

# SI-3000KD Series Surface-Mount, Low Current Consumption, Low Dropout Voltage

## ■ Features

- Compact surface-mount package (TO263-5)
- Output current: 1.0A
- Low dropout voltage:  $V_{DIF} \leq 0.6V$  (at  $I_o = 1.0A$ )
- Low circuit current consumption:  $I_q \leq 350 \mu A$  (600  $\mu A$  for SI-3010KD, SI-3050KD)
- Low circuit current at output OFF:  $I_q (OFF) \leq 1 \mu A$
- Built-in overcurrent, thermal protection circuits
- Compatible with low ESR capacitors (SI-3012KD and SI-3033KD)

## ■ Absolute Maximum Ratings

(T<sub>a</sub>=25°C)

Parameter	Symbol	Ratings		Unit
		SI-3012KD/3033KD	SI-3010KD/3050KD	
DC Input Voltage	V <sub>IN</sub>	17	35 <sup>*1</sup>	V
Output Control Terminal Voltage	V <sub>c</sub>	V <sub>IN</sub>		V
DC Output Current	I <sub>o</sub>	1.0		A
Power Dissipation	P <sub>D</sub> <sup>*2</sup>	3		W
Junction Temperature	T <sub>j</sub>	-30 to +125		°C
Storage Temperature	T <sub>stg</sub>	-30 to +125		°C
Thermal Resistance (Junction to Ambient Air)	θ <sub>JA</sub>	33.3		°C/W
Thermal Resistance (Junction to Case)	θ <sub>JC</sub>	3		°C/W

\*1: A built-in input-overvoltage-protection circuit shuts down the output voltage at the Input Overvoltage Shutdown Voltage of the electrical characteristics.

\*2: When mounted on glass-epoxy board of 1600mm<sup>2</sup> (copper laminate area 100%).

## ■ Applications

- Secondary stabilized power supply (local power supply)

## ■ Electrical Characteristics 1 (Low Input Voltage type compatible with low ESR output capacitor) (T<sub>a</sub>=25°C, V<sub>c</sub>=2V, unless otherwise specified)

Parameter	Symbol	Ratings						Unit
		SI-3012KD (Variable type)			SI-3033KD			
		min.	typ.	max.	min.	typ.	max.	
Input Voltage	V <sub>IN</sub>	2.4 <sup>*3</sup>		*4	*3		*4	V
Output Voltage (Reference Voltage for SI-3012KD)	V <sub>O</sub> (V <sub>ADJ</sub> )	1.24	1.28	1.32	3.234	3.300	3.366	V
Line Regulation	Conditions	V <sub>IN</sub> =3.3V, I <sub>o</sub> =10mA			V <sub>IN</sub> =5V, I <sub>o</sub> =10mA			
	ΔV <sub>OLINE</sub>			15			15	mV
Load Regulation	Conditions	V <sub>IN</sub> =3.3 to 8V, I <sub>o</sub> =10mA (V <sub>o</sub> =2.5V)			V <sub>IN</sub> =5 to 10V, I <sub>o</sub> =10mA			
	ΔV <sub>LOAD</sub>			40			50	mV
Dropout Voltage	Conditions	V <sub>IN</sub> =3.3V, I <sub>o</sub> =0 to 1A (V <sub>o</sub> =2.5V)			V <sub>IN</sub> =5V, I <sub>o</sub> =0 to 1A			
	V <sub>DIF</sub>			0.4			0.4	V
	Conditions	I <sub>o</sub> =0.5A (V <sub>o</sub> =2.5V)			I <sub>o</sub> =0.5A			
Quiescent Circuit Current	I <sub>q</sub>			350			350	μA
	Conditions	V <sub>IN</sub> =3.3V, I <sub>o</sub> =0A, V <sub>c</sub> =2V, R <sub>2</sub> =2.4kΩ			V <sub>IN</sub> =5V, I <sub>o</sub> =0A, V <sub>c</sub> =2V			
	Conditions	I <sub>o</sub> =1A (V <sub>o</sub> =2.5V)			I <sub>o</sub> =1A			
Circuit Current at Output OFF	I <sub>q</sub> (OFF)			1			1	μA
	Conditions	V <sub>IN</sub> =3.3V, V <sub>c</sub> =0V			V <sub>IN</sub> =5V, V <sub>c</sub> =0V			
Temperature Coefficient of Output Voltage	ΔV <sub>o</sub> /ΔT <sub>a</sub>		±0.3			±0.3		mV/°C
	Conditions	T <sub>j</sub> =0 to 100°C (V <sub>o</sub> =2.5V)			T <sub>j</sub> =0 to 100°C			
Ripple Rejection	R <sub>REJ</sub>		55			55		dB
	Conditions	V <sub>IN</sub> =3.3V, f=100 to 120Hz, I <sub>o</sub> =0.1A (V <sub>o</sub> =2.5V)			V <sub>IN</sub> =5V, f=100 to 120Hz, I <sub>o</sub> =0.1A			
Overcurrent Protection Starting Current <sup>*1</sup>	I <sub>s1</sub>	1.1			1.1			A
	Conditions	V <sub>IN</sub> =3.3V			V <sub>IN</sub> =5V			
V <sub>c</sub> Terminal	Control Voltage (Output ON) <sup>*2</sup>	2			2			V
	Control Voltage (Output OFF)			0.8			0.8	V
	Control Current (Output ON)			40			40	μA
	Conditions	V <sub>c</sub> =2V			V <sub>c</sub> =2V			
	Control Current (Output OFF)		-5	0		-5	0	μA
Conditions	V <sub>c</sub> =0V			V <sub>c</sub> =0V				

\*1: I<sub>s1</sub> is specified at the 5% drop point of output voltage V<sub>o</sub> under the condition of Output Voltage parameter.

\*2: Output is OFF when the output control terminal (V<sub>c</sub> terminal) is open. Each input level is equivalent to LS-TTL level. Therefore, the device can be driven directly by LS-TTLs.

\*3: Refer to the Dropout Voltage parameter.

\*4: V<sub>IN</sub> (max) and I<sub>o</sub> (max) are restricted by the relation P<sub>D</sub> = (V<sub>IN</sub> - V<sub>o</sub>) × I<sub>o</sub>. Please calculate these values referring to the Copper laminate area vs. Power dissipation data.

■Electrical Characteristics 2 (High Input Voltage Type)

Parameter	Symbol	Ratings						Unit	
		SI-3010KD (Variable type)			SI-3050KD				
		min.	typ.	max.	min.	typ.	max.		
Input Voltage	V <sub>IN</sub>	2.4 <sup>*1</sup>		27 <sup>*5</sup>	<sup>*1</sup>			V	
Output Voltage (Reference Voltage V <sub>ADJ</sub> for SI-3010KD)	V <sub>O</sub> (V <sub>ADJ</sub> )	0.98	1.00	1.02	4.90	5.00	5.10	V	
	Conditions	V <sub>IN</sub> =7V, I <sub>O</sub> =10mA			V <sub>IN</sub> =7V, I <sub>O</sub> =10mA				
Line Regulation	ΔV <sub>OLINE</sub>			30			30	mV	
	Conditions	V <sub>IN</sub> =6 to 11V, I <sub>O</sub> =10mA (V <sub>O</sub> =5V)			V <sub>IN</sub> =6 to 11V, I <sub>O</sub> =10mA				
Load Regulation	ΔV <sub>OLOAD</sub>			75			75	mV	
	Conditions	V <sub>IN</sub> =7V, I <sub>O</sub> =0 to 1A (V <sub>O</sub> =5V)			V <sub>IN</sub> =7V, I <sub>O</sub> =0 to 1A				
Dropout Voltage	V <sub>DIF</sub>			0.3			0.3	V	
	Conditions	I <sub>O</sub> =0.5A (V <sub>O</sub> =5V)			I <sub>O</sub> =0.5A				
	Conditions	I <sub>O</sub> =1A (V <sub>O</sub> =5V)			I <sub>O</sub> =1A				
Quiescent Circuit Current	I <sub>q</sub>			600			600	μA	
	Conditions	V <sub>IN</sub> =7V, I <sub>O</sub> =0A, V <sub>C</sub> =2V R <sub>2</sub> =10kΩ			V <sub>IN</sub> =7V, I <sub>O</sub> =0A, V <sub>C</sub> =2V				
Circuit Current at Output OFF	I <sub>q</sub> (OFF)			1			1	μA	
	Conditions	V <sub>IN</sub> =7V, V <sub>C</sub> =0V			V <sub>IN</sub> =7V, V <sub>C</sub> =0V				
Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT <sub>a</sub>		±0.5			±0.5		mV/°C	
	Conditions	T <sub>J</sub> =0 to 100°C (V <sub>O</sub> =5V)			T <sub>J</sub> =0 to 100°C				
Ripple Rejection	RREJ		75			75		dB	
	Conditions	V <sub>IN</sub> =7V, f=100 to 120Hz, I <sub>O</sub> =0.1A (V <sub>O</sub> =5V)			V <sub>IN</sub> =7V, f=100 to 120Hz, I <sub>O</sub> =0.1A				
Overcurrent Protection Starting Current <sup>*2</sup>	I <sub>S1</sub>	1.1			1.1			A	
	Conditions	V <sub>IN</sub> =7V			V <sub>IN</sub> =7V				
V <sub>C</sub> Terminal	Control Voltage (Output ON) <sup>*3</sup>	V <sub>C</sub> , I <sub>H</sub>	2.0		2.0			V	
	Control Voltage (Output OFF) <sup>*3</sup>	V <sub>C</sub> , I <sub>L</sub>			0.8		0.8	V	
	Control Current (Output ON)	I <sub>C</sub> , I <sub>H</sub>			40		40	μA	
		Conditions	V <sub>C</sub> =2V			V <sub>C</sub> =2V			
	Control Current (Output OFF)	I <sub>C</sub> , I <sub>L</sub>	-5	0		-5	0		μA
	Conditions	V <sub>C</sub> =0V			V <sub>C</sub> =0V				
Input Overvoltage Shutdown Voltage	V <sub>OVP</sub>	33			26			V	
	Conditions	I <sub>O</sub> =10mA			I <sub>O</sub> =10mA				

\*1: Refer to the Dropout Voltage parameter.

\*2: I<sub>S1</sub> is specified at the 5% drop point of output voltage V<sub>O</sub> under the condition of Output Voltage parameter.

\*3: Output is OFF when the output control terminal (V<sub>C</sub> terminal) is open. Each input level is equivalent to LS-TTL level. Therefore, the device can be driven directly by LS-TTLs.

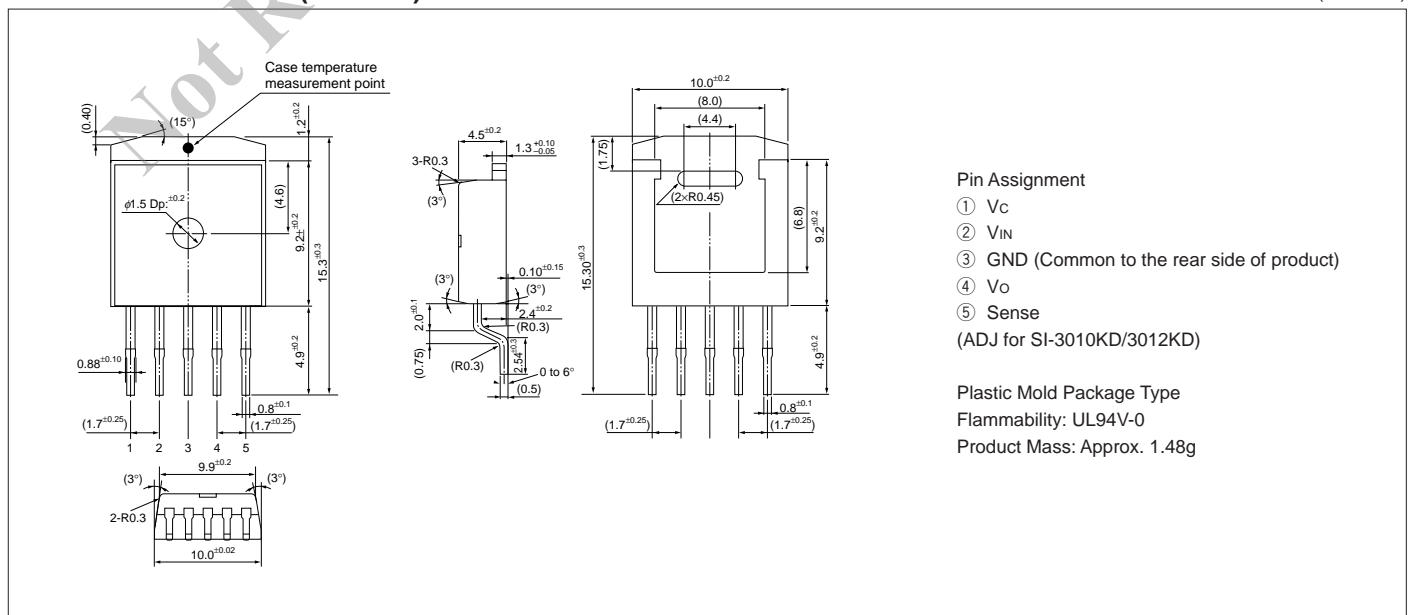
\*4: SI-3010KD, SI-3050KD, cannot be used in the following applications because the built-in foldback-type overcurrent protection may cause errors during start-up stage.

(1) Constant current load (2) Positive and negative power supply (3) Series-connected power supply (4) V<sub>O</sub> adjustment by raising ground voltage

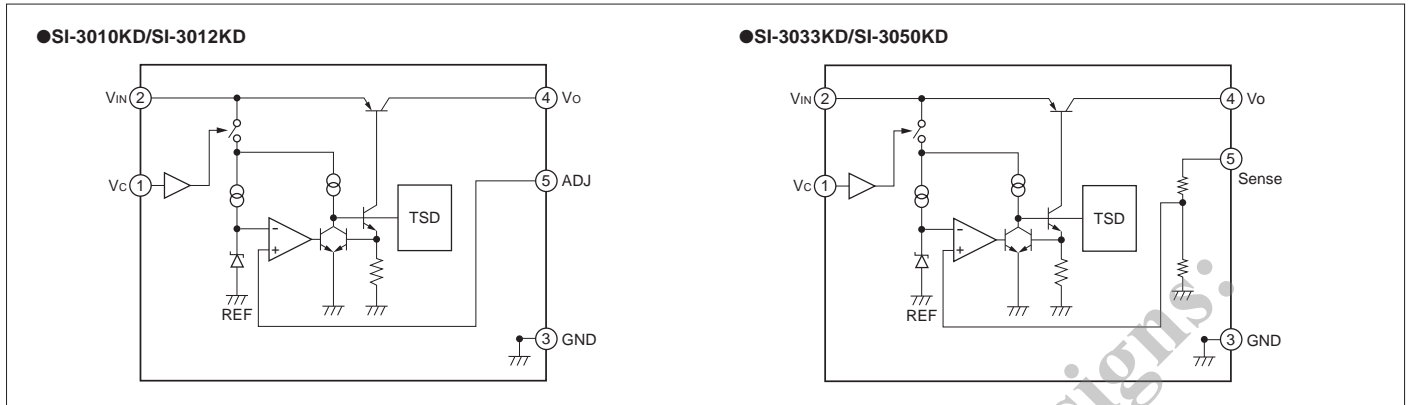
\*5: V<sub>IN</sub> (max) and I<sub>O</sub> (max) are restricted by the relation P<sub>b</sub> = (V<sub>IN</sub> - V<sub>O</sub>) X I<sub>O</sub>. Please calculate these values referring to the Copper laminate area vs. Power dissipation data as shown hereinafter.

■External Dimensions (TO263-5)

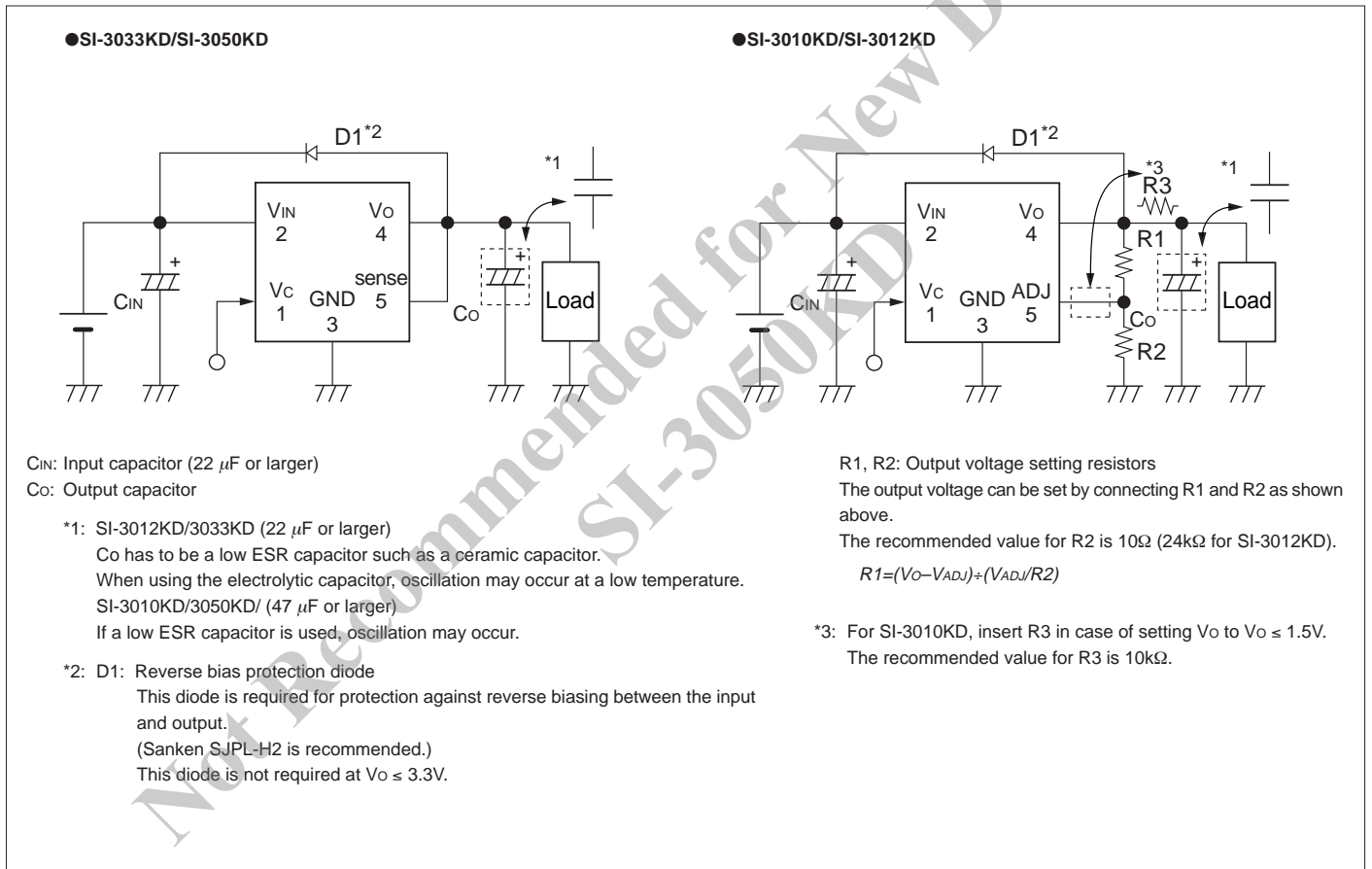
(unit : mm)



■Block Diagram

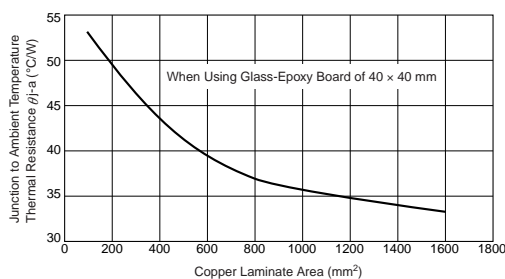


■Typical Connection Diagram



■Reference Data

Copper Laminate Area (on Glass-Epoxy Board) vs. Thermal Resistance (from Junction to Ambient Temperature) (Typical Value)



- A higher heat radiation effect can be achieved by enlarging the copper laminate area connected to the inner frame to which a monolithic ICs is mounted.
- Obtaining the junction temperature  
 Measure the case temperature  $T_c$  with a thermocouple, etc. Then, substitute this value in the following formula to obtain the junction temperature.

$$T_j = P_D \times \theta_{j-c} + T_c \quad (\theta_{j-c} = 3^{\circ}\text{C/W}) \quad P_D = (V_{IN} - V_o) \cdot I_{OUT}$$