iC-DP
HIGHSIDE SWITCH

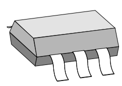
FEATURES

- 36 V highside switch/level shifter
- p-channel output driver without charge pump for short activation time
- Decoupling of input and output reference voltages (SOT23-6L) permits control by 5V logic
- 200 mA of output current
- Short-circuit protected
- Output with an active freewheeling circuit
- On-chip overtemperature protection with hysteresis
- 4 to 36 V input voltage range
- Input with hysteresis
- 3-pin configuration possible
- Wide temperature range of -40 to 120 °C

APPLICATIONS

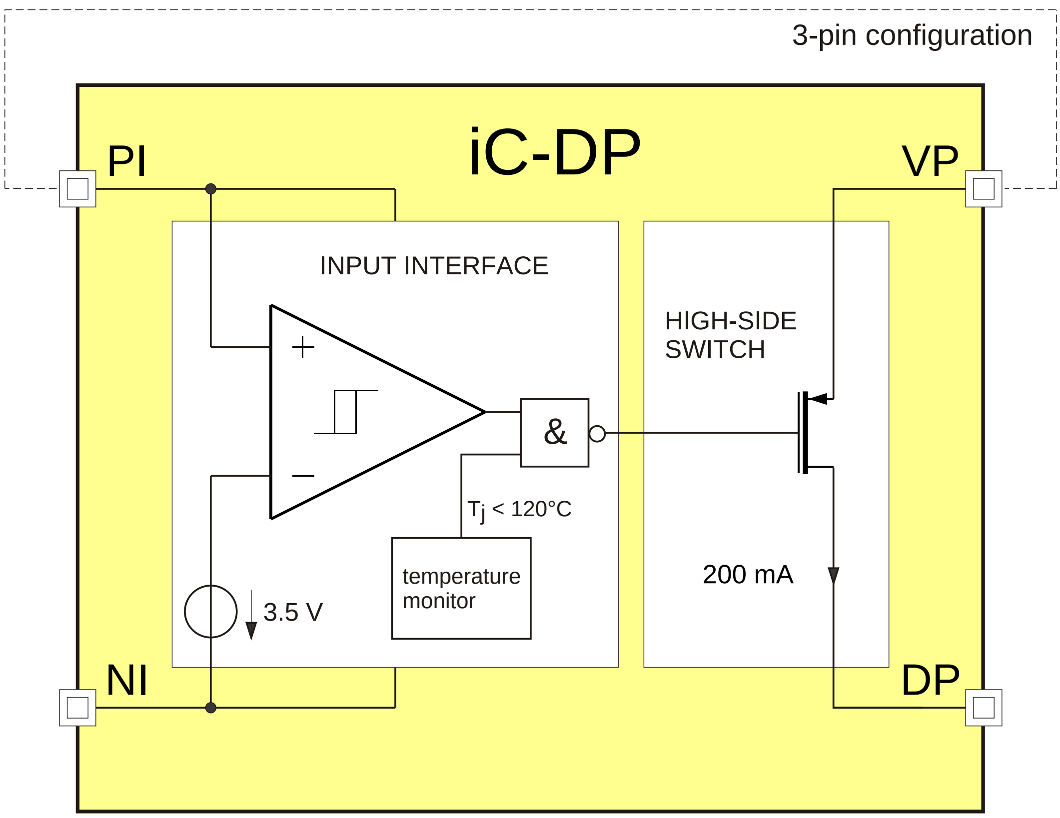
Highside switch for industrial applications, such as relays, inductive proximity sensors and light barriers

PACKAGES



SOT23-6L

BLOCK DIAGRAM



DESCRIPTION

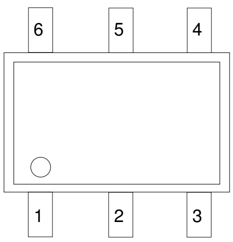
iC-DP is a monolithic highside switch for ohmic, inductive and capacitive loads.

Designed for a wide input voltage range of 4 to 36 V, it is capable of supplying a minimum output current of 200 mA. The output acts as a current source with a low saturation voltage; protection against short-circuiting is provided by the device shutting down with excessive temperature. The chip is activated when the input voltage threshold V(PI)-V(NI) of typically 3.5 V is exceeded.

When used as a 4-pin element, the input (PI, NI) and output (DP, VP) reference voltages are decoupled. The maximum permissive voltage difference between VP and PI is 36 V.

PACKAGES SOT23-6L (JEDEC)

PIN CONFIGURATION
SOT23-6L (JEDEC), 1.6 mm



PIN FUNCTIONS

No.	Name	Function
1	NI	Negative Input
2	PI	Positive Input
3	DP	Output
4	VP	Supply
5	n.c.	
6	n.c.	

ABSOLUTE MAXIMUM RATINGS

Beyond these values damage may occur; device operation is not guaranteed. Absolute Maximum Ratings are no Operating Conditions. Integrated circuits with system interfaces, e.g. via cable accessible pins (I/O pins, line drivers) are per principle endangered by injected interferences, which may compromise the function or durability. The robustness of the devices has to be verified by the user during system development with regards to applying standards and ensured where necessary by additional protective circuitry. By the manufacturer suggested protective circuitry is for information only and given without responsibility and has to be verified within the actual system with respect to actual interferences.

Item No.	Symbol	Parameter	Conditions	Min.	Max.	Unit
G001	V()	VP, PI Input Voltage with reference to NI	V()=V(VP)-V(NI) bzw. V()=V(PI)-V(NI)	-0.3	40	V
G002	V(DP)	DP Output Voltage with reference to VP	no free wheeling	-40	0.3	V
G003	I(DP)	DP Output Current		-300		mA
G004	I(PI)	PI Input Current			10	mA
G005	I(NI)	NI Input Current		-10		mA
G006	Vd()	ESD Susceptibility, all pins with reference to VP, DP	HBM, 100 pF discharged through 1.5 kΩ		2	kV
G007	Tj	Max. Junction Temperature		-40	150	°C
G008	Ts	Storage Temperature Range		-40	150	°C
G009	Eas	Inductive load switch-off energy dissipation	temperature monitor not active, Tj < Ton		5	mJ

THERMAL DATA

Operating Conditions: V(PI) = 4...36 V, unless otherwise stated

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
T01	Ta	Ambient Temperature Range		-40		120	°C

All voltages are referenced to ground (NI) unless otherwise stated.
All currents flowing into the device pins are positive; all currents flowing out of the device pins are negative.

ELECTRICAL CHARACTERISTICS

Operating Conditions: V(PI) = 0...36 V, Tj = -40...120 °C, unless otherwise stated

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Total Device							
001	V()	VP, PI Supply Voltage	V()= V(VP)-V(NI) bzw. V()=V(PI)-V(NI)	4		36	V
002	I(PI)	PI Supply Current	No load; V(PI) - V(NI) > V(PI)on V(PI) - V(NI) < V(PI)off	 0 0		 1000 250	 µA µA
003	I(VP)	VP Supply Current	No load; V(PI) - V(NI) > V(PI)on V(PI) - V(NI) < V(PI)off	 80 0		 680 2000	 µA µA
004	I(NI)	NI Input Current	No load; V(PI) - V(NI) > V(PI)on V(PI) - V(NI) < V(PI)off	 -1000 -2000		 -130 0	 µA µA
005	Ilk(DP)	DP Output Leakage Current	V(PI) - V(NI) < V(PI)off, V(DP) = 0..V(VP)	-100		100	µA
006	Vc(DP)lo	DP Clamp Voltage low	Vc(DP)lo = V(DP) - V(VP), I(DP) = -10 mA	-70	-45	-40	V
007	Vc(DP)hi	DP Clamp Voltage high	Vc(DP)hi = V(DP) - V(VP), I(DP) = 10 mA	0.3		1	V
008	Vc()hi	PI, VP Clamp Voltage high	Vc()hi = V() - V(NI), I() = 4 mA	37	40		V
009	tpiohi	Activation Delay NI → DP	V(PI)on < V(PI) - V(NI) < 48 V, V(Rload) = 48 V, Rload = 360 Ω, I(DP) = 0 → -90 mA, |Input slew rate| > 10 V/µs	1		25	µs
010	tpiolo	Deactivation Delay NI → DP	V(PI) - V(NI) < V(PI)off, V(Rload) = 36 V, Rload = 360 Ω, I(DP) = -100 → -10 mA, |Input slew rate| > 10 V/µs	1		15	µs
Highside Output DP							
101	Vs(DP)	Output Saturation Voltage	DP = hi, with reference to VP I(DP) = -200 mA, I(DP) = -50 mA	 -800 -200			 mV mV
102	Isc(DP)	Output Short-Circuit Current	V(VP) - V(DP) = 1 V...VB, DP = hi Tj = -40 °C Tj = 27 °C Tj = 120 °C	 -800 	 -400 	 -200 -200 -200	 mA mA mA
103	SR(DP)on	Slew Rate, V(DP) → VP	V(PI) - V(NI) > V(PI)on, V(Rload) = 36 V, Rload = 360 Ω, V(VP) - V(DP) = 32.4 → 3.6 V		50		V/µs
104	SR(DP)off	Slew Rate, V(DP) → V(NI)	V(PI) - V(NI) < V(PI)off, V(Rload) = 36 V, Rload = 360 Ω, V(VP) - V(DP) = 3.6 → 32.4 V		20		V/µs
105	Vfw(DP)	Freewheeling Voltage	I(DP) = -200 mA, with reference to VP, including Zener noise voltage	-60	-45	-40	V
Temperature Monitor							
201	Toff	Thermal Shutdown Threshold		120		150	°C
202	Ton	Thermal Release Threshold	Decreasing temperature	110		135	°C
203	Thys	Thermal Shutdown Hysteresis	Thys = Toff - Ton		15		°C
Input Threshold							
301	V(PI)on	Power-On Threshold Voltage	V(PI) - V(NI)	2.7		4.1	V
302	V(PI)off	Power-Off Threshold Voltage	V(PI)-V(NI), decreasing voltage	2.3		3.7	V
303	V(PI)hys	Hysteresis	V(PI)hys = V(PI)on - V(PI)off	170	380	590	mV

ELECTRICAL CHARACTERISTIC: DIAGRAMS

Simulation Data
(current consumption without load; leakage currents not included)

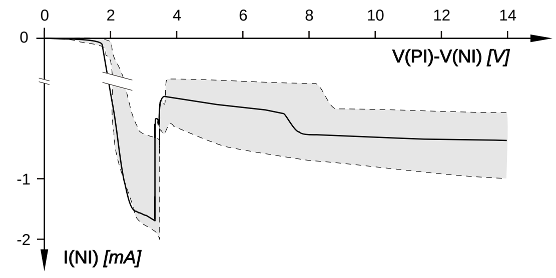


Figure 1: NI input current, no load

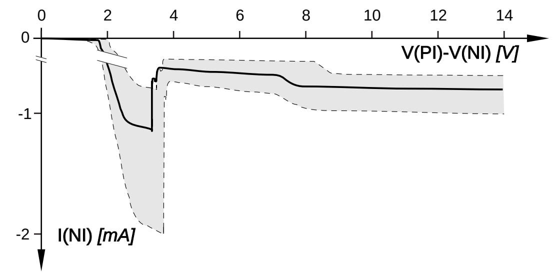


Figure 2: NI input current, I(DP) = -5 mA

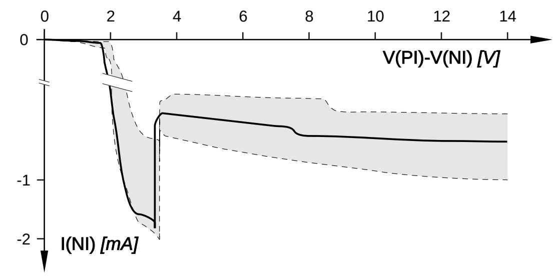


Figure 3: NI input current, I(DP) = -100 mA

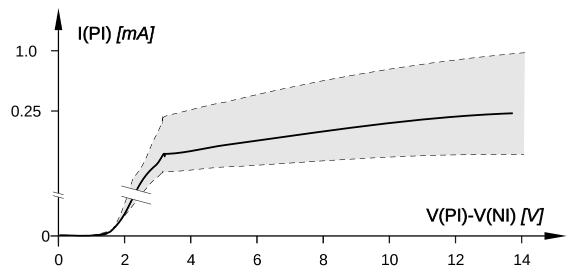


Figure 4: PI input current, load independent

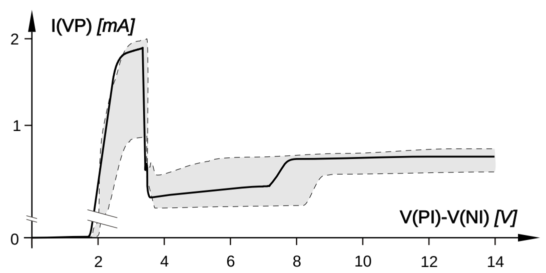


Figure 5: VP supply current, no load

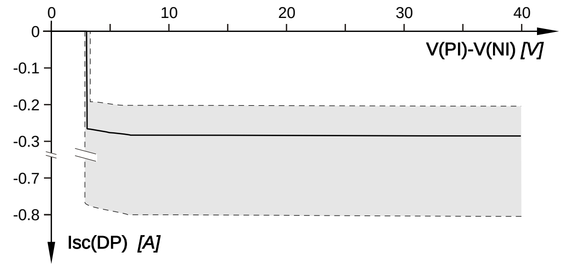


Figure 6: DP short-circuit output current

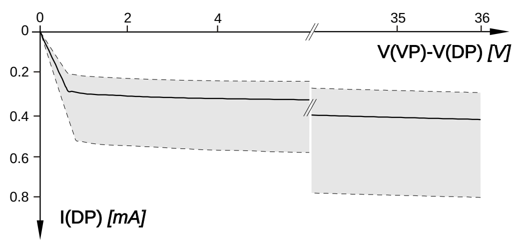


Figure 7: DP output characteristic

APPLICATION NOTES

Example application circuits for SOT23-6L package

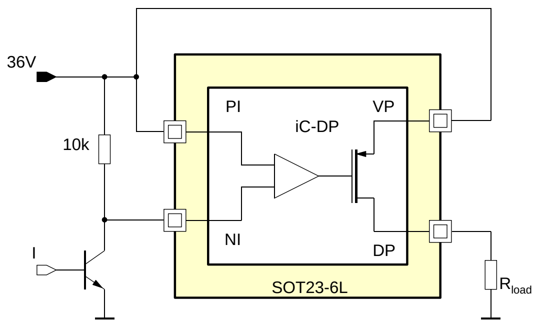


Figure 8: 36 V supply, NPN input control

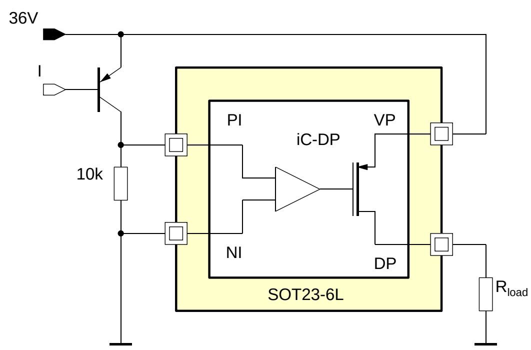


Figure 9: 36 V supply, PNP input control

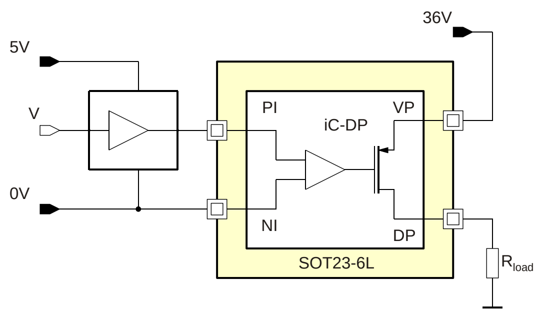


Figure 10: 5 V µC operating at 5 to 0 V input control, 36 V output supply

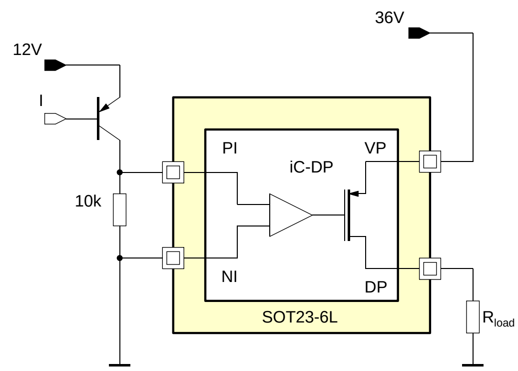


Figure 11: 12 V PNP input control, 36 V output supply

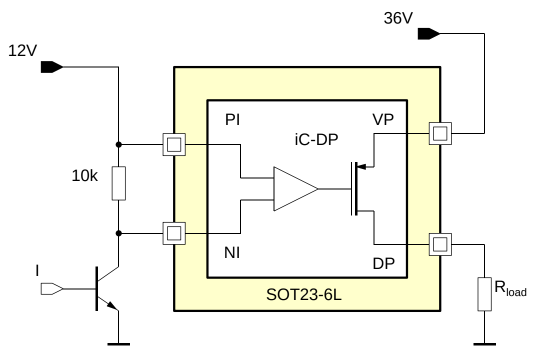


Figure 12: 12 V NPN input control, 36 V output supply

ORDERING INFORMATION

Type	Package	Order Designation
iC-DP	SOT23-6L (JEDEC)	iC-DP SOT23-6L

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