THL 20-WI Series

Application Note

DC/DC Converter 9 to 36Vdc or 18 to 75Vdc Input
3.3 to 15Vdc Single Outputs and ±12 & ±15Vdc Dual Outputs, 20W

226037

Complete THL 20WI datasheet can be downloaded at:
http://www.tracopower.com/products/thl20WI.pdf

Features

- Single output up to 4.5A
- Dual output up to ±835mA
- 20 watts maximum output power
- 4:1 ultra wide input voltage range of 9-36 and 18-75VDC
- Six-sided continuous shield
- High efficiency up to 89%
- Complies with EN 55022 class A
- Low profile: 25.4×25.4×10.2 mm (1.00×1.00×0.40 inch)
- Input to output isolation: 1500Vdc for 1 minute
- Over-voltage protection
- Over-current protection, auto-recovery
- Output short circuit protection
- Remote on/off
- Soft Start

Options

- Heat sinks available for extended operation

Applications

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

General Description

Tracopower THL 20WI series, comprising 14 different models, specially addressing data communication equipments, mobile battery driven equipments, distributed power systems, telecommunication equipments, mixed analog/digital subsystems, process/machine control equipments, computer peripheral systems and industrial robot systems.

Packing up to 20W of power into a 1 x 1 x 0.4 inch package, with efficiency as high as 89%, the THL 20WI has wide input ranges of 9 – 3 6Vdc and 18 – 75Vdc and is available in output voltages of 3.3Vdc, 5Vdc, 12Vdc, 15Vdc, 24Vdc, ±12Vdc and ±15Vdc.

Other features include continuous short circuit protection, overvoltage protection, remote on/off, six-sided shielded case, and EN55022 Class A conducted noise compliance minimize design-in time, cost and eliminate the need for external filtering.

Table of contents

Absolute Maximum Rating

Parameter	Model	Min	Max	Unit
Input Voltage	THL 20-24xxWI	9	36	Vdc
Continuous	THL 20-48xxWI	18	75	
Transient (for 100ms max.)	THL 20-24xxWI		50	
	THL 20-48xxWI		100	
Operating Ambient Temperature		-40		°C
Without heatsink / with heatsink	THL 20-4810WI		68 / 74	
	THL 20-2410WI		64 / 71	
	THL 20-xx11WI & THL 20-xx12WI		60 / 67	
	THL 20-xx13WI & THL 20-xx22WI			
	THL 20-xx23WI			
	THL 20-xx15WI		55 / 63	
Operating Case Temperature	All	-40	+105	°C
Storage Temperature	All	-50	+125	°C

Output Specification

Parameter	Model	Min	Nominal	Max	Unit
Output Voltage (V_{in} = $V_{in\ nom}$; Full Load; T_A = 25°C)	THL 20-xx10WI	3.267	3.3	3.333	VDC
	THL 20-xx11WI	4.95	5	5.05	
	THL 20-xx12WI	11.88	12	12.12	
	THL 20-xx13WI	14.85	15	15.15	
	THL 20-xx15WI	23.76	24	24.24	
	THL 20-xx22WI	±11.88	±12	±12.12	
	THL 20-xx23WI	±14.85	±15	±15.15	
Output Regulation	Single Output			±0.2	%
Line ($V_{in\ min}$ to $V_{in\ max}$ at Full Load)	Dual Output			±0.5	
Output Regulation	3.3V & 5V Models			±0.5	%
Load (Min Load to 100% of Full Load)	12V, 15V & 24 Models			±0.2	
	Dual Output Models			±1.0	
Output Ripple & Noise	3.3V & 5V Models		75		mV pk-pk
Peak-to-Peak (5Hz to 20MHz bandwidth)	12V & 15V Models		100		
(Measured with a 1µF/25V & 10µF/25V TC)	24V Model		150		
	Dual Output Models		100		

Output Specification (Continued)

Parameter	Model	Min	Nominal	Max	Unit
Temperature Coefficient	All			±0.02	%V_{out}/°C
Output Voltage Overshoot ($V_{in\ min}$ to $V_{in\ max}$; Full Load; T_A = 25°C	All			5	%V_{out}
Dynamic Load Response (V_{in} = $V_{in\ nom}$; T_A = 25°C Load step change form 75% to 100% or 100 to 75% of Full Load	All				
Peak Deviation			±3% V_{out}	±5% V_{out}	mV
Setting Time (V_{out} < 10% peak deviation)			300		µS
Output Current	THL 20-xx10WI	0		4500	mA
	THL 20-xx11WI	0		4000	
	THL 20-xx12WI	0		1670	
	THL 20-xx13WI	0		1340	
	THL 20-xx15WI	0		835	
	THL 20-xx22WI	±60		±835	
	THL 20-xx23WI	±50		±670	
Output Over Current Protection	All	Current Limitation at 150% typ. of Iout max., Hiccup			
Output Short Circuit Protection	All	Hiccup Automatic Recovery			

Input Specification

Parameter	Model	Min	Nominal	Max	Unit
Operating Input Voltage	THL 20-24xxWI	9	24	36	Vdc
	THL 20-48xxWI	18	48	75	
Under Voltage Lockout Turn-on Threshold	THL 20-24xxWI			9	Vdc
	THL 20-48xxWI			18	
Input reflected ripple current (5 to 20MHz, 12µH source impedance)	THL 20-24xxWI		50		mA pk-pk
	THL 20-48xxWI		30		
Input Current (Typical value at V_{in}= 12Vdc; Full Load)	THL 20-2410WI		711		mA
	THL 20-2411WI		936		
	THL 20-2412WI		938		
	THL 20-2413WI		941		
	THL 20-2415WI		949		
	THL 20-2422WI		938		
	THL 20-2423WI		941		
Input Current (Typical value at V_{in}= 24Vdc; Full Load)	THL 20-4810WI		352		
	THL 20-4811WI		468		
	THL 20-4812WI		469		
	THL 20-4813WI		471		
	THL 20-4815WI		474		
	THL 20-4822WI		469		
	THL 20-4823WI		471		

Input Specification

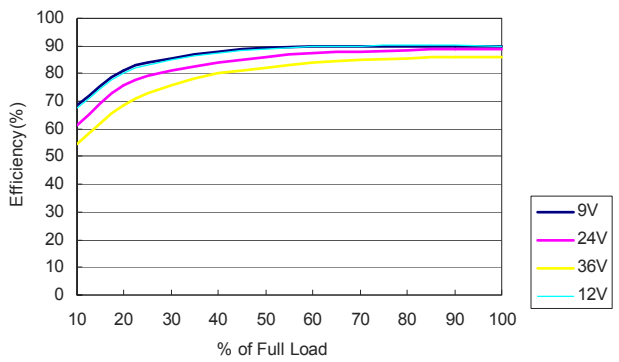
Parameter	Model	Min	Nominal	Max	Unit
Input Standby current (Typical value at V_{in} = $V_{in\ nom}$; No Load)	THL 20-2410WI		80		mA
	THL 20-2411WI		90		
	THL 20-2412WI		40		
	THL 20-2413WI		40		
	THL 20-2415WI		40		
	THL 20-2422WI		40		
	THL 20-2423WI		40		
	THL 20-4810WI		40		
	THL 20-4811WI		45		
	THL 20-4812WI		25		
	THL 20-4813WI		25		
	THL 20-4815WI		25		
	THL 20-4822WI		25		
	THL 20-4823WI		25		
Remote ON/OFF Control (The On/Off pin voltage is referenced to-V_{in}) Positive logic	All				
On/Off pin High Voltage (Remote ON)		3.5		12	Vdc
On/Off pin Low Voltage (Remote OFF)		0		1.2	Vdc
Remote Off Stand by Input Current	All			10	mA
Input Current of Remote Control Pin	All			0.5	mA

General Specification

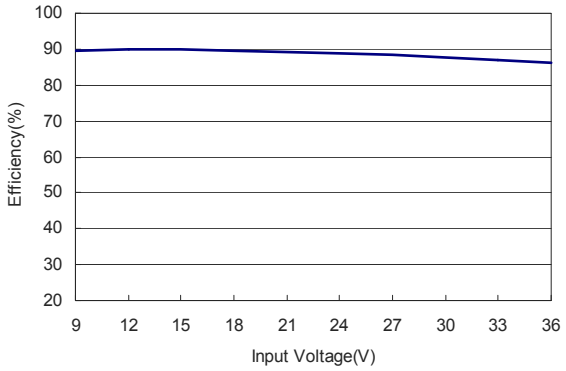
Parameter	Model	Min	Nominal	Max	Unit
Efficiency (V_{in} = 12Vdc; Full Load; T_A = 25°C)	THL 20-2410WI		87		%
	THL 20-2411WI		89		
	THL 20-2412WI		89		
	THL 20-2413WI		89		
	THL 20-2415WI		88		
	THL 20-2422WI		89		
	THL 20-2423WI		89		
Efficiency (V_{in} = 24Vdc; Full Load; T_A = 25°C)	THL 20-4810WI		88		
	THL 20-4811WI		89		
	THL 20-4812WI		89		
	THL 20-4813WI		89		
	THL 20-4815WI		88		
	THL 20-4822WI		89		
	THL 20-4823WI		89		
Isolation Voltage [Input to Output (for 60 seconds)]		1500			Vdc
Isolation Resistance	All	1000			MΩ
Isolation Capacitance				1500	pF
Switching Frequency			330		KHz
MTBF [MIL-STD-217F, TC=25°C]			451'600		Hours

Characteristic Curves

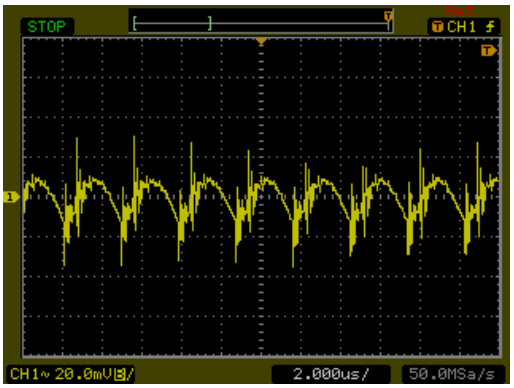
All test conditions are at 25°C. The figures are identical for THL 20-2410WI



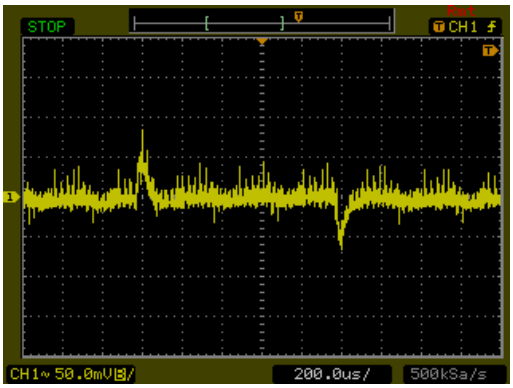
Efficiency Versus Output Current



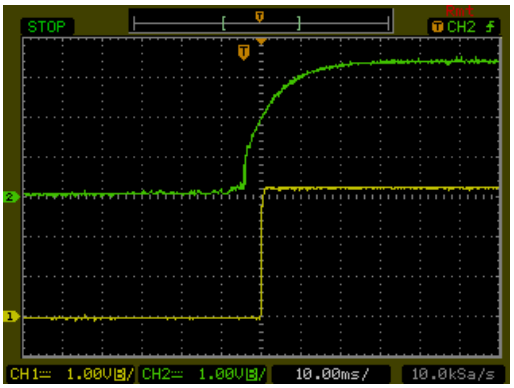
Efficiency Versus Input Voltage. Full Load



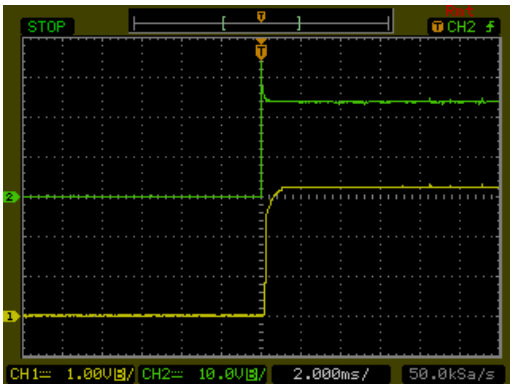
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



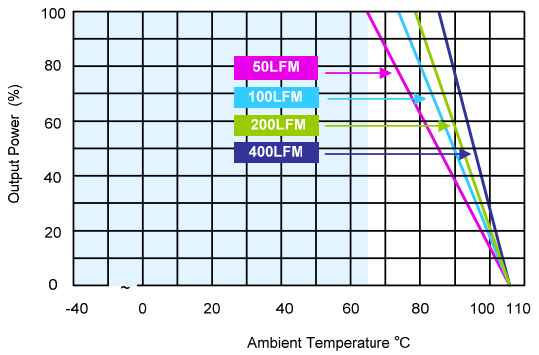
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



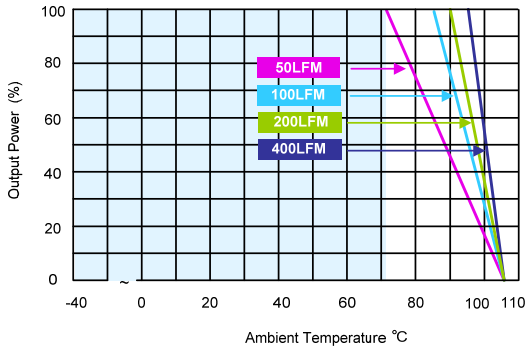
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

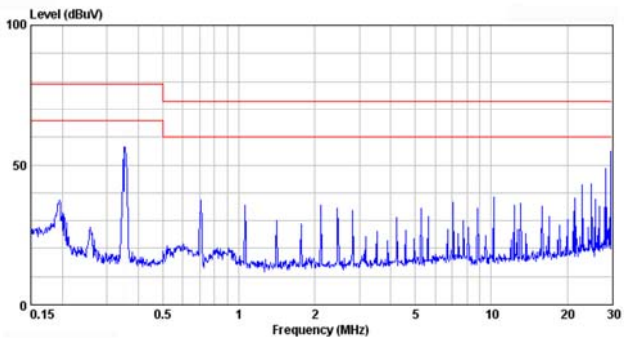
All test conditions are at 25°C. The figures are identical for THL 20-2410WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (without heatsink)



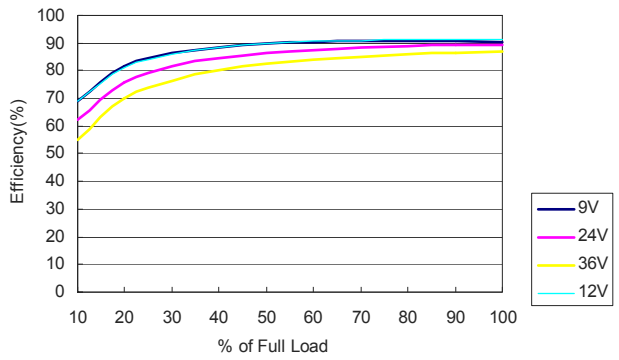
Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (with heatsink)



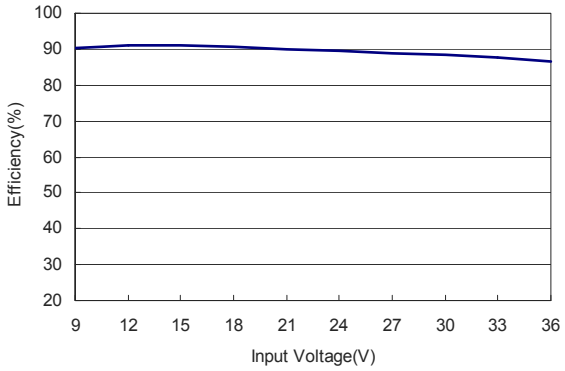
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

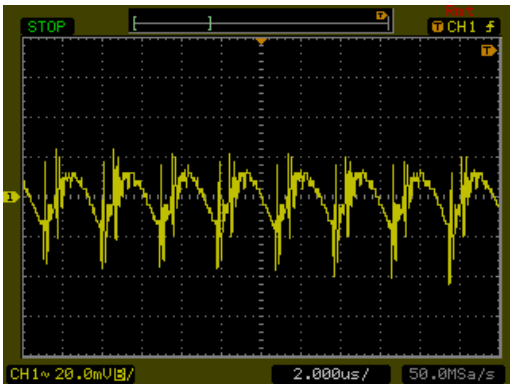
All test conditions are at 25°C. The figures are identical for THL 20-2411WI



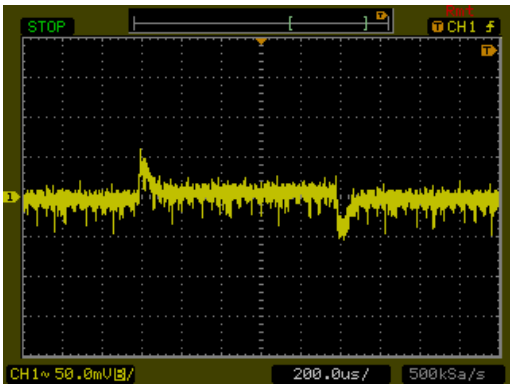
Efficiency Versus Output Current



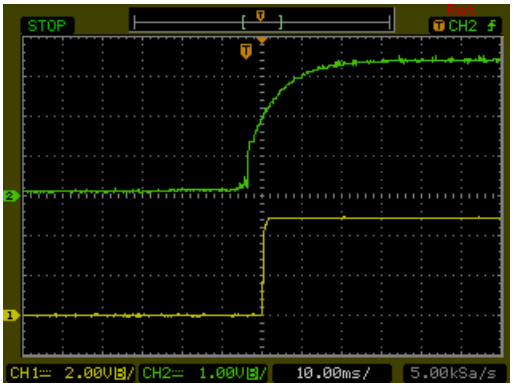
Efficiency Versus Input Voltage. Full Load



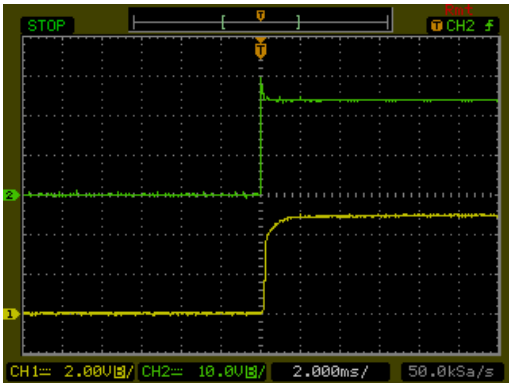
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



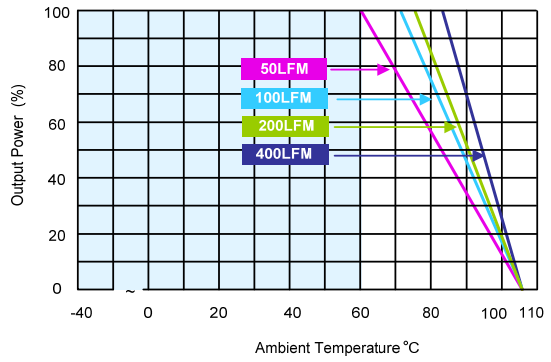
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



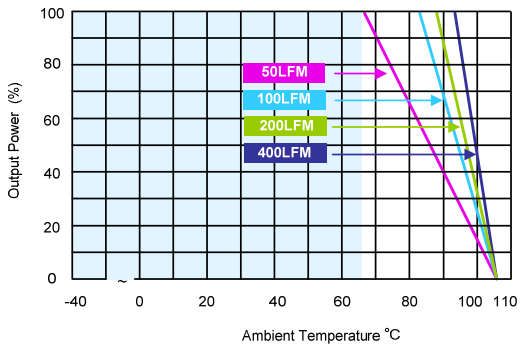
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

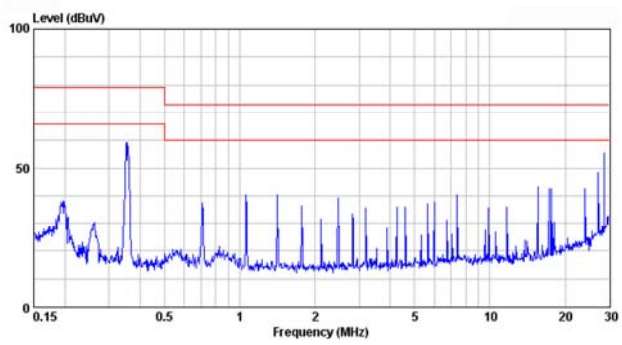
All test conditions are at 25°C. The figures are identical for THL 20-2411WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (without heatsink)



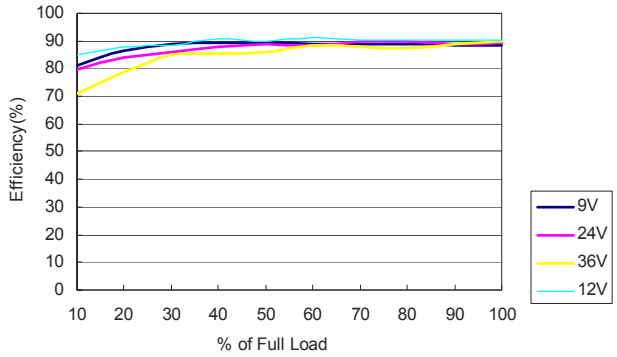
Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (with heatsink)



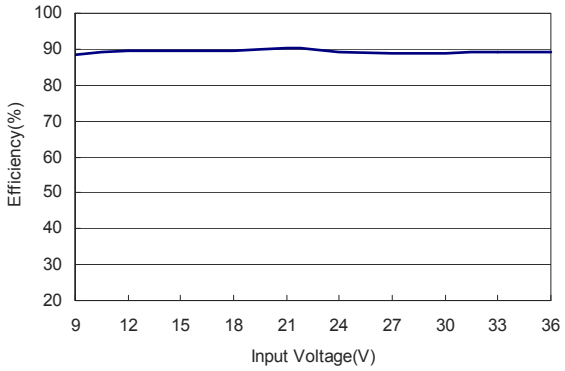
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

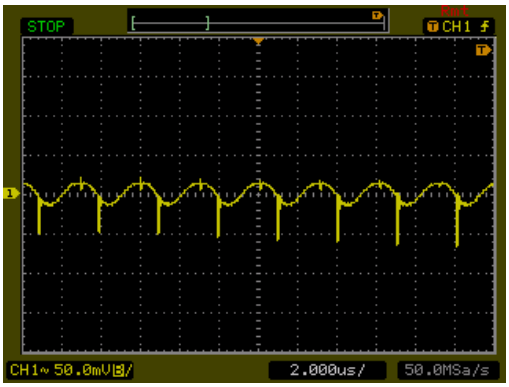
All test conditions are at 25°C. The figures are identical for THL 20-2412WI



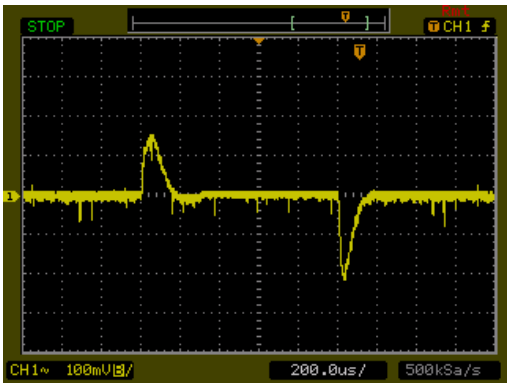
Efficiency Versus Output Current



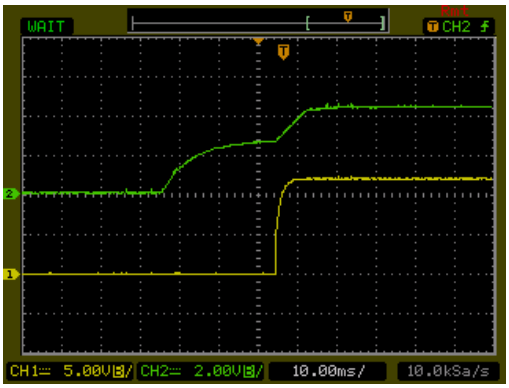
Efficiency Versus Input Voltage. Full Load



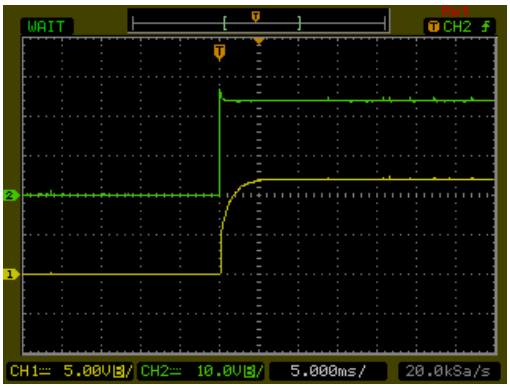
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



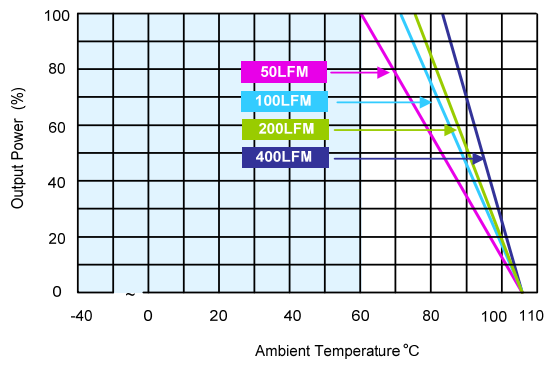
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



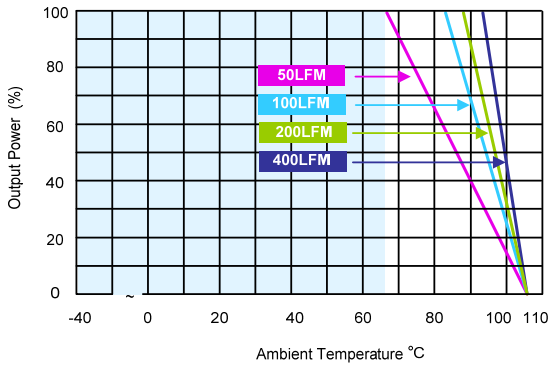
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

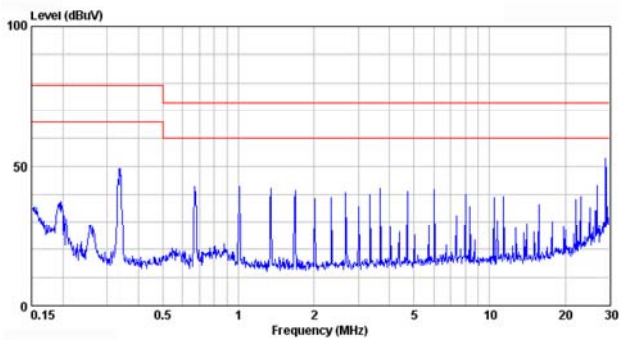
All test conditions are at 25°C. The figures are identical for THL 20-2412WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (without heatsink)



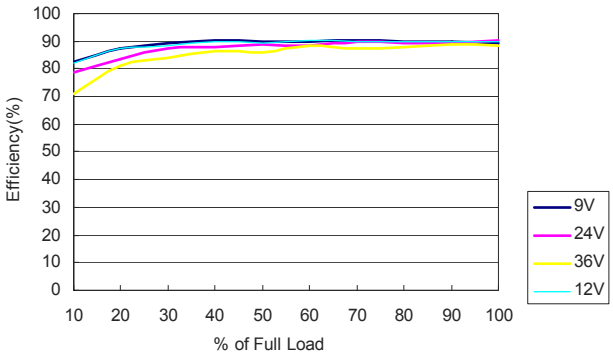
Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (with heatsink)



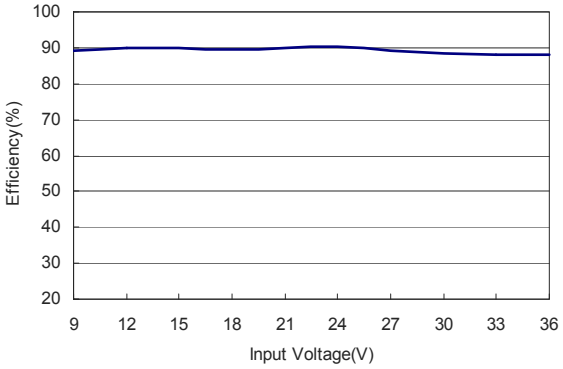
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

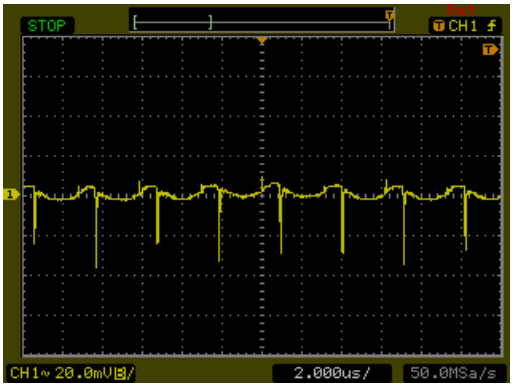
All test conditions are at 25℃ The figures are identical for THL 20-2413WI



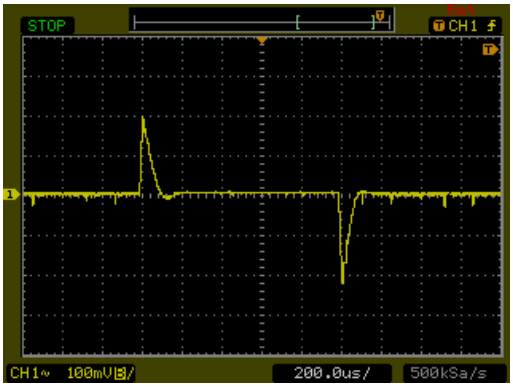
Efficiency Versus Output Current



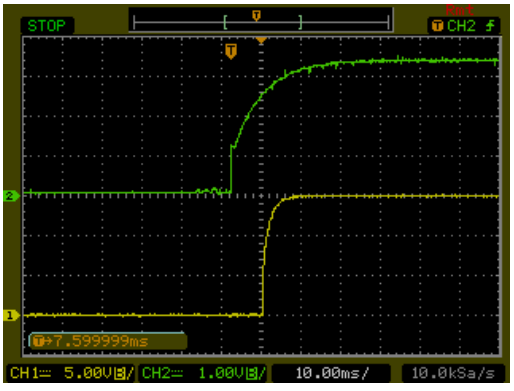
Efficiency Versus Input Voltage. Full Load



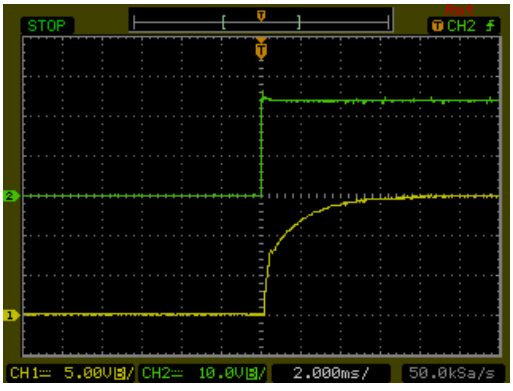
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



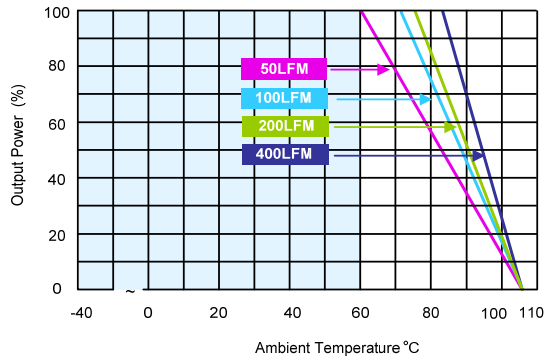
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



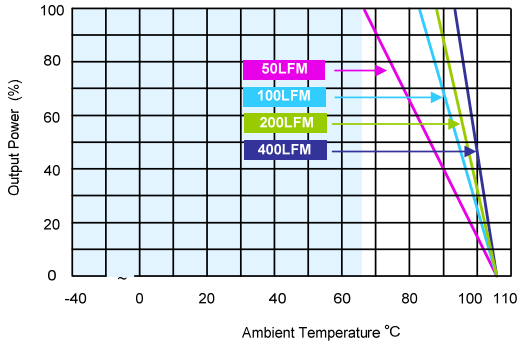
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

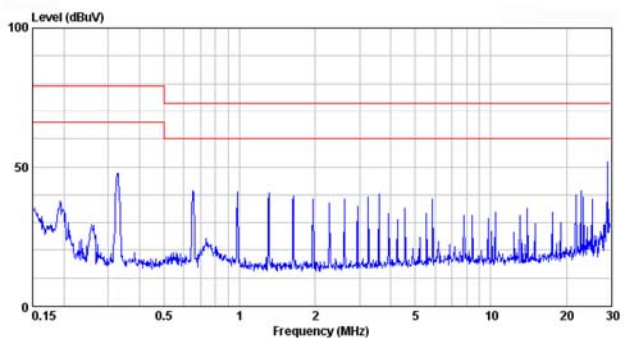
All test conditions are at 25°C. The figures are identical for THL 20-2413WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow V_{in} = $V_{in\ nom}$ (without heatsink)



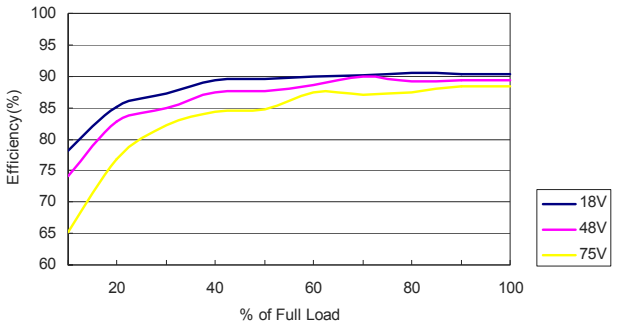
Derating Output Current Versus Ambient Temperature and Airflow V_{in} = $V_{in\ nom}$ (with heatsink)



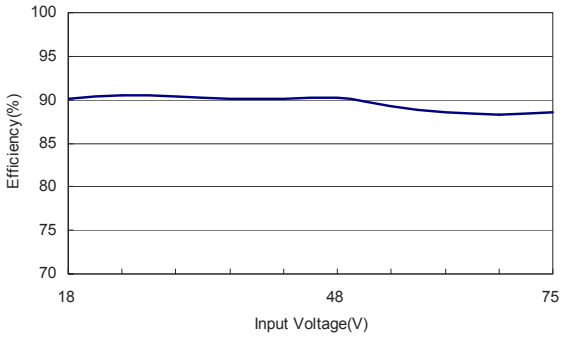
Conduction Emission of EN55022 Class A
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

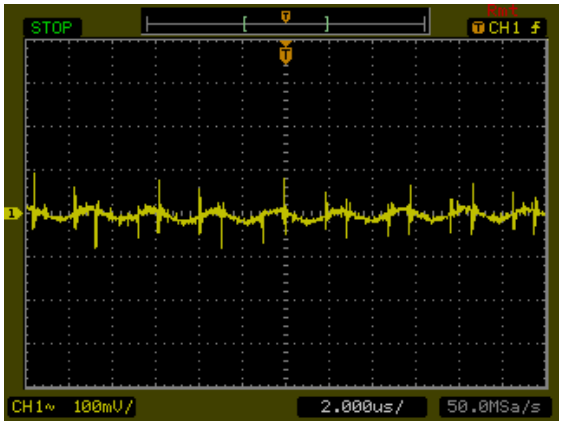
All test conditions are at 25°C. The figures are identical for THL 20-2415WI



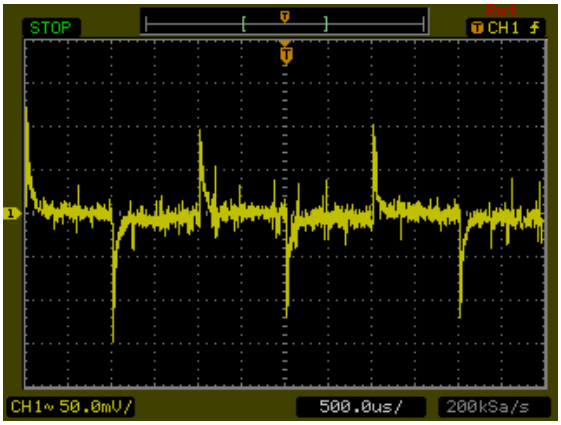
Efficiency Versus Output Current



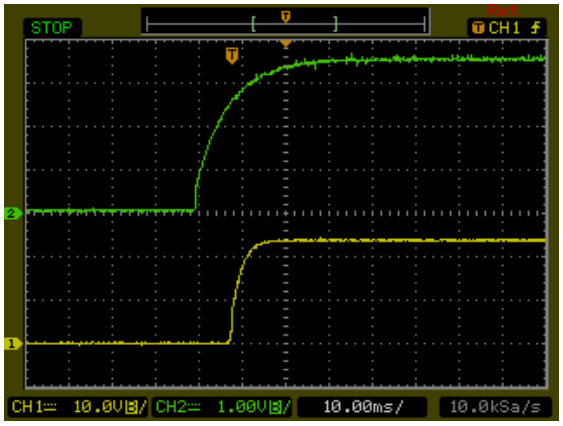
Efficiency Versus Input Voltage. Full Load



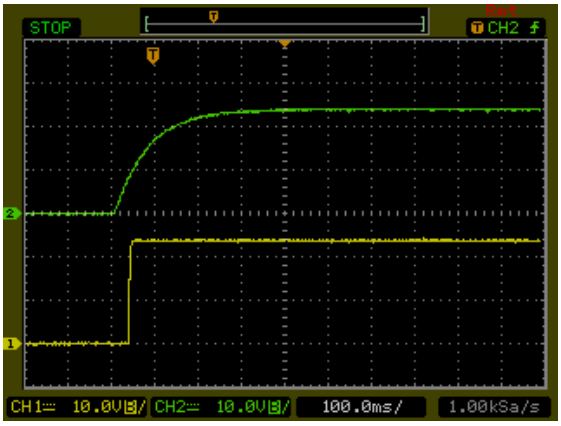
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



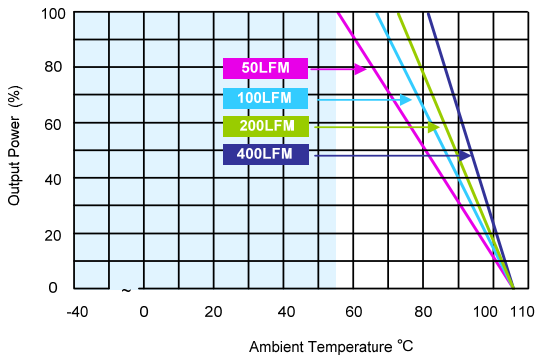
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



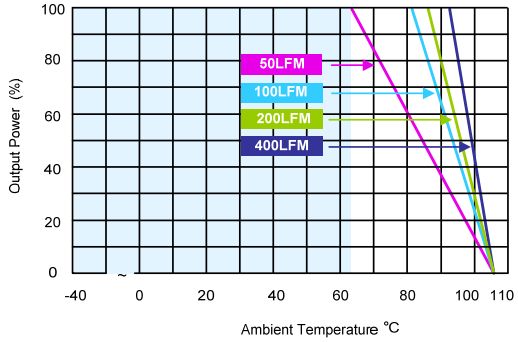
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

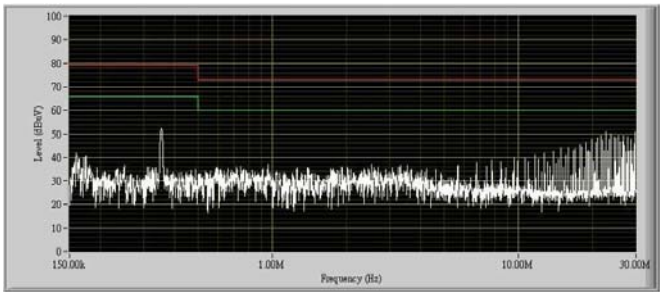
All test conditions are at 25°C. The figures are identical for THL 20-2415WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (without heatsink)



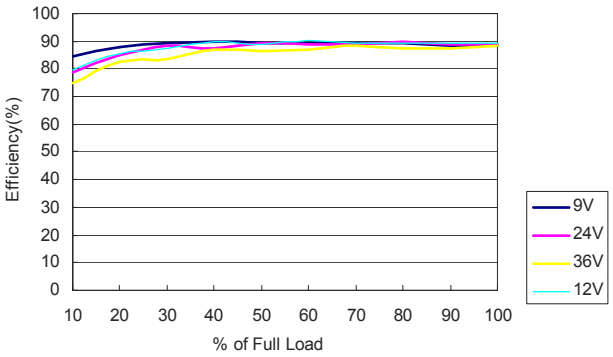
Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (with heatsink)



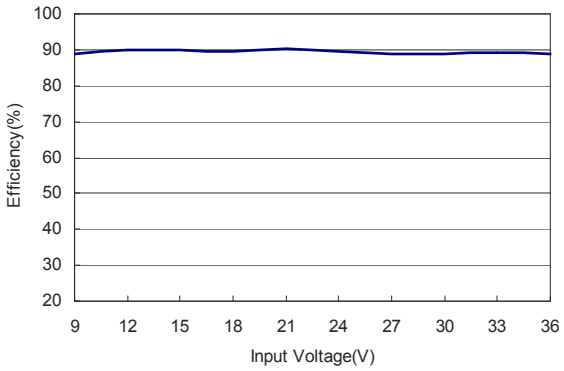
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

All test conditions are at 25°C. The figures are identical for THL 20-2422WI

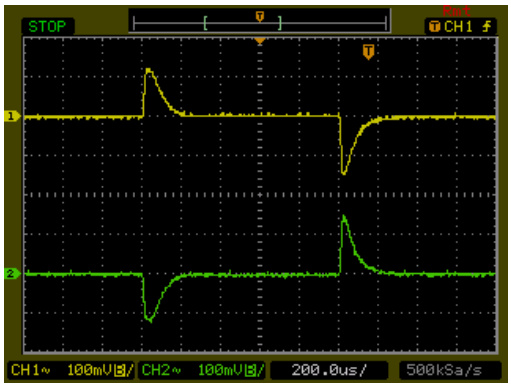


Efficiency Versus Output Current

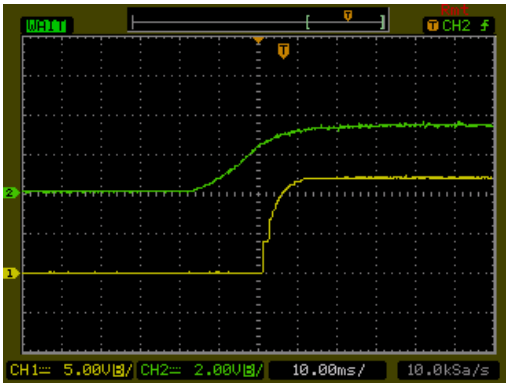


Efficiency Versus Input Voltage. Full Load

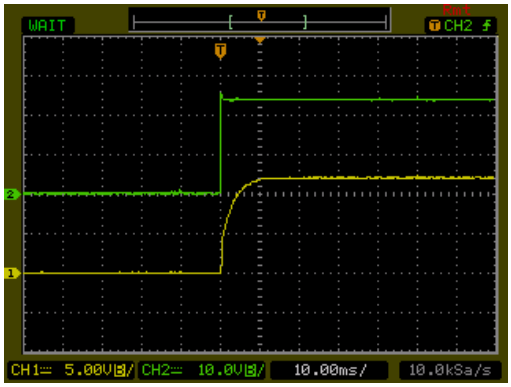
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



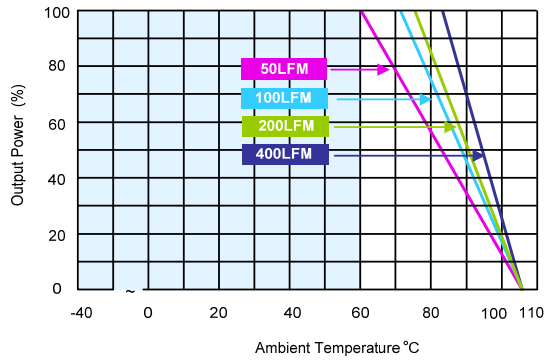
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



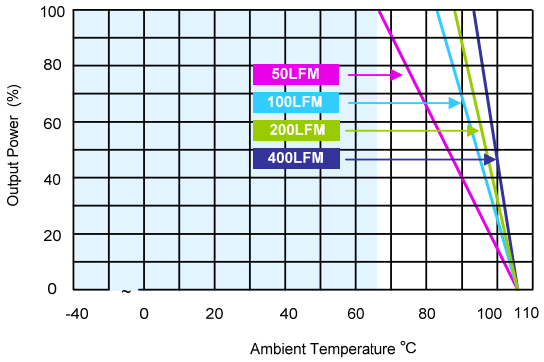
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

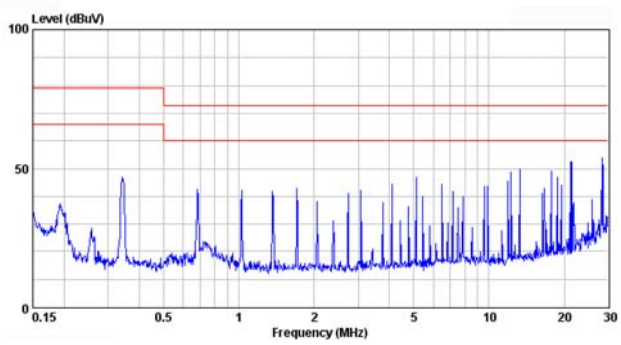
All test conditions are at 25°C. The figures are identical for THL 20-2422WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (without heatsink)



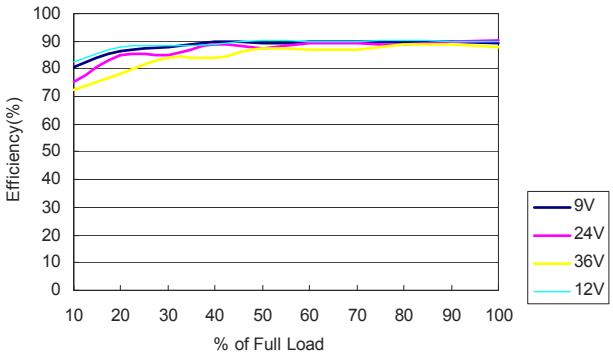
Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (with heatsink)



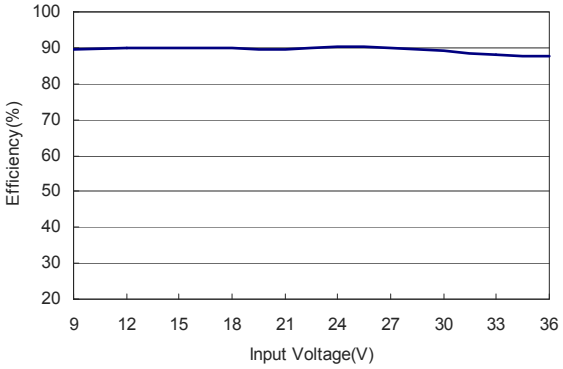
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

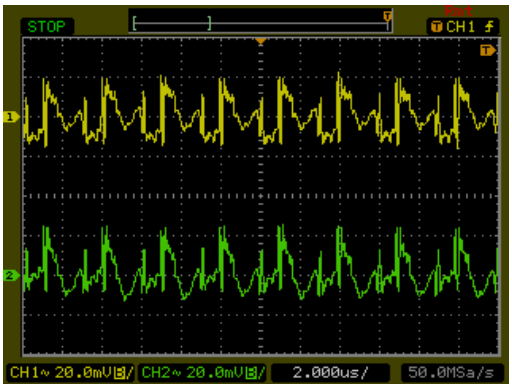
All test conditions are at 25°C. The figures are identical for THL 20-2423WI



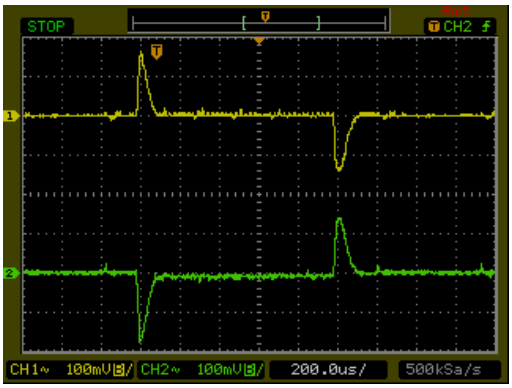
Efficiency Versus Output Current



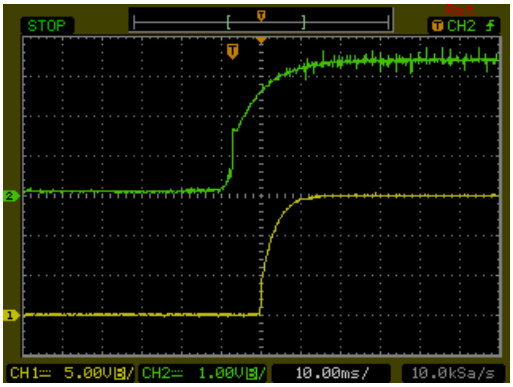
Efficiency Versus Input Voltage. Full Load



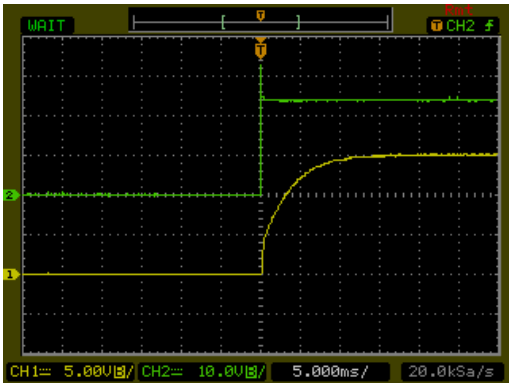
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



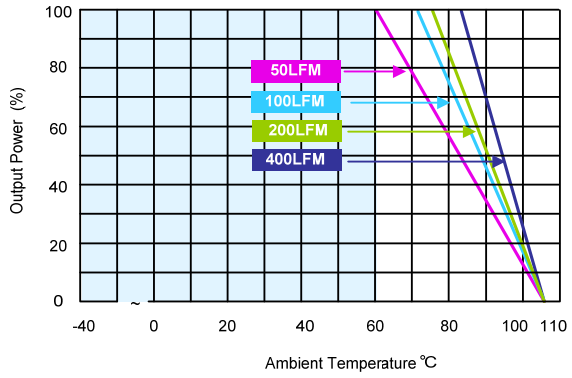
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



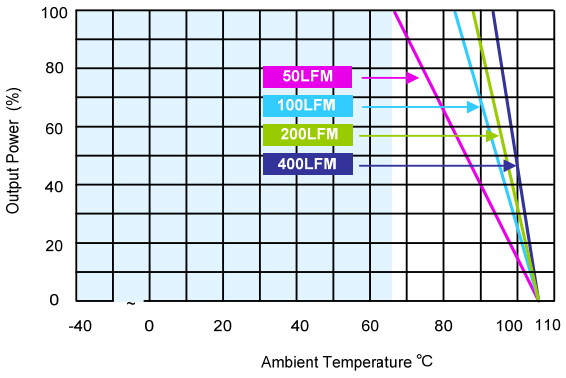
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

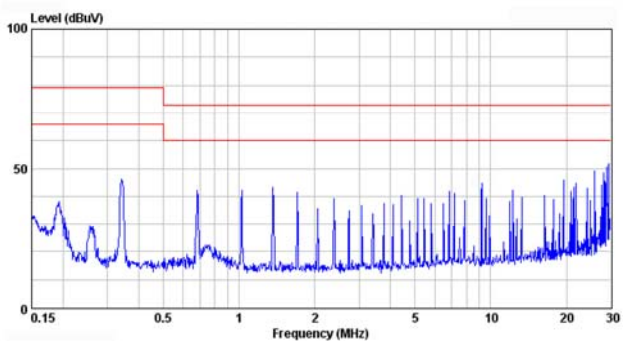
All test conditions are at 25°C. The figures are identical for THL 20-2423WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (without heatsink)



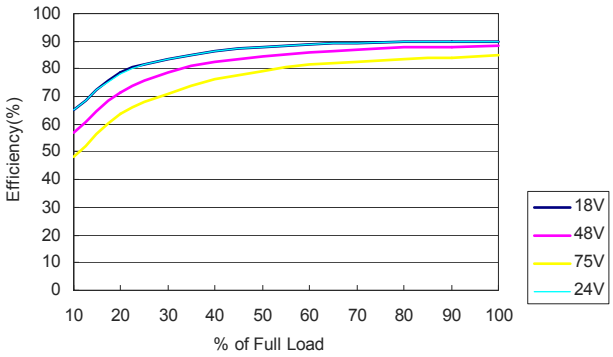
Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (with heatsink)



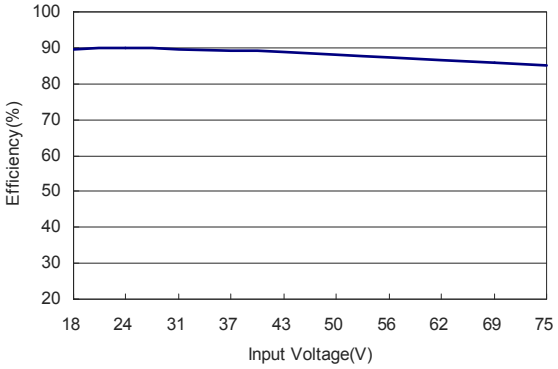
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

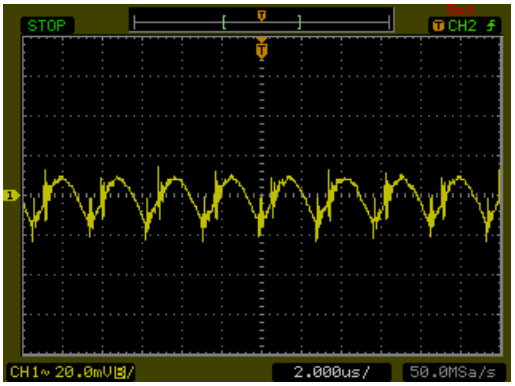
All test conditions are at 25°C. The figures are identical for THL 20-4810WI



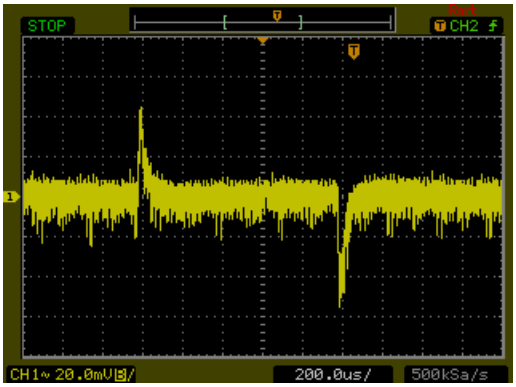
Efficiency Versus Output Current



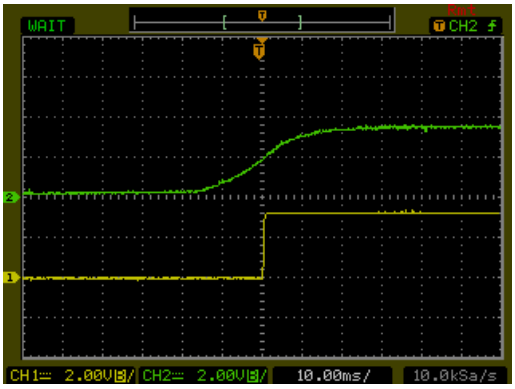
Efficiency Versus Input Voltage. Full Load



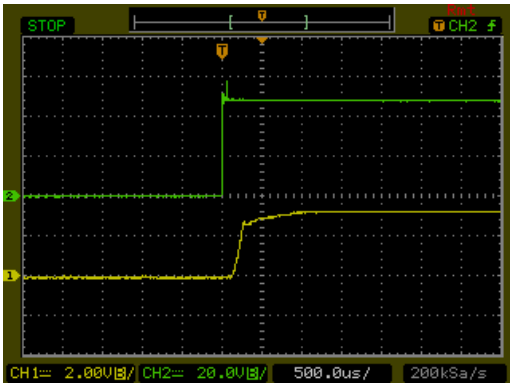
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



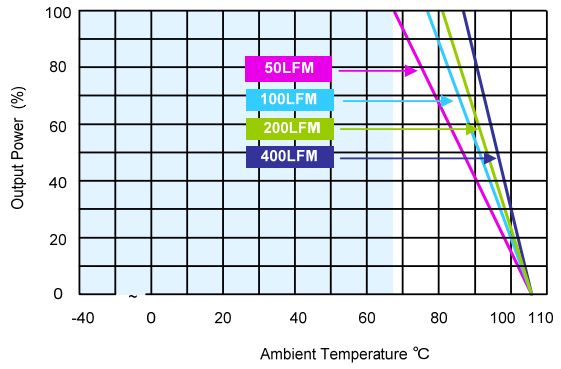
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



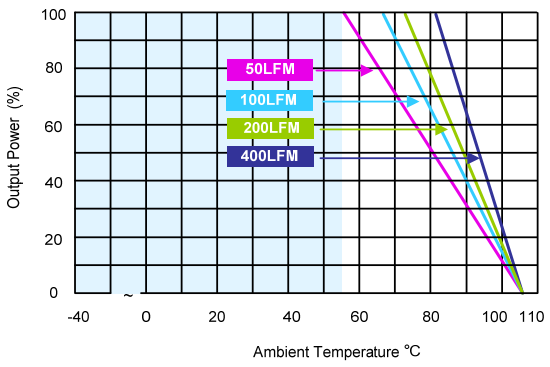
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

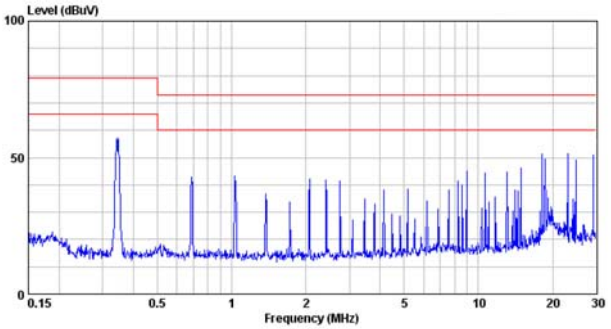
All test conditions are at 25°C. The figures are identical for THL 20-4810WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (without heatsink)



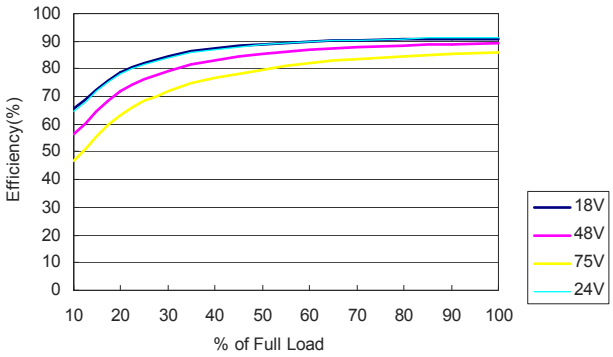
Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (with heatsink)



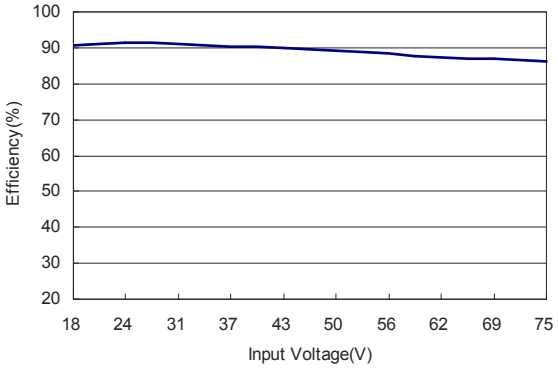
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

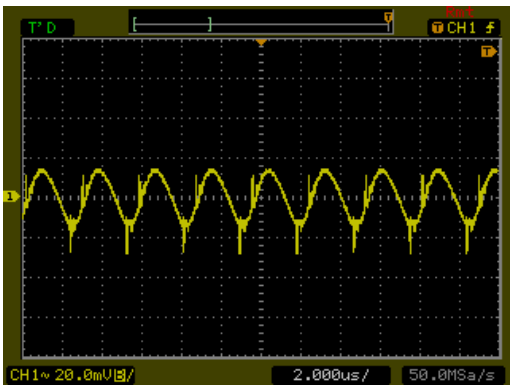
All test conditions are at 25°C. The figures are identical for THL 20-4811WI



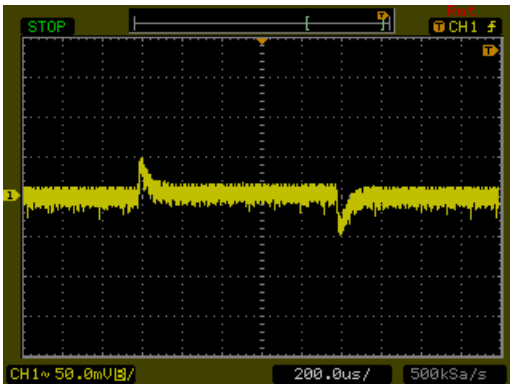
Efficiency Versus Output Current



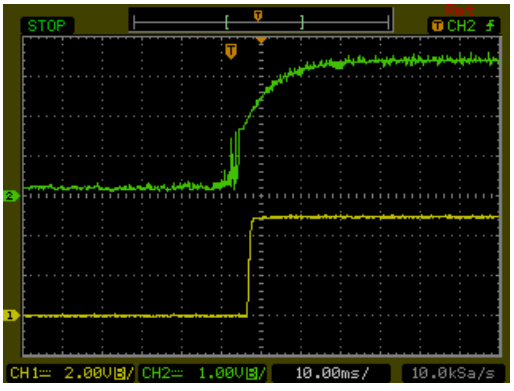
Efficiency Versus Input Voltage. Full Load



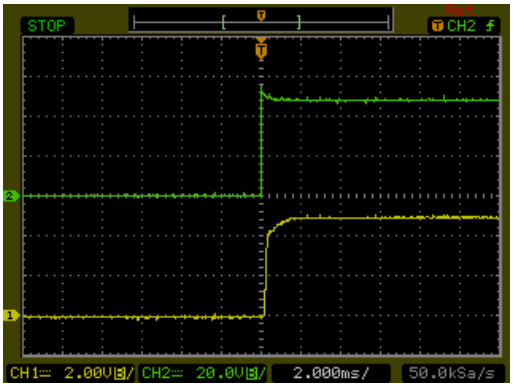
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



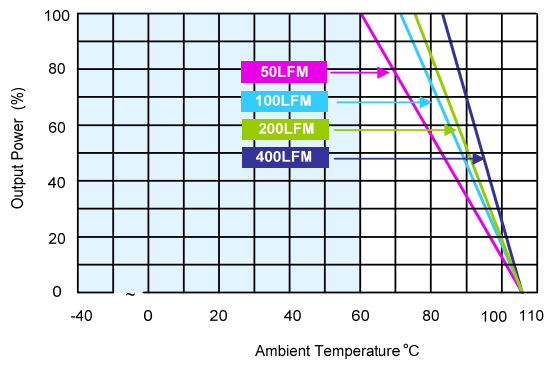
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



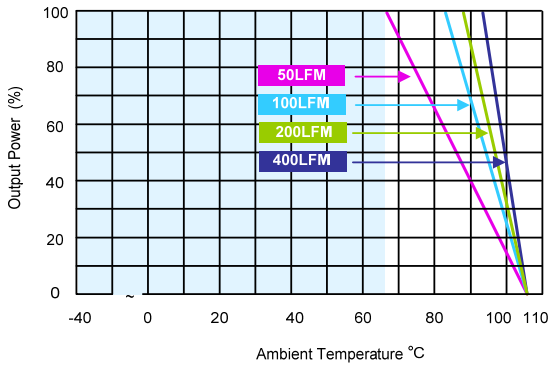
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

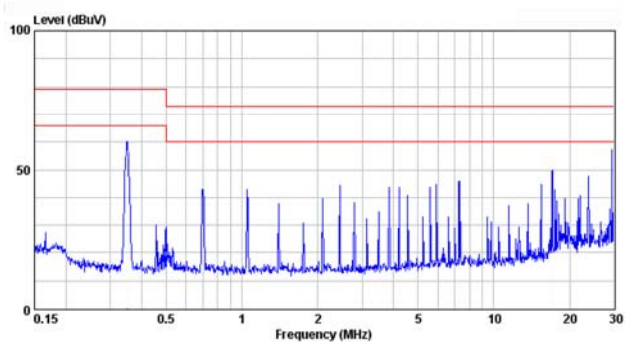
All test conditions are at 25°C. The figures are identical for THL 20-4811WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (without heatsink)



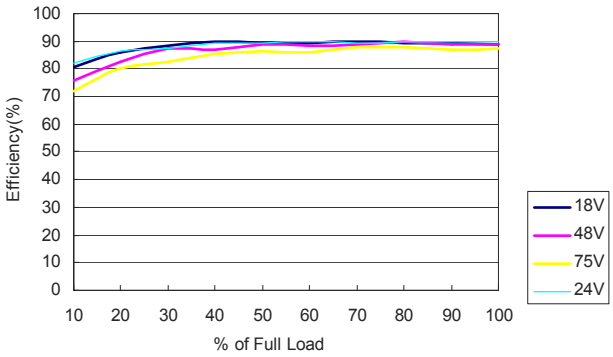
Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (with heatsink)



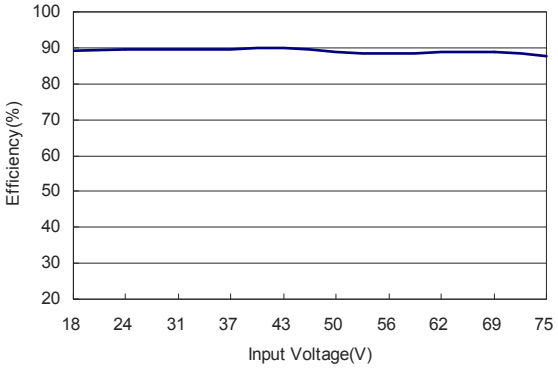
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

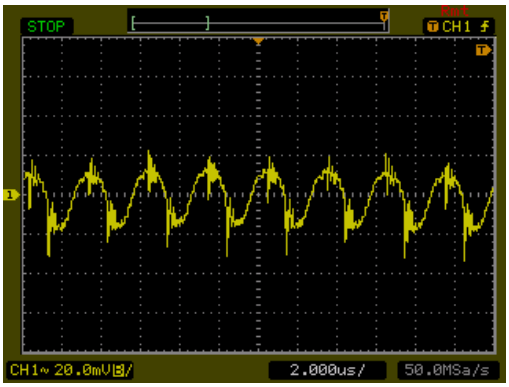
All test conditions are at 25°C. The figures are identical for THL 20-4812WI



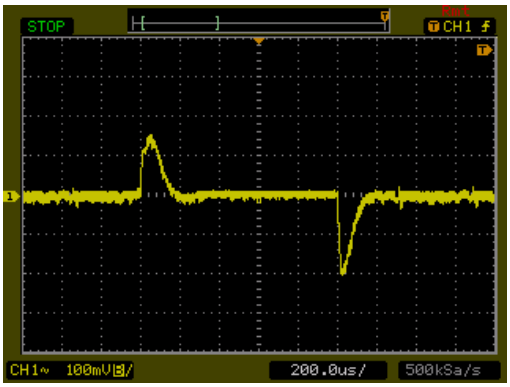
Efficiency Versus Output Current



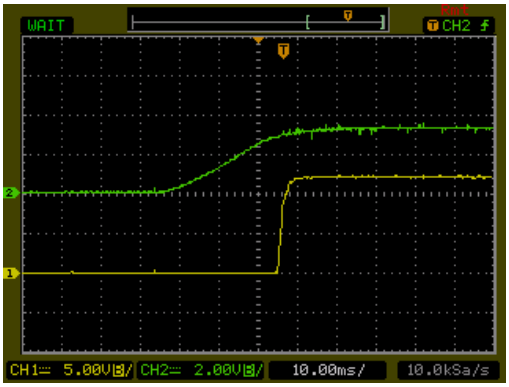
Efficiency Versus Input Voltage. Full Load



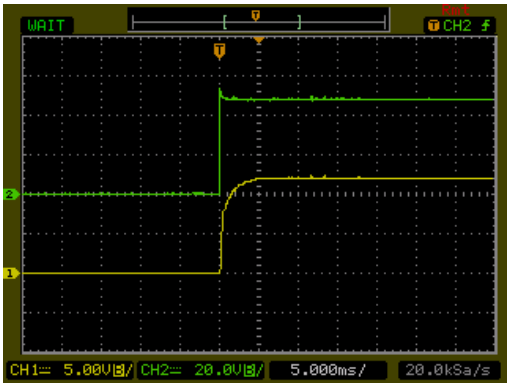
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



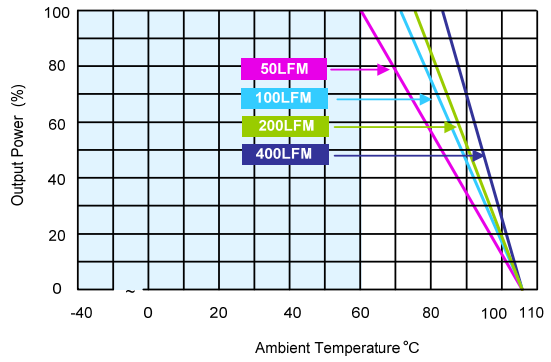
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



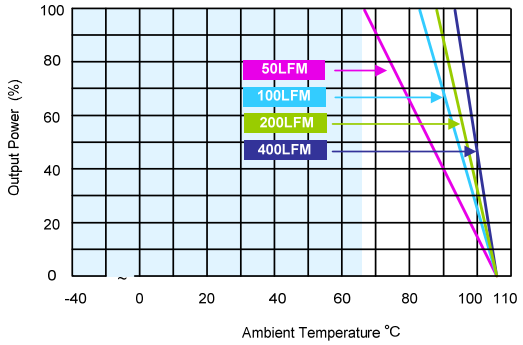
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

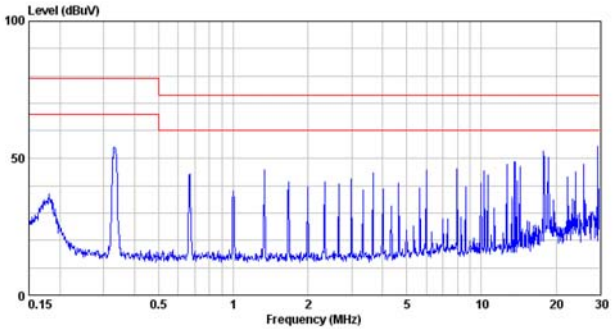
All test conditions are at 25°C. The figures are identical for THL 20-4812WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow V_{in} = $V_{in\ nom}$ (without heatsink)



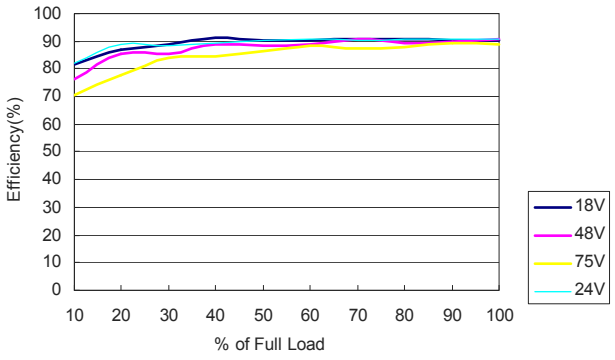
Derating Output Current Versus Ambient Temperature and Airflow V_{in} = $V_{in\ nom}$ (with heatsink)



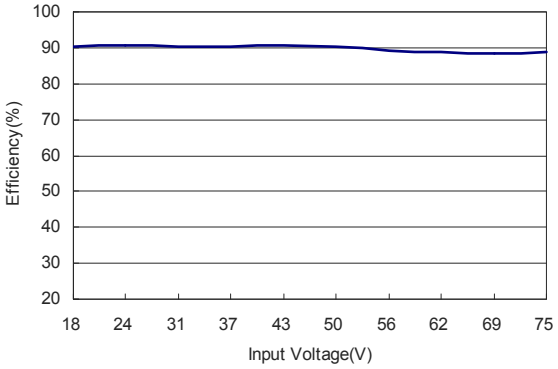
Conduction Emission of EN55022 Class A
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

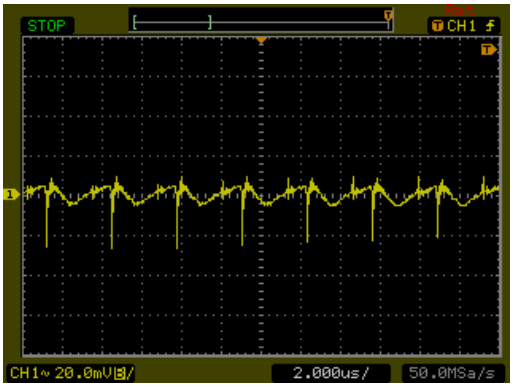
All test conditions are at 25°C. The figures are identical for THL 20-4813WI



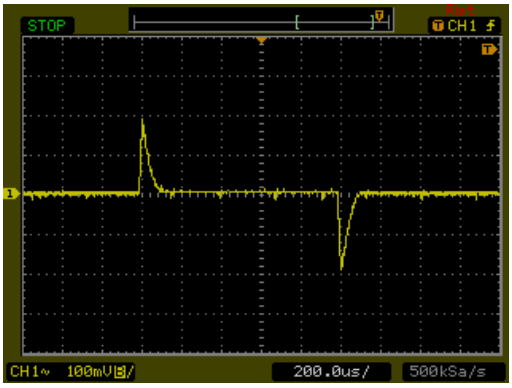
Efficiency Versus Output Current



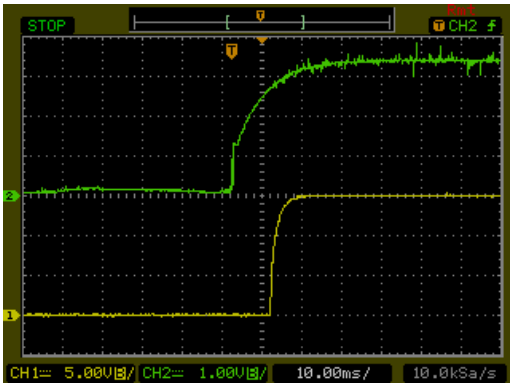
Efficiency Versus Input Voltage. Full Load



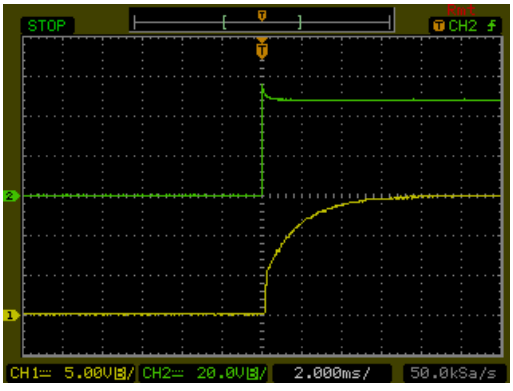
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



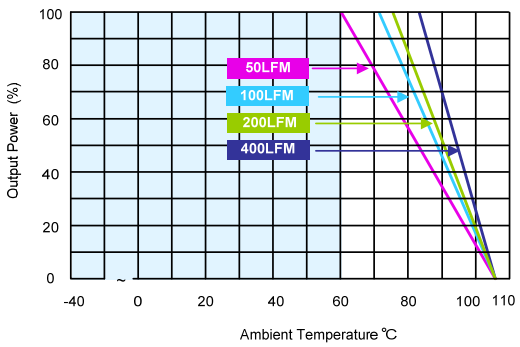
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



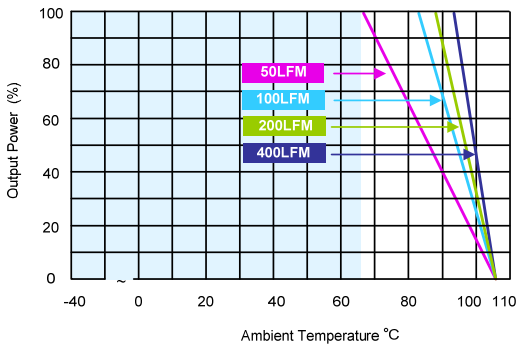
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

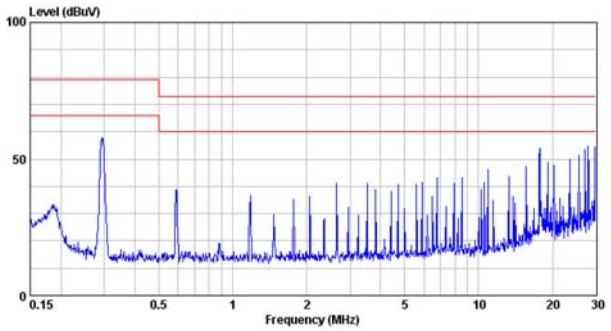
All test conditions are at 25°C. The figures are identical for THL 20-4813WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow V_{in} = $V_{in\ nom}$ (without heatsink)



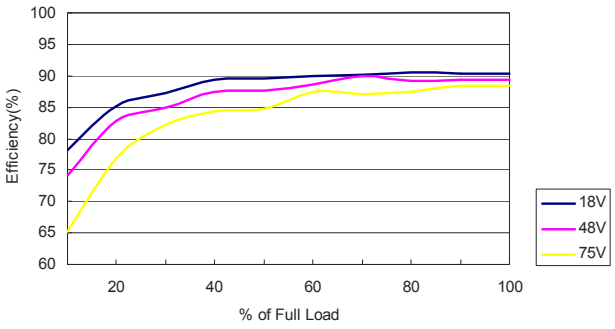
Derating Output Current Versus Ambient Temperature and Airflow V_{in} = $V_{in\ nom}$ (with heatsink)



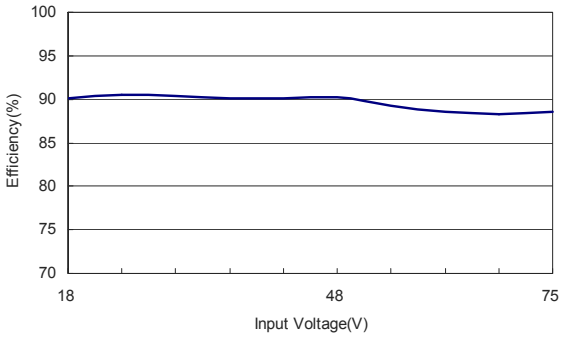
Conduction Emission of EN55022 Class A
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

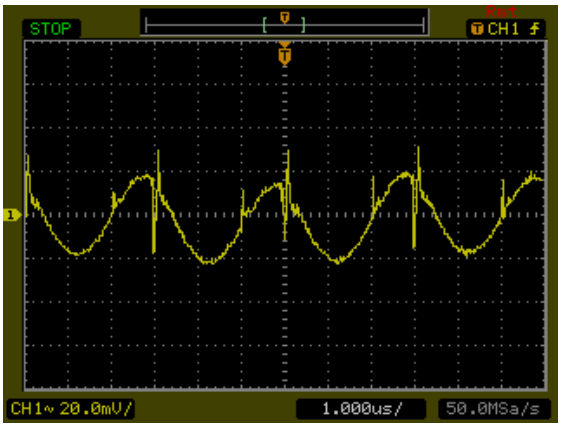
All test conditions are at 25°C. The figures are identical for THL 20-4815WI



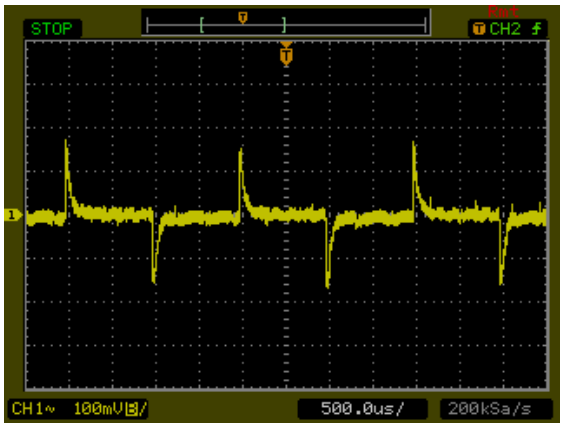
Efficiency Versus Output Current



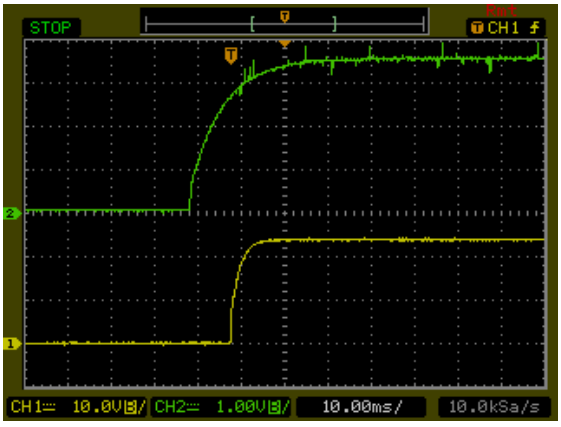
Efficiency Versus Input Voltage. Full Load



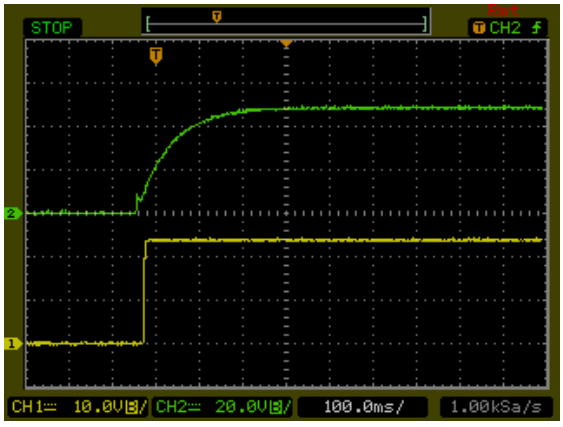
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



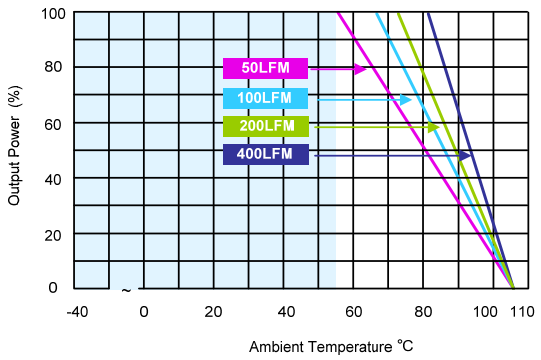
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic V_{in} = $V_{in\ nom}$; Full Load



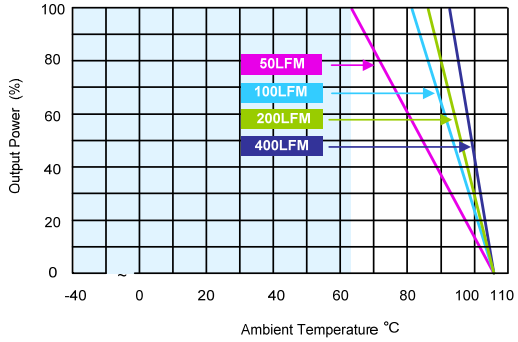
Typical Input Start-Up and Output Rise Characteristic V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

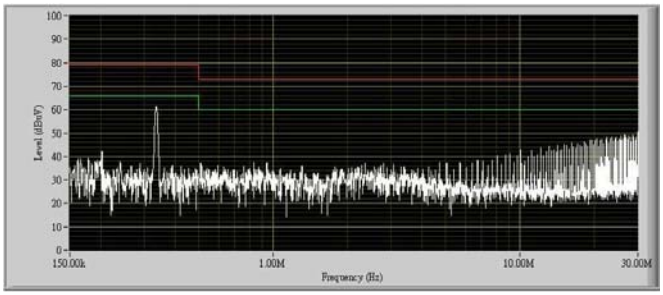
All test conditions are at 25°C. The figures are identical for THL 20-4815WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (without heatsink)



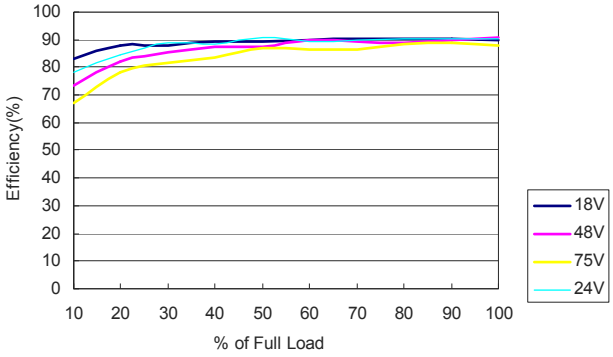
Derating Output Current Versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$ (with heatsink)



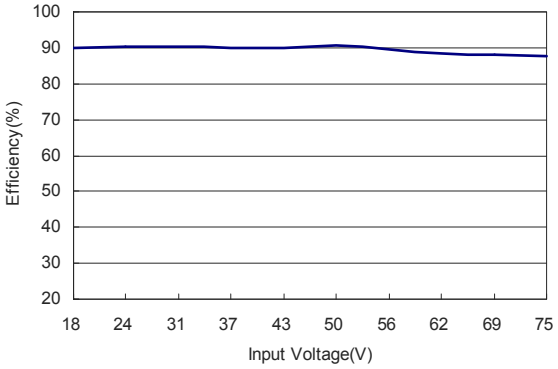
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

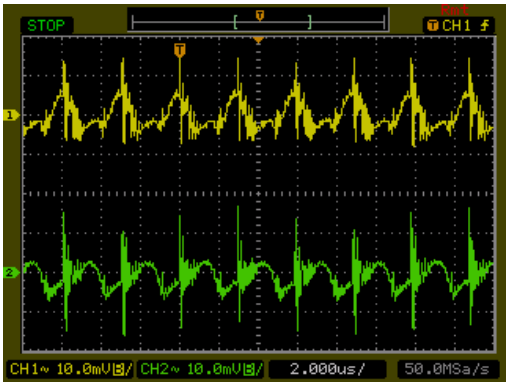
All test conditions are at 25°C. The figures are identical for THL 20-4822WI



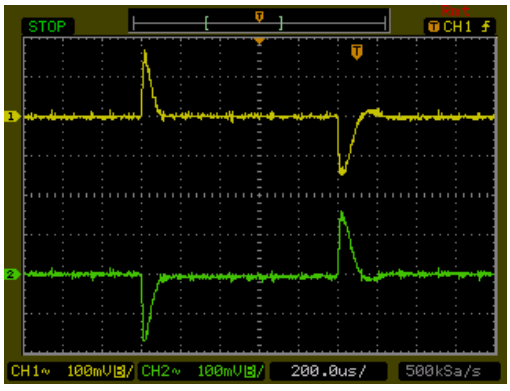
Efficiency Versus Output Current



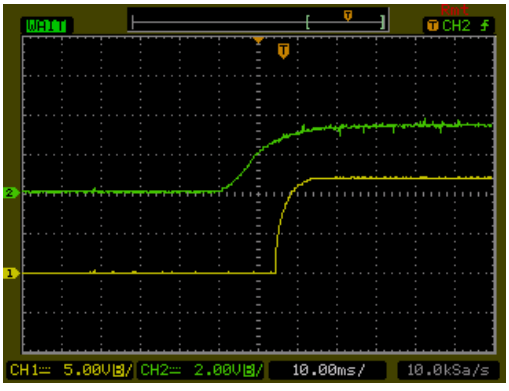
Efficiency Versus Input Voltage. Full Load



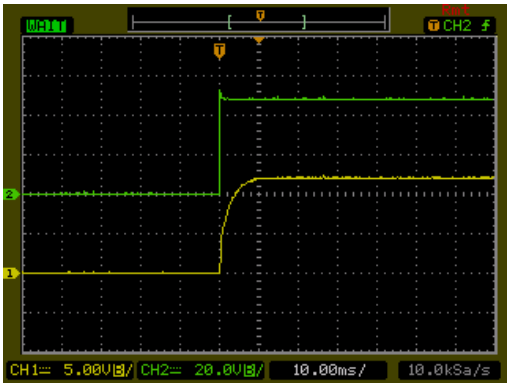
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



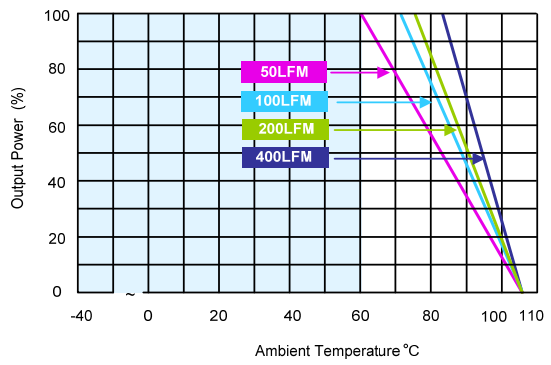
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



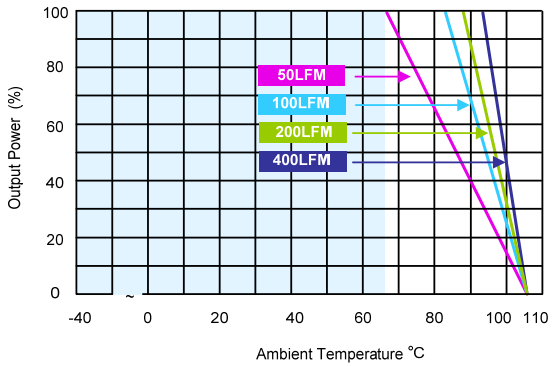
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

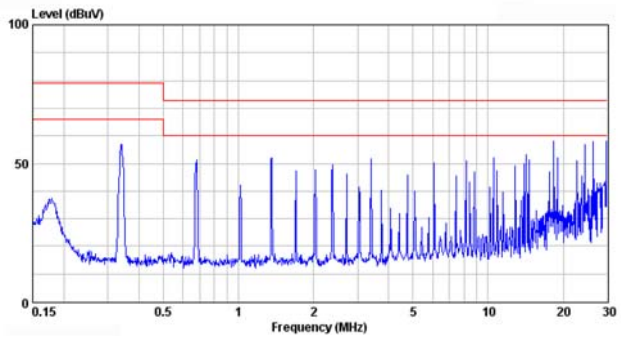
All test conditions are at 25°C. The figures are identical for THL 20-4822WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow V_{in} = $V_{in\ nom}$ (without heatsink)



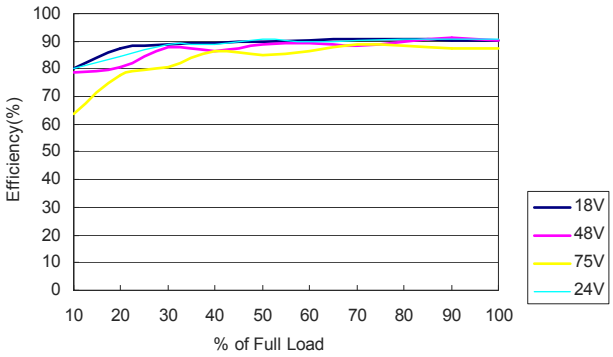
Derating Output Current Versus Ambient Temperature and Airflow V_{in} = $V_{in\ nom}$ (with heatsink)



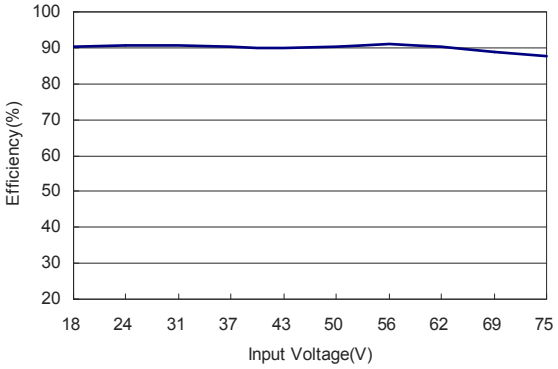
Conduction Emission of EN55022 Class A
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

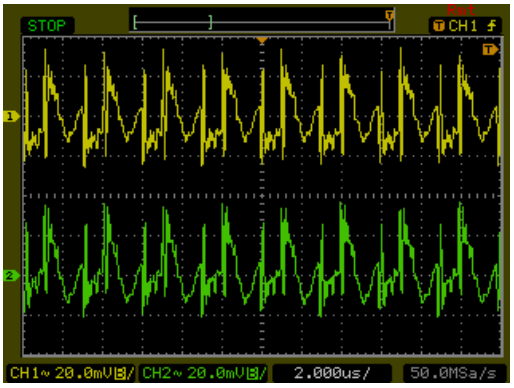
All test conditions are at 25°C. The figures are identical for THL 20-4823WI



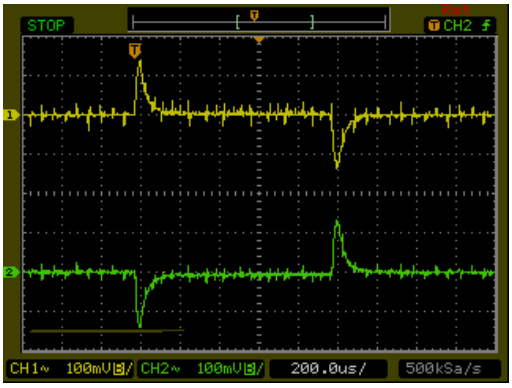
Efficiency Versus Output Current



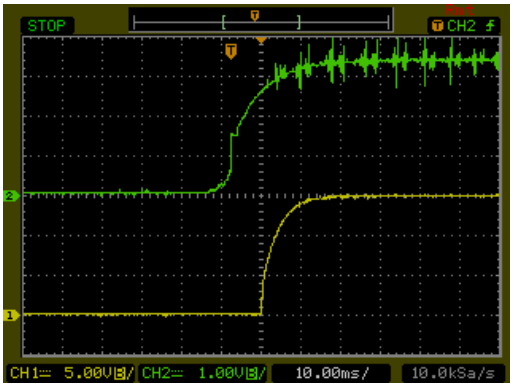
Efficiency Versus Input Voltage. Full Load



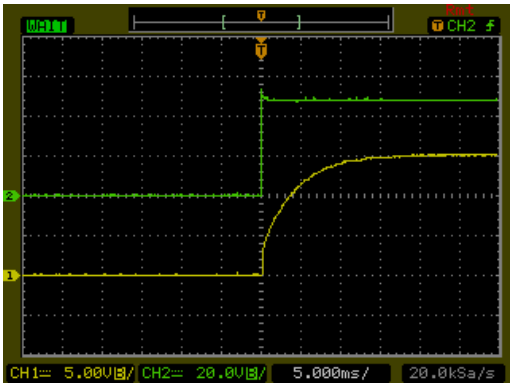
Typical Output Ripple and Noise.
V_{in} = $V_{in\ nom}$; Full Load; T_A



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



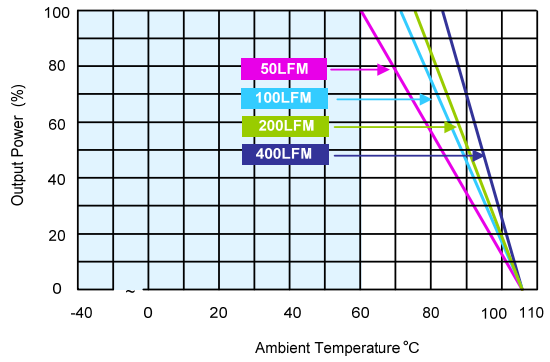
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load



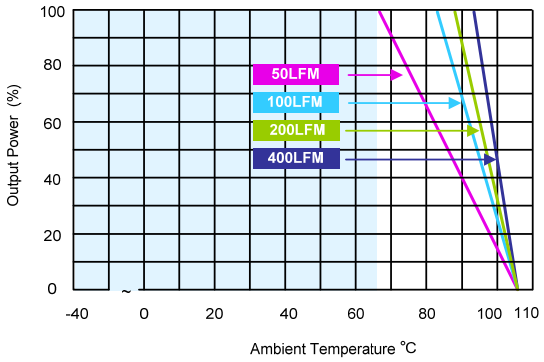
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

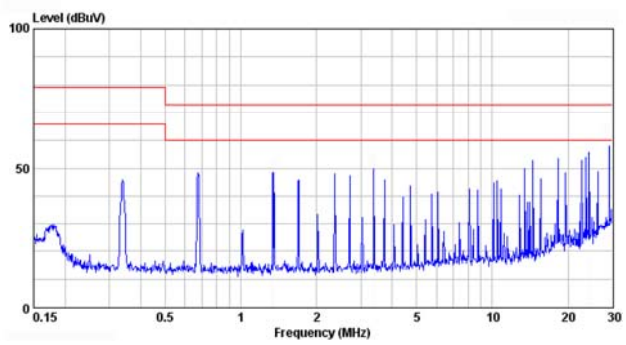
All test conditions are at 25°C. The figures are identical for THL 20-4823WI (Continued)



Derating Output Current Versus Ambient Temperature and Airflow V_{in} = $V_{in\ nom}$ (without heatsink)



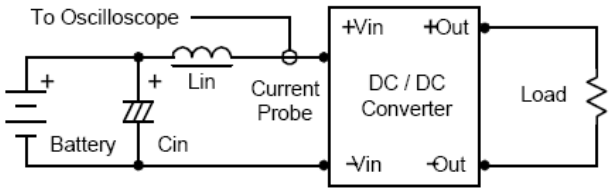
Derating Output Current Versus Ambient Temperature and Airflow V_{in} = $V_{in\ nom}$ (with heatsink)



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

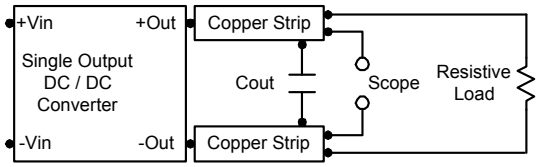
Testing Configurations

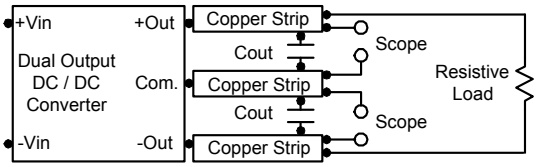
Input reflected-ripple current measurement test up

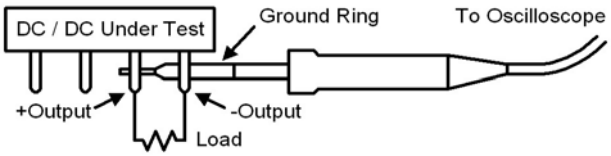


Component	Value	Reference
L	4.7µH	-----
C	220µF (ESR<1.0Ω at 100KHz)	Aluminum Electrolytic Capacitor

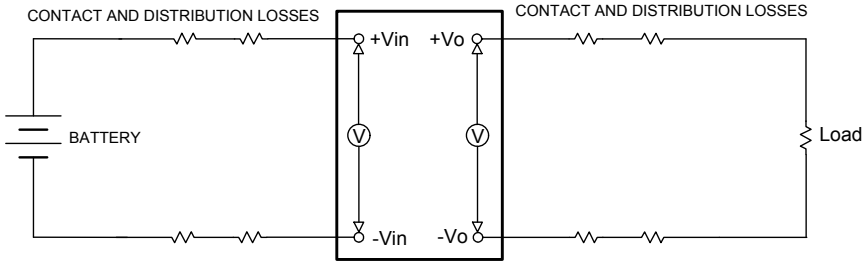
Peak-to-peak output ripple & noise measurement test up





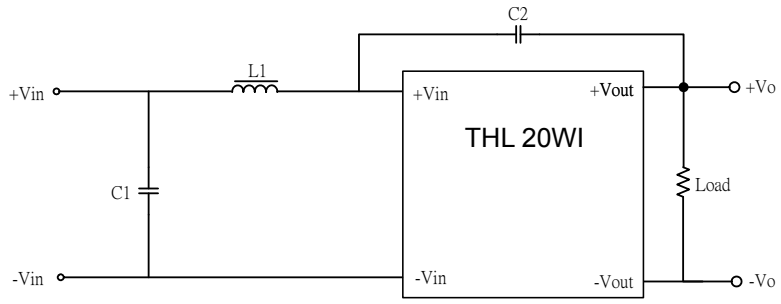


Output voltage and efficiency measurement test up

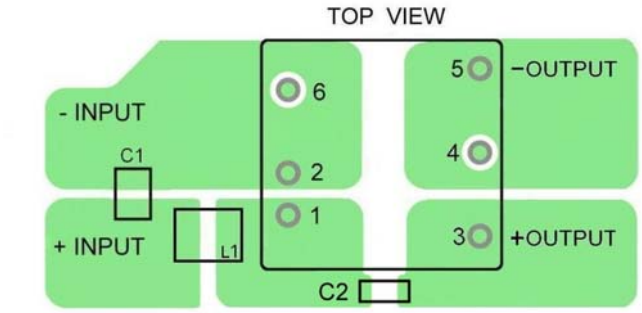


$$Efficiency = \left(\frac{V_{out} \times I_{out}}{V_{in} \times I_{in}} \right) \times 100\% = [\%]$$

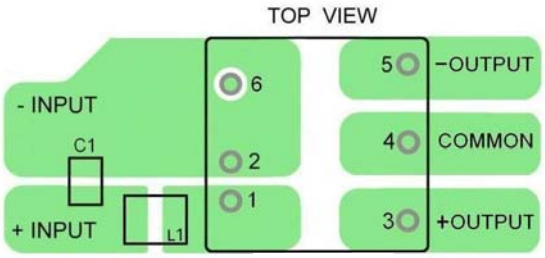
EMC considerations



Recommended EN55022 Class A Filter



THL 20WI
Single



THL 20WI
Dual

Recommended PCB Layout with Input Filter

Model	Component	Value
THL 20-24xxWI	C1	3.3µF/50V 1210 X7R MLCC
	C2 (THL 20-2415WI only)	220pF/2KV 1808 MLCC
	L1	6.8µH
THL 20-48xxWI	C1	2.2µF/100V 1210 X7R MLCC
	C2 (THL 20-4815WI only)	220pF/2KV 1808 MLCC
	L1	12µH

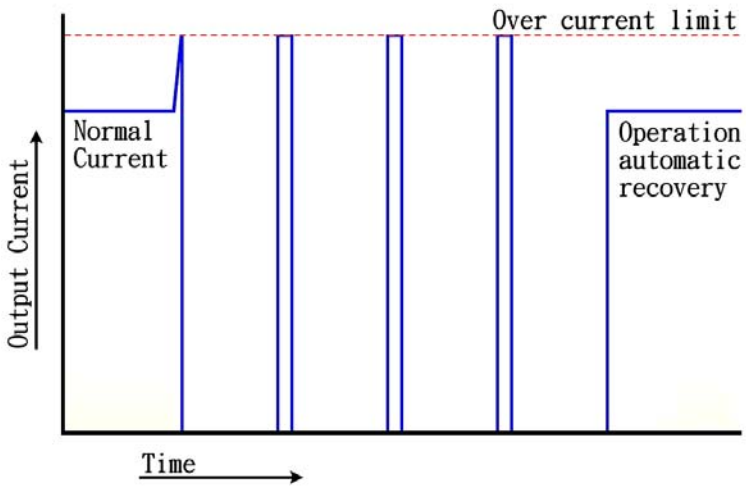
Input Source Impedance

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 4.7μH and capacitor is Nippon Chemi-con 220μF/100V. The capacitor must as close as possible to the input terminals of the power module for lower impedance.

Output Over Current Protection

THL 20WI series converters contain hiccup mode output over current protection that prevents damage to the product in the event of an overload or a short circuit. Normally, over current is maintained at approximately 115 ~ 150 percent of rated current for THL 20 series. Depending upon the converter design, there are other ways of protecting the converter against over current conditions such as the constant current limiting or current foldback methods.

With “hiccup” over current protection, the converter shuts off upon an occurrence of an over current condition. After a brief time interval, it automatically tries to restart the converter. If the restart is successful, normal operation continues. If the over current condition still exists, the converter will shut off again. With a sustained over current condition, such as a short circuit on the output, this automatic retry behavior will result in periodic pulses of current and voltage on the output. The output current waveform with hiccup over current protection is shown in figure below.



Hiccup operation has none of the drawbacks of the other two protection methods, although its circuit is more complicated because it requires a timing circuit. The excess heat due to overload lasts for only a short duration in the hiccup cycle, hence the junction temperature of the power devices is much lower.

The hiccup operation can be done in various ways. For example, one can start hiccup operation any time once an over-current event is detected; or prohibit hiccup during a designated start-up is usually larger than normal operation and it is easier for an over-current event is detected; or prohibit hiccup during a designated start-up interval (usually a few milliseconds). The reason for the latter operation is that during start-up, the converter needs to provide extra current to charge up the output capacitor. Thus the current demand during start-up is usually larger than during normal operation and it is easier for an over-current event to occur. If the converter starts to hiccup once there is an over-current, it might never start up successfully. Hiccup mode protection will give the best protection for a converter against over current situations, since it will limit the average current to the load at a low level, so reducing power dissipation and case temperature in the power devices.

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.

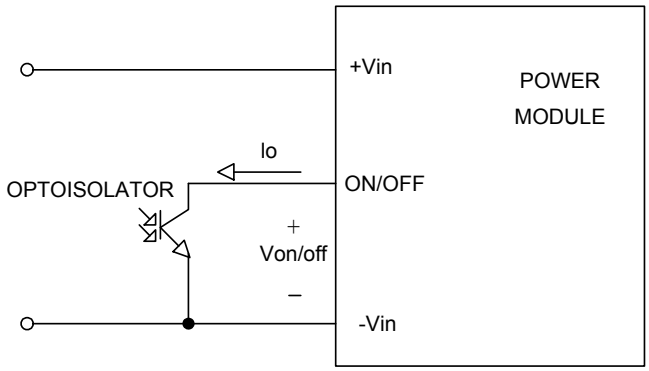
Short Circuitry Protection

Continuous, hiccup and auto-recovery mode.
During short circuit, converter still shut down, The average current during this condition will be very low and the device will be safe in this condition.

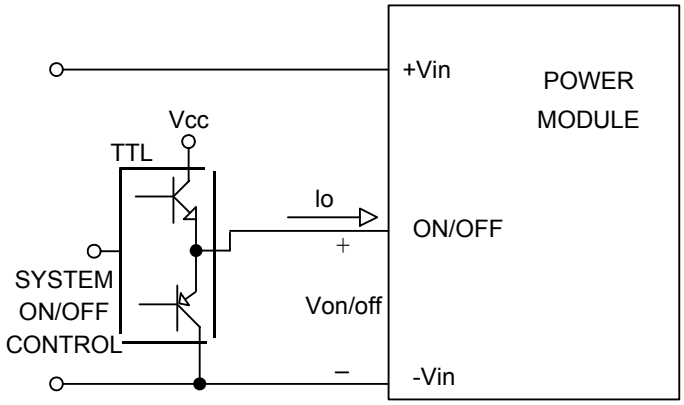
Remote ON/OFF Control

Turns the module ON during logic High on the ON/Off pin and turns OFF during logic Low. The ON/OFF input signal (Von/off) that referenced to GND. If not using the remote on/off feature, please open circuit between on/off pin and -Vin pin to turn the module on.

Remote ON/OFF implementation

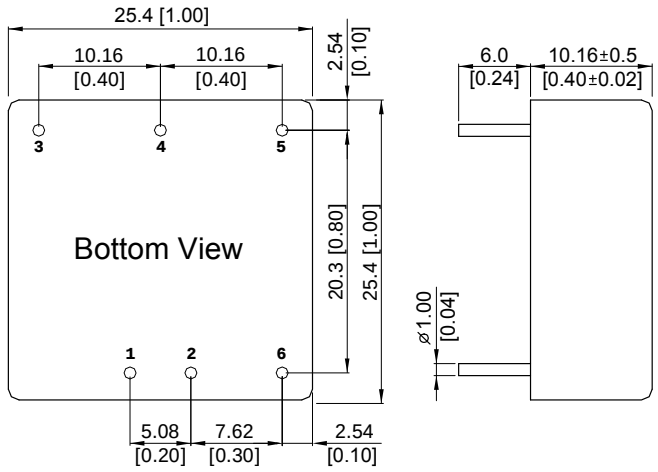


Isolated-Closure Remote ON/OFF



Level Control Using TTL Output

Mechanical Dimensions

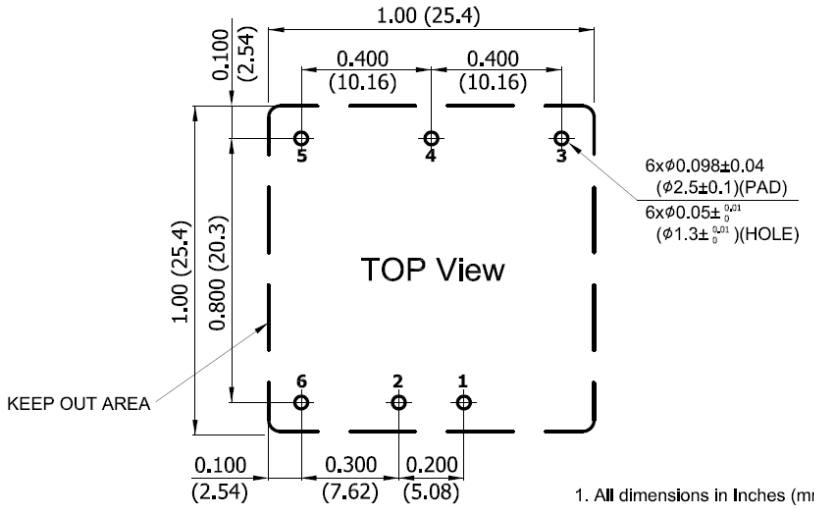


Pin Connections		
Pin	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	Trim	Common
5	-Vout	-Vout
6	Remote On/Off	Remote On/Off

1. All dimensions in mm (inches)
   Tolerance: X.X ±0.25 (X.XX ±0.01")
   X.XX ±0.13 (X.XXX ±0.005")
2. Pin pitch tolerance: ±0.25 (±0.01")
3. Pin dimension tolerance: ±0.1 (±0.004")

Weight: 15g

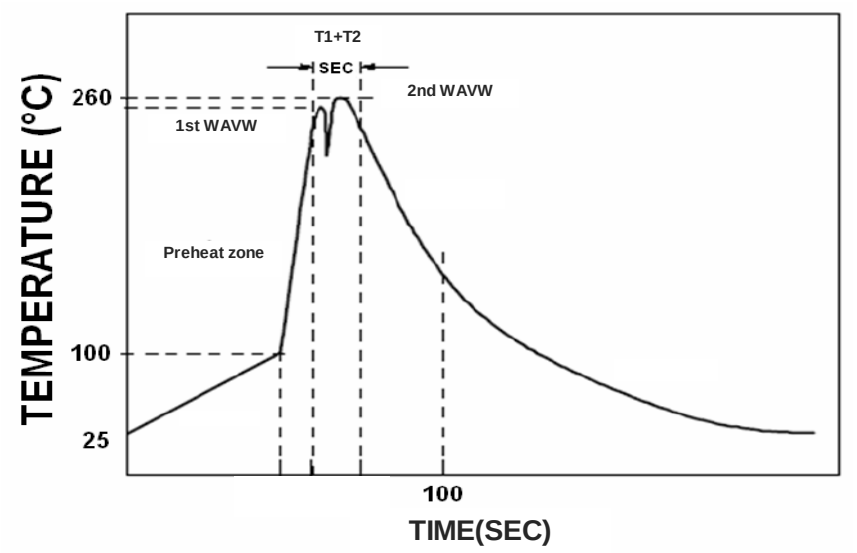
Recommended Pad Layout for Single & Dual Output Converter



1. All dimensions in Inches (mm)
   Tolerance: X.XX±0.02" (X.X±0.5)
   X.XXX±0.01" (X.XX±0.25mm)
2. Pin pitch tolerance:±0.01" (±0.25mm)
3. Pin dimension tolerance:±0.004" (±0.1mm)

Soldering and Reflow Considerations

Lead free wave solder profile for THL 20WI Series



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): 4~6 sec

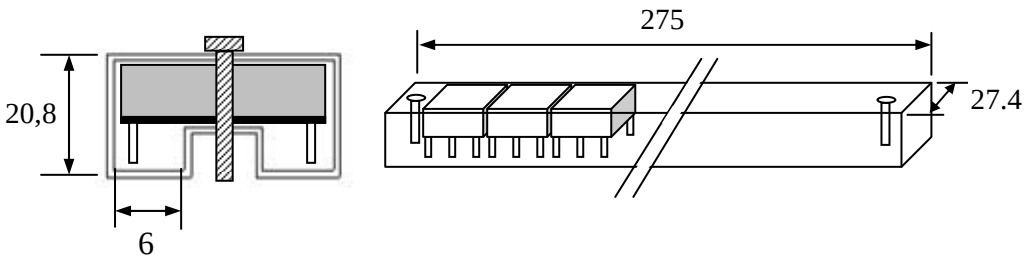
Reference Solder: Sn-Ag-Cu: Sn-Cu: Sn-Ag

Hand Welding: Soldering iron: Power 60W

Welding Time: 2~4 sec

Temperature: 380~400°C

Packaging Information



All densions in millimeters

10 PCS per TUBE

Part Number Structure

Model Number	Input Range (VDC)	Output Voltage (VDC)	Max. Output Current (mA)	Input Current at Full Load(1) (mA)	Efficiency(1) (%)
THL 20-2410WI	9 – 36	3.3	4500	711	87
THL 20-2411WI	9 – 36	5	4000	936	89
THL 20-2412WI	9 – 36	12	1670	938	89
THL 20-2413WI	9 – 36	15	1340	941	89
THL 20-2415WI	9 – 36	24	835	949	88
THL 20-2422WI	9 – 36	±12	±835	938	89
THL 20-2423WI	9 – 36	±15	±670	941	89
THL 20-4810WI	18 – 75	3.3	4500	352	88
THL 20-4811WI	18 – 75	5	4000	468	89
THL 20-4812WI	18 – 75	12	1670	469	89
THL 20-4813WI	18 – 75	15	1340	471	89
THL 20-4815WI	18 – 75	24	835	474	88
THL 20-4822WI	18 – 75	±12	±835	469	89
THL 20-4823WI	18 – 75	±15	±670	471	89

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 5A for the THL 20-24xxWI converters and 2.5A for the THL 20-48xxWI converters. 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 THL 20WI series of DC/DC converters has been calculated using MIL-HDBK 217F NOTICE2, Operating Temperature 25°C and Ground Benign.

THL 20-2410WI	→	MTBF = 418'000 Hours
THL 20-2411WI	→	MTBF = 448'000 Hours
THL 20-2412WI	→	MTBF = 680'100 Hours
THL 20-2413WI	→	MTBF = 691'500 Hours
THL 20-2415WI	→	MTBF = 647'500 Hours
THL 20-2422WI	→	MTBF = 630'000 Hours
THL 20-2423WI	→	MTBF = 670'800 Hours

THL 20-4810WI	→	MTBF = 422'600 Hours
THL 20-4811WI	→	MTBF = 451'600 Hours
THL 20-4812WI	→	MTBF = 683'500 Hours
THL 20-4813WI	→	MTBF = 790'000 Hours
THL 20-4815WI	→	MTBF = 648'100 Hours
THL 20-4822WI	→	MTBF = 638'200 Hours
THL 20-4823WI	→	MTBF = 673'500 Hours