

TOSHIBA Power Transistor Module Silicon NPN&PNP Epitaxial Type (Darlington power transistor 6 in 1)

MP6301

High Power Switching Applications

3-Phase Motor Drive and Bipolar Drive of Pulse Motor

- Small package by full molding (SIP 12 pin)
- High collector power dissipation (6 devices 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) ($V_{CE} = \pm 2 \text{ V}$, $I_C = \pm 1 \text{ A}$)

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 devices operation)		P_T	4.4		W
Junction temperature		T_j	150		$^\circ\text{C}$
Storage temperature range		T_{stg}	-55 to 150		$^\circ\text{C}$

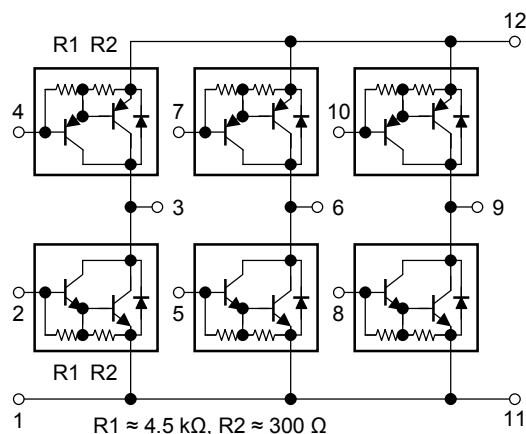
Industrial Applications

Unit: mm

1, 11, 12	EMITTER
2, 4, 5, 7, 8, 10	BASE
3, 6, 9	COLLECTOR
JEDEC	—
JEITA	—
TOSHIBA	2-32C1F

Weight: 3.9 g (typ.)

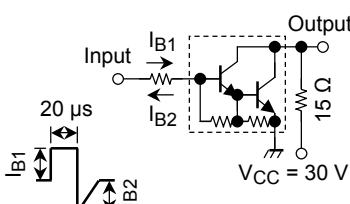
Array Configuration



Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance of junction to ambient (6 devices 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	$^\circ\text{C}$

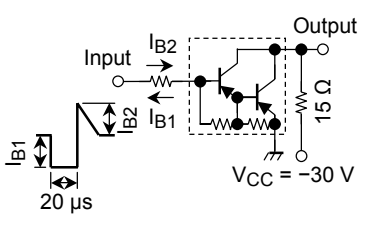
Electrical Characteristics ($T_a = 25^\circ\text{C}$) (NPN transistor)

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>$I_{B1} = -I_{B2} = 4\text{ mA}$, 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 ($T_a = 25^\circ\text{C}$)

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}	 <p>$-I_{B1} = I_{B2} = 4 \text{ mA}, \text{ duty cycle } \leq 1\%$</p>	—	0.4	—	μs
	Storage time	t_{stg}		—	1.8	—	
	Fall time	t_f		—	0.4	—	

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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