PSR: Positive Switching Regulators PSL-Family

No input to output isolation
Single output of 12, 15, 24, 36 or 48 V DC/72...288 W
Input voltage up to 144 V DC

- High efficiency up to 96%
- Extremely wide input voltage range
- Very good dynamic properties
- Input undervoltage cut-out
- External output voltage adjustment and inhibit
- Two temperature ranges
- Continuous no-load and short-circuit proof
- No derating

Safety according to IEC 950

5.1

Table of Contents

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
12 V	6 A	18...144 V	60 V	89%	PSL 126-7R	-9, L, i, P, C, D, A
15 V		22...144 V		90%	PSL 156-7R	
24 V		31...144 V		94%	PSL 246-7R	
36 V		44...144 V	80 V	95%	PSL 366-7R	
48 V		58...144 V		96%	PSL 486-7R	

[1] Surges up to 156 V for 2 sec. See data $\Delta U_{io\,min}$ (min. differential voltage $U_i - U_o$)

Description

The PSL family of positive swiching 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. Modules with input up to 144 V are specially designed for battery driven mobile applications.
Case L04: 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 (without option L) 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.

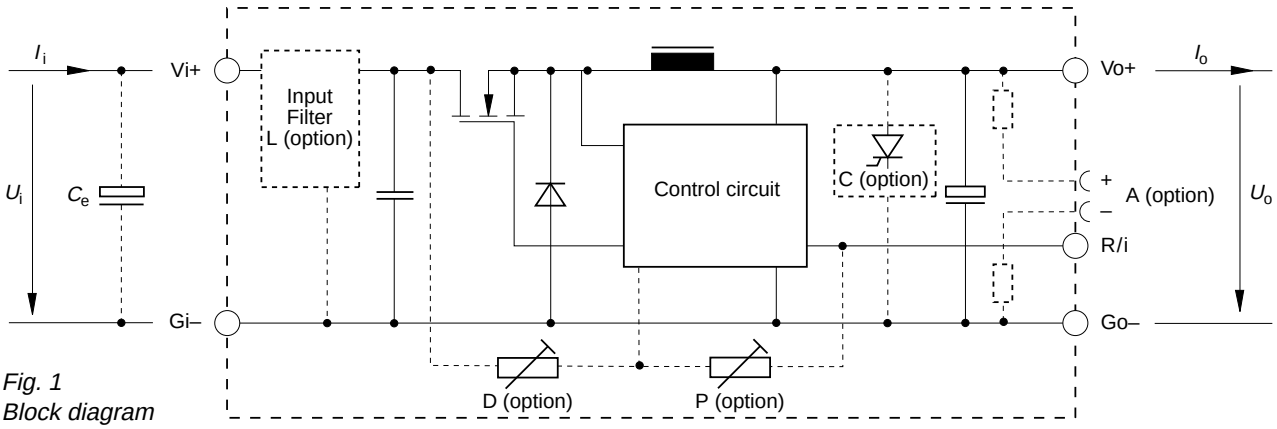


Fig. 1
Block diagram

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, or up to 48 V if option C is fitted.

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 negative 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
		≤144 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
		≤144 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
		≤144 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 (contrary to case marking: "This apparatus must be earthed.").

[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.

Installation Instructions

The connector pin allocation table defines the electrical potentials and the physical pin position on the connector. Pin no. 32 is the protective ground pin and is protruding, i.e. attaching the female connector, this pin provides electrical contact first. The modules should only be wired via the female connector H11 (according to DIN 41612) to ensure requested safety!

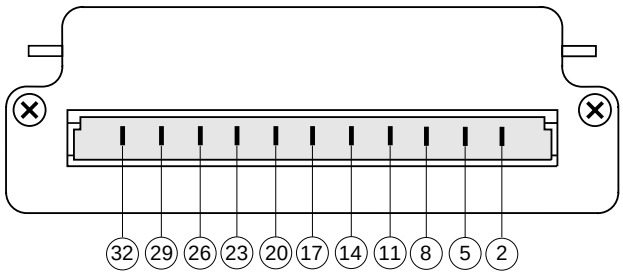


Fig. 2
View of male H11 connector

Protection Degree

The protection degree is defined by IP 30 (equipped with any potentiometer adjustable option: IP 20). The protection degree applies only if the module is plugged-in or the female connector is properly attached to the module.

Table 3: H11 connector pin allocation and designation

Electrical Determination	Type H11 Pin No.	Type H11 Design.
R-input (or inhibit input) [1]	2	R (i)
Undervoltage monitor (Option D)	5	D
Output voltage (negative)	8	Go–
Output voltage (negative)	11	Go–
Output voltage(positive)	14	Vo+
Output voltage (positive)	17	Vo+
Input voltage (negative)	20	Gi–
Input voltage (negative)	23	Gi–
Input voltage (positive)	26	Vi+
Input voltage (positive)	29	Vi+
Protective ground (protruding pin)	32	⏚

[1] R-input (output voltage programming) not available with option P (potentiometer) or option i (inhibit)

Immunity to Environmental Conditions

Table 4: 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: Relative humidity: Duration:	40 $^{\pm 2}$ °C 93 $^{+2/-3}$ % 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: Bump duration: Number of bumps:	100 g_n = 981 m/s^2 6 ms 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: Bump duration: Number of bumps:	40 g_n = 392 m/s^2 6 ms 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): Max. vibration amplitude: Acceleration amplitude: Test duration:	10...2000 Hz 0.35 mm (10...60 Hz) 5 g_n = 49 m/s^2 (60...2000 Hz) 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: Frequency band: Acceleration magnitude: Test duration:	0.05 g^2/Hz 20...500 Hz 4.9 g_{rms} 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: Duration: Storage: Storage duration: Number of cycles:	5% (30°C) 2 h per cycle 40°C, 93% rel. humidity 22 h per cycle 3	Unit not operating

Table 5: Temperature specifications

Temperature			Standard -7		Option -9		
Characteristics		Conditions	min	max	min	max	Unit
T_A	Ambient temperature	$U_{i\,min}$...$U_{i\,max}$ I_o = 0...$I_{o\,nom}$	–25	71	–40	71	°C
T_C	Case temperature		–25	95	–40	95	
T_S	Storage temperature	Not operational	–40	100	–55	100	

Table 6: 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	
	130'000 h	58'000 h	36'000 h	17'000 h	3'900'000 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 earthed.

Table 7: 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					
Voltage surge	IEC 571-1 (1990-07)		i/c, +i/–i	800 V_p	100 µs	100 Ω	1 pos. and 1 neg. voltage surge per coupling mode	yes	2
				1500 V_p	50 µs				
				3000 V_p	5 µs				
				4000 V_p	1 µs				
				7000 V_p	100 ns				
Electrostatic discharge	IEC 801-2 (1991-04)	4	contact discharge to case	8000 V_p	1/50 ns	330 Ω	10 positive and 10 negative discharges	yes	1 3 6
Electric field	IEC 801-3 (1984)	3	antenna in 1m distance	10 V/m	sine wave modulated w. 1 kHz		26…1000 MHz	yes	1
Fast transient/ burst	IEC 801-4 (1988)	4	i/c, +i/–i	4000 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	1 3 6
Transient	IEC 801-5 (Draft 1993-01)	III	i/c	2000 V_p	1.2/50 µs	12 Ω	5 pos. and 5 neg. impulses per coupling mode	yes	1 6
			+i/–i	1000 V_p		2 Ω			
Immunity to conducted disturbancies	IEC 801-6	3	i, o, signal wires	10 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°C, unless T_C is specified.
– With R or option P, output voltage U_o = $U_{o\,nom}$ at $I_{o\,nom}$

Table 8a: Input and output data

Characteristics		Conditions	PSL 126 min	PSL 126 typ	PSL 126 max	PSL 156 min	PSL 156 typ	PSL 156 max	PSL 246 min	PSL 246 typ	PSL 246 max	Unit
Output												
$U_{o\,nom}$	Output voltage	$U_{i\,nom}$, $I_{o\,nom}$	11.92		12.07	14.91		15.09	23.85		24.14	V
$I_{o\,nom}$	Output current	$U_{i\,min}$...$U_{i\,max}$ $T_{C\,min}$...$T_{C\,max}$		6.0			6.0			6.0		A
I_{oL}	Output current limitation response		6.0		7.8	6.0		7.8	6.0		7.8	
u_o	Ripple at output (BW = 20 MHz)	$U_{i\,nom}$ $I_{o\,nom}$		55	75		80	100		80	120	mV_{pp}
$\Delta U_{o\,U}$	Static control deviation versus input voltage U_i	$U_{i\,min}$...$U_{i\,max}$ $I_{o\,nom}$		25	40		25	40		80	100	mV
$\Delta U_{o\,I}$	Static control deviation versus output current I_o	$U_{i\,nom}$ I_o = 0…$I_{o\,nom}$		30	50		30	50		60	100	
$u_{o\,d}$	Dynamic control deviation [1]	$U_{i\,nom}$ $I_{o\,nom} \leftrightarrow {}^1/_3\, I_{o\,nom}$		100			100			120		
t_r	Dynamic load transient time recovery [1]			60			60			80		µs
α_{uo}	Temperature coefficient $\Delta U_o/\Delta T_C$	$U_{i\,min}$...$U_{i\,max}$ $T_{C\,min}$...$T_{C\,max}$ I_o = 0...$I_{o\,nom}$			±2			±3			±5	mV/K
					±0.02			±0.02			±0.02	%/K
Input												
U_i	Input voltage [5]	I_o = 0...$I_{o\,nom}$ $T_{C\,min}$...$T_{C\,max}$	18		144	22		144	31		144	V DC
$\Delta U_{io\,min}$	Minimum differential voltage U_i - U_o [2]			6			7			7		V
$U_{i\,o}$	Undervoltage cut-out			12			15			19		
$I_{i\,0}$	No load input current	I_o = 0 $U_{i\,min}$...$U_{i\,max}$		35			35			35		mA
$I_{i\,m}$	Peak value of inrush current [3]	$U_{i\,nom}$		250			250			250		A
$t_{i\,s}$	Rise time [3]			5			5			5		µs
$t_{i\,r}$	Tail half value time [3]			40			40			40		
$I_{i\,m}$	Peak value of inrush current [3]	$U_{i\,nom}$ with option L		350			350			350		A
$t_{i\,s}$	Rise time [3]			25			25			25		µs
$t_{i\,r}$	Tail half value time [3]			125			125			125		
$u_{i\,rfi}$	RFI level at input, [4] 0.01...30 MHz	VDE 0871 (6.78) $U_{i\,min...max}$, $I_{o\,nom}$			B			B			B	dB (µV)
Efficiency												
η	Efficiency	$U_{i\,nom}$, $I_{o\,nom}$		89			90			94		%
Isolation												
U_{is}	Isolation test voltage electronics to case	Inputs/outputs interconnected		1500			1500			1500		V DC

[1] See "Dynamic characteristics"
[2] The minimum differential voltage $\Delta U_{io\,min}$ between input and output increases linearly from 0 to 1 V at T_A = 46°C and 71°C (T_C = 70°C and 95°C)
[3] Definitions according to VDE 0433, part 3
[4] With option L and additional external input capacitor C_e = 470 µF/200 V, e.g. Chemicon, KME-series or equivalent
[5] Surges up to 156 V for 2 sec. (complying to LES-DB standard for U_N = 110 V)

Table 8b: Input and output data

Characteristics		Conditions	PSL 366 min	PSL 366 typ	PSL 366 max	PSL 486 min	PSL 486 typ	PSL 486 max		Unit
Output										
$U_{o\,nom}$	Output voltage	$U_{i\,nom}$, $I_{o\,nom}$	35.78		36.22	47.70		48.29		V
$I_{o\,nom}$	Output current	$U_{i\,min}$...$U_{i\,max}$ $T_{C\,min}$... $T_{C\,max}$		6.0			6.0			A
I_{oL}	Output current limitation response		6.0		7.8	6.0		7.8		
u_o	Ripple at output (BW = 20 MHz)	$U_{i\,nom}$ $I_{o\,nom}$		80	150		100	200		mV_{pp}
$\Delta U_{o\,U}$	Static control deviation versus input voltage U_i	$U_{i\,min}$...$U_{i\,max}$ $I_{o\,nom}$		200	300		100	200		mV
$\Delta U_{o\,I}$	Static control deviation versus output current I_o	$U_{i\,nom}$ $I_o = 0 \ldots I_{o\,nom}$		120	200		180	250		
$u_{o\,d}$	Dynamic control deviation [1]	$U_{i\,nom}$ $I_{o\,nom} \leftrightarrow {}^1/_3\, I_{o\,nom}$		140			150			
t_r	Dynamic load transient time recovery [1]			100			100			µs
α_{uo}	Temperature coefficient $\Delta U_o/\Delta T_C$	$U_{i\,min}$...$U_{i\,max}$ $T_{C\,min}$... $T_{C\,max}$ $I_o = 0$...$I_{o\,nom}$			±8			±10		mV/K
					±0.02			±0.02		%/K
Input										
U_i	Input voltage [5]	$I_o = 0$...$I_{o\,nom}$ $T_{C\,min}$... $T_{C\,max}$	44		144	58		144		V DC
$\Delta U_{io\,min}$	Minimum differential voltage U_i - U_o [2]			8			10			V
$U_{i\,o}$	Undervoltage cut-out			29			40			
$I_{i\,0}$	No load input current	$I_o = 0$ $U_{i\,min}$...$U_{i\,max}$		40			45			mA
$I_{i\,m}$	Peak value of inrush current [3]	$U_{i\,nom}$		250			250			A
$t_{i\,s}$	Rise time [3]			5			5			µs
$t_{i\,r}$	Tail half value time [3]			40			40			
$I_{i\,m}$	Peak value of inrush current [3]	$U_{i\,nom}$ with option L		350			350			A
$t_{i\,s}$	Rise time [3]			25			25			µs
$t_{i\,r}$	Tail half value time [3]			125			125			
$u_{i\,rfi}$	RFI level at input, [4] 0.01...30 MHz	VDE 0871 (6.78) $U_{i\,nom}$, $I_{o\,nom}$			B			B		dB (µV)
Efficiency										
η	Efficiency	$U_{i\,min...max}$, $I_{o\,nom}$		95			96			%
Isolation										
U_{is}	Isolation test voltage electronics to case	Inputs/outputs interconnected		1500			1500			V DC

[1] See "Dynamic characteristics"
[2] The minimum differential voltage $\Delta U_{io\,min}$ between input and output increases linearly from 0 to 1 V at T_A = 46°C and 71°C (T_C = 70°C and 95°C)
[3] Definitions according to VDE 0433, part 3
[4] With option L and additional external input capacitor C_e = 470 µF/200 V, e.g. Chemicon, KME-series or equivalent
[5] Surges up to 156 V for 2 sec. (complying to LES-DB standard for U_N = 110 V)

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

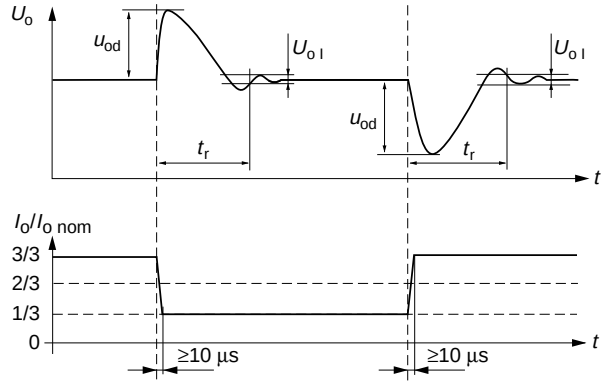


Fig. 3
Behaviour and characteristics under varying load conditions.

Temperature

When a converter is located in free, quasi-stationary air at a temperature T_A = 71°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 $T_{A\,max}$ = 85°C. A simple check of the case temperature T_C ($T_C \leq$ 95°C) at full load ensures correct operation of the system

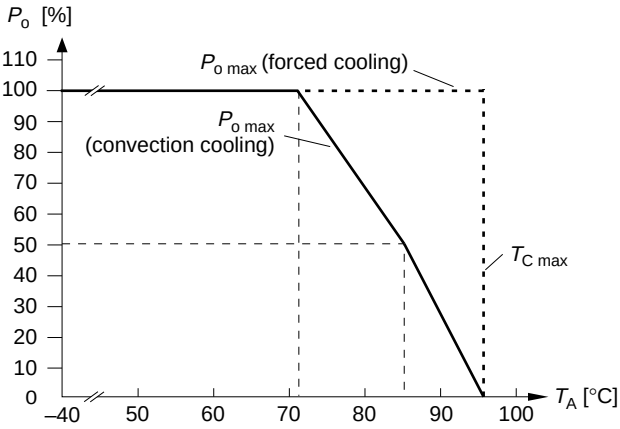


Fig. 4
Output power derating versus ambient temperature

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.

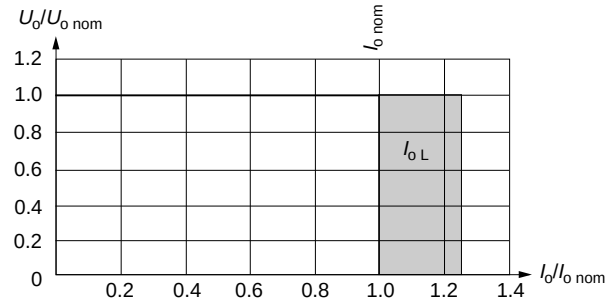


Fig. 5
Overload, short-circuit behaviour U_o versus I_o

Standard Features

R External Output Voltage Adjustment

Note: With open R input, $U_o = U_{o\,nom}$.
R-input together with option i or option P cannot be supported simultaneously.

The output voltage U_o can either be adjusted with an external resistor (R_1 or R_2) or with an external voltage (U_{ex}). The adjustment range is 0…1.08 of $U_{o\,nom}$. The minimal differential voltage $\Delta U_{io\,min}$ between input and output should be maintained (see data). Min. input = Undervoltage cut-out.

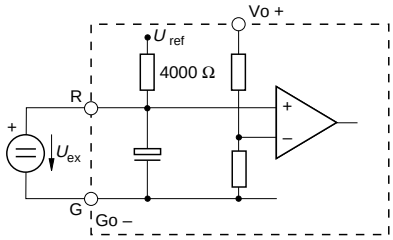


Fig. 6
Voltage adjustment with U_{ex} [V] between R and G (Go-):

a) $U_o \approx U_{ex} \bullet \dfrac{U_{o\,nom}}{U_{ref}}$ (U_{ref} = 2.5 V ±4%)

Caution: To prevent damage U_{ex} should not exceed 2.7 V, nor be negative.

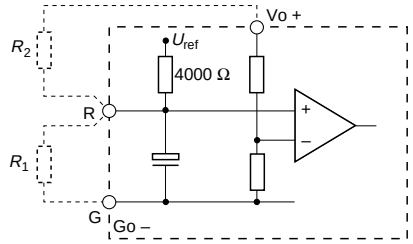


Fig. 7
Voltage adjustment with external resistor R_1 or R_2 [Ω]

b) U_o = 0...100 % $U_{o\,nom}$, using R_1 between R and G (Go-):

$$U_o \approx U_{o\,nom} \bullet \frac{R_1}{R_1 + 4000} \qquad R_1 \approx \frac{4000 \bullet U_o}{U_{o\,nom} - U_o}$$

c) $U_o = U_{o\,nom}...U_{o\,max}$, using R_2 between R and Vo+:
$U_{o\,max} = U_{o\,nom}$ + 8%

$$U_o \approx U_{ref} \bullet \frac{R_2}{k \bullet (R_2 + 4000) - 4000} \qquad k = \frac{U_{ref}}{U_{o\,nom}}$$

$$R_2 \approx 4000 \bullet \frac{U_o \bullet (1\text{-}k)}{k \bullet U_o - U_{ref}} \qquad (U_{ref} = 2.5\ V \pm 4\%)$$

All formulae give approximate values only.

Description of Options

Option i Inhibit

Note: With open i-input, output is enabled (U_o = on)
Inhibit excludes R function.

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.

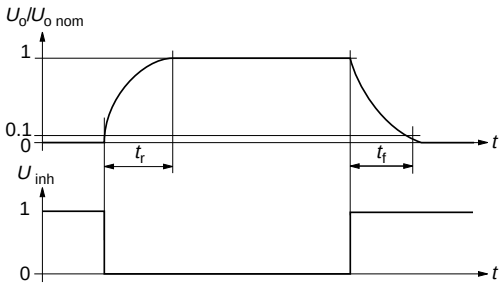


Fig. 9
Output response as a function of inhibit signal

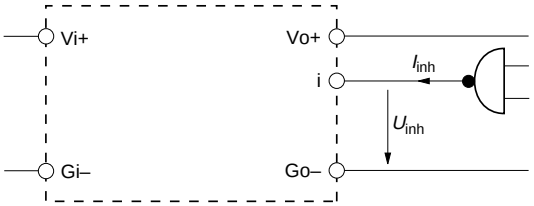


Fig. 8
Definition of I_{inh} and U_{inh}

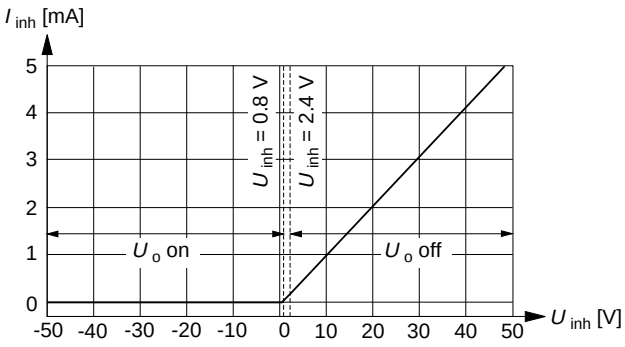


Fig. 10
Inhibit current I_{inh} versus inhibit voltage U_{inh}

Data

Table 9: Inhibit characteristics

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

5.1

Option -9 Extended Temperature Range

The operational ambient temperature range is extended to T_A = –40...71°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 mΩ. 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:

$$u_{i\,max} = 10\ V_{pp} \text{ at } 100\ Hz \text{ or } V_{pp} = 1000\ Hz/f_i \bullet 1\ V$$

Option P Potentiometer

Option P and the R-function cannot be supported simultaneously. The output voltage U_o can be adjusted with a screwdriver in the range from 0.92...1.08 of the nominal output voltage $U_{o\,nom}$.

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

Option U Ambient Temp. Range acc. UL Recognition

Underwriters Laboratories (UL) have approved the PSL family as recognized components up to an ambient temperature of $T_{A\,max}$ – 10 K given by the upper temperature limit of the standard PCB material. If the full maximum ambient temperature $T_{A\,max}$ 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 $T_{A\,max}$ = 71°C without any further precautions.

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 $U_{o\,c}$. Depending on the application, further decentralized overvoltage protection elements may have to be used additionally.

Table 10: Crowbar trigger levels

Characteristics		Conditions	12 V		15 V		24 V		36 V		48 V		Unit
			min	max	min	max	min	max	min	max	min	max	
$U_{o\,c}$	Trigger voltage	$U_{i\,min}...U_{i\,max}$ $I_o = 0...I_{o\,nom}$ $T_{C\,min}...T_{C\,max}$	13.5	16	16.5	19	27	31	40	45.5	55	60	V
t_s	Delay time			1.5		1.5		1.5		1.5		1.5	µs

Option D "Save Data", input undervoltage monitor

Note: Output instead of input undervoltage monitor is available on request (option D1).

If the input voltage U_i is below the adjustable threshold voltage U_t, the control circuit for terminal D has low impedance. Terminal D and Go– are connected to a self-conducting field effect transistor (FET). A 0.5 W Zener diode provides protection against overvoltages.

The voltage U_t can be externally adjusted with a trim potentiometer by means of a screwdriver. The hysteresis U_H of U_t is <2%. Terminal D stays low for a minimum time $t_{low\ min}$, in order to prevent any oscillation. U_t can be set to a value between $U_{i\,min}$ and $U_{i\,max}$ according to fig. 10. It is important to note that the FET can become conductive again when $U_D > U_i$ – 3V.

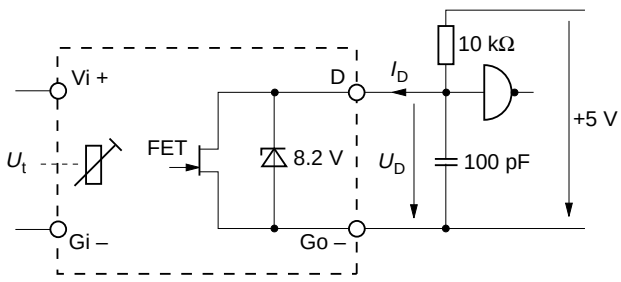


Fig. 11
Test circuit with definition of voltage U_D and current I_D on Terminal D.

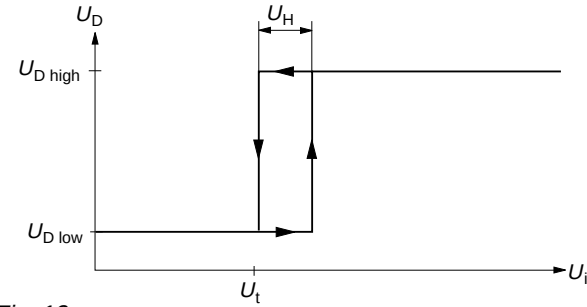


Fig. 12
Definition of U_t and U_H

Data

Table 11: Option D data

Characteristics		Conditions	PSL			Unit
			min	typ	max	
$U_{D\ low}$	Voltage - Terminal D at low impedance	$U_i < U_t$, $I_D \leq 2.5$ mA			0.8	V
$U_{D\ high}$	Voltage - Terminal D at high impedance	$U_i > U_t + U_H$, $I_D > 25$ µA	4.75			
$t_{low\ min}$	Minimum duration $U_{D\ low}$			30		ms
$t_{D\ f}$	Response time to $U_{D\ low}$			1		µs
$I_{D\ max}$	Maximum current - Terminal D				20	mA

Application examples

a) The signal U_D can be utilized in battery powered systems to provide a warning in case of **low batteries**.

b) In case of power failure, the signal can serve to initiate **data save** routines.

Option A Test sockets

Test sockets (pin Ø = 2 mm) for measuring the output voltage are located at the front panel of the module. The output voltage is measured internally directly at the connector pins.

5.1

Mechanical Data

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

European Projection

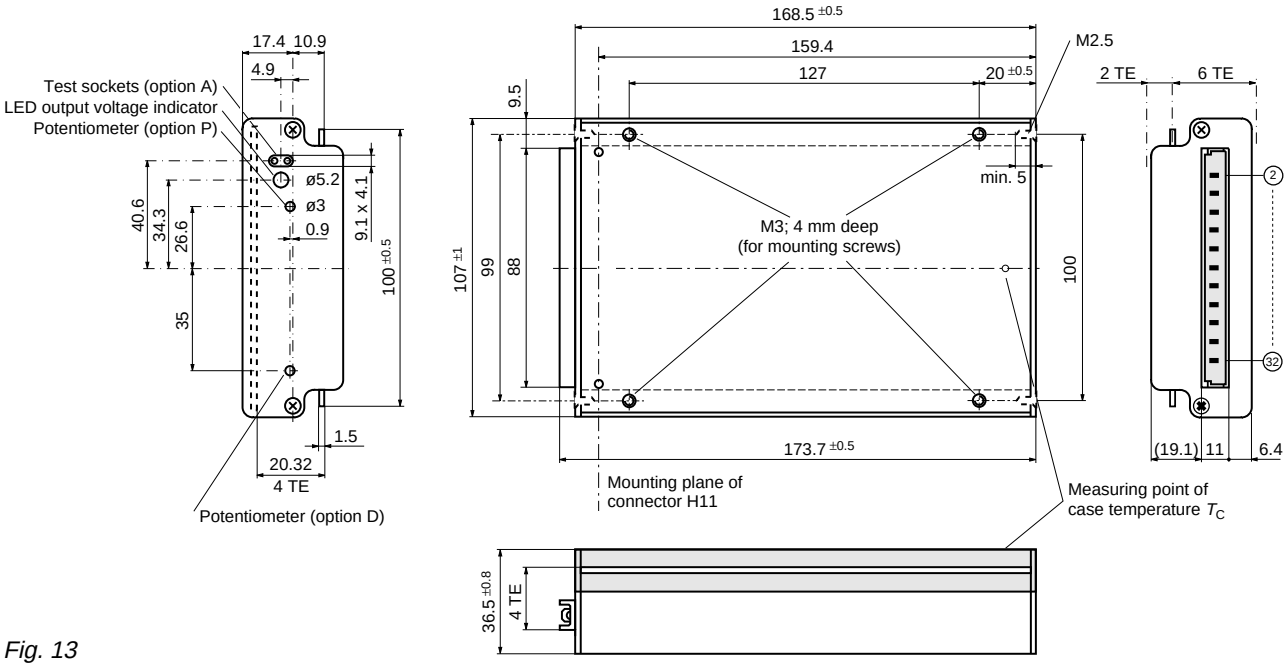
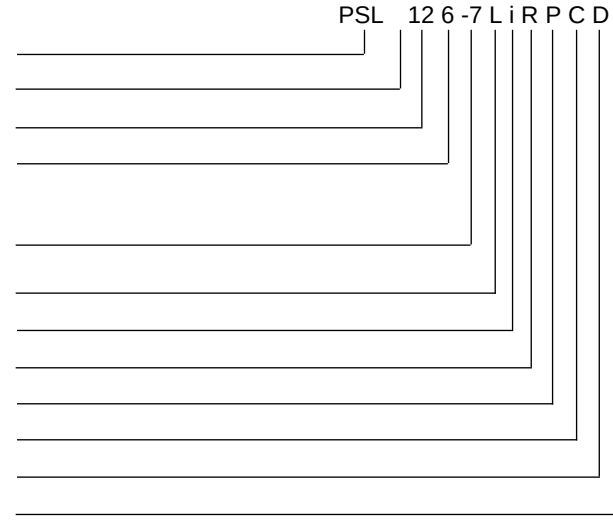


Fig. 13
Case L04 (weight 550 g)

Type Key and Product Marking

Type Key



Positive switching regulator in case L04 ..... PSL
Blank .....
Nominal output voltage in volt ..... 12...48
Nominal output current in ampere 6
Ambient temperature range
T_A = –25...71°C ..... -7
T_A = –40...71°C ..... -9
Input filter L
Inhibit input i
External output voltage adjustment ..... R
Potentiometer ..... P
Thyristor-Crowbar C
"Save Data" undervoltage monitor ..... D
Test sockets ..... A

Example:PSL 126-7LiPC = A positive switching regulator with a 12 V, 6 A output, ambient temperature range of –25…71°C, input filter, inhibit input, potentiometer and thyristor-crowbar.

Produkt Marking

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

Front plate: Identification of LED, optional test sockets and potentiometers.

Back plate: Specific type designation, input voltage range, nominal output voltage and current, pin allocation of options and auxiliary functions 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 production date.