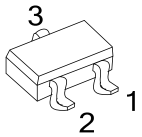
PRECISION MICROPOWER SHUNT VOLTAGE REFERENCE



SOT-23
(EIAJ SC-59)

■ DESCRIPTION

As a shunt voltage reference integrated circuit, UTC **LM4041** can be used for widespread applications with enhancement of the competitive advantage by saving use of external capacitors..

In order to ensure a stable output voltage, the reference not only offers low dynamic impedance, low noise and a low temperature coefficient, but also provides tight output tolerance (Max 1.0 %) and low temperature coefficient (150ppm/°C).

There are two versions of 1.225V and adjustable reverse breakdown voltage. The minimum operating current is 45 μA for the LM4041-1.2 and the LM4041-ADJ.

However, for those applications which the output voltage needs to be adjusted between 1.233V and 10V, an external resistor divider is necessary.

■ FEATURES

*Output Tolerances and Temperature Coefficient: Max 1.0%, 150 ppm
*Low Output Noise : 20μV_{RMS} (Typ.)
* Operating Current range : 45μA ~ 12mA

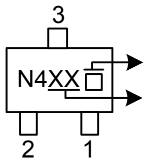
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
LM4041L-xx-AE3-R	LM4041G-xx-AE3-R	SOT-23	Tape Reel

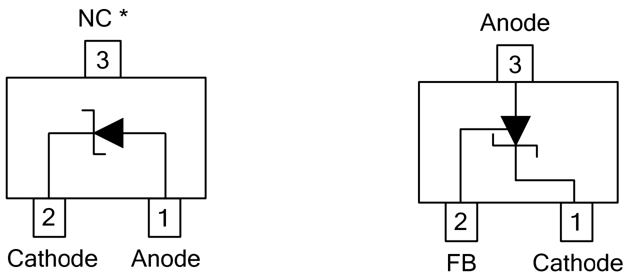
Note: xx: Output Voltage, refer to Marking Information.

LM4041G-xx-AE3-R	
(1)Packing Type	(1) R: Tape Reel
(2)Package Type	(2) AE3: SOT-23
(3)Output Voltage Code	(3) xx: Refer to Marking Information
(4)Green Package	(4) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-23	12: 1.2V AD: ADJ	

■ PIN CONFIGURATION



1.2V ADJ

* This pin must be left floating or connected to pin 2.

■ PIN DESCRIPTION

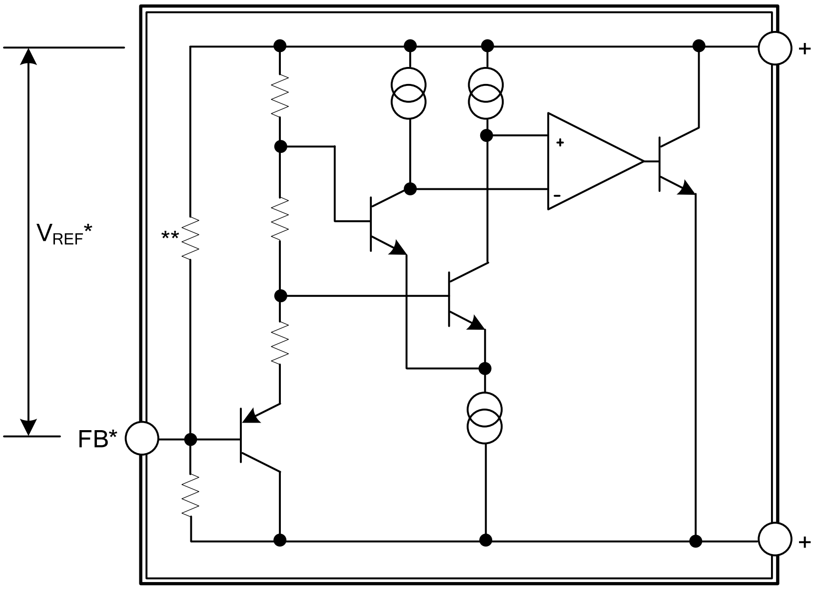
UTC LM4041-1.2

PIN NO.	PIN NAME	DESCRIPTION
1	Anode	Output reference voltage, anode terminal
2	Cathode	Output reference voltage, cathode terminal
3	NC	No Connection

UTC LM4041-ADJ

PIN NO.	PIN NAME	DESCRIPTION
1	Cathode	Output reference voltage, cathode terminal
2	FB	Feedback terminal (for)
3	Anode	Output reference voltage, anode terminal

BLOCK DIAGRAM



* UTC LM4041-ADJ only
** UTC LM4041-1.2 only

■ ABSOLUTE MAXIMUM RATING (T_A = 25°C, unless otherwise specified.)

PARAMETER	SYMBOL	RATINGS	UNIT
Continuous Cathode Voltage	V_Z	15	V
Continuous Cathode Current	I_Z	-10~+25	mA
Junction Temperature	T_J	150	°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.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATINGS	UNIT
Cathode Current (max)	I_Z	12	mA
Reverse Breakdown Voltage	V_Z	10	V
Operating Temperature	T_A	-40~+85	°C

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ_{JA}	206	°C/W

Note: Maximum power dissipation is a function of $T_{J(max)}$, θ_{JA}, and Ta. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_{J(max)} - T_A)/ \theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.

■ ELECTRICAL CHARACTERISTICS (T_A =-40°C~ +85°C, unless otherwise specified.)

FOR UTC LM4041-1.2

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Reverse Breakdown Voltage	V_{REF}	I_Z = 100μA, T_A=25°C			1.225		V
Reverse Breakdown Voltage Tolerance		I_Z = 100μA	T_A=25°C	-12		12	mV
			T_A=-40°C~+85°C	-24		24	mV
Reverse Breakdown Voltage Change With Operating Current Change	$\frac{\Delta V_{REF}}{\Delta I_Z}$	$I_{Z(MIN)} < I_Z <$ 1mA	T_A=25°C		0.7	2.0	mV
			T_A=-40°C~+85°C			2.5	mV
		1mA < I_Z < 12mA	T_A=25°C		2.5	8	mV
			T_A=-40°C~+85°C			10	mV
Minimum Operating Current	$I_{Z(MIN)}$	T_A=25°C			45	65	μA
		T_A=-40°C~+85°C				70	μA
Temperature Coefficient of Output Voltage (Note)	T_CV_O	I_Z =10mA, T_A=25°C			±20		ppm/°C
		I_Z=1mA	T_A=25°C		±15		ppm/°C
			T_A=-40°C~+85°C			±150	ppm/°C
		I_Z=100μA, T_A=25°C			±15		ppm/°C
Reverse Dynamic Impedance	Z_Z	I_Z=1mA, I_{AC}=0.1I_Z, f=120Hz, T_A=25°C			0.5	2.0	Ω
Output Voltage Noise	e_N	I_Z =100μA, 10Hz ≤ f ≤ 10 kHz, T_A=25°C			20		μVrms
Long-term Stability of Reverse Breakdown Voltage		t=1000h, I_Z=100μA, T_A= 25°C±0.1°C,			120		ppm

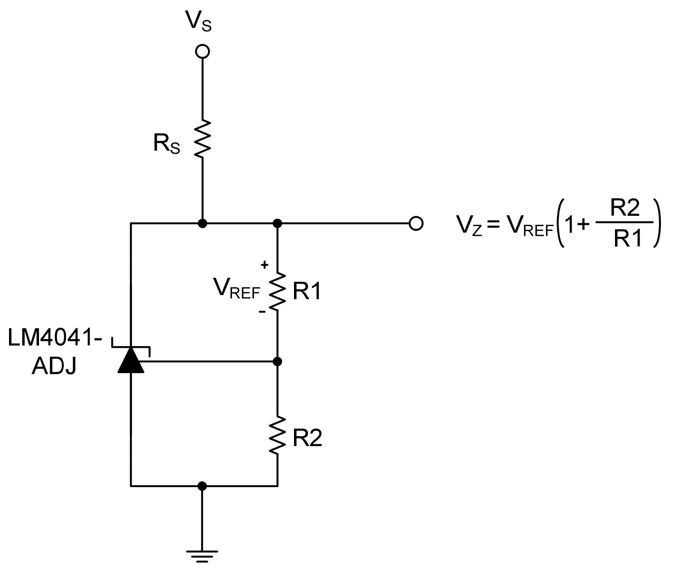
■ ELECTRICAL CHARACTERISTICS (Cont.)

FOR UTC LM4041-ADJ

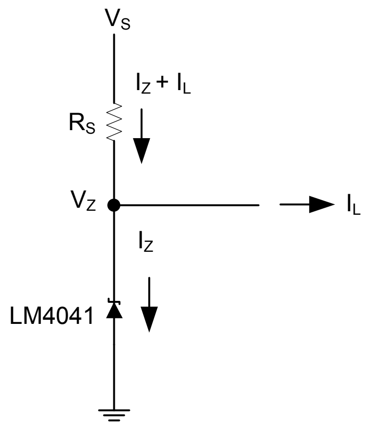
PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Reference Voltage	V_{REF}	V_Z=5V, I_Z = 100μA, T_A=25°C			1.233		V
Reference Voltage Tolerance		V_Z=5V, I_Z = 100μA	T_A=25°C	-12		12	mV
			T_A=-40°C~+85°C	-24		24	mV
Reference Voltage Change With Cathode Current Change	$\frac{\Delta V_{REF}}{\Delta I_Z}$	$I_{Z(MIN)}$ < I_Z < 1mA	T_A=25°C		0.7	2	mV
			T_A=-40°C~+85°C			2.5	mV
		1mA < I_Z < 12mA	T_A=25°C		2	6	mV
			T_A=-40°C~+85°C			8	mV
Reference Voltage Change With Output Voltage Change	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	I_Z=1mA	T_A=25°C		-1.55	-2	mV/V
			T_A=-40°C~+85°C			-3	mV/V
Minimum Cathode Current	$I_{Z(MIN)}$	T_A=25°C			45	75	μA
		T_A=-40°C~+85°C				80	μA
Feedback Current	I_{FB}		T_A=25°C		60	150	nA
			T_A=-40°C~+85°C			200	nA
Temperature Coefficient of Output Voltage (Note)	T_CV_O	V_Z=5V, I_Z =10mA, T_A=25°C			±20		ppm/°C
		V_Z=5V, I_Z=1mA	T_A=25°C		±15		ppm/°C
			T_A=-40°C~+85°C			±150	ppm/°C
		V_Z=5V, I_Z=100μA, T_A=25°C			±15		ppm/°C
Reverse Dynamic Impedance	Z_Z	V_Z=V_{REF}, I_Z=1mA, I_{AC}=0.1I_Z f=120Hz, T_A=25°C			0.3		Ω
		V_Z=10V, I_Z=1mA, I_{AC}=0.1I_Z f=120Hz, T_A=25°C			2		Ω
Output Voltage Noise	e_N	V_Z=V_{REF}, I_Z =100μA 10Hz ≤ f ≤ 10 kHz, T_A=25°C			20		μVrms
Long-term Stability of Reverse Breakdown Voltage		t=1000h, I_Z=100μA, T_A= 25°C±0.1°C,			120		ppm

Note: Reference voltage and average temperature coefficient change with output voltage (V_Z).

■ TYPICAL APPLICATION CIRCUIT



Adjustable Shunt Regulator



Shunt Regulator

APPLICATION INFORMATION

V_Z is set according to the equation shown as below which can be set by a user-defined resistor divider.

Cathode and Load Currents

The total current available to supply the load (I_L) and bias the UTC **LM4041** (I_Z) is set by R_S, so its value must be set properly. In all cases, I_Z must stay in a specified range for proper operation of the reference; R_S must be small enough to supply the minimum I_Z. At maximum V_S and minimum I_L, to limit I_Z to not exceed rating of 12 mA, RS must be large enough.

$$R_S = \frac{(V_S - V_Z)}{(I_L + I_Z)}$$