

100 mA POSITIVE VOLTAGE REGULATORS

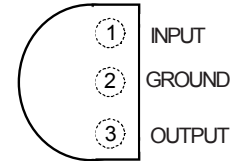
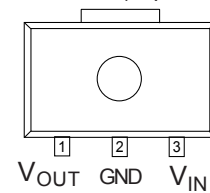
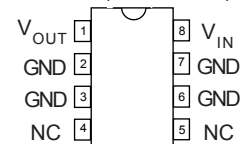
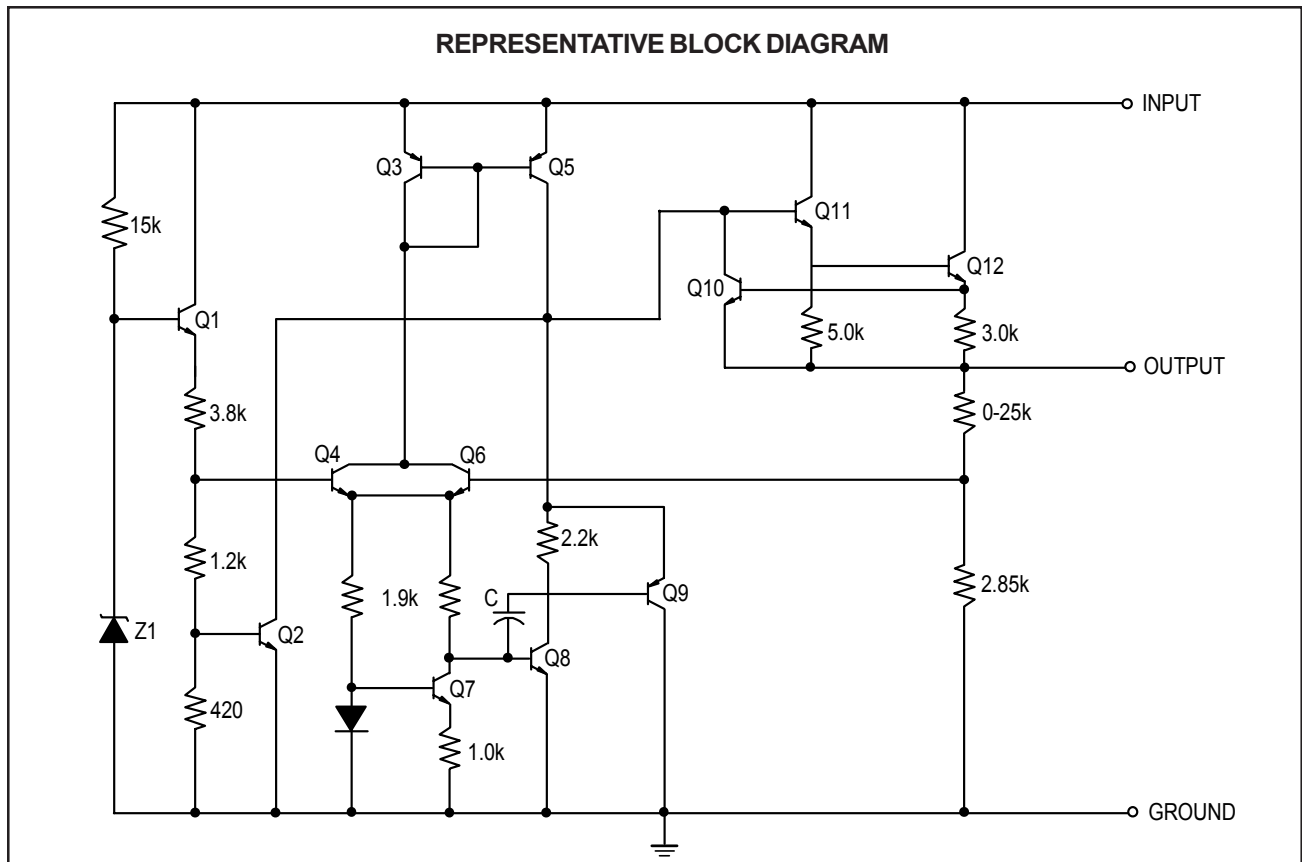
- Wide range of Fixed Output Voltages
- Output Current up to 100 mA
- No External Components Required
- Internal Thermal Overload Protection
- Internal Short Circuit Current-Limiting
- Available in TO-92, SOT-89 and SOP-8 packages

The GM78L00 series of positive voltage regulators are low-cost devices providing a simple solution for a wide variety of applications requiring a regulated supply of up to 100mA.

These virtually indestructible positive voltage regulators are protected by thermal shutdown and internal current-limiting. Most applications require no external components.

The GM78L00's are very versatile. Use them as fixed voltage regulators in a wide range of applications, including local on-card regulation for elimination of noise and distribution problems associated with single-point regulation. They can also be used with power pass elements to make high current voltage regulators.

The GM78L00's offer impressive performance advantages over old-fashioned zener diode-resistor combinations, providing lower output impedance and reduced quiescent current, along with lower noise.

PIN CONFIGURATIONS
TO-92 (TOP VIEW)

SOT-89 (Top View)

SOP-8 (TOP VIEW)

REPRESENTATIVE BLOCK DIAGRAM


100 mA POSITIVE VOLTAGE REGULATORS
■ ELECTRICAL CHARACTERISTICS GM78L05
 $T_A = 0^\circ\text{C to } 125^\circ\text{C}$, $V_I = 10\text{V}$, $I_O = 40\text{mA}$, $C_I = 0.33\mu\text{F}$, unless otherwise specified (Note 1)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	4.8	5.0	5.2	V
Line Regulation	$V_{R\text{ LINE}}$	$T_J = 25^\circ\text{C}$, $7\text{V} \leq V_I \leq 20\text{V}$		32	150	mV
		$T_J = 25^\circ\text{C}$, $8\text{V} \leq V_I \leq 20\text{V}$		26	100	
Load Regulation	$V_{R\text{ LOAD}}$	$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 100\text{mA}$		11	60	mV
		$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 40\text{mA}$		5	30	
Output Voltage (Note 2)	V_O	$7\text{V} \leq V_I \leq 20\text{V}$, $1\text{mA} \leq I_O \leq 40\text{mA}$	4.75	5	5.25	V
		$7\text{V} \leq V_I \leq V_{\text{MAX}}$, $1\text{mA} \leq I_O \leq 70\text{mA}$	4.75	5	5.25	
Quiscent Current	I_Q	$T_J = 25^\circ\text{C}$		3.8	6.0	mA
Quiscent Current Change	ΔI_Q	(with Line) $8\text{V} \leq V_I \leq 20\text{V}$			1.5	mA
		(with Load) $1\text{mA} \leq I_O \leq 40\text{mA}$			0.1	
Noise	N_O	$T_A = 25^\circ\text{C}$, $10\text{Hz} \leq f \leq 100\text{kHz}$		42		μV
Ripple Rejection	$\Delta V_I / \Delta V_O$	$T_J = 25^\circ\text{C}$, $f = 120\text{kHz}$, $8\text{V} \leq V_I \leq 18\text{V}$	41	49		dB
Dropout Voltage	V_{DO}	$T_J = 25^\circ\text{C}$		1.7		V

Note 1: The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperatures as indicated at the initiation of tests.

Note 2: Power Dissipation $\leq 0.75\text{W}$.

■ ELECTRICAL CHARACTERISTICS GM78L06
 $T_A = 0^\circ\text{C to } 125^\circ\text{C}$, $V_I = 11\text{V}$, $I_O = 40\text{mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, unless otherwise specified (Note 1)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	5.75	6.0	6.25	V
Line Regulation	$V_{R\text{ LINE}}$	$T_J = 25^\circ\text{C}$, $8.0\text{V} \leq V_I \leq 20\text{V}$		35	175	mV
		$T_J = 25^\circ\text{C}$, $9.0\text{V} \leq V_I \leq 20\text{V}$		29	125	
Load Regulation	$V_{R\text{ LOAD}}$	$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 100\text{mA}$		16	80	mV
		$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 40\text{mA}$		9	40	
Output Voltage (Note 2)	V_O	$8\text{V} \leq V_I \leq 20\text{V}$, $1\text{mA} \leq I_O \leq 40\text{mA}$	5.7	6	6.3	V
		$8\text{V} \leq V_I \leq V_{\text{MAX}}$, $1\text{mA} \leq I_O \leq 70\text{mA}$	5.7	6	6.3	
Quiscent Current	I_Q	$T_J = 25^\circ\text{C}$		3.9	6.0	mA
Quiscent Current Change	ΔI_Q	(with Line) $9\text{V} \leq V_I \leq 20\text{V}$			1.5	mA
		(with Load) $1\text{mA} \leq I_O \leq 40\text{mA}$			0.1	
Noise	N_O	$T_A = 25^\circ\text{C}$, $10\text{Hz} \leq f \leq 100\text{kHz}$		46		μV
Ripple Rejection	$\Delta V_I / \Delta V_O$	$T_J = 25^\circ\text{C}$, $f = 120\text{kHz}$, $9\text{V} \leq V_I \leq 19\text{V}$	40	48		dB
Dropout Voltage	V_{DO}	$T_J = 25^\circ\text{C}$		1.7		V

Note 1: The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperatures as indicated at the initiation of tests.

Note 2: Power Dissipation $\leq 0.75\text{W}$.

100 mA POSITIVE VOLTAGE REGULATORS
■ ELECTRICAL CHARACTERISTICS GM78L08
 $T_A = 0^\circ\text{C to } 125^\circ\text{C}$, $V_I = 14\text{V}$, $I_O = 40\text{mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, unless otherwise specified (Note 1)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	7.7	8.0	8.3	V
Line Regulation	$V_{R\text{LINE}}$	$T_J = 25^\circ\text{C}$, $11\text{V} \leq V_I \leq 23\text{V}$		42	175	mV
		$T_J = 25^\circ\text{C}$, $12\text{V} \leq V_I \leq 23\text{V}$		36	125	
Load Regulation	$V_{R\text{LOAD}}$	$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 100\text{mA}$		18	80	mV
		$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 40\text{mA}$		10	40	
Output Voltage (Note 2)	V_O	$11\text{V} \leq V_I \leq 23\text{V}$, $1\text{mA} \leq I_O \leq 40\text{mA}$	7.6	8	8.4	V
		$11\text{V} \leq V_I \leq V_{\text{MAX}}$, $1\text{mA} \leq I_O \leq 70\text{mA}$	7.6	8	8.4	
Quiscent Current	I_Q	$T_J = 25^\circ\text{C}$		4	6	mA
Quiscent Current Change	ΔI_Q	(with Line) $12\text{V} \leq V_I \leq 23\text{V}$			1.5	mA
		(with Load) $1\text{mA} \leq I_O \leq 40\text{mA}$			0.1	
Noise	N_O	$T_A = 25^\circ\text{C}$, $10\text{Hz} \leq f \leq 100\text{kHz}$		54		μV
Ripple Rejection	$\Delta V_I / \Delta V_O$	$T_J = 25^\circ\text{C}$, $f = 120\text{kHz}$, $12\text{V} \leq V_I \leq 22\text{V}$	37	46		dB
Dropout Voltage	V_{DO}	$T_J = 25^\circ\text{C}$		1.7		V

Note 1: The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperatures as indicated at the initiation of tests.

Note 2: Power Dissipation $\leq 0.75\text{W}$.

■ ELECTRICAL CHARACTERISTICS GM78L09
 $T_A = 0^\circ\text{C to } 125^\circ\text{C}$, $V_I = 16\text{V}$, $I_O = 40\text{mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, unless otherwise specified (Note 1)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	8.6	9.0	9.4	V
Line Regulation	$V_{R\text{LINE}}$	$T_J = 25^\circ\text{C}$, $12\text{V} \leq V_I \leq 24\text{V}$		45	175	mV
		$T_J = 25^\circ\text{C}$, $13\text{V} \leq V_I \leq 24\text{V}$		40	125	
Load Regulation	$V_{R\text{LOAD}}$	$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 100\text{mA}$		19	90	mV
		$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 40\text{mA}$		11	40	
Output Voltage (Note 2)	V_O	$12\text{V} \leq V_I \leq 24\text{V}$, $1\text{mA} \leq I_O \leq 40\text{mA}$	8.55	9.0	9.45	V
		$12\text{V} \leq V_I \leq V_{\text{MAX}}$, $1\text{mA} \leq I_O \leq 70\text{mA}$	8.55	9.0	9.45	
Quiscent Current	I_Q	$T_J = 25^\circ\text{C}$		4.1	6.0	mA
Quiscent Current Change	ΔI_Q	(with Line) $13\text{V} \leq V_I \leq 24\text{V}$			1.5	mA
		(with Load) $1\text{mA} \leq I_O \leq 40\text{mA}$			0.1	
Noise	N_O	$T_A = 25^\circ\text{C}$, $10\text{Hz} \leq f \leq 100\text{kHz}$		58		μV
Ripple Rejection	$\Delta V_I / \Delta V_O$	$T_J = 25^\circ\text{C}$, $f = 120\text{kHz}$, $15\text{V} \leq V_I \leq 25\text{V}$	38	45		dB
Dropout Voltage	V_{DO}	$T_J = 25^\circ\text{C}$		1.7		V

Note 1: The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperatures as indicated at the initiation of tests.

Note 2: Power Dissipation $\leq 0.75\text{W}$.

100 mA POSITIVE VOLTAGE REGULATORS

■ ELECTRICAL CHARACTERISTICS GM78L10

$T_A = 0^\circ\text{C}$ to 125°C , $V_I=17\text{V}$, $I_O=40\text{mA}$, $C_I=0.33\mu\text{F}$, $C_O=0.1\mu\text{F}$, unless otherwise specified (Note 1)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^\circ\text{C}$	9.6	10	10.4	V
Line Regulation	$V_{R\text{LINE}}$	$T_J=25^\circ\text{C}$, $13\text{V} \leq V_I \leq 24\text{V}$		51	175	mV
		$T_J=25^\circ\text{C}$, $14\text{V} \leq V_I \leq 24\text{V}$		42	125	
Load Regulation	$V_{R\text{LOAD}}$	$T_J=25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 100\text{mA}$		22	100	mV
		$T_J=25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 40\text{mA}$		13	50	
Output Voltage (Note 2)	V_O	$13\text{V} \leq V_I \leq 24\text{V}$, $1\text{mA} \leq I_O \leq 40\text{mA}$	9.5	10	10.5	V
		$13\text{V} \leq V_I \leq V_{\text{MAX}}$, $1\text{mA} \leq I_O \leq 70\text{mA}$	9.5	10	10.5	
Quiscent Current	I_Q	$T_J=25^\circ\text{C}$		4.3	6.5	mA
Quiscent Current Change	ΔI_Q	(with Line) $14\text{V} \leq V_I \leq 24\text{V}$			1.5	mA
		(with Load) $1\text{mA} \leq I_O \leq 40\text{mA}$			0.1	
Noise	N_O	$T_A=25^\circ\text{C}$, $10\text{Hz} \leq f \leq 100\text{kHz}$		62		μV
Ripple Rejection	$\Delta V_I / \Delta V_O$	$T_J=25^\circ\text{C}$, $f=120\text{kHz}$, $16\text{V} \leq V_I \leq 27\text{V}$	37	44		dB
Dropout Voltage	V_{DO}	$T_J=25^\circ\text{C}$		1.7		V

Note 1: The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperatures as indicated at the initiation of tests.

Note 2: Power Dissipation $\leq 0.75\text{W}$.

■ ELECTRICAL CHARACTERISTICS GM78L12

$T_A = 0^\circ\text{C}$ to 125°C , $V_I=19\text{V}$, $I_O=40\text{mA}$, $C_I=0.33\mu\text{F}$, $C_O=0.1\mu\text{F}$, unless otherwise specified (Note 1)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^\circ\text{C}$	11.5	12.0	12.5	V
Line Regulation	$V_{R\text{LINE}}$	$T_J=25^\circ\text{C}$, $14.5\text{V} \leq V_I \leq 27\text{V}$		55	250	mV
		$T_J=25^\circ\text{C}$, $16\text{V} \leq V_I \leq 27\text{V}$		49	200	
Load Regulation	$V_{R\text{LOAD}}$	$T_J=25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 100\text{mA}$		22	100	mV
		$T_J=25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 40\text{mA}$		13	50	
Output Voltage (Note 2)	V_O	$14.5\text{V} \leq V_I \leq 27\text{V}$, $1\text{mA} \leq I_O \leq 40\text{mA}$	11.4	12	12.6	V
		$14.5\text{V} \leq V_I \leq V_{\text{MAX}}$, $1\text{mA} \leq I_O \leq 70\text{mA}$	11.4	12	12.6	
Quiscent Current	I_Q	$T_J=25^\circ\text{C}$		4.3	6.5	mA
Quiscent Current Change	ΔI_Q	(with Line) $16\text{V} \leq V_I \leq 27\text{V}$			1.5	mA
		(with Load) $1\text{mA} \leq I_O \leq 40\text{mA}$			0.1	
Noise	N_O	$T_A=25^\circ\text{C}$, $10\text{Hz} \leq f \leq 100\text{kHz}$		70		μV
Ripple Rejection	$\Delta V_I / \Delta V_O$	$T_J=25^\circ\text{C}$, $f=120\text{kHz}$, $15\text{V} \leq V_I \leq 25\text{V}$	37	42		dB
Dropout Voltage	V_{DO}	$T_J=25^\circ\text{C}$		1.7		V

Note 1: The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperatures as indicated at the initiation of tests.

Note 2: Power Dissipation $\leq 0.75\text{W}$.

100 mA POSITIVE VOLTAGE REGULATORS
■ ELECTRICAL CHARACTERISTICS GM78L15
 $T_A = 0^\circ\text{C to } 125^\circ\text{C}$, $V_I = 23\text{V}$, $I_O = 40\text{mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, unless otherwise specified (Note 1)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	14.4	15.0	15.6	V
Line Regulation	$V_{R\text{LINE}}$	$T_J = 25^\circ\text{C}$, $17.5\text{V} \leq V_I \leq 30\text{V}$		65	300	mV
		$T_J = 25^\circ\text{C}$, $20\text{V} \leq V_I \leq 30\text{V}$		58	250	
Load Regulation	$V_{R\text{LOAD}}$	$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 100\text{mA}$		25	150	mV
		$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 40\text{mA}$		15	75	
Output Voltage (Note 2)	V_O	$17.5\text{V} \leq V_I \leq 30\text{V}$, $1\text{mA} \leq I_O \leq 40\text{mA}$	14.25	15	15.75	V
		$17.5\text{V} \leq V_I \leq V_{\text{MAX}}$, $1\text{mA} \leq I_O \leq 70\text{mA}$	14.25	15	15.75	
Quiscent Current	I_Q	$T_J = 25^\circ\text{C}$		4.7	6.5	mA
Quiscent Current Change	ΔI_Q	(with Line) $20\text{V} \leq V_I \leq 30\text{V}$			1.5	mA
		(with Load) $1\text{mA} \leq I_O \leq 40\text{mA}$			0.1	
Noise	N_O	$T_A = 25^\circ\text{C}$, $10\text{Hz} \leq f \leq 100\text{kHz}$		82		μV
Ripple Rejection	$\Delta V_I / \Delta V_O$	$T_J = 25^\circ\text{C}$, $f = 120\text{kHz}$, $18.5\text{V} \leq V_I \leq 28.5\text{V}$	34	39		dB
Dropout Voltage	V_{DO}	$T_J = 25^\circ\text{C}$		1.7		V

Note 1: The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperatures as indicated at the initiation of tests.

Note 2: Power Dissipation $\leq 0.75\text{W}$.

■ ELECTRICAL CHARACTERISTICS GM78L18
 $T_A = 0^\circ\text{C to } 125^\circ\text{C}$, $V_I = 26\text{V}$, $I_O = 40\text{mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, unless otherwise specified (Note 1)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	17.3	18.0	18.7	V
Line Regulation	$V_{R\text{LINE}}$	$T_J = 25^\circ\text{C}$, $20.5\text{V} \leq V_I \leq 33\text{V}$		70	360	mV
		$T_J = 25^\circ\text{C}$, $22\text{V} \leq V_I \leq 33\text{V}$		64	300	
Load Regulation	$V_{R\text{LOAD}}$	$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 100\text{mA}$		27	180	mV
		$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 40\text{mA}$		19	90	
Output Voltage (Note 2)	V_O	$20.5\text{V} \leq V_I \leq 30\text{V}$, $1\text{mA} \leq I_O \leq 40\text{mA}$	17.1	18	18.9	V
		$20.5\text{V} \leq V_I \leq V_{\text{MAX}}$, $1\text{mA} \leq I_O \leq 70\text{mA}$	17.1	18	18.9	
Quiscent Current	I_Q	$T_J = 25^\circ\text{C}$		4.7	6.5	mA
Quiscent Current Change	ΔI_Q	(with Line) $22\text{V} \leq V_I \leq 33\text{V}$			1.5	mA
		(with Load) $1\text{mA} \leq I_O \leq 40\text{mA}$			0.1	
Noise	N_O	$T_A = 25^\circ\text{C}$, $10\text{Hz} \leq f \leq 100\text{kHz}$		89		μV
Ripple Rejection	$\Delta V_I / \Delta V_O$	$T_J = 25^\circ\text{C}$, $f = 120\text{kHz}$, $21.5\text{V} \leq V_I \leq 31.5\text{V}$	32	36		dB
Dropout Voltage	V_{DO}	$T_J = 25^\circ\text{C}$		1.7		V

Note 1: The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperatures as indicated at the initiation of tests.

Note 2: Power Dissipation $\leq 0.75\text{W}$.

100 mA POSITIVE VOLTAGE REGULATORS
■ ELECTRICAL CHARACTERISTICS GM78L24
 $T_A = 0^\circ\text{C to } 125^\circ\text{C}$, $V_I = 32\text{V}$, $I_O = 40\text{mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, unless otherwise specified (Note 1)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	23	24	25	V
Line Regulation	$V_{R\text{ LINE}}$	$T_J = 25^\circ\text{C}$, $26.5\text{V} \leq V_I \leq 39\text{V}$		95	480	mV
		$T_J = 25^\circ\text{C}$, $29\text{V} \leq V_I \leq 39\text{V}$		78	400	
Load Regulation	$V_{R\text{ LOAD}}$	$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 100\text{mA}$		41	240	mV
		$T_J = 25^\circ\text{C}$, $1\text{mA} \leq I_O \leq 40\text{mA}$		28	120	
Output Voltage (Note 2)	V_O	$26.5\text{V} \leq V_I \leq 39\text{V}$, $1\text{mA} \leq I_O \leq 40\text{mA}$	22.8	24	25.2	V
		$26.5\text{V} \leq V_I \leq V_{\text{MAX}}$, $1\text{mA} \leq I_O \leq 70\text{mA}$	22.8	24	25.2	
Quiscent Current	I_Q	$T_J = 25^\circ\text{C}$		4.8	6.5	mA
Quiscent Current Change	ΔI_Q	(with Line) $22\text{V} \leq V_I \leq 33\text{V}$			1.5	mA
		(with Load) $1\text{mA} \leq I_O \leq 40\text{mA}$			0.1	
Noise	N_O	$T_A = 25^\circ\text{C}$, $10\text{Hz} \leq f \leq 100\text{kHz}$		97		μV
Ripple Rejection	$\Delta V_I / \Delta V_O$	$T_J = 25^\circ\text{C}$, $f = 120\text{kHz}$, $27.5\text{V} \leq V_I \leq 37.5\text{V}$	30	33		dB
Dropout Voltage	V_{DO}	$T_J = 25^\circ\text{C}$		1.7		V

Note 1: The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperatures as indicated at the initiation of tests.

Note 2: Power Dissipation $\leq 0.75\text{W}$.

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNITS
Input Voltage (5.0 to 15V)	V_I	35	V
Power Dissipation	P_D	internally limited	W
Operating Junction Temperature Range	T_J	0 to +125	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	-65 to +150	$^\circ\text{C}$
Lead Temperature (soldering 10sec.)	T_L	265	$^\circ\text{C}$

100 mA POSITIVE VOLTAGE REGULATORS
■ APPLICATION INFORMATION
Design Considerations

The GM78L series regulators have thermal overload protection from excessive power, internal short-circuit protection which limits each circuit's maximum current, and output transistor safe-area protection for reducing the output current as the voltage across each pass transistor is increased.

Although the internal power dissipation is limited, the junction temperature must be kept below the maximum specified temperature (125°C) in order to meet data sheet specifications.

Thermal Considerations

The TO-92 molded package is capable of unusually high power dissipation due to the lead frame design. However, its thermal capabilities are generally overlooked because of a lack of understanding of the thermal paths from the semiconductor junction to ambient temperature.

While thermal resistance is normally specified for the device mounted 1 cm above an infinite heat sink, very little has been mentioned of the options available to improve on the conservatively rated thermal capability. An explanation of the thermal paths of the TO-92 will allow the designer to determine the thermal stress he is applying in any given application.

The TO-92 Package

The TO-92 package thermal paths are complex. In addition to the path through the molding compound to ambient temperature, there is another path through the leads, in parallel with the case path, to ambient temperature, as shown in Figure 1.

The total thermal resistance in this model is then:

$$\theta_{JA} = \frac{(\theta_{JA} + \theta_{CA})(\theta_{JL} + \theta_{LA})}{\theta_{JA} + \theta_{CA} + \theta_{JL} + \theta_{LA}}$$

Where:

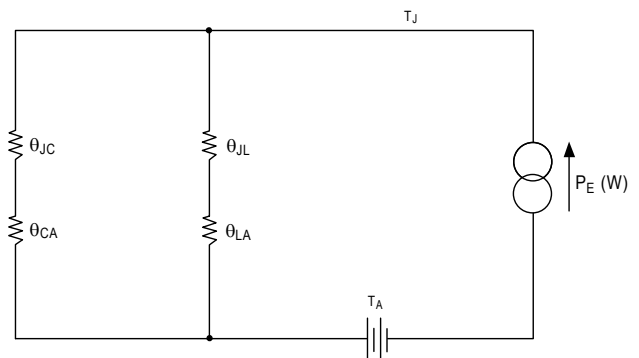
θ_{JC} = thermal resistance of the case between the regulator die and a point on the case directly above the die location.

θ_{CA} = thermal resistance between the case and air at ambient temperature.

θ_{JL} = thermal resistance from regulator die through the input lead to a point $1/16$ inch below the regulator case.

θ_{LA} = total thermal resistance of the input/output ground leads to ambient temperature.

θ_{JA} = junction to ambient thermal resistance.

FIGURE 1. TO-92 Thermal Equivalent Circuit

■ ORDERING INFORMATION

	OUTPUT VOLTAGE	PACKAGE		
		TO-92	SOT-89	SOP 8
GM78L00	5V	GM78L05-T92	GM78L05-ST89	GM78L05-S8
	6V	GM78L06-T92	GM78L06-ST89	GM78L06-S8
	8V	GM78L08-T92	GM78L08-ST89	GM78L08-S8
	9V	GM78L09-T92	GM78L09-ST89	GM78L09-S8
	10V	GM78L10-T92	GM78L10-ST89	GM78L10-S8
	12V	GM78L12-T92	GM78L12-ST89	GM78L12-S8
	15V	GM78L15-T92	GM78L15-ST89	GM78L15-S8
	18V	GM78L18-T92	GM78L18-ST89	GM78L18-S8
	24V	GM78L24-T92	GM78L24-ST89	GM78L24-S8