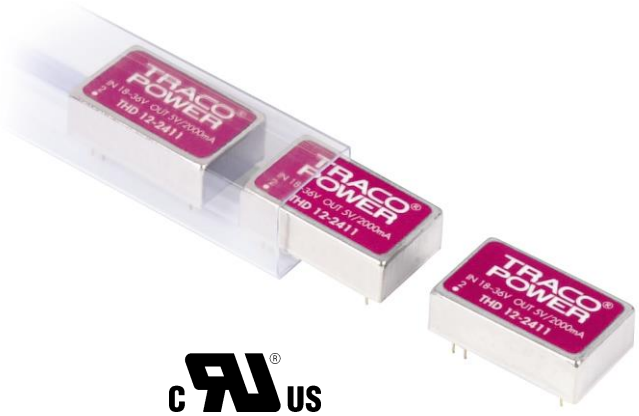
THD 12 Series Application Note

DC/DC Converter 9 to 18 Vdc, 18 to 36 Vdc and 36 to 75Vdc Input
2.5 to 15Vdc Single Outputs and ±5 to ±15 Vdc Dual Outputs, 12W



E188913

Complete THD 12 datasheet can be downloaded at:
http://www.tracopower.com/products/thd12.pdf

Features

- RoHS compliant
- Single output up to 3.5A
- Dual output up to ±1200mA
- Standard 24 PIN DIP and SMD Package
- Five-sided continuous shield
- No minimum load required
- High power density
- High efficiency up to 88%
- Small size 31.8×20.3×10.4 mm (1.25×0.8×0.450 inch)
- Input to output isolation (1500VDC for 60 seconds)
- 2:1 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 series offer 12 watts of output power from a package in an IC compatible 24pin DIP. This product has a 2:1 wide input voltage of 9-18Vdc, 18-36Vdc, 36-75Vdc with an I/O isolation test voltage of 1500Vdc and indefinite short-circuit protection, as well as 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 12-12xx THD 12-24xx THD 12-48xx		20 40 80	Vdc
Input Voltage Transient (100ms)	THD 12-12xx THD 12-24xx THD 12-48xx		36 50 100	
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		100	°C
Storage Temperature	All	-55	125	°C

Output Specification					
Parameter	**Model**	**Min**	**Typ**	**Max**	**Unit**
Output Voltage (V_{in} = $V_{in\,nom}$; Full Load; T_A = 25°C)	THD 12-xx09 THD 12-xx10 THD 12-xx11 THD 12-xx12 THD 12-xx13 THD 12-xx21 THD 12-xx22 THD 12-xx23	2.470 3.260 4.940 11.856 14.820 ±4.940 ±11.856 ±14.820	2.5 3.3 5 12 15 ±5 ±12 ±15	2.530 3.340 5.060 12.144 15.180 ±5.060 ±12.144 ±15.180	Vdc
Output Regulation Line (Vin(min) to Vin(max) at Full Load) Load (0% to 100% of Full Load) (Single Output) Load (0% to 100% of Full Load) (Dual Output)	 All THD 12-xx1x THD 12-xx2x	 -0.2 -0.5 -1.0		 +0.2 +0.5 +1.0	%
Cross Regulation Asymmetrical Load 25% / 100% of Full Load	All	-5.0		+5.0	%
Output Ripple & Noise (see page 54) 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 Setting Time (V_{out} < 10% peak deviation)	 All All	 	 200 250	 	 mV µs
Output Current	THD 12-xx09 THD 12-xx10 THD 12-xx11 THD 12-xx12 THD 12-xx13 THD 12-xx21 THD 12-xx22 THD 12-xx23	0 0 0 0 0 0 0 0		3500 3500 2400 1000 800 ±1200 ±500 ±400	mA

Output Specification (continue)					
Parameter	**Model**	**Min**	**Typ**	**Max**	**Unit**
Output Over Voltage Protection (Single output only)	THD 12-xx09		3.9		
(Zener diode clamp)	THD 12-xx10		3.9		
	THD 12-xx11		6.2		Vdc
	THD 12-xx12		15		
	THD 12-xx13		18		
Output Over Current Protection	All		150		% FL.
Output Short Circuit Protection	All	Continuous, automatics recovery			

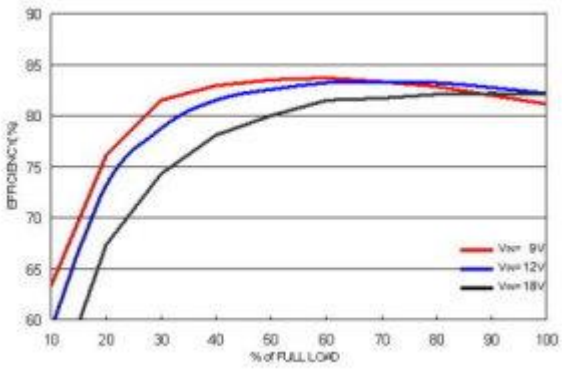
Input Specification					
Parameter	**Model**	**Min**	**Typ**	**Max**	**Unit**
Operating Input Voltage	THD 12-12xx	9	12	18	
	THD 12-24xx	18	24	36	Vdc
	THD 12-48xx	36	48	75	
Input Current	THD 12-1209			935	
(Maximum value at $V_{in} = V_{in\,nom}$; Full Load)	THD 12-1210			1203	
	THD 12-1211			1244	
	THD 12-1212			1219	
	THD 12-1213			1219	
	THD 12-1221			1282	
	THD 12-1222			1205	
	THD 12-1223			1205	
	THD 12-2409			461	
	THD 12-2410			594	
	THD 12-2411			614	
	THD 12-2412			602	mA
	THD 12-2413			602	
	THD 12-2421			633	
	THD 12-2422			595	
	THD 12-2423			595	
	THD 12-4809			231	
	THD 12-4810			297	
	THD 12-4811			307	
	THD 12-4812			301	
	THD 12-4813			301	
	THD 12-4821			316	
	THD 12-4822			297	
	THD 12-4823			297	

Input Specification (continue)					
Parameter	**Model**	**Min**	**Typ**	**Max**	**Unit**
Input Standby current (Typical value at V_{in} = $V_{in\,nom}$; No Load)	THD 12-1209 THD 12-1210 THD 12-1211 THD 12-1212 THD 12-1213 THD 12-1221 THD 12-1222 THD 12-1223 THD 12-2409 THD 12-2410 THD 12-2411 THD 12-2412 THD 12-2413 THD 12-2421 THD 12-2422 THD 12-2423 THD 12-4809 THD 12-4810 THD 12-4811 THD 12-4812 THD 12-4813 THD 12-4821 THD 12-4822 THD 12-4823		50 60 53 15 17 24 19 24 36 36 35 16 17 15 15 18 10 14 23 11 5 6 6 6		mA
Under Voltage Lockout Turn-on Threshold	THD 12-12xx THD 12-24xx THD 12-48xx		9 18 36		Vdc
Under Voltage Lockout Turn-off Threshold	THD 12-12xx THD 12-24xx THD 12-48xx		8 16 33		Vdc
Input reflected ripple current (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 (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

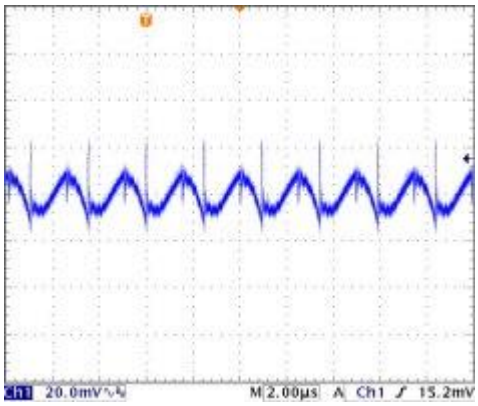
General Specification					
Parameter	**Model**	**Min**	**Typ**	**Max**	**Unit**
Efficiency (V_{in} = $V_{in\,nom}$; Full Load; T_A = 25°C)	THD 12-1209 THD 12-1210 THD 12-1211 THD 12-1212 THD 12-1213 THD 12-1221 THD 12-1222 THD 12-1223 THD 12-2409 THD 12-2410 THD 12-2411 THD 12-2412 THD 12-2413 THD 12-2421 THD 12-2422 THD 12-2423 THD 12-4809 THD 12-4810 THD 12-4811 THD 12-4812 THD 12-4813 THD 12-4821 THD 12-4822 THD 12-4823		82 84 86 86 86 82 87 87 83 85 87 87 87 83 88 88 83 85 87 87 87 83 88 88		%
Isolation voltage (functional Insulation) Input to Output (for 60 seconds) Input to Case, Output to Case (for 60 seconds)	All	 1500 1500			Vdc
Isolation resistance	All	1			GΩ
Isolation capacitance	All			1200	pF
Switching Frequency	All		400		KHz
Weight	All		18.0		g
MTBF Bellcore TR-NWT-000332, T_C = 40°C MIL-STD-217F	All		 2'750'000 1'080'000		hours

Characteristic Curves

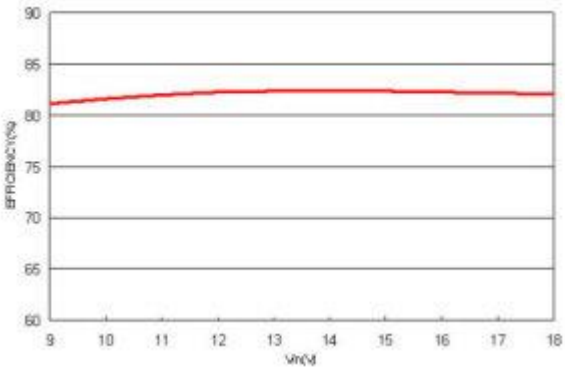
All test conditions are at 25°C. The figures are identical for THD 12-1209



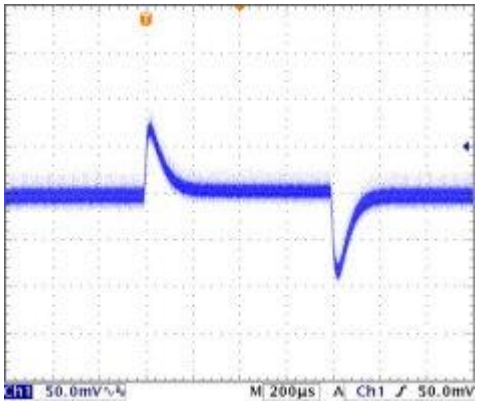
Efficiency versus Output Current



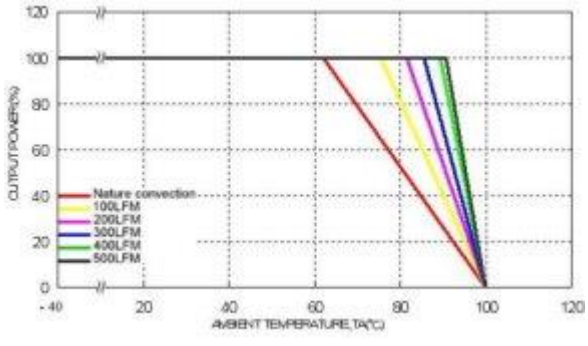
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



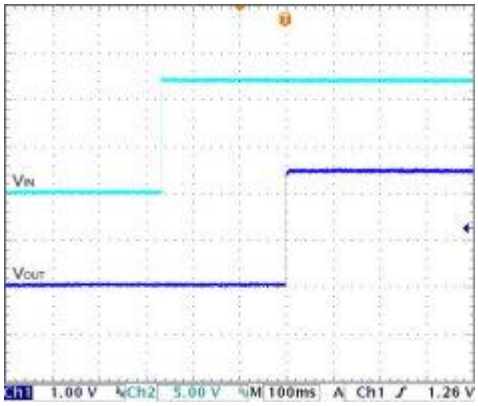
Efficiency versus Input Voltage. Full Load



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



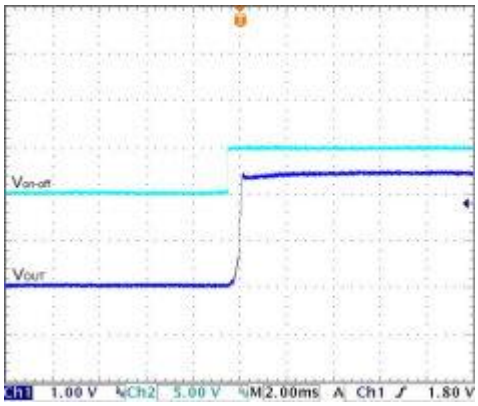
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



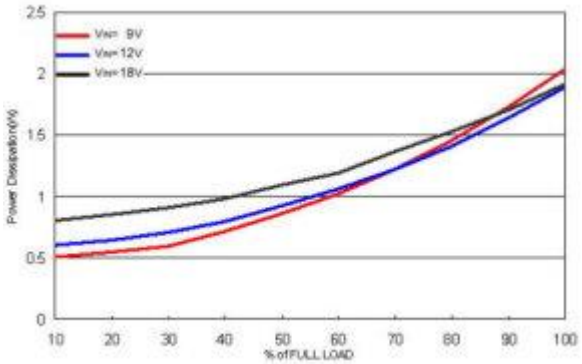
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves

All test conditions are at 25°C. The figures are identical for THD 12-1209 (Continued)



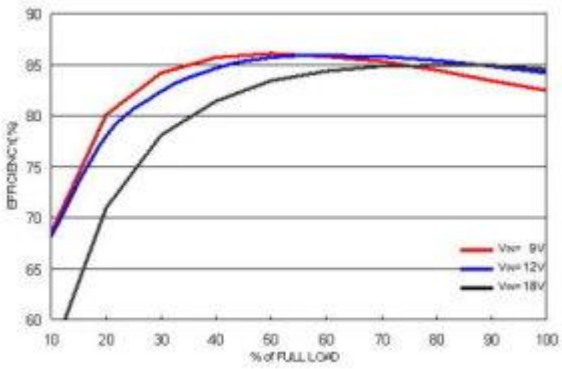
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



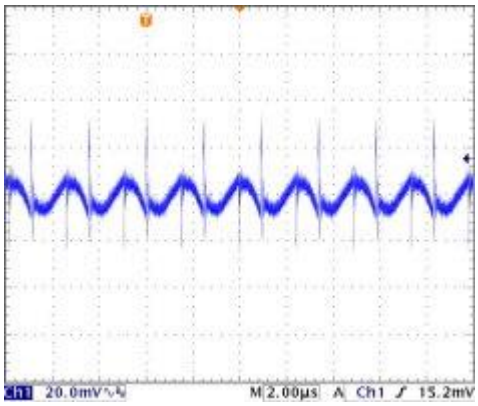
Power Dissipation versus Output Current

Characteristic Curves

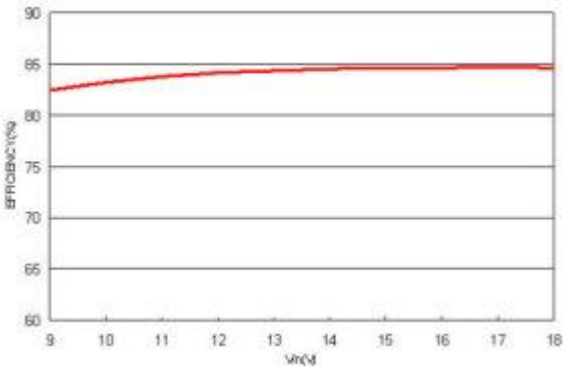
All test conditions are at 25°C. The figures are identical for THD 12-1210



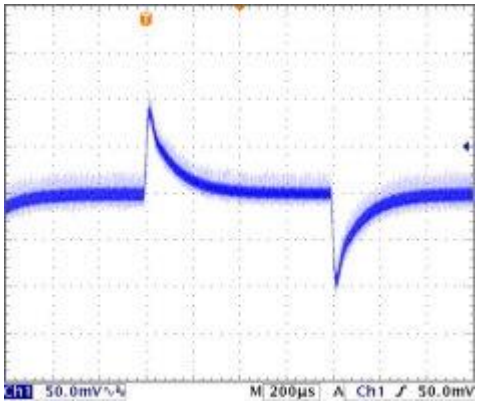
Efficiency versus Output Current



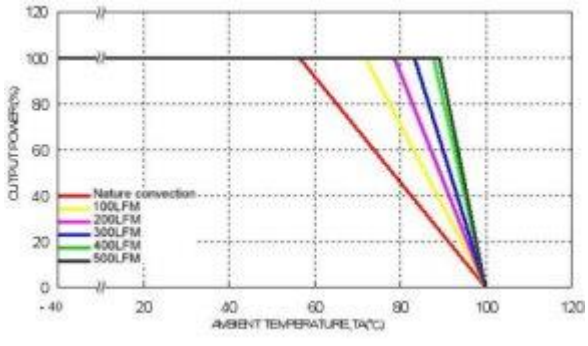
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



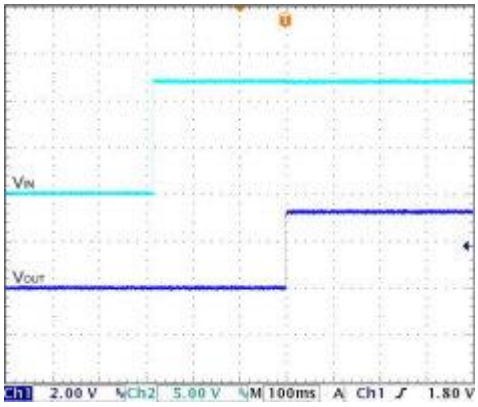
Efficiency versus Input Voltage. Full Load



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



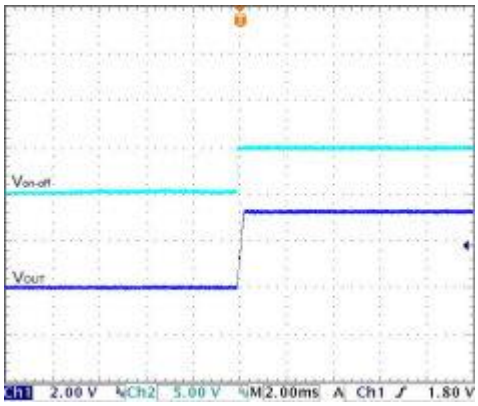
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



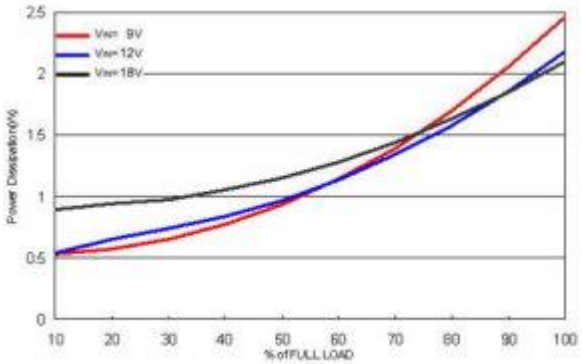
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves

All test conditions are at 25°C. The figures are identical for THD 12-1210 (Continued)



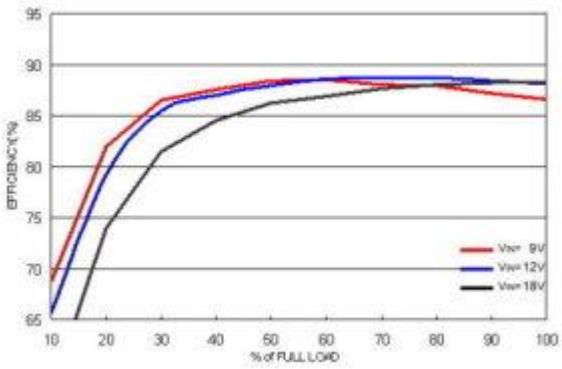
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



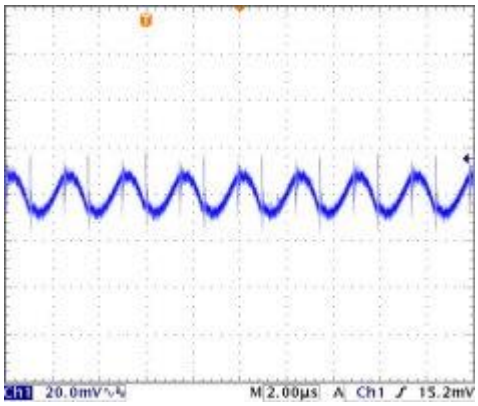
Power Dissipation versus Output Current

Characteristic Curves

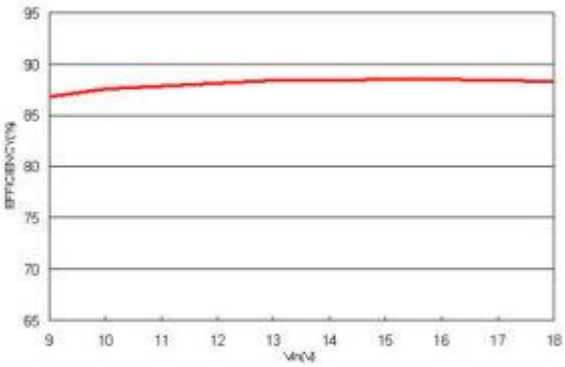
All test conditions are at 25°C. The figures are identical for THD 12-1211



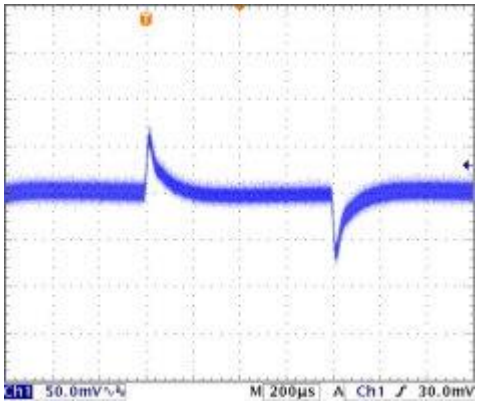
Efficiency versus Output Current



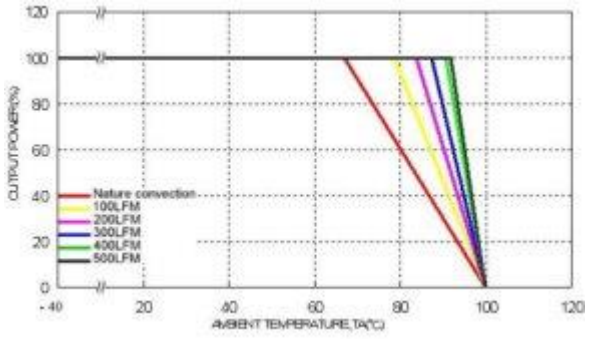
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



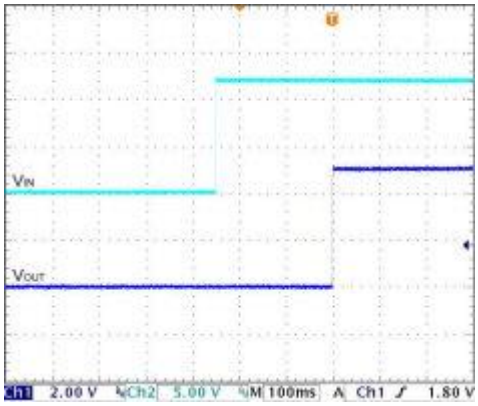
Efficiency versus Input Voltage. Full Load



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



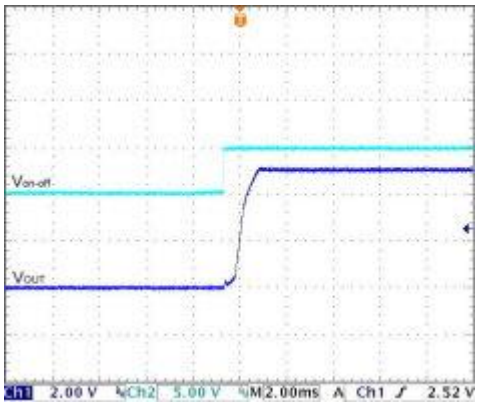
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



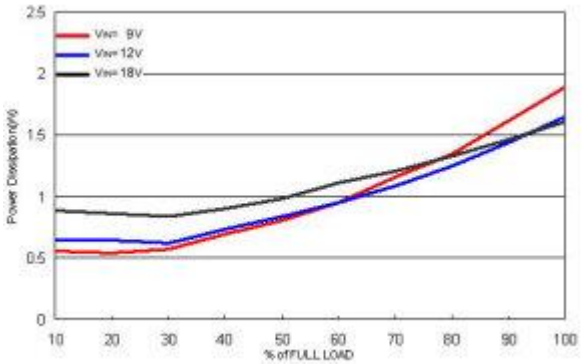
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves

All test conditions are at 25°C. The figures are identical for THD 12-1211 (Continued)



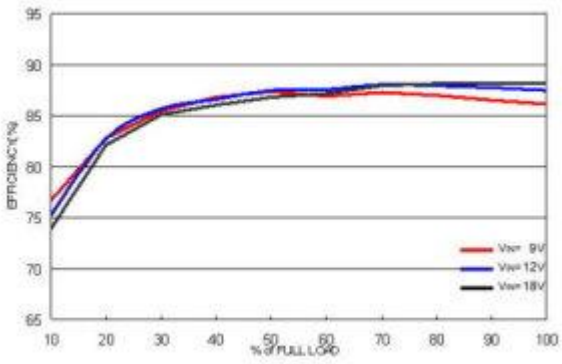
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



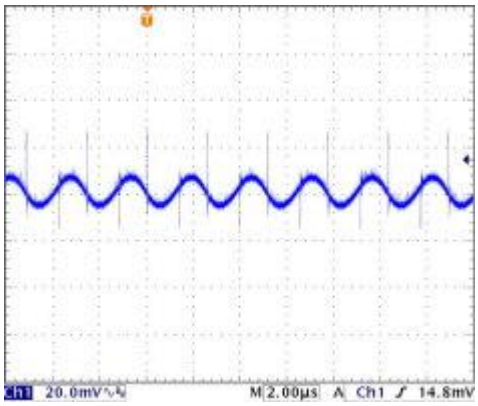
Power Dissipation versus Output Current

Characteristic Curves

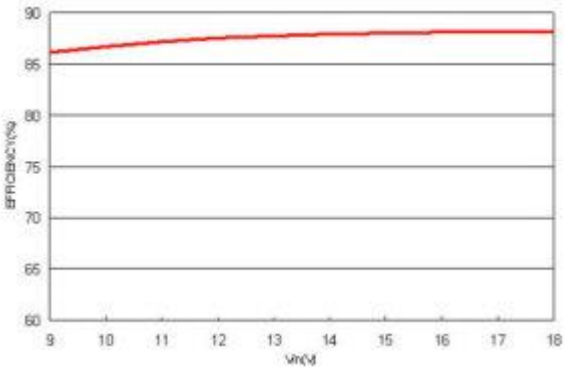
All test conditions are at 25°C. The figures are identical for THD 12-1212



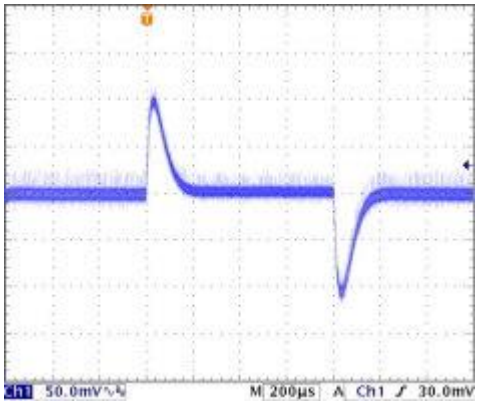
Efficiency versus Output Current



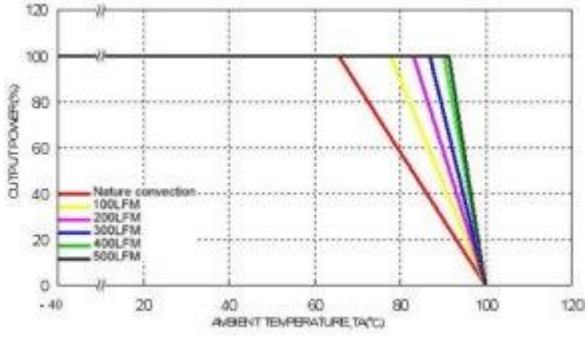
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



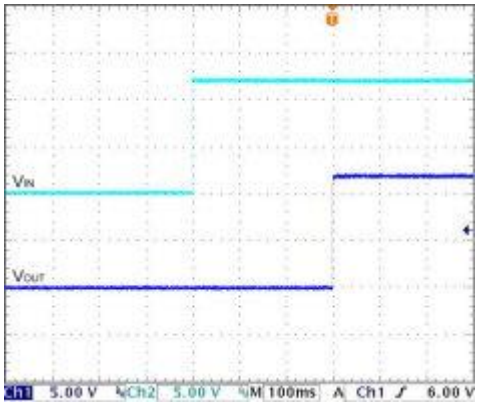
Efficiency versus Input Voltage. Full Load



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



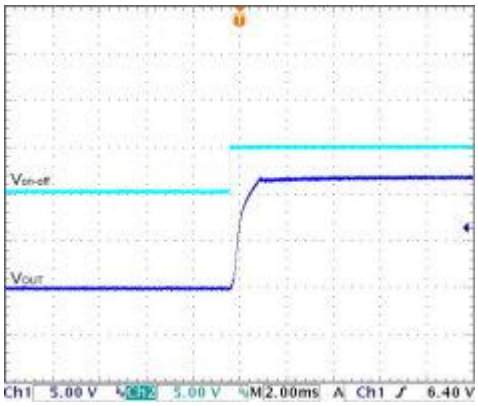
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



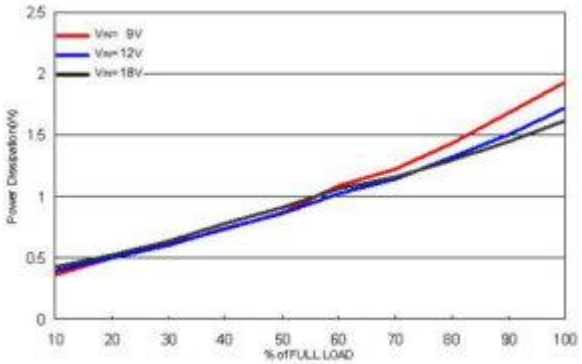
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves

All test conditions are at 25°C. The figures are identical for THD 12-1212 (Continued)



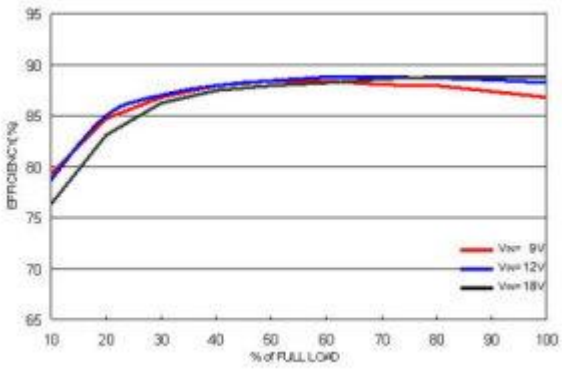
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



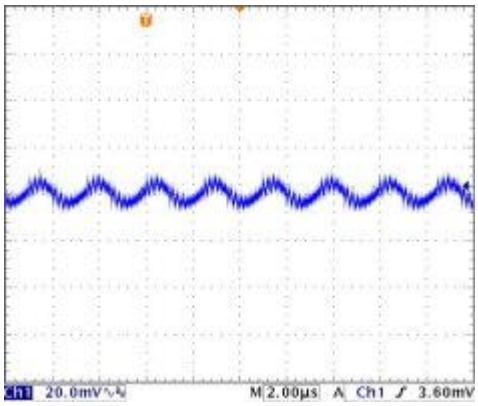
Power Dissipation versus Output Current

Characteristic Curves

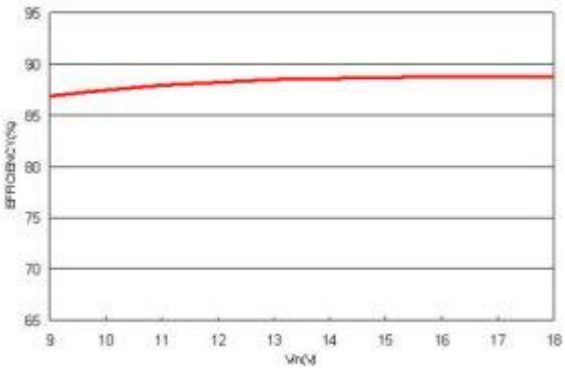
All test conditions are at 25°C. The figures are identical for THD 12-1213



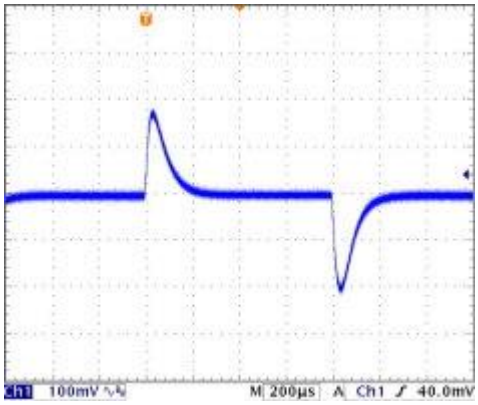
Efficiency versus Output Current



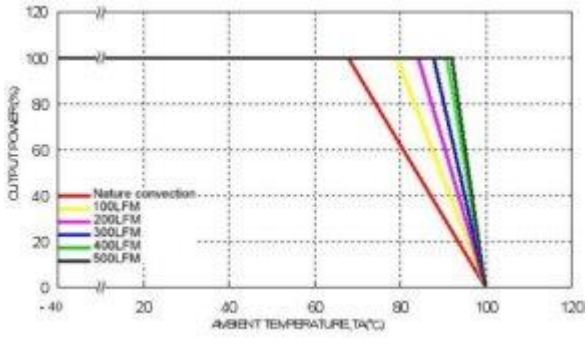
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



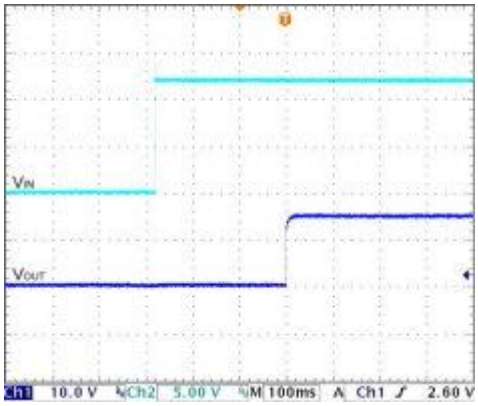
Efficiency versus Input Voltage. Full Load



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



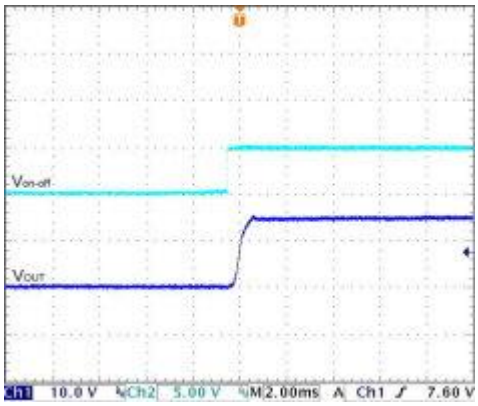
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



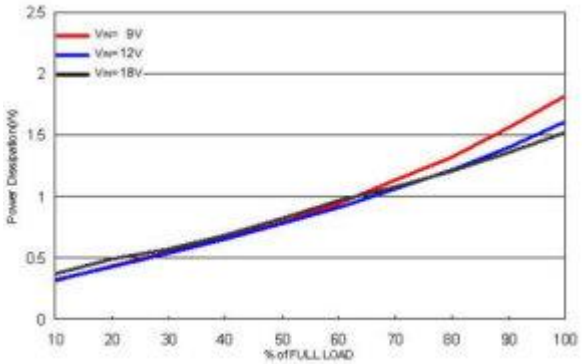
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves

All test conditions are at 25°C. The figures are identical for THD 12-1213 (Continued)



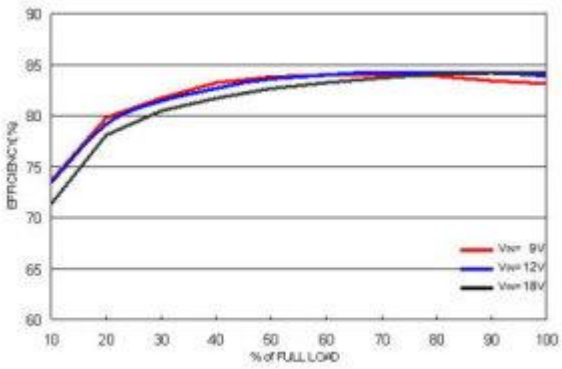
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



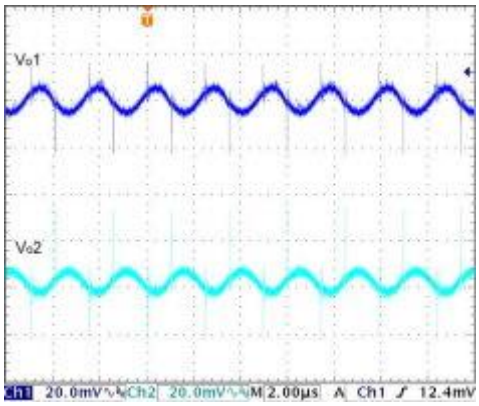
Power Dissipation versus Output Current

Characteristic Curves

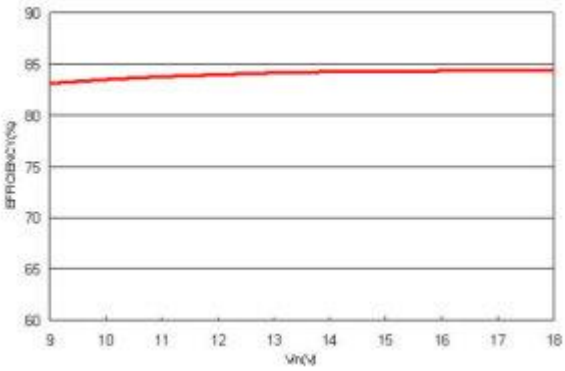
All test conditions are at 25°C. The figures are identical for THD 12-1221



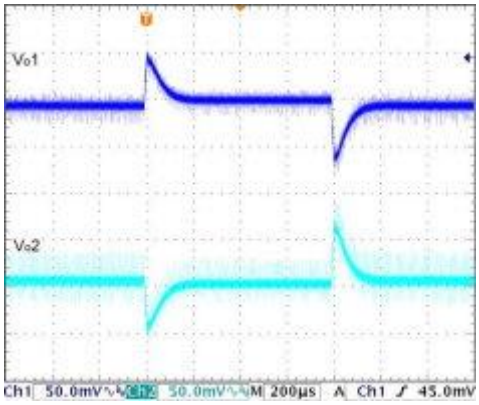
Efficiency versus Output Current



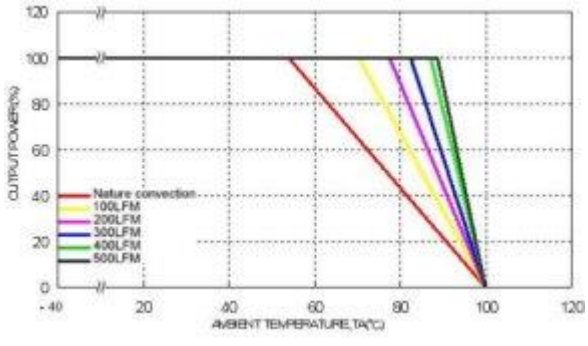
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



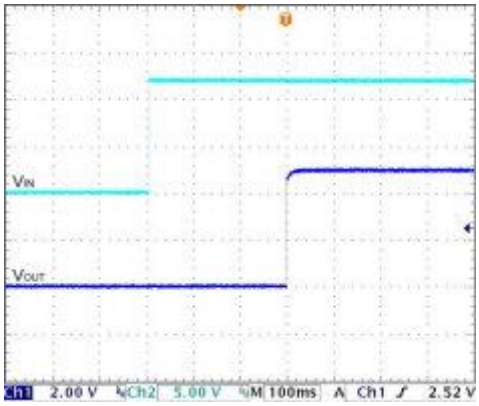
Efficiency versus Input Voltage. Full Load



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



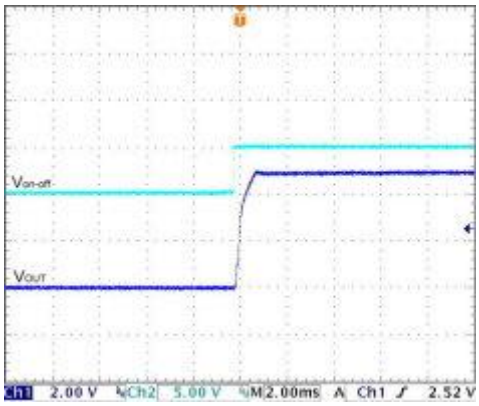
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



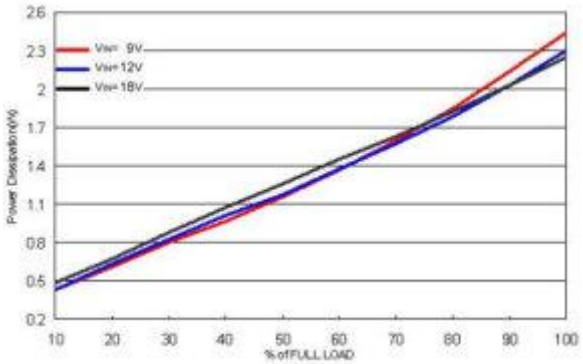
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves

All test conditions are at 25°C. The figures are identical for THD 12-1221 (Continued)



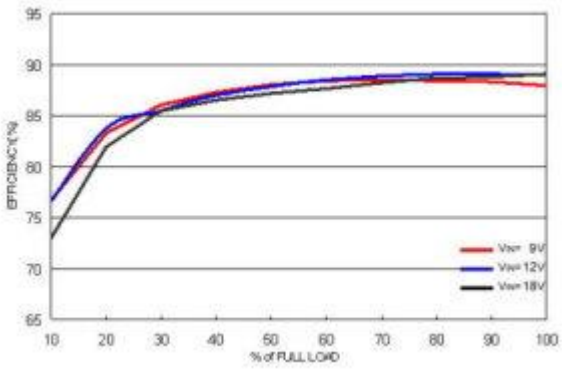
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



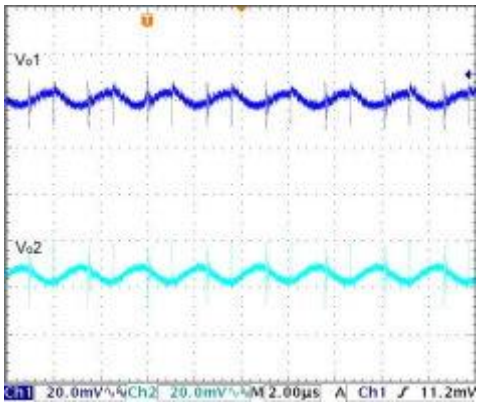
Power Dissipation versus Output Current

Characteristic Curves

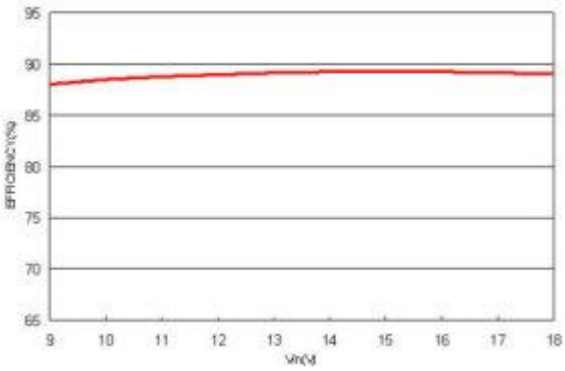
All test conditions are at 25°C. The figures are identical for THD 12-1222



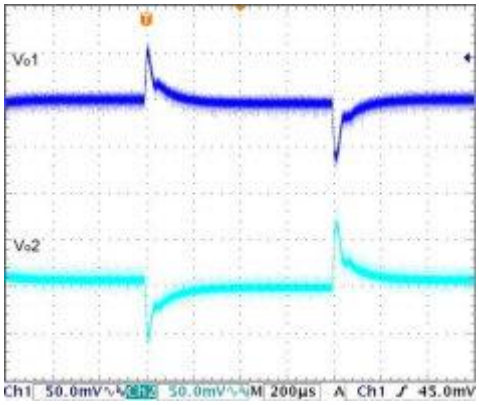
Efficiency versus Output Current



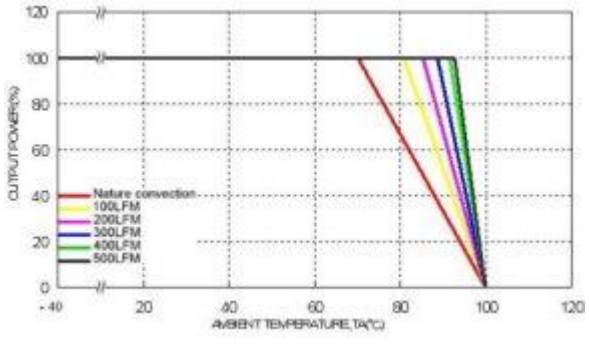
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



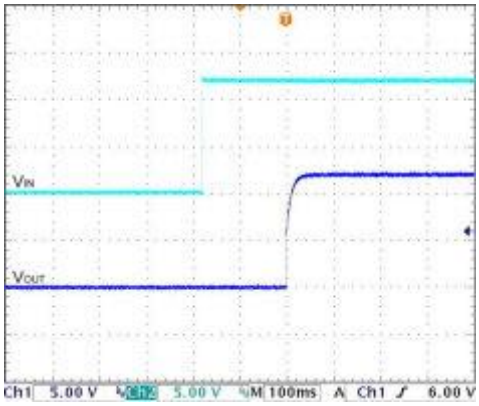
Efficiency versus Input Voltage. Full Load



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



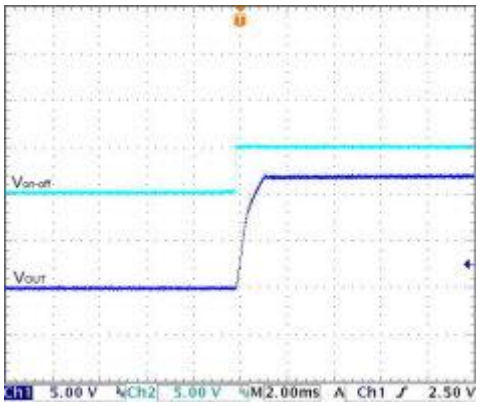
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



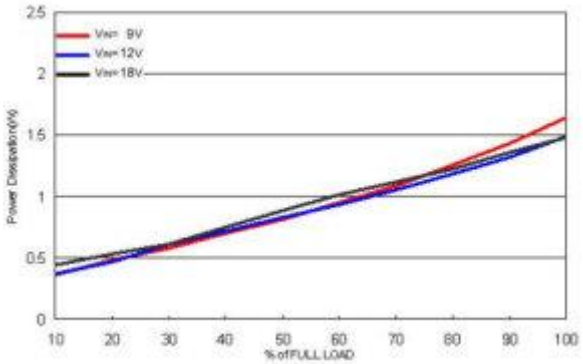
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves

All test conditions are at 25°C. The figures are identical for THD 12-1222 (Continued)



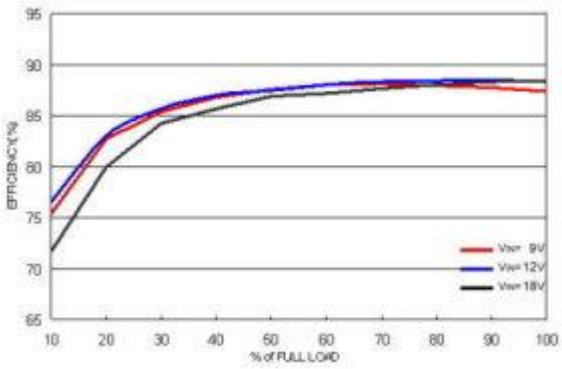
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



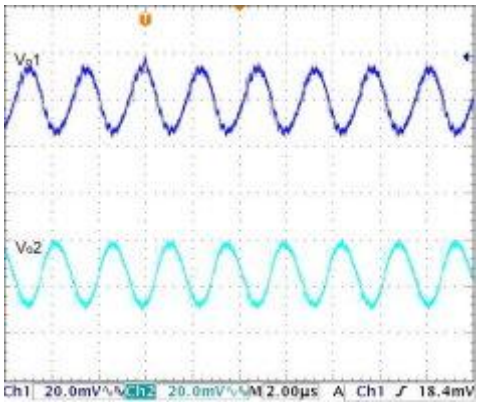
Power Dissipation versus Output Current

Characteristic Curves

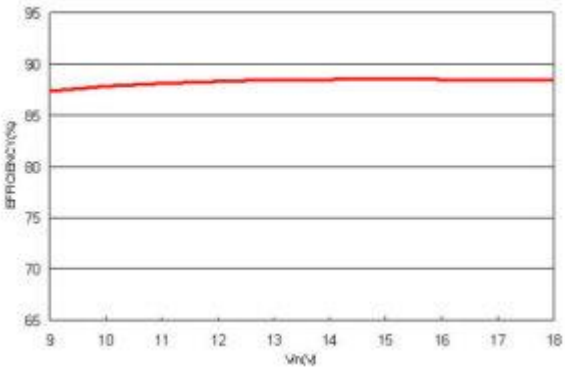
All test conditions are at 25°C. The figures are identical for THD 12-1223



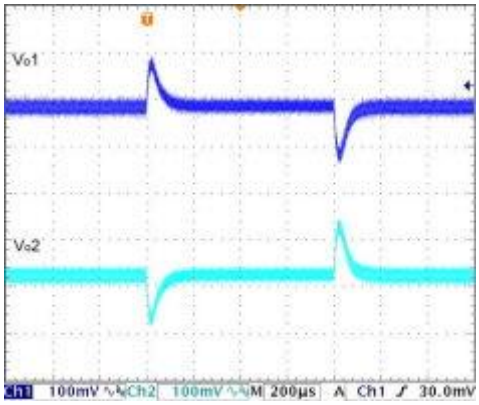
Efficiency versus Output Current



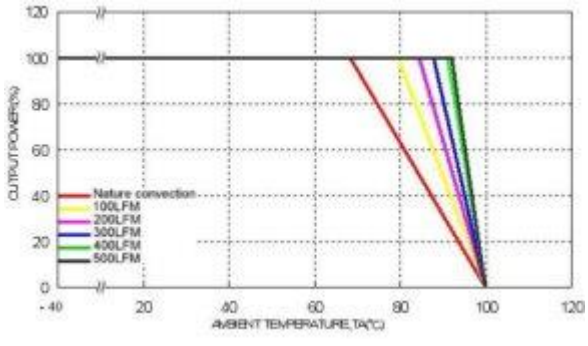
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



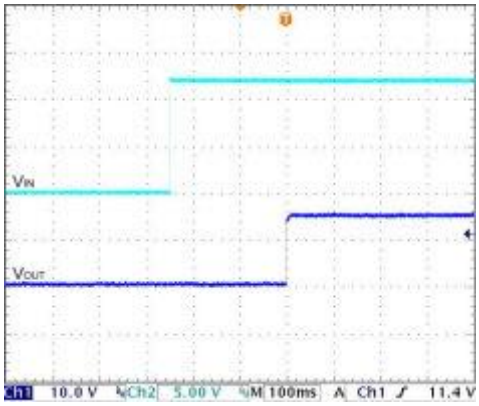
Efficiency versus Input Voltage. Full Load



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



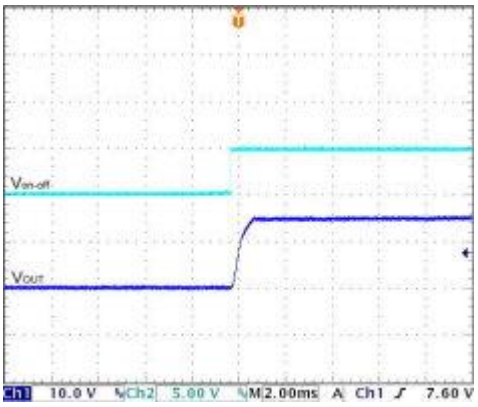
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



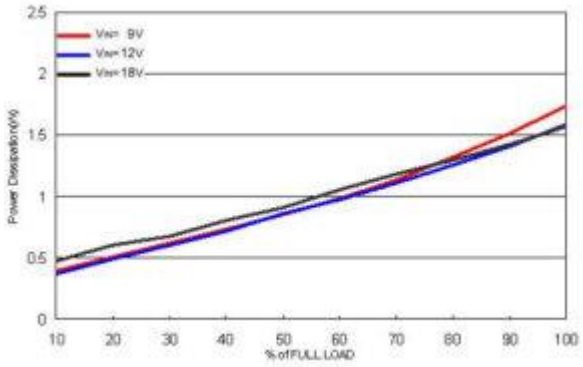
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves

All test conditions are at 25°C. The figures are identical for THD 12-1223 (Continued)



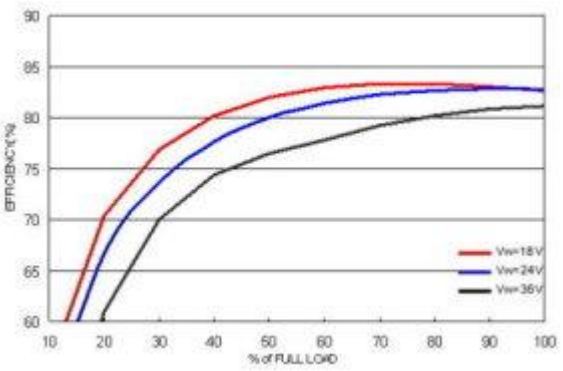
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



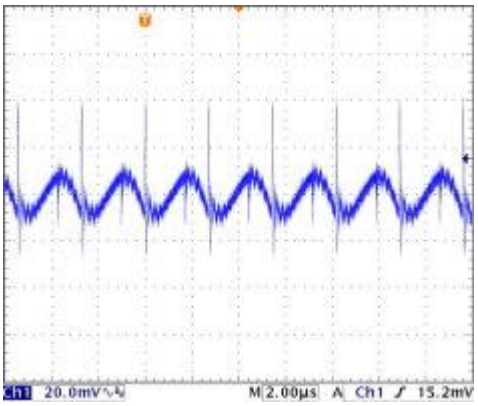
Power Dissipation versus Output Current

Characteristic Curves

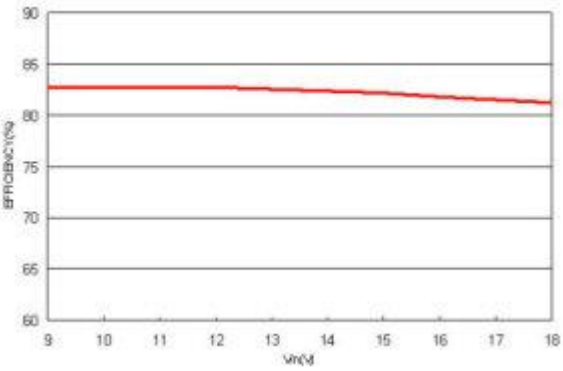
All test conditions are at 25°C. The figures are identical for THD 12-2409



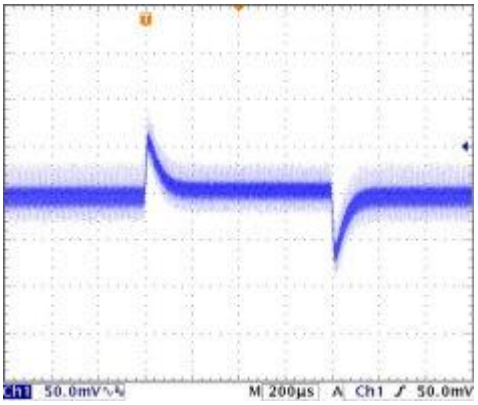
Efficiency versus Output Current



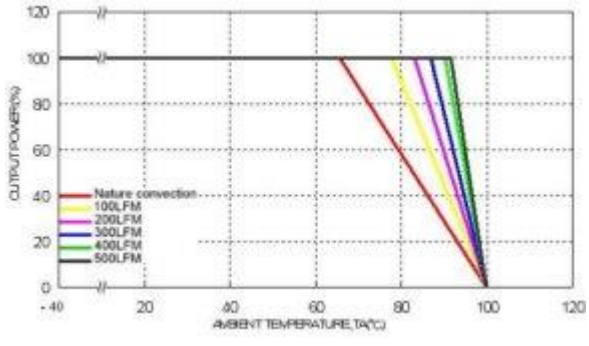
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



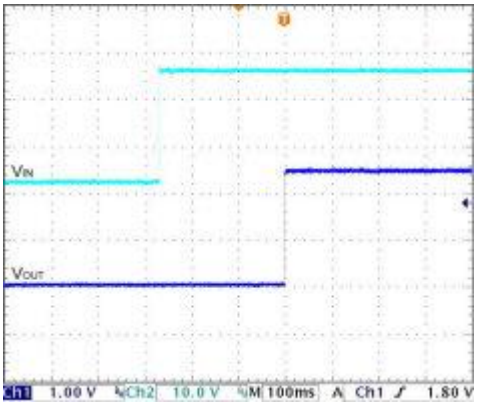
Efficiency versus Input Voltage. Full Load



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



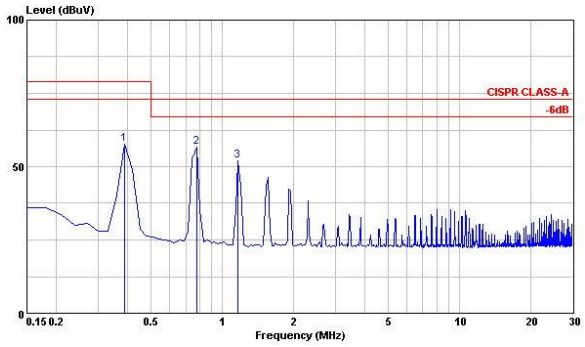
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



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

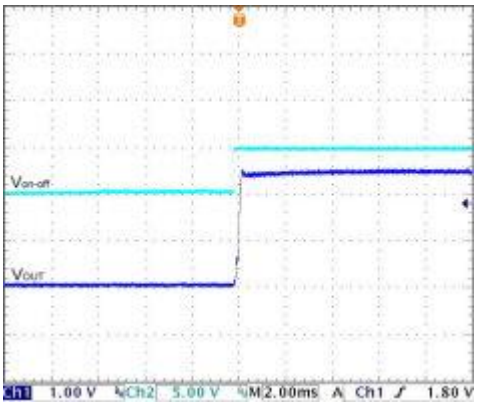
Characteristic Curves

All test conditions are at 25°C. The figures are identical for THD 12-2409 (Continued)



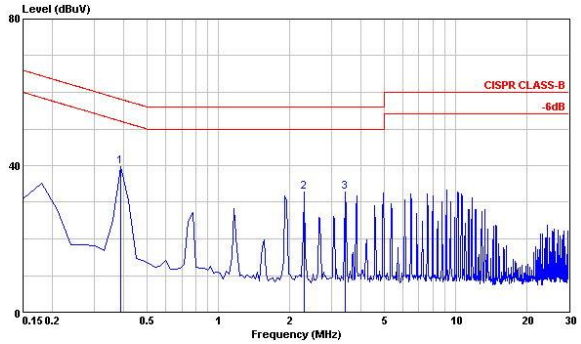
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\,nom}$, Full Load



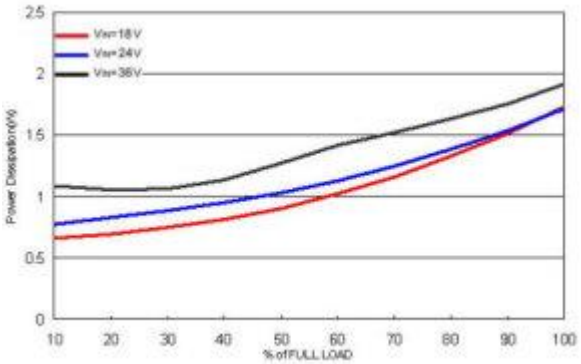
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\,nom}$, Full Load



Conduction Emission of EN55022 Class B

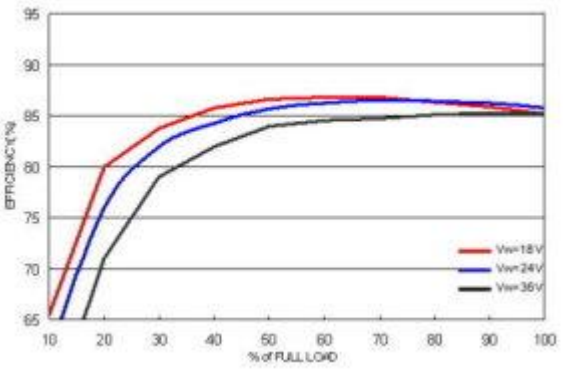
$V_{in} = V_{in\,nom}$, Full Load



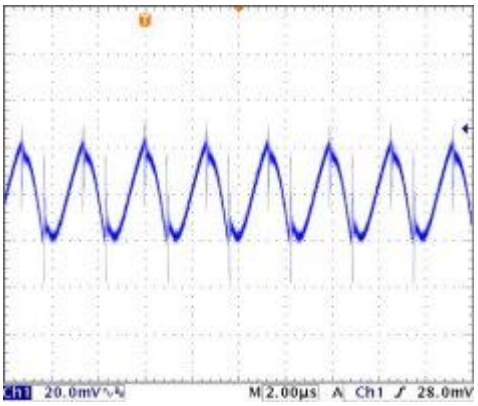
Power Dissipation versus Output Current

Characteristic Curves

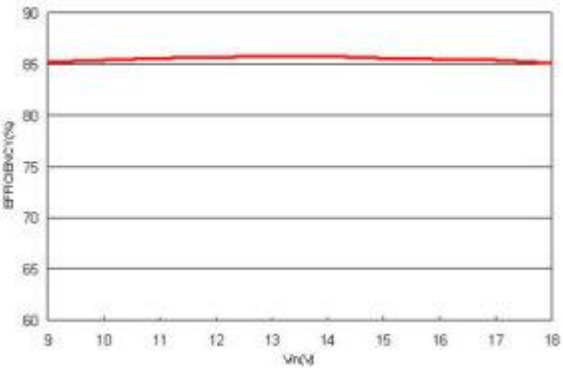
All test conditions are at 25°C. The figures are identical for THD 12-2410



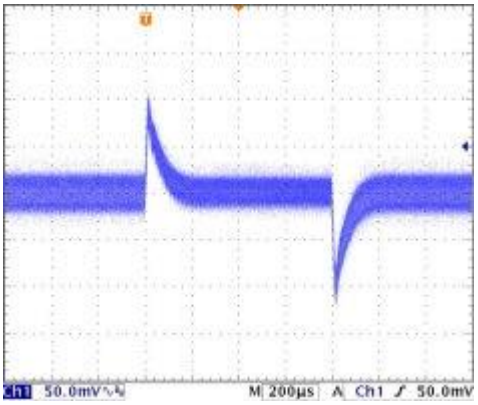
Efficiency versus Output Current



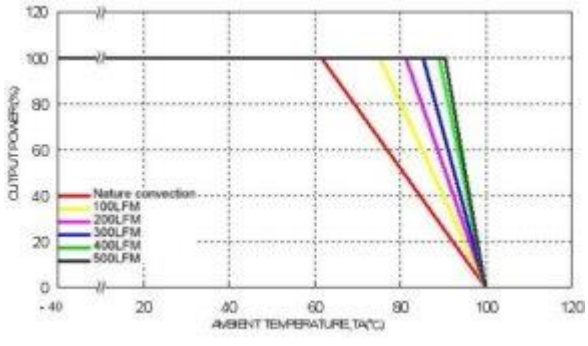
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



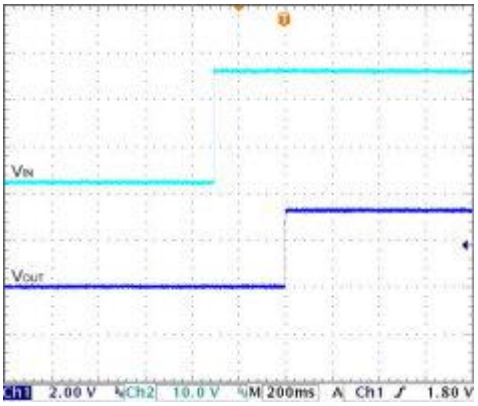
Efficiency versus Input Voltage. Full Load



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



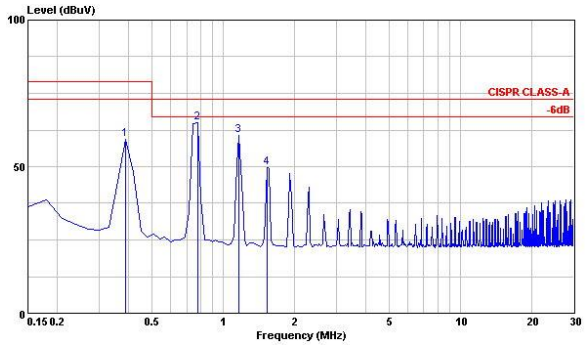
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



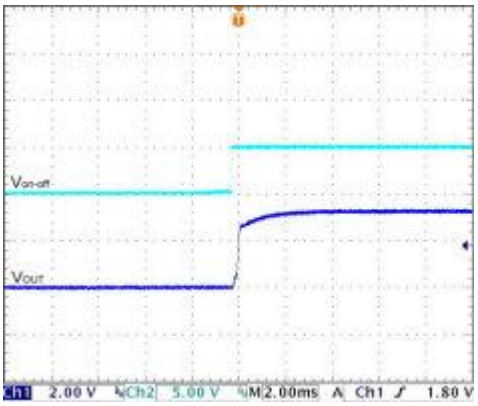
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves

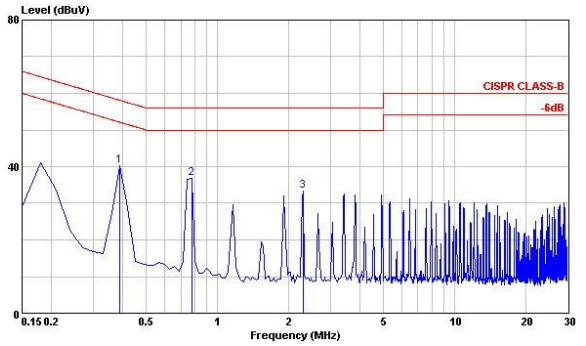
All test conditions are at 25°C. The figures are identical for THD 12-2410 (Continued)



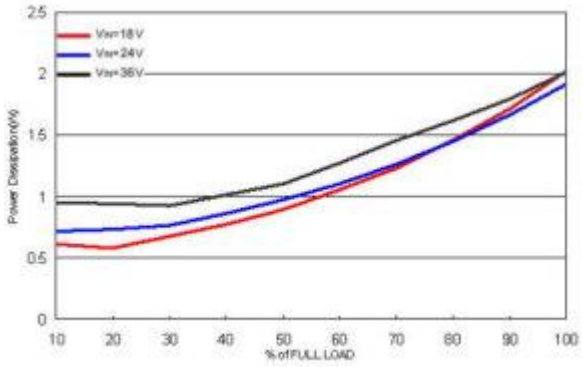
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$, Full Load



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



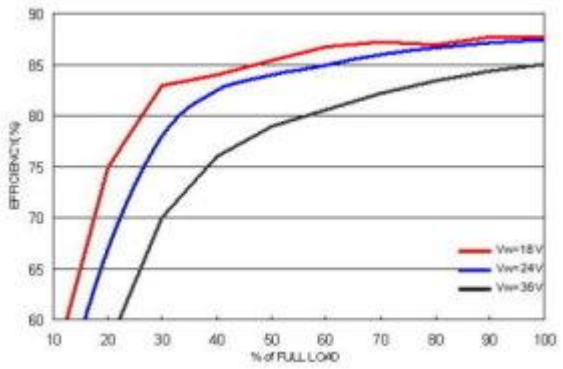
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$, Full Load



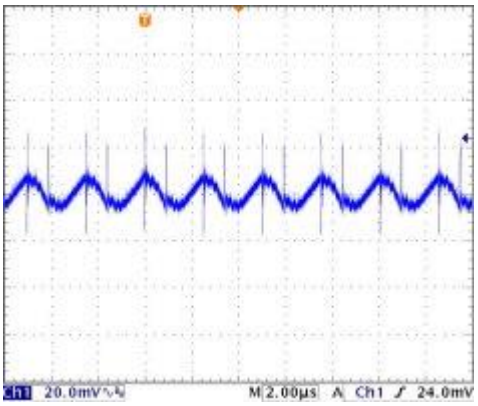
Power Dissipation versus Output Current

Characteristic Curves

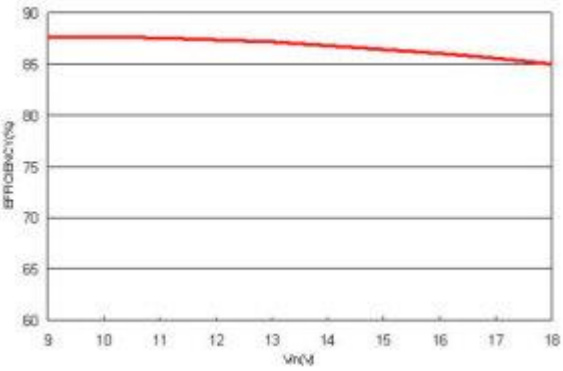
All test conditions are at 25°C. The figures are identical for THD 12-2411



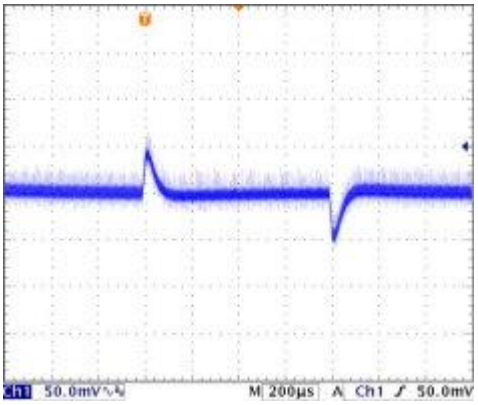
Efficiency versus Output Current



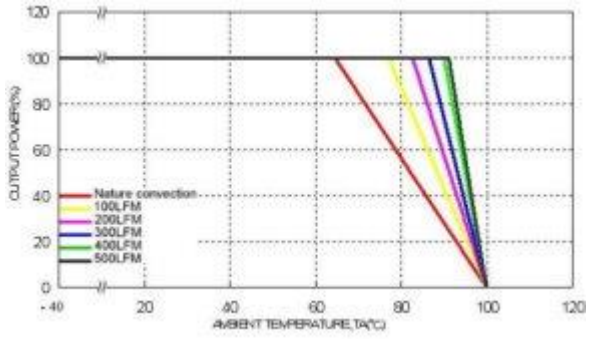
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



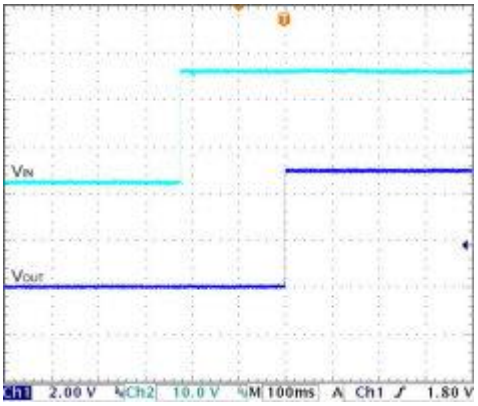
Efficiency versus Input Voltage. Full Load



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



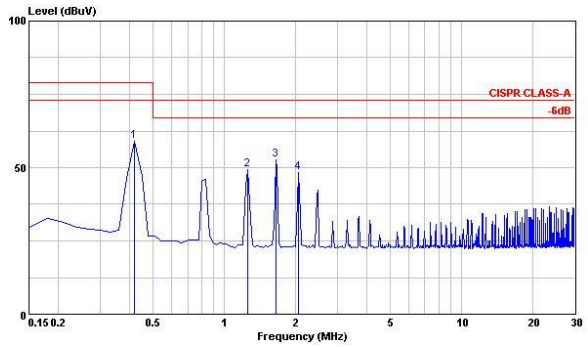
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



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

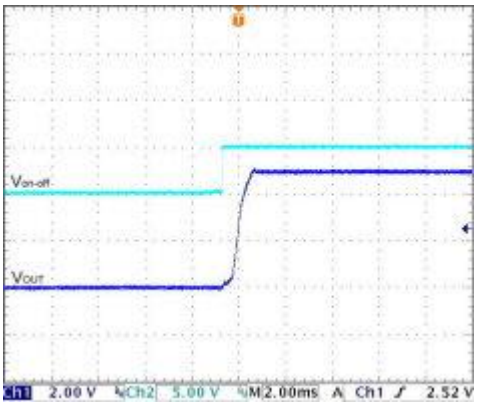
Characteristic Curves

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



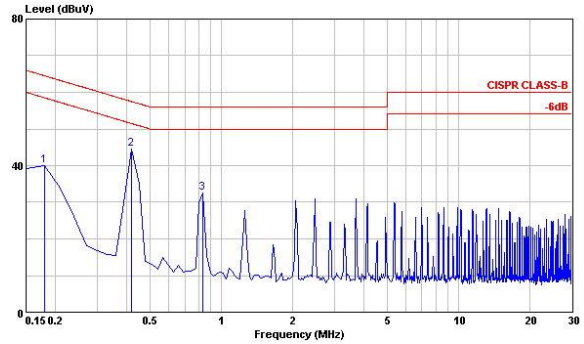
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\,nom}$, Full Load



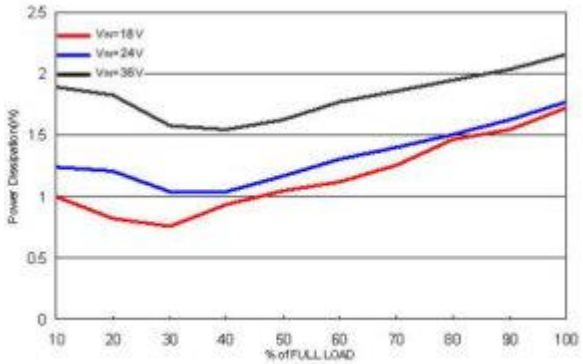
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\,nom}$, Full Load



Conduction Emission of EN55022 Class B

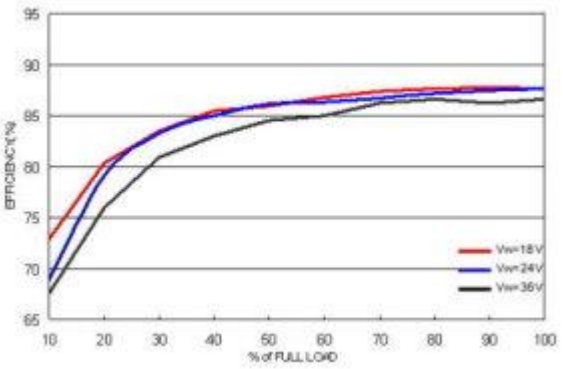
$V_{in} = V_{in\,nom}$, Full Load



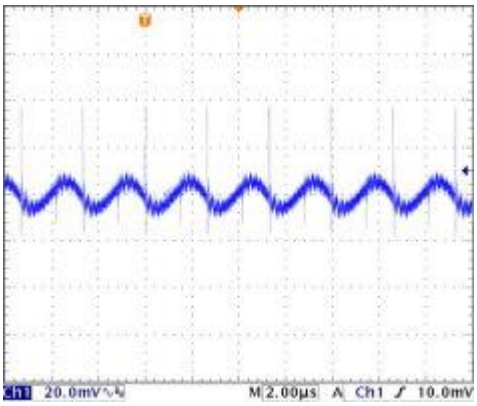
Power Dissipation versus Output Current

Characteristic Curves

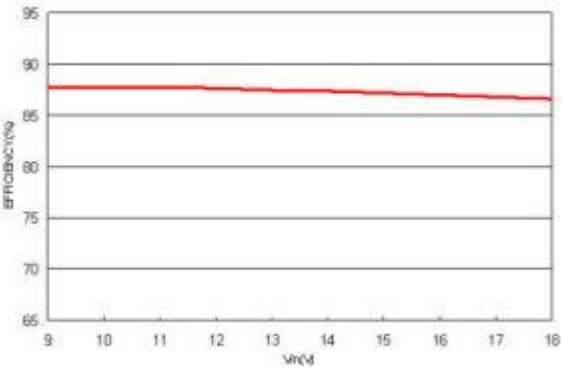
All test conditions are at 25°C. The figures are identical for THD 12-2412



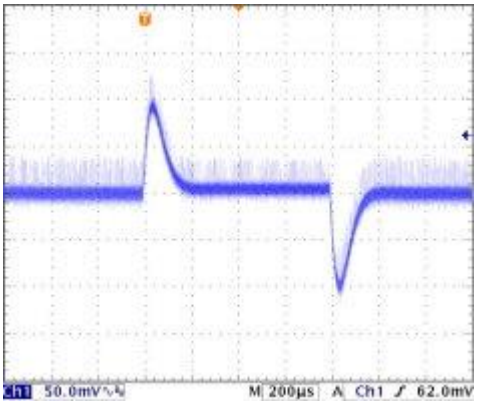
Efficiency versus Output Current



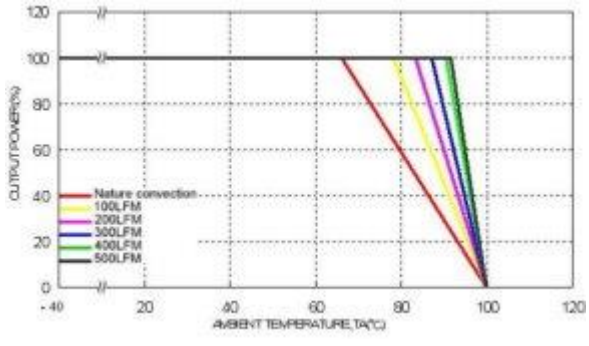
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



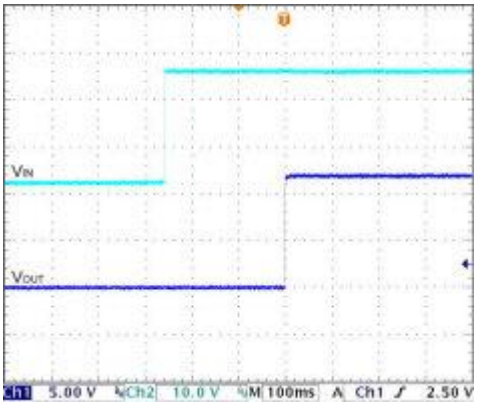
Efficiency versus Input Voltage. Full Load



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



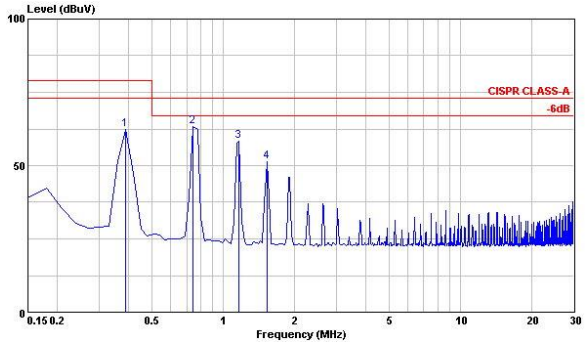
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



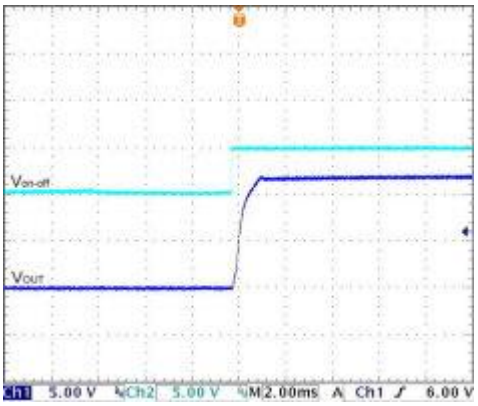
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves

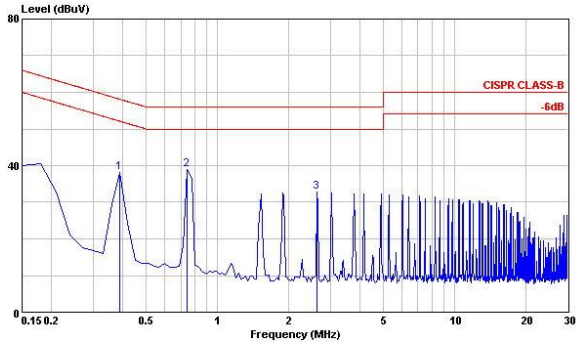
All test conditions are at 25°C. The figures are identical for THD 12-2412 (Continued)



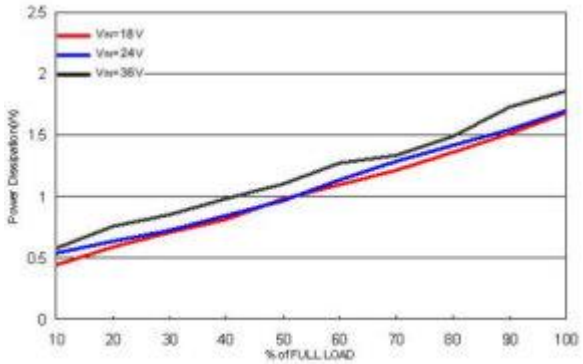
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$, Full Load



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



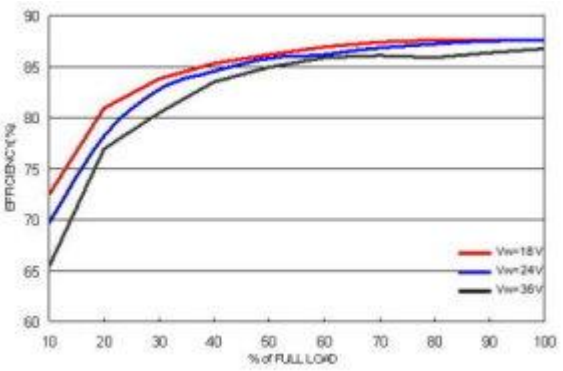
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$, Full Load



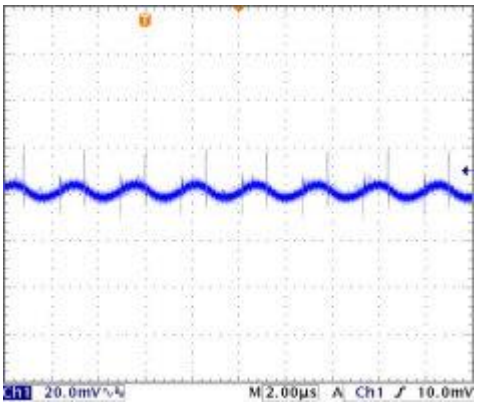
Power Dissipation versus Output Current

Characteristic Curves

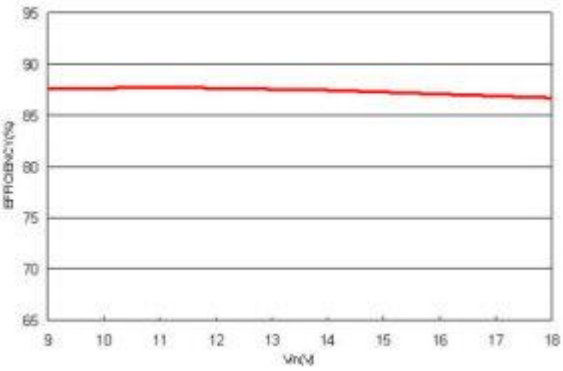
All test conditions are at 25°C. The figures are identical for THD 12-2413



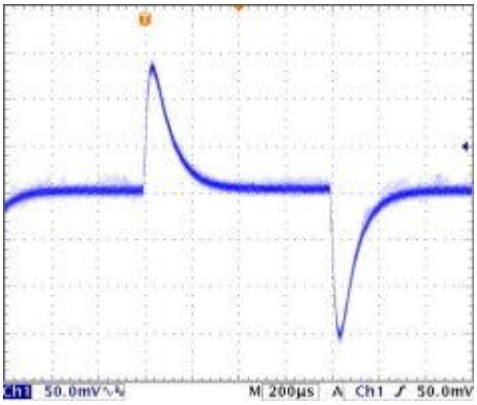
Efficiency versus Output Current



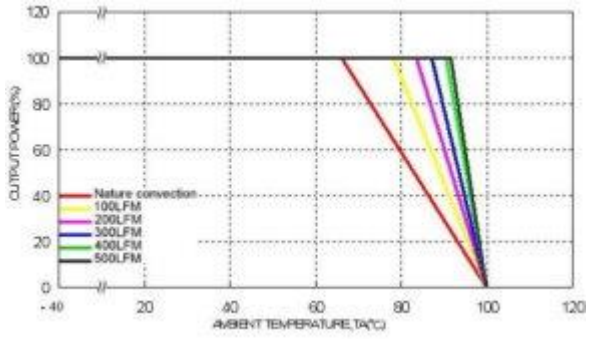
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



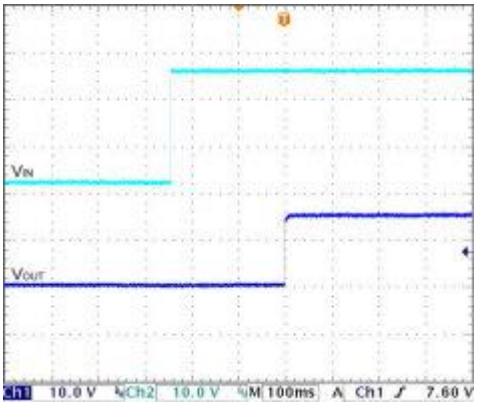
Efficiency versus Input Voltage. Full Load



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



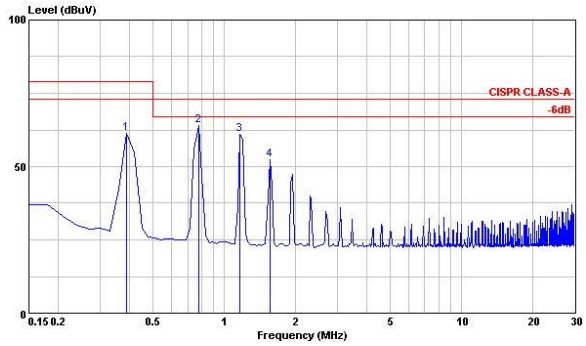
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



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

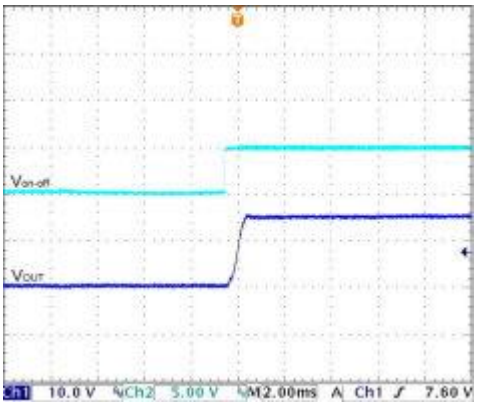
Characteristic Curves

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



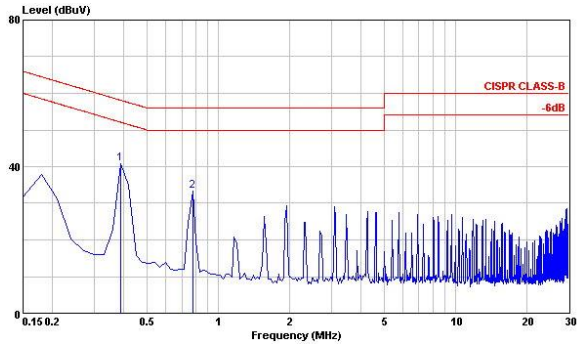
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\,nom}$, Full Load



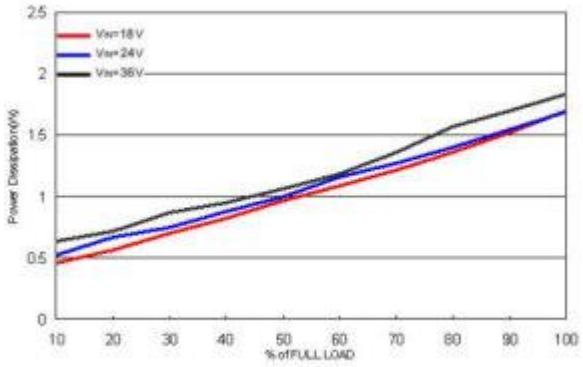
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\,nom}$, Full Load



Conduction Emission of EN55022 Class B

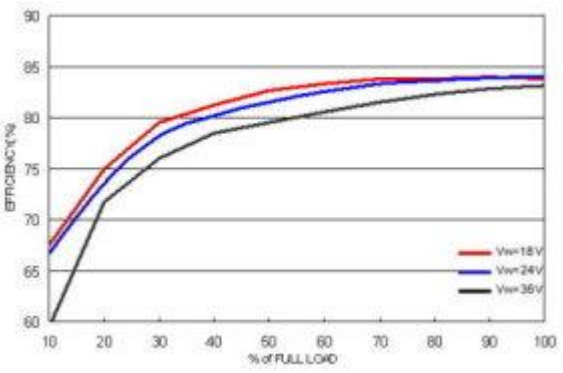
$V_{in} = V_{in\,nom}$, Full Load



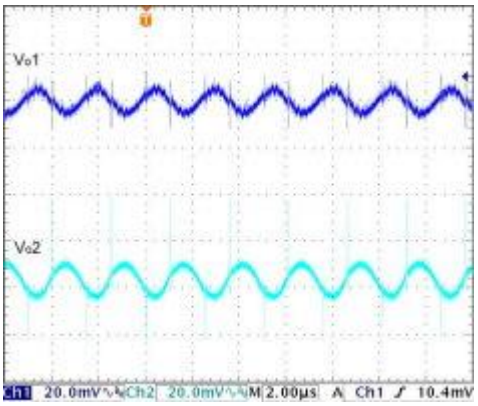
Power Dissipation versus Output Current

Characteristic Curves

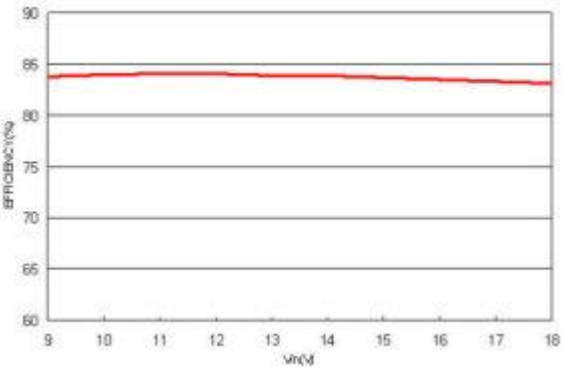
All test conditions are at 25°C. The figures are identical for THD 12-2421



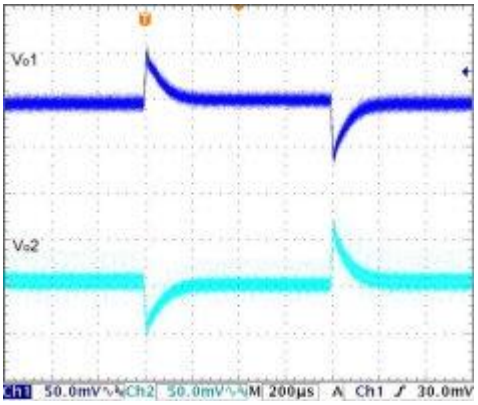
Efficiency versus Output Current



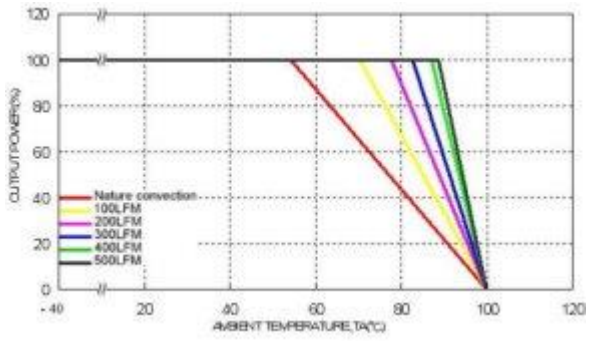
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



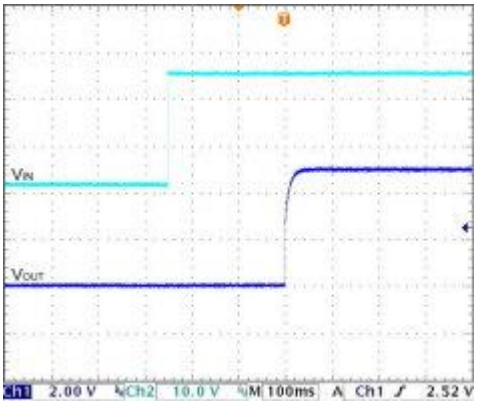
Efficiency versus Input Voltage. Full Load



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



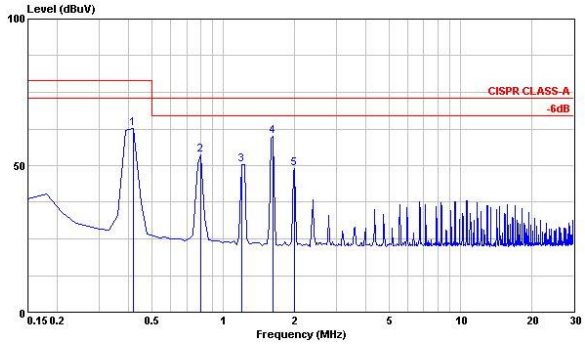
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



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

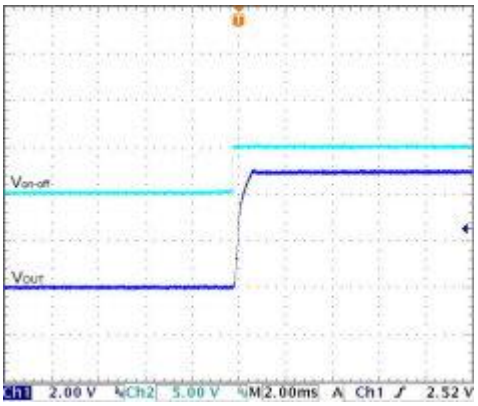
Characteristic Curves

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



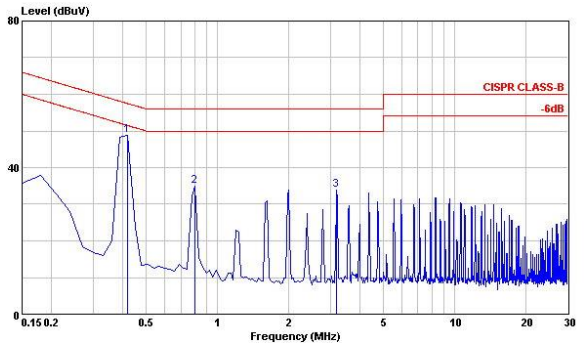
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\,nom}$, Full Load



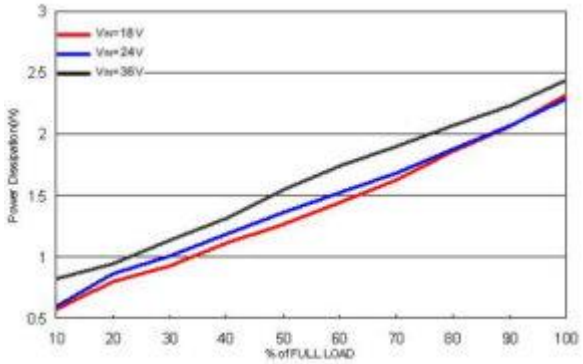
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\,nom}$, Full Load



Conduction Emission of EN55022 Class B

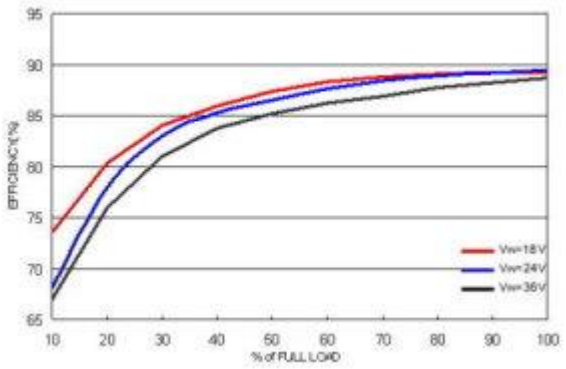
$V_{in} = V_{in\,nom}$, Full Load



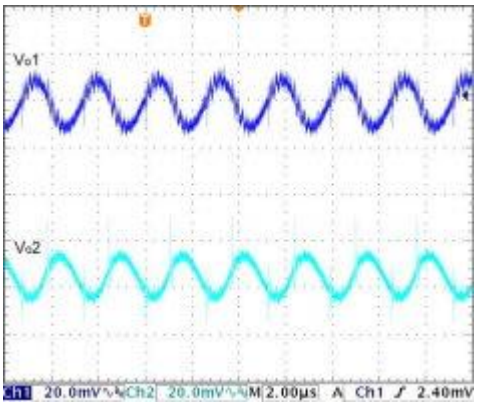
Power Dissipation versus Output Current

Characteristic Curves

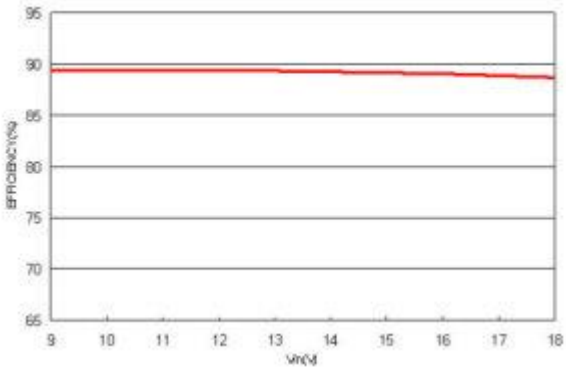
All test conditions are at 25°C. The figures are identical for THD 12-2422



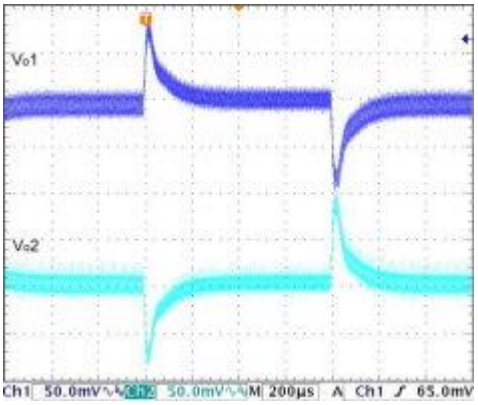
Efficiency versus Output Current



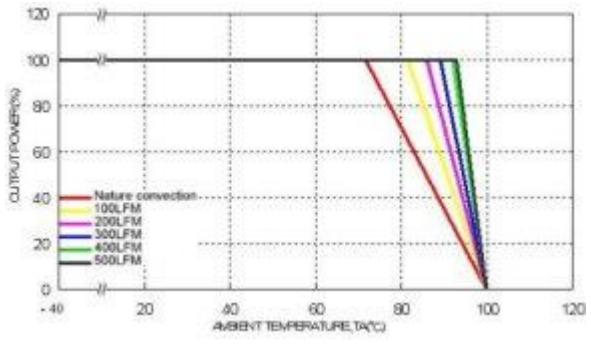
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



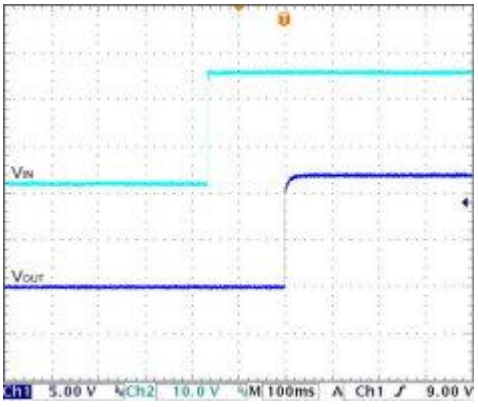
Efficiency versus Input Voltage. Full Load



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



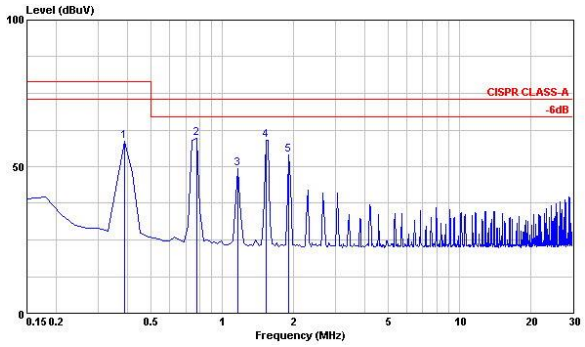
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



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

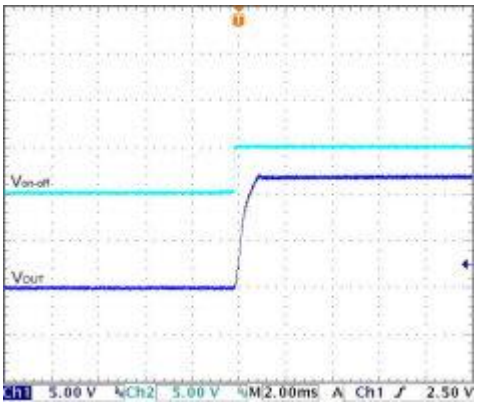
Characteristic Curves

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



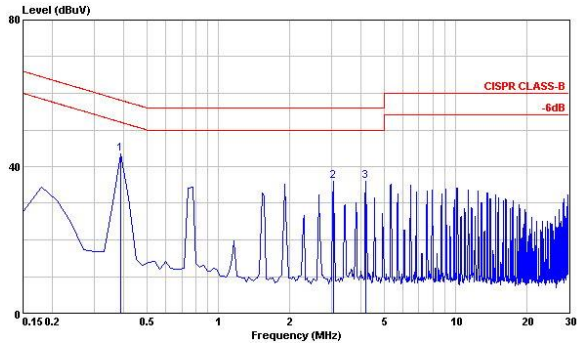
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\,nom}$, Full Load



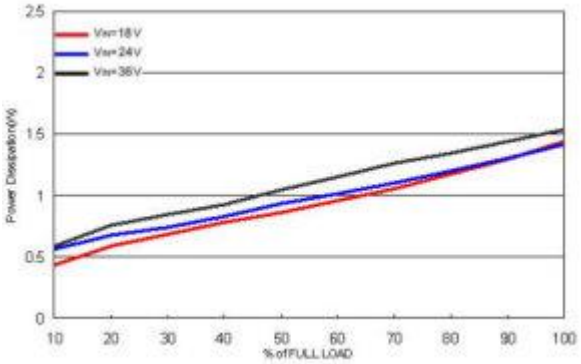
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\,nom}$, Full Load



Conduction Emission of EN55022 Class B

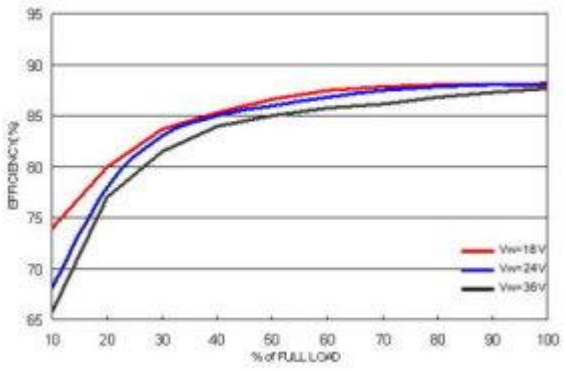
$V_{in} = V_{in\,nom}$, Full Load



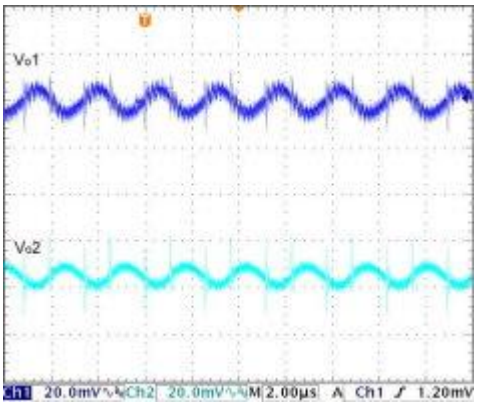
Power Dissipation versus Output Current

Characteristic Curves

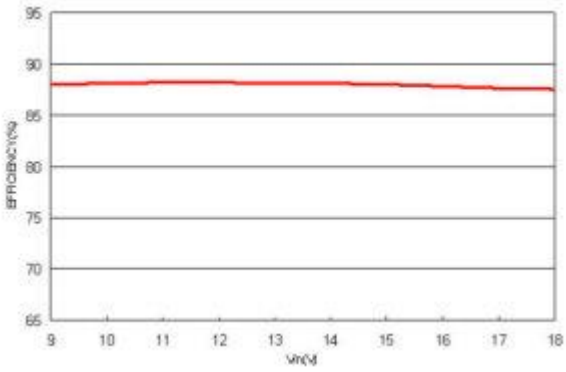
All test conditions are at 25°C. The figures are identical for THD 12-2423



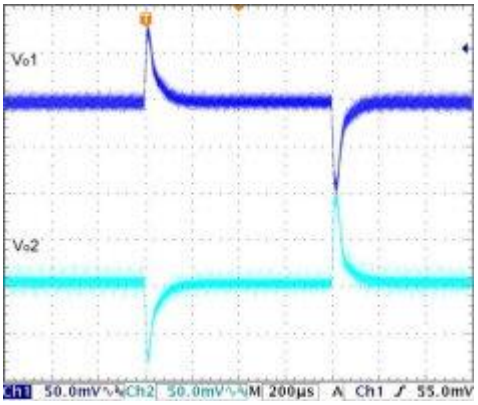
Efficiency versus Output Current



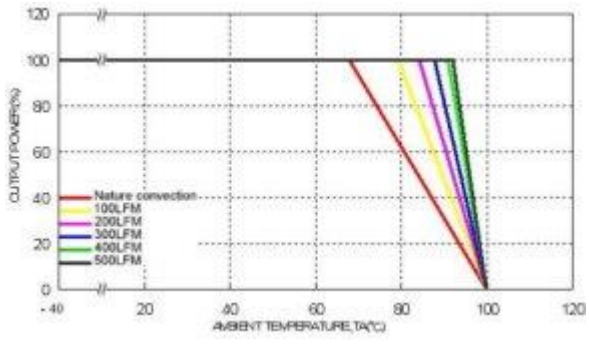
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



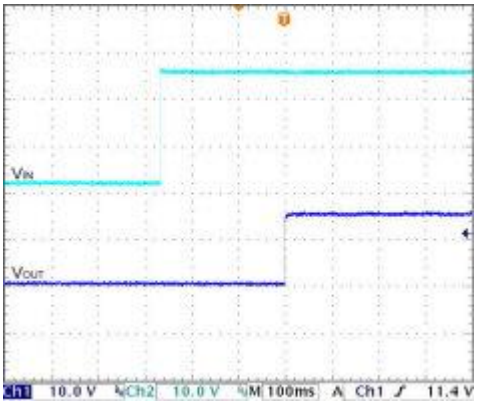
Efficiency versus Input Voltage. Full Load



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



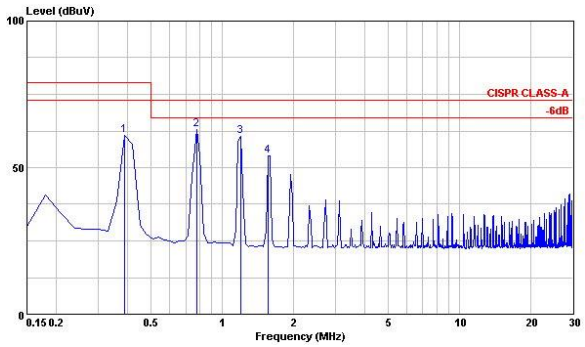
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



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

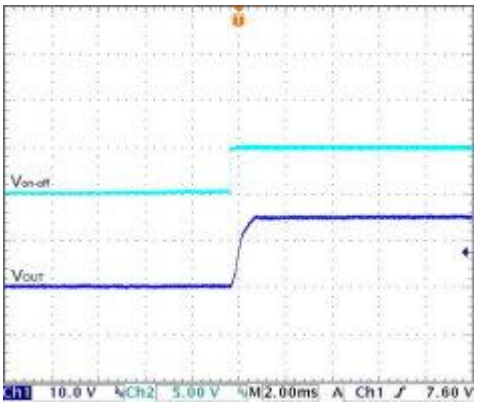
Characteristic Curves

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



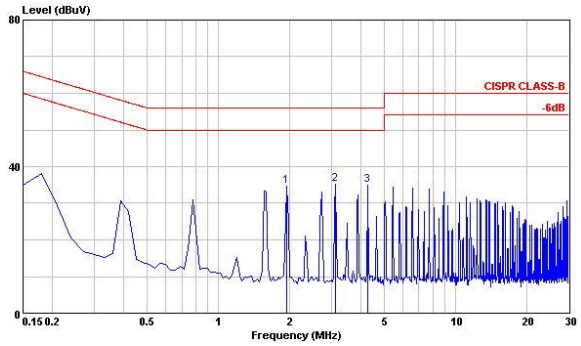
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\,nom}$, Full Load



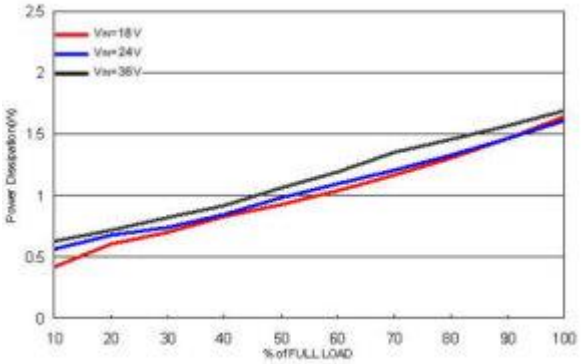
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\,nom}$, Full Load



Conduction Emission of EN55022 Class B

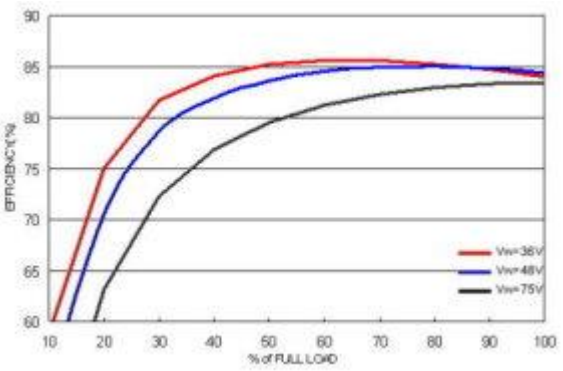
$V_{in} = V_{in\,nom}$, Full Load



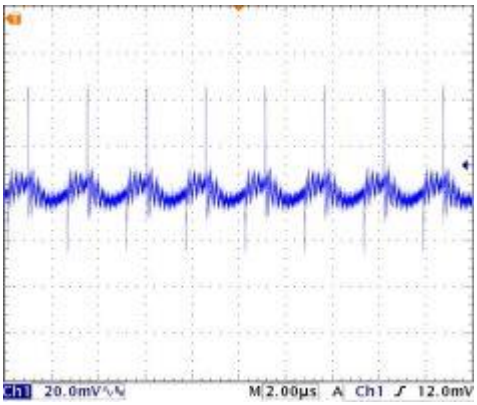
Power Dissipation versus Output Current

Characteristic Curves

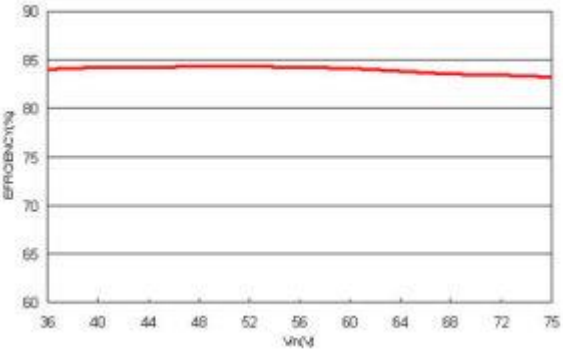
All test conditions are at 25°C. The figures are identical for THD 12-4809



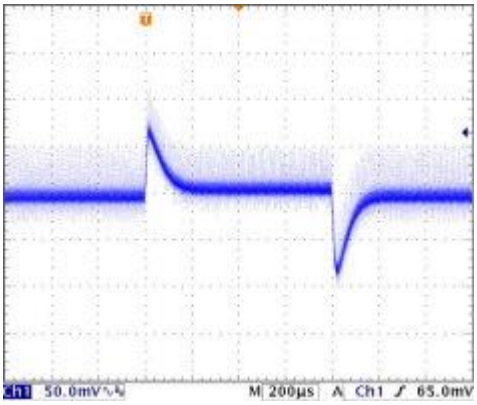
Efficiency versus Output Current



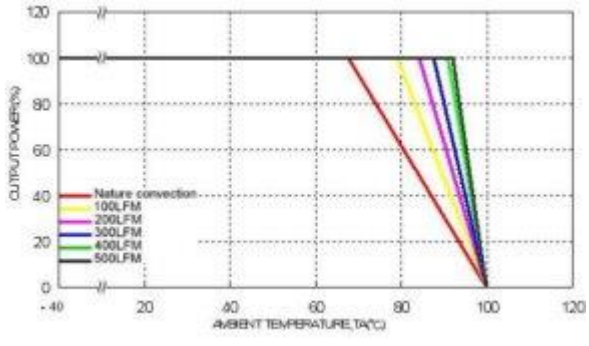
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



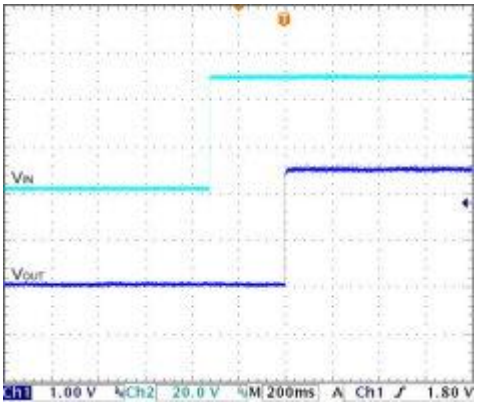
Efficiency versus Input Voltage. Full Load



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



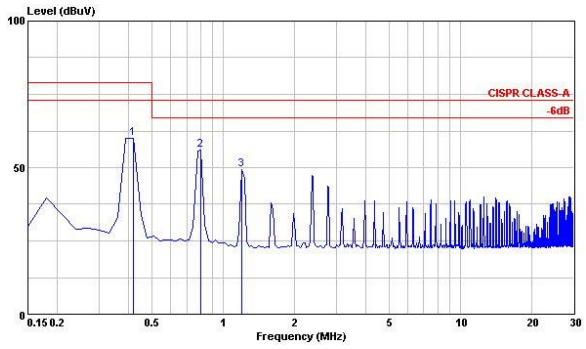
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



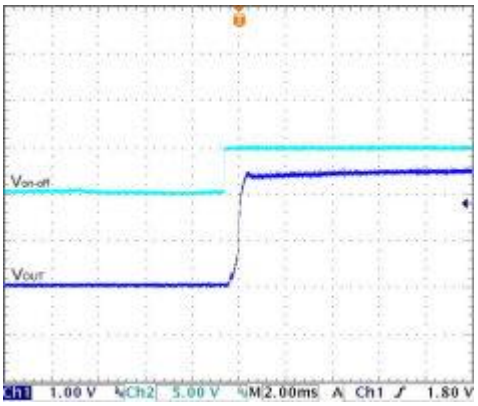
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves

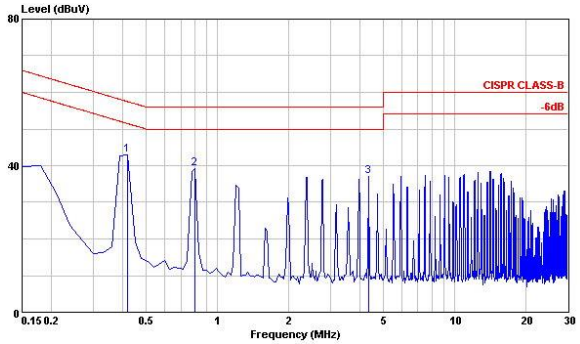
All test conditions are at 25°C. The figures are identical for THD 12-4809 (Continued)



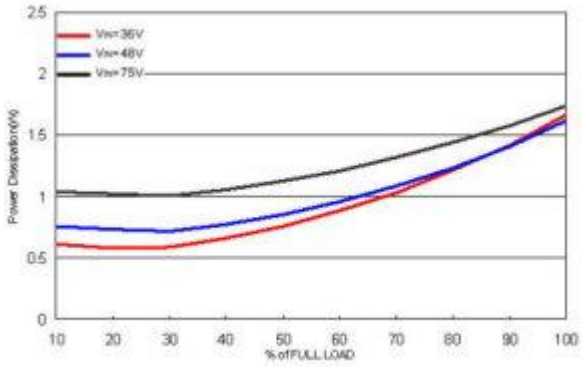
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$, Full Load



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



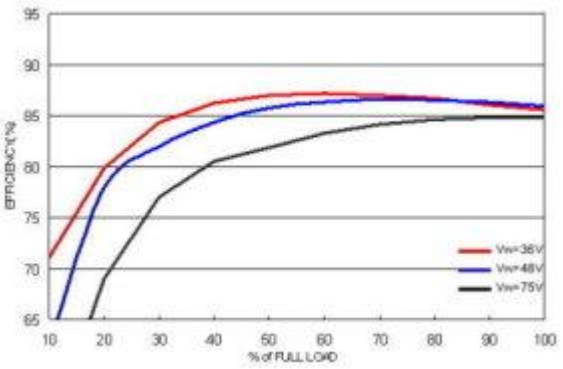
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$, Full Load



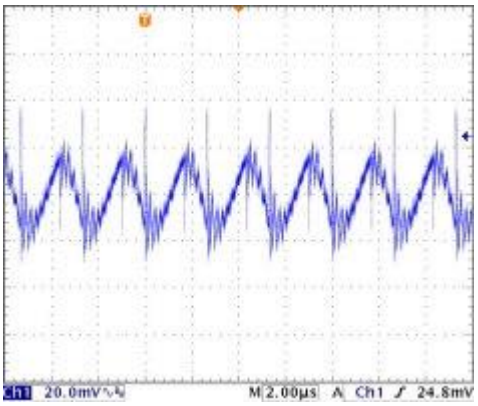
Power Dissipation versus Output Current

Characteristic Curves

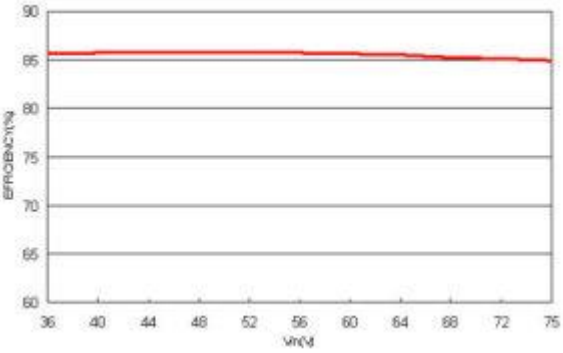
All test conditions are at 25°C. The figures are identical for THD 12-4810



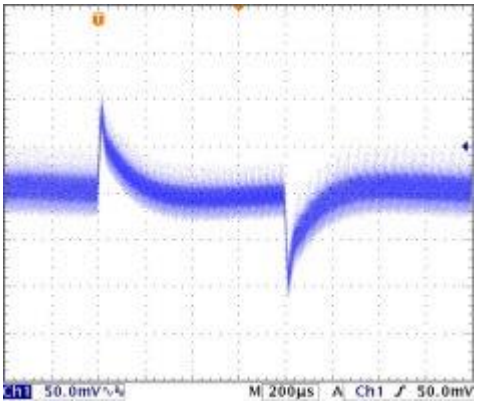
Efficiency versus Output Current



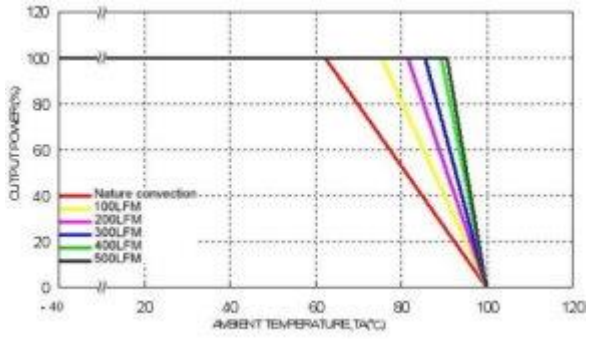
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



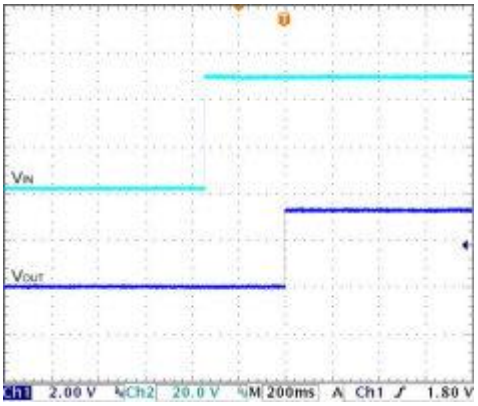
Efficiency versus Input Voltage. Full Load



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



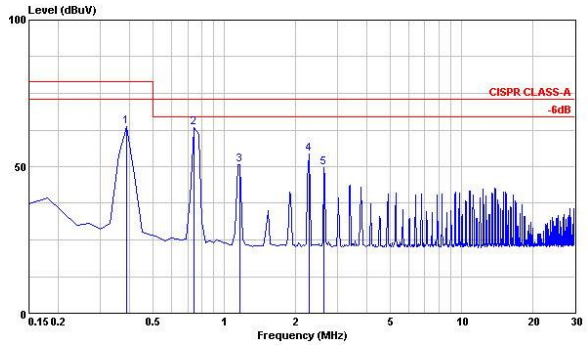
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



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

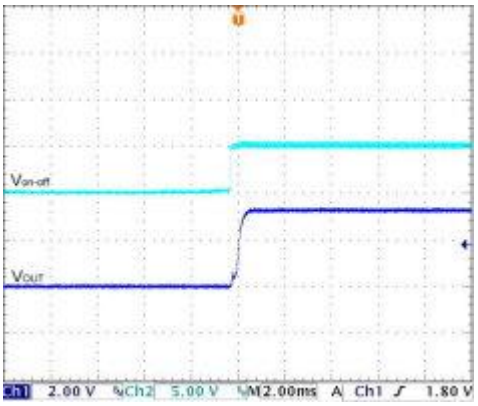
Characteristic Curves

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



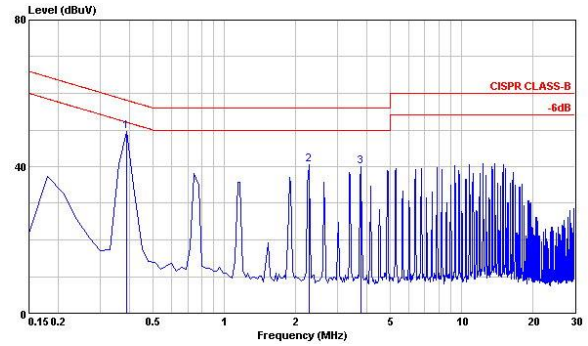
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\,nom}$, Full Load



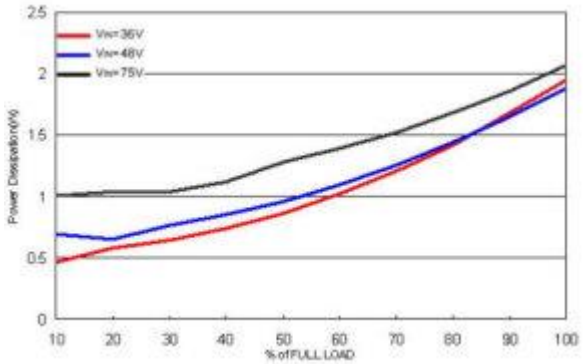
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\,nom}$, Full Load



Conduction Emission of EN55022 Class B

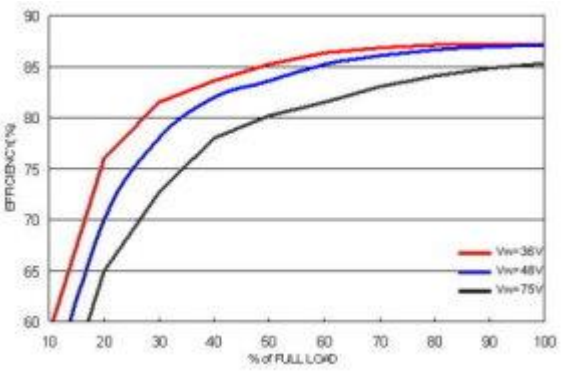
$V_{in} = V_{in\,nom}$, Full Load



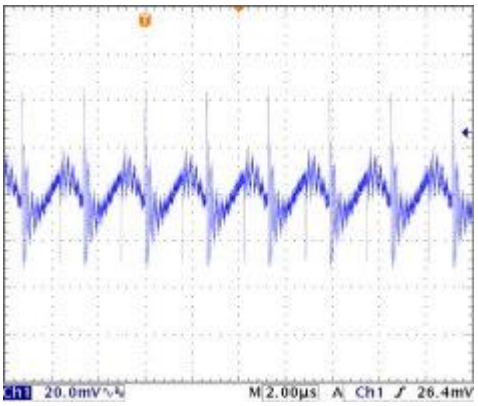
Power Dissipation versus Output Current

Characteristic Curves

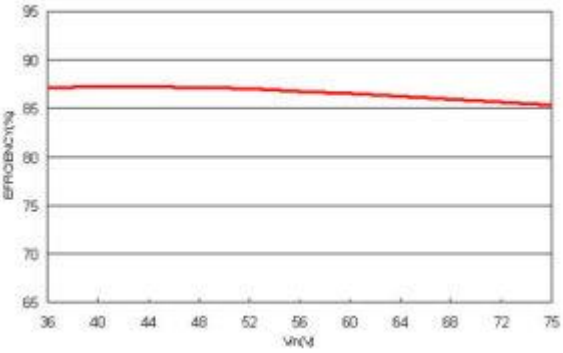
All test conditions are at 25°C. The figures are identical for THD 12-4811



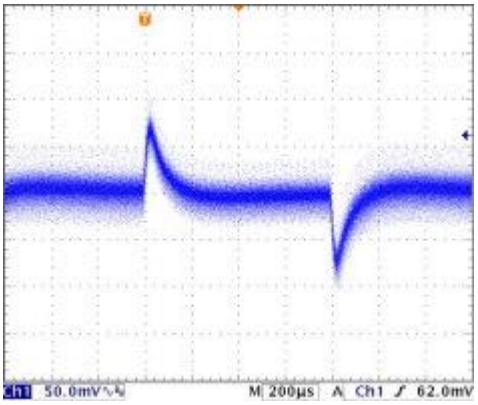
Efficiency versus Output Current



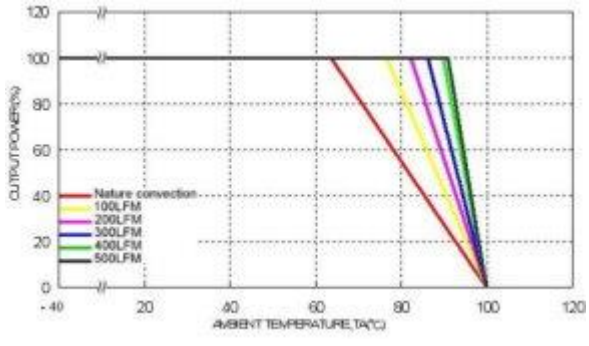
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



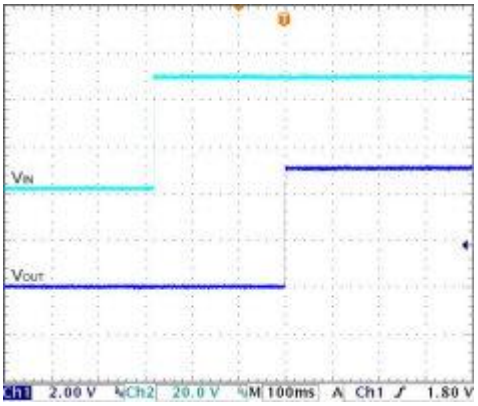
Efficiency versus Input Voltage. Full Load



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



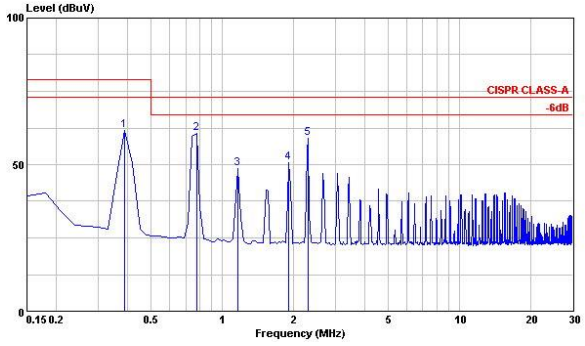
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



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

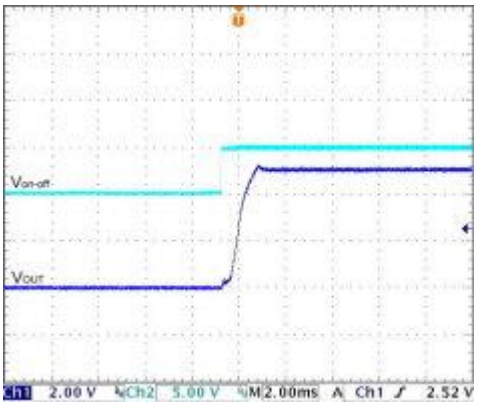
Characteristic Curves

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



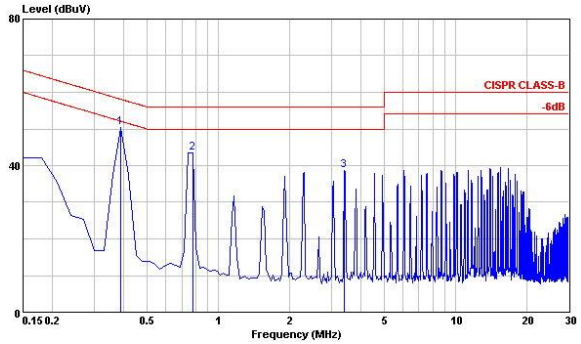
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\,nom}$, Full Load



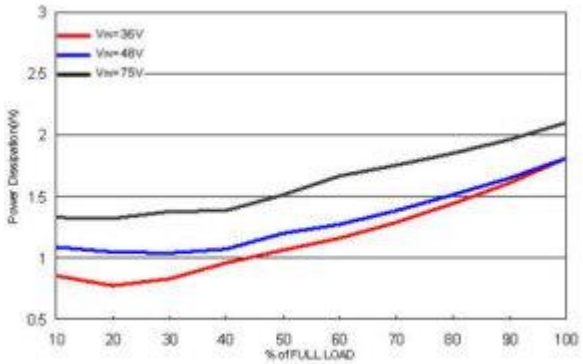
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\,nom}$, Full Load



Conduction Emission of EN55022 Class B

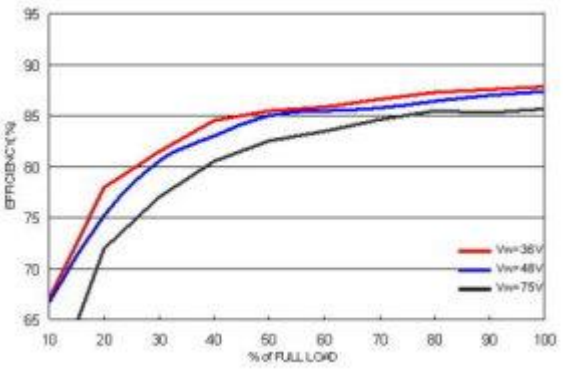
$V_{in} = V_{in\,nom}$, Full Load



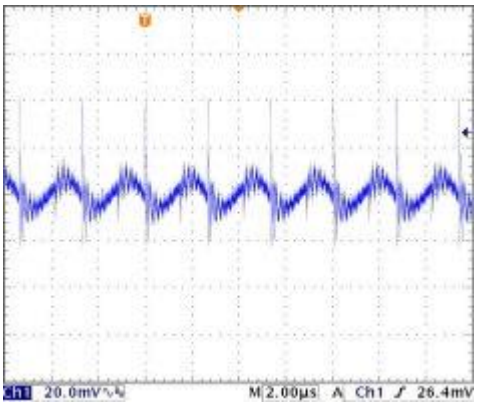
Power Dissipation versus Output Current

Characteristic Curves

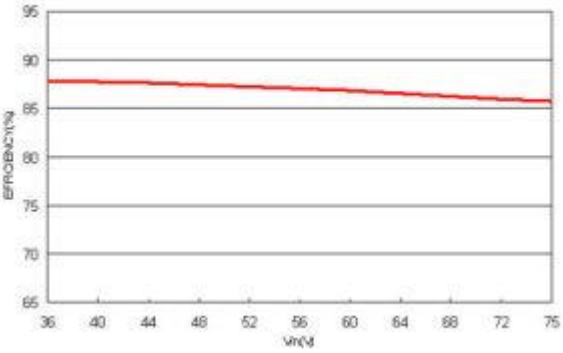
All test conditions are at 25°C. The figures are identical for THD 12-4812



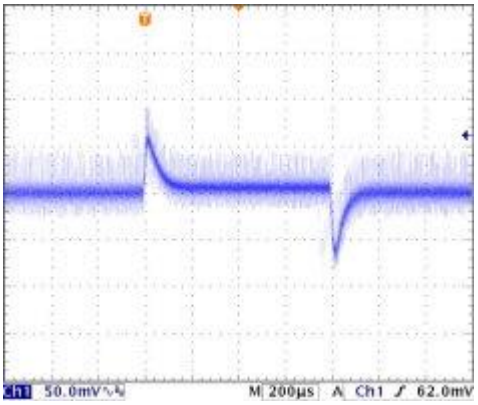
Efficiency versus Output Current



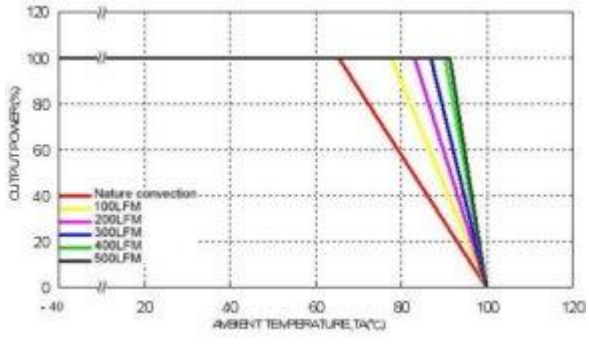
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



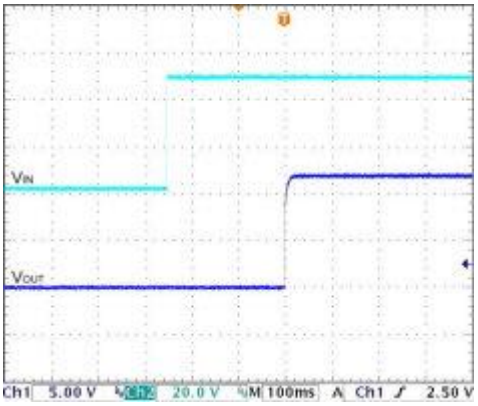
Efficiency versus Input Voltage. Full Load



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



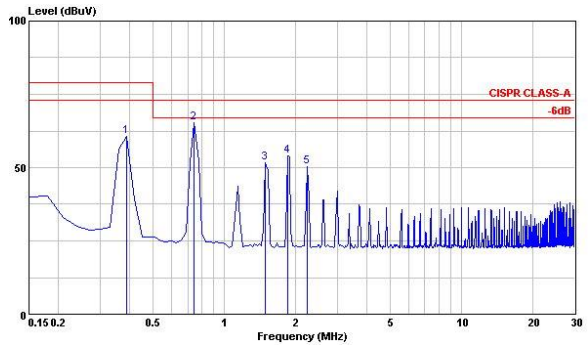
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



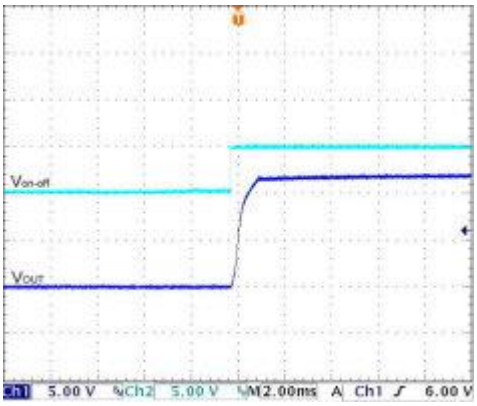
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves

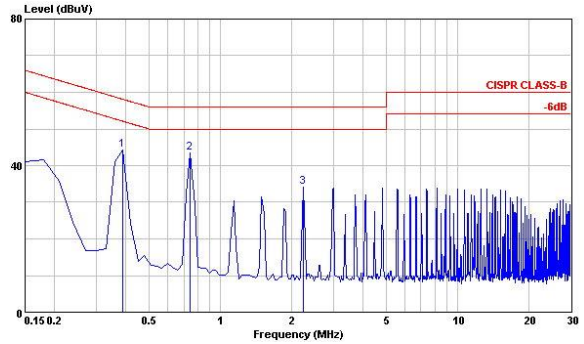
All test conditions are at 25°C. The figures are identical for THD 12-4812 (Continued)



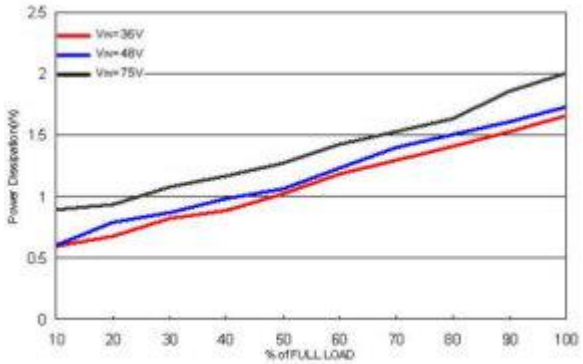
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$, Full Load



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



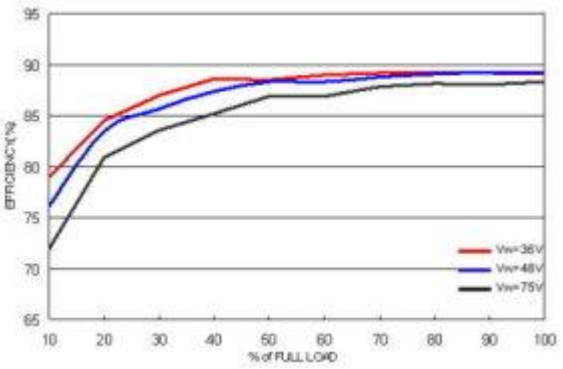
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$, Full Load



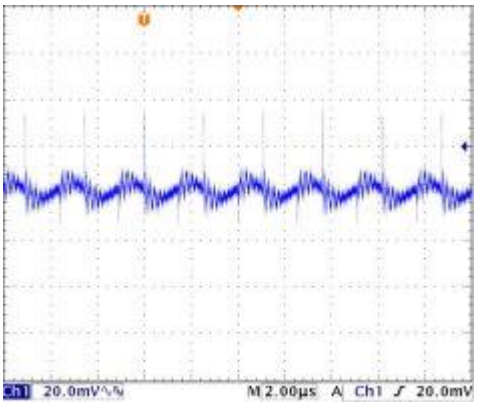
Power Dissipation versus Output Current

Characteristic Curves

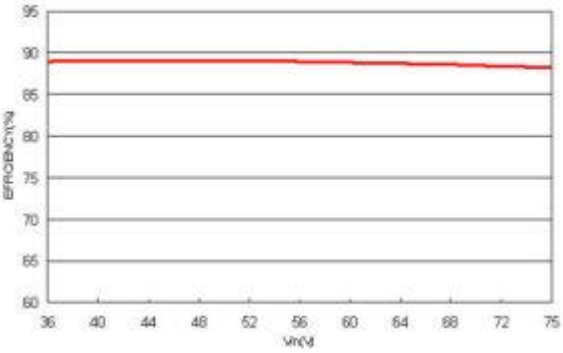
All test conditions are at 25°C. The figures are identical for THD 12-4813



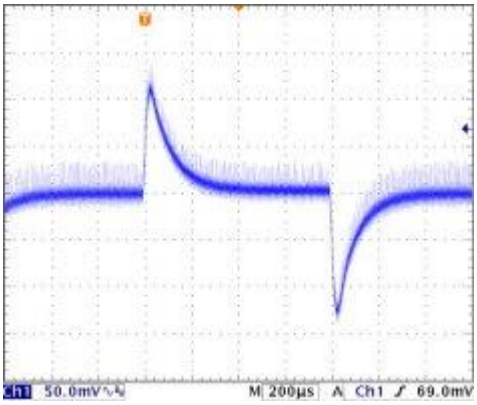
Efficiency versus Output Current



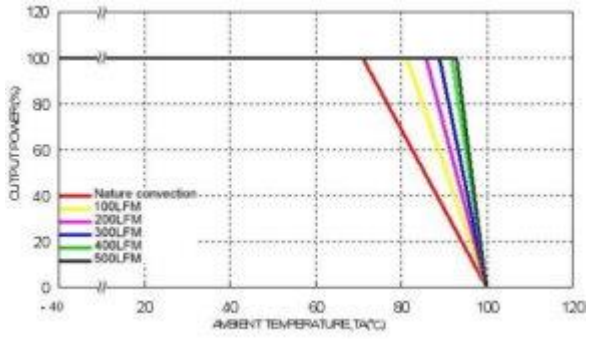
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



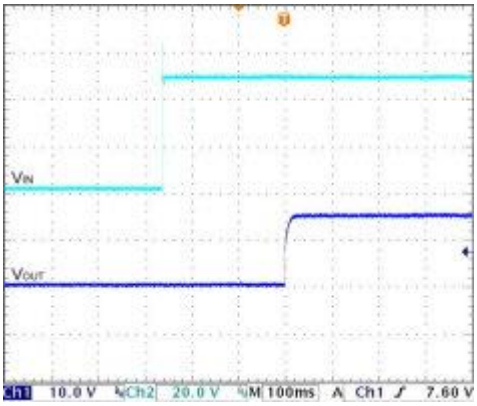
Efficiency versus Input Voltage. Full Load



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



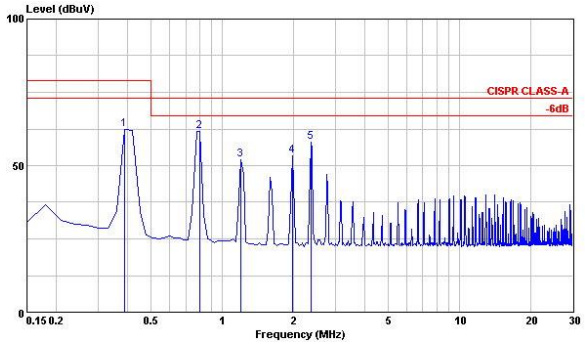
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



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

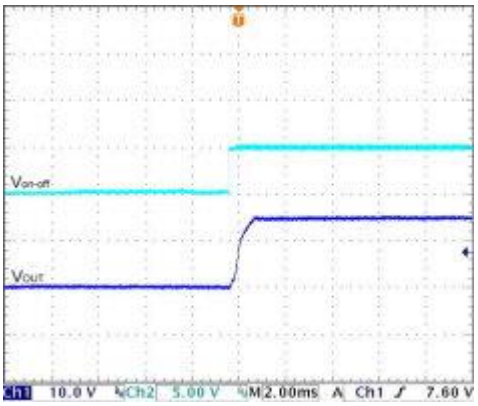
Characteristic Curves

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



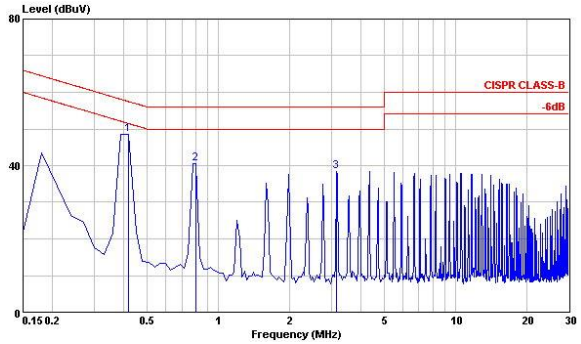
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\,nom}$, Full Load



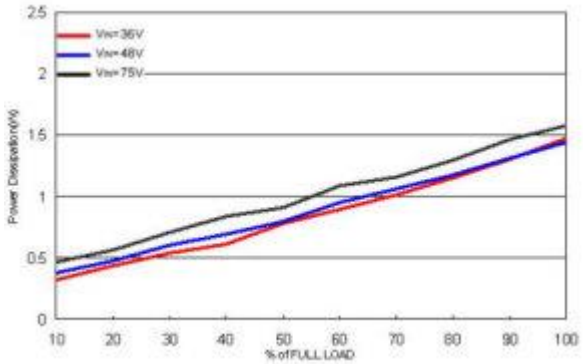
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\,nom}$, Full Load



Conduction Emission of EN55022 Class B

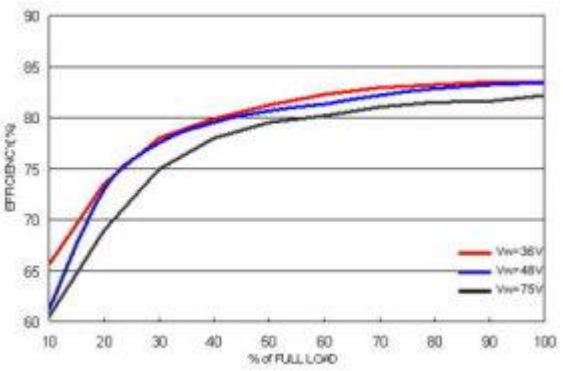
$V_{in} = V_{in\,nom}$, Full Load



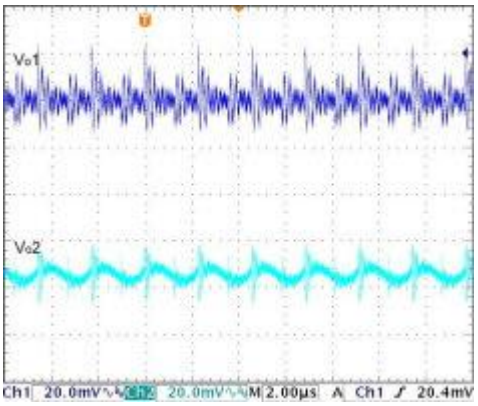
Power Dissipation versus Output Current

Characteristic Curves

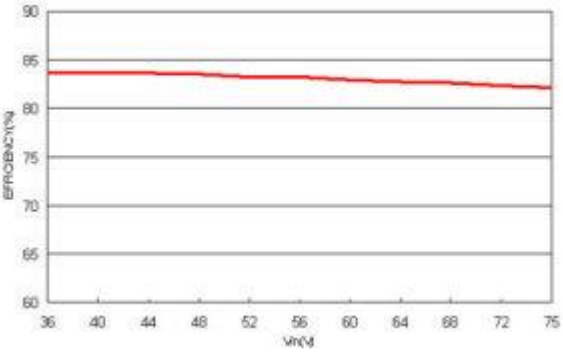
All test conditions are at 25°C. The figures are identical for THD 12-4821



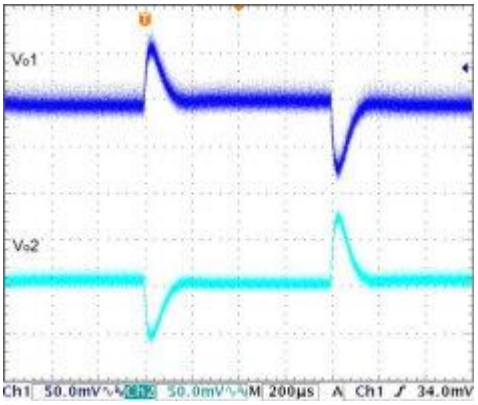
Efficiency versus Output Current



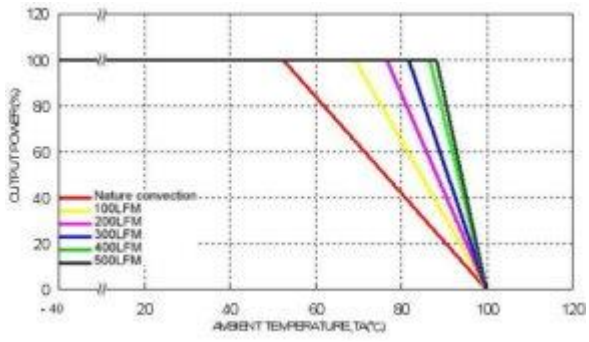
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



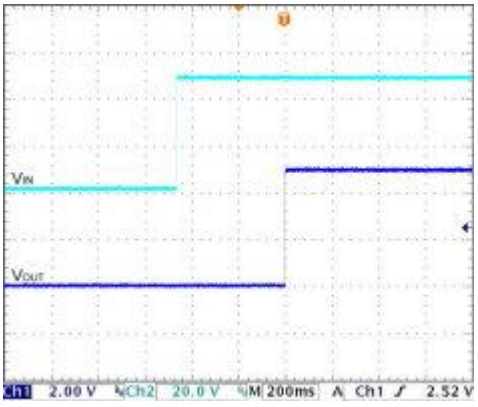
Efficiency versus Input Voltage. Full Load



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



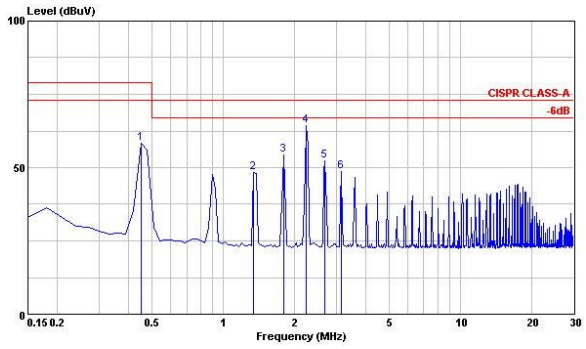
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



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

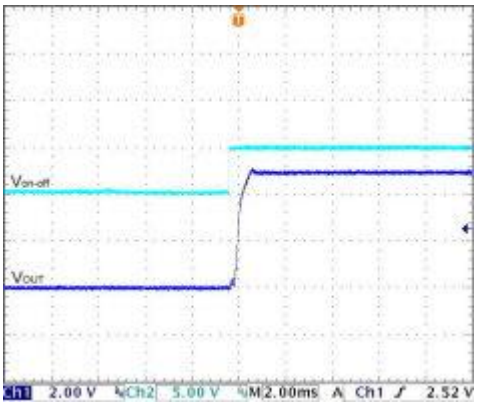
Characteristic Curves

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



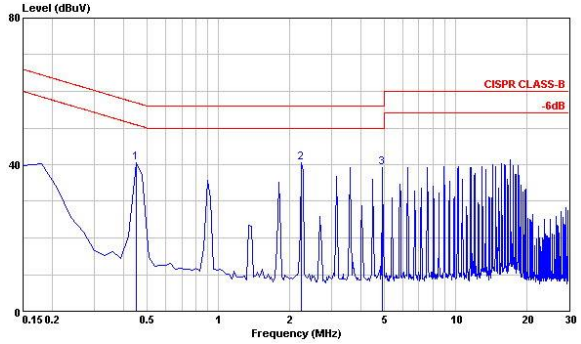
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\,nom}$, Full Load



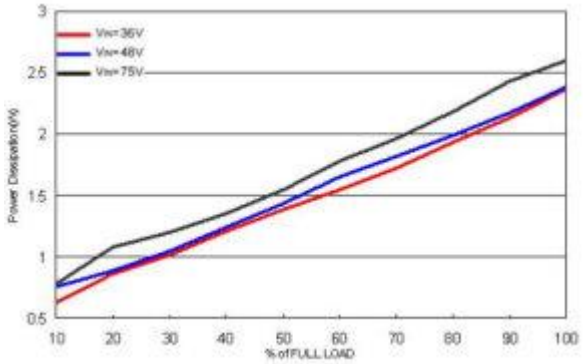
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\,nom}$, Full Load



Conduction Emission of EN55022 Class B

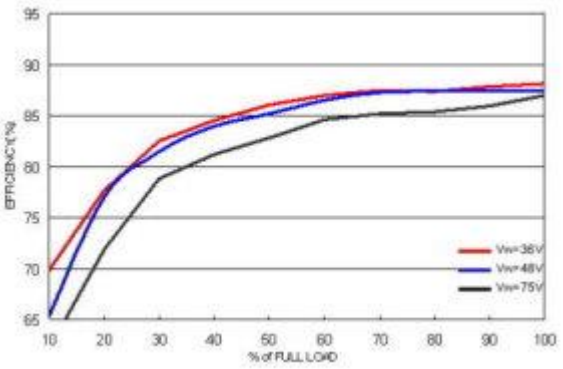
$V_{in} = V_{in\,nom}$, Full Load



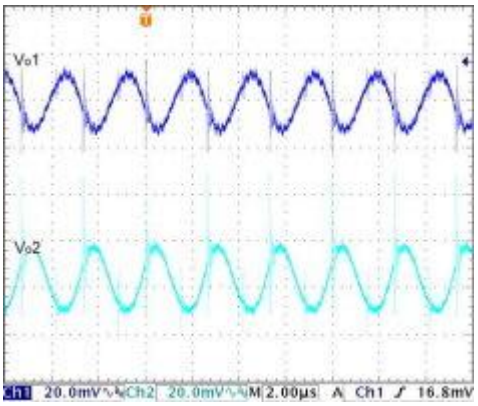
Power Dissipation versus Output Current

Characteristic Curves

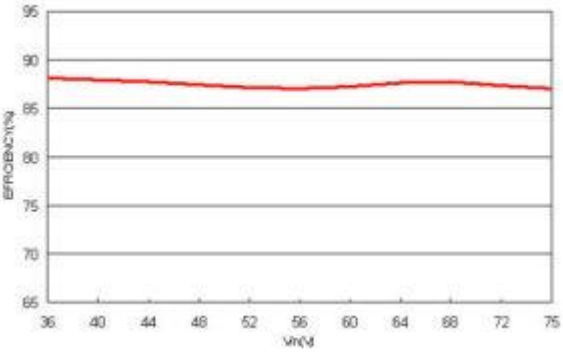
All test conditions are at 25°C. The figures are identical for THD 12-4822



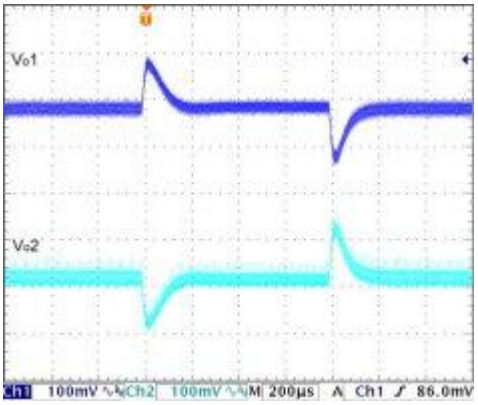
Efficiency versus Output Current



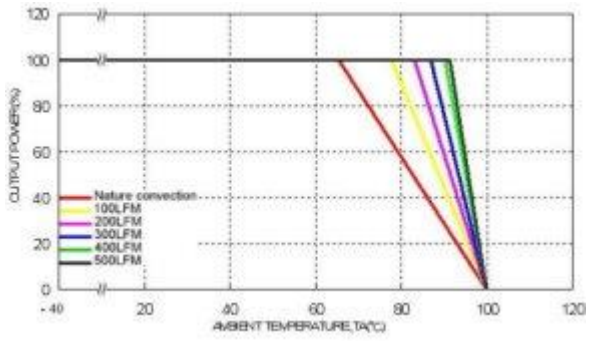
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



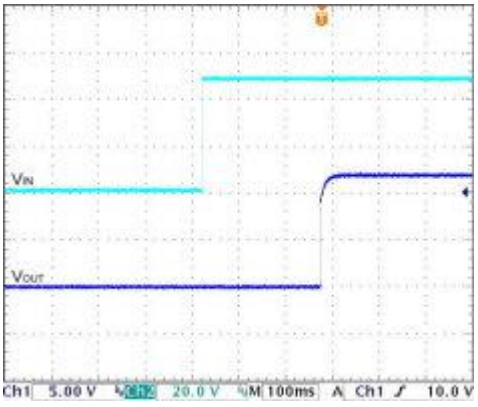
Efficiency versus Input Voltage. Full Load



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



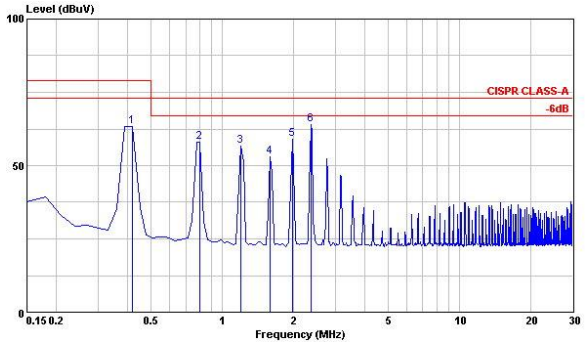
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



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

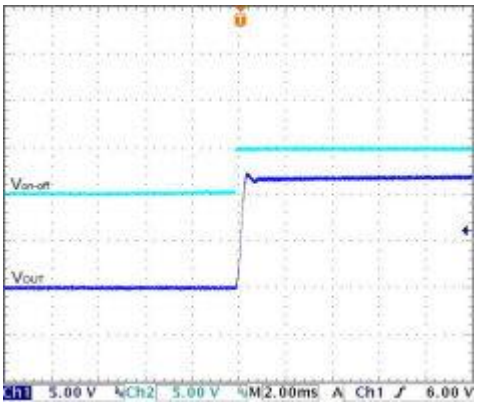
Characteristic Curves

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



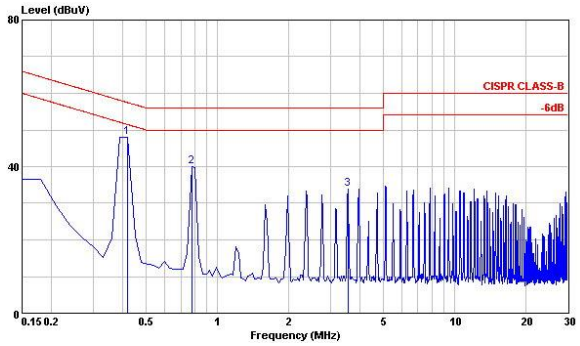
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\,nom}$, Full Load



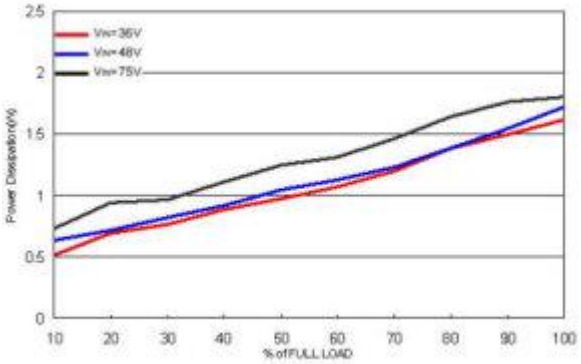
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\,nom}$, Full Load



Conduction Emission of EN55022 Class B

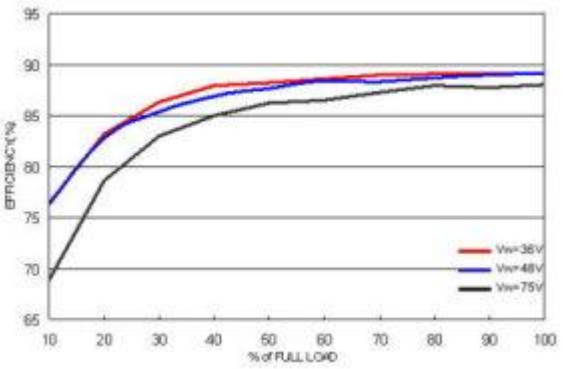
$V_{in} = V_{in\,nom}$, Full Load



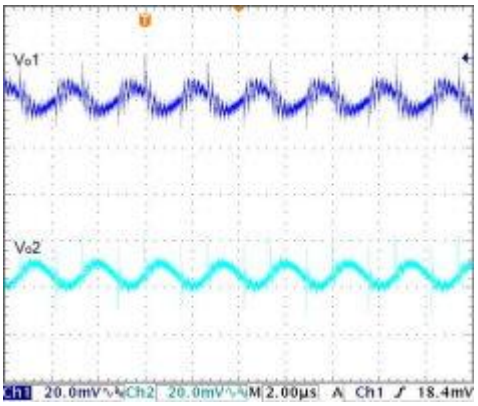
Power Dissipation versus Output Current

Characteristic Curves

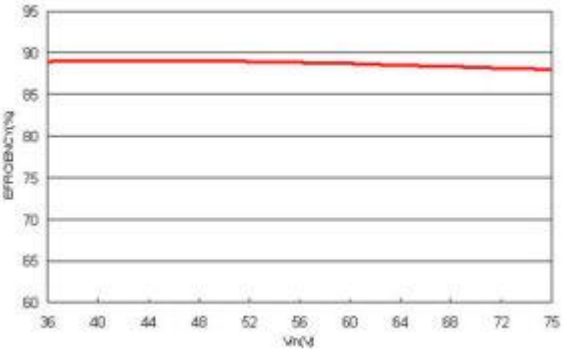
All test conditions are at 25°C. The figures are identical for THD 12-4823



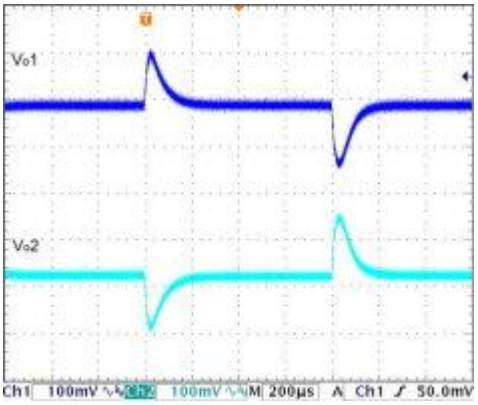
Efficiency versus Output Current



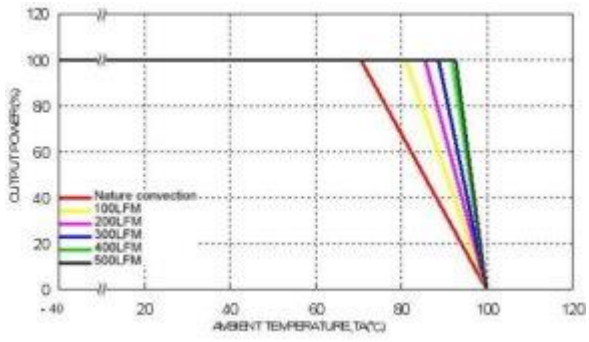
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



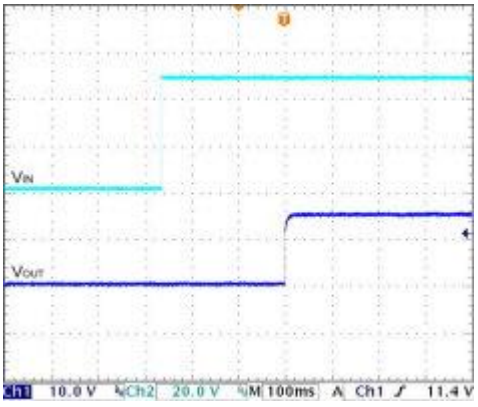
Efficiency versus Input Voltage. Full Load



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



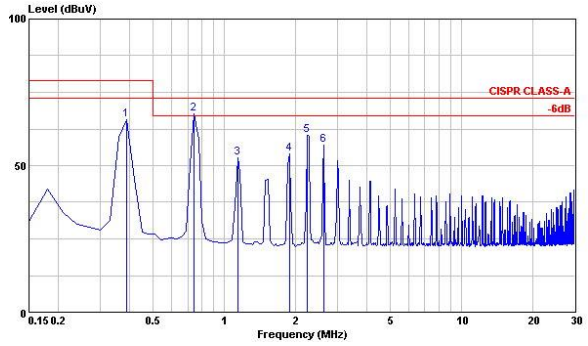
Derating Output Current versus Ambient Temperature and Airflow
$V_{in} = V_{in\,nom}$



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

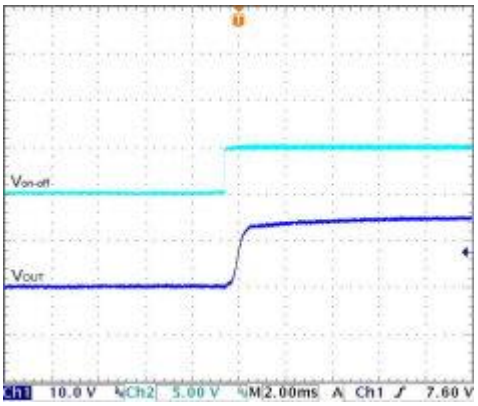
Characteristic Curves

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



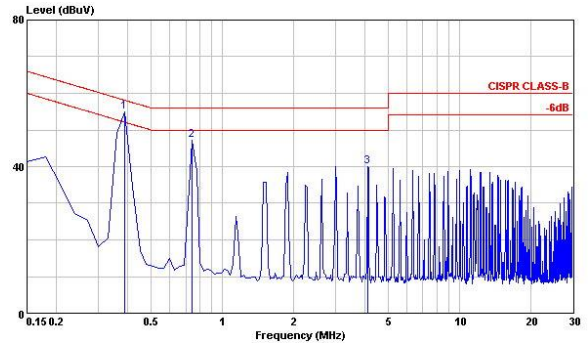
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\,nom}$, Full Load



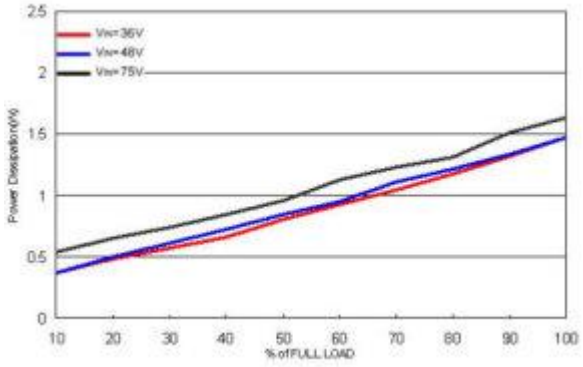
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\,nom}$, Full Load



Conduction Emission of EN55022 Class B

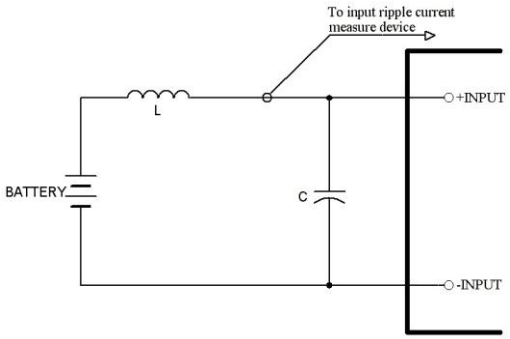
$V_{in} = V_{in\,nom}$, Full Load



Power Dissipation versus Output Current

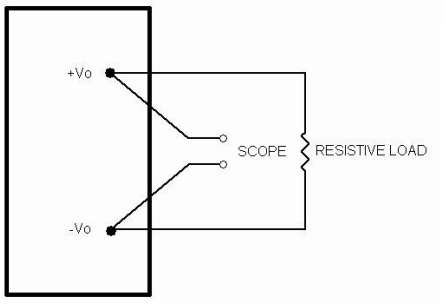
Testing Configurations

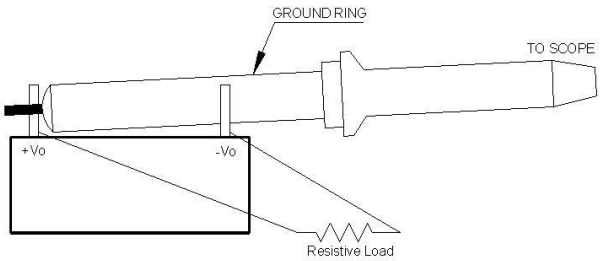
Input reflected-ripple current measurement test up



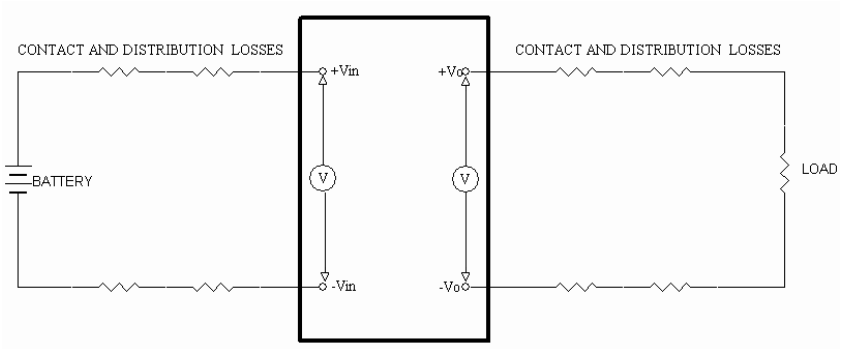
Component	Value	Voltage	Reference
L	12µH	----	----
C	47µF	100V	Aluminum Electrolytic Capacitor

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





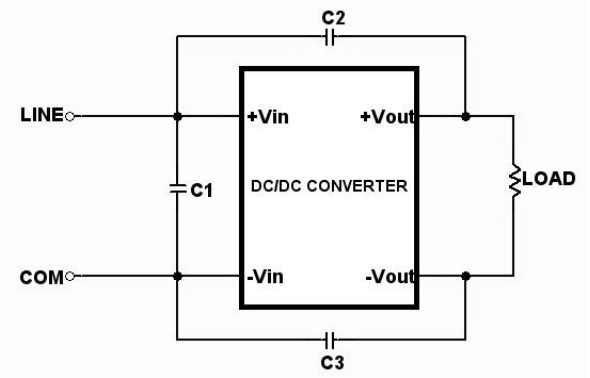
Output voltage and efficiency measurement test up



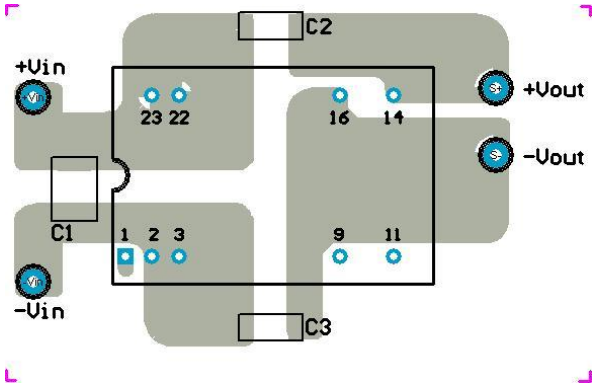
Note: All measurements are taken at the module terminals.

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

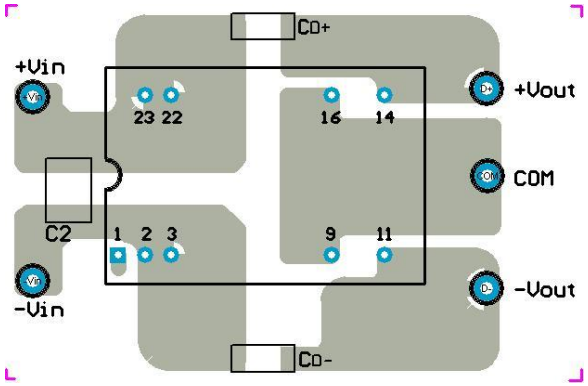
EMC considerations



Suggested Schematic to comply with EN55022 Conducted Emission Class A



recommended track layout with input filter for Single Output



recommended track layout with input filter for Dual Output

To comply with conducted emissions according to EN55022 CLASS A following components are recommended:

THD 12-12xx

Component	Value	Voltage	Reference
C1	6.8µF	50V	1210 MLCC
C2, C3	1000pF	2KV	1206 MLCC

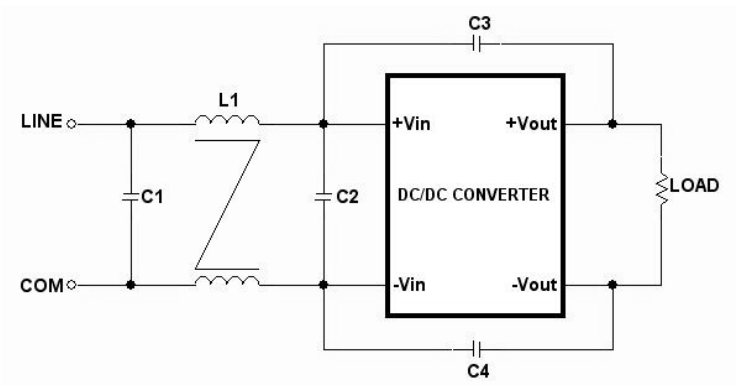
THD 12-24xx

Component	Value	Voltage	Reference
C1	4.7µF	50V	1210 MLCC
C2, C3	1000pF	2KV	1206 MLCC

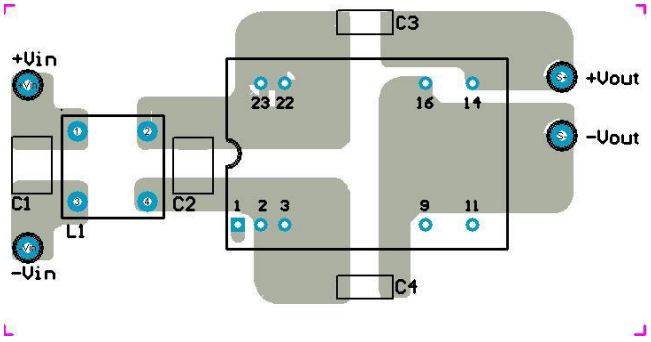
THD 12-48xx

Component	Value	Voltage	Reference
C1	2.2µF	100V	1812 MLCC
C2, C3	1000pF	2KV	1206 MLCC

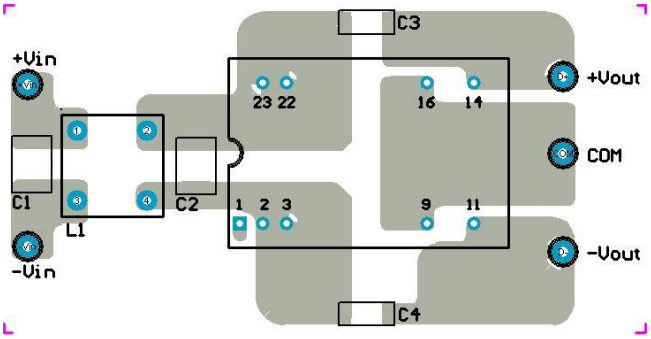
EMC considerations (Continued)



Suggested Schematic to comply with EN55022 Conducted Emission Class B



recommended track layout with input filter for Single Output



recommended track layout with input filter for Dual Output

To comply with conducted emissions according to EN55022 CLASS A following components are recommended:

THD 12-12xx

Component	Value	Voltage	Reference
C1	3.3µF	50V	1812 MLCC
C3, C4	1000pF	2KV	1206 MLCC
L1	325µH	----	Common Choke, P/N: TCK-050

THD 12-24xx

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 12-48xx

Component	Value	Voltage	Reference
C1, C2	2.2µF	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.

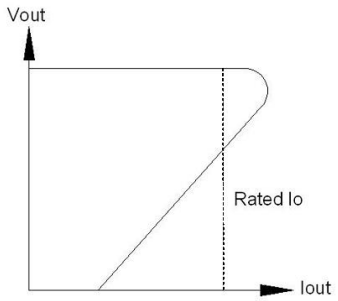
Output Over Current Protection

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 output 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.

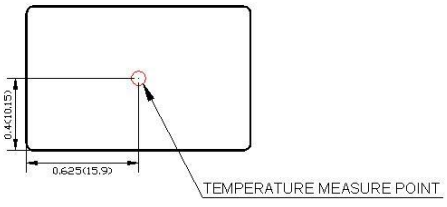


Output Over Voltage Protection

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.



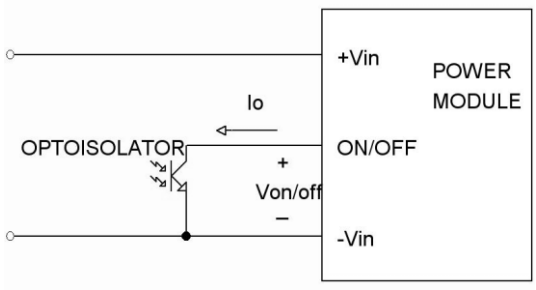
Measurement shown in inches and (millimeters)

TOP VIEW

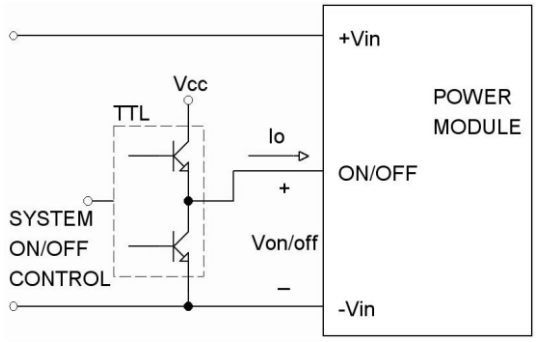
Remote ON/OFF Control

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 –input pin to turn the module on.

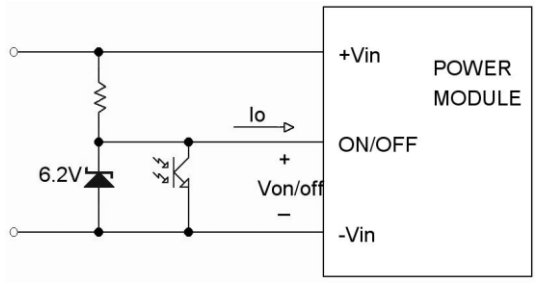
Remote ON/OFF Implementation



Isolated-Closure Remote ON/OFF



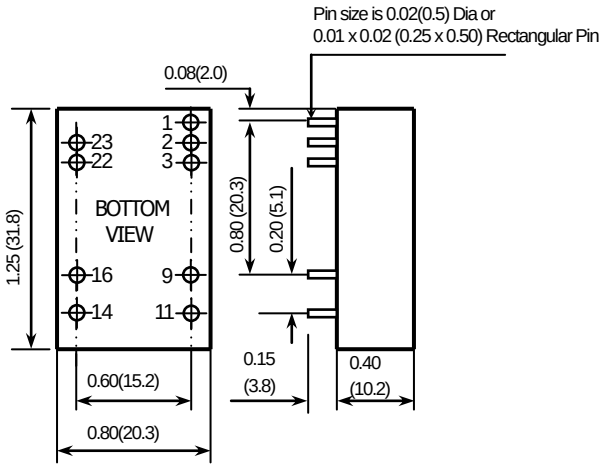
Level Control Using TTL Output



Level Control Using Line Voltage

Mechanical Data

DIP TYPE

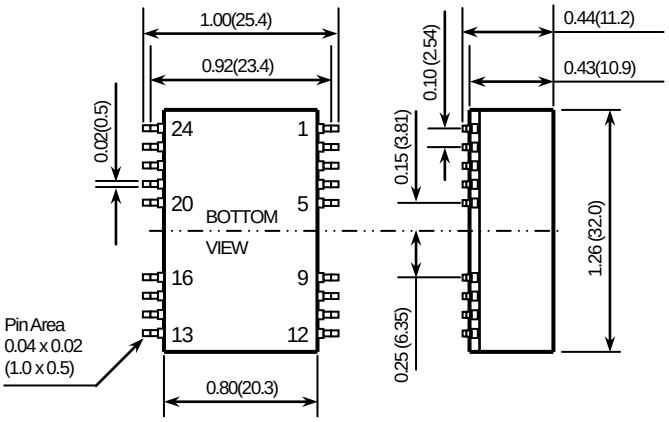


1. All dimensions in Inches (mm)
   Tolerance: x.xx ±0.02 (x.x ±0.5)
2. Pin pitch tolerance: ±0.014 (0.35)

PIN CONNECTION		
PIN	Single Output Define	Dual Output Define
1	CTRL	CTRL
2	– Input [GND]	– Input [GND]
3	– Input [GND]	– Input [GND]
9	NC	Common
11	NC	– Output
14	+Output	+Output
16	– Output	Common
22	+ Input [Vcc]	+ Input [Vcc]
23	+ Input [Vcc]	+ Input [Vcc]

SMD TYPE

Suffix-SMD

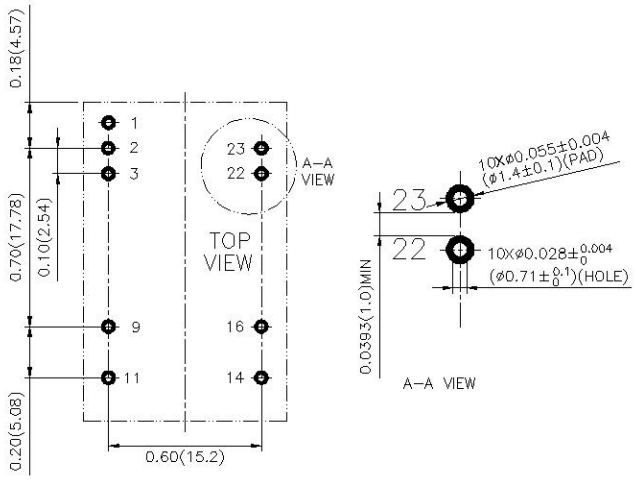


1. All dimensions in Inches (mm)
   Tolerance: x.xx ±0.02 (x.x ±0.5)
2. Pin pitch tolerance: ±0.014 (0.35)

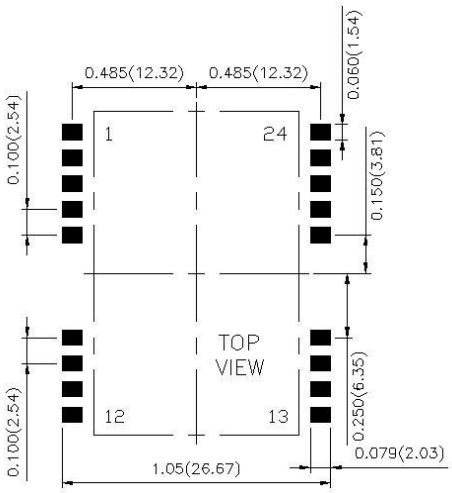
PIN CONNECTION		
PIN	Single Output Define	Dual Output Define
1	CTRL	CTRL
2	– Input [GND]	– Input [GND]
3	– Input [GND]	– Input [GND]
9	NC	Common
11	NC	– Output
14	+Output	+Output
16	– Output	Common
22	+ Input [Vcc]	+ Input [Vcc]
23	+ Input [Vcc]	+ Input [Vcc]
Others	NC	NC

Recommended Pad Layout

DIP TYPE



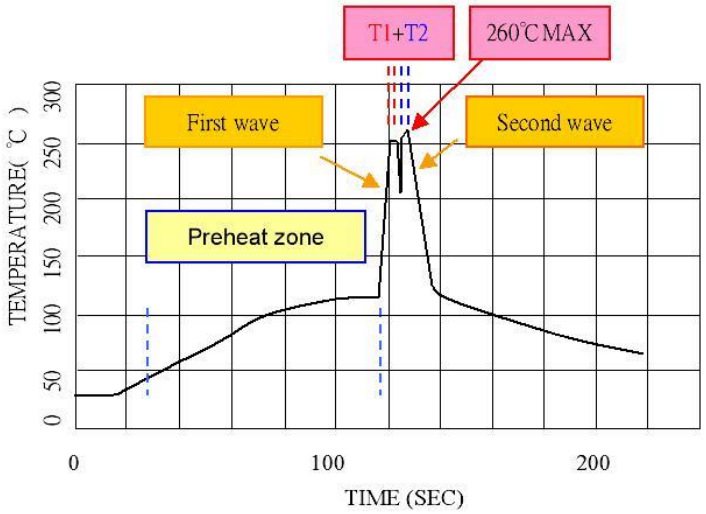
SMD TYPE



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 DIP type



Zone	Reference Parameter
Preheat zone	Rise temperature 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

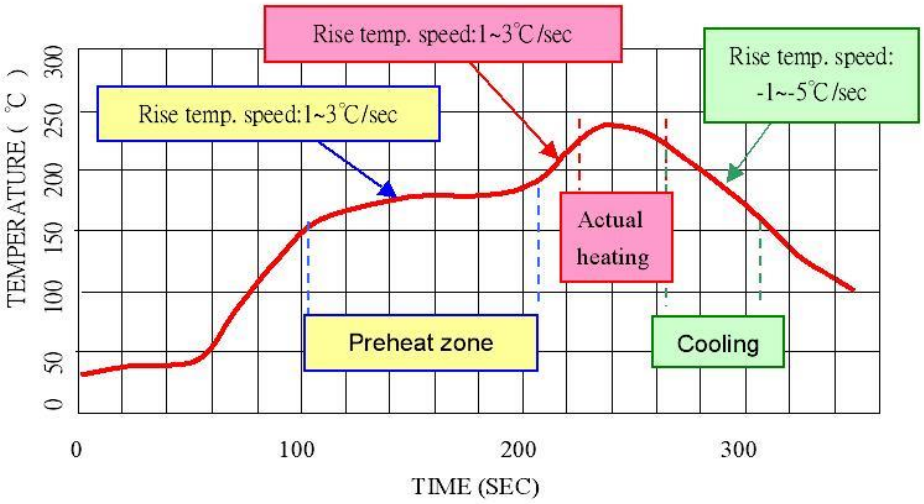
Reference Solder: Sn-Ag-Cu; Sn-Cu

Hand Welding:

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

Soldering and Reflow Considerations (Continued)

Lead free reflow profile for THD 12 SMD type

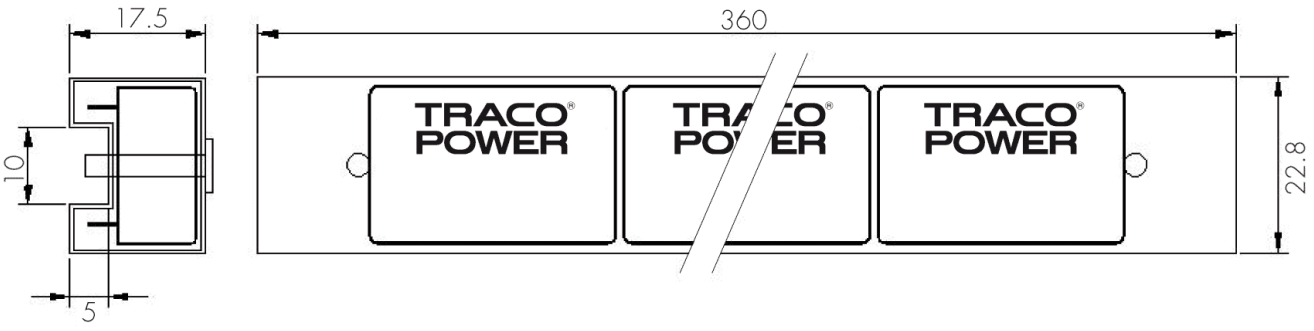


Zone	Reference Parameter	
Preheat zone	Rise temperature speed:	1~3°C / sec
	Preheat time:	60~120°C
	Preheat temperature:	155~185°C
Actual heating	Rise temperature speed:	1~3°C / sec
	Melting time:	30~60 sec
	Melting temperature:	217°C
	Peak temperature:	230~240°C
	Peak time:	10~20 sec
Cooling	Rise temperature speed:	-1~-5°C / sec

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

Packaging Information

10 Pc's THD 12-xxxx Converters per Tube



Order Code

Model Number	Input Range	Output Voltage	Output Current Max. Load	Input Current Full Load[1]	Efficiency [2] (%)
THD 12-1209	9 – 18 Vdc	2.5 Vdc	3500mA	935mA	82
THD 12-1210	9 – 18 Vdc	3.3 Vdc	3500mA	1203mA	84
THD 12-1211	9 – 18 Vdc	5 Vdc	2400mA	1244mA	86
THD 12-1212	9 – 18 Vdc	12.0 Vdc	1000mA	1219mA	86
THD 12-1213	9 – 18 Vdc	15.0 Vdc	800mA	1219mA	86
THD 12-1221	9 – 18 Vdc	±5.0 Vdc	±1200mA	1282mA	82
THD 12-1222	9 – 18 Vdc	±12.0 Vdc	±500mA	1205mA	87
THD 12-1223	9 – 18 Vdc	±15.0 Vdc	±400mA	1205mA	87
THD 12-2409	18 – 36 Vdc	2.5 Vdc	3500mA	461mA	83
THD 12-2410	18 – 36 Vdc	3.3 Vdc	3500mA	594mA	85
THD 12-2411	18 – 36 Vdc	5 Vdc	2400mA	614mA	87
THD 12-2412	18 – 36 Vdc	12.0 Vdc	1000mA	602mA	87
THD 12-2413	18 – 36 Vdc	15.0 Vdc	800mA	602mA	87
THD 12-2421	18 – 36 Vdc	±5.0 Vdc	±1200mA	633mA	83
THD 12-2422	18 – 36 Vdc	±12.0 Vdc	±500mA	595mA	88
THD 12-2423	18 – 36 Vdc	±15.0 Vdc	±400mA	595mA	88
THD 12-4809	36 – 75 Vdc	2.5 Vdc	3500mA	231mA	83
THD 12-4810	36 – 75 Vdc	3.3 Vdc	3500mA	297mA	85
THD 12-4811	36 – 75 Vdc	5 Vdc	2400mA	307mA	87
THD 12-4812	36 – 75 Vdc	12.0 Vdc	1000mA	301mA	87
THD 12-4813	36 – 75 Vdc	15.0 Vdc	800mA	301mA	87
THD 12-4821	36 – 75 Vdc	±5.0 Vdc	±1200mA	316mA	83
THD 12-4822	36 – 75 Vdc	±12.0 Vdc	±500mA	297mA	88
THD 12-4823	36 – 75 Vdc	±15.0 Vdc	±400mA	297mA	88

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 DC/DC converters has been calculated according to:

Bellcore TR-NWT-000332 Case I: 50% stress, Operating Temperature at 40°C (Ground fixed and controlled environment). The resulting figure for MTBF is 2'750'000 hours.
MIL-HDBK 217F NOTICE2 FULL LOAD, Operating Temperature at 25°C. The resulting figure for MTBF is 1'078'000 hours.