

# **Boréas Technologies**

**BOS0614CW – Product Presentation**

**2021-05-27**

# Content

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

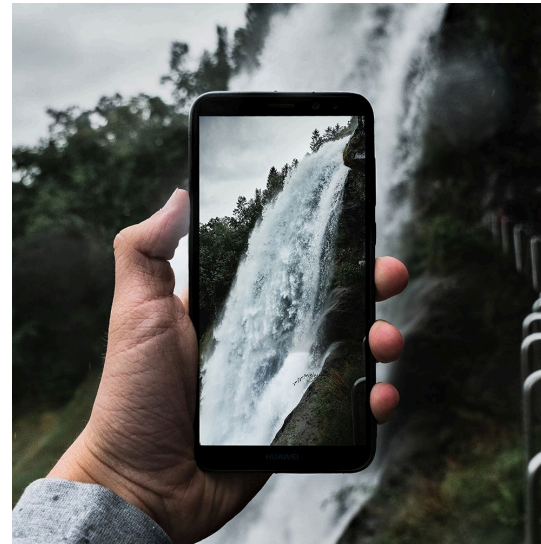
# Applications

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

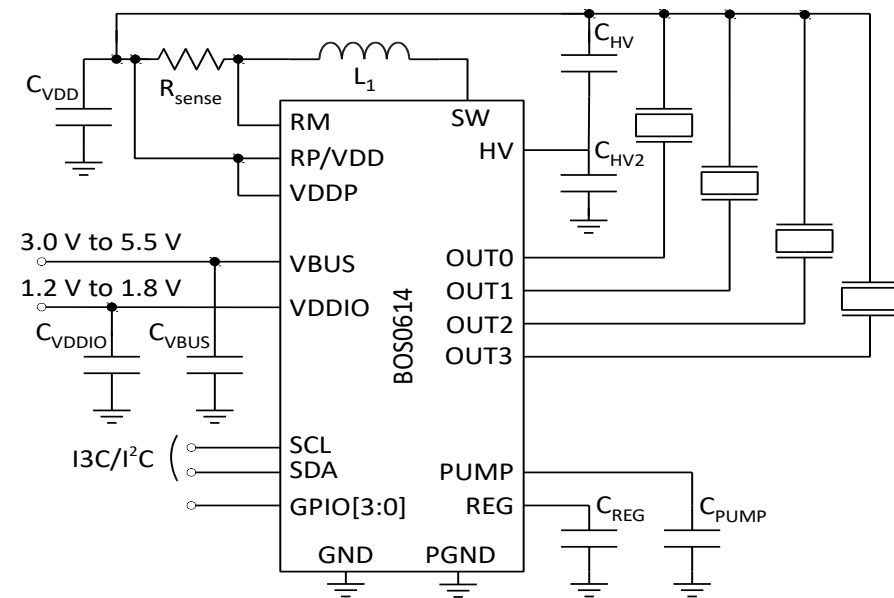


## Phones

- 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  $\mu\text{V}$  sensing resolution
- Integrated Digital Front End
  - I3C/I<sup>2</sup>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 optimized for area

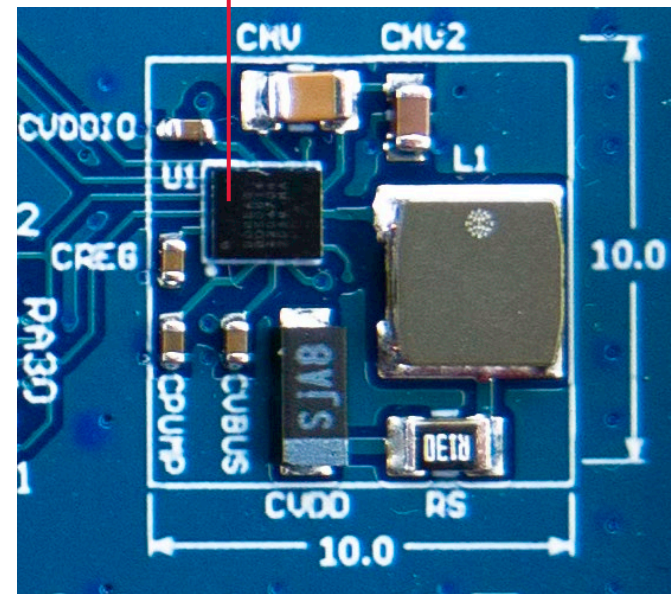
10x10x1.2 mm

## Solution size optimized for height

11.4x10x1 mm

## Number of passive components

9



# Advanced Piezo Sensing Interface



## Zero Power Sensing (ZPS)

Power consumption < 10  $\mu$ A

No latency

Automatic shutdown after detection

Configurable sensitivity

## Native High Resolution High Sampling Rate Sensing

Resolution: 220  $\mu$ V

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

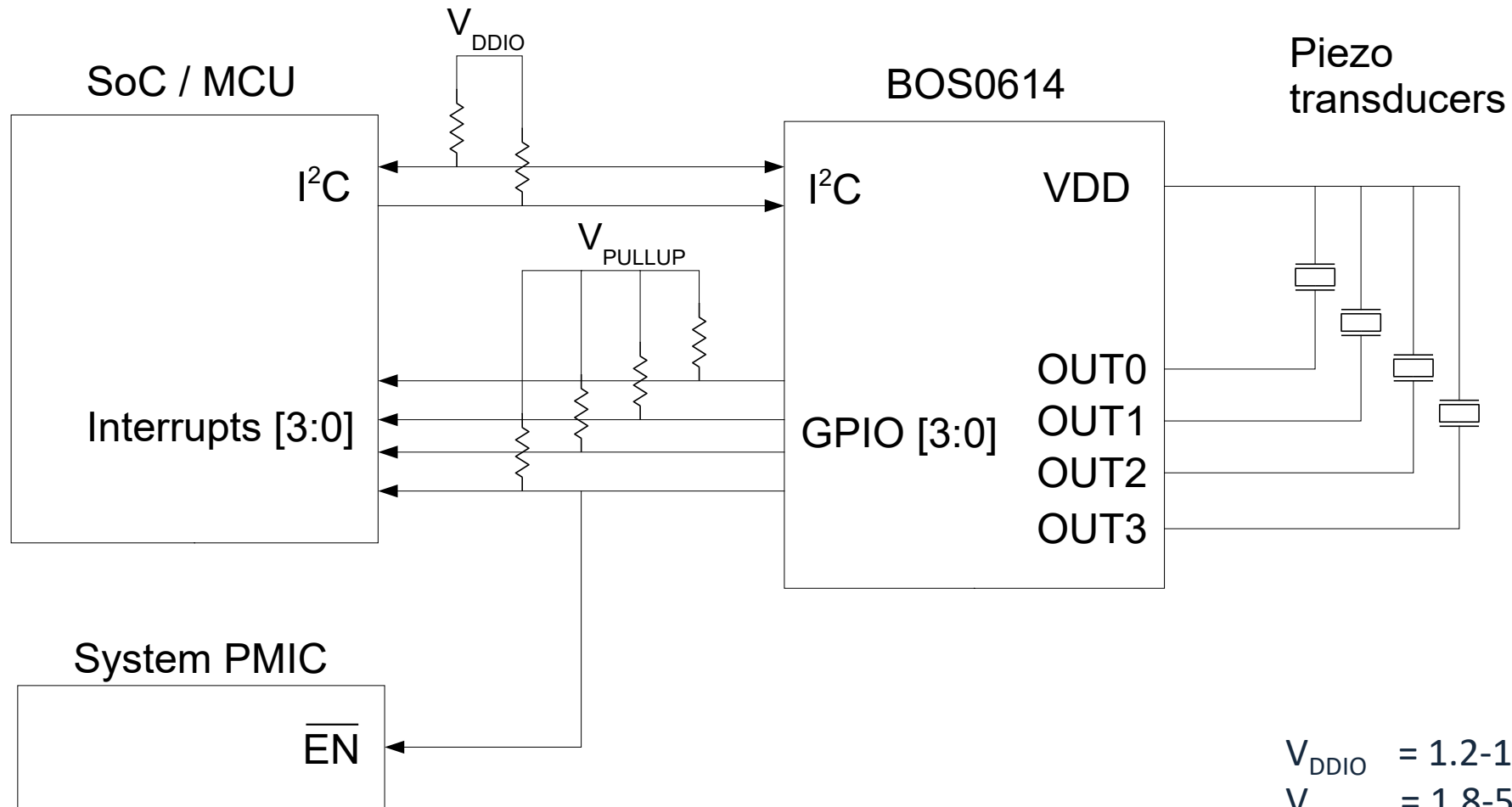
- Analyze force strength

- Go back to sleep autonomously

- Default button state at powerup

# Simplified System Block Diagram

## BOS0614 Force sensing + Haptic



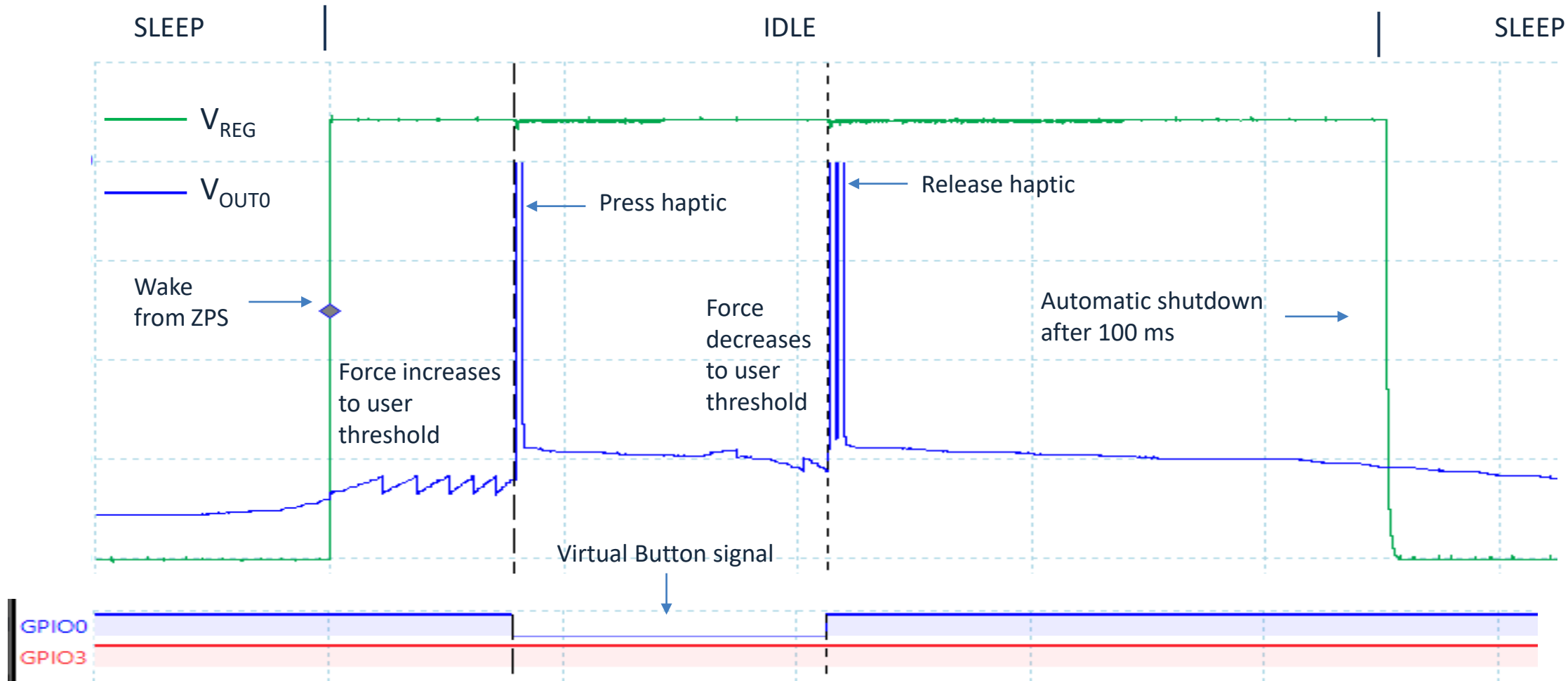
$$V_{DDIO} = 1.2-1.8 \text{ V}$$

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



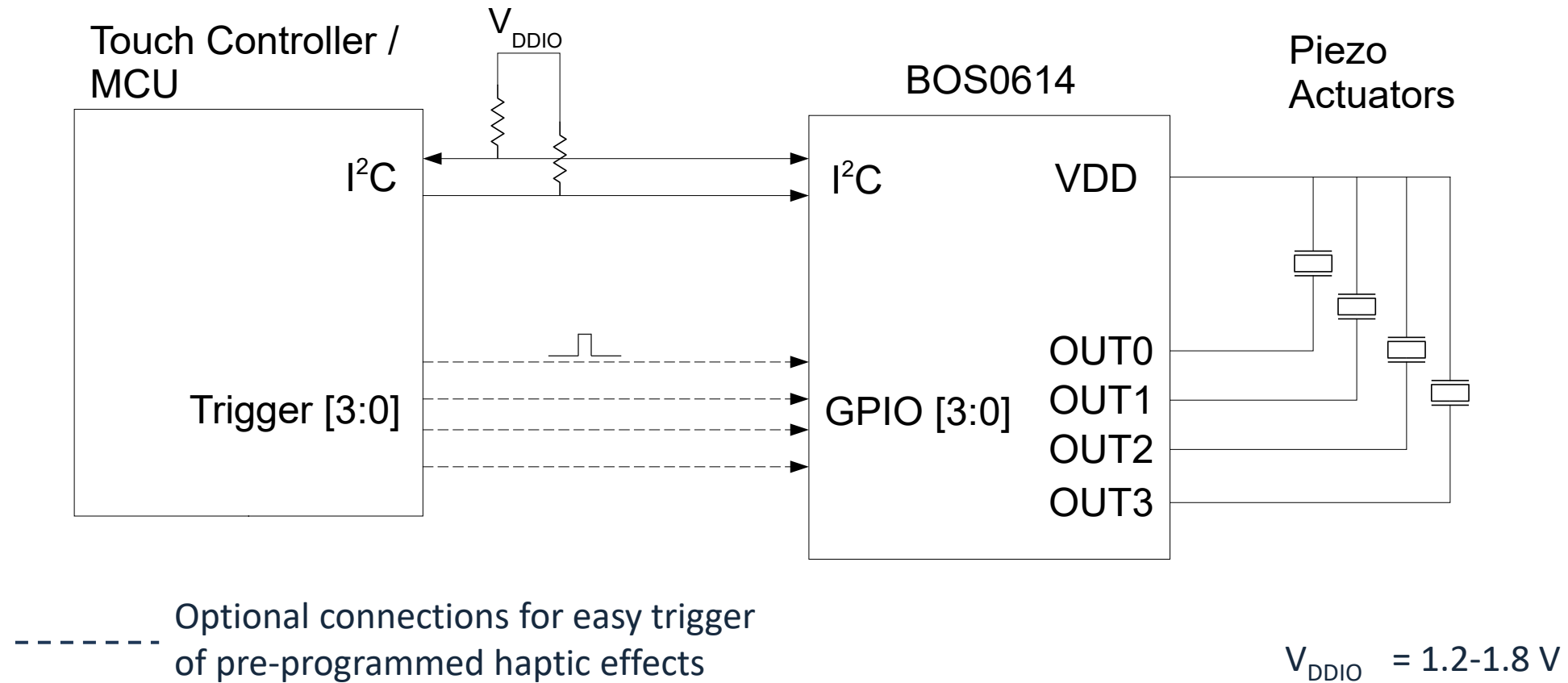
# Mechanical Button Waveforms

Autonomous behavior (No I<sup>2</sup>C communication)



# Simplified System Block Diagram

## External force sensing + BOS0614 Haptic

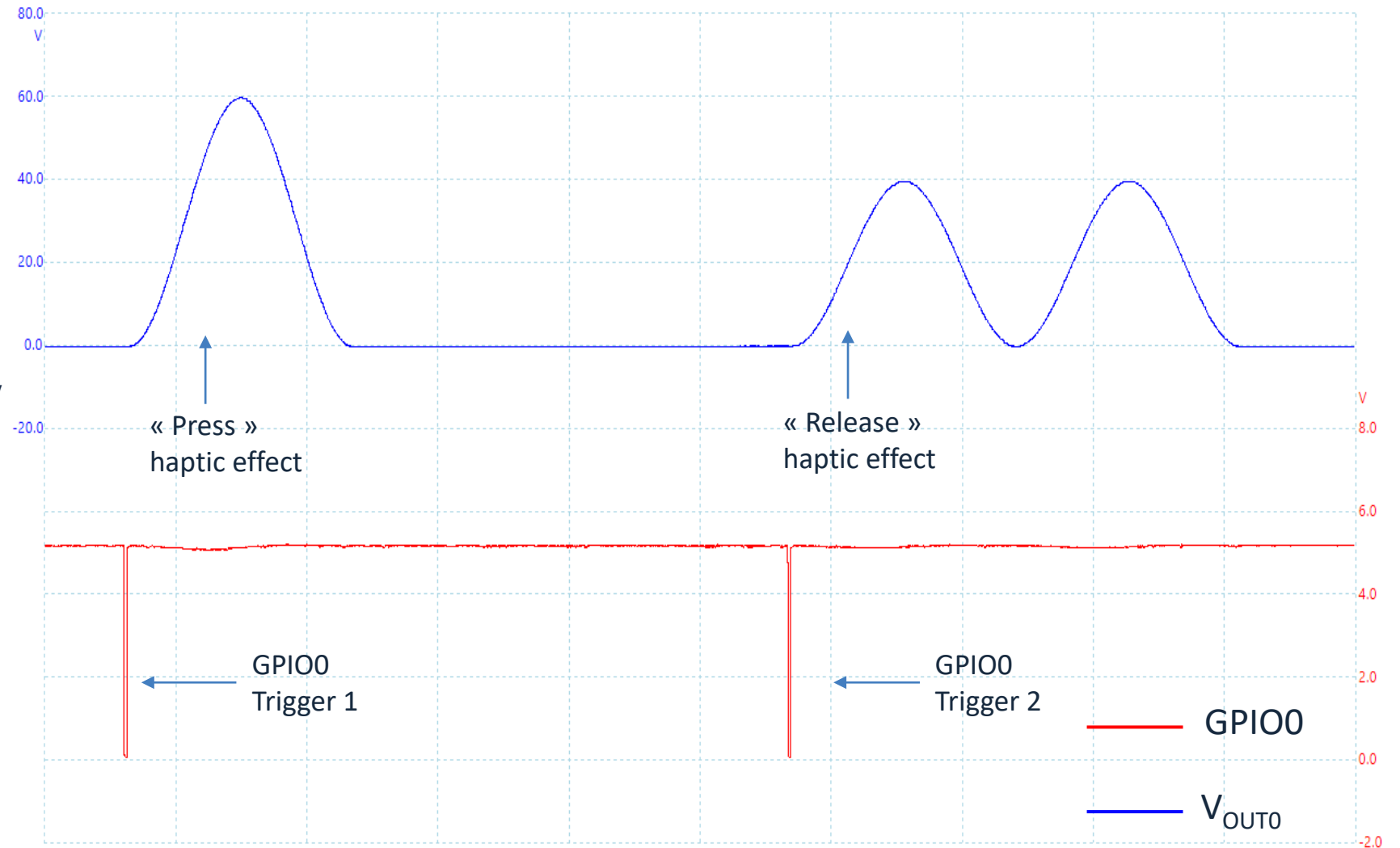


# External Haptic Trigger

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

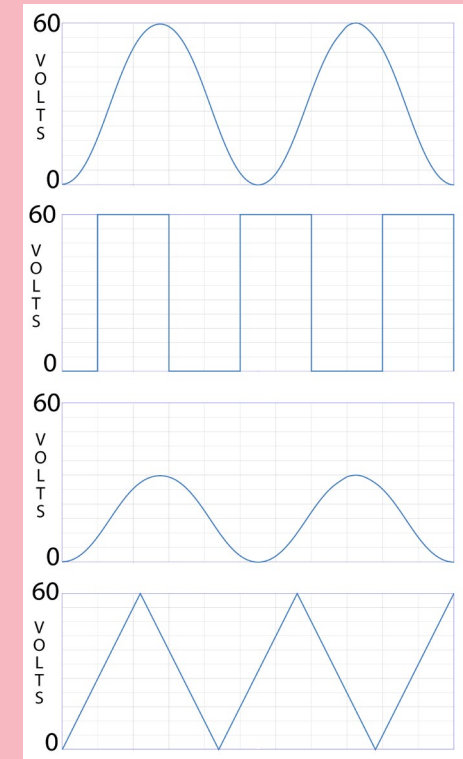
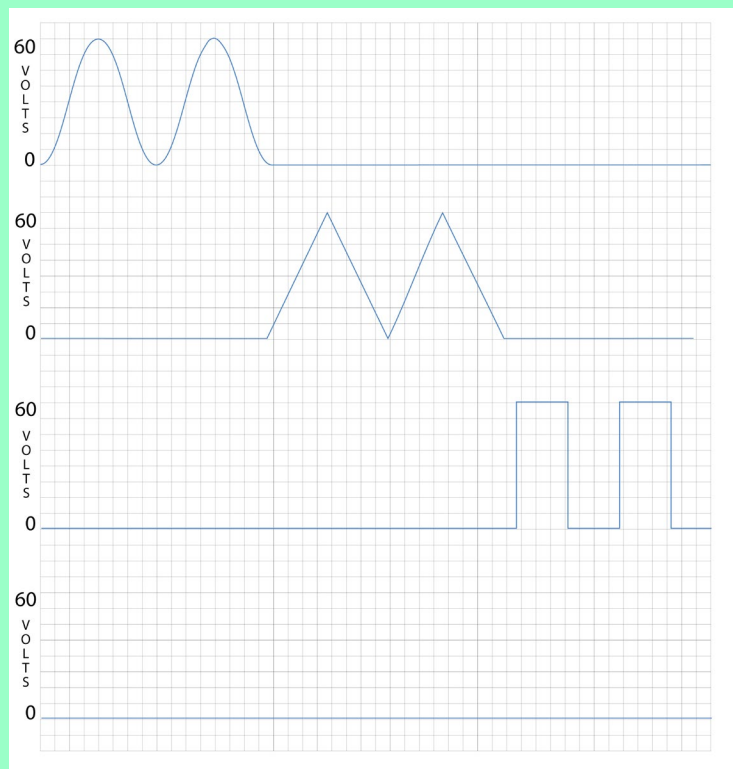
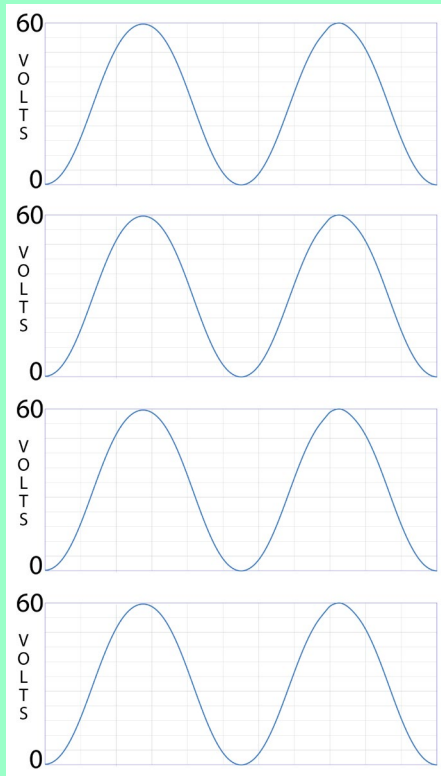
Allowed

Not Allowed

Play the same waveform on different channels simultaneously

Time multiplex different waveforms to different channels

Play different waveforms on different channels simultaneously



# Key Electrical specifications

- Supply
  - $V_{\text{BUS}}$  : 3.0V – 5.5V
  - $V_{\text{DDIO}}$ : 1.2V– 1.8V (I<sup>2</sup>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

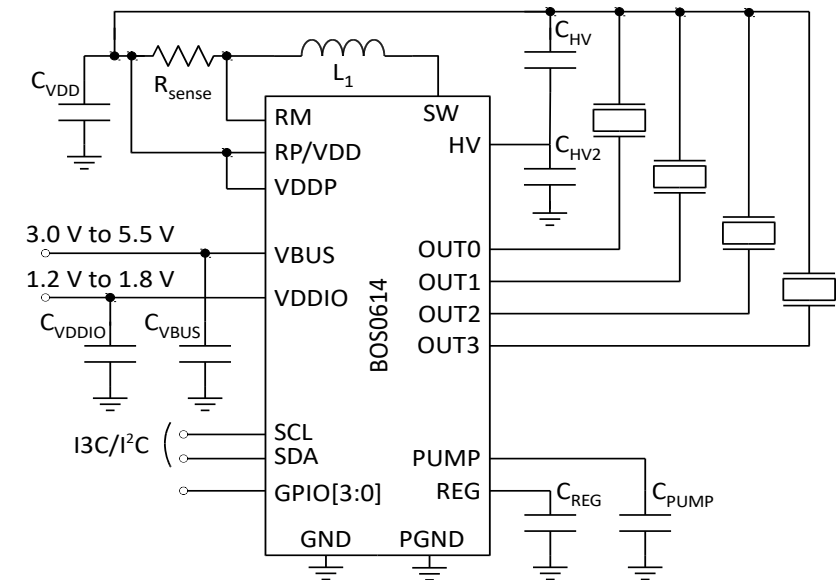
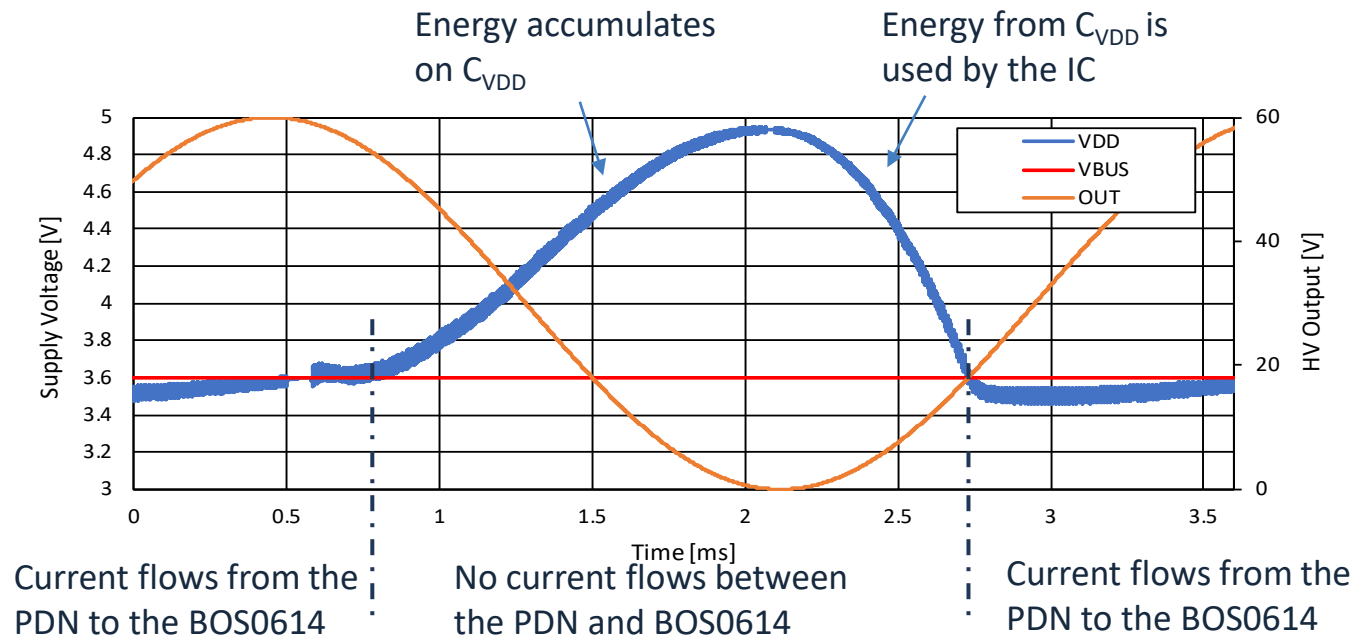
# Typical Current Consumption

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

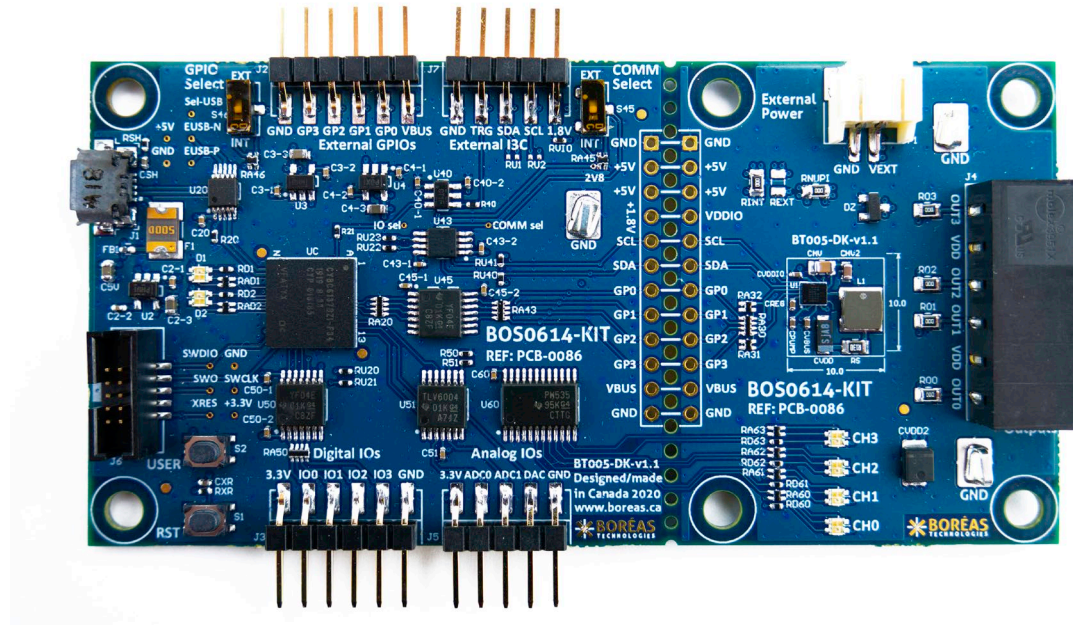
\* $V_{BUS} = 3.6V$

# 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



# BOS0614-KIT

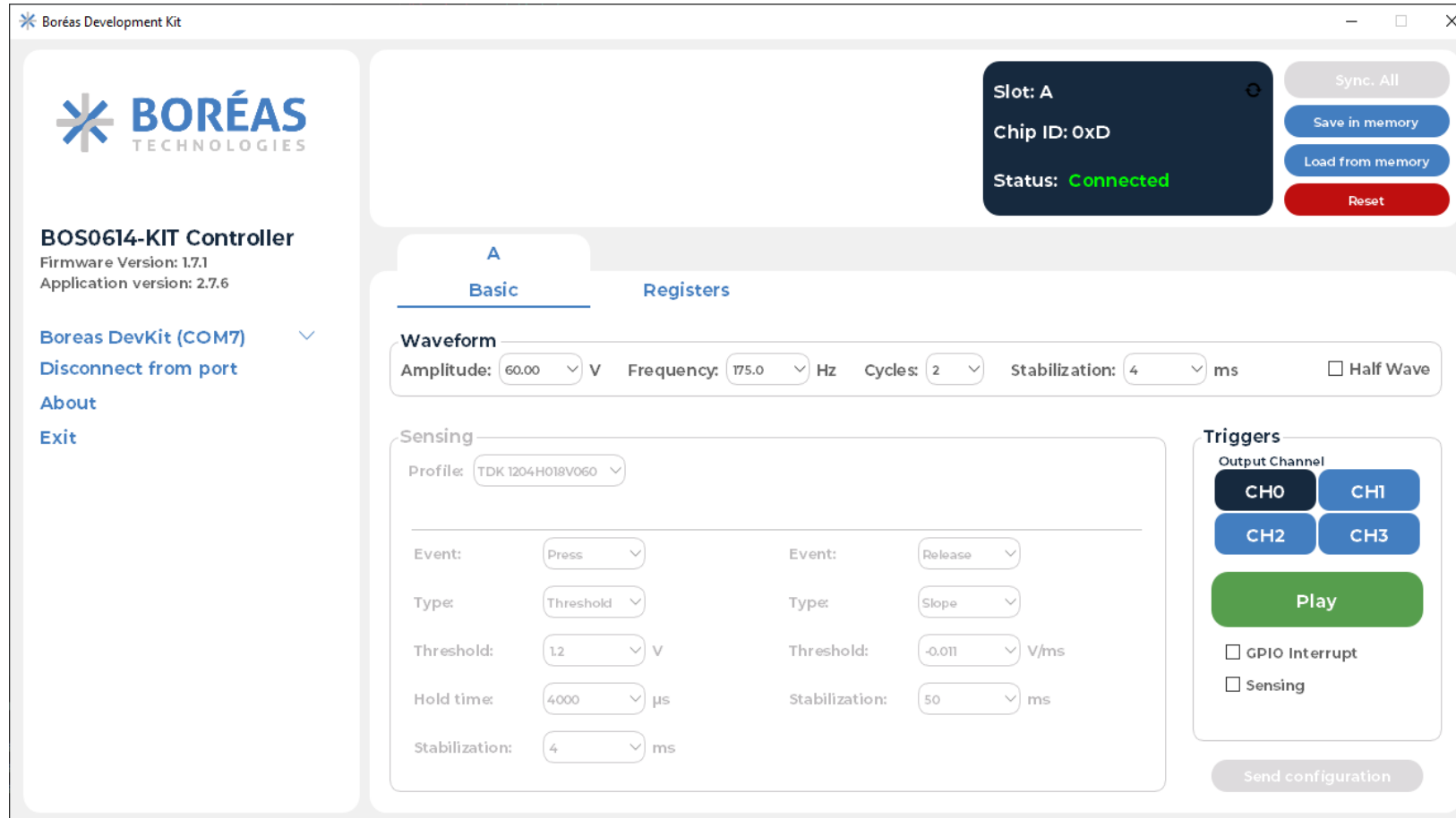


Plug & Play Development Platform  
Four Channel Output  
Breakable PCB for easy prototyping



# Development Kit Software

## Easy configuration of Sensing and Haptic behavior



The screenshot displays the Boréas Development Kit software interface. On the left, a sidebar contains the Boréas Technologies logo, the controller name "BOS0614-KIT Controller", firmware and application versions, and connection options for "Boreas DevKit (COM7)". The main area is divided into "Basic" and "Registers" tabs. The "Basic" tab is active and contains three sections: "Waveform", "Sensing", and "Triggers".

**Waveform Configuration:**

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

**Sensing Configuration:**

- Profile: TDK 1204H018V060
- Event 1: Press
- Event 2: Release
- Type 1: Threshold
- Type 2: Slope
- Threshold 1: 1.2 V
- Threshold 2: -0.011 V/ms
- Hold time: 4000  $\mu$ s
- Stabilization: 50 ms
- Stabilization: 4 ms

**Triggers Configuration:**

- Output Channel: CH0, CH1, CH2, CH3
- Play:
- GPIO Interrupt:
- Sensing:
- Send configuration:

**Connection and Control Panel:**

- Slot: A
- Chip ID: 0xD
- Status: **Connected**
- Buttons: Sync. All, Save in memory, Load from memory, Reset

# **The End**

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