

SWITCHING REGULATOR CONTROL IC

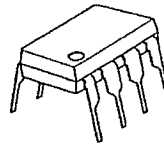
■ GENERAL DESCRIPTION

The NJM2377 is high speed switching regulator control IC which can operate at low voltage.

The NJM2377 consists of low power oscillation circuit, high precision reference, wide band error amplifier, under voltage lockout circuit, and a totem pole output circuit; which can drive an external Bipolar transistor directly.

The NJM2377 is suitable for any portable system, TFT panel to note PC and especially power supply at video CD.

■ PACKAGE OUTLINE



NJM2377D



NJM2377M

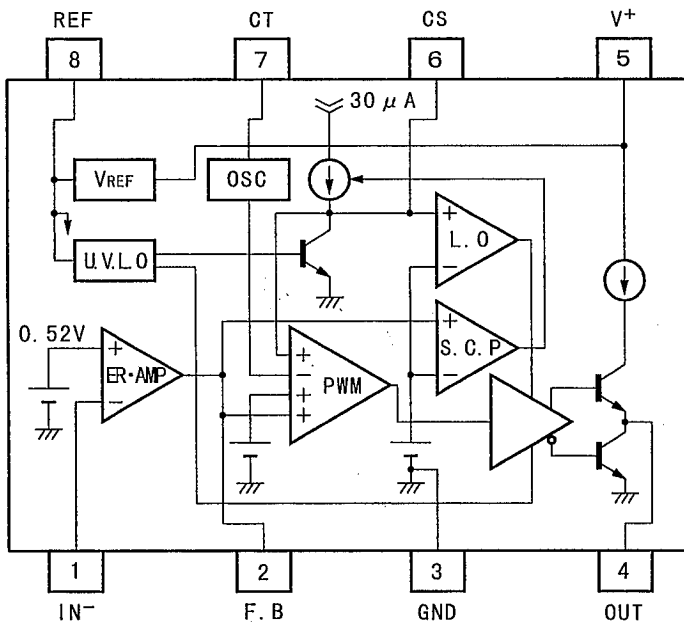


NJM2377V

■ FEATURES

- PWM Type Switching Regulator Control
- Operating Voltage (2.7~18V)
- Wide Oscillator Range (10~500kHz)
- ON/OFF Maximum Duty Cycle (Ton:Toff=9:1)
- Totem Pole Output
- Soft-Start Function
- Under Voltage Lockouts (U. V. L. O.)
- Bipolar Technology
- Package Outline DIP8, DMP8, SSOP8

■ BLOCK DIAGRAM



- PIN FUNCTION
1. IN<sup>-</sup>
  2. F. B
  3. GND
  4. OUT
  5. V<sup>+</sup>
  6. CS
  7. CT
  8. REF

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V <sup>+</sup>	18	V
Reference Output Current	I <sub>o</sub>	±50	mA
Power Dissipation	P <sub>D</sub>	(DIP8) 700 (DMP8) 300 (SSOP8) 250	mW
Operating Temperature Range	T <sub>OPR</sub>	-40~+85	°C
Storage Temperature Range	T <sub>STG</sub>	-50~+150	°C

■ RECOMMENDED OPERATING CONDITIONS (V<sup>+</sup>=3V, Ta=25°C)

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating Voltage	V <sup>+</sup>	2.7	18	V
Feed Back Resistor	R <sub>NF</sub>	100	—	k Ω
Oscillator Timing Capacitor	C <sub>T</sub>	220	22,000	p F
Oscillator Timing Resistor	R <sub>T</sub>	5	100	k Ω
Oscillation Frequency	f <sub>osc</sub>	10	500	k H z

■ ELECTRICAL CHARACTERISTICS ( $V^+=3V$ ,  $R_T=39k\Omega$ ,  $C_T=470pF$ ,  $T_a=25^\circ C$ )

REFERENCE VOLTAGE BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	$V_{REF}$	$I_{OR}=1mA$	1.47	1.50	1.53	V
Line Regulation	$\Delta V_o - V_{IN}$	$V^+=2.7\sim 18V$ , $I_{OR}=1mA$	—	3.8	11.5	mV
Load Regulation	$\Delta V_o - I_o$	$I_{OR}=0.1\sim 5.0mA$	—	5	30	mA

OSCILLATOR BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Oscillation Frequency	$f_{osc}$	$C_T=470pA$ , $R_T=39k\Omega$	80	100	120	kHz
Oscillate Fluctuations1 (Line Fluctuations)	$f_{dv}$	$V^+=2.7\sim 18V$ , $I_{OR}=1mA$	—	1	—	%
Oscillate Fluctuations2 (Temp. Fluctuations)	$f_{dt}$	$T_a=-40\sim +85^\circ C$	—	5	—	%

ERROR AMPLIFIER BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Voltage	$V_B$		0.51	0.52	0.53	V
Input Bias Current	$I_B$		—	5	100	nA
Open Loop Gain	$A_v$		—	90	—	dB
Gain Band width Product	$G_B$		—	1.0	—	MHz
Maximum Output Voltage (F. B Pin)	$V_{OM+}$	$R_{NF}=100k\Omega$ , $I_{N-} Pin=0V$	1.9	2.2	2.4	V
	$V_{OM-}$	$R_{NF}=100k\Omega$ , $I_{N-} Pin=1V$	—	—	200	mA
Output Source Current (F. B Pin)	$I_{OM+}$	$V_{OM}=1V$ , $I_{N-} Pin=0V$	40	85	200	$\mu A$

PWM COMPARABLE BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Bias Voltage (F. B Pin)	$V_{TH0}$	duty·cycle=0%	—	0.45	0.55	V
Input Threshold Voltage (F. B Pin)	$V_{TH80}$	duty·cycle=80%	—	1.05	—	V
Maximum Duty Cycle	$\alpha M$	F. B Pin=1.2V $C_T=470pF$ , $R_T=39k\Omega$	80	90	—	%

SOFT START CIRCUIT BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Bias Current (GS Pin)	$I_{BCS}$		—	250	650	nA
Input Threshold Voltage (GS Pin)	$V_{THCS0}$	duty·cycle=0% F. B Pin=1.2V	—	0.25	0.35	V
Input Threshold Voltage (GS Pin)	$V_{THCS80}$	duty·cycle=80% F. B Pin=1.2V	—	0.79	—	V

6

■ ELECTRICAL CHARACTERISTICS ( $V^+=3V$ ,  $R_T=39k\Omega$ ,  $C_T=470pF$ ,  $T_a=25^\circ C$ )

SHORT CIRCUIT PROTECTION

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Threshold Voltage (F.B Pin)	$V_{THPC}$		1.30	1.50	1.80	V
Charge Current (CS Pin)	$I_{CHG}$	CS Pin=0V, F.B Pin=2V	10	30	50	$\mu A$
Latch mode Threshold Voltage (CS Pin)	$V_{THLA}$		1.20	1.50	1.80	V

UNDER VOLTAGE LOCKOUT

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
ON Threshold Voltage	$V_{THON}$		—	1.95	—	V
OFF Threshold Voltage	$V_{THOFF}$		—	1.78	—	V
Hysteresis Voltage	$V_{HYS}$		60	170	—	mV

OUTPUT BLOCK

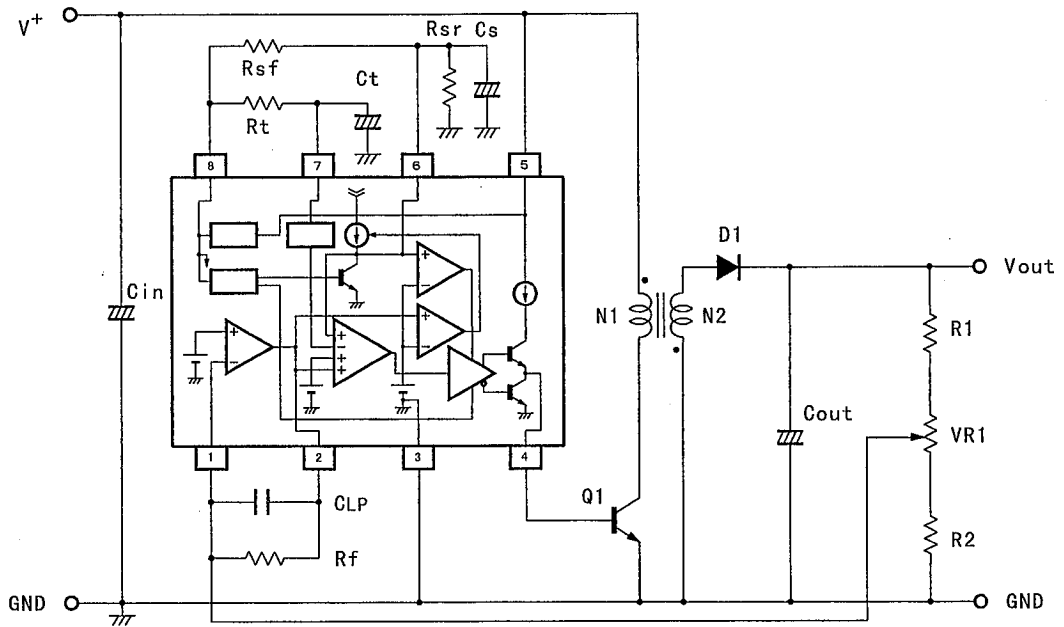
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
H-Output Voltage (OUT Pin)	$V_{OH}$	$R_L=10k\Omega$	1.7	2.0	—	V
L-Output Voltage (OUT Pin)	$V_{OL}$	Output Sink Current=20mA	—	0.25	0.65	V
Output Source Current (OUT Pin)	$I_{SOURCE}$	OUT Pin=0V	23	35	—	mA

GENERAL CHARACTERISTIC

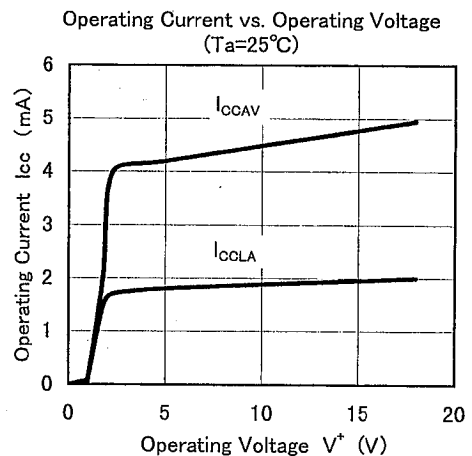
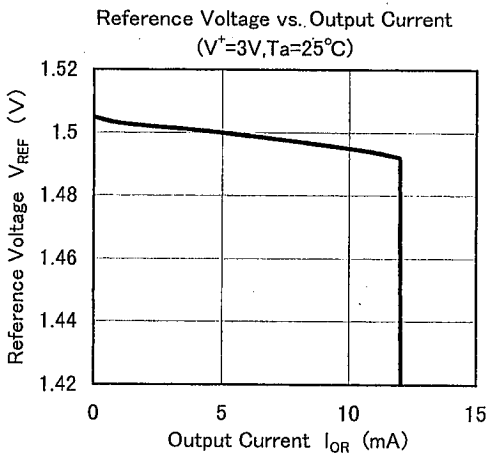
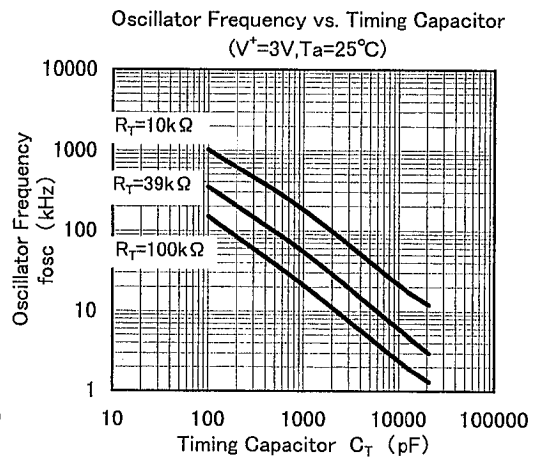
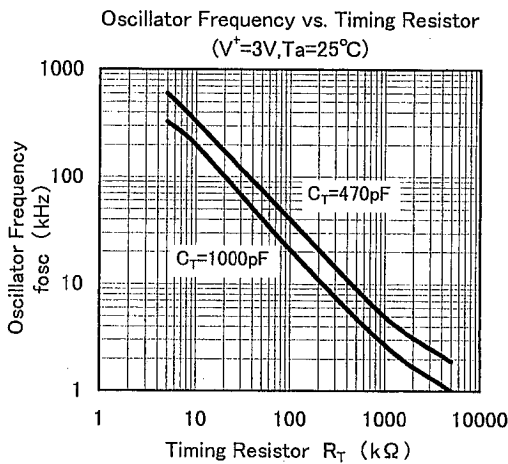
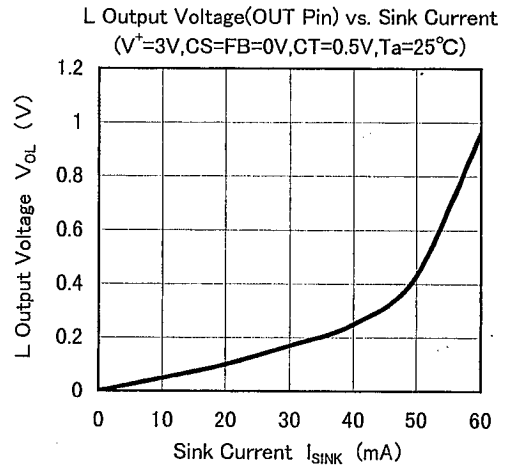
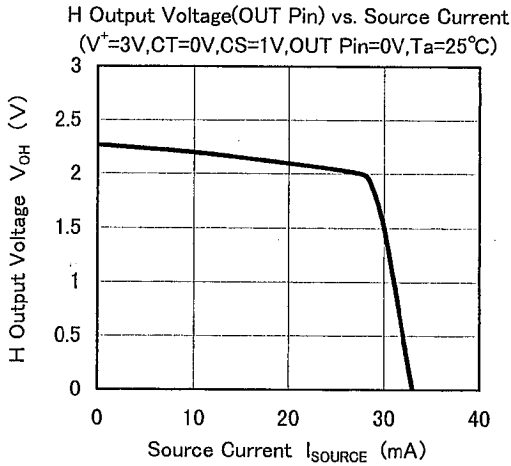
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current	$I_{CCLA}$	Latch Mode, CS Pin=1.8V	—	1.7	2.4	mA
Average Quiescent Current	$I_{CCAV}$	$R_L=\infty$ , duty-cycle=50%	—	5.0	6.8	mA

6

■ TYPICAL APPLICATION

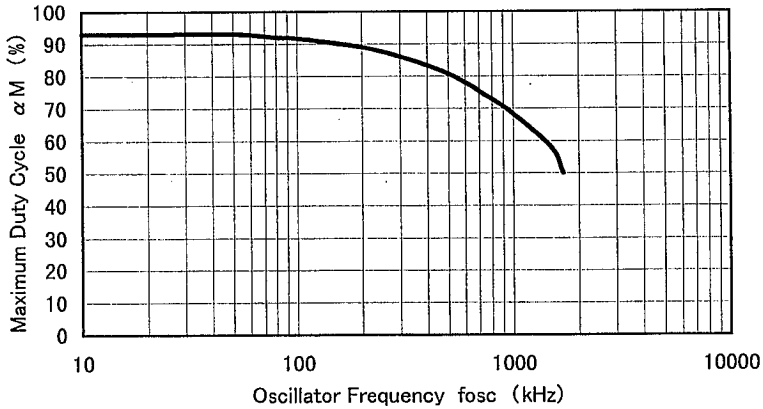


## TYPICAL CHARACTERISTICS

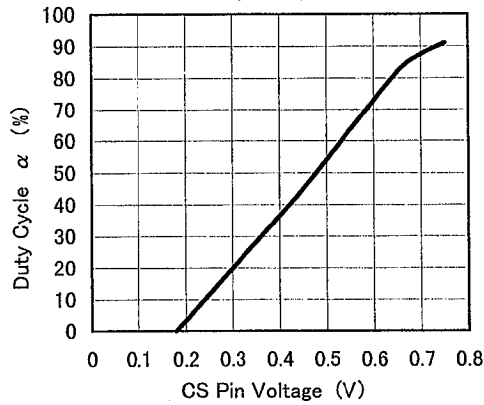


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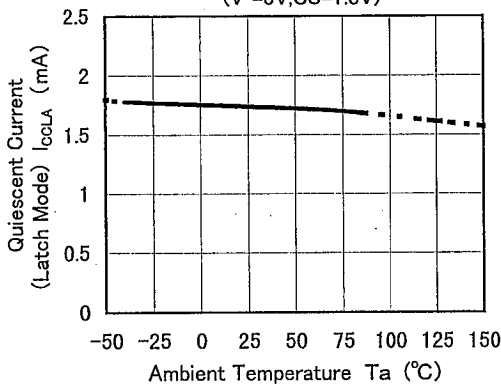
Maximum Duty Cycle vs. Oscillator Frequency  
( $V^+ = 3V$ )



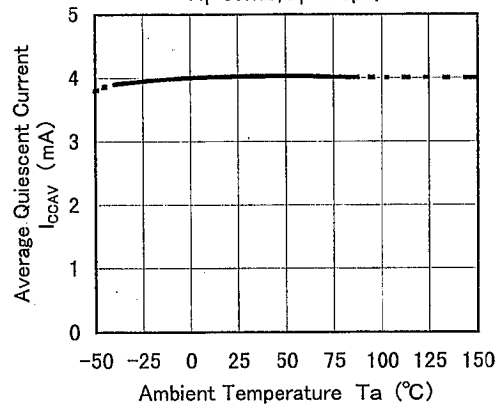
Duty Cycle vs. CS Pin Voltage  
( $V^+ = 3V$ )



Quiescent Current (Latch Mode) vs. Temperature  
( $V^+ = 3V, CS = 1.8V$ )

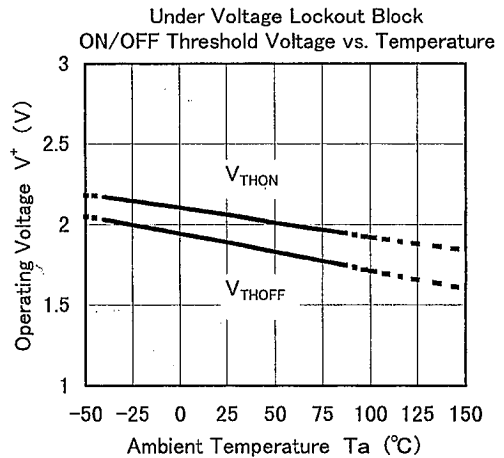
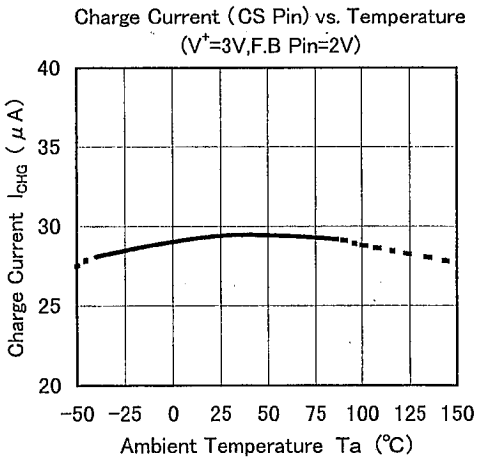
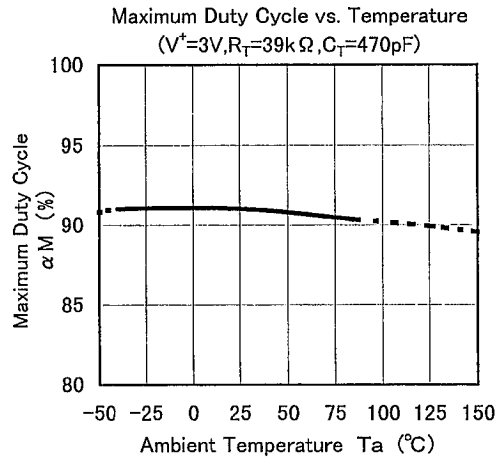
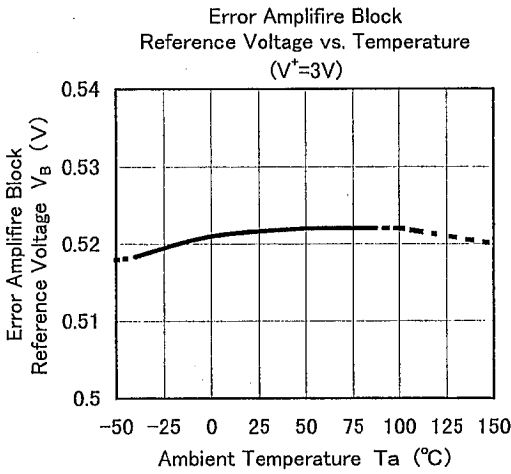
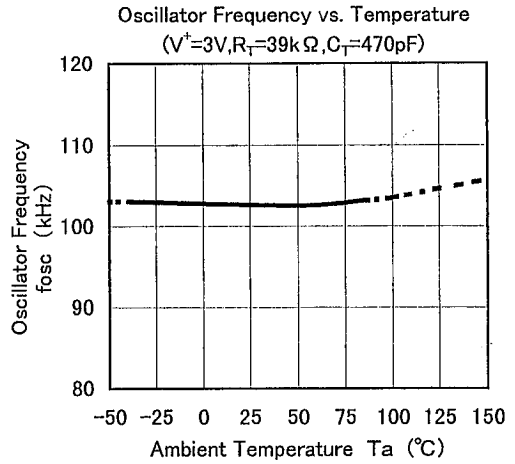
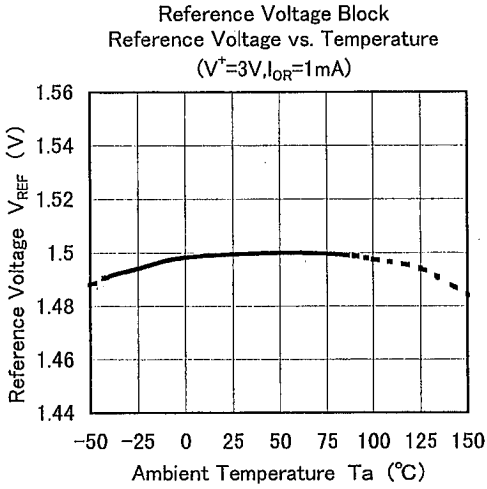


Average Quiescent Current vs. Temperature  
( $V^+ = 3V, R_L = \infty, \text{duty cycle} = 50\%$   
 $R_T = 39k\Omega, C_T = 470pF$ )



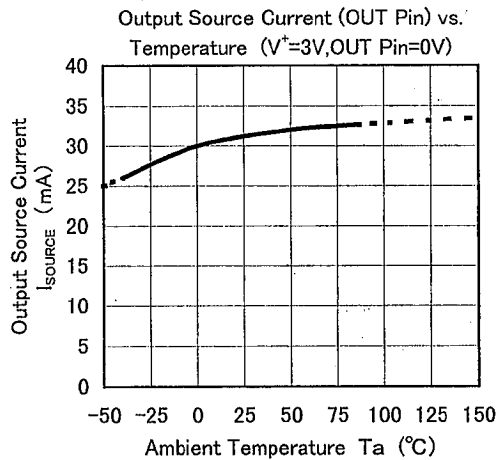
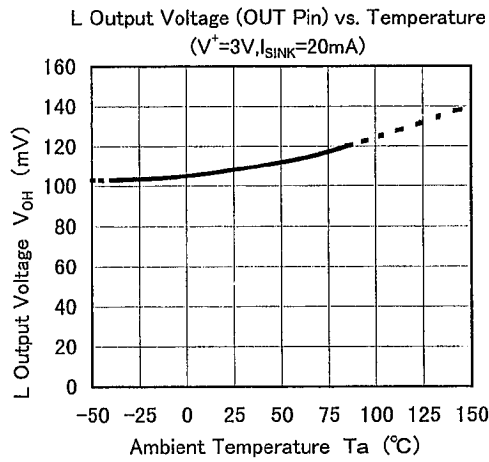
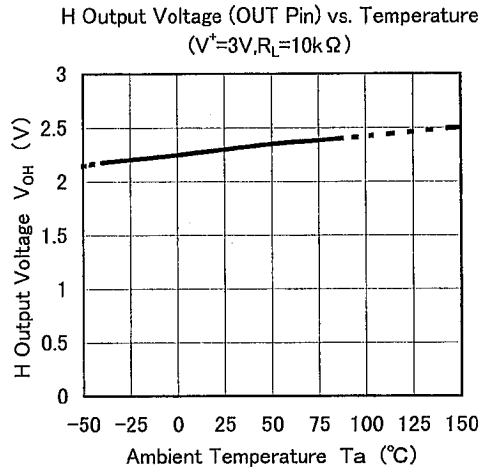
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## TYPICAL CHARACTERISTICS





■ TYPICAL CHARACTERISTICS



## MEMO

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