TEN 15WI Series

15W, Wide Input Range, Single & Dual Output DC/DC Converters

Features

- Efficiency up to 86%
- 1500VDC Isolation
- MTBF > 700,000 Hours
- 4:1 Wide Input Range
- UL60950-1 Safety Approval
- Complies with EN55022 Class A
- Six-Sided Shielding
- Remote On/Off Control
- 3 Years Product Warranty

Applications

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

General Description

TEN 15WI series, comprising 16 different models, has been conceived as an application specific range of DC/DC converters, 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 15W of power into a 2x1x0.4 inch package, with efficiency as high as 86%, the TEN 15WI has ultra-wide input ranges of 9-36VDC and 18-75VDC which is available in output voltages of 3.3V, 5V, 5.1V, 12V, 15V, ±5V, ±12V and ±15VDC.

Other feathers include continuous short circuit 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 Input Surge Voltage (1 sec.)	24VDC Input Models 48VDC Input Models	-0.7 -0.7	50 100	VDC
Operating Ambient Temperature Without Derating With Derating	All	-40 -40	+60 +85	℃
Operating Case Temperature	All		+100	℃
Storage Temperature	All	-50	+125	℃

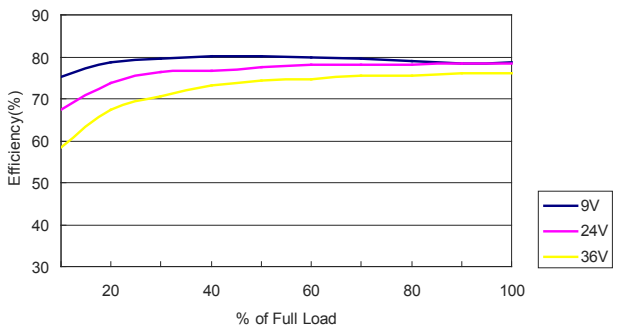
Output Specification					
Parameter	**Model**	**Min**	**Nominal**	**Max**	**Unit**
Output Voltage (V_{in}=$V_{in\ nom}$; Full Load; T_A=25℃)	TEN 15-XX10WI TEN 15-XX11WI TEN 15-XX12WI TEN 15-XX13WI TEN 15-XX21WI TEN 15-XX22WI TEN 15-XX23WI TEN 15-XXXXWI	3.234 4.9 11.76 14.7 ±4.9 ±11.76 ±14.7 4.998	3.3 5 12 15 ±5 ±12 ±15 5.1	3.366 5.1 12.24 15.3 ±5.1 ±12.24 ±15.3 5.202	VDC
Output Regulation Line ($V_{in\ min}$ to $V_{in\ max}$ at Full Load)			±0.1	±0.5	%
Output Regulation Load (10% to 100% of Full Load)			±0.5	±1.0	%
Output Ripple & Noise Peak-to-Peak (5Hz to 20MHz bandwidth)			55	80	mV pk-pk
Temperature Coefficient	All		±0.01	±0.02	%/℃
Dynamic Load Response (V_{in} = $V_{in\ nom}$; TA=25℃ Load step change form 25% Load Step Change Peak Deviation	All		±2%Vo	±4%Vo	mV
Setting Time			300	500	µS
Output Current	TEN 15-XX10WI TEN 15-XX11WI TEN 15-XX12WI TEN 15-XX13WI TEN 15-XX21WI TEN 15-XX22WI TEN 15-XX23WI TEN 15-XXXXWI	300 300 125 100 ±150 ±62.5 ±50 300		3000 3000 1250 1000 ±1500 ±625 ±500 3000	mA
Output Over Current Protection	All	120			%FL
Output Short Circuit Protection	All	Continuous			

Input Specification					
Parameter	**Model**	**Min**	**Nominal**	**Max**	**Unit**
Operating Input Voltage	24V Input Models 48V Input Models	9 18	24 48	36 75	VDC
Under Voltage Lockout Turn-on Threshold	24V Input Models 48V Input Models	8 15	8.5 17	9 18	VDC
Under Voltage Lockout Turn-off Threshold	24V Input Models 48V Input Models	7 13	8 15	8.5 17	VDC
Input reflected ripple current (0 to 500KHz, 4.7µH source impedance)	24V Input Models 48V Input Models		40 30		mA pk-pk
Input Current (Maximum value at V_{in}= $V_{in\ nom}$;Full Load)	TEN 15-2410WI TEN 15-2411WI TEN 15-2412WI TEN 15-2413WI TEN 15-2421WI TEN 15-2422WI TEN 15-2423WI TEN 15-24XXWI		528 762 735 726 771 735 726 787		mA
	TEN 15-4810WI TEN 15-4811WI TEN 15-4812WI TEN 15-4813WI TEN 15-4821WI TEN 15-4822WI TEN 15-4823WI TEN 15-48XXWI		264 381 368 363 386 368 363 393		
Input Standby Current (Typical value at V_{in} = $V_{in\ nom}$; No Load)	TEN 15-2410WI TEN 15-2411WI TEN 15-2412WI TEN 15-2413WI TEN 15-2421WI TEN 15-2422WI TEN 15-2423WI TEN 15-24XXWI		25		mA
	TEN 15-4810WI TEN 15-4811WI TEN 15-4812WI TEN 15-4813WI TEN 15-4821WI TEN 15-4822WI TEN 15-4823WI TEN 15-48XXWI		15		
Remote ON/OFF Control (The On/Off pin voltage is referenced to-V_{in}) Positive logic On/Off pin High Voltage (Remote ON) On/Off pin Low Voltage (Remote OFF) Remote Off Stand by Input Current Control Pin Input Current (Remote ON) Control Pin Input Current (Remote OFF)	All	 2.5 -0.7		 5.5 0.8 10 50 -1	 VDC VDC mA uA mA

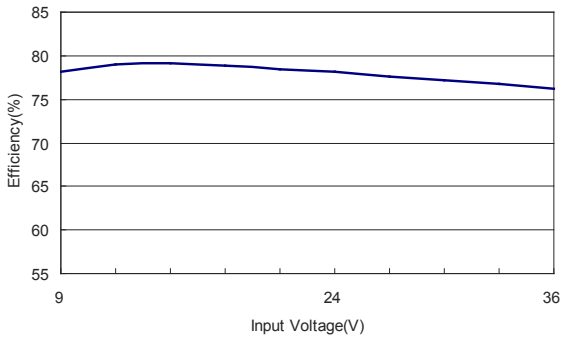
General Specification					
Parameter	**Model**	**Min**	**Nominal**	**Max**	**Unit**
Efficiency (V_{in} =$V_{in\ nom}$; Full Load; T_A =25°C)	TEN 15-2410WI		78		%
	TEN 15-2411WI		82		
	TEN 15-2412WI		85		
	TEN 15-2413WI		86		
	TEN 15-2421WI		81		
	TEN 15-2422WI		85		
	TEN 15-2423WI		86		
	TEN 15-24XXWI		81		
	TEN 15-4810WI		78		
	TEN 15-4811WI		82		
	TEN 15-4812WI		85		
	TEN 15-4813WI		86		
	TEN 15-4821WI		81		
	TEN 15-4822WI		85		
	TEN 15-4823WI		86		
	TEN 15-48XXWI		81		
Isolation Voltage Input to Output (for 60 seconds)		1500			VDC
Isolation Resistance	All	1000			MΩ
Isolation Capacitance			1200	1500	pF
Switching Frequency			330		KHz
MTBF MIL-STD-217F, TC=25°C		700,000			Hours

Characteristic Curves

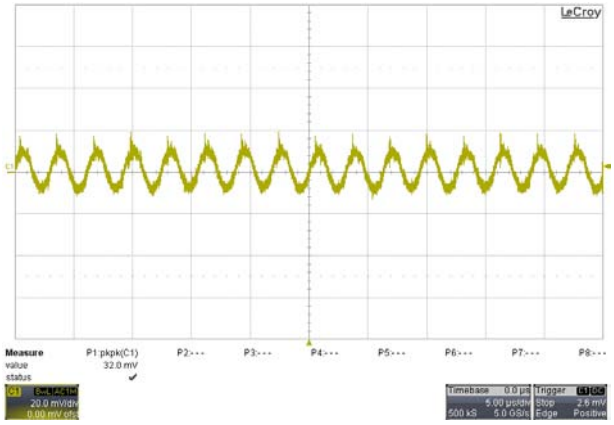
All test conditions are at 25°C The figures are identical for TEN 15-2410WI



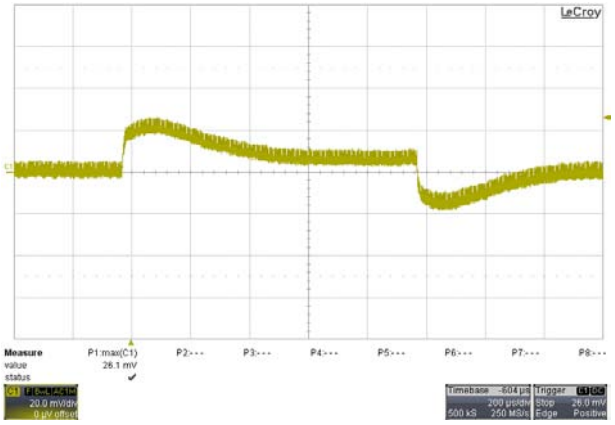
Efficiency Versus Output Current



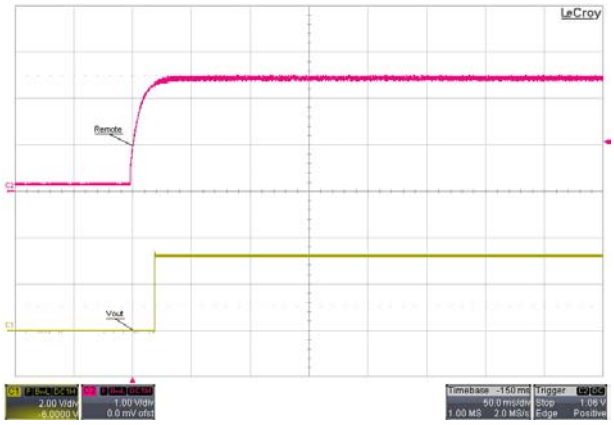
Efficiency Versus Input Voltage
Full Load



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 ; $V_{in} = V_{in\ nom}$

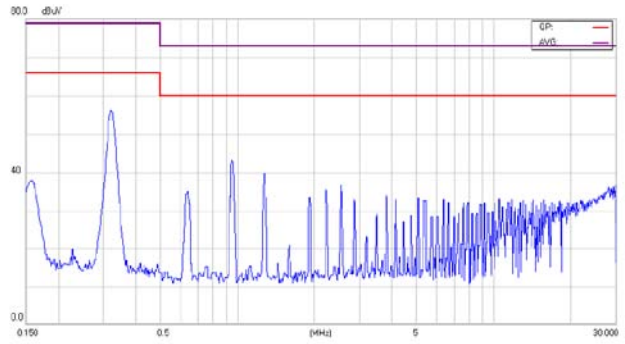


ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

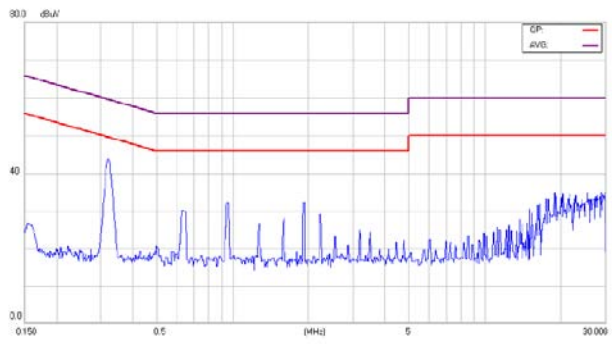
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

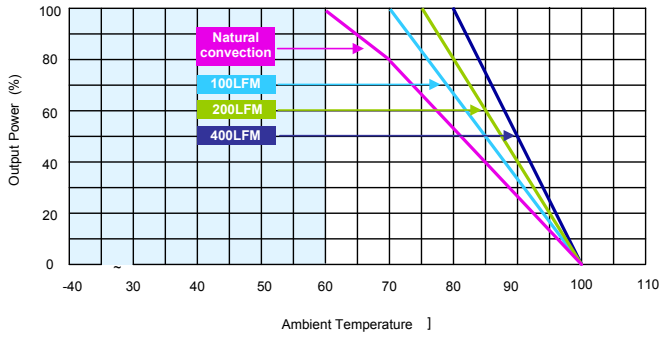
All test conditions are at 25°C The figures are identical for TEN 15-2410WI (Continued)



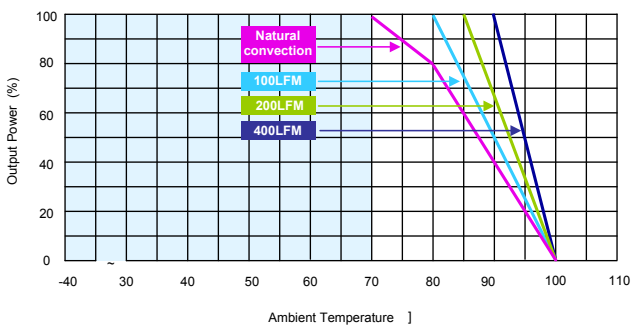
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



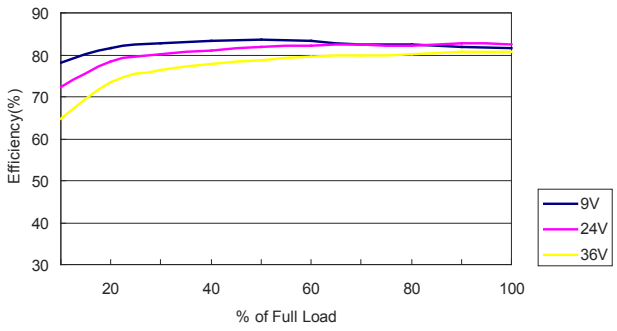
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



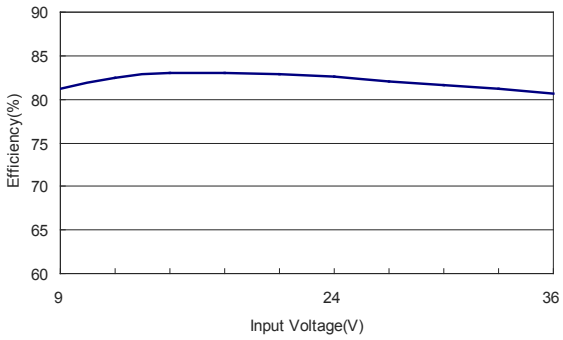
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

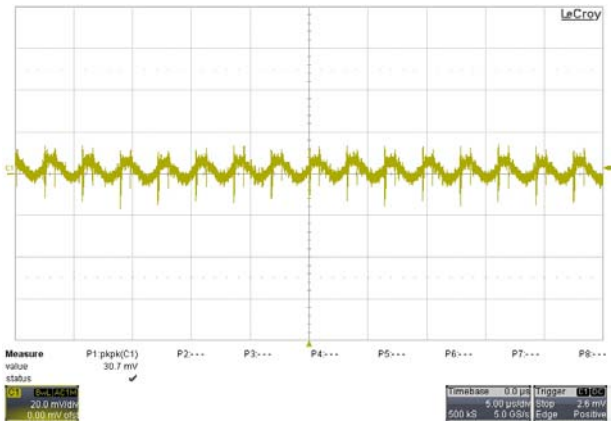
All test conditions are at 25°C The figures are identical for TEN 15-2411WI



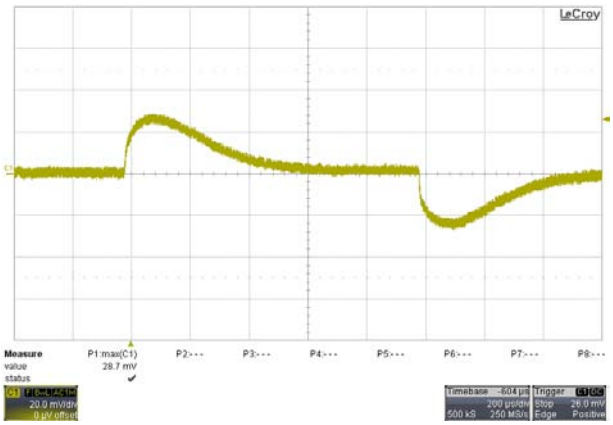
Efficiency Versus Output Current



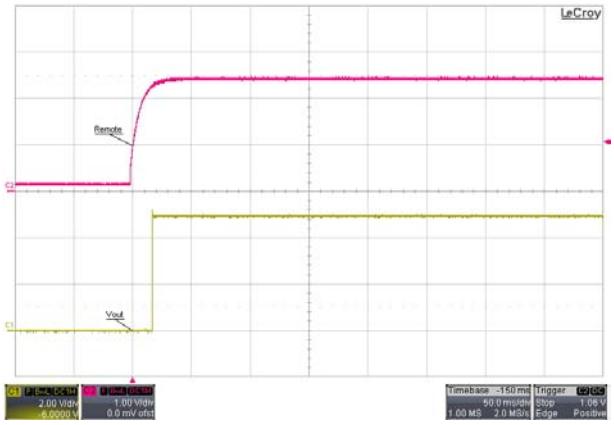
Efficiency Versus Input Voltage
Full Load



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



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

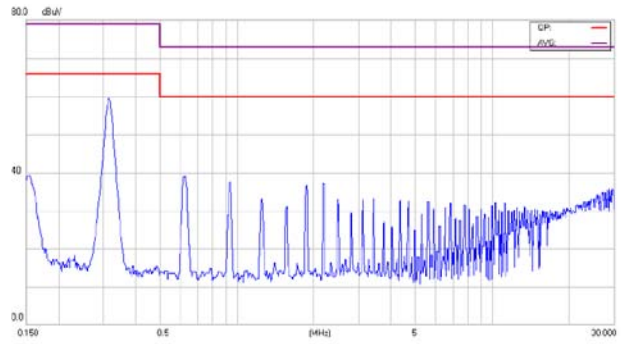


ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

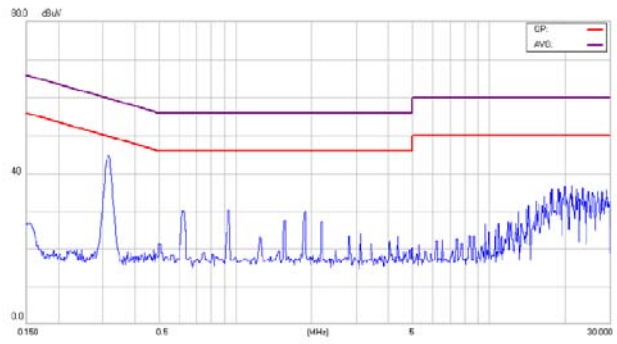
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

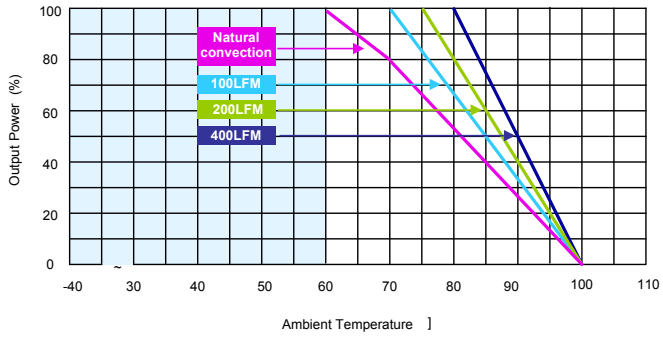
All test conditions are at 25°C The figures are identical for TEN 15-2411WI (Continued)



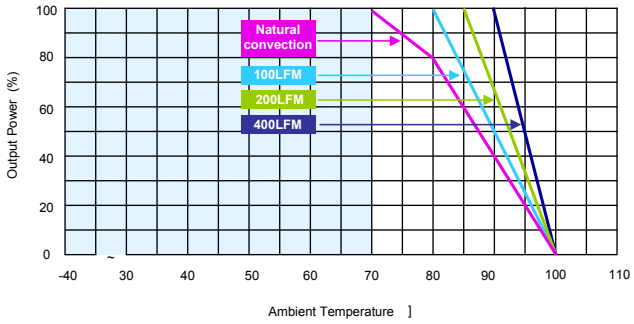
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



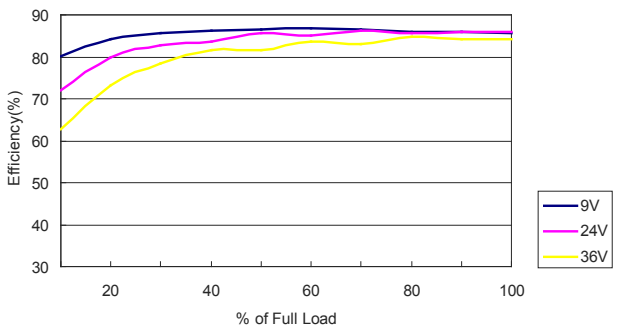
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



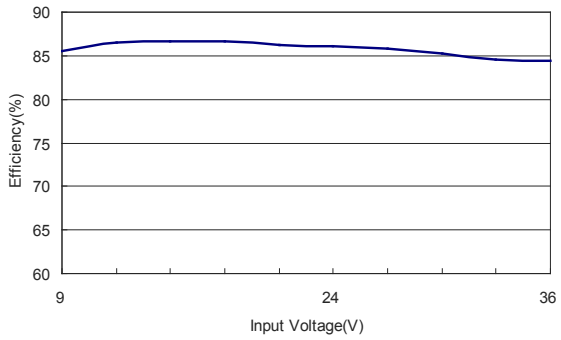
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

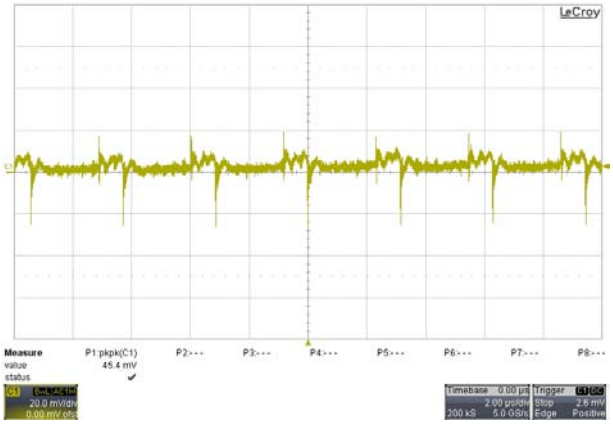
All test conditions are at 25°C The figures are identical for TEN 15-2412WI



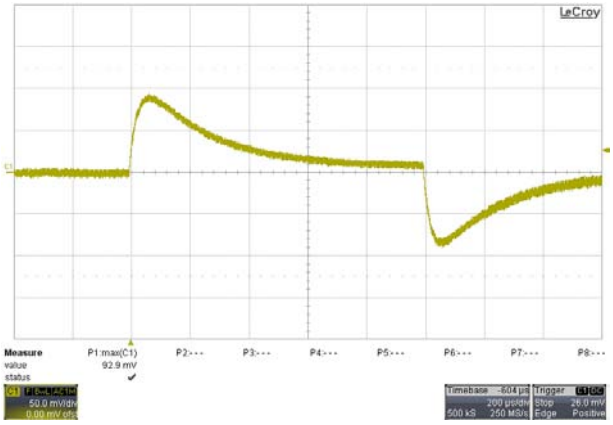
Efficiency Versus Output Current



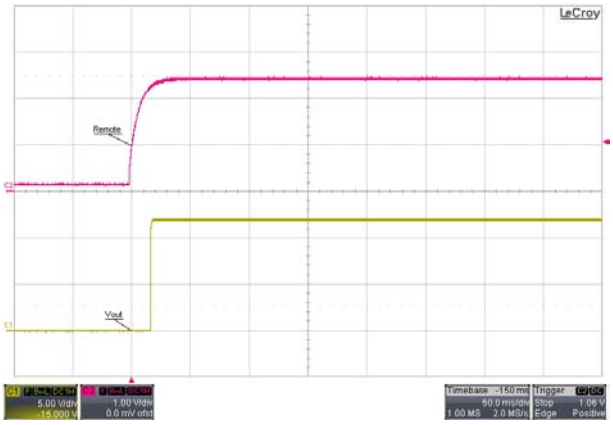
Efficiency Versus Input Voltage
Full Load



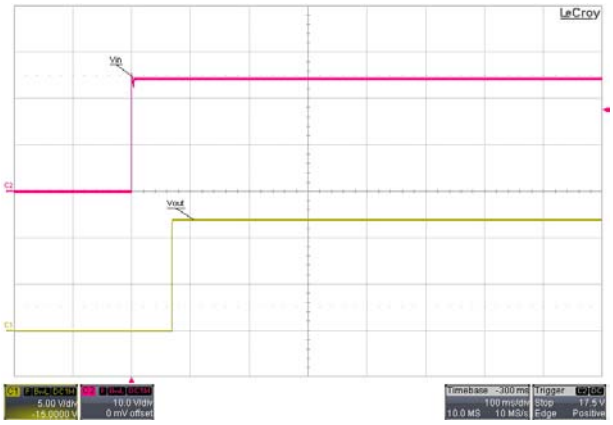
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$; Full Load; T_A



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



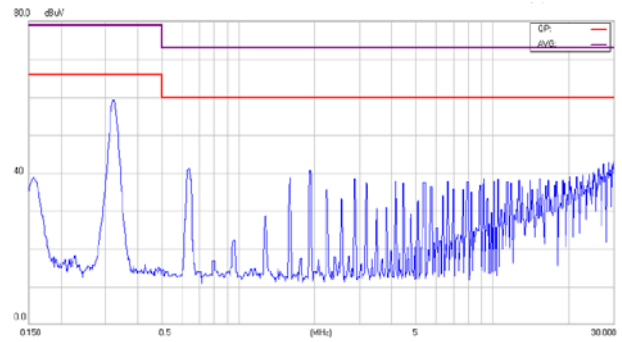
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load



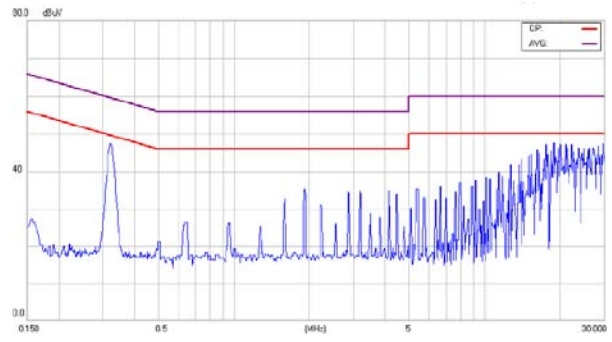
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

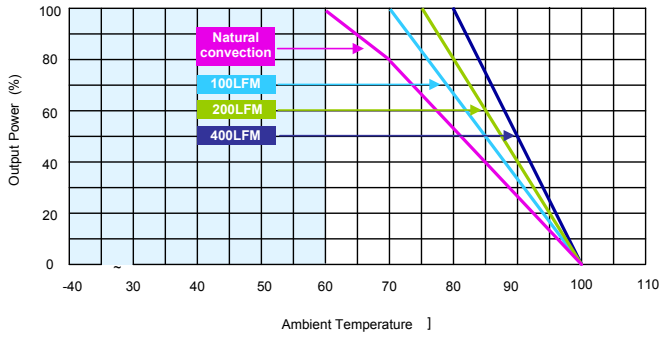
All test conditions are at 25°C The figures are identical for TEN 15-2412WI (Continued)



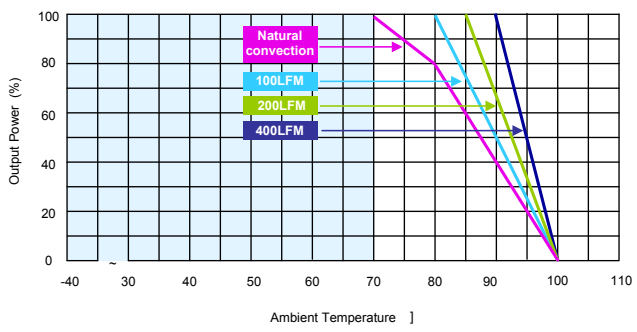
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



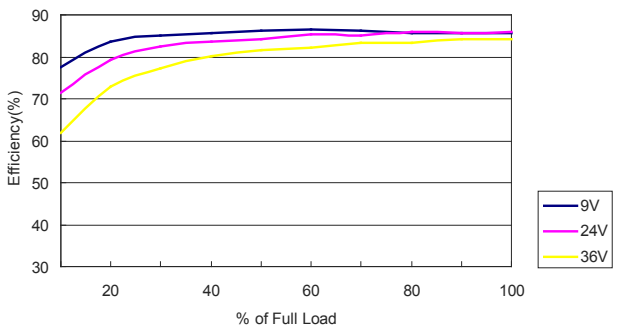
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



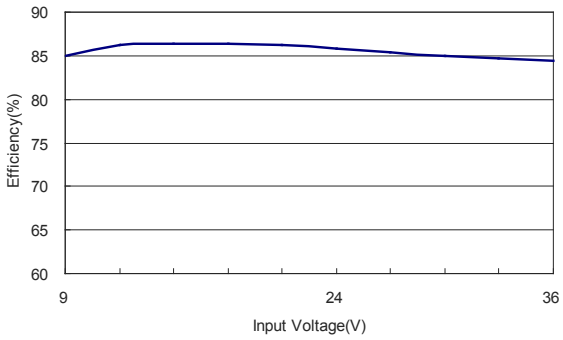
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

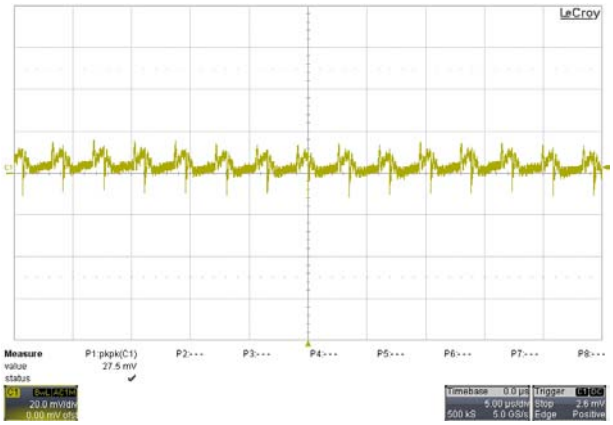
All test conditions are at 25°C The figures are identical for TEN 15-2413WI



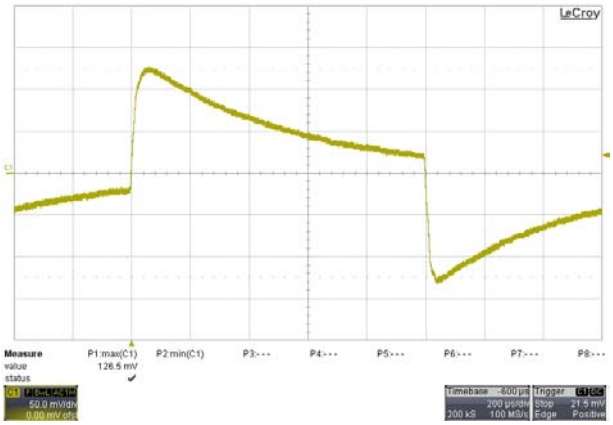
Efficiency Versus Output Current



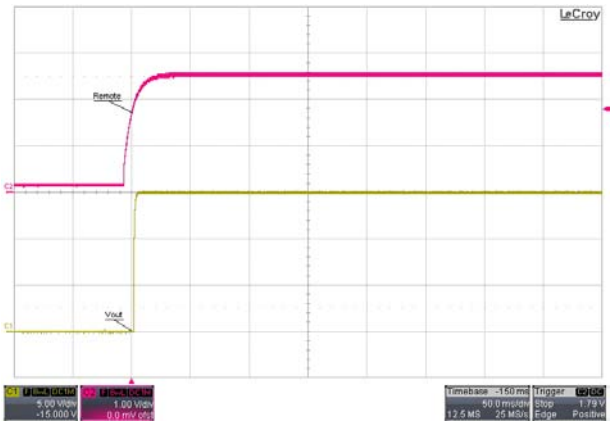
Efficiency Versus Input Voltage
Full Load



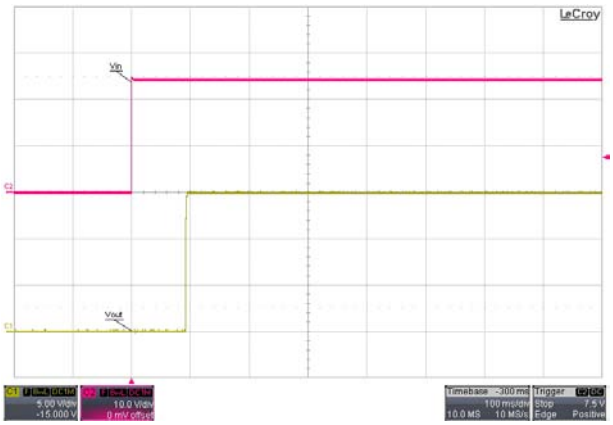
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$; Full Load; T_A



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



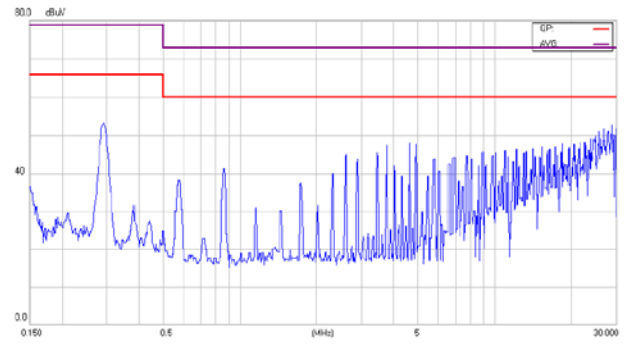
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load



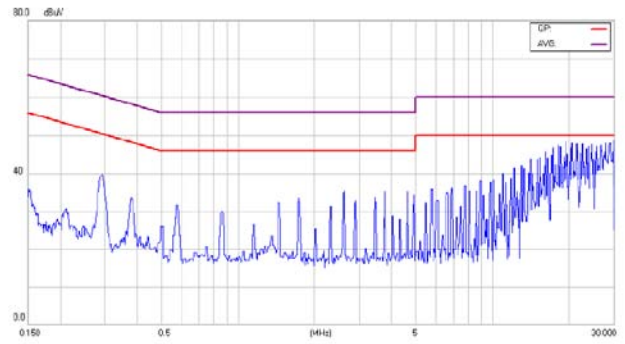
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

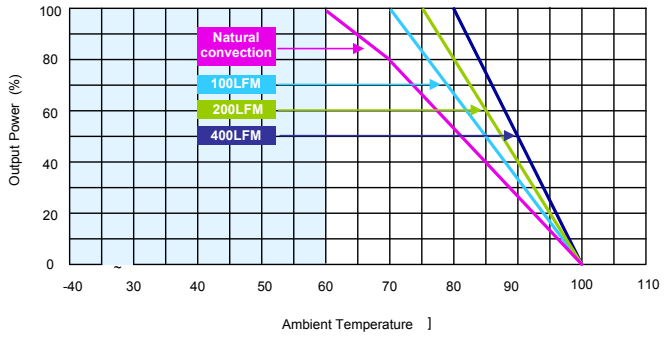
All test conditions are at 25°C The figures are identical for TEN 15-2413WI (Continued)



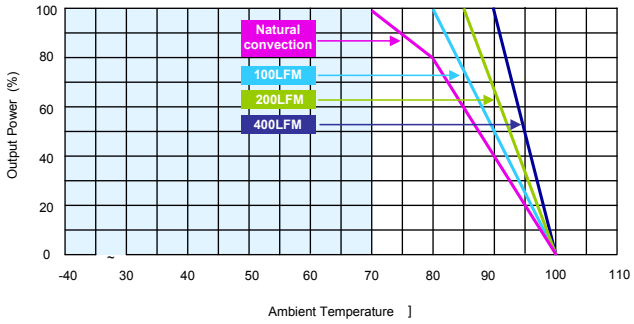
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



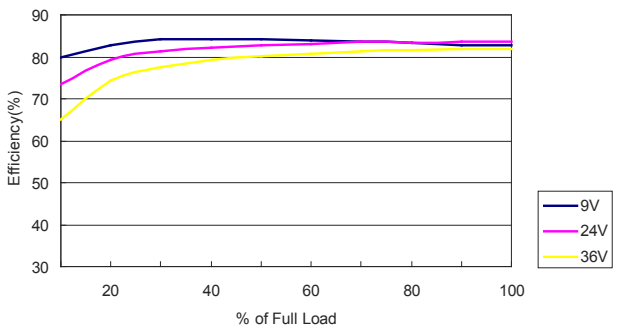
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



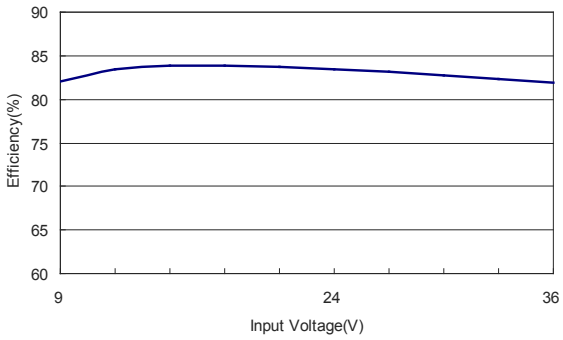
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

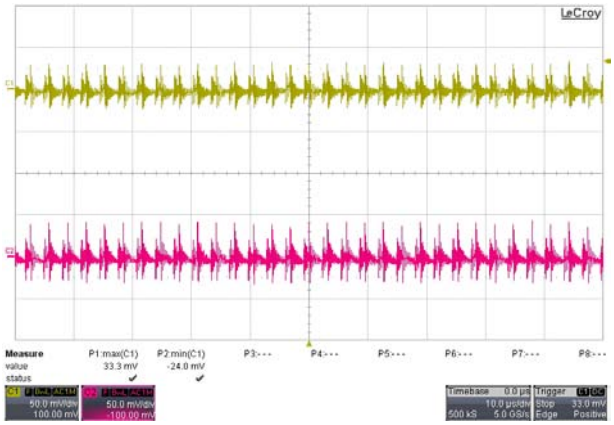
All test conditions are at 25°C The figures are identical for TEN 15-2421WI



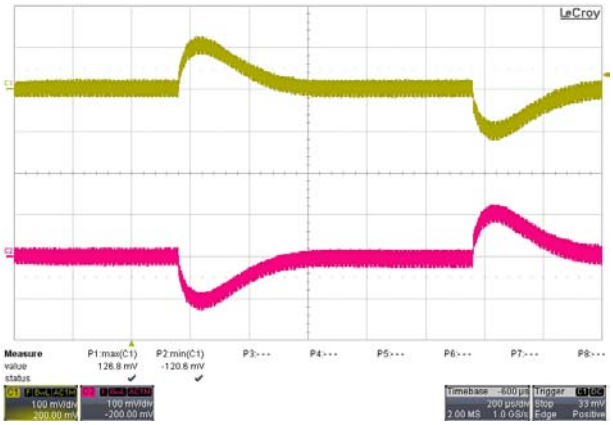
Efficiency Versus Output Current



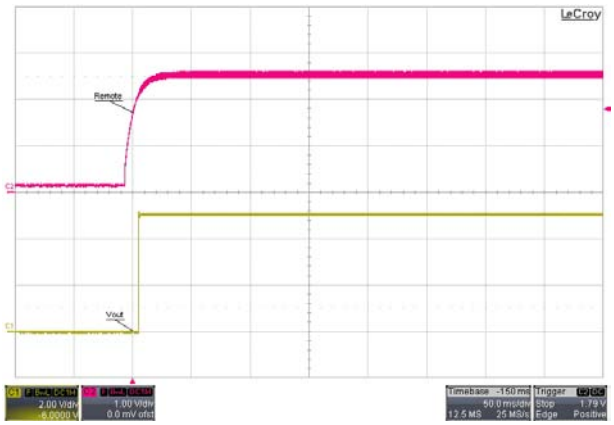
Efficiency Versus Input Voltage
Full Load



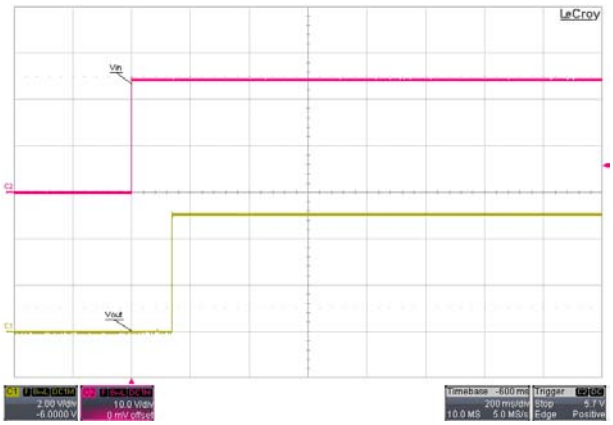
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$; Full Load; T_A



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



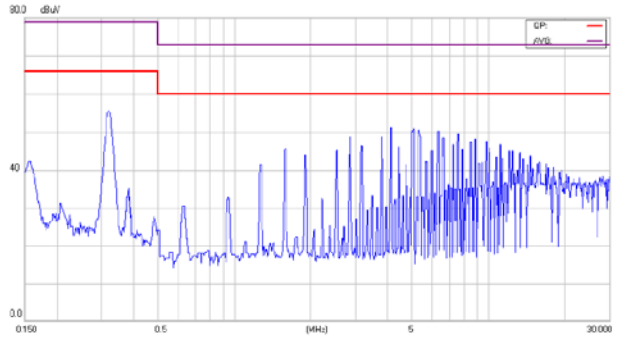
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load



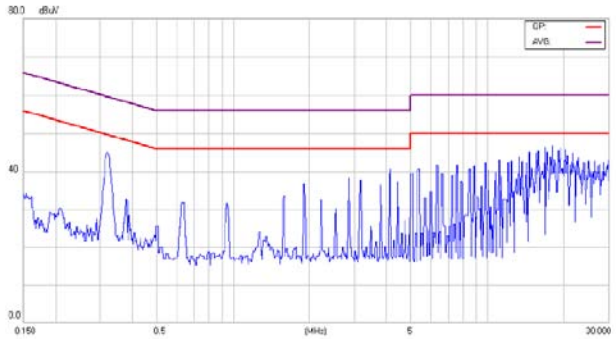
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

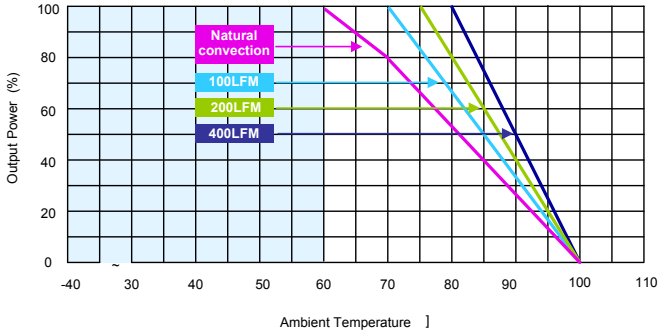
All test conditions are at 25°C The figures are identical for TEN 15-2421WI (Continued)



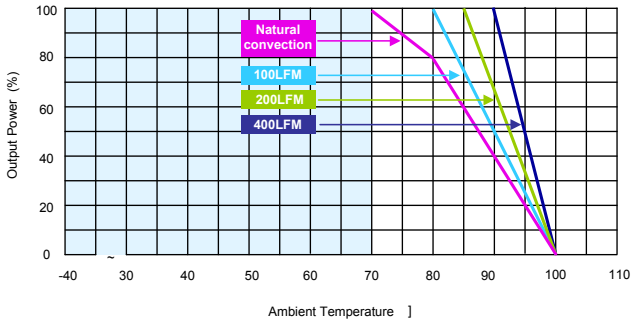
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



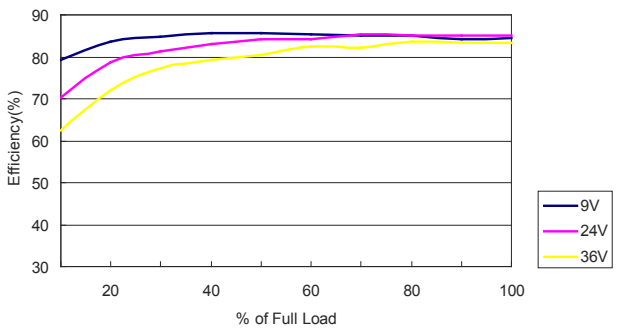
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



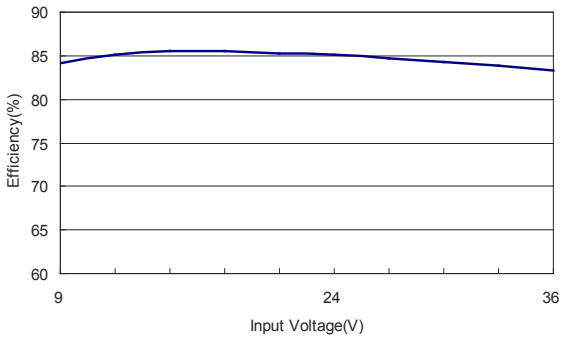
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

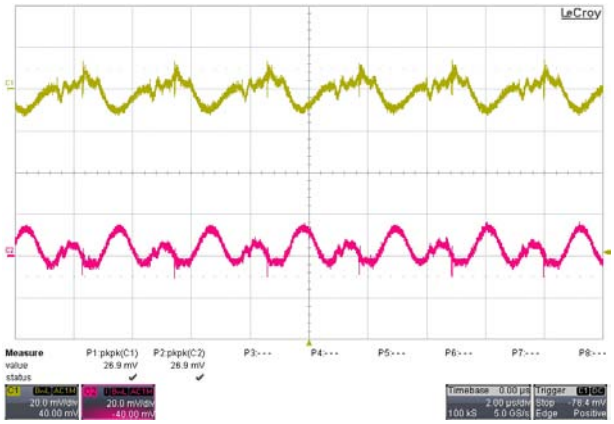
All test conditions are at 25°C The figures are identical for TEN 15-2422WI



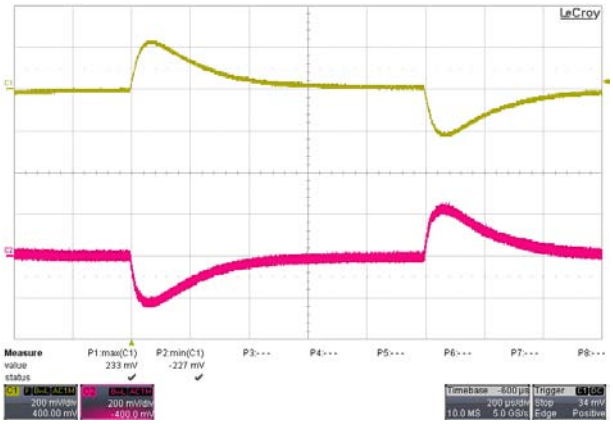
Efficiency Versus Output Current



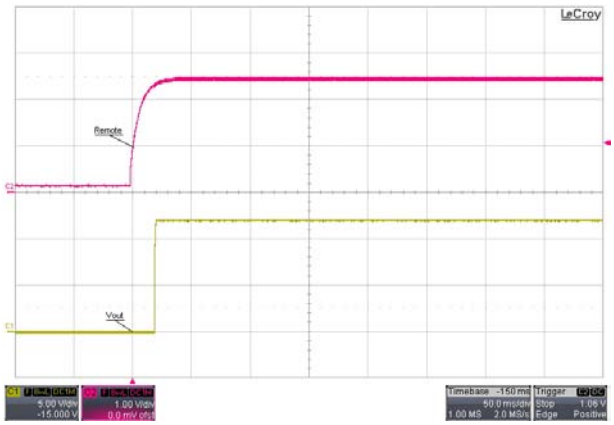
Efficiency Versus Input Voltage
Full Load



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 ; $V_{in} = V_{in\ nom}$

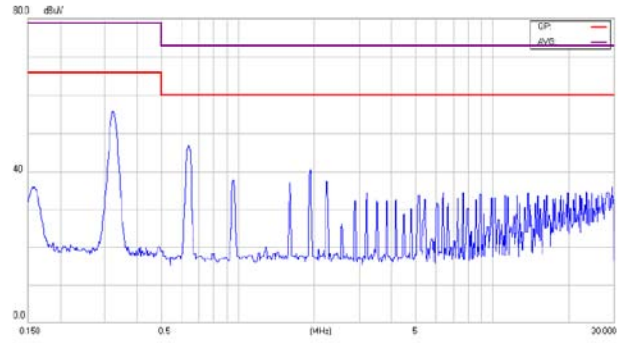


ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

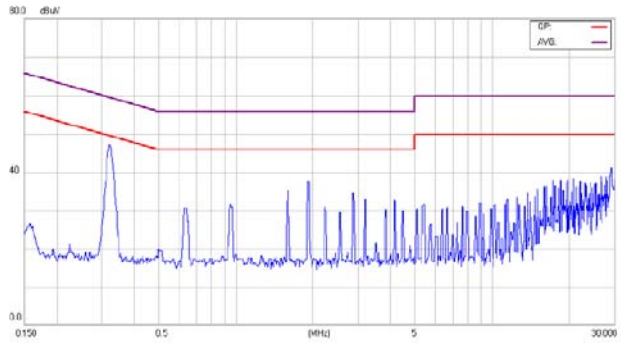
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

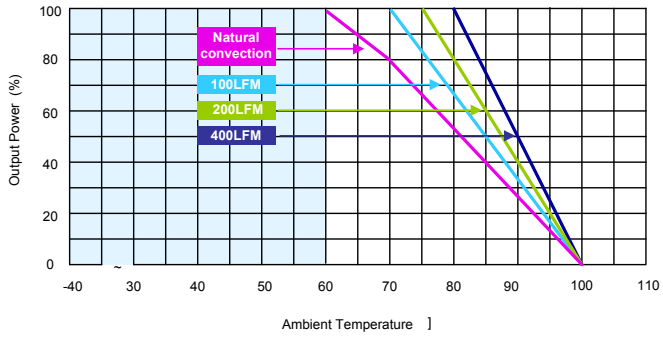
All test conditions are at 25°C The figures are identical for TEN 15-2422WI (Continued)



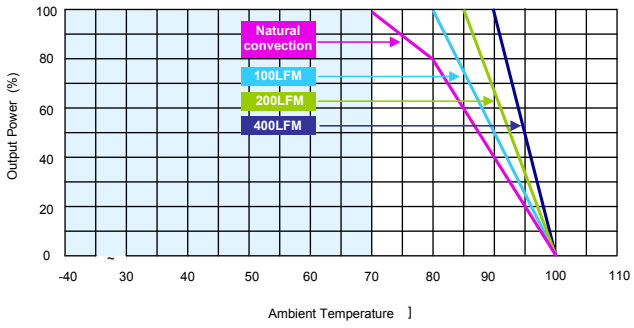
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



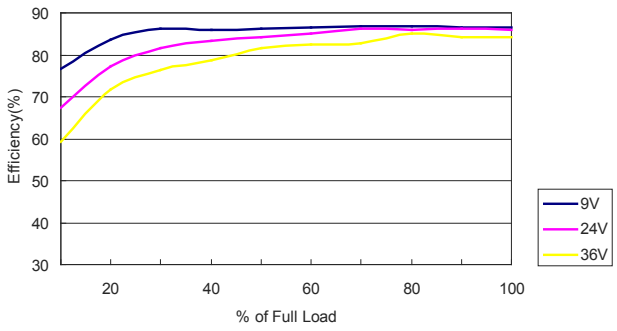
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



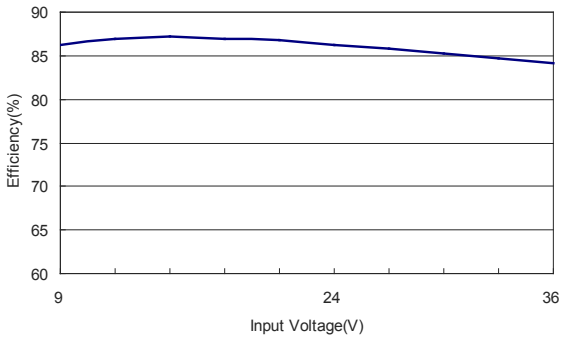
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

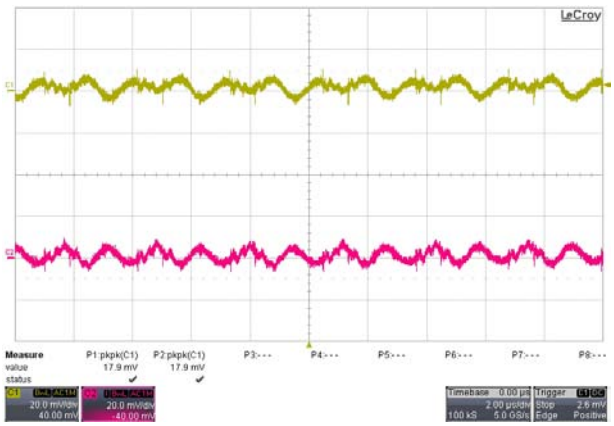
All test conditions are at 25°C The figures are identical for TEN 15-2423WI



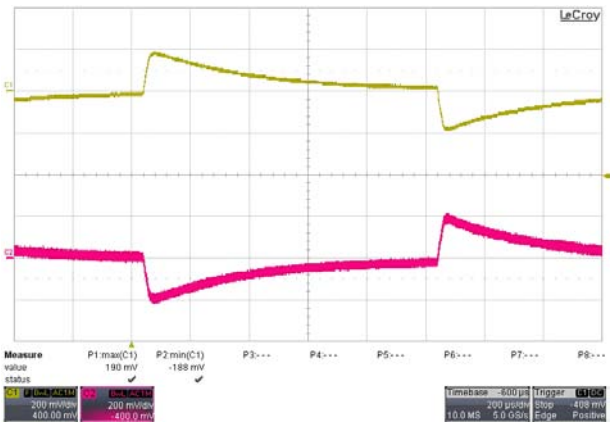
Efficiency Versus Output Current



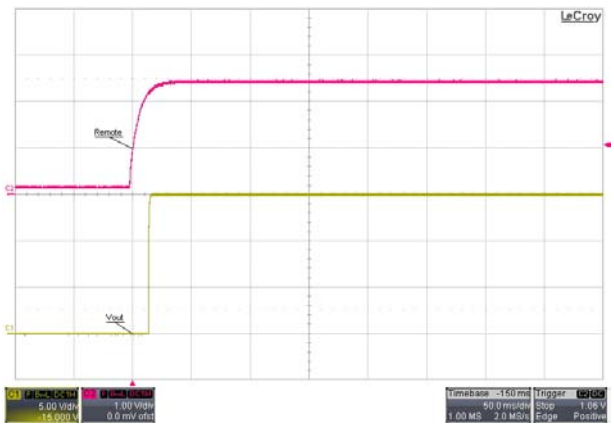
Efficiency Versus Input Voltage
Full Load



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 ; $V_{in} = V_{in\ nom}$

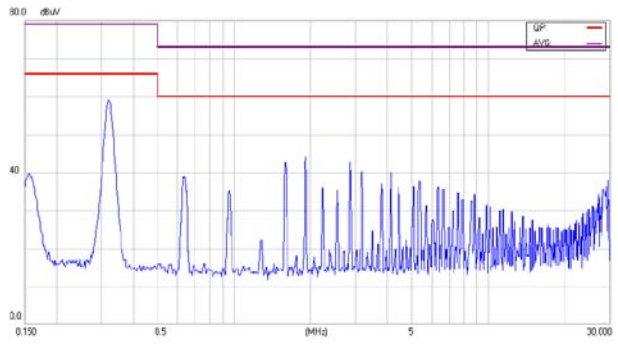


ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

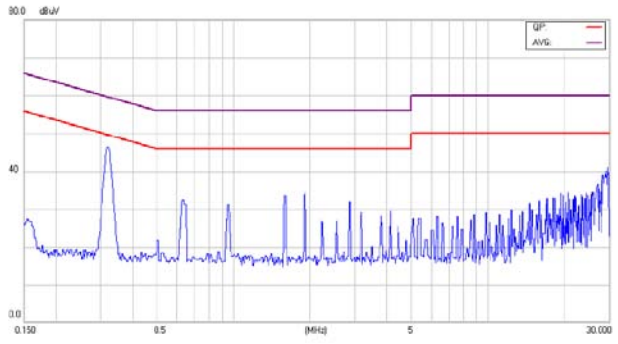
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

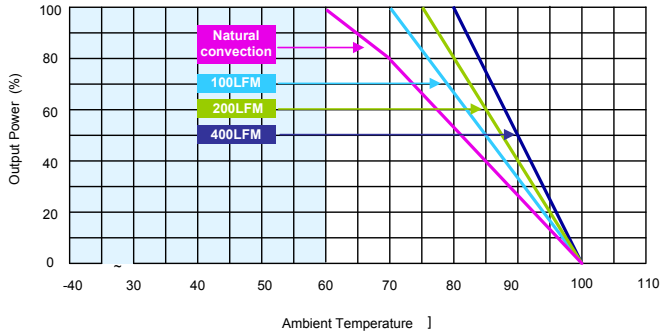
All test conditions are at 25°C The figures are identical for TEN 15-2423WI (Continued)



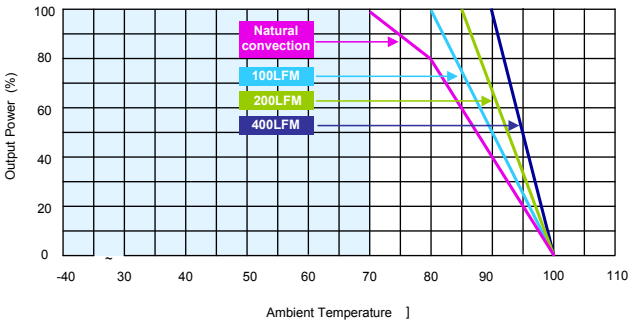
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



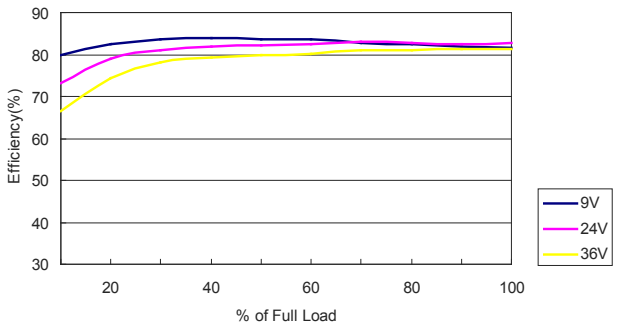
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



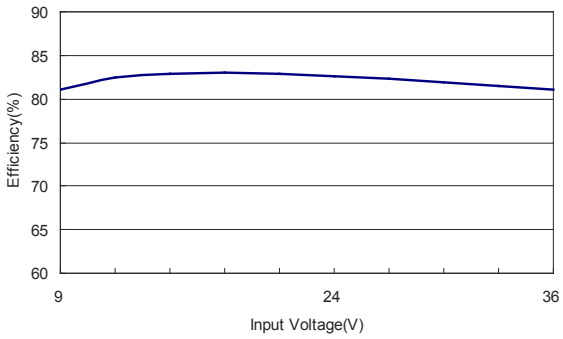
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

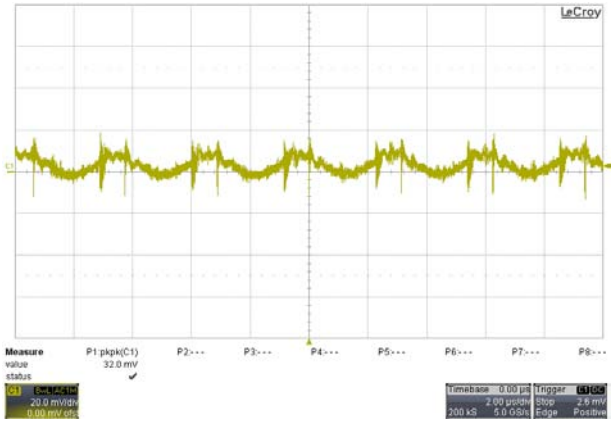
All test conditions are at 25°C The figures are identical for TEN 15-24XXWI



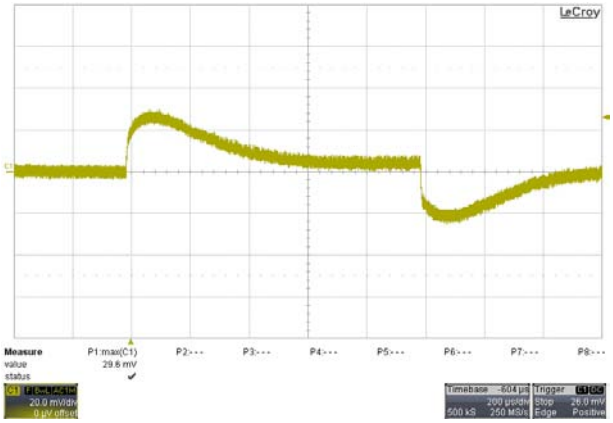
Efficiency Versus Output Current



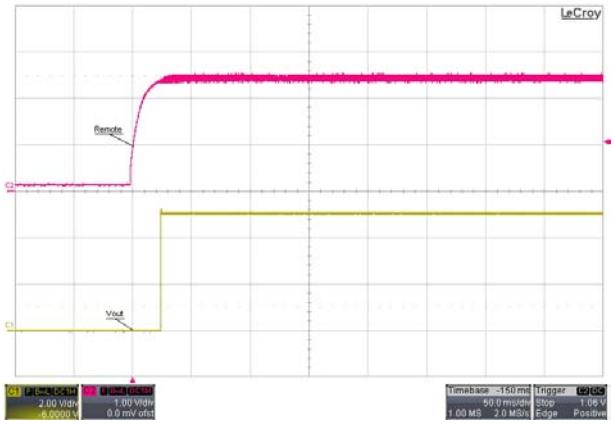
Efficiency Versus Input Voltage
Full Load



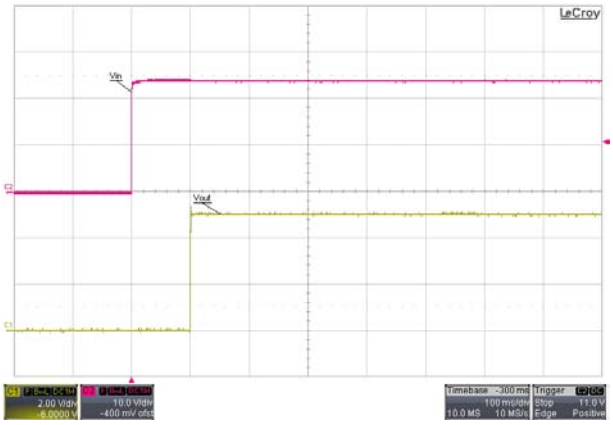
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$; Full Load; T_A



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



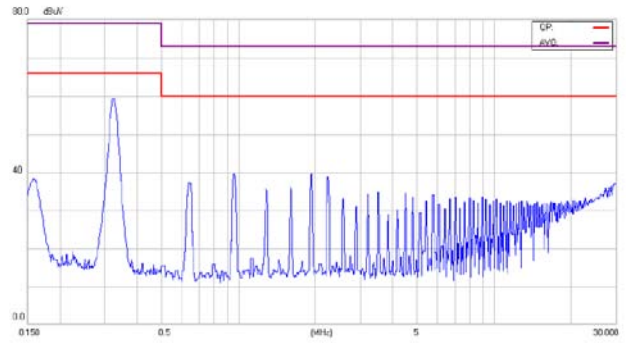
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load



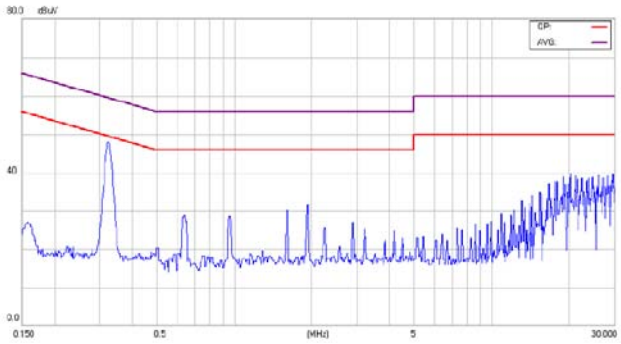
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

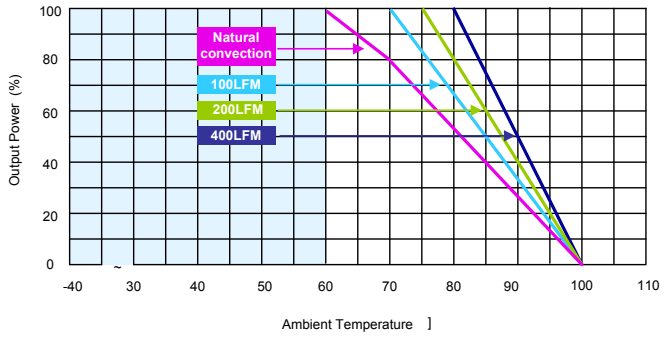
All test conditions are at 25°C The figures are identical for TEN 15-24XXWI (Continued)



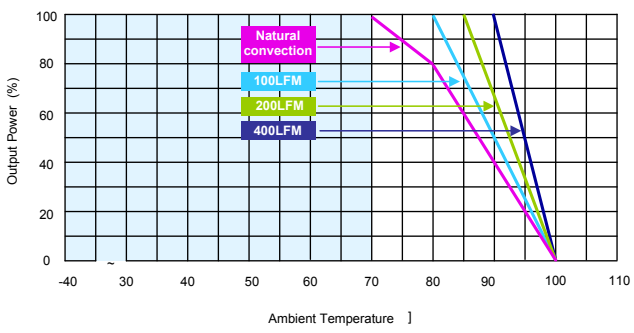
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



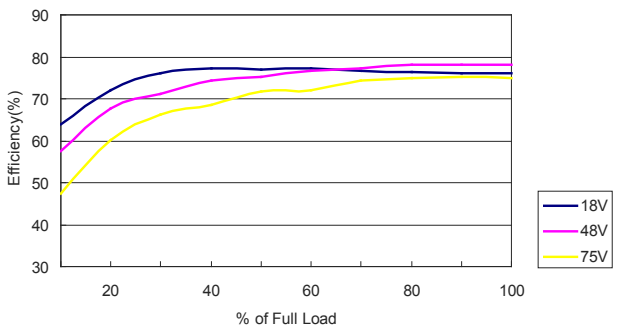
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



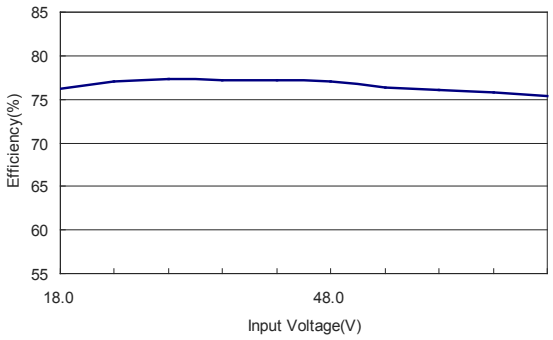
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

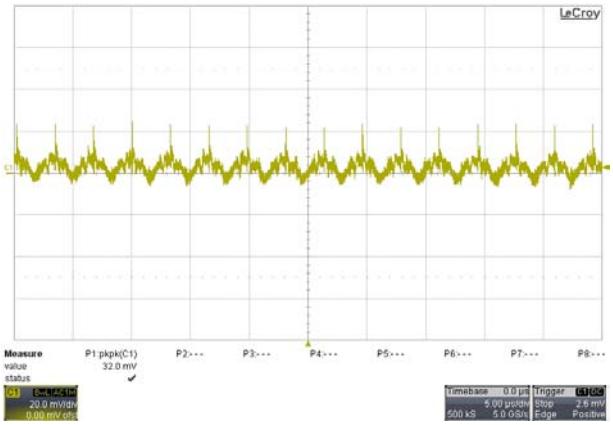
All test conditions are at 25°C The figures are identical for TEN 15-4810WI



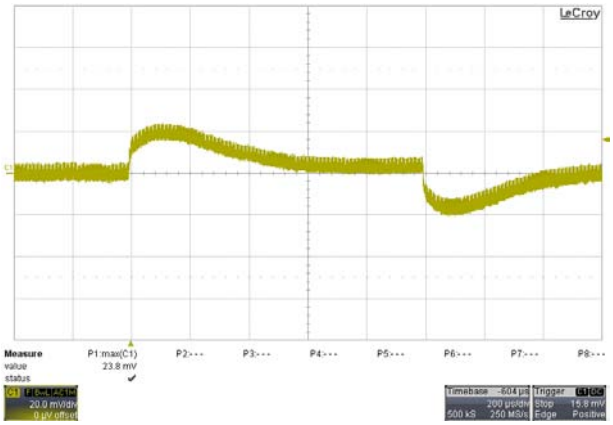
Efficiency Versus Output Current



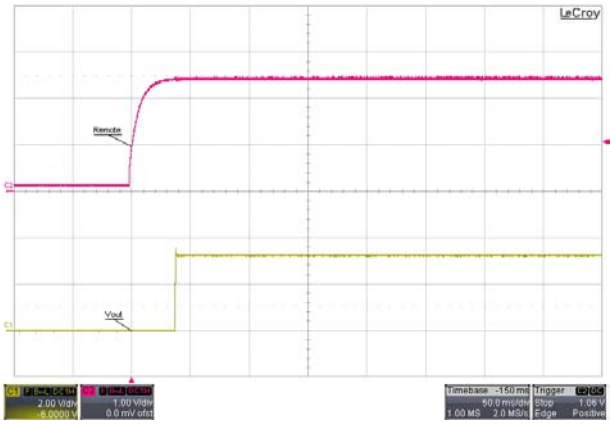
Efficiency Versus Input Voltage
Full Load



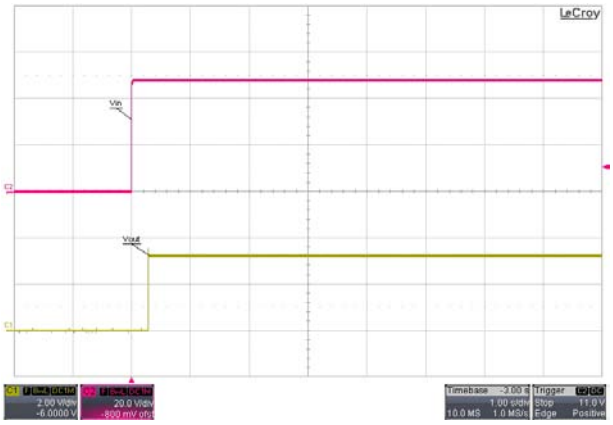
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$; Full Load; T_A



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



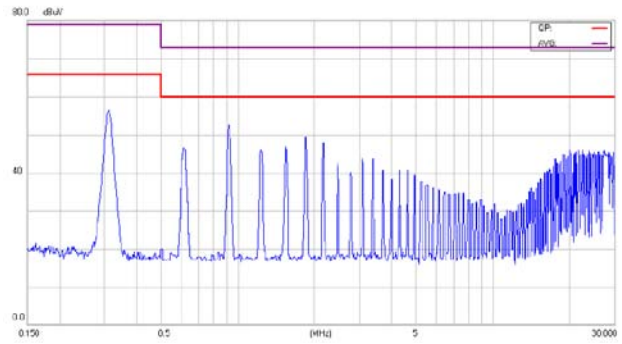
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load



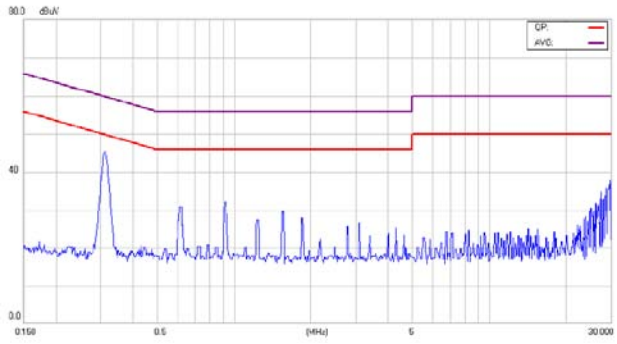
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

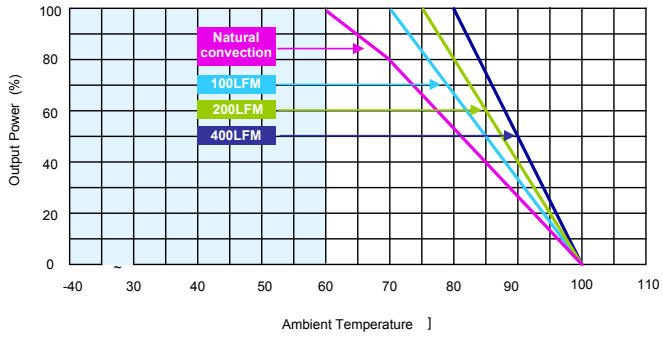
All test conditions are at 25°C The figures are identical for TEN 15-4810WI (Continued)



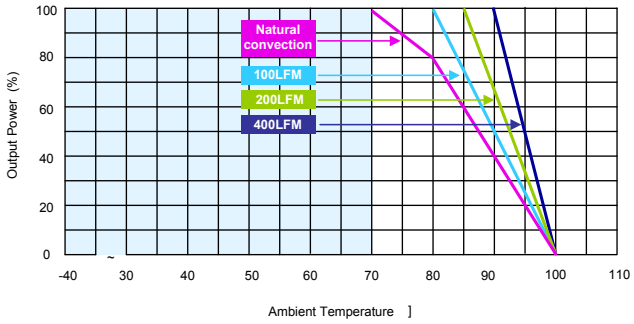
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



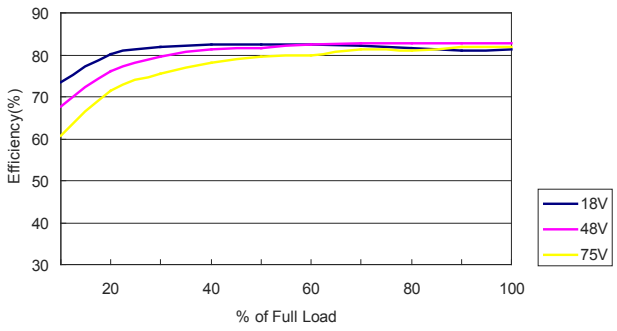
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



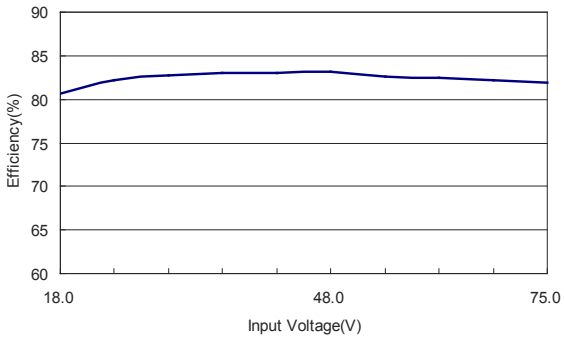
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

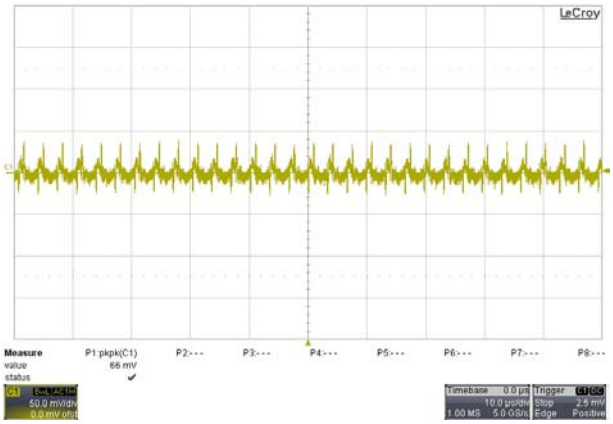
All test conditions are at 25°C The figures are identical for TEN 15-4811WI



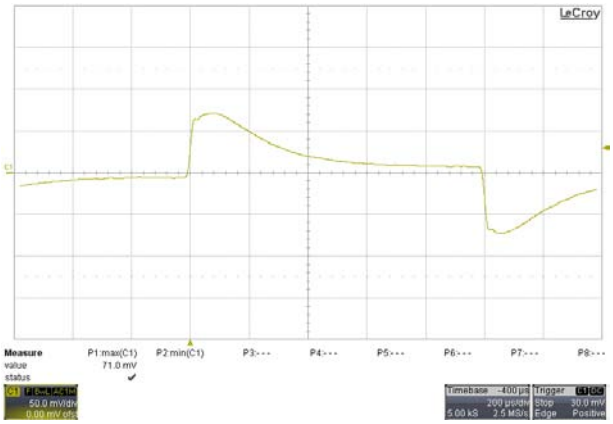
Efficiency Versus Output Current



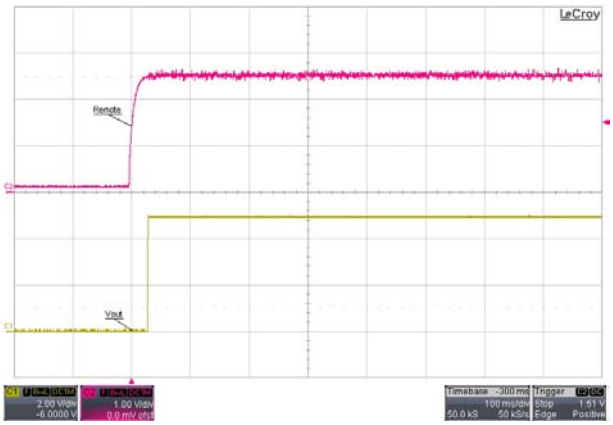
Efficiency Versus Input Voltage
Full Load



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 ; $V_{in} = V_{in\ nom}$

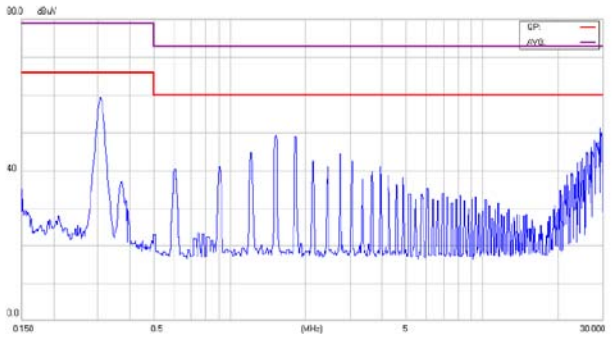


ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

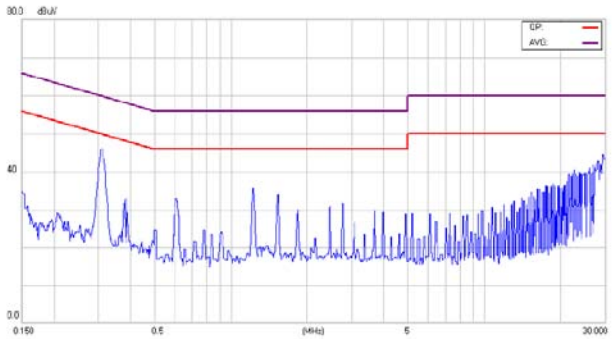
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

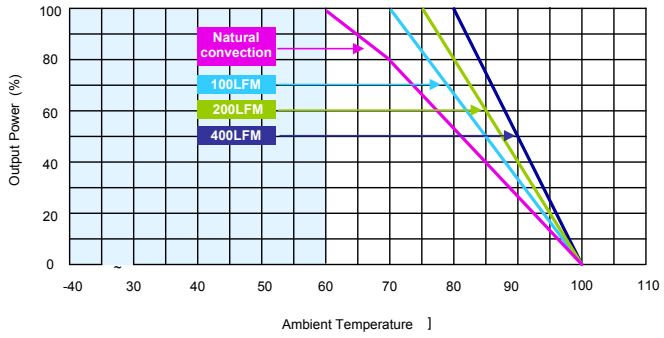
All test conditions are at 25°C The figures are identical for TEN 15-4811WI (Continued)



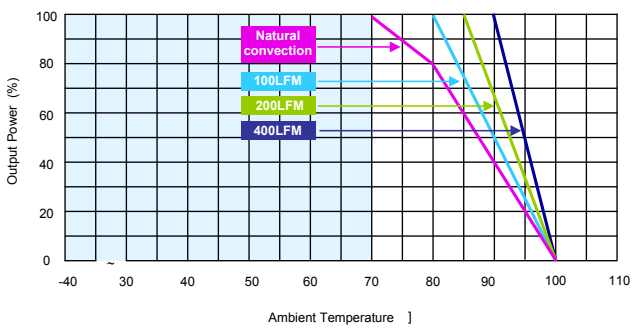
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



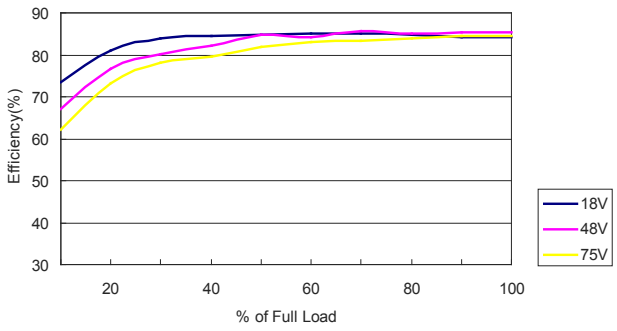
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



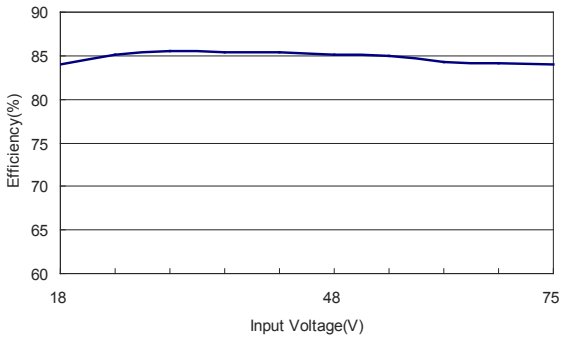
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

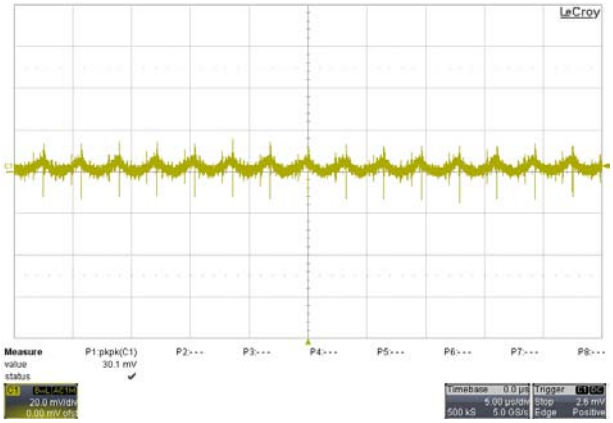
All test conditions are at 25°C The figures are identical for TEN 15-4812WI



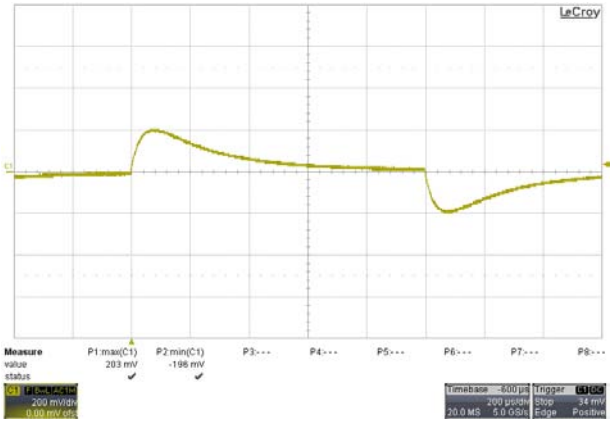
Efficiency Versus Output Current



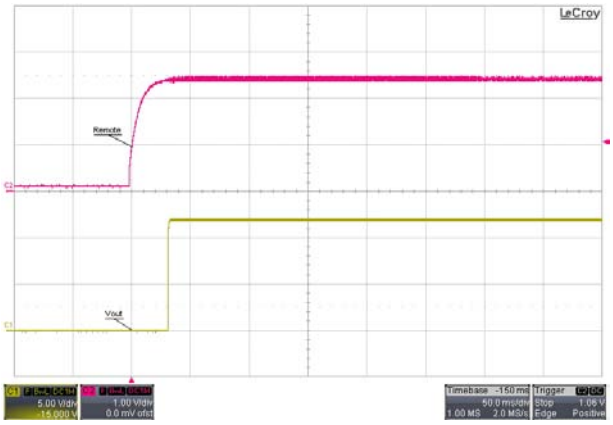
Efficiency Versus Input Voltage
Full Load



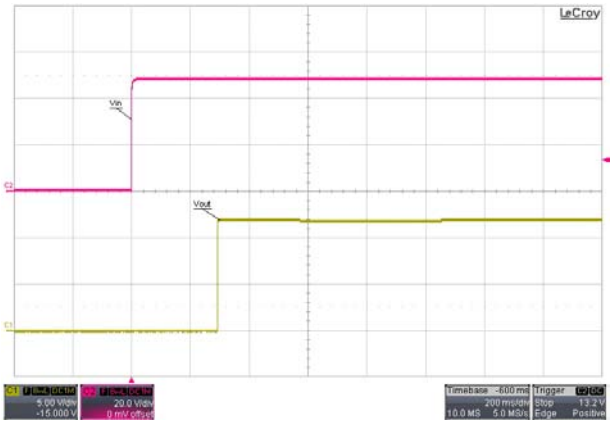
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$; Full Load; T_A



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



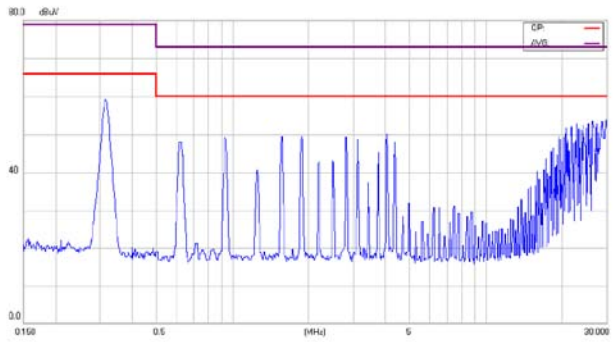
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load



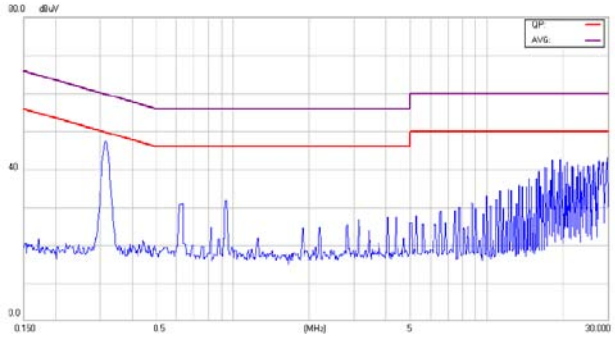
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

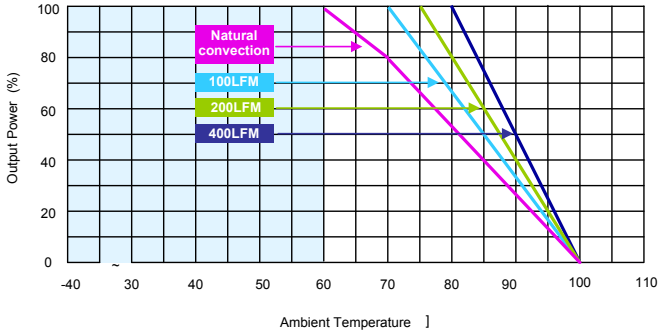
All test conditions are at 25°C The figures are identical for TEN 15-4812WI (Continued)



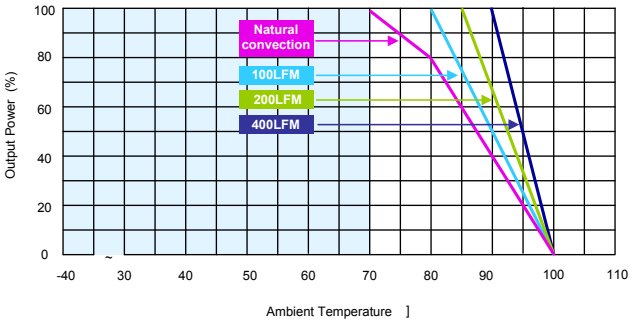
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



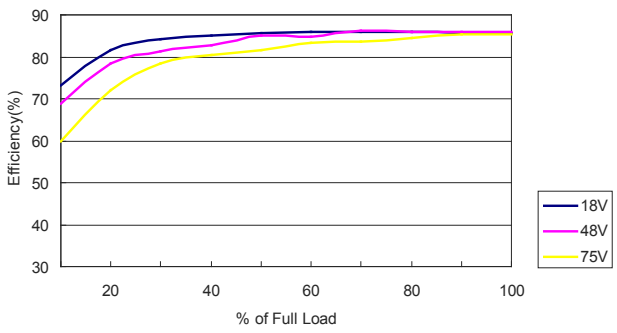
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



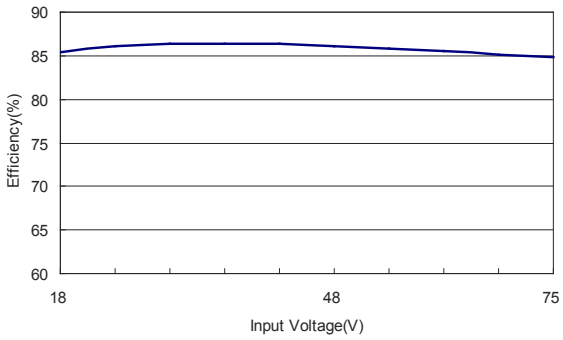
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

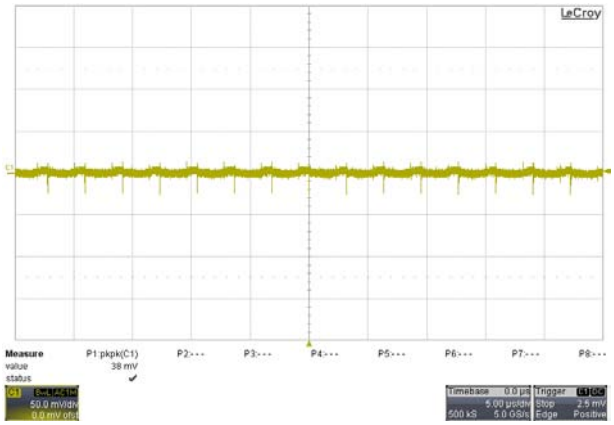
All test conditions are at 25°C The figures are identical for TEN 15-4813WI



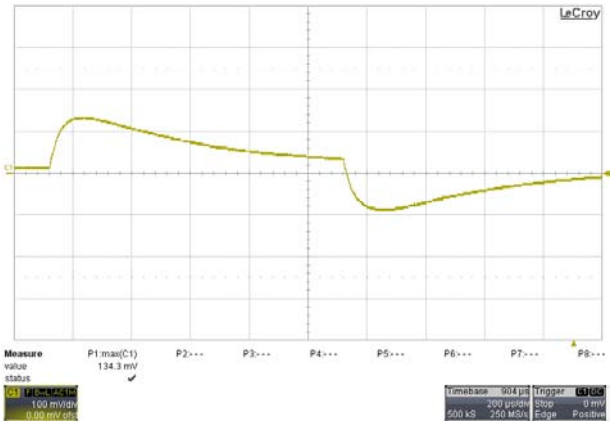
Efficiency Versus Output Current



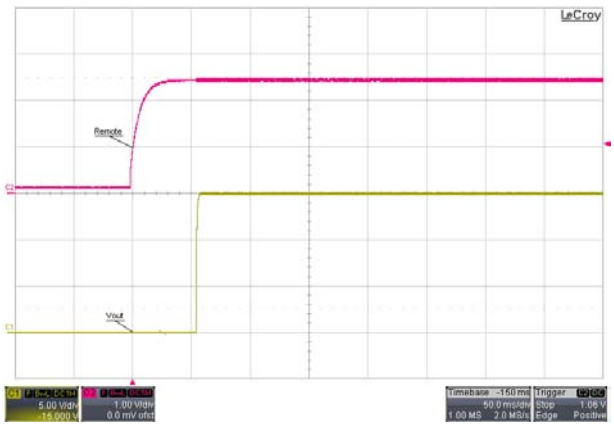
Efficiency Versus Input Voltage
Full Load



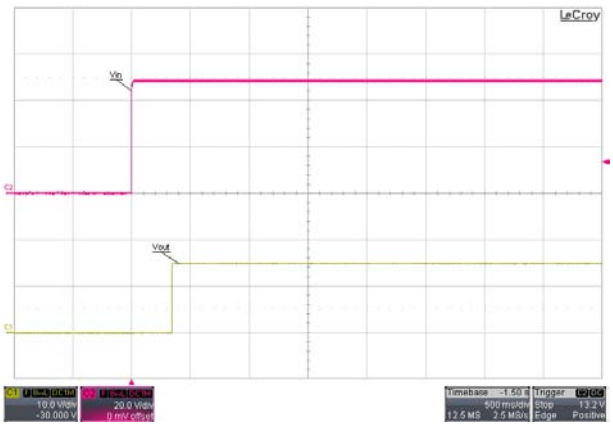
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$; Full Load; T_A



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



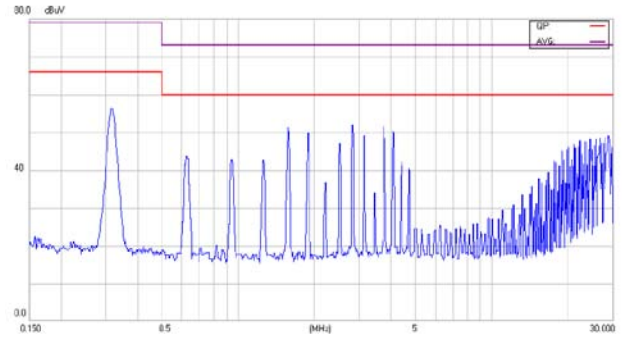
ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load



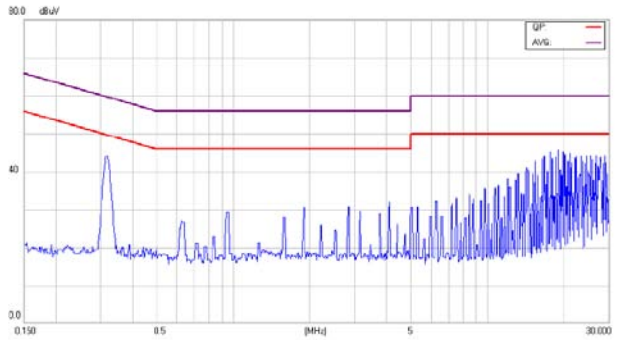
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

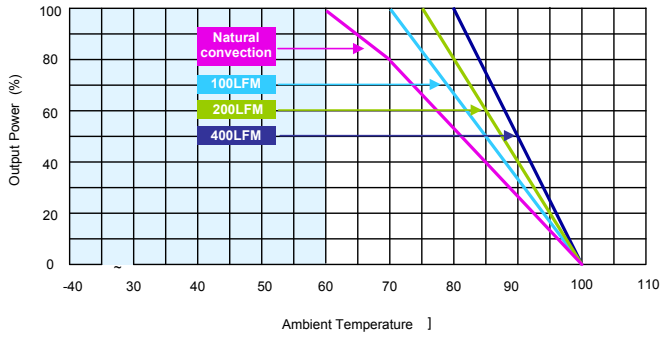
All test conditions are at 25°C The figures are identical for TEN 15-4813WI (Continued)



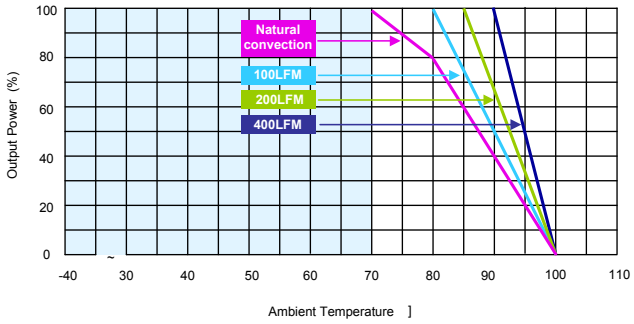
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



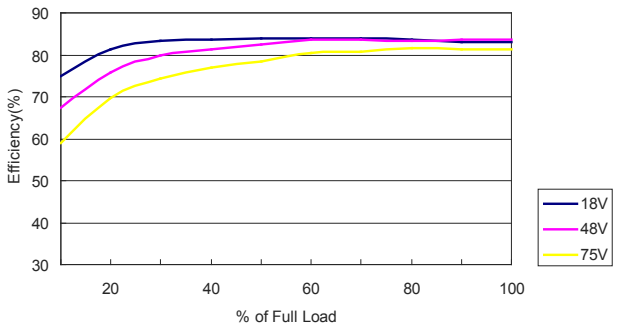
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



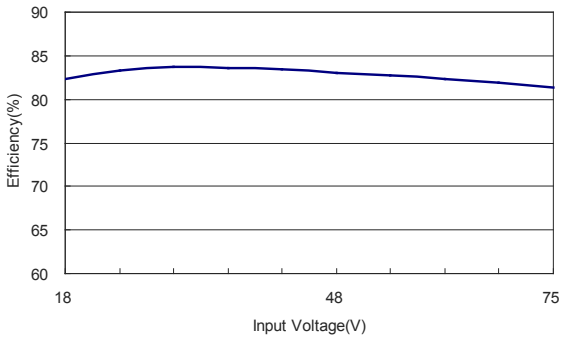
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

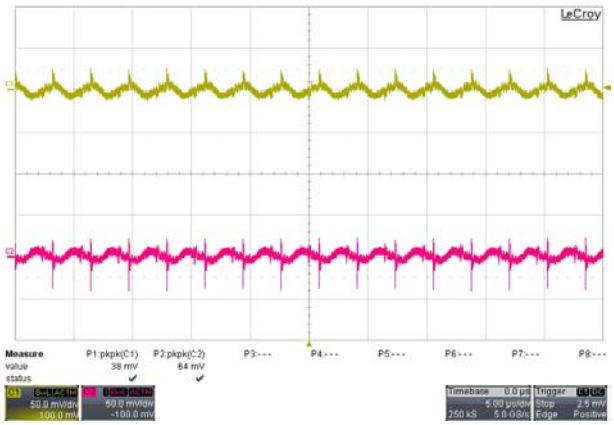
All test conditions are at 25°C The figures are identical for TEN 15-4821WI



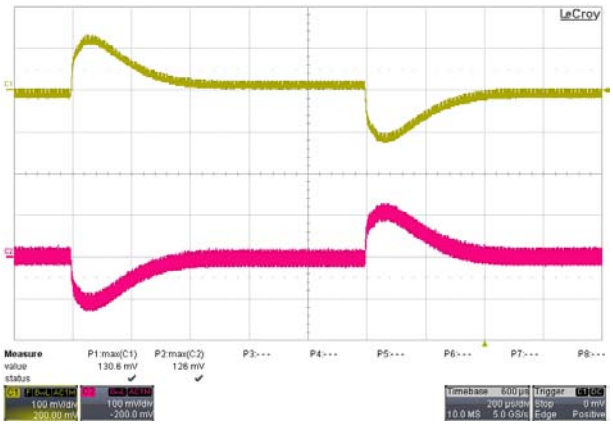
Efficiency Versus Output Current



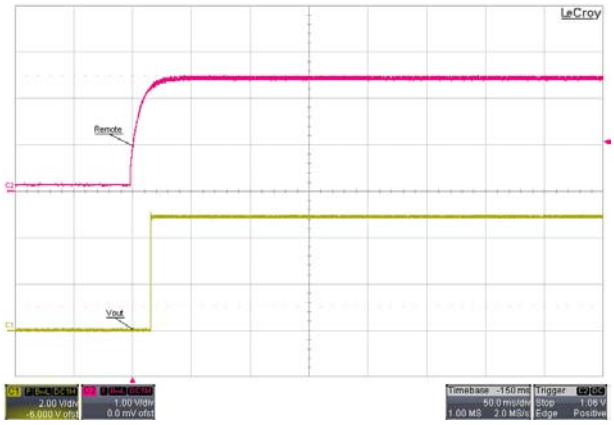
Efficiency Versus Input Voltage
Full Load



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 ; $V_{in} = V_{in\ nom}$

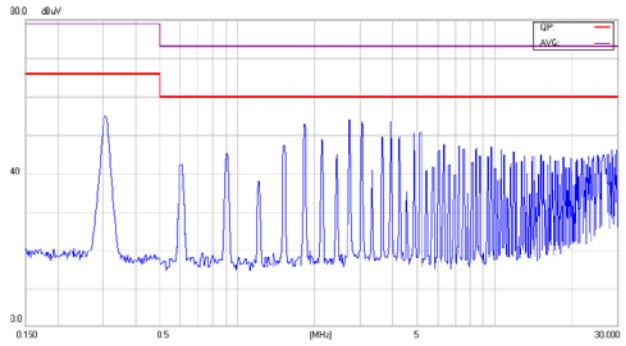


ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

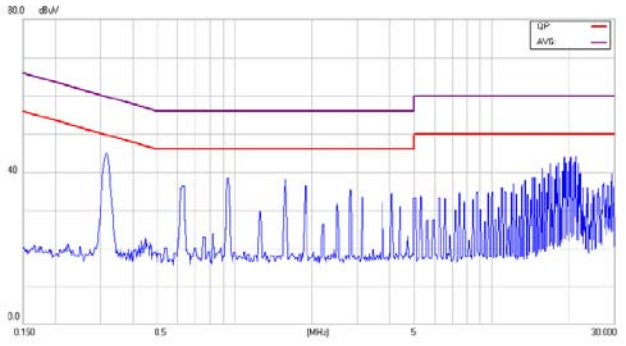
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

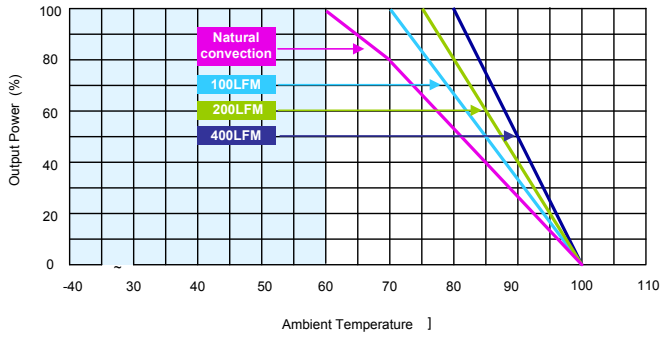
All test conditions are at 25°C The figures are identical for TEN 15-4821WI (Continued)



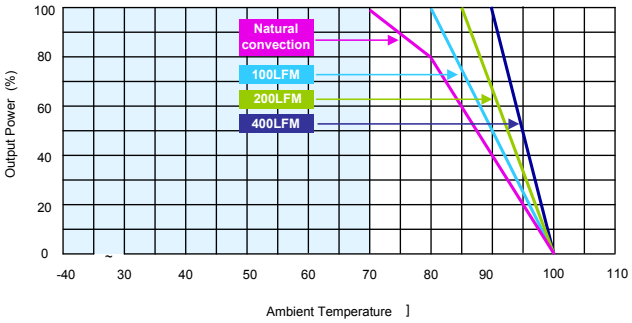
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



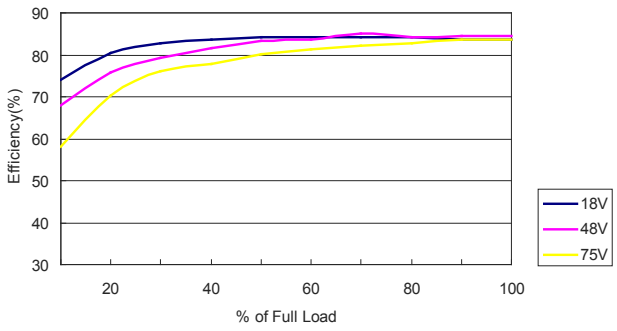
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



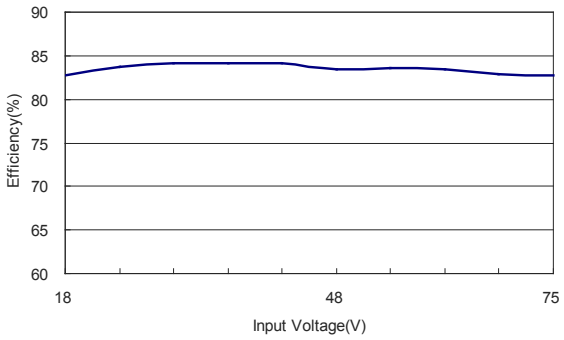
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

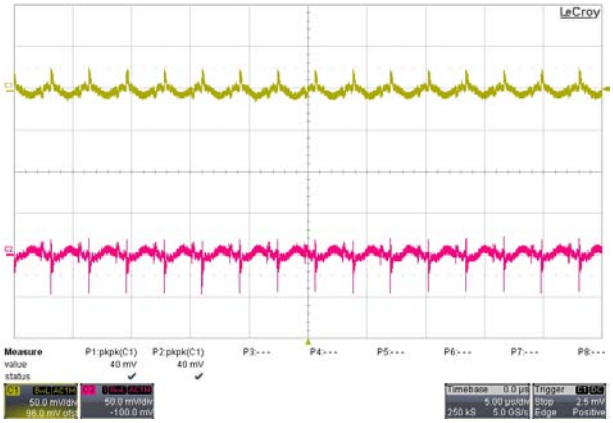
All test conditions are at 25°C The figures are identical for TEN 15-4822WI



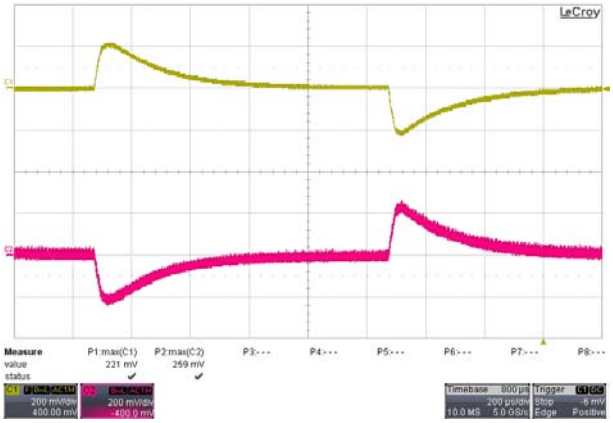
Efficiency Versus Output Current



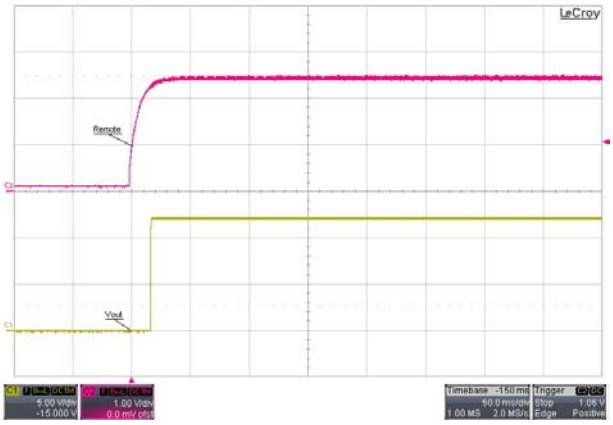
Efficiency Versus Input Voltage
Full Load



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 ; $V_{in} = V_{in\ nom}$

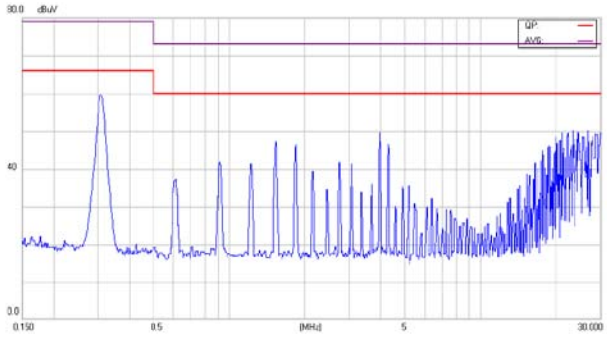


ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

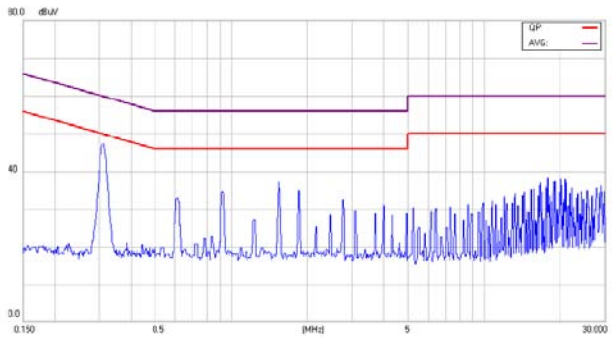
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

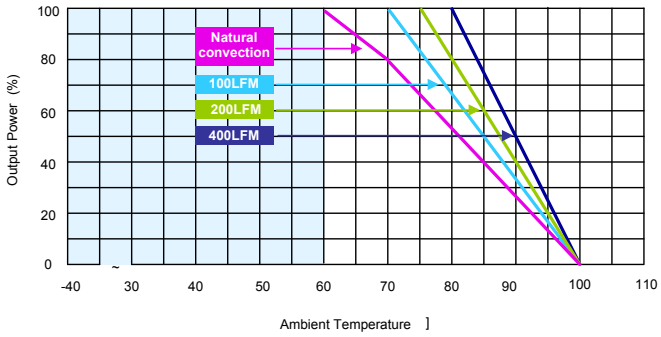
All test conditions are at 25°C The figures are identical for TEN 15-4822WI (Continued)



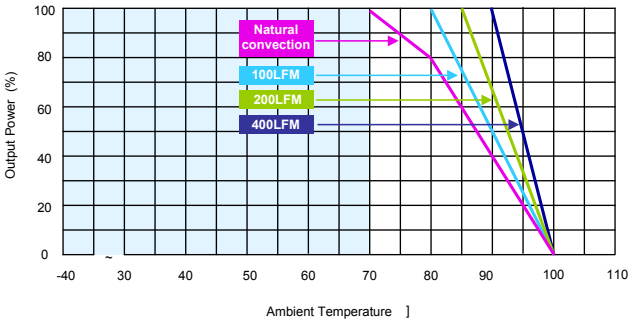
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



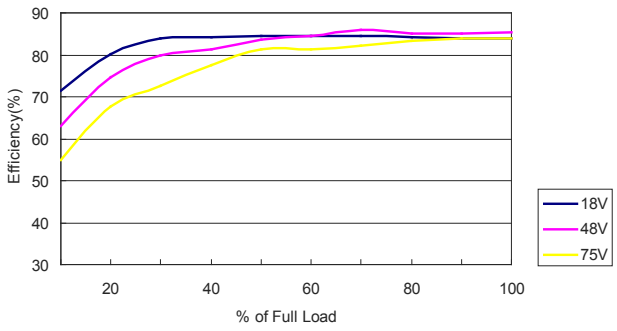
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



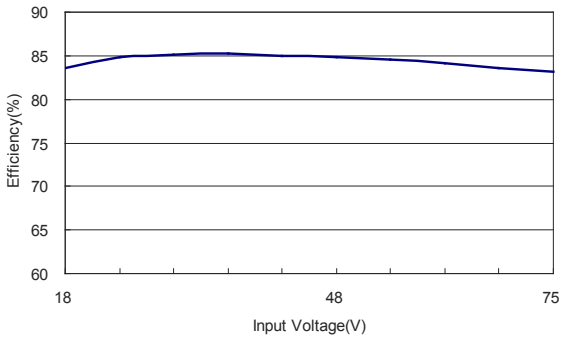
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

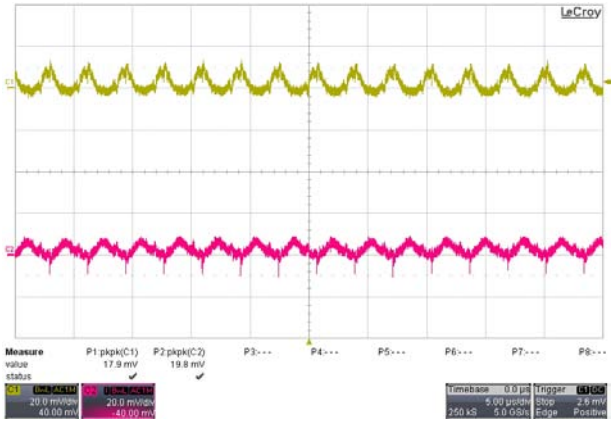
All test conditions are at 25°C The figures are identical for TEN 15-4823WI



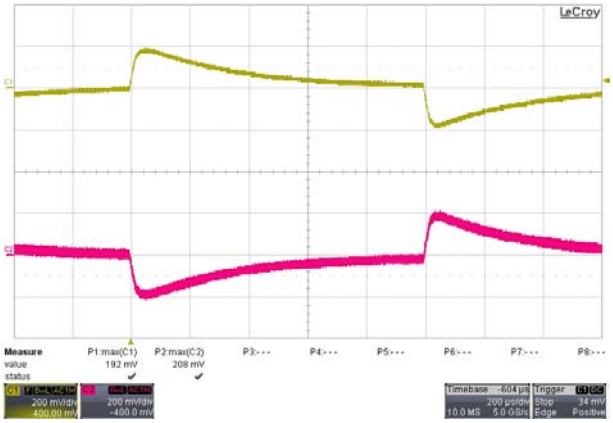
Efficiency Versus Output Current



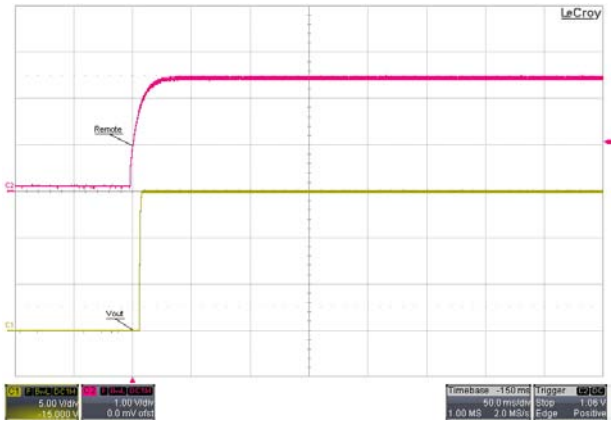
Efficiency Versus Input Voltage
Full Load



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} = $V_{in\ nom}$

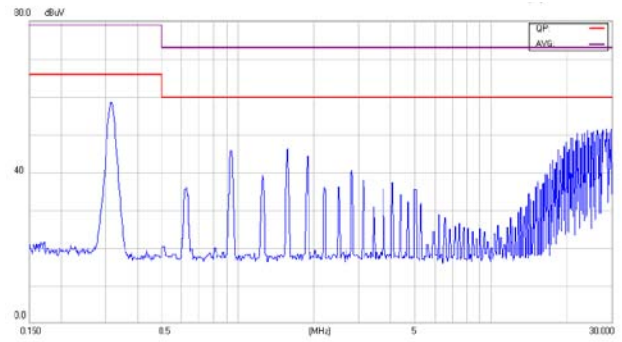


ON/OFF Voltage Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

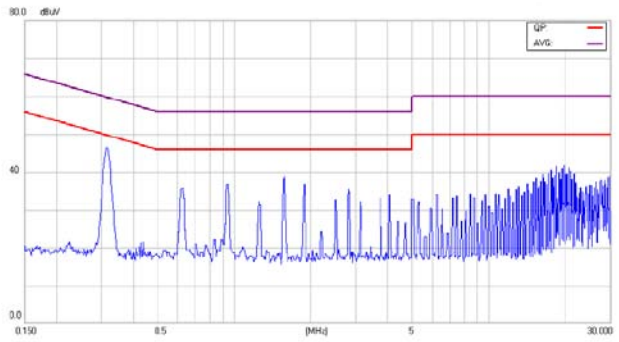
Typical Input Start-Up and Output Rise Characteristic
V_{in} = $V_{in\ nom}$; Full Load

Characteristic Curves

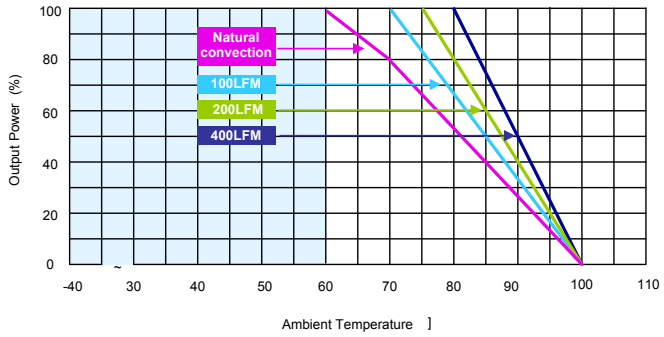
All test conditions are at 25°C The figures are identical for TEN 15-4823WI (Continued)



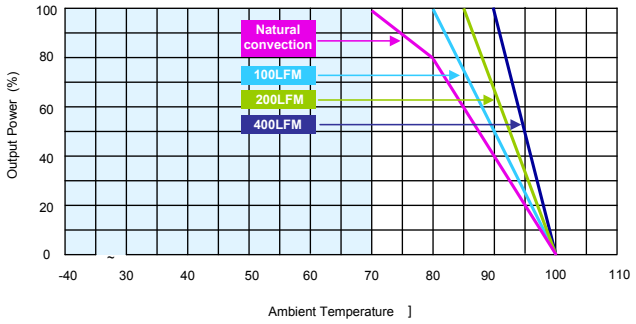
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



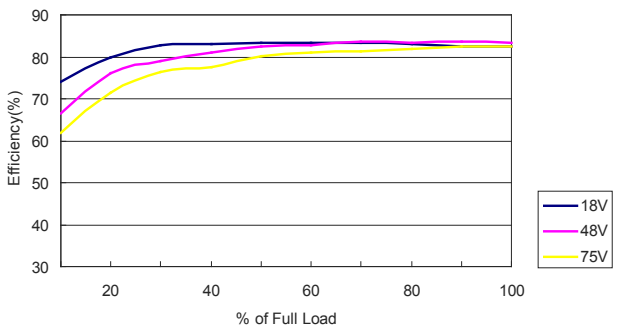
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



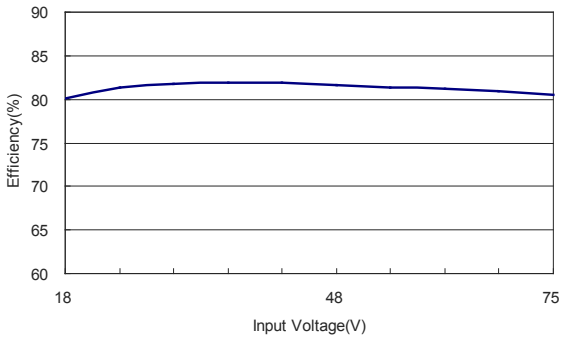
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (with heatsink)

Characteristic Curves

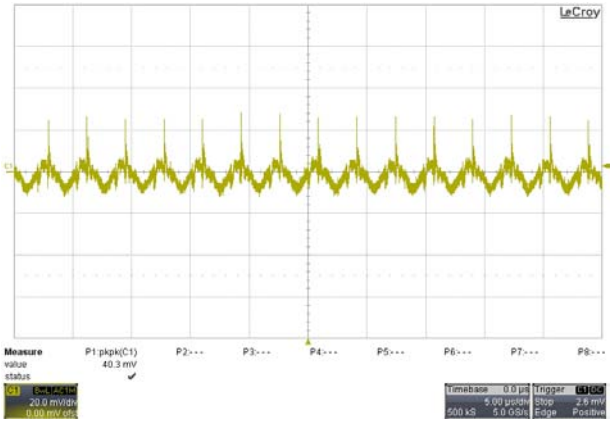
All test conditions are at 25°C The figures are identical for TEN 15-48XXWI



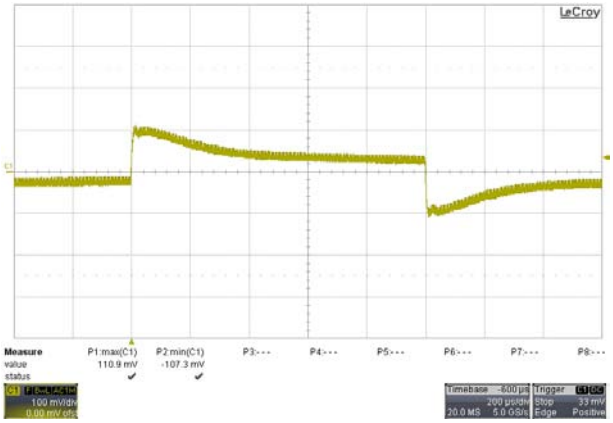
Efficiency Versus Output Current



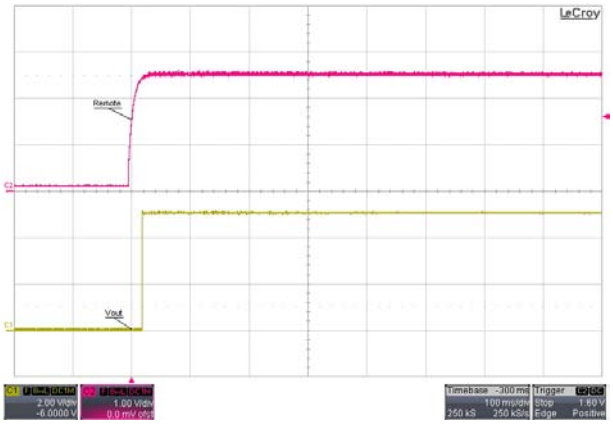
Efficiency Versus Input Voltage
Full Load



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 ; $V_{in} = V_{in\ nom}$

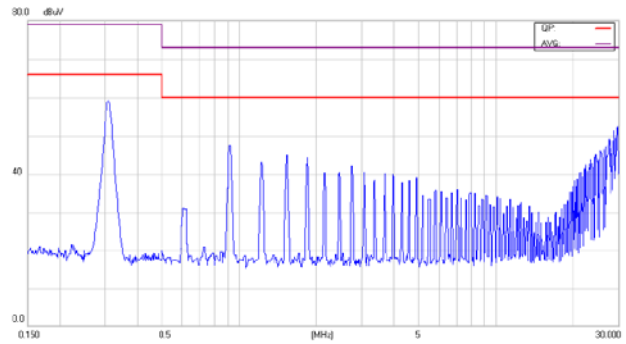


ON/OFF Voltage Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

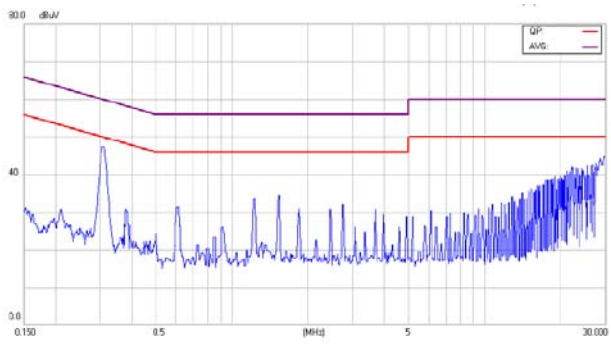
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves

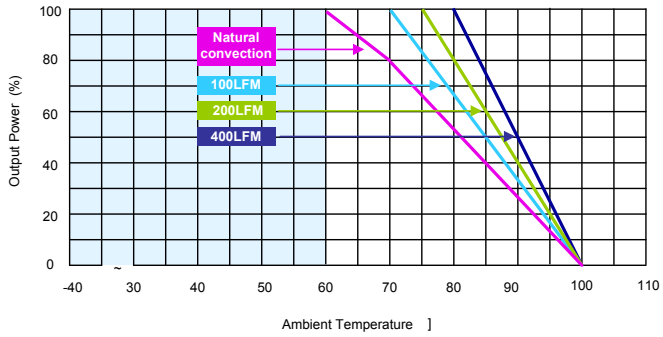
All test conditions are at 25°C The figures are identical for TEN 15-48XXWI (Continued)



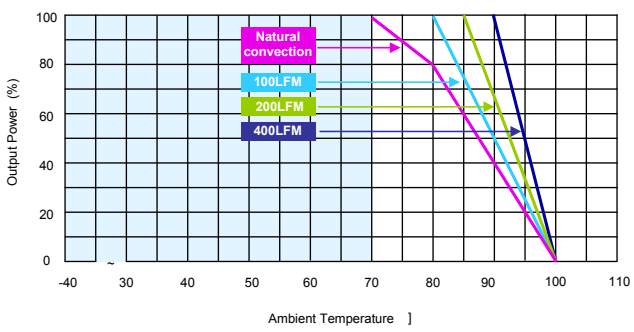
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$; Full Load



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



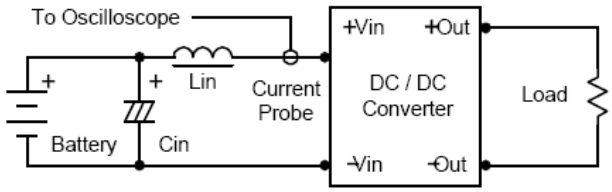
Derating Output Current Versus Ambient Temperature and Airflow
$V_{in} = V_{in\ nom}$ (without heatsink)



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

Testing Configurations

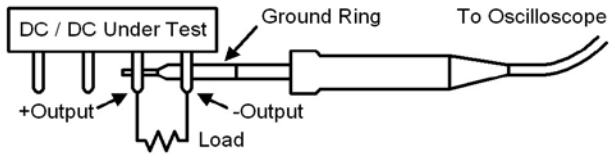
Input reflected-ripple current measurement test up



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

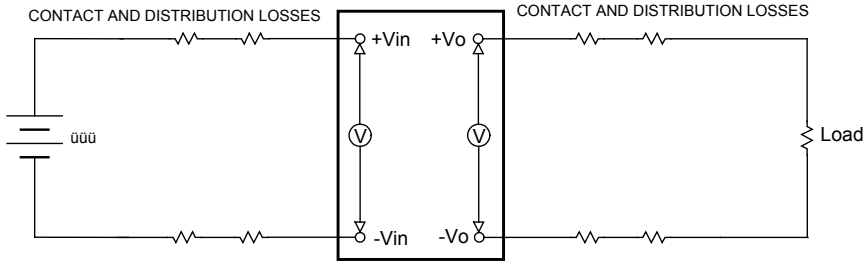
Peak-to-peak output ripple & noise measurement test up

This noise pickup is eliminated as shown in Figure by using a scope probe with an external ground band or ring and pressing this band directly against the output common terminal of the power converter while the tip contacts the voltage output terminal. This makes the shortest possible connection across the output terminals.

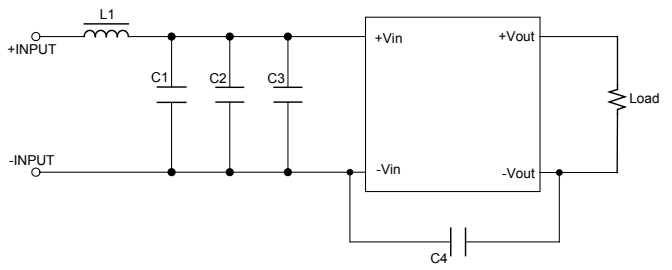


Output voltage and efficiency measurement test up

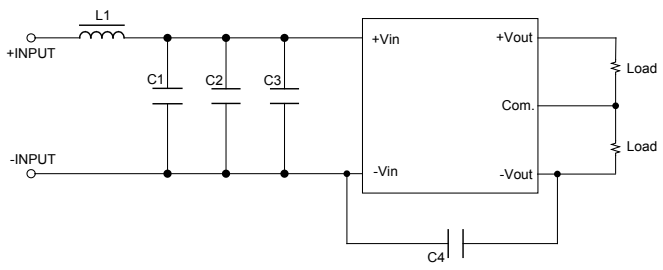
$$Efficiency = \left(\frac{V_{out} \times I_{out}}{V_{in} \times I_{in}} \right) \times 100\% = [\%]$$



EMC considerations

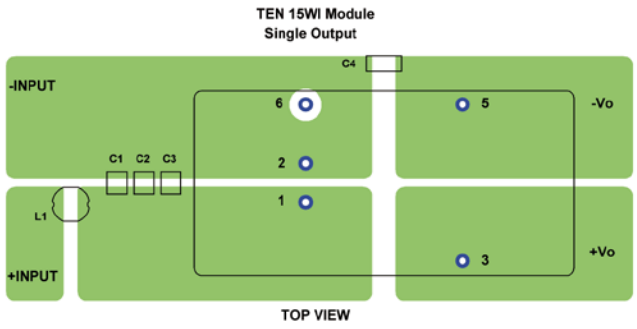


Single Output

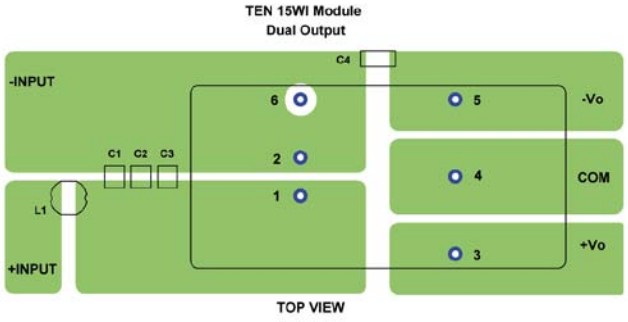


Dual Output

Recommended circuit to comply EN55022 Class B Limits



Single Output



Dual Output

Recommended PCB Layout with Input Filter

To: comply with EN55022 CLASS B following components are needed:

Model	Component	Value
TEN 15-24XXWI	C1,C2,C3	4.7µF/50V 1210 MLCC
	L1	18µH SCD0403T/0.84A
TEN 15-48XXWI	C1,C2,C3	2.2µF/100V 1210 MLCC
	C4	470pF/2KV 1808 X7R
	L1	18µH SCD0403T/0.84A

Input Source Impedance

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.
Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 KHz) capacitor of a 6.8µF for the 24V and 48V devices.

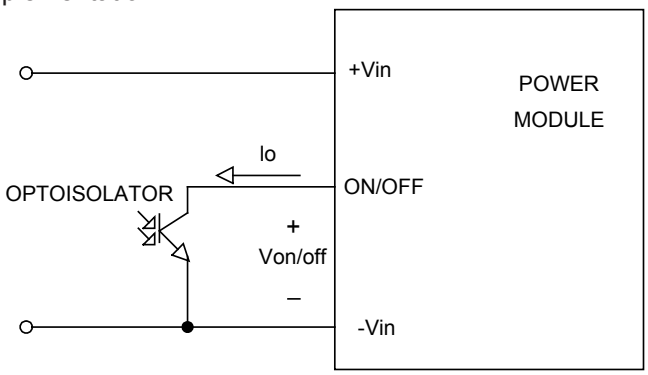
Output Over Current Protection

To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally once the output current is brought back into its specified range.

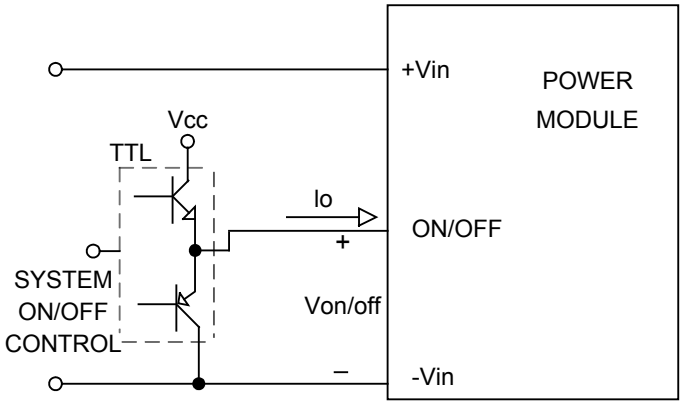
Remote ON/OFF Control

With suffix-RC, the positive logic remote ON/OFF control circuit is included. 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

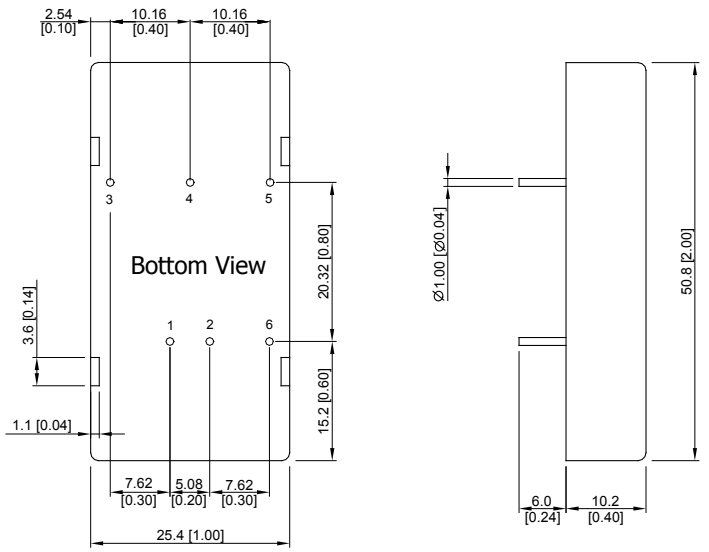


Isolated-Closure Remote ON/OFF



Level Control Using TTL Output

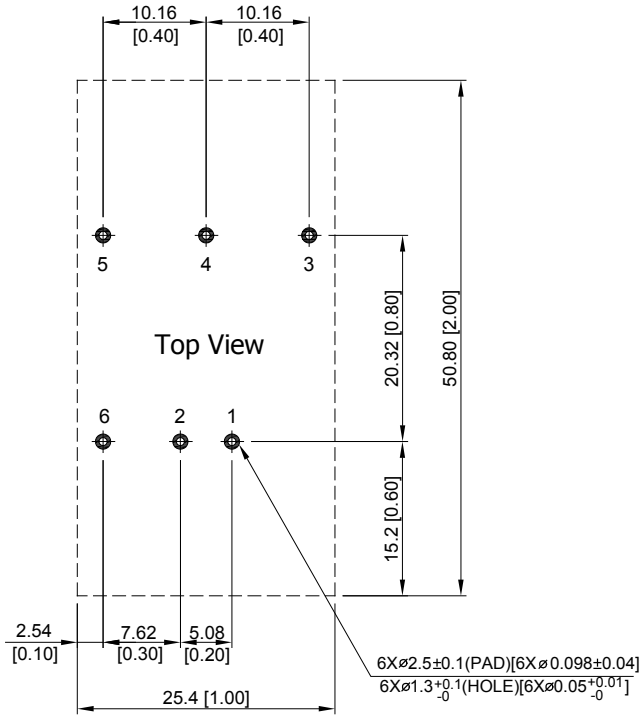
Mechanical Dimensions



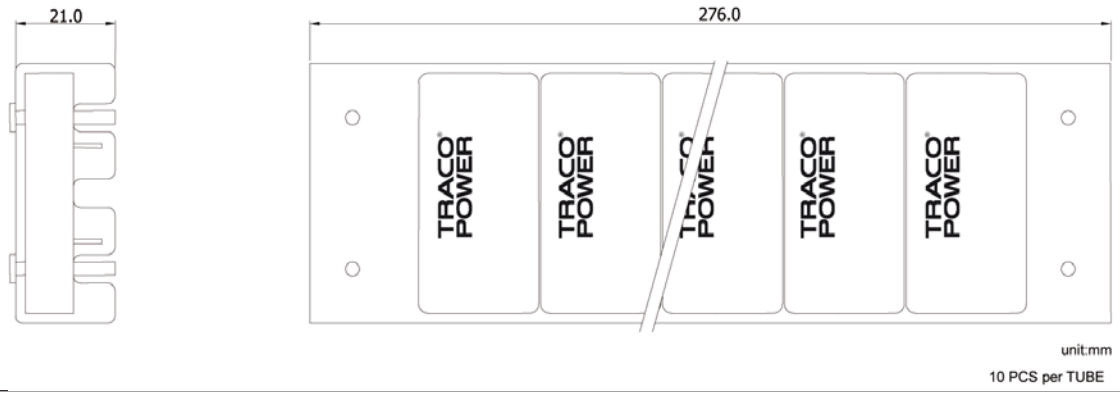
Pin Connections		
Pin	Single Output	Dual Output
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	No Pin	Common
5	-Vout	-Vout
6	Remote On/Off (Optional)	

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:±0.05 (±0.002")

Recommended Pad Layout for Single & Dual Output Converter

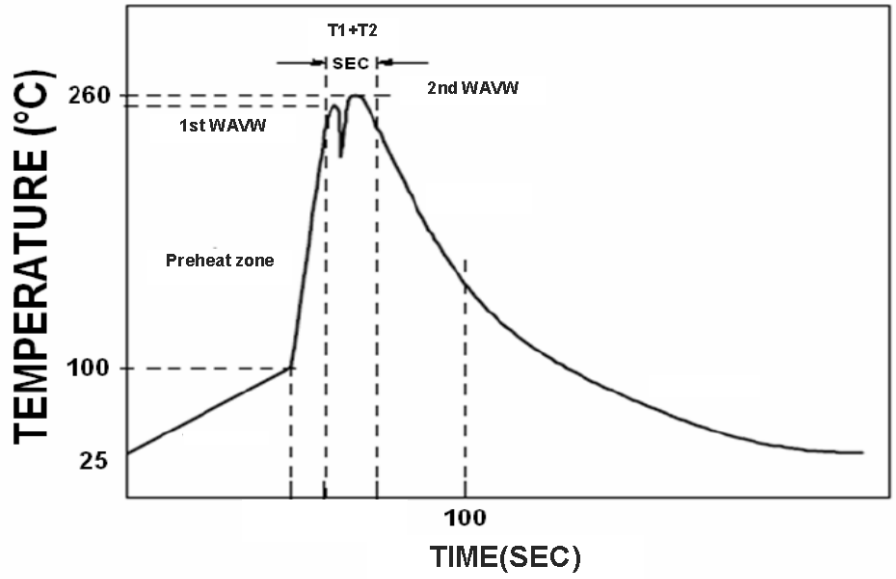


Packaging Information

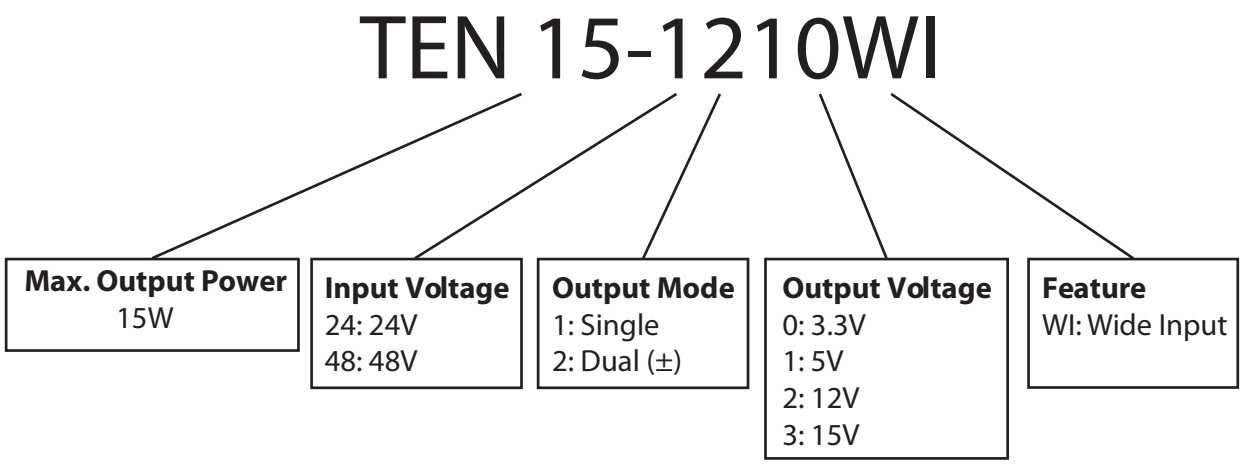


Soldering and Reflow Considerations

Lead free wave solder profile for TEN 15WI Series



Part Number Structure



Model Number	Input Range (VDC)	Output Voltage (VDC)	Max. Output Current (mA)	Input Current at Full Load[1] (mA)	Efficiency[2] (%)
TEN 15-2410WI	9-36	3.3	3000	528	78
TEN 15-2411WI	9-36	5	3000	762	82
TEN 15-2412WI	9-36	12	1250	735	85
TEN 15-2413WI	9-36	15	1000	726	86
TEN 15-2421WI	9-36	±5	±1500	771	81
TEN 15-2422WI	9-36	±12	±625	735	85
TEN 15-2423WI	9-36	±15	±500	726	86
TEN 15-24XXWI	9-36	5.1	3000	787	81
TEN 15-4810WI	18-75	3.3	3000	264	78
TEN 15-4811WI	18-75	5	3000	381	82
TEN 15-4812WI	18-75	12	1250	368	85
TEN 15-4813WI	18-75	15	1000	363	86
TEN 15-4821WI	18-75	±5	±1500	386	81
TEN 15-4822WI	18-75	±12	±625	368	85
TEN 15-4823WI	18-75	±15	±500	363	86
TEN 15-48XXWI	18-75	5.1	3000	393	81

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 slow-blow fuse in 24Vin, 48Vin with maximum rating of 2500mA, 1250mA. 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 TEN 15WI series of DC/DC converters has been calculated using MIL-HDBK 217F NOTICE2, Operating Temperature 25°C, Ground Benign.

Model	MTBF	Unit
TEN 15-2410WI	695,410	Hours
TEN 15-2411WI	696,088	
TEN 15-2412WI	736,485	
TEN 15-2413WI	750,469	
TEN 15-2421WI	692,569	
TEN 15-2422WI	789,453	
TEN 15-2423WI	792,016	
TEN 15-24XXWI	696,088	
TEN 15-4810WI	672,450	
TEN 15-4811WI	691,133	
TEN 15-4812WI	755,801	
TEN 15-4813WI	764,701	
TEN 15-4821WI	696,427	
TEN 15-4822WI	799,105	
TEN 15-4823WI	794,470	
TEN 15-48XXWI	691,133	

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