

SIEMENS

ICs for Consumer Electronics

IR Transmitter
SDA 2218

Data Sheet 01.94

SIEMS02130

| | |
|--------------------------|--|
| SDA 2218 | |
| Revision History: | Original Version: 01.94 |
| Previous Releases: | |
| Page | Subjects (changes since last revision) |
| | |
| | |

Data Classification

Maximum Ratings

Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit.

Characteristics

The listed characteristics are ensured over the operating range of the integrated circuit. Typical characteristics specify mean values expected over the production spread. If not otherwise specified, typical characteristics apply at $T_A = 25\text{ °C}$ and the given supply voltage.

Operating Range

In the operating range the functions given in the circuit description are fulfilled.

For detailed technical information about "**Processing Guidelines**" and "**Quality Assurance**" for ICs, see our "**Short Form Catalog**".

Edition 01.94

This edition was realized using the software system FrameMaker®

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IR Transmitter

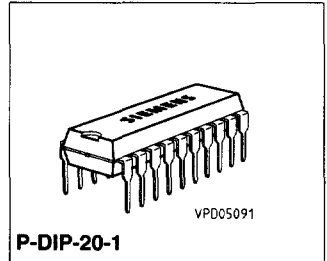
SDA 2218

Preliminary Data

Bipolar IC

Features

- Direct drive of transmitter diodes
- 512 instructions
- Low battery voltage indication
- Low standby current



| Type | Ordering Code | Package |
|----------|---------------|------------|
| SDA 2218 | Q67000-H5132 | P-DIP-20-1 |

The SDA 2218 is designed as a remote control transmitter for direct driving of infrared diodes. The instructions are generated by an input matrix (i.e. keyboard) in the form of biphasic codes. Distributed over 8 levels, there are a max. of 512 instructions available. Two instructions are used for start/stop and low battery voltage indication. The SDA 2218 is compatible with the pins and functions of the SDA 2208-3, except the new low battery voltage indication and the increased output current.

Circuit Description

Power Supply

Current consumption is very low in the standby mode. When a matrix connection to one of the row inputs is closed, the active mode is turned on. After finishing a telegram the IC automatically returns to the standby mode.

Clock Input

The clock input is equipped with a ceramic resonator. In addition, the clock signal can be injected at pin CLKI.

Input Matrix

The matrix consists of 8 rows and 8 columns. Supply voltage V_S is used as column A. To transmit a telegram, the respective rows and columns have to be connected. The transmitter is turned on and sends a telegram. A telegram has a start command, a number of information commands (depending on the duration of the matrix connection), and a stop command. If there is still a connection to a row input, stop commands are added until all matrix connections to row inputs are released. After the last stop command, the battery voltage is checked. If low voltage is detected, the telegram is extended with start command, low battery voltage instruction, and stop command.

Programming via PPIN

The programming pin is used to provide access to all command sets or 512 commands since the 8 x 8 matrix limits the use to one command set or 64 different commands. By subdividing the command sets into 8 levels of 64 commands each a specific level can be selected by either the PPIN open or by combining it with one of the seven column inputs (CB to CH). Connecting PPIN with one column alone, does not increase the standby current.

Safety Features

To start a telegram, a matrix connection row to column must be closed for a minimum time t_{start} . For a telegram with at least one information command, a minimum time of t_{send} is necessary. ($t_{\text{start}} = 19 \text{ ms}$, $t_{\text{send}} = 61 \text{ ms approx.}$, with clock frequency 500 kHz). Operation errors caused by connecting more than one row or more than one column (also multiple PPIN connections) are detected. The telegram will be continued with stop commands until all connections to row inputs are released.

The level selection key PPIN must be connected before t_{read} ($t_{\text{read}} = 52 \text{ ms approx.}$, with clock frequency 500 kHz).

Composition of a Telegram

A telegram consists of the following commands:

| | | Number of Commands |
|---------------------|---------|------------------------------------|
| Start command | No. 511 | 1 |
| Information command | No. key | 0 ... n |
| Stop command | No. 511 | 1 ... n |
| | | with low battery voltage detected: |
| Start command | No. 511 | 1 |
| Low battery command | No. 311 | 1 |
| Stop command | No. 511 | 1 ... n |

Command Structure

Each command consists of a presignal, an infrared pause, a start bit and 9 information bits. During the duration of the presignal ($256/f_{CLK}$), the receiver performs a simple amplitude adjustment of the input amplifier.

The infrared pause between the presignal and the start bit enables the receiver to recognize transmission errors based on the limits of the transmission range.

The start bit has been permanently programmed as "1" and is used as synchronization support for the receiver. The bit structure has been illustrated in the pulse diagram.

Output Driver Stage

The fully integrated driver stage enables the direct connection of the infrared transmitter diodes to the infrared output IRA. The diode current is maintained at a constant level within a defined range to stabilize the transmitting power of the infrared diodes.

Truth Table

Start bit S: always 1

Column connection:

| | A | B | C | Cn |
|----|---|---|---|----|
| CA | 0 | 0 | 0 | 0 |
| CB | 1 | 0 | 0 | 1 |
| CC | 0 | 1 | 0 | 2 |
| CD | 1 | 1 | 0 | 3 |
| CE | 0 | 0 | 1 | 4 |
| CF | 1 | 0 | 1 | 5 |
| CG | 0 | 1 | 1 | 6 |
| CH | 1 | 1 | 1 | 7 |

Row connections:

| | D | E | F | Rn |
|----|---|---|---|----|
| R1 | 0 | 0 | 0 | 0 |
| R2 | 1 | 0 | 0 | 1 |
| R3 | 0 | 1 | 0 | 2 |
| R4 | 1 | 1 | 0 | 3 |
| R5 | 0 | 0 | 1 | 4 |
| R6 | 1 | 0 | 1 | 5 |
| R7 | 0 | 1 | 1 | 6 |
| R8 | 1 | 1 | 1 | 7 |

PPIN connection to column:

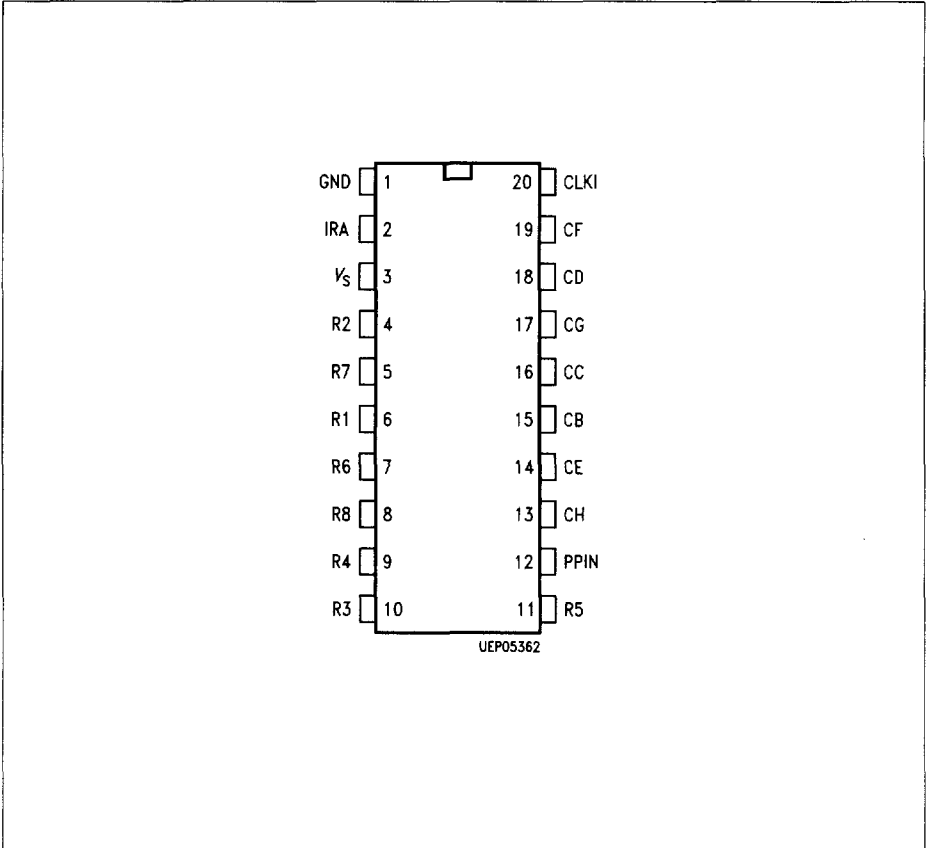
| | G | H | I | Pn |
|------|---|---|---|----|
| free | 0 | 0 | 0 | 0 |
| CB | 1 | 0 | 0 | 1 |
| CC | 0 | 1 | 0 | 2 |
| CD | 1 | 1 | 0 | 3 |
| CE | 0 | 0 | 1 | 4 |
| CF | 1 | 0 | 1 | 5 |
| CG | 0 | 1 | 1 | 6 |
| CH | 1 | 1 | 1 | 7 |

1 command consists of a start bit and 9 data bits, transmitted low order bit first. The command number can be calculated as:

$$\text{command} = Cn + 8 \times Rn + 64 \times Pn$$

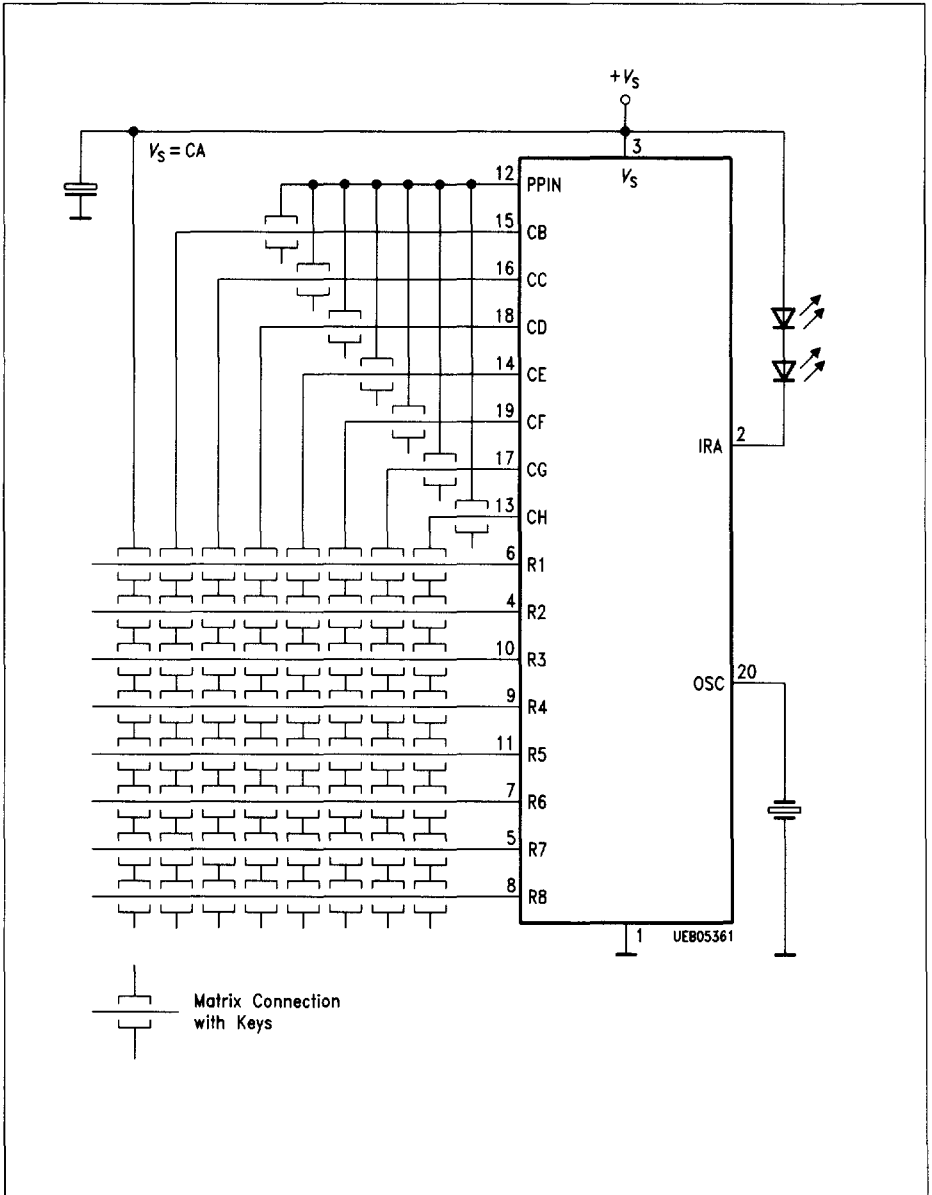
| | S | A | B | C | D | E | F | G | H | I |
|--------------------------|---|---|---|---|---|---|---|---|---|---|
| start/stop command: 511 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| low voltage command: 311 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |

Pin Configuration (top view)



Pin Definitions and Functions

| Pin No. | Symbol | Function |
|----------------|---------------|---------------------------|
| 1 | GND | Ground |
| 2 | IRA | Output IRA |
| 3 | V_S | Supply voltage, column CA |
| 4 | R2 | Matrix connection rows |
| 5 | R7 | Matrix connection rows |
| 6 | R1 | Matrix connection rows |
| 7 | R6 | Matrix connection rows |
| 8 | R8 | Matrix connection rows |
| 9 | R4 | Matrix connection rows |
| 10 | R3 | Matrix connection rows |
| 11 | R5 | Matrix connection rows |
| 12 | PPIN | Programming pin |
| 13 | CH | Matrix connection columns |
| 14 | CE | Matrix connection columns |
| 15 | CB | Matrix connection columns |
| 16 | CC | Matrix connection columns |
| 17 | CG | Matrix connection columns |
| 18 | CD | Matrix connection columns |
| 19 | CF | Matrix connection columns |
| 20 | CLKI | Oscillator input |



Block Diagram

Since the infrared transmitter diodes have to be driven with pulse currents of approx. 1 A, the following has to be complied with during the layout of the PC board:

1. The capacitor between V_S and ground should be located as closely as possible to the pins of the IC.
2. The supply line to the transmitter diodes must not cause cross-talk in the key matrix.
3. No residual currents are to flow over the connection ceramic oscillator/ground pin.

Absolute Maximum Ratings

$T_A = 0$ for 70 °C

| Parameter | Symbol | Limit Values | | Unit | Test Condition |
|----------------------|-----------------------|--------------|-------|-----------------|----------------|
| | | min. | max. | | |
| Output voltage | V_2 | - 0.3 | 13.2 | V | |
| Supply voltage | V_3 | - 0.3 | 13.2 | V | |
| Row voltage | $V_4 \dots V_{11}$ | - 0.3 | V_3 | V | |
| Programming pin | V_{12} | - 0.3 | 13.2 | V | |
| Column voltage | $V_{13} \dots V_{19}$ | - 0.3 | V_3 | V | |
| Oscillator | V_{20} | - 0.3 | V_3 | V | |
| Oscillator AC | V_{20-} | | 5 | V _{pp} | |
| Junction temperature | T_j | - 40 | 150 | °C | |
| Storage temperature | T_{stg} | - 40 | 125 | °C | |
| Thermal resistance | $R_{th SA}$ | | 66 | K/W | |
| ESD voltage, HBM | V_{ESD} | - 4 | 4 | kV | 100 pF, 1500 Ω |

Operating Range

| | | | | | |
|---------------------|-------|---|----|----|--|
| Supply voltage | V_S | 4 | 10 | V | |
| Ambient temperature | T_A | 0 | 70 | °C | |

AC/DC Characteristics

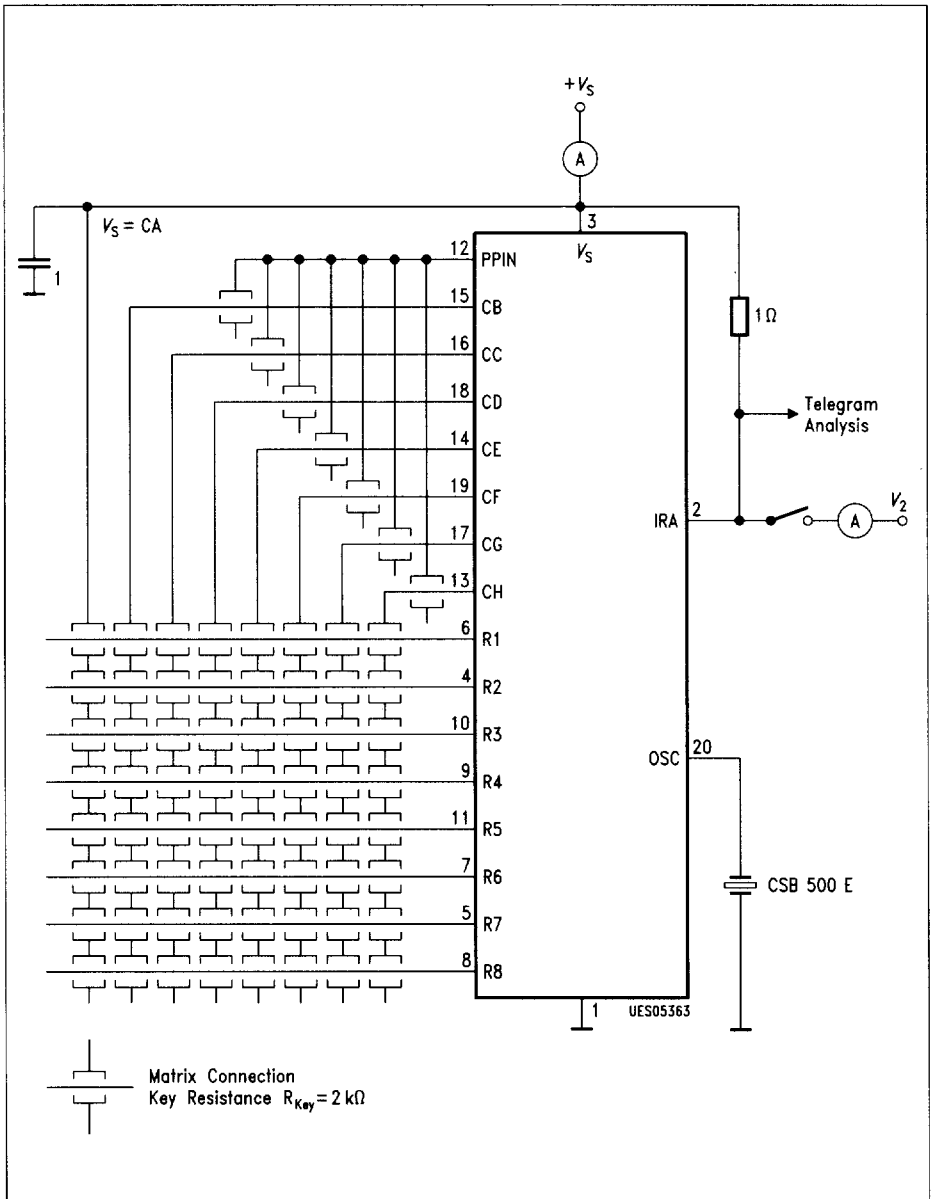
 $V_S = 8 \text{ V}; T_A = 25 \text{ }^\circ\text{C}$

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|---|-----------------------|--------------|-------|------|--------------------|----------------------------|
| | | min. | typ. | max. | | |
| Supply current, active | $I_{3 \text{ Mean}}$ | | 19 | | mA | |
| Supply current, standby | $I_{3 \text{ st}}$ | | 0.5 | 10 | μA | |
| Output off current | $I_{2 \text{ OFF}}$ | | | 100 | μA | $V_2 = 9 \text{ V}$ |
| Output on current high | $I_{2 \text{ Onh}}$ | 750 | 1100 | 1500 | mA | $V_2 = 6 \text{ V}$ |
| Output on current low | $I_{2 \text{ Onl}}$ | 750 | 1100 | 1500 | mA | $V_2 = 2 \text{ V}$ |
| Output voltage low | V_2 | | 1 | 2 | V | $I_2 = 500 \text{ mA}$ |
| Oscillator frequency | $f_{20 \text{ nom}}$ | 495 | 500 | 505 | kHz | CSB 500 E |
| Oscillator frequency range | f_{20} | 430 | 500 | 530 | kHz | |
| Oscillator voltage | V_{20} | | 2.4 | | V | active state |
| Oscillation level, free running | $V_{20 \text{ free}}$ | | 0.3 | | Vpp | |
| Oscillation input level | $V_{20 \text{ inp}}$ | 0.3 | 0.5 | 1 | Vpp | 500 kHz AC |
| Key resistance | R_{Key} | | | 2 | k Ω | any key |
| Load capacity matrix | C_{Load} | | | 150 | pF | row/column/ PPIN |
| Load capacity GND | C_{GND} | | | 150 | pF | row/column/ PPIN to GND |
| Min. matrix connection time to start a telegram | t_{Start} | | 9471 | | $1/f_{\text{CLK}}$ | |
| Min. matrix connection time to send a telegram with information command | t_{Send} | | 30464 | | $1/f_{\text{CLK}}$ | |
| Max. PPIN connection delay | t_{Read} | | 25856 | | $1/f_{\text{CLK}}$ | |

AC/DC Characteristics (cont'd)

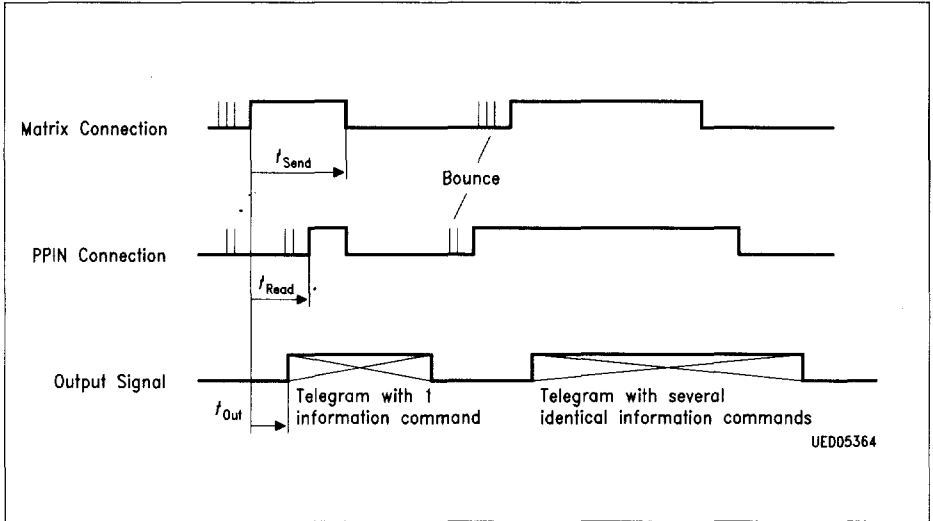
$V_S = 8 \text{ V}; T_A = 25 \text{ }^\circ\text{C}$

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|-----------------------------------|--------------------|--------------|-------|------|--------------------|----------------|
| | | min. | typ. | max. | | |
| Matrix connection to output delay | t_{OUT} | | 12032 | | $1/f_{\text{CLK}}$ | |
| Battery low threshold | $V_{3\text{ low}}$ | 4.25 | 4.5 | 4.75 | V | |
| Low voltage check time after stop | t_{Check} | | 192 | | $1/f_{\text{CLK}}$ | |
| Delay to low voltage telegram | t_{Pause} | | 58880 | | $1/f_{\text{CLK}}$ | |
| Begin start to begin inf | t_{Pre} | | 16384 | | $1/f_{\text{CLK}}$ | |
| Begin inf to begin inf | t_{Rep} | | 65536 | | $1/f_{\text{CLK}}$ | |
| Length of commands | t_{Comm} | | 6656 | | $1/f_{\text{CLK}}$ | |

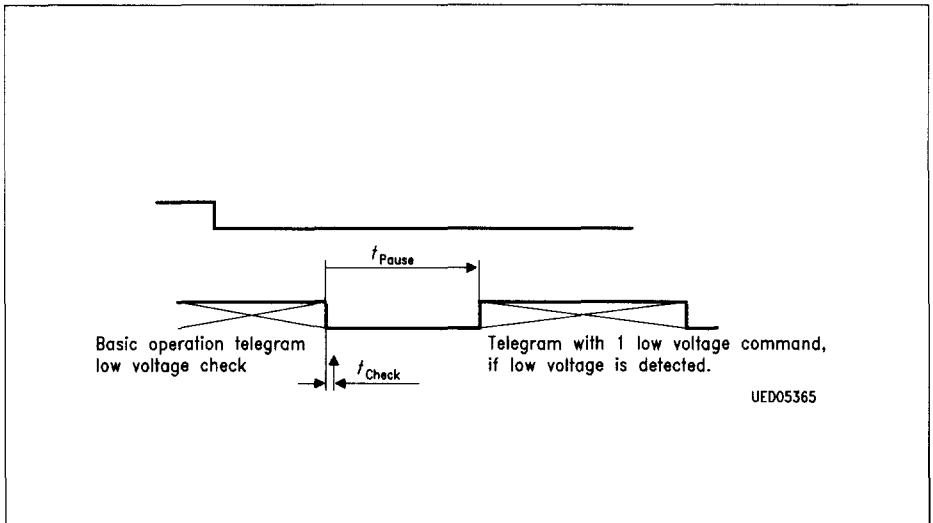


Test Circuit

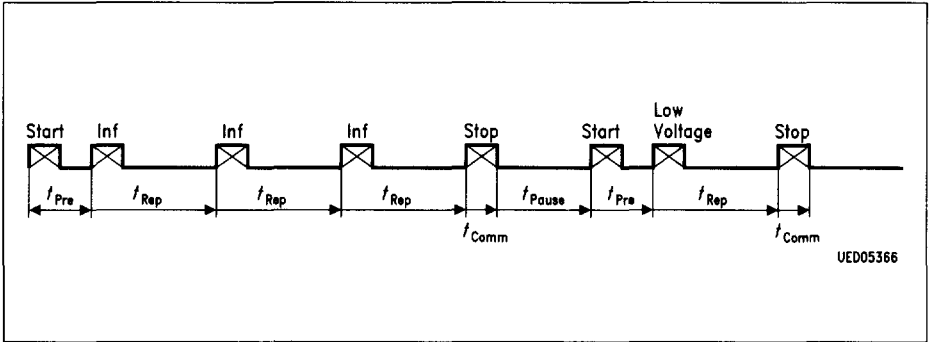
Pulse Diagrams



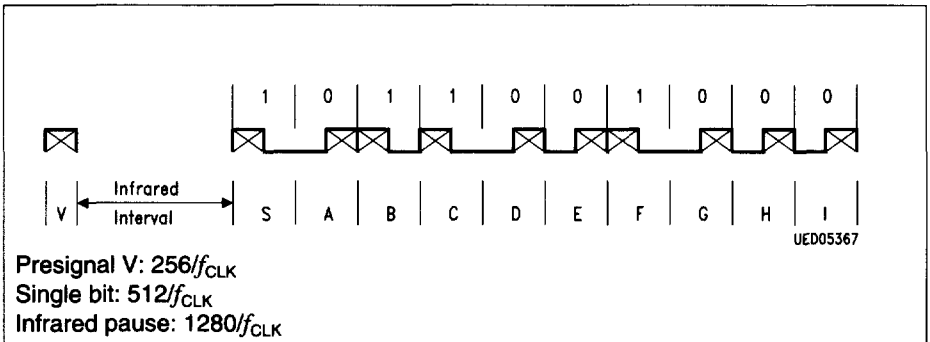
Basic Operating Sequence



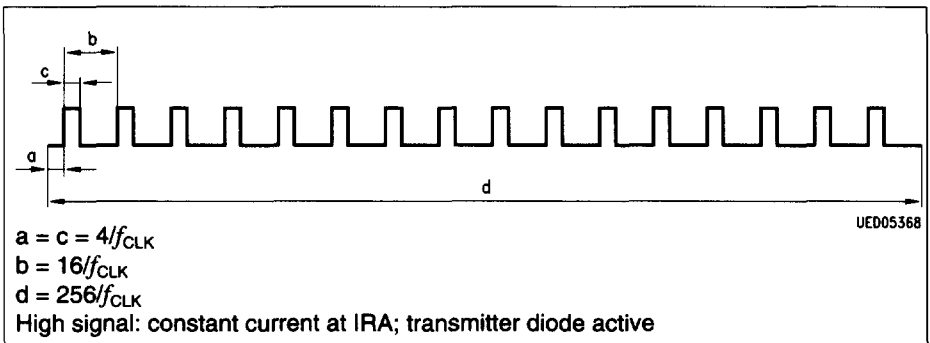
Extended Operating Sequence with Low Battery Command



Composition of Telegram



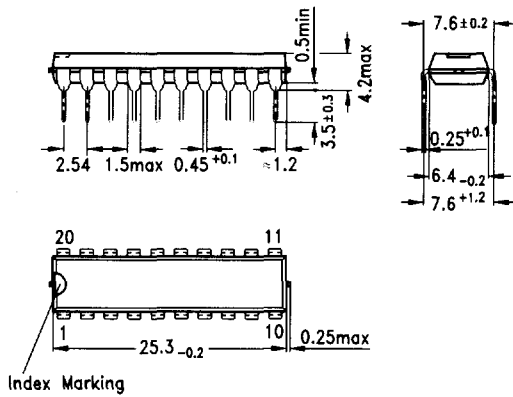
Command Structure in Biphase Code



Structure of Modulated Half Bit (also presignal V)

Package Outlines

Plastic Package, P-DIP-20 (Plastic Dual In-Line Package)



GPD05091

Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information"

Dimensions in mm

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