SI-8008TMX

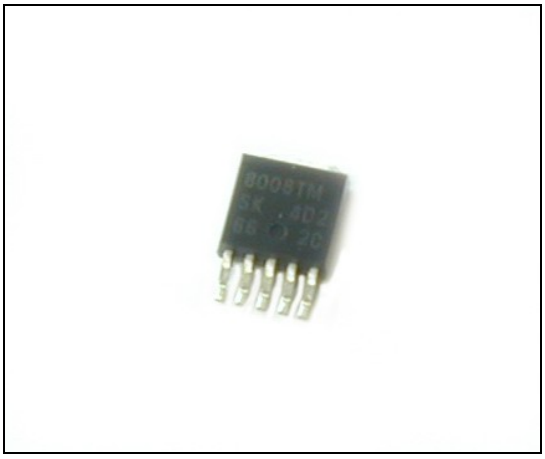
Jan. 2010

◆General description

SI-8008TMX attains an oscillation frequency of 300kHz, and has an integrated miniaturized choke coil, allowing it to serve as a high efficiency power supply in a compact TO252-5 (equivalent to SC-63).
SI-8008TMX regulators provides various features and protection functions (overcurrent and thermal protection) which are necessary for switching regulators.
Only 6 external components are required, and provides high efficiency switching regulation without any need for adjustment.
Device supplies 1.5A output current in a compact surface mount package.

◆Package

Package name: TO252-5



◆Applications

- DVD recorder, FPD TV
- OA equipment (printers, etc)
- On-board local power supplies,

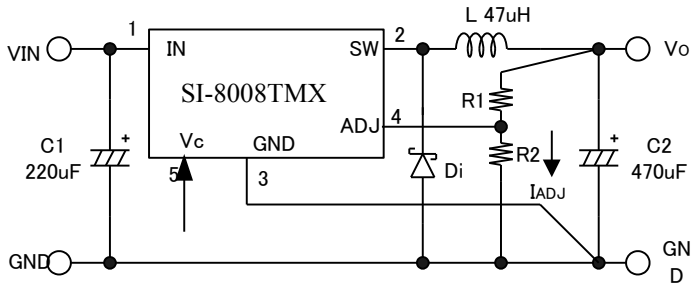
◆ Specification

	SI-8008TMX (variable type)
Input voltage	43V
Output current	0 - 1.5A
Output voltage	0.8V±2% (reference voltage)
Efficiency (MAX)	81% (5V output)

◆Features

- High efficiency 81% (VIN=15V, Io=0.5A)
- Shutdown supply current: 1μA(MAX)
- Requires only 6 discrete components
- Built-in reference oscillator (Oscillating frequency:300kHz(TYP)
- Built-in drooping-type-overcurrent and thermal protection circuits
- Built-in on-off pin (Active Hi) Off in open

Typical application circuit



C1 : 220μF
C2 : 470μF
L1 : 47μH
Di : SJPB-H6 (Sanken)

SI-8008TMX

1. Scope

This specification shall apply to the IC SI-8008TMX for buck switching regulator

2. Outline

Type	Semiconductor integrated circuits (monolithic IC)
Structure	Resin molding type (transfer molding)
Application	・DC regulated power supplies ・Telecommunication on-board local power supplies ・OA equipment ・Stabilization of secondary output voltage of switching regulator

3. Absolute maximum ratings

3.1 Absolute maximum ratings

Item	Symbol	Ratings	Unit	Conditions
Input voltage	V_{IN}	43	V	
Output ON/OFF control pin voltage	V_C	V_{IN}	V	
Allowable dissipation 1	P_{D1}	1.06	W	Glass epoxy board mounting ($900mm^2$, copper foil area 4.3%)
Allowable dissipation 2	P_{D2}	1.65	W	Glass epoxy board mounting ($900mm^2$, copper foil area 50%)
Junction temperature	T_j	−30 - 150	°C	The product incorporates the thermal shut down circuit, and it may operate when the junction temperature exceeds 130°C. It is recommended to design below 125°C for the junction temperature in operation.
Storage temperature	T_{stg}	−40 - 150	°C	
Thermal resistance (junction – case)	θ_{j-c}	6	°C /W	
Thermal resistance (junction – ambient)	θ_{j-a}	95	°C /W	Glass epoxy board mounting ($900mm^2$, copper foil area 4.3%)

3.2 Recommended operation conditions

Item	Symbol	Ratings		Unit	Conditions
		MIN	MAX		
Input voltage range	V_{IN}	Vo+3 *1	40	V	I_O=0 - 1.5A
Output voltage range	V_O	0.8 - 24		V	
Output current range	I_{OUT}	0 - 1.5		A	$V_{IN} \geqq V_O$+3V *2
Junction temperature range in operation	T_{jOP}	−20 - 100		°C	
Operation temperature range	T_{OP}	−20 - 85		°C	*2

*1 The minimum value of input voltage range is 4.5V or V_O + 3V whichever higher.
I_{OUT}=1A (MAX) when V_{IN}= V_O+2 - V_O+3V.

*2 It is necessary to use within the thermal derating curve (refer to 4－3).

4. Electrical characteristics

4.1 Electrical characteristics (Ta=25°C, V_{OUT}=5V, R1=4.2kΩ, R2=0.8kΩ)

Item		Symbol	Ratings			Unit	Conditions
			MIN	TYP	MAX		
Reference voltage		V_{ADJ}	0.784	0.800	0.816	V	V_{IN}=15V, I_O=0.1A
Reference voltage temperature		$\Delta V_{ADJ}/\Delta T$		±0.1		mV/°C	V_{IN}=15V, I_O=0.1A, Tc=0 - 100°C
Efficiency *3		η		81		%	V_{IN}=15V, I_O=0.5A
Switching frequency		f_O		300		kHz	V_{IN}=15V, I_O=0.5A
Line regulation		V_{Line}		60	80	mV	V_{IN}=10 - 30V, I_O=0.5A
Load regulation		V_{Load}		10	40	mV	V_{IN}=15V, I_O=0.2 - 1.5A
Over current protection starting current		I_S	1.6			A	V_{IN}=15V
ON/OFF pin *4	ON/OFF control voltage (output ON)	$V_{C、IH}$	2.0			V	
	ON/OFF control voltage (output OFF)	$V_{C、IL}$			0.8	V	
	ON/OFF control current (output ON)	$I_{C,IH}$		8	20	μA	V_C=2V
Shutdown Supply Current 1		I_q		6		mA	V_{IN}=15V, I_O=0A
Shutdown Supply Current 2		$I_{q(off)}$			1	μA	V_{IN}=15V, V_C=0V

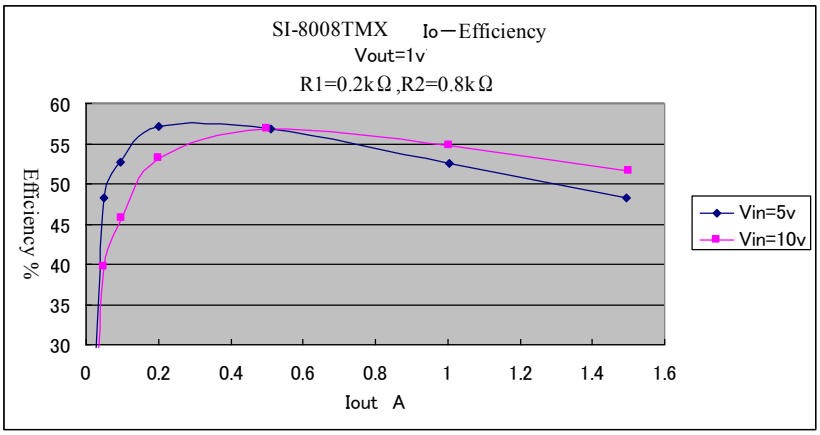
*3 Efficiency should be calculated by using the following equation: Efficiency should be calculated by using the following equation:

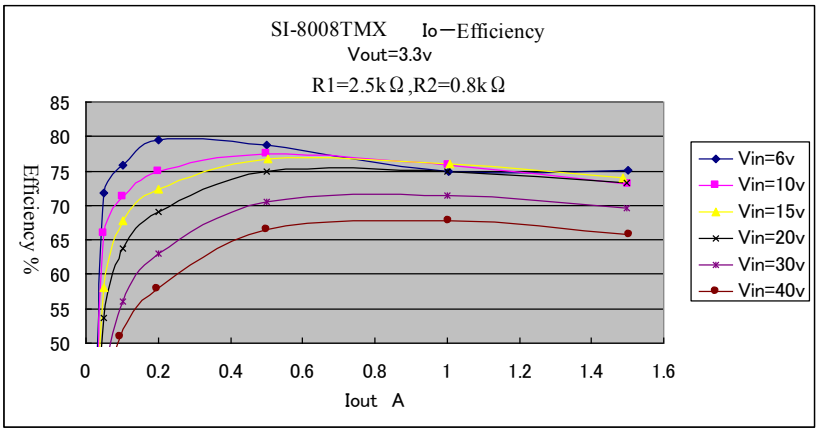
$$\eta(\%) = \frac{V_O \cdot I_O}{V_{IN} \cdot I_{IN}} \times 100$$

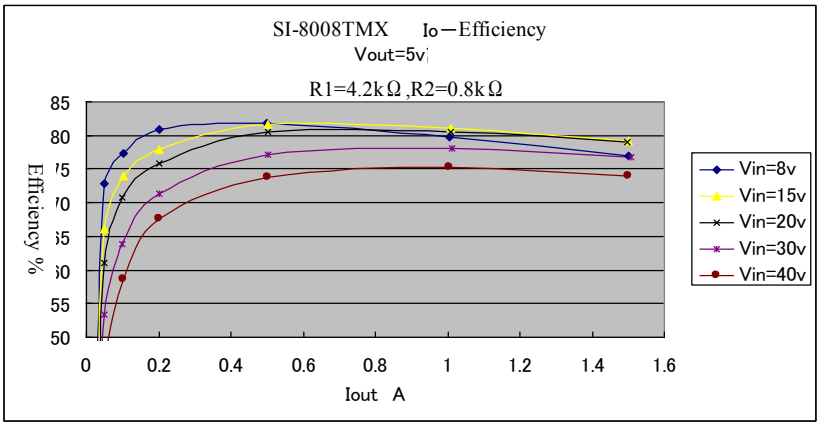
*4 Output control pin Vc turns off in open. Each input level is equivalent to LS-TTL. Therefore the direct drive by LS-TTL is available.

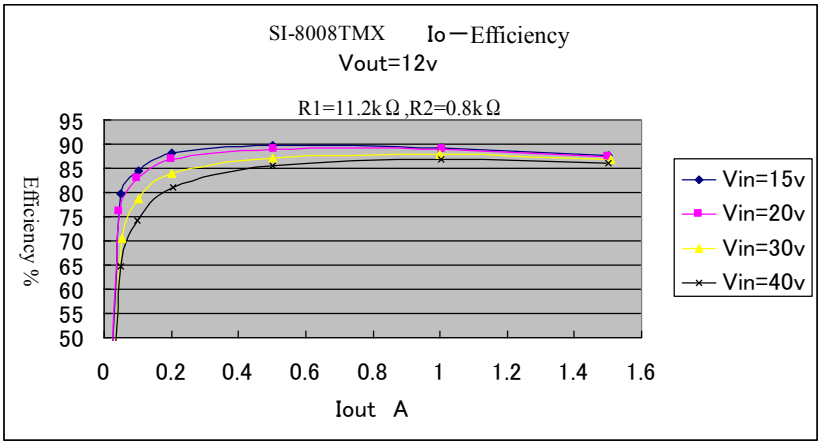
4.2 Typical characteristics (Ta=25°C)

(1) Efficiency



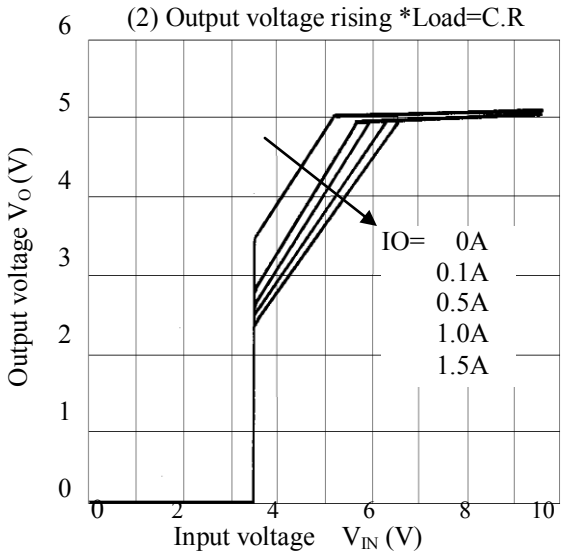




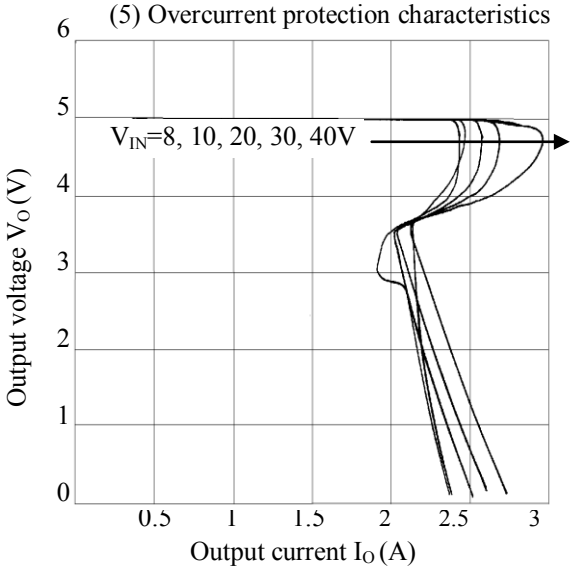


In case of the setup of V_O=5V (R2=0.8kΩ)

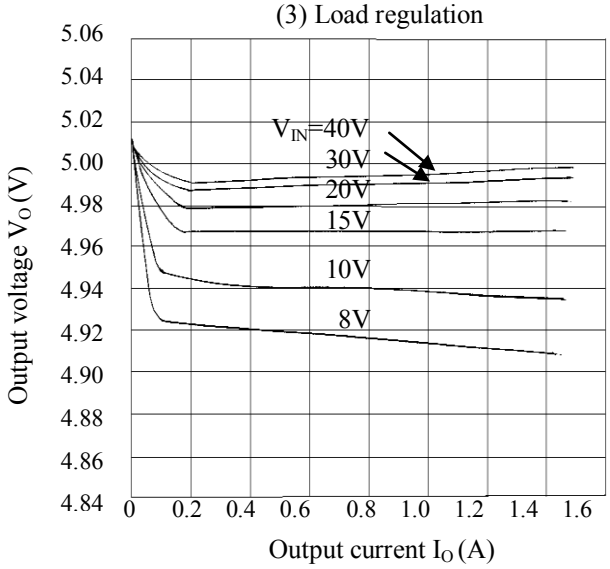
(2) Output voltage rising *Load=C.R



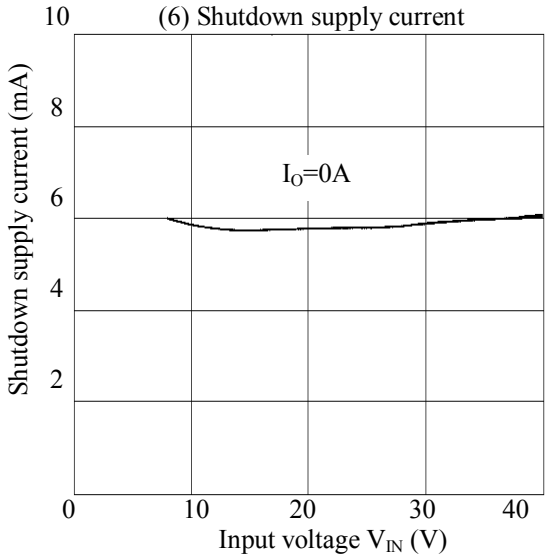
(5) Overcurrent protection characteristics



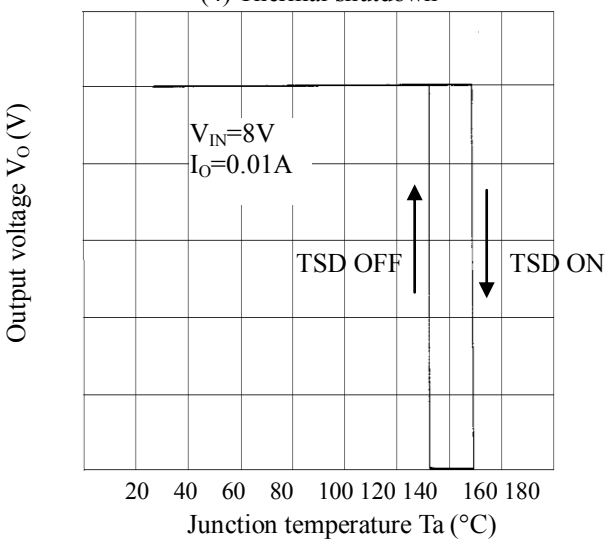
(3) Load regulation



(6) Shutdown supply current



(4) Thermal shutdown



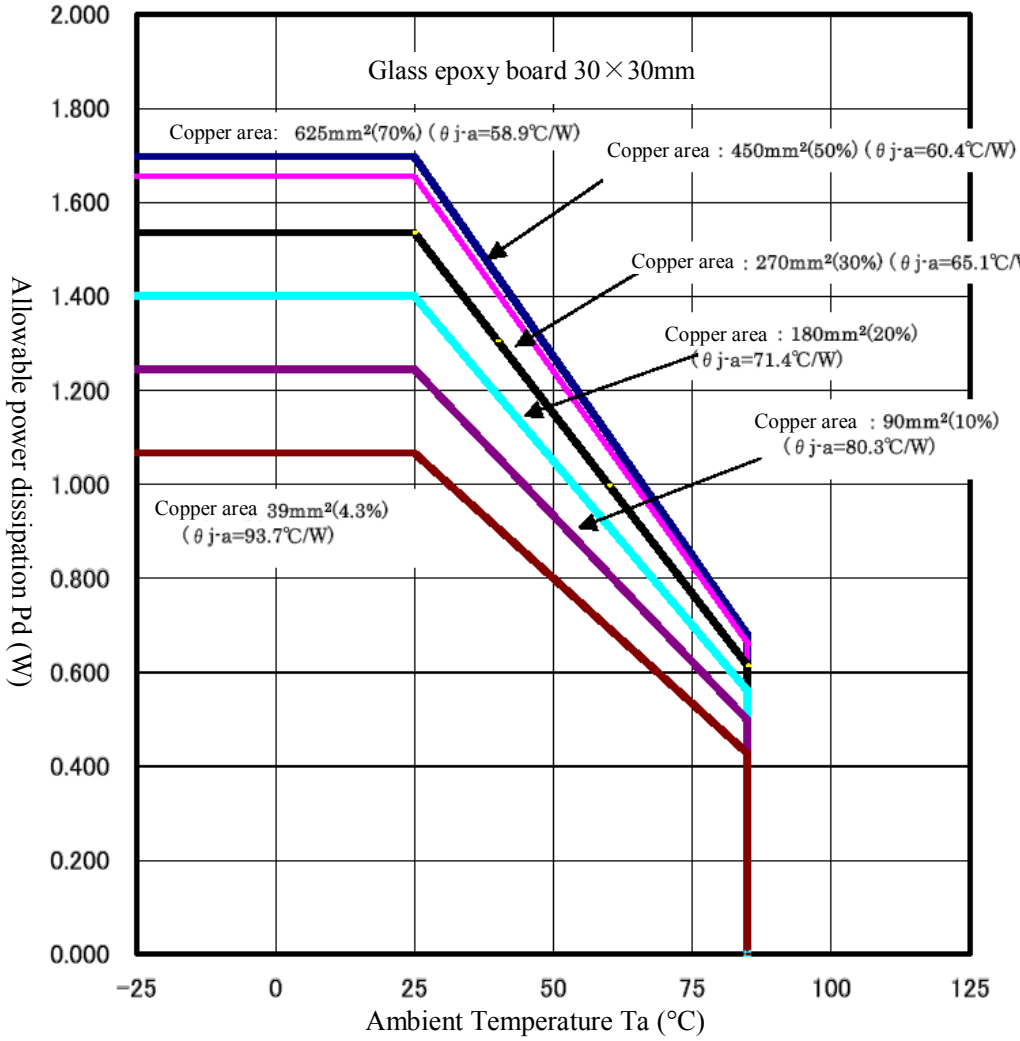
4.3 Thermal derating

$T_{j(MAX)}$=125°C

SI-8000TM series Thermal derating curve

$$P_D = V_O \cdot I_O \left(\frac{100}{\eta_x} - 1 \right) - V_F \cdot I_O \left(1 - \frac{V_O}{V_{IN}} \right)$$

V_O: Output voltage
V_{IN}: Input voltage
I_O: Output current
η_x: Efficiency (%)
V_F: Di forward voltage
SFPB66・・0.5V
(I_O=1.5A)

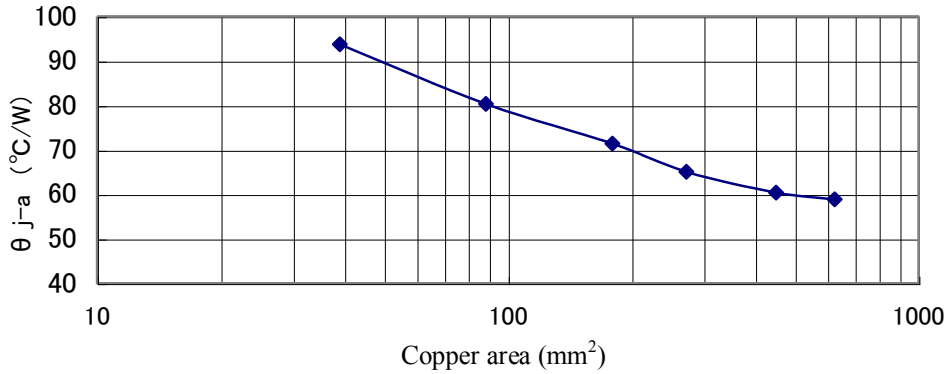


Note 1: As the efficiency is subject to the input voltage and output current, it shall be obtained from the efficiency curve in page 4 and substituted in percent.
Note 2: Thermal design for Di shall be made separately.

4.4 Reference data

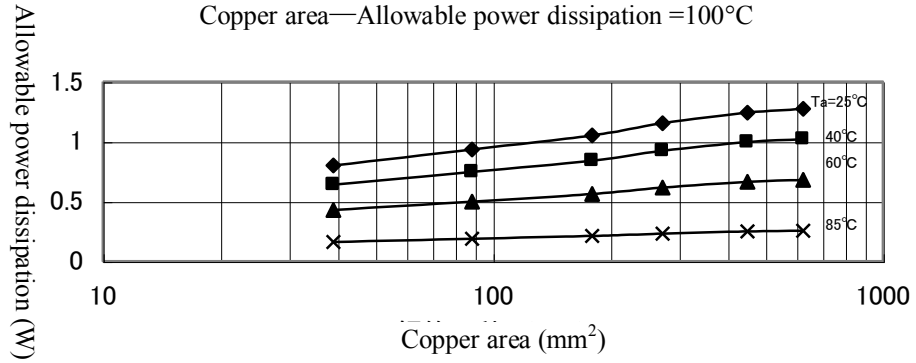
(1) Thermal data

SI-8000TMX Copper area—Thermal resistance



(2) Allowable dissipation

Copper area—Allowable power dissipation =100°C



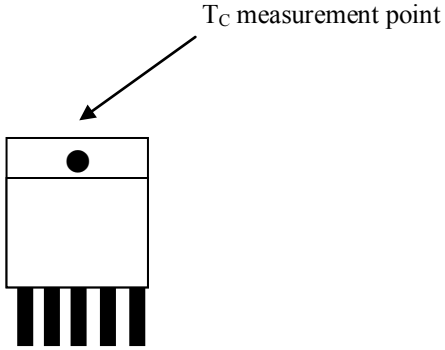
・How to obtain junction temperature

Temperature of lead portion of GND terminal:

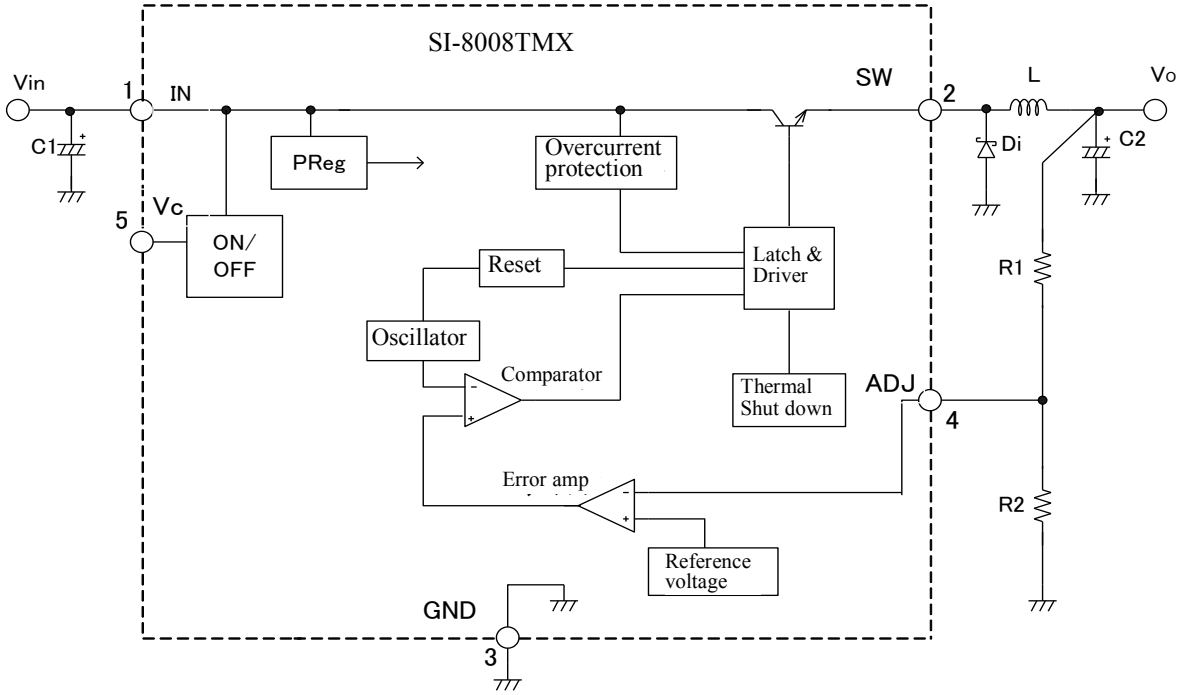
The junction temperature is obtained by measuring Tc with the thermocouple etc. and substituting it in the following equation.

$$Tj = P_D \times \theta_{j-C} + T_C$$

(θ_{j-C}=6°C/W)

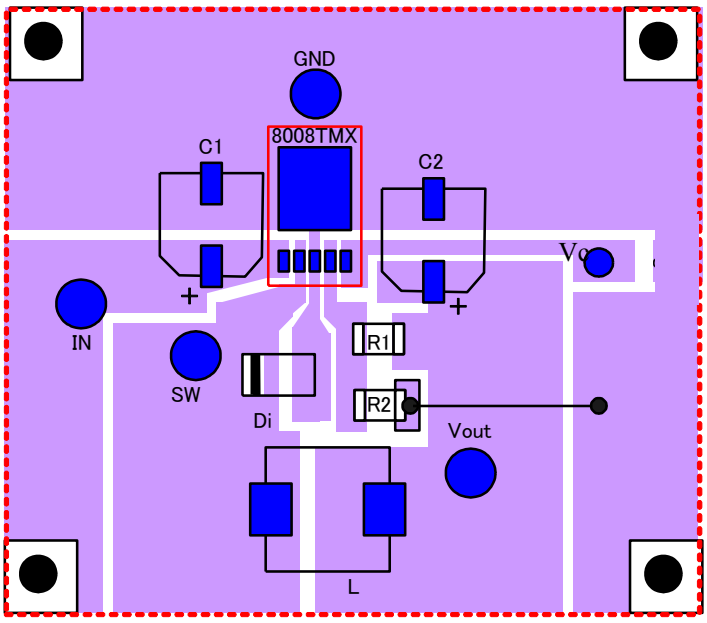


5. Block diagram (Pin assignment)



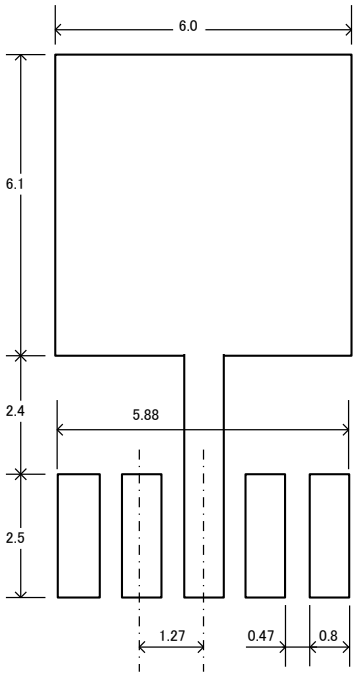
Di : SFPB66 (Sanken)

Recommended pattern



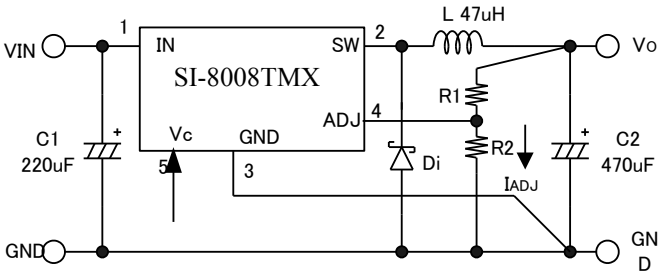
* In order to achieve the best operating conditions, the GND line shall be a 1-point GND wiring with No. 3 terminal in the center

The example of solder pattern design



6. Typical application circuit

6.1 Standard circuit diagram



C1 : 220µF
C2 : 470µF
L1 : 47µH * see Fig1
Di : SFPB66
(Sanken)

Diode Di

For the diode Di, the Schottky barrier diode must be used.

If a fast recovery diode is used, the IC may be destroyed by applying reverse voltage due to the recovery and ON voltage.

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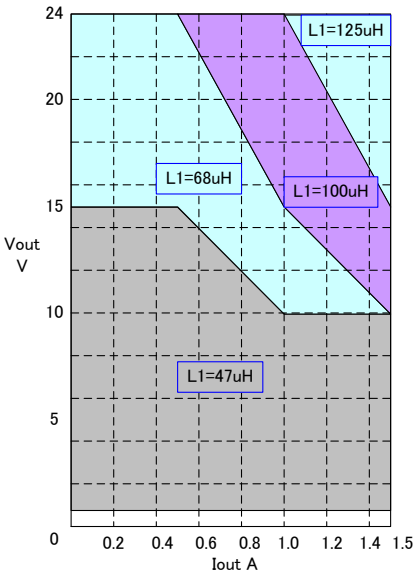


*Fig1choke coil L1

Choke coil L1

・The efficiency may decrease and not reach the rated value if the winding resistance of choke coil is large.

・Since the overcurrent protection start current is around 2.5A, care should be taken for the self heating of choke coil due to magnetic saturation in overload and load short.

・Please refer to Fig.1 and select the inductance value when V_{OUT} is set to 10V or higher.

Capacitor C1 and C2

・Since the high ripple current flows in C1 and C2, the capacitors with high frequency and low impedance for switching power supply should be used. When the impedance of C2 is high, the abnormal switching waveform can be caused in low temperature conditions.

Please avoid to use capacitors with extremely low direct equivalent resistance (ESR) such as OS capacitors and tantalum capacitors because the abnormal oscillation can be caused.

Resistors R1, R2

・R1 and R2 are a resistor for setting the output voltage. The output voltage should be set in a way that IADJ may be 1mA or so. The equation to obtain R1 and R2 values is as follows:

・When setting V_O=0.8V, R2 should be connected for stable operation.

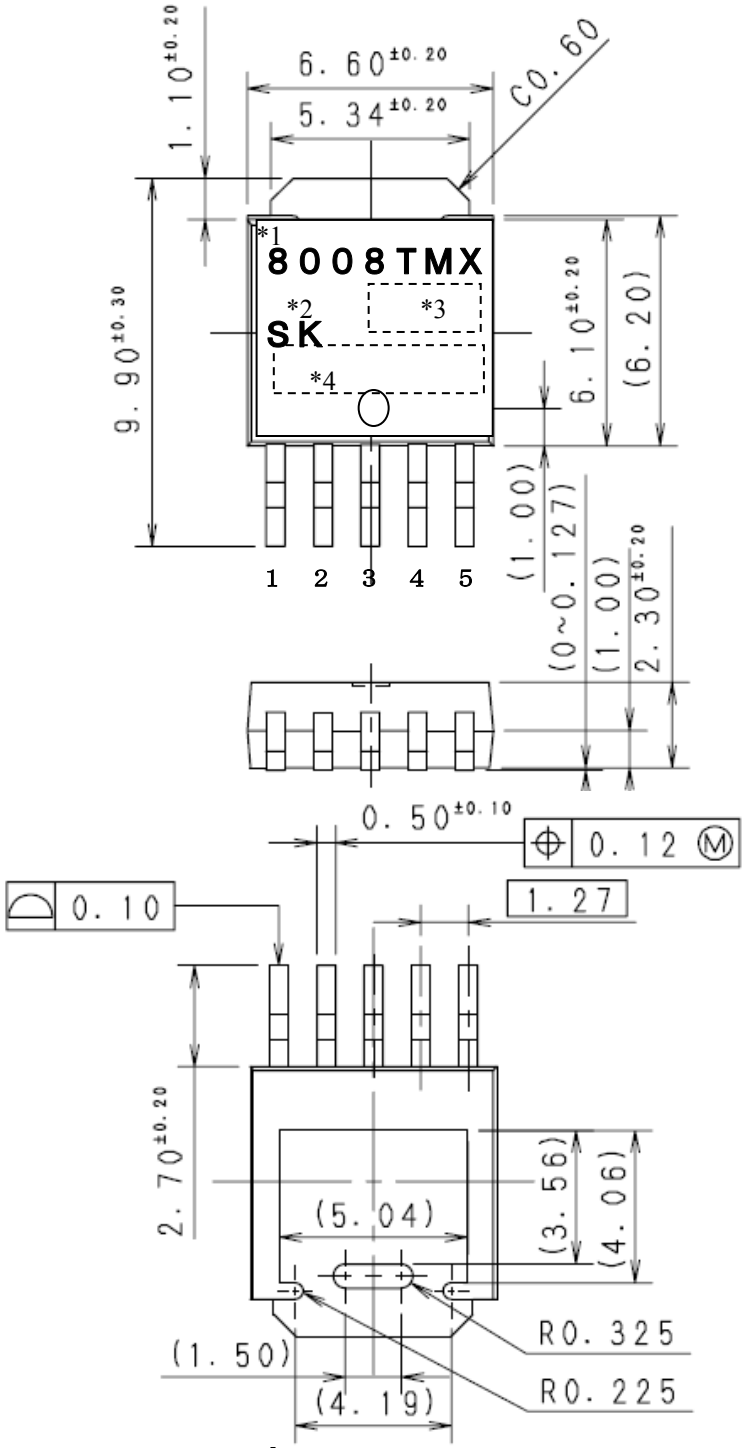
・Recommended output voltage settings: Vo≧VIN×8%

$$R1 = \frac{(V_{OUT} - V_{ADJ})}{I_{ADJ}} = \frac{(V_{OUT} - 0.8)}{1\times10^{-3}}(\Omega), \quad R2 = \frac{V_{ADJ}}{I_{ADJ}} = \frac{0.8}{1\times10^{-3}} \fallingdotseq 0.8k(\Omega)$$

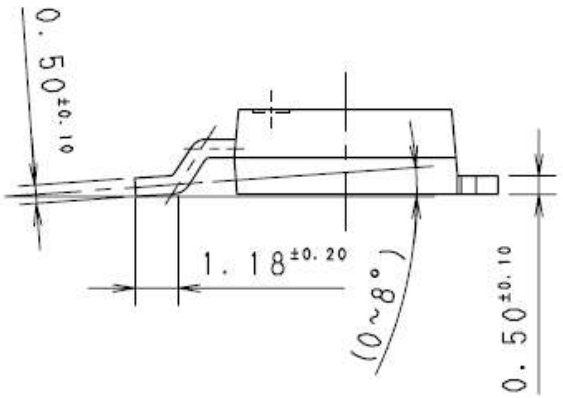
◎In order to achieve the best operating conditions, it is necessary to assign each component with the shortest lines.

7. Package information

7.1 Package type and physical dimensions



Unit: mm



*1 Type number
*2 Logo mark
*3 Lot number
1st letter: The last digit of year
2nd letter: Month
(1 to 9 for Jan. to Sept.,O for Oct. N for Nov. D for Dec.)
3rd letter: day
1 to 9 day: for "1" to "9"
10 to 31 day: for "A" to "Z"
(But, "B","I","O","Q" is removed.
*4 Administer number (Seven digits)

Pin assignment
1. IN
2. SW
3. GND
4. ADJ
5. V_C

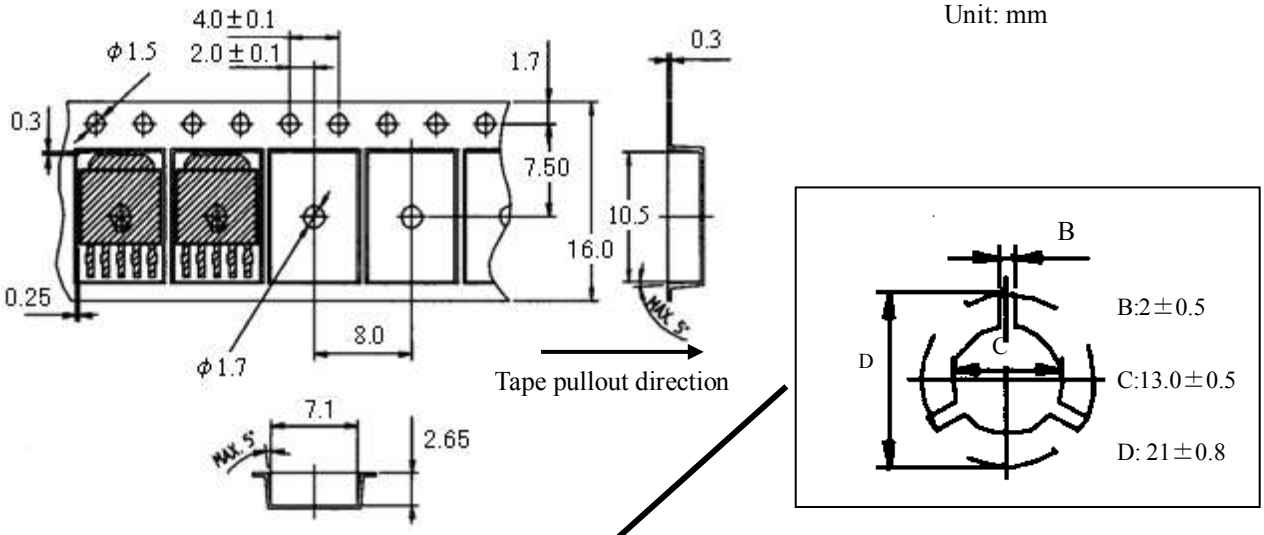
Products Weight: Approx.0.33g

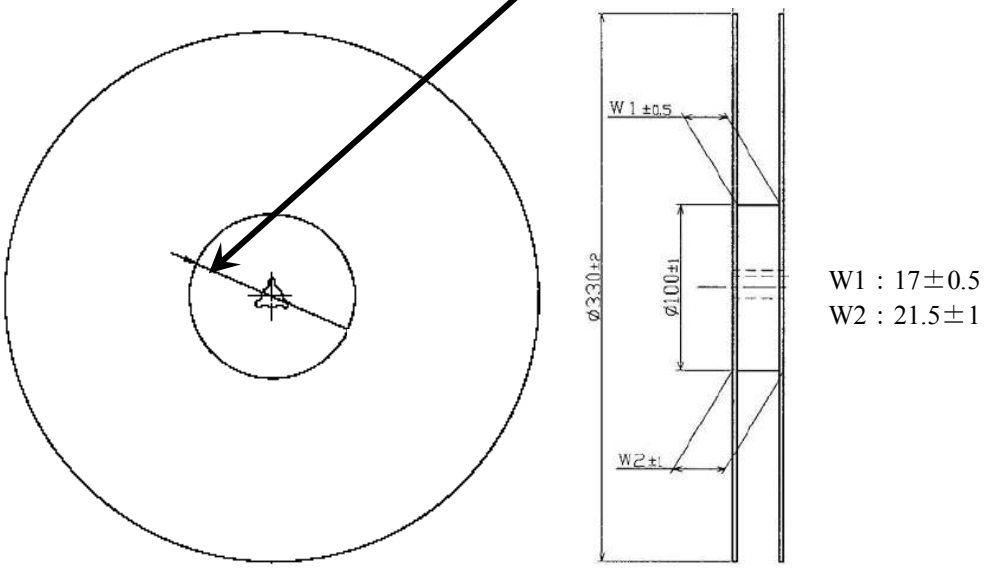
7.2 Appearance
The body shall be clean and shall not bear any stain, rust or flaw.

7.3 Marking
The part number and lot number shall be clearly marked by laser on the body and shall not be erased easily.

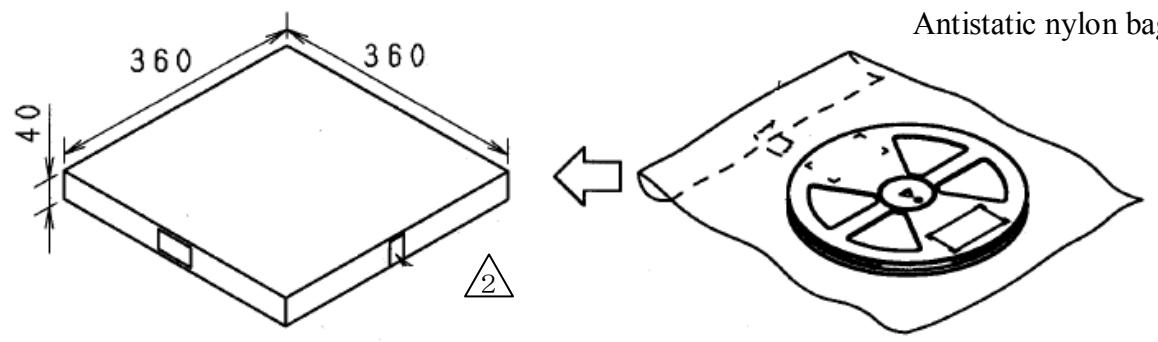
8 Package specification

Unit: mm





Package amount: 3000pcs/reel



9. Operating precautions

9.1 Parallel operation
The parallel operation to increase the current is not available.

9.2 Thermal shut down
SI-8000TMX series has a thermal protection circuit.
This circuit protects the IC from self heatig by the over load.
This circuit cannot guarantee the long-term reliability against the continuously over load status.

9.3 Precaution for handling
Some terminals can be damaged by static electricity.

9.4 Others

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Appendix: Recommended soldering conditions

＜Storage condition＞

Temperature: 5 – 35°C

Humidity: 40 – 70%

Atmosphere: No poisonous gas generation and little dust.
No condensation.

＜Storage period＞

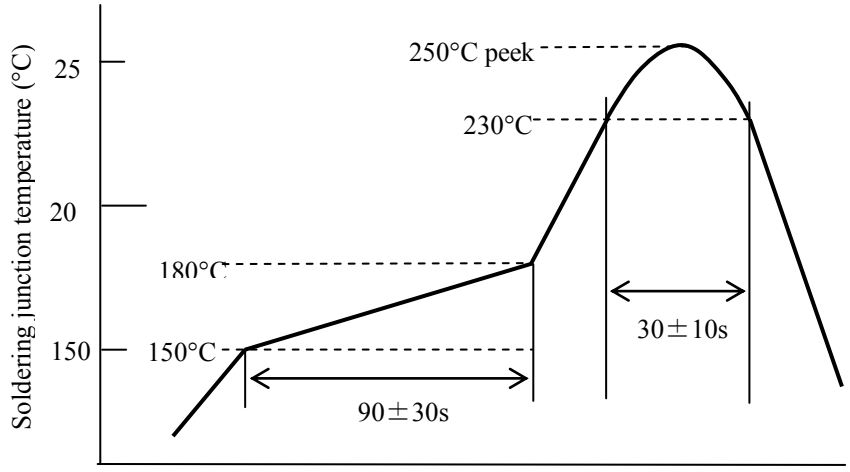
Storage period: 1 year or so in a hermetically sealed condition

(If the long-term storage is expected, please consider vacuum packing or putting silica gel in the airtight container.)

6 months in an unsealed condition

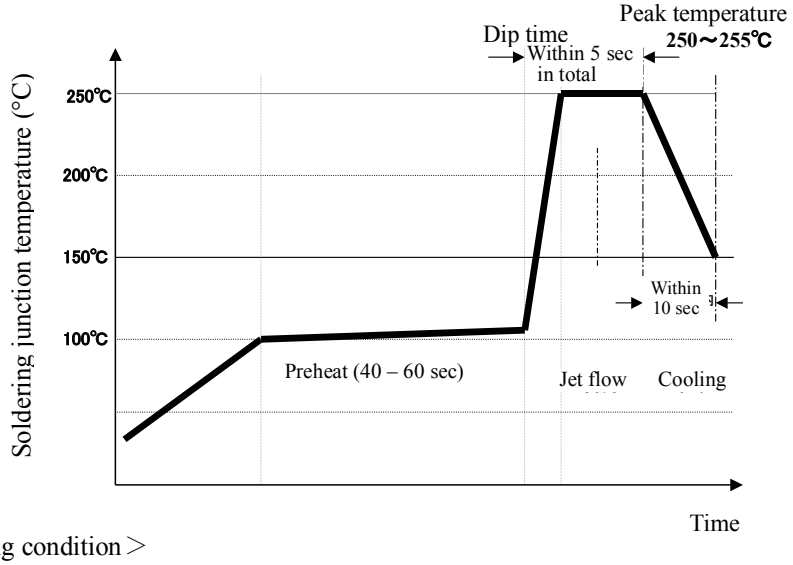
＜Reflow condition＞

* Reflow is limited to twice.



＜Flow condition＞

* Flow is limited to once.



＜Hand soldering condition＞

Temperature of tip of soldering iron: 380±10°C

Time: 3s +1s/－0s

Number of times: Once