

NSR: Negative Switching Regulators

NSR-Family

Case C03

No input to output isolation
Single output of –5 to –36 V DC/50...288 W
Input voltage up to –80 V DC

- High efficiency up to 94 %
- Wide input voltage range
- Low input-to-ouptut differential voltage
- Very good dynamic properties
- Input undervoltage cut-out
- Parallel configurations possible
- Continuous no-load and short-circuit proof
- No derating

Safety according to IEC 950







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Type Survey

Table 1: Type survey

Nominal output voltage $U_{o\ nom}$	Nominal output current $I_{o\ nom}$	Input voltage range U_i^1	Nominal input voltage $U_{i\ nom}$	Efficiency η	Type designation	Options
–5 V	12 A	–7...–40 V	–20 V	81 %	NSR 512-7	–9, L, i, P, R, C
–5 V	10 A	–8...–80 V	–40 V	70%	NSR 510-7	
–12 V	8 A	–15...–80 V	–50 V	89%	NSR 128-7	
–15 V		–19...–80 V		89%	NSR 158-7	
–24 V		–29...–80 V		91%	NSR 248-7	
–36 V		–42...–80 V	–60 V	94%	NSR 368-7	–9, L, i, P, R

¹ See also data $\Delta U_{i0\ min}$. (Minimum differential voltage $U_i - U_o$)

Description

The NSR family of negative switching regulators is designed as power supply modules for electronic systems. Their major advantages include a high level of efficiency that remains virtually constant over the entire input range, high reliability, low ripple and excellent dynamic response. The modules are specially designed for secondary switched and battery driven applications with positive system ground.

Case C03: Aluminium, black finish and self cooling.

External input circuitry

An external capacitor (see "Application Notes") is required in rectifier mode and in DC operation mode only, if the sum of the lengths of the two input lines between source and input is greater than approx. 5 m. For long connection lines the use of option L is recommended in order to reduce superimposed interference voltages or currents and to prevent oscillation.

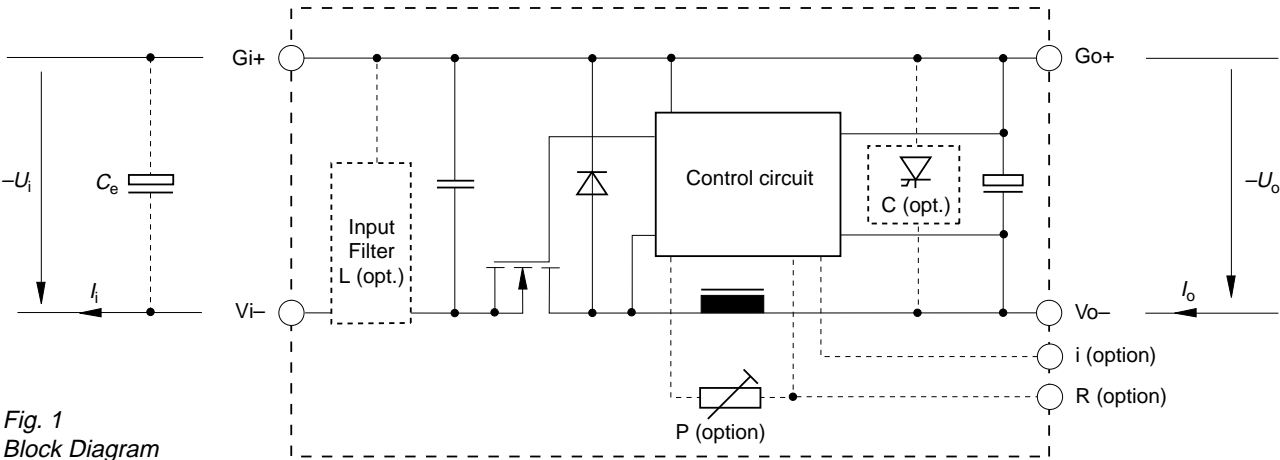


Fig. 1
Block Diagram

Safety and Installation Instructions

Safety

If the output circuit of a switching regulator is operator-accessible according to the IEC 950 related safety standards, it shall be an SELV circuit (Safety Extra Low Voltage circuit, i.e. a circuit, separated from mains by at least basic insulation, that is so designed and protected that under normal and single fault conditions, the voltage between any two conductors and between any conductor and earth does not exceed 60 V DC).

In the following section an interpretation is provided of the IEC 950 safety standard with respect to the safety status of the output circuit. However, it is the sole responsibility of the

installer or user to assure the compliance with the relevant and applicable safety standards.

If the following table is observed, the output of any switching regulator is considered to be an SELV circuit up to a nominal output voltage of 36 V.

Note: Check for hazardous voltages before altering any connections. Do not open the module. The input and the output circuitry are not separated, i.e. the positive path is internally interconnected!

Table 2: Insulation concept for SELV circuits

Nominal mains supply voltage (AC)	Minimum required grade of isolation, to be provided by the AC-DC front end, including mains supplied battery charger	Maximum output voltage from the front end	Minimum required safety status of the front end output circuit	Measures to achieve the specified safety status of the output circuit	Resulting safety status of the switching regulator output circuit
None	Battery supply completely separated from mains	≤60 V	SELV battery circuit	None	SELV circuit
		≤80 V	Hazardous voltage battery circuit ²	Input fuse ¹ and unearthed, non operator-accessible case ²	SELV circuit
			Hazardous voltage battery circuit	Input fuse ¹ and earthed output circuit ³ and earthed ³ or non operator-accessible case	Earthed SELV circuit
≤250 V	Basic	≤60 V	Earthed SELV circuit	Earthed input circuit ³	SELV circuit
			ELV circuit	Input fuse ¹ and earthed output circuit ³	Earthed SELV circuit
		≤80 V	Hazardous voltage secondary circuit	Input fuse ¹ and earthed output circuit ³ and earthed ³ or non operator-accessible case	Earthed SELV circuit
	Double or reinforced	≤60 V	SELV circuit	None	SELV circuit
		≤80 V	Double or reinforced insulated unearthed hazardous voltage secondary circuit ²	Input fuse ¹ and unearthed and non operator-accessible case ²	SELV circuit

¹ The installer shall provide an approved fuse (slow blow type with lowest rating suitable for the application, max. 12.5 A) in the positive or negative input conductor directly at the input of the switching regulator. For UL's purpose, the fuse needs to be UL-listed. If option C is fitted, a suitable fuse is built-in.

² Has to be insulated from earth by double or reinforced insulation according to the relevant safety standard, based on the maximum input voltage of the switching regulator.

³ The earth connection has to be provided by the installer according to the relevant safety standards, e.g. IEC 950.

Standards and Approvals

All Melcher power supplies are subject to manufacturing surveillance in accordance with ISO 9001 standards.

All units are UL recognized as per UL 1950, UL 1012 and CAN/CSA C22.2 No. 234-M90.

Cleaning Agents

In order to avoid possible damage, any penetration of cleaning fluids is to be prevented, since the power supplies are not hermetically sealed.

Protection Degree

The protection degree is defined by IP 40. With option P this reduces to IP 20.

Immunity to Environmental Conditions

Table 3: Mechanical stress

Test Method		Standard	Test Conditions		Status
Ca	Damp heat steady state	DIN 40046 part IEC 68-2-3 MIL-STD-810D section 507.2	Temperature: 40 ±2 °C Relative humidity: 93 +2/-3 % Duration: 56 days		Unit not operating
Ea	Shock (half-sinusoidal)	DIN 40046 part 7 IEC 68-2-27 MIL-STD-810D section 516.3	Acceleration amplitude: 100 g _n = 981 m/s ² Bump duration: 6 ms Number of bumps: 18 (3 each direction)		Unit operating
Eb	Continuous shock (half-sinusoidal)	DIN 40046 part 26 IEC 68-2-29 MIL-STD-810D section 516.3	Acceleration amplitude: 40 g _n = 392 m/s ² Bump duration: 6 ms Number of bumps: 6000 (1000 each direction)		Unit operating
Fc	Vibration (sinusoidal)	DIN 40046 part 8 IEC 68-2-6 MIL-STD-810D section 514.3	Frequency (1 Oct/min): 10...2000 Hz Max. vibration amplitude: 0.35 mm (10...60 Hz) Acceleration amplitude: 5 g _n = 49 m/s ² (60...2000 Hz) Test duration: 7.5 h (2.5 h each axis)		Unit operating
Fda	Random vibration wide band reproducibility high	DIN 40046 part 23 IEC 68-2-35	Acceleration spectral density: 0.05 g ² /Hz Frequency band: 20...500 Hz Acceleration magnitude: 4.9 g _{rms} Test duration: 3 h (1 h each axis)		Unit not operating
Kb	Salt mist cyclic (sodium chloride NaCl solution)	DIN 40046 part 105 IEC 68-2-52	Concentration: 5% (30°C) Duration: 2 h per cycle Storage: 40°C, 93% rel. humidity Storage duration: 22 h per cycle Number of cycles: 3		Unit not operating

Table 4: Temperature specifications, valid for air pressure of 800...1200 hPa (800...1200 mbar)

Temperature		Standard -7		Option -9		Unit
Characteristics	Conditions	min	max	min	max	
T _A	Ambient temperature ¹	-25	71	-40	71	°C
T _C	Case temperature		95	-40	95	
T _S	Storage temperature ¹	-40	100	-55	100	

¹ MIL-STD-810D section 501.2 and 502.2

Table 5: MTBF and device hours

MTBF	Ground Fixed		Ground Mobile		Device Hours ¹
MTBF acc. to MIL-HDBK-217D	T _C = 40°C	T _C = 70°C	T _C = 40°C	T _C = 70°C	1'050'000 h
	130'000 h	58'000 h	36'000 h	17'000 h	

¹ Statistical values , based on an average of 4300 working hours per year and in general field use

Electromagnetic Compatibility EMC

Immunity

General condition: Case not earthed

Table 6: Immunity type tests

Phenomenon	Standard	Class Level	Coupling mode ⁴	Value applied	Waveform	Source Imped.	Test procedure	In oper.	Per-form.
Impulse voltage	IEC 255-4 App. E4 ⁵ (1976)	III	i/o, i/c, o/c +i/-i	5000 V _p	1.2/50 µs	500 Ω	3 pos. and 3 neg. impulses per coupling mode	no	-
High frequency disturbance	IEC 255-4 App. E5 ⁵ (1976)	III	i/o, i/c, o/c	2500 V _p	400 damped 1 MHz waves/s	200 Ω	2 s per coupling mode	yes	1
			+i/-i	1000 V _p					
Electrostatic discharge	IEC 801-2 (1991-04)	3	contact discharge to case	6000 V _p	1/50 ns	330 Ω	10 positive and 10 negative discharges	yes	1 6
Electric field	IEC 801-3 (1984)	2	antenna in 1m distance	3 V/m	sine wave modulated w. 1 kHz		26...1000 MHz	yes	1
Fast transient/ burst	IEC 801-4 (1988)	2	i/c	1000 V _p	bursts of 5/50 ns 5 kHz rep. rate transients with 15 ms burst duration and a 300 ms period	50 Ω	1 min positive 1 min negative bursts per coupling mode	yes	2 6
Transient	IEC 801-5 (Draft 1993-01)	II	i/c	1000 V _p	1.2/50 µs	12 Ω	5 pos. and 5 neg. impulses per coupling mode	yes	2 6
			+i/-i	500 V _p		2 Ω			
Immunity to conducted disturbances	IEC 801-6	2	i, o, signal wires	3 V _{rms} ⁷	80% amplitude modulated with 1 kHz	50 Ω	AM 0.15...80 MHz	yes	1

¹ Normal operation, no deviation from specifications
² Normal operation, temporary deviation from specs possible
³ With option C: manual reset
⁴ i = input, o = output, c = case
⁵ In correspondance with DIN 57435 part 303 and VDE 0435 part 303 (1984-09)
⁶ Option L neccessary
⁷ Open circuit

Emission

For emission levels refer to "Electrical Input and Output Data".

Electrical Input and Output Data

General Conditions

- $T_A = 25^\circ\text{C}$, unless T_C is specified.
- With option P or R, output voltage $U_o = U_{o\text{ nom}}$ at $I_{o\text{ nom}}$

Table 7a: Input and output data

Characteristics		Conditions	NSR 512 min typ max		NSR 510 min typ max		NSR 128 min typ max		Unit
Output									
U_o	Output voltage	$U_{i\text{ nom}}, I_o\text{ nom}$	−4.97	−5.03	−4.97	−5.03	−11.92	−12.07	V
$I_o\text{ nom}$	Output current	$U_{i\text{ min}} \dots U_{i\text{ max}}$	12.0		10.0		8.0		A
I_oL	Output current limitation response	$T_C\text{ min} \dots T_C\text{ max}$	12.0	15.6	10.0	13.0	8.0	10.4	
u_o	Ripple at output (BW = 20 MHz)	$U_{i\text{ nom}}$ $I_o\text{ nom}$	35 60	50 85 ¹	35 60	50 85 ¹	80	150	mV _{pp}
ΔU_{oU}	Static control deviation versus input voltage U_i	$U_{i\text{ min}} \dots U_{i\text{ max}}$ $I_o\text{ nom}$	30	45 55 ¹	30	45	50	85	mV
ΔU_{oI}	Static control deviation versus output current I_o	$U_{i\text{ nom}}$ $I_o = 0 \dots I_o\text{ nom}$	20	25	20	25	28	35 55 ¹	
$u_{o d}$	Dynamic control deviation ²	$U_{i\text{ nom}}$ $I_o\text{ nom} \leftrightarrow^{1/3} I_o\text{ nom}$	135		130		130		
t_r	Dynamic load transient time recovery ²		40		50		60		μs
α_{uo}	Temperature coefficient $\Delta U_o / \Delta T_C$	$U_{i\text{ min}} \dots U_{i\text{ max}}$ $T_C\text{ min} \dots T_C\text{ max}$ $I_o = 0 \dots I_o\text{ nom}$	±1		±1		±2		mV/K
			±0.02		±0.02		±0.02		%/K
Input									
U_i	Input voltage	$I_o = 0 \dots I_o\text{ nom}$ $T_C\text{ min} \dots T_C\text{ max}$	−7	−40	−8	−80	−15	−80	V DC
$\Delta U_{Io\text{ min}}$	Minimum differential voltage U_i - U_o ³		−2		−3		−3		V
$U_{i o}$	Undervoltage cut-out		−6.3		−7.3		−7.3		
$I_{i o}$	No load input current	$I_o = 0$ $U_{i\text{ min}} \dots U_{i\text{ max}}$	45		40		35		mA
$I_{i m}$	Peak value of inrush current ⁴	$U_{i\text{ nom}}$	150		250		250		A
$t_{i s}$	Rise time ⁴		5		5		5		μs
$t_{i r}$	Tail half value time ⁴		40		40		40		
$I_{i m}$	Peak value of inrush current ⁴		$U_{i\text{ nom}}$ with option L	250		350		350	
$t_{i s}$	Rise time ⁴	25		25		25		μs	
$t_{i r}$	Tail half value time ⁴	125		125		125			
$u_{i\text{ rfi}}$	RFI level at input, 0.01...30 MHz	VDE 0871 (6.78) $U_{i\text{ nom}}, I_o\text{ nom}$	A		A		A		dB (μV)
Efficiency									
η	Efficiency	$U_{i\text{ nom}}, I_o\text{ nom}$	81		76		88		%
Isolation									
U_{is}	Isolation test voltage electronics to case	Inputs/outputs interconnected	500		500		500		V DC

¹ Lower row represents option -9 data only

² See "Dynamic Characteristics"

³ The minimum differential voltage $\Delta U_{io\text{ min}}$ between input and output increases linearly from 0 to 1 V at $T_A = 46^\circ\text{C}$ and 71°C ($T_C = 70^\circ\text{C}$ and 95°C)

⁴ Definitions according to VDE 0433, part 3

Table 7b: Input and output data

Characteristics		Conditions	NSR 158		NSR 248		NSR 368		Unit
			min	typ	max	min	typ	max	
Output									
U_o	Output voltage	$U_{i\text{ nom}}, I_o\text{ nom}$	-14.91	-15.09	-23.85	-24.14	-35.78	-36.22	V
$I_o\text{ nom}$	Output current	$U_{i\text{ min}}...U_{i\text{ max}}$	8.0		8.0		8.0		A
I_oL	Output current limitation response	$T_C\text{ min}...T_C\text{ max}$	8.0 10.4		8.0 10.4		8.0 10.4		
u_o	Ripple at output (BW = 20 MHz)	$U_{i\text{ nom}}$ $I_o\text{ nom}$	80 150		100 250		150 300		mV _{pp}
ΔU_{oU}	Static control deviation versus input voltage U_i	$U_{i\text{ min}}...U_{i\text{ max}}$ $I_o\text{ nom}$	70 105		150 220		200 270 370 ¹		mV
ΔU_{oI}	Static control deviation versus output current I_o	$U_{i\text{ nom}}$ $I_o = 0...I_o\text{ nom}$	33 45 65 ¹		120 160		125 160 320 ¹		
$u_{o d}$	Dynamic control deviation ²	$U_{i\text{ nom}}$ $I_o\text{ nom} \leftrightarrow \frac{1}{3} I_o\text{ nom}$	130		150		225		
t_r	Dynamic load transient time recovery ²		60		80		100		μs
α_{uo}	Temperature coefficient $\Delta U_o/\Delta T_C$	$U_{i\text{ min}}...U_{i\text{ max}}$ $T_C\text{ min}...T_C\text{ max}$ $I_o = 0...I_o\text{ nom}$	±3		±5		±8		mV/K
			±0.02		±0.02		±0.02		%/K
Input									
U_i	Input voltage	$I_o = 0...I_o\text{ nom}$ $T_C\text{ min}...T_C\text{ max}$	-19	-80	-29	-80	-42	-80	V DC
$\Delta U_{Io\text{ min}}$	Minimum differential voltage $U_i - U_o$ ³		-4		-5		-6		V
$U_{i o}$	Undervoltage cut-out		-7.3		-12		-19		
I_o	No load input current	$I_o = 0$ $U_{i\text{ min}}...U_{i\text{ max}}$	35		35		40		mA
$I_{i m}$	Peak value of inrush current ⁴	$U_{i\text{ nom}}$	250		250		250		A
$t_{i s}$	Rise time ⁴		5		5		5		μs
$t_{i r}$	Tail half value time ⁴		40		40		40		
$I_{i m}$	Peak value of inrush current ⁴	$U_{i\text{ nom}}$ with option L	350		350		350		A
$t_{i s}$	Rise time ⁴		25		25		25		μs
$t_{i r}$	Tail half value time ⁴		125		125		125		
$u_{i rfi}$	RFI level at input, 0.01...30 MHz	VDE 0871 (6.78) $U_{i\text{ nom}}, I_o\text{ nom}$	A		A		A		dB (μV)
Efficiency									
η	Efficiency	$U_{i\text{ nom}}, I_o\text{ nom}$	89		91		94		%
Isolation									
U_{is}	Isolation test voltage electronics to case	Inputs/outputs interconnected	500		500		500		V DC

¹ Lower row represents option -9 data only² See "Dynamic Characteristics"³ The minimum differential voltage $\Delta U_{io\text{ min}}$ between input and output increases linearly from 0 to 1 V at $T_A = 46^\circ\text{C}$ and 71°C ($T_C = 70^\circ\text{C}$ and 95°C)⁴ Definitions according to VDE 0433, part 3

Characteristics and Definitions

Output Protection

A voltage suppressor diode protects the output against an internally generated overvoltage, which could occur due to a failure of the control circuit, which in worst case conditions fails into a short circuit. The suppressor diode is not designed to withstand externally applied overvoltages. The user should ensure that systems with Melcher power supplies, in the event of a failure, do not result in an unsafe condition (fail-safe).

Dynamic Characteristics

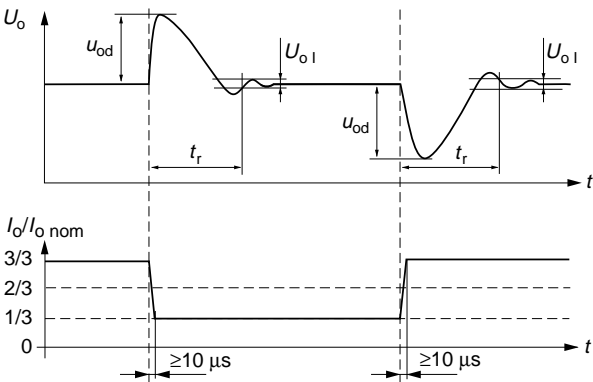


Fig. 2
Behaviour and characteristics under varying load conditions.

Temperature

When a converter is located in free, quasi-stationary air at a temperature $T_A = 71^\circ\text{C}$ and is operated at its nominal output power, the case temperature T_C will be about 95°C after the warm-up phase measured at the measuring point of case temperature T_C (see "Mechanical Data").

Under practical operating conditions, the ambient temperature T_A may exceed 71°C , provided additional measures are taken to ensure that the case temperature T_C does not exceed its maximum value of 95°C (heat sink, fan, etc.).

Example: Sufficient forced cooling allows $T_{A\text{ max}} = 85^\circ\text{C}$. A simple check of the case temperature T_C ($T_C \leq 95^\circ\text{C}$) at full load ensures correct operation of the system

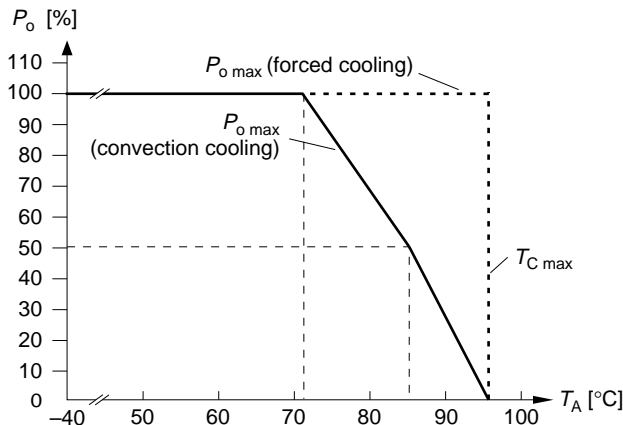


Fig. 3
Output power derating versus ambient temperature

Parallel and Series Connection

Outputs of equal nominal voltages can be parallel-connected. However, the use of a single unit with higher output power, because of its power dissipation, is always a better solution.

In parallel-connected operation, one or several outputs may operate continuously at their current limit knee-point which will cause an increase of the case temperature. Consequently, the max. ambient temperature value should be reduced by 10 K.

Outputs can be series-connected with any other module. In series-connection the maximum output current is limited by the lowest current limitation. Galvanically separated source voltages are needed for each module!

Short circuit behaviour

A constant current limitation circuit holds the output current almost constant whenever an overload or a short circuit is applied to the regulator's output. It acts self-protecting and recovers - in contrary to the fold back method - automatically after removal of the overload or short circuit condition.

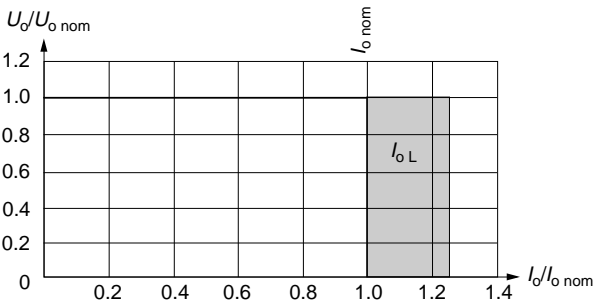


Fig. 4
Overload, short-circuit behaviour U_o versus I_o

Description of Options

Option i Inhibit

Note: With open i-input, output is enabled ($U_o = \text{on}$).
The inhibit input allows the switching regulators to be disabled via a control signal. In systems with several units, this feature can be used, for example, to control the activation sequence of the regulators by a logic signal (TTL, C-MOS, etc.).
An output voltage overshoot will not occur when the units are switched on or off.

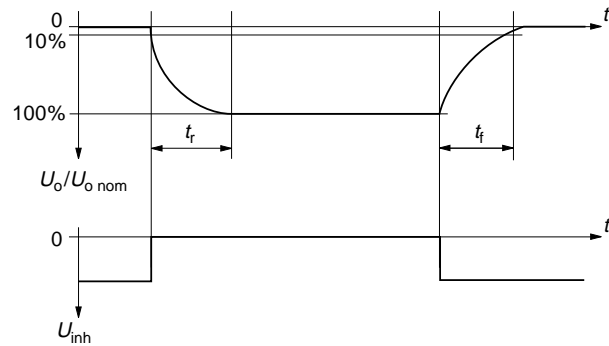


Fig. 6
Output response as a function of inhibit signal

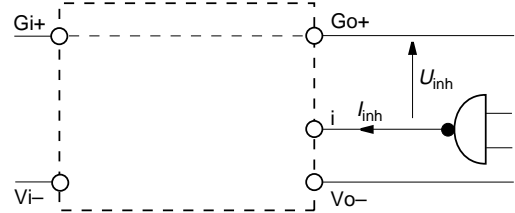


Fig. 5
Definition of I_{inh} and U_{inh}

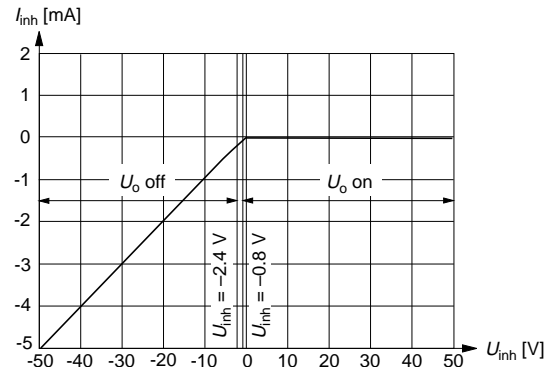


Fig. 7
Inhibit current I_{inh} versus inhibit voltage U_{inh}

Table 8: Inhibit characteristics

Characteristics			Conditions	min	typ	max	Unit
U_{inh}	Inhibit input voltage to keep regulator output voltage...	$U_o = \text{on}$	$U_{i \min} \dots U_{i \max}$	-0.8		+50	V DC
		$U_o = \text{off}$	$T_C \min \dots T_C \max$	-50		-2.4	
t_r	Switch-on time after inhibit command		$U_i = U_{i \text{ nom}}$		5		ms
t_f	Switch-off time after inhibit command		$R_L = U_{o \text{ nom}} / I_{o \text{ nom}}$		10		
$I_{i \text{ off}}$	Input current when inhibited		$I_o = 0, U_i = U_{i \text{ nom}}$		10		mA

Option R Output voltage adjustment

Note: with an open R-pin, $U_o = 1.08 U_{o \text{ nom}}$!
The output voltage U_o can be adjusted either with an external resistance R_{ex} or an external reference voltage U_{ex} . The adjustment range is 0.65...1.08 of $U_{o \text{ nom}}$. The minimum dif-

ferential voltage $\Delta U_{i o \min}$ between input and output voltages as specified in relevant tables must be maintained. Options R and P cannot be supported simultaneously.

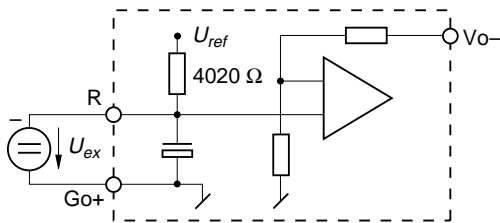


Fig. 8
Voltage adjustment with U_{ex} [V]

$$U_o \approx 1.08 \cdot U_{ex} \cdot \frac{U_{o \text{ nom}}}{U_{ref}} \quad (U_{ref} = -2.49 \text{ V} \pm 4\%)$$

Caution: To prevent damage U_{ex} should not exceed U_{ref} nor be positive!

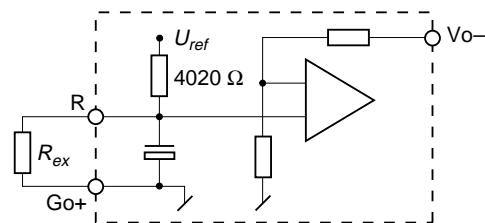


Fig. 9
Voltage adjustment with R_{ex} [ohm]

$$U_o \approx 1.08 \cdot U_{o \text{ nom}} \cdot \frac{R_{ex}}{R_{ex} + 4020}$$

$$R_{ex} \approx 4020 \cdot \frac{U_o}{1.08 \cdot U_{o \text{ nom}} - U_o}$$

All formulae give approximate values only.

Option -9 Extended Temperature Range

The operational ambient temperature range is extended to $T_A = -40...71^{\circ}\text{C}$.

Option L Input filter

Option L is recommended to reduce superimposed interference voltages, and to prevent oscillations, if input lines exceed approx. 5 m in total length. The fundamental wave (approx. 120 kHz) of the reduced interference voltage between Vi+ and Gi- has, with an input line inductance of 5 μH a maximum magnitude of 4 mV_{rms}.
The input impedance of the switching regulator at 120 kHz is about 50 m Ω . The harmonics are small in comparison with the fundamental wave. See also data: RFI.

With option L, the maximum permissible additionally superimposed ripple u_i of the input voltage (rectifier mode) at a specified input frequency f_i has the following values:
Input voltage up to 80 V:
 $u_{i\text{ max}} = 22\text{ V}_{\text{pp}}$ at 100 Hz or $V_{\text{pp}} = 2200\text{ Hz}/f_i \cdot 1\text{ V}$
Input voltage up to 40 V:
 $u_{i\text{ max}} = 12\text{ V}_{\text{pp}}$ at 100 Hz or $V_{\text{pp}} = 1200\text{ Hz}/f_i \cdot 1\text{ V}$

Option P Potentiometer

Option P excludes R option. The output voltage U_o can be adjusted with a screwdriver in the range from 0.92...1.08 of the nominal output voltage $U_{o\text{ nom}}$.

However, the minimum differential voltage $\Delta U_{io\text{ min}}$ between input and output voltages as specified in "Electrical Input and Output Data" should be maintained.

Option C Thyristor Crowbar

This option is recommended to protect the load against power supply malfunction, but it is not designed to sink external currents.
A fixed-value monitoring circuit checks the output voltage U_o . When the trigger voltage U_{oc} is reached, the thyristor crowbar triggers and disables the output. It may be deactivated by removal of the input voltage. In case of a switching transistor defect, an internal fuse prevents excessive current.

Note: As a central overvoltage protection device, the crowbar is usually connected to the external load via distributed inductance of the lines. For this reason, the overvoltage at the load can temporarily exceed the trigger voltage U_{oc} . Depending on the application, further decentralized overvoltage protection elements may have to be used additionally.
Option C is not available for NSR 368 type.

Table 9: Crowbar trigger levels

Characteristics		Conditions	-5 V		-12 V		-15 V		-24 V		Unit
			min	max	min	max	min	max	min	max	
U_{oc}	Trigger voltage	$U_{i\text{ min}}...U_{i\text{ max}}$ $I_o = 0...I_{o\text{ nom}}$	-5.8	-6.8	-13.5	-16	-16.5	-19	-27	-31	V
t_s	Delay time	$T_{C\text{ min}}...T_{C\text{ max}}$	1.5		1.5		1.5		1.5		μs

Option U Ambient Temp. Range acc. UL Recognition

Underwriters Laboratories (UL) have approved the NSR-family as recognized components up to an ambient temperature of $T_{A\text{ max}} - 25\text{ K}$, given by the upper temperature limit of the standard PCB material. If the full maximum ambient temperature $T_{A\text{ max}}$ is required with UL approval, option U should be requested. It consists of an alternative

PCB material with a higher maximum temperature specification.
The European approval boards have in contrast to UL accepted the standard PCB material to be operated up to $T_{A\text{ max}} = 71^{\circ}\text{C}$ without any further precautions.

Mechanical Data

Dimensions in mm. Tolerances ± 0.3 mm unless otherwise specified.

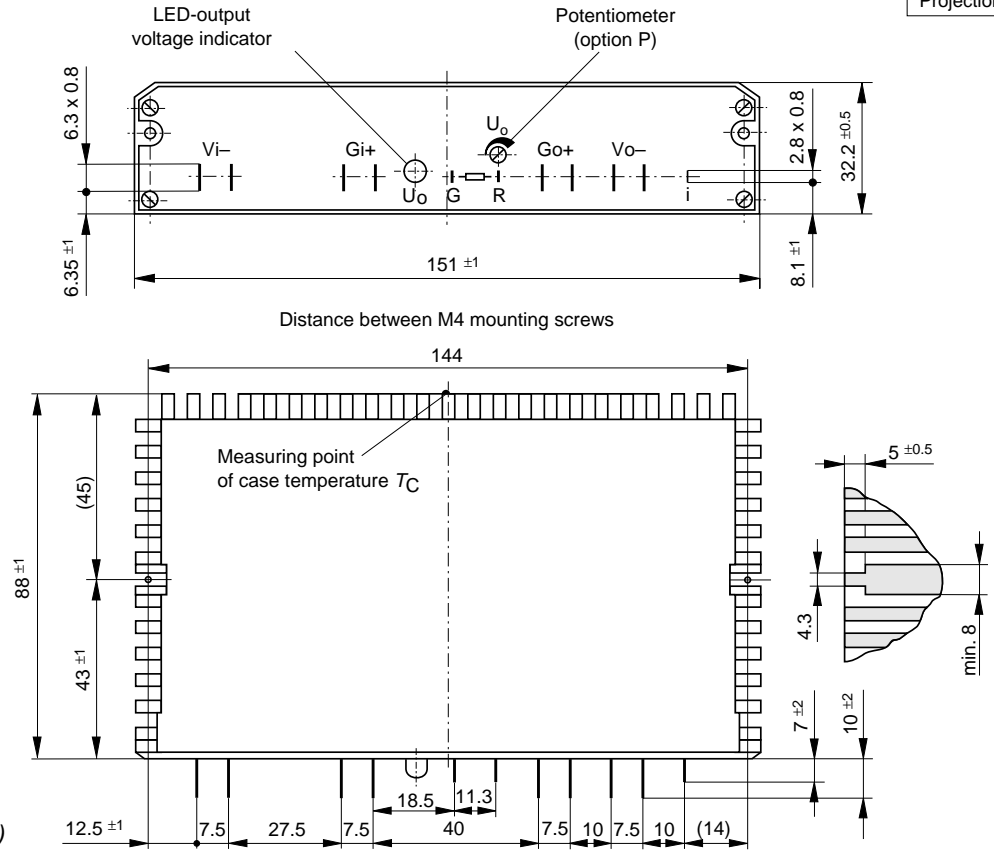
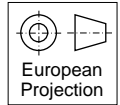


Fig. 10
Case C03 (weight 440 g)

Type Key and Product Marking

Type Key

	NSR	12	8	-7	Li	R	P	C
Negative switching regulator in case C03	NSR							
Blank								
Nominal output voltage in volt	-5...-36							
Nominal output current in ampere	8...12							
Ambient temperature range								
$T_A = -25...71^{\circ}\text{C}$	-7							
$T_A = -40...71^{\circ}\text{C}$	-9							
Input filter	L							
Inhibit input	i							
External output voltage adjustment	R							
Potentiometer	P							
Thyristor-Crowbar	C							

Example: NSR 128-7iP = A negative switching regulator with a -12 V, 8 A output, ambient temperature range of -25...71°C, inhibit input and potentiometer.

Produkt Marking

Main face: Family designation, applicable safety approval and recognition marks, warnings, Melcher patent nos. and company logo.

Cover: Specific type designation, input voltage range, nominal output voltage and current, pin allocation, identification of LED, potentiometers and degree of protection.

Rear side: Label with batch no., serial no. and data code comprising production site, modification status of the main PCB and date of production.