

## HYBRID-HIGH RELIABILITY DC/DC CONVERTERS

## ATR28XXT SERIES 28V Input, Triple Output

### Description

The ATR28XXT Series of DC/DC converters provide 30 watts of output power over the full military temperature range with no derating. These devices are pin compatible with the ATO series converters but offer twice the maximum output power in a lower profile package. A custom CMOS ASIC pulse width modulator operating at a nominal switching frequency of 550KHz combined with a unique magnetic feedback reduces circuit complexity for enhanced reliability. These converters provide 500 volt input to output isolation and operate in highly efficient single forward mode.

The advanced feedback design and high operating frequency provide an extremely wide bandwidth control loop with high gain and phase margin. This results in fast dynamic line and load response as well as superior audio rejection. The control loop is compensated to provide optimum performance over the full military temperature range and over the 16 to 40 volt input voltage range.

These converters are protected against both continuous output short circuits and output overload. Either load fault condition will result in operating in a low power dissipation foldback mode. The converters will shut down for approximately 15 milliseconds, then attempt to restart. This cycle will continue indefinitely unless the load fault is corrected. Recovery to normal operation is automatic upon removal of the load fault.

Manufactured in a facility full qualified to MIL-PRF-38534, these converters are available in four screening grades to satisfy a wide range of requirements. The CH grade is fully compliant to the requirements of MIL-PRF-38534 for class H. The HB grade is processed and screened to the class H requirement, but element evaluation and Periodic Inspections (PI) are not required. Both grades are tested to meet the complete group "A" test specification over the full military temperature range without output power deration.

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### Features

- 30 Watt Output Power
- Flexible Output Loading
- -55°C to +125°C Operation
- Pin Compatible with ATO
- 0.410" Maximum Height
- 16 to 40 VDC Input Range
- 500 Volt Input to Output Isolation
- High Audio Rejection
- MIL-STD-704 Compatible
- Load Fault Protection - Short Circuit and Overload
- TTL level Compatible Synchronization

Two grades with more limited screening are also available for use in less demanding applications. Variations in electrical, mechanical and screening can be limited accommodated. Contact IR Santa Clara with specific requirements.

## ATR28XXT Series Specifications

International  
**IRF** Rectifier

$T_{CASE} = -55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ ,  $V_{IN} = +28\text{V} \pm 5\%$  unless otherwise specified

ABSOLUTE MAXIMUM RATINGS <sup>1</sup>	
Input Voltage Range	-0.5V to 50VDC
Power Output	Internal limited 37.5W
Lead Temperature	+300°C
Storage Temperature	-65°C to 150°C case

Test	Symbol	Conditions -55°C ≤ TC ≤ +125°C, V <sub>IN</sub> = 28 V <sub>DC</sub> ±5%, C <sub>L</sub> =0, unless otherwise specified	ATR2812T		ATR2815T		Units
			Min	Max	Min	Max	
<b>STATIC CHARACTERISTICS</b>							
OUTPUT Voltage <sup>1</sup>	V <sub>OUT</sub>	I <sub>OUT</sub> = 0 (main) +25°C over temp. range	4.95 4.90	5.05 5.10	4.95 4.90	5.05 5.10	V <sub>DC</sub> V <sub>DC</sub>
Current <sup>1,2,3,4</sup>	I <sub>OUT</sub>	I <sub>OUT</sub> = 0 (dual) <sup>1</sup> +25°C over temp. range	±11.88 ±11.76	±12.12 ±12.24	±14.85 ±14.70	±15.15 ±15.30	V <sub>DC</sub> V <sub>DC</sub>
Ripple <sup>1,5</sup>	V <sub>RIP</sub>	V <sub>IN</sub> = 16, 28, and 40VDC (main) V <sub>IN</sub> = 16, 28, and 40VDC (dual) <sup>1</sup>	100.0 0.0	4000 ±625	100.0 0.0	4000 ±500	mA mA
		V <sub>IN</sub> = 16, 28, and 40VDC (dual) BW = 20Hz to 2MHz (main) V <sub>IN</sub> = 16, 28, and 40 VDC BW = 20Hz to 2 MHz (dual)		60 40		60 40	mVp-p mVp-p
REGULATION Line <sup>1,3</sup>	VR <sub>LINE</sub>	V <sub>IN</sub> = 16, 28, and 40 VDC P <sub>OUT</sub> = .5, 10, 20W (main) V <sub>IN</sub> = 16, 28, and 40 VDC(dual)		±25		±25	mV
Load <sup>1,3</sup>	VR <sub>LOAD</sub>	P <sub>OUT</sub> = 0, 5, 10W (dual) V <sub>IN</sub> = 16, 28, and 40 VDC		±60		±75	mV
		P <sub>OUT</sub> = .5, 10, 20W (main) V <sub>IN</sub> = 16, 28, and 40 VDC P <sub>OUT</sub> = 0, 5, 10W (dual)		±50 ±60		±50 ±75	mV mV
INPUT Current	I <sub>IN</sub>	I <sub>OUT</sub> = 0, inhibit (pin 8) Tied to input return (pin 10)		15 75		15 75	mA mA
Ripple Current <sup>4</sup>	I <sub>RIP</sub>	I <sub>OUT</sub> = 0, inhibit (pin 8) = open I <sub>OUT</sub> = 4000mA (main) P <sub>OUT</sub> = 10W (dual) BW = 20Hz to 2MHz		50		50	mAp-p
EFFICIENCY	E <sub>FF</sub>	I <sub>OUT</sub> = 4000mA (main) +25°C P <sub>OUT</sub> = 10W (dual)	75		75		%
		over temp. range	72		72		
ISOLATION	ISO	Input to output or any pin to case (except pin 8)at 500 TC=+25°C	100		100		MΩ
Load Fault Power Dissipation <sup>3</sup>	P <sub>D</sub>	Overload		14 9		14 9	W W
		Short circuit					
Switching Frequency	F <sub>S</sub>		500	600	500	600	KHz
SYNC Frequency Range	F <sub>SYNC</sub>	50% load to/from 100% load no load to/from 50% load	500	700	500	700	KHz
Inhibit Open Circuit Voltage	V <sub>OI</sub>		9	13	9	13	V
Output Response to Step transient Load changes <sup>7</sup>	VO <sub>TLOAD</sub> <sub>D</sub>	50% load to/from 100% load No load to/from 50% load	-500 -1000	+500 +1000	-500 -1000	+500 +1000	mVpk
Recovery Time Step Step transient Load changes <sup>7,8</sup>	TT <sub>LOAD</sub>	50% load to/from 100% load		200		200	μs
		No load to 50% load		5		5	ms
		50% load to no load		10		10	ms

For Notes to Specifications, refer to page 3

$T_{CASE} = -55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ ,  $V_{IN} = +28\text{V} \pm 5\%$  unless otherwise specified

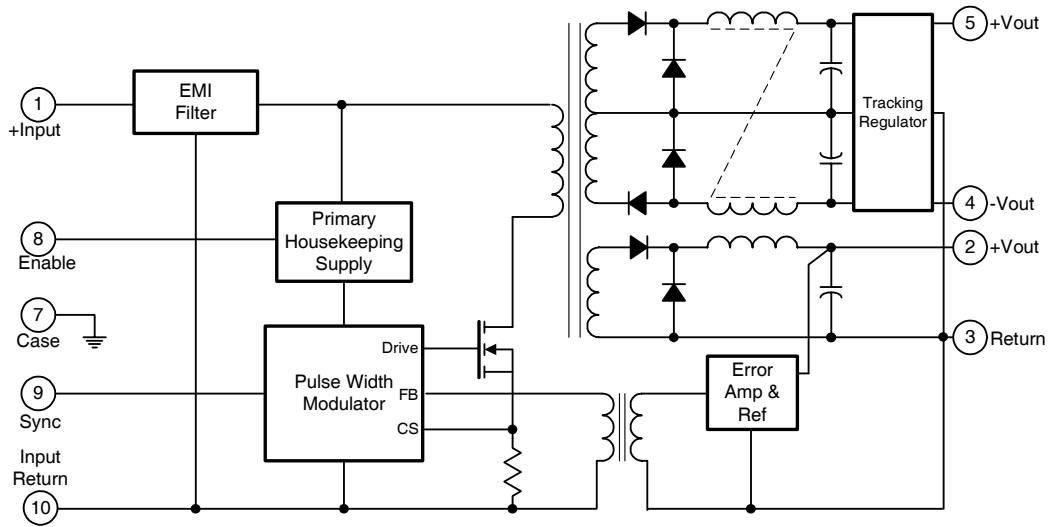
ABSOLUTE MAXIMUM RATINGS		
Input Voltage	-0.5V to 50VDC	
Power Output	Internally limited, 37.5W typical	
Soldering	300°C for 10 seconds	
Temperature Range <sup>6</sup>	Operating	-55°C to +135°C case
	Storage	-65°C to +135°C

Test	Symbol	Conditions -55°C ≤ TC ≤ +125°C, V <sub>IN</sub> = 28 V <sub>DC</sub> ±5%, C <sub>L</sub> =0, unless otherwise specified	ATR2812T		ATR2815T		Units
			Min	Max	Min	Max	
<b>STATIC CHARACTERISTICS</b>							
Output Response to Transient step <sup>9</sup> Line changes <sup>10</sup>	VO <sub>TLINE</sub>	Input step 16 from/to 40 VDC I <sub>OUT</sub> = 4000mA (main) P <sub>OUT</sub> = 10W (dual)		±1500		±1500	mV pk
Recovery Time <sup>8</sup> Transient step <sup>9</sup> Line changes <sup>10</sup>	TT <sub>LINE</sub>	Input step 16 from/to 40 VDC I <sub>OUT</sub> = 4000mA (main) P <sub>OUT</sub> = 10W (dual)		10		10	ms
Turn on Overshoot <sup>1</sup>	VT <sub>onOS</sub>	I <sub>OUT</sub> = 0, and 4000mA (main) P <sub>OUT</sub> = 0, 10W (dual)		1000		1000	mV pk
Turn on Delay <sup>1, 11</sup>	T <sub>onD</sub>	I <sub>OUT</sub> = 0, 4000mA (main) P <sub>OUT</sub> = 0, 10W (dual)		25		25	ms
Load Fault Recovery <sup>10</sup>	TR <sub>LF</sub>			25		25	ms
Device weight				65		65	g

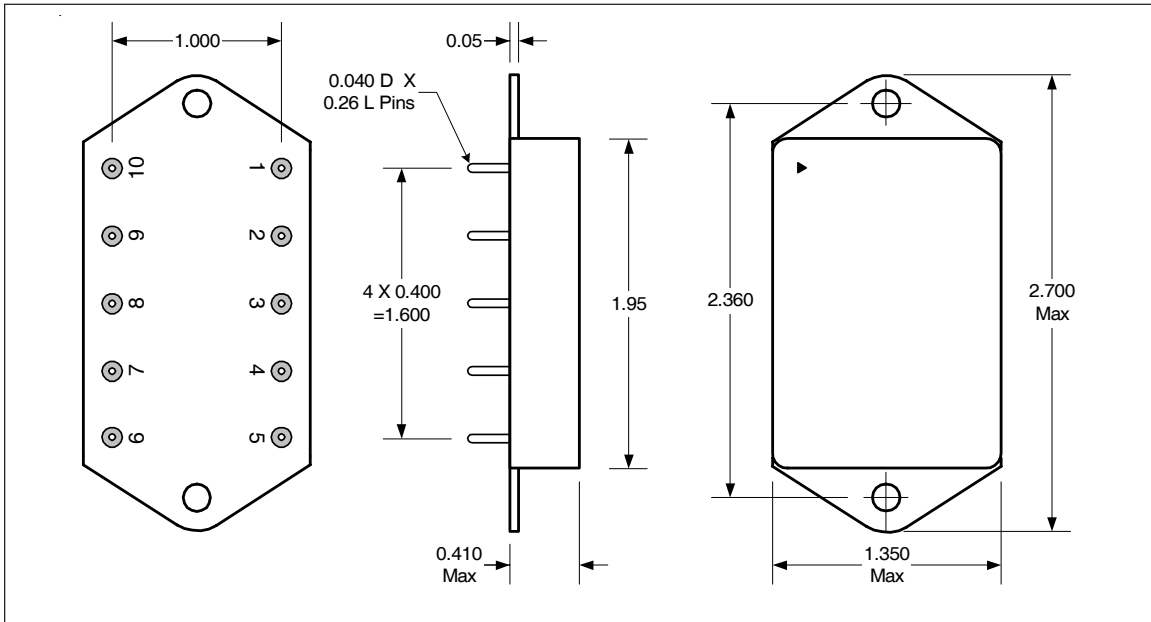
**Notes to Specifications**

1. Tested at each output.
2. Parameter guaranteed byline and load regulation tests.
3. Although operation with no load is permissible, light loading on the main (+5 volt) output may cause the output voltage of the auxiliary outputs (±12 volt or ±15 volt) to drop out of regulation. It is therefore recommended that at least 100mA or 20 percent of the output power, whichever is greater, be taken from the main (+5 volt) output.
4. Total combined output power –30 watts.
5. Bandwidth guaranteed by design. Tested for 20KHz to 2MHz.
6. An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the overload protection circuit and is the condition of maximum power dissipation.
7. Load step transition time between 2 and 10 microseconds.
8. Recovery time is measured from the initiation of the transient to where V<sub>OUT</sub> has returned to within ±1 percent of V<sub>OUT</sub> at 50 percent load.
9. Input step transition time between 2 to 10 microseconds.
10. 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 the table.
11. 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 8) while power is applied to the input.

ATR28XXT Block Diagram



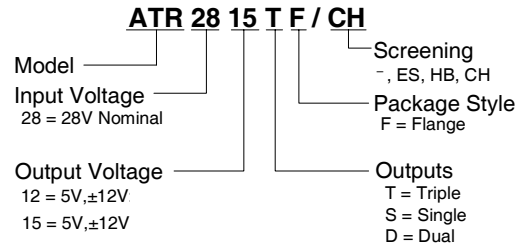
**ATR28XXT Case Outline**



**Pin Designation**

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

**Part Numbering**



**Available Screening Levels and Process Variations for ATR28XXT Series**

Requirement	MIL-STD-883 Method	No Suffix	ES Suffix	HB Suffix	CH Suffix
Temperature Range		-20 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 B	Yes	Yes
Constant Acceleration	2001, Cond A		500g	5,000 g	5,000 g
Burn-in	1015	48hrs @ 85°C	48hrs @ 125°C	160hrs @ 125°C	160hrs @ 125°C
Final Electrical (Group A)	MIL-PRF-38534	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
5962-9315801HXX	52467	ATR2812T/CH
5962-9315801HZX	52467	ATR2812TF/CH
5962-9215901HXX	52467	ATR2815T/CH
5962-9215901HZX	52467	ATR2815TF/CH