

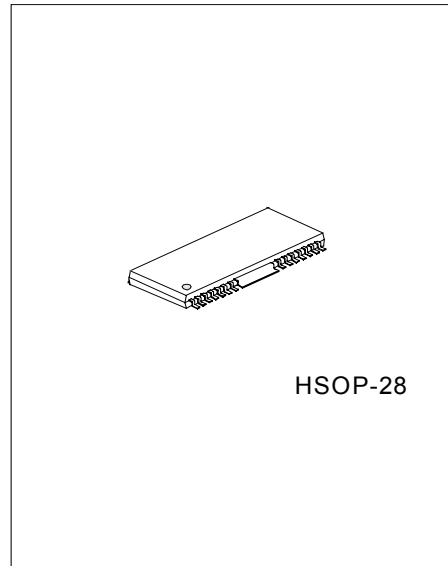
3-phase motor driver for CD-ROMs

DESCRIPTION

The UTC A9849 is ICs developed for CD-ROM spindle motor drives. These ICs possess a short brake and reverserotation brake for two types of brake functions, and also contain FG output and rotation direction detection (FR) circuits, making them high-functionality and high-performance ICs.

FEATURES

- * Three-phase, full-wave, pseudo-linear drive system.
- * Built-in power save and thermal shutdown functions.
- * Built-in current limiter and Hall bias circuits.
- * Built-in FG output.
- * Built-in rotation direction detector.
- * Built-in reverse rotation prevention circuit.
- * Built-in short brake pin.



APPLICATION

* CD-ROM, CD-R, CD-RW, DVD-ROM, and DVD-RAM

ABSOLUTE MAXIMUM RATINGS(Ta =25°C)

PARAMETER	SYMBOL	VALUE	UNIT
Applied Voltage (with 5V Power Supply)	V _{cc}	7	V
Applied Voltage (motor Power Supply1)	V _{M1}	16	V
Applied Voltage (motor Power Supply2)	V _{M2}	16	V
Power Dissipation	P _d	2200(note1)	mW
Operating Temperature	T _{opr}	-20 ~ 75	°C
Storage Temperature	T _{stg}	-55 ~ 15 (Note 2)	°C
Output Current	I _o	1300 (Note 3)	mA

Note 1:Reduced by 17.6mW for increase for Ta of 1°C over 25°C

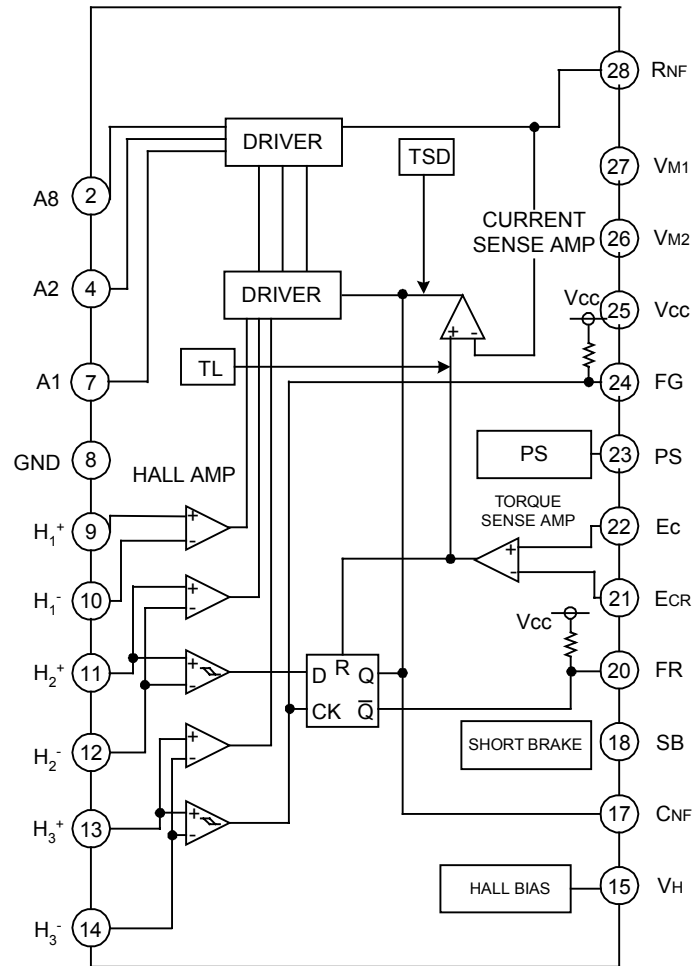
Note 2:Tj should not exceed 150°C

Note 3:Tj should not exceed Pd or ASO value.

RECOMMENDED OPERATING CONDITIONS(Ta =25°C)

PARAMETER	SYMBOL	MIN	MAX	UNIT
Power Supply Voltage	V _{cc}	4.25	5.5	V
	V _{M1}	3.0	15	V
	V _{M2}	3.0	15	V

BLOCK DIAGRAM



PIN DESCRIPTIONS

PIN NO.	PIN NAME	FUNCTION
2	A3	Output
4	A2	Output
7	A1	Output
8	GND	GND
9	H1 ⁺	Hall Signal Input
10	H1 ⁻	Hall Signal Input
11	H2 ⁺	Hall Signal Input
12	H2 ⁻	Hall Signal Input
13	H3 ⁺	Hall Signal Input
14	H3 ⁻	Hall Signal Input
15	V _H	Hall Bias
17	C _{NF}	For connection of phase compensation capacitor
18	SB	Short brake
20	FR	Rotation direction detection
21	E _{CR}	Output voltage control reference
22	E _C	Output voltage control
23	PS	Power save
24	FG	FG signal output
25	V _{CC}	Power Supply
26	V _{M2}	Motor Power Supply 2
27	V _{M1}	Motor Power Supply 1
28	R _{NF}	For connection of output current detection resistor
FIN	-	SUB GND

INPUT/OUTPUT CIRCUIT

(1) Power save

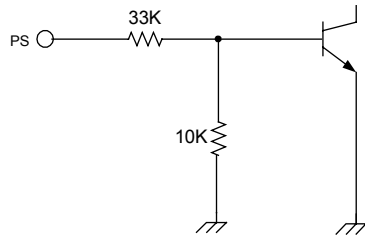


Fig.1

(2) Torque command input

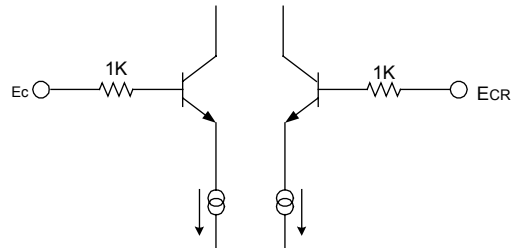


Fig.2

(3) Torque output (A1,A2,and A3)

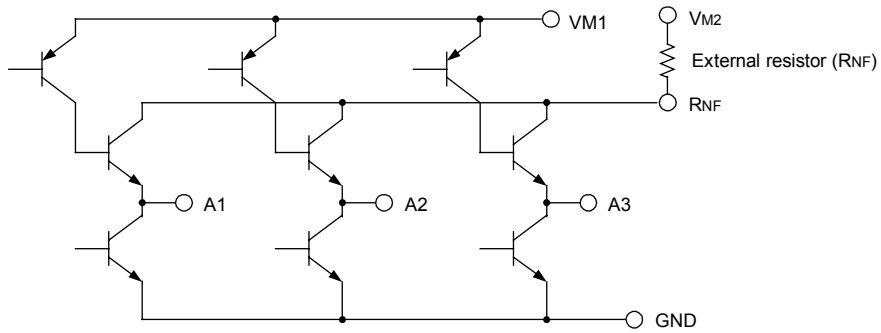


Fig.3

(4) Hall input (H1+,H1-,H2+,H2-,H3+,H3-)

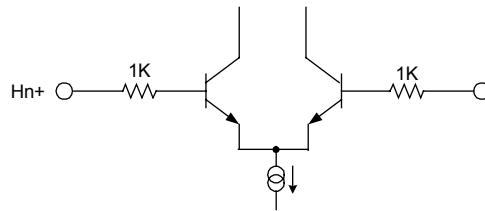


Fig.4

Note: Resistance values are typical values.

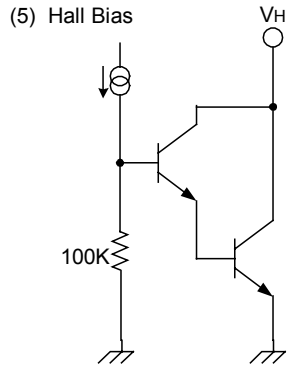


Fig.5

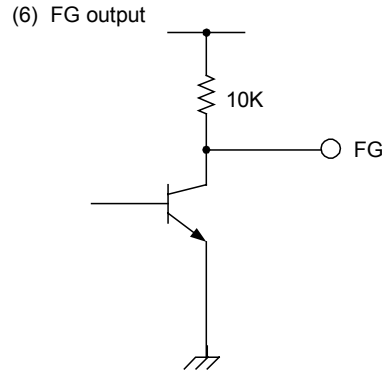


Fig.6

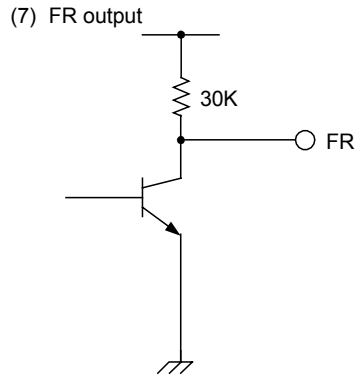


Fig.7

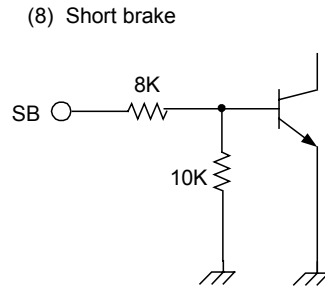


Fig.8

Note: Resistance values are typical values.

ELECTRICAL CHARACTERISTICS

(Ta =25°C ,Vcc=5V,VM1=12V,VM2=12V,UNLESS OTHERWISE NOTED.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
Total device						
Circuit current 1	Icc1	In the power save ON state		0	0.2	mA
Circuit current 2	Icc2	In the power save OFF state		4.1	6.5	mA
Power save						
ON voltage range	V _{PSON}				1.5	V
OFF voltage range	V _{PSOFF}		3.5			V
Hall bias						
Hall bias voltage	V _{HB}	I _{HB} =10mA	0.5	0.9	1.5	V
Hall amplifier						
Input bias current	I _{HA}			0.7	3.0	μA
Same phase input voltage range	V _{HAR}		1.5		4.0	V
Minimum input level	V _{INH}		50			mVp-p
H3 hysteresis level	V _{HYS}		10	20	40	mV
Torque command						
Input Voltage range	E _C		1.0		4.0	V
"-“offset voltage	E _{COFF-}	E _{CR} =2.5V	-80	-50	-20	mV
"+"offset voltage	E _{COFF+}	E _{CR} =2.5V	20	50	80	mV
Input Bias Current	E _{CIN}	E _{CR} = E _C		0.5	2.0	μA
I/O gain	G _{EC}	E _C =1.5V,2.0V	0.41	0.51	0.61	A/V
FG						
FG Output high level voltage	V _{FGH}	I _{FG} = -20μA	4.5	4.8		V
FG Output low level voltage	V _{FGL}	I _{FG} =3mA	0	0.25	0.4	V
Duty (reference value)	D _U			50		%
Rotation detection						
FR output high level voltage	V _{FRH}	V _{FRH} = -20μA	4.1	4.4		V
FR output low level voltage	V _{FRL}	I _{FR} = 3A	0	0.25	0.4	V
Output						
Output saturation high level voltage	V _{OH}	I _O = -600mA		1.0	1.5	V
Output saturation low level voltage	V _{OL}	I _O = 600mA		0.4	0.8	V
Pre-drive current	I _{VML}	E _C =0V output open		35	70	mA
Output limit current	I _{TL}		560	700	840	mA
Short brake						
On voltage range	V _{SBON}		3.5			V
OFF voltage range	V _{SBOFF}				1.5	V

* Not designed for radiation resistance.

Circuit operation

(1) Hall input to coil output

The phase relationship between the Hall input signals and the output current and voltage is shown in Fig.9. The motor position data input via the Hall pins is amplified by the Hall amplifier, and formed into waveforms by the matrix block. These signals are input to the output driver that supplies the drive current to the motor coils.

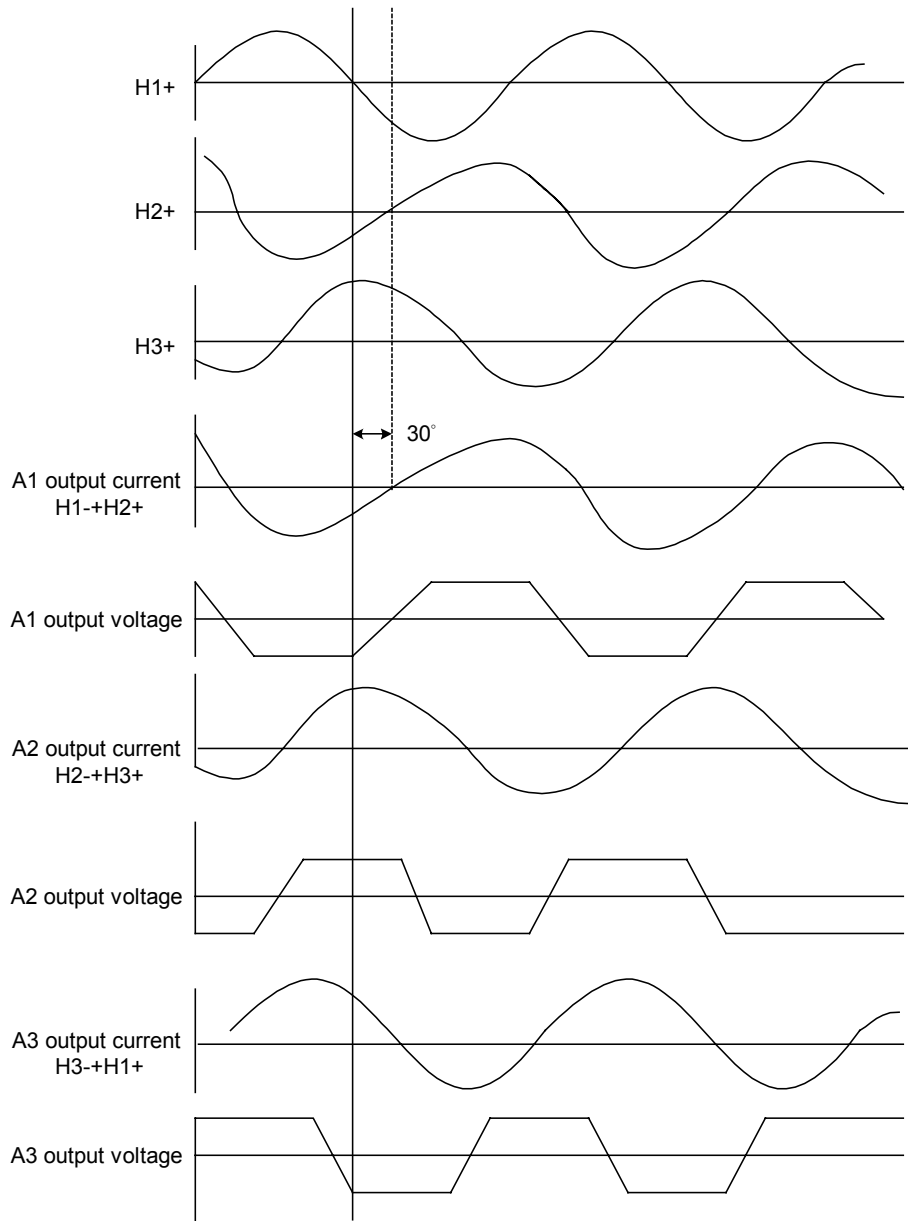


Fig.9

(2) Torque command

The RNF pin voltage with respect to the torque command (E_c) is as follows:

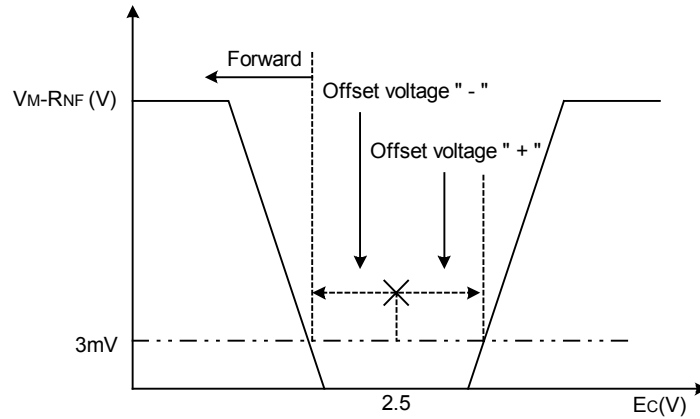


Fig.10

The I / O gain (G_{EC}) from the E_c pin to the RNF pin (output current) is determined by the RNF detector resistor.

$$G_{EC} = 0.255 / R_{NF} [A / V]$$

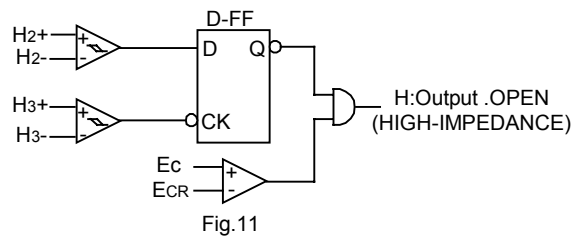
The torque limit current I_{TL} is given by:

$$I_{TL} = 0.35 / R_{NF} [A]$$

	ROTATION DIRECTION
$E_c < E_{CR}$	FORWARD
$E_c > E_{CR}$	REVERSE*

*Stops after detecting reverse

(3) Reverse rotation detection function



	FR SIGNAL OUTPUT PIN
FORWARD	L
REVERSE	H

The reverse detection circuit construction is shown in Fig.11.

1) Forward ($E_c < E_{CR}$)

The phase relationship between the Hall input signals H_{2+} and H_{3+} becomes as shown in Fig.9, and the reverse rotation detection circuit does not operate.

2) Reverse ($E_c > E_{CR}$)

The phase relationship between the signals H_{2+} and H_{3+} is opposite that for forward operation, and the reverse rotation detection circuit operates. The output goes OFF, and becomes open circuit.

(4) Short brake

When 3.5V or more is applied to the short brake pin, the upper-side output transistors of all go off, and the lower-side output transistors go on. Short braking operates regardless of the torque command signal.

(5) Other circuits

When 3.5V or more is applied to the power save pin, all circuits are on. When 1.5V or less is applied, the IC enters power save mode. Also, the Hall bias pins turn on and off with the power save pin.

Application example

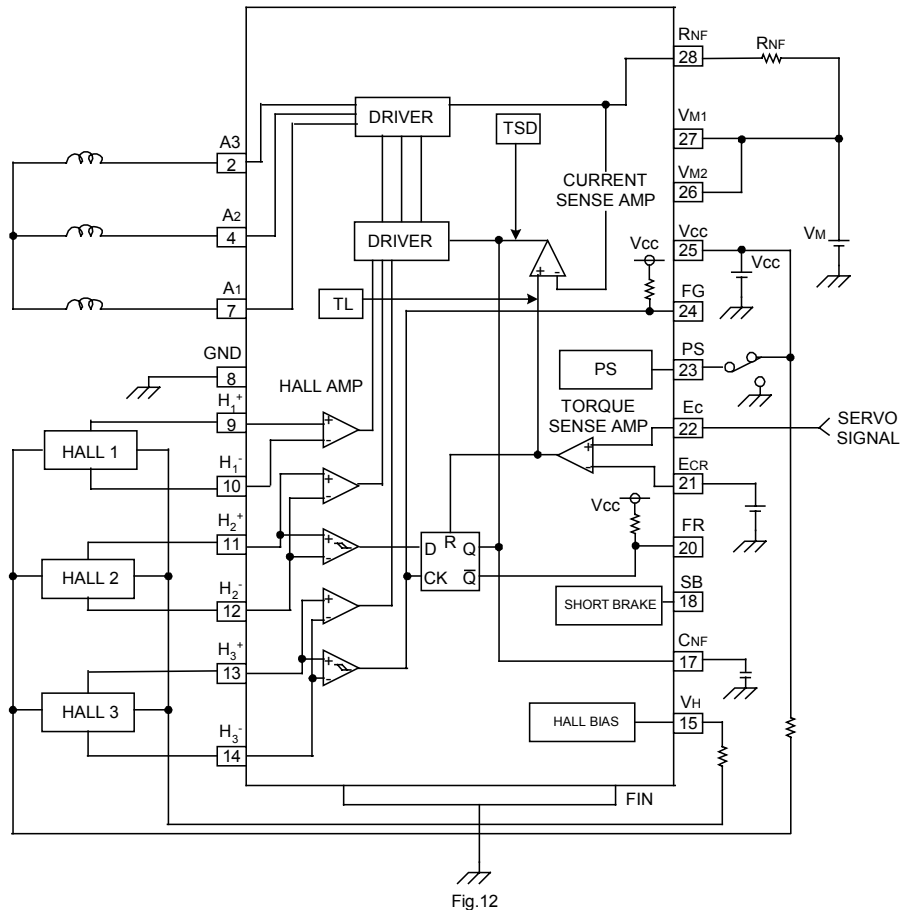


Fig.12

Operation notes*(1) Power save**

The power save input is an I / O circuit like the own shown in Fig.1.

The thermal derating characteristics of the power save pin is $-8\text{mV} / ^\circ\text{C}$, and the resistance will fluctuate between

$\pm 30\%$ so be careful of the input voltage range.

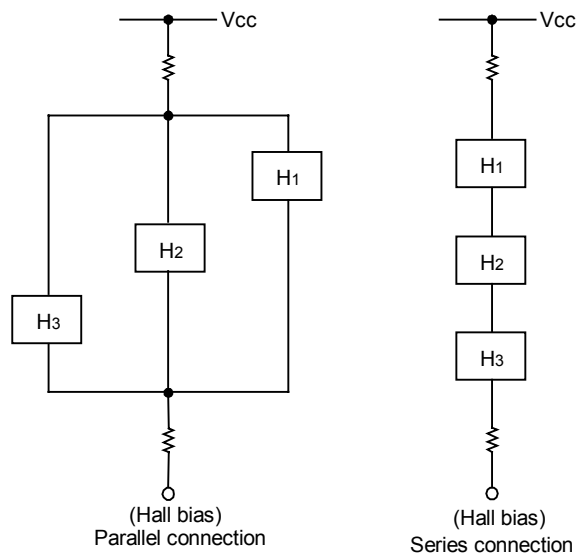
(2) Hall input

The input circuit shown in Fig.4 is used for the Hall inputs.

The Hall elements can be connected either in series or in parallel.

(3) Thermal shutdown (TSD)

When the junction temperature reaches 175°C , the A1, A2, and A3 coil outputs go open circuit. The thermal shutdown has approximately 15°C of hysteresis.



ELECTRICAL CHARACTERISTIC CURVES

Figure.14 Package Derating Characteristics

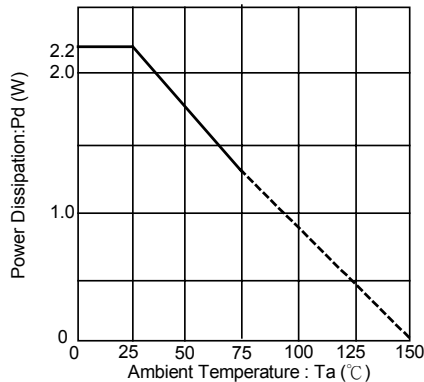


Figure.15 Power Supply Current vs. Power Supply Voltage

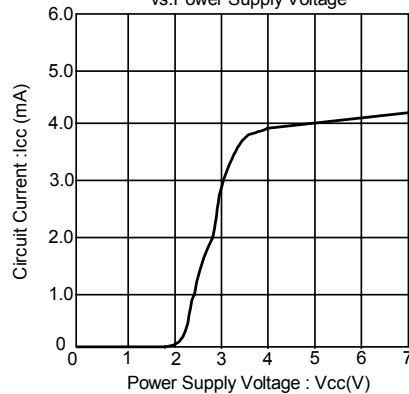


Figure.16 Upper-side Output Saturation Voltage vs. Output Current

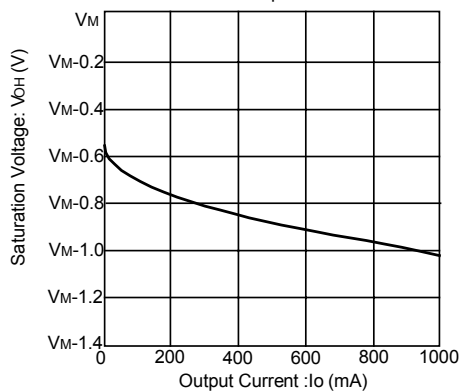
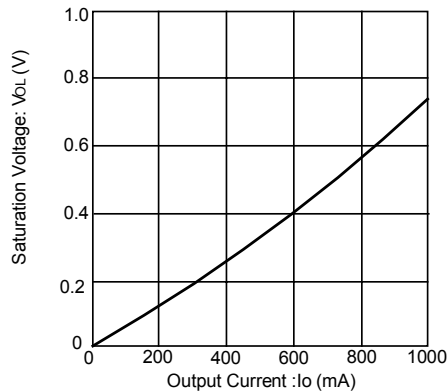


Figure.17 Low-side Output Saturation Voltage vs. Output Current



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