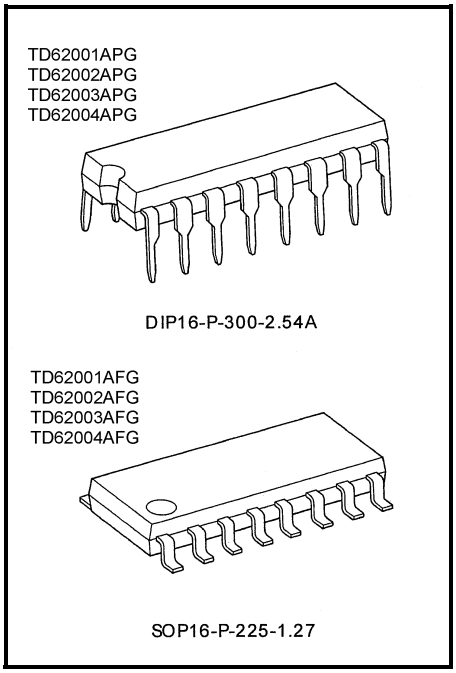
TOSHIBA Bipolar Digital Integrated Circuit Silicon Monolithic

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.
This devices are a product for the Pb free(Sn-Ag).



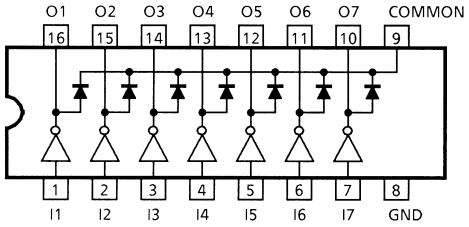
Weight
DIP16−P−300−2.54A : 1.11 g (Typ.)
SOP16−P−225−1.27 : 0.16 g (Typ.)

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)

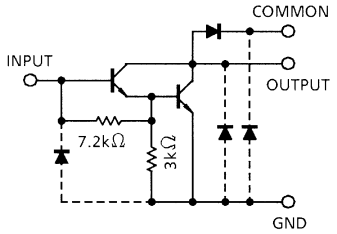
Type	Input base resistor	Designation
TD62001APG/AFG	External	General purpose
TD62002APG/AFG	10.5-kΩ + 7-V Zenner diode	14-V to 25-V PMOS
TD62003APG/AFG	2.7 kΩ	TTL, 5-V CMOS
TD62004APG/AFG	10.5 kΩ	6-V to 15-V PMOS, CMOS

Pin Connection (top view)

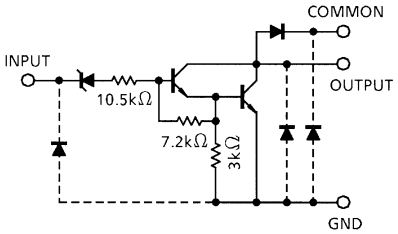


Schematics (each driver)

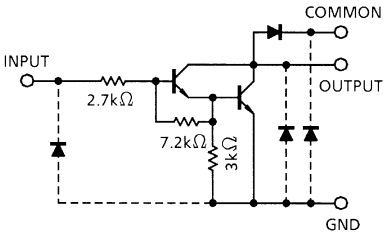
TD62001APG/AFG



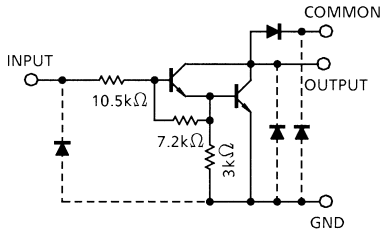
TD62002APG/AFG



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	P_D	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		$V_{CE\ (SUS)}$			0	—	50	V
Output current	APG	I_{OUT}	T_{pw} = 25 ms 7 circuits Ta = 85°C T_j = 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_{IN}			0	—	24	V
Input voltage (output on)	TD62002	$V_{IN\ (ON)}$	I_{OUT} = 400 mA h_{FE} = 800		14.5	—	24	V
	TD62003				2.8	—	24	
	TD62004				6.2	—	24	
Input voltage (output off)	TD62001	$V_{IN\ (OFF)}$			0	—	0.6	V
	TD62002				0	—	7.4	
	TD62003				0	—	0.7	
	TD62004				0	—	1.0	
Input current	Only TD62001	I_{IN}			0	—	10	mA
Clamp diode reverse voltage		V_R			—	—	50	V
Clamp diode forward current		I_F			—	—	350	mA
Power dissipation	APG	P_D	Ta = 85°C		—	—	0.76	W
	AFG		Ta = 85°C	(Note)	—	—	0.325	

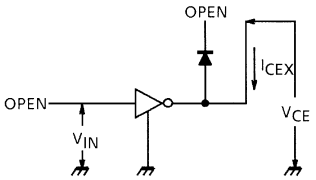
Note: When mounted on a glass-epoxy PCB (30 mm × 30 mm × 1.6 mm, Cu area: 50%)

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

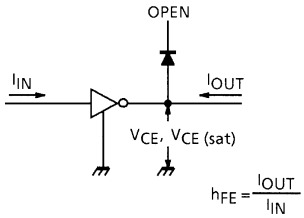
Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Ooutput leakage current		I_{CEX}	1	V_{CE} = 50 V, Ta = 25°C		—	—	50	μA
				V_{CE} = 50 V, Ta = 85°C		—	—	100	
Collector−emitter saturation voltage		$V_{CE\ (sat)}$	2	I_{OUT} = 350 mA, I_{IN} = 500 μA		—	1.3	1.6	V
				I_{OUT} = 200 mA, I_{IN} = 350 μA		—	1.1	1.3	
				I_{OUT} = 100 mA, I_{IN} = 250 μA		—	0.9	1.1	
DC current transfer ratio		h_{FE}	2	V_{CE} = 2 V, I_{OUT} = 350 mA		1000	—	—	
Input current (output on)	TD62002	$I_{IN\ (ON)}$	3	V_{IN} = 20 V, I_{OUT} = 350 mA		—	1.1	1.7	mA
	TD62003			V_{IN} = 2.4 V, I_{OUT} = 350 mA		—	0.4	0.7	
	TD62004			V_{IN} = 9.5 V, I_{OUT} = 350 mA		—	0.8	1.2	
Input current (output off)		$I_{IN\ (OFF)}$	4	I_{OUT} = 500 μA, Ta = 85°C		50	65	—	μA
Input voltage (output on)	TD62002	$V_{IN\ (ON)}$	5	V_{CE} = 2 V h_{FE} = 800	I_{OUT} = 350 mA	—	—	13.7	V
					I_{OUT} = 200 mA	—	—	11.4	
	TD62003				I_{OUT} = 350 mA	—	—	2.6	
					I_{OUT} = 200 mA	—	—	2.0	
	TD62004				I_{OUT} = 350 mA	—	—	4.7	
					I_{OUT} = 200 mA	—	—	4.4	
Clamp diode reverse current		I_R	6	V_R = 50 V, Ta = 25°C		—	—	50	μA
				V_R = 50 V, Ta = 85°C		—	—	100	
Clamp diode forward voltage		V_F	7	I_F = 350 mA		—	—	2.0	V
Input capacitance		C_{IN}	—			—	15	—	pF
Turn−on delay		t_{ON}	8	V_{OUT} = 50 V, R_L = 125 Ω C_L = 15 pF		—	0.1	—	μs
Turn−off delay		t_{OFF}	8	V_{OUT} = 50 V, R_L = 125 Ω C_L = 15 pF		—	0.2	—	

Test Circuit

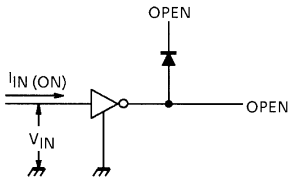
1. I_{CEX}



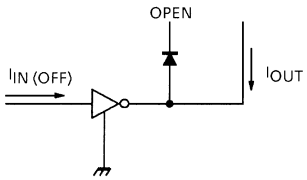
2. $V_{CE\ (sat)}$, h_{FE}



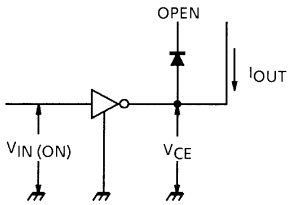
3. IIN (ON)



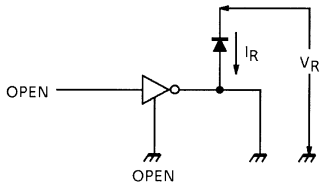
4. $I_{IN\ (OFF)}$



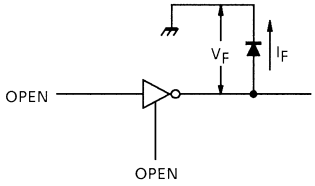
5. $V_{IN\ (ON)}$



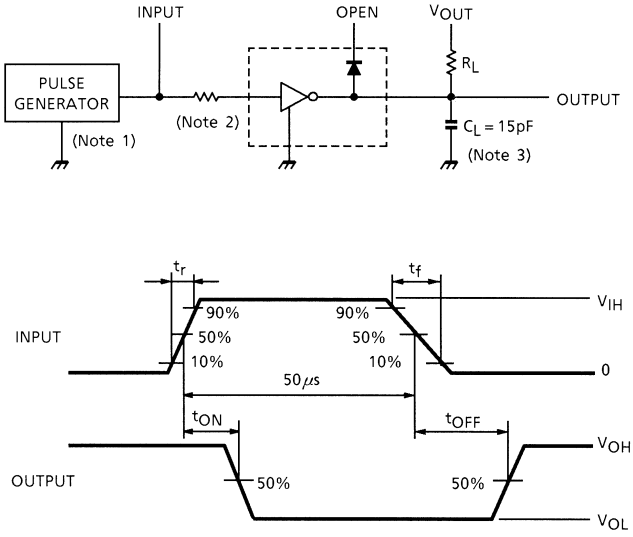
6. I_R



7. V_F



8. t_{ON}, t_{OFF}



Note 1: Pulse width 50 μs, duty cycle 10%
Output impedance 50 Ω, $t_r \leq 5$ ns, $t_f \leq 10$ ns

Note 2: Input conditions are shown as following:

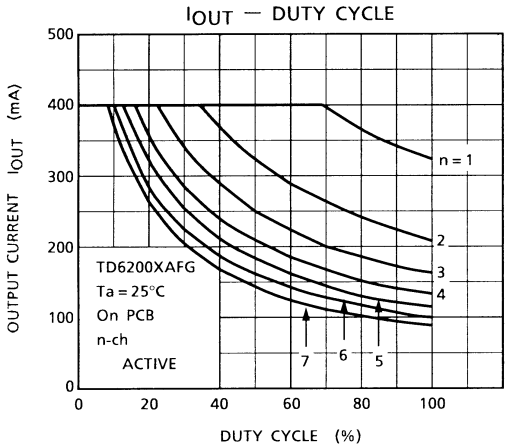
Input Condition

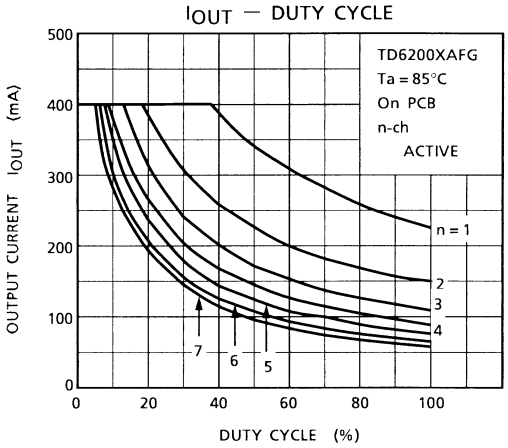
Type Number	R1	V_{IH}
TD62001APG/AFG	2.7 kΩ	3 V
TD62002APG/AFG	0	13 V
TD62003APG/AFG	0	3 V
TD62004APG/AFG	0	8 V

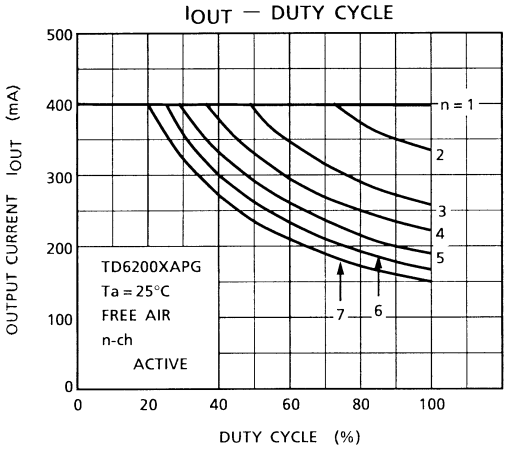
Note 3: C_L includes probe and jig capacitance.

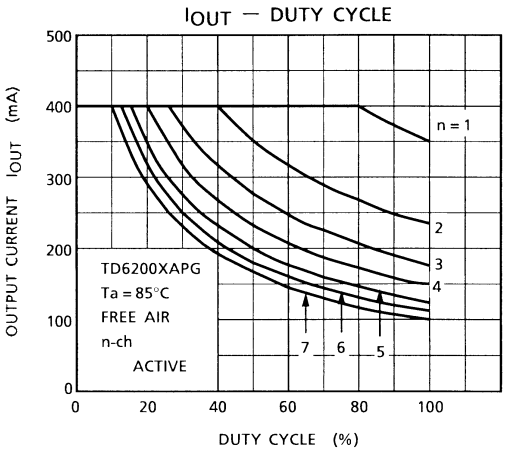
Precautions for Using

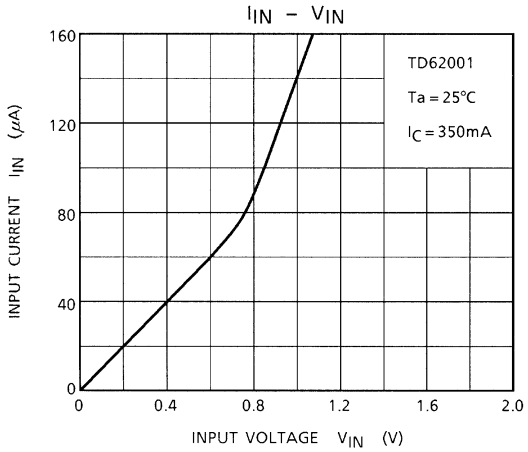
This IC does not include built-in protection circuits for excess current or overvoltage.
If this IC is subjected to excess current or overvoltage, it may be destroyed.
Hence, the utmost care must be taken when systems which incorporate this IC are designed.
Utmost care is necessary in the design of the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

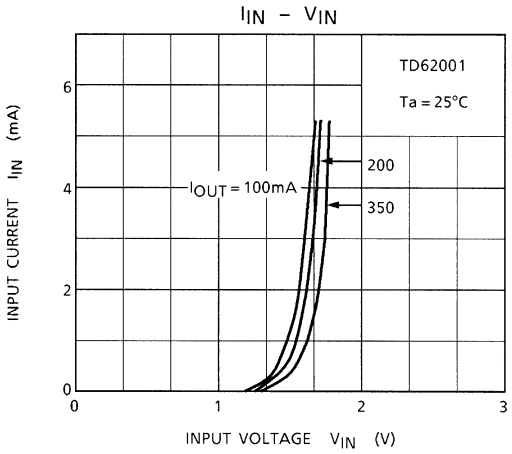

I_{OUT} — DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XAFG
Ta = 25°C
On PCB
n-ch
ACTIVE
n = 1
2
3
4
5
6
7

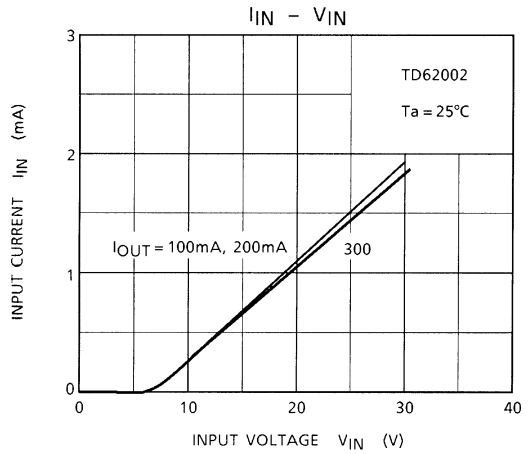

I_{OUT} — DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XAFG
Ta = 85°C
On PCB
n-ch
ACTIVE
n = 1
2
3
4
5
6
7

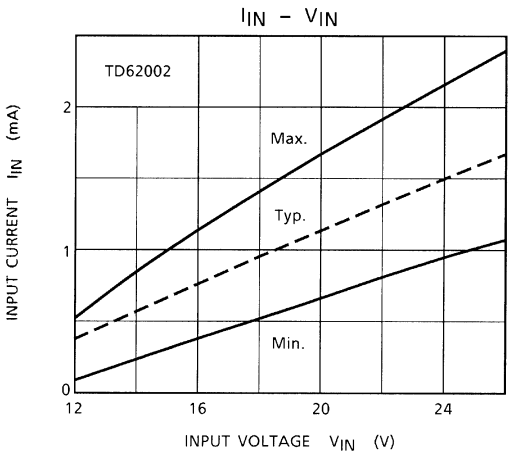

I_{OUT} — DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XAPG
Ta = 25°C
FREE AIR
n-ch
ACTIVE
n = 1
2
3
4
5
6
7

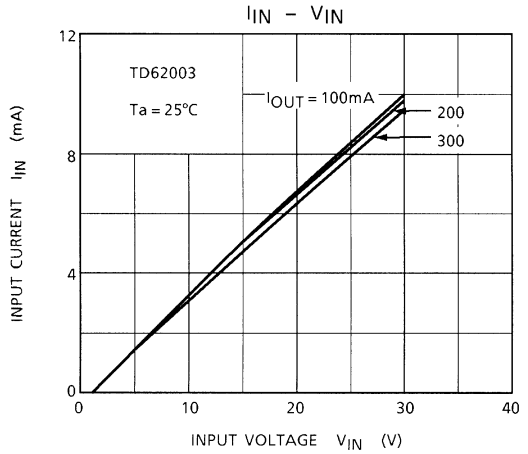

I_{OUT} — DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XAPG
Ta = 85°C
FREE AIR
n-ch
ACTIVE
n = 1
2
3
4
5
6
7

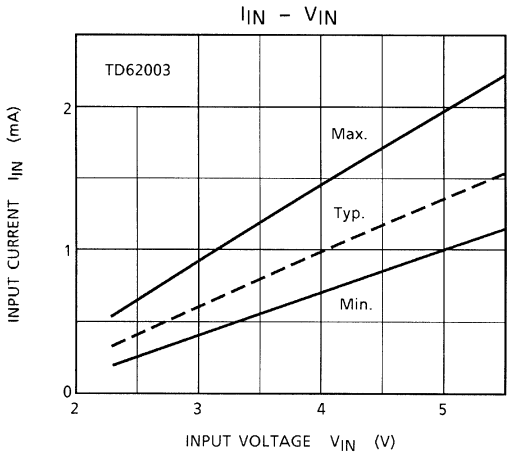

I_{IN} – V_{IN}
TD62001
Ta = 25°C
I_C = 350mA
INPUT CURRENT I_{IN} (μA)
INPUT VOLTAGE V_{IN} (V)
0
40
80
120
160
0.4
0.8
1.2
1.6
2.0


I_{IN} – V_{IN}
TD62001
Ta = 25°C
I_{OUT} = 100mA
200
350
INPUT CURRENT I_{IN} (mA)
INPUT VOLTAGE V_{IN} (V)
0
2
4
6
1
2
3

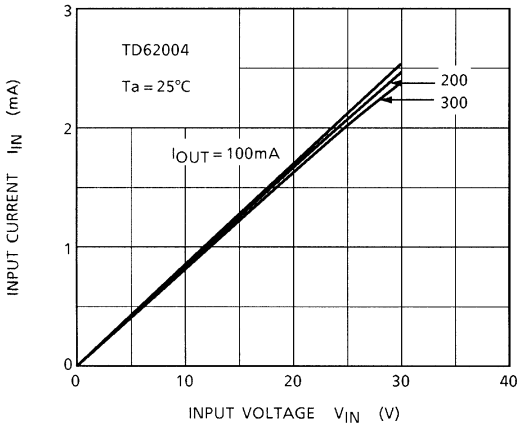

I_{IN} – V_{IN}
TD62002
Ta = 25°C
I_{OUT} = 100mA, 200mA
300
INPUT CURRENT I_{IN} (mA)
INPUT VOLTAGE V_{IN} (V)
0
1
2
3
10
20
30
40


I_{IN} – V_{IN}
TD62002
Max.
Typ.
Min.
INPUT CURRENT I_{IN} (mA)
INPUT VOLTAGE V_{IN} (V)
0
1
2
12
16
20
24

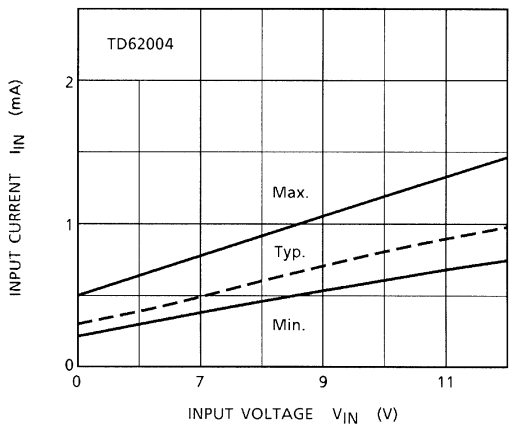

I_{IN} – V_{IN}
TD62003
Ta = 25°C
I_{OUT} = 100mA
200
300
INPUT CURRENT I_{IN} (mA)
INPUT VOLTAGE V_{IN} (V)
0
4
8
12
10
20
30
40


I_{IN} – V_{IN}
TD62003
Max.
Typ.
Min.
INPUT CURRENT I_{IN} (mA)
INPUT VOLTAGE V_{IN} (V)
0
1
2
2
3
4
5

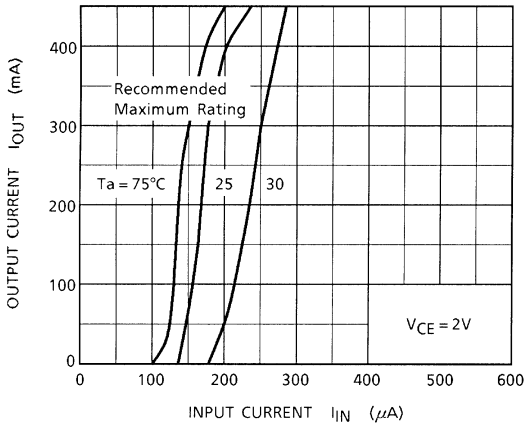
$I_N - V_{IN}$



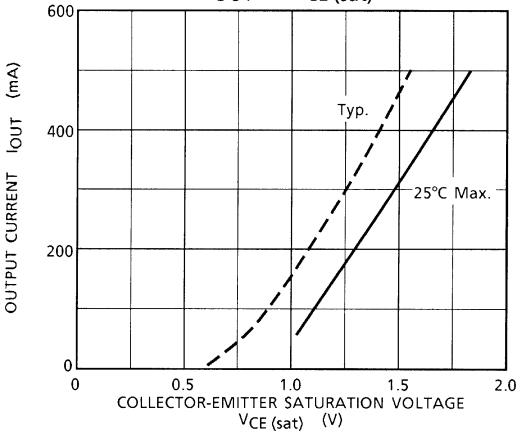
$I_N - V_{IN}$



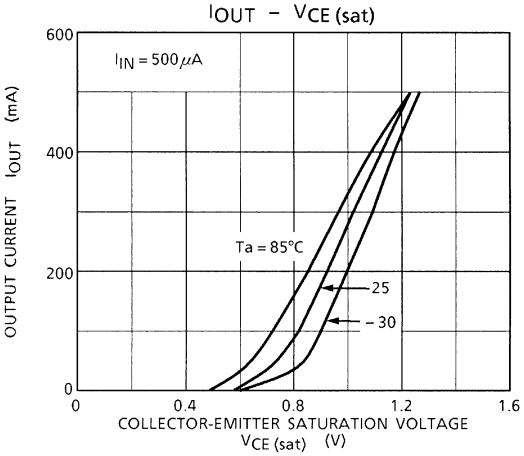
$I_{OUT} - I_{IN}$



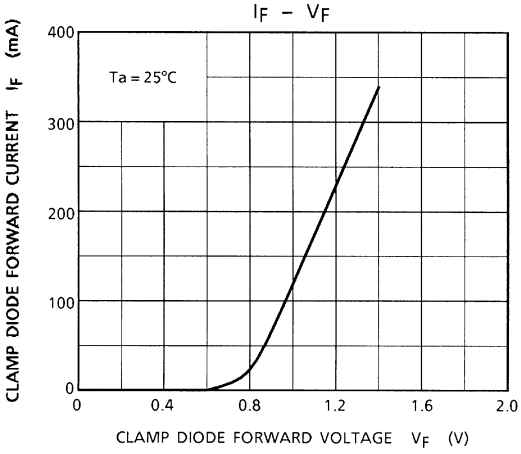
$I_{OUT} - V_{CE\,(sat)}$



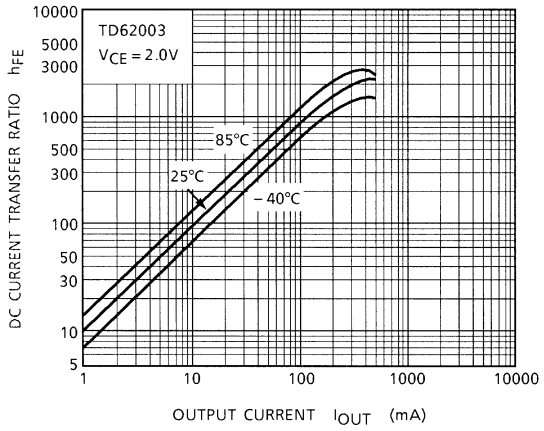
$I_{OUT} - V_{CE\,(sat)}$



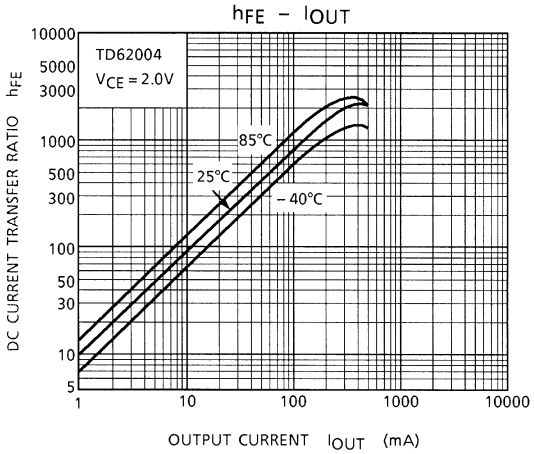
$I_F - V_F$



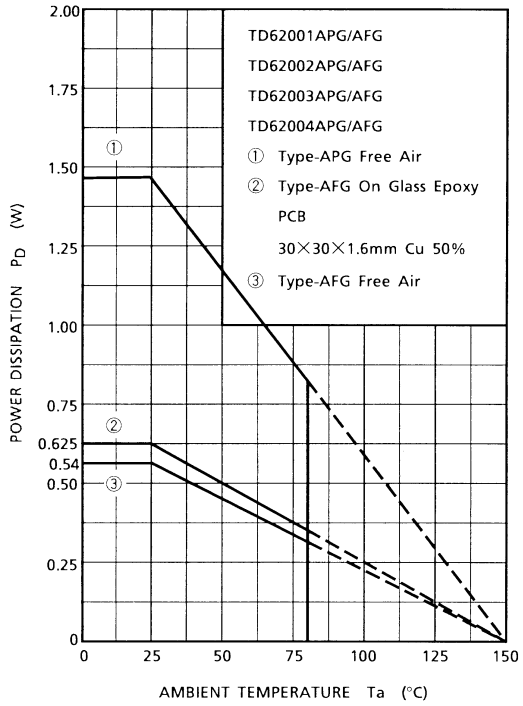
h_{FE} – I_{OUT}



h_{FE} – I_{OUT}

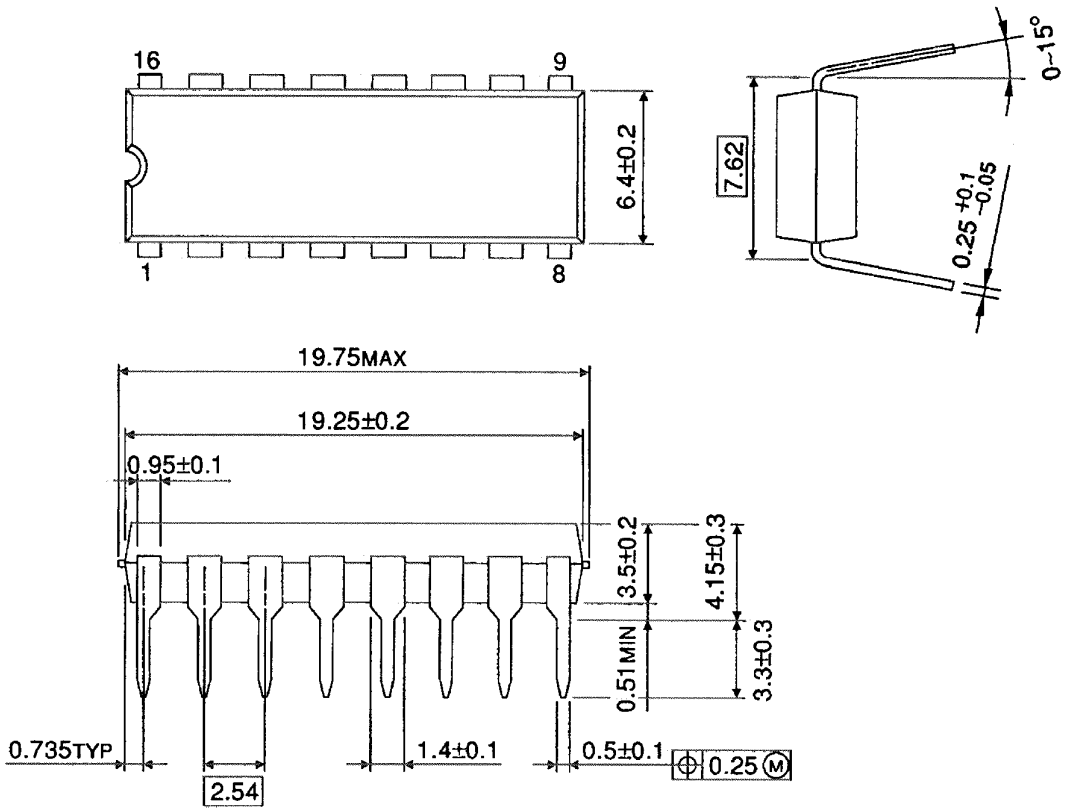


P_D – Ta



Package Dimensions

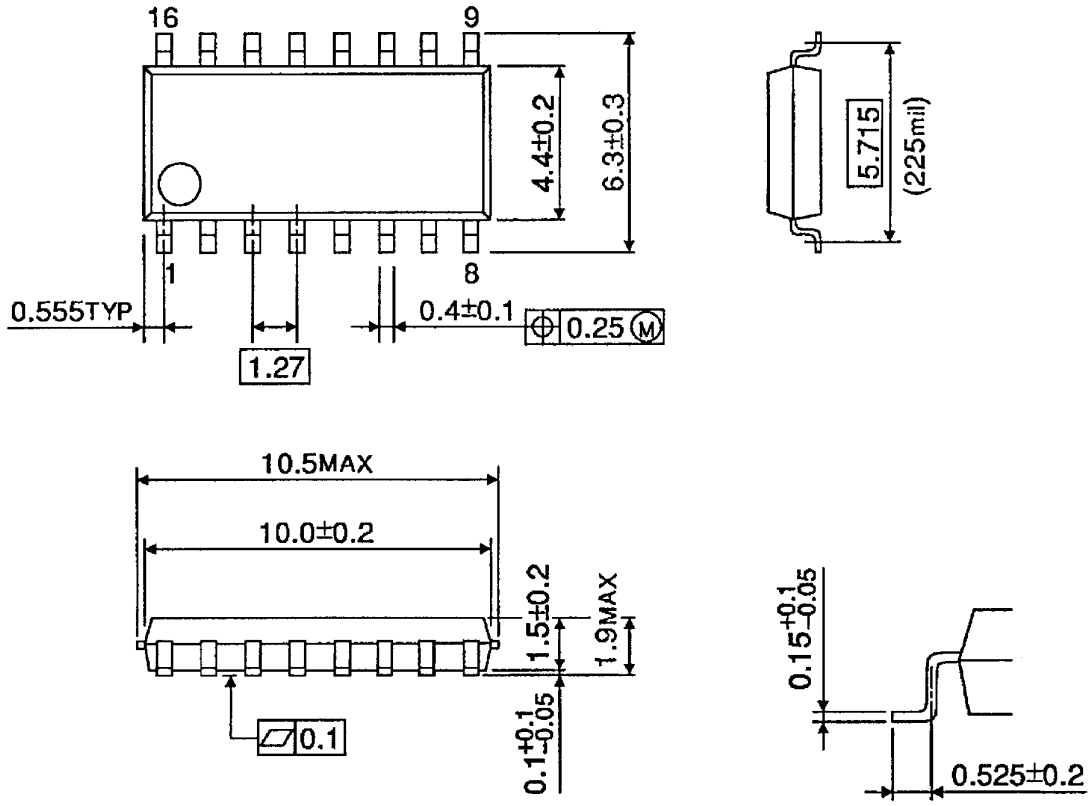
DIP16-P-300-2.54A Unit : mm



Weight: 1.11 g (Typ.)

Package Dimensions

SOP16-P-225-1.27 Unit : mm



Weight: 0.16 g (Typ.)

About solderability, following conditions were confirmed

- Solderability

  (1) Use of Sn-63Pb solder Bath
  - solder bath temperature = 230°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux

  (2) Use of Sn-3.0Ag-0.5Cu solder Bath
  - solder bath temperature = 245°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux

RESTRICTIONS ON PRODUCT USE

030619EBA

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