



CD2003A

High voltage, large current, seven-channel Darlington transistor array

Version: Rev 1.0.0 Date: 2025-6-18

Features ■■

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

Application ■■

- Relay driver
- Stepper and brushed DC motor drivers
- Lamp driver
- Display screen driver (LED and gas discharge components)
- Line driver
- Logical buffer

Description ■■

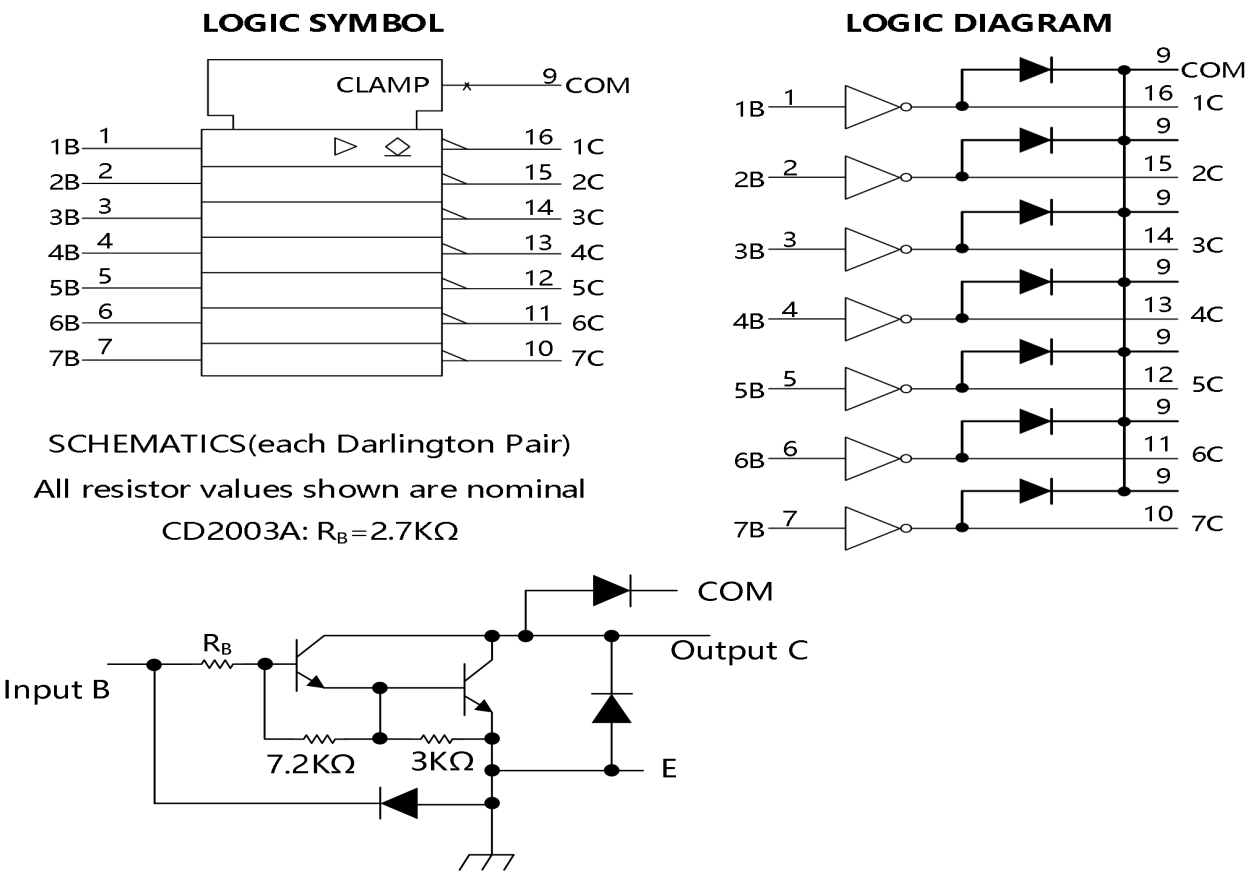
The CD2003A are monolithic high-voltage, high-current Darlington transistor arrays. Each consists of seven n-p-n Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of a single Darlington pair is 500 mA. The Darlington 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 CD2003A has a 2.7-k Ω series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices.

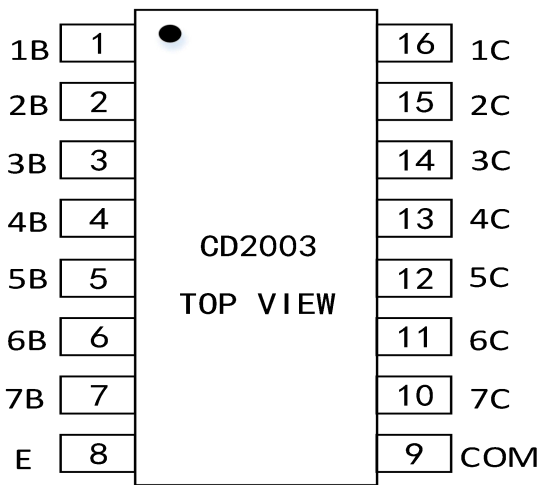
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Functional Block diagram



Pin Configurations



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

Parameter	Symbol	Limit Values		Unit
		Min.	Max.	
Output Sustaining Voltage	VCE(SUS)	−0.5	50	V
Output Current	IOUT	500		mA/ch
Input Voltage	VIN	− 0.5	30	V
Clamp Diode Reverse Voltage	VR	50		V
Clamp Diode Forward Current	IF	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

Recommended Operating Conditions ($T_A = -40 \sim 85^{\circ}\text{C}$)

Parameter		Symbol	Test Condition	Limit Value		Unit
				Min	Max	
Output Sustaining Voltage		VCE(SUS)		0	50	V
Output Current	DIP	IOUT	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

All specifications 25°C , unless otherwise noted.

Parameter	Test Fig.	Test Conditions	Min	Typ	Max	Unit
$V_{I(on)}$	On-state Input Voltage	6	$V_{CE}=2\text{V}$	$I_C=125\text{mA}$		V
				$I_C=200\text{mA}$		
				$I_C=250\text{mA}$		
				$I_C=275\text{mA}$		
				$I_C=300\text{mA}$		
				$I_C=350\text{mA}$		
$V_{CE(sat)}$	Collector-emitter saturation voltage	5	$I_I=250\mu\text{A}$	$I_C=100\text{mA}$	0.9	V
			$I_I=350\mu\text{A}$	$I_C=200\text{mA}$	1	

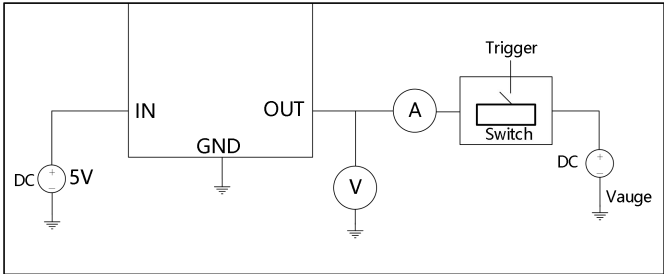
			$I_I=500\mu A$	$I_C=350mA$		1.2	1.6	
ICEX	Collector outoff current	1	$V_{CE}=50V$	$I_I=0$			50	uA
		2	$V_{CE}=50V$, $T_A=85^{\circ}C$	$I_I=0$ $V_I=1V$			100	
HFE	DC Current Transfer Ratio	5	$V_{CE}=2V$, $I_{OUT}=350mA$		100 0			
V_F	Clamp forward voltage	8	$I_F=350mA$			1.7	2	V
II(off)	Off-state input current	3	$V_{CE}=50V$ $T_A=85^{\circ}C$	$I_C=500\mu A$	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
			$V_R=50V$	$T_A=85^{\circ}C$			100	
C_I	Input capacitance		$V_I=0$	$f=1MHz$		15	25	pF

Switching Characteristics

Parameter		Test Conditions	Min	Typ	Max	Unit
TPL H	Propagation delay time low-to-high-level output	See Figure 9		0.25	1	us
TPH L	Propagation delay time high -to- low -level output			0.25	1	us
VO H	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

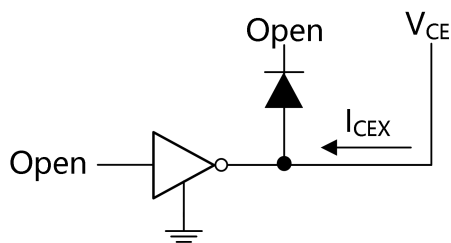


Figure 1 . I_{CEX} Test Circuit

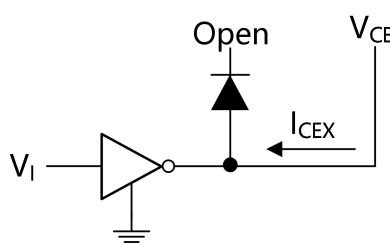


Figure 2 . I_{CEX} Test Circuit

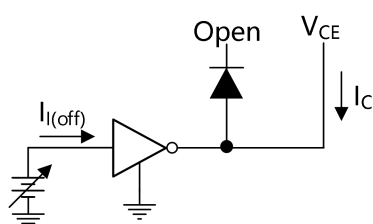


Figure 3 . $I_{I(off)}$ Test Circuit

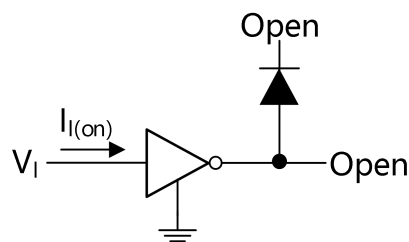
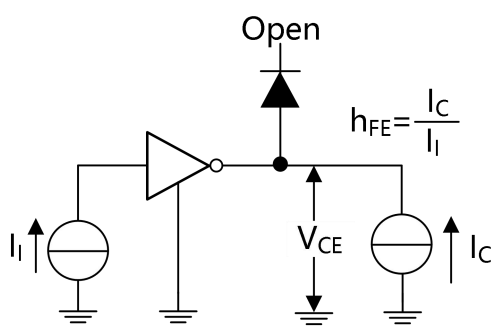


Figure 4 . I_I Test Circuit



Note: I_I is fixed for measuring $V_{CE(sat)}$, Variable or measuring h_{FE}

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

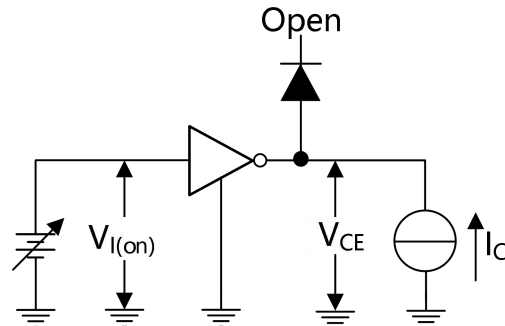


Figure 6 . $V_{I(on)}$ Test Circuit

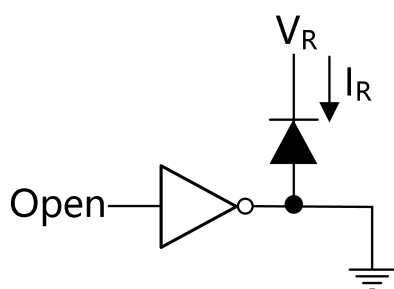


Figure 7 . I_R Test Circuit

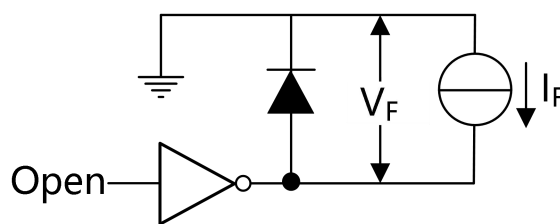
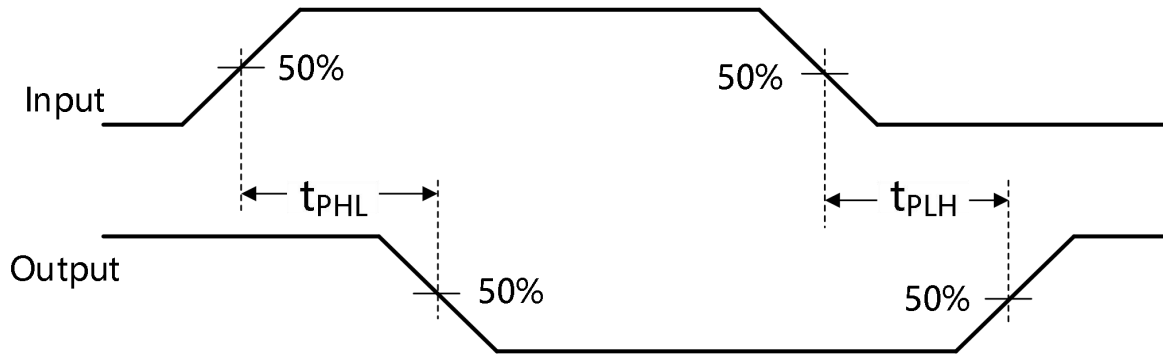


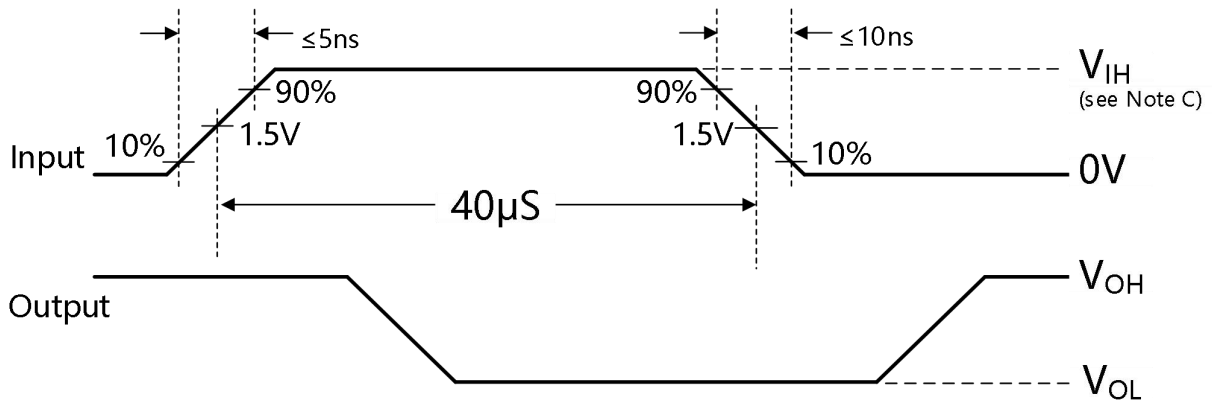
Figure 8 . V_F Test Circuit



VOLTAGE WAVEFORMS

Figure 9. Propagation Delay-Time Waveforms

TEST CIRCUIT



VOLTAGE WAVEFORMS

Figure 10. Latch-Up Test Circuit and Voltage Waveforms

NOTES:

- A. The pulse generator has the following characteristics: $P_{RR} = 12.5 \text{ kHz}$, $Z_O = 50$.
- B. CL includes probe and jig capacitance.
- C. $V_{IH} = 3 \text{ V}$.

Typical Characteristics

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

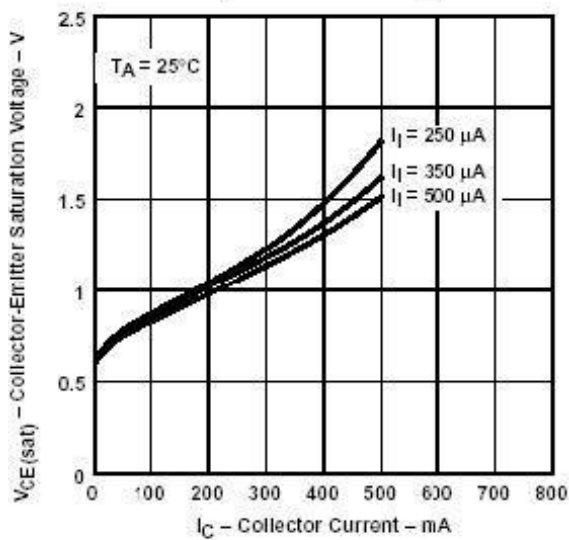


Figure 11

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

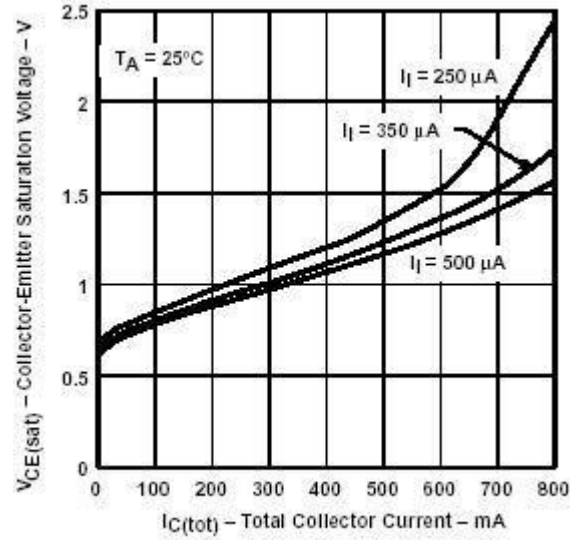


Figure 12

COLLECTOR CURRENT
VS
INPUT CURRENT

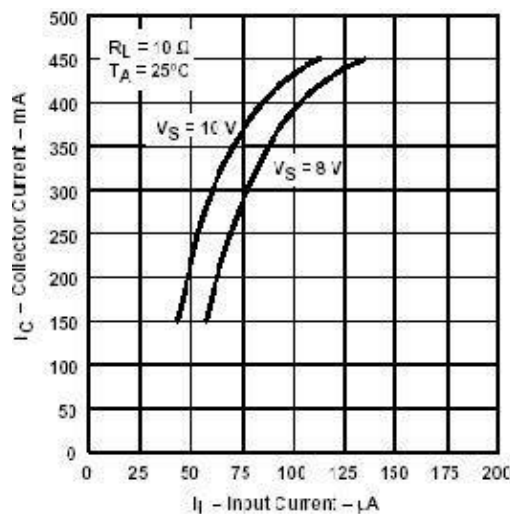


Figure 13

Figure 13

Thermal Information

D PACKAGE
MAXIMUM COLLECTOR CURRENT
VS
DUTY CYCLE

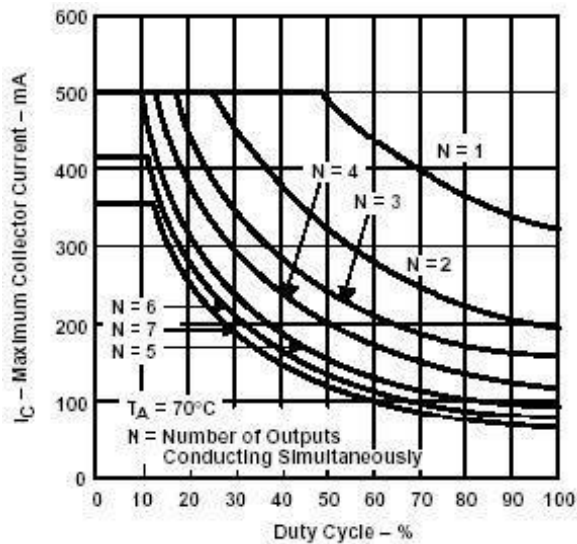


Figure 14

N PACKAGE
MAXIMUM COLLECTOR CURRENT
VS
DUTY CYCLE

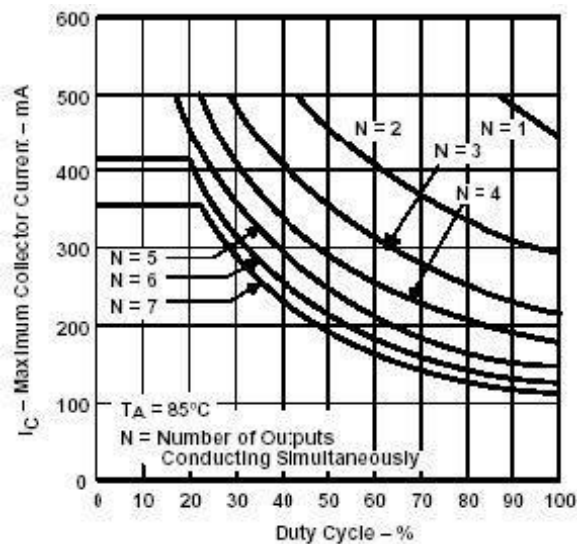
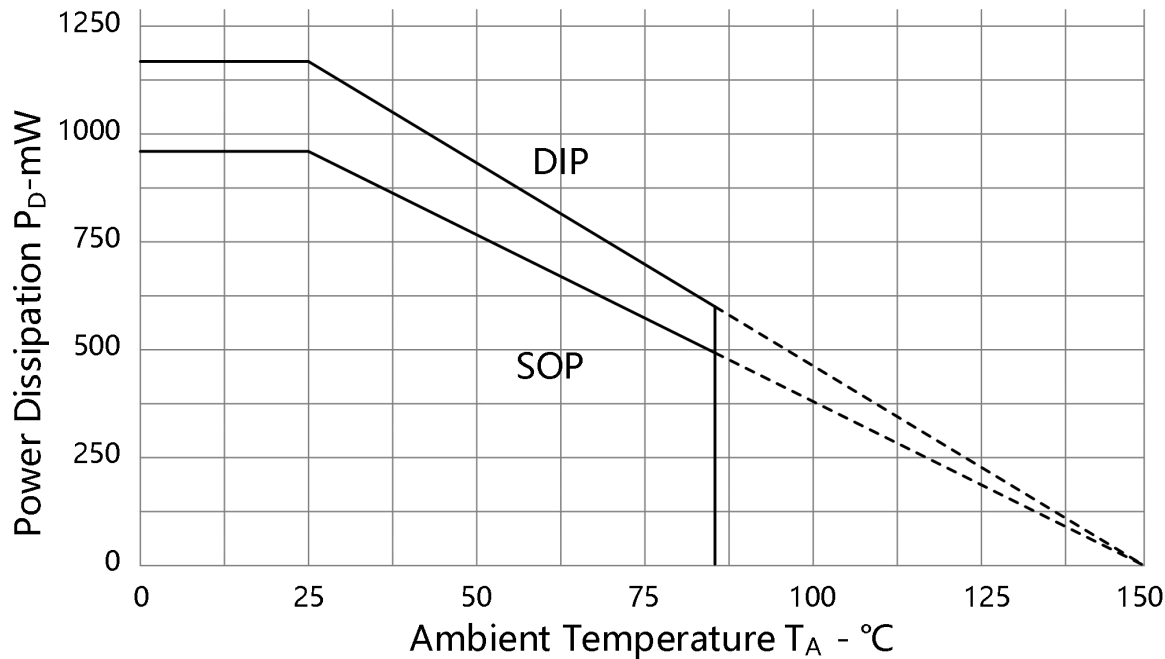


Figure 15

POWER DISSIPATION
VS.
AMBIENT TEMPERATURE



Application Information

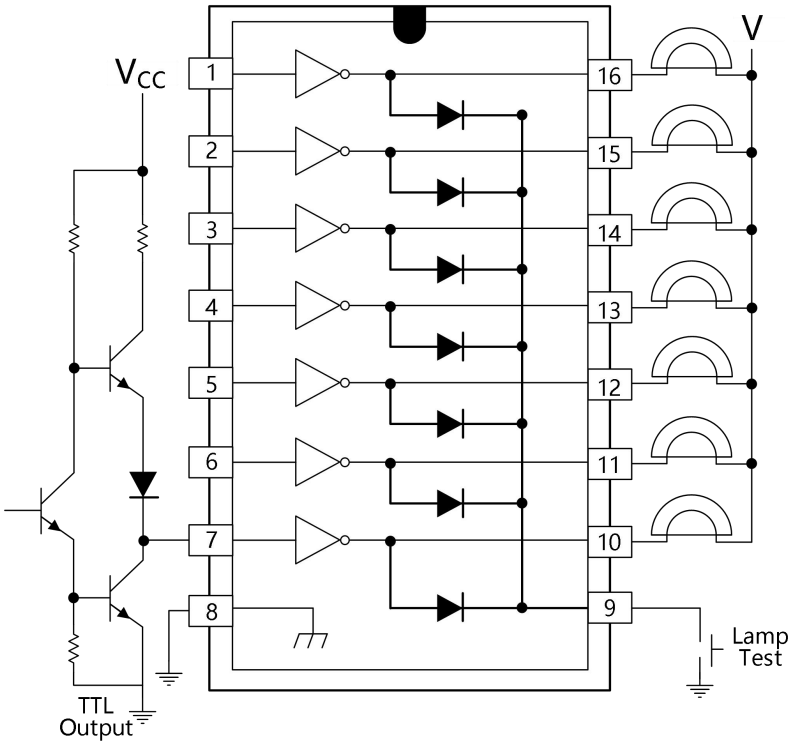


Figure 16. TTL to Load

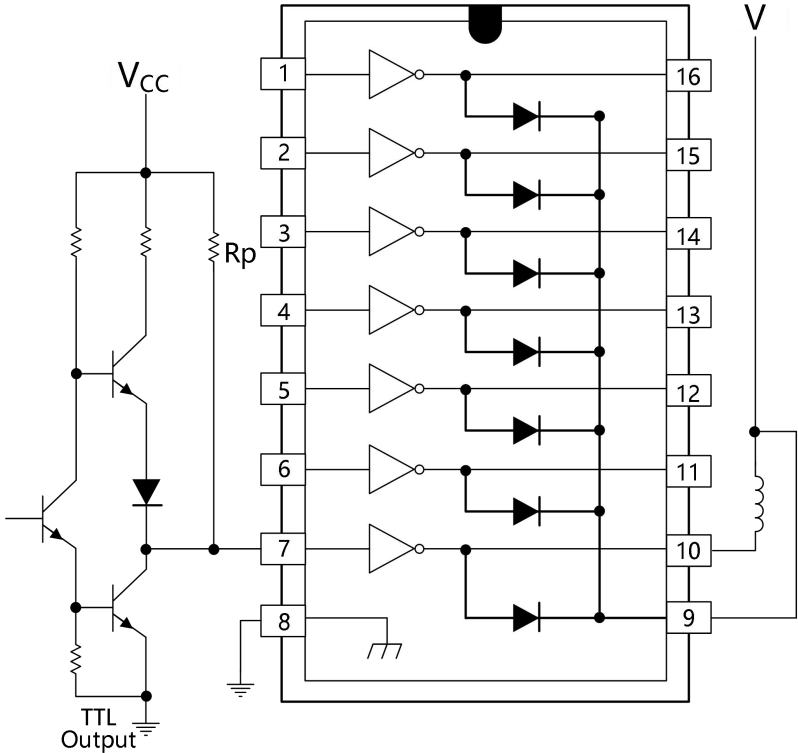
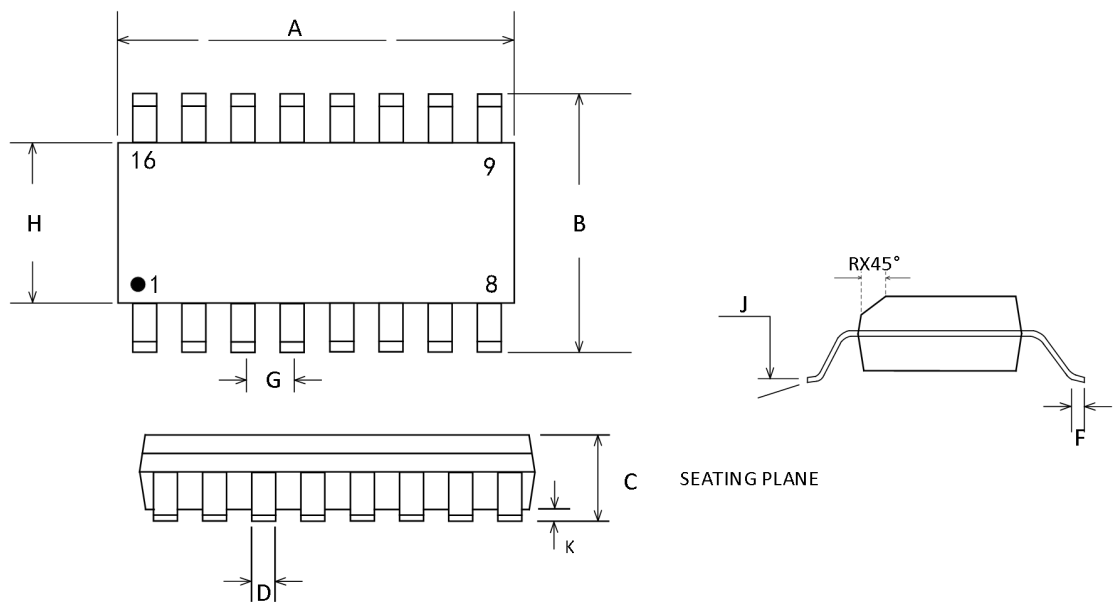


Figure 17. Use of Pullup Resistors to Increase Drive Current

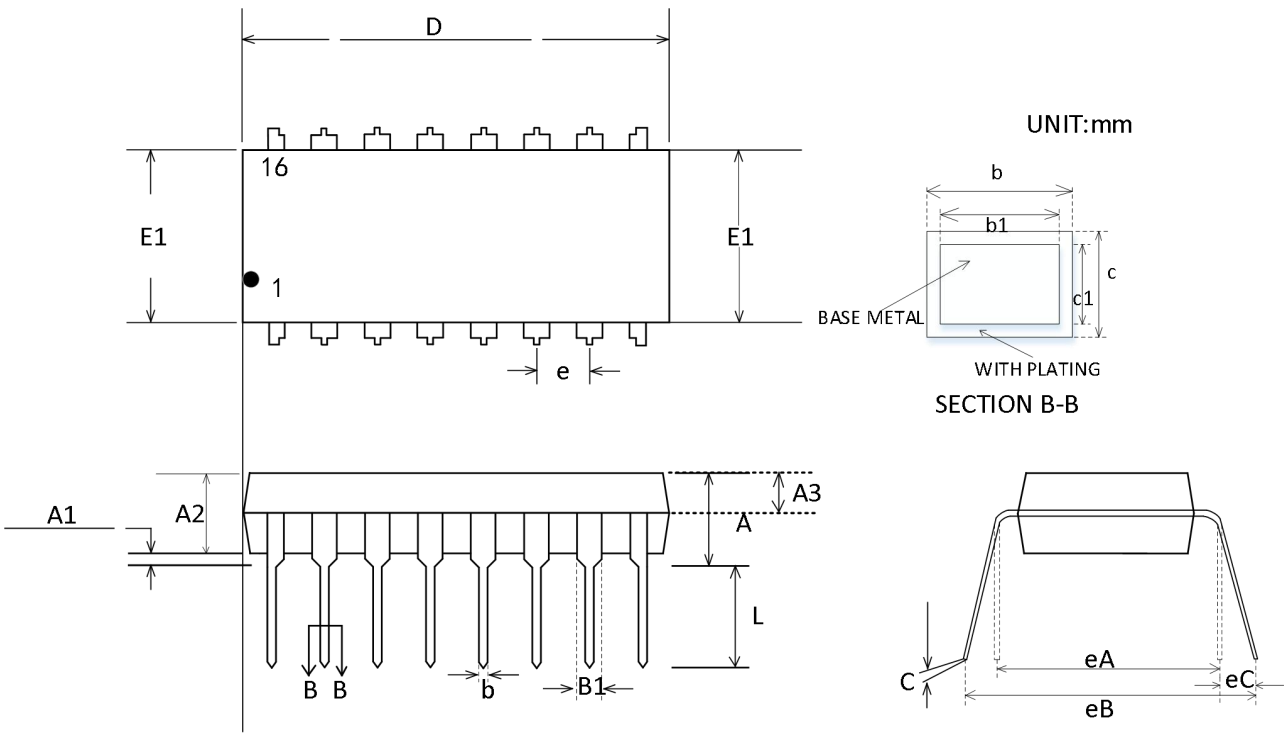
Package Outline Dimensions

SOP-16



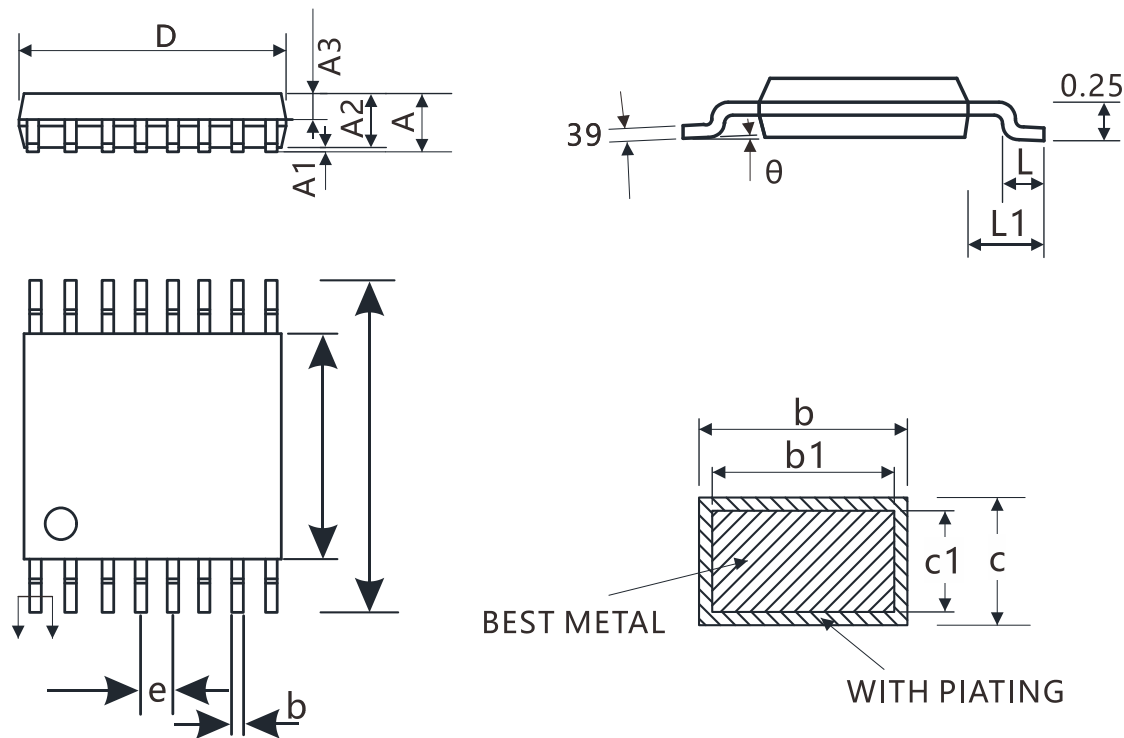
SYMBOL	MILLIMETER (MM)	
	MIN	MAX
A	9.80	9.98
B	5.80	6.20
C	1.52	1.72
D	0.33	0.51
F	0.40	1.27
G	1.27BSC	
H	3.81	3.99
J	0°	8°
K	0.10	0.25
R	0.25	0.5

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

MODEL	TEMPERATURE	PACKAGE DESCRIPTION	PACKAGE OPTION
CD2003AS16	-40℃~85℃	SOP-16	Tape and Reel, 2500
CD2003AS16-RL	-40℃~85℃	SOP-16	Tape and Reel, 3000
CD2003AS16-REEL	-40℃~85℃	SOP-16	Tape and Reel, 4000
CD2003ATS16	-40℃~85℃	TSSOP-16	Tape and Reel, 2500
CD2003ATS16-RL	-40℃~85℃	TSSOP-16	Tape and Reel, 3000
CD2003ATS16-REEL	-40℃~85℃	TSSOP-16	Tape and Reel, 4000
CD2003ADP16	-40℃~85℃	DIP-16	Tube, 2500

Revision Log

Version	Revision date	Change content	Reason for Change	Modified by	Reviewed By	Note
V1.0	2025.6.18	Initial version	Regular update	WW	LYL	