

TOSHIBA Transistor Silicon NPN Triple Diffused Type (Darlington)

2SD2131

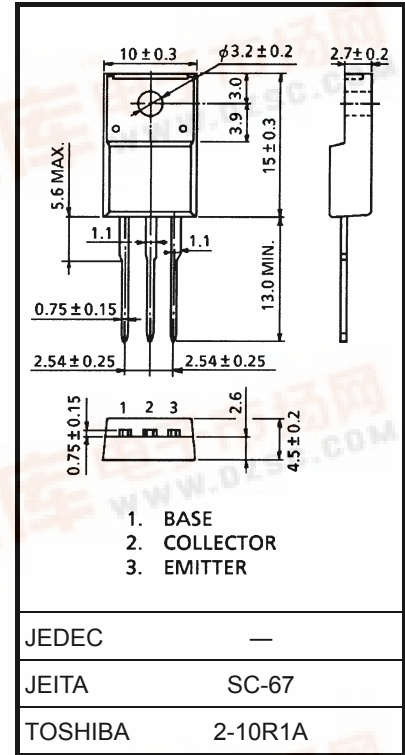
High-Power Switching Applications
Hammer Drive, Pulse Motor Drive Applications

Unit: mm

- High DC current gain: $h_{FE} = 2000$ (min) ($V_{CE} = 3\text{ V}$, $I_C = 3\text{ A}$)
- Low saturation voltage: $V_{CE(sat)} = 1.5\text{ V}$ (max) ($I_C = 3\text{ A}$)
- Zener diode included between collector and base.
- Unclamped inductive load energy: $E = 150\text{ mJ}$ (min)

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

Characteristics		Symbol	Rating	Unit
Collector-base voltage		V_{CBO}	60 ± 10	V
Collector-emitter voltage		V_{CEO}	60 ± 10	V
Emitter-base voltage		V_{EBO}	7	V
Collector current	DC	I_C	5	A
	Pulse	I_{CP}	8	
Base current		I_B	0.5	A
Collector power dissipation	$T_a = 25^\circ\text{C}$	P_C	2.0	W
	$T_c = 25^\circ\text{C}$		30	
Junction temperature		T_j	150	$^\circ\text{C}$
Storage temperature range		T_{stg}	-55 to 150	$^\circ\text{C}$

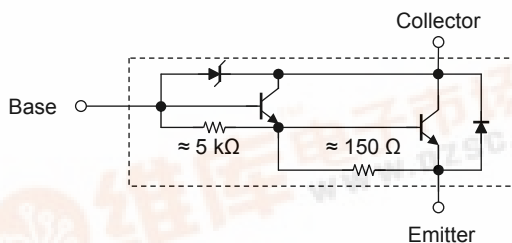


Weight: 1.7 g (typ.)

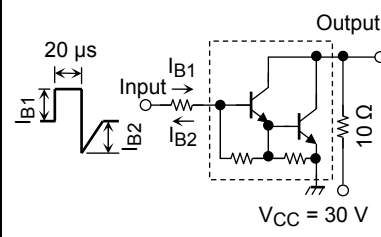
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

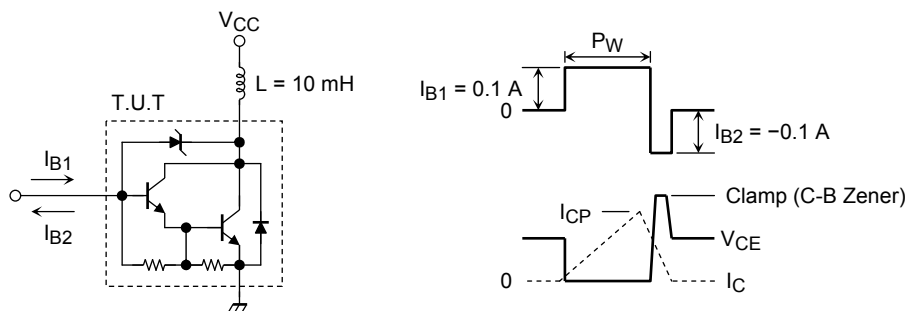
Equivalent Circuit



Electrical Characteristics (Tc = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		I_{CBO}	$V_{CB} = 45\text{ V}, I_E = 0$	—	—	10	μA
Collector cut-off current		I_{CEO}	$V_{CE} = 45\text{ V}, I_B = 0$	—	—	10	μA
Emitter cut-off current		I_{EBO}	$V_{EB} = 6\text{ V}, I_C = 0$	—	—	2.5	mA
Collector-base breakdown voltage		$V_{(BR)CBO}$	$I_C = 1\text{ mA}, I_E = 0$	50	60	70	V
Collector-emitter breakdown voltage		$V_{(BR)CEO}$	$I_C = 10\text{ mA}, I_B = 0$	50	60	70	V
DC current gain		$h_{FE(1)}$	$V_{CE} = 3\text{ V}, I_C = 3\text{ A}$	2000	—	15000	
		$h_{FE(2)}$	$V_{CE} = 3\text{ V}, I_C = 5\text{ A}$	1000	—	—	
Collector-emitter saturation voltage		$V_{CE(sat)(1)}$	$I_C = 3\text{ A}, I_B = 6\text{ mA}$	—	1.1	1.5	V
		$V_{CE(sat)(2)}$	$I_C = 5\text{ A}, I_B = 20\text{ mA}$	—	1.3	2.5	
Base-emitter saturation voltage		$V_{BE(sat)}$	$I_C = 3\text{ A}, I_B = 6\text{ mA}$	—	1.7	2.5	V
Unclamped inductive load energy		$E_{S/B}$	(Note 1)	150	—	—	mJ
Switching time	Turn-on time	t_{on}	 <p>$I_{B1} = -I_{B2} = 6\text{ mA}, \text{duty cycle} \leq 1\%$</p>	—	1.0	—	μs
	Storage time	t_{stg}		—	4.0	—	
	Fall time	t_f		—	2.5	—	

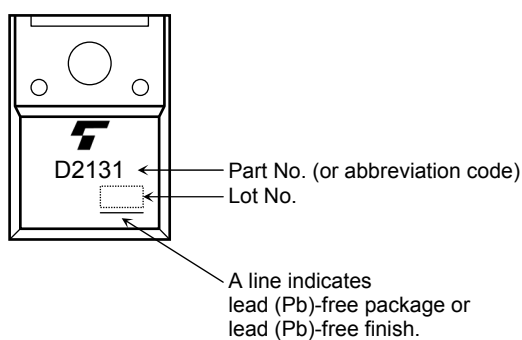
Note 1: Measurement circuit for unclamped inductive load energy

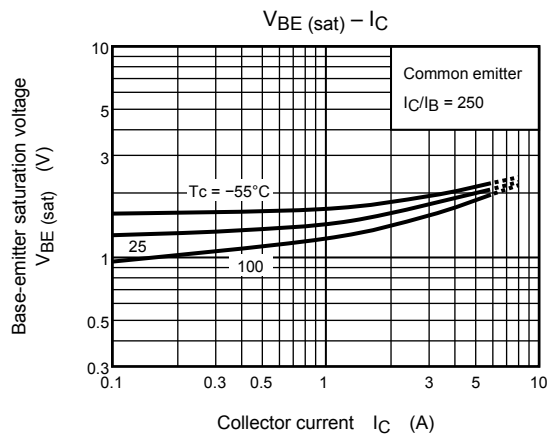
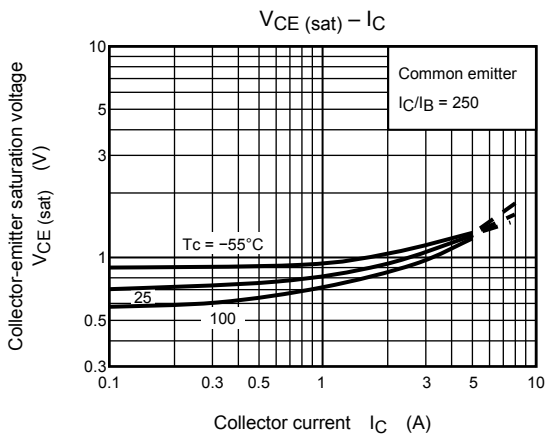
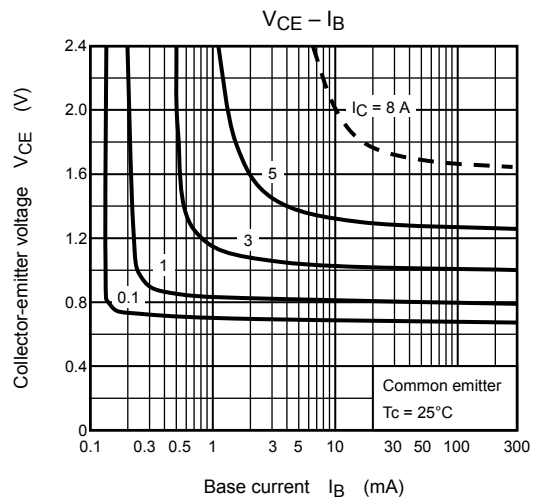
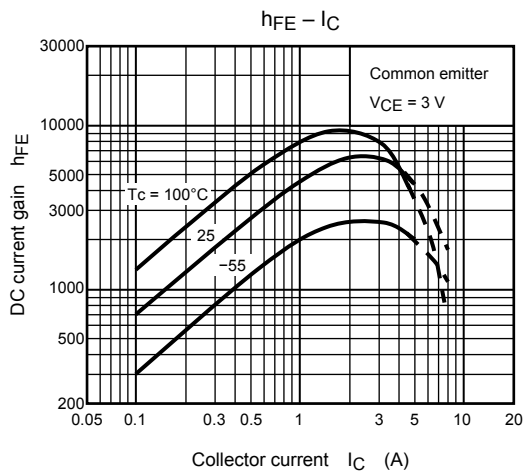
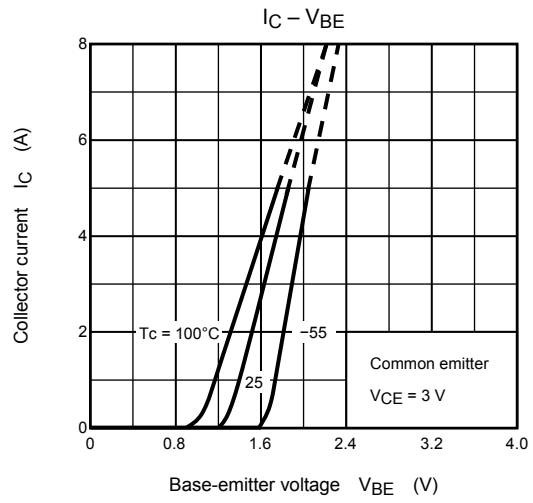
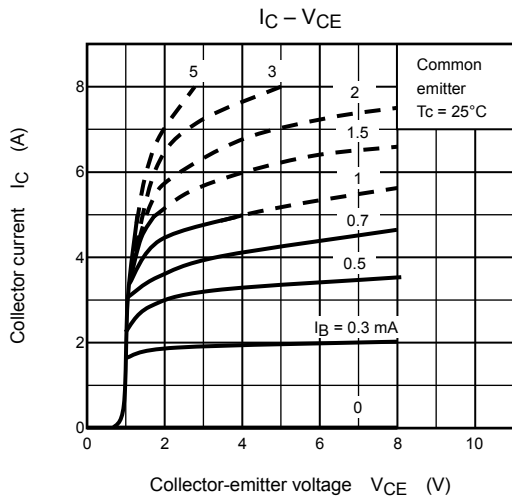


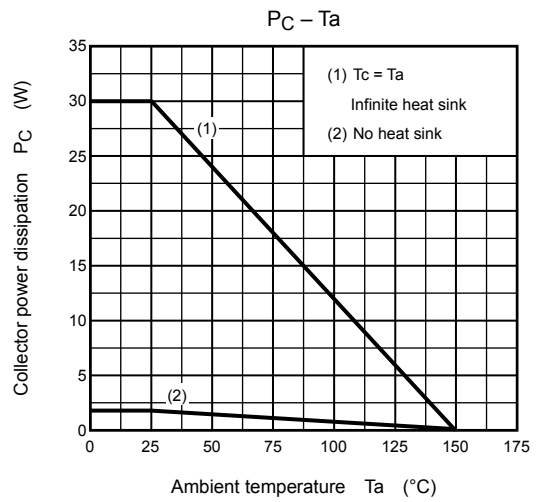
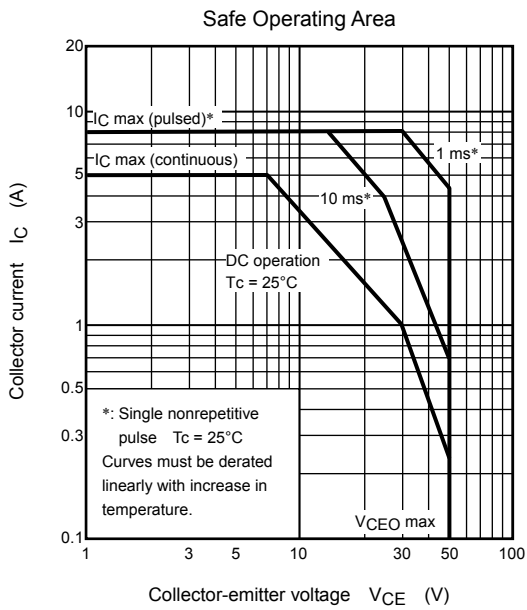
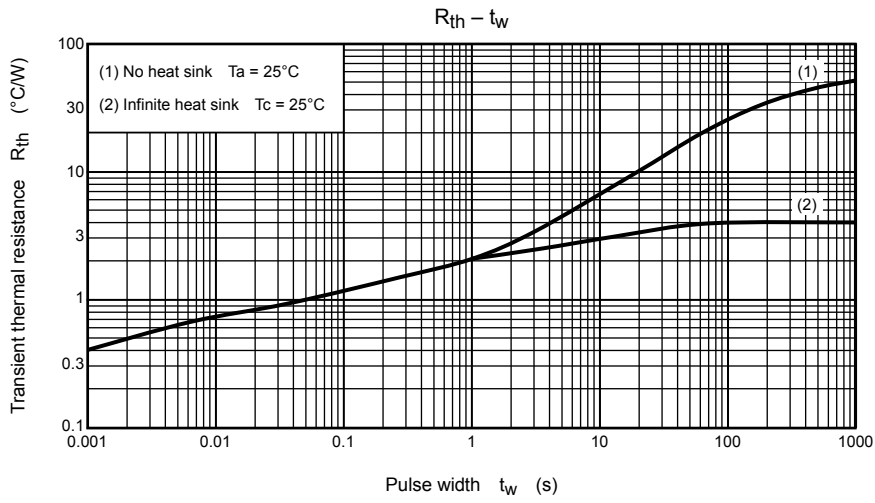
Note 2: (1) Pulse width adjusted for desired I_{CP} ($I_{CP} = 5.47\text{ A min}$)

$$(2) E = 1/2 L I_{CP}^2$$

Marking







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20070701-EN

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