

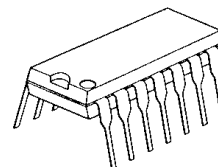
## DC/DC CONVERTER CONTROL IC WITH CURRENT SENSE AMPLIFIER

### ■GENERAL DESCRIPTION

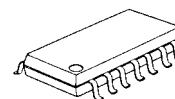
The **NJM2383** is a low voltage operation DC/DC converter control IC featuring high side current protection, soft start and standby functions.

It is suitable for power module application and on-board regulators.

### ■PACKAGE OUTLINE



**NJM2383D**



**NJM2383M**

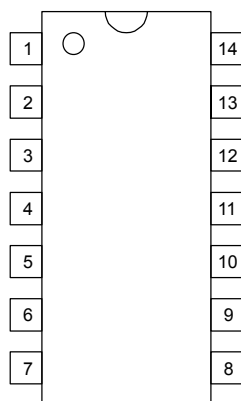


**NJM2383V**

### ■FEATURES

- PWM switching control
- Operating Voltage (3.6 to 32V)
- Wide Oscillator Range (5 to 350 kHz)
- ON/OFF Circuit (High Active)
- Current Sensing Amplifier
- Soft-Start Function
- UVLO(Under Voltage Lockouts)
- Bipolar Technology
- Package Outline DIP14, DMP14, SSOP10

### ■PIN CONFIGURATION

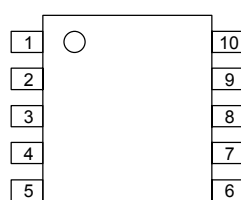


**NJM2383D**

**NJM2383M**

#### PIN FUNCTION

|                     |                   |
|---------------------|-------------------|
| 1.NC                | 8.NC              |
| 2.IN <sup>-</sup> 1 | 9. V <sup>+</sup> |
| 3.IN <sup>-</sup> 2 | 10.CS             |
| 4.F.B               | 11.CT             |
| 5.GND               | 12.REF            |
| 6.OUT               | 13.ON/OFF         |
| 7.NC                | 14.NC             |



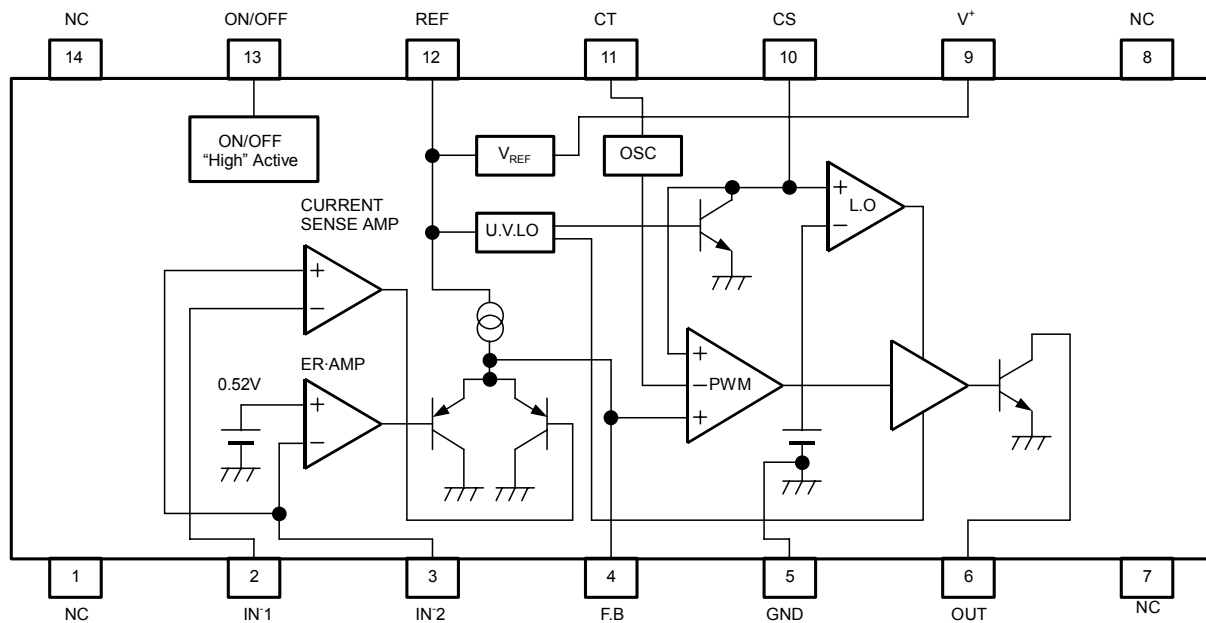
**NJM2383V**

#### PIN FUNCTION

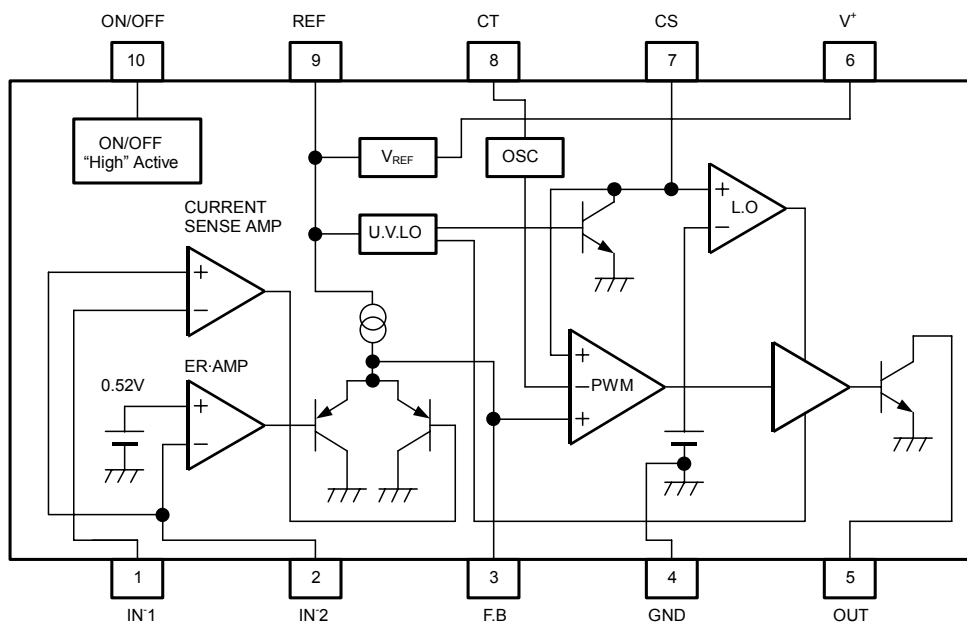
|                     |                   |
|---------------------|-------------------|
| 1.IN <sup>-</sup> 1 | 6. V <sup>+</sup> |
| 2.IN <sup>-</sup> 2 | 7.CS              |
| 3.F.B               | 8.CT              |
| 4.GND               | 9.REF             |
| 5.OUT               | 10.ON/OFF         |

# NJM2383

## ■BLOCK DIAGRAM



(Package: DIP14, DMP14)



(Package: SSOP10)

## ■ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

| PARAMETER                   | SYMBOL              | MAXIMUM RATINGS                               | UNIT |
|-----------------------------|---------------------|-----------------------------------------------|------|
| Input Voltage               | V <sup>+</sup>      | 36                                            | V    |
| Reference Output Current    | I <sub>OR</sub>     | 10                                            | mA   |
| Output Sink Current         | I <sub>SINK</sub>   | 200                                           | mA   |
| Differential Input Voltage  | V <sub>ID</sub>     | 2.5                                           | V    |
| Common Mode Input Voltage   | V <sub>IC</sub>     | -0.3 ~ 2.5                                    | V    |
| ON/OFF Control Voltage      | V <sub>ON/OFF</sub> | -0.3 ~ 36 (note)                              | V    |
| Power Dissipation           | P <sub>D</sub>      | (DIP 14) 700<br>(DMP 14) 300<br>(SSOP 10) 250 | mW   |
| Operating Temperature Range | T <sub>OPR</sub>    | -40 ~ +85                                     | °C   |
| Storage Temperature Range   | T <sub>STG</sub>    | -50 ~ +150                                    | °C   |

(note) When the supply voltage is less than 36V, the absolute maximum input voltage is equal to the supply voltage.

## ■ELECTRICAL CHARACTERISTICS (V<sup>+</sup>=6V, R<sub>T</sub>=33kΩ, C<sub>T</sub>=1000pF, V<sub>ON/OFF</sub>=3V, Ta=25°C)

### REFERENCE VOLTAGE BLOCK

| PARAMETER       | SYMBOL           | TEST CONDITION                                  | MIN. | TYP. | MAX. | UNIT |
|-----------------|------------------|-------------------------------------------------|------|------|------|------|
| Output Voltage  | V <sub>REF</sub> | I <sub>OR</sub> =1mA                            | 2.45 | 2.50 | 2.55 | V    |
| Line Regulation | L <sub>INE</sub> | V <sup>+</sup> =3.6 ~ 32V, I <sub>OR</sub> =1mA | —    | 6.8  | 20.7 | mV   |
| Load Regulation | L <sub>OAD</sub> | I <sub>OR</sub> =0.1 ~ 5.0mA                    | —    | 5    | 30   | mV   |

### OSCILLATOR BLOCK

| PARAMETER                                      | SYMBOL           | TEST CONDITION                               | MIN. | TYP. | MAX. | UNIT |
|------------------------------------------------|------------------|----------------------------------------------|------|------|------|------|
| Oscillation Frequency                          | f <sub>OSC</sub> | R <sub>T</sub> =33kΩ, C <sub>T</sub> =1000pF | 85   | 105  | 125  | kHz  |
| Oscillate Fluctuations1<br>(Line Fluctuations) | f <sub>dV</sub>  | V <sup>+</sup> =3.6 ~ 32V                    | —    | 1    | —    | %    |
| Oscillate Fluctuations2<br>(Temp Fluctuations) | f <sub>dT</sub>  | Ta=-40 ~ 85°C                                | —    | 5    | —    | %    |

### CURRENT SENSE AMPLIFIER BLOCK

| PARAMETER                            | SYMBOL            | TEST CONDITION         | MIN. | TYP.                         | MAX. | UNIT |
|--------------------------------------|-------------------|------------------------|------|------------------------------|------|------|
| Input Offset Voltage1                | V <sub>IO1</sub>  |                        | —    | 2                            | 7    | mV   |
| Input Offset Current1                | I <sub>IO1</sub>  |                        | —    | 5                            | —    | nA   |
| Input Bias Current1                  | I <sub>B1</sub>   |                        | —    | 20                           | 100  | nA   |
| Open Loop Gain1                      | A <sub>V1</sub>   |                        | —    | 90                           | —    | dB   |
| Gain Bandwidth Product1              | G <sub>B1</sub>   |                        | —    | 0.6                          | —    | MHz  |
| Input Common Mode<br>Voltage Ratio1  | V <sub>ICM1</sub> |                        | —    | 0 ~<br>V <sub>REF</sub> -0.8 | —    | V    |
| Maximum Output Voltage1<br>(F.B Pin) | V <sub>OM-1</sub> | R <sub>NF</sub> =100kΩ | —    | —                            | 1    | V    |
| Maximum Source Current1<br>(F.B Pin) | I <sub>OM+1</sub> | V <sub>OM</sub> =0.5V  | 40   | 85                           | 200  | μA   |

# NJM2383

■ ELECTRICAL CHARACTERISTICS ( $V^+=6V, R_T=33k\Omega, C_T=1000pF, V_{ON/OFF}=3V, T_a=25^\circ C$ )

## ERROR AMPLIFIER BLOCK

| PARAMETER                                        | SYMBOL     | TEST CONDITION      | MIN. | TYP. | MAX. | UNIT    |
|--------------------------------------------------|------------|---------------------|------|------|------|---------|
| Reference Voltage <sub>2</sub>                   | $V_{B2}$   |                     | 0.51 | 0.52 | 0.53 | V       |
| Input Bias Current <sub>2</sub>                  | $I_{B2}$   |                     | –    | 5    | 100  | nA      |
| Open Loop Gain <sub>2</sub>                      | $A_{v2}$   |                     | –    | 90   | –    | dB      |
| Gain Bandwidth Product <sub>2</sub>              | $G_{B2}$   |                     | –    | 0.6  | –    | MHz     |
| Maximum Output Voltage <sub>2</sub><br>(F.B Pin) | $V_{OM-2}$ | $R_{NF}=100k\Omega$ | –    | –    | 1    | V       |
| Maximum Source Current <sub>2</sub><br>(F.B Pin) | $I_{OM+2}$ | $V_{OM}=0.5V$       | 40   | 85   | 200  | $\mu A$ |

## PWM COMPARE BLOCK

| PARAMETER                            | SYMBOL      | TEST CONDITION         | MIN. | TYP. | MAX. | UNIT |
|--------------------------------------|-------------|------------------------|------|------|------|------|
| Input Threshold Voltage<br>(F.B Pin) | $V_{TH0}$   | duty·cycle=0% (note)   | –    | 1.65 | 1.75 | V    |
| Input Threshold Voltage<br>(F.B Pin) | $V_{TH100}$ | duty·cycle=100% (note) | –    | 2.10 | –    | V    |

## SOFT START CIRCUIT BLOCK

| PARAMETER                           | SYMBOL       | TEST CONDITION         | MIN. | TYP. | MAX. | UNIT |
|-------------------------------------|--------------|------------------------|------|------|------|------|
| Input Bias Current<br>(CS Pin)      | $I_{BCS}$    | CS Pin=1.8V            | –    | 250  | 650  | nA   |
| Input Threshold Voltage<br>(CS Pin) | $V_{THCS0}$  | duty·cycle=0% (note)   | –    | 0.25 | 0.35 | V    |
| Input Threshold Voltage<br>(CS Pin) | $V_{THCS50}$ | duty·cycle=100% (note) | –    | 0.7  | –    | V    |

## UNDER VOLTAGE LOCKOUT BLOCK

| PARAMETER             | SYMBOL      | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-----------------------|-------------|----------------|------|------|------|------|
| ON Threshold Voltage  | $V_{THON}$  |                | –    | 2.70 | –    | V    |
| OFF Threshold Voltage | $V_{THOFF}$ |                | –    | 2.52 | –    | V    |
| Hysteresis Voltage    | $V_{HYS}$   |                | 60   | 180  | –    | mV   |

## OUTPUT BLOCK

| PARAMETER                  | SYMBOL   | TEST CONDITION            | MIN. | TYP. | MAX. | UNIT |
|----------------------------|----------|---------------------------|------|------|------|------|
| L Output Voltage (OUT Pin) | $V_{OL}$ | Output Sink Current=100mA | –    | 0.25 | 0.65 | V    |

## ■ELECTRICAL CHARACTERISTICS ( $V^+=6V, R_T=33k\Omega, C_T=1000pF, V_{ON/OFF}=3V, T_a=25^\circ C$ )

### ON/OFF BLOCK

| PARAMETER                             | SYMBOL       | TEST CONDITION  | MIN. | TYP. | MAX. | UNIT    |
|---------------------------------------|--------------|-----------------|------|------|------|---------|
| OFF Threshold Voltage<br>(ON/OFF Pin) | $V_{OFF}$    |                 | –    | –    | 0.3  | V       |
| ON Threshold Voltage<br>(ON/OFF Pin)  | $V_{ON}$     |                 | 1.1  | –    | –    | V       |
| Input Bias Current<br>(ON/OFF Pin)    | $I_{ON/OFF}$ | $V_{ON/OFF}=3V$ | –    | 100  | 120  | $\mu A$ |

### GENERAL CHARACTERISTICS

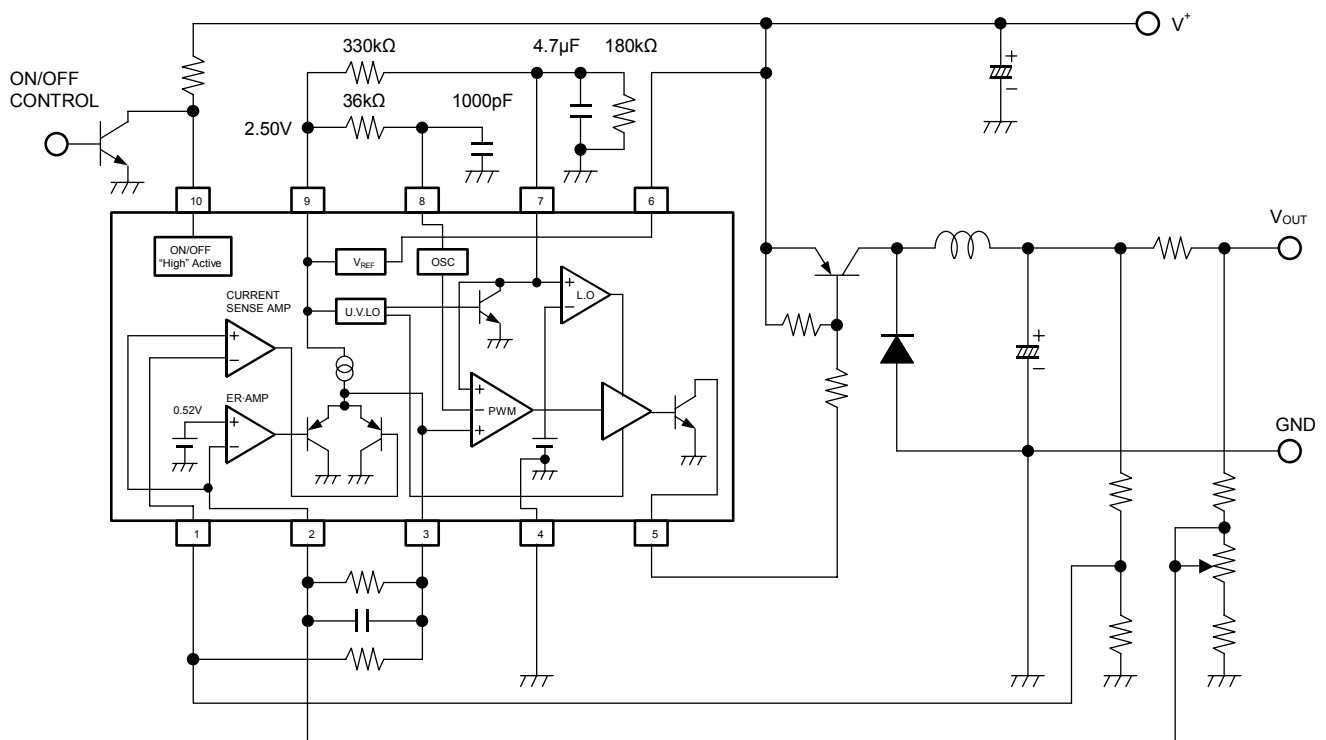
| PARAMETER                                | SYMBOL       | TEST CONDITION                 | MIN. | TYP. | MAX. | UNIT    |
|------------------------------------------|--------------|--------------------------------|------|------|------|---------|
| Stand-by Current                         | $I_{CCSTBY}$ | Stand-by Mode, $V_{ON/OFF}=0V$ | –    | 12   | 20   | $\mu A$ |
| Latch Mode<br>Threshold Voltage (CS Pin) | $V_{THLA}$   |                                | 1.2  | 1.5  | 1.8  | V       |
| Quiescent Current                        | $I_{CCLA}$   | Latch Mode                     | –    | 1.6  | 2.2  | mA      |
| Average Quiescent Current                | $I_{CCAV}$   | $RL = \infty$ , duty-cycle=50% | –    | 5.5  | 10   | mA      |

(note) Duty-Cycle is defined as follows:

Duty-Cycle=0%: IC output transistor is OFF.

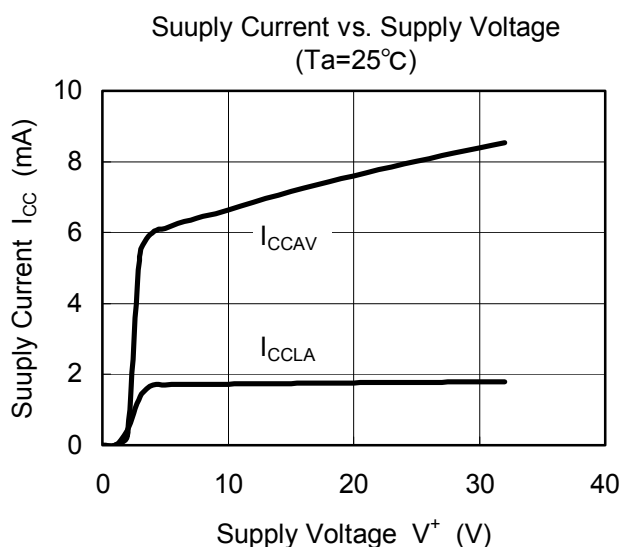
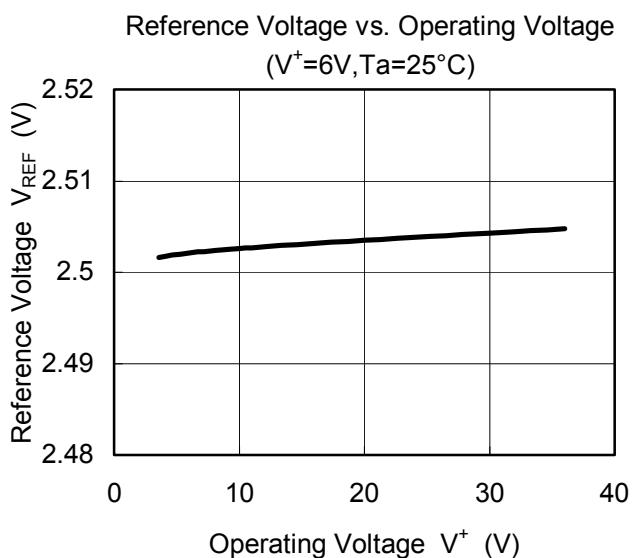
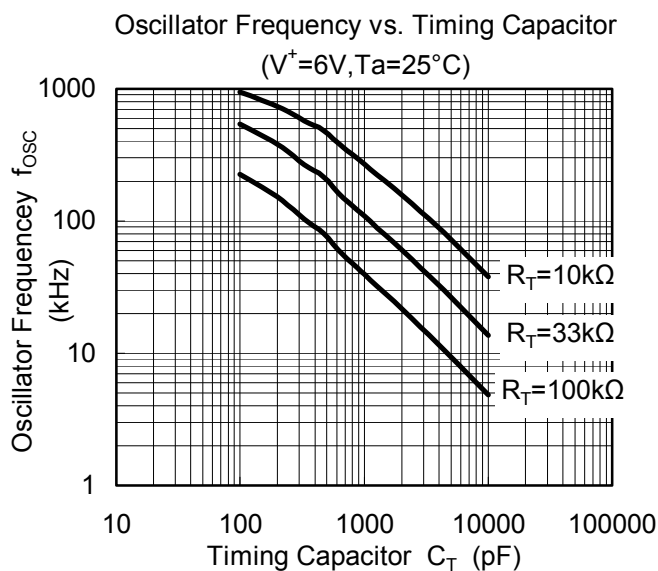
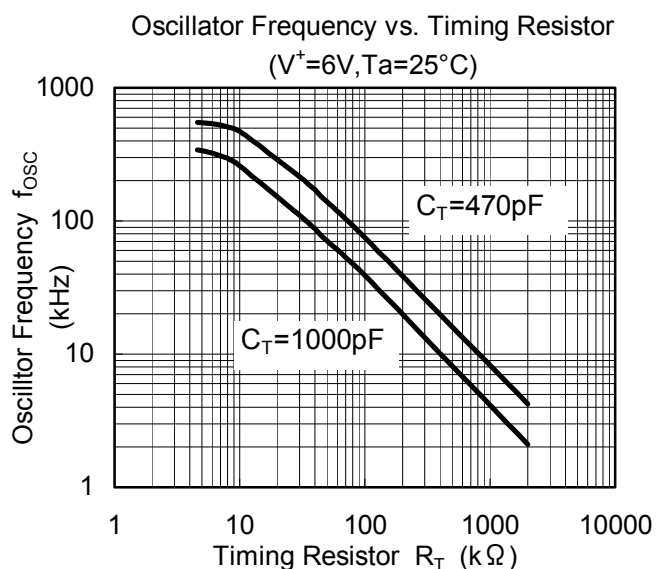
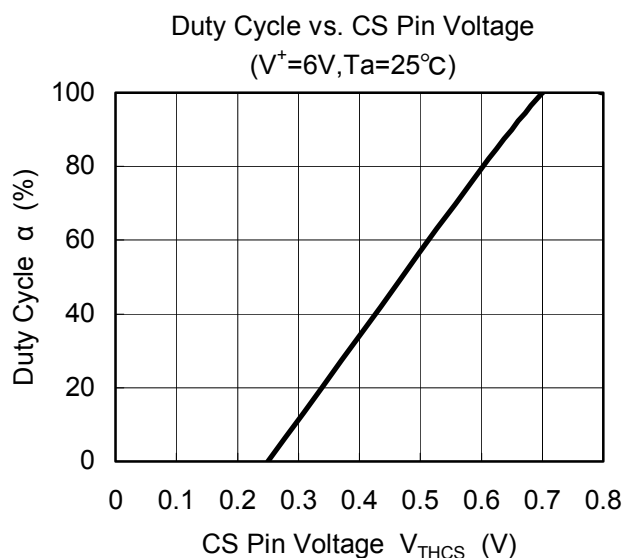
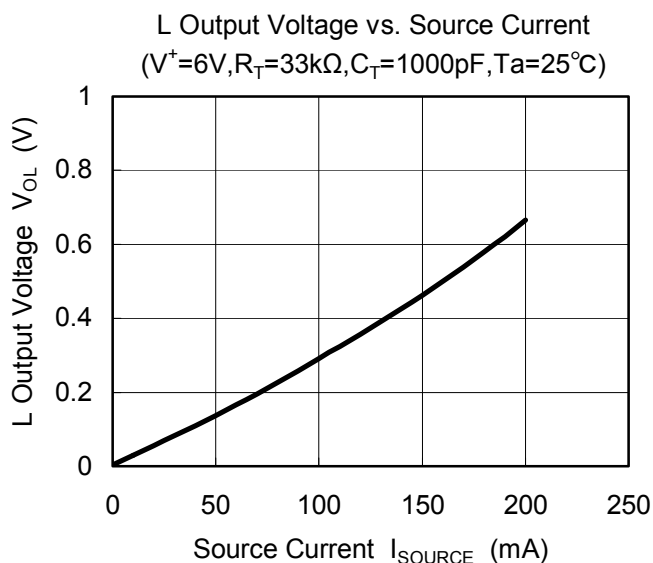
Duty-Cycle=100%: IC output transistor is ON.

### ■TYPICAL APPLICATIONS

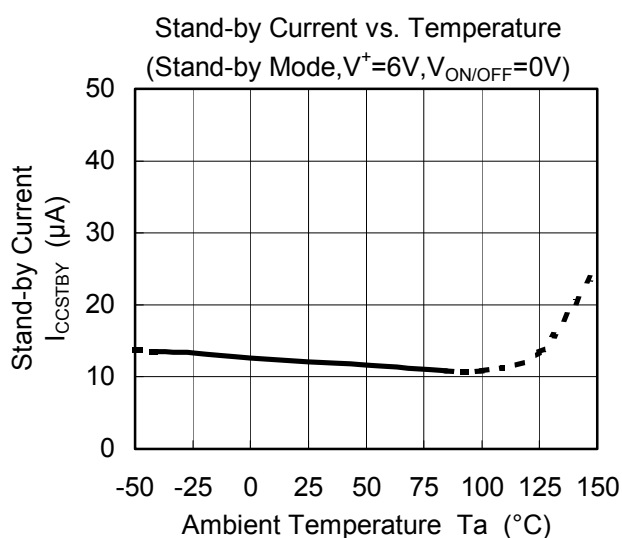
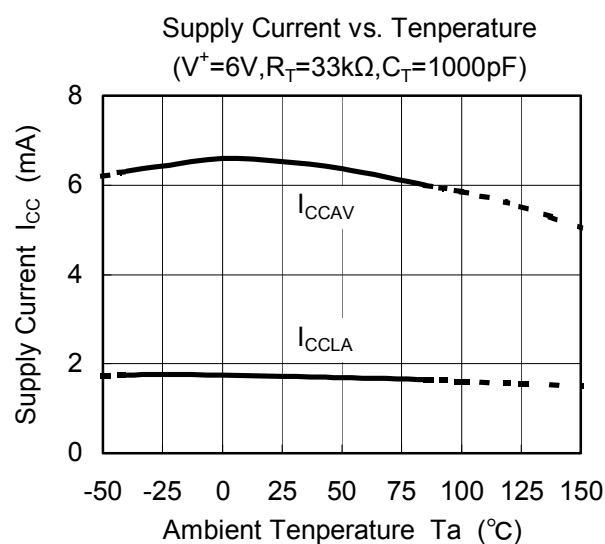
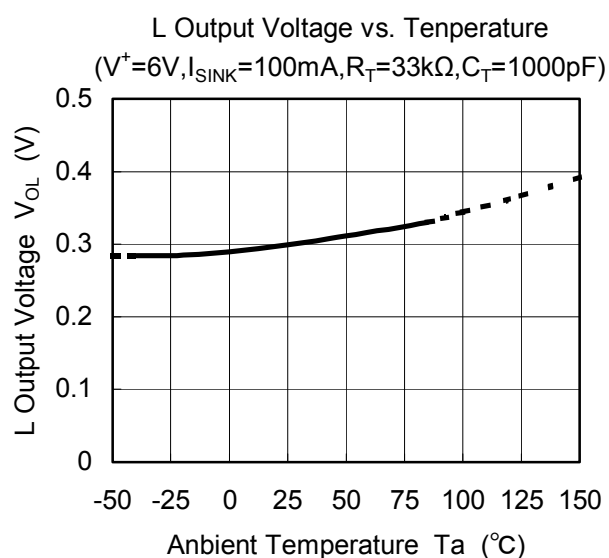
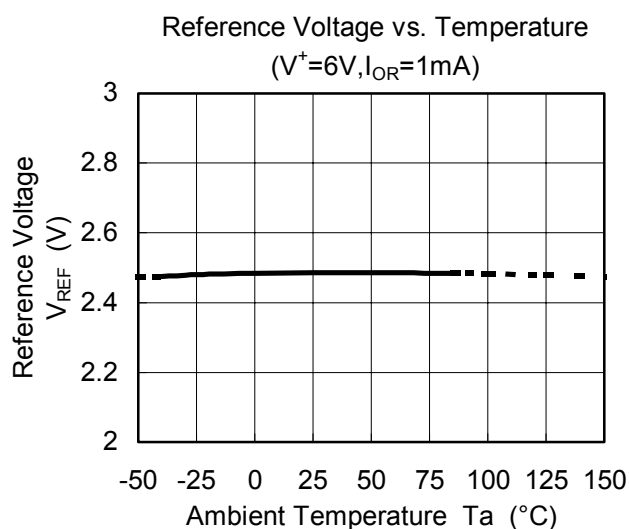
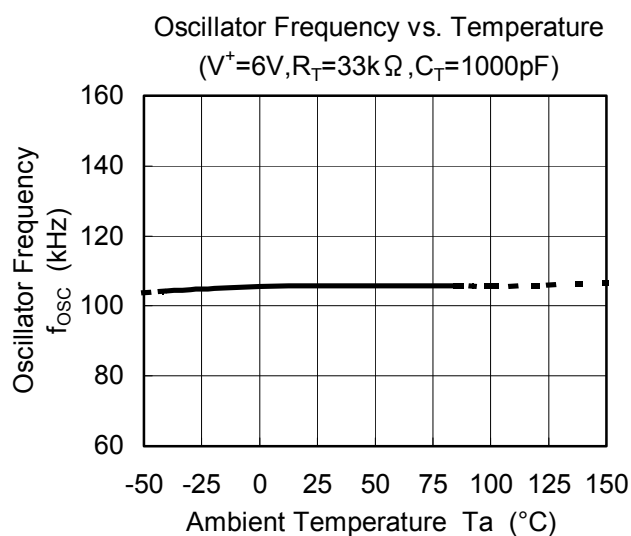


(Package:SSOP10)

## ■TYPICAL CHARACTERISTICS



## TYPICAL CHARACTERISTICS



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