MCP1727

1.5A, Low Voltage, Low Quiescent Current LDO Regulator

Features

- 1.5A Output Current Capability
- Input Operating Voltage Range: 2.3V to 6.0V
- Adjustable Output Voltage Range: 0.8V to 5.0V
- Standard Fixed Output Voltages:
  - 0.8V, 1.2V, 1.8V, 2.5V, 3.0V, 3.3V, 5.0V
- Other Fixed Output Voltage Options Available Upon Request
- Low Dropout Voltage: 330 mV Typical at 1.5A
- Typical Output Voltage Tolerance: 0.5%
- Stable with 1.0 µF Ceramic Output Capacitor
- Fast response to Load Transients
- Low Supply Current: 120 µA (typ)
- Low Shutdown Supply Current: 0.1 µA (typ)
- Adjustable Delay on Power Good Output
- Short Circuit Current Limiting and Overtemperature Protection
- 3x3 DFN-8 and SOIC-8 Package Options

Applications

- High-Speed Driver Chipset Power
- Networking Backplane Cards
- Notebook Computers
- Network Interface Cards
- Palmtop Computers
- 2.5V to 1.XV Regulators

Description

The MCP1727 is a 1.5A Low Dropout (LDO) linear regulator that provides high current and low output voltages in a very small package. The MCP1727 comes in a fixed (or adjustable) output voltage version, with an output voltage range of 0.8V to 5.0V. The 1.5A output current capability, combined with the low output voltage capability, make the MCP1727 a good choice for new sub-1.8V output voltage LDO applications that have high current demands.

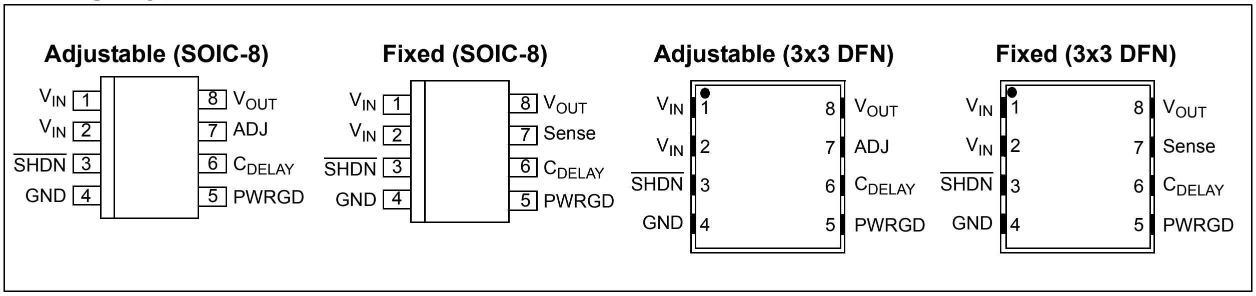
The MCP1727 is stable using ceramic output capacitors that inherently provide lower output noise and reduce the size and cost of the entire regulator solution. Only 1 µF of output capacitance is needed to stabilize the LDO.

Using CMOS construction, the quiescent current consumed by the MCP1727 is typically less than 120 µA over the entire input voltage range, making it attractive for portable computing applications that demand high output current. When shut down, the quiescent current is reduced to less than 0.1 µA.

The scaled-down output voltage is internally monitored and a power good (PWRGD) output is provided when the output is within 92% of regulation (typical). An external capacitor can be used on the C_{DELAY} pin to adjust the delay from 200 µs to 300 ms.

The overtemperature and short circuit current-limiting provide additional protection for the LDO during system fault conditions.

Package Types



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

V_{IN} 6.5V

Maximum Voltage on Any Pin .. (GND – 0.3V) to (V_{DD} + 0.3)V

Maximum Power Dissipation......... Internally-Limited (**Note 6**)

Output Short Circuit Duration...............................Continuous

Storage temperature ....-65°C to +150°C

Maximum Junction Temperature, T_J ....+150°C

ESD protection on all pins (HBM/MM) .... ≥ 2 kV; ≥ 200V

† Notice: Stresses above those listed under “Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

AC/DC CHARACTERISTICS

Electrical Specifications: Unless otherwise noted, $V_{IN} = V_{OUT(MAX)} + V_{DROPOUT(MAX)}$ **(Note 1)**, V_R=1.8V for Adjustable Output, I_{OUT} = 1 mA, $C_{IN} = C_{OUT}$ = 4.7 µF (X7R Ceramic), T_A = +25°C.
Boldface type applies for junction temperatures, T_J (**Note 7**) of **-40°C to +125°C**

Parameters	Sym	Min	Typ	Max	Units	Conditions
Input Operating Voltage	V_{IN}	**2.3**		**6.0**	V	**Note 1**
Input Quiescent Current	I_q	—	120	**220**	µA	I_L = 0 mA, V_{IN} = **Note 1**, V_{OUT} = 0.8V to 5.0V
Input Quiescent Current for $\overline{SHDN}$ Mode	$I_{\overline{SHDN}}$	—	0.1	**3**	µA	$\overline{SHDN}$ = GND
Maximum Output Current	I_{OUT}	**1.5**	—	—	A	V_{IN} = 2.3V to 6.0V V_R = 0.8V to 5.0V, **Note 1**
Line Regulation	$\Delta V_{OUT}/(V_{OUT} \times \Delta V_{IN})$	—	0.05	**0.16**	%/V	**(Note 1)** $\le V_{IN} \le$ 6V
Load Regulation	$\Delta V_{OUT}/V_{OUT}$	**-1.0**	±0.5	**1.0**	%	I_{OUT} = 1 mA to 1.5A, V_{IN} = **Note 1**, (**Note 4**)
Output Short Circuit Current	I_{OUT_SC}	—	2.2	—	A	V_{IN} = **Note 1**, R_{LOAD} < 0.1Ω, Peak Current
Adjust Pin Characteristics (Adjustable Output Only)						
Adjust Pin Reference Voltage	V_{ADJ}	**0.402**	0.410	**0.418**	V	V_{IN} = 2.3V to V_{IN} = 6.0V, I_{OUT} = 1 mA
Adjust Pin Leakage Current	I_{ADJ}	-10	±0.01	+10	nA	V_{IN} = 6.0V, V_{ADJ} = 0V to 6V
Adjust Temperature Coefficient	TCV_{OUT}	—	40	—	ppm/°C	**Note 3**
Fixed-Output Characteristics (Fixed Output Only)						
Voltage Regulation	V_{OUT}	**V_R - 2.5%**	V_R ±0.5%	**V_R + 2.5%**	V	**Note 2**

Note 1: The minimum V_{IN} must meet two conditions: $V_{IN} \ge 2.3V$ and $V_{IN} \ge V_{OUT(MAX)} + V_{DROPOUT(MAX)}$.

2: V_R is the nominal regulator output voltage for the fixed cases. V_R = 1.2V, 1.8V, etc. V_R is the desired set point output voltage for the adjustable cases. $V_R = V_{ADJ} * ((R_1/R_2)+1)$. Figure 4-1.

3: $TCV_{OUT} = (V_{OUT-HIGH} - V_{OUT-LOW}) * 10^6 / (V_R * \Delta Temperature)$. $V_{OUT-HIGH}$ is the highest voltage measured over the temperature range. $V_{OUT-LOW}$ is the lowest voltage measured over the temperature range.

4: Load regulation is measured at a constant junction temperature using low duty-cycle pulse testing. Load regulation is tested over a load range from 1 mA to the maximum specified output current.

5: Dropout voltage is defined as the input-to-output voltage differential at which the output voltage drops 2% below its nominal value that was measured with an input voltage of $V_{OUT} = V_R + V_{DROPOUT(MAX)}$.

6: The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature and the thermal resistance from junction to air. (i.e., T_A, T_J, θ_{JA}). Exceeding the maximum allowable power dissipation will cause the device operating junction temperature to exceed the maximum +150°C rating. Sustained junction temperatures above 150°C can impact device reliability.

7: The junction temperature is approximated by soaking the device under test at an ambient temperature equal to the desired junction temperature. The test time is small enough such that the rise in the junction temperature over the ambient temperature is not significant.

AC/DC CHARACTERISTICS (CONTINUED)

Electrical Specifications: Unless otherwise noted, $V_{IN} = V_{OUT(MAX)} + V_{DROPOUT(MAX)}$ **(Note 1)**, V_R=1.8V for Adjustable Output, I_{OUT} = 1 mA, $C_{IN} = C_{OUT}$ = 4.7 µF (X7R Ceramic), T_A = +25°C.
Boldface type applies for junction temperatures, T_J (**Note 7**) of **-40°C to +125°C**

Parameters	Sym	Min	Typ	Max	Units	Conditions
Dropout Characteristics						
Dropout Voltage	V_{IN}-V_{OUT}	—	330	**550**	mV	**Note 5**, I_{OUT} = 1.5A, $V_{IN(MIN)}$ = 2.3V
Power Good Characteristics						
PWRGD Input Voltage Operating Range	V_{PWRGD_VIN}	1.0	—	6.0	V	T_A = +25°C
		1.2	—	**6.0**		T_A = -40°C to +125°C
						For V_{IN} < 2.3V, I_{SINK} = 100 µA
PWRGD Threshold Voltage (Referenced to V_{OUT})	V_{PWRGD_TH}	—	—	—	%V_{OUT}	Falling Edge
		89	92	**95**		V_{OUT} < 2.5V Fixed, V_{OUT} = Adj.
		90	92	**94**		V_{OUT} >= 2.5V Fixed
PWRGD Threshold Hysteresis	V_{PWRGD_HYS}	**1.0**	2.0	**3.0**	%V_{OUT}	
PWRGD Output Voltage Low	V_{PWRGD_L}	—	0.2	**0.4**	V	$I_{PWRGD\ SINK}$ = 1.2 mA, ADJ = 0V, SENSE = 0V
PWRGD Leakage	P_{WRGD_LK}	—	1	—	nA	$V_{PWRGD} = V_{IN}$ = 6.0V
PWRGD Time Delay	T_{PG}					Rising Edge R_{PULLUP} = 10 kΩ I_{CDELAY} = 140 nA (Typ)
		—	200	—	µs	C_{DELAY} = OPEN
		10	30	**55**	ms	C_{DELAY} = 0.01 µF
		—	300	—	ms	C_{DELAY} = 0.1 µF
Detect Threshold to PWRGD Active Time Delay	$T_{VDET-PWRGD}$	—	200	—	µs	V_{ADJ} or $V_{SENSE} = V_{PWRGD\_TH}$ + 20 mV to V_{PWRGD_TH} - 20 mV
Shutdown Input						
Logic High Input	$V_{SHDN-HIGH}$	**45**			%V_{IN}	V_{IN} = 2.3V to 6.0V
Logic Low Input	$V_{SHDN-LOW}$			**15**	%V_{IN}	V_{IN} = 2.3V to 6.0V
$\overline{SHDN}$ Input Leakage Current	$\overline{SHDN}_{ILK}$	**-0.1**	±0.001	**+0.1**	µA	V_{IN} = 6V, $\overline{SHDN}$ =V_{IN}, $\overline{SHDN}$ = GND
AC Performance						
Output Delay From $\overline{SHDN}$	T_{OR}		100		µs	$\overline{SHDN}$ = GND to V_{IN} V_{OUT} = GND to 95% V_R

Note 1: The minimum V_{IN} must meet two conditions: $V_{IN} \geq 2.3V$ and $V_{IN} \geq V_{OUT(MAX)} + V_{DROPOUT(MAX)}$.

2: V_R is the nominal regulator output voltage for the fixed cases. V_R = 1.2V, 1.8V, etc. V_R is the desired set point output voltage for the adjustable cases. $V_R = V_{ADJ} * ((R_1/R_2)+1)$. Figure 4-1.

3: $TCV_{OUT} = (V_{OUT-HIGH} - V_{OUT-LOW}) *10^6 / (V_R * \Delta Temperature)$. $V_{OUT-HIGH}$ is the highest voltage measured over the temperature range. $V_{OUT-LOW}$ is the lowest voltage measured over the temperature range.

4: Load regulation is measured at a constant junction temperature using low duty-cycle pulse testing. Load regulation is tested over a load range from 1 mA to the maximum specified output current.

5: Dropout voltage is defined as the input-to-output voltage differential at which the output voltage drops 2% below its nominal value that was measured with an input voltage of $V_{OUT} = V_R + V_{DROPOUT(MAX)}$.

6: The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature and the thermal resistance from junction to air. (i.e., T_A, T_J, θ_{JA}). Exceeding the maximum allowable power dissipation will cause the device operating junction temperature to exceed the maximum +150°C rating. Sustained junction temperatures above 150°C can impact device reliability.

7: The junction temperature is approximated by soaking the device under test at an ambient temperature equal to the desired junction temperature. The test time is small enough such that the rise in the junction temperature over the ambient temperature is not significant.

AC/DC CHARACTERISTICS (CONTINUED)

Electrical Specifications: Unless otherwise noted, $V_{IN} = V_{OUT(MAX)} + V_{DROPOUT(MAX)}$ **(Note 1)**, V_R=1.8V for Adjustable Output, I_{OUT} = 1 mA, $C_{IN} = C_{OUT}$ = 4.7 µF (X7R Ceramic), T_A = +25°C.
Boldface type applies for junction temperatures, T_J (**Note 7**) of **-40°C to +125°C**

Parameters	Sym	Min	Typ	Max	Units	Conditions
Output Noise	e_N	—	2.0	—	µV/√Hz	I_{OUT} = 200 mA, f = 1 kHz, C_{OUT} = 10 µF (X7R Ceramic), V_{OUT} = 2.5V
Power Supply Ripple Rejection Ratio	PSRR	—	60	—	dB	f = 100 Hz, C_{OUT} = 10 µF, I_{OUT} = 10 mA, V_{INAC} = 30 mV pk-pk, C_{IN} = 0 µF
Thermal Shutdown Temperature	T_{SD}	—	150	—	°C	I_{OUT} = 100 µA, V_{OUT} = 1.8V, V_{IN} = 2.8V
Thermal Shutdown Hysteresis	ΔT_{SD}	—	10	—	°C	I_{OUT} = 100 µA, V_{OUT} = 1.8V, V_{IN} = 2.8V

Note 1: The minimum V_{IN} must meet two conditions: $V_{IN} \geq 2.3V$ and $V_{IN} \geq V_{OUT(MAX)} + V_{DROPOUT(MAX)}$.

2: V_R is the nominal regulator output voltage for the fixed cases. V_R = 1.2V, 1.8V, etc. V_R is the desired set point output voltage for the adjustable cases. $V_R = V_{ADJ} * ((R_1/R_2)+1)$. Figure 4-1.

3: $TCV_{OUT} = (V_{OUT-HIGH} - V_{OUT-LOW}) *10^6 / (V_R * \Delta Temperature)$. $V_{OUT-HIGH}$ is the highest voltage measured over the temperature range. $V_{OUT-LOW}$ is the lowest voltage measured over the temperature range.

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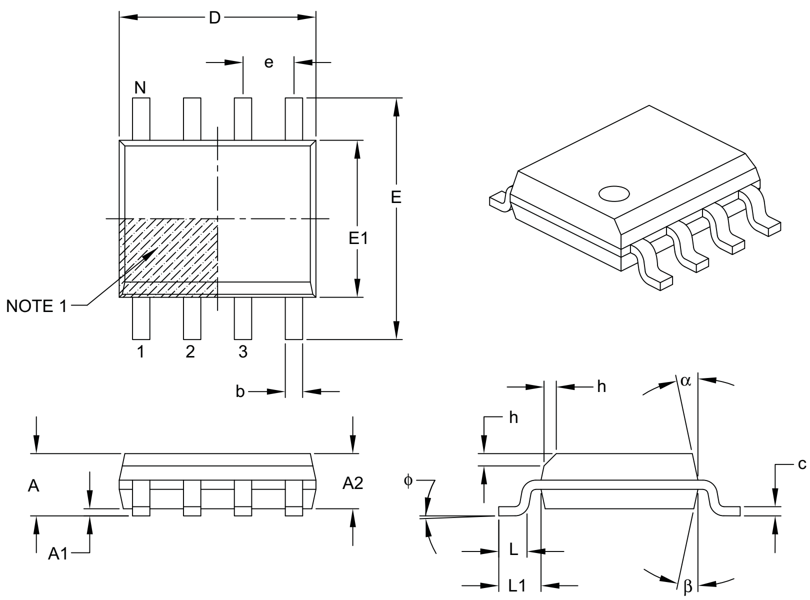
7: The junction temperature is approximated by soaking the device under test at an ambient temperature equal to the desired junction temperature. The test time is small enough such that the rise in the junction temperature over the ambient temperature is not significant.

TEMPERATURE SPECIFICATIONS

Electrical Specifications: Unless otherwise indicated, all limits apply for V_{IN} = 2.3V to 6.0V.

Parameters	Sym	Min	Typ	Max	Units	Conditions
Temperature Ranges						
Operating Junction Temperature Range	T_J	-40	—	+125	°C	Steady State
Maximum Junction Temperature	T_J	—	—	+150	°C	Transient
Storage Temperature Range	T_A	-65	—	+150	°C	
Thermal Package Resistances						
Thermal Resistance, 8LD 3x3 DFN	θ_{JA}	—	41	—	°C/W	4-Layer JC51-7 Standard Board with vias
Thermal Resistance, 8LD SOIC	θ_{JA}	—	150	—	°C/W	4-Layer JC51-7 Standard Board

8-Lead Plastic Small Outline (SN) – Narrow, 3.90 mm Body [SOIC]



Units		MILLMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N	8		
Pitch	e	1.27 BSC		
Overall Height	A	–	–	1.75
Molded Package Thickness	A2	1.25	–	–
Standoff §	A1	0.10	–	0.25
Overall Width	E	6.00 BSC		
Molded Package Width	E1	3.90 BSC		
Overall Length	D	4.90 BSC		
Chamfer (optional)	h	0.25	–	0.50
Foot Length	L	0.40	–	1.27
Footprint	L1	1.04 REF		
Foot Angle	φ	0°	–	8°
Lead Thickness	c	0.17	–	0.25
Lead Width	b	0.31	–	0.51
Mold Draft Angle Top	α	5°	–	15°
Mold Draft Angle Bottom	β	5°	–	15°

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic.
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15 mm per side.
4. Dimensioning and tolerancing per ASME Y14.5M.

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-057B

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

PART NO.	XX	X	X	X/	XX
Device	Output Voltage	Feature Code	Tolerance	Temp.	Package

Device:	MCP1727:	1.5A Low Dropout Regulator
	MCP1727T:	1.5A Low Dropout Regulator Tape and Reel
Output Voltage *:	08 =	0.8V "Standard"
	12 =	1.2V "Standard"
	18 =	1.8V "Standard"
	25 =	2.5V "Standard"
	30 =	3.0V "Standard"
	33 =	3.3V "Standard"
	50 =	5.0V "Standard"
	*Contact factory for other output voltage options	
Extra Feature Code:	0 =	Fixed
Tolerance:	2 =	2.0% (Standard)
Temperature:	E =	-40°C to +125°C
Package Type:	MF =	Plastic Dual Flat No Lead (DFN) (3x3x0.9 mm Body), 8-lead
	SN =	Plastic Small Outline (150 mil Body), 8-lead

Examples:

a) MCP1727-0802E/MF: 0.8V Low Dropout Regulator, DFN8 pkg.
b) MCP1727T-1202E/MF: Tape and Reel, 1.2V Low Dropout Regulator, DFN8 pkg.
c) MCP1727-1802E/MF: 1.8V Low Dropout Voltage Regulator, DFN8 pkg.
d) MCP1727T-2502E/MF: Tape and Reel, 2.5V Low Dropout Voltage Regulator, DFN8 pkg.
e) MCP1727-3002E/MF: 3.0V Low Dropout Voltage Regulator, DFN8 pkg.
f) MCP1727-3302E/MF: 3.3V Low Dropout Voltage Regulator, DFN8 pkg.
g) MCP1727T-5002E/MF: Tape and Reel, 5.0V Low Dropout Voltage Regulator, DFN8 pkg.
h) MCP1727T-0802E/SN: Tape and Reel, 0.8V Low Dropout Voltage Regulator, SOIC8 pkg.
i) MCP1727-1202E/SN: 1.2V Low Dropout Voltage Regulator, SOIC8 pkg.
j) MCP1727T-1802E/SN: Tape and Reel, 1.8V Low Dropout Voltage Regulator, SOIC8 pkg.
k) MCP1727-2502E/SN: 2.5V Low Dropout Voltage Regulator, SOIC8 pkg.
l) MCP1727-3002E/SN: 3.0V Low Dropout Voltage Regulator, SOIC8 pkg.
m) MCP1727-3302E/SN: 3.3V Low Dropout Voltage Regulator, SOIC8 pkg.
n) MCP1727T-5002E/SN: Tape and Reel, 5.0V Low Dropout Voltage Regulator, SOIC8 pkg.