



PHI-CON

1000 mA DC-DC Step Down Converter P78B_C-Series

- 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.	
P78BS1R5C	12	4.75..32	1.5	±4	1000	680	76	66	370
P78BS1R8C	12	4.75..32	1.8	±4	1000	680	79	69	370
P78BS2R5C	12	4.75..32	2.5	±4	1000	680	86	74	370
P78BS3R3C	24	6.5..36	3.3	±4	1000	680	90	80	520
P78BS05C	24	8..36	5.0	±3	1000	680	93	85	520
P78BS6R5C	24	10..36	6.5	±3	1000	680	93	86	520
P78BS09C	24	13..36	9.0	±3	1000	680	94	89	700
P78BS12C	24	16..36	12.0	±3	800	680	95	92	700

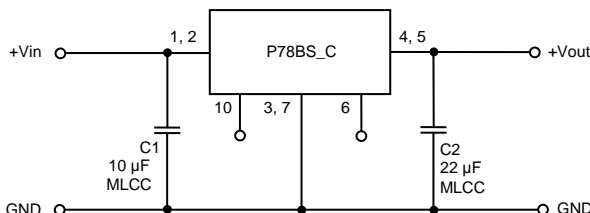
Specifications

Input		
Filter	Capacitor	
No load input current	≤ 1 mA	
ON/OFF remote control threshold	ON: ≥ 3.5 ... 5.5 V or open pin 10 OFF: 0 ... 0.8 V (see Figure 4)	
ON/OFF control current	≤ 200 μA	
OFF state quiescent current	≤ 1 mA	
Output		
Ripple and noise	≤ 75 mVp-p, @ load 20..100 % load (see Figure 2)	
Output voltage trim range (see Page 3)	P78BS1R5C: + 10 % All others: ± 10 %	
Temperature coefficient	± 0.03 % / °C	
Short circuit protection	Continuous, automatic recovery	
Transient response deviation	150 mV, max. @ load change steps 25 %	
Transient recovery time	1 ms, max. @ load change steps 25 %	
Type	Line regulation	Load regulation @ load change 10..100 %
P78BS1R5C	≤ ± 0.6 %	≤ ± 1.5 %
P78BS1R8C	≤ ± 0.6 %	≤ ± 1.5 %
P78BS2R5C	≤ ± 0.6 %	≤ ± 1.5 %
P78BS3R3C	≤ ± 0.6 %	≤ ± 0.6 %
P78BS05C	≤ ± 0.4 %	≤ ± 0.6 %
P78BS6R5C	≤ ± 0.4 %	≤ ± 0.6 %
P78BS09C	≤ ± 0.4 %	≤ ± 0.6 %
P78BS12C	≤ ± 0.4 %	≤ ± 0.6 %

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		
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	Up to 95 %, non condensing	
Cooling	Free air convection, 30...65 LFM	
Physical		
Dimensions	SMD10, 15.24 x 11.4 x 8.25 mm	
Weight	1.7 g	
Case material	Plastic UL94V-0	
Reflow soldering temperature IPC/JEDEC J-STD-020D.1.	≤ 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

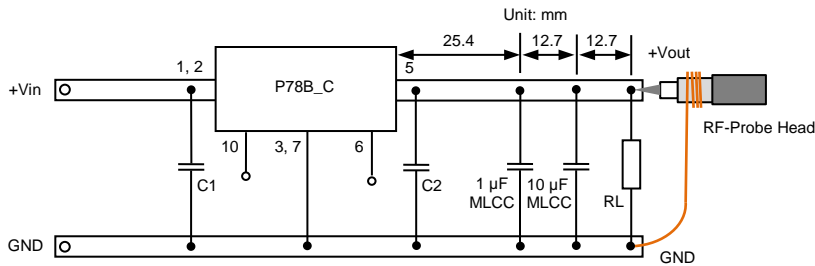


C1 and C2 should be placed as close as possible to the pins of the DC/DC-converter.



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



Application circuit for reducing the output ripple

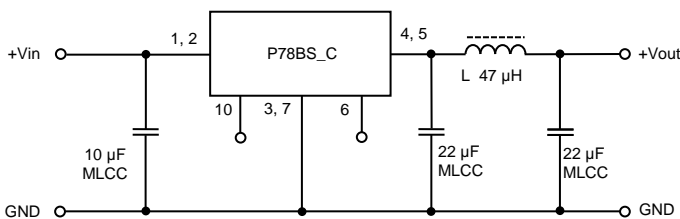


Figure 3 Test circuit for EMS EN 55032 Class B and EMI EN 61000-4-4 and EN 61000-4-5 compliance

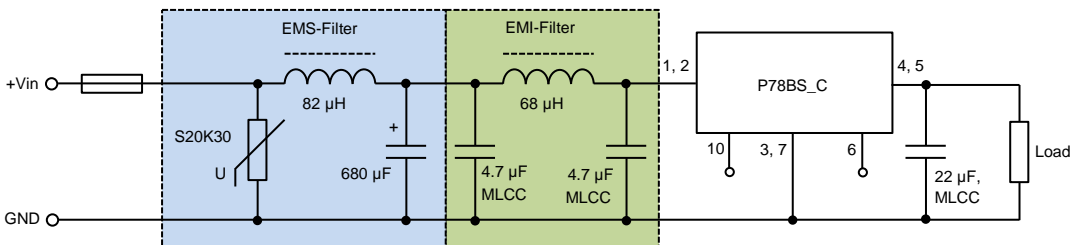
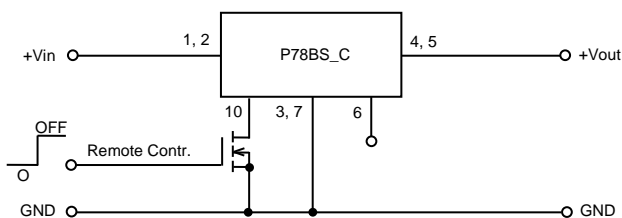


Figure 4 ON / OFF control function

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

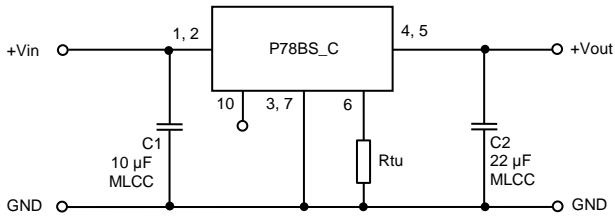




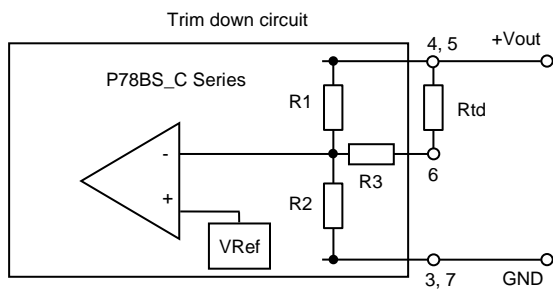
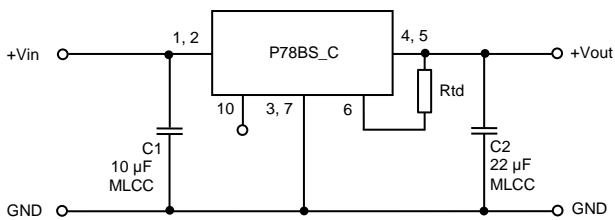
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Application circuit for output voltage trim up



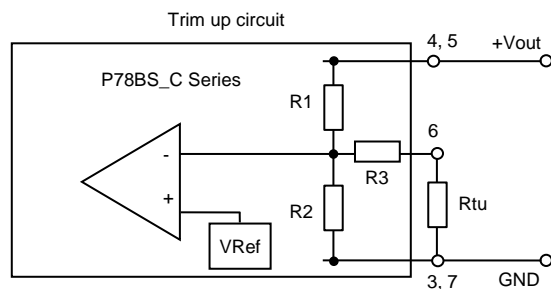
Application circuit for output voltage trim down



Calculation
Trim down resistor

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

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



Calculation
Trim up resistor

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

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

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]
P78BS1.5C	7.5	7.5	15	0.75	Not applicable	22,5
P78BS1.8C	4.7	3.3	6.8	0.75	13,8	15
P78BS2.5C	9.1	3.9	8.2	0.75	46,4	19,1
P78BS3.3C	75	22	75	0.75	420	99
P78BS05C	43	7.5	33	0.75	260	38,7
P78BS6.5C	43	5.6	22	0.75	311	28,3
P78BS09C	43	3.9	22	0.75	322	14,6
P78BS12C	36	2.4	10	0.75	292	12,5

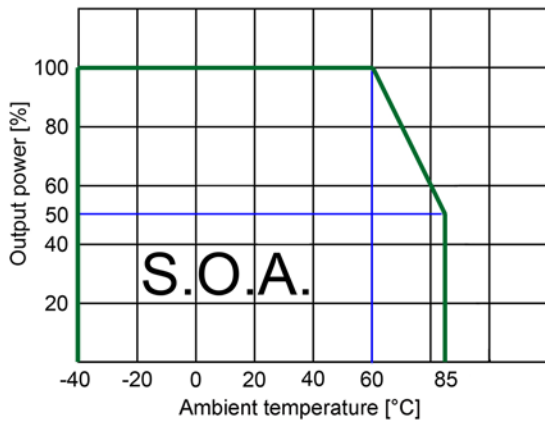
Maximum output voltage adjust range ± 10 % of Vout nominal, see min. value Rtd and Rtu



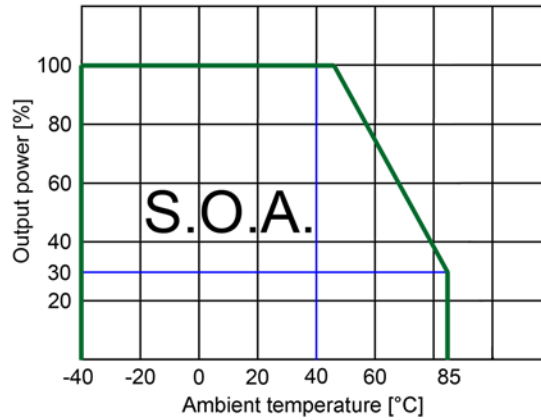
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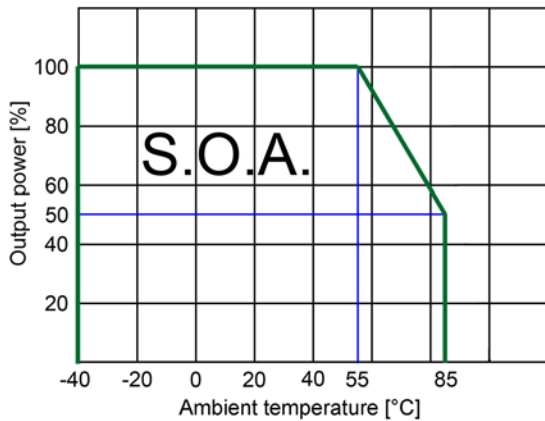
P78AS1R5C, P78AS1R8C, P78AS2R5C,
P78AS3R3C, P78AS05C, P78AS6R5C,
derating diagram at Vin minimum up to 26 V



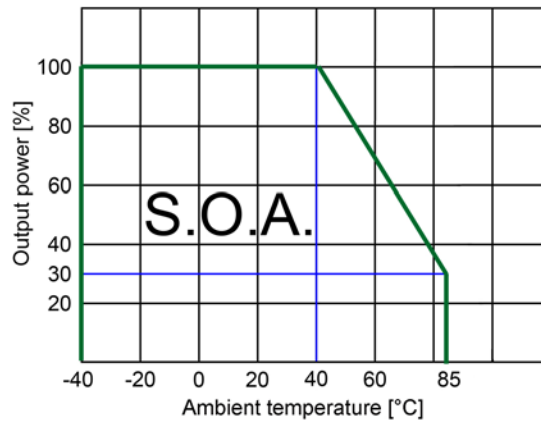
P78AS1R5C, P78AS1R8C, P78AS2R5C,
P78AS3R3C, P78AS05C, P78AS6R5C,
derating diagram at Vin 26 V...36 V



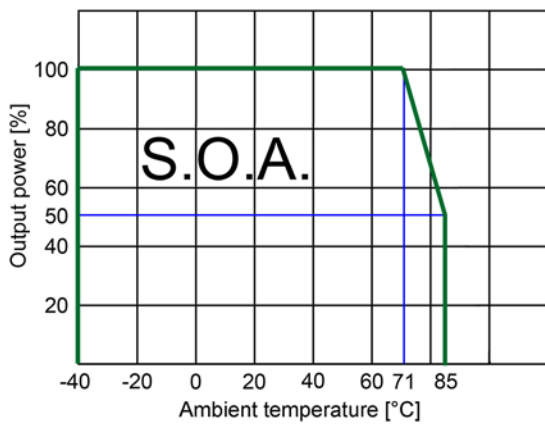
P78AS09C derating diagram
at Vin 13 V ... 26 V



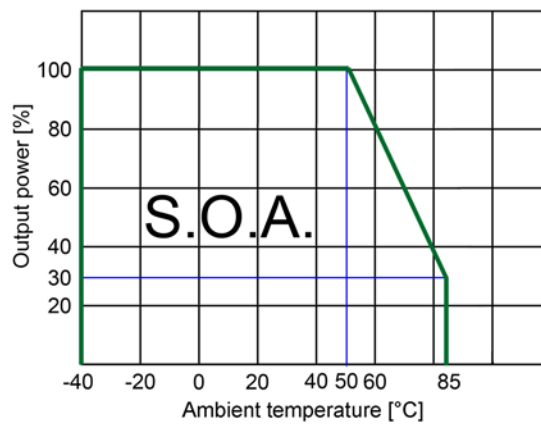
P78AS09C derating diagram
at Vin 26 V ... 36 V



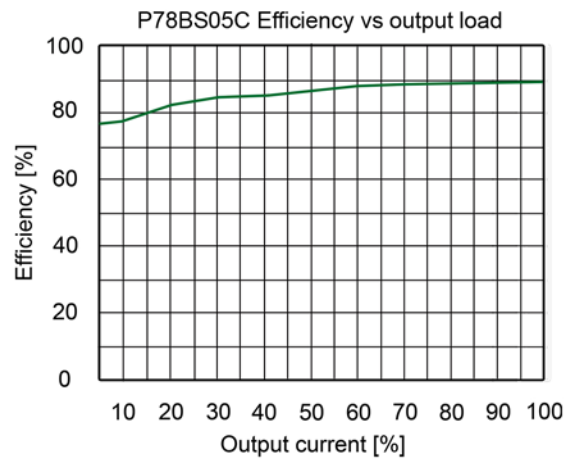
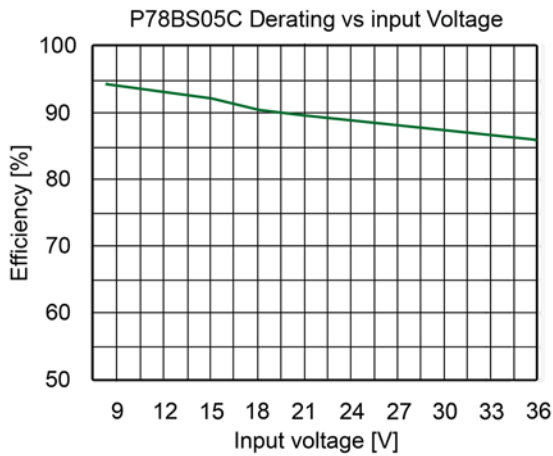
P78AS12C derating diagram
at Vin 16...26 V



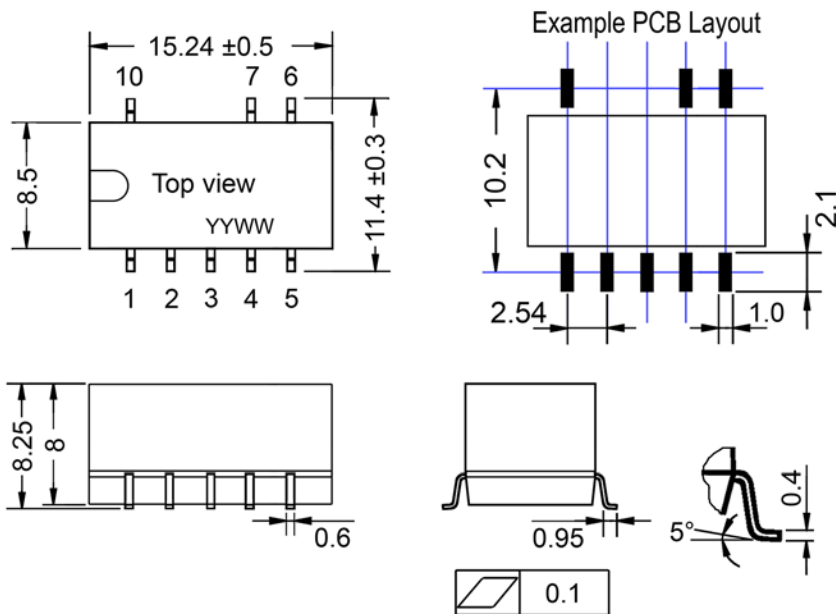
P78AS12C derating diagram
at Vin 26 V ... 36 V



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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 tolerances: ± 0.25 mm

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