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Product Specification

ULN2803A

Eight channel high-voltage,
high current Darlington transistor array

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Description

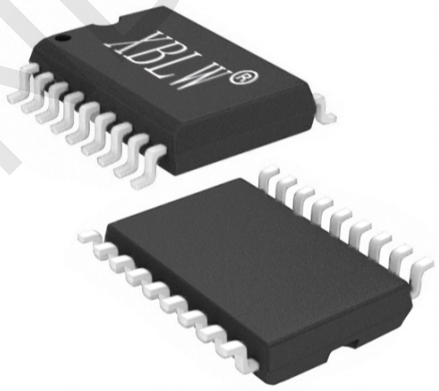
The ULN2803A is a 50V, 500mA Darlington transistor array. The device consists of eight NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of each Darlington pair is 500mA. The Darlington pairs may be connected in parallel for higher current capability.
Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers.
The ULN2803A has a 2.7 kΩ series base resistor for each Darlington pair for operation directly with TTL or 5V CMOS devices.

Features

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

Applications

- Relay Drivers
- Hammer Drivers
- Lamp Drivers
- Line Drivers
- Logic Buffers
- Stepper Motors
- IP Camera
- HVAC Valve and LED Dot Matrix



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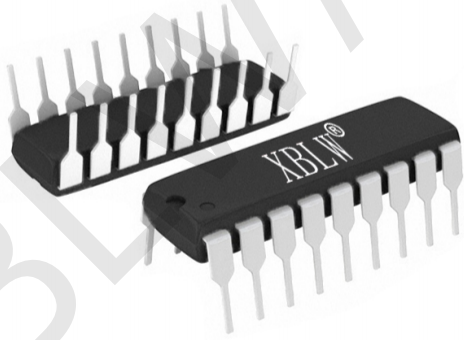

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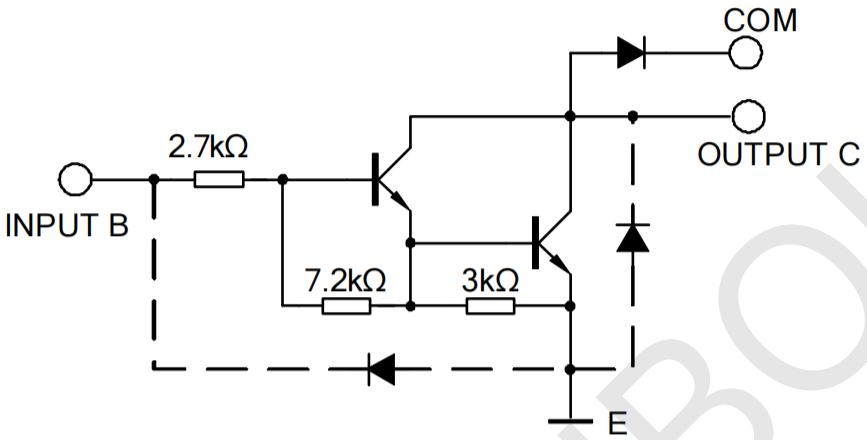
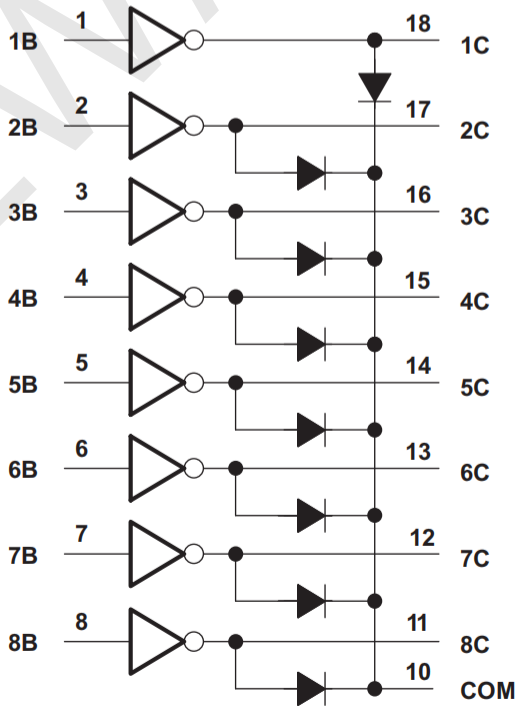
Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBLW ULN2803AN	DIP-18	ULN2803AN	Tube	1000pcs/Box
XBLW ULN2803ADTR	SOP-18	ULN2803A	Tape	2000pcs/Reel

Circuit schematic (single Darlington)



Logic diagram



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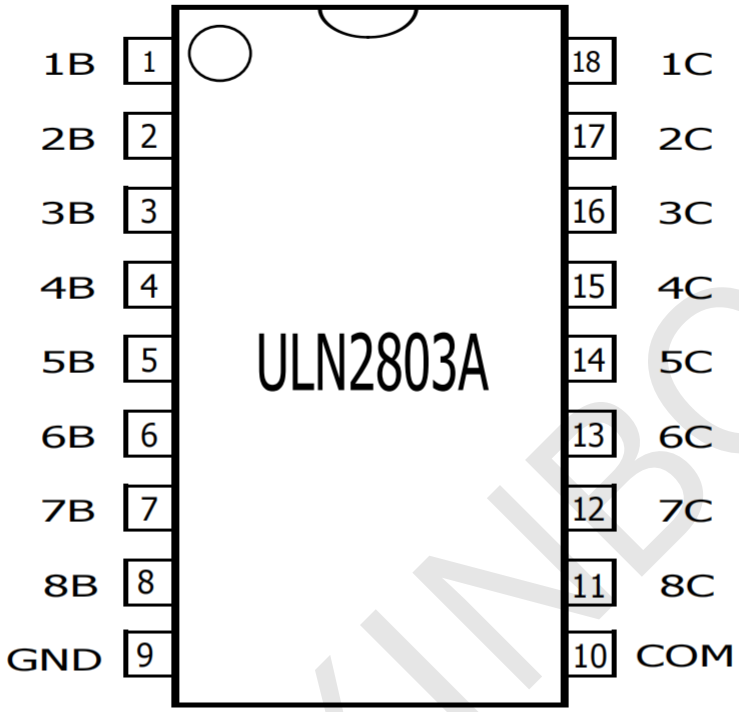
Pin Configurations



Pin Functions

PIN		TYPE	DESCRIPTION
NAME	NO.		
1B	1	I	Channel 1 through 8 Darlington base input
2B	2		
3B	3		
4B	4		
5B	5		
6B	6		
7B	7		
8B	8		
1C	18	O	Channel 1 through 8 Darlington collector output
2C	17		
3C	16		
4C	15		
5C	14		
6C	13		
7C	12		
8C	11		
GND	9	—	Common emitter shared by all channels (typically tied to ground)
COM	10	I/O	Common cathode node for flyback diodes (required for inductive loads)

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Absolute Maximum Ratings

(T_A=25 ℃, unless otherwise specified)

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	-0.5~30	V
Output Voltage	V_{OUT}	-0.5~50	V
Clamp Diode Reverse Voltage	V_R	55	V
Output Current	I_{OUT}	500	mA
Clamp Diode Forward Current	I_F	500	mA
Storage Temperature	T_{STG}	-55~150	℃
Operating Junction Temperature	T_I	-40~150	℃

Recommended Operating Conditions

(T_A=25 ℃, unless otherwise specified)

Parameter	Symbol	Value		Units
		Min	Max	
Collector-Emitter Voltage	V_{CE}	0	50	V
Operating Temperature Range	T_{OPR}	–40	+85	℃

Typical Characteristics

ELECTRICAL CHARACTERISTICS

(T_A=25 ℃, unless otherwise specified)

Parameter		Test Conditions		ULN2803A			Units
				Min	Typ	Max	
I_{CEX}	Collector cutoff current	V_{CE} = 50 V, I_I = 0 see Figure 3				50.0	μA
$I_{I(off)}$	Off-state input current	V_{CE} = 50 V, I_C = 500 μA, T_A = 70°C see Figure 4		50.0	65.0		μA
$I_{I(on)}$	Input current	V_I = 3.85 V, See Figure 5				1.35	mA
$V_{I(on)}$	On-state input voltage	V_{CE} = 2 V, see Figure 6	I_C = 200 mA			2.4	V
			I_C = 250 mA			2.7	
			I_C = 300 mA			3.0	
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_I = 250 μA, see Figure 7	I_C = 100 mA		0.9	1.1	V
		I_I = 350 μA, see Figure 7	I_C = 200 mA		1	1.3	
		I_I = 500 μA, see Figure 7	I_C = 350 mA		1.3	1.6	
I_R	Clamp diode reverse current	V_R = 50 V, see Figure 8		-4.0		50.0	μA
V_F	Clamp diode forward voltage	IF = 350 mA see Figure 9		0.5		2.0	V
I_{CEX-1V}	Collector cutoff current	V_{CE} = 50 V, V_{IN} = 1V see Figure 10		-5.0		80.0	μA
C_i	Input capacitance	V_I = 0, f = 1 MHz			15	25	pF

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Switching Characteristics Ta=25°C

Parameter		Test Conditions	Min	Typ	Max	Units
t_{PLH}	Propagation delay time, low- to high-level output	V_S = 50 V, C_L = 15 pF, R_L = 163 Ω, See Figure 11		130		ns
t_{PHL}	Propagation delay time, high- to low-level output			20		
V_{OH}	High-level output voltage after switching	V_S = 50 V, I_O = 300 mA, see Figure 12	V_S – 20			mV

Typical Characteristics

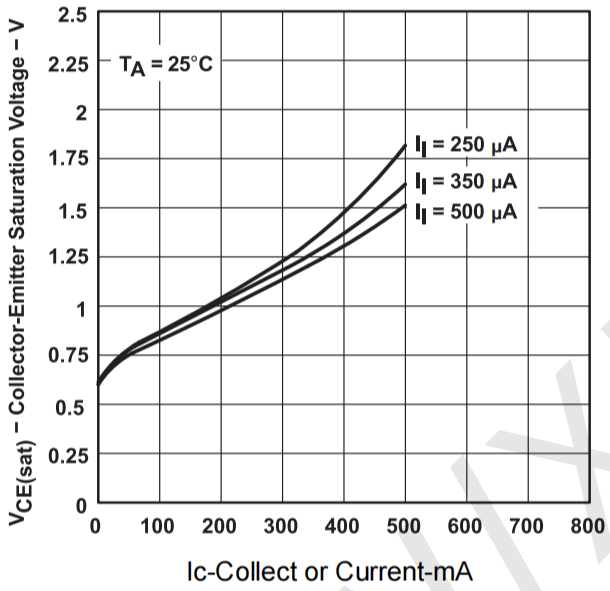

Figure 1.Collector-Emitter Saturation Voltage vs Collector Current(One Darlington)

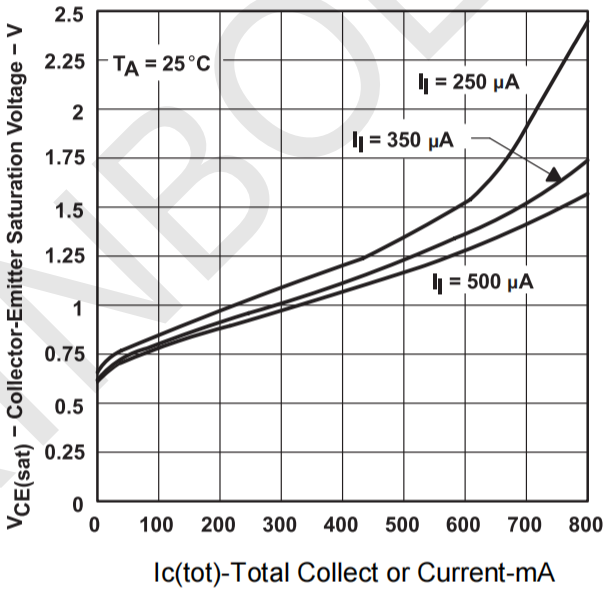

Figure 2.Collector-Emitter Saturation Voltage vs Total Collector Current(Two Darlingtons in Parallel)

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Typical Characteristics Measurement

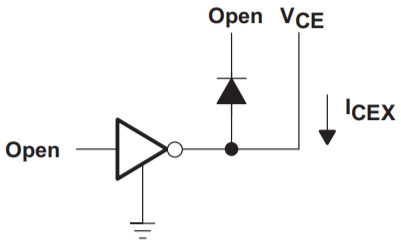

Figure 3. I_{CEX} Test Circuit

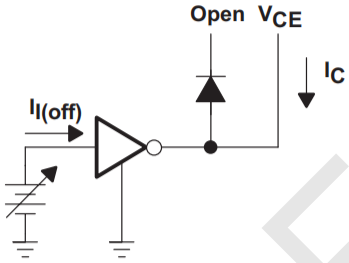

Figure 4. $I_{I(off)}$ Test Circuit

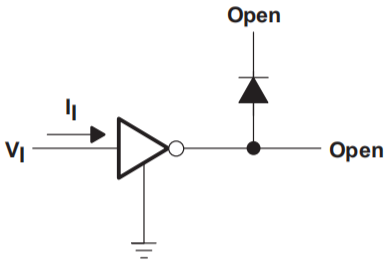

Figure 5. $I_{I(on)}$ Test Circuit

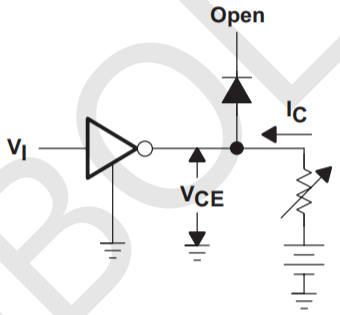

Figure 6. $V_{I(on)}$ Test Circuit

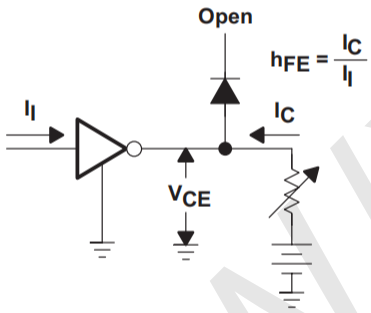

Figure 7. h_{FE}, $V_{CE(sat)}$ Test Circuit

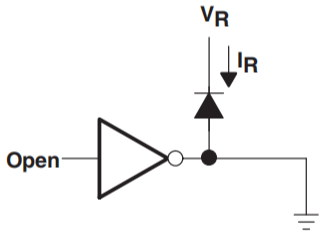

Figure 8. I_R Test Circuit

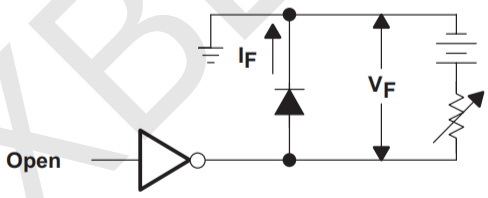

Figure 9. V_F Test Circuit

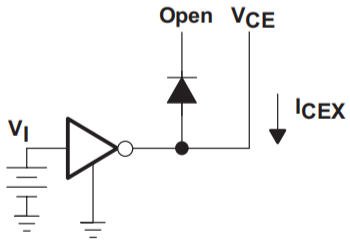

Figure 10. I_{CEX-1V} Test Circuit

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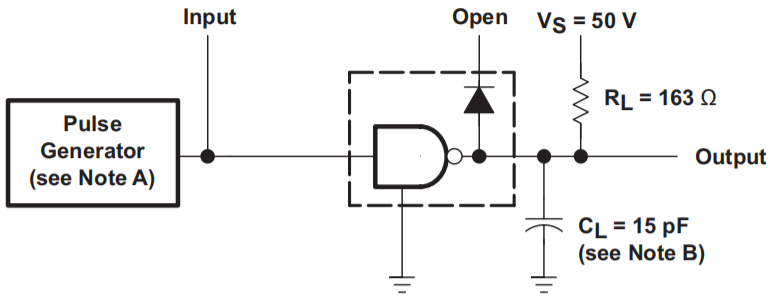
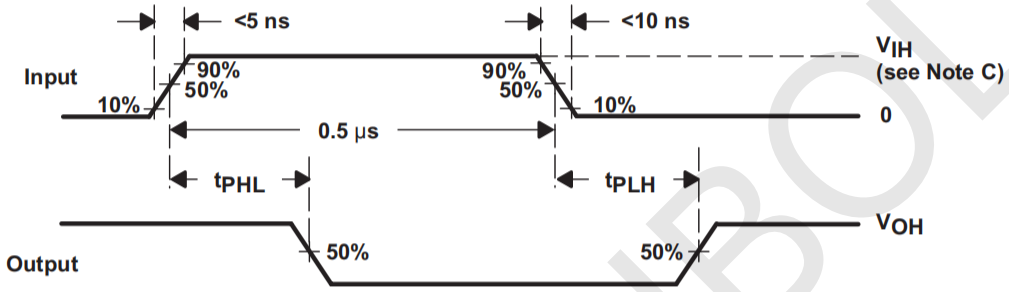
Typical Characteristics Measurement



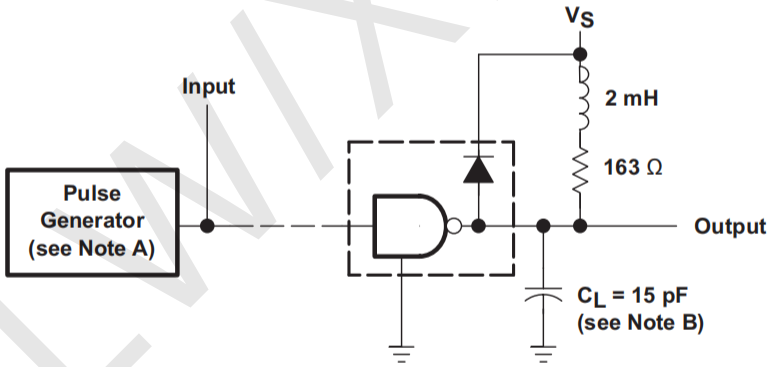
Test Circuit



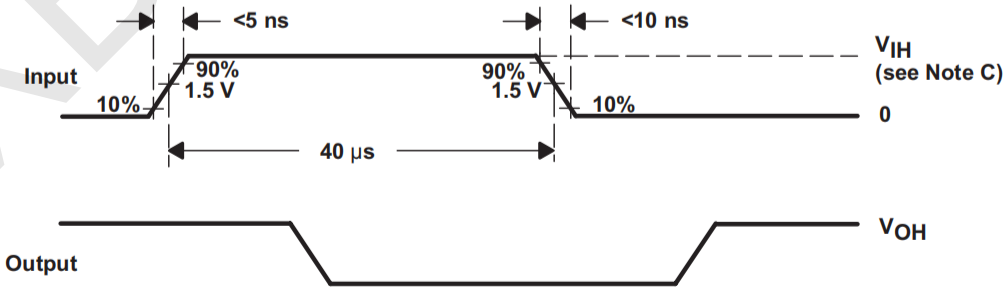
Voltage Waveforms

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

Figure 11. Propagation Delay Times



Test Circuit



Voltage Waveforms

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

Figure 12. Latch-Up Test

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Typical Application

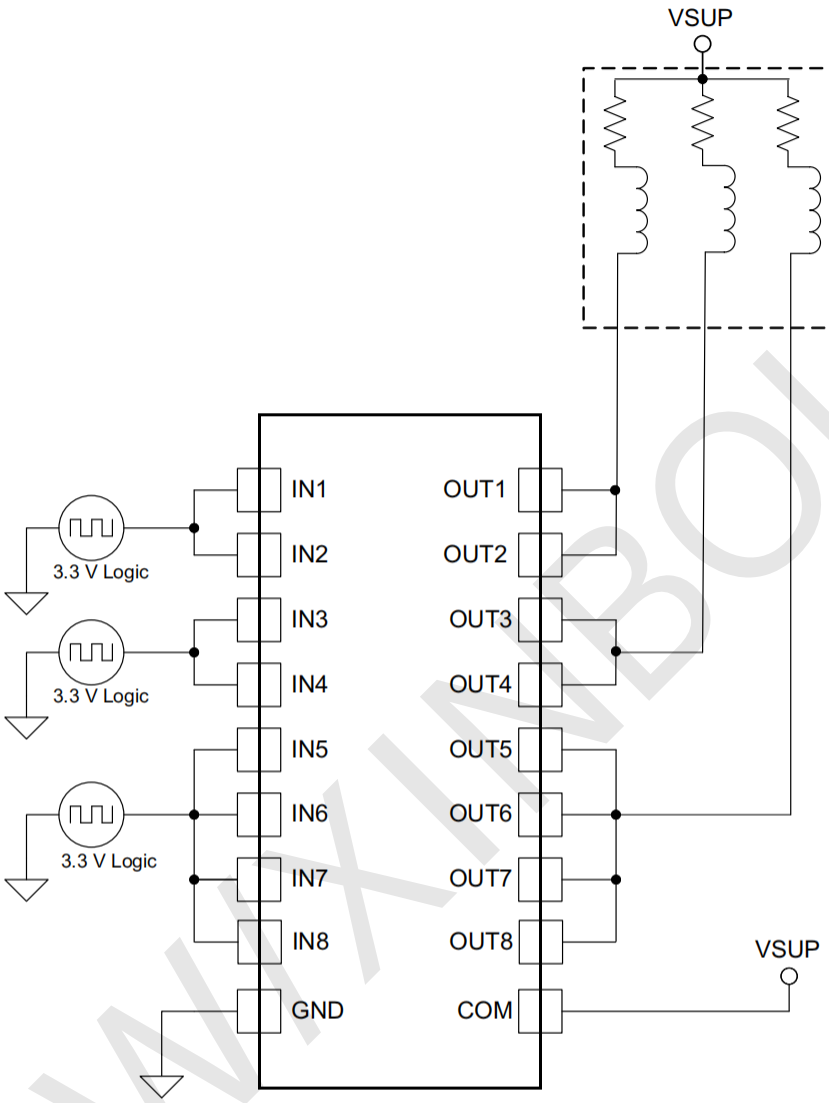

Figure 13. ULN2803A as Inductive Load Driver

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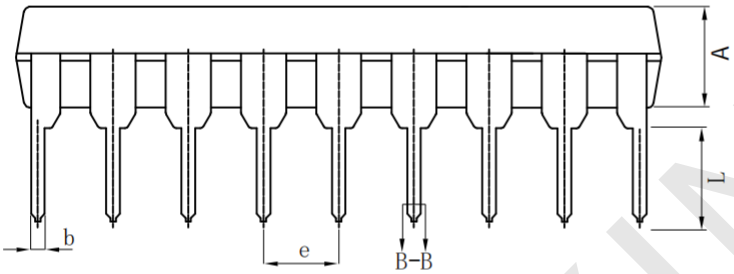
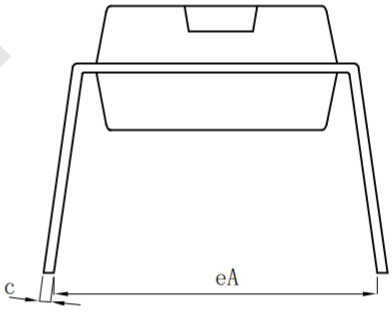
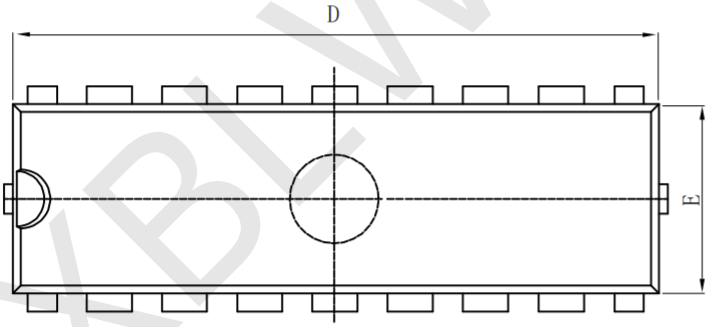
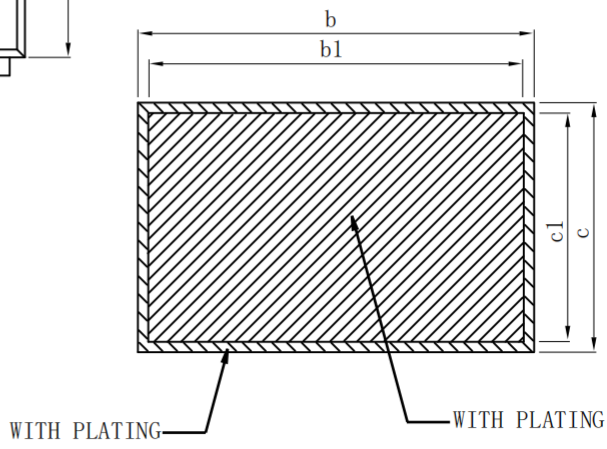
Size / Symbol	Dimensions In Millimeters			Size / Symbol	Dimensions In Inches		
	Min(mm)	Nom(mm)	Max(mm)		Min(in)	Nom(in)	Max(in)
A	3.200	3.300	3.400	A	0.126	0.130	0.134
b	0.440		0.530	b	0.017		0.021
b1	0.430	0.460	0.490	b1	0.017	0.018	0.019
c	0.250		0.300	c	0.010		0.012
c1	0.240	0.250	0.260	c1	0.009	0.010	0.010
D	22.80	22.90	23.00	D	0.898	0.902	0.906
E	6.400	6.500	6.600	E	0.252	0.256	0.260
e	2.54(BSC)			e	0.1(BSC)		
eA	7.620		9.500	eA	0.300		0.374
L	3.000			L	0.118		









SECTION B-B

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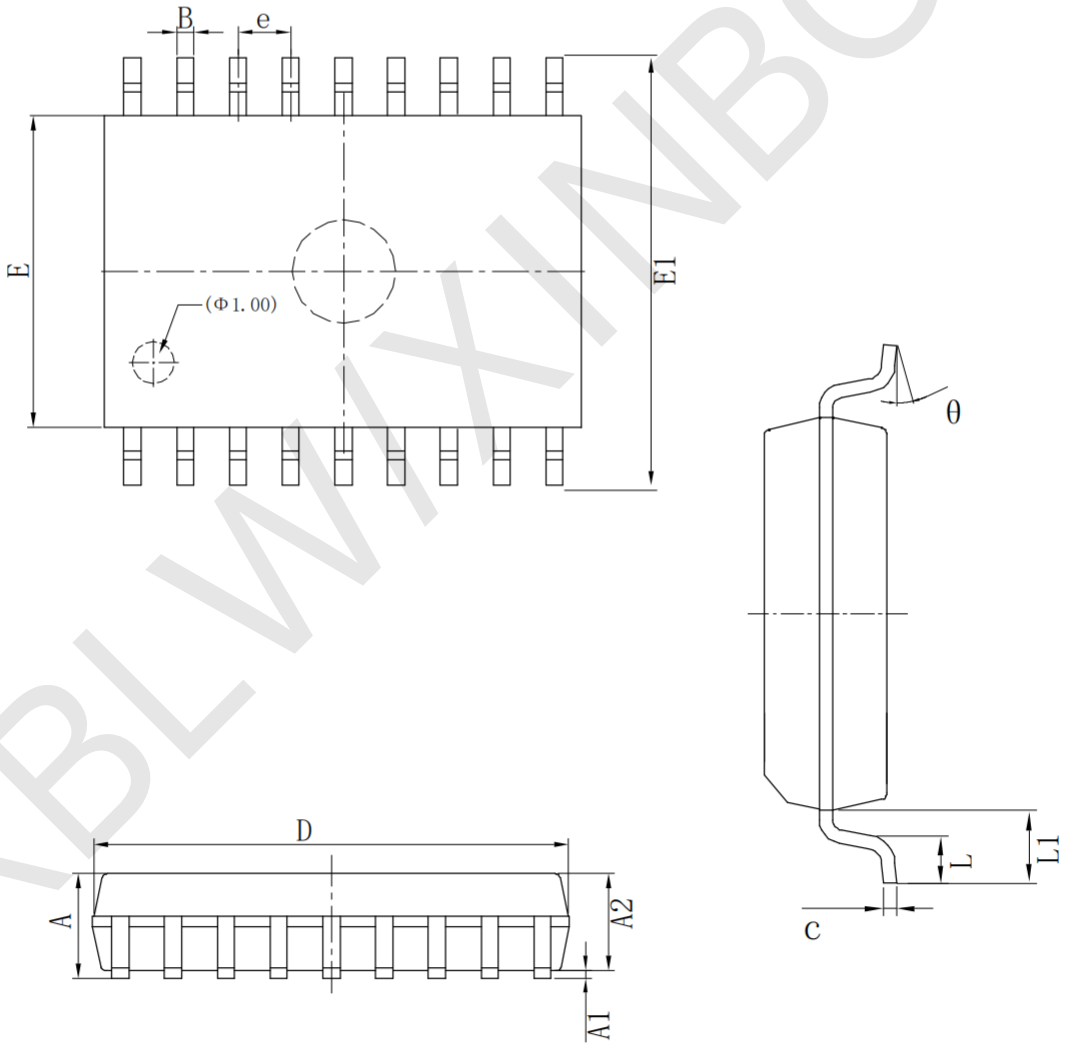
Size / Symbol	Dimensions In Millimeters			Size / Symbol	Dimensions In Inches		
	Min(mm)	Nom(mm)	Max(mm)		Min(in)	Nom(in)	Max(in)
D	11.25	11.45	11.65	D	0.443	0.451	0.459
E	7.300	7.500	7.700	E	0.287	0.295	0.303
E1	10.10	10.30	10.50	E1	0.398	0.406	0.413
B	0.4(TYP)			B	0.016(TYP)		
e	1.27(TYP)			e	0.050(TYP)		
c	0.200	0.250	0.300	c	0.008	0.010	0.012
A2	2.240	2.340	2.440	A2	0.088	0.092	0.096
A1	0.100	0.150	0.250	A1	0.004	0.006	0.010
A			2.590	A			0.102
L1	1.300	1.400	1.500	L1	0.051	0.055	0.059
L	0.700	0.800	1.000	L	0.028	0.031	0.039
θ		4°	8°	θ		4°	8°



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