S1-1W Series

1W Unregulated Single & Dual output

Features

- SIP7 / DIP14 Package
- 1000 VDC Isolation
- Up to 6000 VDC Isolation
- Efficiency up to 84%
- Operation Temperature Range -40 ~ 100°C max.
- Non-Conductive Black Plastic Case
- EMI Complies With EN55032 Class B

PART NUMBER STRUCTURE

S1 - 12 05 SS H6
(1) (2) (3) (4) (5)

(1) Series

(2) Input Voltage Range
- **3R3 -** 2.97-3.63 V
- **05 -** 4.5-5.5 V
- **12 -** 10.8-13.2 V
- **15 -** 13.5-16.5 V
- **24 -** 21.6-26.4 V

(3) Output Voltage
- **3R3 -** 3.3 V
- **05 -** 5.0 V
- **7R2 -** 7.2 V
- **09 -** 9.0 V
- **12 -** 12 V
- **15 -** 15 V
- **18 -** 18 V
- **24 -** 24 V

(4) Case & Output Type
- **SS -** SIP Case, Single Output
- **S -** SIP Case, Dual Output
- **DS -** DIP Case, Single Output
- **D -** DIP Case, Dual Output

(5) Isolation Voltage (Optional)
- **Blank -** 1 KVDC
- **H -** 3 KVDC
- **H4 -** 4KVDC
- **H5 -** 5.2 KVDC
- **H6 -** 6 KVDC

ALL SPECIFICATIONS ARE TYPICAL AT 25°C, NOMINAL INPUT AND FULL LOAD UNLESS OTHERWISE NOTED

Model Number	Input Voltage Range (VDC)	Input Current		Output Voltage (VDC)	Output Current Full Load (mA)	Efficiency @FL (%, typ.)	Capacitive Load @ FL (µF, max.)
		No-Load (mA, max.)	Full Load (mA, typ.)				
S1-3R33R3SS	2.97-3.63	30	399	3.3	303	76	220
S1-3R305SS	2.97-3.63	25	394	5	200	77	220
S1-3R37R2SS	2.97-3.63	40	384	7.2	139	79	220
S1-3R309SS	2.97-3.63	55	384	9	111	79	220
S1-3R312SS	2.97-3.63	35	389	12	83	78	220
S1-3R315SS	2.97-3.63	35	389	15	67	78	220
S1-3R318SS	2.97-3.63	35	389	18	56	78	220
S1-3R324SS	2.97-3.63	45	384	24	42	79	220
S1-053R3SS	4.5-5.5	20	260	3.3	303	77	220
S1-0505SS	4.5-5.5	25	250	5	200	80	220
S1-057R2SS	4.5-5.5	60	244	7.2	139	82	220
S1-0509SS	4.5-5.5	20	244	9	111	82	220
S1-0512SS	4.5-5.5	25	250	12	81	80	220
S1-0515SS	4.5-5.5	60	247	15	67	81	220
S1-0518SS	4.5-5.5	60	247	18	56	81	220
S1-0524SS	4.5-5.5	60	244	24	42	82	220
S1-123R3SS	10.8-13.2	20	110	3.3	303	76	220
S1-1205SS	10.8-13.2	20	108	5	200	77	220
S1-127R2SS	10.8-13.2	20	111	7.2	139	75	220
S1-1209SS	10.8-13.2	13	104	9	111	80	220
S1-1212SS	10.8-13.2	20	107	12	83	78	220
S1-1215SS	10.8-13.2	20	104	15	67	80	220
S1-1218SS	10.8-13.2	18	103	18	56	81	220
S1-1224SS	10.8-13.2	25	111	24	42	75	220
S1-153R3SS	13.5-16.5	15	89	3.3	303	75	220
S1-1505SS	13.5-16.5	15	82	5	200	81	220
S1-157R2SS	13.5-16.5	10	85	7.2	139	78	220
S1-1509SS	13.5-16.5	15	85	9	111	78	220
S1-1512SS	13.5-16.5	15	85	12	83	78	220
S1-1515SS	13.5-16.5	15	85	15	67	78	220
S1-1518SS	13.5-16.5	16	84	18	56	79	220
S1-1524SS	13.5-16.5	20	81	24	42	82	220
S1-243R3SS	21.6-26.4	15	56	3.3	303	75	220
S1-2405SS	21.6-26.4	15	53	5	200	79	220
S1-247R2SS	21.6-26.4	12	56	7.2	139	74	220
S1-2409SS	21.6-26.4	12	55	9	111	76	220
S1-2412SS	21.6-26.4	15	53	12	83	78	220
S1-2415SS	21.6-26.4	15	53	15	67	79	220
S1-2418SS	21.6-26.4	15	51	18	56	81	220
S1-2424SS	21.6-26.4	15	52	24	42	80	220

Model Number	Input Voltage Range (VDC)	Input Current		Output Voltage (VDC)	Output Current Full Load (mA)	Efficiency @FL (%, typ.)	Capacitive Load @ FL (µF, max.)
		No-Load (mA, max.)	Full Load (mA, typ.)				
S1-3R33R3S	2.97-3.63	35	466	±3.3	±152	65	±100
S1-3R305S	2.97-3.63	30	439	±5.0	±100	69	±100
S1-3R37R2S	2.97-3.63	50	410	±7.2	±69	74	±100
S1-3R309S	2.97-3.63	30	394	±9.0	±56	77	±100
S1-3R312S	2.97-3.63	45	384	±12	±42	79	±100
S1-3R315S	2.97-3.63	30	389	±15	±33	78	±100
S1-3R318S	2.97-3.63	30	389	±18	±28	78	±100
S1-3R324S	2.97-3.63	50	384	±24	±21	79	±100
S1-053R3S	4.5-5.5	25	299	±3.3	±152	67	±100
S1-0505S	4.5-5.5	25	270	±5.0	±100	74	±100
S1-057R2S	4.5-5.5	20	260	±7.2	±69	77	±100
S1-0509S	4.5-5.5	20	250	±9.0	±56	80	±100
S1-0512S	4.5-5.5	30	253	±12	±42	79	±100
S1-0515S	4.5-5.5	60	247	±15	±33	81	±100
S1-0518S	4.5-5.5	25	247	±18	±28	81	±100
S1-0524S	4.5-5.5	30	247	±24	±21	81	±100
S1-123R3S	10.8-13.2	15	123	±3.3	±152	68	±100
S1-1205S	10.8-13.2	20	114	±5.0	±100	73	±100
S1-127R2S	10.8-13.2	15	107	±7.2	±69	78	±100
S1-1209S	10.8-13.2	20	110	±9.0	±56	76	±100
S1-1212S	10.8-13.2	18	103	±12	±42	81	±100
S1-1215S	10.8-13.2	20	105	±15	±33	79	±100
S1-1218S	10.8-13.2	20	104	±18	±28	80	±100
S1-1224S	10.8-13.2	25	110	±24	±21	76	±100
S1-153R3S	13.5-16.5	35	111	±3.3	±152	60	±100
S1-1505S	13.5-16.5	15	90	±5.0	±100	74	±100
S1-157R2S	13.5-16.5	20	85	±7.2	±69	78	±100
S1-1509S	13.5-16.5	15	85	±9.0	±56	78	±100
S1-1512S	13.5-16.5	15	83	±12	±42	80	±100
S1-1515S	13.5-16.5	15	84	±15	±33	79	±100
S1-1518S	13.5-16.5	15	85	±18	±28	78	±100
S1-1524S	13.5-16.5	15	85	±24	±21	78	±100
S1-243R3S	21.6-26.4	15	61	±3.3	±152	68	±100
S1-2405S	21.6-26.4	15	58	±5.0	±100	72	±100
S1-247R2S	21.6-26.4	15	53	±7.2	±69	78	±100
S1-2409S	21.6-26.4	15	53	±9.0	±56	79	±100
S1-2412S	21.6-26.4	15	53	±12	±42	78	±100
S1-2415S	21.6-26.4	15	53	±15	±33	79	±100
S1-2418S	21.6-26.4	15	53	±18	±28	79	±100
S1-2424S	21.6-26.4	15	51	±24	±21	81	±100

Model Number	Input Voltage Range (VDC)	Input Current		Output Voltage (VDC)	Output Current Full Load (mA)	Efficiency @FL (%, typ.)	Capacitive Load @ FL (µF, max.)
		No-Load (mA, max.)	Full Load (mA, typ.)				
S1-3R33R3DS	2.97-3.63	40	415	3.3	303	73	220
S1-3R305DS	2.97-3.63	35	394	5	200	77	220
S1-3R37R2DS	2.97-3.63	35	389	7.2	139	78	220
S1-3R309DS	2.97-3.63	30	389	9	111	78	220
S1-3R312DS	2.97-3.63	30	389	12	83	78	220
S1-3R315DS	2.97-3.63	30	389	15	67	78	220
S1-3R318DS	2.97-3.63	35	394	18	56	77	220
S1-3R324DS	2.97-3.63	35	394	24	42	77	220
S1-053R3DS	4.5-5.5	23	260	3.3	303	77	220
S1-0505DS	4.5-5.5	25	247	5	200	81	220
S1-057R2DS	4.5-5.5	23	244	7.2	139	82	220
S1-0509DS	4.5-5.5	20	241	9	111	83	220
S1-0512DS	4.5-5.5	25	247	12	83	81	220
S1-0515DS	4.5-5.5	33	250	15	67	80	220
S1-0518DS	4.5-5.5	25	250	18	56	80	220
S1-0524DS	4.5-5.5	28	247	24	42	81	220
S1-123R3DS	10.8-13.2	20	111	3.3	303	75	220
S1-1205DS	10.8-13.2	20	105	5	200	79	220
S1-127R2DS	10.8-13.2	20	102	7.2	139	82	220
S1-1209DS	10.8-13.2	13	104	9	111	80	220
S1-1212DS	10.8-13.2	25	110	12	83	76	220
S1-1215DS	10.8-13.2	15	102	15	67	82	220
S1-1218DS	10.8-13.2	20	103	18	56	81	220
S1-1224DS	10.8-13.2	30	113	24	42	74	220
S1-153R3DS	13.5-16.5	15	91	3.3	303	73	220
S1-1505DS	13.5-16.5	15	83	5	200	80	220
S1-157R2DS	13.5-16.5	15	85	7.2	139	78	220
S1-1509DS	13.5-16.5	15	85	9	111	78	220
S1-1512DS	13.5-16.5	15	85	12	83	78	220
S1-1515DS	13.5-16.5	20	85	15	67	78	220
S1-1518DS	13.5-16.5	15	84	18	56	79	220
S1-1524DS	13.5-16.5	15	83	24	42	80	220
S1-243R3DS	21.6-26.4	13	56	3.3	303	75	220
S1-2405DS	21.6-26.4	15	53	5	200	78	220
S1-247R2DS	21.6-26.4	10	55	7.2	139	76	220
S1-2409DS	21.6-26.4	10	55	9	111	76	220
S1-2412DS	21.6-26.4	12	53	12	83	78	220
S1-2415DS	21.6-26.4	12	52	15	67	80	220
S1-2418DS	21.6-26.4	10	52	18	56	80	220
S1-2424DS	21.6-26.4	10	52	24	42	80	220

Model Number	Input Voltage Range (VDC)	Input Current		Output Voltage (VDC)	Output Current Full Load (mA)	Efficiency @FL (%, typ.)	Capacitive Load @ FL (µF, max.)
		No-Load (mA, max.)	Full Load (mA, typ.)				
S1-3R33R3D	2.97-3.63	35	466	±3.3	±152	65	±100
S1-3R305D	2.97-3.63	30	427	±5.0	±100	71	±100
S1-3R37R2D	2.97-3.63	30	415	±7.2	±69	73	±100
S1-3R309D	2.97-3.63	30	410	±9.0	±56	74	±100
S1-3R312D	2.97-3.63	30	404	±12	±42	75	±100
S1-3R315D	2.97-3.63	30	404	±15	±33	75	±100
S1-3R318D	2.97-3.63	30	404	±18	±28	75	±100
S1-3R324D	2.97-3.63	30	404	±24	±21	75	±100
S1-053R3D	4.5-5.5	25	290	±3.3	±152	69	±100
S1-0505D	4.5-5.5	55	274	±5.0	±100	73	±100
S1-057R2D	4.5-5.5	25	260	±7.2	±69	77	±100
S1-0509D	4.5-5.5	22	253	±9.0	±56	79	±100
S1-0512D	4.5-5.5	25	253	±12	±42	79	±100
S1-0515D	4.5-5.5	25	247	±15	±33	81	±100
S1-0518D	4.5-5.5	25	244	±18	±28	82	±100
S1-0524D	4.5-5.5	25	244	±24	±21	82	±100
S1-123R3D	10.8-13.2	15	121	±3.3	±152	69	±100
S1-1205D	10.8-13.2	15	114	±5.0	±100	73	±100
S1-127R2D	10.8-13.2	15	108	±7.2	±69	77	±100
S1-1209D	10.8-13.2	20	108	±9.0	±56	77	±100
S1-1212D	10.8-13.2	20	104	±12	±42	80	±100
S1-1215D	10.8-13.2	20	102	±15	±33	82	±100
S1-1218D	10.8-13.2	20	105	±18	±28	79	±100
S1-1224D	10.8-13.2	25	110	±24	±21	76	±100
S1-153R3D	13.5-16.5	25	111	±3.3	±152	60	±100
S1-1505D	13.5-16.5	25	90	±5.0	±100	74	±100
S1-157R2D	13.5-16.5	25	88	±7.2	±69	76	±100
S1-1509D	13.5-16.5	25	88	±9.0	±56	76	±100
S1-1512D	13.5-16.5	25	87	±12	±42	77	±100
S1-1515D	13.5-16.5	10	87	±15	±33	77	±100
S1-1518D	13.5-16.5	15	87	±18	±28	77	±100
S1-1524D	13.5-16.5	15	87	±24	±21	77	±100
S1-243R3D	21.6-26.4	10	62	±3.3	±152	67	±100
S1-2405D	21.6-26.4	10	56	±5.0	±100	74	±100
S1-247R2D	21.6-26.4	10	54	±7.2	±69	77	±100
S1-2409D	21.6-26.4	10	53	±9.0	±56	79	±100
S1-2412D	21.6-26.4	10	53	±12	±42	79	±100
S1-2415D	21.6-26.4	10	52	±15	±33	80	±100
S1-2418D	21.6-26.4	15	52	±18	±28	80	±100
S1-2424D	21.6-26.4	15	53	±24	±21	79	±100

INPUT SPECIFICATIONS					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Input Voltage Range	3.3 V Input	2.97	3.3	3.63	VDC
	5 V Input	4.5	5	5.5	
	12 V Input	10.8	12	13.2	
	15 V Input	13.5	15	16.5	
	24 V Input	21.6	24	26.4	
Input Filter		Capacitor			
Input Reflected Ripple Current (1)			20		mApk-pk
Recommended input fuse (slow blow)	3.3 V Input	1.25			A
	5 V Input	0.75			
	12 V & 15 V Input	0.3			
	24 V Input	0.15			
Note： 1. Measured with a simulated source inductance of 12μH and a source capacitor Cin (47μF, ESR<1.0Ω at 100kHz).					

OUTPUT SPECIFICATIONS					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Output Voltage Accuracy		-3		+3	%
Line Regulation	For 1% Vin Change	-1.4		+1.4	%
Load Regulation	From 20% to 100% Load			17	%
	Output 3.3V Model			20	%
Ripple & Noise	20MHz bandwidth			75	mVpk-pk
Short Circuit Protection		Short Term (1sec)			
Temperature Coefficient		-0.02		+0.02	%/°C
Maximum Capacitive Load	Minimum Vin and constant resistive load	See Table			

ABSOLUTE MAXIMUM RATINGS					
Parameter	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Input Surge Voltage (100 ms)	3.3 V Input			6	VDC
	5 V Input			7	
	12 V Input			15	
	15 V Input			18	
	24 V Input			28	
Soldering Temperature	1.5mm from case 10sec max.			260	°C
Note：These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability.					

GENERAL SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Isolation Voltage	Input-output, and rated for 60sec	Standard Type	1000			VDC
		Suffix “H”	3000			
		Suffix “H4”	4000			
		Suffix “H5”	5200			
		Suffix “H6”	6000			
Isolation Resistance	Input-output		1000			MΩ
Isolation Capacitance	Input-output			60		pF
Switching Frequency				80		kHz
MTBF	MIL-HDBK-217 F @ 25°C		1.121			M hours
Safety Approval	IEC / EN / UL 62368-1		DK-81198-UL, E252573			
Environmental compliance			RoHS			

ENVIRONMENT SPECIFICATIONS

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating Ambient Temperature	See the Derating Curve	-40		100	°C
Maximum Case Temperature				100	°C
Thermal Impedance		57.09			°C/W
Storage Humidity				95	% rel. H
Storage Temperature		-55		125	°C
Cooling	Natural Convection	30-65 LFM			

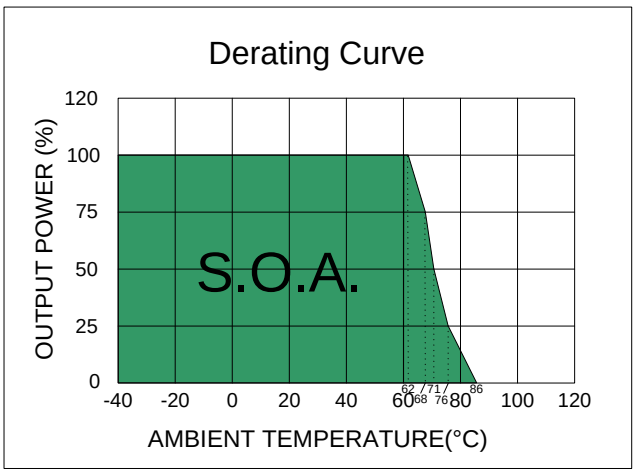
EMC SPECIFICATIONS

Parameter	Standard	Condition	Criterion
Conducted Emissions	EN55032	with external components	B
Radiated Emissions	EN55032		B
ESD	IEC 61000-4-2	Air: ±8kV / Indirect: ±6kV	A
RS	IEC 61000-4-3	10V/m	A
EFT	IEC 61000-4-4	±2.0kV with external components	A
Surge	IEC 61000-4-5	±1.0kV with external components (for SIP) ±0.5kV with external components (for DIP)	A
CS	IEC 61000-4-6	10Vrms	A
PFMF	IEC 61000-4-8	1A/m	A

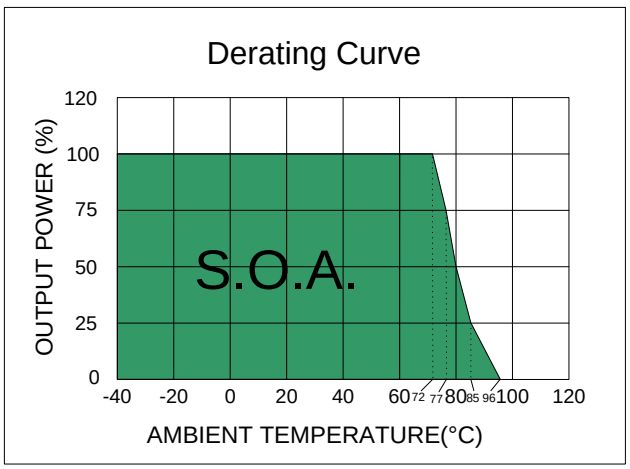
PHYSICAL SPECIFICATIONS

Parameter		Value
Case Material		Nonconductive Black Plastic (UL94V-0 rated)
Pin Material		Alloy 42
Potting Material		Epoxy (UL94V-0 rated)
Weight	SIP Case	2.3 g, typ.
	DIP Case	2.7 g, typ.
Dimensions	SIP Case	0.76" x 0.24" x 0.39"
	DIP Case	0.80" x 0.40" x 0.27"

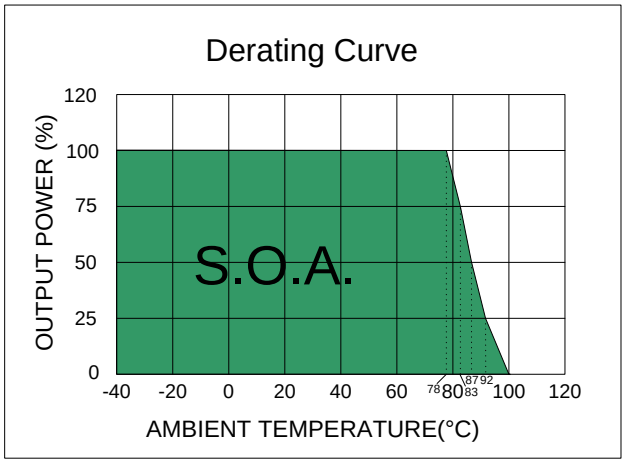
ELECTRICAL CHARACTERISTIC CURVES



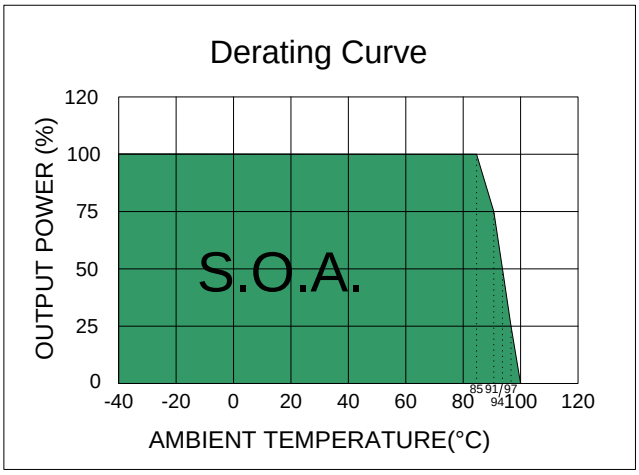
Efficiency : 60% ~ 65%



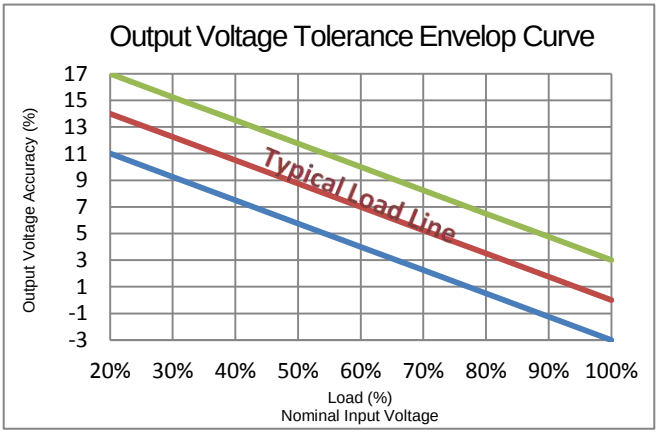
Efficiency : 67% ~ 71%



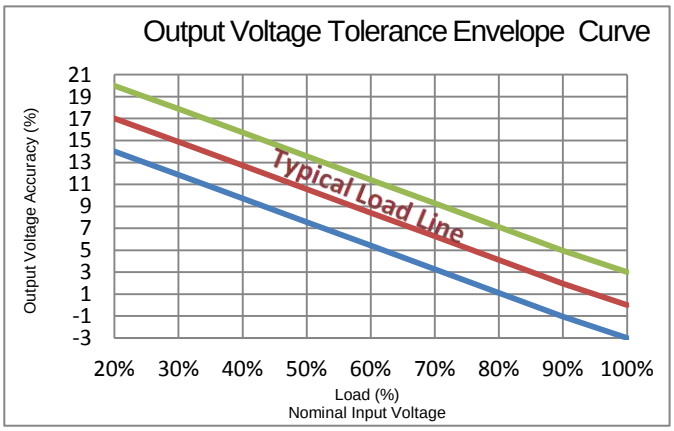
Efficiency : 72% ~ 77%



Efficiency : 78% ~ 83%



From 20% to 100% Load

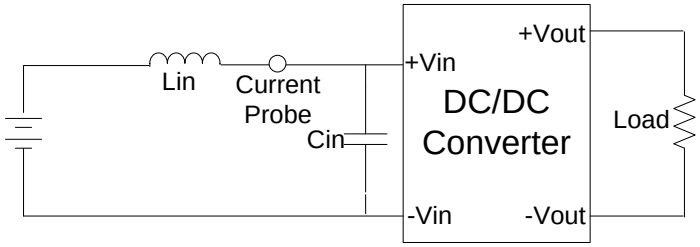


Output 3.3V Model

TEST CONFIGURATIONS

Input Reflected Ripple Current Test Step

Input reflected ripple current is measured with a source inductor Lin (12μH) and a source capacitor Cin (47μF, ESR<1.0Ω at 100kHz) at nominal input and full load.



DESIGN & FEATURE CONFIGURATIONS

Isolation Voltage

This series is designed to meet the functional insulation of UL, both input and output should be maintained within SELV limits (less than 42.4V peak, or 60VDC).

The isolation test voltage represents a measure of immunity to transient voltages and the part should never be used as an element of a safety isolation system. The part could be expected to function correctly with hundreds of volts offset applied continuously across the isolation barrier; but then the circuitry on both sides of the barrier must be regarded as operating at an unsafe voltage and further isolation/insulation systems must form a barrier between these circuits and any user-accessible circuitry according to safety standard requirements.

Repeated High-Voltage Isolation Testing

Repeated high-voltage isolation testing of a barrier component can actually degrade isolation capability, to a lesser or greater degree depending on materials, construction and environment.

This series has isolation transformers without additional insulation between primary and secondary windings of enameled wire.

While parts can be expected to withstand several times the stated test voltage, the isolation capability does depend on the wire insulation.

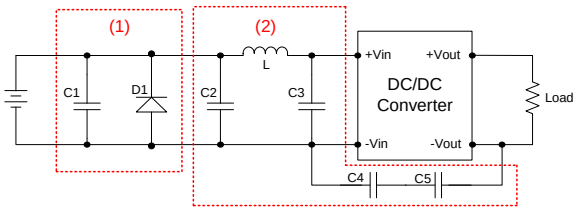
Any material including the enamel (typically polyurethane) is susceptible to eventual chemical degradation when subject to very high applied voltage, thus implying that the number of tests should be strictly limited.

We strongly advise against repeated high voltage isolation testing, but if it is absolutely required, the isolation test voltage should be reduced by 20% from specified test voltage.

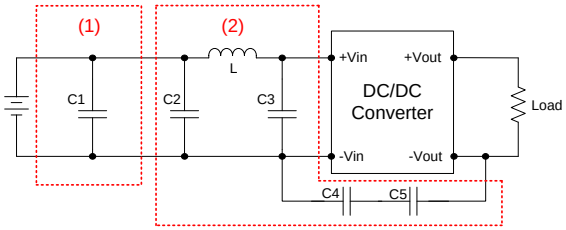
DESIGN & FEATURE CONFIGURATIONS

EMC Filter

The part (1) Circuit is used to meet Surge & EFT test, and the part (2) Circuit is used to meet EMI test.

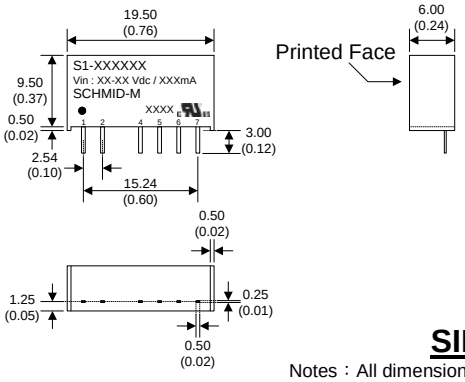


SIP	C1	D1	C2	L	C3	C4	C5
S1-3R3XXXXX	NIPPON Chemi-Con KMH Series 2200μF, 100V	SMAJ5A	MLCC 2.2μF, 100V	18μH			
S1-05XXXXX		SMAJ6.5A					
S1-12XXXXX		SMAJ14A					
S1-15XXXXX		SMAJ18A					
S1-24XXXX		SMAJ26A			MLCC 2.2μF, 100V	MLCC 470pF, 3KV	
S1-24XXXXH							
S1-24XXXXH4~H6					MLCC 2.2μF, 100V	MLCC 1000pF, 3KV	MLCC 1000pF, 3KV



DIP	C1	C2	L	C3	C4	C5
S1-3R3XXXXX	NIPPON Chemi-Con KY Series 470μF, 100V	MLCC 2.2μF, 100V	18μH			
S1-05XXXXX						
S1-12XXXXX						
S1-15XXXXX						
S1-24XXXX				MLCC 2.2μF, 100V	MLCC 470pF, 3KV	
S1-24XXXXH						
S1-24XXXXH4~H6				MLCC 2.2μF, 100V	MLCC 1000pF, 3KV	MLCC 1000pF, 3KV

MECHANICAL SPECIFICATIONS



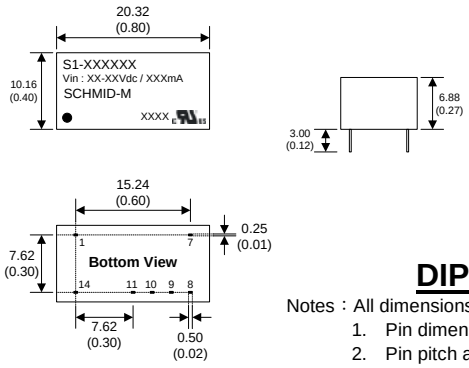
SIP7 Package

Notes：All dimensions are typical in millimeters (inches).

1. Pin dimension tolerance: ±0.05 (±0.002)
2. Pin pitch and length tolerance: ±0.35 (±0.014)
3. Pin to case tolerance: ±0.5 (±0.02)
4. Case Tolerance: ±0.5 (±0.02)

PIN CONNECTIONS				
PIN NUMBER	SINGLE	DUAL	SINGLE-H	DUAL-H
1	+Vin	+Vin	+Vin	+Vin
2	-Vin	-Vin	-Vin	-Vin
4	-Vout	-Vout	N.P.	N.P.
5	N.P.	COM	-Vout	-Vout
6	+Vout	+Vout	N.P.	COM
7	N.P.	N.P.	+Vout	+Vout

N.P.：No PIN



DIP14 Package

Notes：All dimensions are typical in millimeters (inches).

1. Pin dimension tolerance: ±0.05 (±0.002)
2. Pin pitch and length tolerance: ±0.35 (±0.014)
3. Pin to case tolerance: ±0.5 (±0.02)
4. Case Tolerance: ±0.5 (±0.02)

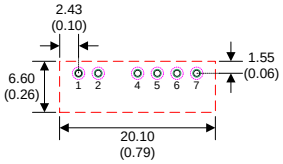
PIN CONNECTIONS				
PIN NUMBER	SINGLE	DUAL	SINGLE-H	DUAL-H
1	-Vin	-Vin	-Vin	-Vin
7	N.C.	N.C.	N.C.	N.C.
8	N.P.	COM	+Vout	+Vout
9	+Vout	+Vout	N.P.	COM
10	N.P.	N.P.	-Vout	-Vout
11	-Vout	-Vout	N.P.	N.P.
14	+Vin	+Vin	+Vin	+Vin

N.P.：No PIN

N.C.：No Connection

RECOMMENDED FOOTPRINT DETAILS

SIP7 Package



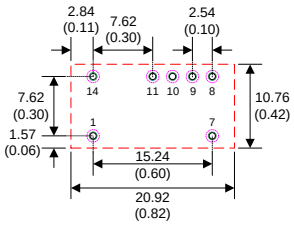
Notes：1. All dimensions are typical in millimeters (inches).

Through hole (black) 1 ~ 7: Ø0.80 (0.031)

Top view pad (green) 1 ~ 7: Ø1.00 (0.039)

Bottom view pad (pink) 1 ~ 7: Ø1.60 (0.063)

DIP14 Package



Notes：1. All dimensions are typical in millimeters (inches).

Through hole (black) 1 ~ 14: Ø0.80 (0.031)

Top view pad (green) 1 ~ 14: Ø1.00 (0.039)

Bottom view pad (pink) 1 ~ 14: Ø1.60 (0.063)