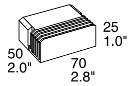
PSR: Positive Switching Regulators

PSR-Series

No input to output isolation
Single output of 5, 12, 15, 24 or 36 V DC/15...72 W
Input voltage up to 80 V DC

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

Safety according to IEC/EN 60950



Summary

The PSR series of positive 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.

Modules with input voltages up to 80 V are specially designed for secondary switched and battery driven applications. The case design allows operation at nominal load up to 71 °C without additional cooling.

Type Survey and Key Data

Table 1: Type survey

Output voltage $U_{o\,nom}$ [V]	Output current $I_{o\,nom}$ [A]	Input voltage range U_i [V] [1]	Input voltage $U_{i\,nom}$ [V]	Efficiency [2]		Type designation	Options
				η_{min} [%]	η_{typ} [%]		
5	5	7...35	20	81	83	PSA 55-7	-9, i, P, R, Y
5	4	7...40	20	82	83	PSR 54-7	-9, i, P, R, Y
5	3	8...80	40	77	79	PSR 53-7	-9, i, P, R, Y
5	2	8...80	40	72	74	PSR 52-7	Y
12	2.5	15...80	40	86	87	PSR 122.5-7	-9, i, P, R, Y
15	2.5	19...80	40	88	89	PSR 152.5-7	-9, i, P, R, Y
24	2	29...80	50	91	92	PSR 242-7	-9, i, P, R, Y
36	2	42...80	60	92	94	PSR 362-7	-9, i, P, R, Y

[1] See also: *Electrical Input Data:* $\Delta U_{io\,min}$.

[2] Efficiency at $U_{i\,nom}$ and $I_{o\,nom}$.

Non standard input/output configurations or special custom adaptions are available on request.
See also: *Commercial Information: Inquiry Form for Customized Power Supply.*

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Type Key

PSR 12 2.5 -7 i R P Y

Positive switching regulator in case A01 .... PSR
Nominal output voltage in volt .... 5...36
Nominal output current in ampere .... 2...5
Operational ambient temperature range T_A
–25...71 °C .... -7
–40...71 °C (option) .... -9

Options:
Inhibit input i
Control input for output voltage adjustment [1] .... R
Potentiometer [1] .... P
PCB soldering pins 0.5 × 1.0 mm ....Y

[1] Option R excludes option P and vice versa.

Example: PSR 122.5-7iPY = A positive switching regulator with a 12 V, 2.5 A output, ambient temperature range of –25…71 °C, inhibit input, potentiometer and PCB soldering pins.

Functional Description

The switching regulators are designed using the buck converter topology. See also: *Technical Information: Topologies*. The input is not electrically isolated from the output. During the on period of the switching transistor, current is transferred to the output and energy is stored in the output choke in the form of flux. During the off period, this energy forces the current to continue flowing through the output, to the load and back through the freewheeling diode. Regulation is accomplished by varying the on to off duty ratio of the power switch.

These regulators are ideal for a wide range of applications, where input to output isolation is not necessary, or where already provided by an external front end (e.g. a transformer with rectifier). To optimise customer's needs, additional options and accessories are available.

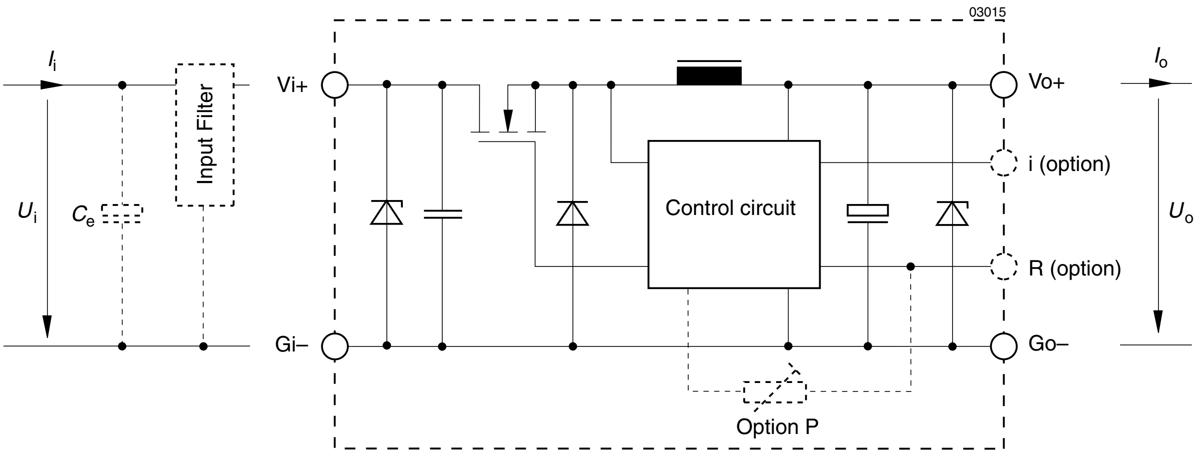


Fig. 1
Block diagram

Electrical Input Data

General Conditions: T_A = 25°C, unless T_C is specified

Table 2a: Input data

Input			PSA 55			PSR 54			PSR 53			PSR 52			
Characteristics		Conditions	min	typ	max	min	typ	max	min	typ	max	min	typ	max	Unit
U_i	Operating input voltage	I_o = 0...$I_{o\,nom}$ $T_{C\,min}$...$T_{C\,max}$	7		35	7		40	8		80	8		80	V DC
$\Delta U_{io\,min}$	Min. diff. voltage $U_i - U_o$ [1]				2			2			3			3	
$U_{i\,o}$	Undervoltage lock-out			6.3			6.3			7.3			7.3		
$I_{i\,0}$	No load input current	I_o = 0, $U_{i\,min}$...$U_{i\,max}$			45			45			40			40	mA
$I_{inr\,p}$	Peak value of inrush current	$U_{i\,nom}$		75			75			150			150		A
$t_{inr\,r}$	Rise time			2.5			2.5			2.5			2.5		µs
$t_{inr\,h}$	Time to half-value			15			15			15			15		
$u_{i\,RFI}$	Input RFI level, EN 55011/22 0.01...30 MHz	$U_{i\,nom}$, $I_{o\,nom}$			B [2]			B [2]			B [3]			B [3]	

Table 2b: Input data

Input			PSR 122.5			PSR 152.5			PSR 242			PSR 362			
Characteristics		Conditions	min	typ	max	min	typ	max	min	typ	max	min	typ	max	Unit
U_i	Operating input voltage	I_o = 0...$I_{o\,nom}$ $T_{C\,min}$...$T_{C\,max}$	15		80	19		80	29		80	42		80	V DC
$\Delta U_{io\,min}$	Min. diff. voltage $U_i - U_o$ [1]				3			4			5			6	
$U_{i\,o}$	Undervoltage lock-out			7.3			7.3			12			19		
$I_{i\,0}$	No load input current	I_o = 0, $U_{i\,min}$...$U_{i\,max}$			35			35			35			40	mA
$I_{inr\,p}$	Peak value of inrush current	$U_{i\,nom}$		150			150			150			150		A
$t_{inr\,r}$	Rise time			2.5			2.5			2.5			2.5		µs
$t_{inr\,h}$	Time to half-value			15			15			15			15		
$u_{i\,RFI}$	Input RFI level, EN 55011/22 0.01...30 MHz	$U_{i\,nom}$, $I_{o\,nom}$			B [3]			B [3]			B [3]			B [3]	

[1] The minimum differential voltage $\Delta U_{io\,min}$ between input and output increases linearly by 0 to 1 V between T_A = 46°C and 71°C (T_C = 70°C and 95°C)
[2] With input filter FP 38 (connected between Uii and Gi, see: *Accessory Products*) and C_e = 470 µF/40 V
[3] With input filter FP 80 (connected between Uii and Gi, see: *Accessory Products*) and C_e = 470 µF/100 V

External Input Circuitry

The sum of the lengths of the supply lines to the source or to the nearest capacitor ≥100 µF or to the nearest external input filter which includes such a capacitor (a + b) should not exceed 0.3 m (0.5 m twisted). An external input filter (FP 38 or FP 80, see: *Accessory Products*) is recommended in order to prevent power line oscillations and reduce superimposed interference voltages. See also: *Technical Information*: *Application Notes.*

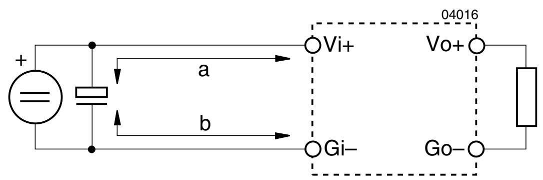


Fig. 2
Switching regulator with long supply lines.

Electrical 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 3a: Output data

Output				**PSA 55**			**PSR 54**			**PSR 53**			**PSR 52**			
Characteristics			Conditions	min	typ	max	min	typ	max	min	typ	max	min	typ	max	Unit
U_o	Output voltage		$U_{i\ nom}$, $I_{o\ nom}$	4.97		5.03	4.97		5.03	4.97		5.03	4.97		5.03	V
I_o	Output current [1]		$U_{i\ min}...U_{i\ max}$ $T_{C\ min}...T_{C\ max}$	0		5.0 [3]	0		4.0	0		3.0	0		2.0	A
I_{oL}	Output current limitation response [1]			5.0		6.5	4.0		5.2	3.0		3.9	2.0		2.6	
u_o	Output voltage noise	Switching freq.	$U_{i\ nom}$, $I_{o\ nom}$ IEC/EN 61204 [2] BW = 20 MHz		20	35		15	25		20	35		20	35	mV_{pp}
		Total			24	39		19	29		24	39		24	39	
$\Delta U_{o\ U}$	Static line regulation		$U_{i\ min}...U_{i\ max}$, $I_{o\ nom}$		30	45		30	45		30	45		30	45	mV
$\Delta U_{o\ I}$	Static load regulation		$U_{i\ nom}$, $I_o = 0...I_{o\ nom}$		20	25		20	25		20	25		20	25	
$u_{o\ d}$	Dynamic load regulation	Voltage deviat.	$U_{i\ nom}$ $I_{o\ nom} \leftrightarrow {}^1/_3\ I_{o\ nom}$ IEC/EN 61204 [2]		250			200			100			100		
t_d		Recovery time			40			40			50			50		µs
α_{Uo}	Temperature coefficient $\Delta U_o/\Delta T_C$ ($T_{C\ min}...T_{C\ max}$)		$U_{i\ min}...U_{i\ max}$ $I_o = 0...I_{o\ nom}$			±1			±1			±1			±1	mV/K
						±0.02			±0.02			±0.02			±0.02	%/K

Table 3b: Output data

Output				**PSR 122.5**			**PSR 152.5**			**PSR 242**			**PSR 362**			
Characteristics			Conditions	min	typ	max	min	typ	max	min	typ	max	min	typ	max	Unit
U_o	Output voltage		$U_{i\ nom}$, $I_{o\ nom}$	11.93		12.07	14.91		15.09	23.86		24.14	35.78		36.22	V
I_o	Output current [1]		$U_{i\ min}...U_{i\ max}$ $T_{C\ min}...T_{C\ max}$	0		2.5	0		2.5	0		2.0	0		2.0	A
I_{oL}	Output current limitation response [1]			2.5		3.25	2.5		3.25	2.0		2.6	2.0		2.6	
u_o	Output voltage noise	Switching freq.	$U_{i\ nom}$, $I_{o\ nom}$ IEC/EN 61204 [2] BW = 20 MHz		30	45		40	75		45	95		80	160	mV_{pp}
		Total			35	50		44	80		50	100		85	165	
$\Delta U_{o\ U}$	Static line regulation		$U_{i\ min}...U_{i\ max}$, $I_{o\ nom}$		50	75		70	100		150	220		200	270	mV
$\Delta U_{o\ I}$	Static load regulation		$U_{i\ nom}$, $I_o = 0...I_{o\ nom}$		35	45		40	55		120	160		125	160	
$u_{o\ d}$	Dynamic load regulation	Voltage deviat.	$U_{i\ nom}$ $I_{o\ nom} \leftrightarrow {}^1/_3\ I_{o\ nom}$ IEC/EN 61204 [2]		180			180			210			250		
t_d		Recovery time			60			60			80			100		µs
α_{Uo}	Temperature coefficient $\Delta U_o/\Delta T_C$ ($T_{C\ min}...T_{C\ max}$)		$U_{i\ min}...U_{i\ max}$ $I_o = 0...I_{o\ nom}$			±2			±3			±5			±8	mV/K
						±0.02			±0.02			±0.02			±0.02	%/K

[1] See also: *Thermal Considerations.*
[2] See: *Technical Information: Measuring and Testing.*
[3] Linear derating from 5 to 4 A between T_A = 61°C and 71°C (T_C = 85°C and 95°C).

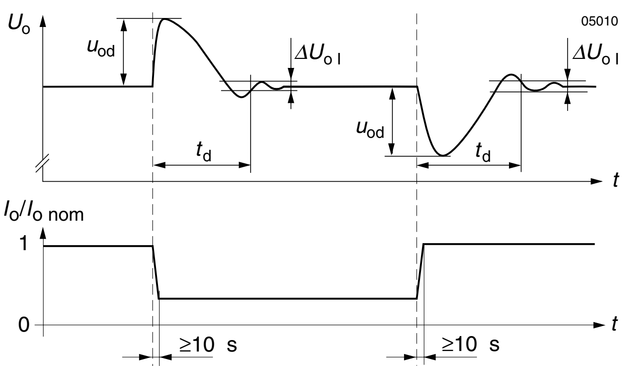


Fig. 3
Dynamic load regulation.

Thermal Considerations

When a switching regulator is located in free, quasi-stationary air (convection cooling) at a temperature $T_A = 71\,°C$ and is operated at its nominal output current $I_{o\ nom}$, 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 (heat sink, fan, etc.) are taken to ensure that the case temperature T_C does not exceed its maximum value of 95°C.

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.

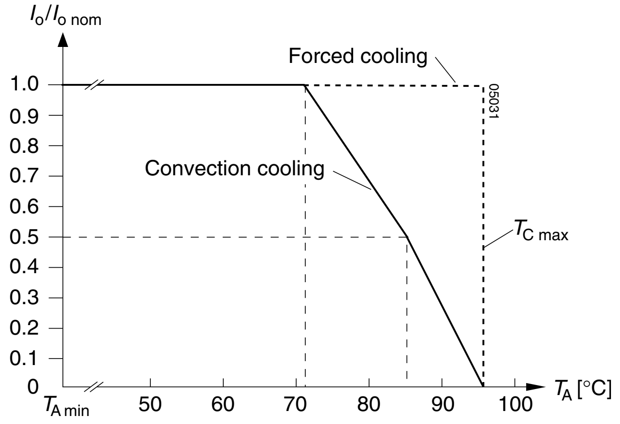


Fig. 4
Output current derating versus temperature

Output Protection

A voltage suppressor diode which in worst case conditions fails into a short circuit, protects the output against an internally generated overvoltage. Such an overvoltage could occur due to a failure of either the control circuit or the switching transistor. The output protection 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).

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 heat generation. 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. Electrically 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.

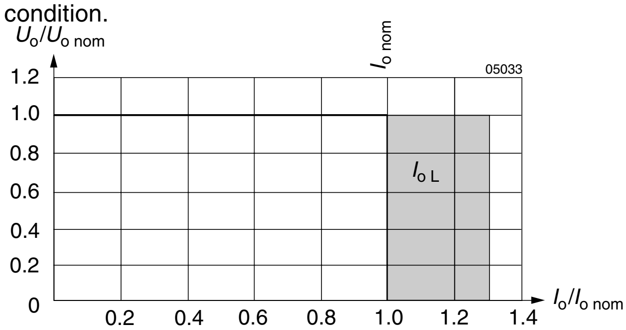


Fig. 5
Overload, short-circuit behaviour U_o versus I_o.

Auxiliary Functions

LED Output Voltage Indicator

A yellow output indicator LED shines when the output voltage is higher than approx. 3 V.

The LED output voltage indicator is not available for PSR 52.

Electromagnetic Compatibility (EMC)

Electromagnetic Immunity

General condition: Case not earthed.

Table 4: Immunity type tests

Phenomenon	Standard[1]	Class Level	Coupling mode[2]	Value applied	Waveform	Source Imped.	Test procedure	In oper.	Per-form.[3]
1 MHz burst disturbance	IEC 60255-22-1	III	i/o, i/c, o/c	2500 V_p	400 damped 1 MHz waves/s	200 Ω	2 s per coupling mode	yes	A
			+i/–i, +o/–o	1000 V_p					
Voltage surge	IEC 60571-1		i/c, +i/–i	800 V_p	100 µs	100 Ω		yes	B
				1500 V_p	50 µs		1 pos. and 1 neg. voltage surge per coupling mode		
				3000 V_p	5 µs				
				4000 V_p	1 µs				
				7000 V_p	100 ns				
Electrostatic discharge	IEC/EN 61000-4-2	3	contact discharge to case	6000 V_p	1/50 ns	330 Ω	10 positive and 10 negative discharges	yes	B[4]
Electromagnetic field	IEC/EN 61000-4-3	2	antenna	3 V/m	AM 80% 1 kHz		26…1000 MHz	yes	A
Electrical fast transient/burst	IEC/EN 61000-4-4	3	i/c, +i/–i	2000 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	A[4]
		4		4000 V_p					B[4]
Surge	IEC/EN 61000-4-5	2	i/c	1000 V_p	1.2/50 µs	12 Ω	5 pos. and 5 neg. surges per coupling mode	yes	B[4]
			+i/–i	500 V_p		2 Ω			
Conducted disturbances	IEC/EN 61000-4-6	3	i, o, signal wires	140 dBµV (10 V_{rms})	AM 80% 1 kHz	150 Ω	0.15...80 MHz	yes	A

[1] For related and previous standards see: *Technical Information: Safety & EMC*.
[2] i = input, o = output, c = case.
[3] A = Normal operation, no deviation from specifications, B = Normal operation, temporary deviation from specs possible.
[4] External input filter FP 38 or FP 80 necessary.

Electromagnetic Emission

For emission levels refer to: *Electrical Input Data*.

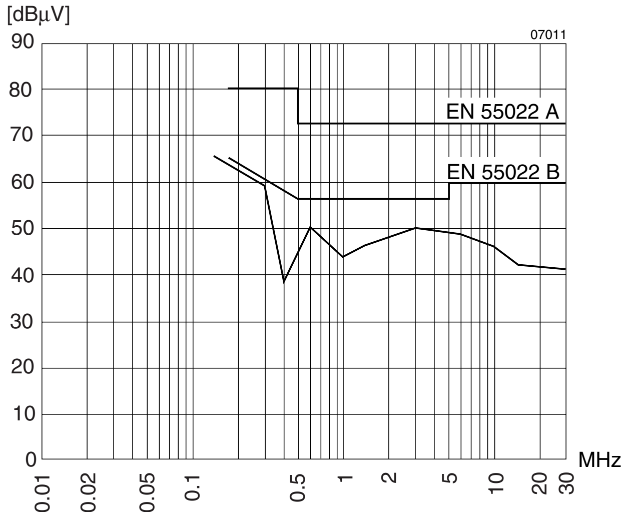


Fig. 6
Typical disturbance voltage (quasi-peak) at the input according to EN 55011/22 measured at $U_{i\,nom}$ and $I_{o\,nom}$.

Immunity to Environmental Conditions

Table 5: Mechanical stress

Test Method		Standard	Test Conditions		Status
Ca	Damp heat steady state	IEC/DIN IEC 60068-2-3 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)	IEC/EN/DIN EN 60068-2-27 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	Bump (half-sinusoidal)	IEC/EN/DIN EN 60068-2-29 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)	IEC/EN/DIN EN 60068-2-6 MIL-STD-810D section 514.3	Acceleration amplitude: Frequency (1 Oct/min): Test duration:	0.7 mm (10...60 Hz) 10 g_n = 98 m/s^2 (60...2000 Hz) 10...2000 Hz 7.5 h (2.5 h each axis)	Unit operating
Fda	Random vibration wide band Reproducibility high	IEC 60068-2-35 DIN 40046 part 23	Acceleration spectral density: Frequency band: Acceleration magnitude: Test duration:	0.2 g^2/Hz 20...500 Hz 9.8 g_{rms} 3 h (1 h each axis)	Unit operating
Kb	Salt mist, cyclic (sodium chloride NaCl solution)	IEC/EN/DIN IEC 60068-2-52	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 6: Temperature specifications, valid for air pressure of 800...1200 hPa (800...1200 mbar)

Temperature			Standard -7		Option -9		
Characteristics		Conditions	min	max	min	max	Unit
T_A	Ambient temperature [1]	Operational [2]	–25	71	–40	71	°C
T_C	Case temperature		–25	95	–40	95	
T_S	Storage temperature [1]	Non operational	–40	100	–55	100	

[1] MIL-STD-810D section 501.2 and 502.2
[2] See: *Thermal Considerations*

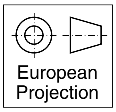
Table 7: MTBF and device hours

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	
	160'000	70'000 h	45'000 h	22'000 h	5'100'000 h

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

Mechanical Data

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



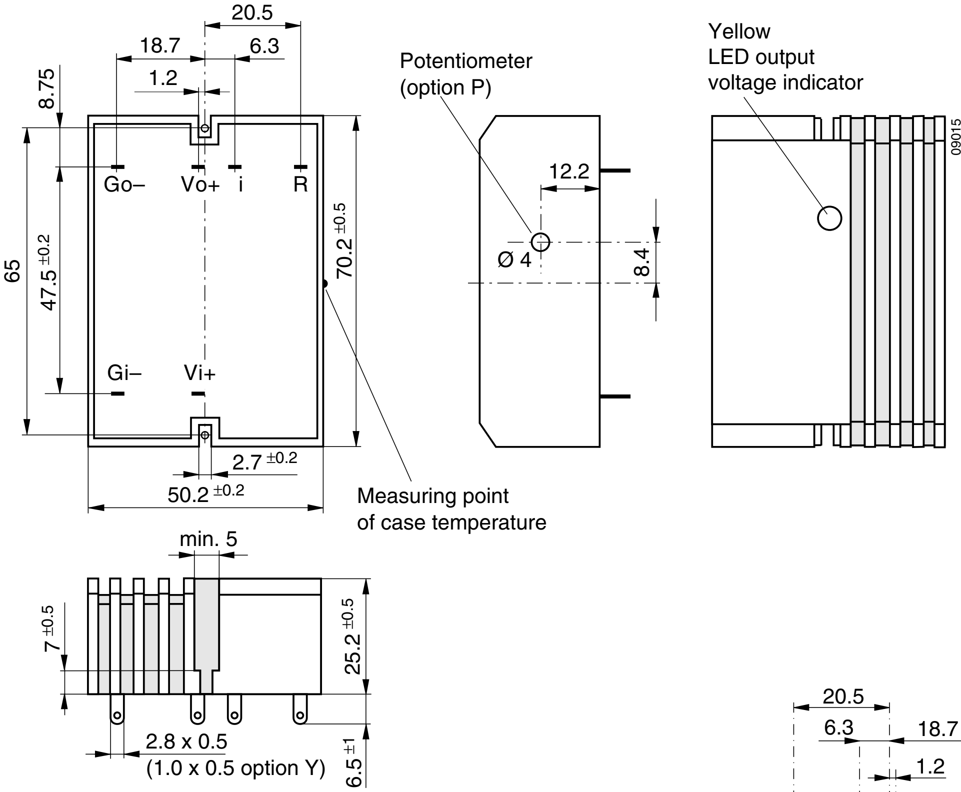


Fig. 7
Case A01, weight 100 g
Aluminium, black finish
and self cooling

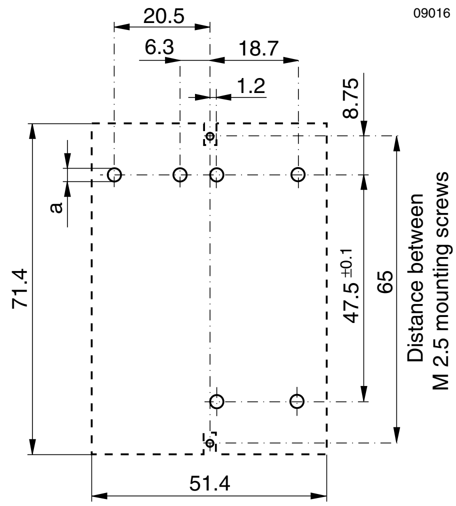


Fig. 8
Case A01 hole locations for circuit board layout (component side view of PCB):
- - - = Space reserved for switching regulator
"a" = 3.0 mm x 0.7 mm slot or Ø 3.0 mm, through plated for hand or machine soldering (fast on)
"a" = Ø 1.3...1.5 mm with option Y pins

Safety and Installation Instructions

Installation Instruction

Installation of the switching regulators must strictly follow the national safety regulations in compliance with the enclosure, mounting, creepage, clearance, casualty, markings and segregation requirements of the end-use application.

Check for hazardous voltages before altering any connections. Connections can be made using fast-on or soldering technique.

The input and the output circuit are not separated, i.e. the negative path is internally interconnected!

The units should be connected to a secondary circuit.

Do not open the module.

Ensure that a unit failure (e.g. by an internal short-circuit) does not result in a hazardous condition. See also: *Safety of operator accessible output circuit.*

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 IP 40, IP 20 with option P and for PSR 52.

Isolation

Electric strength test voltage between input interconnected with output and case: 750 V DC, 1 s.

This test is performed as factory test in accordance with IEC/EN 60950 and UL 1950 and should not be repeated in the field. Melcher will not honour any guarantee claims resulting from electric strength field tests.

Standards and Approvals

All switching regulators are UL recognized according to UL 1950, UL 1012 and EN 60950, UL recognized for Canada to CAN/CSA C22.2 No. 234-M90 and SEV approved to IEC/EN 60950 and EN 55014 standards.

The units have been evaluated for:

- Building in,
- Operational insulation from input to output and input/output to case,
- The use in an overvoltage category II environment,
- The use in a pollution degree 2 environment.

The switching regulators are subject to manufacturing surveillance in accordance with the above mentioned UL and CSA and with ISO 9001 standards.

Safety of Operator Accessible Output Circuit

If the output circuit of a switching regulator is operator-accessible, it shall be an SELV circuit according to IEC/EN 60950 related safety standards

The following table shows some possible installation configurations, compliance with which causes the output circuit of the switching regulator to be an SELV circuit according to IEC/EN 60950 up to a nominal output voltage of 30 V.

However, it is the sole responsibility of the installer or user to assure the compliance with the relevant and applicable safety regulations.

More information is given in: *Technical Information: Safety & EMC.*

Table 8: Insulation concept leading to an SELV output circuit

Conditions	Front end			Switching regulator	Result
Supply voltage	Minimum required grade of isolation, to be provided by the AC-DC front end, including mains supplied battery charger	Maximum DC output voltage from the front end [1]	Minimum required safety status of the front end output circuit	Measures to achieve the specified safety status of the output circuit	Safety status of the switching regulator output circuit
Battery supply, considered as secondary circuit	Double or Reinforced	≤60 V	SELV circuit	None	SELV circuit
		>60 V	Earthed hazardous voltage secondary circuit [2]	Input fuse [3] and earthed [4] or non accessible case [5]	Earthed SELV circuit
			Unearthed hazardous voltage secondary circuit [5]	Input fuse [3] and unearthed, non accessible case [5]	Unearthed SELV circuit
			Hazardous voltage secondary circuit	Input fuse [3] and earthed output circuit [4] and earthed [4] or non accessible case [5]	Earthed SELV circuit
Mains ≤250 V AC	Basic	≤60 V	Earthed SELV circuit [4]	None	
			ELV circuit	Input fuse [3] and earthed output circuit [4] and earthed [4] or non accessible case [5]	
		>60 V	Hazardous voltage secondary circuit		
	Double or reinforced	≤60 V	SELV circuit	None	SELV circuit
		>60 V	Double or reinforced insulated unearthed hazardous voltage secondary circuit [5]	Input fuse [3] and unearthed and non accessible case [5]	Unearthed SELV circuit

[1] The front end output voltage should match the specified input voltage range of the switching regulator.

[2] The conductor to the Gi– terminal of the switching regulator has to be connected to earth by the installer according to the relevant safety standard, e.g. IEC/EN 60950.

[3] The installer shall provide an approved fuse (slow blow type with the lowest current rating suitable for the application, max. 12.5 A) in a non-earthed input conductor directly at the input of the switching regulator. If Vo+ is earthed, insert the fuse in the Gi- line. For UL's purpose, the fuse needs to be UL-listed. If option C is fitted, a suitable fuse is already built-in in the Vi+ line.

[4] The earth connection has to be provided by the installer according to the relevant safety standard, e.g. IEC/EN 60950.

[5] Has to be insulated from earth by double or reinforced insulation according to the relevant safety standard, based on the maximum output voltage from the front end.

Description of Options

i Inhibit for Remote On and Off

Note: With open i-input, output is enabled (U_o = on).
Not available for PSR 52.

The inhibit input allows the switching regulator output 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 switching on or off.

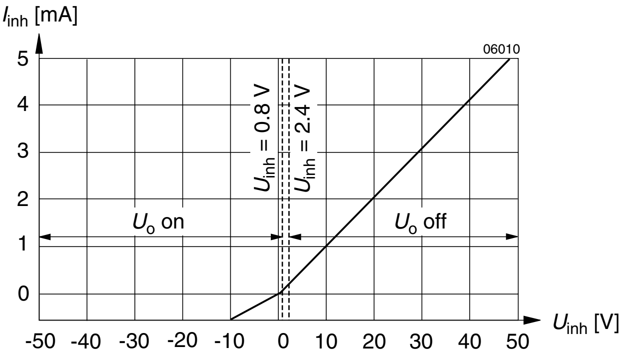


Fig. 9
Typical inhibit current I_{inh} versus inhibit voltage U_{inh}

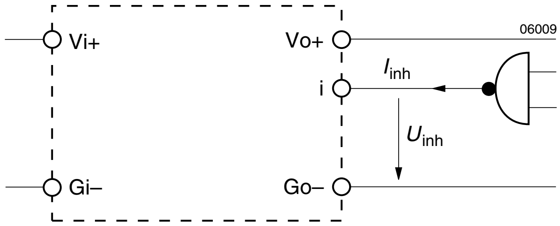


Fig. 10
Definition of I_{inh} and U_{inh}

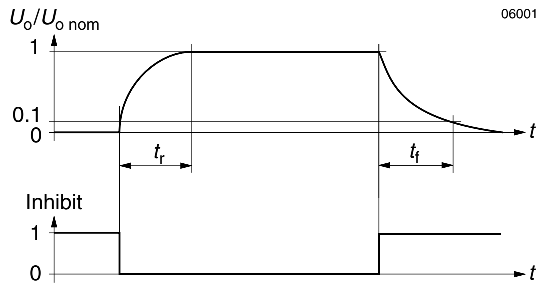


Fig. 11
Output response as a function of inhibit signal

Table 9: Inhibit characteristics

Characteristics			Conditions	min	typ	max	Unit
U_{inh}	Inhibit input voltage to keep regulator output voltage...	U_o = on	$U_{i\,min}...U_{i\,max}$ $T_{C\,min}...T_{C\,max}$	–10		+0.8	V DC
		U_o = off		+2.4		+50	
t_r	Switch-on time after inhibit command		$U_i = U_{i\,nom}$ $R_L = U_{o\,nom} / I_{o\,nom}$		2		ms
t_f	Switch-off time after inhibit command				4		
$I_{i\,inh}$	Input current when inhibited		$U_i = U_{i\,nom}$		10		mA

R Control for Output Voltage Adjustment

Note: With open R input, $U_o \approx 1.08\ U_{o\,nom}$.
(Exception: With option Y, $U_o \approx 1.00\ U_{o\,nom}$)
Option R excludes option P and vice versa.
Not available for PSR 52.

The output voltage U_o can either be adjusted with an external voltage (U_{ext}) or with an external resistor (R_1 or R_2). The adjustment range is 0...108% of $U_{o\,nom}$. The minimum differential voltage $\Delta U_{io\,min}$ between input and output (see: *Electrical Input Data*) should be maintained. Under-voltage lock-out = Minimum input voltage.

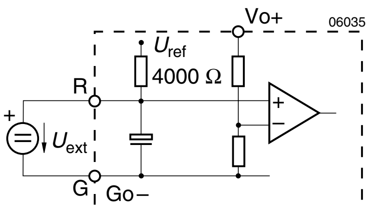


Fig. 12
Voltage adjustment with U_{ext} between R and Go–

a) *Without option Y:* U_o = 0...108% $U_{o\,nom}$, using U_{ext}

$$U_{ext} \approx \frac{2.5\ V \bullet U_o}{1.08 \bullet U_{o\,nom}} \qquad U_o \approx 1.08\ U_{o\,nom} \bullet \frac{U_{ext}}{2.5\ V}$$

b) With option Y: U_o = 0...108% $U_{o\,nom}$

$$U_{ext} \approx \frac{2.5\ V \bullet U_o}{U_{o\,nom}} \qquad U_o \approx U_{o\,nom} \bullet \frac{U_{ext}}{2.5\ V}$$

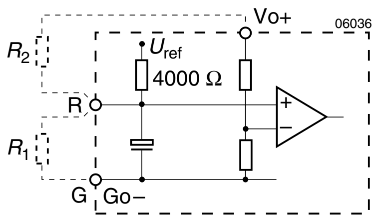


Fig. 13
Voltage adjustment with external resistor R_1 or R_2

c) Without option Y: U_o = 0...108% $U_{o\,nom}$, using R_1

$$R_1 \approx \frac{4000\ \Omega \bullet U_o}{1.08 \bullet U_{o\,nom} - U_o} \qquad U_o \approx \frac{1.08 \bullet U_{o\,nom} \bullet R_1}{R_1 + 4000\ \Omega}$$

d) With option Y: U_o = 0...100% $U_{o\,nom}$, using R_1

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

e) With option Y: U_o = 100...108% $U_{o\,nom}$, using R_2

$$R_2 \approx \frac{4000\ \Omega \bullet U_o \bullet (U_{o\,nom} - 2.5\ V)}{2.5\ V \bullet (U_o - U_{o\,nom})}$$

$$U_o \approx \frac{U_{o\,nom} \bullet 2.5\ V \bullet R_2}{2.5\ V \bullet (R_2 + 4000\ \Omega) - U_{o\,nom} \bullet 4000\ \Omega}$$

Caution: To prevent damage U_{ext} should not exceed 20 V, nor be negative and R_2 should never be less than 47 kΩ.

-9 Extended Temperature Range

Note: Not available for PSR 52.

The operational ambient temperature range is extended to T_A = –40...71 °C. (T_C = –40...95 °C, T_S = –55...100 °C.)

Y PCB Soldering Pins

This option defines soldering pins of 1.0 × 0.5 × 6.5 mm, instead of the standard fast-on terminals of 2.8 × 0.5 × 6.5 mm. Modules with this option can be mounted onto printed circuit boards, providing through-plated finished hole size of Ø 1.3...1.5 mm.

The combination of option Y with option R will result in a different setting of the output voltage (see also description of: *R Control*).

Accessories

A variety of electrical and mechanical accessories are available including:

– Isolation pads for easy and safe PCB-mounting.
– Filters and ring core chockes for ripple and interference reduction.
– Adaptor kit for DIN-rail and chassis mounting.

P Potentiometer

Note: Not available for PSR 52.

Option P excludes option R. 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 Data* should be maintained.