Technical Data Sheet

RPL-1.0 Series / Power Module

1Amp / 3-22VDC / 11 Pad LGA-M Package

RECOM DC/DC Converter

FEATURES

- Wide input range (3 - 22V)
- Low profile 2mm
- Small footprint 3x3mm
- Adjustable output 0.6 to 12V
- 1A output current
- Up to 125°C ambient temperature with derating
- Integrated solution
- 3 years warranty

Dimensions (LxWxH): 3.0 x 3.0 x 2.0mm (0.118 x 0.118 x 0.078inch)
0.1g (0.0002 lbs)

APPLICATIONS

SAFETY & EMC

RoHS² compliant 10 from 10

Reach compliant

DESCRIPTION

The RPL-1.0 is a synchronous buck converter with integrated inductor in a tiny 3mm x 3mm x 2mm thermally-enhanced LGA package. The input range is from 3.0 to 22VDC, allowing 3.3V, 5V, and 12V supply rails to be used. The output voltage can be set with two resistors in the range from 0.6V up to 12V. The output current is up to 1A and is fully protected against continuous short-circuits, output overcurrent, or over-temperature faults. Its high current and small size make the RPL-1.0 ideal for imaging systems, distributed power architectures, 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 (1) typ. [%]
RPL-1.0	3 - 22	0.6 - 12	1000	84

Note1: Efficiency is tested at V_{IN}= 5VDC, V_{OUT}= 3.3VDC full load at +25°C ambient

MODEL NUMBERING

RPL-1.0-__

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

Parameter	Symbol	Condition	Min.	Typ.	Max.
Absolute maximum voltage	V_{IN}		-0.3VDC		24VDC
	V_{CTRL}		-0.3VDC		24VDC
	V_{SW}		-0.3VDC		24VDC
	V_{PG}		0VDC		6.5VDC
		others	-0.3VDC		4.3VDC
Maximum continuous power losses (3)		T_{AMB} = +25°C			1.78W
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.

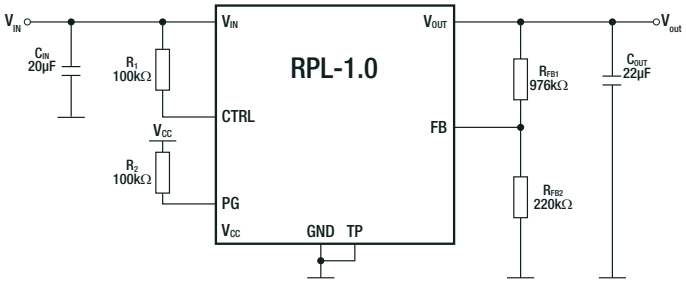
Note4: Stressed beyond those listed under absolute maximum ratings can cause permanent damage to the device.

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

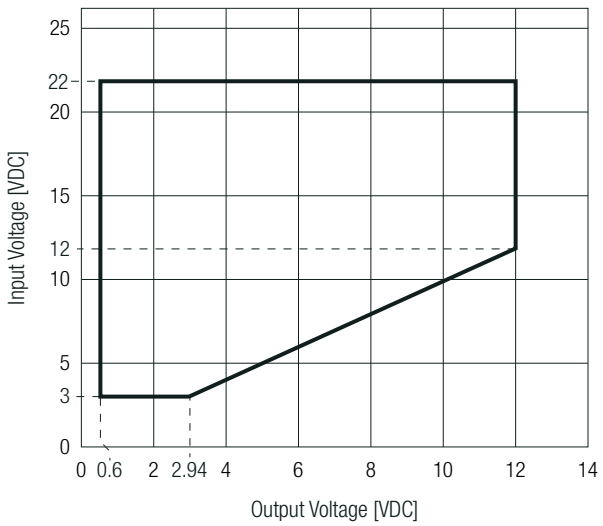
Parameter	Symbol	Condition	Min.	Typ.	Max.
Input voltage range	V_{IN}	refer to **„Safe Operating Area“**	3VDC		22VDC
Under voltage lockout UVLO		rising	2.63VDC	2.8VDC	2.97VDC
Under voltage lockout hysteresis				170mV	
Quiescent current	I_Q	V_{FB} = 0.7VDC		5µA	9µA
Output voltage range	V_{OUT}	refer to **„Safe Operating Area“**	0.6VDC		12VDC
Standby current	I_{IN}				2µA
Feedback voltage	V_{FB}		594mV	600mV	606mV
		T_{AMB}= -40°C to 125°C	591mV	600mV	609mV
Maximum duty cycle	D_{MAX}	V_{FB} = 500mV	96%	98%	
Minimum on time				40ns	
Minimum off time				140ns	
Soft start		V_{OUT} from 10% to 90%	1ms	1.3ms	1.6ms

Typical Application

V_{IN}= 3-22VDC, V_{OUT}= 3.3VDC, I_{OUT}= 1A



Safe Operating Area



CTRL OPERATING CONDITIONS

Parameter	Condition	Min.	Typ.	Max.
ON/OFF CTRL	DC-DC ON			V_{CTRL} > 1.2VDC
	DC-DC OFF			V_{CTRL} < 1.2VDC
CTRL rising threshold		1.05VDC	1.2VDC	1.35VDC
CTRL hysteresis threshold			150mV	
CTRL input current	V_{CTRL}= 2VDC			0.1µA

POWER GOOD OPERATING CONDITIONS

Parameter	Symbol	Condition	Min.	Typ.	Max.
OV rising threshold	PG_{OVHI}		108% of V_{REF}	113% of V_{REF}	118% of V_{REF}
OV falling threshold	PG_{OVLO}		103% of V_{REF}	108% of V_{REF}	113% of V_{REF}
UV rising threshold	PG_{UVHI}		87% of V_{REF}	92% of V_{REF}	97% of V_{REF}
UV falling threshold	PG_{UVLO}		82% of V_{REF}	87% of V_{REF}	92% of V_{REF}
Rise delay				200µs	
Falling delay				50µs	
Sink current capability	V_{PG_SINK}	$sink_{current}$= 1mA			0.4VDC

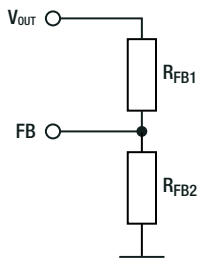
SWITCHING CHARACTERISTICS

Parameter	Symbol	Condition	Min.	Typ.	Max.
Switching Frequency	f_{sw}	CCM, V_{OUT}= 3.3VDC	1125kHz	1250kHz	1375kHz

OUTPUT VOLTAGE SETTING

The external resistor divider is used to set the output voltage. First, choose a value for R_{FB2}. R_{FB2} should be chosen reasonably, a small R_{FB2} will lead to considerable quiescent current loss while too large R_{FB2} makes the FB noise sensitive. It is recommended to choose a value between 100kΩ- 500kΩ for R_{FB2}. Typically, set the current through R_{FB2} between 1-5uA will make a good balance between system stability and also the no load loss. Then R_{FB1} is determined as follow. The values for trim resistors shown in trim tables below are according to standard E96 values; therefore, the specified voltage may slightly vary.

Feedback Network



Calculation:

$$R_{FB1} = \frac{(V_{OUT} - V_{ref})}{V_{ref}} \times R_2$$

Practical example with V_{OUT}= 1.8VDC

$$R_{FB1} = \frac{(1.8V - 0.6V)}{0.6V} \times 220k\Omega = \mathbf{440k\Omega}$$

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

V_{OUT} [VDC]	R_{FB1} [Ω]	R_{FB2} [Ω]
1.0	147k	220k
1.2	220k	
1.8	440k	
2.5	697k	
3.3	976k	
5	1613k	

THERMAL OPERATING CONDITIONS

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		70.3K/W	
	$R_{th_{JC}}$	junction to case		34.9K/W	
	$R_{th_{JB}}$	junction to board		54.9K/W	

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

ENVIRONMENTAL

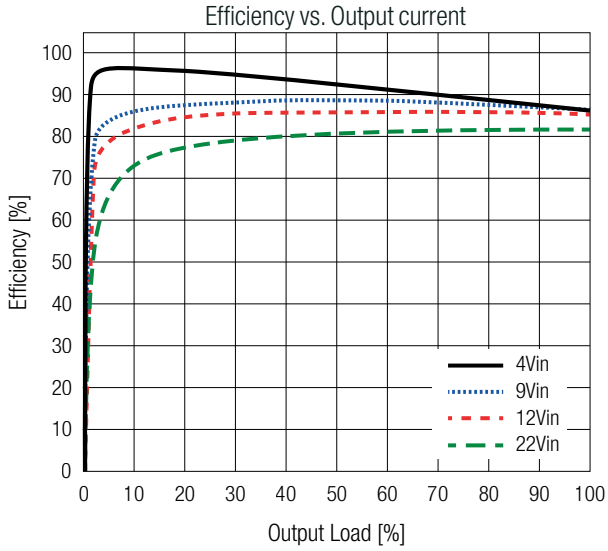
Parameter	Condition	Value
Moisture Sensitive Level		Level 3

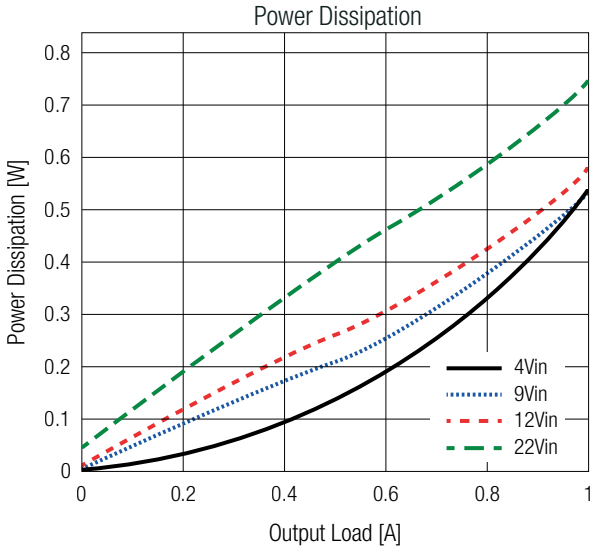
PROTECTIONS

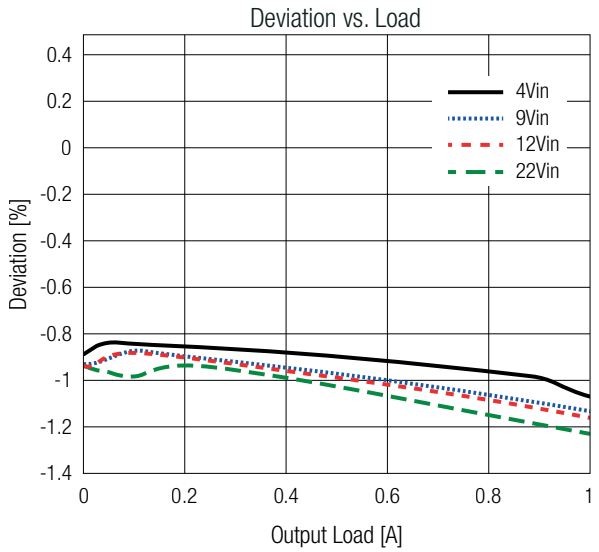
Parameter	Condition		Value
Short Circuit Protection SCP			hiccup, auto recovery
Over Current Protection OCP			hiccup, auto recovery
Output Overvoltage Protection	auto recovery		115% - 125% max.
Output overvoltage deglitch time			8µs typ.
Output overvoltage recovery			105% - 115% max.
Thermal shutdown	restart after cooldown	junction temperature	150°C typ.
		hysteresis	20°C typ.

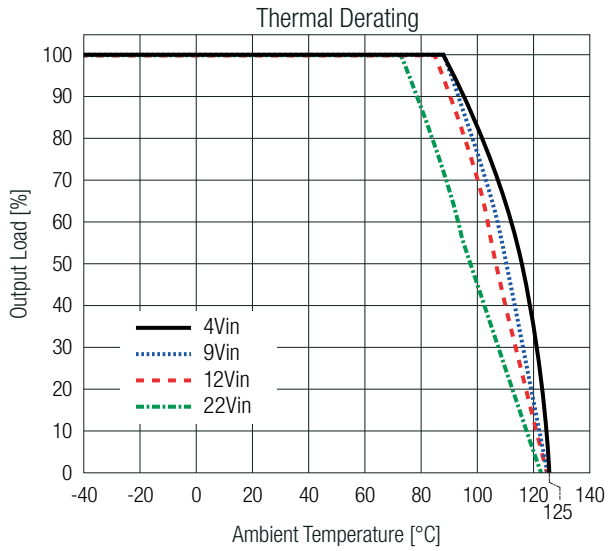
TYPICAL PERFORMANCE CHARACTERISTICS

3.3Vout



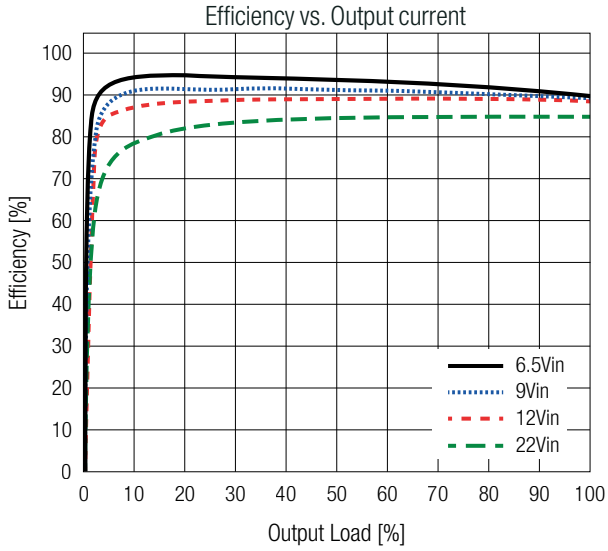


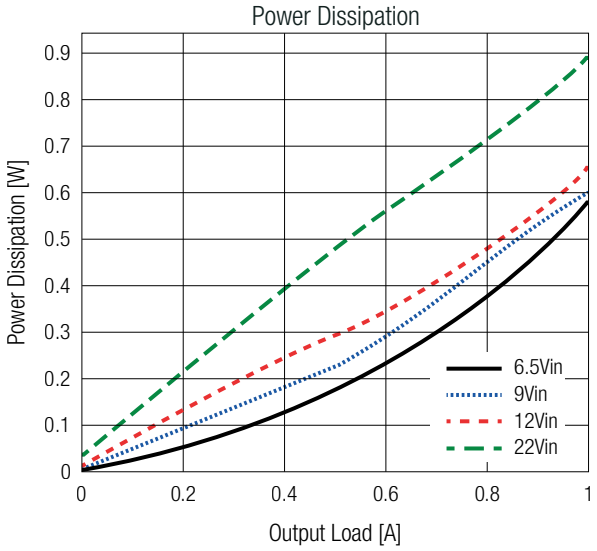


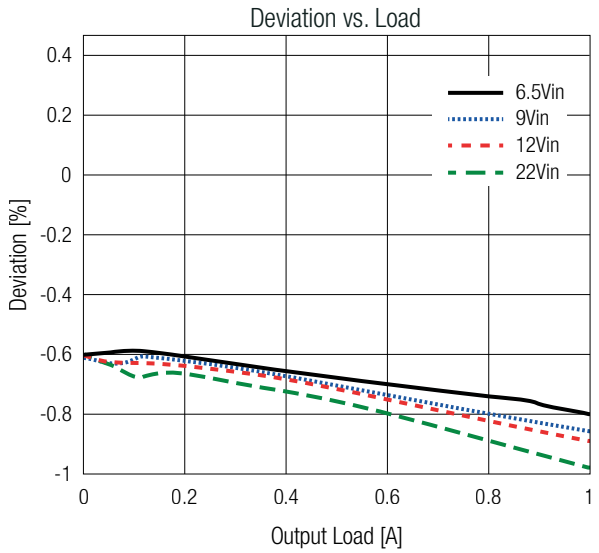


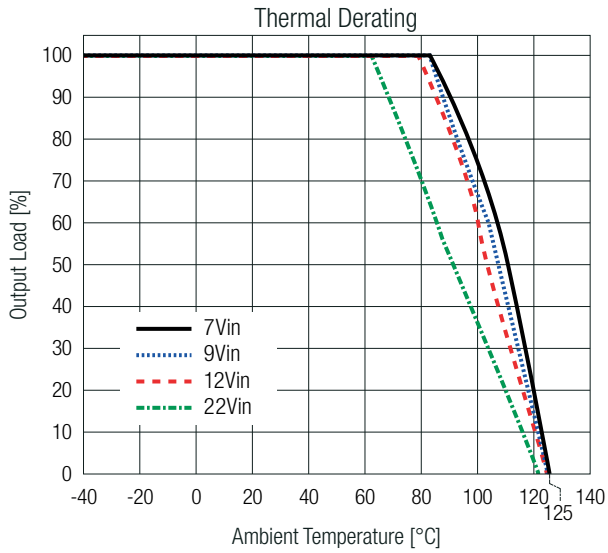
TYPICAL PERFORMANCE CHARACTERISTICS

5Vout









SAFETY & CERTIFICATIONS

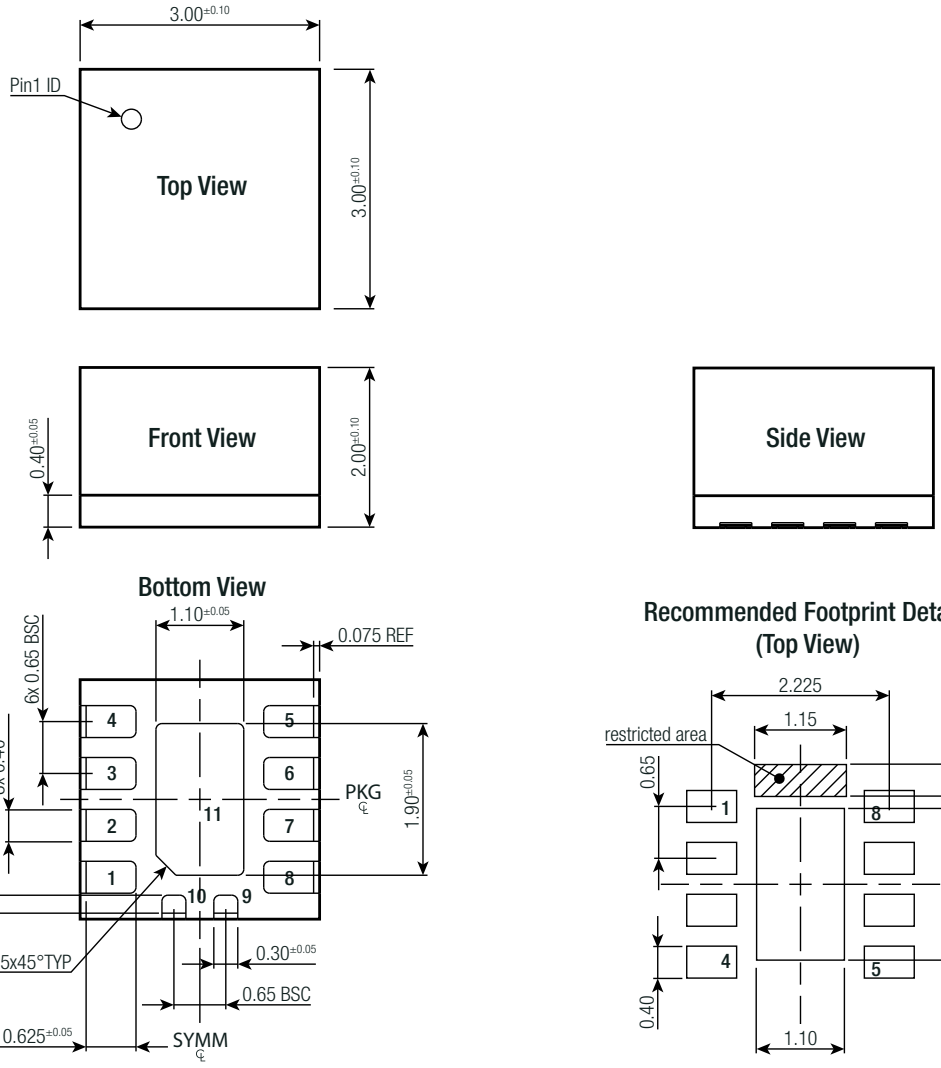
Certificate Type (Safety)	Report Number	Standard
RoHS2		RoHS 2011/65EU + AM2015/863

DIMENSION & PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	case	plastic
Dimension (LxWxH)		3.0 x 3.0 x 2.0mm 0.118 x 0.118 x 0.078inch
Weight		0.1g typ. 0.0002 lbs

DIMENSION & PHYSICAL CHARACTERISTICS

Dimension Drawing (mm)



Pad Information

Pad #	Function	Description
1	CTRL	Control pin. This pin can't float. Apply a logic high voltage on this pin to enable the part, pull EN to logic low can disable the part.
2	V_{IN}	Supply Voltage. The MPM3612 operates from a +3V to +22V input rail. C1 is needed to decouple the input rail. Use wide PCB traces or multiple vias to make the connection.
3	PGND	System Ground. Reference ground of the regulated output voltage. Requires special consideration during PCB layout. Connect PGND with Copper traces and vias, and connect to pin 11.
4, 5	V_{OUT}	Output voltage. Connect external bypass capacitors between this pin and GND close to the pins.
6	FB	Feedback input. Used to set the output voltage between 0.6 and 12V.
7	PG	Power good output. Open drain. Indicates if UVLO and OVP is triggered.
8	V_{CC}	Internal 3.3VDC LDO regulator output.
9, 10	NC1	Do not connect this pin. Leave floating.
11	TP	Function Thermal pad. Description - Connect to Pin 3

Tolerances:
x.x= ±0.1mm
x.xx= ±0.05mm

PACKAGING INFORMATION

Parameter	Type	Value
Packaging Dimension (LxWxH)	Suffix -R: tape & reel (diameter)	Ø330.2
	tape and reel (carton)	355.6 x 355.6 x 50.8mm
	Suffix -CT: moisture barrier bag	100 x 100 x 30mm
Packaging Quantity	Suffix -R: tape & reel	500pcs
	Suffix -CT: moisture barrier bag	10pcs
Tape Width		12mm
Storage Temperature Range		-65°C to +150°C
Storage Humidity	non-condensing	60% RH max.