CS40L25/CS40L25B

Boosted Haptics Drivers with Integrated DSP

Featuring Waveform Memory with Closed Loop
Algorithms and LRA Protection

CIRRUS LOGIC®

Enhanced User Haptics Experience

- Virtual Button Clicks
- Vertical Scrolling
- Sensor Effects
- Haptics Bumps
- Negation
- High-Fidelity Alerts
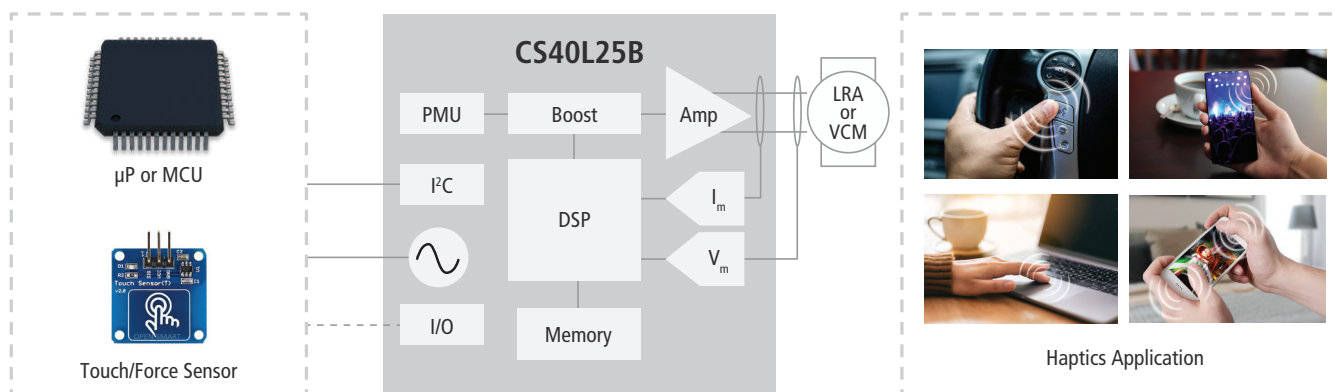- Camera Clicks
- Ringtone Builder

Product Overview

The Cirrus Logic CS40L25 and CS40L25B are currently the industry's leading self-contained haptics signal generators that integrate a high-performance haptics driver, a Halo Core™ digital signal processor and a driver voltage boost converter. These devices are resonance aware to drive high performance linear resonant actuators (LRAs) and voice coil motors (VCMs) for enhancing user experiences with unique haptics waveforms.

The haptics suite for these devices include resonance frequency calibration at the system level for the LRA; output voltage and current monitoring software triggered haptics actuator impedance and resonance frequency reporting; pre-stored haptics waveforms that can be triggered by I²C/GPI for gaming applications and user interface events; and flexible haptics waveform generation that can be triggered by GPI for home button or side button switch replacement.

Cirrus Logic's haptics technology also features closed loop algorithms to maximize LRA effectiveness. This software approach enables strong and consistent haptics; protection of the LRA from over-excursion; and provides for overall long-term reliability of the LRA.

CS40L25/CS40L25B Haptics Driver Solution

μP or MCU

Touch/Force Sensor

CS40L25B

PMU — Boost — Amp — LRA or VCM

I²C

DSP — I_m

I/O — Memory — V_m

Haptics Application

Product	Features	Target Application	Package Type	Temp Range	Part Ordering Number
CS40L25	Supports GPIO + I²S at power up	Mobile, Portable, Gaming	30-Ball WLCSP	-40℃ to +85℃	CS40L25-CWZR
CS40L25B	Supports 4 GPIO at power up	Mobile, Portable, Gaming	30-Ball WLCSP	-40℃ to +85℃	CS40L25B-CWZR
CS40L25B	Supports 4 GPIO at power up	PC, Consumer	32-Pin QFN	-40℃ to +85℃	CS40L25B-CNZR

Target Applications

The CS40L25/CS40L25B provide real time control of both LRA and VCM for virtual buttons and audio-2-haptics applications including smartphones, wearables, PCs, gaming and automotive.

System Features

Low latency for real time control of the haptics motor

- Always-on listening to haptics trigger
- Reduce time from trigger to achieving desired acceleration on the LRA
- Wakeup from AoH hibernate mode in 5 ms
- < 20 μA AoH hibernation
- Provides performance consistency over voltage, temperature and external factors
  - No loss of acceleration strength of the LRA

Haptics driver features

- 11 V amplifier supply voltage MAX for fast startup and braking
- Short circuit protection
- Compatible with LRA impedances as low as 6Ω
- Class D architecture with adaptive output stage reduces idle power consumption, switching loses

Programmable DSP

- Run real-time algorithms with reduced latency and reduced integration effort
- Larger memory for more haptics effects
- Eliminates complicated integration across platforms for running Audio 2 Haptics

Programmable Effects

- Easily design new haptics effects for UI/alerts/button replacement with state-of-the-art tools

Crisp, clean haptics performance

- Can overdrive the motor for strong performance
- Stopping the LRA immediately for crisp haptics with no ringing/buzzy effects

Closed Loop Control for Strong Haptics Effects and Force-Sensitive Interface

- Button replacement and enable new user experience
- Localized haptics

Simplified Tuning

- Almost like plug and play
- Algorithm dynamically handles changes in actuator characteristics to eliminate the need to fine tune for long hours

Class H digital boost converter

- 85% overall efficiency boost
- Programmable boost voltages up to 11 V
- High bandwidth digital control loop
- 2 MHz switching frequency
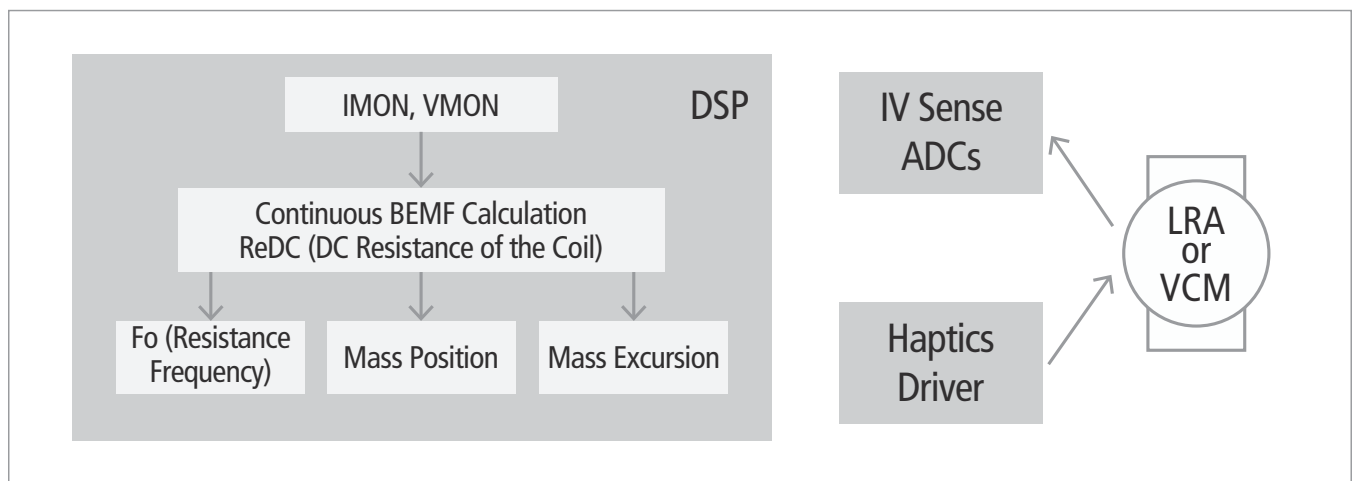- Pulse skipping mode for improved efficiency during low power quiescent operation

System protection

- IC thermal self-protection against over temperature
- Battery rail reactive brownout system protection
- Speaker current sensing via integrated current monitoring sense resistor

Using Closed Loop Algorithms to Maximize LRA Effectiveness

Benefits of Closed Loop Algorithms

- Strong haptics performance
- Consistent haptics performance
- LRA protection from over excursion
- Long-term LRA reliability