

High Performance Synchronous Rectifier IC

20mΩ/60V,

Product Description

DK5V60R20S is a simple but high efficiency synchronous rectifier solution with only two function pins A-K, corresponding A-K pins of Schottky diode. With 60V power NMOS integrated, it can significantly reduce the conduction loss of traditional Schottky diode. Hence it can improve the overall efficiency and replace the same specifications of Schottky rectifier diodes currently on the market. The package of DK5V60R20S is SM-7 (compatible with TO-277).

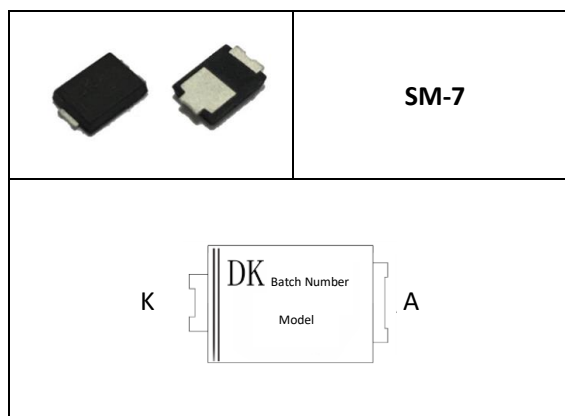
Product Feature

- Suitable for PSR/SSR feedback mode
- Ultra low VF
- Ultra low temperature rise
- 60V/20mΩ NMOS integrated
- Support CCM/DCM/QR fly-back mode
- Patented self-power supply, no need of external power supply component
- With intelligent detection system, no need of front-end synchronization signal
- Improve EMC/EMI effect
- Replace Schottky Diode directly
- No need of external components

Applications

- USB Charger
- Adapter
- LED Driver
- etc

PINS



Pins Function

No.	Name	Description
1	K	Same as diode cathode in application
2	A	Same as diode anode in application

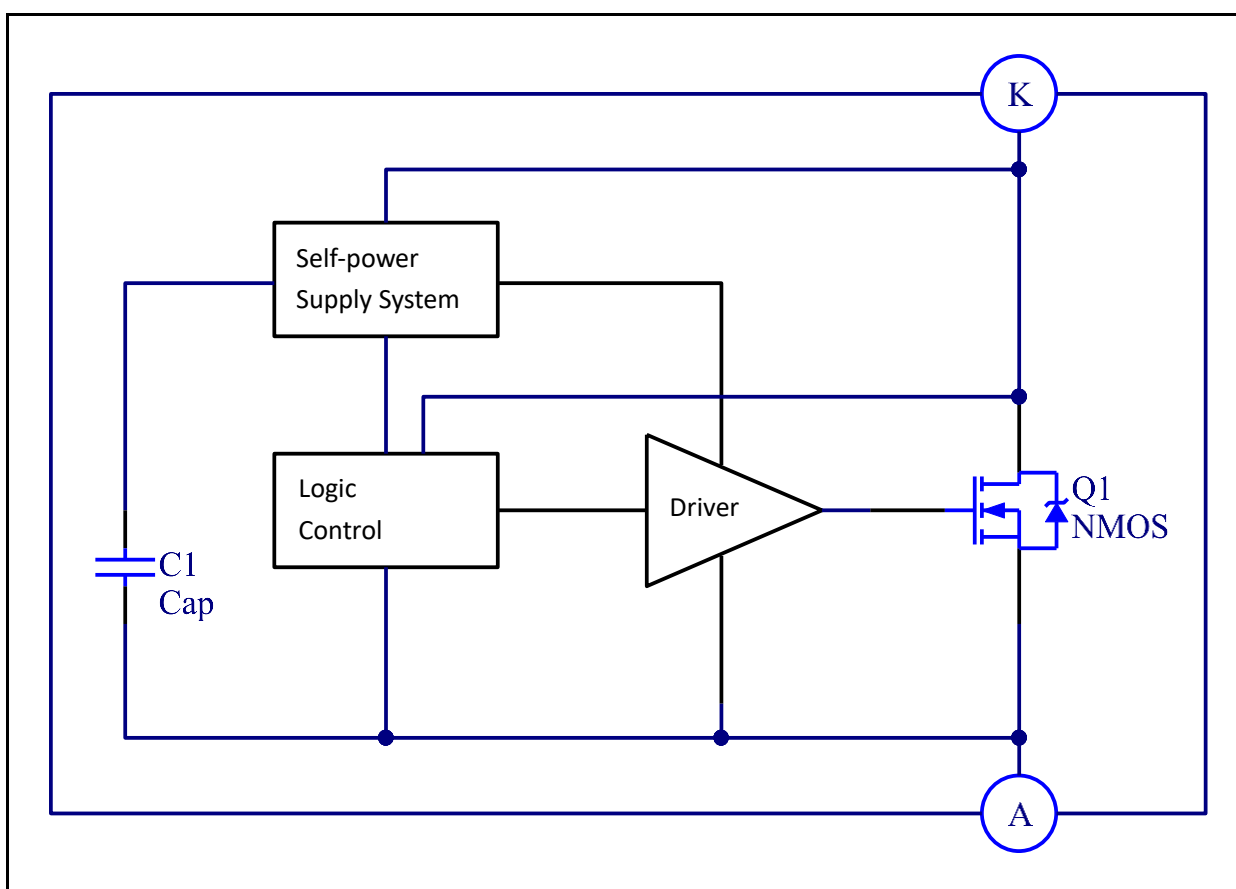
Typical Power

Product Model	Input Voltage	Typical Power
DK5V60R20S	85-265VAC	9V,2.4A

Remark: Test typical power in closed environment @45°C ambient temperature. DK5V60R20S system output rated current is recommended not to exceed 2.4A.

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Functional Structure Diagram



Absolute Maximum Rating (All parameters are measured at 25°C ambient)

Note: Exceeding the limit parameters may damage the device. If the device works beyond the limit parameters, it may not work properly and affect the reliability of the device.

Parameter	Symbol	Min	Typ	Max	Unit
NMOS Breakdown Voltage	$V_{(BR)DSS}$	60			V
NMOS Max. Continuous Current	I_D			35	A
NMOS Max. Peak Current	I_{DS}			50	A
Dissipation power of SM7	P_{DMAX}		1		W
Thermal Resistance (junction to ambient)	$R\theta_{JA}$		76		°C/W
Thermal Resistance (junction to tube)	$R\theta_{JC}$		4		°C/W
Case Temperature Range	T_C	-25		120	°C
Storage Temperature Range	T_{STG}	-55		155	°C
Junction Temperature	T_J	-25		150	°C
Soldering Temperature			260/5S		°C

Electrical Characteristics ($T_A = 25^\circ\text{C}$)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Power Supply Section						
V_{CC} Start-up Voltage ^①	V_{CC_ON}		7.6	7.7	7.8	V
Undervoltage Protection Threshold ^①	V_{CC_uvlo}		3.4	3.5	3.6	V
Overvoltage Protection Threshold ^①	V_{OVP}		7.9	8.0	8.1	V
Smart Detection and Control Section						
NMOS Turn-on Voltage	V_{ON}	K voltage	-210	-213	-216	mV
NMOS Turn-on Delay	T_{DON}				150	ns
NMOS Turn-off Delay	T_{DOFF}				50	ns
NMOS Max. Conduction Duration	T_{ON_MAX}			61	80	μs
NMOS Min. Conduction Duration	T_{ON_MIN}		166	197	222	ns
NMOS Min. Turn-off Duration	T_{OFF_MIN}		495	596	686	ns
Deadtime Duration ^②	T_D			450		ns
Max. Operating Frequency	F_{S_MAX}				120	KHz
NMOS Section						
NMOS Conduction Resistance	R_{DS_ON}				20	mΩ

Remarks: ①. Voltages in specification are referenced at pin A.

②. Deadtime duration can be adjusted automatically based on fluctuation in pin K.

Operation Principle

DK5V60R20S is a simple but high efficiency synchronous rectifier IC with only two function pins, no need of external components. It can significantly reduce the conduction loss of traditional Schottky diode and improve the overall efficiency.

· Start up

DK5V60R20S has patented built-in capacitor for energy storage and self-power supply circuit, which can achieve the driver requirement of the IC and power MOSFET, no need of external power supply. When the voltage of K-point is higher than A-point, Vcc is charged and Vcc voltage increases gradually through self-power supply circuit. When Vcc voltage is lower than starting voltage Vcc_on, the built-in power MOSFET is turned off. When Vcc voltage exceeds Vcc_on, the starting status ends. When Vcc voltage decreases below reset voltage Vcc_uvlo, the synchronous rectifier IC re-enters starting status.

· Power MOSFET control

When the circuit detects the forward voltage of A-K is higher than the turn-on voltage Von, the power MOSFET will be turned on. When it is detected that the current flowing through the power MOSFET decreases to 0 gradually, or when the forward conduction voltage of A-K is 0, the power MOSFET is turned off.

· RC Snubber

During start-up, output short circuit, high input voltage, continuous current mode, etc., it is easy to generate spike voltage across the power MOSFET. To prevent the built-in power MOSFET from overvoltage breakdown, a RC absorption circuit can be connected between A and K to reduce the N-point Spike voltage.

· Conduction Resistance of NMOS

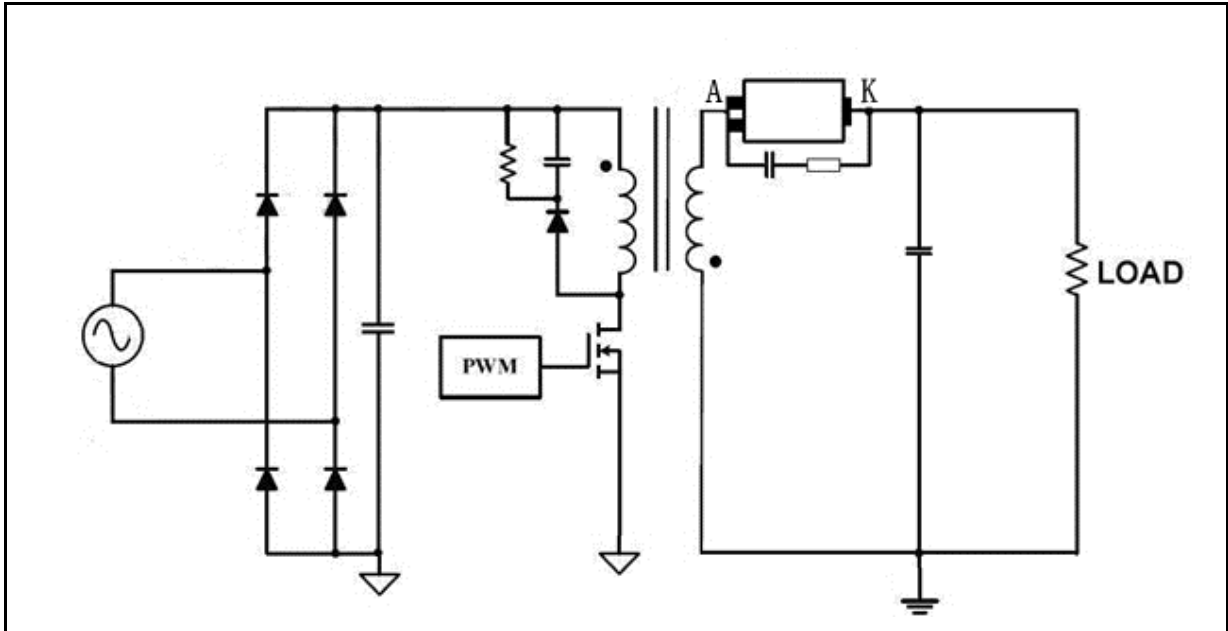
Due to the characteristics of the NMOSFET itself, during operation, the internal resistance will increase and the efficiency will decrease as the temperature rises. Increasing the heat dissipation area appropriately can reduce the operating temperature of the IC.

· Caution!

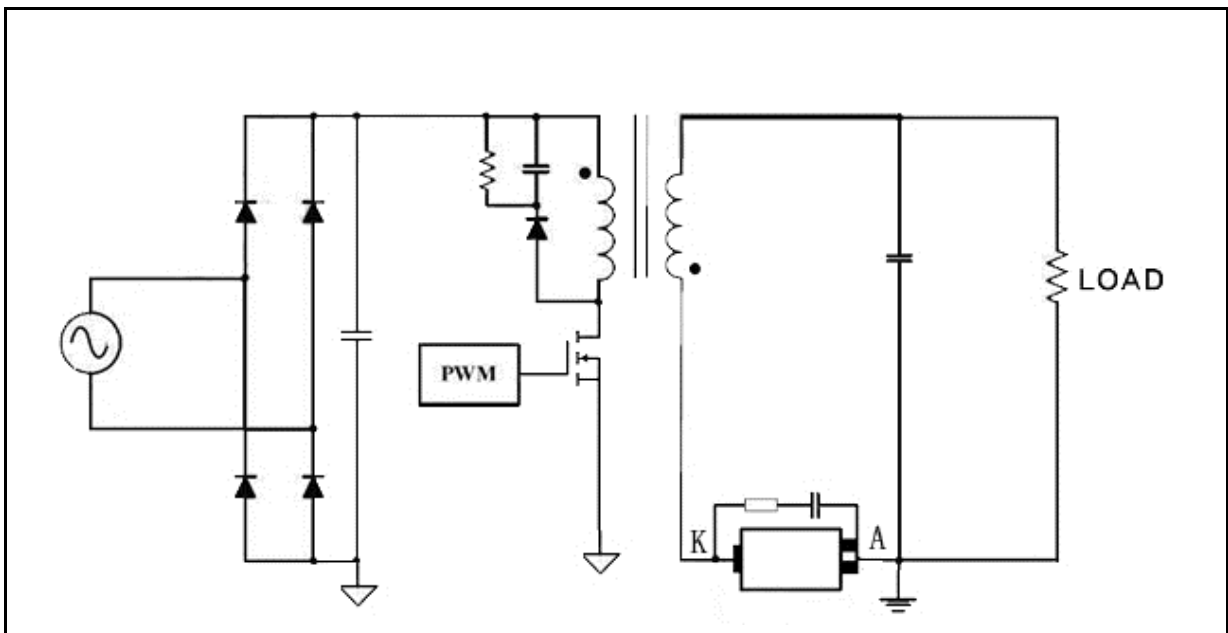
In the application, the breakdown voltage of the synchronous IC needs to be measured to ensure that the maximum operating voltage of the synchronous rectifier IC is lower than breakdown voltage(VBVDSS). In the application, the temperature of the synchronous IC needs to be measured to evaluate whether the maximum operating temperature of the product exceeds the Operating Junction Temperature.

Typical Application Circuit Diagram

1. High side

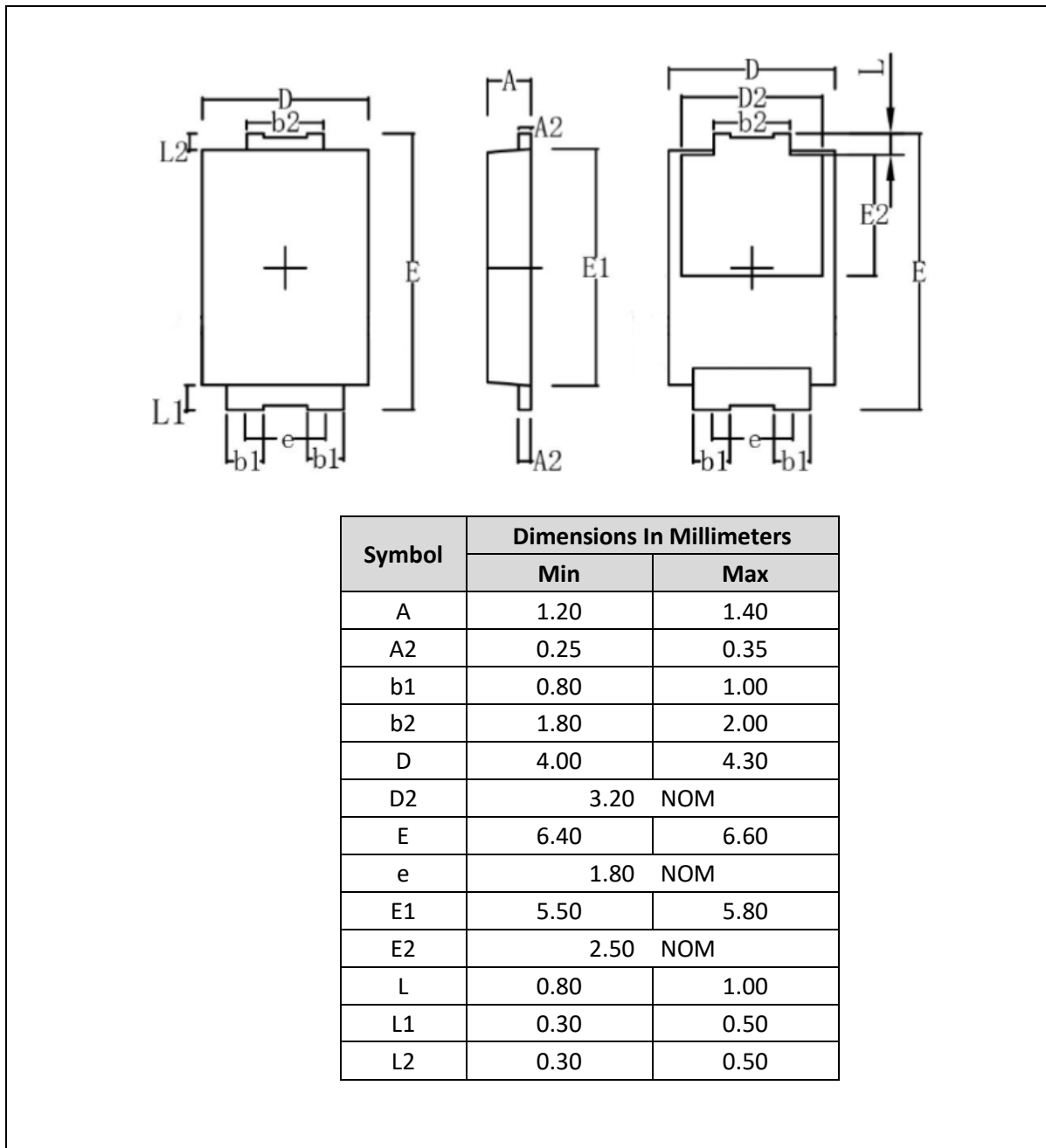


2. Low side

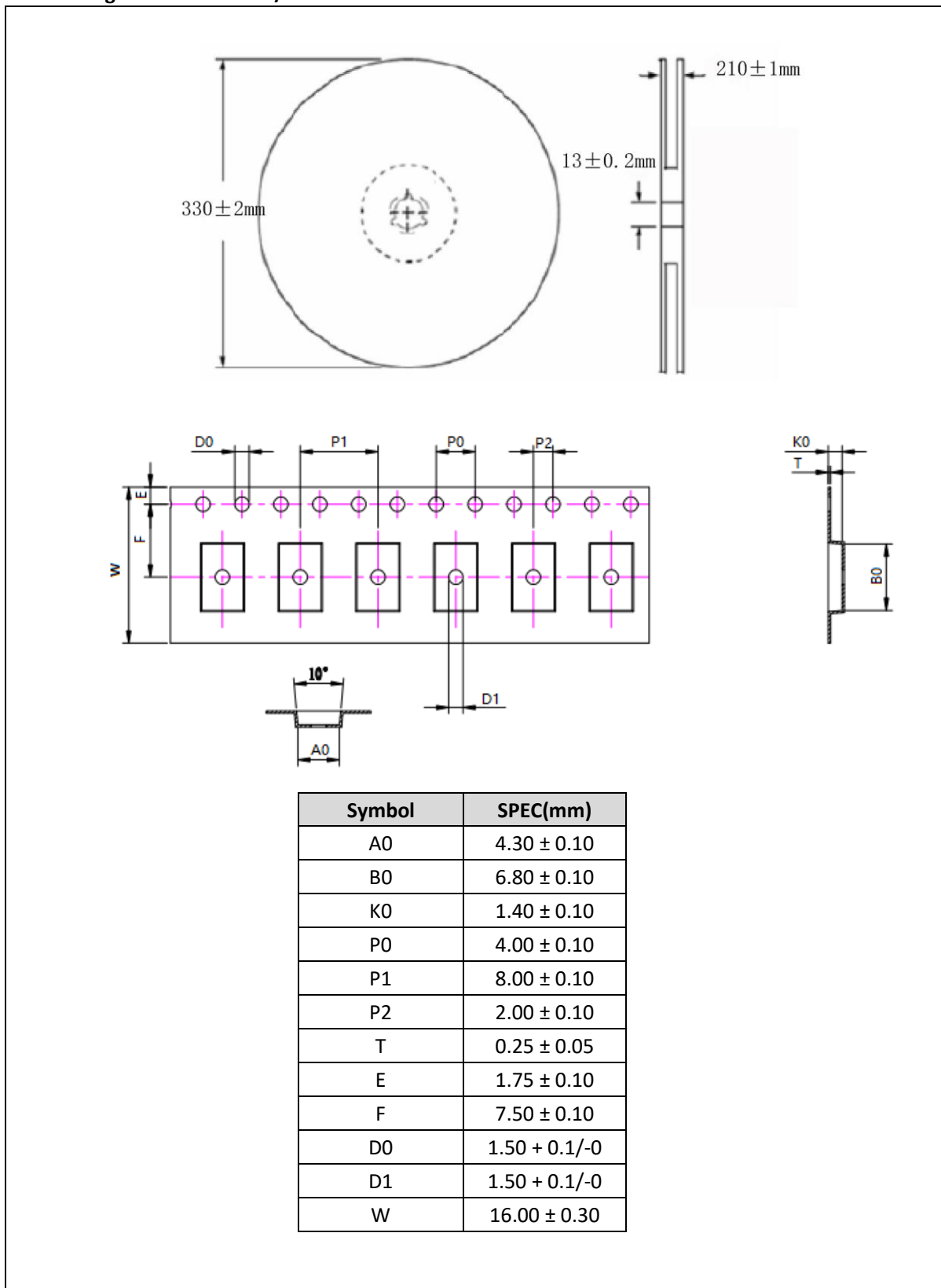


Package and Packing Information

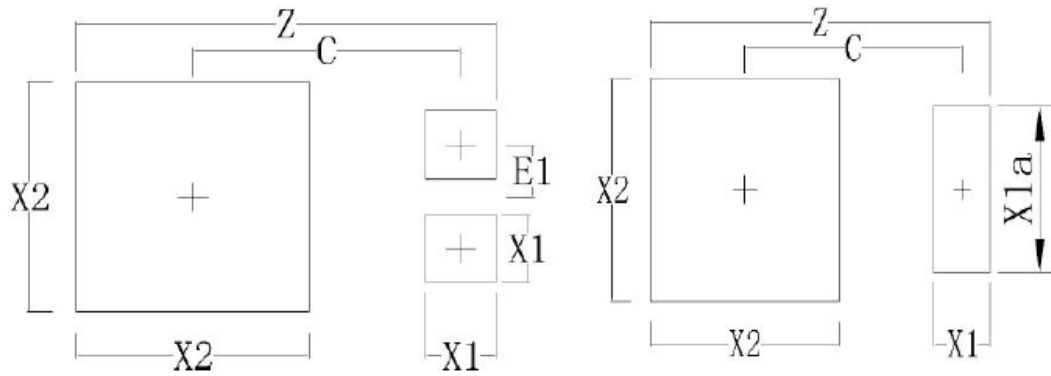
1. SM-7



2. Packing Information: 5K/reel



3. Welding Specification Reference



Symbol	Dimensions In Millimeters
C	4.6
E1	0.9
X1	1.2
X2	4.0
Z	7.2
X1a	3.0



Caution: This product is a static sensitive component, please pay a attention to protect! The scope of ESD damage can be extended from minor performance to equipment failure. Precision IC may be damaged, which may result in component parameters not meeting the published specifications.

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