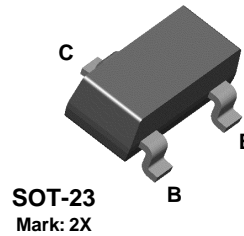


2N4401



MMBT4401



NPN General Purpose Amplifier

This device is designed for use as a medium power amplifier and switch requiring collector currents up to 500 mA.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V _{CEO}	Collector-Emitter Voltage	40	V
V _{CBO}	Collector-Base Voltage	60	V
V _{EBO}	Emitter-Base Voltage	6.0	V
I _C	Collector Current - Continuous	600	mA
T _J , T _{stg}	Operating and Storage Junction Temperature Range	-55 to +150	°C

*These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

NOTES:

- 1) These ratings are based on a maximum junction temperature of 150 degrees C.
- 2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

Thermal Characteristics

TA = 25°C unless otherwise noted

Symbol	Characteristic	Max		Units
		2N4401	*MMBT4401	
P _D	Total Device Dissipation	625	350	mW
	Derate above 25°C	5.0	2.8	mW/°C
R _{θJC}	Thermal Resistance, Junction to Case	83.3		°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient	200	357	°C/W

*Device mounted on FR-4 PCB 1.6" X 1.6" X 0.06."

NPN General Purpose Amplifier

(continued)

2N4401 / MMBT4401

Electrical Characteristics

TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Max	Units
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OFF CHARACTERISTICS

$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	$I_C = 1.0 \text{ mA}, I_B = 0$	40		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	$I_C = 0.1 \text{ mA}, I_E = 0$	60		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	$I_E = 0.1 \text{ mA}, I_C = 0$	6.0		V
I_{BL}	Base Cutoff Current	$V_{CE} = 35 \text{ V}, V_{EB} = 0.4 \text{ V}$		0.1	μA
I_{CEX}	Collector Cutoff Current	$V_{CE} = 35 \text{ V}, V_{EB} = 0.4 \text{ V}$		0.1	μA

ON CHARACTERISTICS*

h_{FE}	DC Current Gain	$I_C = 0.1 \text{ mA}, V_{CE} = 1.0 \text{ V}$ $I_C = 1.0 \text{ mA}, V_{CE} = 1.0 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 1.0 \text{ V}$ $I_C = 150 \text{ mA}, V_{CE} = 1.0 \text{ V}$ $I_C = 500 \text{ mA}, V_{CE} = 2.0 \text{ V}$	20 40 80 100 40	300	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$		0.4 0.75	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$	0.75	0.95 1.2	V

SMALL SIGNAL CHARACTERISTICS

f_T	Current Gain - Bandwidth Product	$I_C = 20 \text{ mA}, V_{CE} = 10 \text{ V},$ $f = 100 \text{ MHz}$	250		MHz
C_{cb}	Collector-Base Capacitance	$V_{CB} = 5.0 \text{ V}, I_E = 0,$ $f = 140 \text{ kHz}$		6.5	pF
C_{eb}	Emitter-Base Capacitance	$V_{BE} = 0.5 \text{ V}, I_C = 0,$ $f = 140 \text{ kHz}$		30	pF
h_{ie}	Input Impedance	$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V},$ $f = 1.0 \text{ kHz}$	1.0	15	$k\Omega$
h_{re}	Voltage Feedback Ratio	$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V},$ $f = 1.0 \text{ kHz}$	0.1	8.0	$\times 10^{-4}$
h_{fe}	Small-Signal Current Gain	$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V},$ $f = 1.0 \text{ kHz}$	40	500	
h_{oe}	Output Admittance	$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V},$ $f = 1.0 \text{ kHz}$	1.0	30	μmhos

SWITCHING CHARACTERISTICS

t_d	Delay Time	$V_{CC} = 30 \text{ V}, V_{EB} = 2 \text{ V},$		15	ns
t_r	Rise Time	$I_C = 150 \text{ mA}, I_{B1} = 15 \text{ mA}$		20	ns
t_s	Storage Time	$V_{CC} = 30 \text{ V}, I_C = 150 \text{ mA}$		225	ns
t_f	Fall Time	$I_{B1} = I_{B2} = 15 \text{ mA}$		30	ns

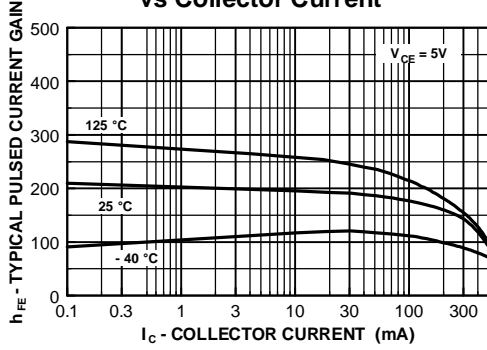
*Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2.0\%$

NPN General Purpose Amplifier
(continued)

2N4401 / MMBT4401

Typical Characteristics

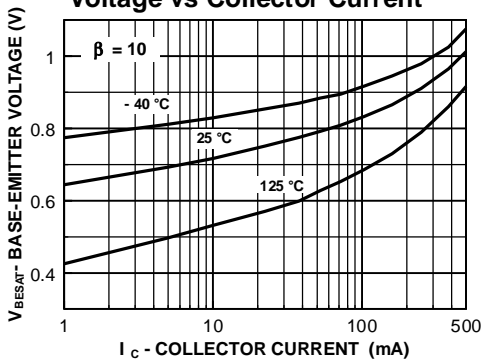
Typical Pulsed Current Gain vs Collector Current



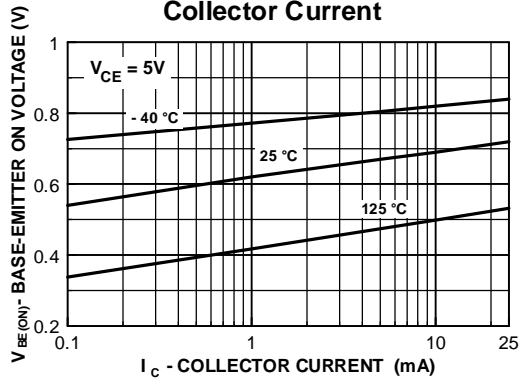
Collector-Emitter Saturation Voltage vs Collector Current



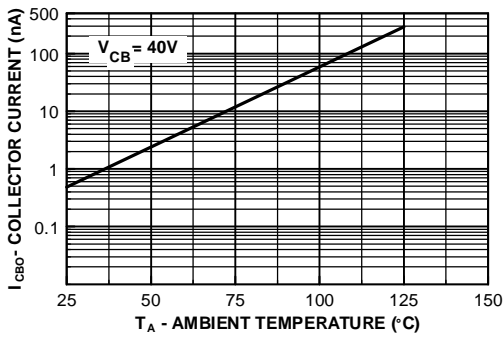
Base-Emitter Saturation Voltage vs Collector Current



Base-Emitter ON Voltage vs Collector Current



Collector-Cutoff Current vs Ambient Temperature



Emitter Transition and Output Capacitance vs Reverse Bias Voltage



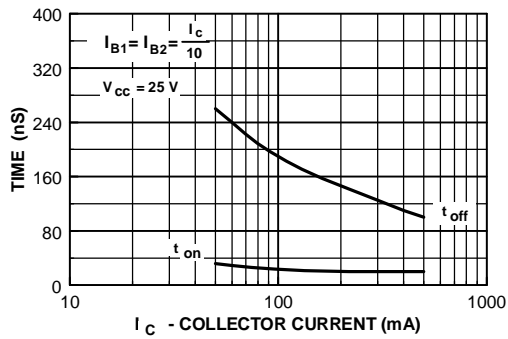
NPN General Purpose Amplifier

(continued)

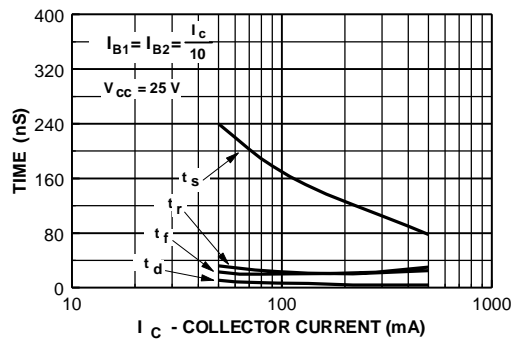
2N4401 / MMBT4401

Typical Characteristics (continued)

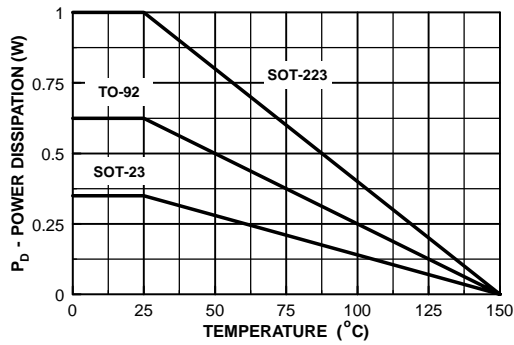
Turn On and Turn Off Times vs Collector Current



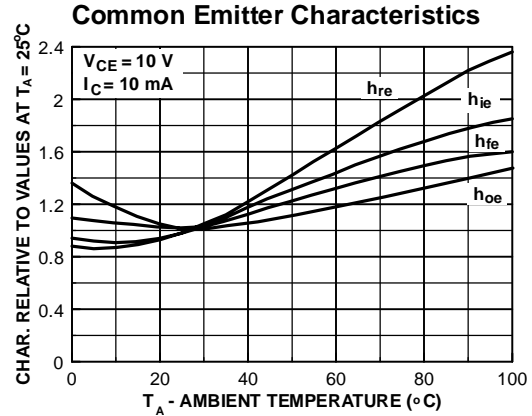
Switching Times vs Collector Current



Power Dissipation vs Ambient Temperature



Typical Common Emitter Characteristics (f = 1.0kHz)



Test Circuits



FIGURE 1: Saturated Turn-On Switching Timer



FIGURE 2: Saturated Turn-Off Switching Time

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Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

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2N4401

NPN General Purpose Amplifier

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General description

This device is designed for use as a medium power amplifier and switch requiring collector currents up to 500 mA.

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Product status/pricing/packageing

BUY

Product	Product status	Pb-free Status	Pricing*	Package type	Leads	Packing method	Package Marking Convention**
2N4401BU	Full Production	 Full Production	\$0.026	TO-92	3	BULK	Line 1: 2N Line 2: 4401 Line 3: -&3
2N4401NLBU	Full Production	 Full Production	\$0.026	TO-92	3	BULK	Line 1: 2N Line 2: 4401 Line 3: -&3
2N4401TA	Full Production	 Full Production	\$0.026	TO-92	3	AMMO	Line 1: 2N Line 2: 4401 Line 3: -&3
2N4401TAR	Full Production		\$0.026	TO-92	3	AMMO	Line 1: 2N Line 2: 4401 Line 3: -&3

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		 Full Production					
2N4401TA_NL	Full Production	 Full Production	N/A	TO-92	3	AMMO	Line 1: 2N Line 2: 4401 Line 3: -&3
2N4401TF	Full Production	 Full Production	\$0.026	TO-92	3	TAPE REEL	Line 1: 2N Line 2: 4401 Line 3: -&3
2N4401TFR	Full Production	 Full Production	\$0.026	TO-92	3	TAPE REEL	Line 1: 2N Line 2: 4401 Line 3: -&3
2N4401_D81Z	Full Production	 Full Production	N/A	TO-92	3	TAPE REEL	Line 1: \$Y (Fairchild logo) & Z (Asm. Plant Code) & 3 (3-Digit Date Code) Line 2: 2N Line 3: 4401
2N4401_J05Z	Full Production	 Full Production	N/A	TO-92	3	BULK	Line 1: \$Y (Fairchild logo) & Z (Asm. Plant Code) & 3 (3-Digit Date Code) Line 2: 2N Line 3: 4401
2N4401_J18Z	Full Production	 Full Production	N/A	TO-92	3	BULK	Line 1: \$Y (Fairchild logo) & Z (Asm. Plant Code) & 3 (3-Digit Date Code) Line 2: 2N Line 3: 4401
2N4401_J60Z	Full Production	 Full Production	N/A	TO-92	3	BULK	Line 1: \$Y (Fairchild logo) & Z (Asm. Plant Code) & 3 (3-Digit Date Code) Line 2: 2N Line 3: 4401
2N4401_J61Z	Full Production	 Full Production	N/A	TO-92	3	BULK	Line 1: \$Y (Fairchild logo) & Z (Asm. Plant Code) & 3 (3-Digit Date Code) Line 2: 2N Line 3: 4401

* Fairchild 1,000 piece Budgetary Pricing

** A sample button will appear if the part is available through Fairchild's on-line samples program. If there is no sample button, please contact a [Fairchild distributor](#) to obtain samples



Indicates product with Pb-free second-level interconnect. For more information [click here](#).

Package marking information for product 2N4401 is available. [Click here for more information](#).

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Models

Package & leads	Condition	Temperature range	Software version	Revision date
PSPICE				
TO-92-3	Electrical	25°C	N/A	N/A

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Application notes

[AN-9006: IGBT Application Note for Camera Strobe](#) (145 K) Jul 27, 2007

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Qualification Support

Click on a product for detailed qualification data

Product
2N4401BU
2N4401NLBU
2N4401TA
2N4401TAR
2N4401TA_NL
2N4401TF
2N4401TFR
2N4401_D81Z
2N4401_J05Z
2N4401_J18Z
2N4401_J60Z
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