

Boréas Technologies

BOS0614CW – Product Presentation

2021-05-27

Content

- Applications
- Key Product Features
- Electrical Specifications Summary
- Development Platform

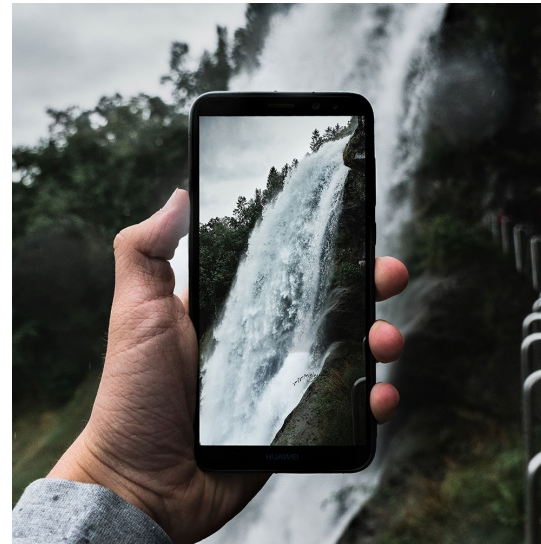
Applications

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

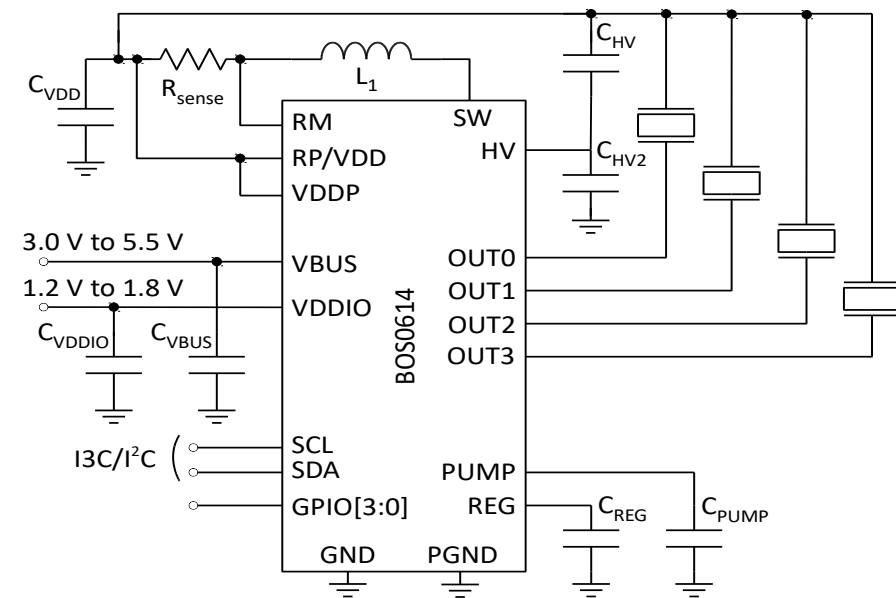


Phones

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

BOS0614 Key Features

- Four Channel 60V CapDrive™ 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 μ V sensing resolution
- Integrated Digital Front End
 - I3C/I²C 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 optimized for area

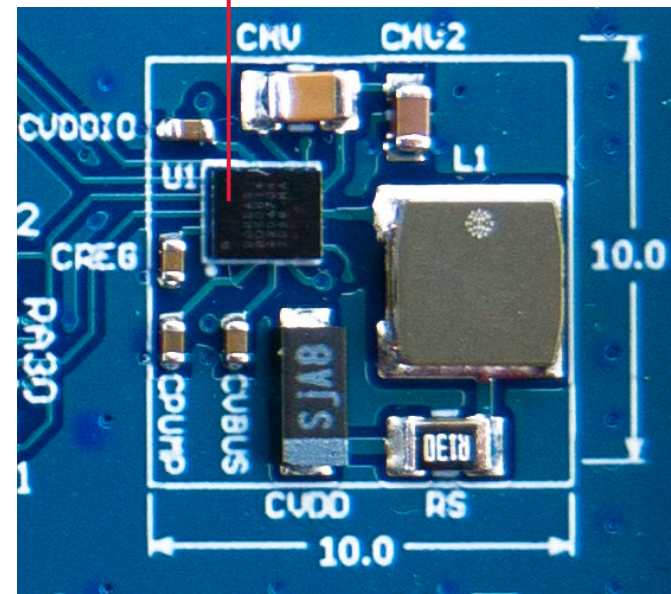
10x10x1.2 mm

Solution size optimized for height

11.4x10x1 mm

Number of passive components

9



Advanced Piezo Sensing Interface

Zero Power Sensing (ZPS)

- Power consumption $< 10 \mu\text{A}$

- No latency

- Automatic shutdown after detection

- Configurable sensitivity

Native High Resolution High Sampling Rate Sensing

- Resolution: $220 \mu\text{V}$

- Sensing range on-chip: $\pm 3.6\text{V}$

- Sensing range with external MCU processing: no limit

- Active sensing power consumption: $< 1.1 \text{ mA} / 4 \text{ channels}$

- 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

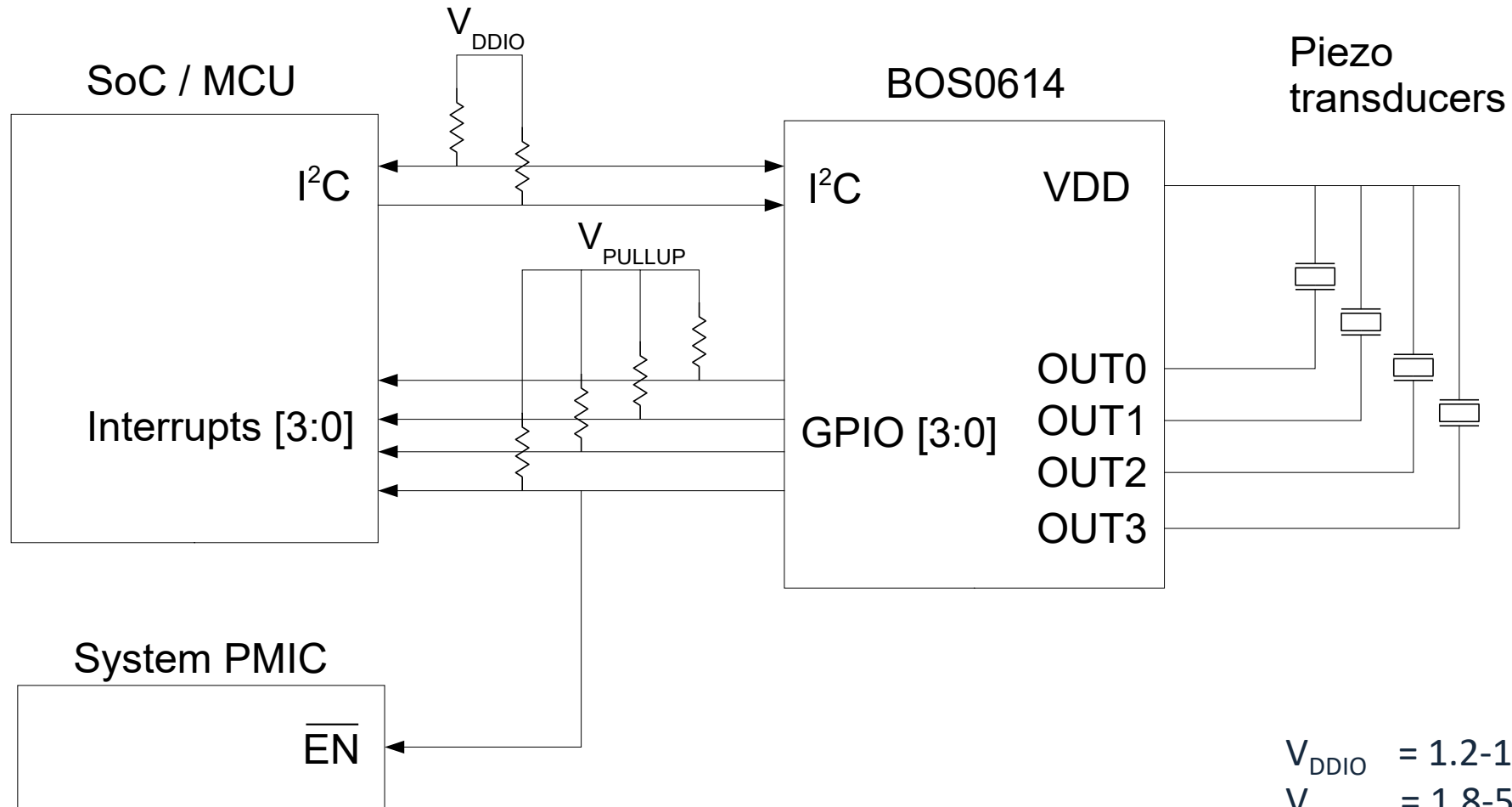
- Analyze force strength

- Go back to sleep autonomously

- Default button state at powerup

Simplified System Block Diagram

BOS0614 Force sensing + Haptic

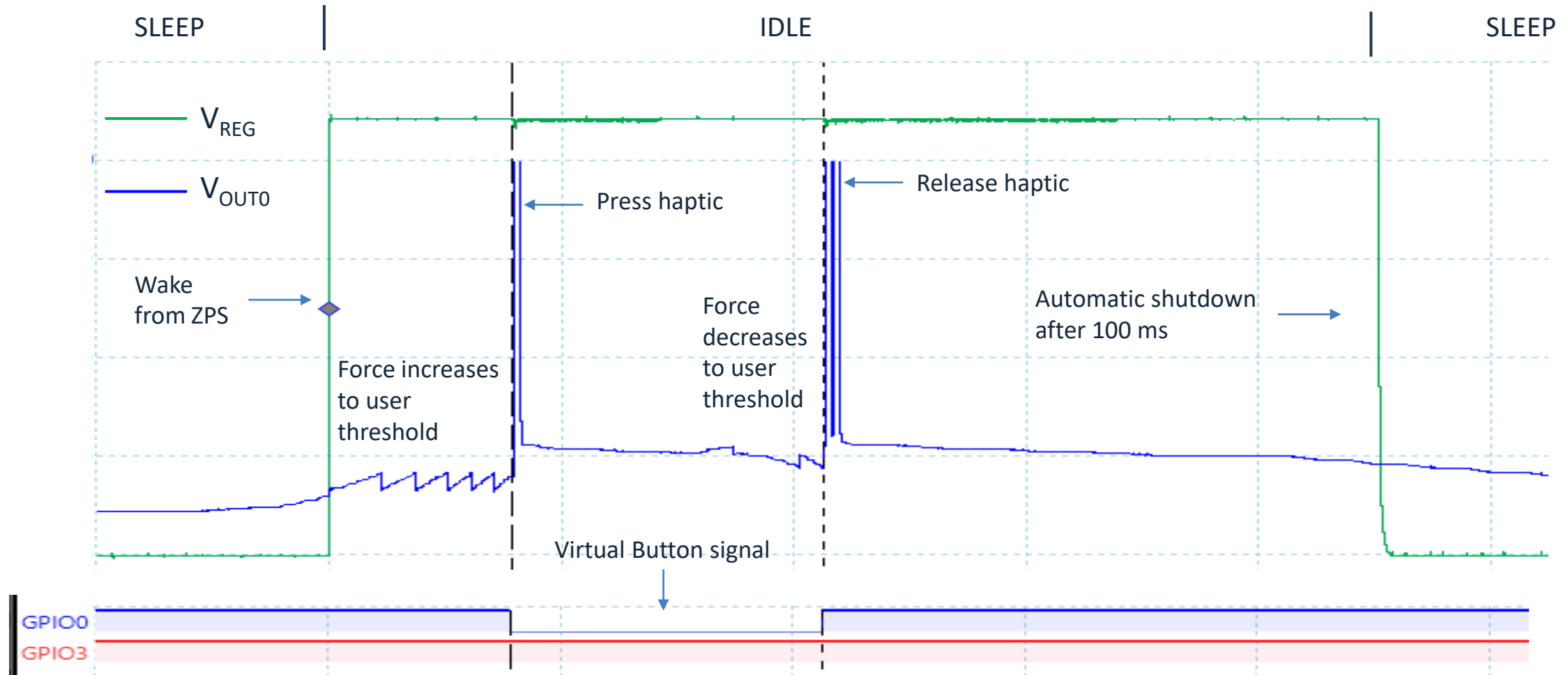


$$V_{DDIO} = 1.2-1.8 \text{ V}$$

$$V_{PULLUP} = 1.8-5 \text{ V}$$

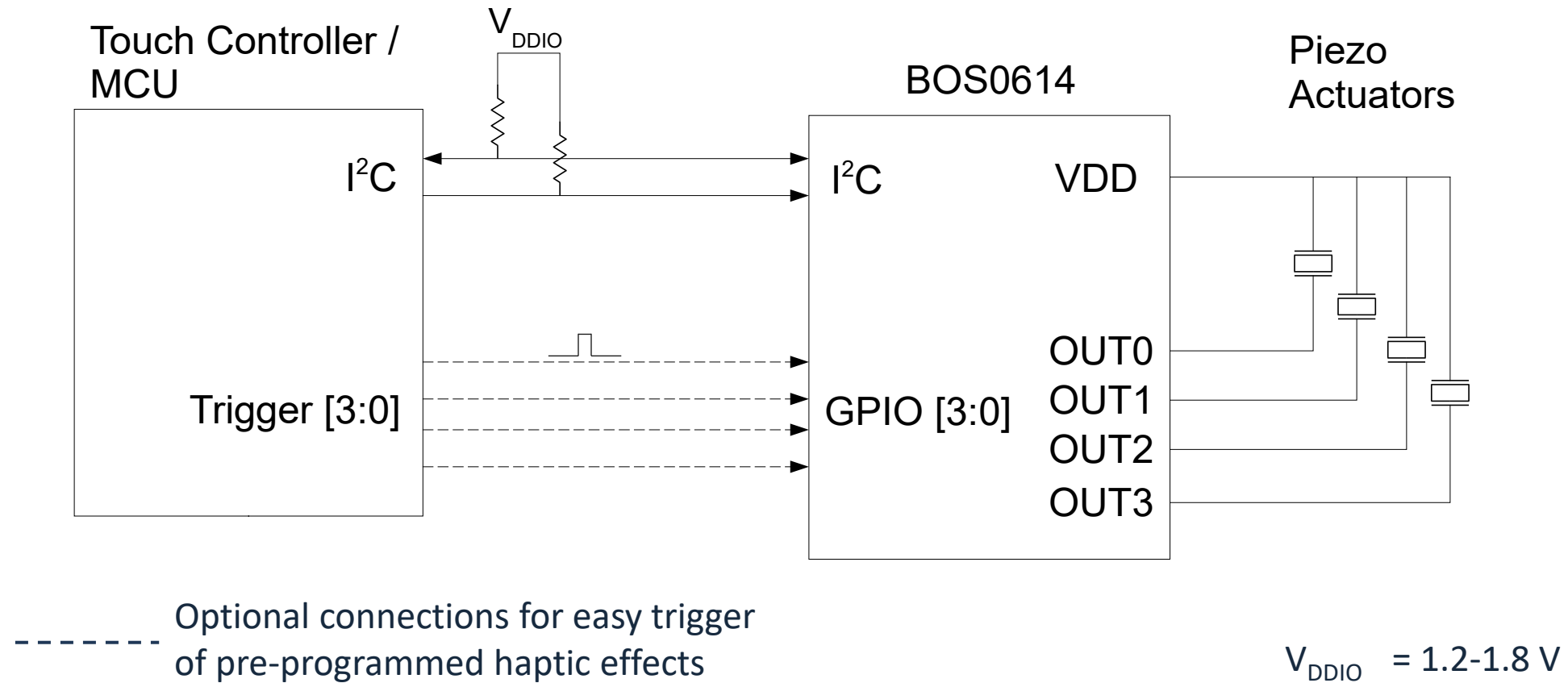
Mechanical Button Waveforms

Autonomous behavior (No I²C communication)



Simplified System Block Diagram

External force sensing + BOS0614 Haptic

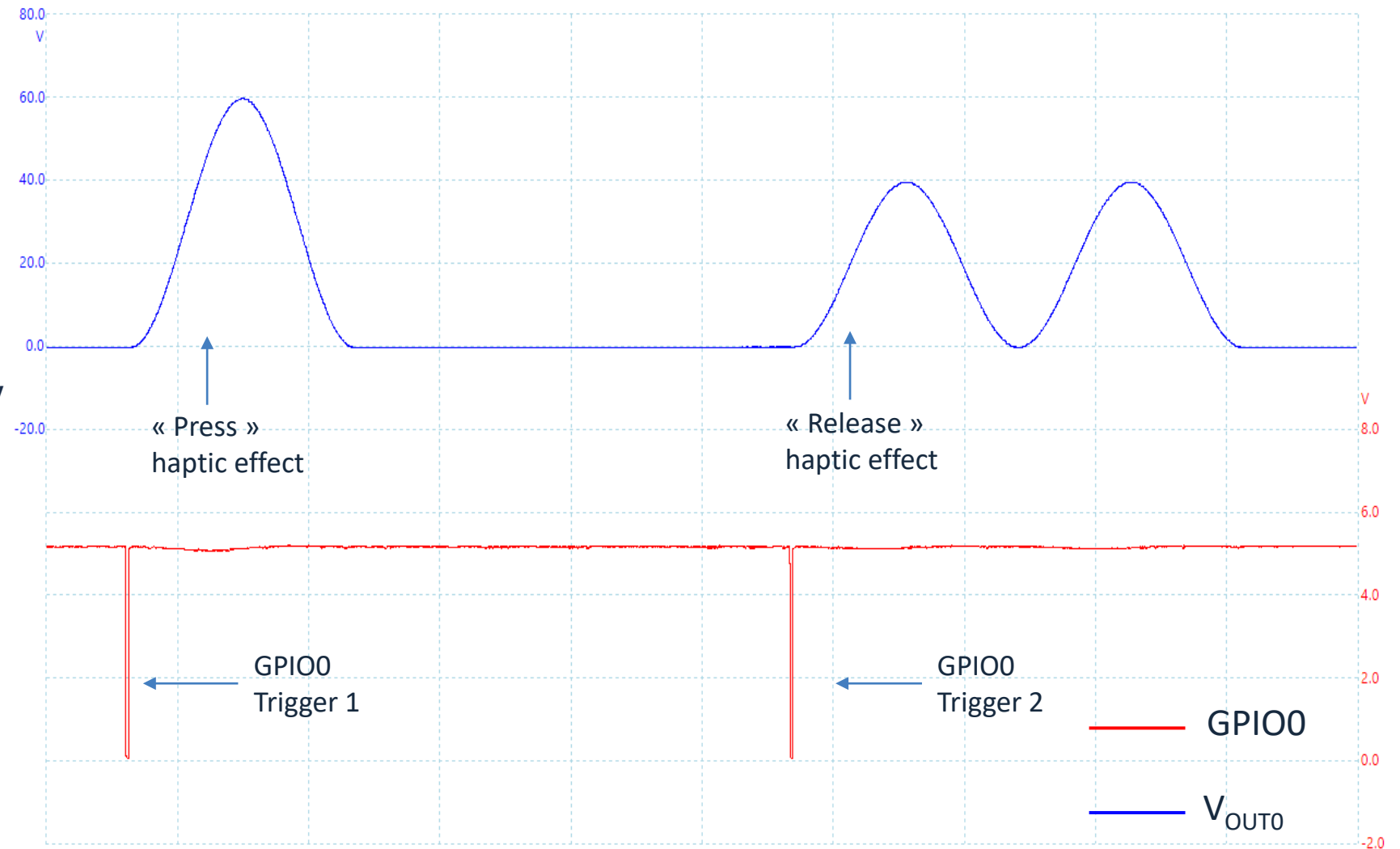


External Haptic Trigger

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

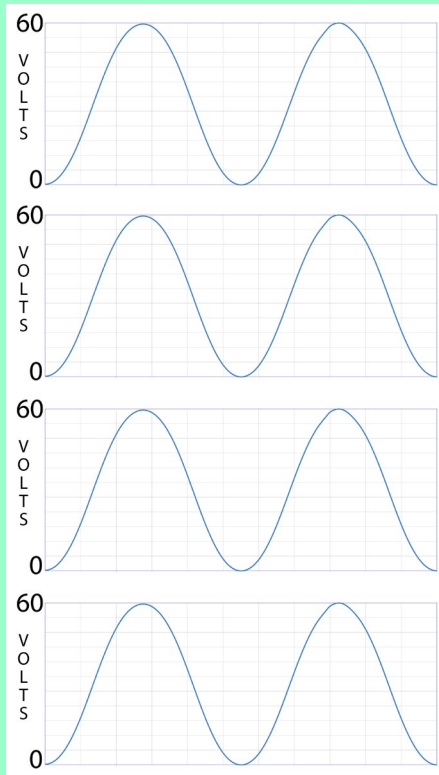
Very easy support of any application using an external force sensor



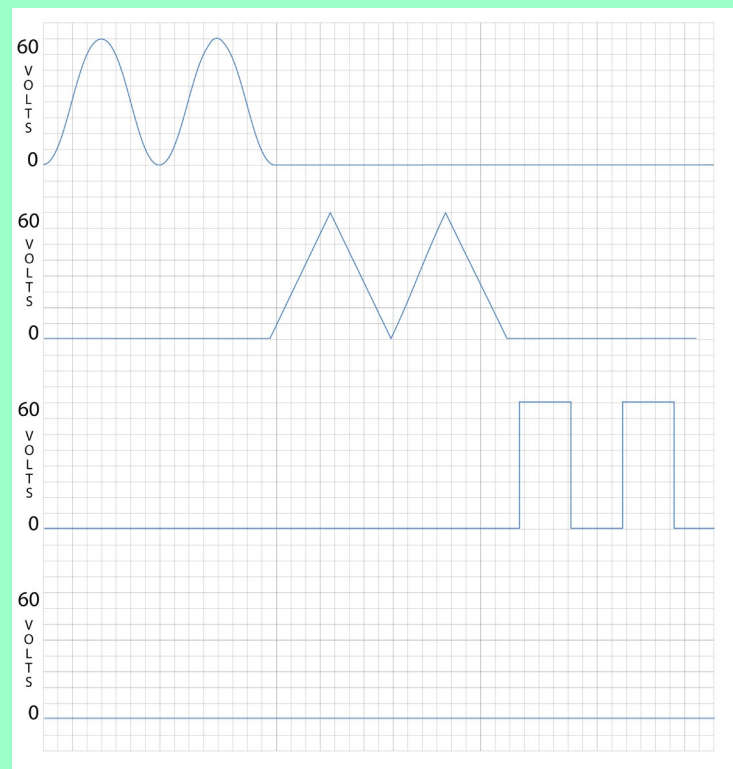
Multi-Channel Possible Use Cases

Allowed

Play the same waveform on different channels simultaneously

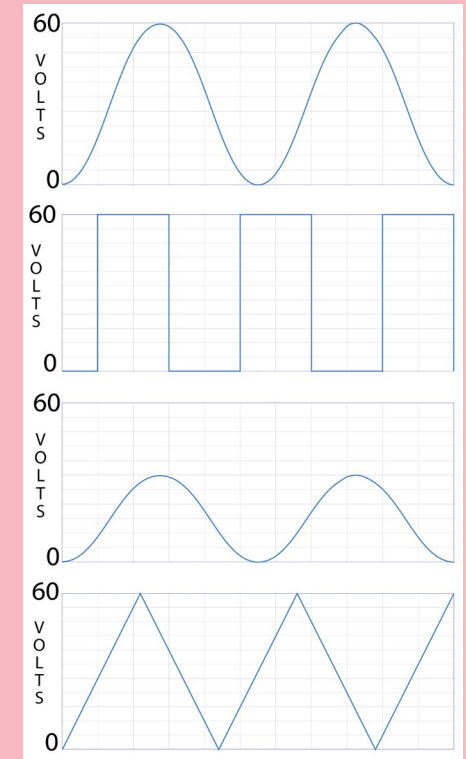


Time multiplex different waveforms to different channels



Not Allowed

Play different waveforms on different channels simultaneously



Key Electrical specifications

- Supply
 - V_{BUS} : 3.0V – 5.5V
 - V_{DDIO} : 1.2V– 1.8V (I²C/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

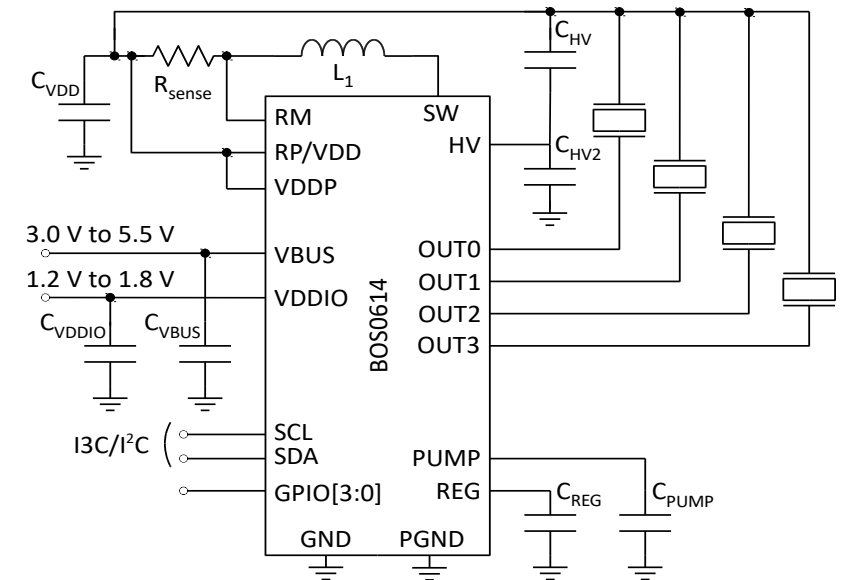
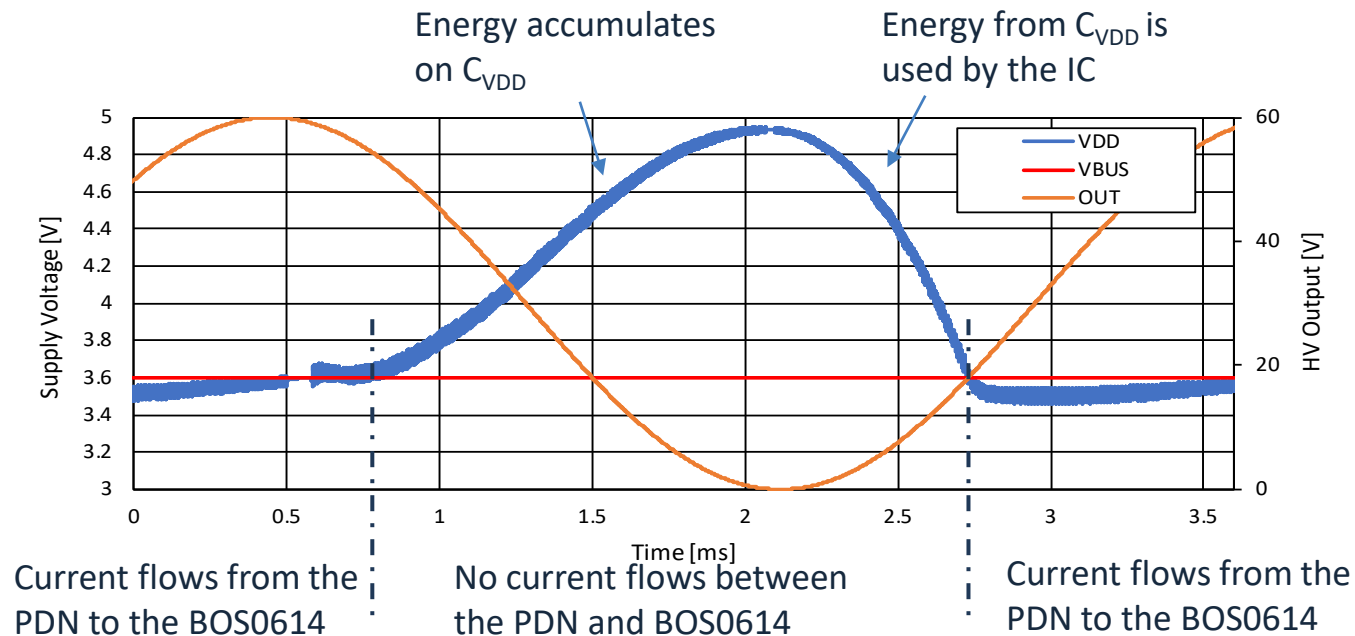
Typical Current Consumption

Symbol	Parameter	Test Conditions*	Typical	Unit
E_{CLICK}	Energy/click	$f_{\text{sig}} = 300 \text{ Hz}$ $V_{\text{OUT}} = 60\text{V}$ $C_{\text{LOAD}} = \text{TDK 1204H018V060}$	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
$I_{\text{VBUS,AVG}}$	Average V_{BUS} supply current during operation	$f_{\text{sig}} = 300 \text{ Hz}$ $V_{\text{OUT}} = 60\text{V}$ $C_{\text{LOAD}} = 440 \text{ nF}$	45	mA
	Average V_{BUS} supply current during operation	$f_{\text{sig}} = 300 \text{ Hz}$ $V_{\text{OUT}} = 60\text{V}$ $C_{\text{LOAD}} = \text{TDK 1204H018V060}$	89	mA

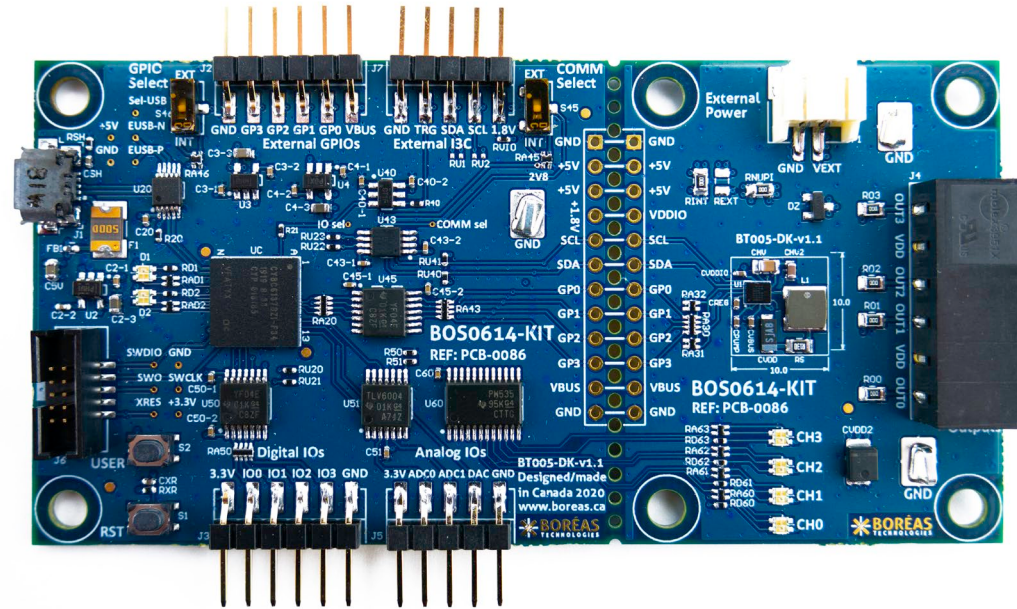
* $V_{\text{BUS}} = 3.6\text{V}$

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



BOS0614-KIT



Plug & Play Development Platform
Four Channel Output
Breakable PCB for easy prototyping

Development Kit Software

Easy configuration of Sensing and Haptic behavior



BOS0614-KIT Controller
Firmware Version: 1.7.1
Application version: 2.7.6

Boreas DevKit (COM7) ▼

[Disconnect from port](#)

[About](#)

[Exit](#)

Slot: A
Chip ID: 0xD
Status: **Connected**

Sync. All
Save in memory
Load from memory
Reset

BasicRegisters

Waveform

Amplitude: 60.00 V Frequency: 175.0 Hz Cycles: 2 Stabilization: 4 ms ☐ Half Wave

Sensing

Profile: TDK 1204H018V060

Event: Press Type: Threshold Threshold: 1.2 V Hold time: 4000 μ s Stabilization: 4 ms

Event: Release Type: Slope Threshold: -0.011 V/ms Stabilization: 50 ms

Triggers

Output Channel
CH0 CH1
CH2 CH3

Play

☐ GPIO Interrupt
☐ Sensing

Send configuration

The End

Let's Grow Your Business Together!