

## 700mA High Speed LDO Regulator with Reverse Current Protection

### ■ GENERAL DESCRIPTION

The XC6227 series is a highly accurate, low noise, high ripple rejection, low dropout, and low power consumption high speed voltage regulator.

The series consists of a voltage reference, an error amplifier, a driver transistor, a current limiter, a thermal protection circuit, a reverse current protection circuit and a phase compensation circuit.

The CE function enables the entire circuit to be placed in a stand-by state by inputting a low level signal to the CE pin. Over-current protection and thermal protection circuits are integrated. The protection circuit starts to operate when either output current reaches the current limit level or junction temperature reaches the temperature limit. With the reverse current protection function of a driver transistor, the reverse current flow is prohibited when  $V_{OUT}$  voltage is higher than  $V_{IN}$  voltage. For an example, when a battery is connected to the  $V_{OUT}$  pin, battery current will not flow back to the XC6227.

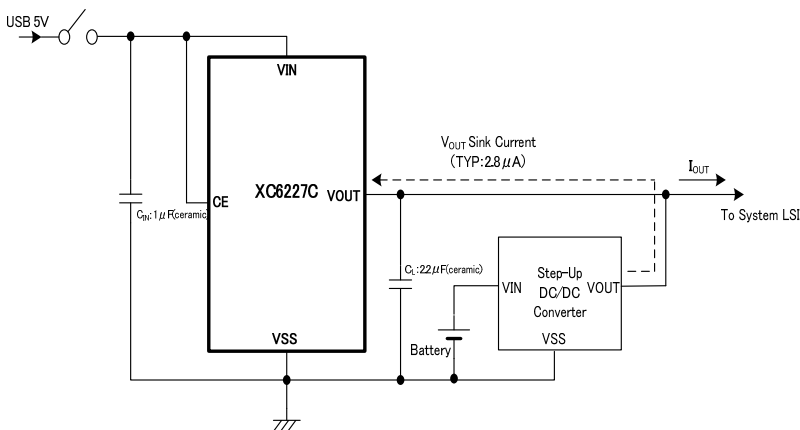
### ■ APPLICATIONS

- USB products and HDMI equipments
- E-book Readers / Electronic dictionaries
- Smart Phones / Mobile phones
- Portable game consoles
- Modules (Wireless, Camera, etc.)

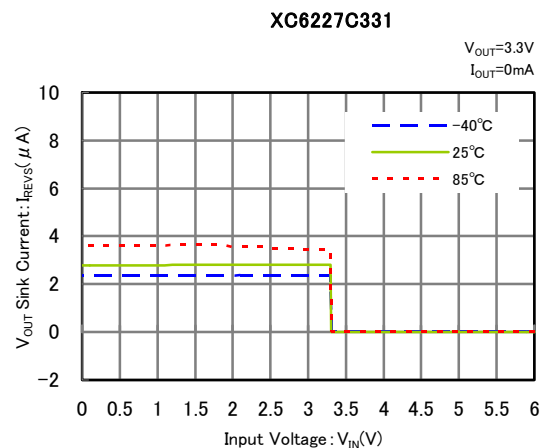
### ■ FEATURES

|                                      |   |
|--------------------------------------|---|
| <b>Maximum Output Current</b>        | : 700mA   |
| <b>Dropout Voltage</b>               | : 120mV @ $I_{OUT}=300mA(V_{OUT}=3.0V)$                                 |
| <b>Operating Voltage Range</b>       | : 1.7V ~ 6.0V   |
| <b>Output Voltages</b>               | : 0.8V~5.0V (0.05V increments)  |
| <b>Accuracy</b>                      | : $\pm 1\%$ ( $V_{OUT} > 2.0V$ )<br>$\pm 0.02V$ ( $V_{OUT} \leq 2.0V$ ) |
| <b>Low Power Consumption</b>         | : 100 $\mu A$   |
| <b>Chip Enable(CE)</b>               | : Active High<br>Standby Current below 0.1 $\mu A$                      |
| <b>High Ripple Rejection</b>         | : 65dB @ 1kHz   |
| <b>Operating Ambient Temperature</b> | : $-40^{\circ}C \sim +85^{\circ}C$                                      |
| <b>Low ESR Capacitor</b>             | : Ceramic capacitor   |
| <b>Packages</b>                      | : USP-6C, SOT-25, SOT-89-5  |
| <b>Environmentally Friendly</b>      | : EU RoHS Compliant, Pb Free  |

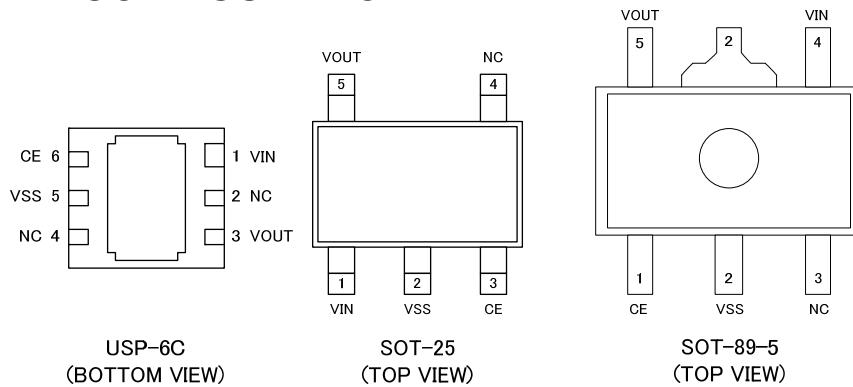
### ■ TYPICAL APPLICATION CIRCUIT ■ TYPICAL PERFORMANCE CHARACTERISTICS



●  $V_{OUT}$  Sink Current VS. Input Voltage



## PIN CONFIGURATION



\*The dissipation pad for the USP-6C 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 VSS (No. 5) pin.

## PIN ASSIGNMENT

| PIN NUMBER |        |          | PIN NAME | FUNCTIONS      |
|------------|--------|----------|----------|----------------|
| USP-6C     | SOT-25 | SOT-89-5 |          |                |
| 1          | 1      | 4        | VIN      | Power Input    |
| 3          | 5      | 5        | VOUT     | Output         |
| 2,4        | 4      | 3        | NC       | No connection  |
| 5          | 2      | 2        | VSS      | Ground         |
| 6          | 3      | 1        | CE       | ON/OFF Control |

## PRODUCT CLASSIFICATION

### Ordering Information

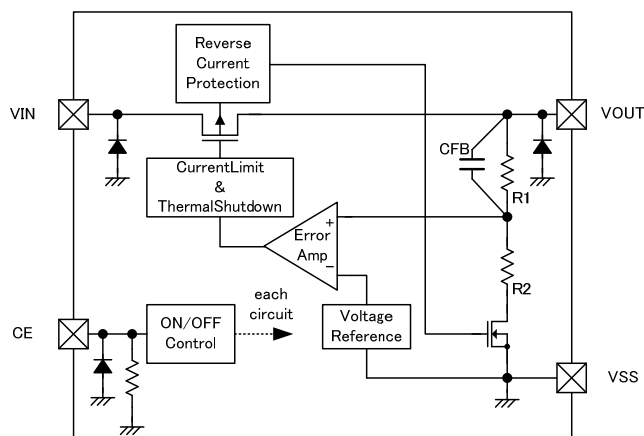
XC6227①②③④⑤⑥-⑦<sup>(\*)</sup>

| DESIGNATOR           | ITEM   | SYMBOL | DESCRIPTION                                       |
|----------------------|--|--------|---|
| ①                    | Type of CE <sup>(*)2</sup>                         | C      | with CE Active High, with CE Pull-down resistor   |
| ②③                   | Output Voltage                                     | 08~50  | e.g. 2.8V → ②=2, ③=8                              |
| ④                    | Output Voltage (the 2 <sup>nd</sup> decimal place) | 1      | Output voltage {x.x0V} e.g. 2.80V → ②=2, ③=8, ④=1 |
|                      |  | B      | Output voltage {x.x5V} e.g. 2.85V → ②=2, ③=8, ④=B |
| ⑤⑥-⑦ <sup>(*)1</sup> | Packages (Order Unit)                              | MR-G   | SOT-25 (3,000/Reel)                               |
|                      |  | PR-G   | SOT-89-5 (1,000/Reel)                             |
|                      |  | ER-G   | USP-6C (3,000/Reel)                               |

(\*)1 The "-G" suffix denotes Halogen and Antimony free as well as being fully EU RoHS compliant.

(\*)2 For without CE Pull-down, please contact your local Torex sales office or representative.

## ■ BLOCK DIAGRAM



XC6227Cseries

\* Diodes inside the circuits are ESD protection diodes and parasitic diodes.

## ■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER                          |        | SYMBOL    | RATINGS                            | UNITS |
|------------------------------------|--------|-----------|------------------------------------|-------|
| Input Voltage                      |        | $V_{IN}$  | $V_{SS} - 0.3 \sim +6.5$           | V     |
| Output Current                     |        | $I_{OUT}$ | 1400 <sup>(*)1</sup>               | mA    |
| Output Voltage                     |        | $V_{OUT}$ | $V_{SS} - 0.3 \sim +6.5$           | V     |
| CE Input Voltage                   |        | $V_{CE}$  | $V_{SS} - 0.3 \sim +6.5$           | V     |
| Power Dissipation                  | USP-6C | Pd        | 120                                | mW    |
|                                    |        |           | 1000 (PCB mounted) <sup>(*)2</sup> |       |
|                                    | SOT-25 |           | 250                                |       |
|                                    |        |           | 600 (PCB mounted) <sup>(*)2</sup>  |       |
|                                    |        |           | SOT-89-5                           |       |
| 1300 (PCB mounted) <sup>(*)2</sup> |        |           |                                    |       |
| Operating Ambient Temperature      |        | $T_{opr}$ | $-40 \sim +85$                     | °C    |
| Storage Temperature                |        | $T_{stg}$ | $-55 \sim +125$                    | °C    |

(\*)1: Please use within the range of  $P_d > \{(V_{IN} - V_{OUT}) \times I_{OUT}\}$

(\*)2: This is a reference data taken by using the test board. Please refer to page 21 to 23 for details.

## ELECTRICAL CHARACTERISTICS

●XC6227 Series

Ta=25°C

| PARAMETER   | SYMBOL  | CONDITIONS  | MIN.                  | TYP.                                | MAX.                  | UNITS      | CIRCUIT |
|---|---|---|-----------------------|-------------------------------------|-----------------------|------------|---------|
| Output Voltage                                    | V <sub>OUT(E)</sub> <sup>(*2)</sup>                           | V <sub>OUT(T)</sub> > 2.0V, V <sub>CE</sub> =V <sub>IN</sub> , I <sub>OUT</sub> =10mA   | ×0.99 <sup>(*3)</sup> | V <sub>OUT(T)</sub> <sup>(*4)</sup> | ×1.01 <sup>(*3)</sup> | V          | ①       |
|   |   | V <sub>OUT(T)</sub> ≤ 2.0V, V <sub>CE</sub> =V <sub>IN</sub> , I <sub>OUT</sub> =10mA   | -0.02 <sup>(*3)</sup> |                                     | +0.02 <sup>(*3)</sup> |            |         |
| Output Current                                    | I <sub>OUTMAX</sub>   | V <sub>CE</sub> =V <sub>IN</sub> , V <sub>IN</sub> =V <sub>OUT(T)</sub> +1.0V<br>V <sub>OUT(T)</sub> > 1.5V   | 700                   | -                                   | -                     | mA         | ①       |
|   |   | V <sub>CE</sub> =V <sub>IN</sub> , V <sub>IN</sub> =2.5V<br>V <sub>OUT(T)</sub> ≤ 1.5V  |                       |                                     |                       |            |         |
| Load Regulation                                   | ΔV <sub>OUT</sub>   | V <sub>CE</sub> =V <sub>IN</sub> , 0.1mA ≤ I <sub>OUT</sub> ≤ 300mA   | E-1                   |                                     |                       | mV         | ①       |
| Dropout Voltage1 <sup>(*5)</sup>                  | V <sub>dif</sub>  | I <sub>OUT</sub> =300mA, V <sub>CE</sub> =V <sub>IN</sub>   | E-2                   |                                     |                       | mV         | ①       |
| Dropout Voltage2 <sup>(*5)</sup>                  | V <sub>dif2</sub>   | I <sub>OUT</sub> =0mA, V <sub>CE</sub> =V <sub>IN</sub>   | E-3                   |                                     |                       | mV         | ①       |
| Supply Current                                    | I <sub>SS</sub>   | V <sub>IN</sub> =V <sub>CE</sub> =V <sub>OUT(T)</sub> +1.0V, I <sub>OUT</sub> =0mA  | -                     | 100                                 | 220                   | μA         | ②       |
| Stand-by Current                                  | I <sub>STBY</sub>   | V <sub>IN</sub> =6.0V, V <sub>CE</sub> =V <sub>SS</sub>   | -                     | 0.01                                | 0.1                   | μA         | ②       |
| Line Regulation                                   | ΔV <sub>OUT</sub> /<br>(ΔV <sub>IN</sub> · V <sub>OUT</sub> ) | V <sub>OUT(T)</sub> +0.5V ≤ V <sub>IN</sub> ≤ 6.0V<br>:V <sub>OUT(T)</sub> ≥ 1.0V<br>V <sub>CE</sub> =V <sub>IN</sub> , I <sub>OUT</sub> =30mA  | -                     | 0.01                                | 0.1                   | %V         | ①       |
|   |   | 1.5V ≤ V <sub>IN</sub> ≤ 6.0V<br>:V <sub>OUT(T)</sub> ≤ 0.95V<br>V <sub>CE</sub> =V <sub>IN</sub> , I <sub>OUT</sub> =30mA  |                       |                                     |                       |            |         |
| Input Voltage                                     | V <sub>IN</sub>   |   | 1.7                   | -                                   | 6.0                   | V          | ①       |
| Output Voltage Temperature Characteristics        | ΔV <sub>OUT</sub> /<br>(ΔTa · V <sub>OUT</sub> )              | V <sub>CE</sub> =V <sub>IN</sub> , I <sub>OUT</sub> =30mA<br>-40°C ≤ Ta ≤ 85°C  | -                     | ±100                                | -                     | ppm<br>/°C | ①       |
| Power Supply Rejection Ratio                      | PSRR  | V <sub>OUT(T)</sub> ≥ 4.8V,<br>V <sub>IN</sub> =5.75V <sub>DC</sub> +0.5Vp-p <sub>AC</sub><br>V <sub>CE</sub> =V <sub>IN</sub> , I <sub>OUT</sub> =30mA, f=1kHz                             | -                     | 65                                  | -                     | dB         | ③       |
|   |   | 1.0V ≤ V <sub>OUT(T)</sub> < 4.8V<br>V <sub>IN</sub> ={V <sub>OUT(T)</sub> +1.0}V <sub>DC</sub> +0.5Vp-p <sub>AC</sub><br>V <sub>CE</sub> =V <sub>IN</sub> , I <sub>OUT</sub> =30mA, f=1kHz |                       |                                     |                       |            |         |
|   |   | V <sub>OUT(T)</sub> < 1.0V,<br>V <sub>IN</sub> =2.0V <sub>DC</sub> +0.5Vp-p <sub>AC</sub><br>V <sub>CE</sub> =V <sub>IN</sub> , I <sub>OUT</sub> =30mA, f=1kHz                              |                       |                                     |                       |            |         |
| Limit Current                                     | I <sub>lim</sub>  | V <sub>CE</sub> =V <sub>IN</sub> , V <sub>IN</sub> =V <sub>OUT(T)</sub> +1.0V<br>V <sub>OUT(T)</sub> > 1.5V   | 720                   | 950                                 | -                     | mA         | ①       |
|   |   | V <sub>CE</sub> =V <sub>IN</sub> , V <sub>IN</sub> =2.5V<br>V <sub>OUT(T)</sub> ≤ 1.5V  |                       |                                     |                       |            |         |
| Short Current                                     | I <sub>short</sub>  | V <sub>CE</sub> =V <sub>IN</sub> , Short V <sub>OUT</sub> to V <sub>SS</sub> level  | -                     | 55                                  | -                     | mA         | ①       |
| CE High Level Voltage                             | V <sub>CEH</sub>  |   | 1.2                   | -                                   | 6.0                   | V          | ①       |
| CE Low Level Voltage                              | V <sub>CEL</sub>  |   | -                     | -                                   | 0.3                   | V          | ①       |
| CE High Level Current                             | I <sub>CEH</sub>  | V <sub>CE</sub> =V <sub>IN</sub> =6.0V, XC6227C Series  | 17.7                  | 24                                  | 36.9                  | μA         | ①       |
| CE Low Level Current                              | I <sub>CEL</sub>  | V <sub>CE</sub> =V <sub>SS</sub>  | -0.1                  | -                                   | 0.1                   | μA         | ①       |
| Reverse Current <sup>(*8)</sup>                   | I <sub>REV</sub>  | V <sub>IN</sub> =0V, V <sub>OUT</sub> =6.0V <sup>(*10)</sup>  | -                     | 0.01                                | 1.5                   | μA         | ①       |
| V <sub>OUT</sub> Pin Sink Current <sup>(*9)</sup> | I <sub>REVS</sub>   | V <sub>IN</sub> =5.0V, V <sub>OUT</sub> =6.0V <sup>(*10)</sup>  | -                     | 2.8                                 | 5.3                   | μA         | ①       |
| Thermal Shutdown Detect Temperature               | T <sub>TSD</sub>  | Junction Temperature  | -                     | 150                                 | -                     | °C         | ①       |
| Thermal Shutdown Release Temperature              | T <sub>TSR</sub>  | Junction Temperature  | -                     | 125                                 | -                     | °C         | ①       |

NOTE:

- \* 1: Unless otherwise stated, input voltage is V<sub>IN</sub>=V<sub>OUT(T)</sub>+1.0V.
- \* 2: V<sub>OUT(E)</sub> is effective output voltage (Refer to the voltage chart E-1 and E-2)  
It is defined as output voltages when an amply stabilized V<sub>OUT(T)</sub>+1.0V is supplied to the V<sub>IN</sub> pin while maintaining a certain I<sub>OUT</sub>.
- \* 3: The relation between V<sub>OUT(E)</sub> and V<sub>OUT(T)</sub> is shown in the voltage chart E-1 and E-2.
- \* 4: V<sub>OUT(T)</sub> is nominal output voltage
- \* 5: V<sub>dif</sub> (V<sub>dif2</sub>)= {V<sub>IN1</sub><sup>(\*7)</sup>-V<sub>OUT1</sub><sup>(\*6)</sup>}
- \* 6: V<sub>OUT1</sub> equals 98% of the output voltage when amply stabilized V<sub>OUT(T)</sub>+1.0V are supplied to the V<sub>IN</sub> pin.
- \* 7: V<sub>IN1</sub> is the input voltage when V<sub>OUT1</sub> appears at the V<sub>OUT</sub> pin while input voltage is gradually decreased.
- \* 8: Reverse current (I<sub>REV</sub>) flows from V<sub>OUT</sub> to V<sub>IN</sub>.
- \* 9: V<sub>OUT</sub> pin sink current (I<sub>REVS</sub>) flows from V<sub>OUT</sub> to V<sub>SS</sub>.
- \*10: Please note when an external power supply connects to the V<sub>OUT</sub> pin, please use it with 6.0V or less.

## ■ OUTPUT VOLTAGE CHART

● Voltage Chart 1

| NOMINAL<br>OUTPUT<br>VOLTAGE<br>(V) | OUTPUT VOLTAGE<br>(V) |        | LOAD REGULATION<br>E-1 (mV) |      | DROPOUT VOLTAGE 1<br>E-2 (mV) |      | DROPOUT VOLTAGE 2<br>E-3 (mV) |      |
|-------------------------------------|-----------------------|--------|-----------------------------|------|-------------------------------|------|-------------------------------|------|
|                                     | $V_{OUT(E)}$          |        | $\Delta V_{OUT}$            |      | $V_{dif}$                     |      | $V_{dif2}$                    |      |
|                                     | MIN.                  | MAX.   | TYP.                        | MAX. | MAX.                          | TYP. | MAX.                          | TYP. |
| 0.80                                | 0.7800                | 0.8200 | 25                          | 50   | 720                           | 880  | 230                           | 510  |
| 0.85                                | 0.8300                | 0.8700 | 25                          | 50   | 720                           | 880  | 230                           | 510  |
| 0.90                                | 0.8800                | 0.9200 | 25                          | 50   | 720                           | 880  | 230                           | 510  |
| 0.95                                | 0.9300                | 0.9700 | 25                          | 50   | 720                           | 880  | 230                           | 510  |
| 1.00                                | 0.9800                | 1.0200 | 25                          | 50   | 570                           | 740  | 75                            | 260  |
| 1.05                                | 1.0300                | 1.0700 | 30                          | 60   | 570                           | 740  | 75                            | 260  |
| 1.10                                | 1.0800                | 1.1200 | 30                          | 60   | 570                           | 740  | 75                            | 260  |
| 1.15                                | 1.1300                | 1.1700 | 30                          | 60   | 570                           | 740  | 75                            | 260  |
| 1.20                                | 1.1800                | 1.2200 | 30                          | 60   | 420                           | 570  | 50                            | 135  |
| 1.25                                | 1.2300                | 1.2700 | 30                          | 60   | 420                           | 570  | 40                            | 80   |
| 1.30                                | 1.2800                | 1.3200 | 30                          | 60   | 420                           | 570  | 40                            | 80   |
| 1.35                                | 1.3300                | 1.3700 | 30                          | 60   | 420                           | 570  | 40                            | 80   |
| 1.40                                | 1.3800                | 1.4200 | 30                          | 60   | 320                           | 470  | 40                            | 80   |
| 1.45                                | 1.4300                | 1.4700 | 30                          | 60   | 320                           | 470  | 40                            | 80   |
| 1.50                                | 1.4800                | 1.5200 | 30                          | 60   | 280                           | 410  | 40                            | 80   |
| 1.55                                | 1.5300                | 1.5700 | 30                          | 60   | 280                           | 410  | 40                            | 80   |
| 1.60                                | 1.5800                | 1.6200 | 30                          | 60   | 280                           | 410  | 40                            | 80   |
| 1.65                                | 1.6300                | 1.6700 | 30                          | 60   | 280                           | 410  | 40                            | 80   |
| 1.70                                | 1.6800                | 1.7200 | 30                          | 60   | 280                           | 410  | 40                            | 80   |
| 1.75                                | 1.7300                | 1.7700 | 30                          | 60   | 280                           | 410  | 40                            | 80   |
| 1.80                                | 1.7800                | 1.8200 | 30                          | 60   | 220                           | 350  | 40                            | 80   |
| 1.85                                | 1.8300                | 1.8700 | 30                          | 60   | 220                           | 350  | 40                            | 80   |
| 1.90                                | 1.8800                | 1.9200 | 30                          | 60   | 220                           | 350  | 40                            | 80   |
| 1.95                                | 1.9300                | 1.9700 | 30                          | 60   | 220                           | 350  | 40                            | 80   |
| 2.00                                | 1.9800                | 2.0200 | 30                          | 60   | 200                           | 320  | 40                            | 80   |
| 2.05                                | 2.0295                | 2.0705 | 35                          | 70   | 200                           | 320  | 40                            | 80   |
| 2.10                                | 2.0790                | 2.1210 | 35                          | 70   | 200                           | 320  | 40                            | 80   |
| 2.15                                | 2.1285                | 2.1715 | 35                          | 70   | 200                           | 320  | 40                            | 80   |
| 2.20                                | 2.1780                | 2.2220 | 35                          | 70   | 200                           | 320  | 40                            | 80   |
| 2.25                                | 2.2275                | 2.2725 | 35                          | 70   | 200                           | 320  | 40                            | 80   |
| 2.30                                | 2.2770                | 2.3230 | 35                          | 70   | 200                           | 320  | 40                            | 80   |
| 2.35                                | 2.3265                | 2.3735 | 35                          | 70   | 200                           | 320  | 40                            | 80   |
| 2.40                                | 2.3760                | 2.4240 | 35                          | 70   | 200                           | 320  | 40                            | 80   |
| 2.45                                | 2.4255                | 2.4745 | 35                          | 70   | 200                           | 320  | 40                            | 80   |
| 2.50                                | 2.4750                | 2.5250 | 35                          | 70   | 160                           | 260  | 40                            | 80   |
| 2.55                                | 2.5245                | 2.5755 | 35                          | 70   | 160                           | 260  | 40                            | 80   |
| 2.60                                | 2.5740                | 2.6260 | 35                          | 70   | 160                           | 260  | 40                            | 80   |
| 2.65                                | 2.6235                | 2.6765 | 35                          | 70   | 160                           | 260  | 40                            | 80   |
| 2.70                                | 2.6730                | 2.7270 | 35                          | 70   | 160                           | 260  | 40                            | 80   |
| 2.75                                | 2.7225                | 2.7775 | 35                          | 70   | 160                           | 260  | 40                            | 80   |
| 2.80                                | 2.7720                | 2.8280 | 35                          | 70   | 160                           | 260  | 40                            | 80   |
| 2.85                                | 2.8215                | 2.8785 | 35                          | 70   | 160                           | 260  | 40                            | 80   |
| 2.90                                | 2.8710                | 2.9290 | 35                          | 70   | 160                           | 260  | 40                            | 80   |
| 2.95                                | 2.9205                | 2.9795 | 35                          | 70   | 160                           | 260  | 40                            | 80   |
| 3.00                                | 2.9700                | 3.0300 | 43                          | 85   | 120                           | 200  | 40                            | 80   |

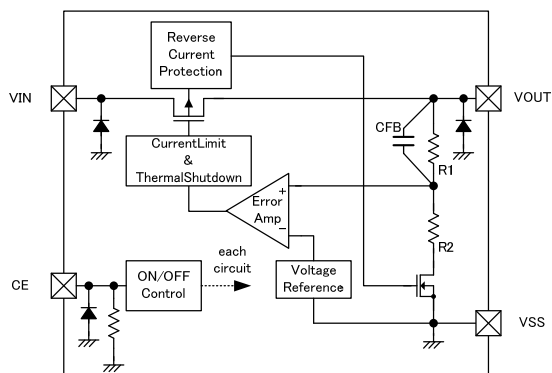
## OUTPUT VOLTAGE CHART (Continued)

● Voltage Chart 2

| NOMINAL<br>OUTPUT<br>VOLTAGE<br>(V) | OUTPUT VOLTAGE<br>(V) |        | LOAD REGULATION<br>E-1 (mV) |      | DROPOUT VOLTAGE 1<br>E-2 (mV) |      | DROPOUT VOLTAGE 2<br>E-3 (mV) |      |
|-------------------------------------|-----------------------|--------|-----------------------------|------|-------------------------------|------|-------------------------------|------|
|                                     | $V_{OUT(E)}$          |        | $\Delta V_{OUT}$            |      | $V_{dif}$                     |      | $V_{dif2}$                    |      |
|                                     | MIN.                  | MAX.   | TYP.                        | MAX. | TYP.                          | MAX. | TYP.                          | MAX. |
| 3.05                                | 3.0195                | 3.0805 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.10                                | 3.0690                | 3.1310 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.15                                | 3.1185                | 3.1815 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.20                                | 3.1680                | 3.2320 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.25                                | 3.2175                | 3.2825 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.30                                | 3.2670                | 3.3330 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.35                                | 3.3165                | 3.3835 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.40                                | 3.3660                | 3.4340 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.45                                | 3.4155                | 3.4845 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.50                                | 3.4650                | 3.5350 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.55                                | 3.5145                | 3.5855 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.60                                | 3.5640                | 3.6360 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.65                                | 3.6135                | 3.6865 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.70                                | 3.6630                | 3.7370 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.75                                | 3.7125                | 3.7875 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.80                                | 3.7620                | 3.8380 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.85                                | 3.8115                | 3.8885 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.90                                | 3.8610                | 3.9390 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 3.95                                | 3.9105                | 3.9895 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 4.00                                | 3.9600                | 4.0400 | 43                          | 85   | 120                           | 200  | 40                            | 80   |
| 4.05                                | 4.0095                | 4.0905 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.10                                | 4.0590                | 4.1410 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.15                                | 4.1085                | 4.1915 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.20                                | 4.1580                | 4.2420 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.25                                | 4.2075                | 4.2925 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.30                                | 4.2570                | 4.3430 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.35                                | 4.3065                | 4.3935 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.40                                | 4.3560                | 4.4440 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.45                                | 4.4055                | 4.4945 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.50                                | 4.4550                | 4.5450 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.55                                | 4.5045                | 4.5955 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.60                                | 4.5540                | 4.6460 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.65                                | 4.6035                | 4.6965 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.70                                | 4.6530                | 4.7470 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.75                                | 4.7025                | 4.7975 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.80                                | 4.7520                | 4.8480 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.85                                | 4.8015                | 4.8985 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.90                                | 4.8510                | 4.9490 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 4.95                                | 4.9005                | 4.9995 | 50                          | 100  | 120                           | 200  | 40                            | 80   |
| 5.00                                | 4.9500                | 5.0500 | 50                          | 100  | 120                           | 200  | 40                            | 80   |

## ■ OPERATIONAL EXPLANATION

The voltage divided by two resistors R1 and R2 is compared with the internal reference voltage by the error amplifier. The P-channel MOSFET connected to the V<sub>OUT</sub> pin, is then driven by the subsequent output signal. The output voltage at the V<sub>OUT</sub> pin is controlled and stabilized by a system of negative feedback. The current limit and short protection operate in relation to the level of output current. The thermal protection operates in relation to the level of heat generation. The reverse current protection operates when V<sub>OUT</sub> voltage is higher than V<sub>IN</sub> voltage. Further, the IC's internal circuitry can be turned off via the CE pin's signal.



XC6227Cseries

### <Input and Output Capacitors>

The XC6227 needs an output capacitor C<sub>L</sub> for phase compensation. Values required for the phase compensation are shown in the chart below. If a loss of the capacitance happens, stable phase compensation may not be obtained. Please ensure to use a capacitor which does not depend on bias or temperature too much. For a stable power input, please connect an input capacitor C<sub>IN</sub> of 1.0 μF between the V<sub>IN</sub> pin and the V<sub>SS</sub> pin.

#### ● Output Capacitor (C<sub>L</sub>) Table

| OUTPUT VOLTAGE (V) | OUTPUT CAPACITOR VALUE        |
|--------------------|-------------------------------|
| 0.8V~2.05V         | C <sub>L</sub> =6.8 μF (MIN.) |
| 2.1V~2.45V         | C <sub>L</sub> =4.7 μF (MIN.) |
| 2.5V~5.0V          | C <sub>L</sub> =2.2 μF (MIN.) |

### <Reverse Current Protection>

The XC6227 series includes reverse current protection to prevent the damage as a result of current flow from V<sub>OUT</sub> pin to the V<sub>IN</sub> pin and V<sub>SS</sub> pin when the power supply is connected to the V<sub>OUT</sub> pin. When V<sub>IN</sub> is smaller than V<sub>OUT</sub>, the reverse current protection works and suppress the reverse current to 1.5 μA (MAX.).

When V<sub>IN</sub> is smaller than V<sub>OUT</sub>, the V<sub>OUT</sub> pin sink current flowing from the V<sub>OUT</sub> pin to the V<sub>SS</sub> pin is 2.8 μA (TYP.) as the IC operation current.

Please also note when an external power supply is connected to the V<sub>OUT</sub> pin, please use it within 6.0V.

### <Current Limiter, Short-Circuit Protection>

The XC6227 series integrates an output current limiter and a fold-back short protection for the output pin. When the load current reaches the current limit level, the fixed current limiter circuit operates and output voltage drops. When the output pin is short-circuited to the V<sub>SS</sub> pin, the current is decreased to a level of 55mA (TYP.).

### <Thermal Shutdown>

When the junction temperature of the built-in driver transistor reaches the temperature limit level (150°C TYP.), the thermal shutdown circuit operates and the driver transistor will be turned OFF. The IC resumes its operation when the thermal shutdown function is released and the IC's operation is automatically restored because the junction temperature drops to the level of 125°C (TYP.) as the thermal shutdown release voltage.

## ■ OPERATIONAL EXPLANATION (Continued)

<CE Pin>

The entire XC6227 circuitry can be turned off via the CE pin signal. In shutdown mode, output at the V<sub>OUT</sub> pin will be pulled down to the V<sub>SS</sub> level via R1 & R2.

The XC6227C series has a pull-down resistor in order to operate normally even the CE pin is left open (when the CE pin is left open, the IC stops operation), so that the CE pin input current flows.

If the CE pin voltage is set with the specified voltage range, the logic is fixed and the IC will operate normally. However, the supply current may increase as a result of shoot-through current in the IC's internal circuitry when a medium voltage is input to the CE pin.

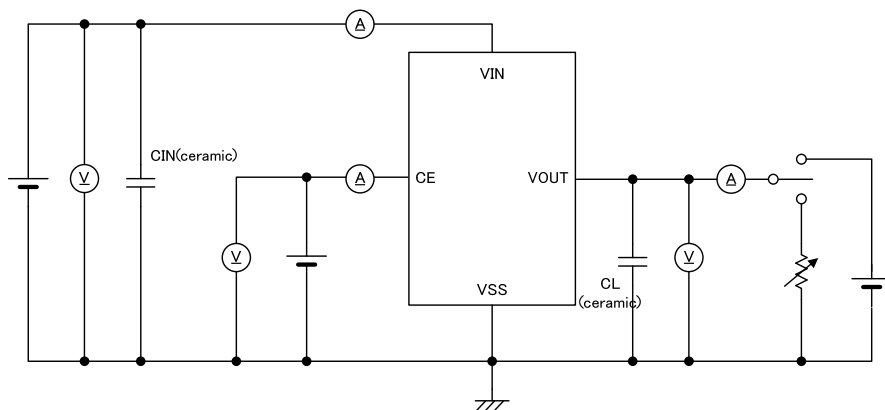
## ■ NOTES ON USE

1. For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded.
2. Where wiring impedance is high, operations may become unstable due to noise and/or phase lag depending on output current.  
Please wire the input capacitor (C<sub>IN</sub>) and the output capacitor (C<sub>L</sub>) as close to the IC as possible.
3. Torex places an importance on improving our products and its reliability.  
However, by any possibility, we would request user fail-safe design and post-aging treatment on system or equipment.

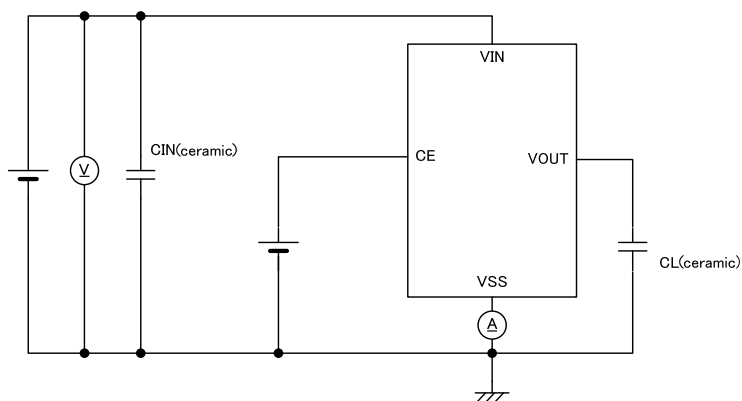


## TEST CIRCUITS

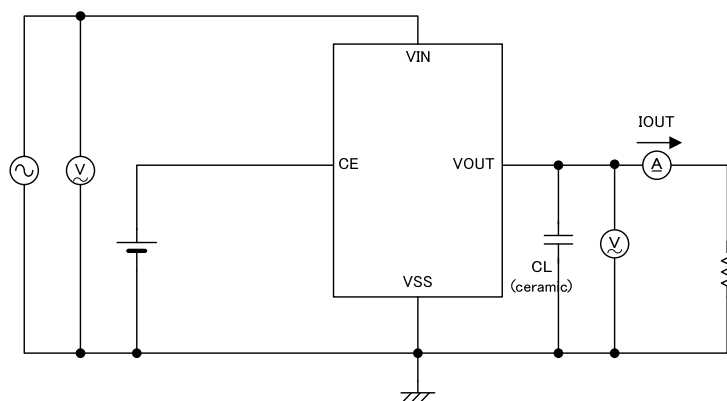
● Circuit ①



● Circuit ②



● Circuit ③



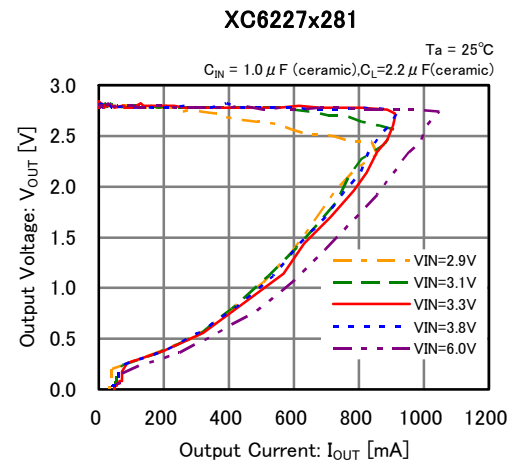
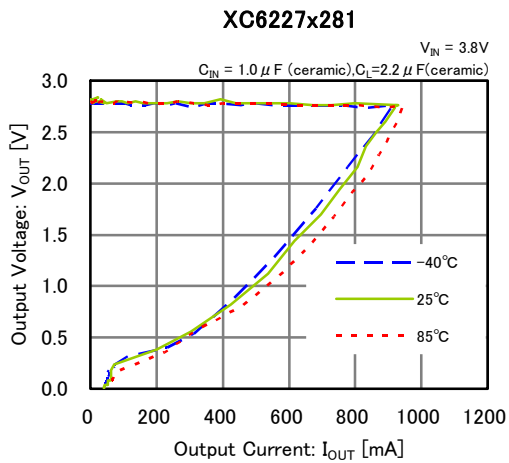
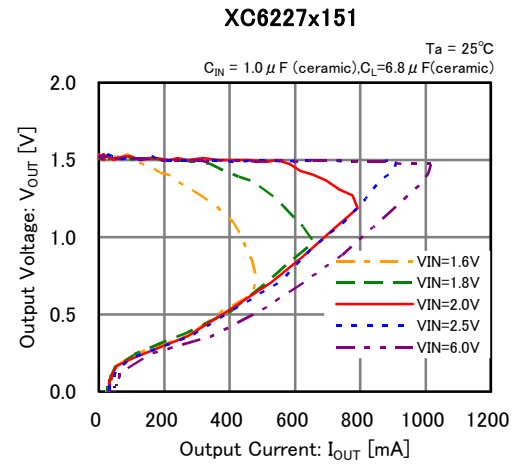
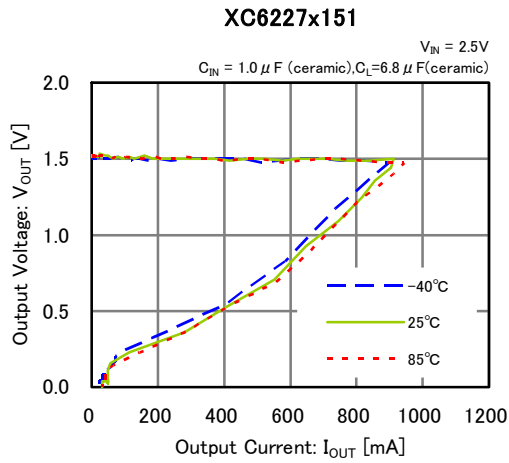
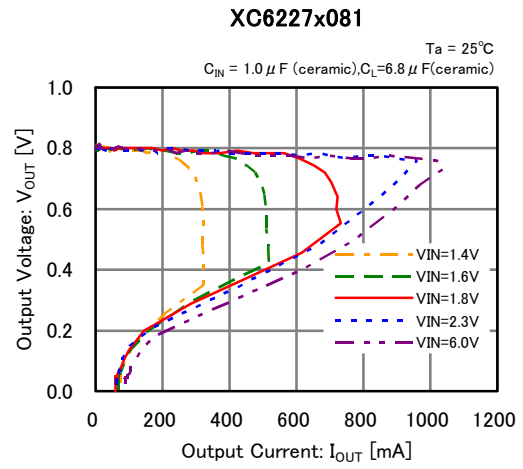
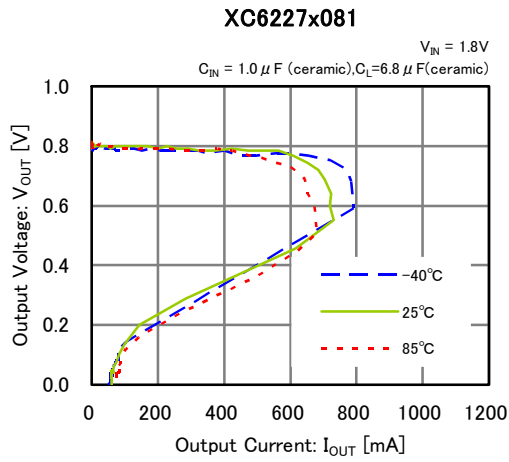
※  $C_{IN}$ : 1.0  $\mu$ F or higher

CL: 2.2  $\mu$ F or higher ( $V_{OUT}$ =2.5~5.0V)  
4.7  $\mu$ F or higher ( $V_{OUT}$ =2.1~2.45V)  
6.8  $\mu$ F or higher ( $V_{OUT}$ =0.8~2.05V)

## TYPICAL PERFORMANCE CHARACTERISTICS

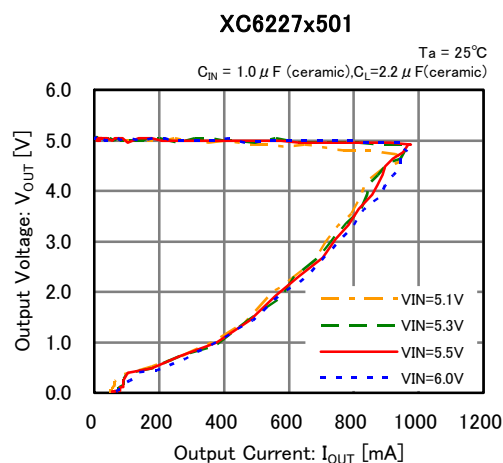
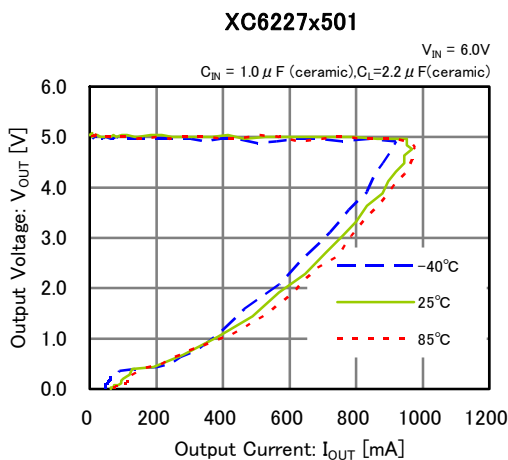
(1) Output Voltage vs. Output Current

\*CE Voltage condition: unless otherwise stated  $V_{CE}=V_{IN}$

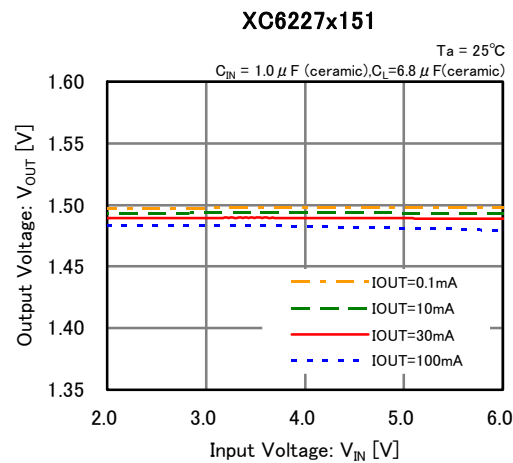
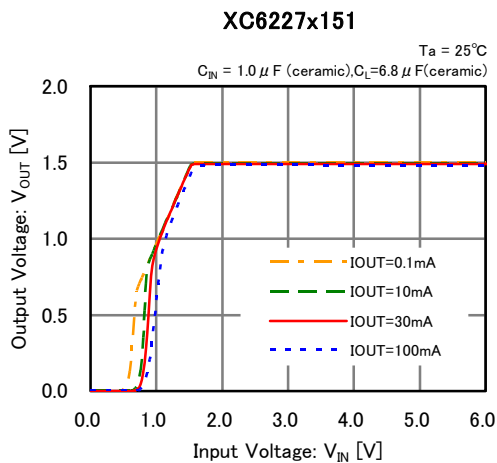
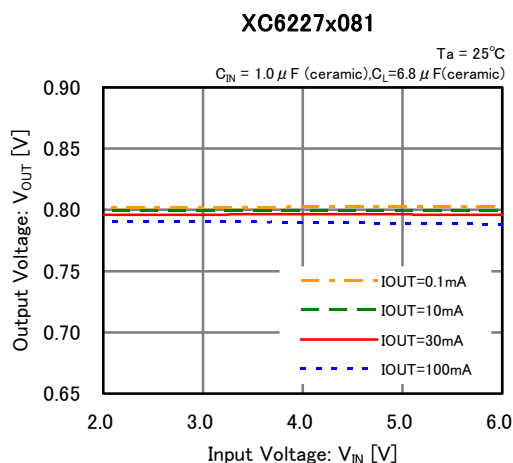
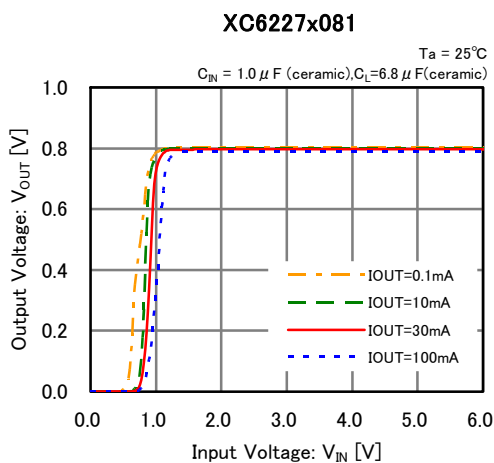


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(1) Output Voltage vs. Output Current (Continued)

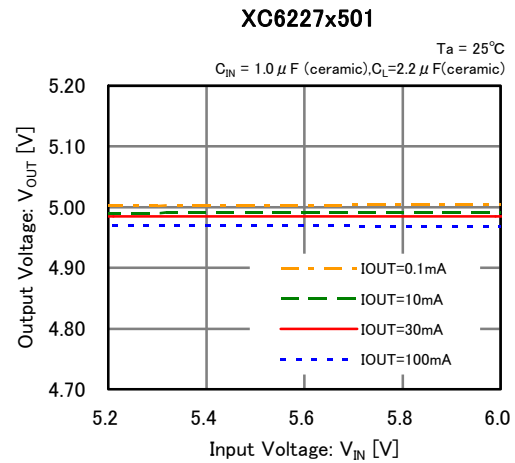
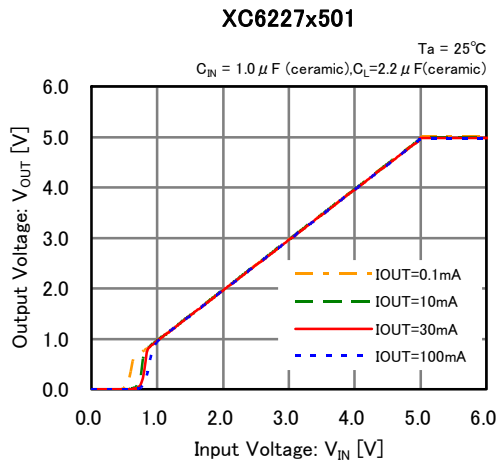
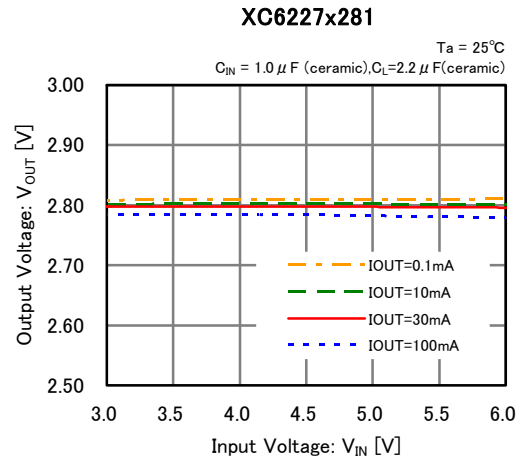
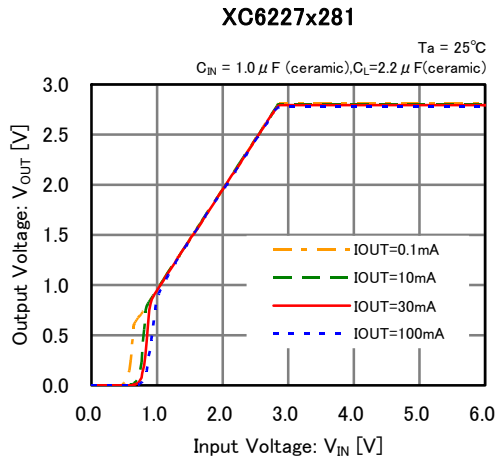


(2) Output Voltage vs. Input Voltage

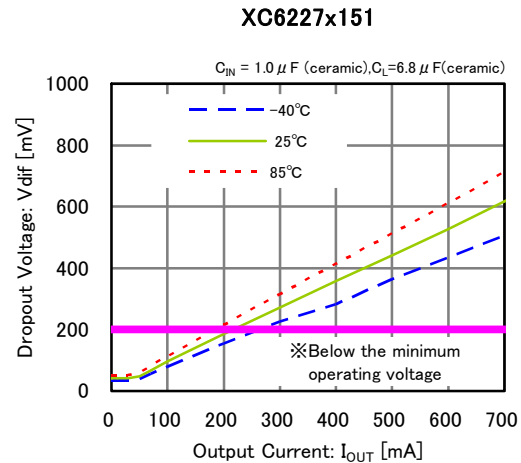
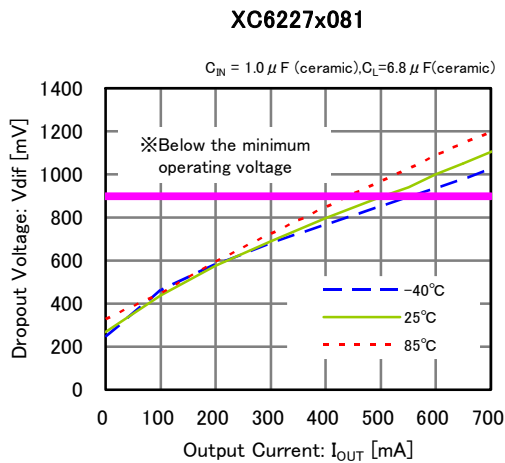


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (2) Output Voltage vs. Input Voltage (Continued)

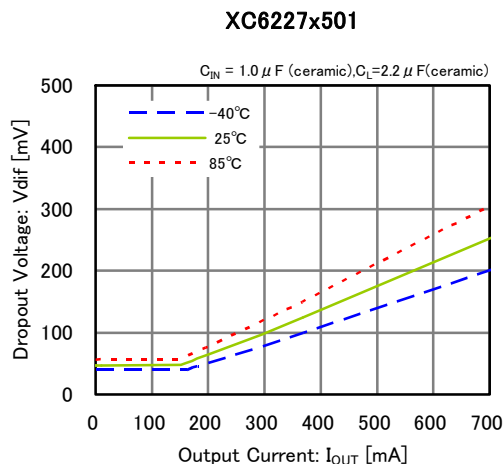
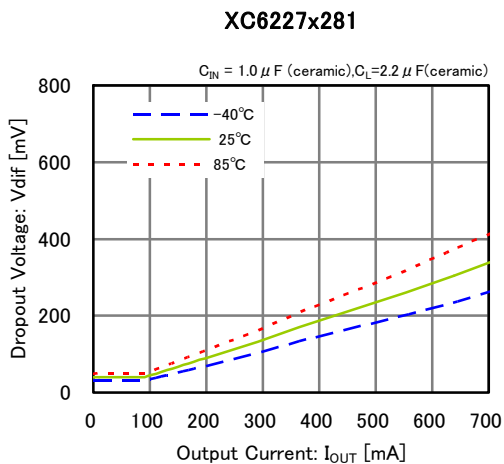


### (3) Dropout Voltage vs. Output Current

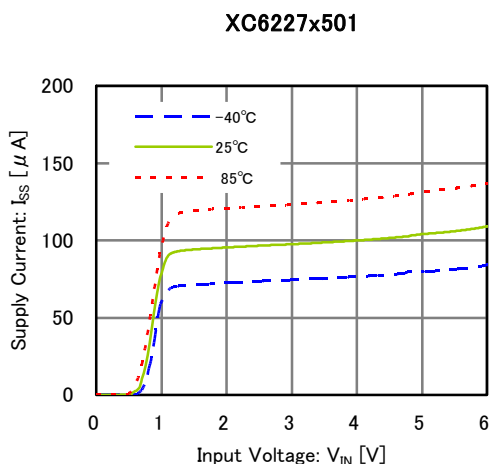
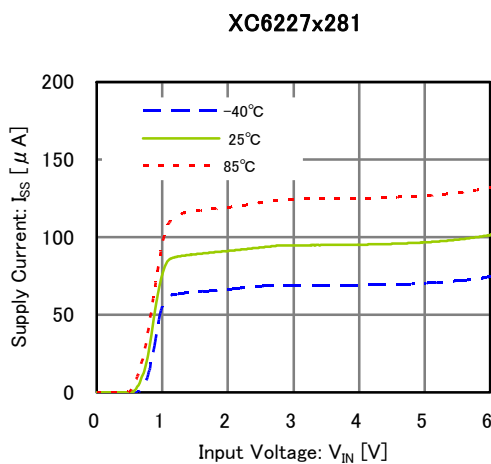
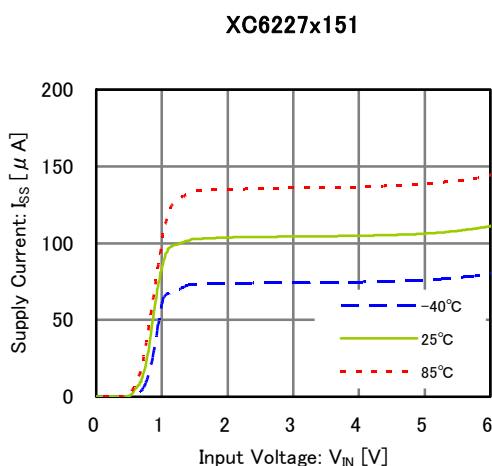
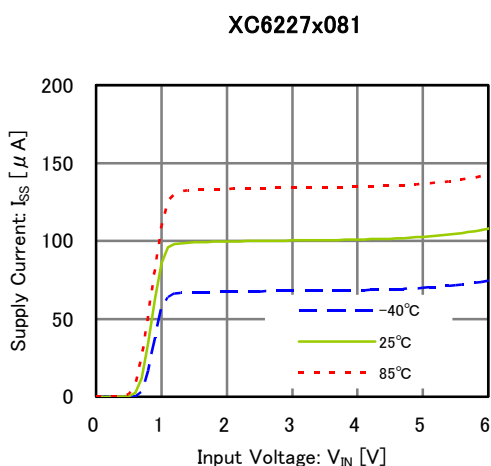


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(3) Dropout Voltage vs. Output Current (Continued)

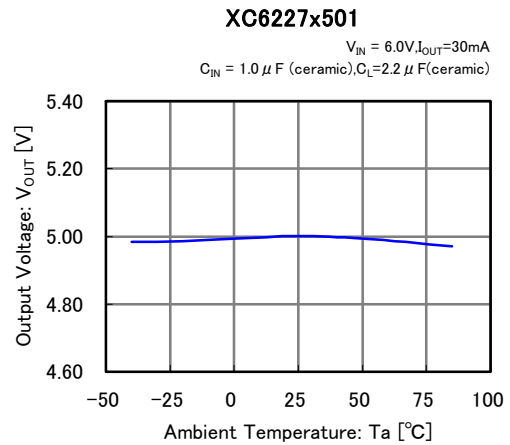
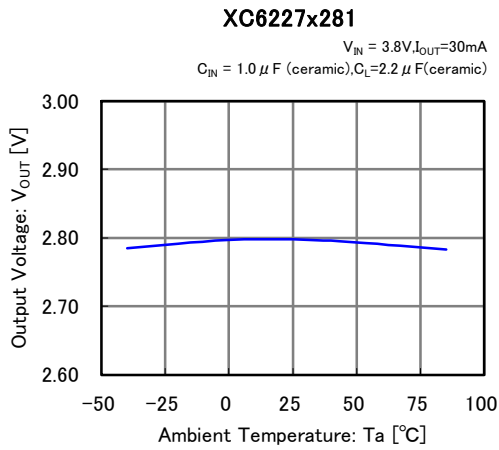
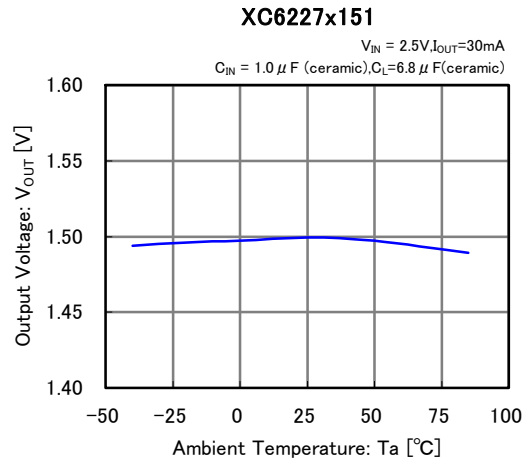
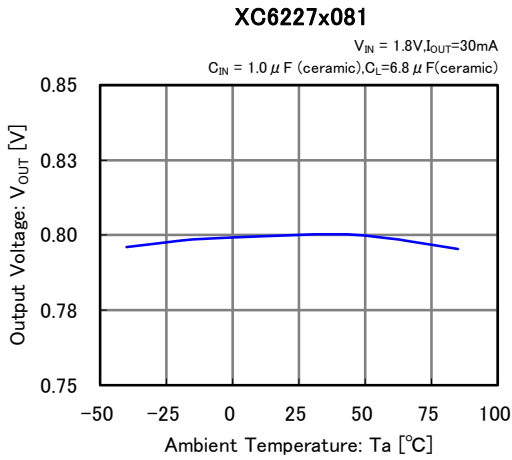


(4) Supply Current vs. Input Voltage

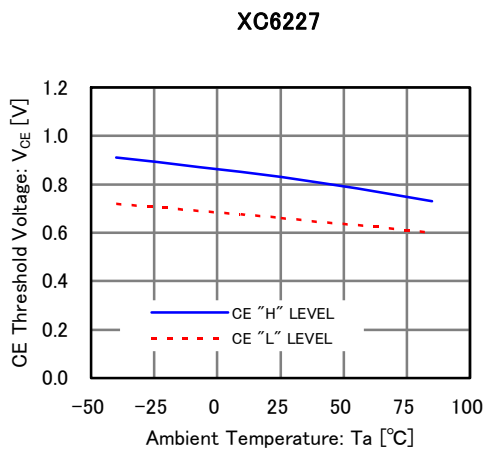


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

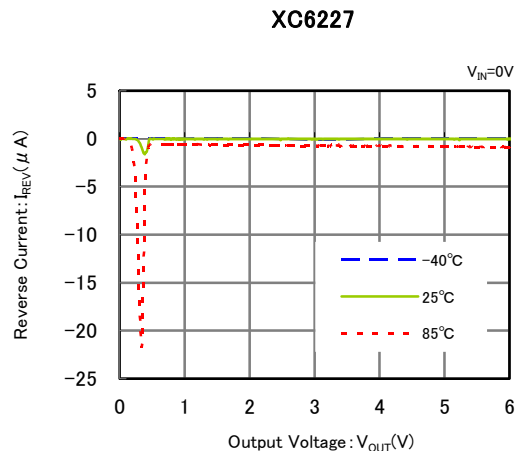
(5) Output Voltage vs. Ambient Temperature



(6) CE Pin Threshold Voltage vs. Ambient Temperature

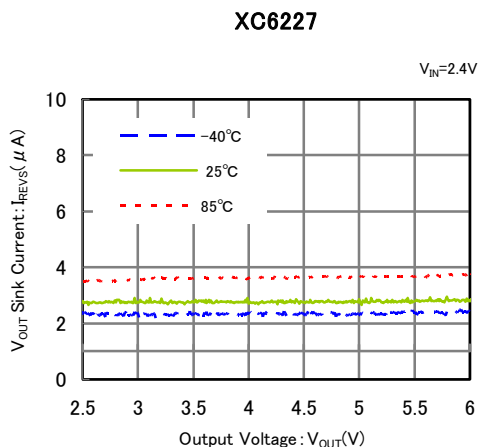


(7) Reverse Current vs. Output Voltage

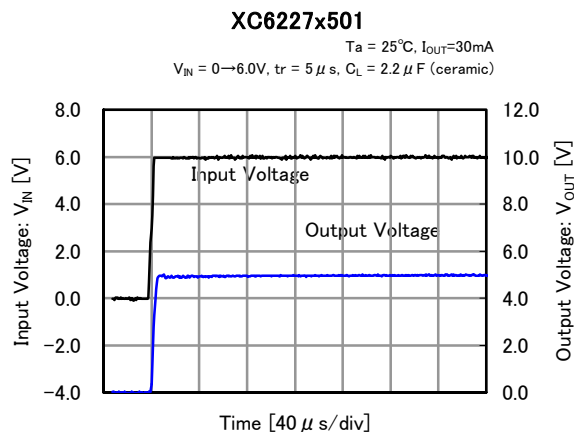
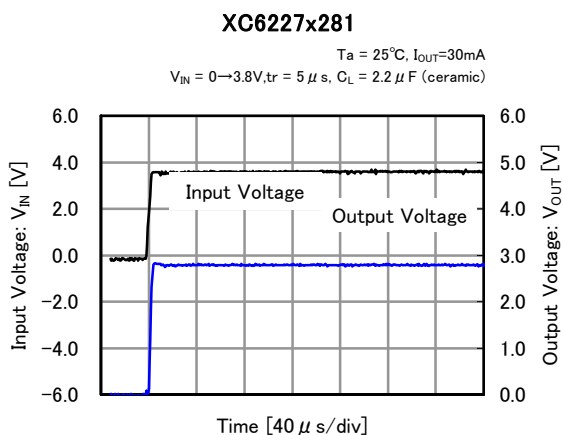
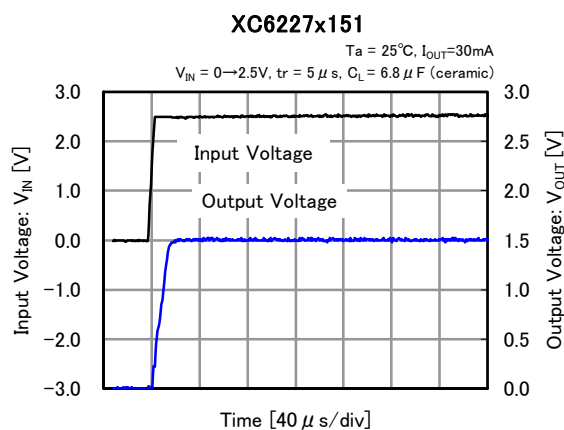
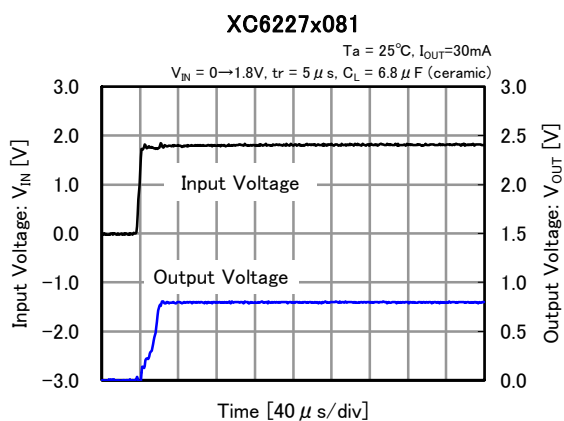


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(8)  $V_{OUT}$  Sink Current vs. Output Voltage

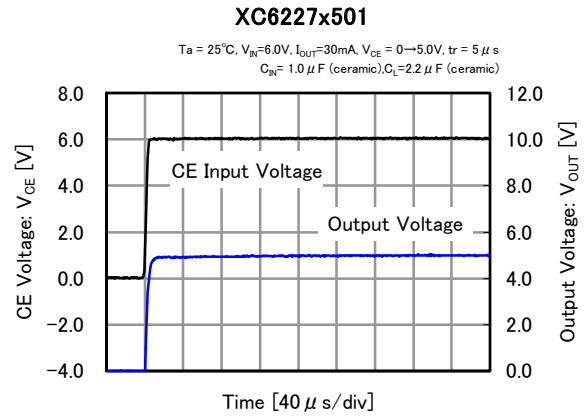
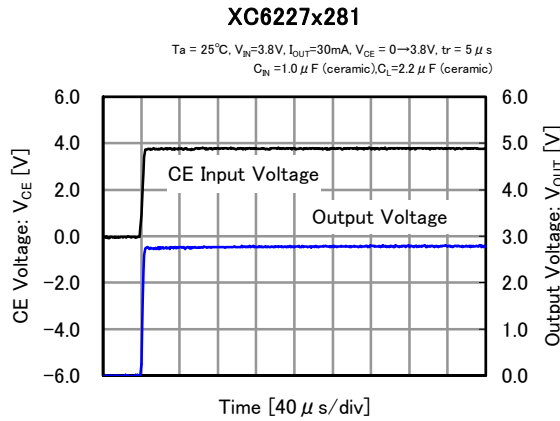
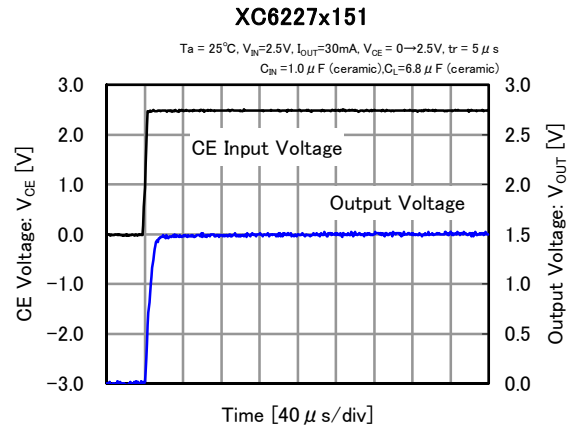
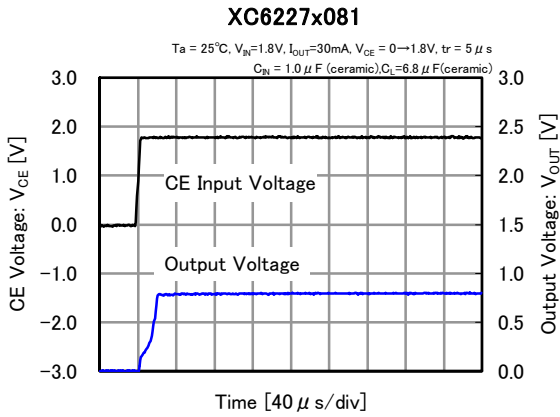


(9) Input Transient Response

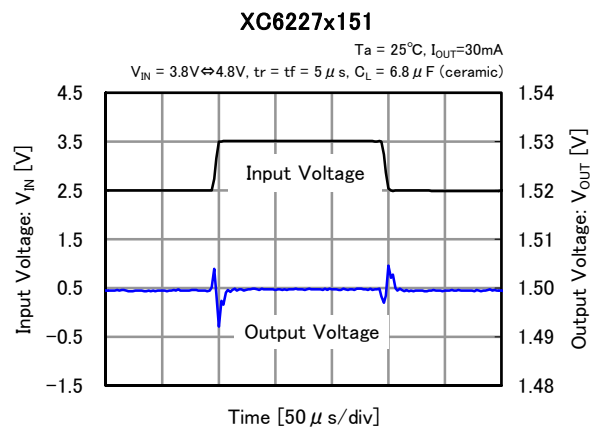
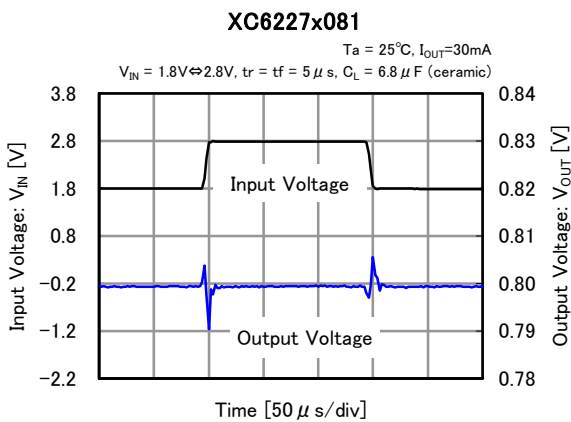


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (10) CE Rising Response Time



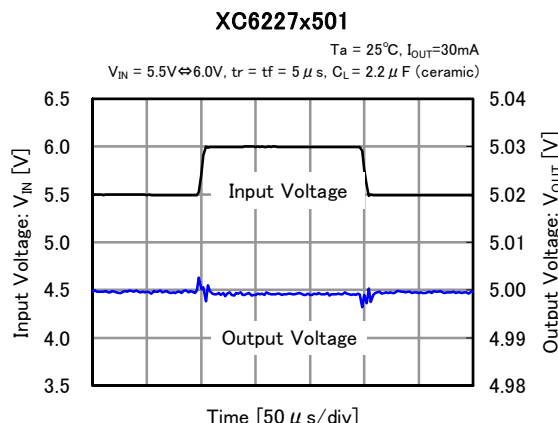
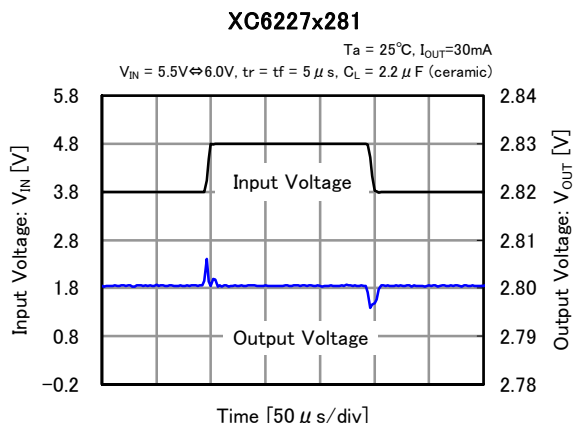
### (11) Input Transient Response



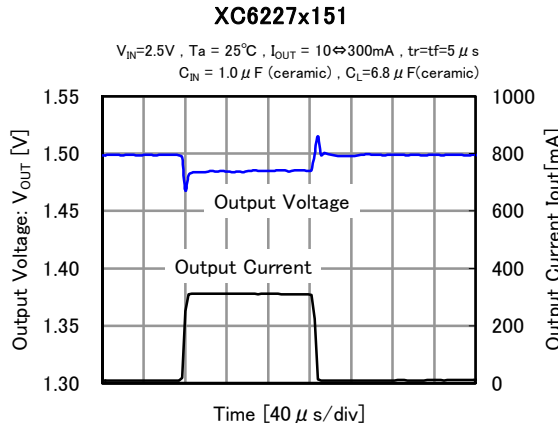
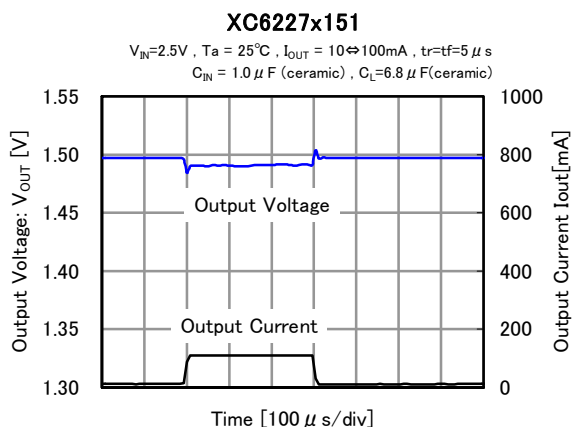
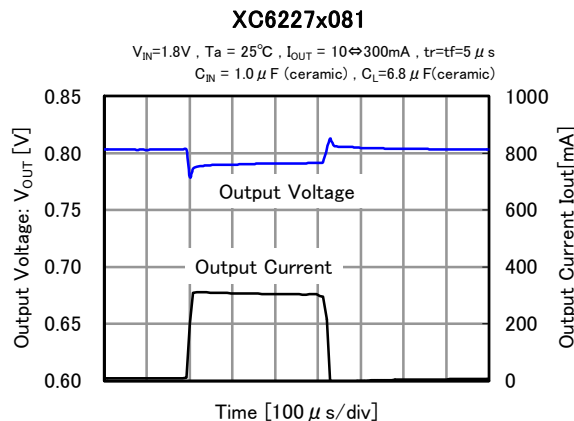
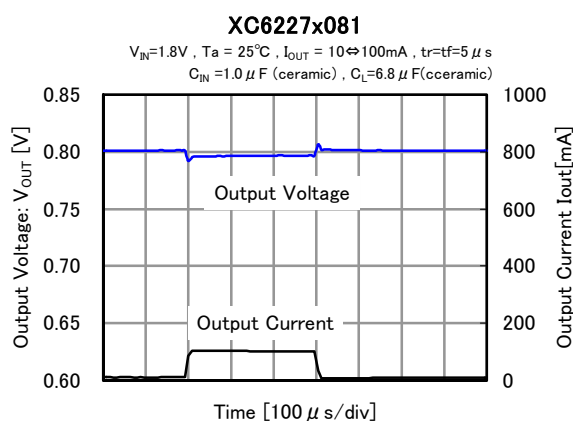


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (11) Input Transient Response (Continued)



### (12) Load Transient Response

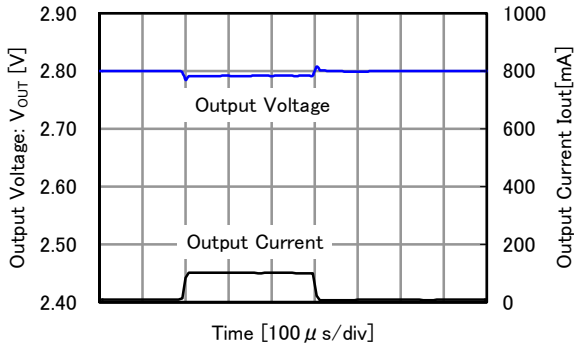


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### (12) Load Transient Response (Continued)

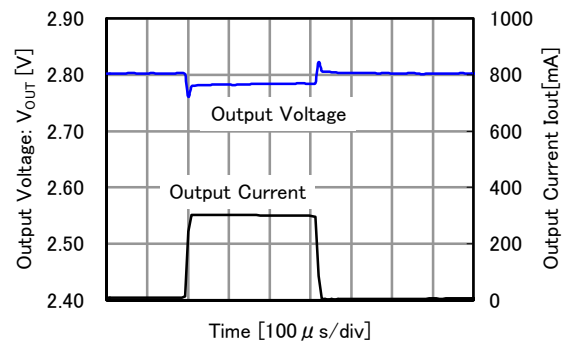
**XC6227x281**

$V_{IN}=3.8V$ ,  $T_a = 25^\circ C$ ,  $I_{OUT} = 10 \Rightarrow 100mA$ ,  $t_r=t_f=5 \mu s$   
 $C_{IN} = 1.0 \mu F$  (ceramic),  $C_L=2.2 \mu F$ (ceramic)



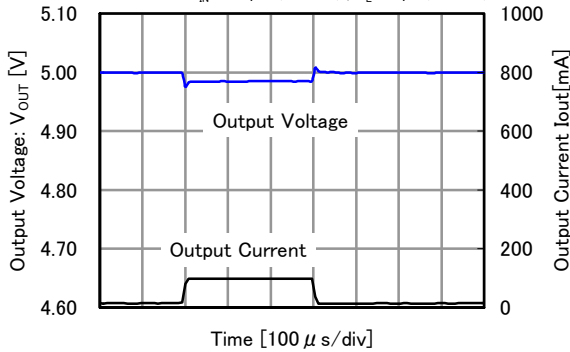
**XC6227x281**

$V_{IN}=3.8V$ ,  $T_a = 25^\circ C$ ,  $I_{OUT} = 10 \Rightarrow 300mA$ ,  $t_r=t_f=5 \mu s$   
 $C_{IN} = 1.0 \mu F$  (ceramic),  $C_L=2.2 \mu F$ (ceramic)



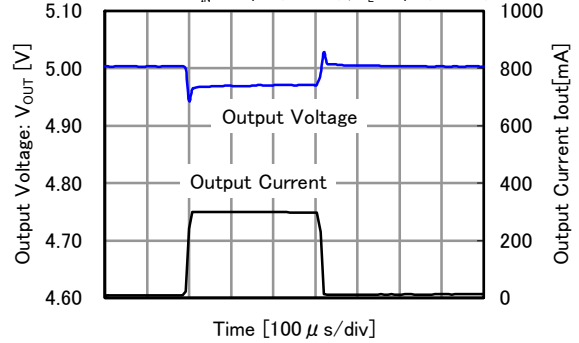
**XC6227x501**

$V_{IN}=6.0V$ ,  $T_a = 25^\circ C$ ,  $I_{OUT} = 10 \Rightarrow 100mA$ ,  $t_r=t_f=5 \mu s$   
 $C_{IN} = 1.0 \mu F$  (ceramic),  $C_L=2.2 \mu F$ (ceramic)



**XC6227x501**

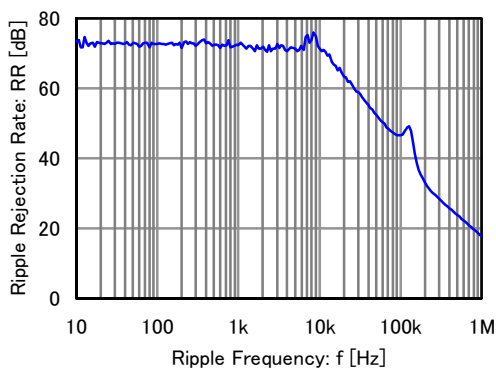
$V_{IN}=6.0V$ ,  $T_a = 25^\circ C$ ,  $I_{OUT} = 10 \Rightarrow 300mA$ ,  $t_r=t_f=5 \mu s$   
 $C_{IN} = 1.0 \mu F$  (ceramic),  $C_L=2.2 \mu F$ (ceramic)



### (13) Ripple Rejection Rate

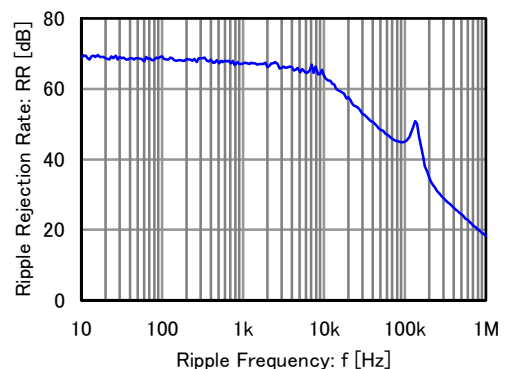
**XC6227x081**

$T_a = 25^\circ C$ ,  $I_{OUT}=30mA$   
 $V_{IN} = 1.8VDC+0.5Vp-pAC$ ,  $C_L = 6.8 \mu F$  (ceramic)



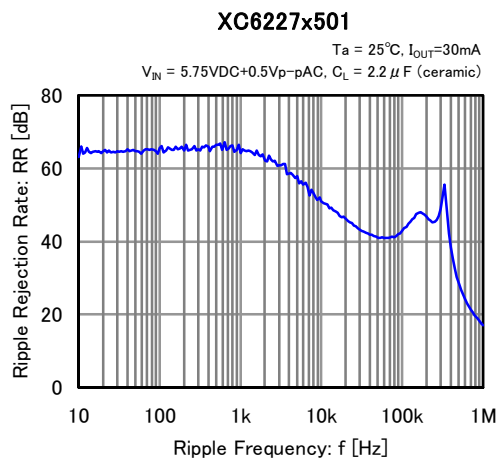
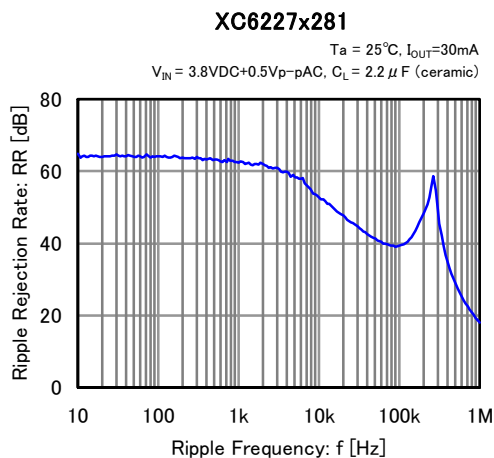
**XC6227x151**

$T_a = 25^\circ C$ ,  $I_{OUT}=30mA$   
 $V_{IN} = 2.5VDC+0.5Vp-pAC$ ,  $C_L = 6.8 \mu F$  (ceramic)

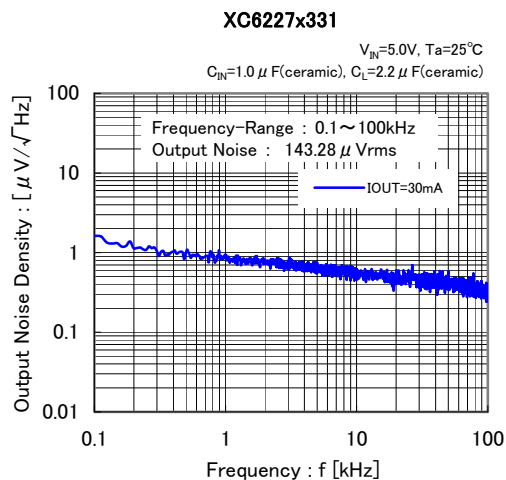
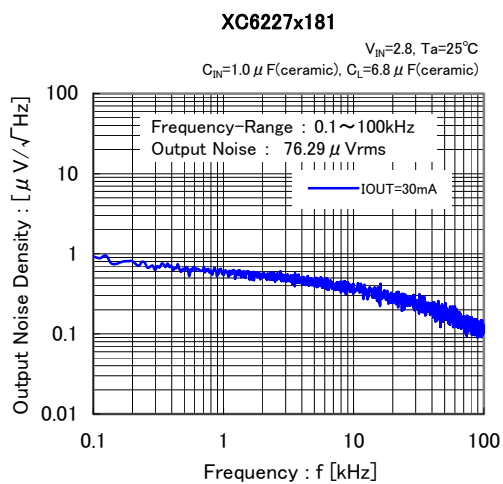
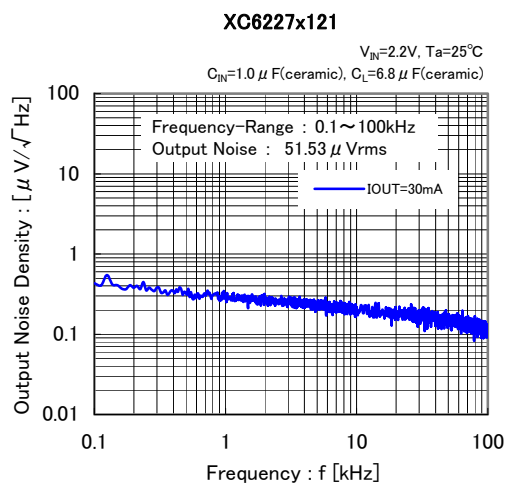


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(13) Ripple Rejection Rate (Continued)

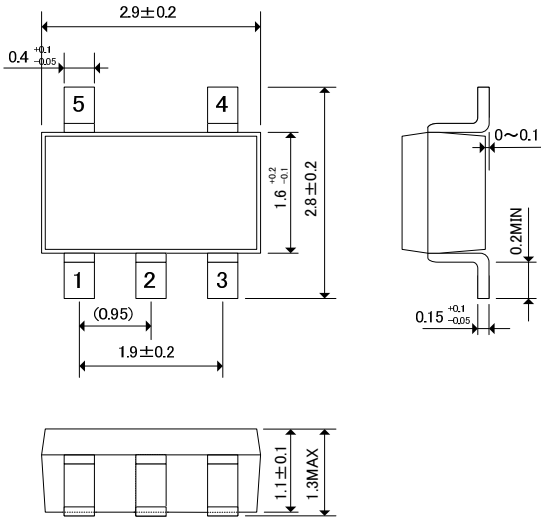


(14) Output Noise Density

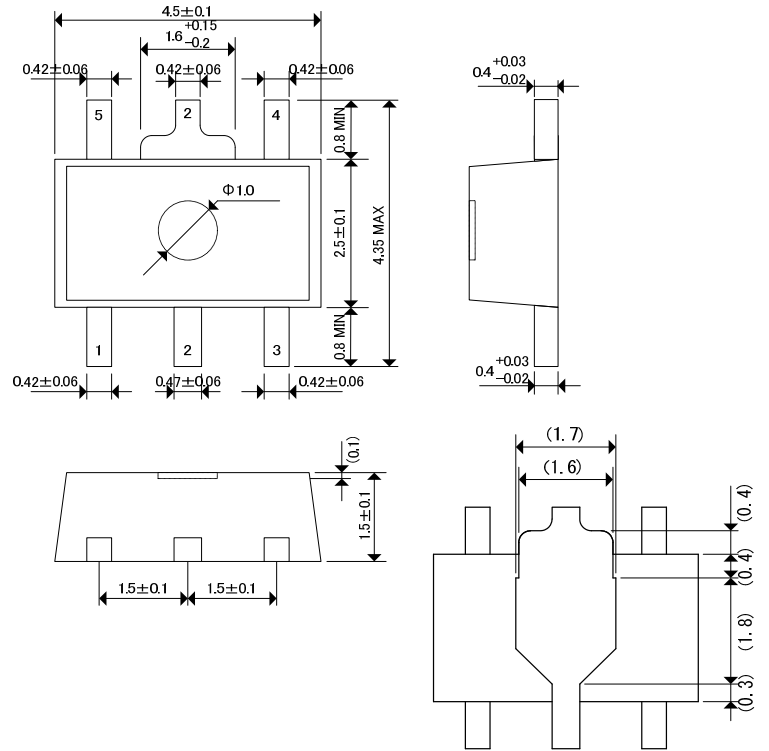


## PACKAGING INFORMATION

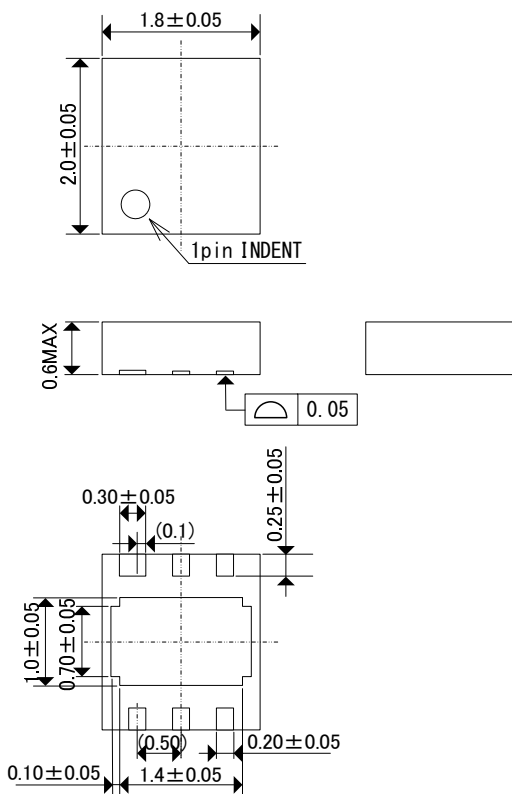
### ● SOT-25



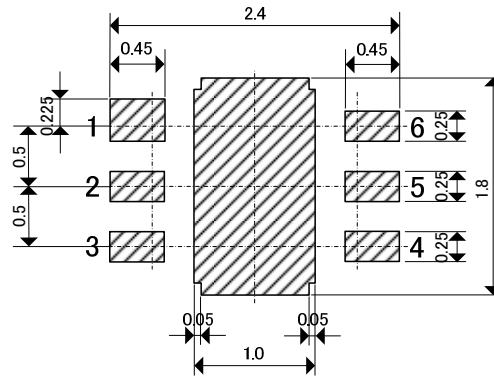
### ● SOT-89-5



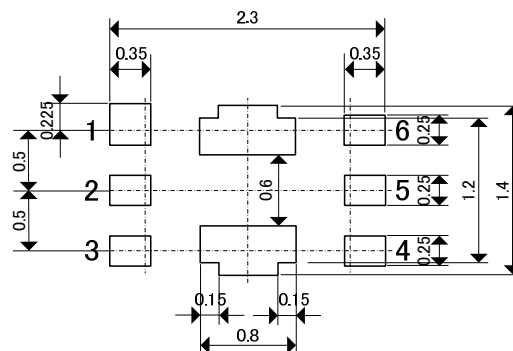
### ● USP-6C



### ● USP-6C Reference Pattern Layout



### ● USP-6C Reference Metal Mask Design



## ■ PACKAGING INFORMATION (Continued)

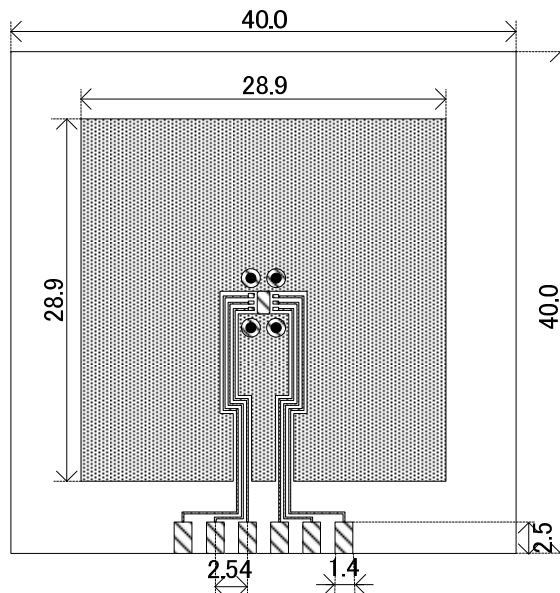
● USP-6C Power Dissipation

Power dissipation data for the USP-6C 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 mm<sup>2</sup> 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: 1.6 mm
- Through-hole: 4 x 0.8 Diameter

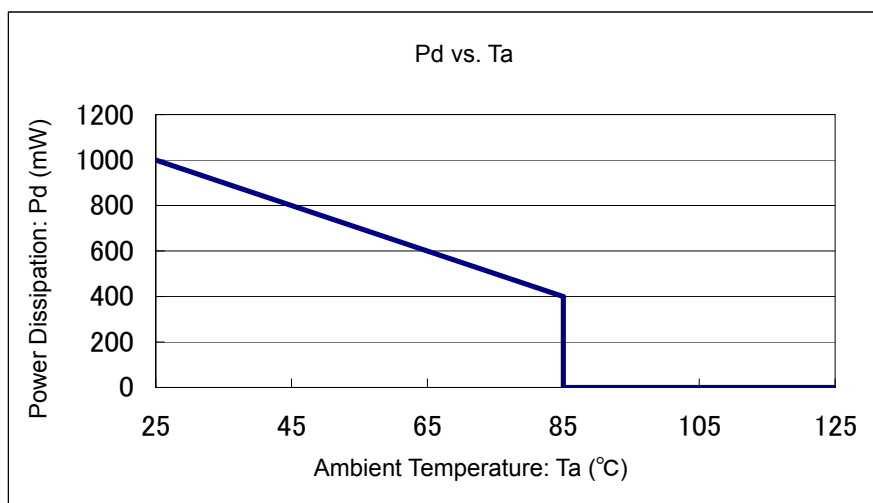


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient Temperature

Board Mount (T<sub>j</sub> max = 125°C)

| Ambient Temperature (°C) | Power Dissipation Pd (mW) | Thermal Resistance (°C/W) |
|--------------------------|---------------------------|---------------------------|
| 25                       | 1000                      | 100.00                    |
| 85                       | 400                       |                           |



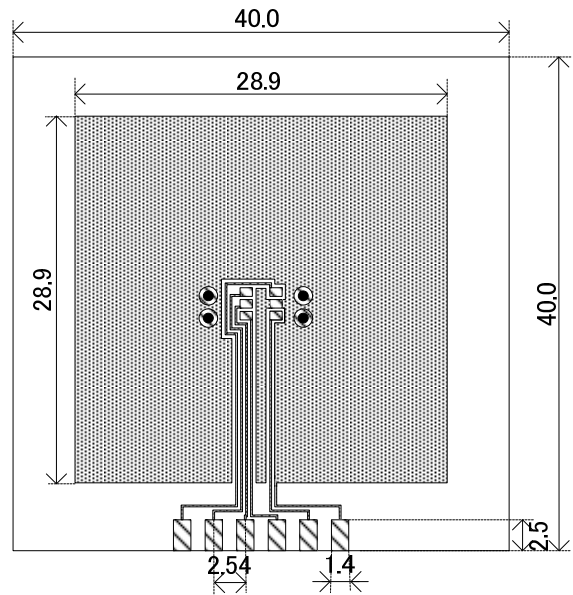
## PACKAGING INFORMATION (Continued)

### SOT-25 Power Dissipation

Power dissipation data for the SOT-25 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 mm<sup>2</sup> 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  
 (Board of SOT-26 is used.)
- Material: Glass Epoxy (FR-4)
- Thickness: 1.6 mm
- Through-hole: 4 x 0.8 Diameter

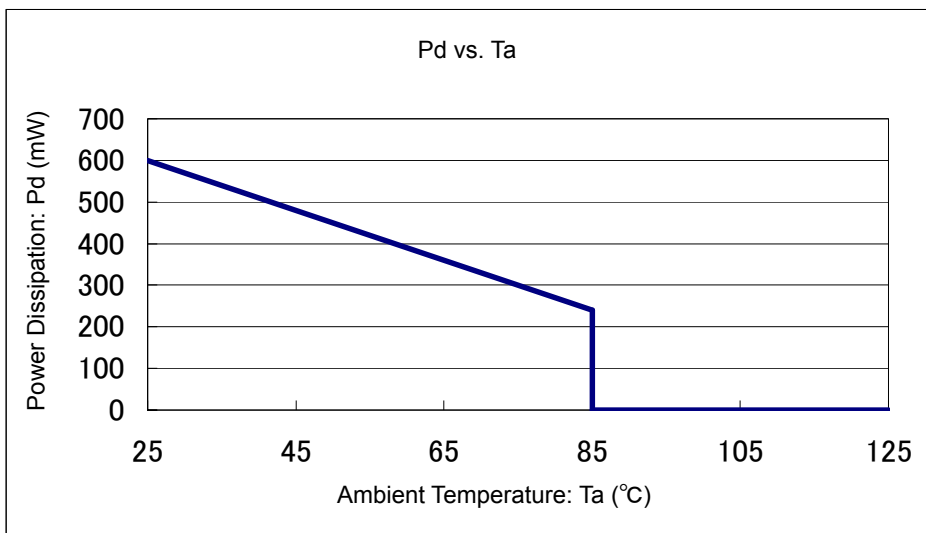


Evaluation Board (Unit: mm)

#### 2. Power Dissipation vs. Ambient Temperature

Board Mount ( $T_j \text{ max} = 125^\circ\text{C}$ )

| Ambient Temperature ( $^\circ\text{C}$ ) | Power Dissipation Pd (mW) | Thermal Resistance ( $^\circ\text{C/W}$ ) |
|--|---------------------------|---|
| 25                                       | 600                       | 166.67                                    |
| 85                                       | 240                       |   |



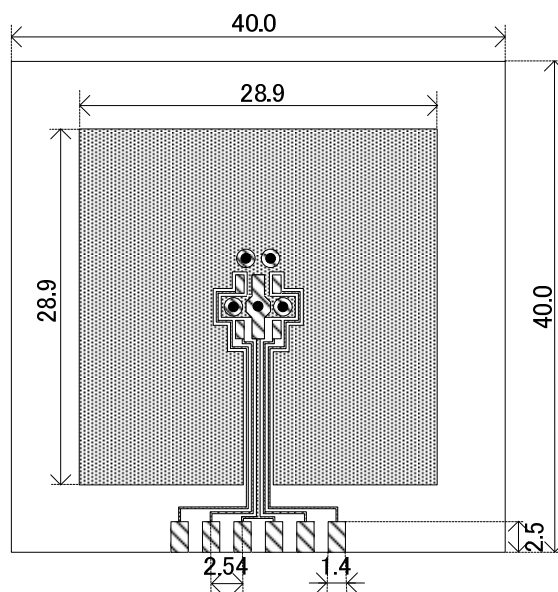
## ■ PACKAGING INFORMATION (Continued)

### ● SOT-89-5 Power Dissipation

Power dissipation data for the SOT-89-5 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 mm<sup>2</sup> 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: 1.6 mm
- Through-hole: 5 x 0.8 Diameter

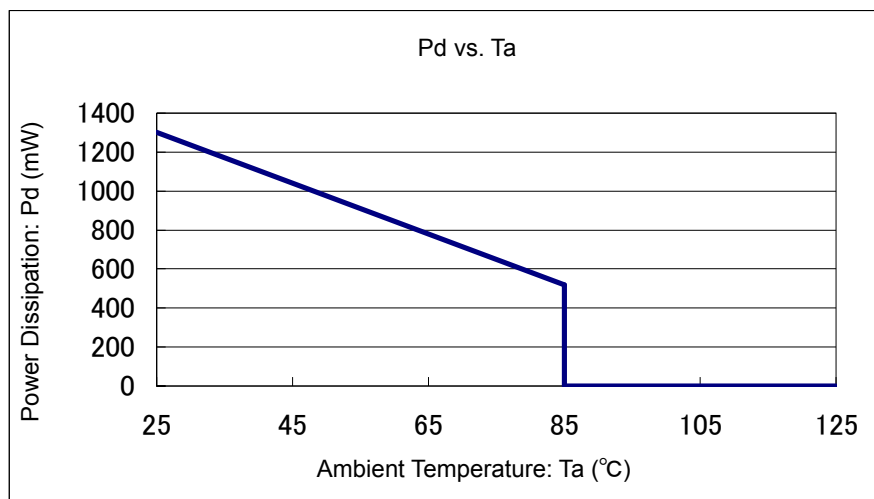


Evaluation Board (Unit: mm)

#### 2. Power Dissipation vs. Ambient Temperature

Board Mount ( $T_j \text{ max} = 125^\circ\text{C}$ )

| Ambient Temperature ( $^\circ\text{C}$ ) | Power Dissipation $P_d$ (mW) | Thermal Resistance ( $^\circ\text{C}/\text{W}$ ) |
|--|------------------------------|--|
| 25                                       | 1300                         | 76.92  |
| 85                                       | 520                          |  |



## MARKING RULE

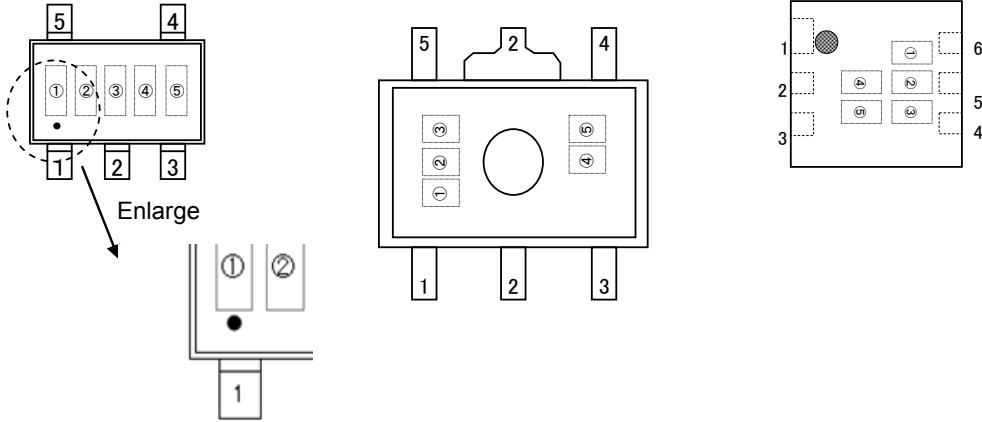
● SOT-25 / SOT-89-5 / USP-6C

(\*) SOT-25 has a dot mark, which is printed under MARK ① (refer to drawings below).

● SOT-25

● SOT-89-5

● USP-6C



① represents product series

| MARK | PRODUCT SERIES |
|------|----------------|
| 3    | XC6227*****G   |

② represents regulator type, voltage range, and accuracy

| MARK | REGULATOR TYPE | OUTPUT VOLTAGE RANGE | ACCURACY | PRODUCT SERIES                |
|------|----------------|----------------------|----------|-------------------------------|
| A    | A              | 0.8~2.9              | 1        | XC6227A081**-G~XC6227A291**-G |
| B    | A              | 0.85~2.95            | B        | XC6227A08B**-G~XC6227A29B**-G |
| C    | A              | 3.0~5.0              | 1        | XC6227A301**-G~XC6227A501**-G |
| D    | A              | 3.05~4.95            | B        | XC6227A30B**-G~XC6227A49B**-G |
| E    | C              | 0.8~2.9              | 1        | XC6227C081**-G~XC6227C291**-G |
| F    | C              | 0.85~2.95            | B        | XC6227C08B**-G~XC6227C29B**-G |
| H    | C              | 3.0~5.0              | 1        | XC6227C301**-G~XC6227C501**-G |
| K    | C              | 3.05~4.95            | B        | XC6227C30B**-G~XC6227C49B**-G |

\* Accuracy "1"- 0.1V step, Accuracy "B"- 0.05V step

③ represents output voltage.

| MARK | OUTPUT VOLTAGE (V) |      | MARK | OUTPUT VOLTAGE (V) |      | MARK | OUTPUT VOLTAGE (V) |      |
|------|--------------------|------|------|--------------------|------|------|--------------------|------|
| 0    | -                  | 3.0x | A    | 1.0x               | 4.0x | N    | 2.0x               | 5.0x |
| 1    | -                  | 3.1x | B    | 1.1x               | 4.1x | P    | 2.1x               | -    |
| 2    | -                  | 3.2x | C    | 1.2x               | 4.2x | R    | 2.2x               | -    |
| 3    | -                  | 3.3x | D    | 1.3x               | 4.3x | S    | 2.3x               | -    |
| 4    | -                  | 3.4x | E    | 1.4x               | 4.4x | T    | 2.4x               | -    |
| 5    | -                  | 3.5x | F    | 1.5x               | 4.5x | U    | 2.5x               | -    |
| 6    | -                  | 3.6x | H    | 1.6x               | 4.6x | V    | 2.6x               | -    |
| 7    | -                  | 3.7x | K    | 1.7x               | 4.7x | X    | 2.7x               | -    |
| 8    | 0.8x               | 3.8x | L    | 1.8x               | 4.8x | Y    | 2.8x               | -    |
| 9    | 0.9x               | 3.9x | M    | 1.9x               | 4.9x | Z    | 2.9x               | -    |

④⑤ represents production lot number

01 to 09, 0A to 0Z, 11 to 9Z, A1 to A9, AA to Z9, ZA to ZZ repeated. (G, I, J, O, Q, W excluded)

\* No character inversion used.



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