10 Watt NT Single Series DC/DC Converters

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
- 5 Year Warranty
- RoHS Compliant

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.

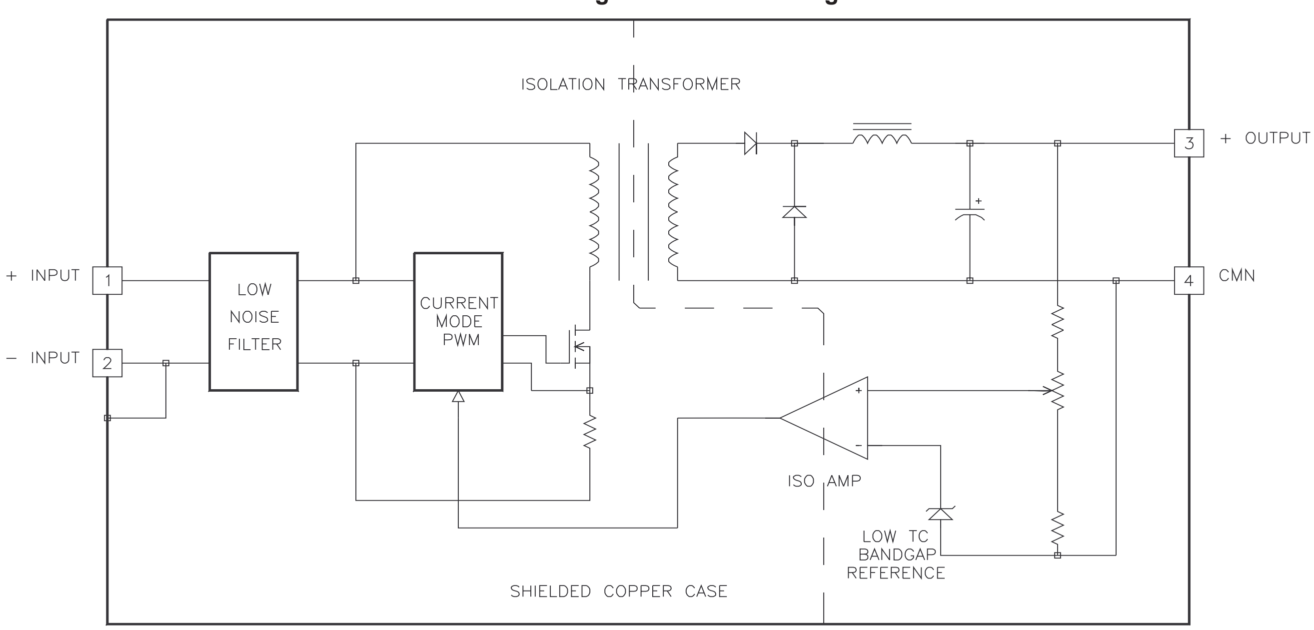
Selection Chart

Model	Input Range VDC		Outputs VDC	Outputs mA
	Min	Max		
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	36	60	5	1500

*Agency Approvals: CSA/UL 60950

**To order add "(RoHS)" to the part number. i.e 24S5.2000NT (RoHS)

10 Watt NT Single Series Block Diagram



Input Parameters (1)								
Model		**12S3.2000NT**	**12S5.2000NT**	**12S12.900NT**	**12S15.700NT**	**24S3.2000NT**	**24S5.2000NT**	**Units**
Voltage Range	MIN MAX	9 18				18 36		VDC
Reflected Ripple, (2)	TYP	280	440			140	210	mA P-P
	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	220						kHz
Maximum Input Overvoltage, 100 ms Maximum	MAX	24				45		VDC
Turn-on Time, 1% Output Error	TYP	6						ms
Recommended Fuse		(3)						AMPS
Model		**24S12.900NT**	**24S15.700NT**	**48S3.2000NT**	**48S5.2000NT**	**48S12.900NT**	**48S15.700NT**	**Units**
Voltage Range	MIN MAX	18 36		36 72				VDC
Reflected Ripple, (2)	TYP	210		110	150			mA P-P
	TYP	70		35	50			mA RMS
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, 100 ms Maximum	MAX	45		85				VDC
Turn-on Time, 1% Output Error	TYP	6						ms
Recommended Fuse		(3)						AMPS
Model		**48S5.1500NT**						**Units**
Voltage Range	MIN MAX	20 60						VDC
Reflected Ripple, (2)	TYP	130						mA P-P
	TYP	40						mA RMS
Input Current Full Load No Load	 TYP TYP	 200 6						mA
Efficiency	TYP	78						%
Switching Frequency	TYP	220						kHz
Maximum Input Overvoltage, 100 ms Maximum	MAX	72						VDC
Turn-on Time, 1% Output Error	TYP	6						ms
Recommended Fuse		(3)						AMPS

(1) All parameters measured at T_C=25ºC, 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

(2) Noise is measured per CALEX Application Notes. Measurement bandwidth is 0-20 MHz for peak-peak measurements, 10 kHz to 1 MHz for RMS measurements. Output noise is measured with a 0.01µF / 100V ceramic capacitor in parallel with a 1µF / 35V Tantalum capacitor, 1 inch from the output pins to simulate standard PCB decoupling capacitance.

(3) To determine the correct fuse size, see CALEX Application 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.

(6) The Transient response is specified as the time required to settle from a 50 to 75 % step load change (rise time of step = 2µSec) to a 1% error band.

(7) Dynamic response is the peak overshoot voltage during the transient as defined in note 6 above.

10 Watt NT Single Series DC/DC Converters

Output Parameters (1)							
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 MAX	<0.05					%/24 Hrs
Long Term Stability	TYP	<0.1					%/kHrs
Transient Response (6)	TYP	100	250	250	400	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	100				75	mV P-P
RMS Noise	TYP	6				5	mV RMS
Temperature Coefficient	TYP MAX	50 150					ppm/ºC
Short Circuit Protection to Common for all Outputs		Continuous, Current Limit Protection					

(8) The input ripple rejection is specified for DC to 120 Hz ripple with a modulation amplitude of 1% Vin.

(9) The functional temperature range is intended to give a additional 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 no guaranteed over the functional temperature range.

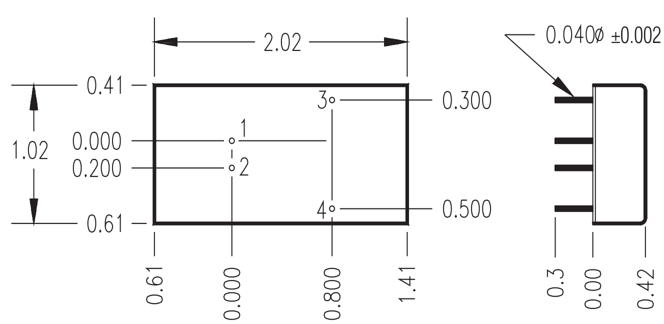
General Specifications			
All Models			**Units**
Isolation (4)			
Isolation Voltage Input-Output 12S, 24S Input-Output 48S 10µA Leakage	MIN MIN	700 1544	VDC
Input to Output Capacitance	TYP	400	pF
Environmental			
Case Operating Range No Derating	MIN MAX	-40 90	ºC
Case Functional Range (9)	MIN MAX	-50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

(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.

(13) RoHS Compliance -
See Calex website www.calex.com/RoHS.html for the complete RoHS compliance statement.
The RoHS marking is as follows. Pb RoHS



TOLERANCE: ALL DIMENSIONS ARE TYPICAL IN INCHES UNLESS OTHERWISE NOTED:	
X.XX	±0.020
X.XXX	±0.005

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

Application Information

General Information

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

Full overload protection is provided by independent pulse-by-pulse current limiting. These protection freatures 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 ºC.

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.

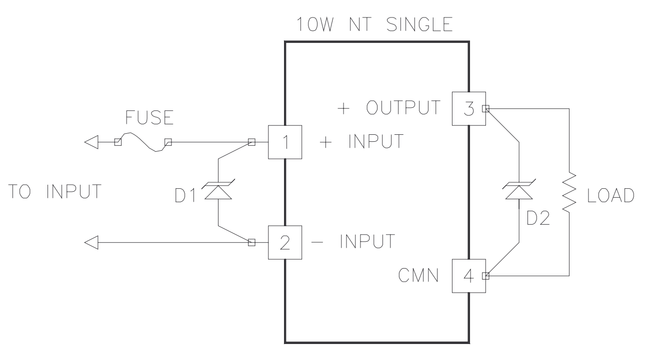


Figure 1.
Standard connections for the 10 Watt NT Single. The input fuse should not be omitted. The overvoltage diodes D1 and D2 may be added to the circuit directly at the converter to provide transient protection to your circuit.

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.

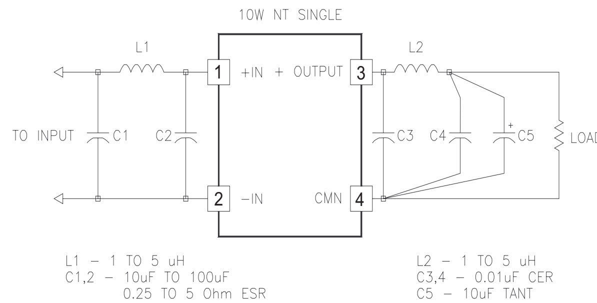


Figure 2.
For very low noise applications the circuits shown above can be used. The input current ripple will be reduced approximately 30 dB of the original value while the output noise will be reduced to below 10 mV P-P. Do not use the biggest ESR capacitors that you can find in these circuits. Large 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 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 head 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 200 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 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 vale 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 90ºC case temperature with derating. Case temperature may be roughly calculated from ambient by knowing that the 10 Watt NT Singles case temperature rise is approximately 10ºC per package watt dissipated.

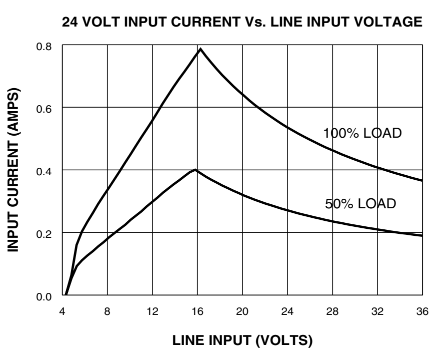
For example: if a 24 Volt input converter was delivering 7 Watts at 24 Volts input, at what ambient could it expect to run with no moving air and no extra sinking.

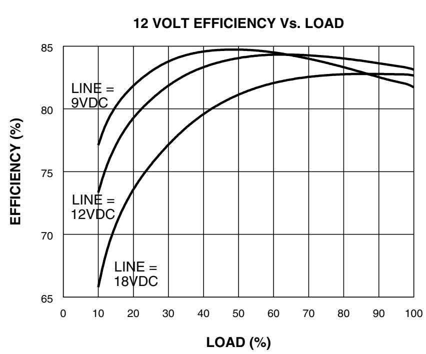
Efficiency for the NT Single is approximately 84%. Check the product curves for exact information. This leads to an input power of about 8.3 Watts. There fore, the case dissipation is 8.3 Watts (input power) minus 7 Watts (output power) or 1.3 Watts. The case temperature rise would be 1.3 Watts x 15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

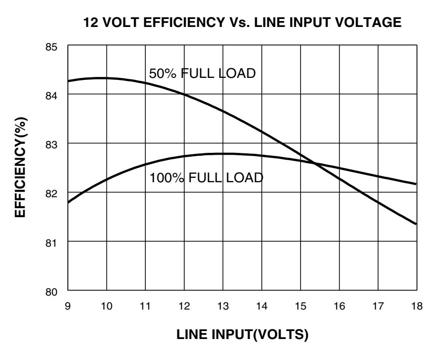
This is a rough approximation of the maximum ambient temperature. Because of the difficulty of defining ambient temperature and the possibility that the load's dissipation may actually increase the local ambient temperature significantly or the convection cooling is suppressed by physical placement of 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=25ºC, Vin=Nom VDC, Rated Load).

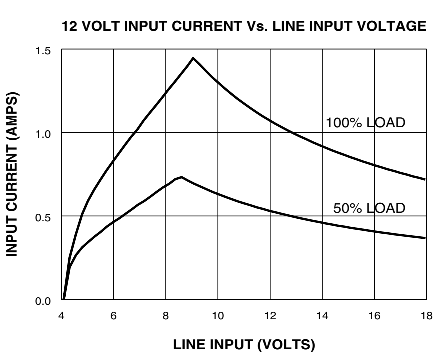
Data for 12 Volt Input Models

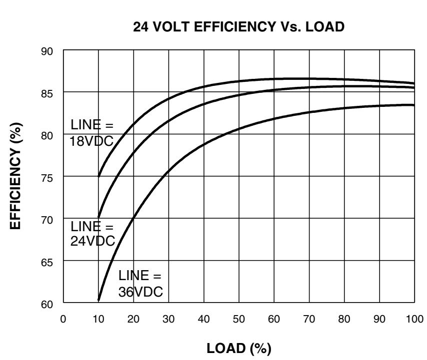


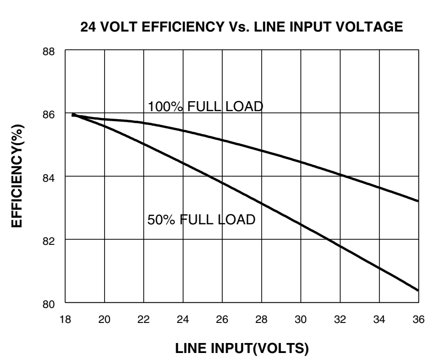




Data for 24 Volt Input Models



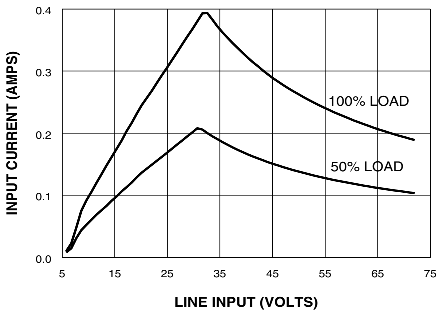




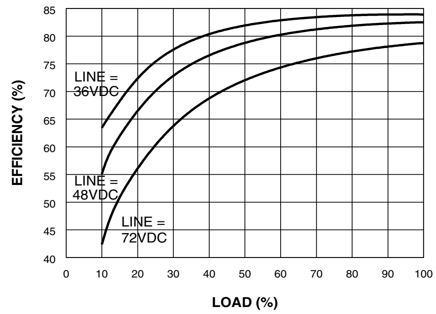
Typical Performance (Tc=25ºC, Vin=Nom VDC, Rated Load).

Data for 48 Volt Input Models

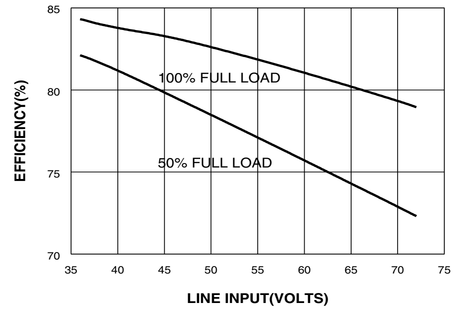
48 VOLT INPUT CURRENT Vs. LINE INPUT VOLTAGE



48 VOLT EFFICIENCY Vs. LOAD

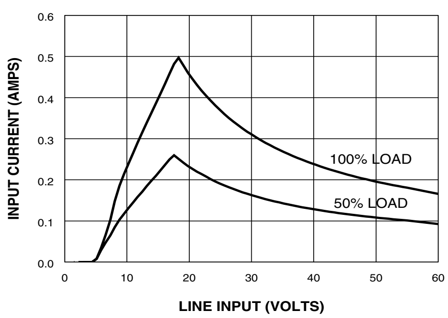


48 VOLT EFFICIENCY Vs. LINE INPUT VOLTAGE

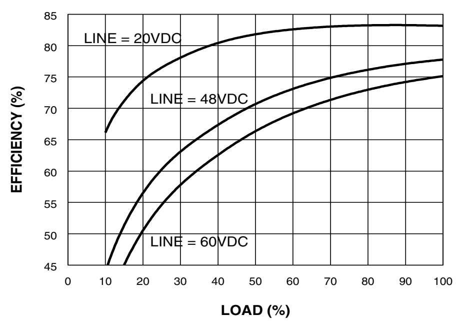


Data for 48S5.1500NT Only

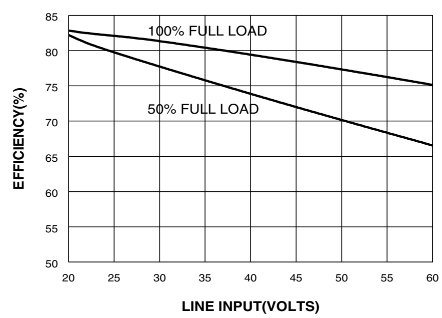
INPUT CURRENT Vs. LINE INPUT VOLTAGE



EFFICIENCY Vs. LOAD

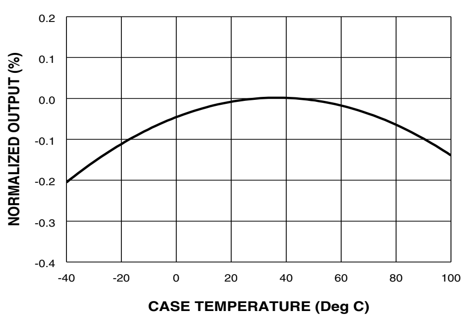


48 VOLT EFFICIENCY Vs. LINE INPUT VOLTAGE

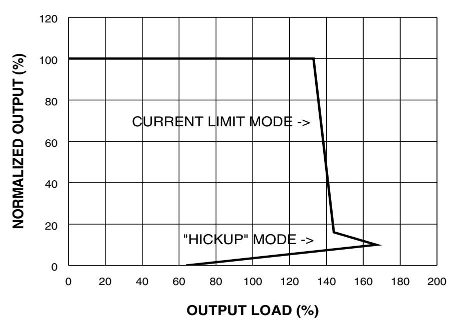


Data For All Models

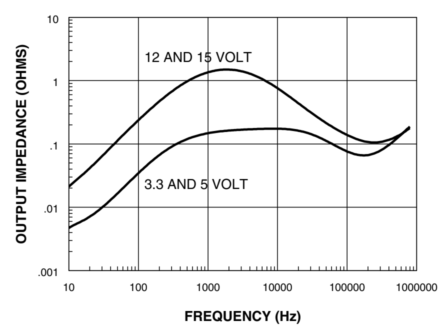
OUTPUT VOLTAGE Vs. CASE TEMPERATURE



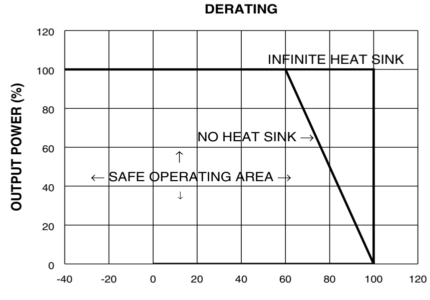
OUTPUT VOLTAGE Vs. OUTPUT LOAD



OUTPUT IMPEDANCE Vs. FREQUENCY



DERATING



NOTES ON USING THE CURVES

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

(1) The input current curves are for 10.8 Watts of output power. For 3.3 Volt output models the input current is approximately 35% less.

(2) The efficiency curves were generated for 12 Volt output models. 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%