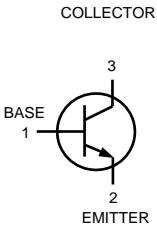
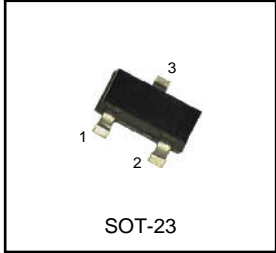


Switching Transistor
NPN Silicon
Lead free product
Halogen-free type

MMBT4401GH



MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V _{CEO}	40	V _{dc}
Collector-Base Voltage	V _{CB0}	60	V _{dc}
Emitter-Base Voltage	V _{EB0}	6.0	V _{dc}
Collector Current-Continuous	I _C	600	mA _{dc}

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max.	Unit
Total Device Dissipation FR-5 Board ⁽¹⁾ TA=25°C Derate above 25°C	P _D	225 1.8	mW mW / °C
Thermal Resistance Junction to Ambient	R _{θJA}	556	°C / W
Total Device Dissipation Alumina Substrate, ⁽²⁾ TA=25°C Derate above 25°C	P _D	300 2.4	mW mW / °C
Thermal Resistance Junction to Ambient	R _{θJA}	417	°C / W
Junction and Storage Temperature	T _J ,T _{STG}	-55 to +150	°C

ELECTRICAL CHARACTERISTICS (TA=25°C unless otherwise noted)

Characteristic	Symbol	Min.	Max.	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdowe Voltage ⁽³⁾ (I _C =1.0mA _{dc} , I _B =0)	V _{(BR)CEO}	40	-	V _{dc}
Collector-Base Breakdowe Voltage (I _C =0.1 mA _{dc} , I _E =0)	V _{(BR)CBO}	60	-	V _{dc}
Emitter-Base Breakdowe Voltage (I _E =0.1 mA _{dc} , I _C =0)	V _{(BR)EBO}	6.0	-	V _{dc}
Base Cutoff Current (V _{CE} =35 V _{dc} , V _{EB} =0.4 V _{dc})	I _{BEV}	-	0.1	uA _{dc}
Collector Cutoff Current (V _{CE} =35 V _{dc} , V _{EB} =0.4 V _{dc})	I _{CEX}	-	0.1	uA _{dc}

ELECTRICAL CHARACTERISTICS (TA=25°C unless otherwise noted) (Continued)

Characteristic	Symbol	Min.	Max.	Unit
ON CHARACTERISTICS⁽³⁾				
DC Current Gain (IC=0.1 mAdc, VCE=1.0 Vdc) (IC=1.0 mAdc, VCE=1.0 Vdc) (IC=10 mAdc, VCE=1.0 Vdc) (IC=150 mAdc, VCE=1.0 Vdc) (IC=500 mAdc, VCE=2.0 Vdc)	HFE	20 40 80 100 40	- - - 300 -	-
Collector-Emitter Saturation Voltage ⁽³⁾ (IC=150 mAdc, IB=15 mAdc) (IC=500 mAdc, IB=50 mAdc)	VCE(sat)	- -	0.4 0.75	Vdc
Base-Emitter Saturation Voltage ⁽³⁾ (IC=150 mAdc, IB=15 mAdc) (IC=500 mAdc, IB=50 mAdc)	VBE(sat)	0.75 -	0.95 1.2	Vdc

SMALL-SIGNAL CHARACTERISTIC

Current-Gain-Bandwidth Product (IC=20 mAdc, VCE=10 Vdc, f=100 MHz)	ft	250	-	MHZ
Collector-Base Capacitance (VCB=5.0 Vdc, IE=0, f=1.0 MHz)	Ccb	-	6.5	pF
Emitter-Base Capacitance (VEB=0.5 Vdc, IC=0, f=1.0 MHz)	Ceb	-	30	pF
Input Impedance (VCE=10 Vdc, IC=1.0 mAdc, f=1.0 kHz)	hie	1.0	15	k ohms
Voltage Feedback Ratio (VCE=10 Vdc, IC=1.0 mAdc, f=1.0 kHz)	hre	0.1	8.0	X 10 ⁻⁴
Small-Signal Current Gain (VCE=10 Vdc, IC=1.0 mAdc, f=1.0 kHz)	hfe	40	500	-
Output Admittance (VCE=10 Vdc, IC=1.0 mAdc, f=1.0 kHz)	hoe	1.0	30	u mhos

SWITCHING CHARACTERISTICS

Delay Time	(VCC=30 Vdc, VBE=2.0 Vdc, IC=150 mAdc, IB1=15 mAdc)	td	-	15	nS
Rise Time		tr	-	20	
Storage Time	(VCC=30 Vdc, IC=150 mAdc, IB1=IB2=15 mAdc)	ts	-	225	nS
Fall Time		tf	-	30	

(1) FR-5=1.0 x 0.75 x 0.062in.

(2) Alumina=0.4 x 0.3 x 0.024in. 99.5% alumina.

(3) Pulse Test : Pulse Width ≤ 300uS, Duty Cycle ≤ 2.0%.

SWITCHING TIME EQUIVALENT TEST CIRCUITS

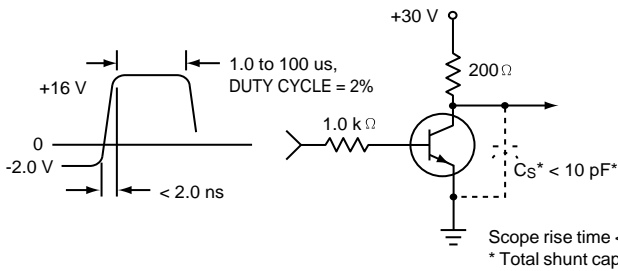


Figure 1. Turn-On Time

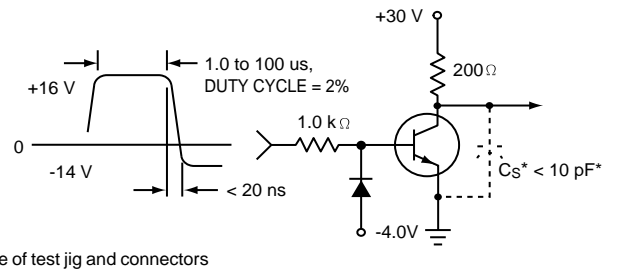


Figure 2. Turn-Off Time

TRANSIENT CHARACTERISTICS

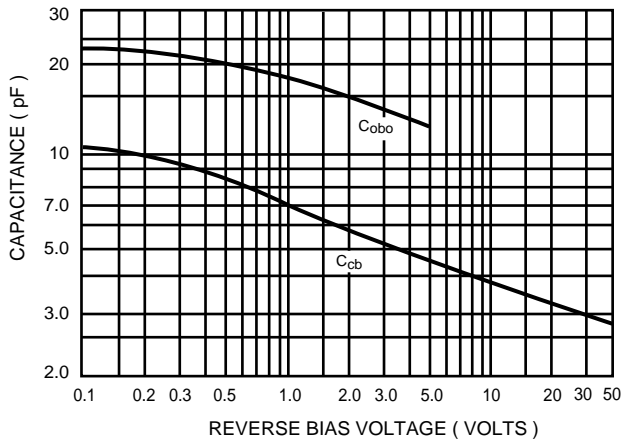


Figure 3. Capacitance

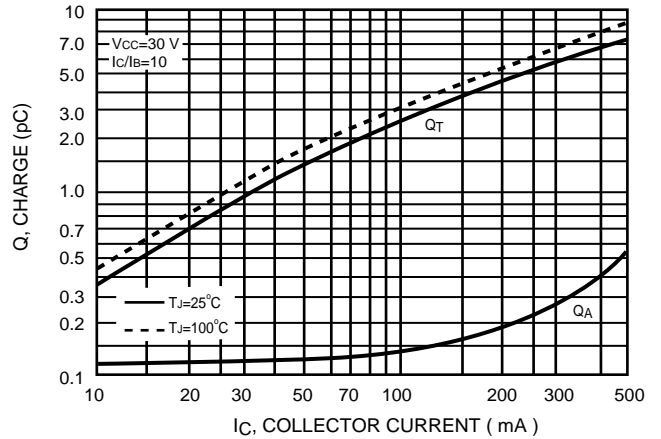


Figure 4. Charge Data

TRANSIENT CHARACTERISTICS

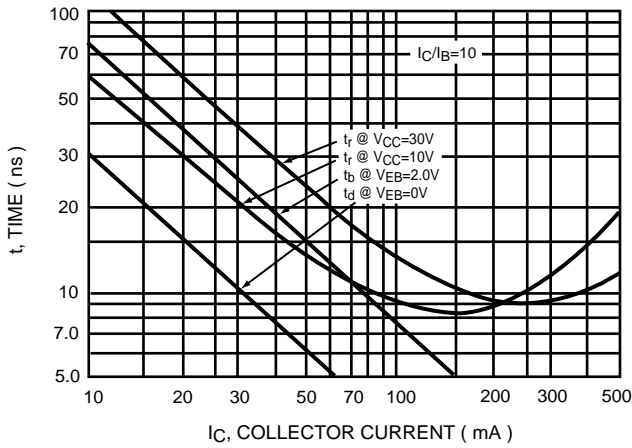


Figure 5. Turn-On Time

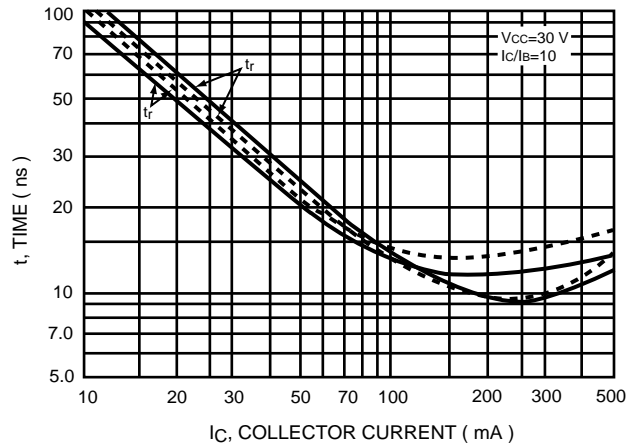


Figure 6. Rise and Fall Times

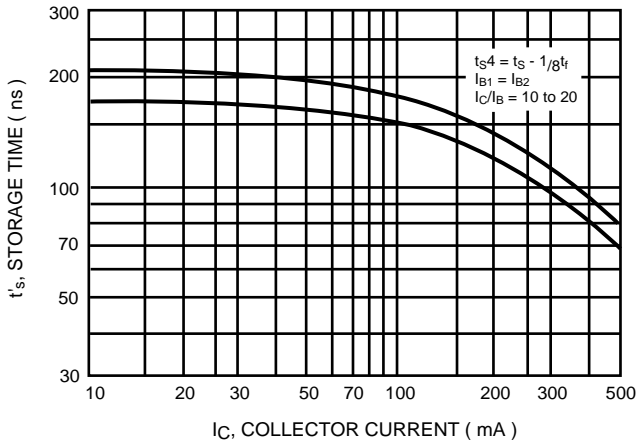


Figure 7. Storage Time

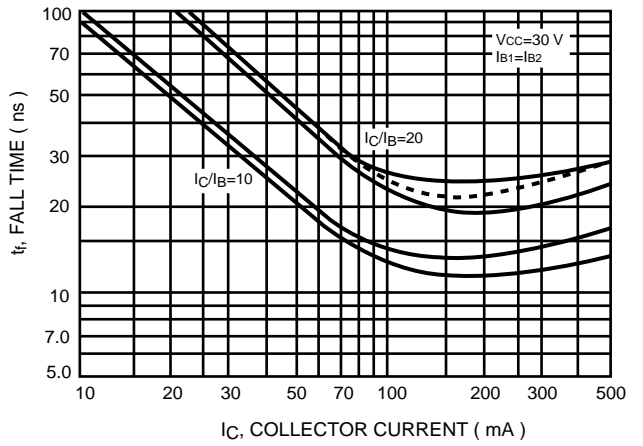


Figure 8. Fall Time

SMALL-SIGNAL CHARACTERISTICS

NOISE FIGURE

$V_{CE}=10\text{ Vdc}$, $T_A=25^\circ\text{C}$
Bandwidth=1.0HZ

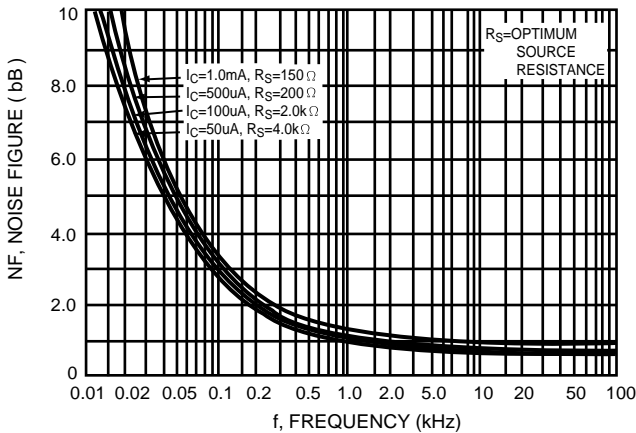


Figure 9. Frequency Effects

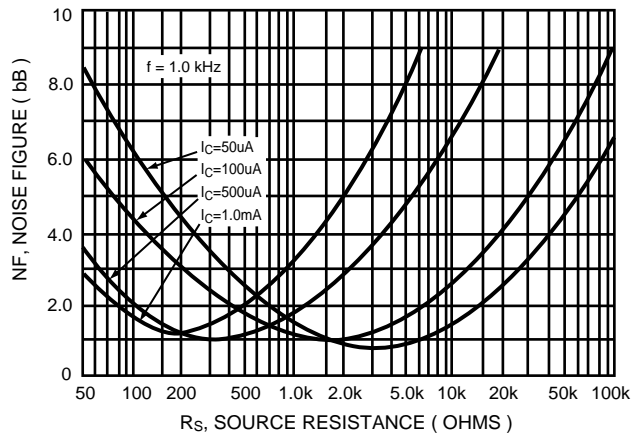


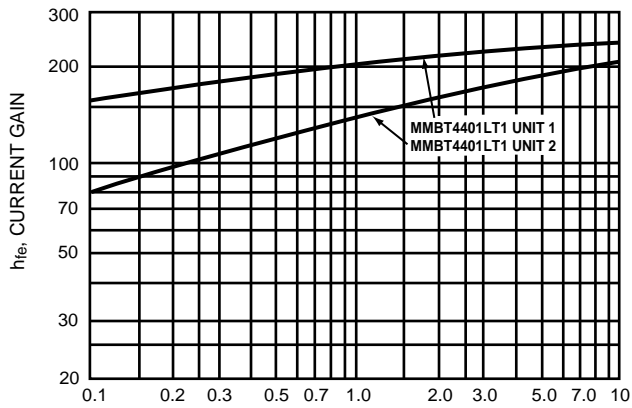
Figure 10. Source Resistance Effects

h PARAMETERS

$V_{CE} = 10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$, $T_A = 25^\circ\text{C}$

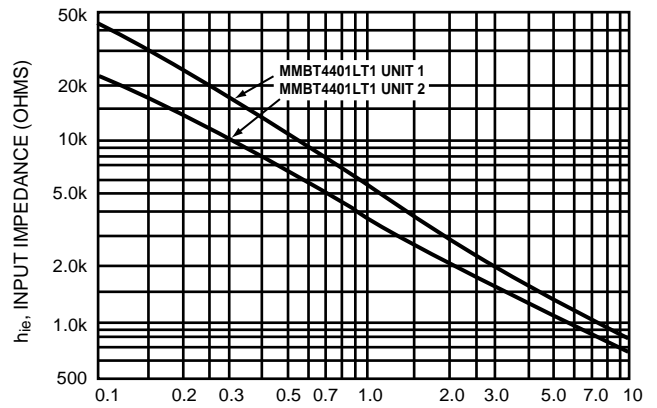
This group of graphs illustrates the relationship between h_{fe} and other "h" parameters for this series of transistors. To obtain these curves, a high-gain and a low-gain unit were

selected from the MMBT4401LT1 lines, and the same units were used to develop the correspondingly numbered curves on each graph.



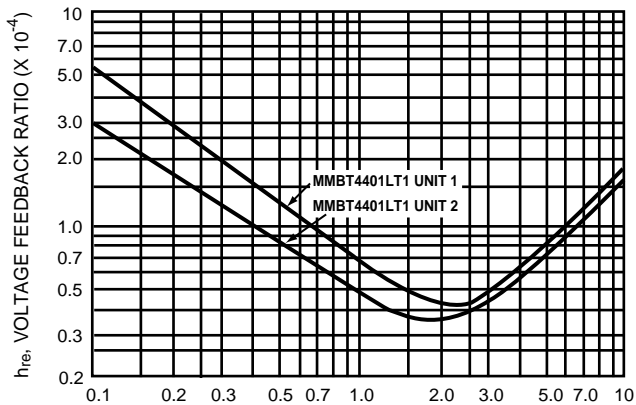
I_C , COLLECTOR CURRENT (mA)

Figure 11. Current Gain



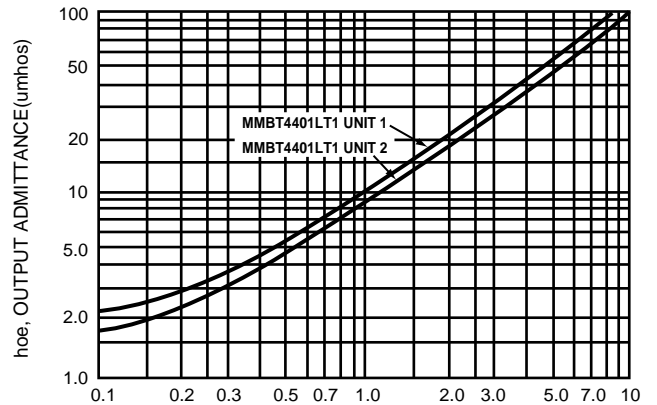
I_C , COLLECTOR CURRENT (mA)

Figure 12. Input Impedance



I_C , COLLECTOR CURRENT (mA)

Figure 13. Voltage Feedback Ratio



I_C , COLLECTOR CURRENT (mA)

Figure 14. Output Admittance

STATIC CHARACTERISTICS

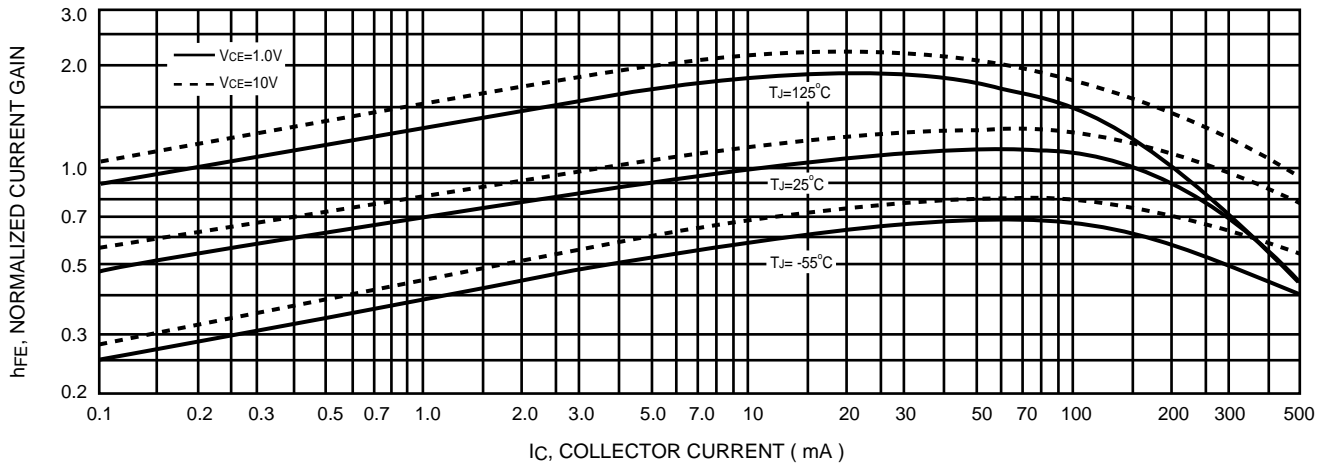


Figure 15. DC Current Gain

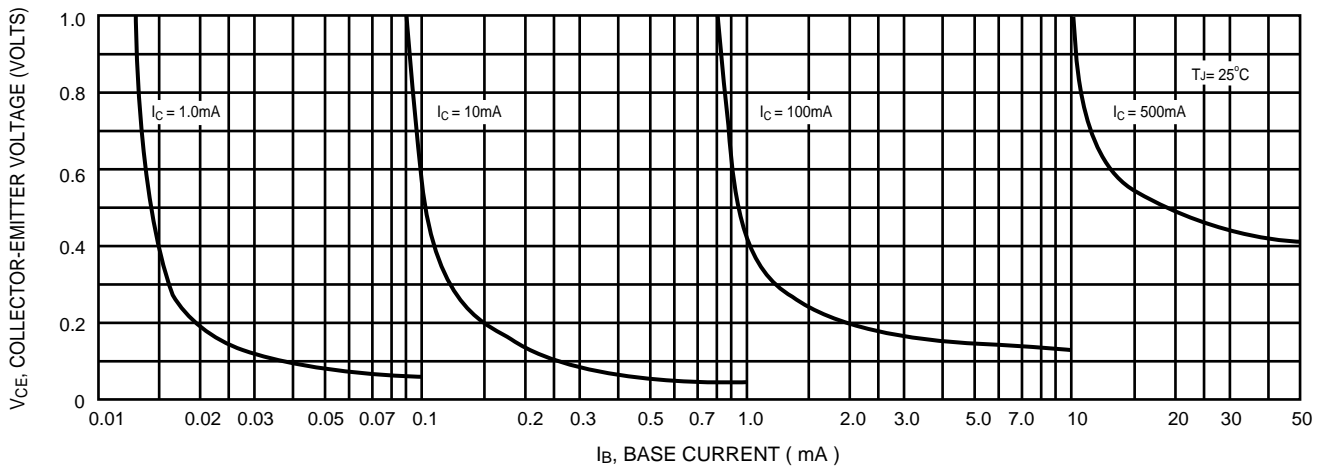


Figure 16. Collector Saturation Region

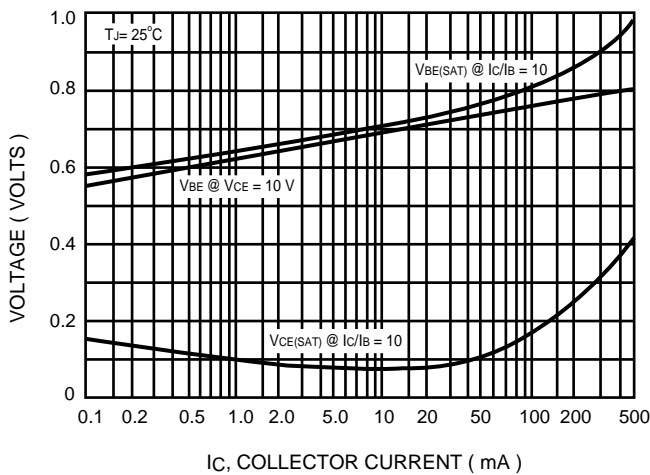


Figure 17. " ON " Voltage

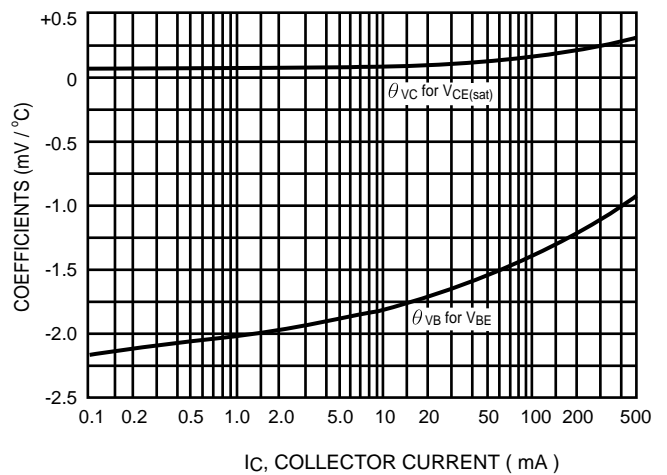


Figure 18. Temperature Coefficients