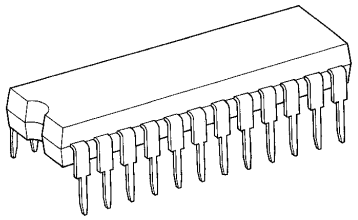
TOSHIBA BIPOLAR DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TD62708N

8CH HIGH CURRENT SOURCE DRIVER

The TD62708N is comprised of eight source current output stages and $\overline{\text{ENABLE}}$ inputs which can gate the outputs.
TD62708N features a large output source current of 1.8A and minimized output voltage change vs output current change. These features make the device optimum for driving the matrix of ink jet printer print heads, LEDs, and the scan side of resistor matrixes.
Before using this device, note the thermal conditions for usage.



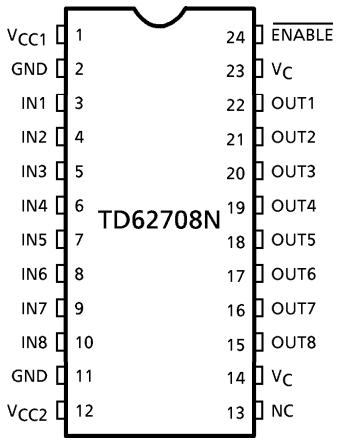
SDIP24-P-300-1.78

Weight : 1.2g (Typ.)

FEATURES

- Input terminal : High active
- $\overline{\text{Enable}}$ terminal : Low input output active mode
- Output current : I_{OUT} = 1.8A (MAX)
- A little change of output voltage
  : $\Delta V_{OH1} \leqq 0.45V$
  (at I_{OH} = 0.18A~1.44A)
- Package type : DIP24N
- Input compatible with TTL, 5V CMOS

PIN CONNECTION (TOP VIEW)



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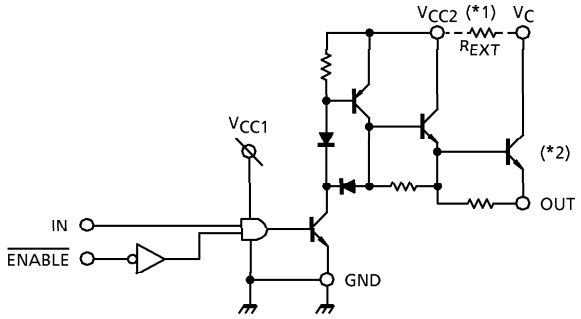
SCHEMATICS (EACH DRIVER)



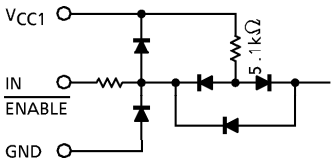
FUNCTION

IN	$\overline{\text{ENABLE}}$	OUT
H	L	ON
L	L	OFF
Don't Care	H	OFF

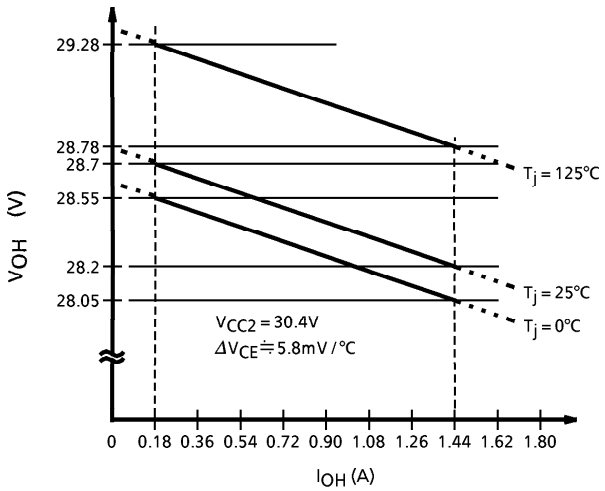
(*1) For normal use, connect V_{CC2} and V_C.
For applications whose thermal conditions are more demanding, TOSHIBA recommends an external resistor (R_{EXT} : approx. 0.9Ω / 2W) be connected between V_{CC2} and V_C.

(*2) When connecting an external resistor between BV_{CC2} and V_C, to avoid parasitic sub currents, set the voltage between V_C and OUT as 0.3V or more.
Set the external resistor value so that the voltage between V_C and OUT is 0.3V or more at the maximum temperature of the operating temperature range.

INPUT CIRCUIT : IN, $\overline{\text{ENABLE}}$



(Note) Since the states of the input pins (pins 3 to 10) are the same as those at high-level input, set the pins for unused channels to GND.



- Output voltage (Temperature characteristic)
  Output Voltage (V_{OH}) has a Temperature Characteristic of 5.8mV / °C, care must be taken to keep Junction Temp (T_j) within safety Limits.

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage 1	V_{CC1}	−0.5~7.0	V
Supply Voltage 2	V_{CC2}	−0.5~40	
Output Current	I_{OUT}	1.8 (Note)	A
Input Voltage	V_{IN}	−0.5~7.0	V
Input Current	I_{IN}	±4.0	mA
Power Dissipation	P_D	1.78	W
Janction Temperature	T_j	150	°C
Operating Temperature	T_{opr}	−40~85	°C
Storage Temperature	T_{stg}	−55~150	°C

(Note 1) 1.8A / ch (32μs, Duty ≦ 76%), Each Channel should not be switched on at same time.

(Note 2) When mounting the device on the PC board, and the temperature exceeds 25°C, derate to 14.2mW / °C.

RECOMMENDED OPERATING CONDITIONS

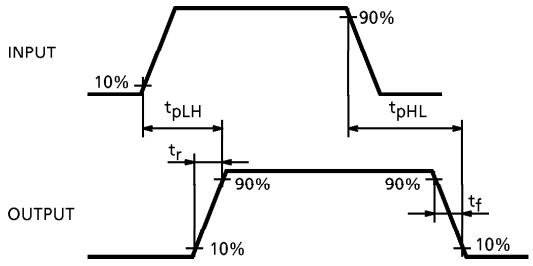
CHARACTERISTIC	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage 1	V_{CC1}	—	4.5	5.0	5.5	V
Supply Voltage 2	V_{CC2}	—	—	—	30	
Output Current	I_{OH} (Note)	—	—	—	1.44	A
Input Voltage	V_{IN} (H)	V_{IN} = H, V_{CC1} = 5.0V	2.4	—	V_{CC}	V
	V_{IN} (L)	V_{IN} = L, V_{CC1} = 5.0V	0	—	0.4	V
	V_{EN} (H)	V_{EN} = H, V_{CC1} = 5.0V	2.4	—	V_{CC}	V
	V_{EN} (L)	V_{EN} = L, V_{CC1} = 5.0V	0	—	0.4	V
Operating Temperature	T_{opr}	—	0	—	70	°C

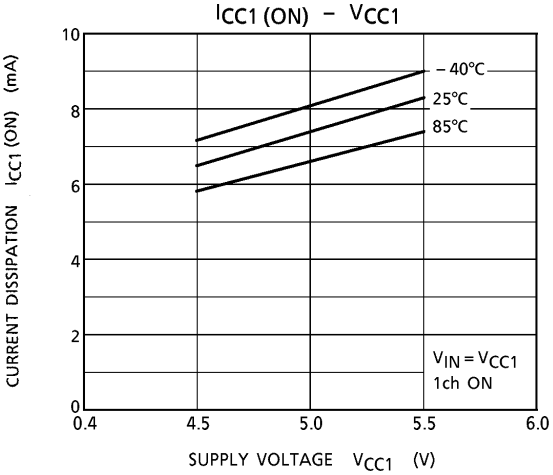
(Note) Each Channel should not be switched on at same time.

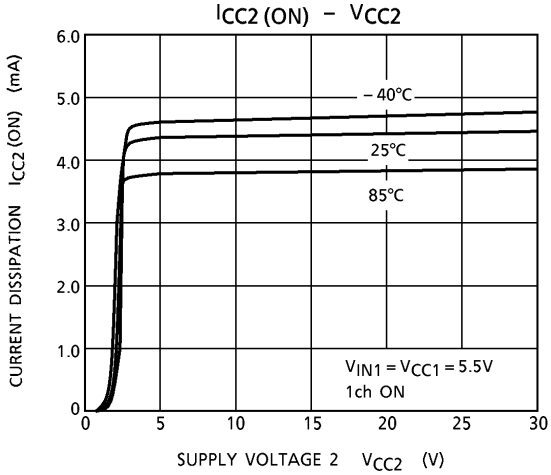
ELECTRICAL CHARACTERISTICS (Ta = 0~70°C)

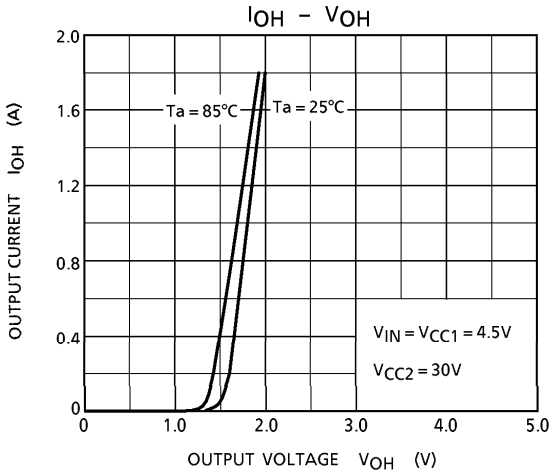
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Leakage Current	I_{L1}	—	V_{CC1} = 7.0V, IN = L, EN = H		—	—	100	μA
	I_{L2}		V_{CC2} = 30V, IN = L, EN = H		—	—	100	
	I_{L3}		V_C = 30V, IN = L, EN = H		—	—	100	
Input Current	I_{IN1}	—	V_{CC1} = 5.0V, V_{IN} = 5.0V		—	0	10	μA
	I_{IN2}		V_{CC1} = 5.0V, V_{IN} = 0V		0.55	0.8	1.1	mA
	I_{EN1}		V_{CC1} = 5.0V, V_{EN} = 5.0V		—	0	10	μA
	I_{EN2}		V_{CC1} = 5.0V, V_{EN} = 0V		0.55	0.8	1.1	mA
Input Voltage	V_{INH}	—	V_{CC1} = 5.0V		2.0	—	V_{CC} + 0.4	V
	V_{INL}		V_{CC1} = 5.0V		GND − 0.4	—	0.8	
	V_{ENH}		V_{CC1} = 5.0V		2.0	—	V_{CC} + 0.4	
	V_{ENL}		V_{CC1} = 5.0V		GND − 0.4	—	0.8	
Output Voltage	V_{OH1}	—	I_{OH} = 1.44A	V_{CC2} = 30V	27.0	27.5	—	V
	V_{OH2}		I_{OH} = 0.18A		27.5	28.0	—	
Change Of Output Voltage	ΔV_{OH1}	—	$V_{OH1} - V_{OH2}$ (T_j = 25°C)		—	0.3	0.45	V
Output Voltage Temperature Characteristic	ΔV_{CE2}	—	V_{OH} (T_j = 105°C) − V_{OH} (T_j = 25°C) I_{OH} = 0.18A		—	0.5	—	V
Propagation Delay Time	t_{pLH1}	—	$V_{CC1} = V_{IN}$ = 4.5V V_{CC2} = 30V	I_{OUT} = 0.18A	—	0.1	1.0	μs
	t_{pLH2}			I_{OUT} = 1.44A	—	0.2	1.0	
	t_{pHL1}			I_{OUT} = 0.18A	—	1.0	3.5	
	t_{pHL2}			I_{OUT} = 1.44A	—	1.5	3.5	
Rise Time	t_{r1}	—	$V_{CC1} = V_{IN}$ = 4.5V V_{CC2} = 30V	I_{OUT} = 0.18A	—	0.05	0.5	
	t_{r2}			I_{OUT} = 1.44A	—	0.1	0.5	
Fall Time	t_{f1}			I_{OUT} = 0.18A	—	0.3	2.0	
	t_{f2}			I_{OUT} = 1.44A	—	0.3	2.0	

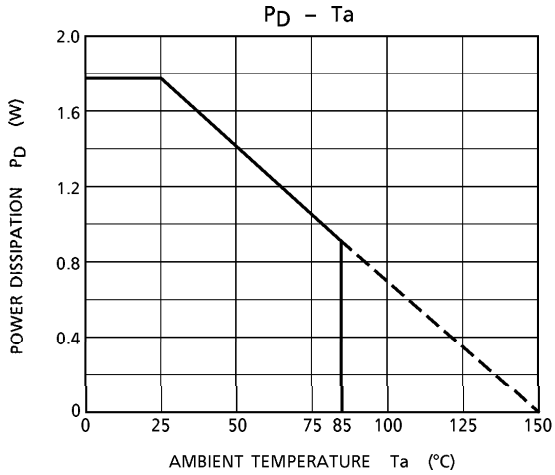
AC TEST CIRCUIT




I_{CC1} (ON) – V_{CC1}
CURRENT DISSIPATION I_{CC1} (ON) (mA)
10
8
6
4
2
0
0.4
4.5
5.0
5.5
6.0
– 40°C
25°C
85°C
$V_{IN} = V_{CC1}$
1ch ON
SUPPLY VOLTAGE V_{CC1} (V)


I_{CC2} (ON) – V_{CC2}
CURRENT DISSIPATION I_{CC2} (ON) (mA)
6.0
5.0
4.0
3.0
2.0
1.0
0
0
5
10
15
20
25
30
– 40°C
25°C
85°C
$V_{IN1} = V_{CC1} = 5.5V$
1ch ON
SUPPLY VOLTAGE 2 V_{CC2} (V)


I_{OH} – V_{OH}
OUTPUT CURRENT I_{OH} (A)
2.0
1.6
1.2
0.8
0.4
0
0
1.0
2.0
3.0
4.0
5.0
Ta = 85°C
Ta = 25°C
$V_{IN} = V_{CC1} = 4.5V$
$V_{CC2} = 30V$
OUTPUT VOLTAGE V_{OH} (V)


P_D – Ta
POWER DISSIPATION P_D (W)
2.0
1.6
1.2
0.8
0.4
0
0
25
50
75
85
100
125
150
AMBIENT TEMPERATURE Ta (°C)

- Thermal calculation

Where, power dissipation = $(V_{CC1} \times I_{CC1}) + (V_{CC2} \times I_{CC2} \times ch \times Duty) + (V_{OH} \times I_{OH} \times ch \times Duty)$
and the transient thermal resistance of DIP24N (R + h) = 70°C / W, the junction temperature (Tj) is :

$T_{j\,(MAX)} \geqq (P_D \times R + h) + Ta\,(MAX)$ ····· expression (A)

Conditions	:	V_{CC1} = 5V (I_{CC1} = approx. 8mA), V_{CC2} = 30V (I_{CC2} = approx. 5mA), 1ch on V_{OH} = approx. 2.0V, I_{OH} = 1.44A, $T_{j\,(MAX)}$ = 120°C, ambient temperature (MAX) : Ta = 70°C

(1) When V_{CC2} and V_C are connected :

Due to expression (a), for designs without cooling fins, duty = approx. 20% is required, as the following calculation shows :

$P_D = (5V \times 8mA) + (30V \times 5mA \times 1ch \times 0.2) + (2.0V \times 1.44A \times 1ch \times 0.2)$
$= 40mW + 30mW + 576mW$
$= 646mW$

$T_{j\,(MAX)} \geqq (646mW \times 70°C / W) + 70°C$ = approx. 115°C ····· OK

(2) When an external resistor ($R_{EXT} = 0.9\Omega$) is connected between V_{CC2} and V_C :

Change the above condition :

$V_{OH} = 2.0V - (0.9\Omega \times 1.44A)$
$= 0.7V$

P_D when substituted in expression (a) :

$P_D = (5V \times 8mA) + (30V \times 5mA \times 1 \times 0.2) + (0.7V \times 1.44A \times 1 \times 0.2)$
$= 40mW + 30mW + 202mW$
$= 272mW$

$T_{j\,(MAX)} \geqq (272mW \times 70°C / W) + 70°C$ = approx. 89°C

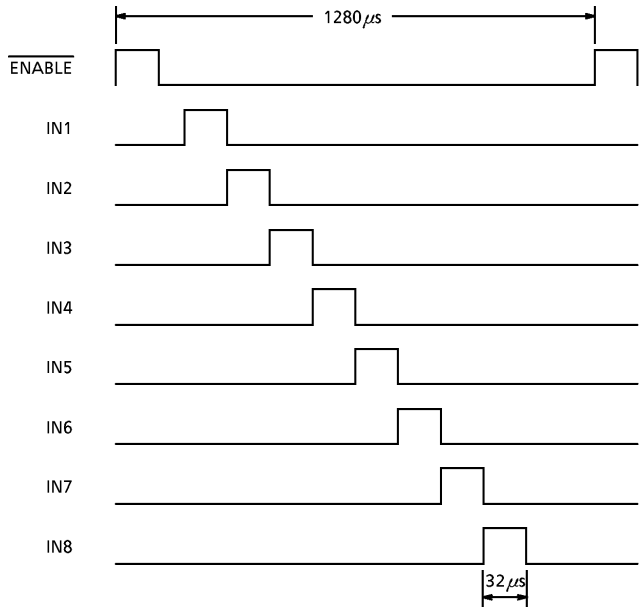
when T_j (MAX) = 120°C

⋮ (calculation omitted)

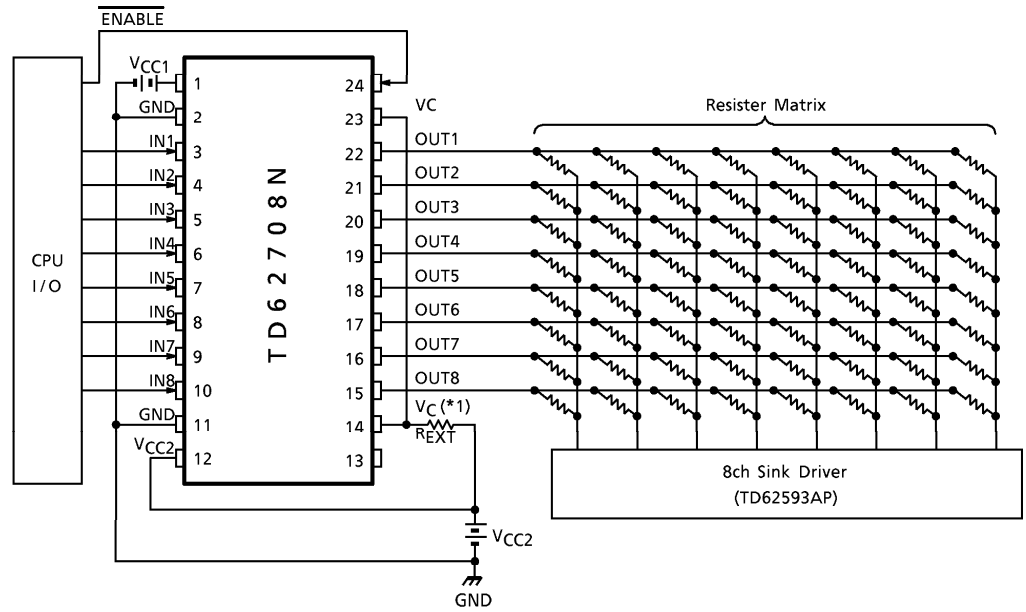
Duty can be approx. 58%.

- Duty (when duty = 20%)

  Condition : pulse width = 32μs (cycle = 1280μs)
  Duty = (32μs × 8ch) ÷ 1280μs = 20%



APPLICATION CIRCUIT



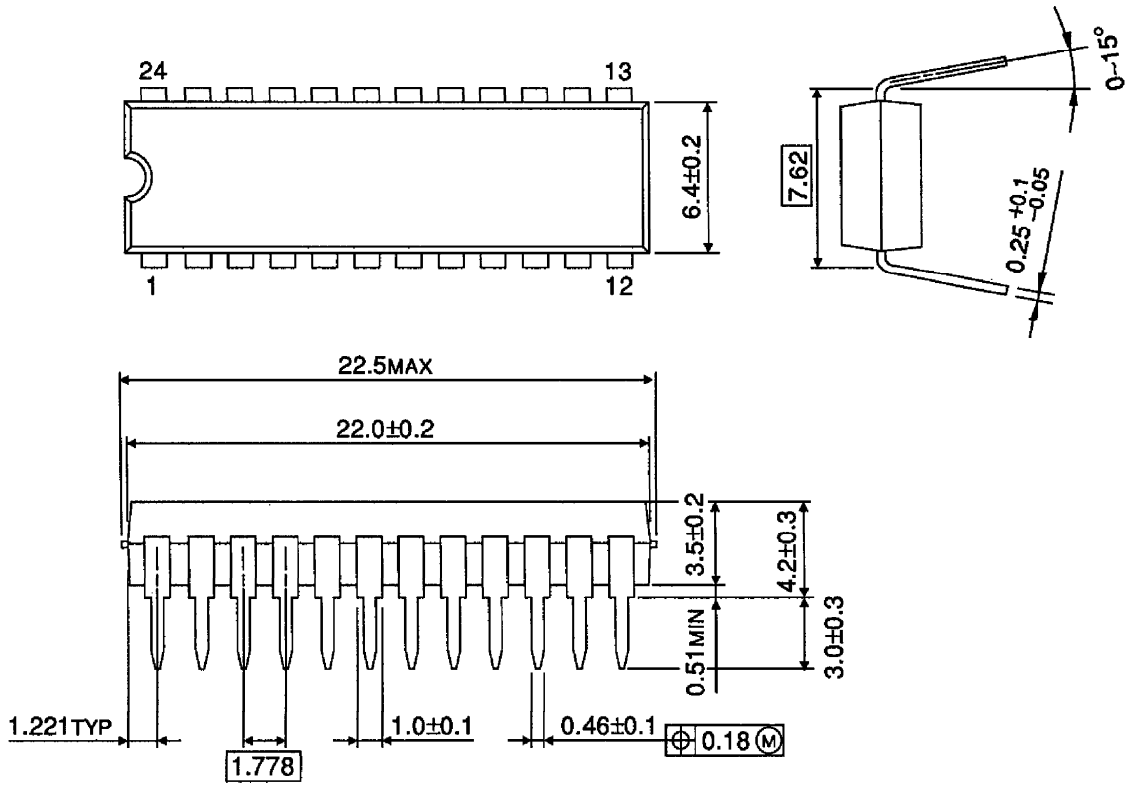
(Note 1) TOSHIBA recommends external resistor R_{EXT} (approx. 0.9Ω / 2W) be connected between V_{CC2} and V_C.

PRECAUTIONS for USING

Utmost care is necessary in the design of the output line, V_{CC} (V_{CC1}, V_{CC2}, V_C) and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

OUTLINE DRAWING

SDIP24-P-300-1.78 Unit : mm



Weight : 1.2g (Typ.)