Interface driver for microcomputer peripheral and display devices

BA13002F

The BA13002F is a high current transistor array consisting of six circuits of Darlington transistors. Because it incorporates built-in surge-absorbing diodes and base current-control resistors needed when using inductive loads such as relay coils, attachments can be kept to a minimum.
With an output withstanding voltage as high as 20V and an output current (sink current) of 320 mA, this product is ideal for use with various drivers and as an interface with other elements.

●Applications
Drivers for LEDs, lamps, relays and solenoids
Interface with other elements

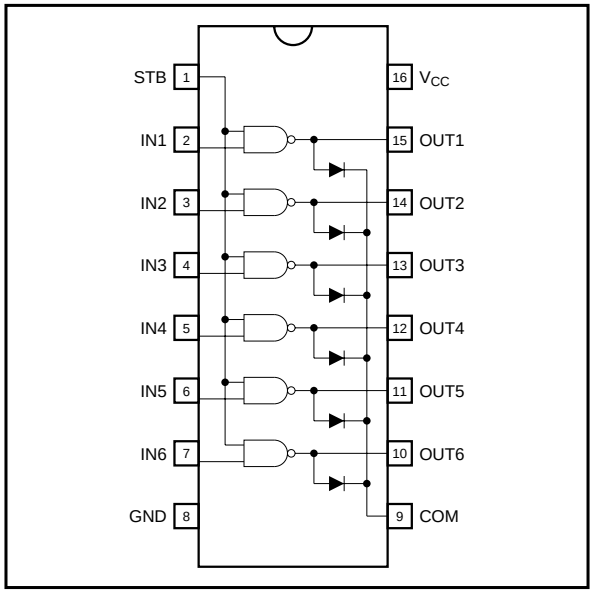
●Features
1) Output withstanding voltage (BVceo) of 20V.
2) High output current (Io) of 320 mA (Max.).
3) High current transfer ratio (h_{FE}) of 1000 (Min.).
4) Wide range of voltages (– 25 to 20 V) can be applied to input.
5) Equipped with output surge-absorbing clamp diode. (Note: Refer to the "Operation notes.")
6) Equipped with strobe input pin.

●Absolute maximum ratings (Ta = 20°C to + 75°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V_{CC}	10	V
Output withstanding voltage	V_{CEO}	– 0.5 ~ + 20	V
Output current	I_O	320	mA
Input voltage	V_I	– 25 ~ + 20	V
Strobe input voltage	$V_{I\ (STB)}$	20	V
Clamp diode reverse voltage	$V_{R\ (D)}$	20	V
Clamp diode forward current	$I_{F\ (D)}$	320	mA
Power dissipation (Ta = 25°C)	Pd	500*1	mW
Operating temperature	Topr	– 20 ~ + 75	°C
Storage temperature	Tstg	– 55 ~ + 125	°C

*1 Reduced by 5.0mW for each increase in Ta of 1°C over 25°C.
(when mounted on a 50 × 50 × 1.6mm glass epoxy board).

●Block diagram

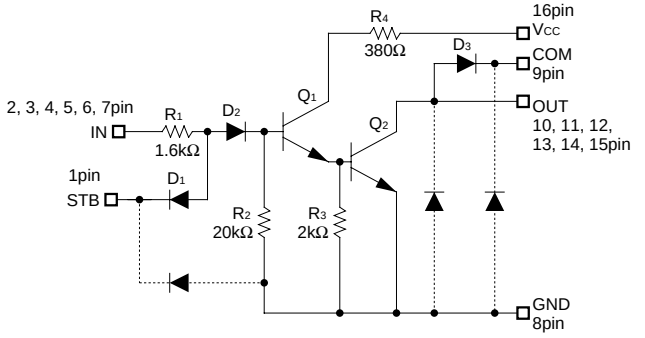


●Recommended operating conditions (Ta = – 20°C to + 75°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Power supply voltage	V_{CC}	3	—	8	V	—
Output voltage	V_O	0	—	20	V	—
Output current	I_O	0	—	300	mA	Duty cycle of 20% or less: Vcc = 6.5V
		0	—	150	mA	Duty cycle of 40% or less: Vcc = 6.5V
Input high level voltage (strobe)	$V_{IH\ (STB)}$	2.4	—	18	V	—
Input low level voltage (strobe)	$V_{IL\ (STB)}$	0	—	0.2	V	—
Input high level voltage	V_{IH}	3.2	—	18	V	I_O = 300mA
Input low level voltage	V_{IL}	0	—	0.7	V	$I_{O\ (leak)}$ = 50μA

●Internal circuit configuration

BA13002F



(Resistor values are typical values.)

●Electrical characteristics (unless otherwise noted, Ta = – 25°C to + 75°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions		Measurement circuit
Output withstanding voltage	V_{CEO}	20	—	—	V	V_{CC} = 8V, V_I = 18V, $V_{I\,(STB)}$ = 0.2V, I_{CEO} = 100µA		Fig. 1
Output saturation voltage	$V_{CE\,(sat)}$	—	0.6	1.0	V	V_I = 7V, $V_{I\,(STB)}$ = 2.4V	V_{CC} = 6.5V, I_O = 300mA	Fig. 2
		—	0.5	0.85	V		V_{CC} = 6.5V, I_O = 250mA	
		—	0.3	0.5	V		V_{CC} = 3V, I_O = 120mA	
Clamp diode forward voltage	$V_{F\,(D)}$	—	1.4	2.4	V	$I_{F\,(D)}$ = 320mA		Fig. 5
Clamp diode reverse voltage	$V_{R\,(D)}$	20	40	—	V	$I_{R\,(D)}$ = 100µA		Fig. 6
Power supply current	I_{CC}	—	120	200	mA	V_{CC} = 8V, V_I = 7V (all inputs), $V_{I\,(STB)}$ = 2.4V		Fig. 7
DC current transfer ratio	h_{FE}	1000	3000	—	—	V_{CE} = 4V, V_{CC} = 6.5V, I_O = 300mA, Ta = 25°C		Fig. 2
Turn-on time	t_{ON}	—	0.1	—	µs	Refer to measurement circuit.		Fig. 8
Turn-off time	t_{OFF}	—	0.1	—				
Input current	I_I	—	0.5	1.4	mA	V_{CC} = 8V, V_I = 3.2V, $V_{I\,(STB)}$ = 2.4V		Fig. 3
Input reverse current	I_R	—	—	– 20	µA	V_{CC} = 8V, V_I = – 25V		
Strobe input current	$I_{I\,(STB)}$	—	– 7.9	—	mA	V_{CC} = 8V, V_I = 3.2V (all inputs), $V_{I\,(STB)}$ = 0.2V		Fig. 4
Strobe input reverse current	$I_{R\,(STB)}$	—	—	20	µA	V_{CC} = 8V, V_I = 0V, $V_{I\,(STB)}$ = 20V		

●Measurement circuits

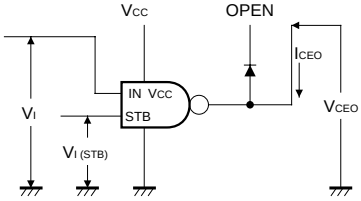


Fig. 1 Output withstanding voltage V_{CEO}

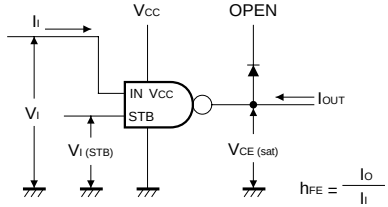


Fig. 2 Output saturation voltage $V_{CE\,(sat)}$ • DC current transfer ratio h_{FE}

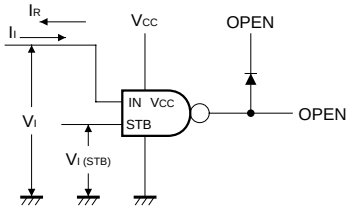


Fig. 3 Input current I_I • Input reverse current I_R

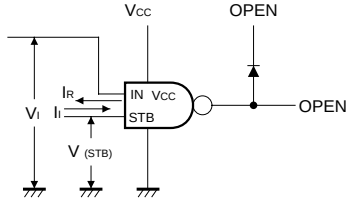


Fig. 4 Strobe input current $I_{I\,(STB)}$ • Strobe input reverse current $I_{R\,(STB)}$

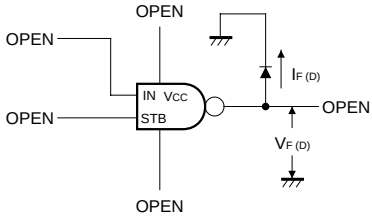


Fig. 5 Clamp diode forward voltage $V_{F\,(D)}$

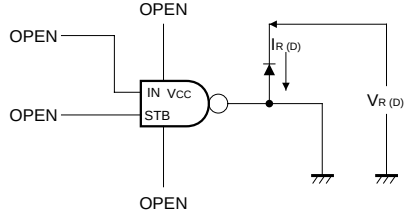


Fig. 6 Clamp diode reverse voltage $V_{R\,(D)}$

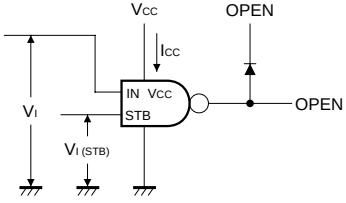
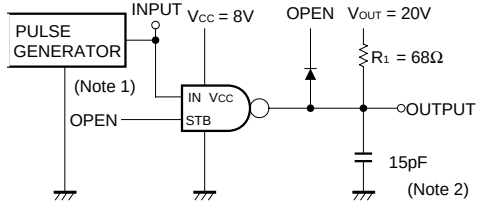


Fig. 7 Power supply current I_{CC}



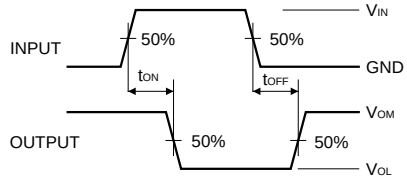


Fig. 8 Turn-on time t_{ON}
Turn-off time t_{OFF}

(Note 1) Pulse width: 10μs, duty cycle ≦ 5%
(Note 2) Including probe capacitance

●Circuit operation

Input / output logic table

IN	STB	OUT
L	L	H
H	L	H
L	H	H
H	H	L

The driver operates based on the logic in the above table.

●Application example

BA13002F

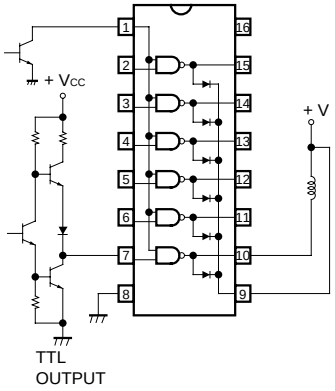


Fig. 9

●Operation notes

Make sure that the duty cycle – output current characteristic range is not exceeded.

Figure 10 shows the configuration of the on-chip diode for surge absorption. In the construction of the surge-absorbing diode, there is an N-P junction between the N-layer (N-well + BL) and the substrate (P-sub) so that when the diode is on, current flows from the output pin to the substrate. In terms of the vertical construction, this diode is configured similar to a PNP transistor.

When using the surge-absorbing diode, take appropriate measures regarding the thermal characteristics of the design considering the current that will be handled. Also, if motor back-rush current or other conditions that will result continued surge current to flow to the surge-absorbing diode can be foreseen, we strongly recommend connecting a Schottky barrier diode (or other type of diode with a low forward voltage) in parallel with the surge-absorbing diode to construct a bypass route for the surge current.

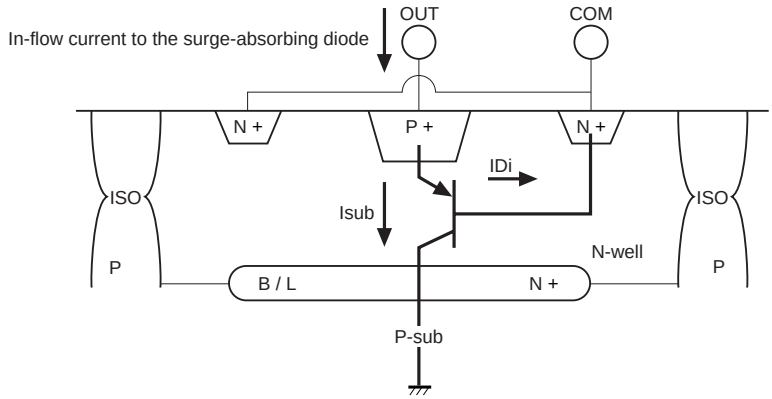


Fig. 10 Vertical construction of the surge-absorbing diode

●Thermal derating curve

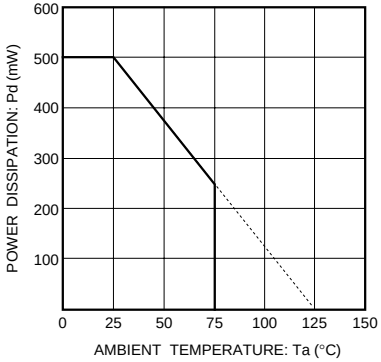


Fig. 11

●Electrical characteristic curves

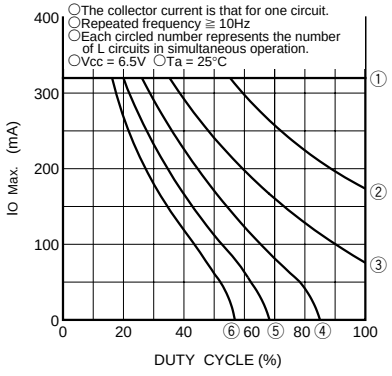


Fig. 12 Duty cycle vs. collector current (Ⅰ)

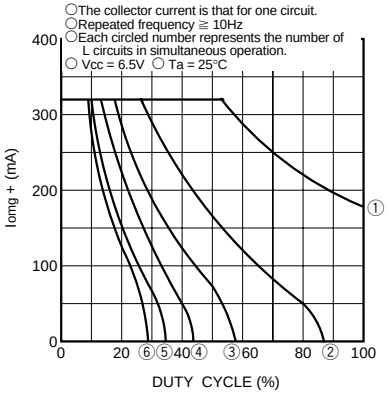


Fig. 13 Duty cycle vs. collector current (Ⅱ)

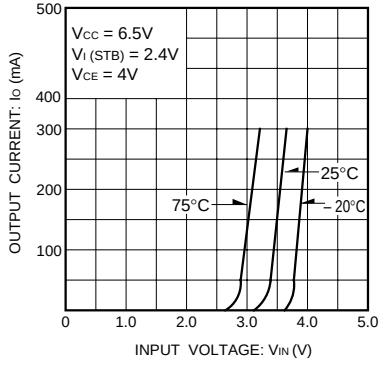


Fig. 14 Output current vs. input voltage

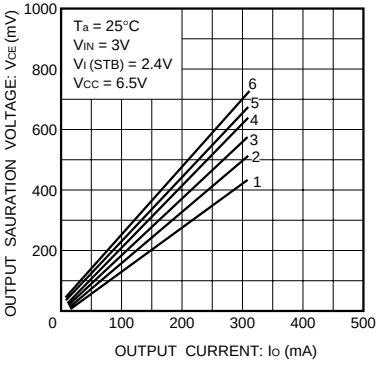


Fig. 15 Output saturation voltage vs. output current

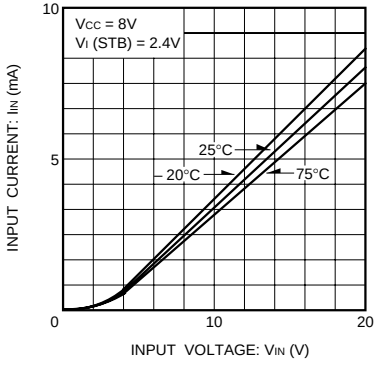


Fig. 16 Input current vs. input voltage

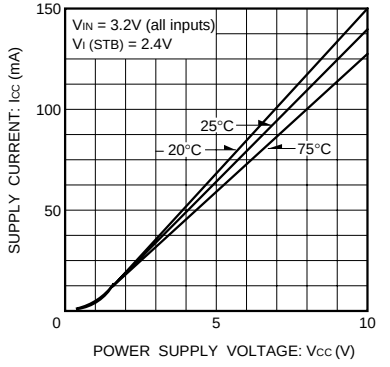


Fig. 17 Power supply current vs. power supply voltage

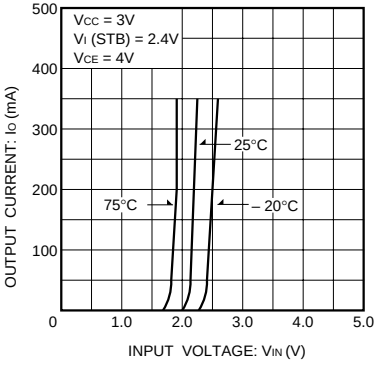


Fig. 18 Output current vs. input voltage (Ⅰ)

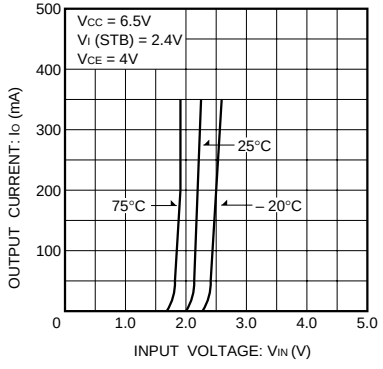


Fig. 19 Output current vs. input voltage (Ⅱ)

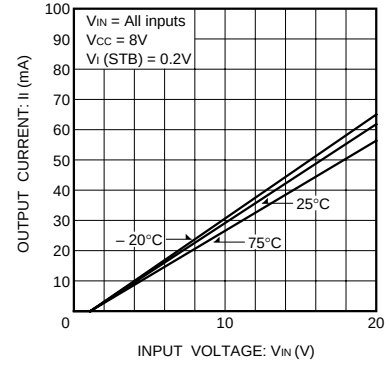


Fig. 20 Input current vs. input voltage

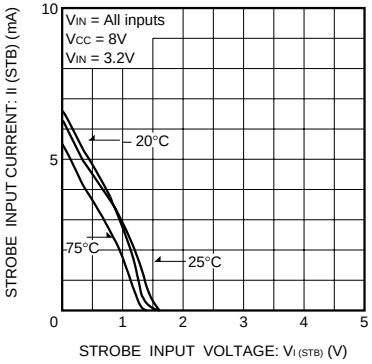


Fig. 21 Strobe terminal input current vs. input voltage

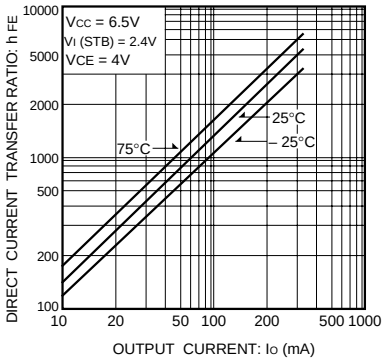
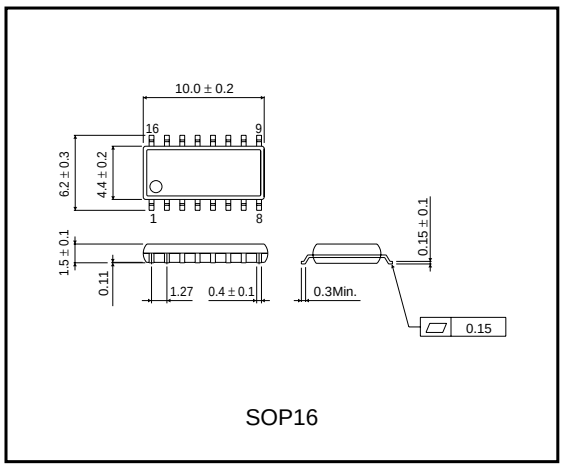


Fig. 22 DC current transfer ratio

●External dimensions (Units: mm)



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