SERIES SAR

High Voltage, Isolated, Adjustable Output Modules

100 to 1500 VDC at 3 W Output
Adjustable down to 0V Output
3 Standard Wide Input Voltages:
5SAR (5-10VDC)
12SAR (7.5-15VDC)
24SAR (18-36VDC)
Single Output with Center Tap
Low Profile DC-DC Converters
Thru Hole and Surface Mount

The SAR Series of Adjustable, Isolated, Single Output High Voltage ultra miniature DC-DC Converters are fully encapsulated for use in a harsh environment. The units in the SAR Series have high efficiency, excellent line/load regulation, and operate over a temperature range of -25°C to +70°C with no electrical de-rating or heat-sinking required.

FEATURES

- Ultra-Miniature Case
- 100 to 1500 VDC Output
- Adjustable Single Output with Center Tap
- Isolated 3W Output Power
- Line Regulated
- Minimal Load Change Effect
- High Efficiency to 82%
- Low Output Ripple
- 1500VDC Input/Output Isolation
- Input Over/Under Voltage Shutdown
- Internal Over Temperature Protection
- Wide Operating Temperature: -25°C to +70°C (Optional : -40°C to +85°C)
- Thru Hole and Surface Mount versions available
- Epoxy Encapsulated

DIMENSIONS:
Thru Hole: 1.10" x 0.80" x 0.425" Typical (WxDxH)
Surface Mount: 1.10" x 0.80" x 0.45" Typical (WxDxH)
Typcial Weight: 12 Grams (Typical)

OPTIONS AVAILABLE :

- Expanded Operating Temperature: -40°C to +85°C and other military options available Per Mil.Std. 883
- Stabilization Bake (at +125°C ambient) - Method 1008
- Thermal Cycle (between -55°C and +125°C) - Method 1010 Condition B
- High Temperature Burn-In - Method 1015
- Vibration, Shock, Humidity, and Altitude per Mil Std 202
- Contact factory to submit any additional requirements for review:

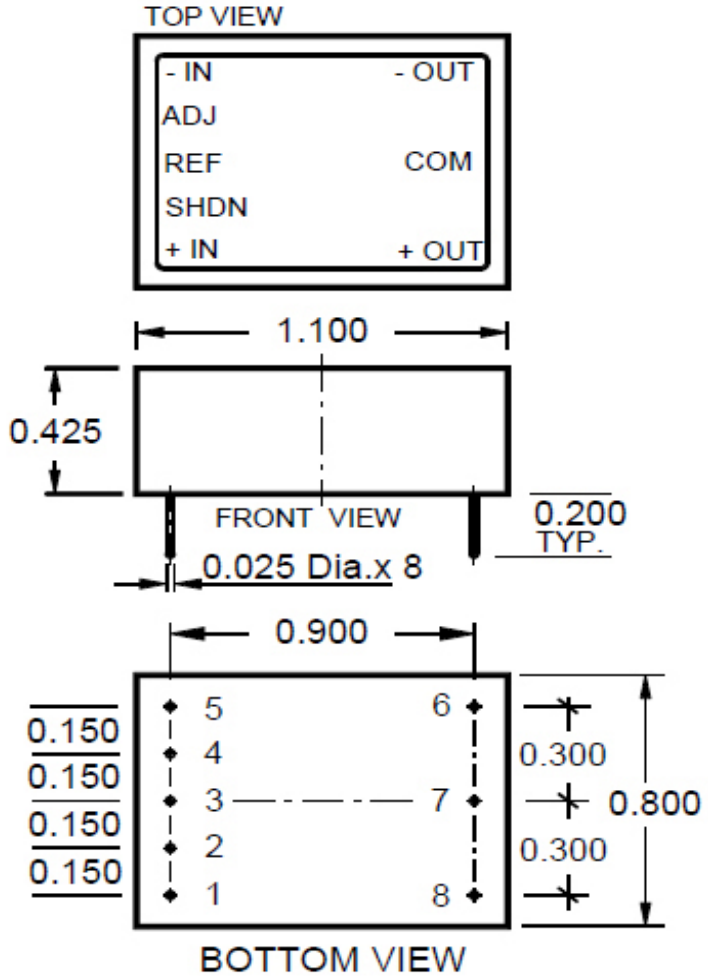
Phone: (800)431-1064
Email:info@picoelectronics.com

OTHER CHARACTERISTICS:
Input Voltage Nominal (Vin, Nom): 5VDC, 12VDC, 24VDC
Input Voltage Range: 5 to 10VDC, 7.5 to 15 VDC, 18 to 36 VDC
Output Voltage Nominal Tolerance: +/-3% VO, Max. at Full Load
Output Power: Max 3W over entire Vin Range
Output Ripple: Max 0.5% Vout Max
Line Regulation: Yes, Less than 0.5% Vout Max.
Load Regulation: 5% Vout Max from No Load to Full Load (Typical)
Converter Frequency: Fixed, Changes with Model from 125kHz to 450kHz
SHDN Pin Current/Voltage for Shutdown: Vshdn<0.4V; Ishdn>0.5mA (Sink Capability)
Over Temperature Shutdown: 105°C (Internal Temperature)
Output Temperature Coefficient: 0.02% Vout, Nom/°C
Input/Output Isolation: 1500VDC
Isolation Resistance: 100MOhm (Min.)
Operation Temperature: -25°C to +70°C
Storage Temperature: -55°C to +125°C
Optional Operating Temperature: -40°C to +85°C

APPLICATIONS

- Ultrasonic Transducers
- Avalanche Photodiodes
- Electron Beam Deflection
- Spectroscopy
- Photomultipler Tubes
- Capacitor Charging
- Electrostatic Lenses
- Piezo Devices

Thru Hole Models



All Dimensions are Typical

PIN #	FUNCTION
1	-IN
2	ADJ
3	REF
4	SHDN
5	+IN
6	+OUT
7	COM
8	-OUT

PIN DESCRIPTION

PIN #1(-IN) and PIN #5 (+IN): Input Voltage to the unit. Unit features a wide input range in the ration of 2:1. Input is Over Voltage and Under Voltage protected with non-latching Shutdown.

PIN #2 (ADJ): used for changing the Output Voltage in Resistor Programming or Voltage Programming mode. A resistor connected between Pin #2 (ADJ) and Pin #1 (-IN) will reduce Vout. A voltage applied across Pin #2 and Pin #1 between 0 and 3V will program Vout between 0 and Vout Max.

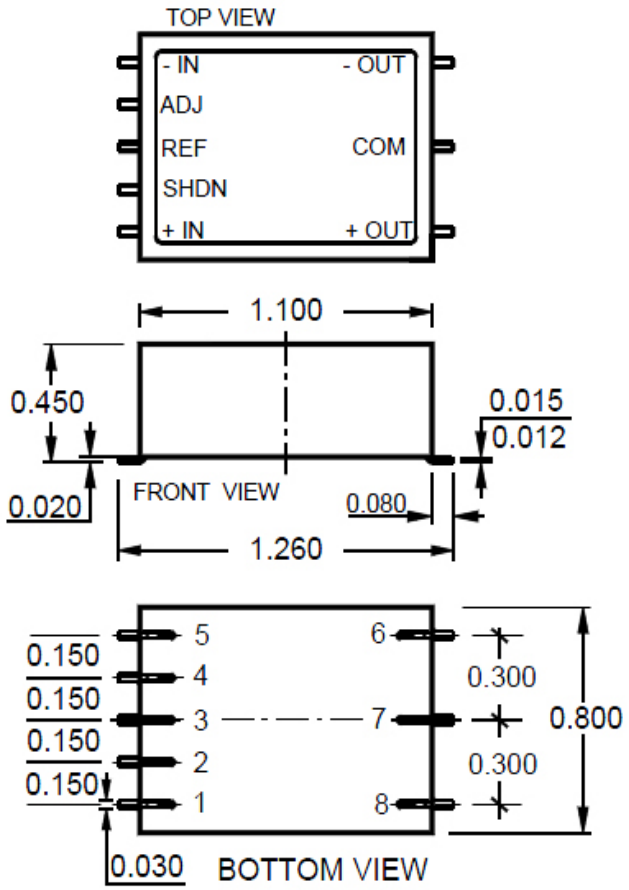
PIN #3 (REF): Onboard Reference, 3V +/- 5% sourcing 1mA Max. A voltage divider connected between Pin #3 (REF) and Pin #1 (-IN) could be used for Output Voltage Programming

PIN #4 (SHDN): Will shut down the output when pulled down to Pin #1 (-IN)

PIN #6 (+OUT) and Pin #8 (-OUT): Output Pins

PIN #7 (COM): Is a Center Tap between (+OUT) and (-OUT) and can be used as a common output pin for Dual Output Bipolar Operation.

Surface Mount Models



Notes: All dimensions are in inches.
Weight: 12 Grams Typical
All Dimensions are Typical

PIN #	FUNCTION
1	-IN
2	ADJ
3	REF
4	SHDN
5	+IN
6	+OUT
7	COM
8	-OUT

PIN DESCRIPTION

PIN #1(-IN) and PIN #5 (+IN): Input Voltage to the unit. Unit features a wide input range in the ration of 2:1. Input is Over Voltage and Under Voltage protected with non-latching Shutdown.

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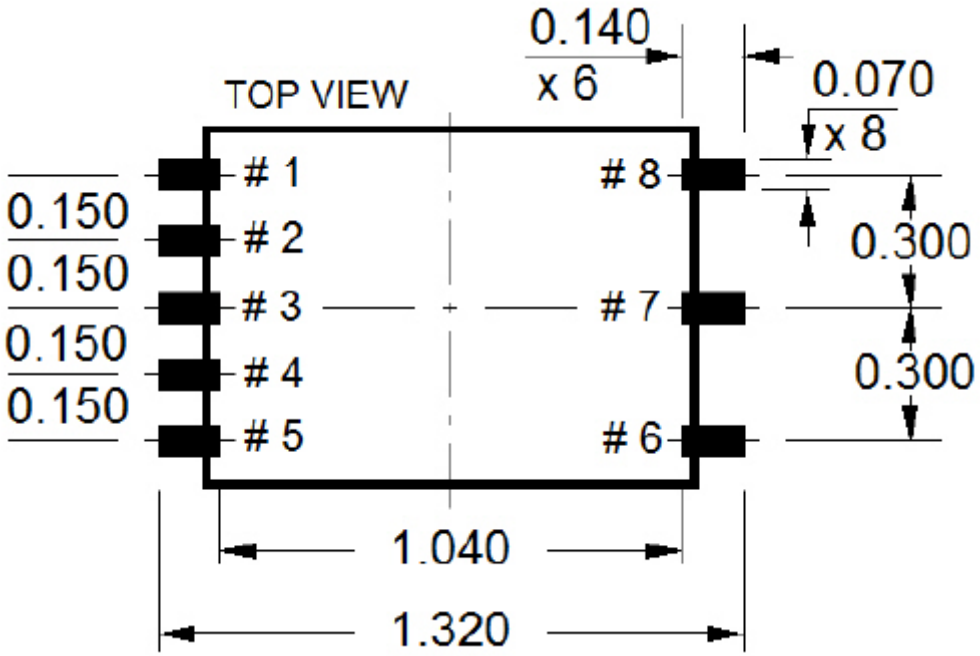
PIN #6 (+OUT) and Pin #8 (-OUT): Output Pins

PIN #7 (COM): Is a Center Tap between (+OUT) and (-OUT) and can be used as a common output pin for Dual Output Bipolar Operation.

LAND PATTERN

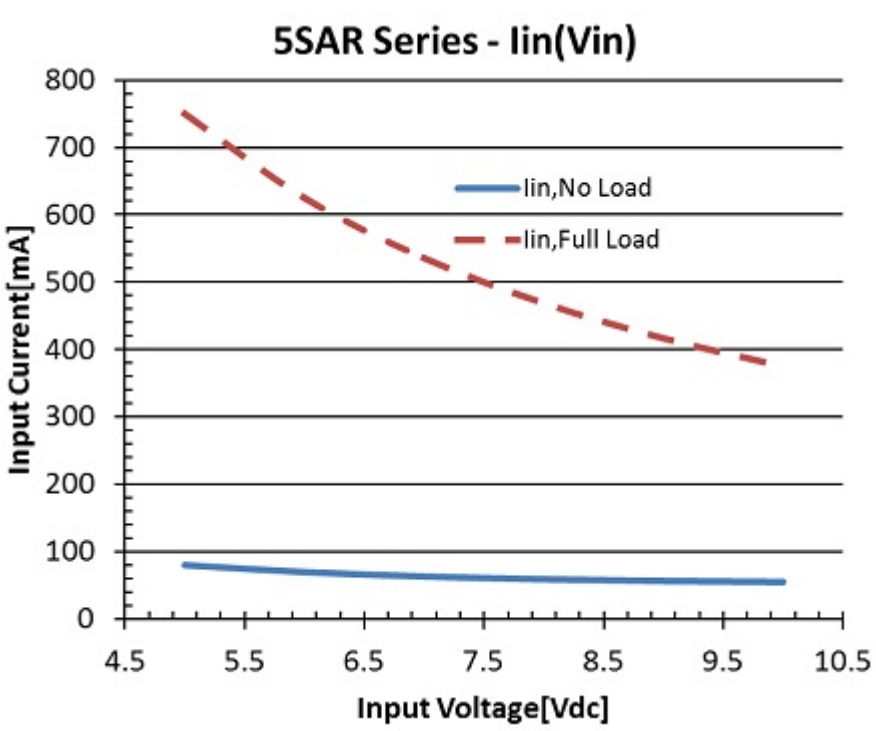


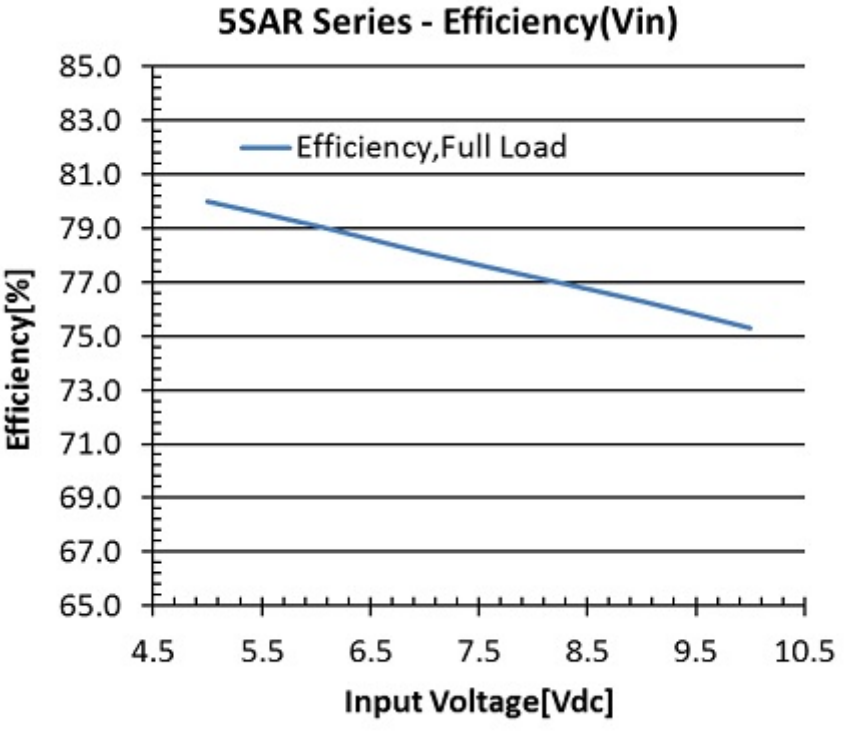
All Dimensions are Typical and in Inches

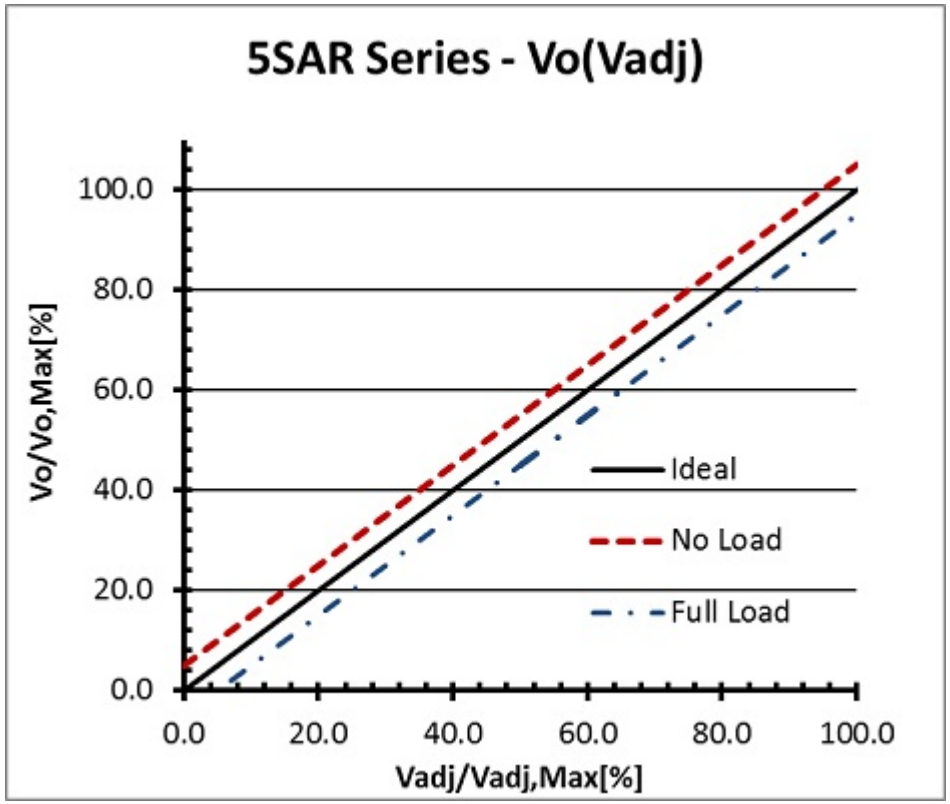
SERIES 5SAR (25°C ambient, Vi, nom and Pout, Max.)																
PICO PART #		INPUT VOLTAGE			OUTPUT VOLTAGE			INPUT CURRENT		MAX. OUTPUT CURRENT (mA)	* MAX. OUTPUT POWER (W)	LINE REG. (%)	** LOAD REG. (%)	EFF. (%)	*** OUTPUT RIPPLE (%)	PRICE (US $)
Thru Hole	Surface Mount	VI Nom (VDC)	RANGE (VDC)		RANGE (VDC)		SETUP TOL (±%)	NO LOAD (mA)	FULL LOAD (mA)							
			MIN	MAX	MIN	MAX										
5SAR100	5SAR100SM	7.5	5	10	0	100	3	45	510	30	3	0.1	8	78	0.2	171.55
5SAR250	5SAR250SM	7.5	5	10	0	250	3	56	512	12	3	0.1	5	78	0.15	197.96
5SAR500	5SAR500SM	7.5	5	10	0	500	3	76	517	6	3	0.1	4	77	0.15	211.94
5SAR1000	5SAR1000SM	7.5	5	10	0	1000	3	76	530	3	3	0.1	5	75	0.2	247.44
5SAR1500	5SAR1500SM	7.5	5	10	0	1500	3	71	546	2	3	0.1	5	74	0.3	289.07

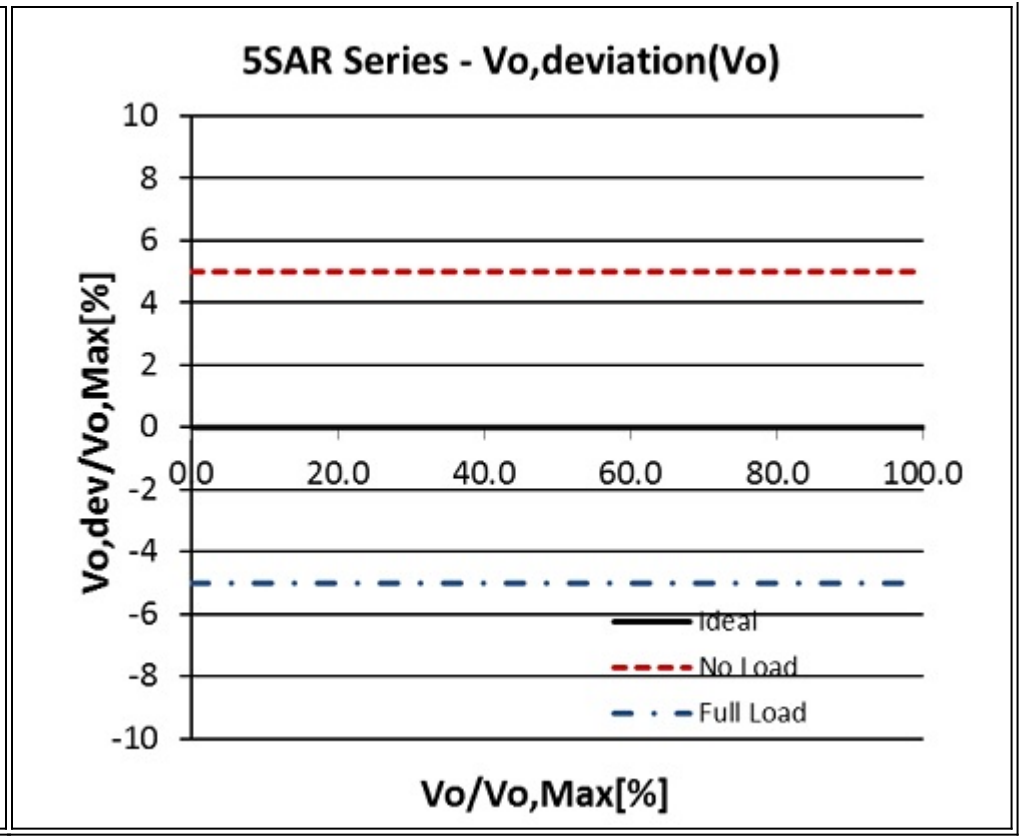
NOTES:
* See Max Power De-rating Diagram
** Load Regulation measured between No Load and Full Load
*** Output Ripple measured with 1MHz Bandwidth

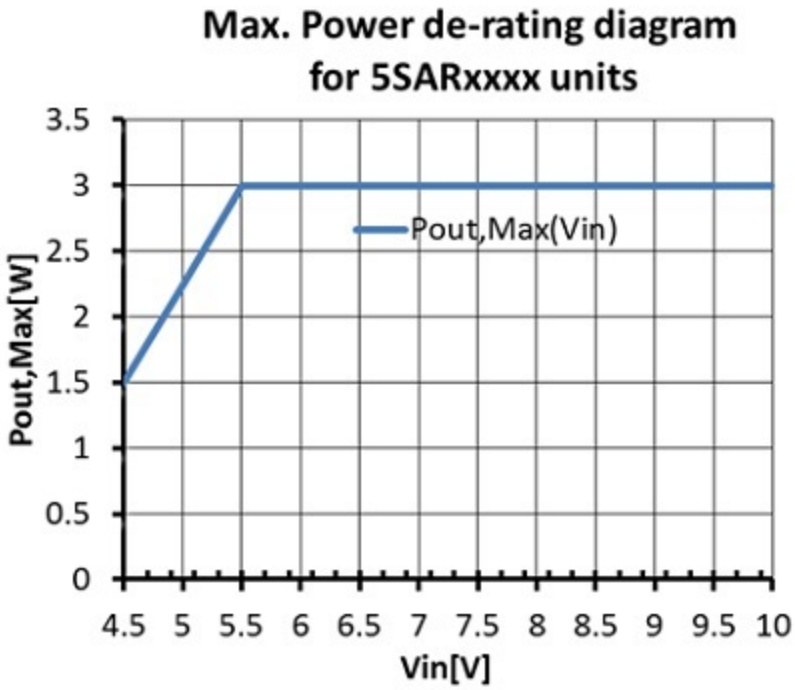
5SAR SERIES DIAGRAMS






5SAR Series - Vo(Vadj)
Vo/Vo,Max[%]
100.0
80.0
60.0
40.0
20.0
0.0
0.0
20.0
40.0
60.0
80.0
100.0
Vadj/Vadj,Max[%]
Ideal
No Load
Full Load


5SAR Series - Vo,deviation(Vo)
Vo,dev/Vo,Max[%]
10
8
6
4
2
0
-2
-4
-6
-8
-10
0.0
20.0
40.0
60.0
80.0
100.0
Vo/Vo,Max[%]
Ideal
No Load
Full Load

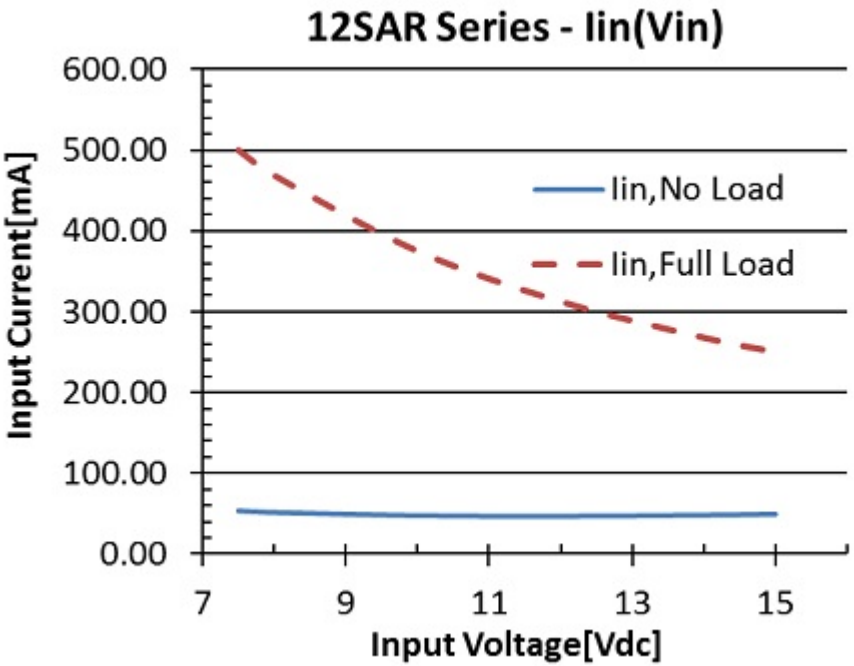


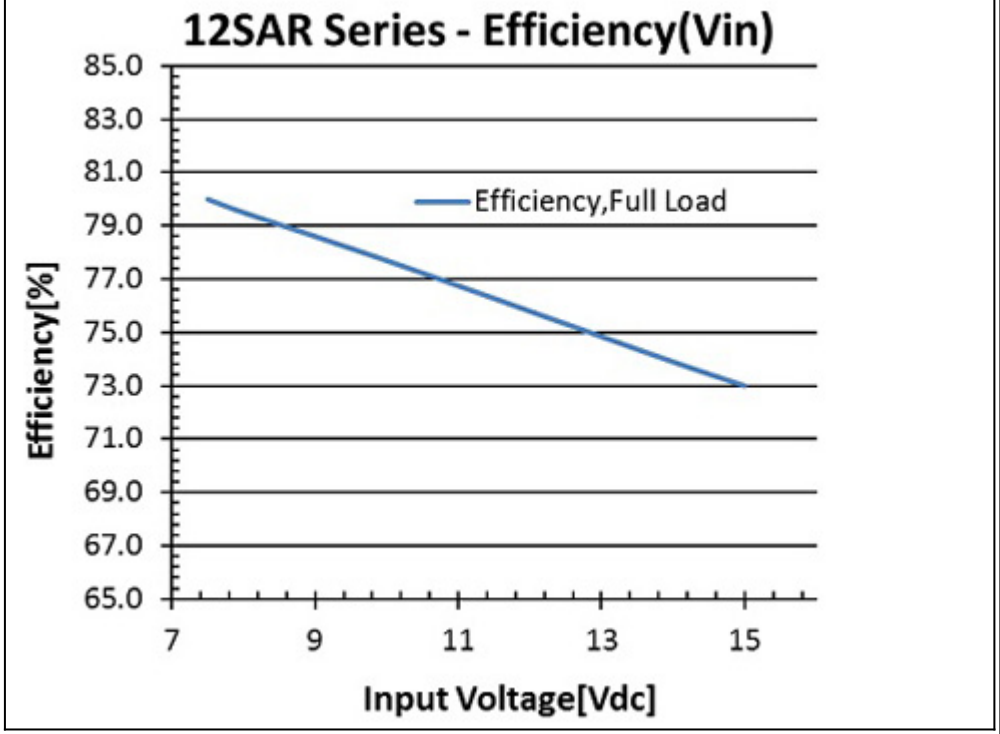
SERIES 12SAR (25°C ambient, Vi, nom and Pout, Max.)																
PICO PART #		INPUT VOLTAGE			OUTPUT VOLTAGE			INPUT CURRENT		MAX. OUT CUR (mA)	MAX. OUT POW (W)	LINE REG. (%)	* LOAD REG. (%)	EFF. (%)	** OUTPUT RIPPLE (%)	PRICE (US $)
Thru Hole	Surface Mount	VI Nom (VDC)	RANGE (VDC)		RANGE (VDC)		SETUP TOL (±%)	NO LOAD (mA)	FULL LOAD (mA)							
			MIN	MAX	MIN	MAX										
12SAR100	12SAR100SM	12	7.5	15	0	100	3	55	310	30	3	0.1	5	80	0.2	171.55
12SAR250	12SAR250SM	12	7.5	15	0	250	3	56	309	12	3	0.1	3	81	0.15	197.96
12SAR500	12SAR500SM	12	7.5	15	0	500	3	44	315	6	3	0.1	4	79	0.4	211.94
12SAR1000	12SAR1000SM	12	7.5	15	0	1000	3	50	320	3	3	0.1	4	79	0.25	247.44

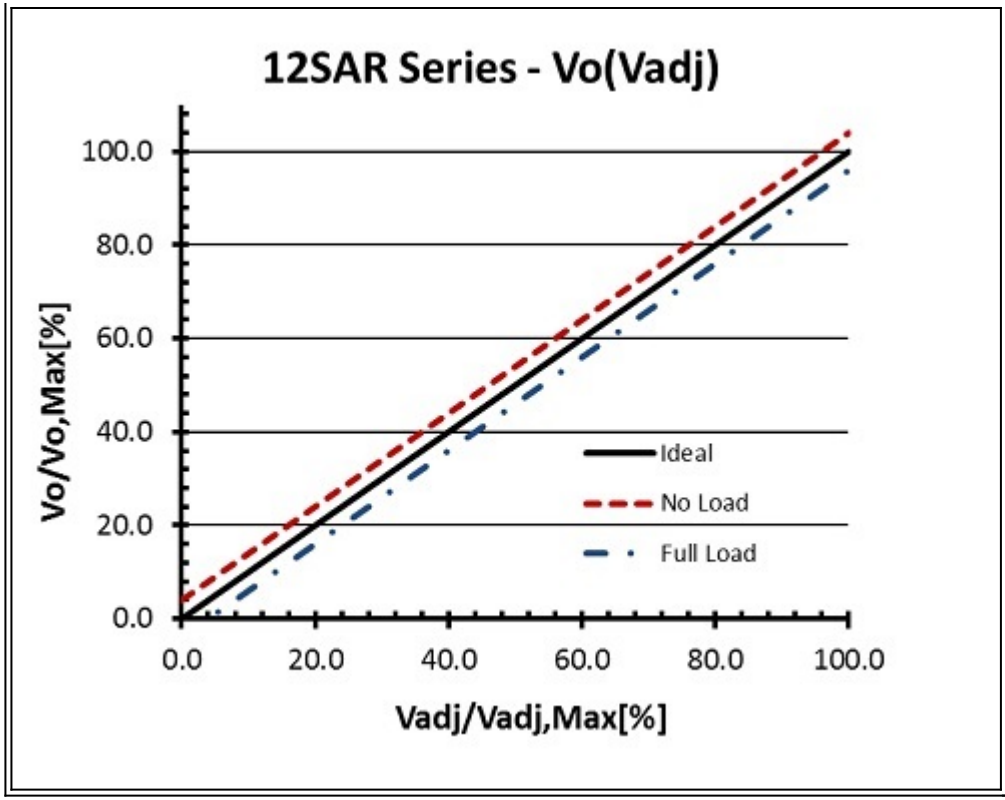
12SAR1500	12SAR1500SM	12	7.5	15	0	1500	3	51	318	2	3	0.1	4	78	0.3	289.07

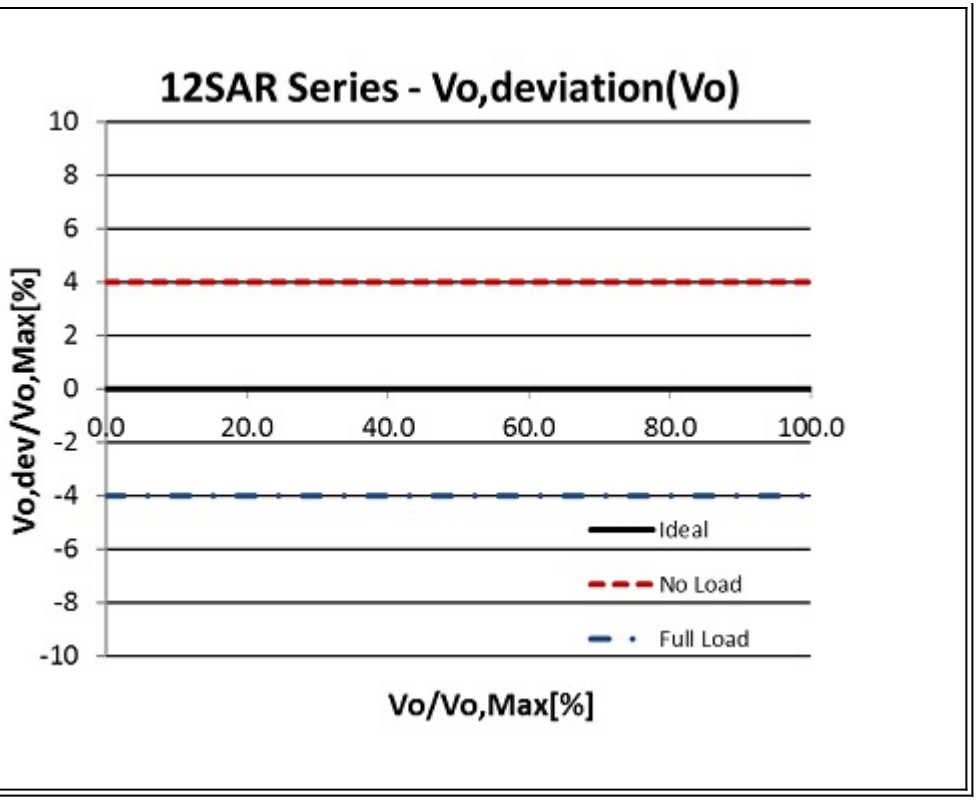
NOTES:
* Load Regulation measured between No Load and Full Load
** Output Ripple measured with 1MHz Bandwidth

12SAR DIAGRAMS







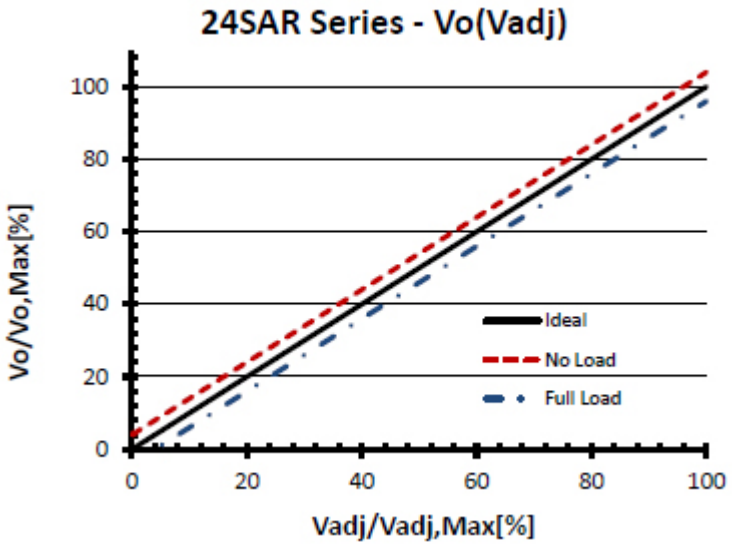


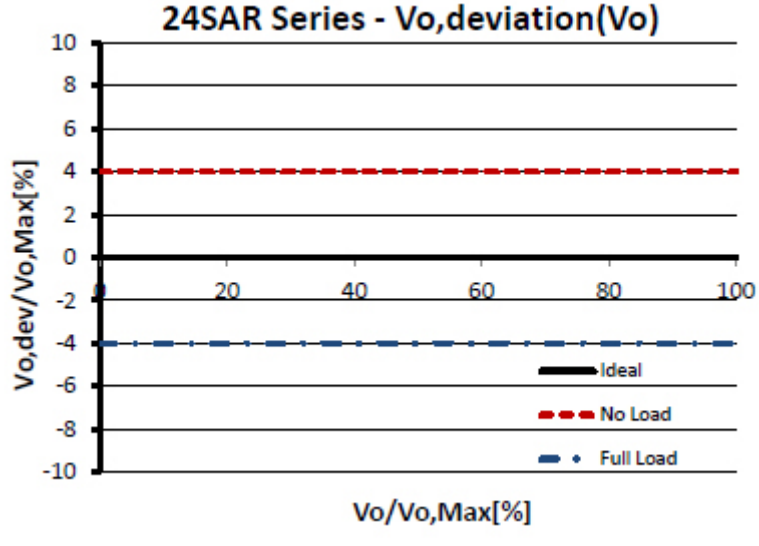
SERIES 24SAR (25°C ambient, Vi, nom and Pout, Max.)																
PICO PART #		INPUT VOLTAGE			OUTPUT VOLTAGE			INPUT CURRENT		MAX. OUT CUR (mA)	MAX. OUT POW (W)	LINE REG. (%)	* LOAD REG. (%)	EFF. (%)	** OUTPUT RIPPLE (%)	PRICE (US $)
Thru Hole	Surface Mount	VI Nom (VDC)	RANGE (VDC)		RANGE (VDC)		SETUP TOL (±%)	NO LOAD (mA)	FULL LOAD (mA)							
			MIN	MAX	MIN	MAX										
24SAR100	24SAR100SM	24	18	36	0	100	3	35	168	30	3	0.5	5	75	0.35	171.56
24SAR250	24SAR250SM	24	18	36	0	250	3	32	165	12	3	0.5	3	75	0.3	197.96
24SAR500	24SAR500SM	24	18	36	0	500	3	29	165	6	3	0.5	4	77	0.2	211.94
24SAR1000	24SAR1000SM	24	18	36	0	1000	3	30	167	3	3	0.5	4	76	0.2	247.44

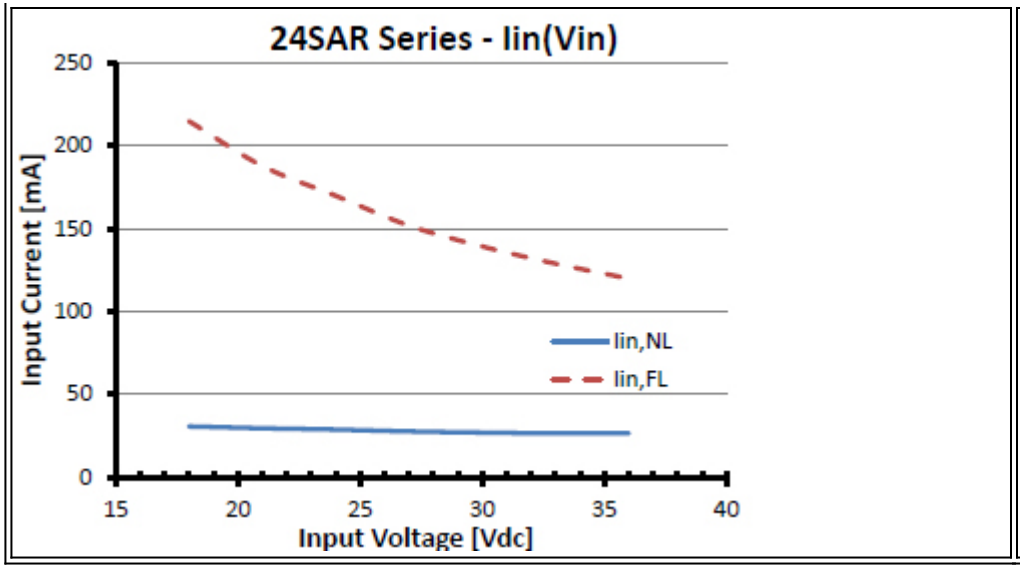
24SAR1500	24SAR1500SM	24	18	36	0	1500	3	39	170	2	3	0.5	4	73	0.2	289.07

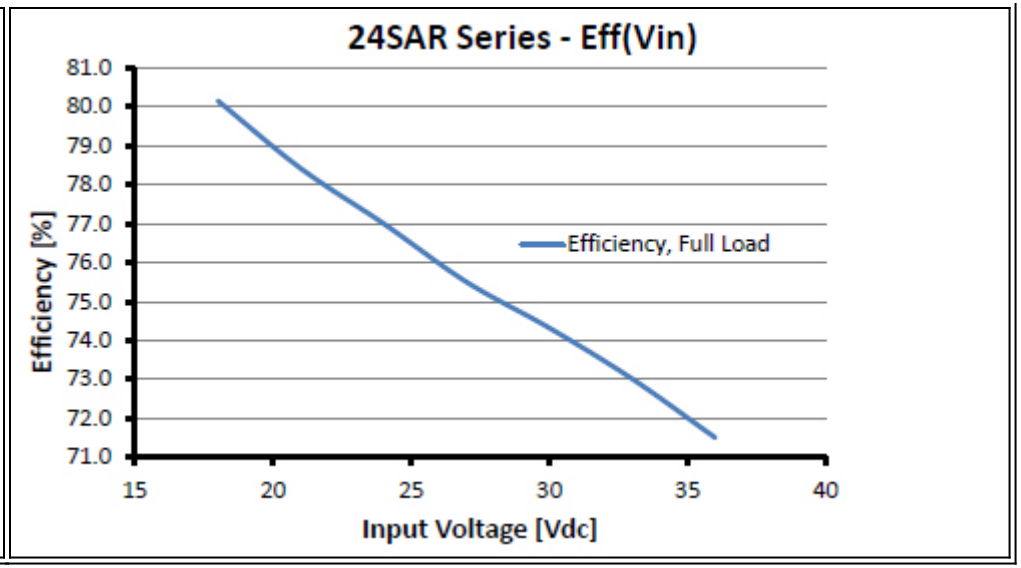
NOTES:
* Load Regulation measured between No Load and Full Load
** Output Ripple measured with 1MHz Bandwidth

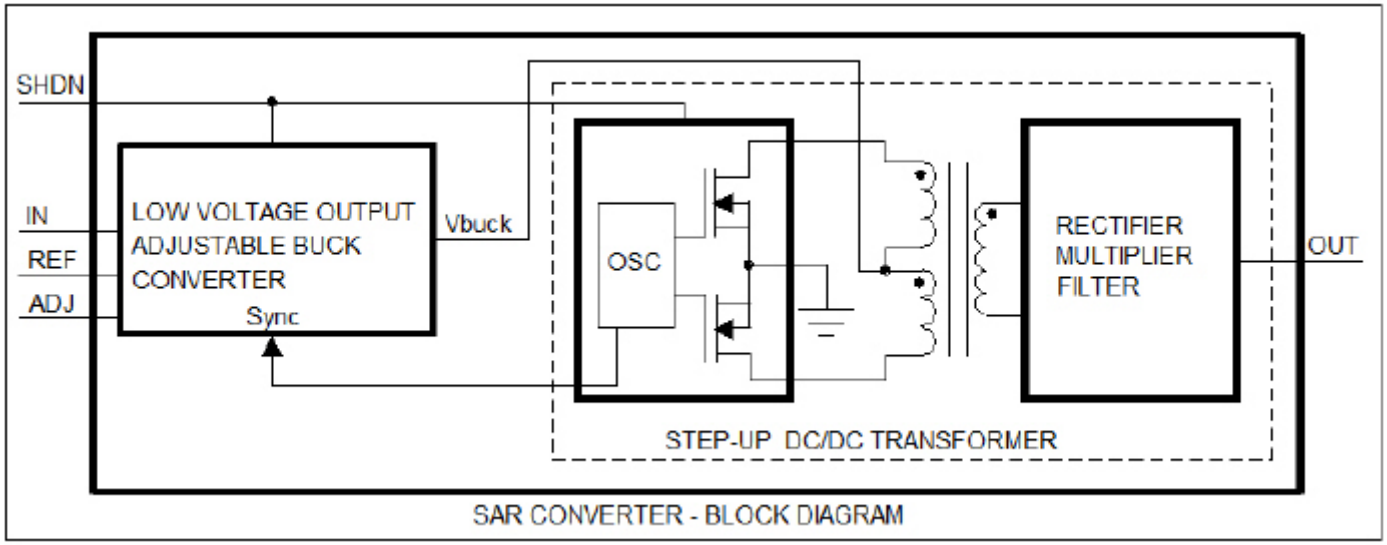
24SAR DIAGRAMS






24SAR Series - Iin(Vin)
Input Current [mA]
250
200
150
100
50
0
15
20
25
30
35
40
Input Voltage [Vdc]
Iin,NL
Iin,FL


24SAR Series - Eff(Vin)
Efficiency [%]
81.0
80.0
79.0
78.0
77.0
76.0
75.0
74.0
73.0
72.0
71.0
15
20
25
30
35
40
Input Voltage [Vdc]
Efficiency, Full Load

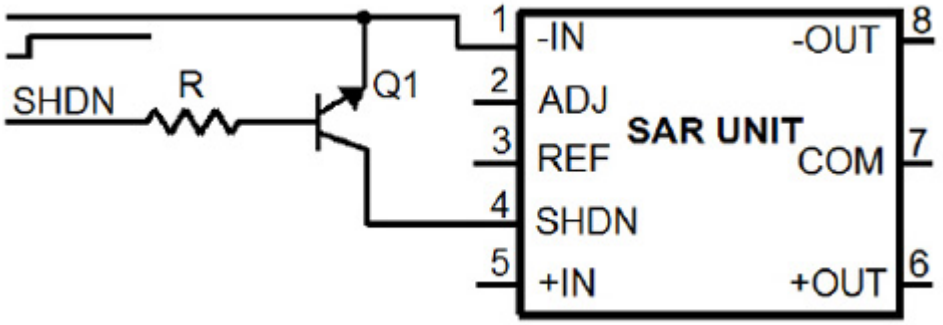

SHDN
IN
REF
ADJ
LOW VOLTAGE OUTPUT
ADJUSTABLE BUCK
CONVERTER
Sync
Vbuck
OSC
RECTIFIER
MULTIPLIER
FILTER
OUT
STEP-UP DC/DC TRANSFORMER
SAR CONVERTER - BLOCK DIAGRAM

The SAR Series of DC-DC High Voltage Converters is based on a two stage design. The first stage is a low voltage Buck Converter that produces a regulated and adjustable voltage (Vbuck) to be stepped-up by the second stage; a fixed step-up ratio DC-DC transformer. The DC-DC transformers consists of a Push-Pull oscillator, synchronized at half the buck frequency, a step-up transformer, followed by a rectifier/multiplier and a filter circuit. It has no active regulation circuit. However, due to a resonant design, it exhibits a very low load effect.
A high impedance programming input (Vadj) controls the Buck Conerter output and allows for 0V to maximum voltage adjustment. The Buck Converter features excellent line regulation an any Vadj level and over the entire input range.
Overal, the SAR Series will provide 0V to Max. HV adjustability with tight input regulation across the input range and a minimal load effect.
The following are designed in functions that increase module versatility:

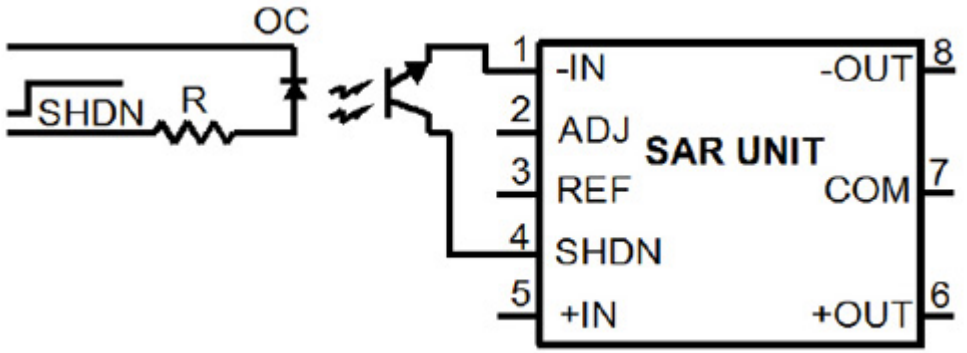
- SHDN Input, pulled down will turn off the unit
- REF Output, 3V +/-5% on board reference voltage simplifies programming
- Thermal Shutdown
- Input Over/Under Voltage Shutdown
- Over Programming protection

INPUT UNDER/OVER VOLTAGE SHUTDOWN			
Unit	**5SAR Series**	**12SAR Series**	**24SAR Series**
UV SHDN (V)	4	7	16
OV SHDN (V)	10.5	16	38

REMOTE SHUTDOWN: The converter is turned off when Pin #4 (SHDN) is clamped to Pin #1 (-IN) within less than 0.4V.

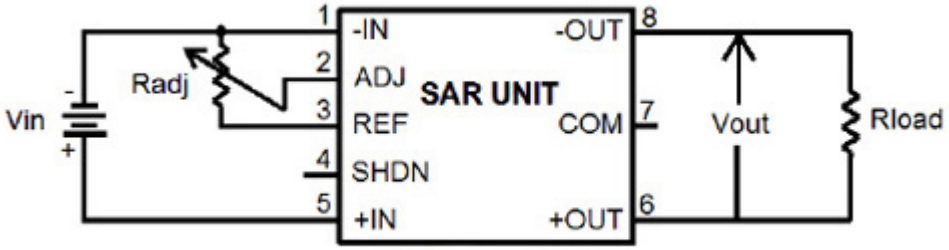


NON-ISOLATED SHUTDOWN

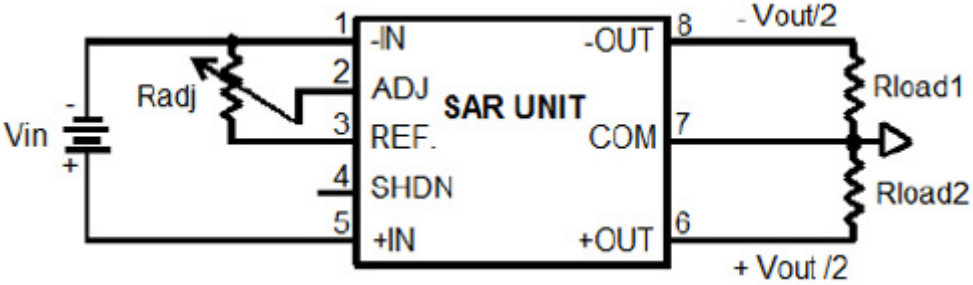


ISOLATED SHUTDOWN

SINGLE/DUAL OUTPUT OPERATION: The converter can be operated as a single output source of nominal Vout with a load connected between (-Out) and (+Out) or as a dual bipolar source with loads connected between (-Out) and (Com) AND (+Out) and (Com) respectively with each load being powered at Vout/2.



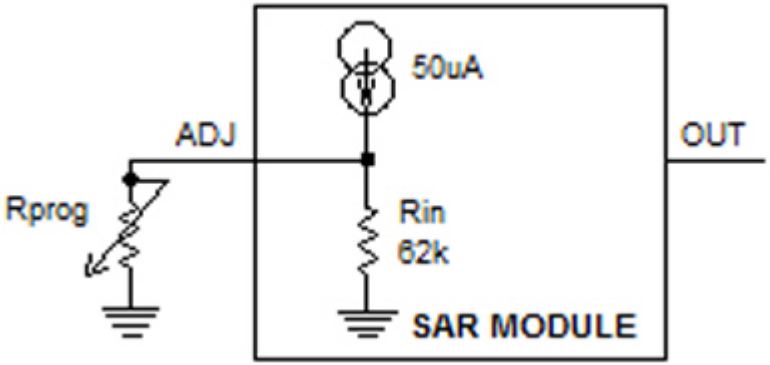
SINGLE OUTPUT



DUAL OUTPUT - BIPOLAR

OUTPUT PROGRAMMING: At power-up and with ADJ pin not connected, the SAR Output will be at maximum voltage.

RESISTOR PROGRAMMING:



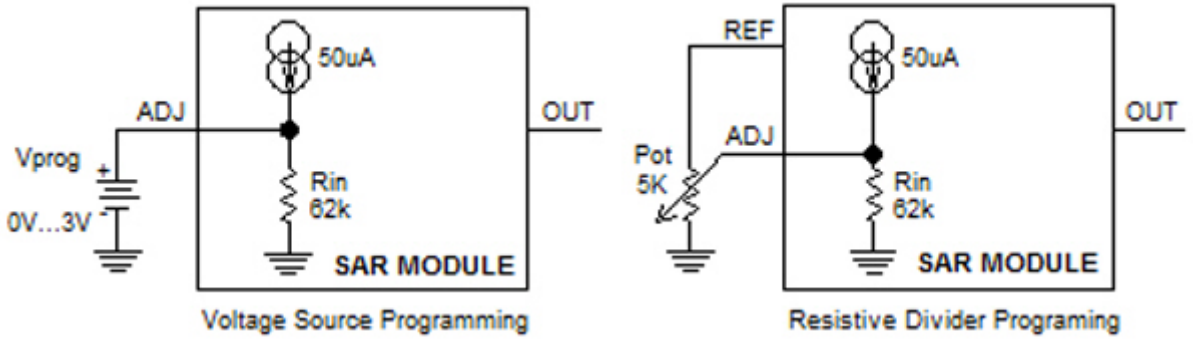
A resistor connected from ADJ pin to ground will decrease the output voltage. The following formula shows, with reasonable accuracy, the relation between Vout and Rprog, where Rprog is in kohm:

$$\frac{Vout}{Vout,Max.} = \frac{1.61}{\left[\frac{1}{Rprog} + \frac{1}{62}\right]} [\%]$$

For instance, to adjust to 25% Vout,Max., Rprog is 21kohm, for 50% is 62kohm, and for 75% it is 187kohm.

NOTE: Resistor Programming in not available for 24SAR Modules

VOLTAGE PROGRAMMING:



A voltage source to ADJ pin will program the output voltage linearly. 0V ADJ corresponds to 0V OUT and 3V ADJ corresponds to Vout,Max. The following formula applies:

$$\frac{\text{Vout}}{\text{Vout,Max.}} = \frac{100 \times \text{Vprog}}{3} \ [\%]$$

Vprog [V] is the voltage applied to ADJ pin.
The REF output is useful for programming purposes. A resistor divider or potentiometer could make the circuit for voltage adjustment. In order to keep programming error low, it is recommended for the overall resistance of the divider to not exceed 5kohm.

For immediate engineering assistance or to place an order:
Call Toll Free: 800-431-1064

PICO Electronics, Inc.

143 Sparks Ave. Pelham, NY 10803
Tel: 914-738-1400 or Fax: 914-738-8225

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