

TOSHIBA Bipolar Digital Integrated Circuit Silicon Monolithic

## TD62001APG, TD62001AFG, TD62002APG, TD62002AFG, TD62003APG, TD62003AFG, TD62004APG, TD62004AFG

### 7-channel Darlington Sink Driver

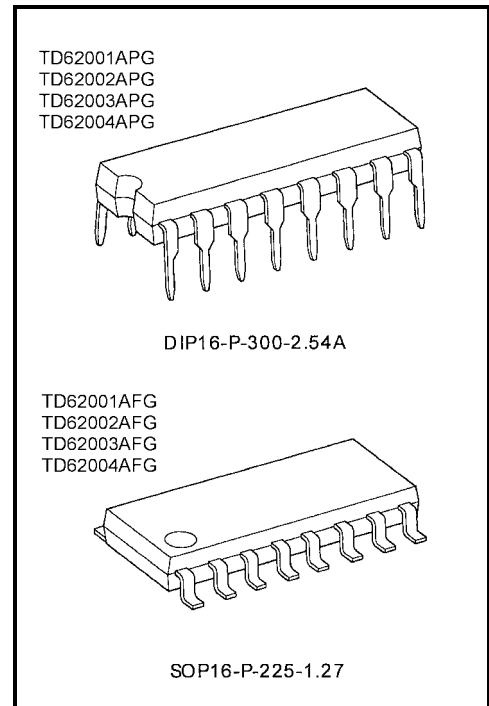
The TD62001APG/AFG Series are high-voltage, high-current darlington drivers comprised of seven NPN darlington pairs. All units feature integral clamp diodes for switching inductive loads.

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

### Features

- Output current (single output): 500 mA (max)
- High sustaining voltage output: 50 V (min)
- Output clamp diodes
- Inputs compatible with various types of logic
- Package type
  - APG: DIP-16 pin (Pb free package)
  - AFG: SOP-16 pin (Pb free package)

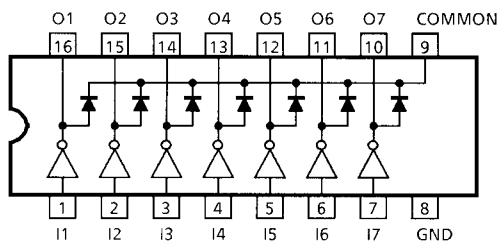
Type	Input base resistor	Designation
TD62001APG/AFG	External	General purpose
TD62002APG/AFG	10.5-kΩ + 7-V Zener diode	14-V to 25-V PMOS
TD62003APG/AFG	2.7 kΩ	TTL, 5-V CMOS
TD62004APG/AFG	10.5 kΩ	6-V to 15-V PMOS, CMOS



### Weight

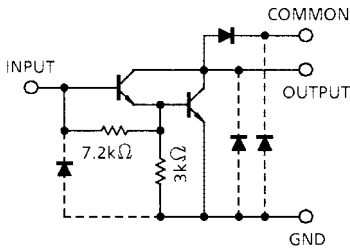
DIP16-P-300-2.54A : 1.11 g (Typ.)  
SOP16-P-225-1.27 : 0.16 g (Typ.)

### Pin Connection (top view)

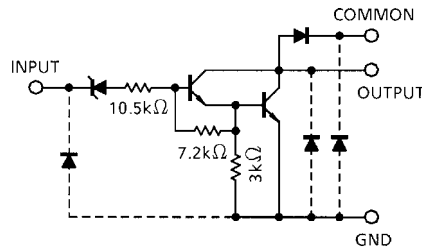


## Schematics (each driver)

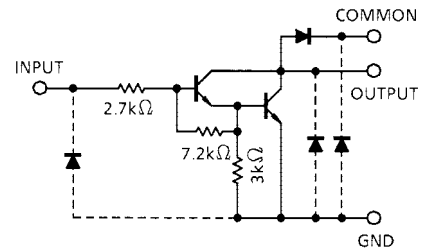
### TD62001APG/AFG



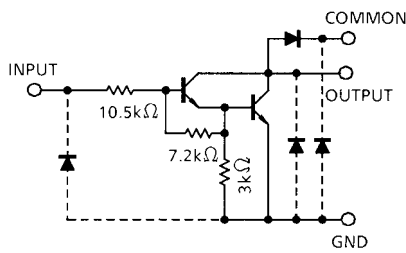
### TD62002APG/AFG



### TD62003PAPG/AFG



### TD62004APG/AFG



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

## Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Output sustaining voltage	$V_{CE(SUS)}$	-0.5 to 50	V
Output current	$I_{OUT}$	500	mA/ch
Input voltage	$V_{IN}$ (Note 1)	-0.5 to 30	V
Input current	$I_{IN}$ (Note 2)	25	mA
Clamp diode reverse voltage	$V_R$	50	V
Clamp diode forward current	$I_F$	500	mA
Power dissipation	APG	1.47	W
	AFG	0.625 (Note 3)	
Operating temperature	$T_{opr}$	-40 to 85	°C
Storage temperature	$T_{stg}$	-55 to 150	°C

Note 1: Except TD62001APG/AFG

Note 2: Only TD62001APG/AFG

Note 3: When mounted on a glass-epoxy PCB (30 mm × 30 mm × 1.6 mm, Cu area: 50%)

## Recommended Operating Conditions (Ta = -40°C to 85°C)

Characteristics		Symbol	Condition	Min	Typ.	Max	Unit	
Output sustaining voltage		V <sub>CE (SUS)</sub>		0	—	50	V	
Output current	APG	I <sub>OUT</sub>	T <sub>pw</sub> = 25 ms 7 circuits Ta = 85°C Tj = 120°C	Duty = 10%	0	—	370	mA/ch
				Duty = 50%	0	—	130	
	AFG			Duty = 10%	0	—	233	
				Duty = 50%	0	—	70	
Input voltage	Except TD62001APG/AFG	V <sub>IN</sub>		0	—	24	V	
Input voltage (output on)	TD62002	V <sub>IN (ON)</sub>	I <sub>OUT</sub> = 400 mA h <sub>FE</sub> = 800	14.5	—	24	V	
	TD62003			2.8	—	24		
	TD62004			6.2	—	24		
Input voltage (output off)	TD62001	V <sub>IN (OFF)</sub>		0	—	0.6	V	
	TD62002			0	—	7.4		
	TD62003			0	—	0.7		
	TD62004			0	—	1.0		
Input current	Only TD62001	I <sub>IN</sub>		0	—	10	mA	
Clamp diode reverse voltage		V <sub>R</sub>		—	—	50	V	
Clamp diode forward current		I <sub>F</sub>		—	—	350	mA	
Power dissipation	APG	P <sub>D</sub>	Ta = 85°C	—	—	0.76	W	
	AFG		Ta = 85°C (Note)	—	—	0.325		

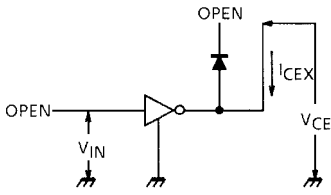
Note: When mounted on a glass-epoxy PCB (30 mm × 30 mm × 1.6 mm, Cu area: 50%)

## Electrical Characteristics (Ta = 25°C unless otherwise noted)

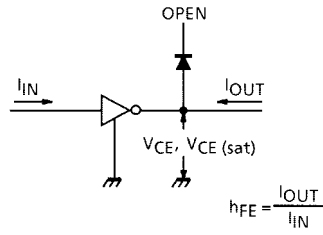
Characteristics		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit	
Output leakage current		ICEX	1	VCE = 50 V, Ta = 25°C	—	—	50	μA	
				VCE = 50 V, Ta = 85°C	—	—	100		
Collector-emitter saturation voltage		VCE (sat)	2	IOUT = 350 mA, IIN = 500 μA	—	1.3	1.6	V	
				IOUT = 200 mA, IIN = 350 μA	—	1.1	1.3		
				IOUT = 100 mA, IIN = 250 μA	—	0.9	1.1		
DC current transfer ratio		hFE	2	VCE = 2 V, IOUT = 350 mA	1000	—	—		
Input current (output on)		IIN (ON)	3	TD62002 VIN = 20 V, IOUT = 350 mA	—	1.1	1.7	mA	
				TD62003 VIN = 2.4 V, IOUT = 350 mA	—	0.4	0.7		
				TD62004 VIN = 9.5 V, IOUT = 350 mA	—	0.8	1.2		
Input current (output off)		IIN (OFF)	4	IOUT = 500 μA, Ta = 85°C	50	65	—	μA	
Input voltage (output on)		VIN (ON)	5	VCE = 2 V hFE = 800	TD62002 IOUT = 350 mA	—	—	13.7	V
					TD62002 IOUT = 200 mA	—	—	11.4	
					TD62003 IOUT = 350 mA	—	—	2.6	
					TD62003 IOUT = 200 mA	—	—	2.0	
					TD62004 IOUT = 350 mA	—	—	4.7	
					TD62004 IOUT = 200 mA	—	—	4.4	
Clamp diode reverse current		IR	6	VR = 50 V, Ta = 25°C	—	—	50	μA	
				VR = 50 V, Ta = 85°C	—	—	100		
Clamp diode forward voltage		VF	7	IF = 350 mA	—	—	2.0	V	
Input capacitance		CIN	—		—	15	—	pF	
Turn-on delay		tON	8	VOUT = 50 V, RL = 125 Ω CL = 15 pF	—	0.1	—	μs	
Turn-off delay		tOFF	8	VOUT = 50 V, RL = 125 Ω CL = 15 pF	—	0.2	—		

## Test Circuit

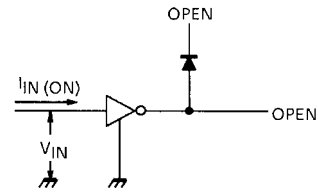
### 1. $I_{CEX}$



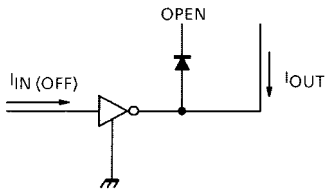
### 2. $V_{CE} (sat), h_{FE}$



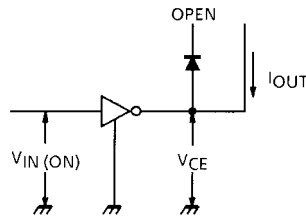
### 3. $I_{IN} (ON)$



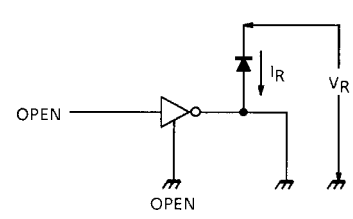
### 4. $I_{IN} (OFF)$



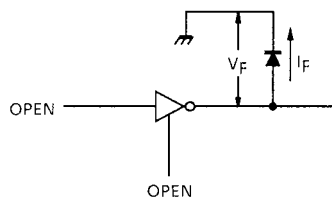
### 5. $V_{IN} (ON)$



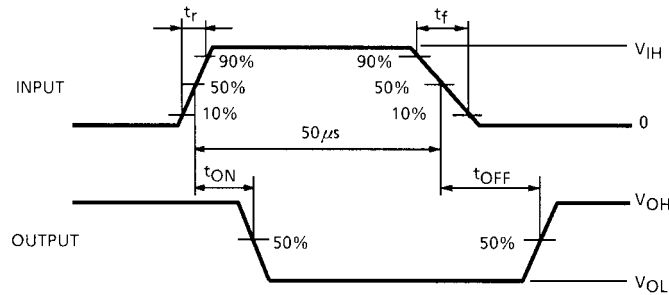
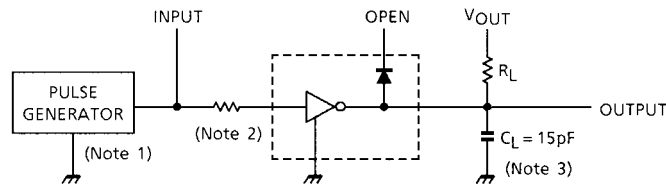
### 6. $I_R$



### 7. $V_F$



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



- Note 1: Pulse width  $50\ \mu\text{s}$ , duty cycle 10%  
Output impedance  $50\ \Omega$ ,  $t_r \leq 5\ \text{ns}$ ,  $t_f \leq 10\ \text{ns}$
- Note 2: Input conditions are shown as following:

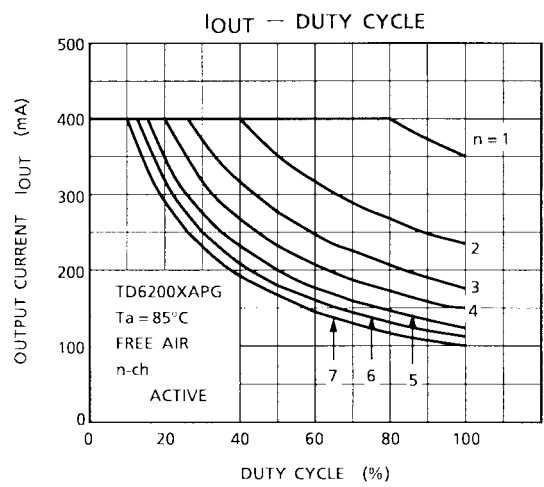
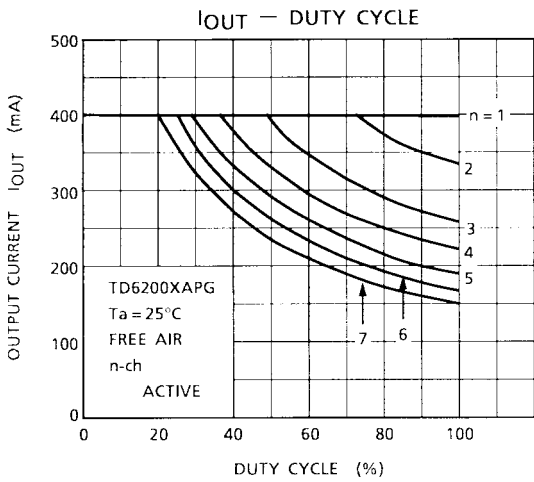
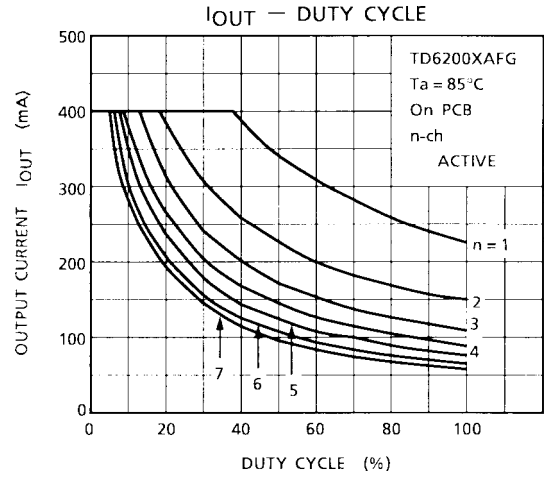
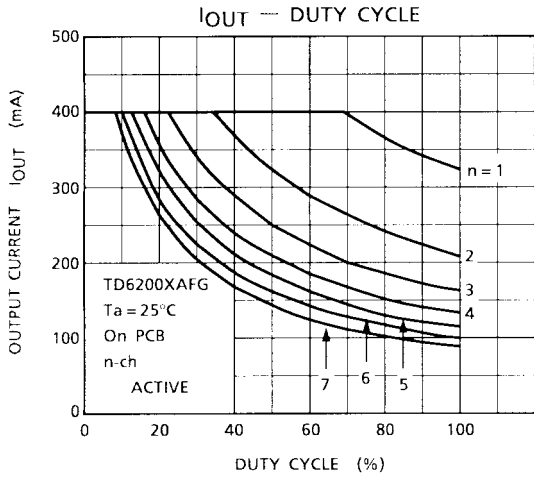
Input Condition

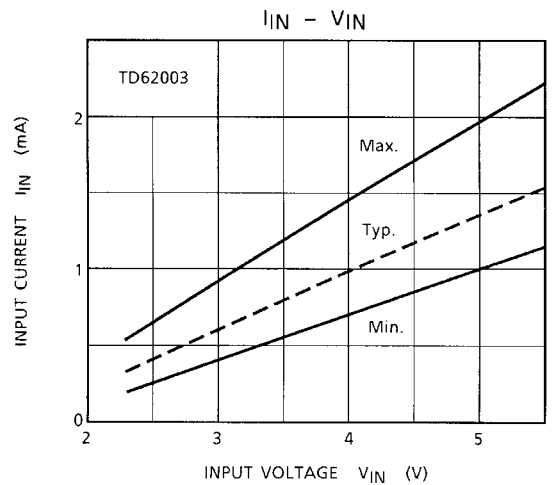
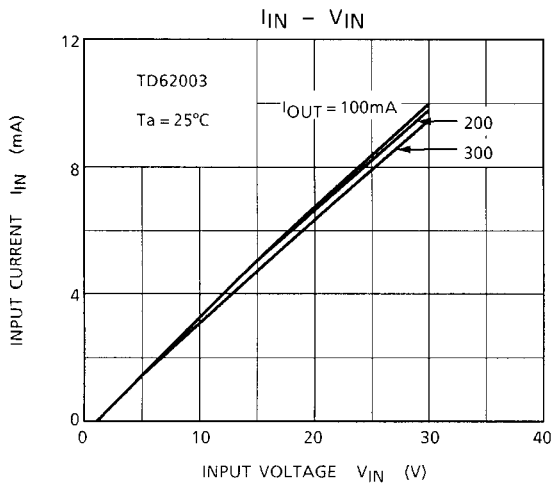
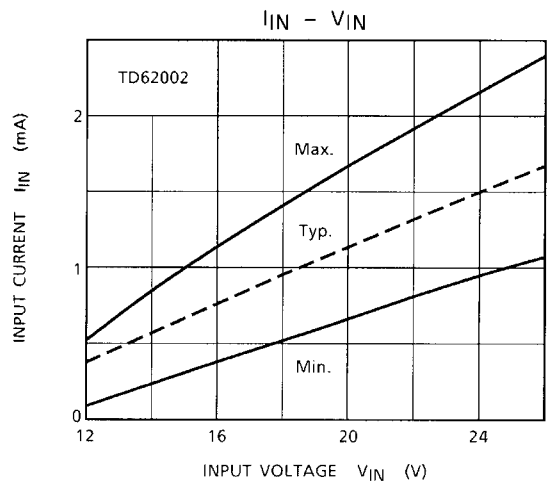
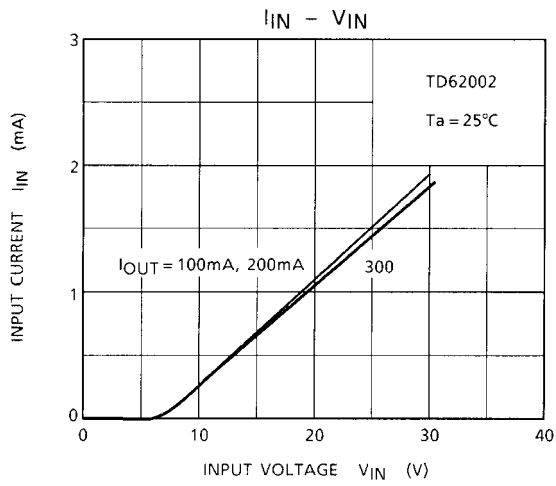
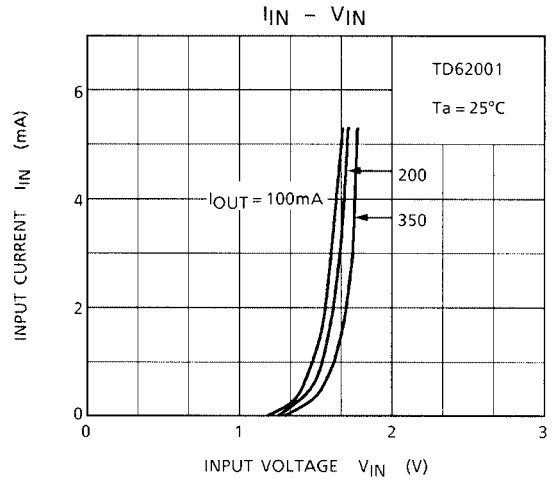
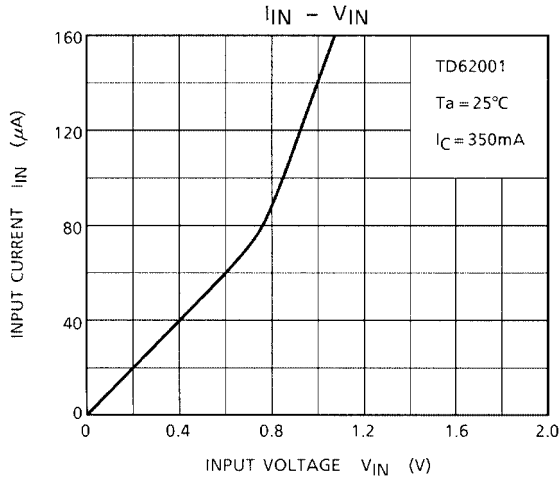
Type Number	R1	$V_{IH}$
TD62001APG/AFG	2.7 k $\Omega$	3 V
TD62002APG/AFG	0	13 V
TD62003APG/AFG	0	3 V
TD62004APG/AFG	0	8 V

Note 3:  $C_L$  includes probe and jig capacitance.

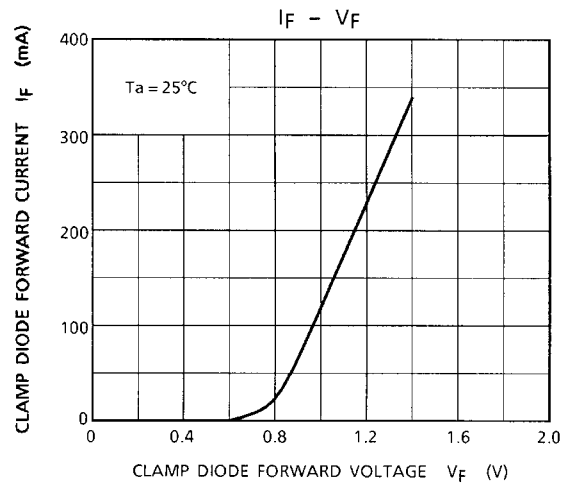
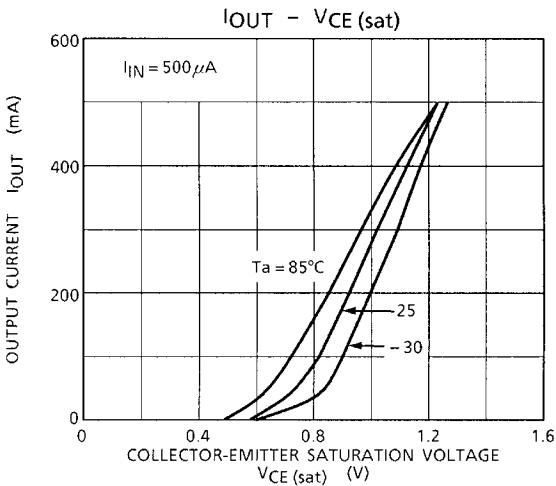
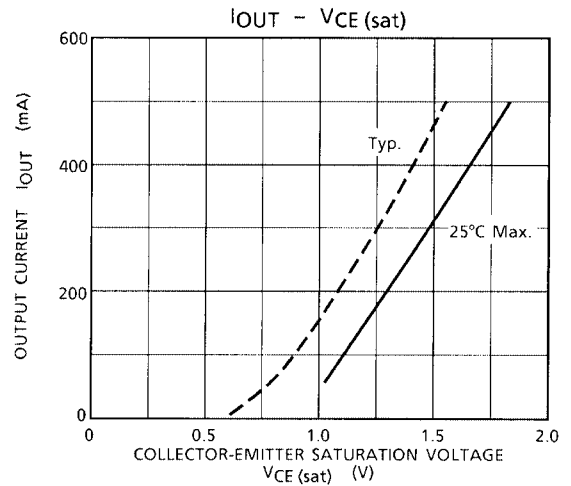
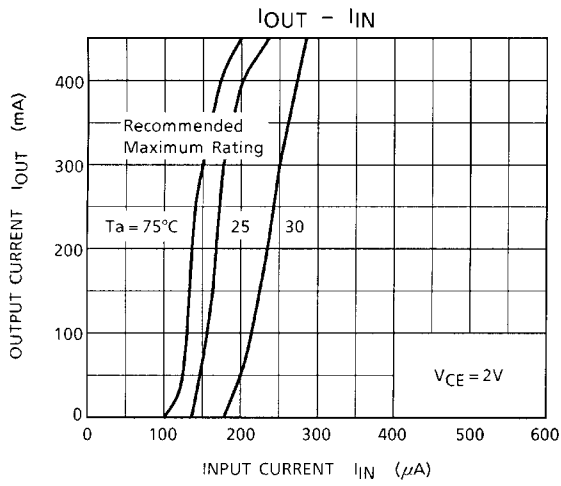
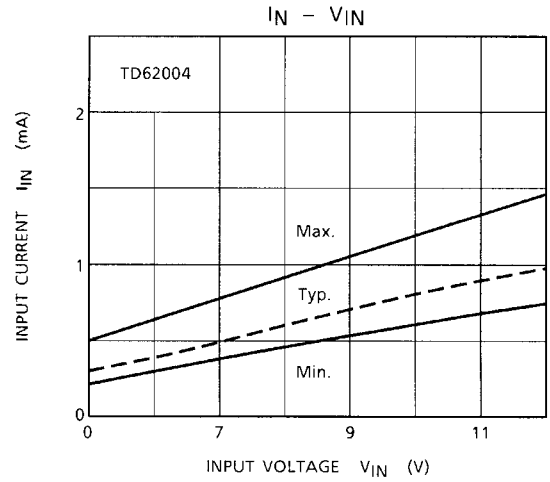
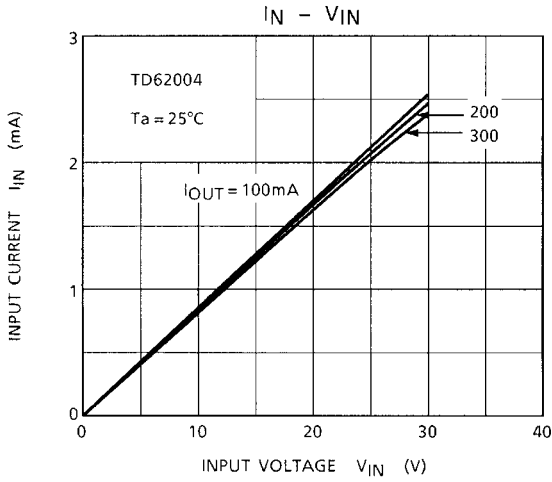
**Precautions for Using**

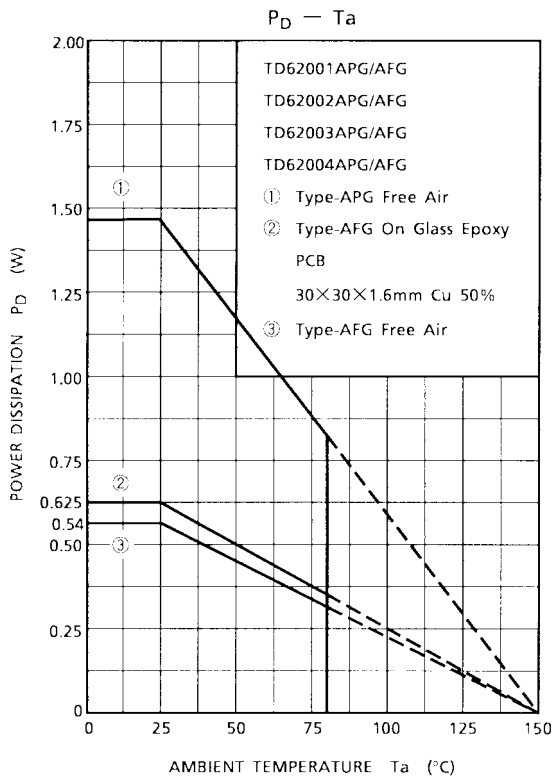
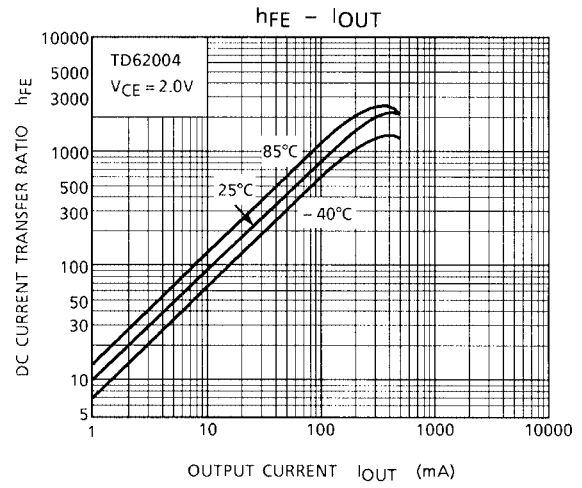
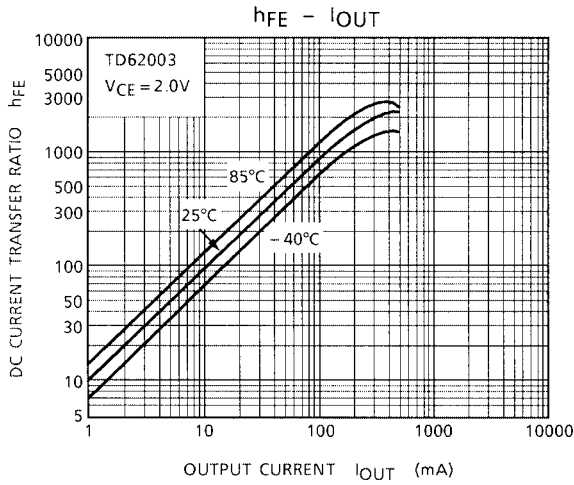
This IC does not include built-in protection circuits for excess current or overvoltage. If this IC is subjected to excess current or overvoltage, it may be destroyed. Hence, the utmost care must be taken when systems which incorporate this IC are designed. Utmost care is necessary in the design of the 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.







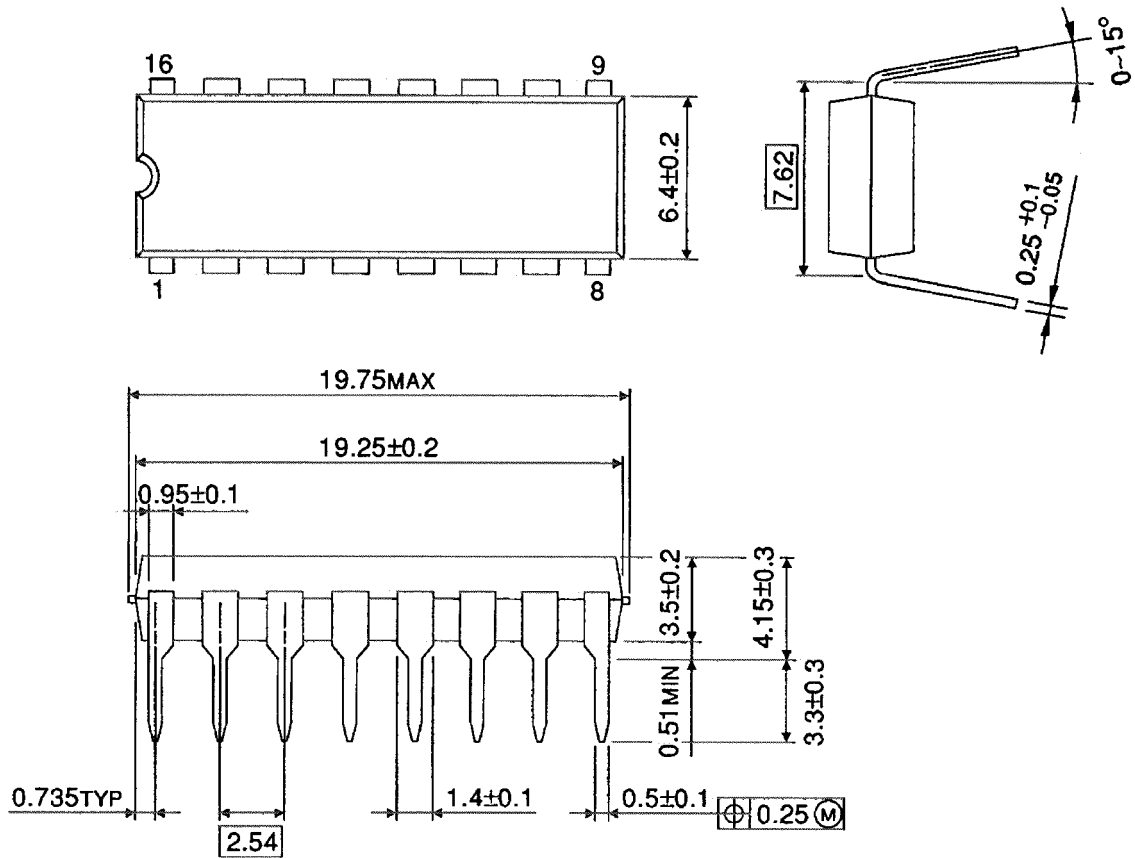




## Package Dimensions

DIP16-P-300-2.54A

Unit : mm

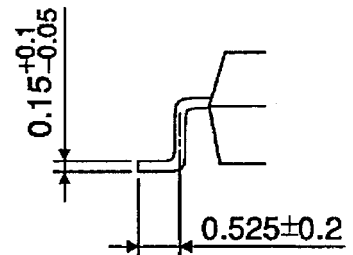
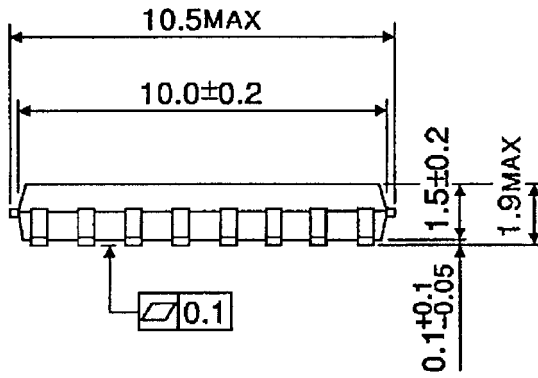
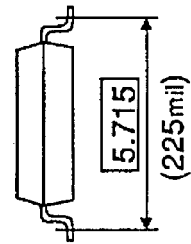
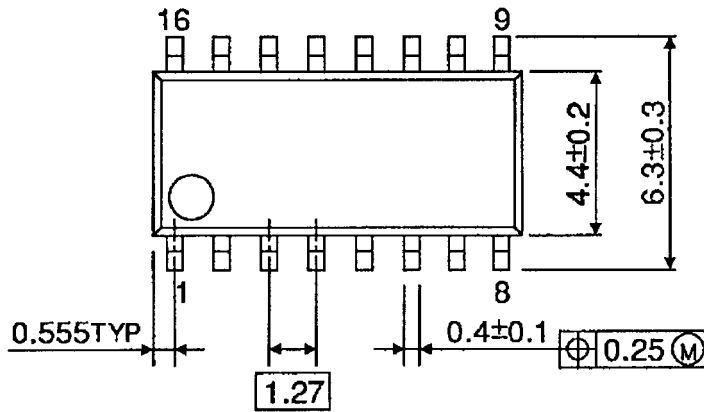


Weight: 1.11 g (Typ.)

**Package Dimensions**

SOP16-P-225-1.27

Unit : mm



Weight: 0.16 g (Typ.)

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000707EBA

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