SERIES: PYB20-T & PYB20-U | **DESCRIPTION:** DC-DC CONVERTER

FEATURES

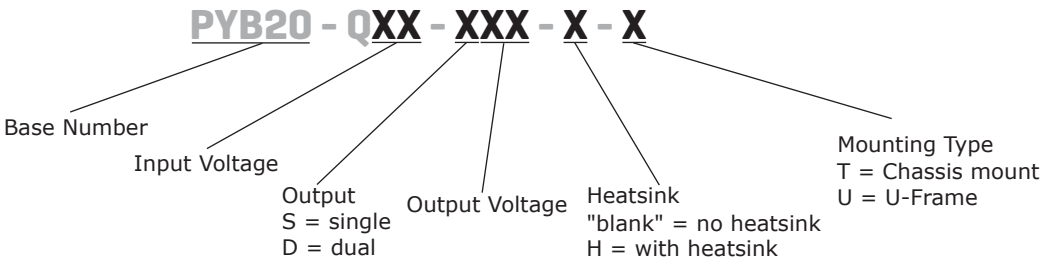
- up to 20 W isolated output
- industry standard pinout
- 4:1 input range (9~36 V, 18~75 V)
- smaller package
- single/dual regulated outputs
- 1,500 Vdc isolation
- continuous short circuit, over current protection, over voltage protection
- reverse polarity protection on chassis mount (-T) models
- temperature range (-40~85°C)
- six-sided metal shielding
- efficiency up to 90%

MODEL

	input voltage		output voltage	output current		output power	ripple and noise[1]	efficiency[2]
	typ (Vdc)	range (Vdc)	(Vdc)	min (mA)	max (mA)	max (W)	max (mVp-p)	typ (%)
PYB20-Q24-S3	24	9~36	3.3	250	5000	16.5	100	86
PYB20-Q24-S5	24	9~36	5	200	4000	20	100	90
PYB20 Q24-S12	24	9~36	12	84	1667	20	100	89
PYB20-Q24-S15	24	9~36	15	67	1333	20	100	90
PYB20-Q24-S24	24	9~36	24	42	834	20	100	90
PYB20-Q24-D5	24	9~36	±5	±100	±2000	20	100	86
PYB20-Q24-D12	24	9~36	±12	±42	±834	20	100	88
PYB20-Q24-D15	24	9~36	±15	±33	±667	20	100	88
PYB20-Q48-S3	48	18~75	3.3	250	5000	16.5	100	86
PYB20-Q48-S5	48	18~75	5	200	4000	20	100	90
PYB20-Q48-S12	48	18~75	12	84	1667	20	100	89
PYB20-Q48-S15	48	18~75	15	67	1333	20	100	90
PYB20-Q48-S24	48	18~75	24	42	834	20	100	90
PYB20-Q48-D5	48	18~75	±5	±100	±2000	20	100	86
PYB20-Q48-D12	48	18~75	±12	±42	±834	20	100	88
PYB20-Q48-D15	48	18~75	±15	±33	±667	20	100	89

Notes: 1. Ripple and noise are measured at 20 MHz BW by "parallel cable" method
2. Efficiency is approximately 2% lower for chassis mount (-T) models.

PART NUMBER KEY



INPUT

parameter	conditions/description	min	typ	max	units
operating input voltage	24 V input models 48 V input models	9 18	24 48	36 75	Vdc Vdc
start-up voltage	24 V input models 48 V input models			9 17.8	Vdc Vdc
under voltage shutdown	24 V input models 48 V input models	7.5 16			Vdc Vdc
surge voltage	for maximum of 1 second 24 V input models 48 V input models	 -0.7 -0.7		 50 100	 Vdc Vdc
start-up time	nominal input, constant load		10		ms
filter	pi filter				
CTRL[1]	models ON (CTRL open or connect TTL high level, 2.5-12 Vdc)				
	models OFF (CTRL connect GND or low level, 0-1.2 Vdc)				
	input current (models OFF)		1		mA

Note: 1. CTRL pin voltage is referenced to GND.

OUTPUT

parameter	conditions/description	min	typ	max	units
line regulation	full load, input voltage from low to high		±0.2	±0.5	%
load regulation	10% to 100% load		±0.5	±1	%
cross regulation	dual output models: main output 50% load, secondary output from 10% to 100% load			±5	%
voltage accuracy			±1	±3	%
voltage balance[2]	dual output, balanced loads		±0.5	±1	%
adjustability[3]			±10		%
switching frequency	PWM mode, PYB20-Q24-S24 PWM mode, all other models	315	 300	345	KHz KHz
transient recovery time	25% load step change		300	500	µs
transient response deviation	25% load step change		±3	±5	%
temperature coefficient	100% load			±0.02	%/°C

Note: 2. For dual output models, unbalanced load can not exceed ±5%. If ±5% is exceeded it may not meet all specifications.
3. Output trimming available on single output models only.

PROTECTIONS

parameter	conditions/description	min	typ	max	units
short circuit protection	hiccup, continuous, automatic recovery				
over current protection			160		%
over voltage protection	3.3 Vdc output models 5 Vdc output models 12 Vdc output models 15 Vdc output models 24 Vdc output models		3.9 6.2 15 18 30		Vdc Vdc Vdc Vdc Vdc

SAFETY AND COMPLIANCE

parameter	conditions/description	min	typ	max	units
isolation voltage	for 1 minute at 1 mA max.	1,500			Vdc
isolation resistance	at 500 Vdc	1,000			MΩ
conducted emissions	CISPR22/EN55022, class A, class B (external circuit required, see Figure 1-b)				
radiated emissions	CISPR22/EN55022, class A, class B (external circuit required, see Figure 1-b)				
ESD	IEC/EN61000-4-2, class B, contact ± 4kV				
radiated immunity	IEC/EN61000-4-3, class A, 10V/m				
EFT/burst	IEC/EN61000-4-4, class B, ± 2kV (external circuit required, see Figure 1-a)				
surge	IEC/EN61000-4-5, class B, ± 2kV (external circuit required, see Figure 1-a)				
conducted immunity	IEC/EN61000-4-6, class A, 3 Vr.m.s				
voltage dips & interruptions	IEC/EN61000-4-29, class B, 0%-70%				
MTBF	as per MIL-HDBK-217F @ 25°C	1,000,000			hours
RoHS compliant	yes				

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	%
case temperature	at full load, Ta=71°C			105	°C
vibration	10~55 Hz for 30 min. along X, Y and Z axis		10		G

MECHANICAL

parameter	conditions/description	min	typ	max	units
dimensions	chassis mount: 76.0 x 31.5 x 21.2 chassis mount with heatsink: 76.0 x 31.5 x 25.1 U-Frame: 52.32 x 54.99 x 19.05 U-Frame with heatsink: 52.32 x 54.99 x 22.90				mm mm mm mm
case material	aluminum alloy				
weight	chassis mount chassis mount with heatsink U-Frame U-Frame with heatsink		50 58 58 66		g g g g

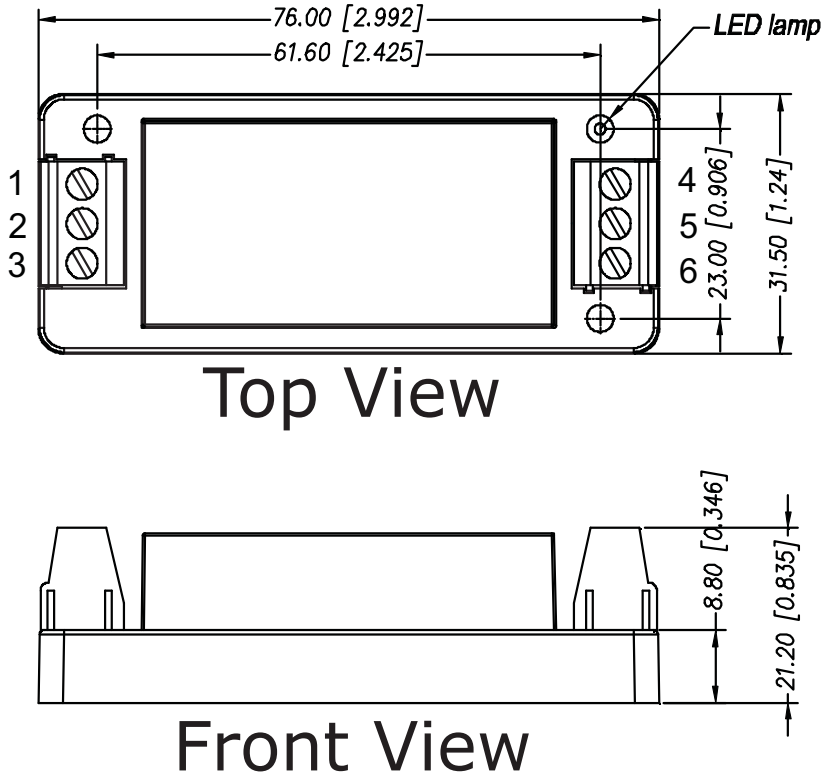
MECHANICAL DRAWING

CHASSIS MOUNT

units: mm[inch]
tolerance: ±0.5[±0.020]

wire range: 24~12 AWG

PIN CONNECTIONS		
PIN	Single Output	Dual Output
1	CTRL	CTRL
2	GND	GND
3	Vin	Vin
4	0V	-Vo
5	Trim	0V
6	+Vo	+Vo

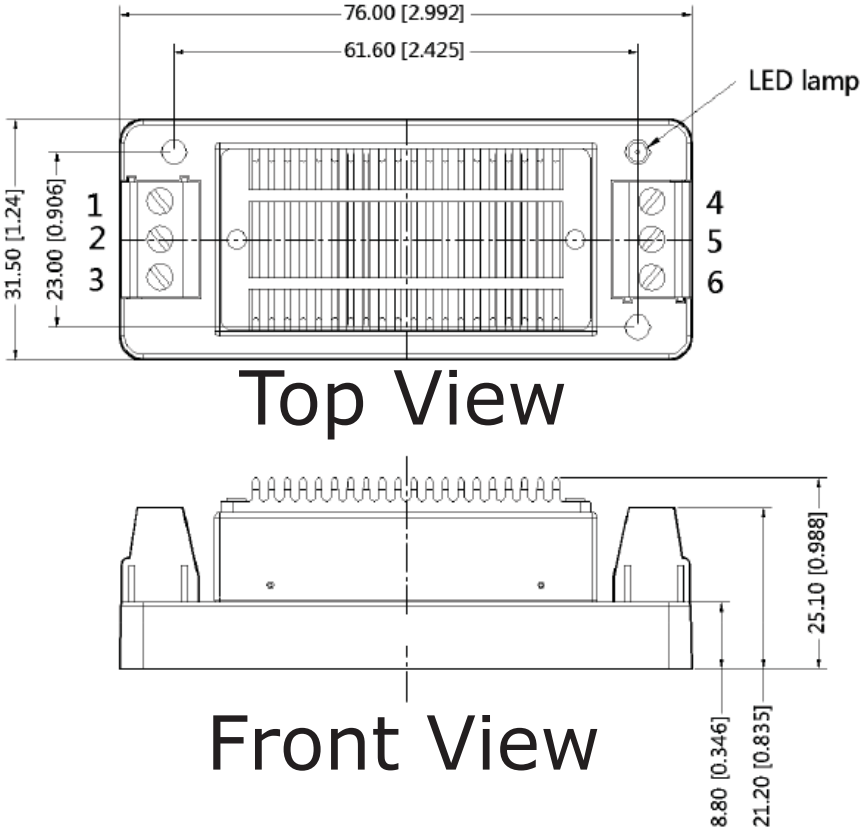


CHASSIS MOUNT WITH HEATSINK

units: mm[inch]
tolerance: ±0.5[±0.020]

wire range: 24~12 AWG

PIN CONNECTIONS		
PIN	Single Output	Dual Output
1	CTRL	CTRL
2	GND	GND
3	Vin	Vin
4	0V	-Vo
5	Trim	0V
6	+Vo	+Vo



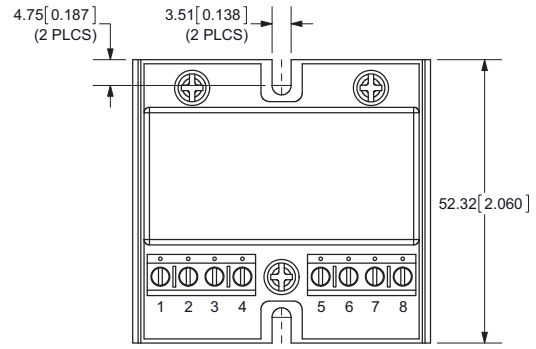
MECHANICAL DRAWING (CONTINUED)

U-FRAME

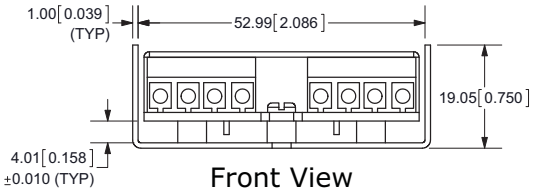
units: mm[inch]
tolerance: ±0.5[±0.020]

Wire range: 22~14 AWG
DIN rail mounting kit available
(part# STK-DIN)

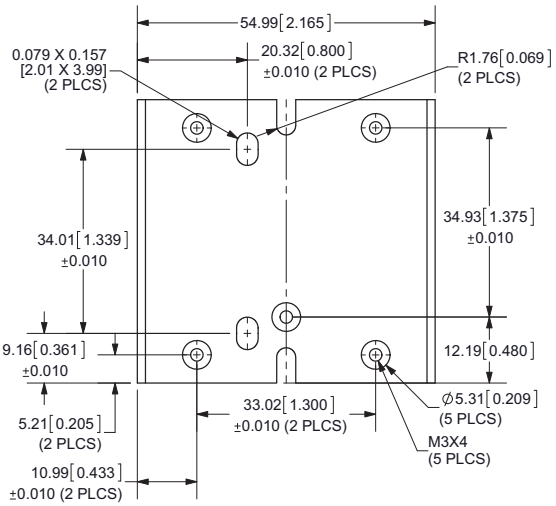
PIN CONNECTIONS		
PIN	Single Output	Dual Output
1	GND	GND
2	Vin	Vin
3	CTRL	CTRL
4	Case	Case
5	NC	NC
6	+Vo	+Vo
7	Trim	0V
8	0V	-Vo



Top View



Front View



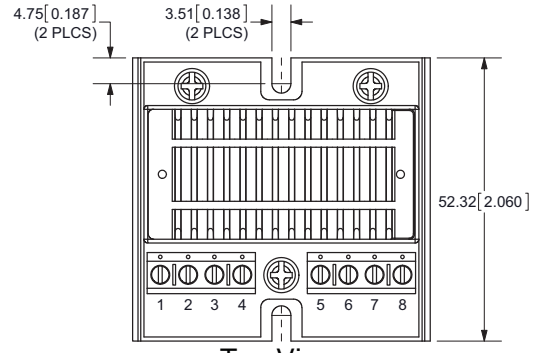
Bottom View

U-FRAME WITH HEATSINK

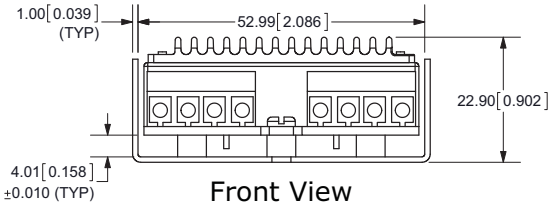
units: mm[inch]
tolerance: ±0.5[±0.020]

Wire range: 22~14 AWG
DIN rail mounting kit available
(part# STK-DIN)

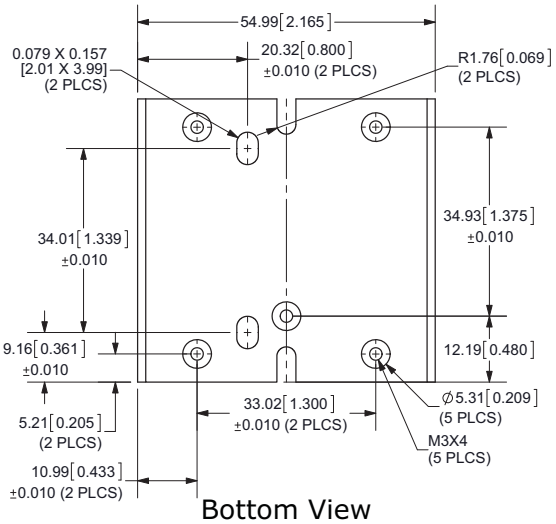
PIN CONNECTIONS		
PIN	Single Output	Dual Output
1	GND	GND
2	Vin	Vin
3	CTRL	CTRL
4	Case	Case
5	NC	NC
6	+Vo	+Vo
7	Trim	0V
8	0V	-Vo



Top View

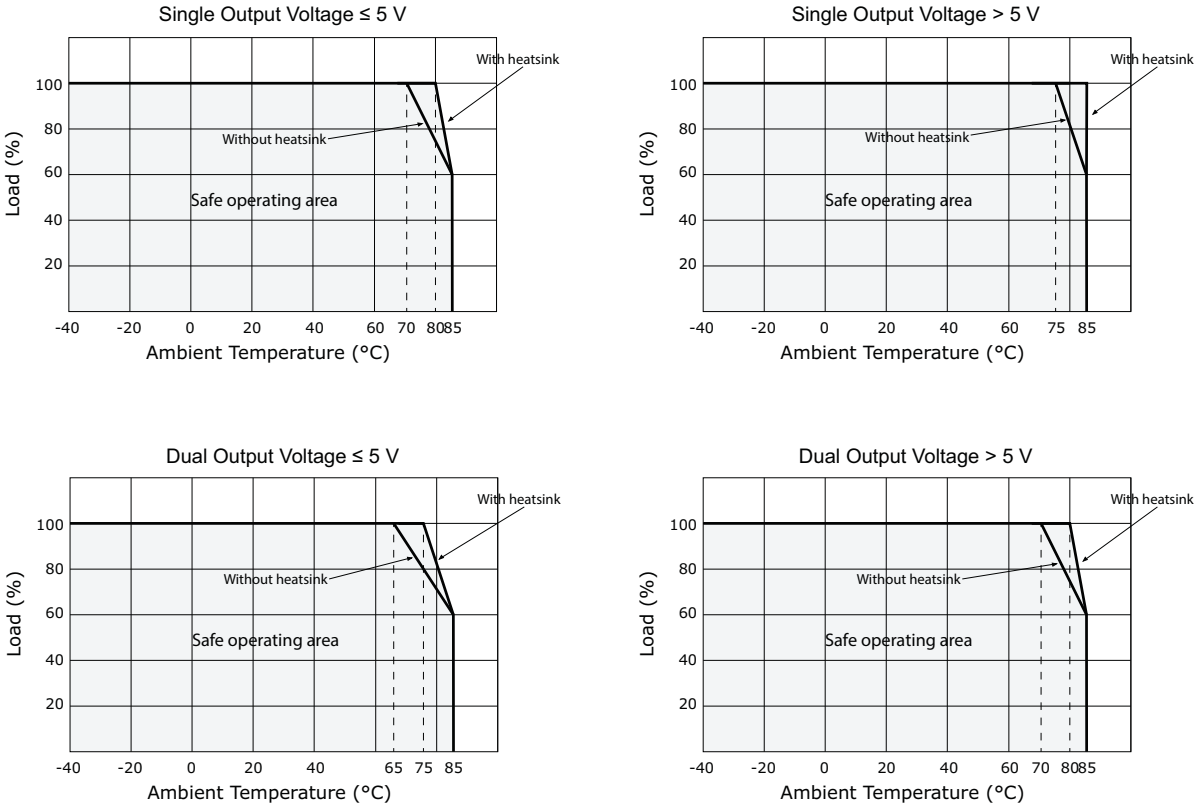


Front View



Bottom View

DERATING CURVES



EMC RECOMMENDED CIRCUIT

Figure 1

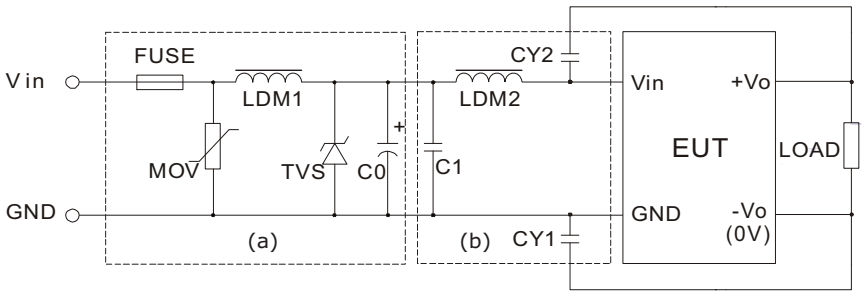


Table 1

Recommended external circuit components		
Vin (Vdc)	24	48
FUSE	Choose according to input current	
MOV	S14K35	S14K60
LDM1	56µH	56µH
TVS	SMCJ48A	SMCJ90A
C0	330µF/50V	330µF/100V
C1	1µF/50V	1µF/100V
LDM2	4.7µH	4.7µH
CY1	1nF/2KV	1nF/2KV
CY2	1nF/2KV	1nF/2KV

TEST CONFIGURATION

Figure 2

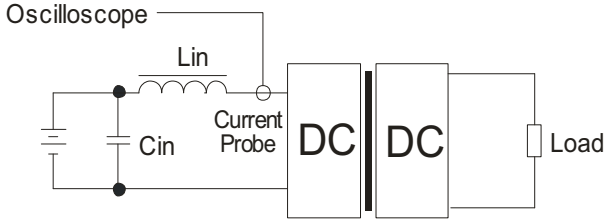


Table 2

External components	
Lin	4.7µH
Cin	220µF, ESR < 1.0Ω at 100 KHz

Note: Input reflected-ripple current is measured with an inductor Lin and Capacitor Cin to simulate source impedance.

APPLICATION NOTES

1. **Recommended circuit**
This series has been tested according to the following recommended testing circuit before leaving the factory. This series should be tested under load (see Figure 3). If you want to further decrease the input/output ripple, you can increase the capacitance accordingly or choose capacitors with low ESR (see Table 3). However, the capacitance of the output filter capacitor must be appropriate. If the capacitance is too high, a startup problem might arise. For every channel of the output, to ensure safe and reliable operation, the maximum capacitance must be less than the maximum capacitive load (see Table 4).

Figure 3

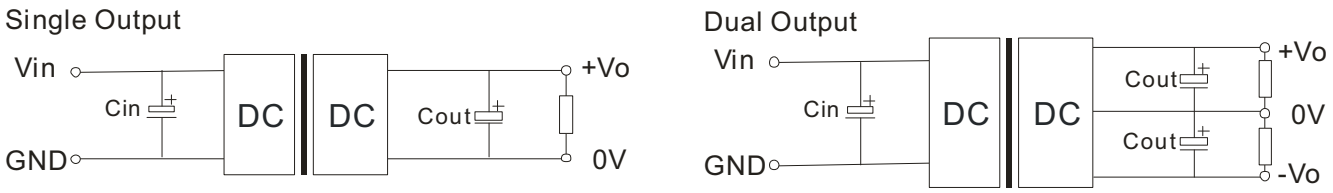


Table 3

Single Vout (Vdc)	Cin (μF)	Cout (μF)	Dual Vout (Vdc)	Cin (μF)	Cout[1] (μF)
3.3	100	470	±5	100	220
5	100	470	±12	100	100
12	100	220	±15	100	100
15	100	220	--	--	--
24	100	100	--	--	--

Note: 1. For each output.

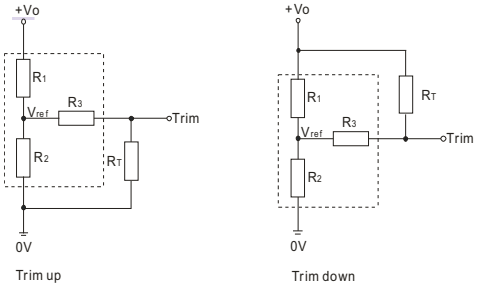
Table 4

Single Vout (Vdc)	Max. Capacitive Load (μF)	Dual Vout (Vdc)	Max. Capacitive Load[1] (μF)
3.3	18700	--	--
5	9600	5	4800
12	1600	12	800
15	1000	15	625
24	500	--	--

Note: 1. For each output.

Output voltage trimming
Leave open if not used.

Figure 4
Application Circuit for Trim pin
(part in broken line is the interior of models)



Formula for Trim Resistor

$$\text{up: } R_T = \frac{aR_2}{R_2 - a} - R_3 \qquad a = \frac{Vref}{Vo' - Vref} \cdot R_1$$

$$\text{down: } R_T = \frac{aR_1}{R_1 - a} - R_3 \qquad a = \frac{Vo' - Vref}{Vref} \cdot R_2$$

Note: Value for R1, R2, R3, and Vref refer to Table 5
R_T: Trim Resistor
a: User-defined parameter, no actual meanings
Vo': The trim up/down voltage

Table 5

Vout (Vdc)	R1 (KΩ)	R2 (KΩ)	R3 (KΩ)	Vref (V)
3.3	4.801	2.863	15	1.24
5	2.883	2.864	10	2.5
12	10.971	2.864	17.8	2.5
15	14.497	2.864	17.8	2.5
24	24.872	2.863	20	2.5

Note: 1. Minimum load shouldn't be less than 5%, otherwise ripple may increase dramatically. Operation under minimum load will not damage the converter, however, they may not meet all specifications listed.
2. Maximum capacitive load is tested at input voltage range and full load.
3. All specifications are measured at Ta=25°C, humidity<75%, nominal input voltage and rated output load unless otherwise specified.

REVISION HISTORY

rev.	description	date
1.0	initial release	06/26/2013
1.01	updated spec	08/16/2013

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

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