

英飞凌驱动芯片产品介绍

英飞凌科技（中国）有限公司
2021年4月

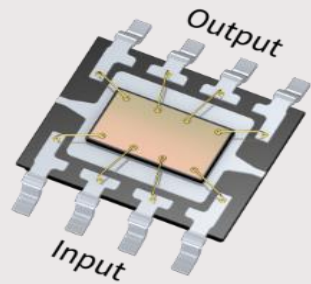


IPC Gate Driver Product Types

Portfolio Segmentation

Non-Isolated

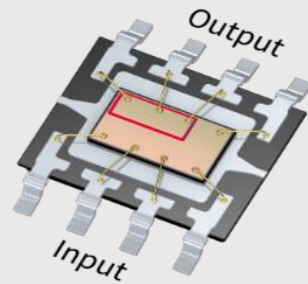
Low Voltage



- > **Comprehensive Families** of single- and dual-low-side drivers with flexible options for output current, logic configurations, and UVLOs
- > **Rugged technology** of the high-voltage gate drivers, and on the latest state-of-the-art 130-nm process
- > **Industry-standard** DSO-8 and small form-factor SOT23 and WSON packages

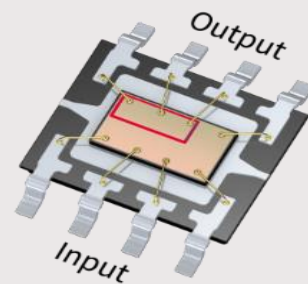
Level-Shift

Junction Isolation



- > **Proven technology** trustfully used in all high-voltage gate drive applications for 20 years
- > **Largest portfolio** of 200 V, 600 V, and 1200 V industry standard gate drivers using rugged proprietary HVIC process
- > **Solution-specific** motor-control and switch-mode power applications

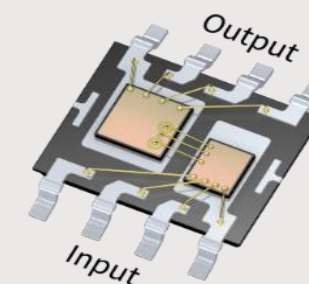
Silicon On Insulator



- > **Infineon SOI technology** for high-voltage applications with inherent integrated boot-strap diode capability and lower level-shift losses
- > Industry **best-in-class robustness** against negative VS transient spikes
- > Higher level of integration reduces BOM and total system cost

Galvanic Isolation

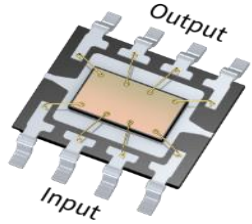
Coreless Transformer



- > **Magnetically-coupled isolation technology** provides galvanic isolation for industrial applications
- > **Strongest gate-drive output currents** (up to 14 A) reducing need for external booster circuits
- > **Reliable and accurate protection** such as precise & tight DESAT protection, active Miller clamp, isolation rating in different packages, UL 1577 and VDE 0884-11 certification

New PL67 Gate Driver product segmentation – HA+ Multiple Consumer and Industrial applications to 10 kW

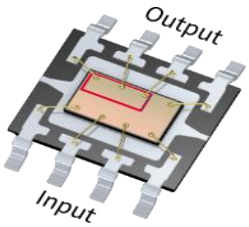
HA+



Low-side Drivers

- › **Low-side:**
 - Comprehensive families of single and dual channel low-side drivers
 - New families with **strong gate drive**, high speed, and **rugged** operation

Target markets	Key Products	Differentiation
<ul style="list-style-type: none"> › MHA (RAC) PFC › SMPS › Industrial 	<ul style="list-style-type: none"> › 1ED44176/5/3 (OCP) › 2ED24427 (Dual 10 A) › IR(S)4427, IRS44273 	<ul style="list-style-type: none"> › New OCP features › Thermal DSO-8 package › Rugged HVIC history



200 V Level-shift Drivers

- › **Level-shift:**
 - **30 years** of product leadership from IRF portfolio (first **HVIC** driver in 1989)
 - State-of-the-art **Infineon SOI** technology for higher operational ruggedness and higher frequency switching

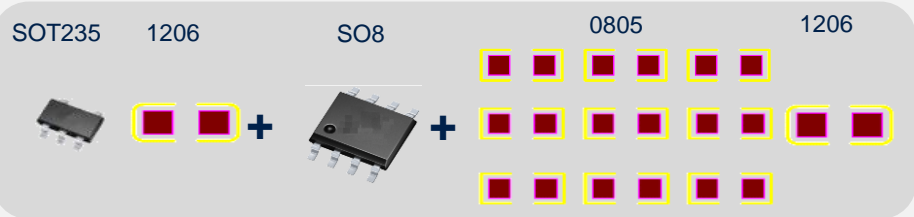
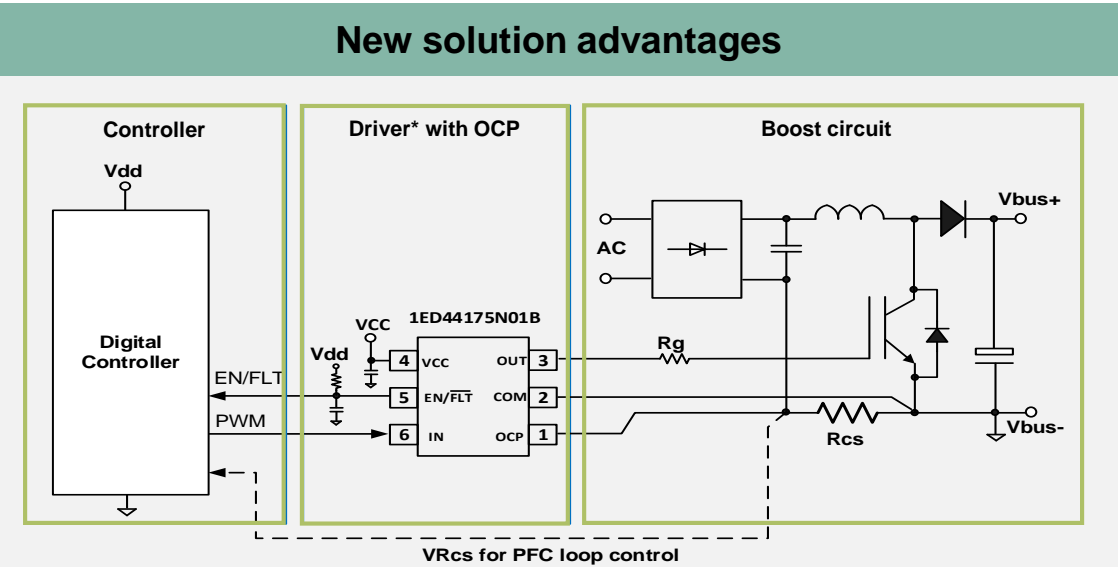
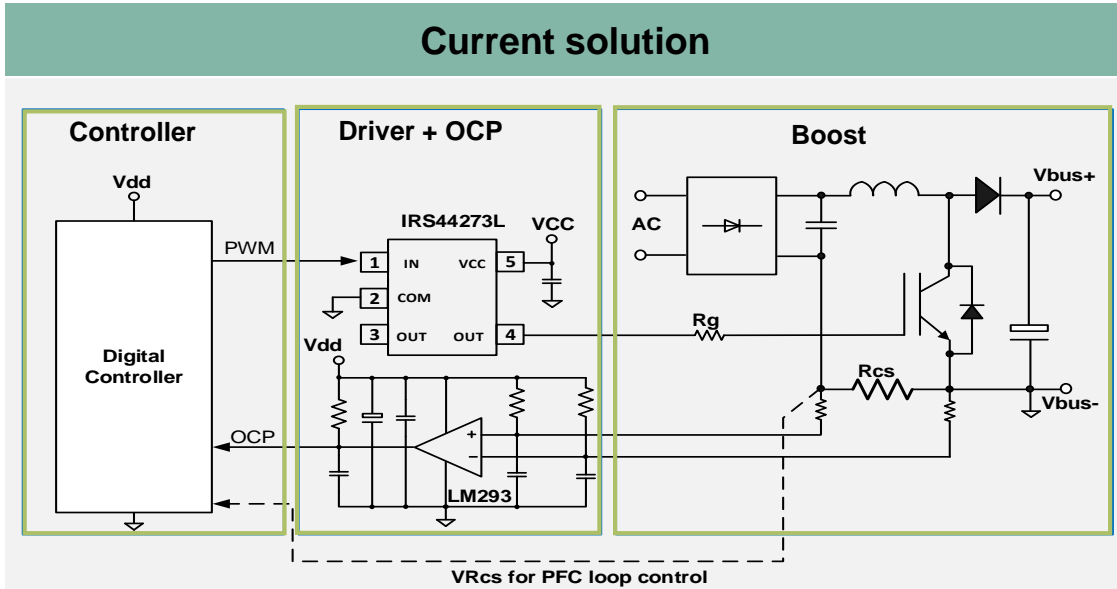
Target markets	Key Products	Differentiation
<ul style="list-style-type: none"> › Battery powered apps › SLEV/LEV › Stepper motors 	<ul style="list-style-type: none"> › IRS2005/7/8M › IR2010 & IR(S)2011 › 6EDL04N02 	<ul style="list-style-type: none"> › Small-package – 4x4mm QFN › Fast-prop delay
<ul style="list-style-type: none"> › MHA & SHA › GPD (Industry 4.0) › eMobility (LEV) 	<ul style="list-style-type: none"> › 2ED2106/8/9(4), 2ED218x(4) › 2ED28073J07F › 2ED2304, 6EDL04N06, IR2136 	<ul style="list-style-type: none"> › Largest standard portfolio › Infineon SOI (BSD, –VS, lower losses)
<ul style="list-style-type: none"> › Low-power industrial drives › CAC 	<ul style="list-style-type: none"> › 6ED2230S12T › IR2214 › IR2233/5 	<ul style="list-style-type: none"> › 3-Phase & HB drivers for low-power drives
<ul style="list-style-type: none"> › Forklift › LSEV › SMPS (Buck converters) 	<ul style="list-style-type: none"> › IRS2127(1) › IRS25752 	<ul style="list-style-type: none"> › Integrated current sensing › Cost effective

BOLD = New Products

BOLD = Today's focus

1ED44175N01B / 1ED44173N01B advantages

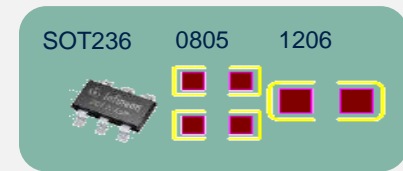
Cost effective, space saving, accurate, and fast time-to-market PFC solutions



Boost PFC IGBT or MOSFET gate driver with OCP in residential air-conditioning application

> 20% Cost Saving
> 50% Space Saving

1ED44175 / 1ED44173 Simplify system design



1ED44175 integrates

- ✓ Low side gate driver
- ✓ Overcurrent protection
- ✓ IGBT UVLO levels
- ✓ Enable Input / Fault output
- ✓ Programmable fault clear time

1ED44173 integrates

- ✓ Low side gate driver
- ✓ Overcurrent protection
- ✓ MOSFET UVLO levels
- ✓ Enable Input / Fault output
- ✓ Programmable fault clear time

* - example circuit with 1ED44175N01

200 V IPC gate driver family at-a-glance

www.infineon.com/200VIC



PN	6EDL04N02	6ED003L02-F2	IRS2008*	IRS2007*	IRS2005*	IRS2011	IR2011	IR2010
Voltage Class	200 V	200 V	200 V	200 V	200 V	200 V	200 V	200 V
Technology	SOI	SOI	JI	JI	JI	JI	JI	JI
Configuration	3-phase	3-phase	HB	HB	HSLs	HSLs	HSLs	HSLs
Io+/- typ.	0.165 / 0.375 A	0.165 / 0.375 A	0.29 / 0.6 A	0.29 / 0.6 A	0.29 / 0.6 A	1 / 1 A	1 / 1 A	3 / 3 A
UVLO (on/off) typ.	9 V / 8.1 V	11.7 / 9.8 V	8.9 / 8.2 V	8.9 / 8.2 V	8.9 / 8.2 V	9.0 / 8.2 V	9.0 / 8.2 V	8.6 / 8.2 V
Propagation delay (on/off) typ.	530 / 530 ns	530 / 490 ns	680 / 150 ns	160 / 150 ns	160 / 150 ns	60 / 60 ns	80 / 75 ns	95 / 65 ns
Deadtime typ.	310 ns	310 ns	520 ns	520 ns	---	---	---	---
Features	Integrated bootstrap diode		Cost effective					
Package Options	TSSOP-28 		DSO-8, 4x4 MLPQ-14 			DSO-8, PDIP8 		DSO-16 wide body, PDIP14 

*IRS2004, IRS2003, and IRS2001 are not recommended for new designs. For new designs we recommend IRS2008, IRS2007, and IRS2005

[IRS2005](#), [IRS2007](#), and [IRS2008](#) at a glance 200 V high & low side and half bridge drivers

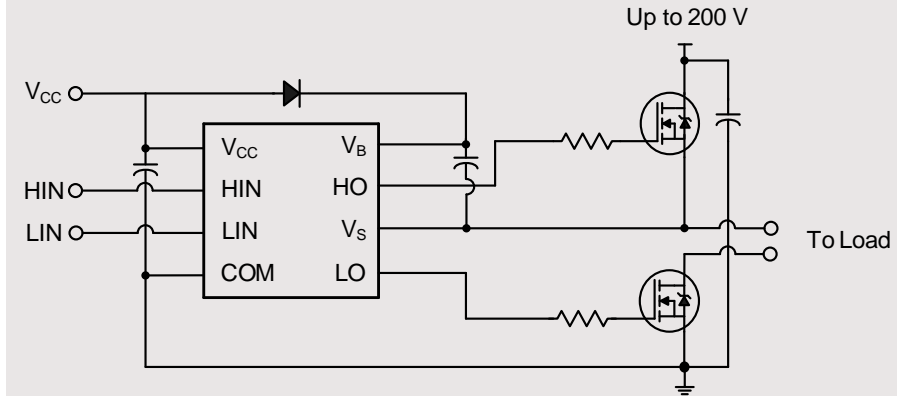
Key Features

- > **200 V** gate driver family tailored for low voltage (24 V, 36 V, and 48 V) and mid voltage (60 V, 80 V and 100 V) motor drive applications
- > Maximum offset voltage **225 V**
- > **290 mA / 600 mA** typical source/sink current
- > **10 V to 20 V** gate drive supply range
- > **3.3 V, 5 V, and 15 V** logic compatible
- > **8.9 / 8.2 V** under-voltage lockout protection
- > Interlocked (IRS2007, IRS2008)
- > Floating channel designed for bootstrap operation
- > Logic operational for VS of **-8 V**
- > Tolerant to negative transient voltage, dV/dt immune
- > Matched propagation delays
- > Shutdown input turns off both channels (IRS2008)

Part Number	Config.	Prop. Delay ton/off typ. (ns)	Deadtime typ. (ns)	Control Inputs	Package
IRS2008	HB	680/150	520	IN, SD	DSO-8, MLPQ-14
IRS2007	HB	160/150	520	HIN, /LIN	
IRS2005	HS+LS	160/150		HIN, LIN	

*IRS2001 is not recommended for new designs, IRS2005 replaces IRS2001. IRS2008 can replace IRS2004. IRS2007 can replace IRS2003.

Sample Schematic



Available Resources

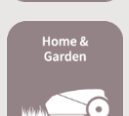
Datasheet: [IRS2005](#), [IRS2007](#), [IRS2008](#)

Simulation Models: Spice Model ([IRS2005](#), [IRS2007](#), [IRS2008](#)), IFX designer ([IRS2007](#))

Evaluation board: [EVAL-PS-IRS200X](#)



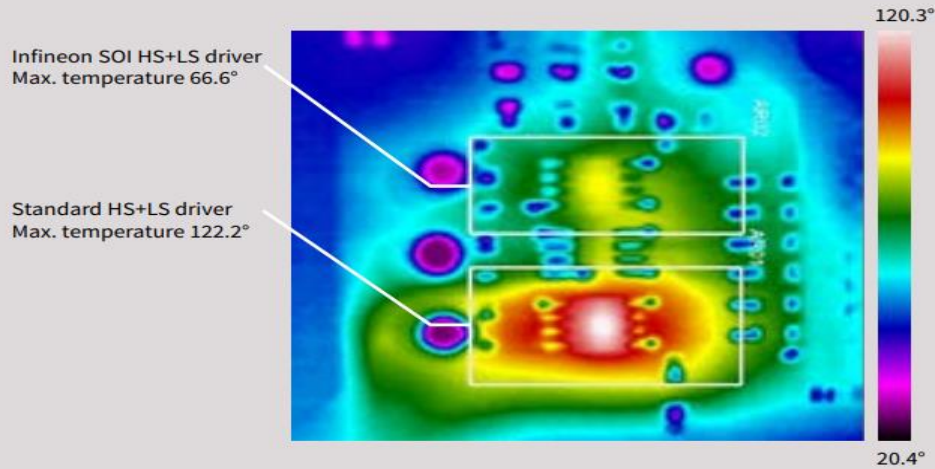
Typ. App.



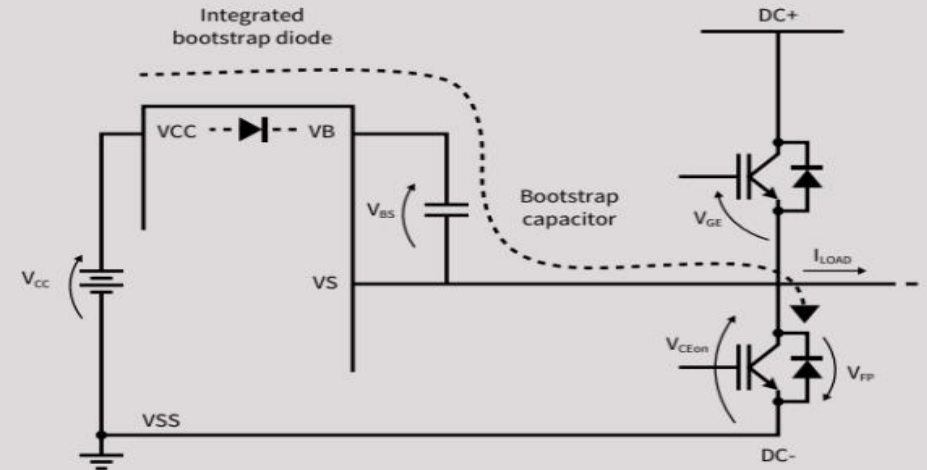
Infinion Silicon-On-Insulator (SOI) technology

Solution advantages

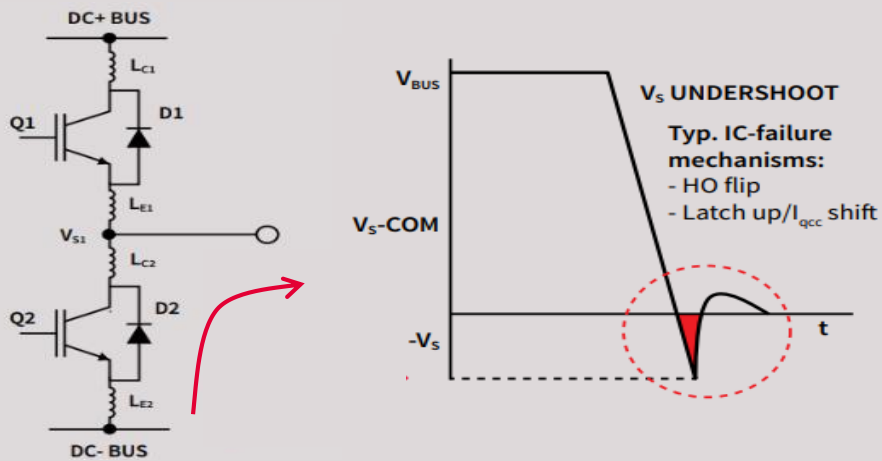
Low level-shift loss in high frequency application



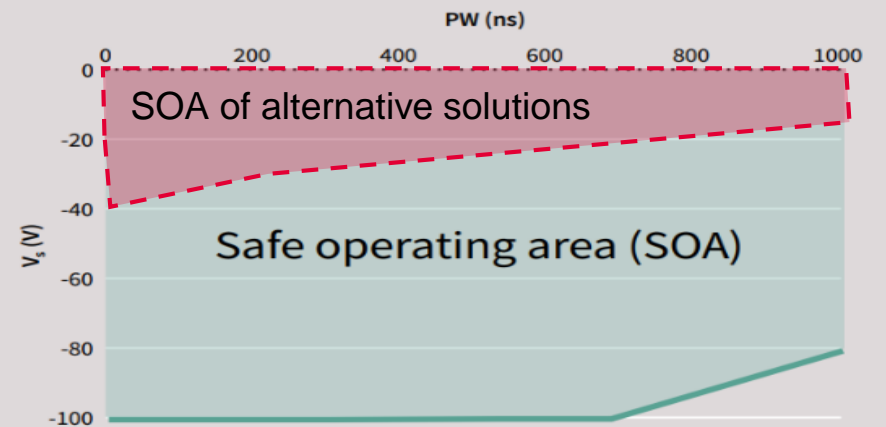
Integrated bootstrap diode (BSD)



Operation robustness of negative VS



Operation robustness of negative VS



**Infineon
SOI**

Infineon 650 V SOI half-bridge and high and low side level-shift gate driver family



2ED2106/8/9—New 650 V, 0.7 A driver family

2ED2181/2/3/4—New 650 V, 2.5 A driver family

- › Integrated bootstrap diode (BSD)
- › Tolerant to negative transient voltage up to 100 V
- › Reduced level shift losses for switching **frequencies above 100 kHz**
- › Superior latch-up immunity with SOI
- › For 650 V IGBT and MOSFET

2ED2106/8/9 & 2ED2181/2/3/4 - Released

- › 200 ns propagation delay, HB & HS+LS, DSO-8/-14
- › Air-Con fans/ Fridge / Motor Drive

2ED2101/3/4 & 2ED2110 – Fast Level Shift Family

- › **100 ns** propagation delay, HB & HS+LS, DSO-8/-16
- › Lighting / SMPS / Motor Drive



EiceDRIVER™ 1ED Compact (1ED-AF/1ED-MF)



Single-channel isolated driver with active Miller clamp or separate output in DSO-8 150 mil

Key Features

- › Single channel isolated gate driver with **up to 10 A** (no booster required)
- › **Active Miller Clamp or Separate outputs**
- › Galvanic functional isolation voltages up to **1200 V**
- › **40 V** absolute maximum output supply voltage (1ED-AF) for Bipolar power supply preventing inadvertent dV/dt turn-on
- › Exceptional CMTI robustness > **100 kV/μs**
- › Low propagation delay of **300 ns** or **125 ns**, suitable for fast switching application
- › **DSO-8 150 mil (4mm creepage)**
- › For high voltage IGBT, MOSFET, CoolSiC™ SiC MOSFET
- › **Evaluation board available:**

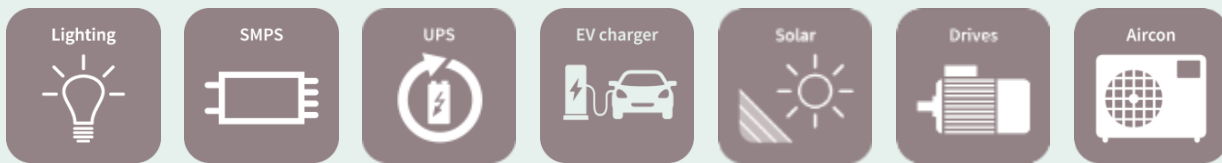
- › EVAL-1EDI60I12AF
- › EVAL-PS-E1BF12-SiC
- › EVAL_HB_PARALLELIGAN
- › EVAL_800W_PSU_3P_P7



ED-C
Compact

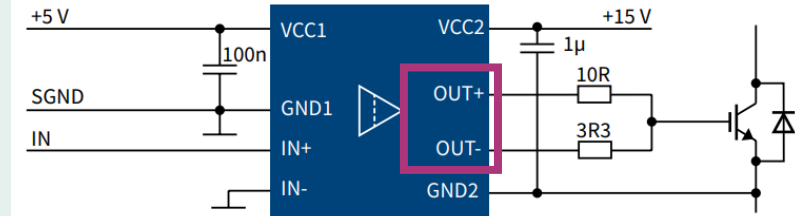
www.infineon.com/gdcompact

Typical Applications

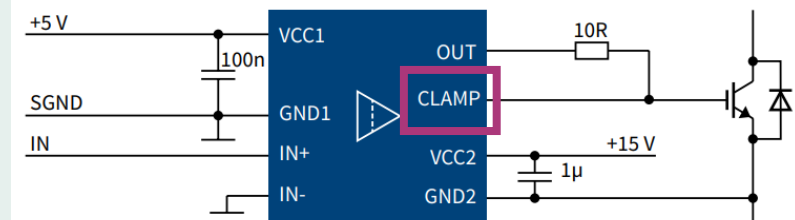


Sample schematic

Separate sink/source outputs



Active Miller clamp



IGBT

+SiC

	DSO-8 150 mil	1EDI60N12AF	1EDI60I12AF	1EDI20N12AF	1EDI30I12MF
Typ. Output current		±10 A	±10 A	±4 A	±6 A
Propagation delay		125 ns	300 ns	125 ns	300 ns
Input Filter		40 ns	240 ns	40 ns	240 ns
CMTI		100 kV/μs	100 kV/μs	100 kV/μs	100 kV/μs
Output supply voltage		40 V	40 V	40 V	20 V
Propagation delay matching		20 ns	20 ns	20 ns	20 ns
UVLO (on)		9 V	12 V	9 V	12 V

EiceDRIVER™ X3 Compact (1ED31xx) family

Single-channel isolated gate driver with active Miller clamp or separate output



New

Product highlights

- › Single channel isolated gate driver with **5.5 / 10 / 14 A** (no booster required)
- › Galvanic functional isolation voltages up to **2300 V**
- › **90 ns** propagation delay with **30 ns** input filter, **7 ns** propagation delay matching
- › **Active Miller Clamp or Separate outputs**
- › Exceptional CMTI robustness > **200 kV/μs**
- › **40 V absolute maximum** output supply voltage
- › Isolation capabilities & certification
 - › 1ED31xxMU12F: **UL 1577 certified** $V_{ISO}=3$ kV(rms)
 - › 1ED31xxMU12H: **UL 1577 certified** $V_{ISO}=5.7$ kV(rms)
 - › 1ED31xxMC12H: **UL 1577 & VDE 0884-11 certified** $V_{IORM}=1767$ V (planned)
- › DSO-8 150 mil (4 mm creepage) & 300 mil package (8 mm creepage)
- › **Evaluation board available:**
 - › EVAL-1ED3121MX12H; EVAL-1ED3122MX12H; EVAL-1ED3124MX12H

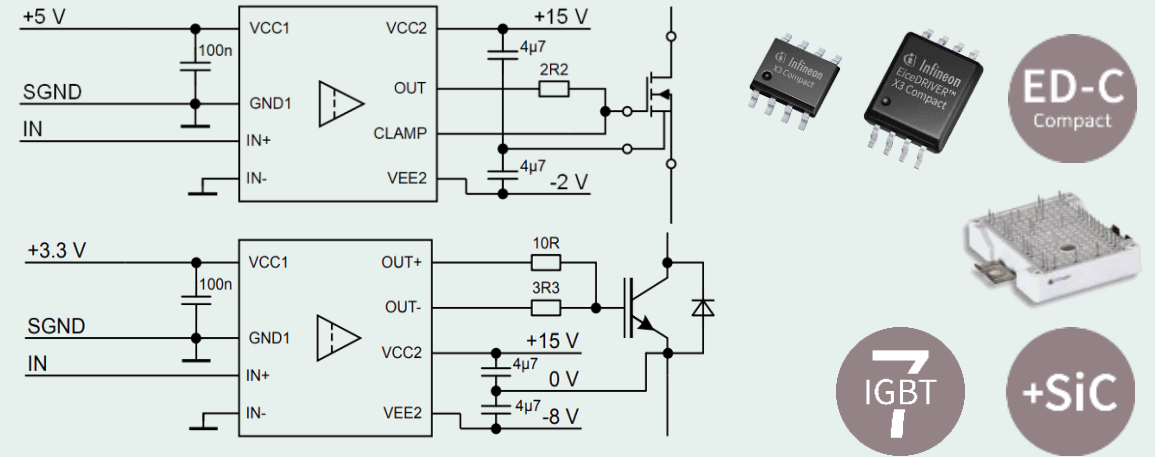


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Typical Applications



Sample schematic



DSO-8 150 mil		1ED3124MU12F		1ED3125MU12F
		1ED3123MU12H	1ED3120MU12H	
DSO-8 300 mil		1ED3131MU12H	1ED3121MU12H	1ED3122MU12H
Typ. Output current	±5.5 A	±14 A	±5.5 A	±10 A
Propagation delay	280 ns	90 ns	90 ns	90 ns
Input Filter	180 ns	30 ns	30 ns	30 ns
CMTI	200 kV/μs	200 kV/μs	200 kV/μs	200 kV/μs
Output supply voltage	40 V	40 V	40 V	40 V
Propagation delay matching	7 ns	7 ns	7 ns	7 ns
UVLO (on)	12 V	10 V or 12 V	10 V or 12 V	10 V or 12 V

EiceDRIVER™ Enhanced 1ED-F2/B2/FT/BT family

Single-channel isolated gate driver with active Miller clamp and DESAT

Key Features

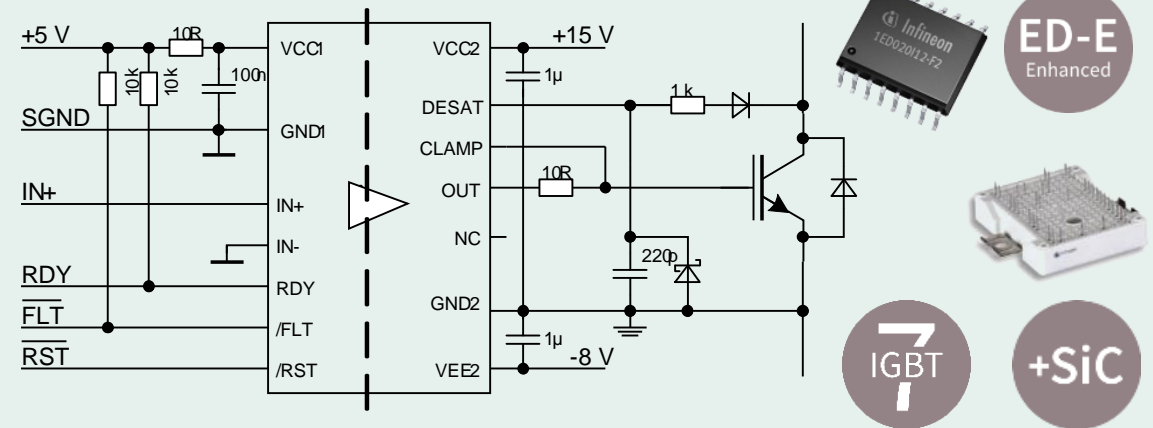
- › Single channel isolated gate driver IC for IGBT and SiC MOSFET
- › Galvanic isolation with coreless transformer up to **1200 V**
- › **2 A** typical rail-to-rail output current
- › Exceptional CMTI robustness > **100 kV/μs**
- › **DESAT, Miller clamp**, Short circuit clamping, Active shut-down, FLT & RDY
- › **195/190 ns** Max. propagation delay (1ED-F2/B2)
- › **Two level turn off**, 2 μs Max. propagation delay (1ED-BT/FT only)
- › **28 V** absolute maximum output supply voltage
- › 1ED-B2/BT Isolation capabilities & certification:
 - UL 1577 with $V_{ISO} = 3750 \text{ V (rms)}$ for 1 min
 - VDE 0884-10 for $V_{IORM}=1420 \text{ V}$, $V_{IOTM}=6000 \text{ V}$ (standard expired, while testing methodology remain unchanged)
- › DSO-16 300 mil wide body package with **8 mm** creepage

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Typical Applications



Sample Schematic



Value Proposition

- › Immunity against negative transient voltages, no latch up
- › Optimal controllability of application with dedicated UVLO
- › Reduced external components enables simple PCB layout and faster design-in
- › **Evaluation board available:**
 - EVAL-1ED020112-B2
 - EVAL-1ED020112-BT
 - 2ED250E12-F
 - 6ED100E12-F2
 - 2ED100E12-F2



EiceDRIVER™ Enhanced 2ED020112-F2 (2ED-F2)

Dual-channel isolated gate driver with active Miller clamp and DESAT

Key Features

- > **Dual channel** isolated gate driver IC for IGBT and SiC MOSFET
- > Galvanic isolation with coreless transformer up to **1200 V**
- > **2 A** typical rail-to-rail output current
- > **170 ns / 165 ns** propagation delay
- > Exceptional CMTI robustness > **50 kV/μs**
- > **DESAT, Miller clamp**, Short circuit clamping, Active shut-down, FLT & RDY
- > **28 V** absolute maximum output supply voltage
- > **11 V / 12 V** under-voltage lockout
- > Small footprint in **DSO-36 300 mil** package with **8 mm** creepage
- > Evaluation board available:
 - EVAL-2ED020112-F2

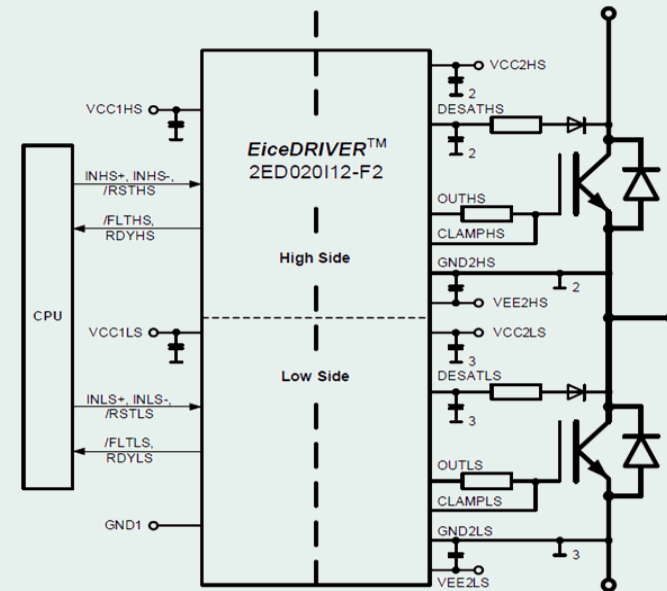


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Typical Applications



Sample Schematic



ED-E
Enhanced



7
IGBT

+SiC

Value Proposition

- > Galvanic Insulation
- > Integrated protection features such as DESAT and active Miller clamp
- > Suitable for operation at high ambient temperature

DSO-36



EiceDRIVER™ Enhanced 2ED020I12-FI & 2ED020I06-FI (2ED-FI)

Half-bridge isolated gate driver (isolated only on high side)



Key Features

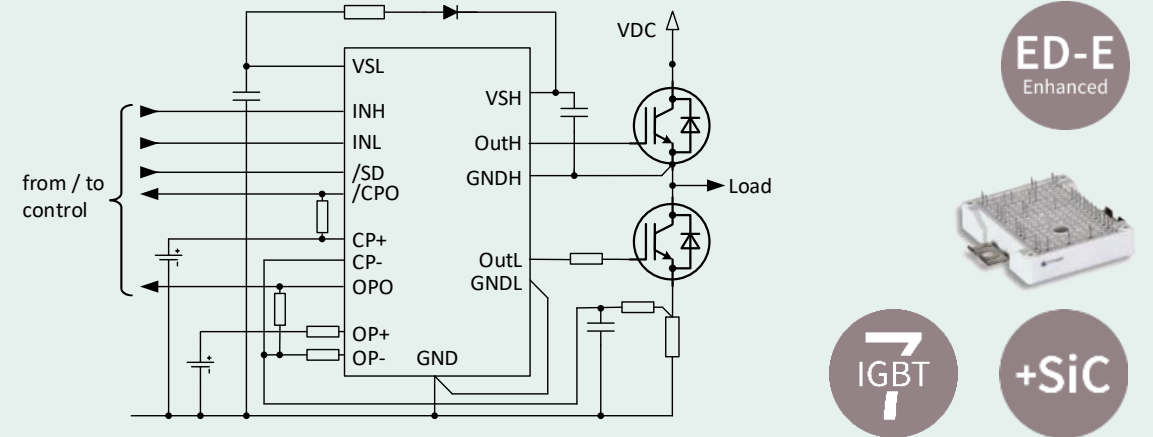
- › Galvanic isolation based on coreless transformer on the high side, **half bridge** isolated gate driver IC
- › Drive up to **1200 V IGBT** and n channel power **MOSFET** (2ED020I12-FI)
- › **Interlock** (shoot through protection)
- › Power supply operating range from **14 V to 18 V**
- › Gate drive currents of **+1 A / -2 A**
- › Dedicated **Shutdown** input
- › Matched propagation delay for both channels (typ. 85ns propagation delay / ± 25 ns propagation delay mismatch)
- › High dV/dt immunity
- › Low power consumption
- › General purpose **operational amplifier**
- › General purpose **comparator**
- › For High Power Constant Current Power Supply
- › 600 V version also available: 2ED020I06-FI

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Typical Applications



Sample Schematic



Value Proposition

- › Best **cost performance ratio** product in EiceDRIVER™ Enhanced family
- › General purpose operational amplifier and the comparator for **current measurement and OCP** reduce system cost by up to 0.15€ per half bridge
- › Reduced external components enables a simpler PCB layout, faster design-in, and improved reliability



DSO-18

6ED2230S12T 3-Phase, 1200V SOI Gate Driver

Key Features

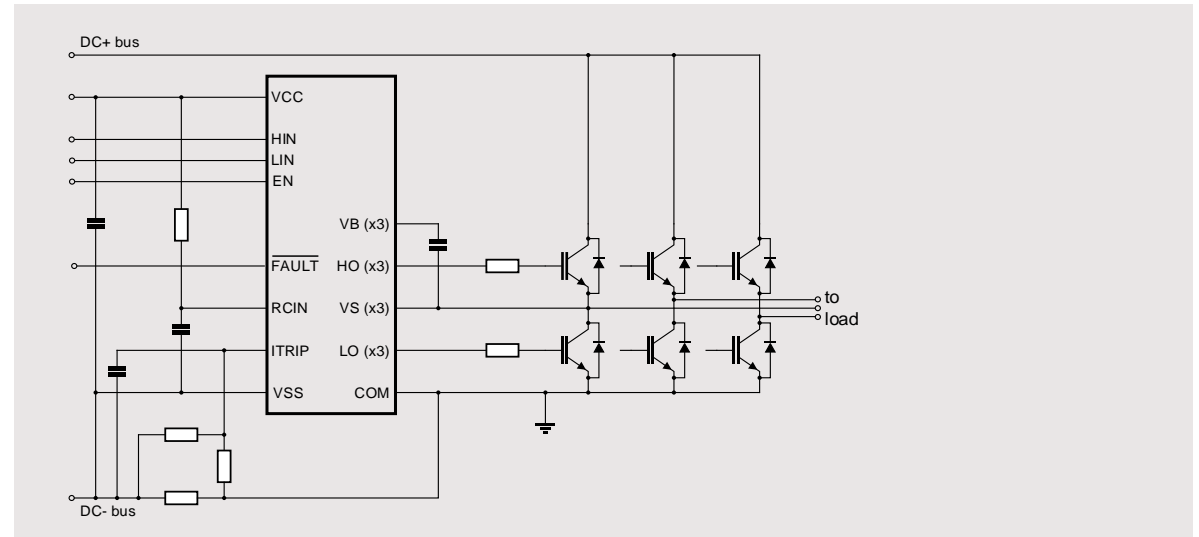
- › 6ED2230S12T (1200 V Infineon SOI Technology)
- › **Integrated, Ultra fast, low $R_{DS(ON)}$ bootstrap diode**
- › Integrated 360ns dead-time
- › Output current: I_{O+} 350mA, I_{O-} 650mA
- › Independent Under-voltage lockout for V_{CC} and V_{BS}
- › **25 V V_{CC} maximum voltage supply**
- › 3.3V, 5V, 15V input logic compatible
- › Best in class minus VS performance
 - › **-100 V with repetitive 700 ns pulses**
- › SOIC-28 package (with 4 pins removed for high clearance)
- › Over current protection (**ITRIP +/-5% reference**)
- › **Less than 1 us output shutdown for OCP events**
- › Fault reporting, automatic Fault clear and Enable function on the same pin (**RFE**)
- › 2kV HBM ESD

I_{O+} (typ) [mA]	Ton/off (typ) [ns]	DT (typ) [ns]	Tr/f (typ) [ns]	Input Filter (Typ) (ns)	V_{CC}/V_{BS} UVLO typ.
350/650	600	360	40	300	10.4-11.4 / 9.4-10.4

Typical Applications



Sample Schematic



Performance and Value

- › Integrated, fast, and low $R_{DS(ON)}$ Bootstrap Diode
 - › Simplified lower-cost driver for 1200V IGBTs
- › Industry leading minus VS robustness
 - › Increased reliability and noise immunity
- › Over-current protection with +/-5% reference
- › Independent UVLO for V_{CC} and V_{BS}
- › Matched propagation delay
- › Easy to use for fast time to market



Infineon gate driver success story

Induction heating (IH) multi-stove oven



- › **Application:** IH multi-stove oven (3.5 kW)
- › **Customer:** world-wide home appliance customer
- › **Products:**
 - **Gate Driver:** 2ED21824S06J
 - 650 V, 2.5 A, half bridge driver
 - **Switch:** IKW50N60H3
- › **Competition:** Toshiba + AOS
- › **WHY we are successful:**
 - Infineon's advantage when fighting with **Opto-coupler** solution;
 - **Longer lifetime & reliability**
 - **Accurate current sensing and sampling, smaller t_{ON} / t_{OFF}**
 - **Total solution** with Driver + IGBTs.
 - **System know-how** and direct engagement.

Infineon gate driver success story

Residential air conditioners (RAC)



- > **Application:** Boost-PFC in residential aircon
- > **Customer:** World-wide market-leaders for residential air conditioners in China and India with MPs from CY20Q4
- > **Product:**
 - **Gate Driver:** 1ED44175N01B
 - 25 V, 2.6 A, single low side driver with OCP
 - **Switch:**
 - PFC IGBT: e.g. TRENCHSTOP™ 5 IGBT
 - PFC Diode: e.g. RAPID™ 1 Diode
 - Controller & CIPOS™ IPM: e.g. IM564-X6D
- > **WHY we are successful:**
 - Cost effective and space saving
 - **NEW** 2.6 A 1-ch low-side driver with **integrated OCP, fault, and enable**
 - Fits perfectly with CIPOS™ IPM with PFC
 - Strong technical support and know-how of low-side gate drive circuits from **20 years of experience**
 - **Excellent business continuity** support for sudden high volume ramp-up

Infineon gate driver success story

200 W compressor inverter for refrigerators



- › **Application:** 200 W motor control inverter for linear compressor
- › **Customer:** world-wide refrigerator compressor market-leader (Americas)
- › **Products:**
 - **Gate Driver:** 2ED2304S06F derivative
 - 650 V, 0.7 A, half bridge driver
 - **Switch:** IGBT
- › **WHY we are successful:**
 - **Infineon SOI** technology
 - Reduced Level shift losses for higher efficiency
 - **Integrated Boot Strap Diode** for reduce size / BOM cost
 - **High negative VS** rating for improved reliability / robustness
 - Integrated, **advanced input filter** for stable operation
 - Technical workshops, application support, fast turn-around



Part of your life. Part of tomorrow.

