QAM60T series

XP Power

60W Baseplate cooled

DC-DC converters

The QAM60T series of medically approved 60W DC-DC converters combines high efficiency, a wide 4:1 input range, and single / dual outputs from 5V to 24VDC in a compact quarter-brick package. Designed to help optimize board space and simplify thermal management, the QAM60T series provides a reliable power solution for a wide range of applications. Its global medical safety approvals, reinforced isolation, remote on/off control, and extended temperature operation ensure dependable performance in demanding environments.

While ideally suited to CF-rated medical equipment, including patient monitoring, diagnostic and imaging systems, patient treatment, and surgical equipment, the QAM60T is also suitable for telecommunications infrastructure, distributed power architectures, battery-operated equipment and factory automation.

Features

- Suitable for CF-rated applications
- Regulated single & dual outputs from 5 to 30VDC
- Wide 4:1 input range 9V to 36VDC
- Industry standard ¼ brick package
- IEC60601-1 medical safety agency approvals
- 5kVAC reinforced isolation
- Ultra-low patient leakage current
- Short circuit, overload & overvoltage protection
- Output trim -10% to +20%
- Remote sense, Remote On/Off
- -40°C to +105°C operating temperature
- 3 year warranty

Applications

- Patient monitoring
- Surgical equipment
- Diagnostics
- Imaging
- Factory automation
- Telecommunications

Dimensions

57.9 x 36.8 x 12.7mm (2.28" x 1.45" x 0.5")
¼ brick package

Documentation

For further information click the link or scan the code

→ xppower.com

Models & ratings

Model number[1]	Input voltage	Output voltage	Output current	Input current[2]		Efficiency[3]
				No load	Full load	
QAM60T24S05	9 to 36VDC (24VDC nominal)	5.0VDC	12.0A	15mA	2.809A	89.0%
QAM60T24S12		12.0VDC	5.0A	15mA	2.674A	93.5%
QAM60T24S15		15.0VDC	4.0A	15mA	2.674A	93.5%
QAM60T24S24		24.0VDC	2.5A	15mA	2.778A	90.0%
QAM60T24D12		±12.0VDC	±2.5A	15mA	2.778A	90.0%
QAM60T24D15		±15.0VDC	±2.0A	15mA	2.762A	90.5%

Notes:

1. Add suffix '-N' to the model number to receive the unit with negative logic Remote On/Off..
2. Input current specified at 24VDC nominal input voltage.
3. Typical value at 24VDC nominal input voltage and full load.
4. To order heatsink, use part number QSB75 HEATSINK-V

Input

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Input voltage range	9		36	VDC	24VDC nominal
Undervoltage lockout		8.3		VDC	Turn on voltage, full load
		7.6			Turn off voltage, full load
Input surge			50	VDC	For 100ms
Input current	See models and ratings table				
Input reflected ripple current		30		mA	Thru 12µH inductor, 5Hz to 20mHz, 24VDC nominal
Input filter	Pi type				

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Output voltage trim	-10		+20	%	5V: -5% to 10% , See application notes
Initial set accuracy			±1.0	%	24VDC nominal input voltage, full load
Line regulation			±0.2	%	Measured from high line to low line, full load
Load regulation			±0.2	%	Single output, measured from 0-100% load
			±1.0	%	Dual output, measured from 0-100% load
Cross regulation			±5.0	%	On dual output models, with one output set to 50% load and the other varied from 25% to 100% load
Transient response			5	%	Maximum deviation, recovery to within 1% in 250µs, slew rate 0.1A/µs, 25% step load change
Start up delay		5		ms	
Rise time		10		ms	
Ripple and noise			100	mV pk-pk	5VDC, 20MHz bandwidth with 1µF ceramic capacitor, full load
			150		Others, 20MHz bandwidth with 1µF ceramic capacitor, full load
Overcurrent protection	110		170	%	Hiccup, auto recovery
Short circuit protection	Continuous, auto recovery				
Overvoltage protection	120		130	%	Clamp, auto recovery
Thermal shutdown		115		°C	Case temperature, non latching
		85			Restart
Patient leakage current			4.5	µA	
Temperature coefficient			±0.02	%/°C	
Remote On/Off	Output is 'ON' if remote On/Off (pin 2) is open or high (3.5-75VDC) with respect to -Vin (pin 3) Output turns 'OFF' if remote On/Off (pin 2) is low (<1.2VDC max) with respect to -Vin (pin3) Negative Logic: Output is 'OFF' if remote On/Off (pin 2) is open or high (3.5-75VDC) with respect to -Vin (pin 3) Output turns 'ON" if remote On/Off (pin 2) is low (<1.2VDC max) with respect to -Vin (pin3).				
Remote Sense	Compensates up to 10% / 20% (5VDC / others) of Vout nominal				

QAM60T series

General

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Efficiency	See models & ratings table				
Isolation: input to output	5000			VAC	Reinforced isolation
Isolation resistance	10^9			Ω	
Isolation capacitance		40		pF	
Switching frequency		200		kHz	
Mean time between failure		1000		khrs	MIL-HDBK-217F, +25°C GB
Power density		2.22 (36.04)		Wcm^3 (W/in^3)	
Weight		67 (0.15)		g (lbs)	

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Operating temperature	-40		+105	°C	See derating curve
Maximum case temperature			+105	°C	See mechanical drawings
Storage temperature	-55		+125	°C	
Operating humidity			95	%RH	Non-condensing
Operating altitude			5000	m	
Vibration	Single axis 10-500Hz at 2g sweep and endurance at resonance in all 3 planes. Conforms to EN60068-2-6				
Shock	±3 x 30g shocks in each plane, total 18 shocks. 30g = 11ms (±0.5msecs), half sine. Conforms to EN60068-2-27				

EMC: emissions

Phenomenon	Standard	Test level	Notes & conditions
Conducted	EN55032 / EN55011	A	With external components
Radiated	EN55032 / EN55011	A	With external components

EMC: Immunity

Phenomenon	Standard	Test level	Criteria	Notes & conditions
Medical device EMC	IEC60601-1-2	Ed 4.1: 2014	as below	
ITE / Low voltage PSU EMC	EN55035/ EN 61204-3		as below	
ESD immunity	EN61000-4-2	±8kV contact, ±15kV air	A	
Radiated	EN61000-4-3	10V/m	A	
EFT/burst	EN61000-4-4	±2kV	A	On power input port with external components
Surges	EN61000-4-5	±2kV	A	With external components
Conducted	EN61000-4-6	10Vrms	A	
Magnetic fields	EN61000-4-8	30A/m	A	

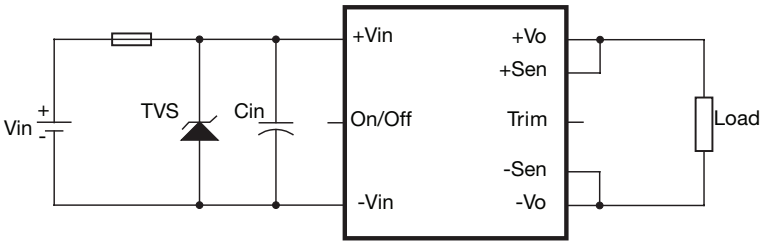
Safety approvals

Safety agency	Standard	Notes & conditions
CB	IEC60601-1	Medical, 2 x MOPP, suitable for CF applications
EN	EN60601-1	Medical, 2 x MOPP, suitable for CF applications
UL	ANSI/AAMI ES60601-1	Medical, 2 x MOPP, suitable for CF applications
CE	Meets all applicable directives	
UKCA	Meets all applicable legislation	

Application notes

Input fusing and safety considerations

The QAM60T series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 12A time delay fuse. It is recommended that the circuit has a transient voltage suppressor diode (TVS) and external input capacitor (Cin) across the input terminals to protect the unit against surge or spike voltages and input reverse voltage (as shown). A suitable part would be SMDJ40A (TVS) and 470µF / 100V (Cin).



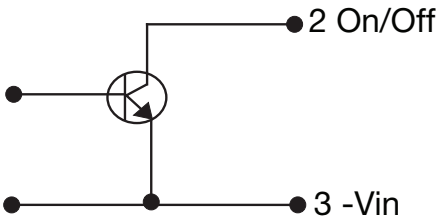
Output voltage adjustment

The Trim input permits the user to adjust the output voltage up by 20% or down by 10% (except for 5VDC which is +10% to -5%). This is accomplished by connecting an external resistor between the Trim pin and either the +Sense pin or the -Sense pin.

Output voltage sensing

The module will automatically trim the output voltage via the sense pins to the default values either locally or at the load. If not required, the sense pins should be connected locally as indicated in the example circuit.

Remote On/Off control



Positive logic: "On" if pin 2 is open circuit or high >3.5V to 75VDC
"Off" if pin 2 is shorted to pin 3 or low <1.2V to 0VDC

To trim up

Connecting an external resistor (Ru) between the Trim pin and the -Sense pin increases the output voltage. The following table can be used to determine the required external resistor value to obtain a percentage output voltage change of Δ%.

Trim up	5V	12V	15V	24V	±12V	±15V
%	Ru (kΩ)					
1	61.55	231.71	256.72	267.53	267.53	210.43
2	29.99	113.90	126.86	131.81	131.81	103.27
3	19.47	74.64	83.57	86.58	86.58	67.54
4	14.21	55.00	61.93	63.96	63.96	49.68
5	11.06	43.22	48.94	50.39	50.39	38.97
6	8.95	35.37	40.29	41.34	41.34	31.82
7	7.45	29.76	34.10	34.88	34.88	26.72
8	6.32	25.55	29.47	30.03	30.03	22.89
9	5.45	22.28	25.86	26.26	26.26	19.91
10	4.75	19.66	22.97	23.24	23.24	17.53
11		17.52	20.61	20.78	20.78	15.58
12		15.73	18.64	18.72	18.72	13.96
13		14.22	16.98	16.98	16.98	12.59
14		12.93	15.55	15.49	15.49	11.41
15		11.81	14.31	14.20	14.20	10.39
16		10.83	13.23	13.06	13.06	9.50
17		9.96	12.28	12.07	12.07	8.71
18		9.19	12.43	11.18	11.18	8.01
19		8.50	10.67	10.39	10.39	7.38
20		7.88	9.99	9.67	9.67	6.82

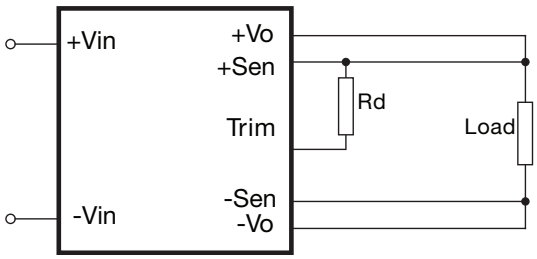
To trim down

Connecting an external resistor (Rd) between the Trim pin and the +Sense pin decreases the output voltage. The following table can be used to determine the required external resistor value to obtain a percentage output voltage change of Δ%.

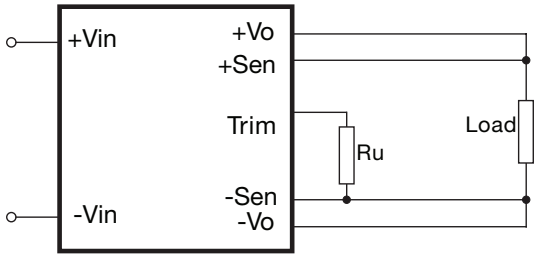
Trim down	5V	12V	15V	24V	±12V	±15V
%	Rd (kΩ)					
1	116.39	571.58	826.28	1614.98	1614.98	2306.37
2	56.50	279.74	406.14	795.99	795.99	1138.43
3	36.53	182.46	266.09	522.99	522.99	749.16
4	26.55	133.82	196.07	386.49	386.49	554.52
5	20.56	104.64	154.06	304.60	304.60	437.73
6		85.18	126.05	250.00	250.00	359.88
7		71.28	106.04	211.00	211.00	304.27
8		60.86	91.03	181.75	181.75	262.56
9		52.75	79.36	159.00	159.00	230.12
10		46,27	70.03	140.80	140.80	204.17

External trim

Voltage trim down

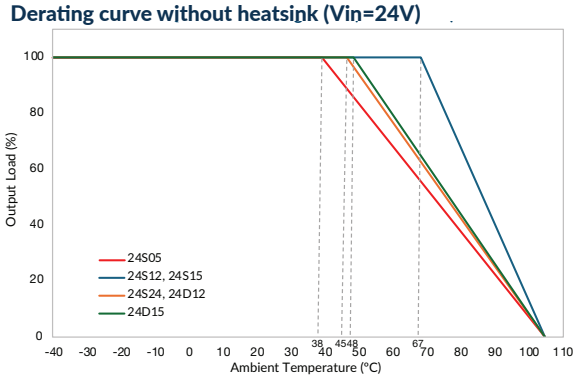


Voltage trim up



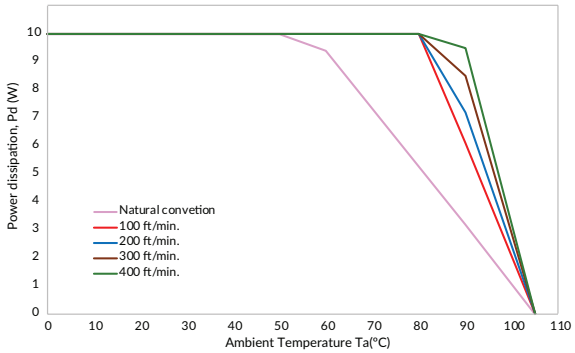
Application notes

Derating curve without heatsink (Vin=24V)



Airflow derating graph (Vin=24V)

Maximum power dissipation vs. Ambient temperature & Air Flow with heatsink



Air flow rate	Typical Rca
Natural Convection 20ft./min. (0.1m/s)	4.78 °C/W
100 ft./min. (0.5m/s)	2.44 °C/W
200 ft./min. (1.0m/s)	2.06 °C/W
300 ft./min. (1.5m/s)	1.76 °C/W
400 ft./min. (2.0m/s)	1.58 °C/W

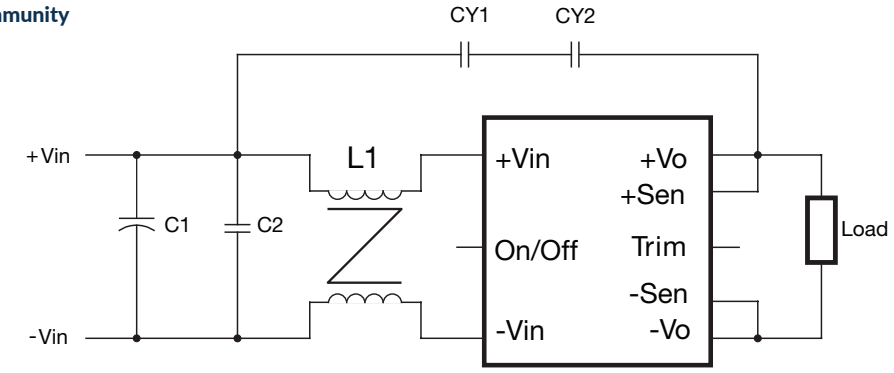
Rca = Thermal resistance from case to ambient
To order heatsink, use part number **QSB75 HEATSINK-V**

Example with heatsink

To determine the minimum airflow necessary for a QAM60T24S05 operating at nominal line voltage, an output current of 12A and maximum ambient of +75°C.
Determine power dissipation (Pd):
Pd=Pi-Po=Po(1-η)/η,
Where Pi = Input power, Po = Output power and η = Efficiency (refer to models & ratings table)
Pd=5×12×(1-0.89)/0.89=7.42Watts
Determine airflow from airflow derating graph using data points for Pd = 7.42W and Ta=+75°C, then take the next line up to get the minimum airflow = 100ft/min

To determine the heatsink/typical Rca, refer to the Air flow Rate table.
To check the maximum case temperature of +105°C is not exceeded:
Determine maximum temperature rise (ΔT):
ΔT= Pd×Rca, where Rca is the thermal resistance from case to ambient
ΔT= 7.42×2.44=18.105°C
Determine the maximum case temperature (Tc):
Tc=Ta+ΔT, where Ta is ambient temperature
Tc=75 + 18.105 = 93.105°C <105°C

EMC filter – Emissions and immunity

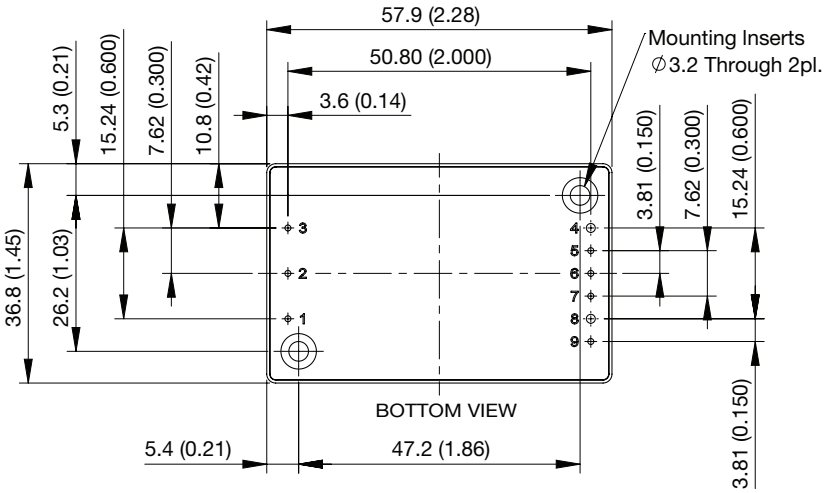


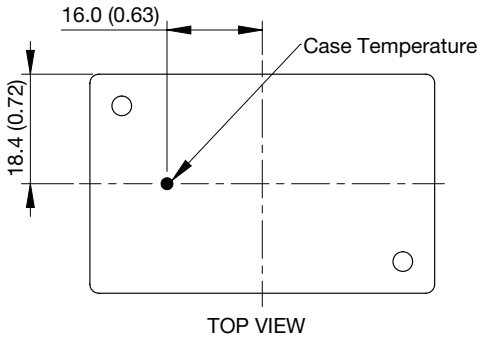
C1	C2	CY1, CY2	L1
100uF/100V Aluminum cap	2.2uF/100V X7R 1210 Ceramic cap	100pF Y1 cap	0.175mH CMCK 74482210002 Wurth

Notes:

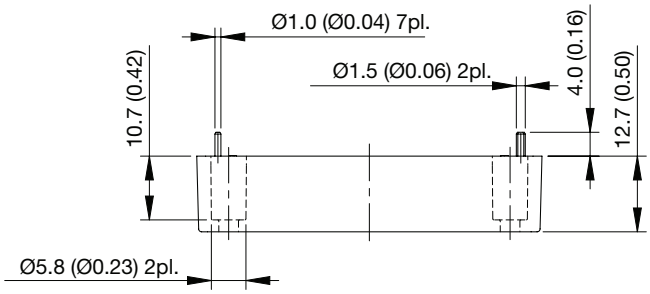
1. C1: 100uF/100V YXJ series aluminium capacitor or equivalent.

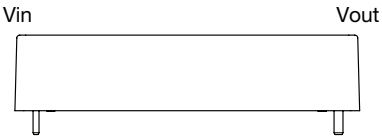
Mechanical details





The center point of the case is offset by 16mm toward the input size

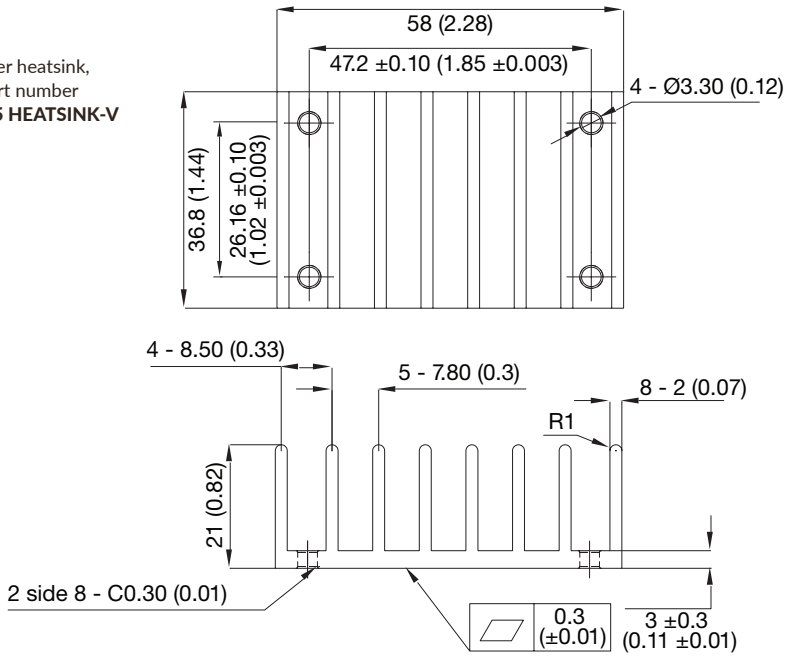




Pin	Single output	Dual output
1	+Vin	+Vin
2	Remote On/Off	Remote On/Off
3	-Vin	-Vin
4	-Vout	-Vout
5	-Sense	-Sense
6	Trim	Common
7	+Sense	+Sense
8	+Vout	+Vout
9	NP	Trim

Pin 4 & pin 8: Pin size is 1.5±0.1 (0.06±0.004)
Other pins: Pin size is 1.0±0.1 (0.04±0.004)
NP-No pin

To order heatsink, use part number **QSB75 HEATSINK-V**



Notes:

1. All dimensions are in mm (inches)
2. Weight: 67g (0.15lbs) approx.
3. Tolerance: x.xx = x.x = ±0.5 (±0.02), x.xxx = x.xx = ±0.25 (±0.01)