8-channel Darlington current driver

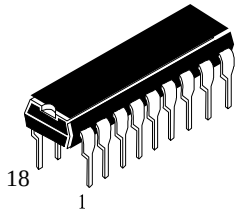
(Functional equivalent of TD62083AFN, TD62084AFN Toshiba)

The ULN2803AD, ULN2803AN, ULN2804AD, ULN2804AN are 8- channel current driver, consisting of eight Darlington transistors.

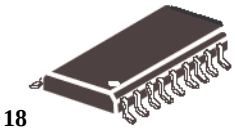
Transistors, having high-voltage outputs with high-current load are coupled in common-cathode circuit for commutation of inductive load.

Collector current of one Darlington pair not exceed 500 mA. Darlington pairs can be bridged to increase current.

The ULN2803AD, ULN2803AN, ULN2804AD, ULN2804AN are purposed in different devices: relays, lamps, displays (LED & gas discharge cells), telecommunication lines and logic devices.



MS-001AC package



MS-013AB package

Fig. 1 – View of ICs in MS-001AC, MS-001AC packages

Main features:

- The ULN2803AD, ULN2803AD are realized in 18-pin SO - package MS-013AB, ULN2804AN, ULN2804AN – in 18-pin DIP – package MS-001AC;
- High output sustaining voltage up to 50 V;
- One channel output current up to 500 mA;

Allowable value of electrostatic potential 2000V

Table 1 – Electric circuitry difference of ICs

IC marking	Input resistor, kΩ	Applicable with ICs
ULN2803AD, ULN2803AN	2,7	TTL, 5 V CMOS
ULN2804AD, ULN2804AN	10,5	6 ÷ 15 V P-MOS, CMOS

Table 2 – Package pins and contact pad description

Contact pad number	Pin number (MS-013AB, MS-001AC packages)	Symbol	Description
01	01	IN 1	Input
02	02	IN 2	Input
03	03	IN 3	Input
04	04	IN 4	Input
05	05	IN 5	Input
06	06	IN 6	Input
07	07	IN 7	Input
08	08	IN 8	Input
09	09	GND	Common pin (ground)
10	10	COM	Control pin
11	11	$\overline{\text{OUT 8}}$	Output
12	12	$\overline{\text{OUT 7}}$	Output
13	13	$\overline{\text{OUT 6}}$	Output
14	14	$\overline{\text{OUT 5}}$	Output
15	15	$\overline{\text{OUT 4}}$	Output
16	16	$\overline{\text{OUT 3}}$	Output
17	17	$\overline{\text{OUT 2}}$	Output
18	18	$\overline{\text{OUT 1}}$	Output

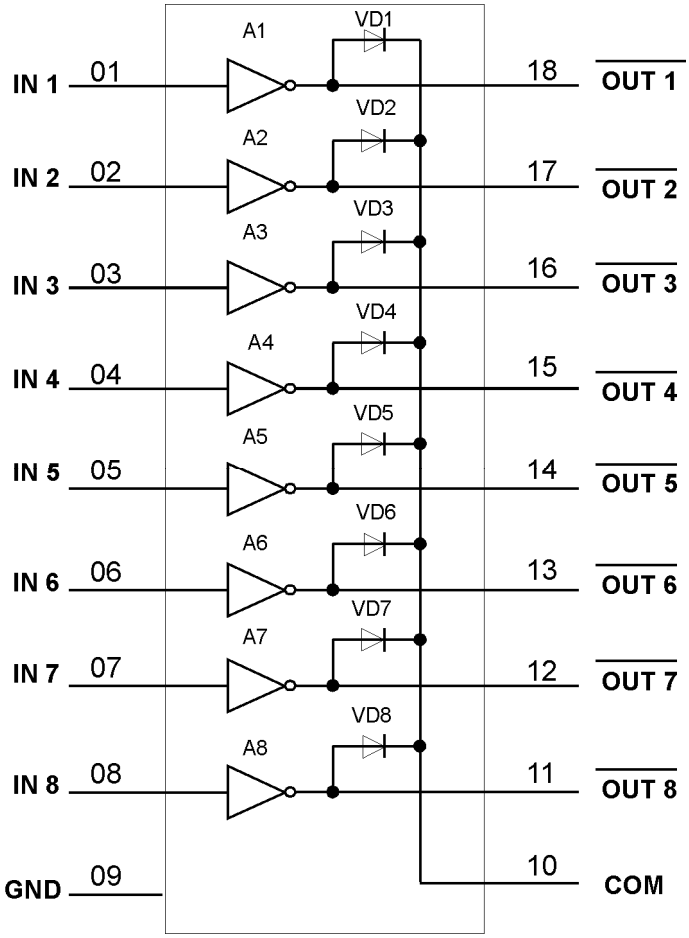
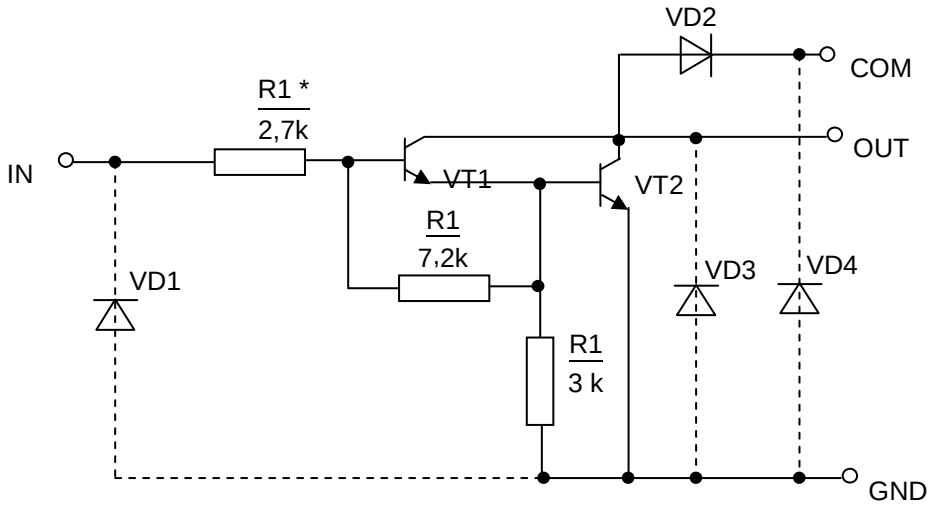


Fig 2 – Electric block diagram



* For ICs ULN2804AD, ULN2804AN - 10,5 kΩ.

Fig. 3 – Electrical scheme of one Darlington cascade of ULN2803AD, ULN2803AN, ULN2804AD, ULN2804AN

Table 3 –Maximum ratings

Symbol	Parameter	Norm		Unit
		Min	Max	
$V_{CE(SUS)}$	Output sustaining voltage	-0,5	50	V
I_{OUT}	Output current (one channel)	-	500*	mA
V_{IN}	Input voltage	-0,5	30	V
V_R	Clamp pin diode reverse voltage	-	50	V
I_F	Clamp pin diode forward current	-	500	mA
T_{stg}	Storage temperature	-60	150	^oC
P_D	Power dissipation	-	0,4	W

*On PCB with dimensions 50 × 50 × 1,6 mm, 40% Cu

Table 4 – Recommended operation modes

Symbol	Parameter		Norm		Unit
			Min	Max	
$V_{CE(SUS)}$	Output sustaining voltage		0	50	V
I_{OUT}	Output current (one channel)		-	350	mA
	8 channels at T_{pw} = 25 ms, T_a =85 ^oC,	Output pulse duration 10%	-	260*	
	T_j = 120 ^oC	Output pulse duration 50%	-	90*	
V_{IN}	Input voltage		0	30	V
V_R	Clamp diode reverse voltage		-	50	V
I_F	Clamp pin diode forward current		-	400	mA

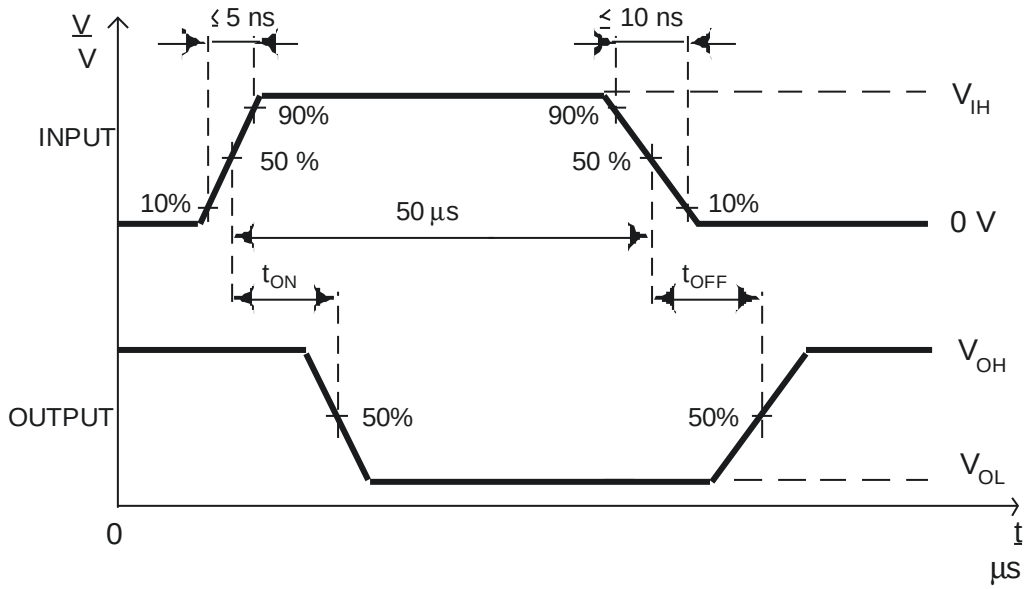
*On PCB with dimensions 50 × 50 × 1,6 mm, 40% Cu

Table 5 – Electric parameters of ICs

Symbol	Parameter	Measurement mode	Norm		Ambient, temperature °C	Unit
			Min	Max		
$V_{IN(ON)}$	Input voltage	I_{OUT} = 200 mA V_{CE} = 2 V	-	2,4 2,9	25±10 -40 85	V
		I_{OUT} = 250 mA V_{CE} = 2 V	-	2,7 3,24		
	ULN2803AD, ULN2803AN	I_{OUT} = 300 mA V_{CE} = 2 V	-	3,0 3,6		
	ULN2804AD, ULN2804AN	I_{OUT} = 125 mA V_{CE} = 2 V	-	5,0 6,0		
		I_{OUT} = 200 mA V_{CE} = 2 V	-	6,0 7,2		
		I_{OUT} = 275 mA V_{CE} = 2 V	-	7,0 8,4		
		I_{OUT} = 350 mA V_{CE} = 2 V	-	8,0 9,6		
h_{FE}	DC current transfer ratio	I_{OUT} = 350 mA V_{GCE} = 2 V	1000	-	25±10 -40 85	-
$V_{CE(sat)}$	Output saturation voltage	I_{OUT} = 100 mA I_{IN} = 250 µA	-	1,1 1,32	25±10 -40 85	V
		I_{OUT} = 200 mA I_{IN} = 350 мкАµA	-	1,3 1,56		
		I_{OUT} = 350 mA I_{IN} = 500 µA	-	1,6 1,92		
I_{CEX}	Output leakage current ULN2803AD, ULN2803AN	V_{CE} = 50 V V_{IN} = 0 V	-	50 100		µA
	ULN2804AD, ULN2804AN	V_{CE} = 50 V V_{IN} = 1 V	-	500 600		
V_F	Clamp diode forward voltage	I_F = 350 mA	-	2,0 2,4		V
		I_F = 400 mA		3,0 3,6		
$I_{IN(OFF)}$	Input current	V_{CE} = 50 V I_{OUT} = 500 µA	50	-	85	µA
$I_{IN((ON)}$	Input current ULN2803AD, ULN2803AN	V_{IN} = 3,85 V	-	1,35 1,62	25±10 -40 85	mA
	ULN2804AD, ULN2804AN	V_{IN} = 5 V	-	0,5 0,6		
		V_{IN} = 12 V	-	1,45 1,74		
I_R	Clamp diode reverse current	V_R = 50 V	-	50 100		µA

Table 6 – Typical electric parameters at Ta = 25 °C

Symbol	Parameter	Measurement mode	Typical value	Unit
t_{ON}	Turn -ON delay	R_L = 125 Ω, V_{OUT} = 50 V	0,1	µs
t_{OFF}	Turn-OFF delay		0,2	µs
C_{IN}	Input capacity	-	15	pF



Note - V_{IH} = 3 V for ULN2803AD, ULN2803AN and V_{IH} = 8 V for ULN2804AD, ULN2804AN.

Pulse width 50 µs, ratio (duty cycle) 100% • t_W / T = 10% (t_W – pulse width, µs; T – period , µs)

Fig. 4 – Time diagram of ULN2803AD, ULN2803AD, ULN2804AN, ULN2804AN at measurement of signal delay at turn -ON t_{ON} and turn-OFF switching t_{OFF}

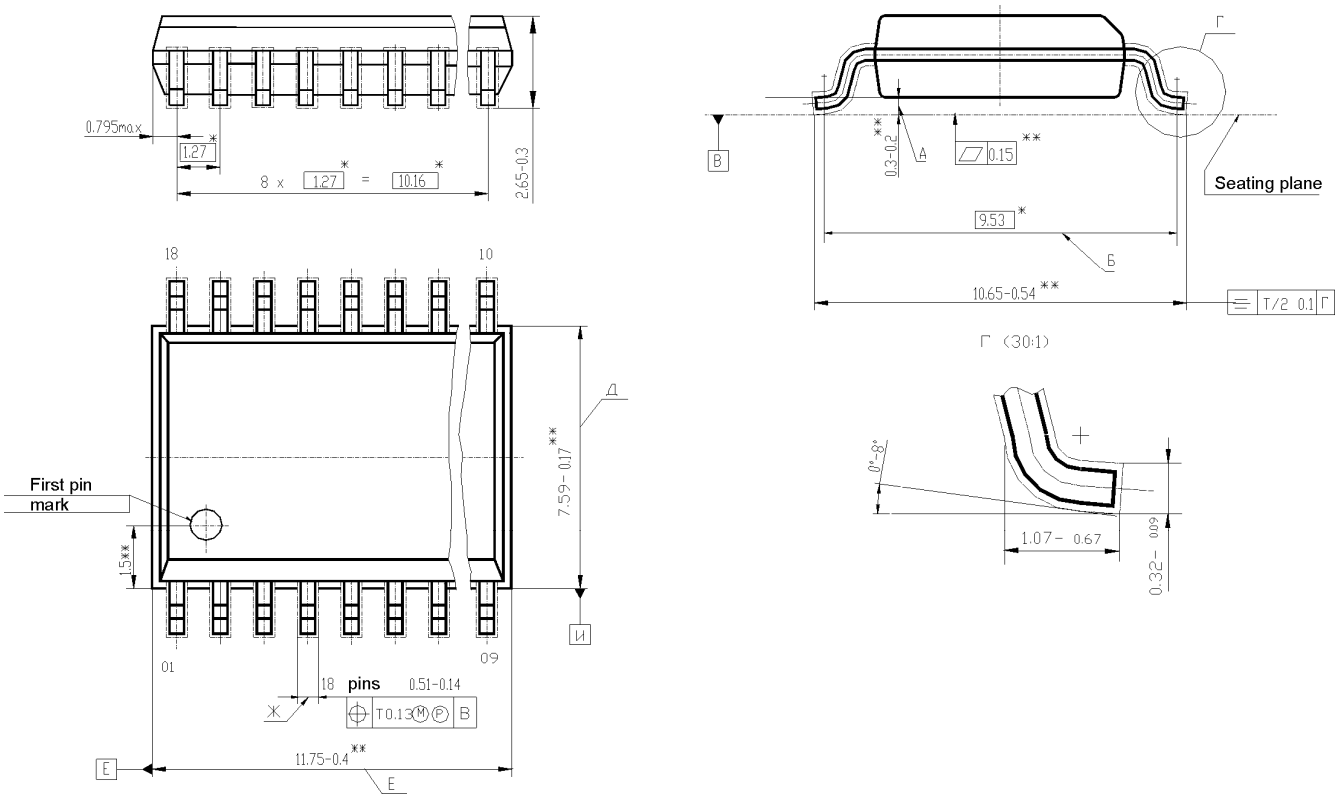


Fig. 5 MS-013AB package outline drawing

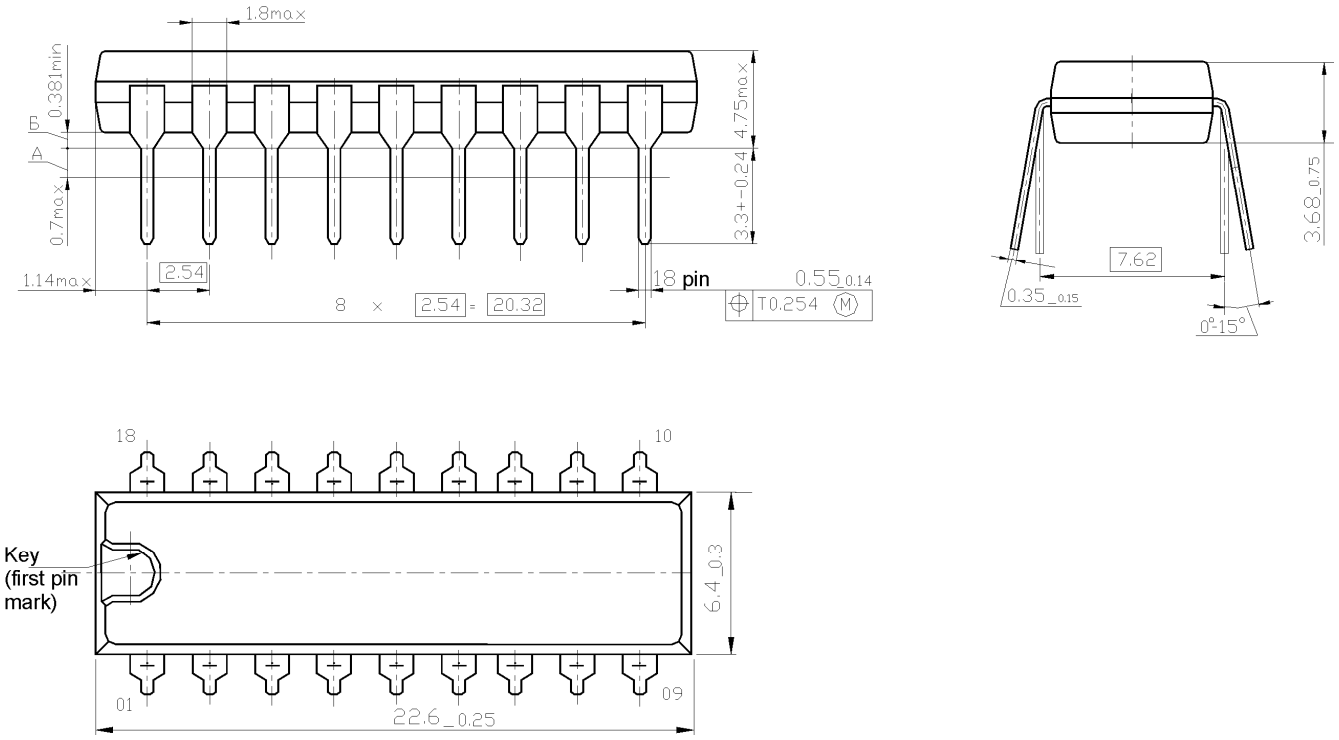


Fig 6 –MS-001AC package outline drawing