

## Dual-Input Smart Push-Button Reset IC

### Features

- Operating Range: 1.6V~5.5V
- Supply Current in standby: <math>< 1\mu\text{A}</math> ( $V_{\text{DD}} = 4\text{V}</math>)$
- Output Delay time (RST0 & 1 input pin): 10s Typ.
- Reset Pulse Time (SRO, nSRO Output): 400ms Typ.
- ESD Protection
  - Human Body Model: 2kV
  - Charged Device Model: 1.5kV
- Over-Temperature Protection
- -40°C to +85°C Temperature Range

### Applications

- Mobile Phones & Tablets
- Wearable Devices
- Portable Instruments
- Remote Controls
- Gaming
- DSC, DVR, GPS

### Brief Description

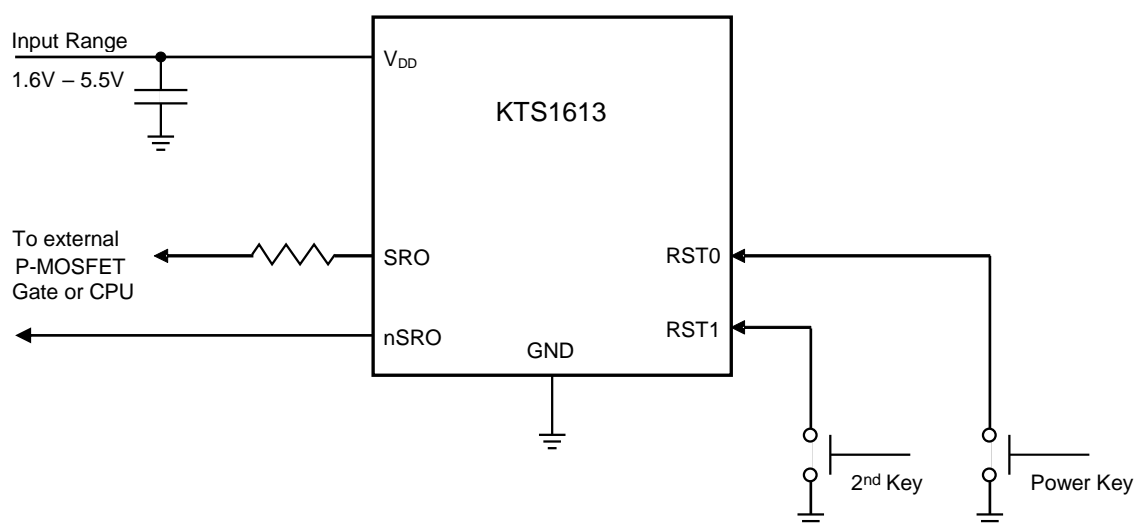
The KTS1613 is a two input, two output Smart Push-Button Reset IC. A reset pulse is generated for a fixed discharge time (400ms typ) after both manual reset inputs have been held low for the reset request time of 10s.

The KTS1613 operates over the 1.6 V to 5.5V supply voltage range, consuming less than 10 $\mu\text{A}$  of supply current at 4V.

The KTS1613 has 2 digital output pins, nSRO and SRO. nSRO is an active-low open-drain output pin. SRO is an active-high push-pull output which can be used to control a P-channel MOSFET battery disconnect switch. It features a soft turn on and turn off feature to reduce VBAT rising and falling overshoot.

The KTS1613 is available in lead-free, fully green compliant, small 10-pin UQFN 2.0mm x 1.5mm package.

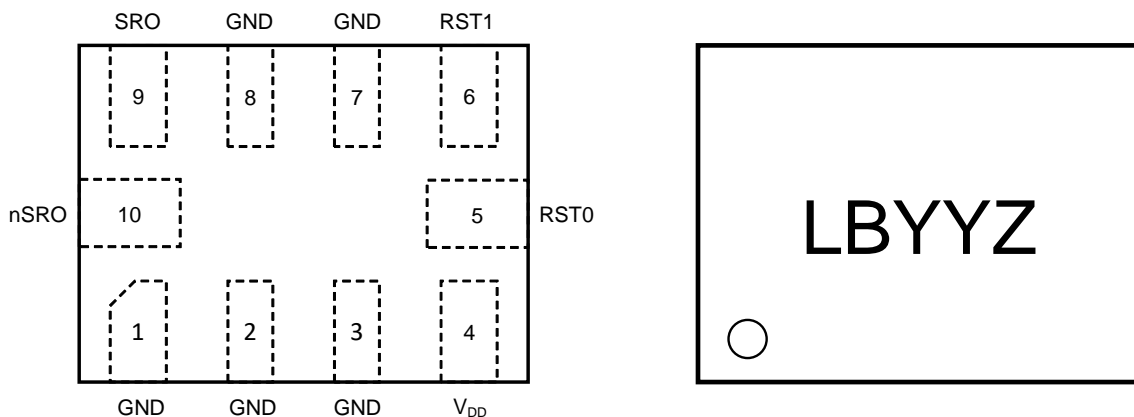
### Typical Application



## Pin Descriptions

| Pin #         | Name            | Function                                       | IO Characteristics           |
|---------------|-----------------|--|------------------------------|
| 1, 2, 3, 7, 8 | GND             | Ground connection.                             | -                            |
| 4             | V <sub>DD</sub> | Power supply input.                            | -                            |
| 5             | RST0            | Reset signal input 0.                          | Internal pull down (8MΩ)     |
| 6             | RST1            | Reset signal input 1.                          | No internal pull up resistor |
| 9             | SRO             | Digital output. Active HIGH (V <sub>DD</sub> ) | Push-Pull                    |
| 10            | nSRO            | Digital output, Active LOW                     | Open-drain                   |

**UQFN2.0x1.5-10**  
(Top View)



10-Lead 2.0mm x 1.50mm x 0.55mm  
WLCSP Package

Top Mark

LB = Device ID Code, YY = Date Code, Z = Assembly Code

## Absolute Maximum Ratings<sup>1</sup>

(T<sub>A</sub> = 25°C unless otherwise noted)

| Symbol                | Description                                     | Value            | Units |
|-----------------------|---|------------------|-------|
| V <sub>DD</sub>       | Power supply input.                             | -0.3 to +12 (DC) | V     |
| RST0, RST1, SRO, nSRO | Reset inputs, Digital outputs.                  | -0.3 to +6       | V     |
| T <sub>J</sub>        | Maximum Junction Temperature Range              | -40 to 150       | °C    |
| T <sub>s</sub>        | Storage Temperature Range                       | -65 to 150       |       |
| T <sub>LEAD</sub>     | Maximum Soldering Temperature (at leads, 10sec) | 300              |       |

## Thermal Capabilities<sup>2</sup>

| Symbol              | Description  | Value | Units |
|---------------------|--|-------|-------|
| θ <sub>JA</sub>     | Thermal Resistance – Junction to Ambient           | 73    | °C/W  |
| P <sub>D</sub>      | Maximum Power Dissipation at T <sub>A</sub> ≤ 25°C | 1712  | mW    |
| ΔP <sub>D</sub> /°C | Derating Factor Above T <sub>A</sub> = 25°C        | 13.7  | mW/°C |

## Ordering Information

| Part Number   | Marking <sup>3</sup> | Operating Temperature | Package        |
|---------------|----------------------|-----------------------|----------------|
| KTS1613EQU-TR | LBYYZ                | -40°C to +85°C        | UQFN2.0x1.5-10 |

## Recommended Operating Range<sup>4</sup>

| Description          | Value         |
|----------------------|---------------|
| V <sub>DD</sub>      | -0.3V to 5.5V |
| RST0, RST1 SRO, nSRO | -0.3V to 5V   |

- Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device. Functional operation at conditions other than the operating conditions specified is not implied. Only one Absolute Maximum rating should be applied at any one time.
- Junction to Ambient thermal resistance is highly dependent on PCB layout. Values are based on thermal properties of the device when soldered to a PCB board.
- “LBYYZ” is the device code, date code and assembly code respectively.
- The device is not guaranteed to function outside of recommended operating condition.

## Electrical Characteristics<sup>5</sup>

The *Min* and *Max* specs are applied over the full operation temperature range of -40°C to +85°C,  $V_{IN} = 1.6V$  to 5.5V unless otherwise noted, while *Typ* values are specified at  $V_{DD} = 4.0V$  and room temperature ( $T_A = 25^\circ C$ ) unless otherwise noted.

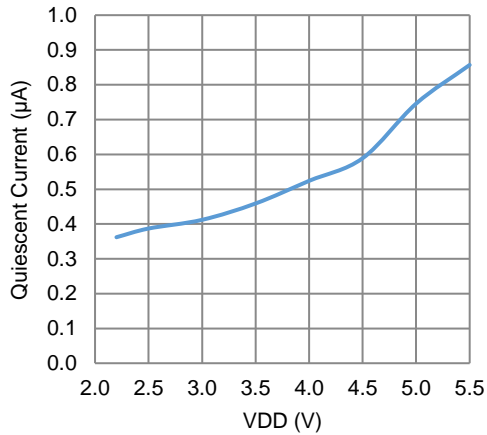
| Symbol                 | Description                     | Conditions  | Min                 | Typ      | Max  | Units   |
|------------------------|---------------------------------|---|---------------------|----------|------|---------|
| <b>Basic Operation</b> |                                 |   |                     |          |      |         |
| $V_{DD}$               | Input Voltage Range             |   | 1.6                 |          | 5.5  | V       |
| $I_Q$                  | Quiescent supply current        | Standby (Exclude pull up/down resistor, Internal oscillator is off, $V_{DD} = 4V$ ) |                     |          | 1    | $\mu A$ |
| $I_{SS}$               | Operation current               | Active (Before reset signal output, Internal oscillator is on, $V_{DD} = 4V$ )      |                     |          | 10   | $\mu A$ |
| <b>Digital IO</b>      |                                 |   |                     |          |      |         |
| $V_{IL}$               | Digital input logic low level   | RST0, RST1 pins<br>$V_{DD} = 2.5V$ to 4.6V  |                     |          | 0.4  | V       |
| $V_{IH}$               | Digital input logic high level  |   | 1.0                 |          |      | V       |
| $V_{OL}$               | Digital output logic low level  | SRO pin, $I = 1.2\mu A$<br>( $V_{DD} = 4V$ )  |                     |          | 0.3  | V       |
| $V_{OH}$               | Digital output logic high level |   | $0.85 \cdot V_{DD}$ | $V_{DD}$ |      | V       |
| $I_L$                  | RST0/RST1 input leakage current |   | -                   | -        | 1    | $\mu A$ |
| $V_{OL}$               | Digital output logic low level  | nSRO, $I_o = 2mA$   |                     |          | 0.3  | V       |
| <b>RESET</b>           |                                 |   |                     |          |      |         |
| $T_R$                  | Reset request time              | $V_{DD} = 4V$   | 8.5                 | 10       | 11.5 | s       |
| $T_D$                  | Reset pulse time                |   |                     | 400      |      | ms      |
| <b>ESD PROTECTION</b>  |                                 |   |                     |          |      |         |
| $V_{ESD}$              | Human Body Model (HBM)          | All pins  |                     | $\pm 2$  |      | kV      |
|                        | IEC61000-4-2 Contact discharge  | $V_{DD}$ pin  |                     | $\pm 8$  |      | kV      |
|                        | IEC61000-4-2 Air gap discharge  | $V_{DD}$ pin  |                     | $\pm 15$ |      | kV      |

5. All specifications are 100% production tested at  $T_A = +25^\circ C$ , unless otherwise noted. Specifications are over -40°C to +85°C and are guaranteed by design.

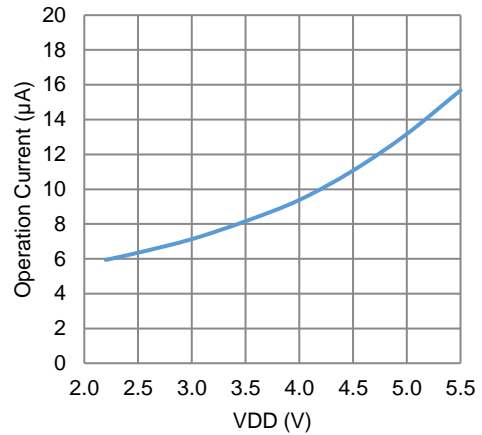
## Typical Characteristics

$V_{DD} = 4V$ ,  $T_A = 25^\circ C$  unless otherwise specified.

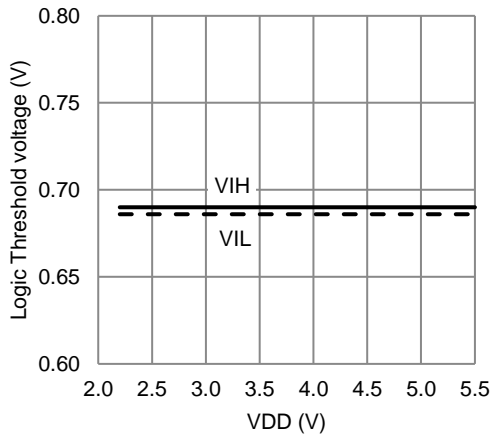
**Quiescent Current vs. VDD**



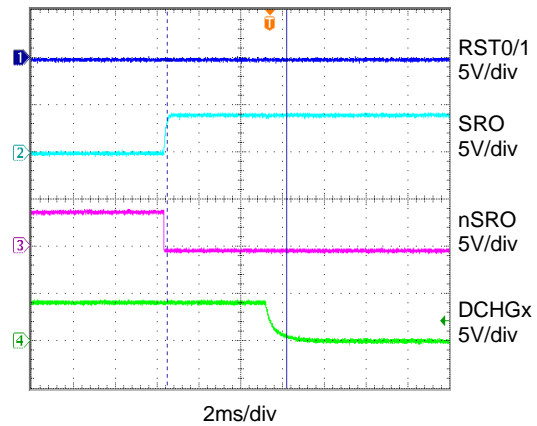
**Operation Current vs. VDD (before Reset pulse)**



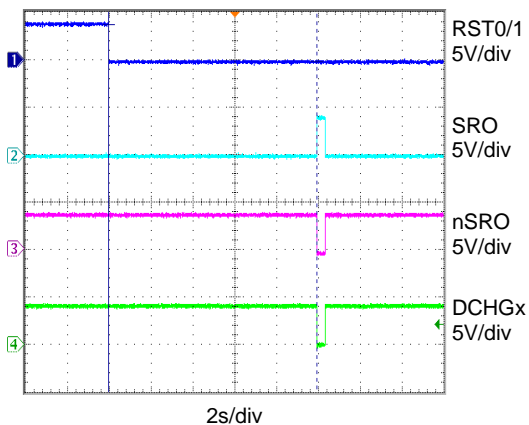
**RST0/RST1 Digital Input Logic Threshold Vs. VDD**



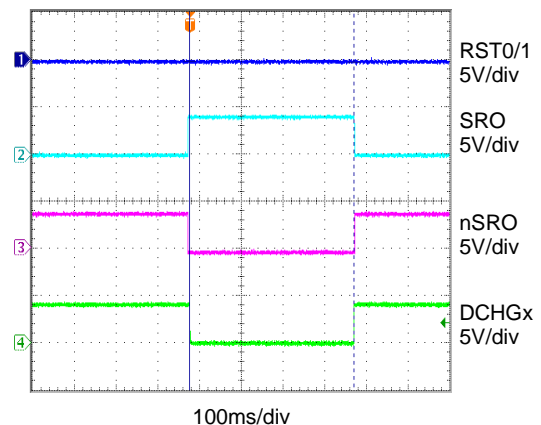
**Reset Mode Trigger**



**Enter Reset Mode**



**Reset Mode Pulse**



**Function Description**

**Reset Timing**

Reset occurs only after both RST0 and RST1 stay low for  $T_r$  duration, SRO output goes high for  $T_d = 400ms$ , then SRO output goes low.

If RST0 & RST1 stay low indefinitely, KTS1613 only resets one time.

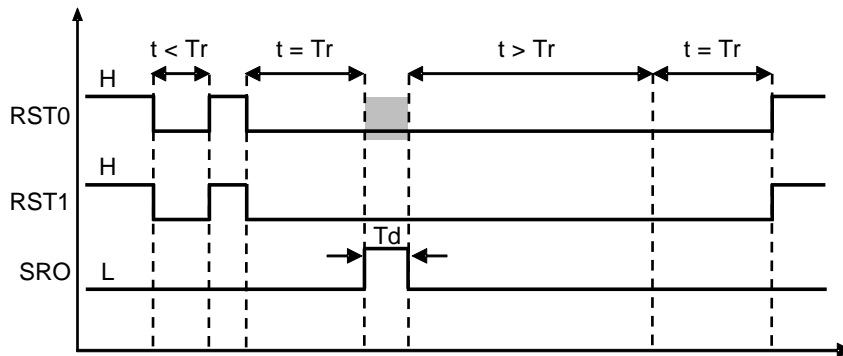


Figure 1. Reset Timing

**Soft Turn ON and OFF**

SRO output has soft turn on and turn off feature in order to reduce VBAT rising and falling overshoot. The output rising and falling time equal to 2ms typical.

nSRO is an open-drain output pin, there is no soft turn on & off feature for nSRO. The timing of SRO and nSRO is shown in Figure 4.

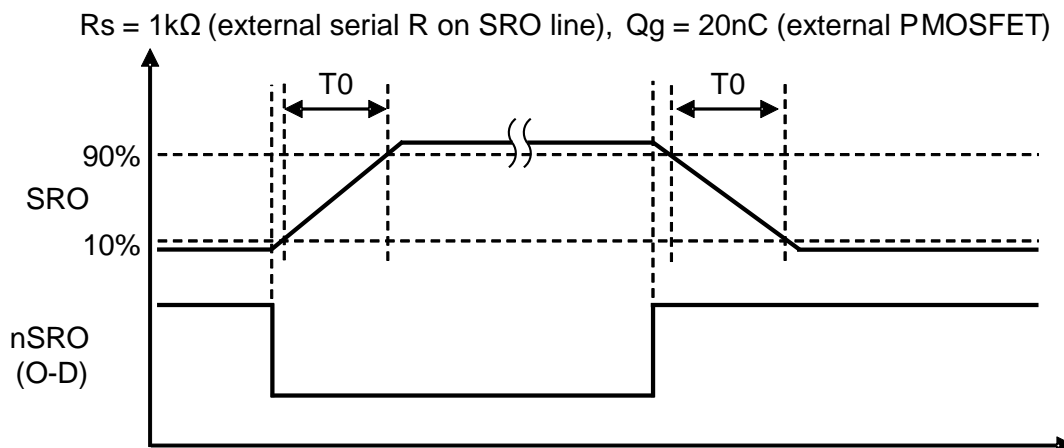
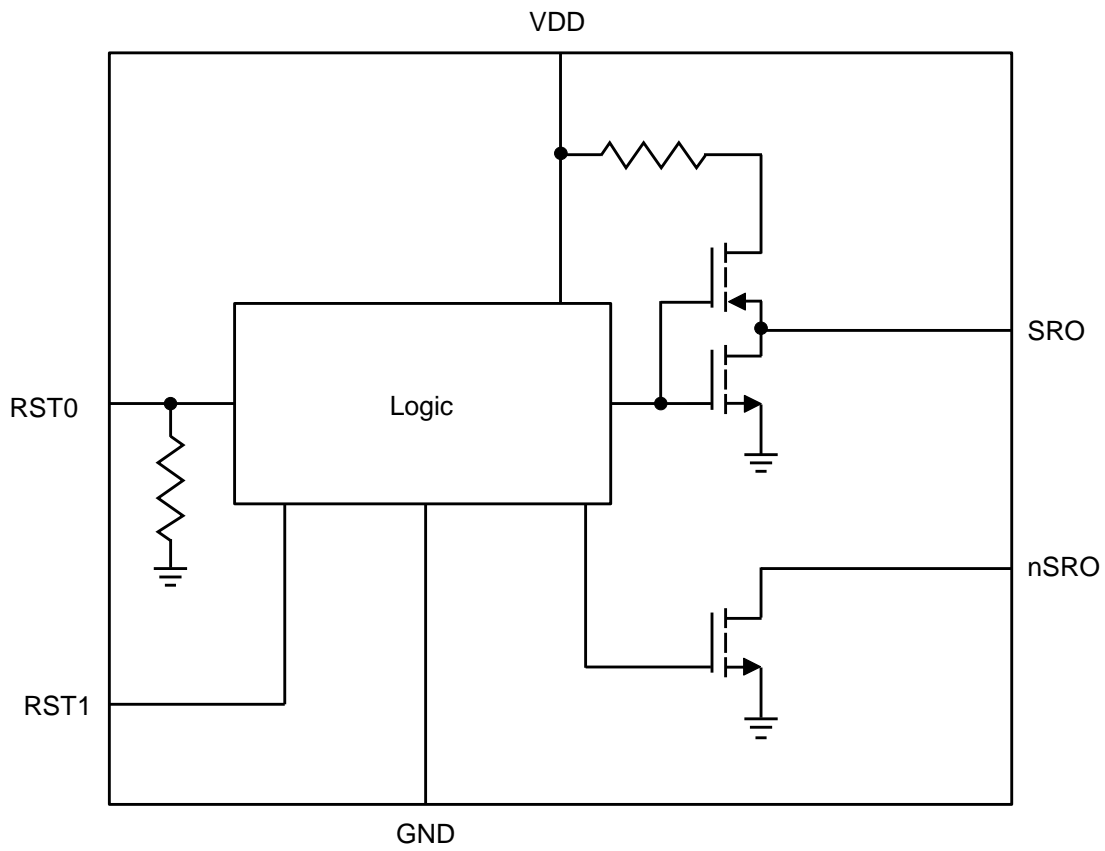


Figure 2. SRO Soft Turn ON and OFF Timing

**Functional Block Diagram**



**Figure 3. Block Diagram**

## Application Circuit

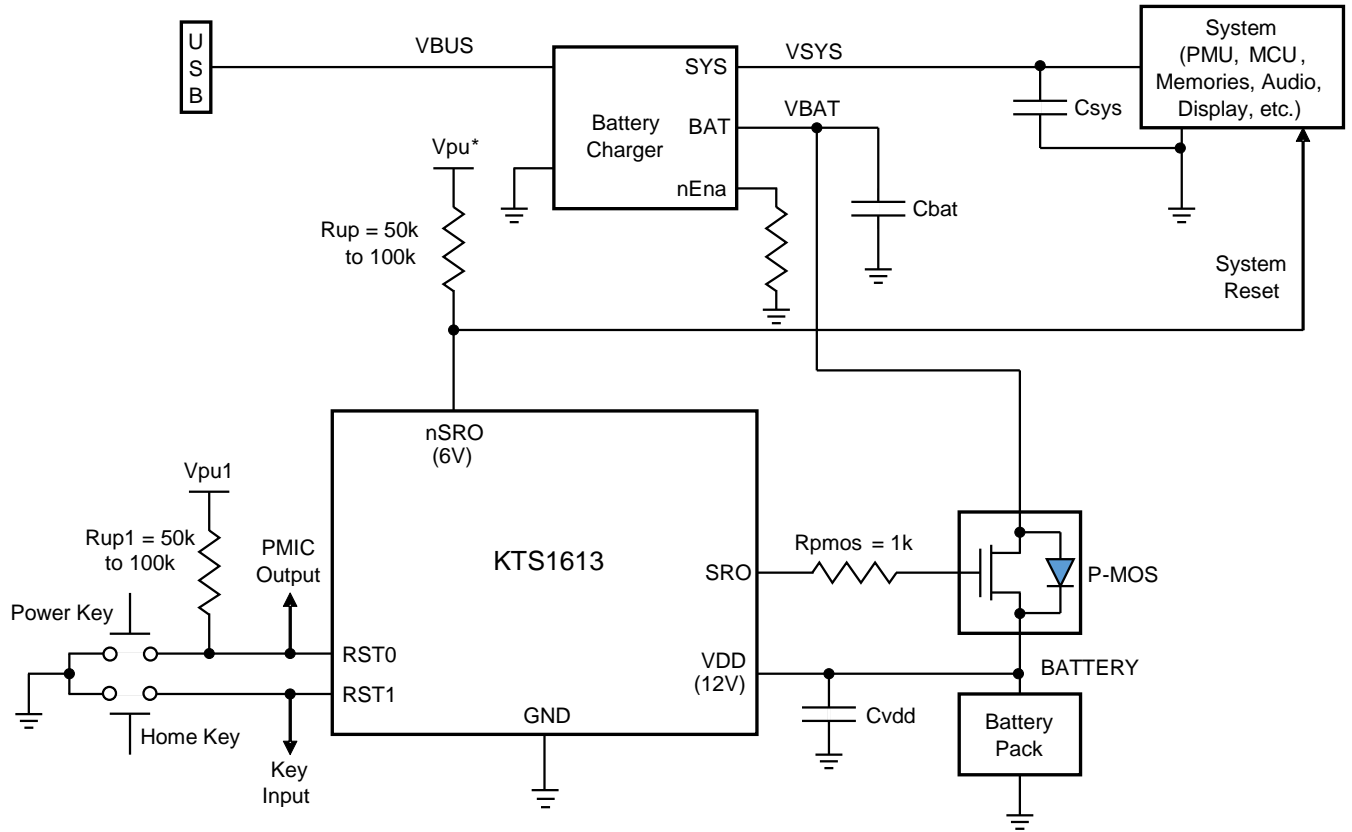
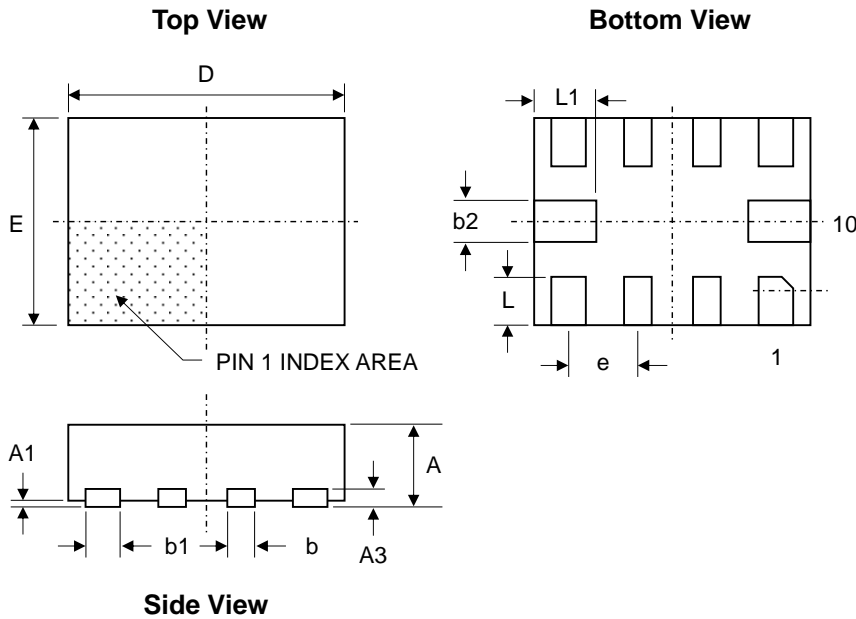


Figure 4. Application Circuit



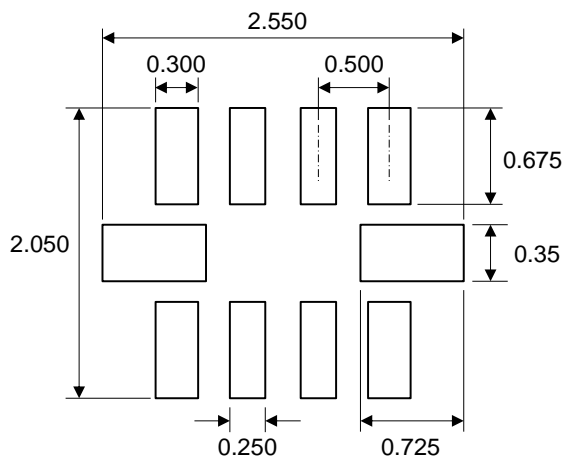
## Packaging Information

UQFN2.0x1.5-10 (2.0mm x 1.50mm x 0.55mm)



| Dimension | mm        |      |      |
|-----------|-----------|------|------|
|           | Min.      | Typ. | Max. |
| A         | 0.50      | 0.55 | 0.60 |
| A1        | 0.00      | -    | 0.05 |
| A3        | 0.152 REF |      |      |
| b         | 0.15      | 0.20 | 0.25 |
| b1        | 0.20      | 0.25 | 0.30 |
| b2        | 0.25      | 0.30 | 0.35 |
| D         | 1.95      | 2.00 | 2.05 |
| D2        | -         | -    | -    |
| E         | 1.45      | 1.50 | 1.55 |
| E2        | -         | -    | -    |
| e         | 0.50 REF  |      |      |
| L         | 0.30      | 0.35 | 0.40 |
| L1        | 0.40      | 0.45 | 0.50 |

### Recommended Footprint



\* Dimensions are in millimeters.

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