

Description

These 10 Watt DC/DC converters were designed for fast integration with your system's power needs. With no external components or filtering necessary for all but the most critical applications, these converters can provide power instantly. This saves you costly engineering time required to design your system around the power converter.

Features

- Fully Self Contained, No External Parts Required for Operation
- Low and Specified Input/Output Capacitance
- Efficiencies to 85%
- Overcurrent Protected for Long, Reliable Operation
- Five-sided, Shielded, Low Thermal Gradient **Copper Case**
- Water Washable Case Design
- Five Year Warranty

Selection Chart					
Model	Input VI	Range DC	Output	Output mA	
	Min	Max	VDC		
12S3.2000NT	9	18	3.33	2000	
12S5.2000NT	9	18	5	2000	
12S12.900NT	9	18	12	900	
12S15.700NT	9	18	15	700	
24S3.2000NT	18	36	3.33	2000	
*24S5.2000NT	18	36	5	2000	
24S12.900NT	18	36	12	900	
24S15.700NT	18	36	15	700	
*48S3.2000NT	36	72	3.33	2000	
*48S5.2000NT	36	72	5	2000	
*48S12.900NT	36	72	12	900	
*48S15.700NT	36	72	15	700	
48S5.1500NT	20	60	5	1500	

*Agency Approvals: CSA/UL 60950

10 Watt NT Single Series Block Diagram



Input Parameters*								
Model		12S3.2000NT	12S5.2000NT	12S12.900NT	12S15.700NT	24S3.2000NT	24S5.2000NT	Units
Voltage Range	MIN MAX	9 18 18 36					8 6	VDC
Deflected Disple (0)	TYP	280 440				140	210	mA P-P
Reflected Ripple (2)	TYP	90		145		45	70	mA RMS
Input Current Full Load No Load	TYP TYP	710 7	1070 7	1100 12	1060 15	340 7	500 7	mA
Efficiency	TYP	78	78	82	83	82	83	%
Switching Frequency	TYP			22	20			kHz
Maximum Input Overvoltage, 100ms Maximum	MAX		24 45					VDC
Turn-on Time, 1% Output Error	TYP			6	6			ms
Recommended Fuse				(3	3)			AMPS
Model	_	24S12.900NT	24S15.700NT	48S3.2000NT	48S5.2000NT	48S12.900NT	48S15.700NT	Units
Voltage Range	MIN MAX	1	8 6		36 72			VDC
Reflected Ripple (2)	TYP	2	10	100		150		mA P-P
	TYP	7	0	35		50	50	
Input Current Full Load No Load	TYP TYP	530 10	510 10	170 6	260 6	270 6	260 6	mA
Efficiency	TYP	85	86	80	81	83	84	%
Switching Frequency	TYP	220				kHz		
Maximum Input Overvoltage, 100ms Maximum	MAX	45 85				VDC		
Turn-on Time, 1% Output Error	TYP		6					
Recommended Fuse		(3) AN						AMPS
Model		48\$5.1500NT					Units	
Voltage Range	MIN MAX	20 60					VDC	
Poflacted Dippla (2)	TYP	130 n					mA P-P	
Reflected Ripple (2)	TYP	40 mA					mA RMS	
Input Current Full Load No Load	TYP TYP	200 6						mA
Efficiency	TYP		78					
Switching Frequency	TYP	220						kHz
Maximum Input Overvoltage, 100ms Maximum	MAX	72					VDC	
Turn-on Time, 1% Output Error	TYP	6					ms	
Recommended Fuse		(3) A				AMPS		

NOTES

- All parameters measured at Tc = 25°C, nominal input voltage and full rated load unless otherwise noted. Refer to the CALEX Application Notes for the definition of terms, measurement circuits and other information.
- Noise is measured per CALEX Application Notes. Measurement (2)bandwidth is 0-20 MHz for peak-peak measurements, 10 kHz to 1 MHz for RMS measurements. Output noise is measured with a $0.01\mu F/100V$ ceramic capacitor in parallel with a $1\mu f/35V$ Tantalum capacitor, 1 inch from the output pins to simulate standard PCB decoupling capacitance.
- To determine the correct fuse size, see CALEX Application (3) Notes.
- (4) The Case is tied to the -input pin.
- (5) Short term stability is specified after a 30 minute warmup at full load, constant line and recording the drift over a 24 hour period.
- The transient response is specified as the time required to settle (6) from a 50 to 75 % step load change (rise time of step = 2 μ Sec) to a 1% error band.

- (7) Dynamic response is the peak overshoot during a transient as defined in note 6 above.
- (8)The input ripple rejection is specified for DC to 120 Hz ripple with a modulation amplitude of 1% of Vin.
- The functional temperature range is intended to give an additional (9) data point for use in evaluating this power supply. At the low functional temperature the power supply will function with no side effects, however, sustained operation at the high functional temperature will reduce expected operational life. The data sheet specifications are not guaranteed over the functional temperature range.
- (10) The case thermal impedance is specified as the case temperature rise over ambient per package watt dissipated.
- (11) Specifications subject to change without notice.
- (12) Water Washability Calex DC/DC converters are designed to withstand most solder/wash processes. Careful attention should be used when assessing the applicability in your specific manufacturing process. Converters are not hermetically sealed.

2401 Stanwell Drive · Concord, California 94520 · Ph: 925/687-4411 or 800/542-3355 · Fax: 925/687-3333 · www.calex.com · Email: sales@calex.com eco# 041007-1, 060831-1

Output Parameters*							
Model		12S3.2000NT 24S3.2000NT 48S3.2000NT	12S5.2000NT 24S5.2000NT 48S5.2000NT	12S12.900NT 24S12.900NT 48S12.900NT	12S15.700NT 24S15.700NT 48S15.700NT	48S5.1500NT	Units
Output Voltage		3.33	5	12	15	5	VDC
Output Voltage Accuracy	MIN TYP MAX	3.30 3.33 3.36	4.95 5.00 5.05	11.90 12.00 12.10	14.90 15.00 15.10	4.95 5.00 5.05	VDC
Rated Load Range	MIN MAX	0.2 2.0	0.0 2.0	0.0 0.9	0.0 0.7	0.0 1.5	A
Load Regulation 25% Max Load - Max Load	TYP MAX	0.1 0.4	0.1 0.4	0.2 0.4	0.2 0.4	0.1 0.3	%
Line Regulation Vin = Min-Max VDC	TYP MAX	0.5 1.0	0.01 0.2	0.2 0.8	0.2 0.8	0.01 0.2	%
Short Term Stability (5)	TYP	< 0.05				%/24Hrs	
Long Term Stability	TYP	< 0.1				%/kHrs	
Transient Response (6)	TYP	100 250 250 400 500			500	μs	
Dynamic Response (7)	TYP	130	90	250	350	125	mV peak
Input Ripple Rejection (8)	TYP	> 40					dB
Noise, Peak - Peak (2)	TYP	60 75				mV P-P	
RMS Noise	TYP	6 5				mV RMS	
Temperature Coefficient	TYP MAX	50 150 pr					ppm/°C
Short Circuit Protection to Common for all Outputs Continuous, Current Limit Protection							

General Specifications*						
All Models						
Isolation (4)						
Isolation Voltage Input to Output 12S, 24S Input to Output 48S 10μA Leakage	MIN MIN	700 1544	VDC			
Input to Output Capacitance	TYP	400	pF			
Environmental						
Case Operating Range No Derating	MIN MAX	-40 90	°C			
Case Functional Range (9)	MIN MAX	-50 100	°C			
Storage Range	MIN MAX	-55 105	°C			
Thermal Impedance (10)	TYP	15	°C/Watt			
General						
Unit Weight	TYP	1.0	oz			
Chassis Mounting Kit	MS6, MS8, MS15					



Mechanical tolerances unless otherwise noted: X.XX dimensions: ±0.020 inches X.XXX dimensions: ±0.005 inches

Pin	Function
1	+INPUT
2	-INPUT
3	+OUTPUT
4	CMN

Applications Information

General Information

Adequate heat sinking and full filtering on both the input and output are included in the 10 Watt NT Single Series, preventing the need for additional components and heat sinking in most applications.

Full overload protection is provided by independent pulseby-pulse current limiting. These protection features assure you that our 10 Watt Single will provide zero failure rate operation.

A fully five-sided shielded, sealed, water washable case is standard along with specified operation over the full industrial temperature range of -40 to +90°C.

Applying the Input

Figure 1 shows the recommended connections for the 10 Watt NT Single DC/DC converter. A fuse is recommended to protect the input circuit and should not be omitted. The fuse serves an important purpose in preventing unlimited current from flowing in the case of a catastrophic system failure. See our application note on input fuse selection for more information.

No external capacitance on the input is required for normal operation. In fact, it can degrade the converter's performance. If extra filtering is desired on the input, see the low noise input circuit in Figure 2.

Extremely low ESR capacitors (< 0.25 ohms) should not be used at the input. This will cause peaking of the input filter's transfer function and actually degrade the filter's performance.

If desired, extra transient overvoltage protection may be added directly at the converter's input pins as shown in Figure 1.



Figure 1.

Standard connections for the 10 Watt NT Single. The input fuse should not be omitted. The overvoltage diodes D1 and D2 may be added to the circuit directly at the converter to provide transient protection to your circuit.

Applying the Output

The output is simply connected to your application circuit and away you go! If extra low output noise is required for your application the circuit shown in Figure 2 may be used to reduce the output noise to below 10 mV P-P.

No external capacitance on the output is required for normal operation. In fact, it can degrade the converter's performance. See our application note "Understanding DC/ DC Converters Output Impedance" and the low noise circuits for more information. The usual 1 to 10 µF aluminum or tantalum and 0.1 to 0.001 µF bypasses may be used around your PCB as required without harm.

Extra transient overvoltage protection may be added directly at the converter's output pins as shown in Figure 1.



Figure 2.

For very low noise applications the circuits shown above can be used. The input current ripple will be reduced approximately 30 dB of the original value while the output noise will be reduced to below 10 mV P-P. Do not use the biggest lowest ESR capacitors that you can find in these circuits. Large capacitors can cause severe peaking in the filter's transfer function and may actually make the conducted noise worse.

Isolation - Case Grounding

The input and output sections are fully floating from each other. They may be operated fully floating or with a common ground. If the input and output sections are connected either directly at the converter or at some remote location from the converter it is suggested that a 1 to 10 µF, 0.5 to 5 ohm ESR capacitor bypass be used directly at the converter output pins. This capacitor prevents any common mode switching currents from showing up at the converter's output as normal mode output noise. Do not use the lowest ESR, biggest value capacitor that you can find! This can only lead to reduced system performance or oscillation.

The case serves not only as a heat sink but also as an EMI shield. The 0.016 inch thick copper provides >25 dB of absorption loss to both electromagnetic and electric fields at 220 kHz, while at the same time providing about 30% more effective heat sinking than competitive 0.01 inch thick steel cases.

The case shield is tied to the -input pin. This connection is shown on the block diagram. The case is floating from the output, coupled only by the 400 pF of isolation capacitance. This low capacitance insures that any AC common mode noise on the inputs is not transferred to your output circuits.

Compare this isolation capacitance value to the 600 to 2000 pF found on competitive designs and you'll see that with CALEX you are getting the best DC and AC isolation available. After all, you are buying an isolated DC/DC converter to cut ground loops. Don't let the isolation capacitance add them back in.

Temperature Derating

The NT Single series can operate up to 90°C case temperature without derating. Case temperature may be roughly calculated from ambient by knowing that the 10 Watt NT Singles case temperature rise is approximately 15°C per package watt dissipated.

For example: If a 24 Volt input converter was delivering 7 Watts at 24 Volts input, at what ambient could it expect to run with no moving air and no extra heat sinking?

Efficiency for the NT Single is approximately 84%. Check the product curves for exact information. This leads to an input power of about 8.3 Watts. Therefore, the case dissipation is 8.3 Watts (input power) minus 7 Watts (output power) or 1.3 Watts. The case temperature rise would be 1.3 Watts x 15 = 20°C. This number is subtracted from the maximum case temperature of 90°C to get 70°C.

This is a rough approximation of the maximum ambient temperature. Because of the difficulty of defining ambient temperature and the possibility that the load's dissipation may actually increase the local ambient temperature significantly or that convection cooling is suppressed by physical placement of the module, these calculations should be verified by actual measurement of operating temperature and your circuit's exact efficiency (efficiency depends on both line input and load value) before committing to a production design.

Typical Performance (Tc=25°C, Vin=Nom VDC, Rated Load).

Data For 12 Volt Input Models







28 30 32 34 36

Data For 24 Volt Input Models



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Typical Performance (Tc=25°C, Vin=Nom VDC, Rated Load).

Data For 48 Volt Input Models







Data For 48S5.1500NT Only



Data For All Models













NOTES ON USING THE CURVES

These notes apply to all curves except the 48S5.1500NT curves.

- The input current curves are for 10.8 Watts of output power. For (1) 3.3 Volt output models the input current is approximately 35% less.
- The efficiency curves were generated for 12 Volt output models. (2)To use for other outputs adjust as follows:

3.33 Volt output......Subtract approximately 3% 5.0 Volt output......Subtract approximately 2% 15.0 Volt output......Add approximately 1%