

# ML6209 Series - High Speed LDO Regulators

(low ESR capacitor compatible, ON/OFF switch)

- **CMOS Low Power Consumption**
- **Dropout Voltage:** 60mV @ 30mA,  
200mV @ 100mA
- **Maximum Output Current:**  
150mA
- **Highly Accurate:** 1.2V ~ 1.95V ± 3%  
2.0V ~ 6.00V ± 2%
- **Output Voltage Range:** 1.5V ~ 6.0V
- **Low ESR capacitor compatible**

## ◆ General Description

The ML6209 series are highly precise, low noise, positive voltage LDO regulators manufactured using CMOS process. The series achieves high ripple rejection and low dropout and consists of a standard voltage source, an error correction, current limiter and a phase compensation circuit plus a driver transistor. Output voltage is selectable in 50mV increments within a range of 1.5V ~ 6.0V.

The series is also compatible with low ESR ceramic capacitors which give added output stability. This stability can be maintained even during load fluctuations due to the excellent transient response of the series. The CE function enables the output to be turned off, resulting in greatly reduced power consumption.

## ◆ Applications

- Mobile phones
- Cordless phones
- Cameras, video recorders
- Portable games
- Portable AV equipment
- Reference voltage
- Battery-powered equipment

## ◆ Features

**Maximum Output Current:** 150mA

**Dropout Voltage:** 200mV (I<sub>OUT</sub> = 100mA)

**Maximum Operating Voltage:** 10V

**Output Voltage Range:** 1.5V ~ 6.0V in 50mV increments

**Highly Accurate:** ± 2%

**Low Power Consumption:** TYP 25µA

**Standby Current:** less than 0.1µA

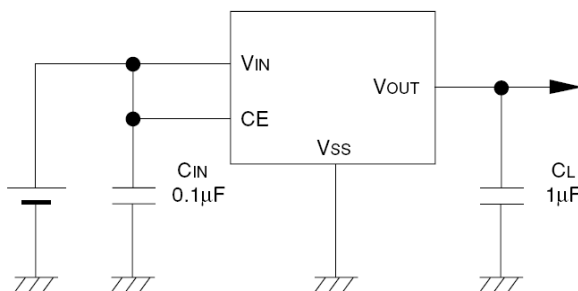
**High Ripple Rejection:** 70dB (10 kHz)

**Low Output Noise:** 30µVrms

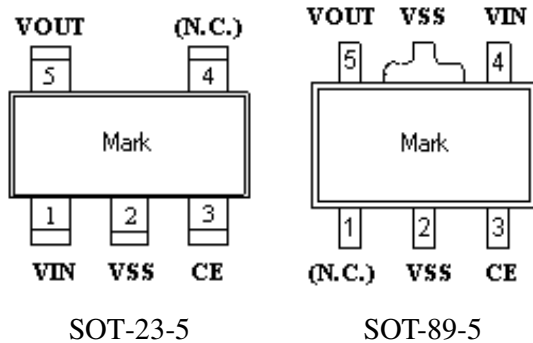
**Operational Temperature Range:** -40°C ~ +85°C

**Low ESR Capacitor Compatible:** Ceramic capacitor

## ◆ Typical Application



◆ **Pin Assignment**



◆ **Pin Function**

| Pin No.  |          | Pin Name | Description    |
|----------|----------|----------|----------------|
| SOT-23-5 | SOT-89-5 |          |                |
| 1        | 4        | VIN      | Input          |
| 2        | 2        | VSS      | Ground         |
| 3        | 3        | CE       | ON/OFF Control |
| 4        | 1        | N.C.     | No Connection  |
| 5        | 5        | VOUT     | Output         |

◆ **Product Classification**

● **Selection Guide**

The following options for the CE pin logic and internal pull-up/down are available:

- Active 'High' + no pull-down resistor built-in (standard)
- Active 'High' + 800kΩ pull-down resistor built-in <between CE-VSS> (semi-custom)
- Active 'Low' + no pull-up resistor built-in (semi-custom)
- Active 'Low' + 800kΩ pull-up resistor built-in <between CE-VSS> (semi-custom)

Note: \*With the pull-up resistor or pull-down resistor built-in types, the supply current during operation will increase by VIN / 800kΩ (TYP.)

● **Ordering Information**

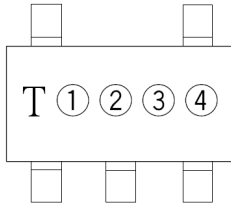
ML6209①②③④⑤⑥⑦

| Designator | Symbol  | Description  |
|------------|---------|--|
| ①          | A       | Active "High" (pull-down resistor built in)  |
|            | B       | Active "High" (no pull-down resistor built in)                                     |
|            | C       | Active "Low" (pull-up resistor built in)   |
|            | D       | Active "Low" (no pull-up resistor built in)  |
| ②③         | 15 ~ 60 | Output Voltage:<br>e.g. 20 ⇒ 2.0V, 30 ⇒ 3.0V etc.                                  |
| ④          | 2       | Output Voltage: 100mV increments, ± 2% accuracy<br>e.g. ②=3, ③=8, ④=2 ⇒ 3.8V, ± 2% |
|            | A       | Output Voltage: 50mV increments, ± 2% accuracy<br>e.g. ②=3, ③=8, ④=A ⇒ 3.85V, ± 2% |
| ⑤          | M       | SOT-23-5 Package   |
|            | P       | SOT-89-5 Package   |
| ⑥          | R       | Embossed Tape: Standard Feed   |
|            | L       | Embossed Tape: Reverse Feed  |
| ⑦          | G       | ROHS Package   |

Please note that "B" version is the standard part while the A, C and D are semi-custom parts.

**◆ Marking Information**

- SOT-23-5

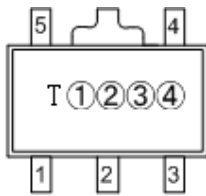


(TOP VIEW)

① represents the product name

| Designator | Product Name |
|------------|--------------|
| P          | ML6209*****  |

- SOT-89-5



(TOP VIEW)

② represents the integer part of the output voltage

| Designator | Output voltage (V) |
|------------|--------------------|
| 1          | 1.0                |
| 2          | 2.0                |
| 3          | 3.0                |
| 4          | 4.0                |
| 5          | 5.0                |
| 6          | 6.0                |

③ represents the decimal part of the output voltage

| Designator | Output Voltage (V) | Designator | Output voltage (V) |
|------------|--------------------|------------|--------------------|
| 0          | 0.0                | A          | 0.05               |
| 1          | 0.1                | B          | 0.15               |
| 2          | 0.2                | C          | 0.25               |
| 3          | 0.3                | D          | 0.35               |
| 4          | 0.4                | E          | 0.45               |
| 5          | 0.5                | F          | 0.55               |
| 6          | 0.6                | G          | 0.65               |
| 7          | 0.7                | H          | 0.75               |
| 8          | 0.8                | I          | 0.85               |
| 9          | 0.9                | J          | 0.95               |

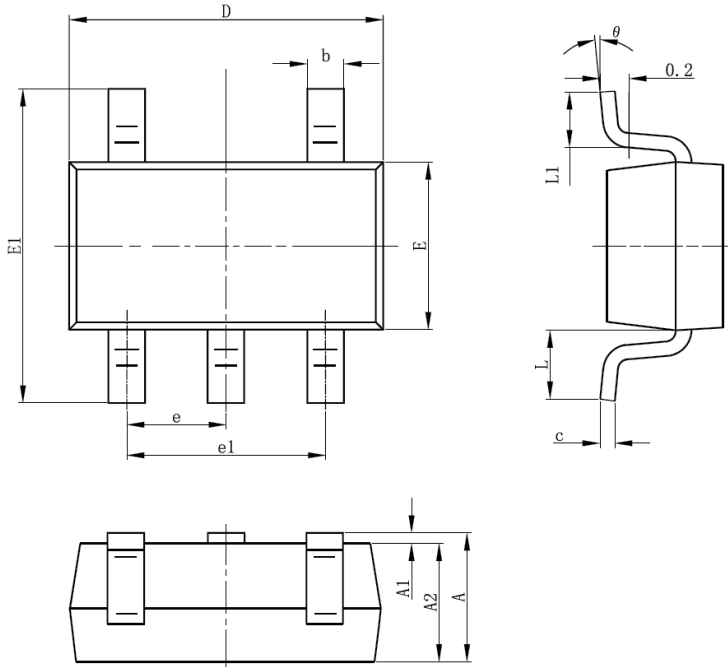
e.g. ②③=12 ⇒ 1.20V and ②③=1C ⇒ 1.25V.

④ represents the resistor version

| Designator | Resistor Version                               |
|------------|--|
| A          | Active “High” (pull-down resistor built in)    |
| B          | Active “High” (no pull-down resistor built in) |
| C          | Active “Low” (pull-up resistor built in)       |
| D          | Active “Low” (no pull-up resistor built in)    |

◆ **Package Information**

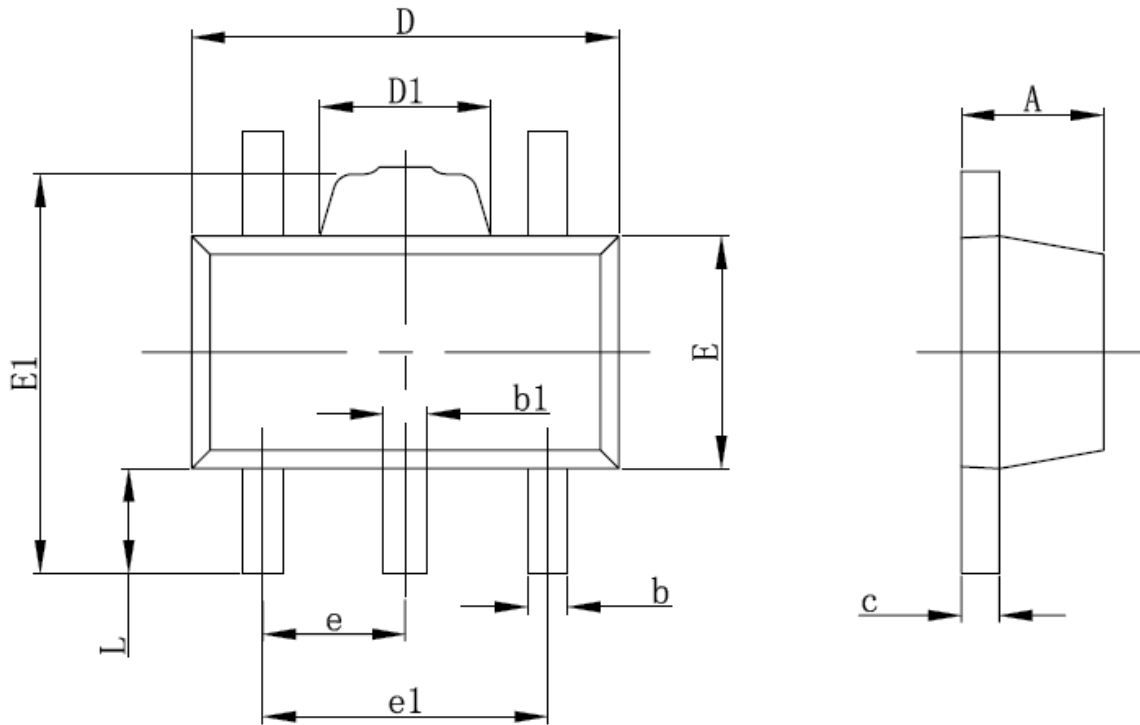
- SOT-23-5



| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min                       | Max   | Min                  | Max   |
| A        | 1.050                     | 1.250 | 0.041                | 0.049 |
| A1       | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2       | 1.050                     | 1.150 | 0.041                | 0.045 |
| b        | 0.300                     | 0.400 | 0.012                | 0.016 |
| c        | 0.100                     | 0.200 | 0.004                | 0.008 |
| D        | 2.820                     | 3.020 | 0.111                | 0.119 |
| E        | 1.500                     | 1.700 | 0.059                | 0.067 |
| E1       | 2.650                     | 2.950 | 0.104                | 0.116 |
| e        | 0.950TYP                  |       | 0.037TYP             |       |
| e1       | 1.800                     | 2.000 | 0.071                | 0.079 |
| L        | 0.700REF                  |       | 0.028REF             |       |
| L1       | 0.300                     | 0.600 | 0.012                | 0.024 |
| $\theta$ | 0°                        | 8°    | 0°                   | 8°    |

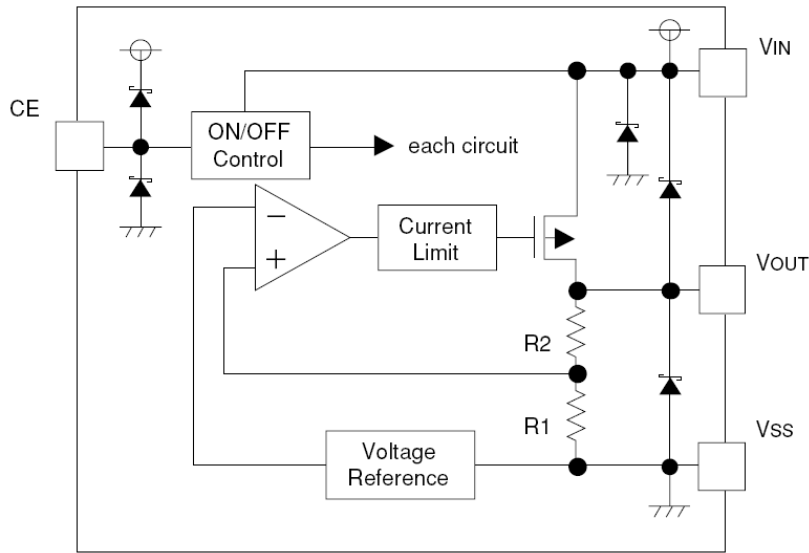
◆ **Package Information**

- SOT-89-5



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.400                     | 1.600 | 0.055                | 0.063 |
| b      | 0.320                     | 0.520 | 0.013                | 0.020 |
| b1     | 0.360                     | 0.560 | 0.014                | 0.022 |
| c      | 0.350                     | 0.440 | 0.014                | 0.017 |
| D      | 4.400                     | 4.600 | 0.173                | 0.181 |
| D1     | 1.400                     | 1.800 | 0.055                | 0.071 |
| E      | 2.300                     | 2.600 | 0.091                | 0.102 |
| E1     | 3.940                     | 4.250 | 0.155                | 0.167 |
| e      | 1.500TYP                  |       | 0.060TYP             |       |
| e1     | 2.900                     | 3.100 | 0.114                | 0.122 |
| L      | 0.900                     | 1.100 | 0.035                | 0.043 |

◆ **Block Diagram**



The diodes in the circuit above are the protective diodes.

◆ **Absolute Maximum Ratings**

| Parameter                     | Symbol | Ratings           | Units |
|-------------------------------|--------|-------------------|-------|
| Input Voltage                 | VIN    | 10                | V     |
| Output Current                | IOUT   | 400               | mA    |
| Output Voltage                | VOUT   | VSS-0.3 ~ VIN+0.3 | V     |
| Power Dissipation SOT25       | Pd     | 250               | mW    |
| Operation Ambient Temperature | Topr   | -40 ~ +85         | °C    |
| Storage Temperature           | Tstg   | -55 ~ +85         | °C    |

\* IOUT= the range of Pd/ (VIN-VOUT)



## ◆ Electrical Characteristics

### ML6209A, B Series

| Parameter                            | Symbol  | Conditions   | Ta=25°C |                     |                 | -40°C ≤ Ta ≤ 85°C |                     |                 | Units             | Circuit |
|--------------------------------------|---|--|---------|---------------------|-----------------|-------------------|---------------------|-----------------|-------------------|---------|
|                                      |   |  | Min     | Typ                 | Max             | Min               | Typ                 | Max             |                   |         |
| Output Voltage                       | V <sub>OUT(E)</sub>                               | I <sub>OUT</sub> = 30mA,<br>1.5V ≤ V <sub>OUT(T)</sub> ≤ 1.95V   | X0.97   | V <sub>OUT(T)</sub> | X1.03           | X0.96             | V <sub>OUT(T)</sub> | X1.04           | V                 | 1       |
|                                      |   | I <sub>OUT</sub> = 30mA,<br>2.0V ≤ V <sub>OUT(T)</sub> ≤ 6.0V  | X0.98   | V <sub>OUT(T)</sub> | X1.02           | X0.97             | V <sub>OUT(T)</sub> | X1.03           |                   |         |
| Maximum Output Current               | I <sub>OUT MAX</sub>                              |  | 150     |                     |                 | 150               |                     |                 | mA                | 1       |
| Load Regulation                      | ΔV <sub>OUT</sub>                                 | 1mA ≤ I <sub>OUT</sub> ≤ 100mA   |         | 15                  | 50              |                   | 30                  | 80              | mV                | 1       |
| Dropout Voltage                      | V <sub>dif1</sub>                                 | I <sub>OUT</sub> = 30mA  | E-1     |                     |                 |                   |                     |                 | mV                | 1       |
|                                      | V <sub>dif2</sub>                                 | I <sub>OUT</sub> = 100mA   | E-2     |                     |                 |                   |                     |                 |                   |         |
| Supply Current (A series)            | I <sub>DD</sub>                                   | V <sub>IN</sub> = V <sub>CE</sub> = V <sub>OUT(T)</sub> + 1.0V   | 20      | 25                  | 40              | 20                | 28                  | 44              | μA                | 2       |
| Supply Current (B series)            |   | V <sub>IN</sub> = V <sub>CE</sub> = V <sub>OUT(T)</sub> + 1.0V   | 20      | 25                  | 40              | 20                | 28                  | 44              |                   |         |
| Standby Current                      | I <sub>stby</sub>                                 | V <sub>IN</sub> = V <sub>OUT(T)</sub> + 1.0V, V <sub>CE</sub> = V <sub>SS</sub>                              |         | 0.01                | 0.10            |                   | 0.05                | 1.00            | μA                | 2       |
| Line Regulation                      | $\frac{\Delta V_{OUT}}{\Delta V_{IN} - V_{OUT}}$  | V <sub>OUT(T)</sub> + 1.0V ≤ V <sub>IN</sub> ≤ 10V<br>I <sub>OUT</sub> = 30mA                                |         | 0.01                | 0.20            |                   | 0.05                | 0.30            | %/V               | 1       |
| Input Voltage                        | V <sub>IN</sub>                                   |  | 2       |                     | 10              | 2                 |                     | 10              | V                 | --      |
| Output Voltage Temp. Characteristics | $\frac{\Delta V_{OUT}}{\Delta T_{opr} - V_{OUT}}$ | I <sub>OUT</sub> = 30mA<br>-40°C ≤ T <sub>opr</sub> ≤ 85°C   |         | 100                 |                 |                   |                     |                 | Ppm/°C            | 1       |
| Output Noise                         | en  | I <sub>OUT</sub> = 10mA<br>300Hz ~ 50kHz   |         | 30                  |                 |                   |                     |                 | μV <sub>rms</sub> | 3       |
| Ripple Rejection Rate                | PSRR  | V <sub>IN</sub> = [V <sub>OUT(T)</sub> + 1.0]V + 1.0V <sub>p-pAC</sub><br>I <sub>OUT</sub> = 50mA, f = 10kHz |         | 70                  |                 |                   |                     |                 | dB                | 4       |
| Current Limited                      | I <sub>Ilim</sub>                                 | V <sub>IN</sub> = V <sub>OUT(T)</sub> + 1.0V, V <sub>CE</sub> = V <sub>IN</sub>                              |         | 300                 |                 |                   | 280                 |                 | mA                | 1       |
| Short-circuit Current                | I <sub>short</sub>                                | V <sub>IN</sub> = V <sub>OUT(T)</sub> + 1.0V, V <sub>CE</sub> = V <sub>IN</sub>                              |         | 50                  |                 |                   | 60                  |                 | mA                | 1       |
| CE "High" Voltage                    | V <sub>CEH</sub>                                  |  | 1.6     |                     | V <sub>IN</sub> | 1.7               |                     | V <sub>IN</sub> | V                 | 1       |
| CE "Low" Voltage                     | V <sub>CEL</sub>                                  |  |         |                     | 0.25            |                   | 0.20                |                 | V                 | 1       |
| CE "High" Current (A series)         | I <sub>CEH</sub>                                  | V <sub>IN</sub> = V <sub>CE</sub> = V <sub>OUT(T)</sub> + 1.0V   | -0.10   |                     | 20              | -0.15             |                     | 25              | μA                | 2       |
| CE "High" Current (B series)         | I <sub>CEH</sub>                                  | V <sub>IN</sub> = V <sub>CE</sub> = V <sub>OUT(T)</sub> + 1.0V   | -0.10   |                     | 0.10            | -0.15             |                     | 0.15            | μA                | 2       |
| CE "Low" Current                     | I <sub>CEL</sub>                                  | V <sub>IN</sub> = V <sub>OUT(T)</sub> + 1.0V, V <sub>CE</sub> = V <sub>SS</sub>                              | -0.10   |                     | 0.10            | -0.15             |                     | 0.15            | μA                | 2       |

Note

(NOTE 1) Unless otherwise stated, V<sub>IN</sub> = V<sub>OUT(T)</sub> + 1.0V

(NOTE 2) V<sub>OUT(T)</sub> = Specified Output Voltage

(NOTE 3) V<sub>OUT(E)</sub> = Effective Output Voltage (I.e. the output voltage when "V<sub>OUT(T)</sub> + 1.0V" is provided at the V<sub>IN</sub> pin while maintaining a certain I<sub>OUT</sub> value)

(NOTE 4) V<sub>dif</sub> = (V<sub>IN1</sub> (NOTE6) - V<sub>OUT1</sub> (NOTES))

(NOTE 5) V<sub>OUT1</sub> = A voltage equal to 98% of the Output Voltage whenever an amply stabilized I<sub>OUT</sub> (V<sub>OUT(T)</sub> + 1.0V) is input.

(NOTE 6) V<sub>IN1</sub> = The Input Voltage when V<sub>OUT1</sub> appears as Input Voltage is gradually decreased.

(NOTE 7) The values for -40°C ≤ T<sub>opr</sub> ≤ 85°C are designed values.

**ML6209C, D Series**

| Parameter                            | Symbol                                       | Conditions   | Ta=25°C |                     |                 | -40°C ≤ Ta ≤ 85°C |                     |                 | Units             | Circuit |
|--------------------------------------|--|--|---------|---------------------|-----------------|-------------------|---------------------|-----------------|-------------------|---------|
|                                      |  |  | Min     | Typ                 | Max             | Min               | Typ                 | Max             |                   |         |
| Output Voltage                       | V <sub>OUT(E)</sub>                          | I <sub>OUT</sub> = 30mA,<br>1.5V ≤ V <sub>OUT(T)</sub> ≤ 1.95V   | X0.97   | V <sub>OUT(T)</sub> | X1.03           | X0.96             | V <sub>OUT(T)</sub> | X1.04           | V                 | 1       |
|                                      |  | I <sub>OUT</sub> = 30mA,<br>2.0V ≤ V <sub>OUT(T)</sub> ≤ 6.0V  | X0.98   | V <sub>OUT(T)</sub> | X1.02           | X0.97             | V <sub>OUT(T)</sub> | X1.03           |                   |         |
| Maximum Output Current               | I <sub>OUT MAX</sub>                         |  | 150     |                     |                 | 150               |                     |                 | mA                | 1       |
| Load Regulation                      | ΔV <sub>OUT</sub>                            | 1mA ≤ I <sub>OUT</sub> ≤ 100mA   |         | 15                  | 50              |                   | 30                  | 80              | mV                | 1       |
| Dropout Voltage                      | V <sub>dif1</sub>                            | I <sub>OUT</sub> = 30mA  | E-1     |                     |                 |                   |                     |                 | mV                | 1       |
|                                      | V <sub>dif2</sub>                            | I <sub>OUT</sub> = 100mA   | E-2     |                     |                 |                   |                     |                 | mV                |         |
| Supply Current (C series)            | I <sub>DD</sub>                              | V <sub>IN</sub> = V <sub>OUT(T)</sub> + 1.0V, V <sub>CE</sub> = V <sub>SS</sub>                              | 20      | 25                  | 40              | 20                | 28                  | 44              | μA                | 2       |
| Supply Current (B series)            |  | V <sub>IN</sub> = V <sub>OUT(T)</sub> + 1.0V, V <sub>CE</sub> = V <sub>SS</sub>                              | 20      | 25                  | 40              | 20                | 28                  | 44              |                   |         |
| Standby Current                      | I <sub>stby</sub>                            | V <sub>IN</sub> = V <sub>CE</sub> = V <sub>OUT(T)</sub> + 1.0V   |         | 0.01                | 0.10            |                   | 0.05                | 1.00            | μA                | 2       |
| Line Regulation                      | $\frac{\Delta V_{OUT}}{\Delta V_{IN-VOUT}}$  | V <sub>OUT(T)</sub> + 1.0V ≤ V <sub>IN</sub> ≤ 10V<br>I <sub>OUT</sub> = 30mA                                |         | 0.01                | 0.20            |                   | 0.05                | 0.30            | %/V               | 1       |
| Input Voltage                        | V <sub>IN</sub>                              |  | 2       |                     | 10              | 2                 |                     | 10              | V                 | --      |
| Output Voltage Temp. Characteristics | $\frac{\Delta V_{OUT}}{\Delta T_{opr-VOUT}}$ | I <sub>OUT</sub> = 30mA<br>-40°C ≤ T <sub>opr</sub> ≤ 85°C   |         | 100                 |                 |                   |                     |                 | Ppm/°C            | 1       |
| Output Noise                         | e <sub>n</sub>                               | I <sub>OUT</sub> = 10mA<br>300Hz ~ 50kHz   |         | 30                  |                 |                   |                     |                 | μV <sub>rms</sub> | 3       |
| Ripple Rejection Rate                | PSRR   | V <sub>IN</sub> = [V <sub>OUT(T)</sub> + 1.0]V + 1.0V <sub>p-pAC</sub><br>I <sub>OUT</sub> = 50mA, f = 10kHz |         | 70                  |                 |                   |                     |                 | dB                | 4       |
| Current Limited                      | I <sub>Iim</sub>                             | V <sub>IN</sub> = V <sub>OUT(T)</sub> + 1.0V, V <sub>CE</sub> = V <sub>SS</sub>                              |         | 300                 |                 |                   | 280                 |                 | mA                | 1       |
| Short-circuit Current                | I <sub>short</sub>                           | V <sub>IN</sub> = V <sub>OUT(T)</sub> + 1.0V, V <sub>CE</sub> = V <sub>SS</sub>                              |         | 50                  |                 |                   | 60                  |                 | mA                | 1       |
| CE "High" Voltage                    | V <sub>CEH</sub>                             |  | 1.6     |                     | V <sub>IN</sub> | 1.7               |                     | V <sub>IN</sub> | V                 | 1       |
| CE "Low" Voltage                     | V <sub>CEL</sub>                             |  |         |                     | 0.25            |                   |                     | 0.20            | V                 | 1       |
| CE "High" Current                    | I <sub>CEH</sub>                             | V <sub>IN</sub> = V <sub>CE</sub> = V <sub>OUT(T)</sub> + 1.0V   | -0.10   |                     | 0.10            | -0.15             |                     | 0.15            | μA                | 2       |
| CE "Low" Current (C series)          | I <sub>CEL</sub>                             | V <sub>IN</sub> = V <sub>OUT(T)</sub> + 1.0V, V <sub>CE</sub> = V <sub>SS</sub>                              | -20     |                     | 0.10            | -25               |                     | 0.15            | μA                | 2       |
| CE "Low" Current (D series)          | I <sub>CEL</sub>                             | V <sub>IN</sub> = V <sub>OUT(T)</sub> + 1.0V, V <sub>CE</sub> = V <sub>SS</sub>                              | -0.10   |                     | 0.10            | -0.15             |                     | 0.15            | μA                | 2       |

## Note

(NOTE 1) Unless otherwise stated, V<sub>IN</sub> = V<sub>OUT(T)</sub> + 1.0V(NOTE 2) V<sub>OUT(T)</sub> = Specified Output Voltage(NOTE 3) V<sub>OUT(E)</sub> = Effective Output Voltage (I.e. the output voltage when "V<sub>OUT(T)</sub> + 1.0V" is provided at the V<sub>IN</sub> pin while maintaining a certain I<sub>OUT</sub> value)(NOTE 4) V<sub>dif</sub> = (V<sub>IN1</sub> (NOTE6) - V<sub>OUT1</sub> (NOTES5))(NOTE 5) V<sub>OUT1</sub> = A voltage equal to 98% of the Output Voltage whenever an amply stabilized I<sub>OUT</sub> (V<sub>OUT(T)</sub> + 1.0V) is input.(NOTE 6) V<sub>IN1</sub> = The Input Voltage when V<sub>OUT1</sub> appears as Input Voltage is gradually decreased.(NOTE 7) The values for -40°C ≤ T<sub>opr</sub> ≤ 85°C are designed values.



**Dropout Voltage – Table 1**

| <b>SYMBOL</b>                                 | <b>E-0</b>                |            | <b>E-1</b>   |                         |                                       |                         | <b>E-2</b>  |                         |                                       |                         |
|---|---------------------------|------------|--|-------------------------|---------------------------------------|-------------------------|---|-------------------------|---------------------------------------|-------------------------|
| <b>PARAMETER</b><br><br><b>OUTPUT VOLTAGE</b> | <b>Output Voltage (V)</b> |            | <b>Dropout Voltage 1 (mV)</b><br><i>(I<sub>OUT</sub>=30mA)</i> |                         |                                       |                         | <b>Dropout Voltage 2 (mV)</b><br><i>(I<sub>OUT</sub>=100mA)</i> |                         |                                       |                         |
|   |                           |            | <i>T<sub>a</sub>=25°C</i>                                      |                         | <i>-40°C ≤ T<sub>opr</sub> ≤ 85°C</i> |                         | <i>T<sub>a</sub>=25°C</i>                                       |                         | <i>-40°C ≤ T<sub>opr</sub> ≤ 85°C</i> |                         |
| <b>V<sub>OUT</sub>(T)</b>                     | <b>V<sub>OUT</sub></b>    |            | <b>V<sub>dif1</sub></b>  | <b>V<sub>dif1</sub></b> | <b>V<sub>dif1</sub></b>               | <b>V<sub>dif1</sub></b> | <b>V<sub>dif2</sub></b>   | <b>V<sub>dif2</sub></b> | <b>V<sub>dif2</sub></b>               | <b>V<sub>dif2</sub></b> |
|   | <b>MIN</b>                | <b>MAX</b> | <b>TYP</b>   | <b>MAX</b>              | <b>TYP</b>                            | <b>MAX</b>              | <b>TYP</b>  | <b>MAX</b>              | <b>TYP</b>                            | <b>MAX</b>              |
| 1.20  | 1.164                     | 1.236      | 650  | 750                     | 670                                   | 800                     | 900   | 950                     | 950                                   | 1000                    |
| 1.30  | 1.261                     | 1.339      | 580  | 700                     | 620                                   | 750                     | 800   | 900                     | 850                                   | 950                     |
| 1.40  | 1.358                     | 1.442      | 500  | 600                     | 530                                   | 650                     | 700   | 850                     | 750                                   | 900                     |
| 1.50  | 1.455                     | 1.545      | 400  | 500                     | 410                                   | 520                     | 600   | 800                     | 620                                   | 820                     |
| 1.55  | 1.504                     | 1.597      | 400  | 500                     | 410                                   | 520                     | 600   | 800                     | 620                                   | 820                     |
| 1.60  | 1.552                     | 1.648      | 300  | 380                     | 310                                   | 400                     | 500   | 680                     | 520                                   | 700                     |
| 1.65  | 1.601                     | 1.700      | 300  | 380                     | 310                                   | 400                     | 500   | 680                     | 520                                   | 700                     |
| 1.70  | 1.649                     | 1.751      | 250  | 320                     | 260                                   | 330                     | 400   | 620                     | 420                                   | 640                     |
| 1.75  | 1.698                     | 1.803      | 250  | 320                     | 260                                   | 330                     | 400   | 620                     | 420                                   | 640                     |
| 1.80  | 1.746                     | 1.854      | 200  | 250                     | 210                                   | 260                     | 350   | 480                     | 360                                   | 500                     |
| 1.85  | 1.795                     | 1.906      | 200  | 250                     | 210                                   | 260                     | 350   | 480                     | 360                                   | 500                     |
| 1.90  | 1.843                     | 1.957      | 140  | 180                     | 150                                   | 190                     | 320   | 460                     | 340                                   | 480                     |
| 1.95  | 1.892                     | 2.009      | 140  | 180                     | 150                                   | 190                     | 320   | 460                     | 340                                   | 480                     |
| 2.00  | 1.960                     | 2.040      | 100  | 150                     | 110                                   | 160                     | 270   | 420                     | 290                                   | 440                     |
| 2.05  | 2.009                     | 2.091      | 100  | 150                     | 110                                   | 160                     | 270   | 420                     | 290                                   | 440                     |
| 2.10  | 2.058                     | 2.142      | 100  | 150                     | 110                                   | 160                     | 250   | 400                     | 280                                   | 410                     |
| 2.15  | 2.107                     | 2.193      | 100  | 150                     | 110                                   | 160                     | 250   | 400                     | 280                                   | 410                     |
| 2.20  | 2.156                     | 2.244      | 100  | 150                     | 110                                   | 160                     | 250   | 400                     | 280                                   | 410                     |
| 2.25  | 2.205                     | 2.295      | 100  | 150                     | 110                                   | 160                     | 250   | 400                     | 280                                   | 410                     |
| 2.30  | 2.254                     | 2.346      | 100  | 150                     | 110                                   | 160                     | 240   | 380                     | 280                                   | 400                     |
| 2.35  | 2.303                     | 2.397      | 100  | 150                     | 110                                   | 160                     | 240   | 380                     | 280                                   | 400                     |
| 2.40  | 2.352                     | 2.448      | 100  | 150                     | 110                                   | 160                     | 240   | 380                     | 280                                   | 400                     |
| 2.45  | 2.401                     | 2.499      | 100  | 150                     | 110                                   | 160                     | 240   | 380                     | 280                                   | 400                     |
| 2.50  | 2.450                     | 2.550      | 90   | 120                     | 100                                   | 130                     | 230   | 350                     | 260                                   | 380                     |
| 2.55  | 2.499                     | 2.601      | 90   | 120                     | 100                                   | 130                     | 230   | 350                     | 260                                   | 380                     |
| 2.60  | 2.548                     | 2.652      | 90   | 120                     | 100                                   | 130                     | 230   | 350                     | 260                                   | 380                     |
| 2.65  | 2.597                     | 2.703      | 90   | 120                     | 100                                   | 130                     | 230   | 350                     | 260                                   | 380                     |
| 2.70  | 2.646                     | 2.754      | 90   | 120                     | 100                                   | 130                     | 230   | 350                     | 260                                   | 380                     |
| 2.75  | 2.695                     | 2.805      | 90   | 120                     | 100                                   | 130                     | 230   | 350                     | 260                                   | 380                     |
| 2.80  | 2.744                     | 2.856      | 90   | 120                     | 100                                   | 130                     | 220   | 330                     | 260                                   | 370                     |
| 2.85  | 2.793                     | 2.907      | 90   | 120                     | 100                                   | 130                     | 220   | 330                     | 260                                   | 370                     |
| 2.90  | 2.842                     | 2.958      | 90   | 120                     | 100                                   | 130                     | 220   | 330                     | 260                                   | 370                     |
| 2.95  | 2.891                     | 3.009      | 90   | 120                     | 100                                   | 130                     | 220   | 330                     | 260                                   | 370                     |
| 3.00  | 2.940                     | 3.060      | 80   | 100                     | 90                                    | 110                     | 220   | 300                     | 260                                   | 350                     |
| 3.05  | 2.989                     | 3.111      | 80   | 100                     | 90                                    | 110                     | 220   | 300                     | 260                                   | 350                     |
| 3.10  | 3.038                     | 3.162      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.15  | 3.087                     | 3.213      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |



**Dropout Voltage – Table 2**

| <b>SYMBOL</b>                                 | <b>E-0</b>                |            | <b>E-1</b>   |                         |                                       |                         | <b>E-2</b>  |                         |                                       |                         |
|---|---------------------------|------------|--|-------------------------|---------------------------------------|-------------------------|---|-------------------------|---------------------------------------|-------------------------|
| <b>PARAMETER</b><br><br><b>OUTPUT VOLTAGE</b> | <b>Output Voltage (V)</b> |            | <b>Dropout Voltage 1 (mV)</b><br><i>(I<sub>OUT</sub>=30mA)</i> |                         |                                       |                         | <b>Dropout Voltage 2 (mV)</b><br><i>(I<sub>OUT</sub>=100mA)</i> |                         |                                       |                         |
|   |                           |            | <i>T<sub>a</sub>=25°C</i>                                      |                         | <i>-40°C ≤ T<sub>opr</sub> ≤ 85°C</i> |                         | <i>T<sub>a</sub>=25°C</i>                                       |                         | <i>-40°C ≤ T<sub>opr</sub> ≤ 85°C</i> |                         |
| <b>V<sub>OUT</sub>(T)</b>                     | <b>V<sub>OUT</sub></b>    |            | <b>V<sub>dif1</sub></b>  | <b>V<sub>dif1</sub></b> | <b>V<sub>dif1</sub></b>               | <b>V<sub>dif1</sub></b> | <b>V<sub>dif2</sub></b>   | <b>V<sub>dif2</sub></b> | <b>V<sub>dif2</sub></b>               | <b>V<sub>dif2</sub></b> |
|   | <b>MIN</b>                | <b>MAX</b> | <b>TYP</b>   | <b>MAX</b>              | <b>TYP</b>                            | <b>MAX</b>              | <b>TYP</b>  | <b>MAX</b>              | <b>TYP</b>                            | <b>MAX</b>              |
| 3.20  | 3.136                     | 3.264      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.25  | 3.185                     | 3.315      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.30  | 3.234                     | 3.366      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.35  | 3.283                     | 3.417      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.40  | 3.332                     | 3.468      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.45  | 3.381                     | 3.519      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.50  | 3.430                     | 3.570      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.55  | 3.479                     | 3.621      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.60  | 3.528                     | 3.672      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.65  | 3.577                     | 3.723      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.70  | 3.626                     | 3.774      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.75  | 3.675                     | 3.825      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.80  | 3.724                     | 3.876      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.85  | 3.773                     | 3.927      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.90  | 3.822                     | 3.978      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 3.95  | 3.871                     | 4.029      | 80   | 100                     | 90                                    | 110                     | 200   | 280                     | 240                                   | 330                     |
| 4.00  | 3.920                     | 4.080      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.05  | 3.969                     | 4.131      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.10  | 4.018                     | 4.182      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.15  | 4.067                     | 4.233      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.20  | 4.116                     | 4.284      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.25  | 4.165                     | 4.335      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.30  | 4.214                     | 4.386      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.35  | 4.263                     | 4.437      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.40  | 4.312                     | 4.488      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.45  | 4.361                     | 4.539      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.50  | 4.410                     | 4.590      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.55  | 4.459                     | 4.641      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.60  | 4.508                     | 4.692      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.65  | 4.557                     | 4.743      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |



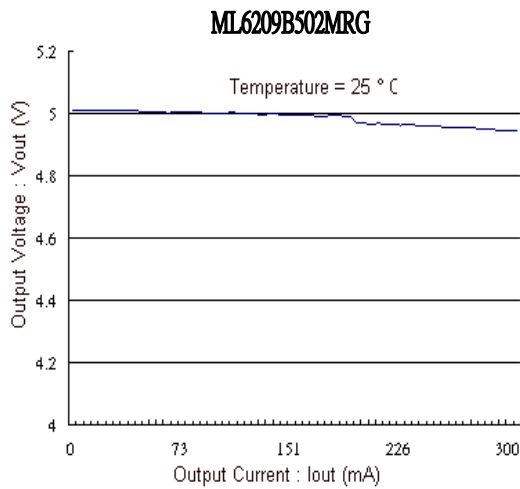
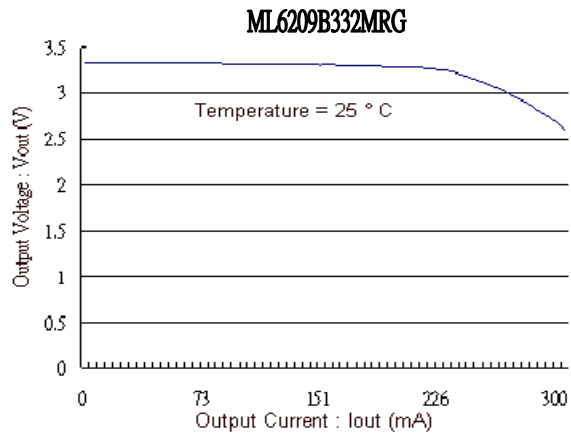
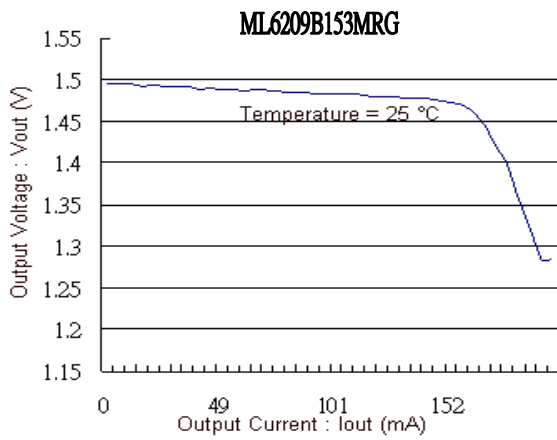
**Dropout Voltage – Table 3**

| <b>SYMBOL</b>                                 | <b>E-0</b>                |            | <b>E-1</b>   |                         |                                       |                         | <b>E-2</b>  |                         |                                       |                         |
|---|---------------------------|------------|--|-------------------------|---------------------------------------|-------------------------|---|-------------------------|---------------------------------------|-------------------------|
| <b>PARAMETER</b><br><br><b>OUTPUT VOLTAGE</b> | <b>Output Voltage (V)</b> |            | <b>Dropout Voltage 1 (mV)</b><br><i>(I<sub>OUT</sub>=30mA)</i> |                         |                                       |                         | <b>Dropout Voltage 2 (mV)</b><br><i>(I<sub>OUT</sub>=100mA)</i> |                         |                                       |                         |
|   |                           |            | <i>T<sub>a</sub>=25°C</i>                                      |                         | <i>-40°C ≤ T<sub>opr</sub> ≤ 85°C</i> |                         | <i>T<sub>a</sub>=25°C</i>                                       |                         | <i>-40°C ≤ T<sub>opr</sub> ≤ 85°C</i> |                         |
| <b>V<sub>OUT</sub>(T)</b>                     | <b>V<sub>OUT</sub></b>    |            | <b>V<sub>dif1</sub></b>  | <b>V<sub>dif1</sub></b> | <b>V<sub>dif1</sub></b>               | <b>V<sub>dif1</sub></b> | <b>V<sub>dif2</sub></b>   | <b>V<sub>dif2</sub></b> | <b>V<sub>dif2</sub></b>               | <b>V<sub>dif2</sub></b> |
|   | <b>MIN</b>                | <b>MAX</b> | <b>TYP</b>   | <b>MAX</b>              | <b>TYP</b>                            | <b>MAX</b>              | <b>TYP</b>  | <b>MAX</b>              | <b>TYP</b>                            | <b>MAX</b>              |
| 4.70  | 4.606                     | 4.794      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.75  | 4.655                     | 4.845      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.80  | 4.704                     | 4.896      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.85  | 4.753                     | 4.947      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.90  | 4.802                     | 4.998      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 4.95  | 4.851                     | 5.049      | 70   | 90                      | 80                                    | 100                     | 180   | 260                     | 220                                   | 310                     |
| 5.00  | 4.900                     | 5.100      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.05  | 4.949                     | 5.151      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.10  | 4.998                     | 5.202      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.15  | 5.047                     | 5.253      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.20  | 5.096                     | 5.304      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.25  | 5.145                     | 5.355      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.30  | 5.194                     | 5.406      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.35  | 5.243                     | 5.457      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.40  | 5.292                     | 5.508      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.45  | 5.341                     | 5.559      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.50  | 5.390                     | 5.610      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.55  | 5.439                     | 5.661      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.60  | 5.488                     | 5.712      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.65  | 5.537                     | 5.763      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.70  | 5.586                     | 5.814      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.75  | 5.635                     | 5.865      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.80  | 5.684                     | 5.916      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.85  | 5.733                     | 5.967      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.90  | 5.782                     | 6.018      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 5.95  | 5.831                     | 6.069      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |
| 6.00  | 5.880                     | 6.120      | 50   | 80                      | 60                                    | 90                      | 160   | 240                     | 200                                   | 290                     |

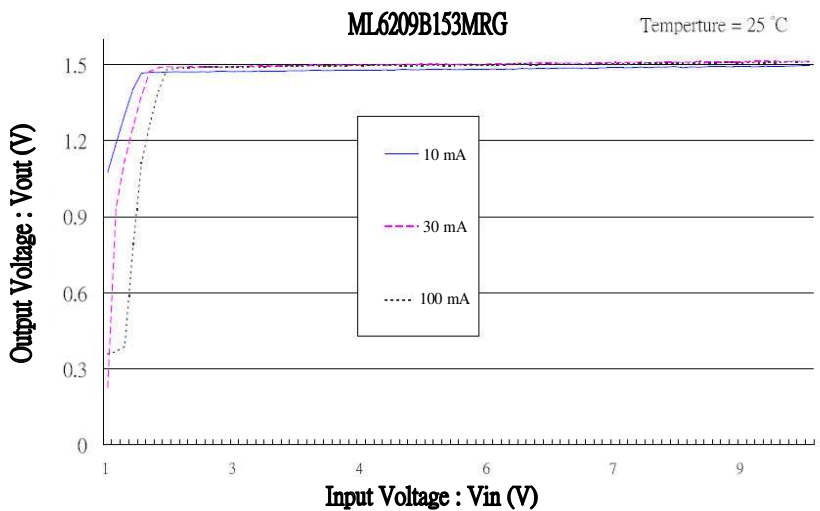


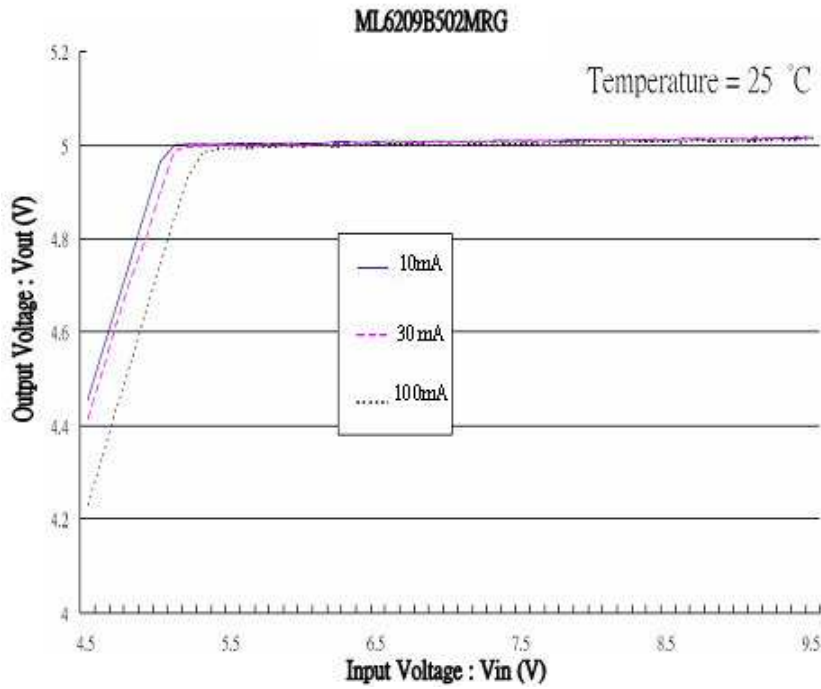
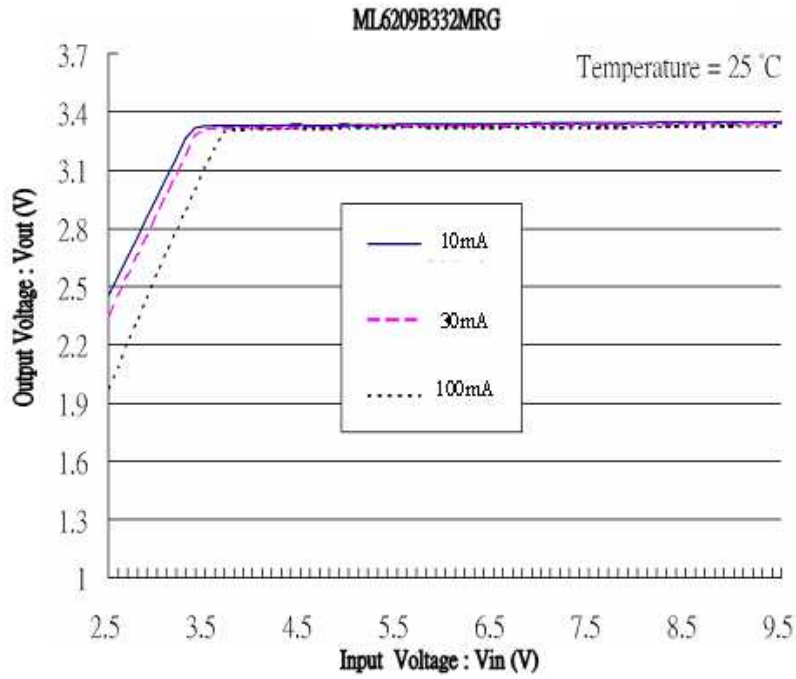
## ■ Typical Performance Characteristics

### (1) Output Voltage VS Output Current



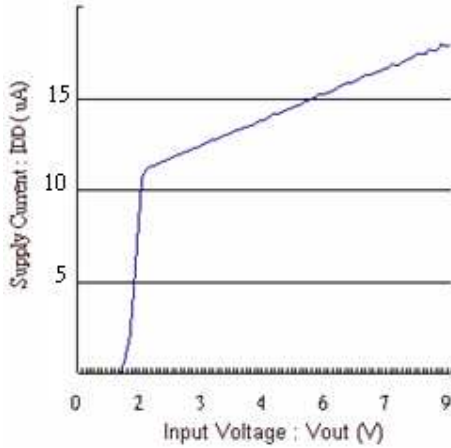
### (2) Output Voltage VS Input Voltage



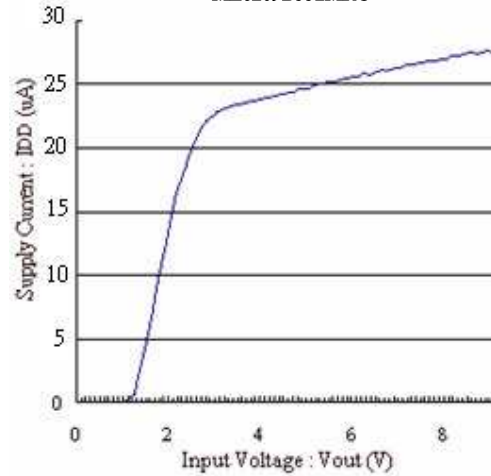


**(3) Supply Current VS Input Voltage**

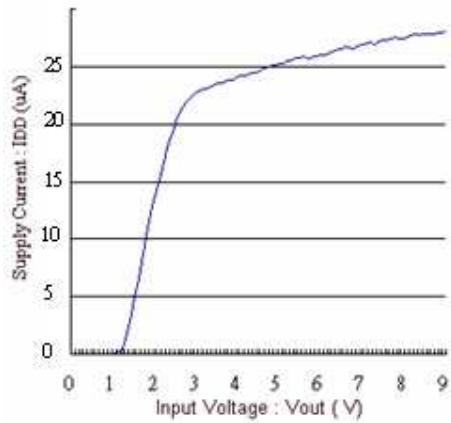
**ML6209B153MRG**



**ML6209B332MRG**



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