RVS002 Micropower Isolated Power Bridge Rectifier

6V/0.3A Power Switch

FEATURES

- Bridge Rectifier Structure
- Highly Integrated, Simple Periphery
- Built-in Two Schottky Diodes
- Built-in Two nLDMOS Transistors
- Integrated Intelligent Voltage Limiter
- Surge Voltage up to 10V
- Operating Temperature: -40°C~+125°C

APPLICATIONS

- IGBT/SiC Gate-drive Power Supplies
- Isolated Interface Auxiliary Power Supplies
- Precision/Medical Equipment
- DCS/PLC Auxiliary Power Supplies
- UPS and PV Inverter
- Distributed/Radio/Telecom Power Supplies

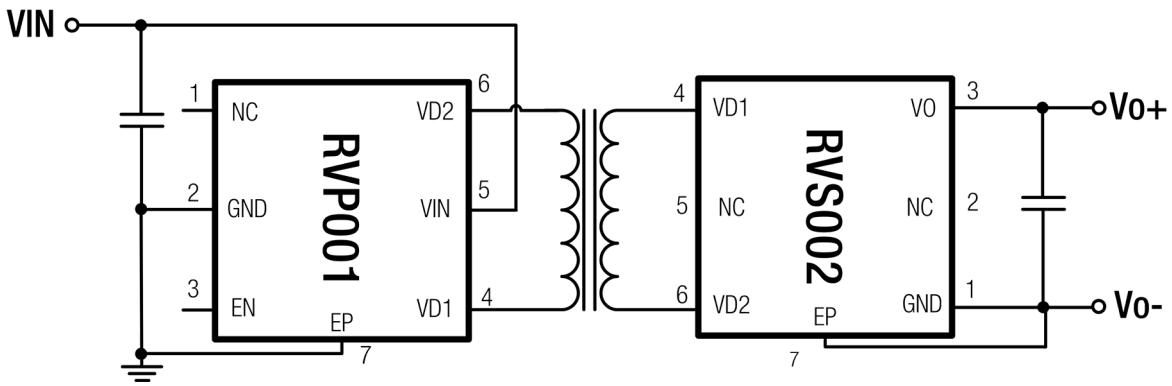
DESCRIPTION

RVS002 is a compact bridge rectifier chip specifically designed for micro-power isolated power supply applications in space-constrained environments. When used with a transformer driver and transformer, it requires only simple output filter capacitors to form a complete isolated power supply system with an output voltage range of 2-6V and output power between 1W and 3W. RVS002 integrates two N-channel power MOSFETs and two Schottky diodes, forming a full bridge rectifier. This design enables rectification using only a single winding on the transformer's secondary side, significantly simplifying transformer design, reducing size, and lowering cost. An integrated intelligent voltage limiter prevents the output voltage from rising excessively under no-load conditions, ensuring voltage stability. When the power supply is under load, the limiter remains inactive and does not draw current, thereby maintaining high efficiency at full load.

Device Information

Part Number	Package	Weight(mg)	Dimension	SPQ
RVS002	DFN2x2-6	10.38	2.0mm x 2.0mm	3000

SIMPLIFIED SCHEMATIC



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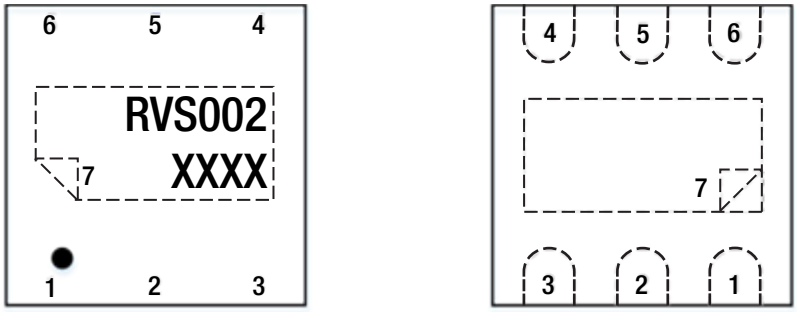
PINOUT AND FUNCTIONS



Name	No.	Type	Description
GND	1	P	Pin 1 serves as the ground of the chip and also functions as the source terminal of the power transistor. It should be connected to a thermally conductive structure or a device with good heat dissipation capability to effectively manage the chip's thermal performance.
NC	2, 5	-	No connected pin.
VO	3	P	Output port, also the cathode of the two Schottky diodes.
VD1	4	I	The drain of the first built-in N-MOSFET and the anode of the first built-in Schottky diode.
VD2	6	I	The drain of the second built-in N-MOSFET and the anode of the second built-in Schottky diode.
EP	7	P	Exposed pads are connected to EP and GND to enhance heat dissipation.For multi-layer boards, adding through holes is recommended.Exposed pads are not intended for use as electrical connection points.

SPECIFICATIONS

Absolute Maximum Ratings

		Min.	Max.	Unit
V_0 Output Voltage	V_0	-0.3	10	V
LDMOS Drain Voltage	VD1, VD2	-0.3	V_0 +0.1	V
LDMOS Peak Current	$I_{(VD1)\ PK}$, $I_{(VD2)\ PK}$		1	A
Maximum Junction Temperature	T_{JMAX}		150	°C
Storage Temperature Range	T_{STG}	-55	150	°C

Stress exceeding the absolute maximum rated value may cause permanent damage to the device. These are only stress ratings and do not imply that the device operates beyond the recommended operating conditions under these or any other conditions. Long term exposure to absolute maximum rated conditions may affect the reliability of the device. All voltages are related to grounding. The current is positive input and negative output.

ESD Ratings

			Value	Unit
$V_{(ESD)}$	Electrostatic discharge	Human Body Model (HBM), per ESDA/JEDEC JS-001-2017;(Zap 1 pulse, Interval:>=0.1S)	±4000	V
		Charged Device Model (CDM), per ESDA/JEDEC JS-002-2014	±1000	V

Thermal Resistance

Packaging	θ_{JA}	Ψ_{JT}	UNIT
DFN2x2-6	90	5.2	°C/W

Note: Measured on a test board with 1oz copper (7.62cm × 11.43cm).

Recommended Operating Conditions

		Min.	Typ.	Max.	Unit
VO Output Voltage	V_0	2		6.0	V
LDMOS Drain Current	I_{VD1}, I_{VD2}			0.3	A
Ambient Temperature	T_A	-40		125	°C

Electrical Characteristics

Unless otherwise noted, all values are at T=25°C.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Output port VO						
V_o	Output voltage range		2.0		6.0	V
I_{OSNK}	Maximum current absorbed by the smart voltage limiter	VD1=0V, VD2=5V, VO=5.0V	1.85	2.31	2.77	mA
		VD1=0V, VD2=5V, VO=5.5V	5.05	6.31	7.57	
		VD1=0V, VD2=5V, VO=6.0V	5.90	7.38	8.86	
Output port VD1\VD2						
$R_{DS(ON)}$	On-resistance of N-MOSFET	T=25°C, I_{DS}=100mA		100	120	mΩ
		T=100°C, I_{DS}=100mA		130	160	
$V_{SD(ON)}$	Switch-on voltage drop of Schottky diode	T=25°C, I_{SD}=100mA		380	450	mV
		T=100°C, I_{SD}=100mA		335	400	
		T=25°C, I_{SD}=10mA		245	295	
		T=100°C, I_{SD}=10mA		149	300	

Typical Characteristics

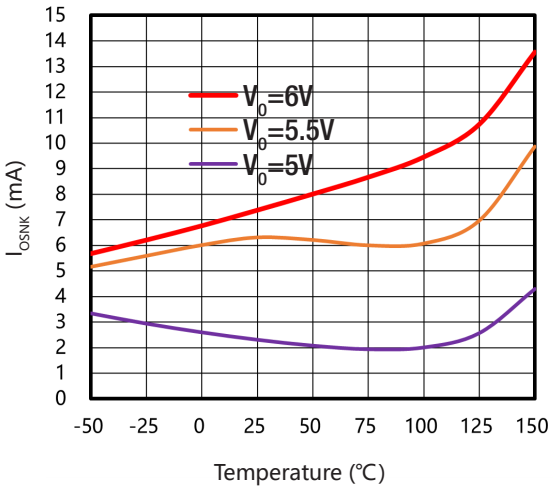


Fig. 1 $I_{OSNK(MAX)}$ vs Temperature

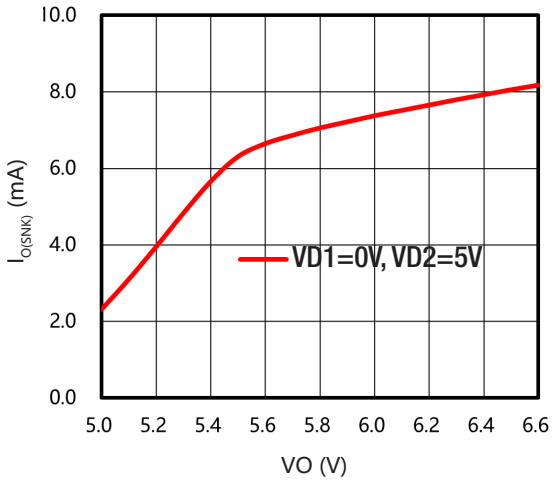


Fig. 2 $I_{O(SNK)}$ vs VO

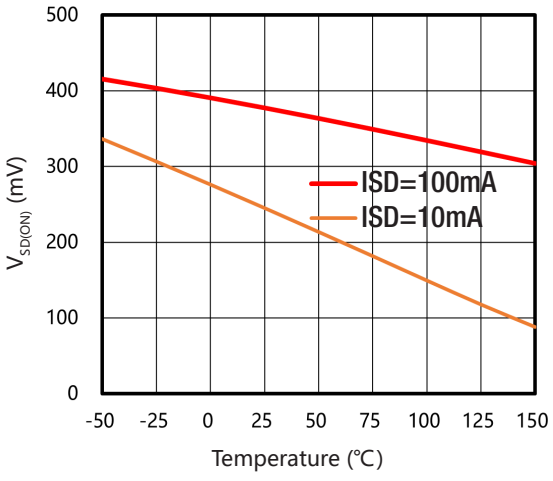


Fig. 3 $V_{SD(ON)}$ vs Temperature

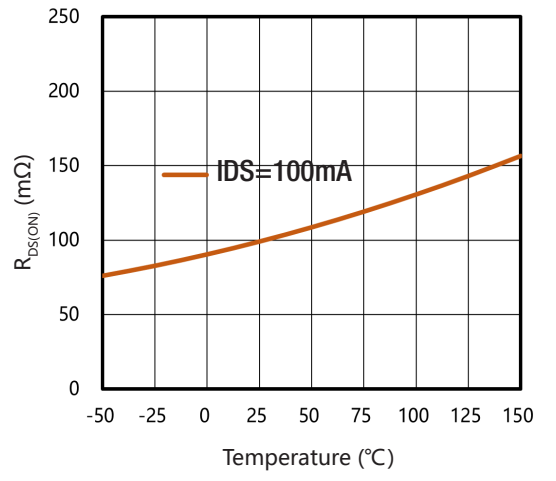


Fig. 4 $R_{DS(ON)}$ vs Temperature

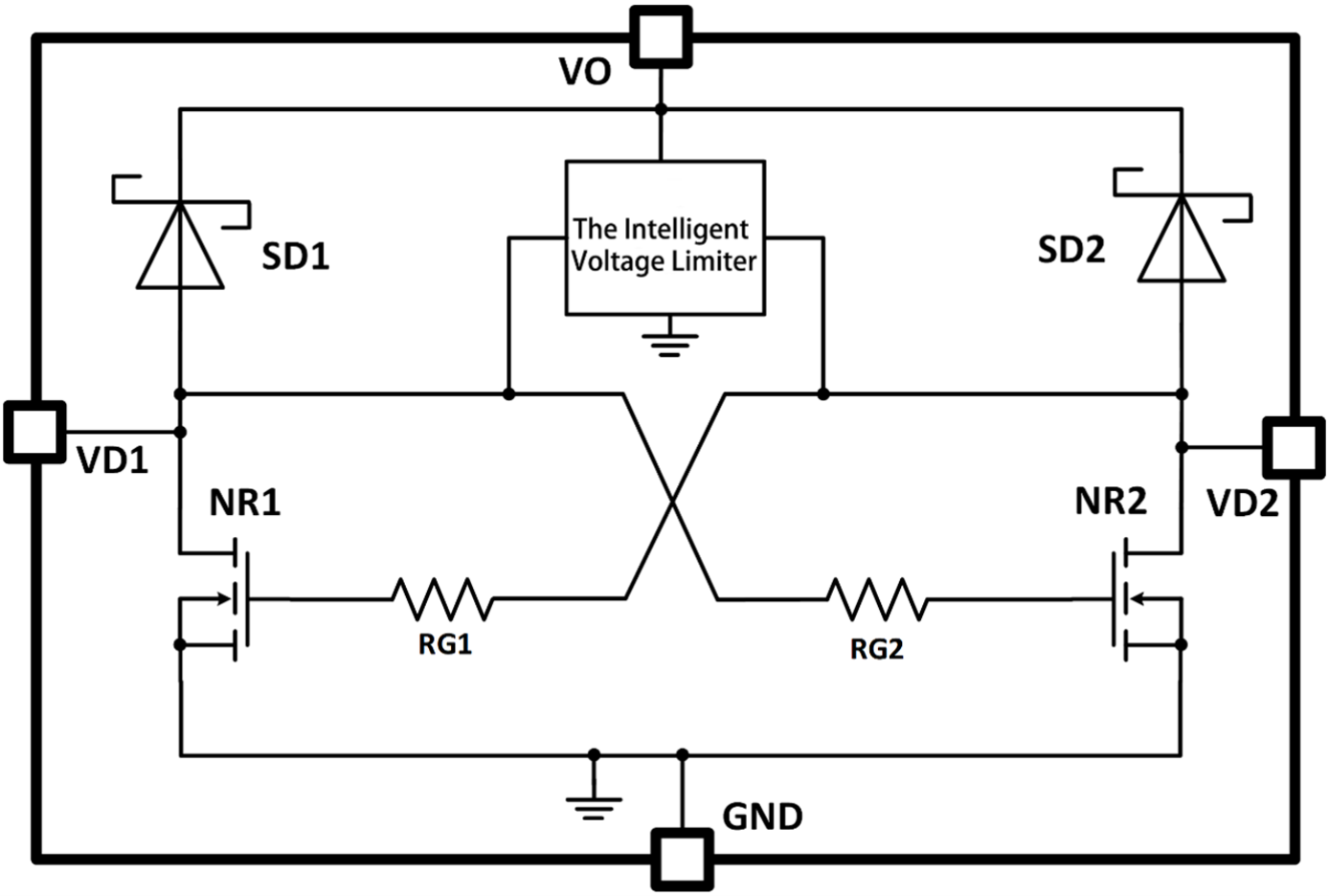
FUNCTIONS AND PRINCIPLES

Overview

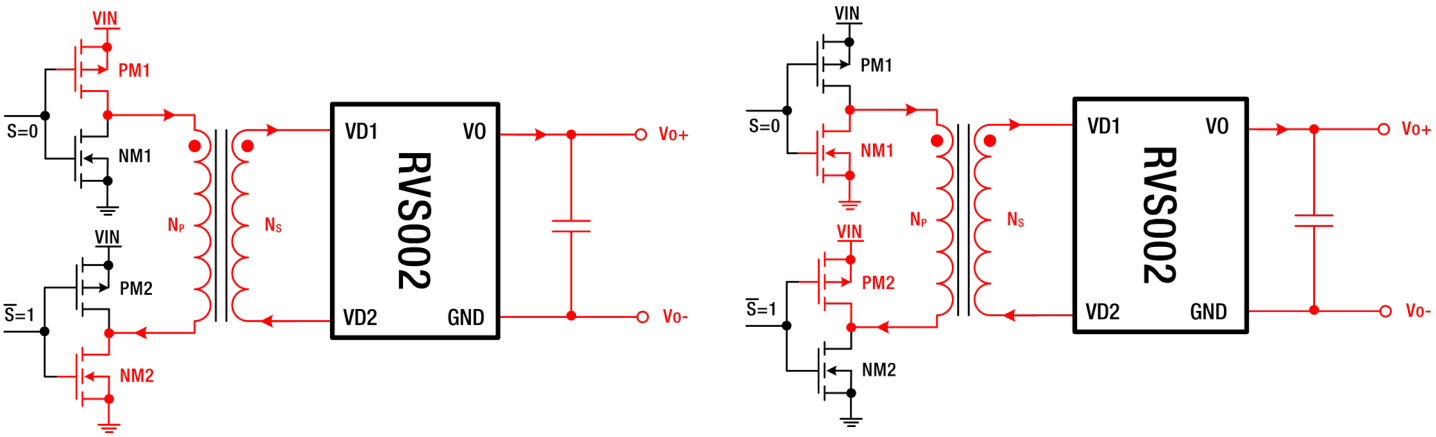
RVS002 is a highly integrated bridge rectifier chip designed for compact, micro power isolated power supply applications. Each arm of the bridge consists of an N-channel MOSFET and a Schottky diode. Thanks to the low conduction voltage drop of the MOSFETs, the overall voltage drop across the rectifier is primarily due to the Schottky diodes. Compared with traditional bridge rectifiers built from four diodes, this configuration results in a lower total voltage drop and significantly improves conversion efficiency.

RVS002 also features a built-in intelligent voltage limiter that eliminates the need for external dummy load resistors. This limiter remains inactive during normal operation under load, ensuring that it does not impact overall efficiency. It only activates under no-load conditions, where it absorbs a small amount of current to prevent the output voltage from rising excessively, thereby maintaining voltage stability. Thanks to its high level of integration, the RVS002 simplifies peripheral circuitry and offers flexible application options. Multiple RVS002 chips can be connected in parallel to increase output power as needed. Alternatively, a single chip can be assigned to rectify the output of an individual transformer winding, which is particularly beneficial in micro-power isolated systems with multiple outputs. These features make the RVS002 an efficient and scalable solution for compact isolated power designs.

Functional Block Diagram



Working Principle



When S = 0, the current in the transformer's primary winding (N_P) flows from the dotted end to the non-dotted end, while the current in the secondary winding (N_S) flows from the non-dotted end to the dotted end. In this condition, VD1 is at a higher potential and VD2 is at a lower potential. The internal N-channel rectifier NR2 and Schottky diode SD1 within the RVS002 are turned on, while NR1 and SD2 remain off. As a result, current from the secondary winding flows from VD1 to VO through SD1, passes through the load to GND, and returns via NR2 to VD2, forming the first rectification loop.

When S = 1, the direction of current in the primary winding reverses, flowing from the non-dotted end to the dotted end. The secondary winding current then flows from the dotted end to the non-dotted end. In this case, VD1 becomes the low potential and VD2 the high potential. The N-channel rectifier NR1 and Schottky diode SD2 are now turned on, while NR2 and SD1 are turned off. The current flows from VD2 through SD2 to VO, then passes through the load to GND, and returns via NR1 to VD1, forming the second rectification loop.

The intelligent voltage limiter in RVS002 plays a critical role under no-load conditions. When the output is unloaded, the converter no longer consumes current, and due to the energy stored in the transformer's leakage inductance, the output voltage VO may rise above the expected level after rectification. The intelligent voltage limiter detects when VO exceeds the higher of the voltages at VD1 and VD2 and begins to absorb current to suppress the voltage rise. The amount of absorbed current increases proportionally with how much VO exceeds the reference level, effectively preventing VO from floating too high. The behaviour of the limiter current (IOSNK) as a function of temperature and VO is illustrated in Figure 1 and Figure 2 in the Typical Characteristics section.

During normal operation with a load, the output voltage VO remains below the high-level reference of VD1 and VD2. In this state, the intelligent voltage limiter remains inactive and does not draw current, ensuring it does not degrade the converter's efficiency. The limiter dynamically adapts to variations in both the reference voltages (VD1 and VD2) and the output load conditions. It only activates under near no-load situations, making it an adaptive and efficient solution for managing no-load voltage stability in isolated power supply applications.

TYPICAL APPLICATION

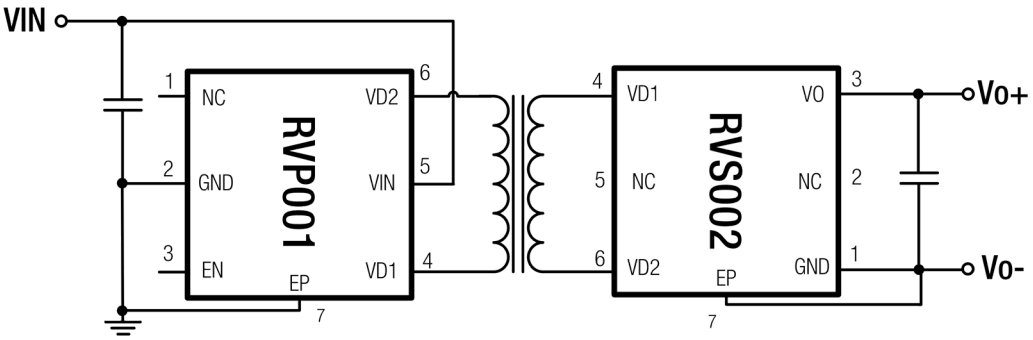


Fig. 5 Full-Bridge Driver + Full-Bridge Rectification (RVS002)

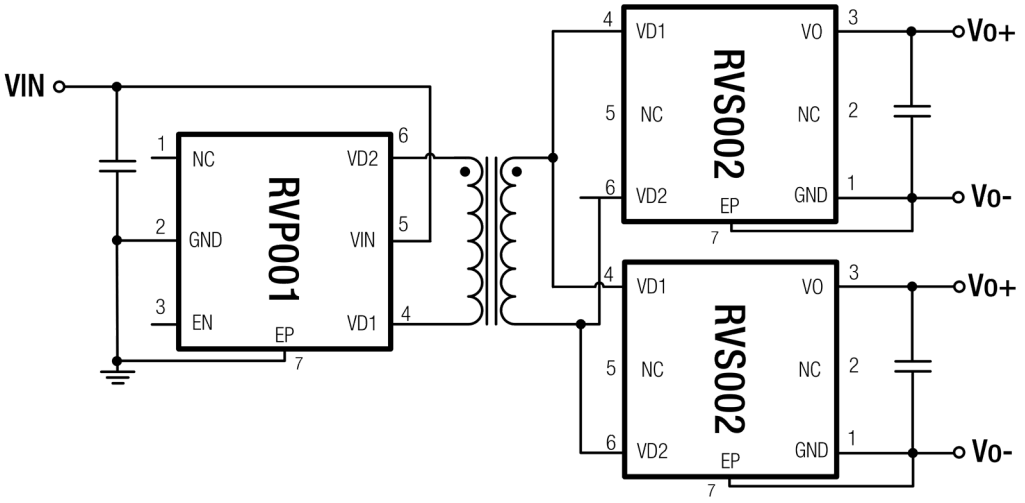


Fig. 6 Two or more RVS002 in parallel to expand output power

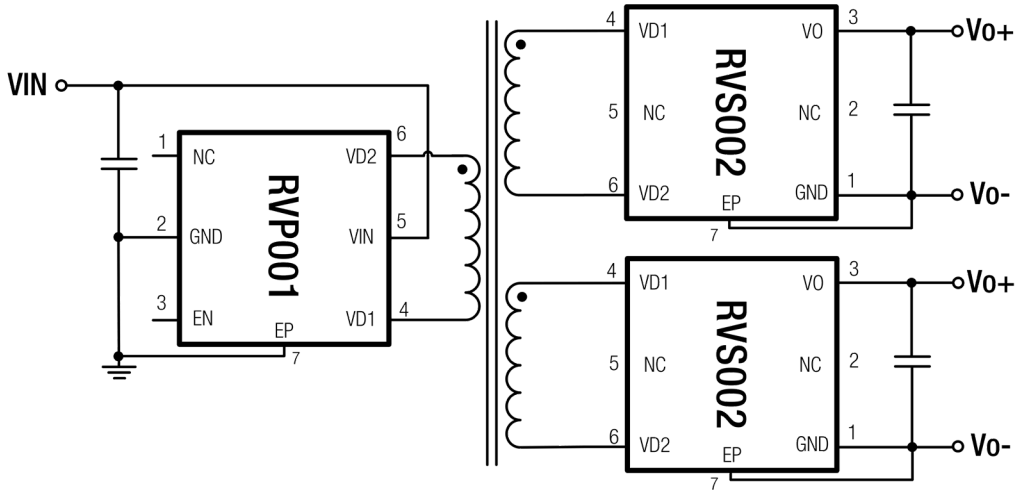
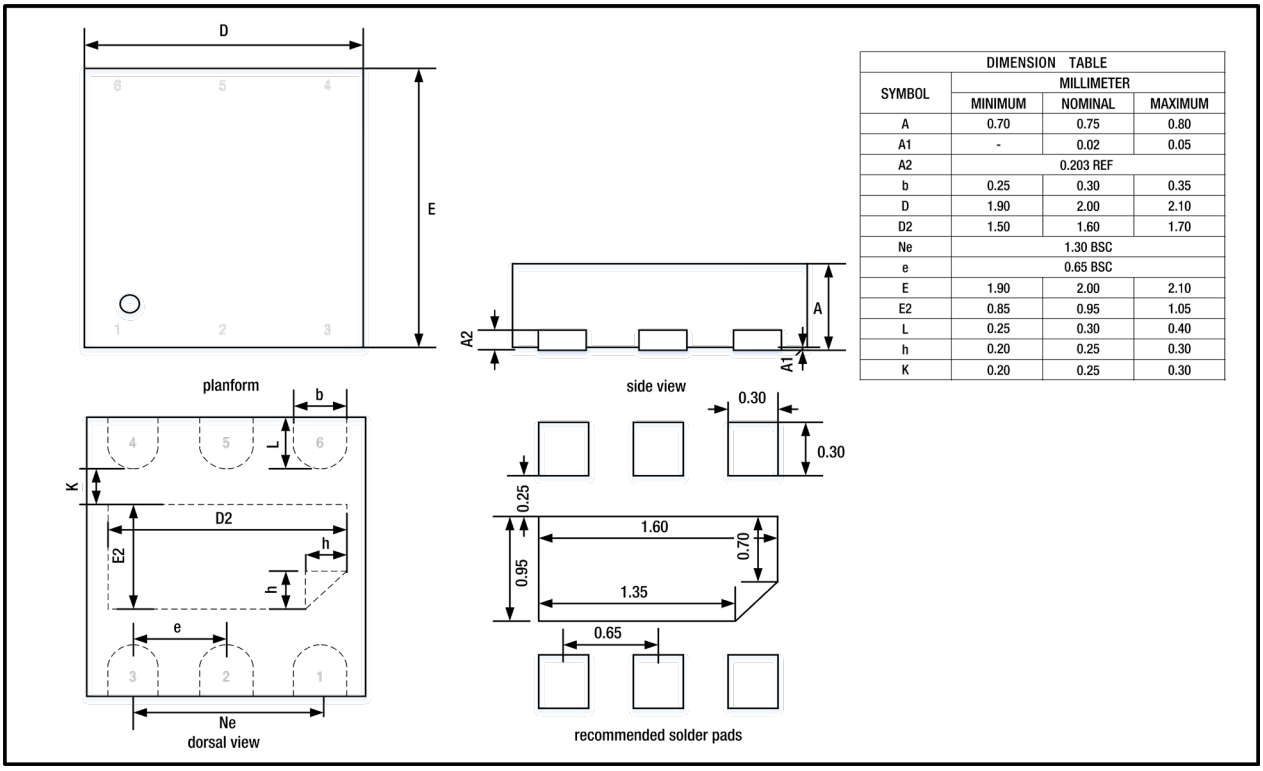


Fig. 7 Two or more RVS002 provide multiple outputs

PACKAGING INFORMATION

DFN2x2-6



DIMENSION TABLE			
SYMBOL	MILLIMETER		
	MINIMUM	NOMINAL	MAXIMUM
A	0.70	0.75	0.80
A1	-	0.02	0.05
A2		0.203 REF	
b	0.25	0.30	0.35
D	1.90	2.00	2.10
D2	1.50	1.60	1.70
Ne		1.30 BSC	
e		0.65 BSC	
E	1.90	2.00	2.10
E2	0.85	0.95	1.05
L	0.25	0.30	0.40
h	0.20	0.25	0.30
K	0.20	0.25	0.30

ORDER INFORMATION

Device	Package Type	PIN	Packaging	QTY	Marking Code*	MSL
RVS002-FB-2DN6-R	DFN2x2-6	6	Tape and Reel	3000	RVS002 XXXX	MSL-3

*Marking Code :
RVS——Company Code
002——Product Code
Model XXXX—— Product Traceability ID Number