Charge pump voltage converter IC
Monolithic IC MM3631

Outline

MM3631XN is an unregulated charge pump voltage converter, convert a input voltage range of 1.8V to 3.3V into a negative voltage. MM3631XN uses two low cost capacitors.
The device is small packaged in a 6-pin SOT-26B CE circuit included. Stand-by current is less than 1 μA, reduce the quiecent current

Features

(Except where noted otherwise : Ta=25℃)

(1) Input voltage range：1.8V ~ 3.3V
(2) Output voltage range：－VIN
(3) Operating temperature range：－30℃~ 80℃
(4) Output current：50mA
(5) consumption current (CE=L)：70 μA (typ.)
(6) Stand-by consumption current (CE=H)：1 μA (max.)
(7) Efficiency：92% (IL=1mA, VIN=2.8V)
(8) Oscillation frequency 120kHz(typ.)
(9) Protective function：Vin voltage protection

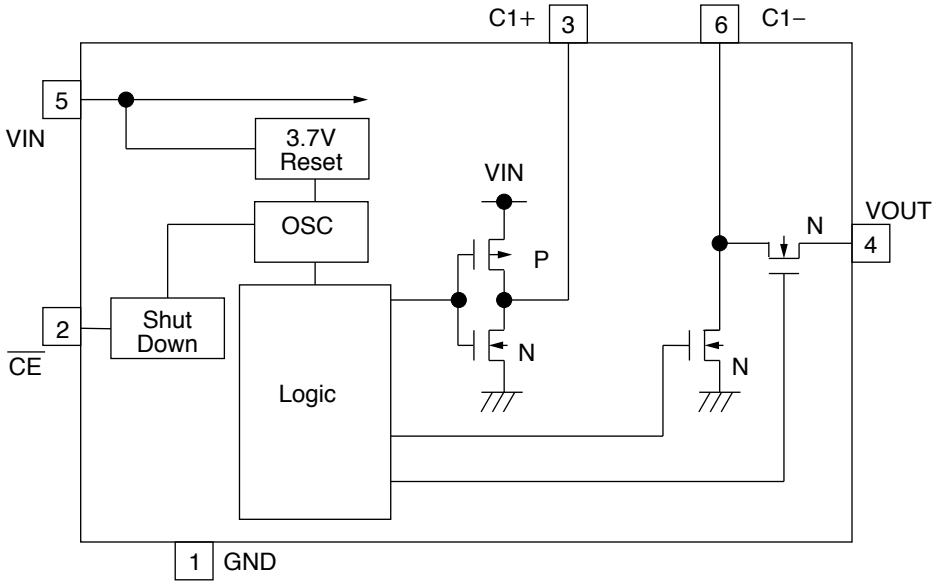
Package

SOT-26B

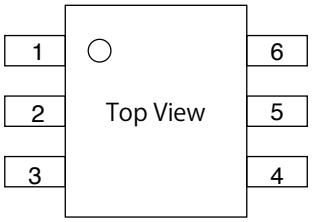
Applications

(1) Portable devices
(2) Operational Amplifier Negative Power Supply

Block diagram



Pin assignmetn



Pin No.	Pin name	Function
1	GND	GND
2	$\overline{CE}$	Shut down terminal
3	C1+	Positive charge pump capacitor terminal
4	VOUT	Negative output terminal
5	VIN	VDD terminal
6	C1 −	Negative charge pump capacitor terminal

Absolute maximum ratings

(Except where noted otherwise : Ta=25℃)

Item	Symbol	Measurement condition	unit
Supply voltage	VIN	−0.3 ~ +6.0	V
VOUT terminal output voltage	VOUT	− 3.5 ~ +0.3	V
C1(+) terminal output voltage	VC1+	−0.3 ~ +6.3	V
C1(−) terminal output voltage	VC1 −	−3.5 ~ +0.3	V
CE terminal output voltage	VCE	− 0.3 ~ +6.0	V
VOUT terminl outout current	IOUT	~ 50	mA
Junction temperature	T_{jMAX}	~ 150	℃
Storage temperature	Tstg	− 40 ~ +125	℃
Power dissipation	Pd	~ 220	mW

Recommended operating condition

Item	Symbol	Rating	Unit
Operating ambient temperature	T_{OPR}	−30 ~ +80	℃
Operating voltage	V_{OP}	1.8 ~ 3.3	V

Electrical characteristics

(Except where noted otherwise : Ta=25℃,VIN=2.8V)

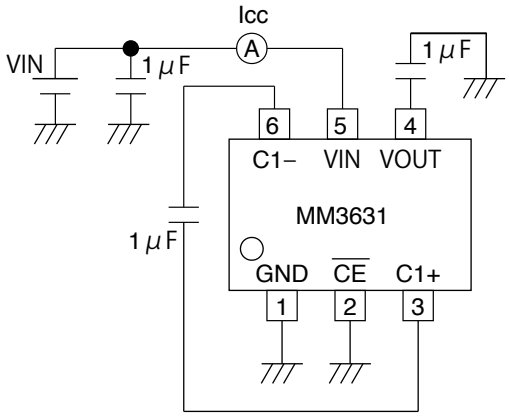
Item	Symbol	Measurement condition	Min.	Typ.	Max.	Unit
Current consumption	Icc	VCE=0V, Unload	35	70	140	μA
Current consumption at stand-by	Iccs	VCE=2.8V, Unload			1	μA
Frequency	fOSC		75	120	192	kHz
Output resistance	Rout	IL=5mA	20	45	90	Ω
CE terminal "H" voltage	Vceh	H=Disable	0.9			V
CE terminal "L" voltage	Vcel	L=Enable			0.25	V
Power efficiency (IL=1mA)	Peff	IL=1mA		92		%
Power efficiency (IL=5mA)	Peff	IL=5mA		85		%
Power efficiency (IL=10mA)	Peff	IL=10mA		80		%
Voltage conversion efficiency (IL=1mA)	Veff	IL=1mA	95			%
Voltage conversion efficiency (IL=5mA)	Veff	IL=5mA	90			%
Voltage conversion efficiency (IL=10mA)	Veff	IL=10mA	80			%
Over voltage *1	VOP		3.50	3.70	3.84	V
Over voltage Chattering *1	VOPchat		0	30	60	mV
Over voltage hysterisis	VOPhys		25	50	100	mV

(*1) VOP ≦ VIN < VOP+VOPchat : VOUT=Chattering
VOP+VOPchat ≦ VIN : VOUT=0V

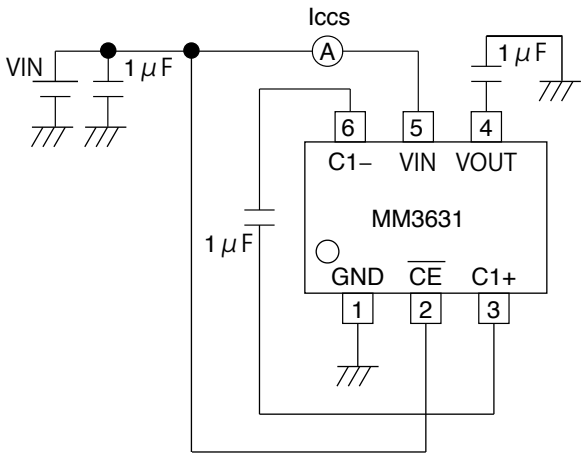
Please refer to p.8 Over Voltage Protection.

Measuring circuit

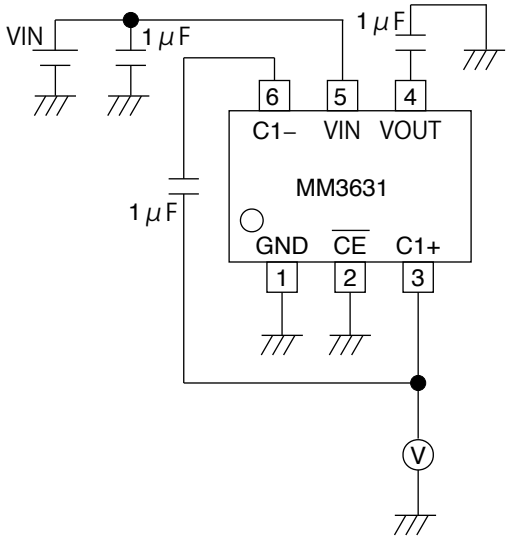
(1) Current consumption	Icc



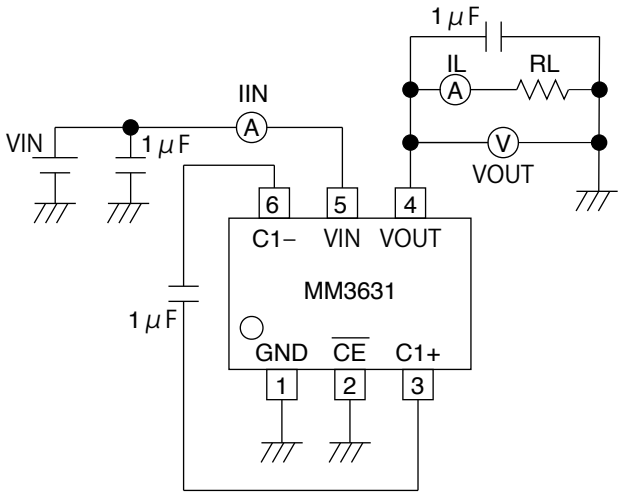
(2) Current consumption at stand-by	Iccs



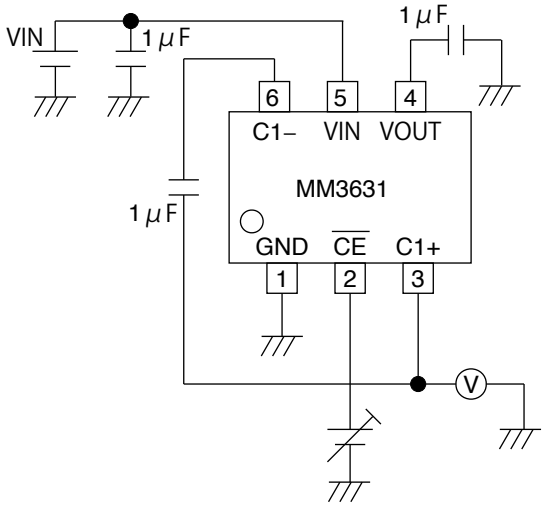
(3) Frequency	fOSC



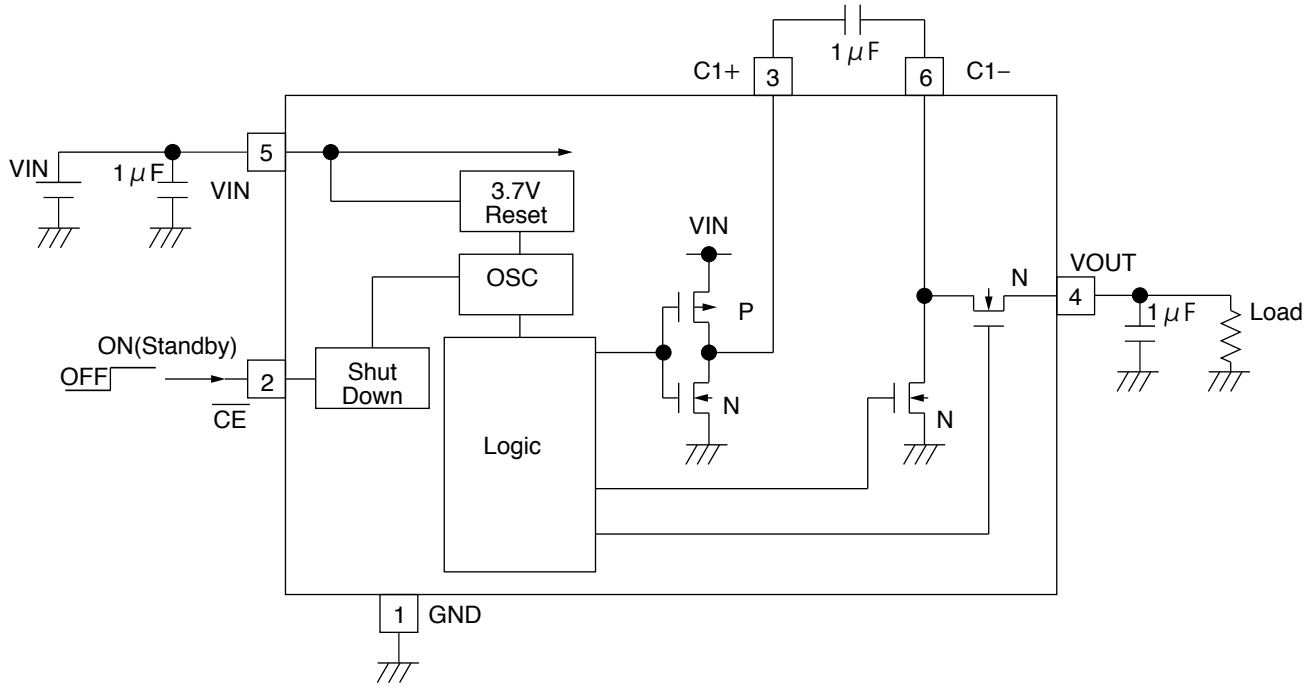
(4) Power efficiency	Peff
Voltage convension efficiency	Veff
Output resistance	Rout



(5) CE terminal "H" / "L" voltage	Vceh, Vcel



Application circuit



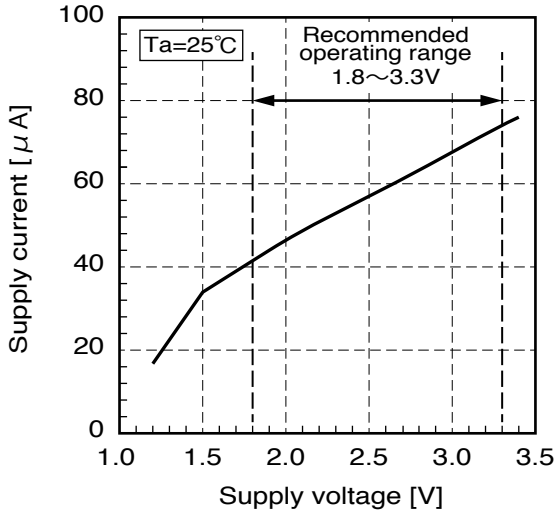
Notes

(1) In case the supply voltage is under MIN value of absolute maximum rating when such as battery connect voltage supply terminal, it is possibility to destroy this IC by overcurrent flowing.
Please use this IC within absolute maximum rating.

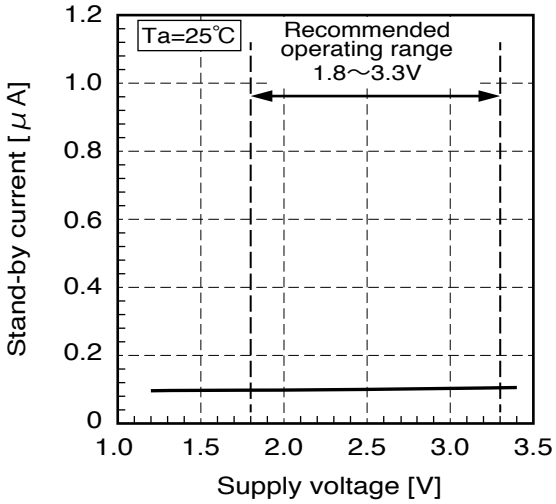
(2) In the event a problem which may affect industrial property or any other rights of us or a third party is encountered during the use of information described in these circuit, we shall not be liable for any such problem, nor grant a license therefore.

Characteristics

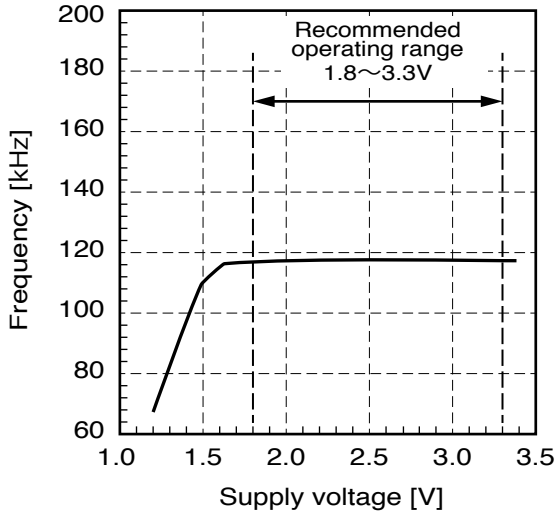
■ Supply current - Supply voltage



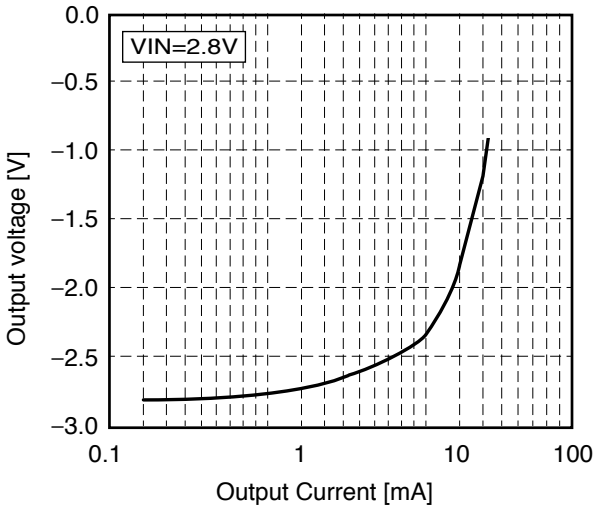
■ Stand-by current - Supply voltage



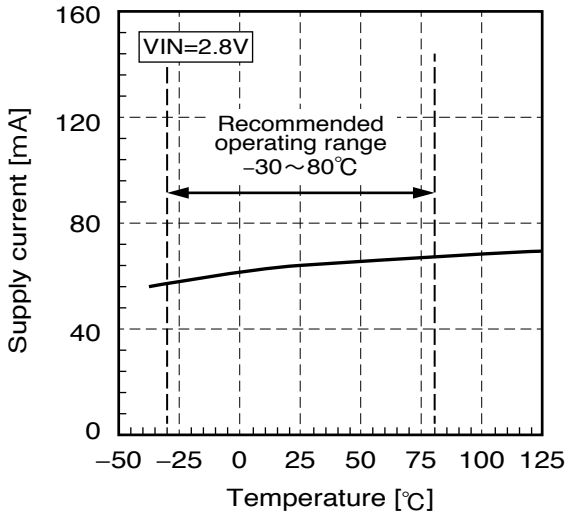
■ Frequency - Supply voltage



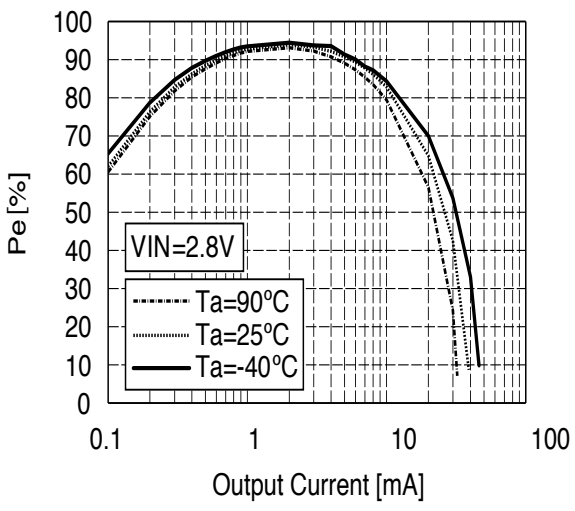
■ Output voltage - Output current



■ Supply voltage - Temperature



■ Power efficiency - Temperature

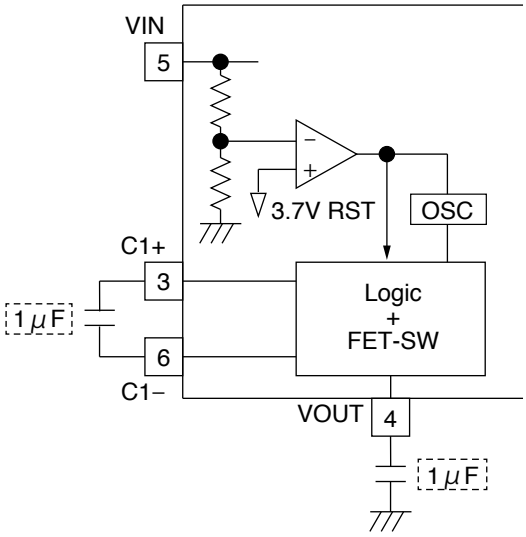


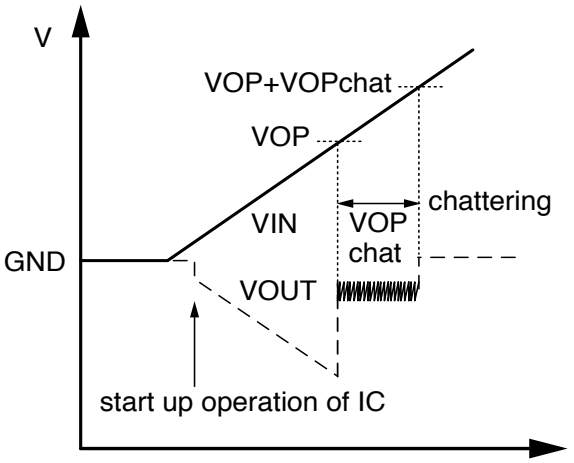
Operation

(1) Over Voltage Protection

When VIN becomes 3.7V or more, VOUT is turned off. (VOP)
OVP cancel by about -50mV from a detection value (VOP). (VOPhys)

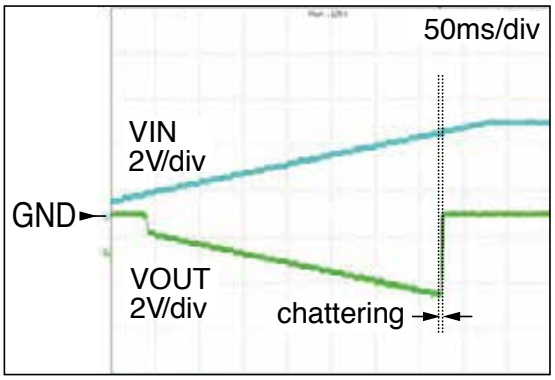
* After OVP detect,Detection and a release are repeated (Chattering).
Output voltage becomes unstable then.
After Chattering occurs for about +30 mV from a detection value, output voltage is set to 0V. (VOPchat)



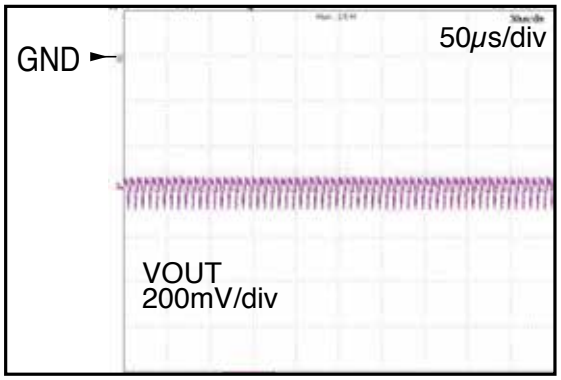


Chattering Waveform

① VIN=0 to 4V



② VOP ≦ VIN < VOP+VOPchat



(2) Recommendation of capacitor for charge pump

1 μ F ceramic capacitor is recommended the following characteristics

ESR : 100m Ω or less
Temperature characteristics : B (± 10%) rank
Capacitance tolerance : K (± 10%) rank
Rated voltage : 10V or more

(3) CE terminal logic

Table 1 shows the function of CE terminal

CE state	Mode
L	Operation
H	Stand-by

Table 1 Truth table

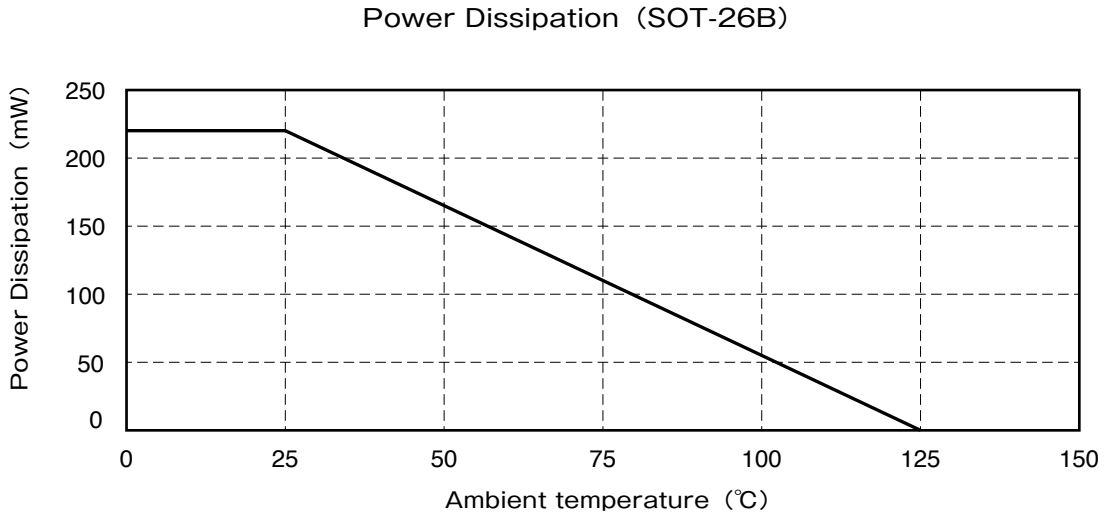
(4) Power dissipation

The Pd value characteristic of SOT-26B(Elemental substances) is the following.

The Power dissipation change if board to mount IC change because radiative heat fix at board.It is reference data below, Evaluate IC in the set.

1. Single Device

Power dissipation 0.22W Ta=25℃



It is recommended to layout the VIA for heat radiation in the GND pattern of reverse (of IC) when there is the GND pattern in the inner layer (in using multiplayer substrate). By increasing these copper foil pattern area of PCB, Power dissipation improves.

Notes

1. The absolute maximum rating , Never exceed it.The functional operation is not assured

2. Please use it in recommended operation voltage

3. Due to restrictions on the package power dissipation, the output current value may not be satisfied.Attention should be paid to the power dissipation of the package when the output current is large or the voltage between Iinput and Output is high

4. The wire of VIN and GND is required to print full ground plane for noise and stability

5. The input capacitor must be connected a distance of less than 1cm from input pin. There is a possibility that it becomes impossible to maintain this performance and reliability IC original when using it exceeding recommended operation voltage. There is a possibility with deterioration and destruction of IC when using it exceeding the absolute maximum rating.

6. It is able to an unstable operation when you use the capacitor with intense capacitance change. The capacitor has the dependency at the power-supply voltage and the temperature. The capacity value changes by the environment used. Please evaluate IC in the set.

7. The overcurrent protection circuit is'nt built into this IC.