Zero-Drift, Single-Supply, Rail-to-Rail Input/ Output Operational Amplifiers

■ General Description

The HM8581, HM8582 and HM8584 are single, dual and quad amplifiers featuring rail-to-rail input and output swings, which has ultralow offset, drift and bias current. All are guaranteed to operate from +2.7 V to +5 V single supply.

With an offset voltage of only 80 μV and drift of 20 nV/°C, the HM8581 is perfectly suited for applications where error sources cannot be tolerated. Temperature, position and pres-sure sensors, medical equipment and strain gage amplifiers benefit greatly from nearly zero drift over their operating temperature range. The rail-to-rail input and output swings provided by the HM858X family make both high-side and low- side sensing easy.

The HM858X series is specified for the extended industrial/automotive (–40°C to +125°C) temperature range. The HM8581 single is available in 5-lead SOT and 8-lead SOP/MSOP packages. The HM8582 dual amplifier is available in 8-lead SOP/MSOP packages. The HM8584 quad is available in narrow 14-lead SOP and 14-lead TSSOP packages.

■ Applications

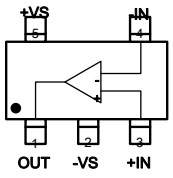
- Temperature Measurements
- Pressure Sensors
- Precision Current Sensing
- Electronic Scales
- Strain Gage Amplifiers
- Medical Instrumentation
- Thermocouple Amplifiers
- Handheld Test Equipment

■ Features

- Low Offset Voltage: 80μV (TYP)
- Rail-to-Rail Input and Output Swing
- 2.7V to 5.0V Single Supply Operation
- Voltage Gain: 145dB (TYP)
- PSRR: 115dB (TYP)
- CMRR: 110dB (TYP)
- Low Input Bias Currents: 130pA
- Low Supply Current: 450μA/Channel
- Overload Recovery Time: 0.1ms
- No External Capacitors Required
- -40℃ to +125℃ Operating Temperature Range
- Small Packaging:
  HM8581 Available in Green SOT-23-5L, SOP8 and MSOP8
  HM8582 Available in Green SOP8 and MSOP8
  HM8584 Available in Green SOP14

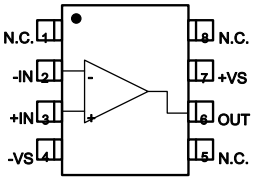
■ Package

HM8581MR



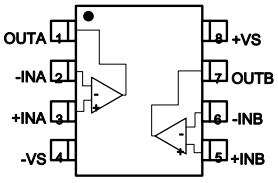
(SOT-23-5L)

HM8581SR/HM8581MMR



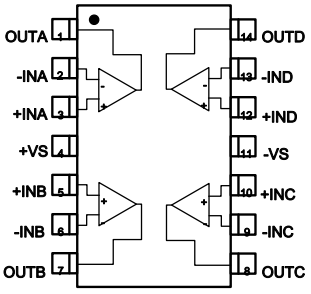
(SOP-8/MSOP-8)

HM8582SR/HM8582MMR



(SOP-8/MSOP-8)

HM8584SSR/HM8584TSR



(SSOP-14/TSSOP-8)

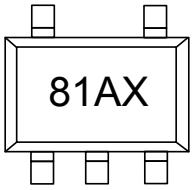
■ Ordering Information

HM858 ①②③

Designator	Symbol	Description
①		**Product No.**
	1	HM8581
	2	HM8582
	4	HM8584
②	—	**Package**
	M	SOT-23-5
	S	SOP-8
	MM	MSOP-8
	SS	SSOP-14
	TS	TSSOP-14
③	—	**Device Orientation**
	R	Embossed Tape: Standard Feed
	L	Embossed Tape: Reverse Feed

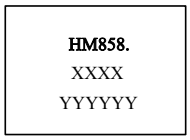
■ Marking

HM8581MR



81----HM8581MR
A-----die code
X-----process code

HM8588①②③



HM858.----HM8581 or HM8582 or HM8584
XXXX--------**process code**
YYYYYY----**lot code**

■ Absolute Maximum Ratings

- ✧ Supply Voltage……...6V
- ✧ Input Voltage……-VS+0.3V—+VS+0.3V
- ✧ Differential Input Voltage……..-5.0V to +5.0V
- ✧ Package Thermal Resistance @ TA = 25℃
  SOT-23-5L……...190℃/W
  MSOP-8……216℃/W
  SOP-8……...125℃/W
  SSOP-14……..120℃/W
  TSSOP-14……180℃/W
- ✧ Storage temperature range……..-65℃ to 150℃
- ✧ Operating junction temperature.....-40℃ to 125℃
- ✧ ESD Human Model……..4000V
- ✧ Lead Temperature Range (Soldering 10 sec)
  ……260℃

■ Electrical Characteristics

（VS = +5V, VCM = +2.5V, VO = +2.5V, TA = +25℃, unless otherwise noted.)

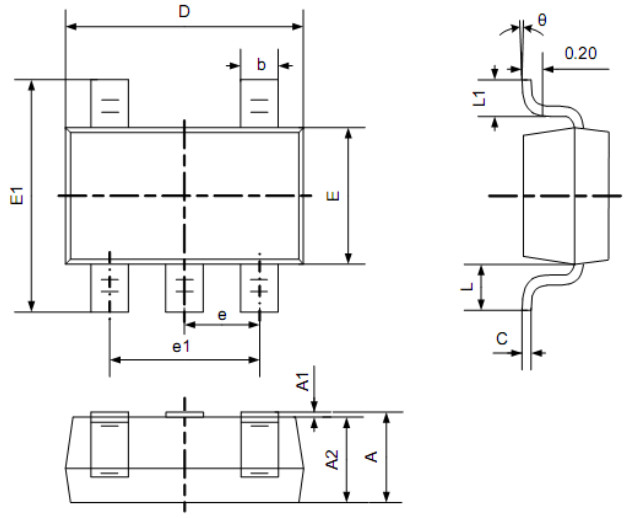
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
INPUT CHARACTERISTICS						
V_{OS}	Input Offset Voltage		—	80	100	μV
I_B	Input Bias Current			100		pA
I_{OS}	Input Offset Current			10		pA
CMRR	Common-Mode Rejection Ratio	V_{CM} = 0V to 5V		110		dB
A_{VO}	Large Signal Voltage Gain	R_L = 10kΩ V_O=0.3V~4.7V		145		dB
$\Delta V_{OS}/\Delta T$	Input Offset Voltage Drift			20		nV/℃
OUTPUT CHARACTERISTICS						
V_{OH}	Output Voltage High	RL = 100kΩ to -VS		4.998		V
		RL = 10kΩ to -VS		4.994		V
V_{OL}	Output Voltage Low	RL = 100kΩ to +VS		2		mV
		RL = 10kΩ to +VS		5		mV
I_{SC}	Short Circuit Limit	RL =10Ω to -VS		43		mA
I_O	Output Current			30		mA
POWER SUPPLY						
PSRR	Power Supply Rejection Ratio	VS = 2.7V to 5.5V		115		dB
I_Q	Quiescent Current	VO = 0V, RL = 0Ω		450		μA
DYNAMIC PERFORMANCE						
GBP	Gain-Bandwidth Product	G = +100		1.44		MHz
SR	Slew Rate	RL = 10kΩ		0.84		V/μs
T_{OR}	Overload Recovery Time			0.10		ms
NOISE PERFORMANCE						
e_n p-p	Voltage Noise	0Hz to 10Hz		0.81		μVp-p
e_n	Voltage Noise Density	f = 1kHz		49		nV/$\sqrt{Hz}$

(VS = +2.7V, VCM = +1.35V, VO = +1.35V, TA = +25℃, unless otherwise noted.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
INPUT CHARACTERISTICS						
V_{OS}	Input Offset Voltage		—	80	100	μV
I_B	Input Bias Current			75		pA
I_{OS}	Input Offset Current			5		pA
CMRR	Common-Mode Rejection Ratio	V_{CM} = 0V to 2.7V		110		dB
A_{VO}	Large Signal Voltage Gain	R_L = 10kΩ V_O=0.3V~2.4V		140		dB
$\Delta V_{OS}/\Delta T$	Input Offset Voltage Drift			20		nV/℃
OUTPUT CHARACTERISTICS						
V_{OH}	Output Voltage High	RL = 100kΩ to -VS		2.699		V
		RL = 10kΩ to -VS		2.697		V
V_{OL}	Output Voltage Low	RL = 100kΩ to +VS		1		mV
		RL = 10kΩ to +VS		2		mV
I_{SC}	Short Circuit Limit	RL =10Ω to -VS		26		mA
I_O	Output Current			10		mA
POWER SUPPLY						
PSRR	Power Supply Rejection Ratio	VS = 2.7V to 5.5V		115		dB
I_Q	Quiescent Current	VO = 0V, RL = 0Ω		450		μA
DYNAMIC PERFORMANCE						
GBP	Gain-Bandwidth Product	G = +100		1.43		MHz
SR	Slew Rate	RL = 10kΩ		0.84		V/μs
T_{OR}	Overload Recovery Time			0.04		ms
NOISE PERFORMANCE						
e_n p-p	Voltage Noise	0Hz to 10Hz		0.90		μVp-p
e_n	Voltage Noise Density	f = 1kHz		53		nV/$\sqrt{Hz}$

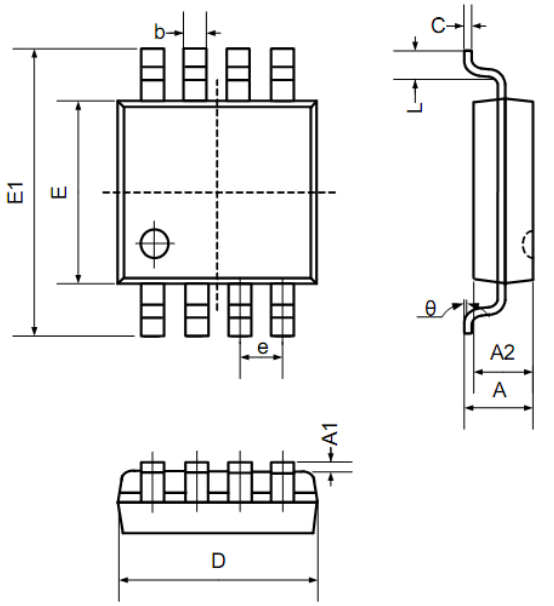
■ Package Information

SOT-23-5L



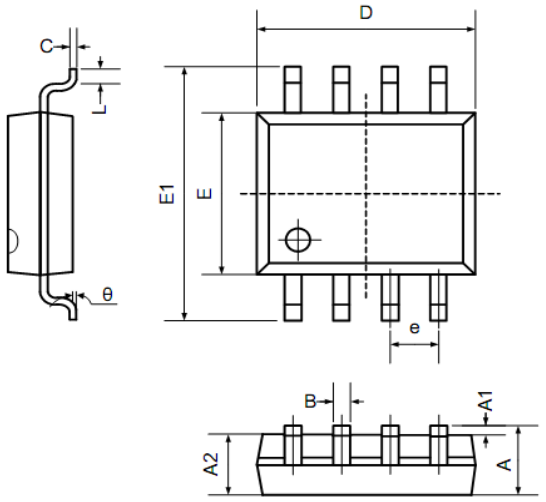
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.400	0.012	0.016
C	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.700REF		0.028REF	
L1	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

MSOP8



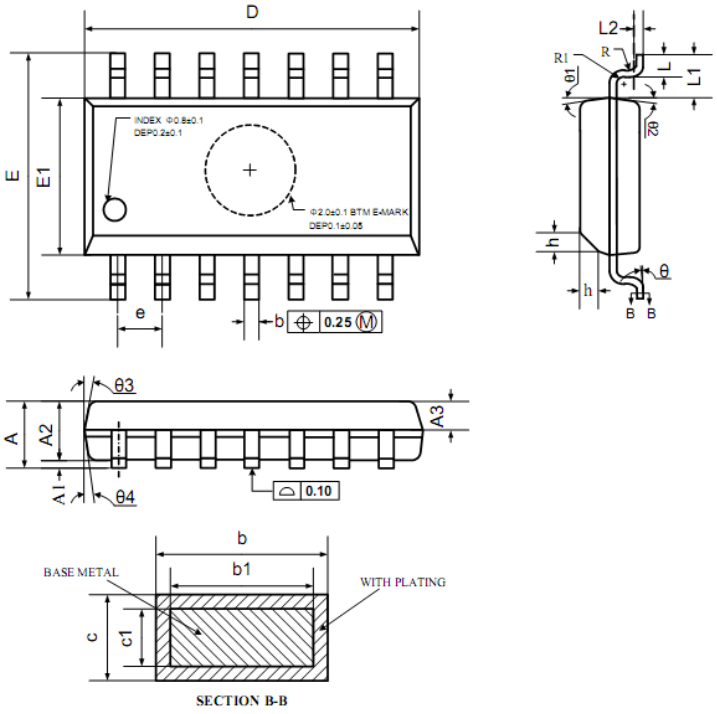
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.200	0.031	0.047
A1	0.000	0.200	0.000	0.008
A2	0.760	0.970	0.030	0.038
b	0.30 TYP		0.012 TYP	
C	0.15 TYP		0.006 TYP	
D	2.900	3.100	0.114	0.122
e	0.65 TYP		0.026 TYP	
E	2.900	3.100	0.114	0.122
E1	4.700	5.100	0.185	0.201
L	0.410	0.650	0.016	0.026
θ	0°	6°	0°	6°

SOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

SOP14



Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	1.35	1.60	1.75
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
A3	0.55	0.65	0.75
b	0.36		0.49
b1	0.35	0.40	0.45
c	0.16		0.25
c1	0.15	0.20	0.25
D	8.53	8.63	8.73
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
L	0.45	0.60	0.80
L1	1.04 REF		
L2	0.25 BSC		
R	0.07		
R1	0.07		
h	0.30	0.40	0.50
θ	0°		8°
θ1	6°	8°	10°
θ2	6°	8°	10°
θ3	5°	7°	9°
θ4	5°	7°	9°