Features and Applications

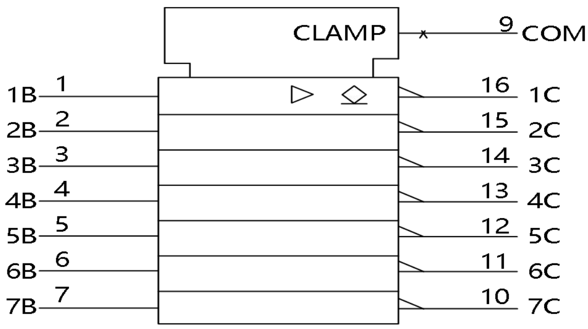
- 500-mA Rated Collector Current (Single Output)
- High-Voltage Outputs . . . 50 V
- Output Clamp Diodes
- Inputs Compatible With Various Types of Logic
- Relay Driver Applications

Description

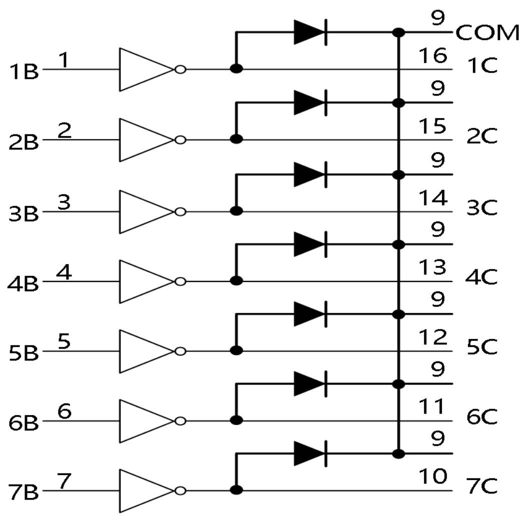
The CBM2003A are monolithic high-voltage, high-current Darlington transistor arrays. Each consists of seven n-p-n Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of a single Darlington pair is 500 mA. The Darlington pairs may be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers.

The CBM2003A has a 2.7-kΩ series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices.

LOGIC SYMBOL



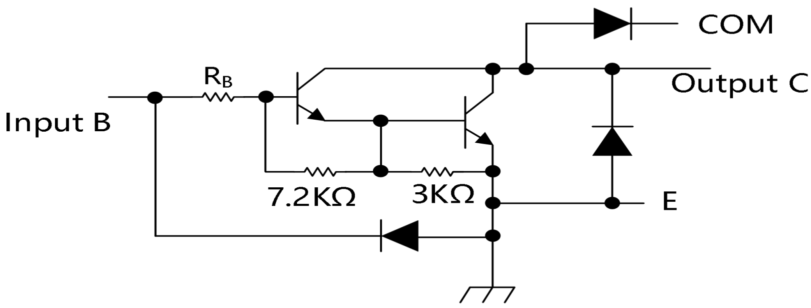
LOGIC DIAGRAM



SCHEMATICS(each Darlington Pair)

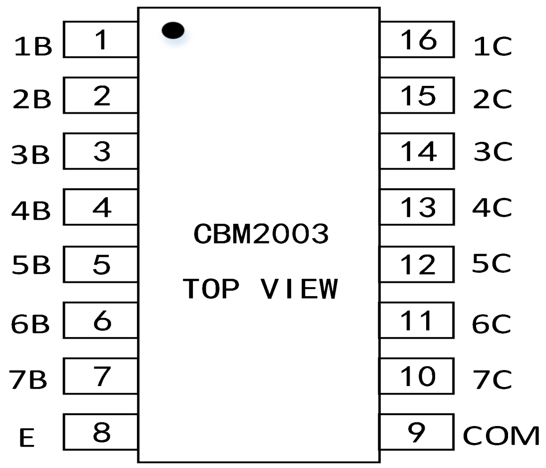
All resistor values shown are nominal

CBM2003A: R_B=2.7KΩ



CATALOG

Pin Configuration



Pin Description

Pin Num	Symbol	I/O	Pin Description
1	1B	I	Channel 1 through 7 Darlington base input
t	2B		
3	3B		
4	4B		
5	5B		
6	6B		
7	7B		
16	1C	O	Channel 1 through 7 Darlington collector output
15	2C		
14	3C		
13	4C		
12	5C		
11	6C		
10	7C		
9	COM	--	Common cathode node for flyback diodes (required for inductive loads)
8	E	--	Common emitter shared by all channels (typically tied to ground)

Absolute Maximum Ratings (T_A =25℃)

Parameter		Symbol	Limit Values		Unit
			Min.	Max.	
Output Sustaining Voltage		$V_{CE(SUS)}$	–0.5	50	V
Output Current		I_{OUT}	500		mA/ch
Input Voltage		V_{IN}	– 0.5	30	V
Clamp Diode Reverse Voltage		V_R	50		V
Clamp Diode Forward Current		I_F	500		mA
Power Dissipation	DIP	P_D	1.15		W
	SOP		0.95		
Operating Temperature		T_{OPR}	-40	85	℃
Storage Temperature		T_{STG}	-55	150	℃

* Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Recommended Operating Conditions (T_A=-40~85℃)

Parameter		Symbol	Test Condition	Limit Value		Unit
				Min	Max	
Output Sustaining Voltage		$V_{CE(SUS)}$		0	50	V
Output Current	DIP	I_{OUT}	T_{PW}=25ms,Duty=10%, 7 Circuits	0	370	mA/ch
			T_{PW}=25ms,Duty=30%, 7 Circuits	0	200	
	SOP		T_{PW}=25ms,Duty=10%, 7 Circuits	0	390	
			T_{PW}=25ms,Duty=30%, 7 Circuits	0	150	
Input Voltage		V_{IN}		0	3.	V
Clamp Diode Reverse Voltage		V_R			50	V
Clamp Diode Forward Current		I_F			400	mA
Power Dissipation	DIP	P_D			0.52	W
	SOP				0.4	

Electrical Characteristics (Ta= 25℃ unless otherwise noted)

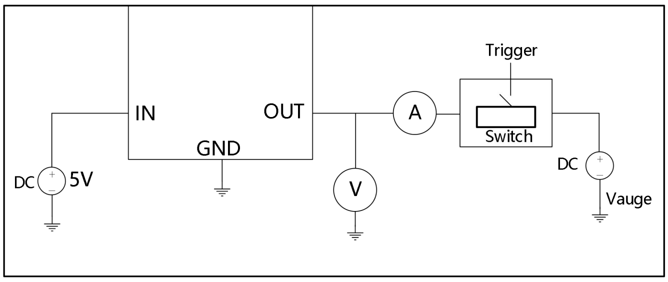
Parameter		Test Fig.	Test Conditions		Min	Typ	Max	Unit
$V_{I(on)}$	On-state Input Voltage	6	V_{CE}=2V	I_C=125mA				V
				I_C=200mA			2.4	
				I_C=250mA			2.7	
				I_C=275mA				
				I_C=300mA			3	
				I_C=350mA				
$V_{CE(sat)}$	Collector-emitter saturation voltage	5	I_I=250uA	I_C=100mA		0.9	1.1	V
			I_I=350uA	I_C=200mA		1	1.3	
			I_I=500uA	I_C=350mA		1.2	1.6	
I_{CEX}	Collector outoff current	1	V_{CE}=50V	I_I=0			50	uA
		2	V_{CE}=50V,	I_I=0			100	
			T_A=85℃	V_I=1V				
H_{FE}	DC Current Transfer Ratio	5	V_{CE}=2V, I_{OUT}=350mA		1000			
V_F	Clamp forward voltage	8	I_F=350mA			1.7	2	V
$I_{I(off)}$	Off-state input current	3	V_{CE}=50V T_A=85℃	I_C=500uA	50	65		uA
I_I	Input current	4	V_I=2.4V			0.4	0.7	mA
			V_I=5V					
			V_I=12V					
I_R	Clamp reverse current	7	V_R=50V				50	uA
			V_R=50V	T_A=85℃			100	
C_I	Input capacitance		V_I=0	f=1MHz		15	25	pF

Switching Characteristics (T_A=25°C)

Parameter		Test Conditions	Min	Typ	Max	Unit
T_{PLH}	Propagation delay time low-to-high-level output	See Figure 9		0.25	1	us
T_{PHL}	Propagation delay time high -to- low –level output			0.25	1	us
V_{OH}	High-level output voltage after switching	V_S=50V, I_O=300mA See Figure 10	V_S-20			mV

* EOS (Electrical Over Stress) Immunity Level

Test Circuit



Test conditions	
V_{CC}	12V
Power on time	5000ms
Current max	1.0A
IN	pin4
OUT	pin13

tE (Endurance time) : time until IC damage / Criterion : IC should survive EOS

EOS Immunity Level: More than 5000ms

Parameter Measurement Information

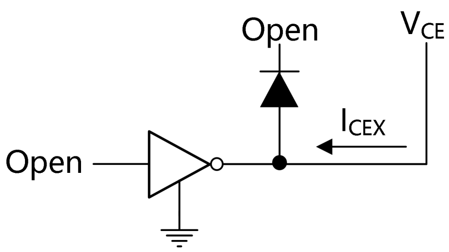


Figure 1 . I_{CEX} Test Circuit

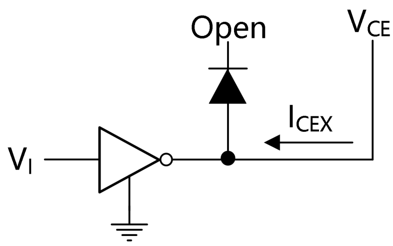


Figure 2 . I_{CEX} Test Circuit

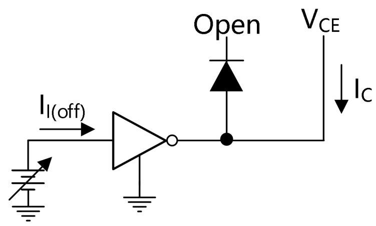


Figure 3 . $I_{I(off)}$ Test Circuit

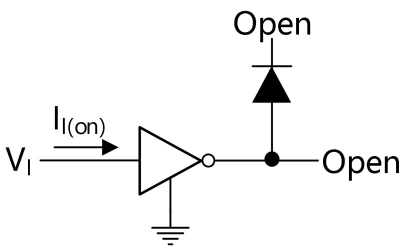
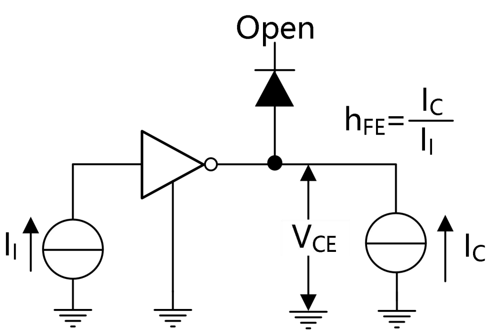


Figure 4 . I_I Test Circuit



Note:II is fixed for measursing VCE(sat),Variable or messuring h=E

Figure 5 . H_{FE} V_{CE} Test Circuit

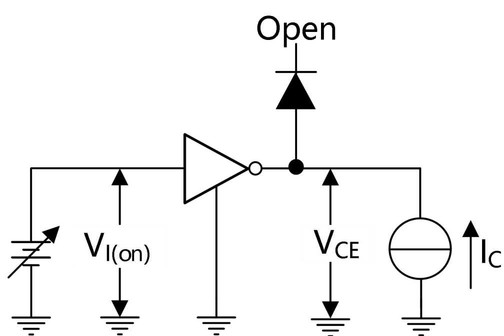


Figure 6 . $V_{I(on)}$ Test Circuit

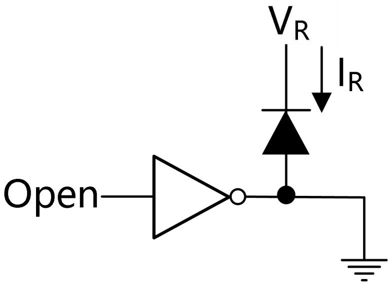


Figure 7 . I_R Test Circuit

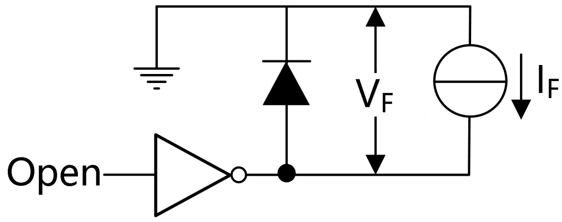


Figure 8 . V_F Test Circuit

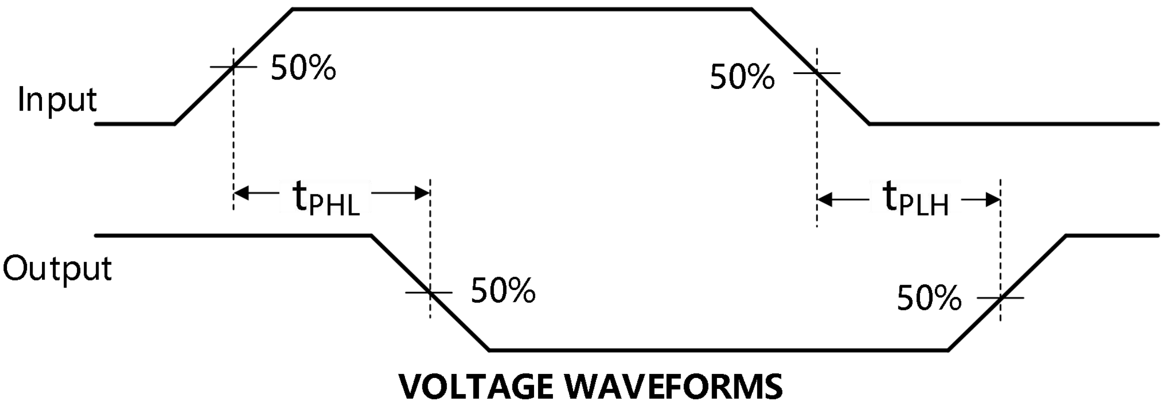


Figure 9. Propagation Delay-Time Waveforms

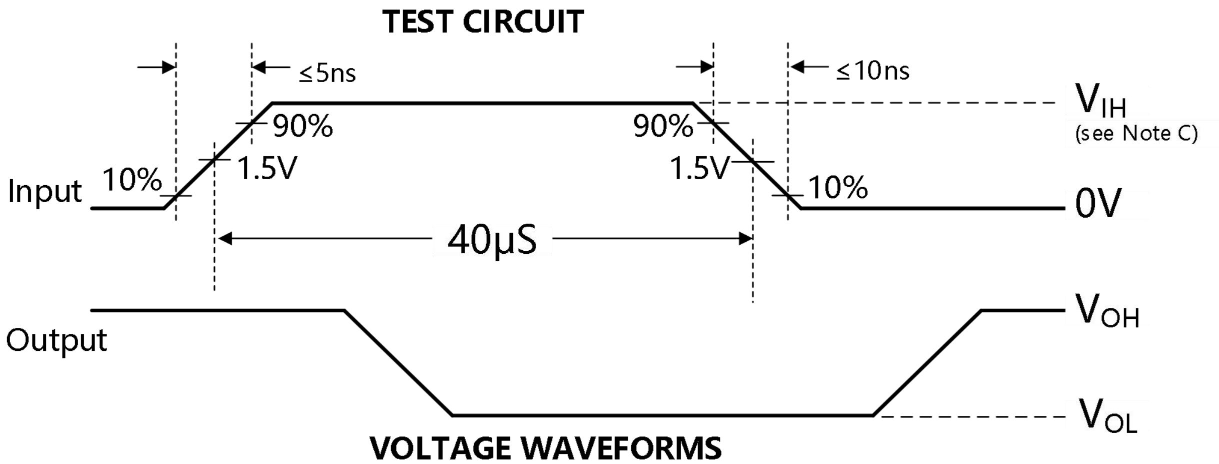


Figure 10. Latch-Up Test Circuit and Voltage Waveforms

NOTES:

A. The pulse generator has the following characteristics: P_{RR} = 12.5 kHz, Z_O=50.

B. CL includes probe and jig capacitance.

C. V_{IH} = 3 V.

Typical Characteristics

COLLECTOR-EMITTER
SATURATION VOLTAGE
vs
COLLECTOR CURRENT
(ONE DARLINGTON)

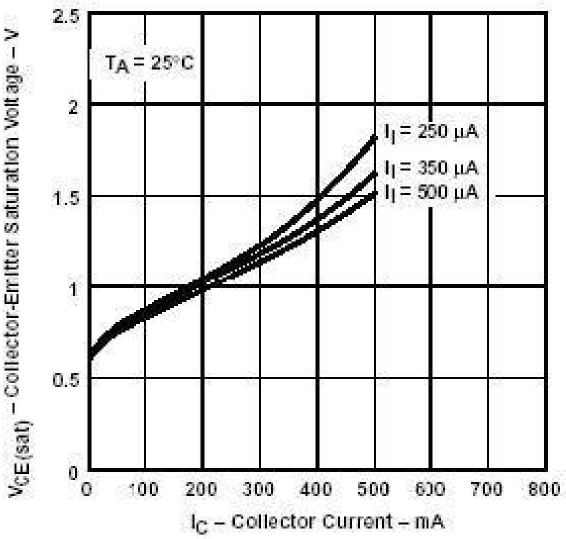


Figure 11

Figure 11

COLLEC TOR-EM ITTER
SATURATION VOLTAGE
vs
TOTAL COLLECTOR CURRENT
TWO DARLINGTONS PARALLELED)

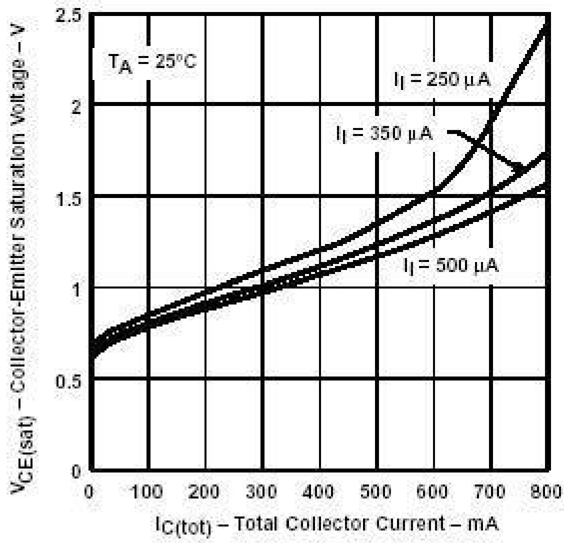


Figure 12

Figure 12

COLLECTOR CURRENT
vs
INPUT CURRENT

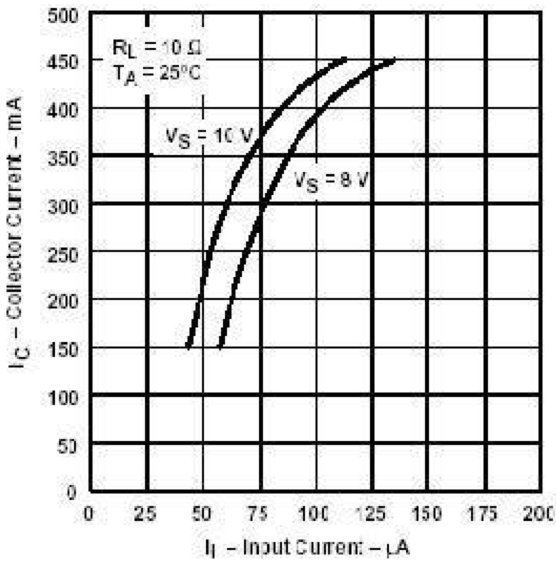


Figure 13

Figure 13

Thermal Information

D PACKAGE
MAXIMUM COLLECTOR CURRENT
vs
DUTY CYCLE

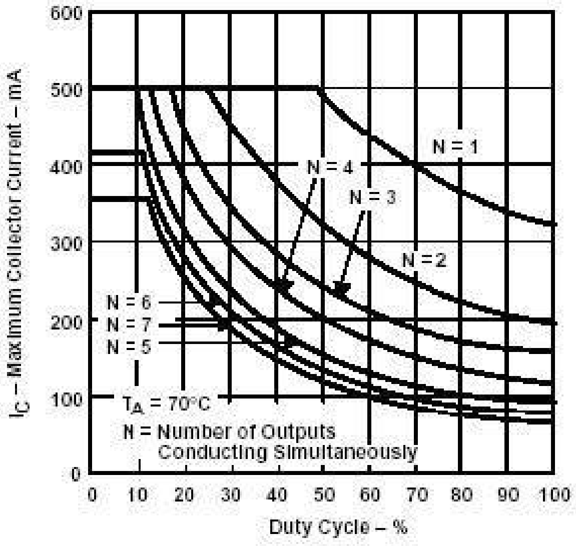


Figure 14

N PACKAGE
MAXIMUM COLLECTOR CURRENT
vs
DUTY CYCLE

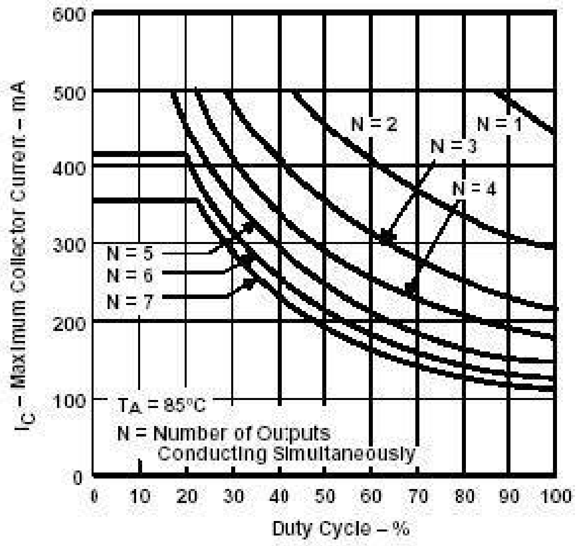
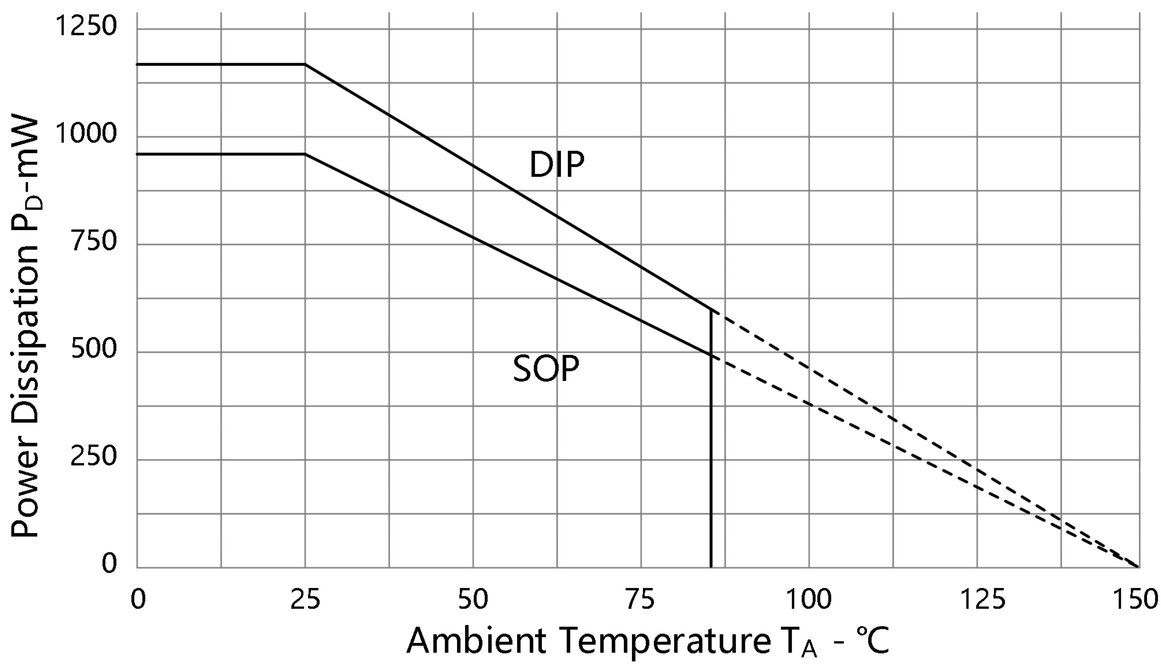


Figure 15

POWER DISSIPATION
VS.
AMBIENT TEMPERATURE



Application Information

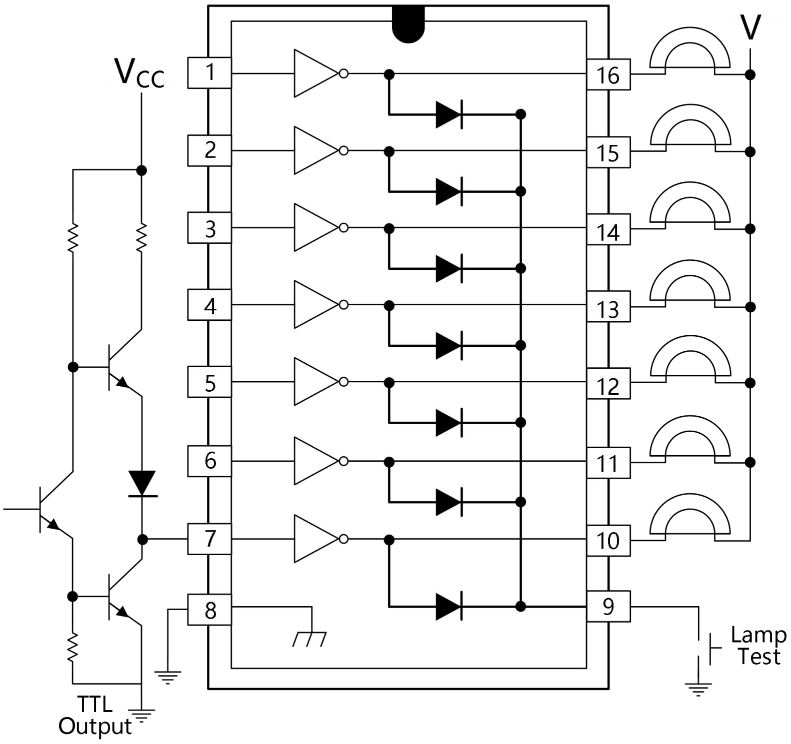


Figure 16. TTL to Load

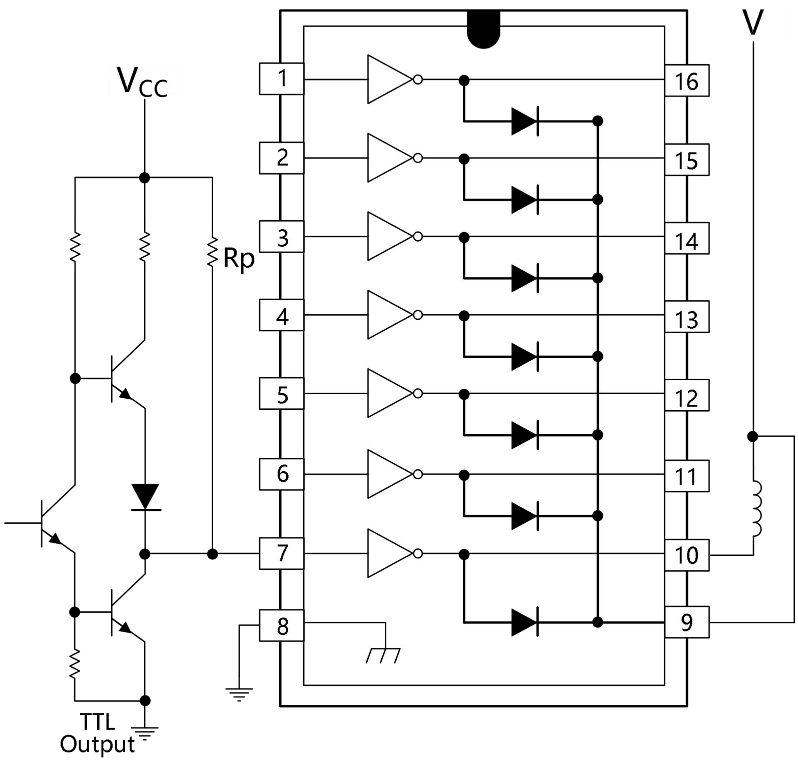
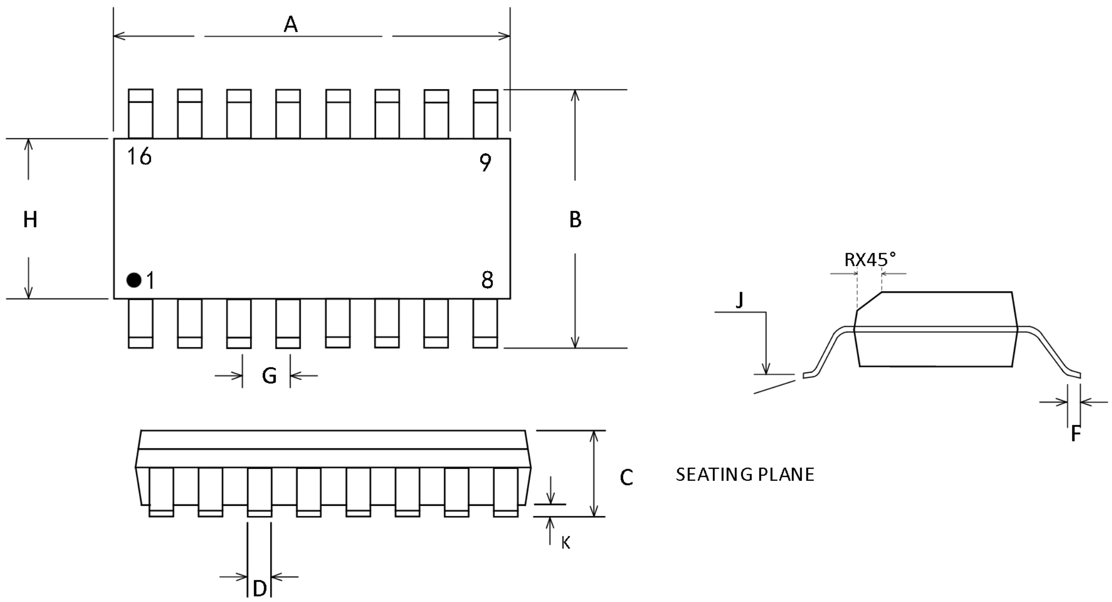


Figure 17. Use of Pullup Resistors to Increase Drive Current

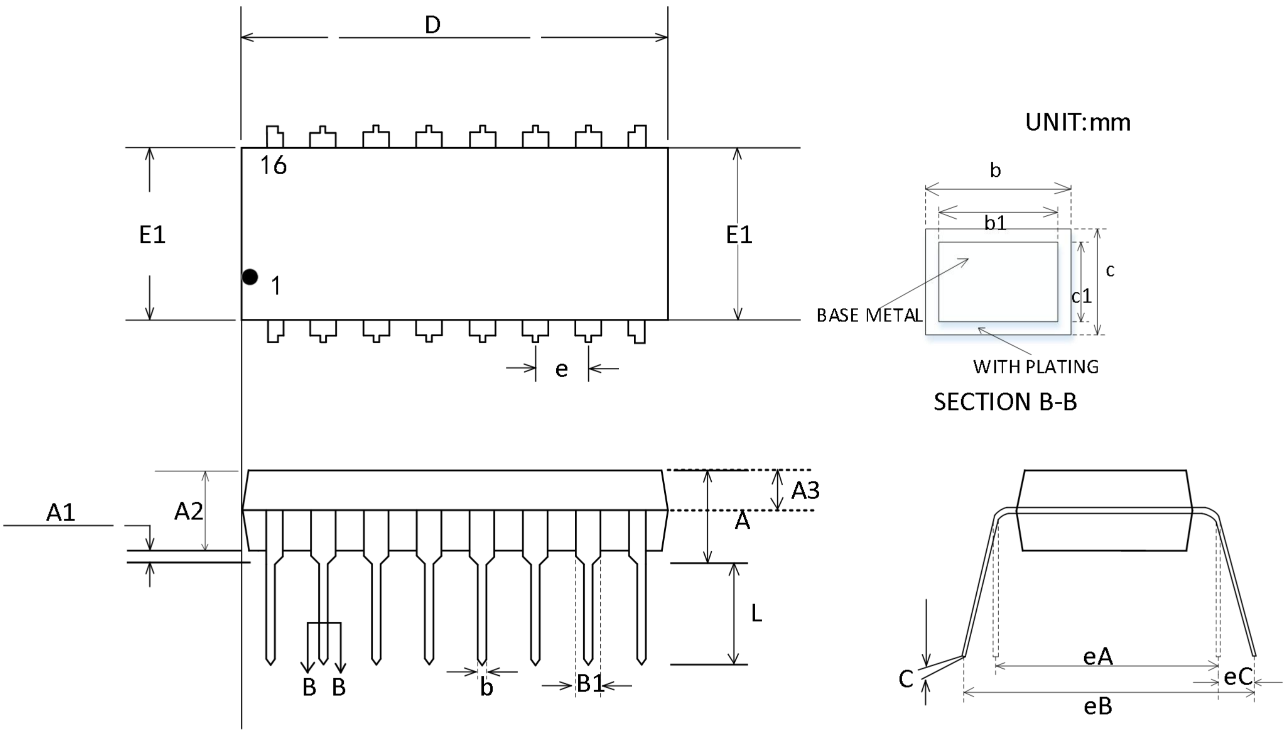
Package Information

SOP-16



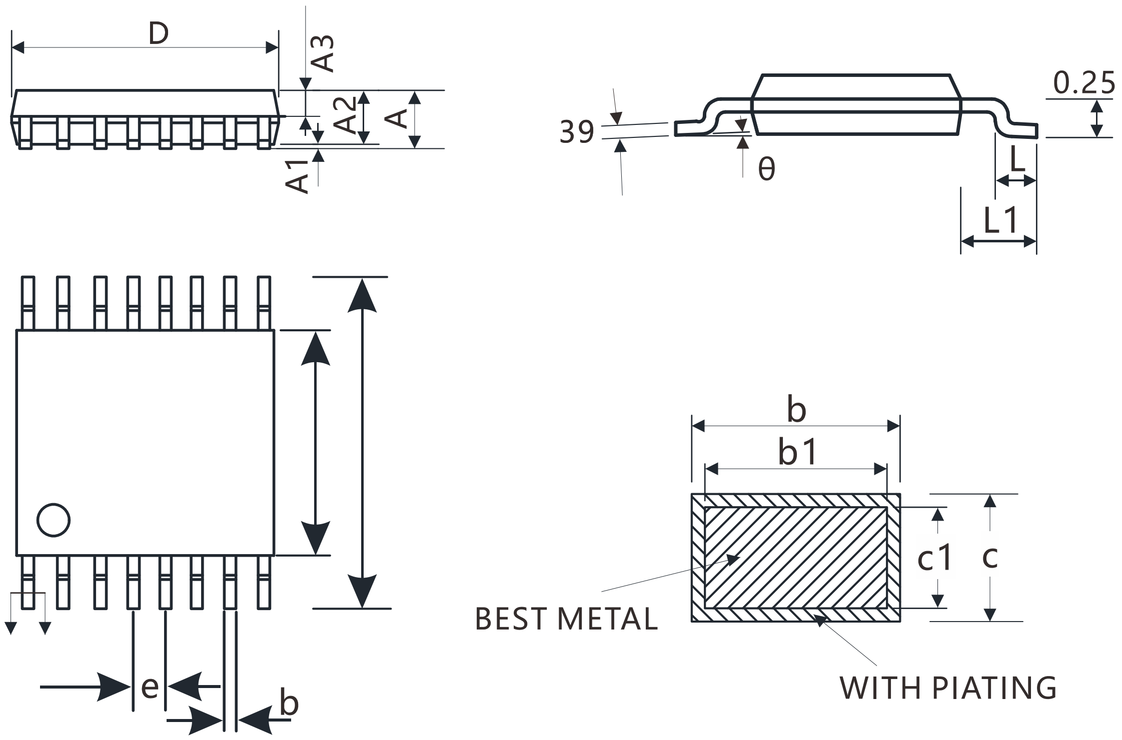
SYMBOL	MILLIMETER(MM)	
	MIN	MAX
A	9.80	9.98
B	5.80	6.20
C	1.52	1.72
D	0.33	0.51
F	0.40	1.27
G	1.27BSC	
H	3.81	3.99
J	0°	8°
K	0.10	0.25
R	0.25	0.5

DIP-16



SYMBOL	MILLIMETER(MM)			SYMBOL	MILLIMETER(MM)		
	MIN	NOM	MAX		MIN	NOM	MAX
A	3.60	3.80	4.00	c1	0.24	0.25	0.26
A1	0.51			D	18.90	19.10	19.30
A2	3.10	3.30	3.50	E1	6.15	6.35	6.55
A3	1.42	1.52	1.62	e	2.54 BSC		
b	0.44		0.53	eA	7.62 BSC		
b1	0.43	0.46	0.48	eB	7.62		9.50
B1	1.52 BSC			eC	0		0.94
c	0.25		0.31	L	3.00		
L/F 载体尺寸（Mil）		80×80					
		110×140					
		140×170					

TSSOP-16



SYMBOL	MILLIMETER(MM)			SYMBOL	MILLIMETER(MM)		
	MIN	NOM	MAX		MIN	NOM	MAX
A			1.75	D	9.70	9.90	10.10
A1	0.10		0.25	E	5.80	6.00	6.20
A2	1.35	1.40	1.45	E1	3.70	3.90	4.10
A3	0.60	0.65	0.70	e	1.27 BSC		
b	0.39		0.48	L	0.50		0.80
b1	0.38	0.41	0.43	L1	1.05 BSC		
c	0.21		0.26	θ	0°		8°
c1	0.19	0.20	0.21				
L/F 载体尺寸（mm)		75×75					
		90×110					
		70×180					

Package/Ordering Information

ORDERING	TEMPRANGE	PACKAGE	MARK	TRANSPOT
CBM2003AS16	-40℃~85℃	SOP-16	CBM2003AS	Tape and Reel, 2500
CBM2003AS16-RL	-40℃~85℃	SOP-16	CBM2003AS	Tape and Reel, 3000
CBM2003AS16-REEL	-40℃~85℃	SOP-16	CBM2003AS	Tape and Reel, 4000
CBM2003ATS16	-40℃~85℃	TSSOP-16	CBM2003AT	Tape and Reel, 2500
CBM2003ATS16-RL	-40℃~85℃	TSSOP-16	CBM2003AT	Tape and Reel, 3000
CBM2003ATS16-REEL	-40℃~85℃	TSSOP-16	CBM2003AT	Tape and Reel, 4000
CBM2003ADP16	-40℃~85℃	DIP-16	CBM2003AD	Tube, 2500