



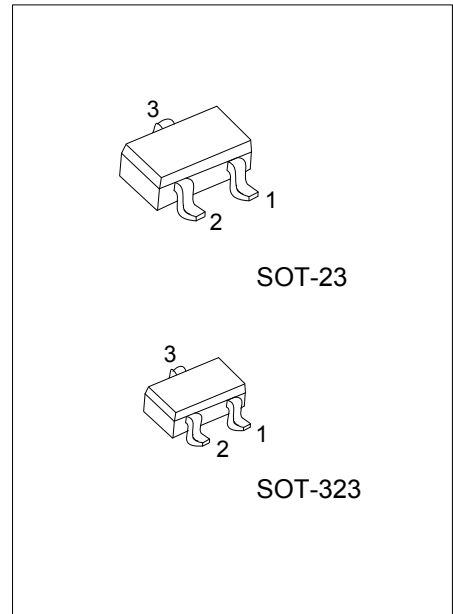
## MMBT4401

## NPN SILICON TRANSISTOR

### NPN GENERAL PURPOSE AMPLIFIER

#### DESCRIPTION

The UTC **MMBT4401** is designed for use as a medium power amplifier and switch requiring collector currents up to 500mA.

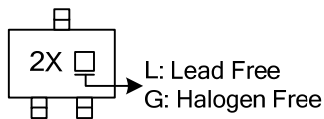


#### ORDERING INFORMATION

Ordering Number			Package	Pin Assignment			Packing
Normal	Lead Free	Halogen Free		1	2	3	
MMBT4401-AE3-R	MMBT4401L-AE3-R	MMBT4401G-AE3-R	SOT-23	E	B	C	Tape Reel
MMBT4401-AL3-R	MMBT4401L-AL3-R	MMBT4401G-AL3-R	SOT-323	E	B	C	Tape Reel

<p>MMBT4401L-AE3-R</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Lead Plating</p>	<p>(1) R: Tape Reel</p> <p>(2) AE3: SOT-23, AL3: SOT-323</p> <p>(3) G: Halogen Free, L: Lead Free Plating, Blank: Pb/Sn</p>
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#### MARKING



# MMBT4401

## NPN SILICON TRANSISTOR

### ■ ABSOLUTE MAXIMUM RATING (Ta=25°C, unless otherwise specified) (Note)

PARAMETER	SYMBOL	RATINGS	UNIT
Collector-Base Voltage	V <sub>CB0</sub>	60	V
Collector-Emitter Voltage	V <sub>CEO</sub>	40	V
Emitter-Base Voltage	V <sub>EBO</sub>	6	V
Collector Current-Continuous	I <sub>C</sub>	600	mA
Total Device Dissipation	P <sub>D</sub>	350	mW
Derate above 25°C		2.8	mW/°C
Junction Temperature	T <sub>J</sub>	+150	°C
Storage Temperature	T <sub>STG</sub>	-40 ~ +150	°C

Note 1. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

2. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ THERMAL DATA (Ta=25°C, unless otherwise specified)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Junction to Ambient	θ <sub>JA</sub>	357	°C / W

### ■ ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Collector-Base Breakdown Voltage	BV <sub>CB0</sub>	I <sub>C</sub> =0.1mA, I <sub>E</sub> =0	60			V
Collector-Emitter Breakdown Voltage (note)	BV <sub>CEO</sub>	I <sub>C</sub> =1mA, I <sub>B</sub> =0	40			V
Emitter-Base Breakdown Voltage	BV <sub>EBO</sub>	I <sub>E</sub> =0.1mA, I <sub>C</sub> =0	6			V
Collector Cut-off Current	I <sub>CEx</sub>	V <sub>CE</sub> =35V, V <sub>EB</sub> =0.4V				µA
Base Cut-off Current	I <sub>BL</sub>	V <sub>CE</sub> =35V, V <sub>EB</sub> =0.4V				µA
<b>ON CHARACTERISTICS (note)</b>						
DC Current Gain	h <sub>FE1</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =0.1mA	20			
	h <sub>FE2</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =1mA	40			
	h <sub>FE3</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =10mA	80			
	h <sub>FE4</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =150mA	100		300	
	h <sub>FE5</sub>	V <sub>CE</sub> =2V, I <sub>C</sub> =500mA	40			
Collector-Emitter Saturation Voltage	V <sub>CE(SAT1)</sub>	I <sub>C</sub> =150mA, I <sub>B</sub> =15mA			0.4	V
	V <sub>CE(SAT2)</sub>	I <sub>C</sub> =500mA, I <sub>B</sub> =50mA			0.75	V
Base-Emitter Saturation Voltage	V <sub>BE(SAT1)</sub>	I <sub>C</sub> =150mA, I <sub>B</sub> =15mA	0.75		0.95	V
	V <sub>BE(SAT2)</sub>	I <sub>C</sub> =500mA, I <sub>B</sub> =50mA			1.2	V
<b>SMALL SIGNAL CHARACTERISTICS1</b>						
Current Gain Bandwidth Product	f <sub>T</sub>	V <sub>CE</sub> =10V, I <sub>C</sub> =20mA, f=100MHz	250			MHz
Collector-Base Capacitance	C <sub>cb</sub>	V <sub>CB</sub> =5V, I <sub>E</sub> =0, f=140kHz			6.5	pF
Emitter-Base Capacitance	C <sub>eb</sub>	V <sub>BE</sub> =0.5V, I <sub>C</sub> =0, f=140kHz			30	pF
Input Impedance	h <sub>ie</sub>	V <sub>CE</sub> =10V, I <sub>C</sub> =1mA, f=1kHz	1		15	kΩ
Voltage Feedback Ratio	h <sub>re</sub>	V <sub>CE</sub> =10V, I <sub>C</sub> =1mA, f=1kHz	0.1		8	×10 <sup>-4</sup>
Small-Signal Current Gain	h <sub>fe</sub>	V <sub>CE</sub> =10V, I <sub>C</sub> =1mA, f=1kHz	40		500	
Output Admittance	h <sub>oe</sub>	V <sub>CE</sub> =10V, I <sub>C</sub> =1mA, f=1kHz	1		30	µmhos
<b>SWITCHING CHARACTERISTICS</b>						
Delay Time	t <sub>D</sub>	V <sub>CC</sub> =30V, V <sub>EB</sub> =2V I <sub>C</sub> =150mA I <sub>B1</sub> =15mA			15	ns
Rise Time	t <sub>R</sub>	V <sub>CC</sub> =30V, V <sub>EB</sub> =2V I <sub>C</sub> =150mA I <sub>B1</sub> =15mA			20	ns
Storage Time	t <sub>S</sub>				225	ns
Fall Time	t <sub>F</sub>	V <sub>CC</sub> =30V, I <sub>C</sub> =150mA I <sub>B1</sub> = I <sub>B2</sub> =15mA			30	ns

Note: Pulse test: PulseWidth≤300µs, Duty Cycle≤2%



■ TEST CIRCUIT

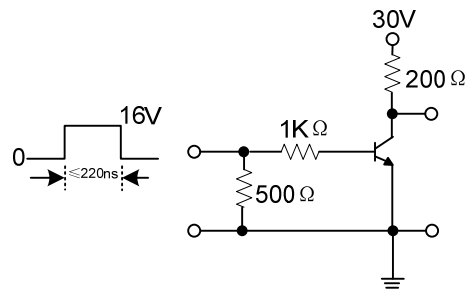


Figure1. Saturated Turn-On Switching Timer

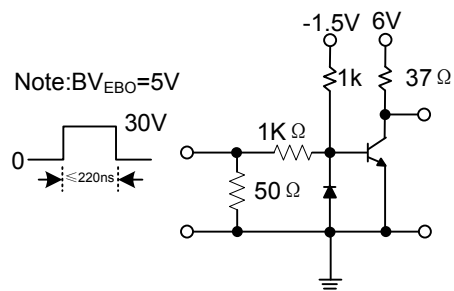
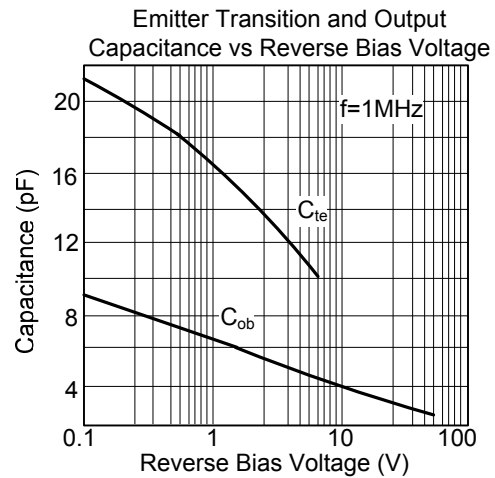
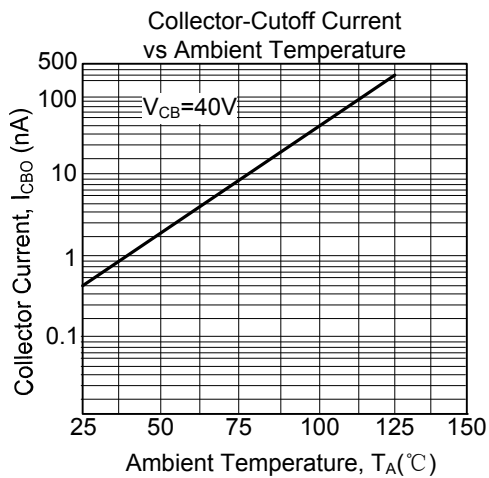
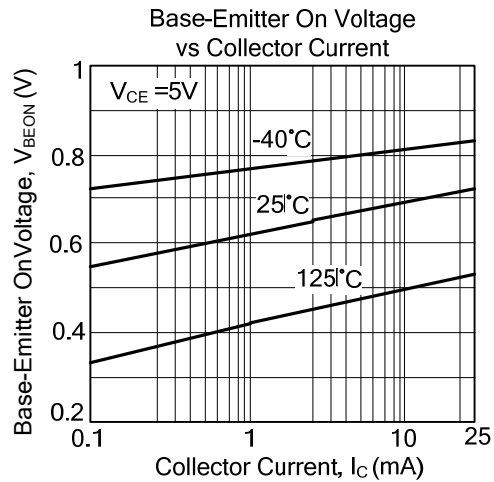
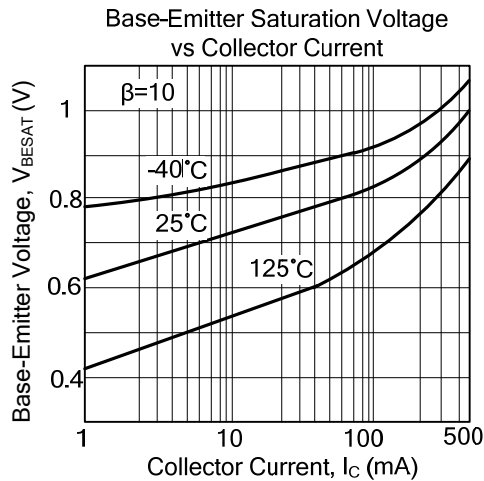
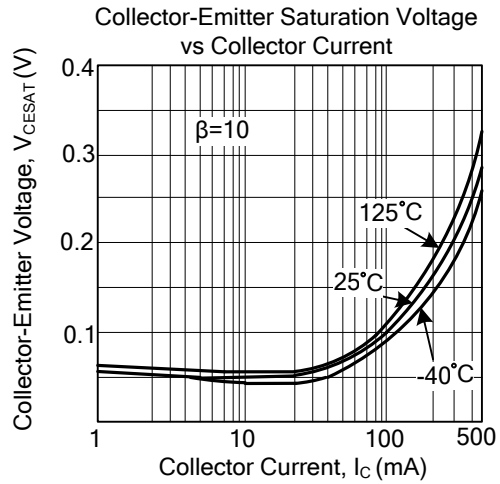
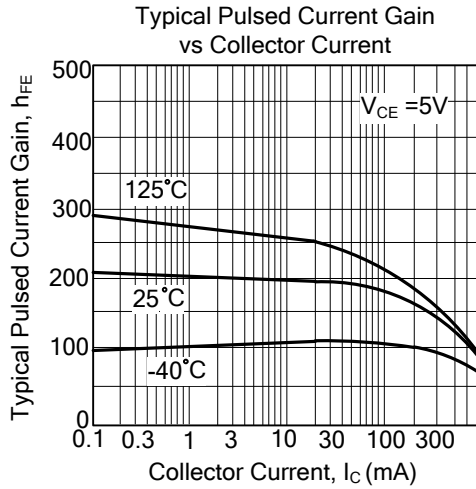
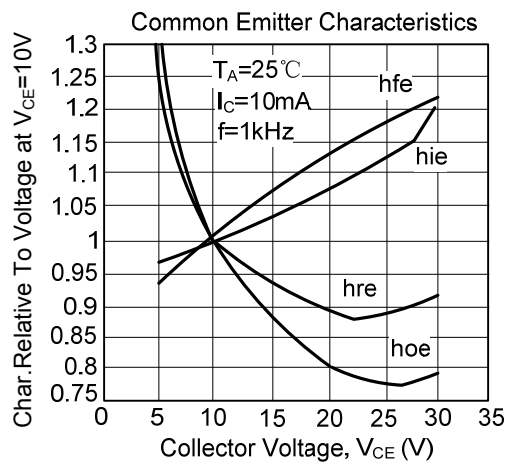
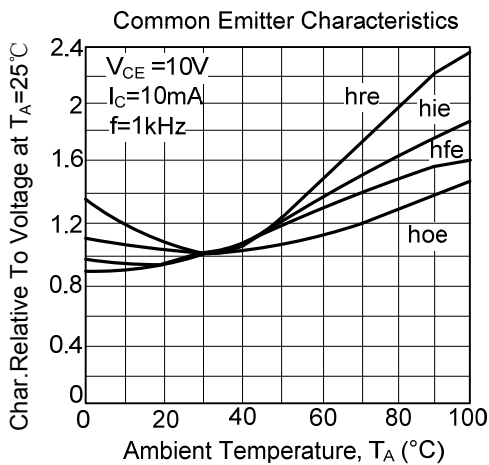
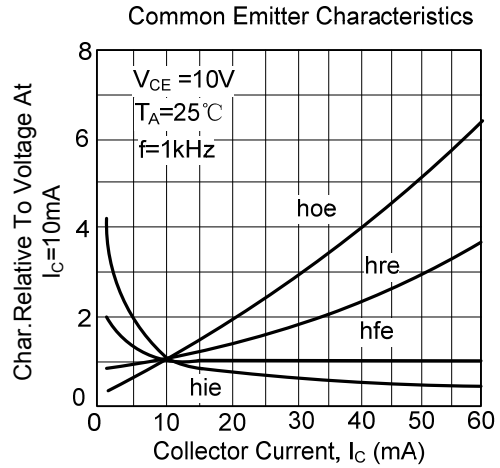
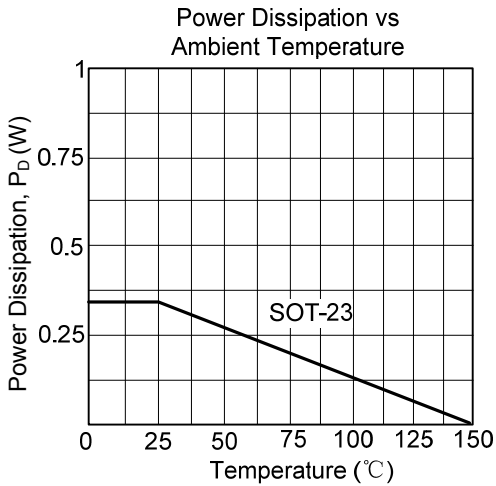
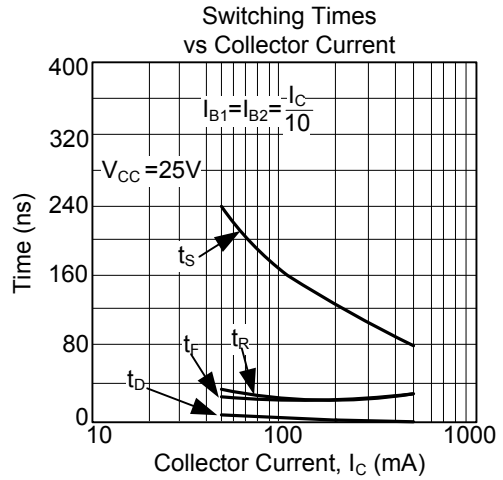
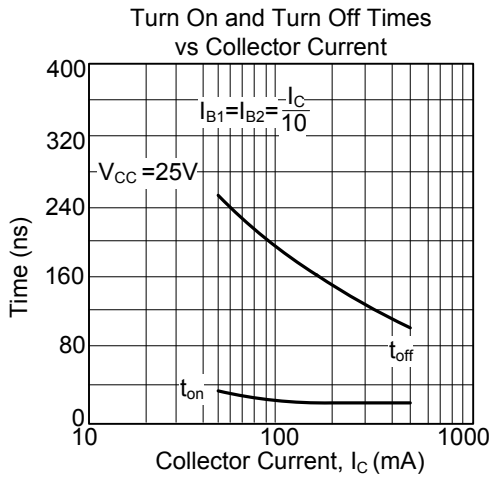


Figure2. Saturated Turn-Off Switching Timer

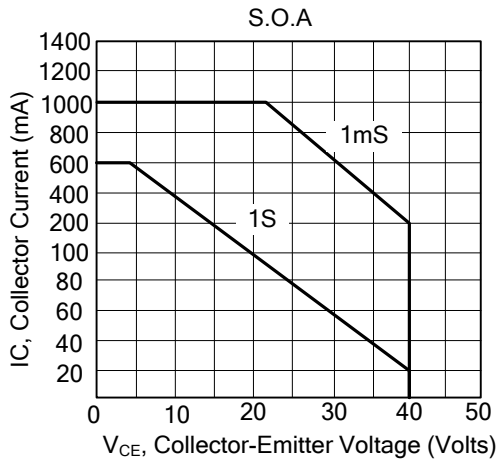
### TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS(Cont.)



### ■ TYPICAL CHARACTERISTICS(Cont.)



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