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AM50QB-UU



¼ brick

The AM50QB-UU series is a high-performance quarter brick DC/DC converter specifically designed for a variety of railway applications. It features 50W of output power with no requirement for minimum load, a wide input voltage of 12-160VDC, operating temperature up to 110°C and reinforced I/O isolation of 4000VDC.

Additionally, this series features include input under-voltage protection, output over-voltage, short-circuit, over-current and over-temperature protection, remote On/Off control, remote sense compensation and output voltage trim adjustment.

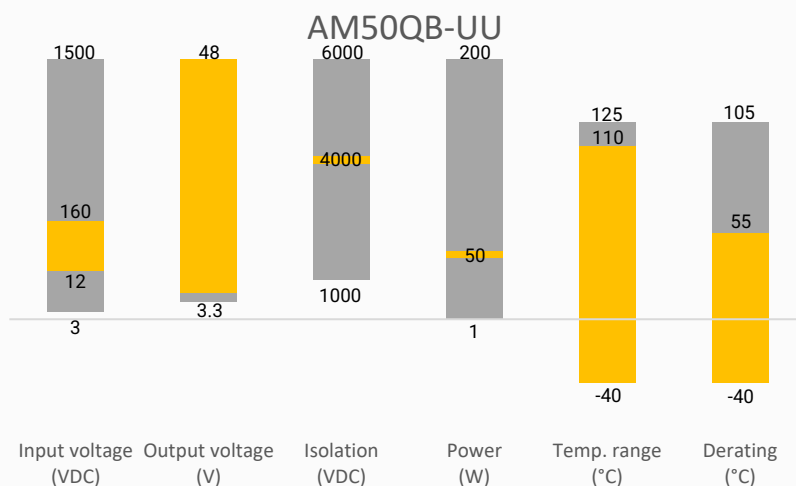
The AM50QB-UU meets EN/UL 62368-1, EN50155 railway standards and are widely used in the centralized lighting, air conditioning and related on-board equipment.

Features

- Operating Temp: -40 °C to +110 °C
- Isolation voltage: 4000VDC
- High efficiency: Up to 90% typ.
- Regulated single output
- Output short circuit, over-current, over-voltage, input under-voltage, over temperature protection
- Standard ¼ brick package
- Design to meet EN/UL 62368-1, EN50155
- Made in Taiwan



Summary



Training



Product Training Video
(click to open)



Press Release

Coming Soon!

Application Notes

Applications



Railway



Industrial

Models & Specifications

Single Output

Model	Input Voltage (VDC)	Output Voltage (VDC)	Nominal Vin Input Current Max (mA)		Output Current Max (A)	Maximum Capacitive Load (μF)	*Efficiency Full Load Typ (%)
			No Load	Full Load			
AM50QB-7203SH40UU	72 (12-160)	3.3	30	820	15.2	3600	85
AM50QB-7205SH40UU	72 (12-160)	5	15	800	10	3000	87
AM50QB-7212SH40UU	72 (12-160)	12	15	780	4.2	1000	90
AM50QB-7215SH40UU	72 (12-160)	15	15	780	3.35	1000	90
AM50QB-7224SH40UU	72 (12-160)	24	15	780	2.1	470	90
AM50QB-7248SH40UU	72 (12-160)	48	15	785	1.05	200	89

Add suffix "-K" for optional heat sink. (ex. AM50QB-7212SH40UU-K is with the heatsink attached version.)

*Vin=72V, T=25°C

Input Specification

Parameters	Conditions	Typical	Maximum	Units
Input voltage	Nominal 72V	12 - 160		VDC
Input surge voltage	1s max.	≥0.3	185	VDC
Start-up voltage		≥11	12	VDC
Shut down voltage		≥10	11	VDC
Input reflected current	Nominal 72V, p-p thru 10μH inductor	40		mA
On/Off control	On	Control pin open or 2.4-5VDC		
	Off	Control pin short to -Vin or 0-0.8VDC		
	Idle current	5	20	mA
Input filter	Pi filter			

Isolation Specification

Parameters	Conditions	Typical	Maximum	Units
Tested isolation voltage	Input / output 60 sec, ≤ 5mA	≥4000		VDC
	Input / case 60 sec, ≤ 5mA	≥2250		VDC
	Output / case 60 sec, ≤ 1mA	≥1500		VDC
Resistance	500VDC	≥100		MΩ
Capacitance	100KHz / 0.1V	1100		pF

Output Specification

Parameters	Conditions	Typical	Maximum	Units
Voltage accuracy	Vin=72V, 100% load, T=25°C		±1	%
Line regulation	LL – HL 100% load		±1	%
Load regulation	Vin= 72V		±1	%
Short circuit protection	Hiccup, Auto recovery			
Over current protection	3.3Vout, Hiccup, Auto recovery	>19	28	A
	5Vout, Hiccup, Auto recovery	>12	16	
	12Vout, Hiccup, Auto recovery	>6	7	
	15Vout, Hiccup, Auto recovery	>5	5.6	
	24Vout, Hiccup, Auto recovery	>2.5	3.8	
	48Vout, Hiccup, Auto recovery	>1.6	1.8	

Over voltage protection	3.3Vout, Vin=72V, T=25°C, Auto recovery 5Vout, Vin=72V, T=25°C, Auto recovery 12Vout, Vin=72V, T=25°C, Auto recovery 15Vout, Vin=72V, T=25°C, Auto recovery 24Vout, Vin=72V, T=25°C, Auto recovery 48Vout, Vin=72V, T=25°C, Auto recovery	>3.63 >5.5 >13.2 >16.5 >26.4 >58	6.6 7.5 18 22.5 36 72	V
Transient Recovery Time	VI = 72 V, Load step 50-75-50% of max Io, di/dt = 100mA/μs(within 1% Vout nominal)		500	μs
Transient Response Deviation		±500		mV
Ripple & Noise*	3.3V output, 100% load	60	100	mV pk-pk
	5V output, 100% load	80	100	mV pk-pk
	12/15/24V output, 100% load	150	200	mV pk-pk
	48V output, 100% load	250	300	mV pk-pk
Trim	Typical output voltage		±10	%
Sense compensation			±5	%

* Tested with the ripple & noise circuit.

General Specifications

Parameters	Conditions	Typical	Maximum	Units
Switching frequency	3.3Vout	130		KHz
	5/12/24Vout	180		KHz
	15/48Vout	150		KHz
Operating temperature	With derating	-40 to +110		°C
Storage temperature		-55 to +125		°C
Over temperature protection	Case temperature	115		°C
Operating Altitude			5000	m
Temperature coefficient	100% Load		± 0.03	%/ °C
Cooling	Free air convection			
Humidity	Non-condensing	≥5	95	% RH
Weight	Pin mountable	60		g
	With optional -K heatsink	100		
Dimensions (L x W x H)	Pin mountable	2.28 x 1.45 x 0.50 inches (57.9 x 36.8 x 12.7 mm)		
	With optional -K heatsink	2.28 x 1.45 x 1.01 inches (57.9 x 36.8 x 25.6 mm)		
Case material	Aluminum base, black plastic case (UL94V-0)			
Potting material	Silicone (UL94V-0)			
MTBF	≥ 700 000 hrs (MIL-HDBK -217F, t=+25°C)			
NOTE: All specifications in this datasheet are measured at an ambient temperature of 25°C, humidity<75%, nominal input voltage and at rated output load unless otherwise specified.				

Environment Approval

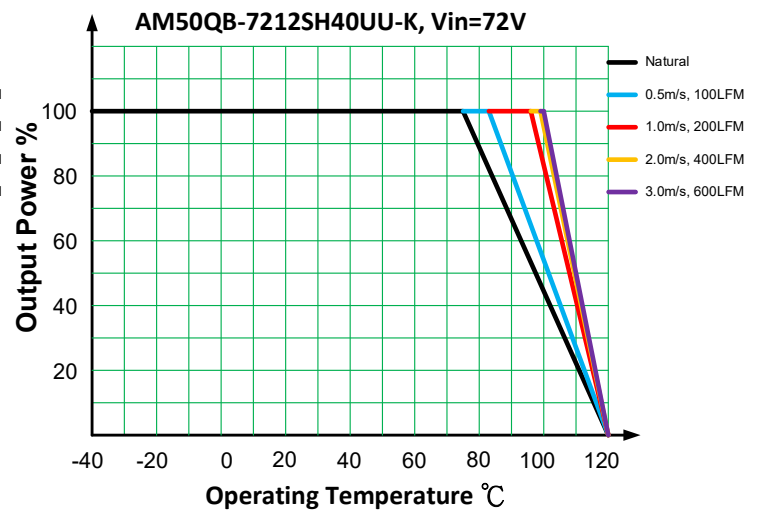
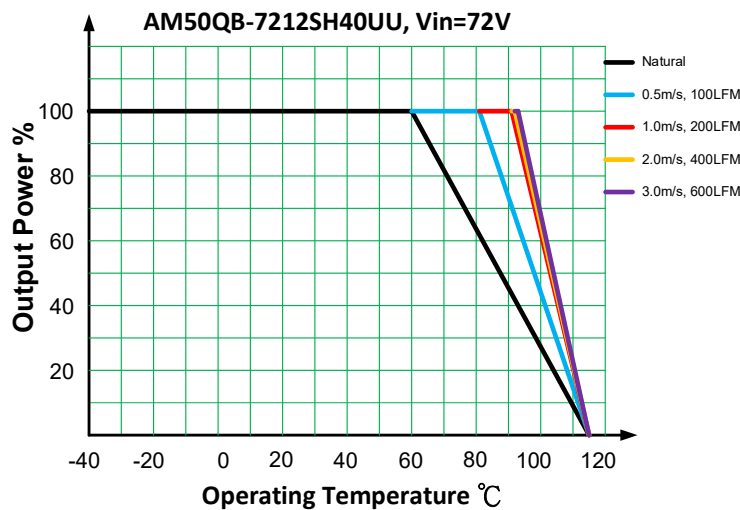
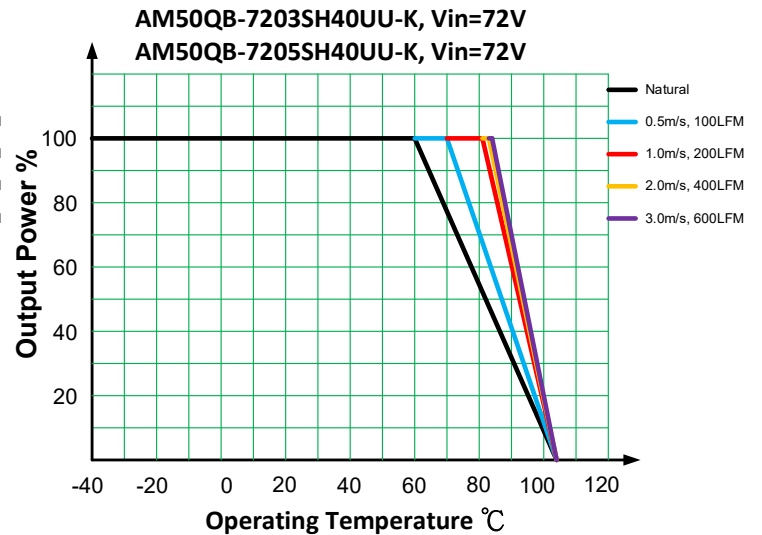
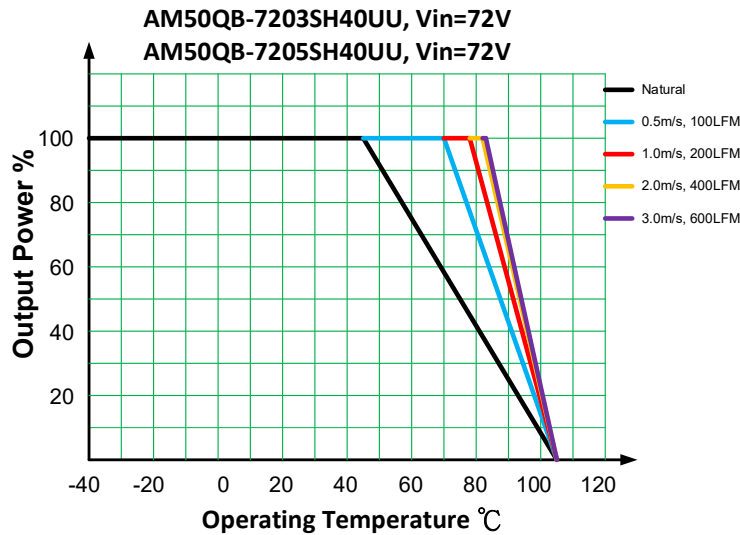
Parameters	Conditions
Cold	EN60068-2-1
Dry heat	EN60068-2-2
Damp heat	EN60068-2-30
Vibration	IEC/EN 61373 Category 1, class B

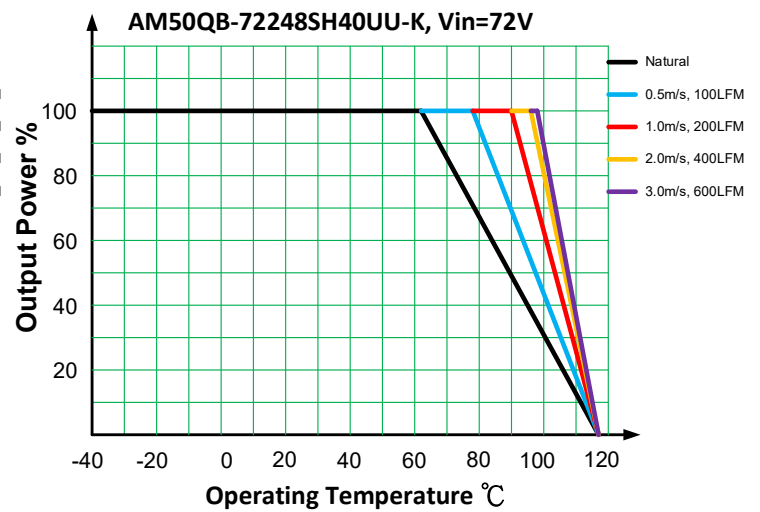
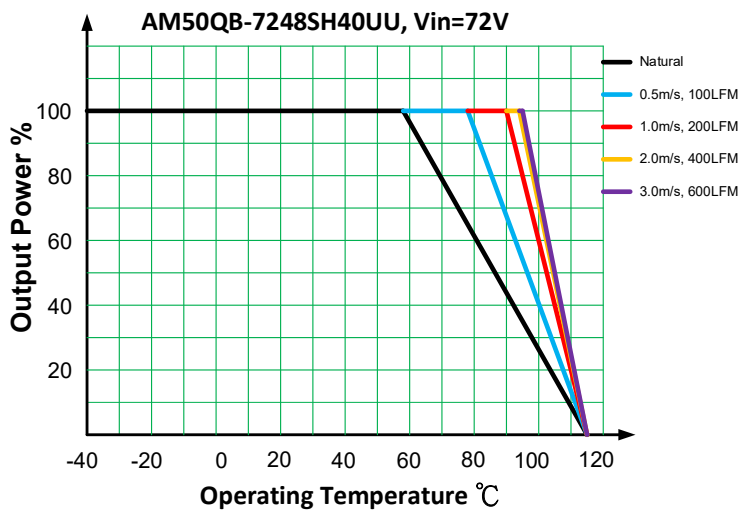
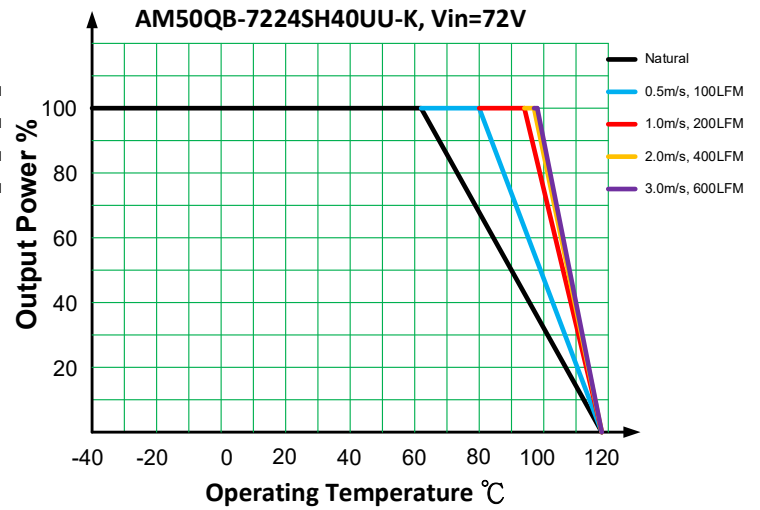
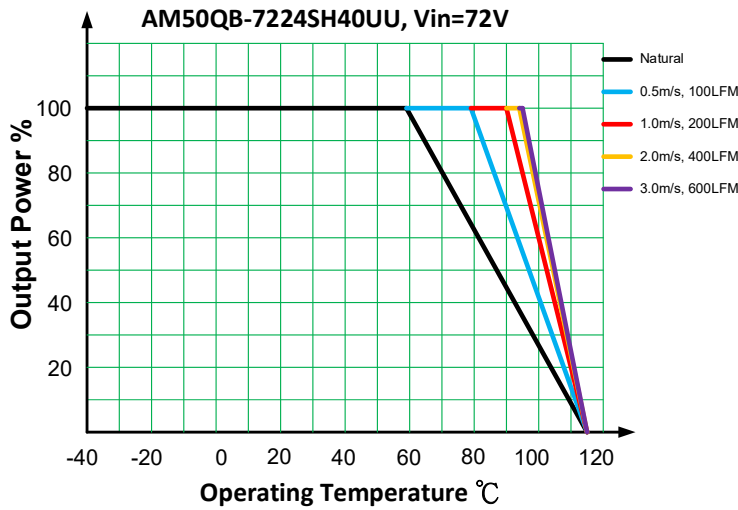
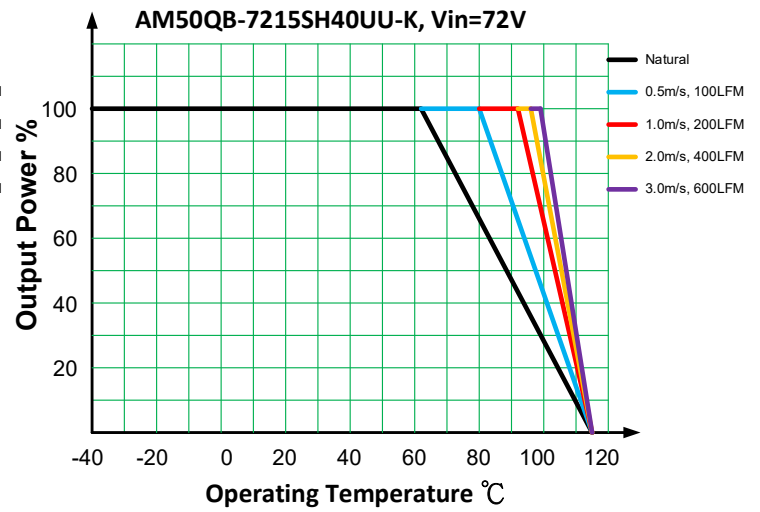
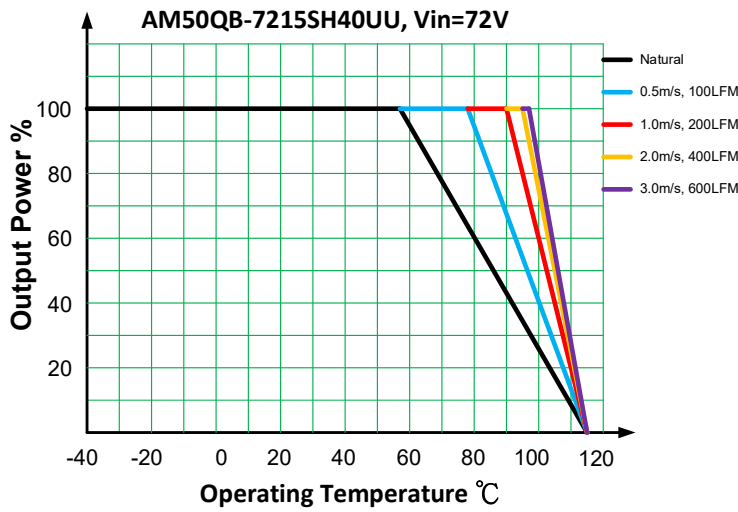
Safety Specifications

Parameters		
Standards	Design to meet IEC/EN/UL 62368-1 (Basic Insulation), EN50155, EN45545-2, EN50121-3-2	
	EMI - Conducted and radiated emission*	CISPR32/EN55032 Class B with the recommended EMC circuit
		EN50121-3-2 with the recommended EN50155 EMC circuit
		EN55016-2-1 with the recommended EN50155 EMC circuit

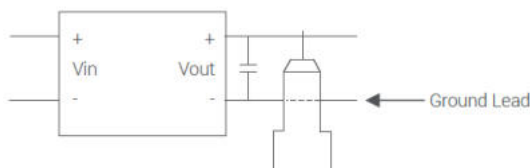
	Electrostatic Discharge Immunity	IEC/EN 61000-4-2, Contact $\pm 6\text{KV}$, Air $\pm 8\text{KV}$, Criteria A
		EN50121-3-2, Contact $\pm 6\text{KV}$, Air $\pm 8\text{KV}$, Criteria A
	RF, Electromagnetic Field Immunity	IEC/EN 61000-4-3, 20V/m, Criteria A
		EN50121-3-2, 20V/m, Criteria A
	Electrical Fast Transient/Burst Immunity	IEC/EN 61000-4-4, $\pm 2\text{KV}$, Criteria A with the recommended EMC circuit
		EN50121-3-2, $\pm 2\text{KV}$, Criteria A with the recommended EN50155 EMC circuit
	Surge Immunity	IEC/EN 61000-4-5, L-L $\pm 2\text{KV}$, Criteria A with the recommended EMC circuit
		EN50121-3-2, L-L $\pm 1\text{KV}$, Criteria A with the recommended EN50155 EMC circuit
	RF, Conducted Disturbance Immunity	IEC/EN 61000-4-6, 10Vr.m.s, Criteria A
		EN50121-3-2, 10Vr.m.s, Criteria A
*CISPR32/EN55032 radiated emission standard does not apply to models with -K heatsink option.		

Derating





Ripple & Noise Circuit



3.3 Vout: 100% load, 20MHZ BW with a 1uF ceramic cap and a 330uF/10V POS-CAP.

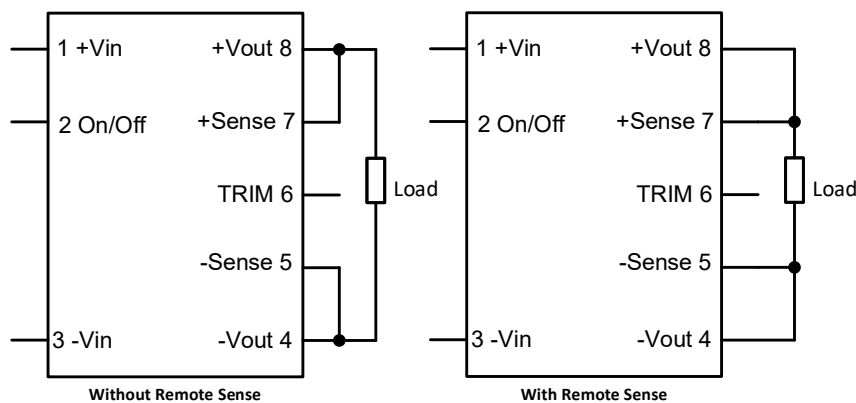
5 Vout: 100% load, 20MHZ BW with a 10uF/25V X7R MLCC and a 47uF/20V POS-CAP.

12/15 Vout: 100% load, 20MHZ BW with a 22uF/25V X7R MLCC and a 22uF/25V POS-CAP.

24 Vout: 100% load, 20MHZ BW with a 1uF ceramic cap and 2pcs 10uF/50V MLCC.

48 Vout: % load, 20MHZ BW with a 1uF ceramic cap and 2pcs 2.2uF/100V MLCC.

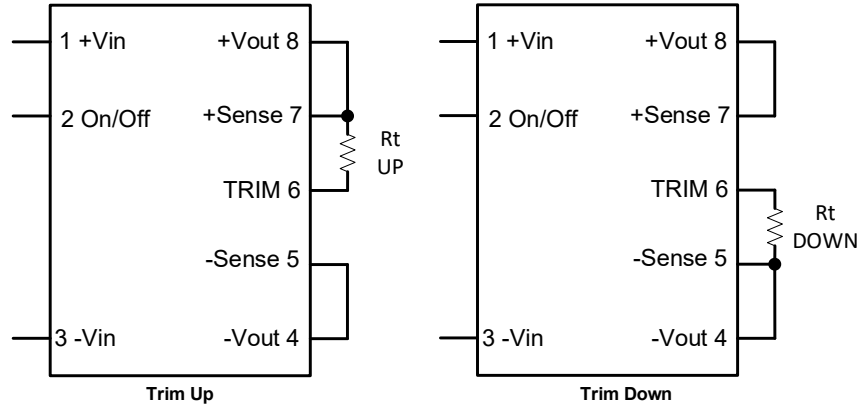
Remote Sense Application



The AM150QB-UU series has a Remote Sense feature, it can correct for voltage drops from the converter's output pins to the load. The Sense wire is not the main path of the system and carries very little current. It is recommended to use twisted wires for the $+Sense$ and $-Sense$ wires or shielded cable to avoid noise and unwanted inductance.

If the Remote Sense feature is not used, please connect $+Sense$ and $-Sense$ pin to $+V_{out}$ and $-V_{out}$.

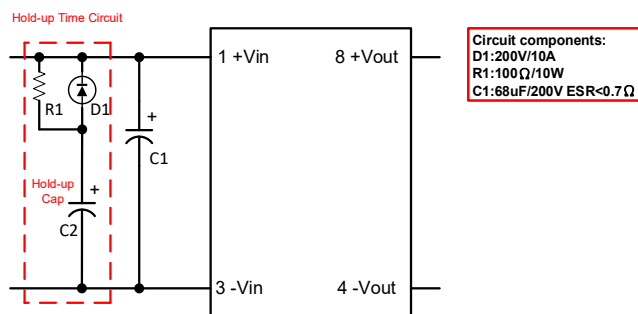
Trim



Vout= 3.3										
Trim down %	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Vout (VDC)	3.267	3.234	3.201	3.168	3.135	3.102	3.069	3.036	3.003	2.970
Rt down (KΩ)	187.019	83.969	49.619	32.444	22.139	15.269	10.362	6.682	3.819	1.529
Trim up %	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Vout (VDC)	3.333	3.366	3.399	3.432	3.465	3.498	3.531	3.564	3.597	3.630
Rt up (KΩ)	187.010	86.005	52.337	35.503	25.402	18.668	13.859	10.251	7.446	5.201
Vout= 5										
Trim down %	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Vout (VDC)	4.950	4.900	4.850	4.800	4.750	4.700	4.650	4.600	4.550	4.500
Rt down (KΩ)	289.025	129.385	76.172	49.565	33.601	22.958	15.356	9.655	5.221	1.673
Trim up %	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Vout (VDC)	5.050	5.100	5.150	5.200	5.250	5.300	5.350	5.400	5.450	5.500
Rt up (KΩ)	282.250	129.125	78.083	52.563	37.250	27.042	19.750	14.281	10.028	6.625
Vout= 12										
Trim down %	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Vout (VDC)	11.880	11.760	11.640	11.520	11.400	11.280	11.160	11.040	10.920	10.800
Rt down (KΩ)	834.129	377.879	225.796	149.754	104.129	73.712	51.986	35.692	23.018	12.879
Trim up %	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Vout (VDC)	12.120	12.240	12.360	12.480	12.600	12.720	12.840	12.960	13.080	13.200
Rt up (KΩ)	662.600	300.300	179.533	119.150	82.920	58.767	41.514	28.575	18.511	10.460
Vout= 15										
Trim down %	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Vout (VDC)	14.850	14.700	14.550	14.400	14.250	14.100	13.950	13.800	13.650	13.500
Rt down (KΩ)	870.620	391.930	232.367	152.585	104.716	72.803	50.009	32.913	19.616	8.978
Trim up %	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Vout (VDC)	15.150	15.300	15.450	15.600	15.750	15.900	16.050	16.200	16.350	16.500
Rt up (KΩ)	850.600	391.300	238.200	161.650	115.720	85.100	63.229	46.825	34.067	23.860

Vout= 24										
Trim down %	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Vout (VDC)	23.760	23.520	23.280	23.040	22.800	22.560	22.320	22.080	21.840	21.600
Rt down (KΩ)	1569.511	708.846	421.958	278.514	192.447	135.069	94.085	63.347	39.440	20.314
Trim up %	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Vout (VDC)	24.240	24.480	24.720	24.960	25.200	25.440	25.680	25.920	26.160	26.400
Rt up (KΩ)	1340.610	610.305	366.870	245.153	172.122	123.435	88.659	62.576	42.290	26.061
Vout= 48										
Trim down %	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Vout (VDC)	47.520	47.040	46.560	46.080	45.600	45.120	44.640	44.160	43.680	43.200
Rt down (KΩ)	3142.388	1419.353	845.008	557.836	385.532	270.663	188.614	127.077	79.215	40.925
Trim up %	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Vout (VDC)	48.480	48.960	49.440	49.920	50.400	50.880	51.360	51.840	52.320	52.800
Rt up (KΩ)	2682.140	1221.070	734.047	490.535	344.428	247.023	177.449	125.268	84.682	52.214

Hold up Time Circuit



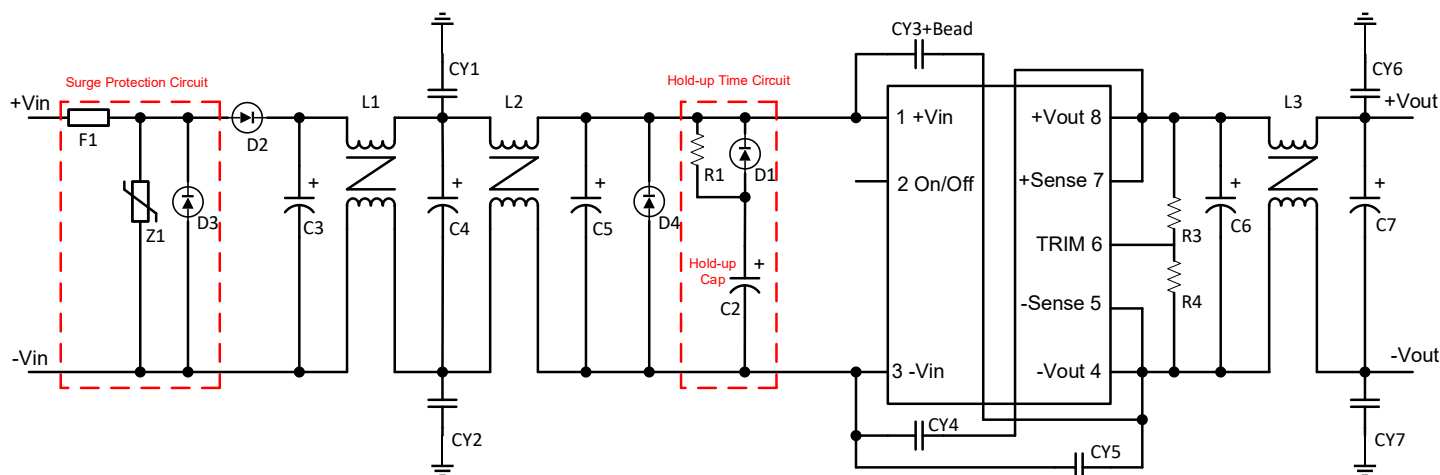
1. The resistor (R1) is used to limit in-rush current during hold-up capacitor charging.
2. The diode (D1) in parallel with the resistor permits the power module to draw whatever energy they need from C2 without being hindered by the resistor(R1).
3. The capacity of C2 decides the hold-up time during interruption of input power. When choosing a hold-up time capacitor(C2), it is recommended to use capacitors with low Equivalent Series Resistance (ESR) as well as high rated for high ripple current.
(When higher voltage is involved, it will be likely necessary to use two or more capacitors in series and / or series parallel configurations to achieve the required total capacitance)
4. The relationship is showed in below table.

$$C_2 = \frac{200 \cdot P_{out} \cdot t_{hold-up}}{1000 \cdot E_{ff} \cdot (V_{inN}^2 - V_{inm}^2)}$$

- C₂: total hold-up capacitance (F)
- P_{out}: Output power (W)
- t_{hold-up}: required hold-up time (ms)
- E_{ff}: efficiency of module(from datasheet) (%)
- V_{inN}: nom. input voltage (V)
- V_{inm}: min. operating input voltage of module (V)
(from datasheet)

Model	Vin		24V	36V	48V	72V	96V	110V
	Hold-up Time							
AM50QB-7203SH40UU	10ms		2530 uF	1000 uF	540 uF	240 uF	130 uF	100 uF
	30ms		7600 uF	3000 uF	1700 uF	700 uF	390 uF	300 uF
AM50QB-7205SH40UU	10ms		2500 uF	1000 uF	520 uF	220 uF	120 uF	100 uF
	30ms		7400 uF	2800 uF	1600 uF	680 uF	380 uF	280 uF
AM50QB-7212SH40UU	10ms		2400 uF	1000 uF	500 uF	220 uF	120 uF	100 uF
AM50QB-7215SH40UU								
AM50QB-7224SH40UU								
AM50QB-7248SH40UU	30ms		7200 uF	2800 uF	1600 uF	660 uF	360 uF	280 uF

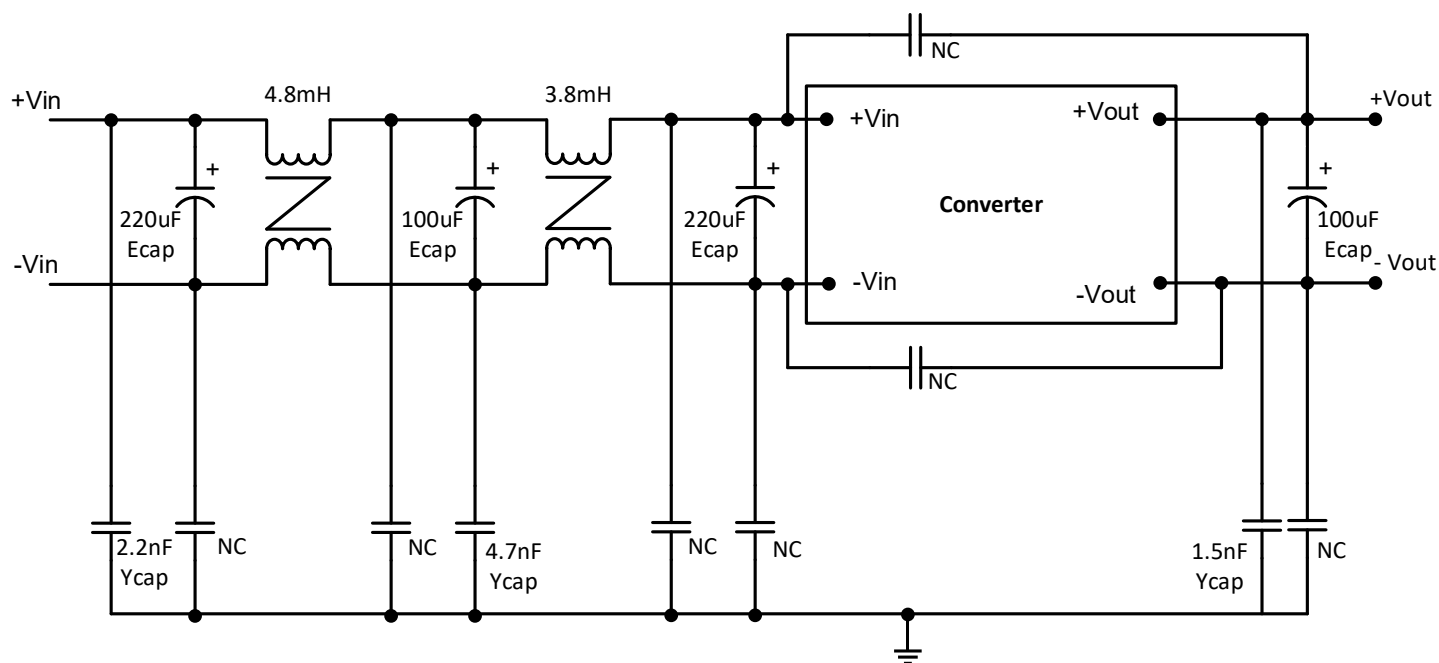
Recommended EN50155 EMC circuit



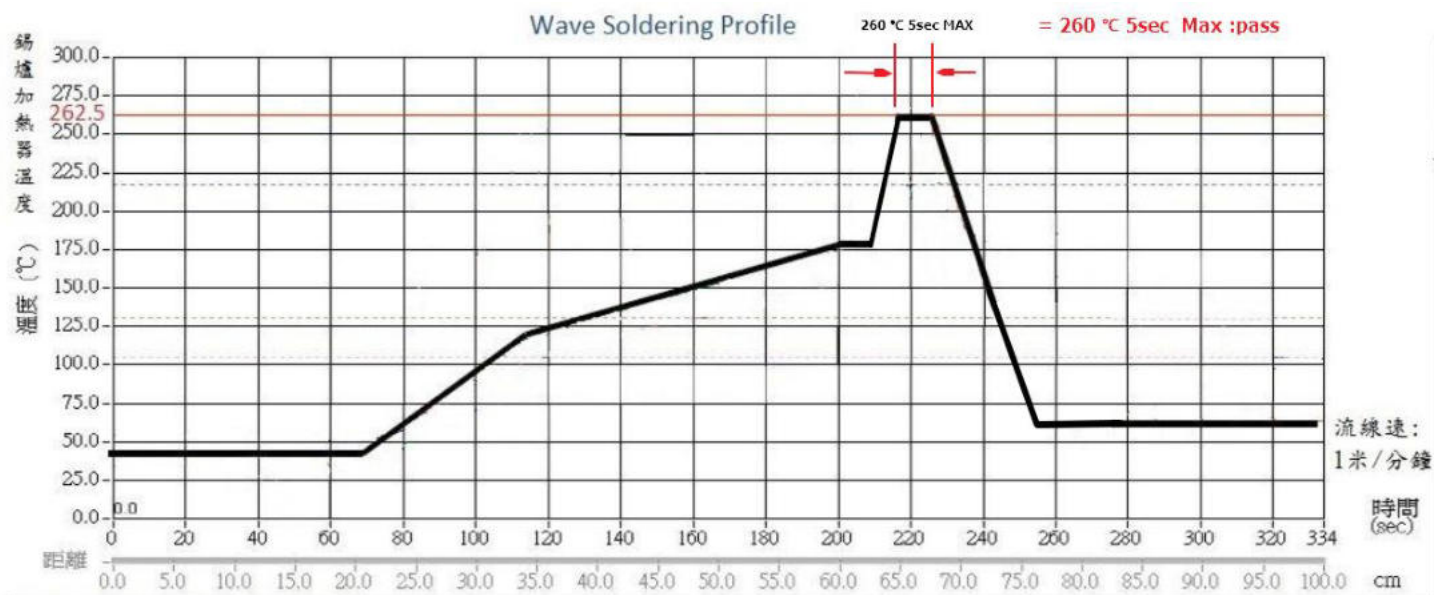
Part No	F1 Fuse	D2 Schottky Diode	D3, D4 TVS	L1 Common mode choke	L2 Common mode choke	L3 Common mode choke	C3 Ecap	C4 Ecap
Value	7.5A slow	200V/20A	5KP150A	4.0mH	0.9mH	10.8mH	220uF/250V	47uF/200V
Part No	C5 Ecap	C6 Ecap	C7 Ecap	CY1, CY2 Ycap	CY6, CY7 Ycap	CY3 Ycap+Bead Core	CY4 Ycap	CY5 Ycap
Value	100uF/200V	330uF/100V	150uF/100V	3.3nF/250VAC	3.3nF/250VAC	2.2nF/250VAC +Bead core	4.7nF/250VAC	1nF/250VAC

EN 50155		
Phenomenon	EN50155 Reference Clause(s)	Reference Standard
Characteristic Test	12.2.1, 12.2.2, 5.1.1.1, 5.1.3, 12.2.9, 12.2.6	-
EMC	12.2.7, 12.2.8	EN 50121-3-2 EN 61000-4 EN 55011
Environmental Tests	12.2.3, 12.2.4, 12.2.5, 12.2.11	EN 60068-2 EN 61373

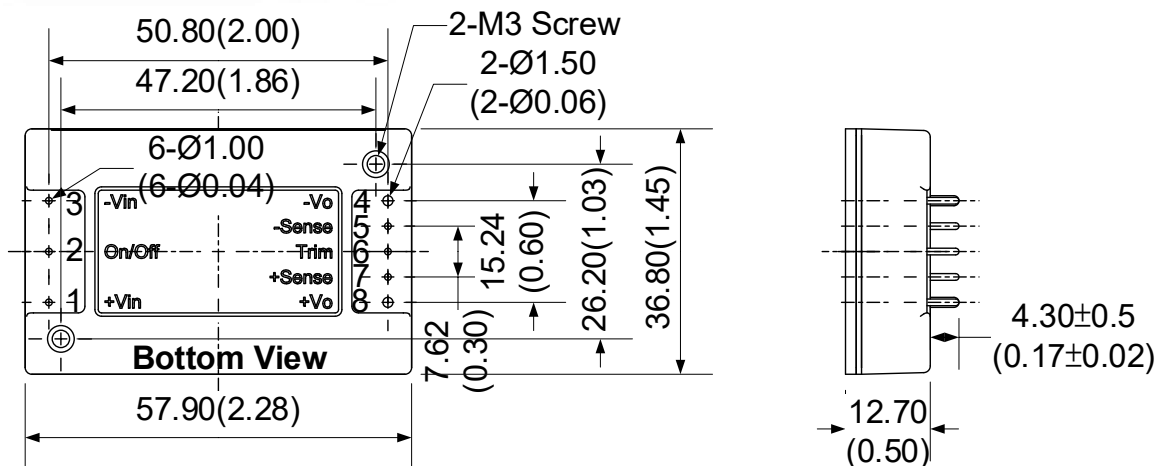
Recommended EMC circuit



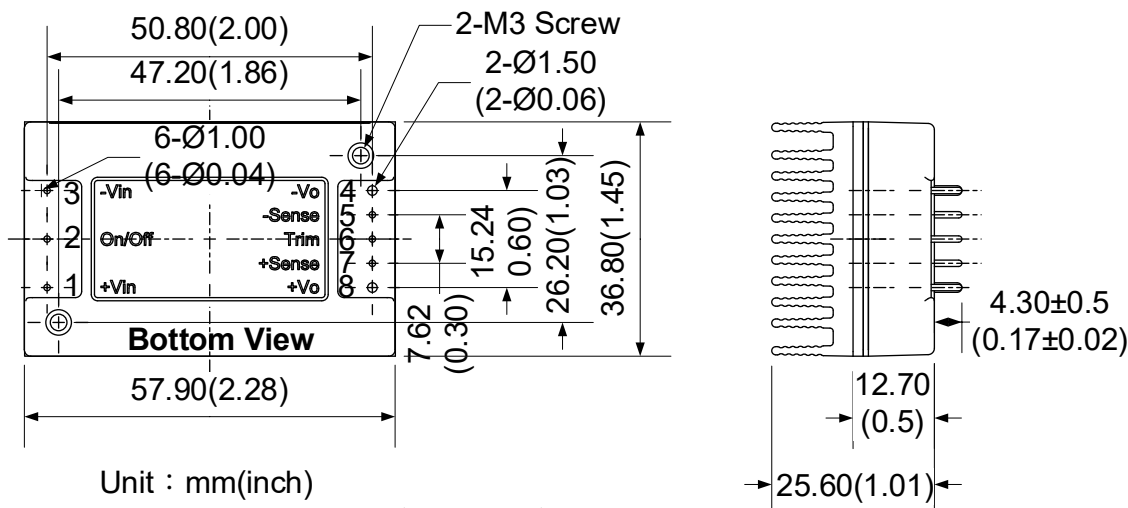
Soldering Information (Wave Soldering Profile)



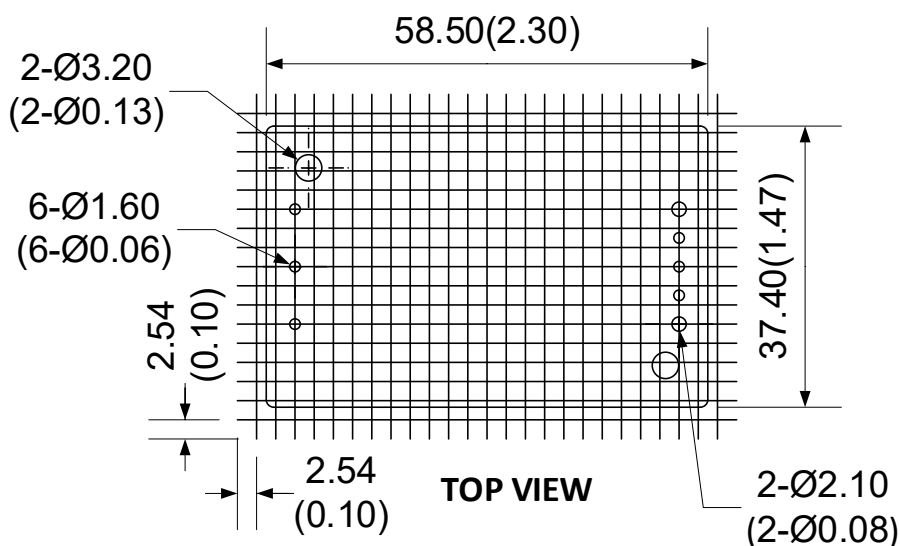
Dimension



Dimension for models with -K option



Recommended Footprint



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