

UTC78MXX

LINEAR INTEGRATED CIRCUIT

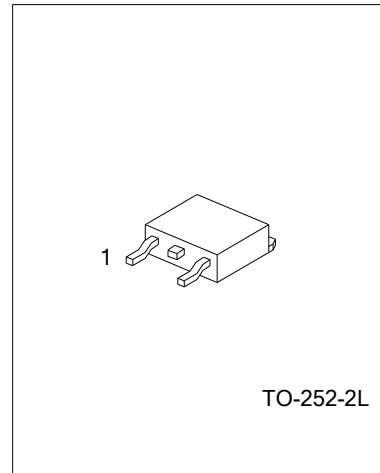
3 TERMINAL 0.5A POSITIVE VOLTAGE REGULATORS

DESCRIPTION

The UTC78MXX of three-terminal positive regulators are available in TO-252 package.Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided ,It can deliver over 0.5A output current, Although designed as fixed voltage regulators, It can be used with external components to obtain adjustable voltage and currents.

FEATURES

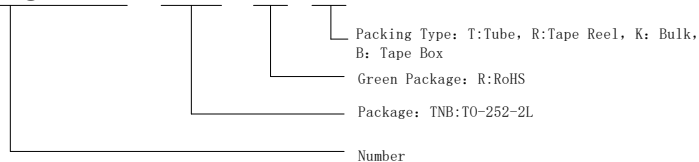
- *Output current up to 0.5A
- *Thermal overload protection
- *Short circuit protection
- *Output transistor SOA protection



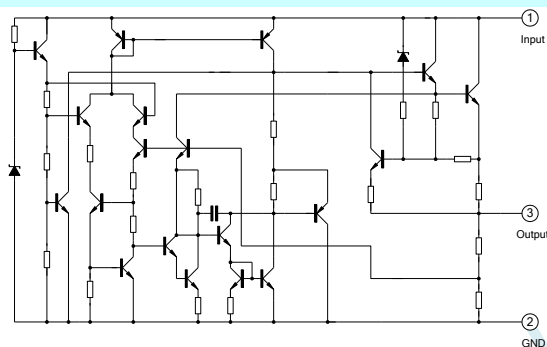
ORDERING INFORMATION

Ordering Number	Package	Print Number	Free	Packing
UTC78MXX-TNB-R-T	TO-252-2L	UTC78MXX	RoHS	Tube
UTC78MXX-TNB-R-R	TO-252-2L	UTC78MXX	RoHS	Tape Reel

UTC78MXX - TNB - R - T



BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
DC input voltage	V_i	35	V
$V_o=5V$ to 18V $V_o=24V$		40	
Output current	I_o	Internally Limited	mA
Power dissipation	P_d	Internally Limited	mW
Storage temperature range	T_{stg}	-65 ~ +150	°C
Operating junction temperature range	T_{opr}	-40 ~ +125	°C
Thermal resistance junction-cases	$R_{\theta JC}$	12.5	°C /W
Thermal resistance junction-air	$R_{\theta JA}$	125	°C /W

UTC78M05 ELECTRICAL CHARACTERISTIC

(Refer to test circuits, $T_j=25^\circ\text{C}$, $I_o=350\text{mA}$, $V_i=10\text{V}$, $C_i=0.33\mu\text{F}$, $C_o=0.1\mu\text{F}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Output voltage			4.8	5.0	5.2	V
Output voltage	V_o	$I_o=5$ to 350mA, $V_i=7$ to 20V	4.75	5.0	5.25	V
Line regulation	ΔV_o	$V_i=7$ to 25V, $I_o=200\text{mA}$			100	mV
		$V_i=8$ to 25V, $I_o=200\text{mA}$			50	
Load regulation	ΔV_o	$I_o=5$ to 500mA, $T_j=25^\circ\text{C}$			100	mV
		$I_o=5$ to 200mA, $T_j=25^\circ\text{C}$			50	
Quiescent current	I_Q				6	mA
Quiescent current change	ΔI_Q	$I_o=5$ to 350mA			0.5	mA
		$V_i=8\text{V}$ to 25V, $I_o=200\text{mA}$			0.8	
Output voltage drift	$\Delta V_o/\Delta T$	$I_o=5\text{mA}$, $T_j=0$ to 125°C		-0.5		mV/°C
Supply voltage rejection	SVR	$V_i=8$ to 18V, $f=120\text{Hz}$, $I_o=300\text{mA}$	62			dB
Output noise voltage	V_N	$f=10\text{Hz}$ to 100kHz		40		μV
Dropout voltage	V_D			2		V
Short circuit current	I_{sc}	$V_i=35\text{V}$		50		mA

UTC78M06 ELECTRICAL CHARACTERISTIC(Refer to test circuits, $T_j=25^{\circ}\text{C}$, $I_o=350\text{mA}$, $V_i=11\text{V}$, $C_i=0.33\mu\text{F}$, $C_o=0.1\mu\text{F}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Output voltage			5.75	6	6.25	V
Output voltage	V_o	$I_o=5$ to 350mA , $V_i=8$ to 21V	5.7	6	6.3	V
Line regulation	ΔV_o	$V_i=8$ to 25V , $I_o=200\text{mA}$			120	mV
		$V_i=9$ to 25V , $I_o=200\text{mA}$			60	
Load regulation	ΔV_o	$I_o=5$ to 500mA , $T_j=25^{\circ}\text{C}$			120	mV
		$I_o=5$ to 200mA , $T_j=25^{\circ}\text{C}$			60	
Quiescent current	I_Q				6	mA
Quiescent current change	ΔI_Q	$I_o=5$ to 350mA			0.5	mA
		$V_i=9\text{V}$ to 25V , $I_o=200\text{mA}$			0.8	
Output voltage drift	$\Delta V_o/\Delta T$	$I_o=5\text{mA}$, $T_j=0$ to 125°C		-0.6		mV/ $^{\circ}\text{C}$
Supply voltage rejection	SVR	$V_i=9$ to 19V , $f=120\text{Hz}$, $I_o=300\text{mA}$	59			dB
Output noise voltage	V_N	$f=10\text{Hz}$ to 100kHz		45		μV
Dropout voltage	V_D			2		V
Short circuit current	I_{SC}	$V_i=35\text{V}$		50		mA

UTC78M08 ELECTRICAL CHARACTERISTIC(Refer to test circuits, $T_j=25^{\circ}\text{C}$, $I_o=350\text{mA}$, $V_i=14\text{V}$, $C_i=0.33\mu\text{F}$, $C_o=0.1\mu\text{F}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Output voltage			7.7	8.0	8.3	V
Output voltage	V_o	$I_o=5$ to 350mA , $V_i=10.5$ to 23V	7.6	8.0	8.4	V
Line regulation	ΔV_o	$V_i=10.5$ to 25V , $I_o=200\text{mA}$			160	mV
		$V_i=11$ to 25V , $I_o=200\text{mA}$			80	
Load regulation	ΔV_o	$I_o=5$ to 500mA , $T_j=25^{\circ}\text{C}$			160	mV
		$I_o=5$ to 200mA , $T_j=25^{\circ}\text{C}$			80	
Quiescent current	I_Q				6	mA
Quiescent current change	ΔI_Q	$I_o=5$ to 350mA			0.5	mA
		$V_i=10.5\text{V}$ to 25V , $I_o=200\text{mA}$			0.8	
Output voltage drift	$\Delta V_o/\Delta T$	$I_o=5\text{mA}$, $T_j=0$ to 125°C		-0.8		mV/ $^{\circ}\text{C}$
Supply voltage rejection	SVR	$V_i=11.5$ to 21.5V , $f=120\text{Hz}$, $I_o=300\text{mA}$	56			dB
Output noise voltage	V_N	$f=10\text{Hz}$ to 100kHz		52		μV
Dropout voltage	V_D			2		V
Short circuit current	I_{SC}	$V_i=35\text{V}$		50		mA

UTC78M09 ELECTRICAL CHARACTERISTIC(Refer to test circuits, $T_j=25^{\circ}\text{C}$, $I_o=350\text{mA}$, $V_i=15\text{V}$, $C_i=0.33\mu\text{F}$, $C_o=0.1\mu\text{F}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Output voltage			8.65	9	9.35	V
Output voltage	V_o	$I_o=5$ to 350mA , $V_i=11.5$ to 24V	8.55	9	9.45	V
Line regulation	ΔV_o	$V_i=11.5$ to 25V , $I_o=200\text{mA}$			180	mV
		$V_i=12$ to 25V , $I_o=200\text{mA}$			90	mV
Load regulation	ΔV_o	$I_o=5$ to 500mA , $T_j=25^{\circ}\text{C}$			180	mV
		$I_o=5$ to 200mA , $T_j=25^{\circ}\text{C}$			90	mV
Quiescent current	I_Q				6	mA
Quiescent current change	ΔI_Q	$I_o=5$ to 350mA			0.5	mA
		$V_i=11.5\text{V}$ to 25V , $I_o=200\text{mA}$			0.8	mA
Output voltage drift	$\Delta V_o/\Delta T$	$I_o=5\text{mA}$, $T_j=0$ to 125°C		-0.9		mV/ $^{\circ}\text{C}$
Supply voltage rejection	SVR	$V_i=12.5$ to 23V , $f=120\text{Hz}$, $I_o=300\text{mA}$	56			dB
Output noise voltage	V_N	$f=10\text{Hz}$ to 100kHz		58		μV
Dropout voltage	V_D			2		V
Short circuit current	I_{sc}	$V_i=35\text{V}$		50		mA

UTC78M10 ELECTRICAL CHARACTERISTIC(Refer to test circuits, $T_j=25^{\circ}\text{C}$, $I_o=350\text{mA}$, $V_i=17\text{V}$, $C_i=0.33\mu\text{F}$, $C_o=0.1\mu\text{F}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Output voltage			9.6	10	10.4	V
Output voltage	V_o	$I_o=5$ to 350mA , $V_i=12.5$ to 25V	9.5	10	10.5	V
Line regulation	ΔV_o	$V_i=12.5$ to 28V , $I_o=200\text{mA}$			210	mV
		$V_i=14$ to 20V , $I_o=200\text{mA}$			120	mV
Load regulation	ΔV_o	$I_o=5$ to 500mA , $T_j=25^{\circ}\text{C}$			210	mV
		$I_o=5$ to 200mA , $T_j=25^{\circ}\text{C}$			120	mV
Quiescent current	I_Q				6	mA
Quiescent current change	ΔI_Q	$I_o=5$ to 350mA			0.5	mA
		$V_i=12.5\text{V}$ to 28V , $I_o=200\text{mA}$			0.8	mA
Output voltage drift	$\Delta V_o/\Delta T$	$I_o=5\text{mA}$, $T_j=0$ to 125°C		1		mV/ $^{\circ}\text{C}$
Supply voltage rejection	SVR	$V_i=12.5$ to 28V , $f=120\text{Hz}$, $I_o=300\text{mA}$	55			dB
Output noise voltage	V_N	$f=10\text{Hz}$ to 100kHz		75		μV
Dropout voltage	V_D			2		V
Short circuit current	I_{sc}	$V_i=35\text{V}$		200		mA

UTC78M12 ELECTRICAL CHARACTERISTIC(Refer to test circuits, $T_j=25^{\circ}\text{C}$, $I_o=350\text{mA}$, $V_i=19\text{V}$, $C_i=0.33\mu\text{F}$, $C_o=0.1\mu\text{F}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Output voltage			11.5	12	12.5	V
Output voltage	V_o	$I_o=5$ to 350mA , $V_i=14.5$ to 27V	11.4	12	12.6	V
Line regulation	ΔV_o	$V_i=14.5$ to 30V , $I_o=200\text{mA}$			240	mV
		$V_i=16$ to 30V , $I_o=200\text{mA}$			120	mV
Load regulation	ΔV_o	$I_o=5$ to 500mA , $T_j=25^{\circ}\text{C}$			240	mV
		$I_o=5$ to 200mA , $T_j=25^{\circ}\text{C}$			120	mV
Quiescent current	I_Q				6	mA
Quiescent current change	ΔI_Q	$I_o=5$ to 350mA			0.5	mA
		$V_i=14.5\text{V}$ to 30V , $I_o=200\text{mA}$			0.8	mA
Output voltage drift	$\Delta V_o/\Delta T$	$I_o=5\text{mA}$, $T_j=0$ to 125°C		-1		mV/ $^{\circ}\text{C}$
Supply voltage rejection	SVR	$V_i=15$ to 25V , $f=120\text{Hz}$, $I_o=300\text{mA}$	55			dB
Output noise voltage	V_N	$f=10\text{Hz}$ to 100kHz		75		μV
Dropout voltage	V_D			2		V
Short circuit current	Isc	$V_i=35\text{V}$		50		mA

UTC78M15 ELECTRICAL CHARACTERISTIC(Refer to test circuits, $T_j=25^{\circ}\text{C}$, $I_o=350\text{mA}$, $V_i=23\text{V}$, $C_i=0.33\mu\text{F}$, $C_o=0.1\mu\text{F}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Output voltage			14.4	15	15.6	V
Output voltage	V_o	$I_o=5$ to 350mA , $V_i=17.5\text{V}$ to 30V	14.25	15	15.75	V
Line regulation	ΔV_o	$V_i=17.5$ to 30V , $I_o=200\text{mA}$			300	mV
		$V_i=20\text{V}$ to 30V , $I_o=200\text{mA}$			150	mV
Load regulation	ΔV_o	$I_o=5$ to 500mA , $T_j=25^{\circ}\text{C}$			300	mV
		$I_o=5$ to 200mA , $T_j=25^{\circ}\text{C}$			150	mV
Quiescent current	I_Q				6	mA
Quiescent current change	ΔI_Q	$I_o=5$ to 350mA			0.5	mA
		$V_i=17.5\text{V}$ to 30V , $I_o=200\text{mA}$			0.8	mA
Output voltage drift	$\Delta V_o/\Delta T$	$I_o=5\text{mA}$, $T_j=0$ to 125°C		-1.1		mV/ $^{\circ}\text{C}$
Supply voltage rejection	SVR	$V_i=18.5\text{V}$ to 28.5V , $f=120\text{Hz}$, $I_o=300\text{mA}$	53			dB
Output noise voltage	V_N	$f=10\text{Hz}$ to 100kHz		100		μV
Dropout voltage	V_D			2		V
Short circuit current	Isc	$V_i=35\text{V}$		50		mA

UTC78M18 ELECTRICAL CHARACTERISTIC(Refer to test circuits, $T_j=25^{\circ}\text{C}$, $I_o=350\text{mA}$, $V_i=26\text{V}$, $C_i=0.33\mu\text{F}$, $C_o=0.1\mu\text{F}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Output voltage			17.3	18	18.7	V
Output voltage	V_o	$I_o=5$ to 350mA , $V_i=20.5\text{V}$ to 33V	17.1	18	18.9	V
Line regulation	ΔV_o	$V_i=21\text{V}$ to 33V , $I_o=200\text{mA}$			360	mV
		$V_i=24\text{V}$ to 33V , $I_o=200\text{mA}$			180	mV
Load regulation	ΔV_o	$I_o=5$ to 500mA , $T_j=25^{\circ}\text{C}$			360	mV
		$I_o=5$ to 200mA , $T_j=25^{\circ}\text{C}$			180	mV
Quiescent current	I_Q				6	mA
Quiescent current change	ΔI_Q	$I_o=5$ to 350mA			0.5	mA
		$V_i=21\text{V}$ to 33V , $I_o=200\text{mA}$			0.8	mA
Output voltage drift	$\Delta V_o/\Delta T$	$I_o=5\text{mA}$, $T_j=0$ to 125°C		-1.1		mV/ $^{\circ}\text{C}$
Supply voltage rejection	SVR	$V_i=22\text{V}$ to 32V , $f=120\text{Hz}$, $I_o=300\text{mA}$	53			dB
Output noise voltage	V_N	$f=10\text{Hz}$ to 100kHz		100		μV
Dropout voltage	V_D			2		V
Short circuit current	I_{sc}	$V_i=35\text{V}$		240		mA

UTC78M24 ELECTRICAL CHARACTERISTIC(Refer to test circuits, $T_j=25^{\circ}\text{C}$, $I_o=350\text{mA}$, $V_i=33\text{V}$, $C_i=0.33\mu\text{F}$, $C_o=0.1\mu\text{F}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Output voltage			23	24	25	V
Output voltage	V_o	$I_o=5$ to 350mA , $V_i=27\text{V}$ to 38V	22.8	24	25.2	V
Line regulation	ΔV_o	$V_i=27\text{V}$ to 38V , $I_o=200\text{mA}$			480	mV
		$V_i=28\text{V}$ to 38V , $I_o=200\text{mA}$			240	mV
Load regulation	ΔV_o	$I_o=5$ to 500mA , $T_j=25^{\circ}\text{C}$			480	mV
		$I_o=5$ to 200mA , $T_j=25^{\circ}\text{C}$			240	mV
Quiescent current	I_Q				6	mA
Quiescent current change	ΔI_Q	$I_o=5$ to 350mA			0.5	mA
		$V_i=27\text{V}$ to 38V , $I_o=200\text{mA}$			0.8	mA
Output voltage drift	$\Delta V_o/\Delta T$	$I_o=5\text{mA}$, $T_j=0$ to 125°C		-1.2		mV/ $^{\circ}\text{C}$
Supply voltage rejection	SVR	$V_i=28\text{V}$ to 38V , $f=120\text{Hz}$, $I_o=300\text{mA}$	50			dB
Output noise voltage	V_N	$f=10\text{Hz}$ to 100kHz		170		μV
Dropout voltage	V_D			2		V
Short circuit current	I_{sc}	$V_i=35\text{V}$		240		mA

UTC78M75 ELECTRICAL CHARACTERISTIC(Refer to test circuits, $T_j=25^{\circ}\text{C}$, $I_o=350\text{mA}$, $V_i=14\text{V}$, $C_i=0.33\mu\text{F}$, $C_o=0.1\mu\text{F}$, unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Output voltage			7.3	7.5	7.8	V
Output voltage	V_o	$I_o=5$ to 350mA , $V_i=10.5\text{V}$ to 23V	7.3	7.5	7.8	V
Line regulation	ΔV_o	$V_i=10\text{V}$ to 24.5V , $I_o=200\text{mA}$			160	mV
		$V_i=10.5\text{V}$ to 24.5V , $I_o=200\text{mA}$			80	mV
Load regulation	ΔV_o	$I_o=5$ to 500mA , $T_j=25^{\circ}\text{C}$			160	mV
		$I_o=5$ to 200mA , $T_j=25^{\circ}\text{C}$			80	mV
Quiescent current	I_Q				6	mA
Quiescent current change	ΔI_Q	$I_o=5$ to 350mA			0.5	mA
		$V_i=10\text{V}$ to 24.5V , $I_o=200\text{mA}$			0.8	mA
Output voltage drift	$\Delta V_o/\Delta T$	$I_o=5\text{mA}$, $T_j=0$ to 125°C		-0.8		mV/ $^{\circ}\text{C}$
Supply voltage rejection	SVR	$V_i=11\text{V}$ to 21V , $f=120\text{Hz}$, $I_o=300\text{mA}$	57			dB
Output noise voltage	V_N	$f=10\text{Hz}$ to 100kHz		52		μV
Dropout voltage	V_D			2		V
Short circuit current	I_{sc}	$V_i=35\text{V}$		50		mA

TEST CIRCUITS

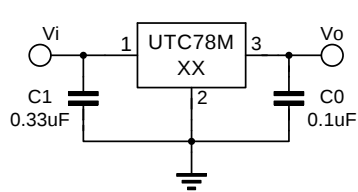


Fig.1 DC PARAMETERS

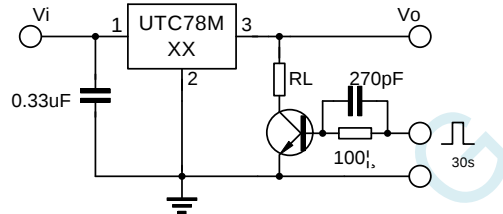


Fig.2 LOAD REGULATION

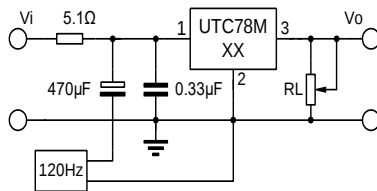


Fig.3 RIPPLE REJECTION

APPLICATION CIRCUITS

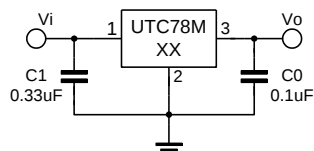


Fig.4 Fixed output regulator

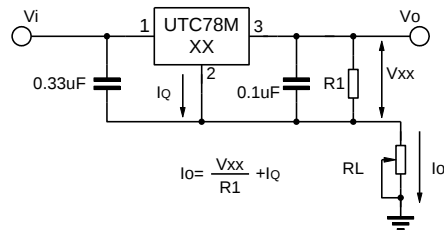


Fig.5 Constant current regulator

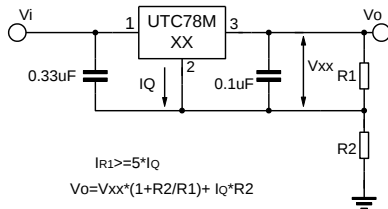


Fig.6 Circuit for increasing Regulator output voltage

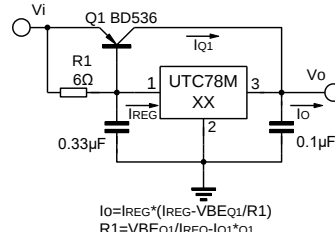


Fig.7 High current with voltage regulator

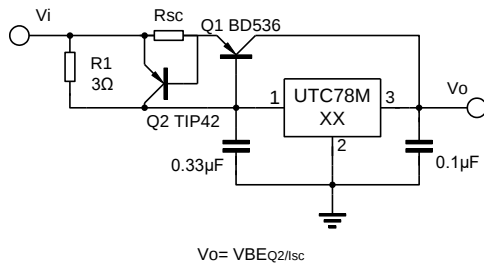


Fig.8 High output current short circuit protection

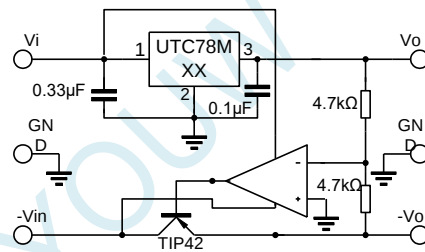


Fig.9 Tracking voltage regulator

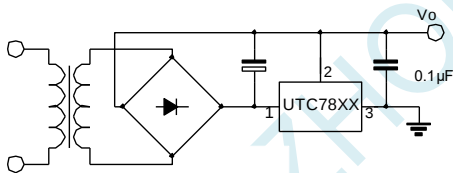


Fig.10 Negative output voltage circuit

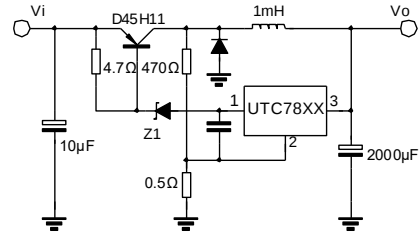


Fig.11 switching regulator

TYPICAL PERFORMANCE CHARACTERISTICS

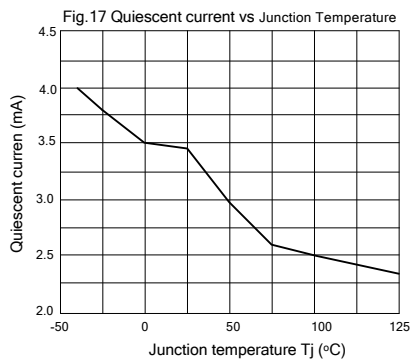
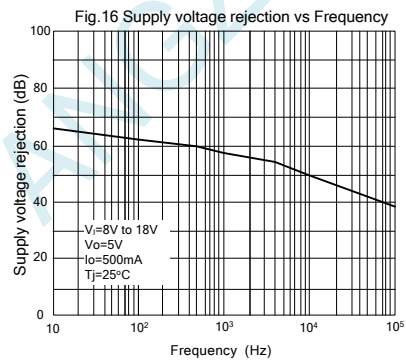
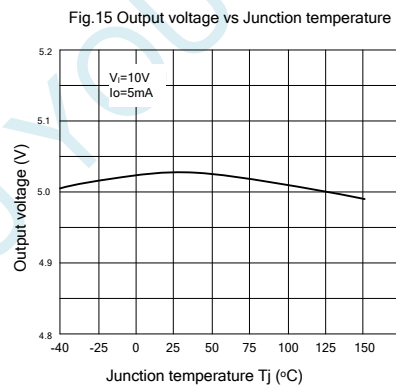
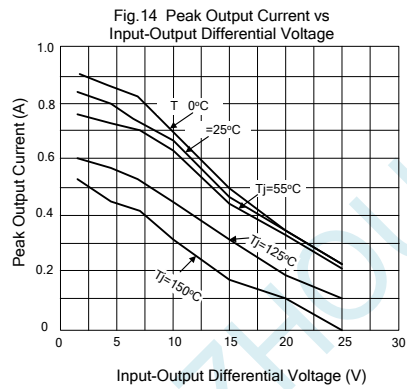
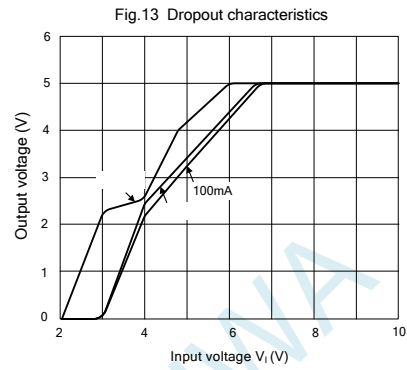
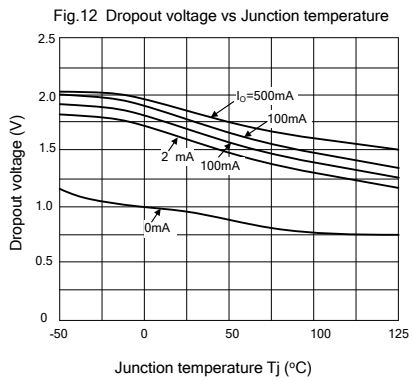


Fig.18 Worst Case Power Dissipation vs Ambient Temperature

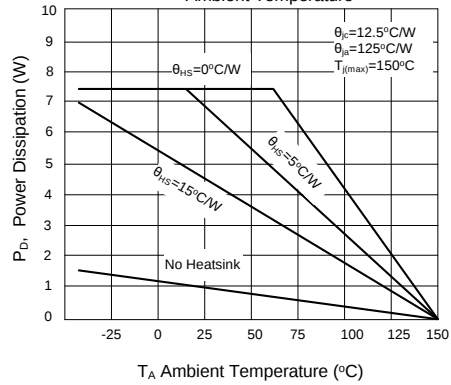


Fig.19 Quiescent current vs Input voltage V_i

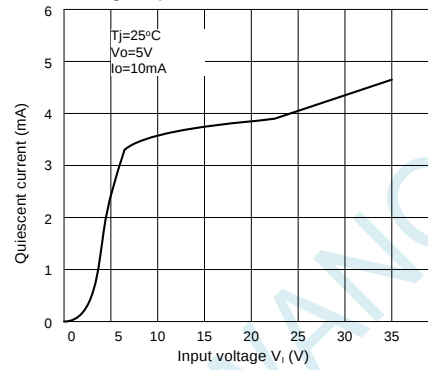


Fig.20 Load Transient Response

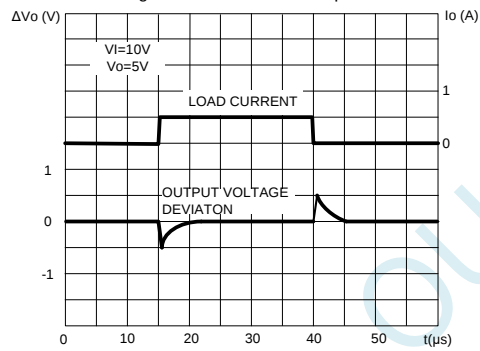
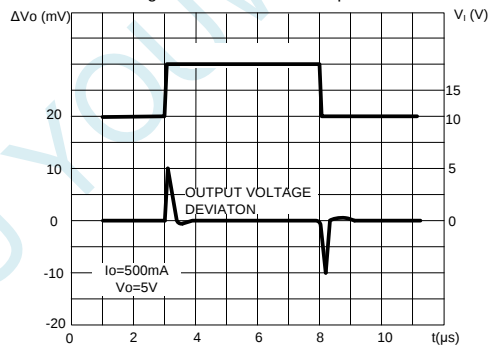
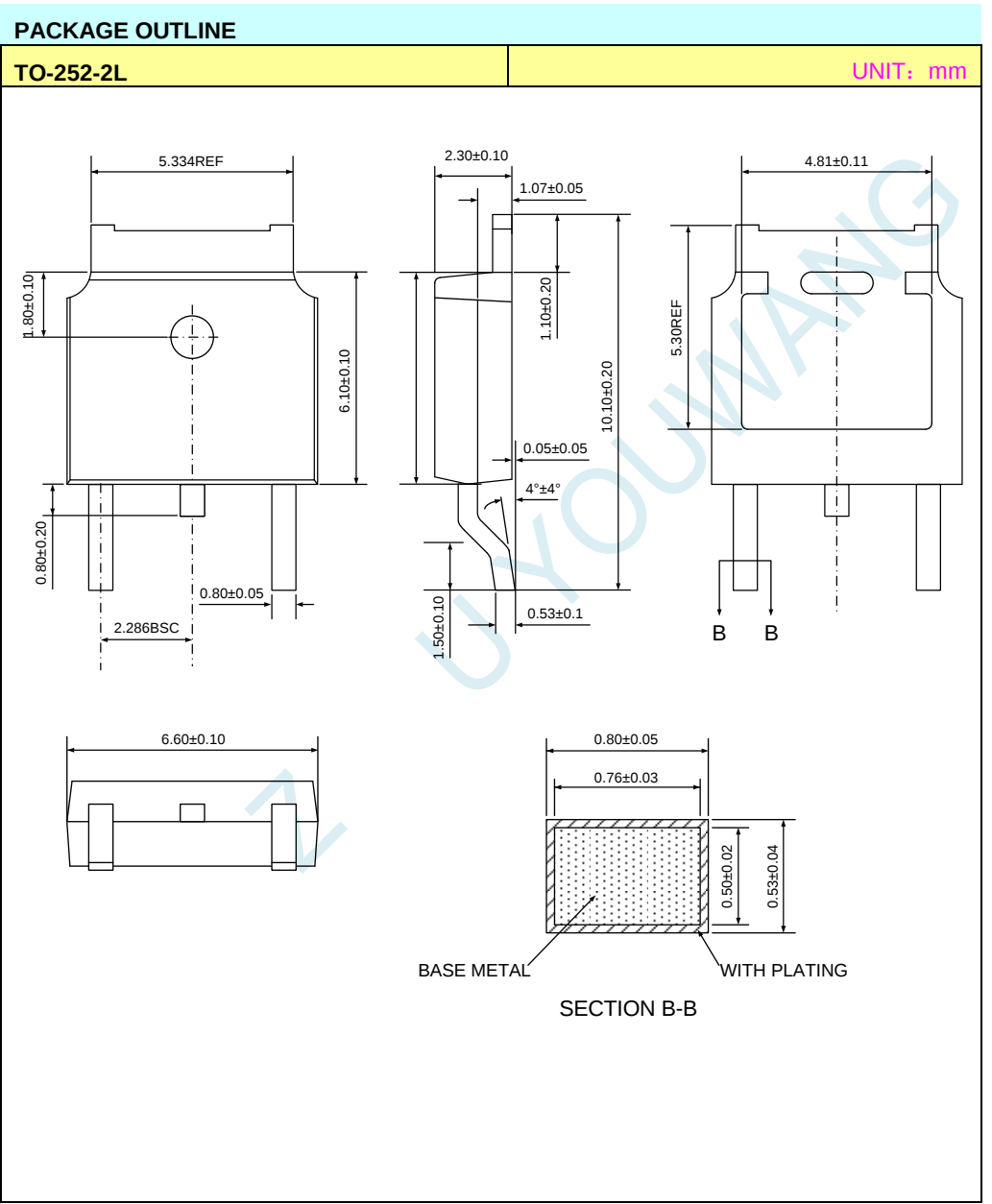


Fig.21 Line Transient Response





ELECTROSTATIC DISCHARGE CAUTION

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage handling to prevent electrostatic damage to the device.