

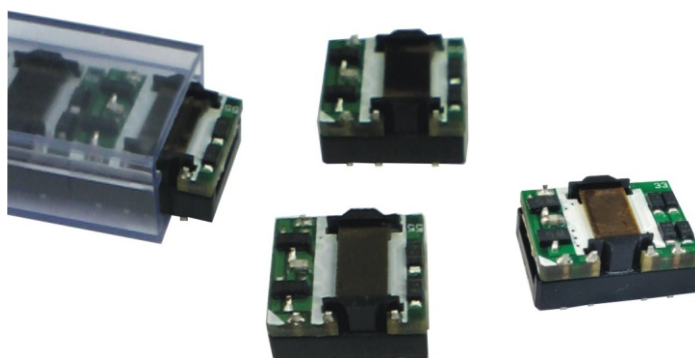
# T2 - Series



2W Unregulated Single & Dual output

## Features

- SMD 8Pin / 10Pin Package
- 4200 VDC High Isolation
- Efficiency up to 81%
- -40 ~ 105°C Operation Temperature Range
- Rated working voltage for 250Vrms and 400Vdc
- Low coupling capacity
- Qualified for Lead-free Reflow Solder Process According to IPC/JEDEC J-STD-020D.1
- Tape & Reel Package Available



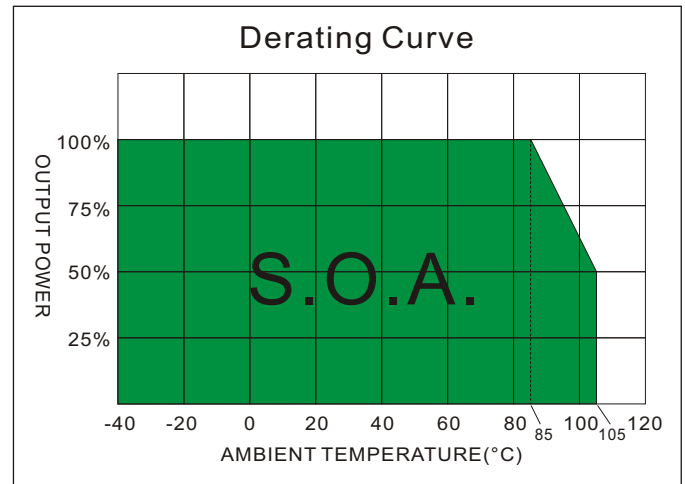
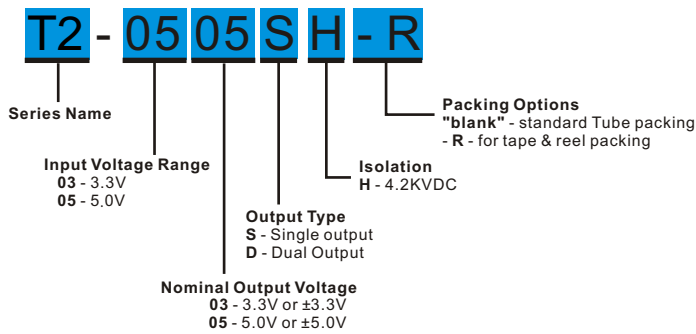
The T2 series is a family of cost effective 2W single & dual output DC-DC converters. These converters achieve low cost and Small SMD package with standard footprint. High performance features include 4200Vdc input/output isolation. Input voltages are 3.3V, 5Vdc. with output voltage of 3.3, 5,  $\pm 3.3$ ,  $\pm 5$ Vdc. Standard features include an input range of  $\pm 10\%$  tolerance and low output noise and ripple.

All specifications typical at Ta=25°C, nominal input voltage and full load unless otherwise specified

OUTPUT SPECIFICATIONS		PHYSICAL SPECIFICATIONS	
Output Voltage Accuracy	See Tolerance Envelope Curve	Base Material	Non-conductive Black Plastic(UL94V-0 rated)
Line Regulation	$\pm 1.2\%$ / Per 1% Vin Change, max.	Pin Material	0.5mm C5191R-H Solder-coated
Load Regulation	(From 10% to 100% Load) 3.3 Vdc output Models $\pm 15\%$ , max. 5 Vdc output Models $\pm 14\%$ , max.	Weight	Single output Models 1.52g Dual output Models 1.80g
Ripple & Noise(1) (20 Mhz bandwidth)	Single output Models 150mVpk-pk, max. Dual output Models $\pm 150$ mVpk-pk, max.	Dimensions	Single output Models 0.50"x0.44"x0.27" Dual output Models 0.60"x0.44"x0.27"
Short Circuit Protection	(Automatic Recovery) 0.5sec, max.	<b>ENVIRONMENT SPECIFICATIONS</b>	
Temperature Coefficient	$\pm 0.03\%/^{\circ}\text{C}$	Operating Temperature	-40°C ~ +105°C (See Derating Curve) -40°C ~ +85°C (For 100% load)
Capacitive Load(2)	See Table, max.	Storage Temperature	-55°C~125°C
<b>INPUT SPECIFICATIONS</b>		Cooling(4)	Nature Convection
Input Voltage Range	$\pm 10\%$ , max.	Lead-free Reflow Solder Process	IPC/JEDEC J-STD-020D.1
Input Current (Full-Load)	See Table, typ.	Reflow Temperature	Peak 245°C (10sec), max.
Input Current (No-Load)	See Table, max.	Vibration	MIL-STD-810F
Input Filter	Capacitor	<b>ABSOLUTE MAXIMUM RATINGS(5)</b>	
Input Reflected Ripple Current(3)	20mA <sub>pk-pk</sub> , typ.	These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability.	
Start up Time (Nominal Vin and constant resistive load)	20mS, typ.	Input Surge Voltage(1000mS)	
<b>GENERAL SPECIFICATIONS</b>		3.3 Models	5 Vdc, max.
Efficiency	See table, typ.	5 Models	9 Vdc, max.
I/O Isolation Voltage	Qualification tested for 60sec, 4200Vdc Production tested for 3sec, 4200Vdc	<b>EMC SPECIFICATIONS</b>	
I/O Isolation Capacitance	25 pF, typ.	Conducted Emissions(6)	EN55032 CLASS B
I/O Isolation Resistance	1000MΩ, min.	Radiated Emissions(6)	EN55032 CLASS B
Switching Frequency	40~80kHz	ESD	IEC 61000-4-2 Perf. Criteria A
Humidity	95% rel H	RS	IEC 61000-4-3 Perf. Criteria A
Reliability Calculated MTBF(MIL-HDBK-217 F)	>6.5 Mhrs	EFT(7)	IEC 61000-4-4 Perf. Criteria A
Safety Standard: (designed to meet)	UL/cUL 60950-1 , 62368-1 IEC/EN 60950-1 , 62368-1	Surge (7)	IEC 61000-4-5 Perf. Criteria A
Safety Approvals: (designed to meet)	UL/cUL 60950-1 , 62368-1 IEC/EN 60950-1 , 62368-1	CS	IEC 61000-4-6 Perf. Criteria A
		PFMF	IEC 61000-4-8 Perf. Criteria A

## T2 - 2W unregulated Single & Dual output

### PART NUMBER STRUCTURE



## MODEL SELECTION GUIDE

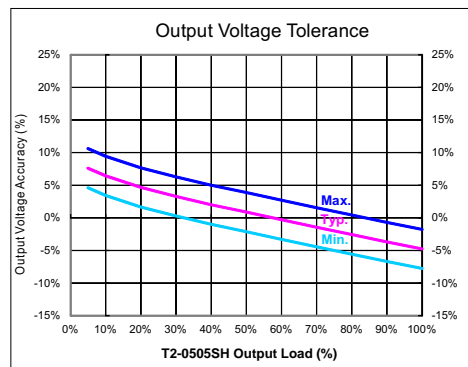
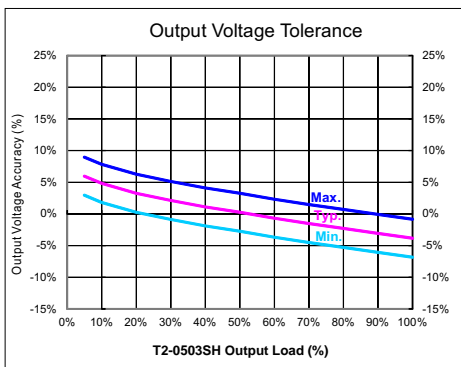
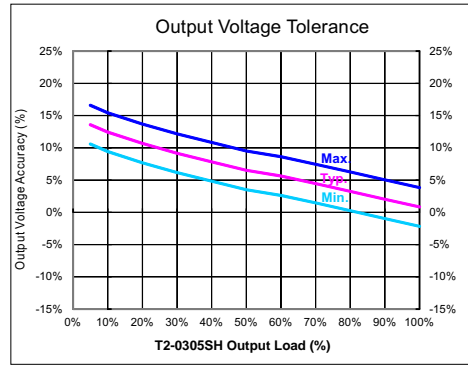
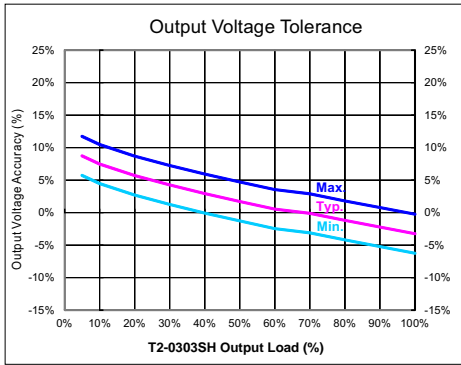
MODEL NUMBER	INPUT Voltage Range (Vdc)	INPUT Current		OUTPUT Voltage (Vdc)	OUTPUT Current Full load (mA)	EFFICIENCY @ FL (% , typ.)	Capacitor Load @ FL (µF, max.)
		No-Load (mA, max.)	Full Load (mA, typ.)				
T2-0303SH	3.3 ( 2.97 ~ 3.63 )	60	650	3.3	500	77	470
T2-0305SH	3.3 ( 2.97 ~ 3.63 )	60	777	5	400	78	470
T2-0503SH	5 ( 4.5 ~ 5.5 )	45	446	3.3	500	76	470
T2-0505SH	5 ( 4.5 ~ 5.5 )	45	513	5	400	78	470
T2-0303SH-R	3.3 ( 2.97 ~ 3.63 )	60	650	3.3	500	77	470
T2-0305SH-R	3.3 ( 2.97 ~ 3.63 )	60	777	5	400	78	470
T2-05053H-R	5 ( 4.5 ~ 5.5 )	45	446	3.3	500	76	470
T2-0505SH-R	5 ( 4.5 ~ 5.5 )	45	513	5	400	78	470
T2-0303DH	3.3 ( 2.97 ~ 3.63 )	60	798	±3.3	±303	78	±220
T2-0305DH	3.3 ( 2.97 ~ 3.63 )	60	758	±5	±200	80	±220
T2-0503DH	5 ( 4.5 ~ 5.5 )	45	541	±3.3	±303	76	±220
T2-0505DH	5 ( 4.5 ~ 5.5 )	45	494	±5	±200	81	±220
T2-0303DH-R	3.3 ( 2.97 ~ 3.63 )	60	798	±3.3	±303	78	±220
T2-0305DH-R	3.3 ( 2.97 ~ 3.63 )	60	758	±5	±200	80	±220
T2-0503DH-R	5 ( 4.5 ~ 5.5 )	45	541	±3.3	±303	76	±220
T2-0505DH-R	5 ( 4.5 ~ 5.5 )	45	494	±5	±200	81	±220

### NOTE

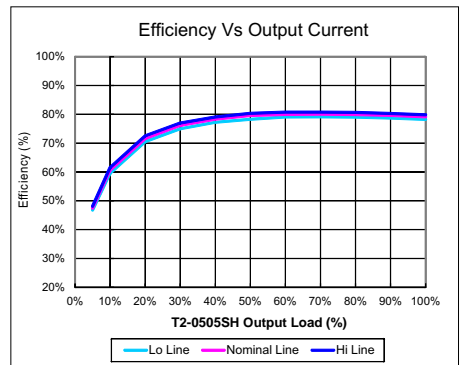
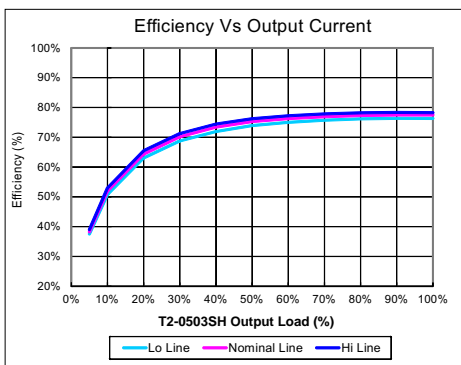
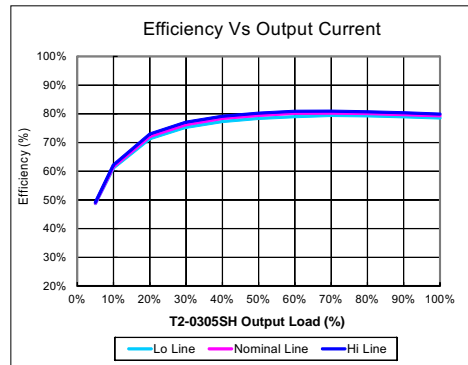
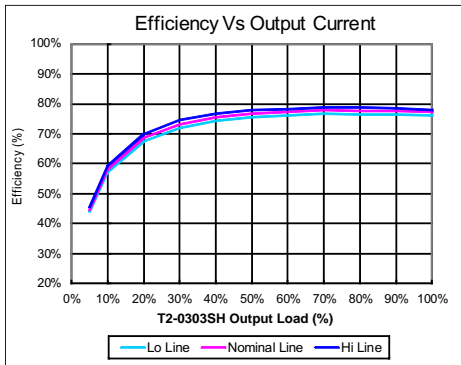
- Ripple/Noise measured with a 10µF electrolytic capacitor and 0.1µF ceramic capacitor.
- Tested by minimal Vin and constant resistive load.
- Measured Input reflected ripple current with a simulated source inductance of 12µH And a source capacitor Cin(47µF, ESR<1.0Ω at100kHz).
- "Nature Convection" is usually about 30-65 LFM but is not equal to still air (0 LFM).
- Exceeding the absolute ratings of the unit could cause damage. It is not allowed for continuous operating.
- Input filter components are required to help meet conducted emission class B, which application refer to the EMI Filter of design & feature configuration.
- Input components (C1,D1) are used to help meet surge test requirement for the module. C1 and D1 recommended nichicon UHE series and Littelfuse SMDJ series.
- Operation under no-load conditions will not damage these devices, however they may not meet all listed specifications.
- The T2 Series of converters are not internally fused so to meet the requirements of UL an anti-surge input line fuse should always be used with ratings as defined below.  
Input Voltage, 3.3V: 2.0A(Slow Burning Fuses)  
Input Voltage, 5.0V: 1.0A(Slow Burning Fuses)  
All fuses should be UL recognized and rated to at least the maximum allowable DC input voltage.
- It is not recommended to use water-washing process on SMT units.

DERATING CURVE AND EFFICIENCY VS OUTPUT CURRENT CURVE

Single Output Tolerance Envelope Curve

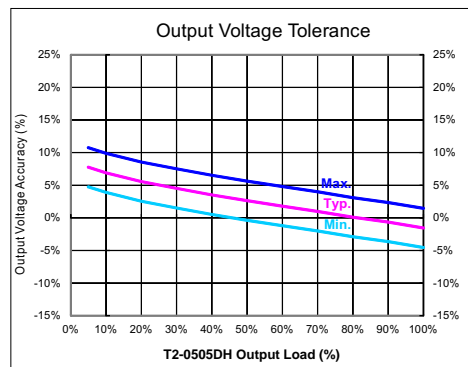
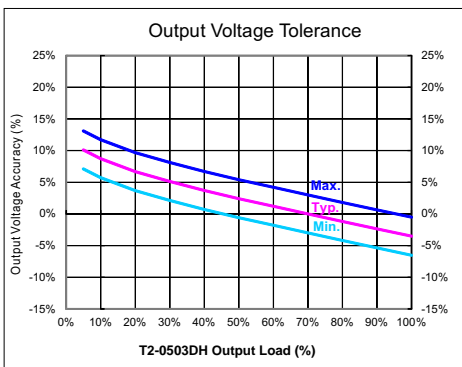
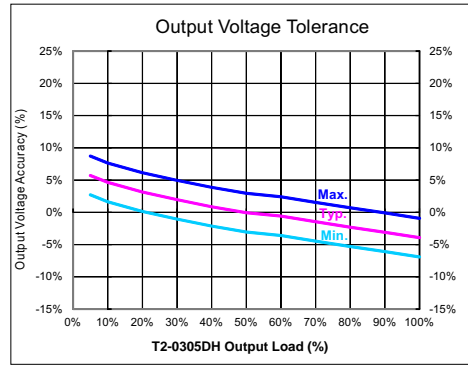
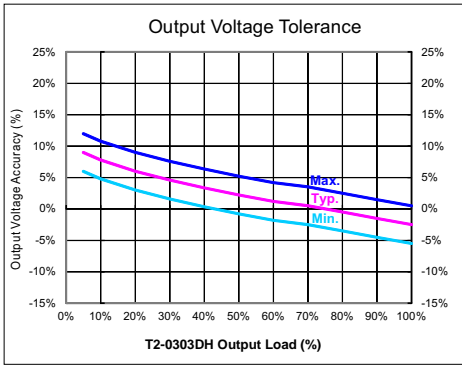


Efficiency Vs Output Current Curve

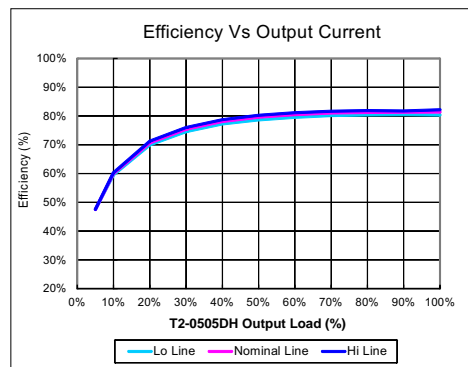
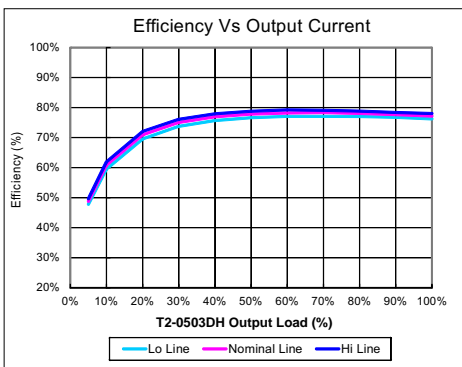
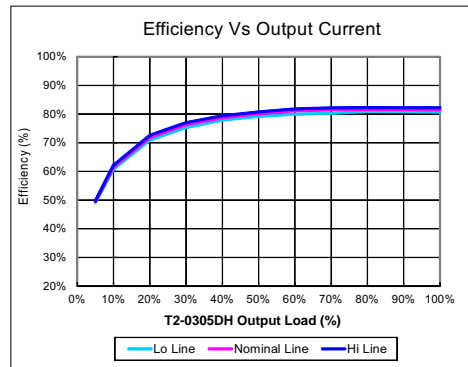
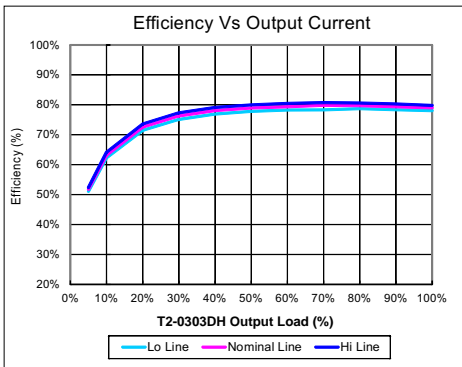


DERATING CURVE AND EFFICIENCY VS OUTPUT CURRENT CURVE

Dual Output Tolerance Envelope Curve



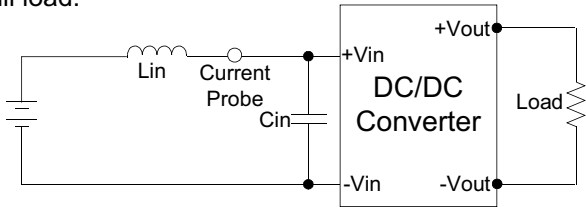
Efficiency Vs Output Current Curve



TEST CONFIGURATIONS

**Input Reflected Ripple Current Test Step**

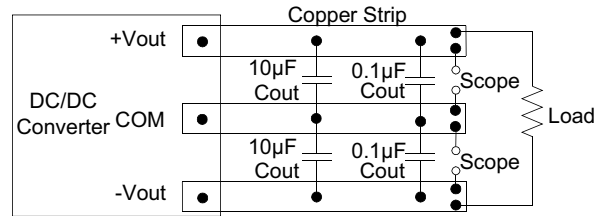
Input reflected ripple current is measured through a source inductor  $L_{in}$ (12 $\mu$ H) and a source capacitor  $C_{in}$ (47 $\mu$ F, ESR<1.0 $\Omega$  at 100kHz) at nominal input and full load.



**Output Ripple & Noise Measurement Test**

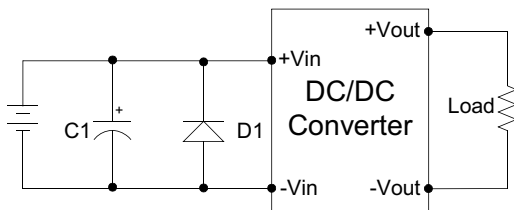
Use a 10 $\mu$ F electrolytic capacitor and 0.1 $\mu$ F ceramic capacitor.

The Scope measurement bandwidth is 0-20MHz.



**EFT & SURGE Filter**

Input components (C1,D1) are used to help meet surge test requirement for the module.



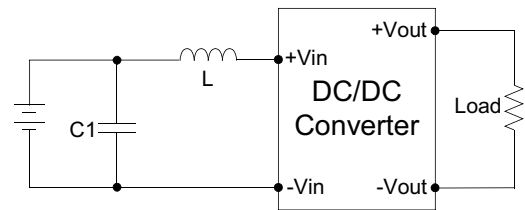
D1: Transient Voltage Suppression Diodes

	C1	D1
T2-03XXXH	220 $\mu$ F/35V	SMDJ6.0A
T2-03XXXH-R	220 $\mu$ F/35V	SMDJ6.0A
T2-05XXXH	330 $\mu$ F/50V	SMDJ9.0A
T2-05XXXH-R	330 $\mu$ F/50V	SMDJ9.0A

XXX : 03S or 03D or 05S or 05D

**EMI Filter**

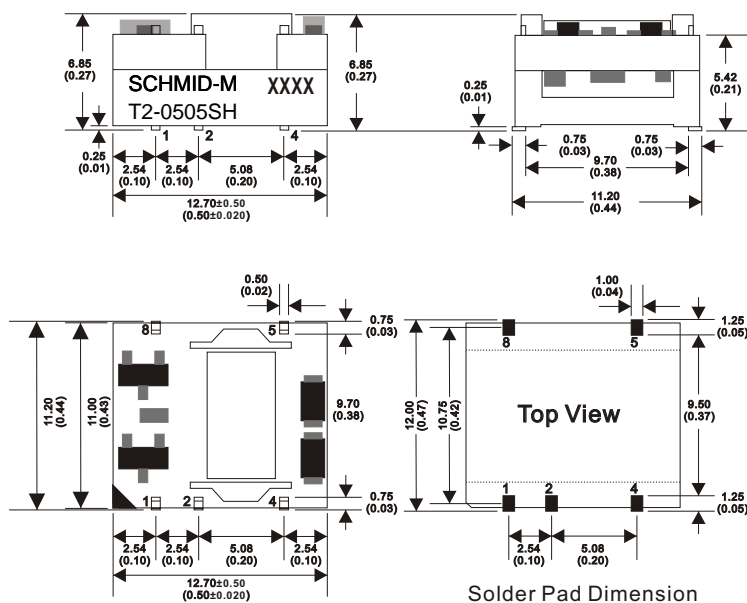
Input filter components (C1,L) are used to help meet conducted emissions requirement for the module. These components should be mounted as close as possible to the module; and all leads should be minimized to decrease radiated noise.



C1	L
1206,22 $\mu$ F/10V	6.8 $\mu$ H

T2 - 2W unregulated Single & Dual output

MECHANICAL SPECIFICATIONS - Single Output Models

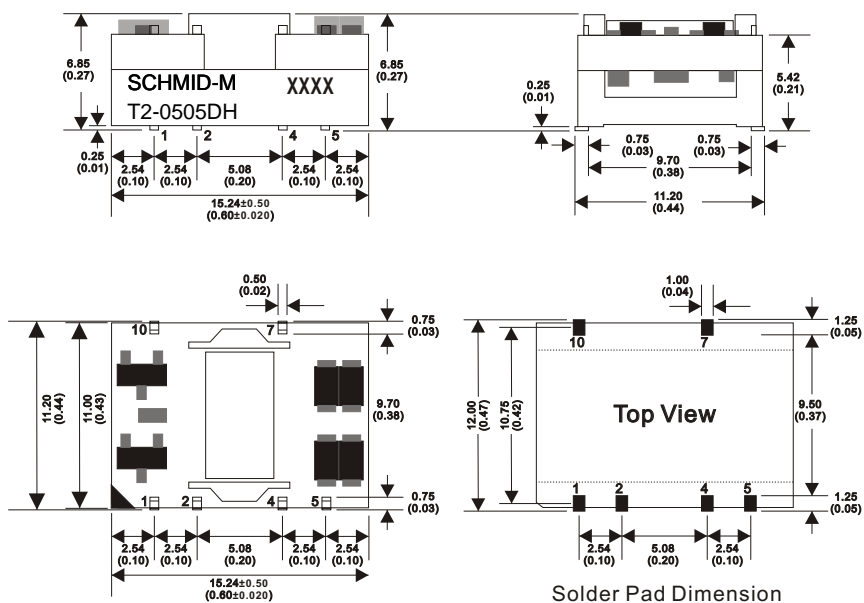


PIN CONNECTIONS	
PIN NUMBER	SINGLE
1	- V Input
2	+V Input
4	- V Output
5	+V Output
8	N.C

SMD 8Pin Package

Notes : All dimensions are typical in millimeters ( inches ).  
 1. Not marked Tolerances:  $\pm 0.25$  (  $\pm 0.01$  )  
 2. N.C = No Connection

MECHANICAL SPECIFICATIONS - Dual Output Models



PIN CONNECTIONS	
PIN NUMBER	DUAL
1	- V Input
2	+V Input
4	Common
5	- V Output
7	+V Output
10	N.C

SMD 10Pin Package

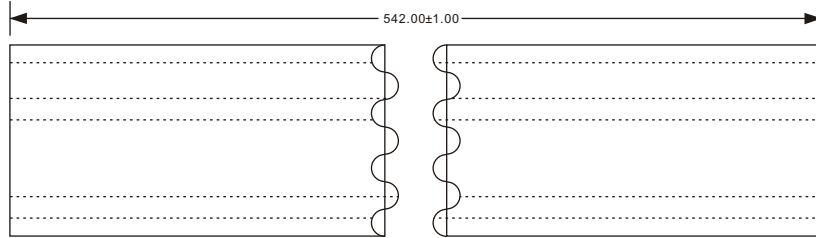
Notes : All dimensions are typical in millimeters ( inches ).  
 1. Not marked Tolerances:  $\pm 0.25$  (  $\pm 0.01$  )  
 2. N.C = No Connection

T2 - 2W unregulated Single & Dual output

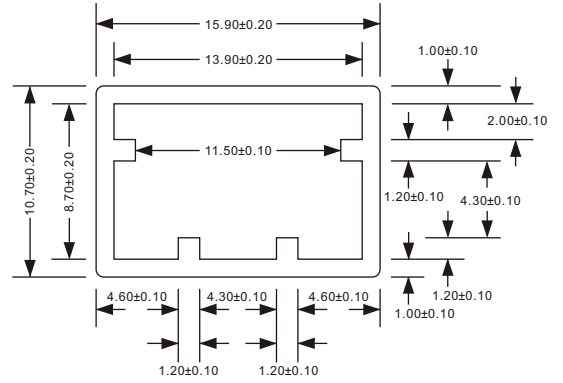
Tube dimension - Single Output Models

Standard packing - Tube

■ 1 Tube contains 40 converters



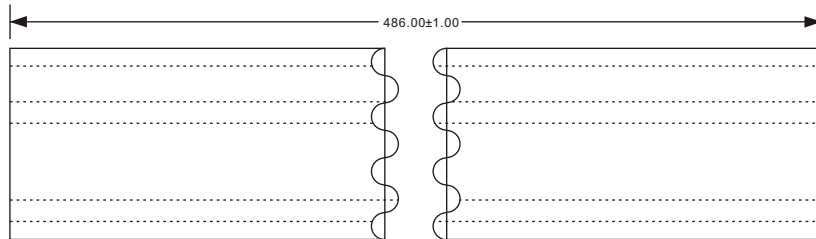
dimensions in [mm]



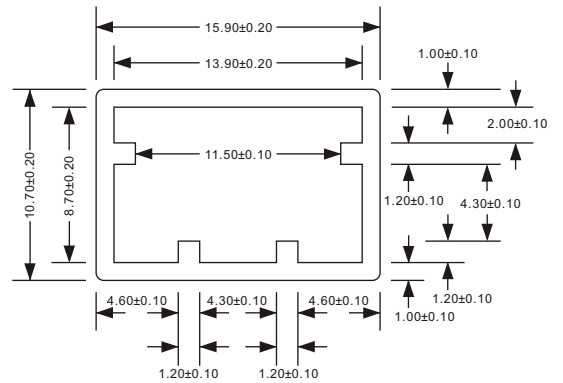
Tube dimension - Dual Output Models

Standard packing - Tube

■ 1 Tube contains 30 converters



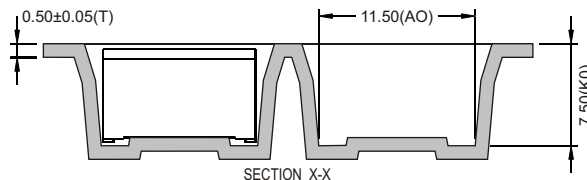
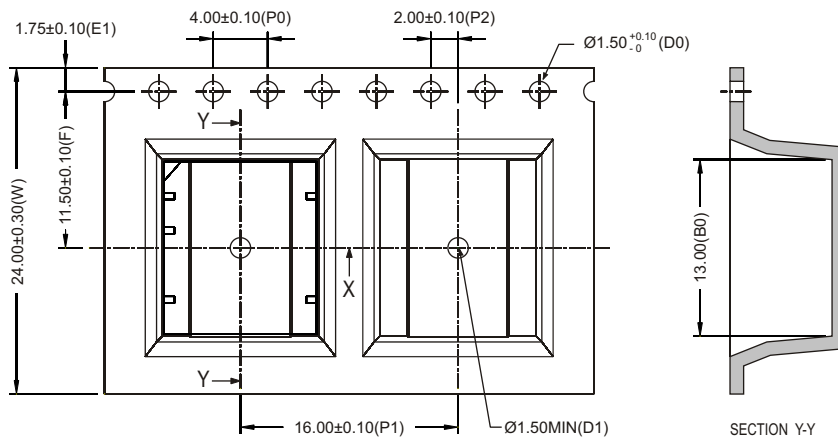
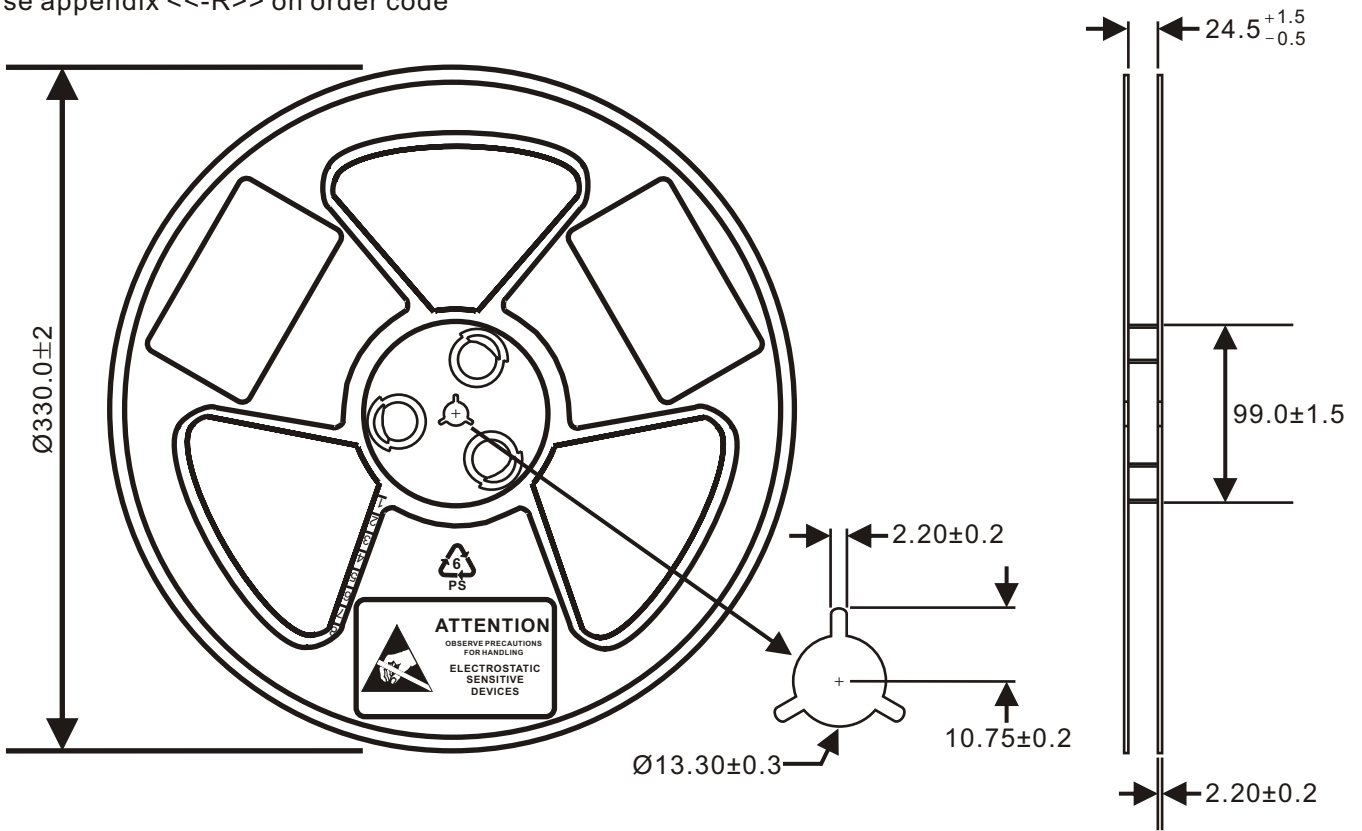
dimensions in [mm]



**Tape & Reel dimension - Single Output Models**

Optional packing - Tape & Reel

- Specifications shall conform with current EIA-481 standard
- 1 Reel contains 500 converters
- Use appendix <<-R>> on order code



SECTION Y-Y

SECTION X-X

dimensions in [mm]

NOTE:

1. Material: Black Polystyrene.
2. Camber not to exceed 1mm in 100mm.
3. 10 sprocket hole pitch cumulative tolerance  $\pm 0.2$
4. A0 and B0 measured on a plane 0.3mm above the bottom of the pocket.
5. K0 measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

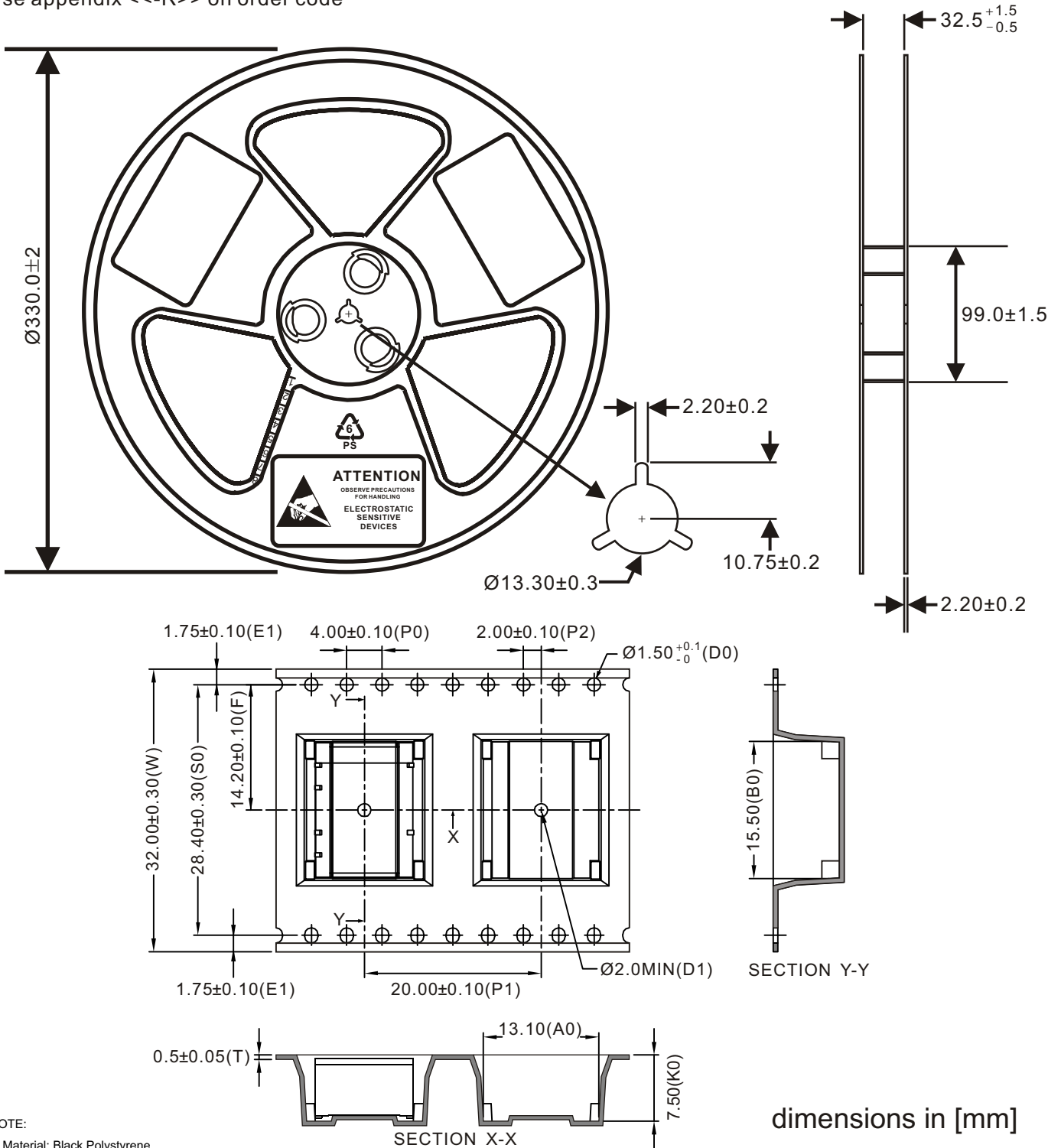
Carrier Length: 26M / 22" reel, Q'ty= 500 pcs/13"reel												
ITEM	W	A0	B0	K0	P1	F	E1	D0	P0	P2	T	D1
DIM	24.0 <sup>+0.30</sup> / <sub>-0.30</sub>	11.5 <sup>+0.10</sup> / <sub>-0.10</sub>	13.0 <sup>+0.10</sup> / <sub>-0.10</sub>	7.50 <sup>+0.15</sup> / <sub>-0.15</sub>	16.0 <sup>+0.10</sup> / <sub>-0.10</sub>	11.50 <sup>+0.10</sup> / <sub>-0.10</sub>	1.75 <sup>+0.10</sup> / <sub>-0.10</sub>	1.50 <sup>+0.10</sup> / <sub>-0.00</sub>	4.00 <sup>+0.10</sup> / <sub>-0.10</sub>	2.00 <sup>+0.10</sup> / <sub>-0.10</sub>	0.50 <sup>+0.05</sup> / <sub>-0.05</sub>	1.50 MIN



**Tape & Reel dimension - Dual Output Models**

Optional packing - Tape & Reel

- Specifications shall conform with current EIA-481 standard
- 1 Reel contains 450 converters
- Use appendix <<-R>> on order code



dimensions in [mm]

NOTE:

1. Material: Black Polystyrene.
2. Camber not to exceed 1mm in 100mm.
3. 10 sprocket hole pitch cumulative tolerance  $\pm 0.2$
4. A0 and B0 measured on a plane 0.3mm above the bottom of the pocket.
5. K0 measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

Carrier Length: 30M / 22" reel, Q'ty= 450 pcs/13"reel													
ITEM	W	S0	F	E1	P0	P1	P2	D0	A0	B0	K0	T	D1
DIM	32.00 <sup>+0.30</sup> <sub>-0.30</sub>	28.40 <sup>+0.30</sup> <sub>-0.30</sub>	14.20 <sup>+0.10</sup> <sub>-0.10</sub>	1.75 <sup>+0.10</sup> <sub>-0.10</sub>	4.00 <sup>+0.10</sup> <sub>-0.10</sub>	20.00 <sup>+0.10</sup> <sub>-0.10</sub>	2.00 <sup>+0.10</sup> <sub>-0.10</sub>	1.50 <sup>+0.10</sup> <sub>-0.00</sub>	13.10 <sup>+0.20</sup> <sub>-0.20</sub>	15.50 <sup>+0.20</sup> <sub>-0.20</sub>	7.50 <sup>+0.20</sup> <sub>-0.20</sub>	0.50 <sup>+0.05</sup> <sub>-0.05</sub>	2.00MIN