CoolSiC™ MOSFETs 400 V G2 for high-/low-Z Class-D amplifier



public

Target application - Commercial Audio

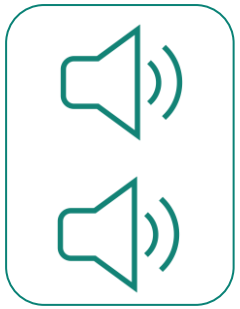
In many use cases today, two different amplifier SKUs are used for commercial low-Z and high-Z applications when using Si MOSFETS. This is primarily due to the relatively high and non-linear capacitive characteristics and $R_{DS(on)}$ of high voltage Si MOSFETs.

1
Low-Z amplifier

Applications - Small venues – coffee shops, churches, cafes, restaurants, home theatre

Load Impedance – Typical 4 ohm to 16 ohms. Not compatible with High Z systems.

Lo-Z amp.



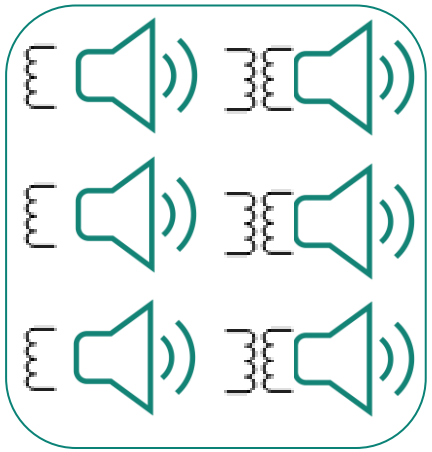
- Low speaker count
- Low voltage, high current

2
High-Z amplifier

Applications – Distributed audio systems - commercial buildings, retail stores, public address systems

Load Impedance - Typical >20 ohms. Constant voltage systems 70 V_{rms} and 100 V_{rms}. Not compatible with low Z systems

Hi-Z amp.

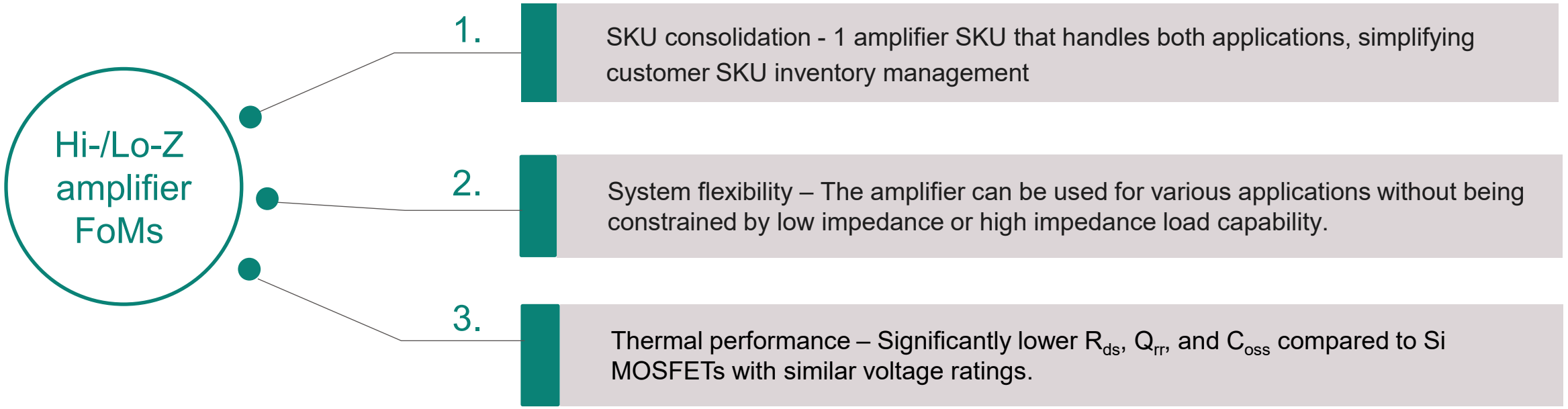


- High speaker count per channel
- High voltage, low current allows for small gauge long wire runs

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Target solution - Hi-/Lo-Z compatible Class-D reference design

What is needed is an amplifier solution that is capable of both Hi-Z and Lo-Z applications



SiC D
Audio amplifier

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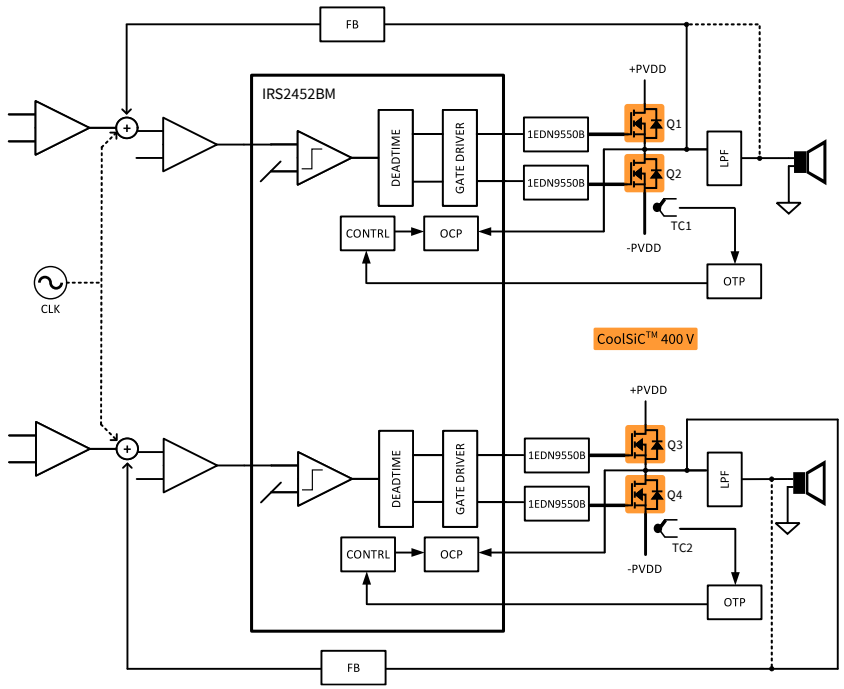
Key parameters and benefits of CoolSiC™ 400 V MOSFETs in Class-D amplifiers

Benefit	Low Q_{fr}	Low and linear C_{oss}	Low R_{DS}	Flat R_{DS} vs T_j
Efficiency	Reduced reverse recovery losses; supports faster switching (higher dv/dt)	Lower switching losses and extended ZVS range due to low Q_{oss}; minimizes heat generation; enables low Z & high Z drive capability	Lower conduction losses; minimizes heat generation; enables low Z drive capability	Maintains efficiency across operating temperature and load range
EMI	Reduces high-frequency from reverse recovery	Lowers high-frequency ringing; linear dv/dt with clean switching waveforms under hard-switching and extended ZVS range	N/A	N/A
Audio Quality	Lowers THD+N by reducing switching noise and shorter dead-times	Reduces distortion through faster dv/dt switching and reduced deadtime.	N/A	N/A

SiC D
Audio amplifier

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Overview
REF_AUDIO_COOLSiC_1KW



Scope and Purpose

– The REF_Audio_CoolSiC_1kW is a high efficiency Class D audio evaluation board designed to demonstrate the advantages of CoolSiC™ G2 400 V transistors in professional audio applications. This reference design enables both constant voltage (High-Z) and low impedance (Low-Z) operation, making it suitable for a wide range of commercial and high-performance sound reinforcement systems. **SiC TOLT, TOLL, and TO-247 compatible.**

Technical details

Target Applications	Commercial installation sound systems.
Topology	2 channel Class D, single ended split supply
Supply voltage range	±50 V to ±180 V
System compatibility	Hi Z - 100 Vrms, 70 Vrms constant voltage systems. Low Z - 4 Ω per channel
Switching frequency	300 kHz
Output power max	1000 W x 2 @ 100 Vrms (10 Ω), 70 Vrms (4 Ω), and 4 Ω
THD+N	≥0.02%, 1kHz ,1 W
Additional technical parameter	Signal to Noise: ≥110 dB. Residual Noise <200 uV

Planning

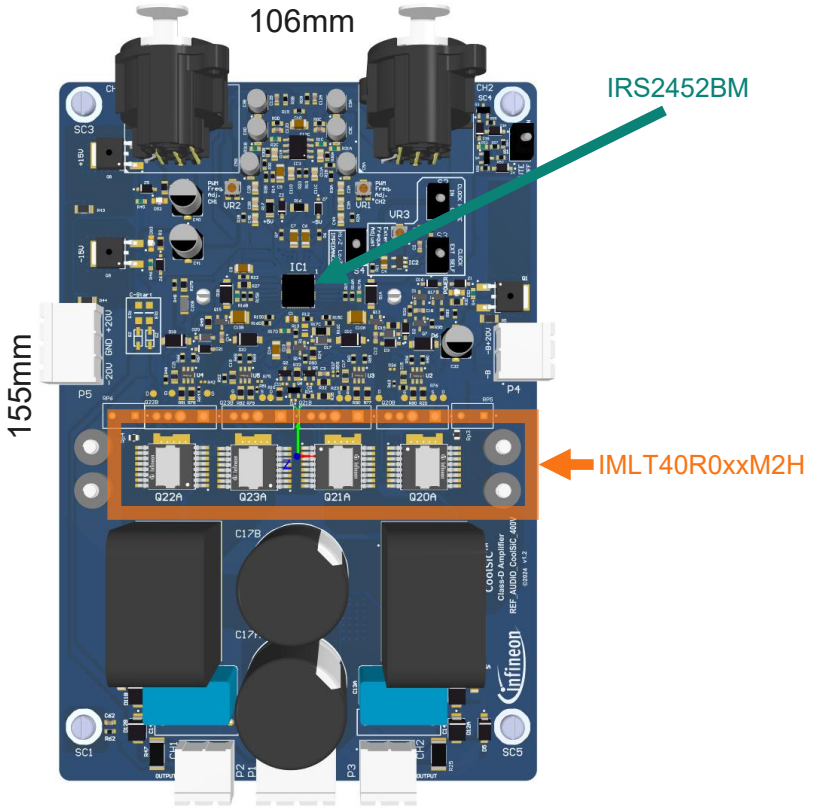
Infineon feature components	IRS2452BM, CoolSiC™ 400V transistors, 1EDN9550B
Timeline for availability	Q4 CY2025
Note:	

Features

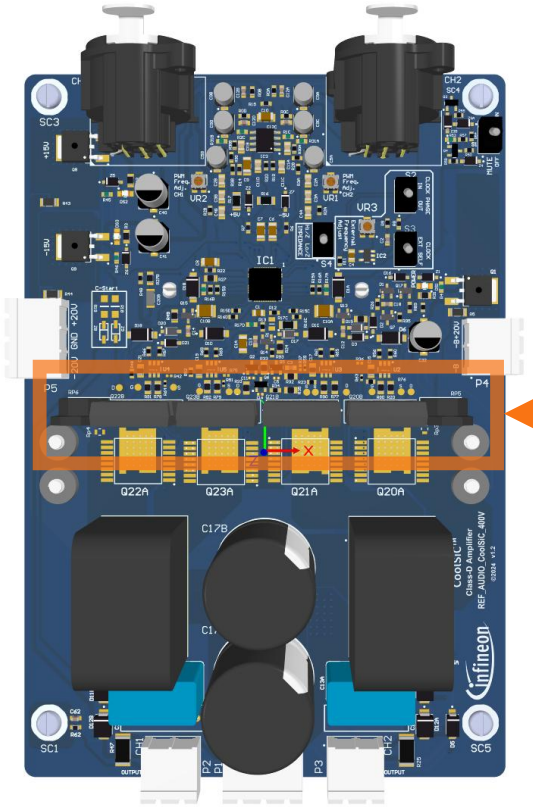
– High Z Low Z compatibility
– Low idle power loss
– **Protection features:** Lossless Over-Current Protection (**OCP**), Over-Temperature Protection (**OTP**), (**UVP**) Under voltage protection, (OVP) Over voltage protection.
– Integrated IRS2452BM audio controller, dead time control, soft start, clickless turn on/off
– Self-oscillating half-bridge topology with optional clock synchronization.
– Operation with or without external heatsink.
– Scalable up to 1000 W per channel.

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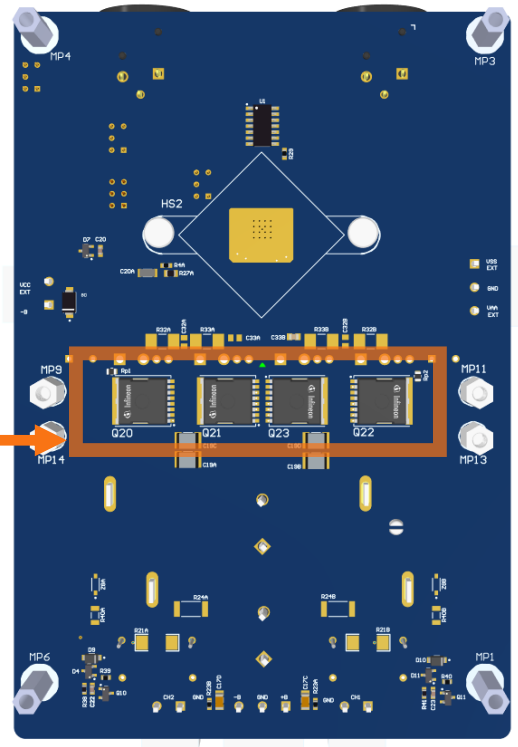
SiC package variants
REF_Audio_CoolSiC_1kW



TOLT



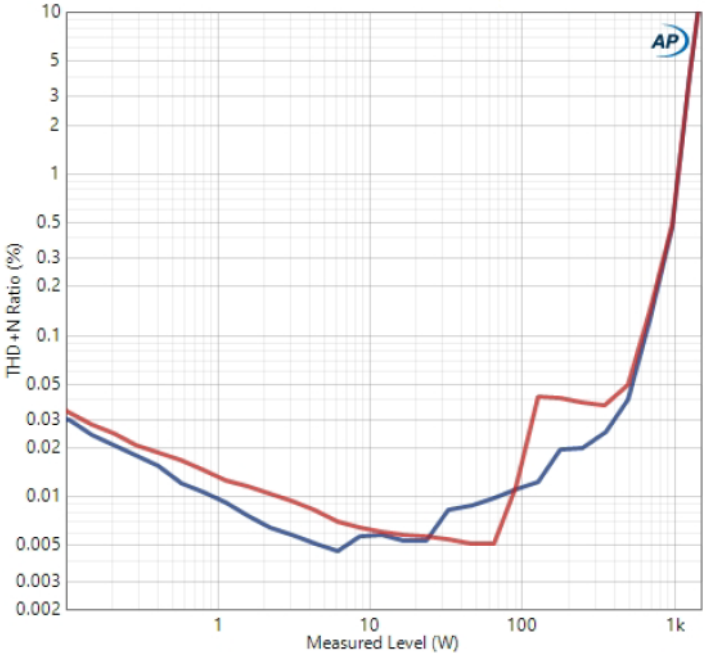
TO-247-4



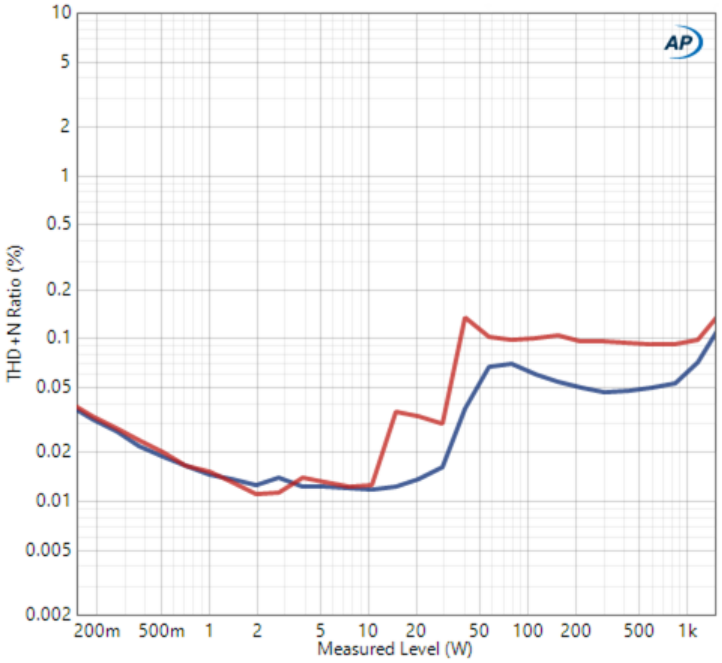
TOLL

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Bench testing
REF_Audio_CoolSiC_1kW



R_{load} = 10 Ω



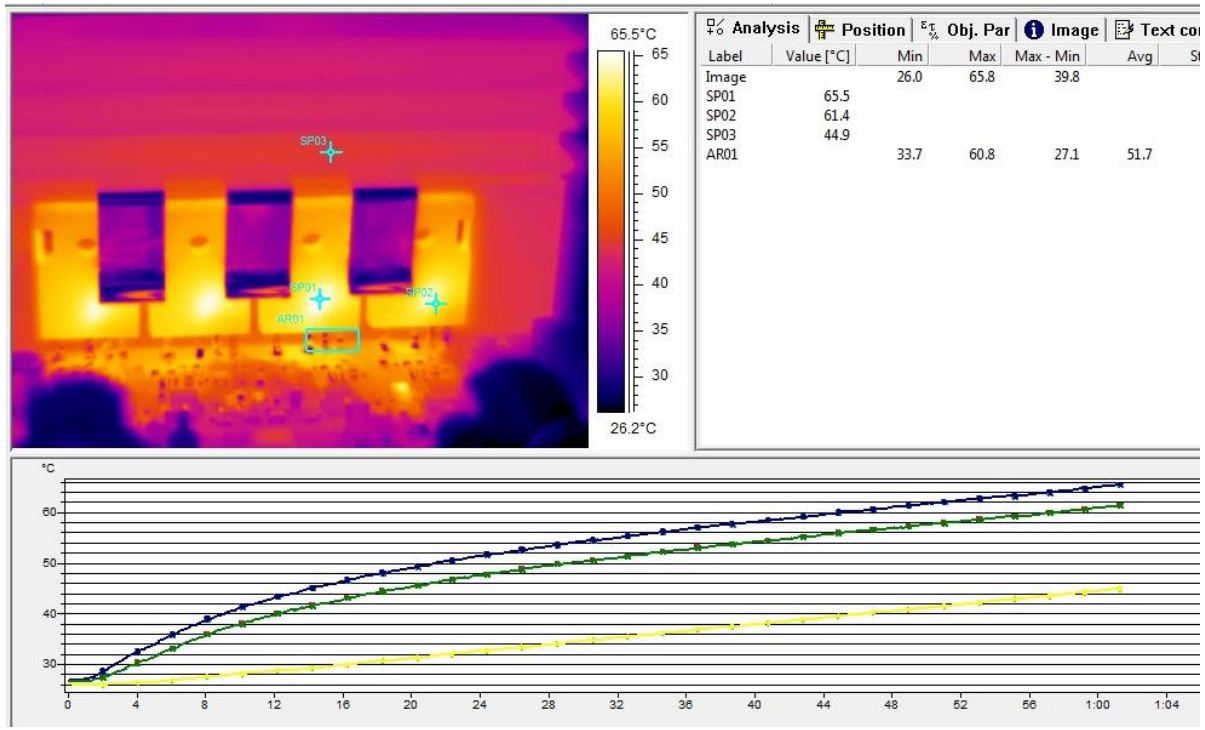
R_{load} = 4 Ω

Test conditions:

- V_{bus} = +/-148 V
- F_{sw} = 300 kHz and F_{audio} = 1 kHz
- DUTs: IMZA40R045M2H

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Bench testing
REF_Audio_CoolSiC_1kW

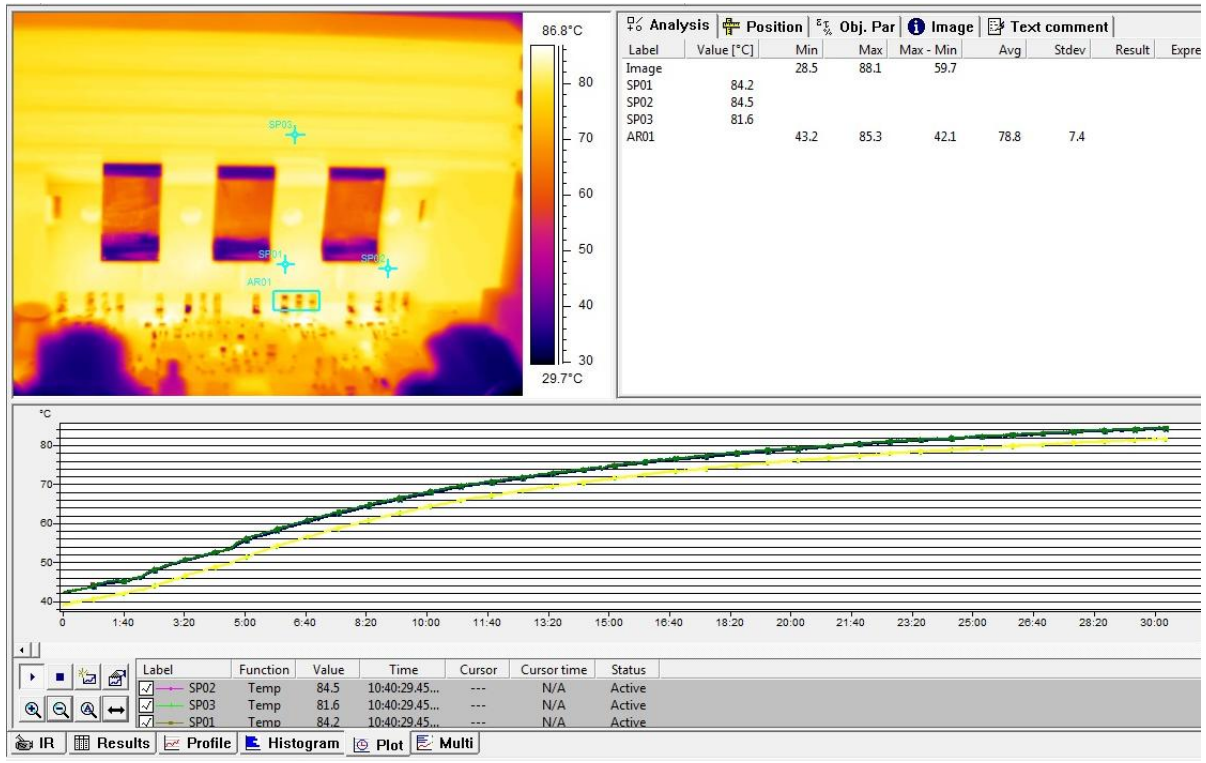


Test conditions:

- 1000W x 2 / 4 Ω after 1 minute
- DUTs: IMZA40R045M2H

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Bench testing
REF_Audio_CoolSiC_1kW



Test conditions:

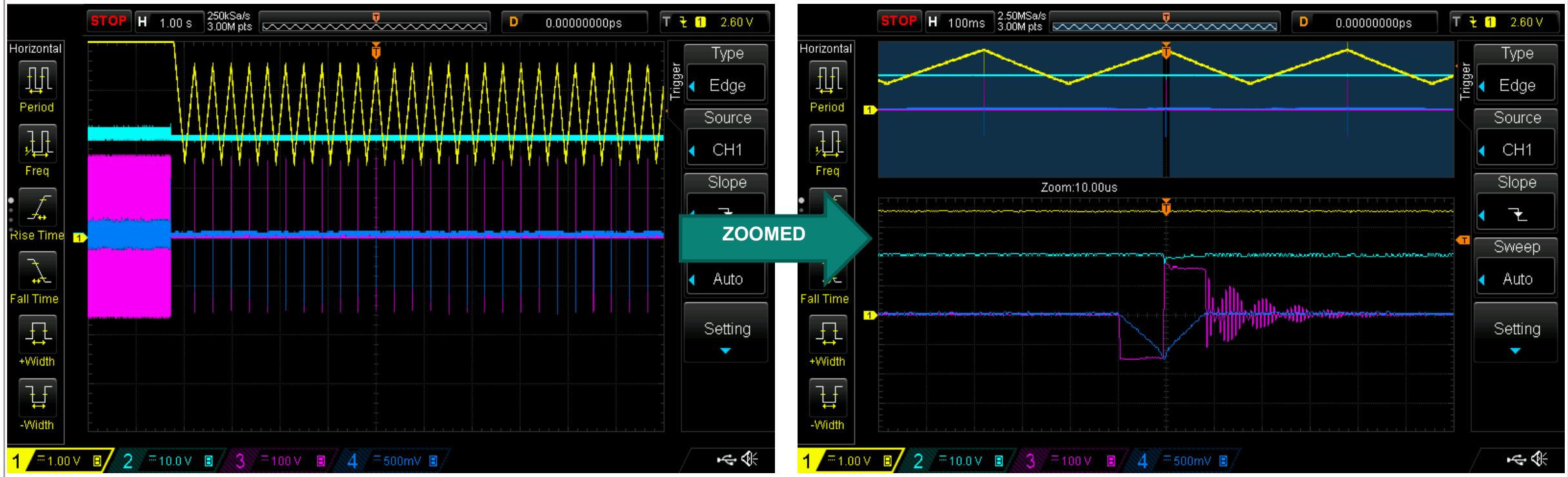
- 125 W x 2 / 4 Ω after 30 minutes
- DUTs: IMZA40R045M2H

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Bench testing
REF_Audio_CoolSiC_1kW

Test conditions:

SCP with continuous output short. DUTs: IMZA40R045M2H.



CH1 = CSD, CH2 = VDD of gate drive, CH3 = VS, CH4 = Output current from a Rogowski coil.

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Bench testing
REF_Audio_CoolSiC_1kW

Test conditions:

Output short under 100 % load at high-side (left) and low-side (right) short. DUTs: IMZA40R045M2H.





CH1 = Output, CH2 = VDD of gate drive, CH3 = VS, CH4 = Output current from a Rogowski coil.

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Summary

SiC enables Hi-/Lo-Z compatible amplifier designs



✓ **ENHANCED THERMAL PERFORMANCE:**

Low Q_{rr}, C_{oss}, and $R_{DS(on)}$ enable SiC to meet thermal targets at full-scale 1000 W output for both low Z and high Z applications without requiring a change in power supply voltage

✓ **IMPROVED LINEARITY:**

SiC allows for shorter dead times, enhancing audio linearity and reducing THD+N for higher fidelity audio

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