

# NPN Transistors

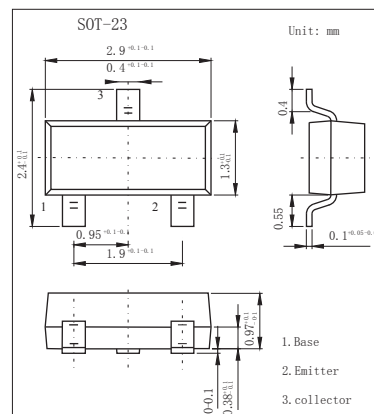
## MMBT4401

### ■ Features

- Ideal for Medium Power Amplification and Switching
- Complementary PNP Type Available (MMBT4403)

### ■ Marking

Marking	2X
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### ■ Absolute Maximum Ratings $T_a = 25^\circ\text{C}$

Parameter	Symbol	Rating	Unit
Collector-base voltage	$V_{CB0}$	60	V
Collector-emitter voltage	$V_{CE0}$	40	V
Emitter-base voltage	$V_{EB0}$	6.0	V
Collector current	$I_C$	600	mA
Total Device Dissipation Alumina Substrate	$P_D$	300	mW
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$

### ■ Electrical Characteristics $T_a = 25^\circ\text{C}$

Parameter	Symbol	Test conditions	Min	Typ	Max	Unit
Collector-base breakdown voltage	$V_{(BR)CB0}$	$I_C = 100\mu\text{A}, I_E = 0$	60			V
Collector-emitter breakdown voltage	$V_{(BR)CE0}$	$I_C = 1.0\text{ mA}, I_B = 0$	40			V
Emitter-base breakdown voltage	$V_{(BR)EB0}$	$I_E = 100\mu\text{A}, I_C = 0$	6.0			V
Collector cut-off current	$I_{CBO}$	$V_{CB} = 50\text{ V}, I_E = 0$			0.1	$\mu\text{A}$
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 5\text{ V}, I_C = 0$			0.1	$\mu\text{A}$
DC current gain *	$h_{FE}$	$I_C = 0.1\text{ mA}, V_{CE} = 1.0\text{ V}$	20			
		$I_C = 1.0\text{ mA}, V_{CE} = 1.0\text{ V}$	40			
		$I_C = 10\text{ mA}, V_{CE} = 1.0\text{ V}$	80			
		$I_C = 150\text{ mA}, V_{CE} = 1.0\text{ V}$	100		300	
		$I_C = 500\text{ mA}, V_{CE} = 2.0\text{ V}$	40			
Collector-emitter saturation voltage *	$V_{CE(sat)}$	$I_C = 150\text{ mA}, I_B = 15\text{ mA}$			0.4	V
		$I_C = 500\text{ mA}, I_B = 50\text{ mA}$			0.75	
Base-emitter saturation voltage *	$V_{BE(sat)}$	$I_C = 150\text{ mA}, I_B = 15\text{ mA}$	0.75		0.95	V
		$I_C = 500\text{ mA}, I_B = 50\text{ mA}$			1.2	
Transition frequency	$f_T$	$I_C = 20\text{ mA}, V_{CE} = 10\text{ V}, f = 100\text{ MHz}$	250			MHz
Delay time	$t_d$	$V_{CC} = 30\text{ V}, V_{EB} = 2.0\text{ V}$			15	ns
Rise time	$t_r$	$I_C = 150\text{ mA}, I_{B1} = 15\text{ mA}$			20	ns
Storage time	$t_s$	$V_{CC} = 30\text{ V}, I_C = 150\text{ mA}$			225	ns
Fall time	$t_f$	$I_{B1} = I_{B2} = 15\text{ mA}$			30	ns

\* Pulse test: pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2.0\%$ .

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### Typical Characteristics

