

# MBT2222ADW1T1

## General Purpose Transistor

### NPN Silicon

Moisture Sensitivity Level: 1  
 ESD Rating: Human Body Model – 4 kV  
 Machine Model – 400 V

#### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	$V_{CEO}$	40	Vdc
Collector–Base Voltage	$V_{CBO}$	75	Vdc
Emitter–Base Voltage	$V_{EBO}$	6.0	Vdc
Collector Current – Continuous	$I_C$	600	mAdc

#### THERMAL CHARACTERISTICS

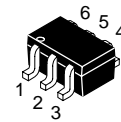
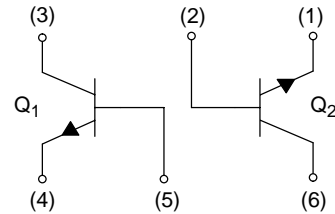
Characteristic	Symbol	Max	Unit
Total Package Dissipation (Note 1) $T_A = 25^\circ\text{C}$	$P_D$	150	mW
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	833	$^\circ\text{C/W}$
Junction and Storage Temperature	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

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



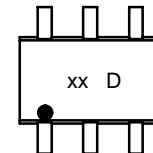
**ON Semiconductor®**

<http://onsemi.com>



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

#### MARKING DIAGRAM



xx = Specific Device Code  
 D = Date Code

#### ORDERING INFORMATION

Device	Package	Shipping
MBT2222ADW1T1	SOT-363	3000/Tape & Reel

# MBT2222ADW1T1

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Breakdown Voltage (I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	40	–	V <sub>dc</sub>
Collector–Base Breakdown Voltage (I <sub>C</sub> = 10 μA <sub>dc</sub> , I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	75	–	V <sub>dc</sub>
Emitter–Base Breakdown Voltage (I <sub>E</sub> = 10 μA <sub>dc</sub> , I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	6.0	–	V <sub>dc</sub>
Collector Cutoff Current (V <sub>CE</sub> = 60 V <sub>dc</sub> , V <sub>EB(off)</sub> = 3.0 V <sub>dc</sub> )	I <sub>CEX</sub>	–	10	nA <sub>dc</sub>
Collector Cutoff Current (V <sub>CB</sub> = 60 V <sub>dc</sub> , I <sub>E</sub> = 0) (V <sub>CB</sub> = 60 V <sub>dc</sub> , I <sub>E</sub> = 0, T <sub>A</sub> = 125°C)	I <sub>CBO</sub>	– –	0.01 10	μA <sub>dc</sub>
Emitter Cutoff Current (V <sub>EB</sub> = 3.0 V <sub>dc</sub> , I <sub>C</sub> = 0)	I <sub>EBO</sub>	–	100	nA <sub>dc</sub>
Base Cutoff Current (V <sub>CE</sub> = 60 V <sub>dc</sub> , V <sub>EB(off)</sub> = 3.0 V <sub>dc</sub> )	I <sub>BL</sub>	–	20	nA <sub>dc</sub>
<b>ON CHARACTERISTICS</b>				
DC Current Gain (I <sub>C</sub> = 0.1 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> ) (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> ) (I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> ) (I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , T <sub>A</sub> = –55°C) (I <sub>C</sub> = 150 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> ) (Note 2) (I <sub>C</sub> = 150 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (Note 2) (I <sub>C</sub> = 500 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> ) (Note 2)	h <sub>FE</sub>	35 50 75 35 100 50 40	– – – – 300 – –	–
Collector–Emitter Saturation Voltage (Note 2) (I <sub>C</sub> = 150 mA <sub>dc</sub> , I <sub>B</sub> = 15 mA <sub>dc</sub> ) (I <sub>C</sub> = 500 mA <sub>dc</sub> , I <sub>B</sub> = 50 mA <sub>dc</sub> )	V <sub>CE(sat)</sub>	– –	0.3 1.0	V <sub>dc</sub>
Base–Emitter Saturation Voltage (Note 2) (I <sub>C</sub> = 150 mA <sub>dc</sub> , I <sub>B</sub> = 15 mA <sub>dc</sub> ) (I <sub>C</sub> = 500 mA <sub>dc</sub> , I <sub>B</sub> = 50 mA <sub>dc</sub> )	V <sub>BE(sat)</sub>	0.6 –	1.2 2.0	V <sub>dc</sub>

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

# MBT2222ADW1T1

## SMALL-SIGNAL CHARACTERISTICS

Current-Gain – Bandwidth Product (Note 3) ( $I_C = 20 \text{ mA}$ , $V_{CE} = 20 \text{ V}$ , $f = 100 \text{ MHz}$ )	$f_T$	300	–	MHz
Output Capacitance ( $V_{CB} = 10 \text{ V}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )	$C_{obo}$	–	8.0	pF
Input Capacitance ( $V_{EB} = 0.5 \text{ V}$ , $I_C = 0$ , $f = 1.0 \text{ MHz}$ )	$C_{ibo}$	–	25	pF
Input Impedance ( $I_C = 1.0 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $f = 1.0 \text{ kHz}$ ) ( $I_C = 10 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $f = 1.0 \text{ kHz}$ )	$h_{ie}$	2.0 0.25	8.0 1.25	k $\Omega$
Voltage Feedback Ratio ( $I_C = 1.0 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $f = 1.0 \text{ kHz}$ ) ( $I_C = 10 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $f = 1.0 \text{ kHz}$ )	$h_{re}$	– –	8.0 4.0	$\times 10^{-4}$
Small-Signal Current Gain ( $I_C = 1.0 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $f = 1.0 \text{ kHz}$ ) ( $I_C = 10 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $f = 1.0 \text{ kHz}$ )	$h_{fe}$	50 75	300 375	–
Output Admittance ( $I_C = 1.0 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $f = 1.0 \text{ kHz}$ ) ( $I_C = 10 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $f = 1.0 \text{ kHz}$ )	$h_{oe}$	5.0 25	35 200	$\mu\text{mhos}$
Collector Base Time Constant ( $I_E = 20 \text{ mA}$ , $V_{CB} = 20 \text{ V}$ , $f = 31.8 \text{ MHz}$ )	$r_b, C_C$	–	150	ps
Noise Figure ( $I_C = 100 \mu\text{A}$ , $V_{CE} = 10 \text{ V}$ , $R_S = 1.0 \text{ k}\Omega$ , $f = 1.0 \text{ kHz}$ )	NF	–	4.0	dB

## SWITCHING CHARACTERISTICS

Delay Time	$(V_{CC} = 30 \text{ V}$ , $V_{BE(off)} = -0.5 \text{ V}$ , $I_C = 150 \text{ mA}$ , $I_{B1} = 15 \text{ mA}$ )	$t_d$	–	10	ns
Rise Time		$t_r$	–	25	
Storage Time	$(V_{CC} = 30 \text{ V}$ , $I_C = 150 \text{ mA}$ , $I_{B1} = I_{B2} = 15 \text{ mA}$ )	$t_s$	–	225	ns
Fall Time		$t_f$	–	60	

3.  $f_T$  is defined as the frequency at which  $|h_{fe}|$  extrapolates to unity.

# MBT2222ADW1T1

## SWITCHING TIME EQUIVALENT TEST CIRCUITS

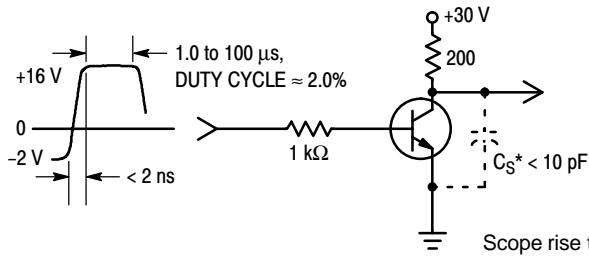


Figure 1. Turn-On Time

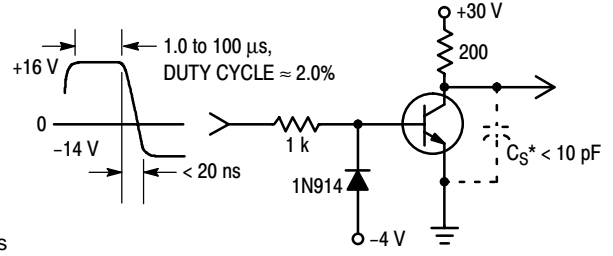


Figure 2. Turn-Off Time

Scope rise time < 4 ns  
 \*Total shunt capacitance of test jig, connectors, and oscilloscope.

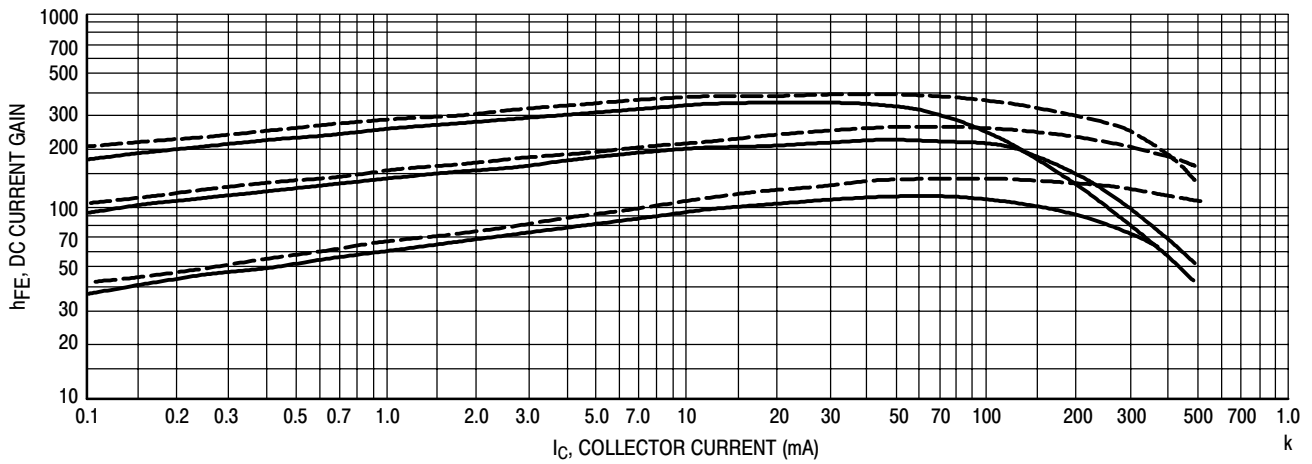


Figure 3. DC Current Gain

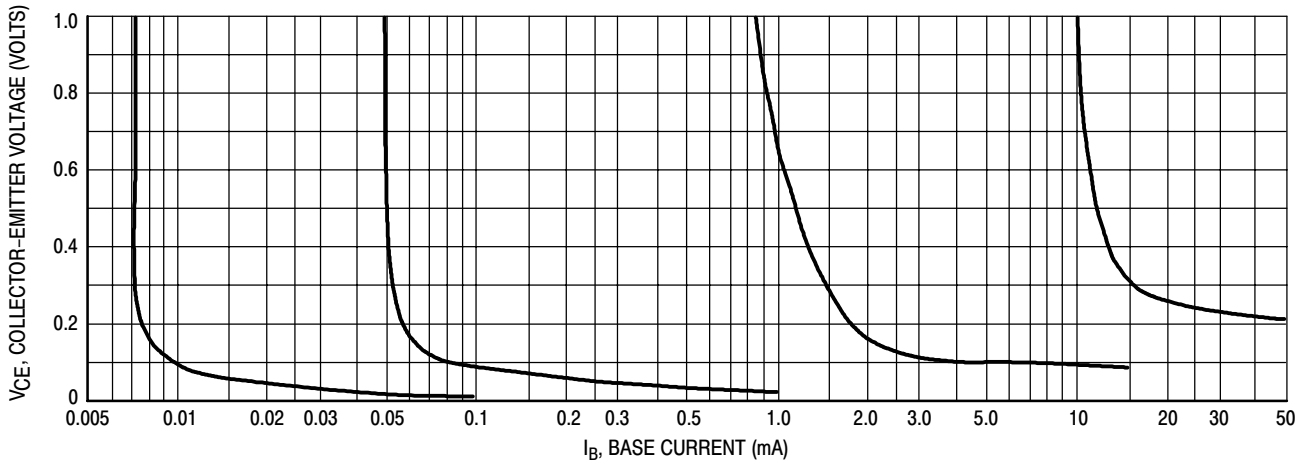


Figure 4. Collector Saturation Region

# MBT2222ADW1T1

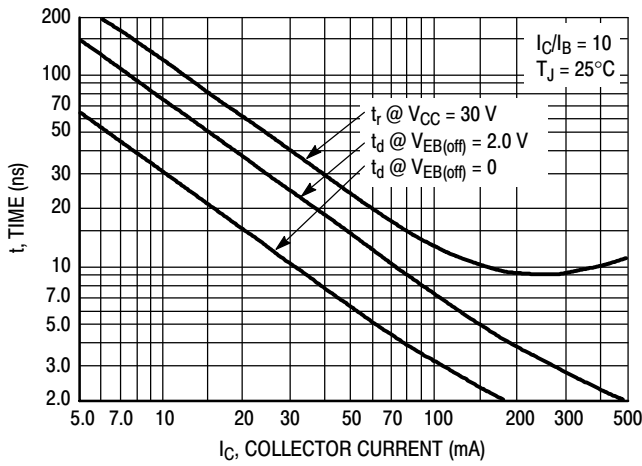


Figure 5. Turn-On Time

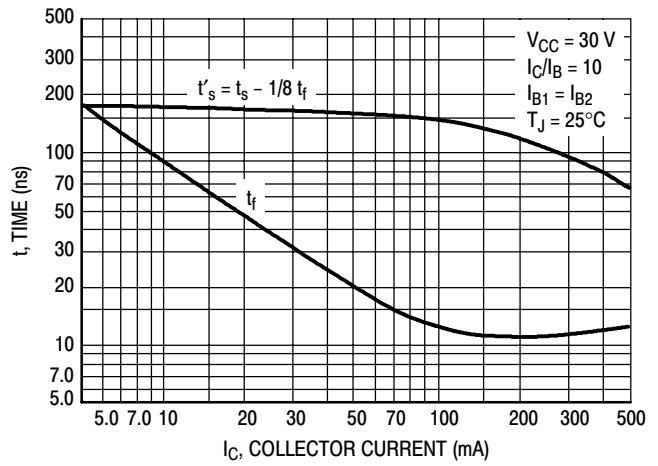


Figure 6. Turn-Off Time

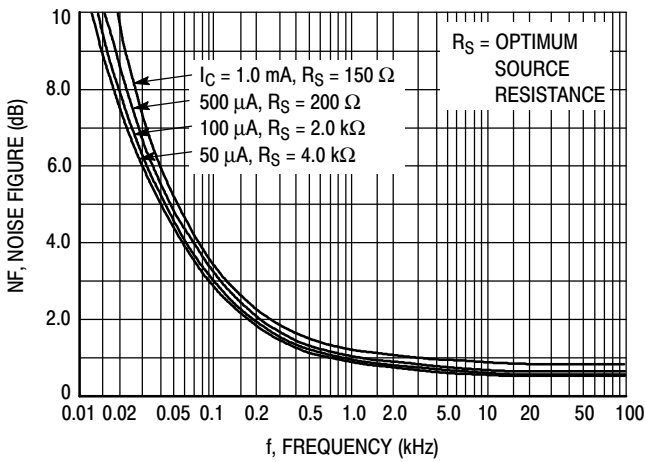


Figure 7. Frequency Effects

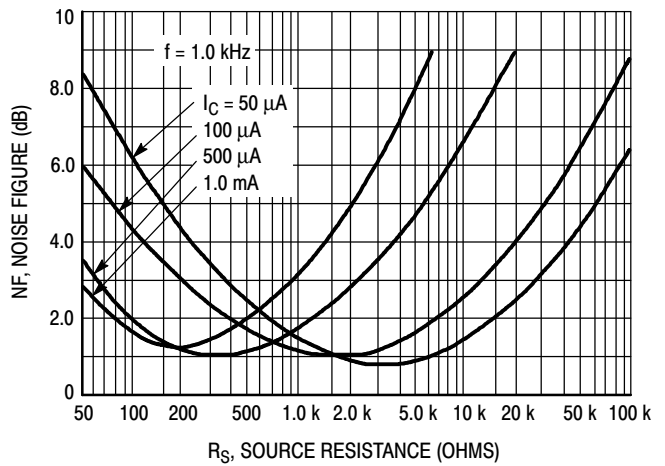


Figure 8. Source Resistance Effects

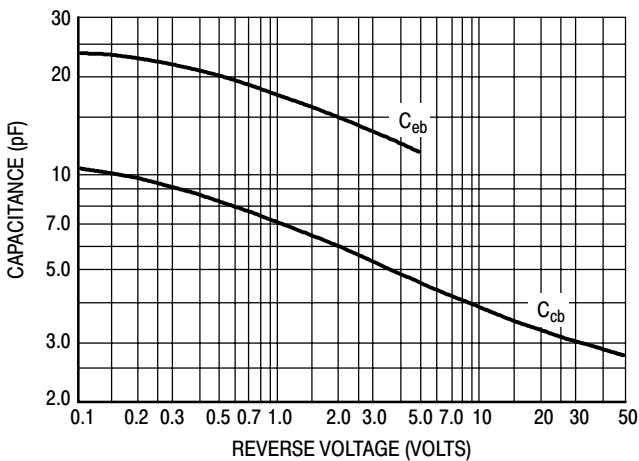


Figure 9. Capacitances

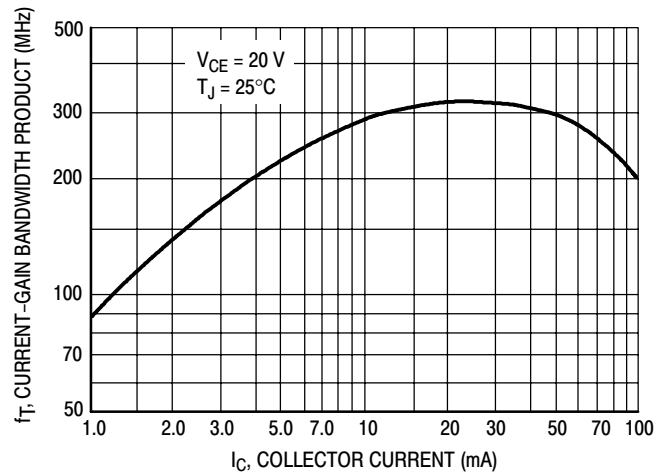


Figure 10. Current-Gain Bandwidth Product

# MBT2222ADW1T1

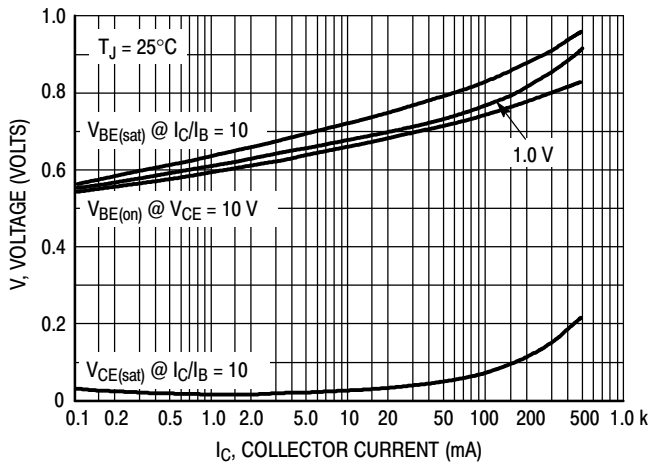


Figure 11. "On" Voltages

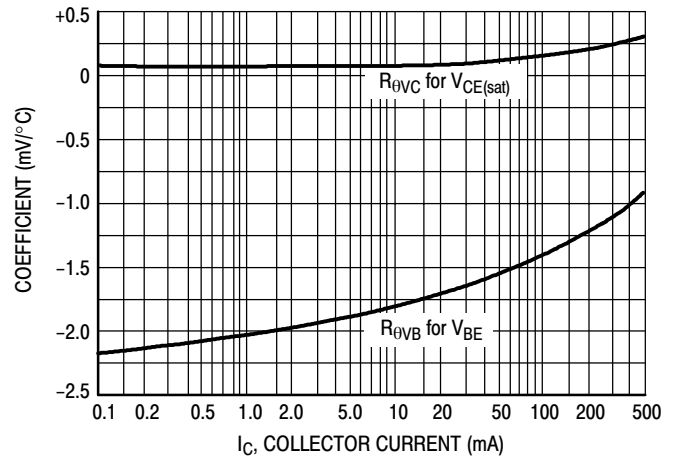
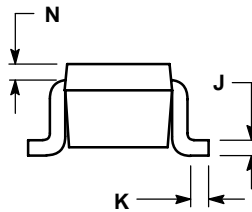
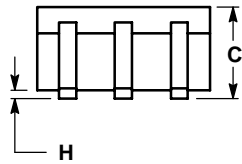
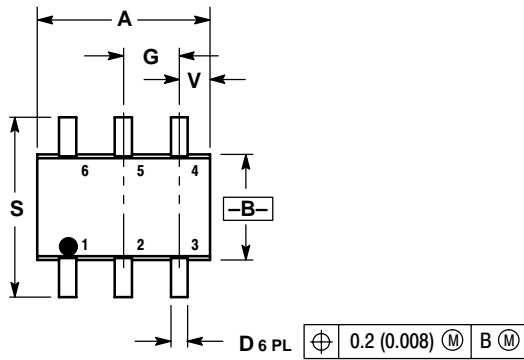


Figure 12. Temperature Coefficients

# MBT2222ADW1T1

## PACKAGE DIMENSIONS


SOT-363/SC-88  
CASE 419B-01  
ISSUE G



- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

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
V	0.012	0.016	0.30	0.40

- STYLE 1:  
PIN 1. EMITTER 2  
2. BASE 2  
3. COLLECTOR 1  
4. EMITTER 1  
5. BASE 1  
6. COLLECTOR 2

**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.

## PUBLICATION ORDERING INFORMATION

### Literature Fulfillment:

Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** ONlit@hibbertco.com

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

**JAPAN:** ON Semiconductor, Japan Customer Focus Center  
4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031  
**Phone:** 81-3-5740-2700  
**Email:** r14525@onsemi.com

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

For additional information, please contact your local Sales Representative.