

## 1. DESCRIPTION

XL494 and XD494 are switching pulse width control circuit, mainly used for switching power supply control.

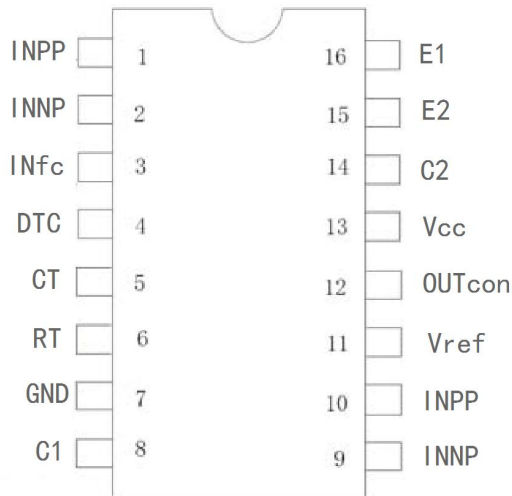
Adopts DIP16, SOP16 encapsulation form.

## 2. FEATURES

- Perfect pulse width control circuit.
- Includes an active or driven oscillator.
- Includes double error amplifier.
- Includes 5V reference power supply.
- The dead zone control is adjustable.
- Independent output transistor (source or trap 200mA).
- The output control mode is push-pull or single-ended.
- Package option: XL494 (SOP16), XD494 (DIP16)

### 3. PIN CONFIGURATIONS AND FUNCTIONS

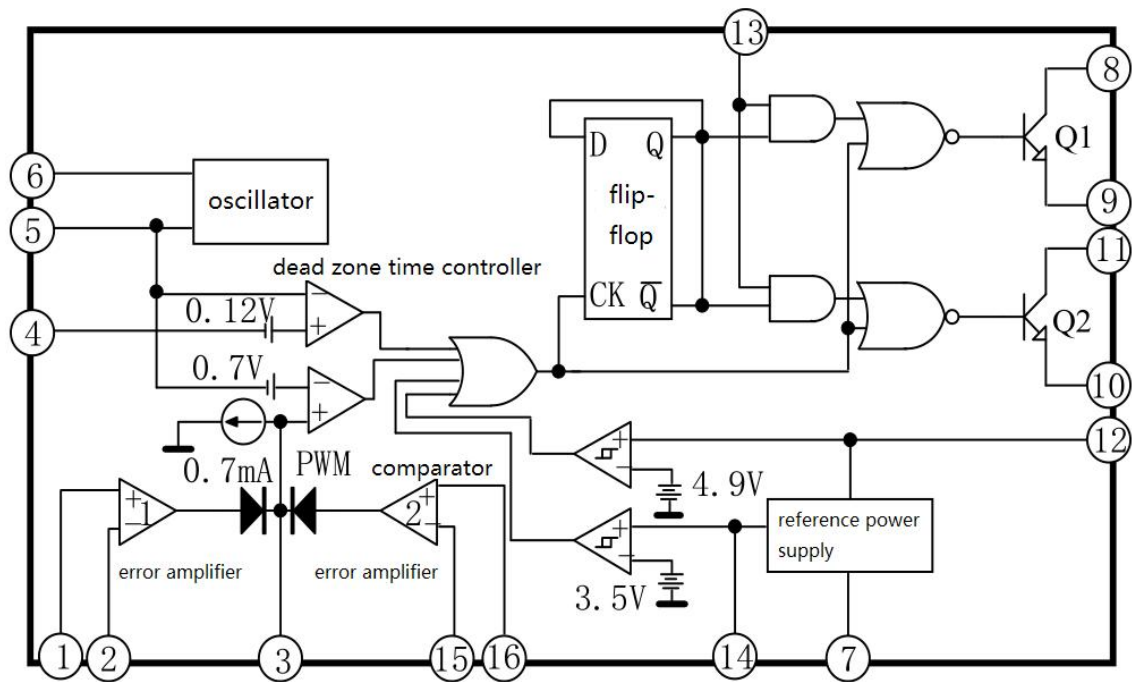
#### (Top View)



#### Pin Functions

Pin	Description	Symbol	Pin	Description	Symbol
1	Positive input	INPP	9	Emitter Output (1)	E1
2	Inverting input	INNP	10	Emitter Output (2)	E2
3	PWM feedback compares the input	INfc	11	Collector voltage	C2
4	Dead-time control	DTC	12	Supply voltage	Vcc
5	Oscillation frequency adjustment capacitor	CT	13	Output control	OUTcon
6	Oscillating frequency adjustment resistor	RT	14	Reference voltage output	Vref
7	Ground	GND	15	Inverting input	INPP
8	Collector voltage	C1	16	Positive input	INNP

#### 4. BLOCK DIAGRAM



**5. LIMITING VALUE**(Absolute maximum rating, if no other provisions, Tamb=25°C)

Parameter	Symbol	Value		Unit
		Min	Max	
Supply voltage	Vcc	7	40	V
Collector output voltage	Vc1;Vc2	-	40	V
Collector output current (single transistor)	Ic1;Ic2	-	200	mA
Amplifier input voltage	Vin	-0.3	Vcc-2	V
Power consumption (Tamb≤45°C)	PD	-	500	mW
Operating ambient temperature	Tamb	-25	80	°C
Storage temperature	Tstg	-55	150	°C

**6. RECOMMENDED WORKING CONDITIONS**

Parameter	Symbol	Value			Unit
		Min	Typ.	Max	
Supply voltage	Vcc	7.0	15	40	V
Collector output voltage	Vc1; Vc2	-	30	40	V
Collector output current (single transistor)	Ic1; Ic2	-	-	200	mA
Amplifier input voltage	Vin	-0.3	-	Vcc-2.0	V
Feedback current	I <sub>fb</sub>	-	-	0.3	mA
Output current of the reference terminal	I <sub>ref</sub>	-	-	10	mA
Timing resistance	RT	1.8	30	500	k
Timing capacitance	CT	0.00047	0.001	10	F
Oscillation frequency	fosc	1.0	40	200	kHz

**7. ELECTRICAL CHARACTERISTIC**(If no other provisions,  $V_{cc}=15V$ ,  $f_{osc}=10kHz$ , for typical values  $T_{amb}=25^{\circ}C$ , for minimum and maximum  $T_{amb}$  is the working environment temperature.)

Parameter	Conditions	Symbol	Value			Unit
			Min	Typ.	Max	
Reference part						
Reference voltage	$I_o=1.0mA$	$V_{ref}$	4.75	5.0	5.25	V
The reference voltage changes with temperature	$\Delta T_{amb}$ From MIN to MAX	$\Delta V_{ref}/\Delta T$	-	1.3	2.6	%
Voltage linearity	$V_{cc}=7.0V\sim 40V$	Reg line	-	2.0	25	mV
Load adjustment rate	$I_o=1.0mA\sim 10mA$	Reg load	-	2.0	15	mV
Short-circuit output current	$V_{ref}=0V$ , $T_{amb}=25^{\circ}C$	$I_{sc}$	-	32		mA

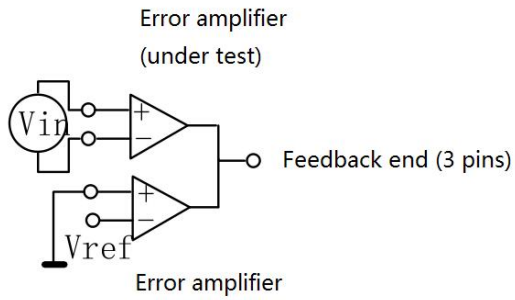
Parameter	Conditions	Symbol	Value			Unit
			Min	Typ.	Max	
Output part						
Collector leakage current	$V_{cc}=40V$ ; $V_{ce}=40V$	$I_{c(off)}$	-	2.0	100	$\mu A$
Emitter leakage current	$V_{cc}=40V$ ; $V_c=40V$ ; $V_e=0V$	$I_{e(off)}$	-	-	-100	$\mu A$
Collector-emitter saturation pressure drop	Common emitter: $V_e=0V$ ; $I_c=200mA$	$V_c(sat)$	-	1.1	1.3	V
	Emitter following: $V_c=15V$ ; $I_e=-200mA$	$V_e(sat)$	-	1.5	2.5	V
Output control pin current	$V_{oc}=V_{ref}$	$I_{OCH}$	-	0.2	3.5	mA
Output voltage rise time	Common emitter: Test Figure 3	$T_r$	-	100	200	ns
	Emitter following: Test Figure 4		-	100	200	ns
Output voltage drop time	Common emitter: Test Figure 3	$T_f$	-	25	100	ns
	Emitter following: Test Figure 4		-	40	100	ns
Error amplifier section						
Input offset	$V_o$ (pin3) =2.5V	$V_{io}$	-	2.0	10	mV

voltage						
Input offset current	$V_o(\text{pin}3) = 2.5\text{V}$	$I_{io}$	-	5.0	250	nA
Input bias current	$V_o(\text{pin}3) = 2.5\text{V}$	$I_{IB}$	-	0.1	1.0	$\mu\text{A}$
Input common-mode voltage range	$V_{cc} = 7.0\text{V} \sim 40\text{V}$	$V_{ICR}$	-0.3	-	$V_{cc} - 2.0$	V
Open-loop voltage gain	$V_o = 0.5\text{V} \sim 3.5\text{V}$ ; $R_L = 2.0\text{k}\Omega$ ; $\Delta V_o = 3.0\text{V}$	$G_{VOL}$	70	95	-	dB
Unit-gain bandwidth	$V_o = 0.5\text{V} \sim 3.5\text{V}$ ; $R_L = 2.0\text{k}\Omega$	$f_c$	-	800	-	kHz
Common mode rejection ratio	$V_{cc} = 40\text{V}$	$CMRR$	65	90	-	dB
Output absorbing current	$V_o(\text{pin}3) = 0.7\text{V}$	$I_{o-}$	0.3	0.7	-	mA
Output source current	$V_o(\text{pin}3) = 3.5\text{V}$	$I_{o+}$	-2.0	-4.0	-	mA
PWM Comparator part (test circuit diagram 2)						
Input threshold voltage	Zero duty cycle	$V_{TH}$	-	4	4.5	V
Input suction current	$V(\text{pin}3) = 0.7\text{V}$	$I_{I-}$	0.3	0.7	-	mA
Dead zone control section (see 2 for test circuit diagram)						
Input bias current	$V_{in} = 0\text{V} \sim 5.25\text{V}$	$I_{IB(DT)}$	-	-2.0	-10	$\mu\text{A}$
Maximum duty cycle (per output)	$V_{in} = 0\text{V}$ ; $R_T = 12\text{k}\Omega$ ; $C_T = 0.1\mu\text{F}$	$DC_{max}$	-	45	-	%
Input Threshold voltage (pin4)	Zero duty cycle	$V_{TH}$	-	3	3.3	V
	Maximum duty cycle		0	-	-	
Oscillator section						
Frequency	$R_T = 12\text{k}\Omega$ ; $C_T = 0.01\mu\text{F}$	$f_{osc}$	-	10	-	kHz
Standard frequency offset	$R_T = 30\text{k}\Omega$ ; $C_T = 0.001\mu\text{F}$	$\Delta f_{osc}$	-	3.0	-	%
Frequency variation with voltage	$V_{cc} = 7.0\text{V} \sim 40\text{V}$	$\Delta f_{osc}/\Delta V$	-	0.1	-	%
The change in frequency with temperature	$R_T = 12\text{k}\Omega$ ; $C_T = 0.01\mu\text{F}$ ; $T_{amb} = T_{low} \sim T_{high}$	$\Delta f_{osc}/\Delta T$	-	-	12	%

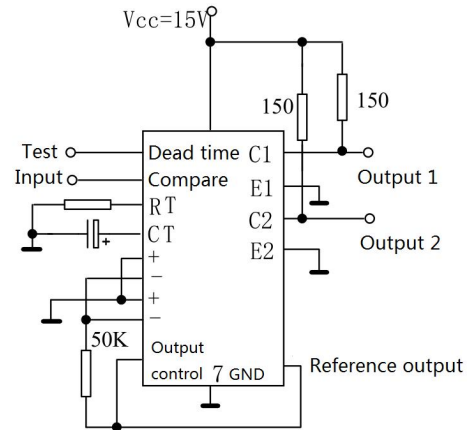
Parameter	Conditions	Symbol	Value			Unit
			Min	Typ.	Max	
Initiation control						
Low current input	V (pin3) =0.4V	ISTL	-	-25	-200	μA
High current input	V (pin13) =2.4V	ISTH	-	25	200	μA
	V (pin13) =Vref		-	75	-	
Integral part						
Standby current (pin 6 is the reference voltage, other input and output are open)	Vcc=15V	Icc	-	6	10	mA
	Vcc=40V		-	9	15	
Average power current (see 2 for test circuit diagram)	Vcc=15V; RT=12kΩ; CT=0.01μF; V (pin14) =2.0V	-	-	7.5	-	mA

## 8. TEST SCHEMATIC DIAGRAM

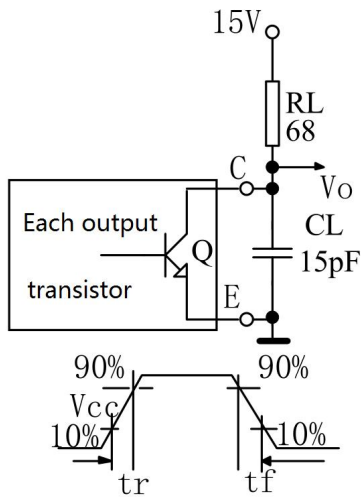
1. Error amplifier characteristic



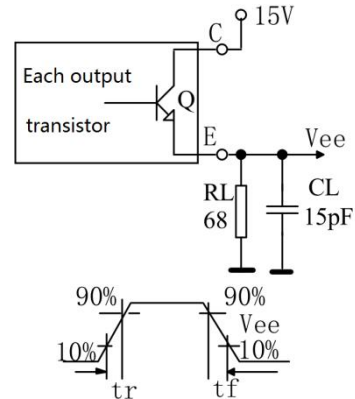
2. Dead time and feedback control test circuit



3. Common emitter connection test circuit and waveform

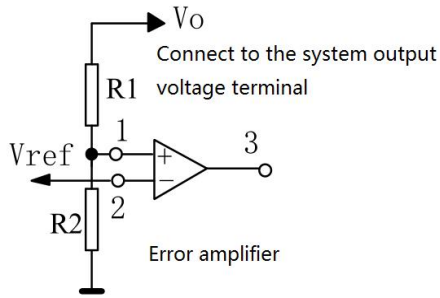


4. The E pole follows the connected test circuit and waveform

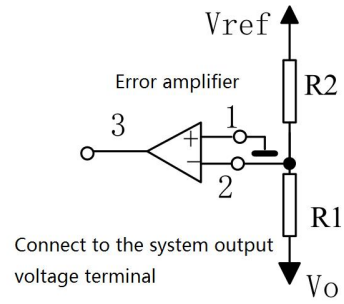




5. Error amplifier sensing technology

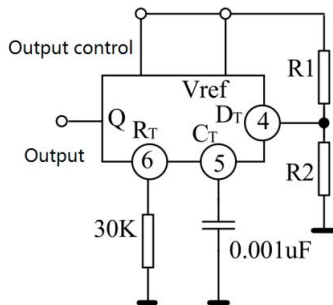


Positive output voltage  
 $V_o = V_{ref} (1 + R_1/R_2)$

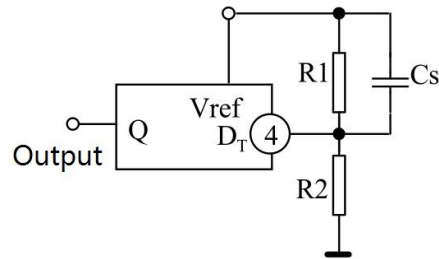


Negative output voltage  
 $V_o = V_{ref} * R_1/R_2$

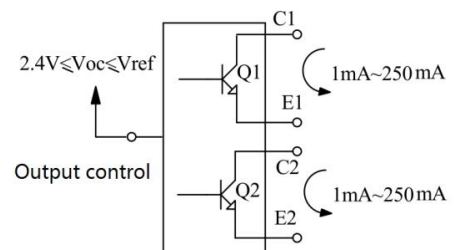
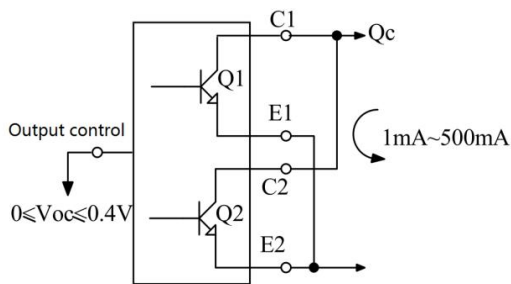
6. Dead-time control circuit



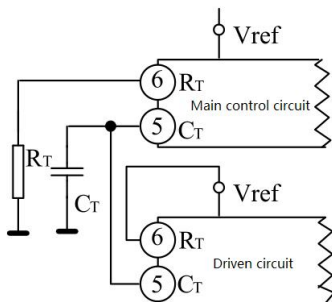
7. Soft starting circuit



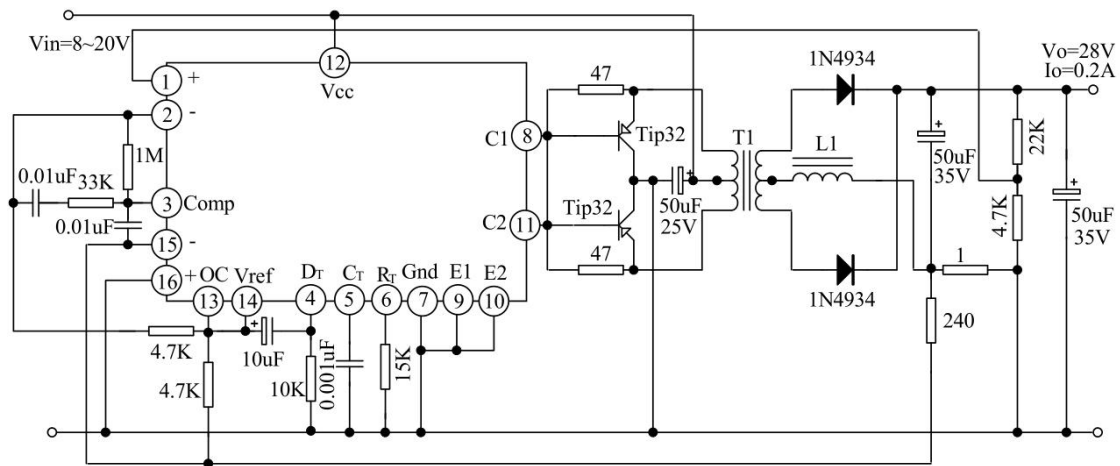
8. Single-ended and push-pull connections



9. Two or more slave control circuits

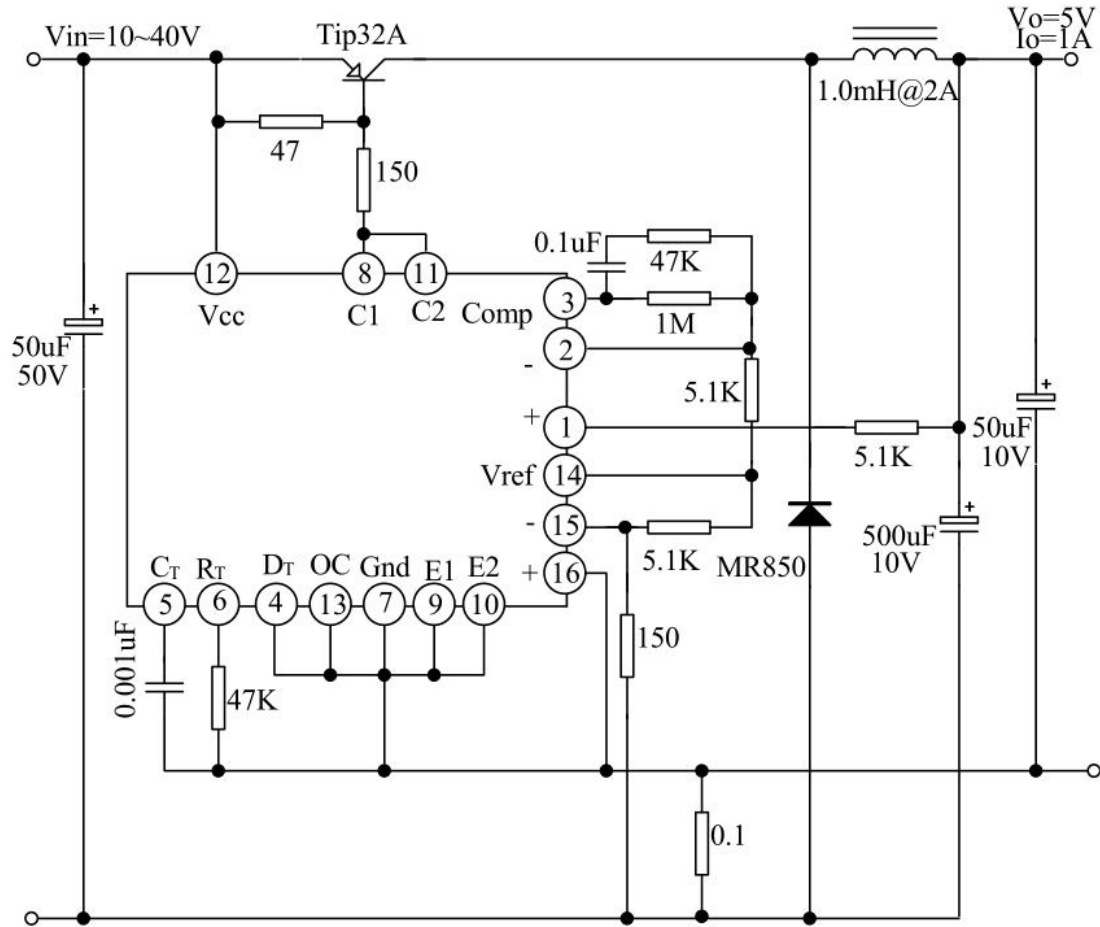


10. Pulse-width modulated push-pull converter



Test item	Conditions	Result
Line supply voltage	$V_{in}=10V\sim 40V$	14mV 0.28%
Load adjustment rate	$V_{in}=28V; I_o=1.0mA\sim 1.0A$	3.0mV 0.06%
Output ripple voltage	$V_{in}=28V; I_o=1.0A$	65mVpp P.A.R.D
Short-circuit current	$V_{in}=28V; R_L=0.1$	1.6A
Efficiency	$V_{in}=28V; I_o=1.0A$	71%

11. Pulse-width modulated step-down converter



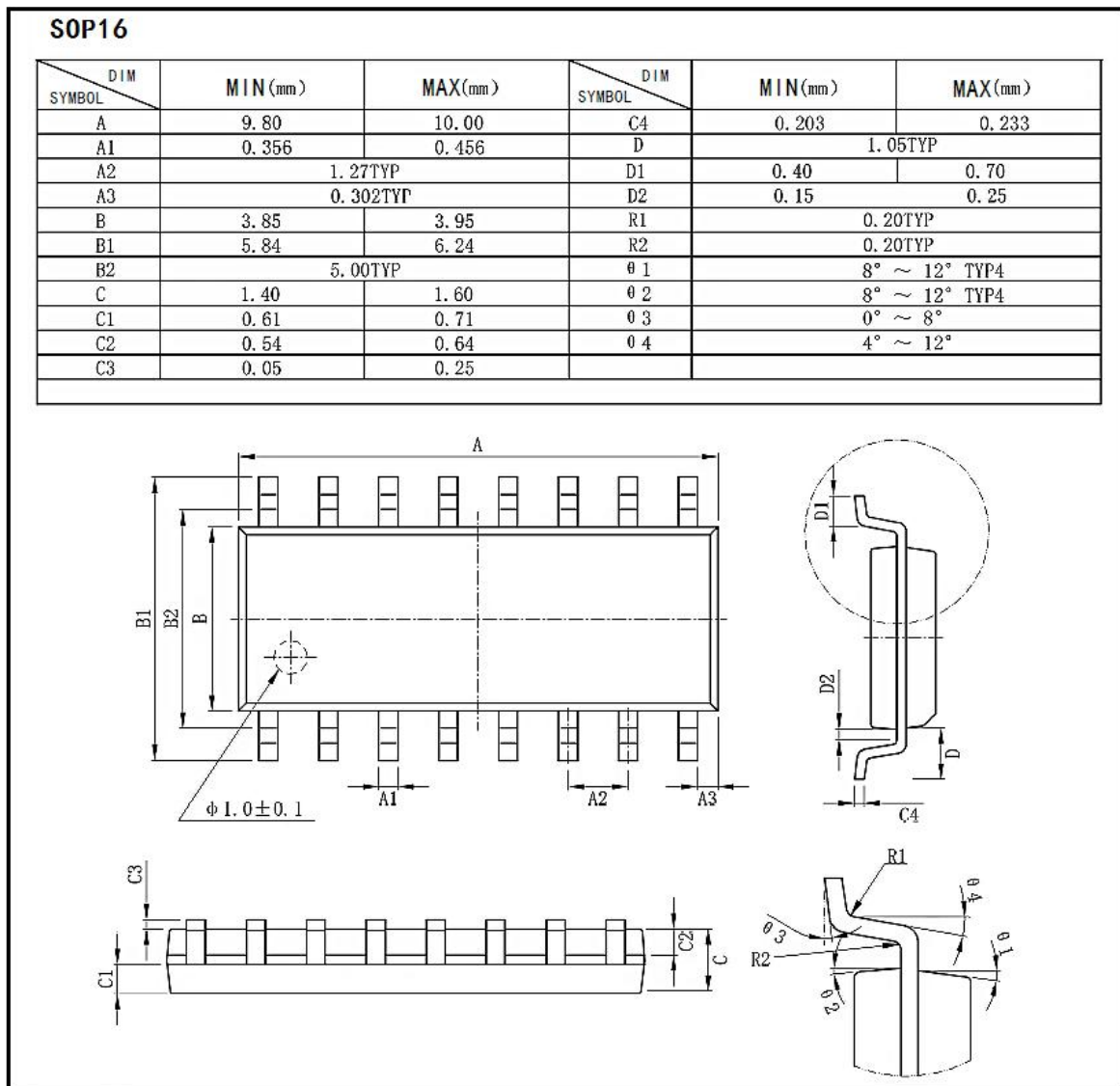
Test item	Conditions	Result
Line supply voltage	$V_{in}=8V\sim 40V$	3.0mV 0.01%
Load adjustment rate	$V_{in}=12.6V$ ; $I_o=0.2mA\sim 200mA$	5.0mV 0.02%
Output ripple voltage	$V_{in}=12.6V$ ; $I_o=200mA$	40mVpp P.A.R.D
Short-circuit current	$V_{in}=12.6V$ ; $R_L=0.1\Omega$	250mA
Efficiency	$V_{in}=12.6V$ ; $I_o=200mA$	71%

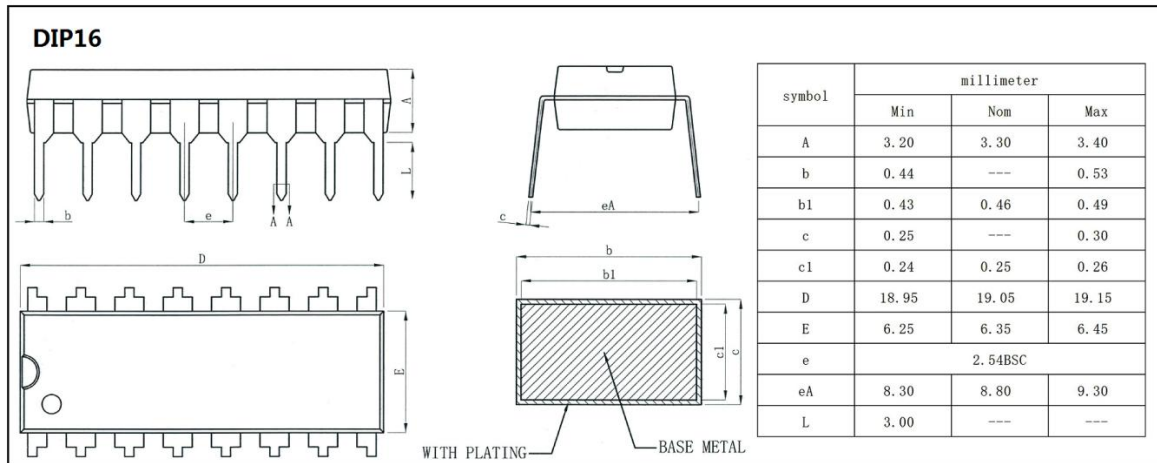
## 9. ORDERING INFORMATION

Ordering Information

Part Number	Device Marking	Package Type	Body size (mm)	Temperature (°C)	MSL	Transport Media	Package Quantity
XL494	XL494	SOP16	10.00 * 3.95	- 2 5 to 80	MSL3	T&R	2500
XD494	XD494	DIP16	19.05 * 6.35	- 2 5 to 80	MSL3	Tube 50	1000

## 10. DIMENSIONAL DRAWINGS





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