TRACO POWER

TON 15-WI Series — Application Note

DC/DC Converter 9 to 36Vdc or 18 to 75 Vdc input, 3.3 to 15 Vdc Single Outputs, 15 Watt

E188913

Complete TON 15-WI datasheet can be downloaded at:
http://www.tracopower.com/products/ton15wi.pdf

Features

- Lead free directive compatible
- Low profile: 27.94 x 23.88 x 8.5mm (1.10 x 0.94 x 0.335 inch)
- Industry standard pin-out TEN 15 series compatible
- 4 : 1 wide input voltage of 18-36, 36-75VDC
- 15 Watts output power
- Input to output isolation: 2250Vdc, min for 60 seconds
- Over-current protection, auto-recovery
- Output over voltage protection
- Under voltage lookout
- Remote on/off control
- Adjustable output voltage
- ISO 9001 certified manufacturing facilities
- UL60950-1 Recognized E188913
- EN 55022 class B / FCC class B conducted noise
- Approved for basic insulation

Applications

- Distributed power architectures
- Communication equipment
- Computer equipment
- Test equipment

Option

- Surface mount

General Description

TON 15-WI single output DC/DC converters provide up to 15 watts of output power in an industry standard package and footprint. These units are specifically designed to meet the power needs of low profile. All models feature with 4:1 ultra wide input voltage of 9-36Vdc and 18-75Vdc, comprehensively protected against over-current, over-voltage and input under-voltage protection conditions, and adjustable output voltage.

Table of contents

Absolute Maximum Rating				
Parameter	**Model**	**Min**	**Max**	**Unit**
Input Voltage Continuous Transient (100mS)	 TON 15–24xxWI TON 15–48xxWI TON 15–24xxWI TON 15–48xxWI		 36 75 50 100	Vdc
Input Voltage Variation (complies with ETS300 132 part 4.4)	All		5	V/mS
Operating Ambient Temperature (with derating)	All	-40	85	°C
Storage Temperature	All	-55	125	°C

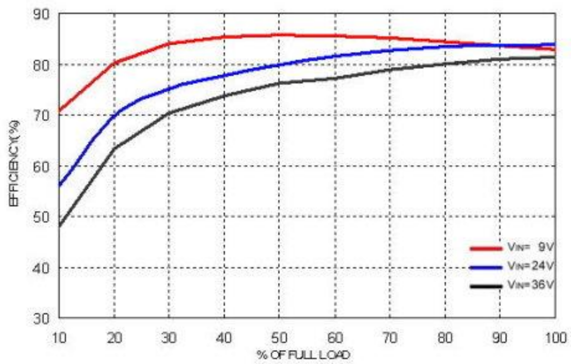
Output Specification					
Parameter	**Model**	**Min**	**Typ**	**Max**	**Unit**
Output Voltage Range ($V_{in} = V_{in\,nom}$; Full Load; T_A = 25°C)	TON 15–xx10WI TON 15–xx11WI TON 15–xx12WI TON 15–xx13WI	3.267 4.95 11.88 14.85	3.3 5 12 15	3.333 5.05 12.12 15.15	Vdc
Voltage Adjustability (See Page 25)	All	-10		+10	%
Output Regulation Line (Vin(min) to Vin(max) at Full Load) Load (0% to 100% of Full Load)	All	 -0.2 -0.2		 +0.2 +0.2	%
Output Ripple & Noise(See Page 21) Peak-to-Peak (20MHz bandwidth) (Measured with a 1µF M/C and a 10µF T/C)	All		100		mV $_{Pk\text{-}Pk}$
Temperature Coefficient	All	-0.02		+0.02	%/°C
Output Voltage Overshoot ($V_{in\,min}$ to $V_{in\,max}$; Full Load; T_A = 25°C)	All			3	% V_{OUT}
Dynamic Load Response ($V_{in} = V_{in\,nom}$;T_A = 25°C) Load step change from 75% to 100% or 100 to 75% of Full Load Peak Deviation Setting Time (V_{OUT} < 10% peak deviation)	 All All		 300 250		 mV µS
Output Current	TON 15–xx10WI TON 15–xx11WI TON 15–xx12WI TON 15–xx13WI	0 0 0 0		4000 3000 1300 1000	mA
Output Over Voltage Protection (Voltage Clamped)	TON 15–xx10WI TON 15–xx11WI TON 15–xx12WI TON 15–xx13WI	3.7 5.6 13.8 16.8		5.4 7.0 17.5 20.5	Vdc
Output Over Current Protection	All		150		% FL.
Output Short Circuit Protection	All	Hiccup, automatics recovery			

Input Specification					
Parameter	**Model**	**Min**	**Typ**	**Max**	**Unit**
Operating Input Voltage	TON 15–24xxWI TON 15–48xxWI	9 18	24 48	36 75	Vdc
Input Current (Maximum value at $V_{in} = V_{in\,nom}$; Full Load)	TON 15–2410WI TON 15–2411WI TON 15–2412WI TON 15–2413WI TON 15–4810WI TON 15–4811WI TON 15–4812WI TON 15–4813WI			688 763 803 772 340 377 392 377	mA
Input Standby Current (Typical value at $V_{in} = V_{in\,nom}$; No Load)	TON 15–2410WI TON 15–2411WI TON 15–2412WI TON 15–2413WI TON 15–4810WI TON 15–4811WI TON 15–4812WI TON 15–4813WI		50 60 15 15 40 40 15 15		mA
Under Voltage Lockout Turn-on Threshold	TON 15–24xxWI TON 15–48xxWI			9 18	Vdc
Under Voltage Lockout Turn-off Threshold	TON 15–24xxWI TON 15–48xxWI		8 16		Vdc
Input Reflected Ripple Current (See Page 21) (5 to 20MHz, 12µH source impedance)	All		30		mA_{Pk-Pk}
Start Up Time ($V_{in} = V_{in\,nom}$ and constant resistive load) Power on Remote ON/OFF	All		 30 30		mS
Remote ON/OFF Control (See Page 27) (The ON/OFF pin voltage is referenced to $-V_{in}$) Positive Logic DC-DC ON (Open) DC-DC OFF (Short)	All	 3 0		 12 1.2	Vdc
Remote Off Input Current	All		2.5		mA
Input Current of Remote Control Pin	All	-0.5		1.0	mA

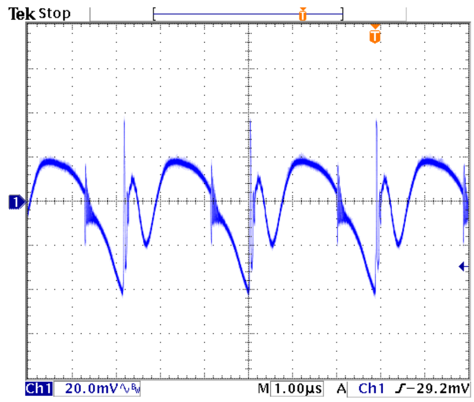
General Specification					
Parameter	**Model**	**Min**	**Typ**	**Max**	**Unit**
Efficiency (See Page 21) ($V_{in} = V_{in\,nom}$; Full Load; $T_A = 25°C$)	TON 15–2410WI TON 15–2411WI TON 15–2412WI TON 15–2413WI TON 15–4810WI TON 15–4811WI TON 15–4812WI TON 15–4813WI		84 86 85 85 85 87 87 87		%
Isolation Voltage Input to Output	All	2250			Vdc
Isolation Resistance	All	10			GΩ
Isolation Capacitance	All			1000	pF
Switching Frequency	TON 15–xx10WI TON 15–xx11WI TON 15–xx12WI TON 15–xx13WI		350 350 400 400		KHz
Weight	All		10.5		g
MTBF (See Page 32) Bellcore TR-NWT-000332, $T_C = 40°C$ MIL-HDBK-217F	All		1’322’000 514’700		hours

Characteristic Curves

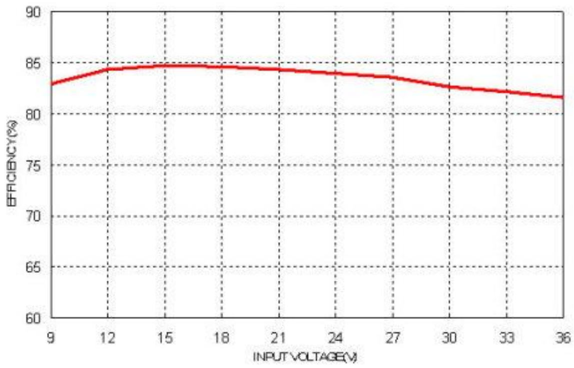
All test conditions are at 25°C. The figures are identical for TON 15-2410WI



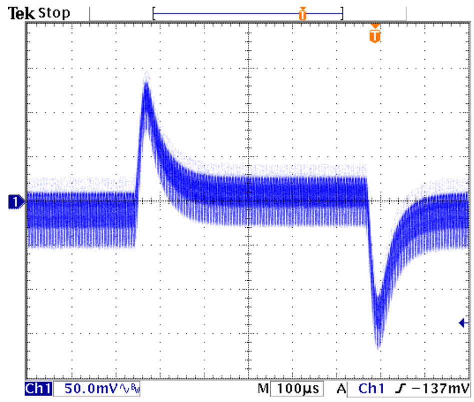
Efficiency versus Output Current



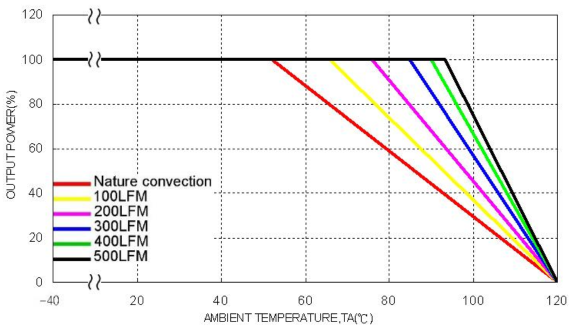
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$; Full Load



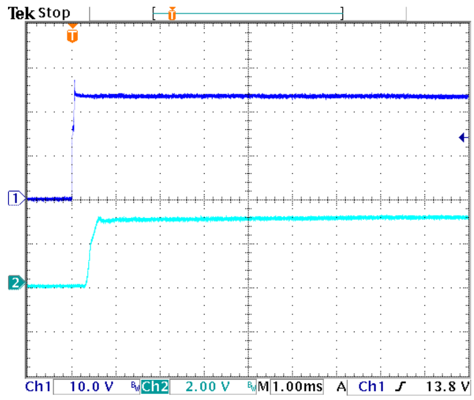
Efficiency versus Input Voltage. Full Load



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



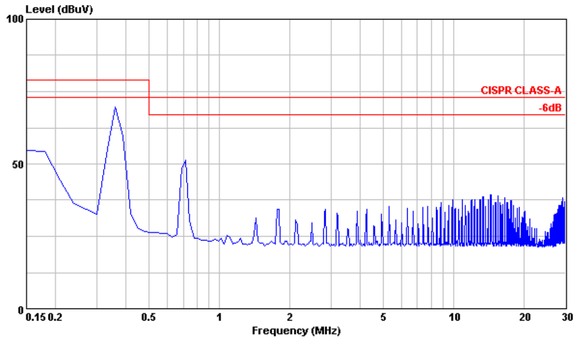
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$



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

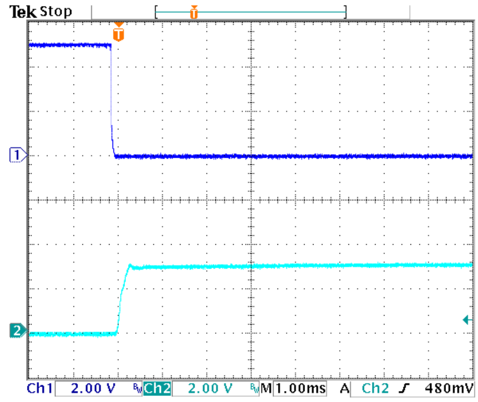
Characteristic Curves (Continued)

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



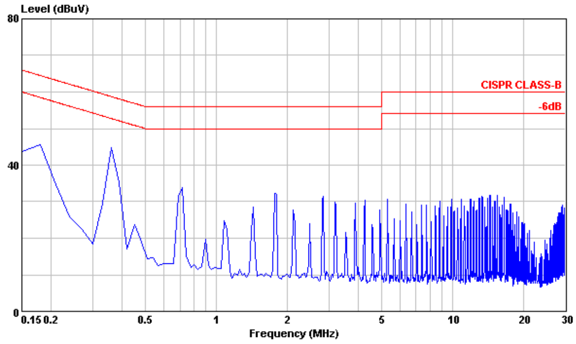
Conduction Emission of EN55022 Class A

$V_{in} = V_{in\ nom}$; **Full Load**



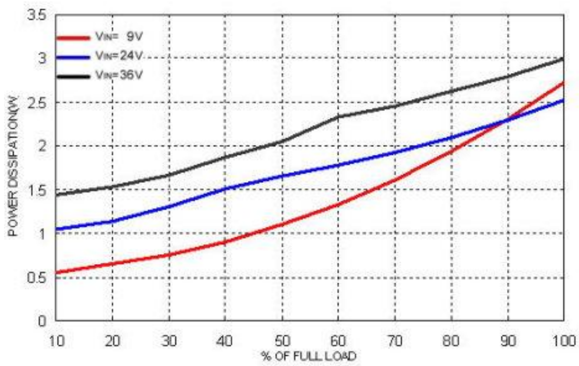
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

$V_{in} = V_{in\ nom}$; **Full Load**



Conduction Emission of EN55022 Class B

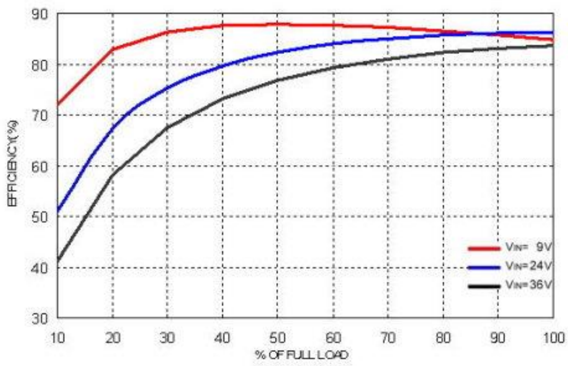
$V_{in} = V_{in\ nom}$; **Full Load**



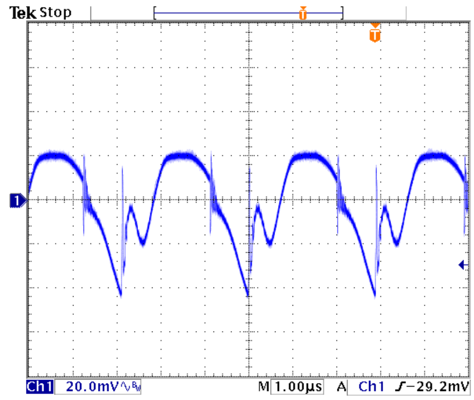
Power Dissipation versus Output Current

Characteristic Curves (Continued)

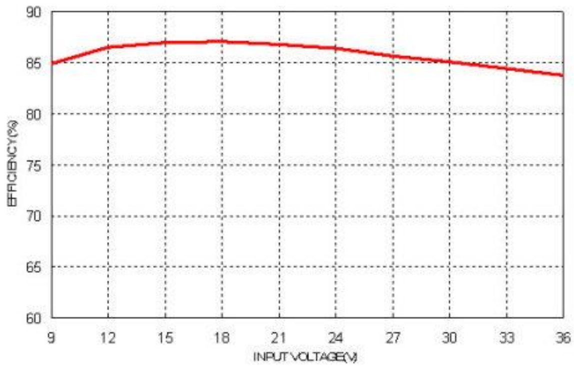
All test conditions are at 25°C. The figures are identical for TON 15-2411WI



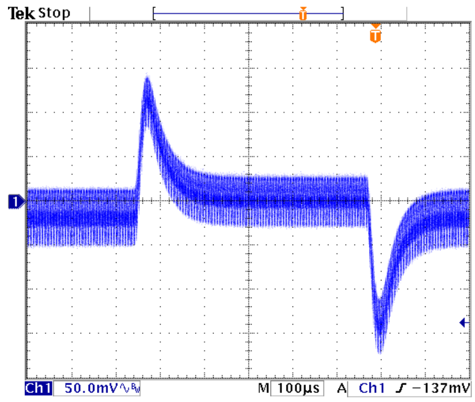
Efficiency versus Output Current



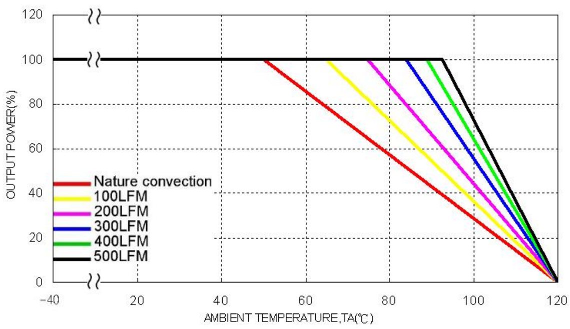
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



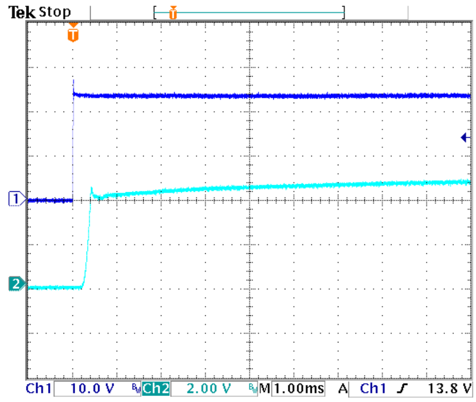
Efficiency versus Input Voltage. Full Load



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



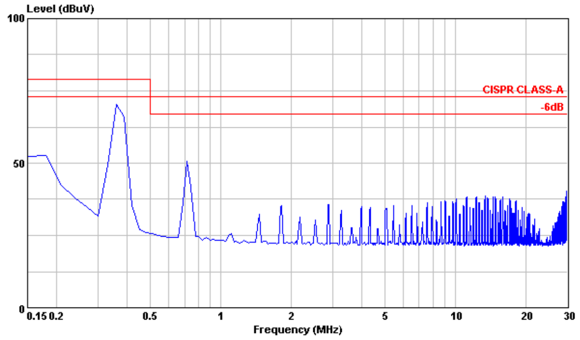
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



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

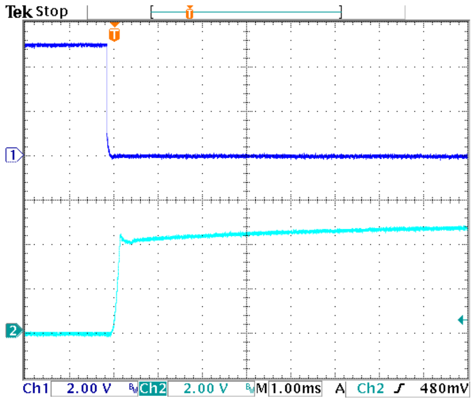
Characteristic Curves (Continued)

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



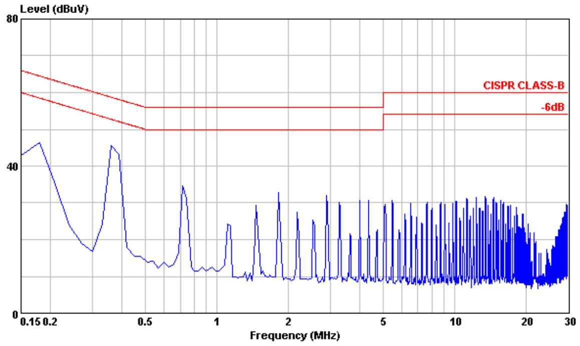
Conduction Emission of EN55022 Class A

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



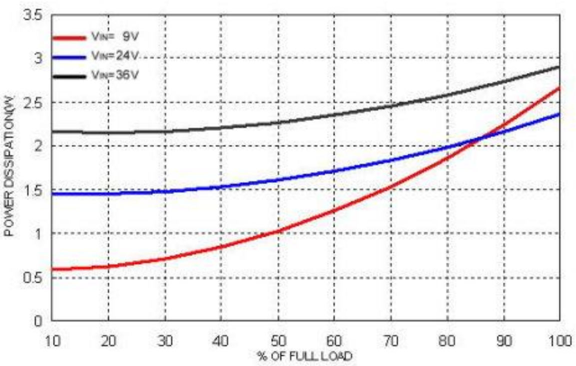
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

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



Conduction Emission of EN55022 Class B

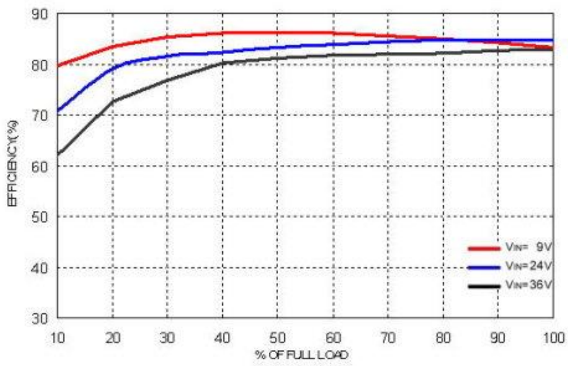
$V_{in} = V_{in\,nom}$; Full Load



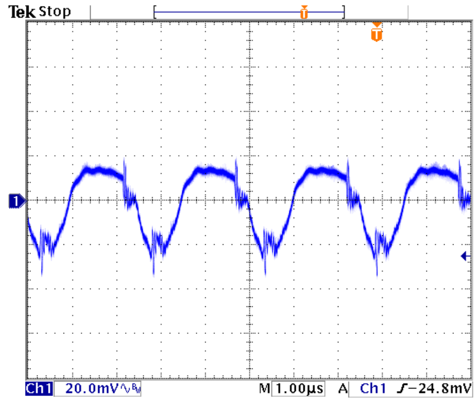
Power Dissipation versus Output Current

Characteristic Curves (Continued)

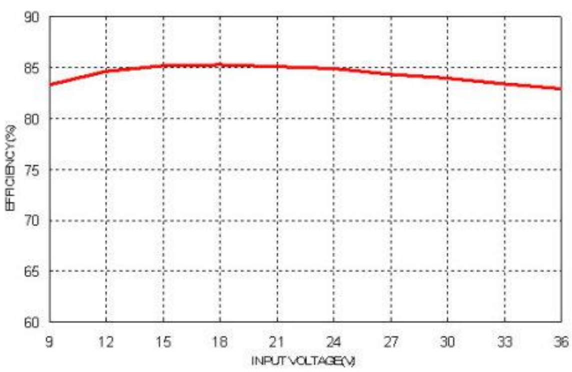
All test conditions are at 25°C. The figures are identical for TON 15-2412WI



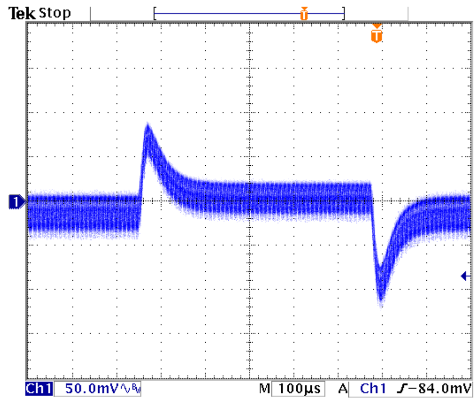
Efficiency versus Output Current



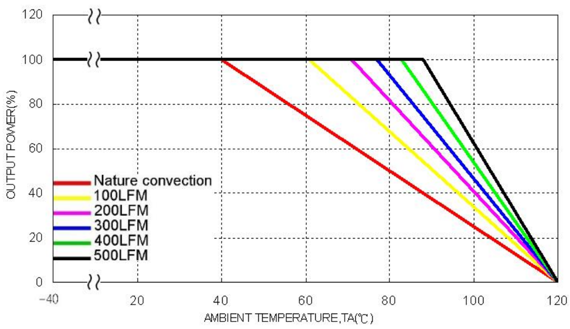
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$; Full Load



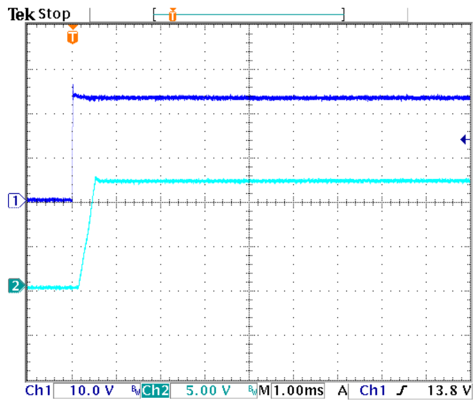
Efficiency versus Input Voltage. Full Load



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



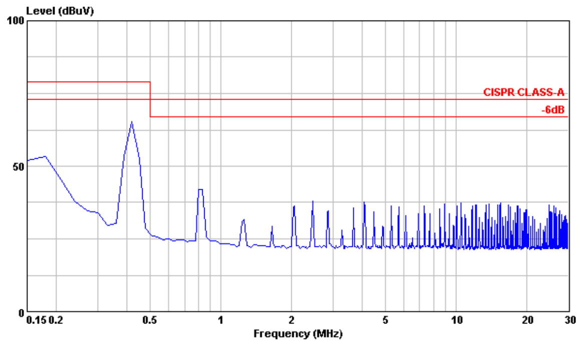
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$



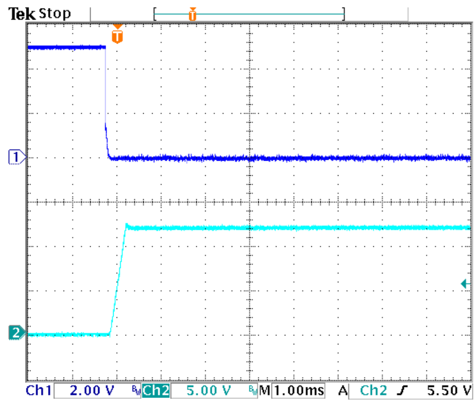
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves (Continued)

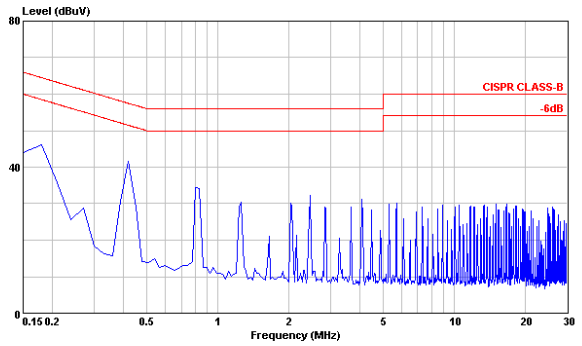
All test conditions are at 25°C. The figures are identical for TON 15-2412WI



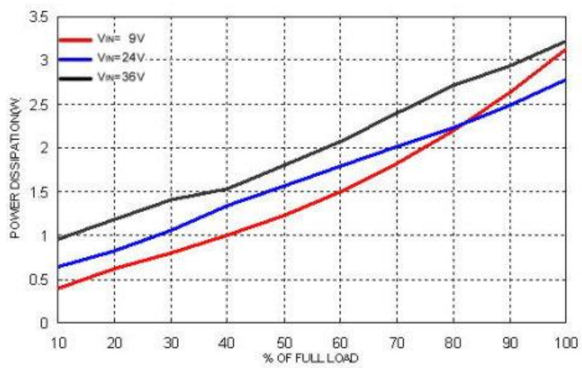
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



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



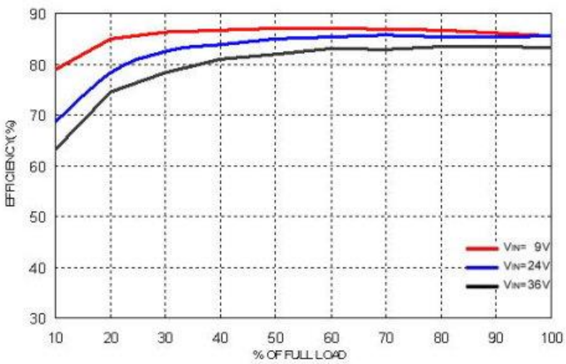
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



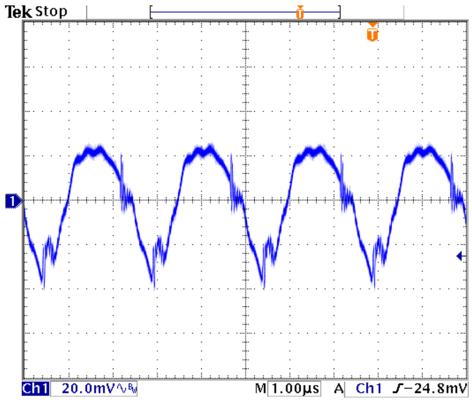
Power Dissipation versus Output Current

Characteristic Curves (Continued)

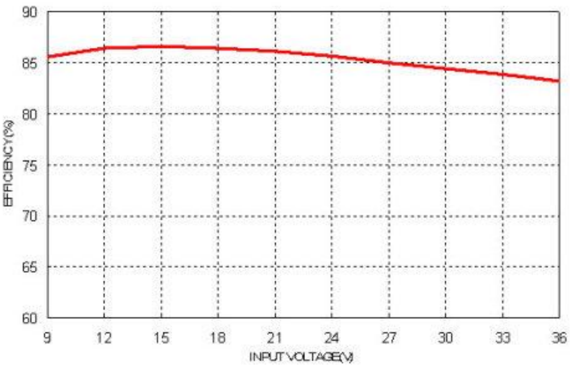
All test conditions are at 25°C. The figures are identical for TON 15-2413WI



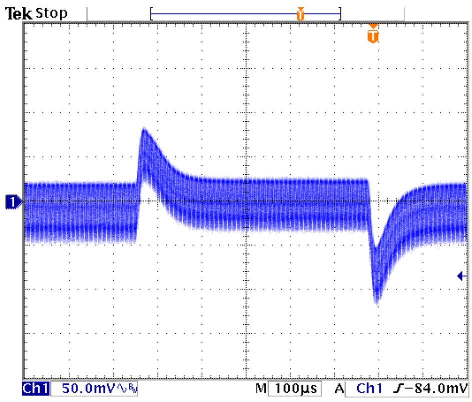
Efficiency versus Output Current



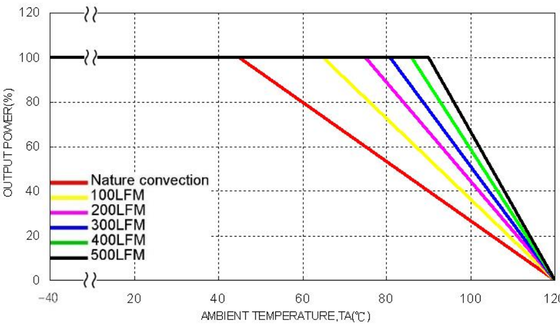
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



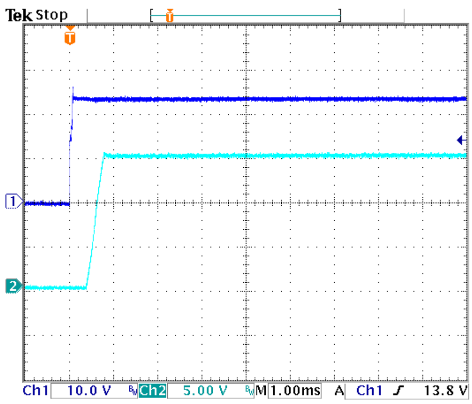
Efficiency versus Input Voltage. Full Load



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



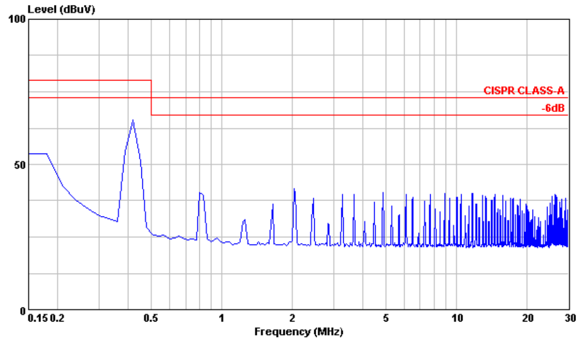
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



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

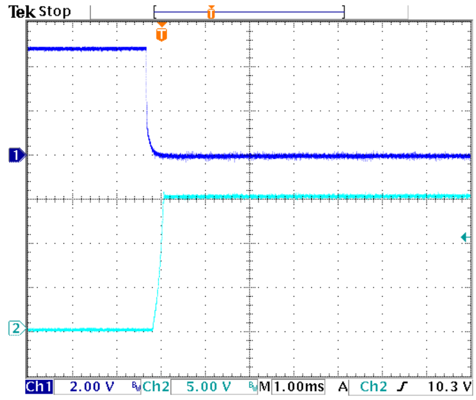
Characteristic Curves (Continued)

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



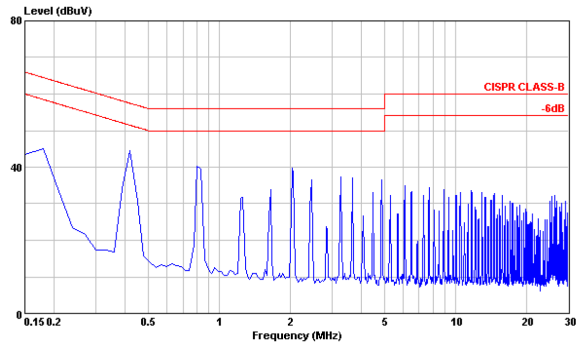
Conduction Emission of EN55022 Class A

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



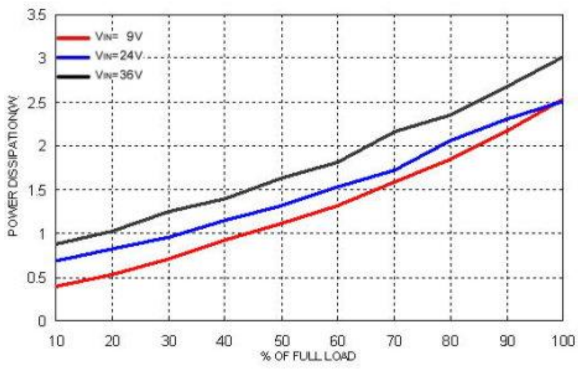
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

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



Conduction Emission of EN55022 Class B

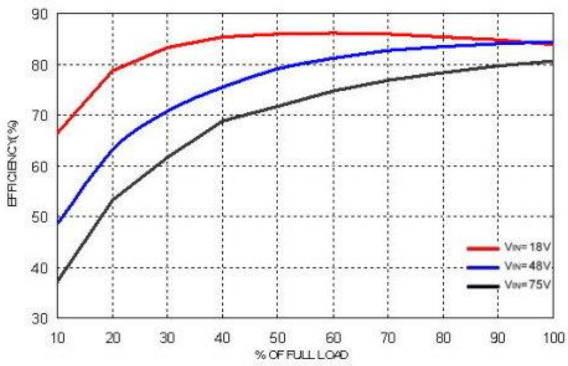
$V_{in} = V_{in\ nom}$; Full Load



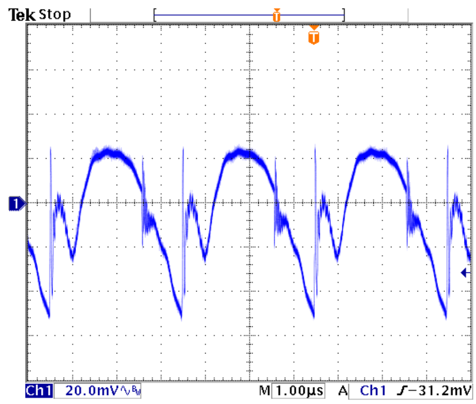
Power Dissipation versus Output Current

Characteristic Curves (Continued)

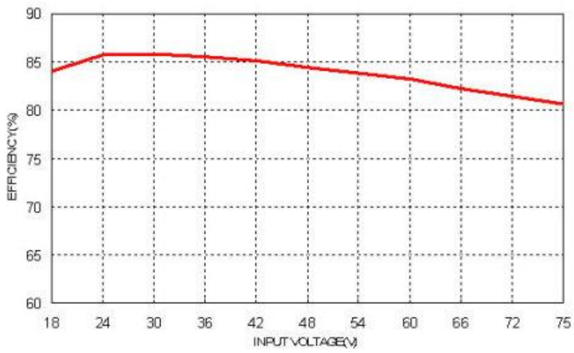
All test conditions are at 25°C. The figures are identical for TON 15-4810WI



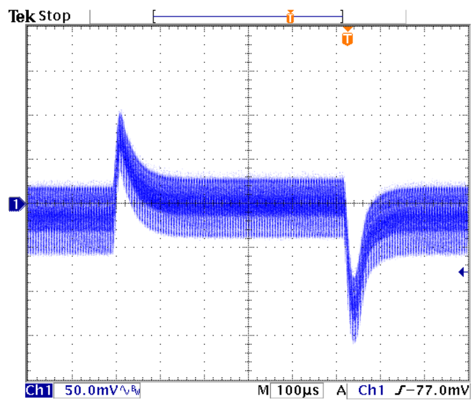
Efficiency versus Output Current



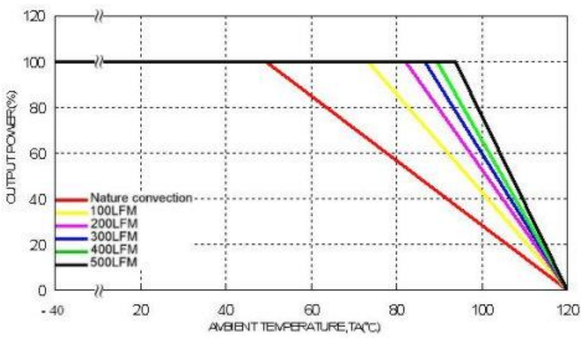
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



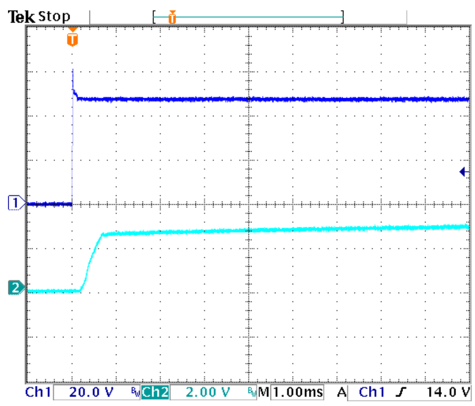
Efficiency versus Input Voltage. Full Load



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



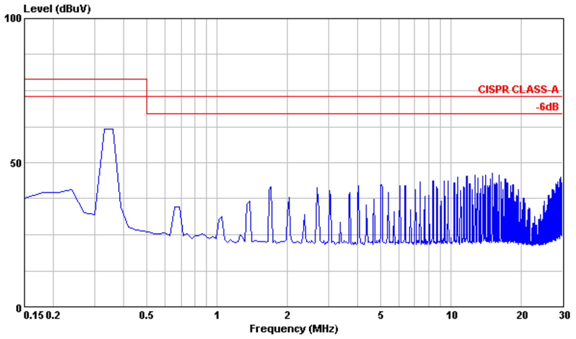
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



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

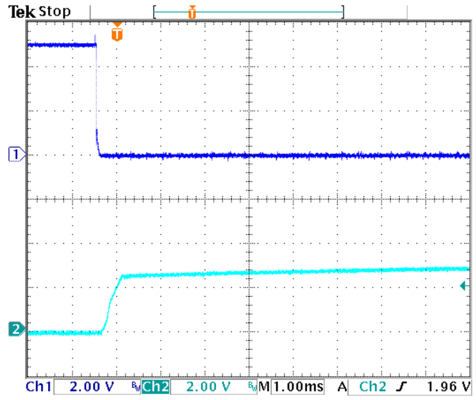
Characteristic Curves (Continued)

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



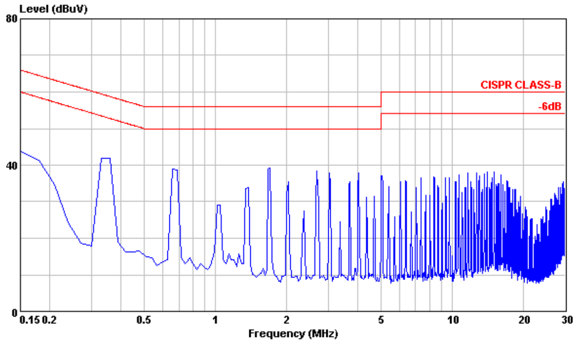
Conduction Emission of EN55022 Class A

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



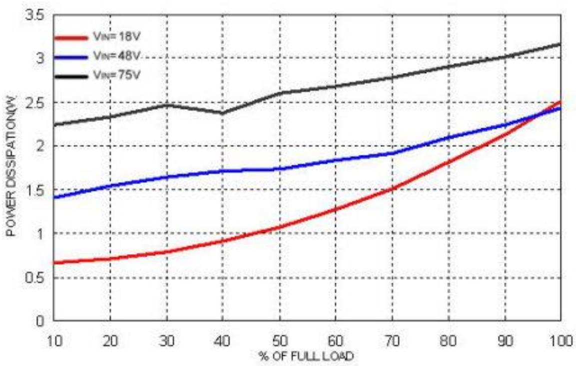
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

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



Conduction Emission of EN55022 Class B

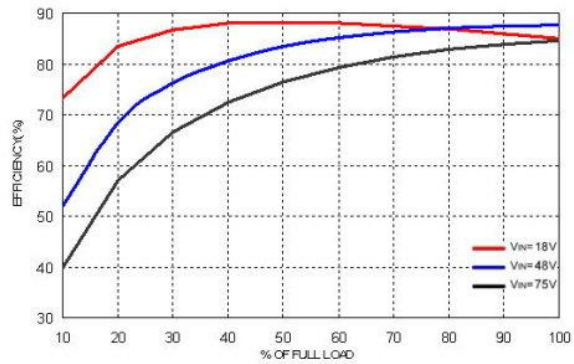
$V_{in} = V_{in\ nom}$; Full Load



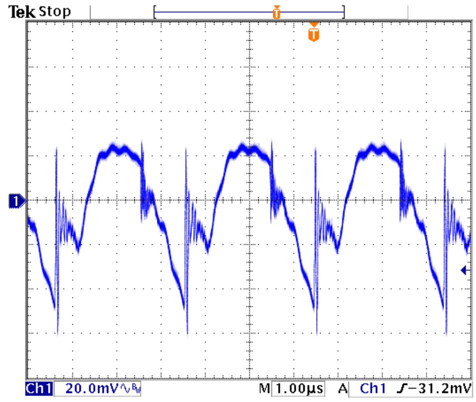
Power Dissipation versus Output Current

Characteristic Curves (Continued)

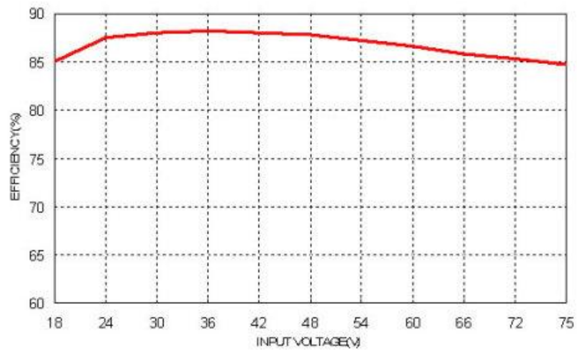
All test conditions are at 25°C. The figures are identical for TON 15-4811WI



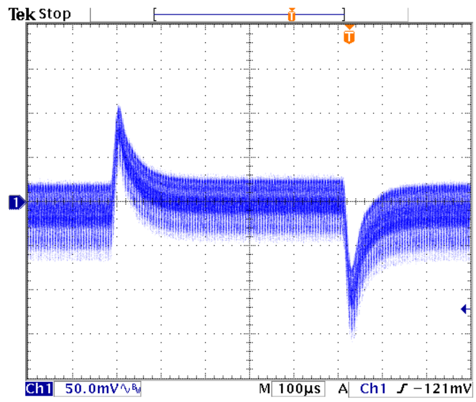
Efficiency versus Output Current



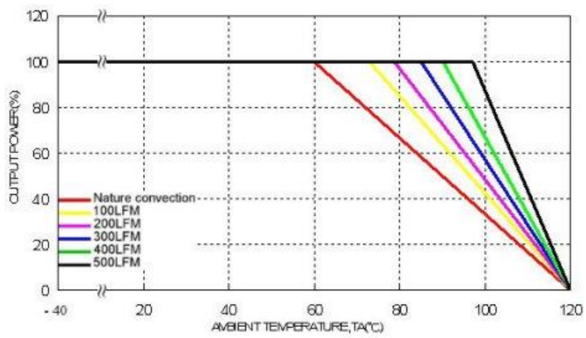
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$; Full Load



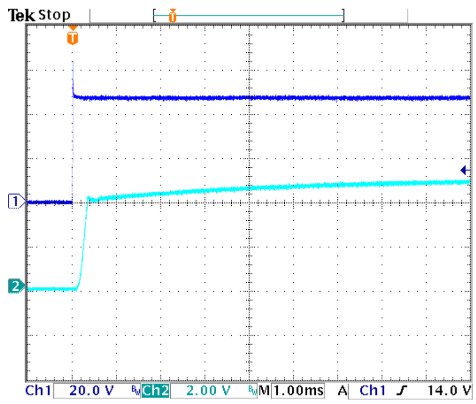
Efficiency versus Input Voltage. Full Load



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



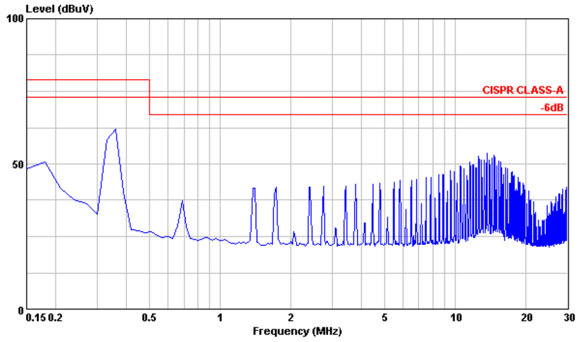
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\ nom}$



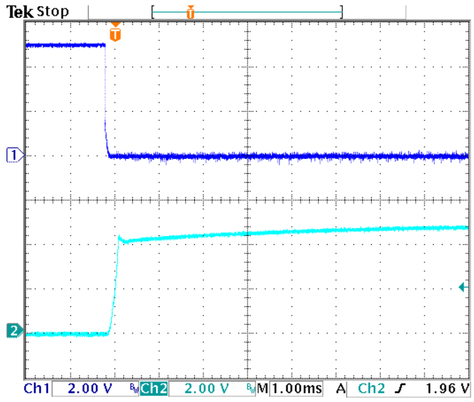
Typical Input Start-Up and Output Rise Characteristic
$V_{in} = V_{in\ nom}$; Full Load

Characteristic Curves (Continued)

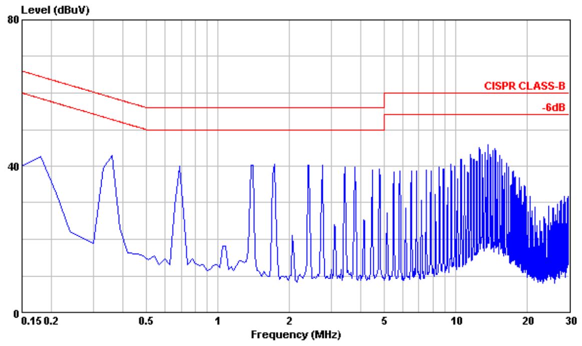
All test conditions are at 25°C. The figures are identical for TON 15-4811WI



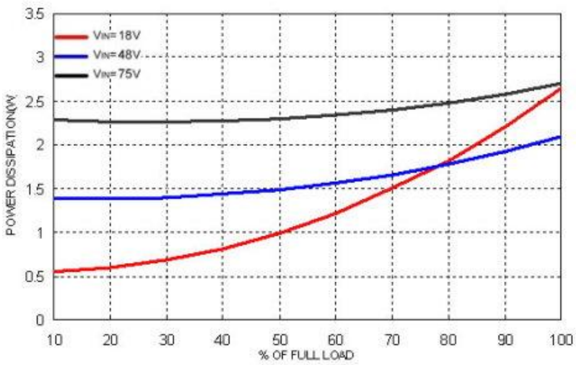
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$; Full Load



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



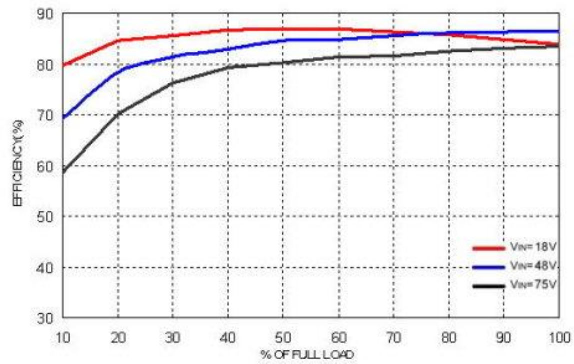
Conduction Emission of EN55022 Class B
$V_{in} = V_{in\,nom}$; Full Load



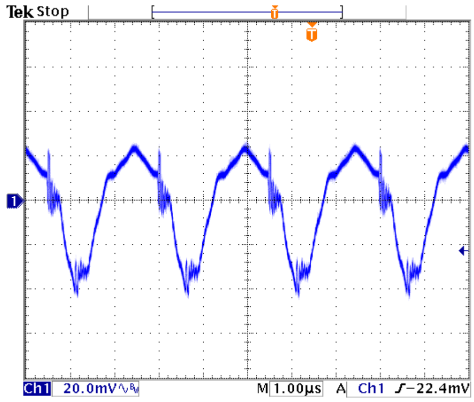
Power Dissipation versus Output Current

Characteristic Curves (Continued)

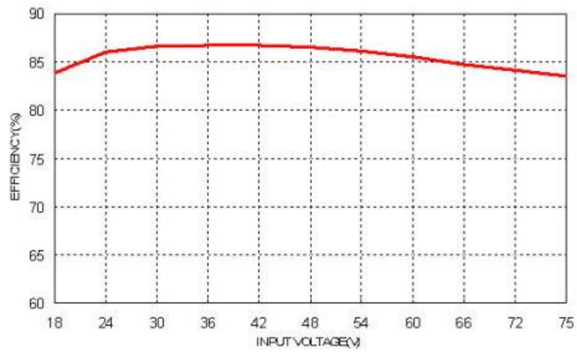
All test conditions are at 25°C. The figures are identical for TON 15-4812WI



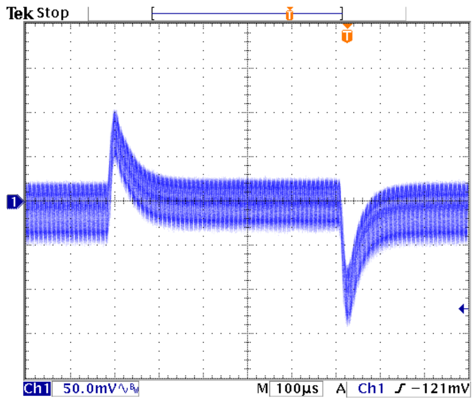
Efficiency versus Output Current



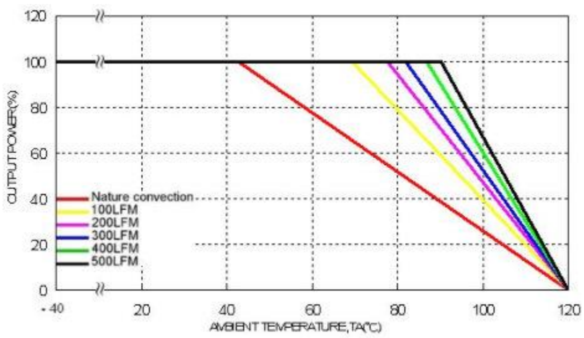
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



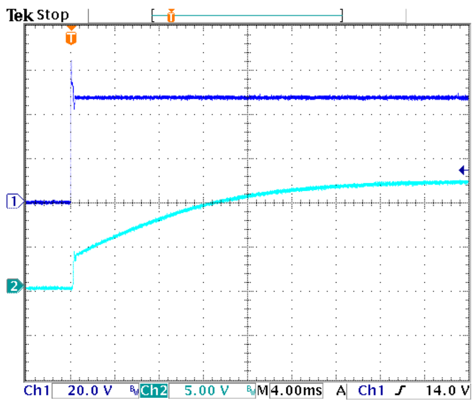
Efficiency versus Input Voltage. Full Load



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



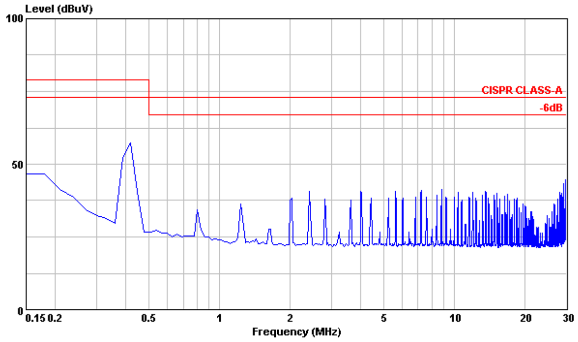
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



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

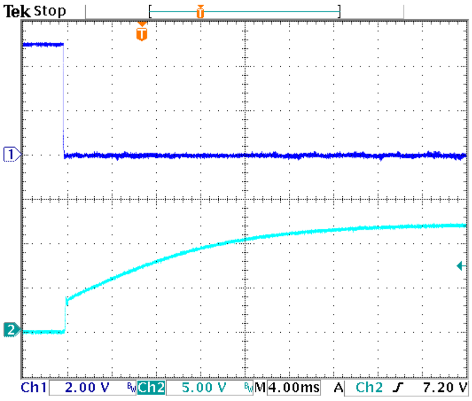
Characteristic Curves (Continued)

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



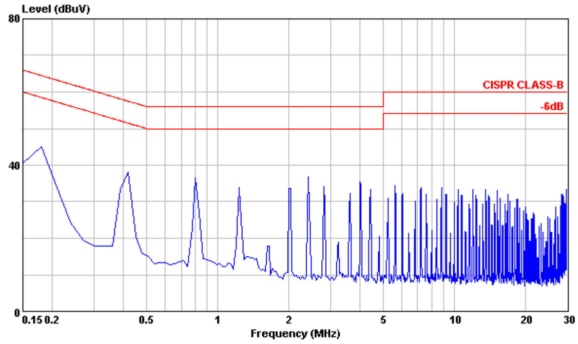
Conduction Emission of EN55022 Class A

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



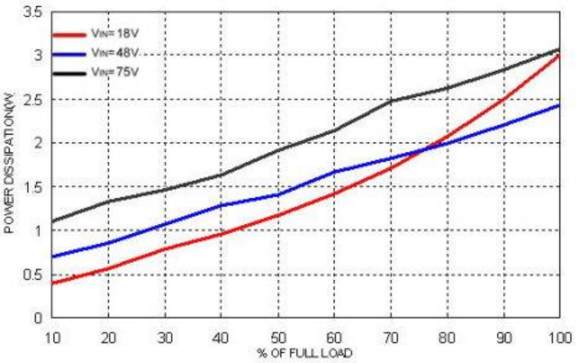
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

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



Conduction Emission of EN55022 Class B

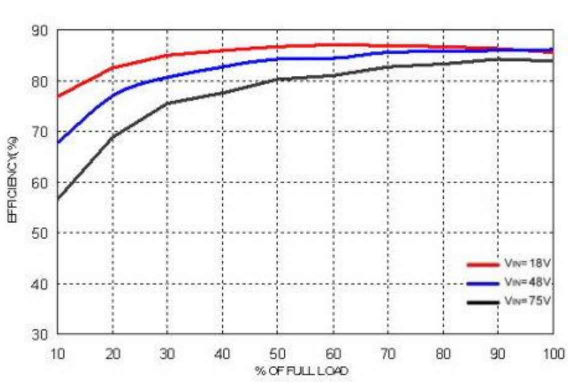
$V_{in} = V_{in\,nom}$; Full Load



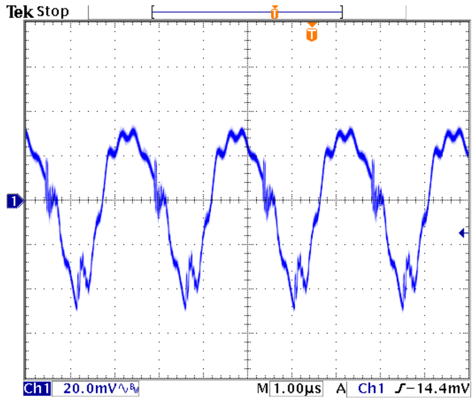
Power Dissipation versus Output Current

Characteristic Curves (Continued)

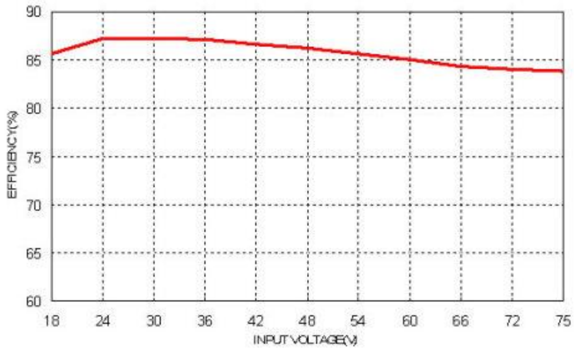
All test conditions are at 25°C. The figures are identical for TON 15-4813WI



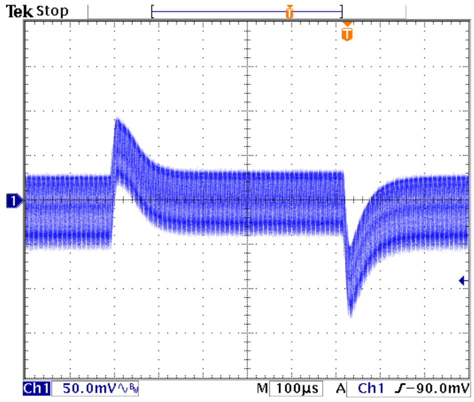
Efficiency versus Output Current



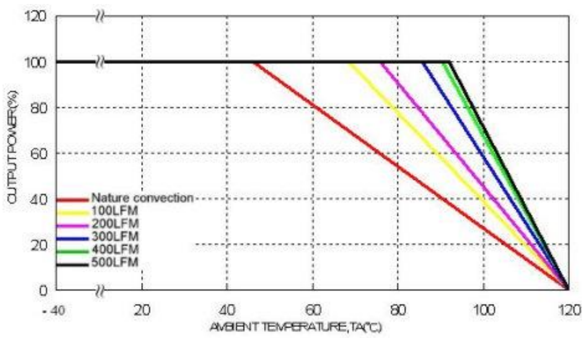
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$; Full Load



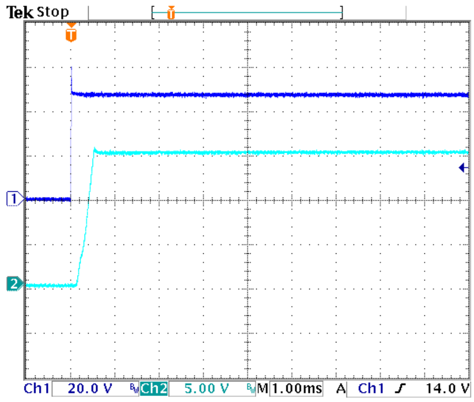
Efficiency versus Input Voltage. Full Load



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



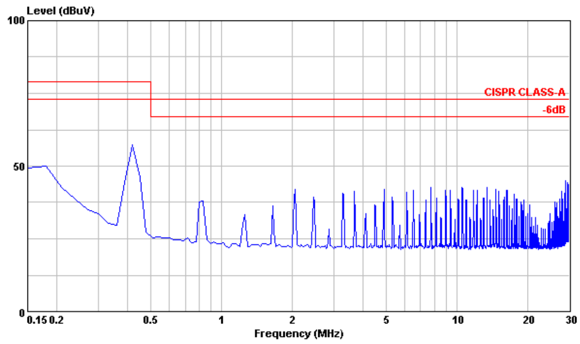
Derating Output Current versus Ambient Temperature and Airflow $V_{in} = V_{in\,nom}$



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

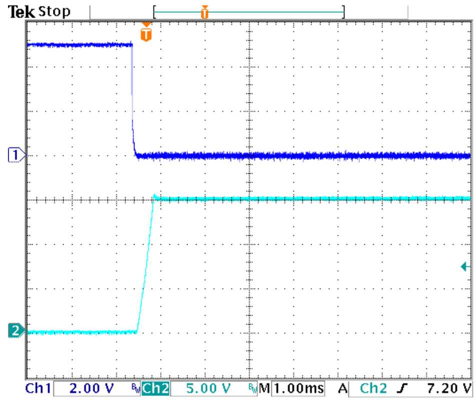
Characteristic Curves (Continued)

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



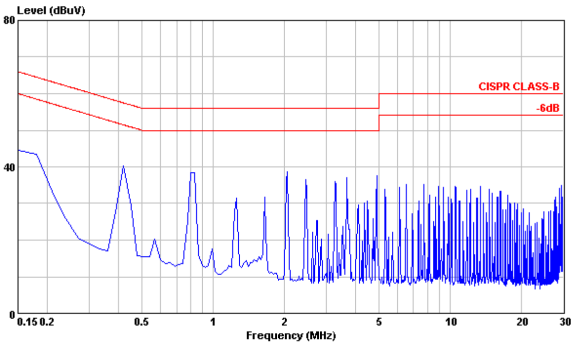
Conduction Emission of EN55022 Class A

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



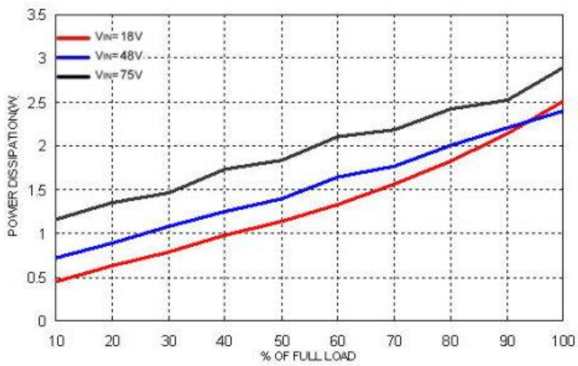
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic

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



Conduction Emission of EN55022 Class B

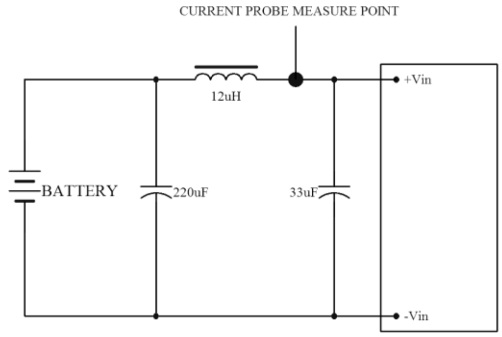
$V_{in} = V_{in\,nom}$; Full Load



Power Dissipation versus Output Current

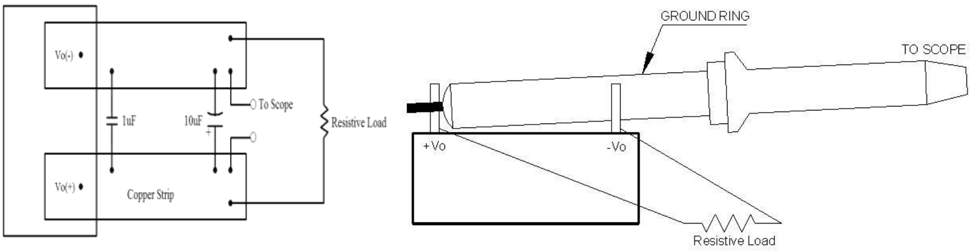
Testing Configurations

Input reflected-ripple current measurement test up

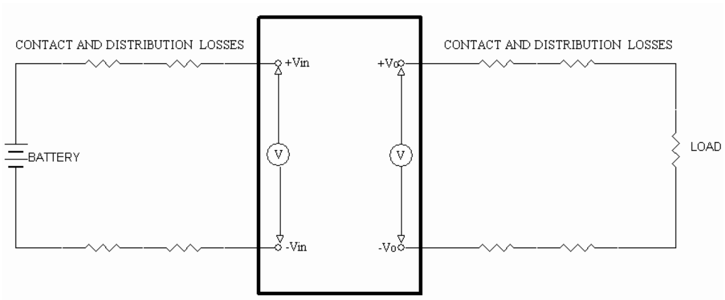


Component	Value	Voltage	Reference
L	12µH	----	----
C	220µF	100V	Aluminum Electrolytic Capacitor
C	33µF	100V	Aluminum Electrolytic Capacitor

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



Output voltage and efficiency measurement test up



Note: All measurements are taken at the module terminals.

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

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 C-L-C filter is recommended to minimize input reflected ripple current. The inductor is simulated source impedance of 12µH and capacitor is Nippon Chemi-con KZE series 220µF/100V&33µF/100V. The capacitor must as close as possible to the input terminals of the power module for lower impedance.

Output Over Current Protection

When excessive output currents occur in the system, circuit protection is required on all power supplies. Normally, overload current is maintained at approximately about 150 percent of rated current for TON 15-WI single output series.

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

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

Output Over Voltage Protection

The output over-voltage protection consists of a Zener diode that monitors the output voltage on the feedback loop. If the voltage on the output terminals exceeds the over-voltage protection threshold, then the Zener diode will send a current signal to the control IC to limiting the output voltage.

Output Voltage Adjustment

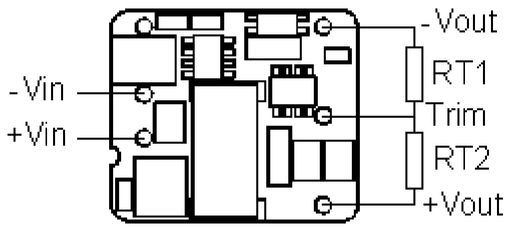
Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of a module. This is accomplished by connecting an external resistor between the TRIM pin and either the $+V_{out}$ or $-V_{out}$ pins. With an external resistor between the TRIM and $-V_{out}$ pin, the output voltage set point increases. With an external resistor between the TRIM and $+V_{out}$ pin, the output voltage set point decreases.

- **Trim up equation**

$$RT1 = \left[\frac{G \times L}{(Vo,up - L - K)} - H \right] \Omega$$

- **Trim down equation**

$$RT2 = \left[\frac{(Vo,down - L) \times G}{(Vo - Vo,down)} - H \right] \Omega$$



- **Trim constants**

Module	G	H	K	L
TON 15-xx10WI	**5110**	**2050**	**0.8**	**2.5**
TON 15-xx11WI	**5110**	**2050**	**2.5**	**2.5**
TON 15-xx12WI	**10000**	**5110**	**9.5**	**2.5**
TON 15-xx13WI	**10000**	**5110**	**12.5**	**2.5**

TRIM TABLE

TON 15-xx10WI

Trim up (%)	1	2	3	4	5	6	7	8	9	10
V_{OUT} (Volts) =	3.333	3.366	3.399	3.432	3.465	3.498	3.531	3.564	3.597	3.630
R_{T1} (KΩ) =	385.071	191.511	126.990	94.730	75.374	62.470	53.253	46.340	40.963	36.662
Trim down (%)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
V_{OUT} (Volts) =	3.267	3.234	3.201	3.168	3.135	3.102	3.069	3.036	3.003	2.970
R_{T2} (KΩ) =	116.719	54.779	34.133	23.810	17.616	13.486	10.537	8.325	6.604	5.228

TON 15-xx11WI

Trim up (%)	1	2	3	4	5	6	7	8	9	10
V_{OUT} (Volts) =	5.050	5.100	5.150	5.200	5.250	5.300	5.350	5.400	5.450	5.500
R_{T1} (KΩ) =	253.450	125.700	83.117	61.825	49.050	40.533	34.450	29.888	26.339	23.500
Trim down (%)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
V_{OUT} (Volts) =	4.950	4.900	4.850	4.800	4.750	4.700	4.650	4.600	4.550	4.500
R_{T2} (KΩ) =	248.340	120.590	78.007	56.715	43.940	35.423	29.340	24.778	21.229	18.390

TON 15-xx12WI

Trim up (%)	1	2	3	4	5	6	7	8	9	10
V_{OUT} (Volts) =	12.120	12.240	12.360	12.480	12.600	12.720	12.840	12.960	13.080	13.200
R_{T1} (KΩ) =	203.223	99.057	64.334	46.973	36.557	29.612	24.652	20.932	18.038	15.723
Trim down (%)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
V_{OUT} (Volts) =	11.880	11.760	11.640	11.520	11.400	11.280	11.160	11.040	10.920	10.800
R_{T2} (KΩ) =	776.557	380.723	248.779	182.807	143.223	116.834	97.985	83.848	72.853	64.057

TON 15-xx13WI

Trim up (%)	1	2	3	4	5	6	7	8	9	10
V_{OUT} (Volts) =	15.150	15.300	15.450	15.600	15.750	15.900	16.050	16.200	16.350	16.500
R_{T1} (KΩ) =	161.557	78.223	50.446	36.557	28.223	22.668	18.700	15.723	13.409	11.557
Trim down (%)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
V_{OUT} (Volts) =	14.850	14.700	14.550	14.400	14.250	14.100	13.950	13.800	13.650	13.500
R_{T2} (KΩ) =	818.223	401.557	262.668	193.223	151.557	123.779	103.938	89.057	77.483	68.223

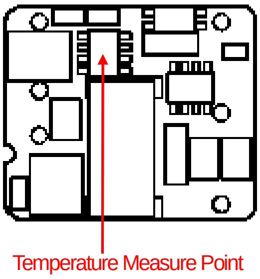
Short Circuitry Protection

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 can be safety in this condition.

Thermal Consideration

The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding Environment. Proper cooling can be verified by measuring the point as the figure below. The temperature at this location should not exceed 120°C. When Operating, adequate cooling must be provided to maintain the test point temperature at or below 120°C. Although the maximum point Temperature of the power modules is 120°C, you can limit this Temperature to a lower value for extremely high reliability.

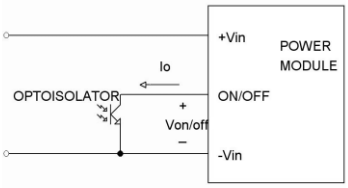


TOP VIEW

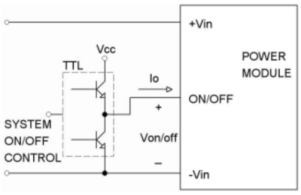
Remote ON/OFF Control

The Remote ON/OFF Pin is controlled DC/DC power module to turn on and off; the user must use a switch to control the logic voltage high or low level of the pin referenced to -V_{in}. The switch can be open collector transistor, FET and Photo-Couple. The switch must be capable of sinking up to 1 mA at low-level logic Voltage. High-level logic of the ON/OFF signal maximum voltage is allowable leakage current of the switch at 15V is 50µA.

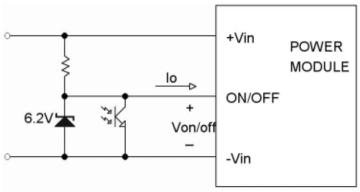
Remote ON/OFF Implementation Circuits



Isolated-Closure Remote ON/OFF

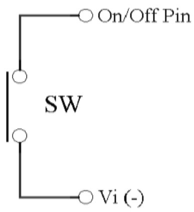


Level Control Using TTL Output

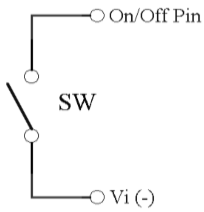


Level Control Using Line Voltage

There are two remote control options available, positive logic and negative logic.
a. The Positive logic structure turned on of the DC/DC module when the ON/OFF pin is at high-level logic and low-level logic is turned off it.

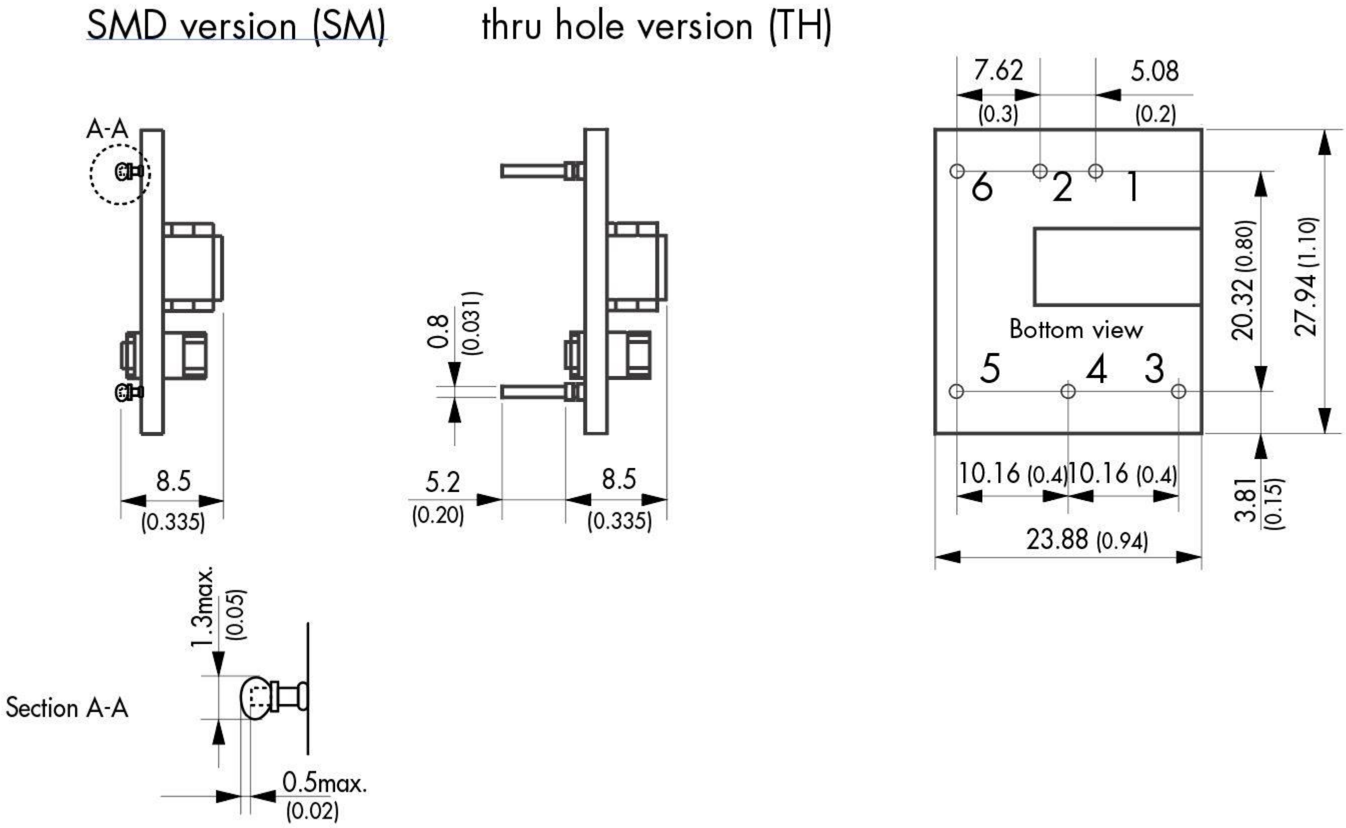


When TON 15-WI module is turned off at Low-level logic



When TON 15-WI module is turned on at High-level logic

Mechanical Data

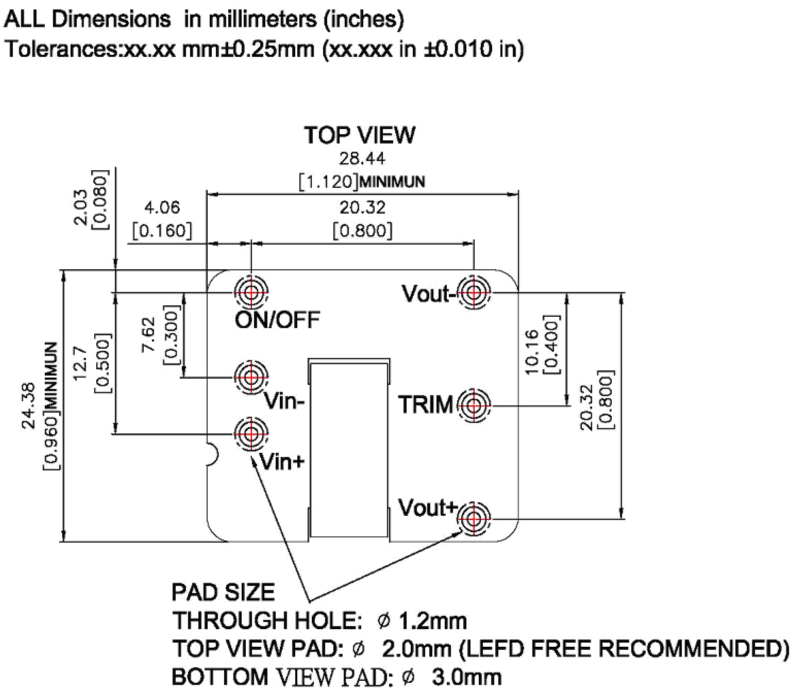


1. All dimensions in inches (mm)
2. Tolerance: x.xx ±0.02 (x.x ±0.5)
   x.xxx ±0.010 (x.xx ±0.25)
3. Pin pitch tolerance: ±0.014 (0.35)

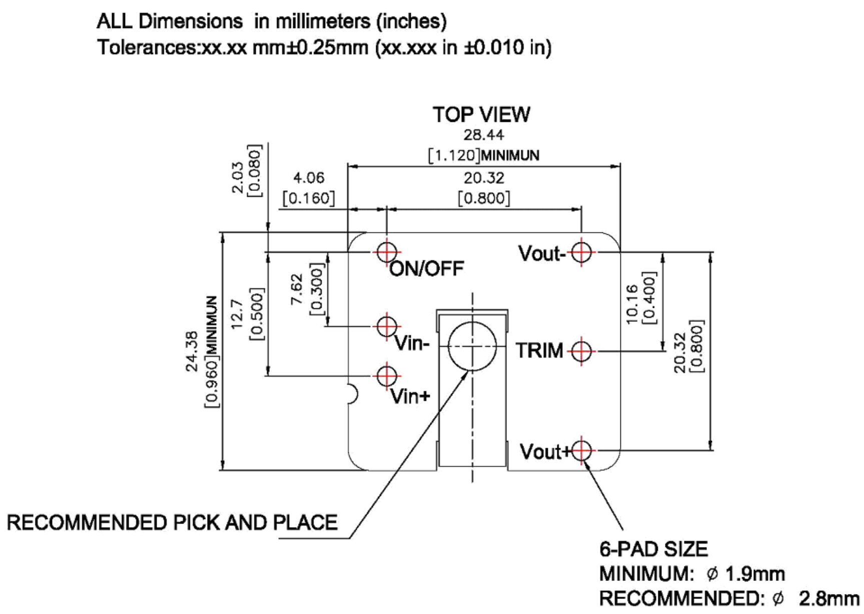
PIN CONNECTION	
PIN	TON 15-WI Series
1	+ INPUT
2	- INPUT
3	ON/OFF
4	+VOUT
5	TRIM
6	-VOUT

Recommended Pad Layout

Recommended pad layout for DIP type

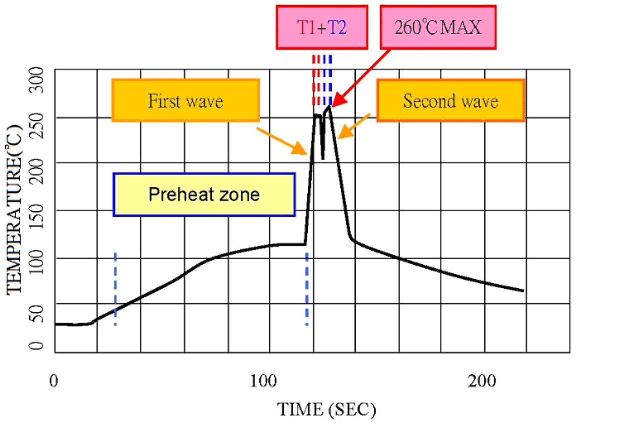


Recommended pad layout for SMD type



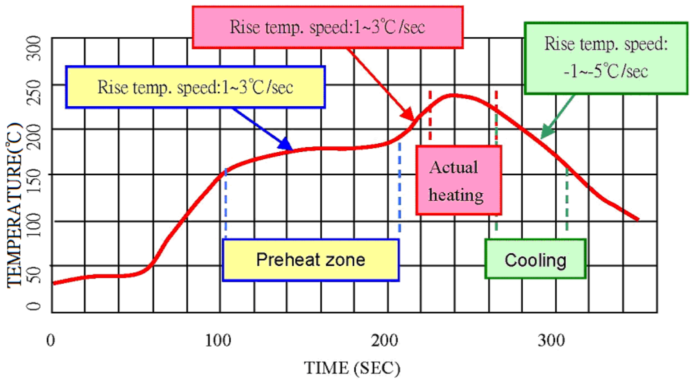
Soldering and Reflow Considerations

Lead free wave solder profile for DIP type



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

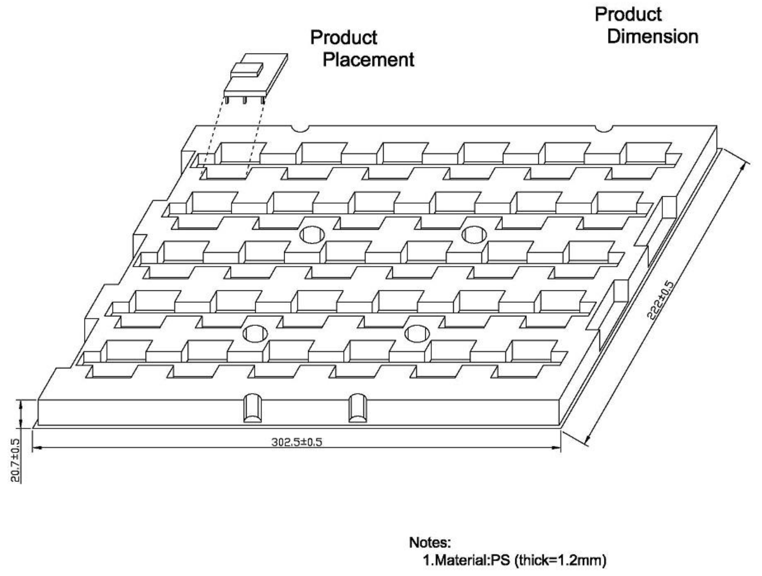
Lead free reflow profile for SMD type



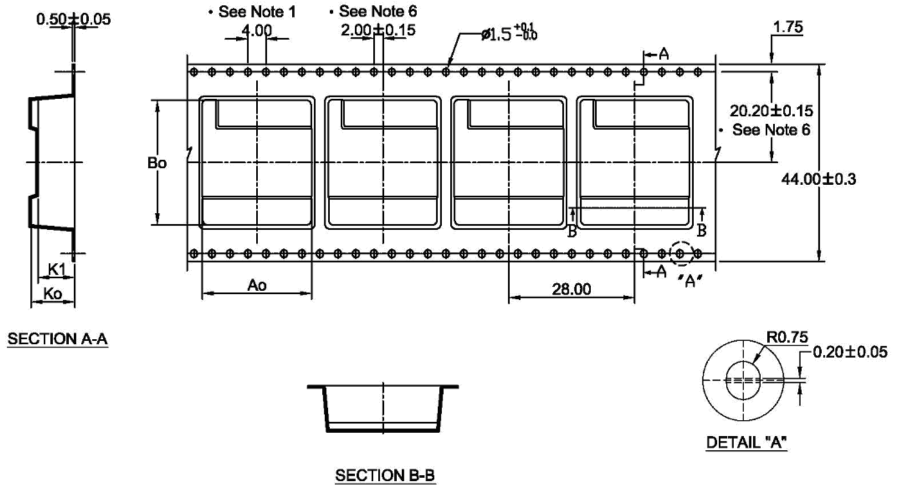
Zone	Reference Parameter	
Preheat zone	Rise temperature speed:	1 ~ 3°C/sec
	Preheat time:	60 ~ 90sec
	Preheat temperature:	155 ~ 185°C
Actual heating	Rise temperature speed:	1 ~ 3°C/sec
	Melting time:	20 ~ 40 sec Melting temperature: 220°C
	Peak temperature:	230 ~ 240°C
	Peak time:	10 ~ 20 sec
Cooling	Rise temperature speed:	-1 ~ -5°C/sec

Packaging Information

Packaging information for DIP type



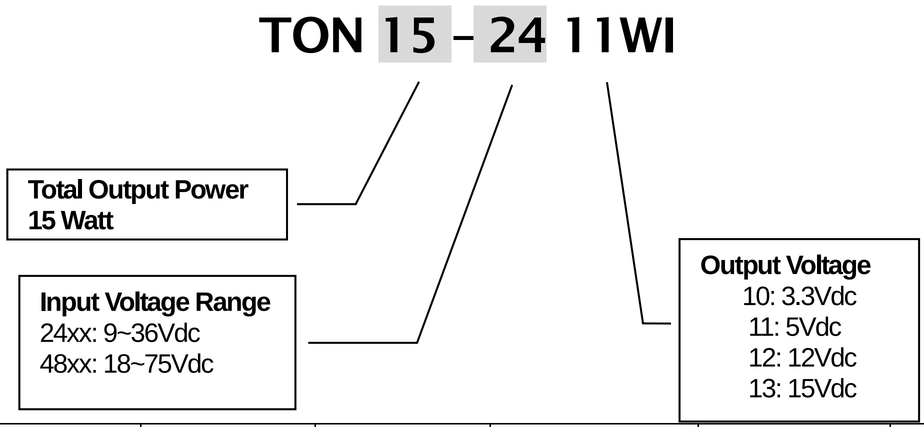
Packaging information for SMD type



Notes:
1. 10 sprocket hole pitch cumulative tolerance ± 0.2
2. Camber not to exceed 1mm in 100mm.
3. Material: Black Advantek Polystyrene.
4. Ao and Bo measured on a plane 0.3mm above the bottom of the pocket.
5. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier tape.
6. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

Ao=24.30mm
Bo=27.80mm
Ko= 9.70mm
K1= 8.20mm

Part Number Structure



Model Number	Input Range	Output Voltage	Output Current Full Load	Input Current Full Load [1]	Efficiency [2] (%)
TON 15-2410WI	9 - 36 Vdc	3.3 Vdc	4.0 A	688 mA	84
TON 15-2411WI	9 - 36 Vdc	5.0 Vdc	3.0 A	763 mA	86
TON 15-2412WI	9 - 36 Vdc	12.0 Vdc	1.3 A	803 mA	85
TON 15-2413WI	9 - 36 Vdc	15.0 Vdc	1.0 A	772 mA	85
TON 15-4810WI	18 - 75 Vdc	3.3 Vdc	4.0 A	340 mA	85
TON 15-4811WI	18 - 75 Vdc	5.0 Vdc	3.0 A	377 mA	87
TON 15-4812WI	18 - 75 Vdc	12.0 Vdc	1.3 A	392 mA	87
TON 15-4813WI	18 - 75 Vdc	15.0 Vdc	1.0 A	377 mA	87

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

Safety and Installation Instruction

Fusing Consideration

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

This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture. To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a normal-blow fuse with maximum rating of 3A for TON 15-24xxWI modules and 1.5A for TON 15-48xxWI modules. 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 TON 15-WI SERIES of DC/DC converters has been calculated according to

Bellcore TR-NWT-000332 Case I: 50% stress, Operating Temperature at 40°C (Ground fixed and controlled environment).

The resulting figure for MTBF is 1´322´000 hours.

MIL-HDBK 217F NOTICE2 FULL LOAD, Operating Temperature at 25°C. The resulting figure for MTBF is 514´700 hours.