Technical Data Sheet

RPZ-6.0 Series / Power Module

6.0 Amp / 2.75-7.0VDC / 24 Pad QFN Package

RECOM DC/DC Converter

FEATURES

- Buck regulator power module with integrated shielded inductor
- 7V maximum input voltage
- Programmable 0.6 - 6.65V output voltage
- 6A maximum output current
- SCP, OCP, OTP, and UVLO protection
- 4mm x 6mm x 1.6mm QFN package
- Flip-Chip technology for improved thermal management
- Efficiency up to 90%

Dimensions (LxWxH): 4.0 x 6.0 x 1.6mm (0.157 x 0.236 x 0.063inch)
0.1g (0.0002lbs)

APPLICATIONS

SAFETY & EMC

RoHS2 compliant 10 from 10 | Reach compliant | WARRANTY 3 YEARS

DESCRIPTION

The RPZ-6.0 series is a cutting-edge non-isolated step-down power module meticulously crafted for electronic designs across a diverse spectrum of applications. This versatile module is poised to empower microcontrollers, sensors, embedded systems, portable electronics, IoT devices, consumer electronics, and medical devices with efficient and reliable power. The RPZ-6.0 is a buck regulator power module featuring an integrated shielded inductor, ensuring optimal performance and ease of use in various scenarios. With a maximum input voltage of 7V, this module strikes the perfect balance between adaptability and efficiency, providing a stable and reliable power source for a wide array of applications. Designed for flexibility, the RPZ-6.0 allows for programmable output voltages ranging from 0.6V to 6.65V. This adaptability makes it an ideal choice for applications with varying power requirements, enabling seamless integration into designs that demand precision and customization. Delivering a robust 6A maximum output current, the RPZ-6.0 is engineered to meet the dynamic needs of modern electronics. Safety is paramount, and this module is equipped with Short Circuit Protection (SCP), Overcurrent Protection (OCP), Overtemperature Protection (OTP), and Undervoltage Lockout (UVLO) features, ensuring the longevity and safeguarding of connected devices. Housed in a compact 4mm x 6mm x 1.6mm QFN package, the RPZ-6.0 is designed to optimize space efficiency without compromising performance. The integration of Flip-Chip technology enhances thermal management, ensuring the module operates at peak efficiency even in demanding conditions. With an efficiency rating of up to 90%, the RPZ-6.0 not only meets but exceeds industry standards. This high efficiency not only minimizes energy consumption but also reduces heat generation, contributing to the overall reliability and extended lifespan of the module.

SELECTION GUIDE

Part Number	Input Voltage Range [VDC]	Output Voltage Range [VDC]	Output Current max. [mA]	Efficiency (1) typ. [%]
RPZ-6.0	2.75 - 7.0	0.6 - 6.65	6000	90

Note1: Efficiency is tested at V_{IN}= 6VDC, full load and V_{OUT}= 3.3VDC

MODEL NUMBERING

RPZ-6.0-

Output Current — Packaging (2)

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°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		8VDC
	V_{SW}	-0.3VDC		V_{IN} + 0.7VDC
	V_{BST}			V_{SW} + 4VDC
	others	-0.3VDC		4VDC
Maximum continuous power losses (3)	T_{AMB} = +25°C			4.8W
Junction Temperature	T_J			+150°C
Lead Temperature				+260°C

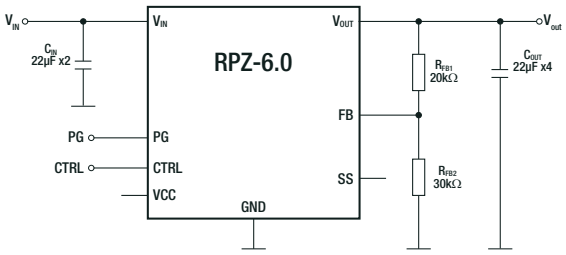
Note3: Exceeding maximum allowable power dissipation causes device to enter thermal shutdown which protects device from permanent damage.

BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, V_{IN}=5VDC, full load and after warm-up unless otherwise stated)

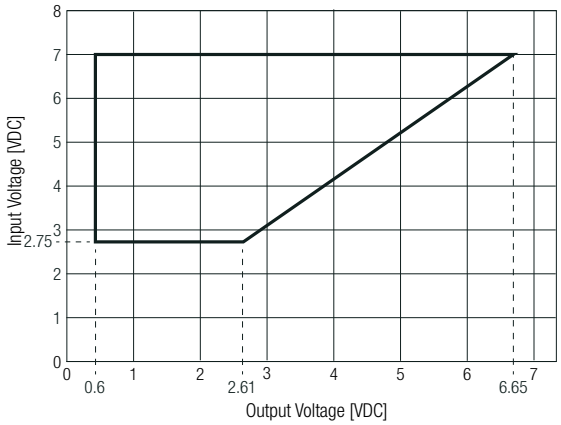
Parameter	Symbol	Condition	Min.	Typ.	Max.
Input Voltage Range	V_{IN}	refer to **„Safe Operating Area“**	2.75VDC		7VDC
Quiescent current	I_Q	V_{CTRL}= 2VDC, V_{FB}= 0.65VDC		105µA	150µA
Output Voltage Range	V_{OUT}	refer to **„Safe Operating Area“**	0.6VDC		6.65VDC
Standby current	I_{IN}	V_{CTRL}= 0VDC, Tj= 25°C		2µA	5µA
Feedback voltage	V_{FB}	Tj= 25°C	594mV	600mV	606mV
		Tj= -40°C to 125°C	591mV	600mV	609mV
Feedback current		V_{FB}= 0.7VDC		10nA	50nA
Valley Current Limit			6A	7A	
Short hiccup duty cycle				10%	
Maximum duty cycle				95%	
Minimum On Time				50ns	
Minimum Off Time				100ns	
Soft Start current			4µA	6µA	8µA

Typical Application

V_{IN}= 2.75-7VDC, V_{OUT}= 1VDC, I_{OUT}= 6A



Safe Operating Area



CTRL OPERATING CONDITIONS (measured @ T_{AMB}= 25°C, V_{IN}= 5VDC, full load and after warm-up unless otherwise stated)

Parameter	Symbol	Condition	Min.	Typ.	Max.
CTRL input logic low voltage			1.19VDC	1.23VDC	1.27VDC
CTRL input logic high voltage			0.96VDC	1VDC	1.04VDC
CTRL pin pull-down resistor				3.3MΩ	

POWER GOOD OPERATING CONDITIONS (measured @ T_{AMB}= 25°C, V_{IN}= 3.6VDC, full load and after warm-up unless otherwise stated)

Parameter	Symbol	Condition	Min.	Typ.	Max.
UV rising threshold			0.85VDC	0.9VDC	0.95VDC
UV falling threshold			0.75VDC	0.8VDC	0.85VDC
OV rising threshold			1.15VDC	1.2VDC	1.25VDC
OV falling threshold			1.05VDC	1.1VDC	1.15VDC
Delay		both edges		50µs	
Sink current capability		sink 1mA			0.4VDC
Leakage current		V_{PG}= 5VDC			10µA

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

Parameter	Symbol	Condition	Min.	Typ.	Max.
Switching Frequency	f_{SW}		0.9MHz	1.2MHz	1.6MHz
Switch leakage	V_{SW}	V_{CTRL}= 0VDC, V_{SW}= 7VDC			5µA

VCC CONDITIONS (measured @ T_{AMB}= 25°C, V_{IN}= 5VDC, full load and after warm-up unless otherwise stated)

Parameter	Symbol	Condition	Min.	Typ.	Max.
VCC regulator		V_{IN}= 5VDC		3.5VDC	
VCC load regulation		I_{CC}= 5mA		3%	
VCC UVLO rising threshold			2.4VDC	2.5VDC	2.6VDC
VCC UVLO threshold hysteresis				200mV	

PROTECTIONS (measured @ T_{AMB}= 25°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	150°C typ.
		hysteresis	20°C typ.

THERMAL OPERATING CONDITIONS (measured @ T_{AMB}= 25°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°C		+125°C
Thermal Resistance [4]	$R_{th_{JA}}$	junction to ambient			25.99K/W
	R_{thJC}	junction to case			7.18K/W

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

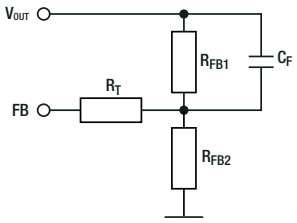
ENVIRONMENTAL

Parameter	Condition	Value
Electrostatic discharge	human body model	2kVDC
	charged device model	2kVDC
Moisture Sensitive Level		Level 3, 245°C, 168hrs

OUTPUT VOLTAGE SETTING

The RPZ-6.0 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. First, choose a value for R_{FB2}. R_{FB2} should be chosen carefully, as too small a value leads to considerable quiescent current loss while too great a value makes FB noise sensitive. It is recommended to choose a value between 2kΩ and 100kΩ for R_{FB2}. Typically, setting the current through R_{FB2} to less than 250µA provides a good balance between system stability and minimal load loss. Then R_{FB1} can be calculated with Equation:

Feedback Network



Calculation:

$$R_{FB1} = \frac{Vout - Vref}{Vref} * R_{FB2}$$

Practical example with V_{OUT}= 1.8VDC

$$R_{FB1} = \frac{1{,}8V - 0{,}6V}{0{,}6V} * 10k\Omega = 20k\Omega$$

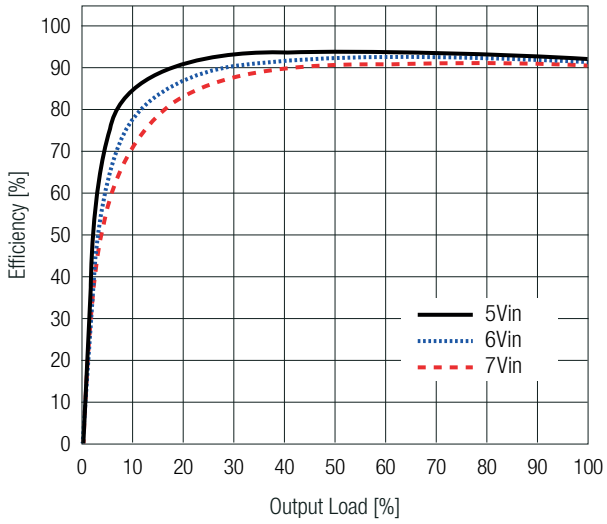
Table below lists recommended resistor values for common V_{OUT}:

V_{OUT} [VDC]	R_{FB1} [Ω]	R_{FB2} [Ω]	CF [pF]	RT [Ω]
1.0	20k	30k	39	0
1.2		20k		
1.5		13k		
1.8		10k		
2.5		6k34		
3.3		4k42		

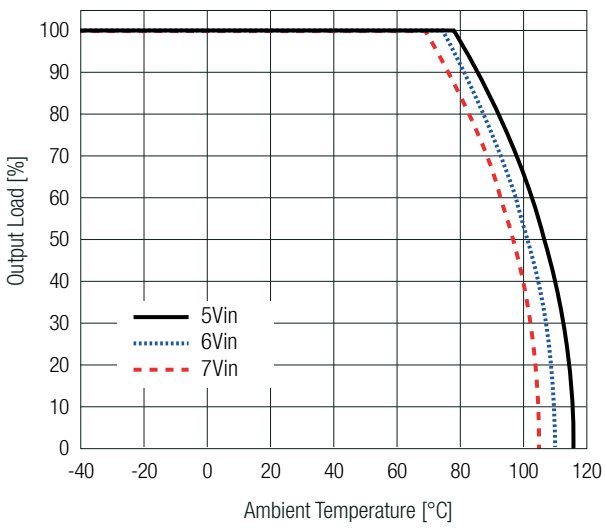
*(according to E96)

TYPICAL PERFORMANCE CHARACTERISTICS (measured @ T_{AMB}= 25°C, V_{OUT}= 3.3VDC)

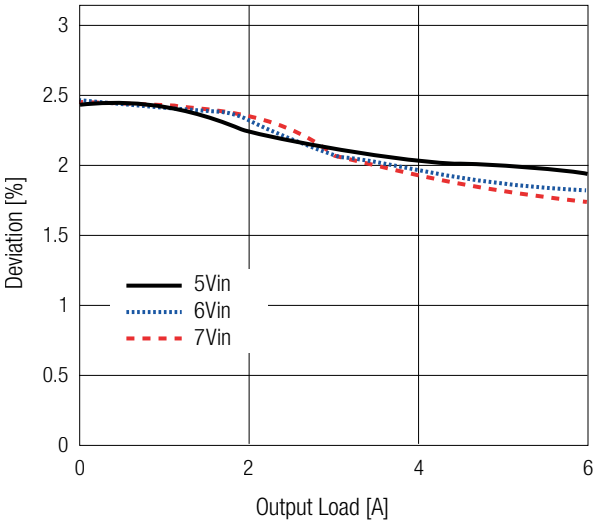
Efficiency vs. Output current



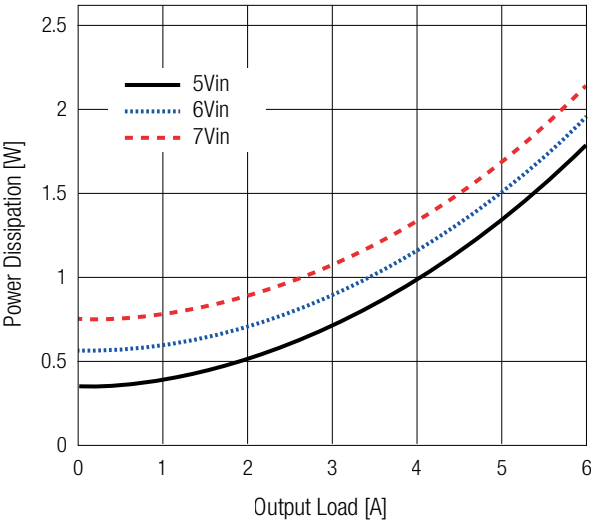
Thermal Derating



Deviation vs. Load



Power Dissipation



SAFETY & CERTIFICATIONS

Certificate Type (Safety)	Report Number	Standard
RoHS2		RoHS 2011/65EU + AM2015/863

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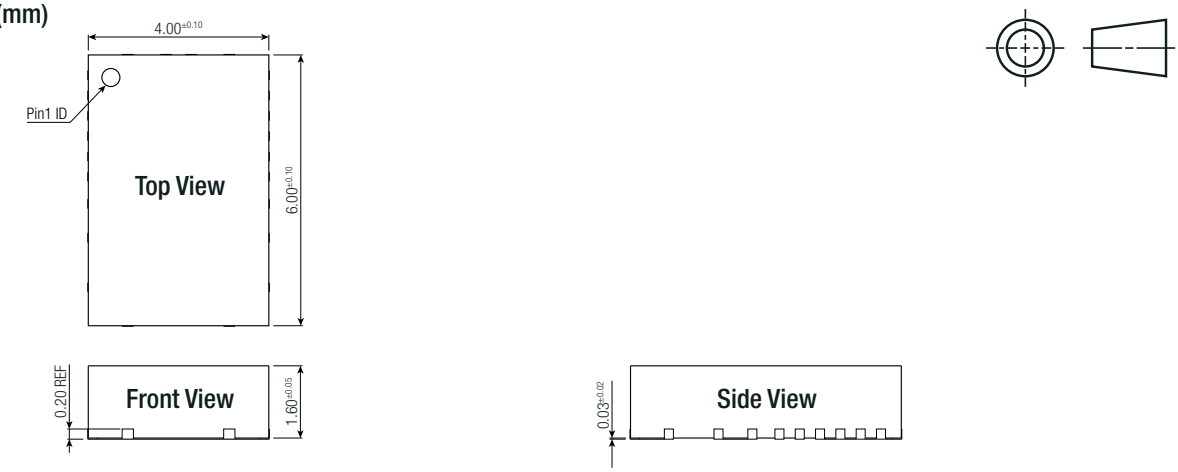
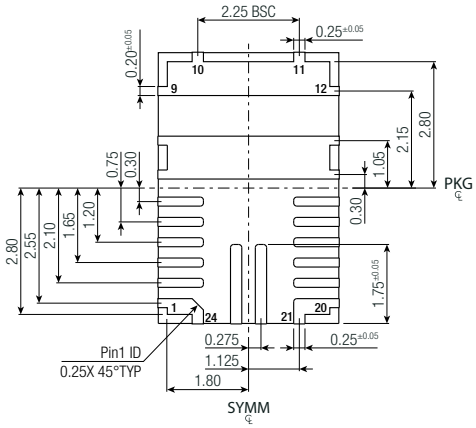
DIMENSION & PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	case	plastic
Dimension (LxWxH)		4.0 x 6.0 x 1.6mm 0.157 x 0.236 x 0.063inch
Weight		0.1g typ. 0.0002lbs

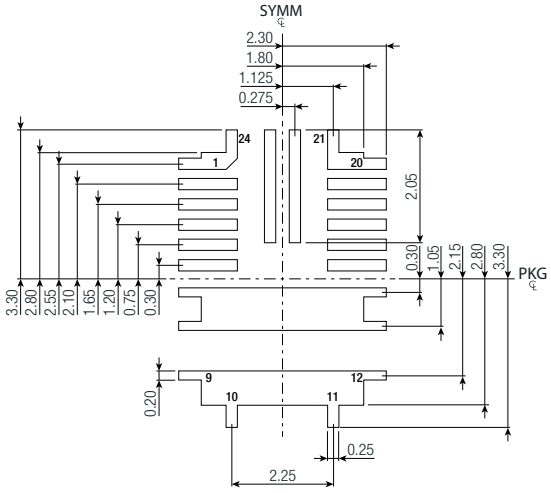
Dimension Drawing (mm)



Bottom View



Recommended Footprint Details (Top View)



Pad Information

Pad #	Function	Description
1, 2, 3, 4, 5, 24	PGND	System Ground. This pin is the reference ground of the regulated output voltage. Because of this, extra care must be taken when laying out the PCB. It is recommended to connect this pin to GND with copper and vias.
6	VCC	Internal bias supply output.
7, 8, 13, 14, 23	SW	Switch output. This pin can be left floating.
9, 10, 11, 12	OUT	Output pin. Connect this pin to COUT.
15	BST	Bootstrap. Internal capacitor connected between SW and BST pins to form a floating supply across the high-side switch driver.
16	CTRL	Enable. Pull CTRL high to enable the part. When floating, CTRL is pulled down to FND by internal 3.3MΩ resistor and is disabled.
17	FB	Feedback. Sets the output voltage when connected to the tap of an external resistor divider that is connected between output and GND.
18	AGND	Signal ground. AGND is not internally connected to PGND, so ensure that AGND is connected to PGND in the PCB layout.
19	SS	Soft start. Connect a capacitor across SS and GND to set the soft-start time and avoid start-up inrush current. This pin includes an internal 22nF SS capacitor.
20, 21	PG	Power good output. The output of this pin is an open-drain output. Its state changes UVP, OCP, OTP or OV occurs.
22	VIN	Supply Voltage. The part operates from a 2.75V to 7V input rail. C1 is necessary to decouple the input rail. Use a wide PCB trace to make the connection.

Tolerances:
x.x= ±0.1mm
x.xx= ±0.05mm

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.