

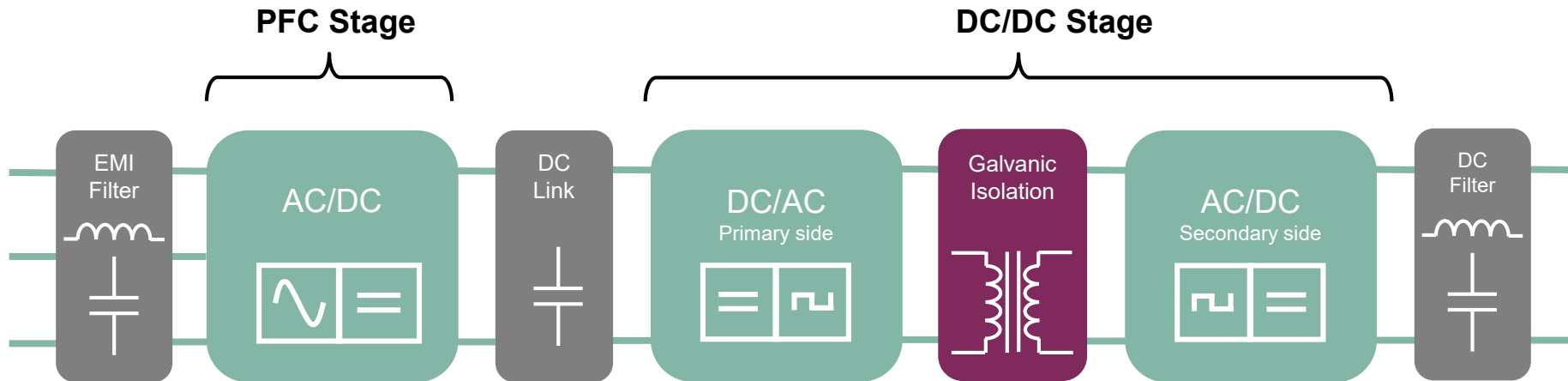
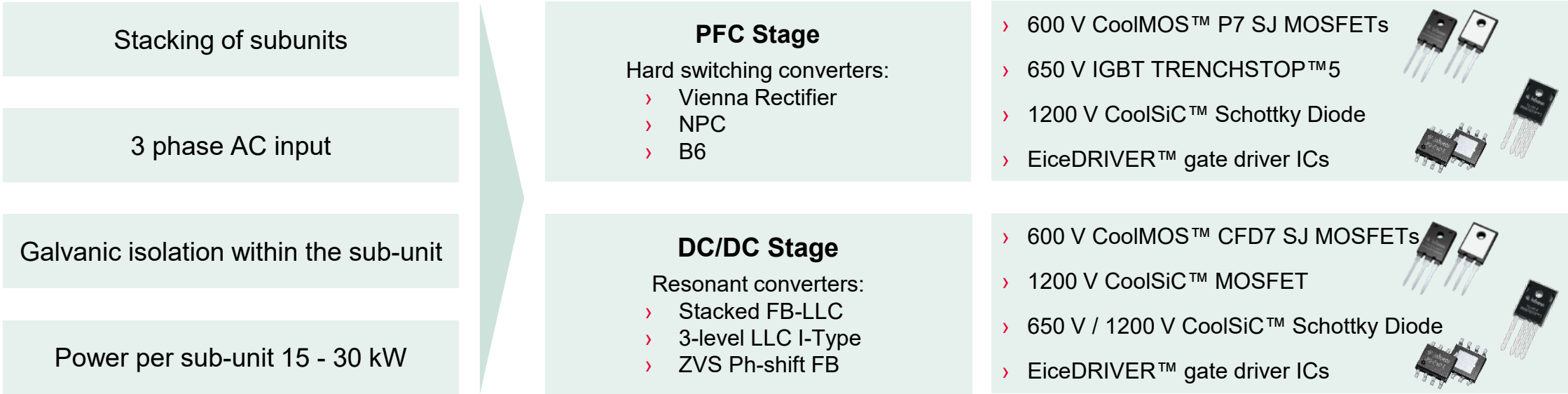
# Gate Driver ICs for EV charging stations and wall boxes

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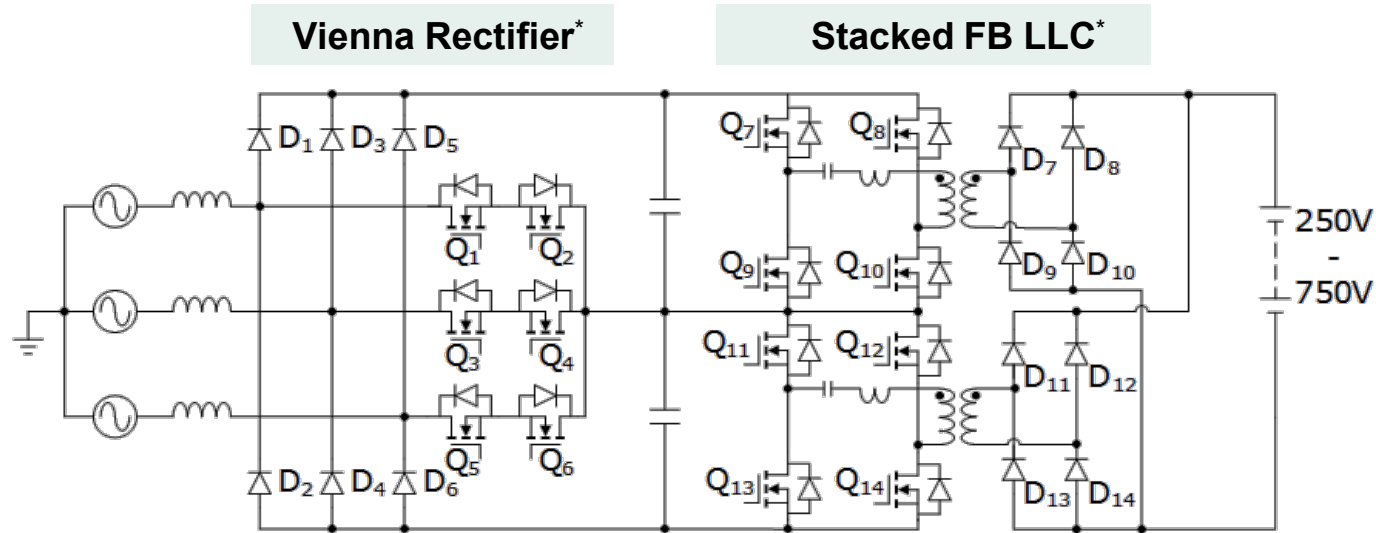


# Fast charging stations from 20 kW to 350 kW

## Functional block diagram overview



# Solution for 30 kW EV-charging module / wall-box - example -



### Key features and benefits

- > High efficiency
  - Super Junction CoolMOS™
  - CoolSiC™ Schottky diode
- > Low design complexity
- > Fast time to market

Stage	Switching Frequency	Devices	Product	Part number	Qty
AC/DC	40 kHz	Q <sub>1</sub> - Q <sub>6</sub>	650 V IGBT TRENCHSTOP™ 5 H5	IKW75N65EH5	12
		D <sub>1</sub> - D <sub>6</sub>	1200 V CoolSiC™ Schottky diode	IDWD20G120C5	12
		Driver IC	EiceDRIVER™ X3 Compact	<b>1ED3121MC12H</b>	6
DC/DC	up to 300kHz	Q <sub>7</sub> - Q <sub>14</sub>	600 V CoolMOS™ CFD7 SJ MOSFET	IPW60R037CSFD	16
		D <sub>7</sub> - D <sub>14</sub>	1200 V CoolSiC™ Schottky diode	IDWD30G120C5	16
		Driver IC	EiceDRIVER™ 2EDi	<b>2EDS8265H</b>	4

### Application example

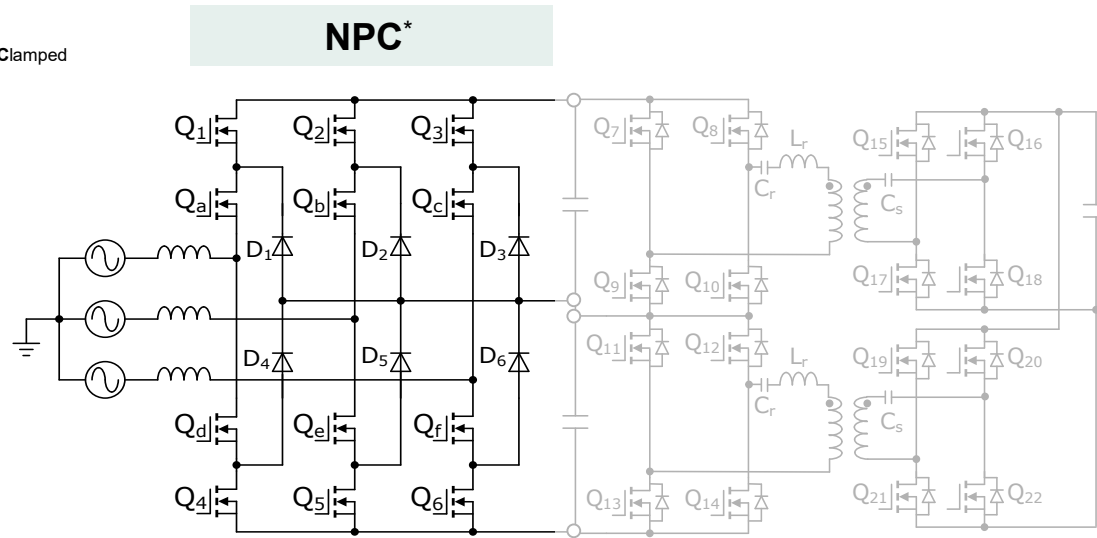
- > 50 A max.
- > 20 kW, 50 A @400 V
- > Air cooled
- > Vienna rectifier for PFC with 2 paralleled MOSFETs
- > 2 stacked FB LLC with 2 paralleled MOSFETs
- > DC Link Voltage 780 V - 840 V

\*) Simplified schematic diagram. Symbols for the schematic diagram are only for illustration purposes and does not refer to the proposed bill of material.

#) with digital isolator for PWM signal

# NPC PFC-stage for Bidirectional charging station / wall-box

NPC =  
Neutral Point Clamped



### Key features and benefits

- > Bi-directional (reactive power, e-storage)
- > Low ripple inductor-current
- > Fixed switching frequency
- > Using 650 – 600 V break-down voltage devices for high input and high output voltage
- > Isolated gate driver ICs

Power	Product type	Devices	Product	Part number	Qty
20 kW	MOSFET	Q <sub>1</sub> - Q <sub>6</sub>	650 V CoolSiC™	IMW65R048M1H	6
		Q <sub>a</sub> - Q <sub>f</sub>	600 V CoolMOS™	IPW60R060P7/C7	6
	Diode	D <sub>1</sub> - D <sub>6</sub>	650 V CoolSiC™ G6	IDH10G65C6	6
30 kW	MOSFET	Q <sub>1</sub> -Q <sub>6</sub>	650 V CoolSiC™	IMW65R027M1H	6
		Q <sub>a</sub> -Q <sub>f</sub>	600 V CoolMOS™	IPW60R037P7/040C7	6
	Diode	D <sub>1</sub> -D <sub>6</sub>	650 V CoolSiC™ G6	IDH16G65C6	6
Driver IC		EiceDRIVER™ for CoolSiC™		<b>1ED3122MC12H</b>	3
		EiceDRIVER™ for CoolMOS™		<b>2EDF7275F</b>	3

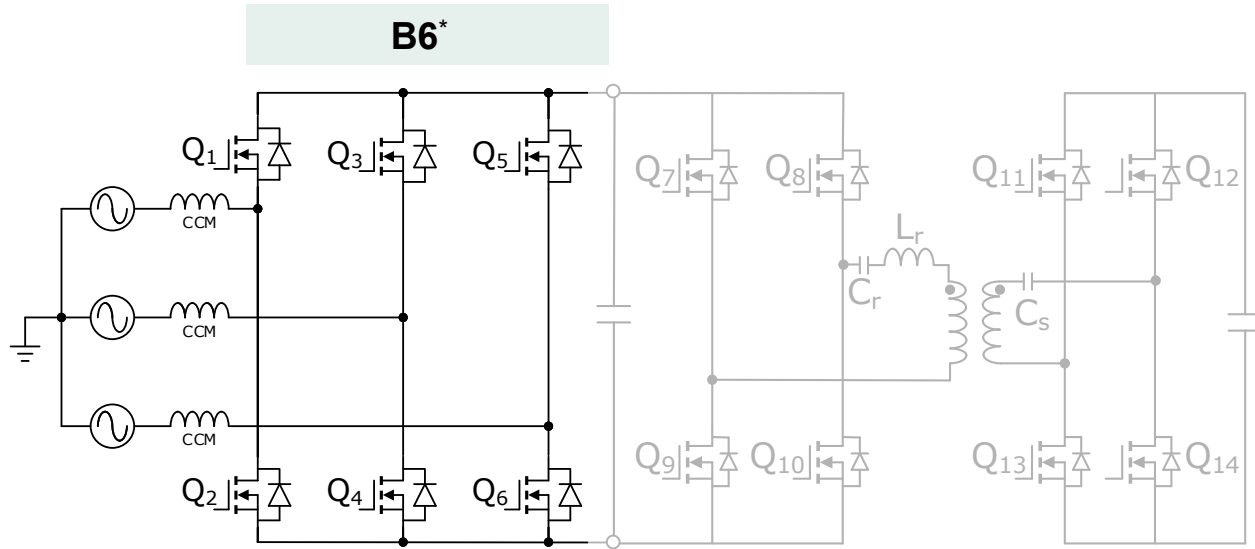
### Application example

- > CCM operation 3-level active neutral clamping converter requires:
  - Low reverse characteristic body diode at Q<sub>1</sub> - Q<sub>6</sub> and D<sub>1</sub> - D<sub>6</sub> SiC diode
  - Q<sub>a</sub> - Q<sub>f</sub> are operated at switching frequency. Q<sub>a</sub> and Q<sub>d</sub> are operated as complementary switch
- > Input voltage is 3-phase 380 Vac
- > Output voltage is +380 to 0 V to - 380 V

\*) Simplified schematic diagram. Symbols for the schematic diagram are only for illustration purposes and does not refer to the proposed bill of material.

# B6 in PFC stage in charging station / wall-box

## - example -



### Key features and benefits

- > Low component count
- > Bi-directional (reactive power, e-storage)
- > Fixed switching frequency
- > Simple control method
- > Isolated gate driver ICs

Power	Product type	Devices	Product	Part number	Qty
20 kW	MOSFET / IGBT	Q <sub>1</sub> - Q <sub>6</sub>	1200V CoolSiC™	IMW120R045M1	6
		Q <sub>1</sub> - Q <sub>6</sub>	1200V IGBT HighSpeed 3	IGW40N120H3	6
	IGBT Diode		1200V CoolSiC™ G5	IDWD30G120C5	6
30 kW	MOSFET	Q <sub>1</sub> - Q <sub>6</sub>	1200V CoolSiC™	IMW120R030M1H	6
		Q <sub>1</sub> - Q <sub>6</sub>	1200V IGBT HighSpeed 3	IGW25N120H3	12
	IGBT Diode		1200V CoolSiC™ G5	IDWD20G120C5	12
	Driver IC		EiceDRIVER™ for CoolSiC™	<b>1ED3122MC12H</b>	6
			EiceDRIVER™ for HighSpeed 3	<b>1ED3121MC12H</b>	3

### Application example

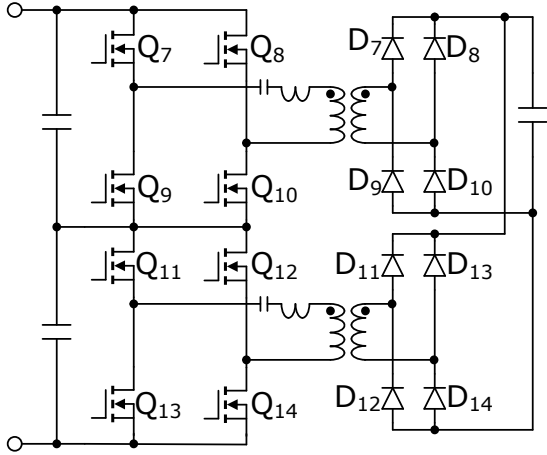
- > CCM operation: 1200V CoolSiC™ or 1200V IGBT with anti-parallel SiC diode required in all switches
- > Q<sub>1</sub> - Q<sub>6</sub> operate at switching frequency
- > Q<sub>1</sub> - Q<sub>6</sub> anti-parallel diodes required to conduct forward current
- > Input voltage: 3-phase 380 Vac
- > Output voltage is 0 V to 800 V
- > Bi-directional power flow possible

\*) Simplified schematic diagram. Symbols for the schematic diagram are only for illustration purposes and does not refer to the proposed bill of material.

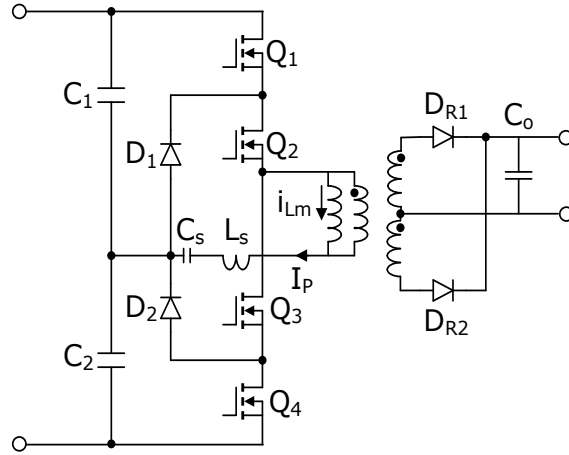
# Unidirectional DC/DC stage alternatives

## - example -

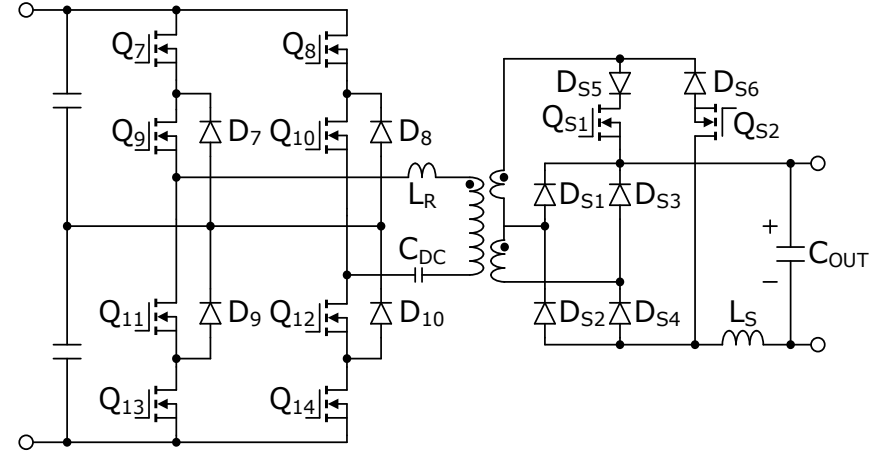
**Stacked FB LLC\***



**3-level LLC I-type\***



**Phase-shift ZVS FB\***



Topology	Product type	Devices	Product	Part number
<b>Stack full-bridge LLC</b> ▪ Traditional approach	MOSFET	Q <sub>7</sub> - Q <sub>14</sub>	600/650 V CoolMOS™ CFD7	IPW60R0XXCFD7
	Reinforced Isolated driver		EiceDRIVER™ for CoolMOS™	<b>2EDS8265H</b>
<b>Three-level LLC</b> ▪ for <u>continuous</u> wide range output voltage, e.g. for PRC and ROK	MOSFET	Q <sub>1</sub> - Q <sub>4</sub>	600/650 V CoolMOS™ CFD7	IPW60R0XXCDF7
	Reinforced Isolated driver		EiceDRIVER™ for CoolMOS™	<b>2EDS8265H</b>
<b>Phase-shift ZVS full-bridge</b> ▪ most frequently used today: straight forward design	MOSFET	Q <sub>7</sub> - Q <sub>14</sub> Q <sub>S1</sub> - Q <sub>S2</sub>	600/650 V CoolMOS™ CFD7 600 V CoolMOS™ C7	IPW60R0XXCFD7 IPW60R0XXC7
	Reinforced Isolated driver Functional Isolated driver		EiceDRIVER™ for CoolMOS™	<b>2EDS8265H</b> <b>1EDB8275F</b>

\*) Simplified schematic diagram. Symbols for the schematic diagram are only for illustration purposes and does not refer to the proposed bill of material.

# Gate-Driver ICs for EV Charging Stations and Wall Boxes

## - examples -



### EiceDRIVER™ 1ED3121

1-channel galvanically isolated gate-driver IC



- › Source current: 5.5 A (0.95 Ω)
- › Sink current: 5.5 A (0.75 Ω)
- ›  $V_{IOTM}$ : 8000 V<sub>peak</sub>
- ›  $UVLO_{VDD\_on}$ : 12.5 V
- › Package: DSO 8-pin 300 mil
- › Separate source and sink output

[www.infineon.com/1ED3121](http://www.infineon.com/1ED3121)

### EiceDRIVER™ 1EDB

1-channel galvanically isolated gate-driver IC



- › Source current: 5.4 A (0.95 Ω)
- › Sink current: 9.8 A (0.48 Ω)
- ›  $V_{IOTM}$ : 4242 V<sub>peak</sub>
- ›  $UVLO_{VDD\_on}$ : 4.2 / 8.0 / 12.2 / 14.9 V
- › Prop. delay accuracy: + 4 ns / - 4 ns
- › Package: DSO 8-pin 150 mil

[www.infineon.com/1edb](http://www.infineon.com/1edb)

### EiceDRIVER™ 2EDF

2-channel galvanically isolated gate-driver IC



- › Source current: 4 A (0.85 Ω)
- › Sink current: 8 A (0.35 Ω)
- ›  $V_{IO}$ : 1500 V
- ›  $UVLO_{VDD\_on (typ.)}$ : 4.2 V, 13.7V
- › Prop. delay accuracy: + 7 ns / - 6 ns
- › Package: DSO 16-pin 150 mil

[www.infineon.com/2edi](http://www.infineon.com/2edi)

### EiceDRIVER™ 1ED3122

1-channel galvanically isolated gate-driver IC



- › Source current: 10 A (0.55 Ω)
- › Sink current: 9 A (0.45 Ω)
- ›  $V_{IOTM}$ : 8000 V<sub>peak</sub>
- ›  $UVLO_{VDD\_on (typ.)}$ : 10.0 V
- › Packages: DSO 8-pin 300 mil
- › Miller clamp

[www.infineon.com/1ED3122](http://www.infineon.com/1ED3122)

### EiceDRIVER™ 2EDN

2-channel low-side gate-driver IC



- › Source current: 5 A (0.65 Ω)
- › Sink current: 5 A (0.5 Ω)
- ›  $UVLO_{VDD\_on (typ.)}$ : 4.2 V, 8.0 V
- › Prop. delay accuracy: + 6 ns / - 4 ns
- › Packages: DSO, TSSOP, WSON

[www.infineon.com/2edn](http://www.infineon.com/2edn)

### EiceDRIVER™ 2EDS

2-channel galvanically isolated gate-driver IC



- › Source current: 4 A (0.85 Ω)
- › Sink current: 8 A (0.35 Ω)
- ›  $V_{IOTM}$ : 8000 V<sub>peak</sub>
- ›  $UVLO_{VDD\_on (typ.)}$ : 4.2 V, 8.0 V, 13.7 V
- › Prop. delay accuracy: + 7 ns / - 6 ns
- › Package: DSO 16-pin 300 mil

[www.infineon.com/2edi](http://www.infineon.com/2edi)



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