1、General Description

The CW78XXCS/ACS/HCS/CZ series are three-terminal positive voltage regulators with fixed output voltage, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shutdown and safe operating area protection, making it essentially indestructible. With adequate heat-sinking they can deliver output currents in excess of 1.0 A.

Features

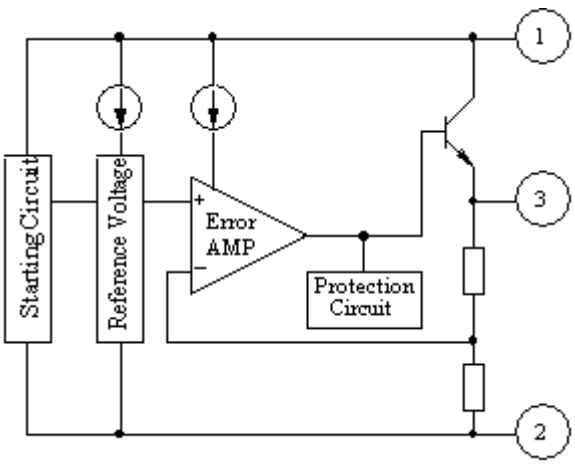
- Output current up to 1A
- Few external components and high flexibility
- Internal thermal and overload protection
- Output transistor safe-area compensation
- Internal short circuit current limiting
- Package: CW78XXCS: TO-220AB
  CW78XXACS: TO-220F
  CW78XXHCS: TO-220, TO-220HJ
  CW78XXCZ: TO-263-2L, TO-252-2L

Output Voltage of the CW78XXCS/ACS/HCS/CZ series:

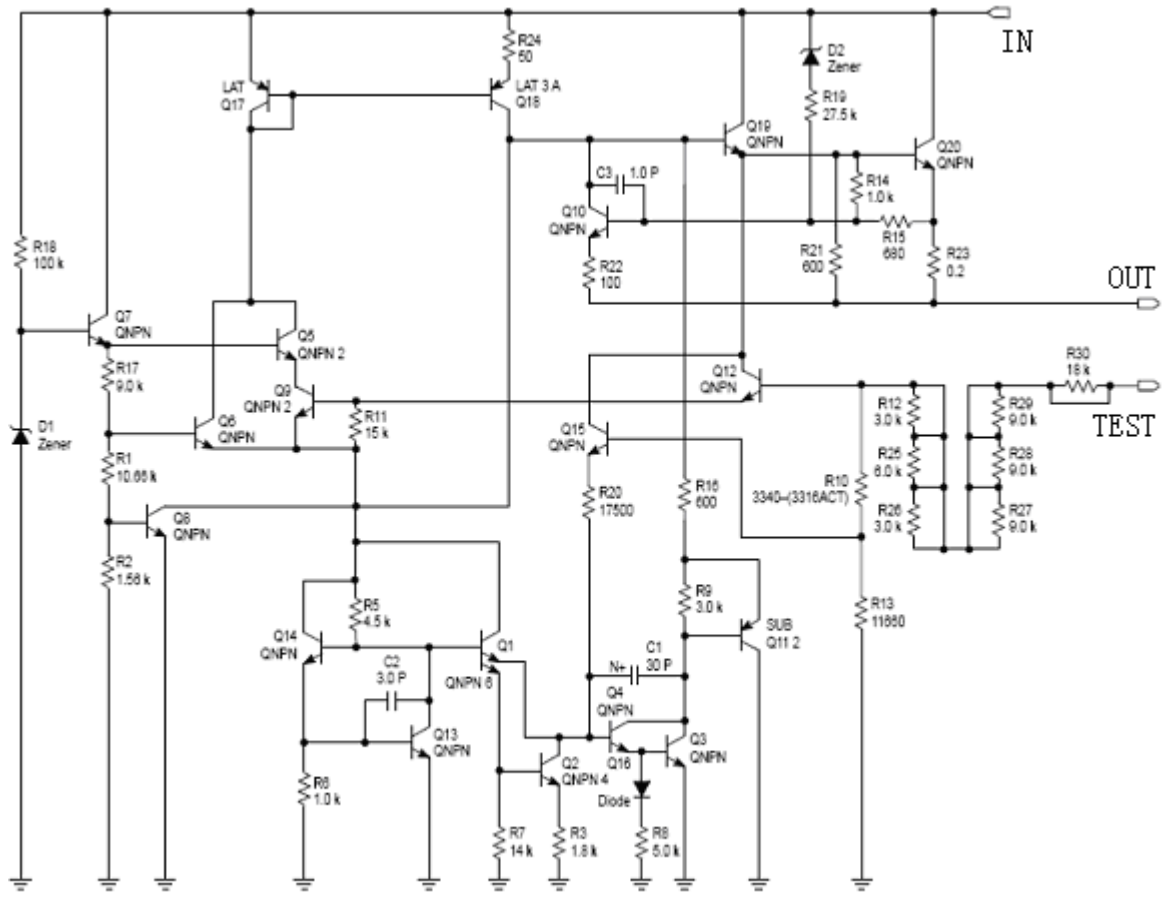
Type	Output Voltage (typ.)	Type	Output Voltage (typ.)
CW7805CS/ACS/HCS/CZ	5V	CW7810CS/ACS/HCS/CZ	10V
CW7806CS/ACS/HCS/CZ	6V	CW7812CS/ACS/HCS/CZ	12V
CW7808CS/ACS/HCS/CZ	8V	CW7815CS/ACS/HCS/CZ	15V
CW7809CS/ACS/HCS/CZ	9V	CW7818CS/ACS/HCS/CZ	18V

2、Function Diagram and Pin Description

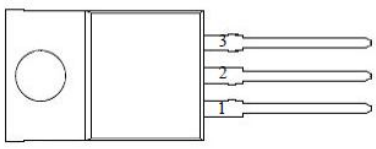
2. 1、Function Diagram



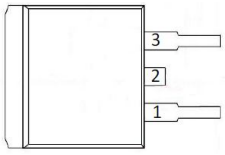
2. 2、Equivalent Circuit



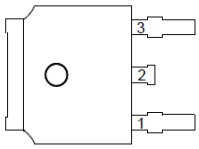
2. 3、Pin Description



TO-220AB/HJ/F



TO-263-2L



TO-252-2L

Pin	Symbol	Function	Pin	Symbol	Function
1	V_{IN}	Input Voltage	3	V_{OUT}	Output Voltage
2	GND	Ground			

3、Electrical Characteristics

3. 1、Absolute Maximum Ratings

Unless otherwise specified, T_{amb}=25℃

Parameter	Symbol	Value			Unit
		TO-220	TO-263	TO-252	
Input Voltage	V_{IN}	7.5~35			V
Power Dissipation	P_D	Internal Limit			W
Thermal Resistance Junction-air	$R_{\theta JA}$	65	70	105	℃/W
Thermal Resistance Junction-cases	$R_{\theta JC}$	5.0	5.0	5.0	℃/W
Operation Temperature	T_{OPR}	-30~125			℃
Storage Temperature	T_{stg}	-65~150			℃
Maximum Junction Temperature	$T_{J(MAX)}$	150			℃

3. 2、Electrical Characteristics

CW7805CS/ACS/HCS/CZ

Unless otherwise specified, V_{IN}=10V, I_O=100mA, -30℃≤T_J≤125℃

Parameter	Symbol	Test Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	V_O	T_J=25℃	4.8	5.0	5.2	V
		5mA≤I_O≤750mA 8V≤V_{IN}≤20V P_D≤10W	4.75	5.0	5.25	
Line Regulation (Note)	R_{EGV}	7.5V≤V_{IN}≤25V		0.5	20	mV
		8V≤V_{IN}≤12V		0.8	10	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A		1.3	25	mV
		250mA≤I_O≤750mA		0.9	13	
Quiescent Current	I_Q	T_J=25℃		3.2	8.0	mA
Quiescent Current Change	ΔI_Q	8V≤V_{IN}≤25V			1.3	mA
		5mA≤I_O≤750mA			0.5	
Ripple Rejection	R.R	f=120Hz 8V≤V_{IN}≤18V		68		dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25℃		2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz		10		μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_J=25℃		0.2		A
Output Resistance	Ro	f=1kHz		15		mΩ
Average Temperature Coefficient of Output Voltage	$\Delta V/T$	I_O=5mA T_J=0~125℃		-0.3		mV/℃

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

CW7806CS/ACS/HCS/CZ

Unless otherwise specified, V_{IN}=11V, I_O=100mA, -30℃≤T_J≤125℃

Parameter	Symbol	Test Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	V_O	T_J=25℃	5.75	6.0	6.25	V
		5mA≤I_O≤750mA P_D≤10W 9V≤V_{IN}≤21V	5.7	6.0	6.3	
Line Regulation (Note)	R_{EGV}	8.0V≤V_{IN}≤25V		0.5	24	mV
		9V≤V_{IN}≤13V		0.8	12	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A		1.3	30	mV
		250mA≤I_O≤750mA		1.0	15	
Quiescent Current	I_Q	T_J=25℃		3.3	8.0	mA
Quiescent Current Change	ΔI_Q	9.0V≤V_{IN}≤25V			1.3	mA
		5mA≤I_O≤750A			0.5	
Ripple Rejection	R.R	f=120Hz 9V≤V_{IN}≤19V		65		dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25℃		2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz		10		μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_A=25℃		0.2		A
Output Resistance	Ro	f=1kHz		15		mΩ
Average Temperature Coefficient of Output Voltage	$\Delta V/T$	I_O=5mA T_J=0~125℃		-0.3		mV/℃

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

CW7808CS/ACS/HCS/CZ

Unless otherwise specified, V_{IN}=13V, I_O=100mA, -30℃≤T_J≤125℃

Parameter	Symbol	Test Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	V_O	T_J=25℃	7.7	8.0	8.3	V
		5mA≤I_O≤750mA P_D≤10W 10.5V≤V_{IN}≤23V	7.6	8.0	8.4	
Line Regulation (Note)	R_{EGV}	10.5V≤V_{IN}≤25V		2.5	32	mV
		11V≤V_{IN}≤17V		1.7	16	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A		6.0	38	mV
		250mA≤I_O≤750mA		3.0	19	
Quiescent Current	I_Q	T_J=25℃		3.3	8.0	mA
Quiescent Current Change	ΔI_Q	11.5V≤V_{IN}≤25V			1.0	mA
		5mA≤I_O≤750mA			0.5	
Ripple Rejection	R.R	f=120Hz 11.5V≤V_{IN}≤18.0V		62		dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25℃		2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz		10		μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_A=25℃		0.2		A
Output Resistance	Ro	f=1kHz		15		mΩ
Average Temperature Coefficient of Output Voltage	$\Delta V/T$	I_O=5mA T_J=0~125℃		-0.4		mV/℃

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

CW7809CS/ACS/HCS/CZ

Unless otherwise specified, V_{IN}=14V, I_O=100mA, -30℃≤T_J≤125℃

Parameter	Symbol	Test Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	V_O	T_J=25℃	8.65	9.0	9.35	V
		5mA≤I_O≤750mA P_D≤10W 11.5V≤V_{IN}≤24V	8.55	9.0	9.45	
Line Regulation (Note)	R_{EGV}	11.5V≤V_{IN}≤26V		3.0	36	mV
		11.5V≤V_{IN}≤17V		1.8	18	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤5A		7.0	40	mV
		250mA≤I_O≤750mA		3.2	20	
Quiescent Current	I_Q	T_J=25℃		3.4	8.0	mA
Quiescent Current Change	ΔI_Q	11.5V≤V_{IN}≤26V			1.0	mA
		5mA≤I_O≤750mA			0.5	
Ripple Rejection	R.R	f=120Hz 12V≤V_{IN}≤22V		61		dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25℃		2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz		10		μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_A=25℃		0.2		A
Output Resistance	Ro	f=1kHz		15		mΩ
Average Temperature Coefficient of Output Voltage	$\Delta V/T$	I_O=5mA T_J=0~125℃		-0.5		mV/℃

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

CW7810CS/ACS/HCS/CZ

Unless otherwise specified, V_{IN}=15V, I_O=100mA, -30℃≤T_J≤125℃

Parameter	Symbol	Test Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	V_O	T_J=25℃	9.6	10.0	10.4	V
		5mA≤I_O≤750mA 12.5V≤V_{IN}≤25V P_D≤10W	9.5	10.0	10.5	
Line Regulation (Note)	R_{EGV}	12.5V≤V_{IN}≤27V		3.3	40	mV
		12.5V≤V_{IN}≤18V		2.0	20	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A		7.0	50	mV
		250mA≤I_O≤750mA		3.5	25	
Quiescent Current	I_Q	T_J=25℃		3.4	8.0	mA
Quiescent Current Change	ΔI_Q	12.5V≤V_{IN}≤27V			1.0	mA
		5mA≤I_O≤750mA			0.5	
Ripple Rejection	R.R	f=120Hz 13V≤V_{IN}≤23V		60		dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25℃		2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz		10		μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_A=25℃		0.2		A
Output Resistance	Ro	f=1kHz		15		mΩ
Average Temperature Coefficient of Output Voltage	$\Delta V/T$	I_O=5mA T_J=0~125℃		-0.6		mV/℃

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

CW7812CS/ACS/HCS/CZ

Unless otherwise specified, V_{IN}=17V, I_O=100mA, -30℃≤T_J≤125℃

Parameter	Symbol	Test Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	V_O	T_J=25℃	11.5	12.0	12.5	V
		5mA≤I_O≤750mA P_D≤10W 14.5V≤V_{IN}≤27V	11.4	12.0	12.6	
Line Regulation (Note)	R_{EGV}	14.5V≤V_{IN}≤30V		3.8	48	mV
		16V≤V_{IN}≤22V		2.2	24	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A		9.0	60	mV
		250mA≤I_O≤750mA		3.5	30	
Quiescent Current	I_Q	T_J=25℃		3.4	8.0	mA
Quiescent Current Change	ΔI_Q	15.0V≤V_{IN}≤30V			1.0	mA
		5mA≤I_O≤750mA			0.5	
Ripple Rejection	R.R	f=120Hz 15V≤V_{IN}≤25V		60		dB
Dropout Voltage	V_I-V_O	I_O=1A, T_J=25℃		2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz		10		μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_A=25℃		0.2		A
Output Resistance	Ro	f=1kHz		15		mΩ
Average Temperature Coefficient of Output Voltage	$\Delta V/T$	I_O=5mA T_J=0~125℃		-0.8		mV/℃

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

CW7815CS/ACS/HCS/CZ

Unless otherwise specified, V_{IN}=20V, I_O=100mA, -30℃≤T_J≤125℃

Parameter	Symbol	Test Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	V_O	T_J=25℃	14.4	15.0	15.6	V
		5mA≤I_O≤750mA P_D≤10W 17.5V≤V_{IN}≤30V	14.25	15.0	15.75	
Line Regulation (Note)	R_{EGV}	17.9V≤V_{IN}≤30V		5.0	60	mV
		20V≤V_{IN}≤26V		3.0	30	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A		10.0	75	mV
		250mA≤I_O≤750mA		3.5	38	
Quiescent Current	I_{CCQ}	T_J=25℃		3.5	8.0	mA
Quiescent Current Change	ΔI_{CCQ}	18.5V≤V_{IN}≤30V			1.0	mA
		5mA≤I_O≤750mA			0.5	
Ripple Rejection	R.R	f=120Hz 18.5V≤V_{IN}≤28.5V		58		dB
Dropout Voltage	V_I-V_O	I_O=1A T_J=25℃		2.0		V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz		10		μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_A=25℃		0.2		A
Average Temperature Coefficient of Output Voltage	$\Delta V/T$	I_O=5mA T_J=0~125℃		-1.0		mV/℃

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

CW7818CS/ACS/HCS/CZ

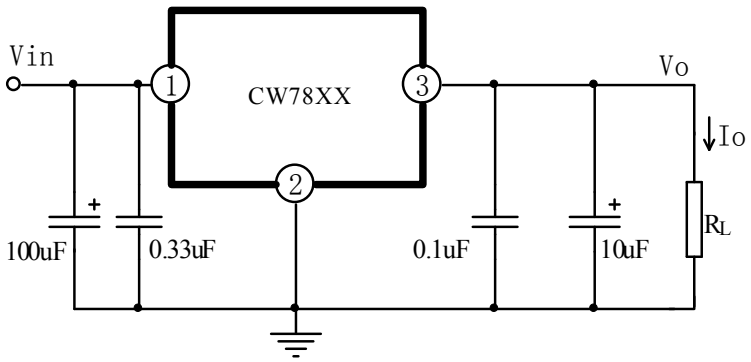
Unless otherwise specified, V_{IN}=23V, I_O=100mA, -30℃≤T_J≤125℃

Parameter	Symbol	Test Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	V_O	T_J=25℃	17.28	18.0	18.72	V
		5mA≤I_O≤750mA 21V≤V_{IN}≤33V P_D≤10W	17.1	18.0	18.9	
Line Regulation (Note)	R_{EGV}	21V≤V_{IN}≤33V		6.0	72	mV
		23V≤V_{IN}≤29V		3.6	36	
Load Regulation (Note)	R_{EGL}	5mA≤I_O≤1A		12	90	mV
		250mA≤I_O≤750mA		3.5	46	
Quiescent Current	I_{CCQ}	T_J=25℃		3.6	8.0	mA
Quiescent Current Change	ΔI_{CCQ}	21.5V≤V_{IN}≤33V			1.0	mA
		5mA≤I_O≤750mA			0.5	
Ripple Rejection	R.R	f=120Hz 22V≤V_{IN}≤32V		56		dB
Dropout Voltage	V_I-V_O	I_O=1A T_J=25℃		2.0	2.5	V
Output Noise Voltage	V_{NO}	f=10Hz~100kHz		10		μV/V_O
Short Circuit Current Limit	I_{SC}	V_{IN}=35V, T_A=25℃		0.2		A
Average Temperature Coefficient of Output Voltage	R_O	f=1kHz		15		mΩ
Average Temperature Coefficient of Output Voltage	$\Delta V/T$	I_O=5mA T_J=0~125℃		-1.0		mV/℃

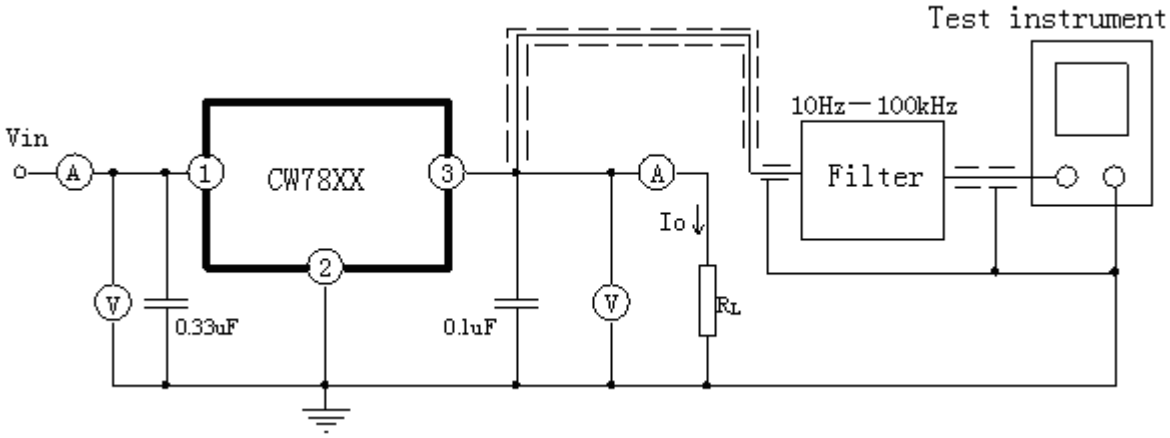
Note: Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.

4、Test Circuit

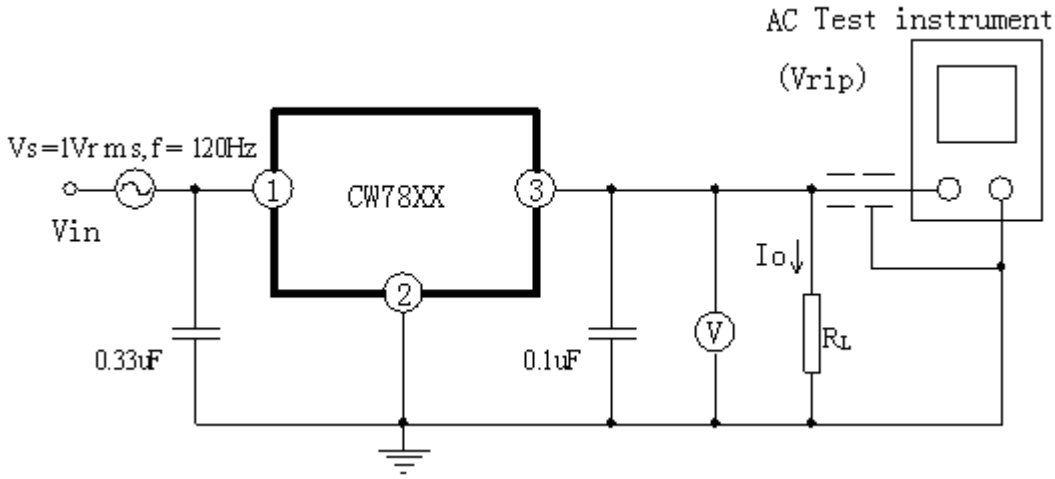
4. 1、Standard Test Circuit



4. 2、V_{NO} Test Circuit

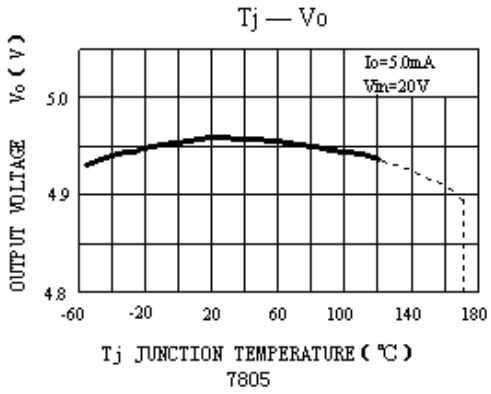


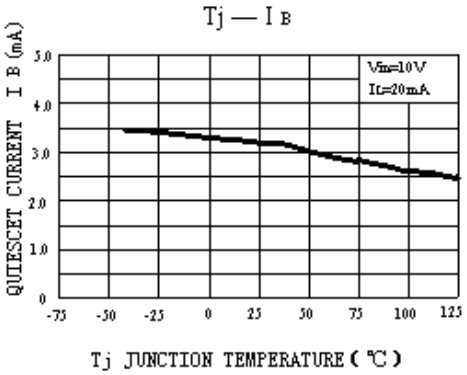
4. 3、Ripple Rejection Test Circuit

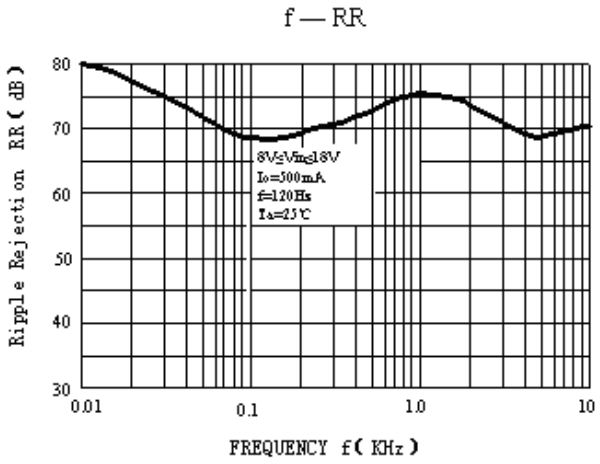


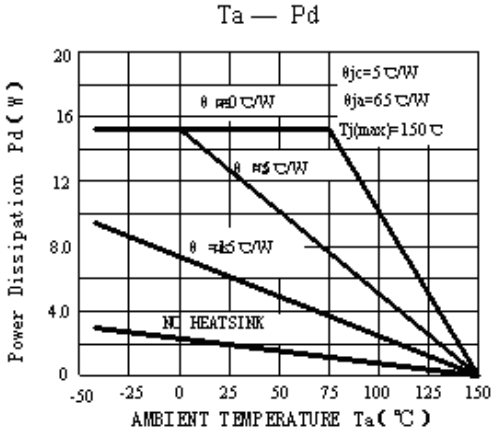
R.R=20log（1000/Vrip）

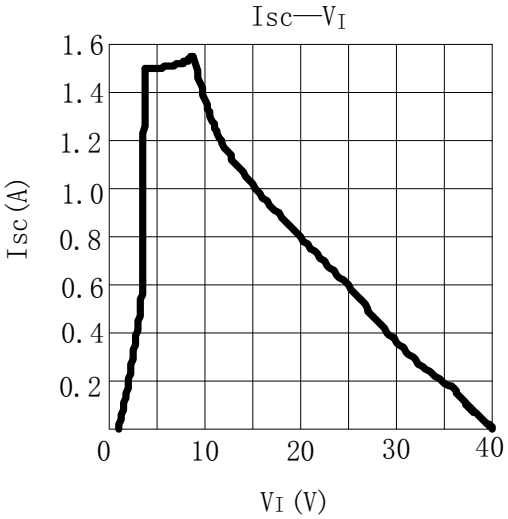
5、Characteristics Curve





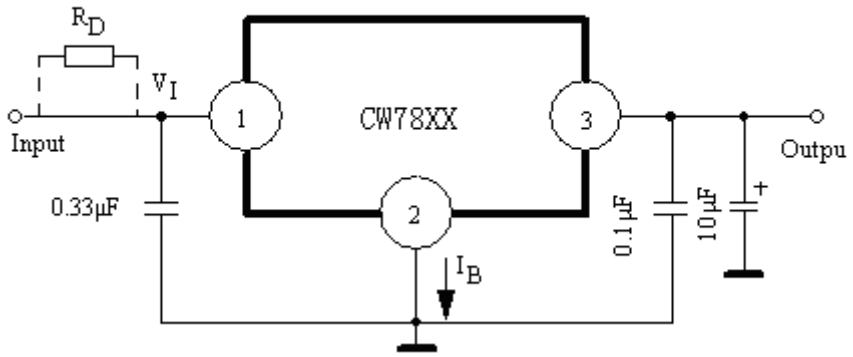




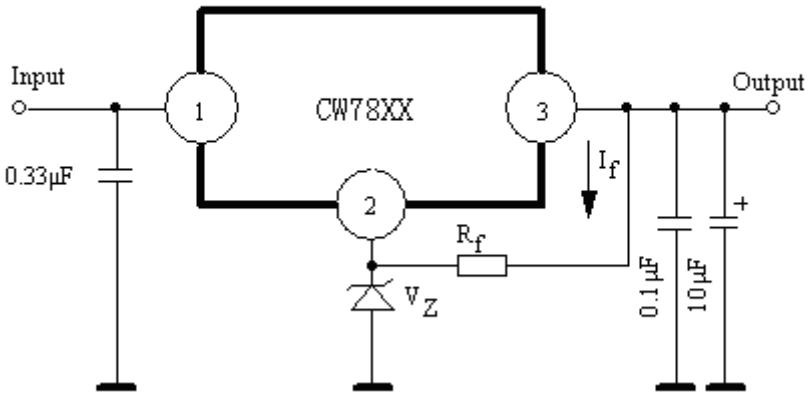


6、Typical Application Circuit

6. 1、Typical Application

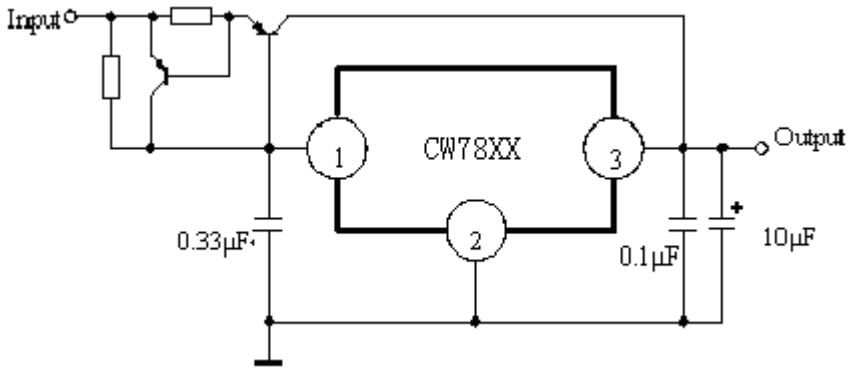


6. 2、Voltage Boost Regulator



$V_O=V_O(IC)+V_Z$, $I_f=V_O(IC)/R_f$, $I_f \geq 5mA$

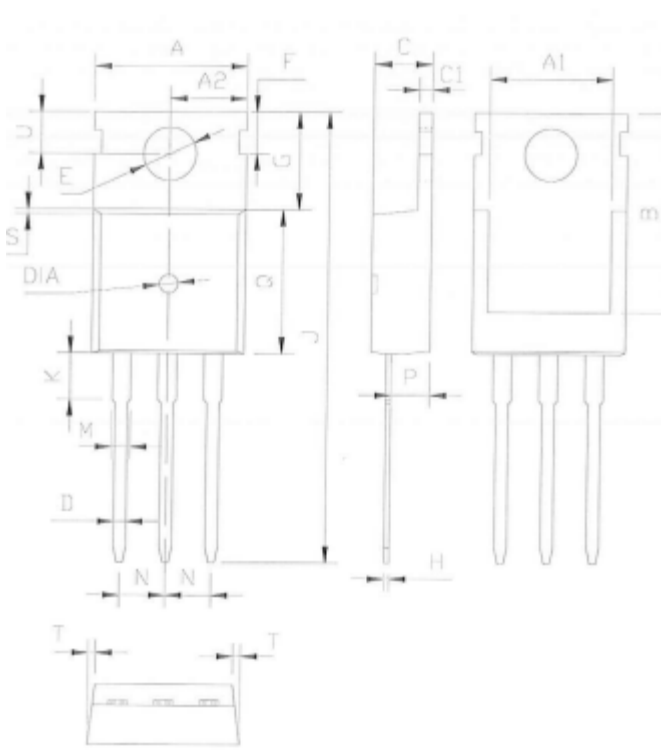
6. 3、Current Boost Regulator With Over Current Protection



7、Package Dimensions (Unit: mm)

7. 1、TO-220

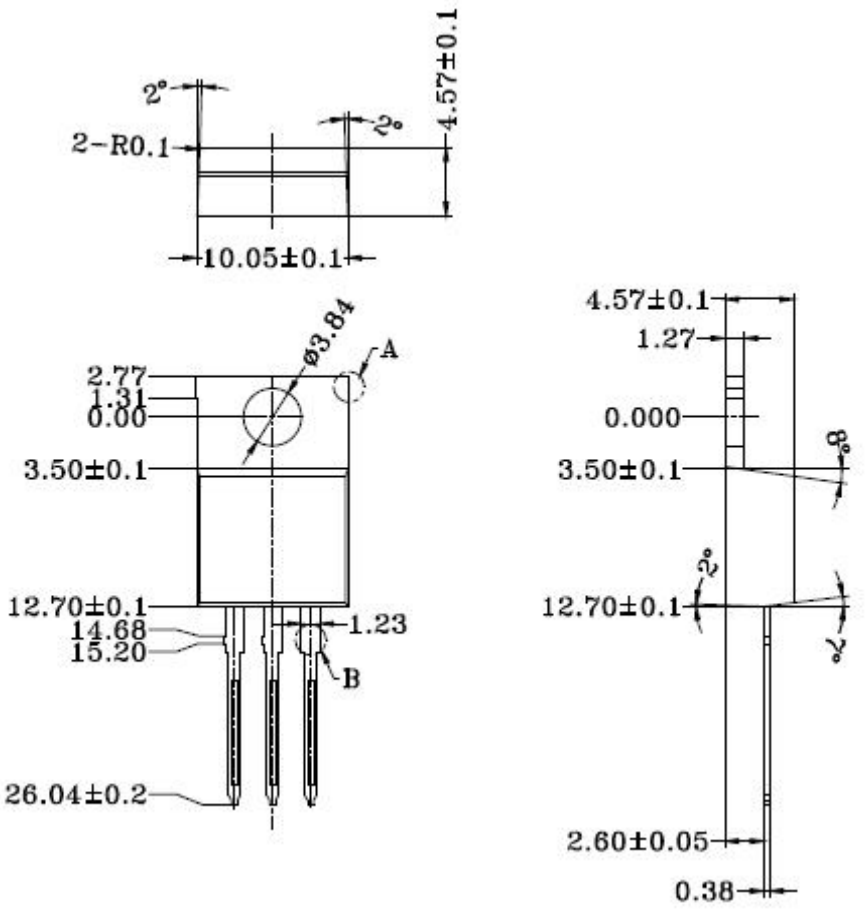
7. 1. 1、Package Outline



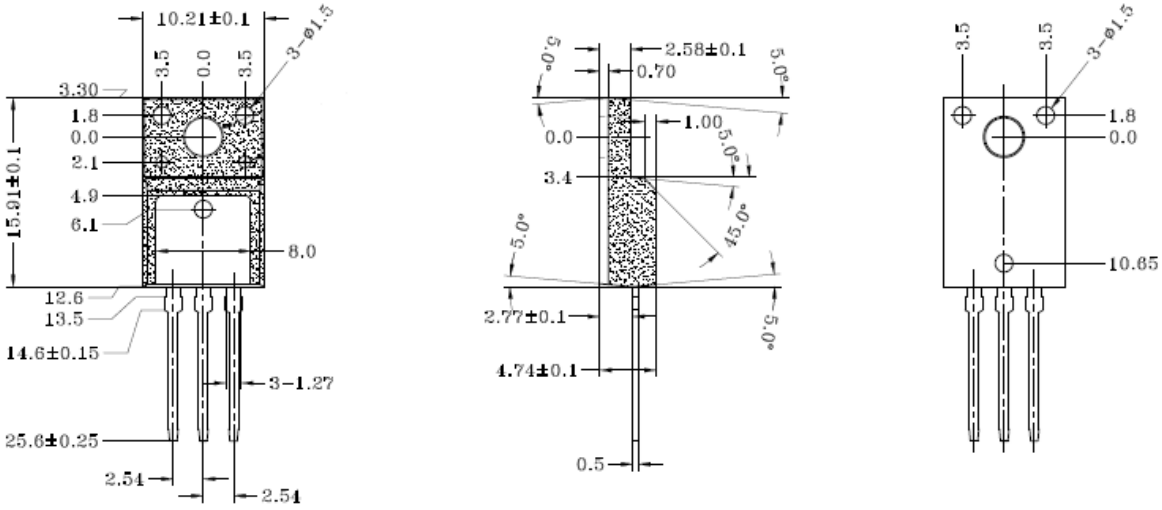
7. 1. 2、Mechanical Data

Symbol	Min.	Nom.	Max.	Symbol	Min.	Nom.	Max.
A	9.70	10.00	10.30	J	28.38	28.88	29.38
A1	7.70	8.00	8.30	K	2.70	3.00	3.30
A2	4.70	5.00	5.30	M	1.00	1.30	1.60
B	12.80	13.20	13.60	N	2.54 TYP		
C	4.30	4.50	4.70	P	2.00	2.40	2.80
C1	1.10	1.30	1.50	Q	8.80	9.20	9.60
D	0.60	0.80	1.00	S	0.10	0.25	0.40
E	3.40	3.60	3.80	T	0.10	0.25	0.40
F	2.70	3.00	3.30	U	2.50	2.80	3.10
G	6.20	6.60	7.00	DIA	Wide 1.50±0.10 Deep 0.50 MAX		

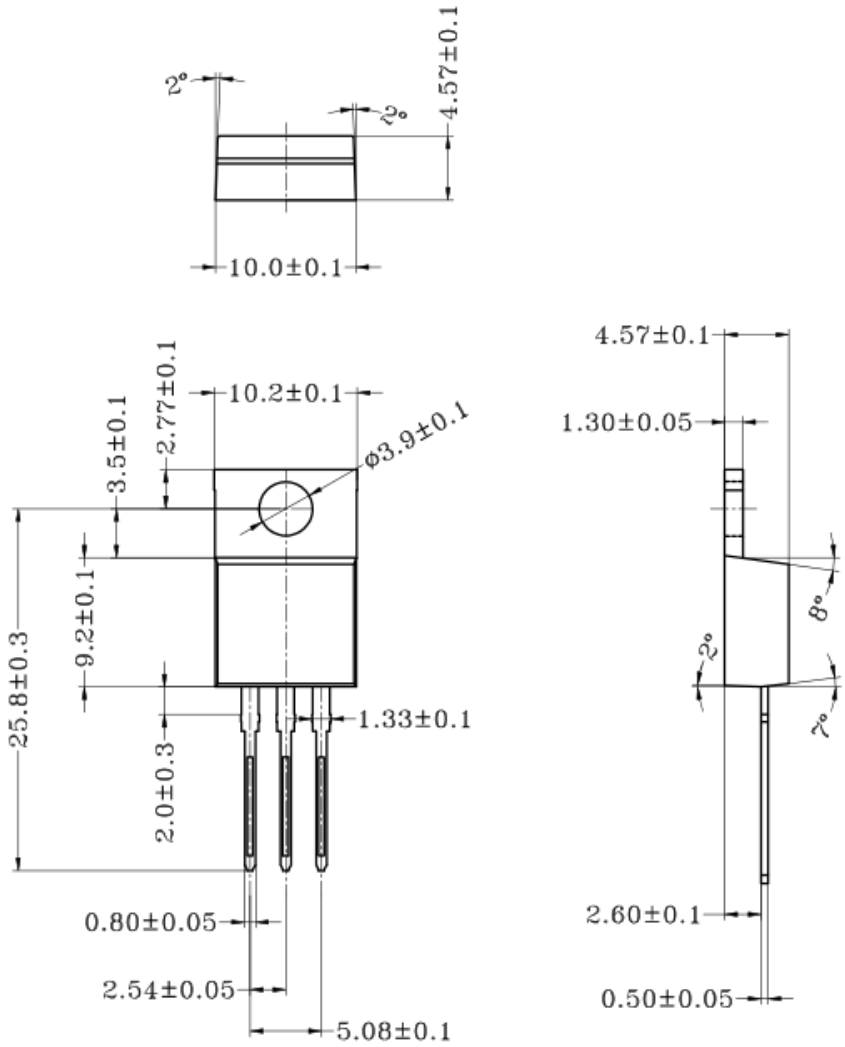
7. 2、TO-220AB



7. 3、TO-220F

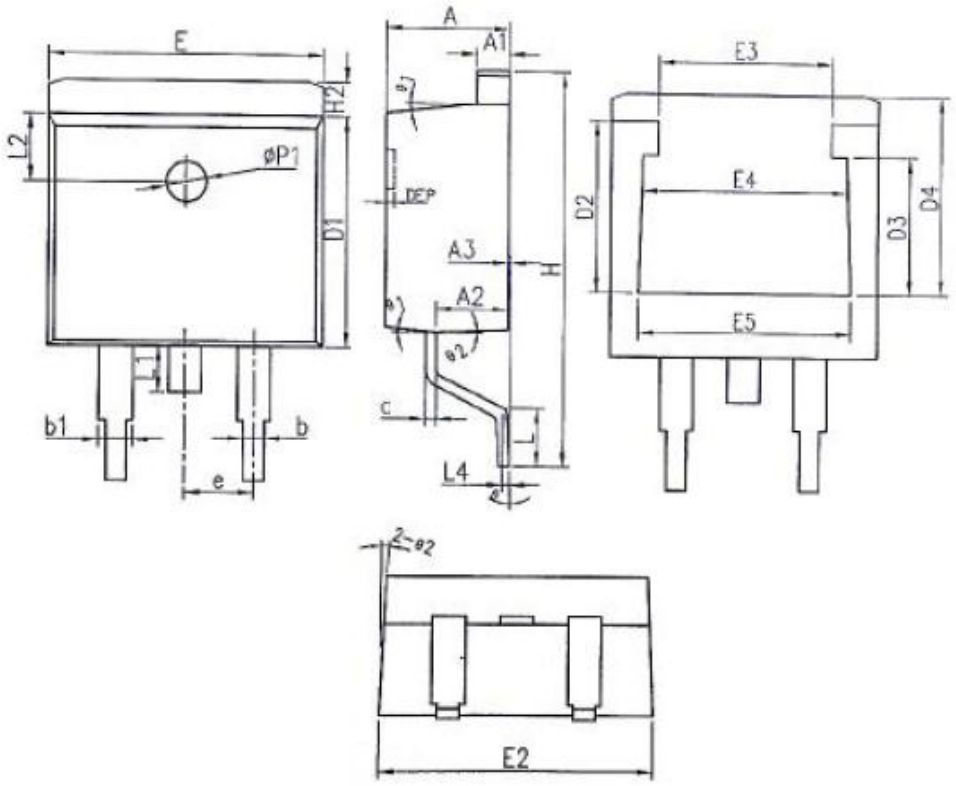


7. 4、TO-220HJ


2°
2°
4.57±0.1
10.0±0.1
4.57±0.1
1.30±0.05
10.2±0.1
2.77±0.1
3.5±0.1
ø3.9±0.1
9.2±0.1
25.8±0.3
1.33±0.1
2.0±0.3
8°
2°
7°
0.80±0.05
2.54±0.05
5.08±0.1
2.60±0.1
0.50±0.05

7. 5、TO-263-2L

7. 5. 1、Package Outline

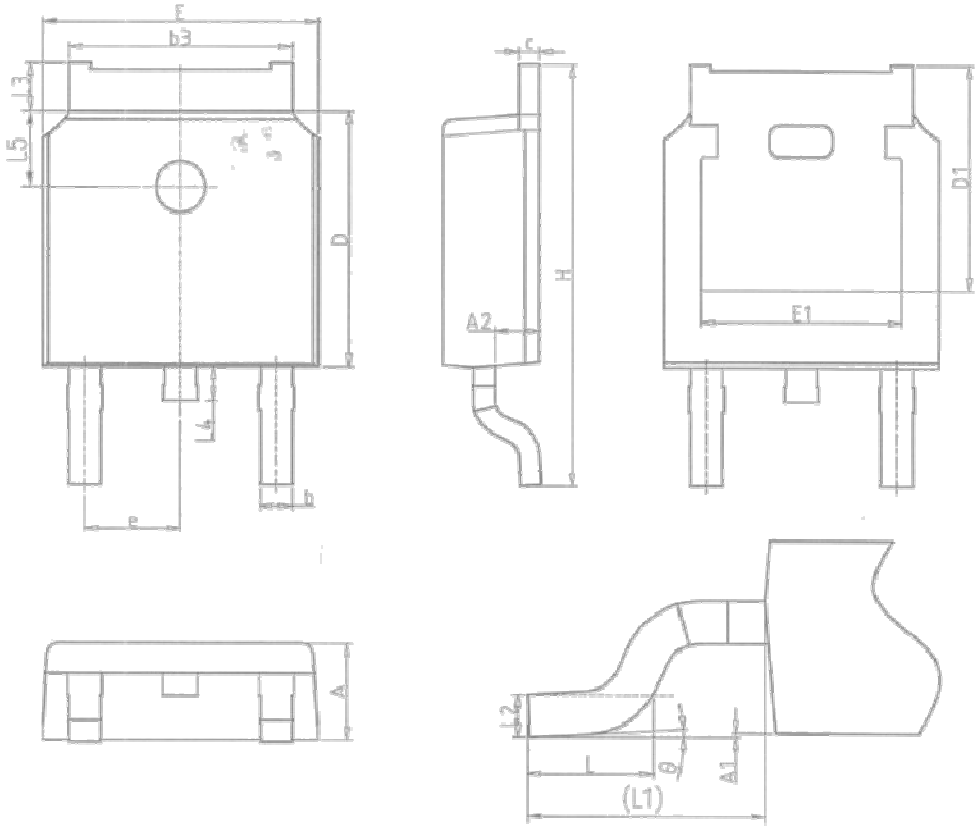


7. 5. 2、Mechanical Data

Symbol	Min.	Nom.	Max.	Symbol	Min.	Nom.	Max.
A	4.40	4.57	4.70	E4	6.67	7.67	7.87
A1	1.22	1.27	1.32	E5	7.06	8.05	8.26
A2	2.59	2.69	2.79	e	2.54BSC		
A3	0.06	0.13	0.20	H	14.70	15.10	15.50
b	0.77	0.813	0.90	H2	1.17	1.27	1.40
b1	1.20	1.27	1.36	L	2.00	2.30	2.60
c	0.34	0.381	0.47	L1	1.45	1.55	1.70
D1	8.60	8.70	8.80	L2	2.50REF		
D2	5.33	6.33	6.53	L4	0.25BSC		
D3	4.54	5.54	5.74	θ	0°	5°	8°
D4	6.60	7.60	7.80	θ1	5°	7°	9°
E	10.00	10.16	10.26	θ2	1°	3°	5°
E2	10.00	10.10	10.20	ΦP1	1.40	1.50	1.60
E3	4.94	5.94	6.14	DEP	0.05	0.10	0.20

7. 6、TO-252-2L

7. 6. 1、Package Outline



7. 6. 2、Mechanical Data

Symbol	Min.	Nom.	Max.	Symbol	Min.	Nom.	Max.
A	2.20	2.30	2.40	e	2.186	2.286	2.386
A1	0.00	-	0.20	H	9.40	10.10	10.50
A2	0.91	1.07	1.17	L	1.38	1.50	1.75
b	0.68	0.78	0.90	L1	2.90 REF		
b3	5.13	5.33	5.50	L2	0.51 BSC		
c	0.43	0.53	0.63	L3	0.7	-	1.5
D	5.98	6.10	6.22	L4	-	-	1.00
D1	5.30	-	5.35	L5	1.60	1.80	1.95
E	6.40	6.60	6.80	θ	0°	-	8°
E1	4.63	-	4.83				

CRM ICBG (wuxi) Co., ltd.

Headquarters address: 180-6 Linghu Avenue, Wuxi, Jiangsu, CHINA. Tel: 0510-85810118
Shanghai Branch Address: No. 12, Lane 299, Wenshui Road, Shibei Zhihuiyuan, Jing 'an District, Shanghai. Tel: 021-60738989
Shenzhen Branch Address: Building A, 8 / F, Tianxiang Building, Tian 'an Digital City, Chegongmiao, Futian District, Shenzhen city, Guangdong Province. Tel: 0755-83572722

Company sales contact point:

East China Office:
180-6 Linghu Dadao, Wuxi City, Jiangsu Province, China Tel: 0510-85810118
Shenzhen Office:
Room 2901, Building 2, Jinlitong Financial Center Building, 1100 Xingye Road, Haiwang Community, Xin 'an Street, Bao 'an District, Shenzhen Tel: 0755-83572766
Guangzhou Office:
3507, Lihe Commercial Center, 98 Tongxing Road, Guzhen Town, Zhongshan City, Guangdong Province
Taiwan Office:
Building A, 8 / F, Tianxiang Building, Tian 'an Digital City, Chegongmiao, Futian District, Shenzhen city, Guangdong Province Tel: 0755-83572722

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