# XC6351A Series

ETR0801_004

Charge Pump Voltage Inverter IC

## ■ GENERAL DESCRIPTION

The XC6351A series are charge pump voltage inverter ICs that have 4 MOSFETs built in. Since highly efficient negative voltages can be generated with only 2 external capacitors connected, GaAs bias power supplies & OpAmp's negative power supplies etc., can be easily accommodated on a standard PCB.

A mini-molded, 6 pin, SOT-26 and USP-6B packages provides for space saving and makes high density mounting possible.

Low power consumption and high efficiency make this series perfect for use with battery operated applications.

Since the IC's operations stop when output is shutdown via the CE (chip enable) function, total power consumption reduction is possible in applications which use this IC.

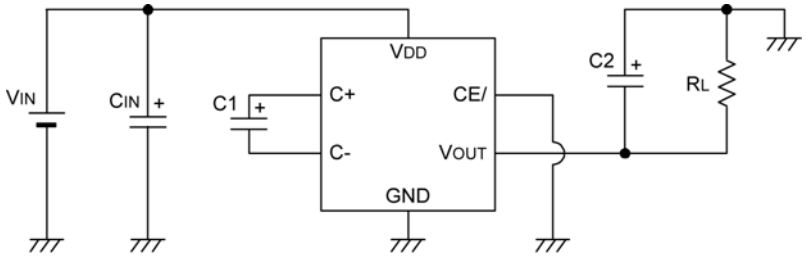
## ■APPLICATIONS

- ●Negative power supplies
- ●Power supplies for Opamp
- ●Cellular and portable phones
- ●Miniature LCD panels
- ●PDAs
- ●Various battery powered systems

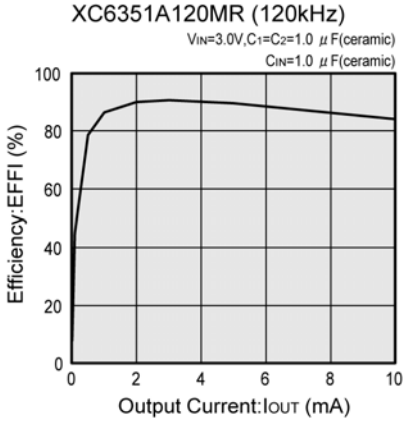
## ■FEATURES

| | |
|---|---|
| **Operating Voltage Range** | : 1.2V ~ 5.0V |
| **Oscillation Frequency** | : 120kHz |
| | : 35kHz ( custom ) |
| **Low Supply Current** | : 310μA ( TYP. ) |
| | : 100μA (35kHz custom TYP.) |
| **High Efficiency** | : 90% (TYP.) ( RL = 2kΩ ) |
| **Stand-by Current** | : 2.0μA (MAX.) |
| **CE(Chip Enable) Function** | |
| **Operating Ambient Temperature** | : -30°C ～ +80°C |
| **Packages** | : SOT-26 ,USP-6B |
| **Environmentally Friendly** | : EU RoHS Compliant, Pb Free |

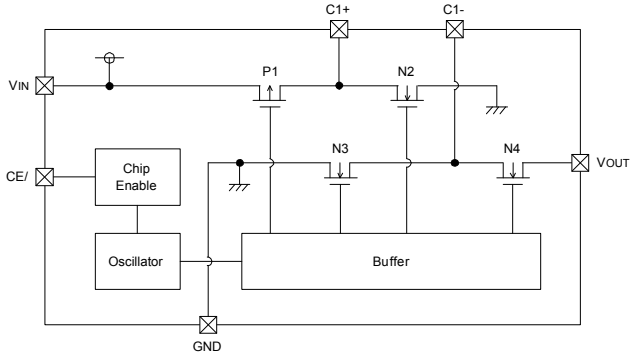
## ■TYPICAL APPLICATION CIRCUIT




## ■TYPICAL PERFORMANCE CHARACTERISTICS



## ■BLOCK DIAGRAM




Note:
1. In operation, the following conditions will be repeated alternately:
   P1 & N3 ON: N2 & N4 OFF
   P1 & N3 OFF: N2 & N4 ON
2. In standby mode, P1, N3 & N4 will be ON and N2 will be OFF. The output pin VOUT will be connected to GND.

## ■PRODUCT CLASSIFICATION

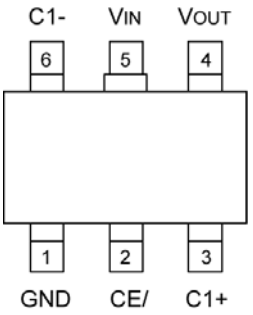
●Ordering Information

XC6351A ①②③④⑤–⑥(*1)

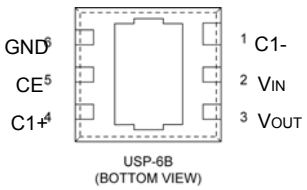
| DESIGNATOR | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|
| ①②③ | Oscillation Frequency | 120 | 120kHz |
| | | 035 | 35kHz (custom) |
| ④⑤-⑥ | Packages Taping Type | MR | SOT-26(3,000pcs/Reel) |
| | | MR-G | SOT-26(3,000pcs/Reel) |
| | | DR | USP-6B(3,000pcs/Reel) |
| | | DR-G | USP-6B(3,000pcs/Reel) |

(*1) The “-G” suffix indicates that the products are Halogen and Antimony free as well as being fully RoHS compliant.

## ■PIN CONFIGURATION




SOT-26
(TOP VIEW)




USP-6B
(BOTTOM VIEW)

*The dissipation pad for the USP-6B package should be solder-plated in recommended mount pattern and metal masking so as to enhance mounting strength and heat release.
If the pad needs to be connected to other pins, it should be connected to the VIN (No. 2) pin.

## ■PIN ASSIGNMENT

| PIN NUMBER | | SYMBOL | FUNCTION |
|---|---|---|---|
| SOT-26 | USP-6B | | |
| 1 | 6 | GND | Ground |
| 2 | 5 | CE/ | Chip Enable (Low Active) |
| 3 | 4 | C1+ | External Capacitor +Pin |
| 4 | 3 | VOUT | Reverse Output |
| 5 | 2 | VIN | Power Supply |
| 6 | 1 | C1- | External Capacitor -Pin |

## ■PIN FUNCTIOS ASSIGNMENT

| CE/PIN | STATUS |
|---|---|
| H | Stand-by |
| L | Active |

## ■ABSOLUTE MAXIMUM RATINGS

Ta = 25℃

| PARAMETER | | SYMBOL | RATINGS | UNITS |
|---|---|---|---|---|
| VIN Input Voltage | | VIN | 6.0 | V |
| VOUT Pin Voltage | | VOUT | -6～0.3 | V |
| C1+ Pin Voltage | | C1+ | -0.3～VIN + 0.3 | V |
| C1- Pin Voltage | | C1- | VOUT - 0.3～0.3 | V |
| CE/ Pin Voltage | | CE/ | -0.3～VIN + 0.3 | V |
| VOUT Pin Current | | IOUT | 50 | mA |
| Power Dissipation | SOT-26 | Pd | 150 | mW |
| | | | 600 (40mm x 40mm Standard board ) (*1) | |
| | USP-6B | | 100 | |
| | | | 1000 (40mm x 40mm Standard board ) (*1) | |
| Operating Temperature Range | | Topr | -30～＋80 | ℃ |
| Storage Temperature Range | | Tstg | -40～＋125 | ℃ |

Each rating voltage is based on the GND

(*1) This is a reference data taken by using the test board. Please see the power dissipation page for the mounting condition.

## ■ELECTRICAL CHARACTERISTICS

fosc＝120kHz, Ta=25℃

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS | CIRCUIT |
|---|---|---|---|---|---|---|---|
| Supply Current | IDD | | - | 310 | 520 | μA | 1 |
| Operating Voltage Range | VIN | RL＝5kΩ | 1.2 | - | 5.0 | V | 2 |
| Oscillation Frequency | fOSC | | 75 | 120 | 192 | kHz | 1 |
| Power Transition Efficiency | EFFI | RL＝2kΩ | - | 90 | - | % | 2 |
| Voltage Transition Efficiency | VEFFI | RL＝∞ | 95 | - | - | % | 2 |
| Output Impedance | ROUT | RL＝5kΩ | - | 45 | 90 | Ω | 2 |
| Stand -by Current | ISTB | CE/＝VIN | - | - | 2.0 | μA | 3 |
| CE/ 'H' Level Voltage | VCEH | | 0.9 | - | - | V | 3 |
| CE/ 'L' Level Voltage | VCEL | | - | - | 0.25 | V | 3 |

Measuring Conditions: Unless otherwise stated, VIN = 5.0V, CE/ = 0V

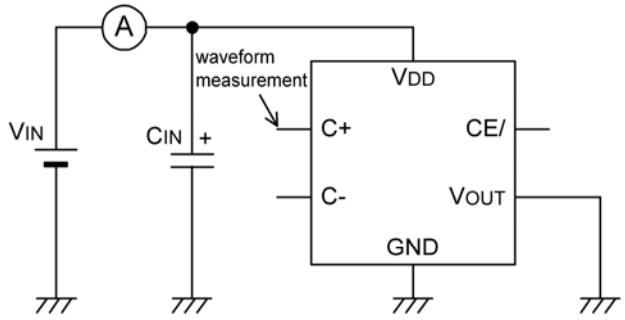
fosc＝35kHz, Ta=25℃

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS | CIRCUIT |
|---|---|---|---|---|---|---|---|
| Supply Current | IDD | | - | 100 | 170 | μA | 1 |
| Operating Voltage Range | VIN | RL＝5kΩ | 1.2 | - | 5.0 | V | 2 |
| Oscillation Frequency | fOSC | | 21 | 35 | 56 | kHz | 1 |
| Power Transition Efficiency | EFFI | RL＝2kΩ | - | 90 | - | % | 2 |
| Voltage Transition Efficiency | VEFFI | RL＝∞ | 95 | - | - | % | 2 |
| Output Impedance | ROUT | RL＝5kΩ | - | 45 | 90 | Ω | 2 |
| Stand -by Current | ISTB | CE/＝VIN | - | - | 2.0 | μA | 3 |
| CE/ 'H' Level Voltage | VCEH | | 0.9 | - | - | V | 3 |
| CE/ 'L' Level Voltage | VCEL | | - | - | 0.25 | V | 3 |

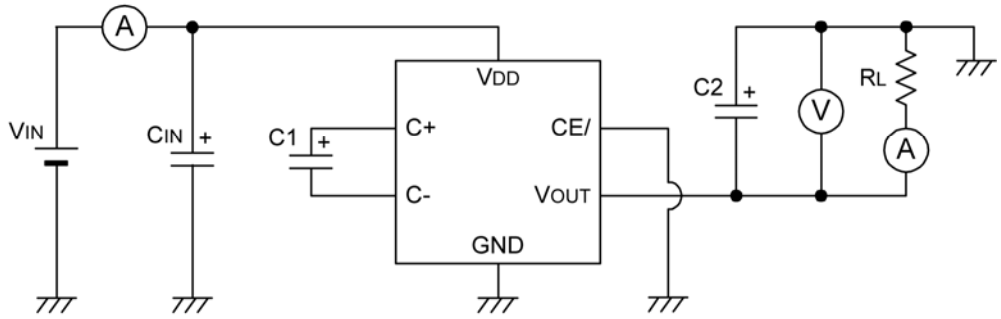
Measuring Conditions: Unless otherwise stated, VIN = 5.0V, CE/ = 0V

## ■TEST CIRCUITS

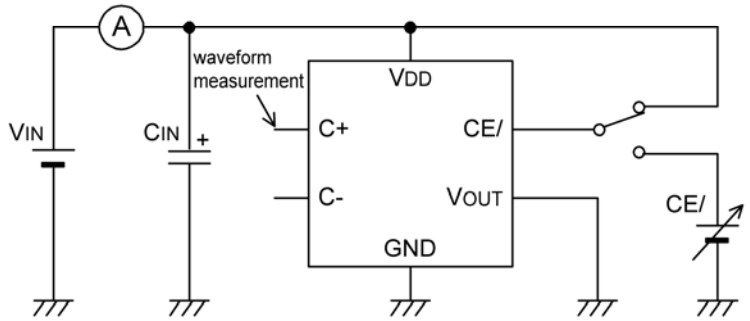
Circuit 1




Circuit 2




Circuit 3




External components:

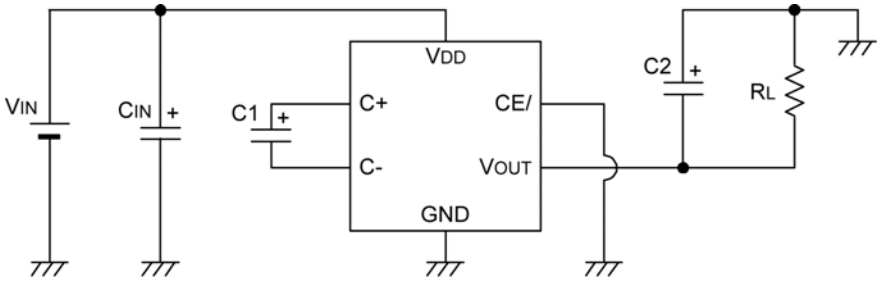
CIN = 1 μF (ceramic capacitor)

C1 = C2 = 1 μF (ceramic capacitor)*

* With the custom 35kHz frequency, C1 = C2 = 3.3 μF

## ■ TYPICAL APPLICATION CIRCUIT

●Standard Circuit




External components:

CIN = 1 μF (ceramic capacitor)

C1 = C2 = 1 μF (ceramic capacitor)*

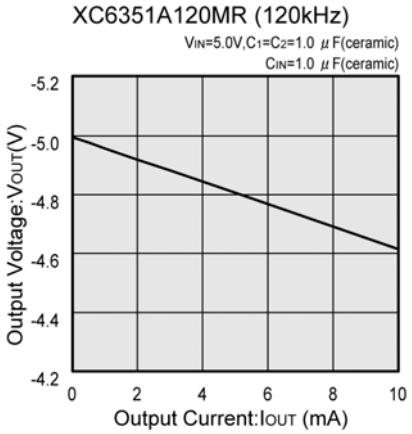
* With the custom 35kHz frequency, C1 = C2 = 3.3 μF

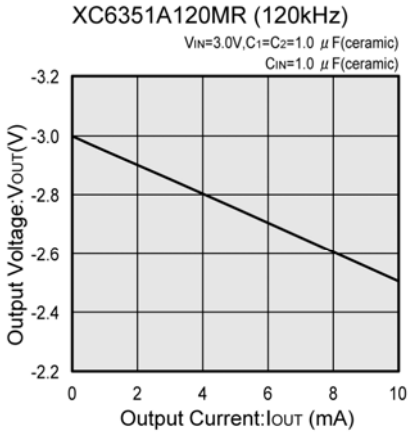
## ■ NOTES ON USE

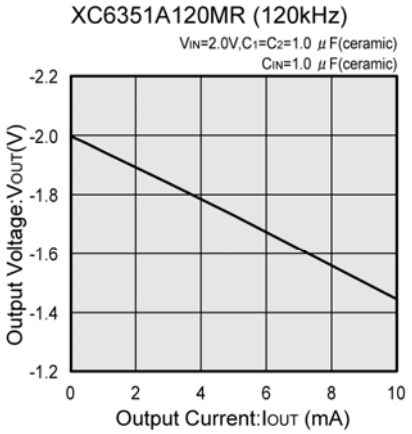
1. Please use the IC & external components: within the specified electrical characteristics range and ensure that absolute maximum ratings are not exceeded.
2. For C1 & C2, please use a capacitor with as small an ESR value as possible.
3. In order to reduce impedance between the IC's input pin and the power supply, we recommend that a capacitor (CIN) be connected to the input side.
4. If an external power supply is applied to the output pin in order to have VOUT connected to GND during standby, large current flows through the IC are a possibility. Further, do not use a capacitor at C2 that has a large capacitance value.

## ■TYPICAL PERFORMANCE CHARACTERISTICS

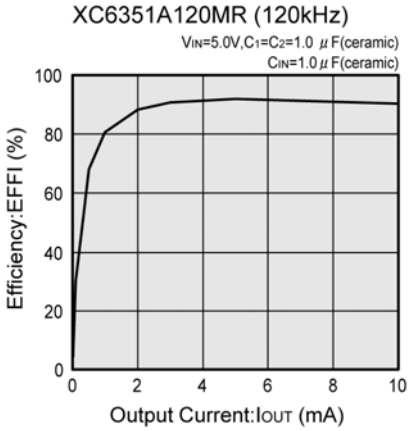
(1) Output Voltage vs. Output Current

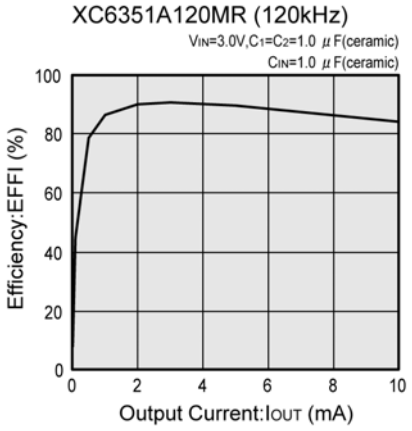


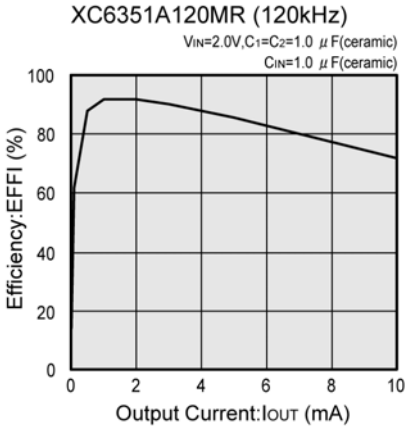



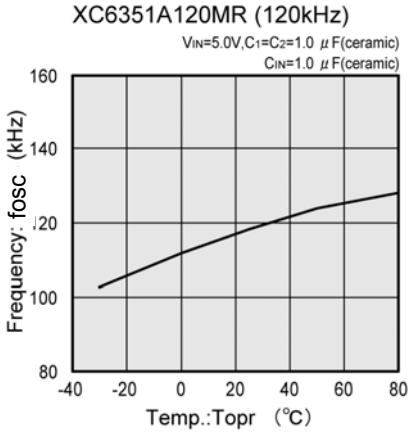

(2) Efficiency vs. Output Current



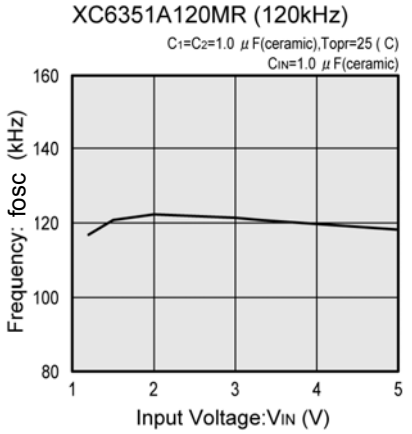




(3) Oscillation Frequency vs. Ambient Temperature



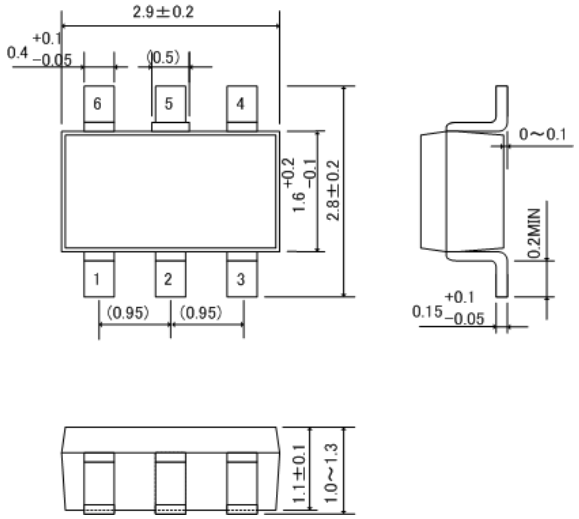

(4) Oscillation Frequency vs. Input Voltage



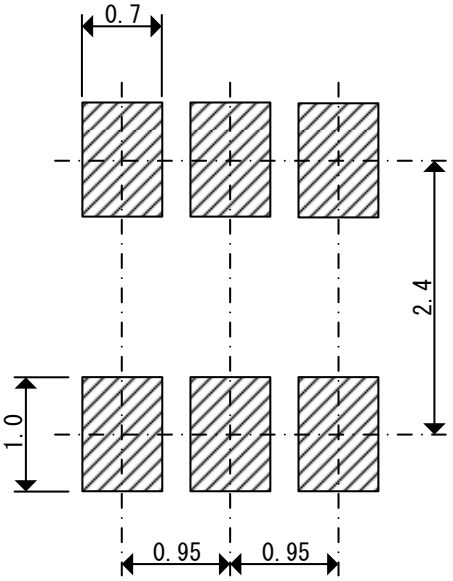
# ■PACKAGING INFORMATION

●SOT-26

Unit : mm

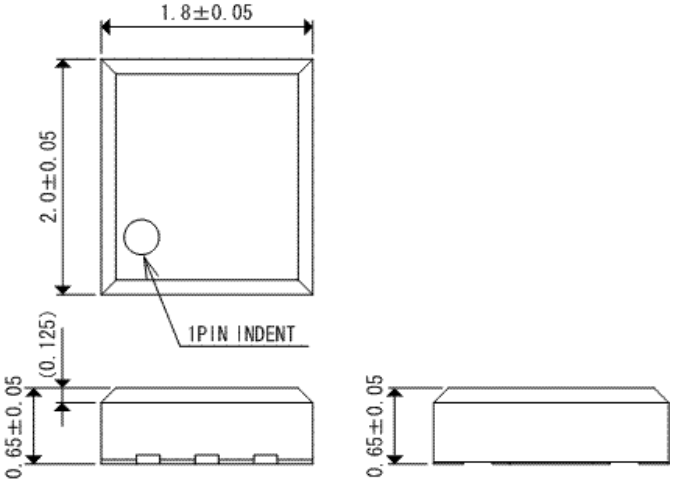


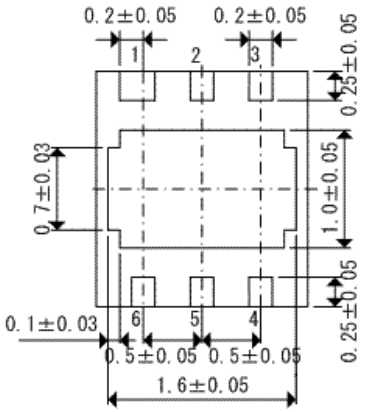

●SOT-26 Reference Pattern Layout



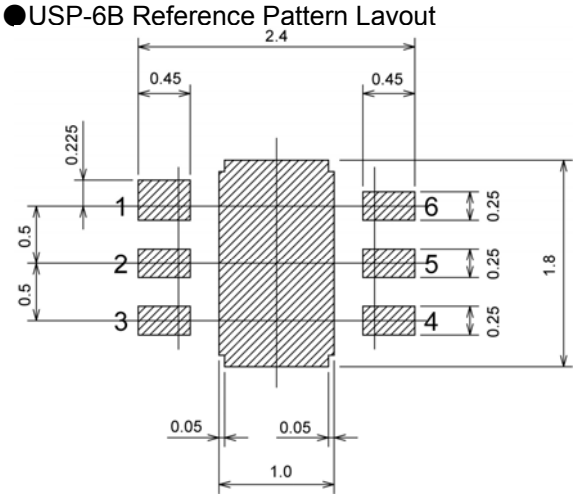

●USP-6B

Unit : mm

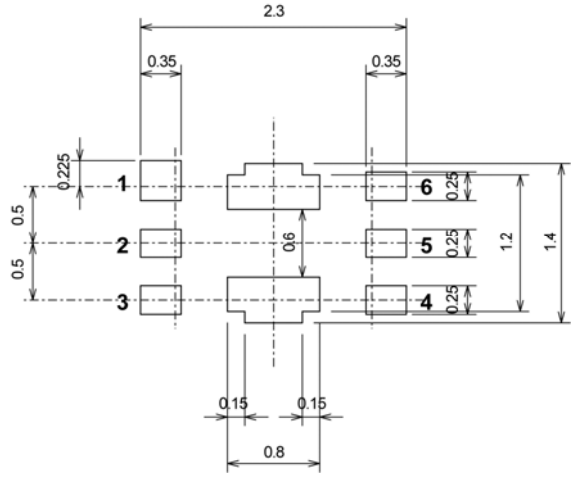



●USP-6B Reference Pattern Lavout




●USP-6B Reference Metal Mask Design

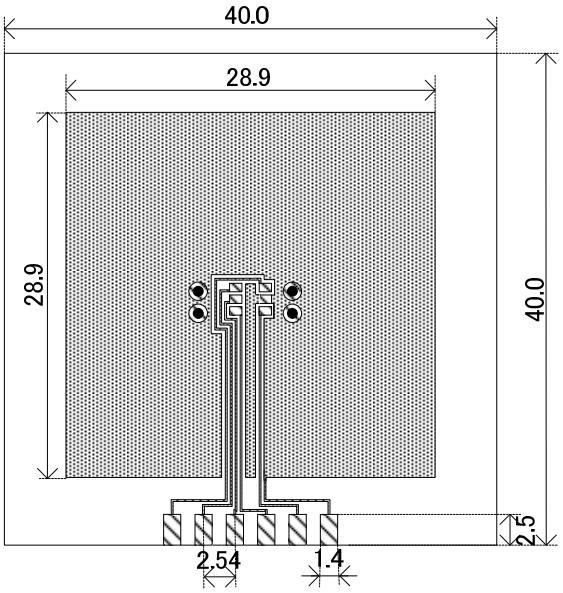


## ●SOT-26 Power Dissipation (40mm x 40mm Standard board)

Power dissipation data for the SOT-26 is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as the reference data taken in the following condition.

### 1. Measurement Condition

Condition: Mount on a board
Ambient: Natural convection
Soldering: Lead (Pb) free
Board: Dimensions 40 x 40 mm
(1600 mm2 in one side)
Copper (Cu) traces occupy 50% of the board area In top and back faces
Package heat-sink is tied to the copper traces
Material: Glass Epoxy (FR-4)
Thickness: 1.6mm
Through-hole: 4 x 0.8 Diameter

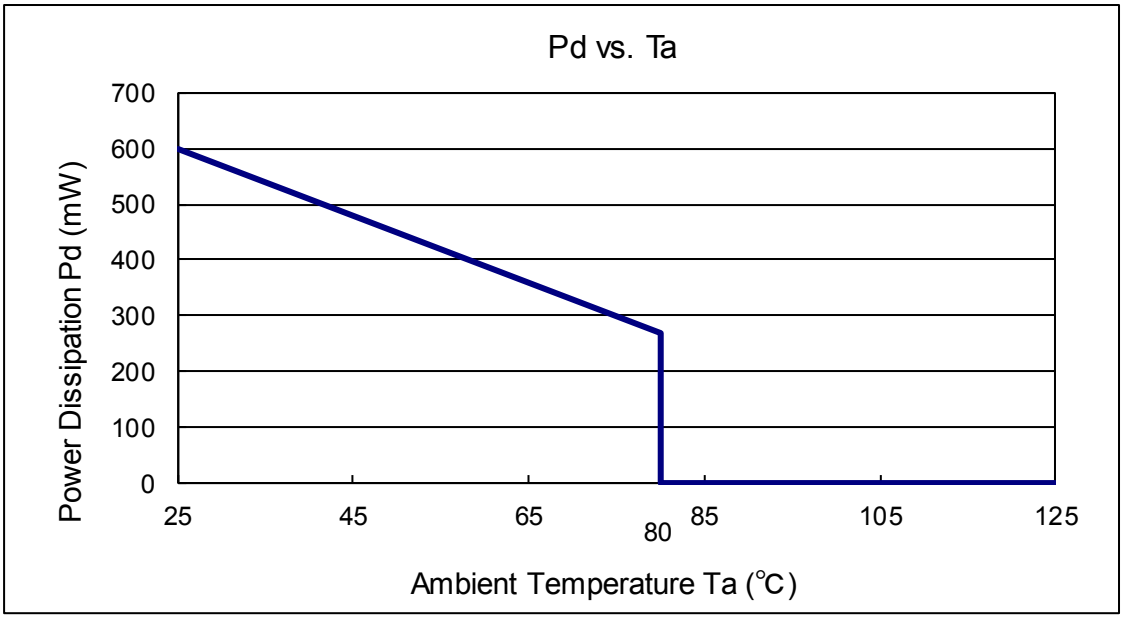



Evaluation Board (Unit: mm)

### 2.Power Dissipation vs. Ambient Temperature

Board Mount (Tj max = 125℃)

| Ambient Temperature (℃) | Power Dissipation Pd (mW) | Thermal Resistance (℃/W) |
|---|---|---|
| 25 | 600 | 166.67 |
| 80 | 270 | |

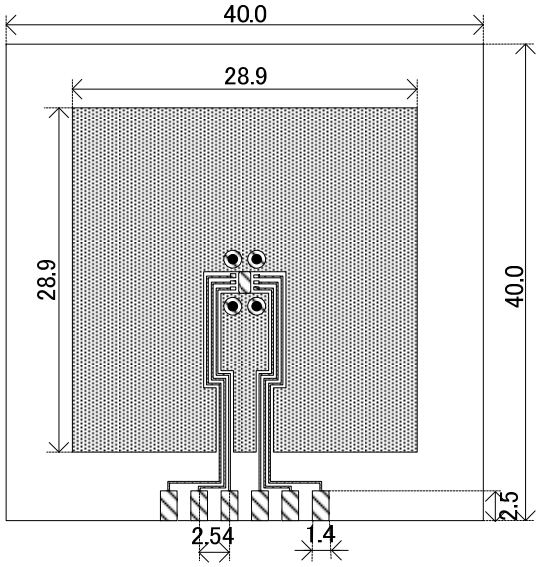


## ●USP-6B Power Dissipation (40mm x 40mm Standard board)

Power dissipation data for theUSP-6B is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as the reference data taken in the following condition.

### 1. Measurement Condition

Condition: Mount on a board
Ambient: Natural convection
Soldering: Lead (Pb) free
Board: Dimensions 40 x 40 mm
(1600 mm2 in one side)
Copper (Cu) traces occupy 50% of the board area In top and back faces
Package heat-sink is tied to the copper traces
Material: Glass Epoxy (FR-4)
Thickness: 1.6mm
Through-hole: 4 x 0.8 Diameter

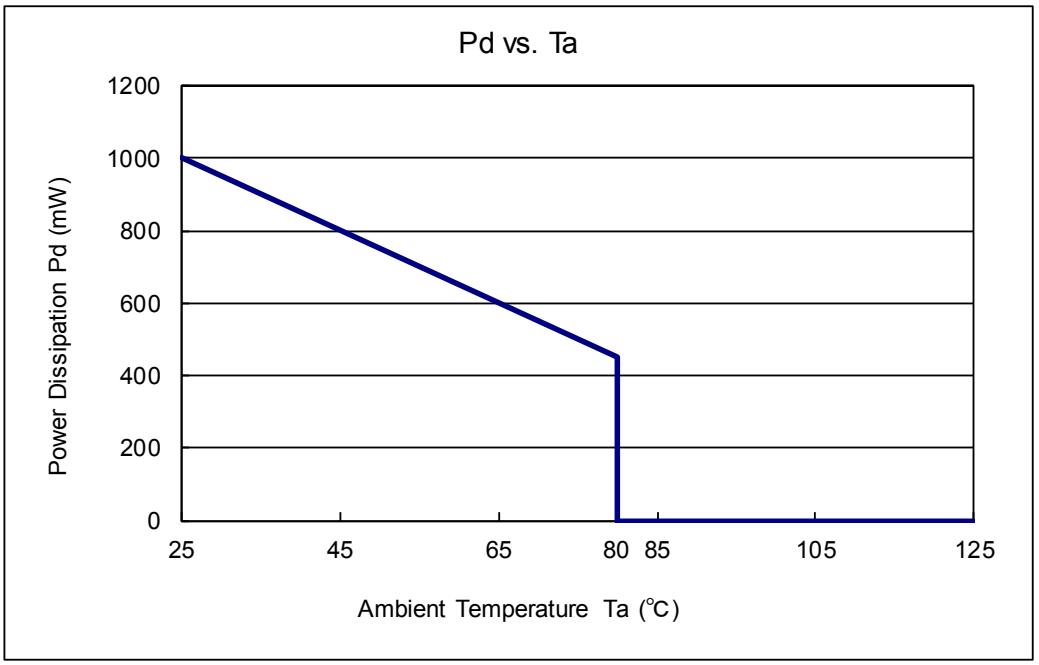



Evaluation Board (Unit: mm)

### 2.Power Dissipation vs. Ambient Temperature

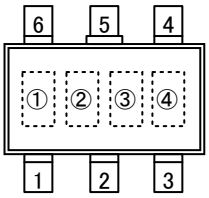
Board Mount (Tj max = 125℃)

| Ambient Temperature (℃) | Power Dissipation Pd (mW) | Thermal Resistance (℃/W) |
|---|---|---|
| 25 | 1000 | 100.00 |
| 80 | 450 | |



## ■MARKING RULE

●SOT-26




SOT-26
(TOP VIEW)

① represents product series

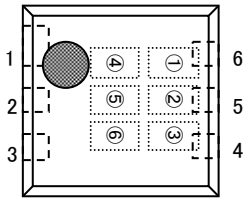
| MARK | PRODUCT SERIES |
|---|---|
| A | XC6351AxxxMx-G |

②,③ represents oscillation frequency

| MARK | | OSCILLATION FREQUENCY | PRODUCT SERIES |
|---|---|---|---|
| ② | ③ | | |
| 0 | 3 | 35kHz | XC6351A035MR-G |
| 1 | 2 | 120kHz | XC6351A120MR-G |

④ represents production lot number
0 to 9, A to Z repeated (G, I, J, O, Q, W excluded)

●USP-6B




①,②,③ represents product series

| MARK | | | PRODUCT SERIES |
|---|---|---|---|
| ① | ② | ③ | |
| 5 | 1 | A | XC6351AxxxDR-G |

④,⑤ represents oscillation frequency

| MARK | | OSCILLATION FREQUENCY | PRODUCT SERIES |
|---|---|---|---|
| ④ | ⑤ | | |
| 0 | 3 | 35kHz | XC6351A035DR-G |
| 1 | 2 | 120kHz | XC6351A120DR-G |

⑥ represents production lot number
0 to 9,A to Z repeated (G, I, J, O, Q, W excluded)
Note: No character inversion used.

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