

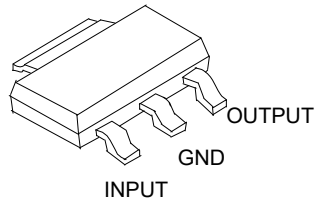
1. Description

The 78MxxA three-terminal positive regulators are available in the TO-252 package with several fixed output voltages making it useful in a wide range of applications.

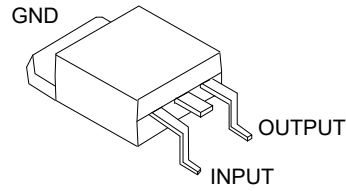
2. Features

- Output Current up to 0.5A
- Output Voltages of 5,6,8,9,12,15,18,24V
- Thermal Overload Protection Short Circuit Protection
- Output Transistor Safe Operating area (SOA) Protection

3. Pinning information

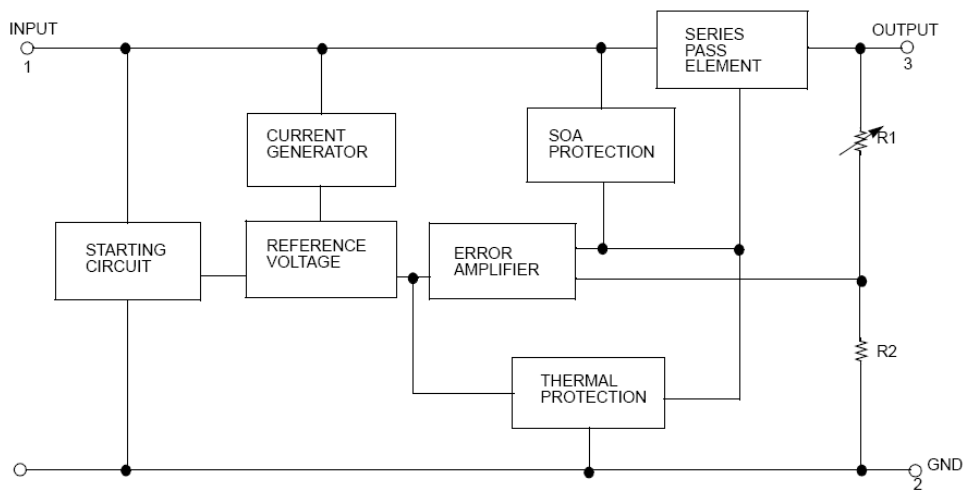


SOT-223



TO-252

4. Internal Block Diagram





5. Absolute Maximum Rating

Parameter		Symbol	Value	Units
DC Input Voltage	for $V_O=5$ to 18V	V_I	35	V
	for $V_O=24$ V		40	V
Output Current		I_{OUT}	0.5	A
Power Dissipation ($T_C=25^\circ\text{C}$)	SOT-223	P_D	1	W
	TO-252		1.5	W
Junction Temperature		T_J	-20 to 125	$^\circ\text{C}$
Storage Temperature		T_{STG}	-55 to 150	$^\circ\text{C}$

6. Thermal Data

Parameter		Symbol	Value	Units
Junction to Case	SOT-223	θ_{JC}	15	$^\circ\text{C/W}$
	TO-252		12.5	$^\circ\text{C/W}$



7.1 Electrical Characteristics (78M05)

(Refer to the test circuits, $0 < T_J < +125^\circ\text{C}$, $I_o = 200\text{mA}$, $V_i = 10\text{V}$, unless otherwise specified, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_o	$I_o = 5\text{mA} \sim 200\text{mA}$, $V_i = 7 \sim 20\text{V}$	4.75	5	5.25	V
Line Regulation(Note)	ΔV_o	$I_o = 200\text{mA}$ $T_J = 25^\circ\text{C}$			100	mV
					50	mV
Load Regulation(Note)	ΔV_o	$T_J = 25^\circ\text{C}$			100	mV
					50	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$			6	mA
Quiescent Current Change	ΔI_q	$I_o = 5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_o = 200\text{mA}$, $V_i = 8 \sim 25\text{V}$			0.8	mA
Output Voltage Drift	$\Delta V / \Delta T$	$I_o = 5\text{mA}$, $T_J = 0 \sim 125^\circ\text{C}$		-0.5		mV/ $^\circ\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz} \sim 100\text{KHz}$		40		μV
Ripple Rejection	RR	$f = 120\text{Hz}$, $V_i = 8 \sim 18\text{V}$		80		dB
Dropout Voltage	V_D	$T_J = 25^\circ\text{C}$, $I_o = 500\text{mA}$		2		V
Short Circuit Current	I_{SC}	$T_J = 25^\circ\text{C}$, $V_i = 35\text{V}$		800		mA
Peak Current	I_{PK}	$T_J = 25^\circ\text{C}$		1300		mA

Notes:

Load and line regulation are specified at constant junction temperature. Change in V_o due to heating effects must be taken into account separately. Pulse testing with low duty is used.



7.2 Electrical Characteristics (78M06)

(Refer to the test circuits, $0 < T_J < +125^\circ\text{C}$, $I_o = 200\text{mA}$, $V_i = 11\text{V}$, unless otherwise specified, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_o	$I_o = 5\text{mA} \sim 200\text{mA}$, $V_i = 8 \sim 21\text{V}$	5.7	6	6.3	V
Line Regulation(Note)	ΔV_o	$I_o = 200\text{mA}$ $T_J = 25^\circ\text{C}$			100	mV
					50	mV
Load Regulation(Note)	ΔV_o	$T_J = 25^\circ\text{C}$			120	mV
					60	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$			8	mA
Quiescent Current Change	ΔI_q	$I_o = 5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_o = 200\text{mA}$, $V_i = 9 \sim 25\text{V}$			0.8	mA
Output Voltage Drift	$\Delta V/\Delta T$	$I_o = 5\text{mA}$, $T_J = 0 \sim 125^\circ\text{C}$		-0.5		mV/ $^\circ\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz} \sim 100\text{KHz}$		45		μV
Ripple Rejection	RR	$f = 120\text{Hz}$, $V_i = 9 \sim 19\text{V}$		80		dB
Dropout Voltage	V_D	$T_J = 25^\circ\text{C}$, $I_o = 500\text{mA}$		2		V
Short Circuit Current	I_{SC}	$T_J = 25^\circ\text{C}$, $V_i = 35\text{V}$		800		mA
Peak Current	I_{PK}	$T_J = 25^\circ\text{C}$		1300		mA

Notes:

Load and line regulation are specified at constant junction temperature. Change in V_o due to heating effects must be taken into account separately. Pulse testing with low duty is used.



7.3 Electrical Characteristics (78M08)

(Refer to the test circuits, $0 < T_J < +125^\circ\text{C}$, $I_o = 200\text{mA}$, $V_i = 14\text{V}$, unless otherwise specified, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_o	$I_o = 5\text{mA} \sim 200\text{mA}$, $V_i = 10.5 \sim 23\text{V}$	7.6	8	8.4	V
Line Regulation(Note)	ΔV_o	$I_o = 200\text{mA}$			100	mV
		$T_J = 25^\circ\text{C}$	$V_i = 10.5\text{V} \sim 25\text{V}$			
Load Regulation(Note)	ΔV_o	$T_J = 25^\circ\text{C}$			160	mV
			$I_o = 5\text{mA} \sim 350\text{mA}$			
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$			6	mA
Quiescent Current Change	ΔI_q	$I_o = 5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_o = 200\text{mA}$, $V_i = 10.5 \sim 25\text{V}$			0.8	mA
Output Voltage Drift	$\Delta V / \Delta T$	$I_o = 5\text{mA}$, $T_J = 0 \sim 125^\circ\text{C}$		-0.8		mV/ $^\circ\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz} \sim 100\text{KHz}$		52		μV
Ripple Rejection	RR	$f = 120\text{Hz}$, $V_i = 11.5 \sim 21.5\text{V}$		80		dB
Dropout Voltage	V_D	$T_J = 25^\circ\text{C}$, $I_o = 500\text{mA}$		2		V
Short Circuit Current	I_{SC}	$T_J = 25^\circ\text{C}$, $V_i = 35\text{V}$		800		mA
Peak Current	I_{PK}	$T_J = 25^\circ\text{C}$		1300		mA

Notes:

Load and line regulation are specified at constant junction temperature. Change in V_o due to heating effects must be taken into account separately. Pulse testing with low duty is used.



7.4 Electrical Characteristics (78M09)

(Refer to the test circuits, $0 < T_J < +125^\circ\text{C}$, $I_o = 200\text{mA}$, $V_i = 15\text{V}$, unless otherwise specified, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_o	$I_o = 5\text{mA} \sim 200\text{mA}$, $V_i = 11.5 \sim 24\text{V}$	8.45	9	9.55	V
Line Regulation(Note)	ΔV_o	$I_o = 200\text{mA}$ $T_J = 25^\circ\text{C}$			100	mV
					50	mV
Load Regulation(Note)	ΔV_o	$T_J = 25^\circ\text{C}$			180	mV
					90	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$			6	mA
Quiescent Current Change	ΔI_q	$I_o = 5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_o = 200\text{mA}$, $V_i = 11.5 \sim 25\text{V}$			0.8	mA
Output Voltage Drift	$\Delta V/\Delta T$	$I_o = 5\text{mA}$, $T_J = 0 \sim 125^\circ\text{C}$		-0.8		mV/ $^\circ\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz} \sim 100\text{KHz}$		52		μV
Ripple Rejection	RR	$f = 120\text{Hz}$, $V_i = 12.5 \sim 22.5\text{V}$		80		dB
Dropout Voltage	V_D	$T_J = 25^\circ\text{C}$, $I_o = 500\text{mA}$		2		V
Short Circuit Current	I_{SC}	$T_J = 25^\circ\text{C}$, $V_i = 35\text{V}$		800		mA
Peak Current	I_{PK}	$T_J = 25^\circ\text{C}$		1300		mA

Notes:

Load and line regulation are specified at constant junction temperature. Change in V_o due to heating effects must be taken into account separately. Pulse testing with low duty is used.



7.5 Electrical Characteristics (78M12)

(Refer to the test circuits, $0 < T_J < +125^\circ\text{C}$, $I_o = 200\text{mA}$, $V_i = 19\text{V}$, unless otherwise specified, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_o	$I_o = 5\text{mA} \sim 200\text{mA}$, $V_i = 14.5 \sim 27\text{V}$	11.4	12	12.6	V
Line Regulation(Note)	ΔV_o	$I_o = 200\text{mA}$			100	mV
		$T_J = 25^\circ\text{C}$	$V_i = 14.5\text{V} \sim 30\text{V}$			
Load Regulation(Note)	ΔV_o	$T_J = 25^\circ\text{C}$			50	mV
			$I_o = 5\text{mA} \sim 350\text{mA}$			240
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$			6	mA
			$I_o = 5\text{mA} \sim 200\text{mA}$			120
Quiescent Current Change	ΔI_q	$I_o = 5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_o = 200\text{mA}$, $V_i = 14.5 \sim 30\text{V}$			0.8	mA
Output Voltage Drift	$\Delta V/\Delta T$	$I_o = 5\text{mA}$, $T_J = 0 \sim 125^\circ\text{C}$		-0.8		mV/ $^\circ\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz} \sim 100\text{KHz}$		75		μV
Ripple Rejection	RR	$f = 120\text{Hz}$, $V_i = 15 \sim 25\text{V}$		80		dB
Dropout Voltage	V_D	$T_J = 25^\circ\text{C}$, $I_o = 500\text{mA}$		2		V
Short Circuit Current	I_{SC}	$T_J = 25^\circ\text{C}$, $V_i = 35\text{V}$		800		mA
Peak Current	I_{PK}	$T_J = 25^\circ\text{C}$		1300		mA

Notes:

Load and line regulation are specified at constant junction temperature. Change in V_o due to heating effects must be taken into account separately. Pulse testing with low duty is used.



7.6 Electrical Characteristics (78M15)

(Refer to the test circuits, $0 < T_J < +125^\circ\text{C}$, $I_o = 200\text{mA}$, $V_i = 23\text{V}$, unless otherwise specified, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_o	$I_o = 5\text{mA} \sim 200\text{mA}$, $V_i = 17.5 \sim 30\text{V}$	14.25	15	15.75	V
Line Regulation(Note)	ΔV_o	$I_o = 200\text{mA}$ $T_J = 25^\circ\text{C}$			100	mV
					50	mV
Load Regulation(Note)	ΔV_o	$T_J = 25^\circ\text{C}$			300	mV
					150	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$			6	mA
Quiescent Current Change	ΔI_q	$I_o = 5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_o = 200\text{mA}$, $V_i = 17.5 \sim 30\text{V}$			0.8	mA
Output Voltage Drift	$\Delta V/\Delta T$	$I_o = 5\text{mA}$, $T_J = 0 \sim 125^\circ\text{C}$		-1		mV/ $^\circ\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz} \sim 100\text{KHz}$		100		μV
Ripple Rejection	RR	$f = 120\text{Hz}$, $V_i = 18.5 \sim 28.5\text{V}$		70		dB
Dropout Voltage	V_D	$T_J = 25^\circ\text{C}$, $I_o = 500\text{mA}$		2		V
Short Circuit Current	I_{SC}	$T_J = 25^\circ\text{C}$, $V_i = 35\text{V}$		800		mA
Peak Current	I_{PK}	$T_J = 25^\circ\text{C}$		1300		mA

Notes:

Load and line regulation are specified at constant junction temperature. Change in V_o due to heating effects must be taken into account separately. Pulse testing with low duty is used.



7.7 Electrical Characteristics (78M18)

(Refer to the test circuits, $0 < T_J < +125^\circ\text{C}$, $I_o = 200\text{mA}$, $V_i = 26\text{V}$, unless otherwise specified, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_o	$I_o = 5\text{mA} \sim 200\text{mA}$, $V_i = 20.5 \sim 33\text{V}$	17.1	18	18.9	V
Line Regulation(Note)	ΔV_o	$I_o = 200\text{mA}$ $T_J = 25^\circ\text{C}$			100	mV
					50	mV
Load Regulation(Note)	ΔV_o	$T_J = 25^\circ\text{C}$			360	mV
					180	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$			6	mA
Quiescent Current Change	ΔI_q	$I_o = 5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_o = 200\text{mA}$, $V_i = 21 \sim 33\text{V}$			0.8	mA
Output Voltage Drift	$\Delta V / \Delta T$	$I_o = 5\text{mA}$, $T_J = 0 \sim 125^\circ\text{C}$		-1.2		mV/ $^\circ\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz} \sim 100\text{KHz}$		100		μV
Ripple Rejection	RR	$f = 120\text{Hz}$, $V_i = 22 \sim 32\text{V}$		70		dB
Dropout Voltage	V_D	$T_J = 25^\circ\text{C}$, $I_o = 500\text{mA}$		2		V
Short Circuit Current	I_{SC}	$T_J = 25^\circ\text{C}$, $V_i = 35\text{V}$		800		mA
Peak Current	I_{PK}	$T_J = 25^\circ\text{C}$		1300		mA

Notes:

Load and line regulation are specified at constant junction temperature. Change in V_o due to heating effects must be taken into account separately. Pulse testing with low duty is used.



7.8 Electrical Characteristics (78M24)

(Refer to the test circuits, $0 < T_J < +125^\circ\text{C}$, $I_o = 200\text{mA}$, $V_i = 33\text{V}$, unless otherwise specified, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$)

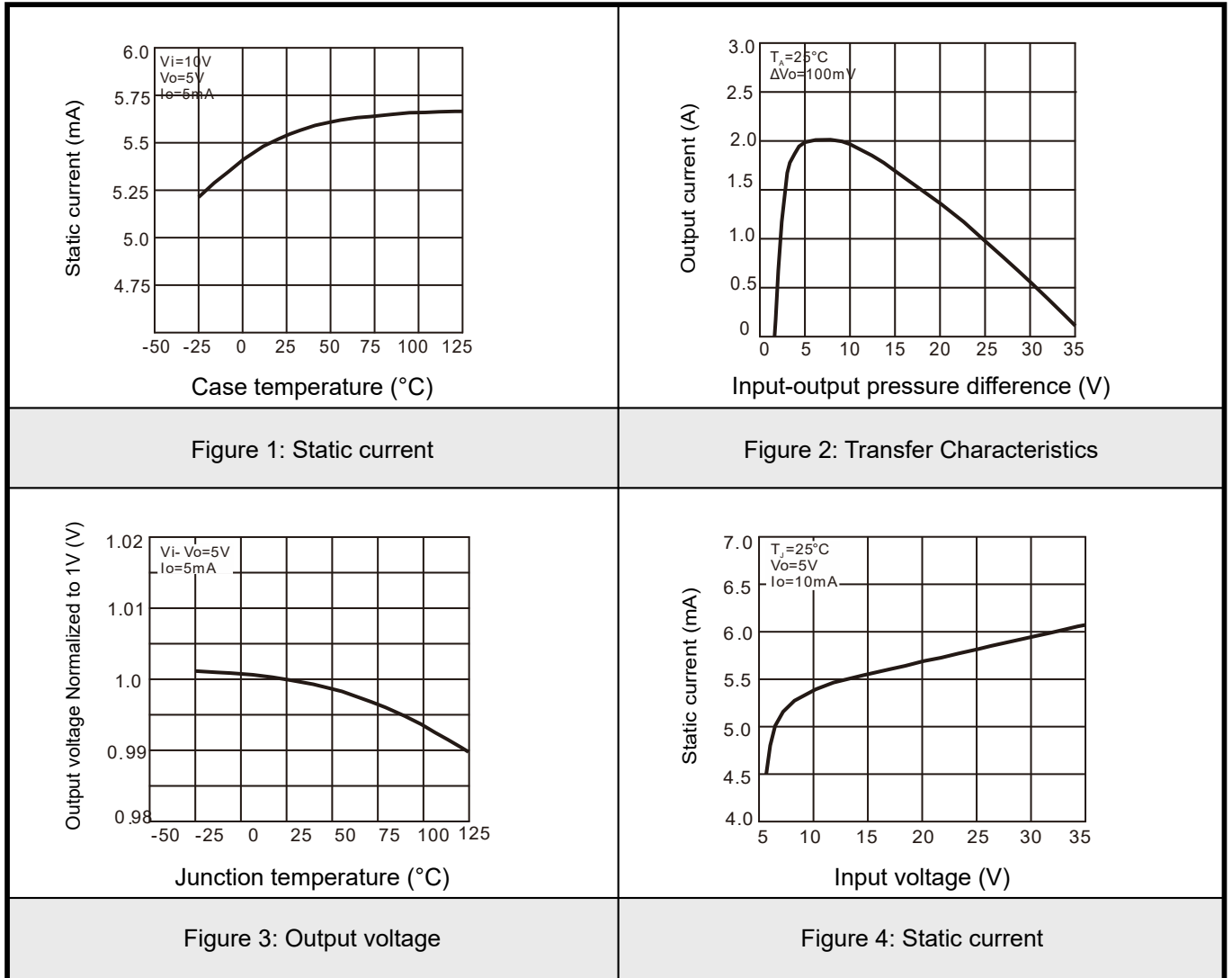
Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V_o	$I_o = 5\text{mA} \sim 200\text{mA}$, $V_i = 27 \sim 35\text{V}$	22.8	24	25.2	V
Line Regulation(Note)	ΔV_o	$I_o = 200\text{mA}$ $T_J = 25^\circ\text{C}$			100	mV
					50	mV
Load Regulation(Note)	ΔV_o	$T_J = 25^\circ\text{C}$			480	mV
					240	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$			6	mA
Quiescent Current Change	ΔI_q	$I_o = 5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_o = 200\text{mA}$, $V_i = 27 \sim 38\text{V}$			0.8	mA
Output Voltage Drift	$\Delta V / \Delta T$	$I_o = 5\text{mA}$, $T_J = 0 \sim 125^\circ\text{C}$		-1.2		mV/ $^\circ\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz} \sim 100\text{KHz}$		170		μV
Ripple Rejection	RR	$f = 120\text{Hz}$, $V_i = 28 \sim 38\text{V}$		70		dB
Dropout Voltage	V_D	$T_J = 25^\circ\text{C}$, $I_o = 500\text{mA}$		2		V
Short Circuit Current	I_{SC}	$T_J = 25^\circ\text{C}$, $V_i = 35\text{V}$		800		mA
Peak Current	I_{PK}	$T_J = 25^\circ\text{C}$		1300		mA

Notes:

Load and line regulation are specified at constant junction temperature. Change in V_o due to heating effects must be taken into account separately. Pulse testing with low duty is used.

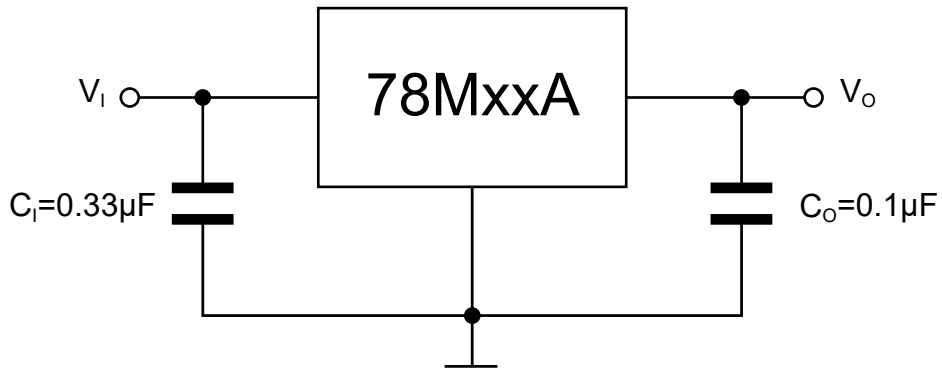


8.1 Typical characteristic



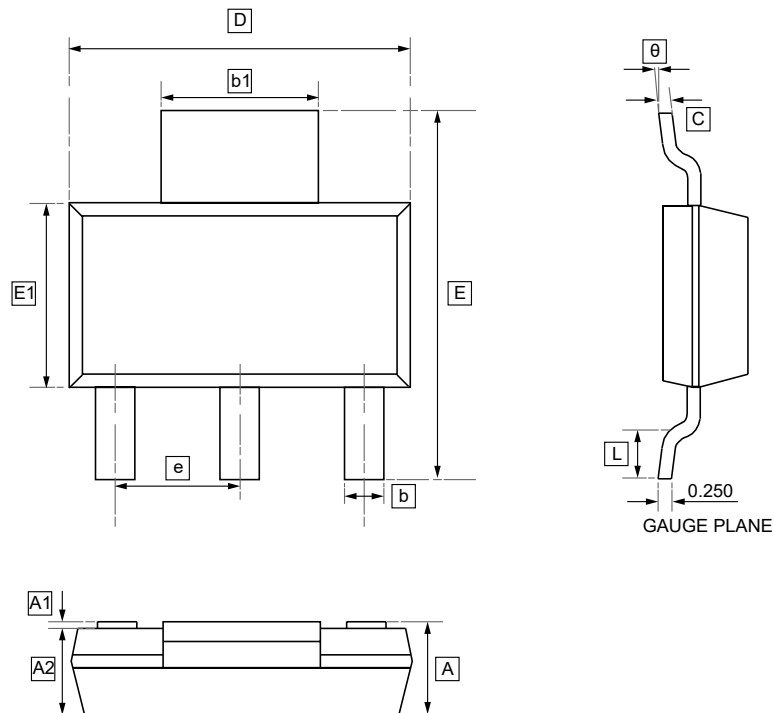


9. Typical Application





10.1SOT-223 Package Outlie Dimensions

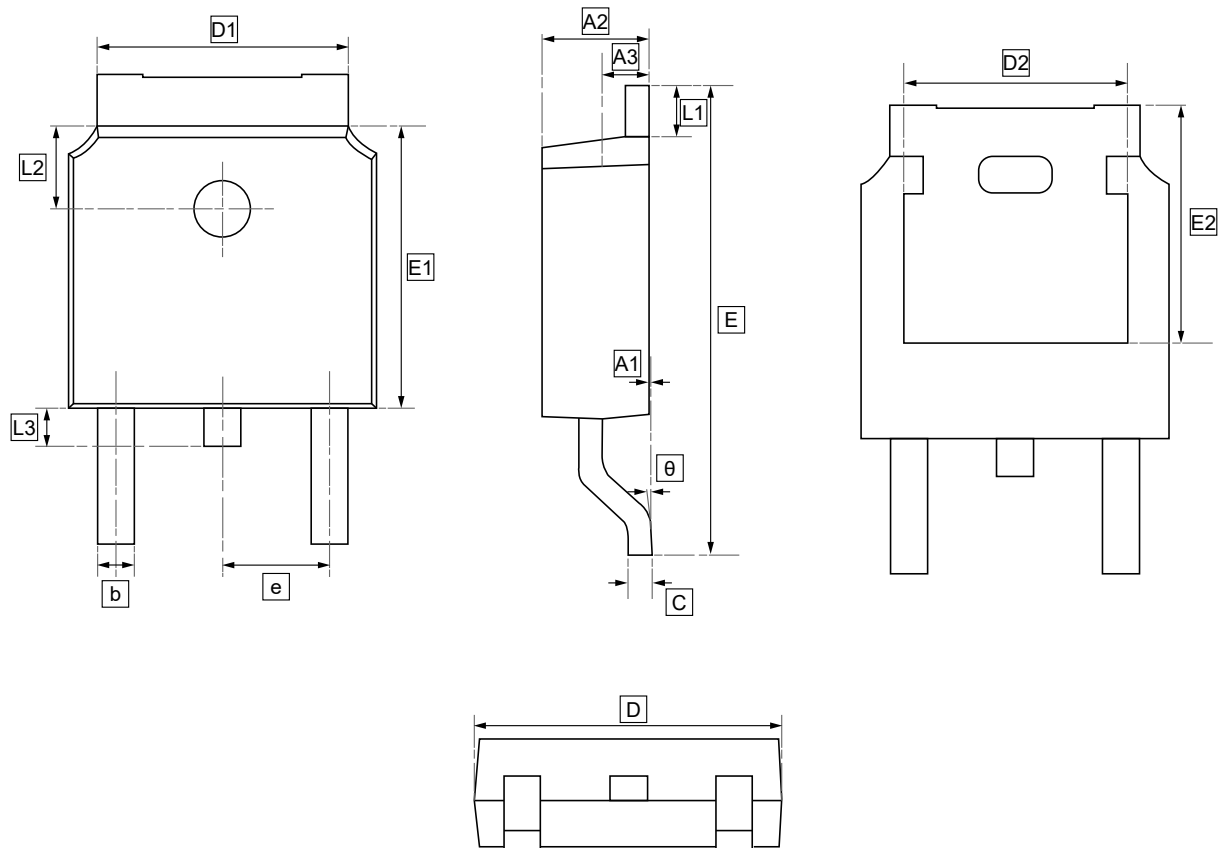


DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	b1	c	D	E	E1	e	L	θ
Min	-	0.020	1.500	0.660	2.900	0.230	6.300	6.700	3.300	2.300	0.750	0°
Max	1.800	0.100	1.700	0.840	3.100	0.350	6.700	7.300	3.700	BSC	-	10°



10.2TO-252 Package Outline Dimensions

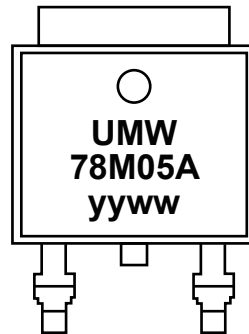


DIMENSIONS (mm are the original dimensions)

Symbol	A1	A2	A3	b	c	D	D1	D2	E	E1	E2	e	L1	L2	L3	θ
Min	0.00	2.18	0.90	0.65	0.46	6.35	4.95	4.32	9.40	5.97	5.21	2.286	0.89	1.70	0.60	0.00
Max	0.13	2.39	1.10	0.85	0.61	6.73	5.46	4.90	10.41	6.22	5.38	BSC	1.27	1.90	1.00	8.00



11. Ordering information



yy: Year Code
ww: Week Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW 78M05A	78M05A	TO-252	2500	Tape and reel
UMW 78M06A	78M06A	TO-252	2500	Tape and reel
UMW 78M08A	78M08A	TO-252	2500	Tape and reel
UMW 78M09A	78M09A	TO-252	2500	Tape and reel
UMW 78M12A	78M12A	TO-252	2500	Tape and reel
UMW 78M15A	78M15A	TO-252	2500	Tape and reel
UMW 78M18A	78M18A	TO-252	2500	Tape and reel
UMW 78M24A	78M24A	TO-252	2500	Tape and reel



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