

ATO2800T Series Hybrid - High Reliability Triple Output DC/DC Converters

DESCRIPTION

The ATO2800T Series of DC/DC converters feature high power density and an extended temperature range for use in military and industrial applications. Designed to the nominal input requirements of MIL-STD-704D, these devices have nominal 28VDC inputs with +5V and $\pm 12V$ or +5V and $\pm 15V$ triple outputs to satisfy a wide range of requirements. The circuit design incorporates a pulse width modulated push-pull topology operating in the feed-forward mode at a nominal switching frequency of 250kHz. Input to output isolation is achieved through the use of transformers in the forward and feedback circuits.

The advanced feedback design provides fast loop response for superior line and load transient characteristics and offers greater reliability and radiation tolerance than devices incorporating optical feedback circuits.

Three standard temperature grades are offered. Refer to Part Number section. They are provided in a standard plug-in package for PC mounting or in a flanged package for more severe environments.

These converters are manufactured in a facility fully qualified to Mil-Std-1772. All processes used to manufacture these converters have been qualified to enable Advanced Analog to deliver compliant devices. Two screening grades are available to satisfy a wide range of requirements. The CH grade converters are fully compliant to Mil-Std-1772 class H. The HB grade converters are processed to full class H screening but do not have class H element evaluation as required by Mil-Std-1772. Both grades are fully tested and operate over the full military temperature range without derating of output power. Variations in electrical, mechanical and screening can be accommodated. Extensive computer simulation using complex modeling enables rapid design modification to be provided. Contact Advanced Analog with specific requirements.

FEATURES

- 16 to 40 VDC input range (28VDC nominal)
- 5V, $\pm 12V$ or 5V, $\pm 15V$ outputs available
- Indefinite short circuit and overload protection
- 15 watts output power
- Fast loop response for superior transient characteristics
- Operating temperature range from -55°C to $+125^{\circ}\text{C}$ available
- Popular industry standard pin-out
- Resistance seam welded case for superior long term hermeticity
- Efficiencies up to 81%
- Shutdown from external signal
- 200,000 hour MTBF at 85°C

SPECIFICATIONS

T_{CASE} = -55°C to +85°C, V_{IN} = +28 V ±5% unless otherwise specified

ABSOLUTE MAXIMUM RATINGS

Input Voltage	-0.5 V to +50 V
Power Output	Internally limited, 17.5W typical
Soldering	300°C for 10 seconds
Temperature Range ⁶	Operating -55°C to 115°C case Storage -65°C to +135°C

Test	Symbol	Conditions -55°C - Tc - +85°C, VIN = 28 Vdc ±5%, CL=0, unless otherwise specified		ATO2812T		ATO2815T		Units
				Limits		Limits		
				Min	Max	Min	Max	
STATIC CHARACTERISTICS								
OUTPUT Voltage ¹	VOUT	IOUT = 0 (main)	Tc = 25°C Over Temp Tc = 25°C Over Temp	4.95	5.05	4.95	5.05	V
		IOUT = 0 (dual) ¹		4.90	5.10	4.90	5.10	V
Current ^{1,2,3}	IOUT	VIN = 16, 28, and 40 VDC (main)		±11.88	±12.12	±14.85	±15.15	V
		VIN = 16, 28, and 40 VDC (dual) ¹		±11.76	±12.24	±14.70	±15.30	V
Ripple Voltage ^{1,4}	VRIP	VIN = 16, 28, and 40 VDC (dual)	0.0	2000	0.0	2000	mA	
		BW = DC to 2 MHz (main)	0.0	±208	0.0	±167	mA	
Power ^{1,2,3}	POUT	VIN = 16, 28, and 40 VDC (dual)		80		80	mV p-p	
		BW = DC to 2 MHz (main)		40		40	mV p-p	
		VIN = 16, 28, and 40 VDC (dual)	10		10		W	
		(+dual)	2.5		2.5		W	
		(-dual)	2.5		2.5		W	
		(total)	15		15		W	
REGULATION Line ^{1,3}	VRLINE	VIN = 16, 28, and 40 VDC IOUT = 0, 1000, 2000 mA (main)	Tc = 25°C Over Temp		25		25	mV
Load ^{1,3}	VRLOAD	VIN = 16, 28, and 40 VDC (dual)			±30		±35	mV
		IOUT = 0, ±84, ±167 mA (dual)			±60		±75	mV
		VIN = 16, 28, and 40 VDC			50		50	mV
		IOUT = 0, 1000, 2000 mA (main)		±60		±75	mV	
		VIN = 16, 28, and 40 VDC						
		IOUT = 0, ±84, ±167 mA (dual)						
INPUT Current	IIN	IOUT = 0, inhibit (pin 8) tied to input return (pin 10)			15		15	mA
Ripple Current ⁴	IRIP	IOUT = 0, inhibit (pin 2) = open			40		40	mA
		IOUT = 2000 mA (main)			50		50	mA p-p
		IOUT = ±167 mA (dual)						
		BW = DC to 2 MHz						
EFFICIENCY	EFF	IOUT = 2000 mA (main) IOUT = ±167 mA (dual) Tc = ±25°C	Tc = +25°C	76		76		%
ISOLATION	ISO	Input to output or any pin to case (except pin 7) at 500 Vdc, Tc = +25°C	Tc = +25°C	100		100		MΩ
LOAD FAULT POWER DISSIPATION ³	PD	Over Load, Tc = +25°C ⁵ Short Circuit, Tc = +25°C	Tc = +25°C		8 6		8 6	W W
SWITCHING FREQUENCY	Fs	IOUT = 2000 mA (main) IOUT = ±167 mA (dual)		225	275	225	275	kHz
INHIBIT OPEN CIRCUIT VOLTAGE	VOI			9	13	9	13	V

Notes:

1. Tested at each output.
2. Parameter guaranteed by line and load regulation tests.
3. At least 20 percent of the total output power should be taken from the (+5 volt) main output.
4. Bandwidth guaranteed by design. Tested for 20 kHz to 2 MHz.
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. Above 85°C case temperature, derate output power linearly to 0 at 135°C case.

SPECIFICATIONS

T_{CASE} = -55°C to +105°C, V_{IN} = +28 V ±5% unless otherwise specified

ABSOLUTE MAXIMUM RATINGS

Input Voltage	-0.5 V to +50 V
Power Output	Internally limited, 17.5W typical
Soldering	300°C for 10 seconds
Temperature Range ⁶	Operating -55°C to 125°C case Storage -65°C to +135°C

Test	Symbol	Conditions -55°C - Tc - +105°C, VIN = 28 VDC ±5%, CL=0, unless otherwise specified		ATO2812T/ES		ATO2815T/ES		Units
				Limits		Limits		
				Min	Max	Min	Max	
STATIC CHARACTERISTICS								
OUTPUT Voltage ¹	VOUT	IOUT = 0 (main)	Tc = 25°C Over Temp Tc = 25°C Over Temp	4.95	5.05	4.95	5.05	V
		IOUT = 0 (dual) ¹		4.90	5.10	4.90	5.10	V
Current ^{1,2,3}	IOUT	VIN = 16, 28, and 40 VDC (main)		±11.88	±12.12	±14.85	±15.15	V
		VIN = 16, 28, and 40 VDC (dual) ¹		±11.76	±12.24	±14.70	±15.30	V
Ripple Voltage ^{1,4}	VRIP	VIN = 16, 28, and 40 VDC (main)	0.0	2000	0.0	2000	mA	
		VIN = 16, 28, and 40 VDC (dual) ¹	0.0	±208	0.0	±167	mA	
Power ^{1,2,3}	POUT	BW = DC to 2 MHz (main)		80		80	mV p-p	
		VIN = 16, 28, and 40 VDC (main)		40		40	mV p-p	
		BW = DC to 2 MHz (dual)						
		VIN = 16, 28, and 40 VDC (main)	10		10		W	
		(+dual)		2.5		2.5	W	
		(-dual)		2.5		2.5	W	
		(total)		15		15	W	
REGULATION Line ^{1,3}	VRLINE	VIN = 16, 28, and 40 VDC IOUT = 0, 1000, 2000 mA (main)	Tc = 25°C Over Temp		25		25	mV
Load ^{1,3}	VRLOAD	VIN = 16, 28, and 40 VDC (dual) IOUT = 0, ±84, ±167 mA (dual)		±30	±35	mV		
		VIN = 16, 28, and 40 VDC (main) IOUT = 0, 1000, 2000 mA (main)		±60	±75	mV		
		VIN = 16, 28, and 40 VDC (dual) IOUT = 0, ±84, ±167 mA (dual)		50	50	mV		
		VIN = 16, 28, and 40 VDC (dual) IOUT = 0, ±84, ±167 mA (dual)		±60		±75	mV	
INPUT Current	IIN	IOUT = 0, inhibit (pin 8) tied to input return (pin 10)		15		15	mA	
Ripple Current ⁴	IRIP	IOUT = 0, inhibit (pin 2) = open		40		40	mA	
		IOUT = 2000 mA (main) IOUT = ±167 mA (dual) BW = DC to 2 MHz		50		50	mA p-p	
EFFICIENCY	EFF	IOUT = 2000 mA (main) IOUT = ±167 mA (dual) Tc = ±25°C	Tc = +25°C	76		76	%	
ISOLATION	ISO	Input to output or any pin to case (except pin 7) at 500 Vdc, Tc = +25°C	Tc = +25°C	100		100	MΩ	
LOAD FAULT POWER DISSIPATION ³	PD	Over Load, Tc = +25°C ⁵ Short Circuit, Tc = +25°C	Tc = +25°C		8 6		8 6	W W
SWITCHING FREQUENCY	Fs	IOUT = 2000 mA (main) IOUT = ±167 mA (dual)		225	275	225	275	kHz
INHIBIT OPEN CIRCUIT VOLTAGE	VOI			9	13	9	13	V

Notes:

1. Tested at each output.
2. Parameter guaranteed by line and load regulation tests.
3. At least 20 percent of the total output power should be taken from the (+5 volt) main output.
4. Bandwidth guaranteed by design. Tested for 20 kHz to 2 MHz.
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. Above 105°C case temperature, derate output power linearly to 0 at 135°C case.

SPECIFICATIONS

T_{CASE} = -55°C to +125°C, V_{IN} = +28 V ±5% unless otherwise specified

ABSOLUTE MAXIMUM RATINGS

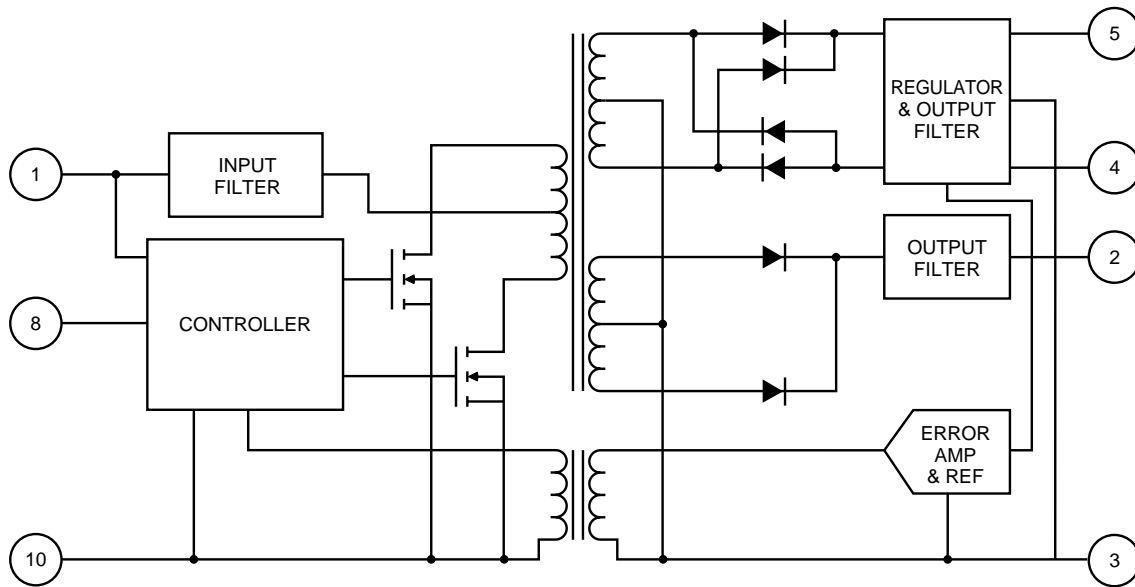
Input Voltage	-0.5 V to +50 V
Power Output	Internally limited, 17.5W typical
Soldering	300°C for 10 seconds
Temperature Range ⁶	Operating -55°C to 135°C case Storage -65°C to +135°C

Test	Symbol	Conditions -55°C - T _C - +125°C, V _{IN} = 28 V _{DC} ±5%, C _L =0, unless otherwise specified		ATO2812T/HB		ATO2815T/HB		Units
				Limits		Limits		
				Min	Max	Min	Max	
STATIC CHARACTERISTICS								
OUTPUT Voltage ¹	V _{OUT}	I _{OUT} = 0 (main)	T _C = 25°C Over Temp T _C = 25°C Over Temp	4.95	5.05	4.95	5.05	V
				4.90	5.10	4.90	5.10	V
		I _{OUT} = 0 (dual) ¹		±11.88	±12.12	±14.85	±15.15	V
				±11.76	±12.24	±14.70	±15.30	V
Current ^{1,2,3}	I _{OUT}	V _{IN} = 16, 28, and 40 V _{DC} (main) V _{IN} = 16, 28, and 40 V _{DC} (dual) ¹		0.0	2000	0.0	2000	mA
Ripple Voltage ^{1,4}	V _{RIP}	V _{IN} = 16, 28, and 40 V _{DC} BW = DC to 2 MHz (main)		0.0	±208	0.0	±167	mA
		V _{IN} = 16, 28, and 40 V _{DC} BW = DC to 2 MHz (dual)			80		80	mV p-p
Power ^{1,2,3}	P _{OUT}	V _{IN} = 16, 28, and 40 V _{DC} (main) (+dual)			40		40	mV p-p
		(-dual)		10		10		W
		(total)		2.5		2.5		W
				2.5		2.5		W
REGULATION								
Line ^{1,3}	V _{RLINE}	V _{IN} = 16, 28, and 40 V _{DC} I _{OUT} = 0, 1000, 2000 mA (main)	T _C = 25°C Over Temp		25		25	mV
Load ^{1,3}	V _{RLOAD}	V _{IN} = 16, 28, and 40 V _{DC} (dual) I _{OUT} = 0, ±84, ±167 mA (dual)			±30		±35	mV
		V _{IN} = 16, 28, and 40 V _{DC} I _{OUT} = 0, 1000, 2000 mA (main)			±60		±75	mV
		V _{IN} = 16, 28, and 40 V _{DC} I _{OUT} = 0, 1000, 2000 mA (main)			50		50	mV
		V _{IN} = 16, 28, and 40 V _{DC} I _{OUT} = 0, ±84, ±167 mA (dual)		±60		±75	mV	
INPUT								
Current	I _{IN}	I _{OUT} = 0, inhibit (pin 8) tied to input return (pin 10)			15		15	mA
Ripple Current ⁴	I _{RIP}	I _{OUT} = 0, inhibit (pin 2) = open			40		40	mA
		I _{OUT} = 2000 mA (main) I _{OUT} = ±167 mA (dual) BW = DC to 2 MHz			50		50	mA p-p
EFFICIENCY								
	EFF	I _{OUT} = 2000 mA (main) I _{OUT} = ±167 mA (dual) T _C = ±25°C	T _C = +25°C	76		76		%
ISOLATION								
	ISO	Input to output or any pin to case (except pin 7) at 500 V _{DC} , T _C = +25°C	T _C = +25°C	100		100		MΩ
LOAD FAULT POWER DISSIPATION ³								
	P _D	Over Load, T _C = +25°C ⁵ Short Circuit, T _C = +25°C	T _C = +25°C		8 6		8 6	W
SWITCHING FREQUENCY								
	F _S	I _{OUT} = 2000 mA (main) I _{OUT} = ±167 mA (dual)		225	275	225	275	kHz
INHIBIT OPEN CIRCUIT VOLTAGE								
	V _{OI}			9	13	9	13	V

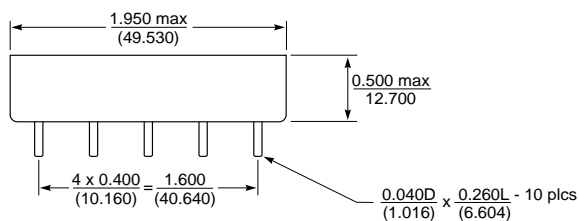
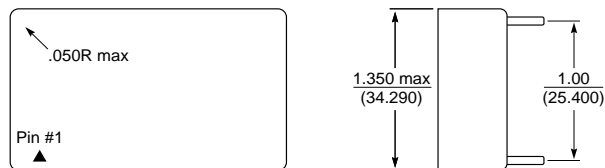
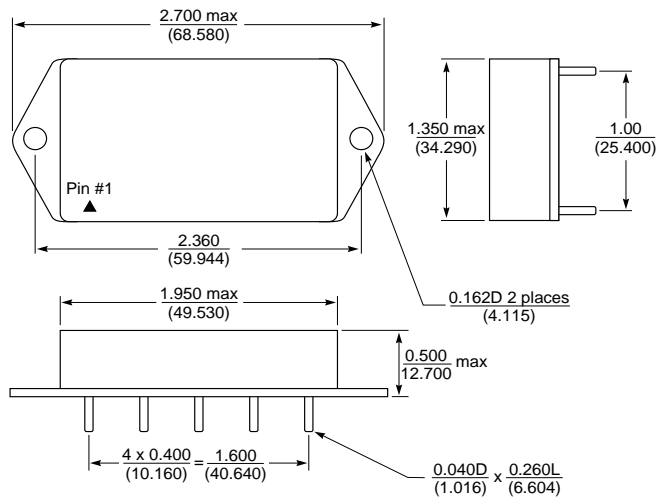
Notes:

1. Tested at each output.
2. Parameter guaranteed by line and load regulation tests.
3. At least 20 percent of the total output power should be taken from the (+5 volt) main output.
4. Bandwidth guaranteed by design. Tested for 20 kHz to 2 MHz.
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. Above 125°C case temperature, derate output power linearly to 0 at 135°C case.

BLOCK DIAGRAMS



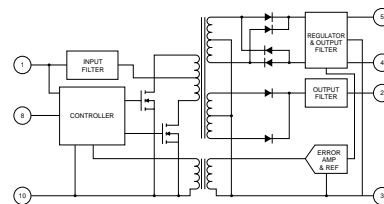
MECHANICAL OUTLINE



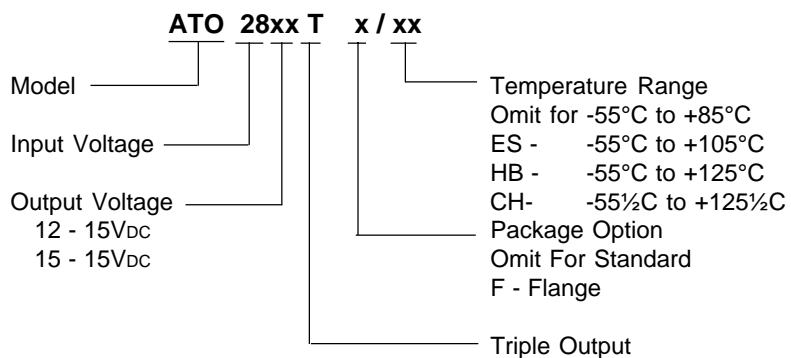
Standard

PIN DESIGNATION

- | | |
|--|---------------------|
| Pin 1 Positive Input | Pin 10 Input Common |
| Pin 2 +5V _{DC} Output | Pin 9 N/C |
| Pin 3 Output Common | Pin 8 Inhibit Input |
| Pin 4 Neg. Dual Output (12/15V _{DC}) | Pin 7 Case Ground |
| Pin 5 Positive Output (12/15V _{DC}) | Pin 6 N/C |



PART NUMBER



CH & HB SCREENING PROCESS

Per MIL-STD-883C

Test Inspection	Method	Condition
Pre-Seal Internal Visual	2017	
Stabilization Bake	1008	C
Temperature Cycling	1010	C
Constant Acceleration	2001	A, Y1 direction
Burn-in	1015	TC = +125°C
Final Electrical Test		TC = -55,+25,+125°C
External Visual	2009	
Gross Leak	1014	C
Fine Leak	1014	A

* CH includes element evaluation

ES SCREENING PROCESS

Same as HB screening except as follows:

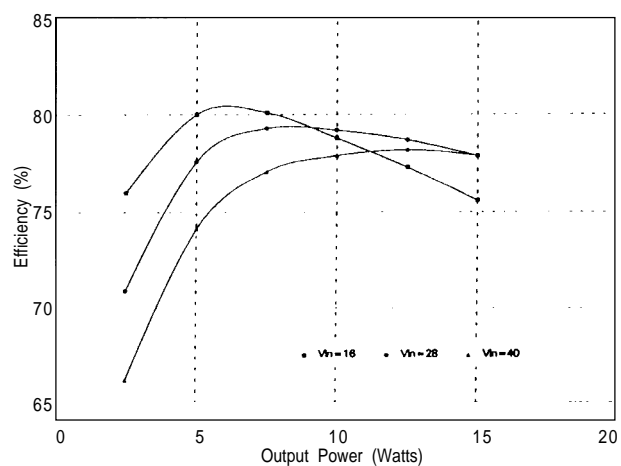
Test Inspection	Method
Constant Acceleration	2001, 500g's
Burn-in	1015, 96 hrs.
Final Electrical	25°C only

* Non-suffixed

STANDARDIZED MILITARY DRAWING CROSS REFERENCE

Standardized military drawing number	Vendor CAGE PIN	Vendor similar
5962-9095401HXX	52467	ATO2815T/CH
5962-9095401HZX	52467	ATO2815TF/CH
5962-9160201HXX	52467	ATO2812T/CH
5962-9160201HZX	52467	ATO2812TF/CH

ATO2815T EFFICIENCY



NOTES

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