MCP1826/MCP1826S

1000 mA, Low Voltage, Low Quiescent Current LDO Regulator

Features

- 1000 mA Output Current Capability
- Input Operating Voltage Range: 2.3V to 6.0V
- Adjustable Output Voltage Range: 0.8V to 5.0V (MCP1826 only)
- 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: 250 mV Typical at 1000 mA
- 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) (MCP1826 only)
- Fixed Delay on Power Good Output (MCP1826 only)
- Short Circuit Current Limiting and Overtemperature Protection
- TO-263-5 (DDPAK-5), TO-220-5, SOT-223-5 Package Options (MCP1826).
- TO-263-3 (DDPAK-3), TO-220-3, SOT-223-3 Package Options (MCP1826S).

Applications

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

Description

The MCP1826/MCP1826S is a 1000 mA Low Dropout (LDO) linear regulator that provides high current and low output voltages. The MCP1826 comes in a fixed or adjustable output voltage version, with an output voltage range of 0.8V to 5.0V. The 1000 mA output current capability, combined with the low output voltage capability, make the MCP1826 a good choice for new sub-1.8V output voltage LDO applications that have high current demands. The MCP1826S is a 3-pin fixed voltage version.

The MCP1826/MCP1826S 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 MCP1826/MCP1826S is typically less than 120 µA over the entire input voltage range, making it attractive for portable computing applications that demand high output current. The MCP1826 versions have a Shutdown ($\overline{SHDN}$) pin. When shut down, the quiescent current is reduced to less than 0.1 µA.

On the MCP1826 fixed output versions 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). The PWRGD delay is internally fixed at 200 µs (typical).

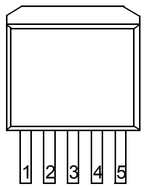
The overtemperature and short circuit current-limiting provide additional protection for the LDO during system fault conditions.

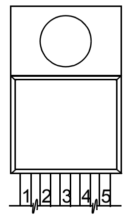
Package Types

MCP1826

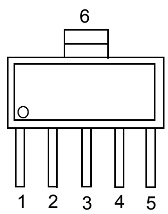
DDPAK-5 **TO-220-5**

Fixed/Adjustable





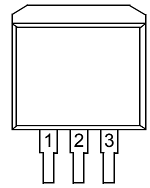
SOT-223-5

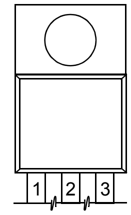


Pin	Fixed	Adjustable
1	$\overline{SHDN}$	$\overline{SHDN}$
2	V_{IN}	V_{IN}
3	GND (TAB)	GND (TAB)
4	V_{OUT}	V_{OUT}
5	PWRGD	ADJ
6	GND (TAB)	GND (TAB)

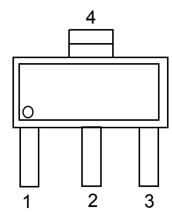
MCP1826S

DDPAK-3 **TO-220-3**





SOT-223-3



Pin	
1	V_{IN}
2	GND (TAB)
3	V_{OUT}
4	GND (TAB)

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) .... ≥ 4 kV; ≥ 300V

† 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_{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}	**1000**	—	—	mA	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.**20**	%/V	**(Note 1)** ≤ V_{IN} ≤ 6V
Load Regulation	$\Delta V_{OUT}/V_{OUT}$	**-1.0**	±0.5	**1.0**	%	I_{OUT} = 1 mA to 1000 mA, (**Note 4**)
Output Short Circuit Current	I_{OUT_SC}	—	2.2	—	A	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: $V_{IN} \geq 2.3V$ 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 $V_{IN} = V_{OUT(MAX)} + V_{DROPOUT(MAX)}$.

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	$V_{DROPOUT}$	—	250	**400**	mV	**Note 5**, I_{OUT} = 1000 mA, $V_{IN(MIN)}$ = 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
PWRGD Leakage	P_{WRGD_LK}	—	1	—	nA	$V_{PWRGD} = V_{IN}$ = 6.0V
PWRGD Time Delay	T_{PG}	—	125	—	µs	Rising Edge R_{PULLUP} = 10 kΩ
Detect Threshold to PWRGD Active Time Delay	$T_{VDET\text{-}PWRGD}$	—	200	—	µs	$V_{OUT} = V_{PWRGD\_TH}$ + 20 mV to V_{PWRGD_TH} - 20 mV
Shutdown Input						
Logic High Input	$V_{SHDN\text{-}HIGH}$	**45**	—	—	$\%V_{IN}$	V_{IN} = 2.3V to 6.0V
Logic Low Input	$V_{SHDN\text{-}LOW}$	—	—	**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
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

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

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)

Parameters	Sym	Min	Typ	Max	Units	Conditions
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**						
Power Supply Ripple Rejection Ratio	PSRR	—	60	—	dB	f = 100 Hz, C_{OUT} = 4.7 µF, I_{OUT} = 100 µA, V_{INAC} = 100 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.

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 $V_{IN} = V_{OUT(MAX)} + V_{DROPOUT(MAX)}$.

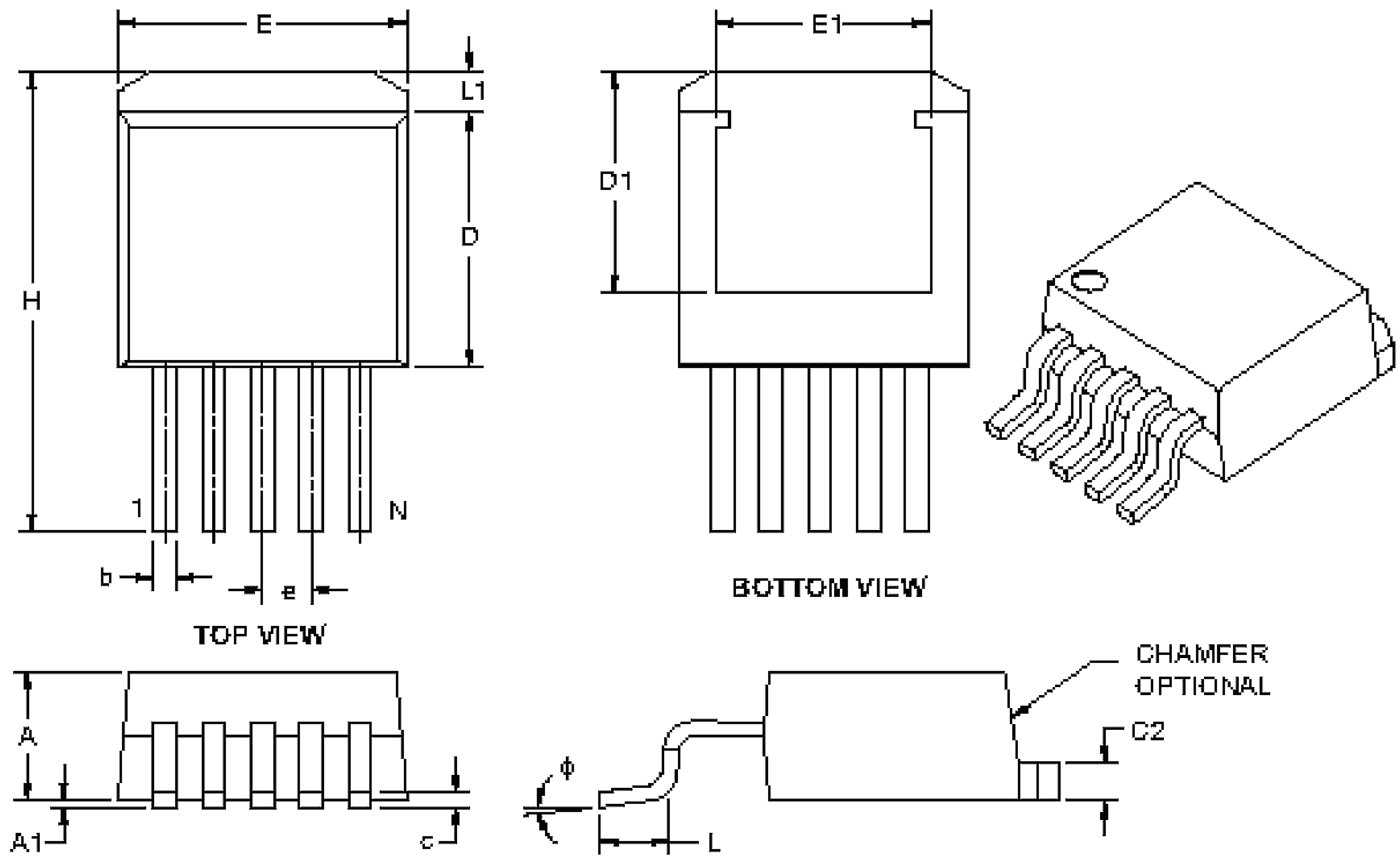
6: The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature and the thermal resistance from junction to air. (i.e., T_A, T_J, θ_{JA}). Exceeding the maximum allowable power dissipation will cause the device operating junction temperature 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.

TEMPERATURE SPECIFICATIONS

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, 3L-DDPAK	θ_{JA}	—	31.4	—	°C/W	4-Layer JC51 Standard Board
	θ_{JC}	—	3.0	—	°C/W	
Thermal Resistance, 3L-TO-220	θ_{JA}	—	29.4	—	°C/W	4-Layer JC51 Standard Board
	θ_{JC}	—	2.0	—	°C/W	
Thermal Resistance, 3L-SOT-223	θ_{JA}	—	62	—	°C/W	EIA/JEDEC JESD51-751-7 4 Layer Board
	θ_{JC}	—	15.0	—	°C/W	
Thermal Resistance, 5L-DDPAK	θ_{JA}	—	31.2	—	°C/W	4-Layer JC51 Standard Board
	θ_{JC}	—	3.0	—	°C/W	
Thermal Resistance, 5L-TO-220	θ_{JA}	—	29.3	—	°C/W	4-Layer JC51 Standard Board
	θ_{JC}	—	2.0	—	°C/W	
Thermal Resistance, 5L-SOT-223	θ_{JA}	—	62	—	°C/W	EIA/JEDEC JESD51-751-7 4 Layer Board
	θ_{JC}	—	15.0	—	°C/W	

5-Lead Plastic (ET) [DDPAK]



Units		INCHES		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N	5		
Pitch	e	.067 BSC		
Overall Height	A	.160	–	.190
Standoff §	A1	.000	–	.010
Overall Width	E	.380	–	.420
Exposed Pad Width	E1	.245	–	–
Molded Package Length	D	.330	–	.380
Overall Length	H	.549	–	.625
Exposed Pad Length	D1	.270	–	–
Lead Thickness	c	.014	–	.029
Pad Thickness	C2	.045	–	.065
Lead Width	b	.020	–	.039
Foot Length	L	.068	–	.110
Pad Length	L1	–	–	.067
Foot Angle	ϕ	0°	–	8°

Notes:
1. § Significant Characteristic.
2. Dimensions D and E do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .005" per side.
3. Dimensioning and tolerancing per ASME Y14.5M.

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

Microchip Technology Drawing C04-012B

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:	MCP1826:	1000 mA Low Dropout Regulator
	MCP1826T:	1000 mA Low Dropout Regulator Tape and Reel
	MCP1826S:	1000 mA Low Dropout Regulator
	MCP1826ST:	1000 mA 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”
	ADJ	= Adjustable Output Voltage ** (MCP1826 only)

*Contact factory for other output voltage options
** When ADJ is used, the “extra feature code” and “tolerance” columns do not apply. Refer to examples.

Extra Feature Code:	0	= Fixed
Tolerance:	2	= 2.0% (Standard)
Temperature:	E	= -40°C to +125°C
Package Type:	AB	= Plastic Transistor Outline, TO-220, 3-lead
	AT	= Plastic Transistor Outline, TO-220, 5-lead
	DB	= Plastic Transistor Outline, SOT-223, 3-lead
	DC	= Plastic Transistor Outline, SOT-223, 5-lead
	EB	= Plastic, DDPAK, 3-lead
	ET	= Plastic, DDPAK, 5-lead

Note: ADJ (Adjustable) only available in 5-lead version.

Examples:

a) MCP1826-0802E/XX: 0.8V LDO Regulator
b) MCP1826-1002E/XX: 1.0V LDO Regulator
c) MCP1826-1202E/XX: 1.2V LDO Regulator
d) MCP1826-1802E/XX 1.8V LDO Regulator
e) MCP1826-2502EXX: 25V LDO Regulator
f) MCP1826-3002E/XX: 3.0V LDO Regulator
g) MCP1826-3302E/XX 3.3V LDO Regulator
h) MCP1826-5002E/XX: 5.0V LDO Regulator
i) MCP1826-ADJE/XX: ADJ LDO Regulator

a) MCP1826S-0802E/XX:0.8V LDO Regulator
b) MCP1826S-1002E/XX:1.0V LDO Regulator
c) MCP1826S-1202E/XX 1.2V LDO Regulator
d) MCP1826S-1802E/XX 1.8V LDO Regulator
e) MCP1826S-2502E/XX 2.5V LDO Regulator
f) MCP1826S-2502E/XX 3.0V LDO Regulator
g) MCP1826S-3302E/XX 3.3V LDO Regulator
h) MCP1826S-5002E/XX 5.0V LDO Regulator

XX = AB for 3LD TO-220 package
= AT for 5LD TO-220 package
= DB for 3LD SOT-223 package
= DC for 5LD SOT-223 package
= EB for 3LD DDPAK package
= ET for 5LD DDPAK package