TRACO POWER

TEP 150-WI Series

Application Note

DC/DC Converter 9 to 36Vdc or 18 to 75Vdc Input and 150 Watt Output Power
3.3Vdc to 48 Vdc Single Output

Pending

Complete TEP-150WI datasheet can be downloaded at:
http://www.tracopower.com/products/tep150wi.pdf

Features

- 200 watts maximum output power
- 4:1 wide input range
- High efficiency up to 88%
- Heat sinks available for extended operation temperature
- CV + CC mode
- No minimum load
- Adjustable output voltage
- Under-voltage lockout
- Input reverse protection
- Input to output basic Insulation
- Meet EN55022 class without external filter
- Six-sided metal shielding
- Wall mount application
- RoHS compliant

Options

- Remote on/off logic configuration

Applications

- Wireless Network
- Telecom/ Datacom
- Industry Control System
- Distributed Power Architectures
- Semiconductor Equipment
- Battery Charger

General Description

TEP 150WI series DC/DC converters provide up to 200 watts of output power. All model features a wide input range, adjustable output voltage and constant current mode output limit. The TEP 150WI Converters are especially suited to telecom, networking and industrial application.

Table of contents

Absolute Maximum Rating				
Parameter	**Device**	**Min**	**Max**	**Unit**
Input Voltage				
Continuous	TEP 150-24xxWI		40	Vdc
	TEP 150-48xxWI		80	Vdc
Transient (1000mS)	TEP 150-24xxWI		50	Vdc
	TEP 150-48xxWI		100	Vdc
Operating Ambient Temperature (with de-rating)	All	-40	85	°C
Storage Temperature	All	-55	125	°C
I/O Isolation Voltage	All	2250		Vdc

Output Specification					
Parameter	**Device**	**Min**	**Typ**	**Max**	**Unit**
Output Voltage					
($V_{in} = V_{in\,nom}$, $I_{out} = I_{out\,max}$, $T_A = 25°C$)	TEP 150-xx12WI	11.88	12	12.12	Vdc
	TEP 150-xx13WI	14.85	15	15.15	Vdc
	TEP 150-xx15WI	23.76	24	24.24	Vdc
	TEP 150-xx16WI	27.72	28	28.28	Vdc
	TEP 150-xx18WI	47.52	48	48.48	Vdc
Voltage Adjustability (see page 26)	All	0		+20	% V_{out}
Output Regulation					
Line ($V_{in\,min}$ to $V_{in\,max}$ at Full Load)	TEP 150-xx12WI			24	mV
	TEP 150-xx13WI			30	mV
	TEP 150-xx15WI			48	mV
	TEP 150-xx16WI			56	mV
	TEP 150-xx18WI			96	mV
Load (0% to 100% of Full Load)	TEP 150-xx12WI			48	mV
	TEP 150-xx13WI			60	mV
	TEP 150-xx15WI			96	mV
	TEP 150-xx16WI			112	mV
	TEP 150-xx18WI			192	mV
Output Ripple & Noise					
($V_{in} = V_{in\,nom}$, $I_{out} = I_{out\,max}$, $T_A = 25°C$).					
Peak-to-Peak (5Hz to 20MHz bandwidth)	TEP 150-xx12WI			100	$mV_{pk\text{-}pk}$
	TEP 150-xx13WI			100	$mV_{pk\text{-}pk}$
	TEP 150-xx15WI			200	$mV_{pk\text{-}pk}$
	TEP 150-xx16WI			200	$mV_{pk\text{-}pk}$
	TEP 150-xx18WI			350	$mV_{pk\text{-}pk}$
Temperature Coefficient	All	-0.02		+0.02	%/°C
Output Voltage Overshoot ($V_{in} = V_{in\,min}$ to $V_{in\,max}$; $I_{out} = I_{out\,max}$, $T_A = 25°C$).	All		0	5	% V_{out}
Dynamic Load Response					
($\Delta I_{out} / \Delta t = 1A/10\mu S$; $V_{in} = V_{in\,nom}$; $T_A = 25°C$)					
Load step change between 75% to 100% of $I_{out\,max}$					
Peak Deviation	TEP 150-xx12WI		900		mV
	TEP 150-xx13WI		900		mV
	TEP 150-xx15WI		1400		mV
	TEP 150-xx16WI		1400		mV
	TEP 150-xx18WI		1400		mV
Setting Time (V_{out} < 10% peak deviation)	All		200		µS

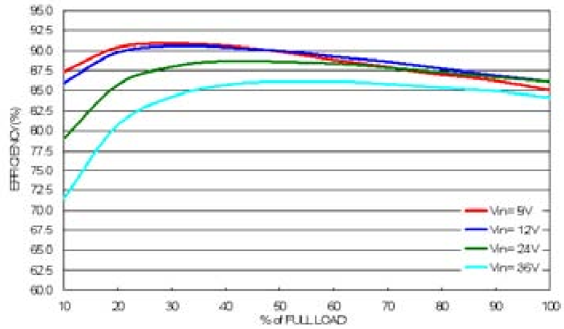
Output Specification (continued)					
Parameter	**Device**	**Min**	**Typ**	**Max**	**Unit**
Output Current	TEP 150-xx12WI	0		12.5	A
	TEP 150-xx13WI	0		10.0	A
	TEP 150-xx15WI	0		6.3	A
	TEP 150-xx16WI	0		5.4	A
	TEP 150-xx18WI	0		3.2	A
Output Over Voltage Protection	TEP 150-xx12WI	15.00		16.80	Vdc
(Non-latch Hiccup)	TEP 150-xx13WI	18.75		21.00	Vdc
	TEP 150-xx15WI	30.00		33.60	Vdc
	TEP 150-xx16WI	35.00		39.20	Vdc
	TEP 150-xx18WI	60.00		67.20	Vdc
Output Over Current Protection (CC Mode)	All	105	110	120	% I_{out}

Input Specification					
Parameter	**Device**	**Min**	**Typ**	**Max**	**Unit**
Operating Input Voltage	TEP 150-24xxWI	9	24	36	Vdc
	TEP 150-48xxWI	18	48	75	Vdc
Input Current	TEP 150-2412WI			7.53	A
(Maximum value at $V_{in} = V_{in\,nom}$, $I_{out} = I_{out\,max}$)	TEP 150-2413WI			7.53	A
	TEP 150-2415WI			7.50	A
	TEP 150-2416WI			7.50	A
	TEP 150-2418WI			7.71	A
	TEP 150-4812WI			3.72	A
	TEP 150-4813WI			3.72	A
	TEP 150-4815WI			3.71	A
	TEP 150-4816WI			3.71	A
	TEP 150-4818WI			3.81	A
Input reflected ripple current (see page 25)	TEP 150-24xxWI		100		mA_{pk-pk}
(5 to 20MHz,)	TEP 150-48xxWI		150		mA_{pk-pk}
Start Up Time	All				
(Vin = Vin(nom) and constant resistive load)					
Power up			25		mS
Remote ON/OFF			25		mS
Remote ON/OFF (see page 29)	All				
(The On/Off pin voltage is referenced to $-V_{IN}$)					
Positive logic (Standard): Device code without Suffix					
DC-DC ON (Open)		3		12	Vdc
DC-DC OFF (Short)		0		1.2	Vdc
Negative logic (Option): Device code with Suffix "-N"					
DC-DC ON (Short)		0		1.2	Vdc
DC-DC OFF (Open)		3		12	Vdc
Remote Off Input Current			3.5		mA
Input Current of Remote Control Pin		-0.5		1.0	mA
Under Voltage Lockout Turn-on Threshold	TEP 150-24xxWI		8.8		Vdc
	TEP 150-48xxWI		17.6		Vdc
Under Voltage Lockout Turn-off Threshold	TEP 150-24xxWI		8.2		Vdc
	TEP 150-48xxWI		16.2		Vdc

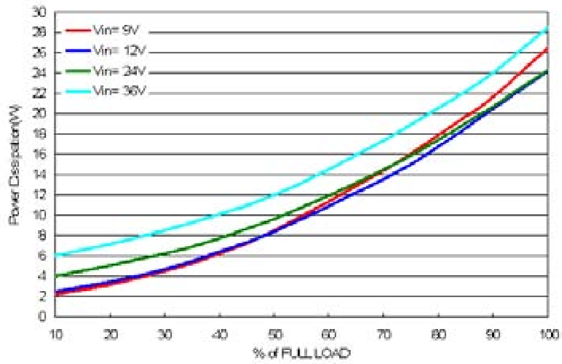
General Specification					
Parameter	**Device**	**Min**	**Typ**	**Max**	**Unit**
Efficiency	TEP 150-2412WI		86		%
($V_{in} = V_{in\ nom}$, $I_{out} = I_{out\ max}$, $T_A = 25°C$)	TEP 150-2413WI		86		%
	TEP 150-2415WI		87		%
	TEP 150-2416WI		87		%
	TEP 150-2418WI		86		%
	TEP 150-4812WI		87		%
	TEP 150-4813WI		87		%
	TEP 150-4815WI		88		%
	TEP 150-4816WI		88		%
	TEP 150-4818WI		87		%
Isolation voltage (for 60 seconds)	All				
Input to Output		2250			Vdc
Input to Case		1600			Vdc
Output to Case		1600			Vdc
Isolation resistance	All	1			GΩ
Isolation capacitance	All			3500	pF
Switching Frequency	TEP 150-xx12WI TEP 150-xx13WI TEP 150-xx15WI TEP 150-xx16WI		300		KHz
	TEP 150-xx18WI		275		
Weight	TEP 150-xxxxWI		225		g
MTBF					
Bellcore TR-NWT-000332, $T_C = 40°C$,	All		1’525’000		hours
MIL-HDBK-217F			135’300		hours
Over Temperature Protection (see page 28)	All		110		°C

Characteristic Curves

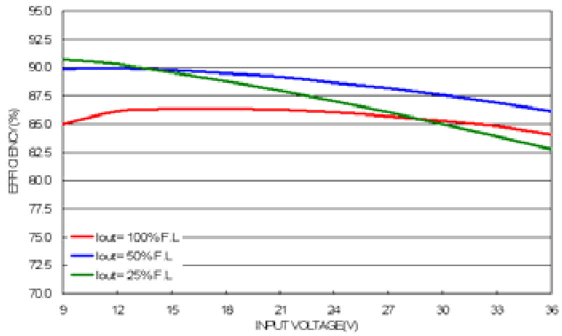
All test conditions are at 25°C. The figures are identical for TEP 150-2412WI



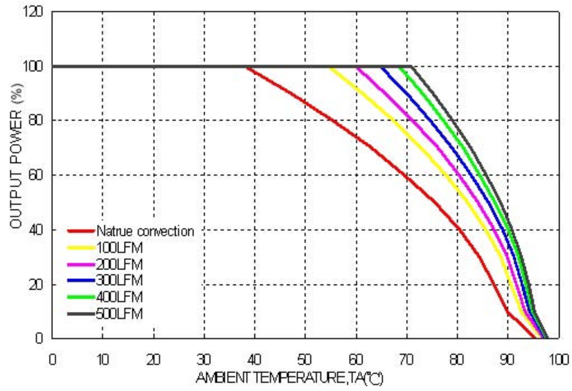
Efficiency versus Output Current



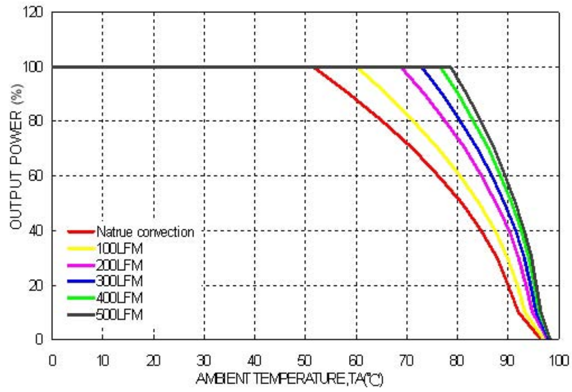
Power Dissipation versus Output Current



Efficiency versus Input Voltage. Full Load



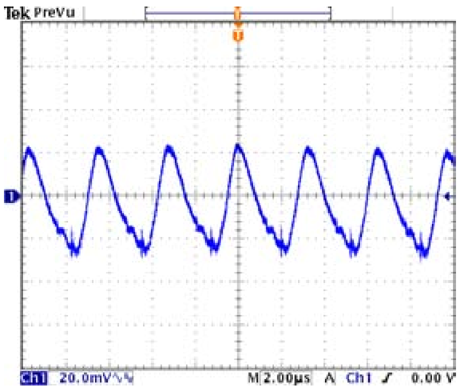
Derating Output Current versus Ambient Temperature
with iron Base plate and Airflow , $V_{in} = V_{in\,nom}$
(The base-plate dimension is 19" * 3.5" * 0.63".
The height is EIA standard 2U.)



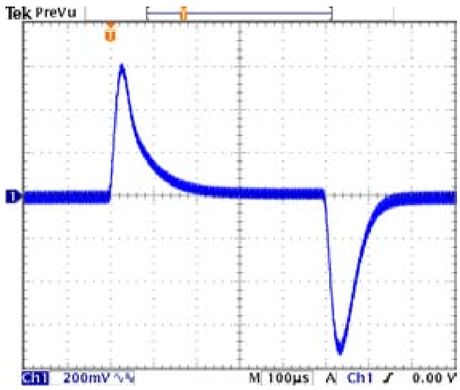
Derating Output Current Versus Ambient Temperature
with iron Base plate , Heat-Sink and Airflow , $V_{in} = V_{in\,nom}$
(The base-plate dimension is 19" * 3.5" * 0.63".
The height is EIA standard 2U.)

Characteristic Curves (Continued)

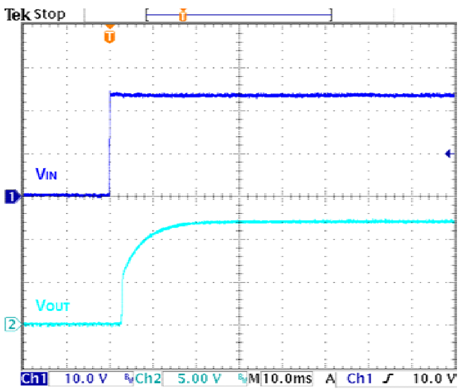
All test conditions are at 25°C. The figures are identical for TEEP 150-2412WI



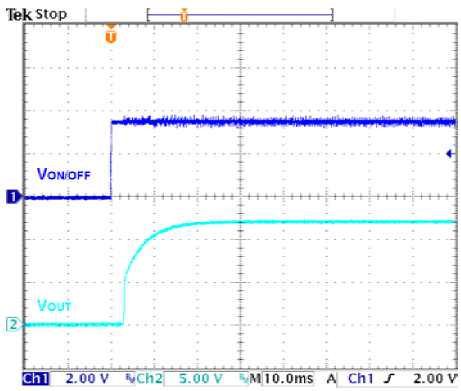
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



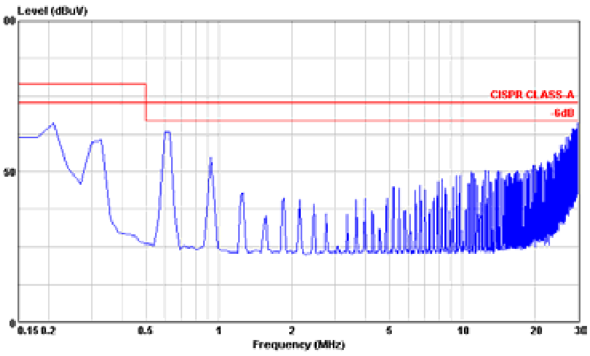
Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



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



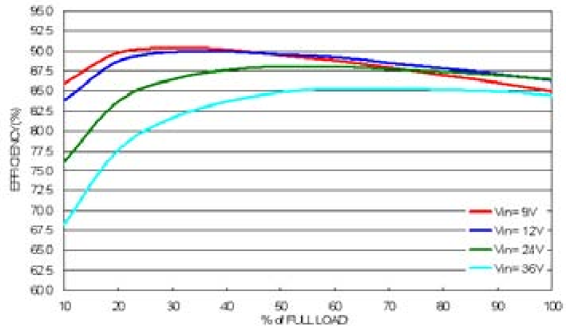
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



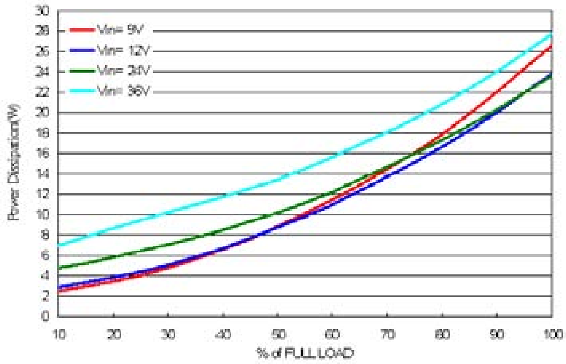
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves (Continued)

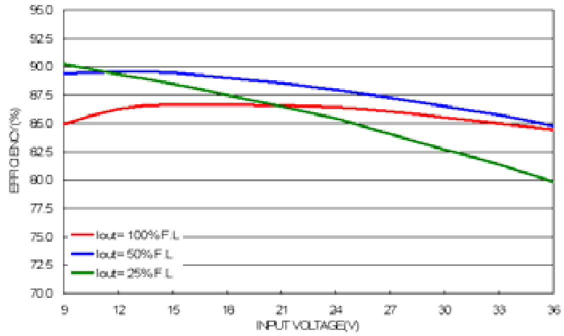
All test conditions are at 25°C. The figures are identical for TEP 150-2413WI



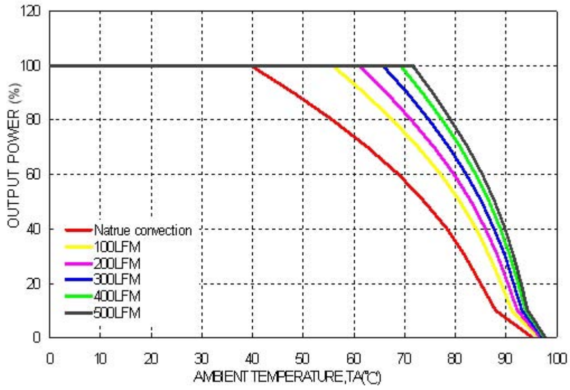
Efficiency versus Output Current



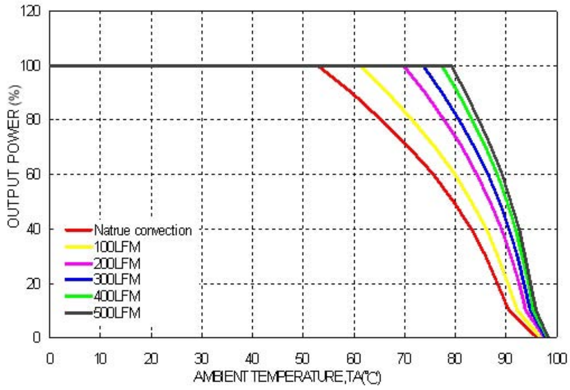
Power Dissipation versus Output Current



Efficiency versus Input Voltage. Full Load



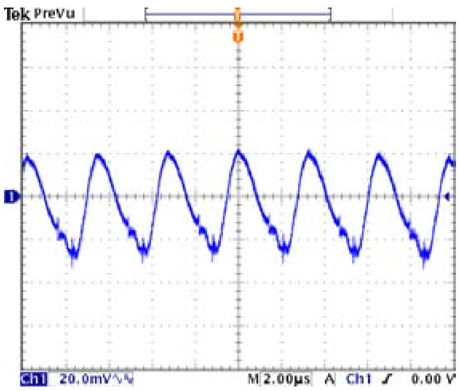
Derating Output Current versus Ambient Temperature with iron Base plate and Airflow , $V_{in} = V_{in\ nom}$ (The base-plate dimension is 19" * 3.5" * 0.63". The height is EIA standard 2U.)



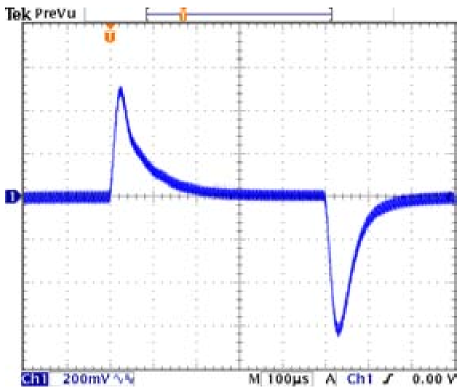
Derating Output Current Versus Ambient Temperature with iron Base plate , Heat-Sink and Airflow , $V_{in} = V_{in\ nom}$ (The base-plate dimension is 19" * 3.5" * 0.63". The height is EIA standard 2U.)

Characteristic Curves (Continued)

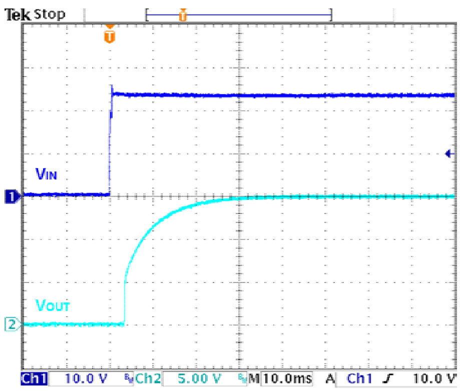
All test conditions are at 25°C. The figures are identical for TEP 150-2413WI



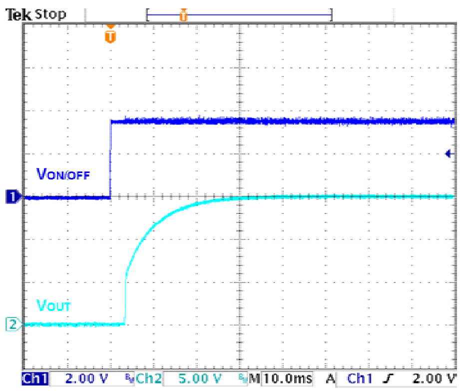
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



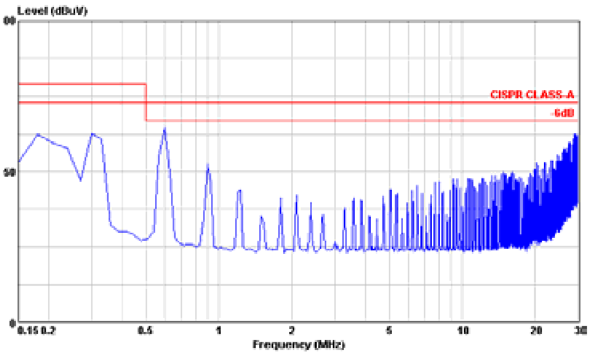
Transient Response to Dynamic Load Change from
100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



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



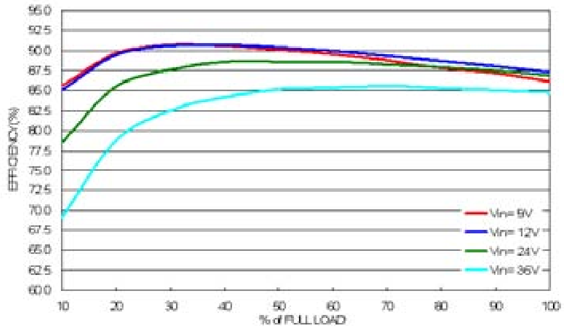
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



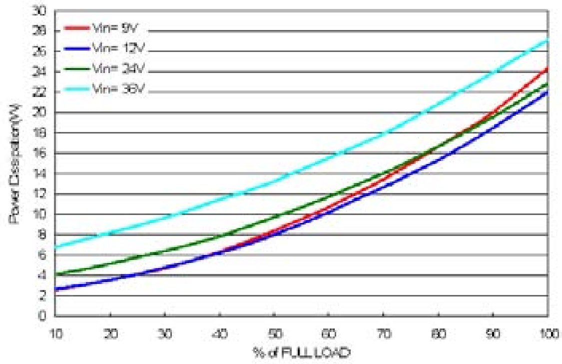
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves (Continued)

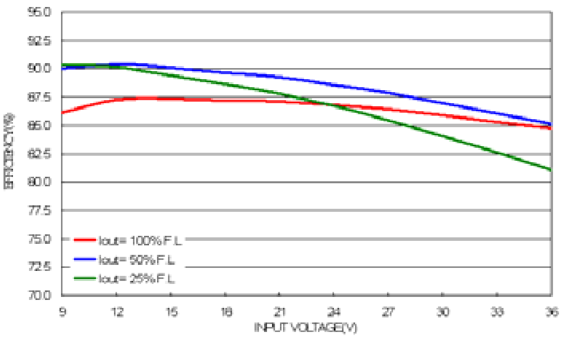
All test conditions are at 25°C. The figures are identical for TEP 150-2415WI



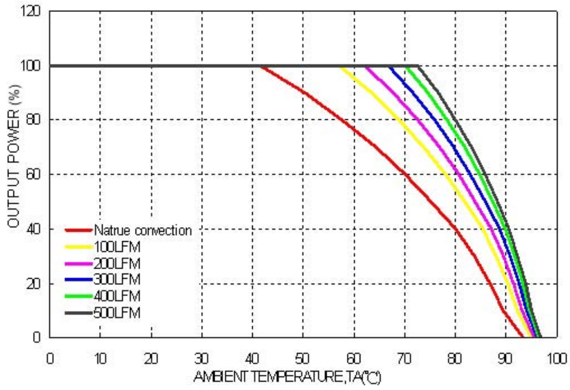
Efficiency versus Output Current



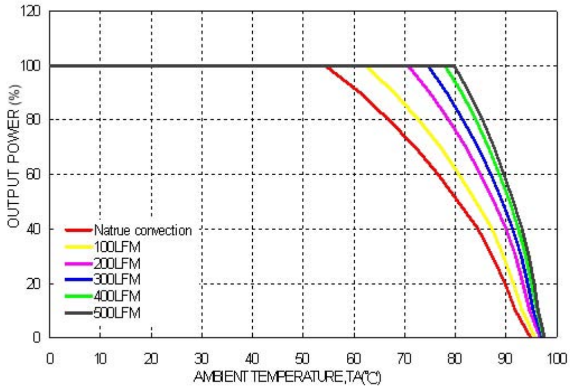
Power Dissipation versus Output Current



Efficiency versus Input Voltage. Full Load



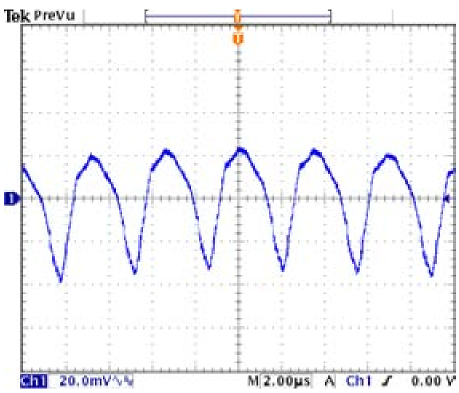
Derating Output Current versus Ambient Temperature with iron Base plate and Airflow , $V_{in} = V_{in\,nom}$
(The base-plate dimension is 19” * 3.5” * 0.63”.
The height is EIA standard 2U.)



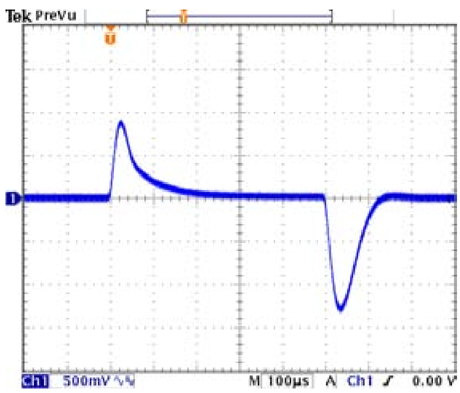
Derating Output Current Versus Ambient Temperature with iron Base plate , Heat-Sink and Airflow , $V_{in} = V_{in\,nom}$
(The base-plate dimension is 19” * 3.5” * 0.63”.
The height is EIA standard 2U.)

Characteristic Curves (Continued)

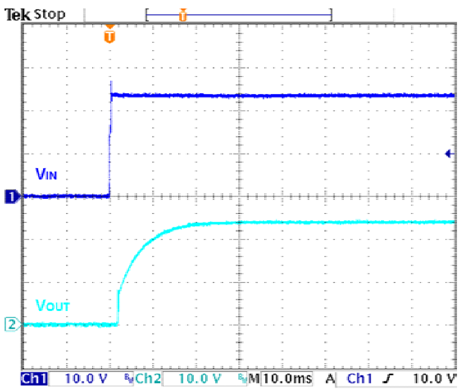
All test conditions are at 25°C. The figures are identical for TEP 150-2415WI



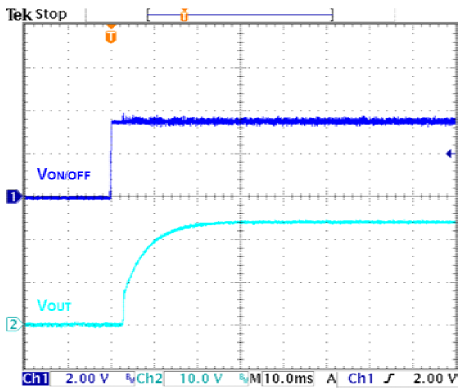
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



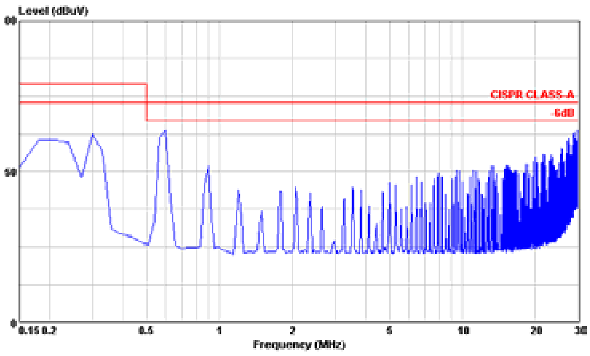
Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



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



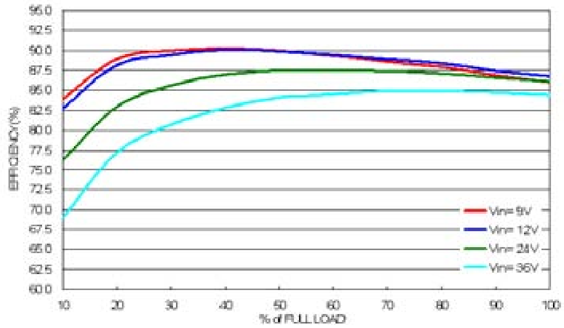
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



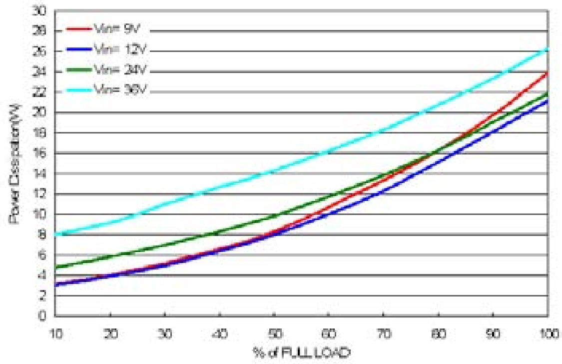
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves (Continued)

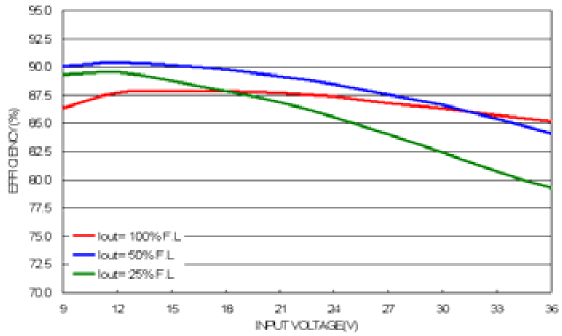
All test conditions are at 25°C. The figures are identical for TEP 150-2416WI



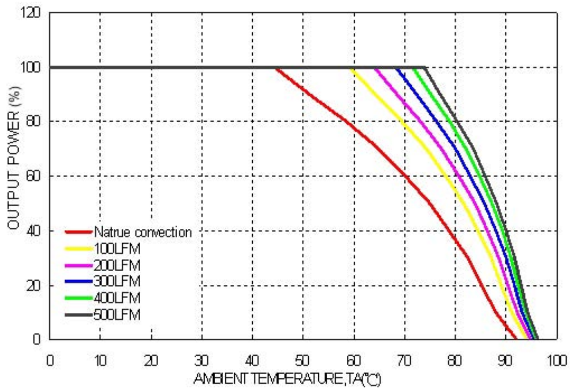
Efficiency versus Output Current



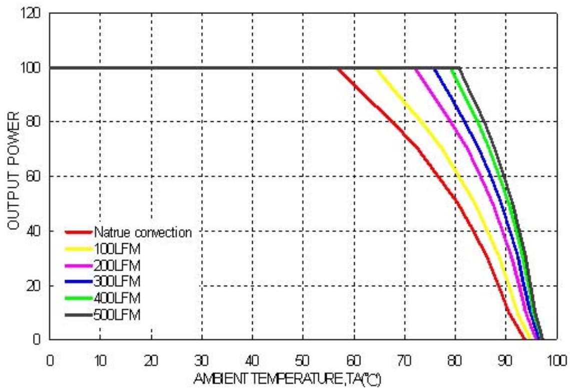
Power Dissipation versus Output Current



Efficiency versus Input Voltage. Full Load



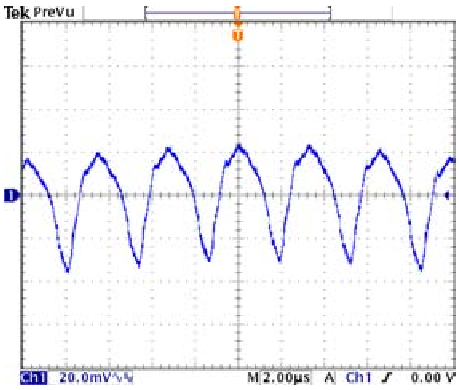
Derating Output Current versus Ambient Temperature with iron Base plate and Airflow , $V_{in} = V_{in\ nom}$ (The base-plate dimension is 19” * 3.5” * 0.63”. The height is EIA standard 2U.)



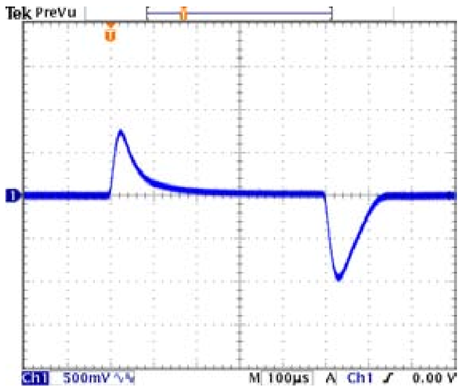
Derating Output Current Versus Ambient Temperature with iron Base plate , Heat-Sink and Airflow , $V_{in} = V_{in\ nom}$ (The base-plate dimension is 19” * 3.5” * 0.63”. The height is EIA standard 2U.)

Characteristic Curves (Continued)

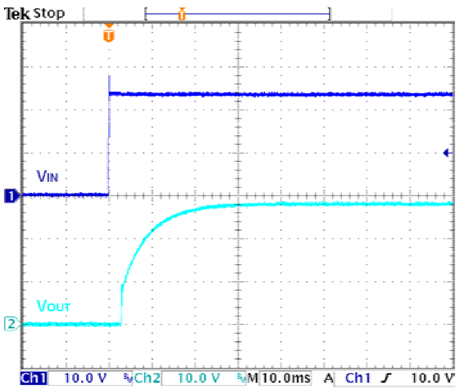
All test conditions are at 25°C. The figures are identical for TEP 150-2416WI



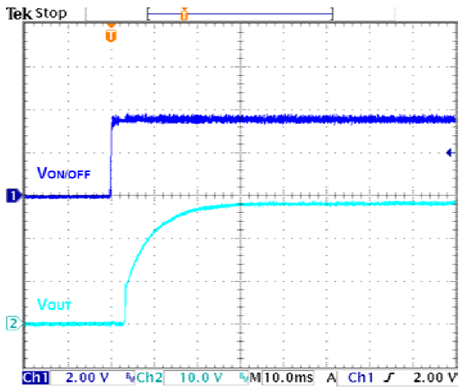
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



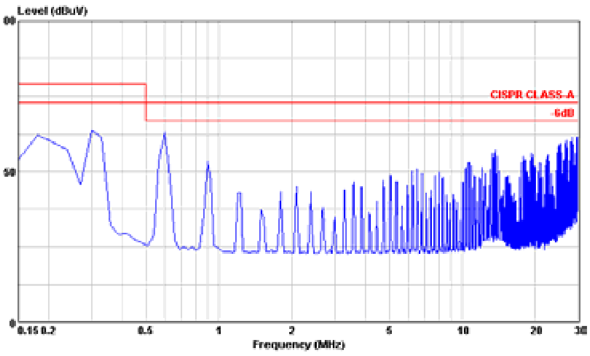
Transient Response to Dynamic Load Change from
100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



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



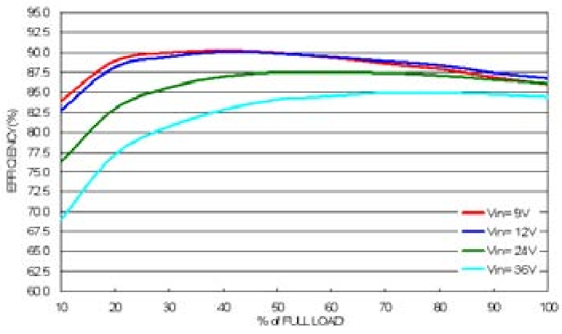
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



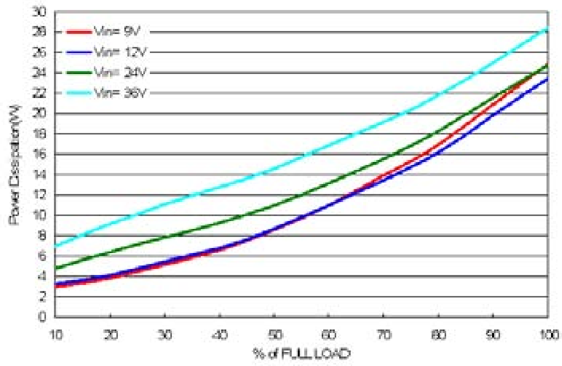
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves (Continued)

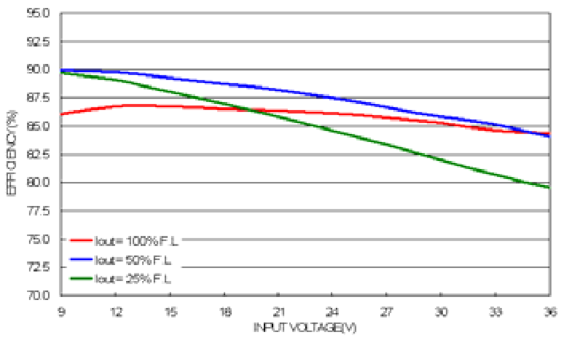
All test conditions are at 25°C. The figures are identical for TEP 150-2418WI



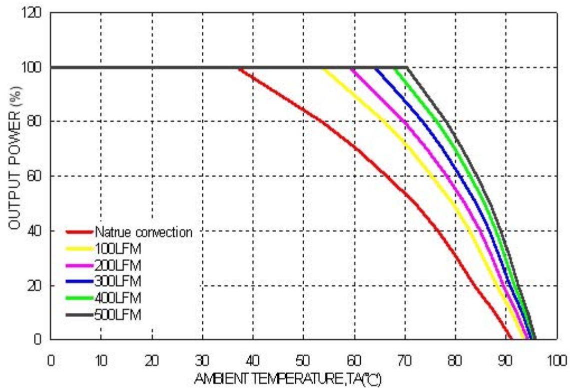
Efficiency versus Output Current



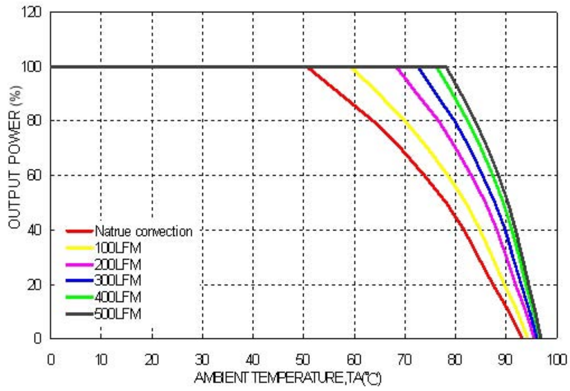
Power Dissipation versus Output Current



Efficiency versus Input Voltage. Full Load



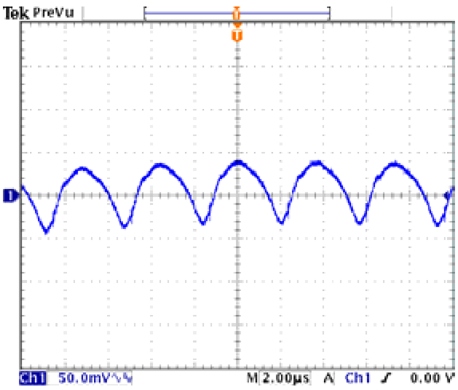
Derating Output Current versus Ambient Temperature with iron Base plate and Airflow , $V_{in} = V_{in\ nom}$
(The base-plate dimension is 19" * 3.5" * 0.63".
The height is EIA standard 2U.)



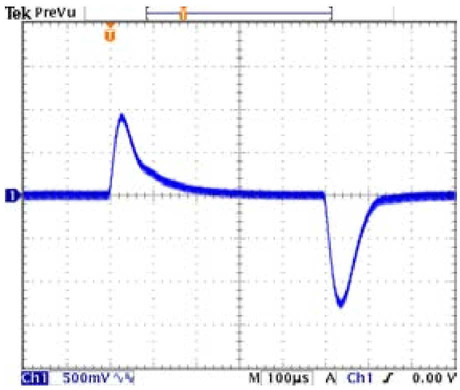
Derating Output Current Versus Ambient Temperature with iron Base plate , Heat-Sink and Airflow , $V_{in} = V_{in\ nom}$
(The base-plate dimension is 19" * 3.5" * 0.63".
The height is EIA standard 2U.)

Characteristic Curves (Continued)

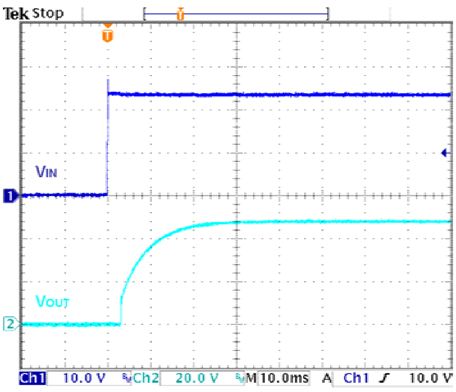
All test conditions are at 25°C. The figures are identical for TEP 150-2418WI



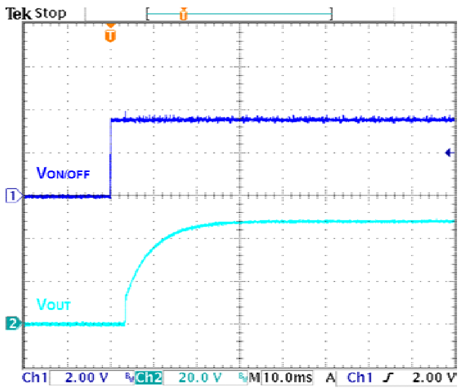
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$, Full Load



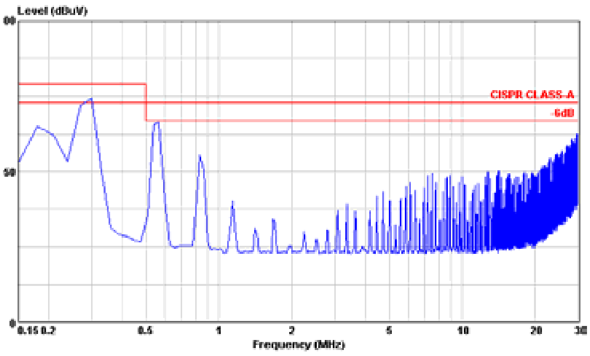
Transient Response to Dynamic Load Change from
100% to 75% to 100% of Full Load ; $V_{in} = V_{in\ nom}$



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



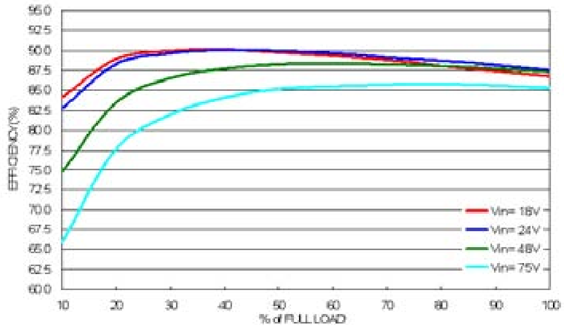
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\ nom}$, Full Load



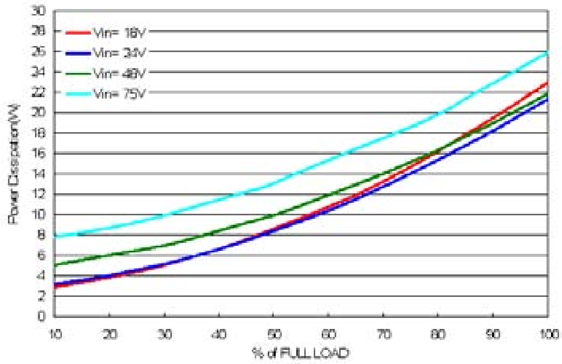
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$, Full Load

Characteristic Curves (Continued)

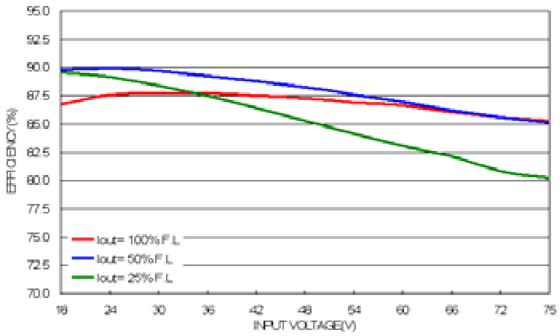
All test conditions are at 25°C. The figures are identical for TEP 150-4812WI



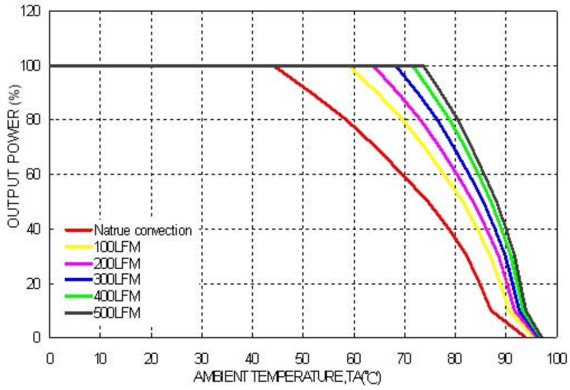
Efficiency versus Output Current



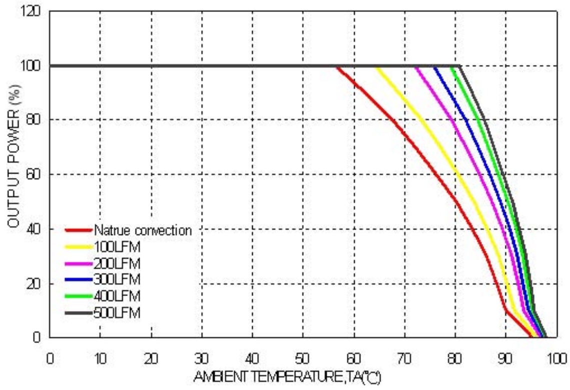
Power Dissipation versus Output Current



Efficiency versus Input Voltage. Full Load



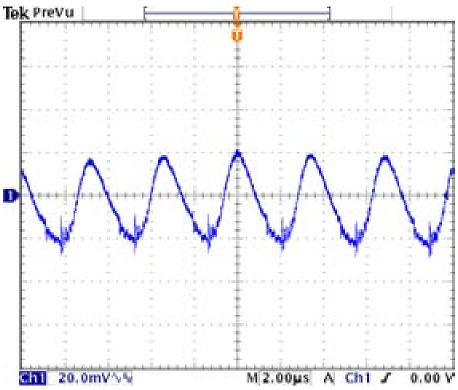
Derating Output Current versus Ambient Temperature with iron Base plate and Airflow , $V_{in} = V_{in\ nom}$
(The base-plate dimension is 19" * 3.5" * 0.63".
The height is EIA standard 2U.)



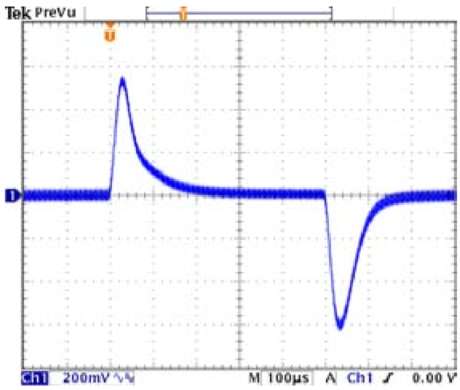
Derating Output Current Versus Ambient Temperature with iron Base plate , Heat-Sink and Airflow , $V_{in} = V_{in\ nom}$
(The base-plate dimension is 19" * 3.5" * 0.63".
The height is EIA standard 2U.)

Characteristic Curves (Continued)

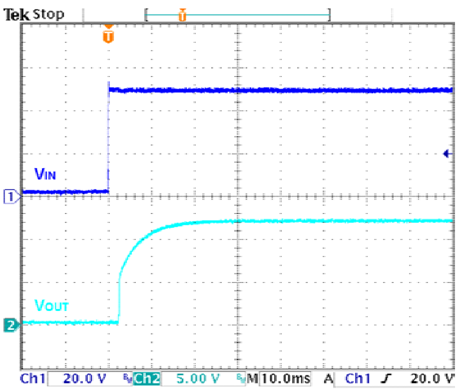
All test conditions are at 25°C. The figures are identical for TEP 150-4812WI



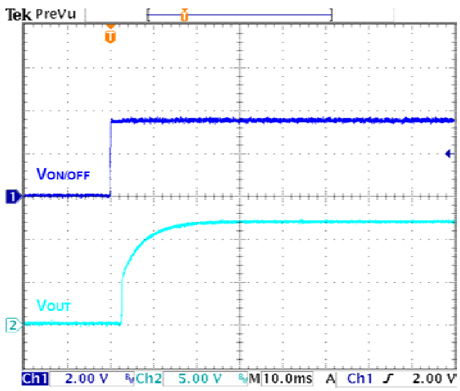
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$, Full Load



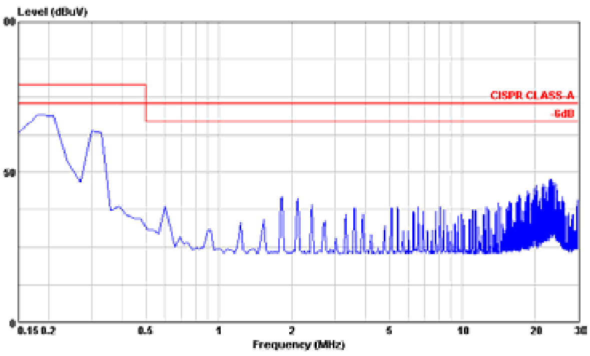
Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\ nom}$



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



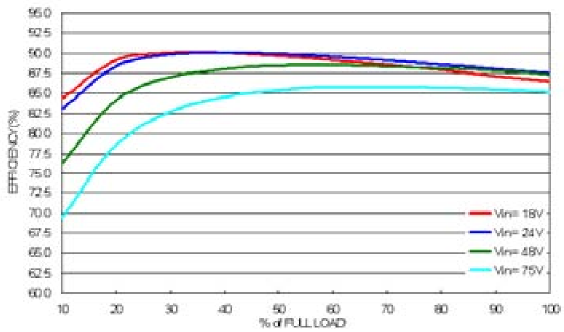
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\ nom}$, Full Load



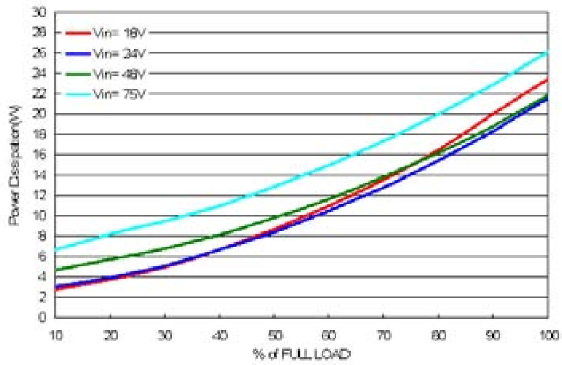
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$, Full Load

Characteristic Curves (Continued)

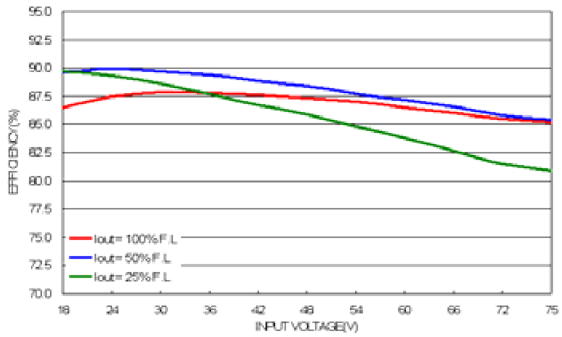
All test conditions are at 25°C. The figures are identical for TEP 150-4813WI



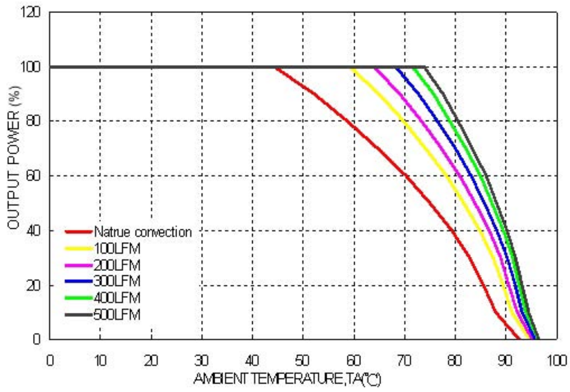
Efficiency versus Output Current



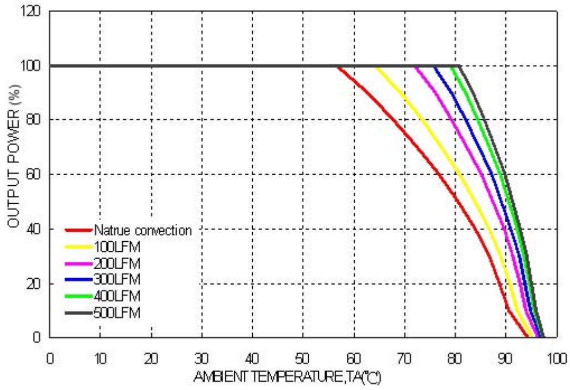
Power Dissipation versus Output Current



Efficiency versus Input Voltage. Full Load



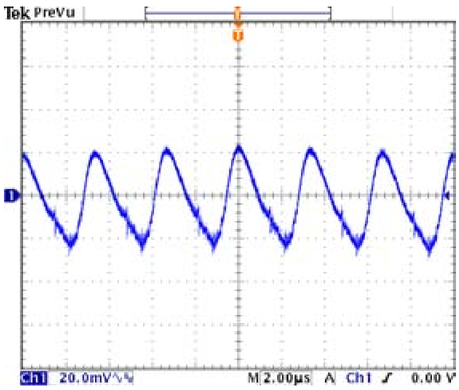
Derating Output Current versus Ambient Temperature with iron Base plate and Airflow , $V_{in} = V_{in\ nom}$ (The base-plate dimension is 19" * 3.5" * 0.63". The height is EIA standard 2U.)



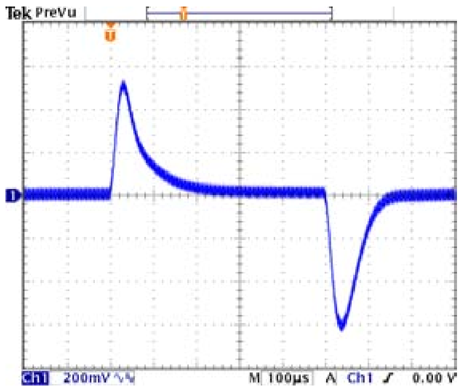
Derating Output Current Versus Ambient Temperature with iron Base plate , Heat-Sink and Airflow , $V_{in} = V_{in\ nom}$ (The base-plate dimension is 19" * 3.5" * 0.63". The height is EIA standard 2U.)

Characteristic Curves (Continued)

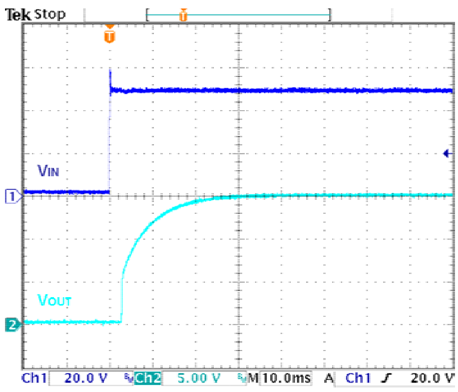
All test conditions are at 25°C. The figures are identical for TEP 150-4813WI



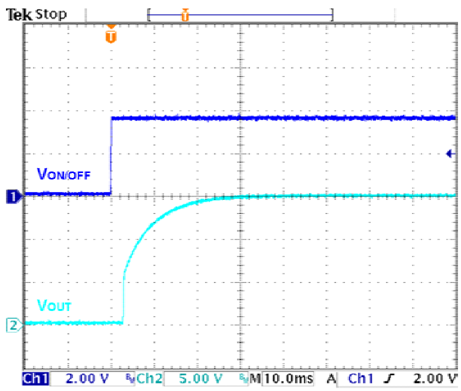
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



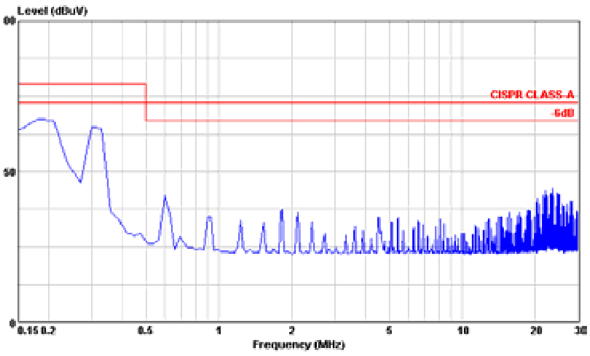
Transient Response to Dynamic Load Change from
100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



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



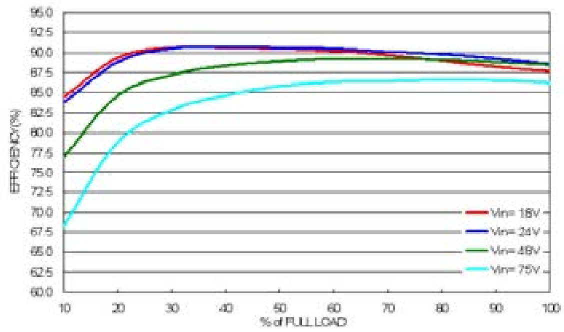
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



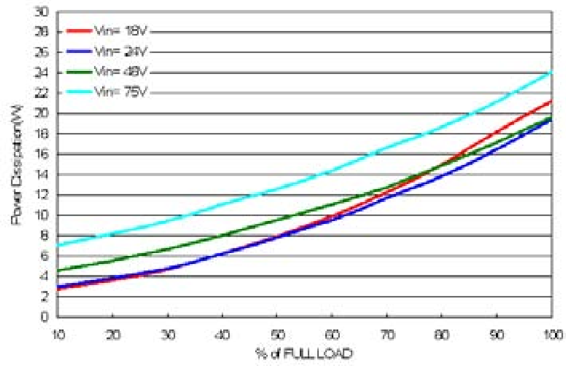
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves (Continued)

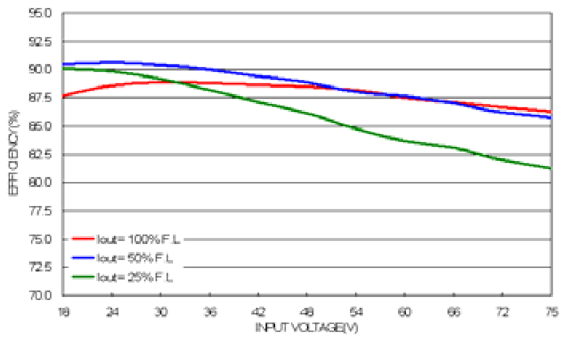
All test conditions are at 25°C. The figures are identical for TEP 150-4815WI



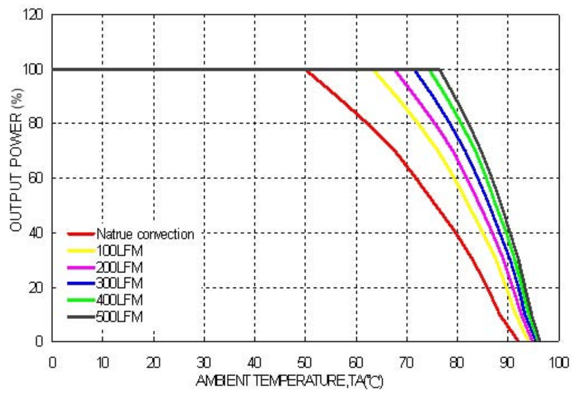
Efficiency versus Output Current



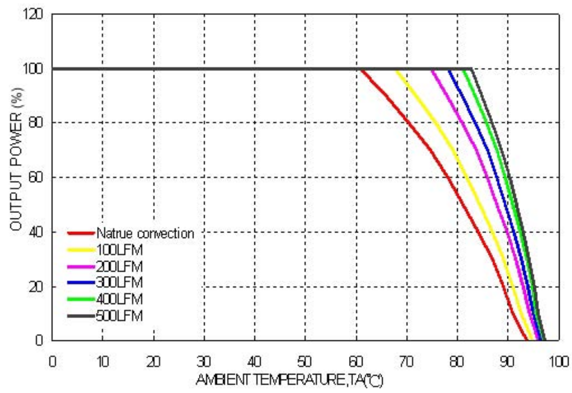
Power Dissipation versus Output Current



Efficiency versus Input Voltage. Full Load



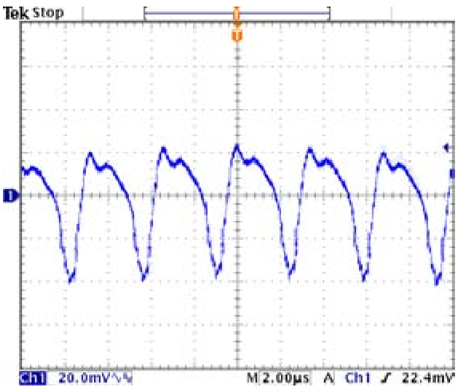
Derating Output Current versus Ambient Temperature with iron Base plate and Airflow , $V_{in} = V_{in\ nom}$
(The base-plate dimension is 19" * 3.5" * 0.63".
The height is EIA standard 2U.)



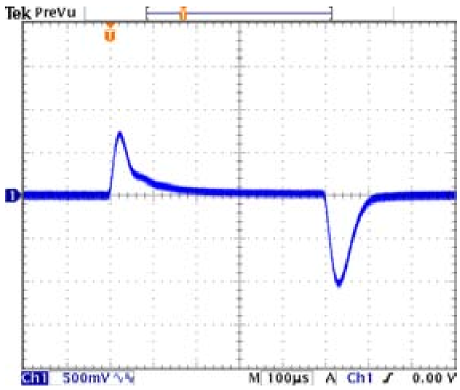
Derating Output Current Versus Ambient Temperature with iron Base plate , Heat-Sink and Airflow , $V_{in} = V_{in\ nom}$
(The base-plate dimension is 19" * 3.5" * 0.63".
The height is EIA standard 2U.)

Characteristic Curves (Continued)

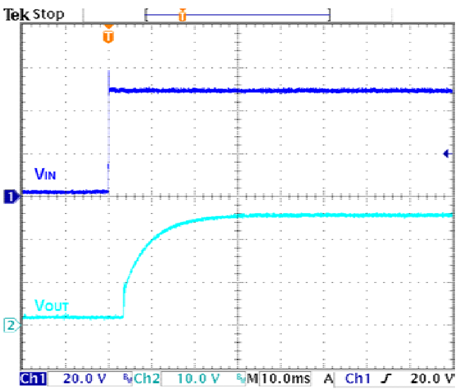
All test conditions are at 25°C. The figures are identical for TEP 150-4815WI



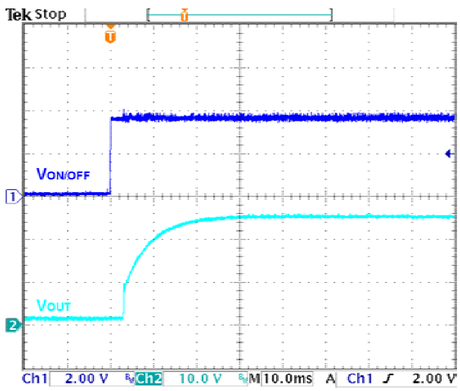
Typical Output Ripple and Noise.
$V_{in} = V_{in\,nom}$, Full Load



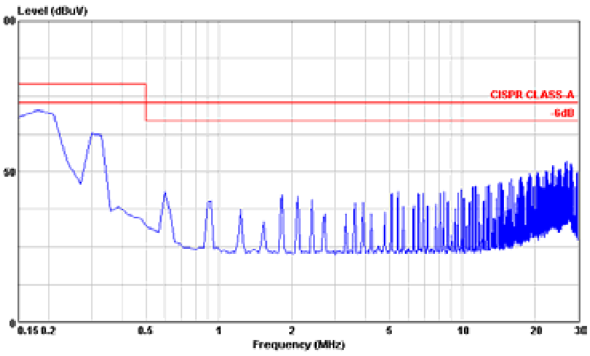
Transient Response to Dynamic Load Change from
100% to 75% to 100% of Full Load ; $V_{in} = V_{in\,nom}$



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



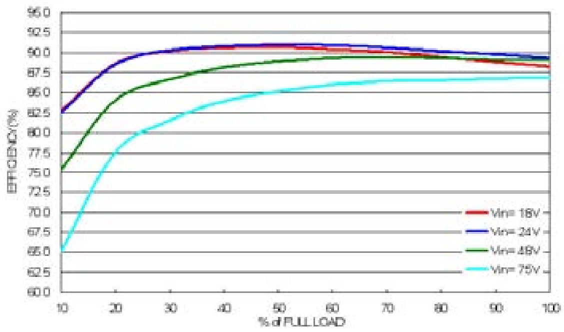
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\,nom}$, Full Load



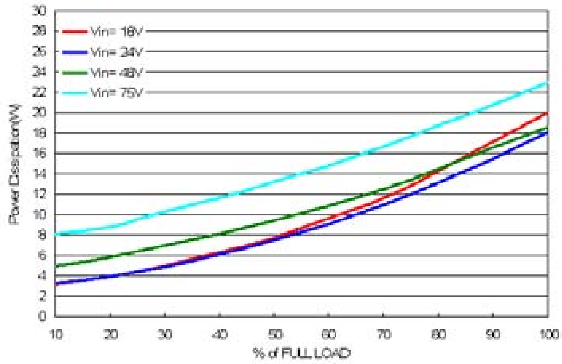
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\,nom}$, Full Load

Characteristic Curves (Continued)

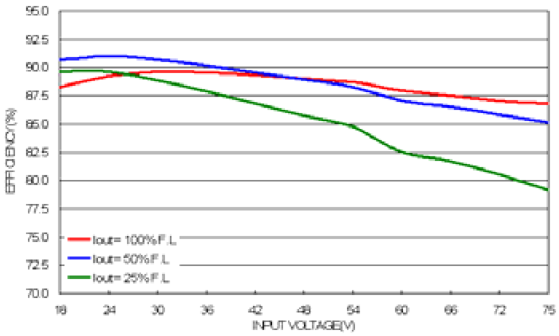
All test conditions are at 25°C. The figures are identical for TEP 150-4816WI



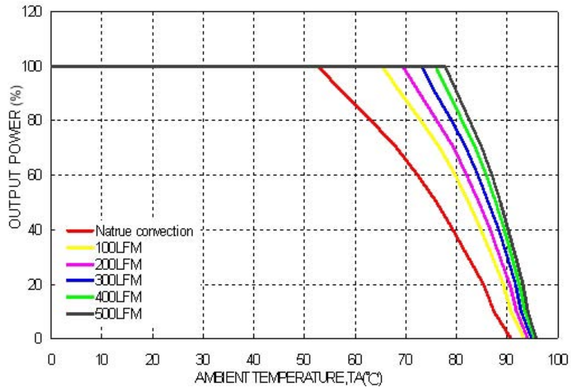
Efficiency versus Output Current



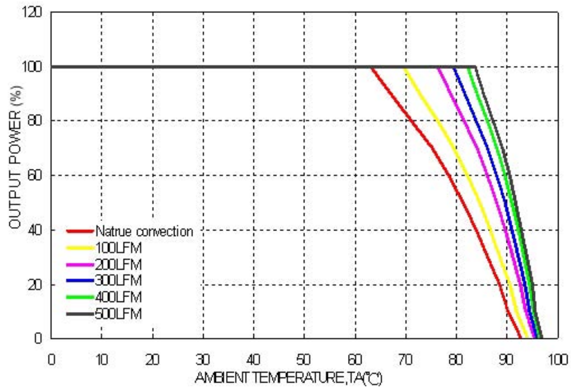
Power Dissipation versus Output Current



Efficiency versus Input Voltage. Full Load



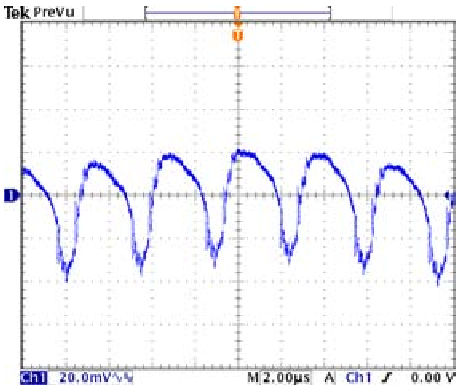
Derating Output Current versus Ambient Temperature with iron Base plate and Airflow , $V_{in} = V_{in\,nom}$
(The base-plate dimension is 19" * 3.5" * 0.63".
The height is EIA standard 2U.)



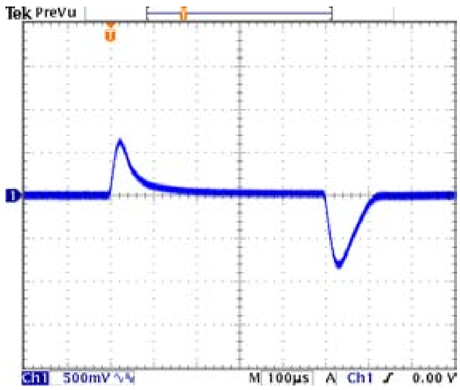
Derating Output Current Versus Ambient Temperature with iron Base plate , Heat-Sink and Airflow , $V_{in} = V_{in\,nom}$
(The base-plate dimension is 19" * 3.5" * 0.63".
The height is EIA standard 2U.)

Characteristic Curves (Continued)

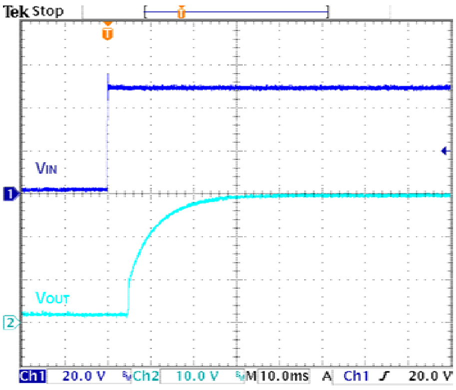
All test conditions are at 25°C. The figures are identical for TEP 150-4816WI



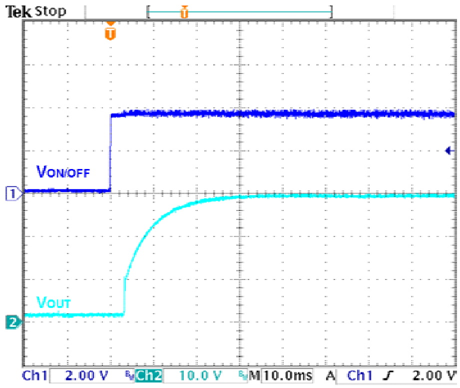
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$, Full Load



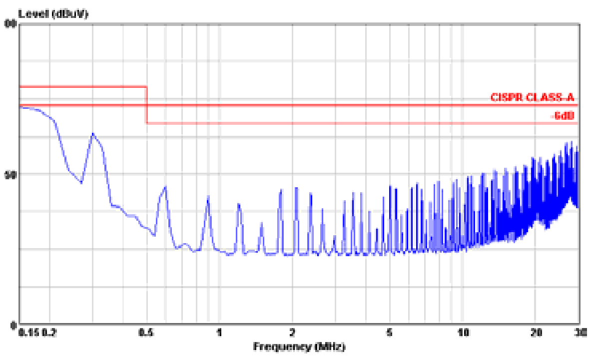
Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load ; $V_{in} = V_{in\ nom}$



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



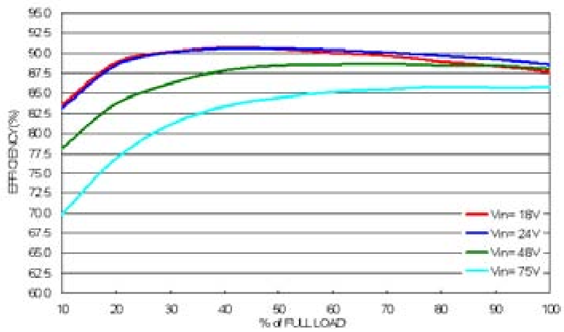
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\ nom}$, Full Load



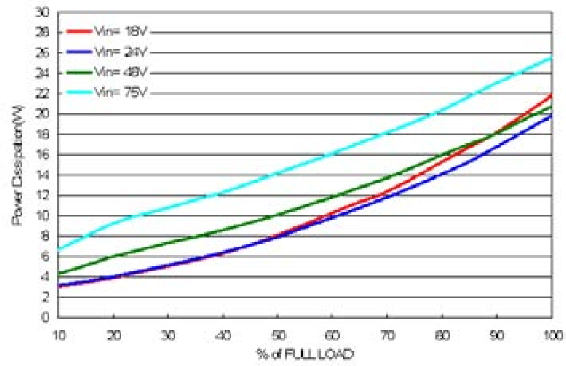
Conduction Emission of EN55022 Class A
$V_{in} = V_{in\ nom}$, Full Load

Characteristic Curves (Continued)

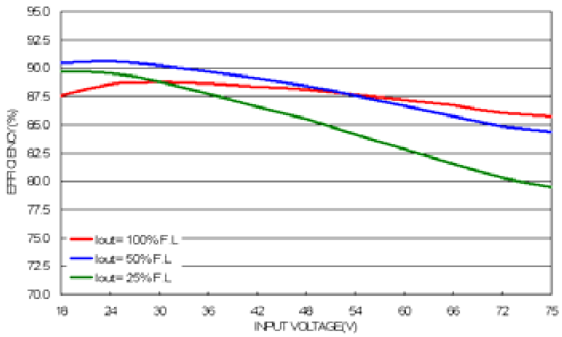
All test conditions are at 25°C. The figures are identical for TEP 150-4818WI



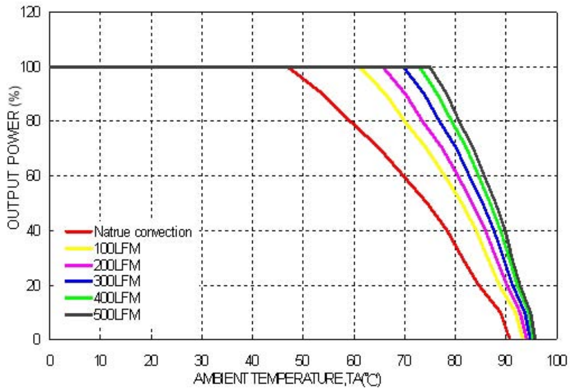
Efficiency versus Output Current



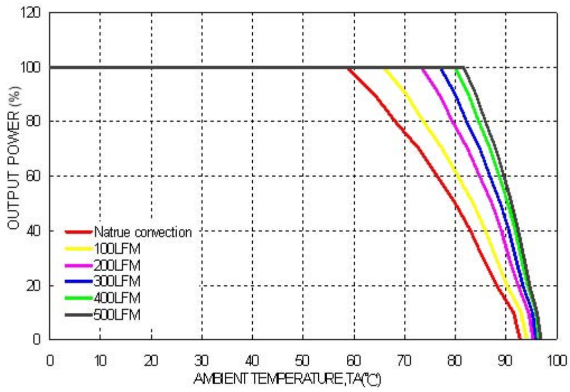
Power Dissipation versus Output Current



Efficiency versus Input Voltage. Full Load



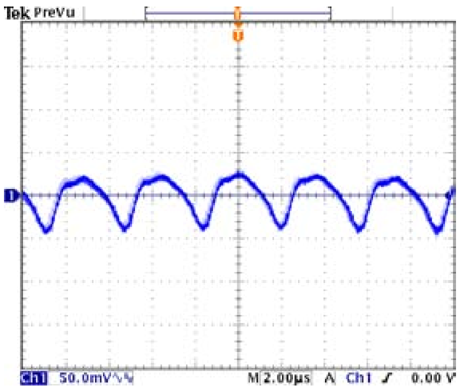
Derating Output Current versus Ambient Temperature with iron Base plate and Airflow , $V_{in} = V_{in\ nom}$ (The base-plate dimension is 19" * 3.5" * 0.63". The height is EIA standard 2U.)



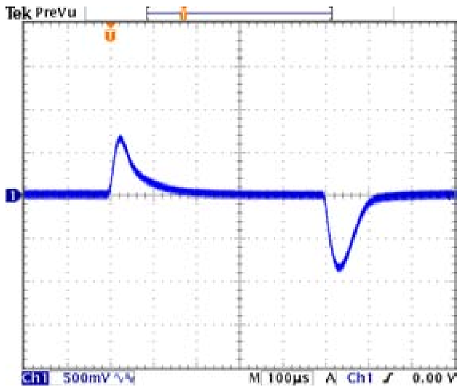
Derating Output Current Versus Ambient Temperature with iron Base plate , Heat-Sink and Airflow , $V_{in} = V_{in\ nom}$ (The base-plate dimension is 19" * 3.5" * 0.63". The height is EIA standard 2U.)

Characteristic Curves (Continued)

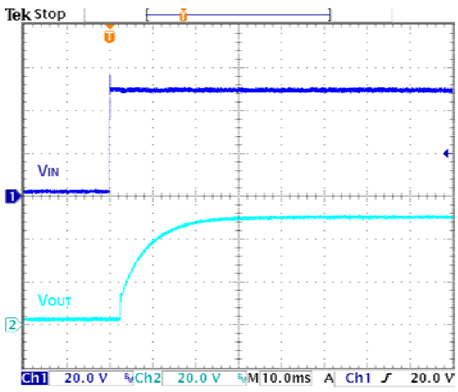
All test conditions are at 25°C. The figures are identical for TEP 150-4818WI



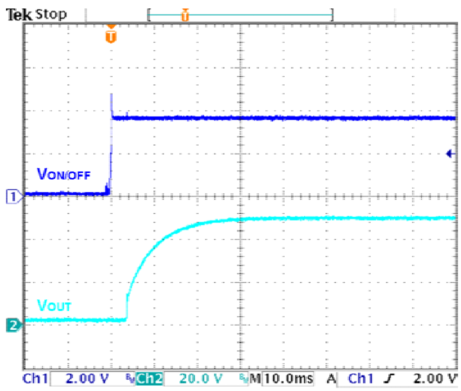
Typical Output Ripple and Noise.
$V_{in} = V_{in\ nom}$, Full Load



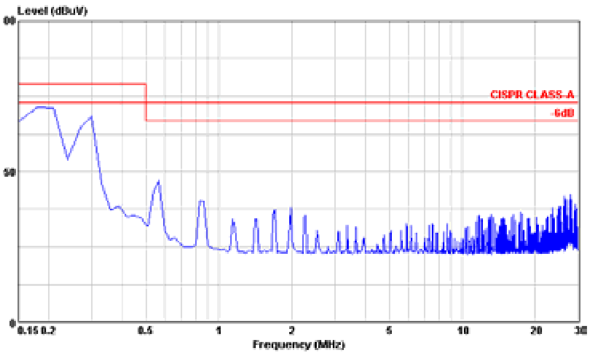
Transient Response to Dynamic Load Change from
100% to 75% to 100% of Full Load ; $V_{in} = V_{in\ nom}$



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



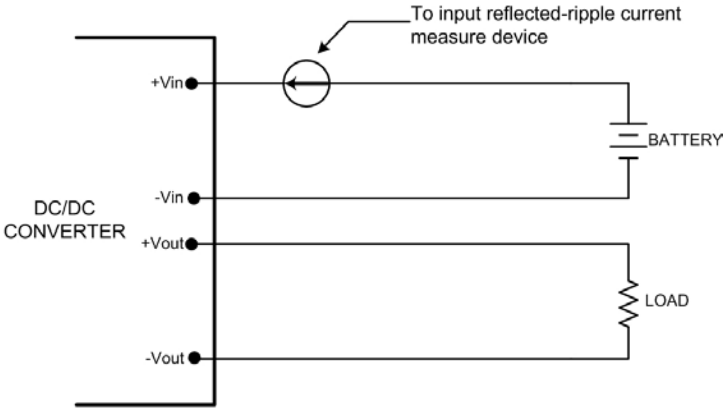
Using ON/OFF Voltage Start-Up and V_{out} Rise Characteristic
$V_{in} = V_{in\ nom}$, Full Load



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

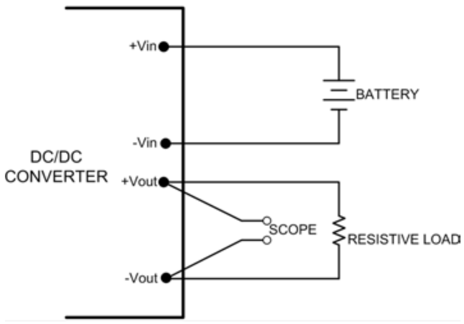
Testing Configurations

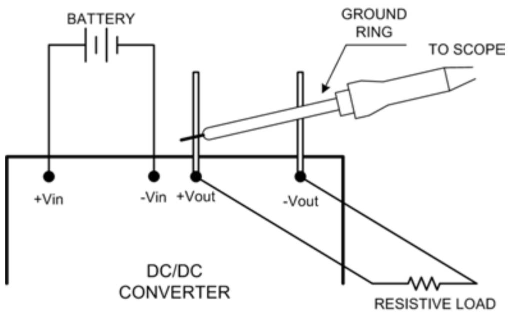
Input reflected-ripple current measurement test up



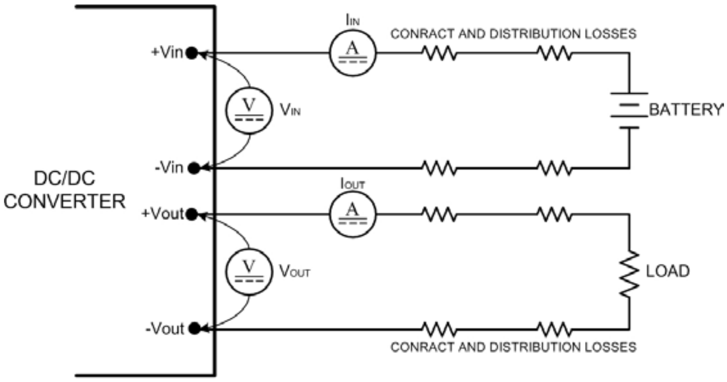
Note: TEP 150WI series test Input reflected-ripple current measurement without external filter.

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





Output voltage and efficiency measurement test up

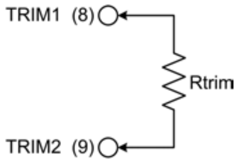


Note: All measurements are taken at the module terminals.

$$Efficiency = \left(\frac{V_{OUT} \times I_{OUT}}{V_{IN} \times I_{IN}} \right) \times 100\%$$

Output Voltage Adjustment

The output voltage is adjustable from 0% to +20% trim up of nominal output voltage by connecting an external resistor between the TRIM1 and TRIM2 pins. With an external resistor between the TRIM1 and TRIM2 pins, the output voltage set point increases. The maximum output deviation is +20%. The value of external resistor can be obtained by trim table shown in next page.



TRIM TABLE

TEP 150-xx12WI

Trim up (%)	1	2	3	4	5	6	7	8	9	10
V_{OUT} (Volts) =	12.12	12.24	12.36	12.48	12.6	12.72	12.84	12.96	13.08	13.2
R_U (KΩ) =	222.64	105.09	66.35	47.06	35.51	27.83	22.34	18.23	15.03	12.48
Trim up (%)	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
V_{OUT} (Volts) =	13.32	13.44	13.56	13.68	13.8	13.92	14.04	14.16	14.28	14.4
R_U (KΩ) =	10.39	8.65	7.18	5.91	4.82	3.86	3.02	2.27	1.60	0.99

TEP 150-xx13WI

Trim up (%)	1	2	3	4	5	6	7	8	9	10
V_{OUT} (Volts) =	15.15	15.3	15.45	15.6	15.75	15.9	16.05	16.2	16.35	16.5
R_U (KΩ) =	238.62	113.62	71.95	51.12	38.62	30.29	24.33	19.87	16.40	13.62
Trim up (%)	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
V_{OUT} (Volts) =	16.65	16.8	16.95	17.1	17.25	17.4	17.55	17.7	17.85	18
R_U (KΩ) =	11.35	9.45	7.85	6.48	5.29	4.25	3.33	2.51	1.78	1.12

TEP 150-xx15WI

Trim up (%)	1	2	3	4	5	6	7	8	9	10
V_{OUT} (Volts) =	24.24	24.48	24.72	24.96	25.2	25.44	25.68	25.92	26.16	26.4
R_U (KΩ) =	212.47	106.69	68.79	49.30	37.43	29.44	23.70	19.37	15.99	13.28
Trim up (%)	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
V_{OUT} (Volts) =	26.64	26.88	27.12	27.36	27.6	27.84	28.08	28.32	28.56	28.8
R_U (KΩ) =	11.06	9.20	7.63	6.28	5.11	4.08	3.18	2.37	1.65	1.00

TEP 150-xx16WI

Trim up (%)	1	2	3	4	5	6	7	8	9	10
V_{OUT} (Volts) =	28.28	28.56	28.84	29.12	29.4	29.68	29.96	30.24	30.52	30.8
R_U (KΩ) =	255.65	121.72	77.08	54.76	41.36	32.44	26.06	21.28	17.56	14.58
Trim up (%)	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
V_{OUT} (Volts) =	31.08	31.36	31.64	31.92	32.2	32.48	32.76	33.04	33.32	33.6
R_U (KΩ) =	12.14	10.11	8.40	6.93	5.65	4.53	3.55	2.67	1.89	1.19

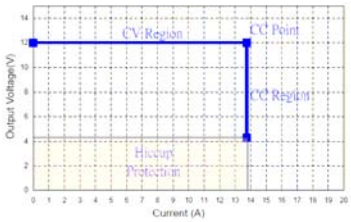
TEP 150-xx18WI

Trim up (%)	1	2	3	4	5	6	7	8	9	10
V_{OUT} (Volts) =	48.48	48.96	49.44	49.92	50.4	50.88	51.36	51.84	52.32	52.8
R_U (KΩ) =	268.86	127.44	80.57	57.19	43.17	33.84	27.17	22.18	18.29	15.18
Trim up (%)	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
V_{OUT} (Volts) =	53.28	53.76	54.24	54.72	55.2	55.68	56.16	56.64	57.12	57.6
R_U (KΩ) =	12.64	10.52	8.73	7.20	5.87	4.70	3.67	2.76	1.94	1.21

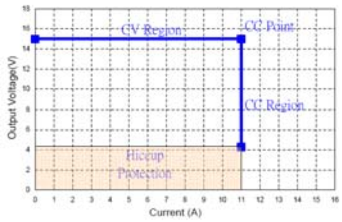
Output Over Current Protection

TEP 150WI series employ a fixed current limit to prevent damage to components within the converters, and will also protect the load provided that the current limiting crossover point is set at a current value that the load can handle without damage.
Normally, the current limit is maintained at approximately 105~120 percent of rated current for TEP 150WI series. If the output load current is over rating, the output current will keep in a constant value. And the output voltage will fall.
All of the TEP 150WI series current limiting supplies are self restoring; that is, when the overload is removed or corrected, the output voltage is automatically restored to the previously set value.
Otherwise, if the output resistance is become short, it will operate in hiccup protection. The details are shown below.

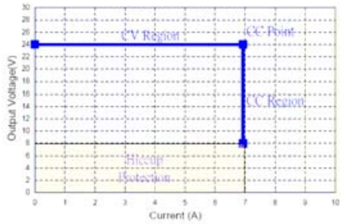
TEP 150-2412WI
TEP 150-4812WI
Vout & Iout Curve



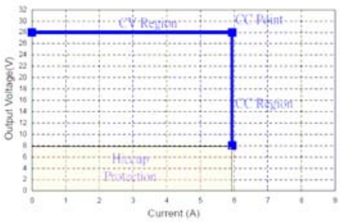
TEP 150-2413WI
TEP 150-4813WI
Vout & Iout Curve



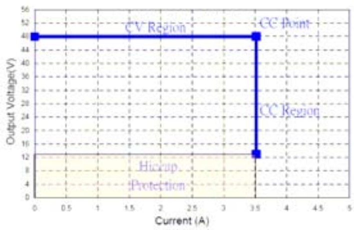
TEP 150-2415WI
TEP 150-4815WI
Vout & Iout Curve



TEP 150-2416WI
TEP 150-4816WI
Vout & Iout Curve



TEP 150-2418WI
TEP 150-4818WI
Vout & Iout Curve



Notes:

- CV Region: In normal operation. The output current in spec.
  Condition: Resistance Load > Vout / Iout (CC Point)
- CC Region: If the output load current is over rating, the output current will keep in a constant value. And the output voltage will fall.
  Condition: Resistance Load < Vout / Iout (CC Point)
- Hiccup Protection: If the output resistance is become short. It will operate in hiccup protection.
  Condition: Vout < 4.3V (typ.) to Output Short. (TEP 150-xx12WI, TEP 150-xx13WI)
  Vout < 8.0V (typ.) to Output Short. (TEP 150-xx15WI, TEP 150-xx16WI)
  Vout < 13V (typ.) to Output Short. (TEP 150-xx18WI)

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.

Output Over Voltage Protection

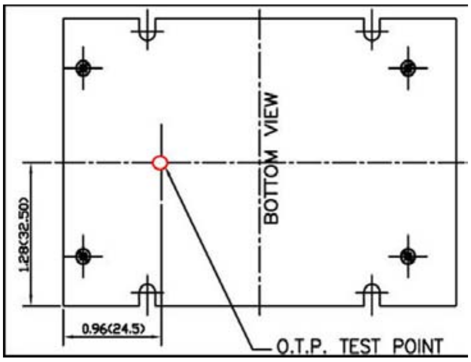
The output over-voltage protection consists of circuitry that monitors the voltage on the output terminals. If the voltage on the output terminals exceeds the over-voltage protection threshold, then the module enter the non-latch hiccup mode.

Over Temperature Protection

Sufficient cooling is needed for the power module and provides more reliable operation of the unit. If a fault condition occurs, the temperature of the unit will be higher. And it will damage the unit. For protecting the power module, the unit includes over-temperature protection circuit. When the temperature of the case is to the protection threshold, the unit enters "Shunt Down" mode. And it will auto restart when the temperature is down.

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 110°C. When Operating, adequate cooling must be provided to maintain the test point temperature at or below 110°C. Although the maximum point temperature of the power modules is 110°C, you can limit this temperature to a lower value for extremely high reliability.



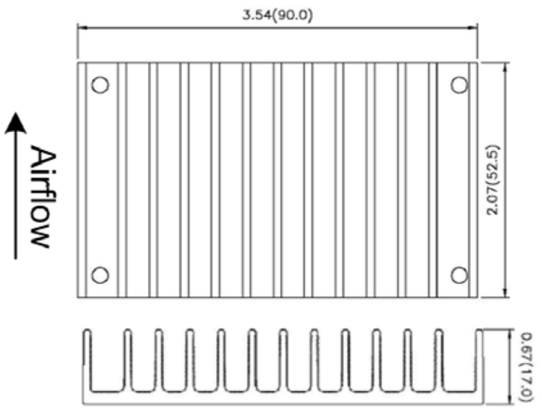
TEP 150WI

BOTTOM VIEW

Measurement shown in inches (mm)

Heatsink

The equipped heatsink is for lower temperature and higher reliability of the module.

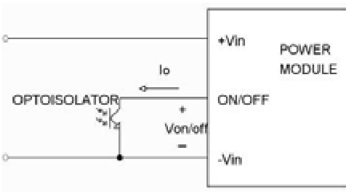


unit: inch (mm)

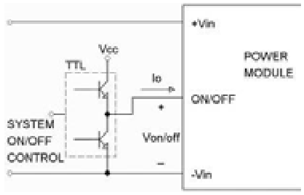
Remote ON/OFF Control

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 12V is 0.5 mA.

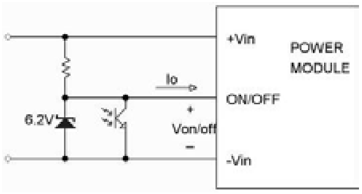
Remote ON/OFF Implementation Circuits



Isolated-Closure Remote ON/OFF



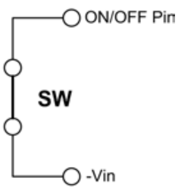
Level Control Using TTL Output



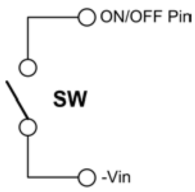
Level Control Using Line Voltage

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.

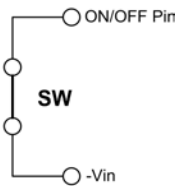


When TEP 150WI module is turned off at Low-level logic

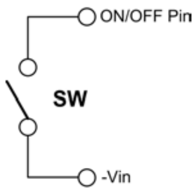


When TEP 150WI module is turned on at High-level logic

b. The Negative logic structure turned on of the DC/DC module when the ON/OFF pin is at low-level logic and turned off when at high-level logic.



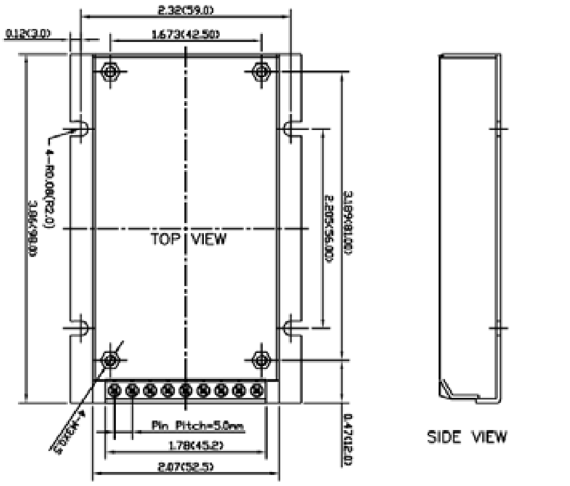
When TEP 150WI module is turned on at Low-level logic

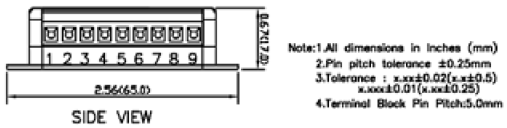


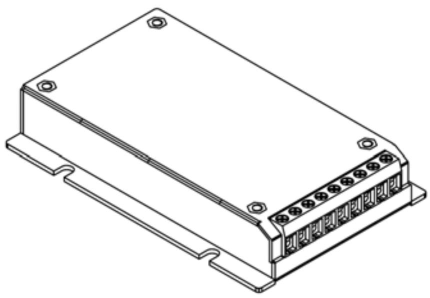
When TEP 150WI module is turned off at High-level logic

Mechanical Data

TEP 150WI DIMENSIONS







PIN CONNECTION		
PIN	Define	Wire Range
1	$+V_{in}$ (VCC)	14 AWG to 16 AWG
2	$+V_{in}$ (VCC)	14 AWG to 16 AWG
3	$-V_{in}$ (GND)	14 AWG to 16 AWG
4	$-V_{in}$ (GND)	14 AWG to 16 AWG
5	Remote on/off	14 AWG to 24 AWG
6	$+V_{out}$	14 AWG to 16 AWG
7	$-V_{out}$	14 AWG to 16 AWG
8	TRIM1	14 AWG to 24 AWG
9	TRIM2	14 AWG to 24 AWG

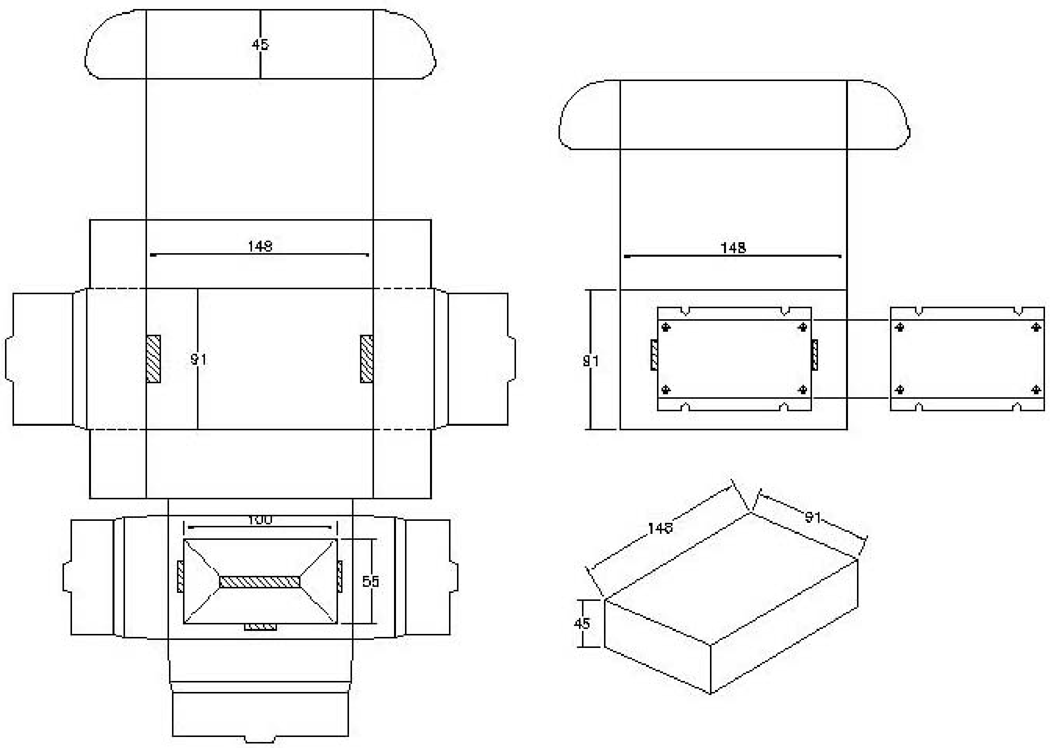
PRODUCT OPTIONS TABLE	
Option	Suffix
Positive remote ON/OFF logic	-
Negative remote ON/OFF logic	-N

Example:

TEP 150-4812WI

TEP 150-4812WI-N

Packaging Information



Dimensions shown in millimeters

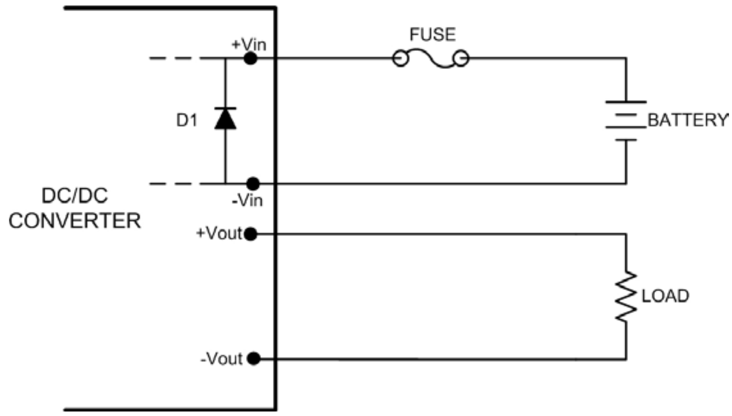
Order Code

Model Number	Input Range	Output Voltage	Output Current Max. Load	Input Current No Load[1]	Input Current Full Load [2]	Efficiency [3] (%)
TEP 150-2412WI	9 – 36Vdc	12Vdc	12.5 A	70mA	7.53A	86
TEP 150-2413WI	9 – 36Vdc	15Vdc	10.0 A	80mA	7.53 A	86
TEP 150-2415WI	9 – 36Vdc	24Vdc	6.3 A	95mA	7.50A	87
TEP 150-2416WI	9 – 36Vdc	28Vdc	5.4 A	120mA	7.50A	87
TEP 150-2418WI	9 – 36Vdc	48Vdc	3.2 A	130mA	7.71A	86
TEP 150-4812WI	18 – 75Vdc	12Vdc	12.5 A	50mA	3.72A	87
TEP 150-4813WI	18 – 75Vdc	15Vdc	10.0 A	60mA	3.72 A	87
TEP 150-4815WI	18 – 75Vdc	24Vdc	6.3 A	60mA	3.71A	88
TEP 150-4816WI	18 – 75Vdc	28Vdc	5.4 A	70mA	3.71A	88
TEP 150-4818WI	18 – 75Vdc	48Vdc	3.2 A	70mA	3.81A	87

Note 1: Typical value at nominal input voltage and no load.
Note 2: Maximum value at nominal input voltage and full load of standard type.
Note 3: Typical value at nominal input voltage and full load.
Note 4: For negative remote on/off logic, please add –N (e.g. TEP 150-2412WI-N)

Safety and Installation Instruction

The TEP 150 Series has built in the protection function of the polarity reverse as the following figure.



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 with maximum rating of 30A for TEP 150–24xxWI and 15A for TEP 150–48xxWI. Based on the information provided in this datasheet 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 TEP 150 series of DC/DC converters has been calculated using

Bellcore TR-NWT-000332 Case 1: 50% stress, Operating Temperature at 40°C. The resulting figure for MTBF is 1'525'000 hours.

MIL-HDBK 217F Notice2 Full Load, Operating Temperature at 40°C, Air Flow = 400LFM (Ground, Benign, controlled environment) The resulting figure for MTBF is 135'300 hours.