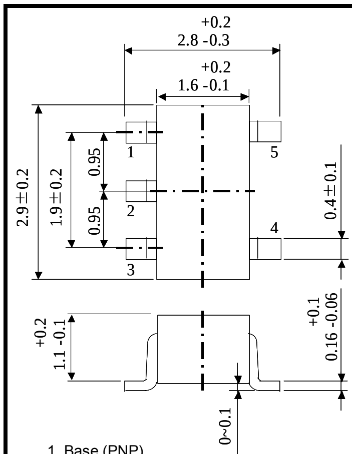
TOSHIBA Transistor Silicon PNP / NPN Epitaxial Type (PCT Process)

HN4B101J

MOS Gate Drive Applications
Switching Applications

Unit: mm



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

JEDEC	―
JEITA	―
TOSHIBA	2-3L1A

Weight: 0.014g (typ.)

- Small footprint due to a small and thin package
- High DC current gain : h_{FE} = 200 to 500 (I_C = −0.12 A)
- Low collector-emitter saturation: PNP $V_{CE\ (sat)}$ = −0.20 V (max)
  : NPN $V_{CE\ (sat)}$ = 0.17 V (max)
- High-speed switching : PNP t_f = 45 ns (typ.)
  : NPN t_f = 50 ns (typ.)

Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating PNP	Rating NPN	Unit
Collector-base voltage		V_{CBO}	−30	50	V
Collector-emitter voltage		V_{CEO}	−30	30	V
Emitter-base voltage		V_{EBO}	−7	7	V
Collector current	DC (Note 1)	I_C	−1.0	1.2	A
	Pulse (Note 1)	I_{CP}	−5.0	5.0	
Base current		I_B	−120	120	mA
Collector power dissipation (t = 10 s)	Single-device operation	Pc (Note 2)	0.85		W
Collector power dissipation (DC)	Single-device operation	Pc (Note 2)	0.55		W
Junction temperature		T_j	150		°C
Storage temperature range		T_{stg}	−55 to 150		°C

Note 1: Ensure that the channel temperature does not exceed 150°C during use of the device.

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

Figure 1. Circuit Configuration (Top View)

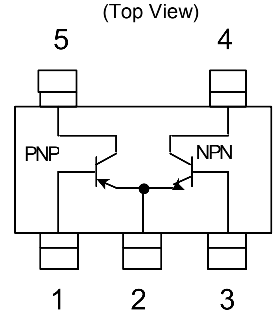
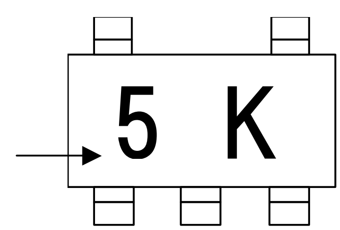


Figure 2. Marking

Part No.
(or abbreviation code)



Electrical Characteristics (Ta = 25°C)

PNP

Characteristic		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 = −0.12 A	200	—	500	
		h_{FE} (2)	V_{CE} = −2 V, I_C = −0.4 A	125	—	—	
Collector-emitter saturation voltage		$V_{CE\ (sat)}$	I_C = −0.4 A, I_B = −13 mA	—	—	−0.20	V
Base-emitter saturation voltage		$V_{BE\ (sat)}$	I_C = −0.4 A, I_B = −13 mA	—	—	−1.10	V
Collector output capacitance		C_{ob}	V_{CB} = −10 V, I_E = 0, f = 1MHz	—	7.8	—	pF
Switching time	Rise time	t_r	See Figure 3 circuit diagram V_{CC} ≃ −16 V, R_L = 40 Ω $-I_{B1} = I_{B2}$ = 13 mA	—	40	—	ns
	Storage time	t_{stg}		—	200	—	
	Fall time	t_f		—	45	—	

NPN

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		I_{CBO}	V_{CB} = 50 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 = 0.12 A	200	—	500	
		h_{FE} (2)	V_{CE} = 2 V, I_C = 0.4 A	125	—	—	
Collector-emitter saturation voltage		$V_{CE\ (sat)}$	I_C = 0.4 A, I_B = 13 mA	—	—	0.17	V
Base-emitter saturation voltage		$V_{BE\ (sat)}$	I_C = 0.4 A, I_B = 13 mA	—	—	1.10	V
Collector output capacitance		C_{ob}	V_{CB} = 10 V, I_E = 0, f = 1MHz	—	7.0	—	pF
Switching time	Rise time	t_r	See Figure 4 circuit diagram V_{CC} ≃ 16 V, R_L = 40 Ω $I_{B1} = -I_{B2}$ = 13 mA	—	45	—	ns
	Storage time	t_{stg}		—	450	—	
	Fall time	t_f		—	50	—	

Figure 3. Switching Time Test Circuit & Timing Chart

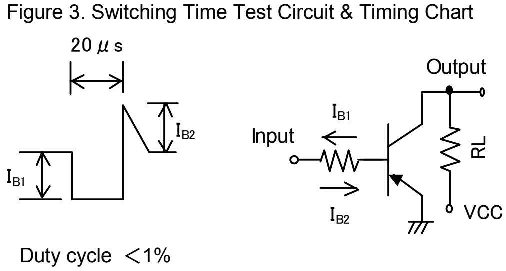
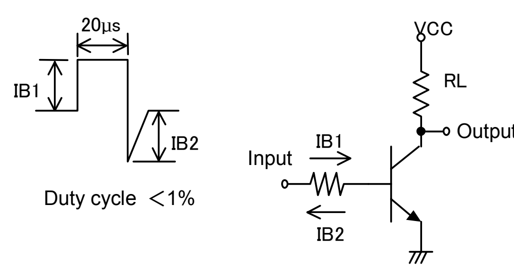
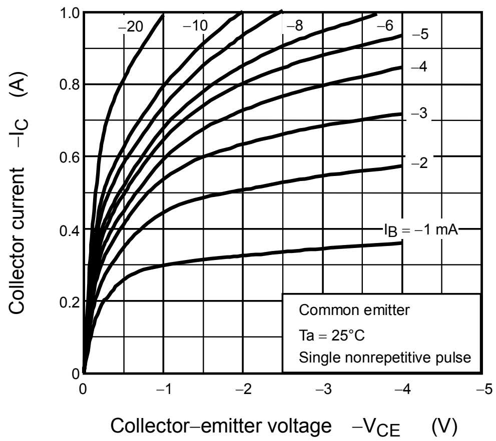


Figure 4. Switching Time Test Circuit & Timing Chart

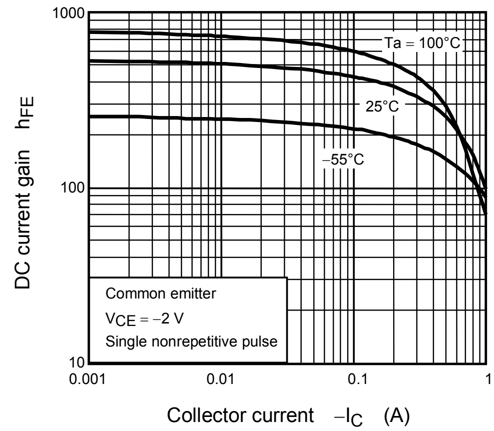


PNP

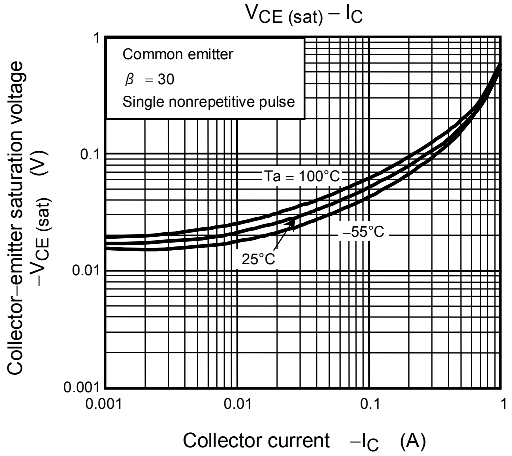
$I_C – V_{CE}$



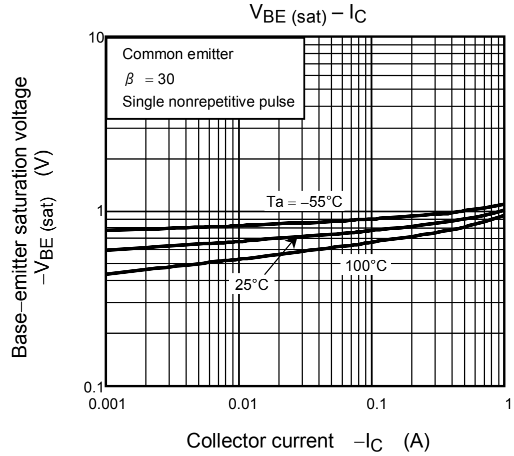
$h_{FE} – I_C$



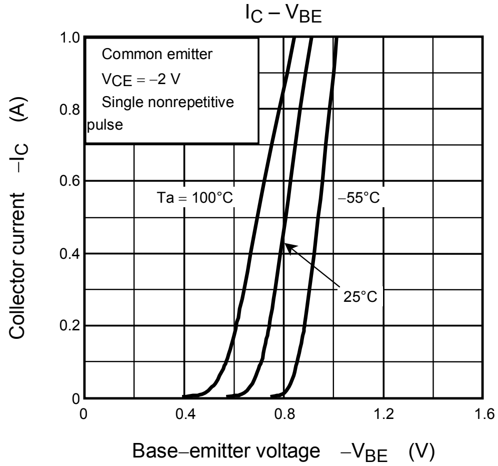
$V_{CE\ (sat)} – I_C$



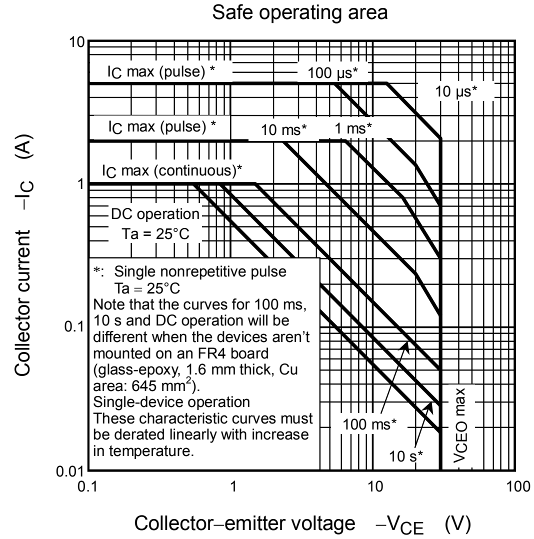
$V_{BE\ (sat)} – I_C$



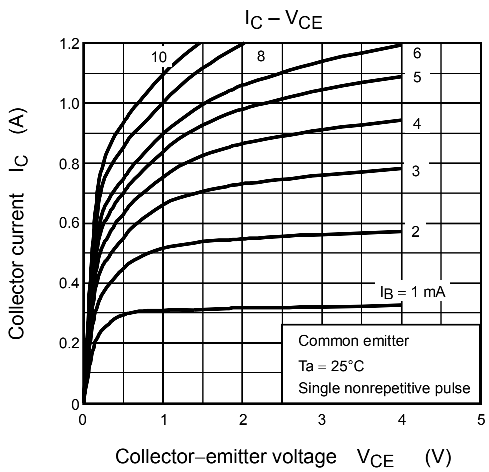
$I_C – V_{BE}$

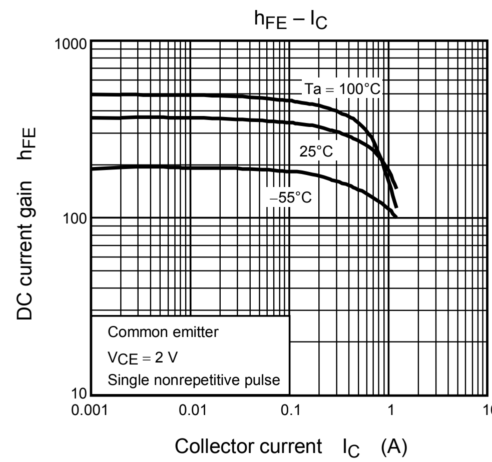


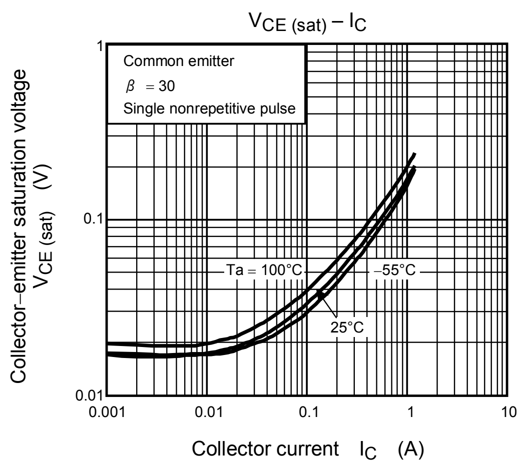
Safe operating area

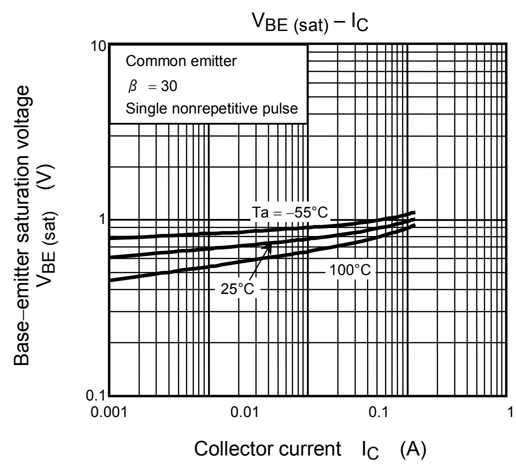


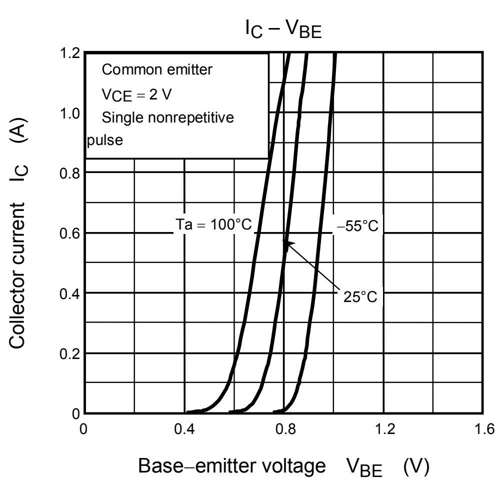
NPN

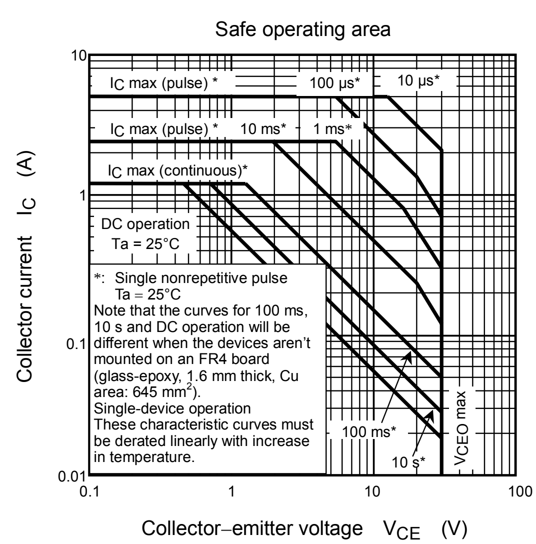

IC – VCE
Collector current IC (A)
Collector−emitter voltage VCE (V)
10
8
6
5
4
3
2
IB = 1 mA
Common emitter
Ta = 25°C
Single nonrepetitive pulse


hFE – IC
DC current gain hFE
Collector current IC (A)
Ta = 100°C
25°C
−55°C
Common emitter
VCE = 2 V
Single nonrepetitive pulse

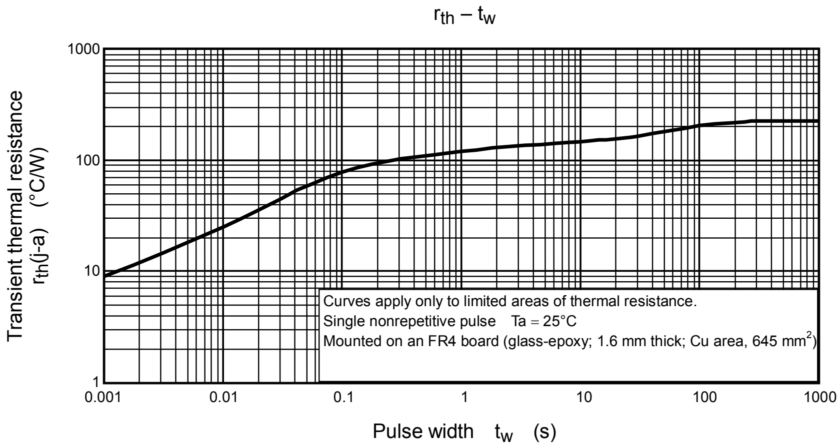

VCE (sat) – IC
Collector−emitter saturation voltage VCE (sat) (V)
Collector current IC (A)
Common emitter
β = 30
Single nonrepetitive pulse
Ta = 100°C
−55°C
25°C

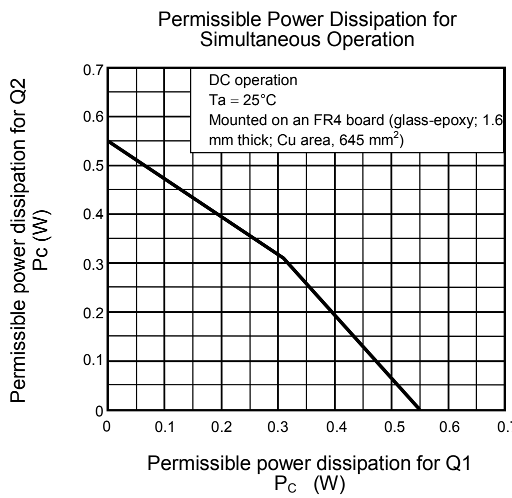

VBE (sat) – IC
Base−emitter saturation voltage VBE (sat) (V)
Collector current IC (A)
Common emitter
β = 30
Single nonrepetitive pulse
Ta = −55°C
25°C
100°C


IC – VBE
Collector current IC (A)
Base−emitter voltage VBE (V)
Common emitter
VCE = 2 V
Single nonrepetitive pulse
Ta = 100°C
−55°C
25°C


Safe operating area
Collector current IC (A)
Collector−emitter voltage VCE (V)
IC max (pulse) *
100 μs*
10 μs*
IC max (pulse) *
10 ms*
1 ms*
IC max (continuous)*
DC operation
Ta = 25°C
*: Single nonrepetitive pulse
Ta = 25°C
Note that the curves for 100 ms, 10 s and DC operation will be different when the devices aren't mounted on an FR4 board (glass-epoxy, 1.6 mm thick, Cu area: 645 mm2).
Single-device operation
These characteristic curves must be derated linearly with increase in temperature.
100 ms*
10 s*
VCEO max

Common





Collector power dissipation at single-device operation is 0.55 W.
Collector power dissipation at single-device value at dual operation is 0.31 W.
Collector power dissipation at dual operation is set to 0.62 W.

RESTRICTIONS ON PRODUCT USE

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