

TOSHIBA Power Transistor Module Silicon NPN&PNP Epitaxial Type
(Six Darlington Power Transistors inOne)

MP6301

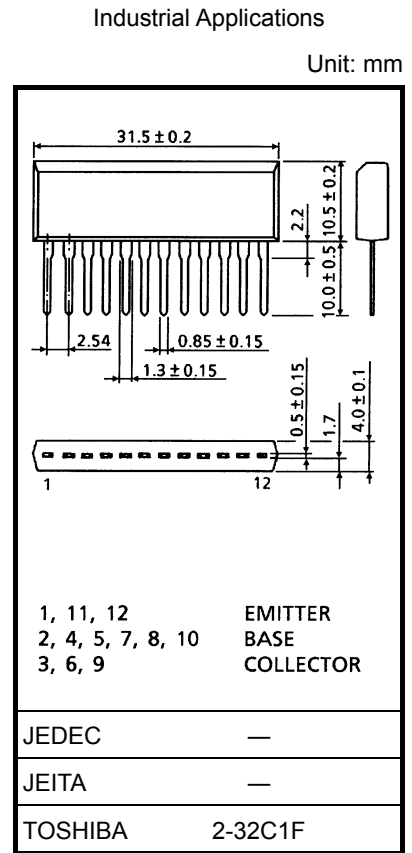
High Power Switching Applications

3-Phase Motor Drive and Bipolar Drive of Pulse Motor

- Small package by full molding (SIP 12 pins)
- High collector power dissipation (6-device operation)
: $P_T = 4.4 \text{ W}$ ($T_a = 25^\circ\text{C}$)
- High collector current: $I_C (\text{DC}) = \pm 3 \text{ A}$ (max)
- High DC current gain: $h_{FE} = 2000$ (min) ($V_{CE} = \pm 2 \text{ V}$, $I_C = \pm 1 \text{ A}$)

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

Characteristics	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}	8	-8	V	
Collector current	DC	I_C	3	-3	A
	Pulse	I_{CP}	5	-5	
Continuous base current	I_B	0.5	-0.5	A	
Collector power dissipation (1-device operation)	P_C	2.0		W	
Collector power dissipation (6-device operation)	P_T	4.4		W	
Junction temperature	T_j	150		$^\circ\text{C}$	
Storage temperature range	T_{stg}	-55 to 150		$^\circ\text{C}$	

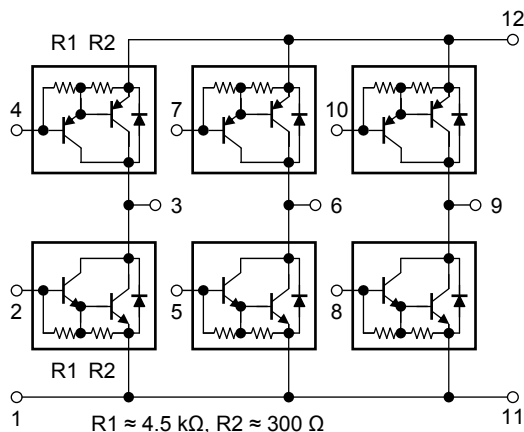


Weight: 3.9 g (typ.)

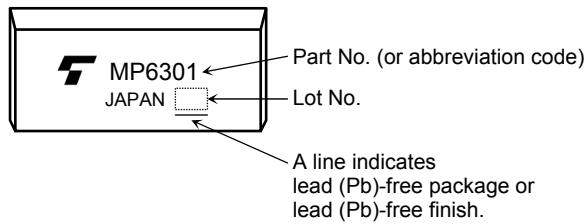
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

Array Configuration



Marking



Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance from junction to ambient (6-device operation, $T_a = 25^\circ\text{C}$)	$\Sigma R_{th(j-a)}$	28.4	$^\circ\text{C/W}$
Maximum lead temperature for soldering purposes (3.2 mm from case for 10 s)	T_L	260	$^\circ\text{C}$

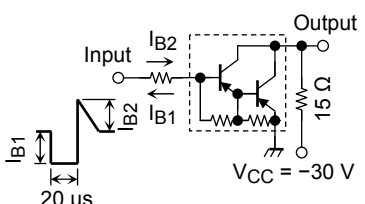
Electrical Characteristics ($T_a = 25^\circ\text{C}$) (NPN transistor)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		I_{CBO}	$V_{CB} = 100\text{ V}, I_E = 0\text{ A}$	—	—	20	μA
Collector cut-off current		I_{CEO}	$V_{CE} = 80\text{ V}, I_B = 0\text{ A}$	—	—	20	μA
Emitter cut-off current		I_{EBO}	$V_{EB} = 8\text{ V}, I_C = 0\text{ A}$	0.8	—	4.0	mA
Collector-base breakdown voltage		$V_{(BR)CBO}$	$I_C = 1\text{ mA}, I_E = 0\text{ A}$	100	—	—	V
Collector-emitter breakdown voltage		$V_{(BR)CEO}$	$I_C = 10\text{ mA}, I_B = 0\text{ A}$	80	—	—	V
DC current gain		$h_{FE(1)}$	$V_{CE} = 2\text{ V}, I_C = 1\text{ A}$	2000	—	—	—
		$h_{FE(2)}$	$V_{CE} = 2\text{ V}, I_C = 2\text{ A}$	1000	—	—	
Saturation voltage	Collector-emitter	$V_{CE(sat)}$	$I_C = 2\text{ A}, I_B = 4\text{ mA}$	—	—	1.8	V
	Base-emitter	$V_{BE(sat)}$	$I_C = 2\text{ mA}, I_B = 4\text{ mA}$	—	—	2.3	
Transition frequency		f_T	$V_{CE} = 2\text{ V}, I_C = 0.5\text{ A}$	—	100	—	MHz
Collector output capacitance		C_{ob}	$V_{CB} = 10\text{ V}, I_E = 0\text{ A}, f = 1\text{ MHz}$	—	20	—	pF
Switching time	Turn-on time	t_{on}	<p>$I_{B1} = -I_{B2} = 4\text{ mA}, \text{duty cycle} \leq 1\%$</p>	—	0.4	—	μs
	Storage time	t_{stg}		—	3.0	—	
	Fall time	t_f		—	0.6	—	

Emitter-Collector Diode Ratings and Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward current	I_{FM}	—	—	—	3	A
Surge current	I_{FSM}	$t = 1 \text{ s}, 1 \text{ shot}$	—	—	5	A
Forward voltage	V_F	$I_F = 1 \text{ A}, I_B = 0 \text{ A}$	—	—	2.0	V
Reverse recovery time	t_{rr}	$I_F = 3 \text{ A}, V_{BE} = -3 \text{ V}, dI_F/dt = -50 \text{ A}/\mu\text{s}$	—	1	—	μs
Reverse recovery charge	Q_{rr}		—	5	—	μC

Electrical Characteristics (Ta = 25°C) (PNP transistor)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit	
Collector cut-off current	I_{CBO}	$V_{CB} = -100 \text{ V}, I_E = 0 \text{ A}$	—	—	-20	μA	
Collector cut-off current	I_{CEO}	$V_{CE} = -80 \text{ V}, I_B = 0 \text{ A}$	—	—	-20	μA	
Emitter cut-off current	I_{EBO}	$V_{EB} = -8 \text{ V}, I_C = 0 \text{ A}$	-0.8	—	-4.0	mA	
Collector-base breakdown voltage	$V_{(BR)CBO}$	$I_C = -1 \text{ mA}, I_E = 0 \text{ A}$	-100	—	—	V	
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	$I_C = -10 \text{ mA}, I_B = 0 \text{ A}$	-80	—	—	V	
DC current gain	$h_{FE(1)}$	$V_{CE} = -2 \text{ V}, I_C = -1 \text{ A}$	2000	—	—	—	
	$h_{FE(2)}$	$V_{CE} = -2 \text{ V}, I_C = -2 \text{ A}$	1000	—	—		
Saturation voltage	Collector-emitter	$V_{CE(sat)}$	$I_C = -2 \text{ A}, I_B = -4 \text{ mA}$	—	—	-1.8	V
	Base-emitter	$V_{BE(sat)}$	$I_C = -2 \text{ A}, I_B = -4 \text{ mA}$	—	—	-2.3	
Transition frequency	f_T	$V_{CE} = -2 \text{ V}, I_C = -0.5 \text{ A}$	—	50	—	MHz	
Collector output capacitance	C_{ob}	$V_{CB} = -10 \text{ V}, I_E = 0 \text{ A}, f = 1 \text{ MHz}$	—	30	—	pF	
Switching time	Turn-on time	t_{on}		—	0.4	—	μs
	Storage time	t_{stg}		—	1.8	—	
	Fall time	t_f		—	0.4	—	

$-I_{B1} = I_{B2} = 4 \text{ mA}, \text{ duty cycle} \leq 1\%$

Emitter-Collector Diode Ratings and Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward current	I_{FM}	—	—	—	3	A
Surge current	I_{FSM}	$t = 1 \text{ s}, 1 \text{ shot}$	—	—	5	A
Forward voltage	V_F	$I_F = 1 \text{ A}, I_B = 0 \text{ A}$	—	—	2.0	V
Reverse recovery time	t_{rr}	$I_F = 3 \text{ A}, V_{BE} = 3 \text{ V}, dI_F/dt = -50 \text{ A}/\mu\text{s}$	—	500	—	μs
Reverse recovery charge	Q_{rr}		—	2.7	—	μC

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