

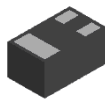
Features

- $BV_{CEO} > 40V$
- $I_C = 200mA$ High Collector Current
- $P_D = 1000mW$ Power Dissipation
- $0.60mm^2$ Package Footprint, 13 Times Smaller than SOT23
- 0.5mm Height Package Minimizing Off-Board Profile
- Complementary PNP Type MMBT3906LP
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e.: parts qualified to AEC-Q101, PPAP capable, and manufactured in IATF 16949 certified facilities), please refer to the related automotive grade (Q-suffix) part. A listing can be found at <https://www.diodes.com/products/automotive/automotive-products/>.**
- **This part is qualified to JEDEC standards (as references in AEC-Q101) for High Reliability. <https://www.diodes.com/quality/product-definitions/>**

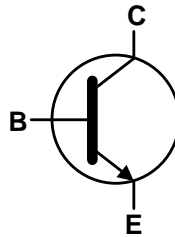
Mechanical Data

- Case: X1-DFN1006-3
- 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 ^(e4)
- Weight: 0.0008 grams (Approximate)

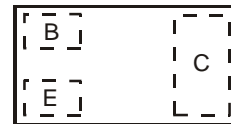
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Bottom View



Device Symbol


 Top View
Device Schematic

Ordering Information (Note 4)

Part Number	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
MMBT3904LP-7	1N	7	8mm	3,000
MMBT3904LP-7B	1N	7	8mm	10,000

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
 2. See <https://www.diodes.com/quality/lead-free/> 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 <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

Marking Information

MMBT3904LP-7	<p>From Date Code 1527 (YYWW), this changes to:</p>
MMBT3904LP-7B	<p>1N = Product Type Marking Code</p>

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 Collector Current	I_{CM}	200	mA

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

Characteristic	Symbol	Value	Unit
Power Dissipation	P_D	(Note 5)	400
		(Note 6)	1000
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	(Note 5)	310
		(Note 6)	120
Thermal Resistance, Junction to Lead	$R_{\theta JL}$	120	$^\circ\text{C/W}$
Operating and Storage and Temperature Range	T_J, T_{STG}	-55 to +150	$^\circ\text{C}$

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:
- 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.
 - Same as Note 5, except the exposed collector pad is mounted on 25mm x 25mm 2oz copper.
 - Thermal resistance from junction to solder-point (on the exposed collector pad).
 - Refer to JEDEC specification JESD22-A114 and JESD22-A115.

Thermal Characteristics

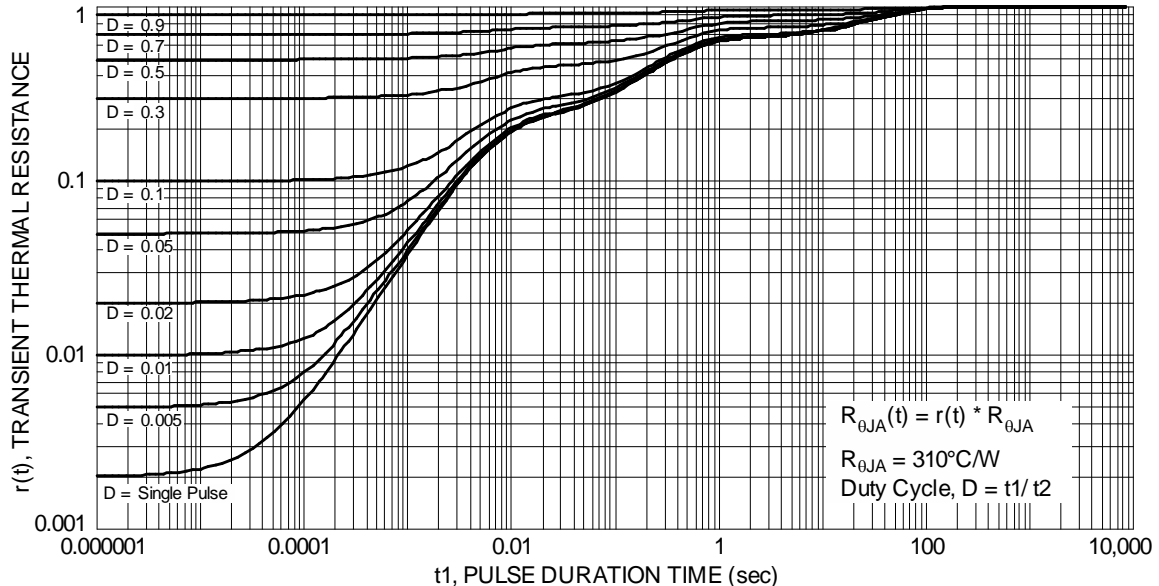


Fig. 1 Transient Thermal Resistance

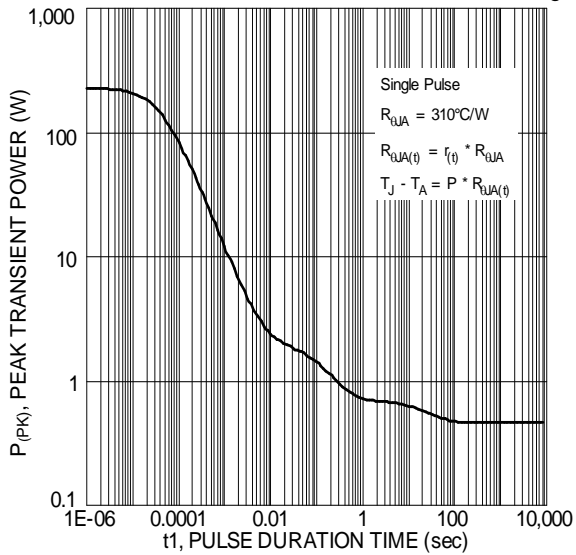


Fig. 2 Single Pulse Maximum Power Dissipation

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS					
Collector-Base Breakdown Voltage	BV _{CBO}	60	—	V	I _C = 10μA, I _E = 0A
Collector-Emitter Breakdown Voltage (Note 9)	BV _{CEO}	40	—	V	I _C = 1.0mA, I _B = 0A
Emitter-Base Breakdown Voltage	BV _{EBO}	6.0	—	V	I _E = 10μA, I _C = 0A
Collector Cutoff Current	I _{CEX}	—	50	nA	V _{CE} = 30V, V _{EB(off)} = 3.0V
Base Cutoff Current	I _{BL}	—	50	nA	V _{CE} = 30V, V _{EB(off)} = 3.0V
ON CHARACTERISTICS (Note 9)					
DC Current Gain	h _{FE}	40	—	—	I _C = 100μA, V _{CE} = 1.0V
		70	—		I _C = 1.0mA, V _{CE} = 1.0V
		100	300		I _C = 10mA, V _{CE} = 1.0V
		60	—		I _C = 50mA, V _{CE} = 1.0V
		30	—		I _C = 100mA, V _{CE} = 1.0V
Collector-Emitter Saturation Voltage	V _{CE(sat)}	—	0.20	V	I _C = 10mA, I _B = 1.0mA
		—	0.30		I _C = 50mA, I _B = 5.0mA
Base-Emitter Saturation Voltage	V _{BE(sat)}	0.65	0.85	V	I _C = 10mA, I _B = 1.0mA
		—	0.95		I _C = 50mA, I _B = 5.0mA
SMALL SIGNAL CHARACTERISTICS					
Output Capacitance	C _{obo}	—	4.0	pF	V _{CB} = 5.0V, f = 1.0MHz, I _E = 0A
Input Capacitance	C _{ibo}	—	8.5	pF	V _{EB} = 0.5V, f = 1.0MHz, I _C = 0A
Input Impedance	h _{ie}	1.0	10	kΩ	V _{CE} = 10V, I _C = 1.0mA, f = 1.0kHz
Voltage Feedback Ratio	h _{re}	0.5	8.0	x 10 ⁻⁴	
Small Signal Current Gain	h _{fe}	100	400	—	
Output Admittance	h _{oe}	1.0	40	μs	
Current Gain-Bandwidth Product	f _T	300	—	MHz	V _{CE} = 20V, I _C = 10mA, f = 100MHz
SWITCHING CHARACTERISTICS					
Delay Time	t _d	—	35	ns	V _{CC} = 3.0V, I _C = 10mA,
Rise Time	t _r	—	35	ns	V _{BE(off)} = 0.5V, I _{B1} = 1.0mA
Storage Time	t _s	—	200	ns	V _{CC} = 3.0V, I _C = 10mA,
Fall Time	t _f	—	50	ns	I _{B1} = -I _{B2} = 1.0mA

Note: 9. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

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

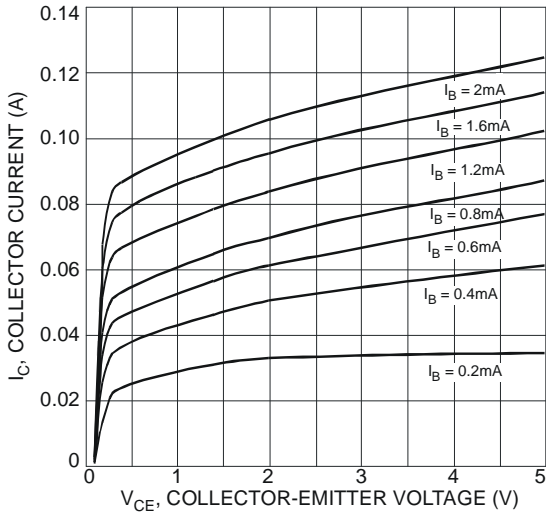


Fig. 3 Typical Collector Current vs. Collector-Emitter Voltage

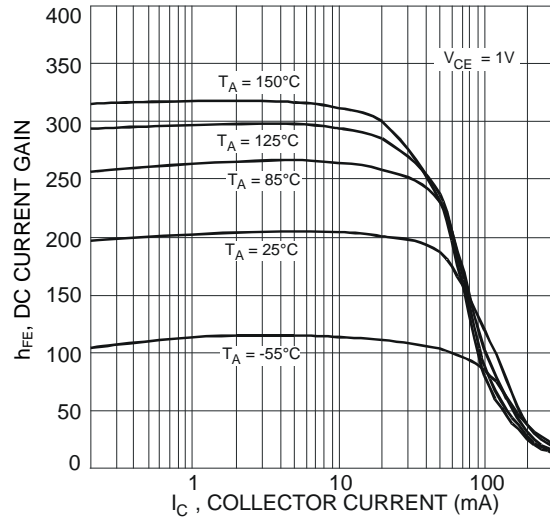


Fig. 4 Typical DC Current Gain vs. Collector Current

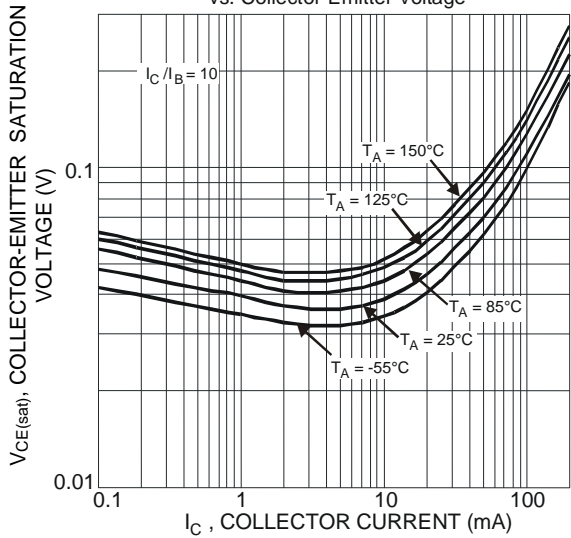


Fig. 5 Typical Collector-Emitter Saturation Voltage vs. Collector Current

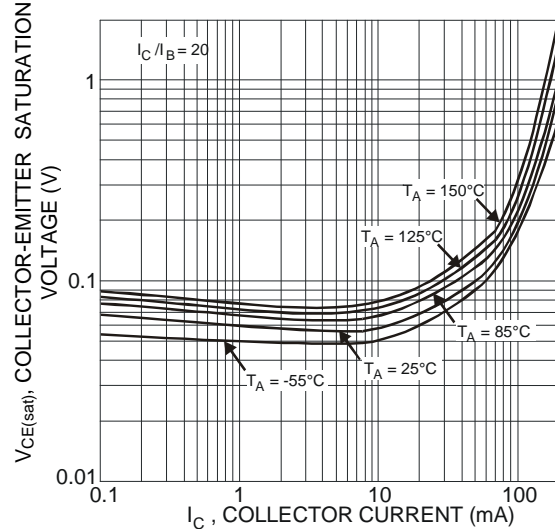


Fig. 6 Typical Collector-Emitter Saturation Voltage vs. Collector Current

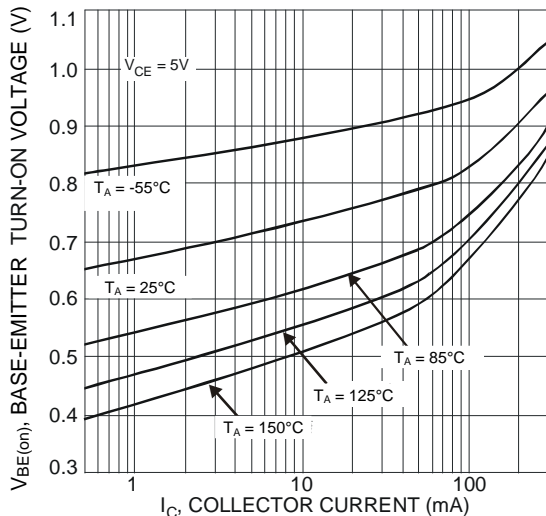


Fig. 7 Typical Base-Emitter Turn-On Voltage vs. Collector Current

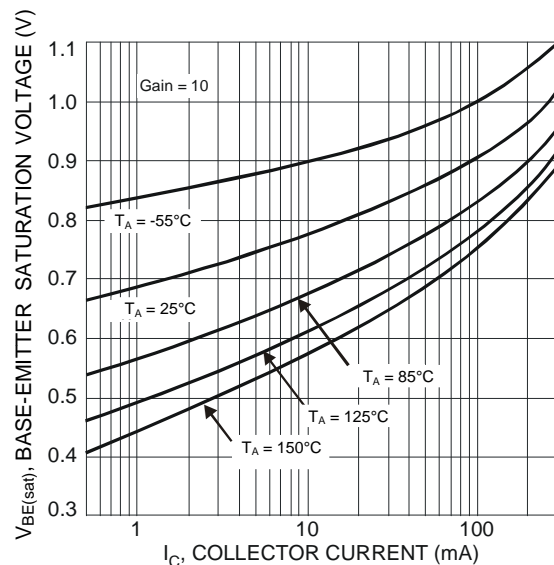
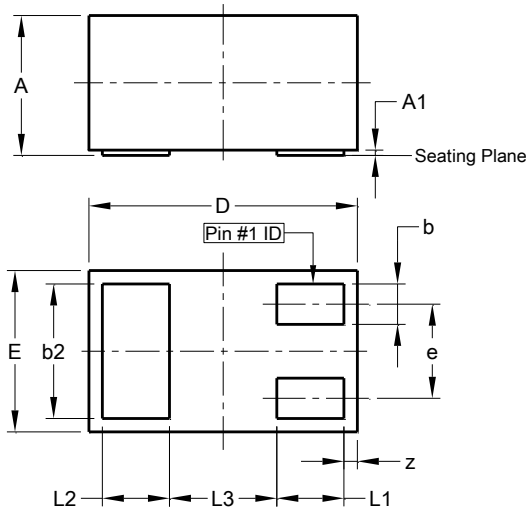


Fig. 8 Typical Base-Emitter Saturation Voltage vs. Collector Current

Package Outline Dimensions

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

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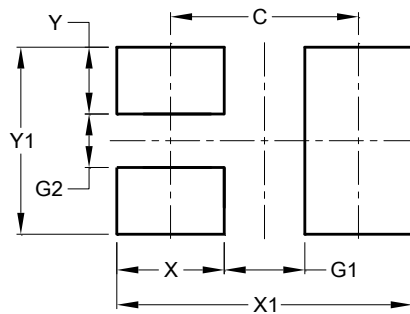


X1-DFN1006-3			
Dim	Min	Max	Typ
A	0.47	0.53	0.50
A1	0.00	0.05	0.03
b	0.10	0.20	0.15
b2	0.45	0.55	0.50
D	0.95	1.075	1.00
E	0.55	0.675	0.60
e	-	-	0.35
L1	0.20	0.30	0.25
L2	0.20	0.30	0.25
L3	-	-	0.40
z	0.02	0.08	0.05
All Dimensions in mm			

Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

X1-DFN1006-3



Dimensions	Value (in mm)
C	0.70
G1	0.30
G2	0.20
X	0.40
X1	1.10
Y	0.25
Y1	0.70

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