



Integration of KICKER F.I.T. Equipped Amplifiers with Class SB Factory Amplifiers

Overview

Many factory automotive audio systems use STMicroelectronics' **Class SB (Single-Ended Bridged)** amplifier designs to maximize efficiency in OEM audio systems while offering Class AB sound quality. When integrating an aftermarket amplifier, these factory amplifiers can serve as a clean signal source; provided the input stage of the aftermarket amplifier is designed to properly interpret their unique output behavior. Kicker amplifiers equipped with **F.I.T. (Fail-safe Integration Technology) Inputs** are designed to accept a wide range of OEM speaker-level signals, and as a result, naturally accommodate Class SB amplifier outputs without distortion or signal degradation.



Class SB Output Behavior

A Class SB amplifier operates in two electrical modes depending on output demand. At low to moderate listening levels, only one speaker terminal is actively driven with the audio signal, while the opposing terminal remains at or near ground potential. In this condition, the amplifier behaves like a traditional single-ended design. As output level increases and the driven terminal approaches the amplifier's available rail voltage, the Class SB topology transitions to prevent clipping. Instead of saturating the driven side, the amplifier activates the previously grounded speaker terminal and drives it out of phase with the primary output. This creates a bridged condition across the speaker, effectively allowing for an increased voltage swing without increasing supply voltage. The transition between single-ended and bridged operation is dynamic and signal-dependent.

While this design improves efficiency and output capability, it results in a speaker signal whose electrical reference changes with signal level - one terminal may be grounded at low output but becomes an active signal at higher output.



Figure 1 Illustrates Class SB output behavior:

The larger waveform represents the primary driver output, while the smaller waveform shows the secondary output becoming active only when the primary output reaches its rail voltage limit. The secondary output is driven out of phase, creating a bridged condition that increases total voltage swing across the speaker without clipping.

Integration Challenges

Conventional amplifier RCA inputs (single ended) and basic line-output converters (LOCs) are both incompatible with this type of signal. Standard RCA inputs (single ended) expect you to have a signal on the positive lead and a reference to ground on the shield. Traditional LOCs expect you to have a differential signal feed into them so the signal on the positive and negative are identical just inverted. When a Class SB amplifier transitions into bridged operation and both speaker terminals become active, this assumption leads to only the positive signal being reproduced causing premature clipping and distortion. In these cases, distortion is introduced at the interface rather than by the factory amplifier itself and will cause a degradation in sound quality produced from the aftermarket equipment.

How F.I.T. Inputs Resolve These Issues

Kicker F.I.T. Inputs are designed as fully differential, high-voltage input stage and treats both speaker wires as active signal conductors. Rather than referencing either wire to ground, the F.I.T. input circuitry continuously measures the voltage difference between the two terminals.

This design allows F.I.T. Inputs to accurately reproduce the audio signal to feed into the power stage of the Kicker amplifier whether the Class SB amplifier is operating in single-ended or bridged mode. When the second terminal becomes active and is driven out of phase, the F.I.T. input stage seamlessly tracks the change inverting and summing the signal to keep your audio distortion and clipping free. High input voltage tolerance and active signal conditioning prevent pre-mature clipping during high-output conditions while maintaining proper load behavior for the factory amplifier.

Clean Signal Delivery

Once conditioned by the F.I.T. circuitry, the signal is converted to a stable internal level and fed to the Kicker amplifier's power stage. The Class SB amplifier effectively becomes a clean signal source, while the Kicker amplifier assumes responsibility for delivering power to the speakers. The result is a noise-free, unclipped signal path across all listening levels.

Conclusion

Class SB amplifiers achieve efficiency by driving only one speaker terminal at low output levels and dynamically engaging the second terminal out of phase when the signal is close to reaching the rail voltage limits. Kicker F.I.T. Inputs are engineered to accommodate this behavior through a differential, high-headroom input architecture that preserves signal integrity. This pairing enables seamless OEM integration while delivering clean, reliable output to the vehicle's speakers with your aftermarket Kicker F.I.T. equipped amplifier.

