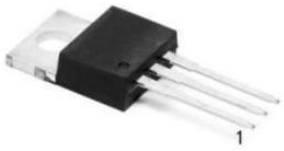
POSITIVE VOLTAGE REGULATORS

FEATURES

- OUTPUT CURRENT TO 1.5A
- OUTPUT VOLTAGES OF 5; 6; 8; 9; 10; 12; 15; 18; 24V
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- OUTPUT TRANSITION SOA PROTECTION



TO-220-3

TO-263-3

ORDERING INFORMATION

DEVICE	Package Type	MARKING	Packing	Packing Qty
LM7805CT	TO-220-3	LM7805C	TUBE	1000pcs/box
LM7806CT		LM7806C	TUBE	1000pcs/box
LM7808CT		LM7808C	TUBE	1000pcs/box
LM7809CT		LM7809C	TUBE	1000pcs/box
LM7810CT		LM7810C	TUBE	1000pcs/box
LM7812CT		LM7812C	TUBE	1000pcs/box
LM7815CT		LM7815C	TUBE	1000pcs/box
LM7818CT		LM7818C	TUBE	1000pcs/box
LM7824CT		LM7824C	TUBE	1000pcs/box
LM7805CS/TR	TO-263-3	LM7805C	REEL	500pcs/reel
LM7806CS/TR		LM7806C	REEL	500pcs/reel
LM7808CS/TR		LM7808C	REEL	500pcs/reel
LM7809CS/TR		LM7809C	REEL	500pcs/reel
LM7810CS/TR		LM7810C	REEL	500pcs/reel
LM7812CS/TR		LM7812C	REEL	500pcs/reel
LM7815CS/TR		LM7815C	REEL	500pcs/reel
LM7818CS/TR		LM7818C	REEL	500pcs/reel
LM7824CS/TR		LM7824C	REEL	500pcs/reel

DESCRIPTION

The LM78XX series of three-terminal positive regulators is available in TO-220， TO263 packages and several fixed output voltages,making it useful in a wide range of applications.

These regulators canprovide local on-card regulation,eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible.If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators,these devices can be used with external components to obtain adjustable voltage and currents.

Schematic Diagram

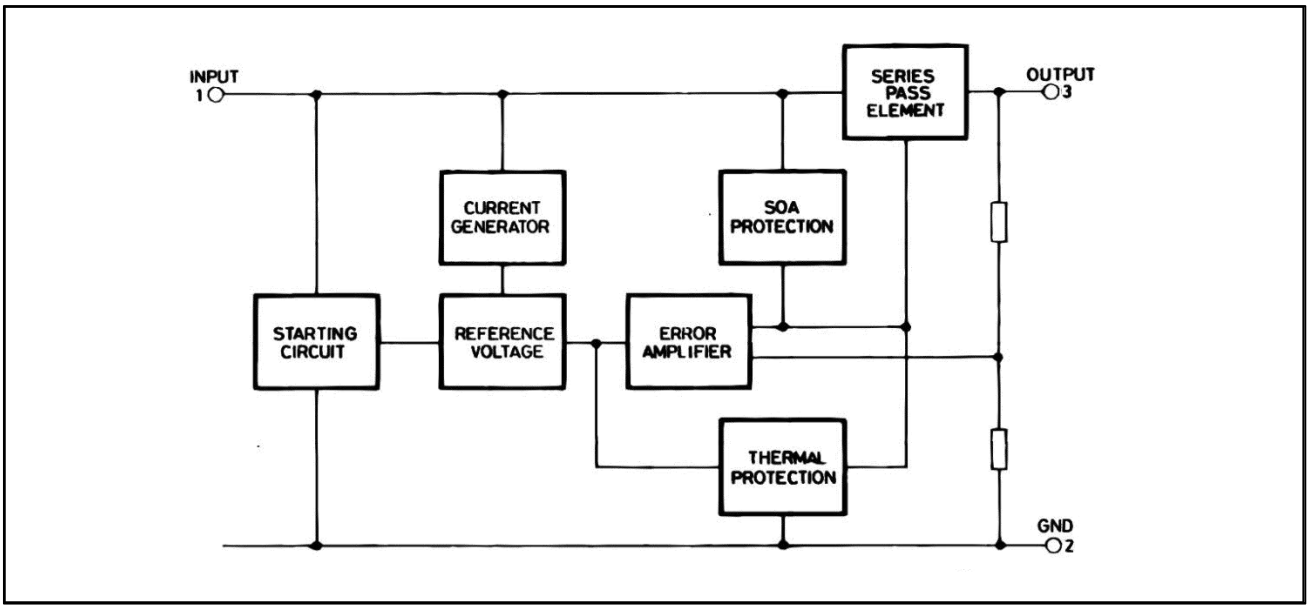


Figure 1:Schematic Diagram

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_I	DC Input Voltage	35	V
I_O	Output Current	Internally Limited	
P_{tot}	Power Dissipation	Internally Limited	
T_{stg}	Storage Temperature Range	-65 to 150	°C
T_{LEAD}	Lead Temperature (Soldering, 10 seconds)	245	°C
T_{op}	Operating Junction Temperature Range	0 to 125	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

Thermal Data

Symbol	Parameter	TO-220	TO-263	Unit
$R_{\theta JA}$	Junction-to-ambient thermal resistance	23.9	44.8	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top)thermal resistance	16.7	45.6	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	5.3	24.4	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	1.7	1.5	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	3.2	11.2	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	5.3	23.4	°C/W

Figure 2:Schematic Diagram

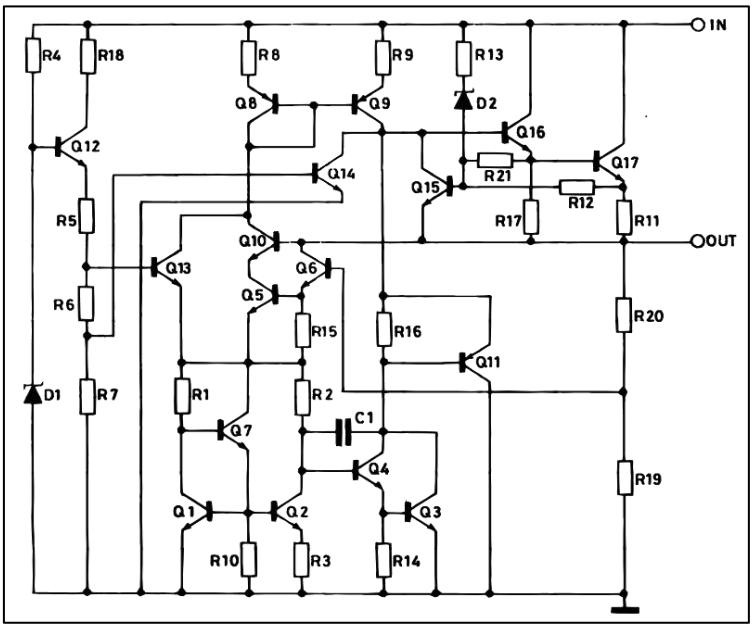
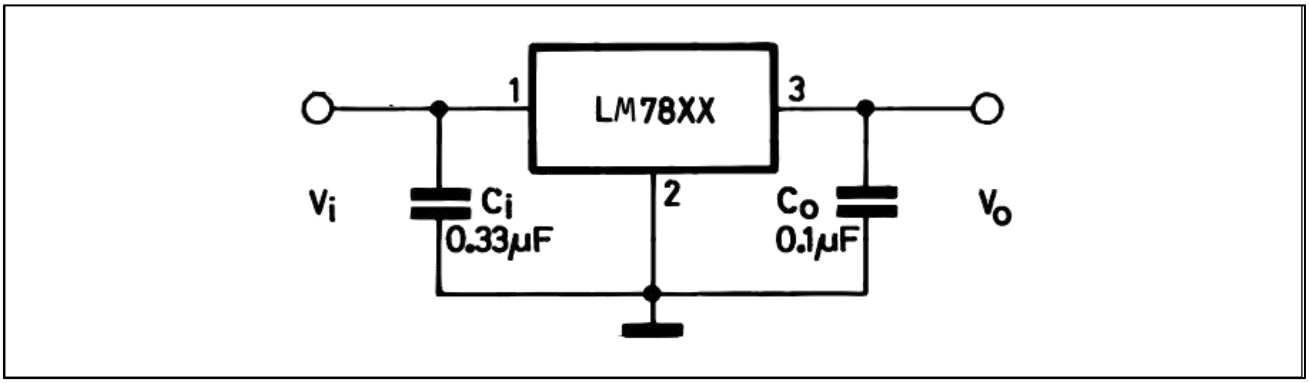


Figure 3:Application Circuits



TEST CIRCUITS

Figure 4:DC Parameter

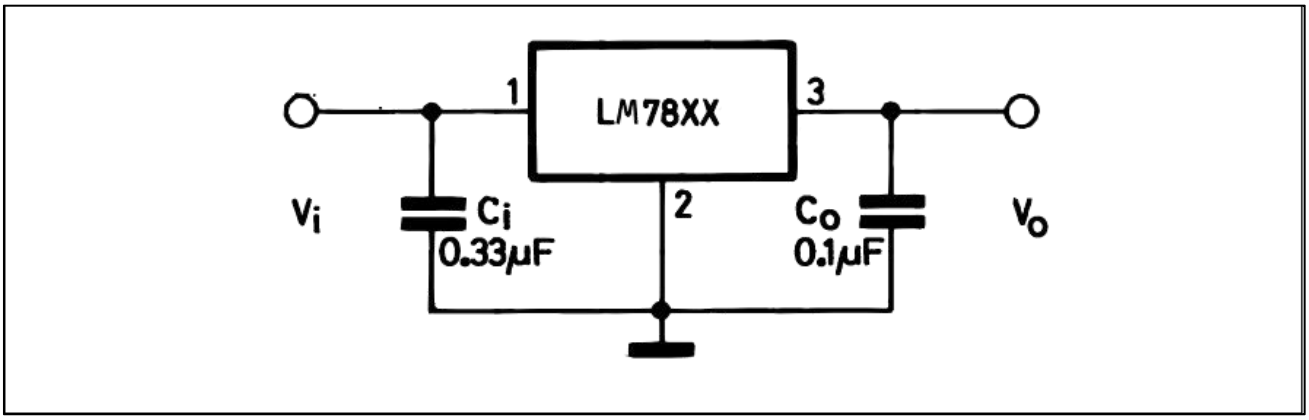


Figure 5:Load Regulation

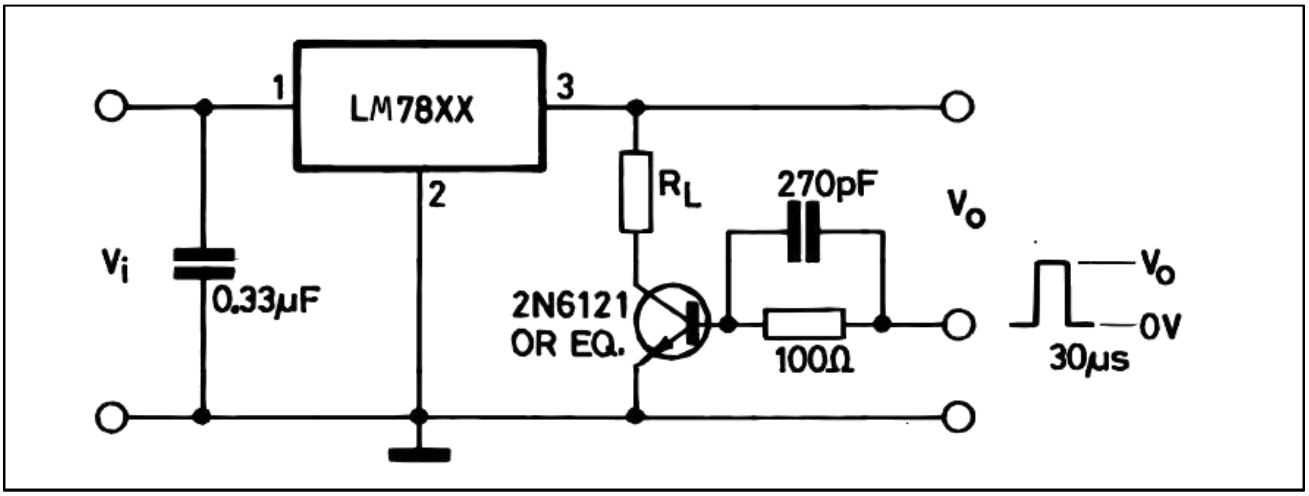
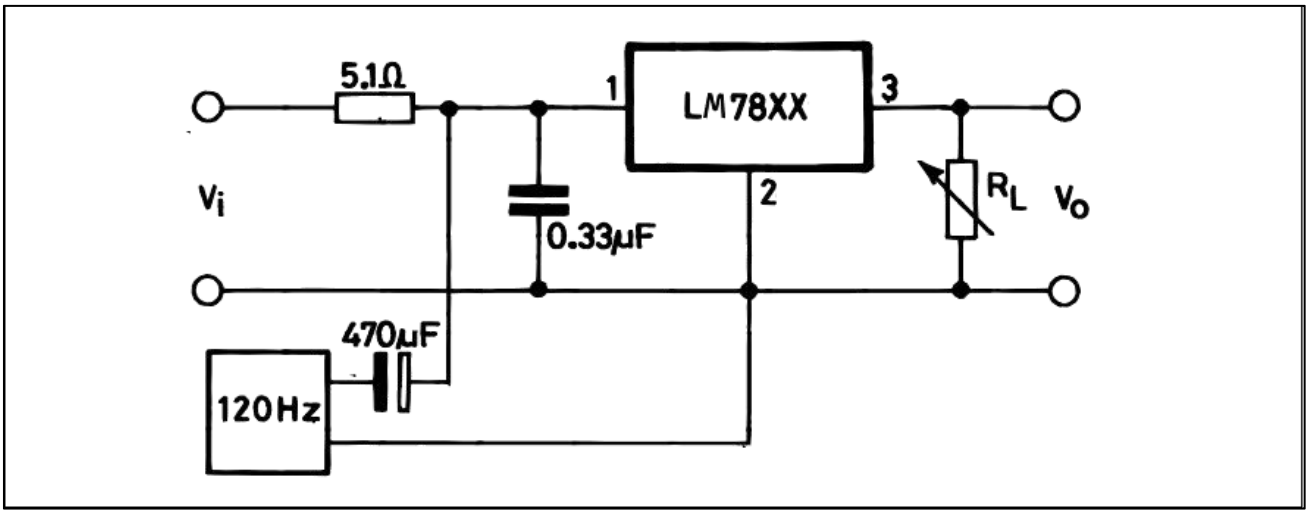


Figure 6:Ripple Rejection



Electrical Characteristics Of LM7805C

(refer to the test circuits, T_J = 0 to 125°C, V_I = 10V, I_O = 500 mA, C_I = 0.33 μF, C_O = 0.1 μF unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	4.8	5	5.2	V
V_O	Output Voltage	I_O = 5 mA to 1 A $P_O \le$ 15W V_I = 7 to 20 V	4.75	5	5.25	V
$\triangle V_O$(*)	Line Regulation	V_I = 7 to 25 V T_J = 25°C		3	100	mV
		V_I = 8 to 12 V T_J = 25°C		1	50	
$\triangle V_O$(*)	Load Regulation	I_O = 5 mA to 1.5 A T_J = 25°C			100	mV
		I_O = 250 to 750 mA T_J = 25°C			50	
I_d	Quiescent Current	T_J = 25°C			8	mA
$\triangle I_d$	Quiescent Current Change	I_O = 5 mA to 1 A			0.5	mA
		V_I = 7 to 25 V			0.8	
$\triangle V_O/\triangle T$	Output Voltage Drift	I_O = 5 mA		-1.1		mV/°C
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		40		μV/V_O
SVR	Supply Voltage Rejection	V_I = 8 to 18 V f = 120Hz	62			dB
V_d	Dropout Voltage	I_O = 1 A T_J = 25°C		2		V
R_O	Output Resistance	f = 1 KHz		17		mΩ
I_{sc}	Short Circuit Current	V_I = 35 V T_J = 25°C		0.75		A
I_{scp}	Short Circuit Peak Current	T_J = 25°C		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in VO due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Electrical Characteristics Of LM7806C

(refer to the test circuits, T_J = 0 to 125°C, V_I = 11V,I_O = 500 mA, C_I = 0.33 μF, C_O = 0.1 μF unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	5.75	6	6.25	V
V_O	Output Voltage	I_O = 5 mA to 1 A P_O ≤ 15W V_I = 8 to 21 V	5.7	6	6.3	V
△V_O(*)	Line Regulation	V_I = 8 to 25 V T_J = 25°C			120	mV
		V_I = 9 to 13 V T_J = 25°C			60	
△V_O(*)	Load Regulation	I_O = 5 mA to 1.5 A T_J = 25°C			120	mV
		I_O = 250 to 750 mA T_J = 25°C			60	
I_d	Quiescent Current	T_J = 25°C			8	mA
△I_d	Quiescent Current Change	I_O = 5 mA to 1 A			0.5	mA
		V_I = 8 to 25 V			1.3	
△V_O/△T	Output Voltage Drift	I_O = 5 mA		-0.8		mV/°C
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		45		μV/V_O
SVR	Supply Voltage Rejection	V_I = 9 to 19 V f = 120Hz	59			dB
V_d	Dropout Voltage	I_O = 1 A T_J = 25°C		2		V
R_O	Output Resistance	f = 1 KHz		19		mΩ
I_{sc}	Short Circuit Current	V_I = 35 V T_J = 25°C		0.55		A
I_{scp}	Short Circuit Peak Current	T_J = 25°C		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in VO due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Electrical Characteristics Of LM7808C

(refer to the test circuits, T_J = 0 to 125°C, V_I = 14V, I_O = 500 mA, C_I = 0.33 μF, C_O = 0.1 μF unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	7.7	8	8.3	V
V_O	Output Voltage	I_O = 5 mA to 1 A P_O ≤ 15W V_I = 10.5 to 25 V	7.6	8	8.4	V
△V_O(*)	Line Regulation	V_I = 10.5 to 25 V T_J = 25°C			160	mV
		V_I = 11 to 17 V T_J = 25°C			80	
△V_O(*)	Load Regulation	I_O = 5 mA to 1.5 A T_J = 25°C			160	mV
		I_O = 250 to 750 mA T_J = 25°C			80	
I_d	Quiescent Current	T_J = 25°C			8	mA
△I_d	Quiescent Current Change	I_O = 5 mA to 1 A			0.5	mA
		V_I = 10.5 to 25 V			1	
△V_O/△T	Output Voltage Drift	I_O = 5 mA		-0.8		mV/°C
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		52		μV/V_O
SVR	Supply Voltage Rejection	V_I = 11.5 to 21.5 V f = 120Hz	56			dB
V_d	Dropout Voltage	I_O = 1 A T_J = 25°C		2		V
R_O	Output Resistance	f = 1 KHz		16		mΩ
I_{sc}	Short Circuit Current	V_I = 35 V T_J = 25°C		0.45		A
I_{scp}	Short Circuit Peak Current	T_J = 25°C		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in VO due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Electrical Characteristics Of LM7809C

(refer to the test circuits, T_J = 0 to 125°C, V_I = 15V,I_O = 500 mA, C_I = 0.33 μF, C_O = 0.1 μF unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	8.64	9	9.36	V
V_O	Output Voltage	I_O = 5 mA to 1 A P_O ≤ 15W V_I = 11.5 to 26 V	8.55	9	9.45	V
△V_O(*)	Line Regulation	V_I = 11.5 to 26 V T_J = 25°C			180	mV
		V_I = 12 to 18 V T_J = 25°C			90	
△V_O(*)	Load Regulation	I_O = 5 mA to 1.5 A T_J = 25°C			180	mV
		I_O = 250 to 750 mA T_J = 25°C			90	
I_d	Quiescent Current	T_J = 25°C			8	mA
△I_d	Quiescent Current Change	I_O = 5 mA to 1 A			0.5	mA
		V_I = 11.5 to 26 V			1	
△V_O/△T	Output Voltage Drift	I_O = 5 mA		-1		mV/°C
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		70		μV/V_O
SVR	Supply Voltage Rejection	V_I = 12 to 23 V f = 120Hz	55			dB
V_d	Dropout Voltage	I_O = 1 A T_J = 25°C		2		V
R_O	Output Resistance	f = 1 KHz		17		mΩ
I_{sc}	Short Circuit Current	V_I = 35 V T_J = 25°C		0.40		A
I_{scp}	Short Circuit Peak Current	T_J = 25°C		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in VO due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Electrical Characteristics Of LM7810C

(refer to the test circuits, T_J = 0 to 125°C, V_I = 16V,I_O = 500 mA, C_I = 0.33 μF, C_O = 0.1 μF unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	9.6	10	10.4	V
V_O	Output Voltage	I_O = 5 mA to 1 A P_O ≤ 15W V_I = 12.5 to 26 V	9.5	10	10.5	V
△V_O(*)	Line Regulation	V_I = 12.5 to 26 V T_J = 25°C			200	mV
		V_I = 13.5 to 19 V T_J = 25°C			100	
△V_O(*)	Load Regulation	I_O = 5 mA to 1.5 A T_J = 25°C			200	mV
		I_O = 250 to 750 mA T_J = 25°C			100	
I_d	Quiescent Current	T_J = 25°C			8	mA
△I_d	Quiescent Current Change	I_O = 5 mA to 1 A			0.5	mA
		V_I = 12.5 to 26 V			1	
△V_O/△T	Output Voltage Drift	I_O = 5 mA		-1		mV/°C
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		70		μV/V_O
SVR	Supply Voltage Rejection	V_I = 13 to 23 V f = 120Hz	55			dB
V_d	Dropout Voltage	I_O = 1 A T_J = 25°C		2		V
R_O	Output Resistance	f = 1 KHz		17		mΩ
I_{sc}	Short Circuit Current	V_I = 35 V T_J = 25°C		0.40		A
I_{scp}	Short Circuit Peak Current	T_J = 25°C		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in VO due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Electrical Characteristics Of LM7812C

(refer to the test circuits, T_J = 0 to 125°C, V_I = 19V, I_O = 500 mA, C_I = 0.33 μF, C_O = 0.1 μF unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	11.5	12	12.5	V
V_O	Output Voltage	I_O = 5 mA to 1 A $P_O \le$ 15W V_I = 14.5 to 27 V	11.4	12	12.6	V
$\triangle V_O$(*)	Line Regulation	V_I = 14.5 to 30 V T_J = 25°C			240	mV
		V_I = 16 to 22 V T_J = 25°C			120	
$\triangle V_O$(*)	Load Regulation	I_O = 5 mA to 1.5 A T_J = 25°C			240	mV
		I_O = 250 to 750 mA T_J = 25°C			120	
I_d	Quiescent Current	T_J = 25°C			8	mA
$\triangle I_d$	Quiescent Current Change	I_O = 5 mA to 1 A			0.5	mA
		V_I = 14.5 to 30 V			1	
$\triangle V_O/\triangle T$	Output Voltage Drift	I_O = 5 mA		-1		mV/°C
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		75		$\mu V/V_O$
SVR	Supply Voltage Rejection	V_I = 15 to 25 V f = 120Hz	55			dB
V_d	Dropout Voltage	I_O = 1 A T_J = 25°C		2		V
R_O	Output Resistance	f = 1 KHz		18		mΩ
I_{sc}	Short Circuit Current	V_I = 35 V T_J = 25°C		0.35		A
I_{scp}	Short Circuit Peak Current	T_J = 25°C		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in VO due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Electrical Characteristics Of LM7815C

(refer to the test circuits, T_J = 0 to 125°C, V_I = 23V,I_O = 500 mA, C_I = 0.33 μF, C_O = 0.1 μF unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	14.5	15	15.6	V
V_O	Output Voltage	I_O = 5 mA to 1 A $P_O \le$ 15W V_I = 17.5 to 30 V	14.25	15	15.75	V
$\triangle V_O$(*)	Line Regulation	V_I = 17.5 to 30 V T_J = 25°C			300	mV
		V_I = 20 to 26 V T_J = 25°C			150	
$\triangle V_O$(*)	Load Regulation	I_O = 5 mA to 1.5 A T_J = 25°C			300	mV
		I_O = 250 to 750 mA T_J = 25°C			150	
I_d	Quiescent Current	T_J = 25°C			8	mA
$\triangle I_d$	Quiescent Current Change	I_O = 5 mA to 1 A			0.5	mA
		V_I = 17.5 to 30 V			1	
$\triangle V_O/\triangle T$	Output Voltage Drift	I_O = 5 mA		-1		mV/°C
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		90		$\mu V/V_O$
SVR	Supply Voltage Rejection	V_I = 18.5 to 28.5 V f = 120Hz	54			dB
V_d	Dropout Voltage	I_O = 1 A T_J = 25°C		2		V
R_O	Output Resistance	f = 1 KHz		19		mΩ
I_{sc}	Short Circuit Current	V_I = 35 V T_J = 25°C		0.23		A
I_{scp}	Short Circuit Peak Current	T_J = 25°C		2.2		A

(*) Load and line regulation are specified at constant junction temperature. Changes in VO due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Electrical Characteristics Of LM7818C

(refer to the test circuits, T_J = 0 to 125°C, V_I = 26V, I_O = 500 mA, C_I = 0.33 μF, C_O = 0.1 μF unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	17.3	18	18.7	V
V_O	Output Voltage	I_O = 5 mA to 1 A $P_O \leq$ 15W V_I = 21 to 33 V	17.1	18	18.9	V
$\triangle V_O$(*)	Line Regulation	V_I = 21 to 33 V T_J = 25°C			360	mV
		V_I = 24 to 30 V T_J = 25°C			180	
$\triangle V_O$(*)	Load Regulation	I_O = 5 mA to 1.5 A T_J = 25°C			360	mV
		I_O = 250 to 750 mA T_J = 25°C			180	
I_d	Quiescent Current	T_J = 25°C			8	mA
$\triangle I_d$	Quiescent Current Change	I_O = 5 mA to 1 A			0.5	mA
		V_I = 21 to 33 V			1	
$\triangle V_O/\triangle T$	Output Voltage Drift	I_O = 5 mA		-1		mV/°C
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		110		μV/V_O
SVR	Supply Voltage Rejection	V_I = 22 to 32 V f = 120Hz	53			dB
V_d	Dropout Voltage	I_O = 1 A T_J = 25°C		2		V
R_O	Output Resistance	f = 1 KHz		22		mΩ
I_{sc}	Short Circuit Current	V_I = 35 V T_J = 25°C		0.20		A
I_{scp}	Short Circuit Peak Current	T_J = 25°C		2.1		A

(*) Load and line regulation are specified at constant junction temperature. Changes in VO due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Electrical Characteristics Of LM7824C

(refer to the test circuits, T_J = 0 to 125°C, V_I = 33V, I_O = 500 mA, C_I = 0.33 µF, C_O = 0.1 µF unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	23	24	25	V
V_O	Output Voltage	I_O = 5 mA to 1 A P_O ≤ 15W V_I = 27 to 35 V	22.8	24	25.2	V
△V_O(*)	Line Regulation	V_I = 27 to 35 V T_J = 25°C			480	mV
		V_I = 30 to 35 V T_J = 25°C			240	
△V_O(*)	Load Regulation	I_O = 5 mA to 1.5 A T_J = 25°C			480	mV
		I_O = 250 to 750 mA T_J = 25°C			240	
I_d	Quiescent Current	T_J = 25°C			8	mA
△I_d	Quiescent Current Change	I_O = 5 mA to 1 A			0.5	mA
		V_I = 27 to 35 V			1	
△V_O/△T	Output Voltage Drift	I_O = 5 mA		-1.5		mV/°C
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		170		µV/V_O
SVR	Supply Voltage Rejection	V_I = 28 to 35 V f = 120Hz	50			dB
V_d	Dropout Voltage	I_O = 1 A T_J = 25°C		2		V
R_O	Output Resistance	f = 1 KHz		28		mΩ
I_{sc}	Short Circuit Current	V_I = 35 V T_J = 25°C		0.15		A
I_{scp}	Short Circuit Peak Current	T_J = 25°C		2.1		A

(*) Load and line regulation are specified at constant junction temperature. Changes in VO due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

Figure 7: Dropout Voltage vs Junction Temperature

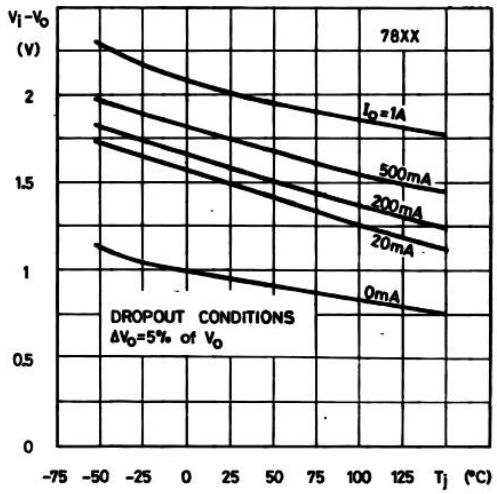


Figure 8: Peak Output Current vs Input/output Differential Voltage

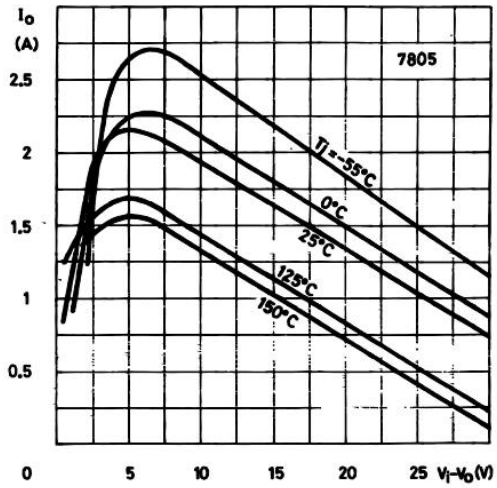


Figure 9: Supply Voltage Rejection vs Frequency

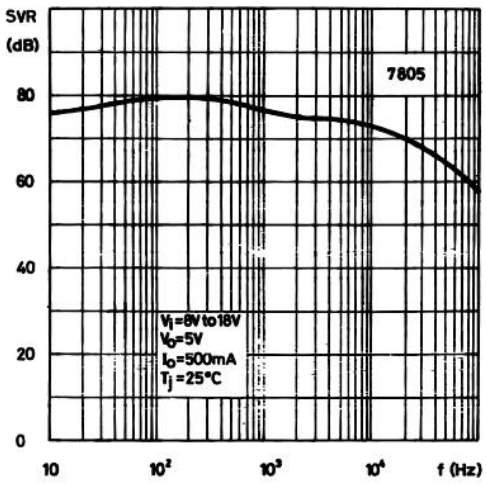


Figure 10: Output Voltage vs Junction Temperature

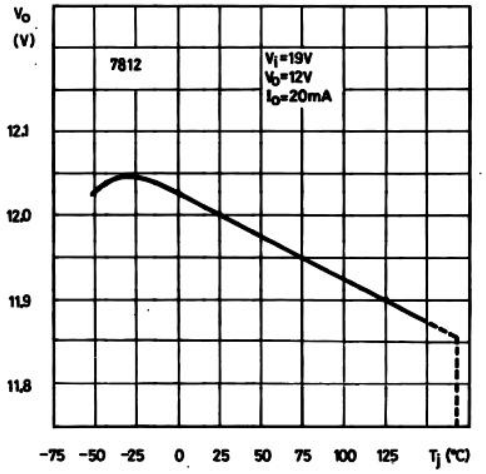


Figure 11: Output Impedance vs Frequency

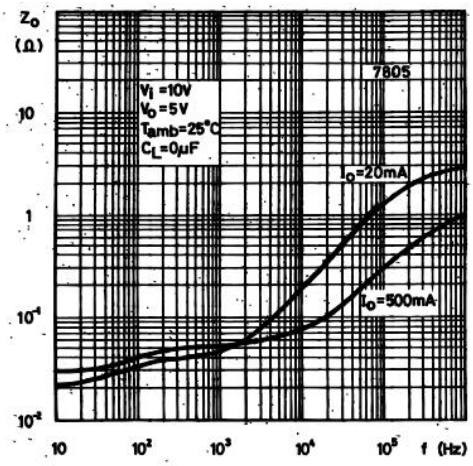


Figure 12: Quiescent Current vs Junction Temperature

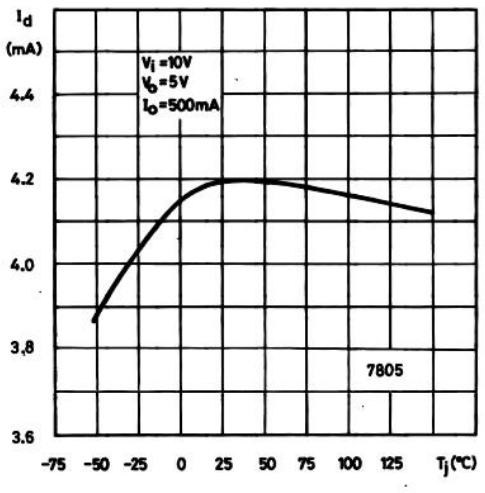


Figure 13: Load Transient Response

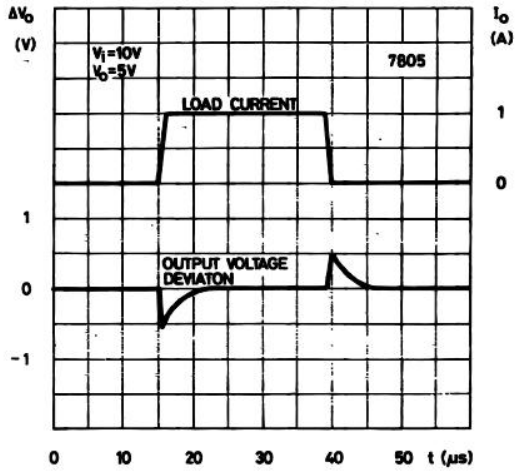


Figure 14: Line Transient Response

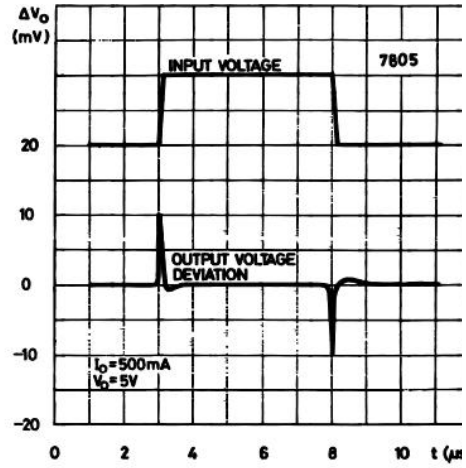


Figure 15: Quiescent Current vs Input Voltage

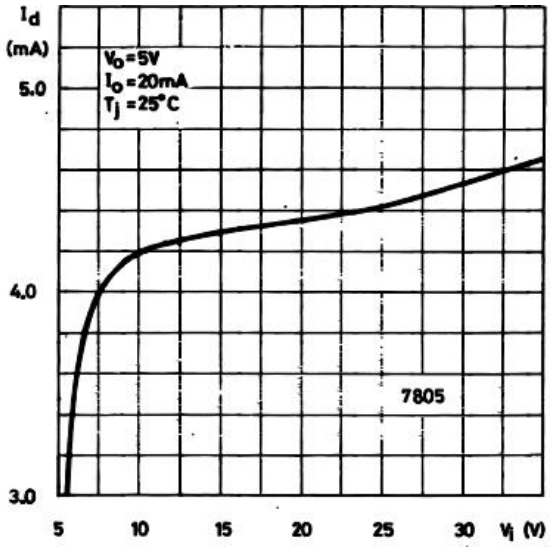
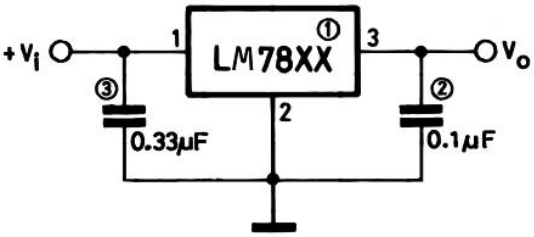


Figure 16: Fixed Output Regulator



NOTE:

1. To specify an output voltage, substitute voltage value for "XX".
2. Although no output capacitor is need for stability, it does improve transient response.
3. Required if regulator is locate an appreciable distance from power supply filter.

Figure 17: Current Regulator

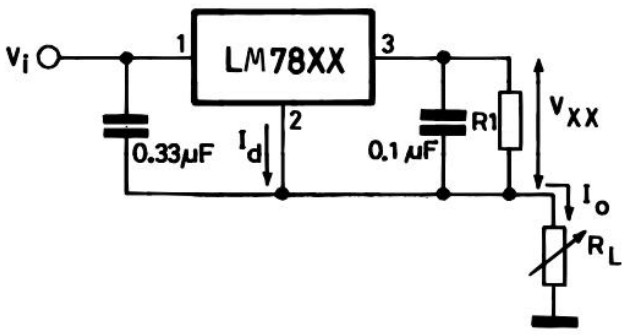


Figure 18: Circuit for Increasing Output Voltage

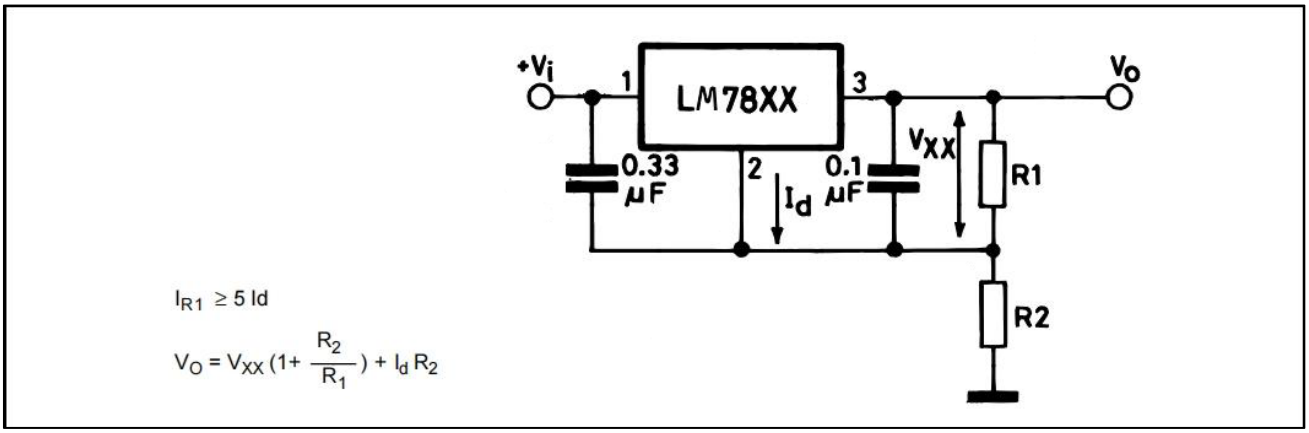


Figure 19: Adjustable Output Regulator (7 to 30V)

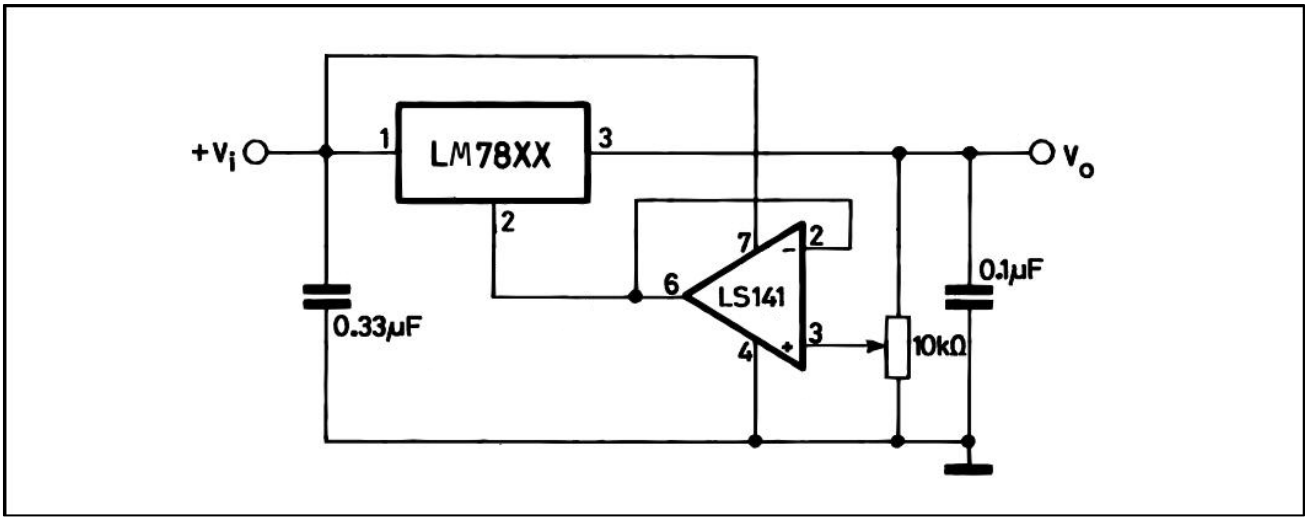
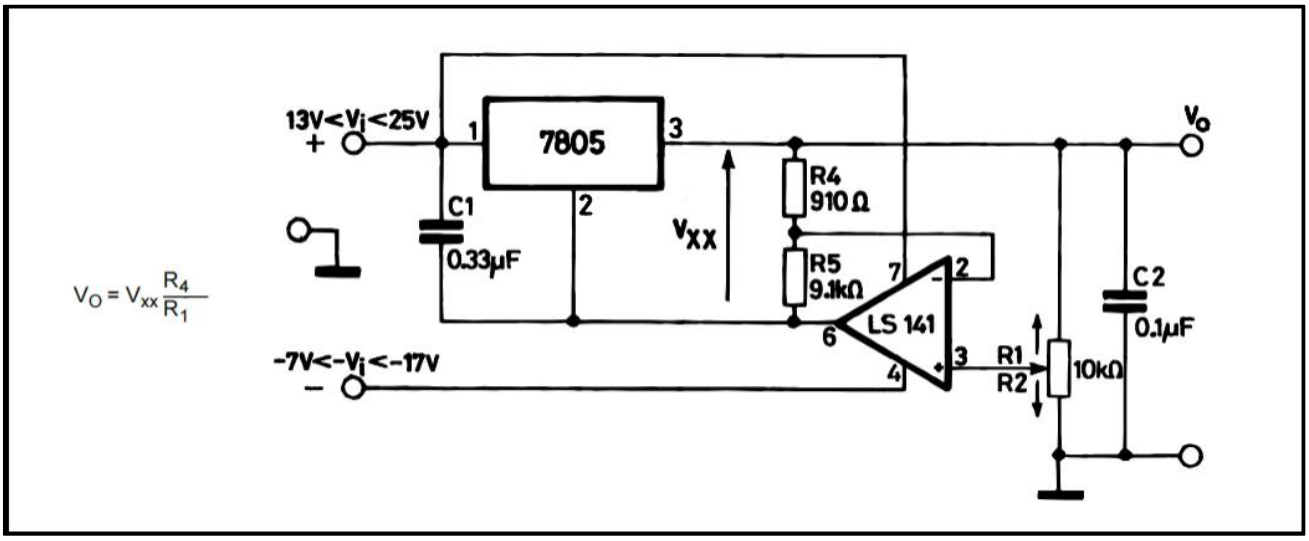
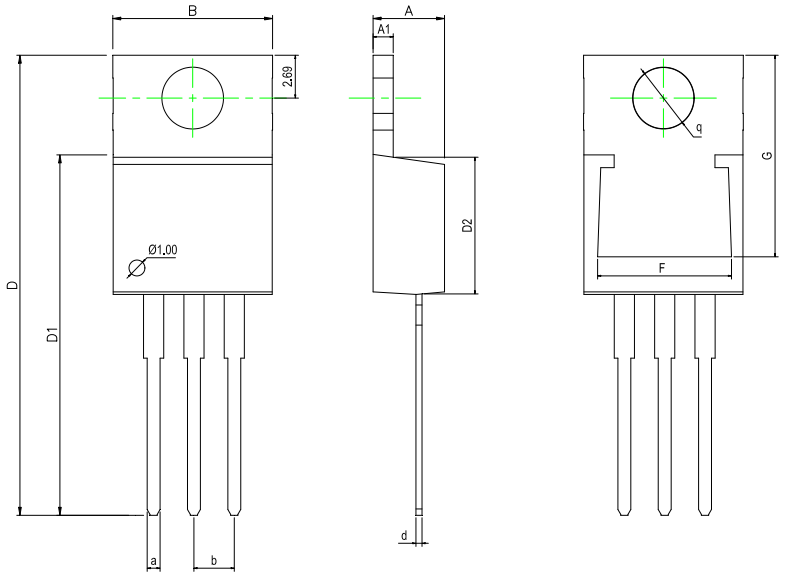


Figure 20: 0.5 to 10V Regulator



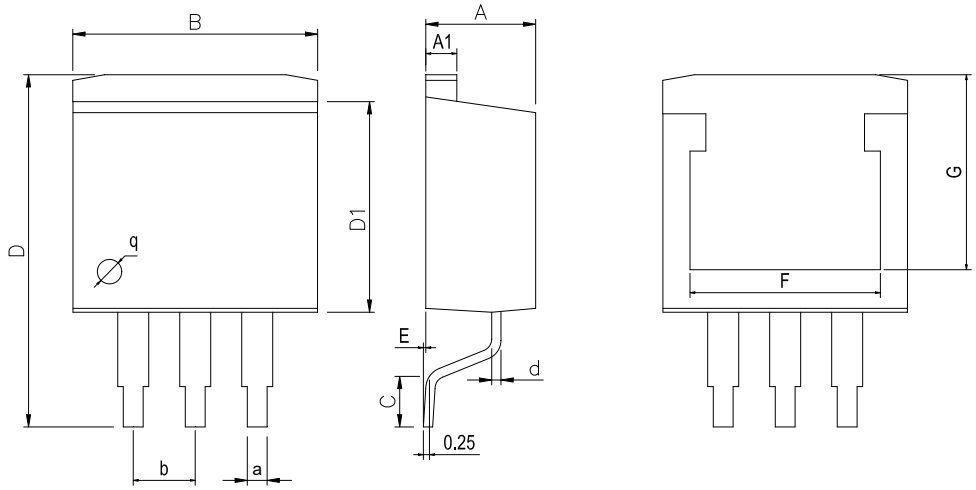
Physical Dimensions

TO-220-3



Dimensions In Millimeters(TO-220-3)												
Symbol:	A	A1	B	D	D1	D2	F	G	a	d	b	q
Min:	4.45	1.22	10	28.2	22.22	8.50	8.30	12.55	0.71	0.33	2.54	3.80
Max:	4.62	1.32	10.4	28.9	22.62	9.10	8.55	12.75	0.97	0.42	BSC	TYP

TO-263-3



Dimensions In Millimeters(TO-263-3)											
Symbol:	A	A1	B	C	D	D1	E	F	G	a	b
Min:	4.45	1.22	10	1.89	13.7	8.38	0	8.332	7.70	0.71	2.54BSC
Max:	4.62	1.32	10.4	2.19	14.6	8.89	0.305	8.552	8.10	0.97	

Revision History

DATE	REVISION	PAGE
2015-6-22	New	1-20
2024-10-8	Updated Thermal Data	3

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