

SWITCHING REGULATOR CONTROL IC FOR FLYBACK WITH CURRENT SENSE AMPLIFIER

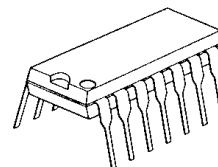
■GENERAL DESCRIPTION

The **NJM2381** is a low voltage operation DC/DC converter control IC.

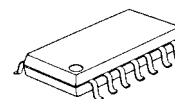
It features totem pole output directly driving external bipolar transistor and operates at high switching frequency which improves transient response.

It is suitable for LCD back light, and other portable applications.

■PACKAGE OUTLINE



NJM2381D



NJM2381M

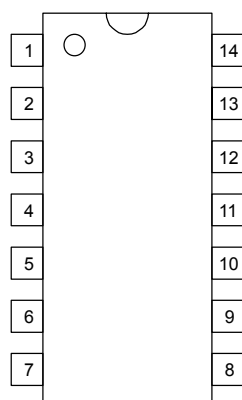


NJM2381V

■FEATURES

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

■PIN CONFIGURATION

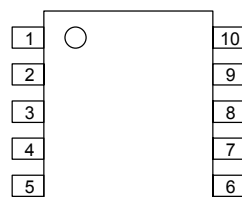


NJM2381D

NJM2381M

PIN FUNCTION

1.NC	8.NC
2.IN ⁻ 1	9. V ⁺
3.IN ⁻ 2	10.CS
4.F.B	11.CT
5.GND	12.REF
6.OUT	13.IN ⁺
7.NC	14.NC



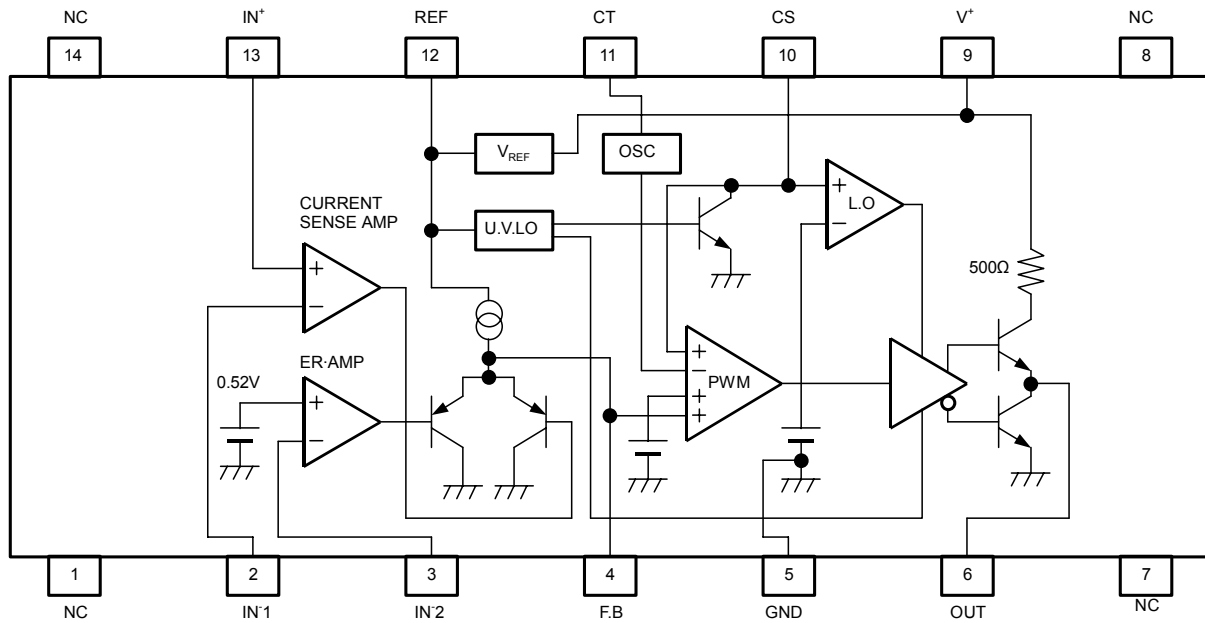
NJM2381V

PIN FUNCTION

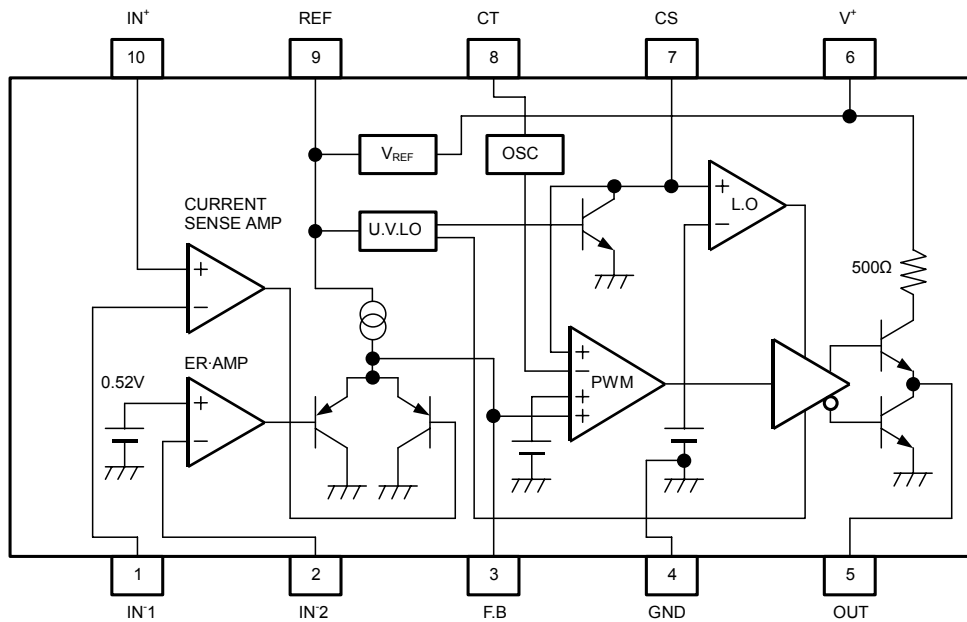
1.IN ⁻ 1	6. V ⁺
2.IN ⁻ 2	7.CS
3.F.B	8.CT
4.GND	9.REF
5.OUT	10.IN ⁺

NJM2381

■BLOCK DIAGRAM



(Package: DIP14, DMP14)



(Package: SSOP10)

■ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Input Voltage	V^+	36	V
Reference Output Current	I_{OR}	10	mA
Output Current	I_O	±50	mA
Differential Input Voltage	V_{ID}	2.5	V
Common Mode Input Voltage	V_{IC}	-0.3 ~ 2.5	V
Power Dissipation	P_D	(DIP 14) 700 (DMP 14) 300 (SSOP 10) 250	mW
Operating Temperature Range	T_{OPR}	-40 ~ +85	°C
Storage Temperature Range	T_{STG}	-50 ~ +125	°C

■ELECTRICAL CHARACTERISTICS ($V^+=6V, R_T=33k\Omega, C_T=1000pF, Ta=25^\circ C$)

REFERENCE VOLTAGE BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{REF}	$I_{OR}=1mA$	2.45	2.50	2.55	V
Line Regulation	L_{INE}	$V^+=3.6 \sim 32V, I_{OR}=1mA$	—	6.8	20.7	mV
Load Regulation	L_{OAD}	$I_{OR}=0.1 \sim 5.0mA$	—	5	30	mV

OSCILLATOR BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Oscillation Frequency	f_{OSC}	$R_T=33k\Omega, C_T=1000pF$	85	105	125	kHz
Oscillate Fluctuations1 (Line Fluctuations)	f_{dV}	$V^+=3.6 \sim 32V$	—	1	—	%
Oscillate Fluctuations2 (Temp Fluctuations)	f_{dT}	$Ta=-40 \sim 85^\circ C$	—	5	—	%

CURRENT SENSE AMPLIFIER BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Offset Voltage1	V_{IO1}		—	2	7	mV
Input Offset Current1	I_{IO1}		—	5	50	nA
Input Bias Current1	I_{B1}		—	5	100	nA
Open Loop Gain1	A_{V1}		—	90	—	dB
Gain Bandwidth Product1	G_{B1}		—	0.6	—	MHz
Input Common Mode Voltage Ratio1	V_{ICM1}		—	0 ~ $V_{REF}-0.8$	—	V
Maximum Output Voltage1 (F.B Pin)	V_{OM-1}	$R_{NF}=100k\Omega$	—	—	1	V
Maximum Source Current1 (F.B Pin)	I_{OM+1}	$V_{OM}=0.5V$	40	85	200	μA

NJM2381

■ELECTRICAL CHARACTERISTICS ($V^+=6V, R_T=33k\Omega, C_T=1000pF, T_a=25^\circ C$)

ERROR AMPLIFIER BLOCK

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

PWM COMPARE BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Threshold Voltage (F.B Pin)	V_{TH0}	duty·cycle=0%	–	1.65	1.75	V
Input Threshold Voltage (F.B Pin)	V_{TH50}	duty·cycle=50%	–	1.88	–	V
Maximum Duty Cycle	αM	Current Sense Amp.=HIGH Error Amp.=HIGH ,CS Pin=1.2V	55	64	85	%

SOFT START CIRCUIT BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Bias Current (CS Pin)	I_{BCS}	CS Pin=1.8V	–	250	650	nA
Input Threshold Voltage (CS Pin)	V_{THCS0}	duty·cycle=0%	–	0.25	0.35	V
Input Threshold Voltage (CS Pin)	V_{THCS50}	duty·cycle=50%	–	0.52	–	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

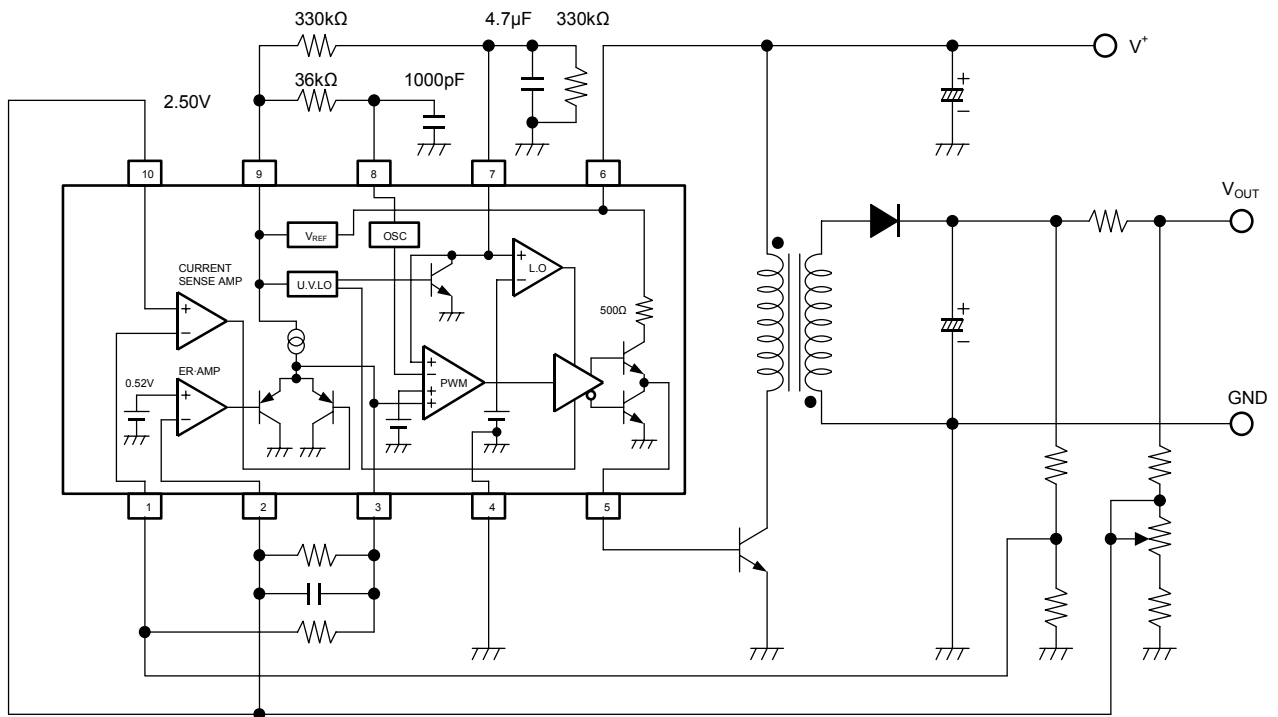
OUTPUT BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
H-Output Voltage (OUT Pin)	V_{OH}	$R_L=10k\Omega$	3.50	4.00	–	V
L-Output Voltage (OUT Pin)	V_{OL}	Output Sink Current=20mA	–	0.25	0.65	V
Output Source Current (OUT Pin)	I_{SOURCE}	OUT Pin=0V	8	11	–	mA

GENERAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Latch Mode 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%	–	3.5	4.8	mA

■ TYPICAL APPLICATIONS

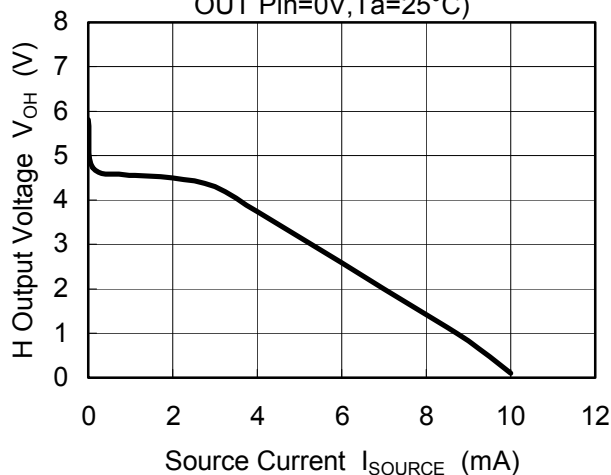


(Package:SSOP10)

TYPICAL CHARACTERISTICS

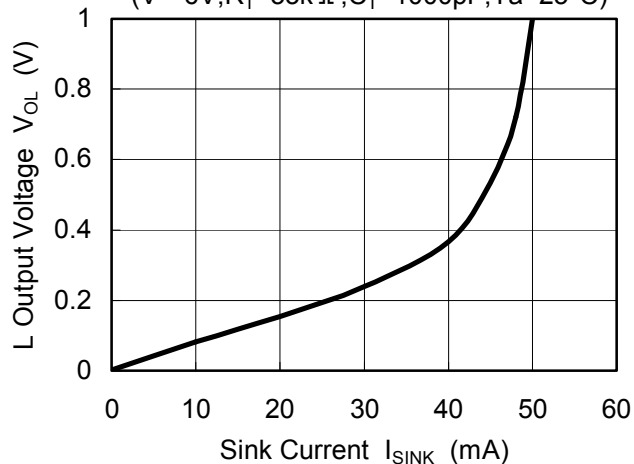
H Output Voltage vs. Source Current

($V^+=6V, R_T=33k\Omega, C_T=1000pF, OUT\ Pin=0V, T_a=25^\circ C$)



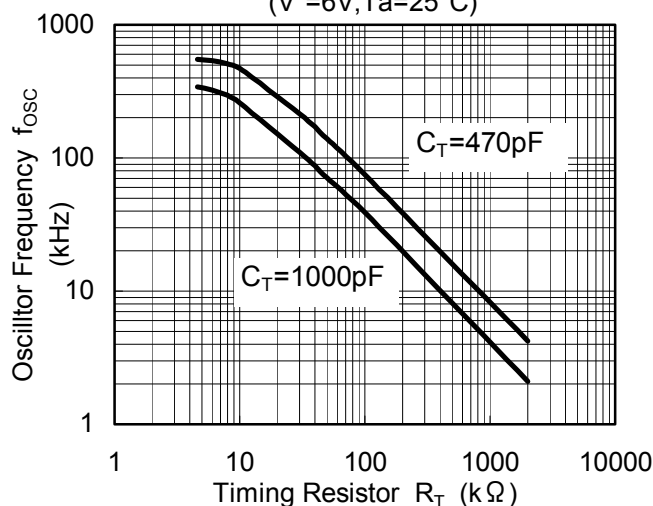
L Output Voltage vs. Sink Current

($V^+=6V, R_T=33k\Omega, C_T=1000pF, T_a=25^\circ C$)



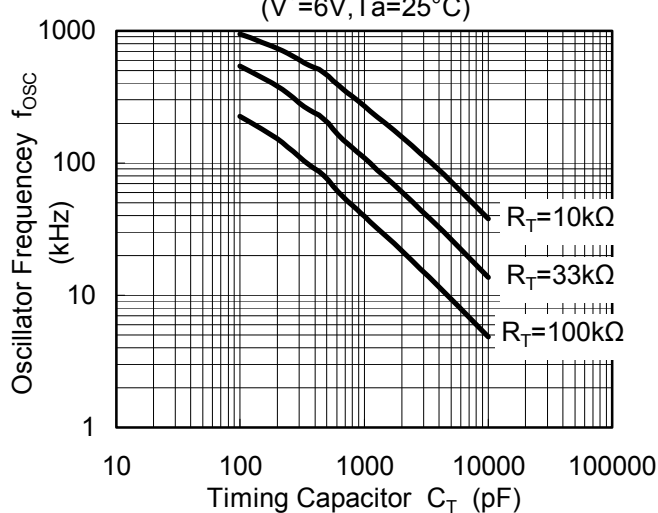
Oscillator Frequency vs. Timing Resistor

($V^+=6V, T_a=25^\circ C$)



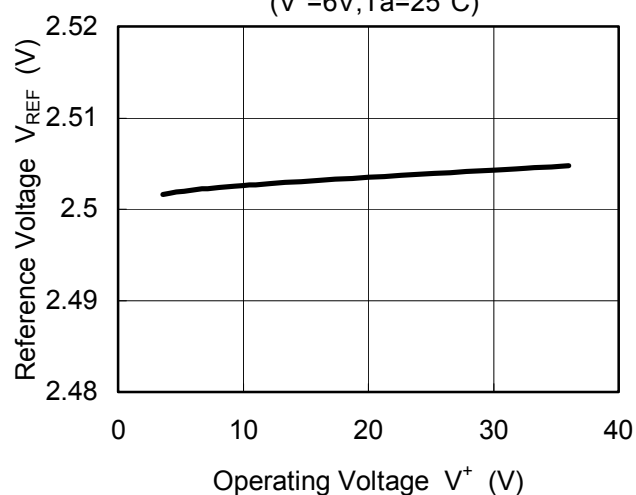
Oscillator Frequency vs. Timing Capacitor

($V^+=6V, T_a=25^\circ C$)



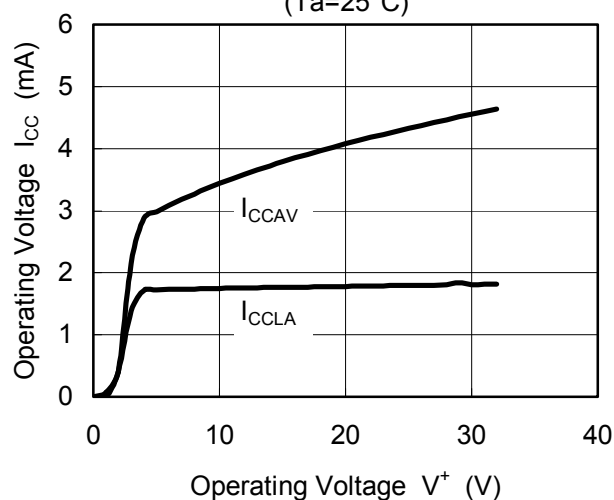
Reference Voltage vs. Operating Voltage

($V^+=6V, T_a=25^\circ C$)

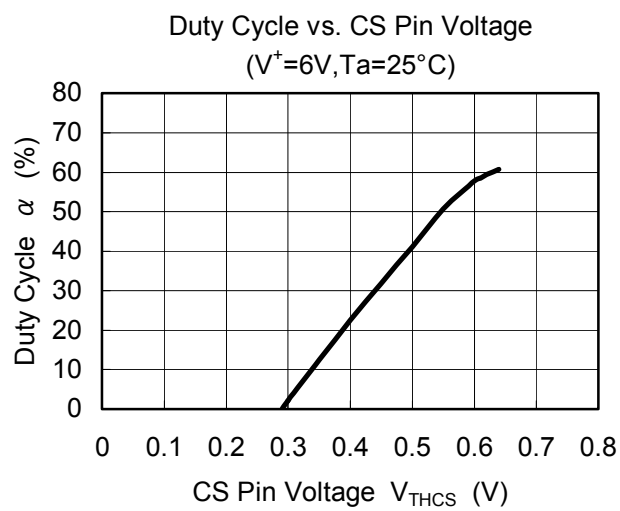
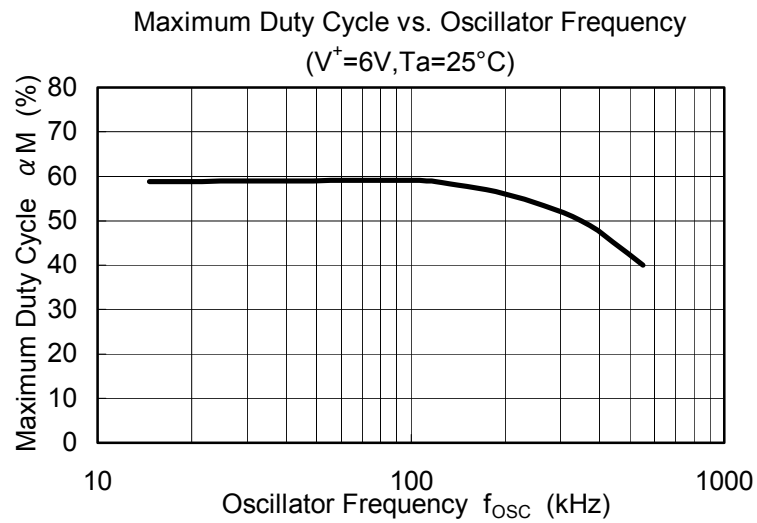


Operating Current vs. Operating Voltage

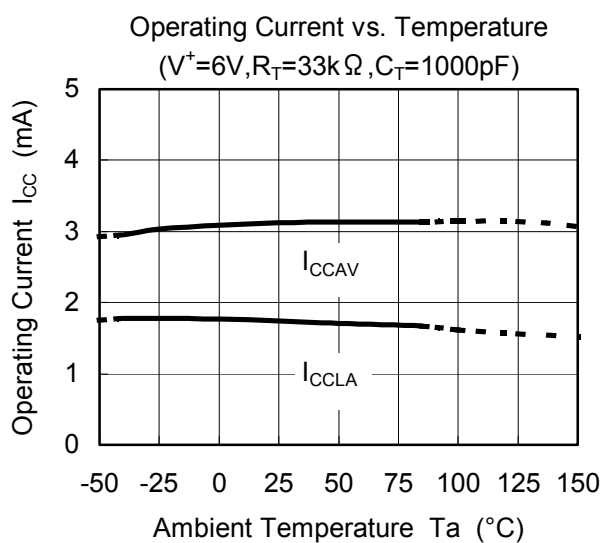
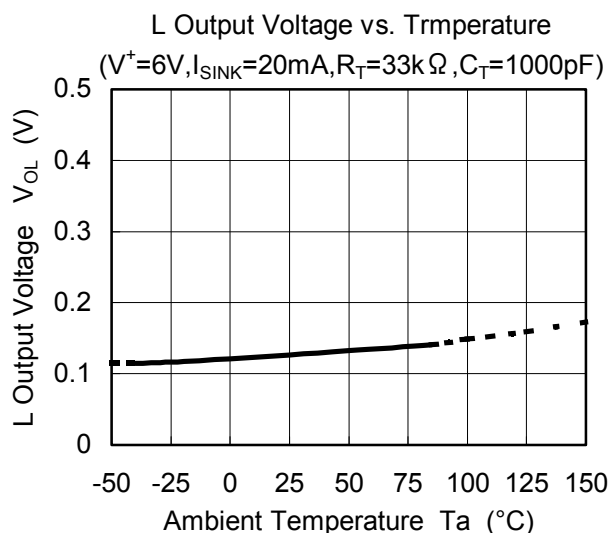
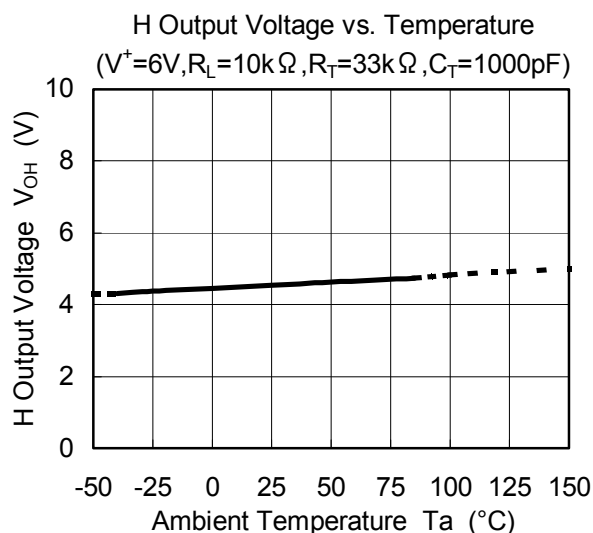
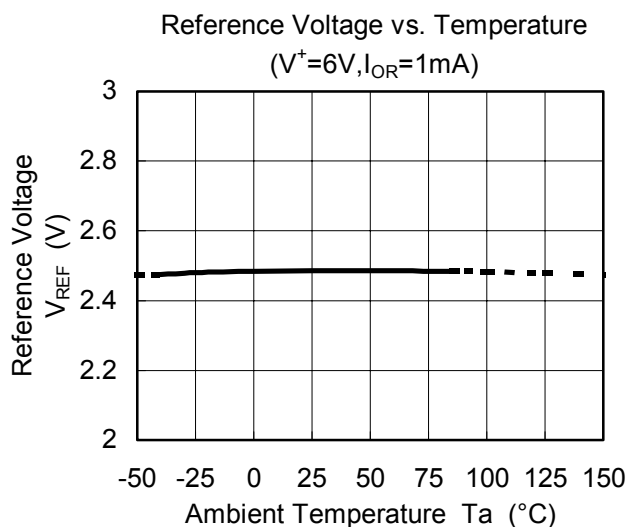
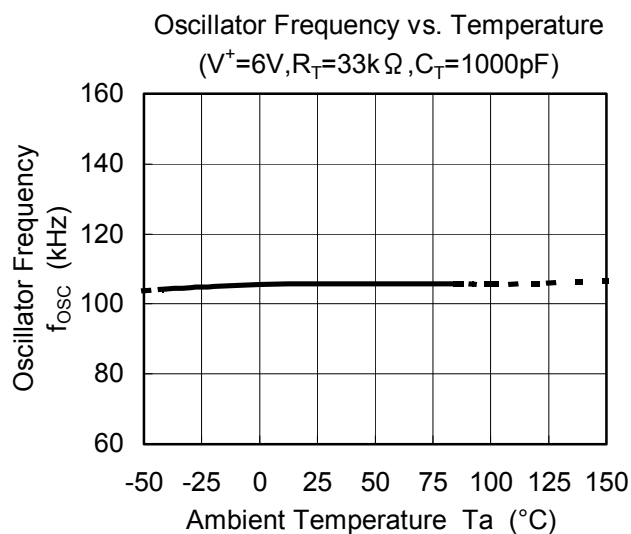
($T_a=25^\circ C$)



■TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS



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