SI-3000KS Series Surface-Mount, Low Current Consumption, Low Dropout Voltage Linear Regulator ICs

■Features

- Compact surface-mount package (SOP8)
- Output current: 1.0 A
- Compatible with low ESR capacitor
- Low circuit current at output OFF Iq ≤ 350 µA (I_O = 0 A, V_C = 2 V)
- Low current consumption Iq (OFF) ≤ 1 µA (V_C = 0 V)
- Low dropout voltage V_{DIF} ≤ 0.6 V (I_O = 1 A)
- 3 types of output voltages (2.5 V, 3.3 V, and variable type) available
- Output ON/OFF control terminal voltage compatible with LS-TTL
- Built-in drooping-type-overcurrent and thermal protection circuits

■Applications

- Local power supplies
- Battery-driven electronic equipment

■Absolute Maximum Ratings

(T_a=25°C)

Parameter	Symbol	Ratings	Unit
DC Input Voltage	V_{IN}*1	17	V
Output Control Terminal Voltage	V_C	V_{IN}	V
DC Output Current	I_O*1	1.0	A
Power Dissipation	P_D*1, *2	0.76	W
Junction Temperature	T_j	–40 to +125	°C
Storage Temperature	T_{stg}	–40 to +125	°C
Thermal Resistance (Junction to Ambient Air)	θ_{j-a}*	130	°C/W
Thermal resistance (Junction to Lead (pin 7))	θ_{j-l}	22	°C/W

*1: V_{IN} (max) and I_O (max) are restricted by the relation PD = (V_{IN} - V_O) × I_O. Please calculate these values referring to the Copper laminate area vs. Power dissipation data as shown hereinafter.
*2: When mounted on a glass epoxy board of 1600 mm^2 (copper laminate area 2%).

■Electrical Characteristics

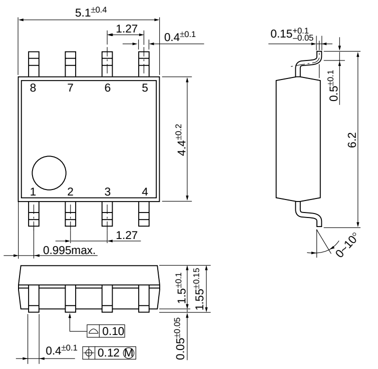
(T_a=25°C, V_c=2 V unless otherwise specified)

Parameter	Symbol	Ratings									Unit
		SI-3012KS (variable type)			SI-3025KS			SI-3033KS			
		min.	typ.	max.	min.	typ.	max.	min.	typ.	max.	
Input Voltage	V_{IN}	2.4			*1			*1			V
Output Voltage (Reference voltage V_{ADJ} for SI-3012KS)	V_O (V_{ADJ})	1.24	1.28	1.32	2.45	2.50	2.55	3.234	3.300	3.366	V
	Conditions	V_{IN}=3.3V, I_O=10mA			V_{IN}=3.3V, I_O=10mA			V_{IN}=5V, I_O=10mA			
Dropout Voltage	V_{DIF}			0.3			0.4			0.4	V
	Conditions	I_O=0.5A (V_O=2.5V)			I_O=0.5A			I_O=0.5A			
				0.6			0.6			0.6	
	Conditions	I_O=1A (V_O=2.5V)			I_O=1A			I_O=1A			
Line Regulation	ΔV_{OLINE}			10			10			15	mV
	Conditions	V_{IN}=3.3 to 8V, I_O=10mA (V_O=2.5V)			V_{IN}=3.3 to 8V, I_O=10mA			V_{IN}=5 to 10V, I_O=10mA			
Load Regulation	ΔV_{OLOAD}			40			40			50	mV
	Conditions	V_{IN}=3.3V, I_O=0 to 1A (V_O=2.5V)			V_{IN}=3.3V, I_O=0 to 1A			V_{IN}=5V, I_O=0 to 1A			
Quiescent Circuit Current	I_q			350			350			350	µA
	Conditions	V_{IN}=3.3V, I_O=0A, V_C=2V, R2=24kΩ			V_{IN}=3.3V, I_O=0A, V_C=2V			V_{IN}=5V, I_O=0A, V_C=2V			
Circuit Current at Output OFF	I_q (OFF)			1			1			1	µA
	Conditions	V_{IN}=3.3V, V_C=0V			V_{IN}=3.3V, V_C=0V			V_{IN}=5V, V_C=0V			
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_a$		±0.3			±0.3			±0.3		mV/°C
	Conditions	T_j=0 to 100°C (V_O=2.5V)			T_j=0 to 100°C			T_j=0 to 100°C			
Ripple Rejection	R_{REJ}		55			55			55		dB
	Conditions	V_{IN}=3.3V, f=100 to 120Hz (V_O=2.5V)			V_{IN}=3.3V, f=100 to 120Hz			V_{IN}=5V, f=100 to 120Hz			
Overcurrent Protection Starting Current*2	I_{S1}	1.2			1.2			1.2			A
	Conditions	V_{IN}=3.3V (V_O=2.5V)			V_{IN}=3.3V			V_{IN}=5V			
V_C Terminal: Control Voltage (Output ON)*3	$V_{C, IH}$	2.0			2.0			2.0			V
V_C Terminal: Control Voltage (Output OFF)	$V_{C, IL}$			0.8			0.8			0.8	V
V_C Terminal: Control Current (Output ON)	$I_{C, IH}$			40			40			40	µA
	Conditions	V_C=2V									
V_C Terminal: Control Current (Output OFF)	$I_{C, IL}$	–5	0		–5	0		–5	0		µA
	Conditions	V_C=0V									

*1: Refer to the Dropout Voltage parameter.
*2: The I_{S1} is specified at the 5% drop point of output voltage V_O on the condition that V_{IN} = V_O + 1 V, and I_O = 10 mA.
*3: Output is OFF when the output control terminal V_C is open. Each input level is equivalent to LS-TTL level. Therefore, the device can be driven directly by LS-TTLs.

■External Dimensions (SOP8)

(Unit : mm)



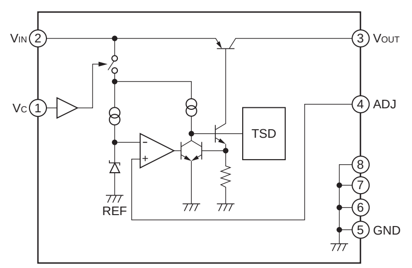
Pin Assignment

① VC
② VIN
③ VO
④ Sence (ADJ for SI-3012KS)
⑤ GND
⑥ GND
⑦ GND
⑧ GND

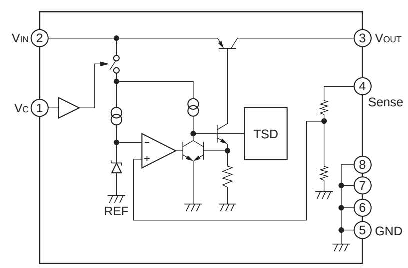
Plastic Mold Package Type
Flammability: UL 94V-0
Product Mass: Approx. 0.1 g

■Block Diagram

●SI-3012KS

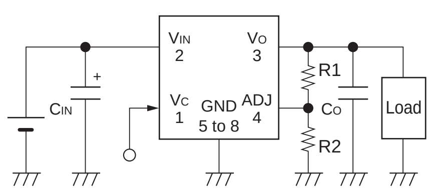


●SI-3025KS, SI-3033KS

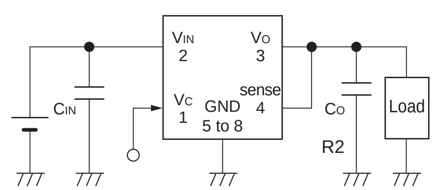


■Typical Connection Diagram

●SI-3012KS



●SI-3025KS, SI-3033KS



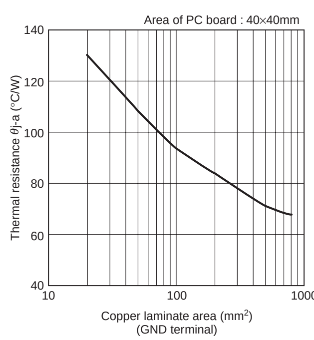
R_1, R_2: Output voltage setting resistors
The output voltage can be set by connecting R_1 and R_2 as shown above.
The recommended value of R_2 is 24 kΩ .

$R1=(V_O-V_{ADJ})\div(V_{ADJ}/R2)$

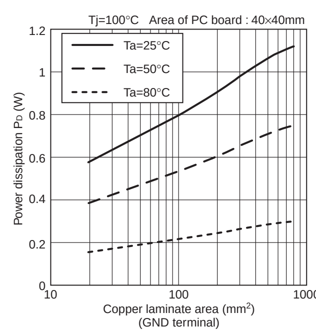
C_{IN}: Input capacitor (22 μF or larger)
C_O: Output capacitor (22 μF or larger)
For SI-3000KS series, Co has to be a low ESR capacitor.
When using the electrolytic capacitor, the SI-3000KS series may oscillate at a low temperature.

■Reference Data

Copper Laminate Area vs. Thermal Resistance



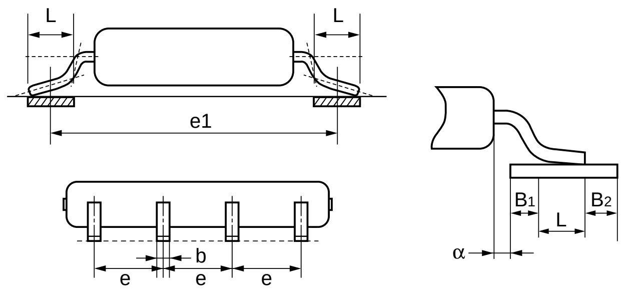
Copper Laminate Area vs. Power Dissipation



- Obtaining the junction temperature
  Measure the temperature T_L at the lead part of the GND pin (pin 7) with a thermocouple, etc. Then, substitute this value in the following formula to obtain the junction temperature.

$T_j=P_D\times\theta_{j-L}+T_L \quad (\theta_{j-L}=22^{\circ}C/W)$

■Example of Solder Pattern Design



Symbol	Dimensions (mm)
e1	5.72
e	1.27±0.15
α	0.2
β1	0.2 to 0.5
β2	0.2
L	0.6
b2	0.76
l2	L+β1+β2

(Reference value conforming to EIAJ Standard ED-7402-1)

*1 The inner frame stage on which a monolithic IC is mounted is directly connected to the GND pins (pins 5 through 8). By expanding the area of the copper connected to the GND pins, the heat radiation can be improved. It is recommended to design the solder pattern by opening the insulation film of the solder patterns of pins 5, 6, 7, and 8, on the wide GND pattern as shown in Figure 1.

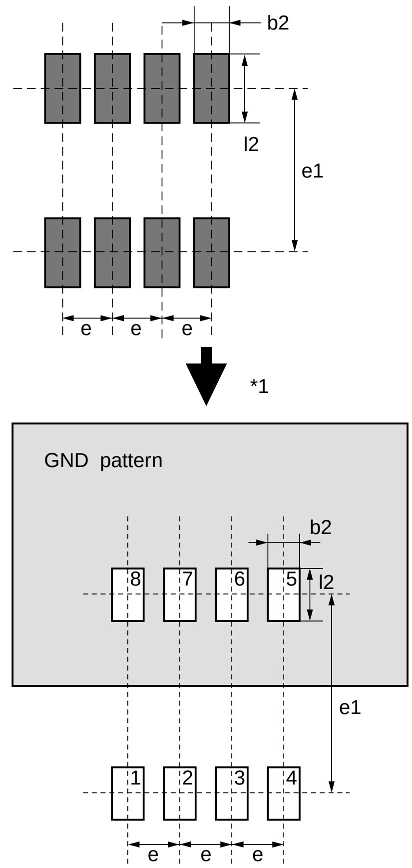
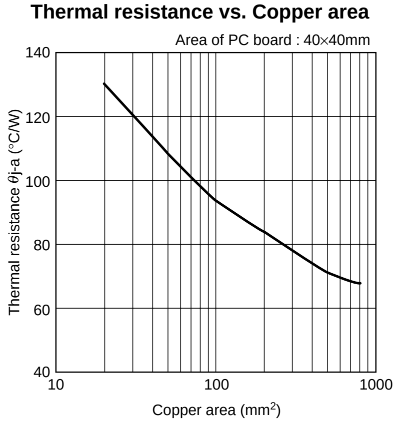


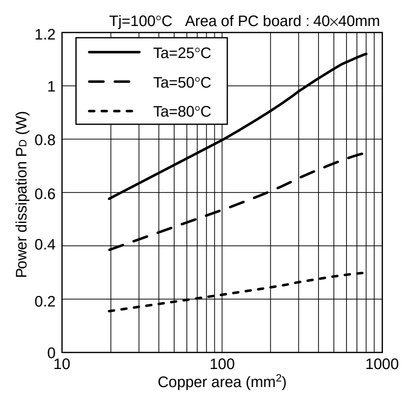
Figure 1

■Reference Data

Thermal resistance vs. Copper area



Power dissipation vs. Copper area



- Calculating junction temperature

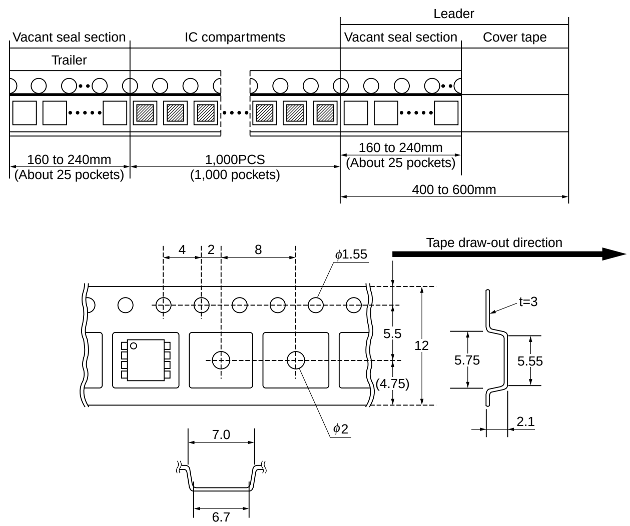
  Measure the temperature TL of the lead of the GND pin (pin 7) by using a thermocouple, and substitute the measured value into the following expression to calculate the junction temperature.

$$T_j = P_D \times \theta_{j-L} + T_L \qquad (\theta_{j-L} = 22^\circ C/W)$$

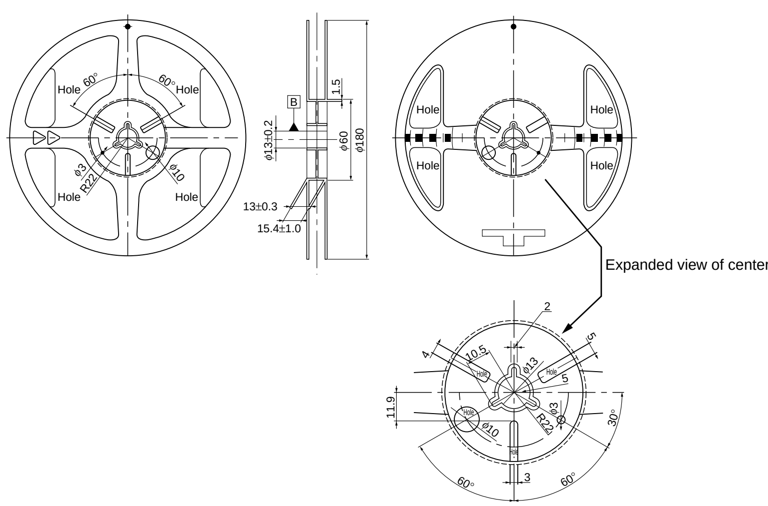
■Taping Specifications

Carrier tape
Surface resistance of embossed tape: 100 kΩ maximum (among 10 pockets)

(Unit : mm)



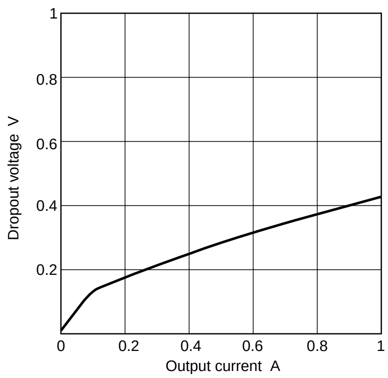
Reel: Number of packed products: 1000



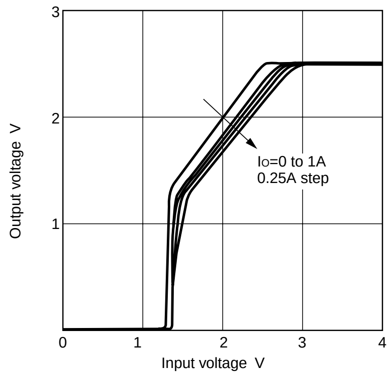
■Typical Characteristics Examples of SI-3012KS and SI-3025KS

(T_a=25°C) *V_{out}=2.5 V for SI-3012KS (RS=24 kΩ)

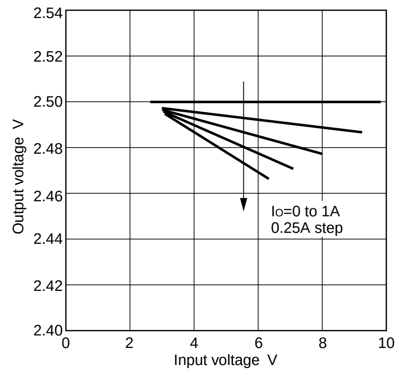
Dropout voltage



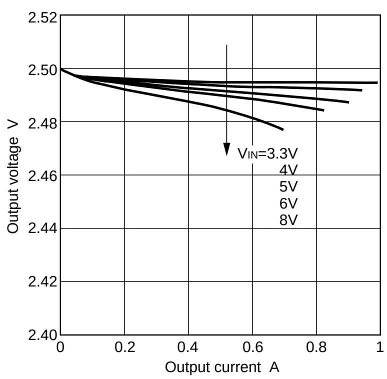
Rise characteristics



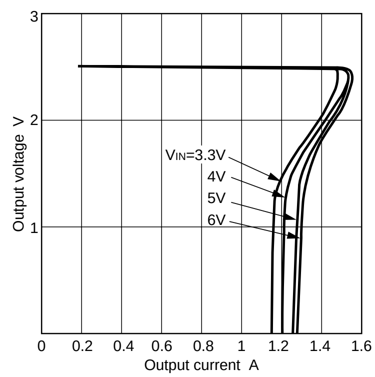
Line regulation



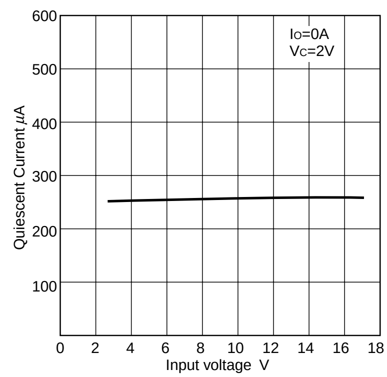
Load regulation



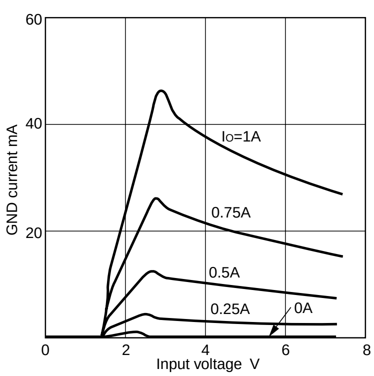
Overcurrent protection characteristics



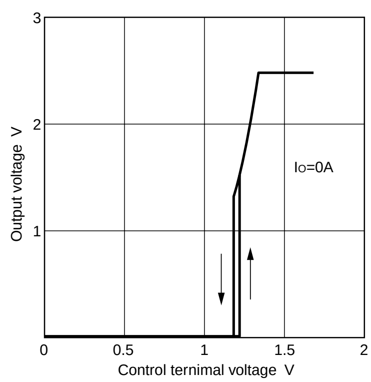
Input voltage vs. Quiescent current



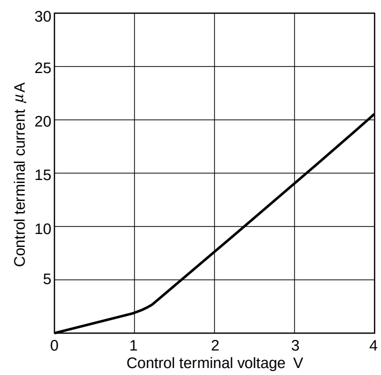
Circuit current



Control terminal voltage vs. Output voltage



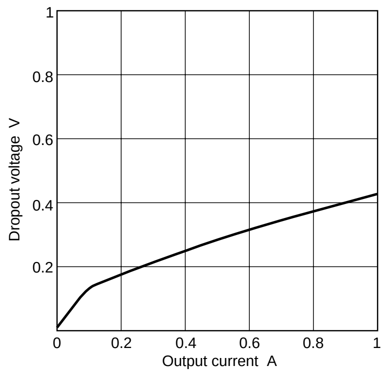
Control terminal voltage vs. Control terminal current



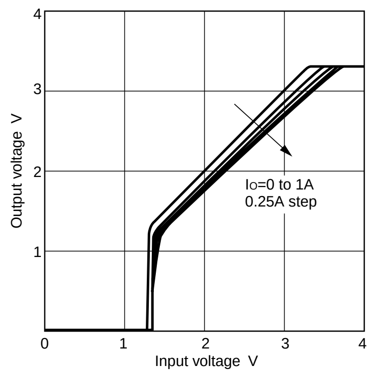
■Typical Characteristics Examples of SI-3033KS

(T_a=25°C)

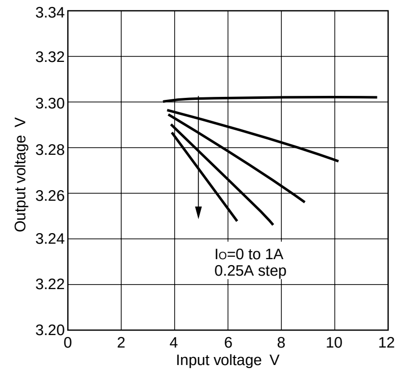
Dropout voltage



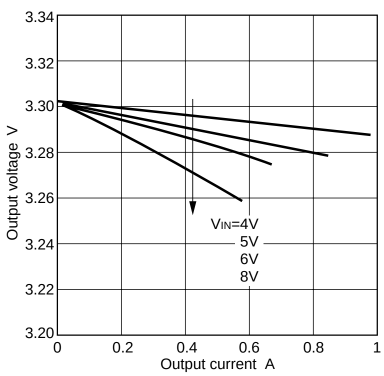
Rise characteristics



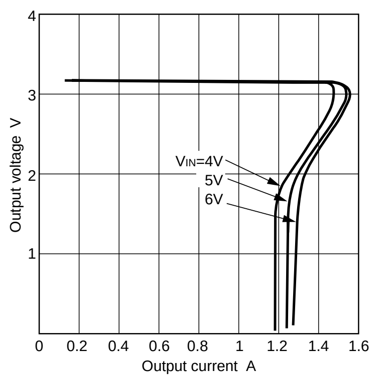
Line regulation



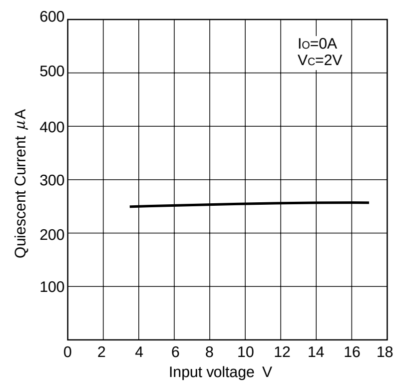
Load regulation



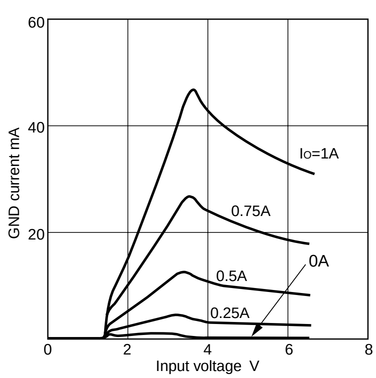
Overcurrent protection characteristics



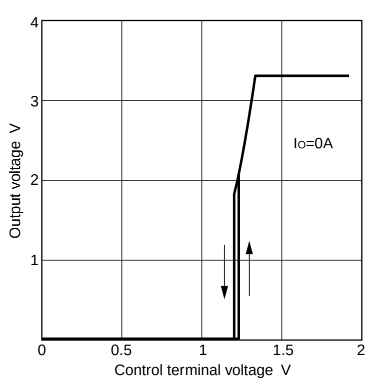
Input voltage vs. Quiescent current



Circuit current



Control terminal voltage vs. Output voltage



Control terminal voltage vs. Control terminal current