

# RPZ-2.0 Series / Power Module

2.0 Amp / 2.75-6.0VDC / 18 Pad QFN Package

## FEATURES

- 2.75 - 6VDC input range
- Low profile 2mm
- Ultra-compact footprint 2.5x3.5mm
- Adjustable output 0.6 to 5.74V
- 2A output current
- Up to 90°C ambient temperature at full load
- Integrated solution



Dimensions (LxWxH): 2.5 x 3.5 x 1.6mm (0.098 x 0.137 x 0.063inch)  
0.1g (0.0002lbs)

## APPLICATIONS



## SAFETY & EMC



## DESCRIPTION

The RPZ-2.0 is a synchronous buck converter with integrated inductor in a tiny 2.5mm x 3.5mm x 1.6mm thermally-enhanced QFN package. The input range is from 2.75 to 6VDC. The output voltage can be set with two resistors in the range from 0.6V up to 5.74V. The output current is up to 2A and is fully protected against continuous short-circuits, output overcurrent, or over-temperature faults. Its high current and small size make the RPZ-2.0 ideal for imaging systems, distributed power architectures, optical modules, FPGA, ASIC, DSP power, and portable battery-powered equipment in telecom as well as industrial applications.

## SELECTION GUIDE

Part Number	Input Voltage Range [VDC]	Output Voltage Range [VDC]	Output Current max. [mA]	Efficiency <sup>(1)</sup> typ. [%]
RPZ-2.0	2.75 - 6.0	0.6 - 5.74	2000	90

Note1: Efficiency is tested at  $V_{IN}= 3.6VDC$ , full load and  $V_{OUT}= 1.2VDC$

## MODEL NUMBERING

**RPZ-2.0-** \_\_\_\_\_  
 Output Current      Packaging <sup>(2)</sup>

Note2: Add suffix "-R" for tape and reel packaging  
 Add suffix "-CT" for bag packaging (refer to „Packaging Information“)

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**ABSOLUTE MAXIMUM RATINGS** (measured @  $T_{AMB} = 25^{\circ}C$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)

Parameter	Symbol	Min.	Typ.	Max.
Absolute maximum voltage	$V_{IN}$	-0.3VDC		6.5VDC
	others	-0.3VDC		6.5VDC
Maximum continuous power losses <sup>(3)</sup>	$T_{AMB} = +25^{\circ}C$			3W
Junction Temperature	$T_J$			+150°C
Lead Temperature				+260°C

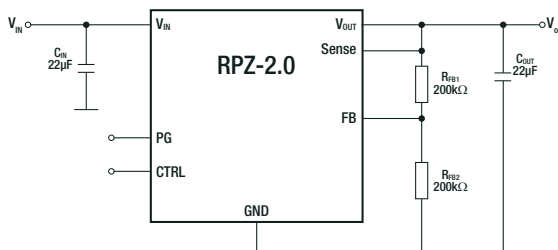
Note3: Exceeding maximum allowable power dissipation causes device to enter thermal shutdown which protects device from permanent damage.

**BASIC CHARACTERISTICS** (measured @  $T_{AMB} = 25^{\circ}C$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)

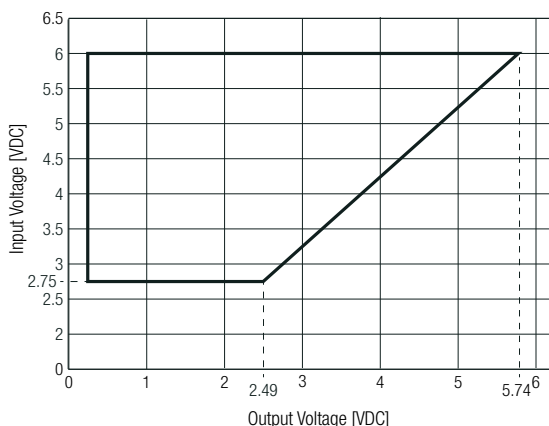
Parameter	Symbol	Condition	Min.	Typ.	Max.
Input Voltage Range	$V_{IN}$	refer to „Safe Operating Area“	2.75VDC		6VDC
Under Voltage Lockout UVLO			2.3VDC	2.5VDC	2.75VDC
Under Voltage Lockout Hysteresis				400mV	
Quiescent current	$I_Q$	$V_{IN} = 3.6VDC, V_{CTRL} = 2VDC, V_{FB} = 0.63VDC$		500µA	
Recommended Input Capacitance		$V_{IN} = 3.6VDC, V_{OUT} = 1.2VDC, I_{OUT} = 2A$	4.7µF	22µF	
Output Capacitance		$V_{IN} = 3.6VDC, V_{OUT} = 1.2VDC, I_{OUT} = 2A$	10µF	22µF	100µF
Output Voltage Range	$V_{OUT}$	refer to „Safe Operating Area“	0.6VDC		5.74VDC
Standby current	$I_{IN}$	$V_{CTRL} = 0VDC, T_J = 25^{\circ}C$		0µA	1µA
Feedback voltage	$V_{FB}$	$2.75VDC \leq V_{IN} \leq 6VDC$	591mV	600mV	609mV
Feedback current	$I_{FB}$	$V_{FB} = 0.6VDC$		10nA	
High Side MosFet Peak Current Limit			2.8A	5.6A	
Low Side Valley Current Limit				1.5A	
Internal Inductor L Value	L	Inductance value at 1MHz		1µH	
Dropout resistance	$R_{DR}$	100% on duty		130mΩ	
Output Ripple		$V_{OUT} = 1.2VDC, I_{OUT} = 2000mA, C_{OUT} = 22µF$		5mV	
Load transient peak-to-peak voltage		$C_{OUT} = 22µF, I_{OUT} = 0$ to 2000mA @1A/µs			100mV
Minimum On Time				80ns	
Minimum Off Time				230ns	
On time	$T_{ON}$	$V_{IN} = 5VDC, V_{OUT} = 1.2VDC$		185ns	
		$V_{IN} = 3.6VDC, V_{OUT} = 1.2VDC$		250ns	

**Typical Application**

$V_{IN} = 2.75-6VDC, V_{OUT} = 1.2VDC, I_{OUT} = 2A$



**Safe Operating Area**



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**CTRL OPERATING CONDITIONS (measured @  $T_{AMB}= 25^{\circ}\text{C}$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)**

Parameter	Symbol	Condition	Min.	Typ.	Max.
CTRL input logic low voltage					0.3VDC
CTRL input logic high voltage			1.2VDC		
CTRL input current		$V_{CTRL}= 2\text{VDC}$		2 $\mu\text{A}$	
		$V_{CTRL}= 0\text{VDC}$		0 $\mu\text{A}$	

**POWER GOOD OPERATING CONDITIONS (measured @  $T_{AMB}= 25^{\circ}\text{C}$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)**

Parameter	Symbol	Condition	Min.	Typ.	Max.
UV threshold				-10%	
OV threshold				10%	
Delay				100 $\mu\text{s}$	
Sink current capability		sink 1mA			0.4VDC
Logic high voltage		$V_{IN}= 5\text{VDC}$ , $V_{FB}= 0.6\text{VDC}$	4VDC		
Internal pull-up resistor				440k $\Omega$	

**SWITCHING CHARACTERISTICS (measured @  $T_{AMB}= 25^{\circ}\text{C}$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)**

Parameter	Symbol	Condition	Min.	Typ.	Max.
Switching Frequency	$f_{SW}$	$V_{OUT}= 1.2\text{VDC}$ , $I_{OUT}= 1000\text{mA}$		1150kHz	
Switch leakage	$V_{SW}$	$V_{CTRL}= 0\text{VDC}$ , $V_{IN}= 6\text{VDC}$ , $V_{SW}= 0\text{VDC}$ and $6\text{VDC}$		0 $\mu\text{A}$	2 $\mu\text{A}$

**PROTECTIONS (measured @  $T_{AMB}= 25^{\circ}\text{C}$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)**

Parameter	Condition	Value	
Short Circuit Protection SCP		hiccup, auto recovery	
Over Current Protection OCP		hiccup, auto recovery	
Thermal shutdown	restart after cooldown	junction temperature	160 $^{\circ}\text{C}$ typ.
		hysteresis	30 $^{\circ}\text{C}$ typ.

**THERMAL OPERATING CONDITIONS (measured @  $T_{AMB}= 25^{\circ}\text{C}$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)**

Parameter	Symbol	Condition	Min.	Typ.	Max.
Operating Junction Temperature	$T_J$	refer to „Thermal Derating“	-40 $^{\circ}\text{C}$		+125 $^{\circ}\text{C}$
Thermal Resistance <sup>(4)</sup>	$R_{thJA}$	junction to ambient			42K/W
	$R_{thJC}$	junction to case			13K/W

Note4: Test PCB= 6.4 x 6.4cm double sided PCB with 20oz copper, natural convection

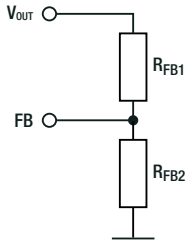
**ENVIRONMENTAL**

Parameter	Condition	Value
Moisture Sensitive Level		Level 3, 245 $^{\circ}\text{C}$ , 168hrs

### OUTPUT VOLTAGE SETTING

The RPZ-2.0 series offers the feature of trimming the output voltage by using external trim resistors (see „**Typical Application**“). The external resistor divider is used to set the output voltage. The feedback resistor ( $R_{FB1}$ ) cannot be too large or too small considering the trade-off for stability and dynamics. There is no strict requirement for the feedback resistor.  $R_{FB2}$  can be calculated with Equation:

#### Feedback Network



#### Calculation:

$$R_{FB2} = \frac{R_{FB1}}{\frac{V_{OUT}}{0.6} - 1}$$

#### Practical example with $V_{OUT} = 1.8VDC$

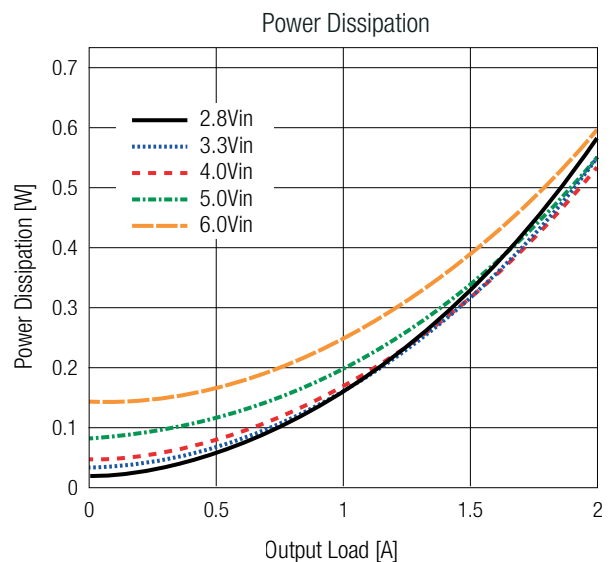
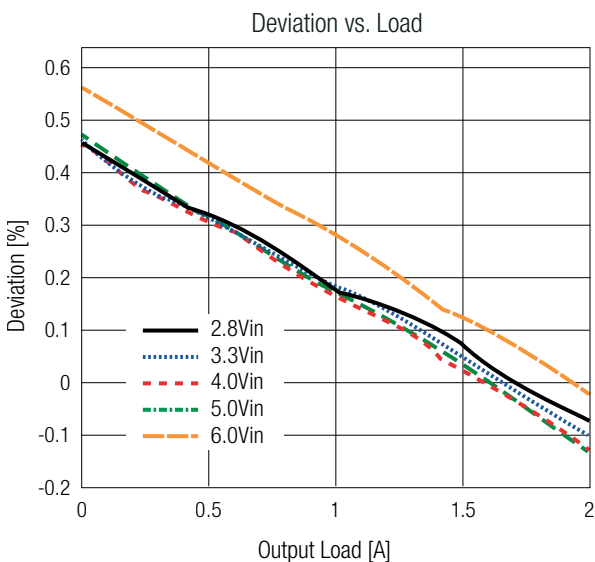
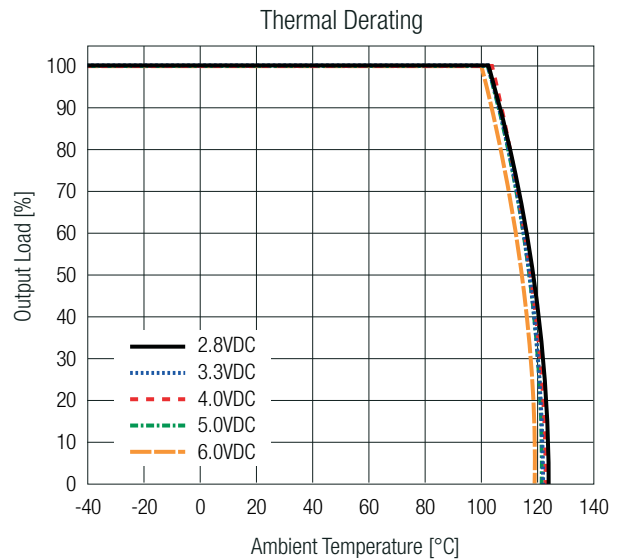
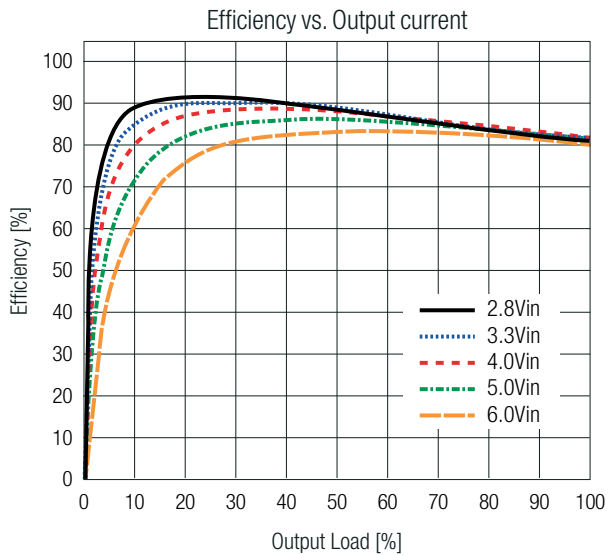
$$R_{FB2} = \frac{200k\Omega}{\frac{1.8}{0.6} - 1} = 100k\Omega$$

Table below lists recommended resistor values for common  $V_{OUT}$ :

$V_{OUT}$ [VDC]	$R_{FB1}$ [ $\Omega$ ]	$R_{FB2}$ [ $\Omega$ ]
1.0	200k	300k
1.2		200k
1.8		100k
2.5		63k2
3.3		44k2

\*(according to E96)

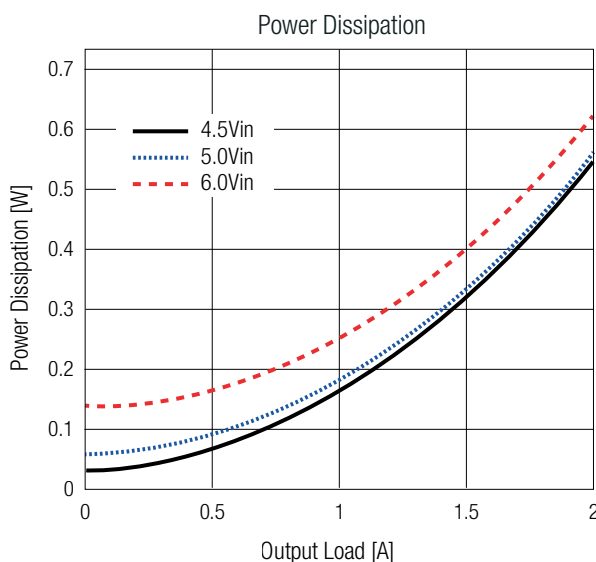
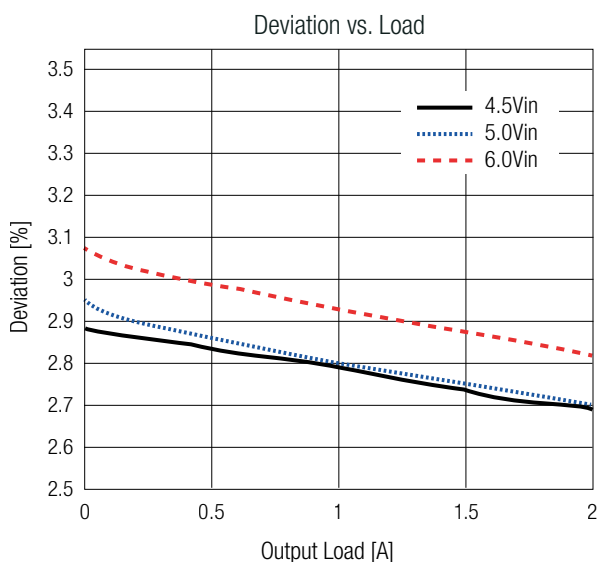
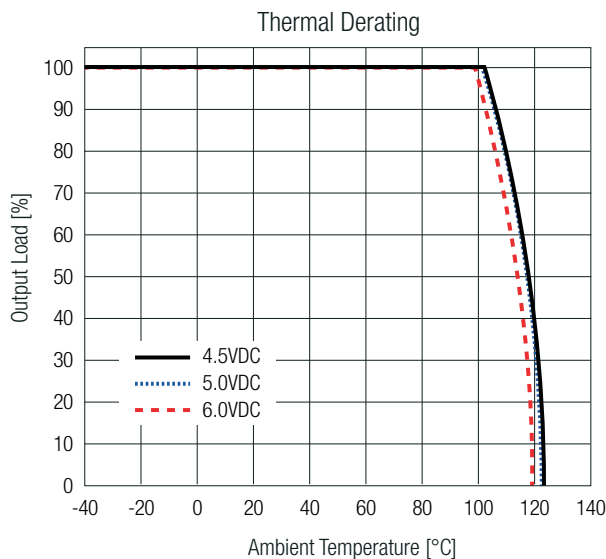
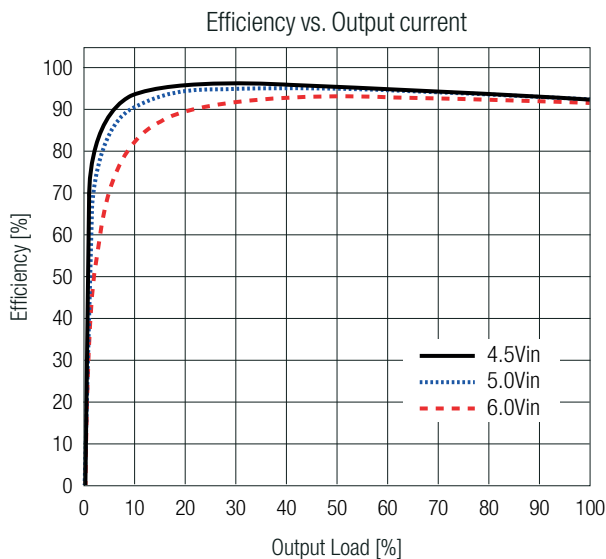
### TYPICAL PERFORMANCE CHARACTERISTICS (measured @ $T_{AMB} = 25^\circ C, V_{OUT} = 1.2VDC$ )



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TYPICAL PERFORMANCE CHARACTERISTICS (measured @  $T_{AMB} = 25^{\circ}C$ ,  $V_{OUT} = 3.3VDC$ )



## SAFETY & CERTIFICATIONS

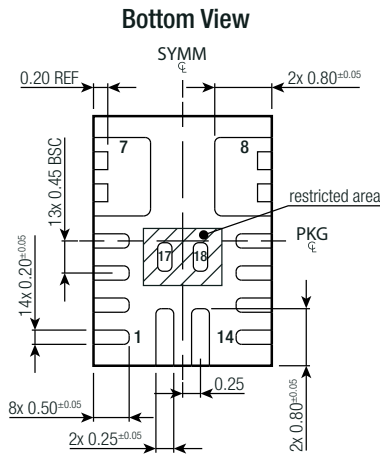
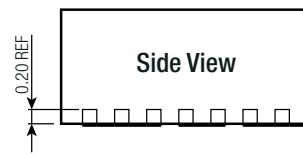
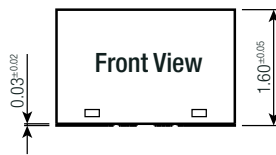
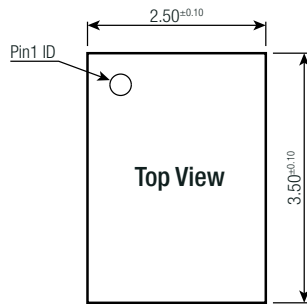
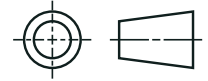
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RoHS2		RoHS 2011/65EU + AM2015/863

## DIMENSION & PHYSICAL CHARACTERISTICS

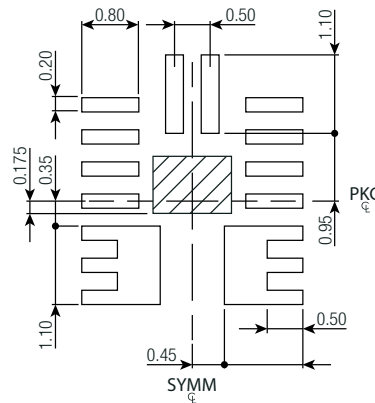
Parameter	Type	Value
Material	case	plastic
Dimension (LxWxH)		2.5 x 3.5 x 1.6mm 0.098 x 0.137 x 0.063inch
Weight		0.1g typ. 0.0002lbs

### DIMENSION & PHYSICAL CHARACTERISTICS

Dimension Drawing (mm)



Recommended Footprint Details (Top View)



### Pad Information

Pad #	Function	Description
1	AGND	Analog ground for the internal control circuit
2	FB	Feedback. Use an external resistor divider from the output to GND tapped to FB to set the output voltage
3	SENSE	Output voltage sense
4	CTRL	On/off control
5-7, 15	SW	Switch output
8-10	V <sub>OUT</sub>	Power Output
11	NC	Do not connect this pin. Leave floating.
12	PG	Power good indicator. The output of PG is an open drain with an internal pull-up resistor to IN. PG is pulled up to IN when the FB voltage is within 10% of the regulation level; otherwise, PG is low.
13, 14	V <sub>IN</sub>	Supply Voltage. The RPZ-2.0 operates from a +2.75V to +6V unregulated input range. A decoupling capacitor is needed to prevent large voltage spikes from appearing at the input.
16	PGND	Power Ground
17, 18	DNC	No connection. Leave DNC floating

Tolerances:  
 x.x= ±0.1mm  
 x.xx= ±0.05mm

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## PACKAGING INFORMATION

Parameter	Type	Value
Packaging Dimension (LxWxH)	Suffix -R: tape & reel	355.6 x 355.6 x 50.8mm
		14.0 x 14.0 x 2.0inch
	Suffix -CT: moisture barrier bag	100 x 100 x 30mm
		3.94 x 3.94 x 1.18inch
Packaging Quantity	Suffix -R: tape & reel	500pcs.
	Suffix -CT: moisture barrier bag	10pcs.
Storage Temperature Range		-65°C to +150°C
Storage Humidity	non-condensing	60% RH max.

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