iC-DN
LOWSIDE SWITCH

preliminary

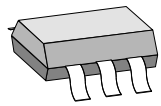
FEATURES

- 36 V lowside switch/level shifter
- 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 over-temperature 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
- Package option on request: (SC59-3L, CSP, DFN)

APPLICATIONS

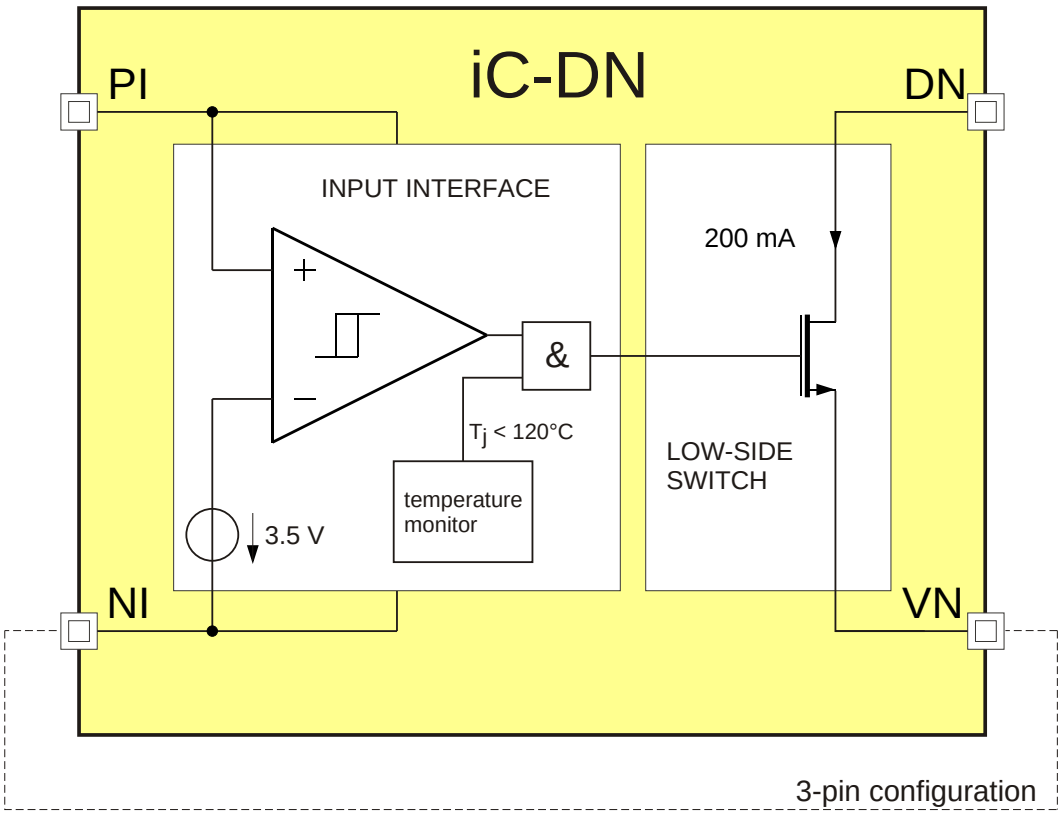
- Lowside switch for industrial applications, such as relays, inductive proximity sensors and light barriers

PACKAGES



SOT23-6L

BLOCK DIAGRAM



DESCRIPTION

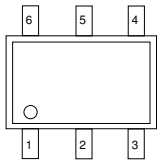
iC-DN is a monolithic lowside switch for ohmic, inductive and capacitive loads.

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.

With four leads, the input (PI, NI) and output (DN, VN) reference voltages are decoupled. The maximum permissive voltage difference between NI and VN is 36 V.

PACKAGES SOT23-6L (JEDEC)

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



PIN FUNCTIONS

No.	Name	Function
1	n.c.	
2	VN	Ground, Substrate
3	NI	Input Reference Voltage
4	n.c.	
5	PI	Positive Input, Supply
6	DN	Output

SC59-3L, DFN and CSP packages availabe on request.

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	Fig.	Min.	Max.	Unit
G001	V()	PI, NI Input Voltage with reference to VN	V() = V(PI) – V(VN) or V() = V(NI) – V(VN)		-0.3	40	V
G002	V(DN)	DN Output Voltage	no free wheeling		-0.3	40	V
G003	I(DN)	DN Output Current				300	mA
G004	I(PI)	PI Input Current				10	mA
G005	I(NI)	NI Input Current			-10		mA
G006	Vd()	ESD Susceptibility	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	Fig.	Min.	Typ.	Max.	Unit
T01	Ta	Ambient Temperature Range			-40		120	°C

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

ELECTRICAL CHARACTERISTICS

Operating Conditions: V(PI) = 4...36 V, Tj = -40...120 °C, unless otherwise stated

Item No.	Symbol	Parameter	Conditions	Tj °C	Fig.	Min.	Typ.	Max.	Unit
Total Device									
001	V(PI)	PI Supply Voltage with reference to VN				4		36	V
002	I(PI)	PI Supply Current	No load; (V(PI) - V(NI)) > V(PI)on (301) (V(PI) - V(NI)) < V(PI)off (302)			 250 0		 950 750	 µA µA
003	I(NI)	NI Input Current	No load; (V(PI) - V(NI)) > V(PI)on (V(PI) - V(NI)) < V(PI)off			 -500 -200		 20 0	 µA µA
004	I(VN)	VN Supply Current	No load; (V(PI) - V(NI)) > V(PI)on (V(PI) - V(NI)) < V(PI)off			 -650 -600		 -200 0	 µA µA
005	Ilk(DN)	DN Output Leakage Current	(V(PI) - V(NI)) < V(PI)off, V(DN) = 0...36 V			-100		100	µA
006	Vc(DN)hi	DN Clamp Voltage high	Vc(DN)hi = V(DN) - V(VN), I(DN) = 10 mA			40	45	60	V
007	Vc(DN)lo	DN Clamp Voltage low	Vc(DN)lo = V(DN) - V(VN), I(DN) = -10 mA			-1		-0.3	V
008	Vc()hi	PI, NI Clamp Voltage high	Vc()hi = V() - V(VN), I() = 4 mA			37	40		V
009	Vc()lo	PI, NI Clamp Voltage low	Vc()lo = V() - V(VN), I() = -4 mA			-1		-0.3	V
010	tpiohi	Activation Delay PI → DN	V(PI)on < (V(PI) - V(NI)) < 36 V, V(Rload) = 36 V, Rload = 360 Ω, I(DN) = 0 → 90 mA			0.6		6	µs
011	tpiolo	Deactivation Delay PI → DN	(V(PI) - V(NI)) < V(PI)off, V(Rload) = 36 V, Rload = 360 Ω, I(DN) = 100 → 10 mA			0.6		35	µs
Lowside Output DN									
101	Vs(DN)	Output Saturation Voltage	DN = lo; I(DN) = 200 mA I(DN) = 50 mA					 600 150	 mV mV
102	Isc(DN)	Output Short-Circuit Current	V(DN) = 1 V...VB, DN = lo			200	300	550	mA
103	SR(DN)on	Slew Rate V(DN) → 0	(V(PI) - V(NI)) > V(PI)on, V(Rload) = 36 V, Rload = 360 Ω, V(DN) = 32.4 → 3.6 V				65		V/µs
104	SR(DN)off	Slew Rate V(DN) → V(PI)	(V(PI) - V(NI)) < V(PI)off, V(Rload) = 36 V, Rload = 360 Ω, V(DN) = 3.6 → 32.4 V				20		V/µs
105	Vfw(DN)	Freewheeling Voltage	I(DN) = 200 mA			40	45	60	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		4.3	V
302	V(PI)off	Power-Off Threshold Voltage V(PI) – V(NI)	Decreasing voltage			1.7		3.9	V
303	V(PI)hys	Hysteresis	V(PI)hys = V(PI)on – V(PI)off			160	250	1200	mV

ELECTRICAL CHARACTERISTIC: DIAGRAMS

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

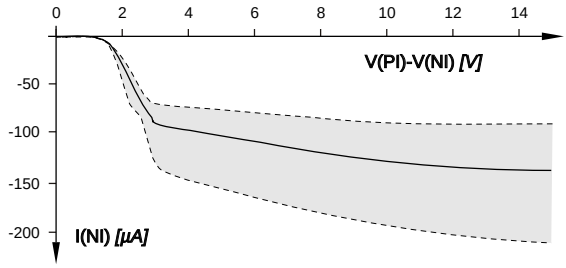


Figure 1: NI input current, load independent

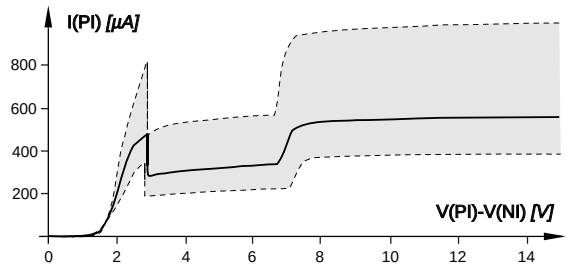


Figure 2: PI input current, no load

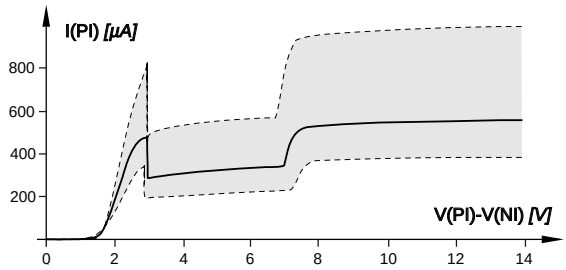


Figure 3: PI input current, I(DN) = 5 mA

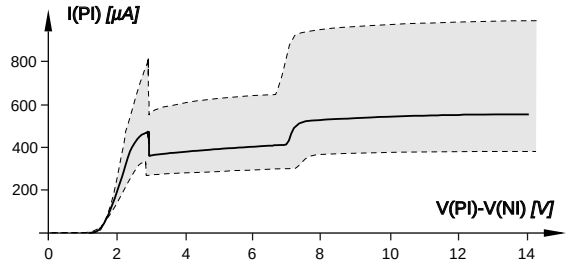


Figure 4: PI input current, I(DN) = 100 mA

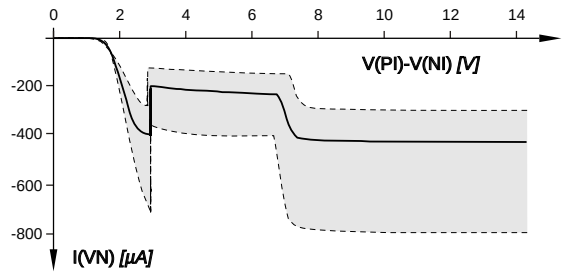


Figure 5: VN supply current

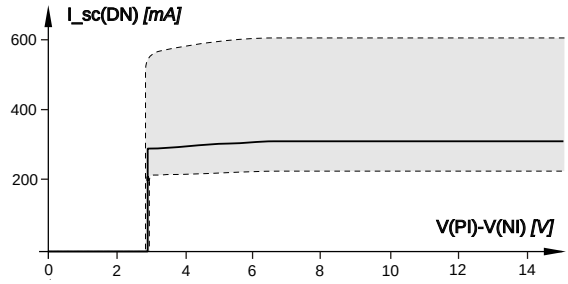


Figure 6: DN short-circuit output current

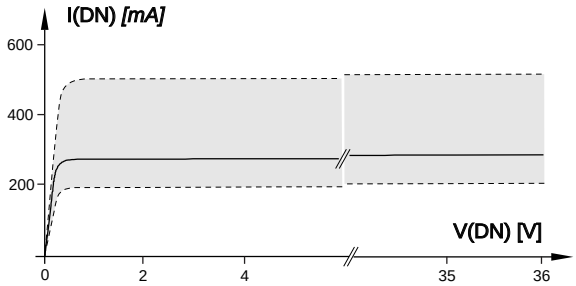


Figure 7: DN output characteristic

APPLICATION NOTES

Example application circuits

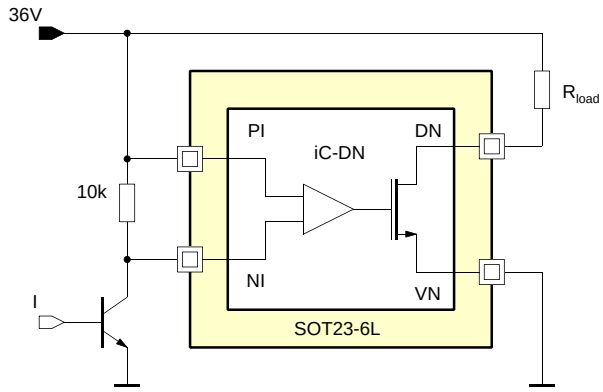


Figure 8: 36 V supply, NPN input control

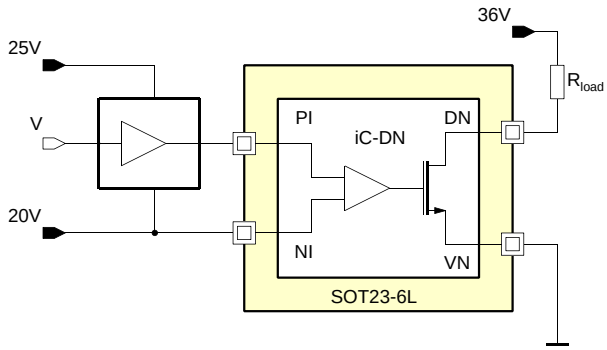


Figure 9: 5 V µC operation at 20 to 25 V input control, 36 V output supply

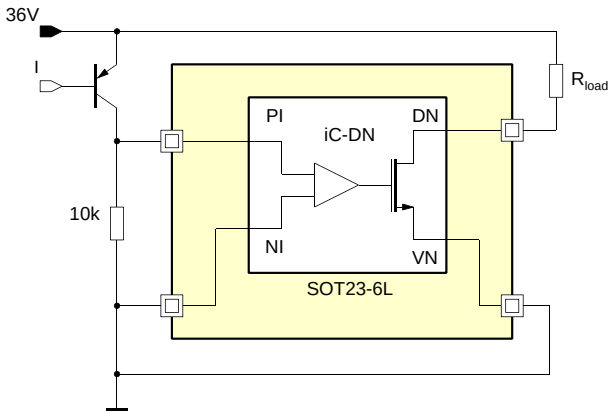


Figure 10: 36 V supply, PNP input control

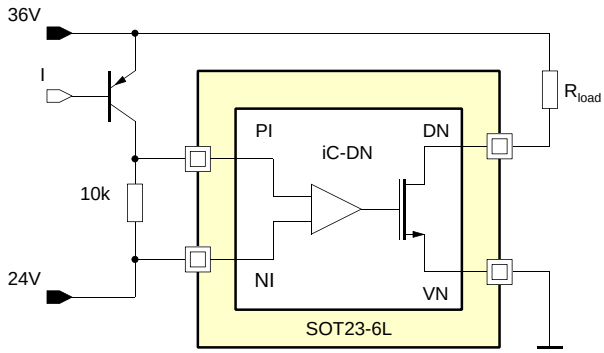


Figure 11: 12 V PNP input control, 36 V supply

ORDERING INFORMATION

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

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