40V NPN SMALL SIGNAL SURFACE MOUNT TRANSISTOR

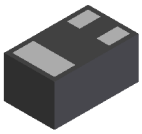
Features

- Low Collector-Emitter Saturation Voltage, $V_{CE(sat)}$
- Ultra-Small Leadless Surface Mount Package
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

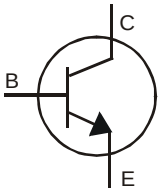
Mechanical Data

- Case: X2-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 over Copper leadframe. Solderable per MIL-STD-202, Method 208 e4
- Weight: 0.0009 grams (Approximate)

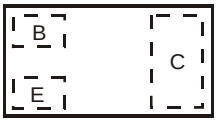
X2-DFN1006-3



Bottom View



Device Symbol



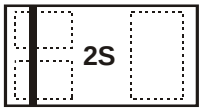
Top View
Device Schematic

Ordering Information (Note 4)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
MMBT2222ALP4-7B	2S	7	8	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 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.

Marking Information



Top View

2S = Product Type Marking Code
Bar Denotes Base and Emitter Side

Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	75	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current - Continuous	I_C	600	mA
Peak Collector Current	I_{CM}	800	mA

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

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	P_D	460	mW
Power Dissipation (Note 6)	P_D	1	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	272	°C/W
Thermal Resistance, Junction to Ambient (Note 6)	$R_{\theta JA}$	120	°C/W
Thermal Resistance, Junction to Lead (Note 7)	$R_{\theta JL}$	110	°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	≥ 8,000	V	3B
Electrostatic Discharge - Machine Model	ESD MM	≥ 400	V	C

Notes:
5. For a device surface mounted on minimum recommended pad layout FR-4 PCB with single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition. The entire exposed collector pad is attached to the heatsink.
6. Same as note 5, except device is surface mounted on 25mm X 25mm collector pad heatsink with 1oz copper.
7. Thermal resistance from junction to solder-point (at the end of the collector lead).
8. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

Thermal Characteristics

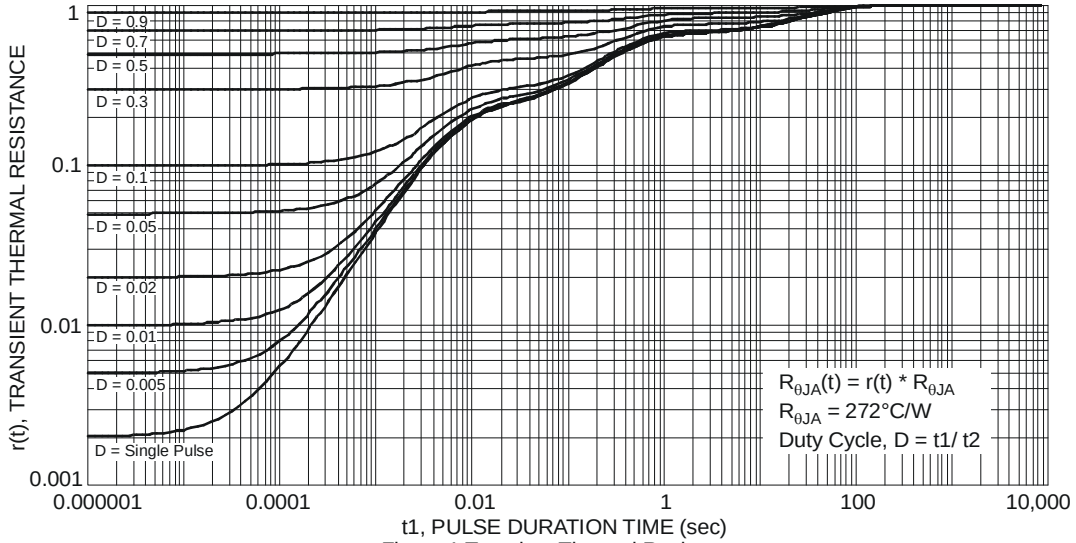


Figure 1 Transient Thermal Resistance

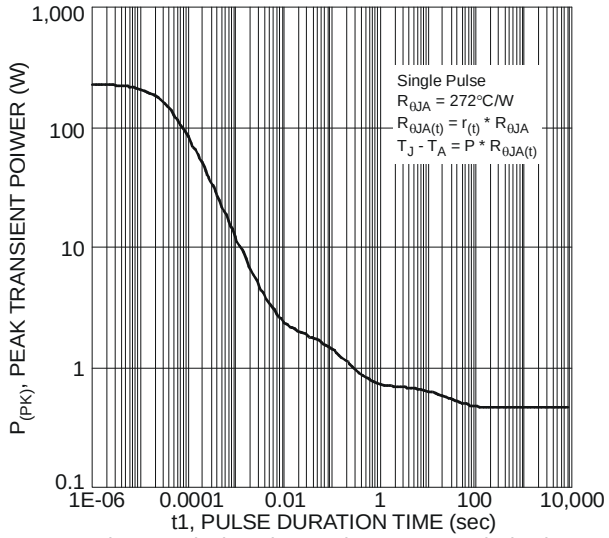


Figure 2 Single Pulse Maximum Power Dissipation

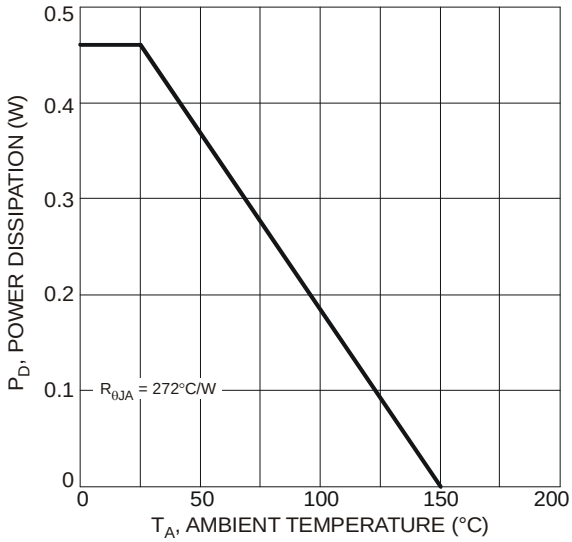


Figure 3 Power Dissipation vs. Ambient Temperature

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Collector-Base Breakdown Voltage	BV_{CBO}	75	—	—	V	I_C = 100μA, I_E = 0
Collector-Emitter Breakdown Voltage (Note 6)	BV_{CEO}	40	—	—	V	I_C = 10mA, I_B = 0
Emitter-Base Breakdown Voltage	BV_{EBO}	6	—	—	V	I_E = 100μA, I_C = 0
Collector Cutoff Current	I_{CEX}	—		10	nA	V_{CE} = 60V, $V_{EB(off)}$ = 3V
Collector Cutoff Current	I_{CBO}	—	—	10	nA	V_{CB} = 60V, I_E = 0
		—	—	10	μA	V_{CB} = 60V, I_E = 0, T_A = +125°C
Emitter Cutoff Current	I_{EBO}	—	—	10	nA	V_{EB} = 5V, I_C = 0
Base Cutoff Current	I_{BL}	—	—	20	nA	V_{CE} = 60V, $V_{EB(off)}$ = 3V
ON CHARACTERISTICS (Note 6)						
DC Current Gain	h_{FE}	35	—	—	—	V_{CE} = 10V, I_C = 0.1mA
		50	—	—	—	V_{CE} = 10V, I_C = 1mA
		75	—	—	—	V_{CE} = 10V, I_C = 10mA
		35	—	—	—	V_{CE} = 10V, I_C = 10mA, T_A = -55°C
		100	—	300	—	V_{CE} = 10V, I_C = 150mA
		50	—	—	—	V_{CE} = 1V, I_C = 150mA
		40	—	—	—	V_{CE} = 10V, I_C = 500mA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	—	—	0.3	V	I_C = 150mA, I_B = 15mA
		—	—	1.0		I_C = 500mA, I_B = 50mA
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	0.6	—	1.2	V	I_C = 150mA, I_B = 15mA
		—	—	2.0		I_C = 500mA, I_B = 50mA
SMALL SIGNAL CHARACTERISTICS (Note 6)						
Output Capacitance	C_{obo}	—	—	8	pF	V_{CB} = 10V, f = 1.0MHz, I_E = 0
Input Capacitance	C_{ibo}			25	pF	V_{EB} = 0.5V, f = 1.0MHz, I_C = 0
Current Gain-Bandwidth Product	f_T	300	—	—	MHz	V_{CE} = 20V, I_C = 20mA, f = 100MHz
Noise Figure	NF	—	—	4.0	dB	V_{CE} = 10V, I_C = 100μA, R_S = 1.0kΩ, f = 1.0kHz
Input Impedance	h_{ie}	0.25	—	1.25	kΩ	I_C = 10mA, V_{CE} = 10V, f = 1.0kHz
Voltage Feedback Ratio	h_{re}	—	—	4.0	X 10^{-4}	
Small-Signal Current Gain	h_{fe}	75	—	375	—	
Output Admittance	h_{oe}	25	—	200	μS	
SWICHING CHARACTERISTICS (Note 6)						
Delay Time	t_d	—	—	10	nS	V_{CC} = 30V, $V_{BE(off)}$ = -0.5V, I_C = 150mA, I_{B1} = 15mA
Rise Time	t_r	—	—	25		
Storage Time	t_s	—	—	225		V_{CC} = 30V, I_C = 150mA, I_{B1} = I_{B2}=15mA
Fall Time	t_f	—	—	60		

Notes: 6. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤2%.

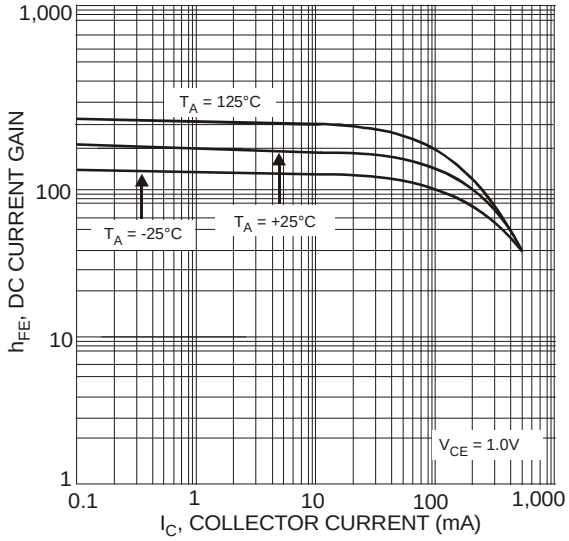


Figure 4 Typical DC Current Gain vs. Collector Current

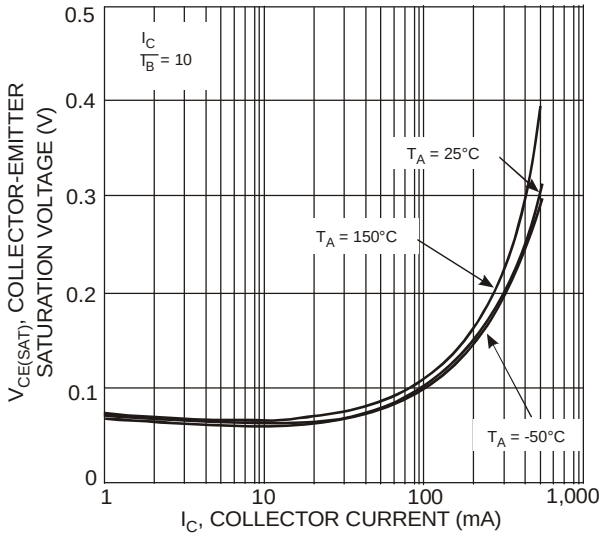


Figure 5 Typical Collector-Emitter Saturation Voltage vs. Collector Current

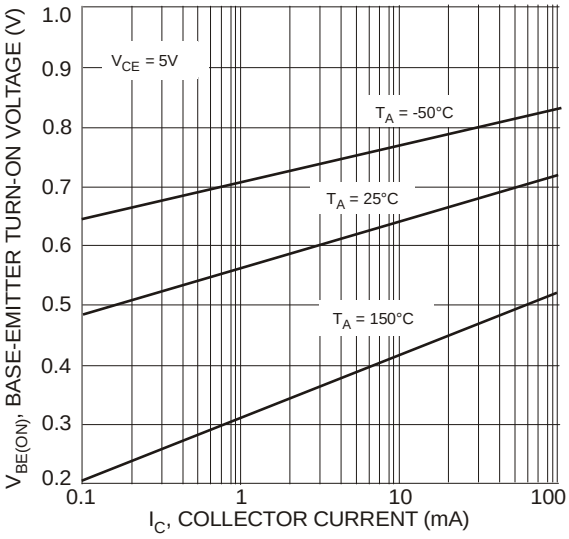


Figure 6 Typical Base-Emitter Turn-On Voltage vs. Collector Current

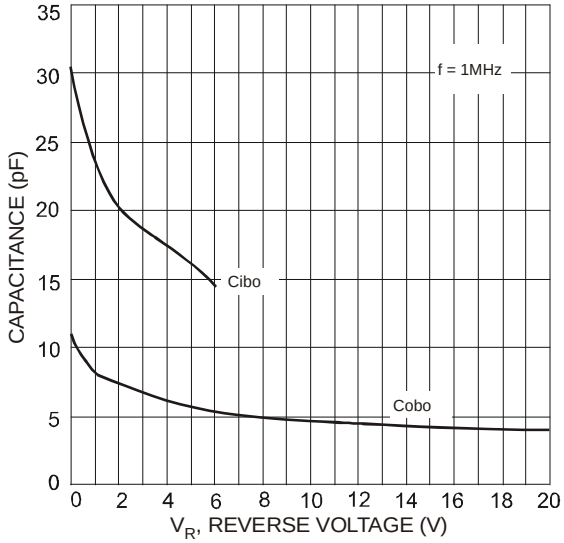


Figure 7 Typical Capacitance Characteristics

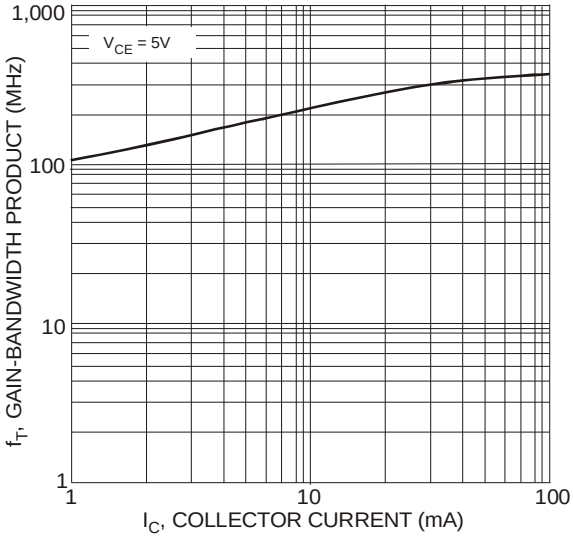


Figure 8 Typical Gain-Bandwidth Product vs. Collector Current

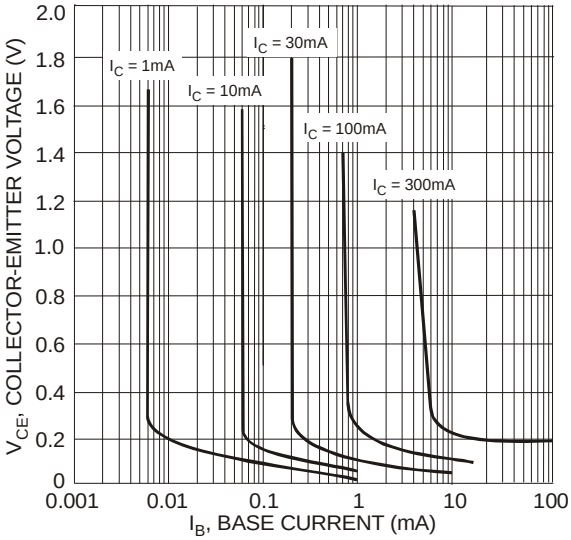
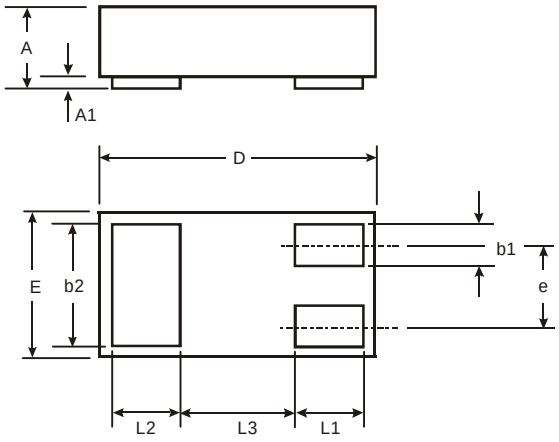


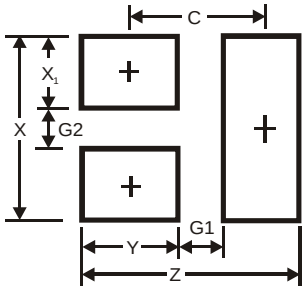
Figure 9 Typical Collector Saturation Region

Package Outline Dimensions



X2-DFN1006-3			
Dim	**Min**	**Max**	**Typ**
A	—	0.40	—
A1	0	0.05	0.03
b1	0.10	0.20	0.15
b2	0.45	0.55	0.50
D	0.95	1.05	1.00
E	0.55	0.65	0.60
e	—	—	0.35
L1	0.20	0.30	0.25
L2	0.20	0.30	0.25
L3	—	—	0.40
All Dimensions in mm			

Suggested Pad Layout



Dimensions	Value (in mm)
Z	1.1
G1	0.3
G2	0.2
X	0.7
X1	0.25
Y	0.4
C	0.7

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