Smart Push-Button Reset with Two Discharge Paths

Features

- Operating Range: 2.2V~5.5V
- Supply Current in standby: < 1µA (V_{DD} = 4V)
- Quiescent Current in Ship mode: < 1µA (V_{DD} = 4V)
- Output Delay time (RST0 & 1 Input pins): 10s Typ.
- Reset Pulse Time (SRO, nSRO Output): 400ms Typ.
- Ship Mode Entry Delay Time (OFF Input): 15s
- Ship Mode Entry Command (OFF Input): 5 cycles
- Ship Mode Exit Delay Time (RST0 Input): Typ. 2s
- Output Discharge Time: 400ms Typ.
- Output Discharge Delay Time: 6ms Max
- ESD Protection
  - Human Body Model: 2kV
  - Charged Device Model: 1.5kV
- Over-Temperature Protection
- -40°C to +85°C Temperature Range

Brief Description

The KTS1612 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 KTS1612 operates over the 2.2 V to 5.5V supply voltage range, consuming less than 10µA of supply current at 4V.

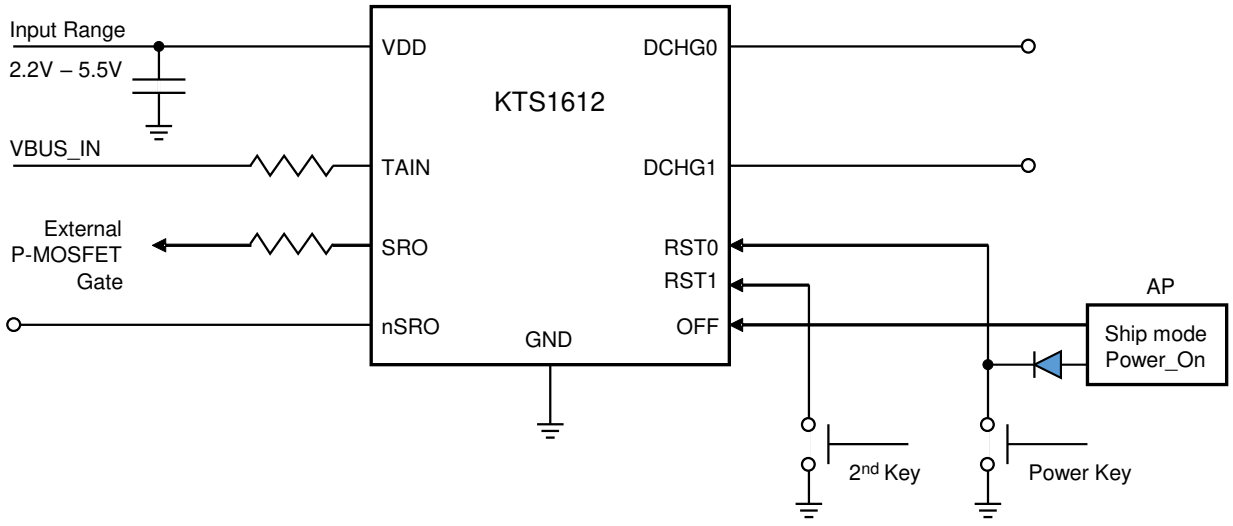
The reset and power sequence is controlled by RST0/RST1 and OFF signals and have the ability to drive an external P-channel MOSFET. The reset IC supports two discharge outputs DCHG0 and DCHG1.

The KTS1612 is available in lead-free, fully green compliant, small 10-pin UQFN 2.0mm x 1.5mm package.

Applications

- Mobile Phones & Tablets
- Wearable Devices
- Portable Instruments
- DSC, DVR, GPS
- Electronics with non-removable batteries

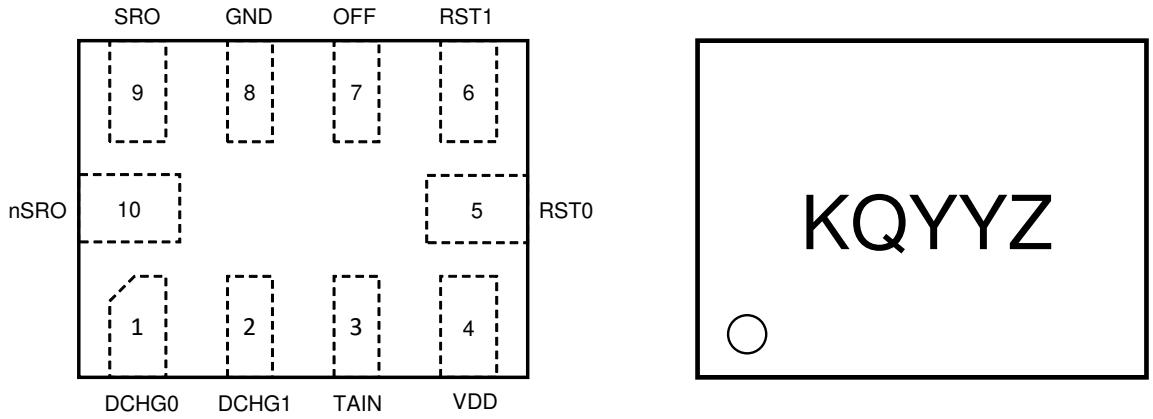
Typical Application



Pin Descriptions

Pin #	Name	Function	IO Characteristics
1	DCHG0	System supply discharge path input.	Open-drain
2	DCHG1	System supply discharge path input.	Open-drain
3	TAIN	Power input. Charger insert detection.	R dividing circuit
4	VDD	Power supply input.	-
5	RST0	Reset signal input 0.	Internal pull down (8MΩ)
6	RST1	Reset signal input 1.	No internal pull up resistor
7	OFF	Digital input. Ship mode enter command input.	Internal pull down (1MΩ)
8	GND	GND	-
9	SRO	Digital output, active high (VDD)	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
UQFN Package

Top Mark
KQ = Device ID Code, YY = Date Code, Z = Assembly Code

Ordering Information

Part Number	Marking[1]	Operating Temperature	Package
KTS1612EQU-TR	KQYYZ	-40°C to +85°C	UQFN2.0x1.5-10

1. "KQYYZ" is the device code, date code and assembly code respectively.

Absolute Maximum Ratings[2]

(T_A = 25°C unless otherwise noted)

Symbol	Description	Value	Units
VDD,DCHG0, DCHG1, RST0	Power supply input, Discharge path input & Reset input pins.	-0.3 to +12 (DC)	V
TAIN	Travel adaptor input pin.	-0.3 to +30	V
RST1, SRO, nSRO, OFF	Reset inputs, Digital outputs, Ship mode enter input pins	-0.3 to +6	V
T_J	Maximum Junction Temperature Range	-40 to 150	°C
T_s	Storage Temperature Range	-65 to 150	
T_{LEAD}	Maximum Soldering Temperature (at leads, 10sec)	300	

Thermal Capabilities[3]

Symbol	Description	Value	Units
θ_{JA}	Thermal Resistance – Junction to Ambient	73	°C/W
P_D	Maximum Power Dissipation at $T_A \leq 25°C$	1712	mW
$\Delta P_D/°C$	Derating Factor Above T_A = 25°C	13.7	mW/°C

Recommended Operating Range[4]

Description	Value
VDD, DCHG0, DCHG1	-0.3 to 5.5V
RST0, RST1, SRO, nSRO, OFF	-0.3 to 5V
TAIN	-0.3 to 5.5V

2. 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.

3. 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.

4. The device is not guaranteed to function outside of recommended operating condition.

Electrical Characteristics[5]

The *Min* and *Max* specs are applied over the full operation temperature range of -40°C to +85°C, V_{IN} = 2.2V to 5.5V unless otherwise noted, while *Typ* values are specified at V_{DD} = 4.0V and room temperature (T_A = 25°C) unless otherwise noted.

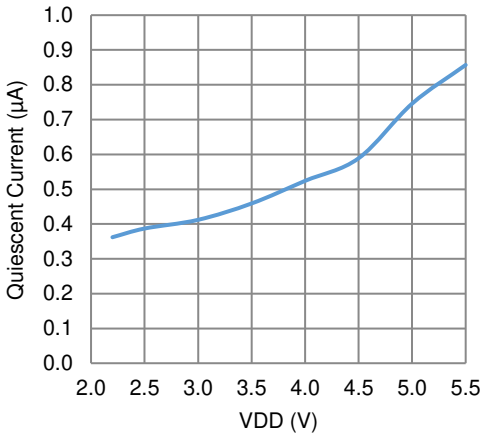
Symbol	Description	Conditions	Min	Typ	Max	Units
Basic Operation						
VDD	Input Voltage Range		2.2		5.5	V
I_Q	Quiescent supply current	Stand by when PMOS turn on (Exclude pull up/down resistor, Internal oscillator is off, V_{DD} = 4V)			1	µA
I_{OFF}	Ship mode current	Stand by when PMOS turn off (Exclude pull up/down resistor, Internal oscillator is off, V_{DD} = 4V)			1	µA
I_{SS}	Operation current	Active (Before reset signal output, Internal oscillator is on, V_{DD} = 4V)			10	µA
Digital IO						
V_{IL}	Digital input logic low level	RST0, RST1, OFF pin 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=1.2uA (V_{DD}=4V)			0.3	V
V_{OH}	Digital output logic high level		0.85*V_{DD}	V_{DD}		V
I_L	RST0/RST1 input leakage current		-	-	1	µA
V_{OL}	Digital output logic low level	nSRO, Io=2mA			0.3	V
T_O	SRO rising and falling time	(V_{DD} = 4V, R_S = 1kΩ, Qg = 20nC)	1		3	ms
TAIN						
$V_{TA\_detection}$	R_{TA} input active threshold voltage	Voltage before external 100K pull up resistor	3.8	-	4.6	V
T_{TA}	Debounce time	RST0,RST1,TAIN		10		ms
RESET						
T_R	Reset request time	V_{DD} = 4V	8.5	10	11.5	s
T_D	Discharge time		340	400	460	ms
T_{dd}	Discharge delay time		4	5	6	ms
I_D	DCHGx discharge current, V_{OUT} = 4V		30	52	67	mA
SHIP MODE						
R_OFF	OFF pin pull down resistor			1		MΩ
Tdo	OFF pin debounce time			250	350	µs
T_S	Ship mode enter delay		12	15	18	s
	Command		-	5	-	cycle
T_1	HIGH and LOW hold time	50% duty cycle	1	2		ms
T_2	Total 5 pulses time				100	ms
T_3	Time of RST keep L to exit ship mode	V_{DD} = 4V	1.6	2	2.4	s
ESD PROTECTION						
V_{ESD}	Human Body Model (HBM)	All pins		±2		kV
	IEC61000-4-2 Contact discharge	V_{DD} pin		±8		kV
	IEC61000-4-2 Air gap discharge	V_{DD} pin		±15		kV

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

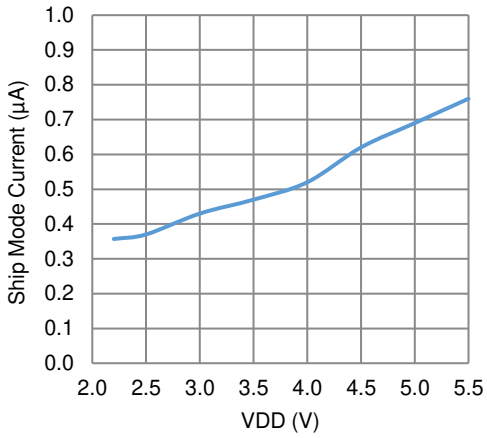
Typical Characteristics

V_{DD} = 4V, T_A = 25°C unless otherwise specified.

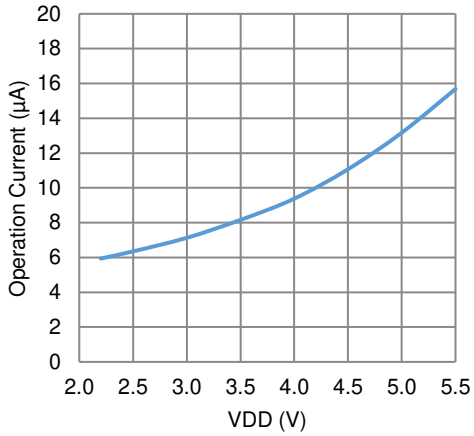
Quiescent Current vs. VDD



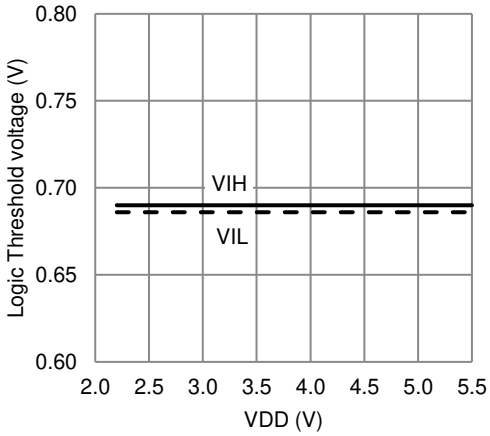
Ship Mode Current vs. VDD



Operation Current vs. VDD (before Reset pulse)



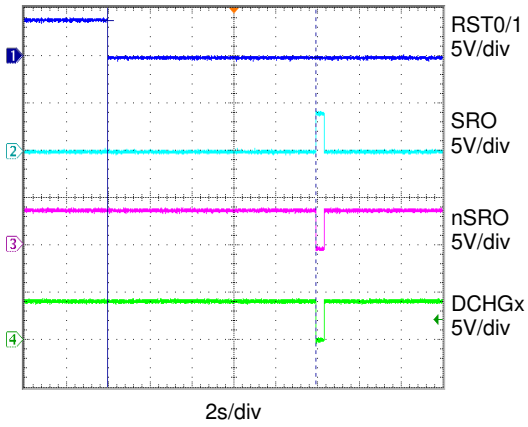
RST0/RST1 Digital Input Logic Threshold Vs. VDD



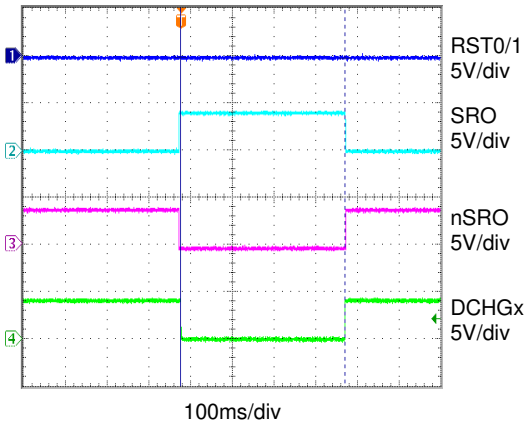
Typical Characteristics (continued)

V_{DD} = 4V, OFF = Low, TAIN = GND, T_A = 25°C unless otherwise specified.

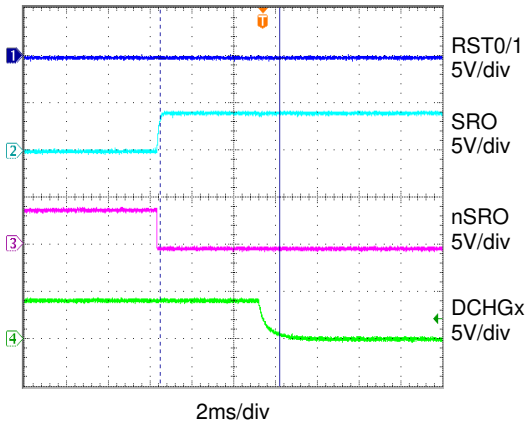
Enter Reset Mode



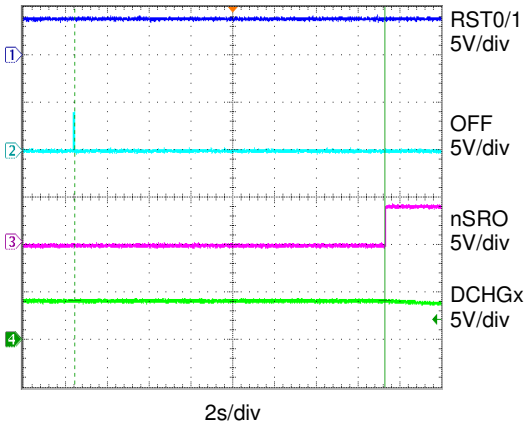
Reset Mode Pulse



Reset Mode Trigger



Enter Ship Mode (OFF = 5 pulses)



Function Description

Real Value Table

Table 1. Logic Real Value Table

("H" = High level, "L" = Low level, "OPEN" = internal FET is open, "↑" = rising edge, "↓" = falling edge)

Pin / State	Event0					STATE 0			Event0 For (in s)	State 1			Time between State 1 & State 2	State 2		
	AVDD	RST0	RST1	TAIN	OFF	SRO	nSRO	DCHGx		SRO	nSRO	DCHGx		SRO	nSRO	DCHGx
POR	VDD ↑	X	X	X	X	unknown	OPEN	OPEN	20m	H	X	X	To	L	OPEN	OPEN
RESET	VDD	H	H	X	L	L	OPEN	OPEN	-	L	OPEN	OPEN	-	L	OPEN	OPEN
	VDD	L	L	X	X	L	OPEN	OPEN	10	↑	↓	↓	Td+2Tdd	↓	↑	↑
ENTER SHIP	VDD	X	X	X	5 pulses	L	OPEN	OPEN	15	↑	OPEN	OPEN	0	H	OPEN	OPEN
	VDD	H	H	L	L	L	OPEN	OPEN	X	L	OPEN	OPEN		L	OPEN	OPEN
EXIT SHIP	VDD	X	X	H	X	H	OPEN	OPEN	10m	H	OPEN	OPEN	0	L	OPEN	OPEN
	VDD	L	X	X	X	H	OPEN	OPEN	2	H	OPEN	OPEN	0	L	OPEN	OPEN

Reset Timing

Reset occurs only after both RST0 and RST1 stay low for Tr duration, SRO output goes high then the discharge paths DCHG0 and DCHG1 are turned on (pulled down to GND). After Td discharge time, the discharge paths are turned off then SRO output goes low.

If RST0 & RST1 stay low indefinitely, KTS1612 only resets one time.

RST0 & RST1 have highest priority. During Tr & Td time period, if there is an adaptor detection signal or enter ship mode signal, KTS1612 will continue the reset process. During Tr & Td time period, KTS1612 ignores the input signals including TAIN, OFF.

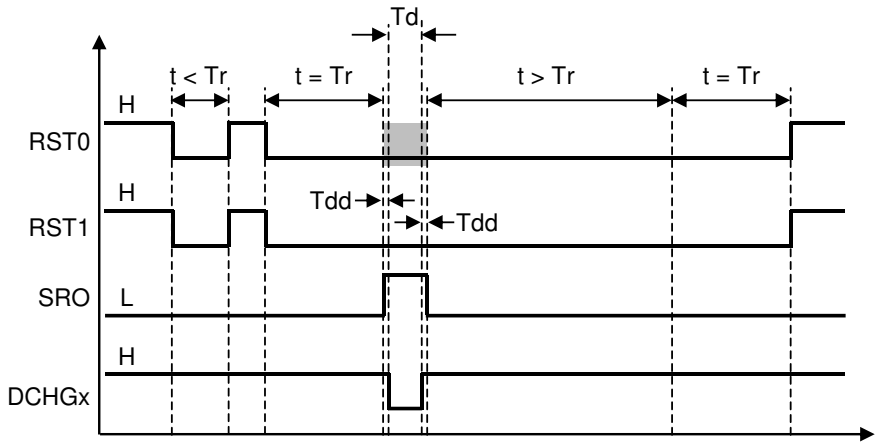


Figure 1. Reset Timing

Ship Mode Enter and Exit Timing

The ship mode enter command consists of 5 pulses in a square waveform with 50% duty and 4ms period. During Ts period, KTS1612 ignores all input signals.

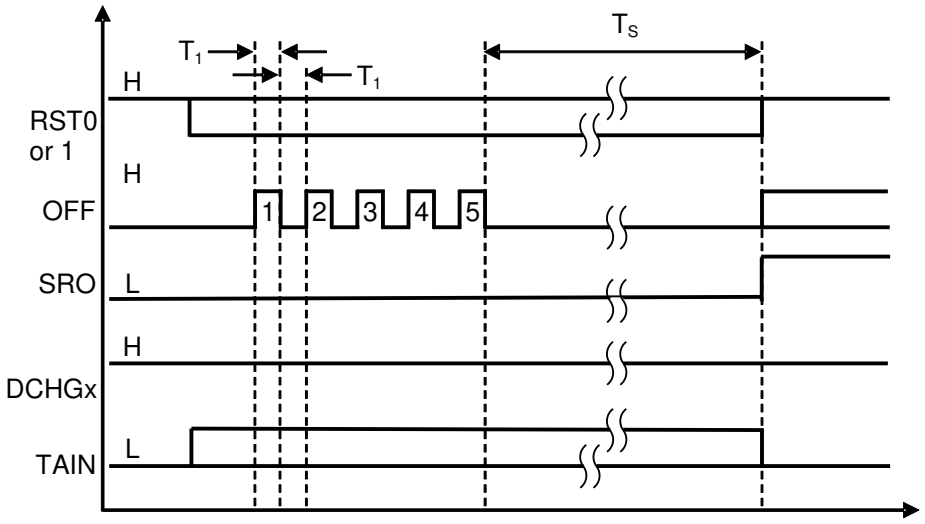


Figure 2. Ship Mode Enter Timing

There are two triggers to exit ship mode: Adaptor is plugged in or RST0 input stays low for 2 seconds. If Adaptor in and RST0 input are low at same time, Adaptor detection has higher priority.

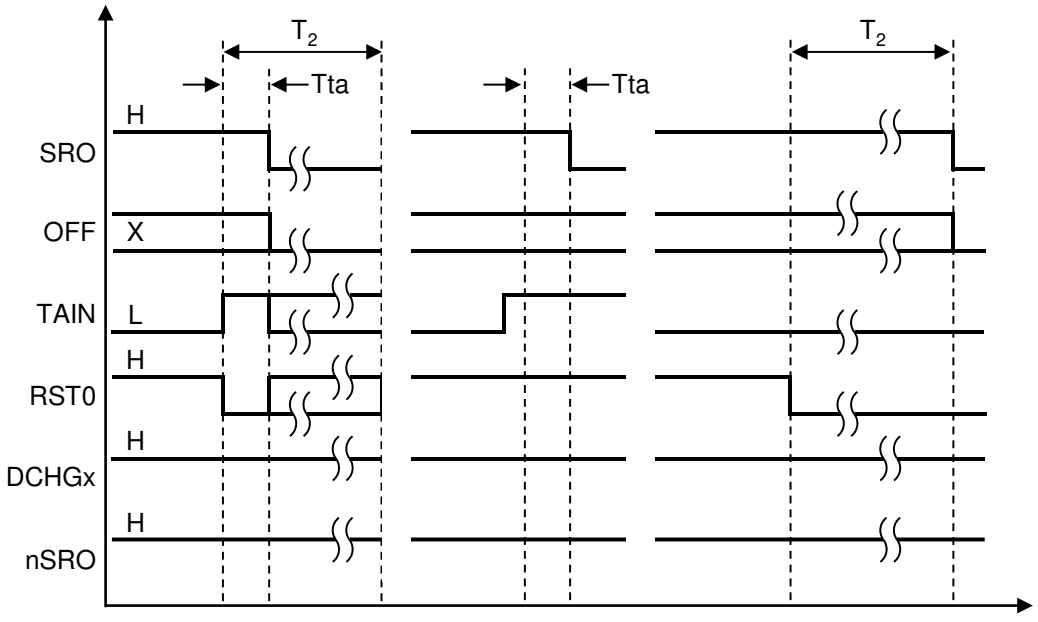


Figure 3. Ship Mode Exit Timing

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:

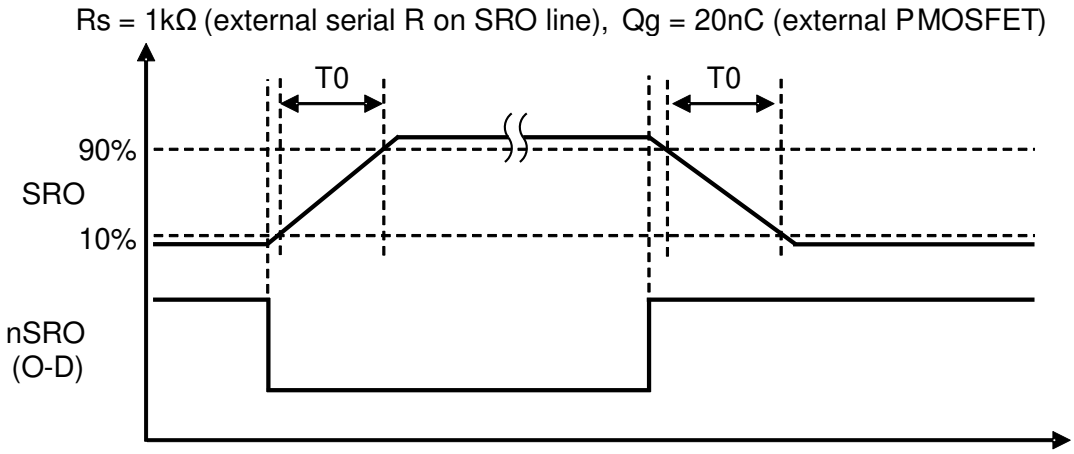


Figure 4. SRO Soft Turn ON and OFF Timing

VSYS Turn OFF and Discharge Timing

1) Reset
   When a reset happens, KTS1612 first turns off the external MOSFET controlled by SRO to disconnect the battery, then starts the discharge with DCHGx.

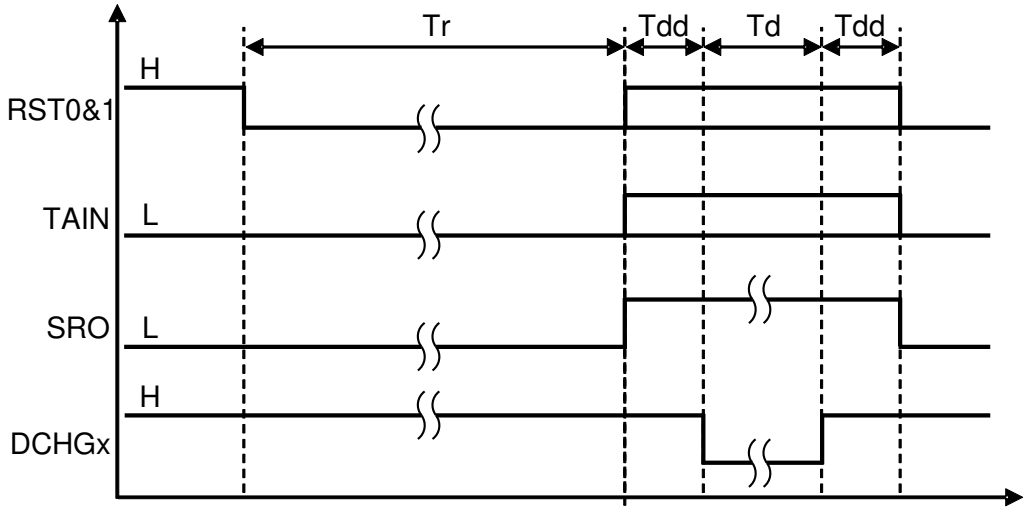


Figure 5. Reset SRO and DCHGx Timing

2) Ship Mode Enter
   During ship mode enter process, DCHGx will not discharge.

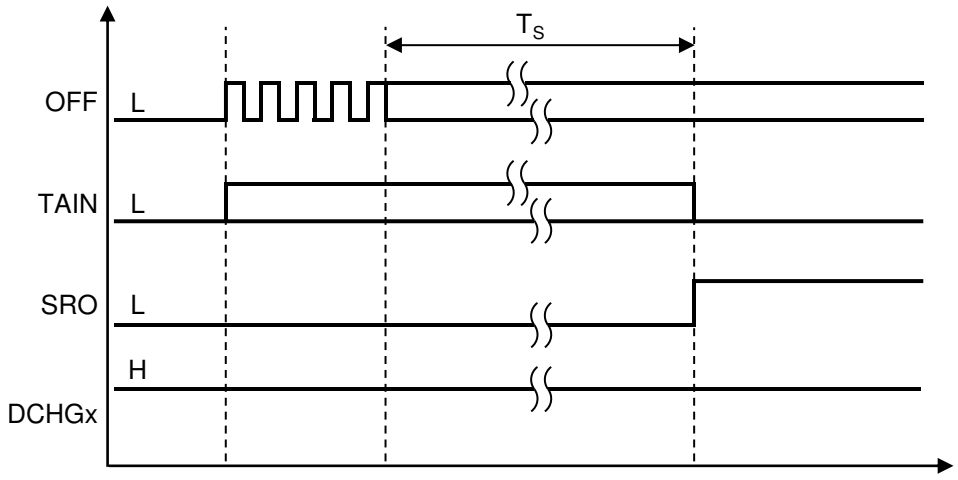


Figure 6. Ship Mode Enter & SRO & DCHGx Timing

3) VDD falling and Power On Reset state.

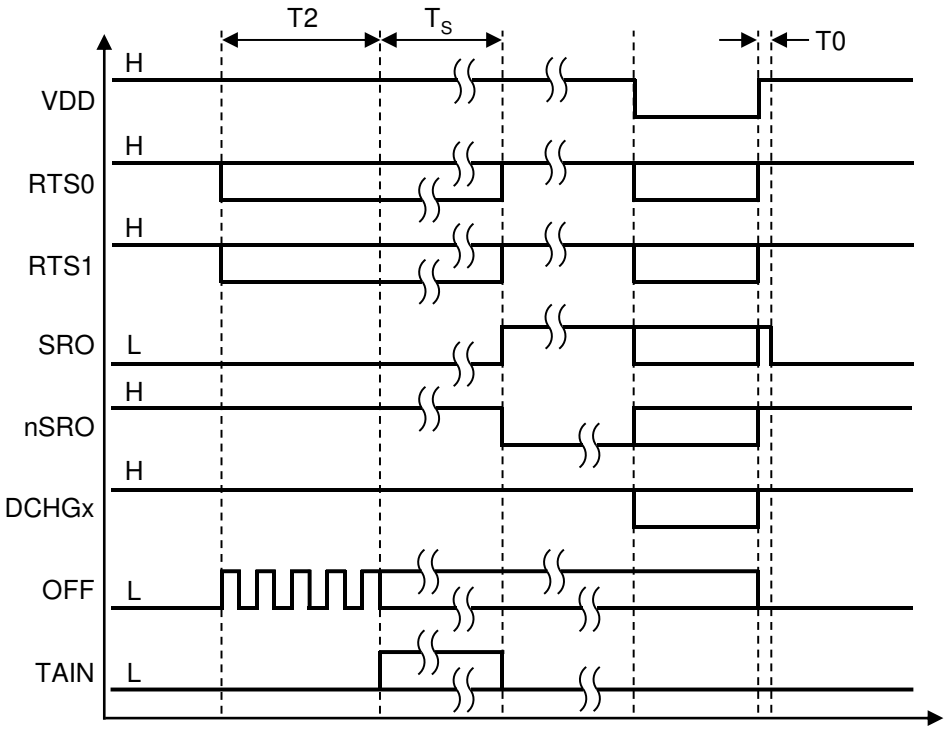


Figure 7. Power ON Reset

Functional Block Diagram

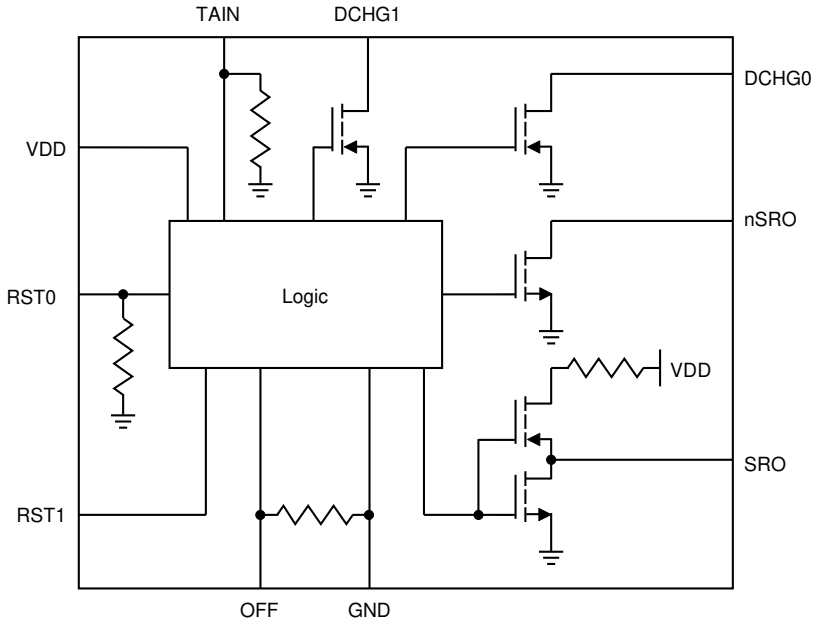
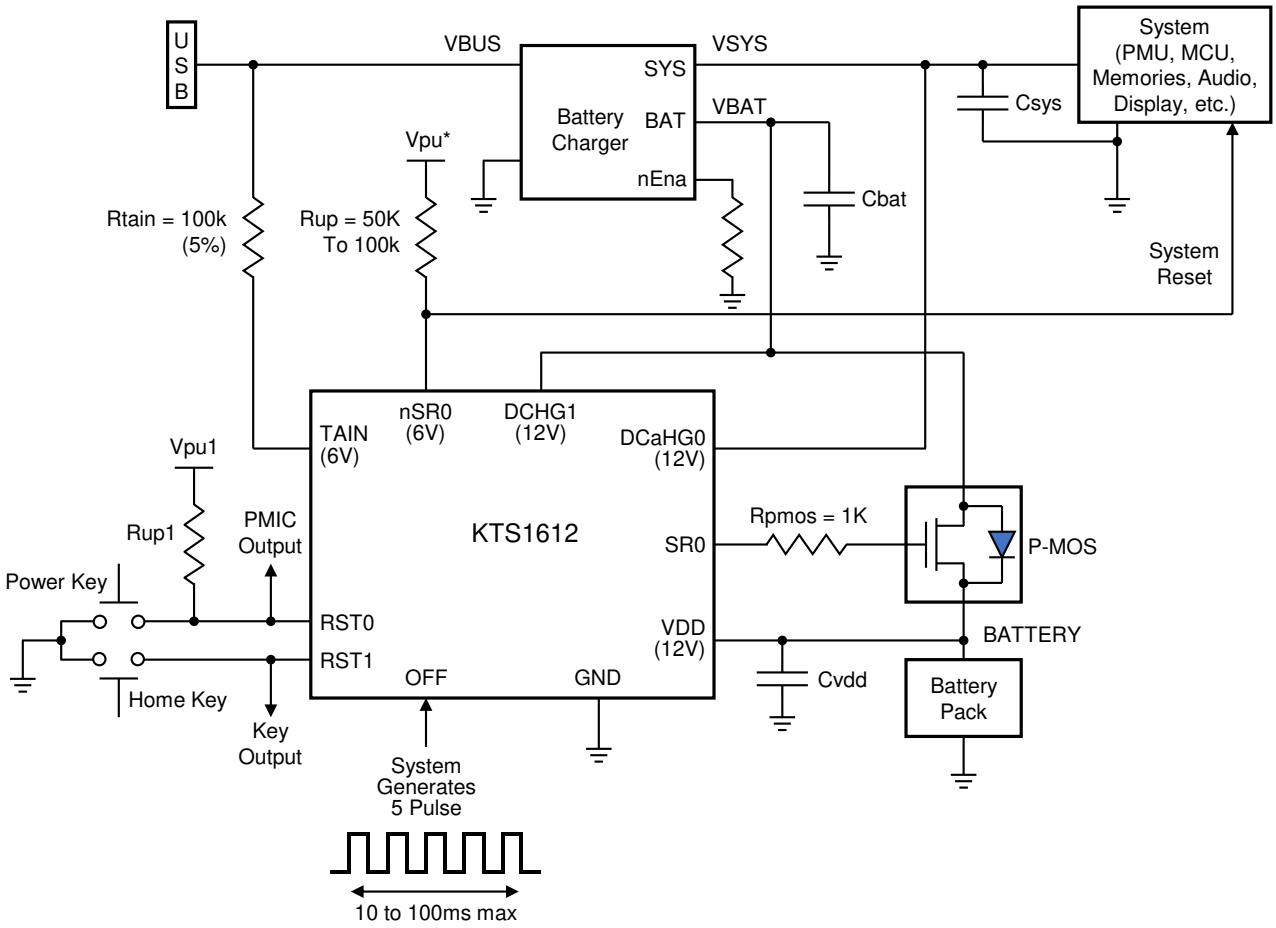


Figure 8. Block Diagram

Application Circuit

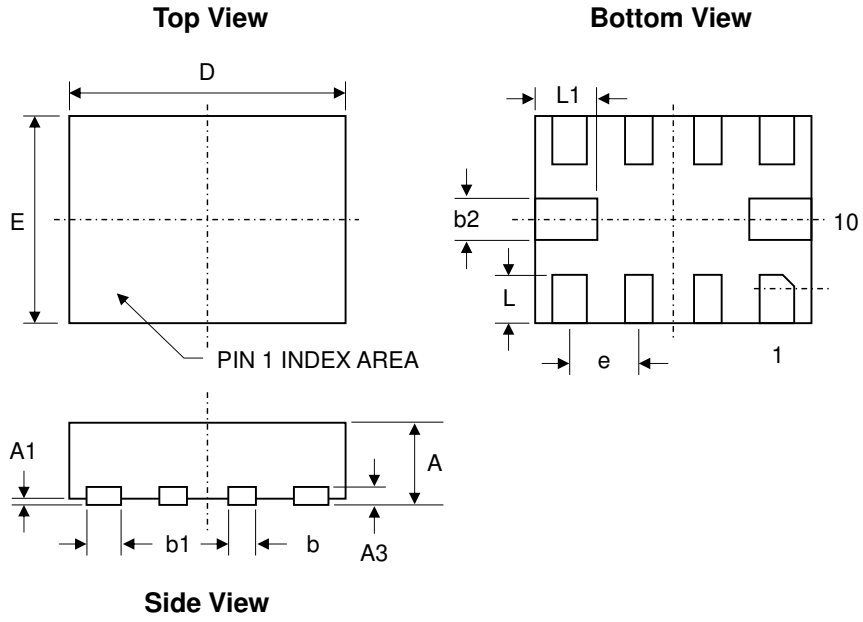


Rup1 = 50K~100KΩ

Figure 9. Application Circuit

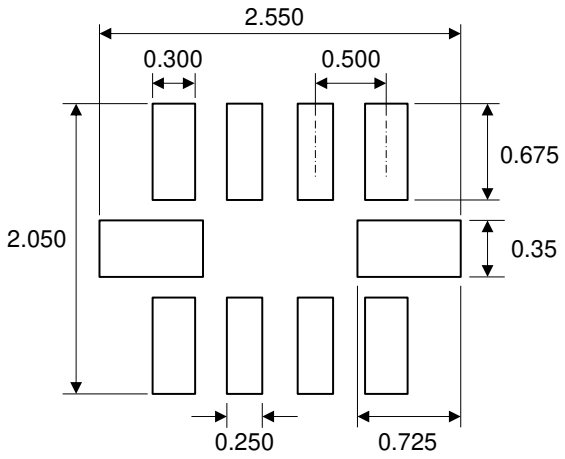
Packaging Information

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.

Kinetic Technologies cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Kinetic Technologies product. No intellectual property or circuit patent licenses are implied. Kinetic Technologies reserves the right to change the circuitry and specifications without notice at any time.