

TOSHIBA POWER TRANSISTOR MODULE SILICON NPN & PNP EPITAXIAL TYPE (DARLINGTON POWER TRANSISTOR 4 IN 1)

MP4005

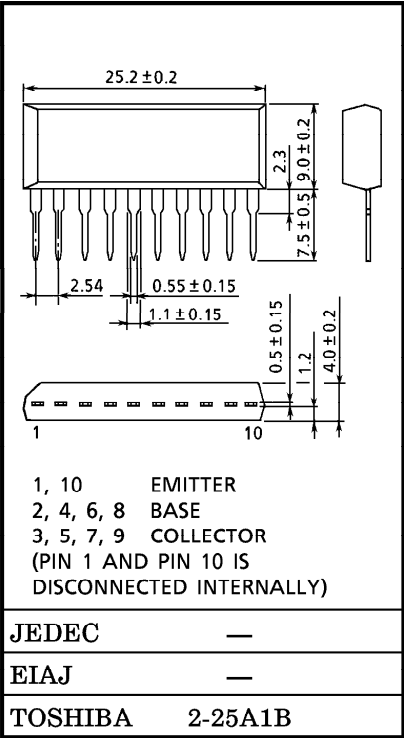
HIGH POWER SWITCHING APPLICATIONS.  
HAMMER DRIVE, PULSE MOTOR DRIVE AND INDUCTIVE  
LOAD SWITCHING.

- Small Package by Full Molding (SIP 10 Pin)
- High Collector Power Dissipation (4 Devices Operation)  
:  $P_T=4W$  ( $T_a=25^{\circ}C$ )
- High Collector Current :  $I_C$  (DC) =  $\pm 4A$  (Max.)
- High DC Current Gain :  $h_{FE}=2000$  (Min.)  
( $V_{CE}=\pm 2V$ ,  $I_C=\pm 1A$ )

MAXIMUM RATINGS ( $T_a=25^{\circ}C$ )

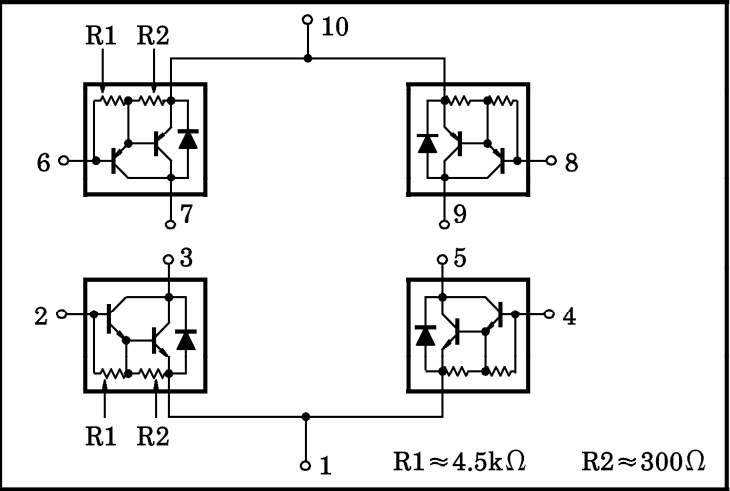
| CHARACTERISTIC                                       |       | SYMBOL    | RATING  |      | UNIT        |
|------------------------------------------------------|-------|-----------|---------|------|-------------|
|                                                      |       |           | NPN     | PNP  |             |
| Collector-Base Voltage                               |       | $V_{CBO}$ | 100     | -100 | V           |
| Collector-Emitter Voltage                            |       | $V_{CEO}$ | 80      | -80  | V           |
| Emitter-Base Voltage                                 |       | $V_{EBO}$ | 5       | -5   | V           |
| Collector Current                                    | DC    | $I_C$     | 4       | -4   | A           |
|                                                      | Pulse | $I_{CP}$  | 6       | -6   |             |
| Continuous Base Current                              |       | $I_B$     | 0.4     | -0.4 | A           |
| Collector Power Dissipation<br>(1 Device Operation)  |       | $P_C$     | 2.0     |      | W           |
| Collector Power Dissipation<br>(4 Devices Operation) |       | $P_T$     | 4.0     |      | W           |
| Junction Temperature                                 |       | $T_j$     | 150     |      | $^{\circ}C$ |
| Storage Temperature Range                            |       | $T_{stg}$ | -55~150 |      | $^{\circ}C$ |

INDUSTRIAL APPLICATIONS  
Unit in mm



Weight : 2.1g

ARRAY CONFIGURATION



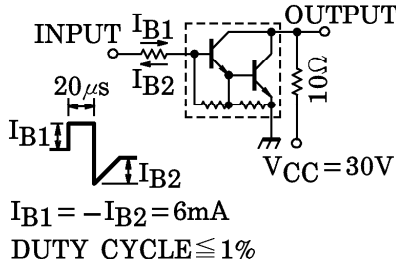
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## THERMAL CHARACTERISTICS

| CHARACTERISTIC                                                                                | SYMBOL               | MAX. | UNIT                        |
|-----------------------------------------------------------------------------------------------|----------------------|------|-----------------------------|
| Thermal Resistance of Junction to Ambient<br>(4 Devices Operation, $T_a = 25^\circ\text{C}$ ) | $\Sigma R_{th(j-a)}$ | 31.3 | $^\circ\text{C} / \text{W}$ |
| Maximum Lead Temperature for Soldering Purposes<br>(3.2mm from Case for 10s)                  | $T_L$                | 260  | $^\circ\text{C}$            |

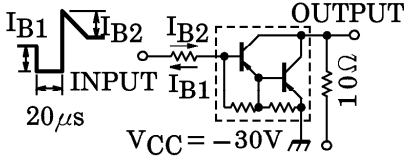
ELECTRICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ ) (NPN TRANSISTOR)

| CHARACTERISTIC                      |                   | SYMBOL        | TEST CONDITION                                                                                                                                                                                                                                                                                                                                                    | MIN. | TYP. | MAX. | UNIT          |
|-------------------------------------|-------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| Collector Cut-off Current           |                   | $I_{CBO}$     | $V_{CB} = 100\text{V}$ , $I_E = 0$                                                                                                                                                                                                                                                                                                                                | —    | —    | 20   | $\mu\text{A}$ |
| Collector Cut-off Current           |                   | $I_{CEO}$     | $V_{CE} = 80\text{V}$ , $I_B = 0$                                                                                                                                                                                                                                                                                                                                 | —    | —    | 20   | $\mu\text{A}$ |
| Emitter Cut-off Current             |                   | $I_{EBO}$     | $V_{EB} = 5\text{V}$ , $I_C = 0$                                                                                                                                                                                                                                                                                                                                  | 0.5  | —    | 2.5  | mA            |
| Collector-Base Breakdown Voltage    |                   | $V_{(BR)CBO}$ | $I_C = 1\text{mA}$ , $I_E = 0$                                                                                                                                                                                                                                                                                                                                    | 100  | —    | —    | V             |
| Collector-Emitter Breakdown Voltage |                   | $V_{(BR)CEO}$ | $I_C = 10\text{mA}$ , $I_B = 0$                                                                                                                                                                                                                                                                                                                                   | 80   | —    | —    | V             |
| DC Current Gain                     |                   | $h_{FE(1)}$   | $V_{CE} = 2\text{V}$ , $I_C = 1\text{A}$                                                                                                                                                                                                                                                                                                                          | 2000 | —    | —    |               |
|                                     |                   | $h_{FE(2)}$   | $V_{CE} = 2\text{V}$ , $I_C = 3\text{A}$                                                                                                                                                                                                                                                                                                                          | 1000 | —    | —    |               |
| Saturation Voltage                  | Collector-Emitter | $V_{CE(sat)}$ | $I_C = 3\text{A}$ , $I_B = 6\text{mA}$                                                                                                                                                                                                                                                                                                                            | —    | —    | 1.5  | V             |
|                                     | Base-Emitter      | $V_{BE(sat)}$ | $I_C = 3\text{A}$ , $I_B = 6\text{mA}$                                                                                                                                                                                                                                                                                                                            | —    | —    | 2.0  |               |
| Transition Frequency                |                   | $f_T$         | $V_{CE} = 2\text{V}$ , $I_C = 0.5\text{A}$                                                                                                                                                                                                                                                                                                                        | —    | 60   | —    | MHz           |
| Collector Output Capacitance        |                   | $C_{ob}$      | $V_{CB} = 10\text{V}$ , $I_E = 0$ , $f = 1\text{MHz}$                                                                                                                                                                                                                                                                                                             | —    | 30   | —    | pF            |
| Switching Time                      | Turn-on Time      | $t_{on}$      |  <p>INPUT <math>I_{B1}</math> <math>I_{B2}</math> <math>20\mu\text{s}</math> <math>I_{B1}</math> <math>I_{B2}</math> <math>V_{CC} = 30\text{V}</math> <math>10\Omega</math> OUTPUT</p> <p><math>I_{B1} = -I_{B2} = 6\text{mA}</math><br/>DUTY CYCLE <math>\leq 1\%</math></p> | —    | 0.2  | —    | $\mu\text{s}$ |
|                                     | Storage Time      | $t_{stg}$     |                                                                                                                                                                                                                                                                                                                                                                   | —    | 1.5  | —    |               |
|                                     | Fall Time         | $t_f$         |                                                                                                                                                                                                                                                                                                                                                                   | —    | 0.6  | —    |               |

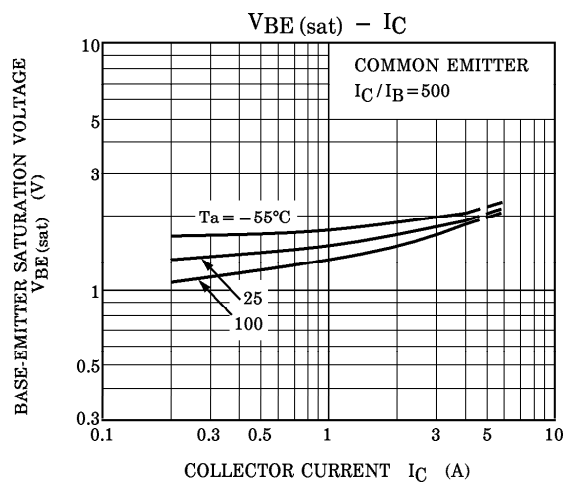
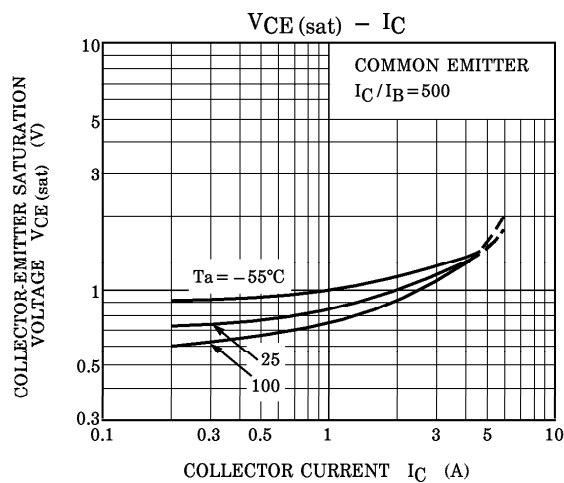
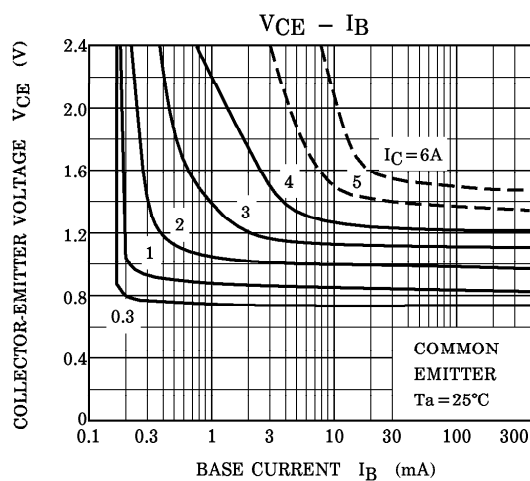
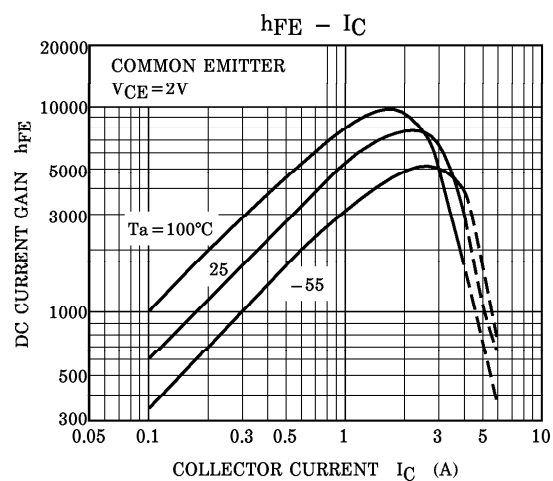
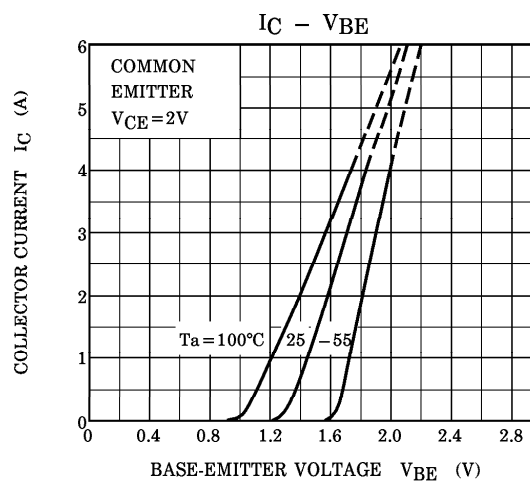
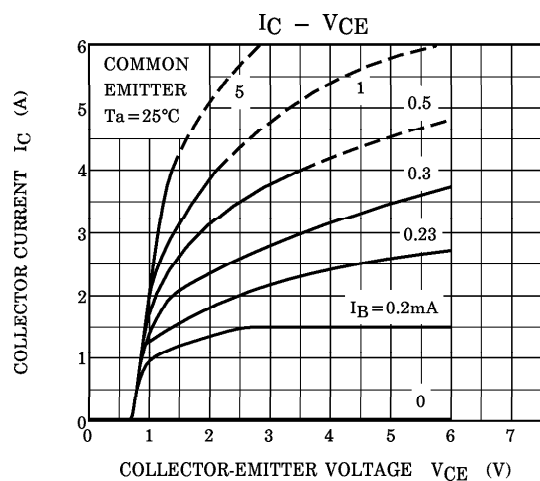
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ELECTRICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ ) (PNP TRANSISTOR)

| CHARACTERISTIC                      |                   | SYMBOL         | TEST CONDITION                                                                                                                                                                                                       | MIN. | TYP. | MAX. | UNIT          |
|-------------------------------------|-------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| Collector Cut-off Current           |                   | $I_{CBO}$      | $V_{CB} = -100\text{V}$ , $I_E = 0$                                                                                                                                                                                  | —    | —    | -20  | $\mu\text{A}$ |
| Collector Cut-off Current           |                   | $I_{CEO}$      | $V_{CE} = -80\text{V}$ , $I_B = 0$                                                                                                                                                                                   | —    | —    | -20  | $\mu\text{A}$ |
| Emitter Cut-off Current             |                   | $I_{EBO}$      | $V_{EB} = -5\text{V}$ , $I_C = 0$                                                                                                                                                                                    | -0.5 | —    | -2.5 | mA            |
| Collector-Base Breakdown Voltage    |                   | $V_{(BR) CBO}$ | $I_C = -1\text{mA}$ , $I_E = 0$                                                                                                                                                                                      | -100 | —    | —    | V             |
| Collector-Emitter Breakdown Voltage |                   | $V_{(BR) CEO}$ | $I_C = -10\text{mA}$ , $I_B = 0$                                                                                                                                                                                     | -80  | —    | —    | V             |
| DC Current Gain                     |                   | $h_{FE(1)}$    | $V_{CE} = -2\text{V}$ , $I_C = -1\text{A}$                                                                                                                                                                           | 2000 | —    | —    |               |
|                                     |                   | $h_{FE(2)}$    | $V_{CE} = -2\text{V}$ , $I_C = -3\text{A}$                                                                                                                                                                           | 1000 | —    | —    |               |
| Saturation Voltage                  | Collector-Emitter | $V_{CE(sat)}$  | $I_C = -3\text{A}$ , $I_B = -6\text{mA}$                                                                                                                                                                             | —    | —    | -1.5 | V             |
|                                     | Base-Emitter      | $V_{BE(sat)}$  | $I_C = -3\text{A}$ , $I_B = -6\text{mA}$                                                                                                                                                                             | —    | —    | -2.0 |               |
| Transition Frequency                |                   | $f_T$          | $V_{CE} = -2\text{V}$ , $I_C = -0.5\text{A}$                                                                                                                                                                         | —    | 40   | —    | MHz           |
| Collector Output Capacitance        |                   | $C_{ob}$       | $V_{CB} = -10\text{V}$ , $I_E = 0\text{A}$ , $f = 1\text{MHz}$                                                                                                                                                       | —    | 55   | —    | pF            |
| Switching Time                      | Turn-on Time      | $t_{on}$       |  <p><math>V_{CC} = -30\text{V}</math></p> <p><math>-I_{B1} = I_{B2} = 6\text{mA}</math>,<br/>DUTY CYCLE <math>\leq 1\%</math></p> | —    | 0.15 | —    | $\mu\text{s}$ |
|                                     | Storage Time      | $t_{stg}$      |                                                                                                                                                                                                                      | —    | 0.80 | —    |               |
|                                     | Fall Time         | $t_f$          |                                                                                                                                                                                                                      | —    | 0.40 | —    |               |

(NPN TRANSISTOR)



(PNP TRANSISTOR)

