

# MBT3906DW1T1

## Dual General Purpose Transistor

The MBT3906DW1T1 device is a spin-off of our popular SOT-23/SOT-323 three-leaded device. It is designed for general purpose amplifier applications and is housed in the SOT-363 six-leaded surface mount package. By putting two discrete devices in one package, this device is ideal for low-power surface mount applications where board space is at a premium.

### Features

- $h_{FE}$ , 100–300
- Low  $V_{CE(sat)}$ ,  $\leq 0.4$  V
- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Available in 8 mm, 7-inch/3,000 Unit Tape and Reel
- Pb-Free Package is Available

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	$V_{CEO}$	–40	Vdc
Collector–Base Voltage	$V_{CBO}$	–40	Vdc
Emitter–Base Voltage	$V_{EBO}$	–5.0	Vdc
Collector Current – Continuous	$I_C$	–200	mAdc
Electrostatic Discharge	ESD	HBM>16000, MM>2000	V

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

### THERMAL CHARACTERISTICS

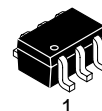
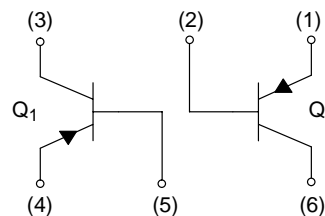
Characteristic	Symbol	Max	Unit
Total Package Dissipation (Note 1) $T_A = 25^\circ\text{C}$	$P_D$	150	mW
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	833	$^\circ\text{C/W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	–55 to +150	$^\circ\text{C}$

1. Device mounted on FR4 glass epoxy printed circuit board using the minimum recommended footprint.



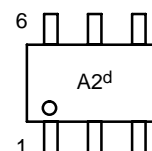
ON Semiconductor®

<http://onsemi.com>



SOT-363/SC-88  
CASE 419B  
STYLE 1

### MARKING DIAGRAM



A2 = Device Code  
d = Date Code

### ORDERING INFORMATION

Device	Package	Shipping†
MBT3906DW1T1	SOT-363	3000 Units/Reel
MBT3906DW1T1G	SOT-363 (Pb-Free)	3000 Units/Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MBT3906DW1T1

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Breakdown Voltage (Note 2)	V <sub>(BR)CEO</sub>	–40	–	Vdc
Collector–Base Breakdown Voltage	V <sub>(BR)CBO</sub>	–40	–	Vdc
Emitter–Base Breakdown Voltage	V <sub>(BR)EBO</sub>	–5.0	–	Vdc
Base Cutoff Current	I <sub>BL</sub>	–	–50	nAdc
Collector Cutoff Current	I <sub>CEX</sub>	–	–50	nAdc

## ON CHARACTERISTICS (Note 2)

DC Current Gain (I <sub>C</sub> = –0.1 mAdc, V <sub>CE</sub> = –1.0 Vdc) (I <sub>C</sub> = –1.0 mAdc, V <sub>CE</sub> = –1.0 Vdc) (I <sub>C</sub> = –10 mAdc, V <sub>CE</sub> = –1.0 Vdc) (I <sub>C</sub> = –50 mAdc, V <sub>CE</sub> = –1.0 Vdc) (I <sub>C</sub> = –100 mAdc, V <sub>CE</sub> = –1.0 Vdc)	h <sub>FE</sub>	60 80 100 60 30	– – 300 – –	–
Collector–Emitter Saturation Voltage (I <sub>C</sub> = –10 mAdc, I <sub>B</sub> = –1.0 mAdc) (I <sub>C</sub> = –50 mAdc, I <sub>B</sub> = –5.0 mAdc)	V <sub>CE(sat)</sub>	– –	–0.25 –0.4	Vdc
Base–Emitter Saturation Voltage (I <sub>C</sub> = –10 mAdc, I <sub>B</sub> = –1.0 mAdc) (I <sub>C</sub> = –50 mAdc, I <sub>B</sub> = –5.0 mAdc)	V <sub>BE(sat)</sub>	–0.65 –	–0.85 –0.95	Vdc

## SMALL–SIGNAL CHARACTERISTICS

Current–Gain – Bandwidth Product	f <sub>T</sub>	250	–	MHz
Output Capacitance	C <sub>obo</sub>	–	4.5	pF
Input Capacitance	C <sub>ibo</sub>	–	10.0	pF

2. Pulse Test: Pulse Width ≤ 300 μs; Duty Cycle ≤ 2.0%.

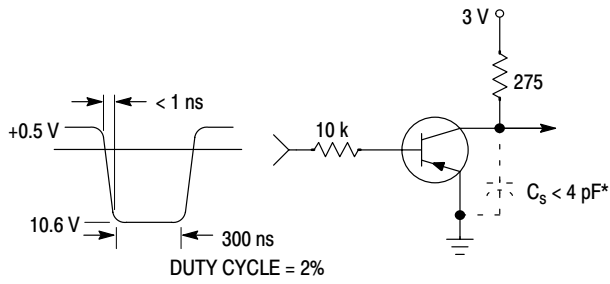
## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Max	Unit
Input Impedance (V <sub>CE</sub> = –10 Vdc, I <sub>C</sub> = –1.0 mAdc, f = 1.0 kHz)	h <sub>ie</sub>	2.0	12	k Ω
Voltage Feedback Ratio (V <sub>CE</sub> = –10 Vdc, I <sub>C</sub> = –1.0 mAdc, f = 1.0 kHz)	h <sub>re</sub>	0.1	10	X 10 <sup>–4</sup>
Small–Signal Current Gain (V <sub>CE</sub> = –10 Vdc, I <sub>C</sub> = –1.0 mAdc, f = 1.0 kHz)	h <sub>fe</sub>	100	400	–
Output Admittance (V <sub>CE</sub> = –10 Vdc, I <sub>C</sub> = –1.0 mAdc, f = 1.0 kHz)	h <sub>oe</sub>	3.0	60	μmhos
Noise Figure (V <sub>CE</sub> = –5.0 Vdc, I <sub>C</sub> = –100 μAdc, R <sub>S</sub> = 1.0 k Ω, f = 1.0 kHz)	NF	–	4.0	dB

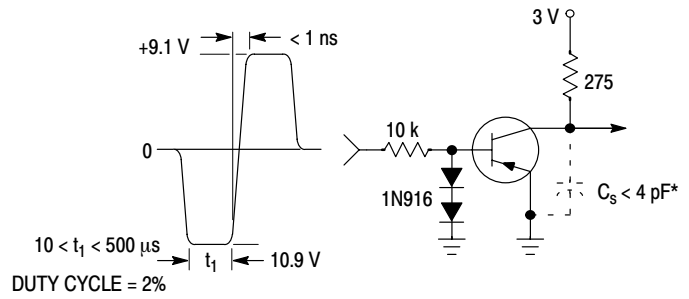
## SWITCHING CHARACTERISTICS

Delay Time	(V <sub>CC</sub> = –3.0 Vdc, V <sub>BE</sub> = 0.5 Vdc)	t <sub>d</sub>	–	35	ns
Rise Time	(I <sub>C</sub> = –10 mAdc, I <sub>B1</sub> = –1.0 mAdc)	t <sub>r</sub>	–	35	
Storage Time	(V <sub>CC</sub> = –3.0 Vdc, I <sub>C</sub> = –10 mAdc)	t <sub>s</sub>	–	225	ns
Fall Time	(I <sub>B1</sub> = I <sub>B2</sub> = –1.0 mAdc)	t <sub>f</sub>	–	75	

# MBT3906DW1T1



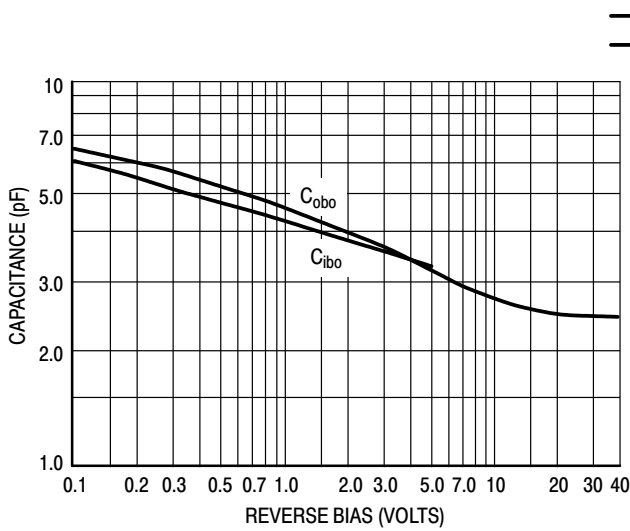
**Figure 1. Delay and Rise Time Equivalent Test Circuit**



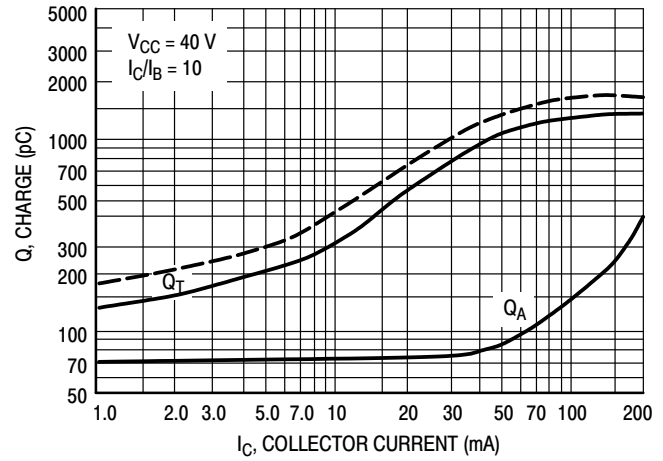
**Figure 2. Storage and Fall Time Equivalent Test Circuit**

\* Total shunt capacitance of test jig and connectors

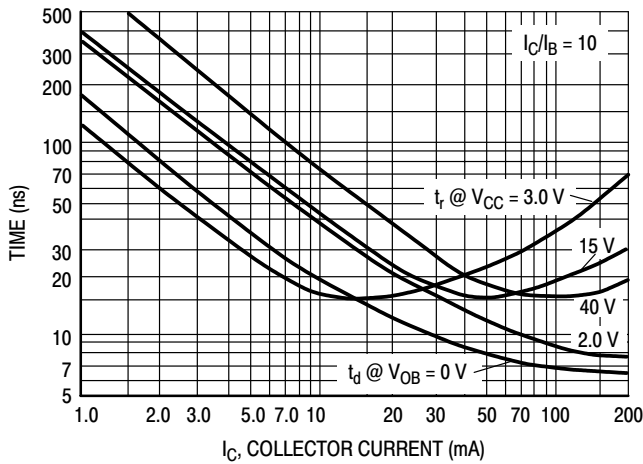
## TYPICAL TRANSIENT CHARACTERISTICS



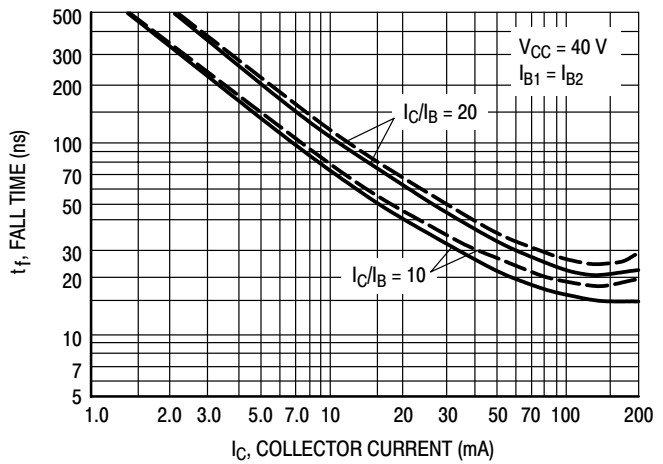
**Figure 3. Capacitance**



**Figure 4. Charge Data**



**Figure 5. Turn-On Time**



**Figure 6. Fall Time**

# MBT3906DW1T1

## TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

( $V_{CE} = -5.0$  Vdc,  $T_A = 25^\circ\text{C}$ , Bandwidth = 1.0 Hz)

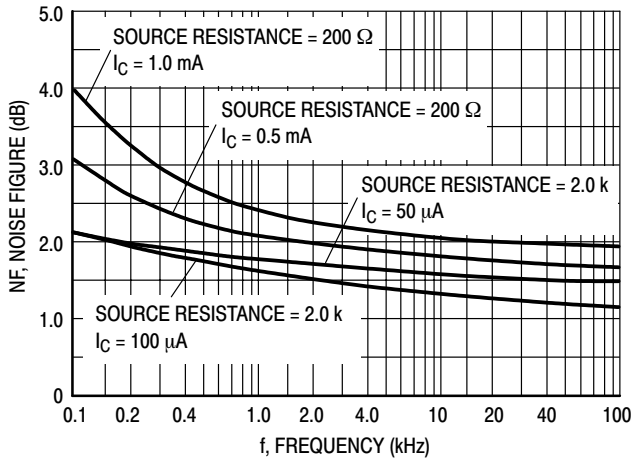


Figure 7.

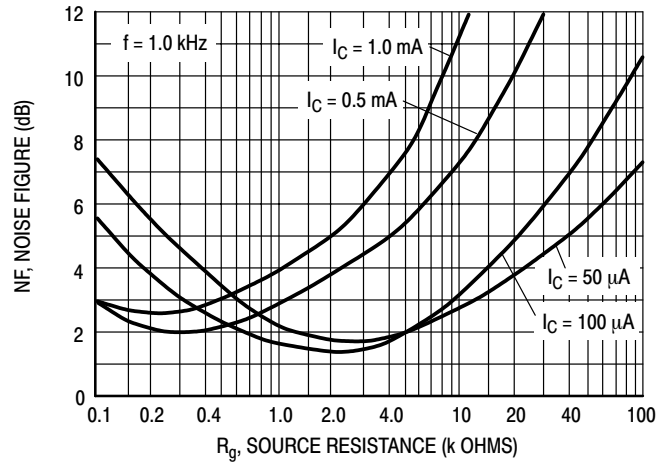


Figure 8.

## h PARAMETERS

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

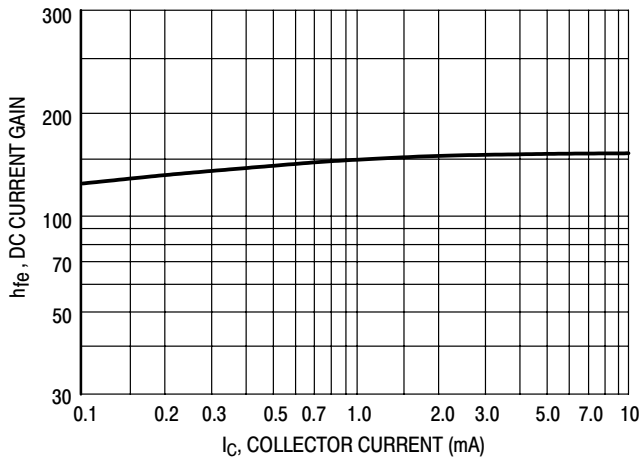


Figure 9. Current Gain

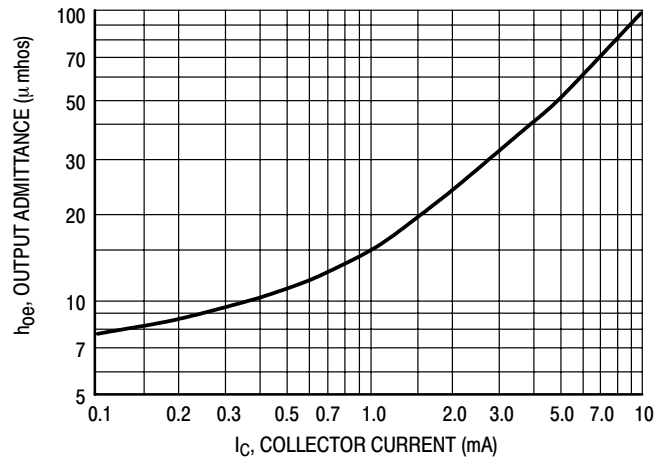


Figure 10. Output Admittance

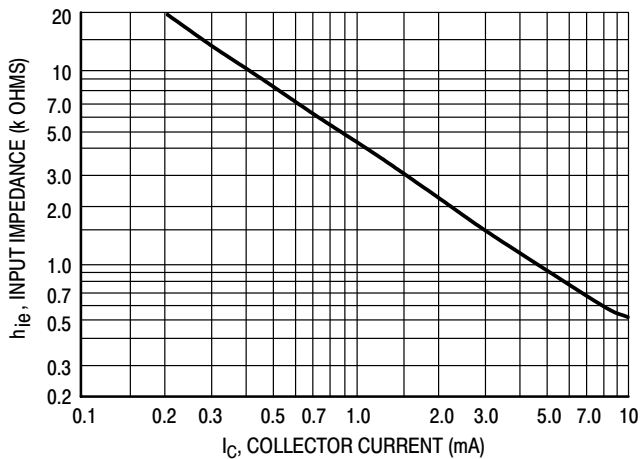


Figure 11. Input Impedance

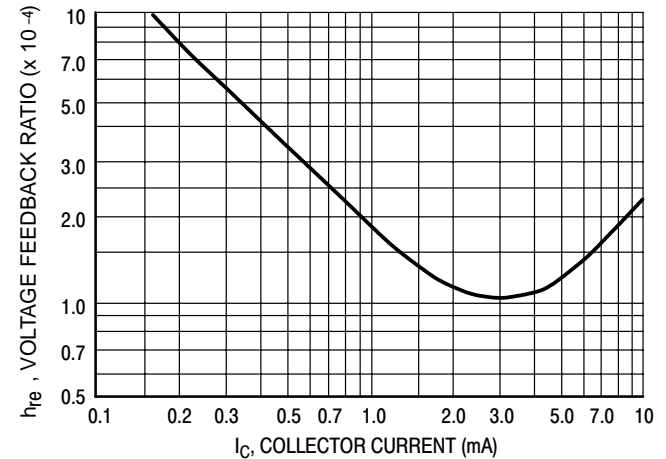


Figure 12. Voltage Feedback Ratio

# MBT3906DW1T1

## TYPICAL STATIC CHARACTERISTICS

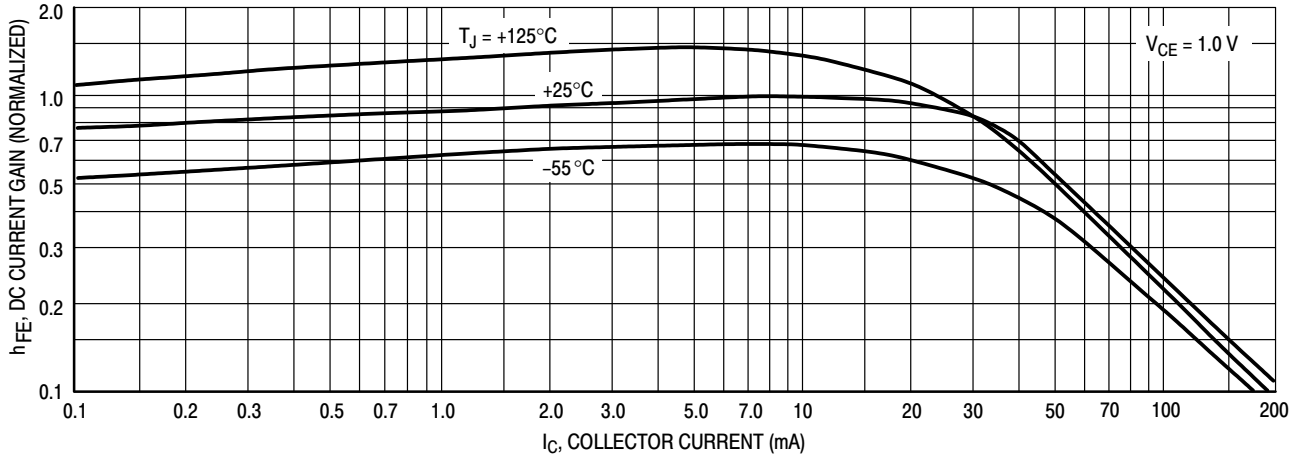


Figure 13. DC Current Gain

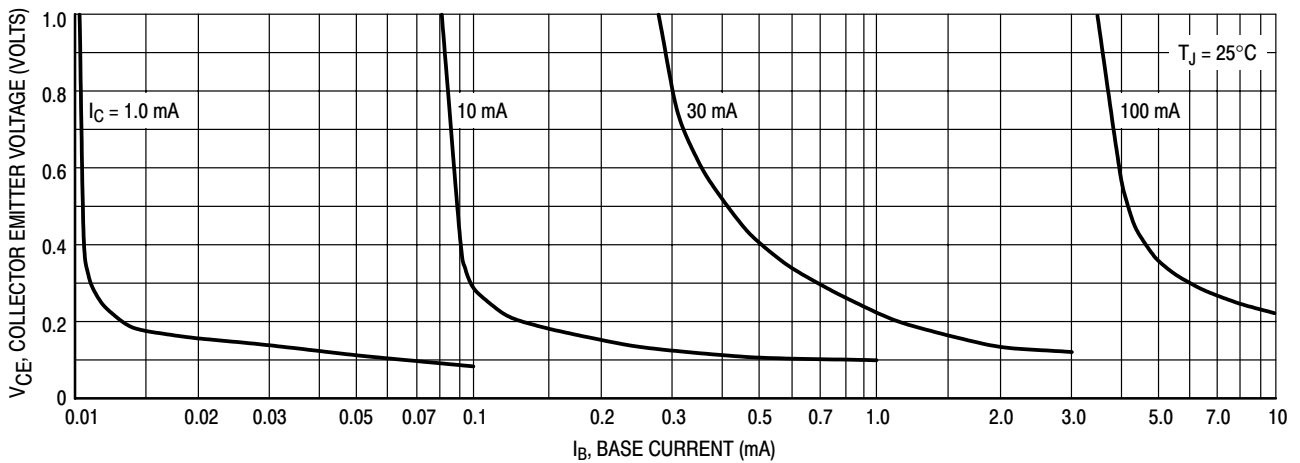


Figure 14. Collector Saturation Region

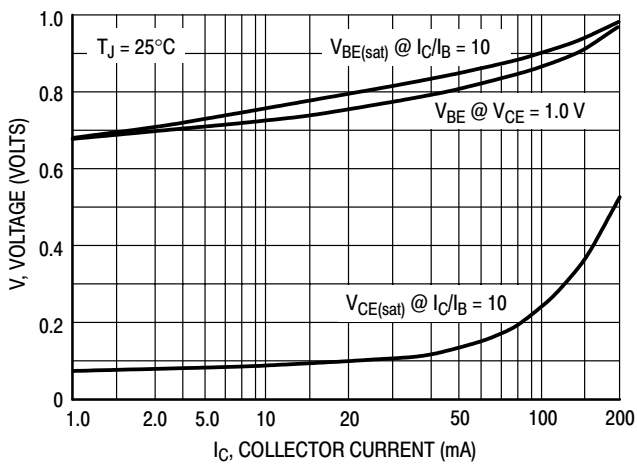


Figure 15. "ON" Voltages

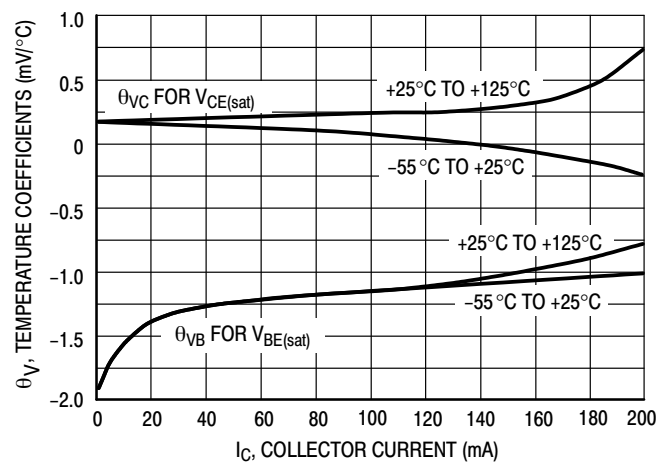
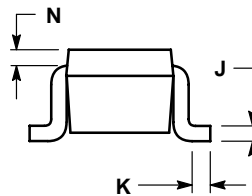
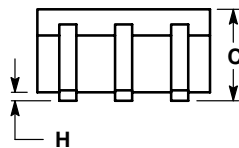
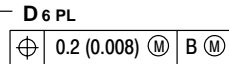
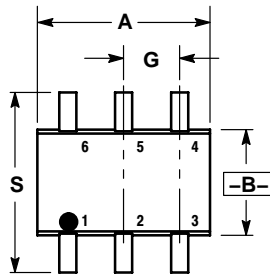


Figure 16. Temperature Coefficients

# MBT3906DW1T1

## PACKAGE DIMENSIONS

SOT-363/SC-88  
CASE 419B-02  
ISSUE U



NOTES:

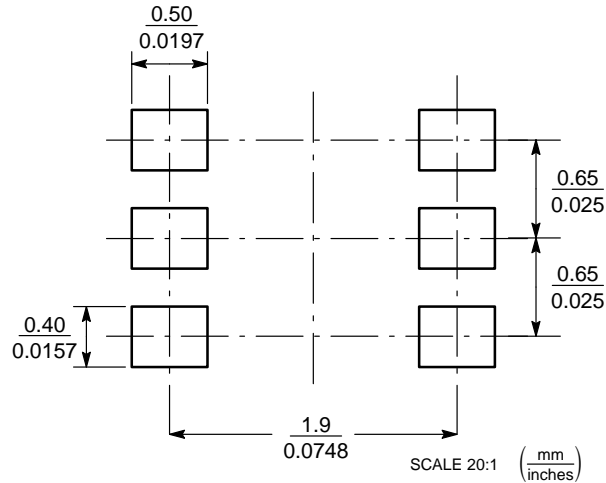
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419B-01 OBSOLETE, NEW STANDARD 419B-02.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20

STYLE 1:

1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4. EMITTER 1
5. BASE 1
6. COLLECTOR 2

### SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
P.O. Box 611312, Phoenix, Arizona 85082-1312 USA  
**Phone:** 480-829-7710 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 480-829-7709 or 800-344-3867 Toll Free USA/Canada  
**Email:** orderlit@onsemi.com

**N. American Technical Support:** 800-282-9855 Toll Free USA/Canada

**Japan:** ON Semiconductor, Japan Customer Focus Center  
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051  
**Phone:** 81-3-5773-3850

**ON Semiconductor Website:** <http://onsemi.com>

**Order Literature:** <http://www.onsemi.com/litorder>

For additional information, please contact your local Sales Representative.