TOSHIBA Multi-Chip Transistor Silicon NPN / PNP Epitaxial Type

TPC6902

High-Speed Switching Applications
MOS Gate Drive Applications

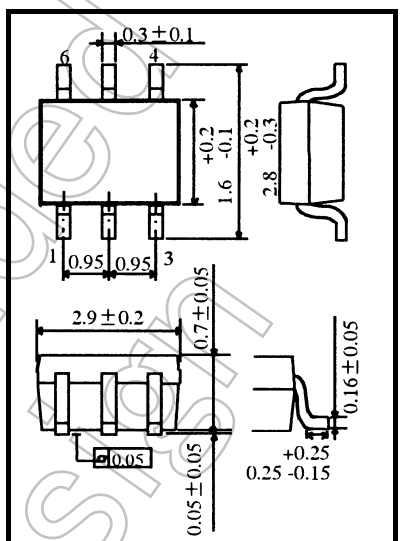
NPN and PNP transistors are mounted on a compact and slim package.

High DC current gain : NPN h_{FE} = 200 to 500 (I_C = 0.2 A)
: PNP h_{FE} = 200 to 500 (I_C = -0.2 A)

Low collector-emitter saturation voltage
: NPN $V_{CE\ (sat)}$ = 0.14 V (max)
: PNP $V_{CE\ (sat)}$ = -0.2 V (max)

High-speed switching : NPN t_f = 45 ns (typ.)
: PNP t_f = 40 ns (typ.)

Unit: mm



1. Base 1 (NPN) 4. Collector 2 (PNP)
2. Emitter 2 (PNP) 5. Emitter 1 (NPN)
3. Base 2 (PNP) 6. Collector 1 (NPN)

JEDEC	—
JEITA	—
TOSHIBA	2-3T1A

Weight: 0.011 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating NPN	Rating PNP	Unit
Collector-base voltage		V_{CBO}	60	- 30	V
Collector-emitter voltage		V_{CEX}	50	- 30	V
		V_{CEO}	30	- 30	V
Emitter-base voltage		V_{EBO}	7	- 7	V
Collector current (Note 1)	DC	I_C	2.0	- 1.7	A
	Pulse	I_{CP}	8.0	- 8.0	A
Base current		I_B	0.5	- 0.5	A
Collector power dissipation (t=10 s) (Note 2)	Single-device operation	P_C	1.0		W
Collector power dissipation (DC) (Note 2)	Single-device operation	P_C	0.7		W
	Single-device value at dual operation	P_C	0.6		W
Thermal resistance, junction to ambient (t=10 s) (Note 2)	Single-device operation	$R_{th\ (j-a)}$	125		°C/W
Thermal resistance, junction to ambient (DC) (Note 2)	Single-device operation	$R_{th\ (j-a)}$	178		°C/W
	Single-device value at dual operation	$R_{th\ (j-a)}$	208		°C/W
Junction temperature		T_j	150		°C
Storage temperature range		T_{stg}	−55 to 150		°C

Note 1: Ensure that the junction temperature does not exceed 150°C.

Note 2: Mounted on an FR4 board (glass epoxy, 1.6 mm thick, Cu area: 645 mm^2)

Note 3: 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).

Start of commercial production
2009-07

Figure 1. Circuit configuration (top view)

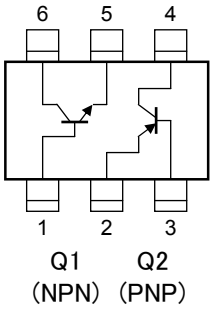
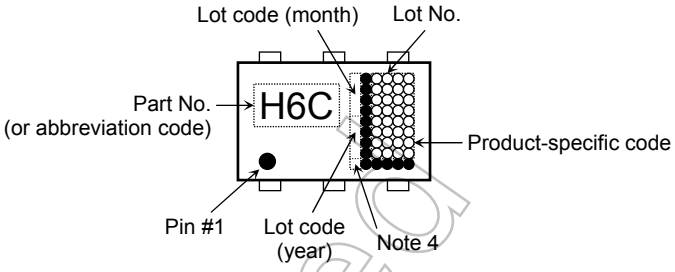


Figure 2. Marking



Note 4: A dot marking identifies the indication of product Labels.
[[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.
The RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Electrical Characteristics (Ta = 25°C) : NPN

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		I_{CBO}	V_{CB} = 60 V, I_E = 0	—	—	100	nA
Emitter cut-off current		I_{EBO}	V_{EB} = 7 V, I_C = 0	—	—	100	nA
Collector-emitter breakdown voltage		$V_{(BR)\ CEO}$	I_C = 10 mA, I_B = 0	30	—	—	V
DC current gain		h_{FE} (1)	V_{CE} = 2 V, I_C = 0.2 A	200	—	500	
		h_{FE} (2)	V_{CE} = 2 V, I_C = 0.6 A	125	—	—	
		h_{FE} (3)	V_{CE} = 2 V, I_C = 2 A	50	—	—	
Collector-emitter saturation voltage		$V_{CE\ (sat)}$	I_C = 0.6 A, I_B = 20 mA	—	—	0.14	V
Base-emitter saturation voltage		$V_{BE\ (sat)}$	I_C = 0.6 A, I_B = 20 mA	—	—	1.1	V
Collector output capacitance		C_{ob}	V_{CB} = 10 V, I_E = 0, f = 1 MHz	—	14	—	pF
Switching time	Rise time	t_r	See Figure 1 circuit diagram. $V_{CC} \approx$ 18 V, R_L = 30 Ω $I_{B1} = I_{B2}$ = 20 mA	—	45	—	ns
	Storage time	t_{stg}		—	580	—	
	Fall time	t_f		—	45	—	

Electrical Characteristics (Ta = 25°C) : PNP

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		I_{CBO}	V_{CB} = - 30 V, I_E = 0	—	—	- 100	nA
Emitter cut-off current		I_{EBO}	V_{EB} = - 7 V, I_C = 0	—	—	- 100	nA
Collector-emitter breakdown voltage		$V_{(BR)\ CEO}$	I_C = - 10 mA, I_B = 0	-30	—	—	V
DC current gain		h_{FE} (1)	V_{CE} = - 2 V, I_C = - 0.2 A	200	—	500	
		h_{FE} (2)	V_{CE} = - 2 V, I_C = - 0.6 A	125	—	—	
		h_{FE} (3)	V_{CE} = - 2 V, I_C = -2A	50	—	—	
Collector-emitter saturation voltage		$V_{CE\ (sat)}$	I_C = - 0.6 A, I_B = - 20 mA	—	—	- 0.2	V
Base-emitter saturation voltage		$V_{BE\ (sat)}$	I_C = - 0.6 A, I_B = - 20 mA	—	—	- 1.1	V
Collector output capacitance		C_{ob}	V_{CB} = - 10 V, I_E = 0, f = 1 MHz	—	16.5	—	pF
Switching time	Rise time	t_r	See Figure 2 circuit diagram. $V_{CC} \approx$ - 18V, R_L = 30 Ω, $I_{B1} = I_{B2}$ = 20 mA	—	40	—	ns
	Storage time	t_{stg}		—	280	—	
	Fall time	t_f		—	40	—	

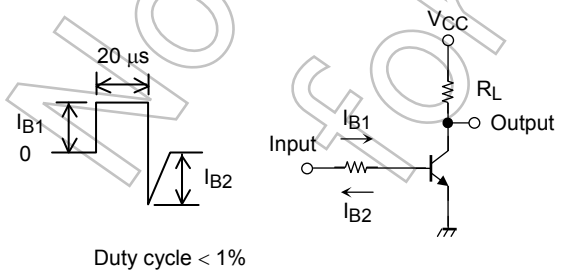


Figure 1 Switching Time Test Circuit & Timing Chart (NPN)

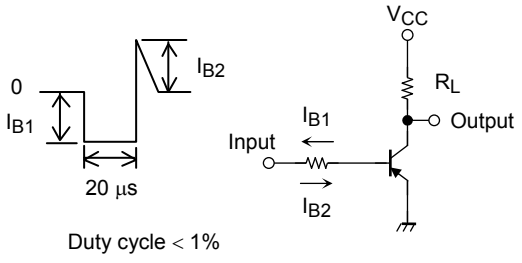
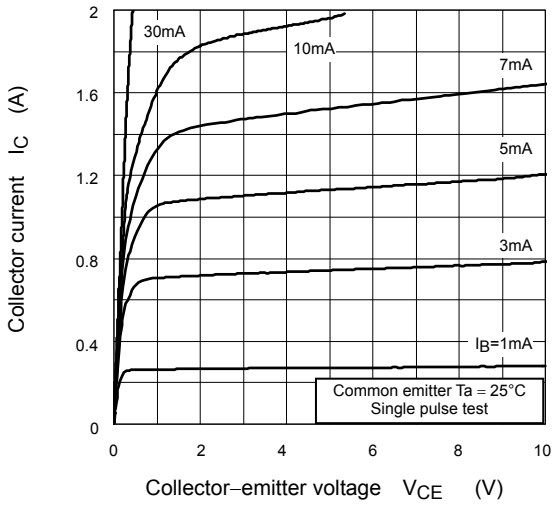


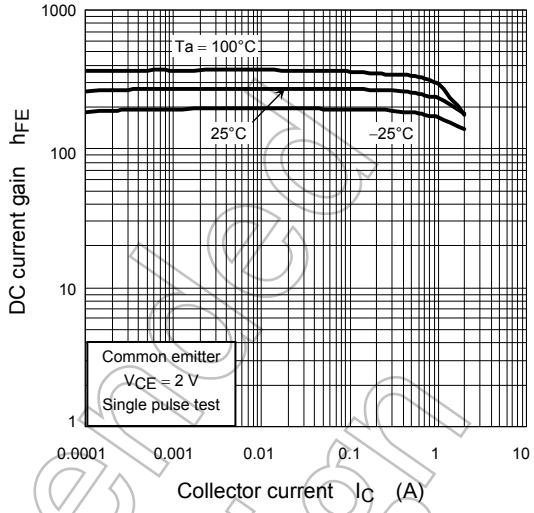
Figure 2 Switching Time Test Circuit & Timing Chart (PNP)

NPN

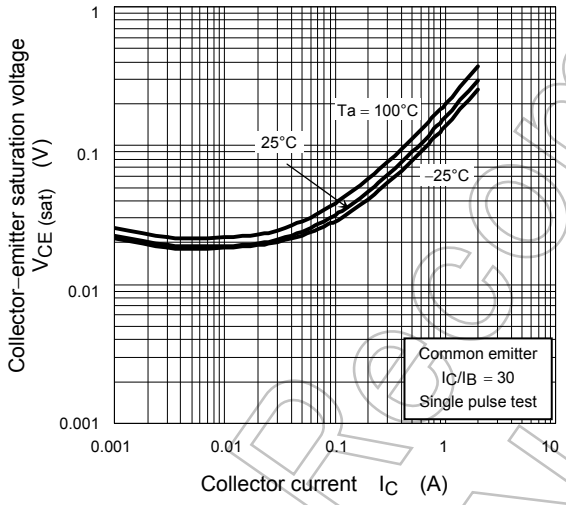
$I_C - V_{CE}$



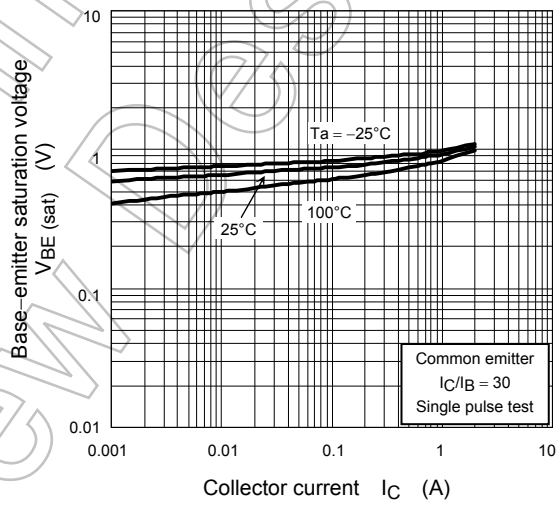
$h_{FE} - I_C$



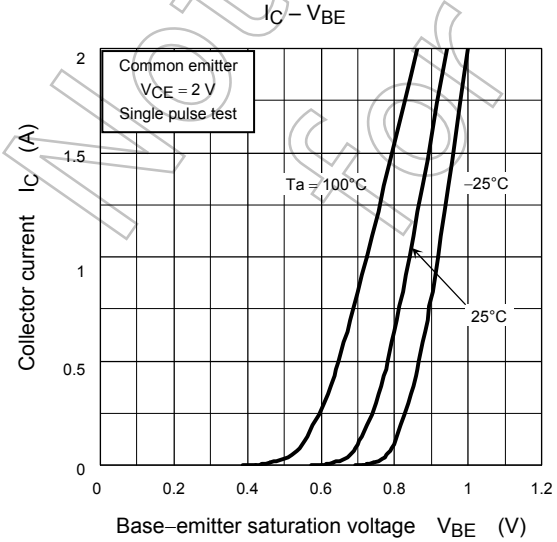
$V_{CE\ (sat)} - I_C$



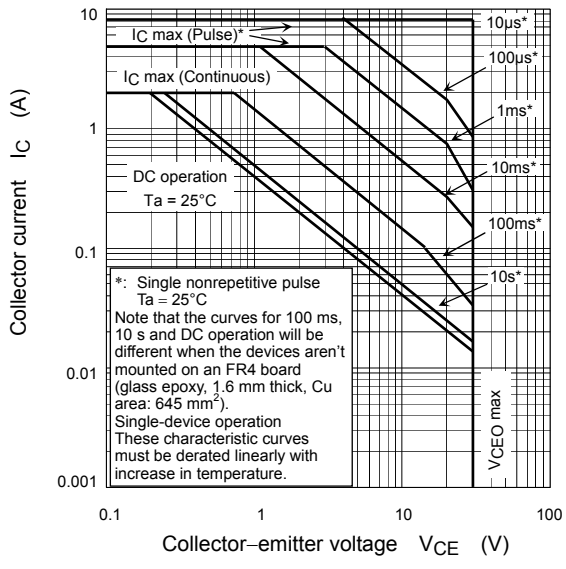
$V_{BE\ (sat)} - I_C$



$I_C - V_{BE}$

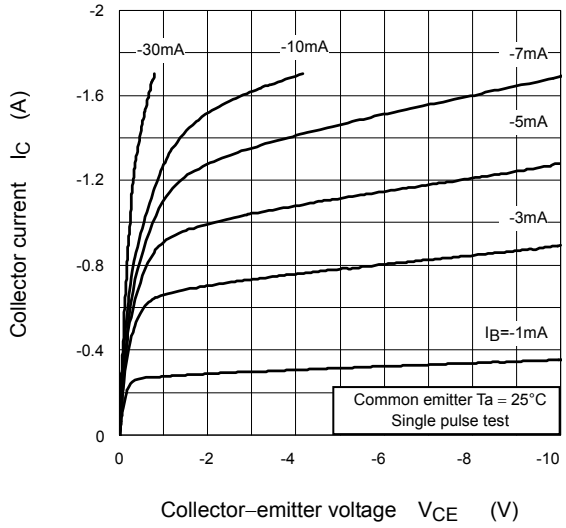


Safe operation area

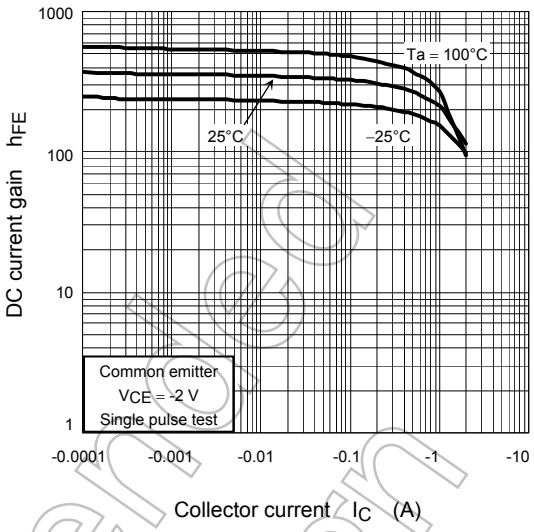


PNP

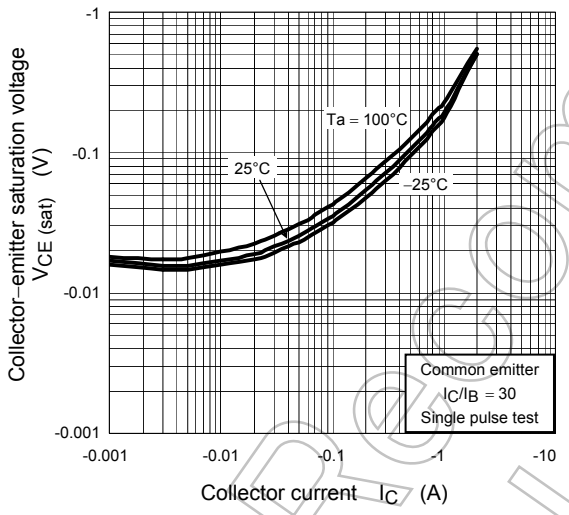
$I_C - V_{CE}$



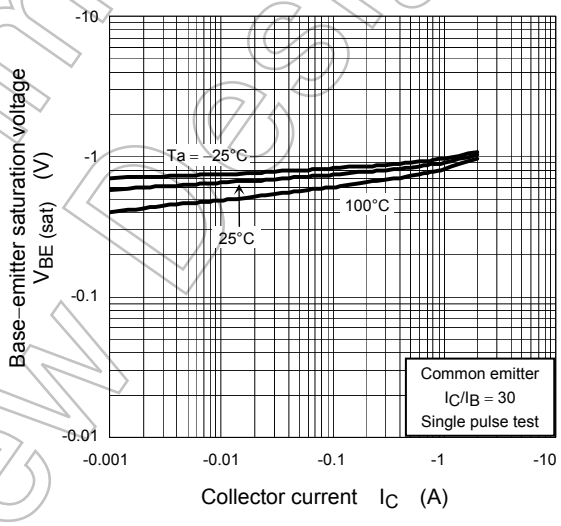
$h_{FE} - I_C$



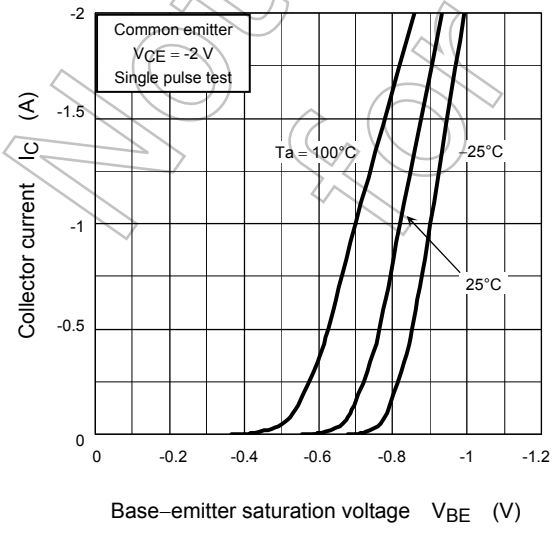
$V_{CE\ (sat)} - I_C$



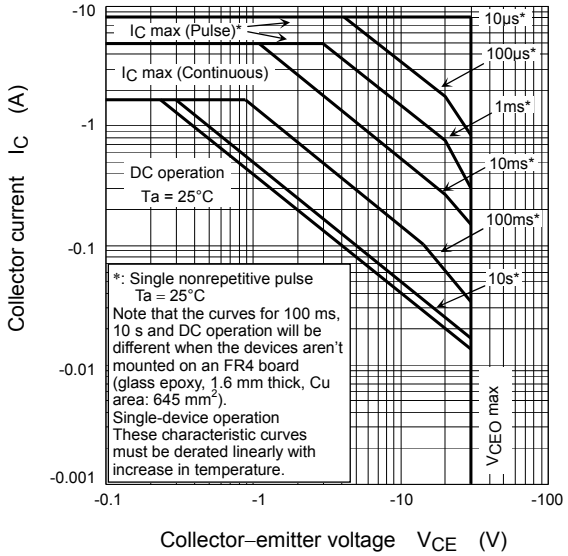
$V_{BE\ (sat)} - I_C$



$I_C - V_{BE}$

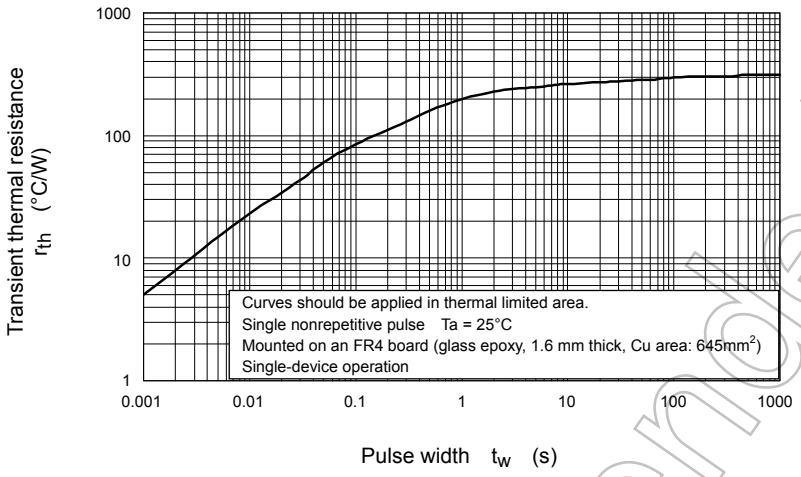


Safe operation area

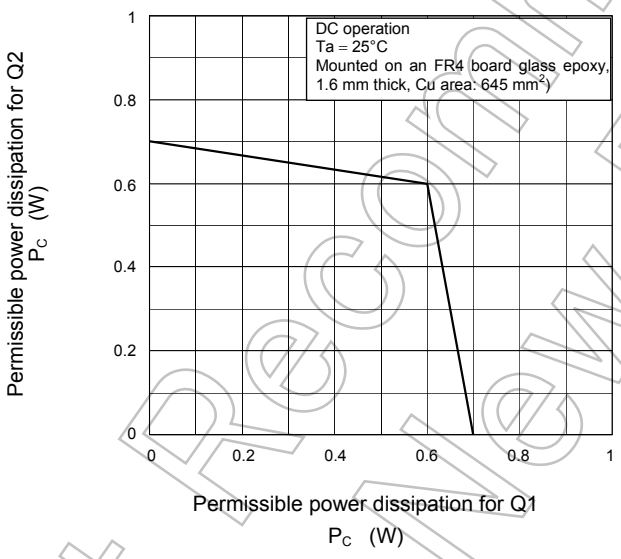


Common

$r_{th} - t_w$



Permissible Power Dissipation for Simultaneous Operation



Collector power dissipation at the single-device operation is 0.7W max.
Collector power dissipation at the single-device value at dual operation is 0.6W max.
Collector power dissipation at the dual operation is set to 1.2W max.

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