

## Features

- $BV_{CEO} > 40V$
- $I_C = 200mA$  High Collector Current
- $P_D = 925mW$  Power Dissipation
- 0.36mm<sup>2</sup> Package Footprint, 40% Smaller than DFN1006
- 0.4mm Height Package Minimizing Off-Board Profile
- Complementary PNP Type MMBT3904FZ
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

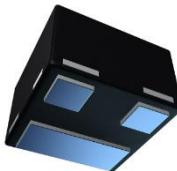
## Mechanical Data

- Case: X2-DFN0606-3
- Case Material: Molded Plastic, "Green" Molding Compound.
- UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — NiPdAu, Solderable per MIL-STD-202, Method 208<sup>(e4)</sup>
- Weight: 0.0008 grams (Approximate)

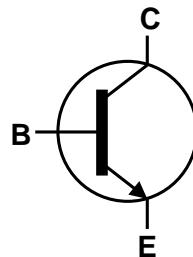
X2-DFN0606-3



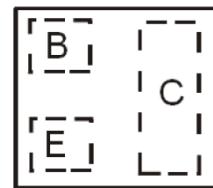
Top View



Bottom View



Device Symbol


 Top View  
 Device Schematic

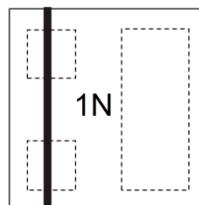
## Ordering Information (Note 4)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
MMBT3904FZ-7B	1N	7	8mm	10,000

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



1N = Product Type Marking Code

Top View  
 Bar Denotes Base  
 and Emitter Side

**Absolute Maximum Ratings** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	60	V
Collector-Emitter Voltage	$V_{CEO}$	40	V
Emitter-Base Voltage	$V_{EBO}$	6.0	V
Collector Current	$I_C$	200	mA
Peak Pulse Collector Current	$I_{CM}$	500	mA

**Thermal Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Power Dissipation	$P_D$	270	mW
(Note 5)	(Note 6)	925	
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	465	°C/W
(Note 5)	(Note 6)	135	
Thermal Resistance, Junction to Lead	$R_{\theta JL}$	135	°C/W
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	°C

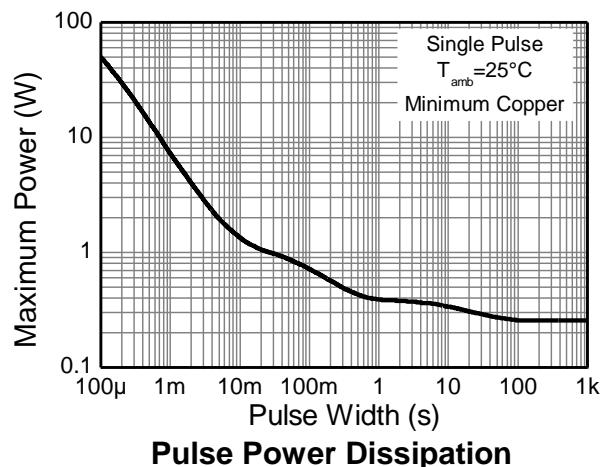
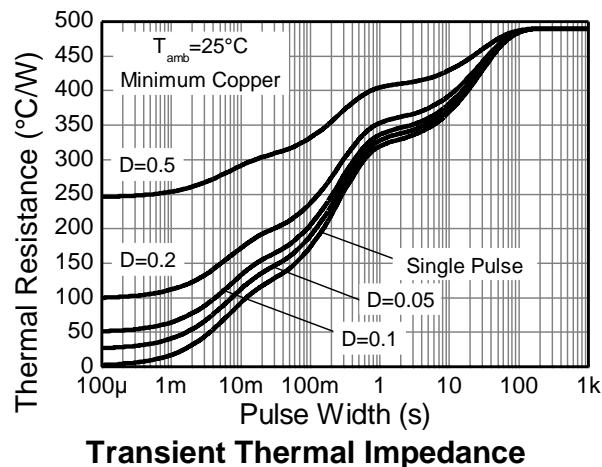
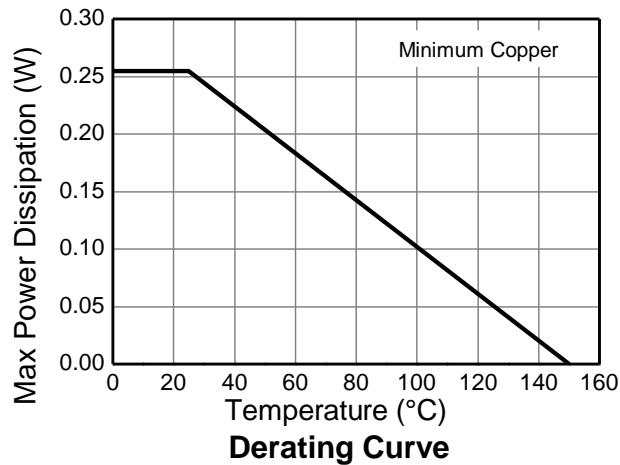
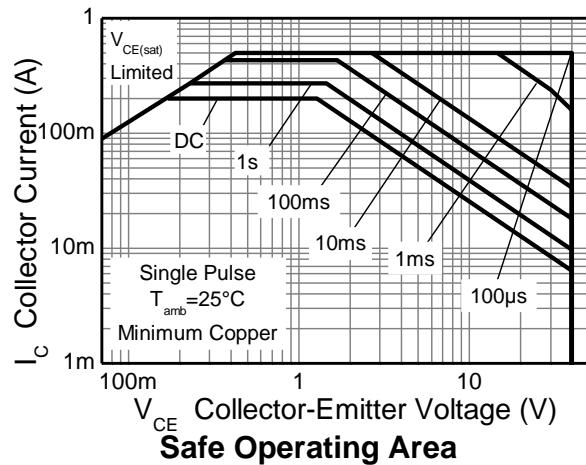
**ESD Ratings** (Note 8)

Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge - Machine Model	ESD MM	200	V	B

Notes:

- 5. For the device mounted on minimum recommended pad layout 1oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in steady state condition. The entire exposed collector pad is attached to the heatsink.
- 6. Same as Note 5, except the exposed collector pad is mounted on 25mm x 25mm 2oz copper.
- 7. Thermal resistance from junction to solder-point (on the exposed collector pad).
- 8. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

## Thermal Characteristics and Derating Information



**Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Min	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>					
Collector-Base Breakdown Voltage	$\text{BV}_{\text{CBO}}$	60	—	V	$I_C = 100\mu\text{A}, I_E = 0$
Collector-Emitter Breakdown Voltage (Note 9)	$\text{BV}_{\text{CEO}}$	40	—	V	$I_C = 10.0\text{mA}, I_B = 0$
Emitter-Base Breakdown Voltage	$\text{BV}_{\text{EBO}}$	6.0	—	V	$I_E = 100\mu\text{A}, I_C = 0$
Collector Cutoff Current	$I_{\text{CEX}}$	—	50	nA	$V_{\text{CE}} = 30\text{V}, V_{\text{EB}(\text{OFF})} = 3.0\text{V}$
Base Cutoff Current	$I_{\text{BL}}$	—	50	nA	$V_{\text{CE}} = 30\text{V}, V_{\text{EB}(\text{OFF})} = 3.0\text{V}$
<b>ON CHARACTERISTICS</b> (Note 9)					
DC Current Gain	$h_{\text{FE}}$	40	—	—	$I_C = 100\mu\text{A}, V_{\text{CE}} = 1.0\text{V}$
		70	—		$I_C = 1.0\text{mA}, V_{\text{CE}} = 1.0\text{V}$
		100	300		$I_C = 10\text{mA}, V_{\text{CE}} = 1.0\text{V}$
		60	—		$I_C = 50\text{mA}, V_{\text{CE}} = 1.0\text{V}$
		30	—		$I_C = 100\text{mA}, V_{\text{CE}} = 1.0\text{V}$
Collector-Emitter Saturation Voltage	$V_{\text{CE}(\text{sat})}$	—	0.20 0.30	V	$I_C = 10\text{mA}, I_B = 1.0\text{mA}$ $I_C = 50\text{mA}, I_B = 5.0\text{mA}$
Base-Emitter Saturation Voltage	$V_{\text{BE}(\text{sat})}$	0.65 —	0.85 0.95	V	$I_C = 10\text{mA}, I_B = 1.0\text{mA}$ $I_C = 50\text{mA}, I_B = 5.0\text{mA}$
<b>SMALL SIGNAL CHARACTERISTICS</b>					
Output Capacitance	$C_{\text{obo}}$	—	4.0	pF	$V_{\text{CB}} = 5.0\text{V}, f = 1.0\text{MHz}, I_E = 0$
Input Capacitance	$C_{\text{ibo}}$	—	9.5	pF	$V_{\text{EB}} = 0.5\text{V}, f = 1.0\text{MHz}, I_C = 0$
Current Gain-Bandwidth Product	$f_T$	300	—	MHz	$V_{\text{CE}} = 20\text{V}, I_C = 10\text{mA}, f = 100\text{MHz}$
<b>SWITCHING CHARACTERISTICS</b>					
Delay Time	$t_d$	—	35	ns	$V_{\text{CC}} = 3.0\text{V}, I_C = 10\text{mA}, V_{\text{BE}(\text{off})} = -0.5\text{V}, I_{B1} = 1.0\text{mA}$
Rise Time	$t_r$	—	35	ns	$V_{\text{CC}} = 3.0\text{V}, I_C = 10\text{mA}, I_{B1} = I_{B2} = 1.0\text{mA}$
Storage Time	$t_s$	—	200	ns	$V_{\text{CC}} = 3.0\text{V}, I_C = 10\text{mA}, I_{B1} = I_{B2} = 1.0\text{mA}$
Fall Time	$t_f$	—	50	ns	$V_{\text{CC}} = 3.0\text{V}, I_C = 10\text{mA}, I_{B1} = I_{B2} = 1.0\text{mA}$

Note: 9. Measured under pulsed conditions. Pulse width  $\leq 300\mu\text{s}$ . Duty cycle  $\leq 2\%$ .

**Typical Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

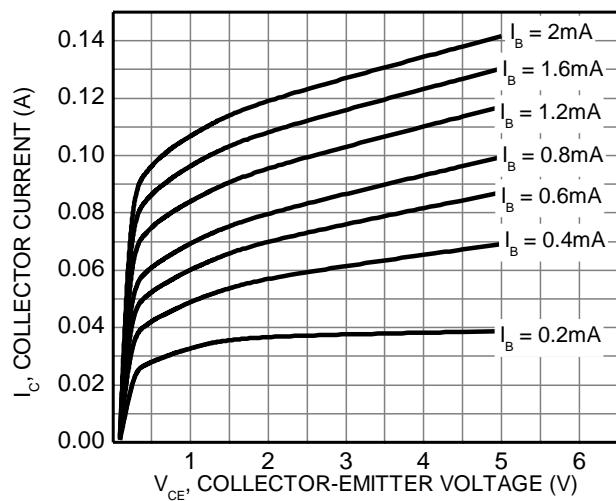


Fig. 4 Typical Collector Current  
vs. Collector-Emitter Voltage

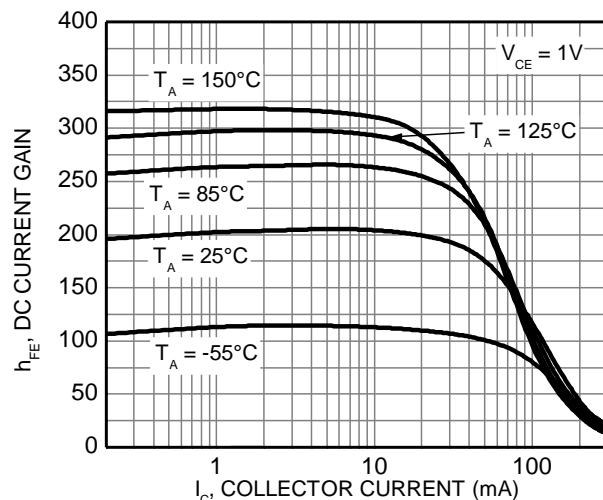


Fig. 5 Typical DC Current Gain  
vs. Collector Current

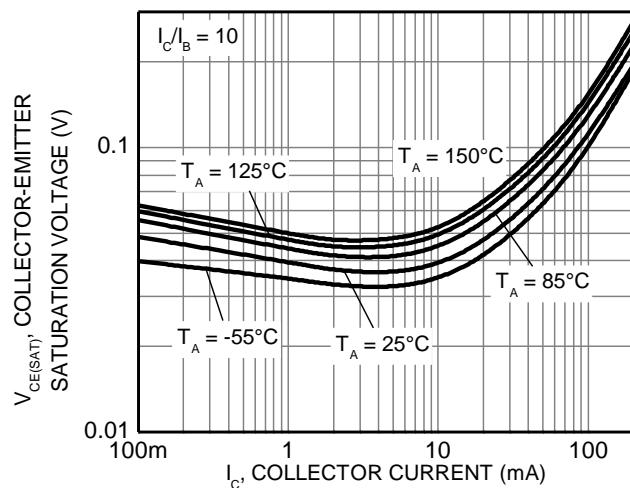


Fig. 6 Typical Collector-Emitter Saturation Voltage  
vs. Collector Current

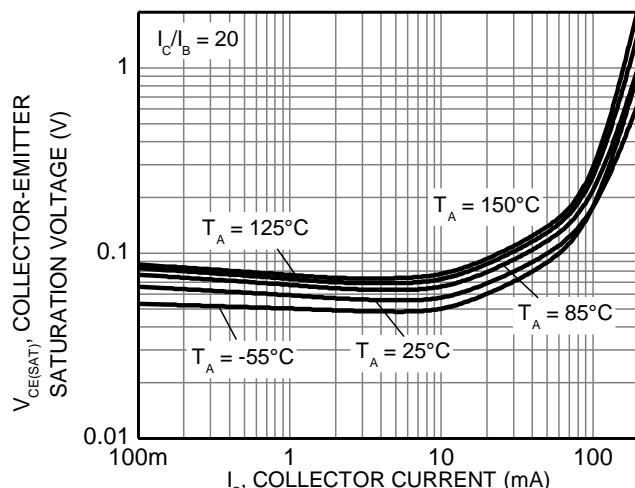


Fig. 7 Typical Collector-Emitter Saturation Voltage  
vs. Collector Current

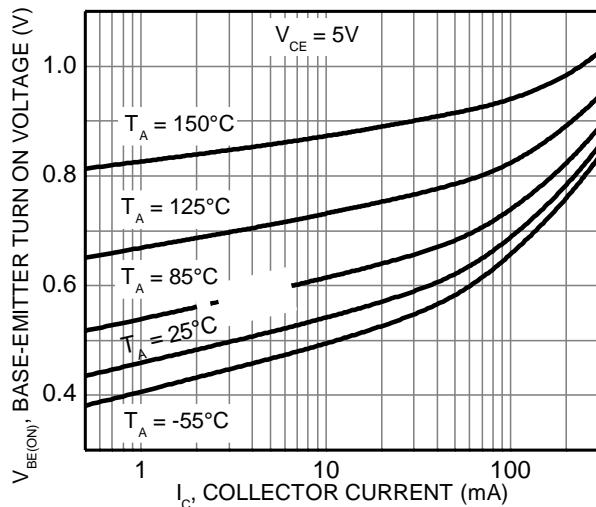


Fig. 8 Typical Base-Emitter Turn On Voltage  
vs. Collector Current

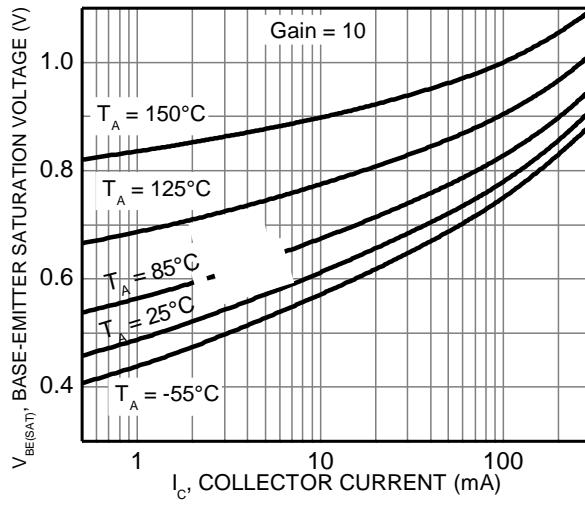
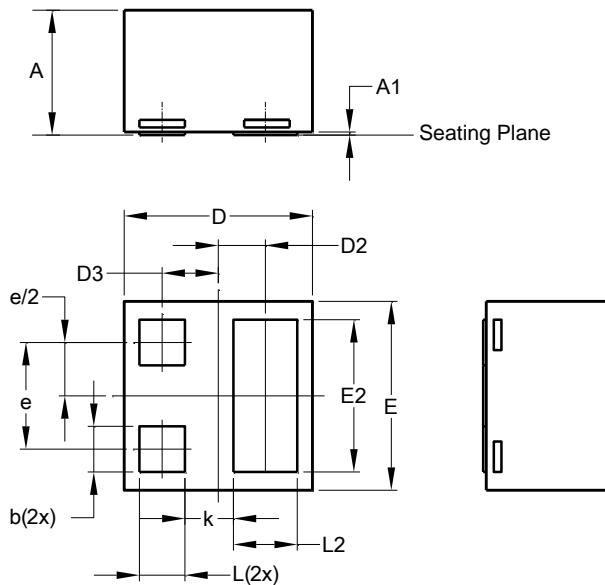


Fig. 9 Typical Base-Emitter Saturation Voltage  
vs. Collector Current

## Package Outline Dimensions

Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.

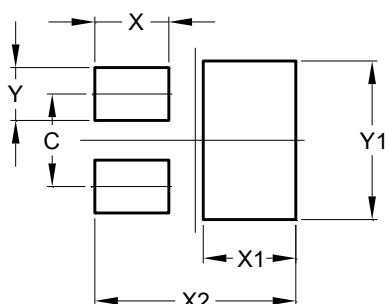


X2-DFN0606-3			
Dim	Min	Max	Typ
<b>A</b>	0.36	0.42	0.39
<b>A1</b>	0	0.05	0.02
<b>b</b>	0.10	0.20	0.15
<b>D</b>	0.57	0.67	0.62
<b>D2</b>	0.155 BSC		
<b>D3</b>	0.185 BSC		
<b>E</b>	0.57	0.67	0.62
<b>E2</b>	0.40	0.60	0.50
<b>e</b>	0.35 BSC		
<b>k</b>	0.16 REF		
<b>L</b>	0.09	0.21	0.15
<b>L2</b>	0.11	0.31	0.21

All Dimensions in mm

## Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



Dimensions	Value (in mm)
<b>C</b>	0.350
<b>X</b>	0.280
<b>X1</b>	0.350
<b>X2</b>	0.760
<b>Y</b>	0.200
<b>Y1</b>	0.600

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