

## VOLTAGE REGULATOR (with Wide Input Voltage Range) with RESET R1150Hxxxx series

### ■ OUTLINE

The R1150Hxxxx series are CMOS-based voltage regulator (VR) ICs equipped with a voltage detector (V<sub>DET</sub>). VR function of the R1150Hxxxx has features of low dropout voltage, high output voltage accuracy, and ultra-low supply current. Each of the R1150HxxxxA types includes also a chip enable circuit. The output of built-in voltage detector is Nch open drain type. The R1150HxxxxC/D types have a pin for connecting external capacitor to set a certain reset delay time instead of chip enable control pin.

The regulator output voltage and the detector threshold voltage are fixed in the IC. The output voltage accuracy is  $\pm 2.0\%$ , while the detector threshold accuracy is  $\pm 2.5\%$ . The R1150HxxxxA (with chip enable function) and C series can supervise input voltage by the built-in detector. R1150HxxxxB type can supervise SENSE pin voltage by the built-in detector. R1150HxxxxD type can supervise V<sub>OUT</sub> voltage, or the regulator output voltage of this IC itself.

Since the package for these ICs is the SOT-89-5 package, high density mounting of the ICs on boards is possible.

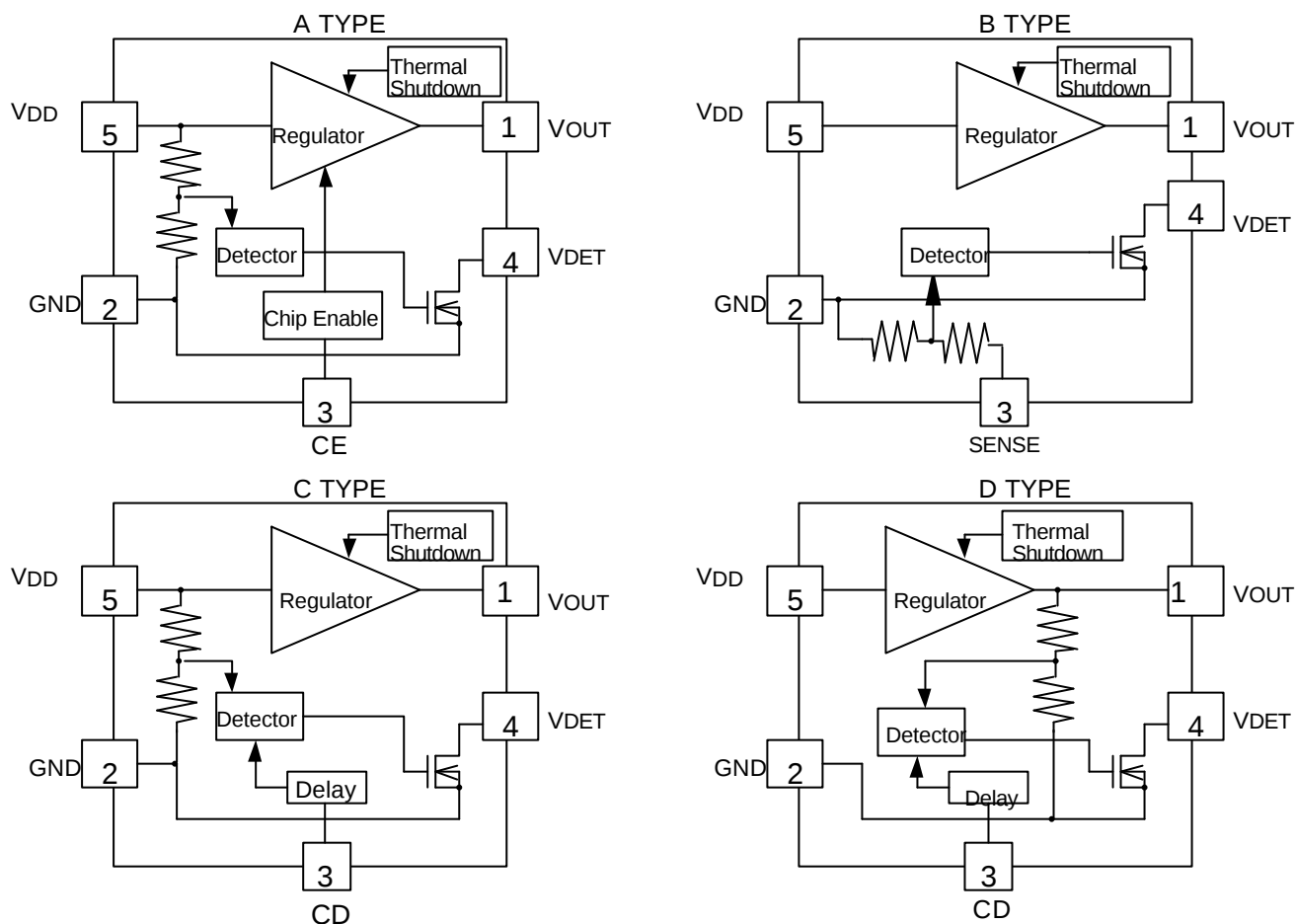
### ■ FEATURES

- Ultra-Low Supply Current..... Typ. 7 $\mu$ A
- Input Voltage ..... Max. 24V
- Output Voltage (VR)..... Stepwise setting with a step of 0.1V in the range of 2.1V to 14.0V
- Detector Threshold Voltage (V<sub>DET</sub>)..... Stepwise setting with a step of 0.1V in the range of 2.3V to 15.0V
- High Output Voltage Accuracy.....  $\pm 2.0\%$ (VR)  $\pm 2.5\%$ (VD)
- Output Current..... Min. 150mA(V<sub>OUT</sub>=5V)
- Small Package ..... SOT-89-5
- Built-in Current Limit Circuit, Thermal Shutdown Circuit (VR)
- Monitoring VDD voltage ..... A/C type
  - Monitoring Sense Pin (<sub>SENSE</sub>) voltage ..... B type
  - Monitoring V<sub>OUT</sub> Pin voltage ..... D type

### ■ APPLICATIONS

- Power source and Reset circuit for cameras, videos and mobile telecommunication equipment.
- Power source and Reset circuit for battery-operated equipment.
- Power source and Reset circuit for home appliances.

## ■ BLOCK DIAGRAMS



## ■ SELECTION GUIDE

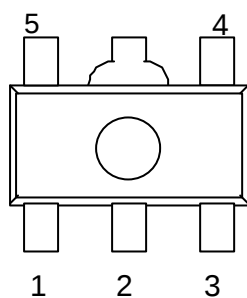
The output voltage and the usage of pin No.3 (as a kind of types in the R1150Hxxxx series) can be selected at the user's request. The selection can be made with designating the part number as follows;

R1150HXXXX-XX ← Part Number

↑    ↑    ↑    ↑  
 a    b    c    d

| Code | Contents                                                                                                                                                                                                                                                                                                                         |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a    | Designation of package type; H : SOT89-5                                                                                                                                                                                                                                                                                         |
| b    | Serial Number for Voltage Setting                                                                                                                                                                                                                                                                                                |
| c    | Designation of option;<br>A: Built-in Chip Enable Circuit (VDET supervises VIN level.)<br>B: VDET supervises SENSE pin.<br>C: Used with an external capacitor for setting output delay time of VDET. (VDET supervises VIN.)<br>D: Used with an external capacitor for setting output delay time of VDET. (VDET supervises VOUT.) |
| d    | Designation of Taping Type;<br>(Refer to Taping Specifications)                                                                                                                                                                                                                                                                  |

## PIN CONFIGURATION



SOT-89-5

## PIN DESCRIPTION

| Pin No. | Symbol        | Description                                                             |
|---------|---------------|-------------------------------------------------------------------------|
| 1       | VOUT          | Voltage Regulator Output Pin                                            |
| 2       | GND           | Ground Pin                                                              |
| 3       | CE(A type)    | Chip Enable Pin                                                         |
|         | SENSE(B type) | Sense Pin for Voltage Detector                                          |
|         | CD(C/D type)  | Pin for External Capacitor for Setting Output Delay of Voltage Detector |
| 4       | VDET          | Voltage Detector Output Pin                                             |
| 5       | VDD           | Input Pin                                                               |

## ABSOLUTE MAXIMUM RATINGS

| Item                                 | Symbol | Rating           | Unit |
|--------------------------------------|--------|------------------|------|
| Input Voltage                        | VIN    | 26.0             | V    |
| Input Voltage(CE Input Pin)*Note1    | VCE    | -0.3 ~ VIN+0.3   | V    |
| Input Voltage(SENSE Input Pin)*Note2 | VSENSE | -0.3 ~ VIN+0.3   | V    |
| Input Voltage(CD Input Pin)*Note3    | VCD    | -0.3 ~ VIN+0.3   | V    |
| Output Voltage(VDET Output Pin)      | VDET   | -0.3 ~ VIN+0.3   | V    |
| Output Voltage                       | VOUT   | -0.3 ~ VIN+0.3   | V    |
| Output Current(VR)                   | IOUT1  | 300              | mA   |
| Output Current(VDET)                 | IOUT2  | 10               | mA   |
| Power Dissipation                    | PD     | Internal Limited |      |
| Operating Temperature                | Topt   | -40 ~ 85         | °C   |
| Storage Temperature                  | Tstg   | -55 ~ 125        | °C   |

\*Note1: This item is for A Version.

\*Note2: This item is for B Version

\*Note3: This item is for C/D Version

## ■ ELECTRICAL CHARACTERISTICS

### ●R1150HxxxA

(T<sub>opt</sub>=25°C)

| Item                                  | Symbol           | Conditions                                                                                                                                                                                                      | Min.                            | Typ. | Max. | Unit |
|---------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------|------|------|
| Input Voltage                         | V <sub>IN</sub>  |                                                                                                                                                                                                                 |                                 |      | 24.0 | V    |
| Supply Current 1                      | I <sub>SS1</sub> | V <sub>IN</sub> =V <sub>CE</sub><br>V <sub>OUT</sub> ≥(-V <sub>DET</sub> ):<br>V <sub>IN</sub> -V <sub>OUT</sub> =2.0V<br>V <sub>OUT</sub> <(-V <sub>DET</sub> ):<br>V <sub>IN</sub> =(-V <sub>DET</sub> )+2.0V |                                 | 7    | 14   | μA   |
| Supply Current 2                      | I <sub>SS2</sub> | V <sub>DD</sub> =24V, V <sub>CE</sub> =0V                                                                                                                                                                       | Refer to Supply Current 2 Table |      |      |      |
| Thermal Shutdown Temperature          | T <sub>SD</sub>  | Junction Temperature                                                                                                                                                                                            |                                 | 150  |      | °C   |
| Thermal Shutdown Released Temperature | T <sub>SR</sub>  | Junction Temperature                                                                                                                                                                                            |                                 | 120  |      | °C   |

### VR part

(T<sub>opt</sub>=25°C)

| Item                                   | Symbol                                   | Conditions                                                                                                     | Min.                           | Typ. | Max.            | Unit       |
|----------------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------|------|-----------------|------------|
| Output voltage                         | V <sub>OUT</sub>                         | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V<br>I <sub>OUT</sub> =20mA                                              | x0.98                          |      | x1.02           | V          |
| Output Current                         | I <sub>OUT</sub>                         | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V                                                                        | Refer to Output Current Table  |      |                 |            |
| Load Regulation                        | ΔV <sub>OUT</sub> /<br>ΔI <sub>OUT</sub> | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V<br>1mA≤I <sub>OUT</sub> ≤40mA                                          | Refer to Load Regulation Table |      |                 |            |
| Line Regulation                        | ΔV <sub>OUT</sub> /<br>ΔV <sub>IN</sub>  | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V<br>I <sub>OUT</sub> =20mA<br>V <sub>OUT</sub> +1V≤V <sub>IN</sub> ≤24V |                                | 0.05 | 0.15            | %/V        |
| Dropout Voltage                        | V <sub>DIF</sub>                         | I <sub>OUT</sub> =20mA                                                                                         | Refer to Dropout Voltage Table |      |                 |            |
| Output Voltage Temperature Coefficient | ΔV <sub>OUT</sub> /<br>ΔT                | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V<br>I <sub>OUT</sub> =20mA<br>-40°C ≤ T <sub>opt</sub> ≤ 85°C           |                                | ±100 |                 | ppm<br>/°C |
| Short Current Limit                    | I <sub>LIM</sub>                         | V <sub>OUT</sub> =0V                                                                                           |                                | 45   |                 | mA         |
| CE "H" Input Voltage                   | V <sub>CEH</sub>                         |                                                                                                                | 1.5                            |      | V <sub>IN</sub> | V          |
| CE "L" Input Voltage                   | V <sub>CEL</sub>                         |                                                                                                                | 0                              |      | 0.25            | V          |

### V<sub>DET</sub> part

(T<sub>opt</sub>=25°C)

| Item                                       | Symbol                     | Conditions                                     | Min.                       | Typ.                       | Max.                       | Unit       |
|--------------------------------------------|----------------------------|------------------------------------------------|----------------------------|----------------------------|----------------------------|------------|
| Detector Threshold                         | -V <sub>DET</sub>          |                                                | x0.975                     |                            | x1.025                     | V          |
| Detector Threshold Hysteresis              | V <sub>HYS</sub>           |                                                | -V <sub>DET</sub><br>x0.03 | -V <sub>DET</sub><br>x0.05 | -V <sub>DET</sub><br>x0.07 | V          |
| Sink Current                               | I <sub>DOU</sub>           | V <sub>IN</sub> =2.0V, V <sub>DET</sub> =0.05V | 0.15                       | 0.20                       |                            | μA         |
| Minimum Operating Voltage                  | V <sub>DDL</sub>           | *Note 1                                        |                            | 0.9                        | 1.2                        | V          |
| Detector Threshold Temperature Coefficient | Δ-V <sub>DET</sub> /<br>ΔT | -40°C≤T <sub>opt</sub> ≤85°C                   |                            | ±100                       |                            | ppm<br>/°C |
| Output Delay Time                          | t <sub>PLH</sub>           | *Note 2                                        |                            | 0.5                        | 1.0                        | ms         |

●R1150HxxxB

(T<sub>opt</sub>=25°C)

| Item                                  | Symbol          | Conditions                                                                                                                                                                                               | Min. | Typ. | Max. | Unit |
|---------------------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Input Voltage                         | V <sub>IN</sub> |                                                                                                                                                                                                          |      |      | 24.0 | V    |
| Supply Current                        | I <sub>SS</sub> | V <sub>OUT</sub> ≥ (-V <sub>DET</sub> ):<br>V <sub>IN</sub> = SENSE<br>= V <sub>OUT</sub> + 2.0V<br>V <sub>OUT</sub> < (-V <sub>DET</sub> ):<br>V <sub>IN</sub> = SENSE<br>= (-V <sub>DET</sub> ) + 2.0V |      | 7    | 14   | μA   |
| Thermal Shutdown Temperature          | T <sub>SD</sub> | Junction Temperature                                                                                                                                                                                     |      | 150  |      | °C   |
| Thermal Shutdown Released Temperature | T <sub>SR</sub> | Junction Temperature                                                                                                                                                                                     |      | 120  |      | °C   |

VR part

(T<sub>opt</sub>=25°C)

| Item                                   | Symbol                                   | Conditions                                                                                              | Min.                           | Typ.             | Max.                      | Unit       |
|----------------------------------------|------------------------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------|------------------|---------------------------|------------|
| Output voltage                         | V <sub>OUT</sub>                         | V <sub>IN</sub> - V <sub>OUT</sub> = 2.0V<br>I <sub>OUT</sub> = 20mA                                    | V <sub>SET</sub><br>x0.98      | V <sub>SET</sub> | V <sub>SET</sub><br>x1.02 | V          |
| Output Current                         | I <sub>OUT</sub>                         | V <sub>IN</sub> - V <sub>OUT</sub> = 2.0V                                                               | Refer to Output Current Table  |                  |                           |            |
| Load regulation                        | ΔV <sub>OUT</sub> /<br>ΔI <sub>OUT</sub> | V <sub>IN</sub> - V <sub>OUT</sub> = 2.0V<br>1mA ≤ I <sub>OUT</sub> ≤ 40mA                              | Refer to Load Regulation Table |                  |                           |            |
| Line regulation                        | ΔV <sub>OUT</sub> /<br>ΔV <sub>IN</sub>  | I <sub>OUT</sub> = 20mA<br>V <sub>OUT</sub> + 1V ≤ V <sub>IN</sub> ≤ 24V                                |                                | 0.05             | 0.15                      | %/V        |
| Dropout Voltage                        | V <sub>DIF</sub>                         | I <sub>OUT</sub> = 20mA                                                                                 | Refer to Dropout Voltage Table |                  |                           |            |
| Output Voltage Temperature Coefficient | ΔV <sub>OUT</sub> /<br>ΔT                | V <sub>IN</sub> - V <sub>OUT</sub> = 2.0V<br>I <sub>OUT</sub> = 20mA<br>-40°C ≤ T <sub>opt</sub> ≤ 85°C |                                | ±100             |                           | ppm<br>/°C |
| Short Current Limit                    | I <sub>LIM</sub>                         | V <sub>OUT</sub> = 0V                                                                                   |                                | 45               |                           | mA         |

V<sub>DET</sub> part

(T<sub>opt</sub>=25°C)

| Item                                       | Symbol                     | Conditions                                                 | Min.                       | Typ.                       | Max.                       | Unit       |
|--------------------------------------------|----------------------------|------------------------------------------------------------|----------------------------|----------------------------|----------------------------|------------|
| Detector Threshold                         | -V <sub>DET</sub>          |                                                            | V <sub>SET</sub><br>x0.975 | V <sub>SET</sub>           | V <sub>SET</sub><br>x1.025 | V          |
| Detector Threshold Hysteresis              | V <sub>HYS</sub>           |                                                            | -V <sub>DET</sub><br>x0.03 | -V <sub>DET</sub><br>x0.05 | -V <sub>DET</sub><br>x0.07 | V          |
| Sink Current                               | I <sub>DOUT</sub>          | V <sub>IN</sub> = SENSE = 2.0V,<br>V <sub>DS</sub> = 0.05V | 0.17                       |                            |                            | mA         |
| Minimum Operating Voltage                  | V <sub>DDL</sub>           | *Note 1                                                    |                            | 0.9                        | 1.2                        | V          |
| Detector Threshold Temperature Coefficient | Δ-V <sub>DET</sub> /<br>ΔT | -40°C ≤ T <sub>opt</sub> ≤ 85°C                            |                            | ±100                       |                            | ppm<br>/°C |
| Output Delay Time                          | t <sub>PLH</sub>           | *Note 2                                                    |                            | 1.0                        | 1.5                        | ms         |

●R1150HxxxC

(T<sub>opt</sub>=25°C)

| Item                                  | Symbol          | Conditions                                                                                                                                                                         | Min. | Typ. | Max. | Unit |
|---------------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Input voltage                         | V <sub>IN</sub> |                                                                                                                                                                                    |      |      | 24.0 | V    |
| Supply Current                        | I <sub>SS</sub> | V <sub>OUT</sub> ≥ (-V <sub>DET</sub> ):<br>V <sub>IN</sub> = V <sub>OUT</sub> + 2.0V<br>V <sub>OUT</sub> < (-V <sub>DET</sub> ):<br>V <sub>IN</sub> = (-V <sub>DET</sub> ) + 2.0V |      | 7    | 14   | μA   |
| Thermal Shutdown Temperature          | T <sub>SD</sub> | Junction Temperature                                                                                                                                                               |      | 150  |      | °C   |
| Thermal Shutdown Released Temperature | T <sub>SR</sub> | Junction Temperature                                                                                                                                                               |      | 120  |      | °C   |

VR part

(T<sub>opt</sub>=25°C)

| Item                                   | Symbol                          | Conditions                                                                                        | Min.                           | Typ.             | Max.                      | Unit   |
|----------------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------|------------------|---------------------------|--------|
| Output Voltage                         | V <sub>OUT</sub>                | V <sub>IN</sub> =V <sub>OUT</sub> +2V,<br>I <sub>OUT</sub> =20mA                                  | V <sub>SET</sub><br>x0.98      | V <sub>SET</sub> | V <sub>SET</sub><br>x1.02 | V      |
| Output Current                         | I <sub>OUT</sub>                | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V                                                           | Refer to Output Current Table  |                  |                           |        |
| Load regulation                        | $\Delta V_{OUT}/\Delta I_{OUT}$ | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V<br>1mA≤I <sub>OUT</sub> ≤40mA                             | Refer to Load Regulation Table |                  |                           |        |
| Line regulation                        | $\Delta V_{OUT}/\Delta V_{IN}$  | I <sub>OUT</sub> =20mA<br>V <sub>OUT</sub> +1V≤V <sub>IN</sub> ≤24V                               |                                | 0.05             | 0.15                      | %/V    |
| Dropout Voltage                        | V <sub>DIF</sub>                | I <sub>OUT</sub> =20mA                                                                            | Refer to Dropout Voltage Table |                  |                           |        |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$       | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V<br>I <sub>OUT</sub> =20mA<br>-40°C≤T <sub>opt</sub> ≤85°C |                                | ±100             |                           | ppm/°C |
| Short Current Limit                    | I <sub>LIM</sub>                | V <sub>OUT</sub> =0V                                                                              |                                | 45               |                           | mA     |

V<sub>DET</sub> part(T<sub>opt</sub>=25°C)

| Item                                       | Symbol                     | Conditions                                    | Min.                       | Typ.                       | Max.                       | Unit   |
|--------------------------------------------|----------------------------|-----------------------------------------------|----------------------------|----------------------------|----------------------------|--------|
| Detector Threshold                         | -V <sub>DET</sub>          |                                               | V <sub>SET</sub><br>x0.975 | V <sub>SET</sub>           | V <sub>SET</sub><br>x1.025 | V      |
| Detector Threshold Hysteresis              | V <sub>HYS</sub>           |                                               | -V <sub>DET</sub><br>x0.03 | -V <sub>DET</sub><br>x0.05 | -V <sub>DET</sub><br>x0.07 | V      |
| Sink Current                               | I <sub>DOUT</sub>          | V <sub>IN</sub> =2.0V, V <sub>DS</sub> =0.05V | 0.17                       |                            |                            | mA     |
| Minimum Operating Voltage                  | V <sub>DDL</sub>           | *Note 1                                       |                            | 0.9                        | 1.2                        | V      |
| Detector Threshold Temperature Coefficient | $\Delta -V_{DET}/\Delta T$ | -40°C≤T <sub>opt</sub> ≤85°C                  |                            | ±100                       |                            | ppm/°C |
| Output Delay Time                          | t <sub>PLH</sub>           | C <sub>d</sub> =4.7nF, *Note 2                | 20                         | 30                         | 50                         | ms     |

## ●R1150HxxxD

(T<sub>opt</sub>=25°C)

| Item                                  | Symbol          | Conditions                              | Min. | Typ. | Max. | Unit |
|---------------------------------------|-----------------|-----------------------------------------|------|------|------|------|
| Input Voltage                         | V <sub>IN</sub> |                                         |      |      | 24.0 | V    |
| Supply Current                        | I <sub>SS</sub> | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V |      | 7    | 14   | μA   |
| Thermal Shutdown Temperature          | T <sub>SD</sub> |                                         |      | 150  |      | °C   |
| Thermal Shutdown Released Temperature | T <sub>SR</sub> | Junction Temperature                    |      | 120  |      | °C   |

VR part

(T<sub>opt</sub>=25°C)

| Item                                   | Symbol                          | Conditions                                                                                        | Min.                           | Typ.             | Max.                      | Unit   |
|----------------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------|------------------|---------------------------|--------|
| Output voltage                         | V <sub>OUT</sub>                | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V<br>I <sub>OUT</sub> =20mA                                 | V <sub>SET</sub><br>x0.98      | V <sub>SET</sub> | V <sub>SET</sub><br>x1.02 | V      |
| Output Current                         | I <sub>OUT1</sub>               | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V                                                           | Refer to Output Current Table  |                  |                           |        |
| Load regulation                        | $\Delta V_{OUT}/\Delta I_{OUT}$ | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V<br>1mA≤I <sub>OUT</sub> ≤40mA                             | Refer to Load Regulation Table |                  |                           |        |
| Line regulation                        | $\Delta V_{OUT}/\Delta V_{IN}$  | I <sub>OUT</sub> =20mA<br>V <sub>OUT</sub> +1V≤V <sub>IN</sub> ≤24V                               |                                | 0.05             | 0.15                      | %/V    |
| Output Voltage Temperature Coefficient | $\Delta V_{OUT}/\Delta T$       | V <sub>IN</sub> -V <sub>OUT</sub> =2.0V<br>I <sub>OUT</sub> =20mA<br>-40°C≤T <sub>opt</sub> ≤85°C |                                | ±100             |                           | ppm/°C |
| Short Current Limit                    | I <sub>LIM</sub>                | V <sub>OUT</sub> =0V                                                                              |                                | 45               |                           | mA     |

## VDET part

(T<sub>opt</sub>=25°C)

| Item                                       | Symbol                        | Conditions                                    | Min.           | Typ.           | Max.           | Unit       |
|--------------------------------------------|-------------------------------|-----------------------------------------------|----------------|----------------|----------------|------------|
| Detector Threshold                         | -VDET                         |                                               | VSET<br>x0.975 | VSET           | VSET<br>x1.025 | V          |
| Detector Threshold Hysteresis              | VHYS                          |                                               | -VDET<br>x0.03 | -VDET<br>x0.05 | -VDET<br>x0.07 | V          |
| Sink Current                               | IDOUT                         | V <sub>IN</sub> =2.0V, V <sub>DS</sub> =0.05V | 0.17           |                |                | mA         |
| Minimum Operating Voltage                  | VDDL                          | *Note 1                                       |                | 0.9            | 1.2            | V          |
| Detector Threshold Temperature Coefficient | $\Delta$ -VDET/<br>$\Delta$ T | -40°C≤T <sub>opt</sub> ≤85°C                  |                | ±100           |                | ppm<br>/°C |
| Output Delay Time                          | t <sub>PD</sub>               | C <sub>d</sub> =4.7nF, *Note 2                | 20             | 30             | 50             | ms         |
| Release Margin                             |                               | V <sub>OUT</sub> -0.2-(-VDET)-<br>VHYS        | 50             |                |                | mV         |

Note 1) This item means V<sub>DD</sub> Voltage when Output Voltage is equal or less than 0.1V(Pull-up Resistor=470kΩ, Pull up Voltage=5V)

Note 2) VDET pin is pulled up to V<sub>DD</sub> via 470kΩ. t<sub>PLH</sub> means time interval from rising edge of V<sub>DD</sub> from (-VDET)-2.0V to (-VDET)+2.0V to the point of Output Voltage being 80% of pull-up voltage.

●Output Current (T<sub>opt</sub>=25°C)

| Output Voltage V <sub>OUT</sub> (V) | Output Current (mA) |
|-------------------------------------|---------------------|
|                                     | Min.                |
| 2.1V≤V <sub>OUT</sub> ≤2.9V         | 90                  |
| 3.0V≤V <sub>OUT</sub> ≤4.0V         | 120                 |
| 4.1V≤V <sub>OUT</sub> ≤14V          | 150                 |

●Load Regulation (T<sub>opt</sub>=25°C)

| Output Voltage V <sub>OUT</sub> (V) | Load Regulation (mV) |      |
|-------------------------------------|----------------------|------|
|                                     | Typ.                 | Max. |
| 2.1V≤V <sub>OUT</sub> ≤3.0V         | 15                   | 35   |
| 3.1V≤V <sub>OUT</sub> ≤5.0V         | 25                   | 45   |
| 5.1V≤V <sub>OUT</sub> ≤10.0V        | 40                   | 65   |
| 10.1V≤V <sub>OUT</sub> ≤14.0V       | 50                   | 80   |

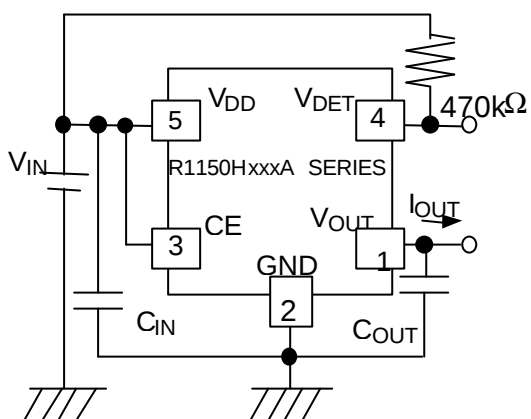
●Dropout Voltage (T<sub>opt</sub>=25°C)

| Output Voltage V <sub>OUT</sub> (V) | Dropout Voltage (V) |      |
|-------------------------------------|---------------------|------|
|                                     | Typ.                | Max. |
| 2.1V≤V <sub>OUT</sub> ≤2.4V         | 0.40                | 0.60 |
| 2.5V≤V <sub>OUT</sub> ≤3.0V         | 0.30                | 0.40 |
| 3.1V≤V <sub>OUT</sub> ≤7.0V         | 0.25                | 0.35 |
| 7.1V≤V <sub>OUT</sub> ≤10.0V        | 0.27                | 0.45 |
| 10.1V≤V <sub>OUT</sub> ≤14.0V       | 0.30                | 0.50 |

●Supply Current 2(Off state with CE) (T<sub>opt</sub>=25°C)

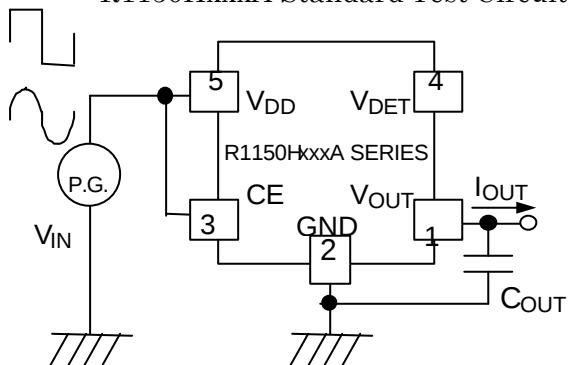
| Detector Threshold Voltage<br>-V <sub>DET</sub> (V) | Supply Current(μA) |      |
|-----------------------------------------------------|--------------------|------|
|                                                     | Typ.               | Max. |
| 2.3V≤(-V <sub>DET</sub> )≤3.0V                      | 2.5                | 5.0  |
| 3.1V≤(-V <sub>DET</sub> )≤15.0V                     | 3.0                | 6.0  |

■ TEST CIRCUITS



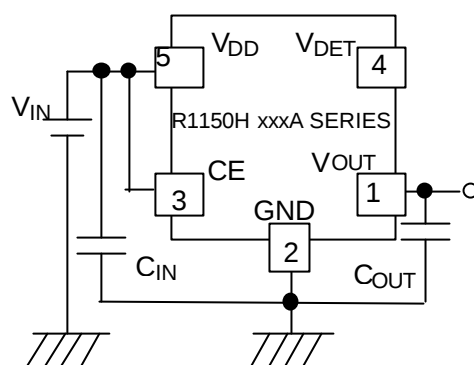
C<sub>IN</sub>=0.1μF, C<sub>OUT</sub>=1μF

R1150HxxxA Standard Test Circuit



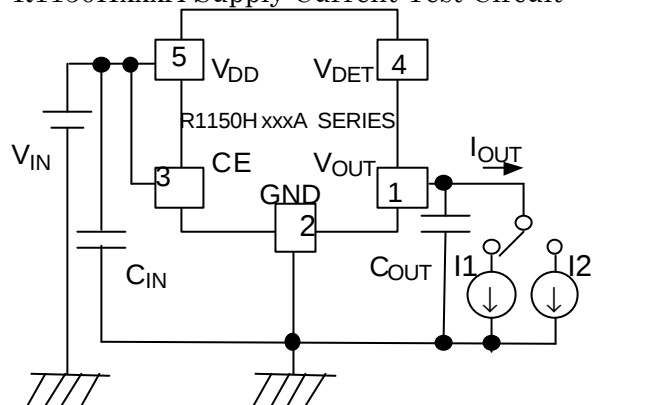
C<sub>IN</sub>=0.1μF, C<sub>OUT</sub>=1μF

R1150HxxxA Input Transient Response /  
Ripple Rejection Test Circuit



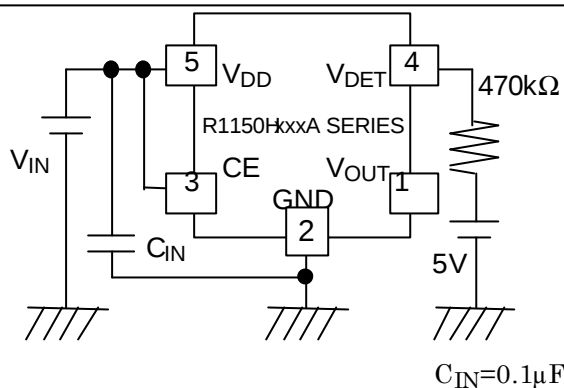
C<sub>IN</sub>=0.1μF, C<sub>OUT</sub>=1μF

R1150HxxxA Supply Current Test Circuit

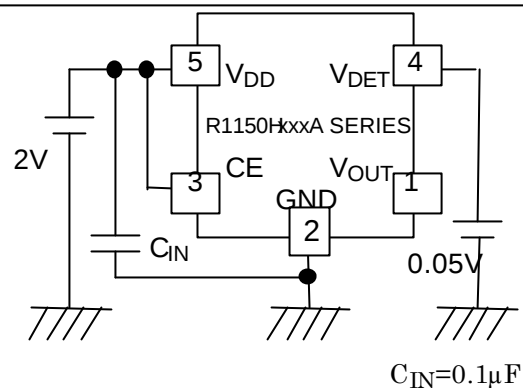


C<sub>IN</sub>=0.1μF, C<sub>OUT</sub>=1μF

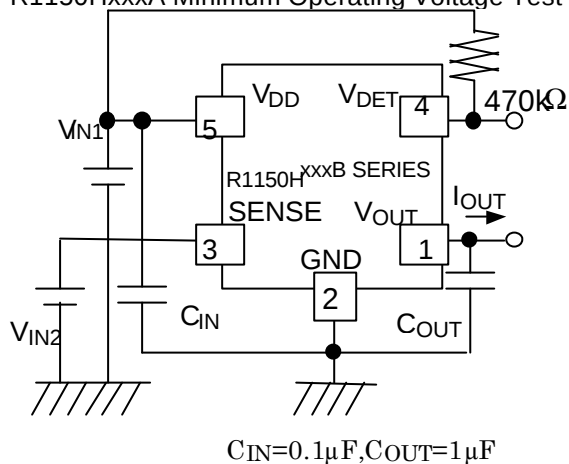
R1150HxxxA Load Transient Response  
Test Circuit



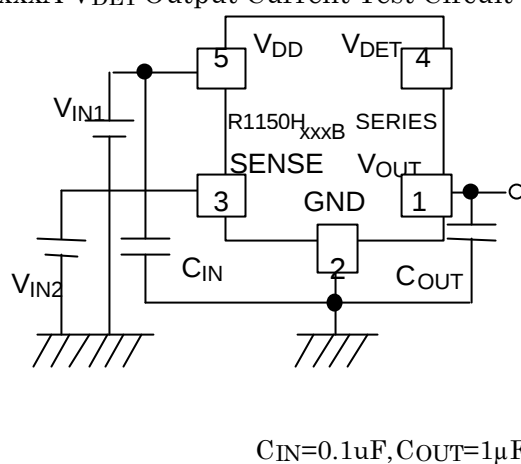
R1150HxxxA Minimum Operating Voltage Test Circuit



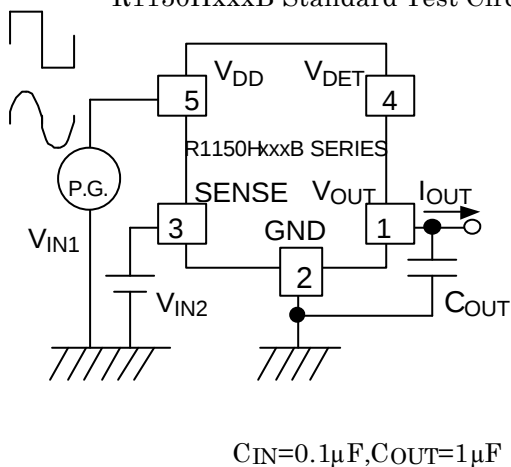
R1150HxxxA  $V_{DET}$  Output Current Test Circuit



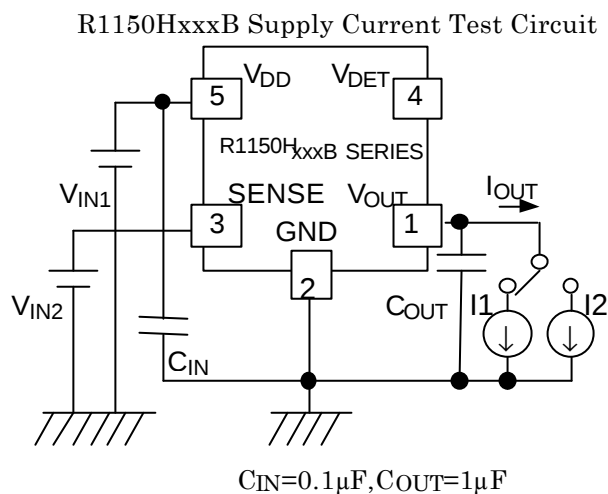
R1150HxxxB Standard Test Circuit



R1150HxxxB Supply Current Test Circuit

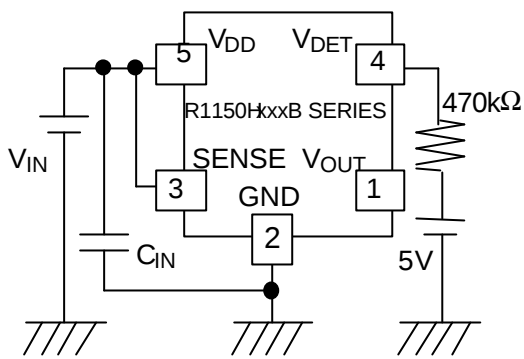


R1150HxxxB Input Transient Response, Ripple Rejection Test Circuit



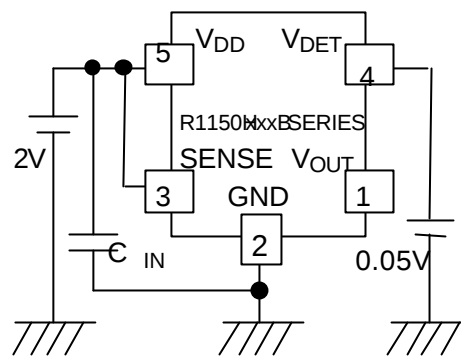
R1150HxxxB Load Transient Response Test Circuit

R1150HxxxB Load Transient Response Test Circuit



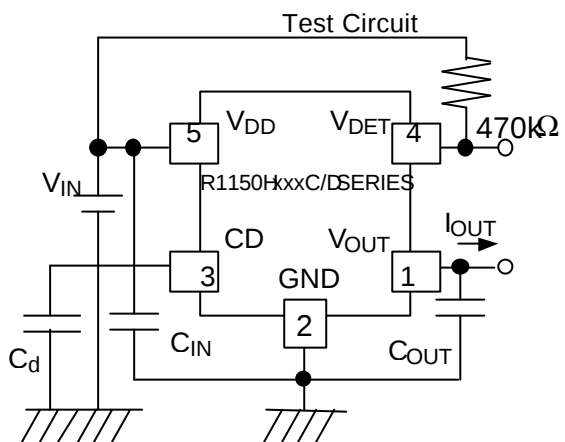
$C_{IN}=0.1\mu F$

R1150HxxxB VDET Minimum Operating Voltage



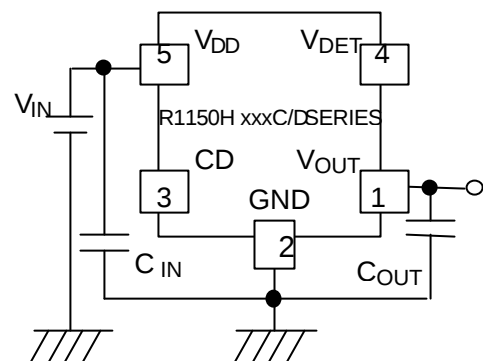
$C_{IN}=0.1\mu F$

R1150HxxxB VDET Output Current Test Circuit



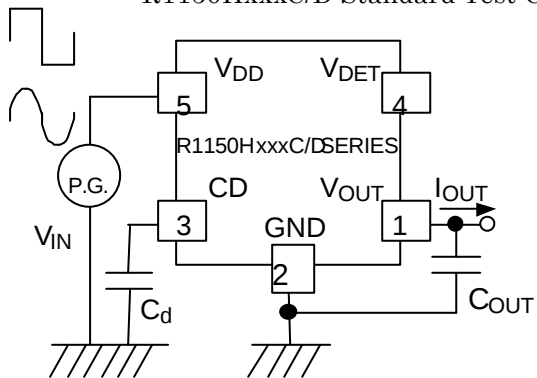
$C_{IN}=0.1\mu F, C_{OUT}=1\mu F$

R1150HxxxC/D Standard Test Circuit



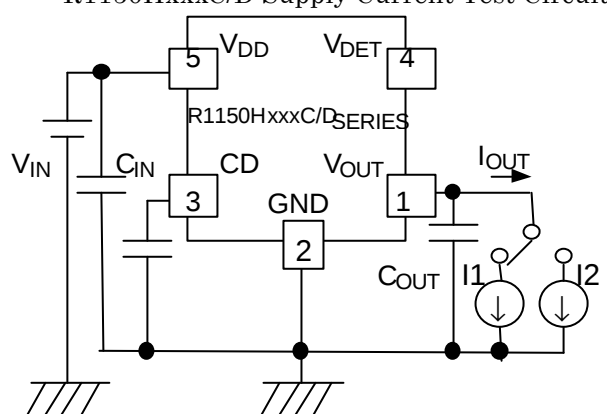
$C_{IN}=0.1\mu F, C_{OUT}=1\mu F$

R1150HxxxC/D Supply Current Test Circuit



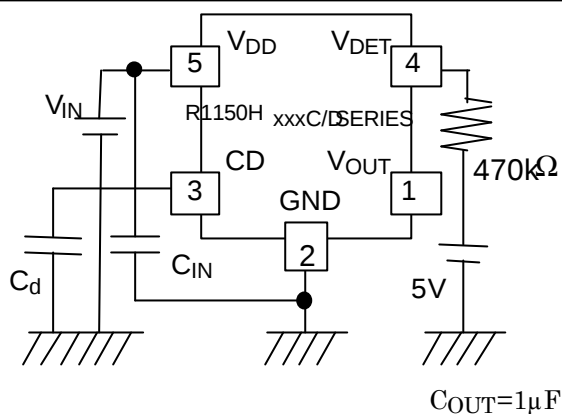
$C_{IN}=0.1\mu F, C_{OUT}=1\mu F$

R1150HxxxC/D Input Transient Response  
/ Ripple Rejection Test Circuit

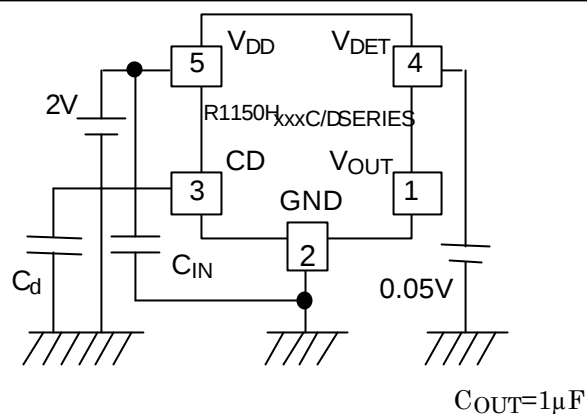


$C_{IN}=0.1\mu F, C_{OUT}=1\mu F$

R1150HxxxC/D Load Transient Response  
Test Circuit



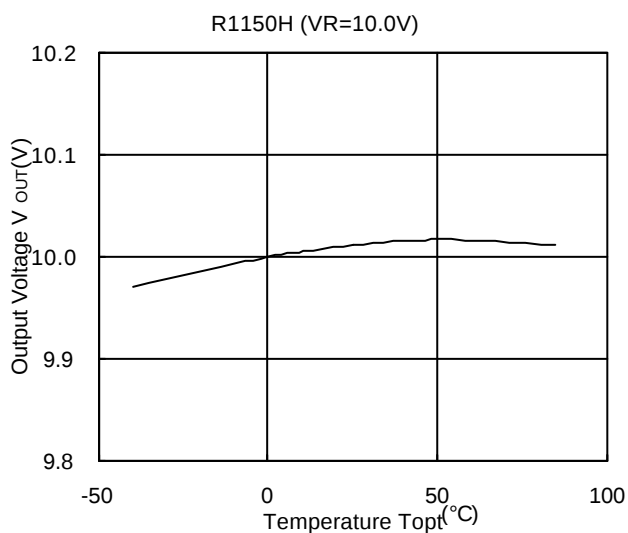
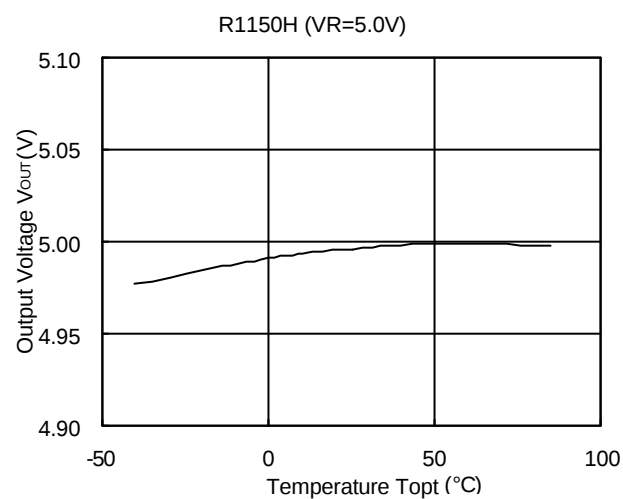
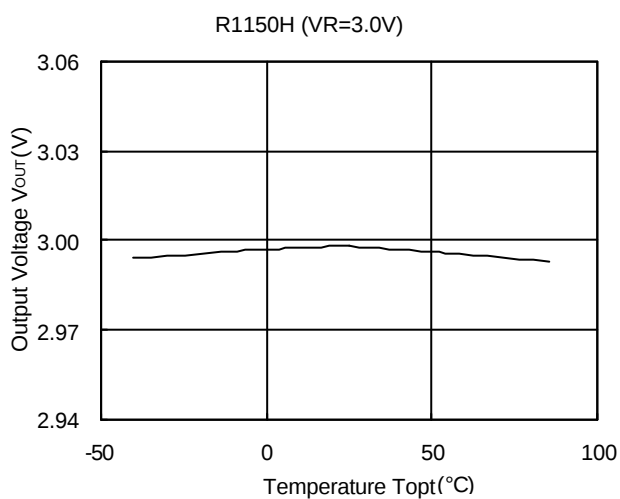
R1150Hxxx C/D VDET Minimum Operating Voltage Test Circuit



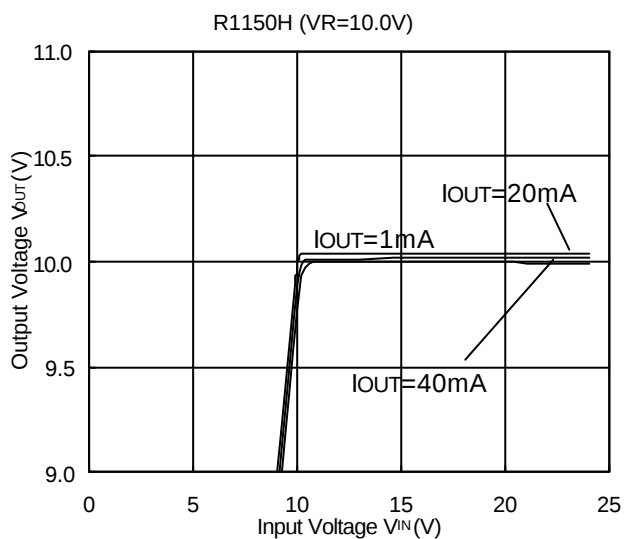
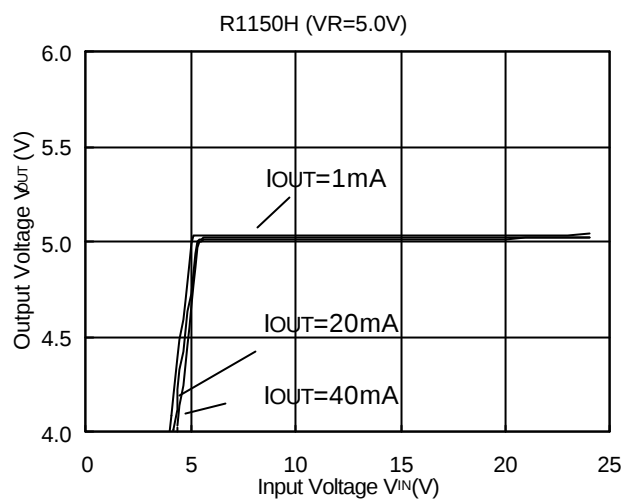
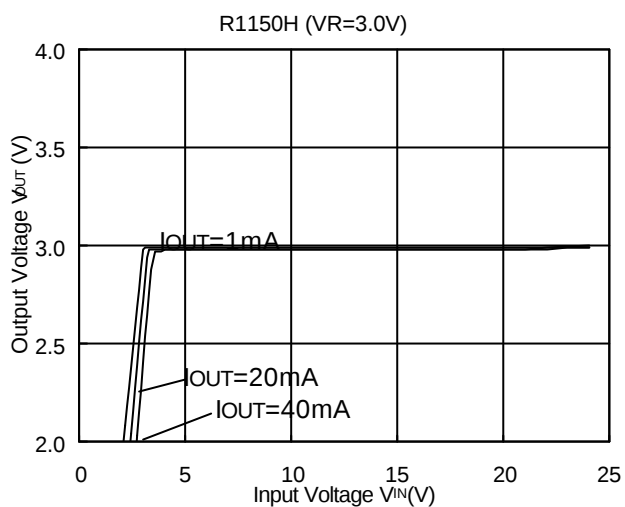
R1150Hxxx C/D VDET Output Current Test Circuit

## TYPICAL CHARACTERISTICS

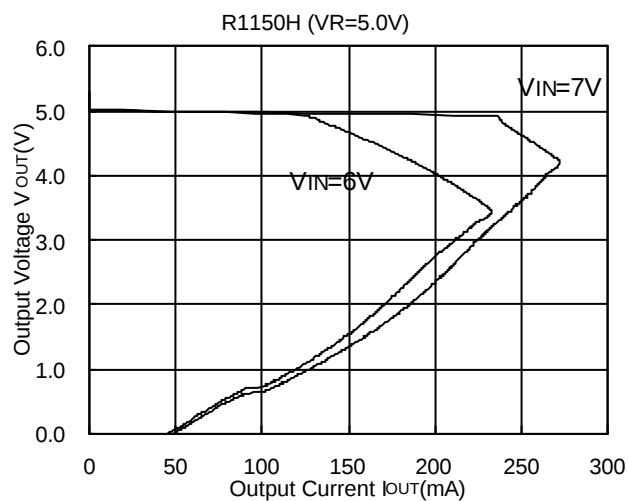
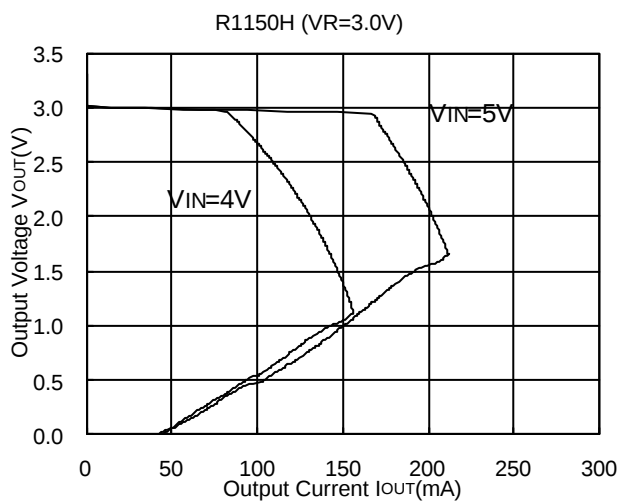
### 1) Output Voltage vs. Temperature

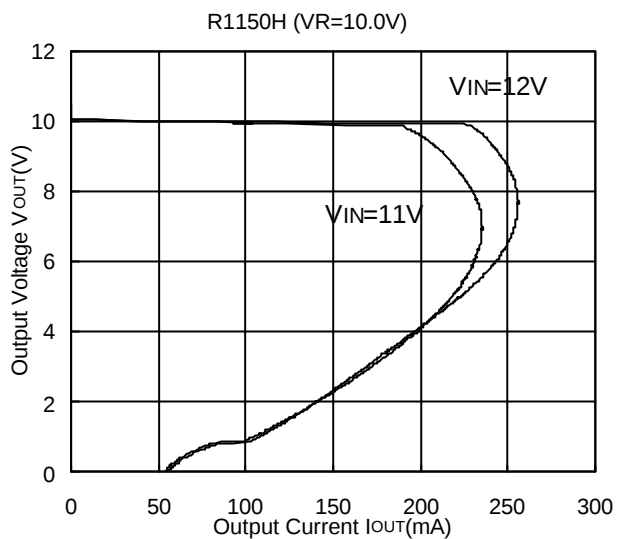


## 2) Input Voltage vs. Output Voltage (T<sub>opt</sub>=25°C)

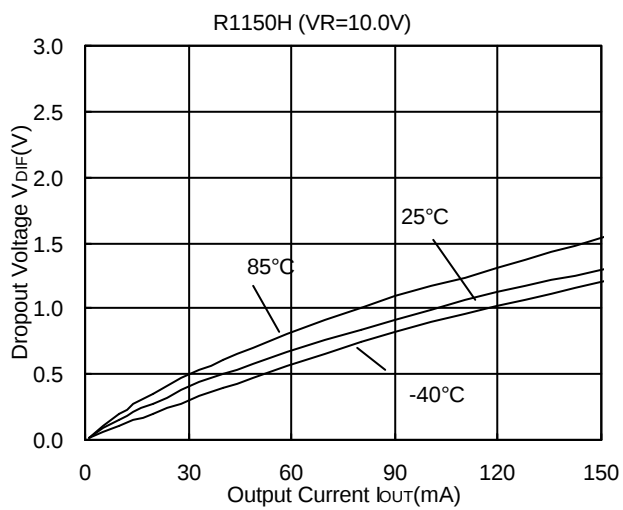
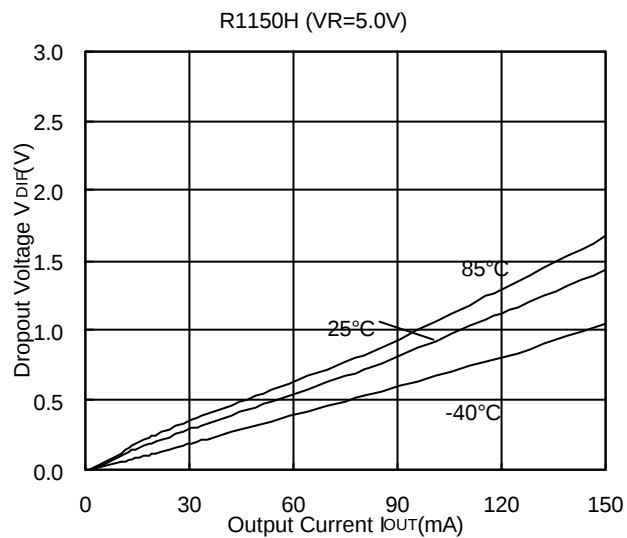
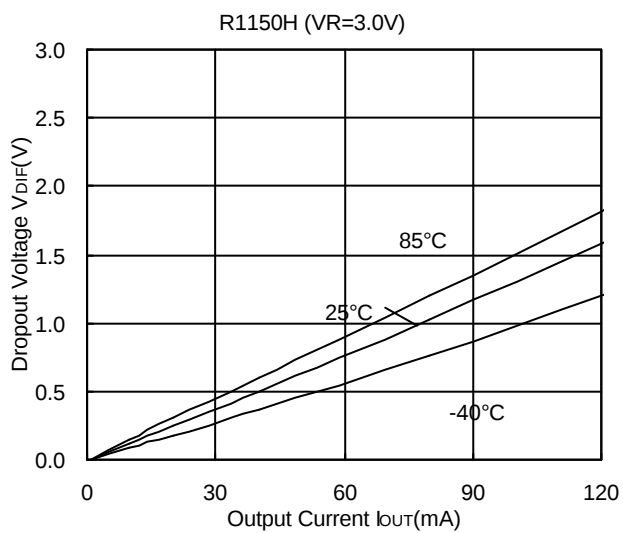


## 3) Output Voltage vs. Output Current (T<sub>opt</sub>=25°C)

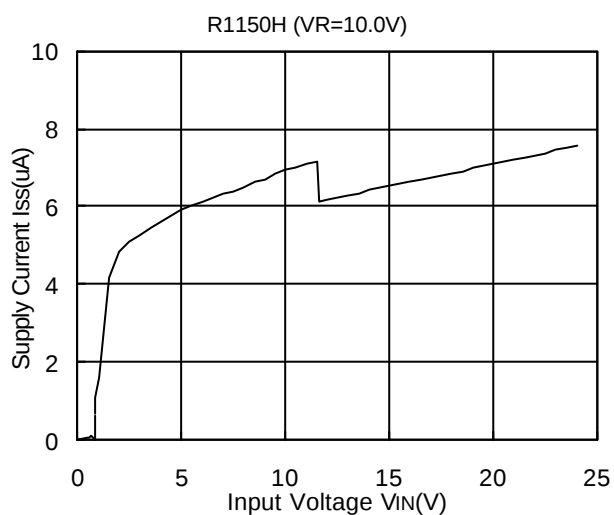
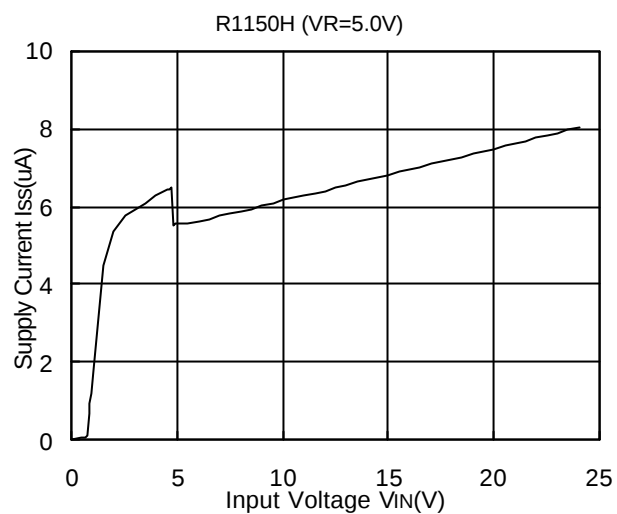
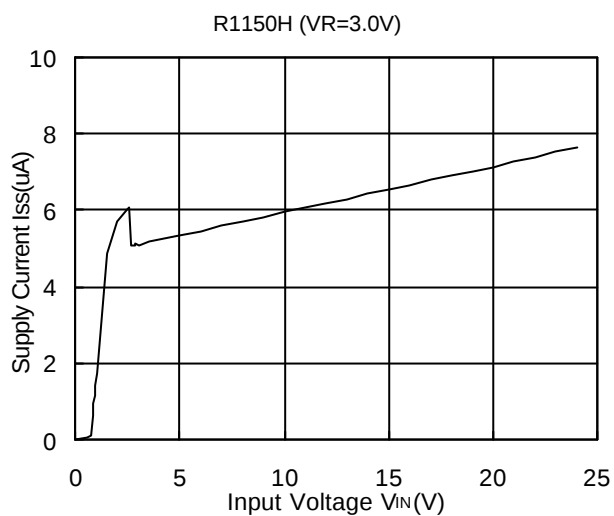




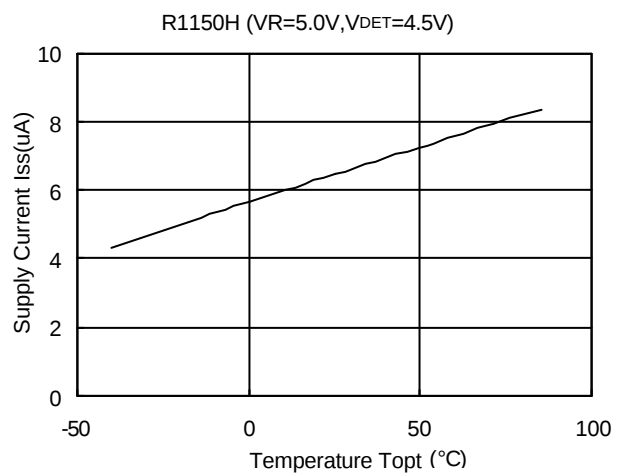
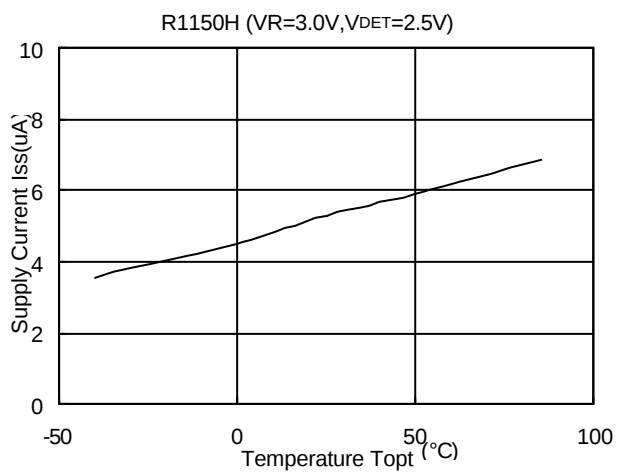
#### 4) Dropout Voltage vs. Output Current

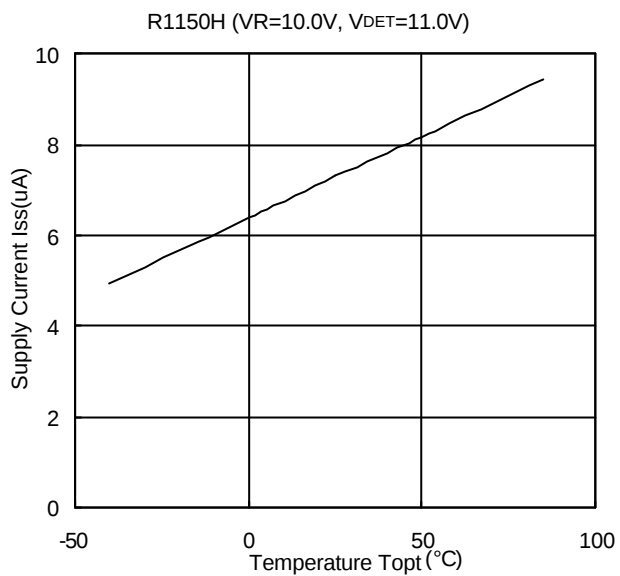


5) Supply Current vs. Input Voltage ( $T_{opt}=25^{\circ}\text{C}$ )

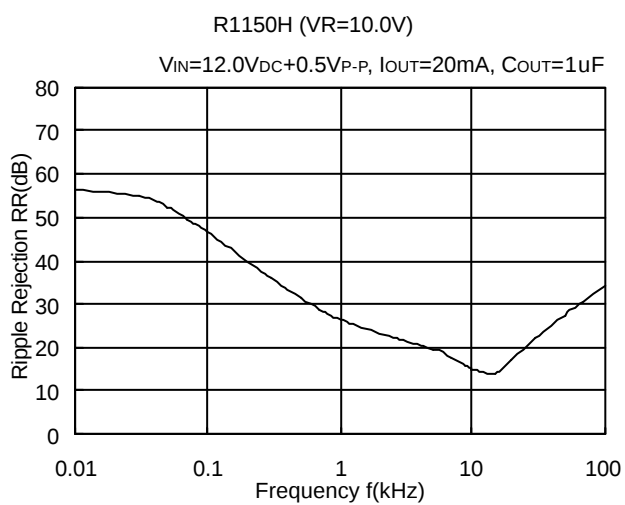
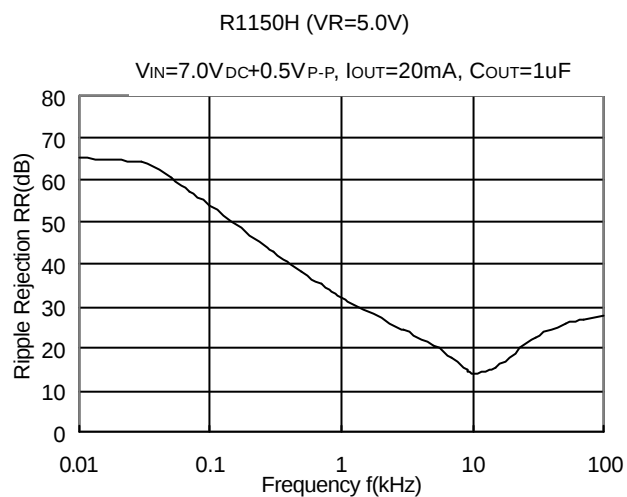
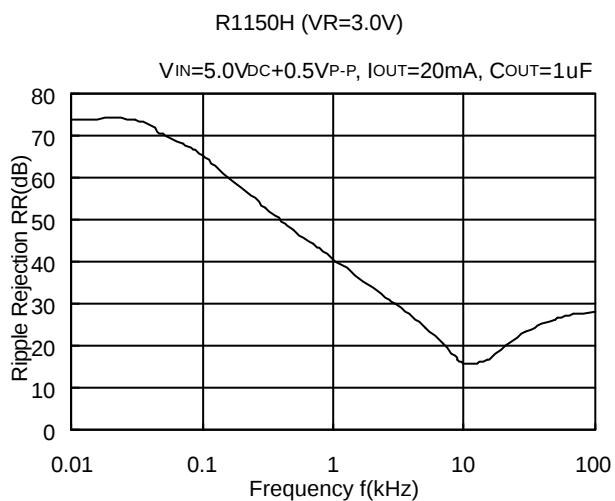


6) Supply Current vs. Temperature

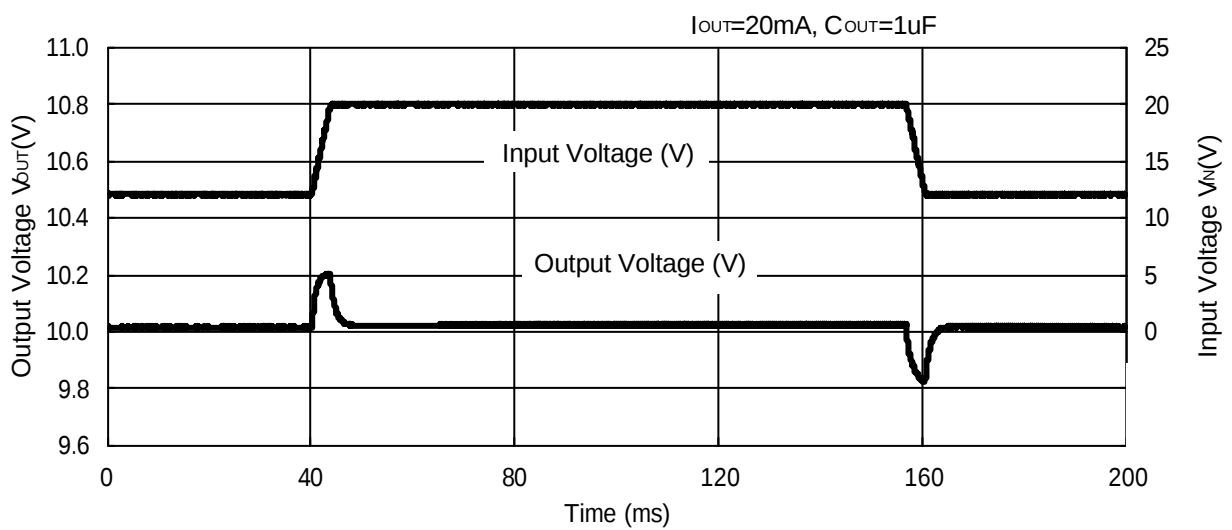
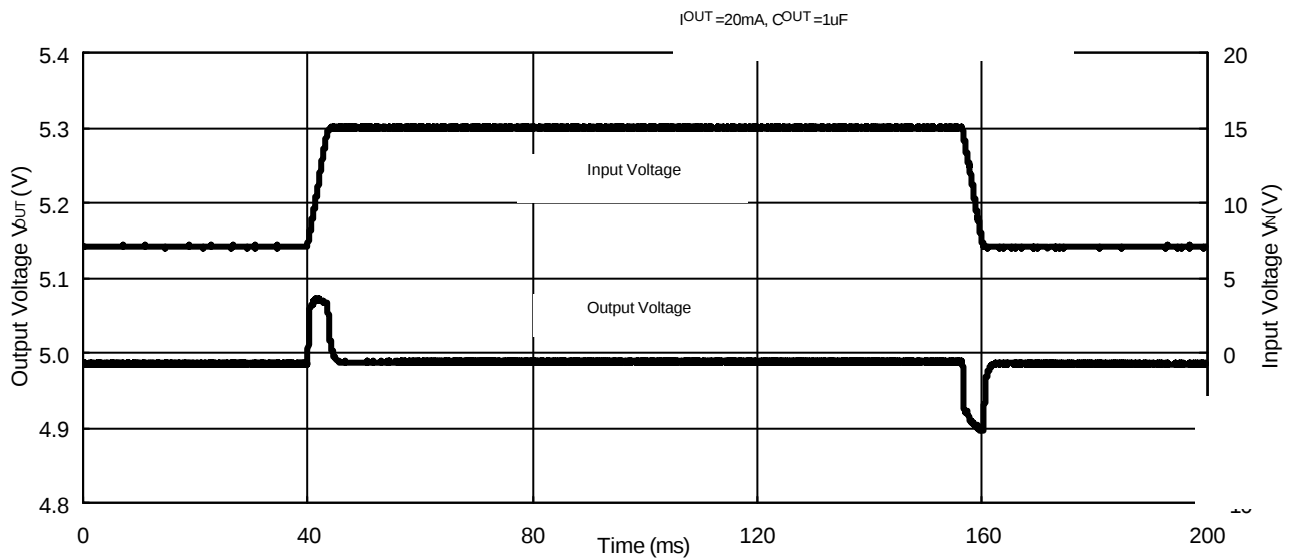
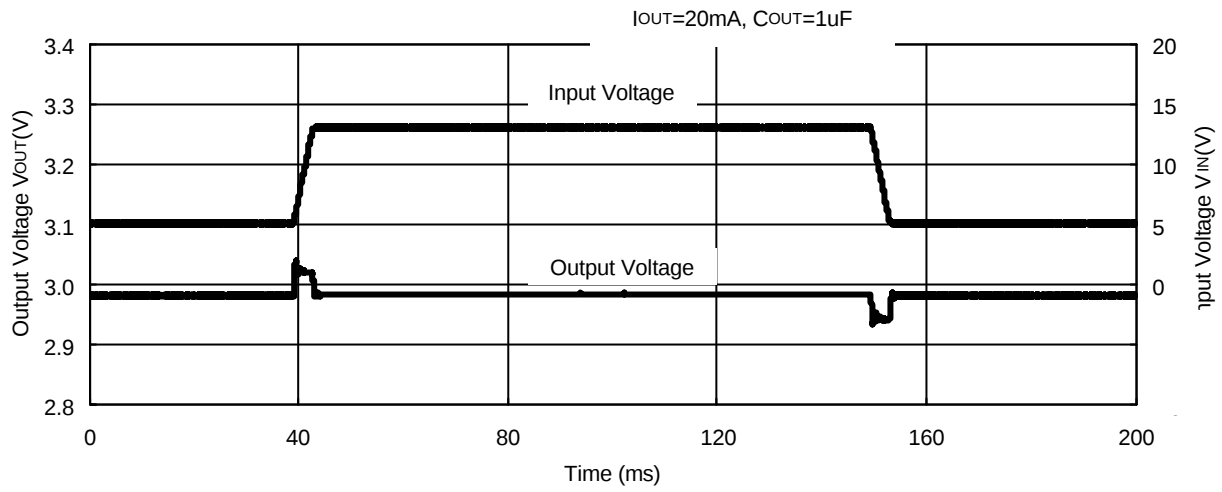




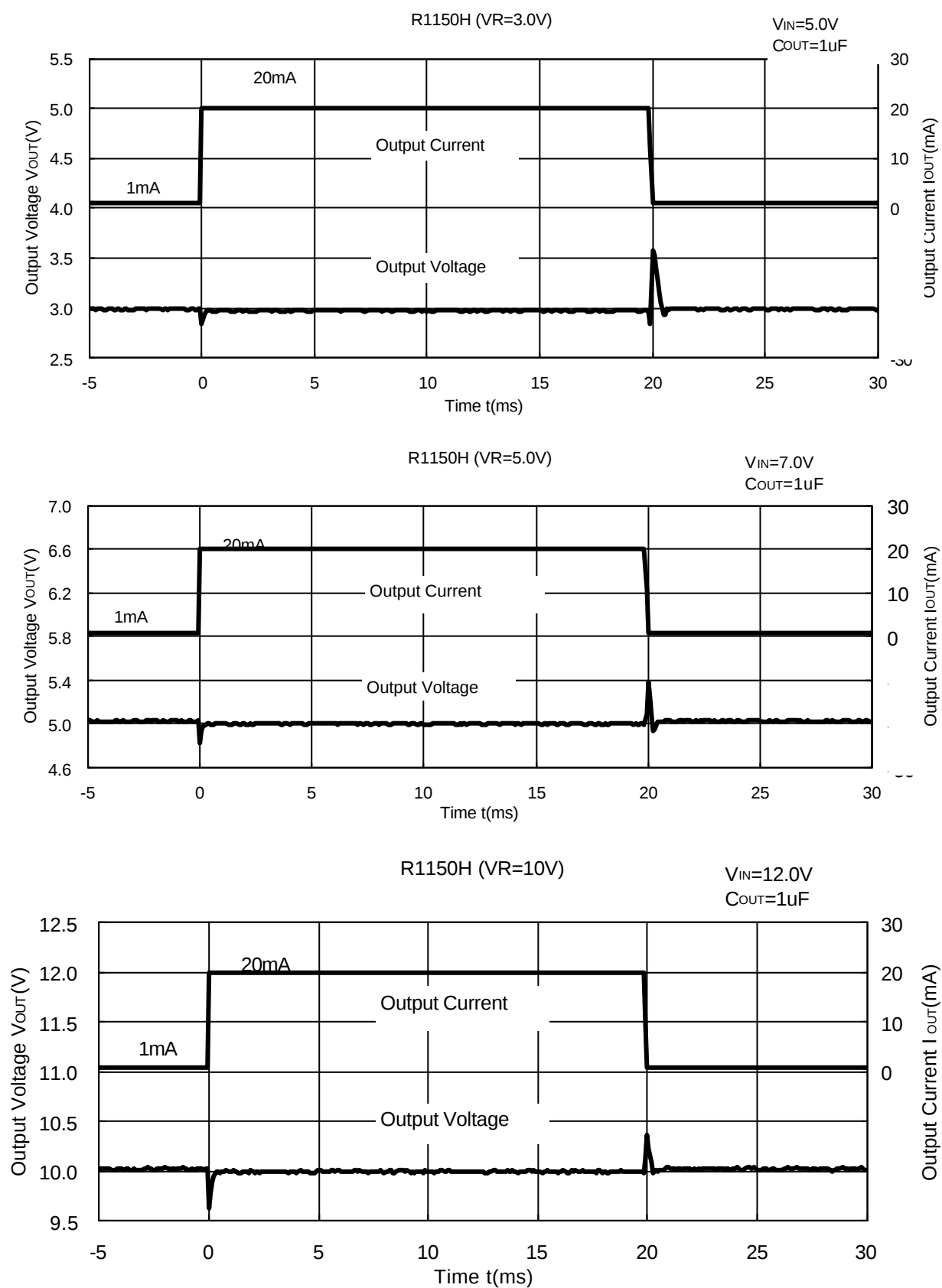
#### 7) Ripple Rejection vs. Frequency (T<sub>opt</sub>=25°C)



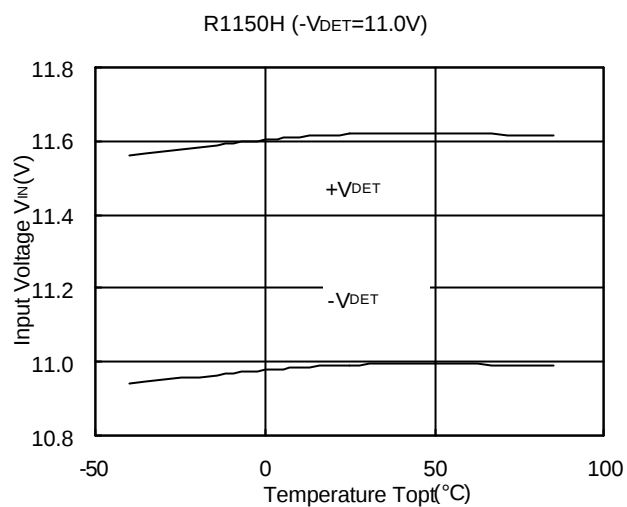
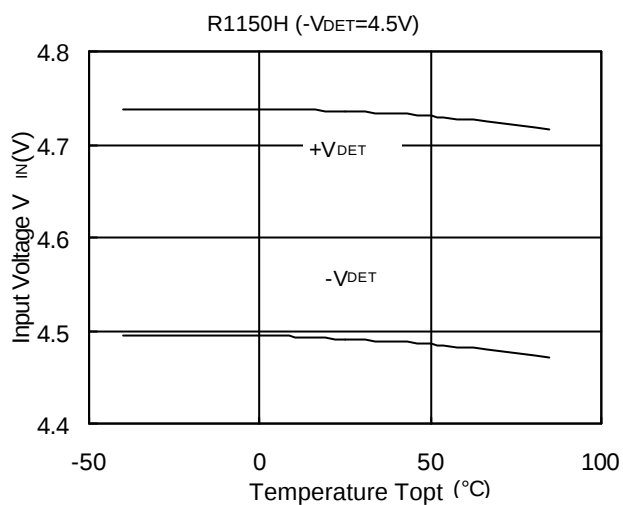
## 8) Input Transient Response



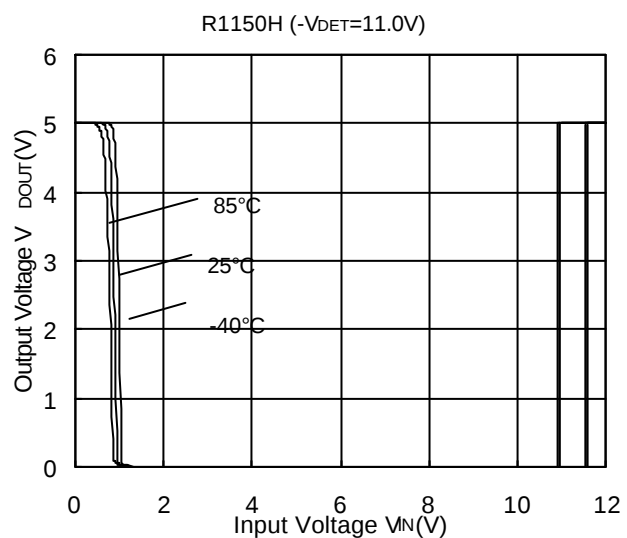
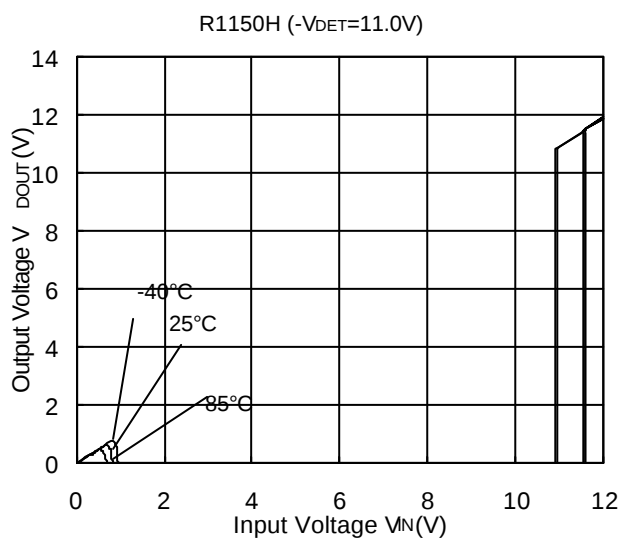
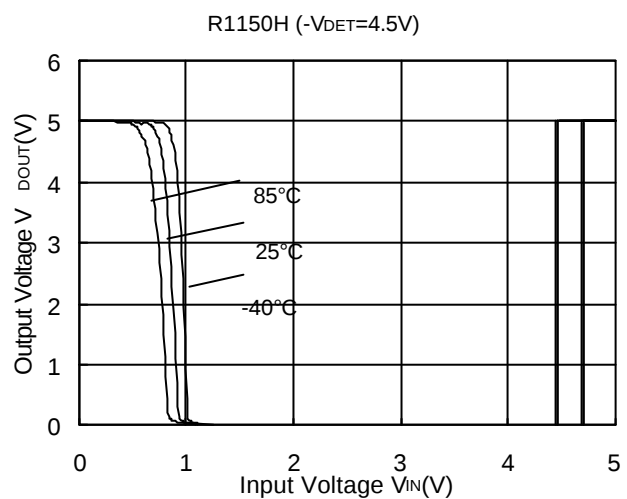
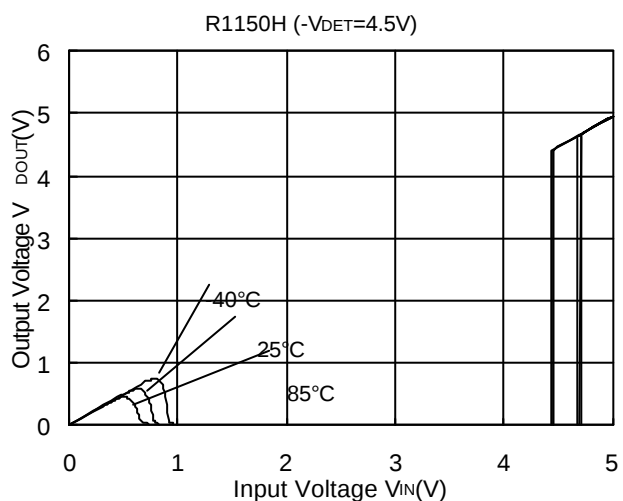
9) Load Transient Response( $T_{opt}=25^{\circ}\text{C}$ )



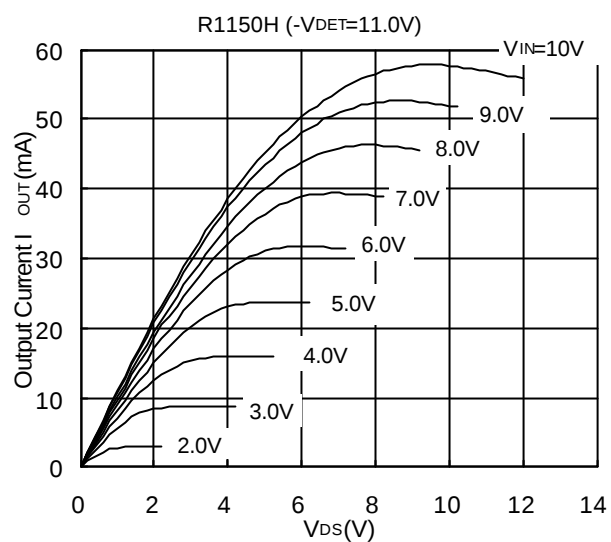
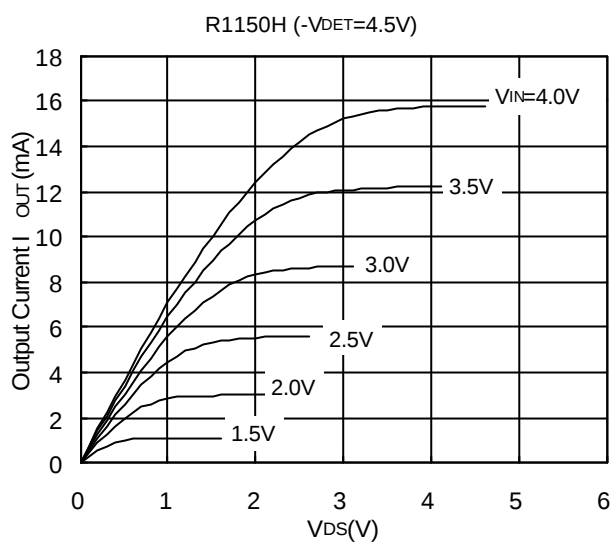
## 10) Detector Threshold vs. Temperature



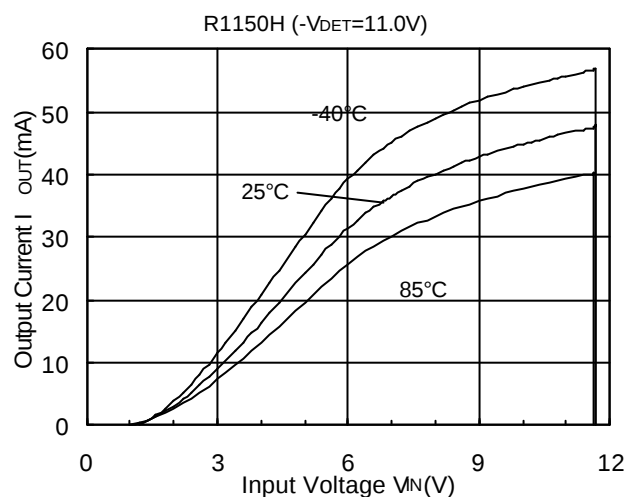
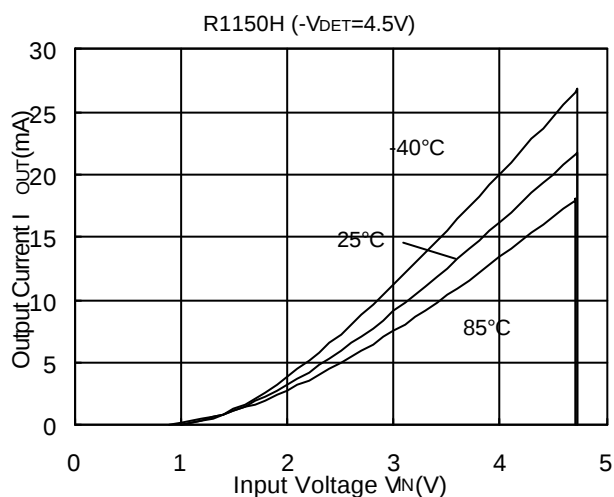
## 11) Detector Threshold vs. Input Voltage



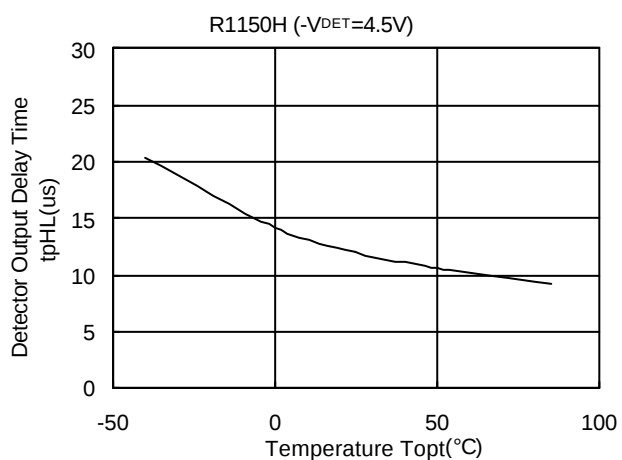
## 12) Nch Driver Output Current vs. VDS



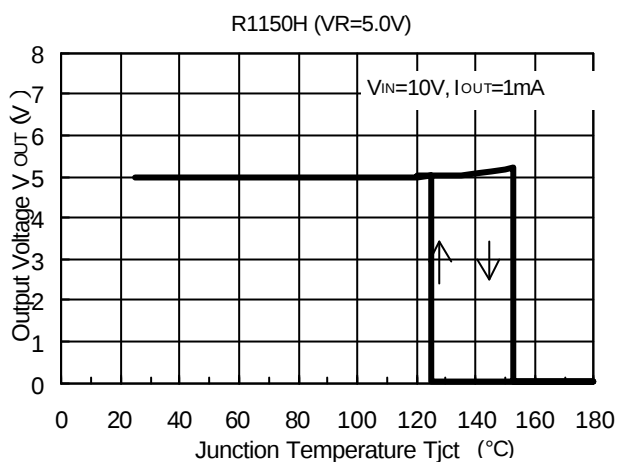
## 13) Nch Driver Output Current vs. Input Voltage



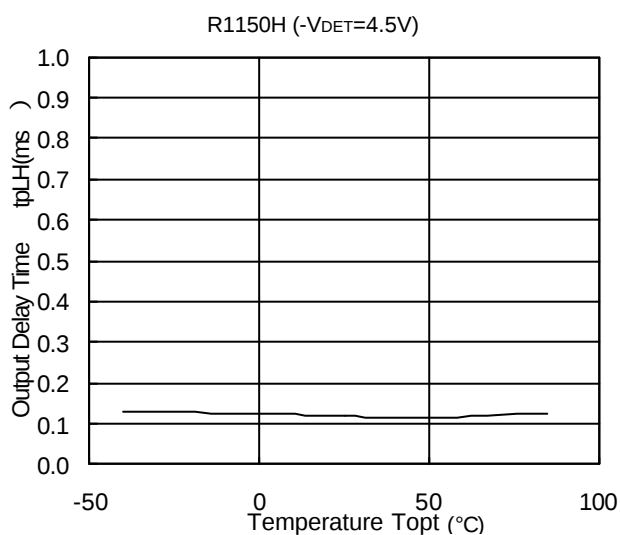
## 14) Detector Output Delay Time vs. Temperature



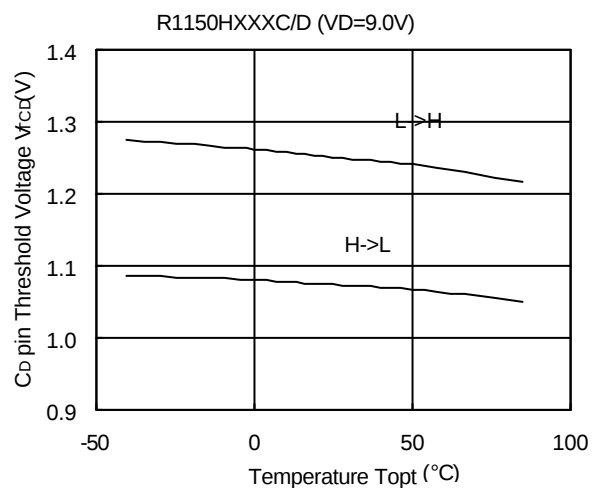
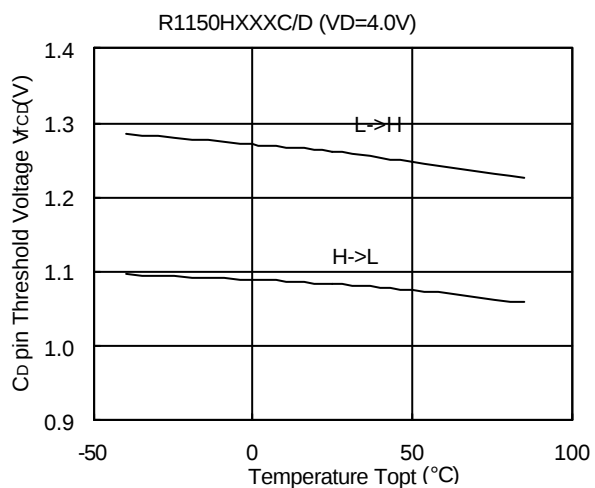
# 15) Thermal Shutdown Temperature vs. Output Voltage



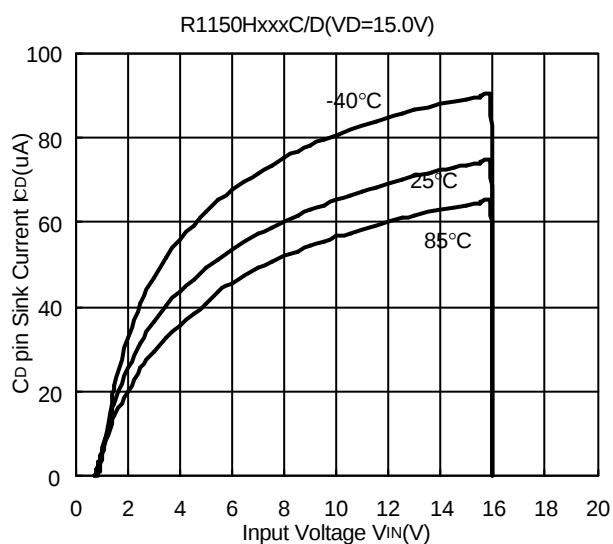
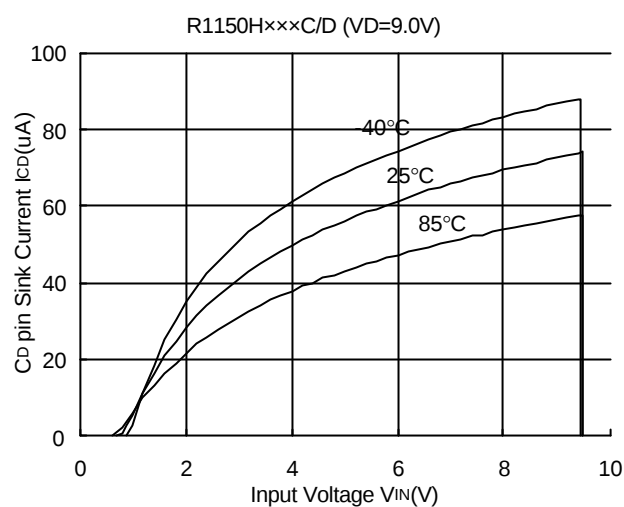
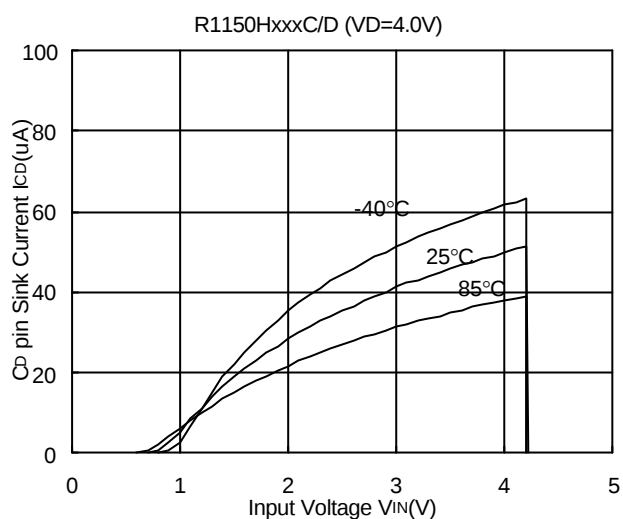
# 16) Output Delay Time vs. Temperature



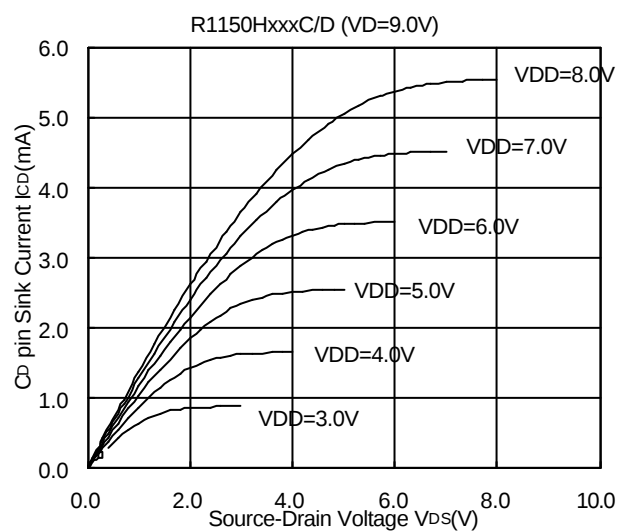
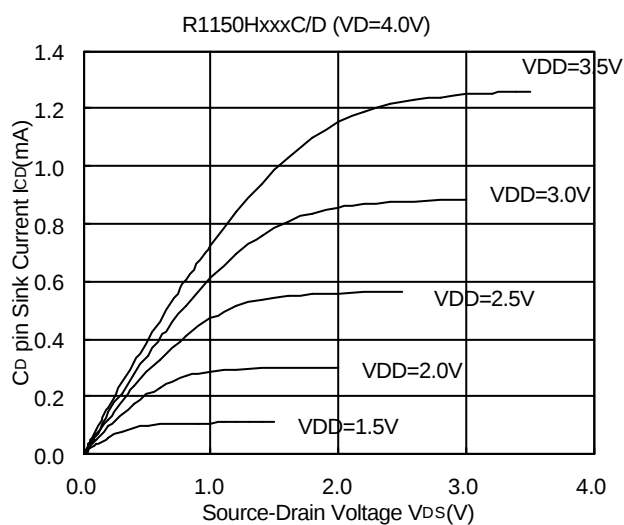
# 17) CD pin Threshold Voltage vs. Temperature

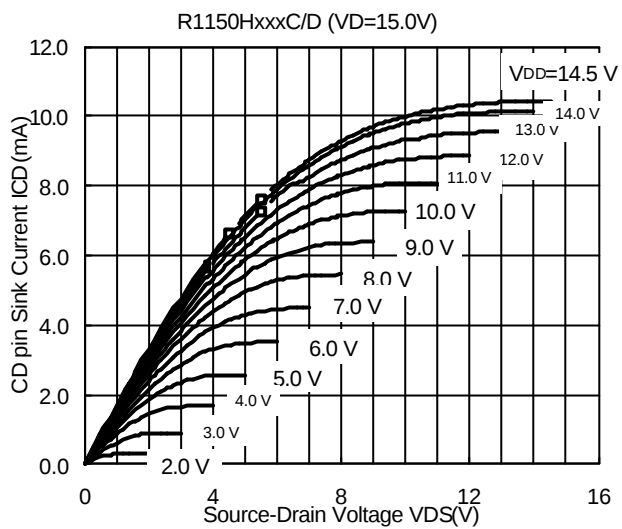


# 18) CD pin Sink Current vs. Input Voltage

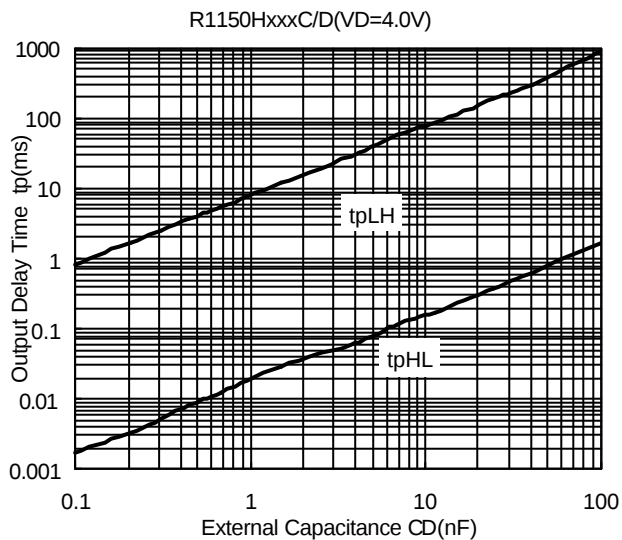


# 19) CD pin Sink Current vs. VDS

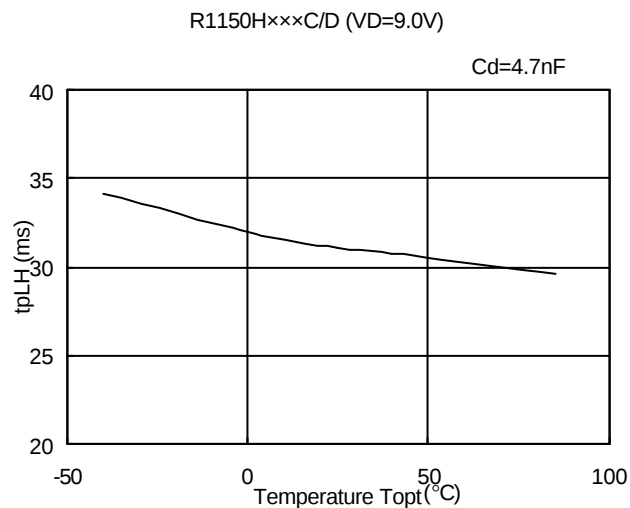
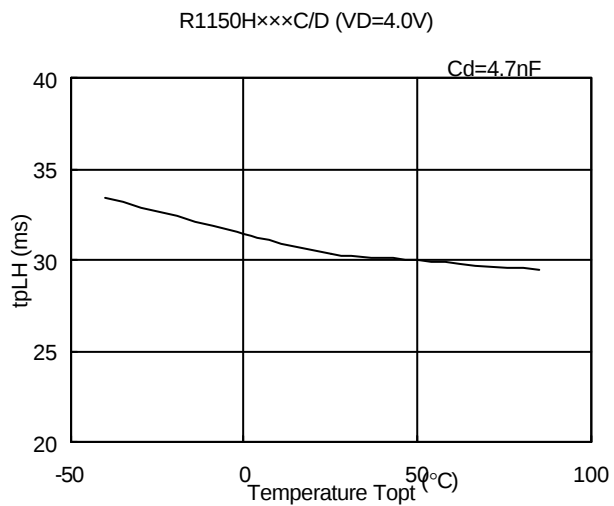




## 20) Output Delay Time vs. External Capacitance



## 21) tpLH vs. Temperature



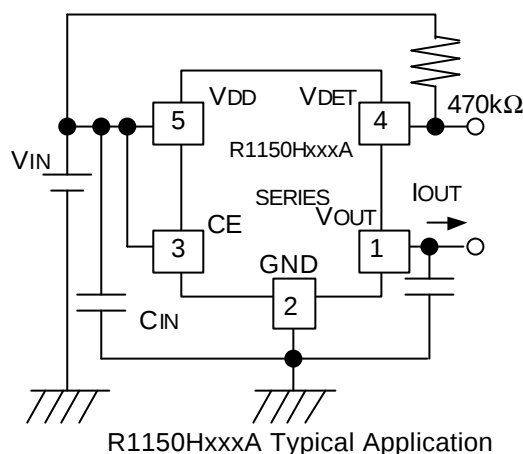
## ■ TECHNICAL NOTES

### Phase Compensation

Phase Compensation of the R1150H Series has been made internally for stable operation even though the load current would vary. Therefore, without the capacitors,  $C_{IN}$  and  $C_{OUT}$ , Output Voltage is regulated, but for more stable operation, use capacitors as  $C_{IN}$  and  $C_{OUT}$ . Recommended value is in the range from 0.1 $\mu$ F to 1.0 $\mu$ F. Wiring should be made as short as possible.

### PCB layout

Current flows into wiring for VDD or GND, thus, if the impedance of the wiring is rather high, it may cause of making noise or unstable operation, thus width and pattern should be enough wide to avoid such problems. Connect the capacitor,  $C_{IN}$  between VDD pin and GND pin as close as possible.



### Thermal Shutdown

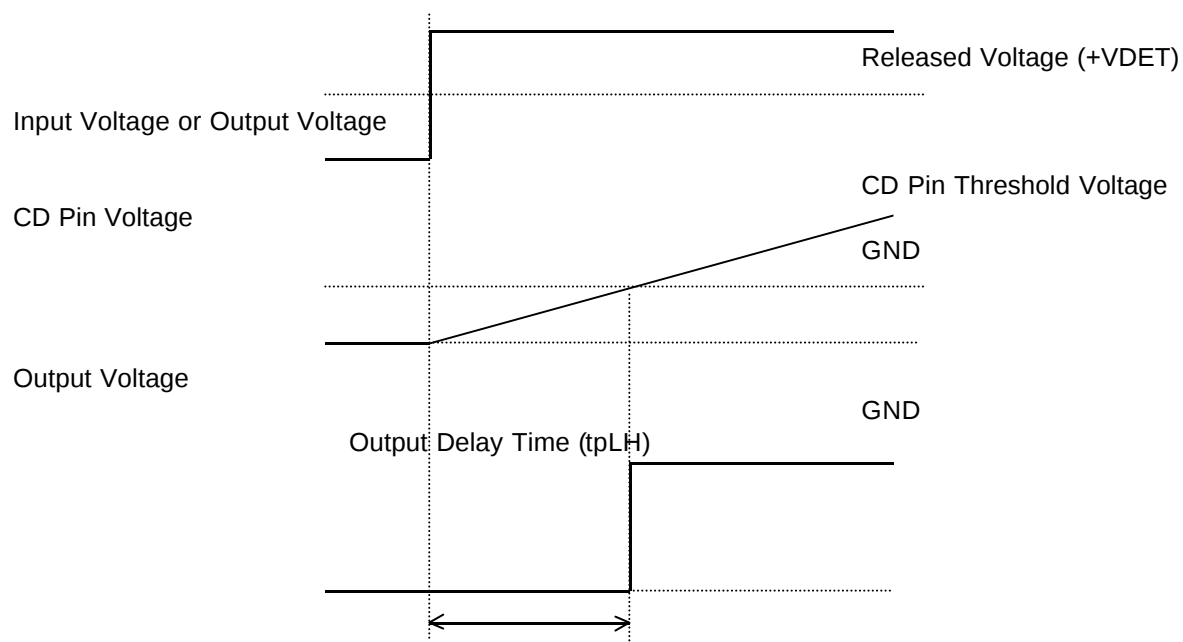
Thermal shutdown function is included in the R1150HxxxA/B/C/D Series, when the junction temperature is equal or more than +150°C (TYP.), the operation of regulator would stop. After that, when the junction temperature is equal or less than +120°C (TYP.), the operation of regulator would restart. Unless the cause of rising temperature would remove, the regulator repeats on and off, and output waveform would be like consecutive pulses.

### Chip Enable Circuit

Do not make voltage level of chip enable pin keep floating level, or in between  $V_{IH}$  and  $V_{IL}$ . Unless otherwise, Output voltage would be unstable or indefinite, or unexpected current would flow internally.

### Output Delay Time for Release VDET

In the R1150Hxx1C/D can set an output delay time for release voltage detector with connecting a capacitor to  $C_D$  pin. When an input voltage (in the case of R1150Hxx1C) or an output voltage (in the case of R1150Hxx1D) surpasses the release voltage of its voltage detector (+VDET), the capacitor which is connected to  $C_D$  pin is started to be charged, as a result,  $C_D$  pin voltage rises. When the  $C_D$  pin voltage surpasses  $C_D$  pin threshold voltage, the output voltage of the voltage detector outputs "H".



Output delay time for release voltage detector can be calculated with the next formula:

$$tpLH = 1.25 / (200 \times 10^{-9}) \times C \text{ (sec)}$$