Intelligent Power Switches (IPS)

Contents

Technology overview

ST offers a series of industrial intelligent power switches (IPS) for high-side, low-side, and push-pull configurations. An IPS integrates a control section (logic interface, drivers, protection and diagnostics) with a power stage.

IPS are based on the consolidated bipolar, multipower BCD and VIPower®M0 technologies.

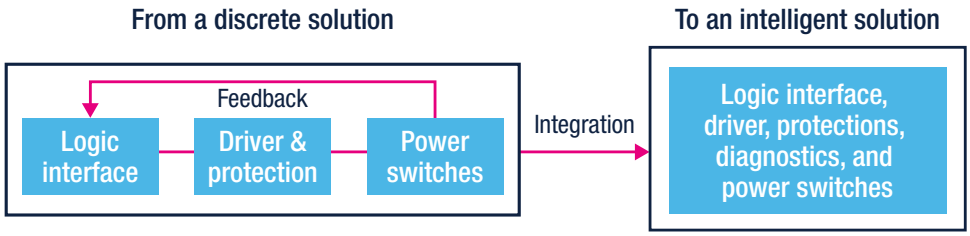
New devices are designed and developed using the latest versions of these technologies, ensuring state-of-the-art solutions for a wide range of applications.

BENEFITS

- Increased system reliability
- Reduced part count
- Space saving
- Built-in protection
- System approach

FEATURES

- Galvanic isolation on chip
- Supply voltage up to 65 V
- High inductive load demagnetization energy
- Very low ON resistance
- Short-circuit and overcurrent protection
- Undervoltage protection and overvoltage shutdown
- Loss of ground protection
- Thermal protection: junction and case
- Per-channel diagnostics
- Open load detection
- Compliance with IEC 61131-2 standards
- Smart management of capacitive loads



SOLUTIONS FOR SAFE AND SMART FACTORY AUTOMATION

In smart factories, an effective safety infrastructure is critical for operators, especially regarding electrical equipment, robots and high power loads. ST embeds safety features in “SIL-ready” products to meet the safety requirements of intended applications.

With an operating supply voltage up to 60 V, embedded protections (such as overload and overtemperature), and extended diagnostics, the IPS160H/IPS161H ($R_{dson(max)}$ = 120 mΩ) and IPS1025H/IPS1025HQ/IPS1025H-32/IPS1025HQ-32 ($R_{dson(max)}$ = 25 mΩ) single-channel, high-side switches offer robustness and features to help the design of safe systems.

In addition, the IPS160HF, IPS161HF, IPS1025HF, and IPS1025HFQ offer fast startup times supporting (< 100 us) to cover application architectures based on multiple switches on high-side branches and to manage appropriate test pulses.

With the recently introduced family of single high-side switches, ST is ready for current and future safety control solutions that minimize power dissipation in safety applications addressing industrial loads from 0.5 to over 12 A.

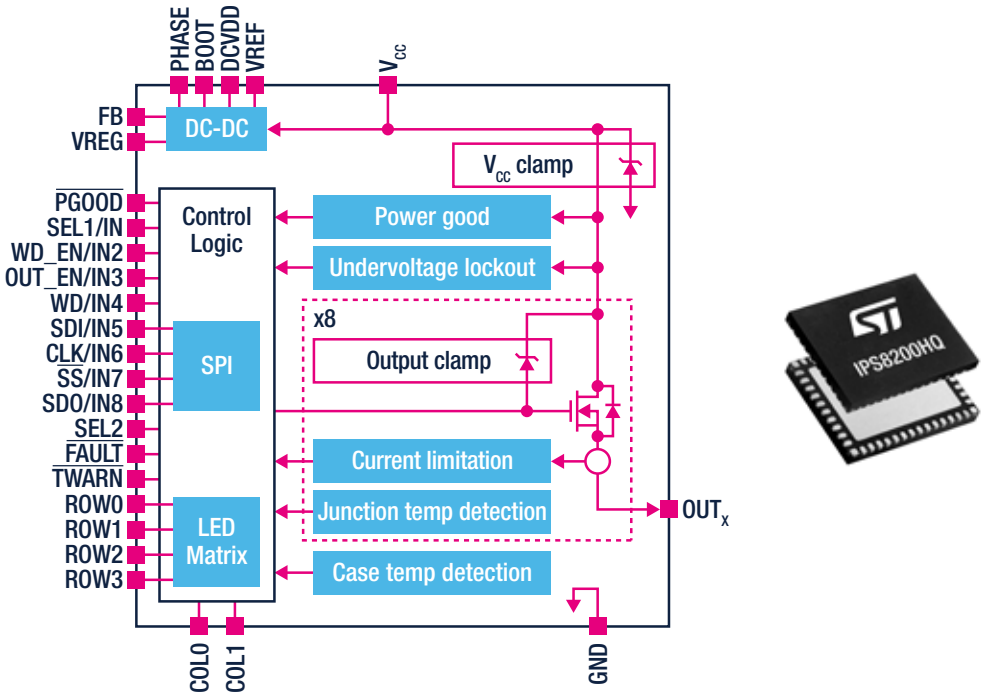


Figure 1: Typical intelligent power switch architecture (IPS8200HQ)

International standards

IPS devices are designed to safely drive every kind of load in low-voltage applications (up to 60 V), handling data coming in and out of the microcontroller by means of status/input signals. IPS devices are designed to comply with the following international standards for EMC and PLC equipment:

- IEC 61000-4-4 (electrical fast transient/burst)
- IEC 61000-4-2 (ESD, immunity test contact/air)
- IEC 61000-4-5 (surge test immunity requirements)
- IEC 61000-4-6 (current injection test)
- IEC 61131-2 (programmable controller, equipment requirements and tests)

ISO8200 and ISO808 isolated IPS devices comply with the following international standards for isolation characteristics and tests:

- UL 1577 (isolation voltage)
- UL 508 (safety for industrial control equipment)
- I/O Safety limits according to VDE V 0884-11 and IEC 60747-17
- IEC 61000-4-8 (power frequency magnetic field immunity test)

Packages

The high thermal capacitance of power packages such as PowerSO-36, PowerSSO-36, PowerSSO-24, PowerSSO-12 and HTSSOP20 allows the absorption of high-energy pulses when an inductive load is driven without any external freewheeling diode.

Technological advances have led to smaller IPS devices, housed in tiny, flat, no-lead plastic packages (CSP, DFN, and QFN)) addressing size-critical applications such as slim PLC modules.

Product portfolio

Output stage	Part number (RPN)	Output channels	Output current per channel (I_{NOM}) (A)	$R_{DS(ON)}$ (Ω) (Typ.)	Supply voltage (V) AMR max.	Operating supply voltage range (V) min.	Note	Package	Evaluation board	Application note/ User manual
High-side	TDE1747	1	< 0.5		60	8	Adjustable I_{OUT}	SO-14		
	TDE3247	1	< 0.5		36	8	Adjustable I_{OUT}	SO-14		
	IPS161H	1	0.5	0.06	65	8	Open load diag	PowerSSO-12	STEVAL-IFP034V1	DB3177, AN4998
	IPS161HF*	1	0.5	0.06	65	8	Open load diag	PowerSSO-12	X-NUCLEO-OUT10A1	UM2716, DB4176
									STEVAL-FSM01M1	DF5014, UM3175
	L6375S	1	0.5	0.4	50	8		SO-8		
	L6377	1	0.5	0.4	50	8	Adjustable I_{OUT}	SO-14		
	TDE1897R	1	0.5	0.4	50	18		SO-20		AN453
	TDE1898C	1	0.5	0.4	50	18		SO-20		AN453
	TDE1798DP	1	0.5		50	6		mini-DIP8		
	IPS1025H	1	2	0.012	65	8	Smart load management	PowerSSO-24	X-NUCLEO-OUT05A1	DB4211, UM2865, AN5840
									STEVAL-SILKT01	DF5133, UM3263
								QFN48L 8X6	STEVAL-IFP045V1	DB4786, UM3057, AN5840
	IPS1025HF*	1	2	0.012	65	8	Smart load management	PowerSSO-24	X-NUCLEO-OUT15A1	DB4730, UM3036, AN5840
								QFN48L 8X6	STEVAL-IFP040V1	DF4775, UM3052, AN5840
	VN540SP-E	1	2	0.05	45	10		PowerSO-10		
	IPS160H	1	2	0.06	65	8	Open load diag	PowerSSO-12	STEVAL-IFP028V1	DB2872, AN4781
	IPS160HF*	1	2	0.06	65	8	Open load diag	PowerSSO-12	X-NUCLEO-OUT08A1	DB4175, UM2715
									STEVAL-FSM01M1	DF5014, UM3175
									STEVAL-SILPLC01	DF4645
	VN751PT	1	2	0.06	45	5.5		PPAK	STEVAL-IFP005V2	DB0862
	VN751S	1	2	0.06	45	5.5		SO-8		
	L6370	1	2	0.1	50	9.5	Open load diag, adjustable I_{OUT}	PowerSO-20		
	IPS1025H-32	1	5	0.012	65	8	Smart load management	PowerSSO-24	X-NUCLEO-OUT06A1	AN5840, DB4212, UM2866
								QFN48L 8X6	STEVAL-IFP046V1	DF4787, UM3058
	VNI2140J	2	1	0.08	45	9	Open load diag	PowerSSO-12	STEVAL-IFP010V3	AN2985, DB1515
	IPS2050H	2	2	0.025	65	8	Smart load management	PowerSSO-24	X-NUCLEO-OUT03A1	DB4205, UM2727
								QFN48L 8X6	STEVAL-IFP043V1	DB4770, UM3049
									P-NUCLEO-IOD3A1	DB5218
	IPS2050H-32	2	5	0.025	65	8	Smart load management	PowerSSO-24	X-NUCLEO-OUT04A1	DB4206, UM2728
									P-NUCLEO-IOD04A1	DB5109
								QFN48L 8X6	STEVAL-IFP044V1	DB4771, UM3050
	VNQ860-E	4	< 0.5	0.27	41	5.5		SO-20		
	VNQ860SP-E	4	< 0.5	0.27	41	5.5		PowerSO-10™		
	VNI4140K	4	0.5	0.08	41	10.5	Per channel diag	PowerSSO-24		AN2684, AN2795
	IPS4140HQ***	4	0.5	0.08	41	10.5	Per channel diag	QFN48L 8X6	X-NUCLEO-DO40A1***	DB5346, UM3411
	VN330SP-E	4	0.5	0.2	45	10		PowerSO-10		
	VN340SP-E	4	0.5	0.2	45	10	Per channel diag	PowerSO-10		AN2208
	L6376	4	0.5	0.64	50	9.5		PowerSO-20		
	VNI4140K-32	4	1	0.08	41	10.5	Per channel diag	PowerSSO-24	STEVAL-IFP019V1	AN4009, DB1498
	IPS4140HQ-1***	4	1	0.08	41	10.5	Per channel diag	QFN48L 8X6	X-NUCLEO-DO41A1***	DB5347, UM3412
	VN340SP-33-E	4	1	0.2	45	10	Per channel diag	PowerSO-10		AN2208
	VNI8200XP	8	0.5	0.11	45	10.5	LED matrix driver, DCDC, SPI, Per channel diag	PowerSSO-36	STEVAL-IFP022V1	AN4284, UM1918
									X-NUCLEO-PLC01A1	DB2622, UM1918
	VN808-E	8	0.5	0.15	45	10.5		PowerSO-36		AN2208
	VN808CM-E	8	0.5	0.16	45	10.5	Logic level Inputs	PowerSO-36	STEVAL-IFP001V1	AN2443, DB0319
	IPS8160HQ	8	0.5	0.16	45	10.5	Parallel interface	QFN48L 8X6	X-NUCLEO-OUT09A1	DB4738, UM3509, AN6132
	IPS8200HQ	8	0.5	0.11	45	10.5	LED matrix driver, DCDC, SPI, Per channel diag	QFN48L 8X6	X-NUCLEO-OUT16A1	DB5104, UM3246
	IPS8160HQ-1	8	1	0.16	45	10.5	Parallel interface	QFN48L 8X6	X-NUCLEO-OUT19A1	DB4747, UM3074, AN6132
	VNI8200XP-32	8	1	0.11	45	10.5	LED matrix driver, DCDC, SPI, Per channel diag	PowerSSO-36	STEVAL-IFP032V1	DB2828, AN4862
	IPS8200HQ-1	8	1	0.11	45	10.5	LED matrix driver, DCDC, SPI, Per channel diag	QFN48L 8X6	X-NUCLEO-OUT17A1	DB5105, UM3247
	VN808-32-E	8	1	0.15	45	10.5		PowerSO-36		AN2208
	VN808CM-32-E	8	1	0.16	45	10.5	VCC level Inputs	PowerSO-36		AN2443

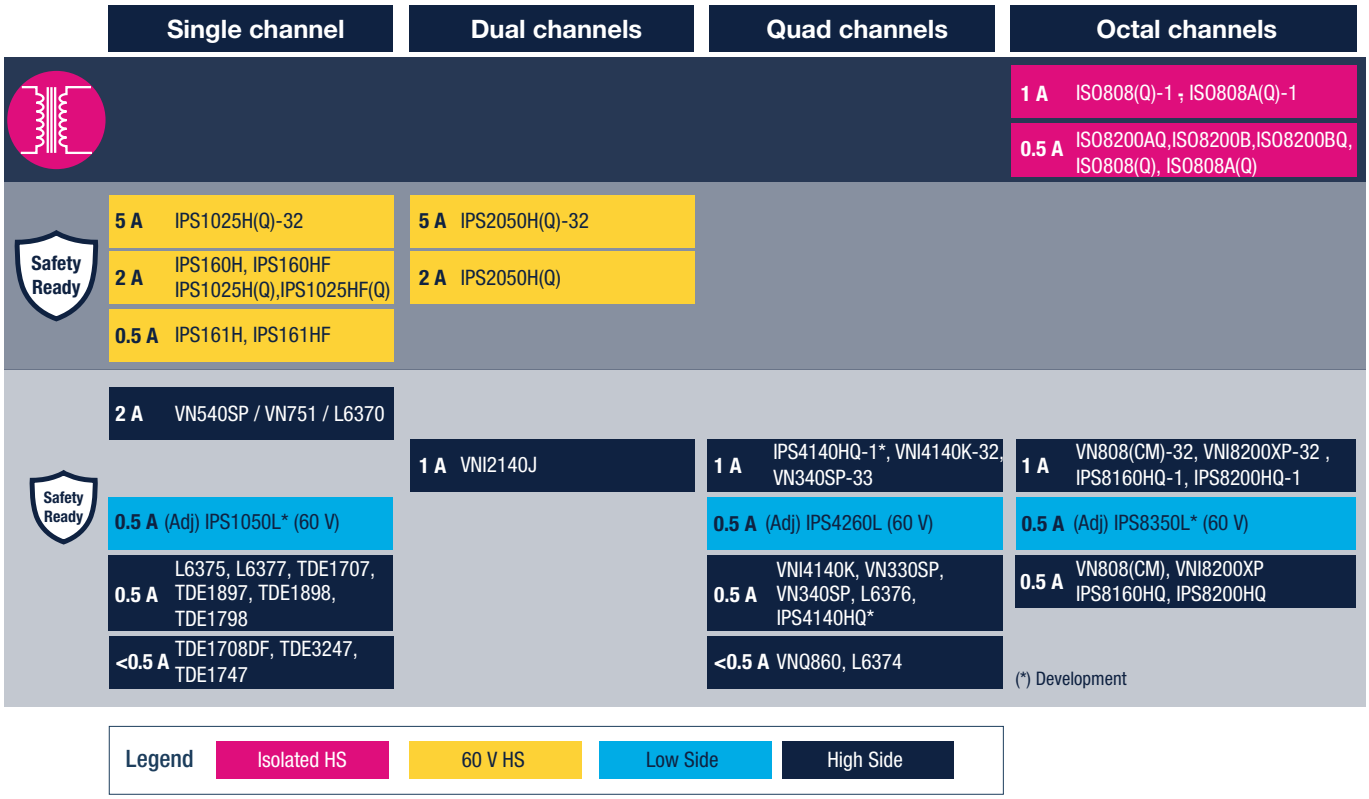
Output stage	Part number (RPN)	Output channels	Output current per channel (I_{NOM}) (A)	$R_{DS(ON)}$ (Ω) (Typ.)	Supply voltage (V) AMR max.	Operating supply voltage range (V) min.	Note	Package	Evaluation board	Application note/ User manual
Isolated-high-side	ISO8200AQ	8	0.5	0.12	45	10.5	Isolated, SPI, Per channel diag	QFN 9x11	X-NUCLEO-OUT02A1	DB3767, UM2507
									STEVAL-PLC001V1	DB4542, UM2933
	ISO8200B	8	0.5	0.12	45	10.5	Isolated, Parallel interface	PowerSO-36	STEVAL-IFP015V2	DB2037, AN4373
	ISO8200BQ	8	0.5	0.12	45	10.5	Isolated, Parallel interface	QFN 9x11	STEVAL-IFP033V1	DB3287, AN4373
									X-NUCLEO-OUT01A2	DB5030, UM3184
	ISO808	8	0.5	0.125	45	9	Isolated, SPI	POWER-SO36	X-NUCLEO-OUT12A1	DB4834, UM3080
								QFN 9 X 11	STEVAL-IFP042V1	DB4947, UM3136
	ISO808A	8	0.5	0.125	45	9	Isolated, SPI	POWER-SO36	X-NUCLEO-OUT12A1	DB4834, UM3080
								QFN 9 X 11	STEVAL-IFP042V1	DB4947, UM3136
	ISO808-1	8	1	0.125	45	9	Isolated, Parallel interface	POWER-SO36	X-NUCLEO-OUT13A1	DB4835, UM3081
								QFN 9 X 11	STEVAL-IFP047V1	DB4951, UM3137
	ISO808A-1	8	1	0.125	45	9	Isolated, SPI	POWER-SO36	X-NUCLEO-OUT14A1	DB4836 UM3082
								QFN 9 X 11	STEVAL-IFP048V1	DB4953, UM3138
High / Low- side	TDE1708DFT**	1	< 0.5		50	6		DFN 8L 4x4	STEVAL-IFS006V2	AN2863, AN2813
	TDE1707**	1	0.5		50	6		SO-8		AN1213, AN495
Low-side	IPS4260L	4	0.5	0.26	55	8	Adjustable Iout, open load / Per channel diag & catch diode	HTSSOP-20	STEVAL-IFP029V1	DB3337, UM2297
									EVLIOL4LSV1	DB5300
									STEVAL-PLC001V1	DB4542, UM2933
									STEVAL-SILKT01	DB5133, UM3263
Push-pull	L6374	4	< 0.5	4	50	10.8	Push-pull line driver	SO-20		

Note: * Suitable for SIL applications requiring for interface type C (or D) Class 3

** The TDE1707 and TDE1708DFT are specific IPS developed to match all types of industrial detectors. They can be coupled with inductive, capacitive, ultra-sonic or optical detectors and can be used in high-side or in low-side driver configuration in 3-wire networks"

*** Available in Q4 2024

STMicroelectronics provides a minimum longevity commitment of 15 years for these devices, ensuring a stable supply of critical components for an extended period.



IPS EVALUATION BOARDS REDUCE YOUR TIME TO MARKET

Octal channel galvanically isolated IPS

ISO808 family

Parallel version				SPI version			
PowerSO-36		QFN		PowerSO-36		QFN	
ISO808	ISO808-1	ISO808Q	ISO808Q-1	ISO808A	ISO808A-1	ISO808AQ	ISO808AQ-1
							
X-NUCLEO-OUT11A1	X-NUCLEO-OUT13A1	STEVAL-IFP041V1	STEVAL-IFP047V1	X-NUCLEO-OUT12A1	X-NUCLEO-OUT14A1	STEVAL-IFP042V1	STEVAL-IFP048V1

ISO8200 family

ISO8200B	ISO8200BQ	ISO8200AQ
		
STEVAL-IFP015V2	X-NUCLEO-OUT01A2	X-NUCLEO-OUT02A1

IPS 60 V suitable for safety integrity level systems

Single channel				Dual channel	
PowerSSO-12		PowerSSO-12		PowerSSO-24	
IPS160H	IPS160HF	IPS161H	IPS161HF	IPS2050H	IPS2050H-32
					
STEVAL-IFP028V1	X-NUCLEO-OUT08A1	STEVAL-IFP034V1	X-NUCLEO-OUT10A1	X-NUCLEO-OUT03A1	X-NUCLEO-OUT04A1

Single channel						Dual channel	
PowerSSO-24			QFN48L 8X6			QFN48L 8X6	
IPS1025H	IPS1025H-32	IPS1025HF	IPS1025HQ	IPS1025HQ-32	IPS1025HFQ	IPS2050HQ	IPS2050HQ-32
							
X-NUCLEO-OUT05A1	X-NUCLEO-OUT06A1	X-NUCLEO-OUT15A1	STEVAL-IFP045V1	STEVAL-IFP046V1	STEVAL-IFP040V1	STEVAL-IFP043V1	STEVAL-IFP044V1

Compact IPS devices and high-end features

Single channel	Quad channel		Octal channel		
PPAK	HTSSOP-20	PowerSSO-24	PowerSSO-36		
VN751PT	IPS4260L*	VNI4140K-32	VNI8200XP	VNI8200XP	VNI8200XP-32
					
STEVAL-IFP005V2	STEVAL-IFP029V1	STEVAL-IFP019V1	STEVAL-IFP022V1	X-NUCLEO- PLC01A1	STEVAL-IFP032V1

Dual channel	Quad channel		Octal channel			
PowerSSO-12	QFN48L 8X6		QFN48L 8X6			
VNI2140J			IPS8160HQ	IPS8160HQ-1	IPS8200HQ	IPS8200HQ-1
						
STEVAL-IFP010V3	X-NUCLEO-DO40A1	X-NUCLEO-DO401A1	X-NUCLEO-OUT19A1	X-NUCLEO-OUT16A1	X-NUCLEO-OUT16A1	X-NUCLEO-OUT17A1

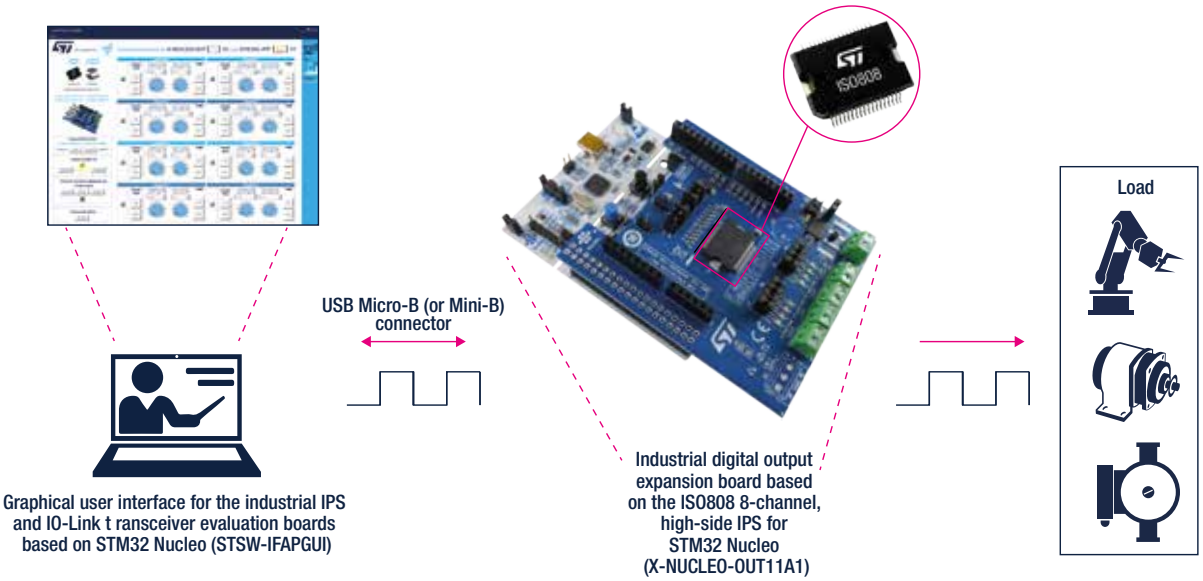
Note *: Low side architecture

IPS Reference design boards

IPS161HF, IPS160HF	IPS1025H, IPS4260L	IPS4260L, I6364Q	ISO808	ISO8200AQ	IPS8160HQ, L6360
					
STEVAL-FSM01M1	STEVAL-SILKT01	EVLIOL4LSV1	STEVAL-SILPLC01	STEVAL-PLC001V1	EVLETC8IOLMV1C**

Note **: Available in Q2 2025

BASIC EVALUATION BOARD SETUP



Transceiver ICs

Industrial transceiver ICs for IO-LINK and SIO mode

By using a state-of-the-art technology (MultiPower BCD) that allows the design of the logic part and robust LV power MOSFETs enabling high switching frequencies (> kHz) in the same chip, ST offers an efficient, compact and cost-effective solution to drive any 3-wire digital sensor. Modern sensors and actuators require:

- remote service
- standardization
- sensor functionality verification
- diagnostics
- monitoring

The L6360, L6362A and L6364 I/O industrial transceiver ICs meet all these requirements. These integrated circuits (ICs) provide the market with IO-LINK sensors and actuators that operate without the need for special cables. They feature an advanced solution that can be seamlessly integrated into existing systems, remaining neutral to any field bus while maintaining point-to-point communication.

Designed to comply with IO-LINK specifications and SIO mode requirements, these industrial transceiver ICs ensure robust electromagnetic immunity. This includes protection against burst/fast transients, electrostatic discharge (ESD) contact/air, surge pulses, and both RF emissions and conduction.

Industrial transceiver IC portfolio

Part number	Supply voltage (V)	V_{DD} (V)	Output current (A)	Imax linear reg. (mA)	Technology	Output channels	Input channels	Package
L6360 (Master)	18 to 32.5	3.3/5	0.5	65	MultiBCD	2	2	QFN 26L 3.5 x 5 mm
L6362A (Device)	7 to 36	3.3/5	0.22	10	MultiBCD	1	1	DFN 12L 3 x 3 mm
L6364Q (Device)	6 to 35	3.3/5	0.25/0.5*	50	MultiBCD	2	2	QFN 20L 4 x 4 mm
L6364W (Device)	6 to 35	3.3/5	0.25/0.5*	50	MultiBCD	2	2	CSP 19 2.5 x 2.5 mm

Note: * join mode

IO-Link evaluation boards

Part number	Order code	Description	Application note / User manual
L6360	STEVAL-IDP004V2	IO-Link master multi-port evaluation board based on L6360	AN5041
	STEVAL-IOM001V1	IO-Link master evaluation board based on L6360 equipped with ST morpho connectors for STM32 Nucleo	DB 3632, UM2430
	P-NUCLEO-IOM01M1	STM32 Nucleo pack for IO-Link master based on L6360 device with IO-Link v1.1 (PHY and stack)	DB3629, UM2421
L6362A	STEVAL-IDP003V1	IO-Link industrial modular sensor board based on L6362A	AN5041
	STEVAL-BFA001V2B	Multi-sensor predictive maintenance kit with L6362A and IO-Link stack v.1.1	UM2663
	STEVAL-IOD003V1	IO-Link (PHY) device evaluation board based on L6362A with Arduino connectors for STM32 Nucleo	DB3634, UM2424
	P-NUCLEO-IOD01A1	STM32 Nucleo pack for IO-Link device based on L6362A device fully compatible with IO-Link v1.1 (PHY and stack)	DB3635, UM2425
	P-NUCLEO-IOD3A1	STM32 Nucleo pack for IO-Link device applications based on L6362A transceiver, IPS2050H power switch and STM32L073RZ	DB5218
L6364Q	X-NUCLEO-IOD02A1	Expansion board IO-Link device based on L6364Q device fully compatible with IO-Link v1.1 (PHY and stack)	DB3883, UM2741
	P-NUCLEO-IOD02A1	STM32 Nucleo pack for IO-Link device applications based on L6364Q transceiver, industrial sensors and STM32L452RE MCU	DB3404, UM2782
	P-NUCLEO-IOD04A1	STM32 Nucleo pack for IO-Link device applications based on L6364Q transceiver, IPS2050H-32 power switch and STM32L073RZ	DB 5109, UM3240
L6364W	P-NUCLEO-IOD7A1	STM32 Nucleo pack for IO-Link device applications based on L6364Q transceiver, IPS4260LM power switch and STM32G071RB	DB5339
	STEVAL-IOD002V1	Dual channel IO-Link device expansion board based on L6364W for STM32 Nucleo	DB4387, UM2822
	STEVAL-IOD04KT1	Industrial smart sensor kit based on L6364W dual IO-Link device transceiver	DB4571, UM2942

IO-LINK COMMUNICATION MASTER / DEVICE TRANSCEIVER IC

Evaluation boards

QFN 26L 3.5 x 5

P-NUCLEO-IOM01M1 kit

EMBEDDED IO-LINK STACK BY TE Concept

STEVAL-IOM001V1

STEVAL-IDP004V2

EMBEDDED IO-LINK STACK BY TE Concept

DFN 12L 3 x 3

P-NUCLEO-IOD01A1 kit

EMBEDDED IO-LINK STACK BY TE Concept

STEVAL-IOD003V1

STEVAL-IDP003V1

STEVAL-BFA001V2B

EMBEDDED IO-LINK STACK BY TE Concept

QFN 20L 4 x 4

P-NUCLEO-IOD02A1 kit

ST Stack included !

X-NUCLEO-IOD02A1

ST Stack included !

P-NUCLEO-IOD04A1

CSP 19L 2.5 x 2.5

STEVAL-IOD002V1

STEVAL-IOD004KT1

ST Stack included !

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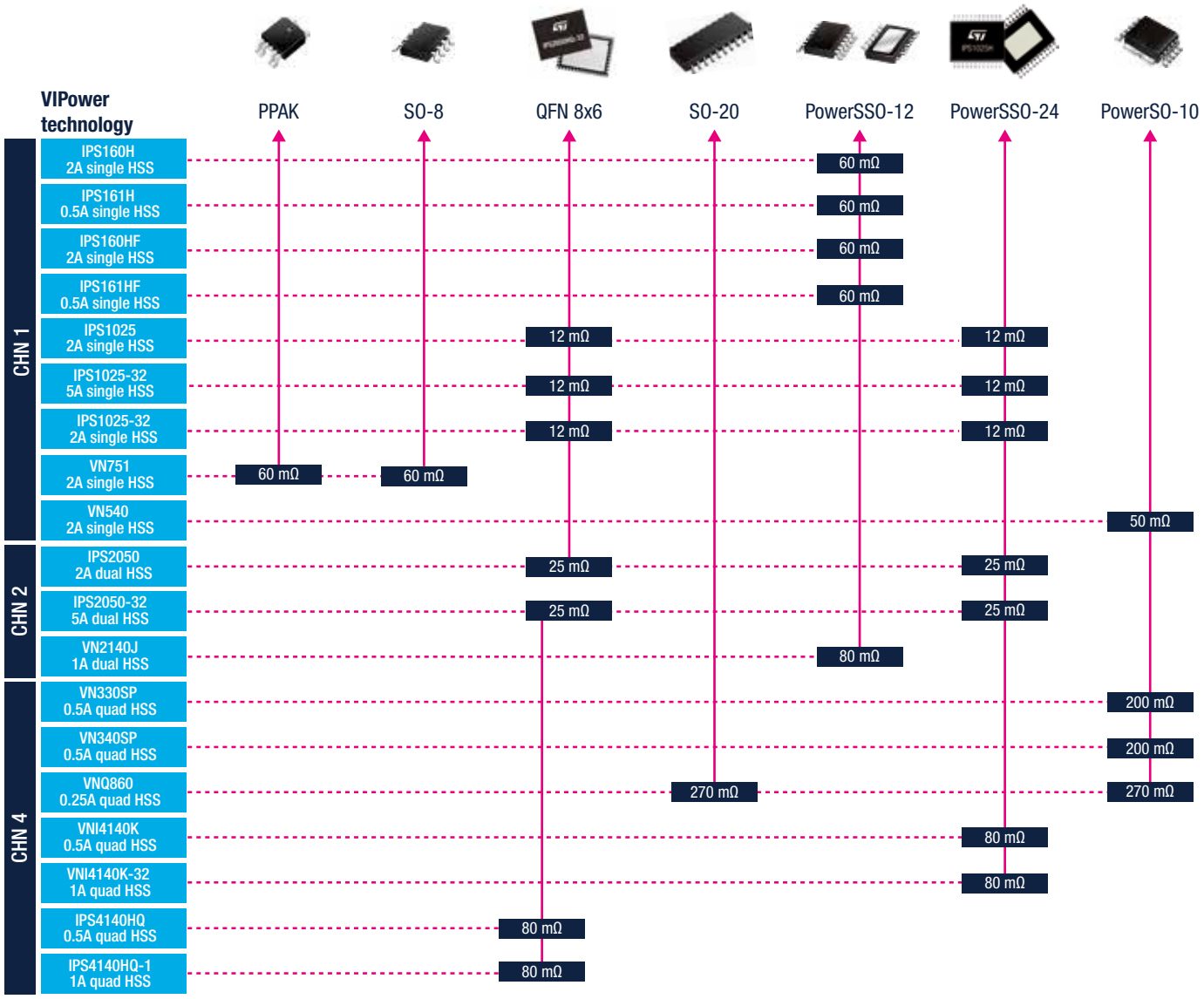
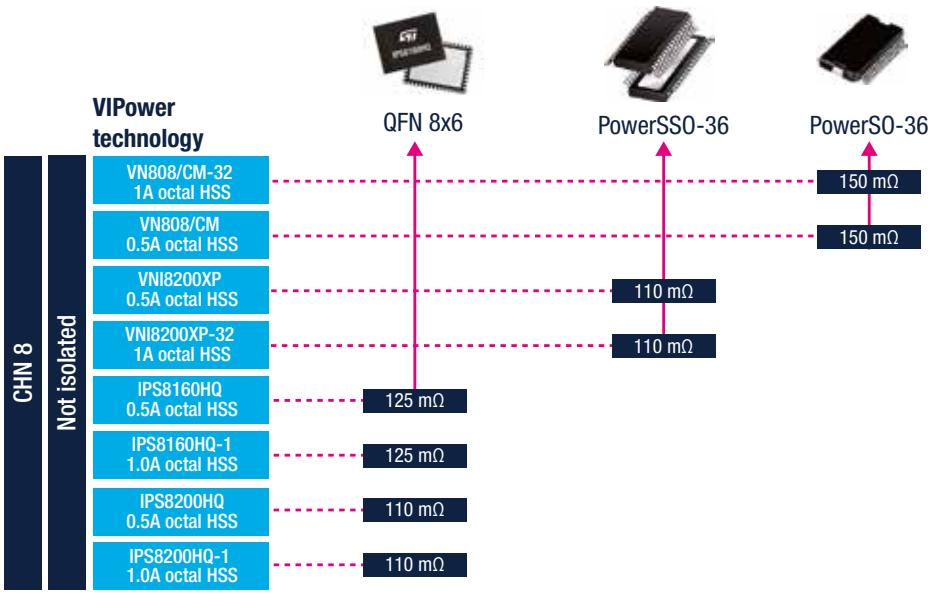
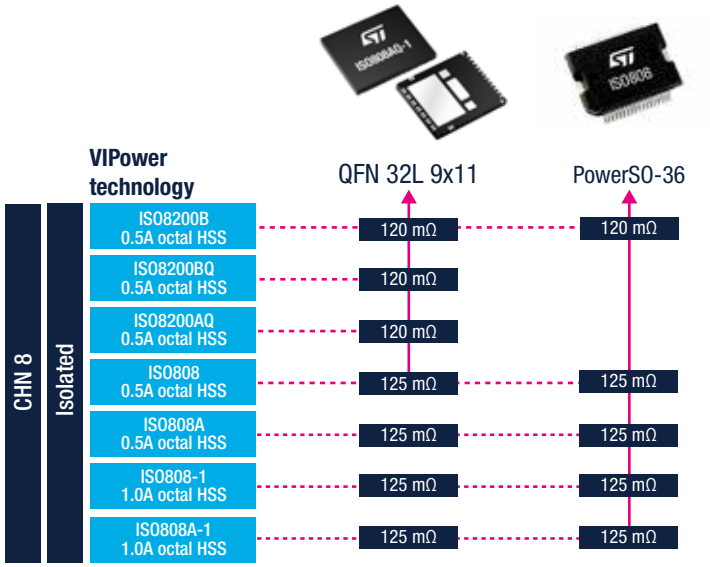
Power stage selection guide




VIPower technology
CHN 8
Not isolated
VN808/CM-32 1A octal HSS
VN808/CM 0.5A octal HSS
VNI8200XP 0.5A octal HSS
VNI8200XP-32 1A octal HSS
IPS8160HQ 0.5A octal HSS
IPS8160HQ-1 1.0A octal HSS
IPS8200HQ 0.5A octal HSS
IPS8200HQ-1 1.0A octal HSS
QFN 8x6
PowerSSO-36
PowerSO-36
150 mΩ
150 mΩ
110 mΩ
110 mΩ
125 mΩ
125 mΩ
110 mΩ
110 mΩ


VIPower technology
CHN 8
Isolated
ISO8200B 0.5A octal HSS
ISO8200BQ 0.5A octal HSS
ISO8200AQ 0.5A octal HSS
ISO808 0.5A octal HSS
ISO808A 0.5A octal HSS
ISO808-1 1.0A octal HSS
ISO808A-1 1.0A octal HSS
QFN 32L 9x11
PowerSO-36
120 mΩ
120 mΩ
120 mΩ
125 mΩ
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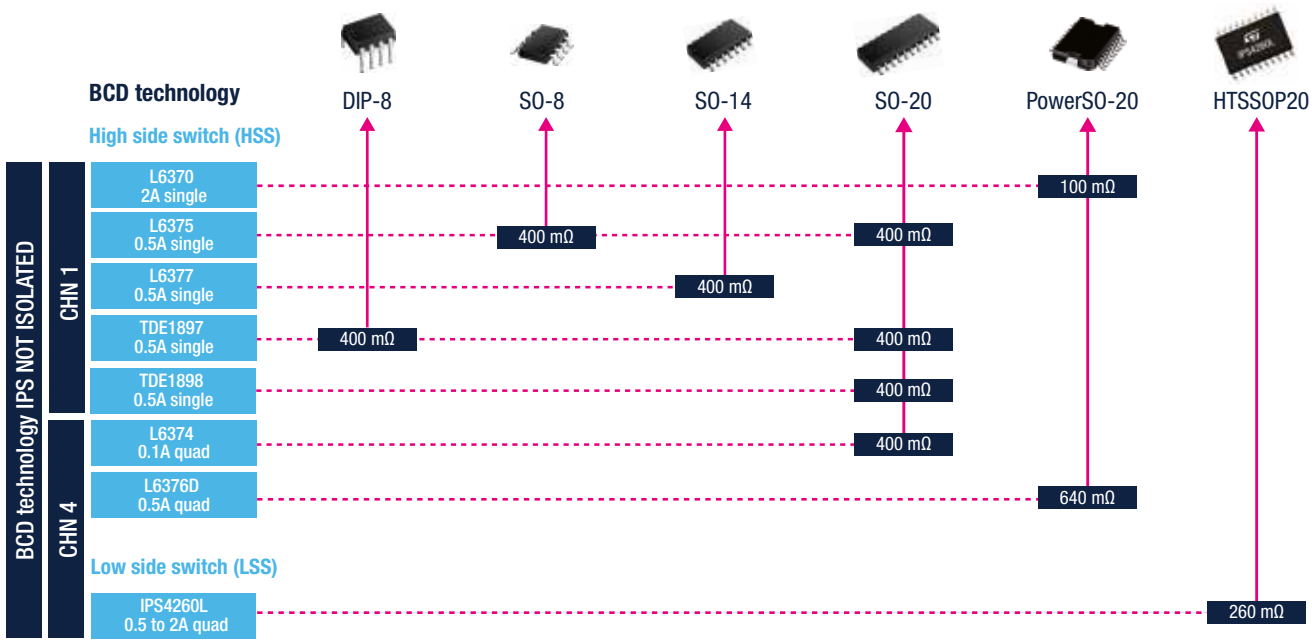
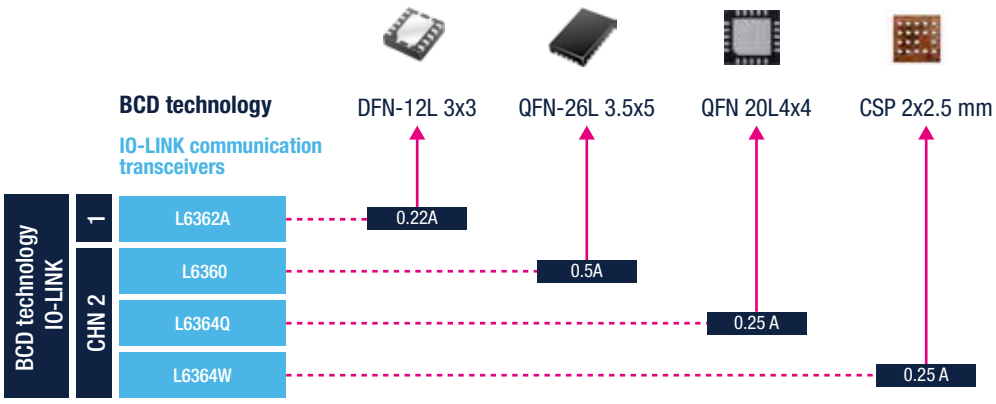
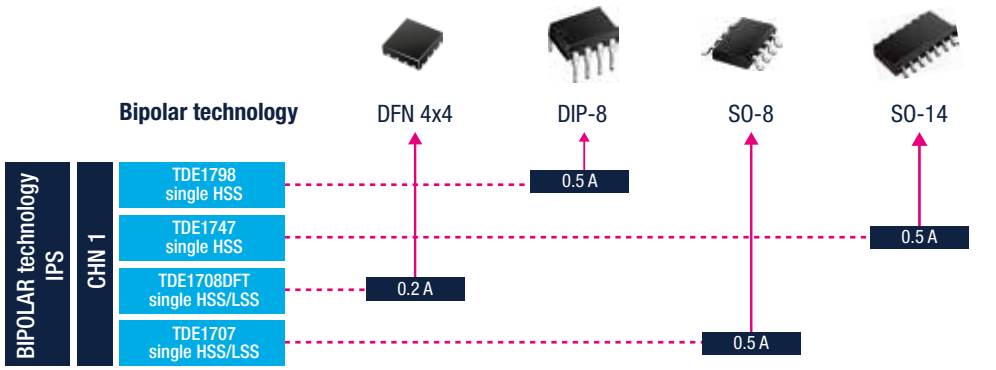

BCD technology
High side switch (HSS)
DIP-8
SO-8
SO-14
SO-20
PowerSO-20
HTSSOP20
BCD technology IPS NOT ISOLATED
CHN 1
CHN 4
L6370 2A single
L6375 0.5A single
L6377 0.5A single
TDE1897 0.5A single
TDE1898 0.5A single
L6374 0.1A quad
L6376D 0.5A quad
400 mΩ
400 mΩ
400 mΩ
400 mΩ
400 mΩ
400 mΩ
100 mΩ
640 mΩ
Low side switch (LSS)
IPS4260L 0.5 to 2A quad
260 mΩ


BCD technology
IO-LINK communication transceivers
DFN-12L 3x3
QFN-26L 3.5x5
QFN 20L4x4
CSP 2x2.5 mm
BCD technology IO-LINK
1
CHN 2
L6362A
L6360
L6364Q
L6364W
0.22A
0.5A
0.25 A
0.25 A


Bipolar technology
DFN 4x4
DIP-8
SO-8
SO-14
BIPOLAR technology IPS
CHN 1
TDE1798 single HSS
TDE1747 single HSS
TDE1708DFT single HSS/LSS
TDE1707 single HSS/LSS
0.5 A
0.5 A
0.2 A
0.5 A

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