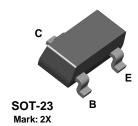


2N4401

MMBT4401





NPN General Pupose 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.

Thermal Characteristics TA = 25°C unless otherwise noted

Symbol	Characteristic	Max Units		Units
		2N4401	*MMBT4401	
P _D	Total Device Dissipation	625	350	mW
	Derate above 25°C	5.0	2.8	mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	357	°C/W

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

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

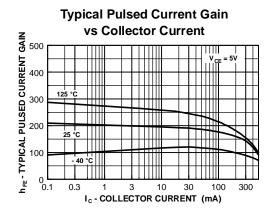
NPN General Purpose Amplifier (continued)

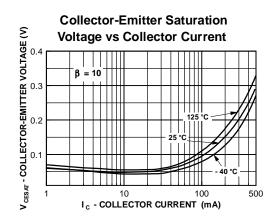
Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHA	RACTERISTICS				
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	$I_C = 1.0 \text{ mA}, I_B = 0$	40		V
V _{(BR)CBO}	Collector-Base Breakdown Voltage	$I_{\rm C} = 0.1 \text{ mA}, I_{\rm E} = 0$	60		V
V _{(BR)EBO}	Emitter-Base Breakdown Voltage	$I_E = 0.1 \text{ mA}, I_C = 0$	6.0		V
I _{BL}	Base Cutoff Current	$V_{CE} = 35 \text{ V}, V_{EB} = 0.4 \text{ V}$		0.1	μΑ
I _{CEX}	Collector Cutoff Current	$V_{CE} = 35 \text{ V}, V_{EB} = 0.4 \text{ V}$		0.1	μА
ON CHAR	ACTERISTICS*				
h _{FE}	DC Current Gain	$I_C = 0.1 \text{ mA}, V_{CE} = 1.0 \text{ V}$	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	
	Outleader Fusition Outlead in Maliana	$I_C = 500 \text{ mA}, V_{CE} = 2.0 \text{ V}$	40	0.4	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$		0.4 0.75	V
\/	Base-Emitter Saturation Voltage	$I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$ $I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$	0.75	0.75	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	$I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$	0.75	1.2	V
SMALL SI	GNAL CHARACTERISTICS Current Gain - Bandwidth Product	I _C = 20 mA, V _{CE} = 10 V, f = 100 MHz	250		MHz
C _{cb}	Collector-Base Capacitance	$V_{CB} = 5.0 \text{ V}, I_{E} = 0,$ f = 140 kHz		6.5	pF
C _{eb}	Emitter-Base Capacitance	$V_{BE} = 0.5 \text{ V}, I_{C} = 0,$ f = 140 kHz		30	pF
h _{ie}	Input Impedance	$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V},$ f = 1.0 kHz	1.0	15	kΩ
h _{re}	Voltage Feedback Ratio	$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V},$ f = 1.0 kHz	0.1	8.0	x 10 ⁻⁴
h _{fe}	Small-Signal Current Gain	$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V},$ f = 1.0 kHz	40	500	
h _{oe}	Output Admittance	$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V},$ f = 1.0 kHz	1.0	30	μmhos
SWITCHI	NG 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

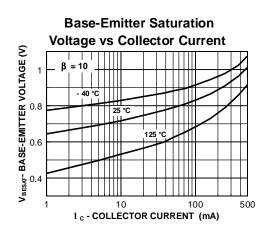
^{*}Pulse Test: Pulse Width \leq 300 μ s, Duty Cycle \leq 2.0%

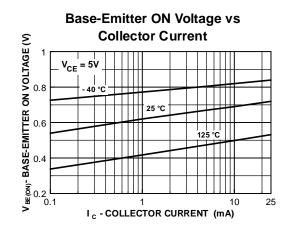
(continued)

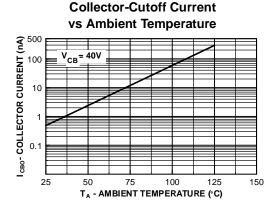
Typical Characteristics

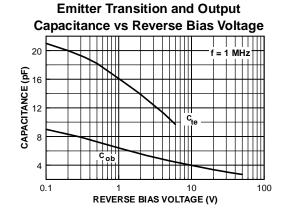








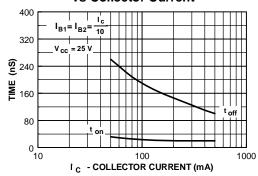




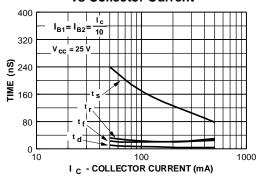
(continued)

Typical Characteristics (continued)

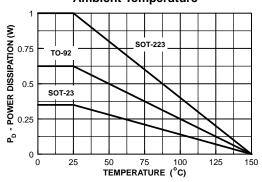
Turn On and Turn Off Times vs Collector Current



Switching Times vs Collector Current

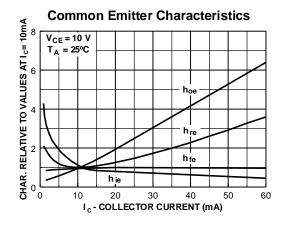


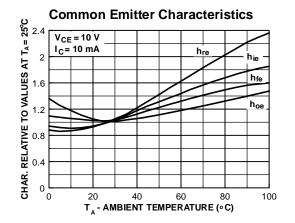
Power Dissipation vs Ambient Temperature

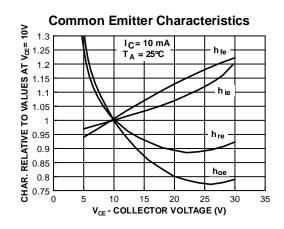


(continued)

Typical Common Emitter Characteristics (f = 1.0kHz)







(continued)

Test Circuits

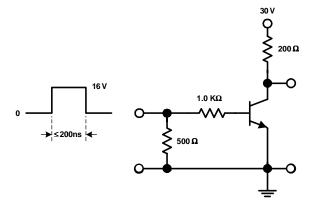


FIGURE 1: Saturated Turn-On Switching Timer

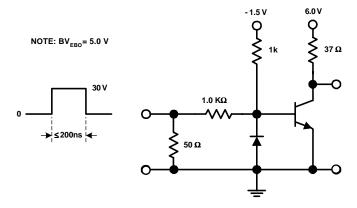


FIGURE 2: Saturated Turn-Off Switching Time

TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

 $ACEx^{TM}$ FASTr™ PowerTrench® SyncFET™ Bottomless™ QFET™ TinyLogic™ GlobalOptoisolator™ QSTM UHC™ CoolFET™ GTO™ **VCX**TM $CROSSVOLT^{TM}$ QT Optoelectronics™ HiSeC™

DOME™ ISOPLANAR™ Quiet Series™

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

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.