

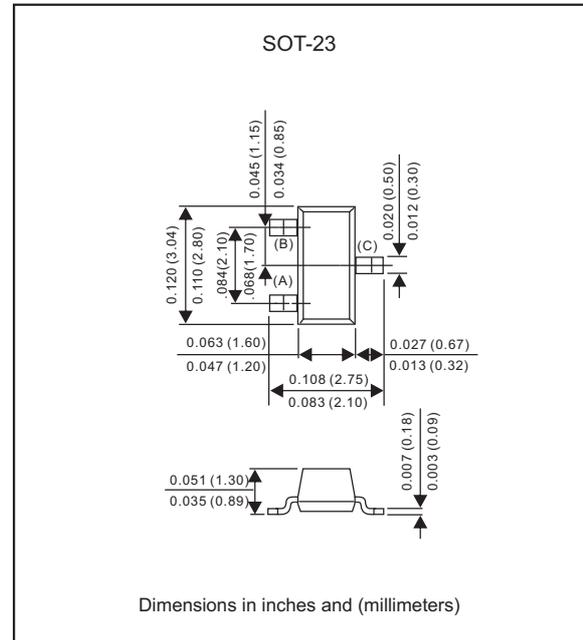
### Features

- Lead-free parts for green partner, exceeds environmental standards of MIL-STD-19500 /228
- Compliant to Halogen-free

### Mechanical data

- Epoxy:UL94-V0 rated flame retardant
- Case : Molded plastic, SOT-23
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Mounting Position : Any

### Package outline



### Maximum ratings (AT $T_A=25^\circ\text{C}$ unless otherwise noted)

PARAMETER	CONDITIONS	Symbol	Value	UNIT
Collector -Base Voltage		$V_{CBO}$	-160	Vdc
Collector -Emitter Voltage		$V_{CEO}$	-150	Vdc
Emitter -Base Voltage		$V_{EBO}$	-5.0	Vdc
Collector Current - Continuous		$I_C$	-500	mAdc

### Thermal Characteristics

Characteristics	CONDITIONS	Symbol	Max	UNIT
Total device dissipation FR-5 board (1)	$T_A = 25^\circ\text{C}$	$P_D$	225	mW
	Derate above $25^\circ\text{C}$	$P_D$	1.8	mW/ $^\circ\text{C}$
Thermal resistance	Junction to ambient	$R_{\theta JA}$	556	$^\circ\text{C}/\text{W}$
Total device dissipation alumina substrate(2)	$T_A = 25^\circ\text{C}$	$P_D$	300	mW
	Derate above $25^\circ\text{C}$	$P_D$	2.4	mW/ $^\circ\text{C}$
Thermal resistance	Junction to ambient	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Operating temperature		$T_J$	-55 ~ +150	$^\circ\text{C}$
Storage temperature		$T_{STG}$	-55 ~ +150	

1.FR-5 = 1.0 X 0.75 X 0.062 in.

2.Alumina = 0.4 X 0.3 X 0.024 in. 99.5% alumina.

### Electrical Characteristics (AT $T_A=25^\circ\text{C}$ unless otherwise noted)

#### OFF characteristics

PARAMETER	CONDITIONS	Symbol	Min.	Max.	UNIT
Collector-Base Breakdown Voltage	$I_C = -100\mu\text{Adc}, I_E = 0$	$V_{(BR)CBO}$	-160		Vdc
Collector-Emitter Breakdown Voltage	$I_C = -1.0\text{mAdc}, I_B = 0$	$V_{(BR)CEO}$	-150		Vdc
Emitter-Base Breakdown Voltage	$I_E = -10\mu\text{Adc}, I_C = 0$	$V_{(BR)EBO}$	-5.0		Vdc
Collector Cutoff Current	$V_{CB} = -120\text{Vdc}, I_E = 0$ $V_{CB} = -120\text{Vdc}, I_E = 0, T_A = 100^\circ\text{C}$	$I_{CES}$		-100 -100	nAdc uAdc

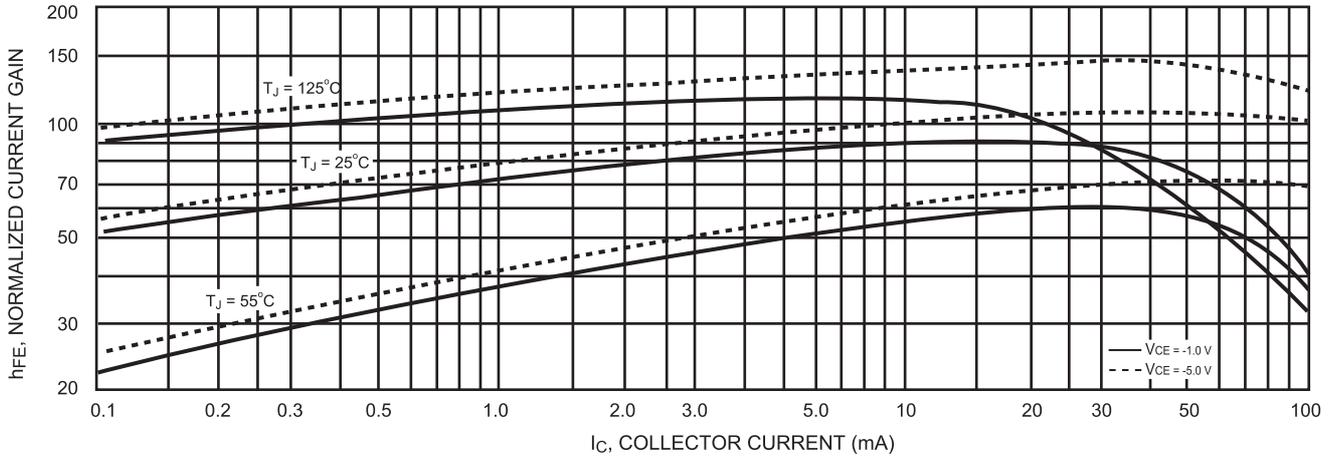
#### ON characteristics

PARAMETER	CONDITIONS	Symbol	Min.	Max.	UNIT
DC Current Gain	$I_C = -1.0\text{mAdc}, V_{CE} = -5.0\text{Vdc}$ $I_C = -10\text{mAdc}, V_{CE} = -5.0\text{Vdc}$ $I_C = -50\text{mAdc}, V_{CE} = -5.0\text{Vdc}$	$h_{FE}$	50 60 50	300	-
Collector-Emitter Saturation Voltage	$I_C = -10\text{mAdc}, I_B = -1.0\text{mAdc}$ $I_C = -50\text{mAdc}, I_B = -5.0\text{mAdc}$	$V_{CE(sat)}$		-0.2 -0.5	Vdc
Base-Emitter Saturation Voltage	$I_C = -10\text{mAdc}, I_B = -1.0\text{mAdc}$ $I_C = -50\text{mAdc}, I_B = -5.0\text{mAdc}$	$V_{BE(sat)}$		-1.0 -1.0	Vdc

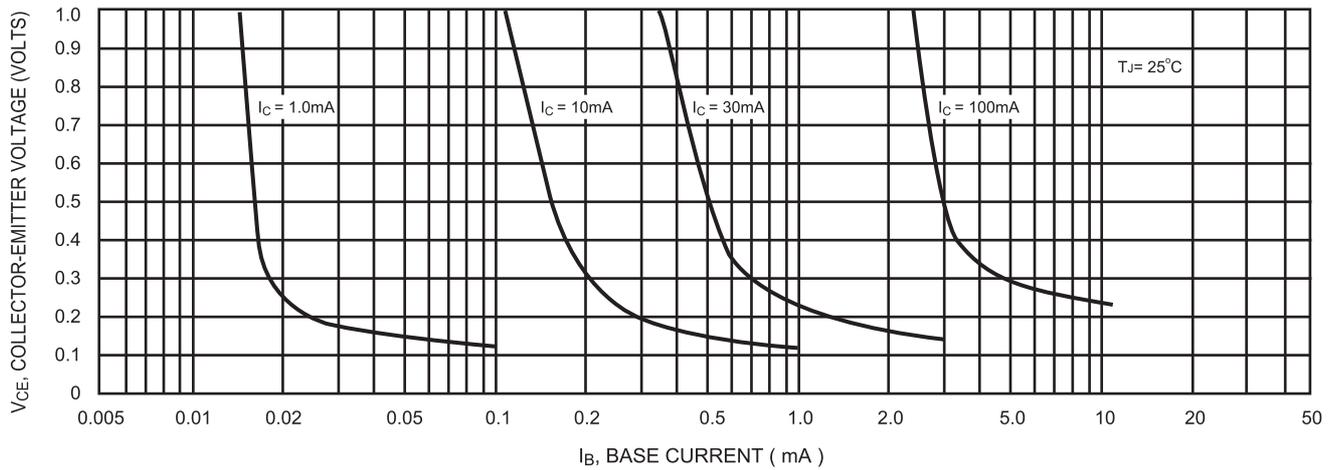
#### Small-Signal characteristics

PARAMETER	CONDITIONS	Symbol	Min.	Max.	UNIT
Current-Gain-Bandwidth Product	$I_C = -10\text{mAdc}, V_{CE} = -10\text{Vdc}, f = 100\text{MHz}$	$f_T$	100	300	MHZ
Output Capacitance	$V_{CB} = -10\text{Vdc}, I_E = 0, f = 1.0\text{MHz}$	$C_{obo}$		6.0	pF
Small Signal Current Gain	$I_C = -1.0\text{mAdc}, V_{CE} = -10\text{Vdc}, f = 1.0\text{KHz}$	$h_{fe}$	40	200	-
Noise Figure	$I_C = -200\mu\text{Adc}, V_{CE} = -5.0\text{Vdc}, R_s = 10\Omega, f = 1.0\text{KHz}$	NF		8.0	dB

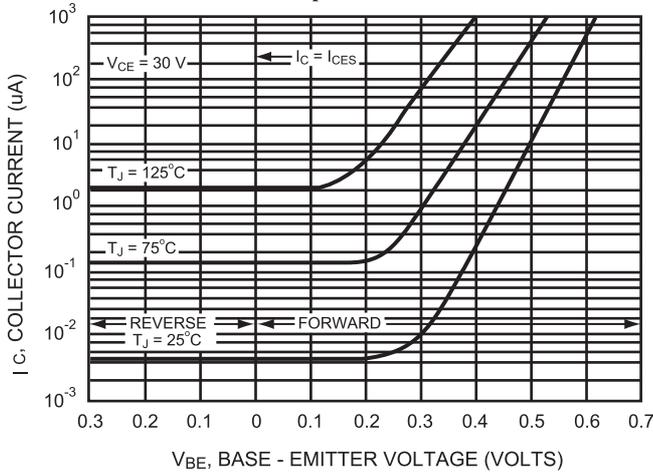
**FIG.1 DC Current Gain**



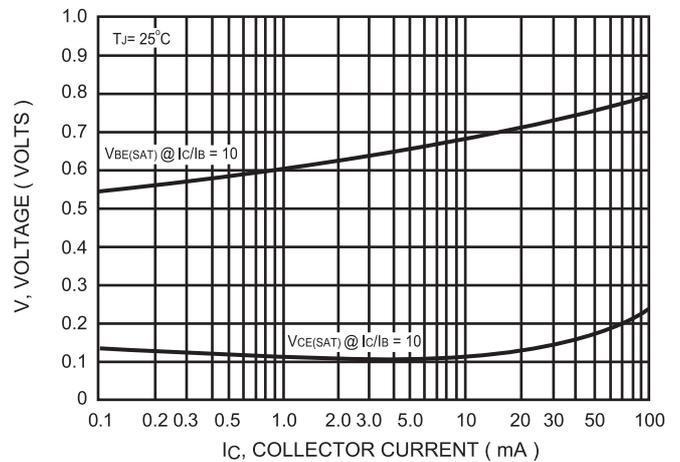
**FIG.2 Collector Saturation Region**



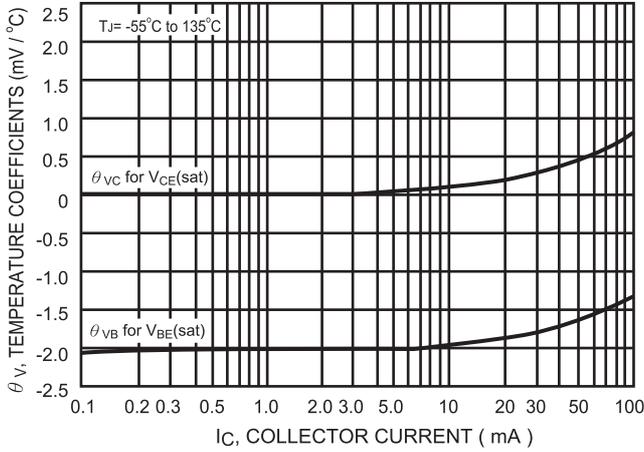
**FIG.3 Temperature Coefficients**



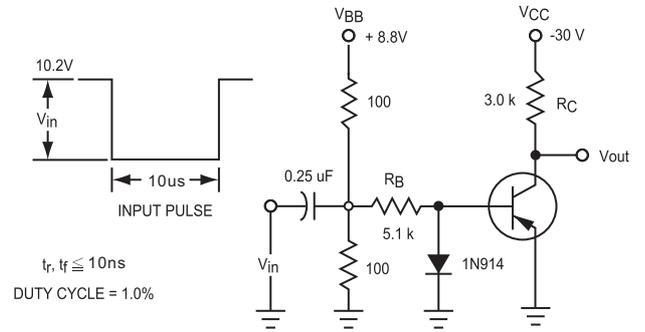
**FIG.4 " On " Voltages**



**FIG.5 Temperature Coefficients**

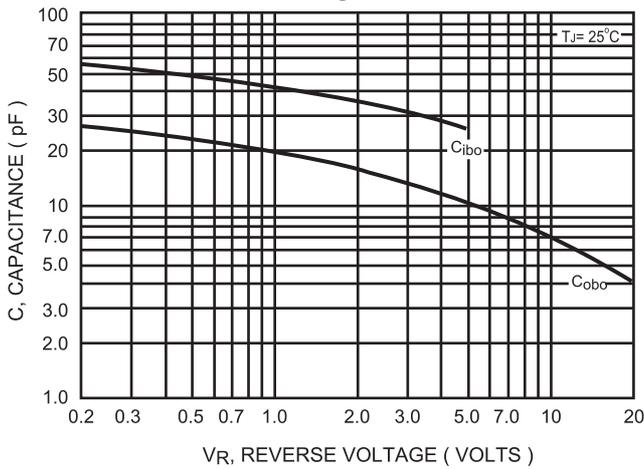


**FIG.6 Switching Time Test Circuit**

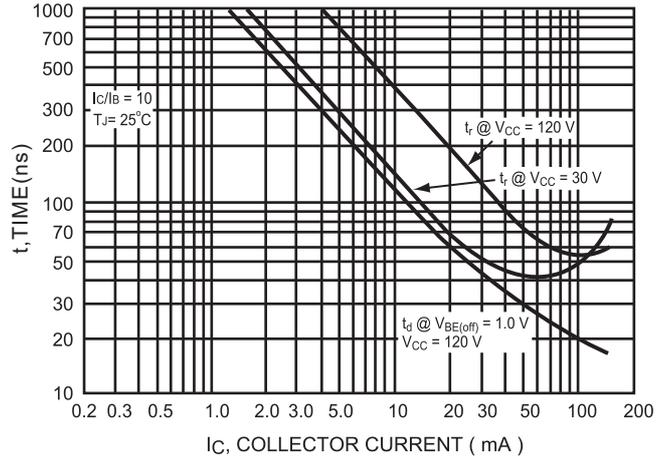


VALUES SHOWN ARE FOR  $I_C @ 10\text{mA}$

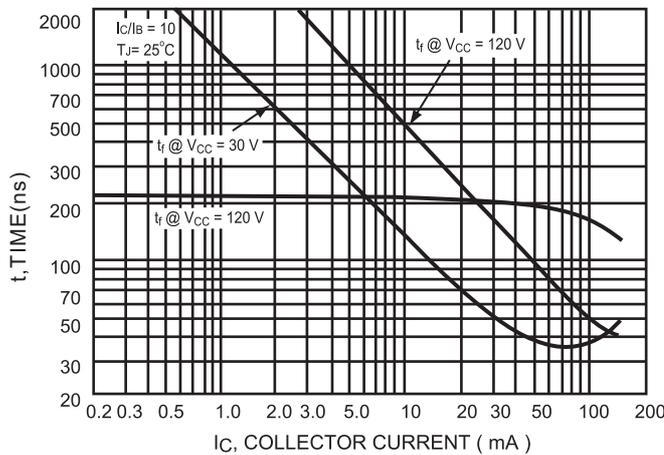
**FIG.7 Capacitances**



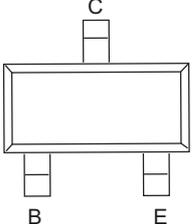
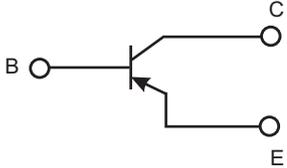
**FIG.8 Turn - On Time**



**FIG.9 Turn - Off Time**



### Pinning information

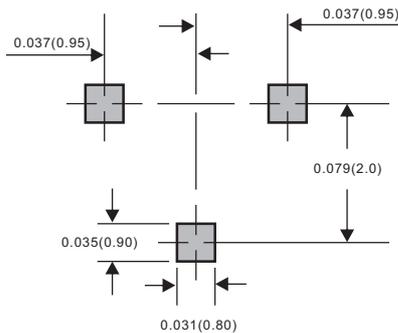
Pin	Simplified outline	Symbol
PinB Base PinC Collector PinE Emitter		

### Marking

Type number	Marking code
MMBT5401	2L

### Suggested solder pad layout

#### SOT-23



Dimensions in inches and (millimeters)