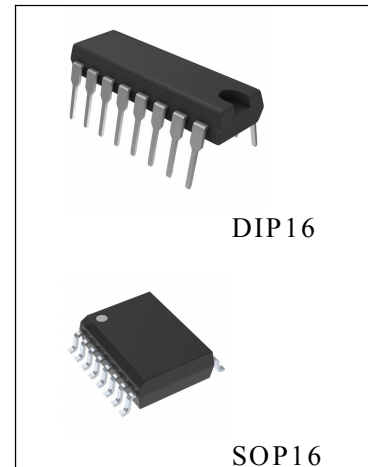




## General Description

The D2010 is designed as a phase-control circuit in bipolar technology. It enables load-current detection and has a soft-start function as well as reference voltage output. Motor control with load-current feedback and overload protection are preferred applications.

The D2010 is available in SOP16 and DIP16 packages.



## Features

- Full wave current sensing
- Mains supply variation compensated
- Programmable load-current limitation with over-and high-load output
- Variable soft-start
- Voltage and current synchronization
- Automatic retriggering switchable
- Triggering pulse typical 125mA
- Internal supply voltage monitoring
- Current requirement  $\leq 3\text{mA}$
- Temperature compensated reference voltage

## Package Information

Part NO.	Package Description	Package Marking	Package Option
D2010	DIP16	CHMC SXXXX D2010	25/Tube
D2010F	SOP16	CHMC SXXXX D2010F	50/Tube 1800/Reel

CHMC:Trademark

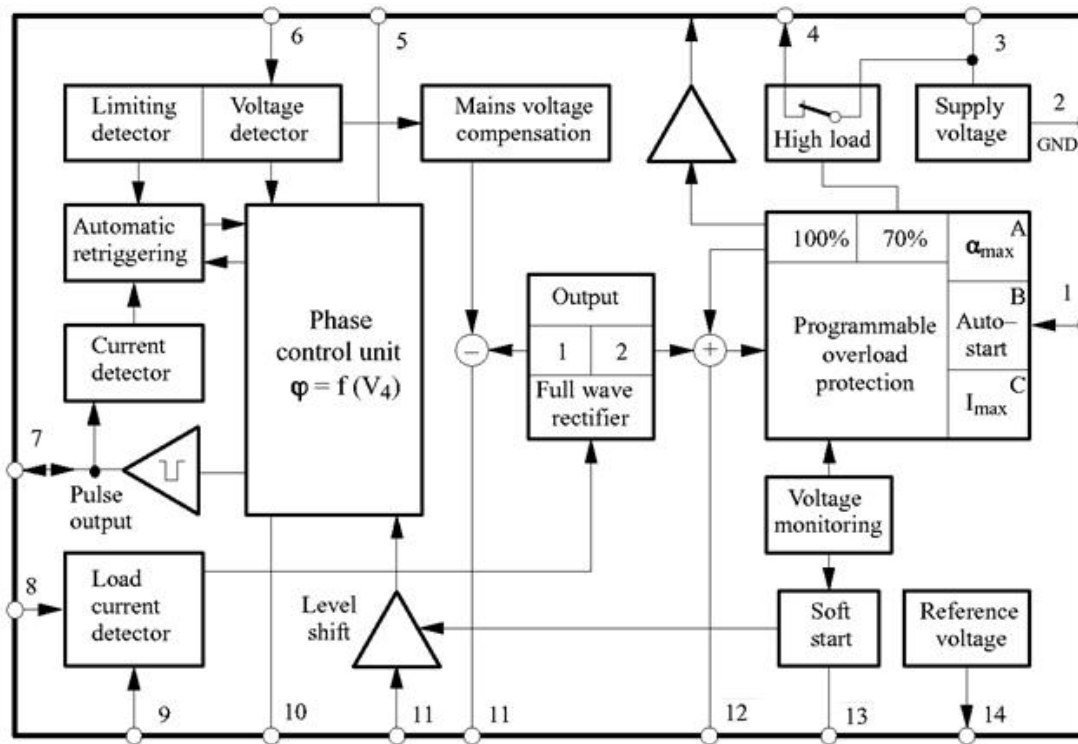
D2010/D2010F:Part NO.

SXXXX:Lot NO.

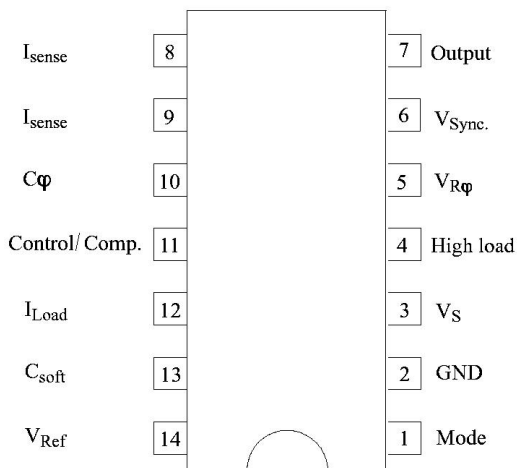
## Applications

- Advanced motor control
- Grinder
- Drilling machine

## Block Diagram

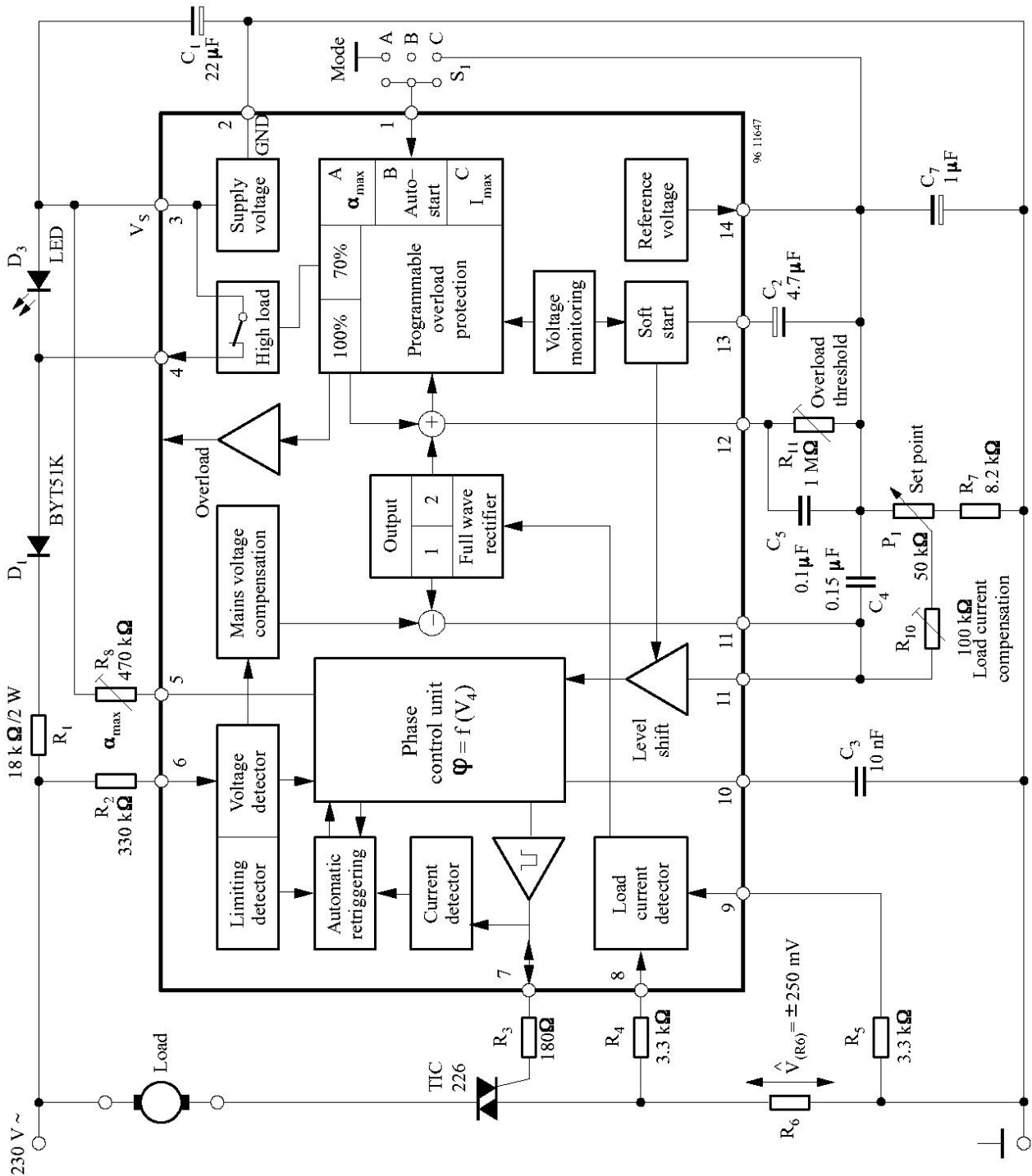


## Pin Configuration



Pin	Symbol	Function
1	Mode	Mode selection
2	GND	Ground
3	V <sub>s</sub>	Supply voltage
4	High load	High load indication
5	V <sub>Rφ</sub>	Ramp current adjust
6	V <sub>sync.</sub>	Voltage synchronization
7	Output	Trigger output
8	I <sub>sense</sub>	Load current sensing
9	I <sub>sense</sub>	Load current sensing
10	C <sub>φ</sub>	Ramp voltage
11	Control/Comp.	Control input/ Compensation output
12	I <sub>LOAD</sub>	Load current limitation
13	C <sub>soft</sub>	Soft start
14	V <sub>Ref</sub>	Reference voltage

Block Diagram With External Circuit



**Absolute Maximum Rating** (  $T_{amb}=25^{\circ}\text{C}$  )

Characteristics	Symbol	Value	Unit
Sink current      pin 11 $t \leq 10\mu\text{s}$	$-I_S$ $-i_s$	30 100	mA
Sync. current      pin 15 $t \leq 10\mu\text{s}$	$\pm I_{\text{sync}V}$ $\pm i_{\text{sync}V}$	5 20	mA
<b>Phase control</b>			
Control voltage	$-V_I$	$0-V_8$	V
Input current	$\pm I_I$	500	$\mu\text{A}$
Charging current	$-I_{\phi\text{max}}$	0.5	mA
<b>Soft-start</b>			
Input voltage	$-V_I$	$0-V_8$	V
<b>Pulse output</b>			
Input voltage      pin 16	$+V_I$ $-V_I$	2 $V_{11}$	V
<b>Reference voltage source</b>			
Output current      pin 8 $t \leq 10\mu\text{s}$	$I_o$	10 30	mA
<b>Load current sensing</b>			
Input current      pin 1 and 2	$\pm I_i$	1	mA
Input voltage      pin 5 and 6	$-V_i$	$0-V_8$	V
Overload output      pin 13	$I_L$	1	mA
High-load output      pin 12 $t \leq 10\mu\text{s}$	$I_L$	30 100	mA
Storage temperature range	$T_{\text{stg}}$	-40 to +125	$^{\circ}\text{C}$
Junction temperature range	$T_j$	125	$^{\circ}\text{C}$
Ambient temperature range	$T_{\text{amb}}$	-10 to +100	$^{\circ}\text{C}$

**Thermal Resistance**

Characteristics	Symbol	Value	Unit
Junction ambient      DIP16 SOP16 on p.c. SOP16 on ceramic	$R_{\text{thJA}}$	120 180 100	K/W

## Electrical Characteristics

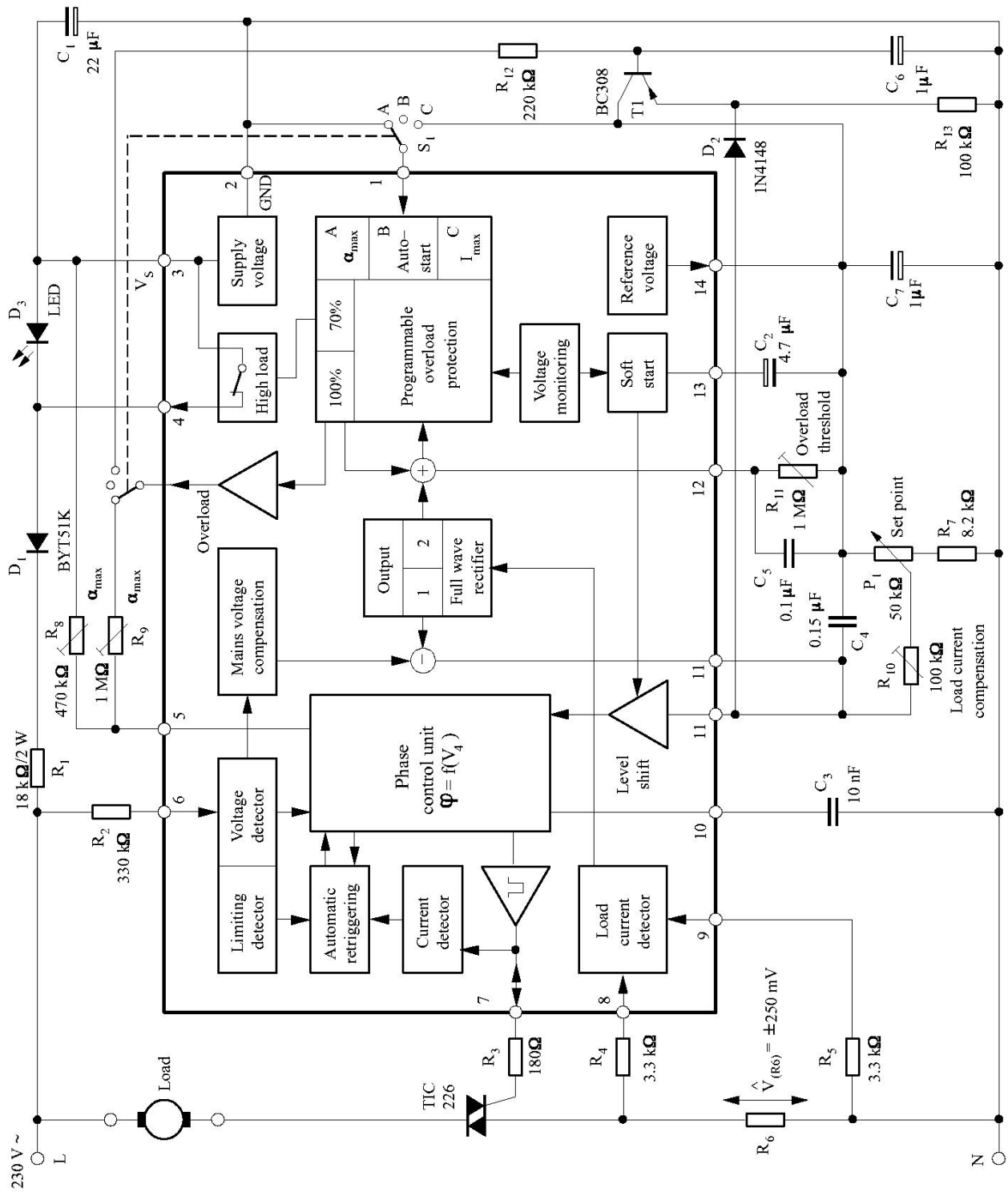
(Unless otherwise specified,  $V_s = -13V$ ,  $T_a = 25^\circ C$  reference point pin 10)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
<b>Supply</b>						
Supply voltage limitation	$-V_s$	$-I_s = 3.5mA$ $-I_s = 30mA$	14.5 14.6		16.5 16.8	V
Current requirement	$-I_s$	$-V_s = 13.0V$ (pins 1, 2, 8 and 15 open)			3.2	mA
<b>Reference voltage source</b>						
Reference voltage	$-V_{Ref}$	$I_L = 10\mu A$ $I_L = 2.5mA$	8.6 8.4	8.9 8.8	9.2 9.1	V
Temperature coefficient	$TC_{V_{Ref}}$	$I_s = 2.5mA$ $I_s = 10\mu A$		-0.004 +0.006		%/K
<b>Voltage monitoring pin11</b>						
Turn-on threshold	$-V_{son}$			11.3	12.3	V
<b>Phase control-synchronization</b>						
Input current	$\pm I_{syncV}$	Voltage sync.	0.15		2	mA
Voltage limitation	$\pm V_{syncV}$	$\pm I_L = 2mA$	8.0	8.5	9.0	V
Input current	$\pm I_{syncI}$	Current sync. Pin16	3		30	$\mu A$
<b>Reference ramp</b>						
Charging current	$-I_\phi$	Pin14	1		100	$\mu A$
Start voltage	$-V_{max}$	Pin3	1.85	1.95	2.05	V
Temperature coefficient of start voltage	$TC_R$	Pin3		-0.003		%/K
Final voltage	$-V_{min}$	Pin3	$V_8 \pm 200mV$			
$R_\phi$ -reference voltage	$V_{R\phi}$	$I_\phi = 10\mu A$ pin14 and 11	0.96	1.02	1.10	V
Temperature coefficient	$TC_{V_{R\phi}}$	$I_\phi = 10\mu A$ pin14 $I_\phi = 1\mu A$		0.03 0.06		%/K
Pulse output current	$I_0$	$V_{16} = -1.2V$ pin16	100	125	150	mA
Output pulse width	$t_p$	$V_s = V_{limit}$ , $C_3 = 3.3nF$ pin16		30		$\mu s$
<b>Automatic retriggering</b>						
Repetition rate	$t_{pp}$	$I_{15} \geq 150\mu A$	3	5	7.5	tp
Threshold voltage	$\pm V_I$	Pin16	20		60	mV
<b>Soft start pin 7</b>						
Starting current	$-I_0$	$V_7 = V_8$	5	10	15	$\mu A$
Final current	$-I_0$	$V_{7-10} = -1V$	15	25	40	$\mu A$
Discharge current	$+I_0$		0.5			mA
Output current	$+I_0$	Pin4	0.2		2	mA
<b>Supply voltage compensation pin 15</b>						
Transfer gain	$G_i$	$I_{15/I5}$ pin15/5 (pins 1 and 2 open)	14	17	20	
Output offset current	$\pm I_0$	$V_{(R6)} = V_{15} = V_5 = 0$			2	$\mu A$

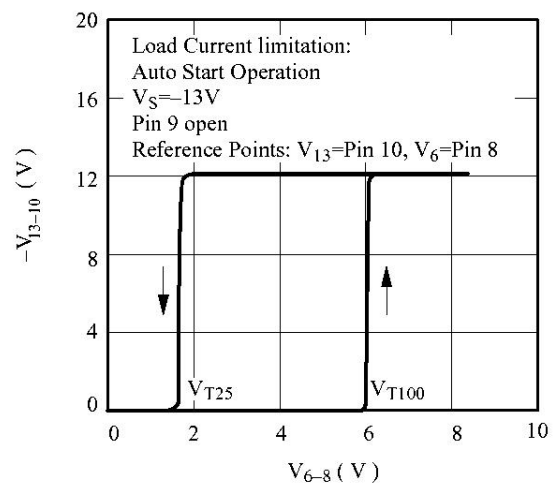
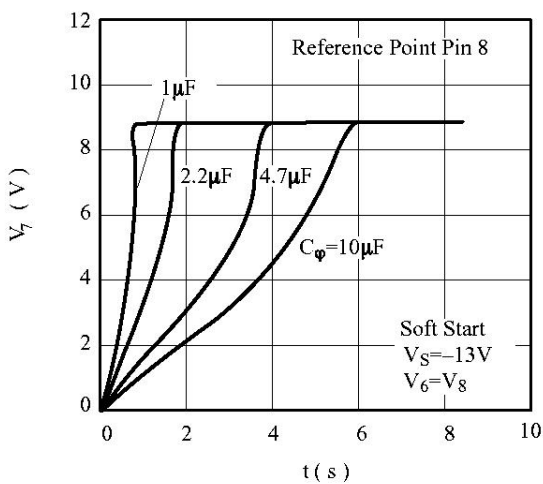
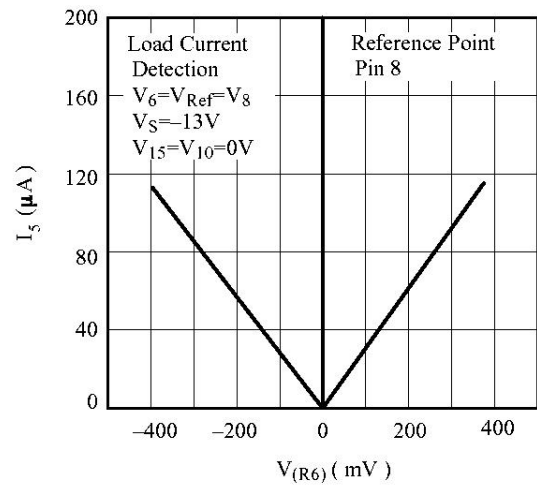
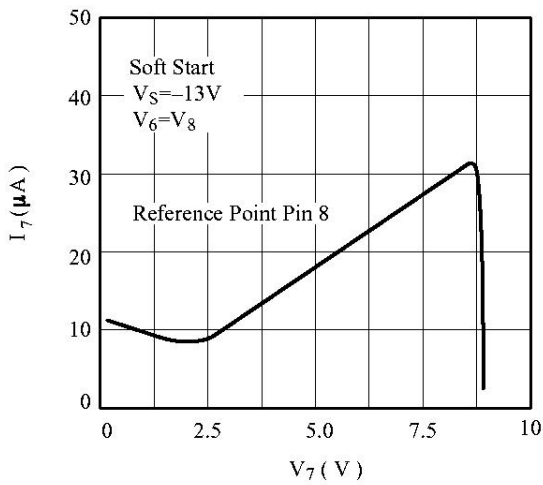
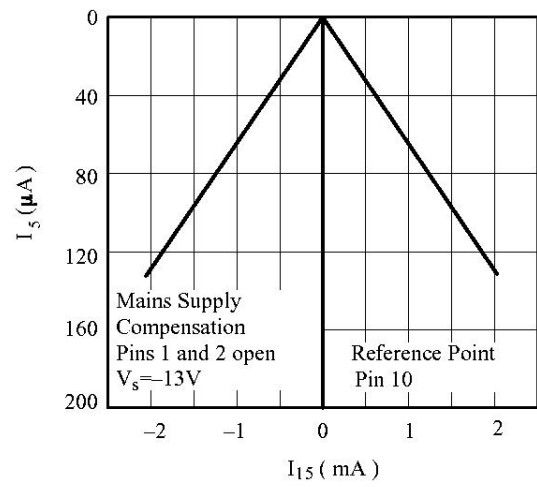
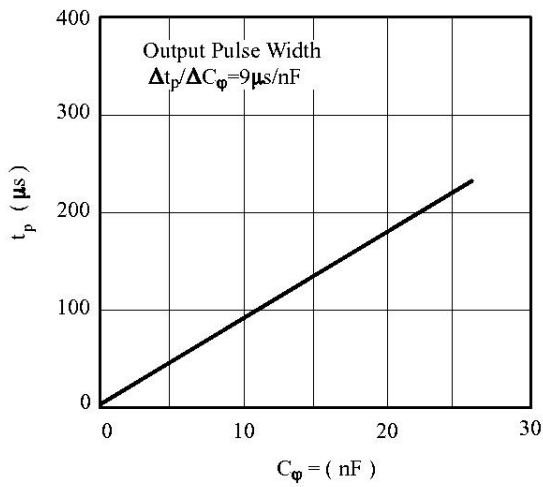
Continue:

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
<b>Load current detection</b> $R_1=R_2=3k\Omega, V_{15}=0, V_5=V_6=V_8$						
Transfer gain	$G_I$	$I_5/150mV, I_6/150mV$	0.28	0.32	0.37	$\mu A/mV$
Output offset current	$-I_0$	Pin5, pin6-8	0	3	6	$\mu A$
Reference voltage	$-V_{Ref}$	$I_1, I_2=100\mu A$ pins 1 and 2	300		400	mV
Shunt voltage amplitude	$\pm V_{(R6)}$				250	mV
<b>Load current limitation pin6-8</b>						
High load switching	$V_{T70}$	Threshold $V_{T70}$	4	4.35	4.7	V
Overload switching	$V_{T100}$	Threshold $V_{T100}$	5.8	6.2	6.6	V
Restart switching	$V_{T25}$	Threshold $V_{T25}$	1.25	1.55	1.85	V
Input current	$I_i$	Enquiry mode			1	$\mu A$
Output impedance	$R_o$	Switching mode	2	4	8	$k\Omega$
<b>Programming input pin9</b>						
Input voltage-auto-start	$-V_9$	Pin 9 open	3.8	4.3	4.7	V
Input current	$-I_9$	$V_9=0(\alpha_{max})$	5	10	20	$\mu A$
	$I_9$	$V_9=V_8(I_{max})$	5	10	20	
<b>High load output <math>V_{T70}</math> pin11-12 <math>I_{12}=-3mA</math></b>						
Saturation voltage	$V_{sat}$	$V_{6-8} \leq V_{T70}$	0.5	0.75	1.0	V
	$V_{lim}$	$V_{6-8} \geq V_{T70}$	7.0	7.4	7.8	
<b>Overload output <math>V_{T100}</math> <math>V_9=open</math> or <math>V_9=V_{10}</math></b>						
Leakage current	$I_{lkg}$	$V_{6-8} \leq V_{T25}$ $V_{13}=(V_{11}+1)V$ pin 13			0.5	$\mu A$
Saturation voltage	$V_{sat}$	$V_{6-8} \geq V_{T100}$ $I_{13}=10\mu A$ pin11-13			0.1	V
Output current,max.load	$I_{13}$	$V_9=V_8$ pin 13			1	mA
Leakage current	$I_{lkg}$	$V_6 \leq V_{T100}$ pin 13			4	$\mu A$
Output impedance	$R_o$	Open collector $V_6 \geq V_{T100}$ pin 13	2	4	8	$k\Omega$
Saturation voltage	$V_{13-8}$	$V_{6-8} \geq V_{T100}$ $I_{13}=10\mu A$ pin13		100		mV

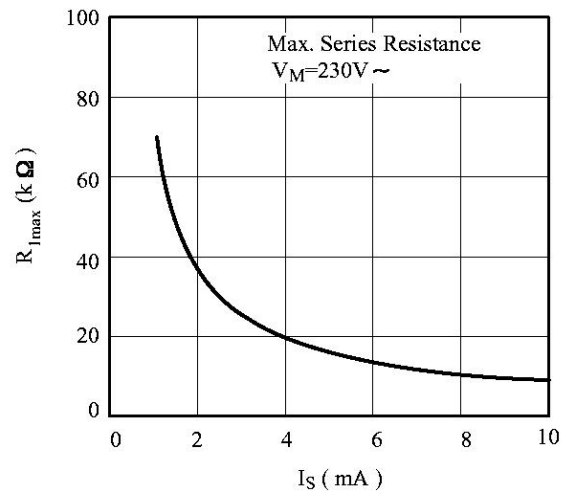
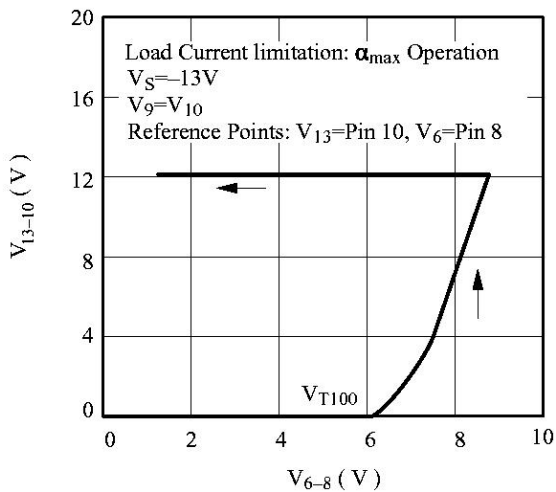
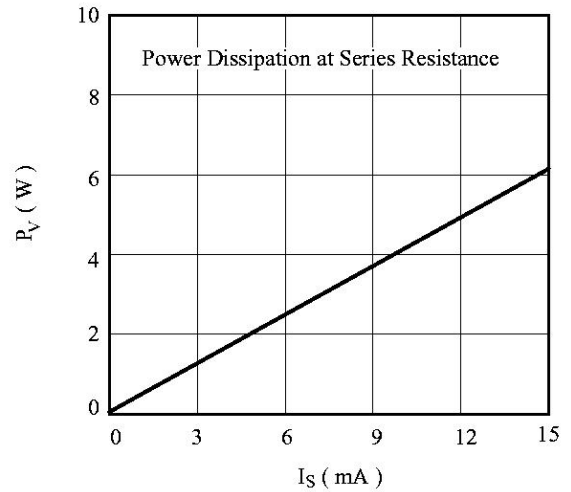
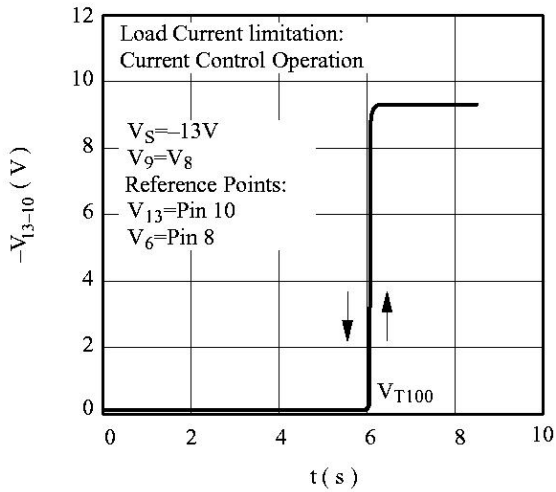
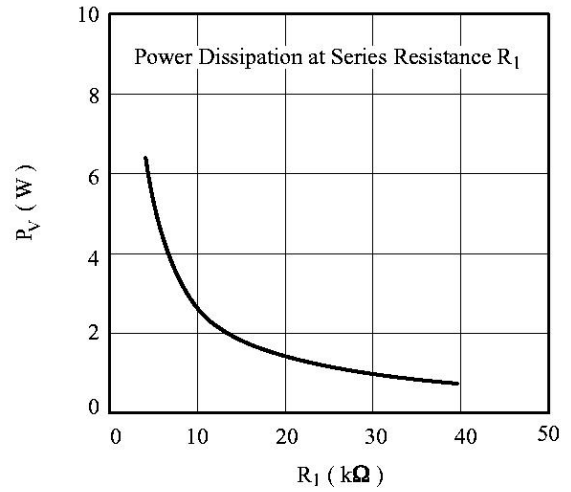
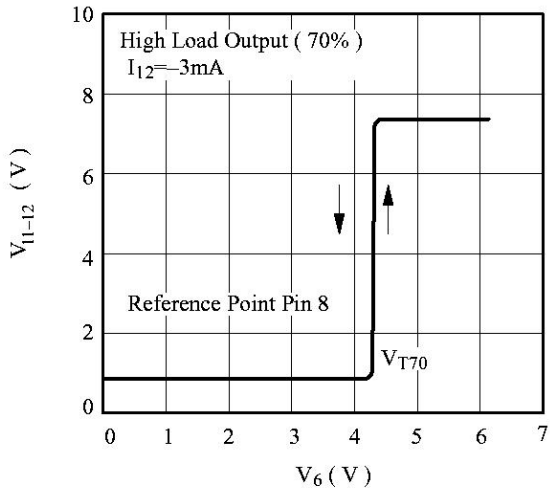
Application Circuit

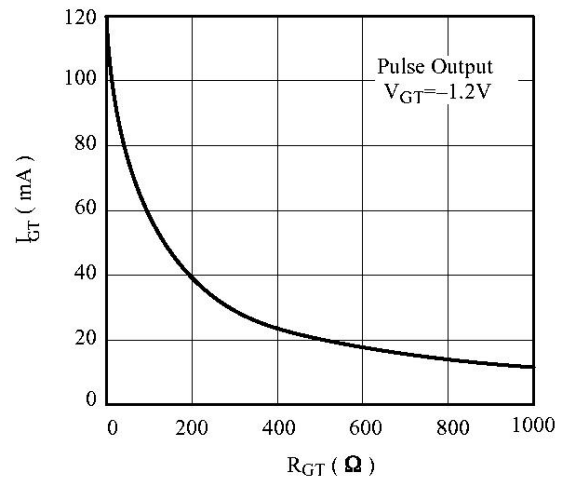
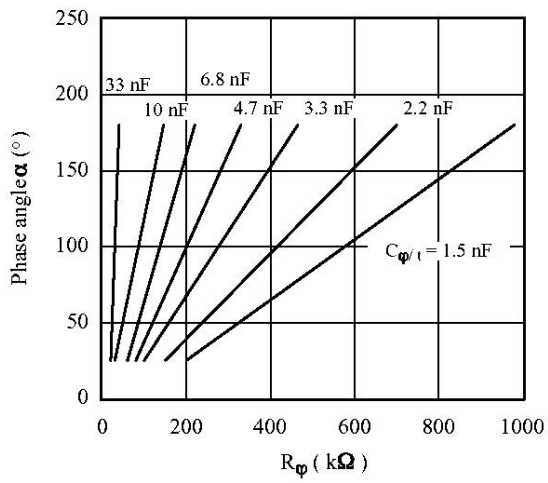


## Characteristics Curves

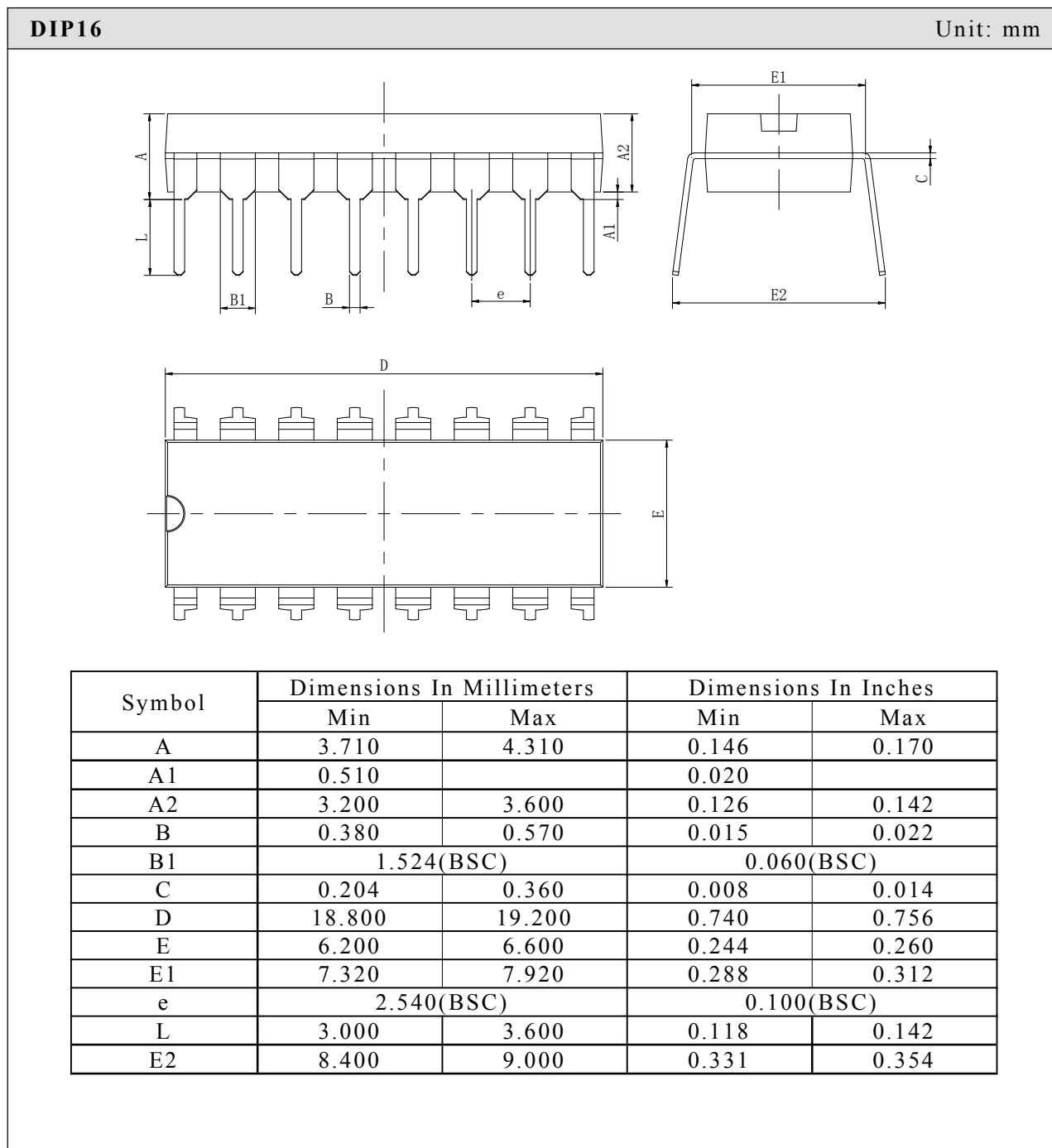






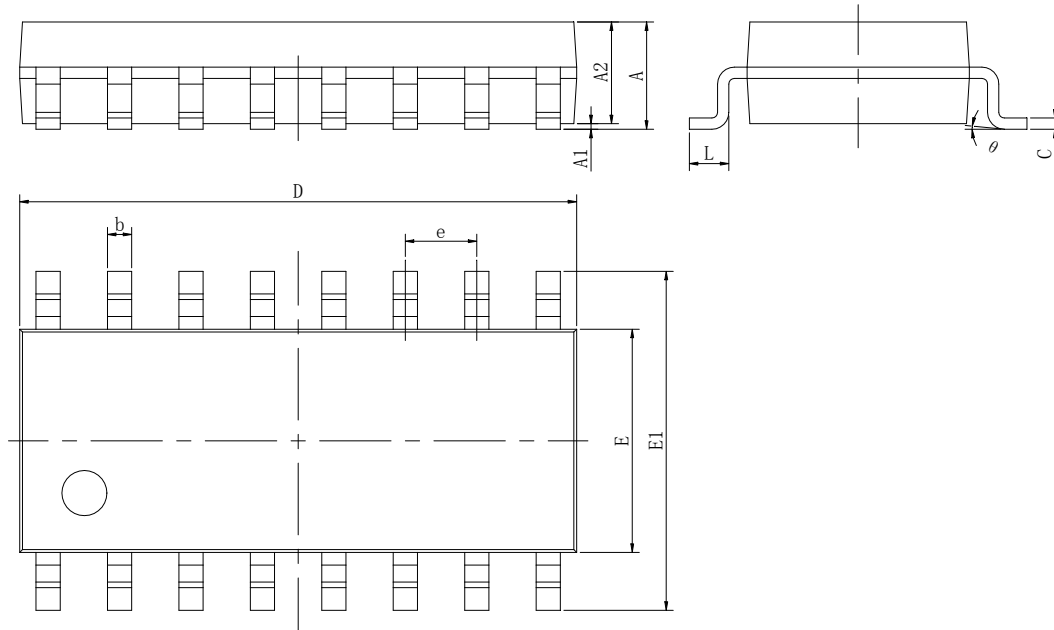


## Outline Dimensions



SOP16

Unit: mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	9.800	10.200	0.386	0.402
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
theta	0°	8°	0°	8°

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