

iC-DN

LOWSIDE SWITCH



Rev C1, Page 1/10

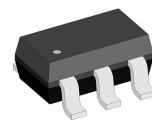
FEATURES

- ◆ 36 V lowside switch/level shifter
- ◆ Decoupling of input and output reference voltages permits control by 5 V 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
- ◆ Wide temperature range of -40 to 120 °C

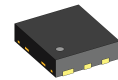
APPLICATIONS

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

PACKAGES

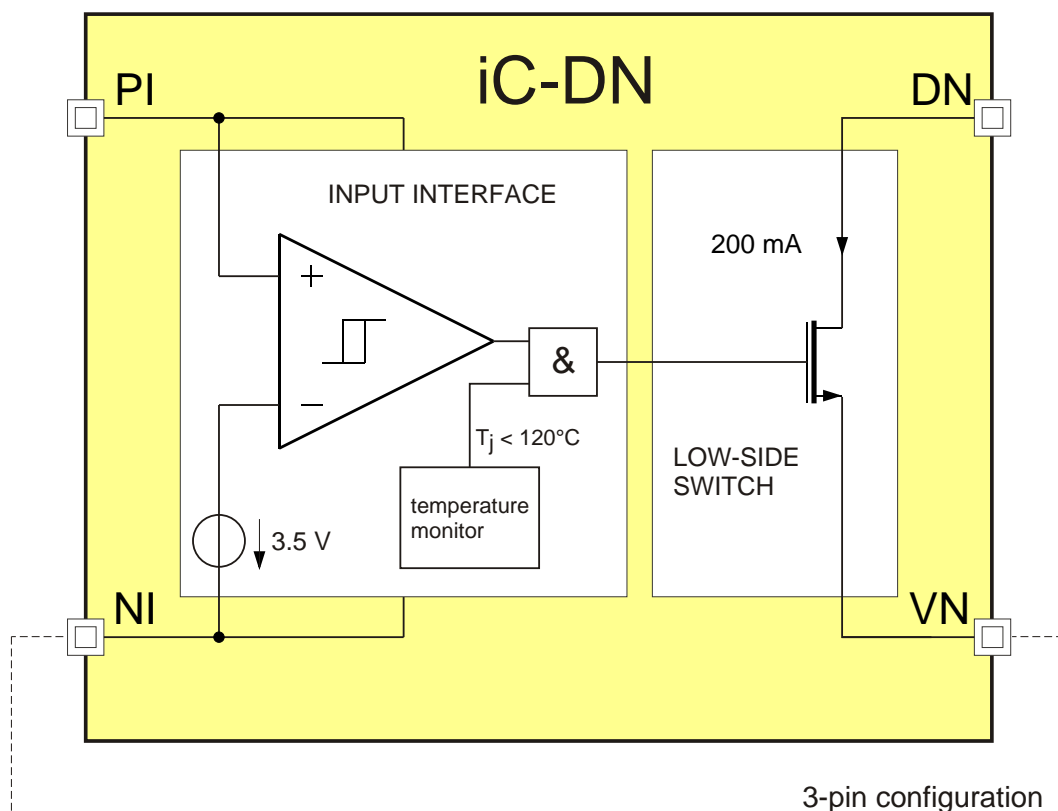


SOT23-6L



UDFN6-1.8x2

BLOCK DIAGRAM



iC-DN

LOWSIDE SWITCH



Rev C1, Page 2/10

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

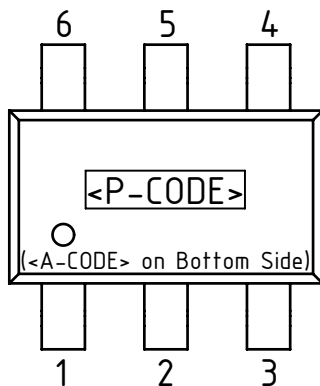
excessive temperature. The chip is activated when the input voltage threshold $V(PI)-V(NI)$ of typically 3.5 V is exceeded.

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

PACKAGING INFORMATION

PIN CONFIGURATION

SOT23-6L (JEDEC), 1.6 mm



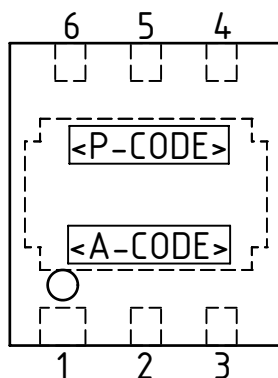
PIN FUNCTIONS

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

PIN CONFIGURATION

UDFN6-1.8x2



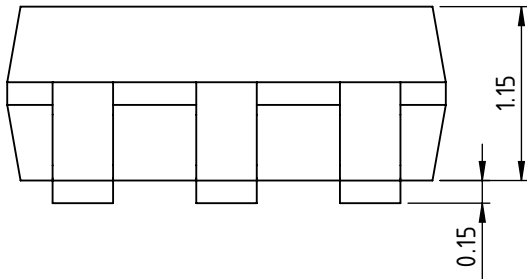
PIN FUNCTIONS

No. Name Function

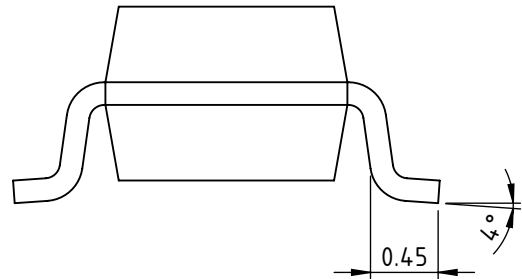
1	NI	Input Reference Voltage
2	VN	Ground, Substrate
3	n.c.	
4	DN	Output
5	n.c.	
6	PI	Positive Input, Supply

PACKAGE DIMENSIONS

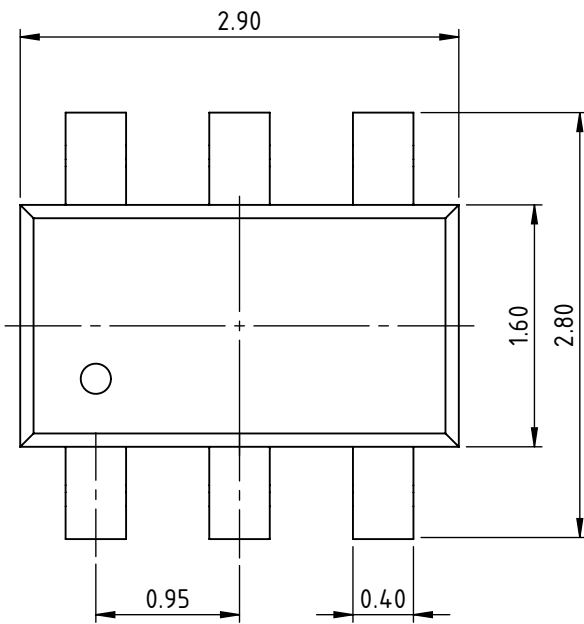
SIDE



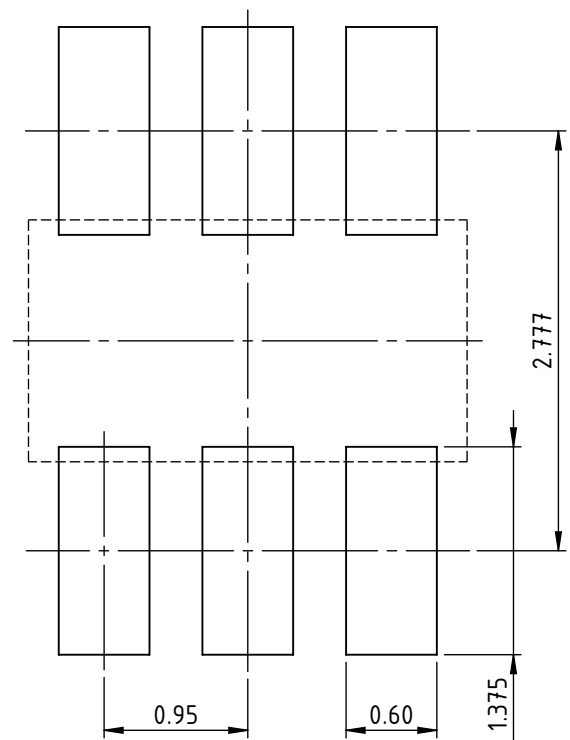
FRONT



TOP



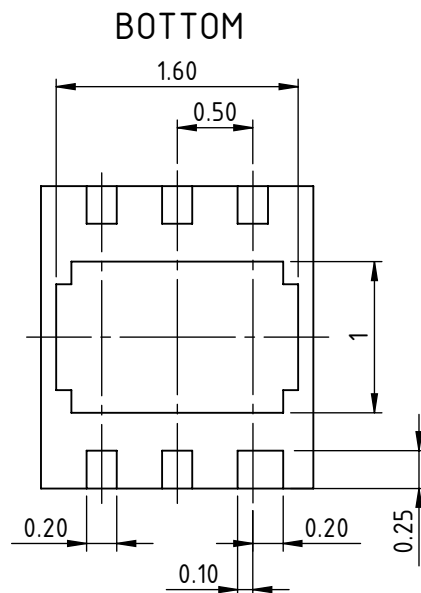
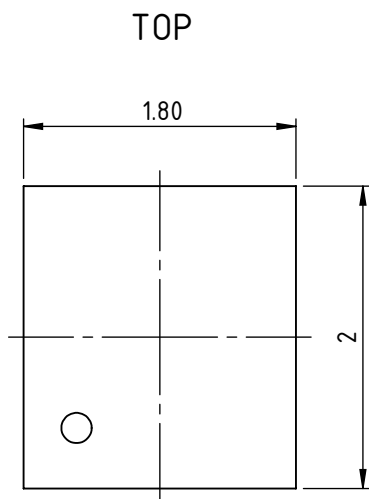
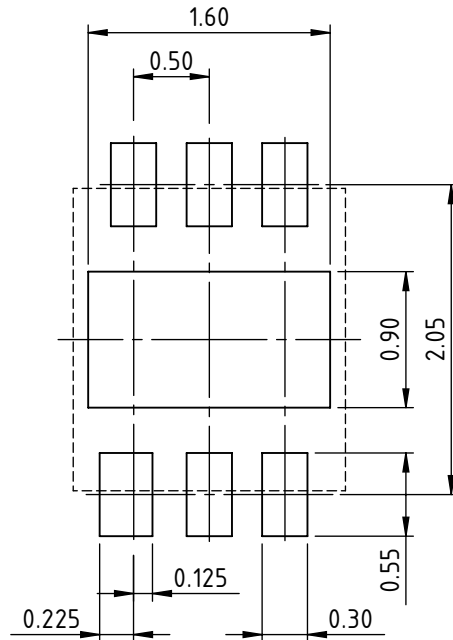
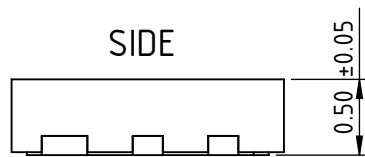
RECOMMENDED PCB-FOOTPRINT



All dimensions given in mm. Tolerances of form and position according to JEDEC MO-178.

PACKAGE DIMENSIONS

RECOMMENDED PCB-FOOTPRINT



All dimensions given in mm.
Tolerances of form and position according to JEDEC MO-229.

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 regard 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
				Min.	Max.	
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, $T_j < T_{on}$		5	mJ

THERMAL DATA

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

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

All voltages are referenced to ground (VN) unless otherwise stated.

All currents flowing into the device pins are positive; all currents flowing out of the device pins are negative.

iC-DN

LOWSIDE SWITCH



Rev C1, Page 6/10

ELECTRICAL CHARACTERISTICS

Operating Conditions: $V(PI) = 4...36\text{ V}$, $T_j = -40...120\text{ °C}$, unless otherwise stated

Item No.	Symbol	Parameter	Conditions	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	I _{lk} (DN)	DN Output Leakage Current	$(V(PI) - V(NI)) < V(PI)_{off}$, $V(DN) = 0...36\text{ V}$	-100		100	μA
006	V _c (DN) _{hi}	DN Clamp Voltage high	$V_c(DN)_{hi} = V(DN) - V(VN)$, $I(DN) = 10\text{ mA}$	40	45	60	V
007	V _c (DN) _{lo}	DN Clamp Voltage low	$V_c(DN)_{lo} = V(DN) - V(VN)$, $I(DN) = -10\text{ mA}$	-1		-0.3	V
008	V _c (_{)_{hi}}	PI, NI Clamp Voltage high	$V_c()_{hi} = V() - V(VN)$, $I() = 4\text{ mA}$	37	40		V
009	V _c (_{)_{lo}}	PI, NI Clamp Voltage low	$V_c()_{lo} = V() - V(VN)$, $I() = -4\text{ mA}$	-1		-0.3	V
010	tp _{iohi}	Activation Delay PI → DN	$V(PI)_{on} < (V(PI) - V(NI)) < 36\text{ V}$, $V(Rload) = 36\text{ V}$, $Rload = 360\ \Omega$, $I(DN) = 0 \rightarrow 90\text{ mA}$	0.6		6	μs
011	tp _{iol}	Deactivation Delay PI → DN	$(V(PI) - V(NI)) < V(PI)_{off}$, $V(Rload) = 36\text{ V}$, $Rload = 360\ \Omega$, $I(DN) = 100 \rightarrow 10\text{ mA}$	0.6		35	μs
Lowside Output DN							
101	V _s (DN)	Output Saturation Voltage	DN = I _o ; $I(DN) = 200\text{ mA}$ $I(DN) = 50\text{ mA}$			600 150	mV mV
102	I _{sc} (DN)	Output Short-Circuit Current	$V(DN) = 1\text{ V}...V_B$, DN = I _o	200	300	550	mA
103	SR(DN) _{on}	Slew Rate V(DN) → 0	$(V(PI) - V(NI)) > V(PI)_{on}$, $V(Rload) = 36\text{ V}$, $Rload = 360\ \Omega$, $V(DN) = 32.4 \rightarrow 3.6\text{ V}$		65		V/ μs
104	SR(DN) _{off}	Slew Rate V(DN) → V(PI)	$(V(PI) - V(NI)) < V(PI)_{off}$, $V(Rload) = 36\text{ V}$, $Rload = 360\ \Omega$, $V(DN) = 3.6 \rightarrow 32.4\text{ V}$		20		V/ μs
105	V _{fw} (DN)	Freewheeling Voltage	$I(DN) = 200\text{ mA}$	40	45	60	V
Temperature Monitor							
201	T _{off}	Thermal Shutdown Threshold		120		150	°C
202	T _{on}	Thermal Release Threshold	Decreasing temperature	110		135	°C
203	Th _{ys}	Thermal Shutdown Hysteresis	$Th_{ys} = T_{off} - T_{on}$		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)

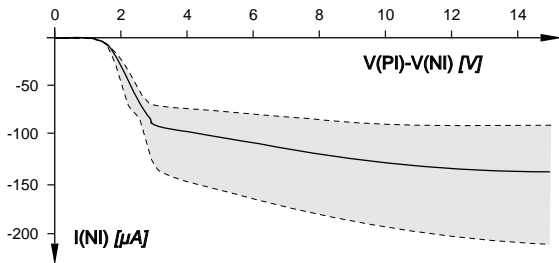


Figure 1: NI input current, load independent

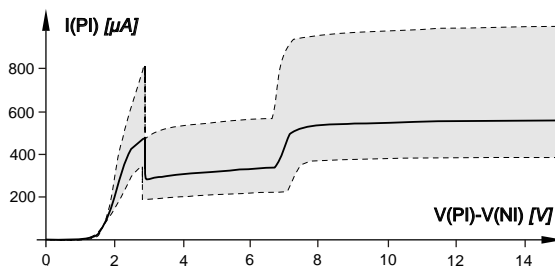


Figure 2: PI input current, no load

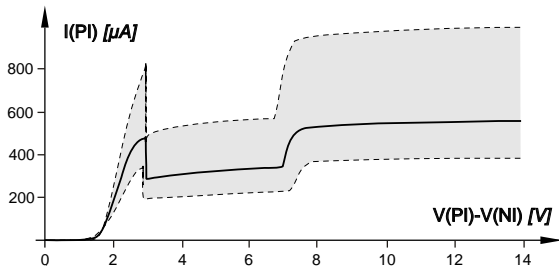


Figure 3: PI input current, $I(\text{DN}) = 5 \text{ mA}$

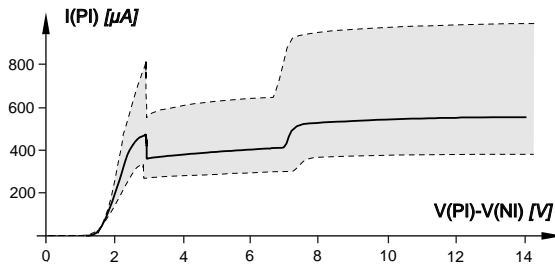


Figure 4: PI input current, $I(\text{DN}) = 100 \text{ mA}$

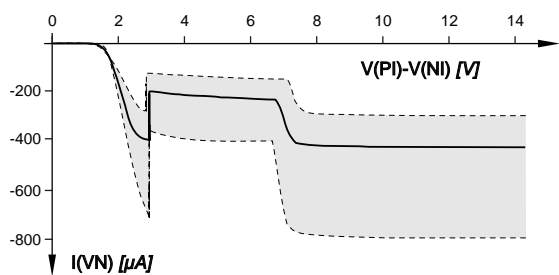


Figure 5: VN supply current

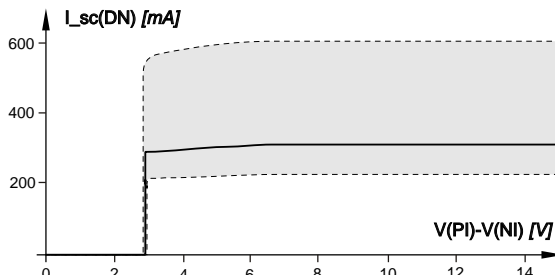


Figure 6: DN short-circuit output current

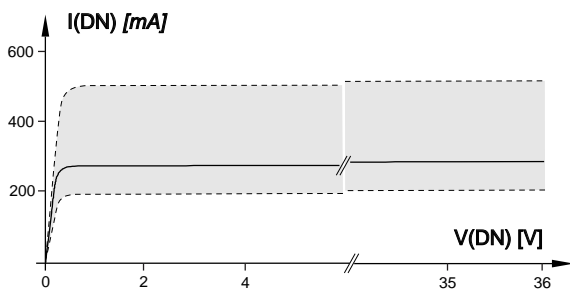


Figure 7: DN output characteristic

APPLICATION NOTES

Example application circuits

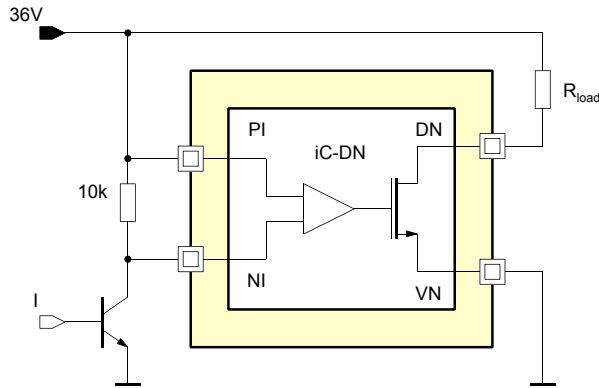


Figure 8: 36 V supply, NPN input control

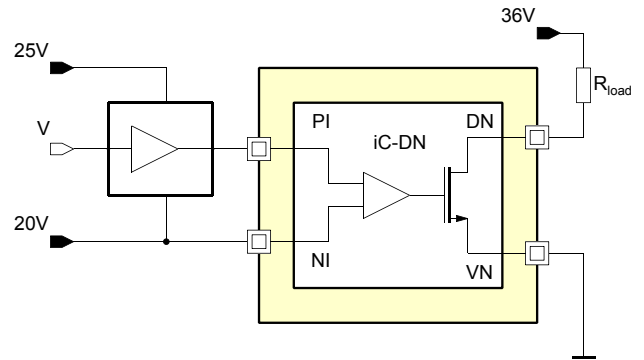


Figure 9: 5 V μ C operation at 20 to 25 V input control, 36 V output supply

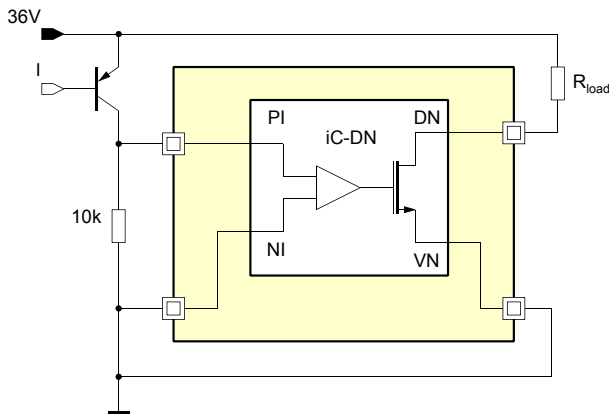


Figure 10: 36 V supply, PNP input control

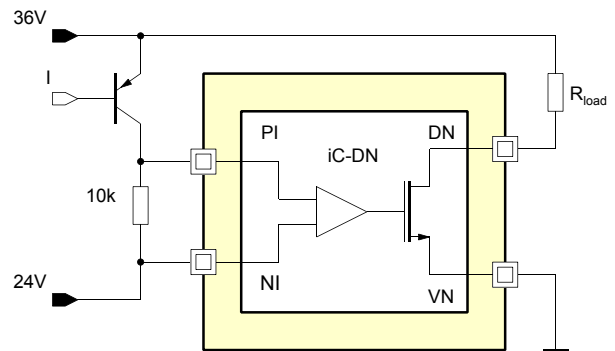


Figure 11: 12 V PNP input control, 36 V supply

REVISION HISTORY

Rel.	Rel. Date*	Chapter	Modification	Page
B1	2007-04-03		previous version	

Rel.	Rel. Date*	Chapter	Modification	Page
C1	2016-04-07	PACKAGES	new package type UDFN6 introduced	2,3,4
	2016-04-07	ORDERING INFORMATION	ordering information added for UDFN6 package	10
	2016-04-07	APPLICATION NOTES	figures modified	8

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* Release Date format: YYYY-MM-DD

ORDERING INFORMATION

Type	Package	Order Designation
iC-DN	SOT23-6L UDFN6-1.8x2	iC-DN SOT23-6L iC-DN UDFN6-1.8x2

Please send your purchase orders to our order handling team:

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E-Mail: dispo@ichaus.com

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