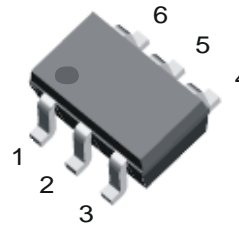


**General Description**

- LMN150B01 is best suited for applications where the load needs to be turned on and off using control circuits like micro-controllers, comparators etc. particularly at a point of load. It features a discrete PNP pass transistor with stable  $V_{ce\_sat}$  which does not depend on the input voltage and can support maximum continuous current of 150 mA up to 125 °C (see fig. 1). It also contains a discrete NPN that can be used as a control. The component devices can be used as a part of a circuit or as standalone discrete devices.



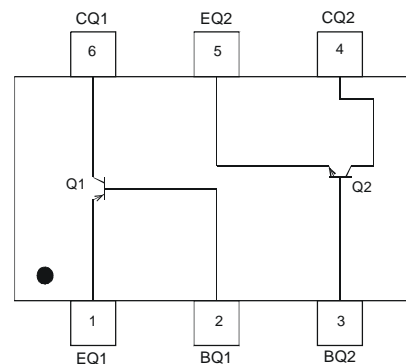
SOT-26

**Features**

- Epitaxial Planar Die Construction
- Ideally Suited for Automated Assembly Processes
- Lead Free By Design/ROHS Compliant (Note 1)**
- "Green" Device (Note 2)**

**Mechanical Data**

- Case: SOT-26
- Case Material: Molded Plastic. "Green Molding" Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020C
- Terminal Connections: See Diagram
- Terminals: Finish - Matte Tin annealed over Copper leadframe. Solderable per MIL-STD -202, Method 208
- Marking Information: See Page 6
- Ordering Information: See Page 6
- Weight: 0.016 grams (approximate)



Schematic and Pin Configuration

**Maximum Ratings, Total Device** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

Characteristic	Symbol	Value	Unit
Output Current	$I_{out}$	150	mA

**Thermal Characteristics** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 3)	$P_D$	300	mW
Power Derating Factor above 120 °C	$P_{der}$	2.33	mW/°C
Thermal Resistance, Junction to Ambient Air (Note 3) (Equivalent to one heated junction of PNP transistor)	$R_{\theta JA}$	417	°C/W
Junction Operation and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	°C

- Notes:
- No purposefully added lead.
  - Diodes Inc.'s "Green" policy can be found on our website at [http://www.diodes.com/products/lead\\_free/index.php](http://www.diodes.com/products/lead_free/index.php).
  - Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch; pad layout as shown on Page 7.

**Maximum Ratings: Discrete PNP Transistor (Q1)** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	-40	V
Collector-Emitter Voltage	$V_{CEO}$	-40	V
Emitter-Base Voltage	$V_{EBO}$	-6	V
Output Current - continuous (Note 4)	$I_C$	-200	mA

**Maximum Ratings: Discrete NPN Transistor (Q2)** @ $T_A = 25^\circ\text{C}$  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	V
Output Current - continuous (Note 4)	$I_C$	200	mA

**Electrical Characteristics: Discrete PNP Transistor (Q1)** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

Characteristic	Symbol	Min	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 4)</b>					
Collector-Base Breakdown Voltage	$V_{CBO}$	-40	—	V	$I_C = -10\mu\text{A}$ , $I_E = 0$
Collector-Emitter Breakdown Voltage	$V_{CEO}$	-40	—	V	$I_C = -1.0\text{mA}$ , $I_B = 0$
Emitter-Base Breakdown Voltage	$V_{EBO}$	-6	—	V	$I_E = -10\mu\text{A}$ , $I_C = 0$
Collector Cutoff Current	$I_{CEX}$	—	-50	nA	$V_{CE} = -30\text{V}$ , $V_{EB(OFF)} = -3.0\text{V}$
Base Cutoff Current	$I_{BL}$	—	-50	nA	$V_{CE} = -30\text{V}$ , $V_{EB(OFF)} = -3.0\text{V}$
Collector-Base Cut Off Current	$I_{CBO}$	—	-50	nA	$V_{CB} = -30\text{V}$ , $I_E = 0$
Collector-Emitter Cut Off Current	$I_{CEO}$	—	-50	nA	$V_{CE} = -30\text{V}$ , $I_B = 0$
Emitter-Base Cut Off Current	$I_{EBO}$	—	-50	nA	$V_{EB} = -5\text{V}$ , $I_C = 0$
<b>ON CHARACTERISTICS (Note 4)</b>					
DC Current Gain	$h_{FE}$	105	—	—	$V_{CE} = -1\text{V}$ , $I_C = -100\mu\text{A}$
		110	—	—	$V_{CE} = -1\text{V}$ , $I_C = -1\text{mA}$
		120	—	—	$V_{CE} = -1\text{V}$ , $I_C = -10\text{mA}$
		90	—	—	$V_{CE} = -1\text{V}$ , $I_C = -50\text{mA}$
		32	—	—	$V_{CE} = -1\text{V}$ , $I_C = -100\text{mA}$
		10	—	—	$V_{CE} = -1\text{V}$ , $I_C = -200\text{mA}$
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	—	-0.08	V	$I_C = -10\text{mA}$ , $I_B = -1\text{mA}$
		—	-0.15		$I_C = -50\text{mA}$ , $I_B = -5\text{mA}$
		—	-0.5		$I_C = -200\text{mA}$ , $I_B = -20\text{mA}$
Equivalent on-resistance	$R_{CE(SAT)}$	—	2.5	$\Omega$	$I_C = -200\text{mA}$ , $I_B = -20\text{mA}$
Base-Emitter Turn-on Voltage	$V_{BE(ON)}$	—	-0.92	V	$V_{CE} = -5\text{V}$ , $I_C = -200\text{mA}$
Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	—	-0.95	V	$I_C = -10\text{mA}$ , $I_B = -1\text{mA}$
		—	-1.1		$I_C = -50\text{mA}$ , $I_B = -5\text{mA}$
<b>SMALL SIGNAL CHARACTERISTICS</b>					
Output Capacitance	$C_{OBO}$	—	4	pF	$V_{CB} = -5.0\text{V}$ , $f = 1.0\text{MHz}$ , $I_E = 0$
Input Capacitance	$C_{IBO}$	—	8	pF	$V_{EB} = -5.0\text{V}$ , $f = 1.0\text{MHz}$ , $I_C = 0$
Input Impedance	$h_{iE}$	2	12	$\text{K}\Omega$	$V_{CE} = 1.0\text{V}$ , $I_C = 10\text{mA}$ , $f = 1.0\text{KHz}$
Voltage Feedback ratio	$h_{rE}$	0.1	10	$\times 10\text{E-}4$	
Small Signal Current Gain	$h_{FE}$	100	400	—	
Output Admittance	$h_{oE}$	3	60	$\mu\text{S}$	
Current Gain-Bandwidth Product	$f_T$	250	—	MHz	$V_{CE} = -20\text{V}$ , $I_C = -10\text{mA}$ , $f = 100\text{MHz}$
Noise Figure	NF	—	4	dB	$V_{CE} = -5\text{V}$ , $I_C = -100\mu\text{A}$ , $R_s = 1\Omega$ , $f = 1\text{KHz}$
<b>SWITCHING CHARACTERISTICS</b>					
Delay Time	$t_d$	—	35	ns	$V_{CC} = -3.0\text{V}$ , $I_C = -10\text{mA}$ ,
Rise Time	$t_r$	—	35	ns	$V_{BE(OFF)} = 0.5\text{V}$ , $I_{B1} = -1.0\text{mA}$
Storage Time	$t_s$	—	225	ns	$V_{CC} = -3.0\text{V}$ , $I_C = -10\text{mA}$ ,
Fall Time	$t_f$	—	75	ns	$I_{B1} = I_{B2} = -1.0\text{mA}$

Notes: 4. Short duration pulse test used to minimize self-heating effect.

## Electrical Characteristics: Discrete NPN Transistor (Q2) @ $T_A = 25^\circ\text{C}$ unless otherwise specified

Characteristic	Symbol	Min	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 4)</b>					
Collector-Base Breakdown Voltage	$V_{CBO}$	60	—	V	$I_C = 10\mu\text{A}, I_E = 0$
Collector-Emitter Breakdown Voltage	$V_{CEO}$	40	—	V	$I_C = 1.0\text{mA}, I_B = 0$
Emitter-Base Breakdown Voltage	$V_{EBO}$	6	—	V	$I_E = 10\mu\text{A}, I_C = 0$
Collector Cutoff Current	$I_{CEX}$	—	50	nA	$V_{CE} = 30\text{V}, V_{EB(OFF)} = 3.0\text{V}$
Base Cutoff Current	$I_{BL}$	—	50	nA	$V_{CE} = 30\text{V}, V_{EB(OFF)} = 3.0\text{V}$
Collector-Base Cut Off Current	$I_{CBO}$	—	50	nA	$V_{CB} = 30\text{V}, I_E = 0$
Collector-Emitter Cut Off Current	$I_{CEO}$	—	50	nA	$V_{CE} = 30\text{V}, I_B = 0$
Emitter-Base Cut Off Current	$I_{EBO}$	—	50	nA	$V_{EB} = 5\text{V}, I_C = 0$
<b>ON CHARACTERISTICS (Note 4)</b>					
DC Current Gain	$h_{FE}$	150	—	—	$V_{CE} = 1\text{V}, I_C = 100\mu\text{A}$
		170	—	—	$V_{CE} = 1\text{V}, I_C = 1\text{mA}$
		160	—	—	$V_{CE} = 1\text{V}, I_C = 10\text{mA}$
		70	—	—	$V_{CE} = 1\text{V}, I_C = 50\text{mA}$
		30	—	—	$V_{CE} = 1\text{V}, I_C = 100\text{mA}$
		12	—	—	$V_{CE} = 1\text{V}, I_C = 200\text{mA}$
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	—	0.08	V	$I_C = 10\text{mA}, I_B = 1\text{mA}$
		—	0.16		$I_C = 50\text{mA}, I_B = 5\text{mA}$
		—	0.36		$I_C = 200\text{mA}, I_B = 20\text{mA}$
Equivalent on-resistance	$R_{CE(SAT)}$	—	1.8	$\Omega$	$I_C = 200\text{mA}, I_B = 20\text{mA}$
Base-Emitter Turn-on Voltage	$V_{BE(ON)}$	—	0.98	V	$V_{CE} = 5\text{V}, I_C = 200\text{mA}$
Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	—	0.95	V	$I_C = 10\text{mA}, I_B = 1\text{mA}$
		—	1.1		$I_C = 50\text{mA}, I_B = 5\text{mA}$
<b>SMALL SIGNAL CHARACTERISTICS</b>					
Output Capacitance	$C_{OBO}$	—	4	pF	$V_{CB} = 5.0\text{V}, f = 1.0\text{MHz}, I_E = 0$
Input Capacitance	$C_{IBO}$	—	8	pF	$V_{EB} = 5.0\text{V}, f = 1.0\text{MHz}, I_C = 0$
Input Impedance	$h_{iE}$	2	12	$\text{K}\Omega$	$V_{CE} = 1.0\text{V}, I_C = 10\text{mA}, f = 1.0\text{KHz}$
Voltage Feedback ratio	$h_{rE}$	0.1	10	$\times 10E-4$	
Small Signal Current Gain	$h_{fE}$	100	400	—	
Output Admittance	$h_{oE}$	3	60	$\mu\text{S}$	
Current Gain-Bandwidth Product	$f_T$	250	—	MHz	$V_{CE} = 20\text{V}, I_C = 0\text{mA}, f = 100\text{MHz}$
Noise Figure	NF	—	4	dB	$V_{CE} = 5\text{V}, I_C = 100\mu\text{A}, R_s = 1\Omega, f = 1\text{KHz}$
<b>SWITCHING CHARACTERISTICS</b>					
Delay Time	$t_d$	—	35	ns	$V_{CC} = -3.0\text{V}, I_C = 10\text{mA}$
Rise Time	$t_r$	—	35	ns	$V_{BE(OFF)} = 0.5\text{V}, I_{B1} = 1.0\text{mA}$

## Typical Characteristics

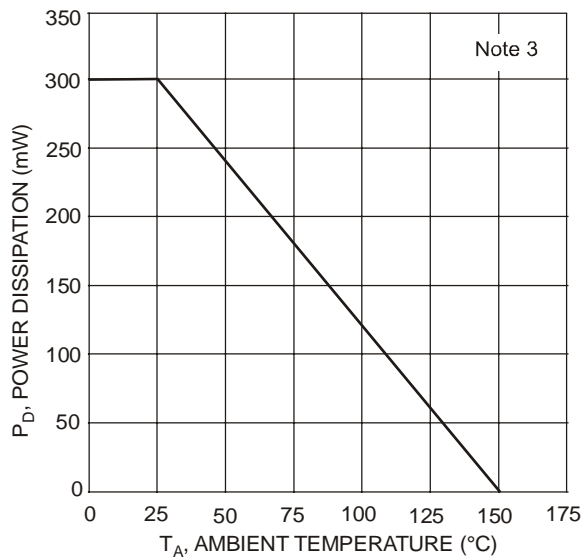


Fig. 1 Max Power Dissipation vs Ambient Temperature

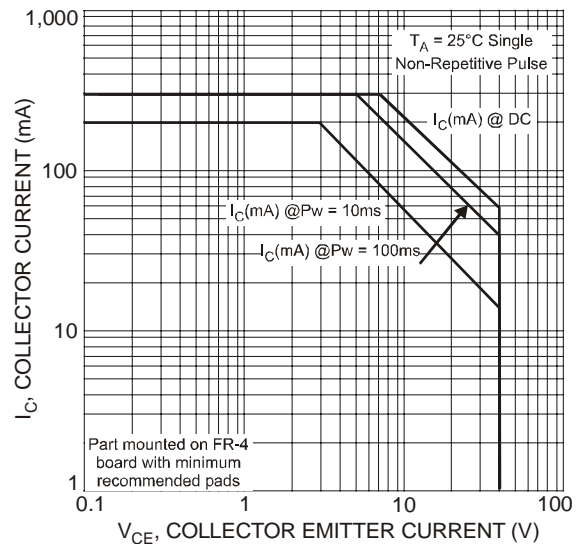


Fig. 2 Safe Operating Area

## Characteristics of NPN Transistor (Q2):

NEW PRODUCT

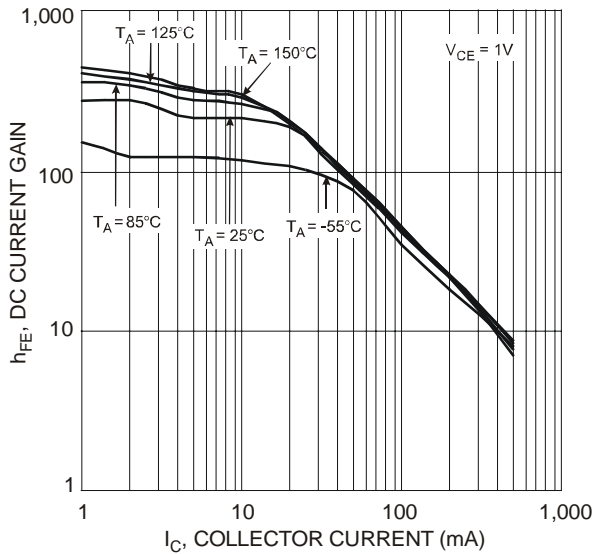


Fig. 3 Typical DC Current Gain vs. Collector Current

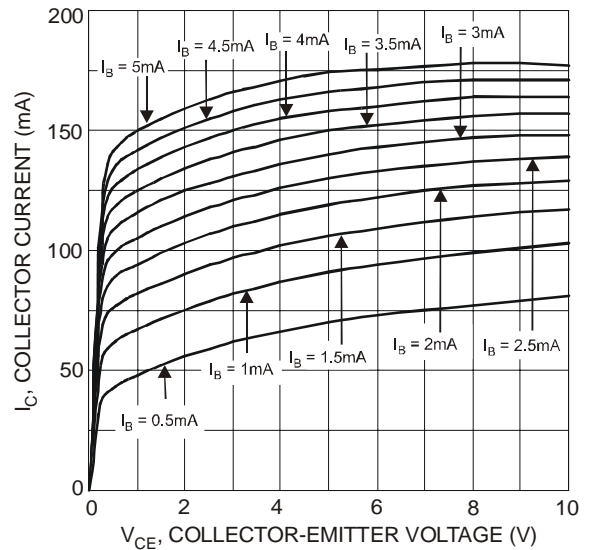


Fig. 4 Collector Current vs. Collector-Emitter Voltage

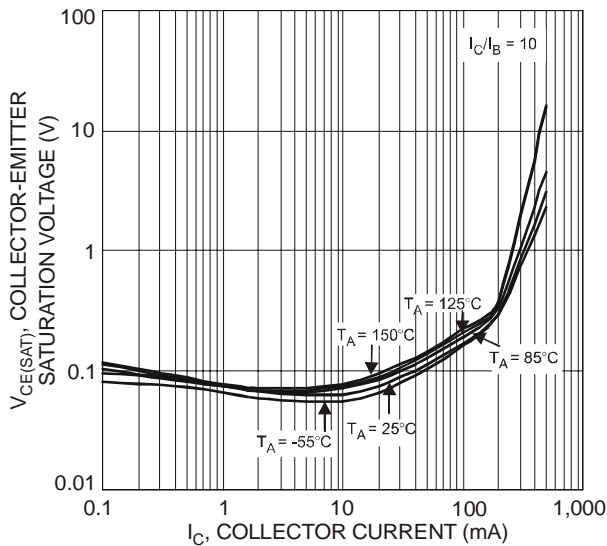


Fig. 5 Collector-Emitter Saturation Voltage vs. Collector Current

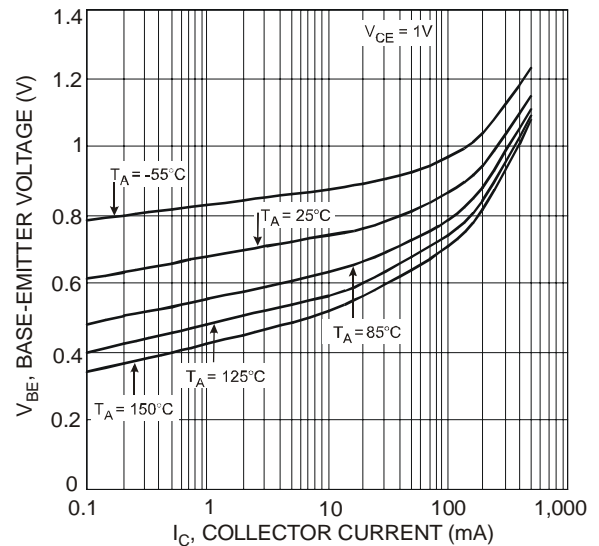


Fig. 6 Base-Emitter Turn-on Voltage vs. Collector Current

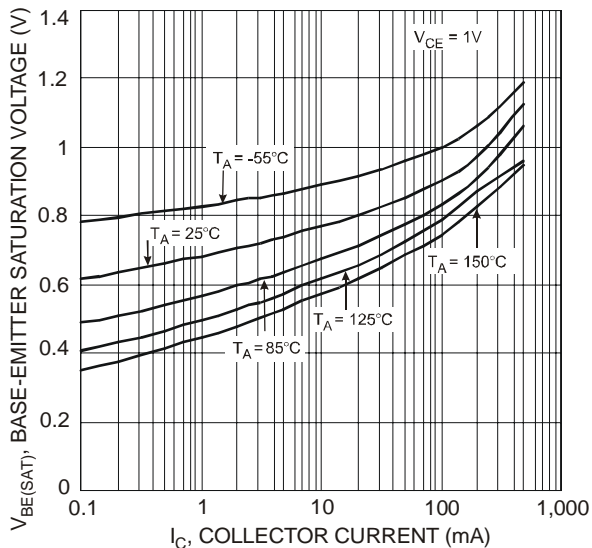


Fig. 7 Base-Emitter Saturation Voltage vs. Collector Current

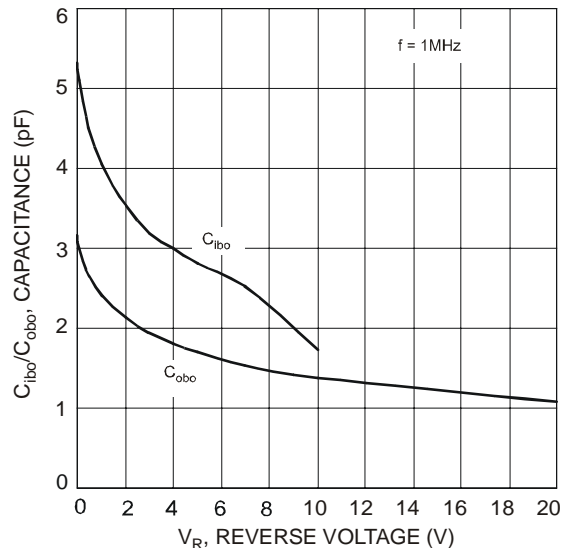


Fig. 8 Typical Capacitance Characteristics

## Characteristics of PNP Transistor (Q1):

NEW PRODUCT

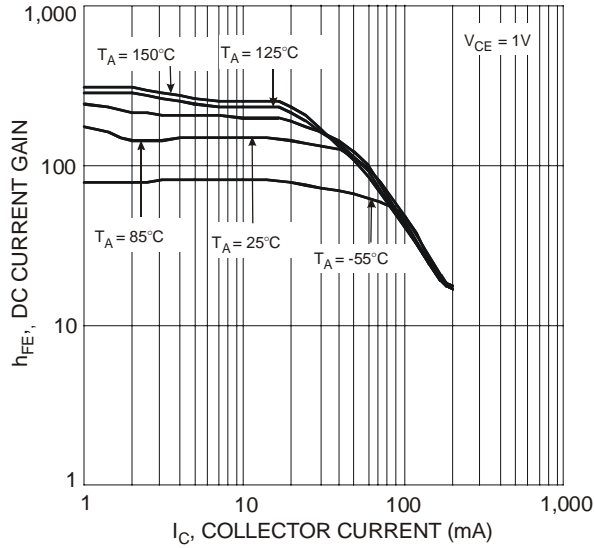


Fig. 9 Typical DC Current Gain vs. Collector Current

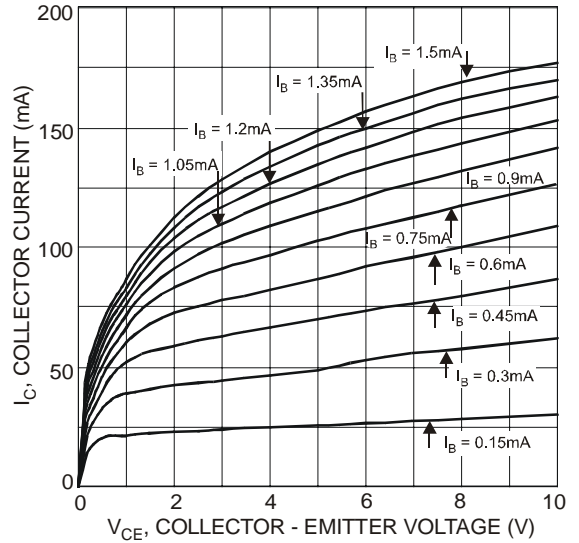


Fig. 10 Collector Current vs. Collector-Emitter Voltage

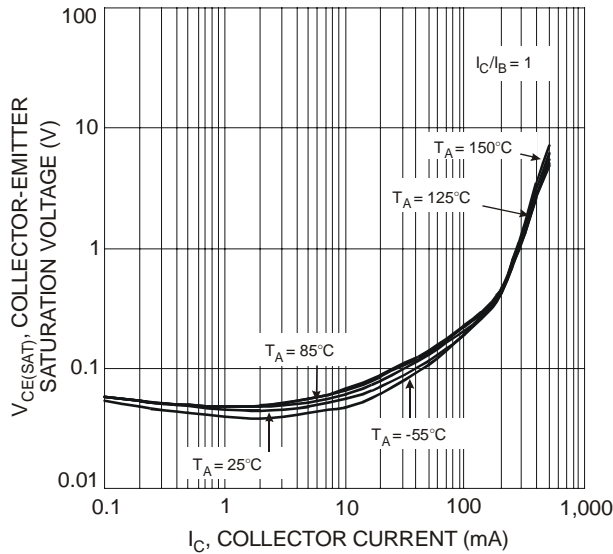


Fig. 11 Collector-Emitter Saturation Voltage vs. Collector Current

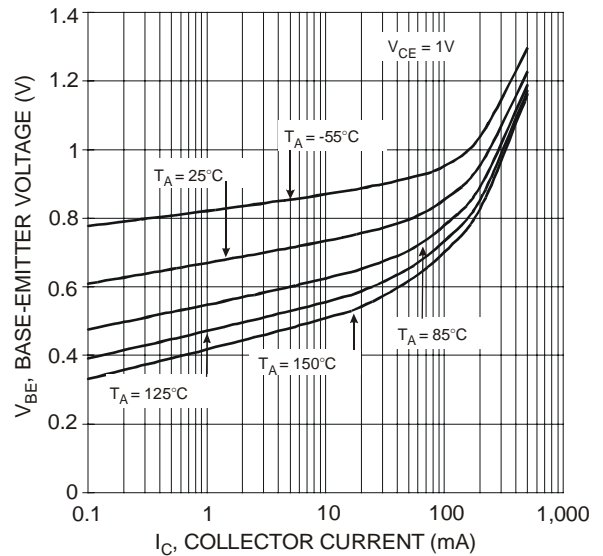


Fig. 12 Base-Emitter Turn-On Voltage vs. Collector Current

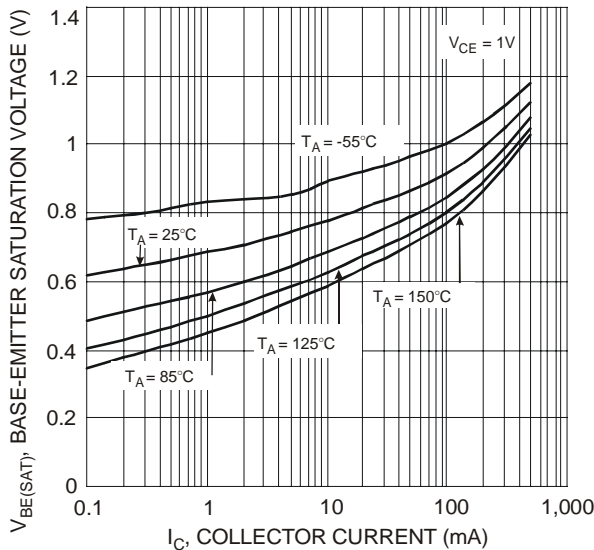


Fig. 13 Base-Emitter Saturation Voltage vs. Collector Current

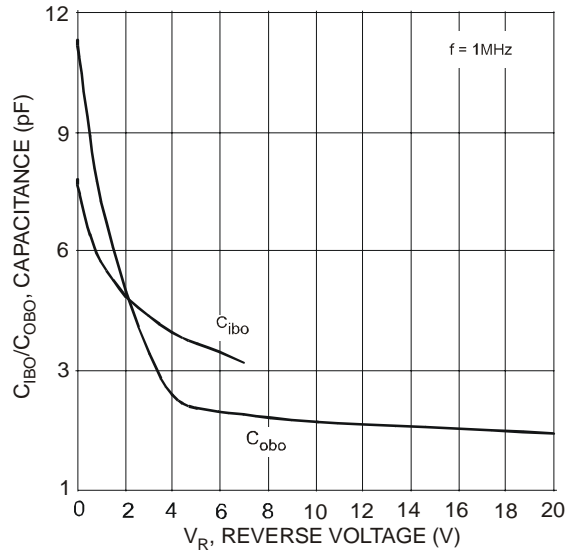
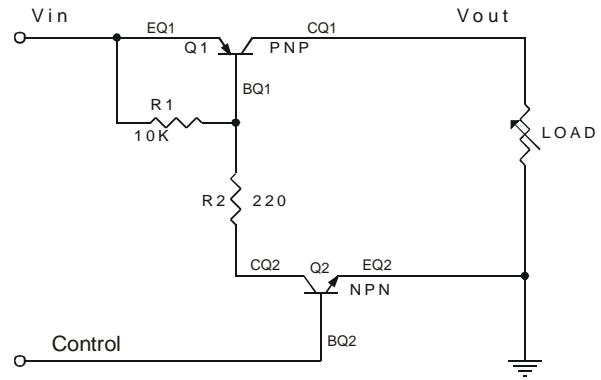


Fig. 14 Typical Capacitance Characteristics

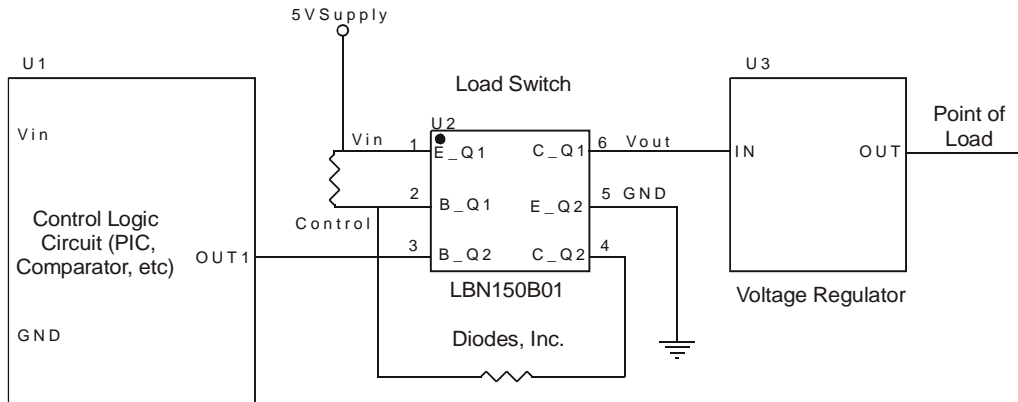
## Application Details

- PNP Transistor and NPN Transistor integrated as one in LBN150B01 can be used as a discrete entity for general purpose applications or as a part of a circuit to function as a Load Switch. When it is used as the latter as shown in Example Circuit Schematic, various input voltage sources can be used as long as they do not exceed the maximum rating of the device. These devices are designed to deliver continuous output load current up to maximum of 150 mA. The use of the NPN as a switch eliminates the need for higher current required to overcome the gate charge in the event an N-MOSFET is used. Care must be taken for higher levels of dissipation while designing for higher load conditions. These devices provide power on demand and also consume less space. It mainly helps in optimizing power usage, thereby conserving battery life in a controlled load system like portable battery powered applications. (Please see Figure below for one example of typical application circuit used in conjunction with a voltage regulator as a part of power management system).



Example Circuit Schematic

## Typical Application Circuit

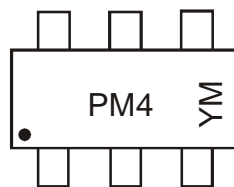


## Ordering Information (Note 5)

Device	Marking Code	Packaging	Shipping
LBN150B01-7	PM4	SOT-26	3000/Tape & Reel

Notes: 5. For packaging details, go to our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

## Marking Information



PM4 = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year ex: T = 2006  
 M = Month ex: 9 = September

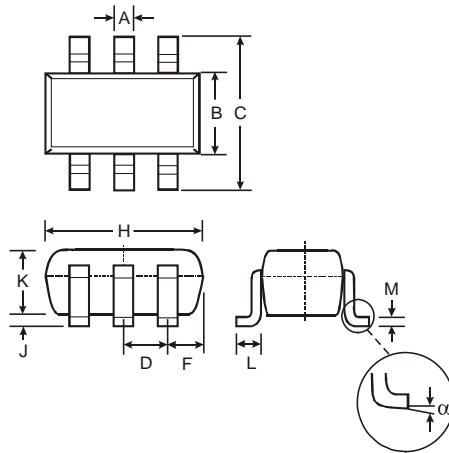
### Date Code Key

Year	2006	2007	2008	2009	2010	2011	2012
Code	T	U	V	W	X	Y	Z

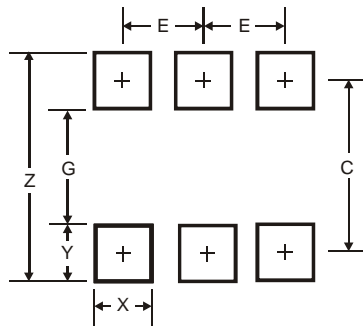
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	O	N	D

**Package Outline Dimensions**



SOT-26			
Dim	Min	Max	Typ
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	—	—	0.95
F	—	—	0.55
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
α	0°	8°	—
<b>All Dimensions in mm</b>			

**Suggested Pad Layout**



Dimensions	Value (in mm)
Z	3.20
G	1.60
X	0.55
Y	0.80
C	2.40
E	0.95

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