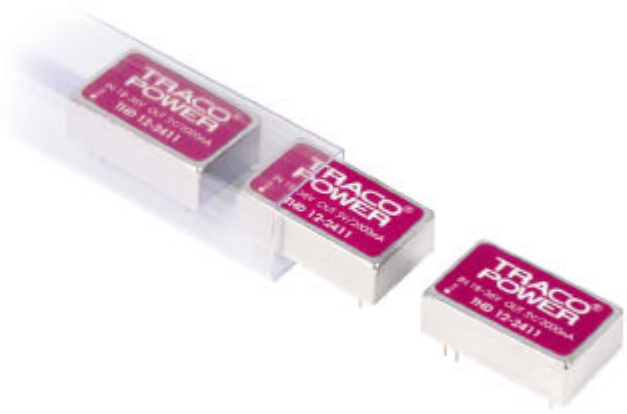
THD 12-WI Series Application Note

DC/DC Converter 9 to 36Vdc or 18 to 75 Vdc input voltage
3.3 to 15 Vdc Single Output and ±5 to ±15 Vdc Dual Output 12Watts Output Power



E188913

Complete THD 12-WI datasheet can be downloaded at:
http://www.tracopower.com/products/thd12WI.pdf

Features

- RoHS compliant
- Single output up to 3.5A
- Dual Output up to ±1.2A
- Standard 24 PIN DIP
- Five-sided continuous shield
- No minimum load required
- High power density
- High efficiency up to 88%
- Small size 31.8×20.3×10.4mm (1.25×0.8×0.450 inch)
- Input to output isolation (1500VDC / 60 seconds)
- 4:1 ultra wide input voltage range
- Fixed switching frequency
- Input under-voltage protection
- Output over-voltage protection
- Over-current protection
- Output short circuit protection
- Remote on/off

Applications

- Distributed power architectures
- Workstations
- Computer equipment
- Communications equipment

General Description

The THD 12-WIseries offer 12 watts of output power from a package in an IC compatible 24pin DIP. THD 12-WI series have 4:1 ultra wide input voltage of 9-36VDC, 18-75VDC. THD 12-WI series features 1500VDC of isolation, short circuit protection and five sided shielding. All models are particularly suited to telecommunications, industrial, mobile telecom and test equipment applications.

Table of contents

Absolute Maximum Rating				
Parameter	**Model**	**Min**	**Max**	**Unit**
Input Voltage				
Continuous	THD 12-24xxWI		40	Vdc
	THD 12-48xxWI		80	V
Transient (100ms)	THD 12-24xxWI		50	Vdc
	THD 12-48xxWI		100	V
Input Voltage Variation (complies with EST300 132 part 4.4)	All		5	V/ms
Operating Ambient Temperature (with derating)	All	-40	85	°C
Operating Case Temperature	All		105	°C
Storage Temperature	All	-55	125	°C

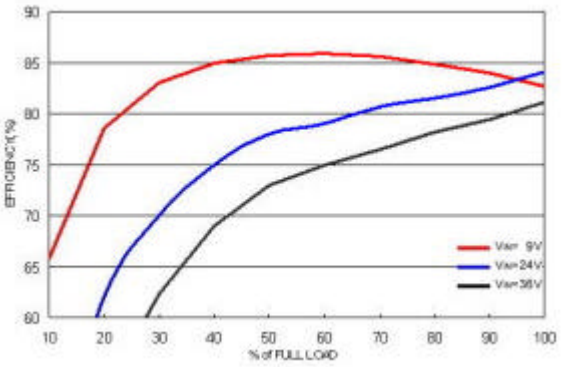
Output Specification					
Parameter	Model	Min	Typ	Max	Unit
Output Voltage	THD 12-xx10WI	3.260	3.3	3.340	
(V_{in} = $V_{in\,nom}$; Full Load; T_A = 25°C)	THD 12-xx11WI	5.039	5.1	5.161	
	THD 12-xx12WI	11.856	12	12.144	
	THD 12-xx13WI	14.820	15	15.180	Vdc
	THD 12-xx21WI	±4.940	±5.0	±5.060	
	THD 12-xx22WI	±11.856	±12.0	±12.144	
	THD 12-xx23WI	±14.820	±15.0	±15.180	
Output Regulation					
Line ($V_{in\,min}$ to $V_{in\,max}$ at Full Load)	All	-0.2		+0.2	%
Load (0% to 100% of Full Load) DIP type		-0.5		+0.5	
Output Ripple & Noise (see page 21) Peak-to-Peak (5Hz to 20MHz bandwidth)	All			85	mV pk-pk
Temperature Coefficient	All	-0.02		+0.02	%/°C
Output Voltage Overshoot (V_{in} = $V_{in\,min}$ to $V_{in\,max}$; Full Load ; T_A = 25°C)	All		0	3	% V_{out}
Dynamic Load Response (V_{in} = $V_{in\,nom}$; T_A = 25°C) Load step change from 75% to 100% or 100 to 75% of Full Load					
Peak Deviation	All		200		mV
Setting Time (Vo< 10% peak deviation)	All		250		µs
Output Current	THD 12-xx10WI	0		3500	
	THD 12-xx11WI	0		2400	
	THD 12-xx12WI	0		1000	
	THD 12-xx13WI	0		800	mA
	THD 12-xx21WI	0		±1200	
	THD 12-xx22WI	0		±500	
	THD 12-xx23WI	0		±400	
Output Over Voltage Protection	THD 12-xx10WI		3.9		
(only Single Output; Zener diode clamp)	THD 12-xx11WI		6.2		Vdc
	THD 12-xx12WI		15		
	THD 12-xx13WI		18		
Output Over Current Protection	All		150		% FL.
Output Short Circuit Protection	All	Continuous, automatics recovery			

Input Specification					
Parameter	Model	Min	Typ	Max	Unit
Operating Input Voltage	THD 12-24xxWI THD 12-48xxWI	9 18	24 48	36 75	Vdc
Input Current (Maximum value at $V_{in} = V_{in\,nom}$; Full Load)	THD 12-2410WI THD 12-2411WI THD 12-2412WI THD 12-2413WI THD 12-2421WI THD 12-2422WI THD 12-2423WI THD 12-4810WI THD 12-4811WI THD 12-4812WI THD 12-4813WI THD 12-4821WI THD 12-4822WI THD 12-4823WI			602 614 610 610 625 610 610 301 307 302 298 309 301 301	mA
Input Standby current (Typical value at $V_{in} = V_{in\,nom}$; No Load)	THD 12-2410WI THD 12-2411WI THD 12-2412WI THD 12-2413WI THD 12-2421WI THD 12-2422WI THD 12-2423WI THD 12-4810WI THD 12-4811WI THD 12-4812WI THD 12-4813WI THD 12-4821WI THD 12-4822WI THD 12-4823WI		55 55 25 25 20 25 25 20 20 13 13 10 13 13		mA
Under Voltage Lockout Turn-on Threshold	THD 12-24xxWI THD 12-48xxWI		9 18		Vdc
Under Voltage Lockout Turn-off Threshold	THD 12-24xxWI THD 12-48xxWI		8 16		Vdc
Input reflected ripple current (see page 21) (5 to 20MHz, 12µH source impedance)	All		20		mA pk-pk
Start Up Time ($V_{in} = V_{in\,nom}$ and constant resistive load) Power up Remote ON/OFF	All		 450 5		ms
Remote ON/OFF Control (see page 25) (The On/Off pin voltage is referenced to negative input) On/Off pin High Voltage (Remote ON) On/Off pin Low Voltage (Remote OFF) On/Off pin Low Voltage, input current	All	 3.0 0		 12 1.2 2.5	 Vdc Vdc mA

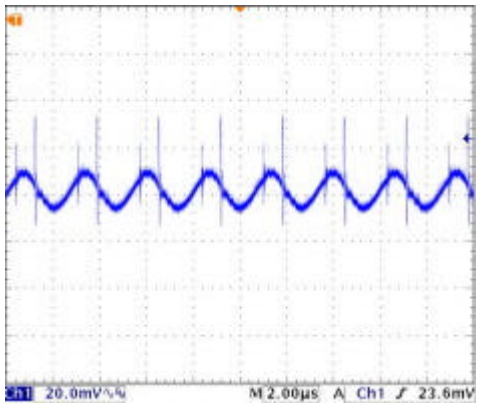
General Specification					
Parameter	**Model**	**Min**	**Typ**	**Max**	**Unit**
Efficiency (see page 21) (V_{in} = $V_{in\,nom}$; Full Load; T_A = 25°C)	THD 12-2410WI THD 12-2411WI THD 12-2412WI THD 12-2413WI THD 12-2421WI THD 12-2422WI THD 12-2423WI THD 12-4810WI THD 12-4811WI THD 12-4812WI THD 12-4813WI THD 12-4821WI THD 12-4822WI THD 12-4823WI		84.0 87.0 86.0 86.0 84.0 86.0 86.0 84.0 87.0 87.0 88.0 85.0 87.0 87.0		%
Isolation voltage 60 seconds Input to Output DIP TYPE Input to Case, Output to Case DIP TYPE	All	 1500 1500			Vdc
Isolation resistance	All	1			GO
Isolation capacitance	All			1500	pF
Switching Frequency	All		400		KHz
Weight	All		18.0		g
MTBF Bellcore TR-NWT-000332, TC = 40°C MIL-STD-217F	All		2'350'000 875'000		hours

Characteristic Curves

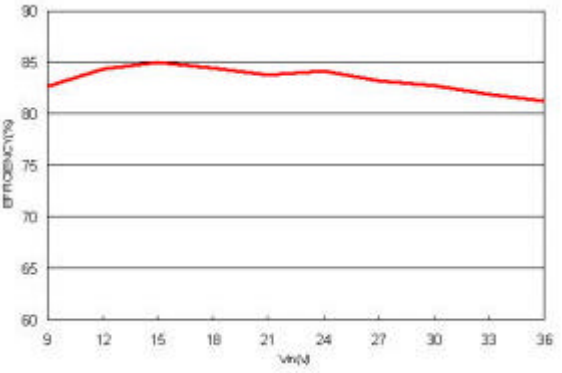
All test conditions are at 25°C. The figures are identical for THD 12-2410WI



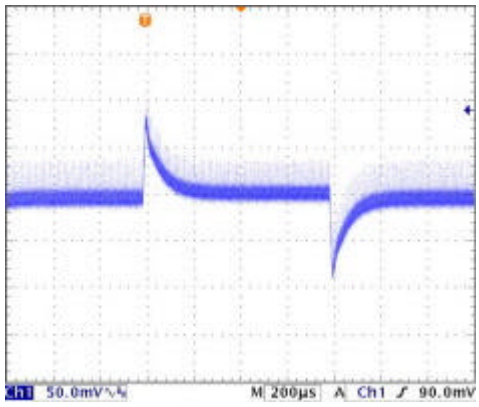
Efficiency versus Output Current



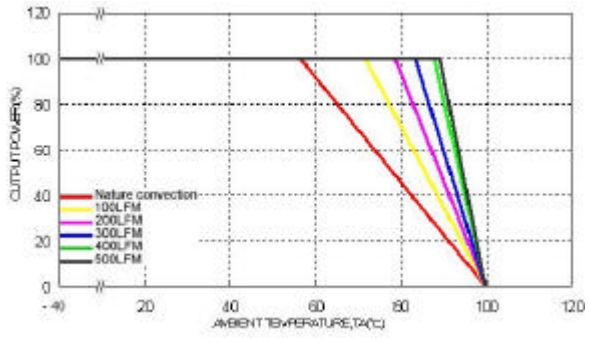
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



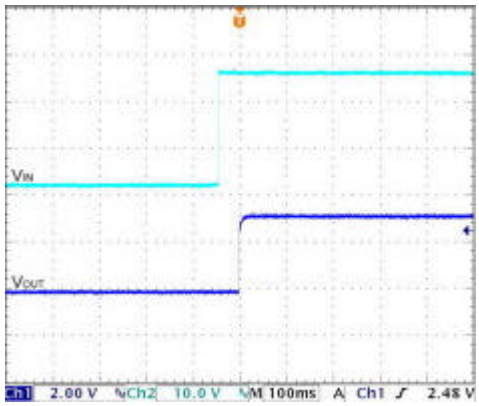
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



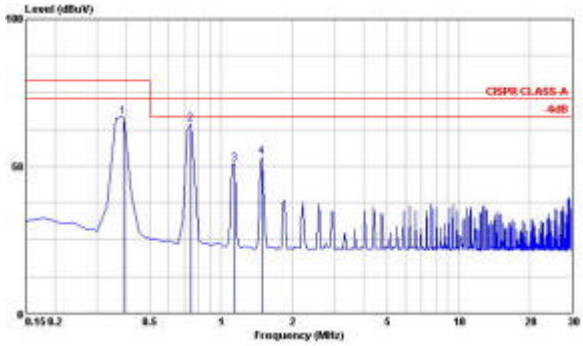
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



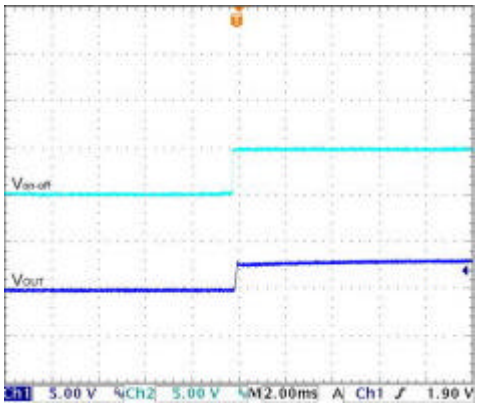
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

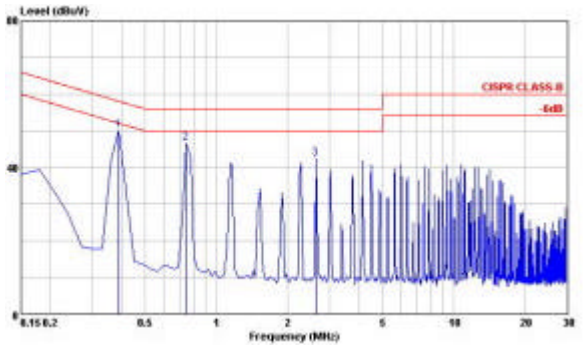
All test conditions are at 25°C. The figures are identical for THD 12-2410WI (Continued)



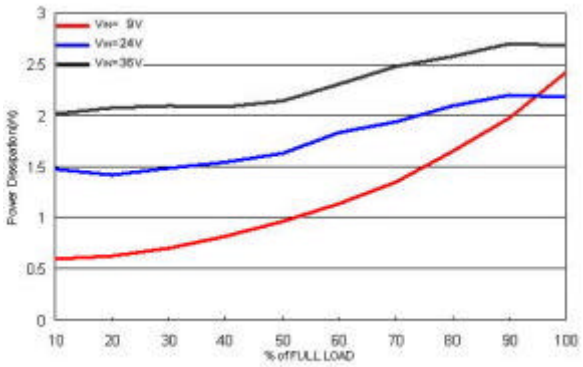
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



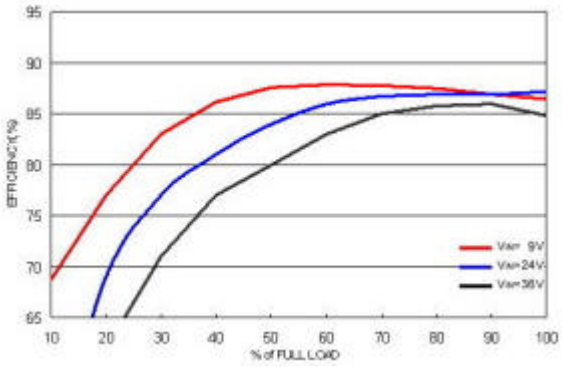
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



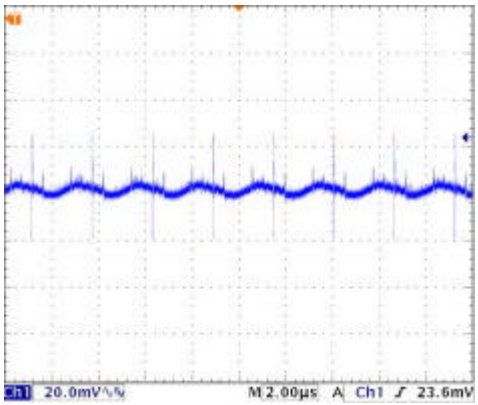
Power Dissipation versus Output Current

Characteristic Curves

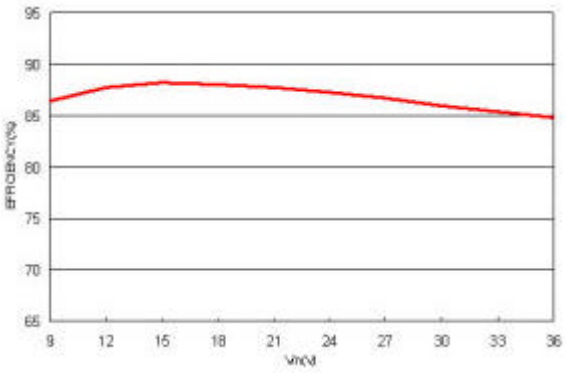
All test conditions are at 25°C. The figures are identical for THD 12-2411WI



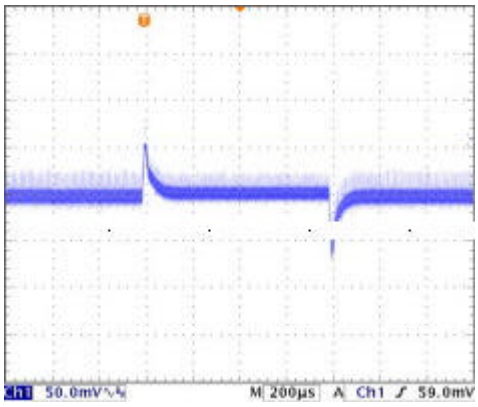
Efficiency versus Output Current



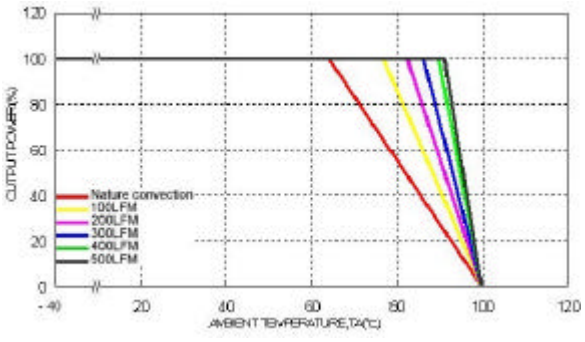
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



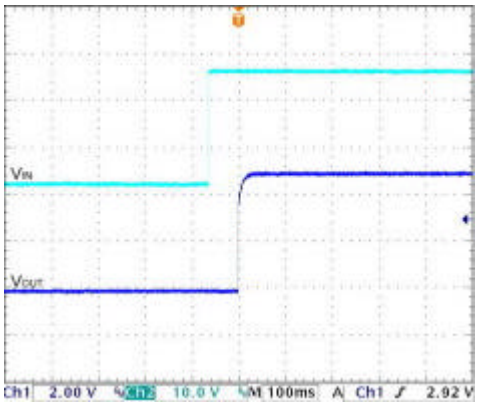
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



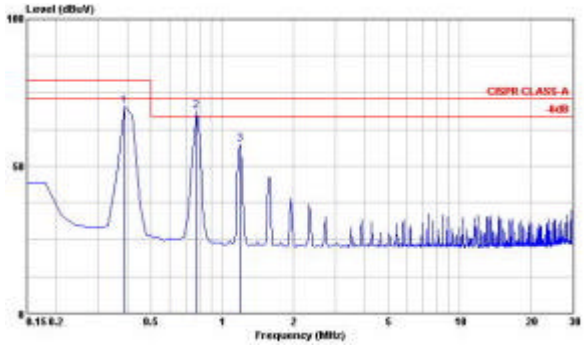
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



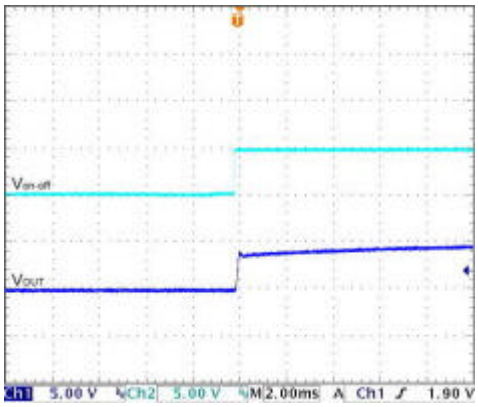
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

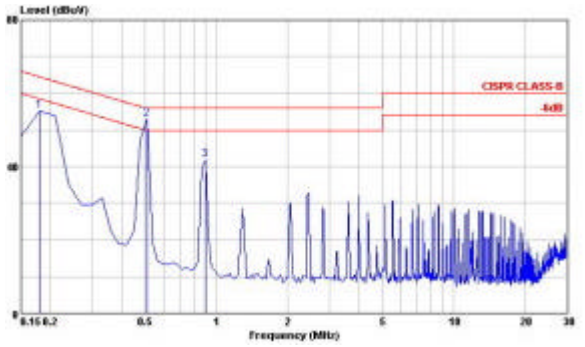
All test conditions are at 25°C. The figures are identical for THD 12-2411WI (Continued)



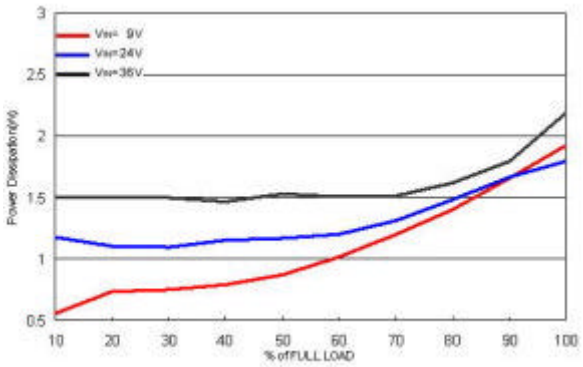
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



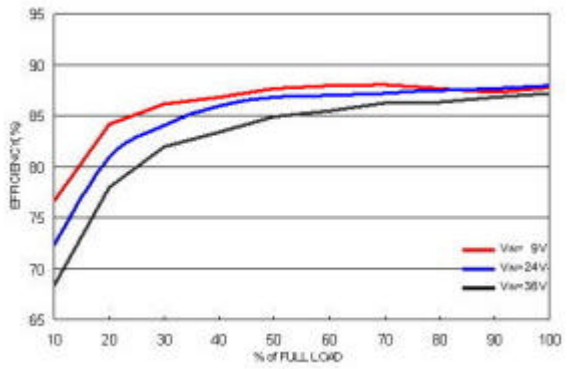
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



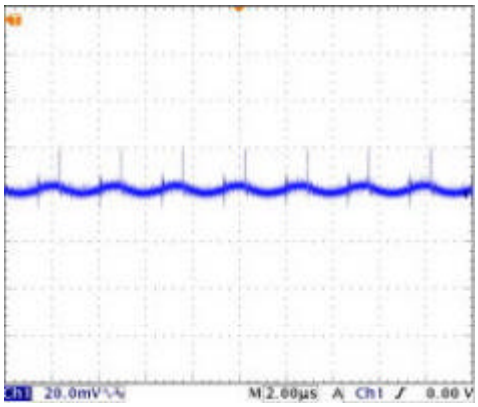
Power Dissipation versus Output Current

Characteristic Curves

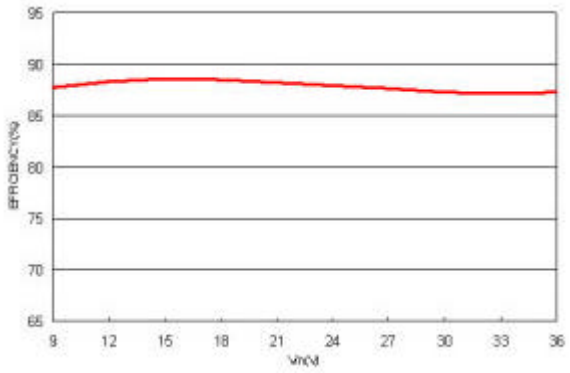
All test conditions are at 25°C. The figures are identical for THD 12-2412WI



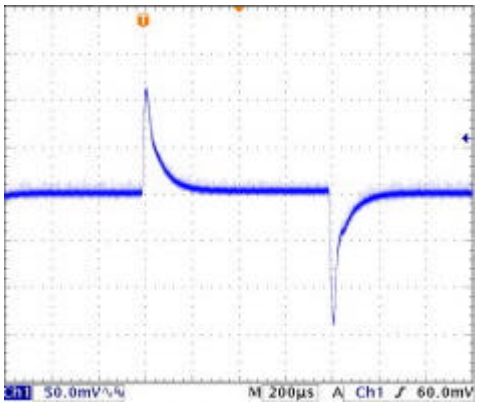
Efficiency versus Output Current



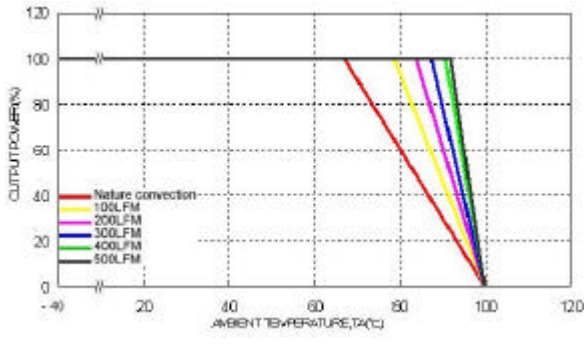
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



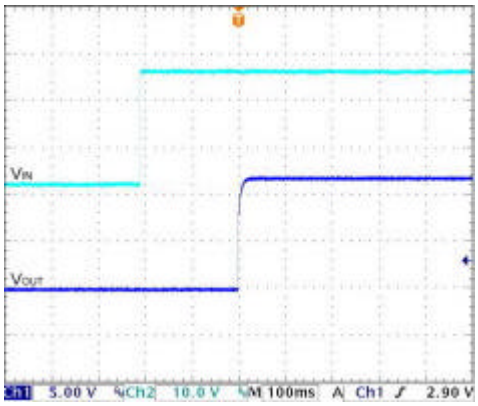
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



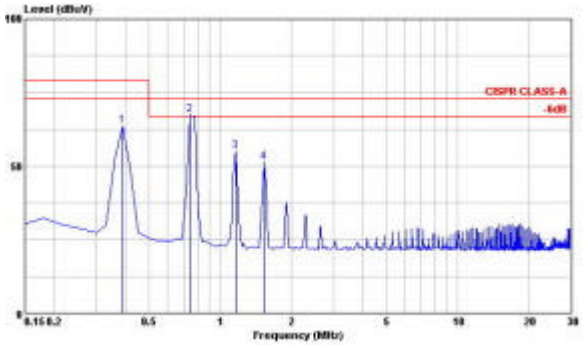
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



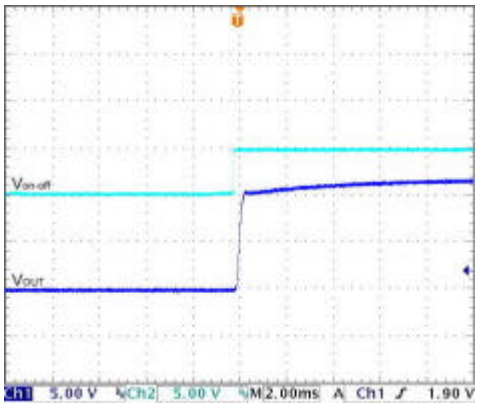
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

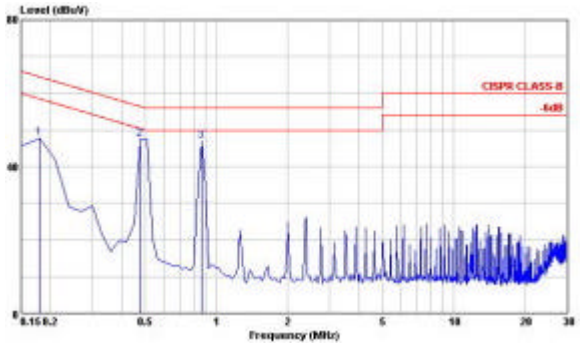
All test conditions are at 25°C. The figures are identical for THD 12-2412WI (Continued)



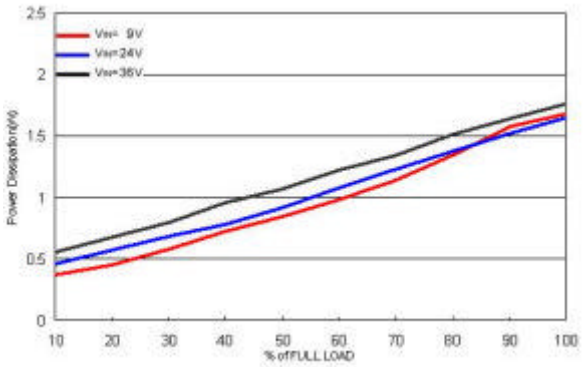
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



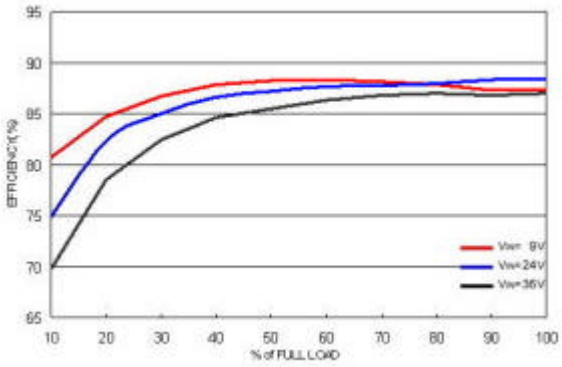
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



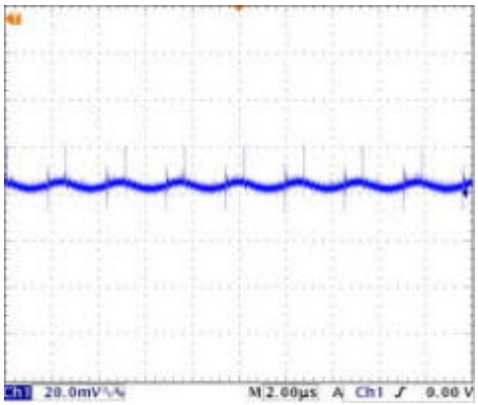
Power Dissipation versus Output Current

Characteristic Curves

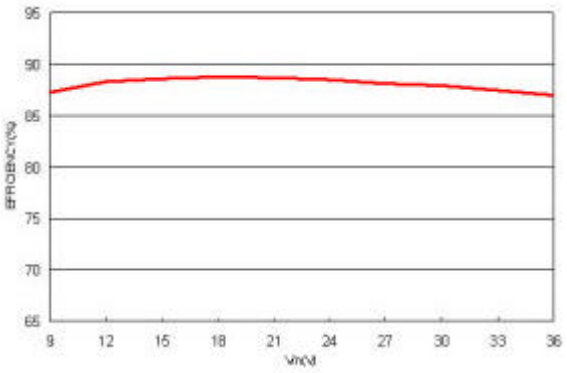
All test conditions are at 25°C. The figures are identical for THD 12-2413WI



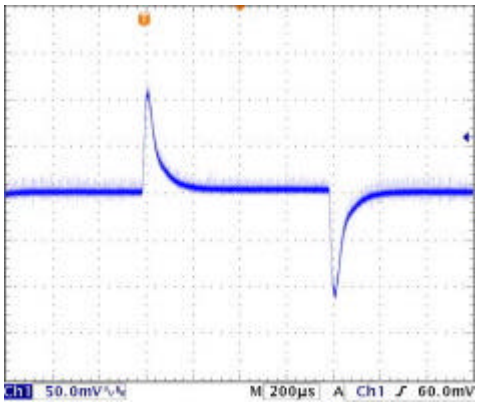
Efficiency versus Output Current



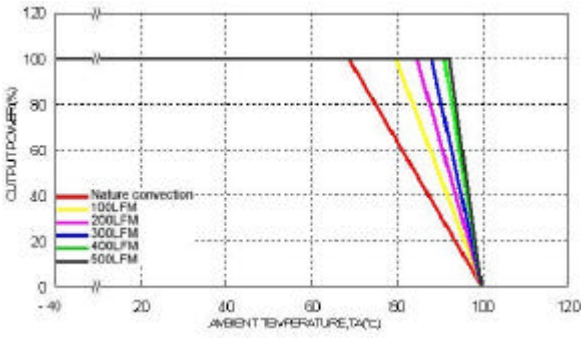
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



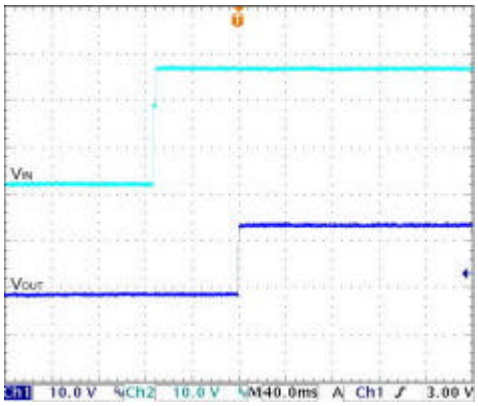
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



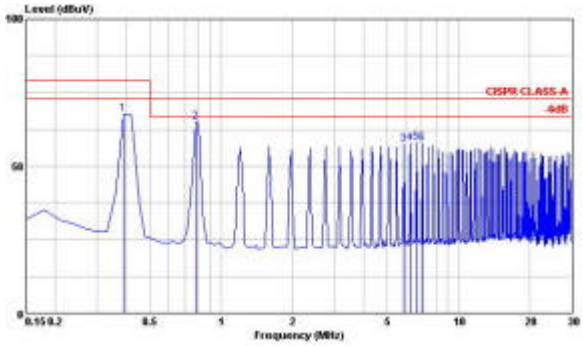
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



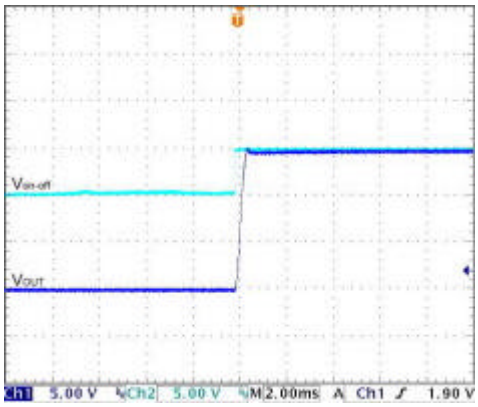
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

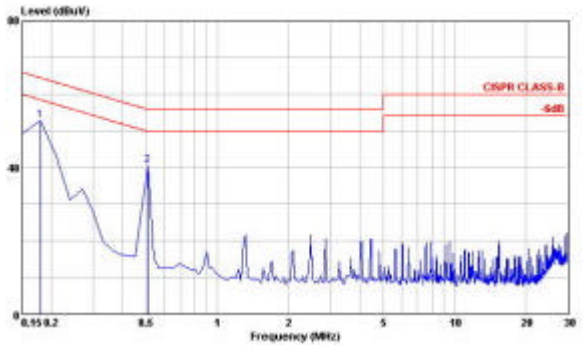
All test conditions are at 25°C. The figures are identical for THD 12-2413WI (Continued)



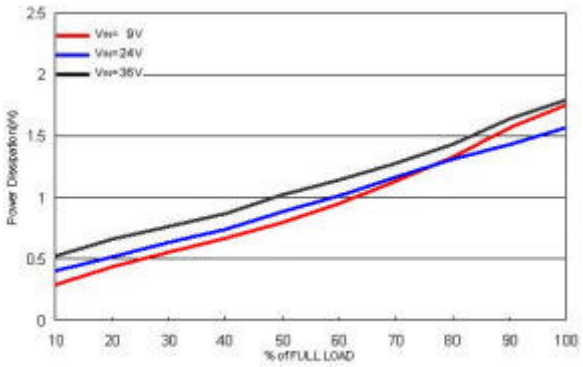
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



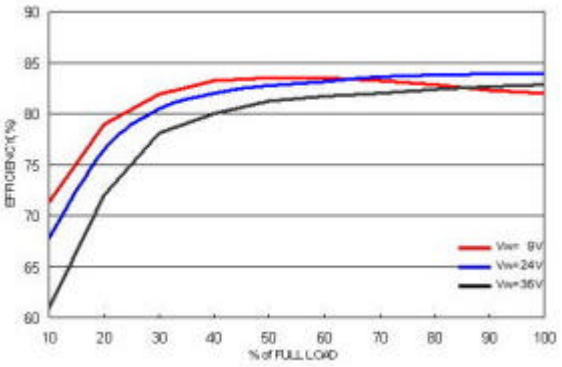
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



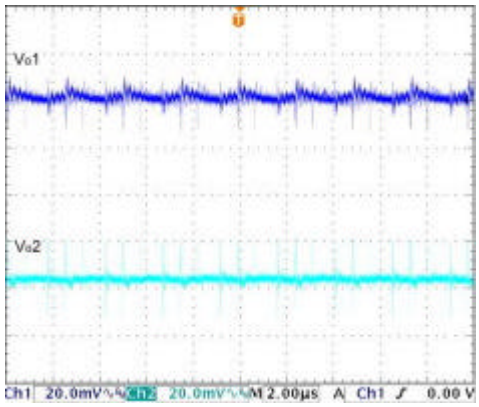
Power Dissipation versus Output Current

Characteristic Curves

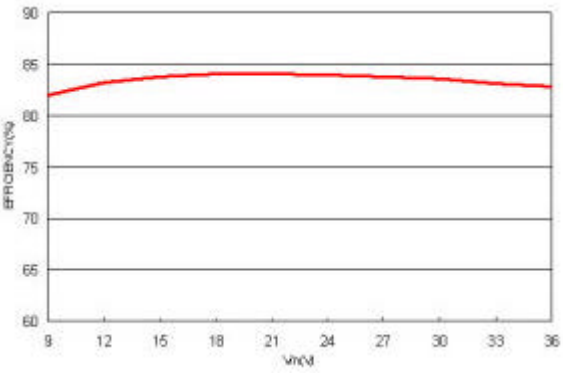
All test conditions are at 25°C. The figures are identical for THD 12-2421WI



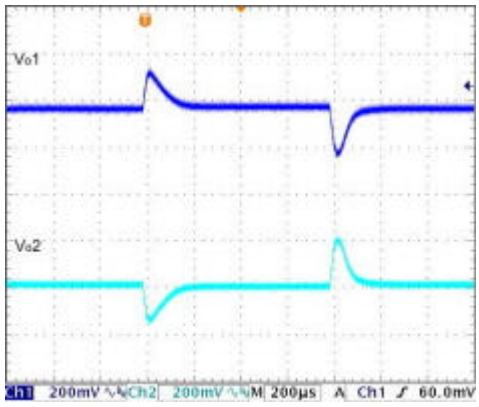
Efficiency versus Output Current



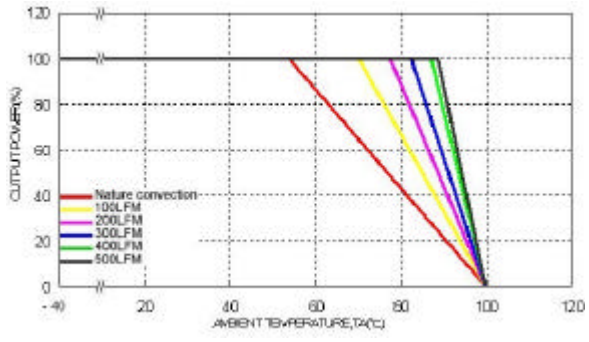
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



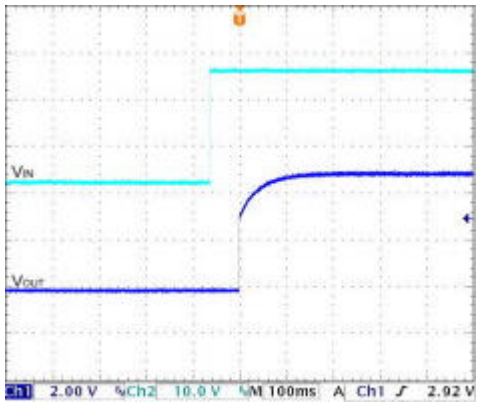
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



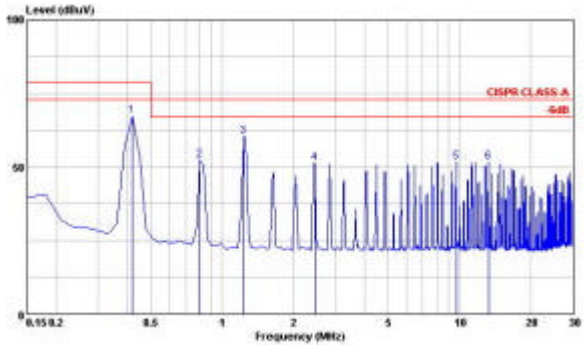
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



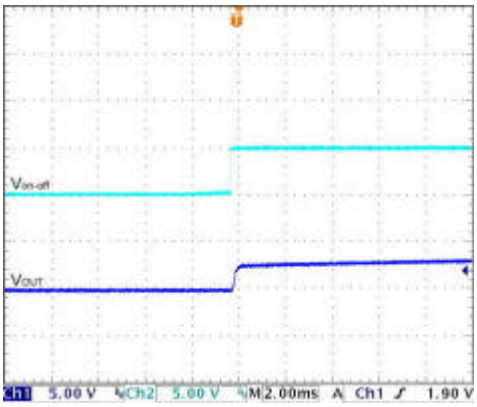
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

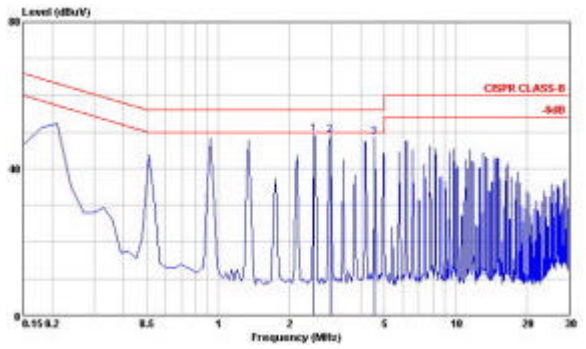
All test conditions are at 25°C. The figures are identical for THD 12-2421WI (Continued)



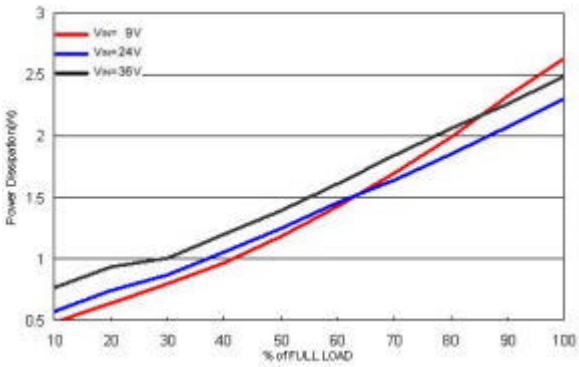
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



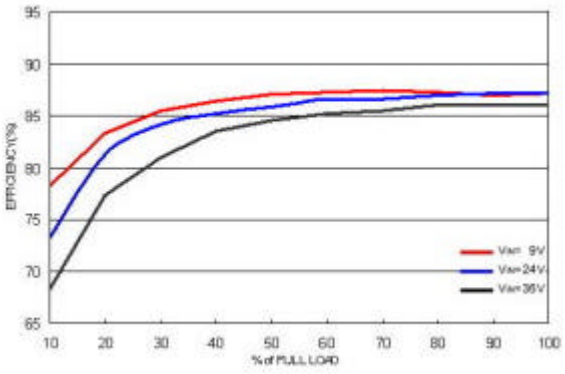
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



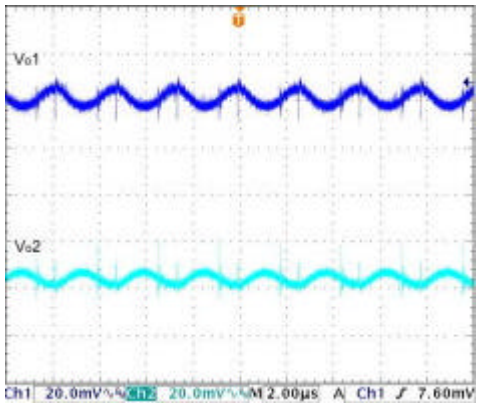
Power Dissipation versus Output Current

Characteristic Curves

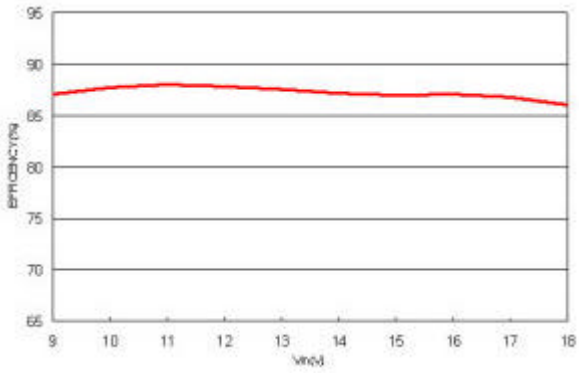
All test conditions are at 25°C. The figures are identical for THD 12-2422WI



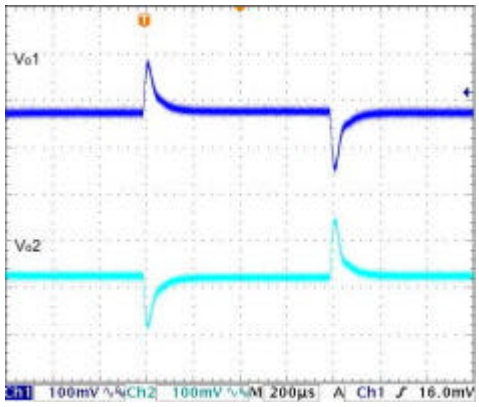
Efficiency versus Output Current



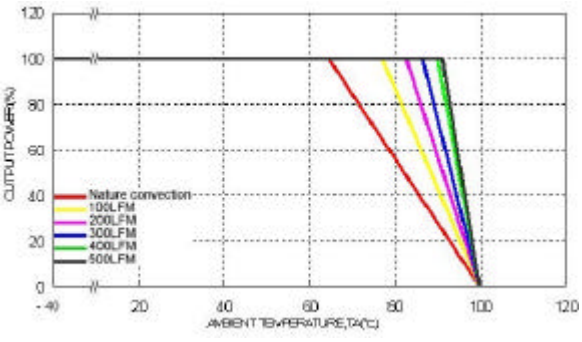
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



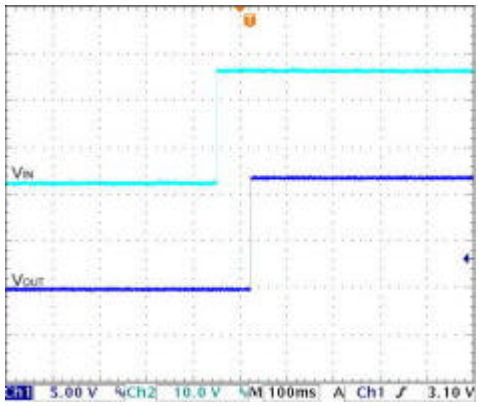
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



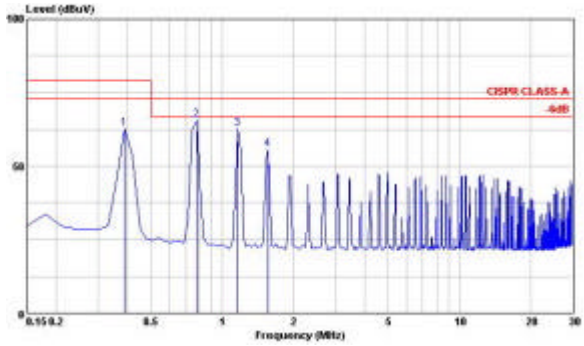
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



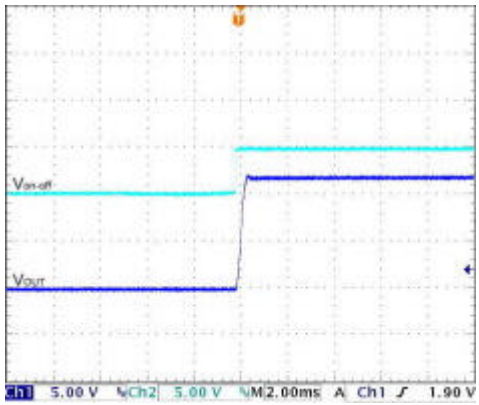
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

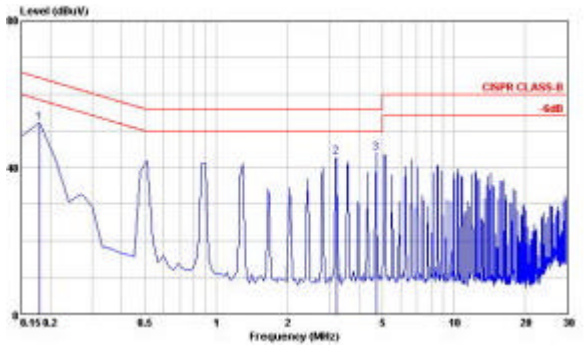
All test conditions are at 25°C. The figures are identical for THD 12-2422WI (Continued)



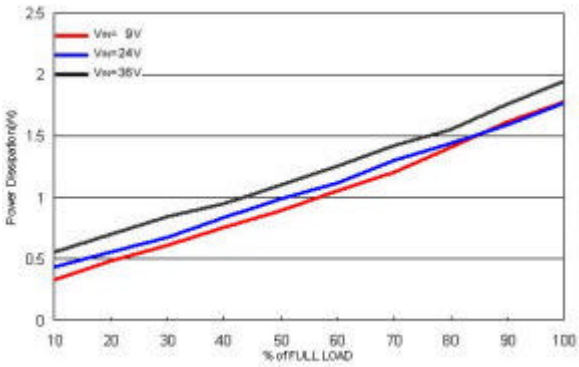
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



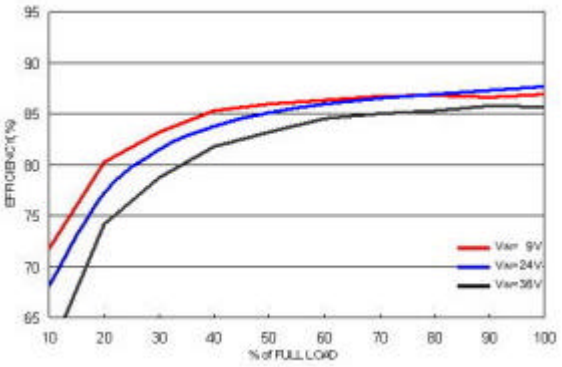
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



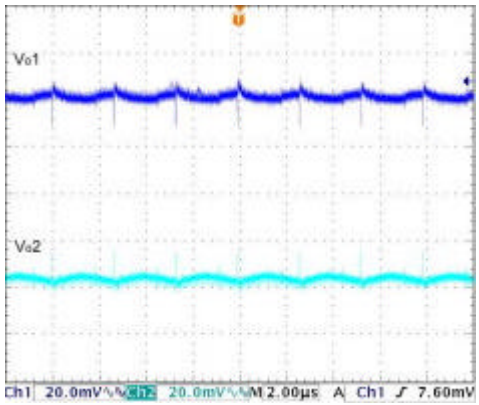
Power Dissipation versus Output Current

Characteristic Curves

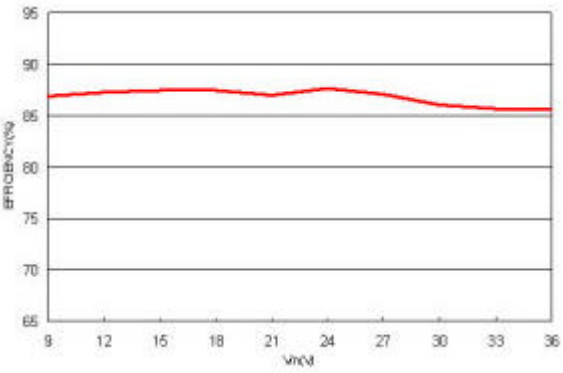
All test conditions are at 25°C. The figures are identical for THD 12-2423WI



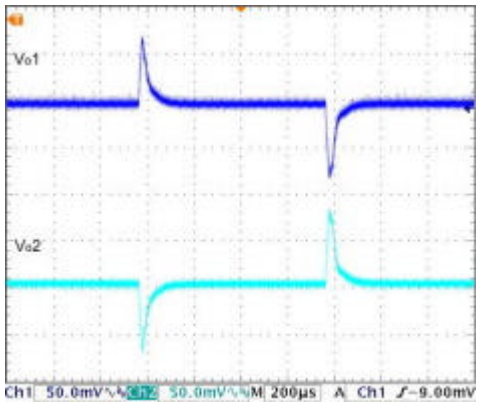
Efficiency versus Output Current



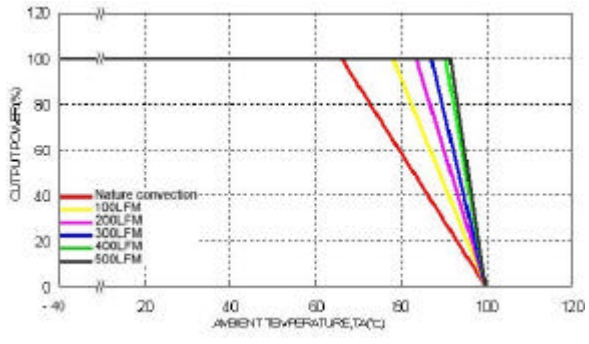
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



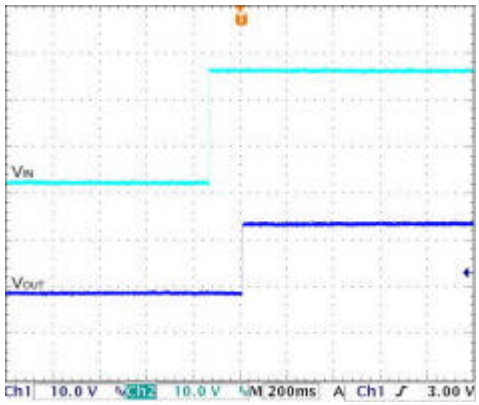
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



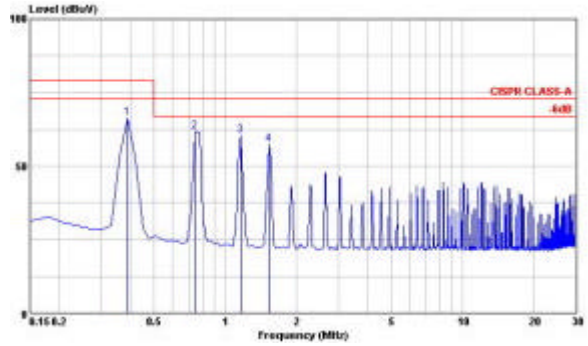
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



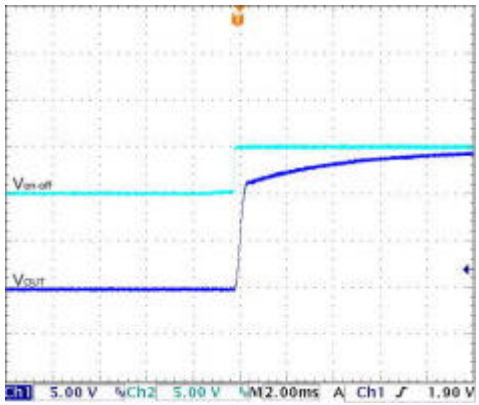
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

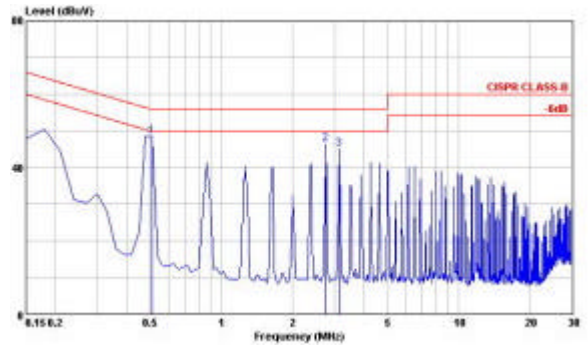
All test conditions are at 25°C. The figures are identical for THD 12-2423WI (Continued)



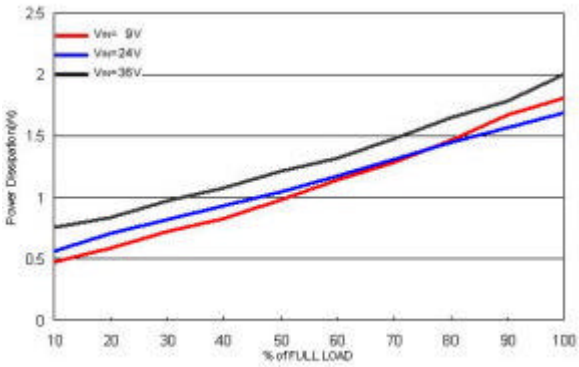
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



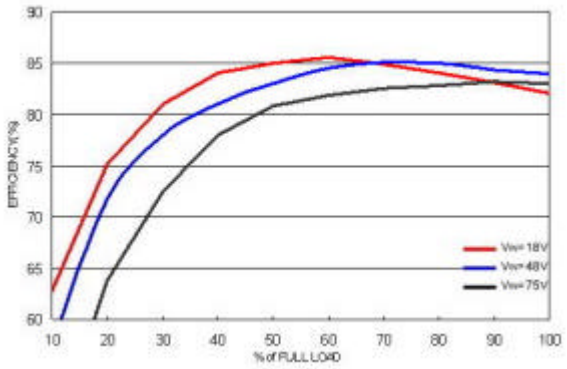
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



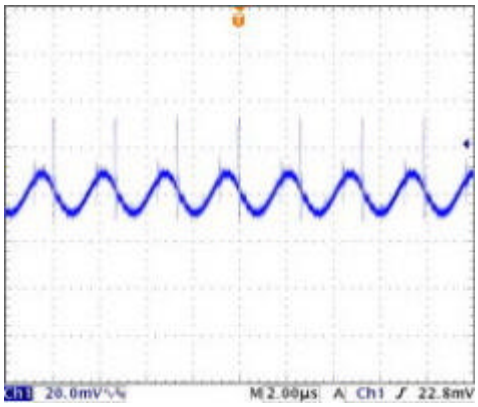
Power Dissipation versus Output Current

Characteristic Curves

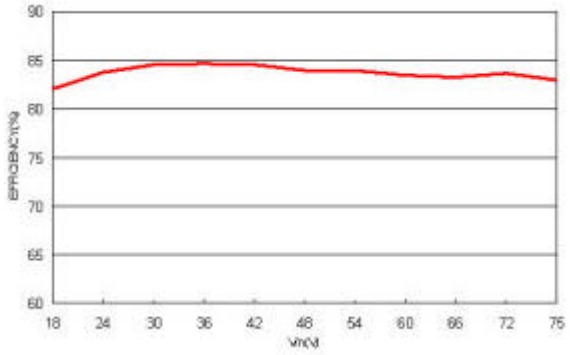
All test conditions are at 25°C. The figures are identical for THD 12-4810WI



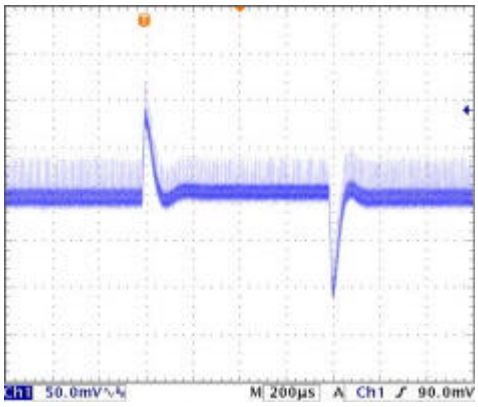
Efficiency versus Output Current



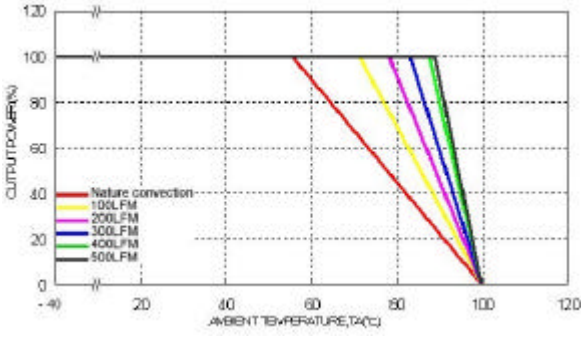
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



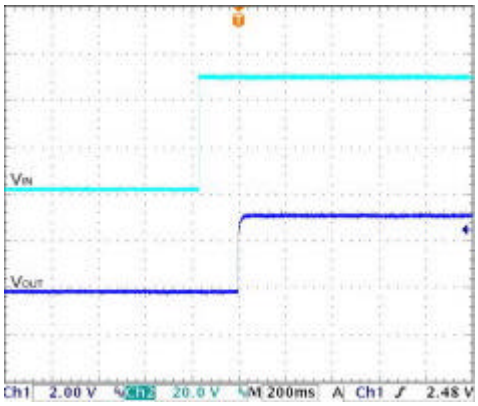
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



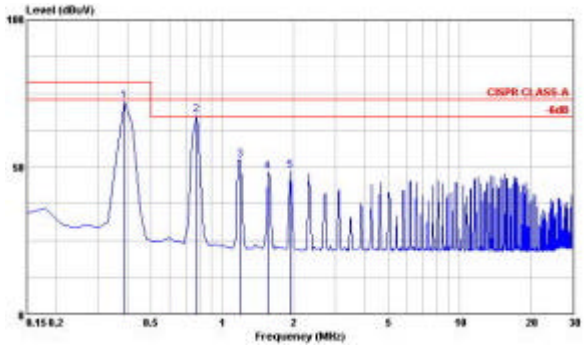
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



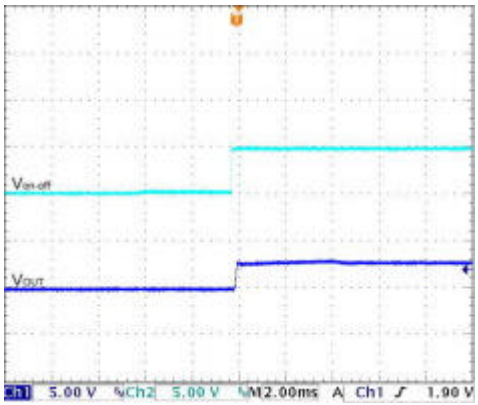
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

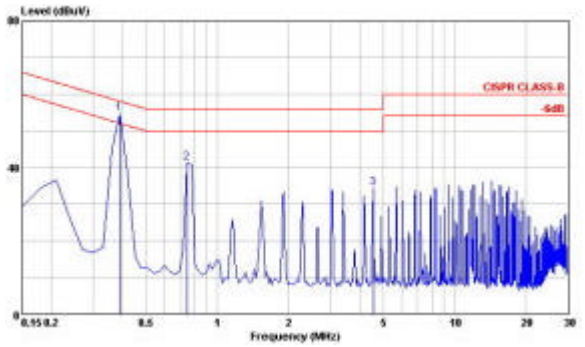
All test conditions are at 25°C. The figures are identical for THD 12-4810WI (Continued)



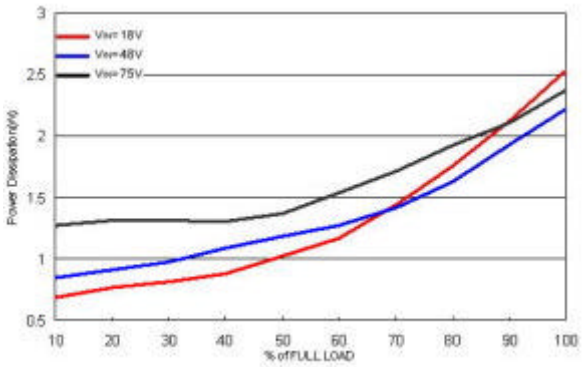
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



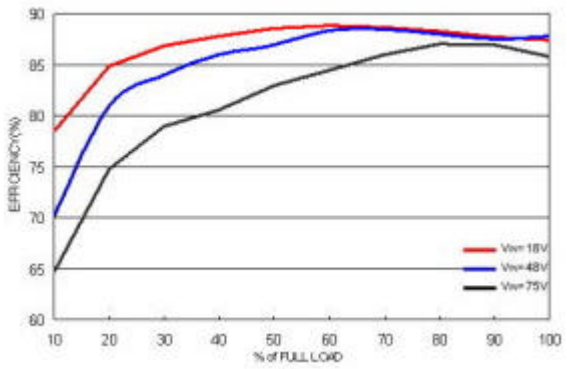
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



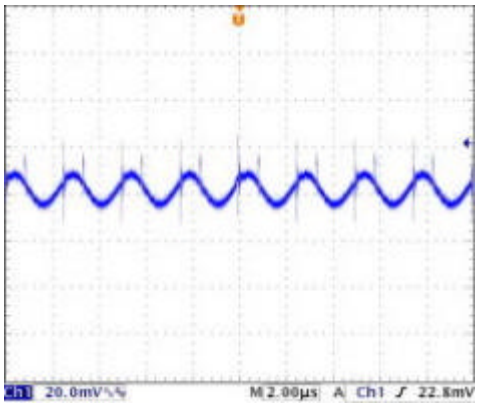
Power Dissipation versus Output Current

Characteristic Curves

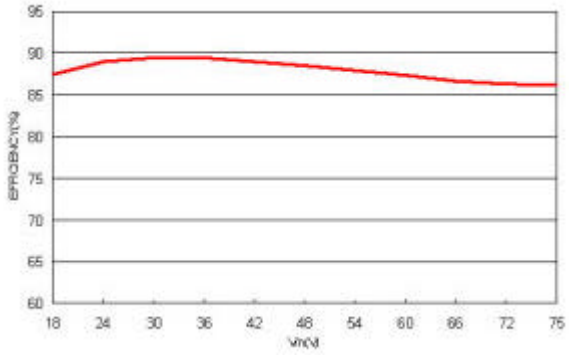
All test conditions are at 25°C. The figures are identical for THD 12-4811WI



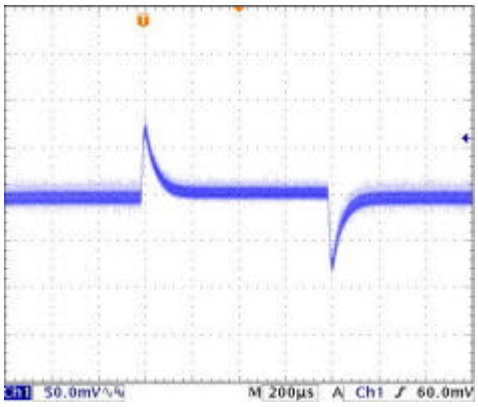
Efficiency versus Output Current



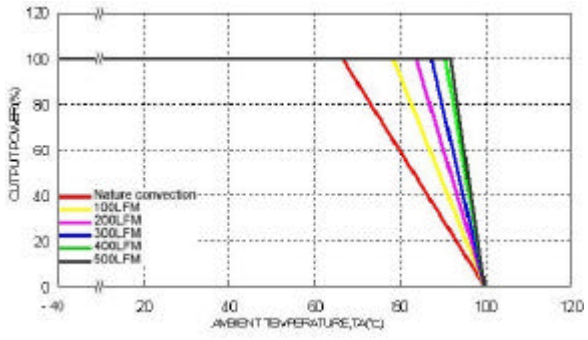
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



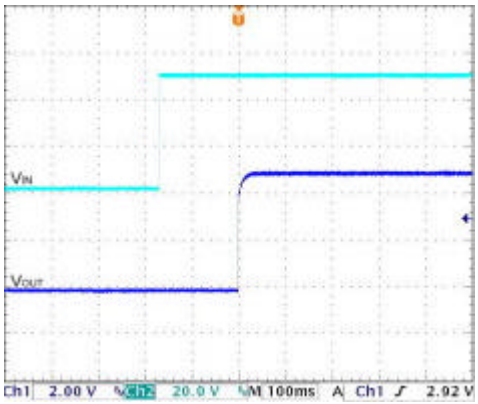
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



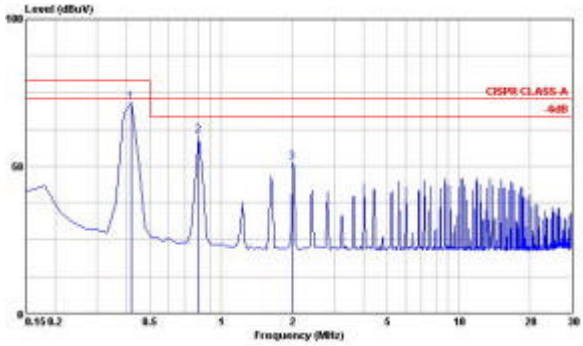
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



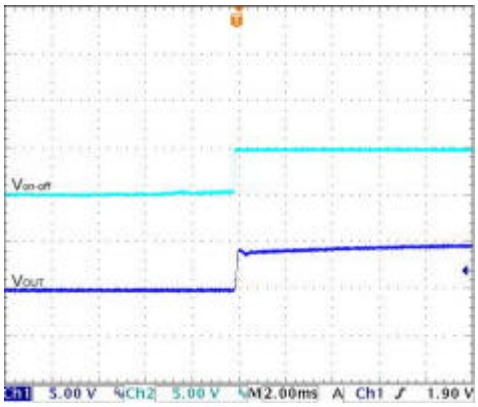
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

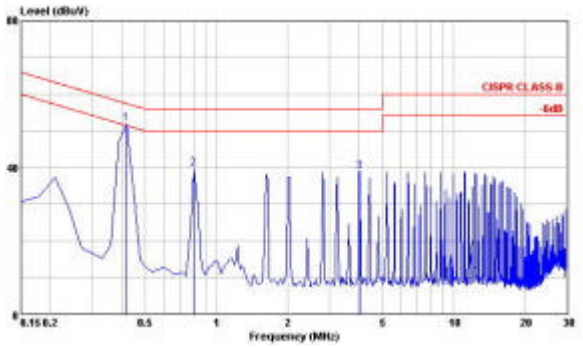
All test conditions are at 25°C. The figures are identical for THD 12-4811WI (Continued)



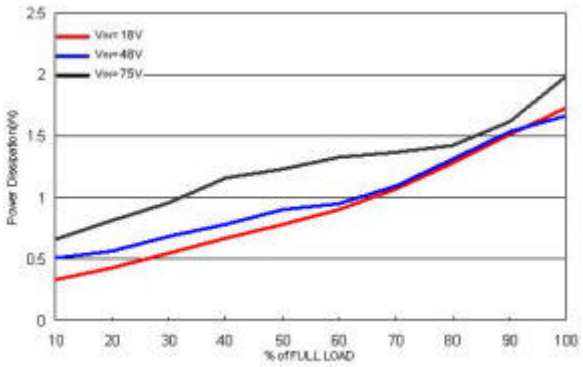
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



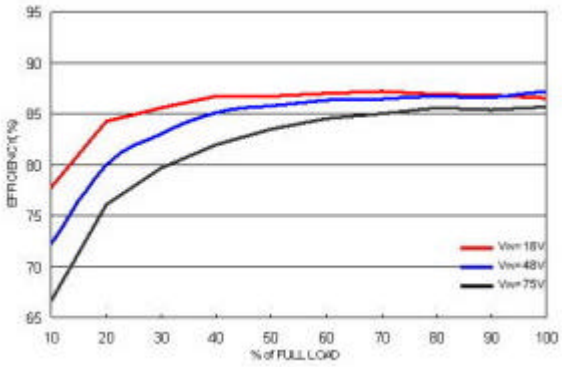
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



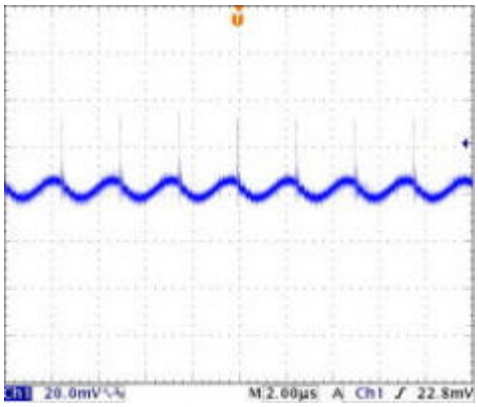
Power Dissipation versus Output Current

Characteristic Curves

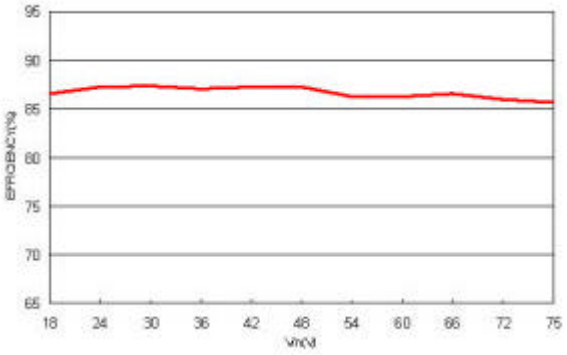
All test conditions are at 25°C. The figures are identical for THD 12-4812WI



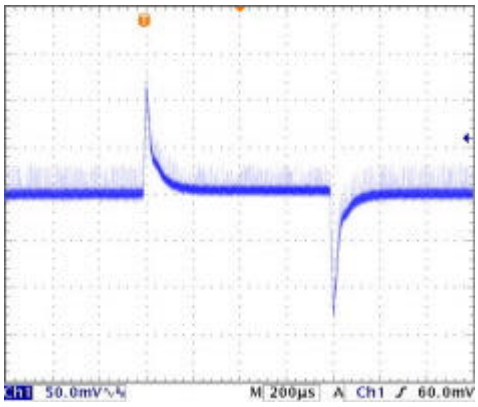
Efficiency versus Output Current



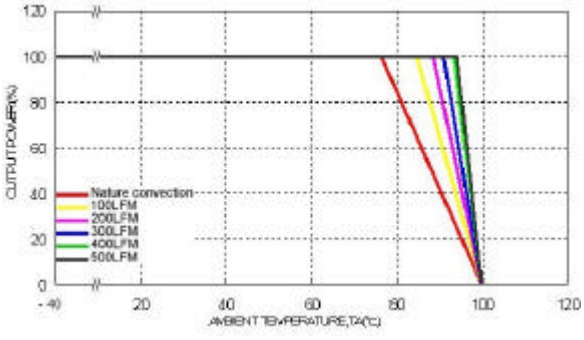
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



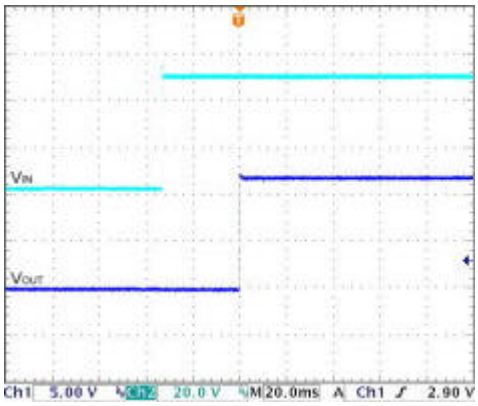
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



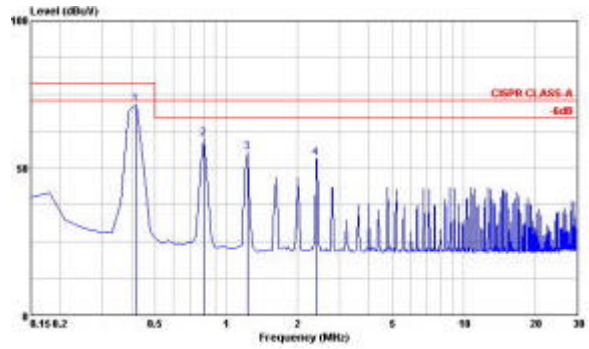
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



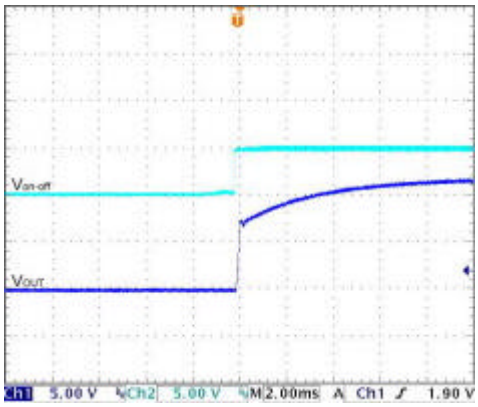
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

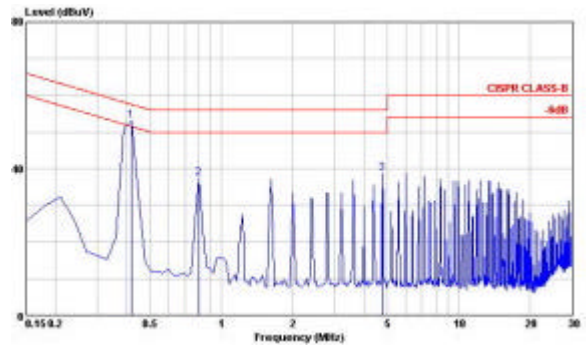
All test conditions are at 25°C. The figures are identical for THD 12-4812WI (Continued)



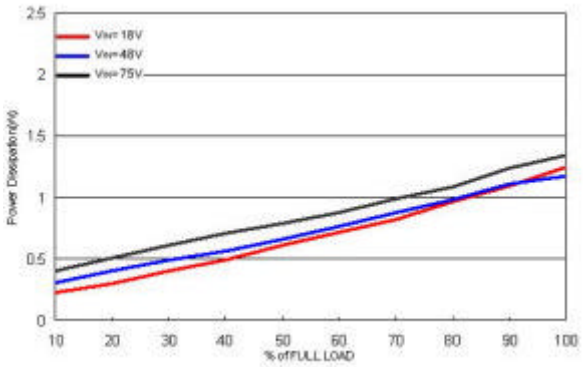
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



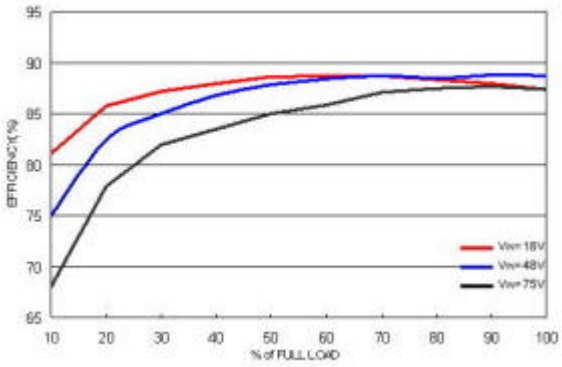
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



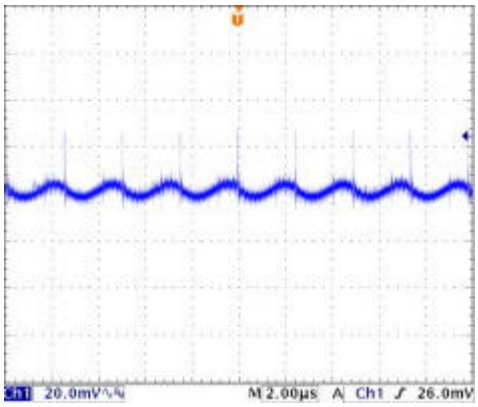
Power Dissipation versus Output Current

Characteristic Curves

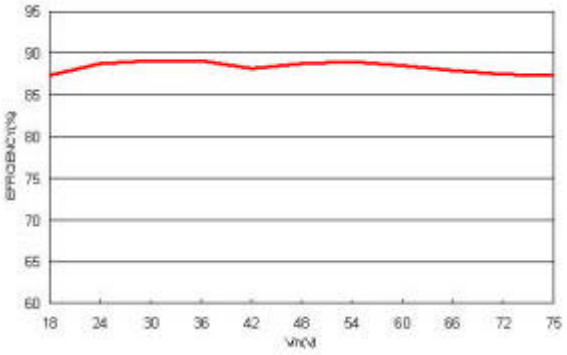
All test conditions are at 25°C. The figures are identical for THD 12-4813WI



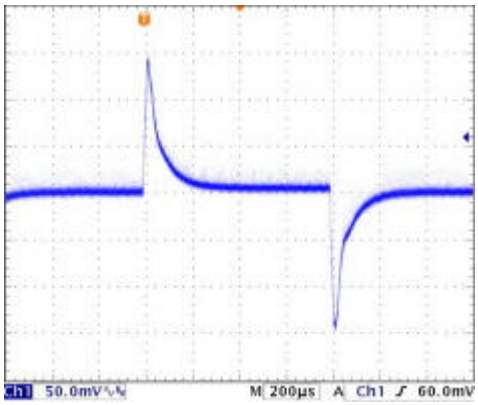
Efficiency versus Output Current



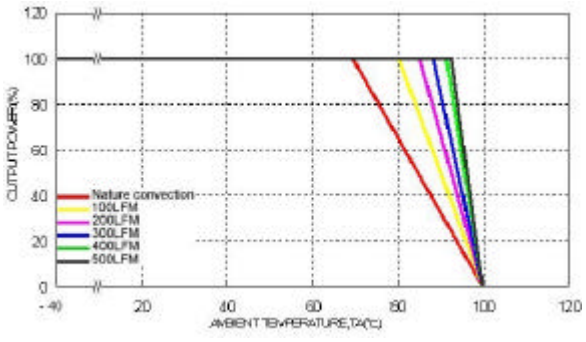
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



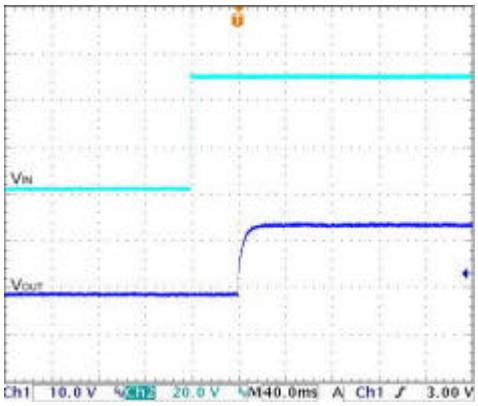
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



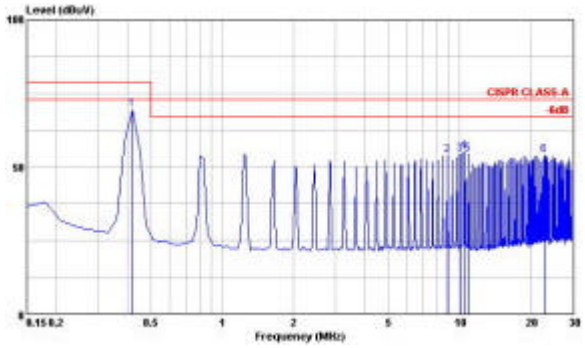
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



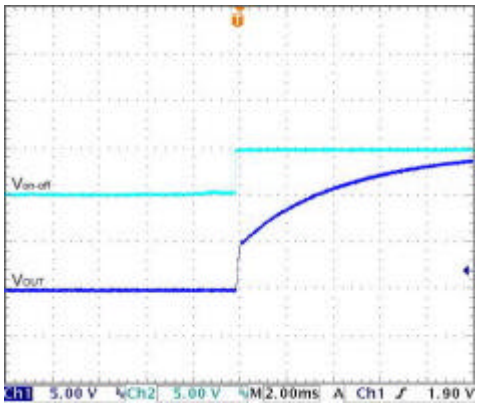
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

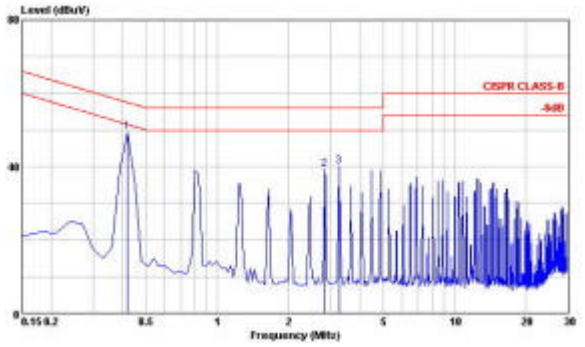
All test conditions are at 25°C. The figures are identical for THD 12-4813WI(Continued)



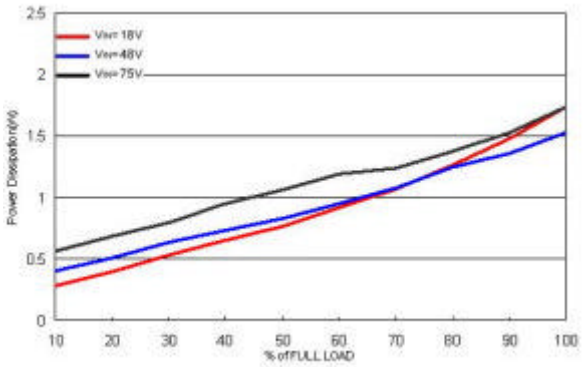
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



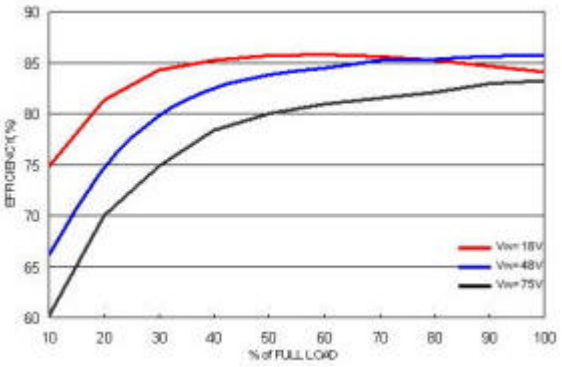
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



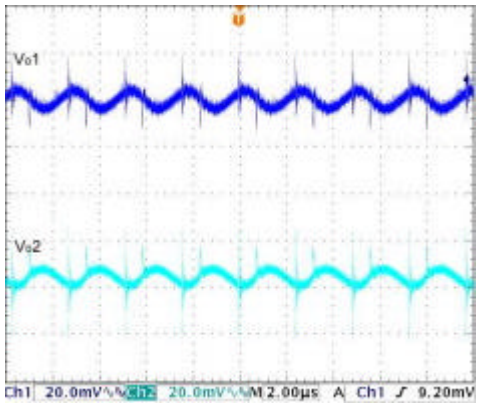
Power Dissipation versus Output Current

Characteristic Curves

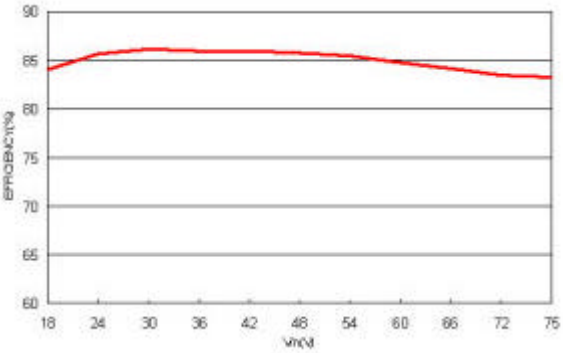
All test conditions are at 25°C. The figures are identical for THD 12-4821WI



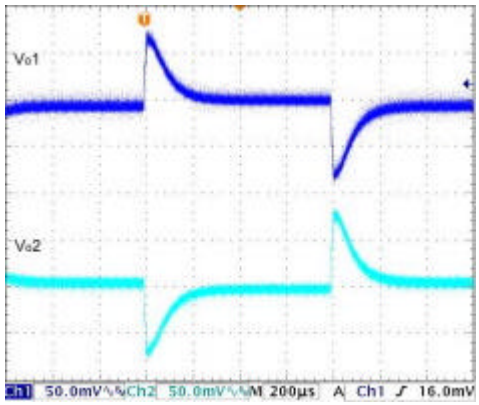
Efficiency versus Output Current



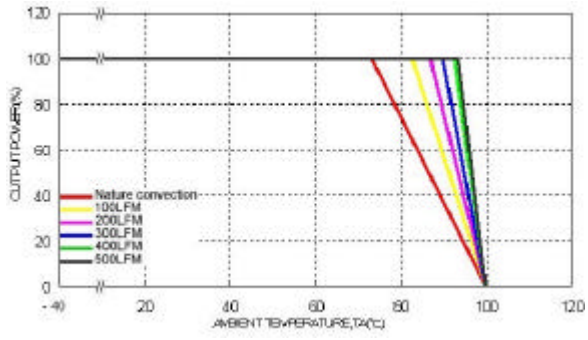
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



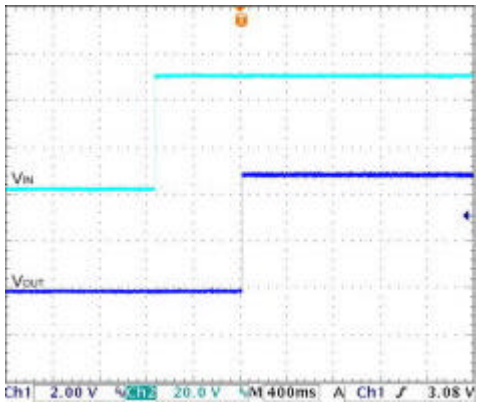
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



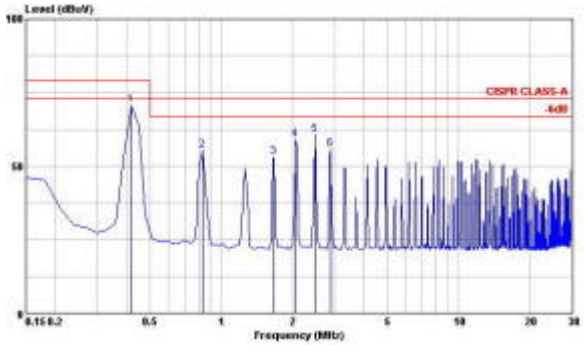
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



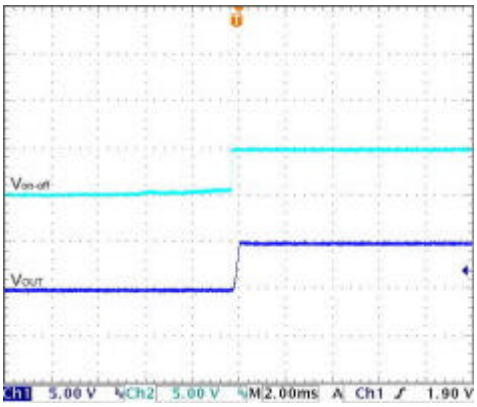
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

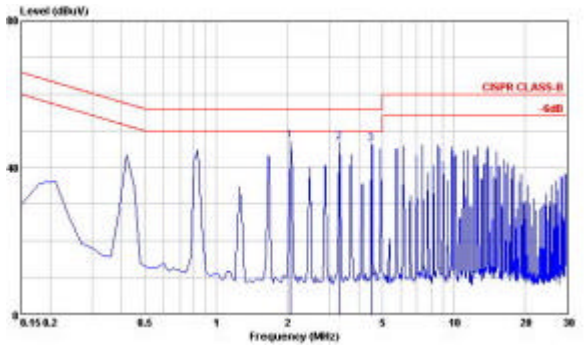
All test conditions are at 25°C. The figures are identical for THD 12-4821WI (Continued)



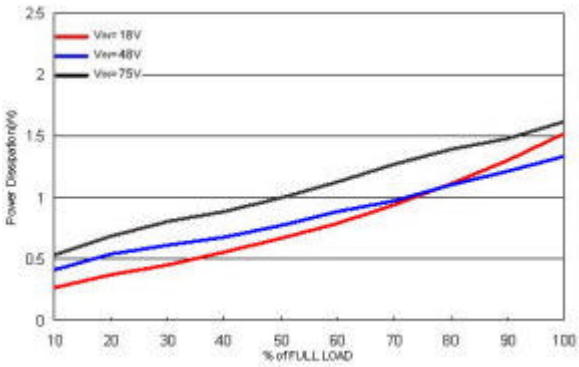
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



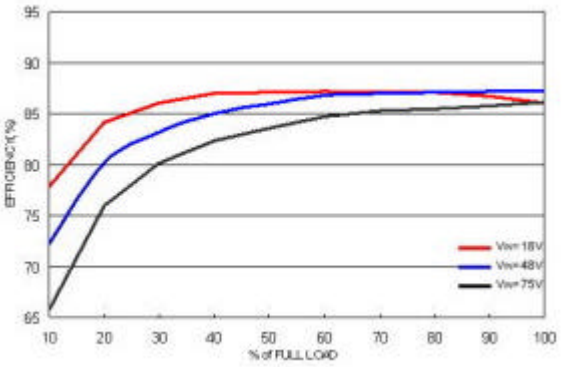
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



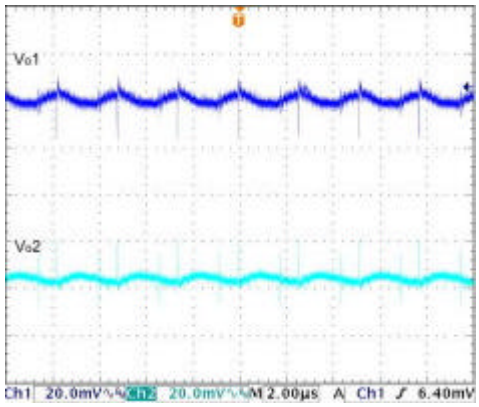
Power Dissipation versus Output Current

Characteristic Curves

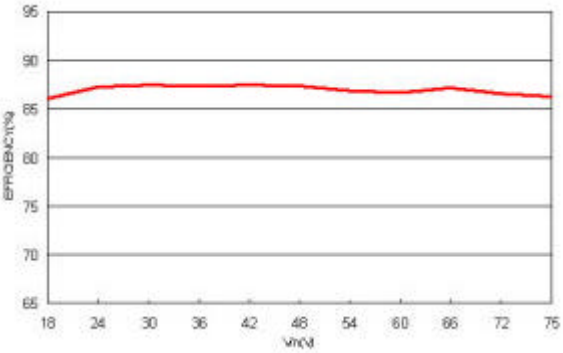
All test conditions are at 25°C. The figures are identical for THD 12-4822WI



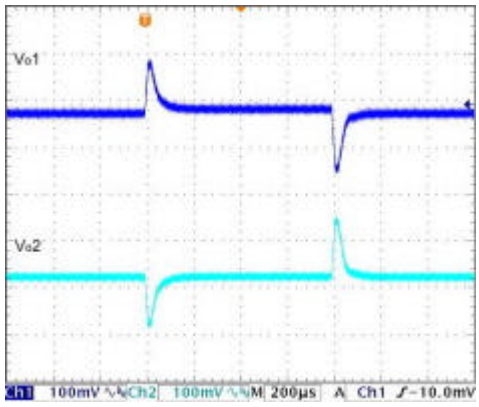
Efficiency versus Output Current



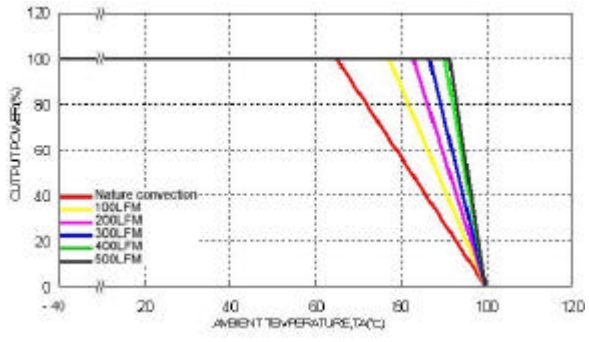
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



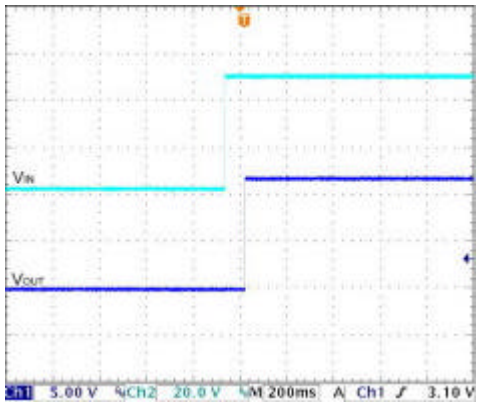
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



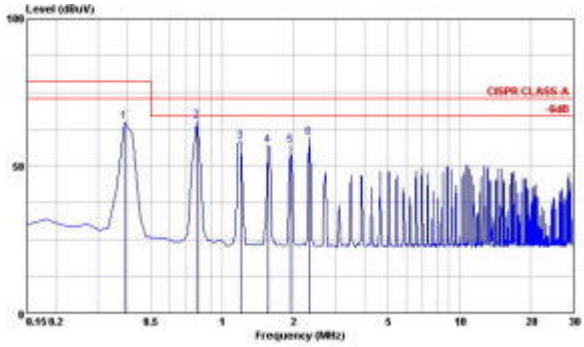
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



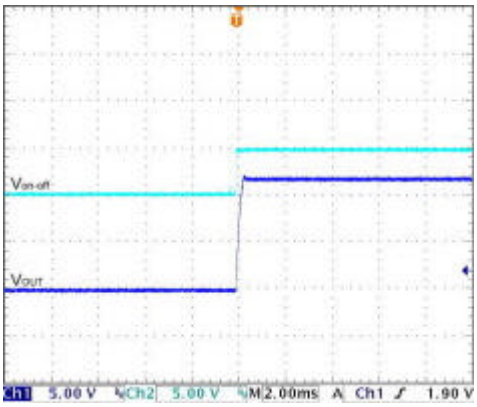
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

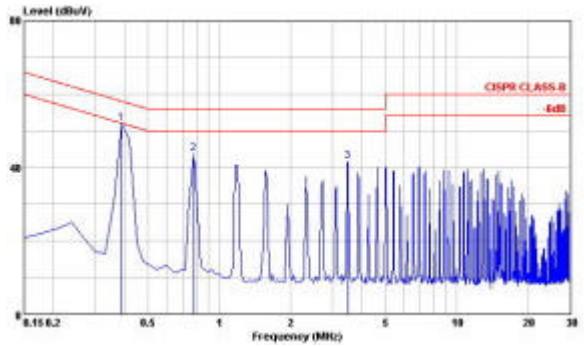
All test conditions are at 25°C. The figures are identical for THD 12-4822WI (Continued)



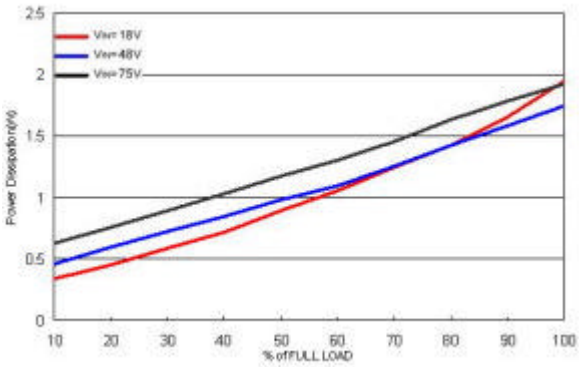
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



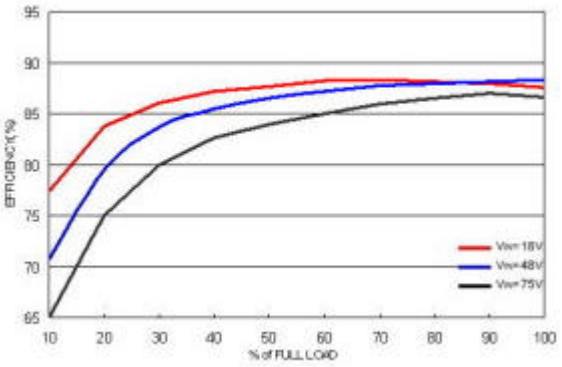
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



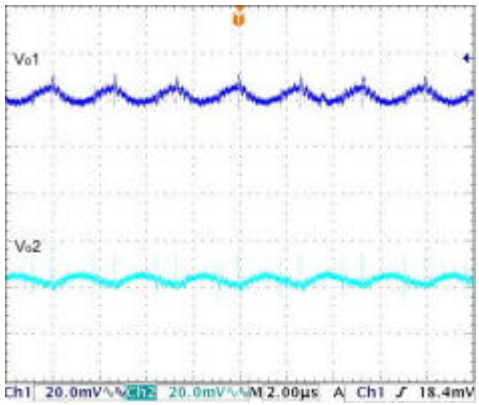
Power Dissipation versus Output Current

Characteristic Curves

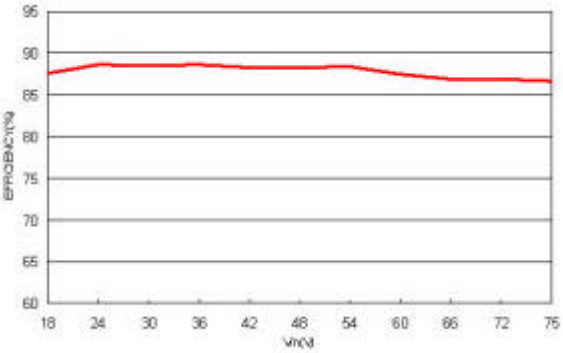
All test conditions are at 25°C. The figures are identical for THD 12-4823WI



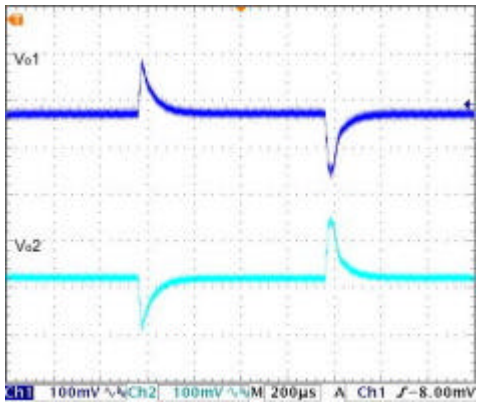
Efficiency versus Output Current



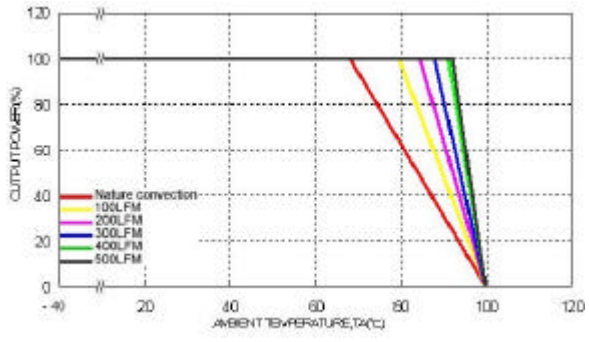
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



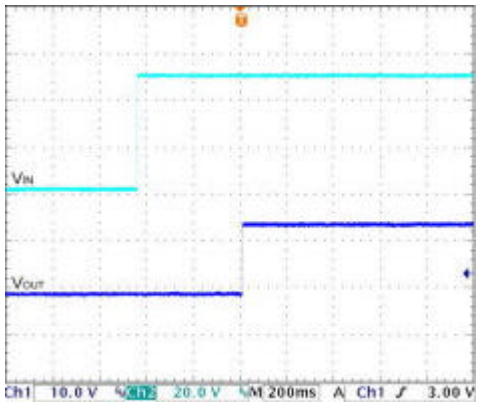
Efficiency versus Input Voltage. Full Load



Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



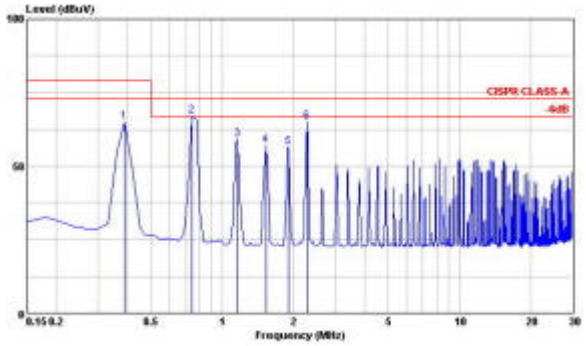
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



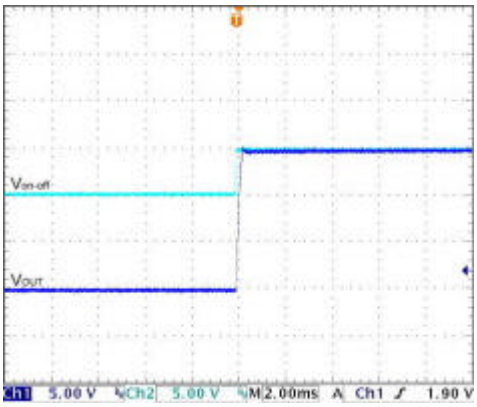
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load

Characteristic Curves

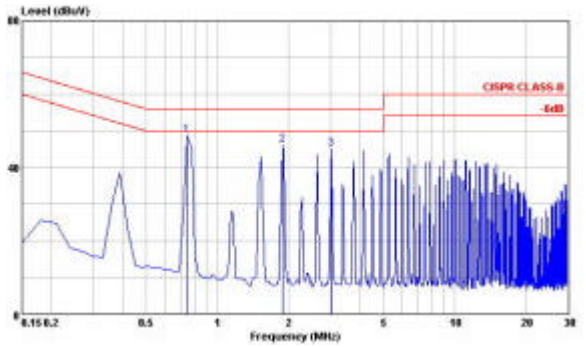
All test conditions are at 25°C. The figures are identical for THD 12-4823WI (Continued)



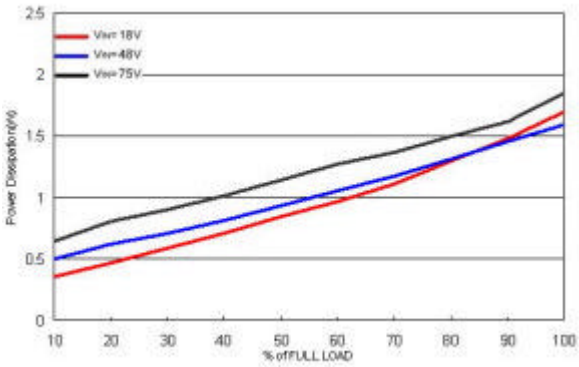
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$; Full Load



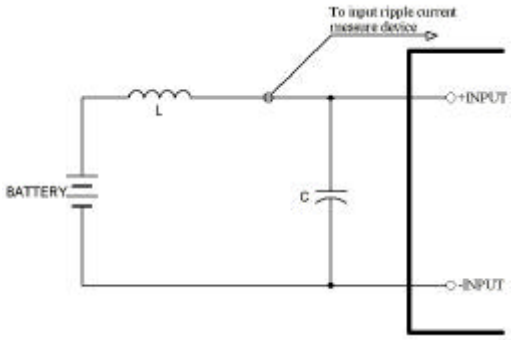
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



Power Dissipation versus Output Current

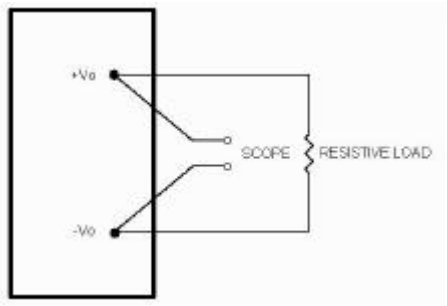
Testing Configurations

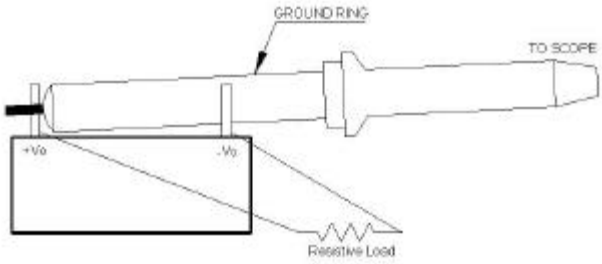
Input reflected-ripple current measurement test up



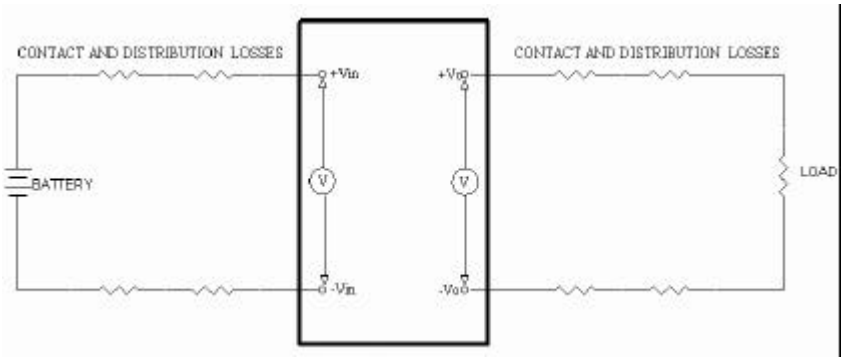
Component	Value	Voltage	Reference
L	12µH	----	----
C	47µF	100V	Aluminum Electrolytic Capacitor

Peak-to-peak output ripple & noise measurement test up





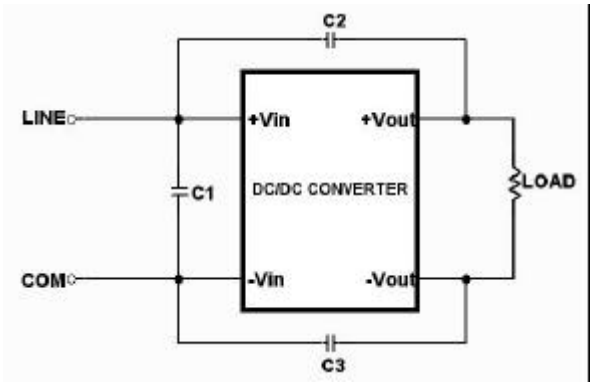
Output voltage and efficiency measurement test up



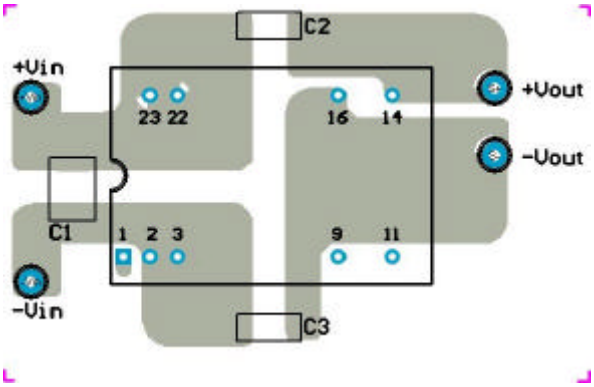
Note: All measurements are taken at the module terminals.

$$Efficiency = \left(\frac{V_o \times I_o}{V_{in} \times I_{in}} \right) \times 100\%$$

EMC considerations



Suggested Schematic for EN55022 Conducted Emission Class A Limits



recommended Layout With Input Filter

To meet conducted emissions EN55022 CLASS A needed the following components:

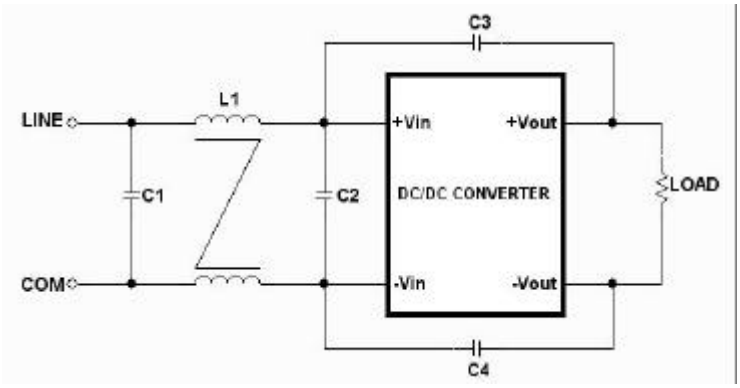
THD 12-24xxWI

Component	Value	Voltage	Reference
C1	1µF	50V	1210 MLCC
C2, C3	1000pF	2KV	1206 MLCC

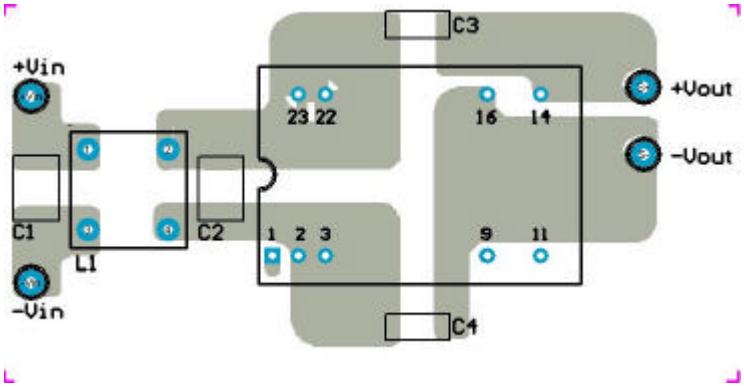
THD 12-48xxWI

Component	Value	Voltage	Reference
C1	0.47µF	100V	1812 MLCC
C2, C3	1000pF	2KV	1206 MLCC

EMC considerations (Continued)



Suggested Schematic for EN55022 Conducted Emission Class B Limits



recommended Layout With Input Filter

To meet conducted emissions EN55022 CLASS B needed the following components:

THD 12-24xxWI

Component	Value	Voltage	Reference
C1	4.7µF	50V	1812 MLCC
C3, C4	1000pF	2KV	1206 MLCC
L1	325µH	----	Common Choke, P/N: TCK-050

THD 12-48xxWI

Component	Value	Voltage	Reference
C1, C2	1.5µF	100V	1812 MLCC
C3, C4	1000pF	2KV	1206 MLCC
L1	325µH	----	Common Choke, P/N: TCK-050

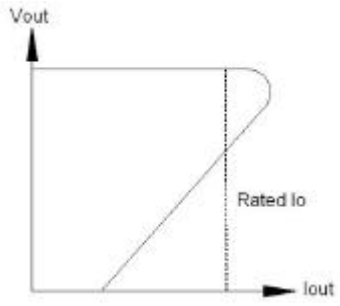
Input Source Impedance

The power module should be connected to a low impedance input source. Highly inductive source impedance can affect the stability of the power module. Input external L-C filter is recommended to minimize input reflected ripple current. The inductor is simulated source impedance of 12µH and capacitor is Nippon chemi-con KZE series 47µF/100V. The capacitor must as close as possible to the input terminals of the power module for lower impedance.

Output Over Current Protection

When excessive output currents occur in the system, circuit protection is required on all power supplies. Normally, overload current is maintained at approximately about 150 percent of rated current for THD 12-WI series.

Fold back-mode is a method of operation in a power supply whose purpose is to protect the power supply from being damaged during an over-current fault condition. It also enables the power supply to operate normally when the fault is removed.



One of the problems resulting from over current is that excessive heat may be generated in power devices; especially MOSFET and Schottky diodes and the temperature of those devices may exceed their specified limits. A protection mechanism has to be used to prevent those power devices from being damaged.

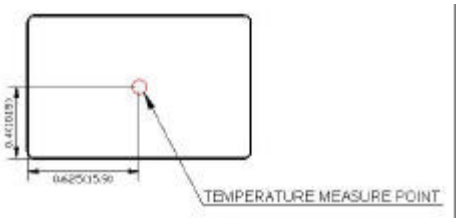
The operation of fold back is as follows. When the current sense circuit sees an over-current event, the output voltage of the module will be decreased for low power dissipation and decrease the heat of the module.

Output Over Voltage Protection

The output over-voltage protection consists of output Zener diode that monitors the voltage on the output terminals. If the voltage on the output terminals exceeds the over-voltage protection threshold, then the Zener diode clamps the output voltage.

Thermal Consideration

The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding Environment. Proper cooling can be verified by measuring the point as the figure below. The temperature at this location should not exceed 105°C. When Operating, adequate cooling must be provided to maintain the test point temperature at or below 105°C. Although the maximum point Temperature of the power modules is 105°C, you can limit this Temperature to a lower value for extremely high reliability.



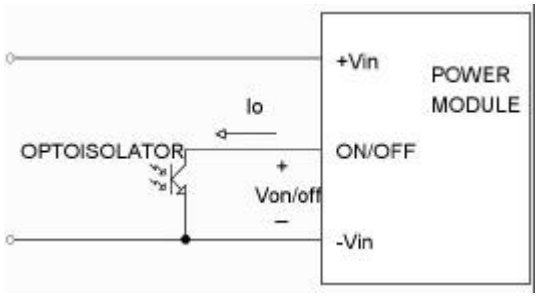
Measurement shown in inches and (millimeters)

TOP VIEW

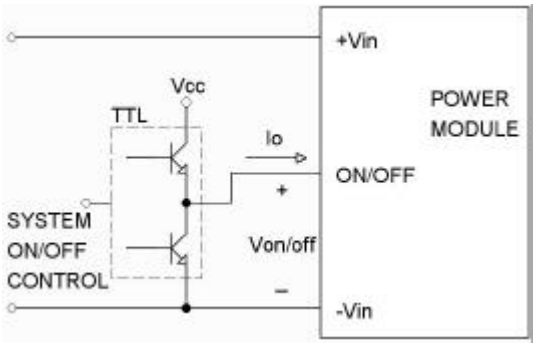
Remote ON/OFF Control

The positive logic remote ON/OFF control circuit is included.
Turns the module ON during a logic High on the On/Off pin and turns OFF during a logic Low.
The On/Off pin is an open collector/drain logic input signal (Von/off) that referenced to GND.
If not using the remote on/off feature, please open circuit between on/off pin and $-V_{in}$ pin to turn the module on.

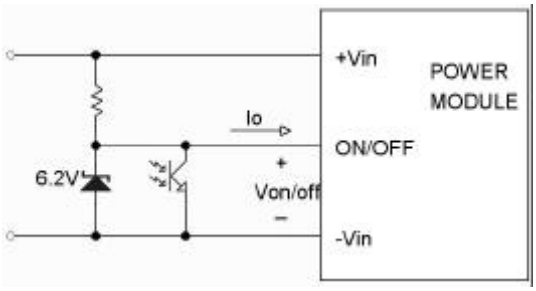
Remote ON/OFF Implementation



Isolated-Closure Remote ON/OFF



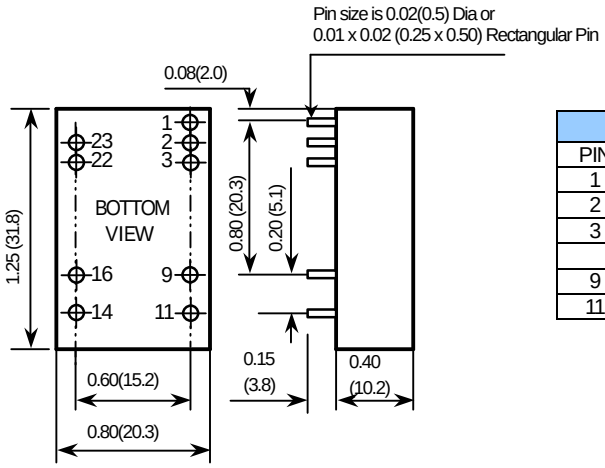
Level Control Using TTL Output



Level Control Using Line Voltage

Mechanical Data

DIP TYPE

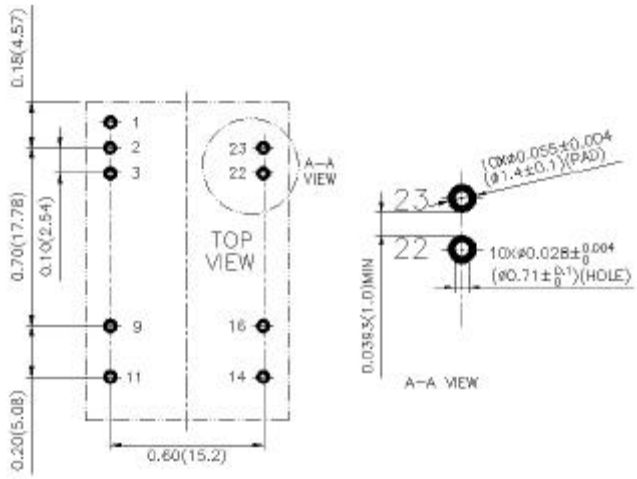


PIN CONNECTION			
PIN	Define	PIN	Define
1	CTRL		
2	-INPUT	23	+INPUT
3	-INPUT	22	+INPUT
9	NC	16	-OUTPUT
11	NC	14	+OUTPUT

1. All dimensions in Inches (mm)
   Tolerance : x.xx±0.02 (x.x±0.5)
2. Pin pitch tolerance ±0.014(0.35)

Recommended Pad Layout

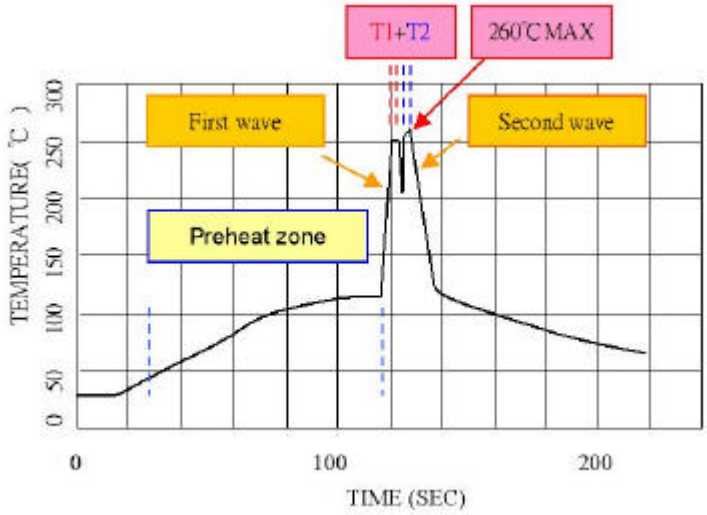
DIP TYPE



1. All dimensions in Inches (mm)
2. Pin pitch tolerance ±0.35mm
3. Tolerance: x.xx±0.02 (x.x±0.5)
   x.xxx±0.01 (x.xx±0.25)

Soldering and Reflow Considerations

Lead free wave solder profile for THD 12-WI DIP type



Zone	Reference Parameter
Preheat zone	Rise temp. speed: 3°C/ sec max. Preheat temperature: 100~130°C
Actual heating	Peak temperature: 250~260°C Peak time (T1+T2 time): 4~6 sec

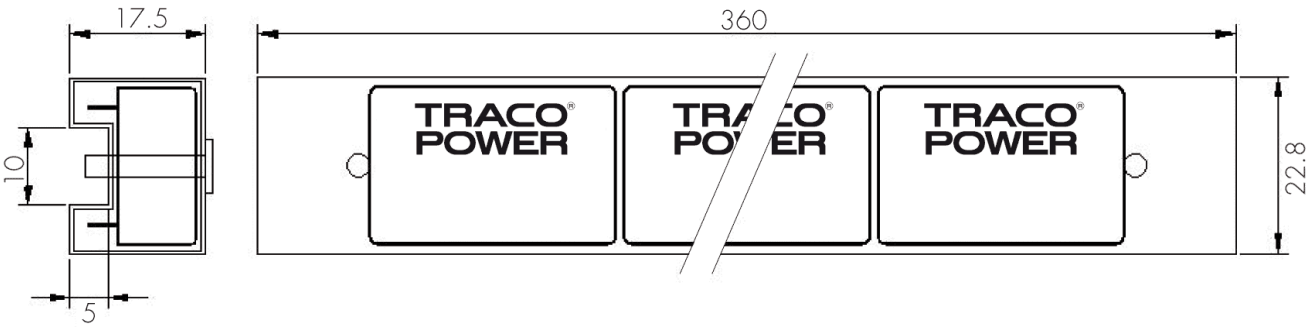
Reference Solder: Sn-Ag-Cu ; Sn-Cu

Hand Welding :

Soldering iron: Power 90W
Welding Time: 2~4 sec
Temperature: 380~400°C

Packaging Information

10 Pcs THD 12-xxxxWI Converters per Tube



Part Number Structure

THD

12 – 48

W

05

Max Output Power:
12 Watt

Input Voltage Range
24 : 9 ~ 36Vdc
48 : 18 ~ 75Vdc

Output Voltage

10	: 3.3Vdc
11	: 5.1Vdc
12	: 12Vdc
13	: 15Vdc
21	: ±5Vdc
22	: ±12Vdc
23	: ±15Vdc

Model Number	Input Range	Output Voltage	Output Current Max. Load	Input Current Full Load[1]	Efficiency [2] (%)
THD 12-2410WI	9 – 36 Vdc	3.3 Vdc	3500mA	602mA	84
THD 12-2411WI	9 – 36 Vdc	5.1 Vdc	2400mA	614mA	87
THD 12-2412WI	9 – 36 Vdc	12 Vdc	1000mA	610mA	86
THD 12-2413WI	9 – 36 Vdc	15 Vdc	800mA	610mA	86
THD 12-2421WI	9 – 36 Vdc	±5.0Vdc	± 1200mA	625mA	84
THD 12-2422WI	9 – 36 Vdc	±12.0Vdc	± 500mA	610mA	86
THD 12-2423WI	9 – 36 Vdc	±15.0Vdc	± 400mA	610mA	86
THD 12-4810WI	18 – 75 Vdc	3.3 VDC	3500mA	301mA	84
THD 12-4811WI	18 – 75 Vdc	5.1 VDC	2400mA	307mA	87
THD 12-4812WI	18 – 75 Vdc	12 VDC	1000mA	302mA	87
THD 12-4813WI	18 – 75 Vdc	15 VDC	800mA	298mA	88
THD 12-4821WI	18 – 75 Vdc	±5.0Vdc	± 1200mA	309mA	85
THD 12-4822WI	18 – 75 Vdc	±12.0Vdc	± 500mA	301mA	87
THD 12-4823WI	18 – 75 Vdc	±15.0Vdc	± 400mA	301mA	87

Note 1. Maximum value at nominal input voltage and full load of standard type.
Note 2. Typical value at nominal input voltage and full load.

Safety and Installation Instruction

Fusing Consideration

Caution: This power module is not internally fused. An input line fuse must always be used.

This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture. To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a normal-blow fuse with maximum rating of 3A. Based on the information provided in this data sheet on Inrush energy and maximum dc input current; the same type of fuse with lower rating can be used. Refer to the fuse manufacturer's data for further information.

MTBF and Reliability

The MTBF of THD 12-WI SERIES of DC/DC converters has been calculated using

Bellcore TR-NWT-000332 Case I: 50% stress, Operating Temperature at 40°C (Ground fixed and controlled environment). The resulting figure for MTBF is 2'350'000 hours.

MIL-HDBK 217F NOTICE2 FULL LOAD, Operating Temperature at 25°C. The resulting figure for MTBF is 874'500 hours.