



ROHM starts production of 150V GaN HEMTs: Featuring breakthrough 8V withstand Gate Voltage

The first series of the new EcoGaN™ family contributes to lower power consumption and greater miniaturization in data centers and base stations

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ROHM Co., Ltd.
Marketing Communication Division

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*Please note that this document is current as of the date of publication

Provide optimal products that contribute to energy and space saving from power devices to ICs and modules

Power Devices (power semiconductors)

SiC Devices

- SiC MOSFETs
- SiC SBD (Schottky barrier diodes)



Si Devices

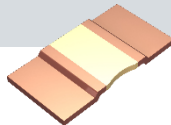
- IGBTs
- SJ-MOSFETs
- SBD, FRD (Fast recovery diodes)



GaN Devices (GaN HEMT)

Passive Devices

- Shunt Resistors



Power ICs

Power Management ICs

- DC/DC Converter ICs
- LDOs (Low dropout)
- AC/DC converter ICs (SMPS)



Driver ICs

- Gate Driver ICs
- Motor Driver ICs

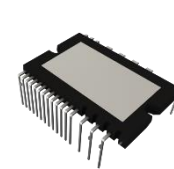


Standard ICs

- IPDs

Power Modules

- Full SiC Power Modules
- IPMs



We are also providing products that combine power device elements and IC technology, such as AC/DV converter ICs with built-in SiC MOSFETs.

GaN device is a device that could expand the ROHM's power portfolio

GaN (Gallium Nitride)

= A type of compound semiconductor material

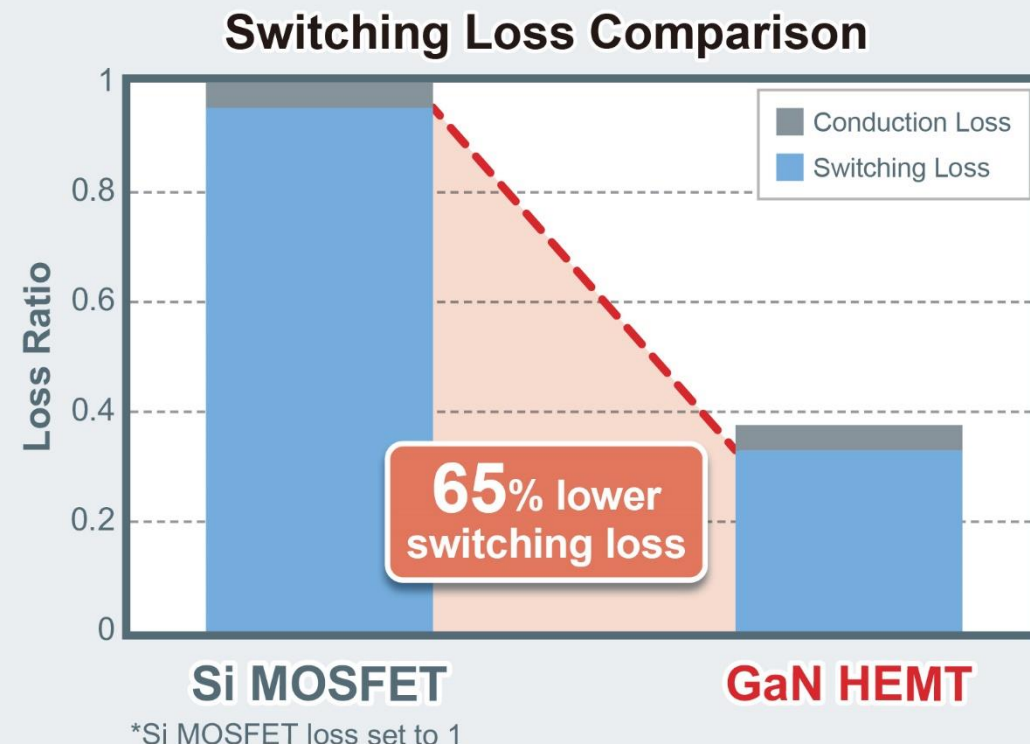
	Si	4H-SiC	GaN
Bandgap (eV)	1.12	3.2	3.4
Dielectric constant	11.7	9.66	8.9
Breakdown field (MV/cm)	0.3	3	3.3
Electron saturation velocity (10 ⁷ cm/s)	1	2	2.5
Electron mobility in the bulk (cm ² /Vs)	1350	720	900
Thermal conductivity (W/cm·K)	1.5	4.5	2 to 3

- Wide band gap
- High electron saturation velocity
- Large breakdown electric field

GaN is a great potential material that could contribute further energy saving, such as SiC

HEMT (High Electron Mobility Transistor)

= A type of transistor element structure



GaN HEMTs can significantly reduce switching losses compared to Si MOSFETs

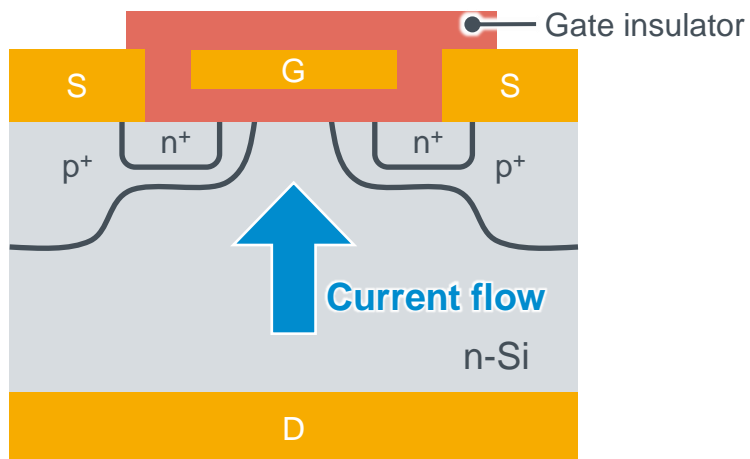
Device Comparison

(Comparison in the 650V band)

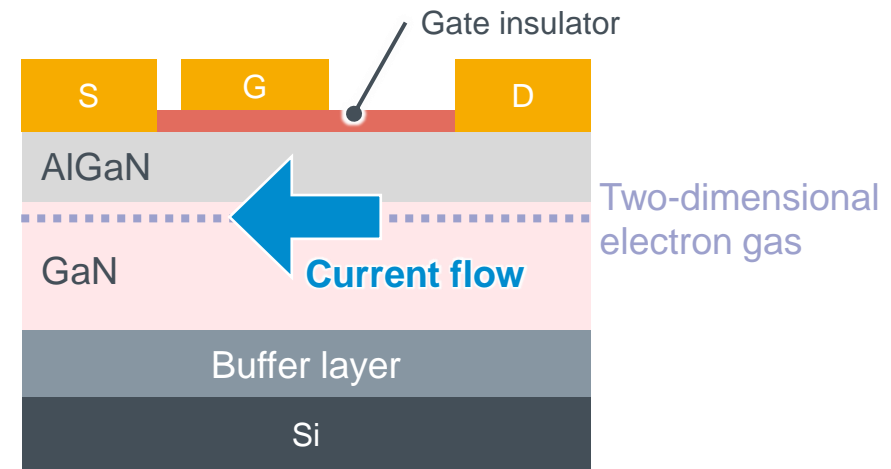
	Si SJ MOSFET	SiC MOSFET	GaN HEMT
Voltage range	500V to 1kV	600V to a few kV	Less than 650V
Large current	Better	Better	Good
High speed switching characteristic	Good	Better	Excellent
$R_{on} \cdot Q_g$ *1	1 *2	0.63	0.05
Switching loss	1 *2	0.2	0.1

*1: index that represents switching performance. The lower the value, the better the switching performance. *2: Set R_{on} / Q_g and switching loss of Si SJ MOSFET to 1.

Si, SiC MOSFET vertical structure

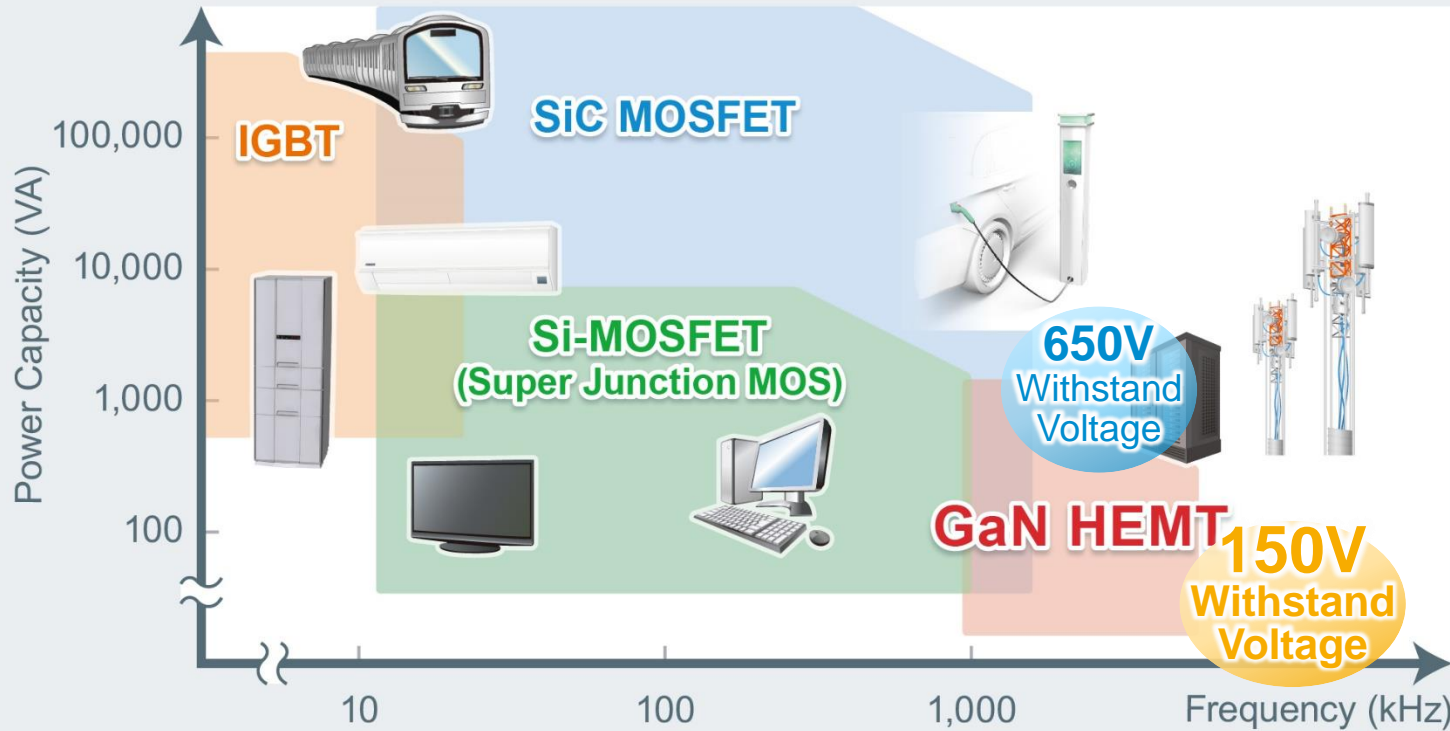


GaN HEMT lateral structure



Power devices have different power (VA) and operating frequency bands, depending on the materials and device

Power Device Application Scope



SiC

- High Power
- High voltage (>600V)
- High frequency (20 to 200kHz)

- EV inverter, HV DC/DC, OBC
- Server primary power supply
- Solar/wind power
- Industrial power supply
- Railroad

GaN

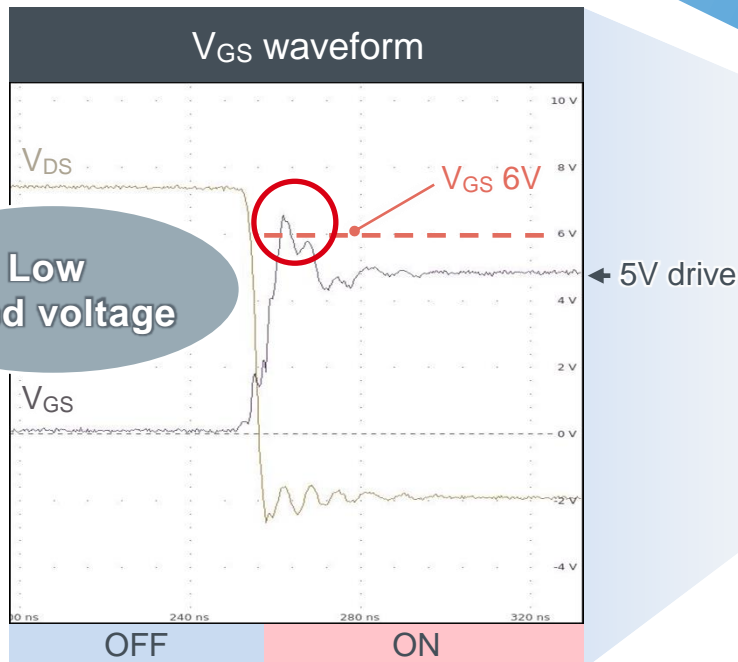
- Middle power
- Middle voltage (100 to 600V)
- High frequency (More than 200kHz)

- Server power supply for data center
- Base station power supply
- Small AC adaptor(consumer)
- Automotive OBC, 48V DC/DC

ROHM begins development of 150V GaN device as a device to complement SiC devices

GaN HEMT is expected as a device with extremely high frequency operation in the medium voltage range

1 Start development by taking advantage of the GaN features

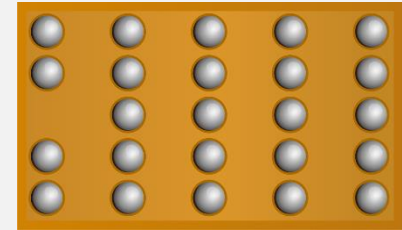


2 The market has started up, but issues have become apparent

Low gate-source rated voltage
Package is not user-friendly

Not user-friendly

BGA package



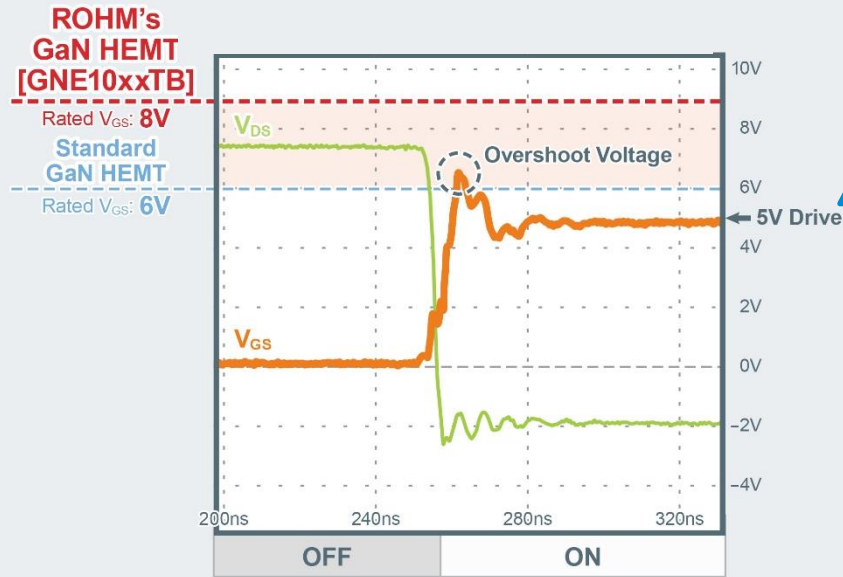
3 Problem solving from the user's perspective is essential for popularization

ROHM develops technology that solves the problems and promotes the spread of GaN devices

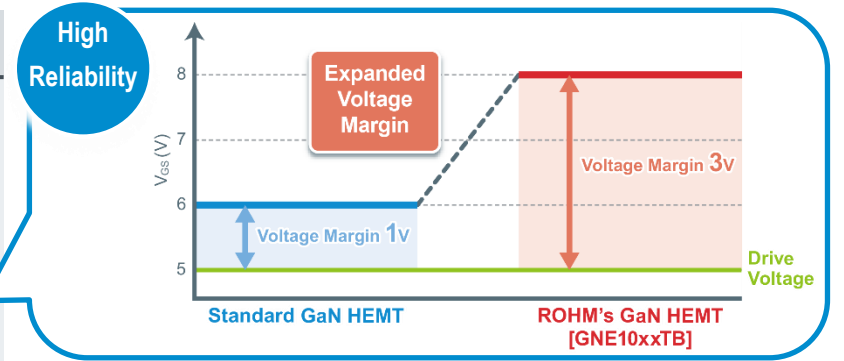
Mainly Characteristics

- Voltage (V_{DS}): 150V
- **Gate-source rated voltage: 8V**
- **Original mold package**
 - **High reliability**
 - **Good mountability**
 - **High heat dissipation**
 - Low parasitic inductance
- High speed switching (>1MHz)
- Normally-off
- Reverse recovery time 0

Gate-Source Voltage (V_{GS}) Waveform

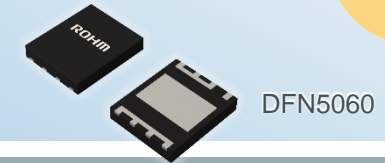
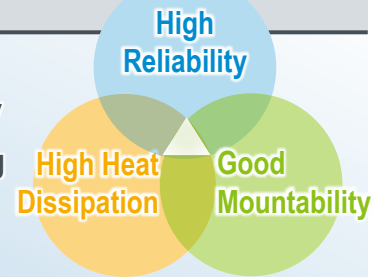


Increased V_g rating voltage (8V) provides better usability and could maximize the GaN benefit



Package Image

Superior heat dissipation and large current capability
Facilitating handling during the mounting process



Product Lineup

Part No.	V_{DS} [V]	V_{GS} [V]	I_{DS} [A] $T_c=25^\circ C$	$R_{DS(on)}$ [m Ω]	Q_g [nC]	Package [mm]
New GNE1040TB	150	8	10	40	2.0	DFN5060 [5.0×6.0×1.0]
☆ GNE1015TB			15	15	4.9	
☆ GNE1007TB			20	7	10.2	

Applications

- Data center server
- Base station (5G)
- LiDAR
- D-class audio amplifier



Data center



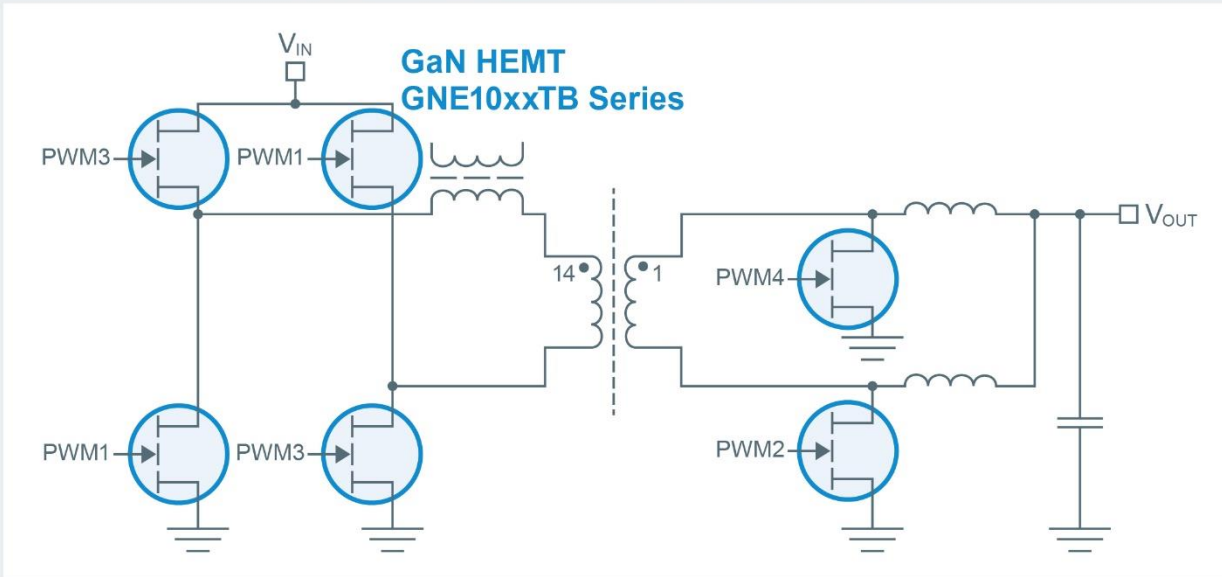
Base station



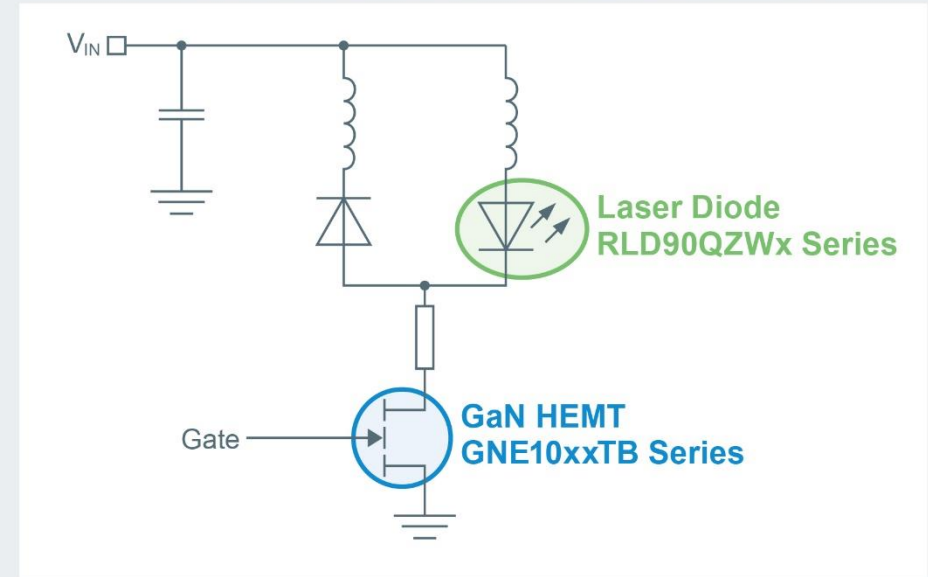
Drone (LiDAR)

Schematics

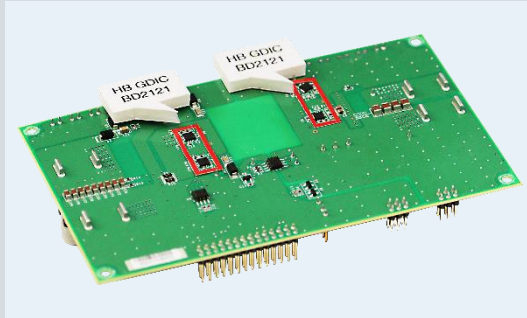
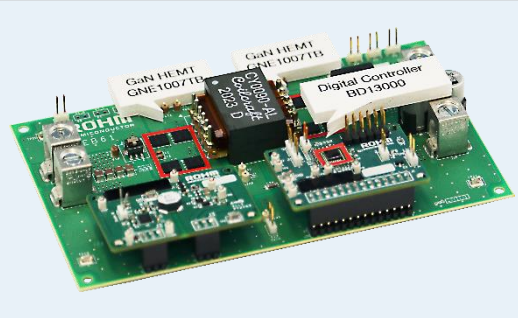
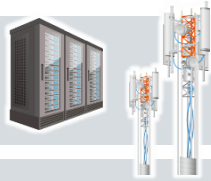
Isolated DC/DC Converter Circuit



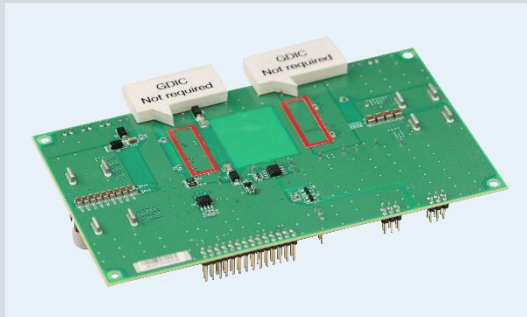
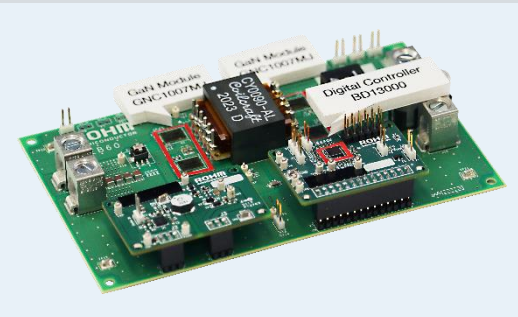
Laser Diode Drive Circuit for LiDAR



400W Isolated DC/DC Converter*1 (48V to 24V)



GaN HEMT solution including Gate driver and controller



GaN module solution

*1: For exhibit

LiDAR Reference Design*2



Simulation (Models & Web Sim)

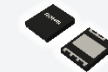
- Simulation model equivalent to real devices
- Solution boards and reference circuit library for various power supply topologies
- Web based simulator

Reference Design / EVK

- Reference design with Thermal and EMC tested
- Device evaluation is possible under conditions close to real use cases.
- Provide various design files

Proposal as a Solution

Propose the best topology and parameter settings for power management ICs and power devices for various applications as a reference design



GaN HEMT



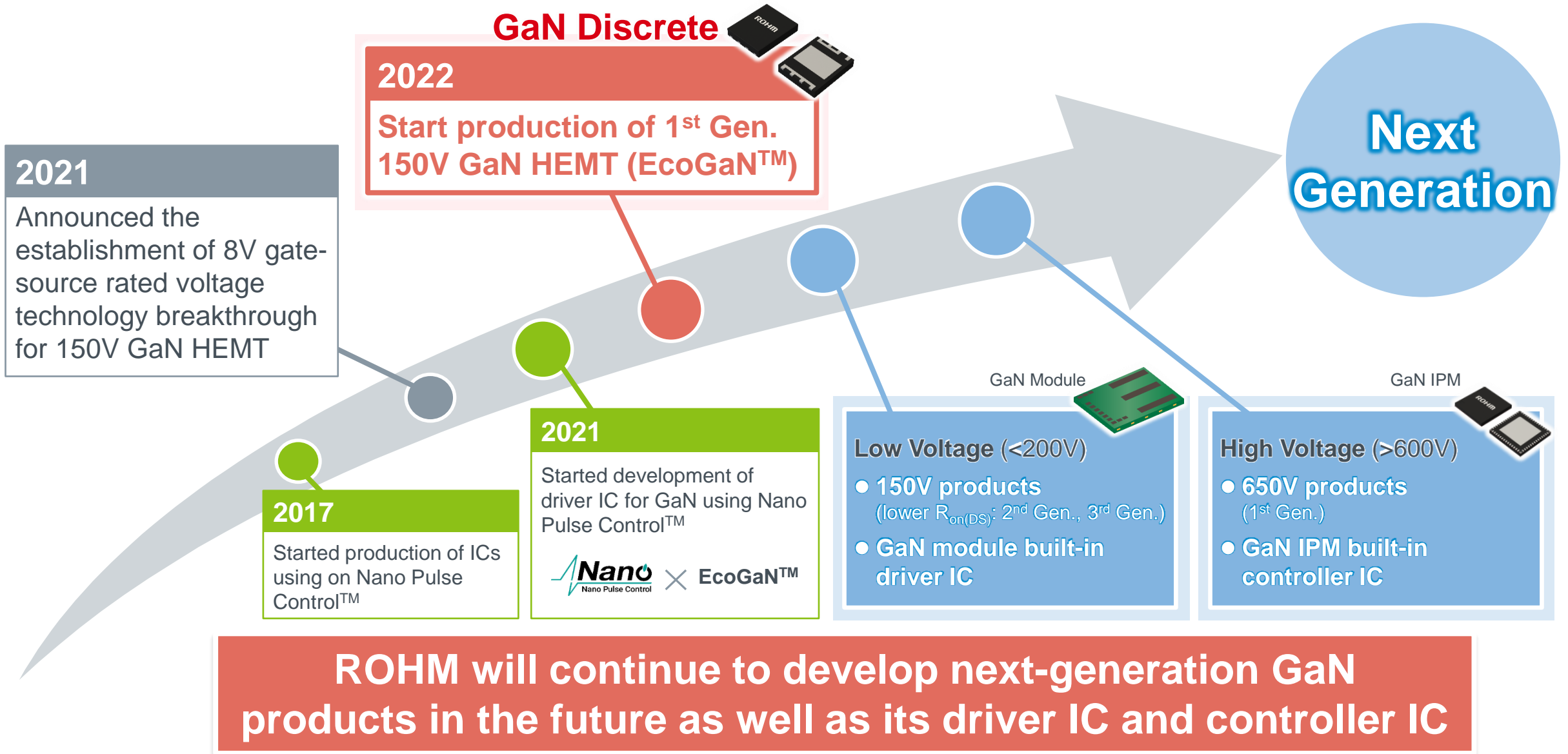
Driver IC



Laser Diode

*2: Planning

Provide solution and reference design to support customers





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