MERUS™ class D audio solutions

Cooler, smaller and lighter amplifiers for great sounding audio products

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MERUS™ class D audio amplifier solutions

Infineon enables customers to create better sounding products, for the benefit of all who love audio.
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Infineon’s solutions for audio applications
No compromise on quality – products for exceptional audio performance

Hear it, feel it, experience it - it’s all about clear sound. MERUS™ products are developed to enable exactly that, relying on a set of three basic principles that audio components:
› must produce sound in the speakers, not heat to its surroundings
› must be heard, not seen; smaller and lighter is better while bulky and heavy is history
› must be robust and flexible, not delicate and demanding

By combining our core principles, competencies, and leadership in groundbreaking power semiconductors with revolutionary audio technologies, such as MERUS™ multilevel class D audio amplifier ICs, we provide solutions that are smaller, lighter, more robust and flexible, running with less heat dissipation.

With patented architectures, proprietary algorithms, advanced manufacturing technologies, as well as elaborate verification and testing, we offer our expertise and partnership to manufacturers aiming to deliver progressive audio products for an unprecedented sound experience.

Design with Infineon’s solutions to benefit from:

- Exceptional audio performance
- Maximized power efficiency
- Maximized output power
- Design freedom
- Fast time to market

MERUS™ portfolio of advanced audio amplifier solutions ensures outstanding performance, maximum flexibility, and highest reliability.

Performance
Infineon’s MERUS™ amplifier solutions are designed to maximize power efficiency and dynamic range while providing best-in-class audio performance in product form factors that make them an optimal fit for any audio application, in both low (< 40 V) and high voltage (100-600 V) ranges. Having this at hand, our customers are enabled to manufacture heatsink-free and filterless high performance audio products with fewer components, lower total system costs, and longer battery playback time. By utilizing patented IC architectures, proprietary algorithms and sophisticated manufacturing processes, our MERUS™ amplifier ICs provide unsurpassed peak-to-idle-power ratios, best-in-class audio performance and size-optimized solutions.

Flexibility
MERUS™ portfolio addresses a broad range of premium class D audio applications. It includes fully integrated monolithic audio amplifier ICs, multi-chip audio amplifier modules (MCMs) as well as discrete audio amplifier driver IC and power MOSFET solutions, scalable in the output power range from 20 watts to several kilowatts to meet the most stringent and demanding application needs.

Reliability
Thanks to enhanced design and production standards, customers can rely on the robustness of Infineon’s MERUS™ amplifiers for complete system stability and reliability over their entire product lifetime. Standardized design processes used by our world-class high-voltage/mixed-signal IC design and verification teams along with extremely high manufacturing and product testing standards result in exceptional product durability and benchmark quality.*

*The MERUS™ MA12070 4–26 V ultraefficient audio amplifier was the first amplifier to receive the “WiSA endorsed” certification in the market (December, 2018)
Audio applications and use cases
Audio amplifier solutions for advanced audio products

MERUS™ audio amplifiers address a wide range of applications in the field of portable/battery powered, home and professional audio applications.

Application overview

Portable/battery powered audio applications
- Battery powered speakers
- On-the-go Bluetooth speakers
- Docking speakers
- Boom boxes
- Wearable speakers

Home audio applications
- Multiroom systems
- Home hubs
- TVs
- Sound bars
- Home theater systems
- Smart speakers

Professional audio applications
- Power-over-ethernet (PoE) audio systems
- Touring amplifiers
- Active speakers
- Public announcement 70-100 V systems
- Music instrument amplifiers

Let’s innovate! Unleash your creativity and together we can work on your customized design. Visit www.infineon.com/merus for more product-related information or www.infineon.com/audio for application-specific details and get in touch!

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MERUS™ audio amplifiers in portable/battery powered audio

When designing portable/battery-powered audio devices, it is essential to maximize battery playback time, and at the same time, maintain excellent audio performance. Infineon’s MERUS™ amplifiers provide up to twice as long battery playback time in combination with the best-in-class audio performance and unsurpassed sound quality.

Solution example: 2.1 configuration (2xBTL + 1xPBTL)

Solution specification

Number of audio channels: 2 bridge-tied load (BTL) and 1 parallel BTL channels

Peak power output: 2x37 W @ 4 Ω, 10% THD and 74 W @ 2 Ω, 10% THD

Featured audio ICs: Ultra low idle power MA2304DNS (integrated DSP) and MA2304PNS (digital volume control and limiter)
Modern home audio products vary in shapes, sizes and configurations, but common requirement is great sound in combination with outstanding industrial and acoustic design. In addition to producing exceptional sound quality, MERUS™ amplifiers from Infineon can completely eliminate the need for bulky and expensive LC output filters and heatsinks. This allows the design of new innovative and great-sounding home audio products in form factors and shapes that were previously unthinkable.

Solution example: 2.1 configuration (2xBTL + 1xPBTL)

**Solution specification**
- **Number of audio channels**: 2 bridge-tied load (BTL) and 1 parallel BTL channels
- **Peak power output**: 2x37 W @ 4 Ω, 10% THD and 74 W @ 2 Ω, 10% THD
- **Featured audio ICs**: Ultra low idle power MA2304DNS (integrated DSP) and MA2304PNS (digital volume control and limiter)

---

**Solution example: 4.1 configuration (4xBTL + 1xPBTL)**

**Solution specification**
- **Number of audio channels**: 5 bridge-tied load (BTL)
- **Peak power output**: 4x37 W @ 4 Ω, 10% THD; 400 W @ 8 Ω, 10% THD
- **Featured audio ICs**: MA2304DNS, MA2304PNS, MA5332MS
MERUS™ audio amplifiers in professional audio

Professional audio equipment is all about maximizing output power and power density. Big, heavy, and not very much energy-efficient professional audio electronics is now history. Infineon's MERUS™ discrete audio amplifier ICs combined with a set of power MOSFETs and GaN HEMTs make it possible to develop both amplifiers and power supply units with great audio performance and high efficiency in a very compact space with smaller parts and reduced BOM count. With these combinations, Infineon is offering to its customers advantageous scalability of output power levels to achieve the sound quality of professional standard - relentlessly perfect.

Solution example: touring amplifiers (one channel)

Solution specification
Number of audio channels: 2 half-bridge channels
Peak power output: 3000 W @ 4 Ω, 1% THD
Featured audio ICs: IRS2092SPBF, IRS20957SPBF

Solution example: active speakers

Solution specification
Number of audio channels: 2 half-bridge channels
Peak power output: 500 W @ 4 Ω, 1% THD
Featured audio ICs: IRS2092S, IRS20957S

Solution example: public announcement 70-100 V system

Solution specification
Number of channels: 2 half bridge channels
Peak power output: 500 W, 70 V rms/100 V rms, 1% THD
Featured audio ICs: IRS2452AM

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Audio amplifier solutions
Unsurpassed power efficiency and flexibility

Class D audio amplifiers have practically eliminated class A and class B amplifiers for their substantially improved energy efficiency and small form factors, even for high power amplification. In addition, since class D audio amplifiers can reach 0 percent distortion and 100 percent energy efficiency (i.e. an ideal power switch), the class D stage is ideal for providing excellent sound quality with practically negligible thermal design limitations.

MERUS™ class D audio amplifier solutions

Competitive advantage
Infineon’s portfolio stretches from fully integrated single-chip audio solutions to discrete audio solutions with highly scalable audio amplifier driver IC and power MOSFET combinations. With MERUS™ as one brand for all class D audio applications, we offer compelling class D audio solutions that are ideally suited for a broad range of class D audio applications with output power levels ranging from 20 W up to over 2000 W per channel. Choose from:

MERUS™ integrated multilevel audio amplifier ICs
MERUS™ integrated audio amplifier multi-chip modules (MCMs)
MERUS™ discrete audio amplifier driver ICs with
CoolGaN™ 400 V e-mode HEMT
MERUS™ evaluation environment
Integrated multilevel audio amplifier IC evaluation boards
Integrated audio amplifier multi-chip module (MCM) evaluation boards
Discrete audio amplifier driver IC and MOSFET evaluation boards
Discrete audio amplifier driver IC and CoolGaN™ 400 V evaluation board
Power supply for audio evaluation boards

We help you reduce complexity. The scalability in output power level of MERUS™ products, amongst other features, helps you meet the most stringent and demanding application needs.
Low power audio solutions (<40 V)

Multilevel switching for ultrahigh power efficiency and filterless amplification

MERUS™ low power class D amplifier solutions are tailored for audio applications with voltage classes below 40 V. These monolithic ICs enable optimization of audio systems.

MERUS™ integrated multilevel audio amplifier ICs

With its revolutionary MERUS™ integrated multilevel class D audio amplifier ICs, Infineon is leading in efficiency and power density. Compared to traditional class D amplifier ICs, which produce only two voltage output levels, multilevel amplifier ICs use additional on-chip MOSFETs and capacitors to produce outputs with a higher signal granularity i.e. higher switching frequencies and/or multiple output signal levels - typically up to five voltage levels.

Multilevel switching - technology breakthrough with MERUS™ integrated multilevel audio amplifier ICs

Infineon is the first company to apply the multilevel switching technology to class D audio amplifier products, what positively affects the most important amplifier evaluation parameters: power consumption, solution size, audio performance, electromagnetic interference, and BOM cost. In addition to these, MERUS™ integrated multilevel audio amplifier ICs bring other advantages - such as potential LC filter removal, low THD+N, and cooler operation.

Power consumption advantage

Even in idle and near-idle mode, traditional class D amplifiers continue to have a lot of internal switching activity, which increases power consumption. MERUS™ integrated multilevel audio amplifier ICs use scalable signal “granularity” to keep the power loss extremely low. Due to the proprietary circuits architecture, there is virtually no switching loss measurable in idle mode - one of the parameters where MERUS™ integrated multilevel audio amplifier ICs excel.

Source of power loss: idle vs. playback mode

Traditional class D amplifiers are only efficient at highest music volume levels, with high THD, which renders this quality less useful in practice. In realistic audio playback situations, they consume significantly more input power (~1 W on average) than the second generation of MERUS™ integrated multilevel audio amplifier ICs (~0.06 W).

Audio amplifier efficiency

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Efficiency where it matters for audio reproduction

For MERUS™ integrated multilevel audio amplifier ICs, amplifier efficiency at average output power is key. As the graph on the left shows, MERUS™ multilevel amplifier is much more effective than the traditional class D amplifier, which translates into less power consumption in AC input and in battery powered audio applications.

Filterless topology with “flying capacitor” of an integrated class D IC

MERUS™ Gen1 and Gen 2 integrated multilevel audio amplifier IC product portfolio

<table>
<thead>
<tr>
<th>Specifications</th>
<th>MA2304DNS</th>
<th>MA2304PNS</th>
<th>MA12070</th>
<th>MA12070P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of audio channels</td>
<td>2xBTL</td>
<td>2xBTL</td>
<td>2xBTL</td>
<td>2xBTL</td>
</tr>
<tr>
<td>Max. peak power @ 4 ohm 10% THD</td>
<td>2x37 W</td>
<td>2x80 W</td>
<td>2x80 W</td>
<td>2x80 W</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>10-20 V</td>
<td>4-26 V</td>
<td>4-26 V</td>
<td>4-26 V</td>
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<tr>
<td>3-level and 5-level modulation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Max. PWM frequency</td>
<td>726 kHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selectable power mode profiles</td>
<td>Low power consumption (LPC) or high audio performance (HAP)</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Audio input</td>
<td>Digital</td>
<td>Analog</td>
<td>Digital</td>
<td></td>
</tr>
<tr>
<td>HiRes audio compliant</td>
<td>FS/TDM</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Volume and dynamic range control</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idle power dissipation</td>
<td>52 mW (LPC mode)</td>
<td>&lt;160 mW</td>
<td>&lt;400 mW</td>
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</tr>
<tr>
<td>Audio performance (PMP2)</td>
<td>106 dB DNR 52 µVrms output noise &lt;0.03% THD+N</td>
<td>&gt;110dB SNR 45 µV output integrated 0.004% THD+N</td>
<td>101dB SNR 140 µV output noise 0.007% THD+N</td>
<td></td>
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<tr>
<td>Sample rates</td>
<td>32, 44.1, 48, 88.2, 96, 176.4, 192 kHz</td>
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<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Comprehensive protection scheme*</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Configurable for SE or PBTL operation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>I2C communication</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Filterless implementation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Package type</td>
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<td>64-pin QFN package with exposed thermal pad</td>
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<tr>
<td>Evaluation boards</td>
<td>EVAL_AUDIO_MA2304DNS</td>
<td>EVAL_AUDIO_MA2304PNS</td>
<td>EVAL_AUDIO_MA12070</td>
<td>EVAL_AUDIO_MA12070P</td>
</tr>
</tbody>
</table>

*All ICs carry a full protection scheme comprising undervoltage lockout, overtemperature warning/error, short circuit/overload protection, power stage pin-to-pin short circuit, error reporting through serial interface (I2C), and DC protection
High power audio solutions (100–600 V)

Integrated and discrete components for scalable output power and superb audio performance

MERUS™ high power solutions address audio applications in the voltage range from 100 V to 600 V. The offering covers both integrated audio solutions, with MERUS™ integrated multi-chip modules (MCMs), and discrete solutions, with discrete audio amplifier driver ICs, power MOSFETs and e-mode HEMTs.

MERUS™ integrated audio amplifier multi-chip modules (MCMs)

Multi-chip modules integrate PWM controller and power MOSFETs in a single package to offer a highly efficient, compact solution that reduces component count, shrinks PCB size up to 70 percent, and simplifies class D amplifier design.

Key advantages
- Single package with integrated PWM controller and audio-performance-optimized power MOSFET
- Overcurrent protection
- Thermal shutdown
- Floating differential input
- Clip detection
- Best-in-class power efficiency and audio performance
- Lower component count, leading to design simplification
- Compatible with single supply or split rail configuration
- Click noise reduction

Key benefits
- Extended battery playback time
- Unrivalled audio performance
- Smaller solution size (BOM reduction, system level cost savings)
- Eliminated need for heatsink
- High noise immunity
- Reliable operation
- Thermal efficiency

Multi-chip audio amplifier module

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# High power audio solutions

**MERUS™ integrated audio amplifier multi-chip modules (MCMs)**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>IR4301M</th>
<th>IR4321M</th>
<th>IR4302M</th>
<th>IR4322M</th>
<th>MAS332MS</th>
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<tr>
<td>Number of audio channels</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Max. power per channel</td>
<td>160 W</td>
<td>90 W</td>
<td>130 W</td>
<td>100 W</td>
<td>200 W</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>~ ± 31 V or 62 V</td>
<td>~ ± 25 V or 50 V</td>
<td>~ ± 31 V or 62 V</td>
<td>~ ± 25 V or 50 V</td>
<td>~ ± 23 V or 40 V</td>
</tr>
<tr>
<td>Max. PWM frequency</td>
<td>500 kHz</td>
<td>500 kHz</td>
<td>500 kHz</td>
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<table>
<thead>
<tr>
<th>Features</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Differential audio input</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Overcurrent protection</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Integrated power MOSFET</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Voltage</td>
<td>80 V</td>
<td>60 V</td>
<td>80 V</td>
<td>60 V</td>
<td>100 V</td>
</tr>
<tr>
<td>PWM controller</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Thermal shutdown</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Click noise reduction</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Package type</td>
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<td>5x6 mm QFN</td>
<td>7 x 7 mm QFN</td>
<td>7 x 7 mm QFN</td>
<td>7 x 7 mm QFN</td>
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<tr>
<td>Evaluation boards</td>
<td>IRAUDAMP12 IRAUDAMP19</td>
<td>IRAUDAMP16 IRAUDAMP17</td>
<td>IRAUDAMP22</td>
<td>EVAL_AUDAMP2S</td>
<td></td>
</tr>
</tbody>
</table>
Infineon’s MERUS™ discrete audio amplifier driver IC portfolio and accompanying assortment of power MOSFETs and GaN HEMTs, optimized for class D audio applications, enable audio system manufacturers to more efficiently design products with superior audio performance and higher reliability in smaller footprint.

**Benefits**

- Unified design platform
- Scalable output power up to over 2 kW per channel
- Simple yet effective - exchange of external MOSFET triggers alteration in output power level
- Best-in-class power efficiency

**Key values**

- Superior audio performance
- Increased reliability
- Unique audio experience

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### MERUS™ discrete audio amplifier driver IC product portfolio

<table>
<thead>
<tr>
<th>Specifications</th>
<th>IRS20957SPBF</th>
<th>IRS2092SPBF</th>
<th>IRS2052M</th>
<th>IRS2093MPBF</th>
<th>IRS2452AM</th>
</tr>
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<tbody>
<tr>
<td>Number of audio channels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. power per channel</td>
<td>500 W</td>
<td>500 W</td>
<td>300 W</td>
<td>300 W</td>
<td>500 W</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>± 100 V</td>
<td>± 100 V</td>
<td>± 100 V</td>
<td>± 100 V</td>
<td>± 200 V</td>
</tr>
<tr>
<td>Gate sink/source current</td>
<td>1.2/1.0 A</td>
<td>1.2/1.0 A</td>
<td>0.6/0.5 A</td>
<td>0.6/0.5 A</td>
<td>0.6/0.5 A</td>
</tr>
<tr>
<td>Overcurrent protection</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Overcurrent flag</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
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<td>PWM input</td>
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<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Floating input</td>
<td>✓</td>
<td>✓</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Dead time</td>
<td>✓</td>
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</tr>
<tr>
<td>Protection control logic</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>PWM controller</td>
<td>✓</td>
<td>✓</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Clip detection</td>
<td>✓</td>
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<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Click noise reduction</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Temperature sensor input</td>
<td>✓</td>
<td></td>
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<tr>
<td>Thermal shutdown</td>
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<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Clock input</td>
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<td></td>
<td></td>
<td>✓</td>
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<td>Package type</td>
<td>16-pin SOIC narrow</td>
<td>16-pin SOIC narrow</td>
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<td>MLPQ48</td>
<td>MLPQ32</td>
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<tr>
<td>Evaluation boards</td>
<td>IRAUDAMP4A, IRAUDAMP6</td>
<td>IRAUDAMP5, IRAUDAMP9</td>
<td>IRAUDAMP10</td>
<td>IRAUDAMP8</td>
<td>IRAUDAMP23</td>
</tr>
</tbody>
</table>

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For class D audio amplifier applications, Infineon is offering power MOSFETs optimized to contribute to high efficiency and improved audio performance. The same audio amplifier driver IC can be used with a variety of MOSFETs making it scalable to various output power levels. Replacing the external MOSFET with a matching one is enough to trigger an alteration in the chipset output power level. The extensive range of MOSFETs (Through-hole, DirectFET™) addresses key parameters, such as on-state resistance ($R_{DS(on)}$), gate charge ($Q_G$), and reverse recovery charge ($Q_{rr}$), with the purpose of maximizing efficiency, THD, and EMI.

**Recommended power MOSFETs**

IRS2093MPBF works up to 150 W and IRS2052M works up to 300 W. IRS2092SPBF and IRS20957SPBF work with all power levels listed above.

**Recommended MOSFET (through-hole) product portfolio**

<table>
<thead>
<tr>
<th>Output power</th>
<th>Recommended driver IC</th>
<th>Speaker resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 W</td>
<td>IRS2093MPBF</td>
<td>IRF4019</td>
</tr>
<tr>
<td></td>
<td>IRFB4019</td>
<td>IRF4019</td>
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<tr>
<td></td>
<td>IRF4020H-117P</td>
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</tr>
<tr>
<td>200 W</td>
<td>IRS2052M</td>
<td>IRF6565</td>
</tr>
<tr>
<td></td>
<td>IRF6565</td>
<td>IRF6565</td>
</tr>
<tr>
<td></td>
<td>IRF6775M</td>
<td></td>
</tr>
<tr>
<td>300 W</td>
<td>IRS2092SPBF</td>
<td>IRF6645</td>
</tr>
<tr>
<td></td>
<td>IRF6645</td>
<td>IRF6645</td>
</tr>
<tr>
<td></td>
<td>IRF6775M</td>
<td></td>
</tr>
<tr>
<td>500 W</td>
<td>IRS20957SPBF</td>
<td>IRF6644</td>
</tr>
<tr>
<td></td>
<td>IRF6644</td>
<td>IRF6644</td>
</tr>
<tr>
<td></td>
<td>IRF6775M</td>
<td></td>
</tr>
<tr>
<td>750 W</td>
<td>IRF6641</td>
<td>IRF6422 x 2</td>
</tr>
<tr>
<td></td>
<td>IRF6422</td>
<td>IRF6422</td>
</tr>
<tr>
<td>1000 W</td>
<td>IRS2093MPBF</td>
<td>IRF4668</td>
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</tr>
</tbody>
</table>

IRS2093MPBF works up to 150 W and IRS2052M works up to 300 W. IRS2092SPBF and IRS20957SPBF work with all power levels listed above.

**Recommended MOSFET (DirectFET™) product portfolio**

<table>
<thead>
<tr>
<th>Output power</th>
<th>Recommended driver IC</th>
<th>Speaker resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 W</td>
<td>IRS2093MPBF</td>
<td>IRF6645</td>
</tr>
<tr>
<td></td>
<td>IRF6645</td>
<td>IRF6645</td>
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<tr>
<td></td>
<td>IRF6775M</td>
<td></td>
</tr>
<tr>
<td>200 W</td>
<td>IRS2052M</td>
<td>IRF6646</td>
</tr>
<tr>
<td></td>
<td>IRF6646</td>
<td>IRF6775M</td>
</tr>
<tr>
<td></td>
<td>IRF6775M</td>
<td></td>
</tr>
<tr>
<td>300 W</td>
<td>IRS2092SPBF</td>
<td>IRF6644</td>
</tr>
<tr>
<td></td>
<td>IRF6644</td>
<td>IRF6775M</td>
</tr>
<tr>
<td></td>
<td>IRF6775M</td>
<td></td>
</tr>
<tr>
<td>500 W</td>
<td>IRS20957SPBF</td>
<td>IRF6643</td>
</tr>
<tr>
<td></td>
<td>IRF6643</td>
<td>IRF6641</td>
</tr>
</tbody>
</table>

IRS2093MPBF works up to 150 W and IRS2052M works up to 300 W. IRS2092SPBF and IRS20957SPBF work with all power levels listed above.

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CoolGaN™ 400 V e-mode HEMT for audio solutions

Gallium nitride (GaN) is a material driving the next generation of power semiconductor products such as high electron mobility transistors (HEMTs). GaN has a much higher critical electrical field density allowing very low on-resistance. Very high electron mobility enables small die size, therefore, small input and output capacitances in the device, which makes GaN HEMTs great for high speed switching.

The CoolGaN™ 400 V enhancement-mode (e-mode) HEMT offering is built around class D audio requirements in a high performing SMD package to fully exploit the benefits of GaN. Class D audio amplifiers offer 0 percent distortion and 100 percent efficiency. The decrease of the actual number depends on how close the PWM is to an ideal waveform shape and how great power loss is in the device. The zero reverse recovery charge in the body diode and very small linear input and output capacitances from Infineon’s CoolGaN™ technology allow switching waveforms to be close to an ideal switch device.

**CoolGaN™ 400 V e-mode HEMT benefits in class D amplifiers**
- Efficient - best FOM of 400 V power devices
- Very low noise - zero reverse recovery charge enables quiet hard switching
- Small and linear Coss narrows deadtime window for better THD
- Easy-to-use - compatible with class D audio control ICs

**Recommended CoolGaN™ 400 V e-mode HEMT product offering**

<table>
<thead>
<tr>
<th>Package</th>
<th>CoolGaN™ 400 V e-mode HEMT</th>
<th>Recommended discrete audio amplifier driver IC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package</td>
<td>HSOF-8-3 (TO-leadless)</td>
<td>IRS20957SPBF</td>
</tr>
<tr>
<td>P_{max}</td>
<td>Up to 200 W</td>
<td></td>
</tr>
<tr>
<td>R_{on(max)}</td>
<td>70 mΩ</td>
<td></td>
</tr>
<tr>
<td>OPN</td>
<td>IGT40R07D1 E8220</td>
<td></td>
</tr>
</tbody>
</table>

www.infineon.com/merus
www.infineon.com/gan
Recommended audio evaluation boards

Enabling fast time to market and device performance evaluation

MERUS™ portfolio of advanced class D audio amplifiers is accompanied with a variety of evaluation boards, for both integrated and discrete solutions, at both low and high power levels. These boards allow designers to evaluate the performance of the amplifier ICs within their system. Via our evaluation environment, products are developed faster, resulting in shorter time to market.

MERUS™ integrated multilevel audio amplifier IC evaluation boards

EVAL_AUDIO_MA2304DNS
The demonstration board EVAL_AUDIO_MA2304DNS is an evaluation and demonstration board for MERUS™ audio MA2304DNS. It contains a digital input and a variety of output and setup/selection features. It also contains an on-board power supply generator (selectable 1.8 or 3.3 V buck-converted) so only one external power supply (PVDD) is necessary. It can be controlled and programmed with its software GUI.

The board can be used for evaluating or demonstrating key features/advantages of the MERUS™ technology:
› Energy efficiency: power losses at typical audio listening levels/ultralow idle power consumption
› Adaptive power management system
› Minimum output filter components: significant cost and size reduction
› THD performance and audio quality
› Integrated MERUS™ DSP

EVAL_AUDIO_MA2304PNS
The demonstration board EVAL_AUDIO_MA2304PNS is an evaluation and demonstration board for MERUS™ audio MA2304PNS. It contains a digital input and a variety of output and setup/selection features. It also contains an on-board power supply generator (selectable 1.8 or 3.3 V buck-converted) so only one external power supply (PVDD) is necessary. It can be controlled and programmed with its software GUI.

The board can be used for evaluating or demonstrating key features/advantages of the MERUS™ technology:
› Energy efficiency: power losses at typical audio listening levels/ultralow idle power consumption
› Adaptive power management system
› Minimum output filter components: significant cost and size reduction
› THD performance and audio quality
› Integrated volume and limiter processors

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**EVAL_AUDIO_MA12070_B**  
**Number of audio channels:**  
2 channels BTL or  
1 channel PBTL or  
2 channels SE + 1 BTL or  
4 channels SE  
**Output power per channel (2xBTL, Peak, 10% THD, 4 Ω):**  
2x 80 W  
**Featured module IC:** MA12070  
**Input:** Analog  
**OPN:**  
EVAL_AUDIO_MA12070_B

**EVAL_AUDIO_MA12070P_B**  
**Number of audio channels:**  
2 channels BTL or  
1 channel PBTL or  
2 channels SE + 1 BTL or  
4 channels SE  
**Output power per channel (2xBTL, Peak, 10% THD, 4 Ω):**  
2x 80 W  
**Featured module IC:** MA12070P  
**Input:** Digital  
**OPN:**  
EVAL_AUDIO_MA12070P_B

www.infineon.com/merus
KIT_ARDMKR_AMP_40W
Kit board MA12070P audio amplifier - compatible with Arduino MKR boards

Summary of features
› Equipped with MERUS™ MA12070P proprietary multilevel amplifier
› Power input: 5 V/2.5 A - sourced from the same single USB-C power supply or battery pack
› No need for external or extra power supplies
› Up to 40 W instantaneous peak output power with a USB-C power supply or battery pack

Benefits
› Compatible with Arduino MKRZERO and MKR1000 WIFI
› Full hardware control and customization
› Error monitoring through Arduino programming framework

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EVAL_AUDAMP25
Number of audio channels: 2
Output power per channel [RMS]: 200 W
Featured class D IC: MA5332MS
Input: analog
OPN: EVALAUDAMP25STOBO1

Summary of features
› Output power: 200 W x 2 channels (10 percent THD+N, 4 Ω at ±36.5 V)
› Multiple protection features:
  – Over-Current Protection (OCP), high-side and low-side
  – Over-Voltage Protection (OVP)
  – Under-Voltage Protection (UVP), high-side and low-side
  – DC Protection (DCP)
  – Over-Temperature Protection (OTP)
› PWM modulator:
  – Self-oscillating half-bridge topology with optional clock synchronization

Benefits
› Split power supply
› SE/BTL/PSE output
› High audio quality
› Low noise
› High efficiency

REF_MA5332BTLSPS
Number of audio channels: 1
Output power per channel [RMS]: 200 W
Featured class D IC: MA5332MS
Input: analog
OPN: REFM5332BTLSPSTOBO1

Summary of features
› Output power:
  – 200 W x 1 channels (10 percent THD+N, 4 Ω at 40 V)
› Multiple protection features:
  – Over-Current Protection (OCP), high-side and low-side
  – Over-Voltage Protection (OVP)
  – Under-Voltage Protection (UVP), high-side and low-side
  – DC Protection (DCP)
  – Over-Temperature Protection (OTP)
› PWM modulator:
  – Self-oscillating half-bridge topology with optional clock synchronization

Benefits
› Single power supply
› Full-bridge output
› High audio quality
› Low noise
› High efficiency
**MERUS™ integrated audio amplifier multi-chip module (MCM) evaluation boards**

- **IRAUDAMP12**
  - Number of audio channels: 2
  - Output power per channel [RMS]: 130 W
  - Featured class D IC: IR4301M
  - Input: Analog
  - OPN:

- **IRAUDAMP17**
  - Number of audio channels: 2
  - Output power per channel [RMS]: 100 W
  - Featured class D IC: IR4302M
  - Input: Analog
  - OPN:

- **IRAUDAMP19**
  - Number of audio channels: 2
  - Output power per channel [RMS]: 100 W
  - Featured class D IC: IR4301M
  - Input: Analog
  - OPN:

- **IRAUDAMP21**
  - Number of audio channels: 2
  - Output power per channel [RMS]: 135 W
  - Featured class D IC: IR4321M
  - Input: Analog
  - OPN:

**Discrete MERUS™ audio amplifier driver IC and MOSFET evaluation boards**

- **IRAUDAMP4A**
  - Number of audio channels: 2
  - Output power per channel [RMS]: 120 W
  - Featured driver IC: IRS20957S
  - Featured MOSFET: IRF6645TRPbF
  - OPN:

- **IRAUDAMP5**
  - Number of audio channels: 2
  - Output power per channel [RMS]: 120 W
  - Featured driver IC: IRS2092S
  - Featured MOSFET: IRF6645TRPbF
  - OPN:

- **IRAUDAMP6**
  - Number of audio channels: 2
  - Output power per channel [RMS]: 250 W
  - Featured driver IC: IRS20957S
  - Featured MOSFET: IRF6785MTRPbF
  - OPN:

- **IRAUDAMP7S**
  - Number of audio channels: 2
  - Output power per channel [RMS]: 500 W
  - Featured driver IC: IR4302M
  - Featured MOSFET: IRF60R180C7
  - OPN:

- **IRAUDAMP9**
  - Number of audio channels: 1
  - Output power per channel [RMS]: 1700 W
  - Featured driver IC: IRS2092S
  - Featured MOSFET: IRF6427PbF
  - OPN: www.infineon.com/merus

- **IRAUDAMP10**
  - Number of audio channels: 2
  - Output power per channel [RMS]: 370 W
  - Featured driver IC: IRS2052M
  - Featured MOSFET: IRF6775MTRPbF
  - OPN:

- **IRAUDAMP23**
  - Number of audio channels: 2
  - Output power per channel [RMS]: 500 W
  - Featured driver IC: IRS20957S
  - Featured MOSFET: IRF60R180C7
  - OPN:

- **IRAUDAMP12**
  - Number of audio channels: 2
  - Output power per channel [RMS]: 130 W
  - Featured class D IC: IR4301M
  - Input: Analog
  - OPN:
Discrete audio amplifier driver IC and CoolGaN™ 400 V evaluation board

EVAL_AUDAMP24
Number of audio channels: 2
Output power per channel [RMS]: 200 W
Featured driver IC: IRS20957SPBF
Featured HEMT: IGT40R070D1 E8220
OPN: EVAL_AUDAMP24

Power supply units for audio evaluation boards

IRAUDPS1
Input voltage: 12 V<sub>DC</sub>
Output voltage: ± 35 V
Output power per channel [RMS]: 100 W
Featured driver IC: IR2085S
Description: 250-1000 W scalable audio power supply
OPN: IRAUDPS1

IRAUDPS3
Input voltage: 110/220 V<sub>AC</sub>
Output voltage: ± 30 V
Output power per channel [RMS]: 200 W
Featured driver IC: IRS27952
Description: Power supply for class D audio amplifier
OPN: IRAUDPS3

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A world leader in semiconductor solutions

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We make life easier, safer and greener.

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We partner
We innovate
We perform

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› China, mainland .......... 4001 200 951 (Mandarin/English)
› India .......................... 000 800 4402 951 (English)
› USA ............................ 1-866 951 9519 (English/German)
› Other countries .......... 00* 800 951 951 951 (English/German)
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