



# Si823Hx Gate Driver Board

March 2024

Connecting Everyone and Everything, All the Time.



# Si823Hx Gate Driver Board



## APPLICATIONS

- Motor drives
- Industrial inverters & UPS
- Solar inverters

## FEATURES

- Two input, high-side/low-side driver
- Integrated dead-time control and overlap protection
- Differential inputs for increased noise immunity
- Reverse polarity protection for 12 V input supply
- 4 A symmetric peak output current
- 0  $\Omega$ , 1  $\Omega$ , or 4  $\Omega$  sourcing/sinking gate resistors
- Built-in +15 V and -3.5 V isolated gate bias supplies
- 5 kV<sub>RMS</sub> safety rated isolation
- 125 kV/ $\mu$ s common mode transient immunity (CMTI)
- DC bus voltage up to 800 V
- Switch temperature (NTC) feedback
- Reference design available





# Si823Hx Gate Driver Board Details

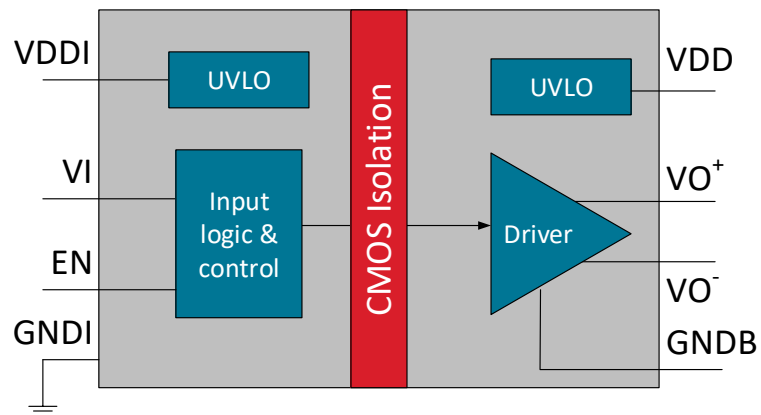
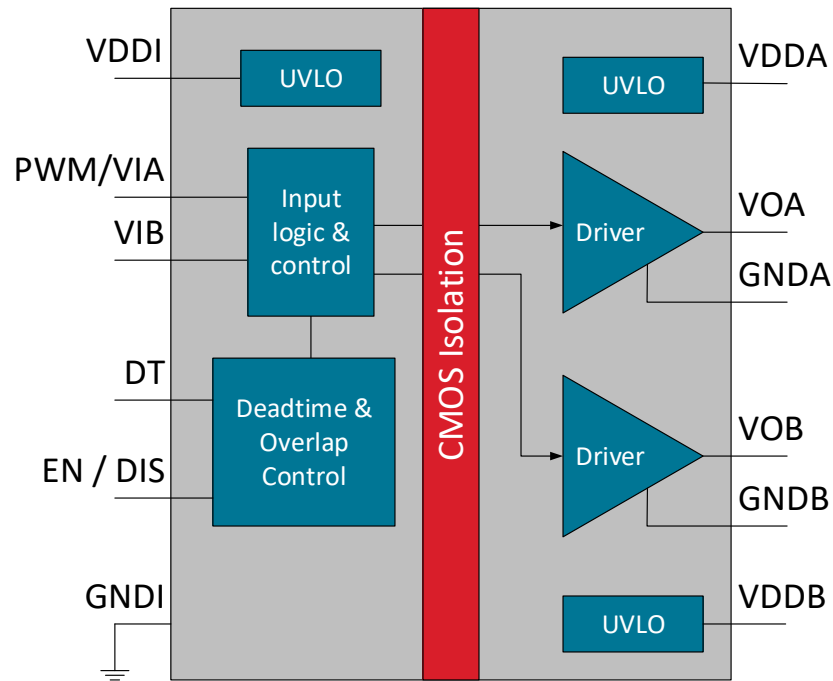
- Compact and thermally optimized board design (2" x 3")
  - Optimized for power dissipation and noise immunity
- Tightly integrated, Si823H2x for high-performance
  - Two channel package with shoot-through protection
  - 4 A of symmetric output current for fast slew rates
- Efficient use of Si8842x for isolated power and signaling
  - Single DC-DC converter provides power for entire board
  - Digital isolation provides module temperature feedback
- Versatile transformer configuration delivers all voltage domains
  - 12 V input yields 5 V non-isolated output & 2 fully-isolated gate supplies
  - Adjustable gate supply voltage
  - User-configurable unipolar or bipolar gate bias



Top

Bottom

# Si823Hx: High Input VDDI Gate Drivers



## APPLICATIONS

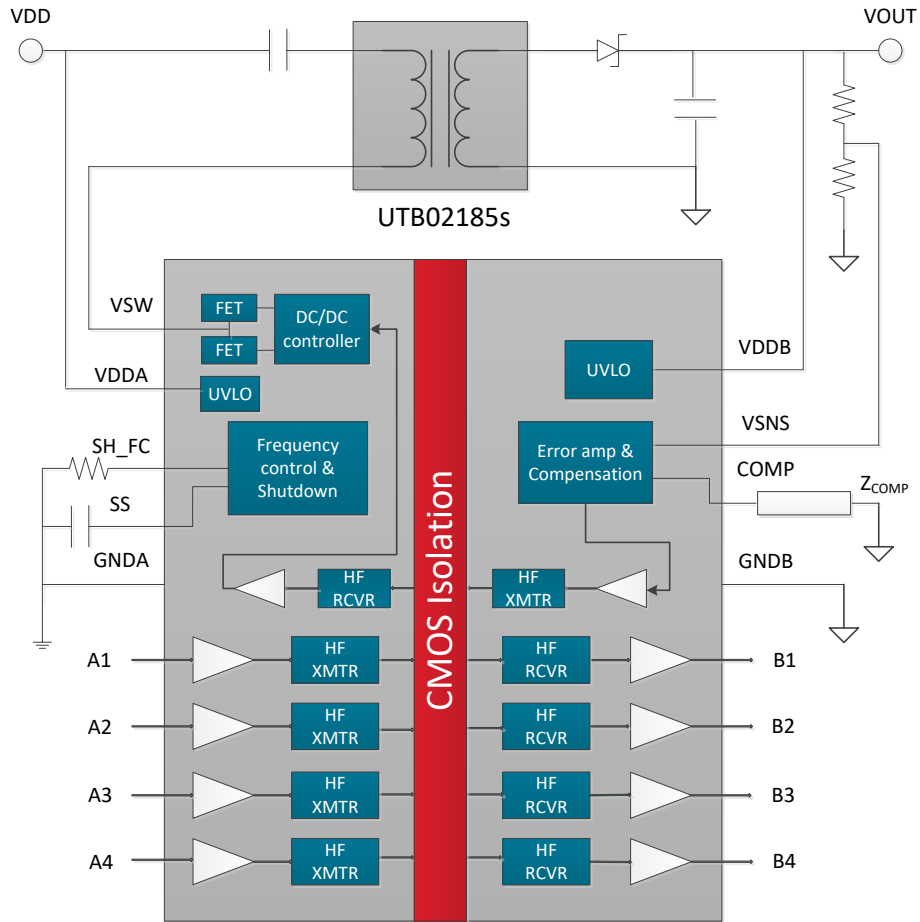
- Power supplies
- Industrial inverters & UPS
- Motor control & Drives
- Solar inverters

## FEATURES

- VDDI: 4.5 V–20 V or 3.0 V–5.5 V options; VDDA/B: 5.5 V – 30 V (36 V<sub>max</sub>)
- Drive strength: Symmetric 4 A sink/source
- Isolation: 5 kV<sub>rms</sub>, 10 kV surge with VDE 0884-10 reinforced
- CMTI: Min 125 kV/μs; T<sub>PLH</sub>/T<sub>PHL</sub>: 30 ns max
- Over-temp protection for safety
- Input de-glitch for noise filtering (Si823H3x options)
- Package specs (16 WB, NB, QFN-14)
  - 8 mm creepage (WB), missing pins 12 &13, MSL 2



# Si88xx: Digital Isolator With DC-DC Converter



Si88240: 100Mbps quad digital isolator with 2W DCDC converter

## APPLICATIONS

- Factory automation
- Process & motor control
- Battery management systems (BMS)
- PLCs & control systems

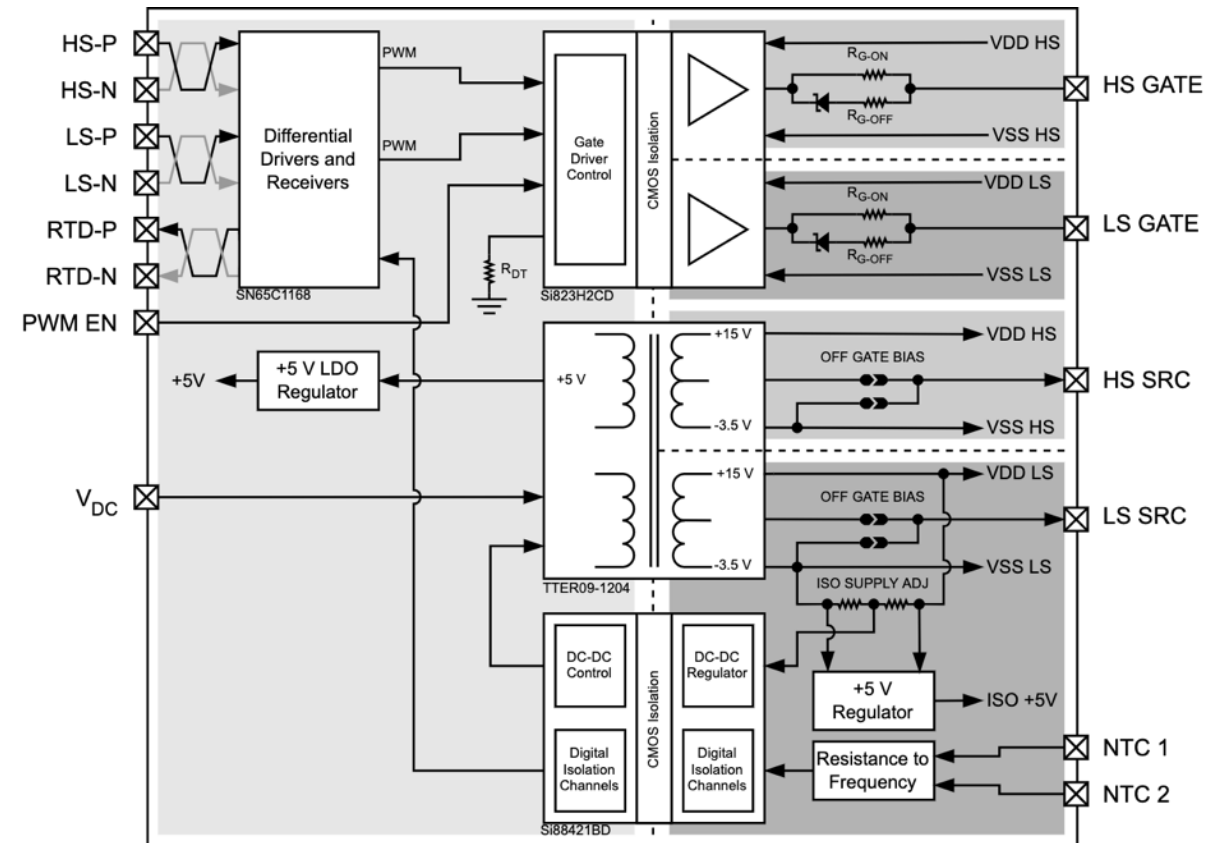
## FEATURES

- Integrated dc-dc converter with secondary sensing & feedback
  - Internal switch: 2 W of power & 78 % efficiency
  - External switch: 5 W, 83% efficiency
  - Full featured with soft start, frequency control, shutdown options
- Robust Isolation
  - 5 kVrms reinforced
  - Unmatched noise immunity of 100 kV/ $\mu$ s
  - Up-to four high speed (100 Mbps) digital channels, multiple configurations
  - Low prop delay of 18 ns

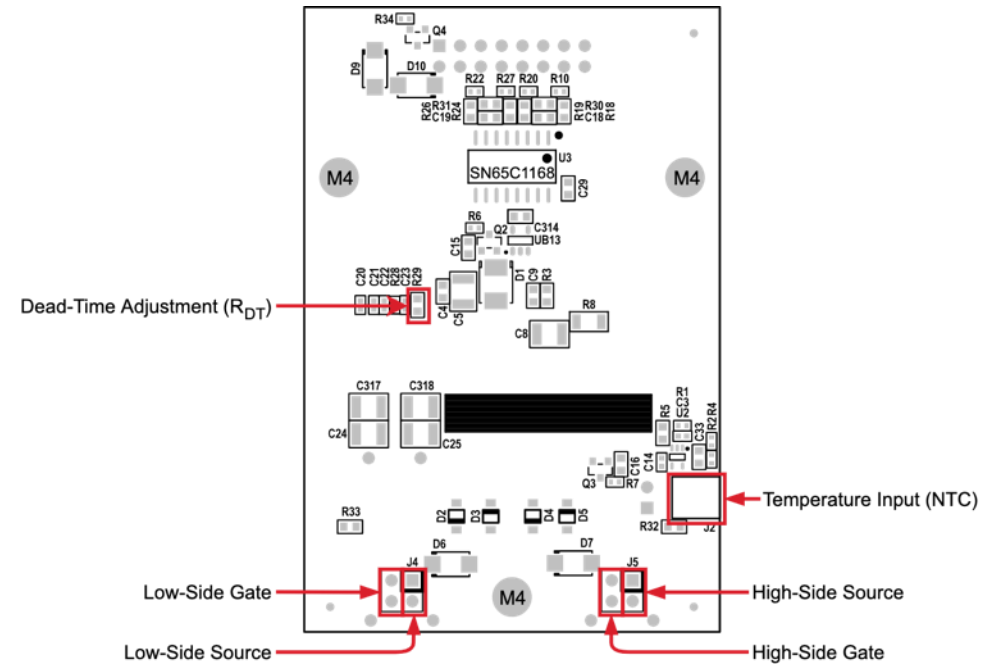
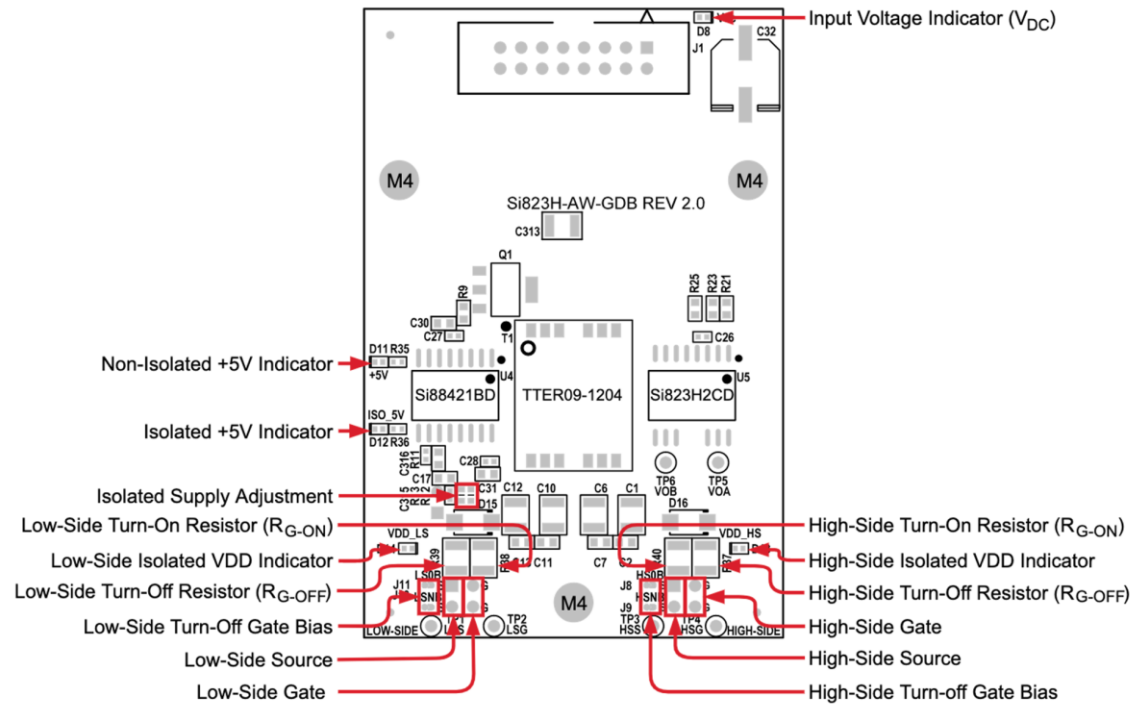


# Si823Hx Gate Driver Board Block Diagram

- 16-pin interface
  - Differential HS and LS PWM signals
  - Differential temperature signal (Digital Freq.)
  - Single ended driver enable signal
  - 12 V<sub>DC</sub> single supply input
- Si88xx Digital Isolator and DC-DC Controller
  - External switching transistor product option
  - Cross-regulation for all secondary windings
  - 5 V LDO regulates non-isolated secondary for greater efficiency
  - 5 V NPN based regulator powers isolated components
- User-configurable features
  - Dead-time adjusted through resistor value
  - Turn-on/turn-off slew rate through resistor adjustment
  - Secondary voltage adjusted through voltage divider
  - Selectable unipolar or bipolar gate bias through solder bump



# Si823Hx Gate Driver Board Layout

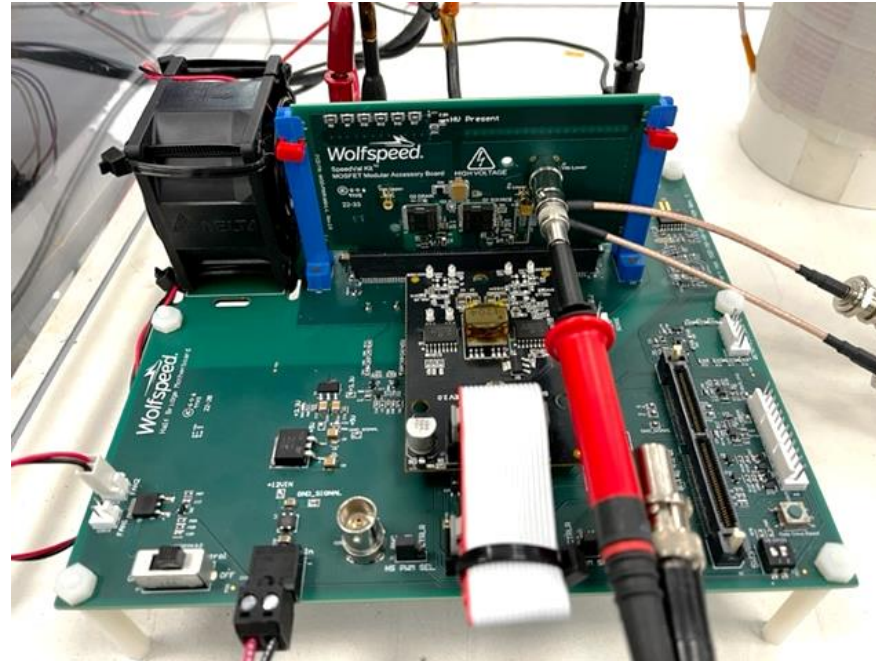
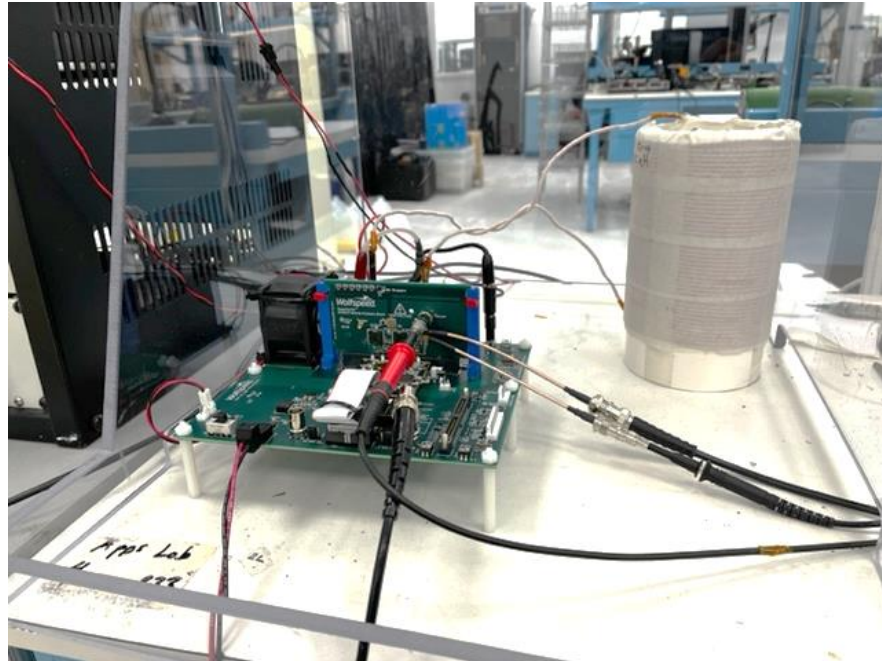


- Optimized for power dissipation and noise immunity
- Isolation maintained while using single transformer and two channel gate driver
- Test points and power supply indicators included for evaluation
- User-configurable components easily accessible



# SpeedVal and Si823Hx Gate Driver Board Validation

*Tested with C3M0045065L (45Ω device in TOLL package)*



## Conditions:

$T_{vj} = 25^{\circ}\text{C}$

$V_{DD} = 400\text{V}$

$R_{G(\text{ext})} = 5\Omega$

$V_{GS} = -3\text{V}/+15\text{V}$

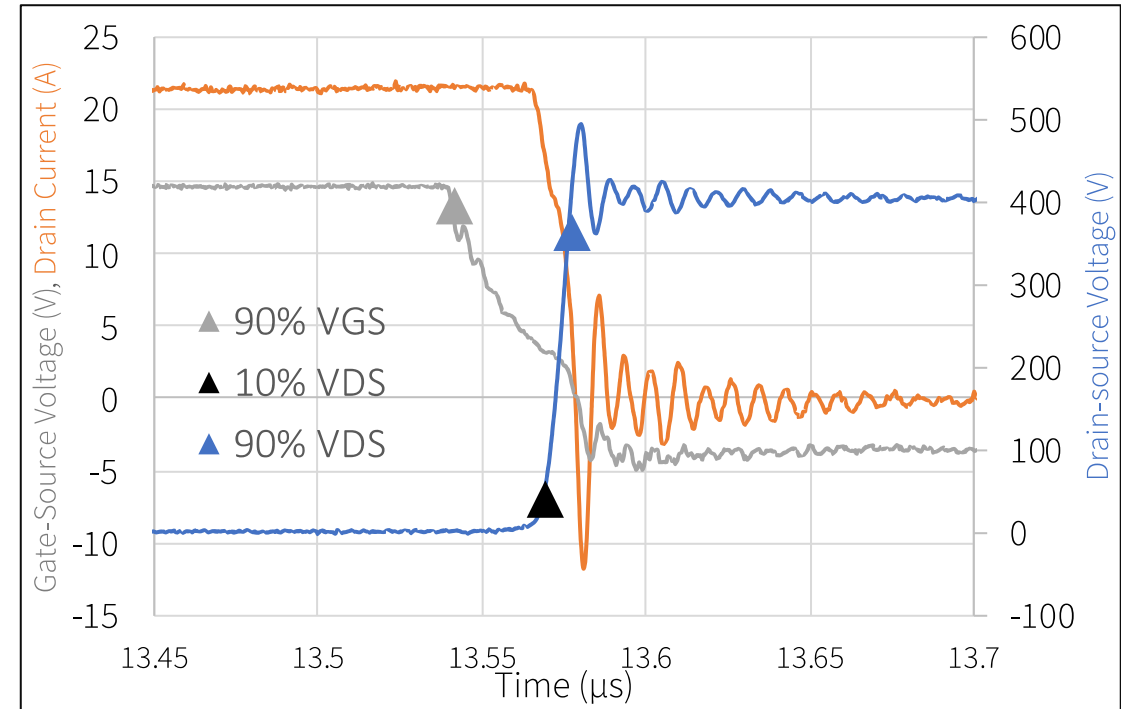
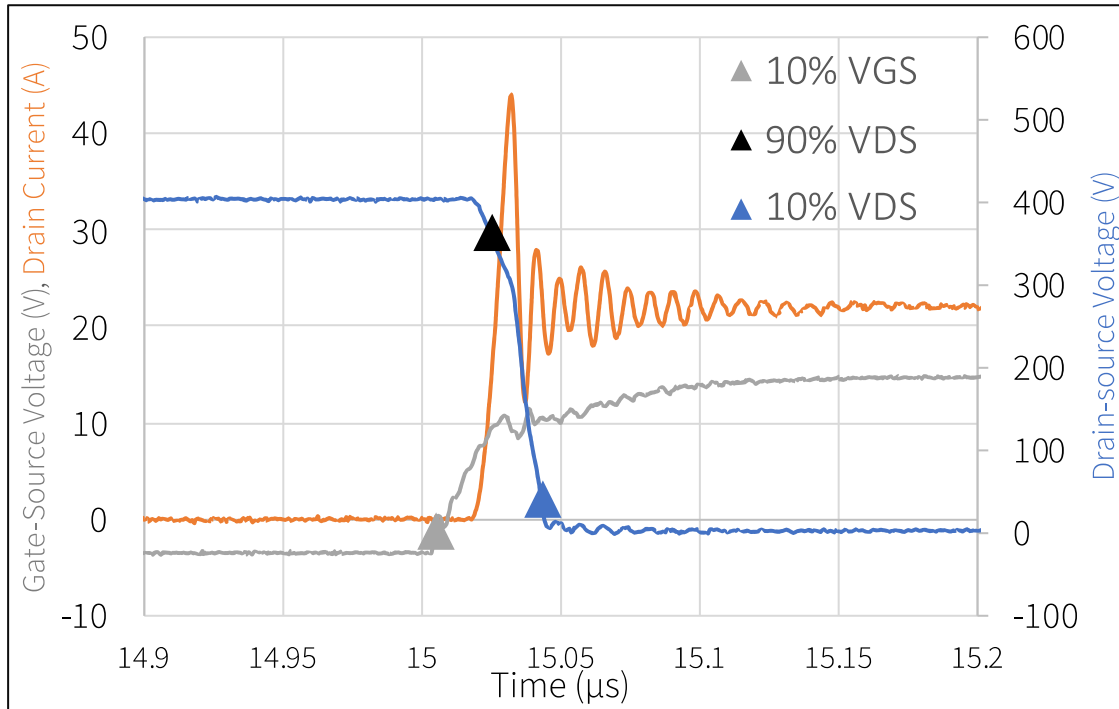
FWD = body diode

$L = 142\mu\text{H}$



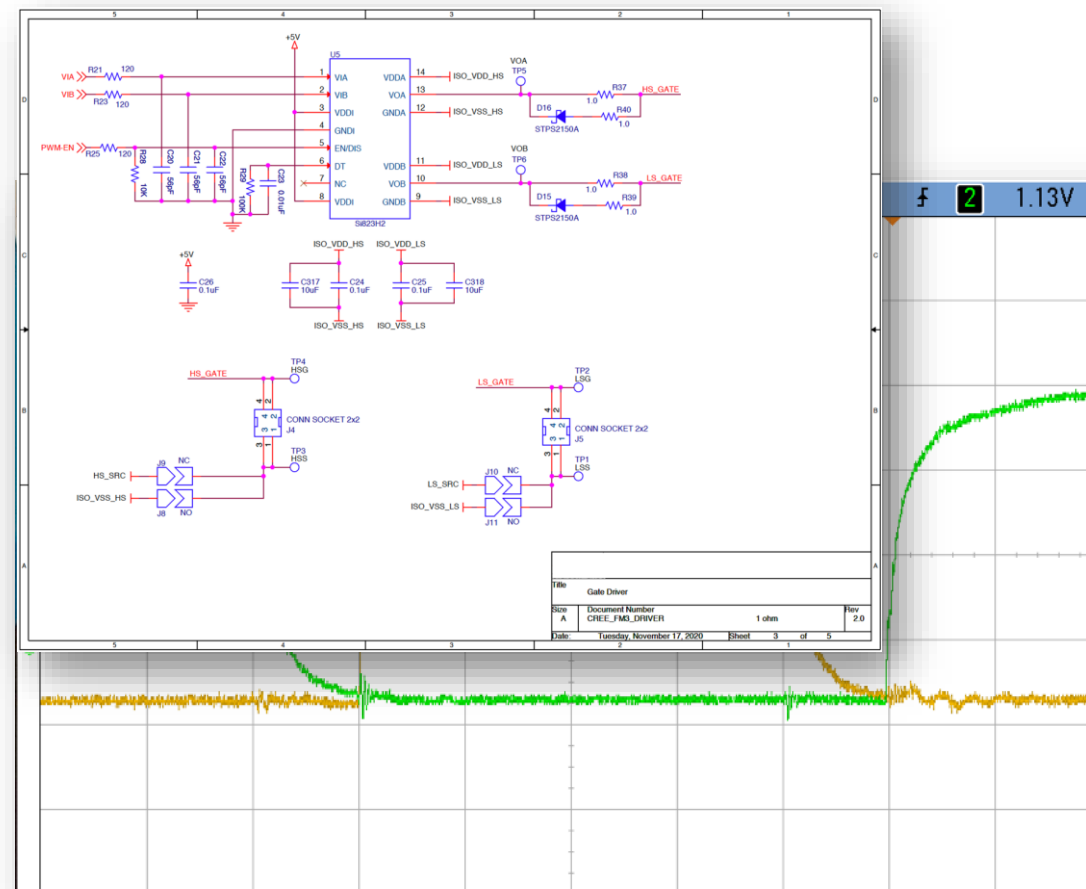
# SpeedVal and Si823Hx Gate Driver Board Validation

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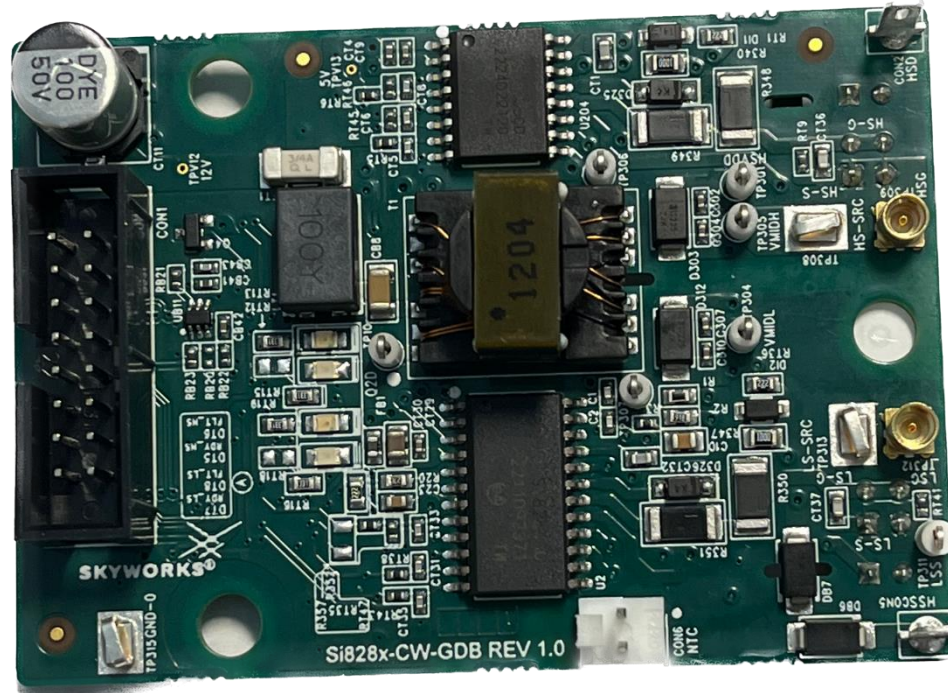
# Evaluation and Development Collateral Available

- Gate driver board reference design
  - Schematic
  - Detailed BOM
  - Digital layout files
- Comprehensive test report
  - Wolfspeed WolfPACK™ - Tested with demanding 11 mΩ module
- Extensive development resources
  - [Si823Hx Gate Driver Board User's Guide](#)
  - [Si823Hx Data Sheet](#)
  - [Si88x2x Data Sheet](#)
  - [AN892: Design Guide for Isolated DC-DC Using the Si882xx/883xx](#)
  - [AN901: Design Guide for Isolated DC-DC Using the Si884xx/886xx](#)
  - [AN1131: Design Guide for Reducing Radiated and Conducted Emissions in Isolated Systems Using Skyworks' Isolators](#)
  - [AN1167: Safety Considerations for Skyworks Series Capacitor Isolators](#)



# Si828x Gate Driver Board

All-in-one gate drive solution for power modules



Gate Driver Board for Wolfspeed XM3 Module

## APPLICATIONS

- Motor drives
- Industrial inverters & UPS
- Solar inverters

## FEATURES

- Two single channel drivers with safety interlock
- Built-in miller clamp
- <1  $\mu$ s fault response protects SiC FETs from short circuits
- Differential inputs for increased noise immunity
- Reverse polarity protection for 12 V input supply
- 4 A peak output current
- Built-in +15 V and -3.5 V isolated gate bias supplies
- 5 kV<sub>RMS</sub> safety rated isolation
- 125 kV/ $\mu$ s common mode transient immunity (CMTI)
- DC bus voltage up to 800 V
- Switch temperature (NTC) feedback
- Reference design available



# A Decade of Proven Isolation Technology



- Leader in automotive, solar & server power
- Patented capacitive isolation technology
- Field proven, >1B channels shipped



Digital Isolators



Isolated Gate Drivers



Industrial I/O



Isolated Analog  
and ADCs



Isolated FET  
Drivers





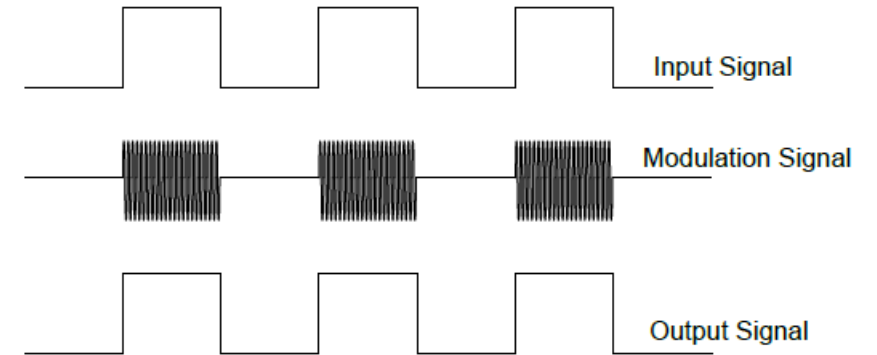
# History of Innovation

## First to address emissions with Capacitive Isolation

- Digital isolation mechanisms have inherent emissions challenges
- Our capacitive isolation architecture reduced emissions >15-20db over competition

## First to use On-Off Keying (OOK)

- Proprietary OOK provides error-free transmission & robust noise tolerance
- Pulsed architecture can latch on noise glitches, propagating errors



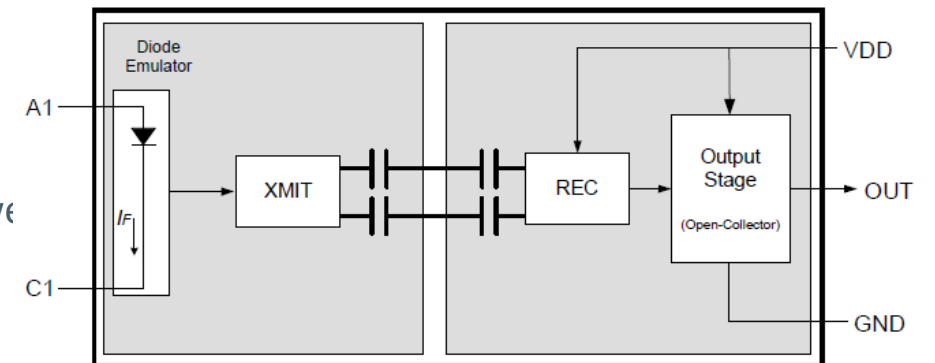
OOK Modulation

## First with LED emulator input

- Provides a direct replacement for inferior optocouplers and opto-drivers
- Developed into highly integrated PLC input product

## First with SSR replacement driver

- Innovative power transfer across Isolation barrier eliminates field side power supply
- Cost efficient, simple way to build solid-state relays



LED Emulator Input

## First with fast-switching dual gate driver

- 200 kV/ $\mu$ s CMTI allows for switching fastest FETs, including GaN
- Required for achieving highest level of power density in SMPS design

# Skyworks Isolation Portfolio



Digital Isolator

## Si86xx/T

- 1-6 ch, 5 kV<sub>RMS</sub>
- Pin 2 pin - ADI, TI
- T=10kV Surge

## Si87xx

- Replaces Optos
- Faster, robust
- Same price

## Si88xx

- Si86xx + dc/dc
- 5 W power, 80% eff
- Low noise

## Si86Sx

Sampling Now

- Robust Isolation
- Noise immunity
- High functionality



Isolated Analog

## Si8920

- Analog isolator
- Differential I/O
- Shunt R sensing

## Si8921x/2x

- Current sensor
- SE or DIFF output
- High performance

## Si893x

- Voltage sensor
- SE, DIFF, or DSM output

## Si894x

- Current sensor
- DSM Output
- High performance



Isolated Drivers

## Si823x/39x

- Ideal for Si FETs
- 2.5V VDDI
- UVLO flag + shutoff

## Si826x

- Replaces Opto-drivers
- Low drift over time
- Drives SiC FETs

## Si827x

- Fastest MOSFETs
- SiC & GaN FETs
- 200 kV/μs CMTI

## Si828x

- Drives IGBT & SiC
- DCDC option
- 125 kV/μs CMTI

## Si823Hx

- 20 V VDDI
- 30 ns max latency
- 125 kV/μs CMTI



Industrial I/O

## Si838x

- Ideal for PLC input
- 8 ch. sinking/sourcing
- Use any digital levels

## Si834x

- Ideal for PLC output
- 4 ch. sinking/sourcing
- Ideal for relays

## Si875x

- Isolated FET driver
- Choose your FET
- Build-your-own SSR

## Si876x

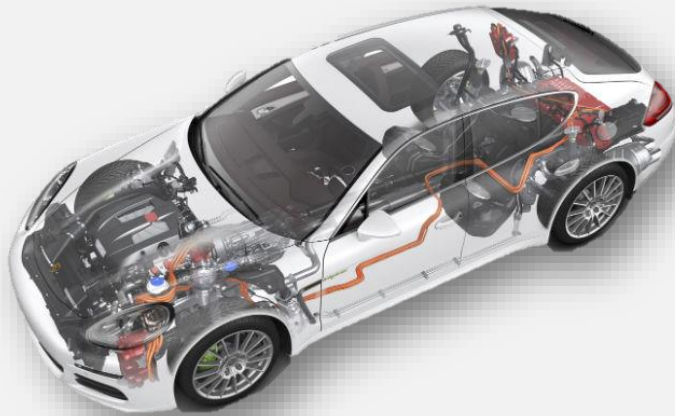
Sampling Now

- Compact SSR
- Built-in FETs



# Skyworks Isolation Markets

## AUTOMOTIVE



Battery Mgmt Systems (BMS)  
On Board Chargers (OBC)  
DC - DC Converters  
Traction Inverters

## INDUSTRIAL / MOTOR CONTROL



Programmable Logic Controllers  
Remote I/O  
Motor Control  
Isolated Fieldbus (RS-485)

## POWER SUPPLY / SOLAR



Server / Cloud Power Supplies  
Telecom Power Supplies  
Uninterruptible Power Supplies  
Solar Inverters



# Thank You!