AHF28XX SERIES

28V Input, Single and Dual Output

HYBRID-HIGH RELIABILITY DC-DC CONVERTER

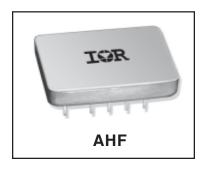
Description

The AHF Series of DC-DC converters feature single or dual outputs over the full military temperature range. No derating in output power is required, making them suitable for use in rugged military applications. The low profile, small outline package is ideally suited to the tight board space requirements of many industrial and aerospace applications. Designed for nominal 28Vdc inputs, this family of converters will meet the requirements of MIL-STD-704D. The basic circuit utilizes a pulse width modulated, feed-forward topology at a nominal switching frequency of 550KHz. Input to output isolation is achieved through the use of transformers in the forward and feedback circuits.

The proprietary magnetic feedback circuit provides for an extremely wide bandwidth control loop with a high phase margin. The closed loop frequency response of this converter family extends to approximately 50KHz, resulting in superior line and load transient characteristics. This feedback method is also inherently temperature and radiation insensitive. This gives the AHF Series an important advantage over converters that incorporate opto-couplers in their design.

Manufactured in a facility fully qualified to MIL-PRF-38534, these converters are fabricated utilizing DSCC qualified processes. For available screening options, refer to device screening table in the data sheet. Variations are electrical, mechanical and screening can be accommodated.

Extensive computer simulation using complex modeling enables rapid design modification to be provided. Contact IR San Jose with specific requirements.



Features

- 16V to 40VDC Input Range (28 VDC Nominal)
- Single and Dual Outputs
- 12W Output Power
- 22.8W/in3 Power Density
- Low Input / Output Noise (50mA/60mVp-p max. respectively)
- Indefinite Short Circuit and Overload Protection
- Wideband Control Loop for Superior Transient Characteristics
- No derating for -55°C to +125°C Operation
- Constant Switching Frequency (550KHz Nominal)
- Standard Microcircuit Drawings Available

Specifications AHF2803R3S

Absolute Maximum Ratings				
Input voltage	-0.5V to +50V			
Soldering temperature	300°C for 10 seconds			
Operating case temperature	-55°C to +125°C			
Storage case temperature	-65°C to +135°C			

Table I. Electrical Performance Characteristics

Test	Symbol	Conditions	Group A	Device	Lin	Limits	
		-55°C ≤ Tc ≤ +125°C	Subgroups	Types			
		$Vin = 28Vdc \pm 5\%, C_L = 0$					
		Unless otherwise specified			Min	Max	
Output valtage	Vout	I _{OUT} = 0	1	01	3.26	3.34	V
Output voltage	VOUT	IOUT = 0	2,3	01	3.23	3.36	v
Output current ¹	I _{OUT}	V _{IN} = 16, 28, and 40Vdc	1,2,3	01		3000	mA
2	V	V _{IN} = 16, 28, and 40Vdc,	1.0.0	01		60	m\/ n n
Output ripple voltage ²	V_{RIP}	B.W. = 20 Hz to 2MHz	1,2,3	01		60	mV p-p
		V _{IN} = 16, 28, and 40Vdc,					
Line regulation	VR _{LINE}	lout = 0%, 50% and 100%	1,2,3	01		25	mV
		rated load					
		V _{IN} = 16, 28, and 40Vdc,					
Load regulation	VR_{LOAD}	I _{OUT} = 0%, 50% and 100%	1,2,3	01		50	mV
		rated load					
		I _{OUT} = 0, inhibit (pin 1)				12	
	I _{IN}	tied to input return (pin 7)	1,2,3	01		12	mA
Input current		I _{OUT} = 0,	1,2,3	01	30	20	
		inhibit (pin 1) = open				30	
land discolation at 2	1	I _{OUT} = 100% rated load	1,2,3	01		50	mA p-p
Input ripple current ²	I _{RIP}	B.W. = 20 Hz to 2.0MHz	1,2,3	01		30	IIIA þ-þ
Efficiency	E _{FF}	I _{OUT} = 100% rated load	1	01	72		%
Liliciency	∟ FF	1007 = 10078 rated load	2,3	O1	70		/0
		Input to output or any pin					
Isolation	ISO	to case (except pin 6)	1	01	100		$M\Omega$
		at 500Vdc, Tc = +25°C					
Capacitive load ^{3, 4}	C _L	No effect on dc performance,	4	01		500	μF
Capacilive load	OL	Tc = +25°C	4	U I		500	μг
Power dissipation	P _D	Overload 5	1	01		6.0	w
load fault	ГБ	Short circuit	1,2,3	01		2.0	VV
Switching frequency	Fs	I _{OUT} = 100% rated load	4,5,6	01	500	600	KHz

Table I. Electrical Performance Characteristics - continued

AHF2803R3S

Test	Symbol	Conditions	Group A	Device	Limits		Unit
		-55°C ≤ Tc ≤ +125°C	Subgroups	Types			
		$Vin = 28Vdc \pm 5\%, C_L = 0$					
		Unless otherwise specified			Min	Max	
0.4.4		50% to/from 100%	4,5,6		-300	+300	
Output response to step transient load	VO _{TLOAD}	rated load	4,5,0	01	-300	+300	mVpk
changes ⁶	VOILOAD	0% to/from 50%	4,5,6	01	-500	+500	πνρκ
- Tangoo		rated load	4,5,0		-300	+300	
Recovery time step		50% to/from 100% rated load	4,5,6			70	μs
transient load	TT _{LOAD}	0% to/from 50% rated load	4,5,6	01		1200	μs
changes ^{6, 7}		50% to/from 0% rated load	4,5,6			8.0	ms
Output response to		Input step 16V to/from					
transient step line	VO _{TLINE}	40Vdc, I _{OUT} = 100%	4,5,6	01		500	mVpk
changes		rated load 4, 8					
Recovery time		Input step 16V to/from					
transient step line	TT _{LINE}	40Vdc, I _{OUT} = 100%	4,5,6	01		800	μs
changes		rated load 4, 7, 8					
Turn on overshoot	VTonos	I _{OUT} = o and 100% rated load	4,5,6	01		600	mVpk
Turn on delay	Ton _D	I _{OUT} = o and 100% rated load ⁹	4,5,6	01		20	ms
Load fault	Trie		4,5,6	01		20	ms
recovery ^{4, 9}	I I LF		4,5,0	U I		20	1115
Weight						38	g

Notes to Specifications

- 1. Parameter guaranteed by line and load regulation tests.
- 2. Bandwidth guaranteed by design. Tested for 20KHz to 2.0MHz.
- 3. Capacitive load may be any value from 0 to the maximum limit without compromising dc performance. A capacitive in excess of the maximum limit will not disturb loop stability but may interfere with the operation of the load fault detection circuitry, appearing as a short circuit during turn-on.
- 4. Parameter shall be tested as part of design characterization and after design or process changes. Thereafter, parameters shall be guaranteed to the limits specified in Table I.
- 5. An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit protection and is the condition of maximum power dissipation.
- 6. Load step transition time between 2.0 μ s and 10 μ s.
- 7. Recovery time is measured from the initiation of the transient to where V_{OUT} has returned to within ± 1.0 percent of V_{OUT} at 50 percent load.
- 8. Input step transition time between 2.0µs and 10µs.
- 9. Turn-on delay time measurement is for either a step application of power at the input or the removal of ground signal from the inhibit pin (pin 1) while power is applied to the input is unlimited.

Specifications AHF2805S

Absolute Maximum Ratings				
Input voltage	-0.5V to +50V			
Soldering temperature	300°C for 10 seconds			
Operating case temperature	-55°C to +125°C			
Storage case temperature	-65°C to +135°C			

Table II. Electrical Performance Characteristics

Test	Symbol	Conditions	Group A	Device	Lin	nits	Unit
		-55°C ≤ Tc ≤ +125°C	Subgroups	Types			
		$Vin = 28Vdc \pm 5\%, C_L = 0$					
		Unless otherwise specified			Min	Max	
Outrout welters	\/		1	0.1	4.95	5.05	V
Output voltage	V _{OUT}	$I_{OUT} = 0$	2,3	01	4.90	5.10	V
Output current ¹	I _{OUT}	V _{IN} = 16, 28, and 40Vdc	1,2,3	01		2400	mA
Output ripple voltage ²	V _{RIP}	V _{IN} = 16, 28, and 40Vdc, B.W. = 20 Hz to 2MHz	1,2,3	01		60	mV p-p
Line regulation	VR _{LINE}	V _{IN} = 16, 28, and 40Vdc, lout = 0%, 50% and 100% rated load	1,2,3	01		25	mV
Load regulation	VR _{LOAD}	V _{IN} = 16, 28, and 40Vdc, I _{OUT} = 0%, 50% and 100% rated load	1,2,3	01		50	mV
Input current	I _{IN}	I _{OUT} = 0, inhibit (pin 1) tied to input return (pin 7)	1,2,3	01		12	mA
		I _{OUT} = 0, inhibit (pin 1) = open				30	
Input ripple current ²	I _{RIP}	I _{OUT} = 100% rated load B.W. = 20 Hz to 2.0MHz	1,2,3	01		50	mA p-p
Efficiency	E _{FF}	I _{OUT} = 100% rated load	1	01	76		%
Efficiency	∟ FF	I _{OUT} = 100 % rated load	2,3	01	74	Ī	70
Isolation	ISO	Input to output or any pin to case (except pin 6) at 500Vdc, Tc = +25°C	1	01	100		МΩ
Capacitive load ^{3, 4}	C _L	No effect on dc performance, Tc = +25°C	4	01		500	μF
Power dissipation	D.	Overload ⁵	1	01		6.0	W
load fault	P _D	Short circuit	1,2,3	01		2.0	VV
Switching frequency	Fs	I _{OUT} = 100% rated load	4,5,6	01	500	600	KHz

Table II. Electrical Performance Characteristics - continued

AHF2805S

Test	Symbol	Conditions	Group A	Device	Limits		Unit
		-55°C ≤ Tc ≤ +125°C	Subgroups	Types			
		$Vin = 28Vdc \pm 5\%, C_L = 0$					
		Unless otherwise specified			Min	Max	
0. 1 1		50% to/from 100%	4,5,6		-300	+300	
Output response to step transient load	VO _{TLOAD}	rated load	4,5,0	01	-300	+300	mVpk
changes ⁶	VOILOAD	0% to/from 50%	4,5,6	01	-500	+500	шурк
onangeo		rated load	4,5,0		-500	+300	
Recovery time step		50% to/from 100% rated load	4,5,6			70	μs
transient load	TT_{LOAD}	0% to/from 50% rated load	4,5,6	01		1200	μs
changes ^{6, 7}		50% to/from 0% rated load	4,5,6			8.0	ms
Output response to		Input step 16V to/from					
transient step line	VO_{TLINE}	40Vdc, I _{OUT} = 100%	4,5,6	01		500	mVpk
changes		rated load 4,8					
Recovery time		Input step 16V to/from					
transient step line	TT_{LINE}	40Vdc, I _{OUT} = 100%	4,5,6	01		800	μs
changes		rated load 4, 7, 8					
Turn on overshoot	VTon _{OS}	I _{OUT} = o and 100% rated load	4,5,6	01		600	mVpk
Turn on delay	Ton_D	I _{OUT} = o and 100% rated load ⁹	4,5,6	01		20	ms
Load fault	Tr _{LE}		4,5,6	01		20	ms
recovery ^{4, 9}	''LF		4,5,6	ΟI		20	1115
Weight					•	38	g

Notes to Specifications

- 1. Parameter guaranteed by line and load regulation tests.
- 2. Bandwidth guaranteed by design. Tested for 20KHz to 2.0MHz.
- 3. Capacitive load may be any value from 0 to the maximum limit without compromising dc performance. A capacitive in excess of the maximum limit will not disturb loop stability but may interfere with the operation of the load fault detection circuitry, appearing as a short circuit during turn-on.
- 4. Parameter shall be tested as part of design characterization and after design or process changes. Thereafter, parameters shall be guaranteed to the limits specified in Table I.
- 5. An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit protection and is the condition of maximum power dissipation.
- 6. Load step transition time between 2.0 μs and 10 μs .
- Recovery time is measured from the initiation of the transient to where V_{OUT} has returned to within ±1.0 percent of V_{OUT} at 50 percent load.
- 8. Input step transition time between 2.0µs and 10µs.
- 9. Turn-on delay time measurement is for either a step application of power at the input or the removal of ground signal from the inhibit pin (pin 1) while power is applied to the input is unlimited.

Specifications AHF2812S

Absolute Maximum Ratings				
Input voltage	-0.5V to +50V			
Soldering temperature	300°C for 10 seconds			
Operating case temperature	-55°C to +125°C			
Storage case temperature	-65°C to +135°C			

Table III. Electrical Performance Characteristics

Test	Symbol	Conditions	Group A	Device	Lin	nits	Unit
		-55°C ≤ Tc ≤ +125°C	Subgroups	Types			
		$Vin = 28Vdc \pm 5\%, C_L = 0$					
		Unless otherwise specified			Min	Max	Ī
O de de de de de	.,		1	0.1	11.88	12.12	.,
Output voltage	V _{OUT}	$I_{OUT} = 0$	2,3	01	11.76	12.24	V
Output current ¹	I _{OUT}	V _{IN} = 16, 28, and 40Vdc	1,2,3	01		1000	mA
	V	V _{IN} = 16, 28, and 40Vdc,	100	01		00	
Output ripple voltage ²	V_{RIP}	B.W. = 20 Hz to 2MHz	1,2,3	01		60	mV p-p
		V _{IN} = 16, 28, and 40Vdc,					
Line regulation	VR _{LINE}	lout = 0%, 50% and 100%	1,2,3	01		50	mV
		rated load					
		V _{IN} = 16, 28, and 40Vdc,					
Load regulation	VR_{LOAD}	I _{OUT} = 0%, 50% and 100%	1,2,3	01		50	mV
		rated load					
		I _{OUT} = 0, inhibit (pin 1)				12	
Innut augrent	I _{IN}	tied to input return (pin 7)	100	01		12	A
Input current		I _{OUT} = 0,	1,2,3	UI	50	E 0	mA
		inhibit (pin 1) = open				50	
land discolation and 2	1	I _{OUT} = 100% rated load	1,2,3	01		50	mA p-p
Input ripple current ²	I _{RIP}	B.W. = 20 Hz to 2.0MHz	1,2,3	O1		50	па р-р
Efficiency	E _{FF}	I _{OUT} = 100% rated load	1	01	78		%
Linciency	►FF	1007 = 100 % Tated load	2,3	01	75		/0
		Input to output or any pin					
Isolation	ISO	to case (except pin 6)	1	01	100		$M\Omega$
		at 500Vdc, Tc = +25°C					
Capacitive load ^{3, 4}	C _L	No effect on dc performance,	4	01		500	μF
Capacitive load		Tc = +25°C	4	U I		300	μι
Power dissipation	P _D	Overload ⁵	1	01		6.0	w
load fault	r D	Short circuit	1,2,3	01		2.0	VV
Switching frequency	Fs	I _{OUT} = 100% rated load	4,5,6	01	500	600	KHz

Table III. Electrical Performance Characteristics - continued

AHF2812S

Test	Symbol	Conditions	Group A	Device	Limits		Unit
		-55°C ≤ Tc ≤ +125°C	Subgroups	Types			
		$Vin = 28Vdc \pm 5\%, C_L = 0$					
		Unless otherwise specified			Min	Max	
0.1		50% to/from 100%	4		-300	+300	
Output response to step transient load	VO _{TLOAD}	rated load	5,6	01	-450	+450	mVpk
changes ⁶	VOILOAD	0% to/from 50%	4	01	-500	+500	IIIVPK
onangoo		rated load	5,6		-750	+750	
Recovery time step		50% to/from 100% rated load	4,5,6			100	μs
transient load	TT_{LOAD}	0% to/from 50% rated load	4,5,6	01		1500	μs
changes ^{6, 7}		50% to/from 0% rated load	4,5,6			10	ms
Output response to		Input step 16V to/from					
transient step line	VO _{TLINE}	40Vdc, I _{OUT} = 100%	4,5,6	01		1500	mVpk
changes		rated load 4,8					
Recovery time		Input step 16V to/from					
transient step line	TT _{LINE}	40Vdc, I _{OUT} = 100%	4,5,6	01		800	μs
changes		rated load 4, 7, 8					
Turn on overshoot	VTonos	I _{OUT} = o and 100% rated load	4,5,6	01		600	mVpk
Turn on delay	Ton _D	I _{OUT} = o and 100% rated load ⁹	4,5,6	01		20	ms
Load fault	Tr _{i F}		4,5,6	01		20	mo
recovery ^{4, 9}	IILF		4,3,6	UI		20	ms
Weight				_		38	g

Notes to Specifications

- 1. Parameter guaranteed by line and load regulation tests.
- 2. Bandwidth guaranteed by design. Tested for 20KHz to 2.0MHz.
- 3. Capacitive load may be any value from 0 to the maximum limit without compromising dc performance. A capacitive in excess of the maximum limit will not disturb loop stability but may interfere with the operation of the load fault detection circuitry, appearing as a short circuit during turn-on.
- 4. Parameter shall be tested as part of design characterization and after design or process changes. Thereafter, parameters shall be guaranteed to the limits specified in Table II.
- 5. An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit protection and is the condition of maximum power dissipation.
- 6. Load step transition time between 2.0 μ s and 10 μ s.
- 7. Recovery time is measured from the initiation of the transient to where V_{OUT} has returned to within ±1.0 percent of V_{OUT} at 50 percent load. 8. Input step transition time between 2.0µs and 10µs.
- 9. Turn-on delay time measurement is for either a step application of power at the input or the removal of a ground signal from the inhibit pin (pin 1) while power is applied to the input is unlimited.

Specifications AHF2815S

Absolute Maximum Ratings			
Input voltage	-0.5V to +50V		
Soldering temperature	300°C for 10 seconds		
Operating case temperature	-55°C to +125°C		
Storage case temperature	-65°C to +135°C		

Table IV. Electrical Performance Characteristics

Test	Symbol	Conditions	Group A	Device	Lin	nits	Unit
		-55°C ≤ Tc ≤ +125°C	Subgroups	Types			
		$Vin = 28Vdc \pm 5\%, C_L = 0$					
		Unless otherwise specified			Min	Max	
Output voltage	V _{OUT}	I _{OUT} = 0	1	All	14.85	15.15	· V
Output voltage	VOUT	TOUT = 0	2,3	All	14.70	15.30	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
Output current ¹	I _{OUT}	V _{IN} = 16, 28, and 40Vdc	1,2,3	All		800	mA
Output ripple voltage ²	V_{RIP}	V _{IN} = 16, 28, and 40Vdc, B.W. = 20 Hz to 2MHz	1,2,3	All		50	mV p-p
Line regulation	VR _{LINE}	V _{IN} = 16, 28, and 40Vdc, lout = 0%, 50% and 100%	1	All		±35	mV
		rated load	2,3			±75	
Load regulation	VR _{LOAD}	V _{IN} = 16, 28, and 40Vdc, I _{OUT} = 0%, 50% and 100% rated load	1,2,3	All		±150	mV
Input current	I _{IN}	I _{OUT} = 0, inhibit (pin 1) tied to input return (pin 7)	1,2,3	All		18	mA
imput current	TIN	I _{OUT} = 0, inhibit (pin 1) = open	1,2,0	7		50	IIIA
Input ripple current ²	I _{RIP}	I _{OUT} = 100% rated load B.W. = 20 Hz to 2.0MHz	1,2,3	All		20	mA p-p
Efficiency	E _{FF}	I _{OUT} = 100% rated load	1	All	80		%
Efficiency	L-FF	I _{OUT} = 100 % rated load	2,3	All	77		70
Isolation	ISO	Input to output or any pin to case (except pin 6) at 500Vdc, Tc = +25°C	1	All	100		MΩ
Capacitive load ^{3, 4}	CL	No effect on dc performance, Tc = +25°C	4	All		200	μF
Power dissipation	P _D	Overload 5	1	All		6.0	w
load fault	l _L D	Short circuit	1,2,3	All		2.0] vv
				01, 04	250	300	
Switching frequency	Fs	I _{OUT} = 100% rated load	4,5,6	02, 05	250	270	KHz
				03, 06	275	300	

For Notes to Specifications, refer to page 9

Table IV. Electrical Performance Characteristics - continued

AHF2815S

Test	Symbol	Conditions	Group A	Device	Limits		Unit
		-55°C ≤ Tc ≤ +125°C	Subgroups	Types			
		Vin = 28Vdc \pm 5%, $C_L = 0$					
		Unless otherwise specified			Min	Max	
0.44		50% to/from 100%	4,5,6		-800	+800	
Output response to step transient load	VO _{TLOAD}	rated load	4,5,6	All	-800	+600	mVpk
changes ⁶	VOILOAD	0% to/from 50%	4,5,6	All	-1000	+750	шурк
- Tangoo		rated load	4,5,6		-1000	+750	
December time and an		50% to/from 100% rated load	4			100	μs
Recovery time step transient load	TT_{LOAD}	50% to/fforff 100% rated load	5,6	All		200	μο
changes ^{6, 7}		0% to/from 50% rated load	4	All		5.0	ms
- Tangoo			5,6			10	1115
Output response to		Input step 16V to/from		04			
transient step line	VO _{TLINE}	40Vdc, I _{OUT} = 100%	4,5,6	05	-1000	+1000	mVpk
changes		rated load 4,8		06			
Recovery time		Input step 16V to/from					
transient step line	TT _{LINE}	40Vdc, I _{OUT} = 100%	4,5,6	01		500	μs
changes		rated load 4, 7, 8					
Turn on overshoot	VTonos	I _{OUT} = o and 100% rated load	4,5,6	All		750	mVpk
Turn on delay	Ton _D	I _{OUT} = o and 100% rated load ⁹	4,5,6	All		12	ms
Load fault	Tr_{LF}		4,5,6	All		12	ms
recovery4, 9	''LF		4,5,6	All		12	1115
Weight						38	g

Notes to Specifications

- 1. Parameter guaranteed by line and load regulation tests.
- 2. Bandwidth guaranteed by design. Tested for 20KHz to 2.0MHz.
- 3. Capacitive load may be any value from 0 to the maximum limit without compromising dc performance. A capacitive in excess of the maximum limit will not disturb loop stability but may interfere with the operation of the load fault detection circuitry, appearing as a short circuit during turn-on.
- 4. Parameter shall be tested as part of design characterization and after design or process changes. Thereafter, parameters shall be guaranteed to the limits specified in Table III.
- 5. An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit protection and is the condition of maximum power dissipation.
- 6. Load step transition time between 2.0µs and 10µs.
- Recovery time is measured from the initiation of the transient to where V_{OUT} has returned to within ±1.0 percent of V_{OUT} at 50 percent load.
- 8. Input step transition time between 2.0μs and 10μs.
- 9. Turn-on delay time measurement is for either a step application of power at the input or the removal of a ground signal from the inhibit pin (pin 2) while power is applied to the input is unlimited.

Specifications

AHF2805D

Absolute Maximum Ratings					
Input voltage	-0.5V to +50V				
Soldering temperature	300°C for 10 seconds				
Operating case temperature	-55°C to +125°C				
Storage case temperature	-65°C to +135°C				

Table V. Electrical Performance Characteristics

Test	Symbol	Conditions	Group A	Device	Lin	nits	Unit		
		-55°C ≤ Tc ≤ +125°C	Subgroups Types						
		$Vin = 28Vdc \pm 5\%, C_L = 0$							
		Unless otherwise specified			Min	Max			
Output voltage	V _{OUT}	I _{OUT} = 0	1	01	±4.95	±5.05	· V		
Output voltage	V OUT		2,3	01	±4.90	±5.10	V		
Output current ^{1, 2}	I _{OUT}	V _{IN} = 16, 28, and 40Vdc	1,2,3	01	0.12	1.08	Α		
Output current	1001	each output	1,2,0	01	0.12	1.00	^		
Output ripple voltage ³	V _{RIP}	V _{IN} = 16, 28, and 40Vdc,	1,2,3	01		60	mV p-p		
Output ripple voltage	▼ RIP	B.W. = 20 Hz to 2MHz	1,2,0	01		00	πν p-p		
		V _{IN} = 16, 28, and 40Vdc,							
Line regulation ⁴	VR_{LINE}	lout = 0%, 50% and 100%	1,2,3	01		30	mV		
		rated load							
		V _{IN} = 16, 28, and 40Vdc,							
Load regulation ⁴	VR_{LOAD}	I _{OUT} = 0%, 50% and 100%	1,2,3	01		30	mV		
		rated load							
Cross regulation ⁵	VR _{CROSS}	10% to 90% load changes	1,2,3	01		±10	%		
		$I_{OUT} = 0$, inhibit (pin 1)				12			
Input current	I _{IN}	tied to input return (pin 7)	1,2,3	01	01	01			mA
input current	'IN	$I_{OUT} = 0$,	1,2,0	01		60	IIIA		
		inhibit (pin 1) = open				00			
Input ripple current ^{3, 4}	I _{BIP}	I _{OUT} = 100% rated load	1,2,3	01		50	mA p-p		
Input ripple current	IHIP	B.W. = 20 Hz to 2.0MHz	1,2,0	01		30	під р-р		
Efficiency ⁴	E _{FF}	I _{OUT} = 100% rated load,	1,3	01	75		%		
Efficiency	- FF	Tc = +25°C,	2	01	72		76		
		Input to output or any pin							
Isolation	ISO	to case (except pin 6)	1	01	100		$M\Omega$		
		at 500Vdc, Tc = +25°C							
		No effect on dc performance,							
Capacitive load ^{6, 7}	C_L	Tc = +25°C,	4	01		200	μF		
		total for both outputs							
Power dissipation	P _D	Overload, Tc = +25°C	1,2,3	01		6.0	W		
load fault	ט'	Short circuit, Tc = +25°C	1,2,0	O I		2.0	VV		
Switching frequency	Fs	I _{OUT} = 100% rated load	4,5,6	01	500	600	KHz		



Table V. Electrical Performance Characteristics - continued

AHF2805D

Test	Symbol	Conditions	Group A	Device	Lin	nits	Unit
		-55°C ≤ Tc ≤ +125°C	Subgroups	Types			
		$Vin = 28Vdc \pm 5\%, C_L = 0$					
		Unless otherwise specified			Min	Max	
Output response to step transient load	VO_{TLOAD}	50% to/from 100% rated load	4,5,6	01	-400	+400	mVpk
changes ^{4, 9}	VOTLOAD	0% to/from 50% rated load	4,5,6	U1	-800	+800	ШУРК
Recovery time step	TT _{LOAD}	50% to/from 100% rated load	4,5,6	01		70	μs
changes ^{4, 9,10}		0% to/from 50% rated load	4,5,6	01		100	μο
Output response to		Input step 16V to/from					
transient step line	VO _{TLINE}	40Vdc, I _{OUT} = 100%	4,5,6	01	-400	+400	mVpk
changes 4, 7, 11		rated load					
Recovery time		Input step 16V to/from					
transient step line	TT _{LINE}	40Vdc, I _{OUT} = 100%	4,5,6	01		1200	μs
changes ^{4, 7, 10, 11}		rated load					
Turn on overshoot ⁴	VTonos	I _{OUT} = o and 100% rated load	4,5,6	01		600	mVpk
Turn on delay	Ton _D	I _{OUT} = o and 100% rated load ⁹	4,5,6	01		25	ms
Load fault recovery ^{4, 9}	Tr _{LF}		4,5,6	01		25	ms
Weight						38	g

Notes to Specifications

- 1. Parameter guaranteed by line load and cross regulation tests.
- 2. Up to 90 percent of full power is available from either output provided the total output does not exceed 12W.
- 3. Bandwidth guaranteed by design. Tested for 20KHz to 2.0MHz.
- 4. Load current split equally between +V_{OUT} and -V_{OUT}.
 5. 1.2 watt load on output under test, 1.2W to 10.8W load change on other output.
- 6. Capacitive load may be any value from 0 to the maximum limit without compromising dc performance. A capacitive load in excess of the maximum limit will not disturb loop stability but may interfere with the operation of the load fault detection circuitry, appearing as a short circuit during turn-on.
- 7. Parameter shall be tested as part of design characterization and after design or process changes. Thereafter, parameters shall be guaranteed to the limits specified in Table IV.
- 8. An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit protection and is the condition of maximum power dissipation.
- 9. Load step transition time between 2.0µs and 10µs.
- 10. Recovery time is measured from the initiation of the transient to where V_{OLIT} has returned to within ± 1.0 percent of $\boldsymbol{V}_{\text{OUT}}$ at 50 percent load.
- 11. Input step transition time between 2.0µs and 10µs.
- 12. Turn-on delay time measurement is for either a step application of power at the input or the removal of a ground signal from the inhibit pin (pin 1) while power is applied to the input.

International

Specifications

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Absolute Maximum Ratings				
Input voltage	-0.5V to +50V			
Soldering temperature	300°C for 10 seconds			
Operating case temperature	-55°C to +125°C			
Storage case temperature	-65°C to +135°C			

Table VI. Electrical Performance Characteristics

Test	Symbol	Conditions	Group A	Device	Lin	nits	Unit	
		-55°C ≤ Tc ≤ +125°C	Subgroups	Types				
		$Vin = 28Vdc \pm 5\%, C_L = 0$						
		Unless otherwise specified			Min	Max		
Output voltage	V	$I_{OUT} = 0$	1	01	±11.88	±12.12	V	
Output voltage	V _{OUT}		2,3	01	±11.76	±12.24	V	
Output current ^{1, 2}	I _{OUT}	V _{IN} = 16, 28, and 40Vdc	1,2,3	01	100	900	mA	
Output current	OUT	each output	1,2,3	UI	100	900	IIIA	
Output ripple voltage ³	V _{RIP}	V _{IN} = 16, 28, and 40Vdc,	1,2,3	01		60	mV p-p	
Output ripple voltage	▼ RIP	B.W. = 20 Hz to 2MHz	1,2,3	UI		60	шу р-р	
		V _{IN} = 16, 28, and 40Vdc,						
Line regulation ⁴	VR _{LINE}	lout = 0%, 50% and 100%	1,2,3	01		30	mV	
		rated load						
		V _{IN} = 16, 28, and 40Vdc,						
Load regulation ⁴	VR _{LOAD}	I _{OUT} = 0%, 50% and 100%	1,2,3	01		30	0 mV	
		rated load						
Cross regulation ⁵	VR _{CROSS}	10% to 90% load changes	1,2,3	01		3.0	%	
		I _{OUT} = 0, inhibit (pin 1)		01	01		12	
Input current	I _{IN}	tied to input return (pin 7)	1,2,3				12	mA
input current	'IN	$I_{OUT} = 0$,	1,2,0			60	ш	
		inhibit (pin 1) = open				00		
Input ripple current ^{3, 4}	I _{RIP}	I _{OUT} = 100% rated load	1,2,3	01		50	mA p-p	
Input ripple current	INIP	B.W. = 20 Hz to 2.0MHz	1,2,0	01		30	шарр	
Efficiency ⁴	E _{FF}	I _{OUT} = 100% rated load,	1,3	01	77		%	
Linciency	- FF	$Tc = +25^{\circ}C$	2	01	74		/0	
		Input to output or any pin						
Isolation	ISO	to case (except pin 6)	1	01	100		$M\Omega$	
		at 500Vdc, Tc = +25°C						
		No effect on dc performance,						
Capacitive load ^{6, 7}	CL	Tc = +25°C,	4	01		200	μF	
		total for both outputs						
Power dissipation	P _D	Overload, Tc = +25°C	1,2,3	01		6.0	w	
load fault		Short circuit, Tc = +25°C		01		2.0		
Switching frequency	Fs	I _{OUT} = 100% rated load	4,5,6	01	500	600	KHz	

For Notes to Specifications, refer to page 13

Table VI. Electrical Performance Characteristics - continued

AHF2812D

Test	Symbol	Conditions	Group A	Device	Lin	nits	Unit
		-55°C ≤ Tc ≤ +125°C	Subgroups	Types			
		$Vin = 28Vdc \pm 5\%, C_L = 0$					
		Unless otherwise specified			Min	Max	
0.1		50% to/from 100%	4,5,6		-200	+200	
Output response to step transient load	VO _{TLOAD}	rated load	4,5,6	01	-200	+200	mVpk
changes ^{4, 9}	VOILOAD	0% to/from 50%	4,5,6	01	-800	+800	шурк
onangoo		rated load	4,5,0		-800	+600	
Recovery time step		50% to/from 100% rated load	4,5,6			70	
transient load	TT _{LOAD}		.,-,-	01			μs
changes ^{4, 9,10}		0% to/from 50% rated load	4,5,6			1000	,
Output response to		Input step 16V to/from					
transient step line	VO _{TLINE}	40Vdc, I _{OUT} = 100%	4,5,6	01	-750	+750	mVpk
changes 4, 7, 11		rated load					
Recovery time		Input step 16V to/from					
transient step line	TT _{LINE}	40Vdc, I _{OUT} = 100%	4,5,6	01		1200	μs
changes ^{4, 7, 10, 11}		rated load					
Turn on overshoot ⁴	VTonos	I _{OUT} = o and 100% rated load	4,5,6	01		600	mVpk
Turn on delay	Ton _D	I _{OUT} = o and 100% rated load ⁹	4,5,6	01		25	ms
Load fault	Trif		4,5,6	01		25	ms
recovery ^{4, 9}	''LF		4,5,0	01		2.5	1113
Weight						38	g

Notes to Specifications

- 1. Parameter guaranteed by line load and cross regulation tests.
- 2. Up to 90 percent of full power is available from either output provided the total output does not exceed 12W.
- 3. Bandwidth guaranteed by design. Tested for 20KHz to 2.0MHz.
- 4. Load current split equally between $+V_{\text{OUT}}$ and $-V_{\text{OUT}}$. 5. 1.2 watt load on output under test, 1.2W to 10.8W load change on other output.
- 6. Capacitive load may be any value from 0 to the maximum limit without compromising dc performance. A capacitive oad in excess of the maximum limit will not disturb loop stability but may interfere with the operation of the load fault detection circuitry, appearing as a short circuit during turn-on.
- 7. Parameter shall be tested as part of design characterization and after design or process changes. Thereafter, parameters shall be guaranteed to the limits specified in Table V.
- 8. An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit protection and is the condition of maximum power dissipation.
- 9. Load step transition time between 2.0µs and 10µs.
- 10. Recovery time is measured from the initiation of the transient to where V_{OUT} has returned to within ± 1.0 percent of V_{OUT} at 50 percent load.
- 11. Input step transition time between 2.0µs and 10µs.
- 12. Turn-on delay time measurement is for either a step application of power at the input or the removal of a ground signal from the inhibit pin (pin 1) while power is applied to the input.

Specifications

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Absolute Maximum Ratings					
Input voltage	-0.5V to +50V				
Soldering temperature	300°C for 10 seconds				
Operating case temperature	-55°C to +125°C				
Storage case temperature	-65°C to +135°C				

Table VII. Electrical Performance Characteristics

Test	Symbol	Conditions	Group A	Device	Lin	nits	Unit	
		-55°C ≤ Tc ≤ +125°C Subgroups Types						
		$Vin = 28Vdc \pm 5\%, C_L = 0$						
		Unless otherwise specified			Min	Max	1	
Output valtage	V	I - 0	1	01	±14.85	±15.15	V	
Output voltage	V _{OUT}	$I_{OUT} = 0$	2,3	UI	±14.70	±15.30	ľ	
0.11	1	V _{IN} = 16, 28, and 40Vdc	1,2,3	01	80	720	mA	
Output current ^{1, 2}	I _{OUT}	each output	1,2,3	O1	80	720	IIIA	
3	V _{RIP}	V _{IN} = 16, 28, and 40Vdc,	1,2,3	01		60	mV p-p	
Output ripple voltage ³	V RIP	B.W. = 20 Hz to 2MHz	1,2,3	O1		80	шу р-р	
		V _{IN} = 16, 28, and 40Vdc,						
Line regulation ⁴	VR_{LINE}	lout = 0%, 50% and 100%	1,2,3	01		35	mV	
		rated load						
		V _{IN} = 16, 28, and 40Vdc,						
Load regulation ⁴	VR_{LOAD}	I _{OUT} = 0%, 50% and 100%	1,2,3	01		35	mV	
		rated load						
Cross regulation ⁵	VR _{CROSS}	10% to 90% load changes	1,2,3	01		3.0	%	
		I _{OUT} = 0, inhibit (pin 1)				12		
Input current	I _{IN}	tied to input return (pin 7)	1,2,3	01		12	mA	
Imput current	IN	$I_{OUT} = 0$,	1,2,3	01		55	IIIA	
		inhibit (pin 1) = open				55		
Input ripple current ^{3, 4}	I _{RIP}	I _{OUT} = 100% rated load	1,2,3	01	01		50	mA p-p
input ripple current	IRIP	B.W. = 20 Hz to 2.0MHz	1,2,0	01		30	під р-р	
Efficiency ⁴	E _{FF}	I _{OUT} = 100% rated load,	1,3	01	78		%	
Linciency	- rr	Tc = +25°C	2	01	75		70	
		Input to output or any pin						
Isolation	ISO	to case (except pin 6)	1	01	100		$M\Omega$	
		at 500Vdc, Tc = +25°C						
		No effect on dc performance,						
Capacitive load ^{6, 7}	C_L	Tc = +25°C,	4	01		200	μF	
		total for both outputs						
Power dissipation	P _D	Overload, Tc = +25°C	1,2,3	01		6.0	W	
load fault	٠ ٥	Short circuit, Tc = +25°C	1,2,0	O1		2.5	VV	
Switching frequency ⁴	Fs	I _{OUT} = 100% rated load	4,5,6	01	500	600	KHz	

For Notes to Specifications, refer to page 15

Table VII. Electrical Performance Characteristics - continued

AHF2815D

Test	Symbol	Conditions	Group A	Device	Lin	nits	Unit
		-55°C ≤ Tc ≤ +125°C	Subgroups	Types			
		$Vin = 28Vdc \pm 5\%, C_L = 0$					
		Unless otherwise specified			Min	Max	
		50% to/from 100%	456		-200	+200	
Output response to step transient load	VO _{TLOAD}	rated load	4,5,6	01	-200	+200	m\/nk
changes ^{4, 9}	VOTLOAD	0% to/from 50%	4,5,6	U1	-800	+800	mVpk
onanges		rated load	4,5,6		-600	+600	
Recovery time step		50% to/from 100% rated load	4,5,6			70	
transient load	TT _{LOAD}	007010711011110070101001000	1,0,0	01			μs
changes ^{4, 9,10}		0% to/from 50% rated load	4,5,6	•		500	μο
Output response to		Input step 16V to/from					
transient step line	VO _{TLINE}	40Vdc, I _{OUT} = 100%	4,5,6	01	-750	+750	mVpk
changes 4, 7, 11		rated load					
Recovery time		Input step 16V to/from					
transient step line	TT _{LINE}	40Vdc, I _{OUT} = 100%	4,5,6	01		1200	μs
changes ^{4, 7, 10, 11}		rated load					
Turn on overshoot ⁴	VTon _{OS}	I _{OUT} = o and 100% rated load	4,5,6	01		750	mVpk
Turn on delay	Ton _D	I _{OUT} = o and 100% rated load ⁹	4,5,6	01		25	ms
Load fault	Trie		4,5,6	01		25	ms
recovery ^{4, 9}	''LF		4,5,6	UI		25	1115
Weight						38	g

Notes to Specifications

- Parameter guaranteed by line load and cross regulation tests.
 Up to 90 percent of full power is available from either output or Up to 90 percent of full power is available from either output provided the total output does not exceed 12W.
- 3. Bandwidth guaranteed by design. Tested for 20KHz to 2.0MHz.
- Load current split equally between +V_{ουτ} and -V_{ουτ}.
 1.2 watt load on output under test, 1.2W to 10.8W load change on other output.
- 6. Capacitive load may be any value from 0 to the maximum limit without compromising dc performance. A capacitive load in excess of the maximum limit will not disturb loop stability but may interfere with the operation of the load fault detection circuitry, appearing as a short circuit during turn-on.
- 7. Parameter shall be tested as part of design characterization and after design or process changes. Thereafter, parameters shall be guaranteed to the limits specified in Table VI.
- 8. An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit protection and is the condition of maximum power dissipation.
- 9. Load step transition time between 2.0 μ s and 10 μ s.
- 10. Recovery time is measured from the initiation of the transient to where V_{OUT} has returned to within ± 1.0 percent of $\boldsymbol{V}_{\text{OUT}}$ at 50 percent load.
- 11. Input step transition time between 2.0μs and 10μs.
- 12. Turn-on delay time measurement is for either a step application of power at the input or the removal of a ground signal from the inhibit pin (pin 1) while power is applied to the input.

Application Information

Inhibit Function (Enable)

Connecting the enable input (Pin 1) to input common (Pin 7) will cause the converter to shut down. It is recommended that the enable pin be driven by an open collector device capable of sinking at least $400\mu A$ of current. The open circuit voltage of the enable input is $15 \pm 1.0 \text{VDC}$. If the inhibit function is not used, this input can be left unconnected because it is internally pulled-up.

Thermal Management

Assuming that there is no forced air flow, the package temperature rise above ambient (ΔT) may be calculated using the following expression:

$$\Delta T \approx 80 \text{ A}^{-0.7} \text{p}^{0.85} \text{ (°C)}$$

where A = the effective surface area in square inches (including heat sink if used), P = power dissipation in watts.

The total surface area of the AHF package is 4.9 square inches. If a worse case full load efficiency of 78% is assumed, then the case temperature rise can be calculated as follows:

Hence, if
$$T_{AMBIENT}$$
 = +25°C, the DC/DC converter case temperature will be approximately 100°C if no heat sink or air flow is provided.

To calculate the heat sink area required to maintain a specific case temperature rise, the above equation may be manipulated as follows:

$$\mathsf{A}_{\mathsf{HEAT}\,\mathsf{SINK}} = \left[\frac{\Delta T}{80P^{0.85}}\right]^{-1.43} - A_{\mathit{PKG}}$$

As an example, if a maximum case temperature rise of 50°C rise above ambient is desired, then the required effective heat sink area is:

$$A_{HEATSINK} = \left[\frac{50}{80(3.4)^{0.85}}\right]^{-1.43} - 4.9 = 3.75in.^{2}$$

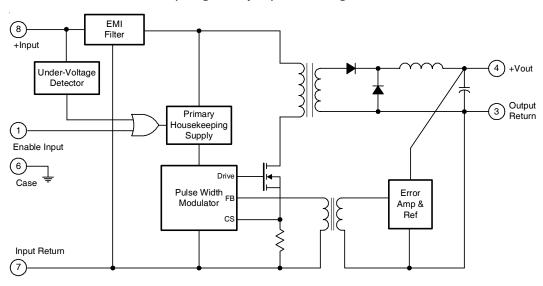
$$P = P_{OUT} \left[\frac{1}{Eff} - 1 \right] = 12 \left[\frac{1}{0.78} - 1 \right] = 3.4W$$

$$\Delta T = 80 (4.9)^{-0.7} (3.4)^{0.85} = 74^{\circ}C$$

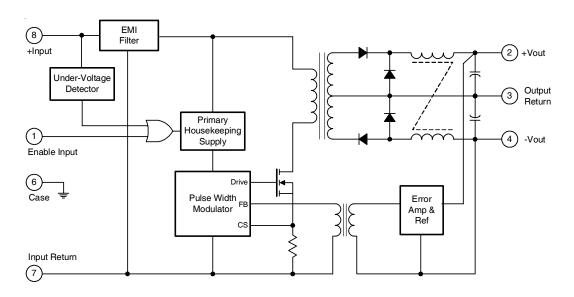
Standard Microcircuit Drawing Equivalence Table

Standard Microcircuit Drawing Number	Vendor Cage Code	IR Standard Part Number
5962-91600	52467	AHF2805S
5962-94568	52467	AHF2812S
5962-94563	52467	AHF2815S
5962-05205	52467	AHF2805D
5962-92111	52467	AHF2812D
5962-92351	52467	AHF2815D

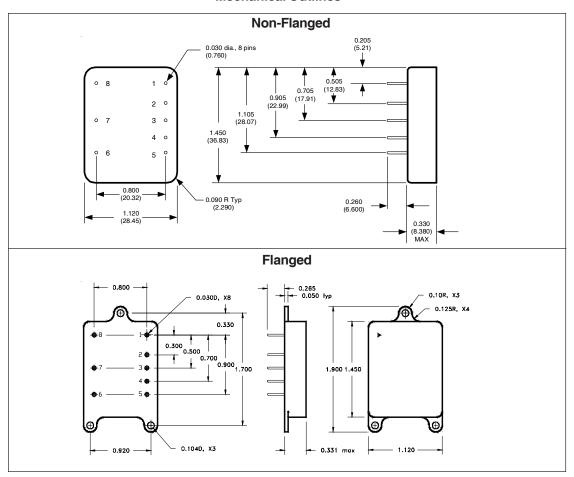
(Single Output) Block Diagram



(Dual Output) Block Diagram



Mechanical Outlines



Pin Designation

Pin #	Single Output	Dual Output	
1	Enable Input	Enable Input	
2	NC	+ Output	
3	Output Return	Output Return	
4	+ Output	- Output	
5	NC	NC	
6	Case	Case	
7	Input Return	Input Return	
8	+Input	+Input	

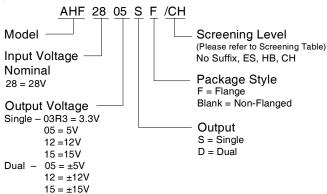
Device Screening

Requirement	MIL-STD-883 Method	No Suffix	ES ②	НВ	СН
Temperature Range	_	-20°C to +85°C	-55°C to +125°C ③	-55°C to +125°C	-55°C to +125°C
Element Evaluation	MIL-PRF-38534	N/A	N/A	N/A	Class H
Non-Destructive	2023	N/A	N/A	N/A	N/A
Bond Pull					
Internal Visual	2017	0	Yes	Yes	Yes
Temperature Cycle	1010	N/A	Cond B	Cond C	Cond C
Constant Acceleration	2001, Y1 Axis	N/A	500 Gs	3000 Gs	3000 Gs
PIND	2020	N/A	N/A	N/A	N/A
Burn-In	1015	N/A	48 hrs@hi temp	160 hrs@125°C	160 hrs@125°C
Final Electrical	MIL-PRF-38534	25°C	25°C ②	-55°C, +25°C,	-55°C, +25°C,
(Group A)	& Specification			+125°C	+125°C
PDA	MIL-PRF-38534	N/A	N/A	N/A	10%
Seal, Fine and Gross	1014	Cond A	Cond A, C	Cond A, C	Cond A, C
Radiographic	2012	N/A	N/A	N/A	N/A
External Visual	2009	0	Yes	Yes	Yes

Notes:

- ① Best commercial practice
- 2 Sample tests at low and high temperatures
- 3 -55°C to +105°C for AHE, ATO, ATW

Part Numbering





WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, Tel: (310) 252-7105 IR SAN JOSE: 2520Junction Avenue, San Jose, California 95134, Tel: (408) 434-5000 Visit us at www.irf.com for sales contact information.

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