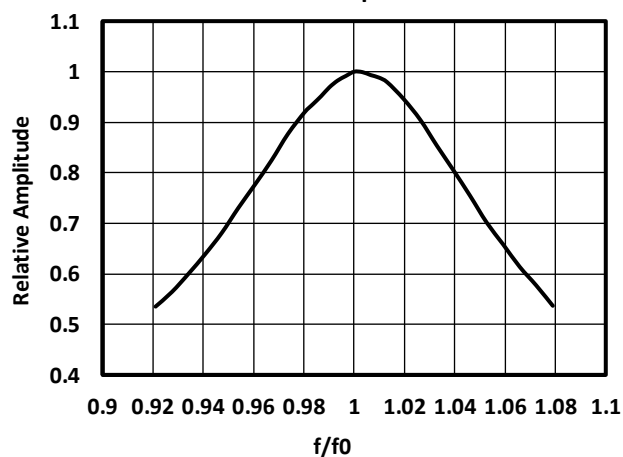
Input Voltage vs Input DC Current



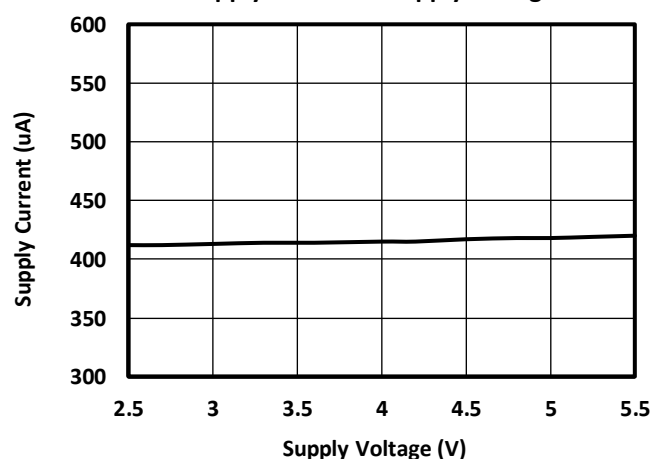
Minimum Detection Threshold Current vs Input DC Current



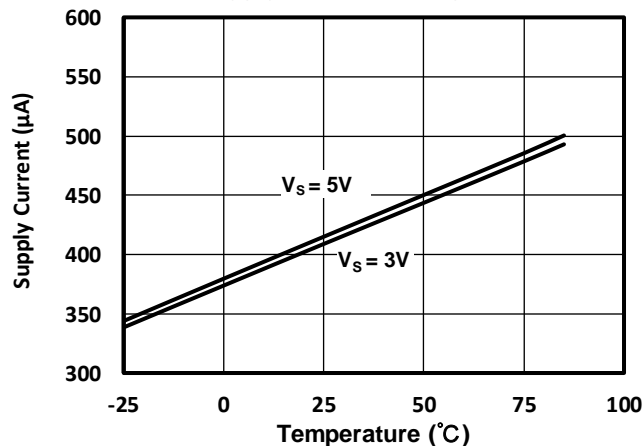
Bandpass



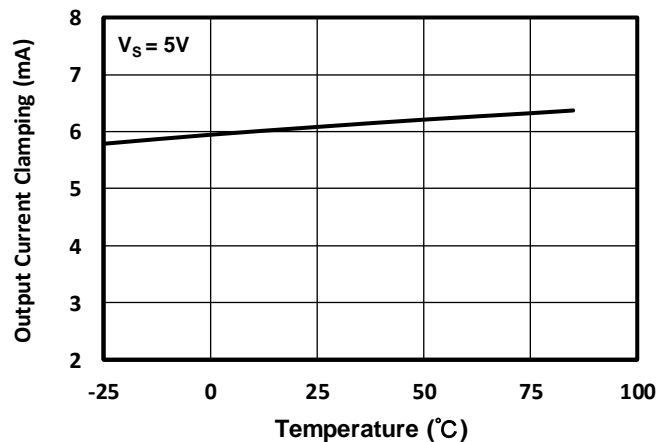
Supply Current vs Supply Voltage



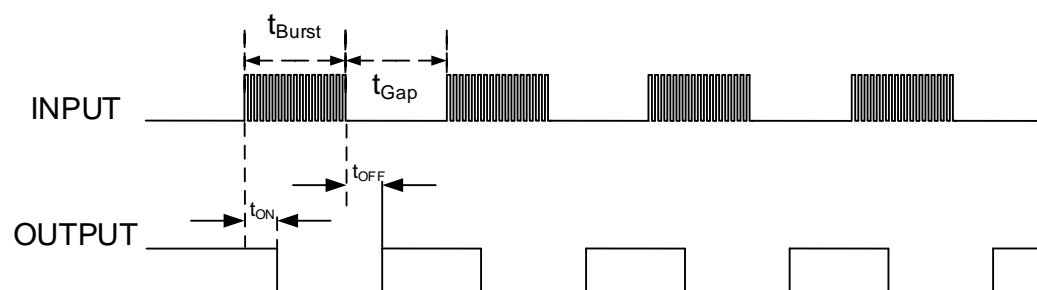
Supply Current vs Temperature



Output Current Clamping vs Temperature



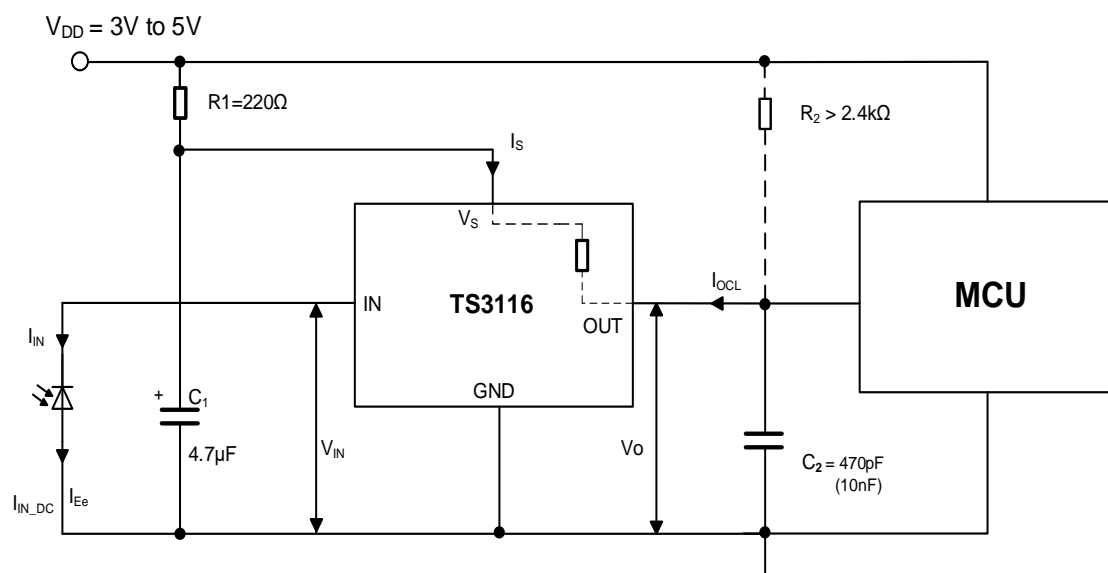
DATA SIGNAL DIAGRAM



DATA SIGNAL LIMITATION

| Symbol | Parameter | TS3116 |
|------------------|---|---|
| T_{Burst_Min} | Minimum Burst Length | 6 cycles/burst |
| T_{Gap_Min} | For bursts greater than a minimum gap time is required of | 6 to 35 cycles ≥ 8 cycles |
| T_{Burst_Max} | For bursts greater than a minimum gap time is required of | TBD cycles $\geq TBD \times \text{burst length}$ |
| N_{BPS_Max} | Maximum number of continuous short bursts/second | 2000 |
| t_{ON} | Turn-on Propagation Delay | TBD cycles |
| t_{OFF} | Turn-off Propagation Delay | TBD cycles |

APPLICATION CIRCUIT



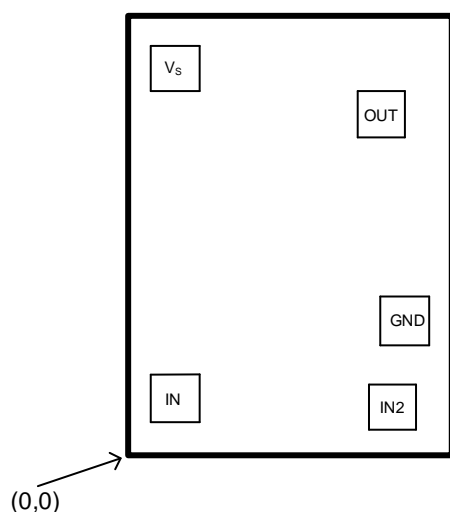
COMPATIBILITY FOR DATA FORMAT

| Item | TS3114 | TS3115 | TS3116 | BEST CHOICE |
|---|--------|--------|--------|-------------|
| NEC code | Yes | Yes | Yes | TS3114 |
| RC5 code | Yes | Yes | Yes | TS3114 |
| RC6 code | Yes | Yes | Yes | TS3114 |
| RCMM code | Yes | NO | Yes | TS3116 |
| RECS-80 code | Yes | Yes | Yes | TS3116 |
| SONY SIRC12 code | Yes | Yes | Yes | TS3114 |
| Panasonic code | Yes | Yes | Yes | TS3114 |
| Sharp code | Yes | Yes | Yes | TS3114 |
| Nokia NRC17 code | Yes | Yes | Yes | TS3114 |
| JVC code | Yes | Yes | Yes | TS3114 |
| RCA code | Yes | Yes | Yes | TS3114 |
| X-Sat code | Yes | Yes | Yes | TS3114 |
| MIT-C8D8/40K | Yes | Yes | Yes | TS3116 |
| MIT-C8D8/33K | Yes | Yes | Yes | TS3116 |
| KONKA code | Yes | Yes | Yes | TS3114 |
| M3004 Carrier code | Yes | Yes | Yes | TS3116 |
| XMP-1 | Yes | Yes | Yes | TS3116 |
| XMP-2 | Yes | Yes | Yes | TS3116 |
| UART-1200bps | No | No | Yes | TS3115 |
| Continues Data(less than t _{Burst_max}) | No | No | No | |

DIE INFORMATION

- 1) Logo: IC2031
- 2) Die Size: 550um x 768um (not including trimming pad)
- 3) hip Size: 630um x 848um (including scribe line)
- 4) Scribe Line: 80um
- 5) Pad Opening Size: 80um x 80um (bond pad), 50um x 50um (test pad)
- 6) Pad Location:

| PAD NAME | x | y |
|----------------|---------|---------|
| IN | 90.580 | 104.285 |
| GND | 483.145 | 241.615 |
| IN2 | 463.280 | 90.580 |
| OUT | 442.390 | 598.710 |
| V _S | 90.580 | 675.550 |



Note: The pad coordinates are given for the center of the pad, values in μm from the origin (0,0)

REVISION HISTORY

NOTE: Page numbers for previous revisions may be different from that of the current version.

2020/10/23 — REV KY1.0.0B

2020/11/5 — REV KY1.0.0A to REV KY1.0.1A
Updated Features.....1

2021/5/26 — REV KY1.0.1A to REV KY1.1.1A
Updated DIE INFORMATION.....6

2021/6/8 — REV KY1.1.1A to REV KY1.2.1A
Added COMPATIBILITY FOR DATA FORMAT Table.....7

CONTACT INFORMATION

Trusignal Microelectronics

Phone: +86 512-65923982

Fax: +86 512-65923995

Email: support@kunyuanic.com; sales@kunyuanic.com