



Three-Terminal Fixed Positive Voltage Regulators

SiP78M05CD	SiP78M08CD	SiP78M12CD	SiP78M18CD
SiP78M06CD	SiP78M09CD	SiP78M15CD	SiP78M24CD

FEATURES

- Output Current In Excess Of 0.5 A
- No External Components Required
- Internal Thermal Overload Protection
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation
- Output Voltage Offered In 4% Tolerance

MECHANICAL DATA

Case: TO-252AB

DESCRIPTION

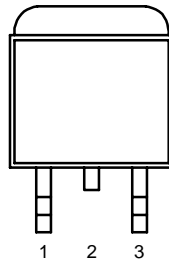
These voltage regulators are monolithic integrated circuits designed as fixed-voltage regulators for a wide variety of applications including local, on-card regulation. These regulators employ internal current limiting, thermal shutdown, and safe-area protection. With adequate heatsinking the

SiP78MxxCD can deliver output currents in excess of 0.5 A.

Although designed primarily as a fixed voltage regulator, these devices can be used with external components to obtain adjustable voltages with currents.

PACKAGING AND PIN DEFINITION

TO-252AB



Top View

Order Number:

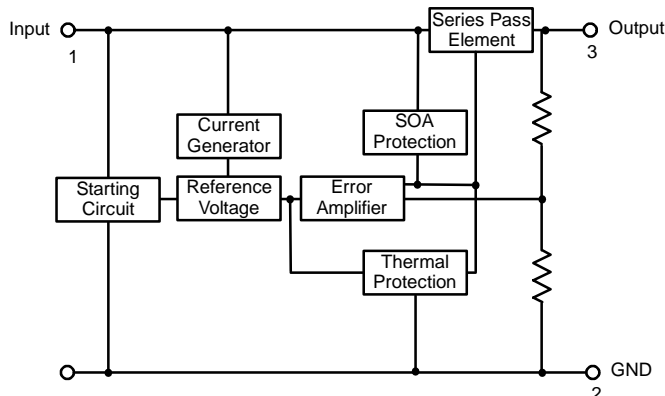
SiP78MxxCD-T4—E3 (Lead (Pb)-Free Package)

Pin Definition

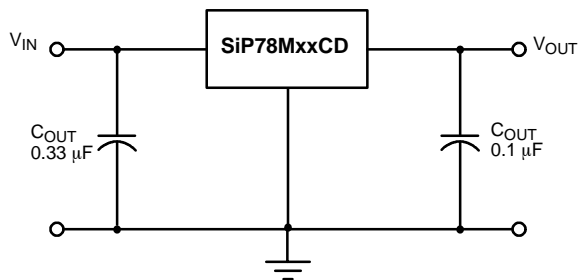
1. V_{IN}
2. GND
3. V_{OUT}

(Heatsink/tab connected to pin 2)

INTERNAL BLOCK DIAGRAM



STANDARD APPLICATION



NOTE:

- A common ground is required between the input and the output voltages.
- The input voltage must remain typically 2.0 V above the output voltage even during the low point on the input ripple voltage.
- xx = these two digits of the part number indicate output voltage.
- C_{IN} is required if regulator is located an appreciable distance from the power supply filter.
- C_{OUT} is not needed for stability, however it does improve transient response.

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)

Parameter	Symbol	Limit	Unit
Input Voltage	V_{IN}	35 ^a	V
		40 ^b	
Operating Temperature Range	T_A	-20 to 85	°C
Storage Temperature Range	T_{stg}	-65 to 150	

Notes

- SiP78M05CD through SiP78M18CD
- SiP78M24CD only

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Limit	Unit
Junction-to-Case	R_{thJC}	8	°C/W

SPECIFICATIONS

SiP78M05CD

Parameter	Symbol	Test Conditions Unless Specified $V_{IN} = 10\text{ V}$, $I_{OUT} = 350\text{ mA}$, $C_{IN} = 0.33\ \mu\text{F}$, $C_{OUT} = 0.1\ \mu\text{F}$ $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	Limits			Unit	
			Min	Typ	Max		
Output Voltage	V_{OUT}	$T_J = 25^\circ\text{C}$	4.80	5.0	5.20	V	
		$7.0\text{ V} \leq V_{IN} \leq 20\text{ V}$, $5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$	4.75		5.25		
Line Regulation	ΔREG_{line}	$T_J = 25^\circ\text{C}$	$7.0\text{ V} \leq V_{IN} < 25\text{ V}$			mV	
Load Regulation	ΔREG_{load}		$5\text{ mA} \leq I_{OUT} < 500\text{ mA}$		20		100
			$5\text{ mA} \leq I_{OUT} < 200\text{ mA}$		10		50
Quiescent Current	I_Q	$I_{OUT} = 0$, $T_J = 25^\circ\text{C}$		3.2	6	mA	
Quiescent Current Change	ΔI_Q	$7.0\text{ V} \leq V_{IN} \leq 25\text{ V}$			0.8		
		$5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$			0.5		
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}$, $T_J = 25^\circ\text{C}$		40		μV	
Ripple Rejection	RR	$f = 120\text{ Hz}$	62	80		dB	
Dropout Voltage	V_{DROD}	$T_J = 25^\circ\text{C}$		2		V	
Output Short Circuit	I_{OS}	$T_J = 25^\circ\text{C}$	$V_{IN} = 35\text{ V}$			mA	
Peak Output	$I_{OUT(peak)}$			700			
Temperature Coefficient	$\Delta V_{OUT}/\Delta T_J$	$I_{OUT} = 5\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$		0.2		mV/°C	



SPECIFICATIONS		SiP78M06CD					
Parameter	Symbol	Test Conditions Unless Specified $V_{IN} = 11\text{ V}$, $I_{OUT} = 350\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$ $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	Limits			Unit	
			Min	Typ	Max		
Output Voltage	V_{OUT}	$T_J = 25^\circ\text{C}$	5.75	6.0	6.25	V	
		$8.0\text{ V} \leq V_{IN} \leq 21\text{ V}$, $5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$	5.70		6.30		
Line Regulation	ΔREG_{line}	$T_J = 25^\circ\text{C}$		3	50	mV	
Load Regulation	ΔREG_{load}		$8.0\text{ V} \leq V_{IN} < 25\text{ V}$		20		120
			$5\text{ mA} \leq I_{OUT} < 500\text{ mA}$		10		60
Quiescent Current	I_Q	$I_{OUT} = 0$, $T_J = 25^\circ\text{C}$		3.2	6.0	mA	
		$8.0\text{ V} \leq V_{IN} \leq 25\text{ V}$			0.8		
Quiescent Current Change	ΔI_Q	$5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$			0.5		
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}$, $T_J = 25^\circ\text{C}$		45		μV	
Ripple Rejection	RR	$f = 120\text{ Hz}$, $9\text{ V} \leq V_{IN} \leq 19\text{ V}$	59	80		dB	
Dropout Voltage	V_{DROP}	$T_J = 25^\circ\text{C}$		2		V	
Output Short Circuit	I_{OS}	$T_J = 25^\circ\text{C}$			50	mA	
Peak Output	$I_{OUT(peak)}$						$V_{IN} = 35\text{ V}$
Temperature Coefficient	$\Delta V_{OUT}/\Delta T_J$	$I_{OUT} = 5\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$		0.2		$\text{mV}/^\circ\text{C}$	

SPECIFICATIONS		SiP78M08CD					
Parameter	Symbol	Test Conditions Unless Specified $V_{IN} = 14\text{ V}$, $I_{OUT} = 350\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$ $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	Limits			Unit	
			Min	Typ	Max		
Output Voltage	V_{OUT}	$T_J = 25^\circ\text{C}$	7.70	8.0	8.30	V	
		$10.5\text{ V} \leq V_{IN} \leq 23\text{ V}$, $5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$	7.60		8.40		
Line Regulation	ΔREG_{line}	$T_J = 25^\circ\text{C}$		6	50	mV	
Load Regulation	ΔREG_{load}		$10.5\text{ V} \leq V_{IN} < 25\text{ V}$		25		160
			$5\text{ mA} \leq I_{OUT} < 500\text{ mA}$		10		80
Quiescent Current	I_Q	$I_{OUT} = 0$, $T_J = 25^\circ\text{C}$		3.2	6.0	mA	
		$10.5\text{ V} \leq V_{IN} \leq 25\text{ V}$			0.8		
Quiescent Current Change	ΔI_Q	$5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$			0.5		
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}$, $T_J = 25^\circ\text{C}$		52		μV	
Ripple Rejection	RR	$f = 120\text{ Hz}$	56	80		dB	
Dropout Voltage	V_{DROP}	$T_J = 25^\circ\text{C}$		2		V	
Output Short Circuit	I_{OS}	$T_J = 25^\circ\text{C}$			50	mA	
Peak Output	$I_{OUT(peak)}$						$V_{IN} = 35\text{ V}$
Temperature Coefficient	$\Delta V_{OUT}/\Delta T_J$	$I_{OUT} = 5\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$		0.2		$\text{mV}/^\circ\text{C}$	

SPECIFICATIONS		SiP78M09CD				
Parameter	Symbol	Test Conditions Unless Specified $V_{IN} = 15\text{ V}$, $I_{OUT} = 350\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$ $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	Limits			Unit
			Min	Typ	Max	
Output Voltage	V_{OUT}	$T_J = 25^\circ\text{C}$	8.64	9	9.45	V
		$11.5\text{ V} \leq V_{IN} \leq 24\text{ V}$, $5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$	8.55		9.45	
Line Regulation	ΔREG_{line}	$T_J = 25^\circ\text{C}$	$11.5\text{ V} \leq V_{IN} < 27\text{ V}$	6	50	mV
Load Regulation	ΔREG_{load}		$5\text{ mA} \leq I_{OUT} < 500\text{ mA}$	25	160	
			$5\text{ mA} \leq I_{OUT} < 200\text{ mA}$	10	90	
Quiescent Current	I_Q	$I_{OUT} = 0$, $T_J = 25^\circ\text{C}$		3.2	6	mA
Quiescent Current Change	ΔI_Q	$11.5\text{ V} \leq V_{IN} \leq 27\text{ V}$			0.8	
		$5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$			0.5	
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}$, $T_J = 25^\circ\text{C}$		52		μV
Ripple Rejection	RR	$f = 120\text{ Hz}$, $12\text{ V} \leq V_{IN} \leq 22\text{ V}$	55	80		dB
Dropout Voltage	V_{DROP}	$T_J = 25^\circ\text{C}$		2		V
Output Short Circuit	I_{OS}	$T_J = 25^\circ\text{C}$	$V_{IN} = 35\text{ V}$	50		mA
Peak Output	$I_{OUT(peak)}$			700		
Temperature Coefficient	$\Delta V_{OUT}/\Delta T_J$	$I_{OUT} = 5\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$		0.2		$\text{mV}/^\circ\text{C}$

SPECIFICATIONS		SiP78M12CD				
Parameter	Symbol	Test Conditions Unless Specified $V_{IN} = 19\text{ V}$, $I_{OUT} = 350\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$ $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	Limits			Unit
			Min	Typ	Max	
Output Voltage	V_{OUT}	$T_J = 25^\circ\text{C}$	11.50	12.0	12.50	V
		$14.5\text{ V} \leq V_{IN} \leq 27\text{ V}$, $5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$	11.40		12.45	
Line Regulation	ΔREG_{line}	$T_J = 25^\circ\text{C}$	$14.5\text{ V} \leq V_{IN} < 30\text{ V}$	10	50	mV
Load Regulation	ΔREG_{load}		$5\text{ mA} \leq I_{OUT} < 500\text{ mA}$	25	240	
			$5\text{ mA} \leq I_{OUT} < 200\text{ mA}$	10	120	
Quiescent Current	I_Q	$I_{OUT} = 0$, $T_J = 25^\circ\text{C}$		3.2	6	mA
Quiescent Current Change	ΔI_Q	$14.5\text{ V} \leq V_{IN} \leq 30\text{ V}$			0.8	
		$5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$			0.5	
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}$, $T_J = 25^\circ\text{C}$		75		μV
Ripple Rejection	RR	$f = 120\text{ Hz}$, $15\text{ V} \leq V_{IN} \leq 25\text{ V}$	55	80		dB
Dropout Voltage	V_{DROP}	$T_J = 25^\circ\text{C}$		2		V
Output Short Circuit	I_{OS}	$T_J = 25^\circ\text{C}$	$V_{IN} = 35\text{ V}$	50		mA
Peak Output	$I_{OUT(peak)}$			700		
Temperature Coefficient	$\Delta V_{OUT}/\Delta T_J$	$I_{OUT} = 5\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$		0.3		$\text{mV}/^\circ\text{C}$

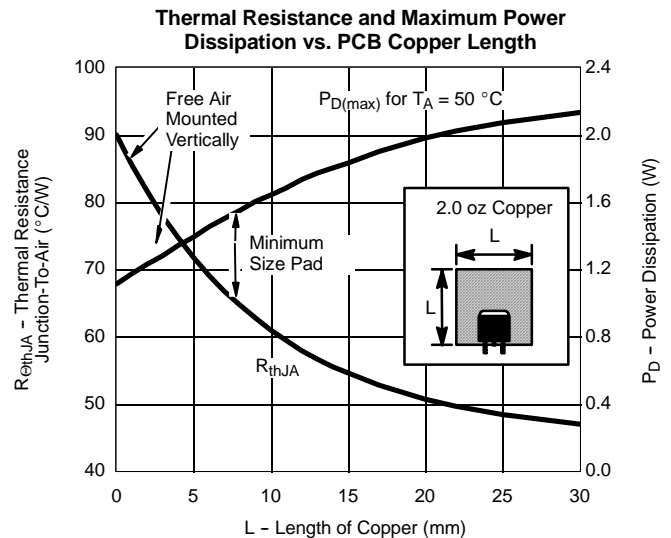
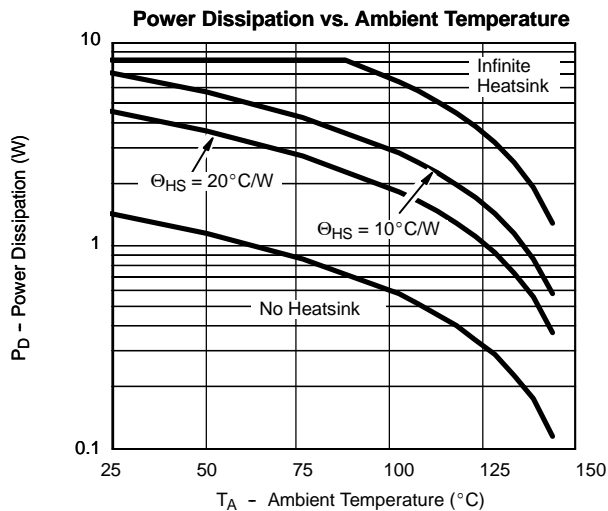


SPECIFICATIONS		SiP78M15CD					
Parameter	Symbol	Test Conditions Unless Specified $V_{IN} = 23\text{ V}$, $I_{OUT} = 350\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$ $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	Limits			Unit	
			Min	Typ	Max		
Output Voltage	V_{OUT}	$T_J = 25^\circ\text{C}$	14.40	15.0	15.60	V	
		$17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$, $5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$	14.25		15.75		
Line Regulation	ΔREG_{line}	$T_J = 25^\circ\text{C}$		11	50	mV	
Load Regulation	ΔREG_{load}		$17.5\text{ V} \leq V_{IN} < 30\text{ V}$		25		300
			$5\text{ mA} \leq I_{OUT} < 500\text{ mA}$		10		150
Quiescent Current	I_Q	$I_{OUT} = 0$, $T_J = 25^\circ\text{C}$		3.2	6	mA	
Quiescent Current Change	ΔI_Q	$17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$			0.8		
		$5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$			0.5		
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}$, $T_J = 25^\circ\text{C}$		90		μV	
Ripple Rejection	RR	$f = 120\text{ Hz}$, $18\text{ V} \leq V_{IN} \leq 28\text{ V}$	54	70		dB	
Dropout Voltage	V_{DROP}	$T_J = 25^\circ\text{C}$		2		V	
Output Short Circuit	I_{OS}	$T_J = 25^\circ\text{C}$			50	mA	
Peak Output	$I_{OUT(peak)}$						$V_{IN} = 35\text{ V}$
Temperature Coefficient	$\Delta V_{OUT}/\Delta T_J$	$I_{OUT} = 5\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$		0.3		$\text{mV}/^\circ\text{C}$	

SPECIFICATIONS		SiP78M18CD					
Parameter	Symbol	Test Conditions Unless Specified $V_{IN} = 27\text{ V}$, $I_{OUT} = 350\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$ $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	Limits			Unit	
			Min	Typ	Max		
Output Voltage	V_{OUT}	$T_J = 25^\circ\text{C}$	17.30	18.0	18.70	V	
		$21\text{ V} \leq V_{IN} \leq 33\text{ V}$, $5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$	17.10		18.90		
Line Regulation	ΔREG_{line}	$T_J = 25^\circ\text{C}$		10	50	mV	
Load Regulation	ΔREG_{load}		$21.0\text{ V} \leq V_{IN} < 33\text{ V}$		30		360
			$5\text{ mA} \leq I_{OUT} < 500\text{ mA}$		10		180
Quiescent Current	I_Q	$I_{OUT} = 0$, $T_J = 25^\circ\text{C}$		3.2	6.5	mA	
Quiescent Current Change	ΔI_Q	$21.0\text{ V} \leq V_{IN} \leq 33\text{ V}$			0.8		
		$5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$			0.5		
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}$, $T_J = 25^\circ\text{C}$		100		μV	
Ripple Rejection	RR	$f = 120\text{ Hz}$, $21\text{ V} \leq V_{IN} \leq 31\text{ V}$	53	70		dB	
Dropout Voltage	V_{DROP}	$T_J = 25^\circ\text{C}$		2		V	
Output Short Circuit	I_{OS}	$T_J = 25^\circ\text{C}$			50	mA	
Peak Output	$I_{OUT(peak)}$						$V_{IN} = 35\text{ V}$
Temperature Coefficient	$\Delta V_{OUT}/\Delta T_J$	$I_{OUT} = 5\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$		0.3		$\text{mV}/^\circ\text{C}$	

SPECIFICATIONS			SiP78M24CD			
Parameter	Symbol	Test Conditions Unless Specified $V_{IN} = 33\text{ V}$, $I_{OUT} = 350\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$ $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	Limits			Unit
			Min	Typ	Max	
Output Voltage	V_{OUT}	$T_J = 25^\circ\text{C}$	23.00	24.0	25.00	V
		$26.0\text{ V} \leq V_{IN} \leq 38\text{ V}$, $5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$	22.80		25.2	
Line Regulation	$\Delta\text{REG}_{\text{line}}$	$T_J = 25^\circ\text{C}$	$26.0\text{ V} \leq V_{IN} < 38\text{ V}$		10	mV
Load Regulation	$\Delta\text{REG}_{\text{load}}$		$5\text{ mA} \leq I_{OUT} < 500\text{ mA}$		30	
			$5\text{ mA} \leq I_{OUT} < 200\text{ mA}$		10	
Quiescent Current	I_Q	$I_{OUT} = 0$, $T_J = 25^\circ\text{C}$		3.2	6.5	mA
Quiescent Current Change	ΔI_Q	$26.0\text{ V} \leq V_{IN} \leq 38\text{ V}$			0.8	
		$5\text{ mA} \leq I_{OUT} \leq 350\text{ mA}$			0.5	
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}$, $T_J = 25^\circ\text{C}$		170		μV
Ripple Rejection	RR	$f = 120\text{ Hz}$, $26\text{ V} \leq V_{IN} \leq 36\text{ V}$	50	70		dB
Dropout Voltage	V_{DROPO}	$T_J = 25^\circ\text{C}$		2		V
Output Short Circuit	I_{OS}	$T_J = 25^\circ\text{C}$	$V_{IN} = 35\text{ V}$		50	mA
Peak Output	$I_{OUT(\text{peak})}$				700	
Temperature Coefficient	$\Delta V_{OUT}/\Delta T_J$	$I_{OUT} = 5\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$		0.5		$\text{mV}/^\circ\text{C}$

TYPICAL CHARACTERISTICS (25 °C UNLESS NOTED)





TYPICAL CHARACTERISTICS (25 °C UNLESS NOTED)

