

Features And Application

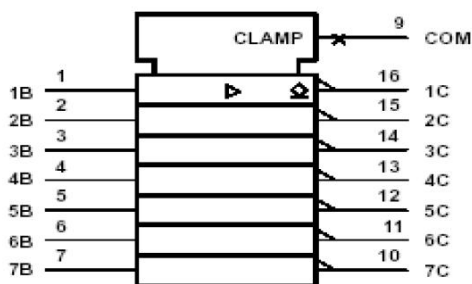
- 500-mA Rated Collector Current (Single Output)
- High-Voltage Outputs . . . 50 V
- Output Clamp Diodes
- Inputs Compatible With Various Types of Logic
- Relay Driver Applications

Description

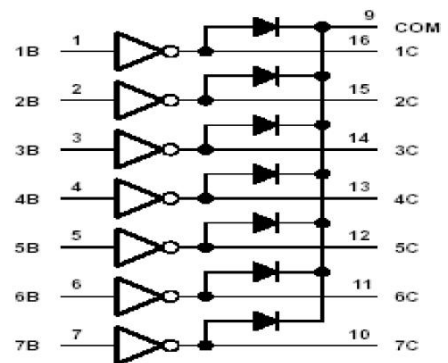
The CBM2003A are monolithic high-voltage, high-current Darlington transistor arrays. Each consists of seven n-p-n Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of a single Darlington pair is 500 mA. The 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-k Ω series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices.

LOGIC SYMBOL



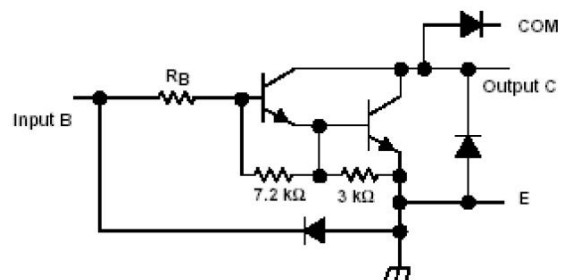
LOGIC DIAGRAM



SCHEMATICS (each Darlington Pair)

All resistor values shown are nominal.

CBM2003A: $R_B = 2.7\text{ k}\Omega$



Absolute Maximum Ratings (Ta =25°C)

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	°C
Storage Temperature	T_{stg}	-55	150	°C

* 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(Ta= -40~85°C)

Parameter	Symbol	Test Condition	Limit Value		Unit	
			Min	Max		
Output Sustaining Voltage	$V_{CE(SUS)}$		0	50	V	
Output Current	DIP	I_{OUT}		0	370	mA/ch
				0	200	
	SOP		0	390		
			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°C (unless otherwise noted)

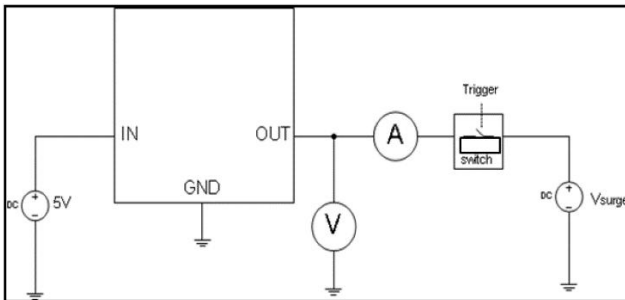
Parameter	Test Fig.	Test Conditions	Min	Typ	Max	Unit	
V _{I(on)} On-state Input Voltage	6	V _{CE} =2V	I _C =125mA				V
			I _C =200mA			2.4	
			I _C =250mA			2.7	
			I _C =275mA				
			I _C =300mA			3	
			I _C =350mA				
V _{CE(sat)} Collector-emitter saturation voltage	5	I _I =250uA I _C =100mA		0.9	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 T _A =85°C V _I =1V			100		
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 I _C =500uA T _A =85°C	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°C			100		
C _I Input capacitance		V _I =0 f=1MHz		15	25	pF	

Switching Characteristics, TA=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	
VCC	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

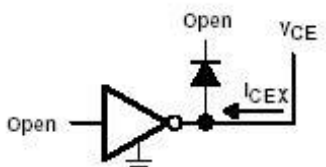


Figure 1. I_{CEX} Test Circuit

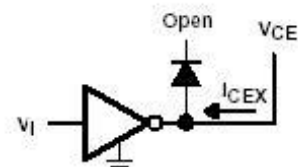


Figure 2. I_{CEX} Test Circuit

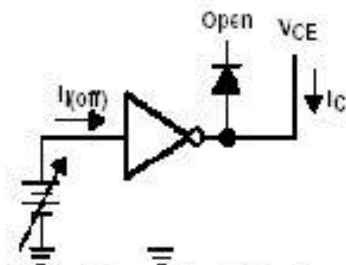


Figure 3. $I_{I(off)}$ Test Circuit

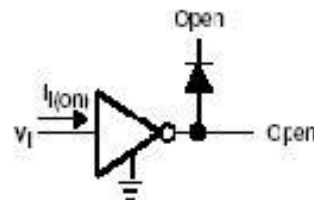
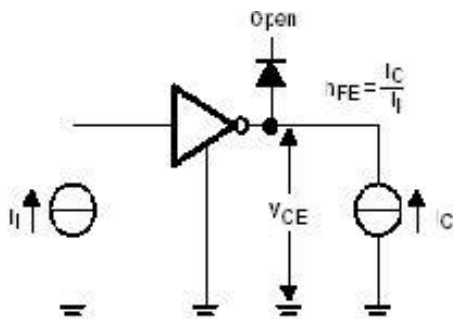


Figure 4. I_I Test Circuit



NOTE: I_I is fixed for measuring $V_{CE(sat)}$, variable for measuring h_{FE} .

Figure 5. h_{FE} $V_{CE(sat)}$ Test Circuit

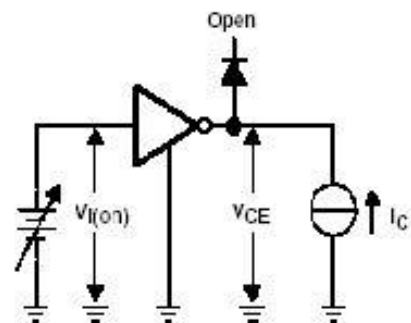


Figure 6. $V_{I(on)}$ Test Circuit

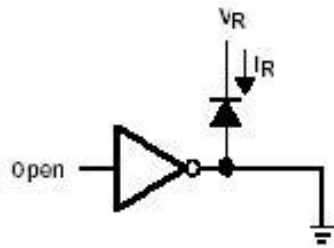


Figure 7. I_R Test Circuit

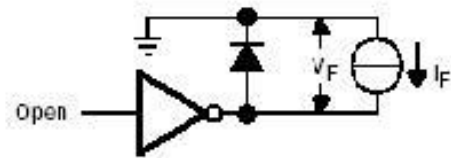


Figure 8. V_F Test Circuit

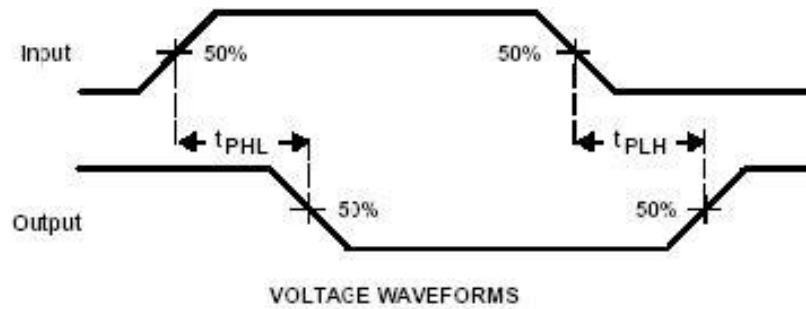


Figure 9. Propagation Delay-Time Waveforms

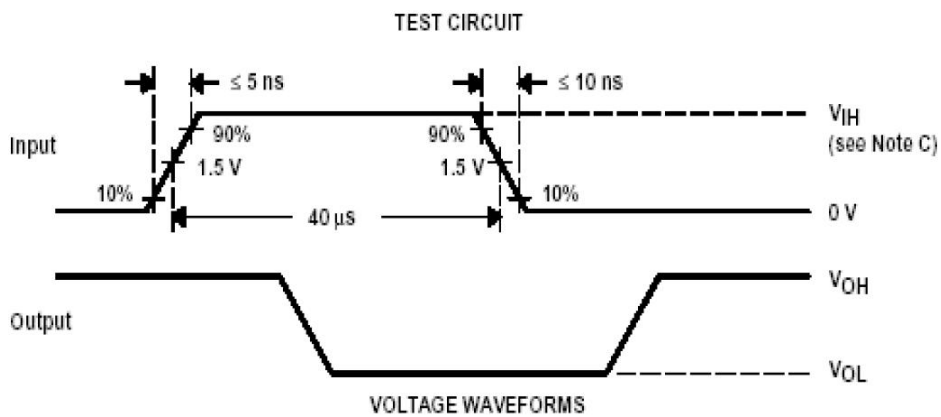


Figure 10. Latch-Up Test Circuit and Voltage Waveforms

NOTES: A. The pulse generator has the following characteristics: PRR = 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)

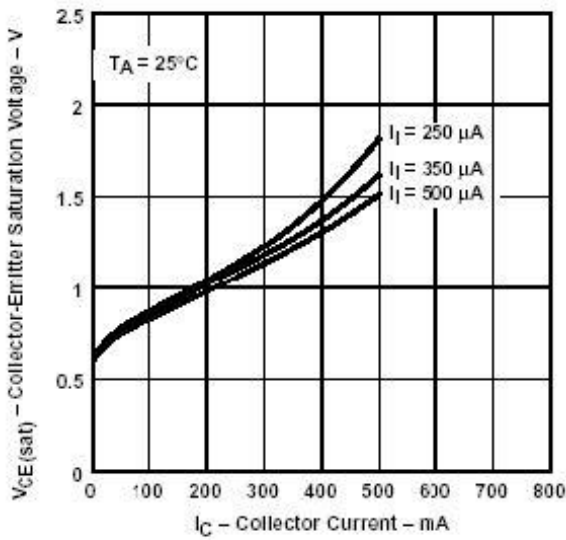


Figure 11

COLLECTOR-EMITTER
SATURATION VOLTAGE
VS
TOTAL COLLECTOR CURRENT
TWO DARLINGTONS PARALLELED

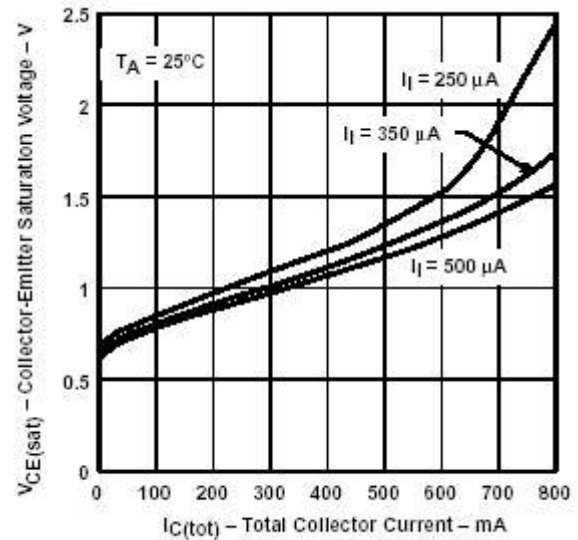


Figure 12

COLLECTOR CURRENT
VS
INPUT CURRENT

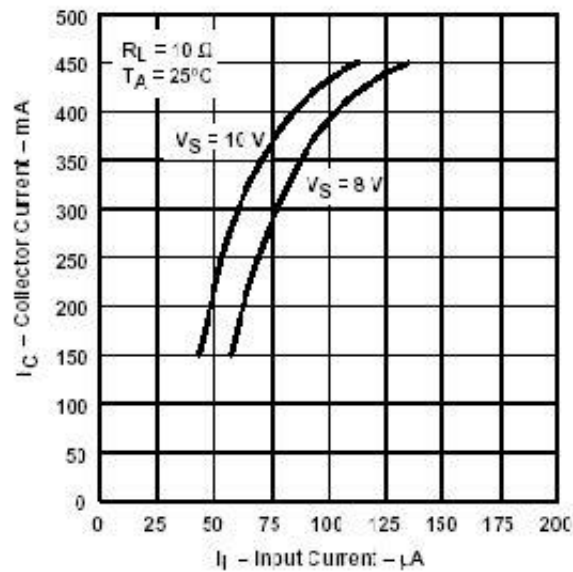


Figure 13

THERMAL INFORMATION

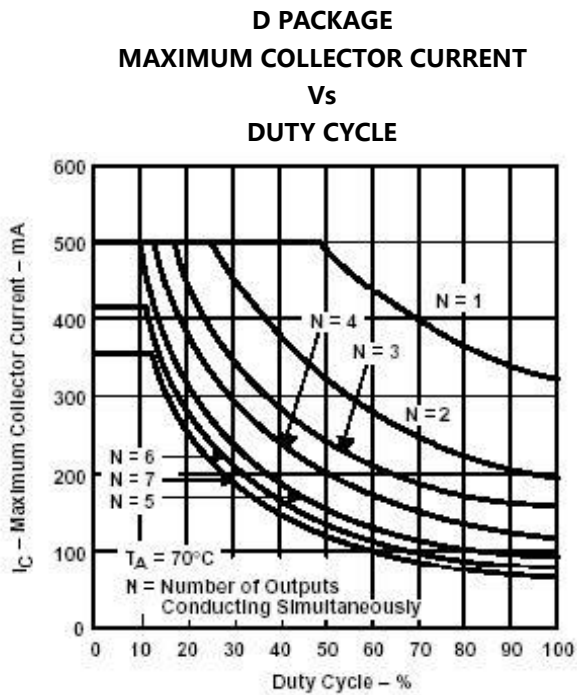


Figure 14

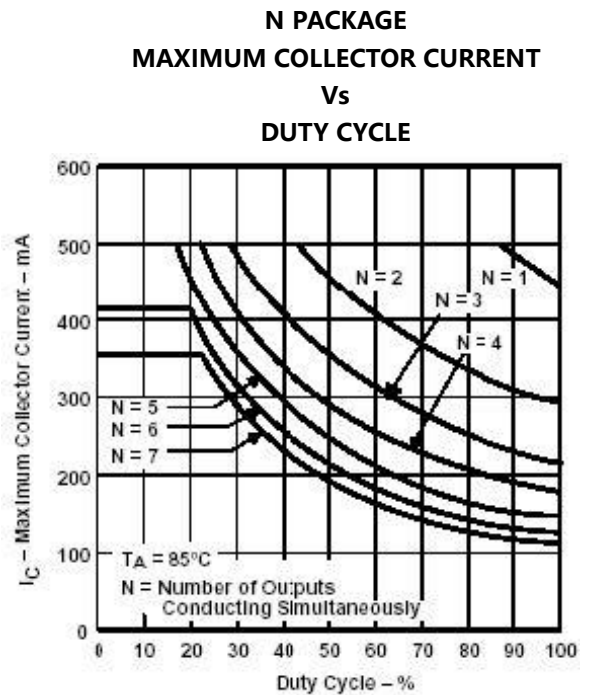
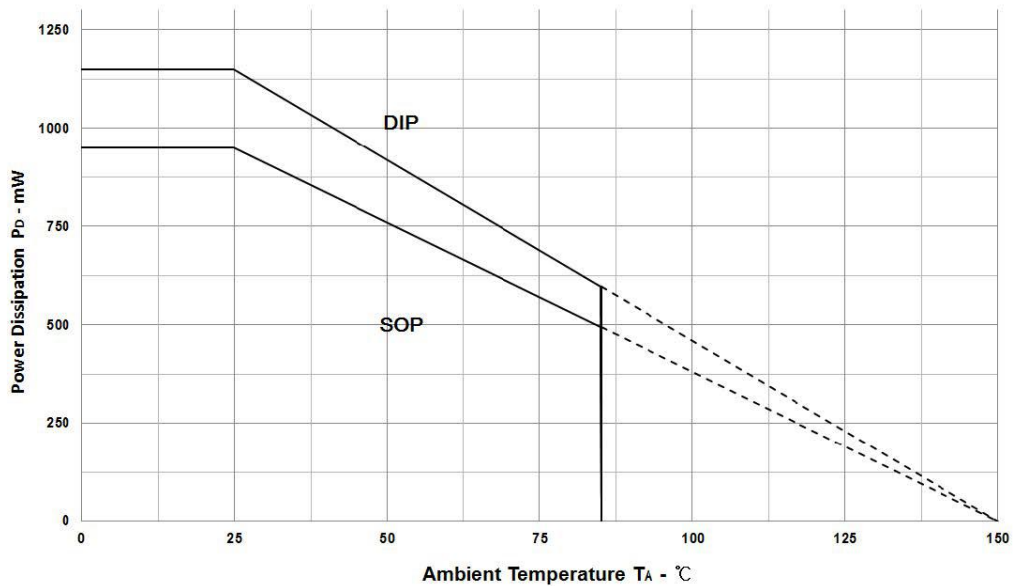


Figure 15

POWER DISSIPATION
VS.
AMBIENT TEMPERATURE



APPLICATION INFORMATION

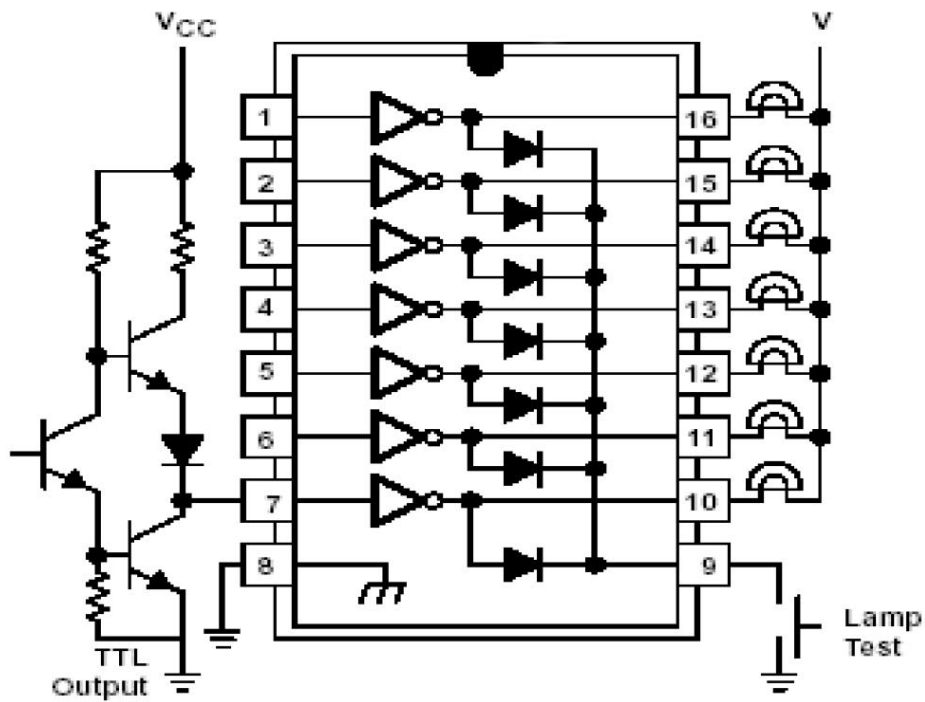


Figure 16. TTL to Load

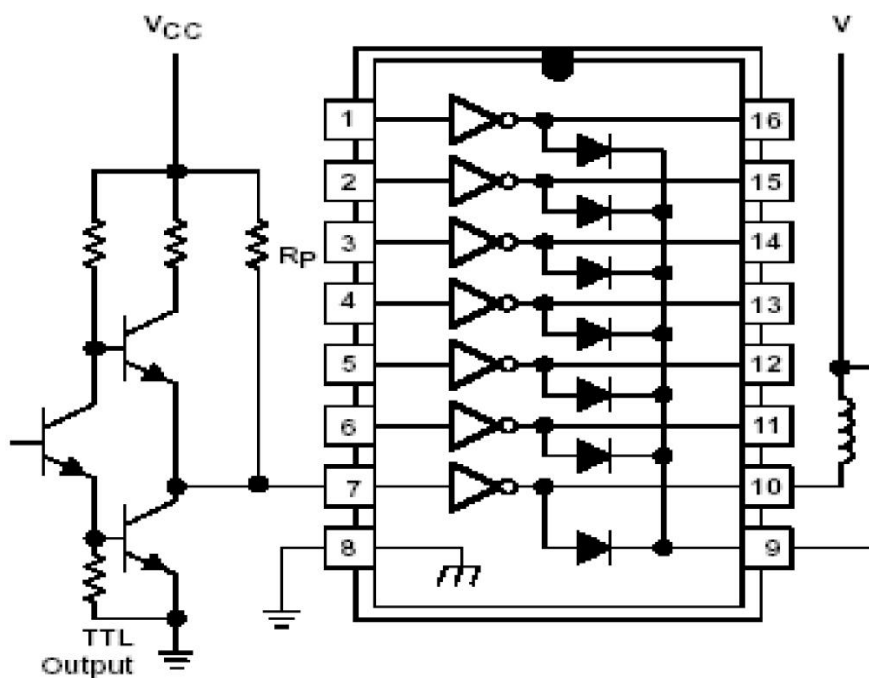
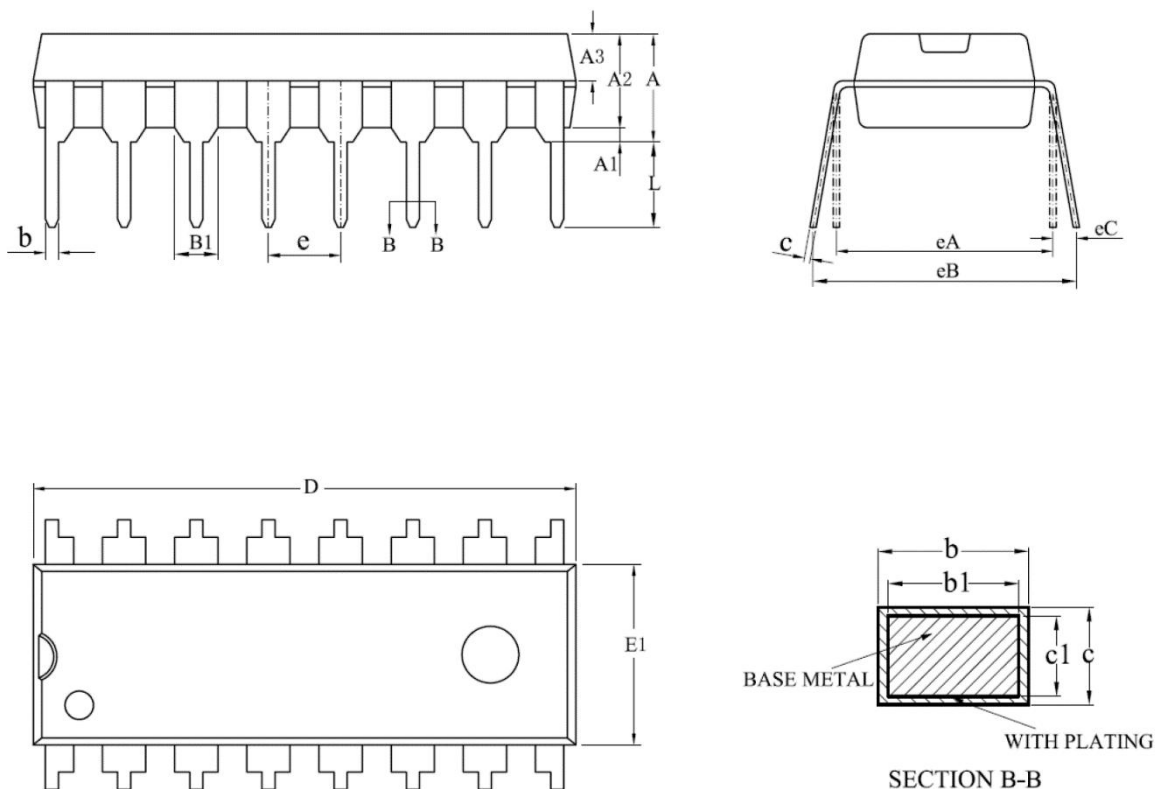


Figure 17. Use of Pullup Resistors to Increase Drive Current

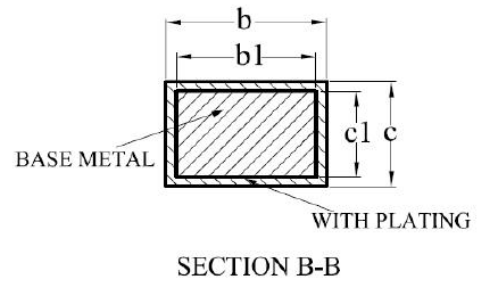
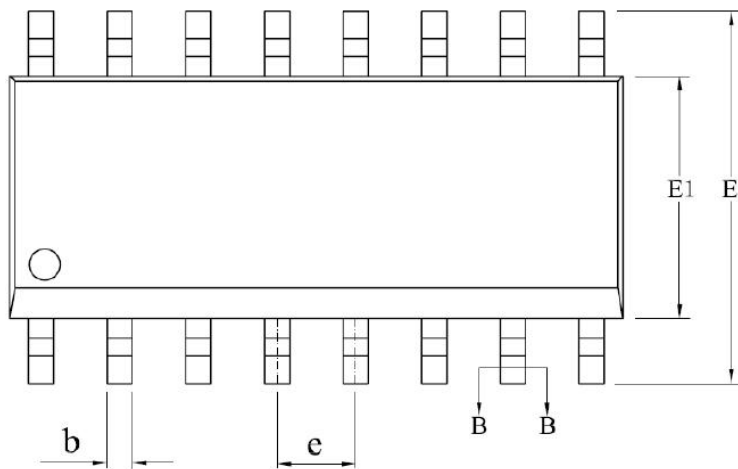
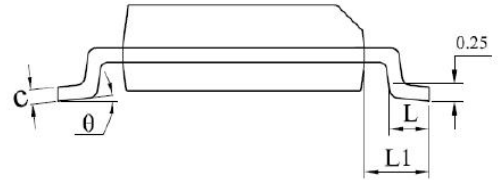
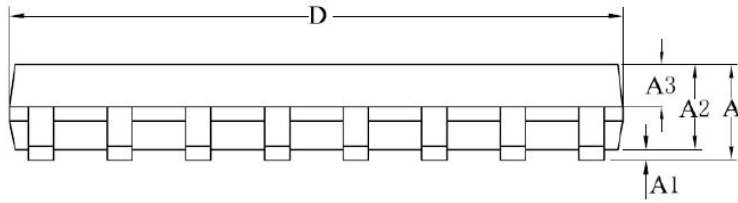
Package Dimensions

DIP-16



SYMBOL	MILLIMETER			SYMBOL	MILLIMETER		
	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						

SOP-16



SYMBOL	MILLIMETER			SYMBOL	MILLIMETER		
	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 (Mil)	75×75						
	90×110						
	70×180						

PACKAGE/ORDERING INFORMATION

PRODUCT	ORDERING	TEMPRANGE	PACKAGE	PAKEAGE	TRANSPOT
CBM2003	CBM2003AS16	-40°C~85°C	SOP-16	CBM2003AS	Tape and Reel,2500
CBM2003	CBM2003ADP16	-40°C~85°C	SOP-16	CBM2003AD	Tape and Reel,50