

**ULN2803AP, ULN2803AFW, ULN2804AP, ULN2804AFW**

**8CH DARLINGTON SINK DRIVER**

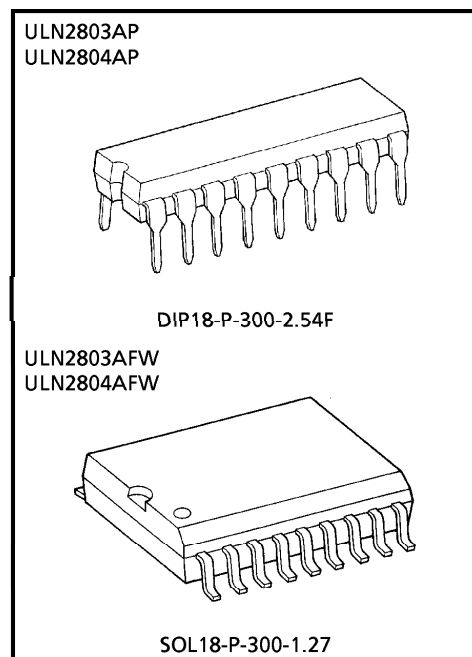
The ULN2803AP / AFW Series are high-voltage, high-current darlington drivers comprised of eight NPN darlington pairs.

All units feature integral clamp diodes for switching inductive loads.

Applications include relay, hammer, lamp and display (LED) drivers.

**FEATURES**

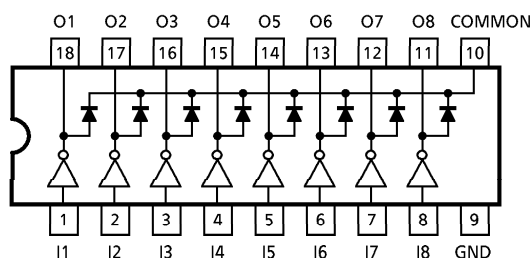
- Output current (single output)  
500mA (Max.) (ULN2803AP / AFW series)
- High sustaining voltage output  
50V (Min.) (ULN2803AP / AFW series)
- Output clamp diodes
- Inputs compatible with various types of logic.
- Package type-AP : DIP-18pin
- Package type-AFW : SOL-18pin



**Weight**  
 DIP18-P-300-2.54F : 1.478g (Typ.)  
 SOL18-P-300-1.27 : 0.48g (Typ.)

TYPE	INPUT BASE RESISTOR	DESIGNATION
ULN2803AP / AFW	2.7kΩ	TTL, 5V CMOS
ULN2804AP / AFW	10.5kΩ	6~15V PMOS, CMOS

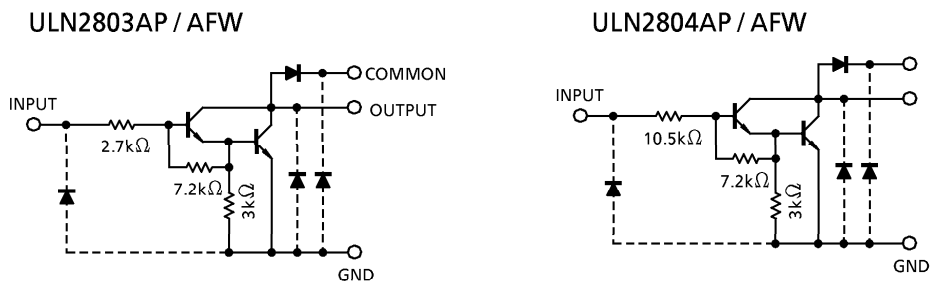
**PIN CONNECTION (TOP VIEW)**



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**SCHEMATICS (EACH DRIVER)**



(Note) The input and output parasitic diodes cannot be used as clamp diodes.

**MAXIMUM RATINGS (Ta = 25°C)**

CHARACTERISTIC		SYMBOL	RATING	UNIT
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	AP	$P_D$	1.47	W
	AFW		0.92 / 1.31 (Note)	
Operating Temperature		$T_{opr}$	- 40~85	°C
Storage Temperature		$T_{stg}$	- 55~150	°C

(Note) On Glass Epoxy PCB (75 × 114 × 1.6mm Cu 20%)

**RECOMMENDED OPERATING CONDITIONS (Ta = -40~85°C)**

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Sustaining Voltage		V <sub>CE (SUS)</sub>		0	—	50	V
Output Current	AP	I <sub>OUT</sub>	T <sub>pw</sub> = 25ms, Duty = 10%, 8 Circuits	0	—	347	mA / ch
			T <sub>pw</sub> = 25ms, Duty = 50%, 8 Circuits	0	—	123	
	AFW		T <sub>pw</sub> = 25ms, Duty = 10%, 8 Circuits	0	—	268	
			T <sub>pw</sub> = 25ms, Duty = 50%, 8 Circuits	0	—	90	
Input Voltage		V <sub>IN</sub>		0	—	30	V
Input Voltage (Output On)	ULN2803AP / AFW	V <sub>IN (ON)</sub>		3.5	—	30	V
	ULN2804AP / AFW			8	—	30	
Clamp Diode Reverse Voltage		V <sub>R</sub>		—	—	50	V
Clamp Diode Forward Current		I <sub>F</sub>		—	—	400	mA
Power Dissipation	AP	P <sub>D</sub>	Ta = 85°C	—	—	0.76	W
	AFW		Ta = 85°C (Note)	—	—	0.48	

(Note) On Glass Epoxy PCB (75 × 114 × 1.6mm Cu 20%)

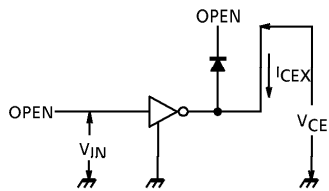
**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Leakage Current	ULN2804AP / AFW	I <sub>CEX</sub>	1	V <sub>CE</sub> = 50V, Ta = 25°C	—	—	50	μA
				V <sub>CE</sub> = 50V, Ta = 85°C	—	—	100	
				V <sub>CE</sub> = 50V, V <sub>IN</sub> = 1V	—	—	500	
Collector-Emitter Saturation Voltage		V <sub>CE (sat)</sub>	2	I <sub>OUT</sub> = 350mA, I <sub>IN</sub> = 500μA	—	1.3	1.6	V
				I <sub>OUT</sub> = 200mA, I <sub>IN</sub> = 350μA	—	1.1	1.3	
				I <sub>OUT</sub> = 100mA, I <sub>IN</sub> = 250μA	—	0.9	1.1	
Input Current	ULN2803AP / AFW	I <sub>IN (ON)</sub>	2	V <sub>IN</sub> = 3.85V	—	0.93	1.35	mA
	ULN2804AP / AFW			V <sub>IN</sub> = 5V	—	0.35	0.5	
				V <sub>IN</sub> = 12V	—	1.0	1.45	
		I <sub>IN (OFF)</sub>	4	I <sub>OUT</sub> = 500μA, Ta = 85°C	50	65	—	μA
Input Voltage (Output On)	ULN2803AP / AFW	V <sub>IN (ON)</sub>	5	V <sub>CE</sub> = 2V, I <sub>OUT</sub> = 200mA	—	—	2.4	V
				V <sub>CE</sub> = 2V, I <sub>OUT</sub> = 250mA	—	—	2.7	
				V <sub>CE</sub> = 2V, I <sub>OUT</sub> = 300mA	—	—	3.0	
	ULN2804AP / AFW			V <sub>CE</sub> = 2V, I <sub>OUT</sub> = 125mA	—	—	5.0	
				V <sub>CE</sub> = 2V, I <sub>OUT</sub> = 200mA	—	—	6.0	
				V <sub>CE</sub> = 2V, I <sub>OUT</sub> = 275mA	—	—	7.0	
				V <sub>CE</sub> = 2V, I <sub>OUT</sub> = 350mA	—	—	8.0	
DC Current Transfer Ratio		h <sub>FE</sub>	2	V <sub>CE</sub> = 2V, I <sub>OUT</sub> = 350mA	1000	—	—	
Clamp Diode Reverse Current		I <sub>R</sub>	6	Ta = 25°C (Note)	—	—	50	μA
				Ta = 85°C (Note)	—	—	100	
Clamp Diode Forward Voltage		V <sub>F</sub>	7	I <sub>F</sub> = 350mA	—	—	2.0	V
Input Capacitance		C <sub>IN</sub>	—		—	15	—	pF
Turn-On Delay		t <sub>ON</sub>	8	R <sub>L</sub> = 125Ω, V <sub>OUT</sub> = 50V	—	0.1	—	μs
Turn-Off Delay		t <sub>OFF</sub>		R <sub>L</sub> = 125Ω, V <sub>OUT</sub> = 50V	—	0.2	—	

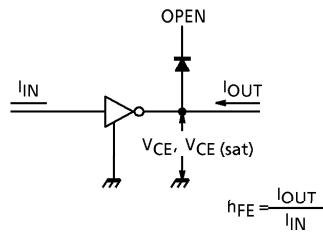
(Note) V<sub>R</sub> = V<sub>R</sub> MAX.

**TEST CIRCUIT**

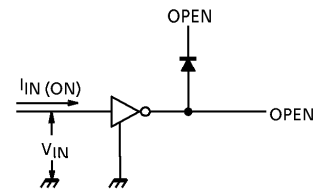
1.  $I_{CEX}$



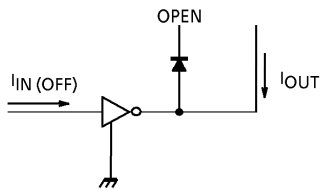
2.  $V_{CE(sat)}$ ,  $h_{FE}$



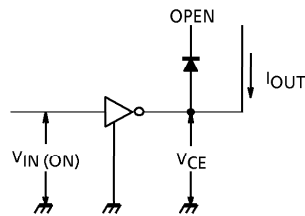
3.  $I_{IN(ON)}$



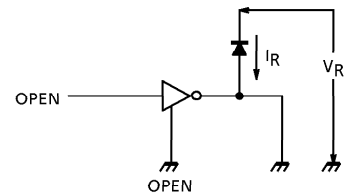
4.  $I_{IN(OFF)}$



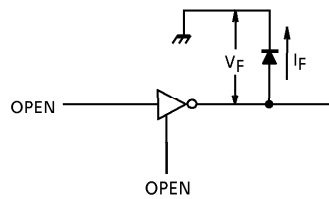
5.  $V_{IN(ON)}$



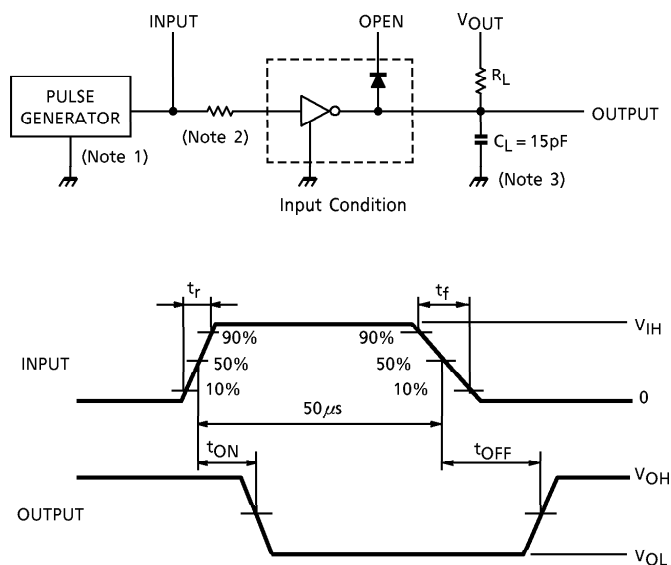
6.  $I_R$



7.  $V_F$



8.  $t_{ON}$ ,  $t_{OFF}$



- (Note 1) Pulse Width  $50\mu s$ , Duty Cycle 10%  
Output Impedance  $50\Omega$ ,  $t_r \leq 5ns$ ,  $t_f \leq 10ns$
- (Note 2) See below.

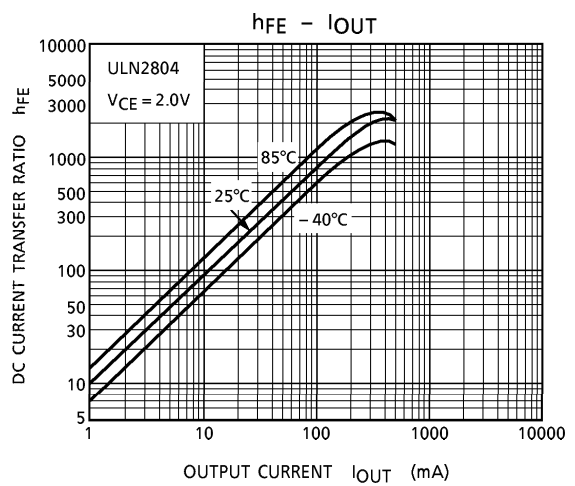
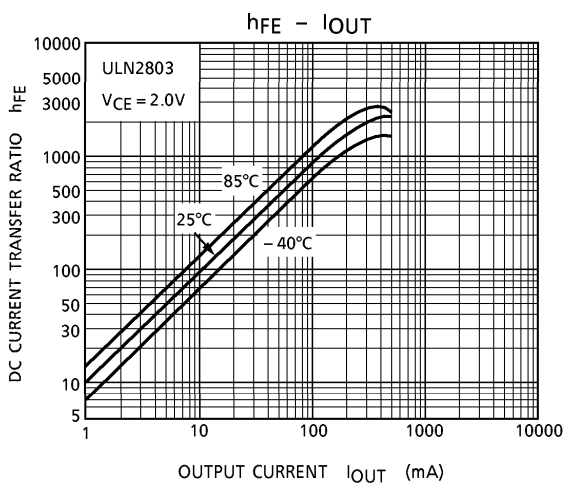
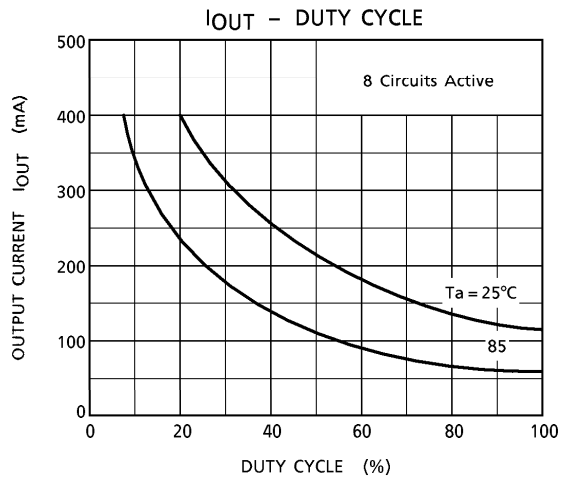
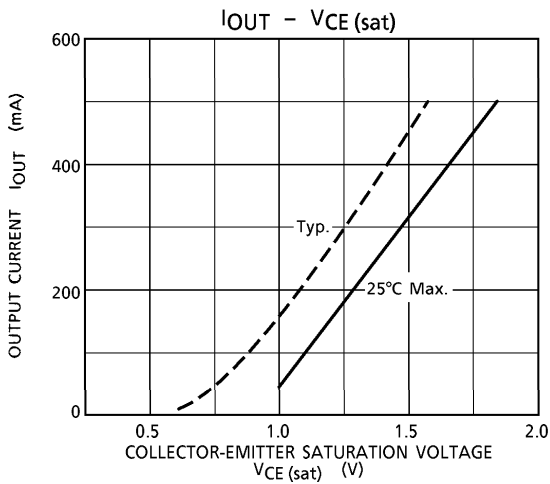
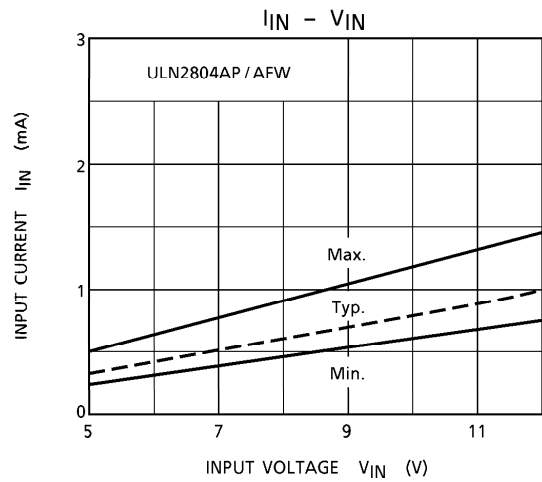
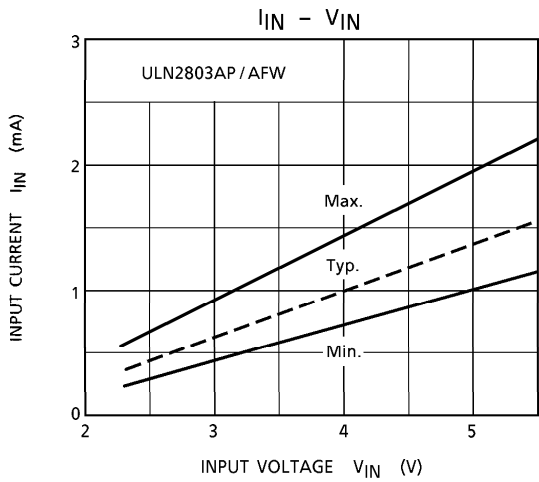
INPUT CONDITION

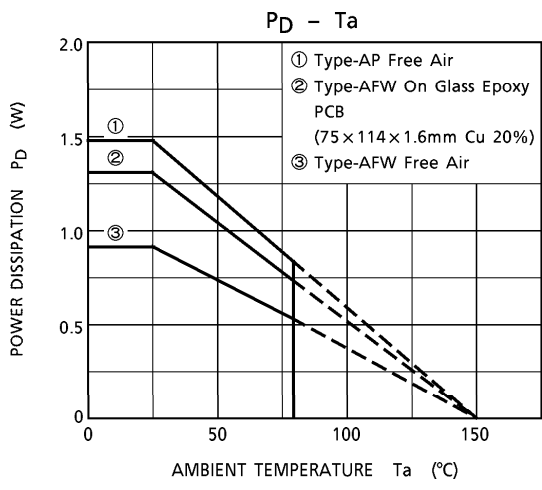
TYPE NUMBER	R1	$V_{IH}$
ULN2803AP / AFW	$0\Omega$	3V
ULN2804AP / AFW	$0\Omega$	8V

- (Note 3)  $C_L$  includes probe and jig capacitance

PRECAUTIONS for USING

Utmost care is necessary in the design of the output line, COMMON and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

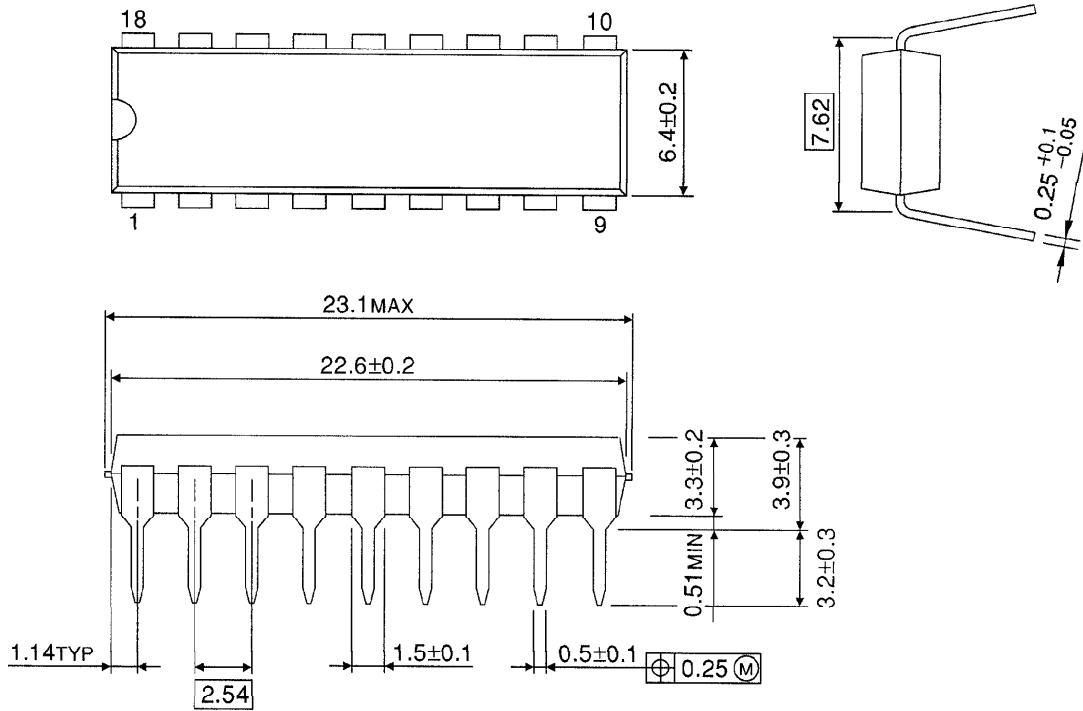






**OUTLINE DRAWING**  
DIP18-P-300-2.54F

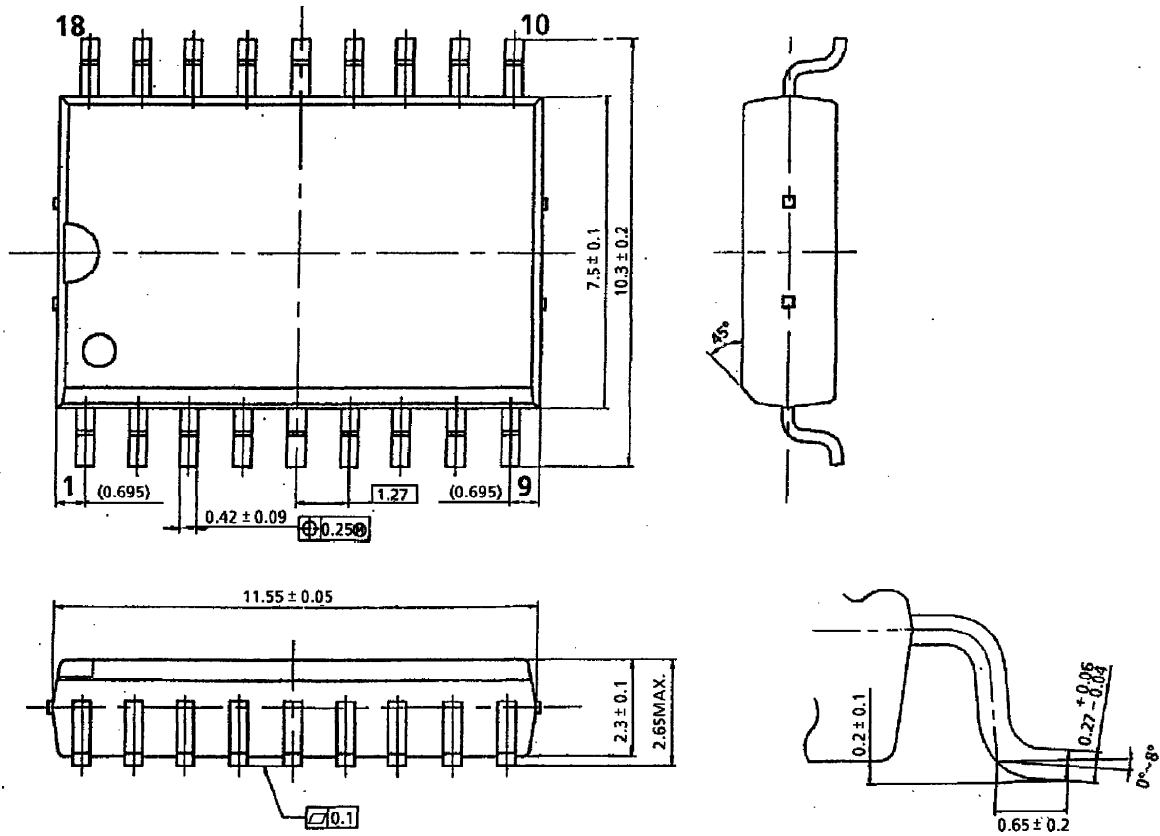
Unit : mm



Weight : 1.478g (Typ.)

OUTLINE DRAWING  
SOL18-P-300-1.27

Unit : mm



Weight : 0.48g (Typ.)