International
IOR Rectifier

PD - 94582

ATO28XXT SERIES

28V Input, Triple Output

ATO

ADVANCED ANALOG HYBRID-HIGH RELIABILITY DC/DC CONVERTERS

Description

The ATO28XXT 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 ±12V or +5V and ±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-PRF-38534 for class H. The HB grade converters are processed to full class H screening requirements but do not have class H element evaluation as directed by MIL-PRF-39534. 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 modest design modifications to be accommodated. Contact Advanced Analog with specific requirements.

Features

- 16 to 40 VDC Input Range (28VDC Nominal)
- 5V, ±12V or 5V, ±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°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

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Specifications

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

ABSOLUTE MAXIMUM RATINGS		
Input Voltage	-0.5V to 50V	
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	Condition -55°C ≤ T_C ≤ +85°C, V_{IN} = 28 V_{DC} ±5%, C_L=0 unless otherwise specified		ATO2812T		ATO2815T		Units
				Min	Max	Min	Max	
STATIC CHARACTERISTICS								
OUTPUT								
Voltage [1]	V_{OUT}	I_{OUT} = 0 (main)	TC = 25°C	4.95	5.05	4.95	5.05	V
			Over Temp	4.90	5.10	4.90	5.10	V
		I_{OUT} = 0 (dual)[1]	TC = 25°C	±11.88	±12.12	±14.85	±15.15	V
			Over Temp	±11.76	±12.24	±14.70	±15.30	V
Current [1,2,3]	I_{OUT}	V_{IN} = 16, 28, and 40 VDC (main)		0.0	2000	0.0	2000	mA
		V_{IN} = 16, 28, and 40 VDC (dual)[1]		0.0	±208	0.0	±167	mA
		V_{IN} = 16, 28, and 40 VDC (dual)			80		80	mVp-p
Ripple Voltage [1,4]	V_{RIP}	BW = DC to 2 MHz (main) V_{IN} = 16, 28, and 40 VDC BW = DC to 2 MHz (dual))			40		40	mVp-p
Power [1,2,3]	P_{OUT}	V_{IN} = 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]	VR_{LINE}	V_{IN} = 16, 28, and 40 VDC I_{OUT} = 0, 1000, 2000mA (main)			25		25	mV
		V_{IN} = 16, 28, and 40 VDC (dual)	TC = 25°C		±30		±35	mV
		I_{OUT} = 0, ±84, ±167mA (dual)	Over Temp		±60		±75	mV
Load [1,3]	VR_{LOAD}	V_{IN} = 16, 28, and 40 VDC I_{OUT} = 0, 1000, 2000mA (main)			50		50	mV
		V_{IN} = 16, 28, and 40 VDC I_{OUT} = 0, ±84, ±167mA (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_{OUT} = 0, inhibit (pin 2) = open			40		40	mA
	I_{RIP}	I_{OUT} = 2000 mA (main)			50		50	mAp-p
		I_{OUT} = ±167mA (dual) BW = DC to 2MHz						
EFFICIENCY	E_{FF}	I_{OUT} = 2000mA (main) I_{OUT} = ±167mA (dual)	TC = 25°C	76		76		%
ISOLATION	ISO	Input to output or any pin to case (except pin 7) at 500 VDC,	TC = 25°C	100		100		MΩ
Load Fault Power Dissipation [3]	P_D	Overload Short Circuit	TC = 25°C		8 6		8 6	W W
Switching Frequency	F_S	I_{OUT} = 2000mA (main) I_{OUT} = ±167mA (dual)		225	275	225	275	KHz
Inhibit Open Circuit Voltage	V_{OI}			9	13	9	13	V

Notes to Specifications

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 (+5V volt) main output.
4. Bandwidth guaranteed by design. Tested for 20KHz to 2MHz.
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 115°C case.

Specifications

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

ABSOLUTE MAXIMUM RATINGS		
Input Voltage	-0.5V to 50V	
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	Condition -55°C ≤ T_C ≤ +105°C, V_{IN} = 28 V_{DC} ±5%, C_L=0 unless otherwise specified		ATO2812T/ES		ATO2815T/ES		Units
				Min	Max	Min	Max	
STATIC CHARACTERISTICS								
OUTPUT								
Voltage [1]	V_{OUT}	I_{OUT} = 0 (main)	TC = 25°C	4.95	5.05	4.95	5.05	V
			Over Temp	4.90	5.10	4.90	5.10	V
		I_{OUT} = 0 (dual)[1]	TC = 25°C	±11.88	±12.12	±14.85	±15.15	V
			Over Temp	±11.76	±12.24	±14.70	±15.30	V
Current [1,2,3]	I_{OUT}	V_{IN} = 16, 28, and 40 VDC (main)		0.0	2000	0.0	2000	mA
		V_{IN} = 16, 28, and 40 VDC (dual)[1]		0.0	±208	0.0	±167	mA
Ripple Voltage [1,4]	V_{RIP}	V_{IN} = 16, 28, and 40 VDC BW = DC to 2 MHz (main)			80		80	mVp-p
		V_{IN} = 16, 28, and 40 VDC BW = DC to 2 MHz (dual))			40		40	mVp-p
Power [1,2,3]	P_{OUT}	V_{IN} = 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]	VR_{LINE}	V_{IN} = 16, 28, and 40 VDC I_{OUT} = 0, 1000, 2000mA (main)			25		25	mV
		V_{IN} = 16, 28, and 40 VDC (dual)	TC = 25°C		±30		±35	mV
		I_{OUT} = 0, ±84, ±167mA (dual)	Over Temp		±60		±75	mV
Load [1,3]	VR_{LOAD}	V_{IN} = 16, 28, and 40 VDC I_{OUT} = 0, 1000, 2000mA (main)			50		50	mV
		V_{IN} = 16, 28, and 40 VDC I_{OUT} = 0, ±84, ±167mA (dual)			±60		±75	mV
INPUT								
Current	I_{IN}	I_{OUT} = 0, Inhibit (pin 8) Tied to input return (pin 10)			15		15	mA
		I_{OUT} = 0, inhibit (pin 2) = open			40		40	mA
Ripple Current [4]	I_{RIP}	I_{OUT} = 2000 mA (main) I_{OUT} = ±167mA (dual) BW = DC to 2MHz			50		50	mAp-p
EFFICIENCY	E_{FF}	I_{OUT} = 2000mA (main) I_{OUT} = ±167mA (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]	P_D	Overload, TC = +25°C[5]	TC = 25°C		8		8	W
		Short Circuit, TC = +25°C			6		6	W
Switching Frequency	F_S	I_{OUT} = 2000mA (main) I_{OUT} = ±167mA (dual)		225	275	225	275	KHz
Inhibit Open Circuit Voltage	V_{OI}			9	13	9	13	V

Notes to Specifications

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 (+5V volt) main output.
4. Bandwidth guaranteed by design. Tested for 20KHz to 2MHz.
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 125°C case

Specifications

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

ABSOLUTE MAXIMUM RATINGS		
Input Voltage	-0.5V to 50V	
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	Condition -55°C ≤ T_C ≤+125°C, V_{IN} = 28 V_{DC} ±5%, C_L=0 unless otherwise specified		ATO2812T/HB		ATO2815T/HB		Units
				Min	Max	Min	Max	
STATIC CHARACTERISTICS								
OUTPUT								
Voltage [1]	V_{OUT}	I_{OUT} = 0 (main)	TC = 25°C	4.95	5.05	4.95	5.05	V
			Over Temp	4.90	5.10	4.90	5.10	V
		I_{OUT} = 0 (dual)[1]	TC = 25°C	±11.88	±12.12	±14.85	±15.15	V
			Over Temp	±11.76	±12.24	±14.70	±15.30	V
Current [1,2,3]	I_{OUT}	V_{IN} = 16, 28, and 40 VDC (main)		0.0	2000	0.0	2000	mA
		V_{IN} = 16, 28, and 40 VDC (dual)[1]		0.0	±208	0.0	±167	mA
Ripple Voltage [1,4]	V_{RIP}	V_{IN} = 16, 28, and 40 VDC BW = DC to 2 MHz (main)			80		80	mVp-p
		V_{IN} = 16, 28, and 40 VDC BW = DC to 2 MHz (dual))			40		40	mVp-p
Power [1,2,3]	P_{OUT}	V_{IN} = 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]	VR_{LINE}	V_{IN} = 16, 28, and 40 VDC I_{OUT} = 0, 1000, 2000mA (main)			25		25	mV
		V_{IN} = 16, 28, and 40 VDC (dual)	TC = 25°C		±30		±35	mV
		I_{OUT} = 0, ±84, ±167mA (dual)	Over Temp		±60		±75	mV
Load [1,3]	VR_{LOAD}	V_{IN} = 16, 28, and 40 VDC I_{OUT} = 0, 1000, 2000mA (main)			50		50	mV
		V_{IN} = 16, 28, and 40 VDC I_{OUT} = 0, ±84, ±167mA (dual)			±60		±75	mV
INPUT								
Current	I_{IN}	I_{OUT} = 0, Inhibit (pin 8) Tied to input return (pin 10)			15		15	mA
		I_{OUT} = 0, inhibit (pin 2) = open			40		40	mA
Ripple Current [4]	I_{RIP}	I_{OUT} = 2000 mA (main) I_{OUT} = ±167mA (dual) BW = DC to 2MHz			50		50	mAp-p
EFFICIENCY	E_{FF}	I_{OUT} = 2000mA (main) I_{OUT} = ±167mA (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]	P_D	Overload, TC = +25°C[5]	TC = 25°C		8		8	W
		Short Circuit, TC = +25°C			6		6	W
Switching Frequency	F_S	I_{OUT} = 2000mA (main) I_{OUT} = ±167mA (dual)		225	275	225	275	KHz
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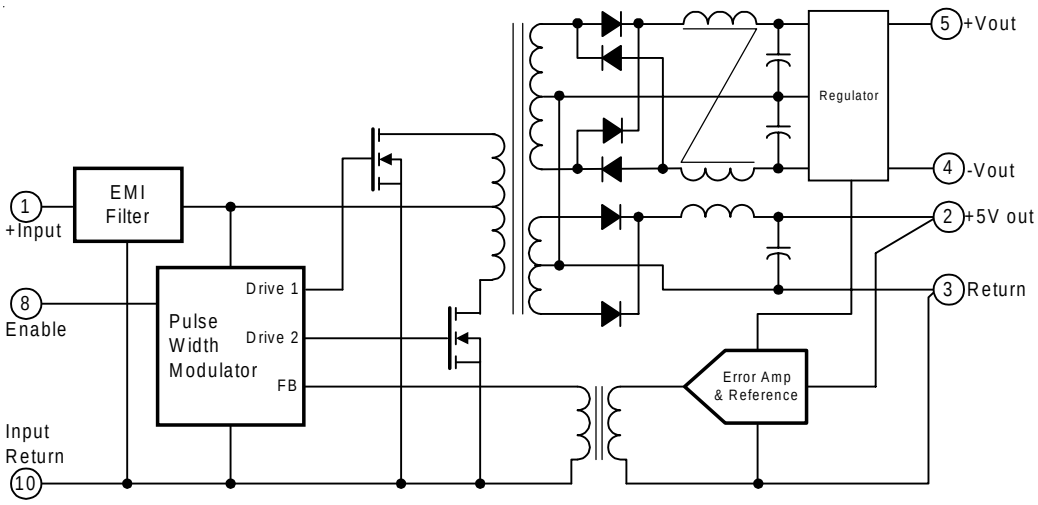
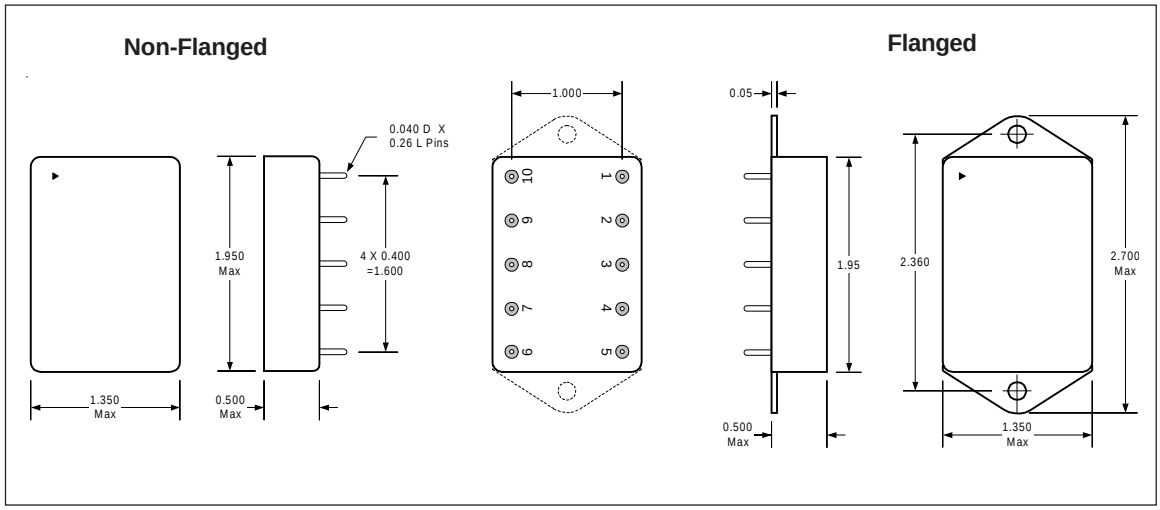
4. Bandwidth guaranteed by design. Tested for 20KHz to 2MHz.
5. An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit protection and is the condition of maximum power dissipation.
6. Above 125°C case temperature, derate output power linearly to 0 at 135°C case

ATO28XXT Block Diagram



ATO28XXT Case Outline



Pin Designation

Pin No.	Designation
1	+ Input
2	+ 5V Output
3	Output Return
4	-Dual Output
5	+ Dual Output
6	N/C
7	Case Ground
8	Enable Input
9	N/C
10	Input Return

Part Numbering

ATO 28 15 T / CH

- Model
- Input Voltage
  - 28 = 28V
- Output Voltages
  - 15 = 5V, ± 15V
  - 12 = 5V, ± 12V
- Outputs
  - T = Triple
- Screening Level
  - —, ES, HB, CH

Available Screening Levels and Process Variations for ATO28XXT Series

Requirement	MIL-STD-883 Method	No Suffix	ES Suffix	HB Suffix	CH Suffix
Temperature Range		-55°C to +85°C	-55°C to +125°C	-55°C to +125°C	-55°C to +125°C
Element Evaluation					MIL-PRF-38534
Internal Visual	2017	*	Yes	Yes	Yes
Temperature Cycle	1010, Cond C		Cond A	Yes	Yes
Constant Acceleration	2001, Cond A		500g	5,000g	5,000g
Burn-in	1015	48 hrs @ 85ºC	48hrs @ 105°C	160hrs @ 125°C	160hrs @ 125°C
Final Electrical (Group A)	MIL-PRF-38534 & Specification	25°C	25°C	-55, +25, +125°C	-55, +25, +125°C
Seal, Fine & Gross	1014		Yes	Yes	Yes
External Visual	2009	*	Yes	Yes	Yes

* Per Commercial Standards

Available Standard Military Drawing (SMD) Cross Reference

Standardized Military Drawing Pin	Vendor CAGE Code	Vendor Similar Pin
5962-9095401HXX	52467	ATO2815T/CH
5962-9095401HZX	52467	ATO2815TF/CH
5962-9160201HXX	52467	ATO2812T/CH
5962-9160201HZX	52467	ATO2812TF/CH

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