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

MP6301

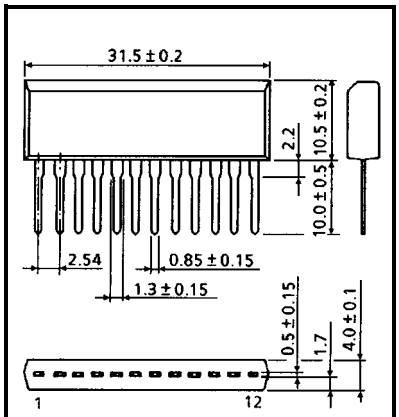
Industrial Applications

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 W (Ta = 25°C)
- High collector current: $I_{C\ (DC)}$ = ±3 A (max)
- High DC current gain: h_{FE} = 2000 (min) (V_{CE} = ±2 V, I_C = ±1 A)

Unit: mm



1, 11, 12	EMITTER
2, 4, 5, 7, 8, 10	BASE
3, 6, 9	COLLECTOR

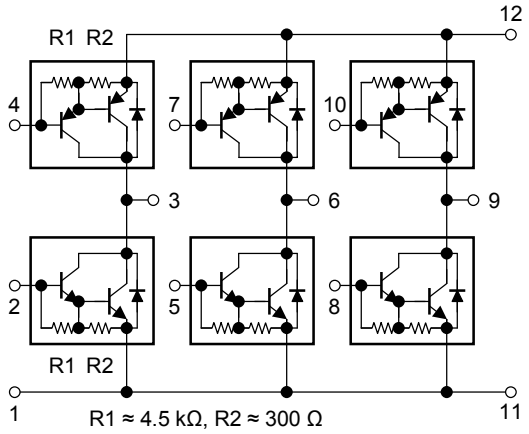
JEDEC	—
JEITA	—
TOSHIBA	2-32C1F

Weight: 3.9 g (typ.)

Maximum Ratings (Ta = 25°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		°C
Storage temperature range		T_{stg}	−55 to 150		°C

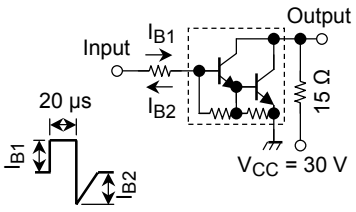
Array Configuration



Thermal Characteristics

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

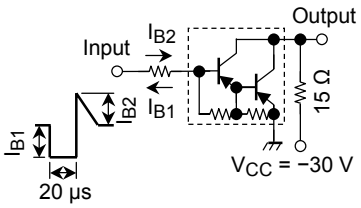
Electrical Characteristics (Ta = 25°C) (NPN transistor)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		I_{CBO}	V_{CB} = 100 V, I_E = 0 A	—	—	20	μA
Collector cut-off current		I_{CEO}	V_{CE} = 80 V, I_B = 0 A	—	—	20	μA
Emitter cut-off current		I_{EBO}	V_{EB} = 8 V, I_C = 0 A	0.8	—	4.0	mA
Collector-base breakdown voltage		$V_{(BR)\ CBO}$	I_C = 1 mA, I_E = 0 A	100	—	—	V
Collector-emitter breakdown voltage		$V_{(BR)\ CEO}$	I_C = 10 mA, I_B = 0 A	80	—	—	V
DC current gain		$h_{FE\ (1)}$	V_{CE} = 2 V, I_C = 1 A	2000	—	—	—
		$h_{FE\ (2)}$	V_{CE} = 2 V, I_C = 2 A	1000	—	—	
Saturation voltage	Collector-emitter	$V_{CE\ (sat)}$	I_C = 2 A, I_B = 4 mA	—	—	1.8	V
	Base-emitter	$V_{BE\ (sat)}$	I_C = 2 mA, I_B = 4 mA	—	—	2.3	
Transition frequency		f_T	V_{CE} = 2 V, I_C = 0.5 A	—	100	—	MHz
Collector output capacitance		C_{ob}	V_{CB} = 10 V, I_E = 0 A, f = 1 MHz	—	20	—	pF
Switching time	Turn-on time	t_{on}	 $I_{B1} = -I_{B2}$ = 4 mA, duty cycle ≤ 1%	—	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 s, 1 shot	—	—	5	A
Forward voltage	V_F	I_F = 1 A, I_B = 0 A	—	—	2.0	V
Reverse recovery time	t_{rr}	I_F = 3 A, V_{BE} = −3 V, dI_F/dt = −50 A/μs	—	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 V, I_E = 0 A	—	—	−20	μA
Collector cut-off current		I_{CEO}	V_{CE} = −80 V, I_B = 0 A	—	—	−20	μA
Emitter cut-off current		I_{EBO}	V_{EB} = −8 V, I_C = 0 A	−0.8	—	−4.0	mA
Collector-base breakdown voltage		$V_{(BR)\ CBO}$	I_C = −1 mA, I_E = 0 A	−100	—	—	V
Collector-emitter breakdown voltage		$V_{(BR)\ CEO}$	I_C = −10 mA, I_B = 0 A	−80	—	—	V
DC current gain		$h_{FE\ (1)}$	V_{CE} = −2 V, I_C = −1 A	2000	—	—	—
		$h_{FE\ (2)}$	V_{CE} = −2 V, I_C = −2 A	1000	—	—	
Saturation voltage	Collector-emitter	$V_{CE\ (sat)}$	I_C = −2 A, I_B = −4 mA	—	—	−1.8	V
	Base-emitter	$V_{BE\ (sat)}$	I_C = −2 A, I_B = −4 mA	—	—	−2.3	
Transition frequency		f_T	V_{CE} = −2 V, I_C = −0.5 A	—	50	—	MHz
Collector output capacitance		C_{ob}	V_{CB} = −10 V, I_E = 0 A, f = 1 MHz	—	30	—	pF
Switching time	Turn-on time	t_{on}		—	0.4	—	μs
	Storage time	t_{stg}		—	1.8	—	
	Fall time	t_f	$-I_{B1} = I_{B2}$ = 4 mA, duty cycle ≤ 1%	—	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 s, 1 shot	—	—	5	A
Forward voltage	V_F	I_F = 1 A, I_B = 0 A	—	—	2.0	V
Reverse recovery time	t_{rr}	I_F = 3 A, V_{BE} = 3 V, dI_F/dt = −50 A/μs	—	500	—	μs
Reverse recovery charge	Q_{rr}		—	2.7	—	μC

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