

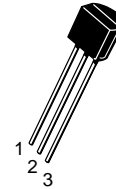
# Switching Transistor

## PNP Silicon

# MPS3638A

### MAXIMUM RATINGS

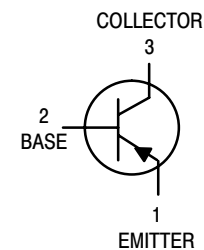
Rating	Symbol	Value	Unit
Collector–Emitter Voltage	$V_{CEO}$	–25	Vdc
Collector–Emitter Voltage	$V_{CES}$	–25	Vdc
Collector–Base Voltage	$V_{CBO}$	–25	Vdc
Emitter–Base Voltage	$V_{EBO}$	–4.0	Vdc
Collector Current — Continuous	$I_C$	–500	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	625 5.0	mW mW/°C
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5 12	Watts mW/°C
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	–55 to +150	°C



CASE 29–11, STYLE 1  
TO–92 (TO–226AA)

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}^{(1)}$	200	°C/W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	°C/W



### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Breakdown Voltage ( $I_C = -100 \mu\text{Adc}$ , $V_{BE} = 0$ )	$V_{(BR)CES}$	–25	—	Vdc
Collector–Emitter Sustaining Voltage <sup>(2)</sup> ( $I_C = -10 \text{ mAdc}$ , $I_B = 0$ )	$V_{CEO(sus)}$	–25	—	Vdc
Collector–Base Breakdown Voltage ( $I_C = -100 \mu\text{Adc}$ , $I_E = 0$ )	$V_{(BR)CBO}$	–25	—	Vdc
Emitter–Base Breakdown Voltage ( $I_E = -100 \mu\text{Adc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	–4.0	—	Vdc
Collector Cutoff Current ( $V_{CE} = -15 \text{ Vdc}$ , $V_{BE} = 0$ ) ( $V_{CE} = -15 \text{ Vdc}$ , $V_{BE} = 0$ , $T_A = -65^\circ\text{C}$ )	$I_{CES}$	— —	–0.035 –2.0	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = -3.0 \text{ V}$ , $I_C = 0$ )	$I_{EBO}$	—	–35	nA
Base Current ( $V_{CE} = -15 \text{ Vdc}$ , $V_{BE} = 0$ )	$I_B$	—	–0.035	$\mu\text{Adc}$

- $R_{\theta JA}$  is measured with the device soldered into a typical printed circuit board.
- Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ ; Duty Cycle  $\leq 2.0\%$ .

# MPS3638A

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Max	Unit
<b>ON CHARACTERISTICS<sup>(2)</sup></b>				
DC Current Gain ( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ ) ( $I_C = -10\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ ) ( $I_C = -50\text{ mAdc}$ , $V_{CE} = -1.0\text{ Vdc}$ ) ( $I_C = -300\text{ mAdc}$ , $V_{CE} = -2.0\text{ Vdc}$ )	$h_{FE}$	80 100 100 20	— — — —	—
Collector–Emitter Saturation Voltage ( $I_C = -50\text{ mAdc}$ , $I_B = -2.5\text{ mAdc}$ ) ( $I_C = -300\text{ mAdc}$ , $I_B = -30\text{ mAdc}$ )	$V_{CE(sat)}$	— —	-0.25 -1.0	Vdc
Base–Emitter Saturation Voltage ( $I_C = -50\text{ mAdc}$ , $I_B = -2.5\text{ mAdc}$ ) ( $I_C = -300\text{ mAdc}$ , $I_B = -30\text{ mAdc}$ )	$V_{BE(sat)}$	— -0.80	-1.1 -2.0	Vdc

## SMALL–SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product ( $V_{CE} = -3.0\text{ Vdc}$ , $I_C = -50\text{ mAdc}$ , $f = 100\text{ MHz}$ )	$f_T$	150	—	MHz
Output Capacitance ( $V_{CB} = -10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{obo}$	—	10	pF
Input Capacitance ( $V_{EB} = -0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )	$C_{ibo}$	—	25	pF
Input Impedance ( $I_C = -10\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{ie}$	—	2000	$k\Omega$
Voltage Feedback Ratio ( $I_C = -10\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{re}$	—	15	$\times 10^{-4}$
Small–Signal Current Gain ( $I_C = -10\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	100	—	—
Output Admittance ( $I_C = -10\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{oe}$	—	1.2	mmhos

## SWITCHING CHARACTERISTICS

Delay Time	$(V_{CC} = -10\text{ Vdc}$ , $I_C = -300\text{ mAdc}$ , $I_{B1} = -30\text{ mAdc}$ )	$t_d$	—	20	ns
Rise Time		$t_r$	—	70	ns
Storage Time	$(V_{CC} = -10\text{ Vdc}$ , $I_C = -300\text{ mAdc}$ , $I_{B1} = -30\text{ mAdc}$ , $I_{B2} = -30\text{ mAdc}$ )	$t_s$	—	140	ns
Fall Time		$t_f$	—	70	ns
Turn–On Time	$(I_C = -300\text{ mAdc}$ , $I_{B1} = -30\text{ mAdc}$ )	$t_{on}$	—	75	ns
Turn–Off Time	$(I_C = -300\text{ mAdc}$ , $I_{B1} = -30\text{ mAdc}$ , $I_{B2} = 30\text{ mAdc}$ )	$t_{off}$	—	170	ns

2. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ ; Duty Cycle  $\leq 2.0\%$ .

# MPS3638A

## SWITCHING TIME EQUIVALENT TEST CIRCUIT

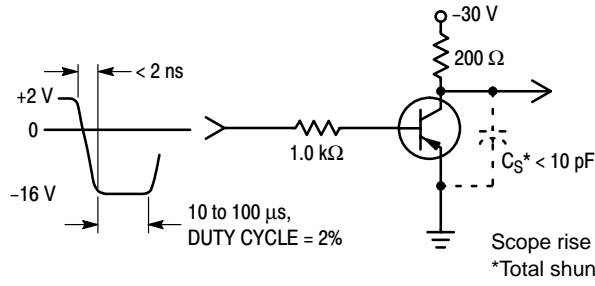


Figure 1. Turn-On Time

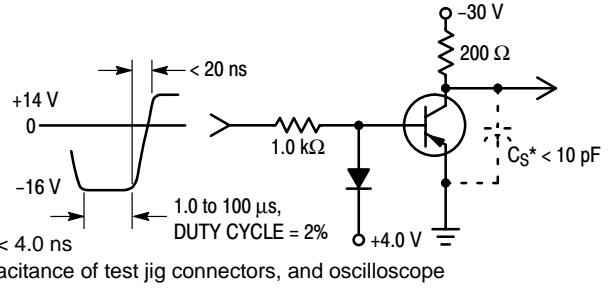


Figure 2. Turn-Off Time

## TRANSIENT CHARACTERISTICS

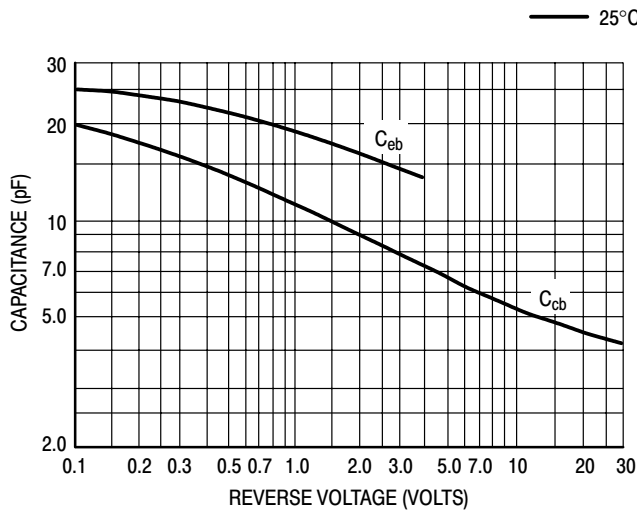


Figure 3. Capacitances

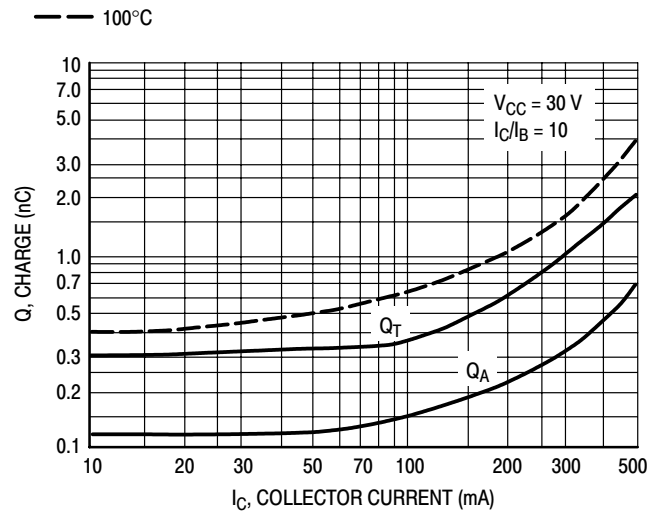


Figure 4. Charge Data

# MPS3638A

## TRANSIENT CHARACTERISTICS (Continued)

— 25°C    - - - 100°C

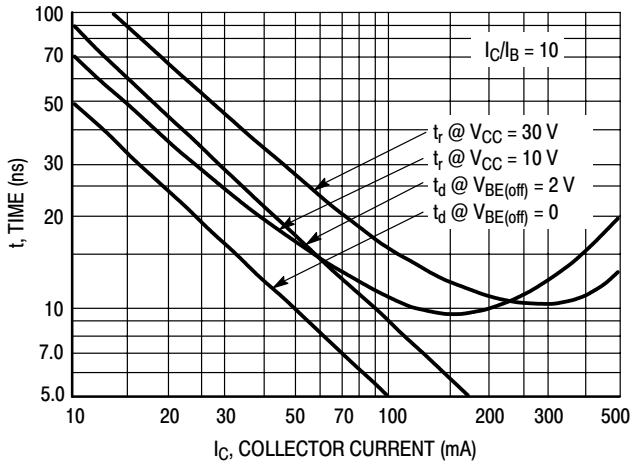


Figure 5. Turn-On Time

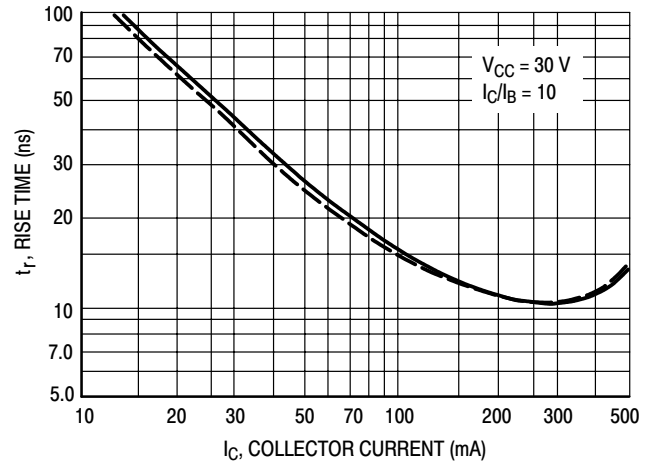


Figure 6. Rise Time

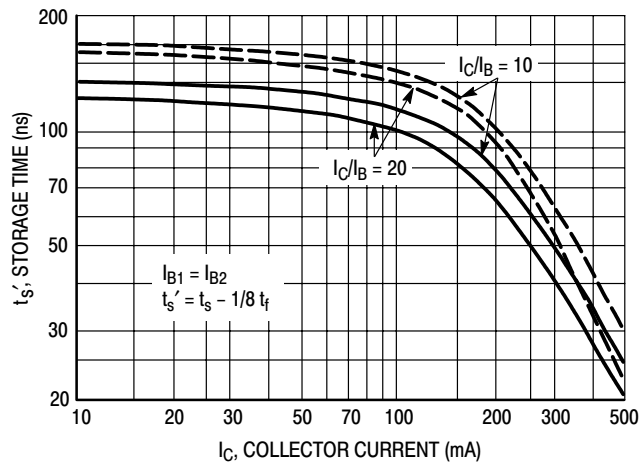


Figure 7. Storage Time

# MPS3638A

## SMALL-SIGNAL CHARACTERISTICS

### NOISE FIGURE

$V_{CE} = -10 \text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$

Bandwidth = 1.0 Hz

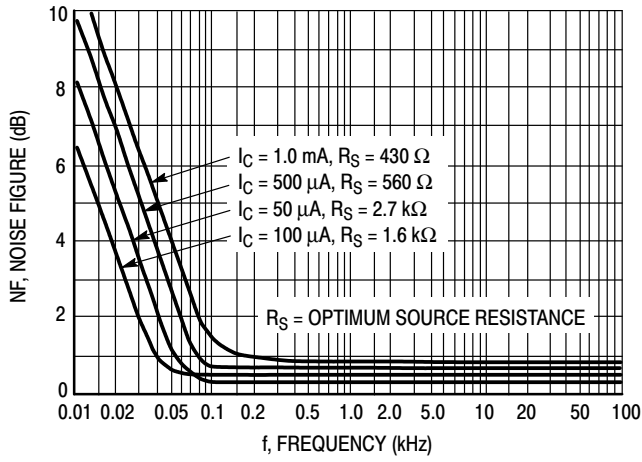


Figure 8. Frequency Effects

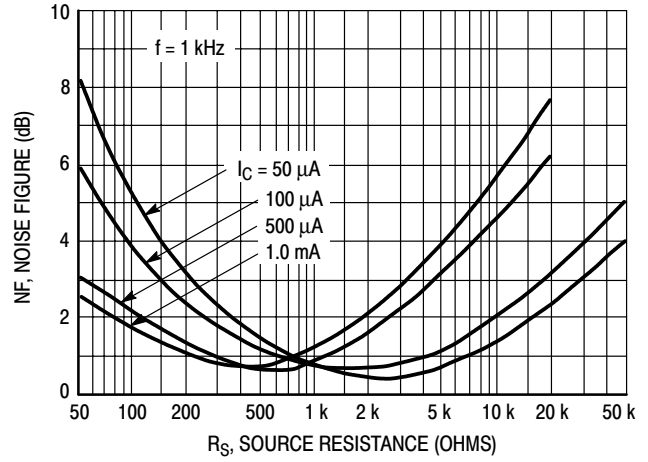


Figure 9. Source Resistance Effects

# MPS3638A

## h PARAMETERS

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

This group of graphs illustrates the relationship between  $h_{fe}$  and other "h" parameters for this series of transistors. To obtain these curves, a high-gain and a low-gain unit were

selected from the 2N4402 line, and the same units were used to develop the correspondingly-numbered curves on each graph.

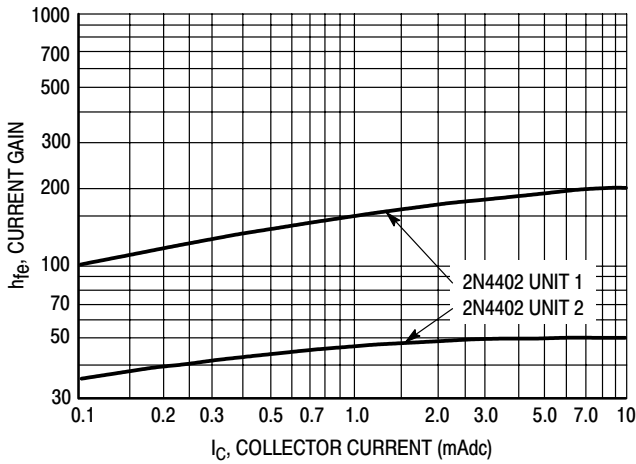


Figure 10. Current Gain

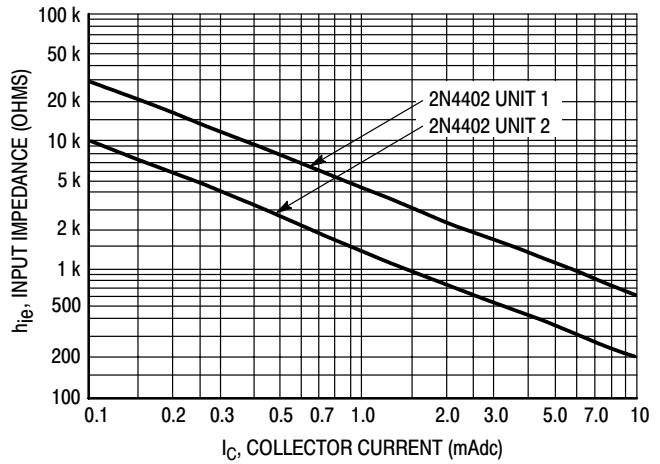


Figure 11. Input Impedance

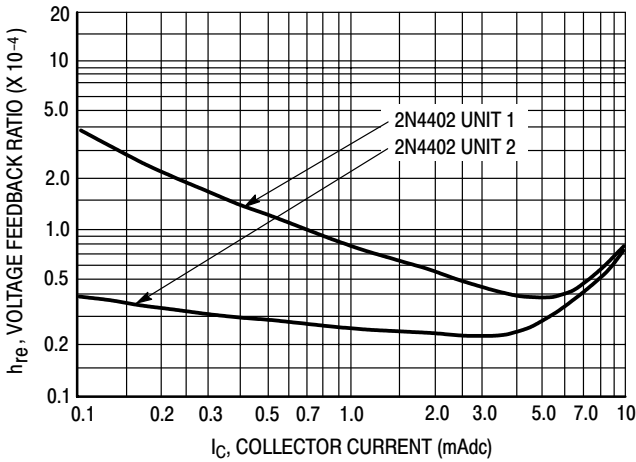


Figure 12. Voltage Feedback Ratio

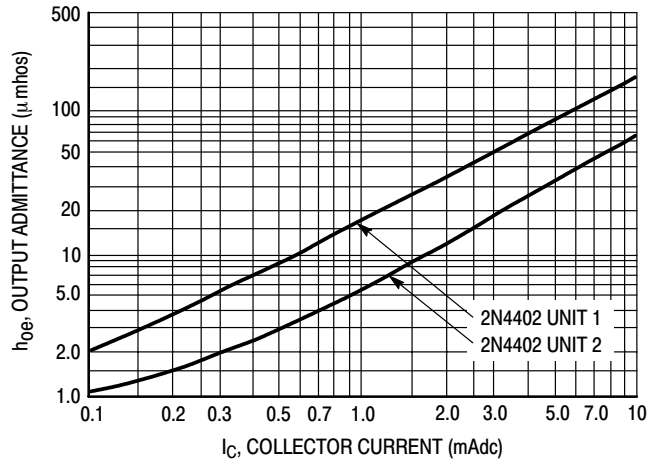


Figure 13. Output Admittance

# MPS3638A

## STATIC CHARACTERISTICS

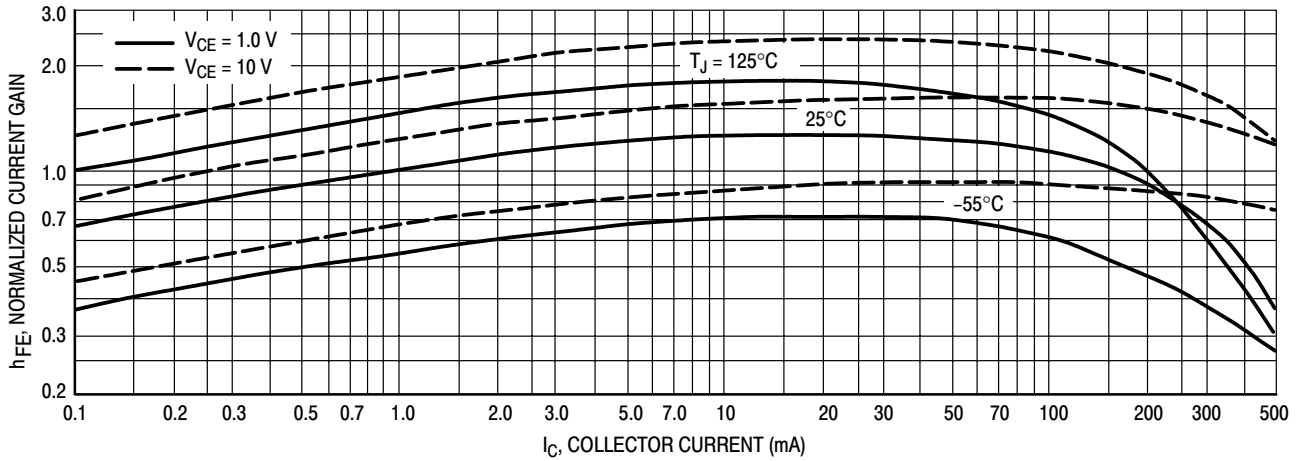


Figure 14. DC Current Gain

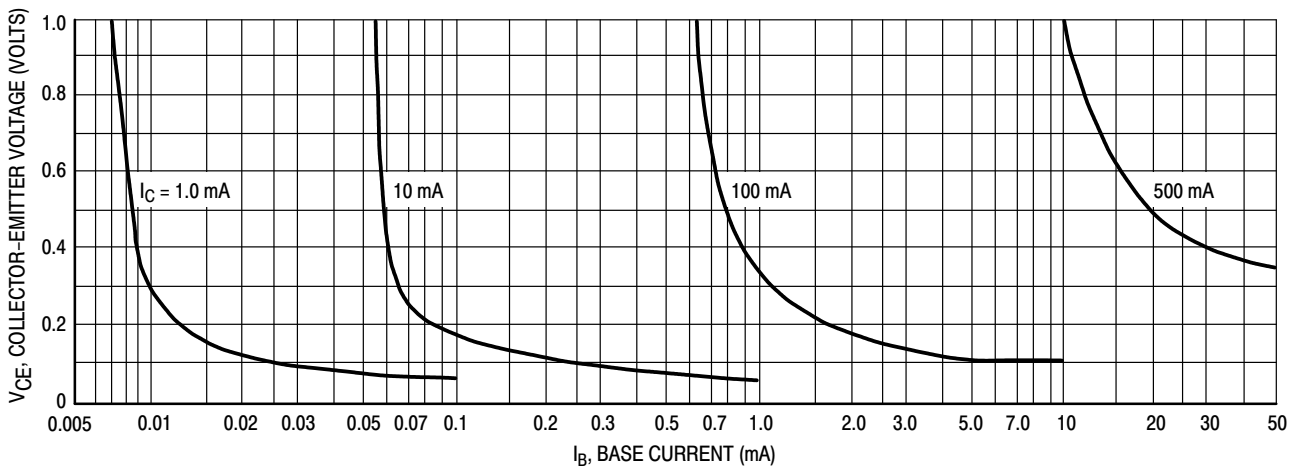


Figure 15. Collector Saturation Region

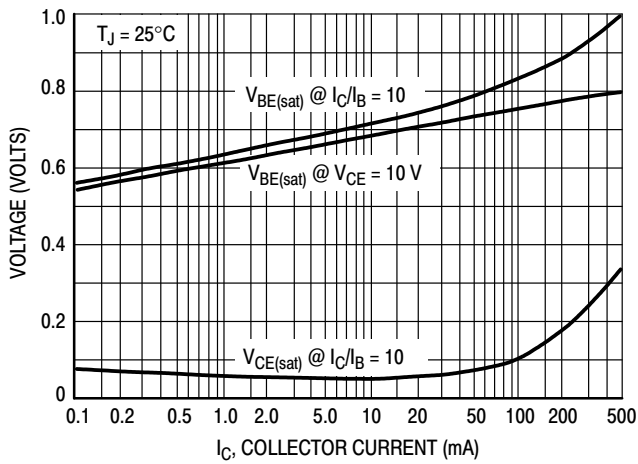


Figure 16. "On" Voltages

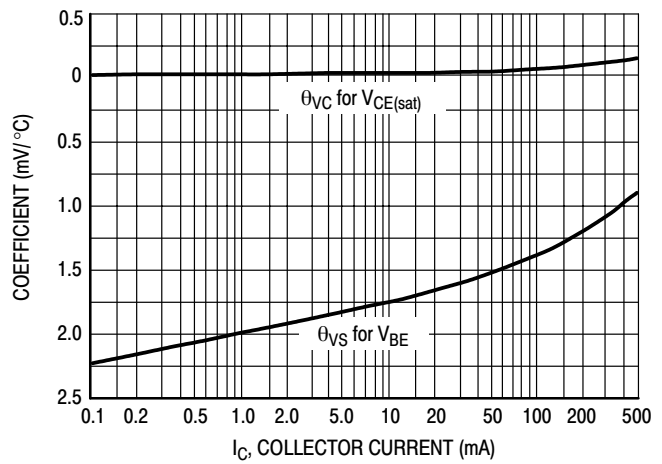
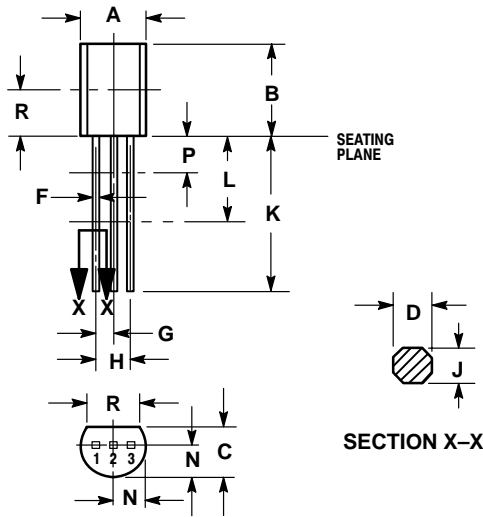


Figure 17. Temperature Coefficients

# MPS3638A

## PACKAGE DIMENSIONS

### CASE 029-11 (TO-226AA) ISSUE AD




STYLE 1:  
PIN 1. EMITTER  
2. BASE  
3. COLLECTOR

#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSIONS D AND J APPLY BETWEEN L AND K MINIMUM. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.44	5.21
B	0.290	0.310	7.37	7.87
C	0.125	0.165	3.18	4.19
D	0.018	0.021	0.457	0.533
F	0.016	0.019	0.407	0.482
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.018	0.024	0.46	0.61
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.080	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.135	---	3.43	---

**ON Semiconductor** and  are 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

### NORTH AMERICA 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  
Fax Response Line: 303-675-2167 or 800-344-3810 Toll Free USA/Canada

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

### EUROPE: LDC for ON Semiconductor – European Support

**German Phone:** (+1) 303-308-7140 (Mon-Fri 2:30pm to 7:00pm CET)  
**Email:** ONlit-german@hibbertco.com  
**French Phone:** (+1) 303-308-7141 (Mon-Fri 2:00pm to 7:00pm CET)  
**Email:** ONlit-french@hibbertco.com  
**English Phone:** (+1) 303-308-7142 (Mon-Fri 12:00pm to 5:00pm GMT)  
**Email:** ONlit@hibbertco.com

### EUROPEAN TOLL-FREE ACCESS\*: 00-800-4422-3781

\*Available from Germany, France, Italy, UK, Ireland

### CENTRAL/SOUTH AMERICA:

**Spanish Phone:** 303-308-7143 (Mon-Fri 8:00am to 5:00pm MST)  
**Email:** ONlit-spanish@hibbertco.com  
**Toll-Free from Mexico:** Dial 01-800-288-2872 for Access –  
then Dial 866-297-9322

### ASIA/PACIFIC: LDC for ON Semiconductor – Asia Support

**Phone:** 303-675-2121 (Tue-Fri 9:00am to 1:00pm, Hong Kong Time)  
**Toll Free from Hong Kong & Singapore:**  
**001-800-4422-3781**  
**Email:** ONlit-asia@hibbertco.com

### 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.