

TOSHIBA Transistor Silicon NPN Epitaxial Type (Darlington Power)

# 2SD2686

Solenoid Drive Applications  
 Motor Drive Applications

- High DC current gain:  $h_{FE} = 2000$  (min) ( $V_{CE} = 2\text{ A}$ ,  $I_C = 1\text{ A}$ )
- Zener diode included between collector and base

## Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

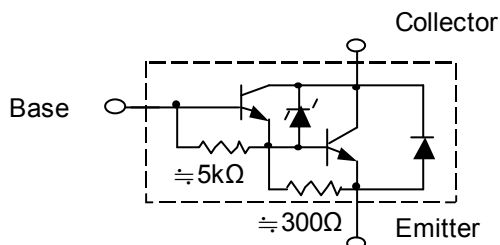
Characteristic	Symbol	Rating	Unit
Collector-base voltage	$V_{CBO}$	50	V
Collector-emitter voltage	$V_{CEO}$	$60 \pm 10$	V
Emitter-base voltage	$V_{EBO}$	8	V
Collector current	DC	$I_C$	1
	Pulse	$I_{CP}$	3
Base current	$I_B$	0.5	A
Collector power dissipation	DC	$P_C$ (Note 1)	1.0
	$t = 10\text{ s}$		2.5
Junction temperature	$T_j$	150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55 to 150	$^\circ\text{C}$

Note 1: Mounted on an FR4 board (glass-epoxy; 1.6 mm thick; Cu area, 645 mm<sup>2</sup>)

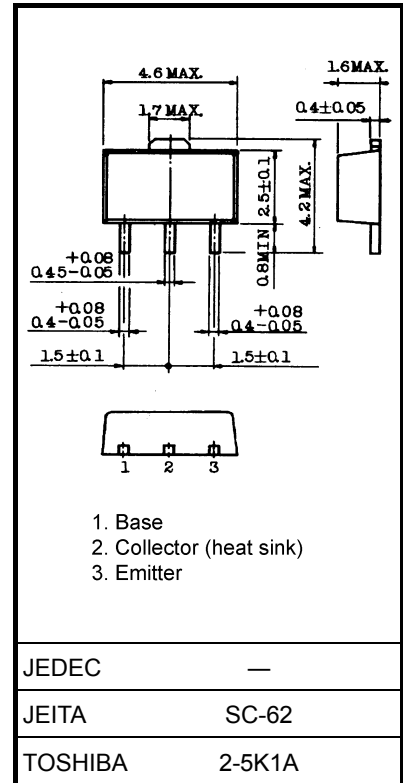
Note 2: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

## Equivalent Circuit



Unit: mm

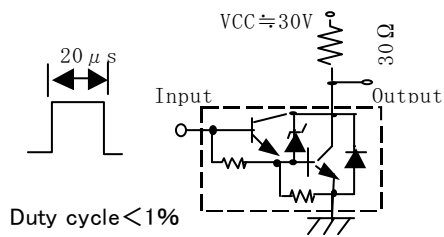


Weight: 0.05 g (typ.)

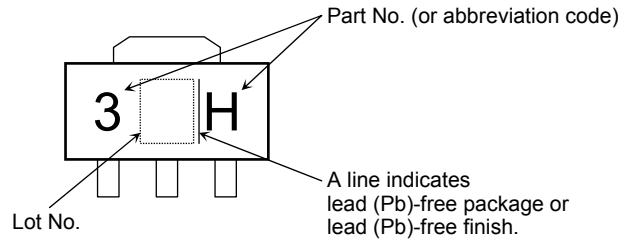
**Electrical Characteristics (Ta = 25°C)**

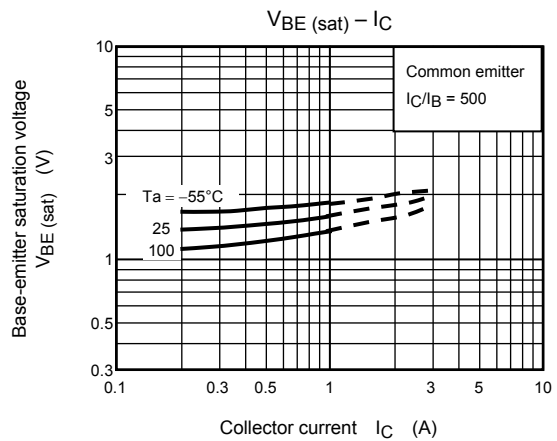
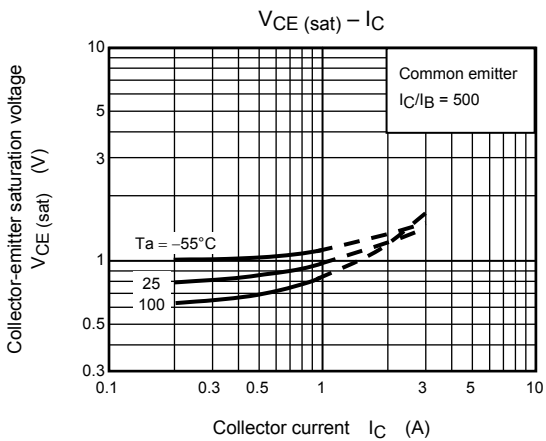
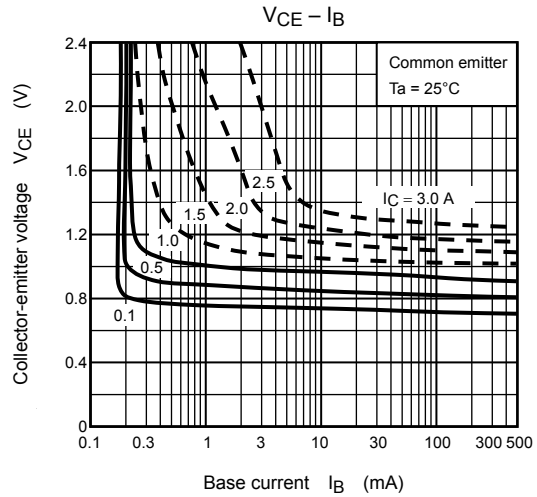
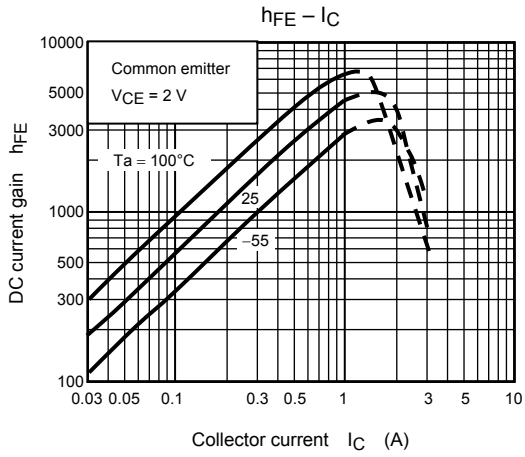
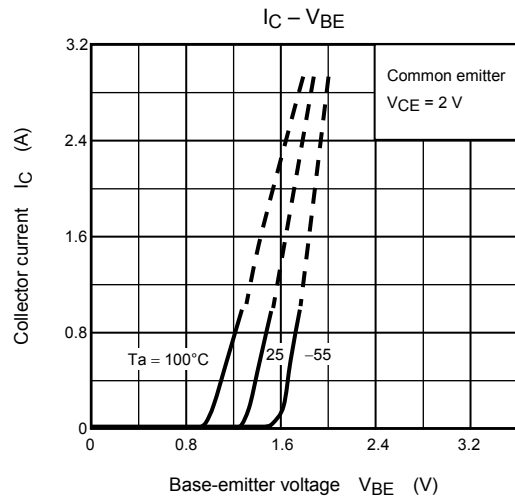
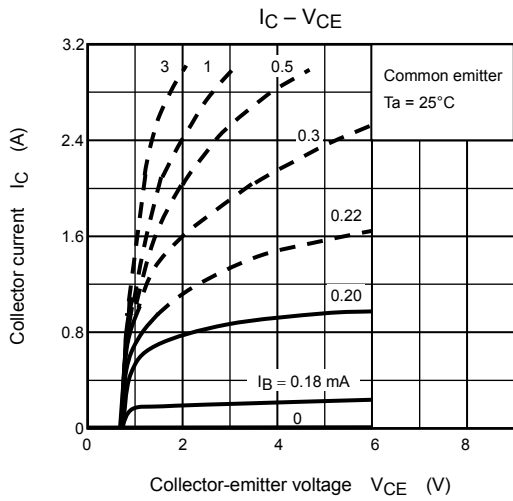
Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cutoff current		$I_{CBO}$	$V_{CB} = 45\text{ V}, I_E = 0$	—	—	10	$\mu\text{A}$
		$I_{CEO}$	$V_{CE} = 45\text{ V}, I_E = 0$	—	—	10	$\mu\text{A}$
Emitter cutoff current		$I_{EBO}$	$V_{EB} = 8\text{ V}, I_C = 0$	0.80	—	4.0	mA
Collector-emitter breakdown voltage		$V_{(BR)CEO}$	$I_C = 10\text{ mA}, I_B = 0$	50	60	70	V
DC current gain		$h_{FE}$	$V_{CE} = 2\text{ V}, I_C = 1.0\text{ A}$	2000	—	—	
Collector-emitter saturation voltage		$V_{CE(sat)}(1)$	$I_C = 0.5\text{ A}, I_B = 1\text{ mA}$	—	—	1.2	V
		$V_{CE(sat)}(2)$	$I_C = 1.0\text{ A}, I_B = 1\text{ mA}$	—	—	1.5	V
Base-emitter saturation voltage		$V_{BE(sat)}$	$I_C = 1.0\text{ A}, I_B = 1\text{ mA}$	—	—	2.0	V
Switching time	Rise time	$t_{on}$	See Figure 1 circuit diagram. $V_{CC} \approx 30\text{ V}, R_L = 30\ \Omega$	—	0.4	—	$\mu\text{s}$
	Storage time	$t_{stg}$		—	4.0	—	
	Fall time	$t_f$		—	0.6	—	

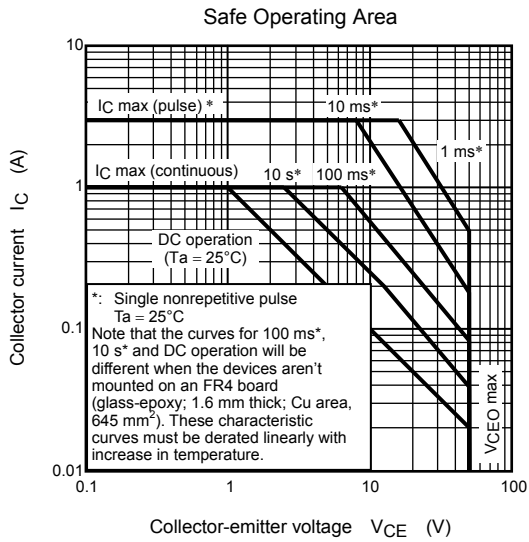
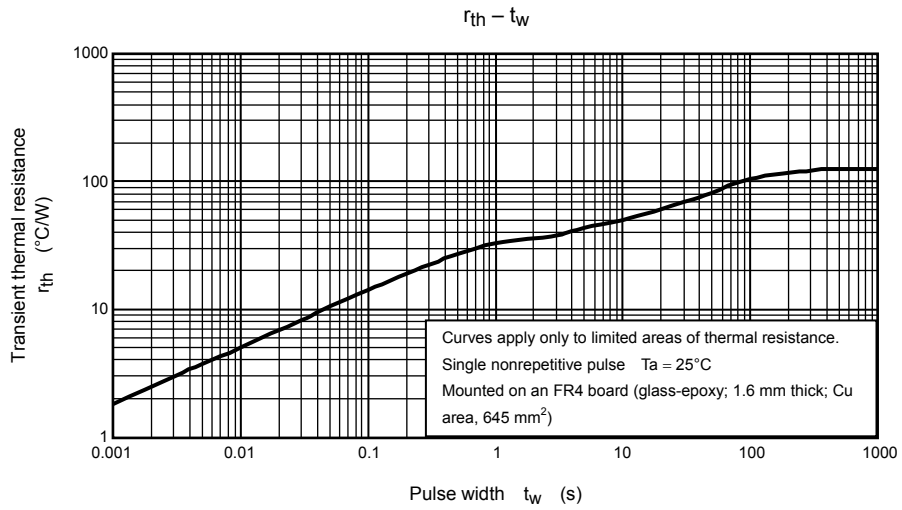
**Figure 1. Switching Time Test Circuit & Timing Chart**



**Marking**







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