Ordering number : EN7232C

LB1940T

ON Semiconductor®

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Monolithic Digital IC

2-ch H-Bridge Constant Current Driver

Overview

The LB1940T is 2-phase exciter type bipolar stepper motor driver ICs that feature low-voltage, (supporting 3V battery) and low current operation with low saturation voltage. This IC enable constant-current control of actuators, and are optimal for driving the actuators of PC peripherals such as USB compatible scanners, FDDs, and printers, as well as for controlling the shutter, iris, and AF of a digital still camera.

Features

- Low-voltage driving
  2-power source type: VS = 1.6 to 7.5V, V_{DD} = 1.9 to 6.5V
  Single power source type: VS = V_{DD} = 1.9 to 7.5V
- Low saturation output: V_O(sat) = 0.3V at I_O of 200mA
- Constant-current control
- Built-in reference voltage (Vref = 0.9V)
- Small-sized, low-profile package (TSSOP20; 225mil; thickness (t) = 1.2mm max.)

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	VB max	VS1, VS2, V_{DD}	-0.3 to +10.5	V
Output applied voltage	V_{OUT} max	OUT1, OUT2, OUT3, OUT4	-0.3 to +10.5	V
Output Current	I_O max		400	mA
Input applied voltage	V_{IN} max	ENA1, ENA2, IN1, IN2, VC	-0.3 to +10.5	V
Allowable power dissipation	Pd max	Mounted on a specified board *	800	mW
Operating temperature	Topr		-20 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

* Mounted on a Specified board: 114.3mm×76.1mm×1.6mm, glass epoxy

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

Allowable Operating Range at Ta = 25°C

Parameter	Symbol	Conditions	Ratings			unit
			min	typ	max	
Function-guaranteed voltage range	VOPR1	V_{DD} system, VS = 2.0V	1.9		6.5	V
	VOPR2	VS system, V_{DD} = 5.0V	1.6		7.5	
Low level input threshold voltage	V_{IL}	ENA1, ENA2, IN1, IN2	-0.3		1.0	V
High level input threshold voltage	V_{IH}	ENA1, ENA2, IN1, IN2	2.0		6.0	V
VC input voltage	VC		0.19		1.0	V

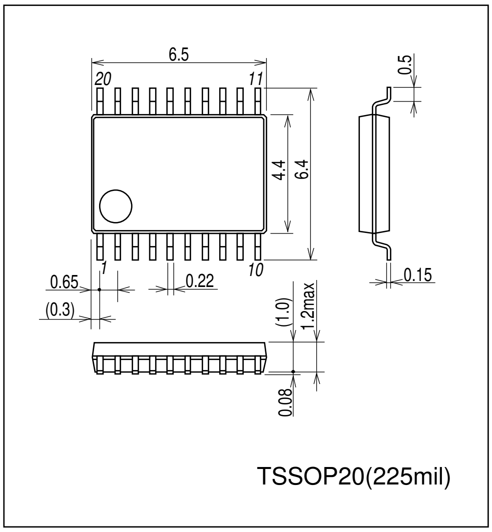
Electrical Characteristics at Ta = 25°C, VS = 3V, V_{DD} = 5V

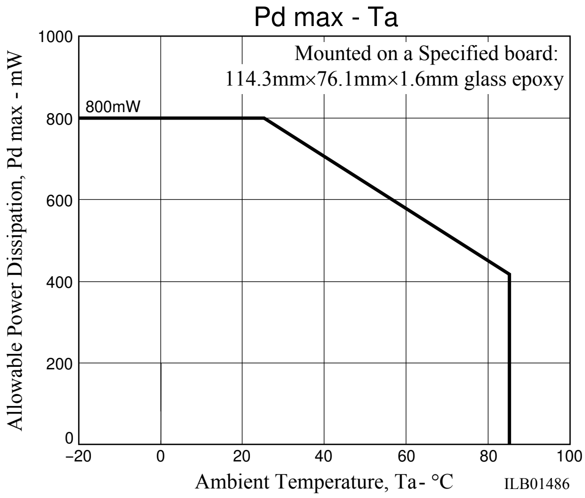
Parameter	Symbol	Conditions	Ratings			unit
			min	typ	max	
Standby current dissipation	ISTB	VS = V_{DD} = 6.5V		0.1	1.0	μA
Regulator output circuit						
VREF output voltage	VREF	I_{OL} = 0 to 1mA	0.85	0.9	0.95	V
SVDD output voltage	VSVDD	I_{OL} = 10mA	4.70	4.85		V
H bridge output circuit						
OUT output saturation voltage (at saturation control)	V_O(sat)1	V_{DD} = 5.0V, VS = 2.0V I_O = 200mA (PNP side)		0.20	0.30	V
	V_O(sat)2	V_{DD} = 5.0V, VS = 2.0V I_O = 200mA (NPN side)		0.10	0.15	V
OUT output current (at constant current control)	$I_{OUT}1$	V_{DD} = 6.0V, VC = 0.2V, VS = 3.5V R_L = 5Ω (between OUT-OUT), RFB = 2Ω	94	100	106	mA
	$I_{OUT}2$	$VC = \frac{Rb}{Ra + Rb}$ VREF (Ra = 70kΩ, Rb = 20kΩ) * V_{DD} = 6.0V, VS = 2.0V R_L = 5Ω (between OUT-OUT), RFB = 1Ω	180	200	220	mA
VS system operating current consumption	IS1	$VC = \frac{Rb}{Ra + Rb}$ VREF (Ra = 70kΩ, Rb = 20kΩ) *		1.5	3	mA
V_{DD} system operating current dissipation	$I_{DD}1$	$VC = \frac{Rb}{Ra + Rb}$ VREF (Ra = 70kΩ, Rb = 20kΩ) * ENA1 = 2V		4	7	mA
VC input current	IVC	V_{DD} = 6.0V, VS = 2.0V, VC = 1.9V	0		-1	μA
Control input circuit						
Control pin maximum input current	I_{IH}	V_{IH} = 5.5V		80	100	μA
	I_{IL}	V_{IL} = GND	-1		0	

* For Ra and Rb, refer to Application Circuit Diagram.

Package Dimensions

unit : mm (typ)

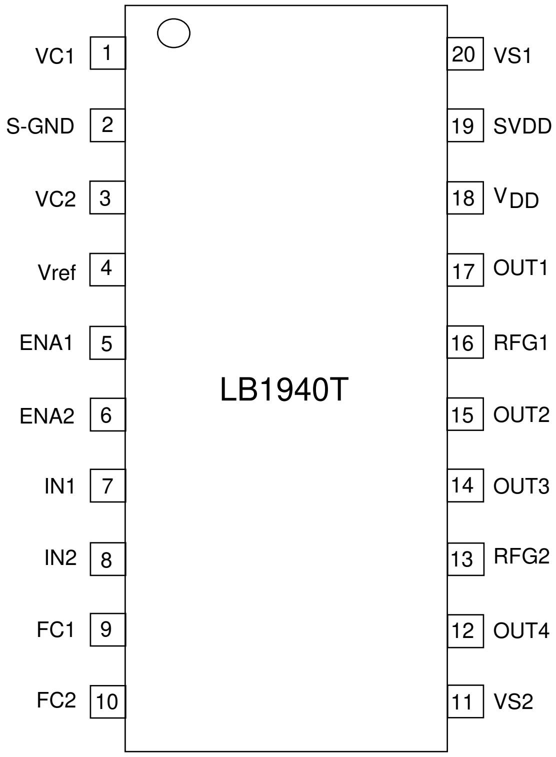




True Table

Input				Output					Mode
ENA		IN		OUT				SVDD	
1	2	1	2	1	2	3	4		
L	L								Standby (current dissipation zero)
H		H		L	H			on	Reverse rotation
		L		H	L			on	Forward rotation
	H		H			L	H	on	Reverse rotation
			L			H	L	on	Forward rotation
A blank means “don’t care”.				A blank means “off”.					

Pin Assignment

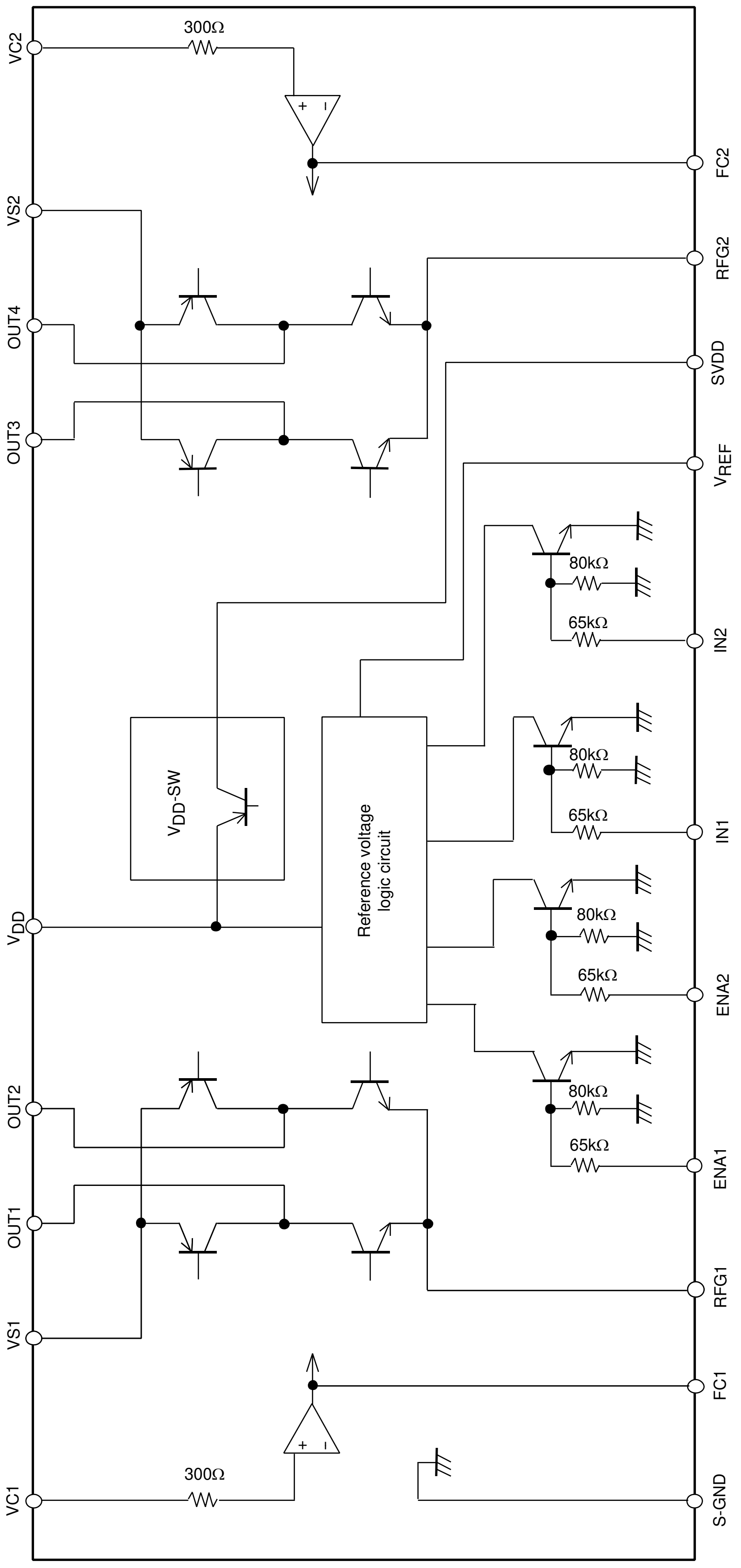


Top view

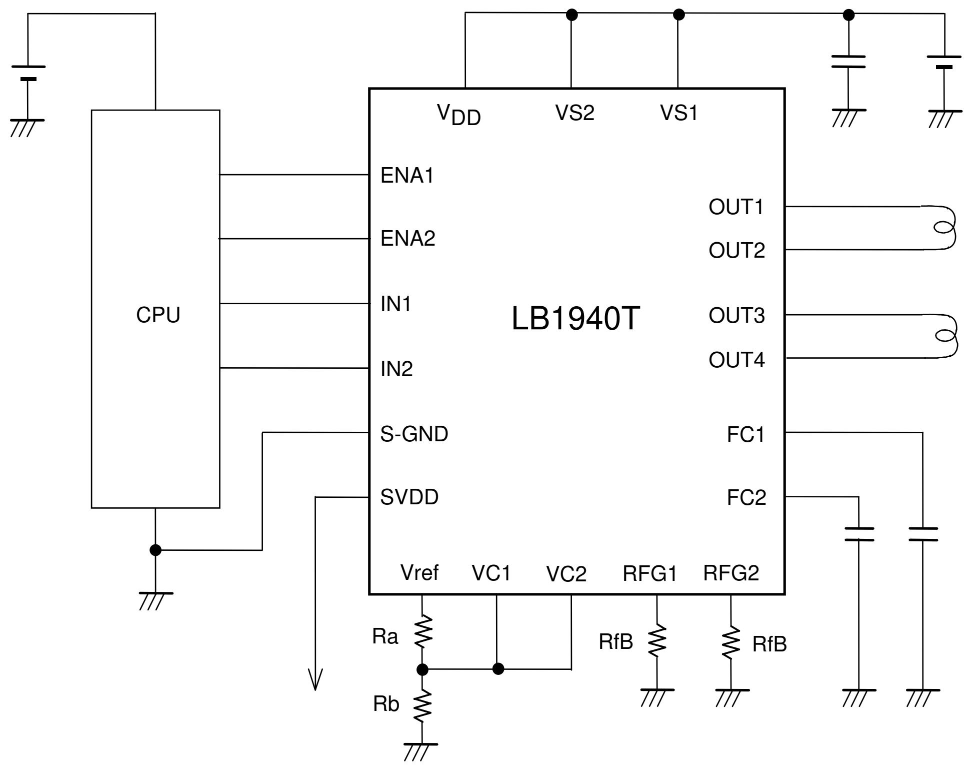
Pin Description

Pin No. LB1940T	Pin Name	Description	Pin No. LB1940T	Pin Name	Description
1	VC1	Reference voltage input for 1ch control	11	VS2	Motor power supply (+)
2	S-GND	GND for control system	12	OUT4	Motor drive output 4
3	VC2	Reference voltage input for 2ch control	13	RFG2	Constant-current detection pin
4	Vref	Reference voltage output	14	OUT3	Motor drive output 3
5	ENA1	Signal input for 1ch control	15	OUT2	Motor drive output 2
6	ENA2	Signal input for 2ch control	16	RFG1	Constant-current detection pin 1
7	IN1	Signal input for 1ch control	17	OUT1	Motor drive output 1
8	IN2	Signal input for 2ch control	18	V_{DD}	Control system power supply (+)
9	FC1	C connection pin for 1ch phase compensation	19	SVDD	Control system power output
10	FC2	C connection pin for 2ch phase compensation	20	VS1	Motor power supply (+)

Block Diagram



Application Circuit Diagram



At constant-current control: The OUT current is controlled so that the RFG pin voltage is equal to the VC input pin voltage.

For example, I_{OUT} = 200mA (= 0.2V/1Ω) when VC = 0.2V and RFB = 1Ω.

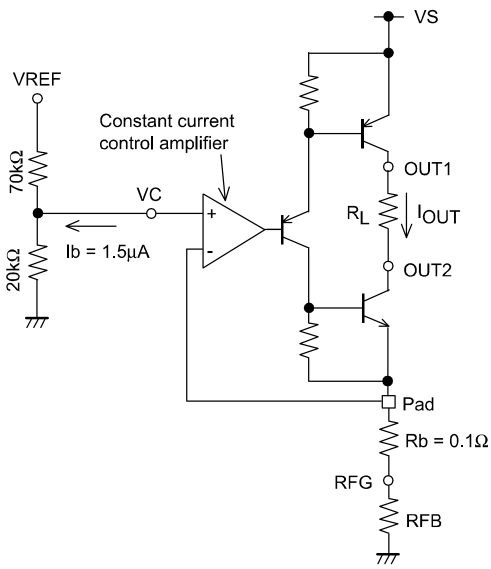
*: There is no priority relationship between respective input voltages (ENA, IN) and respective supply voltages (V_{DD}, VS). For example, operation with V_{IN} = 5V, V_{DD} = 3V, VS = 2V is possible.

Note: The input voltage range to the reference voltage input pin VC for constant-current setting is from 0.19V to 1.0V.

Constant current setting

The composition of the constant-control circuit of this IC is as shown in the figure below.

The voltage entered in the VC pin is entered as a reference to the "+" side input of the constant-current control amplifier.
The "-" side of this constant-current control amplifier is connected to the RFG pin via the wire bonded resistor Rb (= 0.1Ω).
The constant-current control circuit consists of comparison of the voltage generated at the external current detection resistor with the above reference voltage.



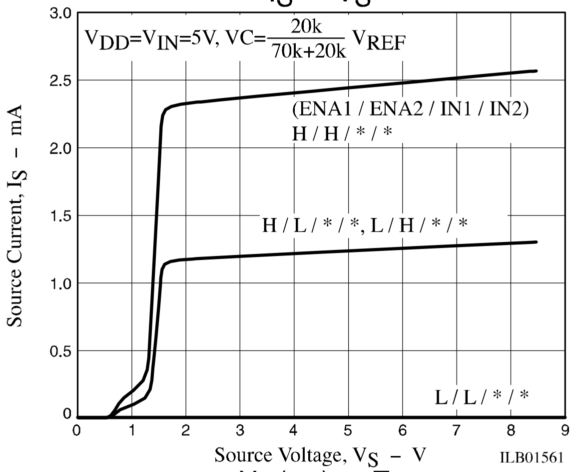
In addition, since the bias current Ib (= 1.5µA) flows out of the positive (+) input of the constant current control amplifier during the constant current control, if the voltage is input to the VC pin by dividing the VREF voltage by 4.5 according to the dividing resistance (70kΩ and 20kΩ) as shown in the figure, the formula for calculating the VC voltage is as follows :

$$VC = VREF/4.5+Ib\times 20k\Omega = VREF/4.5+0.03$$

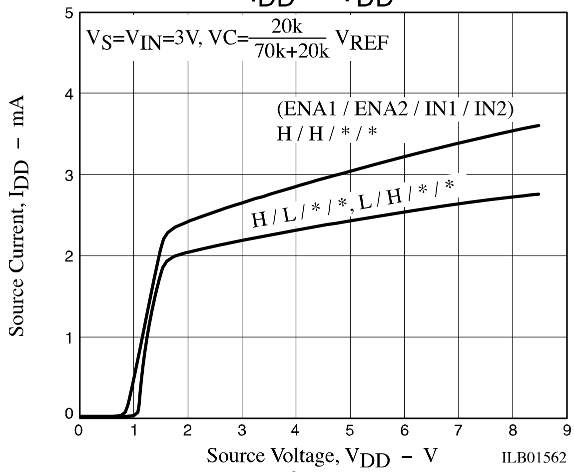
Therefore, the theoretical equation to set the constant current I_{OUT} is as follows:

$$I_{OUT} = VC/(RFB+Rb) = (VREF/4.5+0.03)/(RFB+Rb)$$

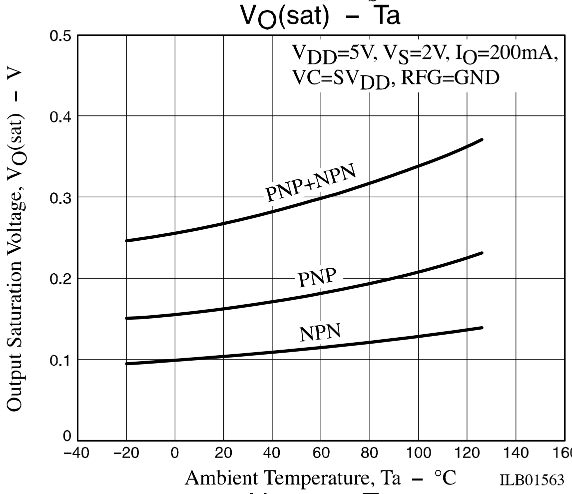
I_S – V_S



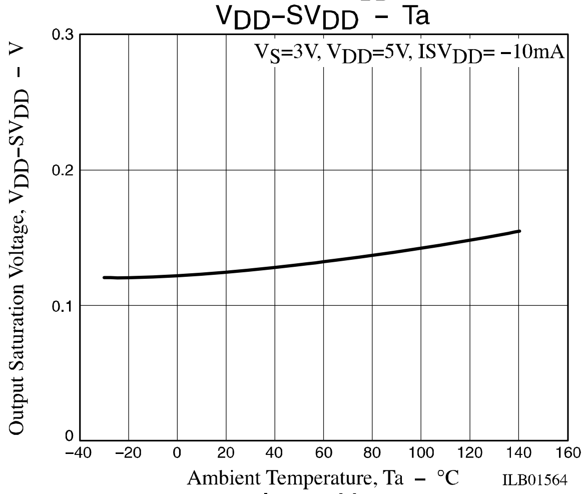
I_{DD} – V_{DD}



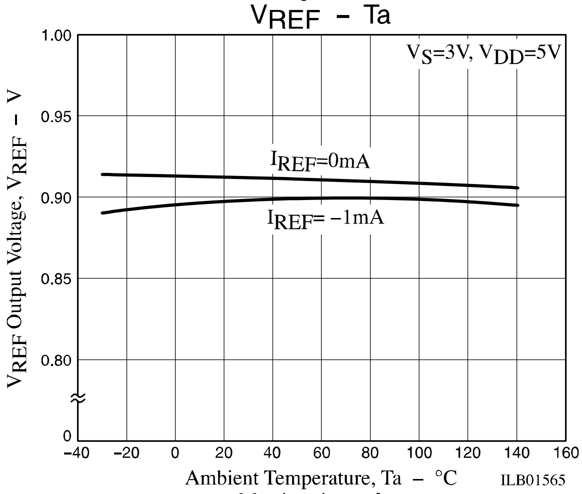
V_O(sat) – Ta



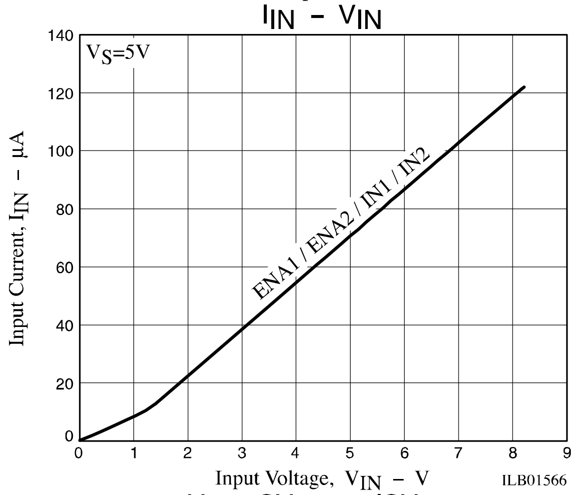
V_{DD}–SV_{DD} – Ta



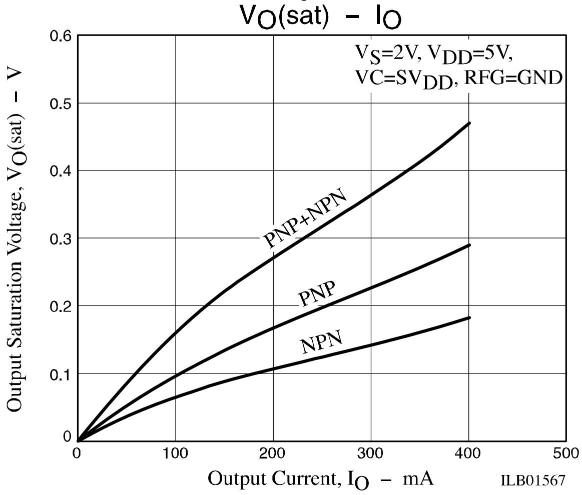
V_{REF} – Ta



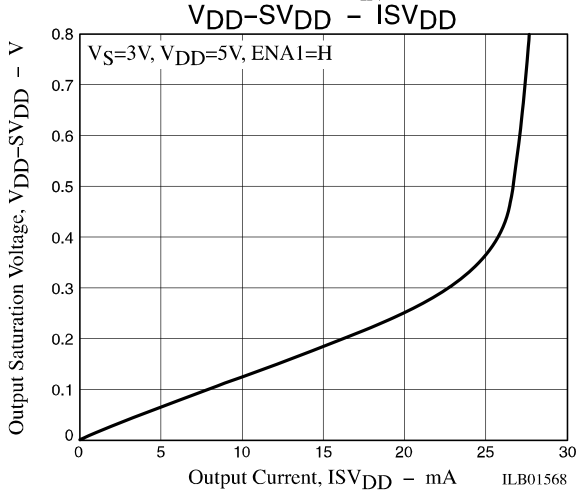
I_{IN} – V_{IN}

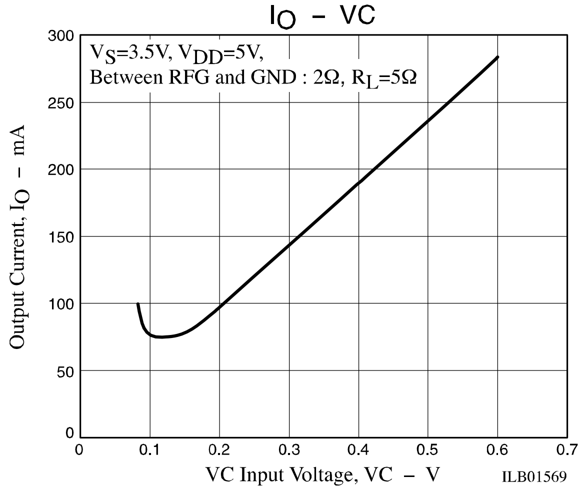


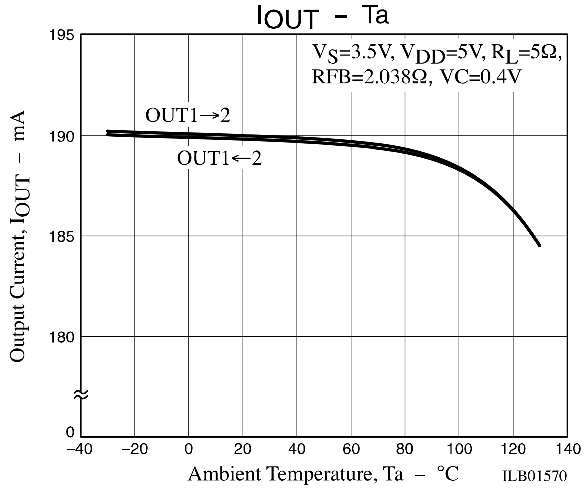
V_O(sat) – I_O



V_{DD}–SV_{DD} – ISV_{DD}







ORDERING INFORMATION

Device	Package	Shipping (Qty / Packing)
LB1940T-MPB-E	TSSOP20(225mil) (Pb-Free)	70 / Fan-Fold
LB1940T-MPB-H	TSSOP20(225mil) (Pb-Free / Halogen Free)	70 / Fan-Fold
LB1940T-TLM-H	TSSOP20(225mil) (Pb-Free / Halogen Free)	2000 / Tape and Reel