

500 mA DC-DC Step Down Converter P78AS_C-Series



PHI-CON

- Non isolated
- 10 Pin SMD package
- Efficiency up to 95 %
- Operating temperature range -40...85 °C
- Continuous short circuit protected
- Adjustable output voltage



Model guide

Type	Input voltage		Output				Efficiency		Switching frequency [kHz] typ.
	Nominal [V _{DC}]	Range [V _{DC}]	Voltage		Current [mA] max.	Capacitive load [μF] max.	@ V _{in} min.	@ V _{in} max.	
			[V _{DC}]	Tol. [%]			[%] typ.	[%] typ.	
P78AS1R5C	12	4.75..28	1.5	±4	500	680	76	67	370
P78AS1R8C	12	4.75..28	1.8	±4	500	680	76	69	700
P78AS2R5C	12	4.75..32	2.5	±4	500	680	81	74	700
P78AS3R3C	24	4.75..36	3.3	±4	500	680	86	80	700
P78AS05C	24	6.5..36	5.0	±3	500	680	90	84	700
P78AS6R5C	24	8..36	6.5	±3	500	680	92	87	700
P78AS09C	24	12..36	9.0	±3	500	680	93	90	700
P78AS12C	24	16..36	12.0	±3	500	680	94	91	700
P78AS15C	24	19..36	15.0	±3	500	680	95	93	700

Specifications

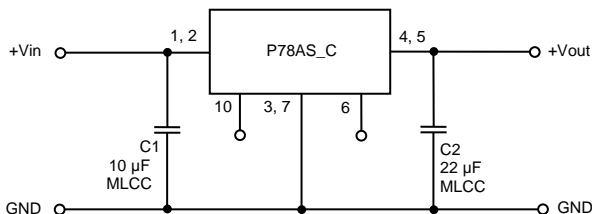
Input	
Filter	Capacitor
No load input current	≤ 1.5 mA
ON/OFF remote control threshold	ON: ≥ 3.5 ... 5.5 V or open pin 10 OFF: 0 ... 0.8 V (see Figure 4)
OFF state quiescent current	≤ 0.1 mA
Output	
Ripple and noise(BW 20 MHz)	≤ 50 mVp-p, @ load 10..100 % load (see Figure 2)
Output voltage trim range (see Page 3)	P78AS1R5C: + 10 % All others: ± 10 %
Temperature coefficient	≤ ± 0.03 % / °C
Short circuit protection	Continuous, automatic recovery
Transient response deviation	≤ 200 mV, @ load change steps 25%
Transient recovery time	≤ 1 ms, @ load change steps 25 %

Type	Line regulation @ full Vin range	Load regulation @ load change 10..100 %
P78AS1R5C	≤ ± 0.4 %	≤ ± 0.6 %
P78AS1R8C	≤ ± 0.4 %	≤ ± 0.6 %
P78AS2R5C	≤ ± 0.4 %	≤ ± 0.6 %
P78AS3R3C	≤ ± 0.4 %	≤ ± 0.6 %
P78AS05C	≤ ± 0.4 %	≤ ± 0.3 %
P78AS6R5C	≤ ± 0.4 %	≤ ± 0.3 %
P78AS09C	≤ ± 0.4 %	≤ ± 0.3 %
P78AS12C	≤ ± 0.4 %	≤ ± 0.3 %

EMS	
CE	EN 55032, CISPR 32 Class B (see Figure 3)
RE	EN 55032, CISPR 32 Class B (see Figure 3)
EMI	
ESD	EN-, IEC 61000-4-2 Contact ± 4 kV, perf. Crit. B
RS	EN-, IEC 61000-4-3 10 V/m perf. Crit. A
EFT	EN-, IEC 61000-4-4 ± 1 kV perf. Crit. B (see Figure 3)
Surge	EN-, IEC 61000-4-5 Line to Line ± 1 kV perf. Crit. B (see Figure 3)
CS	EN-, IEC 61000-4-6 3 Vr.m.s. perf. Crit. A
Safety standard	EN 62368-1
General	
Switching frequency	P78AS1R5C: 370 kHz All others: 700 kHz
Reliability calc. MTBF @ 25 °C MIL-HDBK-217F	≥ 2 Mio. h
Environmental	
Operating ambient temperature	-40...85 °C
Storage temperature	-55...125 °C
Derating	see diagram
Storage humidity	≤ 95 %, non condensing
Cooling	Free air convection, 30...65 LFM
Physical	
Dimensions	SMD10, 15.24 x 11.4 x 8.25 mm
Weight	1.5 g
Case material	Plastic UL94V-0
Reflow soldering temperature	≤ 245 °C peak, duration 10 s, ≤ 217 °C duration 60 s

1. All specifications measured at Ta 25 °C, humidity < 75 %, nominal input voltage and rated output load unless otherwise specified.
2. Do not connect the converter parallel or a hot swap

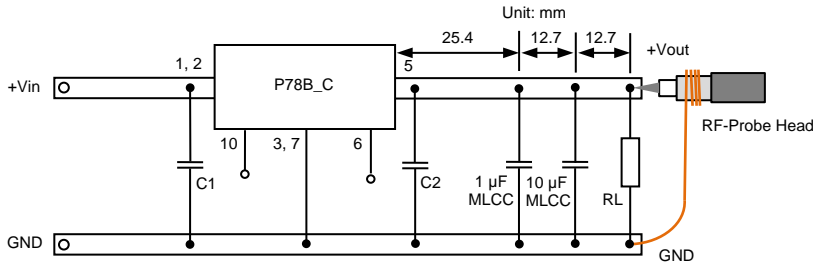
Figure 1 Typical application circuit



C1 and C2 should be placed as close as possible to the pins of the DC/DC-converter.

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Figure 2 Measure circuit for output ripple and noise (BW 20 MHz)



Application circuit for reducing the output ripple

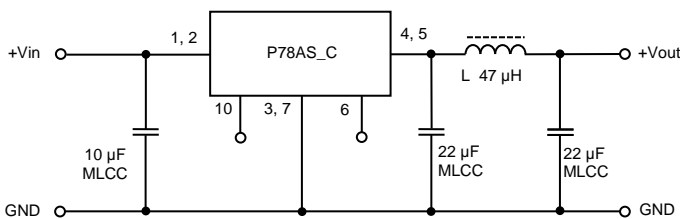


Figure 3 Test circuit for EMS EN 55032 Class B and EMI EN 61000-4-4 and EN 61000-4-5 compliance

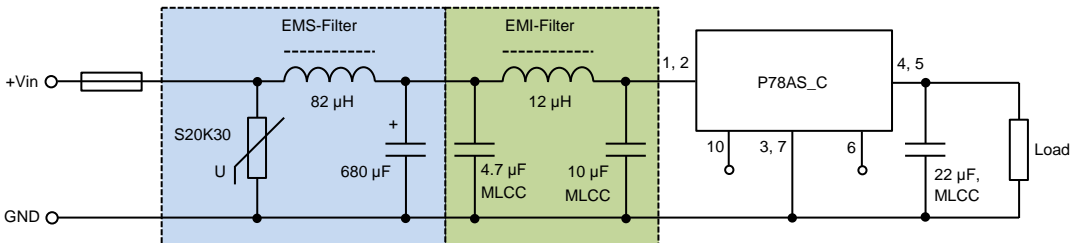
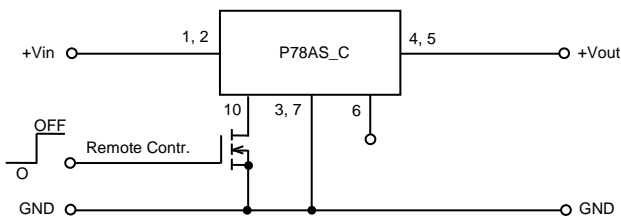


Figure 4 ON / OFF control function

The application circuit shows a digital on/off-control with an open-drain FET as pull down switch.

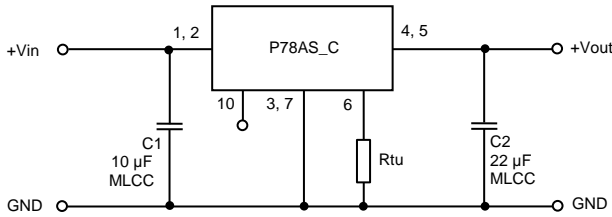




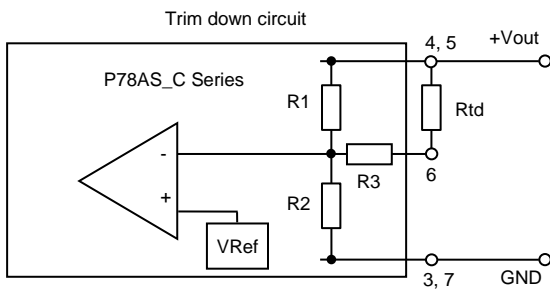
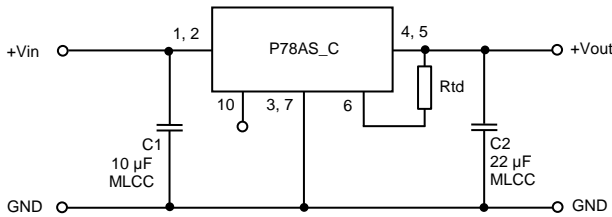
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Application circuit for output voltage trim up



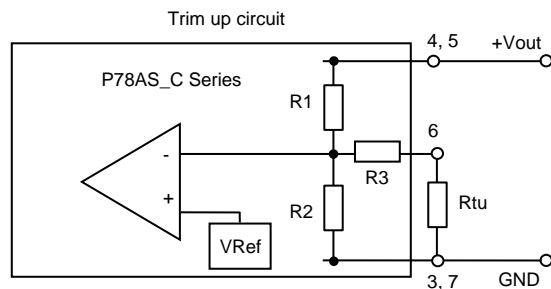
Application circuit for output voltage trim down



Calculation
Trim down resistor

$$b = \frac{V_{out} - V_{ref}}{V_{ref}} * R_2$$

$$R_{td} = \frac{R_1 * b}{R_1 - b} - R_3$$



Calculation
Trim up resistor

$$a = \frac{V_{ref}}{V_{out} - V_{ref}} * R_1$$

$$R_{tu} = \frac{R_2 * a}{R_2 - a} - R_3$$

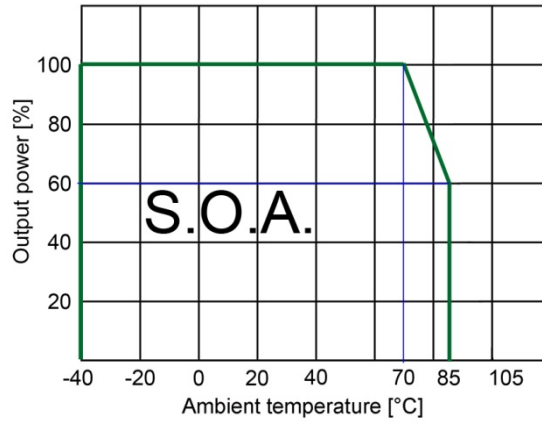
Value table for calculation of trim down resistor (Rtd) or trim up resistor (Rtu)						
Type	R1 [kΩ]	R2 [kΩ]	R3 [kΩ]	V Ref [V]	Rtd min. [kΩ]	Rtu min. [kΩ]
P78AS1.5C	7.5	7.5	15	0.75	Not applicable	22.5
P78AS1.8C	35.7	26.29	100	0.765	66	55
P78AS2.5C	27	11.858	51	0.765	105	34
P78AS3.3C	33	9.9	47	0.765	164	33
P78AS05C	75	13.5	75	0.765	470	43.3
P78AS6.5C	75	10	51	0.765	533	37.6
P78AS09C	51	4.7	27	0.765	360	19.8
P78AS12C	75	5.1	27	0.765	592	21.4
P78AS15C	82	4.423	27	0.765	694	13.4

Maximum output voltage adjust range ± 10 % of Vout nominal, see min. value Rtd and Rtu

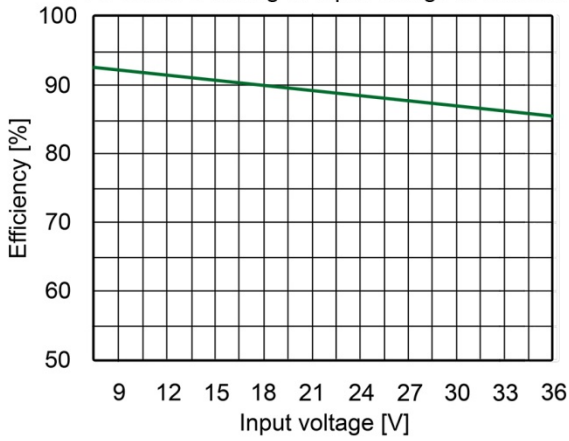
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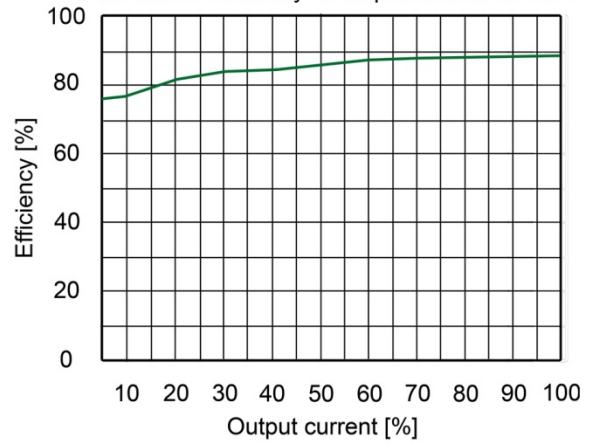
Derating diagram



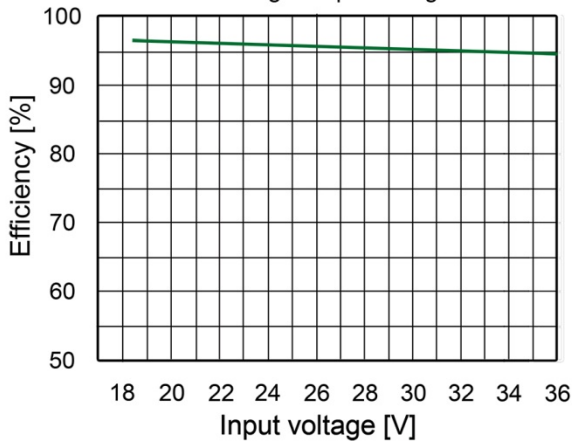
P78AS05C Derating vs input voltage at full load



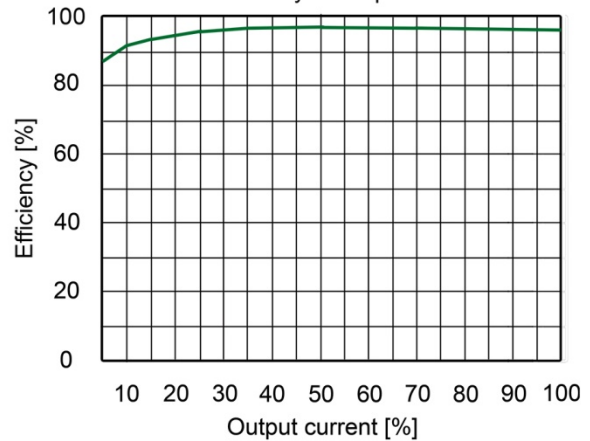
P78AS05C Efficiency vs output load at Vin 24 V



P78AS15C Derating vs input voltage at full load



P78AS15C Efficiency vs output load at Vin 24 V

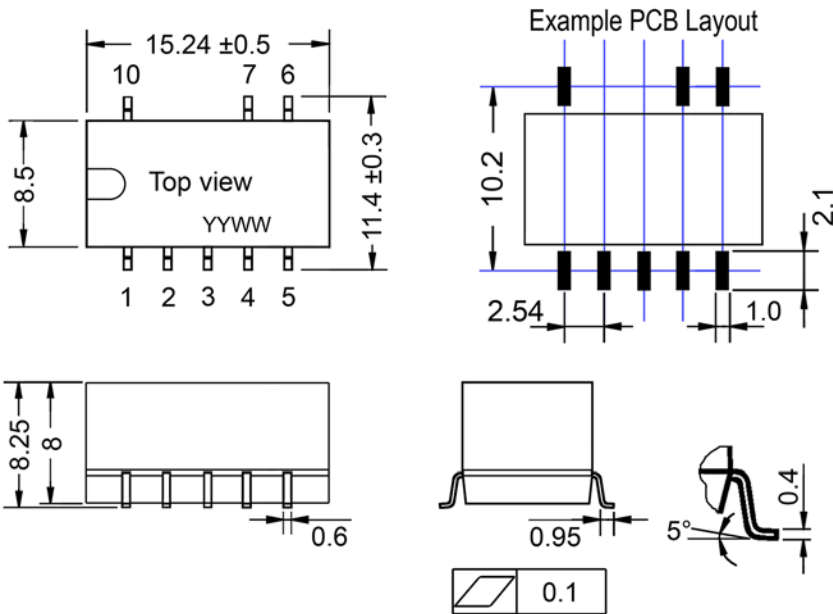




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Mechanical dimensions



Pin assignment	
Pin	Function
1	+V Input
2	+V Input
3	GND
4	+V Output
5	+V Output
6	Trim input
7	GND
10	ON/OFF control

Note:
 All dimensions in mm
 Lead tolerances: ± 0.1 mm
 General tolerance: ± 0.25 mm

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