Boréas Technologies

BOS0614CW – Product Presentation

2021-05-27

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- Electrical Specifications Summary
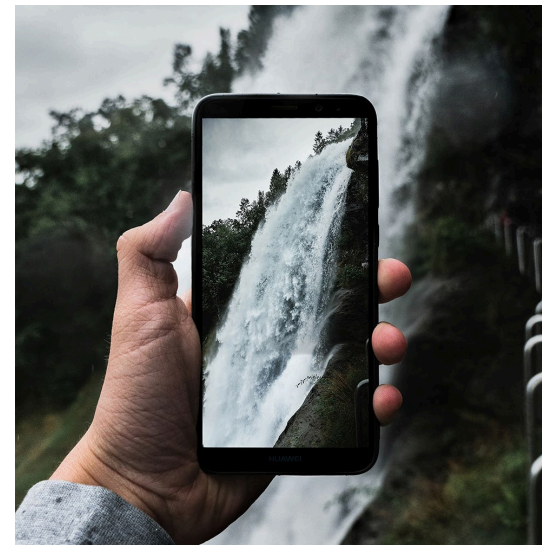- Development Platform

Applications

Piezo haptic buttons in smartphones to enhance user experience with new UI technology beyond the touchscreen

Gaming Phones Trigger Buttons
- Lower Latency
- Higher Click-per-Second Rate
- Custom Haptics
- Force Sensing

Phones
- Custom Haptics
- Force Sensing
- New UX Use Cases
- Industrial Design Flexibility

BOS0614 Key Features

- Four Channel 60V CapDrive^{TM} Piezo Driver
- Advanced Piezo Sensing Interface
  - Zero Power Sensing for system wake-up
  - Customizable force threshold
  - Automatic handling of customized press and release haptic effects
  - 220 µV sensing resolution
- Integrated Digital Front End
  - I3C/I^{2}C with 1.2-1.8V logic levels
  - 2 kB RAM waveform memory
  - On-chip waveform synthesis
  - State retention in sleep mode
  - 1024 samples FIFO
- Four GPIOs
  - Open-Drain / Push-Pull
  - Mechanical Button Replacement
  - External Trigger Inputs
  - Output interrupt signals
  - 1.8 V − 5 V compatible
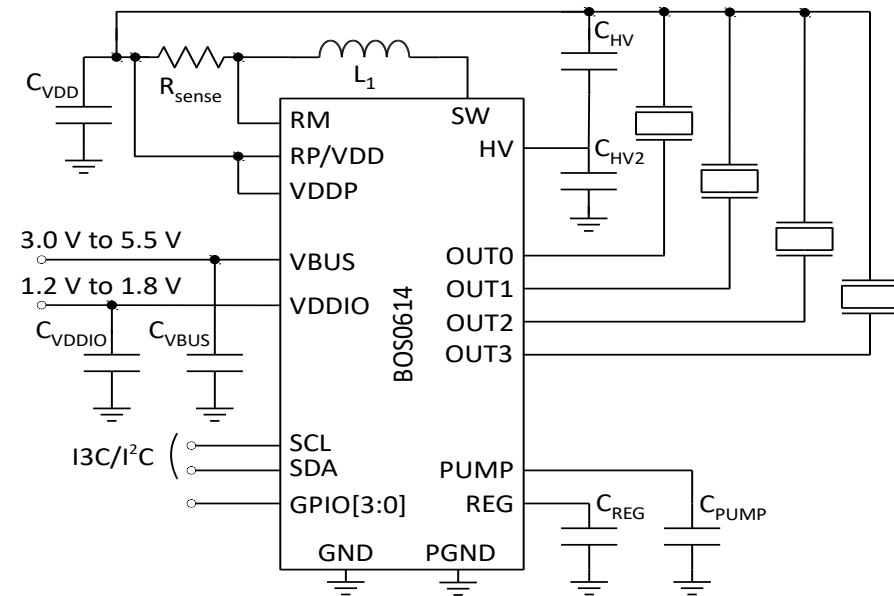
Small Footprint / Low Height

IC size
 WLCSP 30 balls
 2.1x2.5x0.6 mm
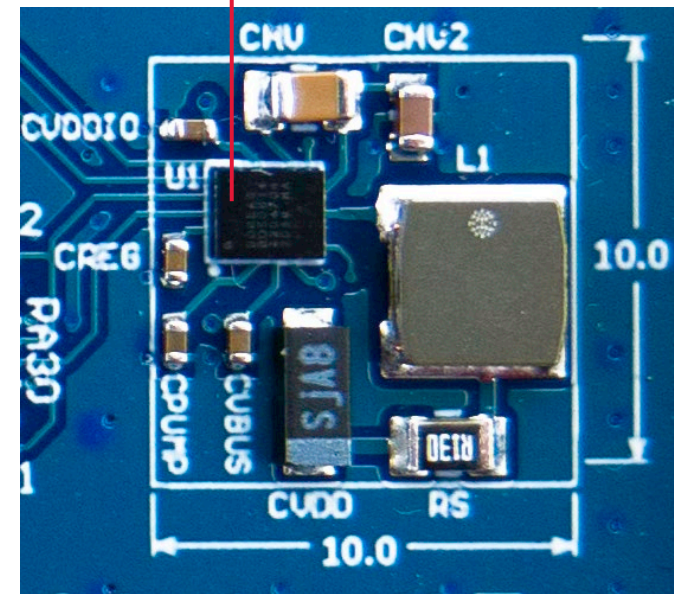 0.4 mm pitch

Solution size <u>optimized for area</u>
 10x10x1.2 mm

Solution size <u>optimized for height</u>
 11.4x10x1 mm

Number of passive components
 9

Advanced Piezo Sensing Interface

Zero Power Sensing (ZPS)

Power consumption < 10 µA

No latency

Automatic shutdown after detection

Configurable sensitivity

Native High Resolution High Sampling Rate Sensing

Resolution: 220 µV

Sensing range on-chip: +/- 3.6V

Sensing range with external MCU processing: no limit

Active sensing power consumption: <1.1 mA / 4 channels

Native sampling rate: 10 kS/s

Mechanical Button Replacement

Active low GPIO
- Replace natively mechanical buttons without complete system redesign
- Open-drain outputs
- 1.8V to 5V logic level compatibility
- No debouncing necessary

Autonomous Operation
- Customizable press and release haptic effects
- Customizable press and release trigger conditions
- GPIO represents the virtual button state
- No real-time software support necessary

System Power Button Support
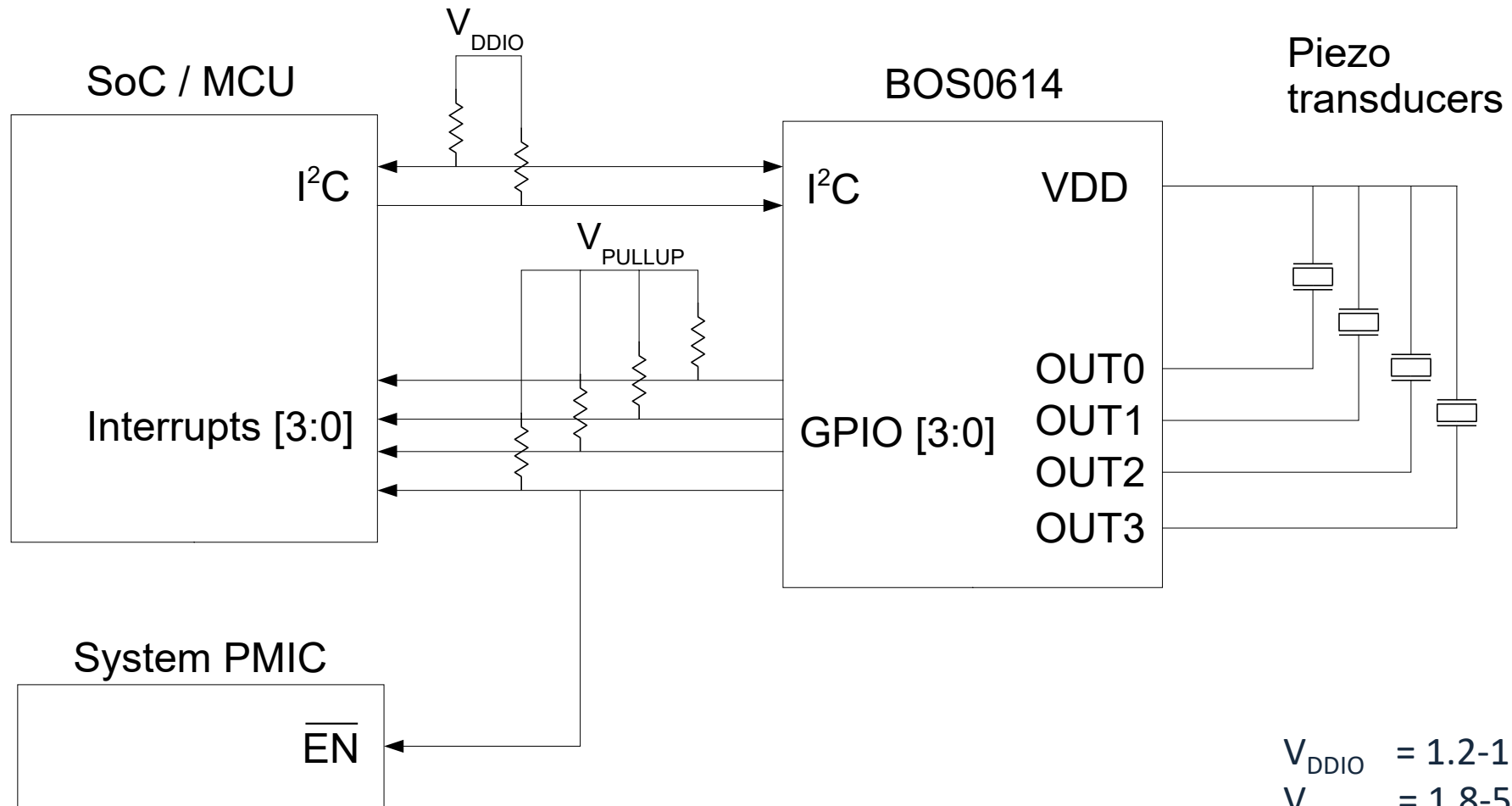- Wake from sleep from force detection
- Analyze force strength
- Go back to sleep autonomously
- Default button state at powerup

Simplified System Block Diagram
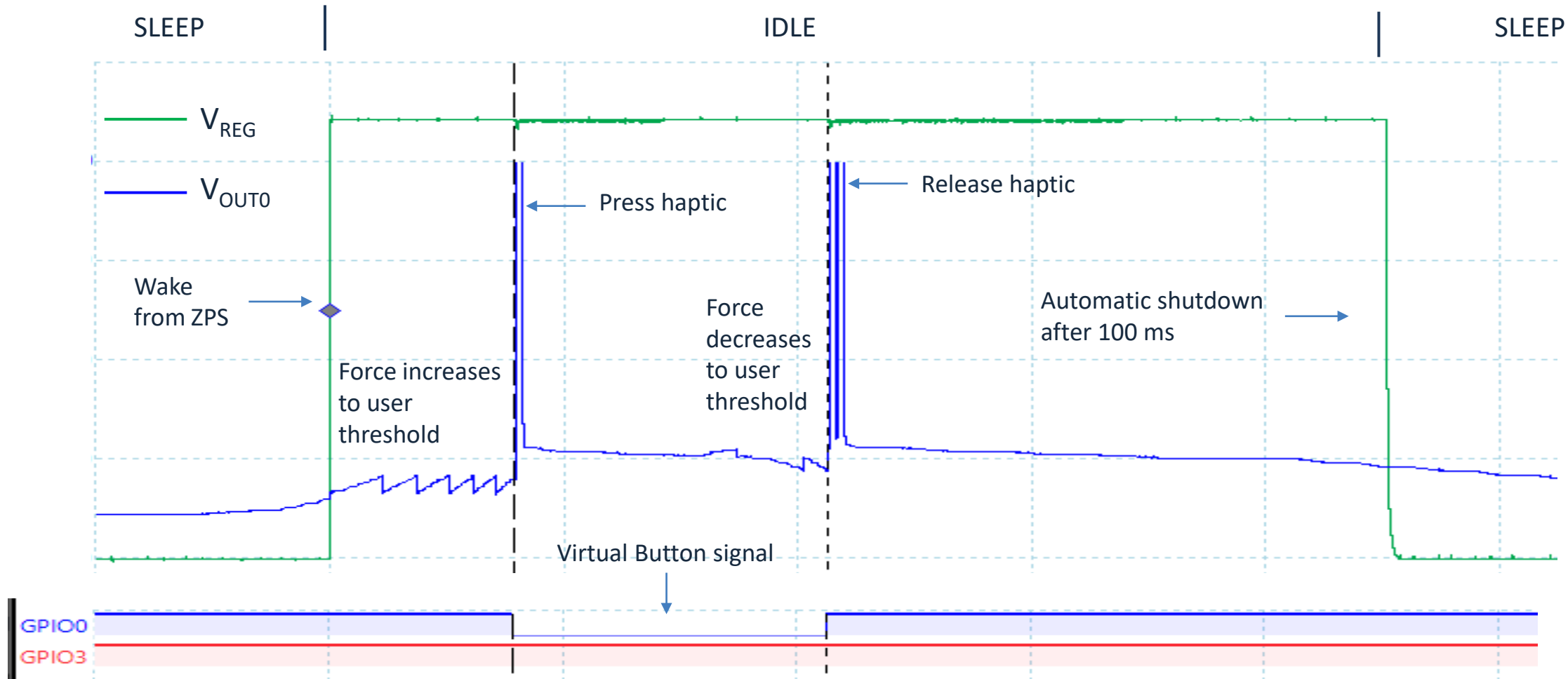
BOS0614 Force sensing + Haptic

SoC / MCU

V_{DDIO}

BOS0614

Piezo transducers

I^2C

I^2C

VDD

V_{PULLUP}

Interrupts [3:0]

GPIO [3:0]

OUT0
OUT1
OUT2
OUT3

System PMIC

$\overline{EN}$

V_{DDIO} = 1.2-1.8 V
V_{PULLUP} = 1.8-5 V

Mechanical Button Waveforms

Autonomous behavior (No I²C communication)

SLEEP | IDLE | SLEEP

V$_{REG}$

V$_{OUT0}$

Press haptic

Release haptic

Wake from ZPS

Force increases to user threshold

Force decreases to user threshold

Automatic shutdown after 100 ms

Virtual Button signal

GPIO0

GPIO3

Confidential

Simplified System Block Diagram

External force sensing + BOS0614 Haptic

Optional connections for easy trigger of pre-programmed haptic effects

V_{DDIO} = 1.2-1.8 V
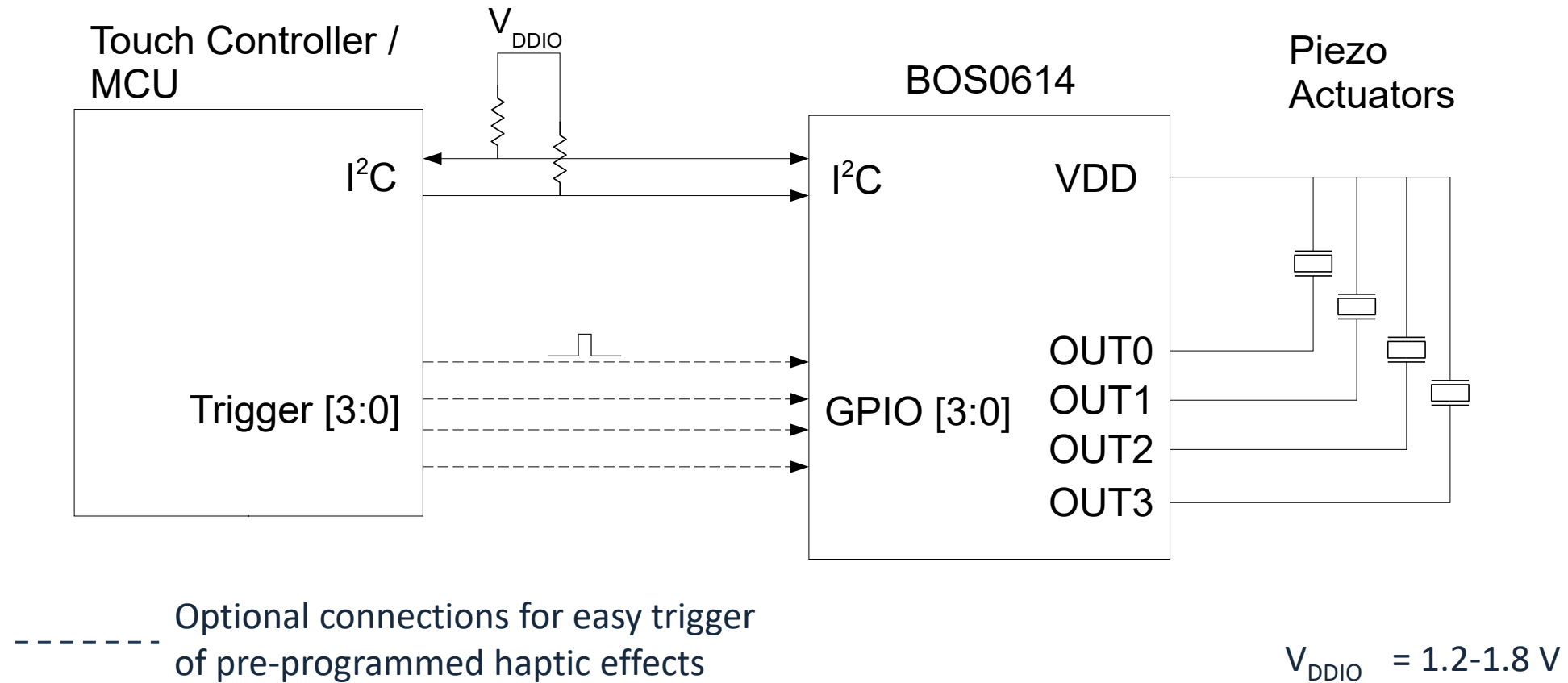
External Haptic Trigger

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Up to two different waveforms can be automatically played by a GPIO trigger

The BOS0614 automatically changes it`s internal state between "Press" and "Release" at each trigger

Very easy support of any application using an external force sensor

« Press » haptic effect

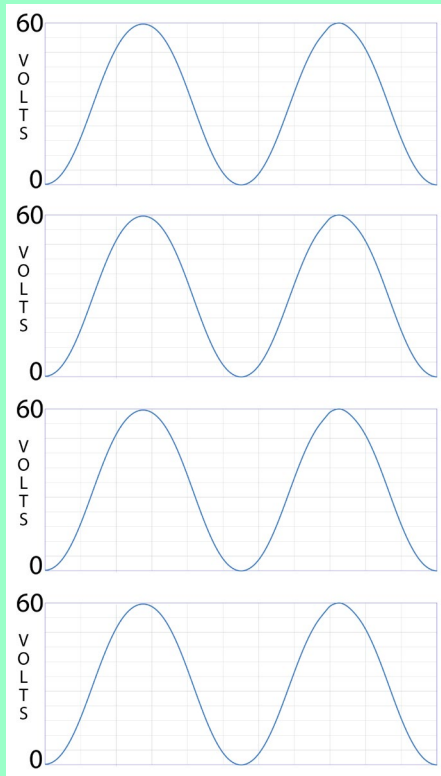« Release » haptic effect

GPIO0 Trigger 1

GPIO0 Trigger 2

GPIO0

V_{OUT0}
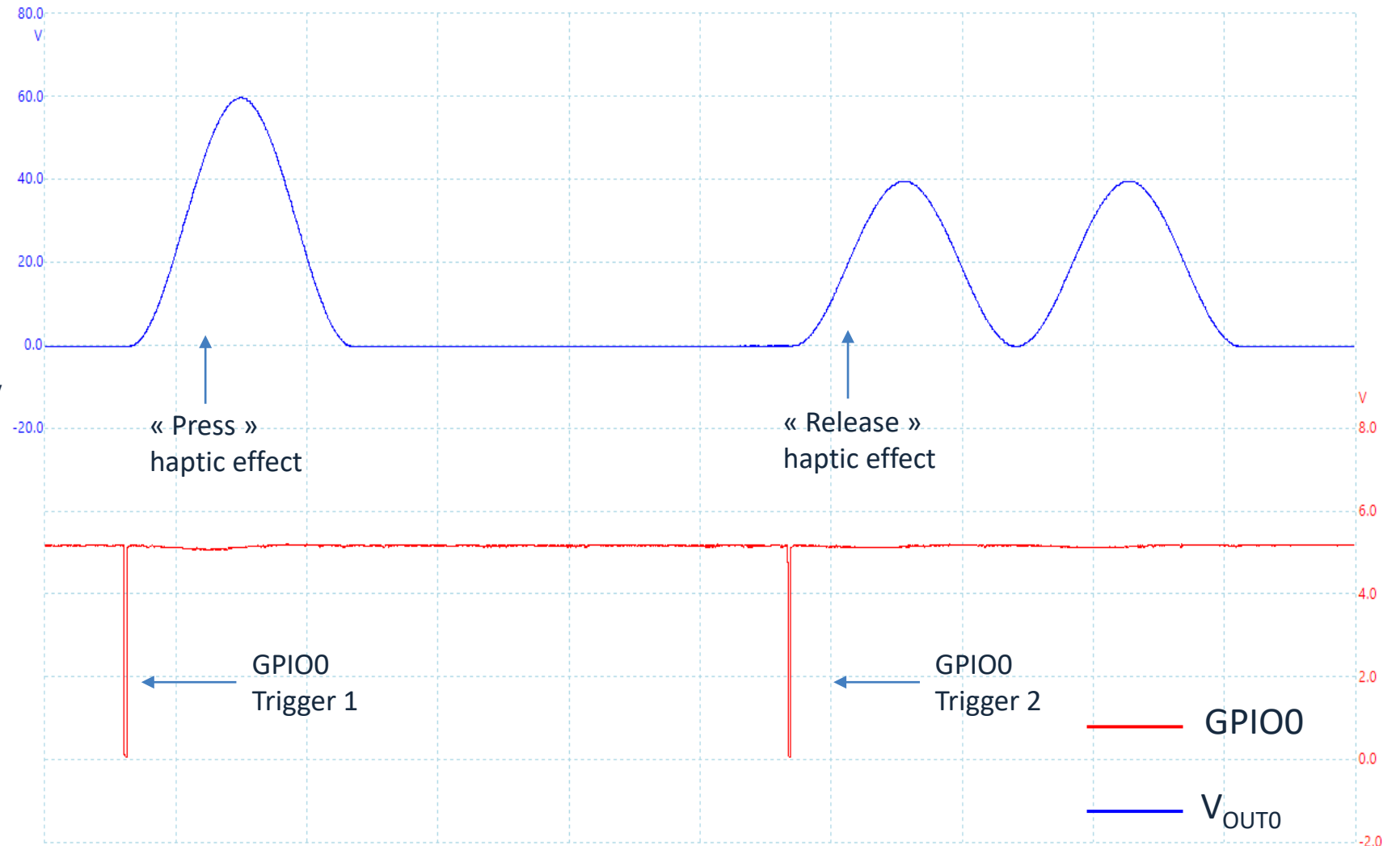
Multi-Channel Possible Use Cases

Allowed

Not Allowed

Play the same waveform on different channels simultaneously

Time multiplex different waveforms to different channels

Play different waveforms on different channels simultaneously

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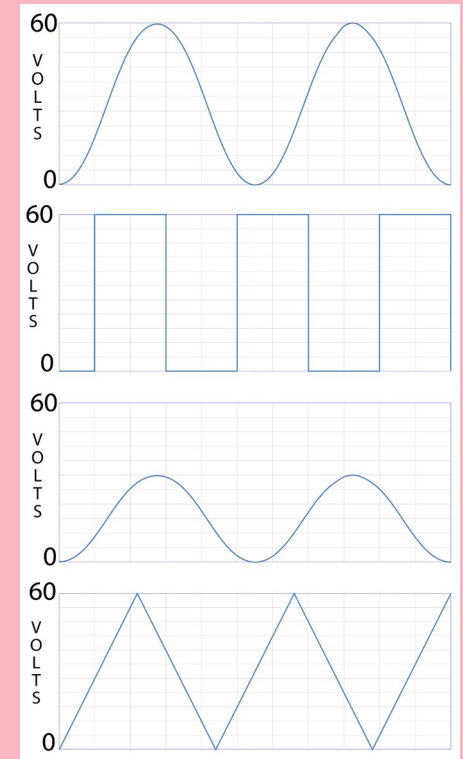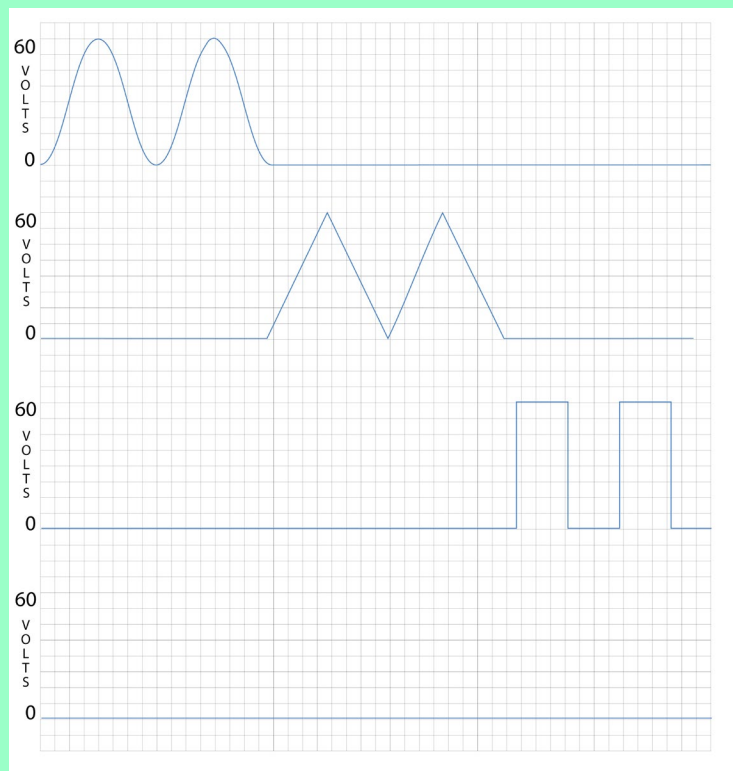
Key Electrical specifications

- Supply
  - V_{BUS} : 3.0V – 5.5V
  - V_{DDIO}: 1.2V– 1.8V (I^{2}C/I3C)

- Waveform output voltage range
  - 0 to 60V

- Maximum load capacitance
  - 800 nF per channel @ 300 Hz, 60V
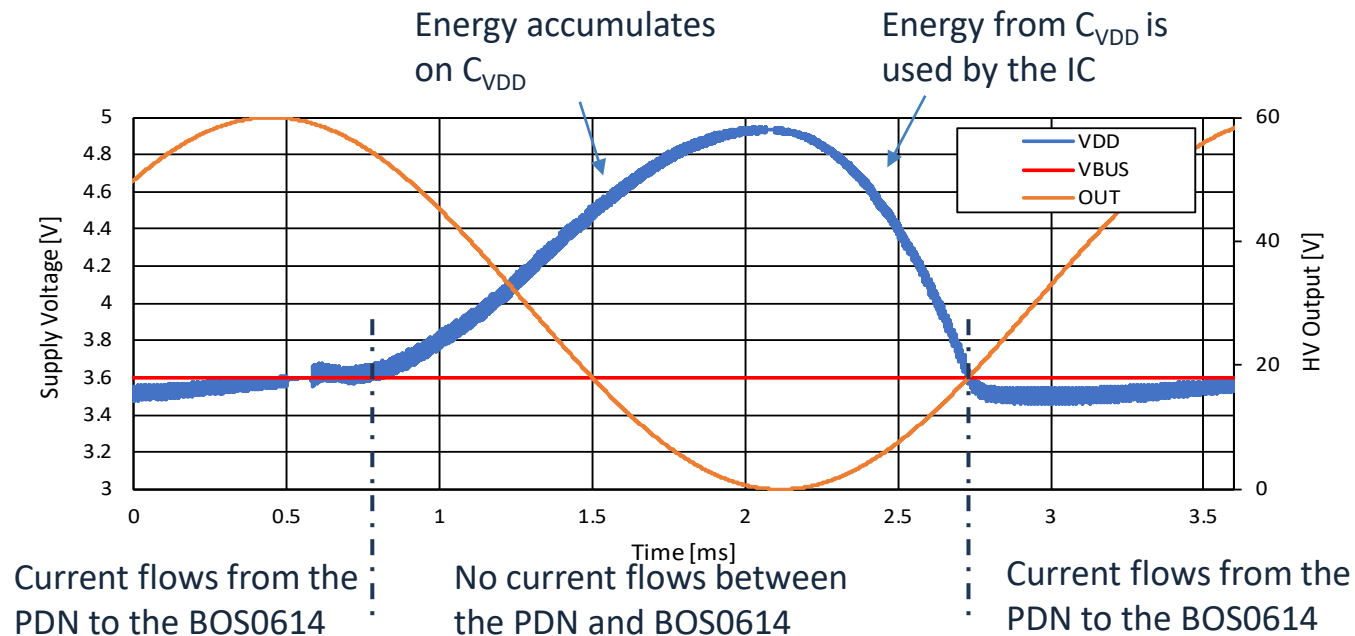 - 1600 nF simultaneous channels @ 300 Hz, 60V

Typical Current Consumption

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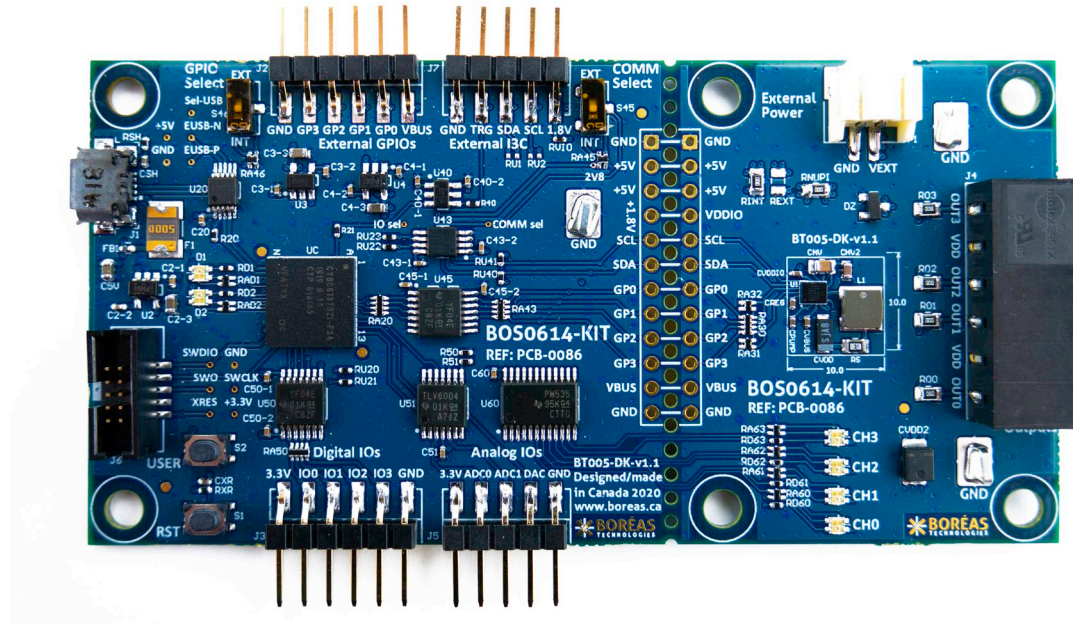| Symbol	Parameter	Test Conditions*	Typical	Unit
E_{CLICK}	Energy/click	f_{sig} = 300 Hz V_{OUT} = 60V C_{LOAD} = TDK 1204H018V060	0.08	µAh
I_{Q_VBUS}	SLEEP	ZPS deactivated	5	µA
	SLEEP(ZPS 1 Ch.)	ZPS activated on one channel	7	µA
	SLEEP(ZPS 4 Ch.)	ZPS activated on all channels	9	µA
	IDLE	No sensing	850	µA
	IDLE (Sensing 4 Ch.)	Sensing on all channels	1100	µA
$I_{VBUS,AVG}$	Average V_{BUS} supply current during operation	f_{sig} = 300 Hz V_{OUT} = 60V C_{LOAD} = 440 nF	45	mA
	Average V_{BUS} supply current during operation	f_{sig} = 300 Hz V_{OUT} = 60V C_{LOAD} = TDK 1204H018V060	89	mA

*V_{BUS} = 3.6V

Unidirectional Power Input

- Unidirectional Power Input (UPI) is a system that enables the IC to store the recovered energy near the IC

- The benefits of this optional mode are:
  - Reduce the RMS current on the power delivery network (PDN)
  - Prevent forcing current back into the PDN when it would create system level issues
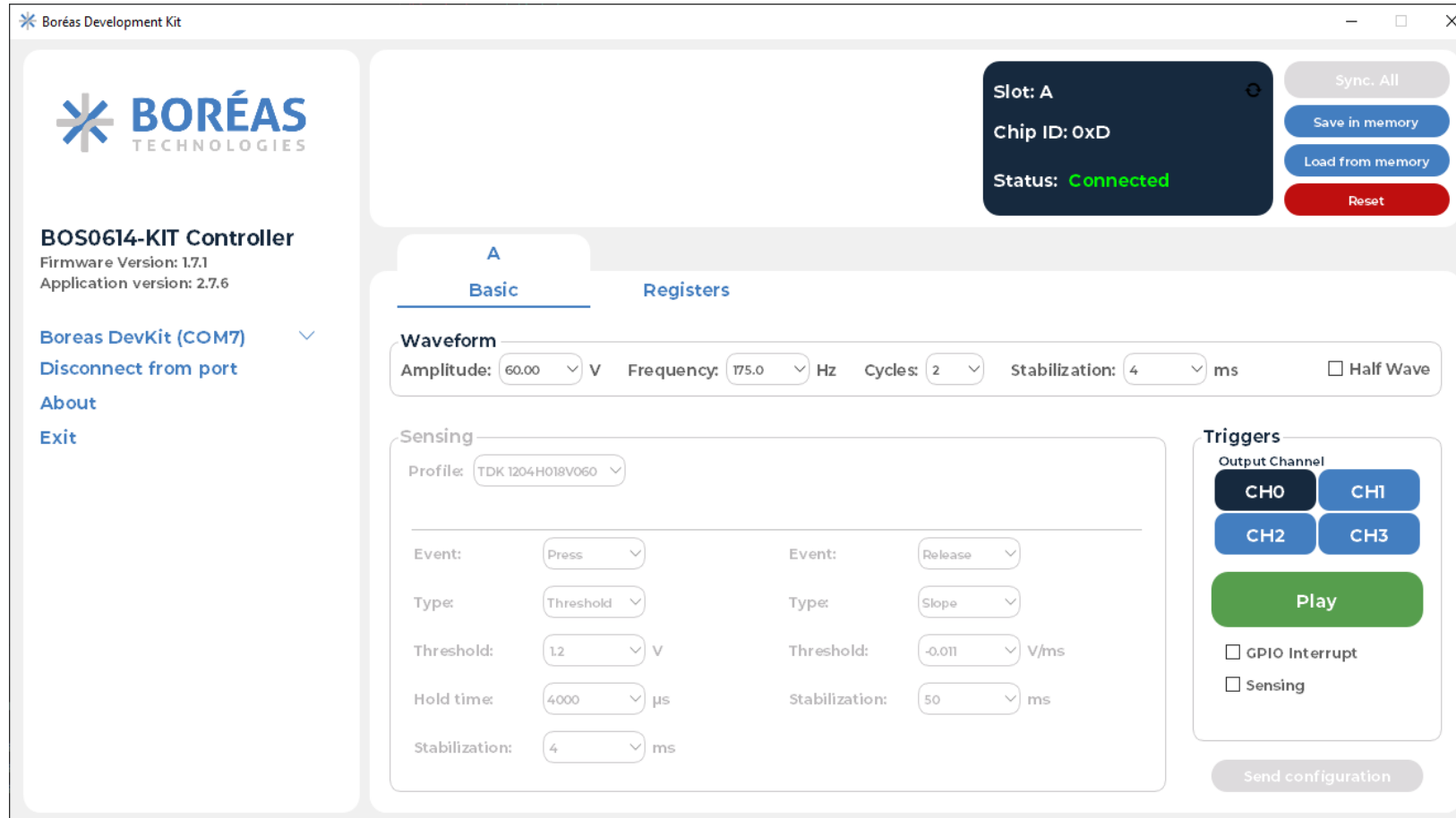

Energy accumulates on C_{VDD}

Energy from C_{VDD} is used by the IC

Current flows from the PDN to the BOS0614

No current flows between the PDN and BOS0614

Current flows from the PDN to the BOS0614
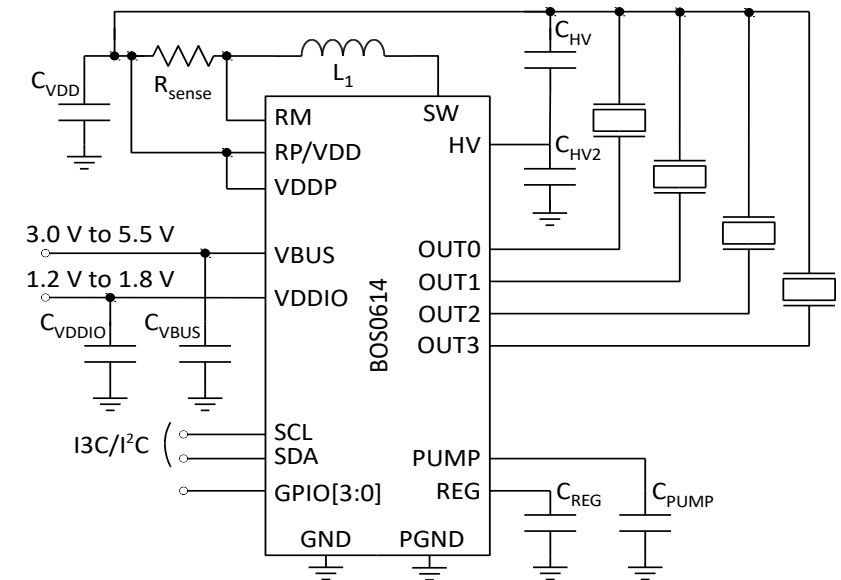
BOS0614-KIT

Plug & Play Development Platform

Four Channel Output

Breakable PCB for easy prototyping

Development Kit Software

Easy configuration of Sensing and Haptic behavior

The End
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