

**SERIES:** P78-2000-S | **DESCRIPTION:** NON-ISOLATED SWITCHING REGULATOR

**FEATURES**

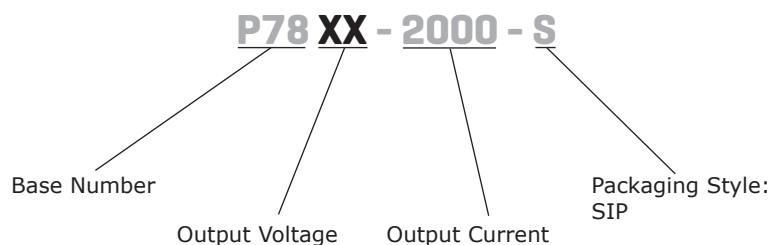
- 2 A of output current
- high efficiency up to 95%
- no-load input current as low as 0.1 mA
- wide temperature range: -40°C ~ +85°C
- output short circuit protection
- pin-out compatible with linear regulators
- designed to meet EN/BS EN 62368



MODEL	input voltage		output voltage (Vdc)	output current max (mA)	output power max (W)	ripple and noise <sup>1,2</sup> max (mVp-p)	efficiency typ (%)
	typ (Vdc)	range (Vdc)					
P78X2-2000-S	24	4.5~28	1.8	2000	3.6	75	83
P7802-2000-S	24	4.5~36	2.5	2000	5	75	89
	12	8~32	-2.5	1000	-2.5	150	84
P7803-2000-S	24	6~36	3.3	2000	6.6	75	89
	12	8~31	-3.3	1000	-3.3	150	83
P7805-2000-S	24	8~36	5	2000	10	75	92
	12	8~30	-5	1000	-5	150	84
P7806-2000-S	24	10~36	6.5	2000	13	75	92
	12	8~29	-6.5	1000	-6.5	150	85
P7809-2000-S	24	13~36	9	2000	18	75	95
	12	8~26	-9	1000	-9	150	84
P7812-2000-S	24	16~36	12	2000	24	75	96
	12	8~23	-12	1000	-12	150	85
P7815-2000-S	24	18~36	15	2000	30	75	96
	12	8~20	-15	1000	-15	150	85

Notes: 1. Ripple and noise are measured at 20 MHz BW, nominal input, full load by "parallel cable" method with 1 µF ceramic and 10 µF electrolytic capacitors on the output.  
2. 20~100% load ripple & noise ≤ 100 mVp-p. 0~20% load ripple & noise ≤ 180 mVp-p

**PART NUMBER KEY**



## INPUT

parameter	conditions/description	min	typ	max	units
operating input voltage	1.8 Vdc output model	4.5	24	28	Vdc
	2.5 Vdc output model	4.5	24	36	Vdc
	3.3 Vdc output model	6	24	36	Vdc
	5.0 Vdc output model	8	24	36	Vdc
	6.5 Vdc output model	10	24	36	Vdc
	9 Vdc output model	13	24	36	Vdc
	12 Vdc output model	16	24	36	Vdc
no load input current	positive output, nominal Vin	1.8 & 2.5 Vdc output all other outputs		0.2 0.1	mA mA
	negative output, nominal Vin	-2.5, -3.3, -5, -6.5 Vdc output all other outputs		1 2	mA mA
filter	capacitance filter				

## OUTPUT

parameter	conditions/description	min	typ	max	units
capacitive load	1.8 & 2.5 Vdc output models			2000	μF
	3.3 Vdc output model			1800	μF
	5 & 6.5 Vdc output models			1000	μF
	9 Vdc output model			680	μF
	12 & 15 Vdc output models			470	μF
line regulation	input voltage range, full load		±0.4	±0.8	%
load regulation	from 10% to 100% load		±0.5	±1.5	%
voltage accuracy	100% load, input voltage range				
	1.8, 2.5, 3.3 Vdc output models all other models		±2 ±2	±4 ±3	% %
switching frequency	100% load, nominal input				
	5 Vdc output model			200	kHz
	12 Vdc output model			270	kHz
	15 Vdc output model			300	kHz
transient recovery time	all other models		400		kHz
	25% load step change		0.2	1	mS
transient response deviation	25% load step change				
	1.8 & 2.5 Vdc output models		80	150	mV
	positive output: all other models negative output: all other models		50 100	150 150	mV mV
temperature coefficient	-40°C ~ 85°C			±0.03	%/°C

## PROTECTIONS

parameter	conditions/description	min	typ	max	units
short circuit protection	continuous, automatic recovery				

## SAFETY AND COMPLIANCE

parameter	conditions/description	min	typ	max	units
safeties approval	designed to meet 62368: EN, BS EN				
conducted emissions	CISPR32/EN55032 class B (see fig. 4-② for recommended circuit)				
radiated emissions	CISPR32/EN55032 class B (see fig. 4-② for recommended circuit)				
ESD	IEC/EN 61000-4-2, contact ± 6kV, perf. Criteria B				
radiated immunity	IEC/EN 61000-4-3, 10V/m, perf. Criteria A				
EFT/burst	IEC/EN 61000-4-4, ± 1kV (see fig. 4-① for recommended circuit), perf. Criteria B				
surge	IEC/EN 61000-4-5, line to line ± 1kV (see fig. 4-① for recommended circuit), perf. Criteria B				
conducted immunity	IEC/EN 61000-4-6, 3 Vr.ms, perf. Criteria A				

## SAFETY AND COMPLIANCE

parameter	conditions/description	min	typ	max	units
MTBF	as per MIL-HDBK-217F @ 25°C	2,000			K hours
RoHS	2011/65/EU				

## ENVIRONMENTAL

parameter	conditions/description	min	typ	max	units
operating temperature	see derating curve	-40		85	°C
storage temperature		-55		125	°C
storage humidity	non-condensing	5		95	%

## SOLDERABILITY

parameter	conditions/description	min	typ	max	units
hand soldering	1.5mm from case for 10 seconds			260	°C

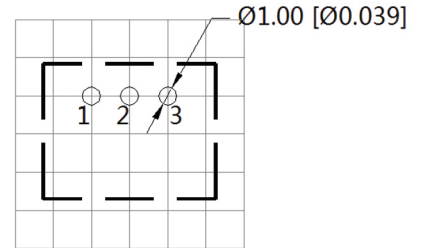
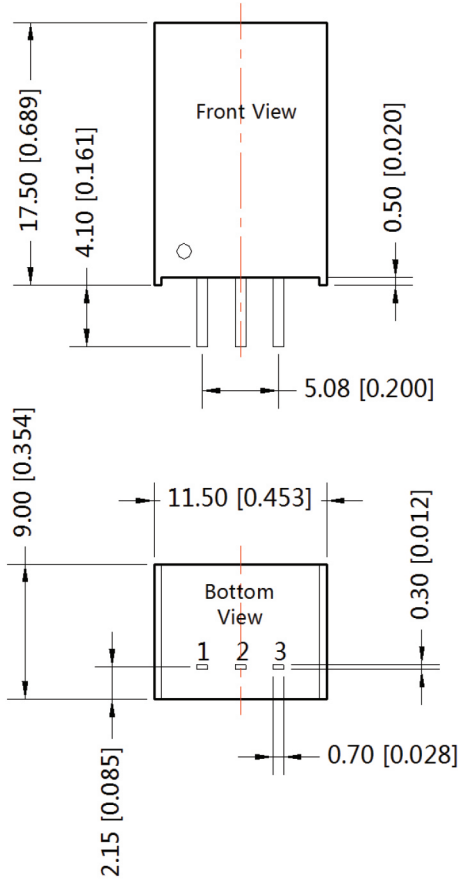
## MECHANICAL

parameter	conditions/description	min	typ	max	units
dimensions	11.50 x 9.00 x 17.50 (0.453 x 0.354 x 0.689 inch)				mm
case material	Black flame-retardant and heat-resistant plastic (UL94-V0)				
weight			3.8		g

## MECHANICAL DRAWING

units: mm [inches]  
 tolerance:  $\pm 0.25$  [ $\pm 0.010$ ]  
 pin section tolerance:  $\pm 0.10$  [ $\pm 0.004$ ]

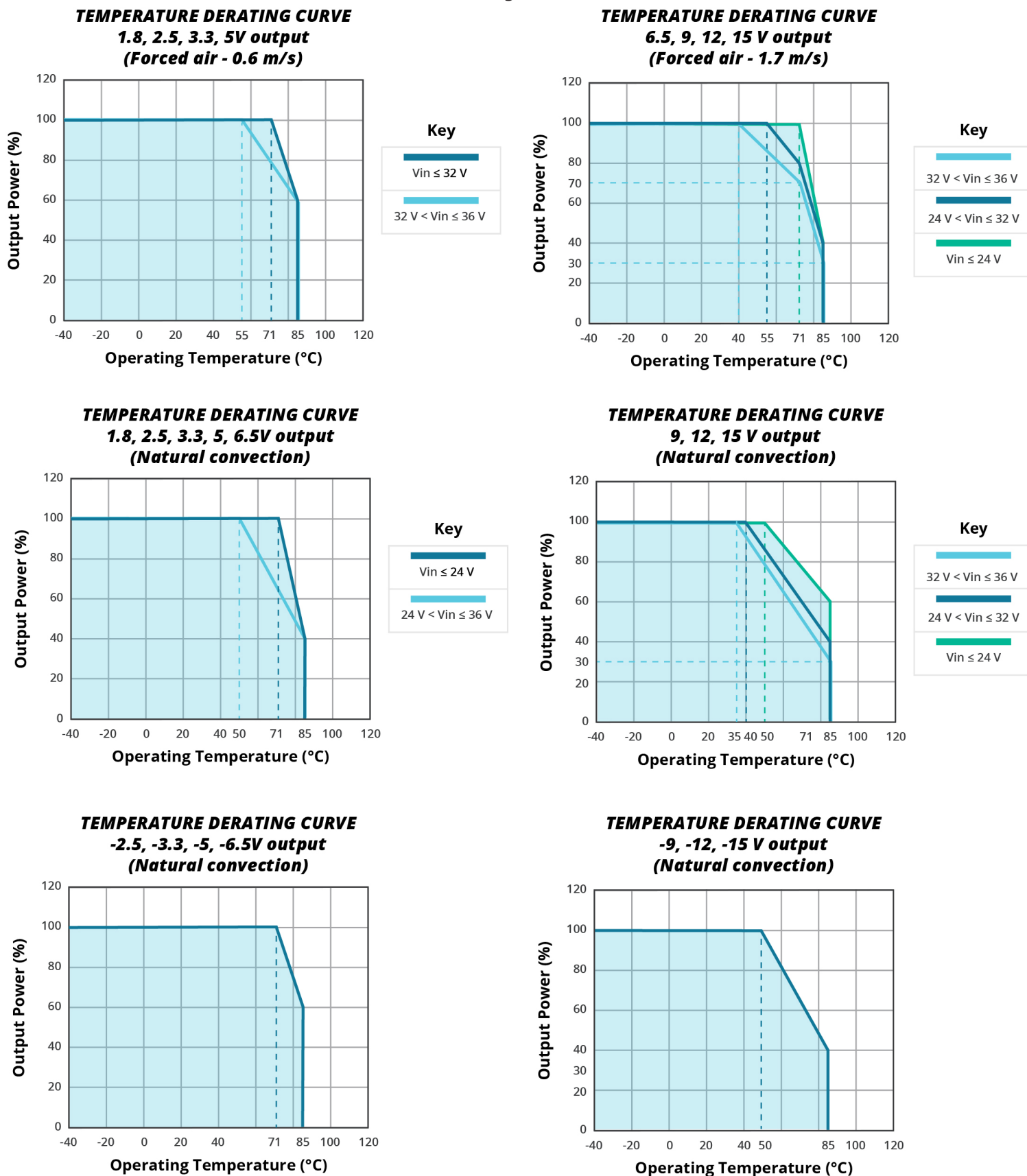
PIN CONNECTIONS		
Pin	Function (positive output)	Function (negative output)
1	+Vin	+Vin
2	GND	-Vo
3	+Vo	GND



Note : Grid 2.54\*2.54mm

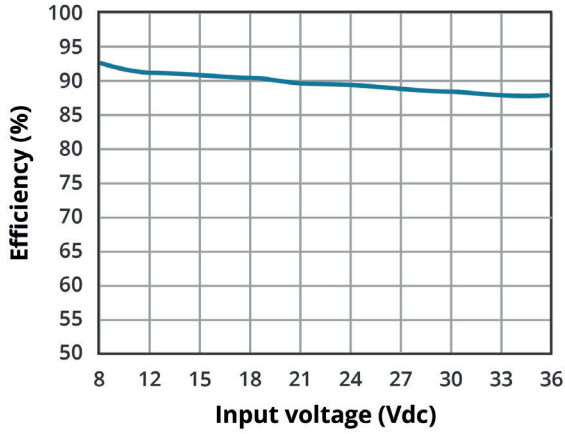
## DERATING CURVES

Figure 1

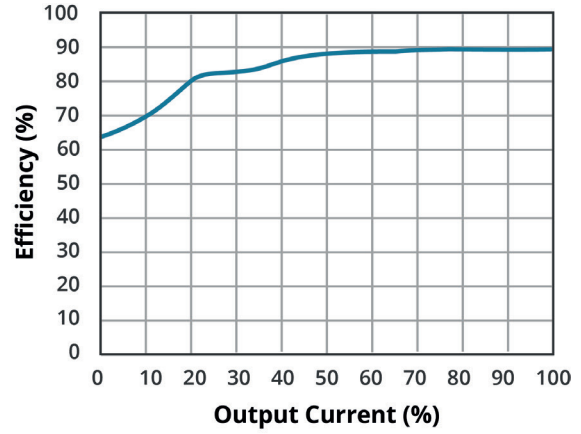


## EFFICIENCY CURVES

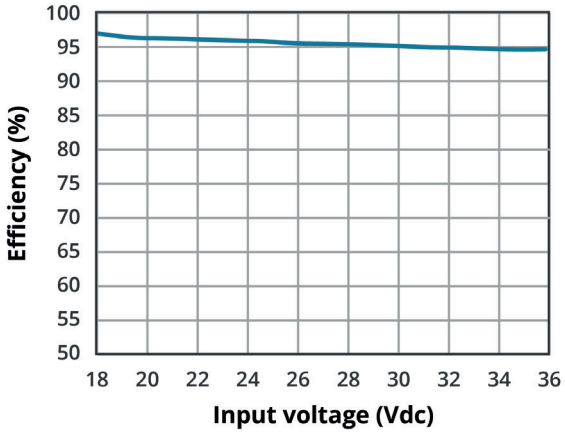
**EFFICIENCY VS INPUT LOAD  
P7805-2000-S (full load)**



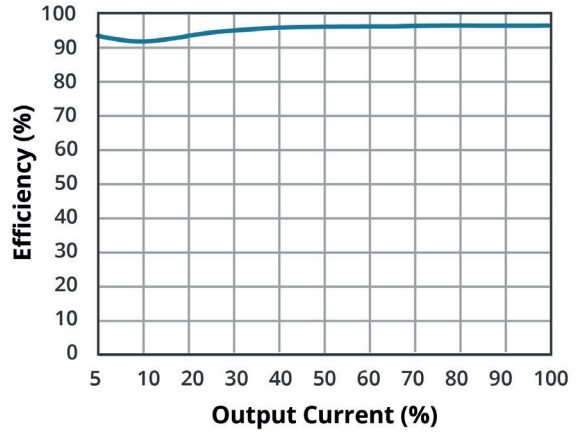
**EFFICIENCY VS OUTPUT LOAD  
P7805-2000-S (Vin = 24 V)**



**EFFICIENCY VS INPUT LOAD  
P7815-2000-S (full load)**

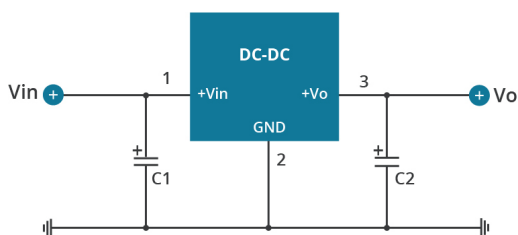


**EFFICIENCY VS OUTPUT LOAD  
P7815-2000-S (Vin = 24 V)**

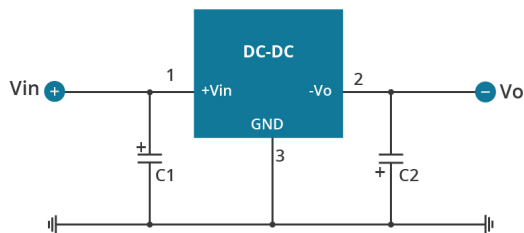


## TYPICAL APPLICATION CIRCUIT

**Figure 2  
positive output**



**Figure 2  
negative output**



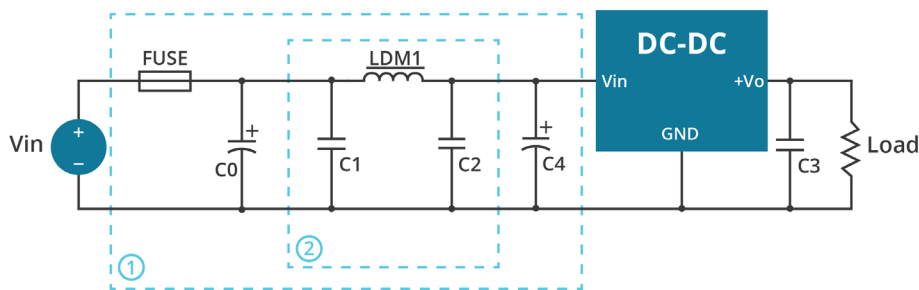
- Note:
1. C1 and C2 are required and should be connected close to the pin terminal of the module.
  2. The capacitance of C1 and C2 refer to Sheet 1.
  3. To reduce the output ripple further, C2 can be increased properly if required, tantalum capacitor and aluminum electrolytic capacitor of low ESR may also suffice.
  4. Cannot be used in parallel to enlarge the power for output and hot swap.

**Table 1**

Part No.	C1 (ceramic capacitor)	C2 (ceramic capacitor)
P78X2-2000-S	22 $\mu$ F/50V	22 $\mu$ F/10V
P7802-2000-S	22 $\mu$ F/50V	22 $\mu$ F/10V
P7803-2000-S	22 $\mu$ F/50V	22 $\mu$ F/10V
P7805-2000-S	22 $\mu$ F/50V	22 $\mu$ F/10V
P7806-2000-S	22 $\mu$ F/50V	22 $\mu$ F/10V
P7809-2000-S	22 $\mu$ F/50V	22 $\mu$ F/16V
P7812-2000-S	22 $\mu$ F/50V	22 $\mu$ F/25V
P7815-2000-S	22 $\mu$ F/50V	22 $\mu$ F/25V

## EMC RECOMMENDED CIRCUIT

**Figure 3**



**Table 2**

Recommended external circuit components	
FUSE	choose according to practical input current
C0	100 $\mu$ F /100V
LDM1	22 $\mu$ H
C4	680 $\mu$ F /50V
C1/C2	10 $\mu$ F /50V
C3	22 $\mu$ F/25V

- Note: Part ① in the Fig. 4 is for EMS test, part ② is for EMI filtering; parts ① and ② can be added based on actual requirement.

## REVISION HISTORY

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rev.	description	date
1.0	initial release	01/22/2020
1.01	logo update	02/21/2020
1.02	derating curve, efficiency curves and circuit figures updated	09/23/2021
1.03	datasheet updated	05/24/2022
1.04	CE certification removed	11/02/2022
1.05	1.8V, 2.5V & 6.5V input model added	09/22/2023

The revision history provided is for informational purposes only and is believed to be accurate.



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