



M385

Preliminary

LINEAR INTEGRATED CIRCUIT

MICROPOWER VOLTAGE REFERENCE

DESCRIPTION

The UTC **M385** is a micropower voltage reference. This device features good temperature stability and extreme low dynamic impedance when it is operated over a 20 μ A to 20mA current. Low noise and good long-term stability are achieved because the UTC **M385** bandgap reference applies only bipolar transistors and resistors.

The UTC **M385** can be used in almost any reference application due to the exceptional tolerance of capacitive loading. This voltage reference can be applied in portable meters, regulators, or general-purpose analog circuitry with battery life approaching shelf life. The wide dynamic operating range contributes to its use with widely varying supplies with excellent regulation. The low power drain of the UTC **M385** is useful for micropower circuitry. On-chip trimming gives it the tight voltage tolerance. Furthermore, the wide operating current can replace older references with a tighter tolerance.

The UTC **M385** can be used in such applications, for example, portable and battery-powered equipment, instrumentation, process control, energy management, product testing, automotive, precision audio components, and so on.

FEATURES

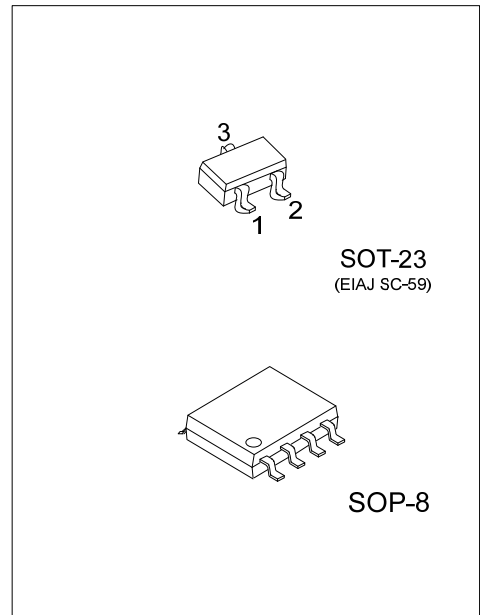
- * Initial tolerance: 1%
- * Operating current range: 10 μ A~20mA for $V_R=1.235V$
20 μ A~20mA for $V_R=2.5V$
- * Low temperature coefficient
- * Low voltage reference

ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
M385L-xx-AE3-R	M385G-xx-AE3-R	SOT-23	A	K	NC	Tape Reel
M385L-xx-AE3-A-R	M385G-xx-AE3-A-R	SOT-23	K	A	NC	Tape Reel
M385L-xx-S08-R	M385G-xx-S08-R	SOP-8	refer to PIN CONNECTIONS			Tape Reel

Note: xx: Output Voltage, refer to Marking Information.

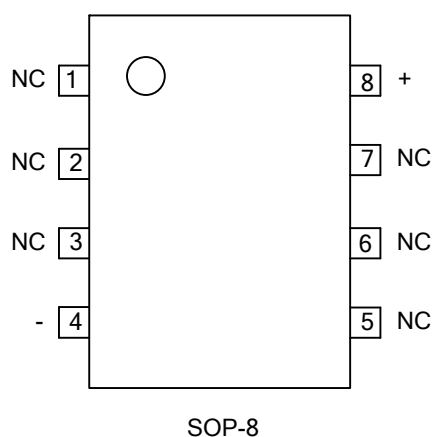
<p>M385G-xx-AE3-A-R</p>	<p>(1) R: Tape Reel (2) refer to Pin Assignment (3) AE3: SOT-23, S08: SOP-8 (4) xx: refer to Marking Information (5) G: Halogen Free and Lead Free, L: Lead Free</p>
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MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-23		
SOP-8	12: 1.2V 25: 2.5V	

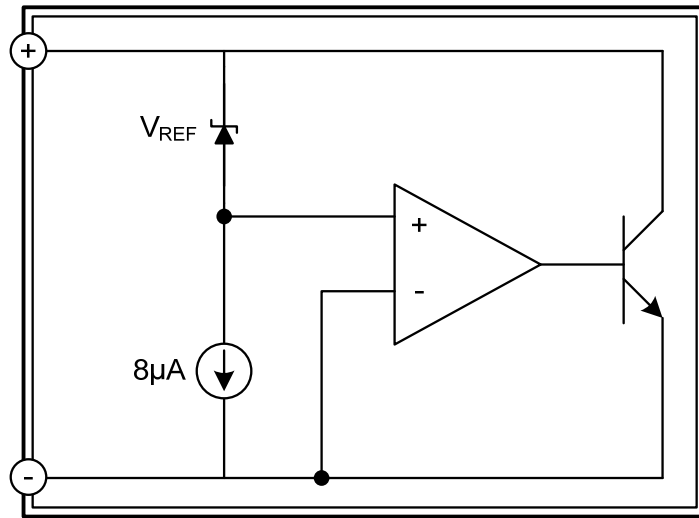
PIN CONNECTIONS



PIN DESCRIPTIONS

PIN NO.	PIN NAME	PIN FUNCTION
1	NC	Not connected
2	NC	Not connected
3	NC	Not connected
4	-	Pin-sources current for normal application, the current value is the same as Pin+
5	NC	Not connected
6	NC	Not connected
7	NC	Not connected
8	+	Sinks current with a range from 20 μ A to 20mA for normal applications, a stable positive voltage, relative to Pin-, occurs on Pin-

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Reverse Current	I_R	30	mA
Forward Current	I_F	10	mA
Junction Temperature	T_J	+125	°C
Operating Temperature	T_{OPR}	-40 ~ +85	°C
Storage Temperature	T_{STG}	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS ($T_A=25^\circ\text{C}$, unless otherwise specified.)

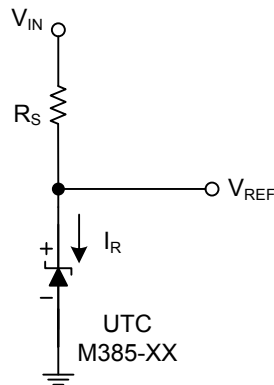
M385-1.2V

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Reverse Breakdown Voltage	V_R	$I_R=100\mu\text{A}$	1.222	1.235	1.248	V
Reverse Breakdown Voltage Charge with Current	ΔV_R	$10\mu\text{A} < I_R < 1\text{mA}$ $1\text{mA} < I_R < 20\text{mA}$			2 20	mV mV
Reverse Dynamic Impedance	Z_R	$I_R=100\mu\text{A}$, $f=20\text{Hz}$			1	Ω
Minimum Operating Current	$I_{R(MIN)}$			8	15	μA
Wideband Noise	e_N	$I_R=100\mu\text{A}$, $10\text{Hz} \leq f \leq 10\text{KHz}$		60		μV_{rms}
Average Temperature Coefficient	αV_R	$I_R=100\mu\text{A}$		100		ppm/°C
Long Term Stability	$\frac{\Delta V_R}{\Delta t}$	$I_R=100\mu\text{A}$, $T=1000\text{Hrs}$, $T_A=25^\circ\text{C}$		20		ppm

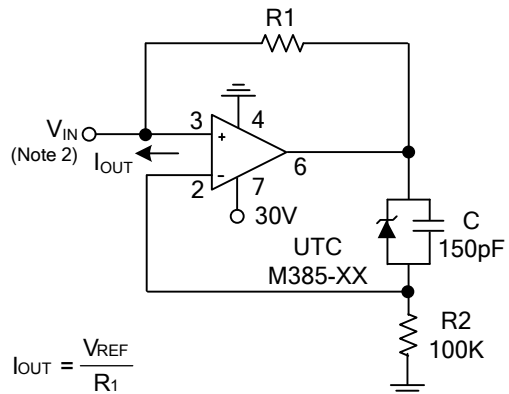
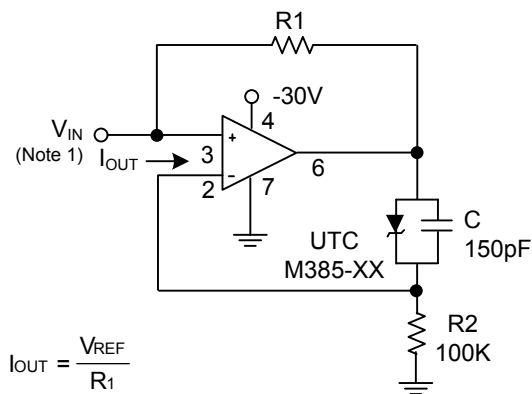
M385-2.5V

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Reverse Breakdown Voltage	V_R	$I_R=100\mu\text{A}$	2.475	2.5	2.525	V
Reverse Breakdown Voltage Charge with Current	ΔV_R	$20\mu\text{A} < I_R < 1\text{mA}$ $1\text{mA} < I_R < 20\text{mA}$			3.2 20	mV mV
Reverse Dynamic Impedance	Z_R	$I_R=100\mu\text{A}$, $f=20\text{Hz}$			1	Ω
Minimum Operating Current	$I_{R(MIN)}$			15	25	μA
Wideband Noise	e_N	$I_R=100\mu\text{A}$, $10\text{Hz} \leq f \leq 10\text{KHz}$		60		μV_{rms}
Average Temperature Coefficient	αV_R	$I_R=100\mu\text{A}$		100		ppm/°C
Long Term Stability	$\frac{\Delta V_R}{\Delta t}$	$I_R=100\mu\text{A}$, $T=1000\text{Hrs}$, $T_A=25^\circ\text{C}$		20		ppm

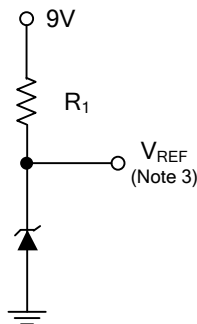
■ TEST CIRCUIT



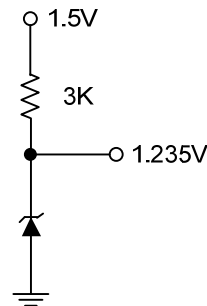
■ APPLICATION CIRCUITS



Precision 1μA to 1mA Current Source



Micropower Reference from 9V Battery



Reference from 1.5V Battery (Only for M385-1.2V)

- Notes: 1. $V_{REF}=1.235V, -2.3V \leq V+ \leq -27V, V_{REF}=2.5V, -3.7V \leq V+ \leq -27V$
 2. $V_{REF}=1.235V, 2.3V \leq V+ \leq 27V, V_{REF}=2.5V, 3.7V \leq V+ \leq 27V$
 3. $V_{REF}=1.235V, R1=900K\Omega, V_{REF}=2.5V, R1=220K\Omega$

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