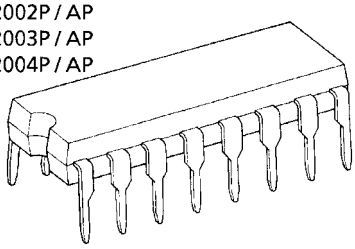
TOSHIBA BIPOLAR DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TD62001P,TD62001AP,TD62001F,TD62001AF,TD62002P
TD62002AP,TD62002F,TD62002AF,TD62003P,TD62003AP,TD62003F
TD62003AF,TD62004P,TD62004AP,TD62004F,TD62004AF

7CH DARLINGTON SINK DRIVER

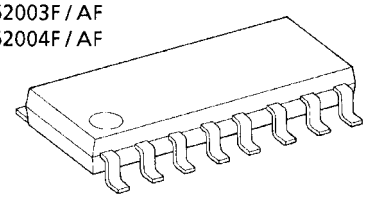
The TD62001P / AP / F / AF Series are high−voltage, high−current darlington drivers comprised of seven NPN darlington pairs.
All units feature integral clamp diodes for switching inductive loads.
Applications include relay, hammer, lamp and display (LED) drivers.

TD62001P / AP
TD62002P / AP
TD62003P / AP
TD62004P / AP



DIP16-P-300-2.54A

TD62001F / AF
TD62002F / AF
TD62003F / AF
TD62004F / AF



SOP16-P-225-1.27

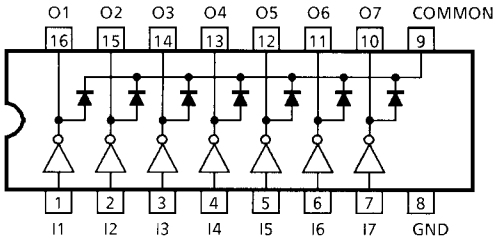
Weight
DIP16−P−300−2.54A : 1.11 g (Typ.)
SOP16−P−225−1.27 : 0.16 g (Typ.)

FEATURES

- Output current (single output) 500 mA MAX.
- High sustaining voltage output
  35 V MIN. (TD62001P / F Series)
  50 V MIN. (TD62001AP / AF Series)
- Output clamp diodes
- Inputs compatible with various types of logic
- Package Type−P, AP: DIP−16 pin
- Package Type−F, AF: SOP−16 pin

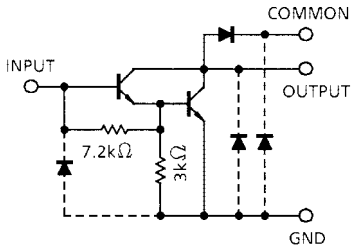
TYPE	INPUT BASE RESISTOR	DESIGNATION
TD62001P / AP / F / AF	External	General Purpose
TD62002P / AP / F / AF	10.5−kΩ + 7 V Zenner diode	14~25 V PMOS
TD62003P / AP / F / AF	2.7 kΩ	TTL, 5 V CMOS
TD62004P / AP / F / AF	10.5 kΩ	6~15 V PMOS, CMOS

PIN CONNECTION (TOP VIEW)

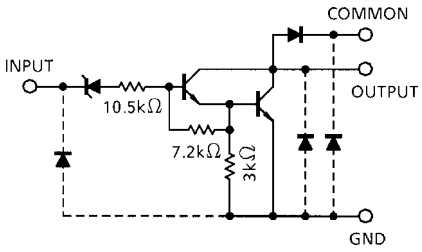


SCHEMATICS (EACH DRIVER)

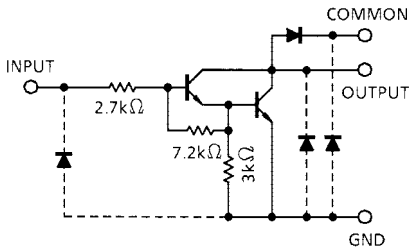
TD62001P / AP / F / AF



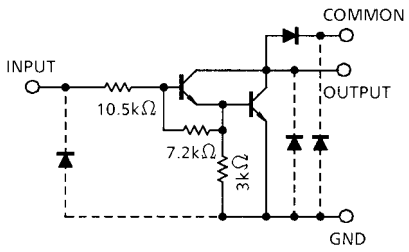
TD62002P / AP / F / AF



TD62003P / AP / F / AF



TD62004P / AP / F / AF



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	P, F	$V_{CE\ (SUS)}$	−0.5~35	V
	AP, AF		−0.5~50	
Output Current		I_{OUT}	500	mA / ch
Input Voltage		V_{IN} (Note 1)	−0.5~30	V
Input Current		I_{IN} (Note 2)	25	mA
Clamp Diode Reverse Voltage	P, F	V_R	35	V
	AP, AF		50	
Clamp Diode Forward Current		I_F	500	mA
Power Dissipation	P	P_D	1.0	W
	AP		1.47	
	F, AF		0.54 / 0.625 (Note 3)	
Operating Temperature	P	T_{opr}	−30~75	°C
	AP, F, AF		−40~85	
Storage Temperature		T_{stg}	−55~150	°C

Note 1: Except TD62001P / AP / F / AF
Note 2: Only TD62001P / AP / F / AF
Note 3: On glass epoxy PCB (30 × 30 × 1.6 mm Cu 50%)

RECOMMENDED OPERATING CONDITIONS
(Ta = −40~85°C and Ta = −30~75°C for only Type−P)

CHARACTERISTIC		SYMBOL	CONDITION		MIN	TYP.	MAX	UNIT
Output Sustaining Voltage	P, F	$V_{CE\ (SUS)}$			0	—	35	V
	AP, AF				0	—	50	
Output Current	AP	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	
	P			Duty = 10%	0	—	295	
				Duty = 50%	0	—	95	
	F, AF			Duty = 10%	0	—	233	
				Duty = 50%	0	—	70	
Input Voltage	Except TD62001P / AP / F / AF	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	P, F	V_R			—	—	35	V
	AP, AF				—	—	50	
Clamp Diode Forward Current		I_F			—	—	350	mA
Power Dissipation	P	P_D	Ta = 85°C		—	—	0.6	W
	AP				—	—	0.76	
	AF, F		Ta = 85°C	(Note)	—	—	0.325	

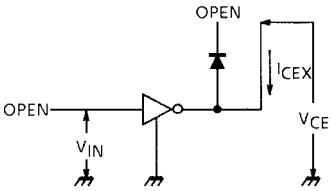
Note: On glass epoxy PCB (30 × 30 × 1.6 mm Cu 50%)

ELECTRICAL CHARACTERISTICS (Ta = 25°C unless otherwise noted)

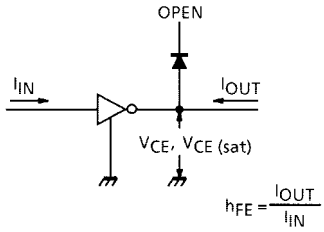
CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN	TYP.	MAX	UNIT
Output Leakage Current	AP, AF	I_{CEX}	1	V_{CE} = 50 V, Ta = 25°C		—	—	50	μA
				V_{CE} = 50 V, Ta = 85°C		—	—	100	
	F			V_{CE} = 35 V, Ta = 25°C		—	—	50	
				V_{CE} = 35 V, Ta = 85°C		—	—	100	
	P			V_{CE} = 35 V, Ta = 25°C		—	—	50	
				V_{CE} = 35 V, Ta = 75°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)	P	$I_{IN\ (OFF)}$	4	I_{OUT} = 500 μA, Ta = 75°C		50	65	—	μA
	AP, F, AF			I_{OUT} = 500 μA, Ta = 85°C		50	65	—	
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	AP, AF	I_R	6	V_R = 50 V, Ta = 25°C		—	—	50	μA
				V_R = 50 V, Ta = 85°C		—	—	100	
	F			V_R = 35 V, Ta = 25°C		—	—	50	
				V_R = 35 V, Ta = 85°C		—	—	100	
	P			V_R = 35 V, Ta = 25°C		—	—	50	
				V_R = 35 V, Ta = 75°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	P, F	t_{ON}	8	V_{OUT} = 35 V, R_L = 87.5 Ω, C_L = 15 pF		—	0.1	—	μs
	AP, AF			V_{OUT} = 50 V, R_L = 125 Ω, C_L = 15 pF		—	0.1	—	
Turn−Off Delay	P, F	t_{OFF}	8	V_{OUT} = 35 V, R_L = 87.5 Ω, C_L = 15 pF		—	0.2	—	
	AP, AF			V_{OUT} = 50 V, R_L = 125 Ω, C_L = 15 pF		—	0.2	—	

TEST CIRCUIT

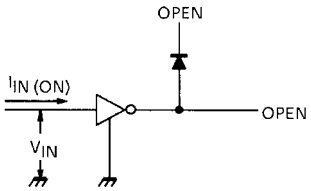
1. I_{CEX}



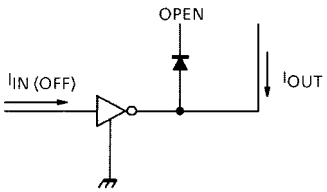
2. $V_{CE\ (sat)}$, h_{FE}



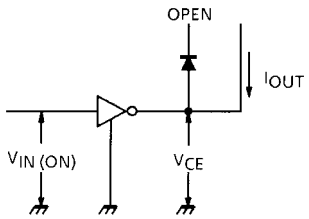
3. IIN (ON)



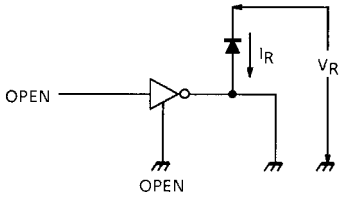
4. $I_{IN\ (OFF)}$



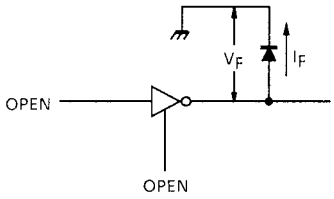
5. $V_{IN\ (ON)}$



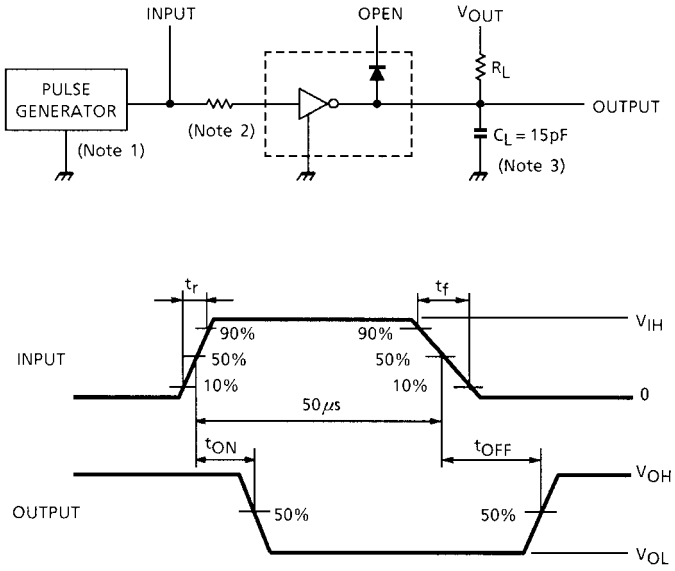
6. I_R



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: See below

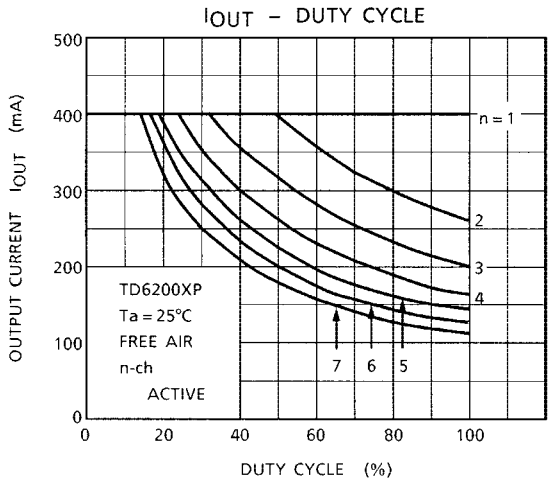
INPUT CONDITION

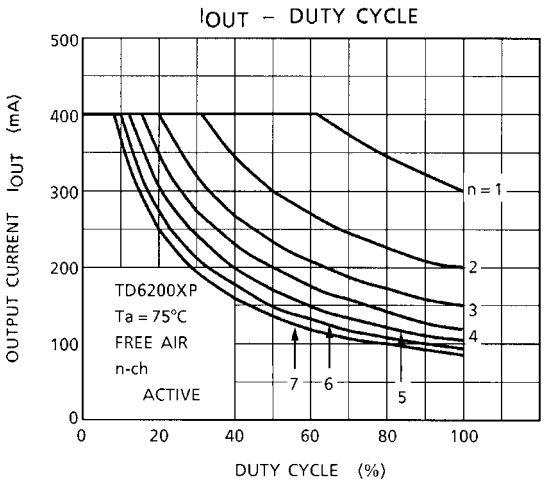
TYPE NUMBER	R1	V_{IH}
TD62001P / AP / F / AF	2.7 kΩ	3 V
TD62002P / AP / F / AF	0	13 V
TD62003P / AP / F / AF	0	3 V
TD62004P / AP / F / AF	0	8 V

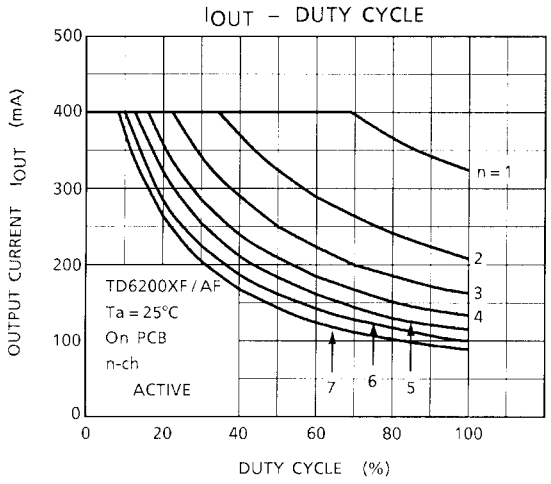
Note 3: C_L includes probe and jig capacitance.

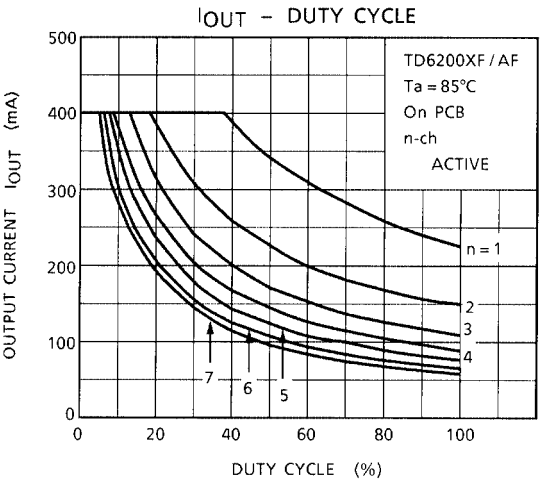
PRECAUTIONS for USING

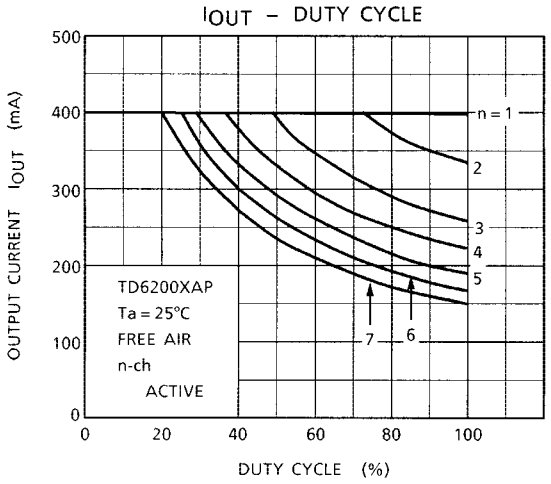
This IC does not include built-in protection circuits for excess current or overvoltage.
If this IC is subjected to excess current or overvoltage, it may be destroyed.
Hence, the utmost care must be taken when systems which incorporate this IC are designed.
Utmost care is necessary in the design of the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

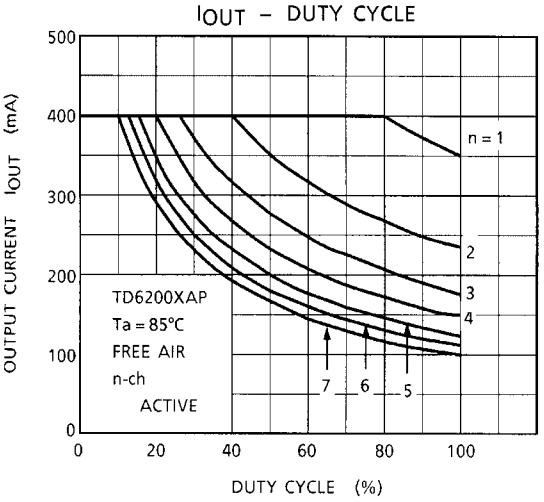

I_{OUT} – DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XP
Ta = 25°C
FREE AIR
n-ch
ACTIVE
n = 1
2
3
4
5
6
7


I_{OUT} – DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XP
Ta = 75°C
FREE AIR
n-ch
ACTIVE
n = 1
2
3
4
5
6
7

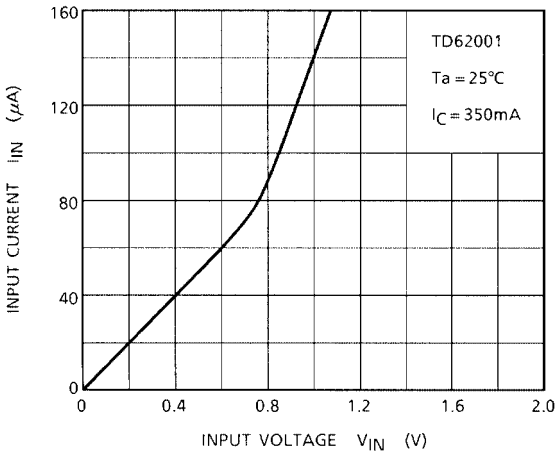

I_{OUT} – DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XF / AF
Ta = 25°C
On PCB
n-ch
ACTIVE
n = 1
2
3
4
5
6
7


I_{OUT} – DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XF / AF
Ta = 85°C
On PCB
n-ch
ACTIVE
n = 1
2
3
4
5
6
7

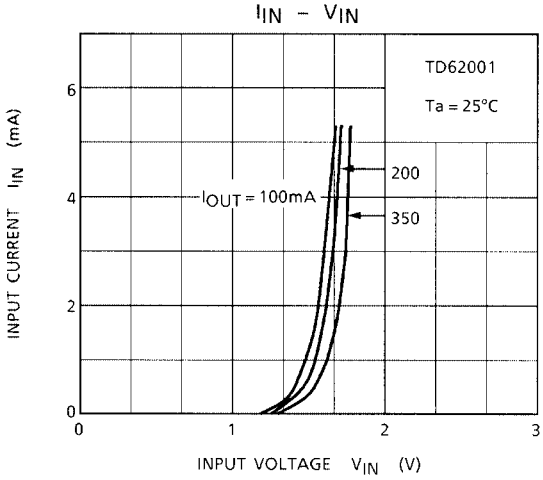

I_{OUT} – DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XAP
Ta = 25°C
FREE AIR
n-ch
ACTIVE
n = 1
2
3
4
5
6
7


I_{OUT} – DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XAP
Ta = 85°C
FREE AIR
n-ch
ACTIVE
n = 1
2
3
4
5
6
7

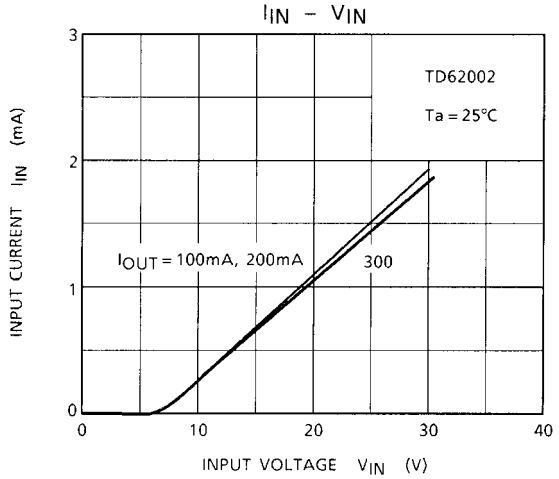
I_{IN} – V_{IN}



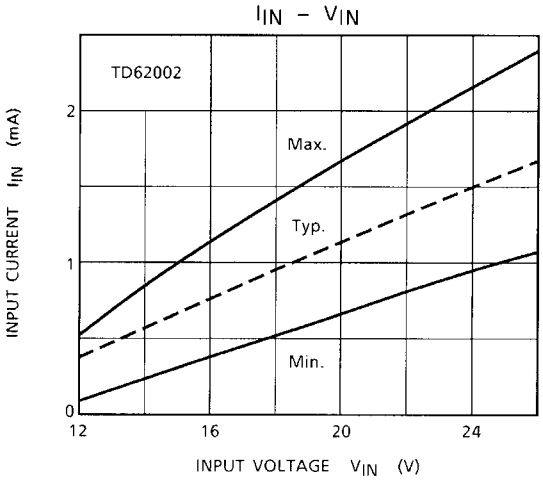
I_{IN} – V_{IN}



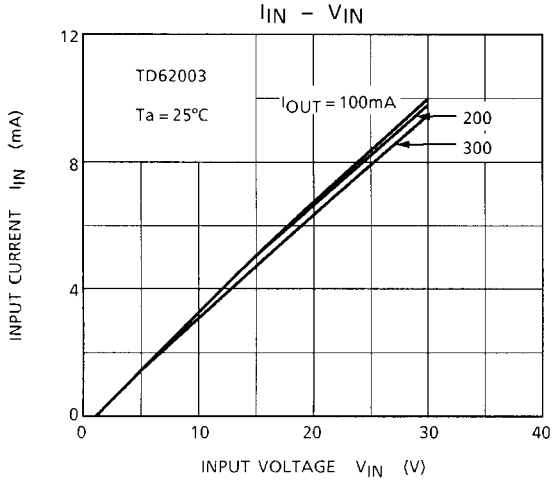
I_{IN} – V_{IN}



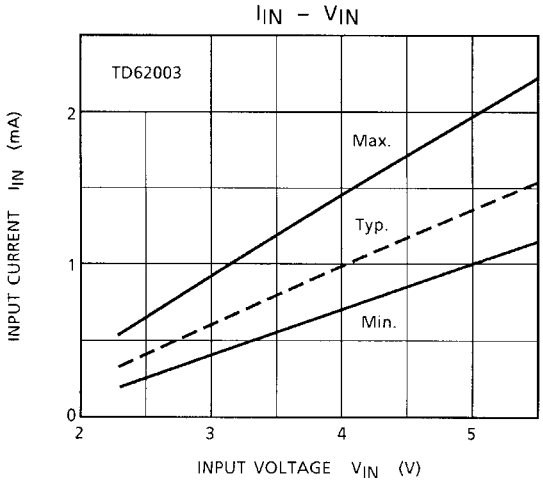
I_{IN} – V_{IN}



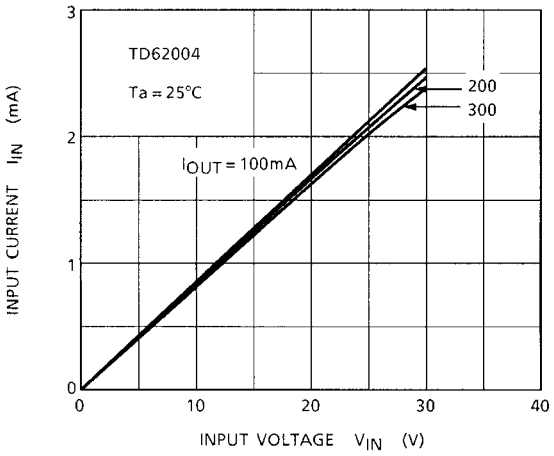
I_{IN} – V_{IN}



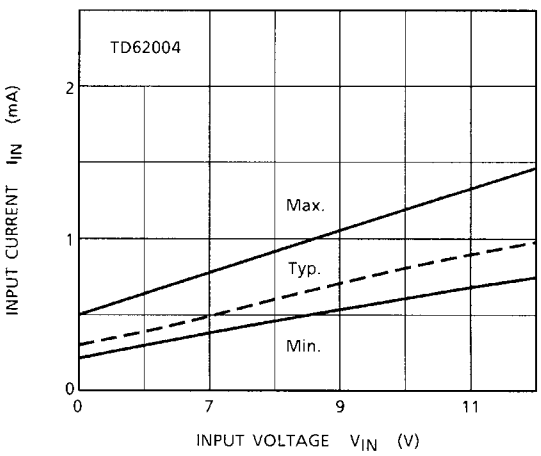
I_{IN} – V_{IN}



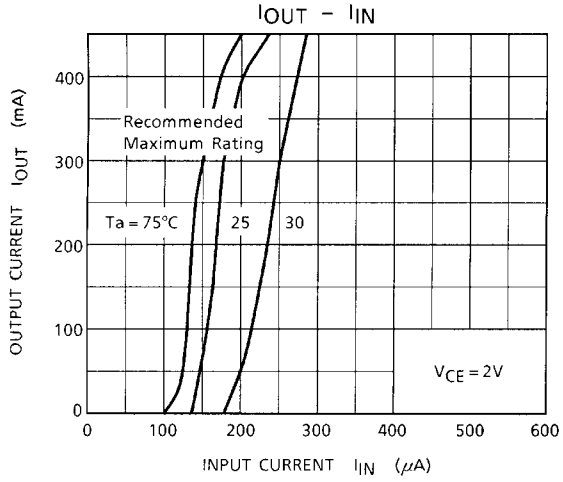
$I_N - V_{IN}$



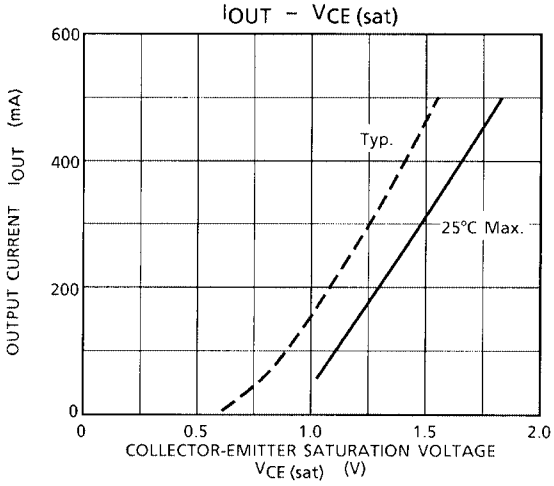
$I_N - V_{IN}$



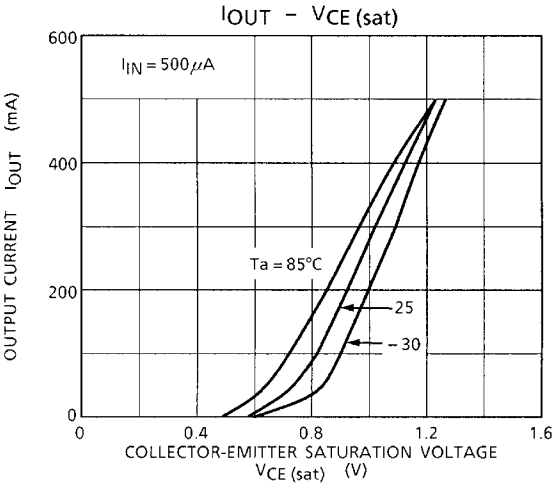
$I_{OUT} - I_{IN}$



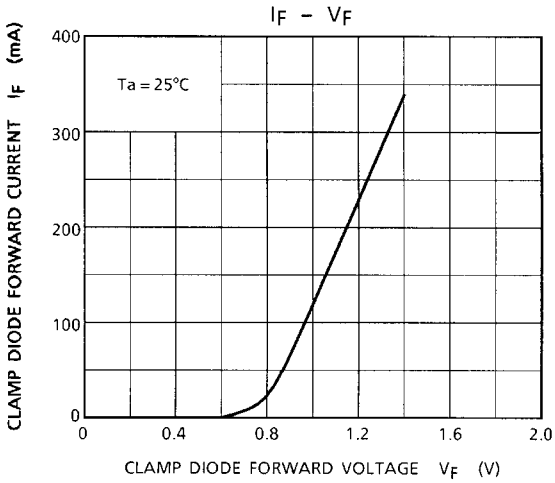
$I_{OUT} - V_{CE\,(sat)}$

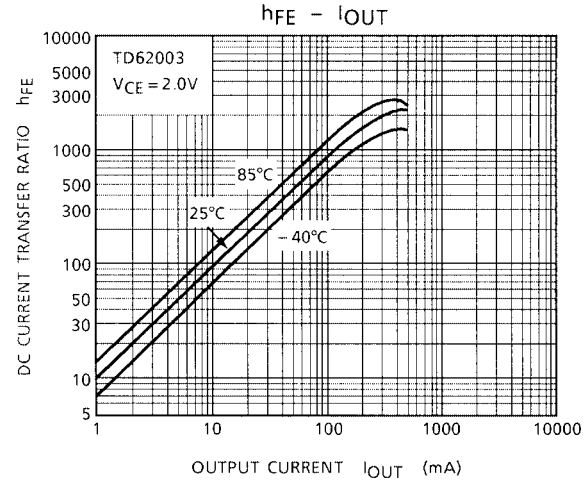


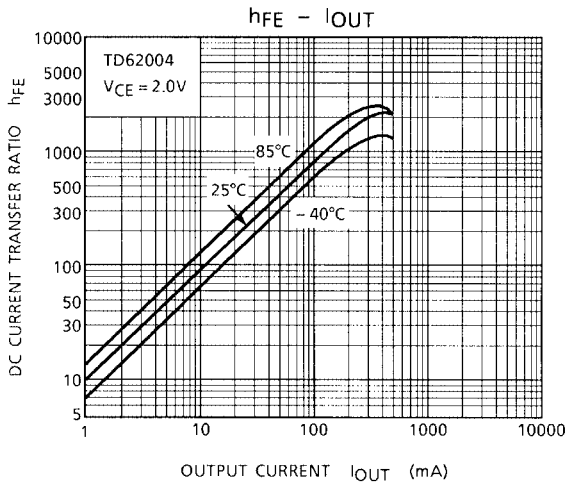
$I_{OUT} - V_{CE\,(sat)}$

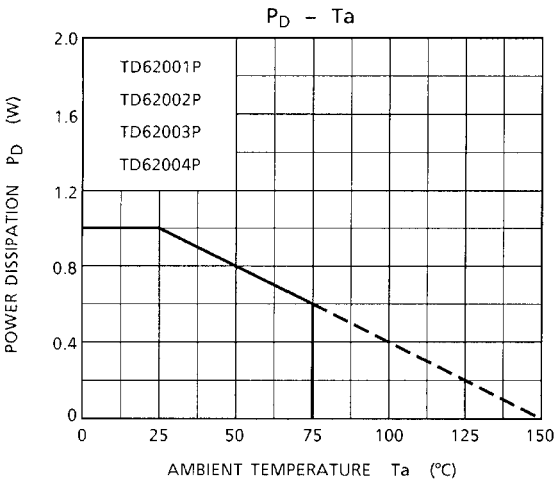


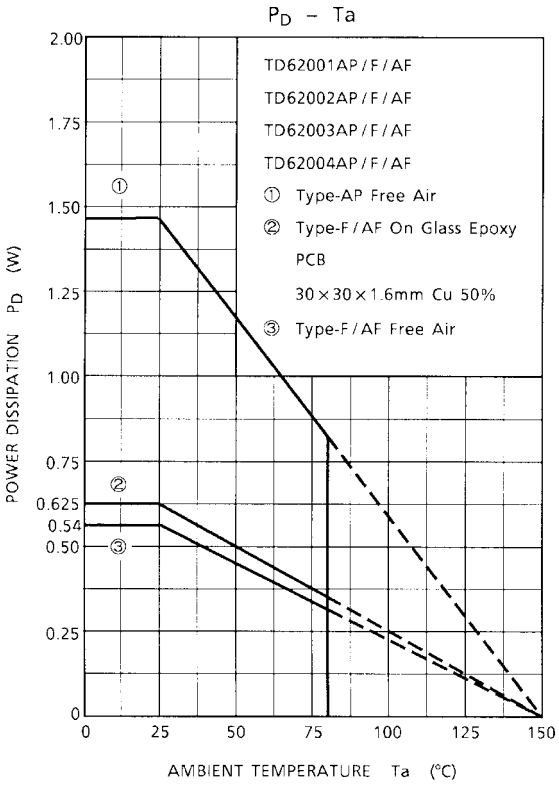
$I_F - V_F$




h_{FE} – I_{OUT}
TD62003
V_{CE} = 2.0V
85°C
25°C
– 40°C
DC CURRENT TRANSFER RATIO h_{FE}
OUTPUT CURRENT I_{OUT} (mA)
10000
5000
3000
1000
500
300
100
50
30
10
5
1
10
100
1000
10000

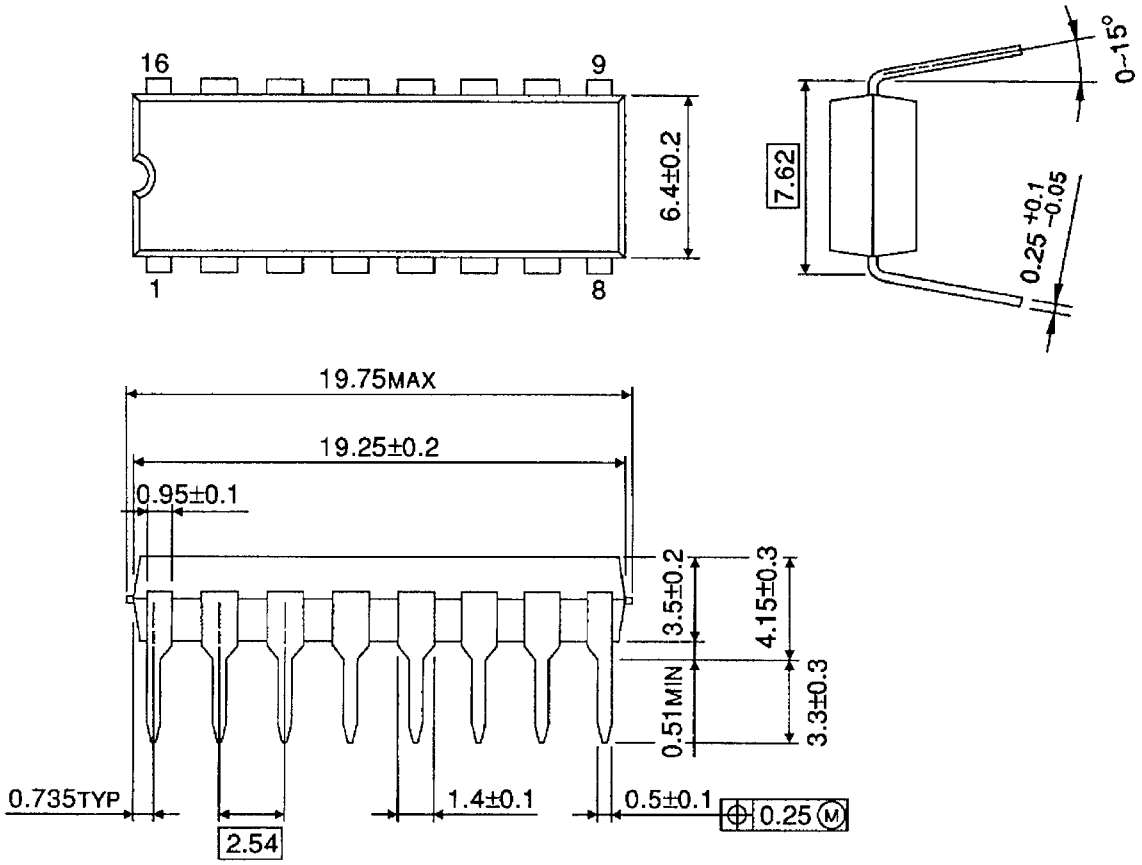

h_{FE} – I_{OUT}
TD62004
V_{CE} = 2.0V
85°C
25°C
– 40°C
DC CURRENT TRANSFER RATIO h_{FE}
OUTPUT CURRENT I_{OUT} (mA)
10000
5000
3000
1000
500
300
100
50
30
10
5
1
10
100
1000
10000


P_D – Ta
TD62001P
TD62002P
TD62003P
TD62004P
POWER DISSIPATION P_D (W)
AMBIENT TEMPERATURE Ta (°C)
2.0
1.6
1.2
0.8
0.4
0
0
25
50
75
100
125
150


P_D – Ta
TD62001AP/F/AF
TD62002AP/F/AF
TD62003AP/F/AF
TD62004AP/F/AF
① Type-AP Free Air
② Type-F/AF On Glass Epoxy PCB
30×30×1.6mm Cu 50%
③ Type-F/AF Free Air
POWER DISSIPATION P_D (W)
AMBIENT TEMPERATURE Ta (°C)
2.00
1.75
1.50
1.25
1.00
0.75
0.625
0.54
0.50
0.25
0
0
25
50
75
100
125
150

PACKAGE DIMENSIONS

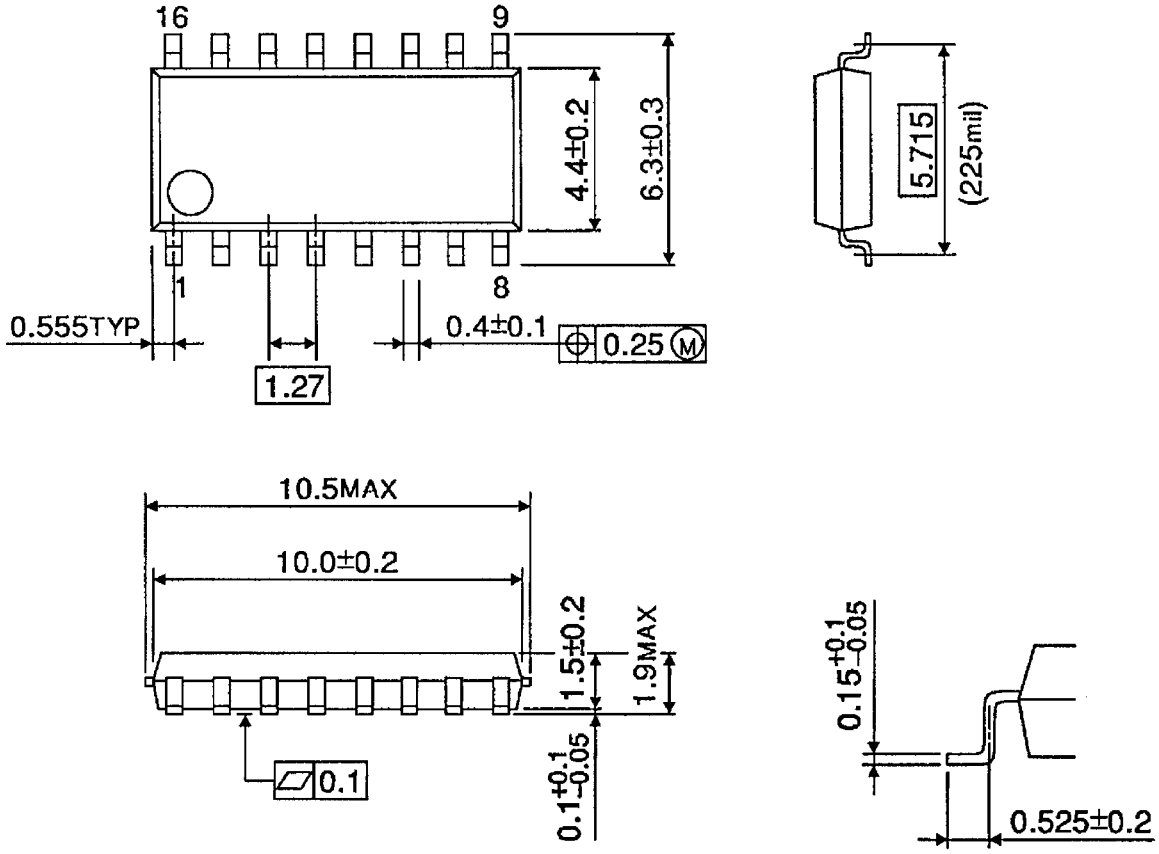
DIP16−P−300−2.54A Unit : mm



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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