# XC6215 Series

## 0.8μA Low Power Consumption Voltage Regulator with ON/OFF Switch

## ■GENERAL DESCRIPTION

The XC6215 series are highly precise, low noise, positive voltage LDO regulators manufactured using CMOS processes. The series achieves very low supply current, 0.8μA (TYP.) and consists of a reference voltage source, an error amplifier, a current foldback circuit, and a phase compensation circuit plus a driver transistor.
Ultra small packages USP-3, USP-4, USPN-4 and SSOT-24, and small package SOT-25 packages make high density mounting possible. Therefore, the series is ideal for applications where high density mounting is required such as in mobile phones.
Output voltage is selectable in 0.1V increments within a range of 0.9V ~ 5.0V by laser trimming
The series is also compatible with low ESR ceramic capacitors, which give added output stability.
The current limiter's foldback circuit also operates as a short protect for the output current limiter and the output pin.
Furthermore, the CE function allows the output of the regulator to be turned off, resulting in greatly reduced power consumption.

## ■APPLICATIONS

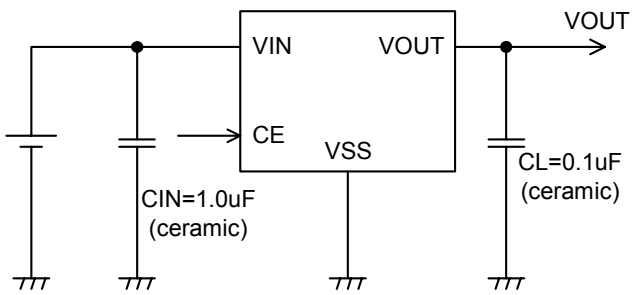
- ●Smart phones / Mobile phones
- ●Portable game consoles
- ●Digital still cameras / Camcorders
- ●Digital audio equipments
- ●Mobile devices / terminals

## ■FEATURES

| | |
|---|---|
| **Maximum Output Current** | : 200mA (300mA Limit, TYP.)<br>@ $V_{OUT}$=3.0V, $V_{IN}$=4.0V |
| **Dropout Voltage** | : 320mV @ $I_{OUT}$ = 100mA<br>@ $V_{OUT}$ = 3.0V |
| **Operating Input Voltage** | : 1.5V ~ 6.0V |
| **Output Voltage Range** | : 0.9V ~ 5.0V (0.1V Increments) |
| **Highly Accurate** | : Set voltage accuracy ±2%<br>(1.5V<$V_{OUT(T)}$≦5.0V)<br>Set voltage accuracy ±30mV<br>(0.9V≦$V_{OUT(T)}$≦1.5V) |
| **Low Power Consumption** | : 0.8μA (TYP.) |
| **Stand-by Current** | : Less than 0.1μA |
| **Operating Temperature Range** | : - 40℃~ 85℃ |
| **Low ESR Capacitor Compatible** | : Ceramic capacitor |
| **Current Limiter Circuit Built-In** | |
| **Packages** | : USP-4<br>SSOT-24<br>USP-3 (For the XC6215P series only)<br>SOT-25<br>USPN-4 |
| **Environmentally Friendly** | : EU RoHS Compliant, Pb Free |

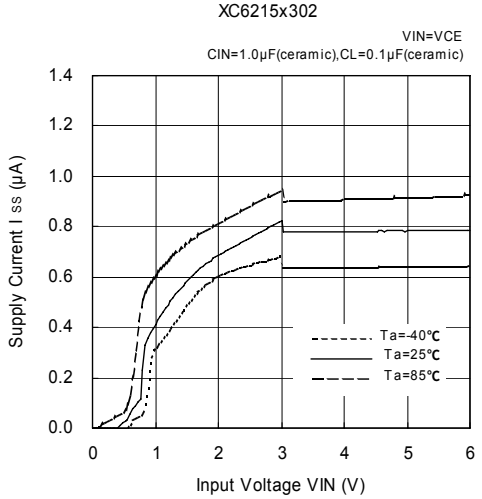
## ■TYPICAL APPLICATION CIRCUIT

●USP-4, SSOT-24, SOT-25,USPN-4 packages
(For the USP-3 package, with no CE pin)

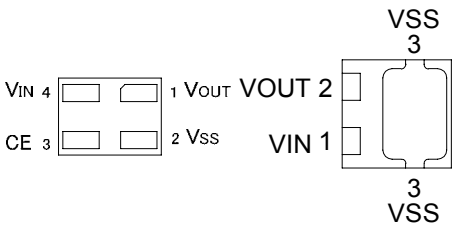



## ■TYPICAL PERFORMANCE CHARACTERISTICS

●Supply Current vs. Input Voltage

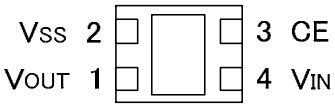


## ■PIN CONFIGURATION

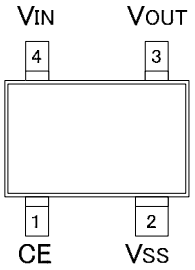



USPN-4 (BOTTOM VIEW)

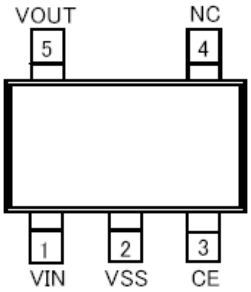
USP-3 (BOTTOM VIEW)




USP-4 (BOTTOM VIEW)




SSOT-24 (TOP VIEW)




SOT-25 (TOP VIEW)

* For mounting intensity and heat dissipation, please refer to recommended mounting pattern and recommended metal mask when soldering the pad of USP-4. Mounting should be electrically isolated or connected to the VSS (No.2) pin.

## ■PIN ASSIGNMENT

| PIN NUMBER | | | | | PIN NAME | FUNCTION |
|---|---|---|---|---|---|---|
| USPN-4 | USP-3 | USP-4 | SSOT-24 | SOT-25 | | |
| 4 | 1 | 4 | 4 | 1 | VIN | Power Supply |
| 2 | 3 | 2 | 2 | 2 | VSS | Ground |
| 3 | - | 3 | 1 | 3 | CE | ON / Off Switch |
| 1 | 2 | 1 | 3 | 5 | VOUT | Output |
| - | - | - | - | 4 | NC | No Connection |

## ■PRODUCT CLASSIFICATION

●Ordering Information

XC6215①②③④⑤⑥-⑦(*1)

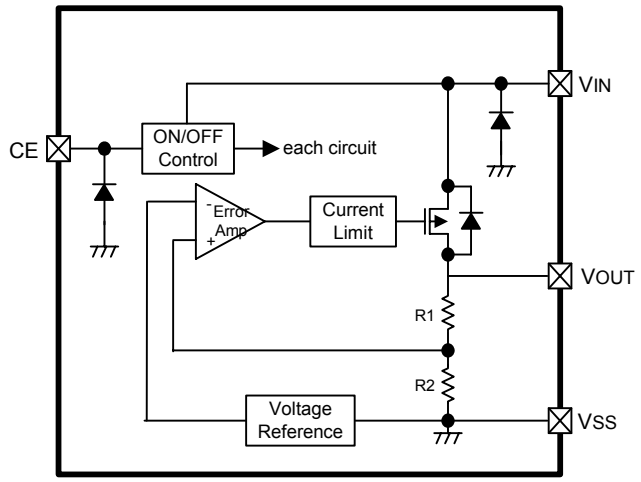
| DESIGNATOR | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|
| ① | Type of Regulator | B | CE logic = High active with no pull-down resistor |
| | | P | 3 pin regulator with no CE pin (USP-3 only) |
| ②③ | Output Voltage | 09 ~ 50 | 0.9 V ~ 5.0V, 0.1V step<br>e.g. VOUT=3.0V⇨②=3, ③=0 |
| ④ | Output Voltage Accuracy | 2 | ± 2 % accuracy<br>e.g. VOUT=3.0V⇨②=3, ③=0, ④=2 |
| ⑤⑥-⑦ | Packages<br>Taping Type (*2) | GR-G | USP-4 |
| | | NR | SSOT-24 |
| | | NR-G | SSOT-24 |
| | | MR | SOT-25 |
| | | MR-G | SOT-25 |
| | | HR | USP-3 (for the XC6215P series only) |
| | | HR-G | USP-3 (for the XC6215P series only) |
| | | 7R-G | USPN-4 |

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

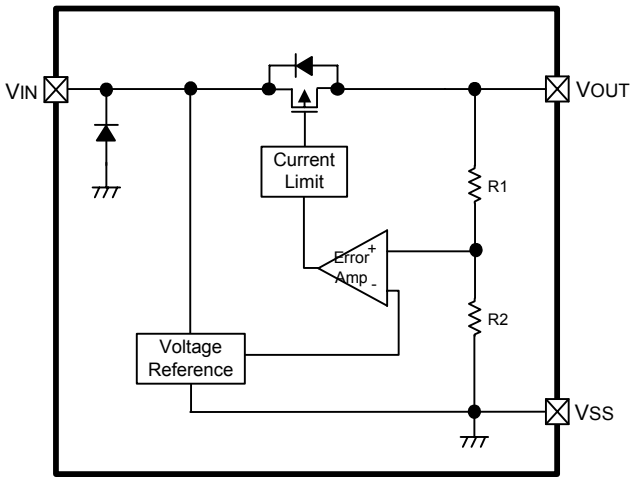
(*2) The device orientation is fixed in its embossed tape pocket. For reverse orientation, please contact your local Torex sales office or representative. (Standard orientation: ⑤R-⑦, Reverse orientation: ⑤L-⑦)

# ■BLOCK DIAGRAMS

●XC6215B Series




●XC6215P Series




* Diodes shown in the above circuit are ESD protection diodes and parasitic diodes

# ■ABSOLUTE MAXIMUM RATINGS

| PARAMETER | | SYMBOL | RATINGS | UNITS |
|---|---|---|---|---|
| Input Voltage | | $V_{IN}$ | - 0.3 ~ + 7.0 | V |
| Output Current | | $I_{OUT}$ | 500 (*1) | mA |
| Output Voltage | | $V_{OUT}$ | $V_{SS}$ - 0.3 ~ $V_{IN}$ + 0.3 | V |
| CE Input Voltage (*2) | | $V_{CE}$ | $V_{SS}$ - 0.3 ~ + 7.0 | V |
| Power Dissipation | SOT-25 | Pd | 250 | mW |
| | | | 600(PCB mounted)(*3) | |
| | SSOT-24 | | 150 | |
| | | | 500(PCB mounted)(*3) | |
| | USP-4 | | 120 | |
| | | | 1000(PCB mounted)(*3) | |
| | USP-3 | | 120 | |
| | USPN-4 | | 100 | |
| | | | 600(PCB mounted)(*3) | |
| Operating Temperature Range | | Topr | - 40 ~ + 85 | ℃ |
| Storage Temperature Range | | Tstg | - 55 ~ +125 | ℃ |

Note:
*1: IOUT = Pd/ (VIN-VOUT)
*2: Except for the XC6215P series
*3: The power dissipation figure shown is PCB mounted. Please refer to pages 33 to 35 for details.

## ■ELECTRICAL CHARACTERISTICS

●XC6215B Series

Ta = 25℃

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNIT. | CIRCUIT |
|---|---|---|---|---|---|---|---|
| Output Voltage (*2) | $V_{OUT(E)}$ | $V_{IN}=V_{CE}=V_{OUT(T)}$ (*1) + 1.0V, $I_{OUT}$=1mA | E-0(*6) | | | V | ① |
| Maximum Output Current | $I_{OUTMAX}$ | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V $V_{OUT(T)}$=0.9V | 50 | 70 | - | mA | ① |
| | | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V $V_{OUT(T)}$=1.0V ~ 1.1V | 60 | 80 | - | | |
| | | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V V $V_{OUT(T)}$=1.2V ~ 1.3V | 80 | 110 | - | | |
| | | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V $V_{OUT(T)}$=1.4V ~ 1.6V | 100 | 140 | - | | |
| | | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V $V_{OUT(T)}$=1.7V ~ 2.2V | 120 | 150 | - | | |
| | | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V $V_{OUT(T)}$=2.3V ~ 2.9V | 150 | 195 | - | | |
| | | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V $V_{OUT(T)}\geqq$3.0V | 200 | 300 | - | | |
| Load Regulation | △$V_{OUT}$ | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V $V_{OUT(T)}$=0.9V 1mA≦$I_{OUT}$≦50mA | - | 15 | 70 | mV | ① |
| | | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V $V_{OUT(T)}$= 1.0V ~ 1.1V 1mA≦$I_{OUT}$≦60mA | | | | | |
| | | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V $V_{OUT(T)}$=1.2V~1.3V 1mA≦$I_{OUT}$≦80mA | | | | | |
| | | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V $V_{OUT(T)}\geqq$1.4V 1mA≦$I_{OUT}$≦100mA | | | | | |
| Dropout Voltage (*3) | Vdif | $V_{CE}=V_{IN}$, $V_{OUT(T)}$=0.9V $I_{OUT}$=50mA | E-1(*6) | | | mV | ① |
| | | $V_{CE}=V_{IN}$, $V_{OUT(T)}$=1.0V ~ 1.1V $I_{OUT}$=60mA | | | | | |
| | | $V_{CE}=V_{IN}$, $V_{OUT(T)}$=1.2V ~ 1.3V $I_{OUT}$=80mA | | | | | |
| | | $V_{CE}=V_{IN}$, $V_{OUT(T)}\geqq$1.4V $I_{OUT}$=100mA | | | | | |
| Supply Current | $I_{DD}$ | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V $V_{OUT(T)}\leqq$3.9V | - | 0.8 | 1.5 | μA | ② |
| | | $V_{IN}=V_{CE}=V_{OUT(T)}$ + 1.0V $V_{OUT(T)}\geqq$4.0V | - | 1.0 | 1.8 | | |
| Stand-by Current | Istby | $V_{IN}=V_{OUT(T)}$ + 1.0V, $V_{CE}=V_{SS}$ | - | 0.01 | 0.10 | μA | ② |

# ■ELECTRICAL CHARACTERISTICS (Continued)

●XC6215B Series (Continued)

Ta = 25℃

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNIT. | CIRCUIT |
|---|---|---|---|---|---|---|---|
| Line Regulation | $\frac{\triangle V_{OUT}}{\triangle V_{IN} \cdot V_{OUT}}$ | $V_{OUT(T)}$=0.9V, $V_{CE}$=$V_{IN}$<br>1.5V≦$V_{IN}$≦6.0V<br>$I_{OUT}$=1mA | - | 0.05 | 0.15 | %/V | ① |
| | | $V_{OUT(T)}$=1.0V~1.2V, $V_{CE}$=$V_{IN}$<br>$V_{OUT(T)}$+0.5V≦$V_{IN}$≦6.0V<br>$I_{OUT}$=1mA | | | | | |
| | | $V_{OUT(T)}$≧1.3V, $V_{CE}$=$V_{IN}$<br>$V_{OUT(T)}$+0.5V≦$V_{IN}$≦6.0V<br>$I_{OUT}$=30mA | | | | | |
| Input Voltage | $V_{IN}$ | - | 1.5 | - | 6.0 | V | - |
| Output Voltage Temperature Characteristics | $\frac{\triangle V_{OUT}}{\triangle Topr \cdot V_{OUT}}$ | $V_{IN}$=$V_{CE}$=$V_{OUT(T)}$+1.0V, $I_{OUT}$=30mA<br>- 40℃≦ Topr ≦ 85℃ | - | ±100 | - | ppm /℃ | ① |
| Current Limit | $I_{lim}$ | $V_{OUT}$=$V_{OUT(E)}$×0.95<br>$V_{OUT(T)}$=0.9V<br>$V_{IN}$=$V_{CE}$= $V_{OUT(T)}$+2.0V | 100 | 300 | - | mA | ① |
| | | $V_{OUT}$=$V_{OUT(E)}$×0.95<br>$V_{OUT(T)}$=1.0V ~ 1.1V<br>$V_{IN}$=$V_{CE}$= $V_{OUT(T)}$+2.0V | 120 | 300 | - | | |
| | | $V_{OUT}$=$V_{OUT(E)}$×0.95<br>$V_{OUT(T)}$=1.2V ~ 1.3V<br>$V_{IN}$=$V_{CE}$= $V_{OUT(T)}$+2.0V | 160 | 300 | - | | |
| | | $V_{OUT}$=$V_{OUT(E)}$×0.95<br>$V_{OUT(T)}$=1.4V ~ 2.9V<br>$V_{IN}$=$V_{CE}$= $V_{OUT(T)}$+2.0V | 200 | 300 | - | | |
| | | $V_{OUT}$=$V_{OUT(E)}$×0.95<br>$V_{OUT(T)}$≧3.0V<br>$V_{IN}$=$V_{CE}$= $V_{OUT(T)}$+1.0V | 200 | 300 | - | | |
| Short Circuit Current | Ishort | $V_{IN}$=$V_{CE}$=$V_{OUT(T)}$+1.0V,<br>$V_{OUT}$=0V | - | 50 | - | mA | ① |
| CE 'H' Level Voltage | $V_{CEH}$ | $V_{IN}$=$V_{OUT(T)}$+1.0V | 1.0 | - | 6.0 | V | ① |
| CE 'L' Level Voltage | $V_{CEL}$ | $V_{IN}$=$V_{OUT(T)}$+1.0V | - | - | 0.3 | | |
| CE 'H' Level Current | $I_{CEH}$ | $V_{IN}$=$V_{CE}$=$V_{OUT(T)}$+1.0V | - 0.1 | - | 0.1 | μA | ② |
| CE 'L' Level Current | $I_{CEL}$ | $V_{IN}$=$V_{OUT(T)}$+1.0V, $V_{CE}$=$V_{SS}$ | - 0.1 | - | 0.1 | | |

NOTE:

*1: $V_{OUT(T)}$: Fixed output voltage

*2: $V_{OUT(E)}$ = Effective output voltage

(i.e. the output voltage when "$V_{OUT(T)}$ + 1.0V" is provided at the $V_{IN}$ pin while maintaining a certain $I_{OUT}$ value).

*3: Vdif = { $V_{IN1}$ (*4)– $V_{OUT1}$ (*5)}

*4: $V_{IN1}$ = The input voltage when $V_{OUT1}$ appears as input voltage is gradually decreased.

*5: $V_{OUT1}$ = A voltage equal to 98% of the output voltage whenever an amply stabilized $I_{OUT}$ { $V_{OUT(T)}$ + 1.0V } is input.

*6: Refer to "VOLTAGE CHART".

## ■ELECTRICAL CHARACTERISTICS (Continued)

●XC6215P Series

Ta = 25℃

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNIT. | CIRCUIT |
|---|---|---|---|---|---|---|---|
| Output Voltage (*2) | $V_{OUT(E)}$ | $V_{IN}=V_{OUT(T)}$ (*1) + 1.0V, $I_{OUT}$=1mA | E-0 (*6) | | | V | ① |
| Maximum Output Current | $I_{OUTMAX}$ | $V_{IN}=V_{OUT(T)}$ + 1.0V<br>$V_{OUT(T)}$=0.9V | 50 | 70 | - | mA | ① |
| | | $V_{IN}=V_{OUT(T)}$ + 1.0V<br>$V_{OUT(T)}$=1.0V ~ 1.1V | 60 | 80 | - | | |
| | | VIN=$V_{OUT(T)}$ + 1.0V<br>$V_{OUT(T)}$=1.2V ~ 1.3V | 80 | 110 | - | | |
| | | $V_{IN}=V_{OUT(T)}$ + 1.0V<br>$V_{OUT(T)}$=1.4V ~ 1.6V | 100 | 140 | - | | |
| | | $V_{IN}=V_{OUT(T)}$ + 1.0V<br>$V_{OUT(T)}$=1.7V ~ 2.2V | 120 | 150 | - | | |
| | | $V_{IN}=V_{OUT(T)}$ + 1.0V<br>$V_{OUT(T)}$=2.3V ~ 2.9V | 150 | 195 | - | | |
| | | $V_{IN}=V_{OUT(T)}$ + 1.0V<br>$V_{OUT(T)}$≧3.0V | 200 | 300 | - | | |
| Load Regulation | △$V_{OUT}$ | $V_{IN}=V_{OUT(T)}$ + 1.0V<br>$V_{OUT(T)}$=0.9V<br>1mA≦$I_{OUT}$≦50mA | - | 15 | 70 | mV | ① |
| | | $V_{IN}=V_{OUT(T)}$ + 1.0V<br>$V_{OUT(T)}$= 1.0V~1.1V<br>1mA≦$I_{OUT}$≦60mA | | | | | |
| | | $V_{IN}=V_{OUT(T)}$ + 1.0V<br>$V_{OUT(T)}$=1.2V~1.3V<br>1mA≦$I_{OUT}$≦80mA | | | | | |
| | | $V_{IN}=V_{OUT(T)}$ + 1.0V<br>$V_{OUT(T)}$≧1.4V<br>1mA≦$I_{OUT}$≦100mA | | | | | |
| Dropout Voltage (*3) | Vdif | $V_{OUT(T)}$=0.9V<br>$I_{OUT}$=50mA | E-1 (*6) | | | mV | ① |
| | | $V_{OUT(T)}$=1.0V ~ 1.1V<br>$I_{OUT}$=60mA | | | | | |
| | | $V_{OUT(T)}$=1.2V ~ 1.3V<br>$I_{OUT}$=80mA | | | | | |
| | | $V_{OUT(T)}$≧1.4V<br>$I_{OUT}$=100mA | | | | | |
| Supply Current | $I_{DD}$ | $V_{IN}=V_{OUT(T)}$=1.0V<br>$V_{OUT(T)}$≦3.9V | - | 0.8 | 1.5 | μA | ② |
| | | $V_{IN}$= $V_{OUT(T)}$+1.0V<br>$V_{OUT(T)}$≧4.0V | - | 1.0 | 1.8 | | |

# ■ELECTRICAL CHARACTERISTICS (Continued)

●XC6215P Series (Continued)

Ta = 25℃

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNIT. | CIRCUIT |
|---|---|---|---|---|---|---|---|
| Line Regulation | $\frac{\triangle V_{OUT}}{\triangle V_{IN} \cdot V_{OUT}}$ | $V_{OUT(T)}$=0.9V<br>1.5V≦$V_{IN}$≦6.0V<br>$I_{OUT}$=1mA | - | 0.05 | 0.15 | %/V | ① |
| | | $V_{OUT(T)}$=1.0V~1.2V<br>$V_{OUT(T)}$+0.5V≦$V_{IN}$≦6.0V<br>$I_{OUT}$=1mA | | | | | |
| | | $V_{OUT(T)}$≧1.3V<br>$V_{OUT(T)}$+0.5V≦$V_{IN}$≦6.0V<br>$I_{OUT}$=30mA | | | | | |
| Input Voltage | $V_{IN}$ | - | 1.5 | - | 6.0 | V | - |
| Output Voltage Temperature Characteristics | $\frac{\triangle V_{OUT}}{\triangle Topr \cdot V_{OUT}}$ | $V_{IN}$=$V_{OUT(T)}$+1.0V, $I_{OUT}$= 30mA<br>- 40℃≦ Topr ≦ 85℃ | - | ±100 | - | ppm /℃ | ① |
| Current Limit | $I_{lim}$ | $V_{OUT}$=$V_{OUT(E)}$×0.95<br>$V_{OUT(T)}$=0.9V<br>$V_{IN}$= $V_{OUT(T)}$+2.0V | 100 | 300 | - | mA | ① |
| | | $V_{OUT}$=$V_{OUT(E)}$×0.95<br>$V_{OUT(T)}$=1.0V ~ 1.1V<br>$V_{IN}$=$V_{OUT(T)}$+2.0V | 120 | 300 | - | | |
| | | $V_{OUT}$=$V_{OUT(E)}$×0.95<br>$V_{OUT(T)}$=1.2V ~ 1.3V<br>$V_{IN}$=$V_{OUT(T)}$+2.0V | 160 | 300 | - | | |
| | | $V_{OUT}$=$V_{OUT(E)}$×0.95<br>$V_{OUT(T)}$=1.4V ~ 2.9V<br>$V_{IN}$=$V_{OUT(T)}$+2.0V | 200 | 300 | - | | |
| | | $V_{OUT}$=$V_{OUT(E)}$×0.95<br>$V_{OUT(T)}$≧3.0V<br>$V_{IN}$=$V_{OUT(T)}$+1.0V | 200 | 300 | - | | |
| Short Circuit Current | Ishort | $V_{IN}$=$V_{OUT(T)}$+1.0V, $V_{OUT}$=0V | - | 50 | - | mA | ① |

NOTE:

*1: $V_{OUT(T)}$: Fixed output voltage

*2: $V_{OUT(E)}$ = Effective output voltage

(i.e. the output voltage when "$V_{OUT(T)}$ + 1.0V" is provided at the $V_{IN}$ pin while maintaining a certain $I_{OUT}$ value).

*3: Vdif = { $V_{IN1}$ (*4) – $V_{OUT1}$ (*5) }

*4: $V_{IN1}$ = The input voltage when $V_{OUT1}$ appears as input voltage is gradually decreased.

*5: $V_{OUT1}$ = A voltage equal to 98% of the output voltage whenever an amply stabilized $I_{OUT}$ { $V_{OUT(T)}$ + 1.0V } is input.

*6: Refer to "VOLTAGE CHART".

## ■VOLTAGE CHART

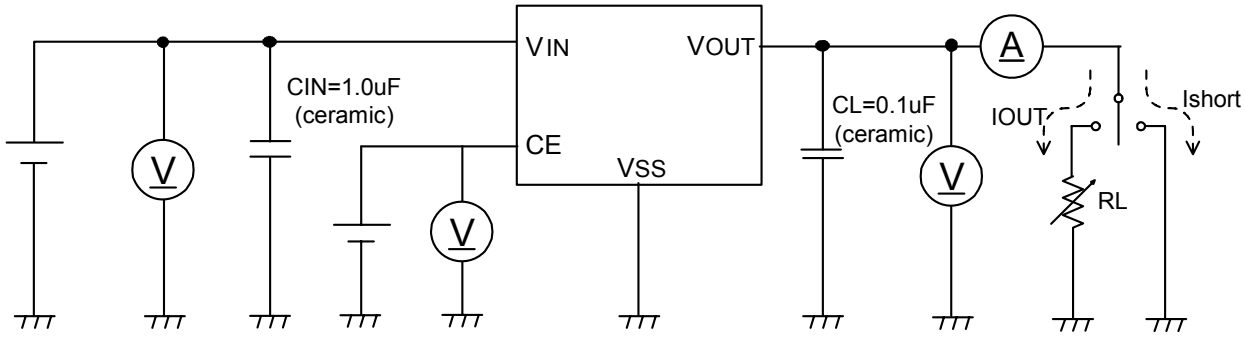
●Dropout Voltage Chart

Ta = 25℃

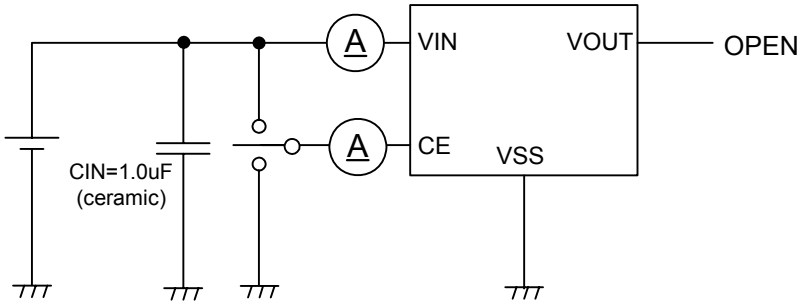
| SETTING OUTPUT VOLTAGE | E-0 | | E-1 | |
|---|---|---|---|---|
| | OUTPUT VOLTAGE (V) | | DROPOUT VOLTAGE (mV) | |
| VOUT(T) | VOUT | | Vdif | |
| | MIN. | MAX. | TYP. | MAX. |
| 0.9 | 0.870 | 0.930 | 870 | 1000 |
| 1.0 | 0.970 | 1.030 | 860 | 1000 |
| 1.1 | 1.070 | 1.130 | 780 | 950 |
| 1.2 | 1.170 | 1.230 | 800 | 1000 |
| 1.3 | 1.270 | 1.330 | 720 | 900 |
| 1.4 | 1.370 | 1.430 | 750 | 960 |
| 1.5 | 1.470 | 1.530 | 700 | 890 |
| 1.6 | 1.568 | 1.632 | 680 | 860 |
| 1.7 | 1.666 | 1.734 | 650 | 830 |
| 1.8 | 1.764 | 1.836 | 630 | 800 |
| 1.9 | 1.862 | 1.938 | 610 | 780 |
| 2.0 | 1.960 | 2.040 | 580 | 740 |
| 2.1 | 2.058 | 2.142 | 580 | 740 |
| 2.2 | 2.156 | 2.244 | 580 | 740 |
| 2.3 | 2.254 | 2.346 | 510 | 650 |
| 2.4 | 2.352 | 2.448 | 510 | 650 |
| 2.5 | 2.450 | 2.550 | 450 | 580 |
| 2.6 | 2.548 | 2.652 | 450 | 580 |
| 2.7 | 2.646 | 2.754 | 450 | 580 |
| 2.8 | 2.744 | 2.856 | 450 | 580 |
| 2.9 | 2.842 | 2.958 | 450 | 580 |
| 3.0 | 2.940 | 3.060 | 320 | 420 |
| 3.1 | 3.038 | 3.162 | 320 | 420 |
| 3.2 | 3.136 | 3.264 | 320 | 420 |
| 3.3 | 3.234 | 3.366 | 320 | 420 |
| 3.4 | 3.332 | 3.468 | 320 | 420 |
| 3.5 | 3.430 | 3.570 | 320 | 420 |
| 3.6 | 3.528 | 3.672 | 320 | 420 |
| 3.7 | 3.626 | 3.774 | 320 | 420 |
| 3.8 | 3.724 | 3.876 | 320 | 420 |
| 3.9 | 3.822 | 3.978 | 320 | 420 |
| 4.0 | 3.920 | 4.080 | 290 | 380 |
| 4.1 | 4.018 | 4.182 | 290 | 380 |
| 4.2 | 4.116 | 4.284 | 290 | 380 |
| 4.3 | 4.214 | 4.386 | 290 | 380 |
| 4.4 | 4.312 | 4.488 | 290 | 380 |
| 4.5 | 4.410 | 4.590 | 290 | 380 |
| 4.6 | 4.508 | 4.692 | 290 | 380 |
| 4.7 | 4.606 | 4.794 | 290 | 380 |
| 4.8 | 4.704 | 4.896 | 290 | 380 |
| 4.9 | 4.802 | 4.998 | 290 | 380 |
| 5.0 | 4.900 | 5.100 | 230 | 310 |

# ■TEST CIRCUITS

●Circuit ①




●Circuit ②

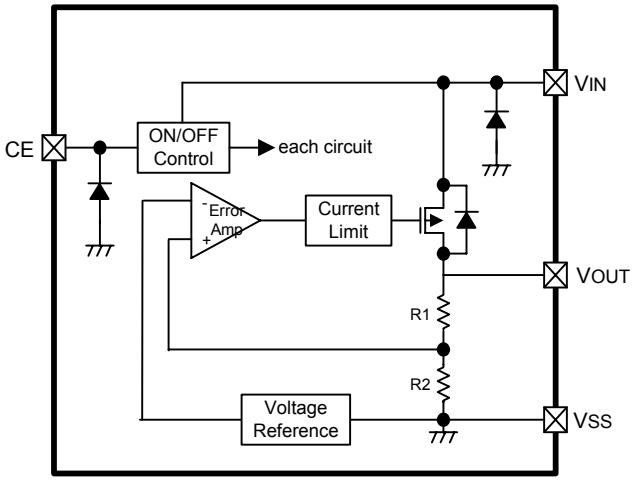


# ■OPERATIONAL EXPLANATION

●XC6215B Series (As for the XC6215P Series, with no CE pin)

<Output Voltage Control>

The voltage divided by resistors R1 & R2 is compared with the internal reference voltage by the error amplifier. The P-channel MOSFET, which is connected to the VOUT pin, is then driven by the subsequent output signal. The output voltage at the VOUT pin is controlled and stabilized by a system of negative feedback. The current limit circuit and short protect circuit operate in relation to the level of output current. Further, the IC's internal circuitry can be operated or shutdown via the CE pin's signal.




<Short Protection Circuit>

The XC6215 series' regulator offers circuit protection by means of a built-in foldback circuit. When the load current reaches the current limit level, the fixed current limiter circuit operates and output voltage drops. As a result of this drop in output voltage, the foldback circuit operates, the output voltage drops further and output current decreases. When the output pin is shorted, a current of about 50mA flows.

<CE Pin>

The IC's internal circuitry can be operated or shutdown via the signal from the CE pin with the XC6215B series. In shutdown mode, output at the VOUT pin will be pulled down to the VSS level via R1 & R2. Note that the XC6215 series' regulator is "High Active/No Pull-Down", operations will become unstable with the CE pin open. We suggest that you use this IC with either a VIN voltage or a VSS voltage input at the CE pin. If this IC is used with the correct specifications for the CE pin, the operational logic is fixed and the IC will operate normally. However, supply current may increase as a result of through current in the IC's internal circuitry.

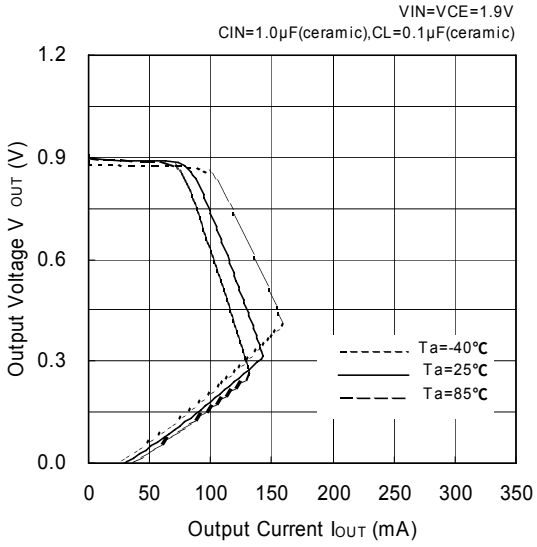
# ■NOTES ON USE

1. Please use this IC within the stated absolute maximum ratings. 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.
3. As for the XC6215 series, internally achieved phase compensation makes a stable operation of the IC possible even when there is no output capacitor (CL). In order to stabilize the VIN's voltage level, we recommend that an input capacitor (CIN) of about 0.1 to 1.0μF be connected between the VIN pin and the VSS pin. Moreover, during transient response, so as to prevent an undershoot or overshoot, we recommend that the output capacitor (CL) of about 0.1 to1.0μF be connected between the VOUT pin and the VSS pin. However, please wire the input capacitor (CIN) and the output capacitor (CL) as close to the IC as possible.

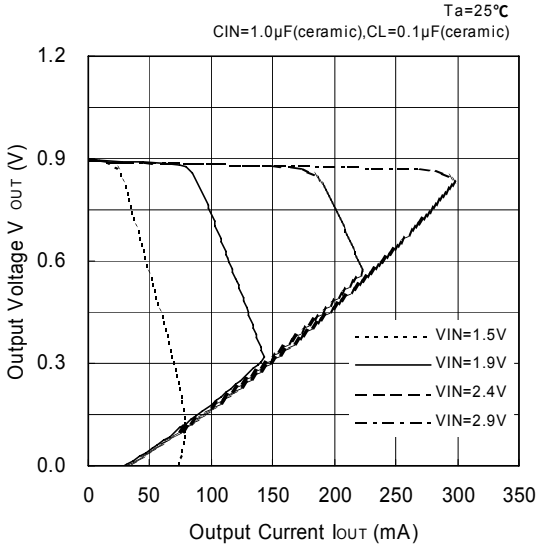
# ■TYPICAL PERFORMANCE CHARACTERISTICS

(1) Output Voltage vs. Output Current

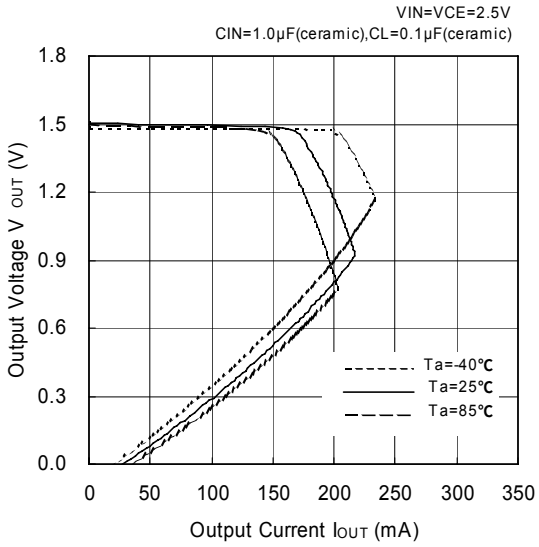
XC6215x092



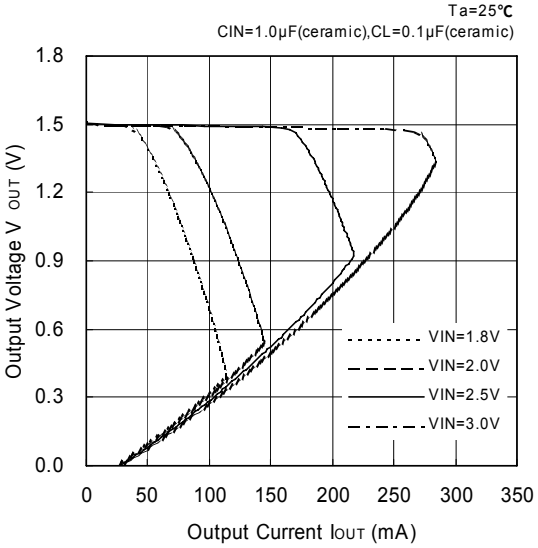

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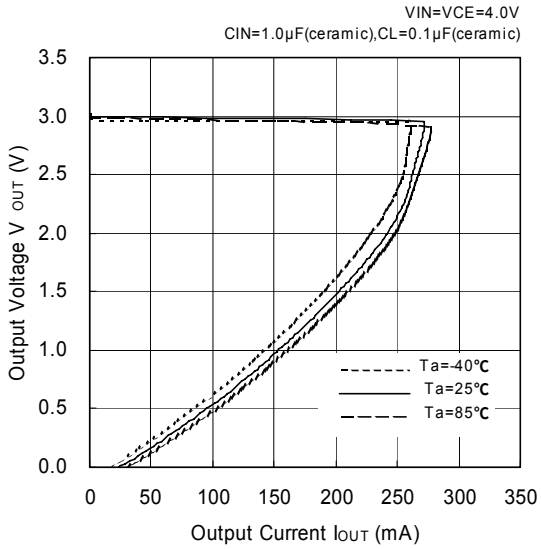

XC6215x152



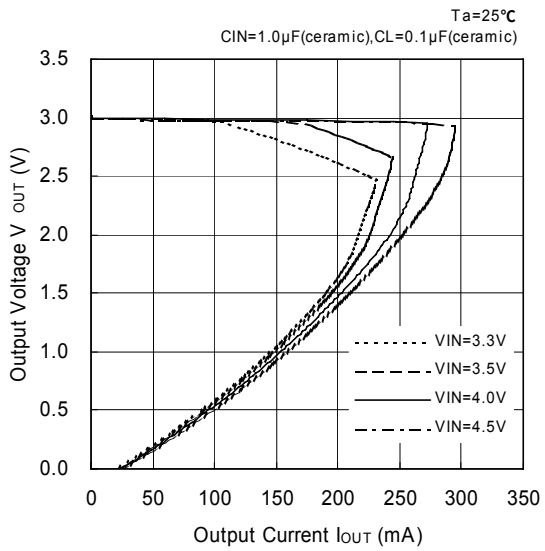

XC6215x152




XC6215x302



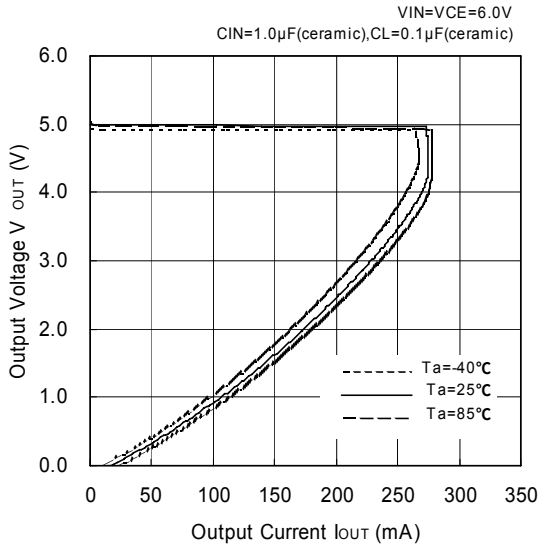

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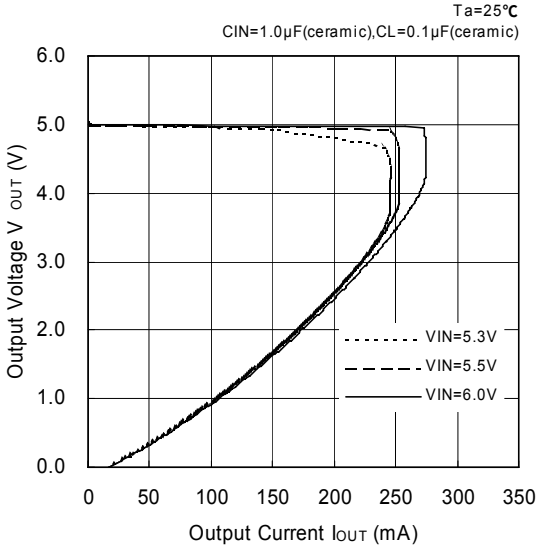
## ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

XC6215x502

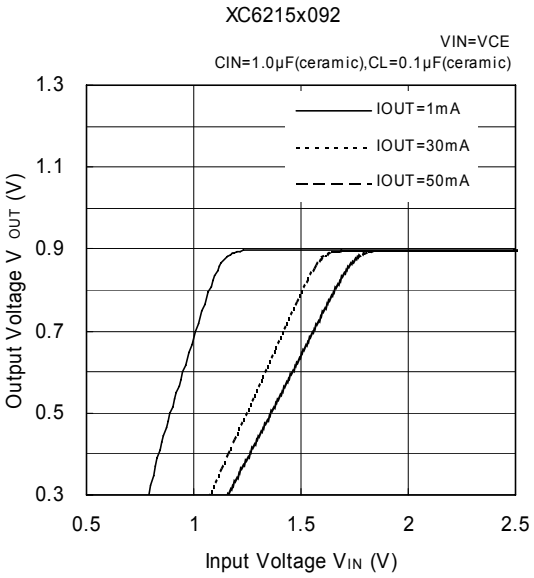



XC6215x502

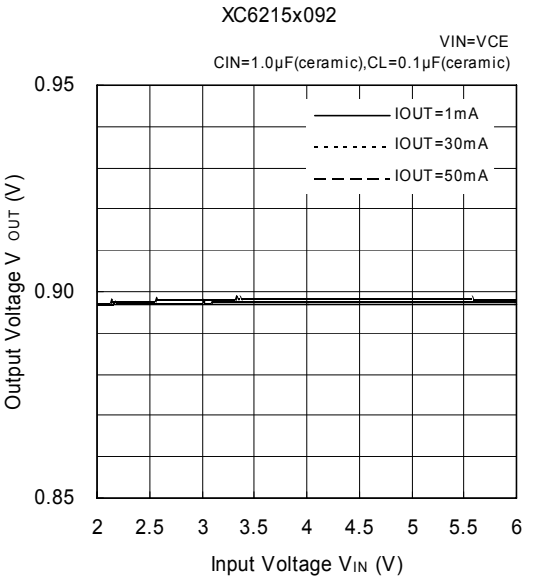



(2) Output Voltage vs. Input Voltage

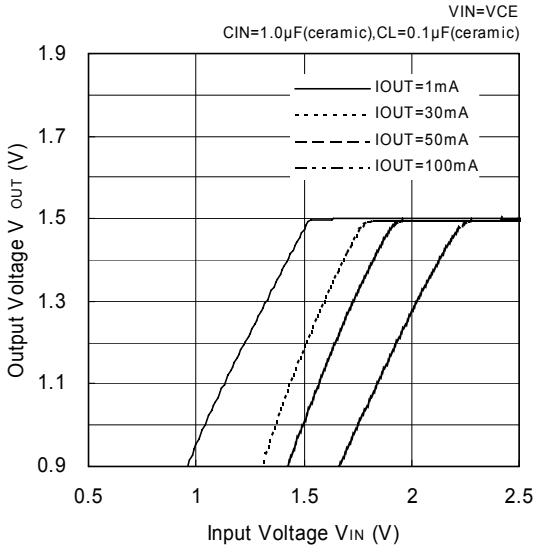
XC6215x092



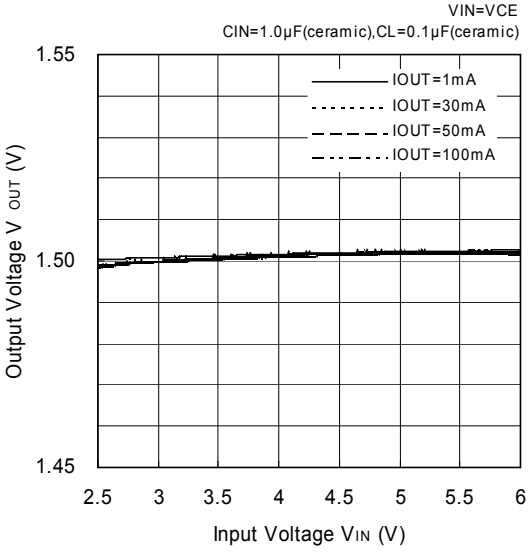

XC6215x092




XC6215x152



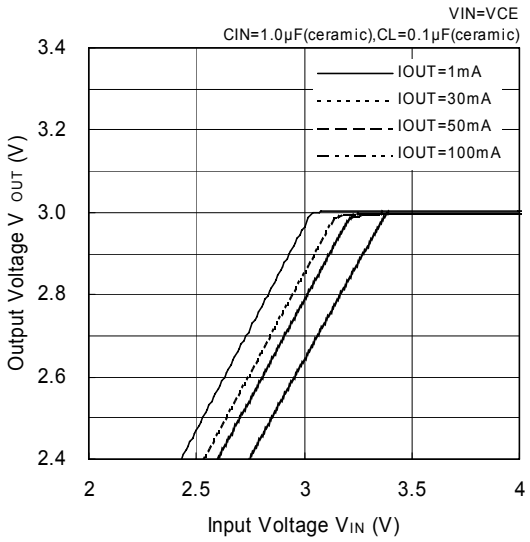

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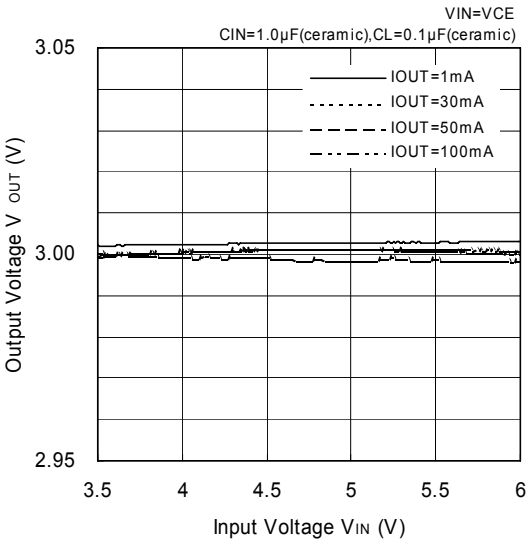
# ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

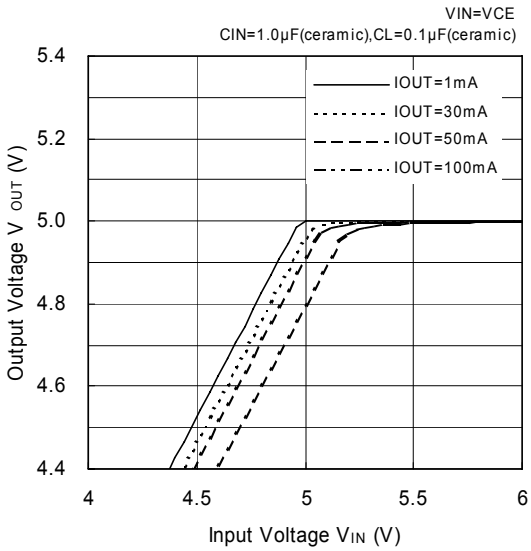
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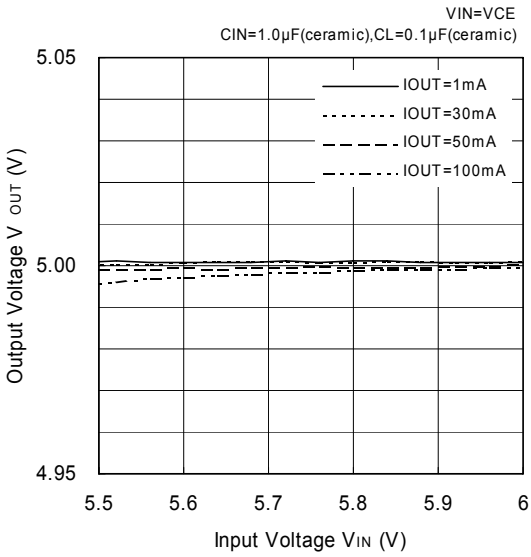

XC6215x302




XC6215x502

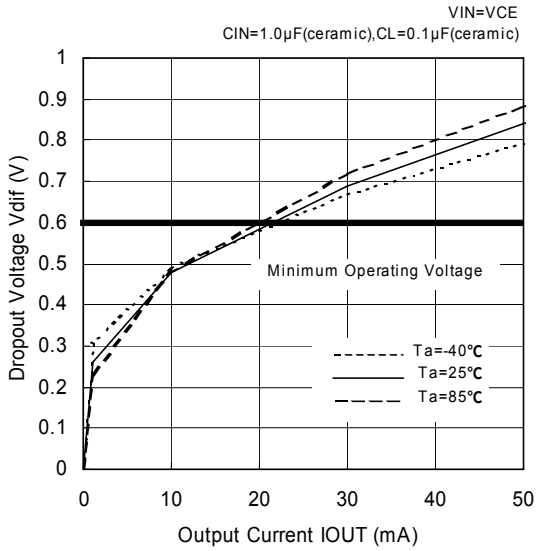



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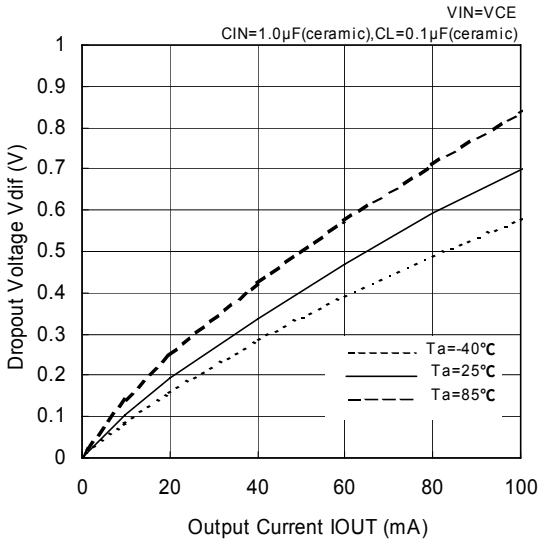



(3) Dropout Voltage vs. Output Current

XC6215x092



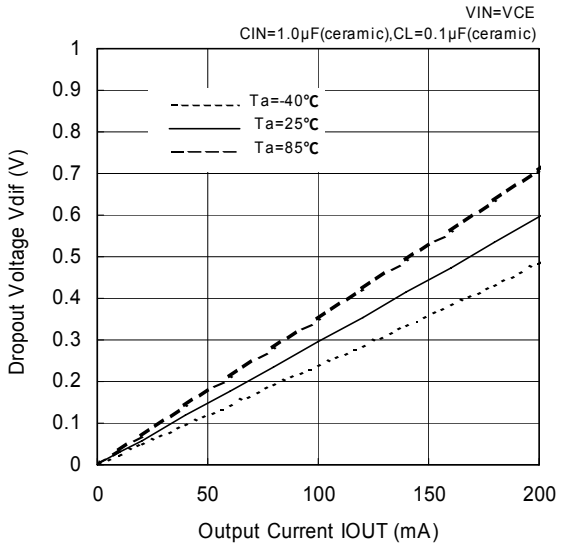

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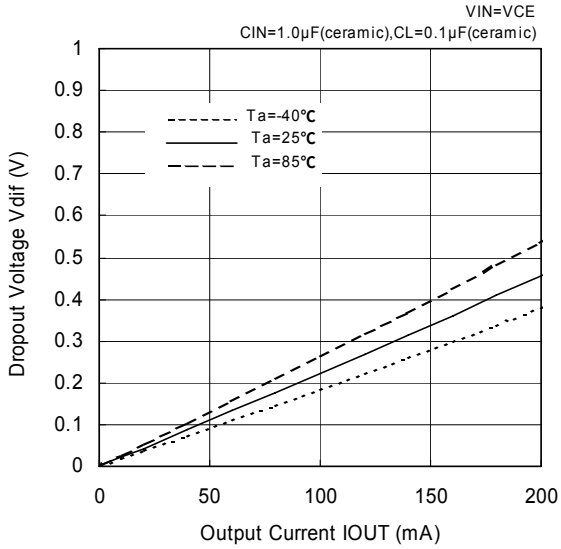
## ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

XC6215x302

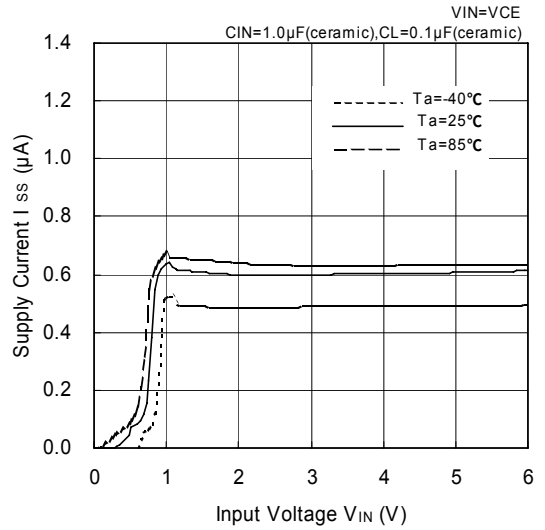



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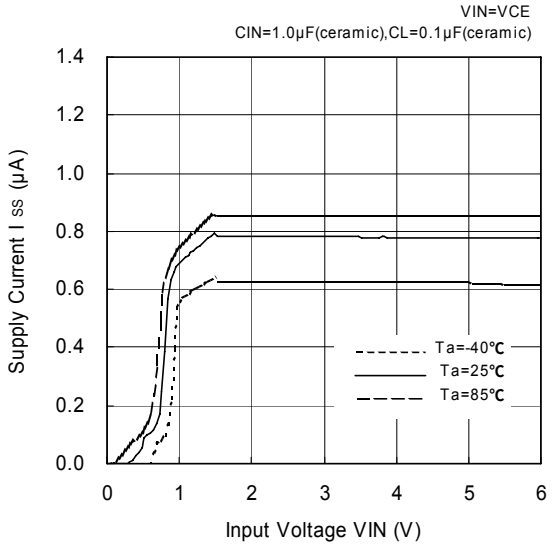



(4) Supply Current vs. Input Voltage

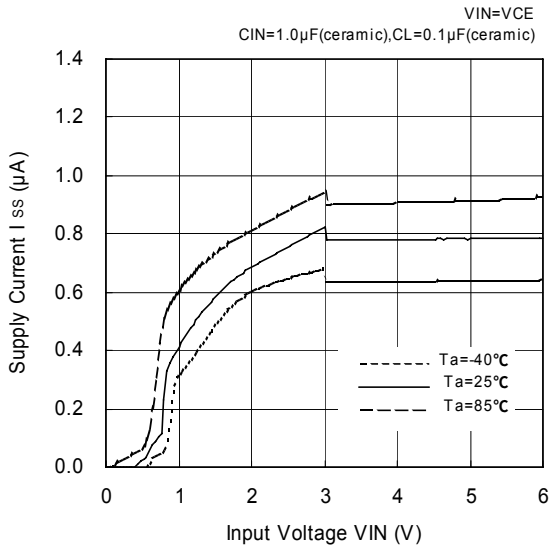
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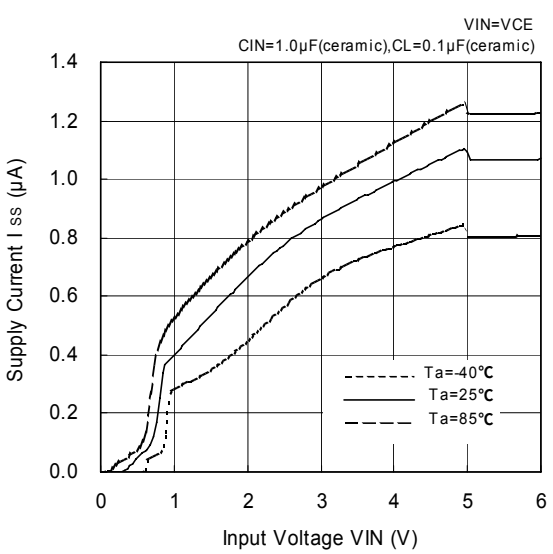

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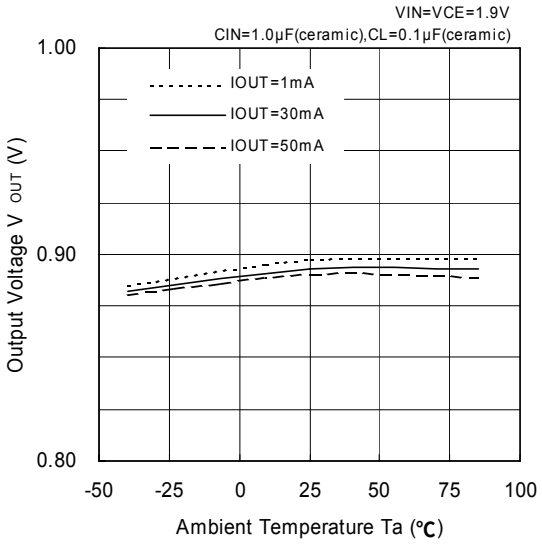

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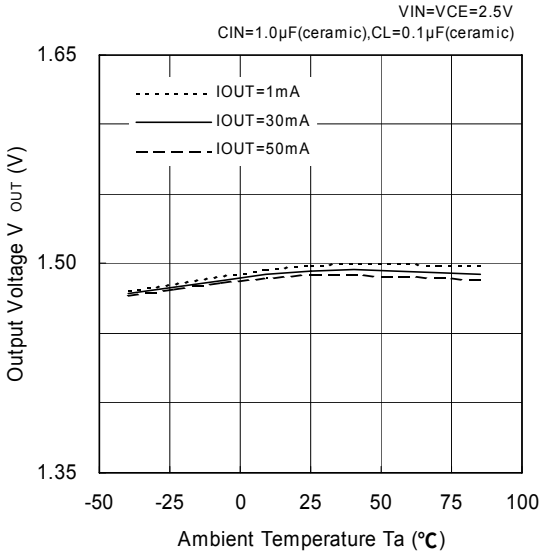
# ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(5) Output Voltage vs. Ambient Temperature

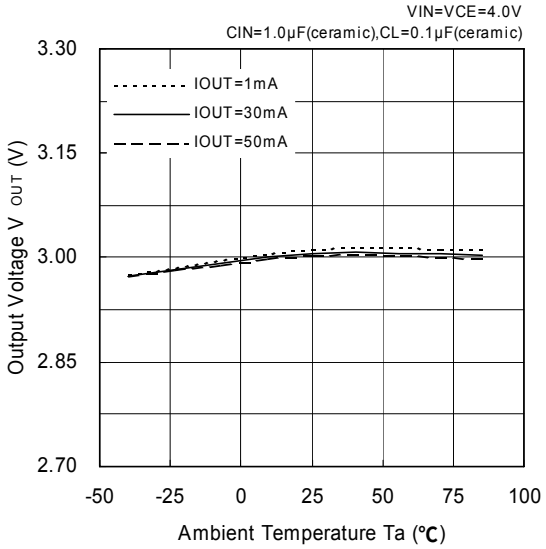
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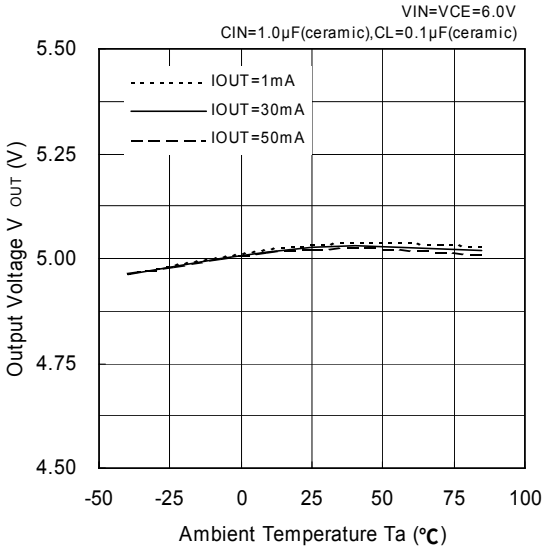

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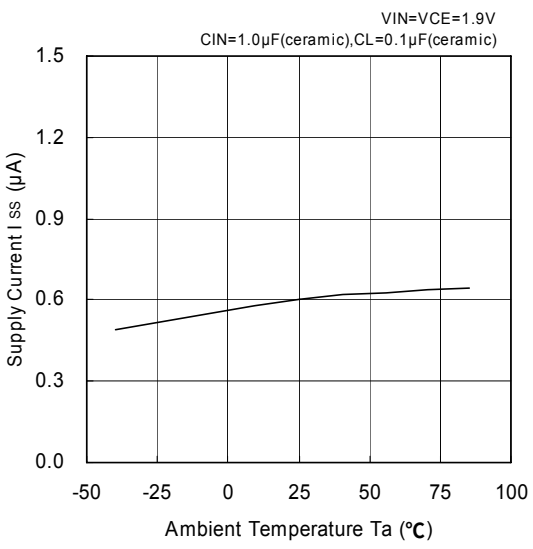



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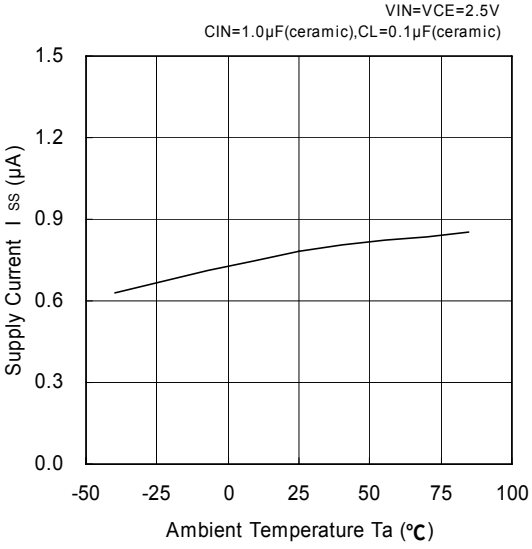



(6) Supply Current vs. Ambient Temperature

XC6215x092



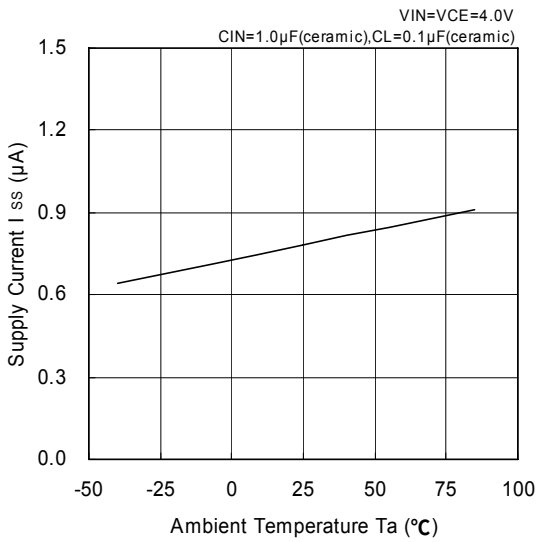

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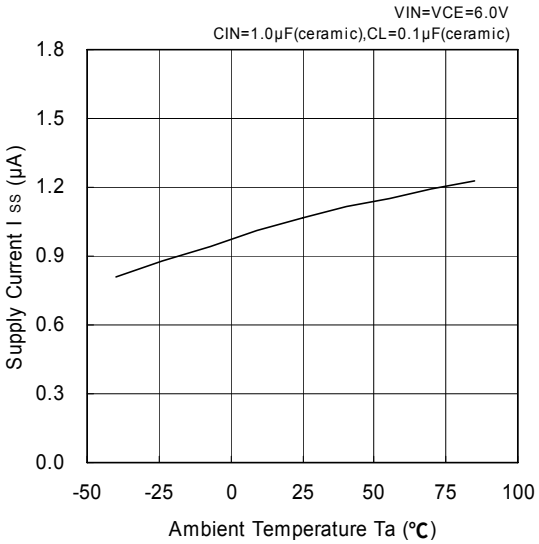
## ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(6) Supply Current vs. Ambient Temperature (Continued)

XC6215x302

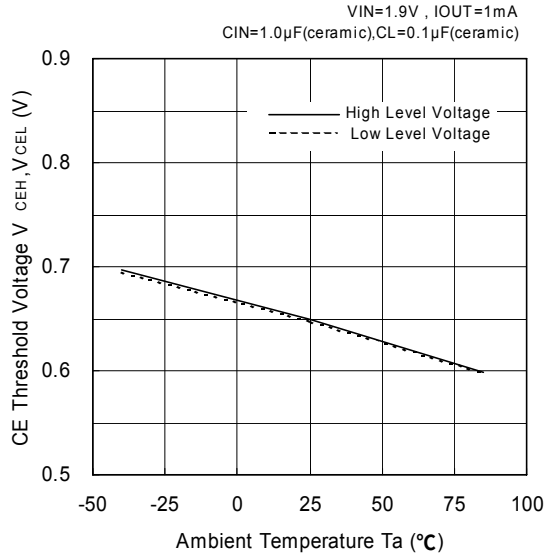



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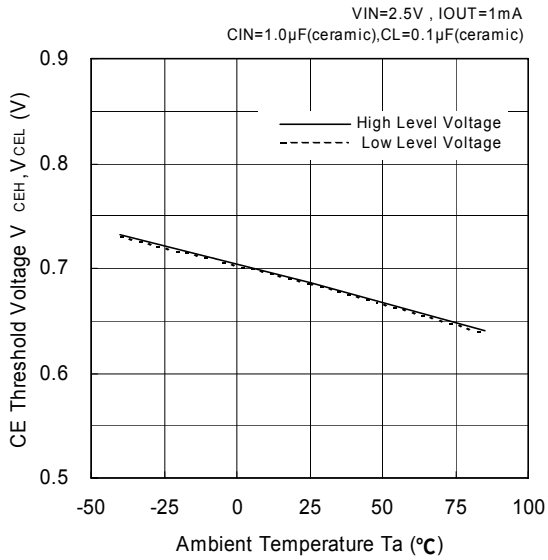



(7) CE Threshold Voltage vs. Ambient Temperature

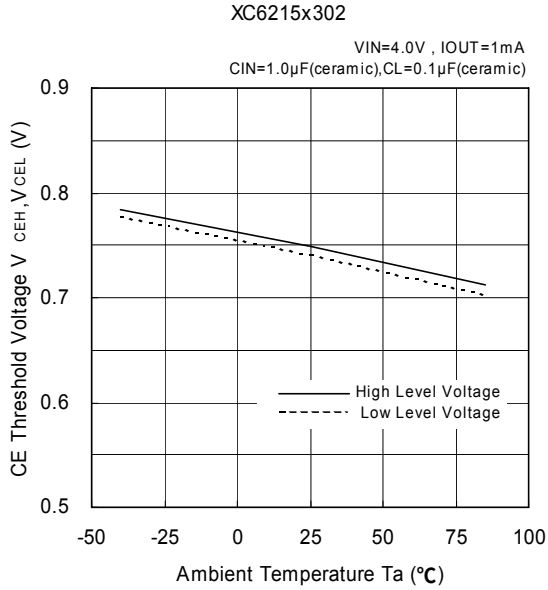
XC6215x092



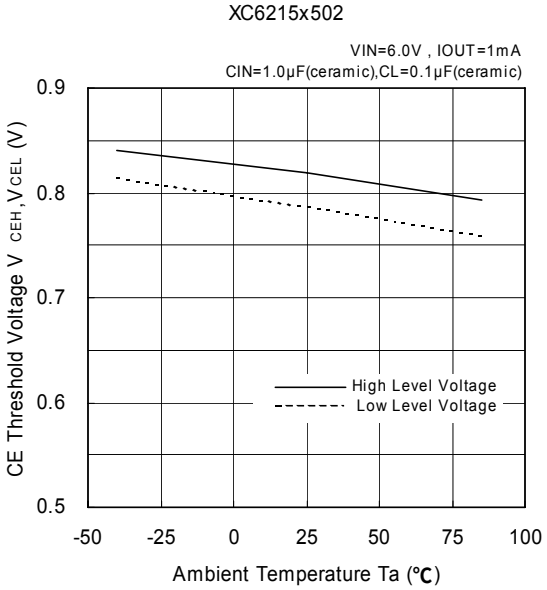

XC6215x152




XC6215x302



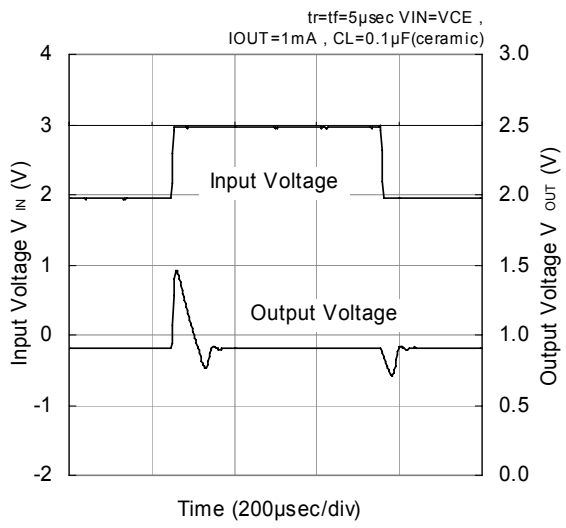

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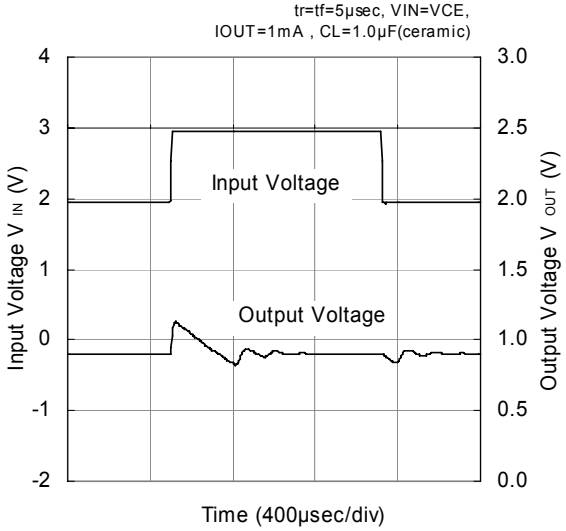
# ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(8) Input Transient Response

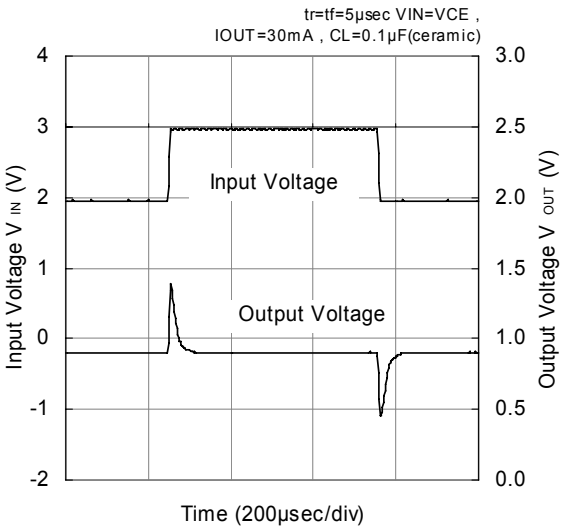
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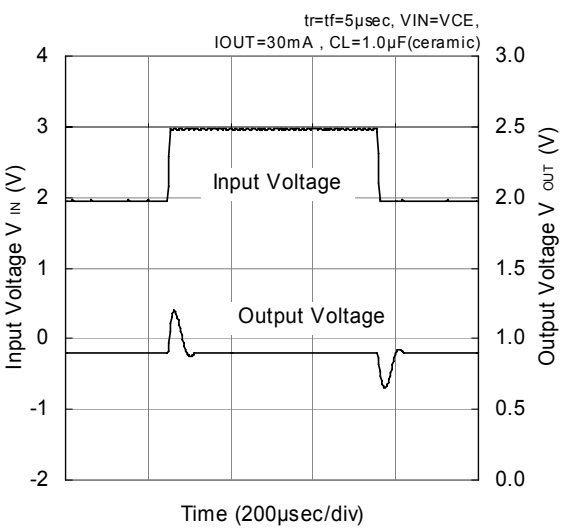

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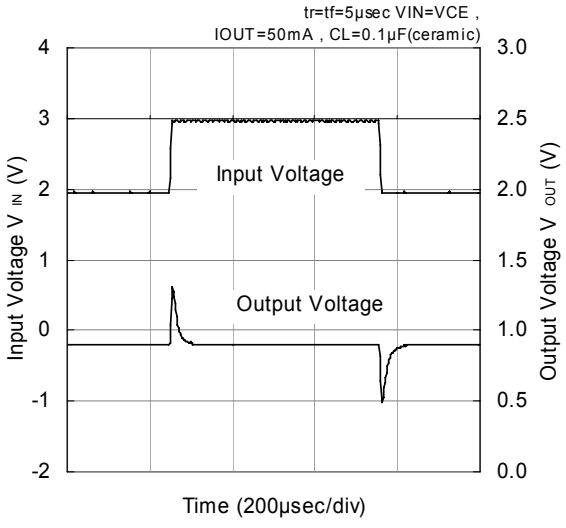

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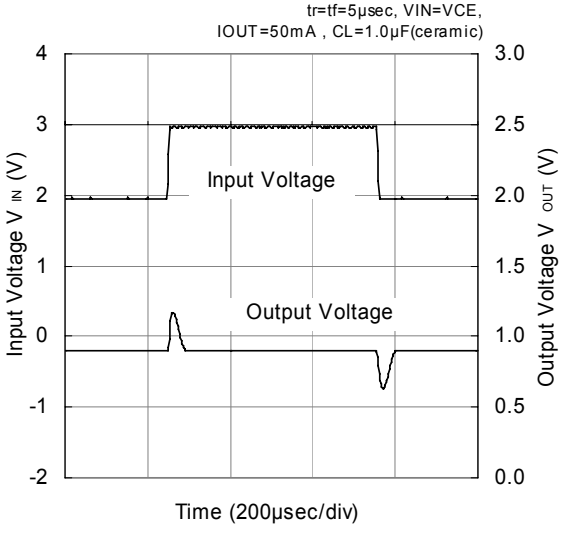

XC6215x092




XC6215x092




XC6215x092

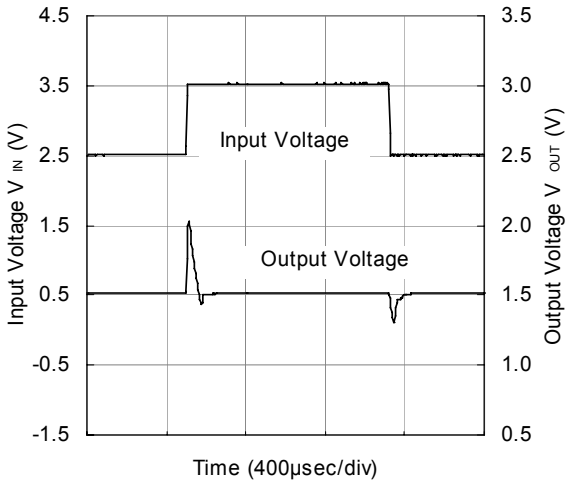


## ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(8) Input Transient Response (Continued)

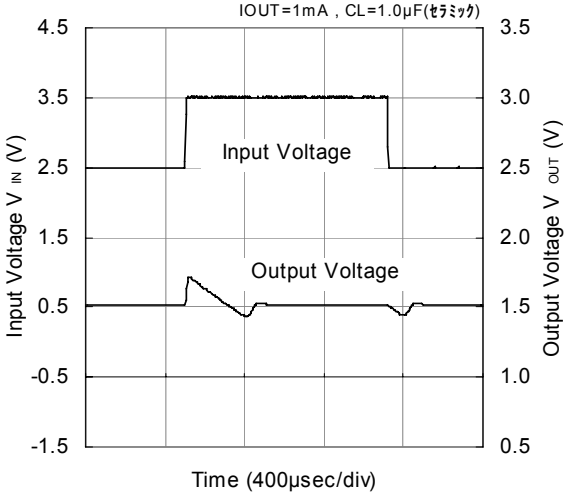
XC6215x152

tr=tf=5μsec VIN=VCE ,
IOUT=1mA , CL=0.1μF(ceramic)



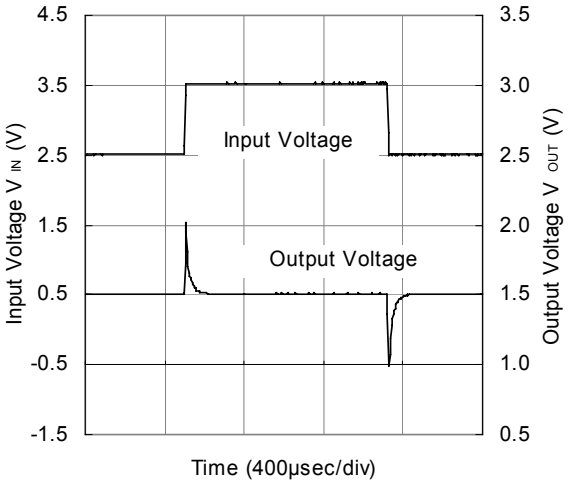

XC6215x152

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IOUT=1mA , CL=1.0μF(セラミック)



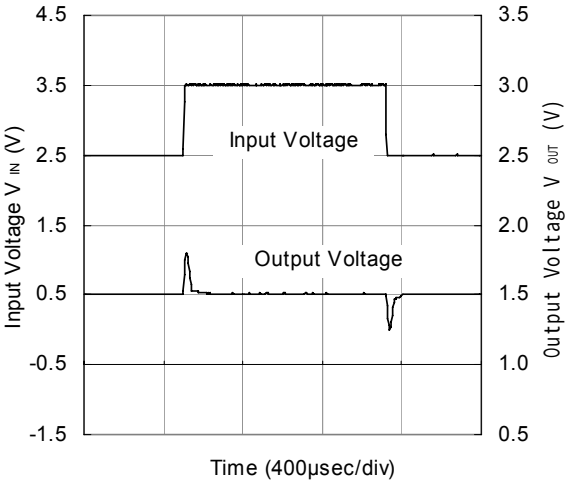

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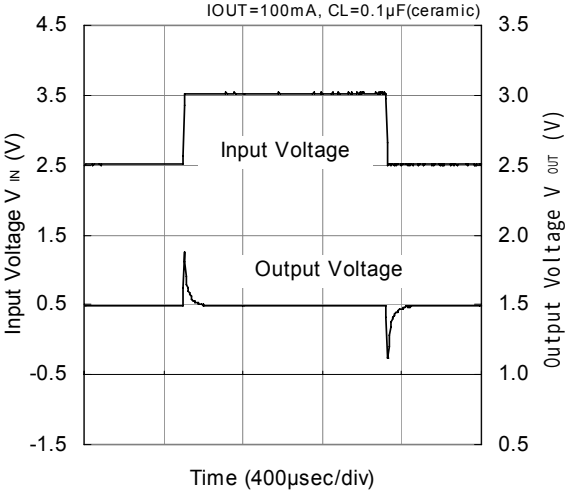

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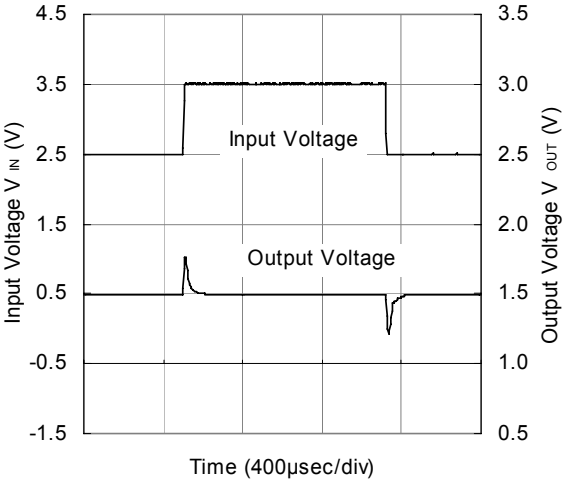

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XC6215x152

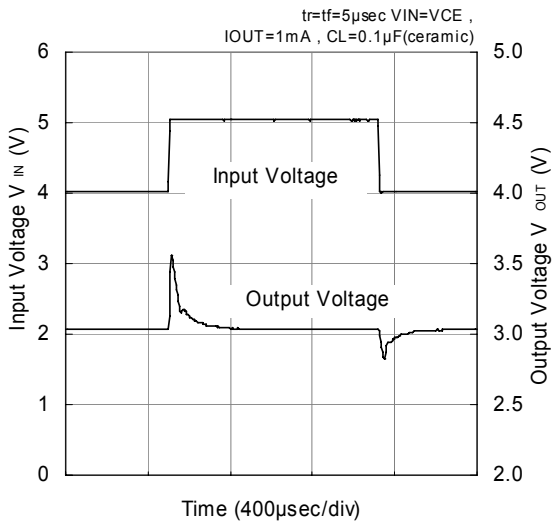
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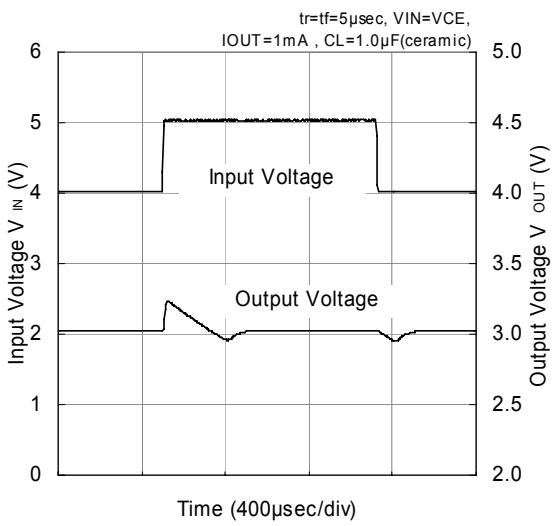
# ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(8) Input Transient Response (Continued)

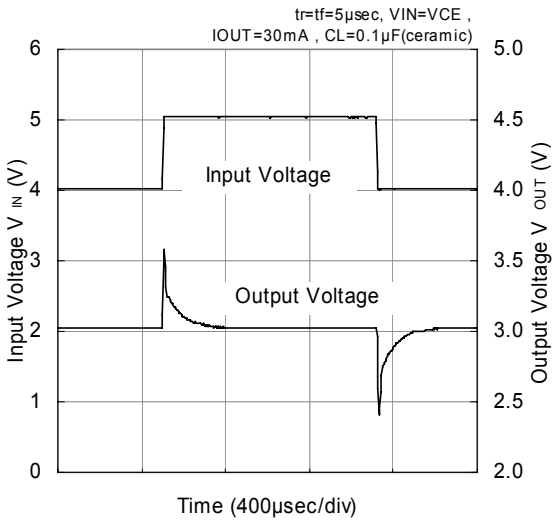
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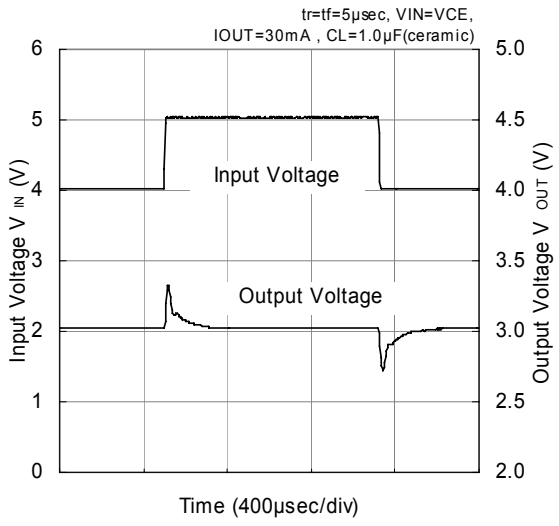

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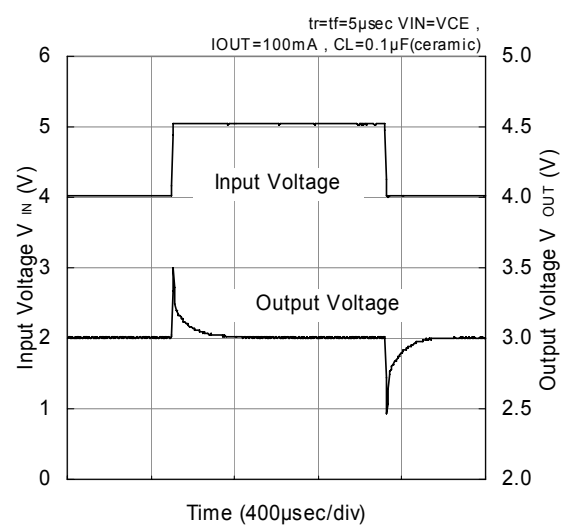

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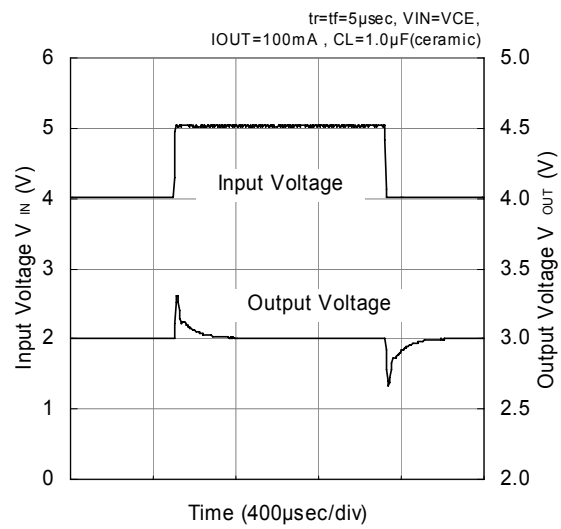

XC6215x302




XC6215x302




XC6215x302

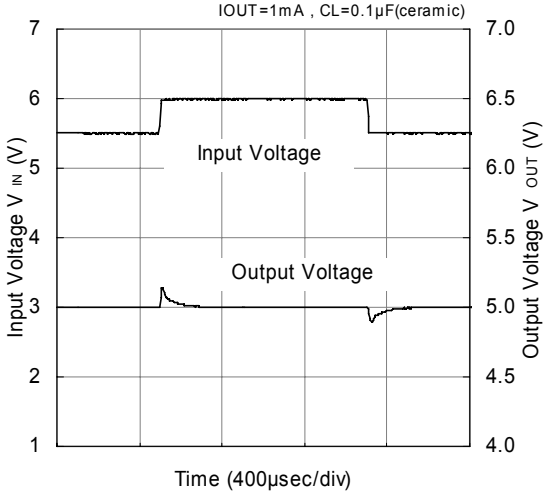


## ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(8) Input Transient Response (Continued)

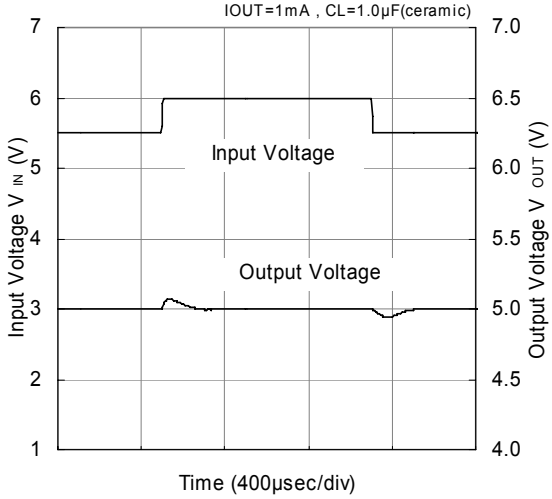
XC6215x502

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IOUT=1mA , CL=0.1μF(ceramic)



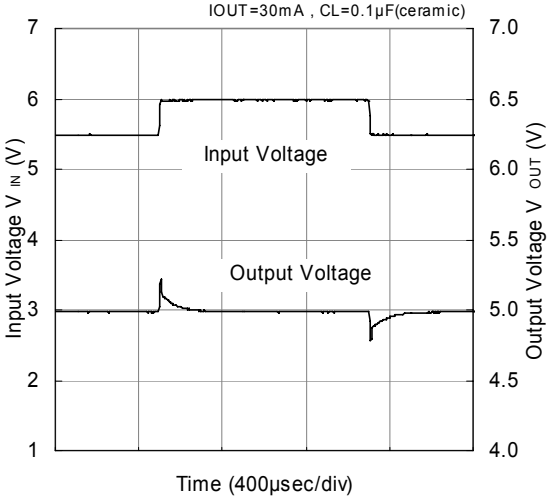

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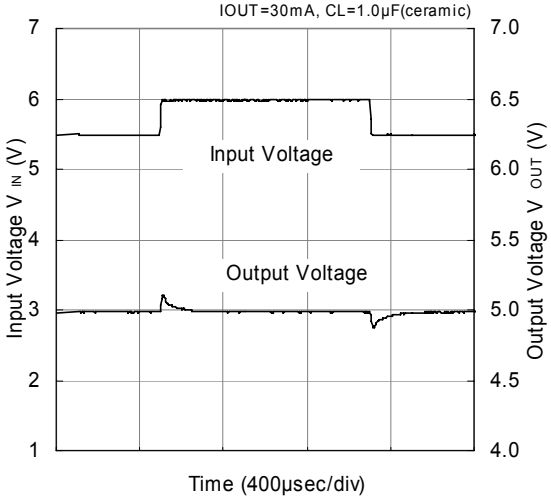

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tr=tf=5μsec, VIN=VCE,
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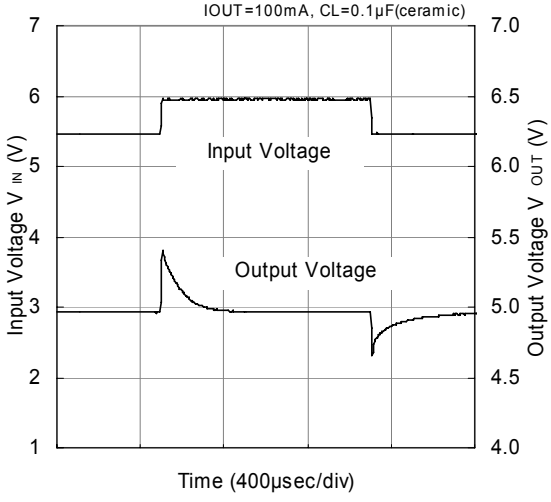

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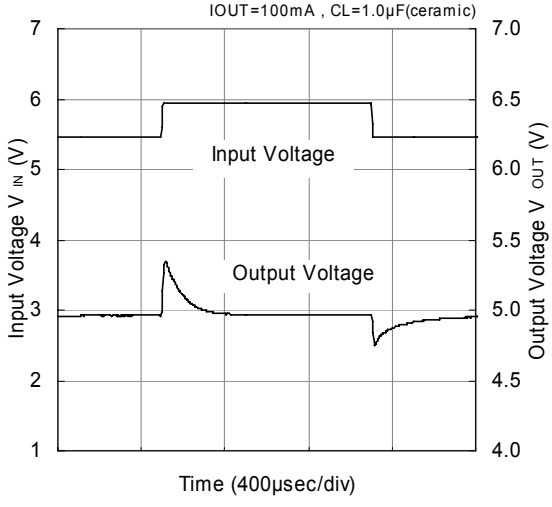

XC6215x502

tr=tf=5μsec, VIN=VCE,
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XC6215x502

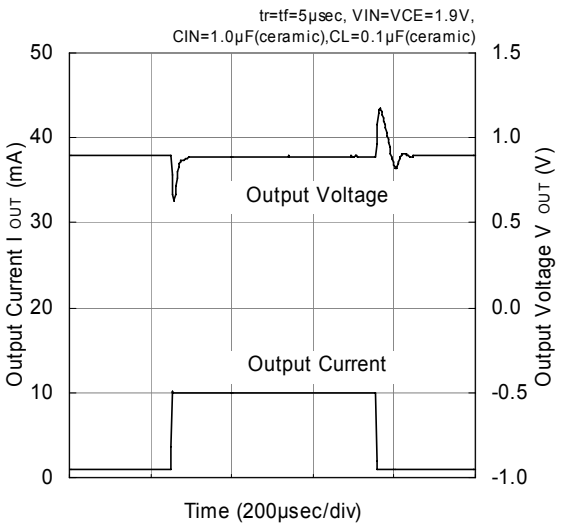
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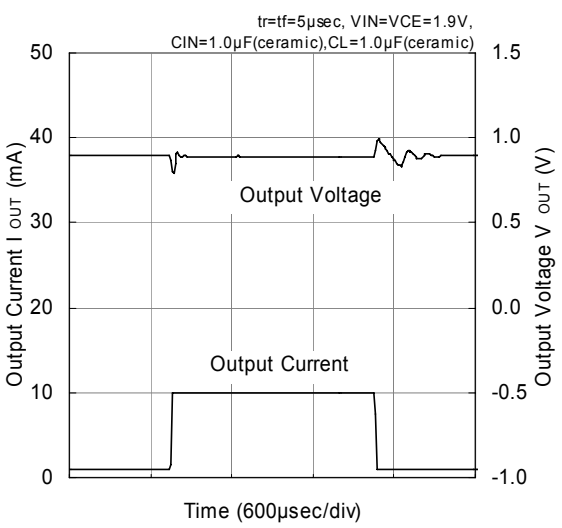
# ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(9) Load Transient Response

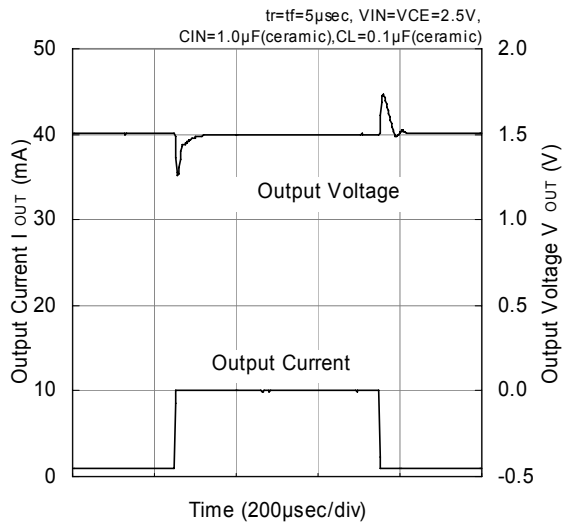
XC6215x092



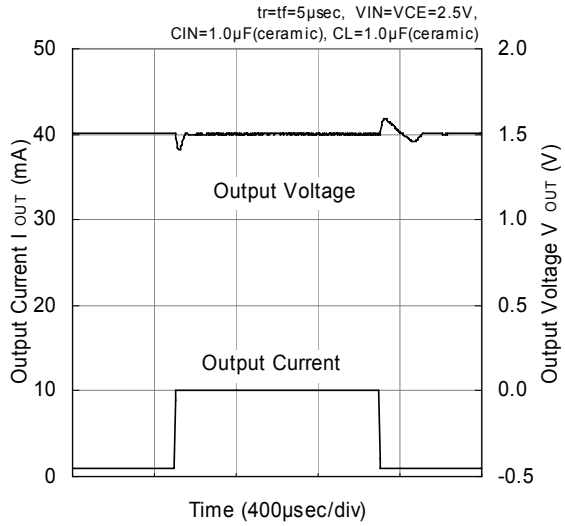

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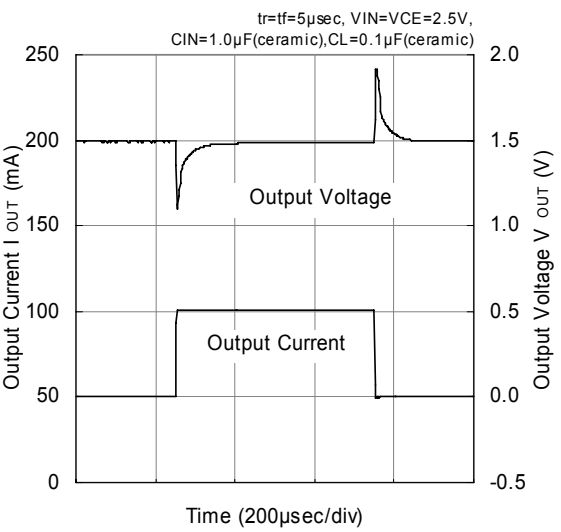

XC6215x152



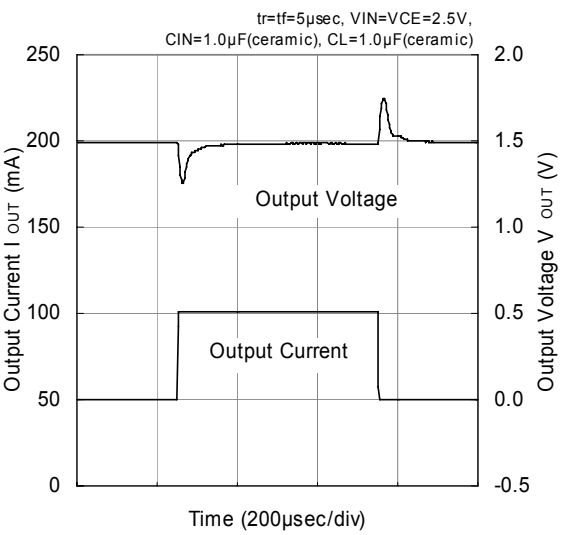

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XC6215x152



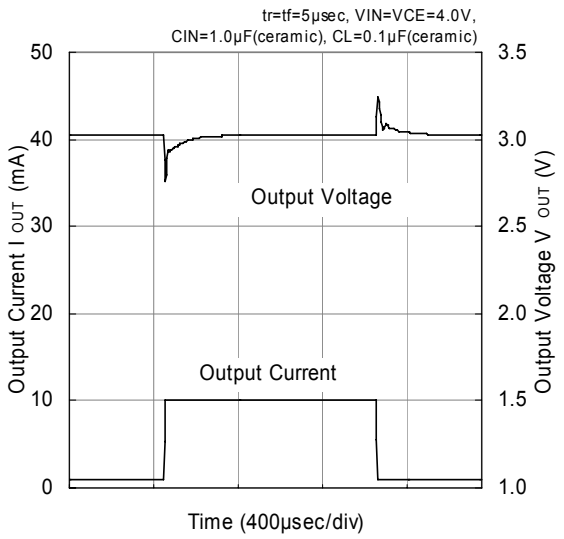

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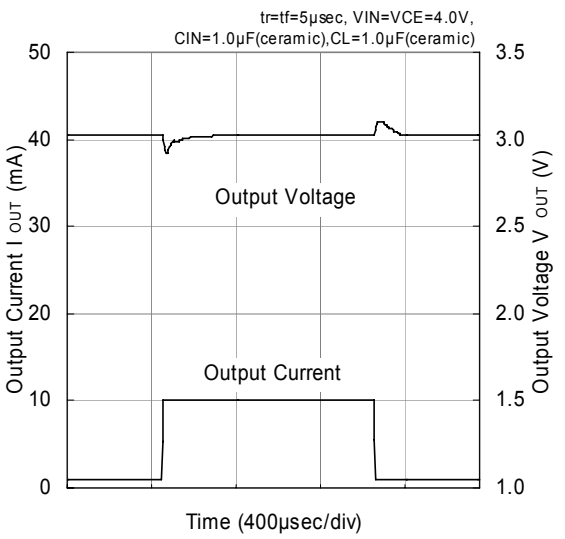
## ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(9) Load Transient Response (Continued)

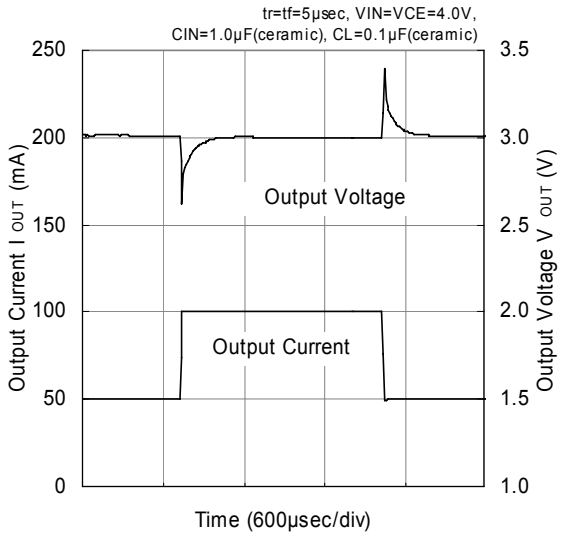
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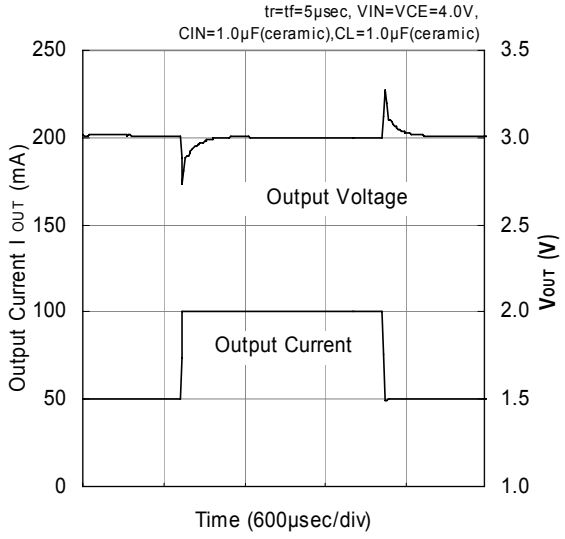

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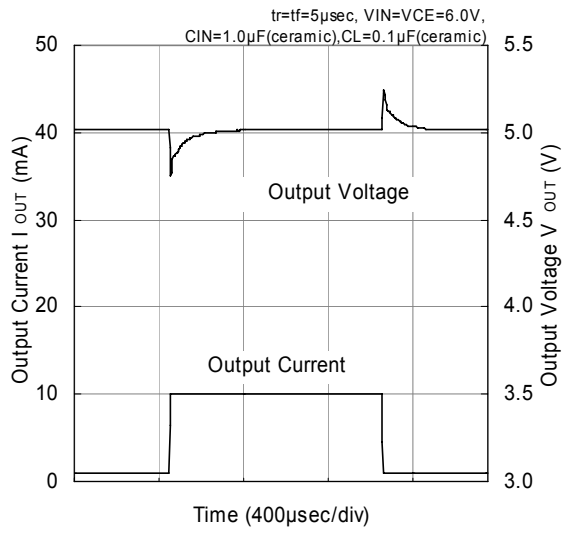

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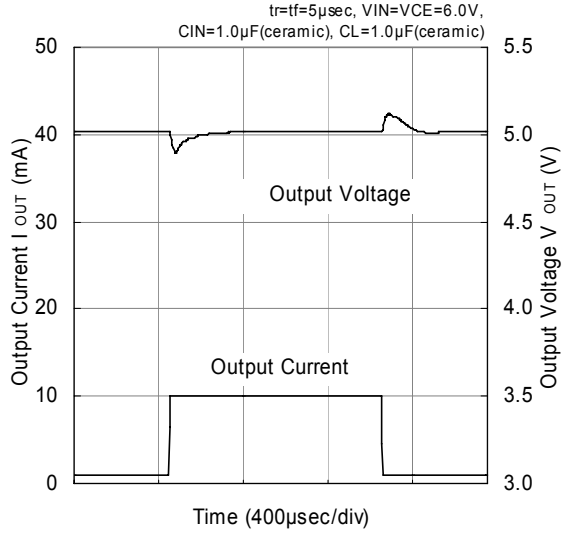

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XC6215x502



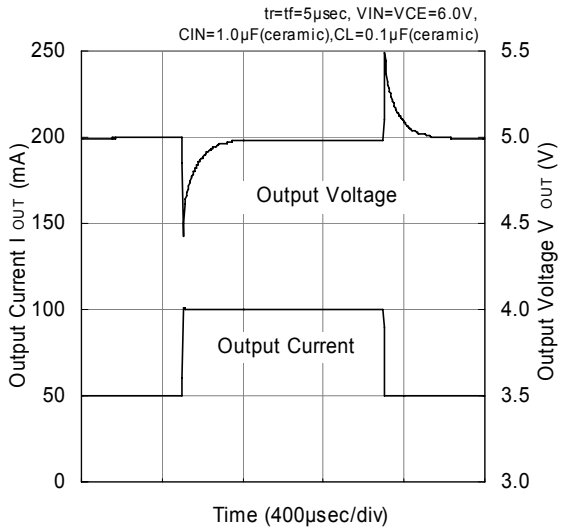

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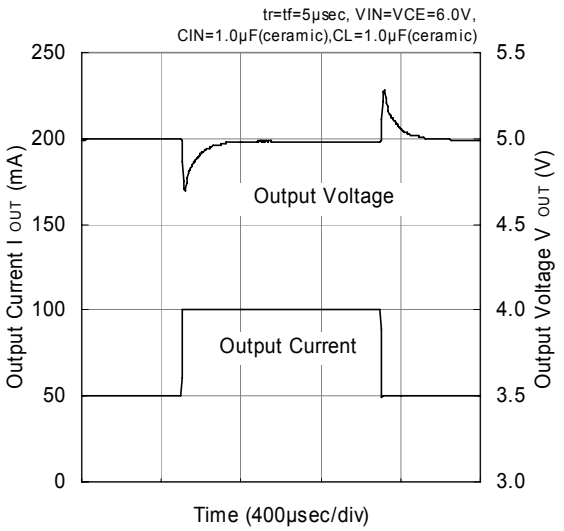
# ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(9) Load Transient Response (Continued)

XC6215x502

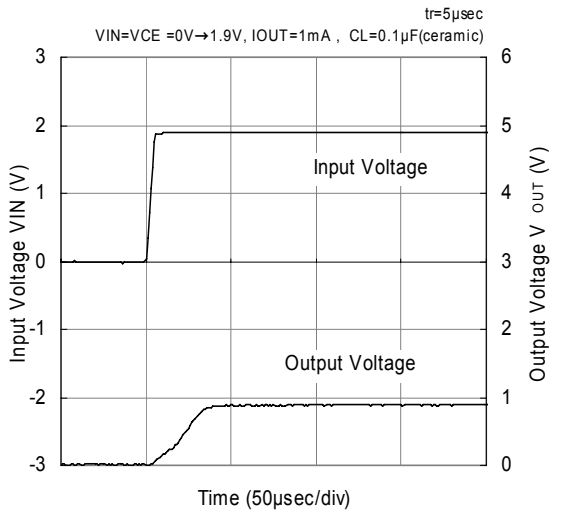



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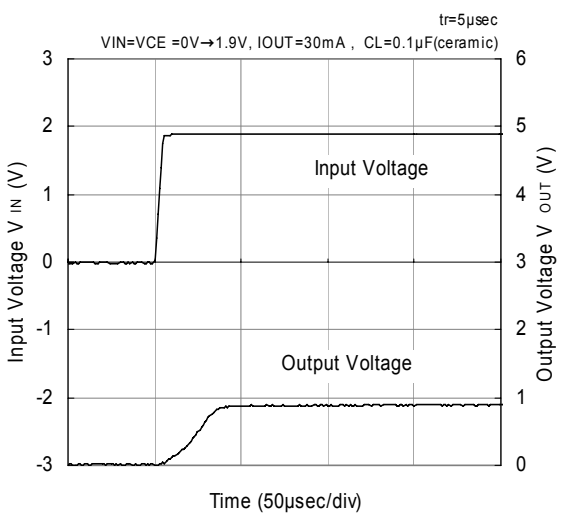



(10) Rising Response Time

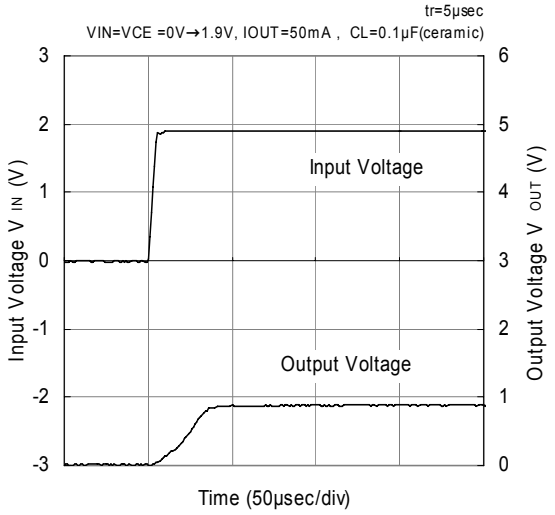
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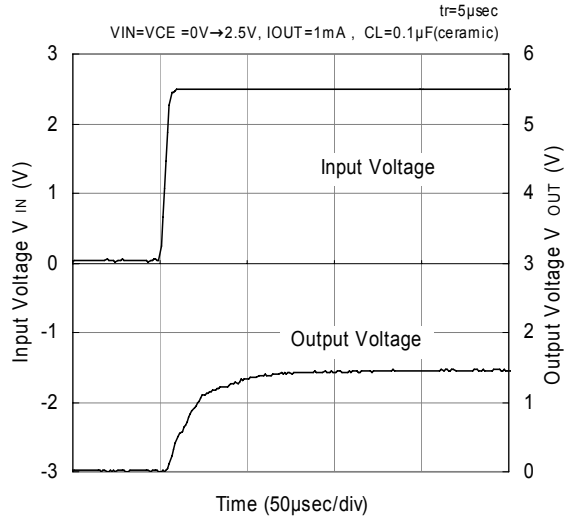

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XC6215x092



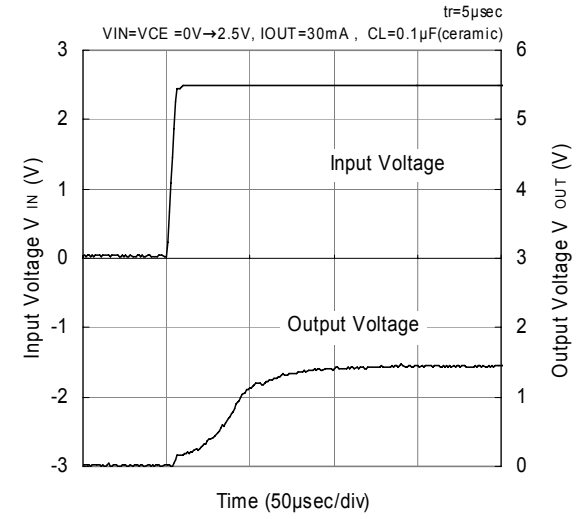

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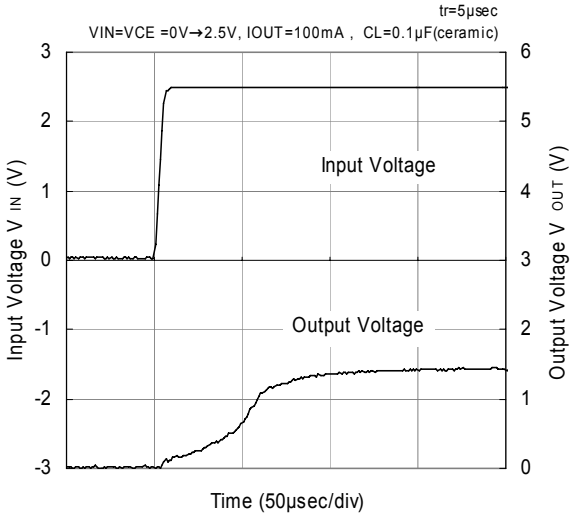
## ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(10) Rising Response Time (Continued)

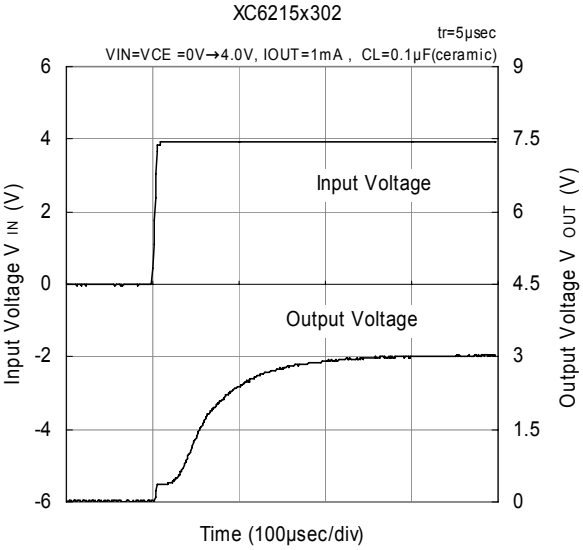
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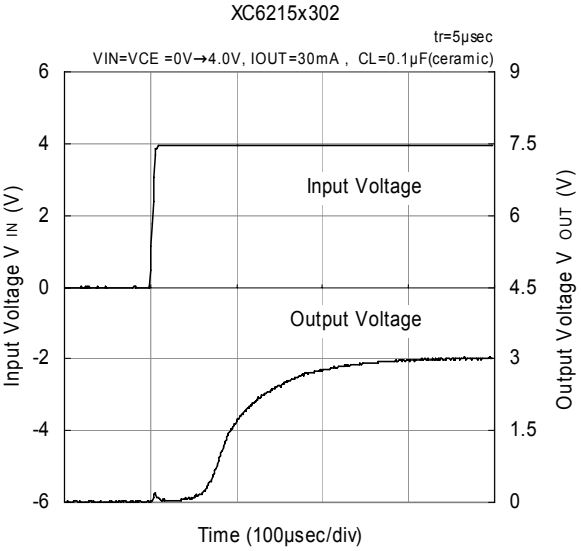

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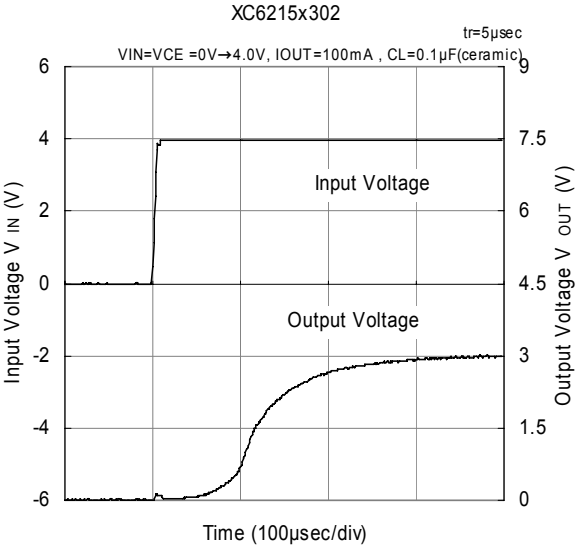

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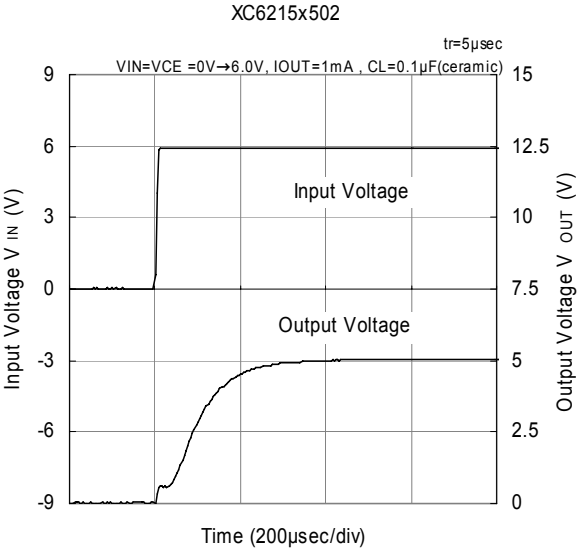

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XC6215x302



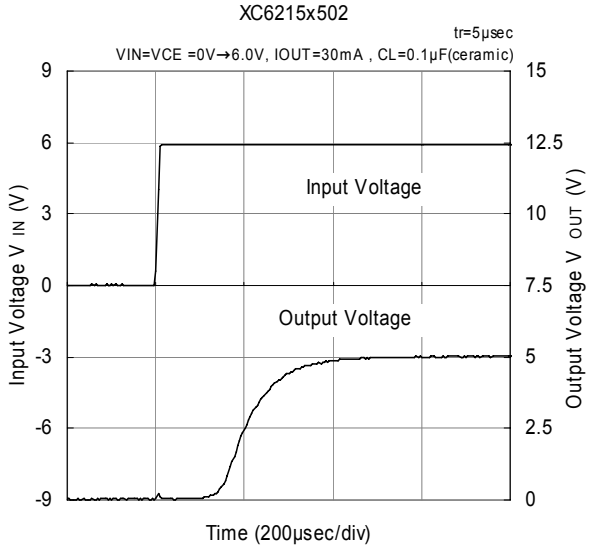

XC6215x502



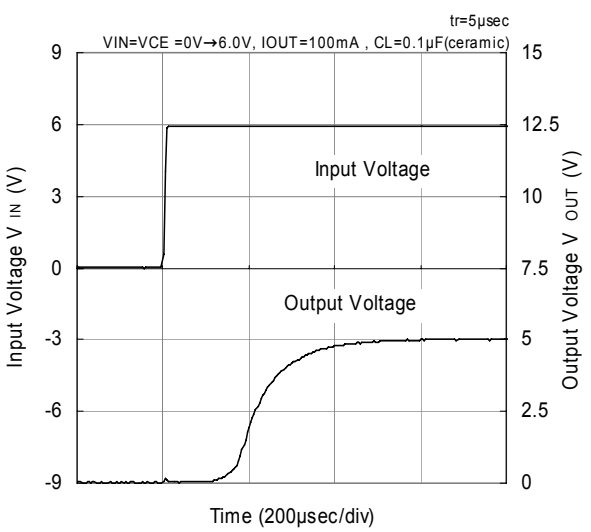
# ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(10) Rising Response Time (Continued)

XC6215x502

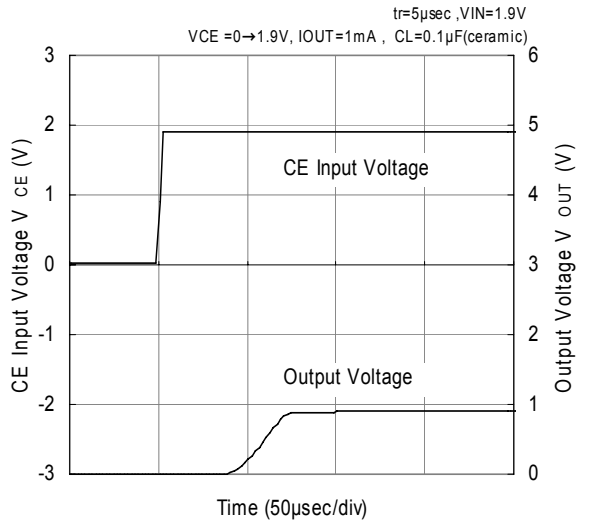



XC6215x502

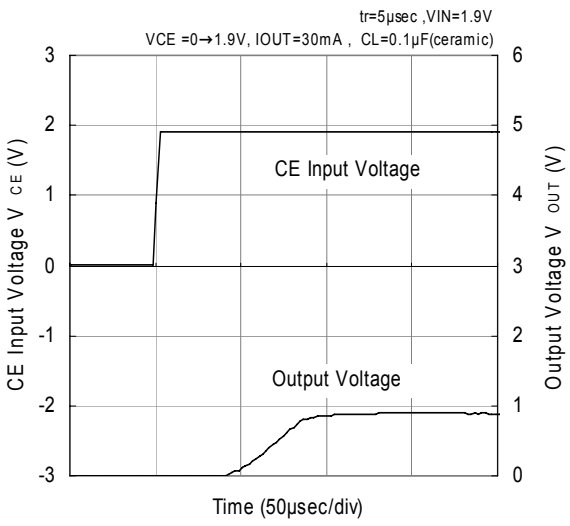



(11) CE Rising Response Time (For XC6215B Type)

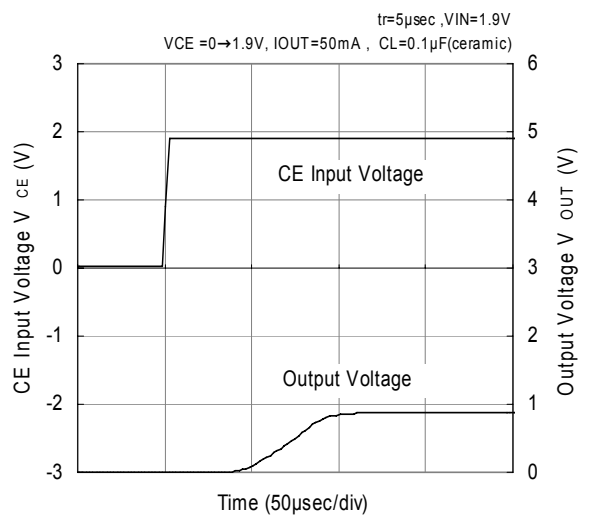
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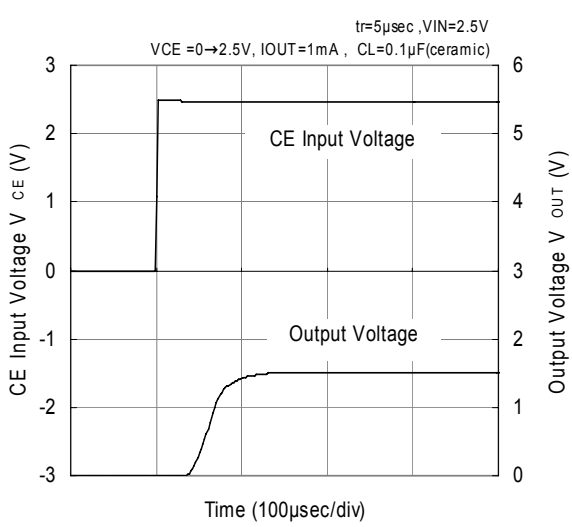

XC6215B092




XC6215B092



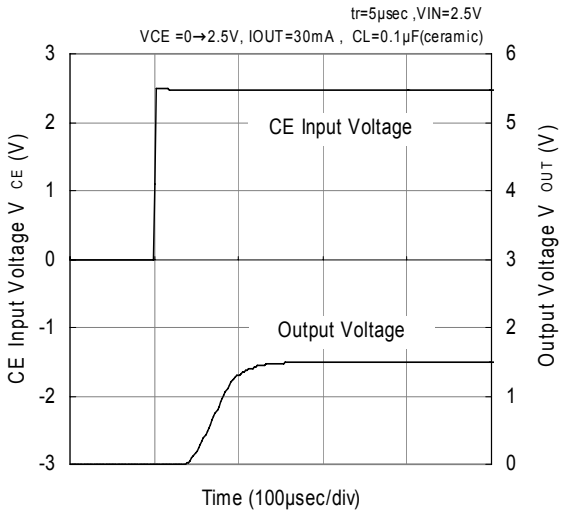

XC6215B152



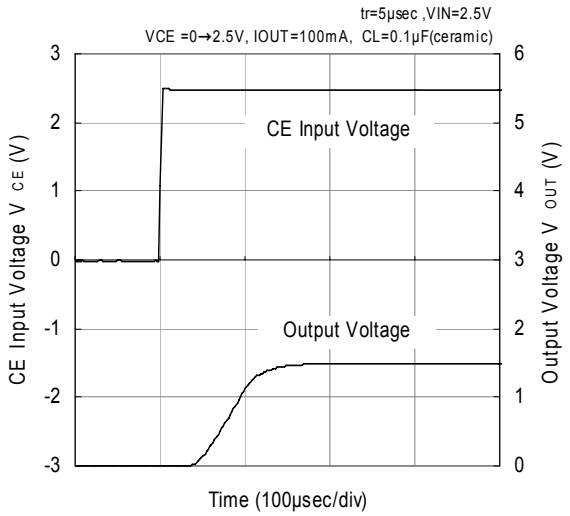
## ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(11) CE Rising Response Time (Continued)

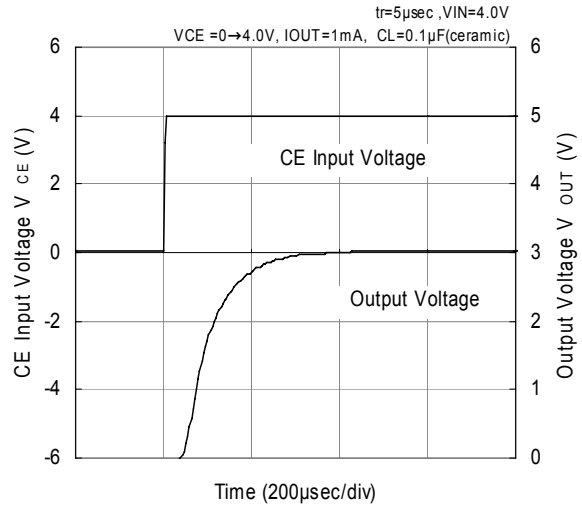
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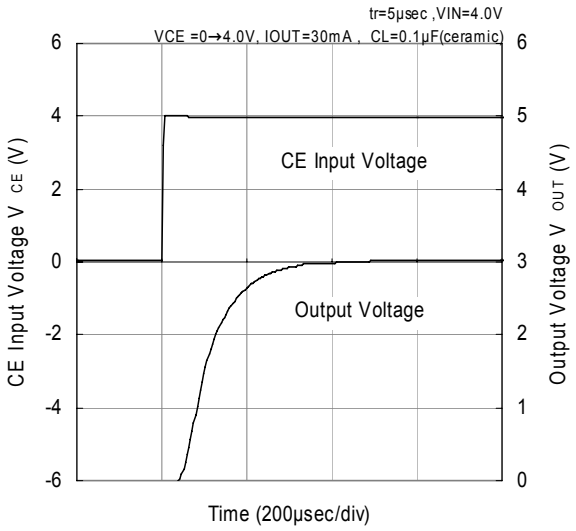

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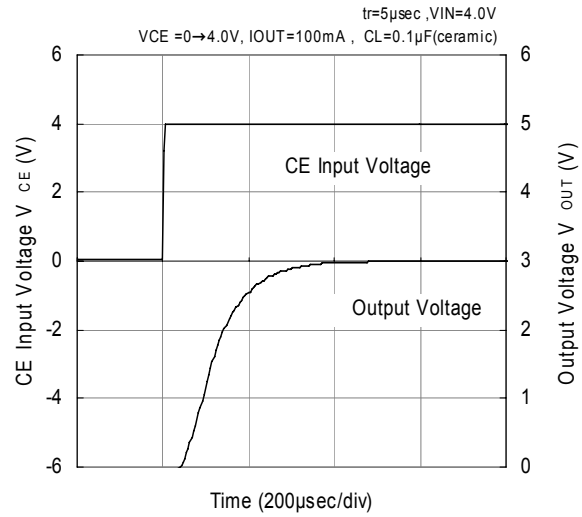

XC6215B302



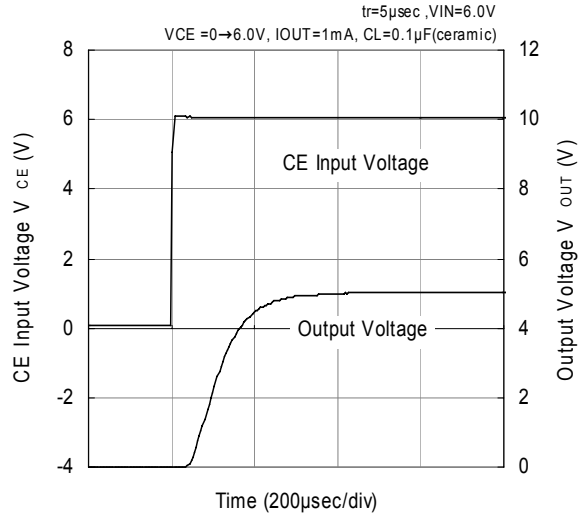

XC6215B302




XC6215B302



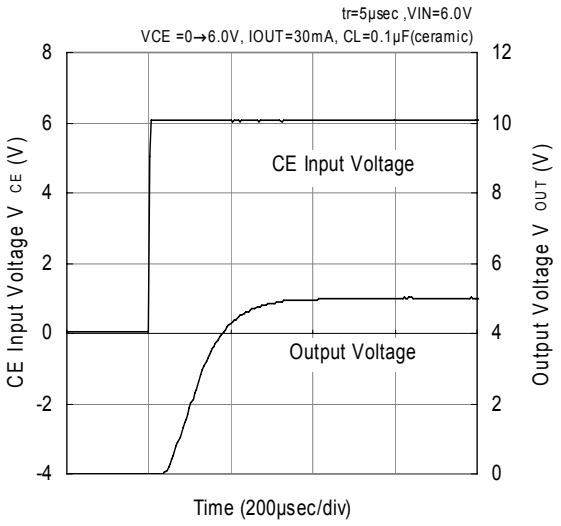

XC6215B502



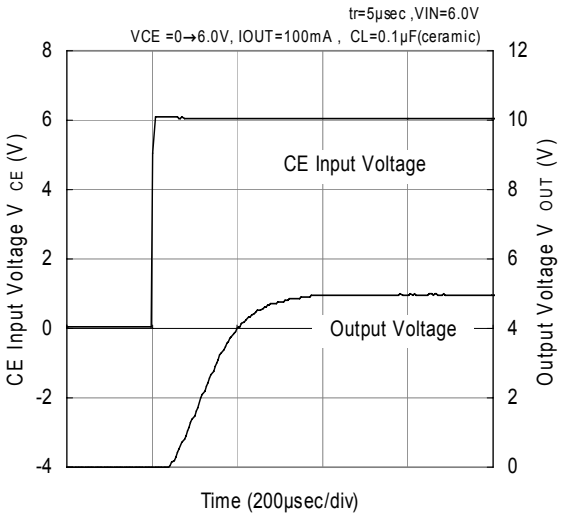
# ■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(11) CE Rising Response Time (For XC6215 Type)

XC6215B502

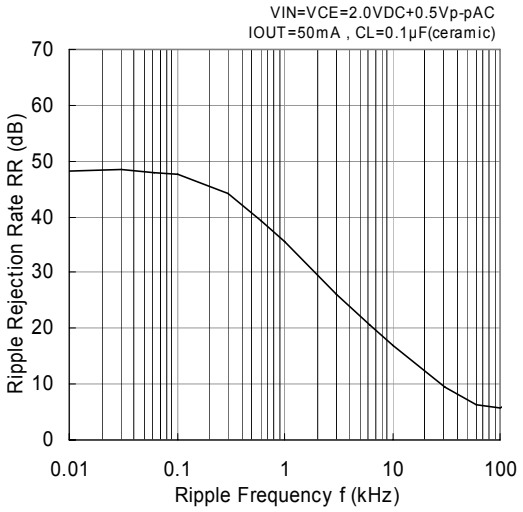



XC6215B502

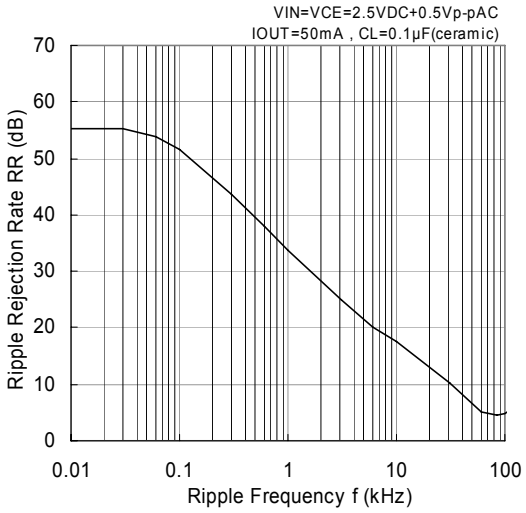



(12) Ripple Rejection Rate

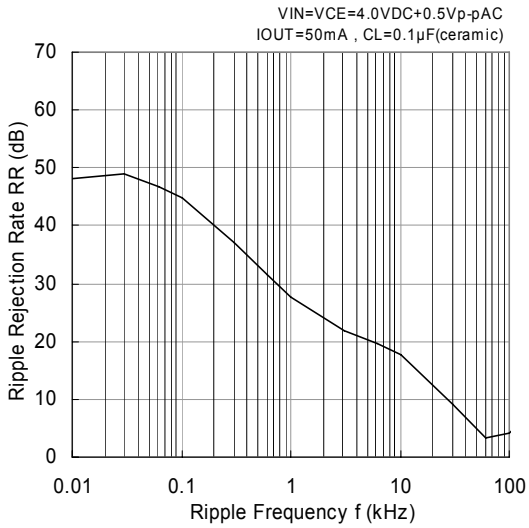
XC6215x092



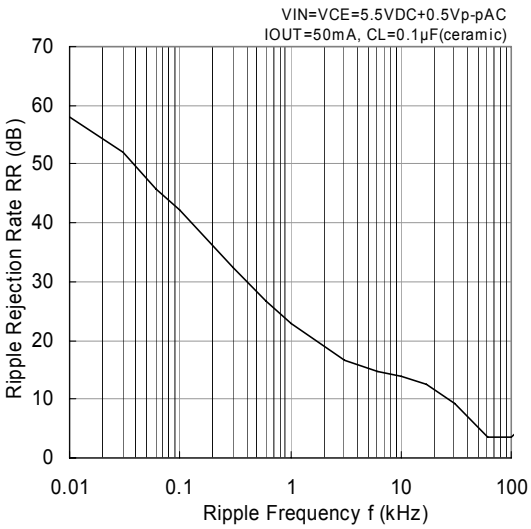

XC6215x152




XC6215x302

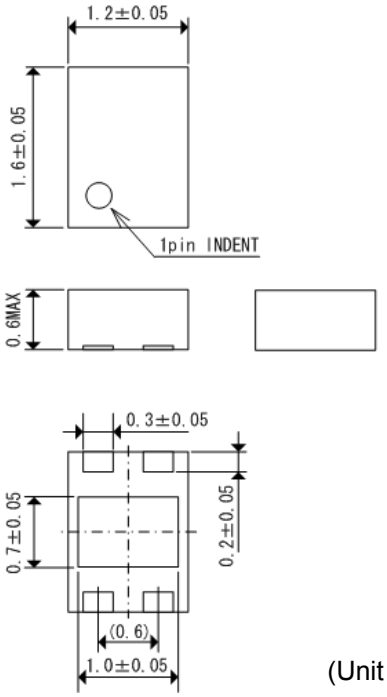



XC6215x502



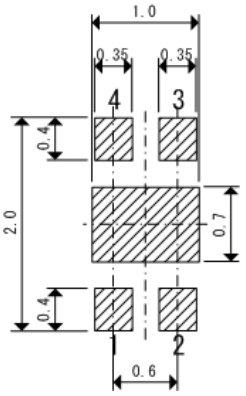
## ■PACKAGING INFORMATION

### ●USP-4

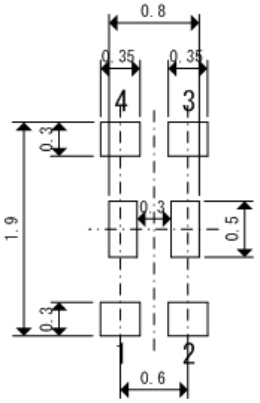



(Unit : mm)

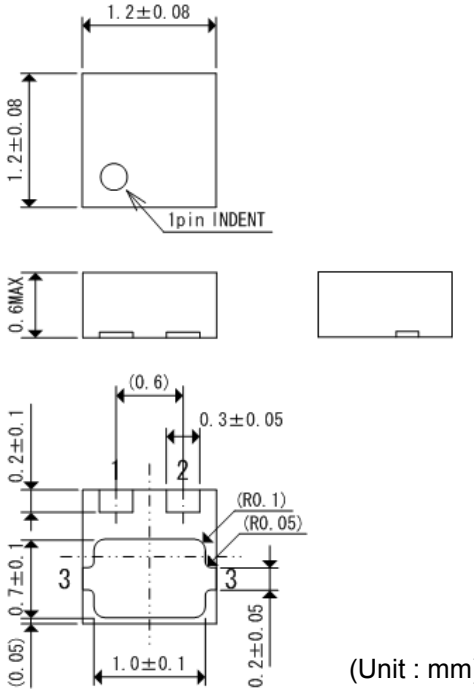
Reference pattern Layout




Reference metal mask design

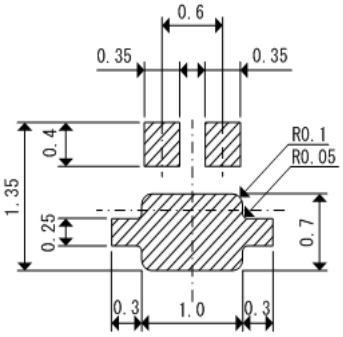



### ●USP-3

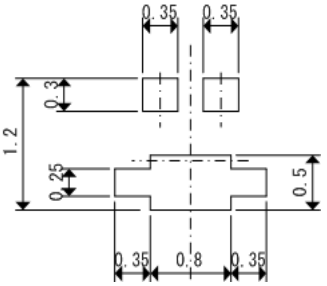



(Unit : mm)

Reference pattern Layout

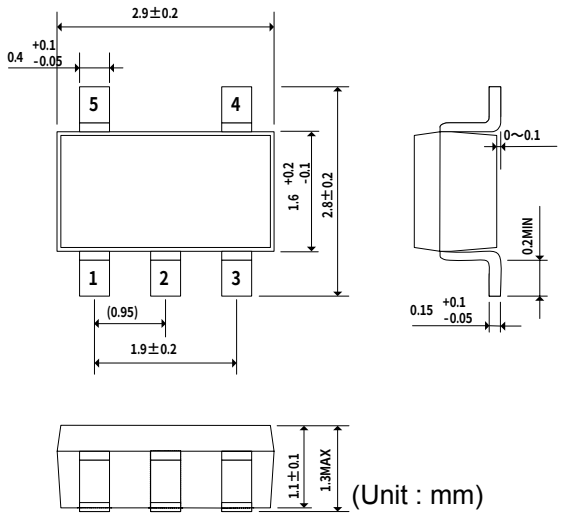



Reference metal mask design



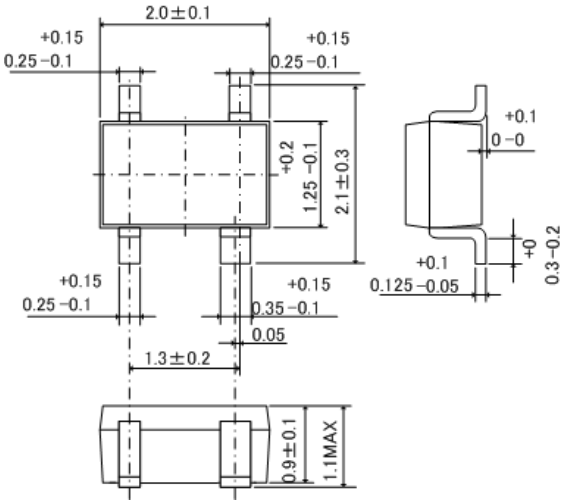
# ■PACKAGING INFORMATION (Continued)

●SOT-25



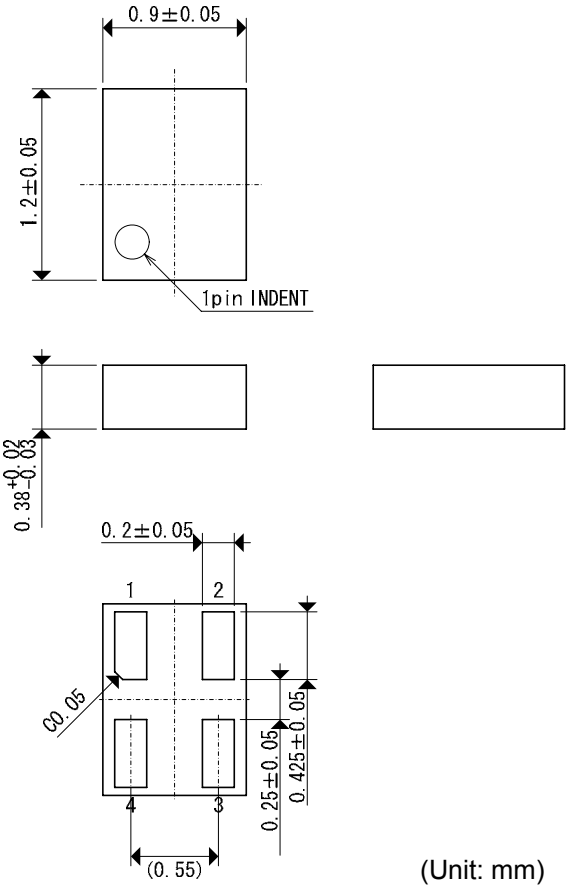

(Unit : mm)

●SSOT-24



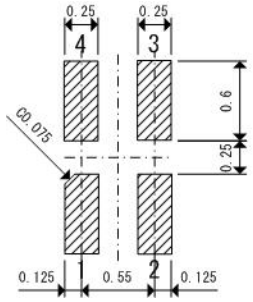

(Unit : mm)

●USPN-4

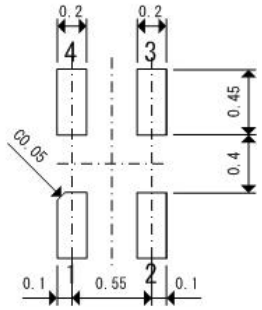



(Unit: mm)

Reference pattern Layout

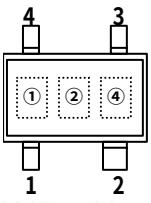



Reference metal mask design



## ■MARKING RULE

●SSOT-24




SSOT-24
(TOP VIEW)

① represents type of regulator and output voltage range

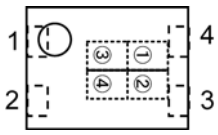
| MARK | TYPE | OUTPUT VOLTAGE RANGE | PRODUCT SERIES |
|---|---|---|---|
| T | CE pin, High Active with no pull-down resistor built in | 0.9V ~ 3.0V | XC6215Bxxxxx |
| U | | 3.1V ~ 5.0V | |

② represents decimal point of output voltage

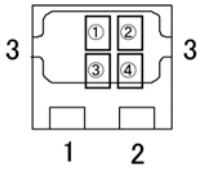
| MARK | OUTPUT VOLTAGE (V) | | | MARK | OUTPUT VOLTAGE (V) | | |
|---|---|---|---|---|---|---|---|
| 0 | - | 3.1 | - | F | 1.6 | 4.6 | - |
| 1 | - | 3.2 | - | H | 1.7 | 4.7 | - |
| 2 | - | 3.3 | - | K | 1.8 | 4.8 | - |
| 3 | - | 3.4 | - | L | 1.9 | 4.9 | - |
| 4 | - | 3.5 | - | M | 2.0 | 5.0 | - |
|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

③ represents production lot number
0 to 9, A to Z repeated. (G, I, J, O, Q, W excluded)
NOTE: No character inversion used.

●USP-4, USP-3




USP-4
(TOP VIEW)




USP-3
(TOP VIEW)

① represents product series

| MARK | PRODUCT SERIES |
|---|---|
| E | XC6215xxxxxx |

② represents type of regulator and output voltage range

| MARK | TYPE | OUTPUT VOLTAGE RANGE | PRODUCT SERIES |
|---|---|---|---|
| T | CE pin, High Active with no pull-down resistor built in | 0.9V ~ 3.0V | XC6215xxxxxx |
| U | | 3.1V ~ 5.0V | |

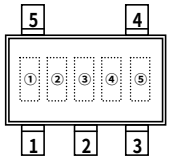
③ represents output voltage

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

④ represents production lot number
0 to 9, A to Z repeated. (G, I, J, O, Q, W excluded)
NOTE: No character inversion used.

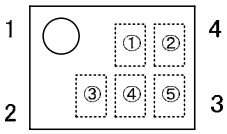
# ■MARKING RULE (Continued)

●SOT-25




SOT-25
(TOP VIEW)

●USPN-4




USPN-4
(TOP VIEW)

① represents product series

| MARK | PRODUCT SERIES |
|---|---|
| E | XC6215xxxxxx |

② represents type of regulators and output voltage range

| MARK | TYPE | OUTPUT VOLTAGE RANGE | PRODUCT SERIES |
|---|---|---|---|
| T | CE pin, High Active with no pull-down resistor built in | 0.9V~3.0V | XC6215xxxxxx |
| U | | 3.1V~5.0V | |

③ represents output voltage

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

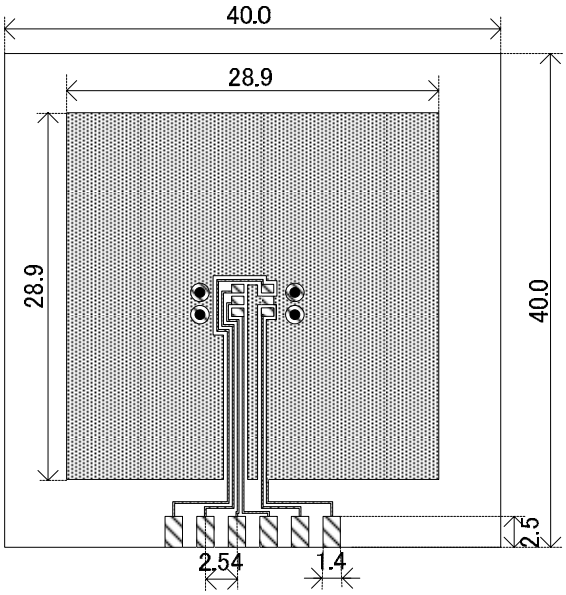
④⑤ represents production lot number
0 to 9, A to Z repeated. (G, I, J, O, Q, W excluded)
NOTE: No character inversion used.

● 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 one of reference data taken in the described condition.

1. Measurement Condition (Reference data)

| | |
|---|---|
| Condition: | Mount on a board |
| Ambient: | Natural convection |
| Soldering: | Lead (Pb) free |
| Board: | Dimensions 40 x 40 mm (1600 $mm^2$ 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 | |

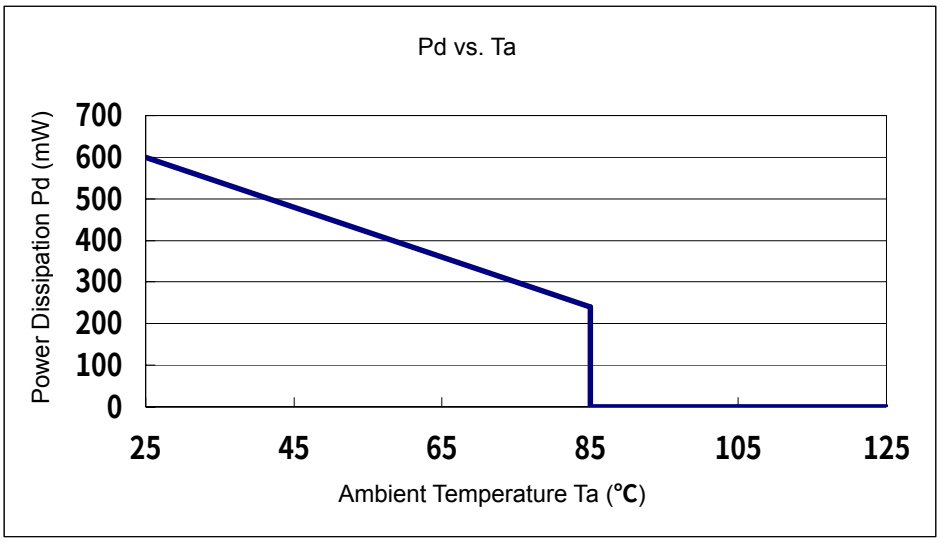



Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient temperature

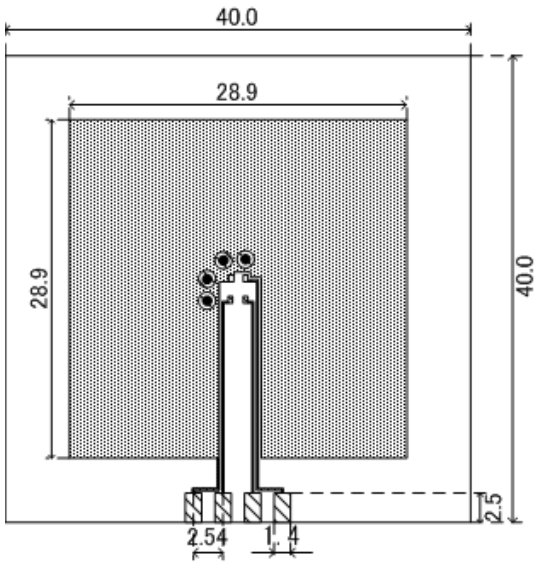
Board Mount (Tj max = 125℃)

| Ambient Temperature (℃) | Power Dissipation Pd (mW) | Thermal Resistance (℃/W) |
|---|---|---|
| 25 | 600 | 166.67 |
| 85 | 240 | |



● SSOT-24 Power Dissipation

Power dissipation data for the SSOT-24 is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as one of reference data taken in the described condition.



Evaluation Board (Unit: mm)

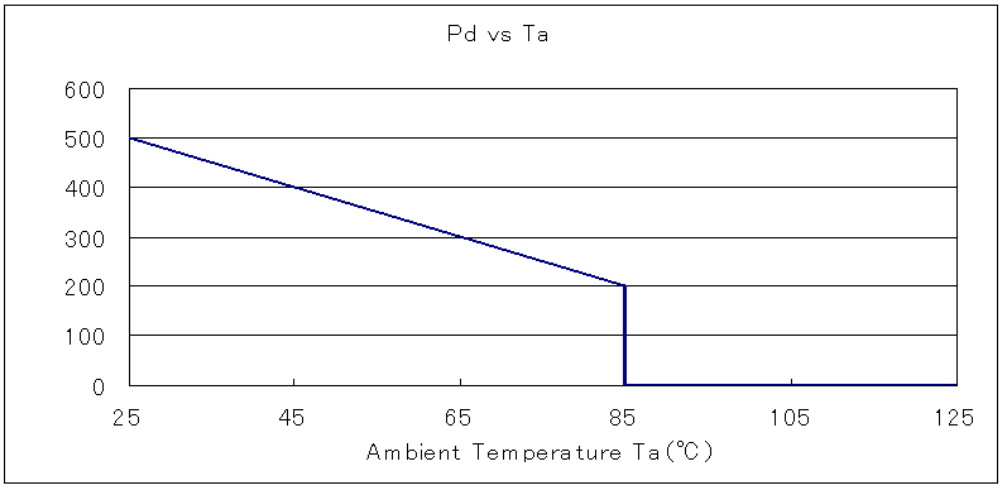
1. Measurement Condition (Reference data)

| | |
|---|---|
| Condition: | Mount on a board |
| Ambient: | Natural convection |
| Soldering: | Lead (Pb) free |
| Board: | Dimensions 40 x 40 mm (1600 $mm^2$ 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 |

2. Power Dissipation vs. Ambient temperature

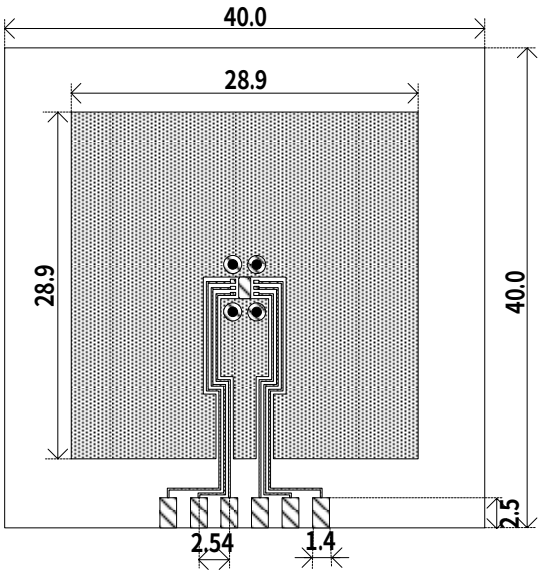
Board Mount (Tj max = 125°C)

| Ambient Temperature (°C) | Power Dissipation Pd (mW) | Thermal Resistance (°C/W) |
|---|---|---|
| 25 | 500 | 200.00 |
| 85 | 200 | |



● USP-4 Power Dissipation

Power dissipation data for the USP-4 is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as one of reference data taken in the described condition.




Evaluation Board (Unit: mm)

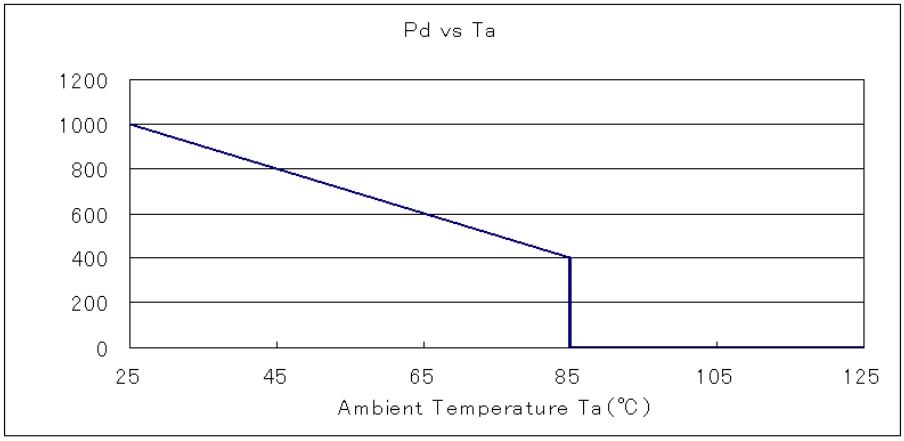
1. Measurement Condition (Reference data)

| | |
|---|---|
| Condition: | Mount on a board |
| Ambient: | Natural convection |
| Soldering: | Lead (Pb) free |
| Board: | Dimensions 40 x 40 mm (1600 $mm^2$ 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 |

2. Power Dissipation vs. Ambient temperature

Board Mount (Tj max = 125°C)

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

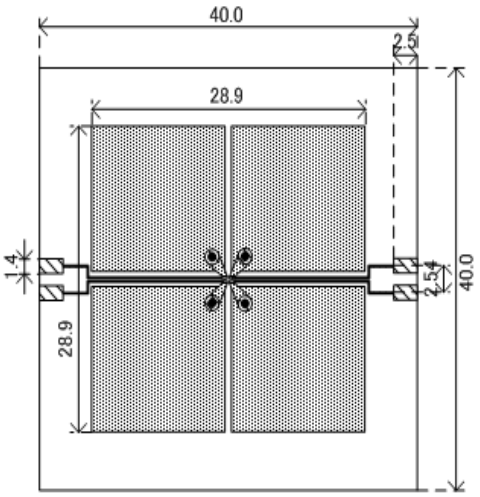


● USPN-4 Power Dissipation

Power dissipation data for the USPN-4 is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as one of reference data taken in the described condition.

1.Measurement Condition (Reference data)

| | |
|---|---|
| Condition: | Mount on a board |
| Ambient: | Natural convection |
| Soldering: | Lead (Pb) free |
| Board: | Dimensions 40 x 40 mm (1600 $mm^2$ in one side) |
| | Copper (Cu) traces occupy 50% of the front and 50% of the back. |
| | The copper area is divided into four block, one block is 12.5% of total. |
| | The USPN-4 package has for terminals. |
| | Each terminal connects one copper block in the front and one in the back. |
| Material: | Glass Epoxy (FR-4) |
| Thickness: | 1.6 mm |
| Through-hole: | 4 x 0.8 Diameter |

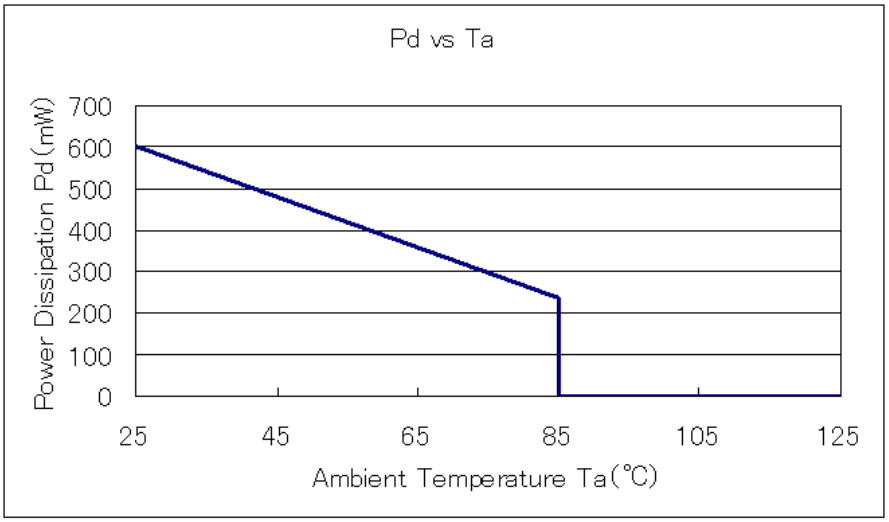



Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient temperature

Board Mount (Tj max = 125℃)

| Ambient Temperature (℃) | Power Dissipation Pd (mW) | Thermal Resistance (℃/W) |
|---|---|---|
| 25 | 600 | 166.67 |
| 85 | 240 | |



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