安森美-第七代 IGBT 模組釋放新的可能性: 助力新一代可再生能源和商用车发展

onsemi latest 7th Gen IGBT Modules Unlocking New Possibilities：Powering New Generation Renewable Energy and CAV

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Focused Market and Application (重点市场及应用)

集中式逆变器

Central PV Inverter

•Three level ANPC topology for DC-AC 1500V system
• **Trend:** cost down thru using high power module to reduce paralleling and cost,

储能系统

Energy Storage PCS

•Three level ANPC topology for Power factor +/-1 1500V
•**Trend**: high power and efficiency for battery technology improvement& density upgrade

重型商用、工程和农用车辆

CAV + VFD

•Two level system with power 100kW ~ 300+KW for 3-phase output
Trend & Driving forces: Electrification, regulation

Central Solar Inverter (集中光伏式逆变器)

全球光伏装机预计到 2024 年将增至490GW，2027 年将增至684GW GAGR (复合年增长率)23.9%

准化能源成本(LCOE)低于传统化石燃料发电厂
LCOE Cost is lower than conventional fossil fuel plant

中央太阳能逆变器占不同地区光伏总量的33%~45%
Central solar inverter 33%~45% among total PV in different regions

适用于需要扩展高功率范围的大型开放地形
Suitable with large open terrain with extended high-power range required

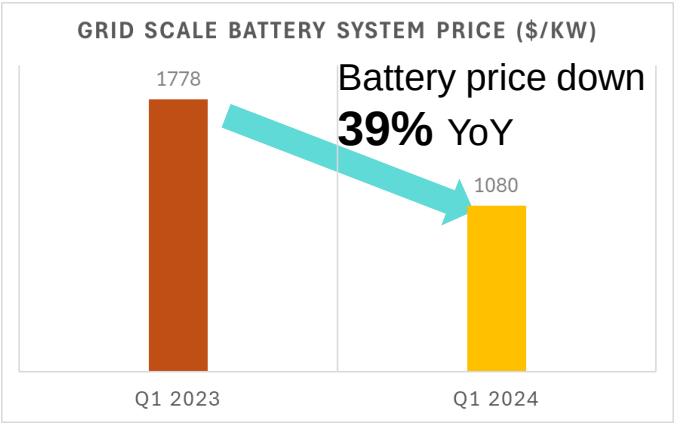
Grid-Scale Energy Storage PCS (电网规模储能PCS)

Market

全球ESS市场预计将从2023年的100GWh增至2026年的283GWh，GAGR(复合年增长率) 52.1%

Global ESS market is expected to increase from 100GWh in 2023 to 283GWh in 2026, with a GAGR (compound annual growth rate) of 52.1%, driven by

- 平衡电力供需 Enhanced grid stability demand by renewable energy/PV
- 削峰填谷/峰谷套利 (Peak shaving)
- 储能电池价格腰斩 Rapidly drop battery price



*Source: Wood Mackenzie

Need

High power density with unit power range up to 3~ 5MW

Scalability for high power output

1500VDC to match solar panel input voltage

electric Commercial Agricultural Vehicle (eCAV)

Rapid Growth
3x penetration rate by 2030

Zero emission
CAV 5% counts for 28% transportation emission

Save cost
Total Ownership Cost of bus and HD truck start lower than ICE

In order to achieve Y2030 CO2 targets: European truck makers estimate around 200,000 zero-emission trucks will be needed by 2030

QDual3 modules provide the high **efficiency** performance and **reliability** eCAV needed

1200V 800A QDual 3 Focus Applications

SNXH800H120L7QDSG

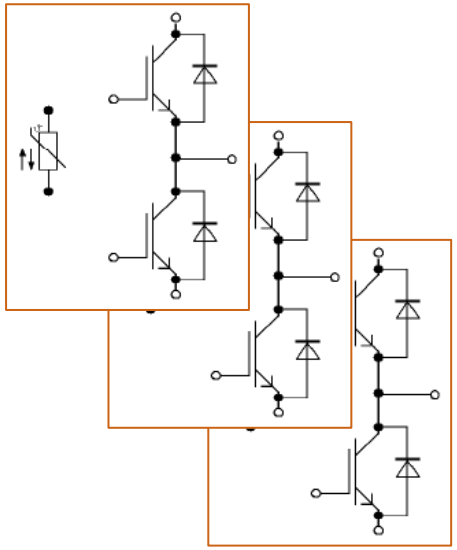
NXH800H120L7QDSG

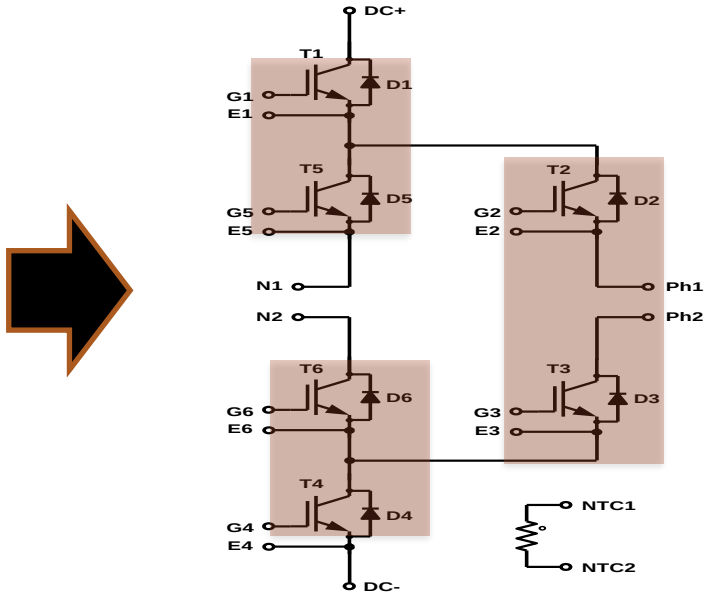
onsemi QDual 3 IGBT Modules

Scale Up with Ease:

➔ **Increase 3-level ANPC module with system set up to 1.6 MW ~ 1.8 MW**

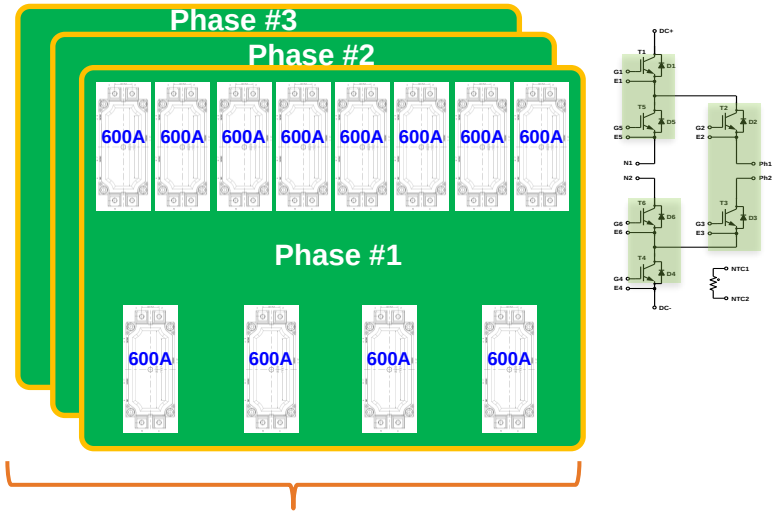
Paralleling Multiple QDual3 Modules





Cost Reduction

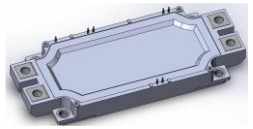
1200V QDual3 utilizing cutting-edge FS7 IGBT to achieve power escalation and system cost reduction simultaneously



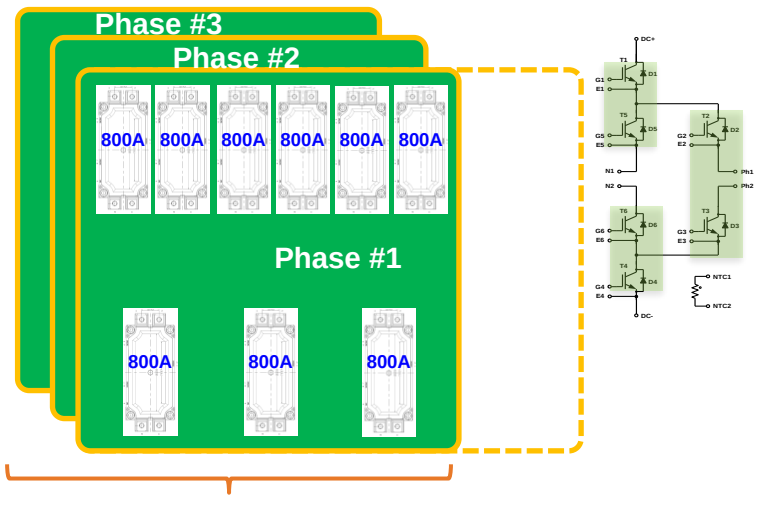
1.725MW

600A module (HB) X **36**

(*72pcs per 3.45MW system*)



- **main market solution currently**
- **3x Half-bridge for ANPC/INPC topology**



1.725MW

800A module (HB) X **27**

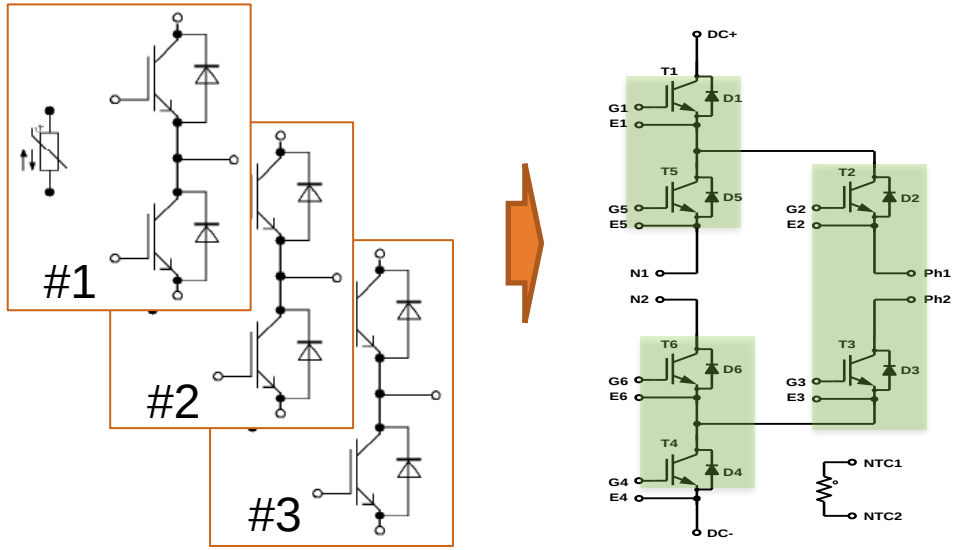
(*54pcs per 3.45MW system*)

QDual3 (in order**)**

- **800A HB QDual3 FS7 IGBT based with leading efficient and high-power density**

NXH800H120L7QDSG for 3-lvl ANPC Solar Central Inverter System

1500V PV	
Output AC voltage L-N	398V
Power per phase (3x module)	210 KVA (power Stackable)
Line frequency	50Hz
modulation	SVPWM



- **Highly efficient design for 3-Lvl ANPC topology in central solar inverter (PV)**
- **Better efficiency than competitor's module, with optimized IGBT/ FRD performance**

▶ Detailed Loss and Thermal Performance of Main Devices (TF, TL,TN, HD, RD, FD) for only each 'One'

Details for Loss (TF, RD, TL, TN, HD, FD)	
	Value
TF_Conduction Loss [W]	333.100136
TF_Turn-on Loss [W]	76.8179132
TF_Turn-off Loss [W]	69.6130878
HD_Conduction Loss [W] (Reactive)	0
HD_Reverse Recovery Loss [W]	0
RD_Conduction Loss [W] (Reactive)	0
RD_Reverse Recovery Loss [W]	0
TL_Conduction Loss [W]	388.147931
TL_Conduction Loss [W] (Reactive)	0
TL_Turn-on Loss [W] (Reactive)	0
TL_Turn-off Loss [W] (Reactive)	0
TN_Conduction Loss [W] (Reactive)	0
TN_Conduction Loss [W]	0
TN_Turn-on Loss [W]	0
TN_Turn-off Loss [W]	0
FD_Conduction Loss [W]	59.9817628
FD_Conduction Loss [W] (Reactive)	0
FD_Reverse Recovery Loss [W]	38.2047936
Sum [W]	965.87

Thermal Performance	
	Value
Ambient Temp. [DegC]	85.0
Heat-sink Temp. [DegC]	85.0
TF - Case Temp. [DegC]	85.0
TF - Junc. Temp. [DegC]	120.5
TN - Case Temp. [DegC]	85.0
TN - Junc. Temp. [DegC]	85.0
RD - Case Temp. [DegC]	85.0
RD - Junc. Temp. [DegC]	85.0
TL - Case Temp. [DegC]	85.0
TL - Junc. Temp. [DegC]	113.7
HD - Case Temp. [DegC]	85
HD - Junc. Temp. [DegC]	85.0
FD - Case Temp. [DegC]	85
FD - Junc. Temp. [DegC]	97.8

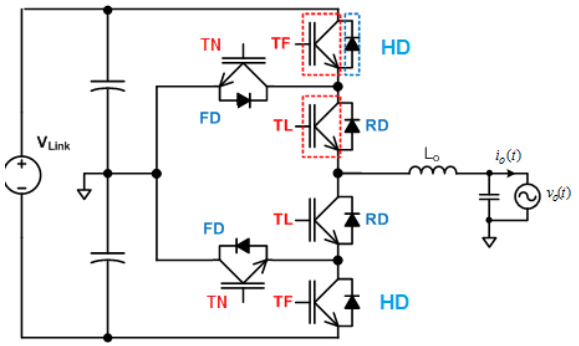
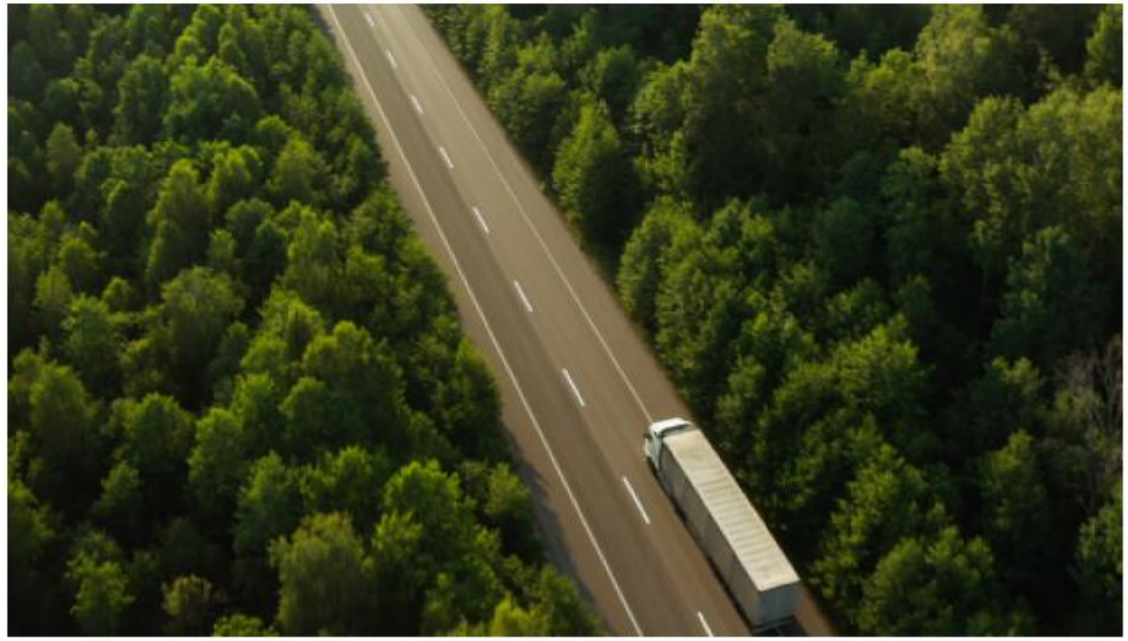
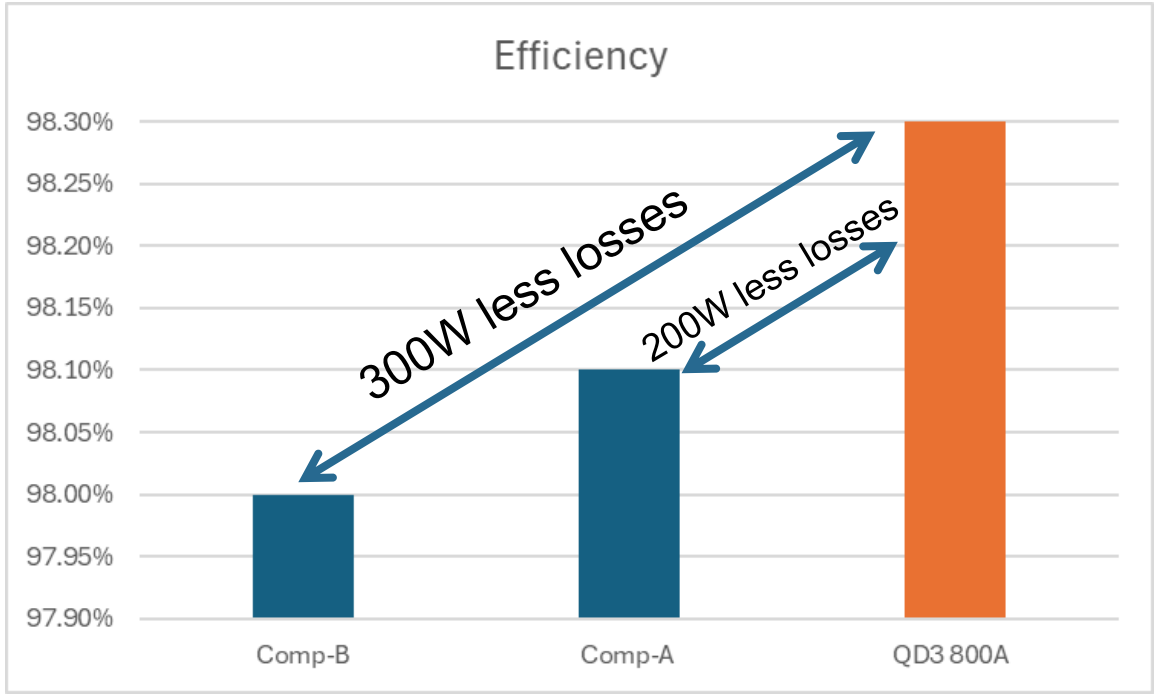


Fig.1. Circuit Daigram of 3-level ANPC Inverter for 1 phase

High Efficiency





Increased Efficiency => Longer Range & Higher Torque

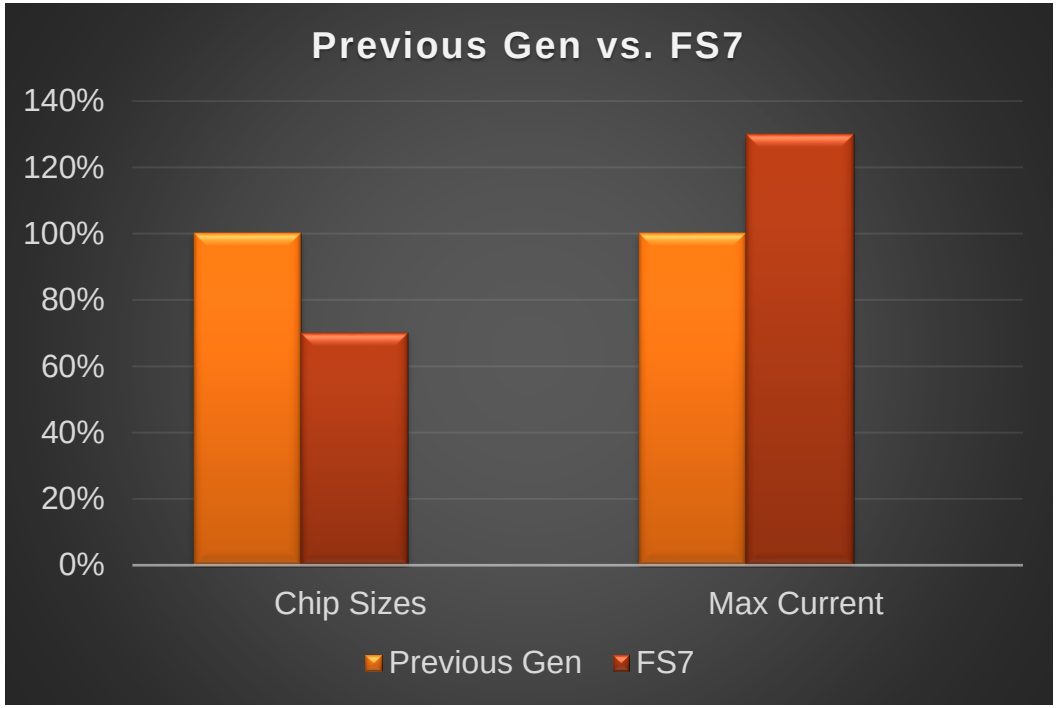
P_O=150kW	IGBT SW [W]	IGBT Con. [W]	Diode SW [W]	Diode Con. [W]	Total Loss(W)	Efficiency
Comp-A	284	135.2	33.7	17.3	2821.2	98.1%
Comp-B	319.3	127.9	34.1	16.4	2986.2	98.0%
QD3 800A	253.6	127.7	39.6	16.3	2623.8	98.3%

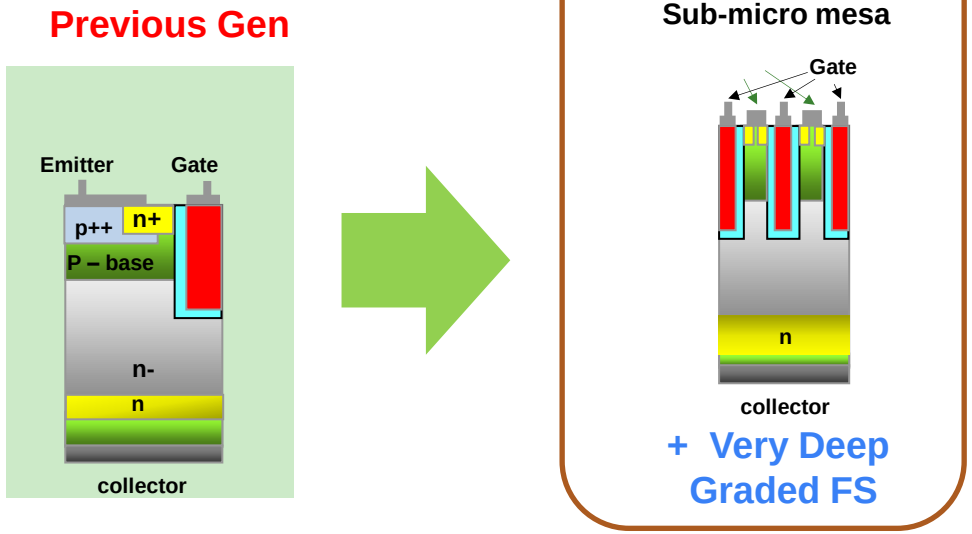
150kW System

onsemi Field Stop 7 (FS7) IGBT Technology

Smaller Size/Power Density:

- **Chip Size** - 30 % smaller
- **Max Current** - 30% increase



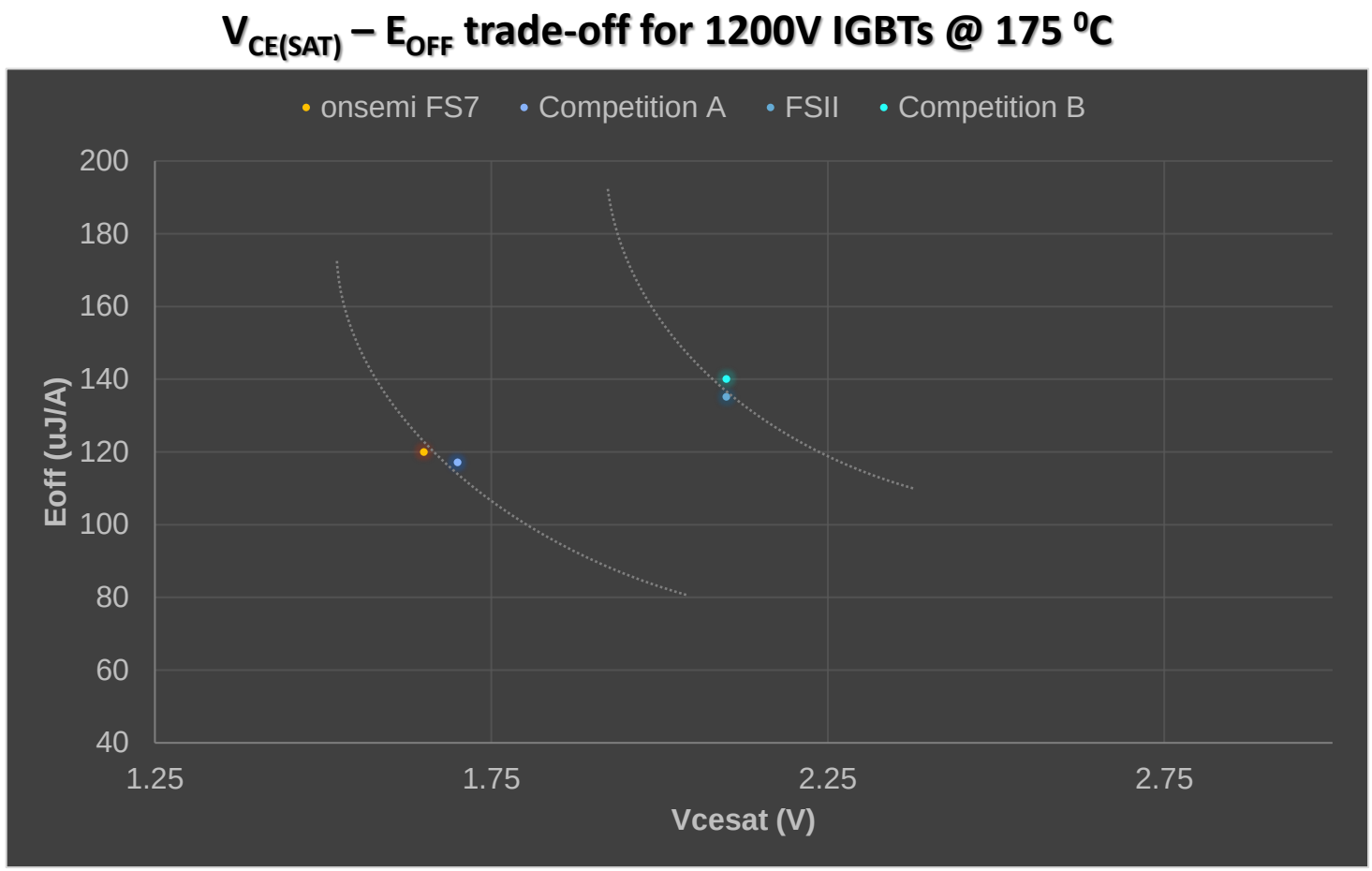


Narrow pitch design for high power density

onsemi Field Stop 7 IGBT Technology

Best-in-Class Vcesat <1.75V and Eoff

Can operate at 175 ^{0}C junction temperature



High Robustness

		onsemi SNXH800H120L7QDSG 	Competitor A	Competitor B
Technology	Chip	7th Gen IGBT -FS7 (latest)	7th Gen – IGBT (latest)	7th Gen –IGBT (latest)
	PKG	Ultra-sonic welding terminal for high robustness	WB terminal	WB terminal
Reliability		**Humidity**: HV-H3TRB 960V / 2000hrs. **Vibration**: 10G, 22 hrs (AQG324, automotive)	**Humidity**: H3TRB 80V / 1000hrs. **Vibration**: 5G, 5 hrs (IEC60068)	**Humidity**: HV-H3TRB 960V / 1000hrs. **Vibration**: 20G, 1hr (Mtd403A).
Mechanical			Pin2pin compatible	

2x longer!

1200V QDual3

Features & Benefit

- Latest Gen7 1200V IGBT/Diode technology with high efficiency and controllability
- Pinout and footprint compatible with industrial standard package
- Solder pin (Released), Press-fit pin (under request)
- Low thermal resistance isolated base plate

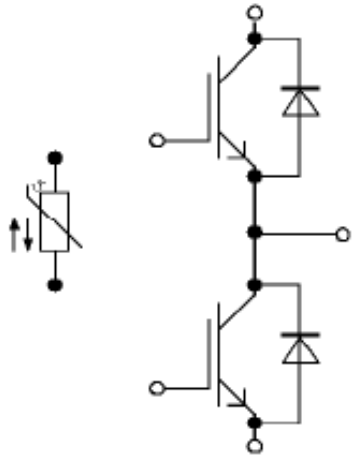
Product	Voltage	Current	Application	Status
NXH800H120L7QDSG	1200V	800A	HB / Solar, Mass Market	Order Now!
SNXH800H120L7QDSG	1200V	800A	HB / eCAV	

Application

Servo Drives
Industrial Drives

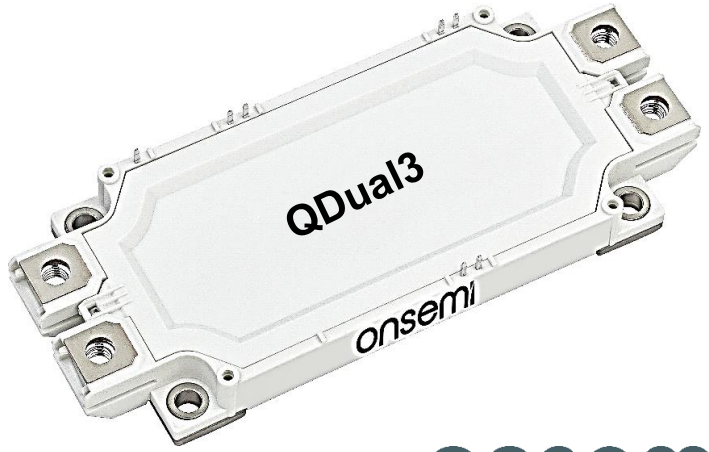
Centralized Solar/ESS
eCAV , Electric bus/vehicles

Circuit

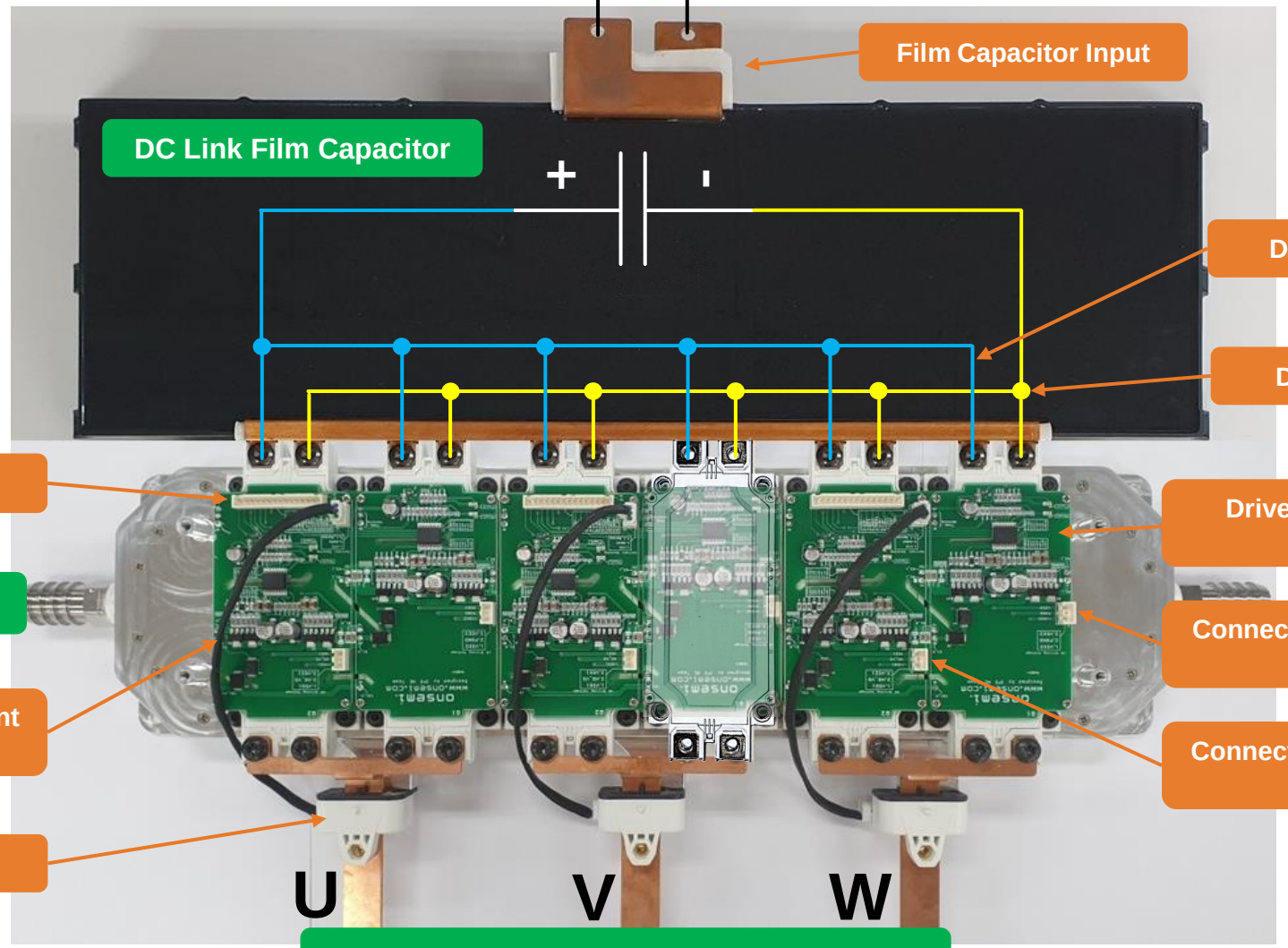


Half-bridge

Package (152.0 mm X 62.5mm)



System for 300kW eCAV Traction Inverter



SNXH800H120L7QDSG

*Kit available for purchase by Sep'24

onsemi eco-System Solution for eCAV

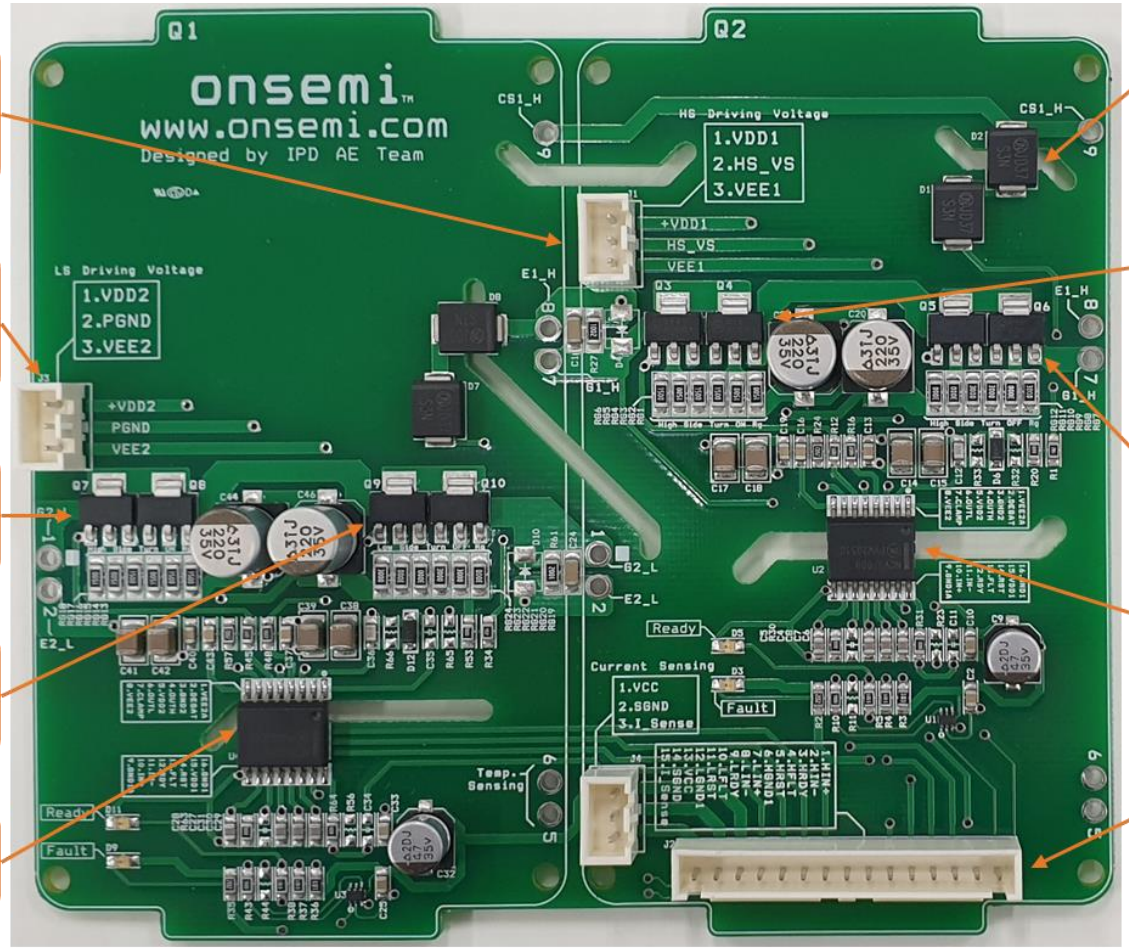
High Side Driving Source
- High side positive bias voltage
- High side bias voltage ground
- High side negative bias voltage

Low Side Driving Source
- Low side positive bias voltage
- Low side bias voltage ground
- Low side negative bias voltage

Low Side Current Sourcing
- NPN Transistors
- onsemi products: NSS60601MZ4

Low Side Current Sinking
- PNP Transistors
- onsemi products: NSS60600MZ4

Low Side Main Driver IC
- onsemi products: NCD57100 or NCV57000



[PCB Designed Drive Board]

Over Current Protection
- Diode for Desat function
- onsemi products: S3N

High Side Current Sourcing
- NPN Transistors
- onsemi products: NSS60601MZ4

High Side Current Sinking
- PNP Transistors
- onsemi products: NSS60600MZ4

High Side Main Driver IC
- onsemi products: NCD57100 or NCV57000

Main Connector
- High/Low side primary input signals
- High/Low side Ready/Fault/ Reset pins
- Primary VCC bias source(VCC/GND)
- Current sensing input pin

Learn More

onsemi.com/igbt-modules

Thank you!

Should you have any ideas and comments

Please contact

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