

LM4040

Precision micropower shunt voltage references

Description

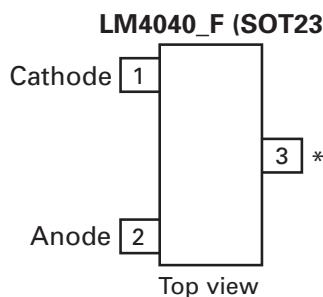
The LM4040 is a family of bandgap circuits designed to achieve precision micro-power voltage references of 2.5V and 5.0V. The devices are available in 0.5% C-grade and 1% D-grade initial tolerances.

They are available in small outline SOT23 surface mount package which is ideal for applications where space saving is important.

Features

- Small packages: SOT23
- No output capacitor required
- Output voltage tolerance
 - LM4040C $\pm 0.5\%$ at 25°C
 - LM4040D $\pm 1\%$ at 25°C
- Low output noise
(10Hz to 10kHz) $45\mu\text{V}_{\text{RMS}}$
- Wide operating current range $60\mu\text{A}$ to 15mA
- Extended temperature range -40°C to $+125^\circ\text{C}$
- Low temperature coefficient $100\text{ ppm}/^\circ\text{C}$ (max)

Pinout information



* Pin 3 must be left floating or connected to pin 2

Ordering information

25°C Tol.	Voltage (V)	Order code	Pack	Part mark	Status	Reel size	Tape width	Quantity per reel
0.5%	2.5	LM4040C25FTA	SOT23	R2C	Preview	7", 180mm	8mm	3000
	5.0	LM4040C50FTA	SOT23	R5C	Preview	7", 180mm	8mm	3000
1%	2.5	LM4040D25FTA	SOT23	R2D	Preview	7", 180mm	8mm	3000
	5.0	LM4040D50FTA	SOT23	R5D	Preview	7", 180mm	8mm	3000

Absolute maximum ratings

Continuous reverse current (I_R)	20mA
Continuous forward current (I_{REF})	10mA
Operating junction temperature	-40°C to 150°C
Storage temperature	-55°C to 150°C

Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability.

Unless otherwise stated voltages specified are relative to the ANODE pin.

Package thermal data

Package	Θ_{JA}	P_{DIS} $T_{amb} = 25^\circ\text{C}, T_J = 150^\circ\text{C}$
SOT23	380°C/W	330mW

Recommended operating conditions

	Min.	Max.	Units
Reverse current	0.06	15	mA
Operating ambient temperature range	-40	125	°C

Electrical characteristics

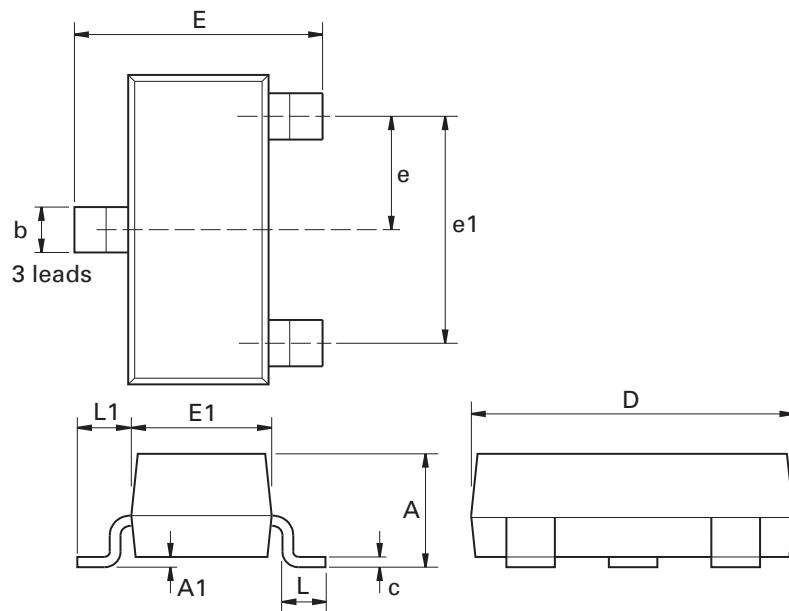
Over recommended operating conditions, $T_{amb} = 25^\circ\text{C}$, unless otherwise stated.

Symbol	Parameter	Conditions		Typ.	LM4040C limits	LM4040D limits	Units	
			T_{amb}					
V_{REF}	Reverse breakdown voltage	$I_R = 100\mu\text{A}$	25°C	2.5			V	
	Reverse breakdown voltage tolerance	$I_R = 100\mu\text{A}$	25°C		± 12	± 25	mV	
I_{RMIN}	Minimum operating current		-40 to 85°C		± 29	± 49		
			-40 to 125°C		± 38	± 63		
			25°C	45	60	65	μA	
$\Delta V_R/\Delta T$	Average reverse breakdown voltage temperature coefficient	$I_R = 10\text{mA}$ $I_R = 1\text{mA}$, $I_R = 100\mu\text{A}$	-40 to 125°C		± 20		ppm/°C	
			-40 to 125°C		± 15	± 100		
			-40 to 125°C		± 15			
$\Delta V_R/\Delta I_R$	Reverse breakdown change with current	$I_{RMIN} < I_R < 1\text{mA}$	25°C	0.3	0.8	1.0	mV	
			-40 to 85°C		1.0	1.2		
			-40 to 125°C		1.0	1.2		
		$1\text{mA} < I_R < 15\text{ mA}$	25°C	2.5	6.0	8.0		
			-40 to 85°C		8.0	10.0		
			-40 to 125°C		8.0	10.0		
Z_R	Dynamic output impedance	$I_R = 1\text{mA}$, $f = 120\text{Hz}$ $I_{AC} = 0.1I_R$		0.3	0.9	1.1	Ω	
e_n	Noise voltage	$I_R = 100\mu\text{A}$ $10\text{Hz} < f < 10\text{kHz}$		45			μV_{RMS}	
ΔV_R	Long term stability (non cumulative)	$t = 1000\text{Hrs}$ $I_R = 100\mu\text{A}$	25°C	120			ppm	
V_{HYST}	Thermal hysteresis	$\Delta T = -40^\circ\text{C} \text{ to } +125^\circ\text{C}$		0.08			%	

Electrical characteristics

Over recommended operating conditions, $T_{amb} = 25^\circ\text{C}$, unless otherwise stated.

Symbol	Parameter	Conditions		Typ	LM4040C limits	LM4040D limits	Units	
			T_{amb}					
V_{REF}	Reverse breakdown voltage	$I_R = 100\mu\text{A}$	25°C	5.00			V	
	Reverse breakdown voltage tolerance	$I_R = 100\mu\text{A}$	25°C		±25	±50	mV	
I_{RMIN}	Minimum operating current		-40 to 85°C		±58	±99		
			-40 to 125°C		±75	±125		
			25°C	54	74	79	μA	
$\Delta V_R/\Delta T$	Average reverse breakdown voltage temperature coefficient		-40 to 85°C		80	85		
			-40 to 125°C		83	88		
	$I_R = 10\text{mA}$	-40 to 125°C	±30			ppm/°C		
$\Delta V_R/\Delta I_R$	Reverse breakdown change with current		$I_R = 1\text{mA}$,	±20	±100		±150	
			$I_R = 100\mu\text{A}$	±20				
		$I_{RMIN} < I_R < 1\text{mA}$	25°C	0.5	1.0	1.3	mV	
			-40 to 85°C		1.4	1.8		
			-40 to 125°C		1.4	1.8		
		$1\text{mA} < I_R < 15\text{mA}$	25°C	3.5	8.0	10.0		
			-40 to 85°C		12.0	15.0		
			-40 to 125°C		12.0	15.0		
Z_R	Dynamic output impedance	$I_R = 1\text{mA}$, $f = 120\text{Hz}$ $I_{AC} = 0.1I_R$	0.5	1.1	1.5		Ω	
e_n	Noise voltage	$I_R = 100\mu\text{A}$ $10\text{Hz} < f < 10\text{kHz}$	105				μV _{RMS}	
ΔV_R	Long term stability (non cumulative)	$t = 1000\text{Hrs}$ $I_R = 100\mu\text{A}$	25°C	120			ppm	
V_{HYST}	Thermal hysteresis	$\Delta T = -40^\circ\text{C}$ to $+125^\circ\text{C}$	0.08				%	

Package outline - SOT23

Dim.	Millimeters		Inches		Dim.	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Max.	Max.
A	-	1.12	-	0.044	e1	1.90 NOM		0.075 NOM	
A1	0.01	0.10	0.0004	0.004	E	2.10	2.64	0.083	0.104
b	0.30	0.50	0.012	0.020	E1	1.20	1.40	0.047	0.055
C	0.085	0.120	0.003	0.008	L	0.25	0.62	0.018	0.024
D	2.80	3.04	0.110	0.120	L1	0.45	0.62	0.018	0.024
e	0.95 NOM		0.0375 NOM		-	-	-	-	-

Note: Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

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Europe	Americas	Asia Pacific	Corporate Headquarters
Zetex GmbH	Zetex Inc	Zetex (Asia Ltd)	Zetex Semiconductors plc
Kustermann-park	700 Veterans Memorial Highway	3701-04 Metroplaza Tower 1	Zetex Technology Park, Chadderton
Balanstraße 59	Hauppauge, NY 11788	Hing Fong Road, Kwai Fong	Oldham, OL9 9LL
D-81541 München	USA	Hong Kong	United Kingdom
Germany			
Telefon: (49) 89 45 49 49 0	Telephone: (1) 631 360 2222	Telephone: (852) 26100 611	Telephone: (44) 161 622 4444
Fax: (49) 89 45 49 49 49	Fax: (1) 631 360 8222	Fax: (852) 24250 494	Fax: (44) 161 622 4446
europ.e.sales@zetex.com	usa.sales@zetex.com	asia.sales@zetex.com	hq@zetex.com

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