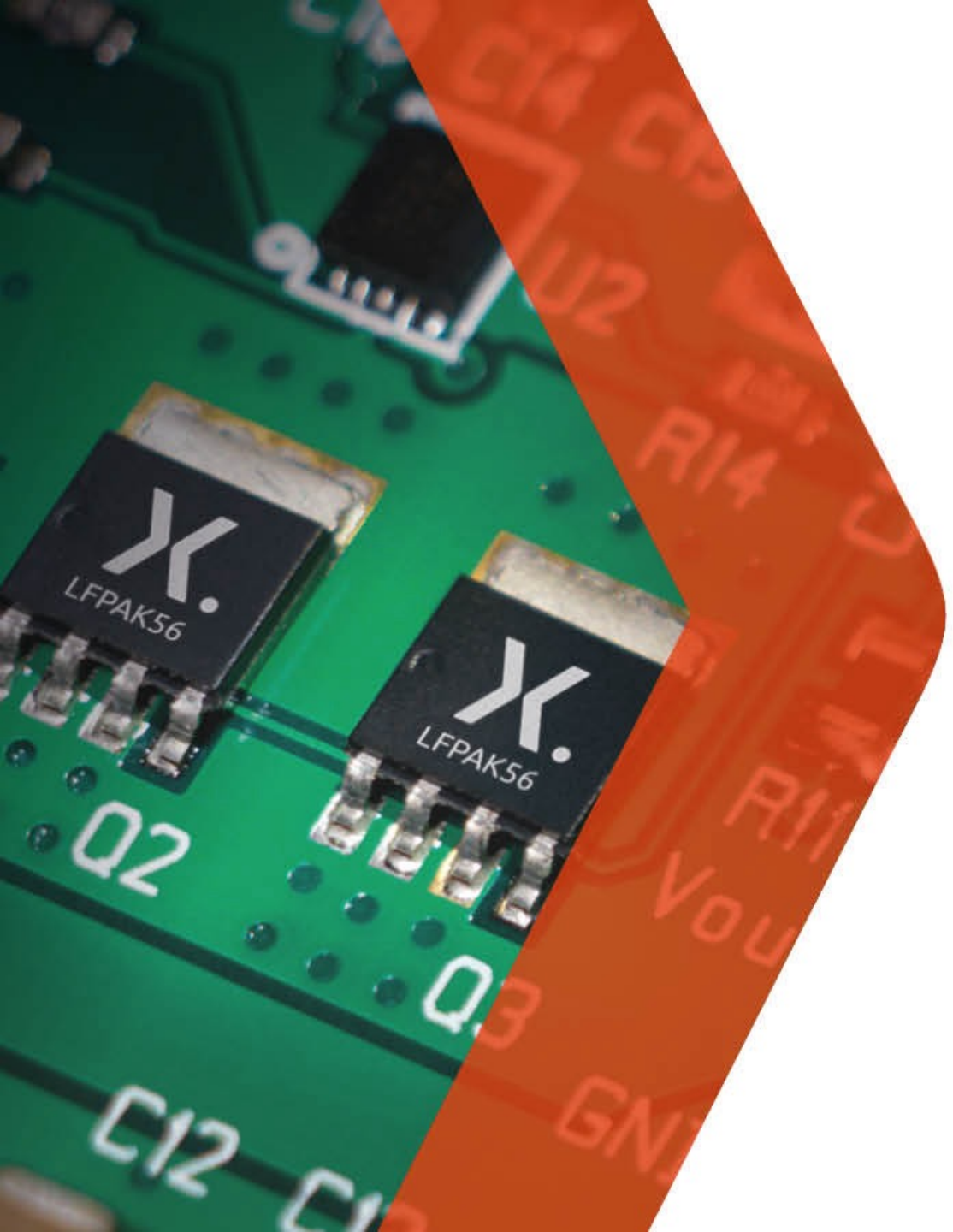


nexperia

Paralleling of Nexperia GaN FETs

How to overcome challenges in Paralleling GaN FETs and increase the power capability of a Power design

September 2021

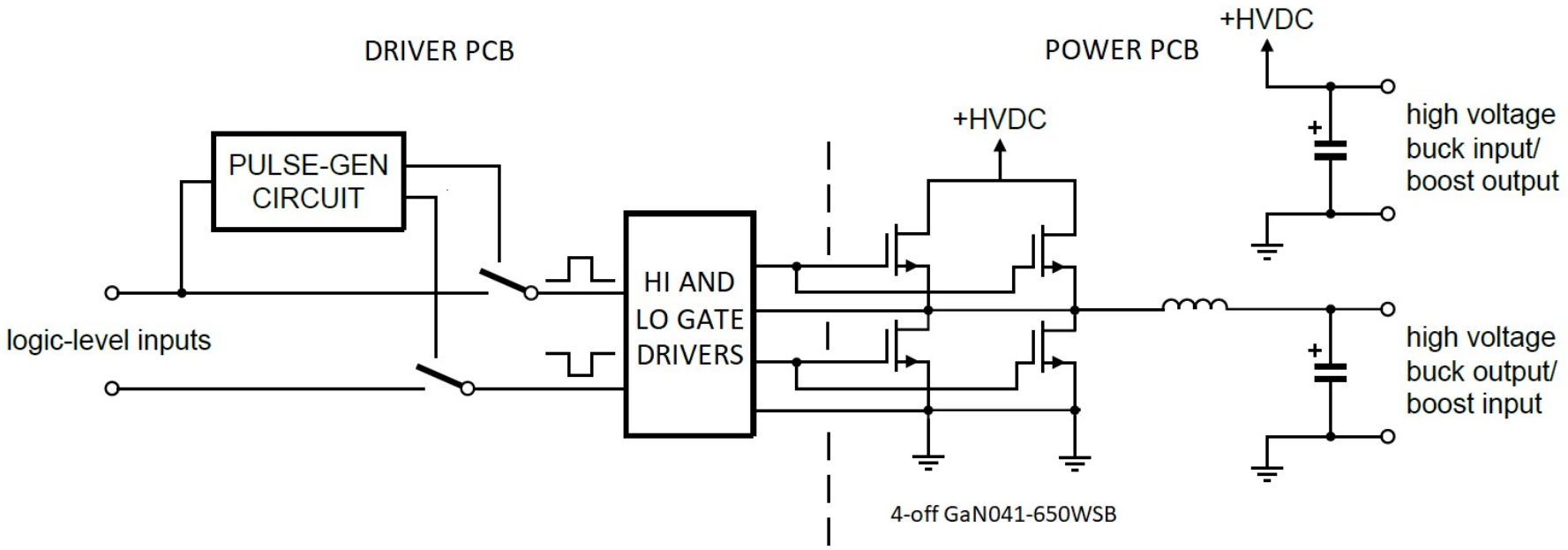
Introduction

- Scott Durkin
- Senior GaN Applications Engineer

- Giuliano Cassataro
- GaN Marketing & Commercial Director

Half-bridge Functional Block Diagram

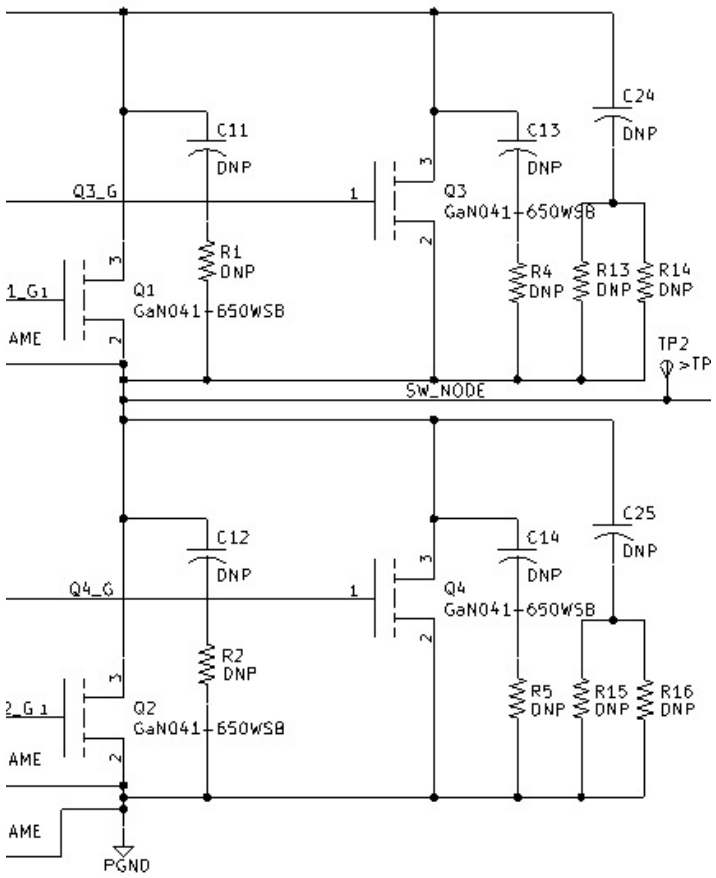
- The Functional Block Diagram of the Half-bridge is shown below.

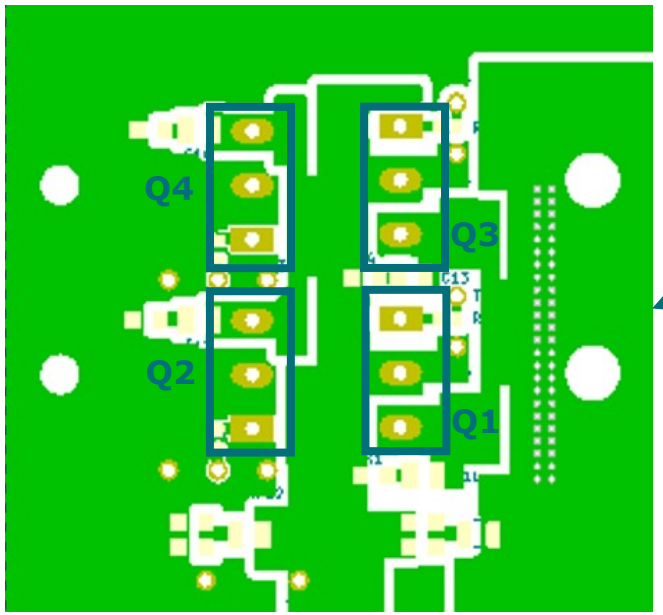


Recommendations for Paralleling Nexperia GaN FETs

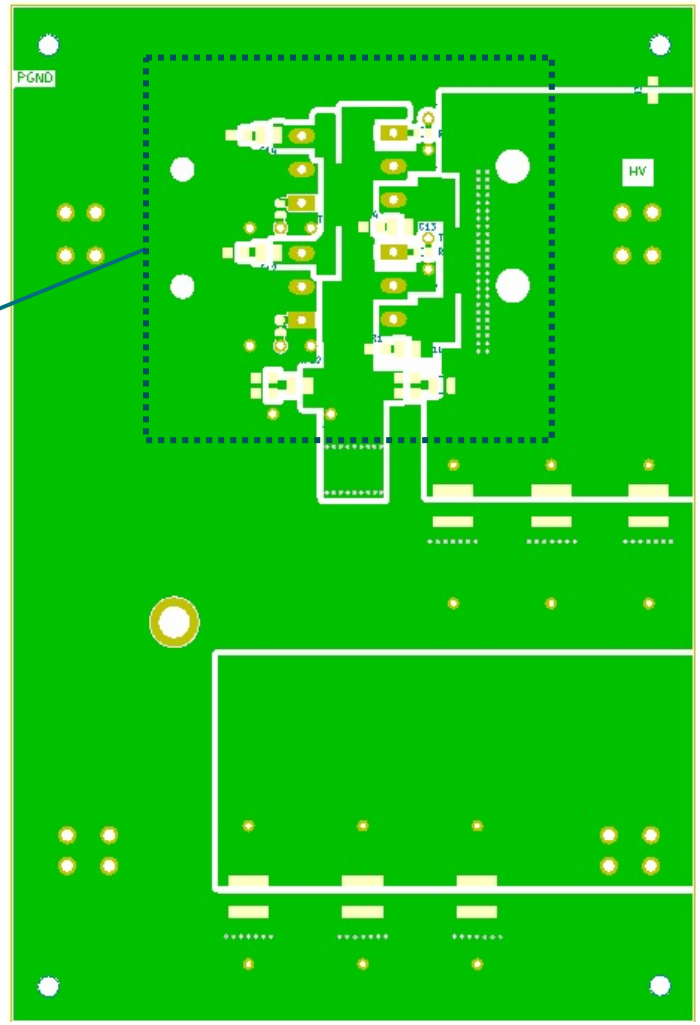
- Symmetrical placement of components, tracking and Gate-Source loops is KEY so that the effective impedance paths are as matched as much as possible.

Recommendations for Paralleling Nexperia GaN FETs

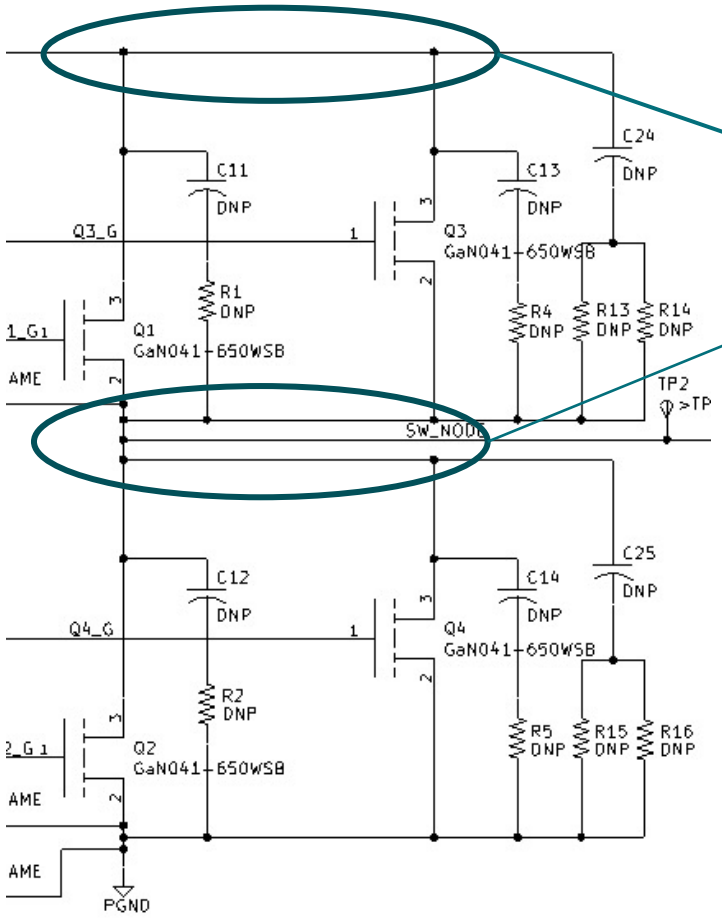


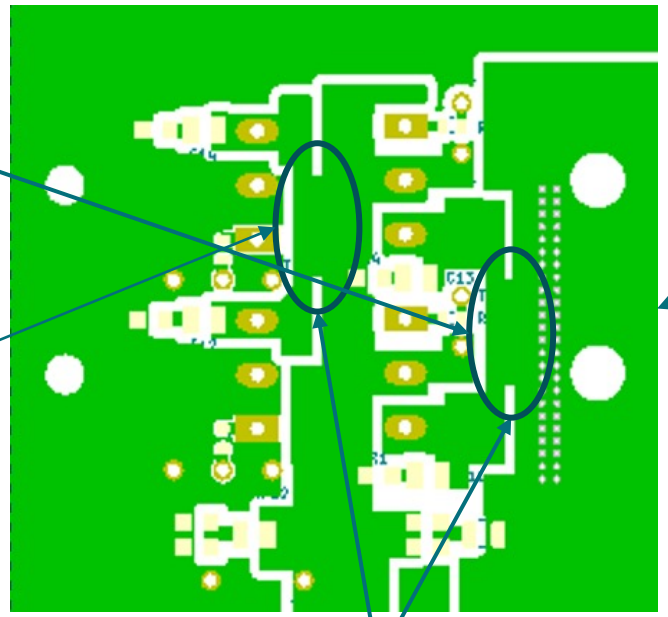


Placement of the four TO-247 GaN FETs

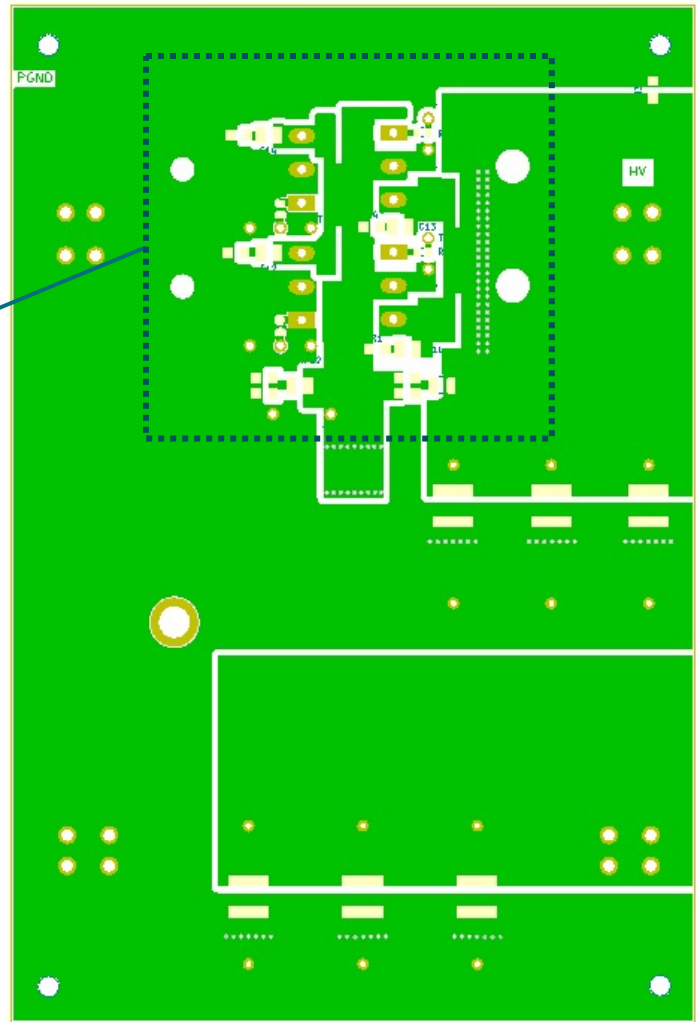


Recommendations for Paralleling Nexperia GaN FETs

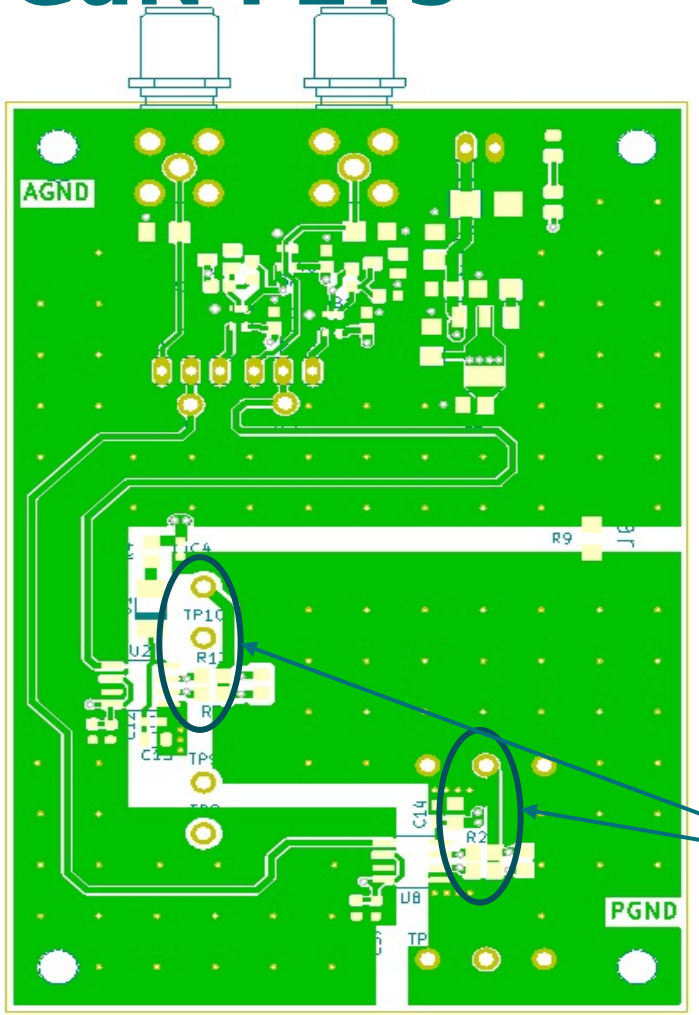


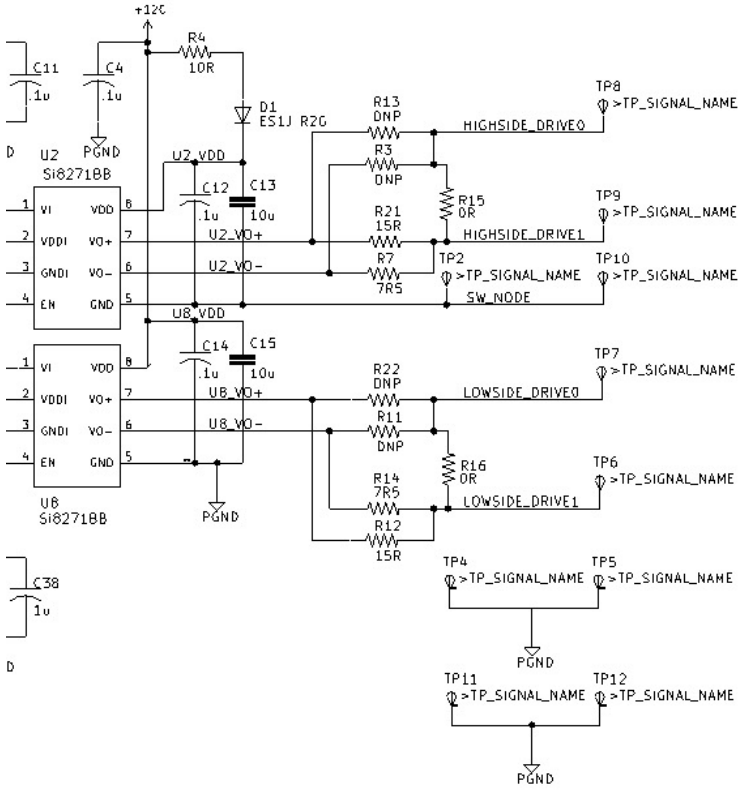


Drain connections have been made symmetrically to switch node and HV.

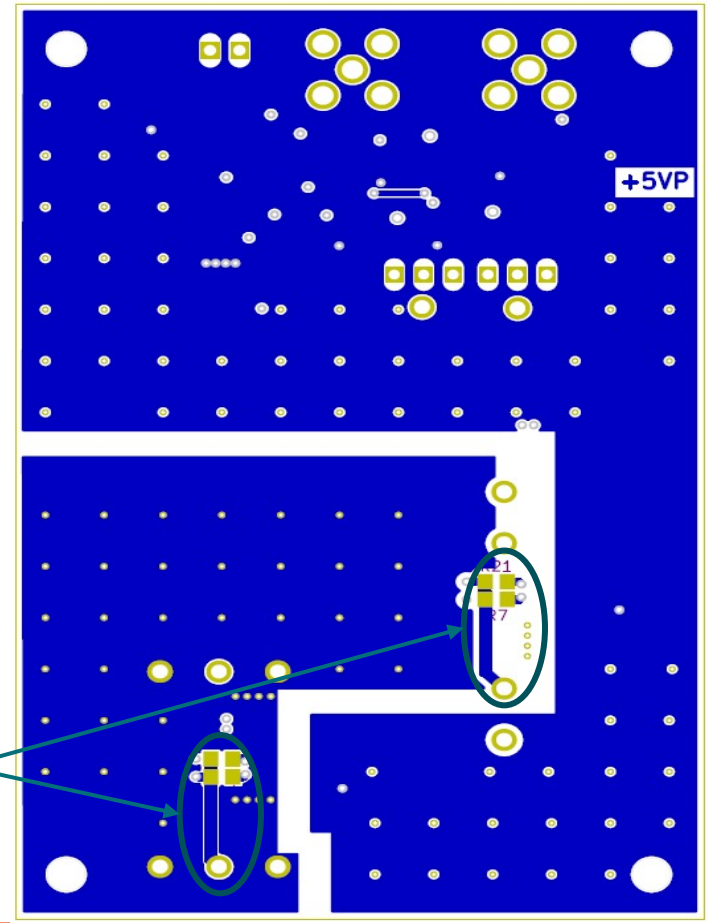


Recommendations for Paralleling Nexperia GaN FETs



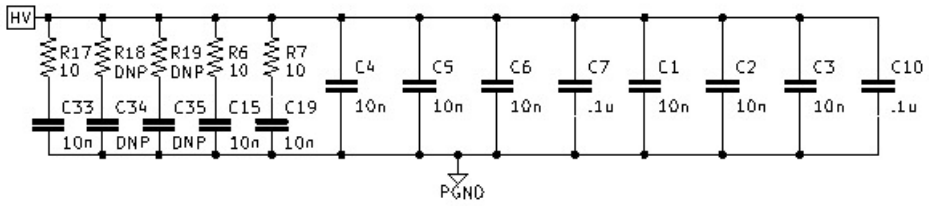


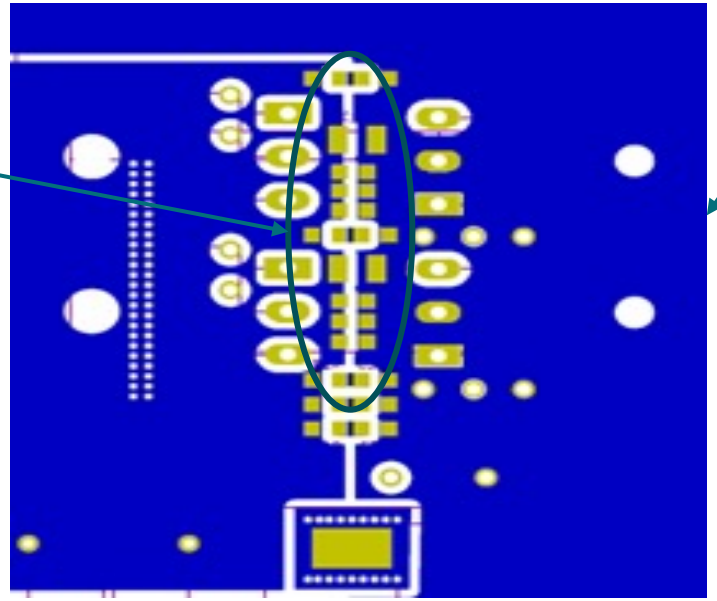
Symmetrical gate drive connections

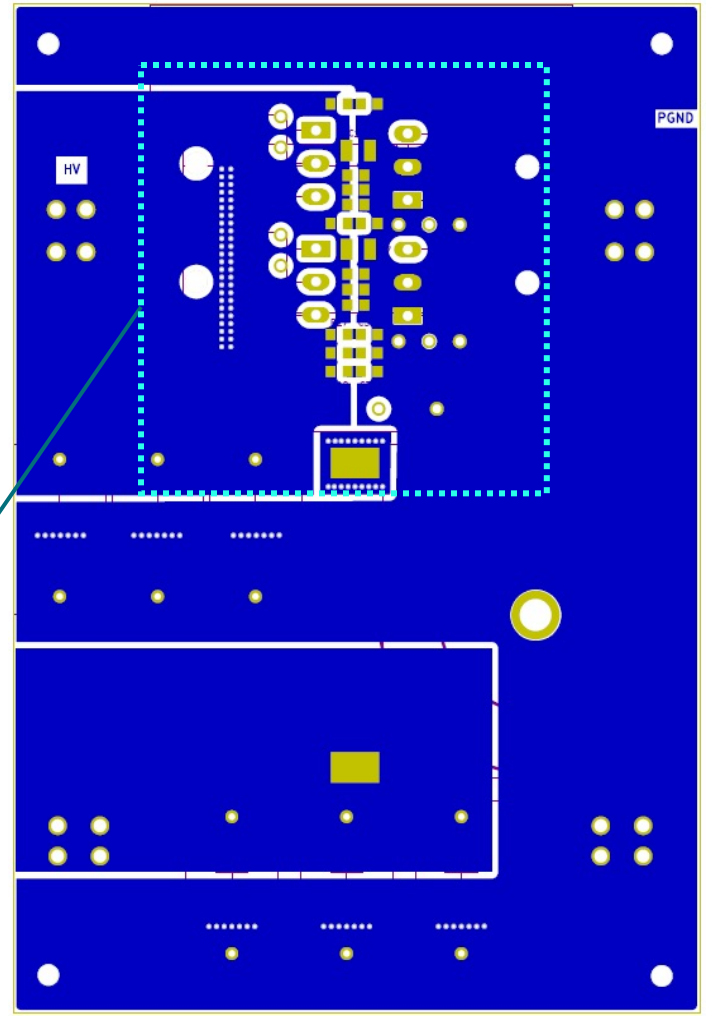


Recommendations for Paralleling Nexperia GaN FETs

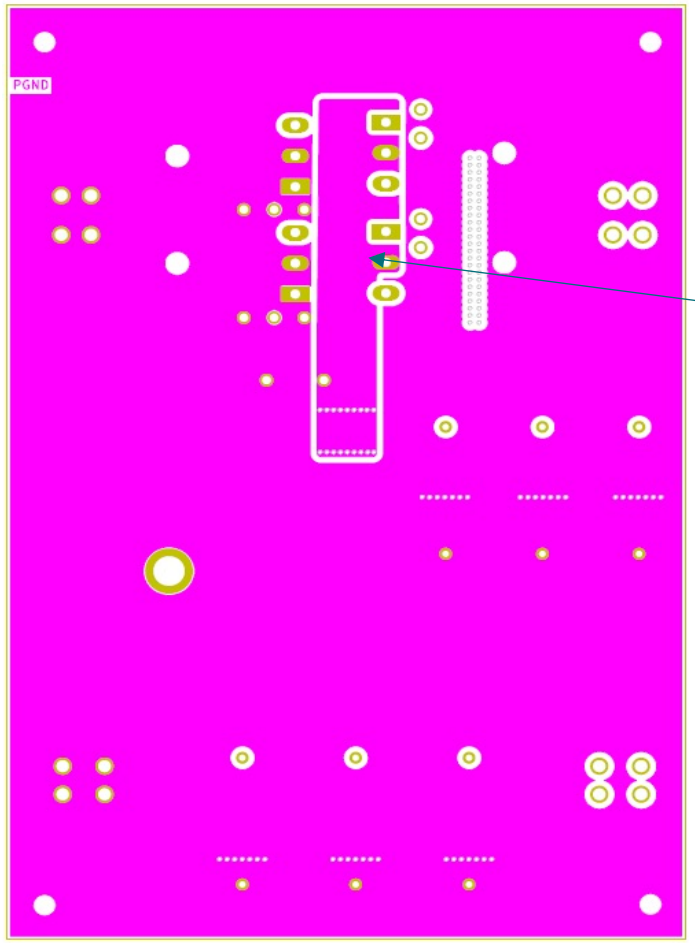
RC snubbers are required to damp any resonance on the DC bus, and along with local decoupling are placed as close as possible to each GaN FET.



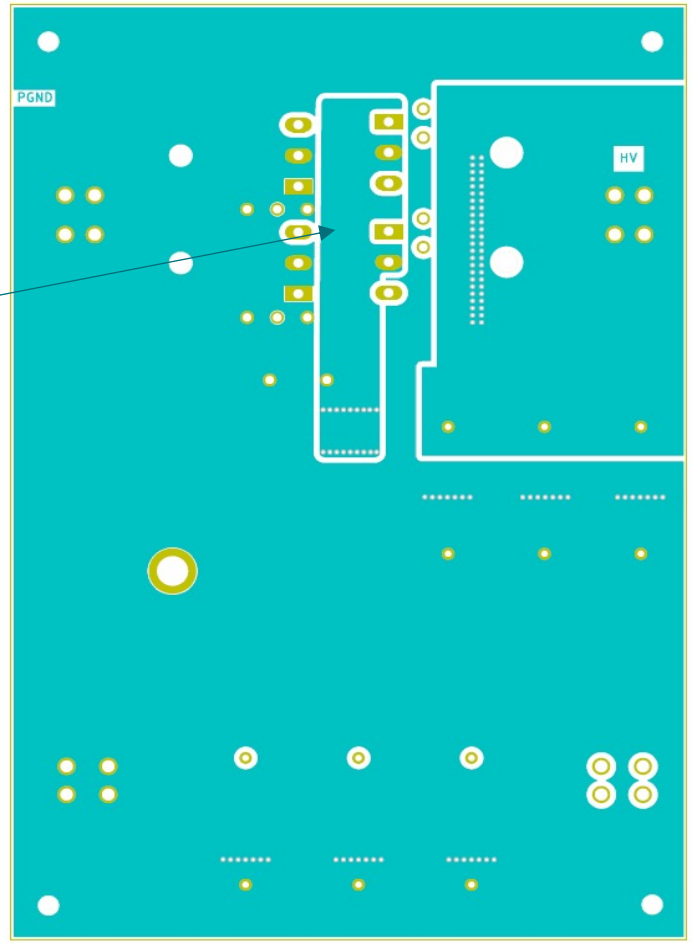




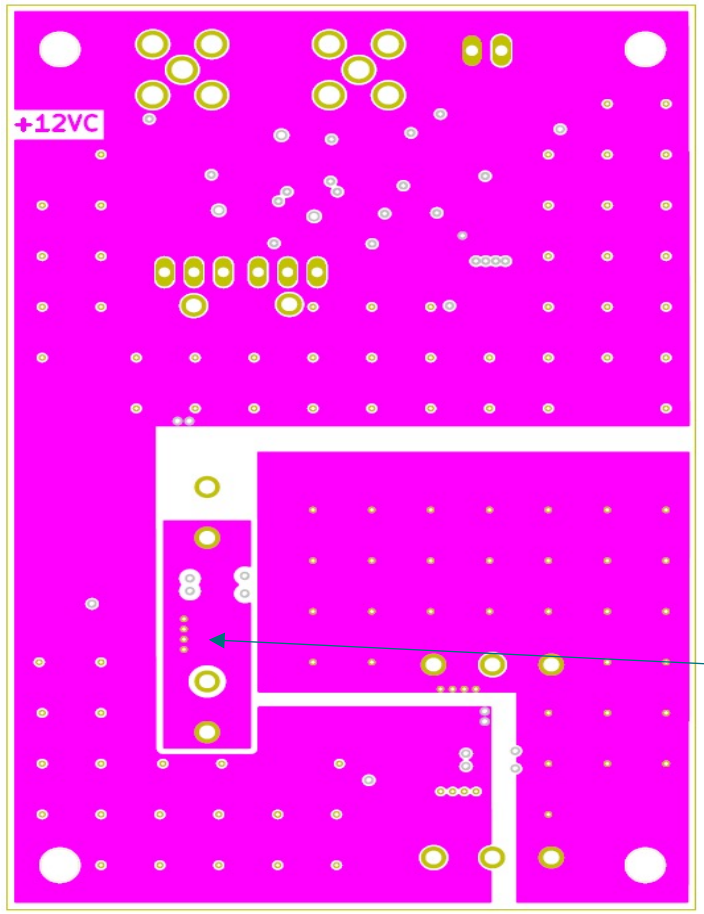
Recommendations for Paralleling Nexperia GaN FETs



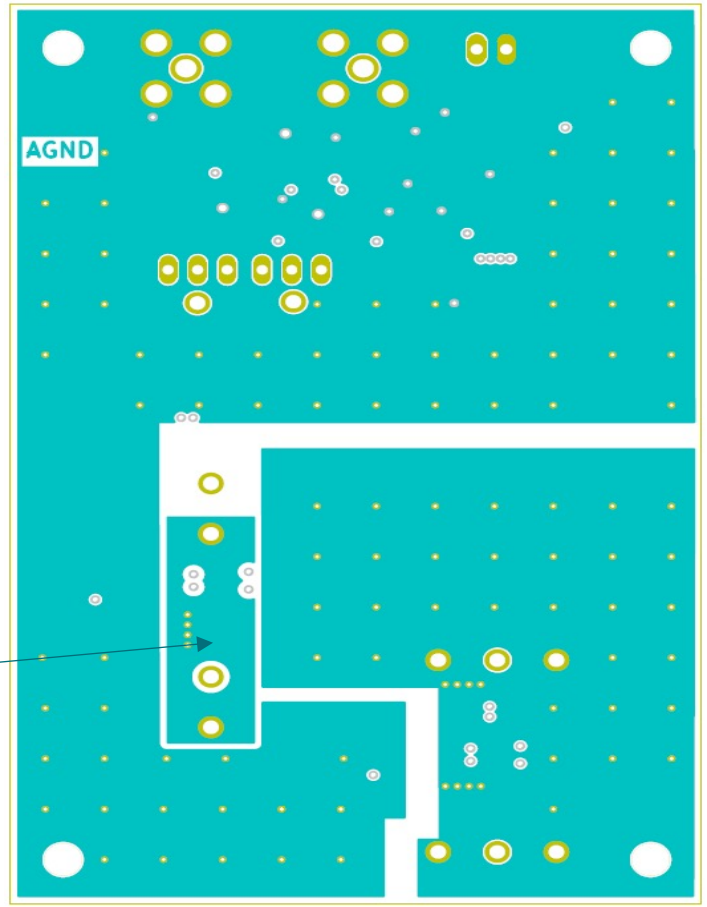
Switch node should be as compact as possible.



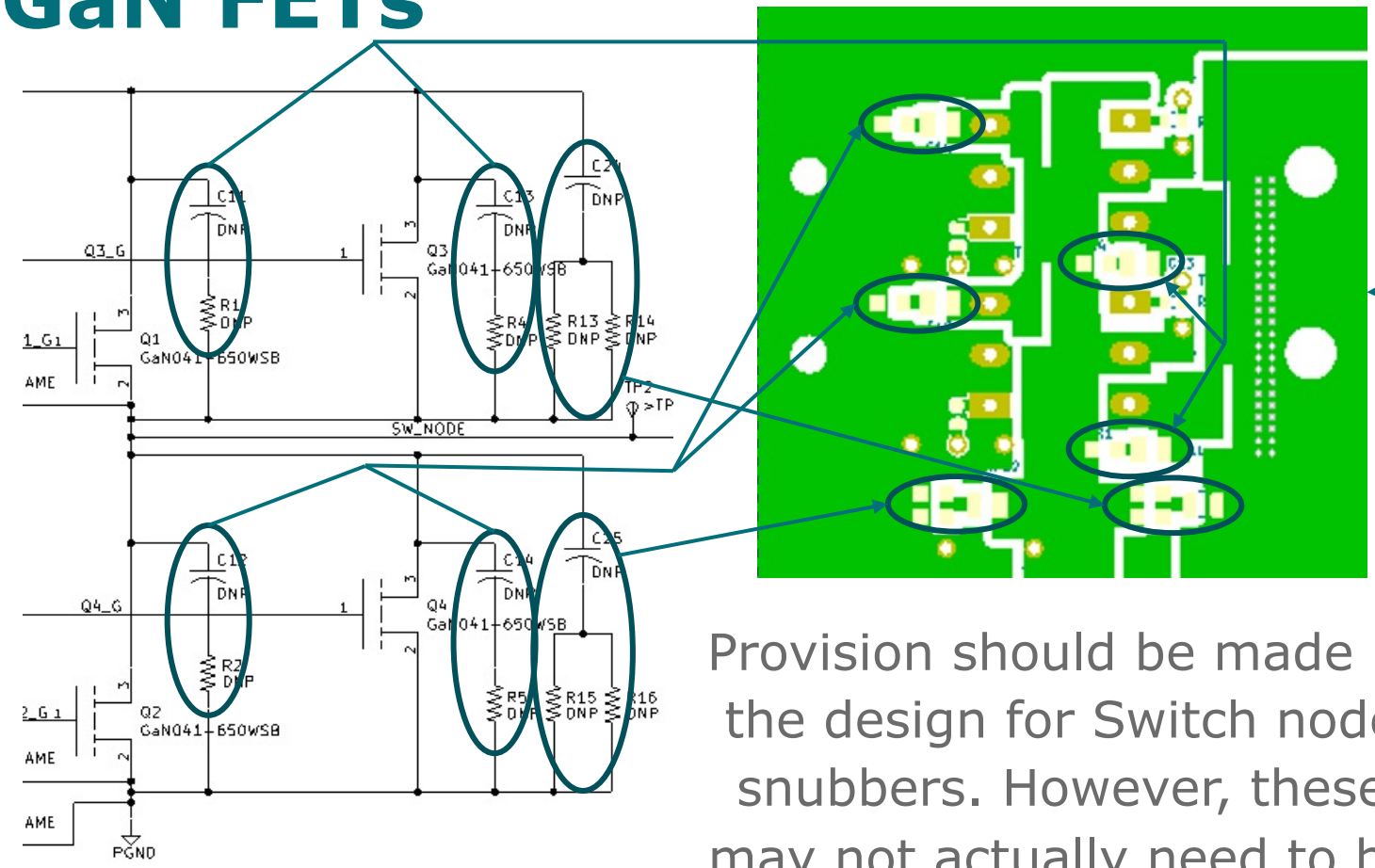
Recommendations for Paralleling Nexperia GaN FETs

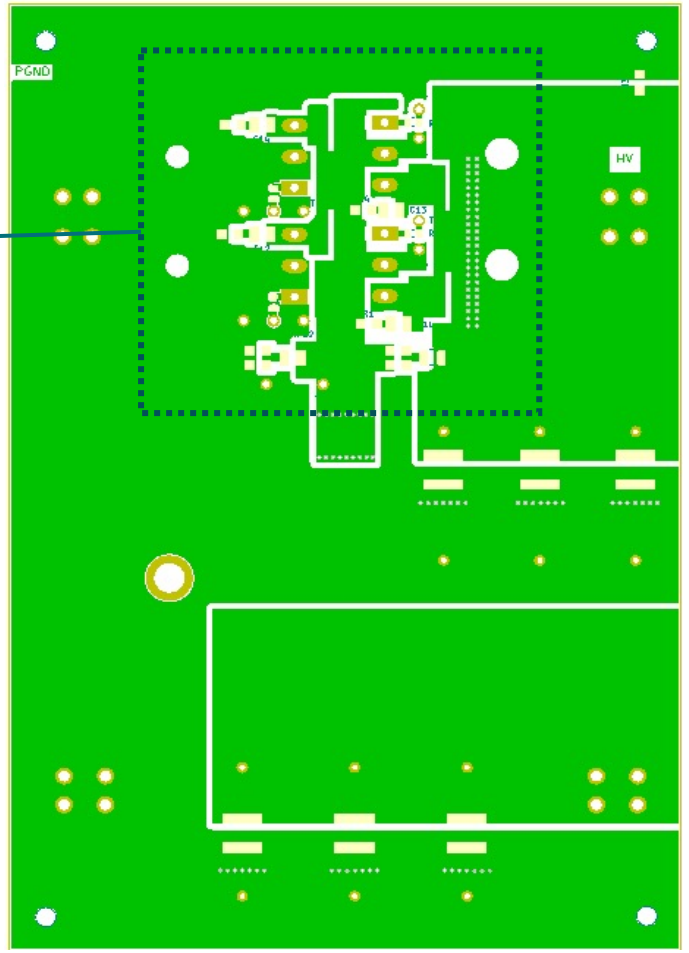


Switch node should be as compact as possible.



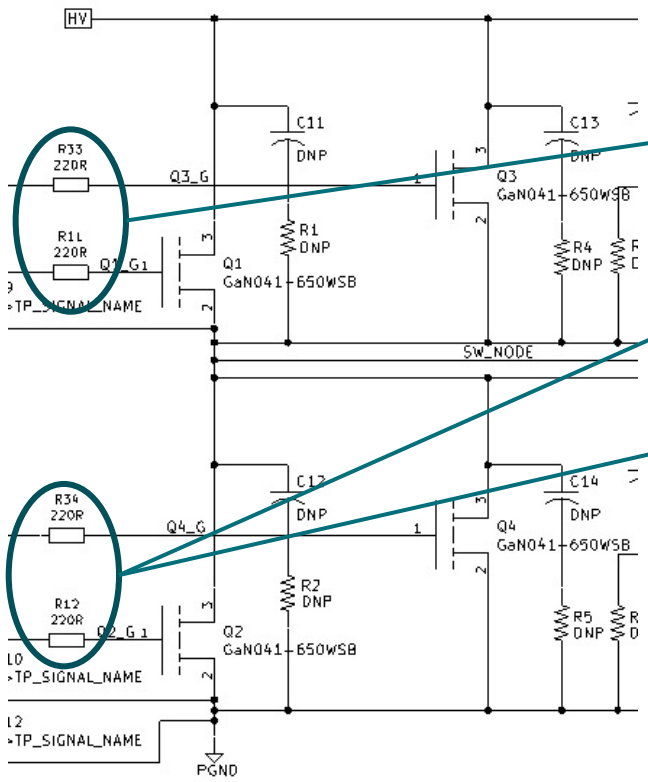
Recommendations for Paralleling Nexperia GaN FETs

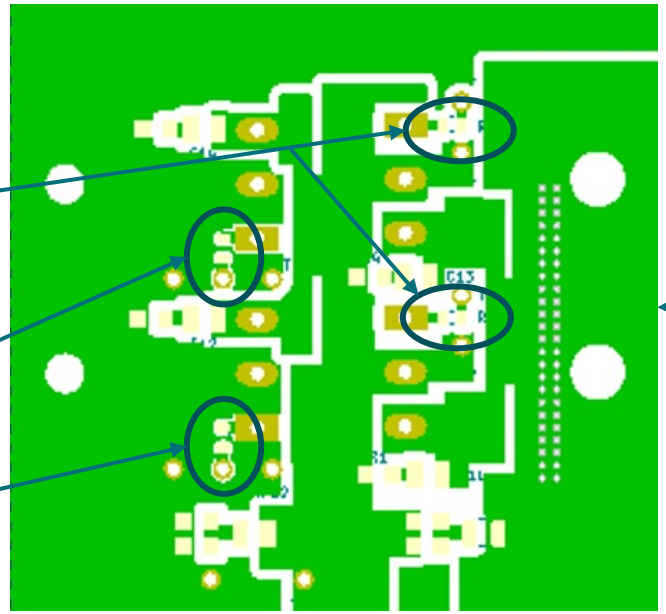


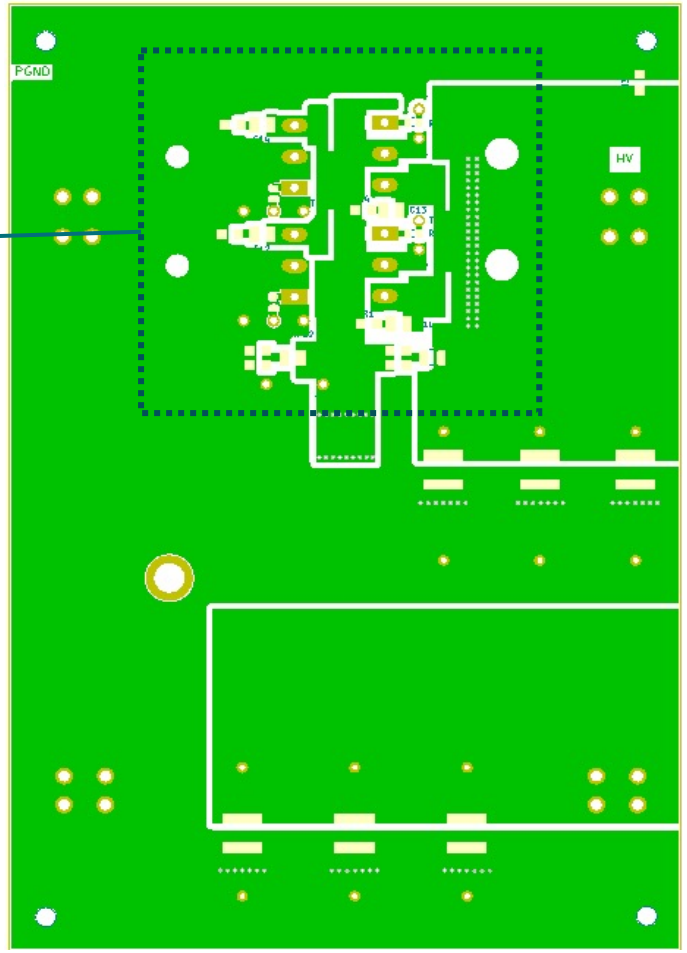


Provision should be made in the design for Switch node snubbers. However, these may not actually need to be populated.

Recommendations for Paralleling Nexperia GaN FETs







Each GaN FET must have a Ferrite bead in the Gate circuit. The recommended component to be used in conjunction with GaN041-650WSB devices is BLM18AG221SN1D, which has a typical impedance of 220 ohms at 100 MHz.

Recommendations for Paralleling Nexperia GaN FETs

- Drivers should be physically close to the GaN FET.

- If they are located on a separate PCB due to design, placement or packaging constraints, then short wide tracks or ideally multiple planes, in association with large gauge terminals soldered between the boards, is advised.
- Use of non-soldered connectors, such as plug and sockets are not recommended in the Gate-Source loop as they typically increase the inductance, leading to an increased risk of oscillation.

Recommendations for Paralleling Nexperia GaN FETs

- Paralleled GaN FETs should be thermally very well connected to each other so that the temperatures are equalised as much as possible, leading to distribution of current equally.

Single-Shot Staircase test to 114 A at 400 V Bus, 100 kHz

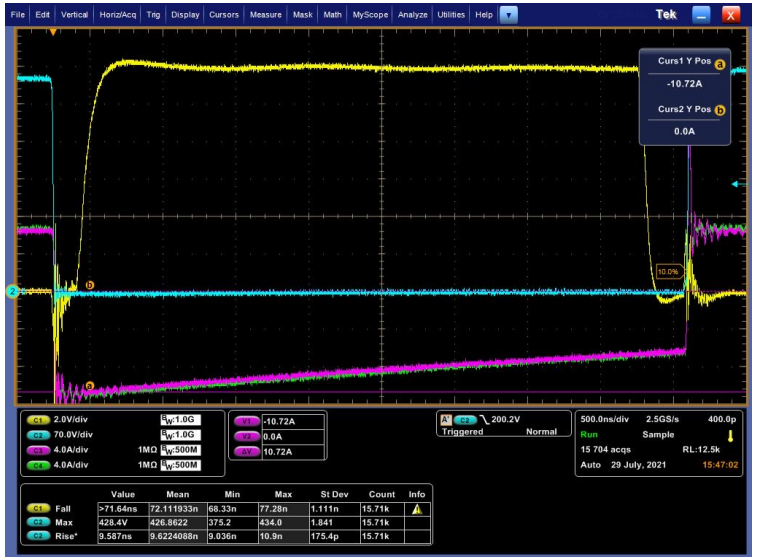
- Yellow and Blue Traces – Lowside GaN FET Gate signals, Magenta Trace – Inductor current, Green Trace – Switch Node voltage

Single-Shot Staircase test to 114 A at 400 V Bus, 100 kHz

- Yellow Trace – Lowside GaN FET Gate signal as trigger, blue trace – Switch node Voltage, magenta and green traces – Lowside GaN FET Device current.

- Note magenta and green are the measured GaN FET currents, showing excellent current sharing between devices.

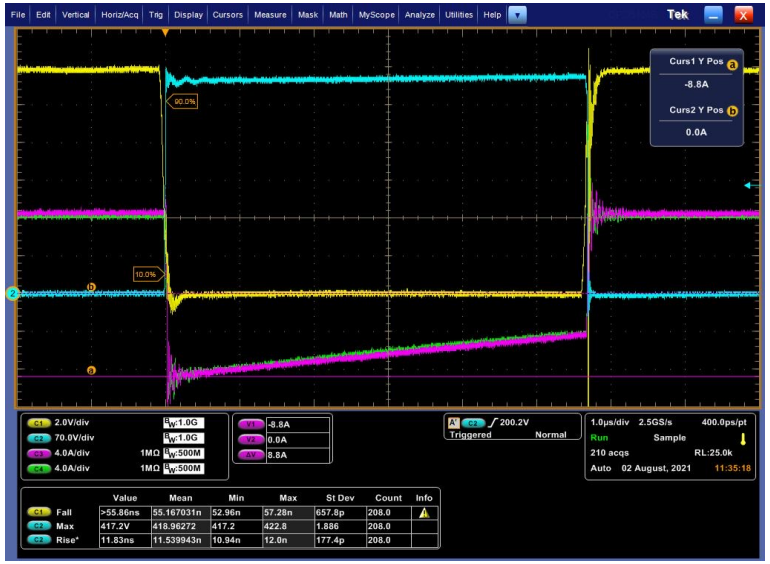
Buck Mode : 400 V Input, 225 V Output, 6.6 kW, 100 kHz



- Yellow Trace – Lowside GaN FET gate signal as trigger, blue trace – Switch node Voltage, magenta and green traces – Highside (left) or Lowside (right) GaN FET device currents.

- Note magenta and green are the measured GaN FET currents, showing excellent current sharing between devices.

Boost Mode : 225 V Input, 400 V Output, 6.6 kW, 100 kHz



- Yellow Trace – Lowside GaN FET gate signal as trigger, blue trace – switch node Voltage, magenta and green Traces – Highside (left) or Lowside (right) GaN FET device currents.

- Note magenta and green are the measured GaN FET currents, showing excellent current sharing between devices.

Further information

Please visit Nexperia.com/GaN-FETs

Nexperia GaN FETs - Performance, efficiency, reliability brochure

MOSFET and GaN FET Application Handbook

Focus package: CCPAK

GaN FETs

Efficient and effective high-power FETs

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Whether designing a motor drive/controller for the next generation of battery-electric vehicles, or a power supply for the latest 5G telecommunication networks, Nexperia's GaN FETs will be key to your solution. Offering high power performance and high-frequency switching, the design and structure of our normally-off GaN FET products ensure standard, low-cost gate drivers can be used in your design.

Featured product	Description
GAN063-650WSA	650 V, 50 mΩ Gallium Nitride (GaN) FET in a TO-247 package
GAN041-650WSB	650 V, 35 mΩ Gallium Nitride (GaN) FET in a TO-247 package
GAN039-650NBB	650 V, 33 mOhm Gallium Nitride (GaN) FET in a CCPAK1212 package
GAN039-650NTB	650 V, 33 mOhm Gallium Nitride (GaN) FET in a CCPAK1212i package

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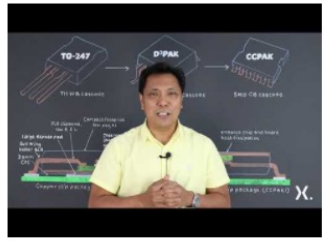

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