

LM3046 Transistor Array

Check for Samples: [LM3046](#)

FEATURES

- Two matched pairs of transistors
 - V_{BE} matched ± 5 mV
 - Input offset current 2 μ A max at $I_C = 1$ mA
- Five general purpose monolithic transistors
- Operation from DC to 120 MHz
- Wide operating current range
- Low noise figure: 3.2 dB typ at 1 kHz

APPLICATIONS

- General use in all types of signal processing systems operating anywhere in the frequency range from DC to VHF
- Custom designed differential amplifiers
- Temperature compensated amplifiers

DESCRIPTION

The LM3046 consists of five general purpose silicon NPN transistors on a common monolithic substrate. Two of the transistors are internally connected to form a differentially-connected pair. The transistors are well suited to a wide variety of applications in low power system in the DC through VHF range. They may be used as discrete transistors in conventional circuits however, in addition, they provide the very significant inherent integrated circuit advantages of close electrical and thermal matching. The LM3046 is supplied in a 14-lead molded small outline package.

Schematic and Connection Diagram

Small Outline Package

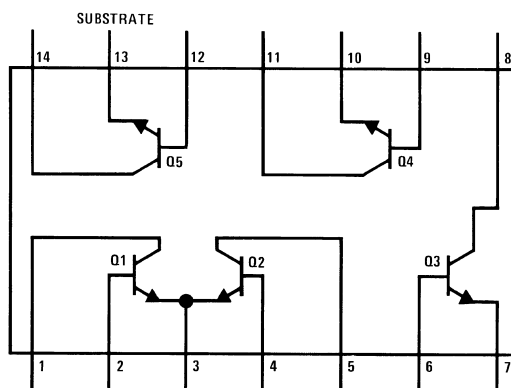


Figure 1. Top View



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.



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Absolute Maximum Ratings ⁽¹⁾(T_A = 25°C)

	LM3046		Units
	Each	Total	
	Transistor	Package	
Power Dissipation:			
T _A = 25°C	300	750	mW
T _A = 25°C to 55°C	300	750	mW
T _A > 55°C	Derate at 6.67		mW/°C
T _A = 25°C to 75°C			mW
T _A > 75°C			mW/°C
Collector to Emitter Voltage, V _{CEO}	15		V
Collector to Base Voltage, V _{CBO}	20		V
Collector to Substrate Voltage, V _{CIO} ⁽²⁾	20		V
Emitter to Base Voltage, V _{EBO}	5		V
Collector Current, I _C	50		mA
Operating Temperature Range	–40°C to +85°C		
Storage Temperature Range	–65°C to +85°C		
Soldering Information			
Dual-In-Line Package Soldering (10 Sec.)	260°C		
Small Outline Package			
Vapor Phase (60 Seconds)	215°C		
Infrared (15 Seconds)	220°C		

- (1) "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits.
- (2) The collector of each transistor is isolated from the substrate by an integral diode. The substrate (terminal 13) must be connected to the most negative point in the external circuit to maintain isolation between transistors and to provide for normal transistor action.

Electrical Characteristics

(T_A = 25°C unless otherwise specified)

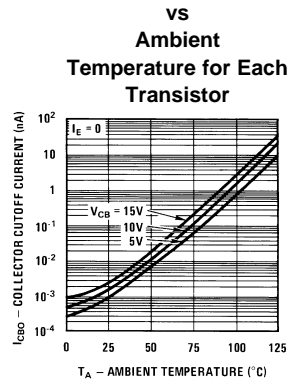
Parameter	Conditions	Limits			Units
		Min	Typ	Max	
Collector to Base Breakdown Voltage (V _{(BR)CBO})	I _C = 10 μA, I _E = 0	20	60		V
Collector to Emitter Breakdown Voltage (V _{(BR)CEO})	I _C = 1 mA, I _B = 0	15	24		V
Collector to Substrate Breakdown Voltage (V _{(BR)CISO})	I _C = 10 μA, I _{CI} = 0	20	60		V
Emitter to Base Breakdown Voltage (V _{(BR)EBO})	I _E = 10 μA, I _C = 0	5	7		V
Collector Cutoff Current (I _{CBO})	V _{CB} = 10V, I _E = 0		0.002	40	nA
Collector Cutoff Current (I _{CEO})	V _{CE} = 10V, I _B = 0			0.5	μA
Static Forward Current Transfer Ratio (Static Beta) (h _{FE})	V _{CE} = 3V, I _C = 10 mA		100		
	I _C = 1 mA	40	100		
	I _C = 10 μA		54		
Input Offset Current for Matched Pair Q ₁ and Q ₂ I _{O1} – I _{O2}	V _{CE} = 3V, I _C = 1 mA		0.3	2	μA
Base to Emitter Voltage (V _{BE})	V _{CE} = 3V, I _E = 1 mA		0.715		V
	I _E = 10 mA		0.800		
Magnitude of Input Offset Voltage for Differential Pair V _{BE1} – V _{BE2}	V _{CE} = 3V, I _C = 1 mA		0.45	5	mV
Magnitude of Input Offset Voltage for Isolated Transistors V _{BE3} – V _{BE4} , V _{BE4} – V _{BE5} , V _{BE5} – V _{BE3}	V _{CE} = 3V, I _C = 1 mA		0.45	5	mV
Temperature Coefficient of Base to Emitter Voltage ($\frac{\Delta V_{BE}}{\Delta T}$) (1)	V _{CE} = 3V, I _C = 1 mA		–1.9		mV/°C
Collector to Emitter Saturation Voltage (V _{CE(SAT)})	I _B = 1 mA, I _C = 10 mA		0.23		V
Temperature Coefficient of Input Offset Voltage ($\frac{\Delta V_{I0}}{\Delta T}$) (2)	V _{CE} = 3V, I _C = 1 mA		1.1		μV/°C

Electrical Characteristics

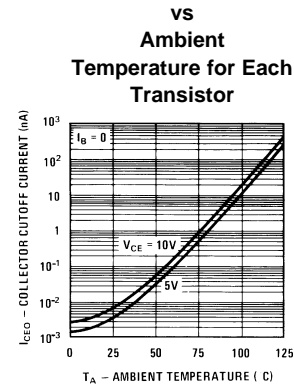
Parameter	Conditions	Min	Typ	Max	Units
Low Frequency Noise Figure (NF)	$f = 1 \text{ kHz}$, $V_{CE} = 3V$, $I_C = 100 \mu A$, $R_S = 1 \text{ k}\Omega$		3.25		dB
LOW FREQUENCY, SMALL SIGNAL EQUIVALENT CIRCUIT CHARACTERISTICS					
Forward Current Transfer Ratio (h_{fe})	$f = 1 \text{ kHz}$, $V_{CE} = 3V$, $I_C = 1 \text{ mA}$		110		
Short Circuit Input Impedance (h_{ie})			3.5		k Ω
Open Circuit Output Impedance (h_{oe})			15.6		μmho
Open Circuit Reverse Voltage Transfer Ratio (h_{re})			1.8×10^{-4}		
ADMITTANCE CHARACTERISTICS					
Forward Transfer Admittance (Y_{fe})	$f = 1 \text{ MHz}$, $V_{CE} = 3V$, $I_C = 1 \text{ mA}$		$31 - j 1.5$		
Input Admittance (Y_{ie})			$0.3 + j 0.04$		
Output Admittance (Y_{oe})			$0.001 + j 0.03$		
Reverse Transfer Admittance (Y_{re})			See Curve		
Gain Bandwidth Product (f_T)	$V_{CE} = 3V$, $I_C = 3 \text{ mA}$	300	550		
Emitter to Base Capacitance (C_{EB})	$V_{EB} = 3V$, $I_E = 0$		0.6		pF
Collector to Base Capacitance (C_{CB})	$V_{CB} = 3V$, $I_C = 0$		0.58		pF
Collector to Substrate Capacitance (C_{CI})	$V_{CS} = 3V$, $I_C = 0$		2.8		pF

Typical Performance Characteristics

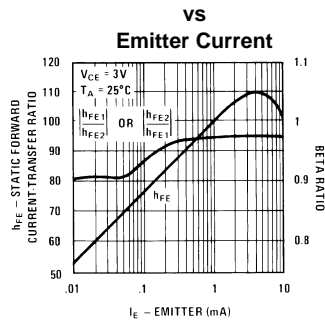
Typical Collector To Base
Cutoff Current



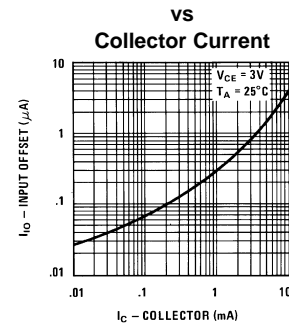
Typical Collector To Emitter
Cutoff Current



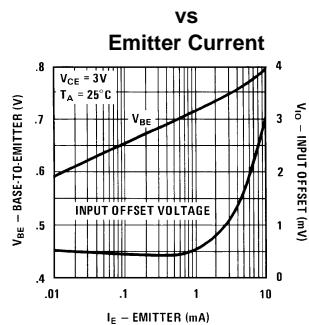
Typical Static Forward
Current-Transfer Ratio and
Beta Ratio for Transistors Q₁
and Q₂



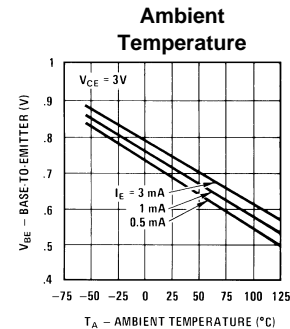
Typical Input Offset Current
for Matched Transistor Pair
Q₁ Q₂



Typical Static Base To Emitter
Voltage Characteristic and Input
Offset Voltage for Differential
Pair and Paired Isolated
Transistors

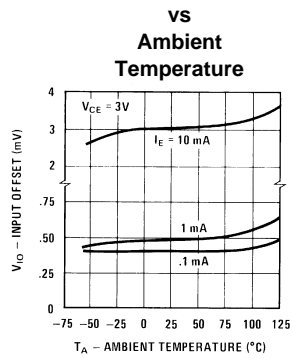


Typical Base To Emitter
Voltage Characteristic for
Each Transistor

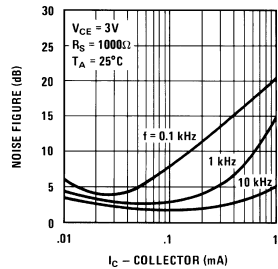


Typical Performance Characteristics (continued)

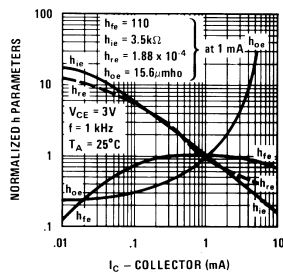
Typical Input Offset Voltage Characteristics for Differential Pair and Paired Isolated Transistors



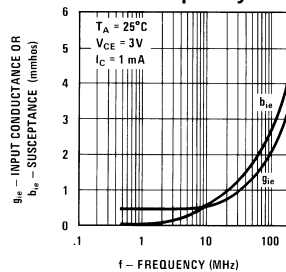
Typical Noise Figure vs Collector Current



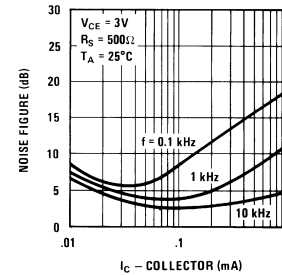
Typical Normalized Forward Current Transfer Ratio, Short Circuit Input Impedance, Open Circuit Output Impedance, and Open Circuit Reverse Voltage Transfer Ratio vs Collector Current



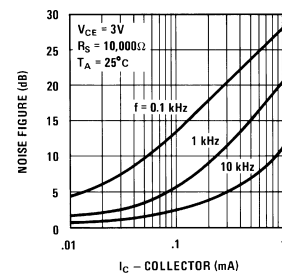
Typical Input Admittance vs Frequency



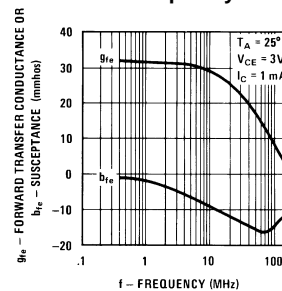
Typical Noise Figure vs Collector Current



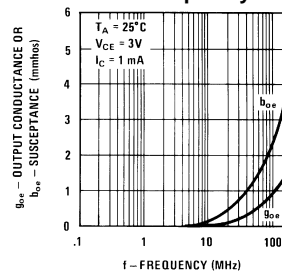
Typical Noise Figure vs Collector Current



Typical Forward Transfer Admittance vs Frequency

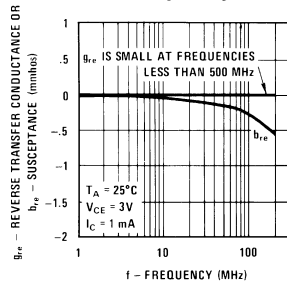


Typical Output Admittance vs Frequency

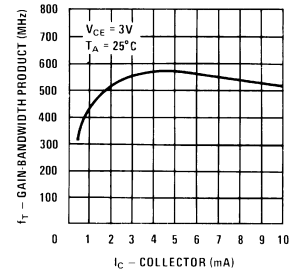


Typical Performance Characteristics (continued)

**Typical Reverse Transfer
Admittance
vs
Frequency**



**Typical Gain-Bandwidth
Product
vs
Collector Current**



PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
LM3046M	ACTIVE	SOIC	D	14	55	TBD	CU SNPB	Level-1-235C-UNLIM	
LM3046M/NOPB	ACTIVE	SOIC	D	14	55	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	
LM3046MX	ACTIVE	SOIC	D	14	2500	TBD	CU SNPB	Level-1-235C-UNLIM	
LM3046MX/NOPB	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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TAPE AND REEL INFORMATION


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM3046MX	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1
LM3046MX/NOPB	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM3046MX	SOIC	D	14	2500	349.0	337.0	45.0
LM3046MX/NOPB	SOIC	D	14	2500	349.0	337.0	45.0

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 E. Reference JEDEC MS-012 variation AB.

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