NPN Multi-Chip General-Purpose Amplifier

FMB3904, MMPQ3904

Description

This device is designed as a general−purpose amplifier and switch. The useful dynamic range extends to 100 mA as a switch and to 100 MHz as an amplifier. Sourced from Process 23.

ABSOLUTE MAXIMUM RATINGS (Note 1)

Symbol	Parameter	Value	Unit
V_{CEO}	Collector-Emitter Voltage	40	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	6.0	V
I_C	Collector Current − Continuous	200	mA
T_J, T_{STG}	Operating and Storage Junction Temperature Range	−55 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. These ratings are based on a maximum junction temperature of 150°C. These are steady-state limits. **onsemi** should be consulted on applications involving pulsed or low-duty cycle operations.

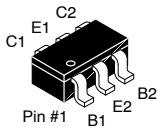
THERMAL CHARACTERISTICS (Note 2)

(Values are at T_A = 25°C, unless otherwise noted.)

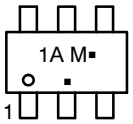
Symbol	Parameter	Max		Unit
		FMB3904	MMPQ3904	
P_D	Total Device Dissipation	700	1,000	mW
	Derate Above 25°C	5.6	8.0	mW/°C
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	180	–	°C/W
	Thermal Resistance, Junction to Ambient, Effective 4 Die	–	125	
	Thermal Resistance, Junction to Ambient, Each Die	–	240	

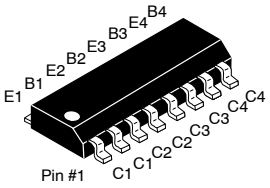
2. PCB size: FR-4 76 x 114 x 0.6T mm^3 (3.0 inch x 4.5 inch x 0.062 inch) with minimum land pattern size.

MARKING DIAGRAM



TSOT23 6-Lead
CASE 419BL



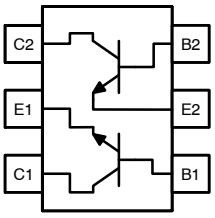


SOIC-16
CASE 751BG

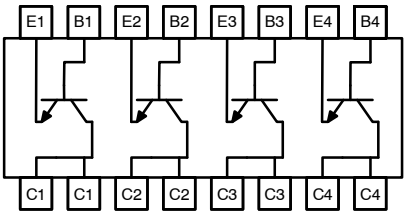
1A, MMPQ3904	= Specific Device Code
M	= Date Code
▪	= Pb-Free Package
A	= Assembly Site
WL	= Wafer Lot Number
Y	= Year of Production
WW	= Work Week Number

(Note: Microdot may be in either location)

INTERNAL CONNECTIONS



FMB3904



MMPQ3904

ORDERING INFORMATION

Device	Package	Shipping†
FMB3904	TSOT23 (Pb-Free, Halide Free)	3000 / Tape & Reel
MMPQ3904	SOIC-16 (Pb-Free, Halide Free)	2500 / Tape & 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.

ELECTRICAL CHARACTERISTICS (Values are at T_A = 25°C unless otherwise noted.)

Symbol	Parameter		Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		I_C = 1.0 mA, I_B = 0	40	–	–	V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage		I_C = 10 μA, I_E = 0	60	–	–	V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage		I_E = 10 μA, I_C = 0	6.0	–	–	V
I_{BL}	Base Cut-Off Current		V_{CE} = 30 V, V_{BE} = –3 V	–	–	50	nA
I_{CEX}	Collector Cut-Off Current		V_{CE} = 30 V, V_{BE} = –3 V	–	–	50	nA
ON CHARACTERISTICS (Note 3)							
h_{FE}	DC Current Gain	FMB3904	I_C = 0.1 mA, V_{CE} = 1.0 V	40	–	–	
		MMPQ3904		30	–	–	
		FMB3904	I_C = 1.0 mA, V_{CE} = 1.0 V	70	–	–	
		MMPQ3904		50	–	–	
		FMB3904	I_C = 10 mA, V_{CE} = 1.0 V	100	–	300	
		MMPQ3904		75	–	–	
		All Devices	I_C = 50 mA, V_{CE} = 1.0 V	60	–	–	
		All Devices	I_C = 100 mA, V_{CE} = 1.0 V	30	–	–	
V_{CE}(sat)	Collector-Emitter Saturation Voltage		I_C = 10 mA, I_B = 1.0 mA	–	–	0.2	V
			I_C = 50 mA, I_B = 5.0 mA	–	–	0.3	
V_{BE}(sat)	Base-Emitter Saturation Voltage		I_C = 10 mA, I_B = 1.0 mA	0.65	–	0.85	V
			I_C = 50 mA, I_B = 5.0 mA	–	–	0.95	
SMALL-SIGNAL CHARACTERISTICS (MMPQ3904 ONLY)							
f_T	Current Gain-Bandwidth Product		I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz	–	200	–	MHz
C_{ob}	Output Capacitance		V_{CB} = 5.0 V, I_E = 0, f = 140 kHz	–	4.0	–	pF
C_{ib}	Input Capacitance		V_{EB} = 0.5 V, I_C = 0, f = 140 kHz	–	8.0	–	pF

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. Pulse test: pulse width ≤ 300 μs, duty cycle ≤ 2.0%.

TYPICAL PERFORMANCE CHARACTERISTICS

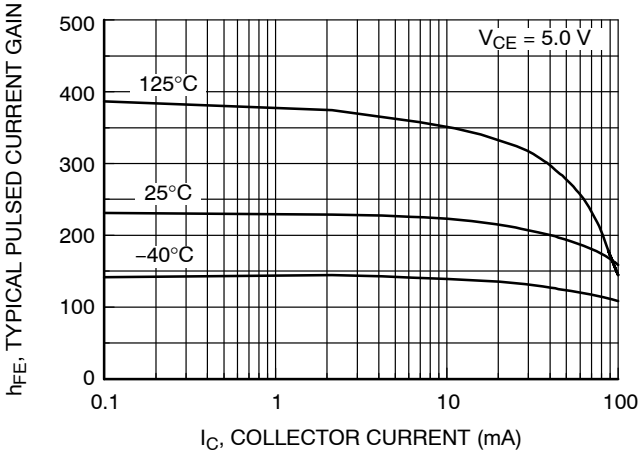


Figure 1. Typical Pulsed Current Gain vs. Collector Current

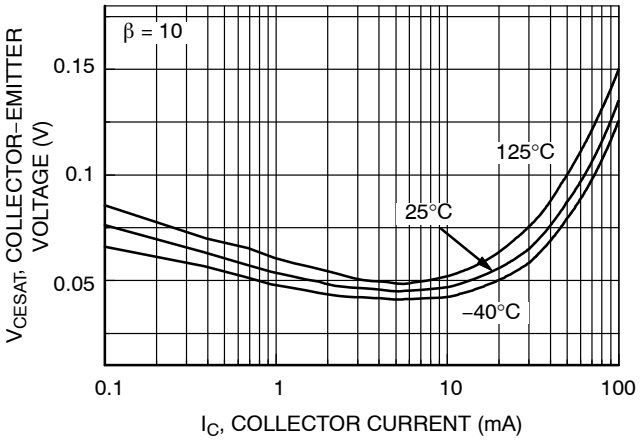


Figure 2. Collector-Emitter Saturation Voltage vs. Collector Current

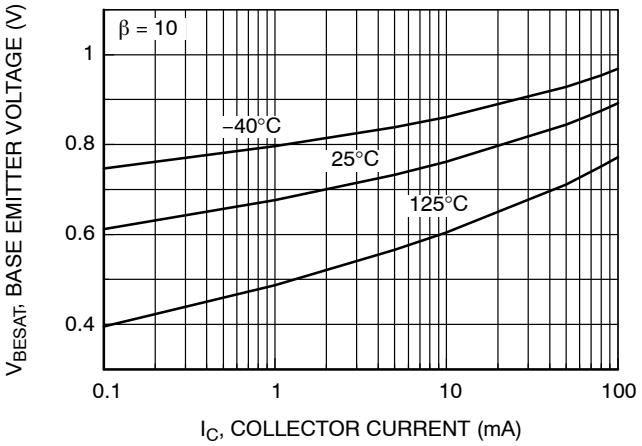


Figure 3. Base-Emitter Saturation Voltage vs. Collector Current

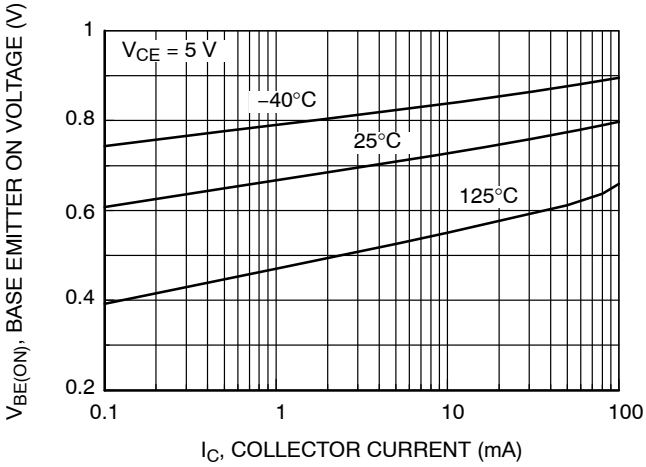


Figure 4. Base-Emitter On Voltage vs. Collector Current

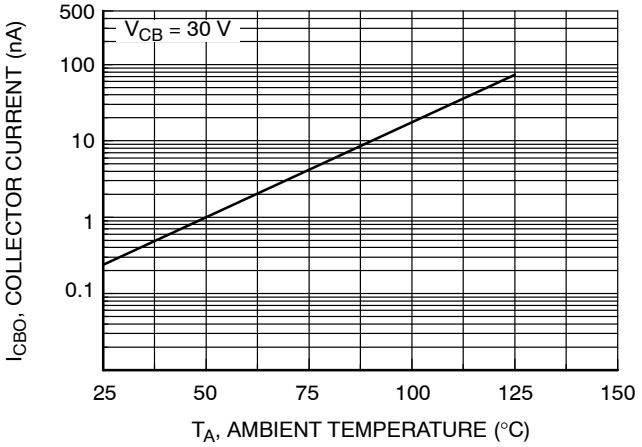


Figure 5. Collector Cut-Off Current vs. Ambient Temperature

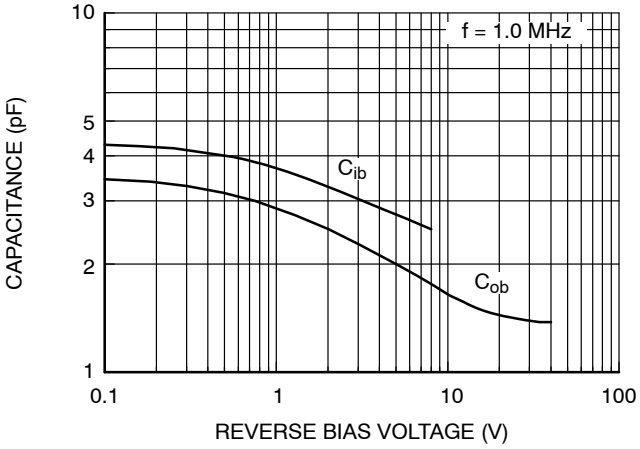


Figure 6. Capacitance vs. Reverse Bias Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

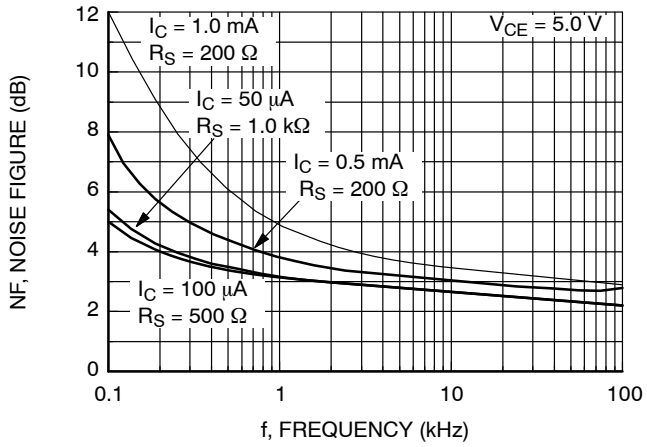


Figure 7. Noise Figure vs. Frequency

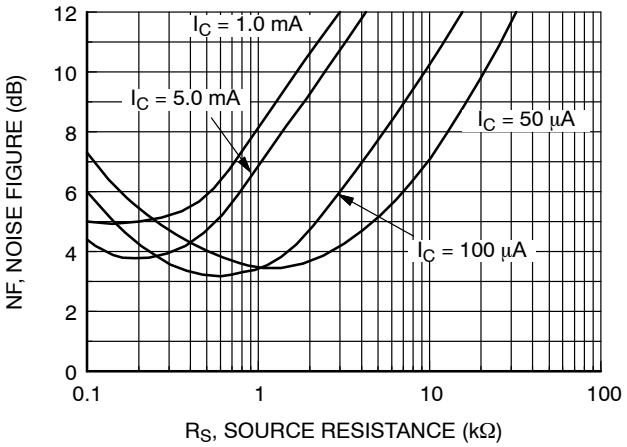


Figure 8. Noise Figure vs. Source Resistance

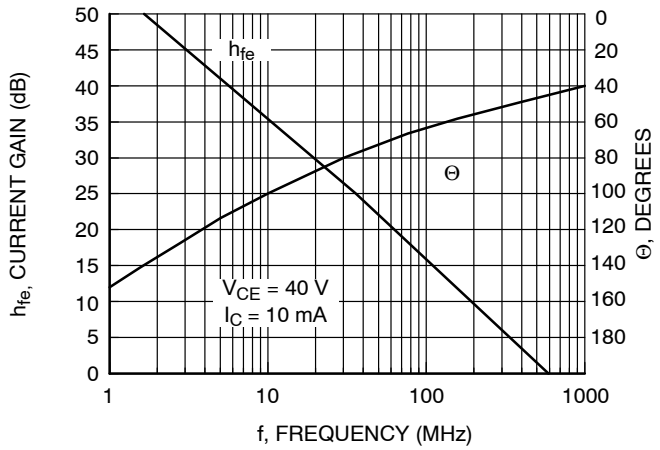


Figure 9. Current Gain and Phase Angle vs. Frequency

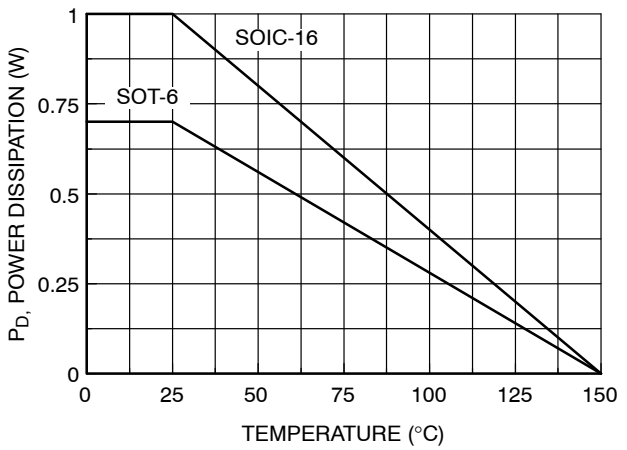


Figure 10. Power Dissipation vs. Ambient Temperature

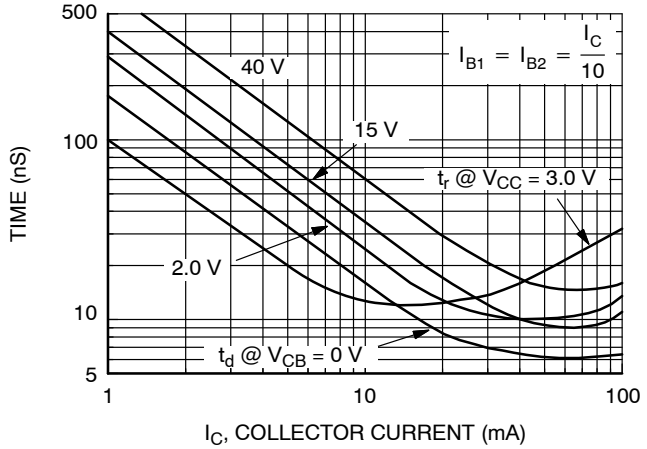


Figure 11. Turn−On Time vs. Collector Current

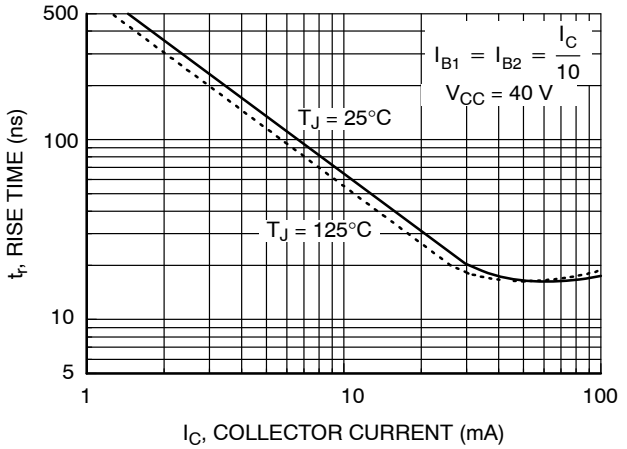


Figure 12. Rise Time vs. Collector Current

TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

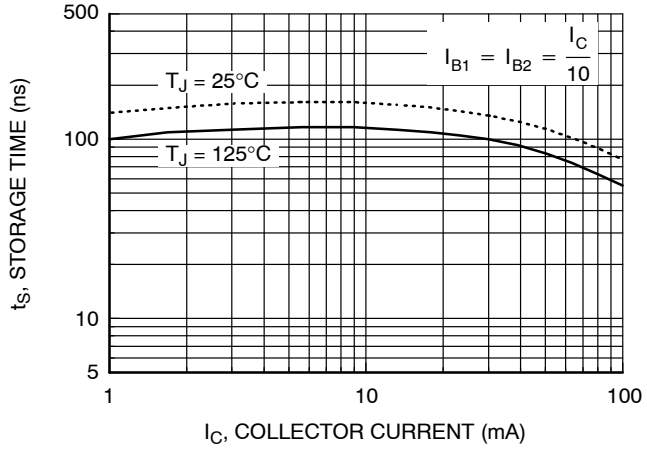


Figure 13. Storage Time vs. Collector Current

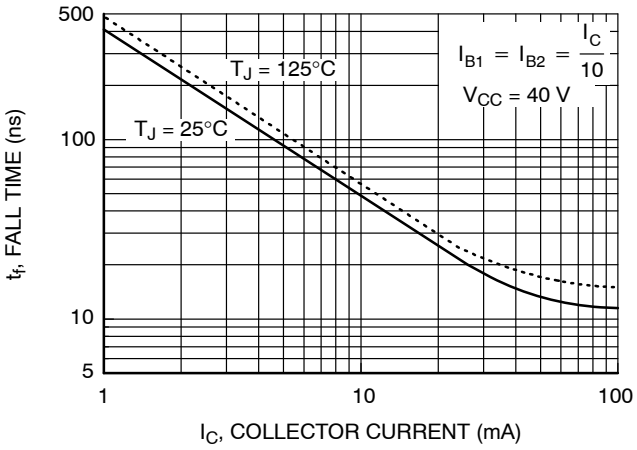


Figure 14. Fall Time vs. Collector Current

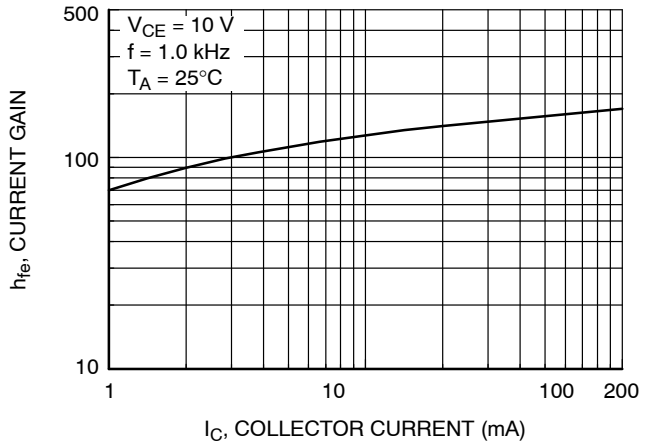


Figure 15. Current Gain

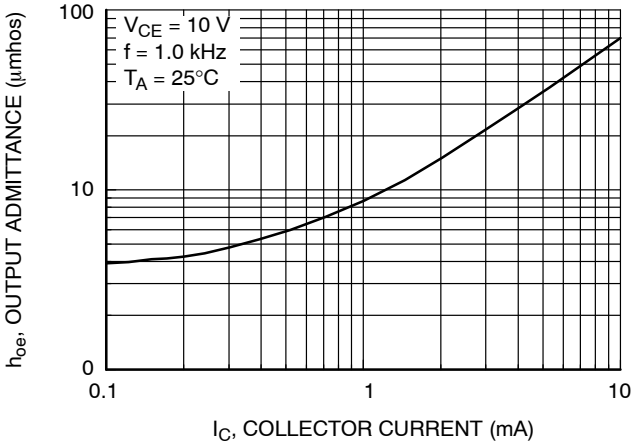


Figure 16. Output Admittance

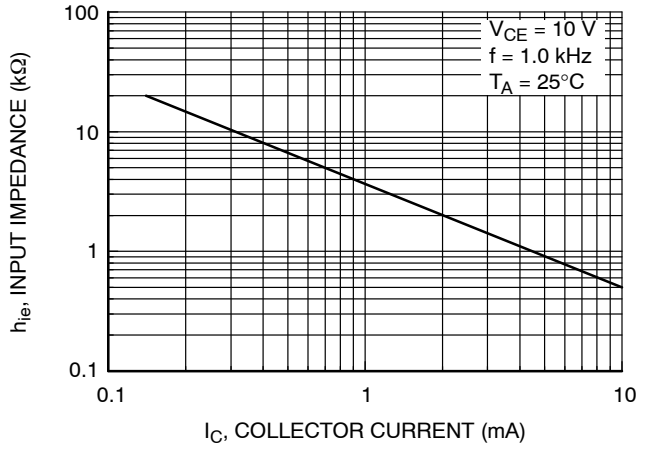


Figure 17. Input Impedance

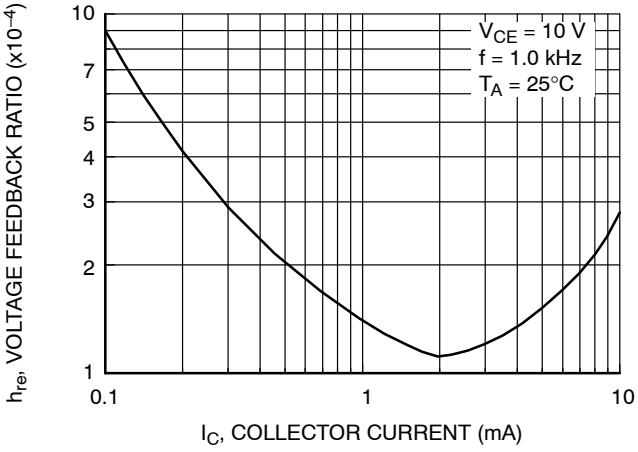
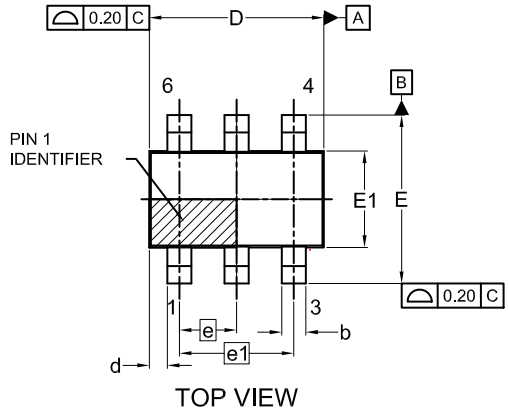


Figure 18. Voltage Feedback Ratio

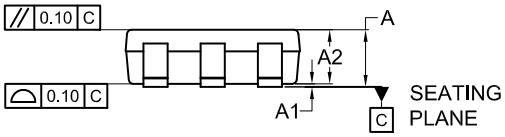
1
SCALE 2:1

TSOT23 6−Lead
CASE 419BL
ISSUE A

DATE 31 AUG 2020

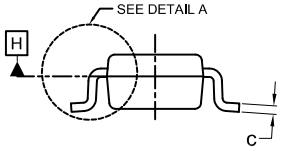


TOP VIEW

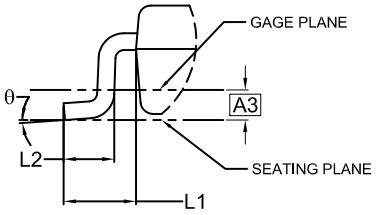


FRONT VIEW

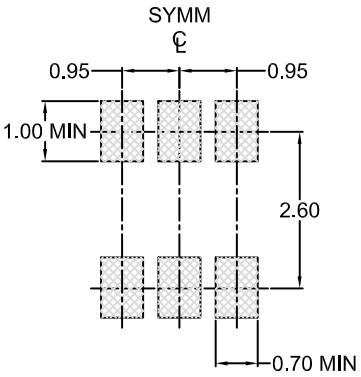
NOTE 4



SIDE VIEW



DETAIL A



LAND PATTERN
RECOMMENDATION

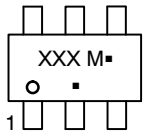
*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.25MM PER END. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
4. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	0.05	0.10
A2	0.70	0.85	1.00
A3		0.25 BSC	
b	0.25	0.38	0.50
c	0.10	0.18	0.26
D	2.80	2.95	3.10
d		0.30 REF	
E	2.50	2.75	3.00
E1	1.30	1.50	1.70
e		0.95 BSC	
e1		1.90 BSC	
L1		0.60 REF	
L2	0.20	0.40	0.60
θ	0°	---	10°

GENERIC MARKING DIAGRAM*



XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

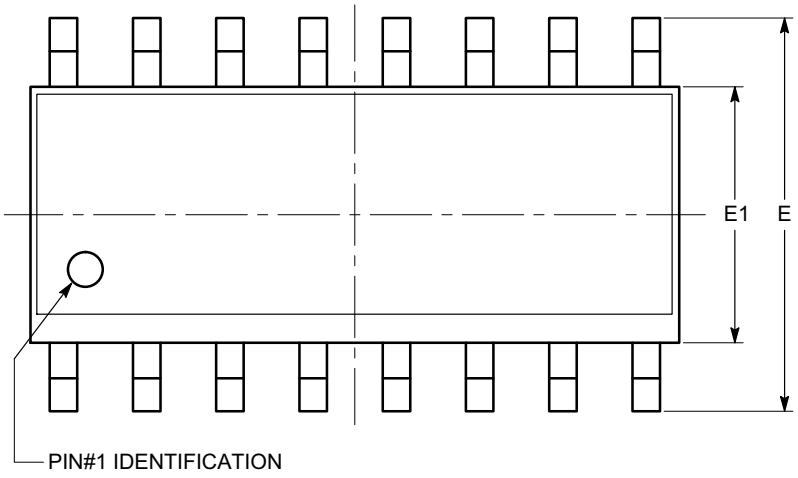
(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot " ▪", may or may not be present. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:	**98AON83292G**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**TSOT23 6−Lead**	**PAGE 1 OF 1**

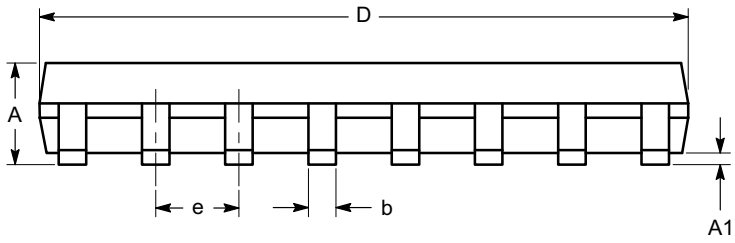
SOIC−16, 150 mils
CASE 751BG
ISSUE O

DATE 19 DEC 2008

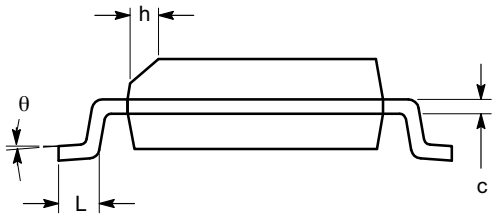


TOP VIEW

SYMBOL	MIN	NOM	MAX
A	1.35		1.75
A1	0.10		0.25
b	0.33		0.51
c	0.19		0.25
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
h	0.25		0.50
L	0.40		1.27
θ	0º		8º



SIDE VIEW



END VIEW

Notes:
(1) All dimensions are in millimeters. Angles in degrees.
(2) Complies with JEDEC MS-012.

DOCUMENT NUMBER:	**98AON34275E**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	**SOIC−16, 150 mils**		**PAGE 1 OF 1**

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

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