

HYBRID-HIGH RELIABILITY DC/DC CONVERTER

Description

The ATR28XXT Series of DC/DC converters provide 30W 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 500V 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 16V to 40V input voltage range.

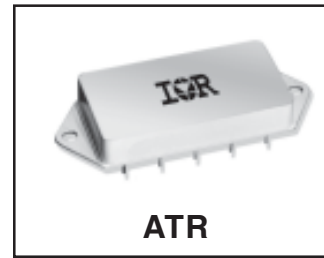
These converters are protected against both continuous output short circuits and output overload. Either load fault condition will result in operating in a low power dissipation foldback mode. The converters will shut down for approximately 15ms, then attempt to restart. This cycle will continue indefinitely 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 fabricated utilizing DSCC qualified processes. For available screening options, refer to device screening table in the data sheet. Variations in electrical, mechanical and screening can be limited accommodated. Contact IR Santa Clara with specific requirements.

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ATR28XXT SERIES

28V Input, Triple Output



Features

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

ATR28XXT Series Specifications

International
IR 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 | |
|--------------------------|-----------------------------------|
| Input voltage | -0.5V to +50VDC |
| Power Output | Internally limited, 37.5W typical |
| Lead temperature | 300°C |
| Storage temperature | -65°C to +135°C |

| Test | Symbol | Conditions $-55^{\circ}\text{C} \leq \text{TC} \leq +125^{\circ}\text{C}$, $V_{IN} = 28 \text{V}_{DC} \pm 5\%$, $C_L = 0$, unless otherwise specified | ATR2812T | | ATR2815T | | Units |
|---|-------------|---|----------------------------|----------------------------|----------------------------|----------------------------|---------------------------|
| | | | Min | Max | Min | Max | |
| STATIC CHARACTERISTICS | | | | | | | |
| OUTPUT Voltage ¹ | V_{OUT} | $I_{OUT} = 0$ (main) $+25^{\circ}\text{C}$ over temp. range | 4.95 4.90 | 5.05 5.10 | 4.95 4.90 | 5.05 5.10 | V_{DC} V_{DC} |
| Current ^{1,2,3,4} | I_{OUT} | $I_{OUT} = 0$ (dual) ¹ $+25^{\circ}\text{C}$ over temp. range $V_{IN} = 16, 28$, and 40VDC (main) | ± 11.88 ± 11.76 | ± 12.12 ± 12.24 | ± 14.85 ± 14.70 | ± 15.15 ± 15.30 | V_{DC} V_{DC} |
| Ripple ^{1,5} | V_{RIP} | $V_{IN} = 16, 28$, and 40VDC (dual) ¹ $V_{IN} = 16, 28$, and 40VDC (dual) BW = 20Hz to 2MHz (main) $V_{IN} = 16, 28$, and 40VDC BW = 20Hz to 2MHz (dual) | 0.0 100 | ± 625 4000 | 0.0 100 | ± 500 4000 | mA mA |
| REGULATION Line ^{1,3} | V_{RLINE} | $V_{IN} = 16, 28$, and 40VDC $P_{OUT} = 0.5, 7.5, 15\text{W}$ (main) $V_{IN} = 16, 28$, and 40VDC (dual) | | ± 25 | | ± 25 | |
| Load ^{1,3} | V_{RLOAD} | $P_{OUT} = 1.2/1.5, 7.5$ and 15W (dual) $V_{IN} = 16, 28$, and 40VDC $P_{OUT} = 0.5, 7.5, 15\text{W}$ (main) $V_{IN} = 16, 28$, and 40VDC $P_{OUT} = 1.2/1.5, 7.5$, and 15W (dual) | | ± 60 | | ± 75 | mV |
| INPUT Current | I_{IN} | $I_{OUT} = 0$, inhibit (pin 8) Tied to input return (pin 10) | | 15 75 | | 15 75 | mA mA |
| Ripple Current ⁴ | I_{RIP} | $I_{OUT} = 0$, inhibit (pin 8) = open $I_{OUT} = 3000\text{mA}$ (main) $P_{OUT} = 15\text{W}$ (dual) BW = 20Hz to 2MHz | | 50 | | 50 | mAp-p |
| EFFICIENCY | E_{FF} | $I_{OUT} = 3000\text{mA}$ (main) $+25^{\circ}\text{C}$ $P_{OUT} = 15\text{W}$ (dual) over temp. range | 75 72 | | 75 72 | | % |
| ISOLATION | ISO | Input to output or any pin to case (except pin 8) at 500 $\text{TC} = +25^{\circ}\text{C}$ | 100 | | 100 | | $\text{M}\Omega$ |
| Load Fault Power Dissipation ³ | P_D | Overload Short circuit | | 14 9.0 | | 14 9.0 | W |
| Switching Frequency | F_S | | 500 | 600 | 500 | 600 | KHz |
| SYNC Frequency Range | F_{SYNC} | 50% load to/from 100% load no load to/from 50% load | 500 | 700 | 500 | 700 | KHz |
| Inhibit Open Circuit Voltage | V_{OI} | | 9.0 | 13 | 9.0 | 13 | V |
| Output Response to Step transient Load changes ⁷ | V_{OLOAD} | 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 ^{7,8} | T_{TLOAD} | 50% load to/from 100% load No load to 50% load 50% load to no load | | 200 5.0 10 | | 200 5.0 10 | μs ms 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

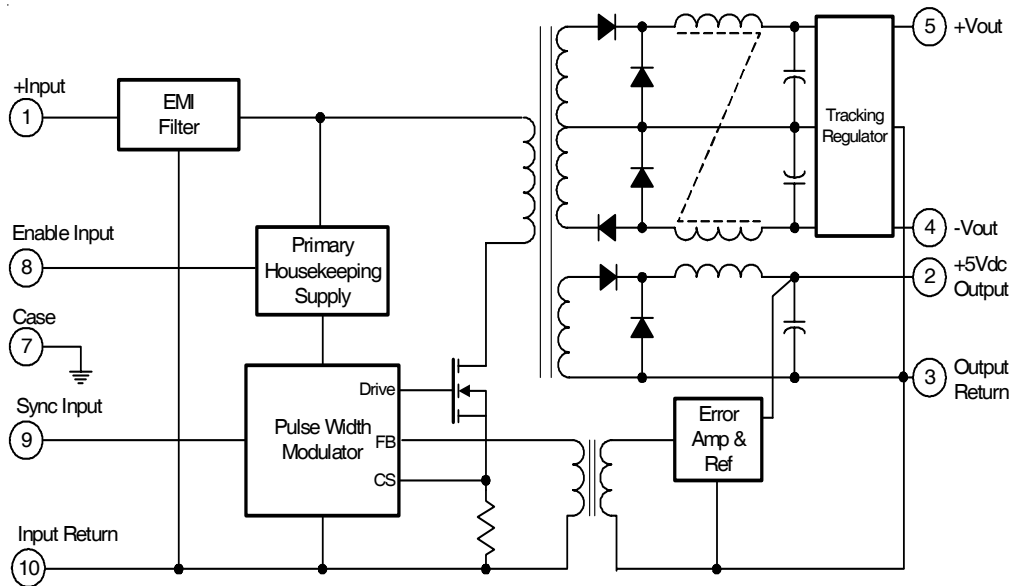
| Absolute Maximum Ratings | | |
|---------------------------------|-----------------------------------|-----------------|
| Input voltage | -0.5V to +50VDC | |
| Power Output | Internally limited, 37.5W typical | |
| Soldering temperature | 300°C for 10 seconds | |
| Temperature Range ⁶ | Operating case temperature | -55°C to +135°C |
| | Storage case temperature | -65°C to +135°C |

| Test | Symbol | Conditions -55°C ≤ TC ≤ +125°C, V _{IN} = 28 V _{DC} ±5%, C _L =0, unless otherwise specified | ATR2812T | | ATR2815T | | Units |
|---|---------------------|--|----------|-------|----------|-------|-------|
| | | | Min | Max | Min | Max | |
| Output Response to Transient step ⁹ Line changes ¹⁰ | V _O LINE | Input step 16 from/to 40 VDC I _{OUT} = 3000mA (main) P _{OUT} = 15W (dual) | | ±1500 | | ±1500 | mV pk |
| Recovery Time ⁸ Transient step ⁹ Line changes ¹⁰ | T _T LINE | Input step 16 from/to 40 VDC I _{OUT} = 3000mA (main) P _{OUT} = 15W (dual) | | 10 | | 10 | ms |
| Turn on Overshoot ¹ | V _{Ton} OS | I _{OUT} = 0, and 3000mA (main) P _{OUT} = 0, 15W (dual) | | 1000 | | 1000 | mV pk |
| Turn on Delay ^{1, 11} | T _{on} D | I _{OUT} = 0, 3000mA (main) P _{OUT} = 0, 15W (dual) | | 25 | | 25 | ms |
| Load Fault Recovery ¹⁰ | T _{RL} F | | | 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 (+5V) output may cause the output voltage of the auxiliary outputs (±12V or ±15V) to drop out of regulation. It is therefore recommended that at least 100mA or 20% of the output power, whichever is greater, be taken from the main (+5V) output and at least 50mA (or ±12V: 1.2W, ±15V: 1.5W) of the output power is taken from the auxiliary (±12V or ±15V) .
4. Total combined output power –30W.
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 2.0µs and 10µs.
8. Recovery time is measured from the initiation of the transient to where V_{OUT} has returned to within ±1.0% of V_{OUT} at 50% load.
9. Input step transition time between 2.0µs to 10µs.
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.

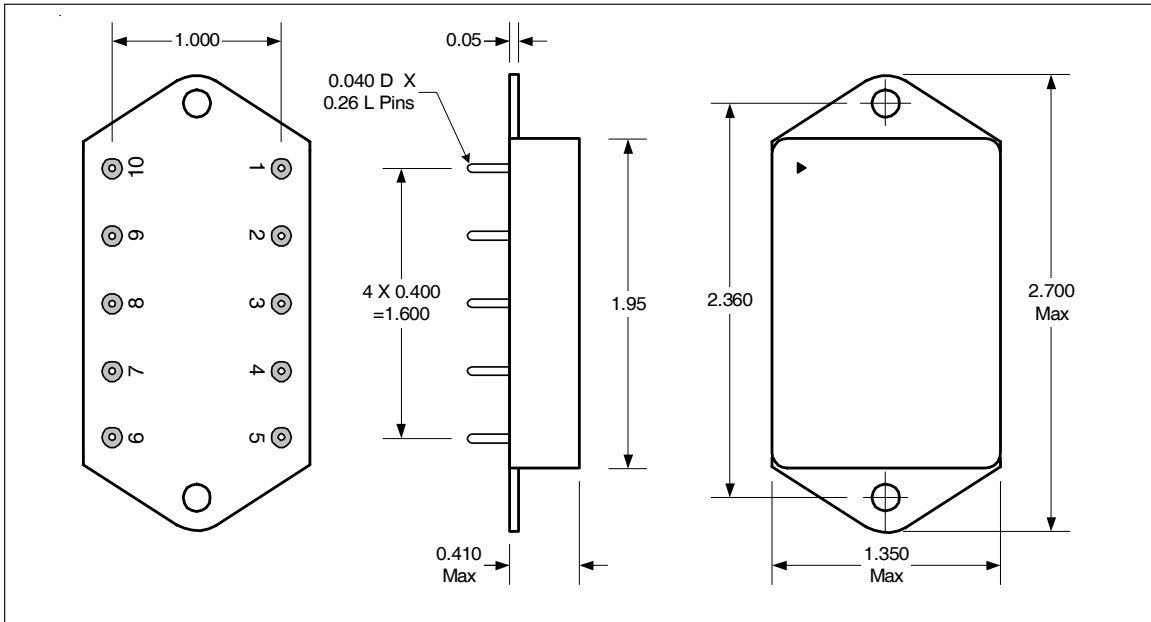
Block Diagram



Standard Microcircuit Drawing Equivalence Table

| Standard Microcircuit Drawing Number | Vendor Cage Code | IR Standard Part Number |
|--------------------------------------|------------------|-------------------------|
| 5962-92159 | 52467 | ATR2815T |
| 5962-93158 | 52467 | ATR2812T |

Mechanical Outlines



Pin Designation

| Pin # | Designation |
|-------|---------------|
| 1 | + Input |
| 2 | +5Vdc Output |
| 3 | Output Return |
| 4 | - Dual Output |
| 5 | + Dual Output |
| 6 | NC |
| 7 | Case Ground |
| 8 | Enable Input |
| 9 | Sync Input |
| 10 | Input Return |

ATR28XXT Series

International
IR Rectifier

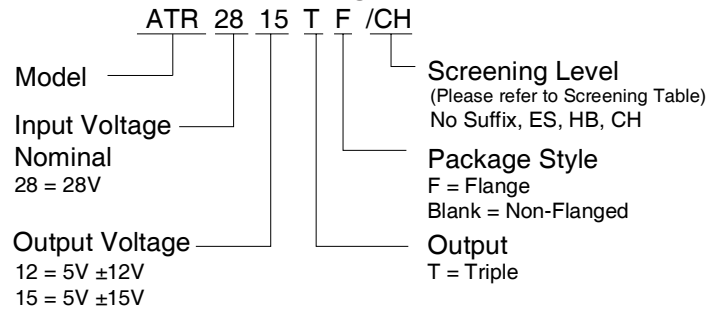
Device Screening

| Requirement | MIL-STD-883 Method | No Suffix | ES ② | HB | CH |
|------------------------------|-------------------------------|----------------|-------------------|----------------------|----------------------|
| 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 Bond Pull | 2023 | N/A | N/A | N/A | N/A |
| Internal Visual | 2017 | ① | 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 (Group A) | MIL-PRF-38534 & Specification | 25°C | 25°C ② | -55°C, +25°C, +125°C | -55°C, +25°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 | ① | 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



International
IR Rectifier

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Visit us at www.irf.com for sales contact information.

Data and specifications subject to change without notice. 08/2007