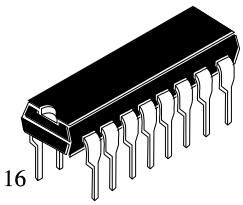
ILN2003A

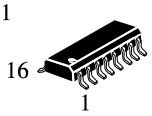
HIGH-VOLTAGE HIGH-CURRENT DARLINGTON TRANSISTOR ARRAYS

The ILN2003A 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 ILN2003A has a 2.7-kΩ series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices.



N SUFFIX
PLASTIC



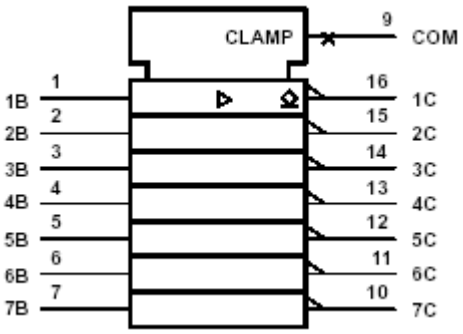
D SUFFIX
SOIC

ORDERING INFORMATION

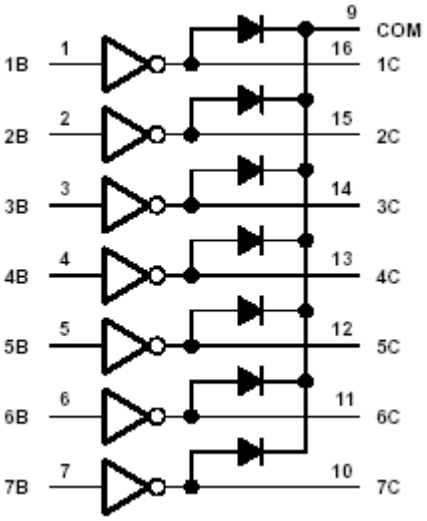
ILN2003AN Plastic
ILN2003AD SOIC
T_A = -40°C to 85° C for all packages

- 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

LOGIC SYMBOL



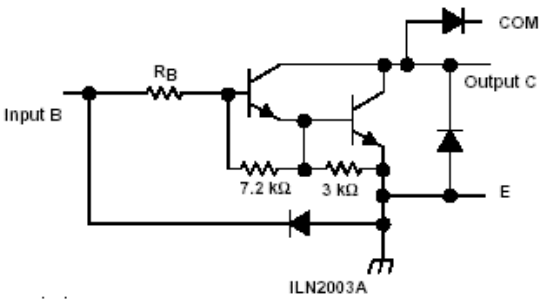
LOGIC DIAGRAM



SCHEMATICS (each Darlington Pair)

All resistor values shown are nominal.

ILN2003A: R_B = 2.7 kΩ



Absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)

Collector-emitter voltage	50 V
Input voltage, V_I (see Note 1)	30 V Peak
collector current (see Figures 14 and 15)	500 mA
Output clamp current, I_{OK}	500 mA
Total emitter-terminal current	–2.5 A
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A	–40°C to 85°C
Storage temperature range, Tstg	–65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

NOTE 1: All voltage values are with respect to the emitter/substrate terminal E, unless otherwise noted.

* 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.

Dissipation Rating Table

Package	T_A=25℃ Power Rating	Derating Factor Above T_A=25℃	T_A=85℃ Power Rating
D	950mW	7.6mW/℃	494mW
N	1150mW	9.2mW/℃	598mW

Electrical characteristics, T_A = 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, T_A=85℃	I_I=0			100	
				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

PARAMETER MEASUREMENT INFORMATION

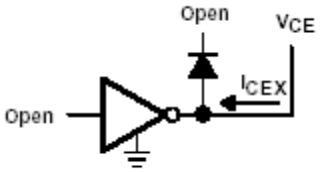


Figure 1. I_{CEX} Test Circuit

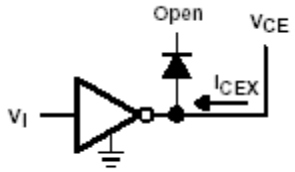


Figure 2. I_{CEX} Test Circuit

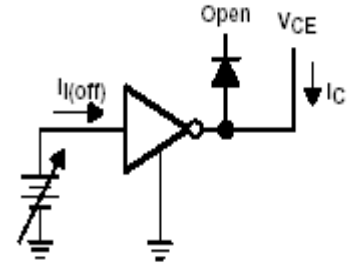


Figure 3. $I_{I(off)}$ Test Circuit

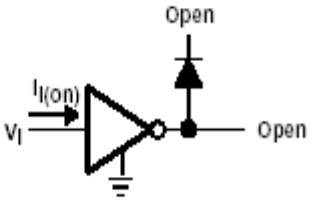
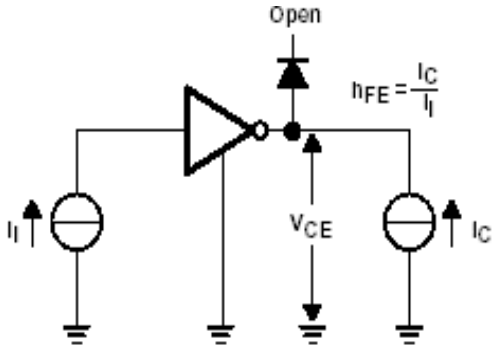


Figure 4. I_I Test Circuit



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

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

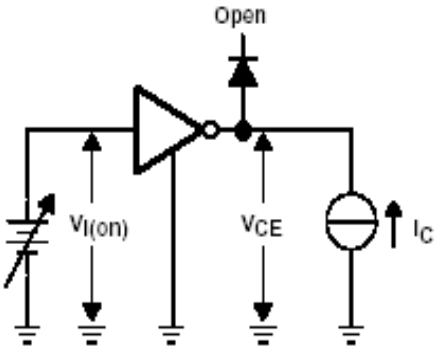


Figure 6. $V_{I(on)}$ Test Circuit

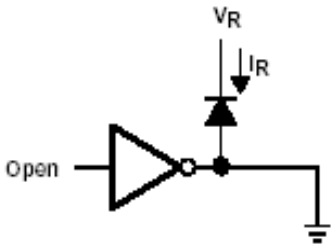


Figure 7. I_R Test Circuit

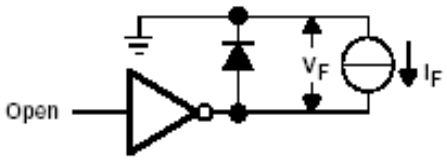


Figure 8. V_F Test Circuit

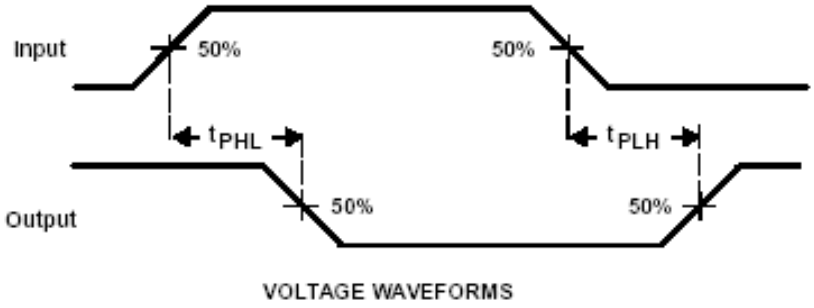
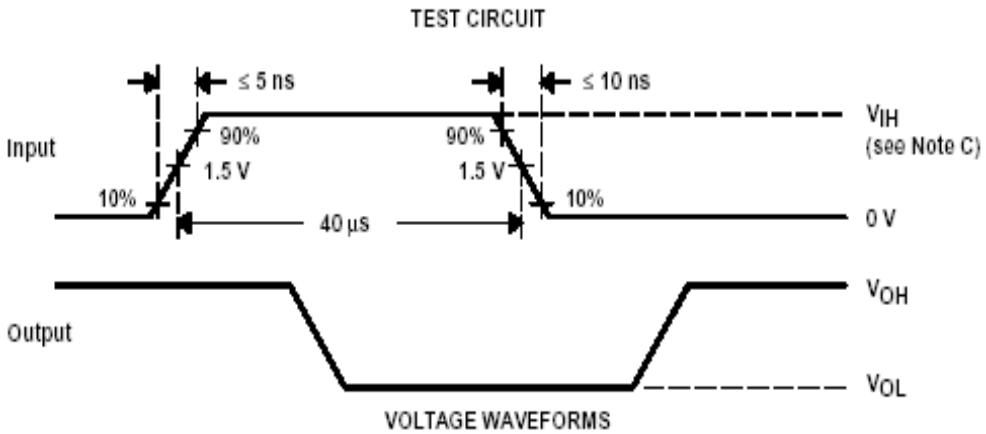


Figure 9. Propagation Delay-Time Waveforms



NOTES: A. The pulse generator has the following characteristics: PRR = 12.5 kHz, Z_O = 50 .
B. C_L includes probe and jig capacitance.
C. V_{IH} = 3 V;

Figure 10. Latch-Up Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

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

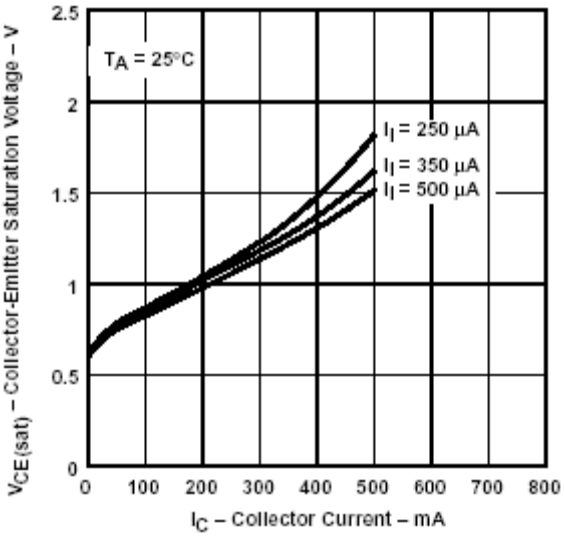


Figure 11

COLLECTOR-EMITTER SATURATION VOLTAGE vs TOTAL COLLECTOR CURRENT TWO DARLINGTONS PARALLELED)

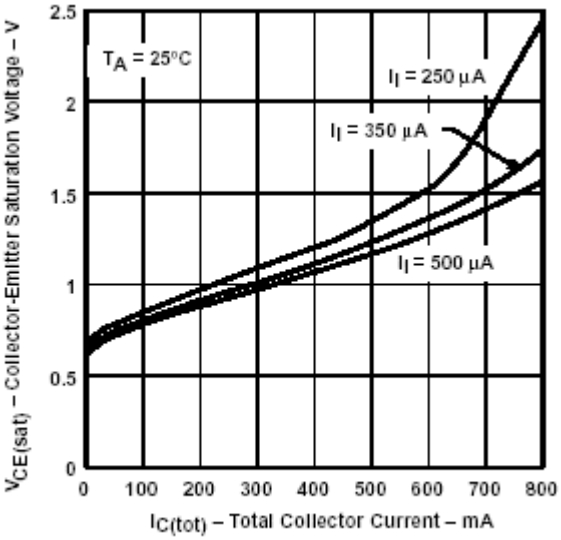


Figure 12

COLLECTOR CURRENT vs INPUT CURRENT

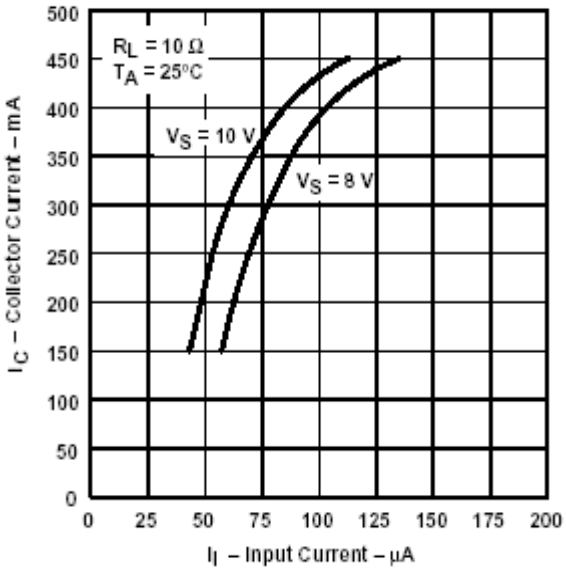


Figure 13

THERMAL INFORMATION

D PACKAGE
MAXIMUM COLLECTOR CURRENT
Vs
DUTY CYCLE

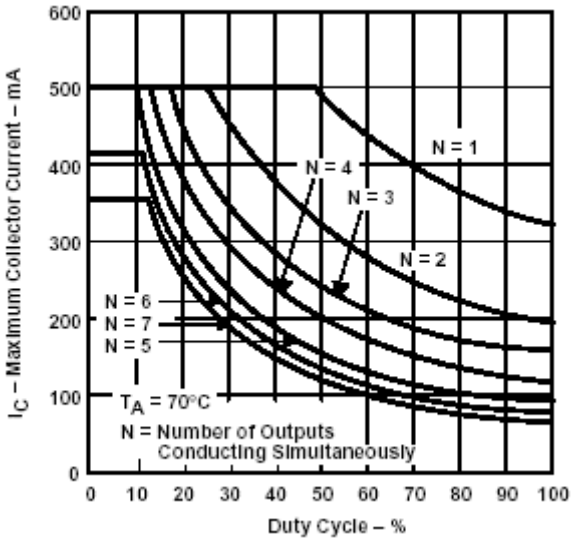


Figure 14

N PACKAGE
MAXIMUM COLLECTOR CURRENT
vs
DUTY CYCLE

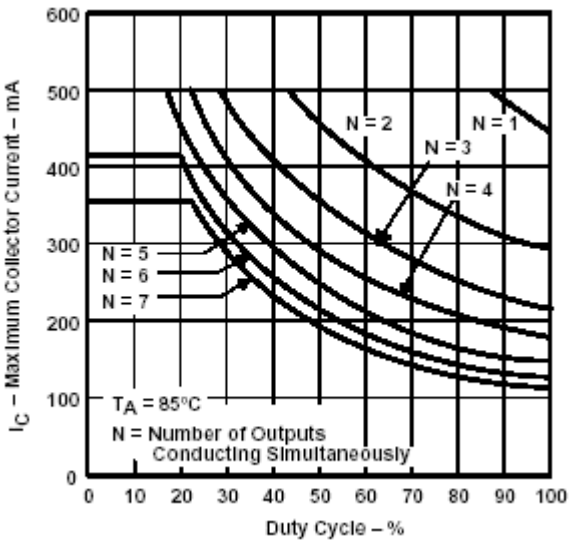


Figure 15

APPLICATION INFORMATION

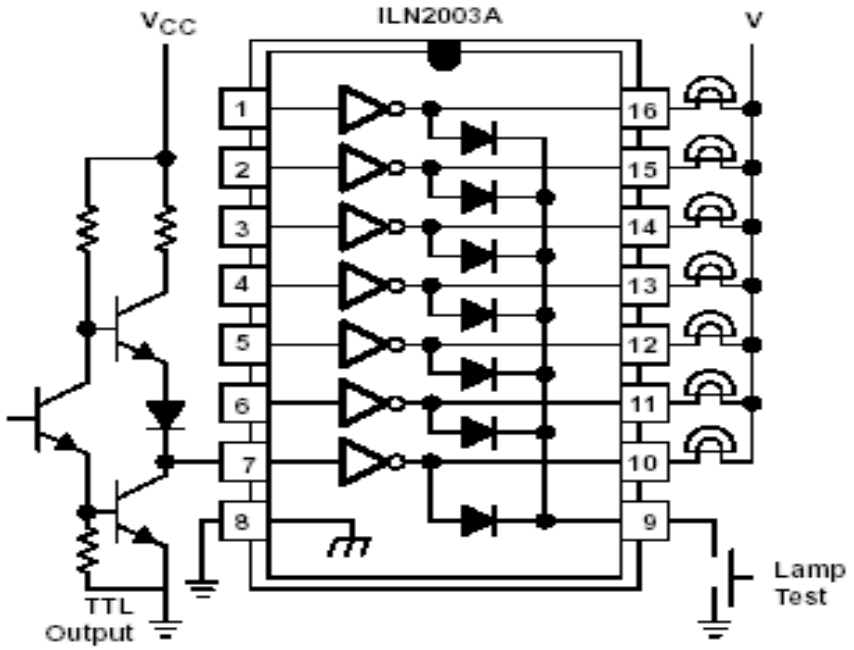


Figure 16. TTL to Load

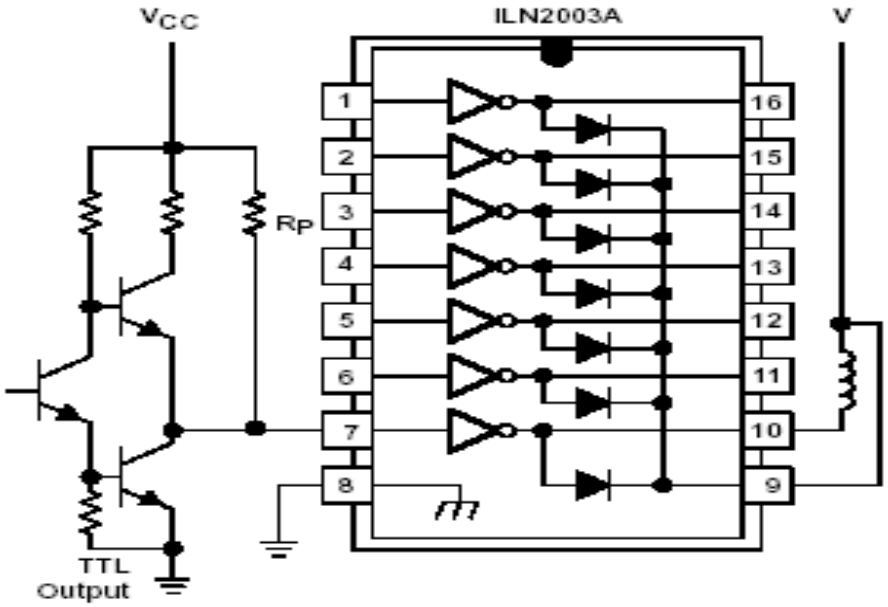
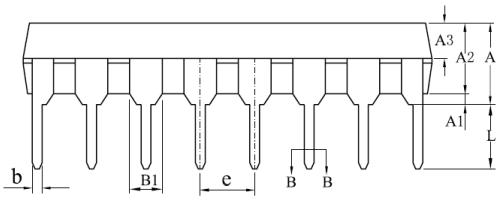
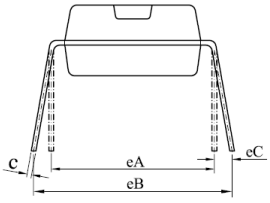
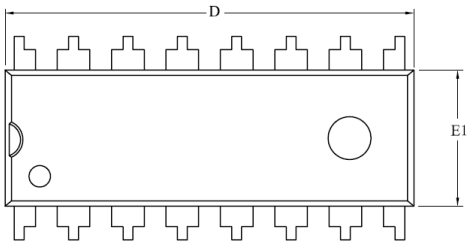


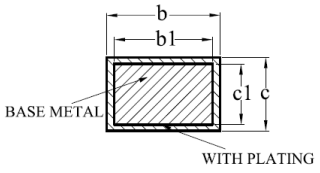
Figure 17. Use of Pullup Resistors to Increase Drive Current

DIP-16





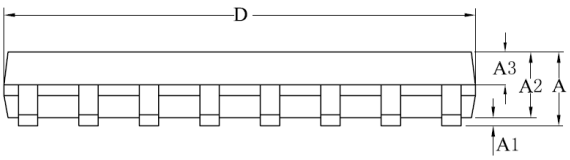


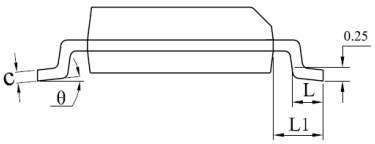


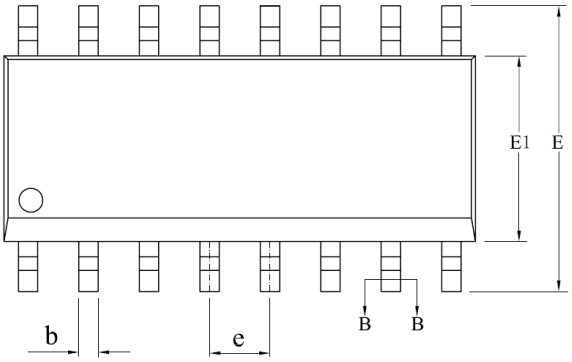
SECTION B-B

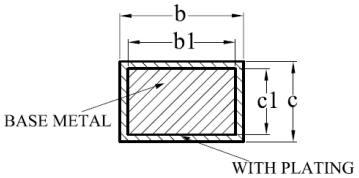
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	3.60	3.80	4.00
A1	0.51	—	—
A2	3.10	3.30	3.50
A3	1.42	1.52	1.62
b	0.44	—	0.53
b1	0.43	0.46	0.48
B1	1.52BSC		
c	0.25	—	0.31
c1	0.24	0.25	0.26
D	18.90	19.10	19.30
E1	6.15	6.35	6.55
e	2.54BSC		
eA	7.62BSC		
eB	7.62	—	9.50
eC	0	—	0.94
L	3.00	—	—
L/F载体尺寸 (Mil)	80*80		
	110*140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

SOP-16









SECTION B-B

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