



P-DUKE POWER

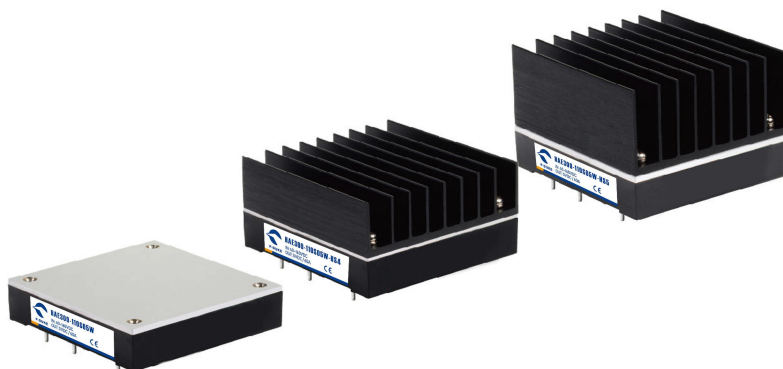
HAE300W Series

Half-Brick DC-DC Converter
Up to 300 Watts

3
YEARS
WARRANTY

ROHS
COMPLIANT

REACH
COMPLIANT



Railway



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Medical



PV



3000 VAC
Reinforced
Insulation

3000 VDC
Basic
Insulation

4 : 1
Wide
Input
Range

NO
Min. Load
Required

Operating
Altitude
5000
meter

REMOTE
ON
OFF

OCP

OTP

OVP

SCP

UVP

PART NUMBER STRUCTURE

DIP Type:

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range	Remote On/Off Options	Assembly Options	
HAE300-	48	S	05	W	-	P	HS4
	24:9~36 48:18~75 110:40~160	S:Single	05:5 12:12 15:15 24:24 28:28 48:48 54:54	4:1	□:Negative logic P:Positive logic	□: None Heat-sink type HS4: 7GA0127P01-F; H=0.65" HS5: 7GA0128P01-F; H=1" Through hole type TH: No thread *The module can't equip Heat-sink with TH option.	

TECHNICAL SPECIFICATION All specifications are typical at nominal input, full load and 25°C unless otherwise noted

Model Number	Input Range	Output Voltage	Output Current @Full Load	Input Current @No Load	Efficiency	Maximum Capacitor Load
	VDC	VDC	A	mA	%	μF
HAE300-24S05W	9 ~ 36	5	60	85	88.5	108000
HAE300-24S12W	9 ~ 36	12	25	85	91	19150
HAE300-24S15W	9 ~ 36	15	20	85	91	12000
HAE300-24S24W	9 ~ 36	24	12.5	85	89	4800
HAE300-24S28W	9 ~ 36	28	10.7	85	90	3450
HAE300-24S48W	9 ~ 36	48	6.2	85	89	1250
HAE300-24S54W	9 ~ 36	54	5.6	85	89	930
HAE300-48S05W	18 ~ 75	5	60	45	90	108000
HAE300-48S12W	18 ~ 75	12	25	45	92	19150
HAE300-48S15W	18 ~ 75	15	20	45	92	12000
HAE300-48S24W	18 ~ 75	24	12.5	45	92	4800
HAE300-48S28W	18 ~ 75	28	10.7	45	92.5	3450
HAE300-48S48W	18 ~ 75	48	6.2	45	90.5	1250
HAE300-48S54W	18 ~ 75	54	5.6	45	90.5	930
HAE300-110S05W	40 ~ 160	5	60	20	89	108000
HAE300-110S12W	40 ~ 160	12	25	20	91	19150
HAE300-110S15W	40 ~ 160	15	20	20	91	12000
HAE300-110S24W	40 ~ 160	24	12.5	20	90	4800
HAE300-110S28W	40 ~ 160	28	10.7	20	90	3450
HAE300-110S48W	40 ~ 160	48	6.2	20	91	1250
HAE300-110S54W	40 ~ 160	54	5.6	20	91	930

INPUT SPECIFICATIONS						
Parameter	Conditions			Min.	Typ.	Max. Unit
Operating input voltage range	24Vin(nom)			9	24	36
	48Vin(nom)			18	48	75
	110Vin(nom)			40	110	160
Start up voltage	24Vin(nom)					9
	48Vin(nom)					18
	110Vin(nom)					40
Shutdown voltage	24Vin(nom)			7.2	7.7	8.3
	48Vin(nom)			15.0	16.0	16.6
	110Vin(nom)			33.0	34.5	35.8
Start up time	Constant resistive load	Power up			75	100
		Remote ON/OFF			75	100
Input surge voltage	1 second, max.	24Vin(nom)				50
		48Vin(nom)				100
		110Vin(nom)				185
Input filter ⁽¹⁾				Pi type		
Remote ON/OFF	Referred to -Vin pin	Negative logic (Standard)	DC-DC ON	Short or 0 ~ 1.2VDC		
		Positive logic (Option)	DC-DC OFF	Open or 3 ~ 12 VDC		
			DC-DC ON	Open or 3 ~ 12 VDC		
			DC-DC OFF	Short or 0 ~ 1.2VDC		
		Input current of Ctrl pin		-0.5		+1.0 mA
		Remote off input current			3	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	-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 be connected to corresponding polarity OUTPUT pins.			10	%
Ripple and noise	Measured by 20MHz bandwidth With a 22μF/25V X7R MLCC and a 22μF/25V SP-CAP 5Vout With a 22μF/25V X7R MLCC and a 22μF/25V SP-CAP 12Vout, 15Vout With a 4.7μF/50V X7R MLCC 24Vout, 28Vout With a 2.2μF/100V X7R MLCC 48Vout, 54Vout		100 125 200 300		mVp-p
Temperature coefficient		-0.02		+0.02	%/°C
Transient response recovery time	25% load step change		200	250	μs
Over voltage protection	% of Vout(nom); Hiccup mode	115		140	%
Over load protection	% of Iout rated; Hiccup mode	120		150	%
Short circuit protection		Continuous, automatic recovery			

GENERAL SPECIFICATIONS

Parameter	Conditions	Min.	Typ.	Max.	Unit
Isolation voltage	1 minute (Reinforced insulation) 110Vin(nom) Input to Output	3000			VAC
	1 minute (Basic insulation) Others Input (Output) to Case	1500 3000 1600			VDC
Isolation resistance	500VDC	1			GΩ
Isolation capacitance				2500	pF
Switching frequency		200	245	290	kHz
Safety approvals(Pending)		IEC /EN/ UL62368-1			
Standard approvals(Pending)		EN50155 EN45545-2			
Case material	24Vin(nom) and 48Vin(nom) 110Vin(nom)	Metal Aluminum base-plate with plastic case			
Base material	24Vin(nom) and 48Vin(nom)	FR4 PCB			
Potting material		Silicone (UL94 V-0)			
Weight		107g (3.77oz)			
MTBF	MIL-HDBK-217F, Full load	5.198 x10 ⁵ hrs			

ENVIRONMENTAL SPECIFICATIONS

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating case temperature	Base-plate	-40		+105	°C
Maximum case temperature				105	°C
Over temperature protection			115		°C
Storage temperature range		-55		+125	°C
Operating altitude				5000	m
Thermal impedance	Module without assembly option Only mount on the iron base-plate Heat-sink type with 0.65" Height Heat-sink type with 1" Height		6.1 2.7 3.2 2.5		°C/W
Thermal shock		MIL-STD-810F			
Shock		EN61373, MIL-STD-810F			
Vibration		EN61373, MIL-STD-810F			
Relative humidity		5% to 95% RH			

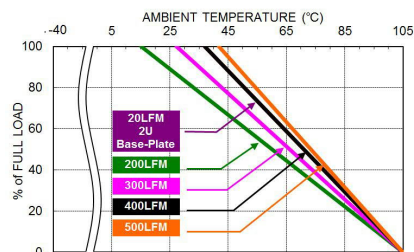
EMC SPECIFICATIONS		
Parameter	Conditions	Level
EMI	EN55032, EN50121-3-2 with external components *Connecting four screw bolts to shield plane will help to reduce the EMI.	Class A, Class B
EMS	EN55035, EN50121-3-2	
ESD	EN61000-4-2 Air $\pm 8\text{kV}$ and Contact $\pm 6\text{kV}$	Perf. Criteria A
Radiated immunity	EN61000-4-3 20V/m	Perf. Criteria A
Fast transient	EN61000-4-4 $\pm 2\text{kV}$ HAE300-24S□□W With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220 μF /100V) and a TVS(SMDJ58A, 58V, 3000Watt peak pulse power) in parallel. HAE300-48S□□W With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220 μF /100V) and a TVS(SMDJ120A, 120V, 3000Watt peak pulse power) in parallel. HAE300-110S□□W With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KXJ series, 220 μF /200V) and a TVS(SMDJ170A, 170V, 3000Watt peak pulse power) in parallel.	Perf. Criteria A
Surge	EN61000-4-5 $\pm 2\text{kV}$ HAE300-24S□□W With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220 μF /100V) and a TVS(SMDJ58A, 58V, 3000Watt peak pulse power) in parallel. HAE300-48S□□W With 2 pcs of aluminum electrolytic capacitor (Nippon Chemi-con KY series, 220 μF /100V) and a TVS(SMDJ120A, 120V, 3000Watt peak pulse power) in parallel. HAE300-110S□□W With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KXJ series, 220 μF /200V) and a TVS(SMDJ170A, 170V, 3000Watt peak pulse power) in parallel.	Perf. Criteria A
Conducted immunity	EN61000-4-6 10Vr.m.s	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8 100A/m continuous; 1000A/m 1 second	Perf. Criteria A

Note:

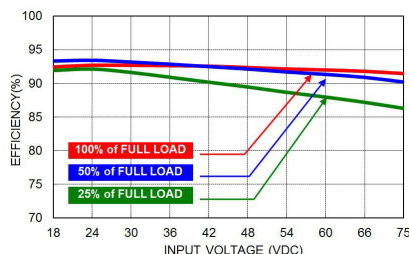
- Input source impedance: The power module will operate as specifications without external components, assuming that the source voltage has a very low impedance and reasonable input voltage regulation. Highly inductive source impedances can affect the stability of the power module. Since real-world voltage source has finite impedance, performance can be improved by adding external filter capacitor.
The HAE300-24S□□W and HAE300-48S□□W recommended Nippon Chemi-con KY series, 220 μF /100V.
The HAE300-110S□□W recommended Chemi-con KXJ series, 150 μF /200V.

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

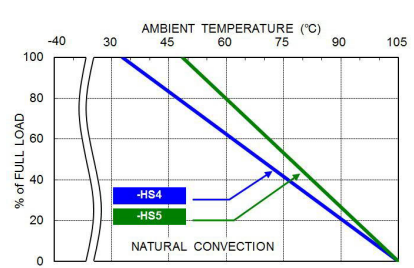
CHARACTERISTIC CURVE



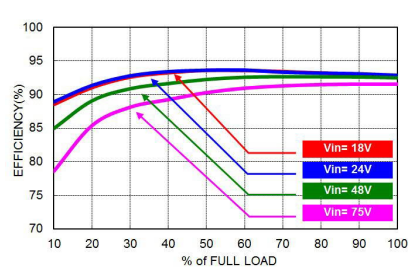
HAE300-48S28W Derating Curve
(See Thermal Considerations)



HAE300-48S28W Efficiency vs. Input Voltage



HAE300-48S28W Derating Curve with Heat-sink
(See Thermal Considerations)



HAE300-48S28W 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.

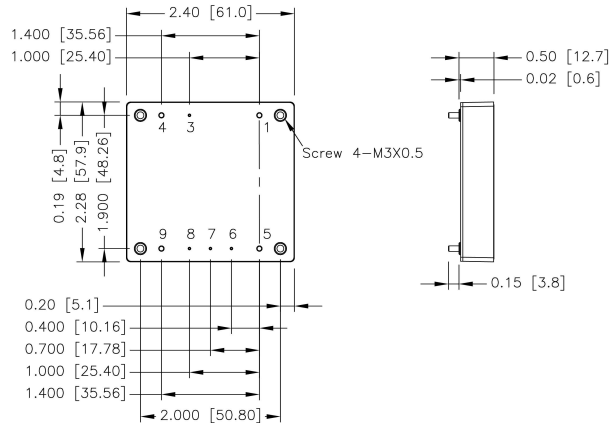
The input line fuse suggest as below :

Model	Fuse Rating (A)	Fuse Type
HAE300-24S□□W	50	Fast-Acting
HAE300-48S□□W	25	Fast-Acting
HAE300-110S□□W	12	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

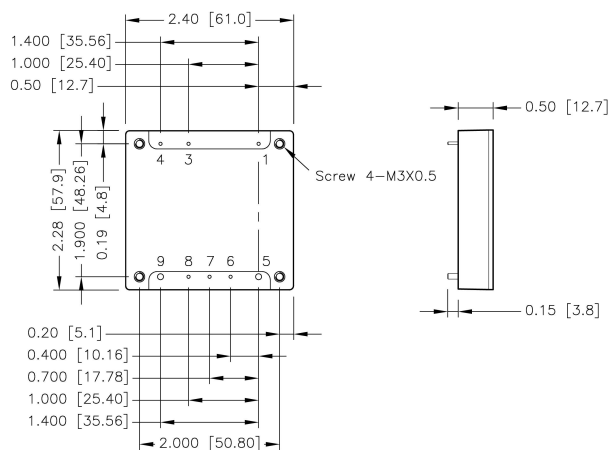
HAE300-24S□□W, HAE300-48S□□W



BOTTOM VIEW

■ The screw locked torque: MAX 3.5kgf-cm/0.34N-m

HAE300-110S□□W



BOTTOM VIEW

■ The screw locked torque: MAX 3.5kgf-cm/0.34N-m

PIN CONNECTION

PIN	DEFINE	DIAMETER
1	-Vin	0.08 Inch
3	Ctrl	0.04 Inch
4	+Vin	0.08 Inch
5	-Vout	0.08 Inch
6	-Sense	0.04 Inch
7	Trim	0.04 Inch
8	+Sense	0.04 Inch
9	+Vout	0.08 Inch

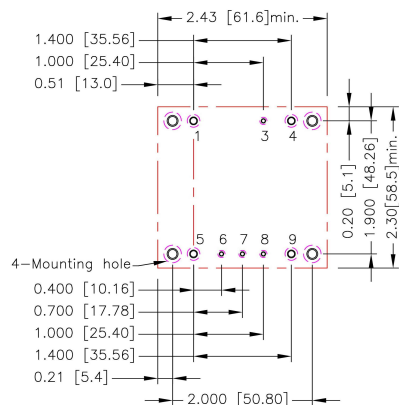
1. All dimensions in inch [mm]
2. Tolerance :x.xx±0.02 [x.x±0.5]
x.xxx±0.01 [x.xx±0.25]
3. Pin dimension tolerance ±0.004[0.10]

PIN	DEFINE	DIAMETER
1	-Vin	0.04 Inch
3	Ctrl	0.04 Inch
4	+Vin	0.04 Inch
5	-Vout	0.08 Inch
6	-Sense	0.04 Inch
7	Trim	0.04 Inch
8	+Sense	0.04 Inch
9	+Vout	0.08 Inch

1. All dimensions in inch [mm]
2. Tolerance :x.xx±0.02 [x.x±0.5]
x.xxx±0.01 [x.xx±0.25]
3. Pin dimension tolerance ±0.004[0.10]

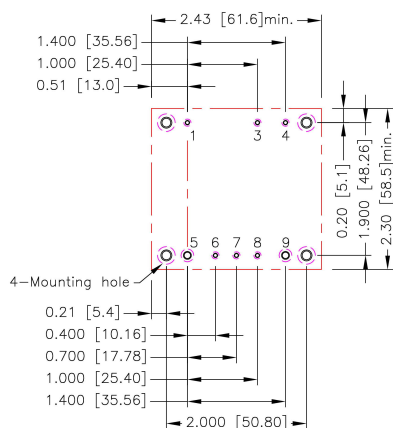
RECOMMENDED PAD LAYOUT

HAE300-24S□□W, HAE300-48S□□W



All dimensions in inch[mm]
 Pad size(lead free recommended)
 Through hole 3.6.7.8: $\Phi 0.051[1.30]$
 Through hole 1.4.5.9: $\Phi 0.091[2.30]$
 Through hole of mounting: $\Phi 0.126[3.20]$
 Top view pad 3.6.7.8: $\Phi 0.064[1.63]$
 Top view pad 1.4.5.9: $\Phi 0.113[2.88]$
 Top view pad of mounting: $\Phi 0.157[4.00]$
 Bottom view pad 3.6.7.8: $\Phi 0.102[2.60]$
 Bottom view pad 1.4.5.9: $\Phi 0.181[4.60]$
 Bottom view pad of mounting: $\Phi 0.252[6.40]$

HAE300-110S□□W



All dimensions in inch[mm]
 Pad size(lead free recommended)
 Through hole 1,3,4,6,7,8: $\Phi 0.051[1.30]$
 Through hole 5,9: $\Phi 0.091[2.30]$
 Through hole of mounting: $\Phi 0.126[3.20]$
 Top view pad 1,3,4,6,7,8: $\Phi 0.064[1.63]$
 Top view pad 5,9: $\Phi 0.113[2.88]$
 Top view pad of mounting: $\Phi 0.157[4.00]$
 Bottom view pad 1,3,4,6,7,8: $\Phi 0.102[2.60]$
 Bottom view pad 5,9: $\Phi 0.181[4.60]$
 Bottom view pad of mounting: $\Phi 0.252[6.40]$

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.

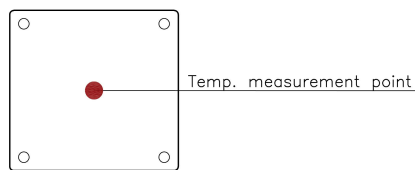
Proper cooling can be verified by measuring the point as the figure below.

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.

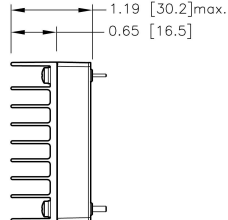
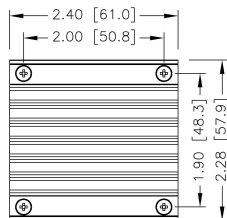
- Thermal test condition with vertical direction by natural convection (20LFM).
- The iron base-plate dimension is 19" X 3.5" X 0.063" (The height is EIA standard 2U).
- The heat-sink is optional and P/N: 7GA0127P01-F, 7GA0128P01-F.



BASE PLATE

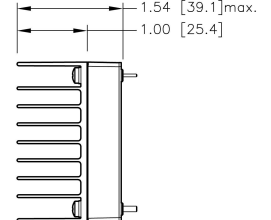
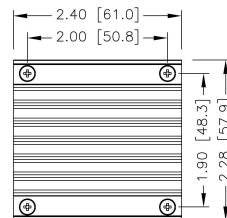
HEAT-SINK TYPE OPTIONS

HAE300-□□S□□W -**HS4**
7GA0127P01-F



SIDE VIEW

HAE300-□□S□□W -**HS5**
7GA0128P01-F



SIDE VIEW

1. All dimensions in inch [mm]
2. Tolerance :x.xx±0.02 [x.x±0.5]
x.xxx±0.01 [x.xx±0.25]

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 increases.

With an external resistor between the Trim and +Sense pin, the output voltage set point decreases.

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

$$R_U = \left[\frac{G \times 2.5}{(V_{o,up} - V_{o,nom})} - H \right] k\Omega$$

Trim Down Equation

$$R_D = \left[\frac{(V_{o,down} - 2.5) \times G}{(V_{o,nom} - V_{o,down})} - H \right] k\Omega$$

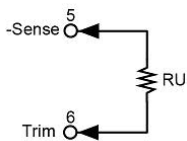
Trim Constants

Module	G	H
HAE300-□□S05W	5.1	2
HAE300-□□S12W	10	5.1
HAE300-□□S15W	10	5.1
HAE300-□□S24W	56	13
HAE300-□□S28W	56	13
HAE300-□□S48W	66	27
HAE300-□□S54W	66	27

EXTERNAL OUTPUT TRIMMING

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

Trim-up



□□S05W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	5.050	5.100	5.150	5.200	5.250	5.300	5.350	5.400	5.450	5.500
RU (kΩ)	253.00	125.50	83.00	61.75	49.00	40.50	34.43	29.88	26.33	23.50

□□S12W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	12.120	12.240	12.360	12.480	12.600	12.720	12.840	12.960	13.080	13.200
RU (kΩ)	203.23	99.07	64.34	46.98	36.57	29.62	24.66	20.94	18.05	15.73

□□S15W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	15.150	15.300	15.450	15.600	15.750	15.900	16.050	16.200	16.350	16.500
RU (kΩ)	161.57	78.23	50.46	36.57	28.23	22.68	18.71	15.73	13.42	11.57

□□S24W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	24.240	24.480	24.720	24.960	25.200	25.440	25.680	25.920	26.160	26.400
RU (kΩ)	570.33	278.67	181.44	132.83	103.67	84.22	70.33	59.92	51.81	45.33

□□S28W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	28.280	28.560	28.840	29.120	29.400	29.680	29.960	30.240	30.520	30.800
RU (kΩ)	487.00	237.00	153.67	112.00	87.00	70.33	58.43	49.50	42.56	37.00

□□S48W

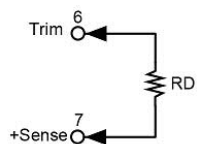
ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	48.480	48.960	49.440	49.920	50.400	50.880	51.360	51.840	52.320	52.800
RU (kΩ)	316.75	144.88	87.58	58.94	41.75	30.29	22.11	15.97	11.19	7.38

□□S54W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	54.540	55.080	55.620	56.160	56.700	57.240	57.780	58.320	58.860	59.400
RU (kΩ)	278.156	125.378	74.452	48.989	33.711	23.526	16.65	11.19	6.95	3.56

OUTPUT VOLTAGE ADJUSTMENT(CONTINUED)

Trim-down



□□S05W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	4.950	4.900	4.850	4.800	4.750	4.700	4.650	4.600	4.550	4.500
RD (k Ω)	247.90	120.40	77.90	56.65	43.90	35.40	29.33	24.78	21.23	18.40

ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	4.450	4.400	4.350	4.300	4.250	4.200	4.150	4.100	4.050	4.000
RD (k Ω)	16.08	14.15	12.52	11.11	9.90	8.84	7.90	7.07	6.32	5.65

□□S12W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	11.880	11.760	11.640	11.520	11.400	11.280	11.160	11.040	10.920	10.800
RD (k Ω)	776.57	380.73	248.79	182.82	143.23	116.84	98.00	83.86	72.86	64.07

ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	10.680	10.560	10.440	10.320	10.200	10.080	9.960	9.840	9.720	9.600
RD (k Ω)	56.87	50.87	45.80	41.45	37.68	34.38	31.47	28.88	26.57	24.48

□□S15W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	14.850	14.700	14.550	14.400	14.250	14.100	13.950	13.800	13.650	13.500
RD (k Ω)	818.23	401.57	262.68	193.23	151.57	123.79	103.95	89.07	77.47	68.23

ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	13.350	13.200	13.050	12.900	12.750	12.600	12.450	12.300	12.150	12.000
RD (k Ω)	60.66	54.34	49.00	44.42	40.46	36.98	33.92	31.20	28.76	26.57

□□S24W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	23.760	23.520	23.280	23.040	22.800	22.560	22.320	22.080	21.840	21.600
RD (k Ω)	4947.67	2439.33	1603.22	1185.17	934.33	767.11	647.67	558.08	488.41	432.67

ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	21.360	21.12	20.88	20.64	20.40	20.16	19.92	19.68	19.44	19.20
RD (k Ω)	378.06	349.06	316.90	289.33	265.44	244.54	226.10	209.70	195.04	181.83

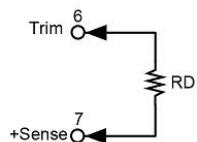
□□S28W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	27.720	27.440	27.160	26.880	26.600	26.320	26.040	25.760	25.480	25.200
RD (k Ω)	5031.00	2481.00	1631.00	1206.00	951.00	781.00	659.57	568.50	497.67	441.00

ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	24.920	24.640	24.360	24.080	23.800	23.520	23.240	22.960	22.680	22.400
RD (k Ω)	394.64	356.00	323.31	295.29	271.00	249.75	231.00	214.33	199.42	186.00

OUTPUT VOLTAGE ADJUSTMENT(CONTINUED)

Trim-down



□□S48W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	47.520	47.04	46.56	46.08	45.60	45.12	44.64	44.16	43.68	43.20
RD (k Ω)	6163.25	3035.13	1992.42	1471.06	1158.25	949.71	800.75	689.03	602.14	532.63
ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	42.720	42.240	41.760	41.280	40.800	40.320	39.840	39.360	38.880	38.400
RD (k Ω)	475.75	428.35	388.25	353.88	324.08	298.2	275.01	254.54	236.28	219.81

□□S54W

ΔV (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	53.460	52.920	52.380	51.840	51.300	50.760	50.220	49.680	49.140	48.600
RD (k Ω)	6201.44	3054.22	2005.15	1480.61	1165.89	956.07	806.21	693.81	606.38	536.44
ΔV (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	48.060	47.520	46.980	46.440	45.900	45.360	44.820	44.280	43.740	43.200
RD (k Ω)	479.22	431.54	391.19	356.60	326.63	300.40	277.26	256.69	238.29	221.72