TSM115

## 3.3V +5V ±12V Housekeeping IC

- **Over voltage and under voltage protection for 3.3V +5V and ±12V without external components**
- **Over current protection for 3.3V 5V and 12V with external components**
- **Under voltage blanking fonction**
- **Power good input/output**
- **Externally adjustable PG delay**
- **Fault output**
- **Remote output**
- **Externally adjustable remote delay**
- **2kV ESD protection**

N
DIP-20
(Plastic Package)

D
SO-20
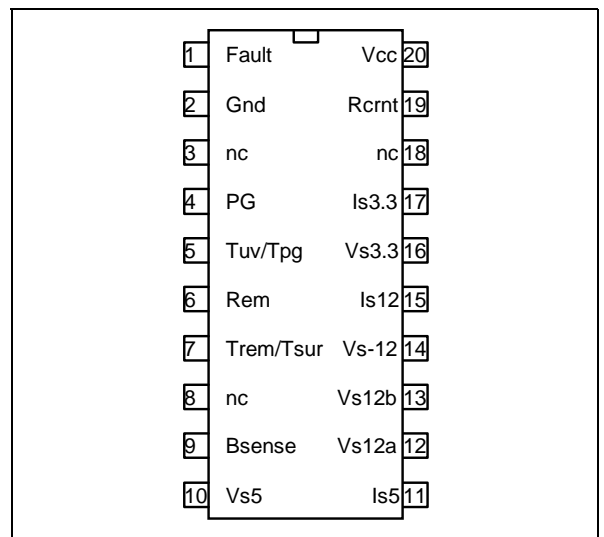(Plastic Micropackage)
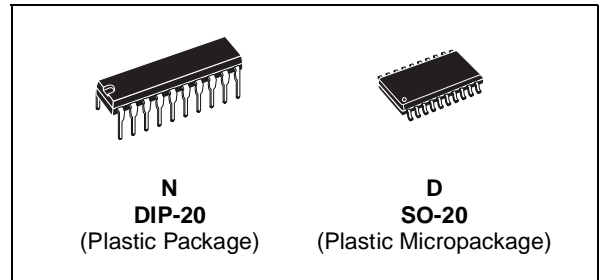
DESCRIPTION

The TSM115 integrated circuit incorporates all sensing circuitry to protect from over and under voltage and over current a multiple output power supply (3.3V, +5V and ±12V).

TSM115 incorporates all the necessary functions for Housekeeping features which allow safe operation in all conditions, and very high system integration.

PIN CONNECTIONS (top view)

Pin	Left	Right	Pin
1	Fault	Vcc	20
2	Gnd	Rcrnt	19
3	nc	nc	18
4	PG	Is3.3	17
5	Tuv/Tpg	Vs3.3	16
6	Rem	Is12	15
7	Trem/Tsur	Vs-12	14
8	nc	Vs12b	13
9	Bsense	Vs12a	12
10	Vs5	Is5	11

APPLICATION

- **PC SMPS Multiple Power Line Housekeeping IC (3.3V +5V ±12V)**

ORDER CODE

Part Number	Temperature Range	Package	Packaging	Marking
TSM115CN	0 to 95°C	DIP	Tube	TSM115C
TSM115CD		SO	Tube or Tape & Reel	M115

1 Pin Description

Name	Pin #	Type	Function
Fault	1	Open collector	**Fault** output. Output of the over voltage and under voltage comparators.
Gnd	2	Power supply	Signal ground and silicon substrate
PG	4	Open collector	Output of the **Tpg** comparator. This pin goes low upon an under voltage condition. Except for the delay set by the **Tpg** capacitor this pin always reflects the actual state of the under voltage sensing comparators output.
Tuv/Tpg	5	Timing capacitor	A capacitor from this pin to **Gnd** provides a delay between outputs rail voltage within regulation and **PG** output going high. Capacitor discharges whenever **Bsense** low or **Rem** high or UVP is detected. This capacitor will also provide the under voltage blanking function when the voltage at this pin is larger than the **Vref** voltage. The under voltage function resume.
Rem	6	Control Input pin	Pulling this pin high will send the **Fault** pin high latching off the power supply, reset the internal latch, discharge the start-up timing capacitors, **Tuv** and **Tpg** capacitors, allowing normal start up of the system. Pulling this pin low will send the **Fault** pin low, initiating a normal start up function.
Trem/Tsur	7	Timing capacitor	A capacitor from this pin to **Gnd** will delay the **Fault** signal when the **Rem** pin is used to shut down the power supply. The **PG** will signal a power failure warming immediately, but the **Fault** pin shut down of the power will be delayed. This capacitor will also provide the overcurrent blanking function (surge current).
Bsense	9	Control input pin	Non inverting input to the **Bsense** voltage sensing comparator. Pulling this pin lower than 2.5V will cause **PG** goes low and **Tuv** goes low.
Vs5	10	Analog input	Over voltage and under voltage detection for +5V rail
Is5	11	Analog Input	5V overcurrent control sense input.
Vs12a	12	Analog input	Over voltage and under voltage detection for +12V rail
Vs12b	13	Analog input	Over voltage and under voltage detection for +12V rail
Vs-12	14	Analog input	Over voltage and under voltage detection for -12V rail.
Is12	15	Analog Input	12V overcurrent control sense input.
Vs3.3	16	Analog input	Over voltage and under voltage detection for 3.3V rail.
Is3.3	17	Analog Input	3.3V overcurrent control sense input.
Rcrnt	19	Analog input	A resistor from this pin to **Gnd** will provide the internal constant current.
Vcc	20	Power supply	Supply input voltage

ABSOLUTE MAXIMUM RATINGS

Symbol	DC Supply Voltage	Value	Unit
Vcc	DC Supply Voltage [1]	-0.3 to 18	V
Vpmax	Terminal voltage Vs3.3, Is3.3, Vs12, Is12, Vs5, Is5	-0.3 to 18	V
Vnmax	Terminal voltage Vs-12	-15 to 5	V
VDBTT	VTpg/Tuv, VTrem/Tsur input voltage	-0.3 to 3.3V	V
VTER	Other terminals	-0.3 to Vcc	V
PT	Power dissipation	1	W
Tstg	Storage temperature	-55 to 150	°C
Tj	Junction temperature	150	°C
ESD	Electrostatic Discharge	2	kV

1) All voltage values, except differential voltage are with respect to network ground terminal.

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
Vcc	DC Supply Conditions	3 to 15	V
Toper	Temperature range	0 to 95	°C

2 Electrical Characteristics

Tamb = 25°C, Vcc=5V, Vs3.3=3.3V, Vs5=5V, Vs12= 12V, Vs-12=-12V, Rem=Low, Rcrnt=12kΩ

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
Total Current Consumption						
Icc	Total Supply Current				1	mA
Iccstdby	Total Supply Current in Stand-by Conditions	Rem=high Vs3.3=0V, Vs5=0V Vs12=0V, Vs-12=0V			1	mA
Vccmin	Min operating Vcc	Tmin < Tamb < Tmax			3	V
Over Voltage and Under Voltage Protection						
Vov12	Over Voltage Sense 12V		13.6	14	14.4	V
Vuv12	Under Voltage Sense 12V		8.85	9.12	9.39	V
Iin12b	Input current Voltage sense 12V		50	100	200	µA
Vov5	Over Voltage Sense 5V		6.01	6.20	6.39	V
Vuv5	Under Voltage Sense 5V		4.00	4.12	4.24	V
Iin5	Input current Voltage Sense 5V		50	100	200	µA
Dis5	Disable Voltage Sense 5V		7	7.5	8	V
Vov3.3	Over Voltage Sense 3.3V		3.88	4.00	4.12	V
Vuv3.3	Under Voltage Sense 3.3V		2.52	2.60	2.68	V
Iin3.3	Input current Voltage Sense 3.3V		25	50	100	µA
Vov-12	Over Voltage Sense -12V		-15.49	-15.04	-14.59	V
Vuv-12	Under Voltage Sense -12V		-9.99	-9.70	-9.41	V
Iin-12	Input current Voltage sense -12V		-200	-100	-50	µA
Dis-12	Disable Voltage Sense -12V			3.3		V
Internal delay time						
Tdelay	Internal time		30	37	45	µs
Over current Protection						
Is3.3	Current source		46	50	54	µA
Vicm3.3	Input common mode		0.7		Vov3.3	V
Vio3.3	Input offset voltage			2	3	mV
Is5	Current source		46	50	54	µA
Vicm5	Input common mode		0.7		Vov5	V
Vio5	Input offset voltage			2	3	mV
Is12	Current source		46	50	54	µA
Vicm12a	Input common mode		0.7		Vov12	V
Vio12a	Input offset voltage			2	3	mV
Vicm12b	Input common mode		0.7		Vov12	V
Vio12b	Input offset voltage			2	3	mV
Iin12a	Input current			10		µA
Bsense						
Thbs	Bsense voltage threshold		1.218		1.282	V
Ilbs	Bsense current leakage	Bsense=1V		0	1	µA
Iobs	Current source	Bsense=1.5V	90	100	110	µA
DIobsT	Current source drift in temperature	Tmin < Tamb < Tmax		5		µA
Vbsoh	Clamp voltage	IoBsense=1µA	2.00	2.15	2.30	V
Iclbs	Clamping current	Bsense > 2.5V Tmin < Tamb < Tmax	3	3.6	5	mA
Vinbs	Input voltage		-0.3		2.5	V

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
Rem						
THrm	High threshold	From Low to high	1.87	1.93	1.99	V
TLrm	Low threshold	From high to low	1.0	1.25	1.4	V
Power Good (PG)						
Ipgol	Sink current	VPg=0.4V	10			mA
Vpgol	Low output voltage	Ipg=10mA			0.4	V
Tpgr	Rise time PG	Rpg=1K			500	ns
Under Voltage Blanking (Tuv) and Power Good (Tpg) times						
Iotuvtpg	Current output source	Vtuvtpg = 0V	4.5	5	5.5	µA
THtuv	High threshold blanking	From low to high voltage	0.287	0.312	0.337	V
TLtuv	Low threshold blanking	From high to low voltage		0.25		V
THtpg	High threshold power good	From low to high voltage	1.218	1.25	1.282	V
TLtpg	Low threshold power good	From high to low voltage	0.9	1	1.1	V
Idtuvtpg	Current discharge of TuvTpg		2	5		mA
Vtuvtpgol	Low output voltage	Iotutpg = 1mA			0.2	V
Vtuvtpgoh	Clamp voltage		2.1	2.3	2.5	V
VinTuvTpg	Input voltage		-0.3		2.3	V
DIotuvtpg	Current source drift in temperature	Tmin < Tamb < Tmax			1	µA
Remote (Trem) and Surge current blanking (Tsur) times						
Iotrm	TRem current source	Vtrmtsur = 0V	90	100	110	µA
Iotsur	Tsur current source	Vtrmtsur = 0V	9	10	11	µA
THtrm	High thresold voltage TRem	From low to high	1.218	1.25	1.282	V
TLtrm	Low thresold voltage TRem	From high to low	0.9	1	1.1	V
Idtrmtsur	Current discharge of TRemTsur		2	5		mA
Vtrmtsurol	Low output voltage	Iotmtsur = 1mA			0.2	V
Vtrmtsuroh	Clamp voltage		2.1	2.3	2.5	V
Vintrmtsur	Input voltage		-0.3		2.3	V
DIotrm	Current source drift in temperature	Tmin < Tamb < Tmax			5	µA
DIotsur	Current source drift in temperature	Tmin < Tamb < Tmax			500	nA
Fault						
Ifltol	IFault sink current	VFault=0.4V	10			mA
Vfltol	Low output voltage	IFault=10mA			0.4	V
THVcc	High threshold voltage, Vcc low to high	Rem low, all lines between UV and OV.			2.95	V
TLVcc	Low threshold voltage, Vcc high to low				2.65	V
HystVcc	Vcc hysteresis : THVcc-TLVcc		TBD	300	TBD	mV
Rcrnt						
VRcrn	Output voltage		1.20	1.25	1.30	V

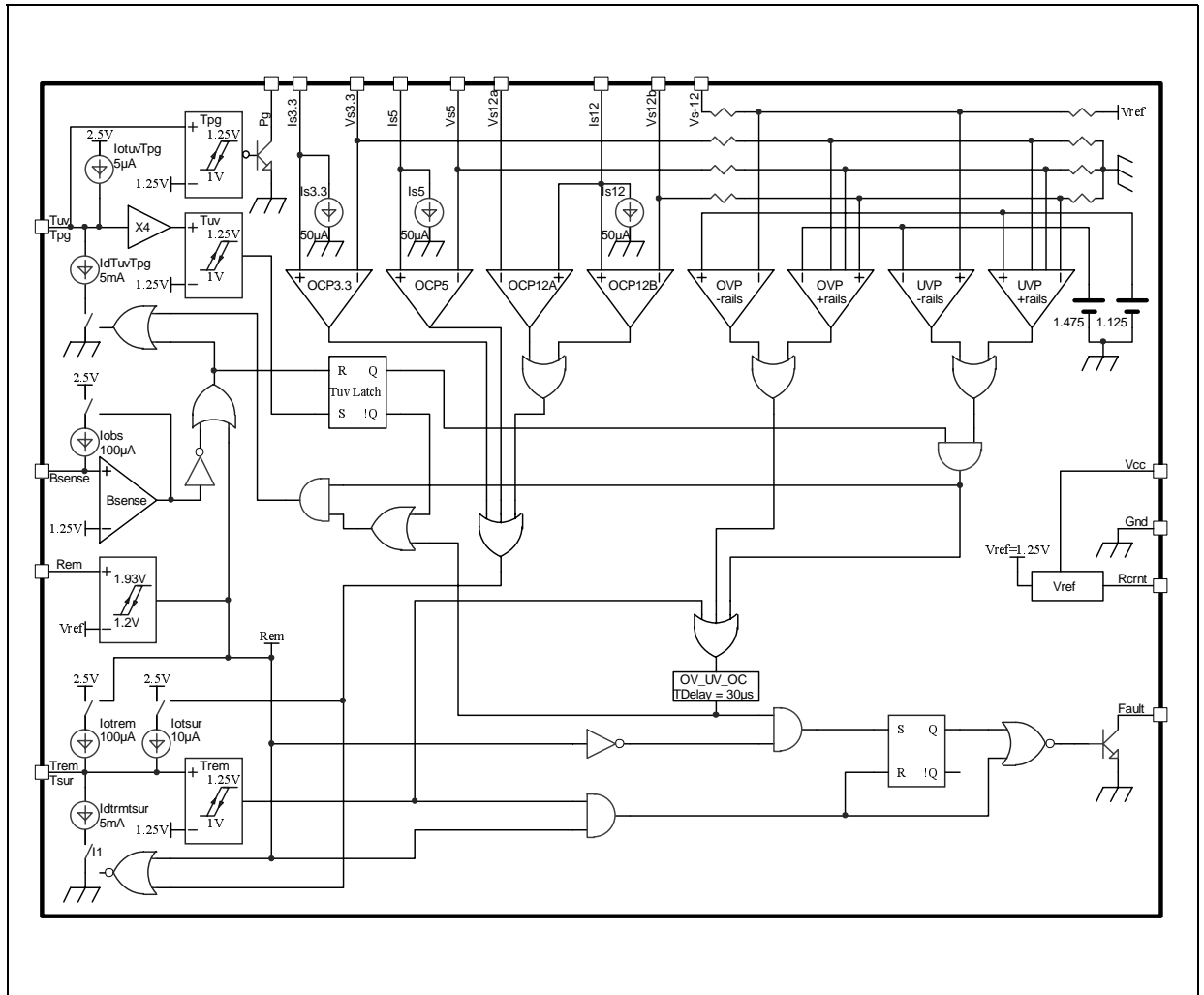**Fig. 1: Application Schematic**
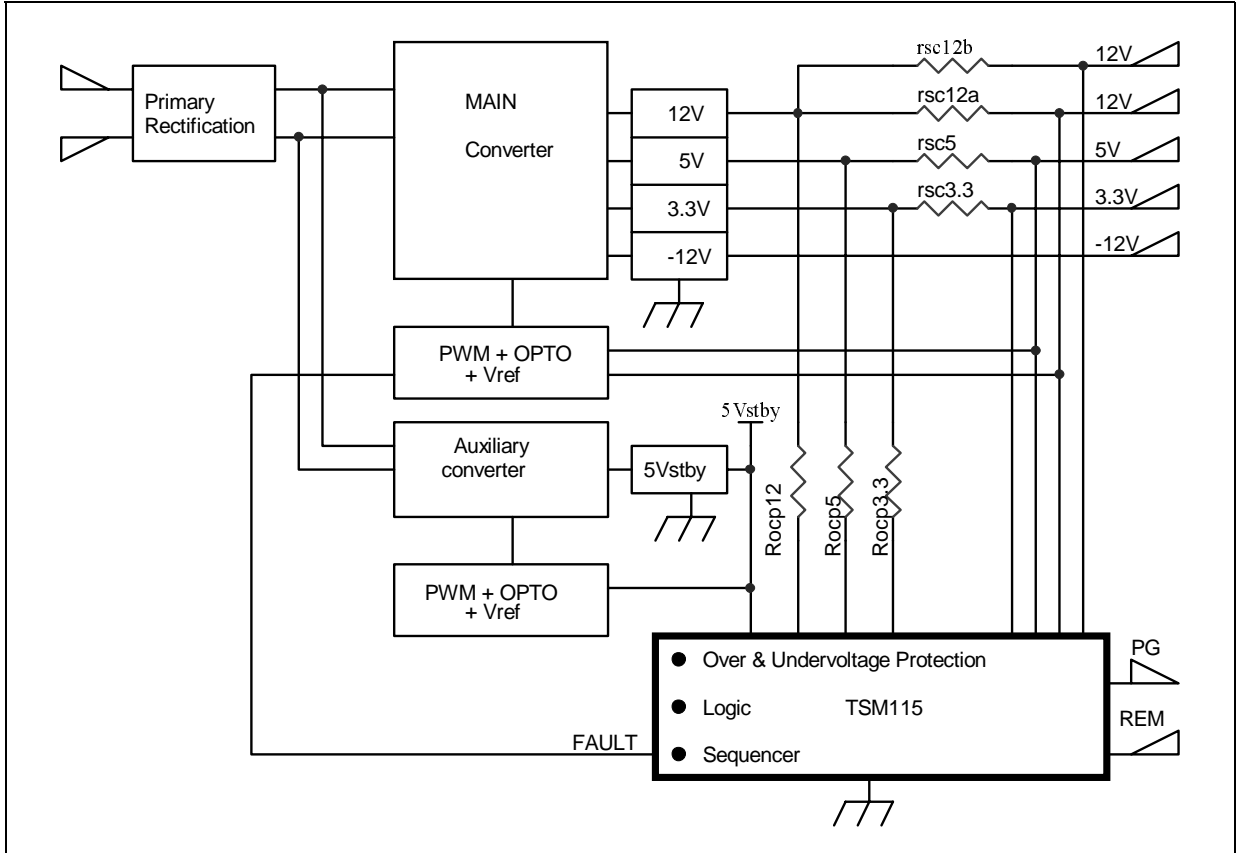
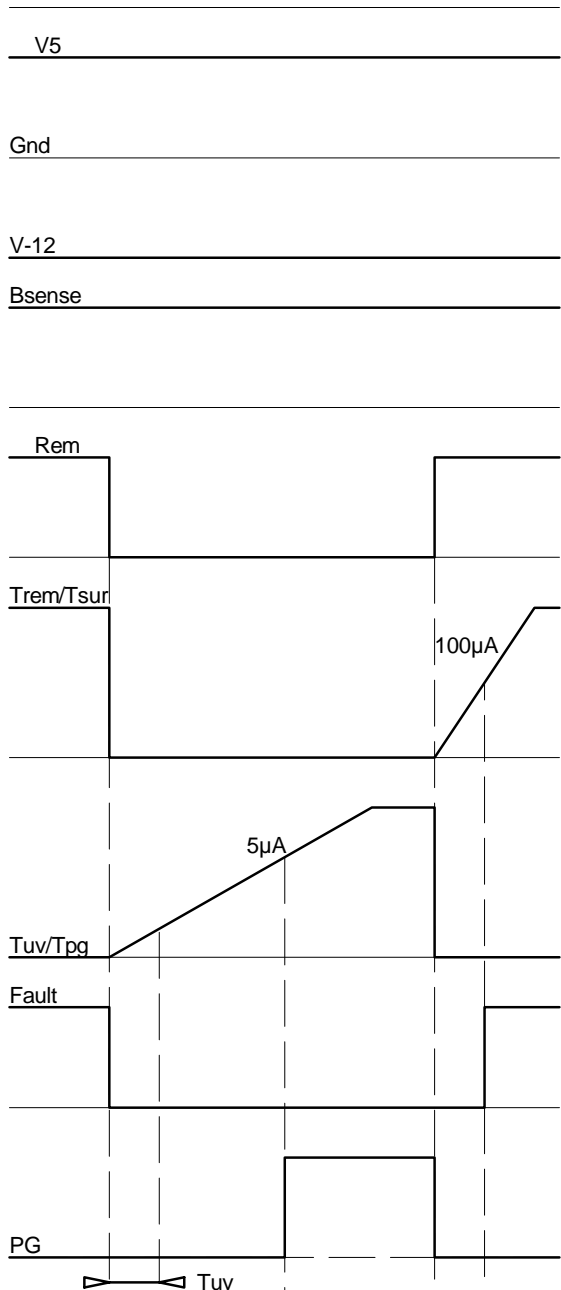

Fig. 2: Internal Bloc Schematic
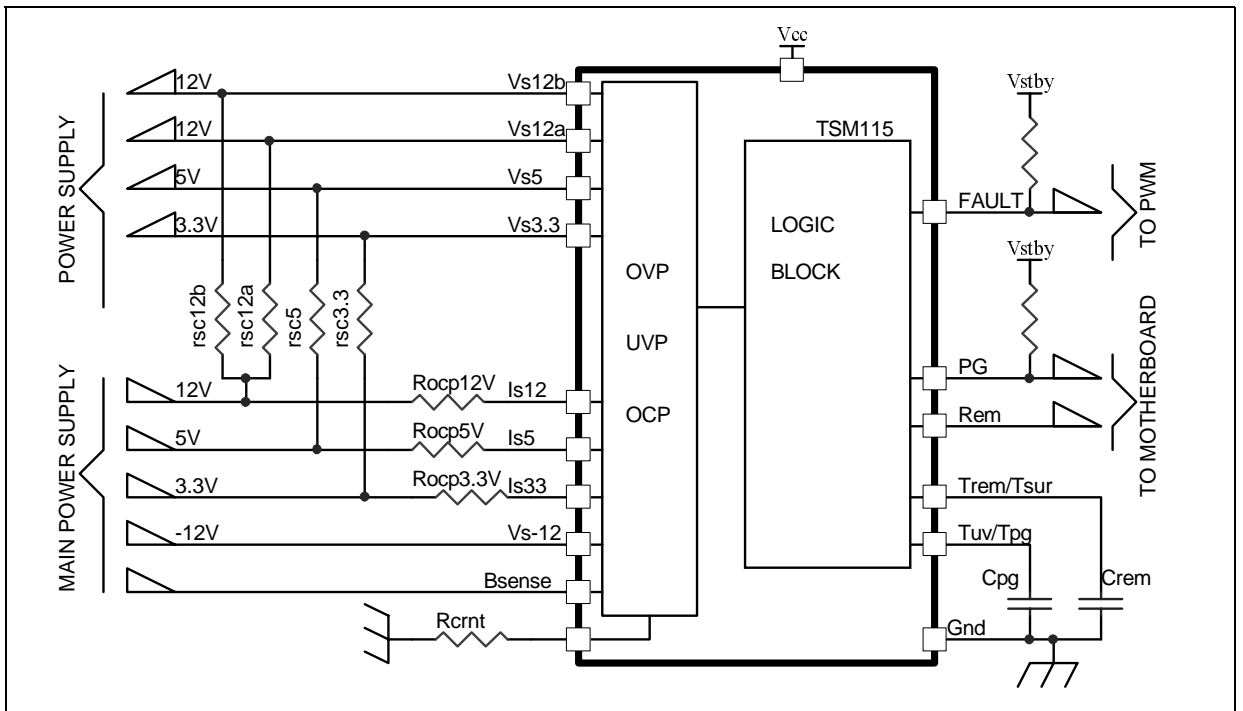
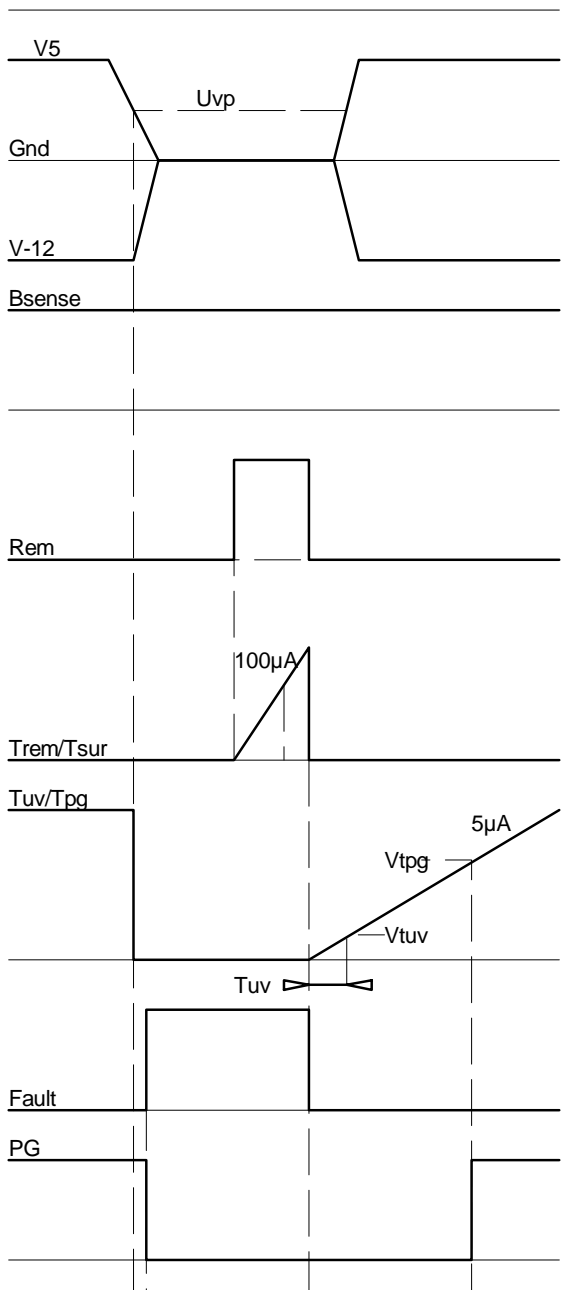## Principle of Operation and Application Hints

Fig. 3: Internal Detailed Schematic

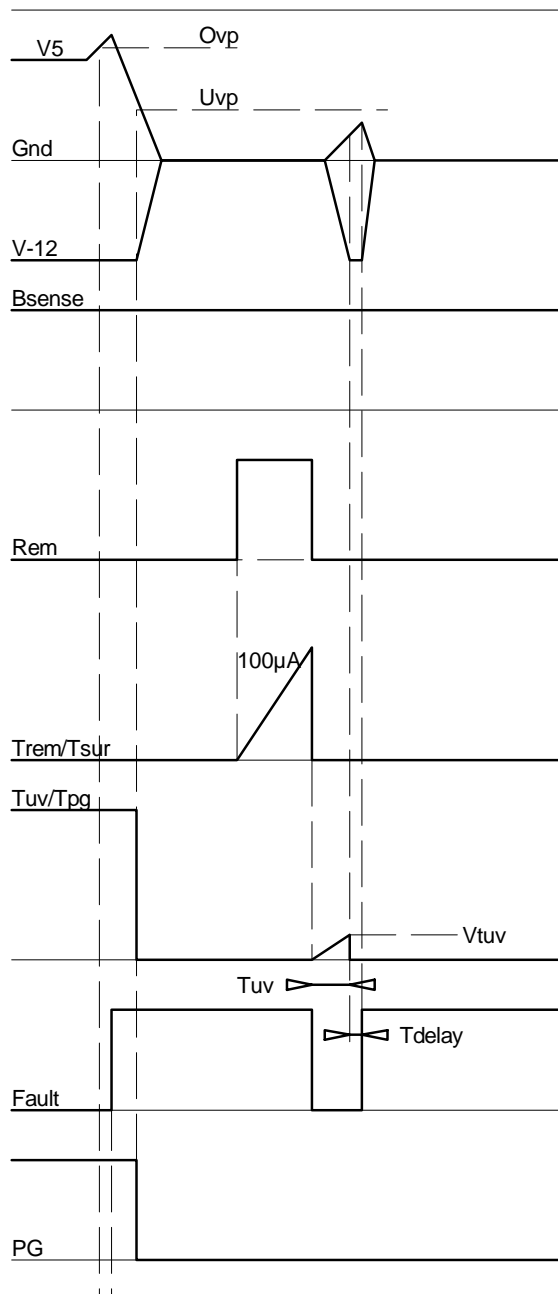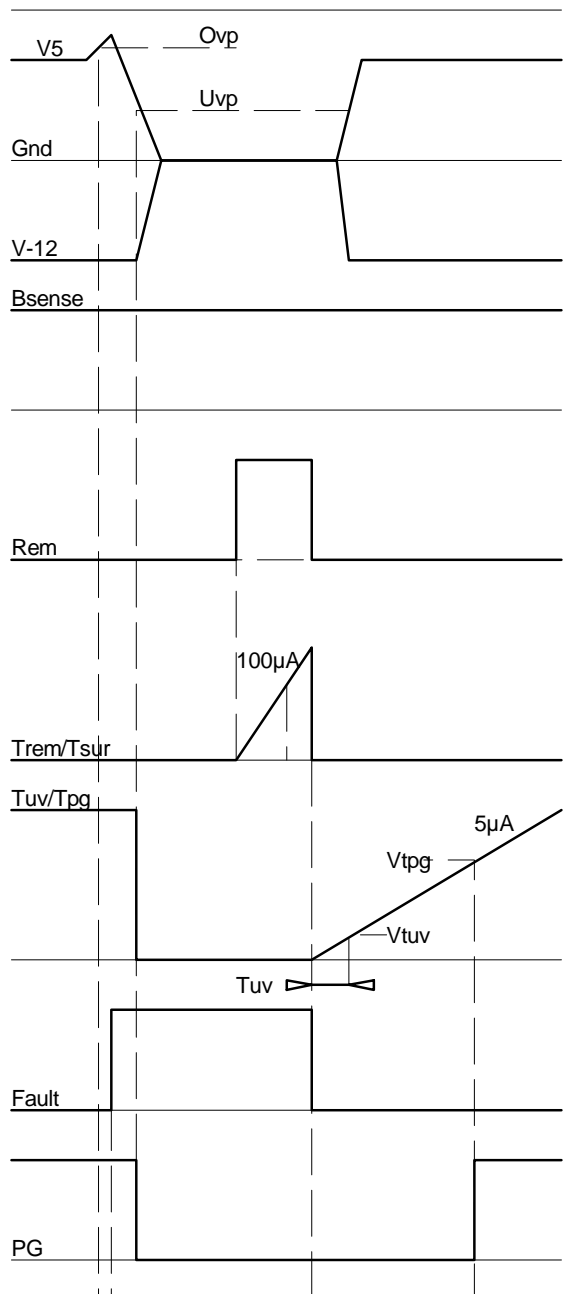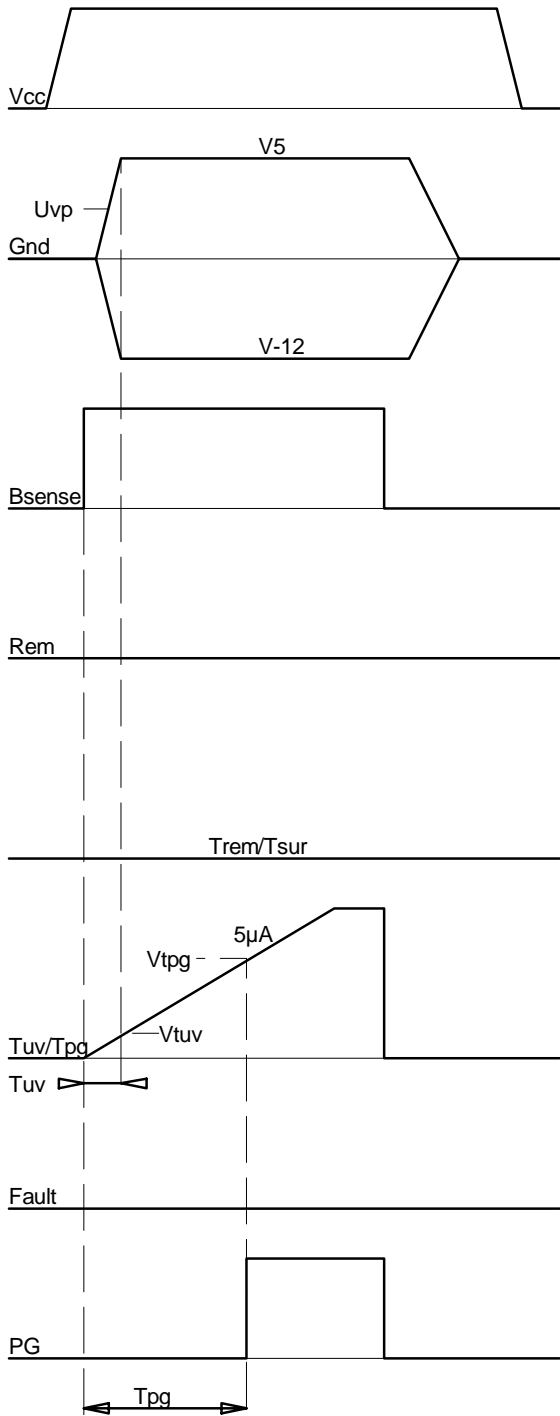**1 - Rem On/Off**   **2 - UVP Function Rem On/Off, Tuv start up OK**

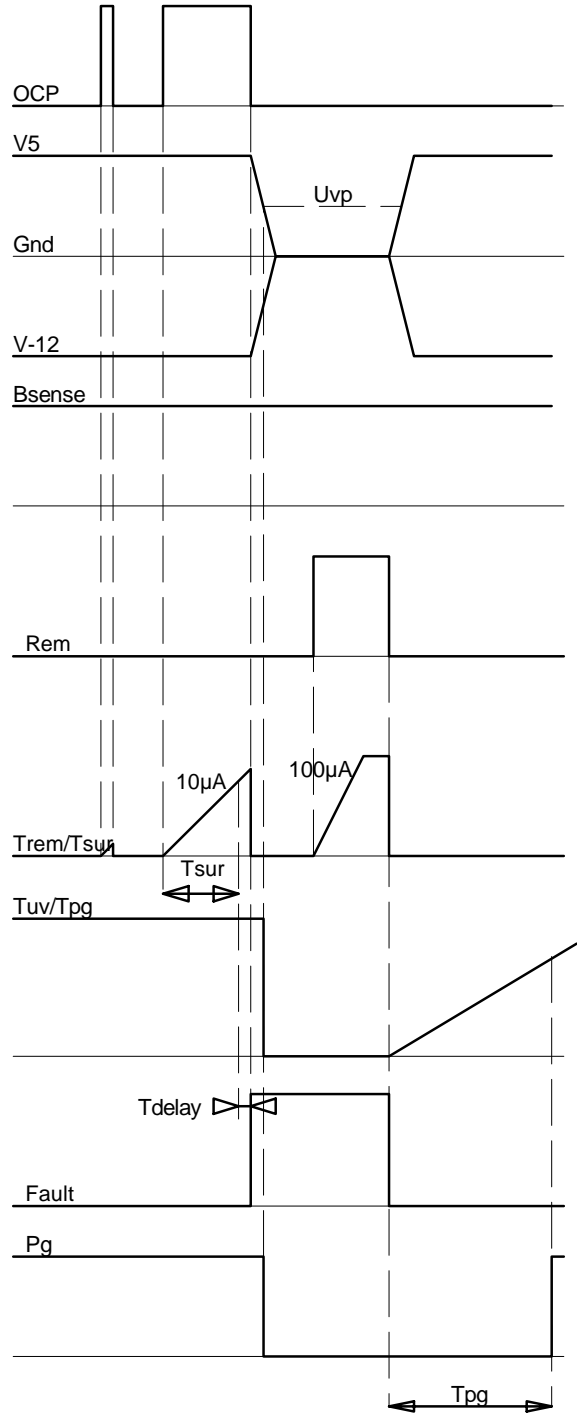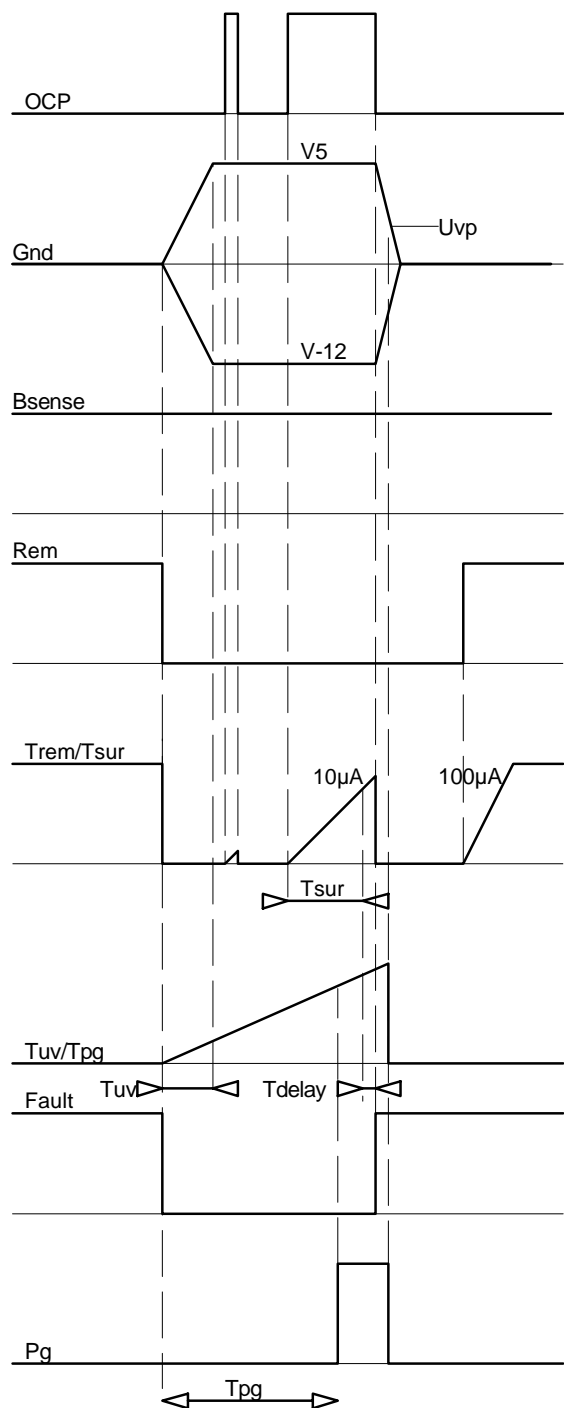**3 - OVP/UVP Function Rem On/Off, Tuv OK**   **4 - OVP/UVP Function Rem On/Off, Tuv Nok**
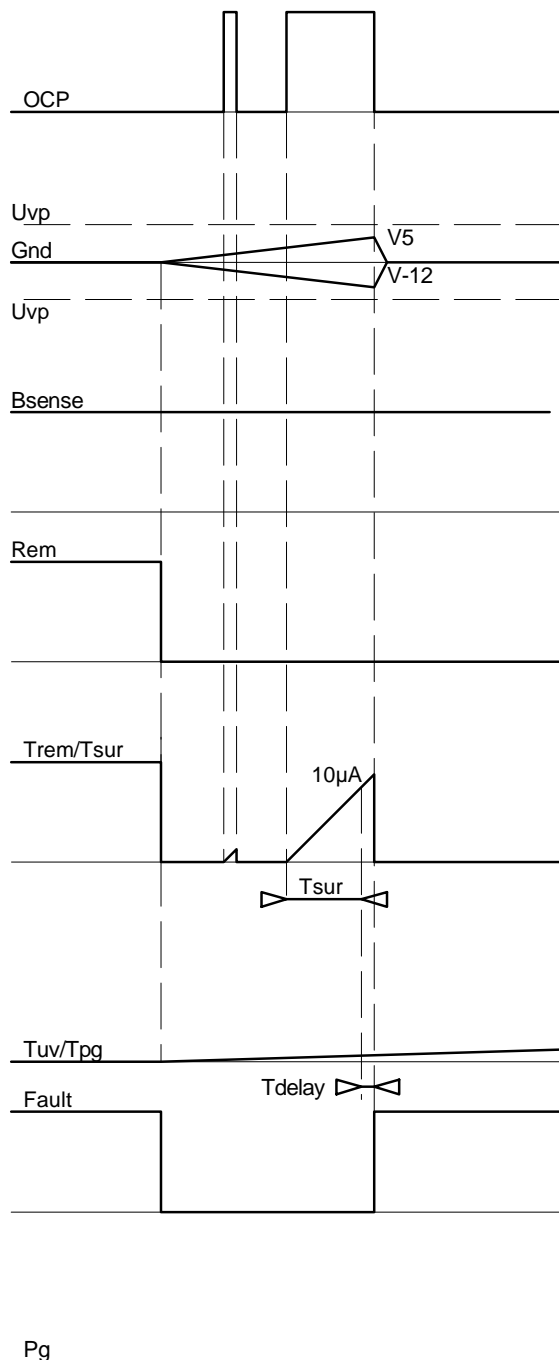
5 - Vcc turn On/off, Bsense

6 - OCP Rem On/Off

7 - Rem On/Off with OCP during Tpg

8 - Rem On/Off with OCP during Tuv

9 - Fault Vcc start up
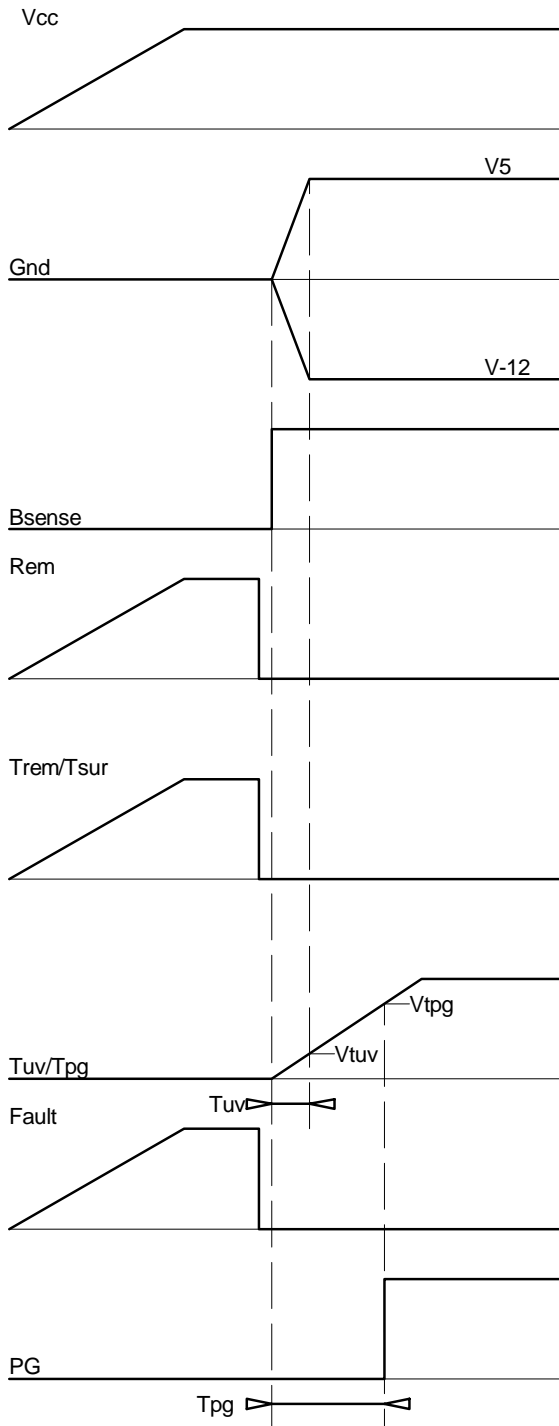
10 - Fault Vcc shut down
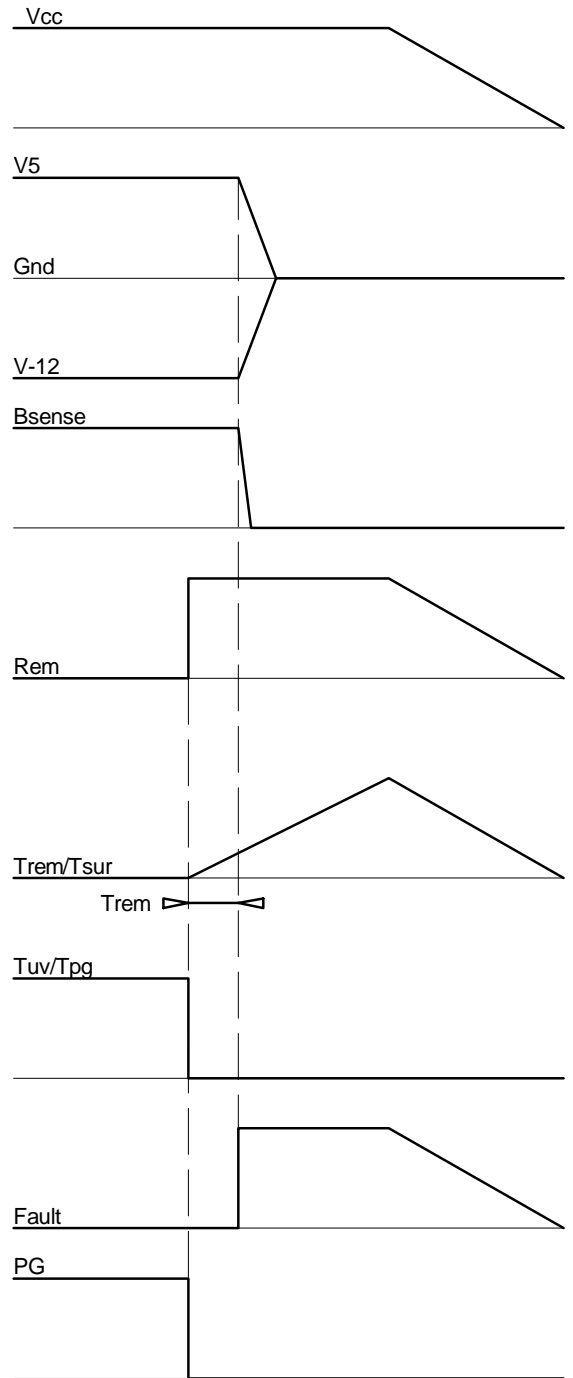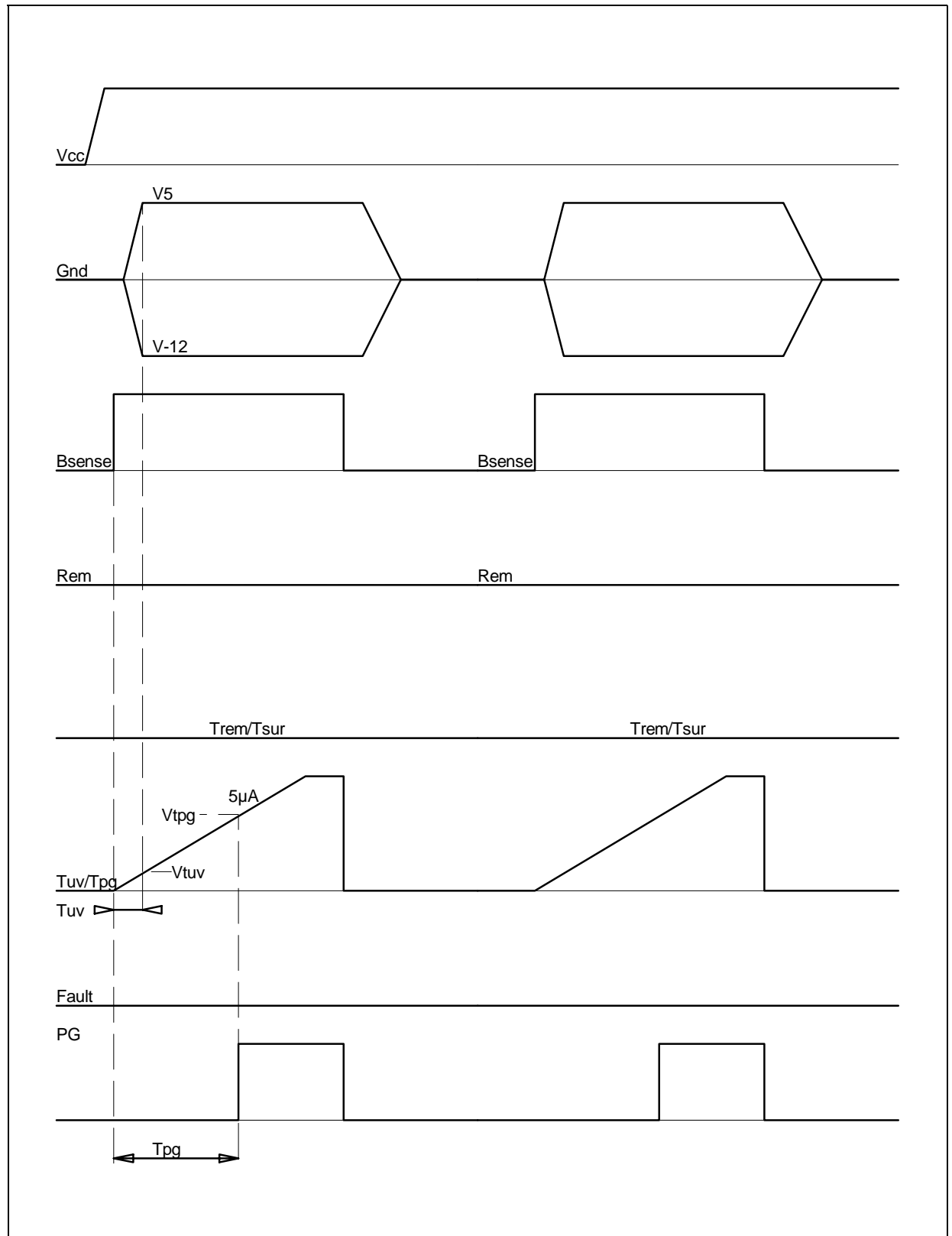
11 - Fault Vcc shut down start up
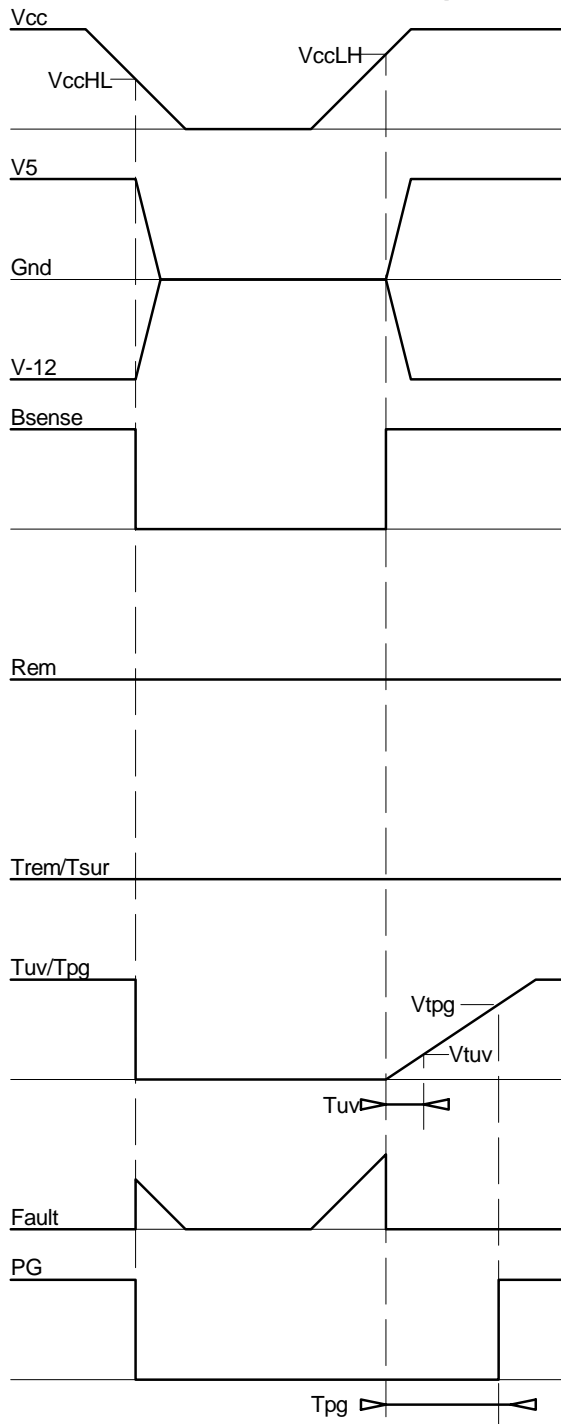
12 - Fault Vcc start up and shut down
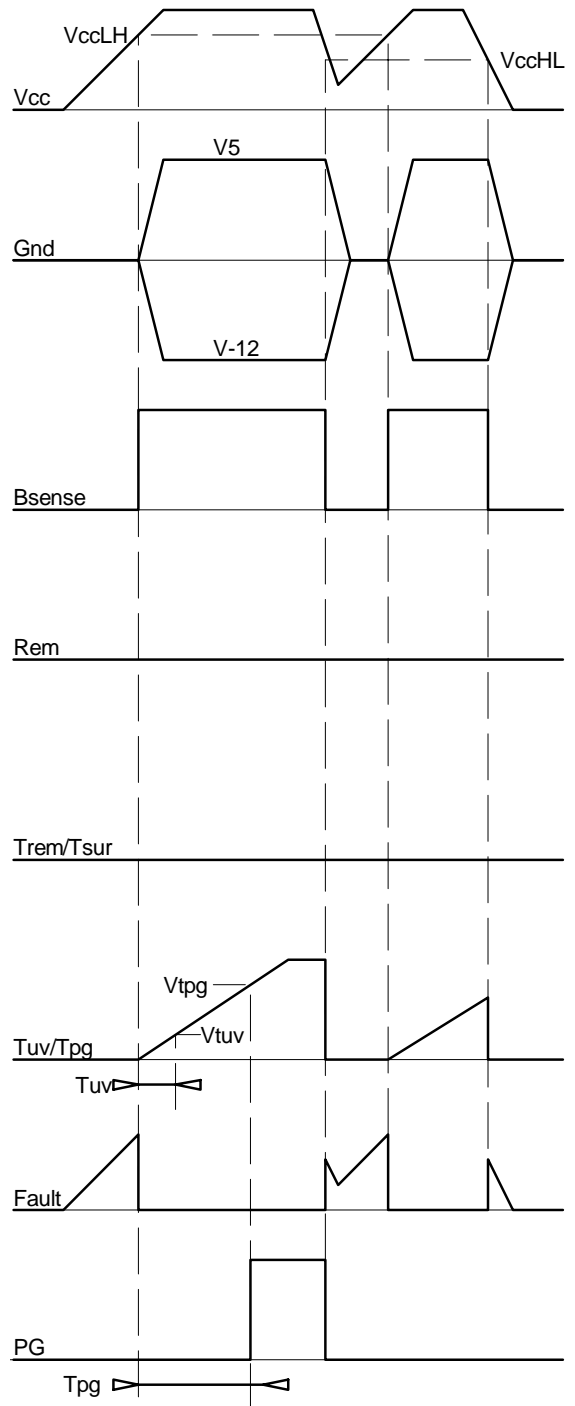
13 - Vcc turn on, OVP function, Remote On/Off
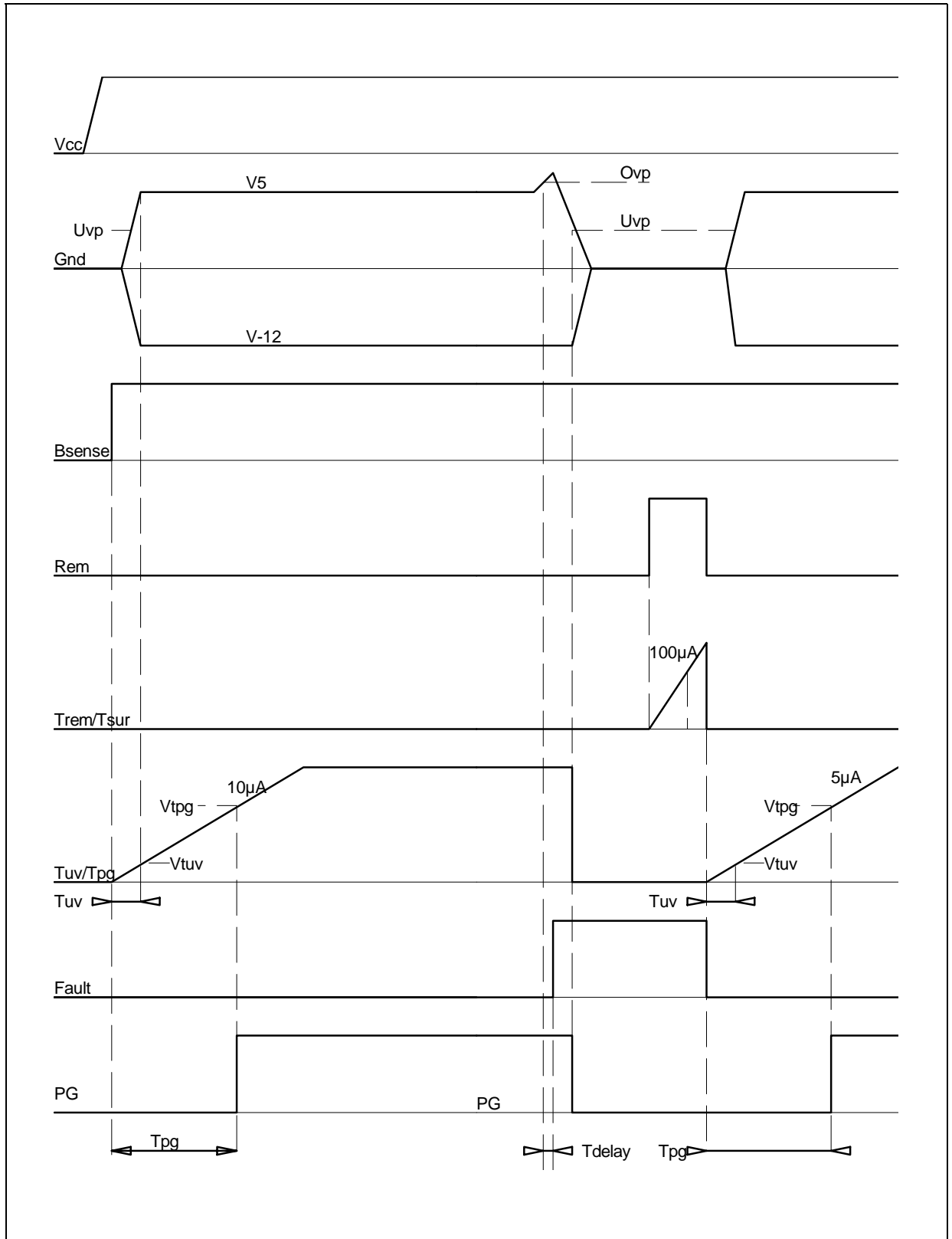
14- Vcc turn On, AC line resume Bsense

TSM115: Housekeeping IC

TSM115 is a one chip solution for all PC SMPS: it integrates on one chip the Housekeeping Circuitry (Over and under voltage and over current protections, with adequate sequencing).

Multiple Power Line Protection

The TSM115 Housekeeping Circuit is dedicated to 3.3V, 5V and ±12V power lines protection. It integrates a multiple Over and under Voltage Protection Circuit and a multiple over current Protection Circuit as well as all the necessary logic and transient timing management circuits for optimal and secure communication with the motherboard, during start up, switch off and stabilized conditions.

Over Voltage Protection

The Over Voltage Protection Circuit is made of comparators with internal voltage thresholds which do not require any external components for proper operation. The outputs of these comparators are ORed.

Under Voltage Protection

The Under Voltage Protection Circuit is made of comparators with internal voltage thresholds which do not require any external components for proper operation. The outputs of these comparators are ORed, and blanked by an internal delay circuitry (Power Up Blanking - Tuv) which can be adjusted with an external capacitor (Cuv). This allows that during power up, the under voltage protection circuit is inhibited.

Over Current Protection

The Over current Protection Circuit is made of comparators with external thresholds which can be adjusted by changing a resistor. The outputs of these comparators are ORed.

FAULT

The Over Voltage and Under Voltage Circuits outputs are ORed before activating a latch. When activated, this latch commands the full switch OFF of the main power lines (3.3V, 5V, 12V) by an external link between the housekeeping and the primary PWM circuits via the main optocoupler or any other device.

Power Good

The Under Voltage Circuits are Ored to switch the Power Good output active (PG) to warn the motherboard that the voltage of at least one of the three power lines is out of range. The PG activation bears an internal Tpg delay circuitry which can be adjusted with an external capacitor (Cpg).

Remote Control

The remote control information from the mother board, enters via the Remote pin (REM) to activate an internal latch. When the Remote pin is active, the external Fault link between Housekeeping circuit and the PWM generator is active (high = PWM OFF) and the PG pin is active (high). Note that to reset effectively the latch, a minimum width Remote pulse should be applied thanks to an internal delay circuitry (Trem) which can be adjusted with an external capacitor (Crem).

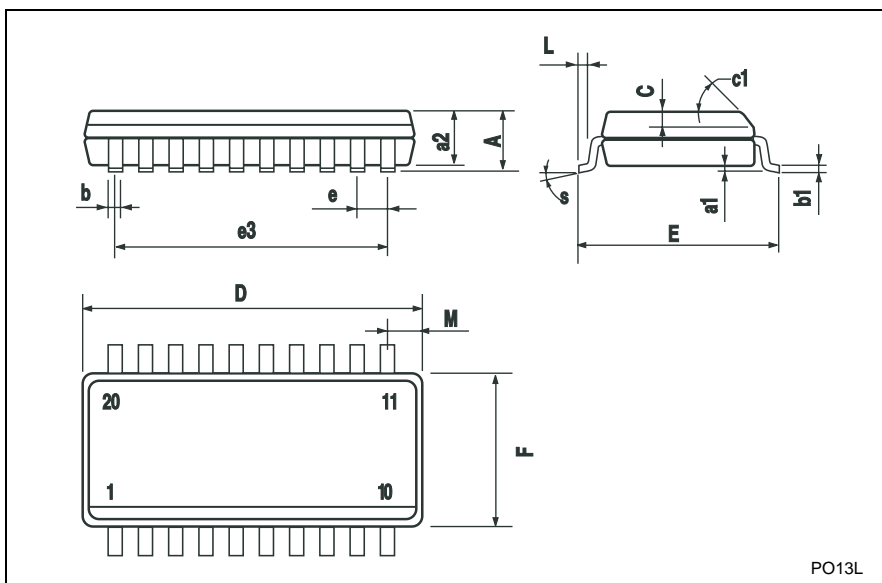# 3 Package Mechanical Data

Plastic DIP-20 (0.25) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.254			0.010		
B	1.39		1.65	0.055		0.065
b		0.45			0.018	
b1		0.25			0.010	
D			25.4			1.000
E		8.5			0.335	
e		2.54			0.100	
e3		22.86			0.900	
F			7.1			0.280
I			3.93			0.155
L		3.3			0.130	
Z			1.34			0.053

P001J
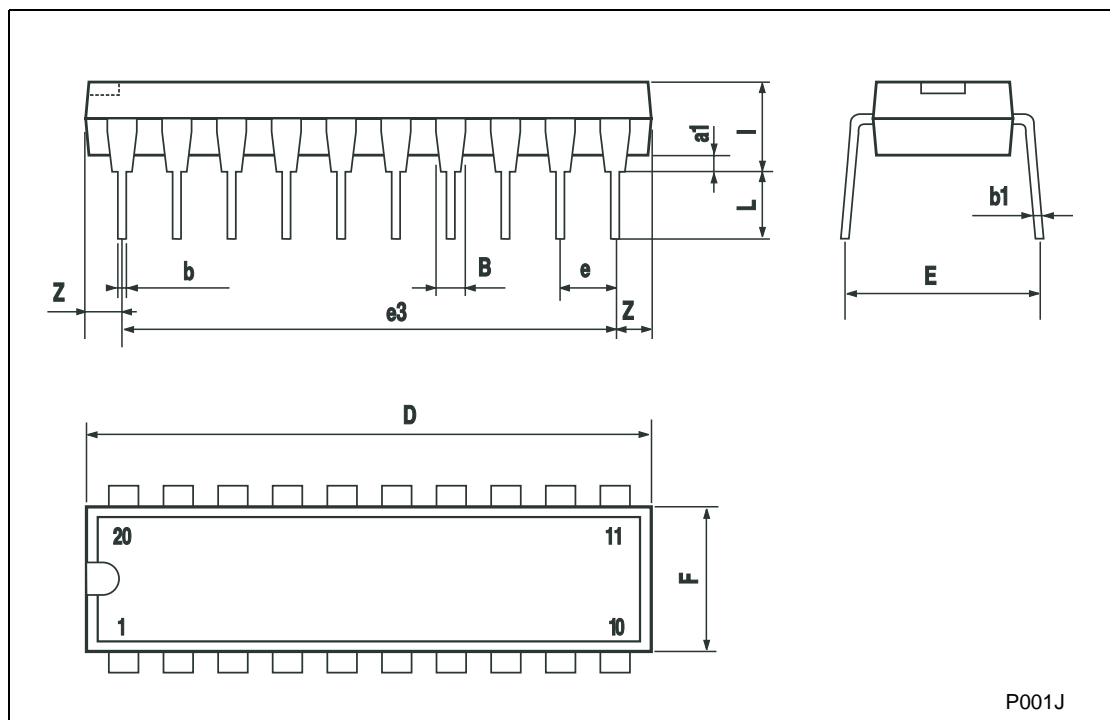
Package Mechanical Data

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45˚ (typ.)					
D	12.60		13.00	0.496		0.512
E	10.00		10.65	0.393		0.419
e		1.27			0.050	
e3		11.43			0.450	
F	7.40		7.60	0.291		0.300
L	0.50		1.27	0.020		0.050
M			0.75			0.029
S	8˚ (max.)					

SO-20 MECHANICAL DATA

PO13L