

Features

- 12:1 Wide Input Range
- Operating Temperature Range: -40~105°C
- Approved to cURus, UKCA, C
- Safety Standards to IEC/UL/EN62368-1
- Efficiency up to 91
- EMC Class A & B
- Single 60W Output Models
- Available with optional heatsink (HS)



Ideal Power's 43QAE60-xSyU 60W Series Pin Connection DC/DC Converters are certified to cURus, UKCA, CE, RoHS, REACH & IEC/UL/EN 62368-1, EN 50155 Standards and comply with Efficiency Regulations. These are primarily used in ITE, Video & Audio, Railway Industries and customised solutions are available upon request.

Part Number Structure

43QAE60-	72	S	05	U	K	P	HS
Series Name	Output Power (VDC)	Output Quantity	Output Voltage (VDC)	Input Range	Bus & UVP adj. Options	Ctrl and Pin Options	Assembly Options
	24: 8.5~36 48: 16.5~75 110: 40~60	S: Single	3P3: 3.3 05: 5 12: 12 15: 15 24: 24 30: 30 48: 48	4:1	<input type="checkbox"/> None K: With Bus & UVP adj V: With UVP adj.	<input type="checkbox"/> Negative logic P: Positive logic	Heat-sink type: HS: 7G-0029B-F;H=0.24" HS1: 7G-0030B-F;H=0.5" HS2: 7G-0031B-F;H=0.24" HS3: 7G-0032B-F;H=0.5" HS4: 7GA0124P01-F;H=0.65" HS5: 7GA0125P01-F;H=1" Through hole type TH: No thread*

* The module can't equip Heat-sink with TH option

Models

Model Number	Input Range	Output Voltage	Output Current @Full Load mA	Input Current @No Load mA	Efficiency %	Maximum Capacitor Load μF
43QAE60-36S05U	9~75	5	12	20	89	24000
43QAE60-36S12U	9~75	12	5	30	89	4200
43QAE60-36S15U	9~75	15	4	30	90	2700
43QAE60-36S24U	9~75	24	2.5	20	90	1100
43QAE60-36S28U	9~75	28	2.15	20	90	780
43QAE60-36S48U	9~75	48	1.25	20	91	260
43QAE60-36S53U	9~75	53	1.14	20	91	220
43QAE60-72S05U	14~160	5	12	15	89	24000
43QAE60-72S12U	14~160	12	5	20	89	4200
43QAE60-72S15U	14~160	15	4	20	89	2700
43QAE60-72S24U	14~160	24	2.5	15	90	1100
43QAE60-72S28U	14~160	28	2.15	15	90	780
43QAE60-72S48U	14~160	48	1.25	15	90	260
43QAE60-72S53U	14~160	53	1.14	15	90	220

Input Specifications

Parameter	Conditions	Min	Typ	Max	Unit	
Operating input voltage range	36Vin(nom)	9	36	75	VDC	
	72Vin(nom)	14	72	160		
Start up voltage	36Vin(nom)	--	--	9	VDC	
	72Vin(nom)	--	--	14		
Shutdown voltage	36Vin(nom)	7.3	7.7	8.1	VDC	
	72Vin(nom)	10	11	12		
Start up time	Constant resistive load	Power up	--	75	100	ms
		Remote ON/OFF	--	75	100	
Input Transient voltage	100 mS, max.	36Vin(nom)	8.1	--	--	VDC
		72Vin(nom)	12	--	--	
Input surge voltage	1 second, max.	36Vin(nom)	--	--	100	VDC
		72Vin(nom)	--	--	185	
(1) Input filter				Pi type		
Remote ON/OFF	Referred to -Vin pin	Negative logic	DC-DC ON	Short or 0 ~ 1.2VDC		
		(Standard)	DC-DC OFF	Open or 3 ~ 12VDC		
		Positive logic	DC-DC ON	Open or 3 ~ 12VDC		
		(Option)	DC-DC OFF	Short or 0 ~ 1.2VDC		
		Input current of Ctrl pin	-0.5	3	1	mA
Remote off input current				1	mA	

Output Specifications

Parameter	Conditions		Min	Typ	Max	Unit
Voltage accuracy			-1.0	--	+1.0	%
Line regulation	Low Line to High Line at Full Load		-0.1	--	+0.1	%
Load regulation	No Load to Full Load	3.3 & 5Vout	-0.2	--	+0.2	%
		Others	-0.1	--	+0.1	%
Voltage adjustability	Maximum output deviation is inclusive of remote sense		-20	--	+10	%
Remote sense	% of Vout(nom). if remote sense is not being used, sense pins should connect to the output pins with the same polarity.		--	--	10	%
Ripple and noise	Measured by 20MHz bandwidth					
	With a 22µF/25V X7R MLCC and a 22µF/25V POS-CAP	3.3Vout, 5Vout	--	75	--	mVp-p
	With a 22µF/25V X7R MLCC	12Vout, 15Vout	--	100	--	
	With a 4.7µF/50V X7R MLCC	24Vout, 30Vout	--	200	--	
With a 2.2µF/100V X7R MLCC	48Vout	--	300	--		
Temperature coefficient			-0.02	--	+0.02	%/°C
Transient response recovery time	25% load step change		--	250	--	µs
Over voltage protection	% of Vout(nom); Hiccup mode		120	--	135	%
Overload protection	% of Iout rated; Hiccup mode		120	--	140	%
Short circuit protection			Continuous, automatic recovery			

General Specifications

Parameter	Conditions		Min	Typ	Max	Unit
Isolation voltage	1 minute (Reinforced insulation)	72Vin(nom) Input to Output	3000	--	--	VAC
		Input (Output) to Base-Plate	1500	--	--	
	1 minute (Basic insulation)	36Vin(nom) Input to Output	2250	--	--	VDC
Input (Output) to Base-Plate	1600	--	--			
Isolation resistance	500VDC		1	--	--	GΩ
Isolation capacitance			--	--	1000	pF
Switching frequency			160	180	200	kHz
Safety approvals	IEC/ EN/ UL62368-1					UL:E193009 CB:UL(Demko)
Standard approvals	EN50155 EN45545-2					
Case material			Aluminum base-plate with plastic case			
Potting material			Silicone (UL94 V-0)			
Weight						64g (2.26oz)
MTBF	MIL-HDBK-217F, Full load					7.381 x 10 ⁵ hrs

Environmental Specifications

Parameter	Conditions	Min	Typ	Max	Unit
Operating base-plate temperature		-40	--	+10	°C
Maximum case temperature		--	--	105	°C
Over temperature protection		--	110	--	°C
Storage temperature range		-55	--	+12	°C
Thermal impedance	Module without assembly option	--	8.3	--	°C/W
	Only mount on the iron base-plate	--	2.5	--	
	Heat-sink type with 0.24" Height	--	7.4	--	
	Heat-sink type with 0.5" Height	--	6.2	--	
	Heat-sink type with 0.65" Height	--	4.9	--	
	Heat-sink type with 1" Height	--	4.0	--	
Thermal shock					MIL-STD-810F
Vibration					MIL-STD-810F
Relative humidity					5% to 95% RH

EMC Specifications

Parameter	Conditions	Level
EMI	EN55032, EN50121-3-2 With external components	Class A, Class B
EMS	EN55024, EN50121-3-2	
ESD	EN61000-4-2 Air ± 8kV and Contact ± 6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3 20 V/m	Perf. Criteria A
Fast transient	EN61000-4-4 ± 2kV	Perf. Criteria A
	43QAE60-36S□□U With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220µF/100V)	
	43QAE60-72S□□U With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KXJ series, 150µF/200V)	
Surge	EN61000-4-5 EN55024:±1kV and EN50121-3-2:±2kV	Perf. Criteria A
	43QAE60-36S□□U With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220µF/100V)	
	43QAE60-72S□□U With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KXJ series, 150µF/200V)	
Conducted immunity	EN61000-4-6 10 Vr.m.s	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8 100A/m continuous; 1000A/m 1 second	Perf. Criteria A

Note:

1. Input source impedance: The power module will operate as specifications without external components, assuming that the source voltage has a very low impedance and reasonable input voltage regulation. Highly inductive source impedances can affect the stability of the power module. Since real-world voltage source has finite impedance, performance can be improved by adding external filter capacitor.

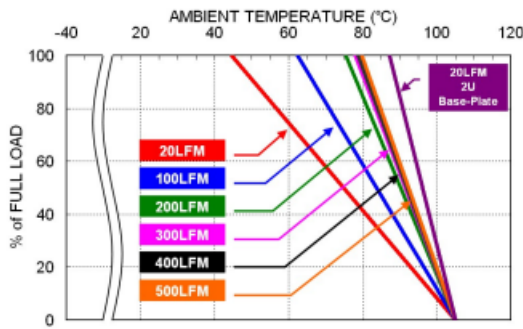
The 43QAE60-36S□□U recommended Nippon Chemi-con KY series, 220µF/100V.

The 43QAE60-72S□□U recommended Nippon Chemi-con KXJ series, 150µF/200V.

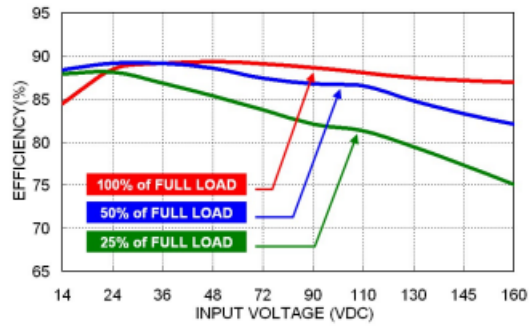
2. BASE-PLATE GROUNDING: When connect two screw bolts to shield plane, the EMI could be reduced.

CAUTION: This power module is not internally fused. An input line fuse must always be used.

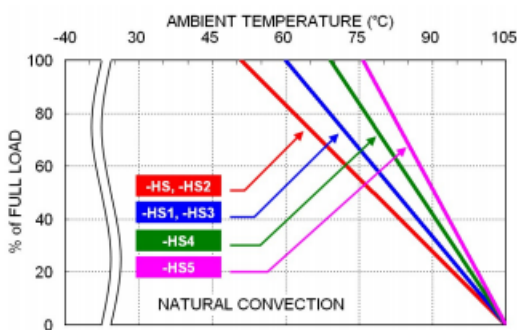
Characteristic Curve



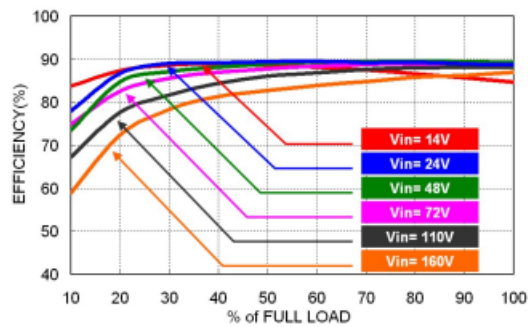
43QAE60-72S05U Derating Curve (See Thermal Considerations)



43QAE60-72S05U Efficiency vs. Input Voltage



43QAE60-72S05U Derating Curve with Heat-sink (See Thermal Considerations)



43QAE60-72S05U Efficiency vs. Output Load

Fuse Consideration

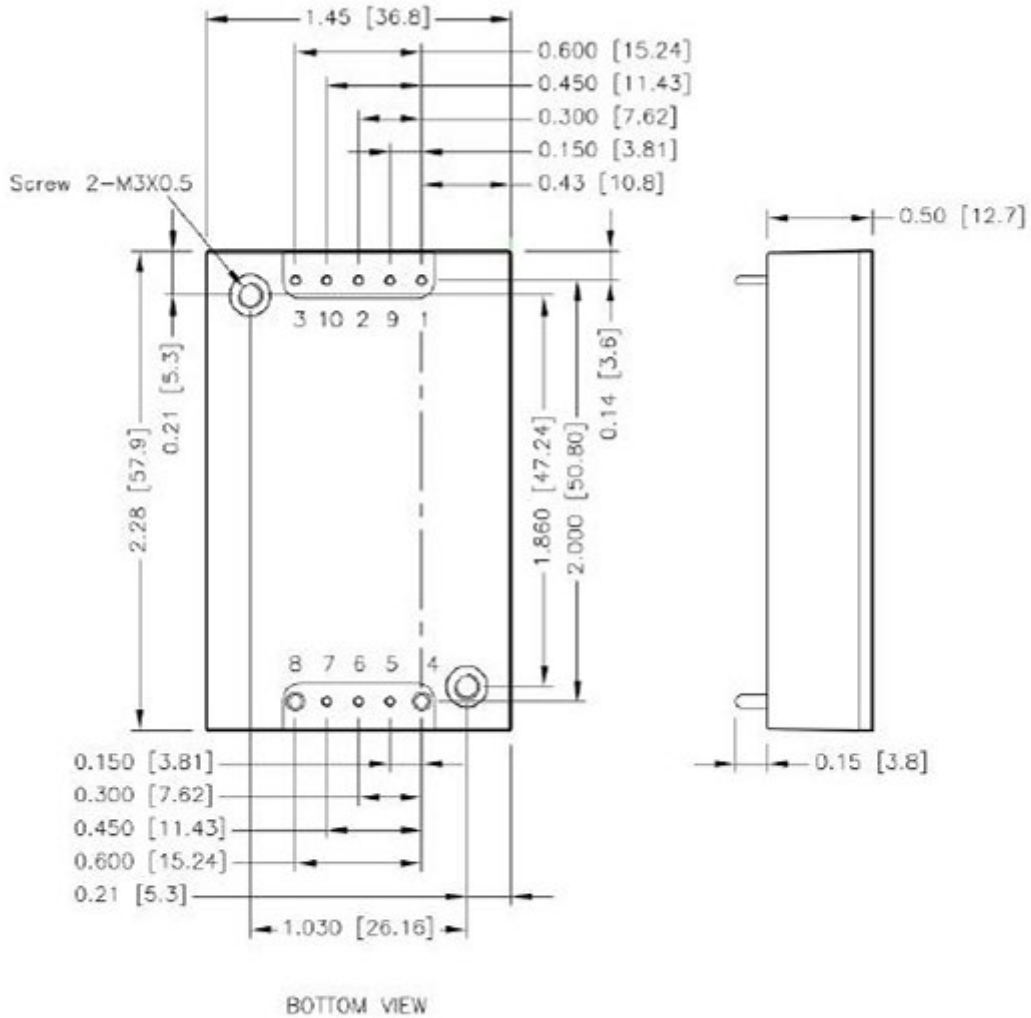
This power module is not internally fused. An input line fuse must always be used. This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture. To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

The input line fuse suggest as below :

Model	Fuse Rating (A)	Fuse Type
43QAE60-36S□□U	12	Fast-Acting
43QAE60-72S□□U	8	Fast-Acting

The table based on the information provided in this data sheet on inrush energy and maximum DC input current at low Vin.

Mechanical Drawing

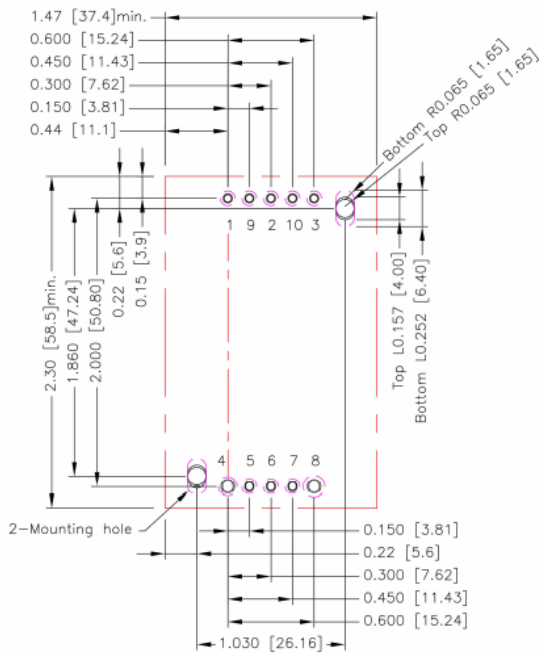


- All dimensions in inch [mm]
Tolerance : x.xx±0.02 [x.x±0.5]
 x.xxx±0.010 [x.xx±0.25]
- Pin pitch tolerance ±0.010 [0.25]
- Pin dimension tolerance ±0.004[0.10]

Pin Connection

Pin	Define	Diameter
1	- Vin	0.04 Inch
2	Ctrl	0.04 Inch
3	+ Vin	0.04 Inch
4	- Vout	0.06 Inch
5	- Sense	0.04 Inch
6	Trim	0.04 Inch
7	+ Sense	0.04 Inch
8	+ Vout	0.06 Inch
9	Bus	0.04 Inch
10	UVLO	0.04 Inch

Recommended Pad Layout

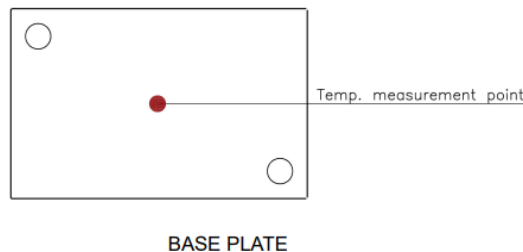


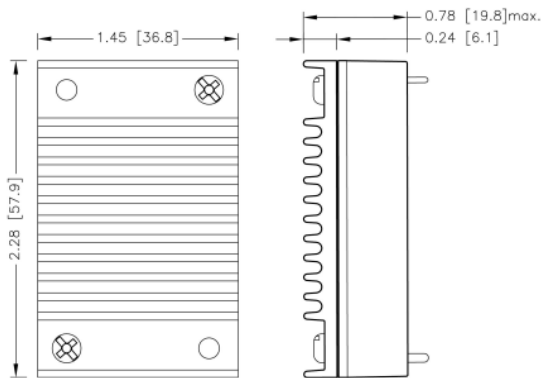
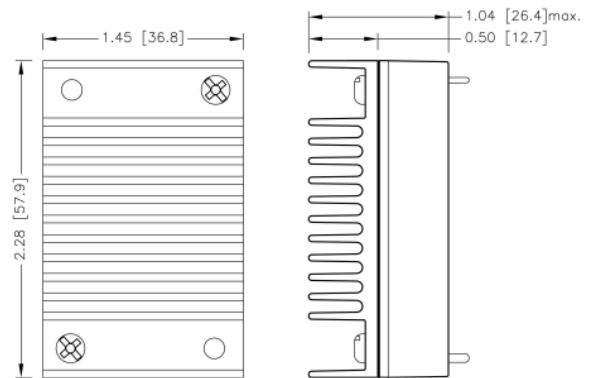
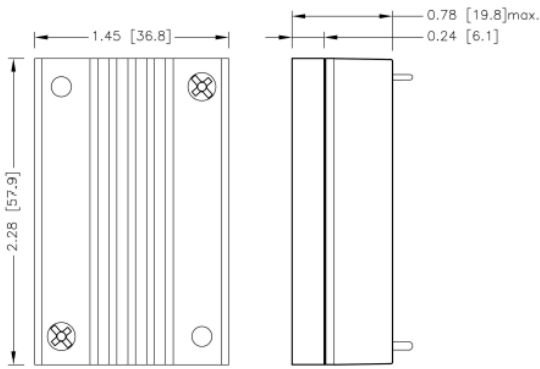
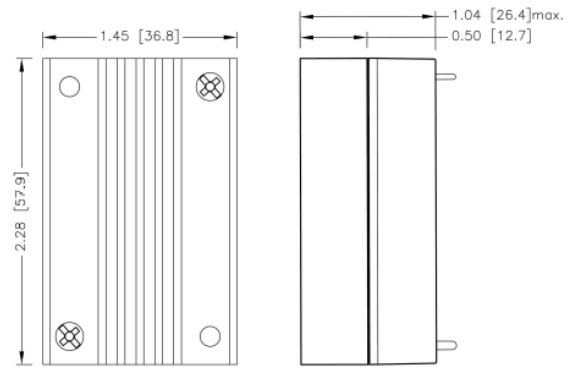
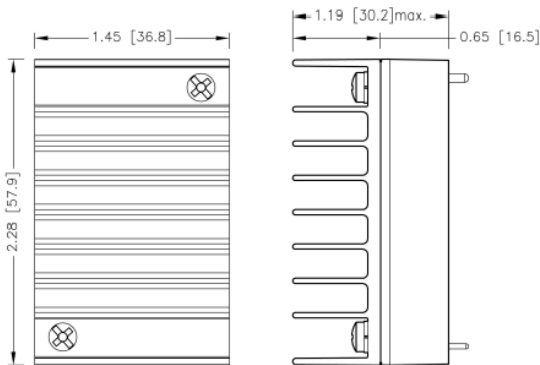
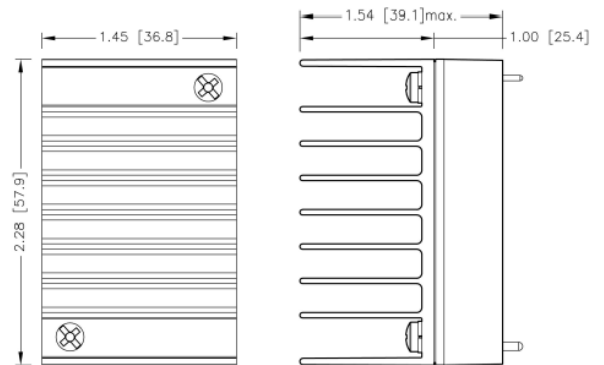
All dimensions in inch[mm]
 Pad size(lead free recommended)
 Through hole 1.2.3.5.6.7.9.10:Ø0.051[1.30]
 Through hole 4.8:Ø0.075[1.90]
 Through hole of mounting:Ø0.126[3.20]
 Top view pad 1.2.3.5.6.7.9.10:Ø0.064[1.63]
 Top view pad 4.8:Ø0.094[2.38]
 Top view pad of mounting:Groove R0.065[1.65]L0.157[4.00]
 Bottom view pad 1.2.3.5.6.7.9.10:Ø0.102[2.60]
 Bottom view pad 8:Ø0.150[3.80]
 Bottom view pad 4:Ø0.130[3.30]
 Bottom view pad of mounting:Groove R0.065[1.65]L0.252[6.40]

Thermal Considerations

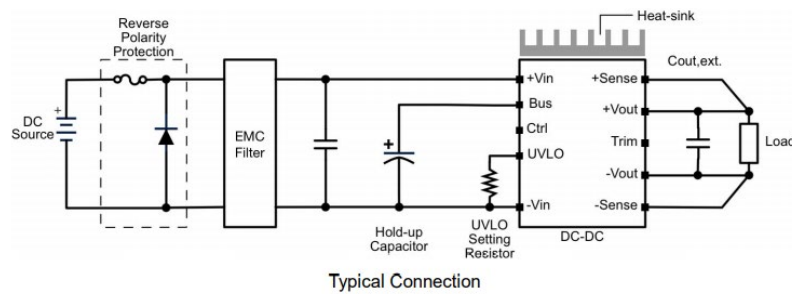
The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding Environment. Proper cooling can be verified by measuring the point as the figure below. The temperature at this location should not exceed "Maximum case temperature". When operating, adequate cooling must be provided to maintain the test point temperature at or below "Maximum case temperature". You can limit this Temperature to a lower value for extremely high reliability.

- Thermal test condition with vertical direction by natural convection (20LFM).
- The iron base-plate dimension is 19" X 3.5" X 0.063" (The height is EIA standard 2U).
- The heat-sink is optional and P/N: 7G-0029B-F, 7G-0030B-F, 7G-0031B-F, 7G-0032B-F, 7GA0124P01-F, 7GA0125P01-F



Heat-Sink Type Options
43QAE60-□□S□□U -HS
7G-0029B-F

43QAE60-□□S□□U -HS1
7G-0030B-F

43QAE60-□□S□□U -HS2
7G-0031B-F

43QAE60-□□S□□U -HS3
7G-0032B-F

43QAE60-□□S□□U -HS4
7GA0124P01-F

43QAE60-□□S□□U -HS5
7GA0125P01-F


1. All dimensions in inch [mm]
2. Tolerance :x.xx±0.02 [x.x±0.5]

Typical Application


Typical Connection

UVLO

This series product has ultra wide input range. It could cover many kind of nominal input voltage in one module. In order to preventing incorrect operating under different input system, it offers UVLO adjustment by connecting a resistor to set UVLO threshold.

UVLO Constants

Model	A	B	C
43QAE60-36S00U	48000	8273	0.96
43QAE60-72S00U	120000	12500	2.4

UVLO Equation

Start-up Voltage

$$V_{\text{start-up}} = 1.25 \times \left[\frac{A \times (R_{\text{UVLO}} + B)}{R_{\text{UVLO}} \times B} + 1 \right]$$

Shutdown Voltage

$$V_{\text{shutdown}} = V_{\text{start-up}} - C$$

UVLO values for various nominal input voltage and RUVLO table
43QAE60-36S00U

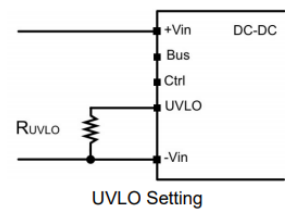
Nominal Vin	12V	24V	36V	48V
Start-up voltage	8.46V	13.36V	20.56V	27.76V
Shutdown voltage	7.5V	12.4V	19.6V	26.8V
UVLO Setting resistor	Open	12.35 KΩ	4.98 KΩ	3.12 KΩ

43QAE60-72S00U

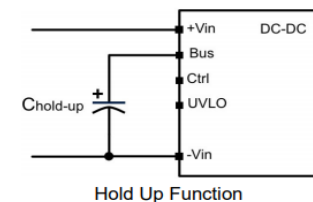
Nominal Vin	24V	36V	48V	72V	96V	110V
Start-up voltage	14.8V	22V	29.2V	43.6V	58V	66.4V
Shutdown voltage	12.4V	19.6V	26.8V	41.2V	55.6V	64V
UVLO Setting resistor	96.77 KΩ	17.14 KΩ	9.40 KΩ	4.94 KΩ	3.35 KΩ	2.82 KΩ

Hold Up Time

Generally, connecting a large number of hold up capacitors on input are necessary to get a long duration of hold up time for S2, C2 described in EN50155. The Bus pin features excellent function can simply connect capacitors to Bus pin with less quantity of capacitors. It helps reduce layout area and smooth the inrush current. For further information, please contact P-DUKE.



UVLO Setting



Hold Up Function

Output Voltage Adjustment

Output voltage is adjustable for 10% trim up or -20% trim down of nominal output voltage by connecting an external resistor between the Trim pin and either the +Sense or -Sense pins. With an external resistor between the Trim and -Sense pin, the output voltage set point decreases. With an external resistor between the Trim and +Sense pin, the output voltage set point increases. Maximum output deviation is +10% inclusive of remote sense. The external TRIM resistor needs to be at least 1/8W of rated power.

Trim Up Equation

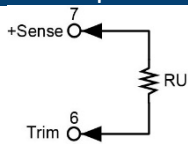
$$R_U = \left(\frac{5.11V_{OUT}(100 + \Delta\%)}{1.225\Delta\%} - \frac{511 + 10.22\Delta\%}{\Delta\%} \right) k\Omega$$

Trim Down Equation

$$R_D = \left(\frac{511}{\Delta\%} - 10.22 \right) k\Omega$$

EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed by using the method shown below.

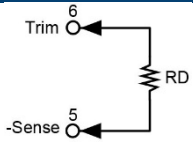
Trim Up


□□S05U										
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	5.05	5.10	5.15	5.20	5.25	5.30	5.35	5.40	5.45	5.50
RU (kΩ)	1585.35	797.994	535.542	404.316	325.58	273.09	235.596	207.476	185.605	168.109
□□S12U										
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	12.12	12.24	12.36	12.48	12.60	12.72	12.84	12.96	13.08	13.20
RU (kΩ)	4534.55	2287.19	1538.08	1163.52	938.78	788.956	681.939	601.676	539.25	489.309
□□S15U										
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	16.50
RU (kΩ)	5798.49	2925.42	1967.73	1488.89	1201.58	1010.04	873.229	770.619	690.812	626.966
□□S24U										
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	24.24	24.48	24.72	24.96	25.20	25.44	25.68	25.92	26.16	26.40
RU (kΩ)	9590.32	4840.11	3256.7	2465	1989.98	1673.3	1447.1	1277.45	1145.5	1039.94
□□S28U										
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	28.28	28.56	28.84	29.12	29.40	29.68	29.96	30.24	30.52	30.80
RU (kΩ)	11275.58	5691.08	3829.58	2898.83	2340.38	1968.08	1702.151	1502.705	1347.58	1223.48
□□S48U										
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	48.48	48.96	49.44	49.92	50.40	50.88	51.36	51.84	52.32	52.80
RU (kΩ)	19701.9	9945.94	6693.96	5067.97	4092.38	3441.99	2977.42	2628.99	2357.99	2141.19
□□S53U										
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	53.53	54.06	54.59	55.12	55.65	56.18	56.71	57.24	57.77	58.30
RU (kΩ)	21808.437	11009.651	7410.056	5610.259	4530.38	3810.461	3296.233	2910.562	2610.596	2370.623

Ideal Power Limited

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Trim Down


□□S□□U

ΔV (%)	1	2	3	4	5	6	7	8	9	10
RD (k Ω)	500.78	245.28	160.113	117.53	91.98	74.947	62.78	53.655	46.558	40.88
ΔV (%)	11	12	13	14	15	16	17	18	19	20
RD (k Ω)	36.235	32.363	29.088	26.28	23.847	21.718	19.839	18.169	16.675	15.33