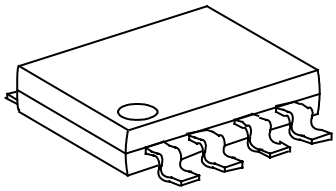
OVER CURRENT PROTECTION IC

GENERAL DESCRIPTION

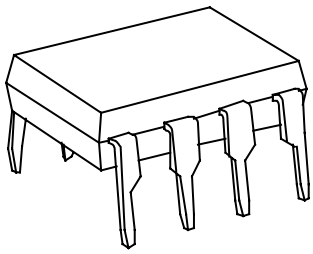
FP131 is a main rail current detection and over current protection IC. It is including a current shunt comparator, photo driver comparator with a non-inverting input precision reference regulator.
The current shunt comparator has the any gain adjustable function for rail current detection using three external resistors, and the comparator non-inverting input has a **1.25V** regulator for over current reference which is comparing with the output of shunt comparator and its output is driving the photo-coupler, and output active when the over current is occurred.
FP131 is used with a few external parts for O.C.P. function and good active point during wide temperature range in secondary main rail power supply of SPS or DC-DC converter power supply application field.

FEATURES

- Wide operating voltage range: +2.7V~ +28V
- Independent shunt and supply voltage
- Low input offset voltage
- Sense gain adjustable
- Comparator reference voltage: 1.25V (2%)
- Output sink current capability up to 16mA
- Package: PDIP8/SOP8



SOP8

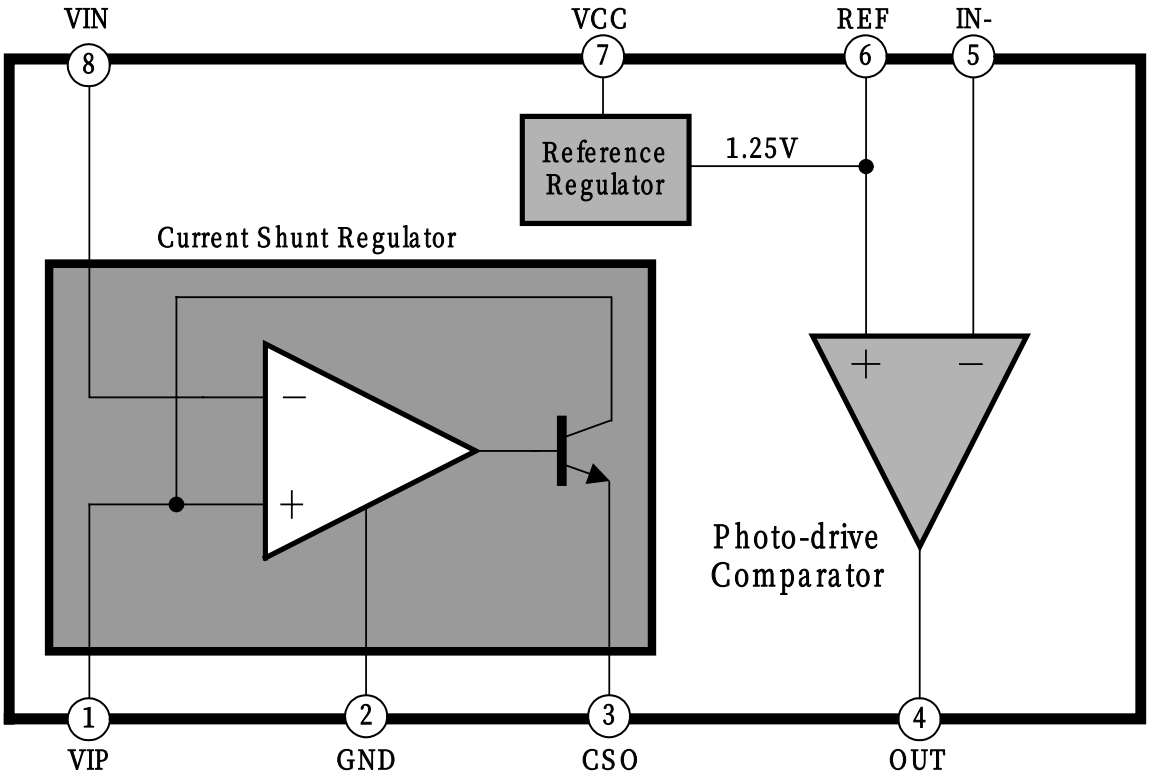


PDIP8

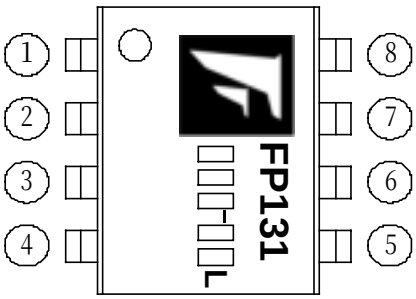
TYPICAL APPLICATION

- SPS
- DC-DC Converter
- AC Adaptor
- Current Sense Instrument

FUNCTIONAL BLOCK DIAGRAM



MARK VIEW



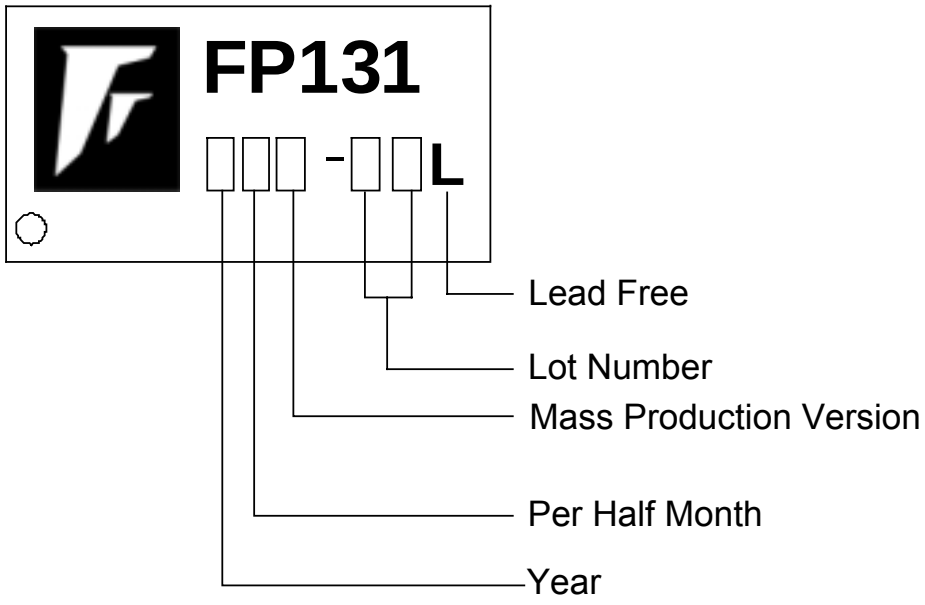
PIN DESCRIPTION

Name	No.	Status	Description
VIP	1	O	Positive Input of Current Shunt OPA
GND	2	P	Ground
CSO	3	I	Output of Current Shunt OPA
OUT	4	P	Output of Comparator
IN-	5	I	Negative Input of Comparator
REF	6	P	V_{REF} Compensation Capacitor
VCC	7	I	Power Supply
VIN	8	O	Negative Input of Current Shunt OPA

ORDER INFORMATION

Part Number	Operating Temperature	Package	Description
FP131P-LF	-20℃ ~ +85℃	PDIP8	Tube
FP131D-LF	-20℃ ~ +85℃	SOP8	Tube
FP131DR-LF	-20℃ ~ +85℃	SOP8	Tape & Reel

IC DATE CODE DISTINGUISH

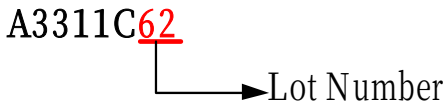


FOR EXAMPLE:

January A (Front Half Month), B (Last Half Month)
February C, D
March E, F ----------And so on.

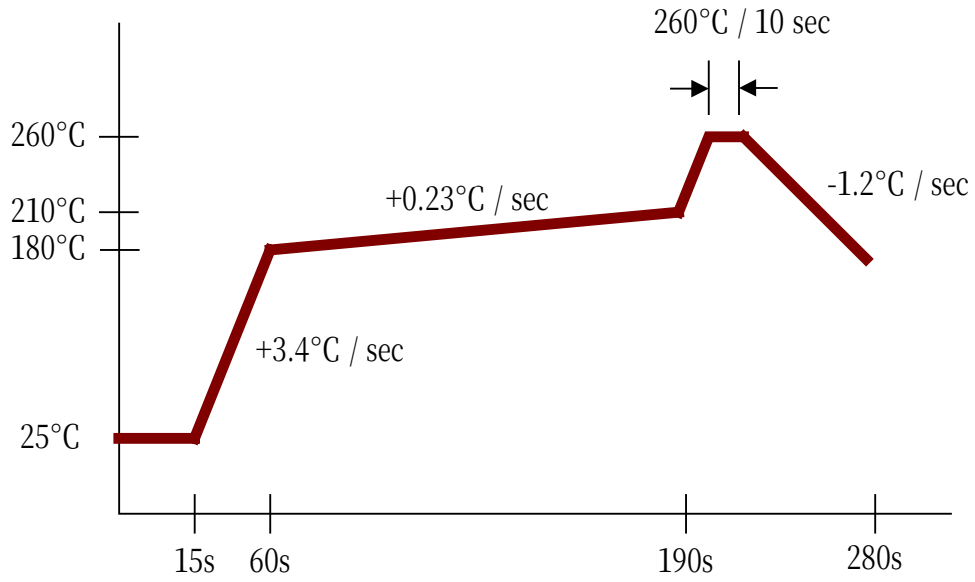
Lot Number is the last two numbers

For Example:



ABSOLUTE MAXIMUM RATINGS

Power Supply Voltage (V_{CC})	+30V
Current Shunt Regulator Common Mode Inputs Voltage	-0.3V ~ 30V
Current Shunt Regulator differential Inputs Voltage (V_{IP} – V_{IN})	-30V ~ 1.5V
Photo-drive Comparator Common Mode Inputs Voltage (IN-)	V_{CC}-1.5V
CSO Voltage	-0.3V ~ V_{CC}
OUT Voltage	-0.3V ~ 30V
OUT Sink Current	+25mA
Operating Junction Temperature (T_J)	+150℃
Operating Ambient Temperature Range (T_A)	-20℃ ~ +85℃
Storage Temperature Range (Ts)	-55℃~ +150℃
Power Dissipation (SOP8, Ta=25℃)	570mW
SOP8 Lead Temperature (soldering, 10 sec)	+260℃
PDIP8 Lead Temperature (soldering, 20 sec)	+260℃



IR Re-flow Temperature vs. Second Curve

DC ELECTRICAL CHARACTERISTICS

Test conditions: Ta= -20°C~+85°C, V_{CC}=5V, V_{IP}=12V, R_{OUT}=125KΩ, unless otherwise noted

Current Shunt Comparator section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Full Scale Sense Voltage	V_{SENSE}	$V_{SENSE}=V_{IP}-V_{IN}$		100	500	mV
Common-Mode Input Voltage	V_{CM}		2.7		28	V
Common-Mode Rejection	CMRR	V_{IP}=2.7V to 28V, V_{SENSE}=50mV	100	120		dB
Input Offset Voltage vs temp	$V_{OFFSET(ta)}$	T_{MIN} to T_{MAX}		4		μV/°C
Input Offset Voltage vs V_{CC}	$V_{OFFSET(vcc)}$	V_{IN}=2.7V to 28V, V_{SENSE}=50mV		2.5	10	μV/V
Input Bias Current	I_{BIAS}	V_{IP},V_{IN}		2		μA
Non-linearity Error	NLE	V_{SENSE}=10mV to 150mV			±1	%
Total Output Error	TOE	V_{SENSE}=100mV			±2	%
Output Impedance	R_{OUT}	-		1||5		GΩ||pF
Voltage Swing to V_{CC}	V_{SCC}	-		V_{CC}-0.8		V
Voltage Swing to V_{CM}	V_{SCM}	-		V_{CM}-0.5		V
Bandwidth	BW	R_{OUT}=125KΩ		32		kHz
Settling Time	t_S	5V Step, R_{OUT}=125KΩ		30		μS
Total Output-Current Noise	I_{NOISE}	BW=100KHz		3		nA
Operating Voltage Range	V_{CC}	-	2.7		28	V
Operating Temperature Range	T_A	-	-20		85	°C

Photo-drive Comparator section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Input Offset Voltage	V_{OFFSET}	-	-	1.0	5.0	mV
Input Bias Current	I_{BIAS}	-	-	25	250	nA
Common-Mode Voltage (IN-)	V_{CM}	-	-0.3	-	V_{CC}-1.5	V
Voltage Gain	A_V	-	50	200	-	V/mV
Large Signal Response Time		-	-	300	-	nS
Response Time		-	-	1.3	-	μS
Output Sink Current	I_{SINK}	VREF-VIN-=-0.75V, VOUT ≦ 1.0V	-	16	-	mA
Saturation Voltage	V_{SAT}	VREF-VIN-=-0.75V I_{SINK} ≦ 10mA	-	-	1000	mV
Output Leakage Current		VREF-VIN- = 1.25V VOUT = 28V	-	0.1	1	μA

Reference section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Reference Voltage (2%)	V_{REF}	T_A=25°C	1.225	1.25	1.275	V
Line Regulation		3V≦V_{CC} ≦28V	-	2	15	mV

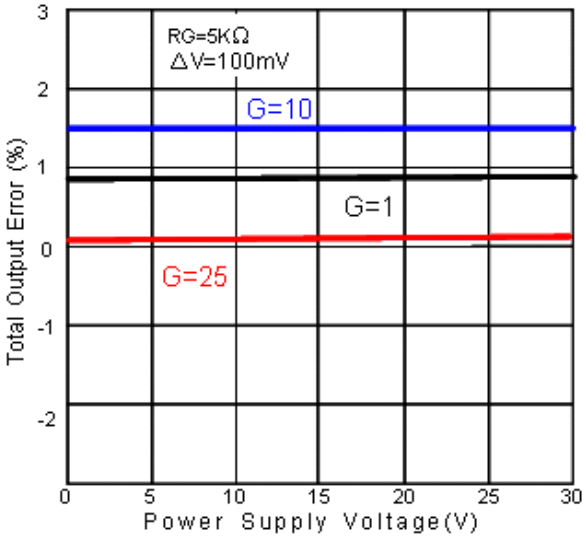
Total device section

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Power Supply Current	I_{CC}	V_{CC}=30V	-	400	-	uA

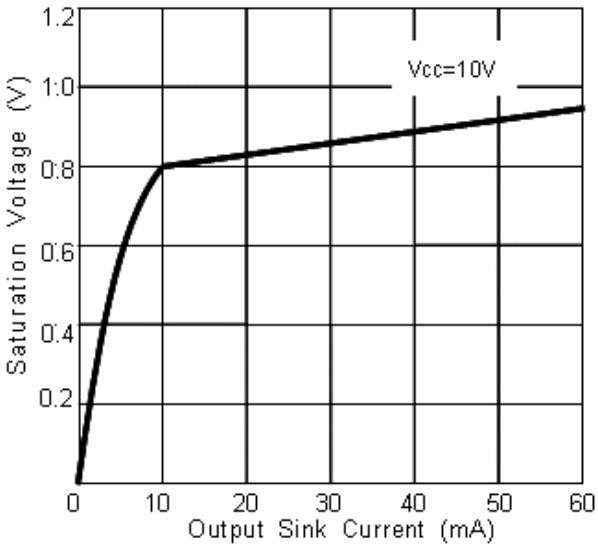
TYPICAL CHARACTERISTICS

Ta=+25℃,V_{IN}=+12V

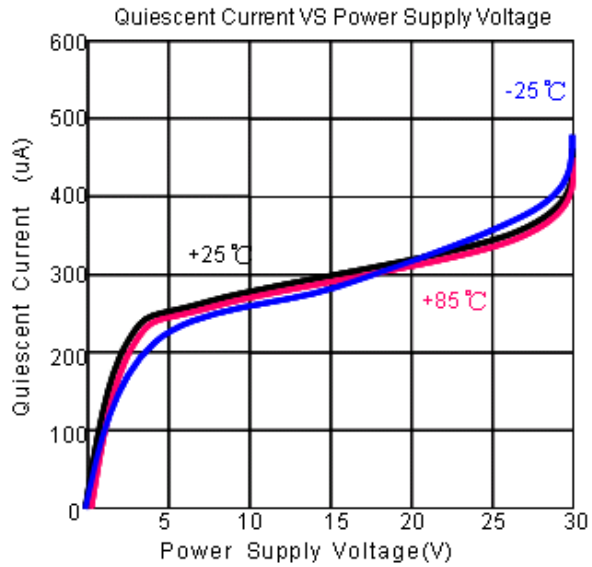
Total Output Error VS Power Supply Voltage (V)



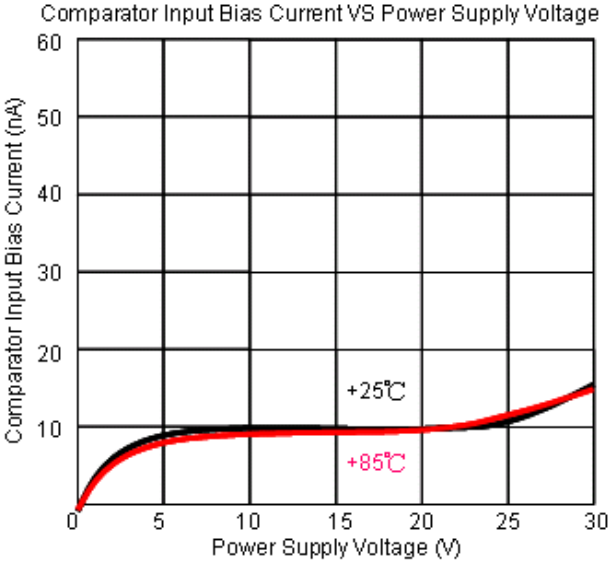
Output Saturation Voltage VS Outpt Sink Current



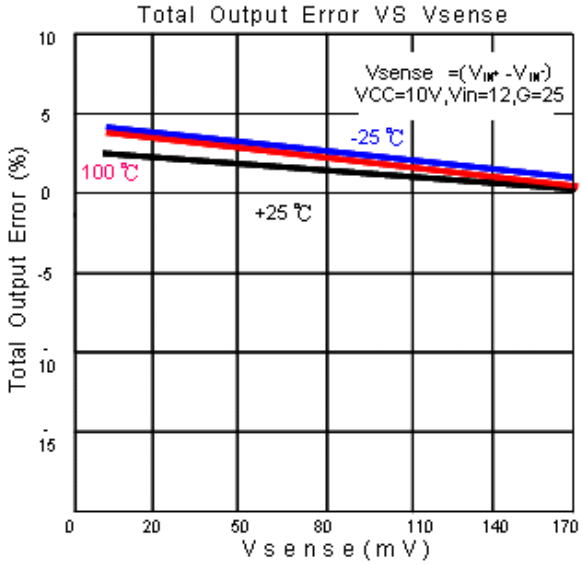
Quiescent Current VS Power Supply Voltage



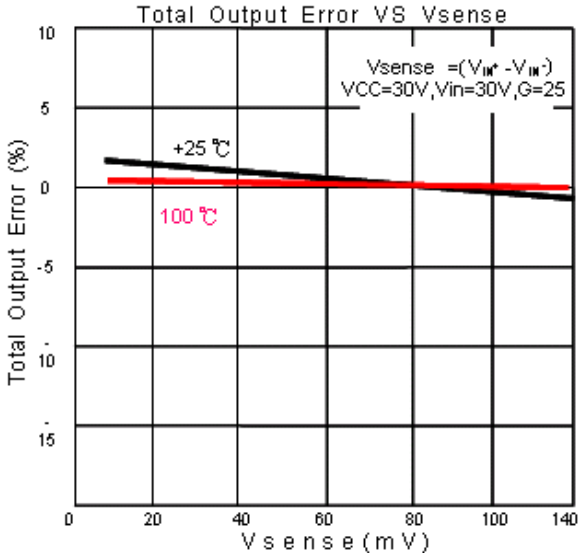
Comparator Input Bias Current VS Power Supply Voltage



Total Output Error VS Vsense



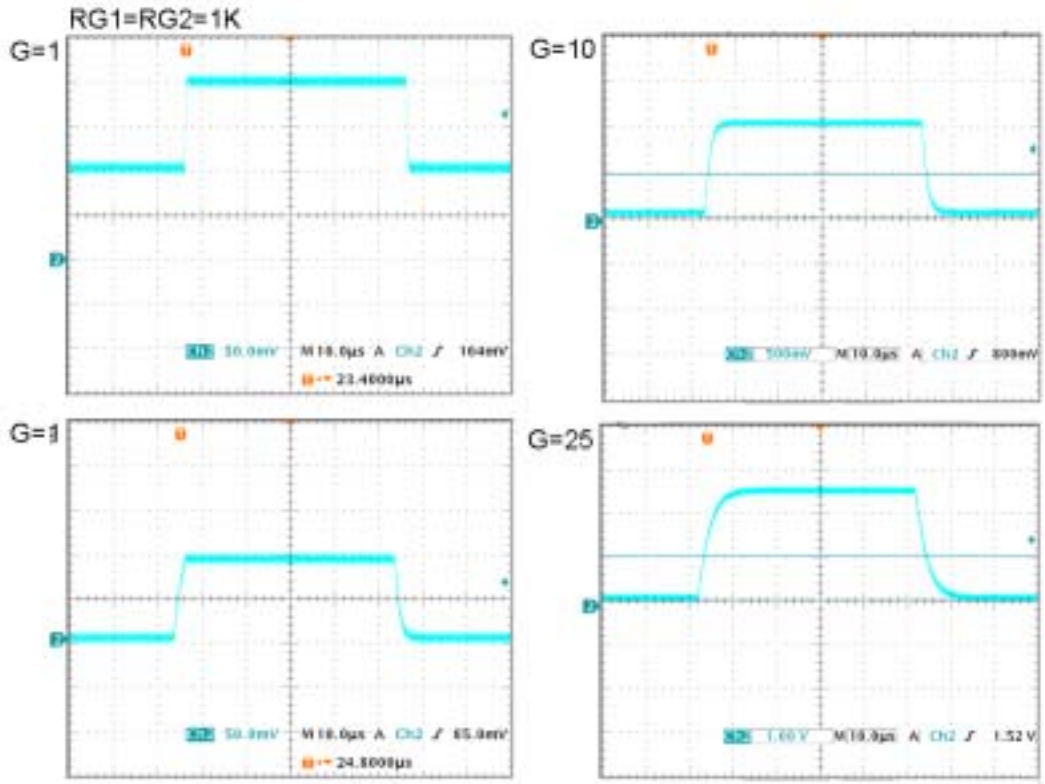
Total Output Error VS Vsense



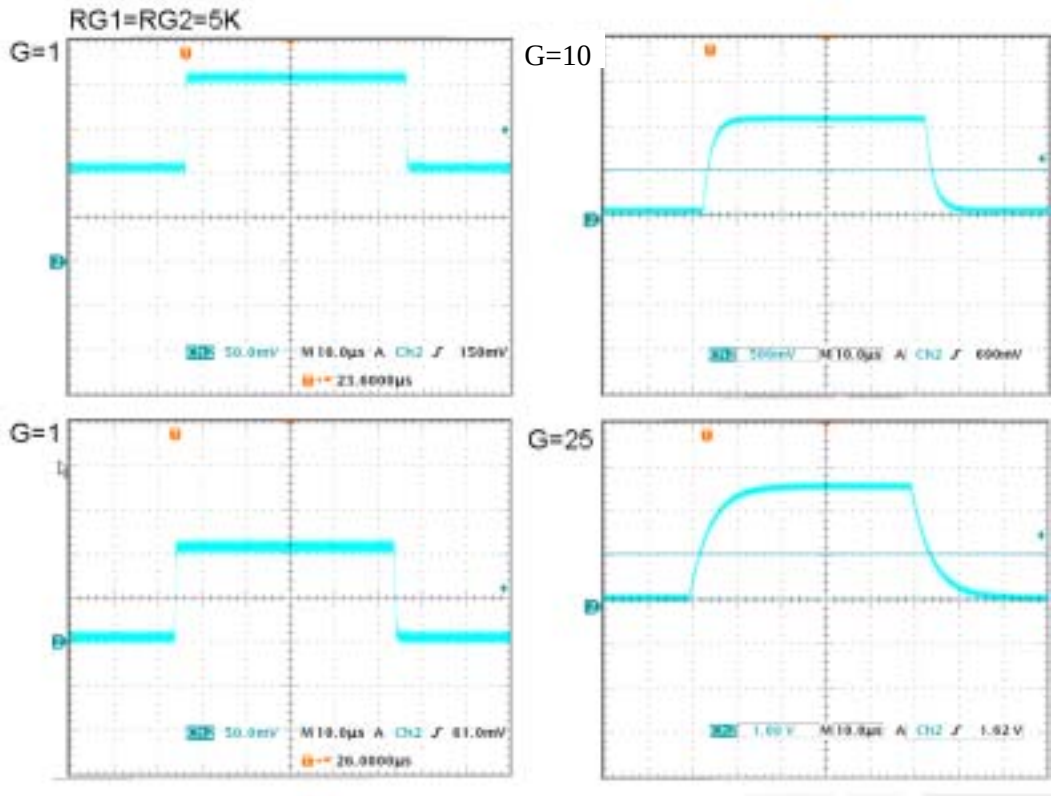
TYPICAL CHARACTERISTICS

Ta=+25℃,VCC=10V,V_{IN}=+12V

RG1=RG2=1KΩ



RG1=RG2=5KΩ



DETAILED DESCRIPTION

Current Shunt Regulator

The figure shows the **FP131** current shunt block, when the load current (I_S) flows from power supply and a drop-out voltage (V_{IN}^+-V_{IN}^-) at the sense resistor (R_S).

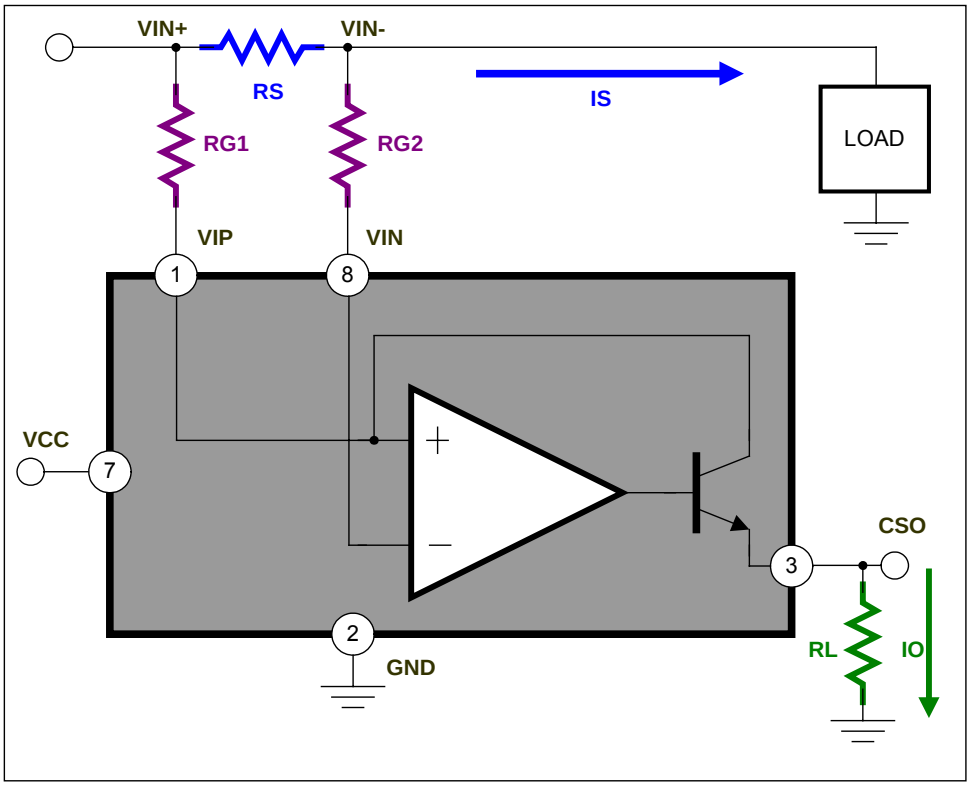
Assume internal NPN transistor collector current is same as emitter current (I_O) and V_{IP} is very close V_{IN}, the **FP131** transfer function is:

$$I_O = \frac{V_{IN}^{+} - V_{IN}^{-}}{RG1} \quad \text{----- (1)}$$

In the figure, the (V_{IN}^+-V_{IN}^-), is equal to $I_S * R_S$ and the current shunt output voltage (VCSO) is equal to $I_O * R_L$. The final transfer function for rail current measurement in this application is:

$$V_{CSO} = G * I_S * R_S \quad \text{---- (2)}$$

$$G = R_L / RG1 \quad \text{---- (3)}$$



NOTE

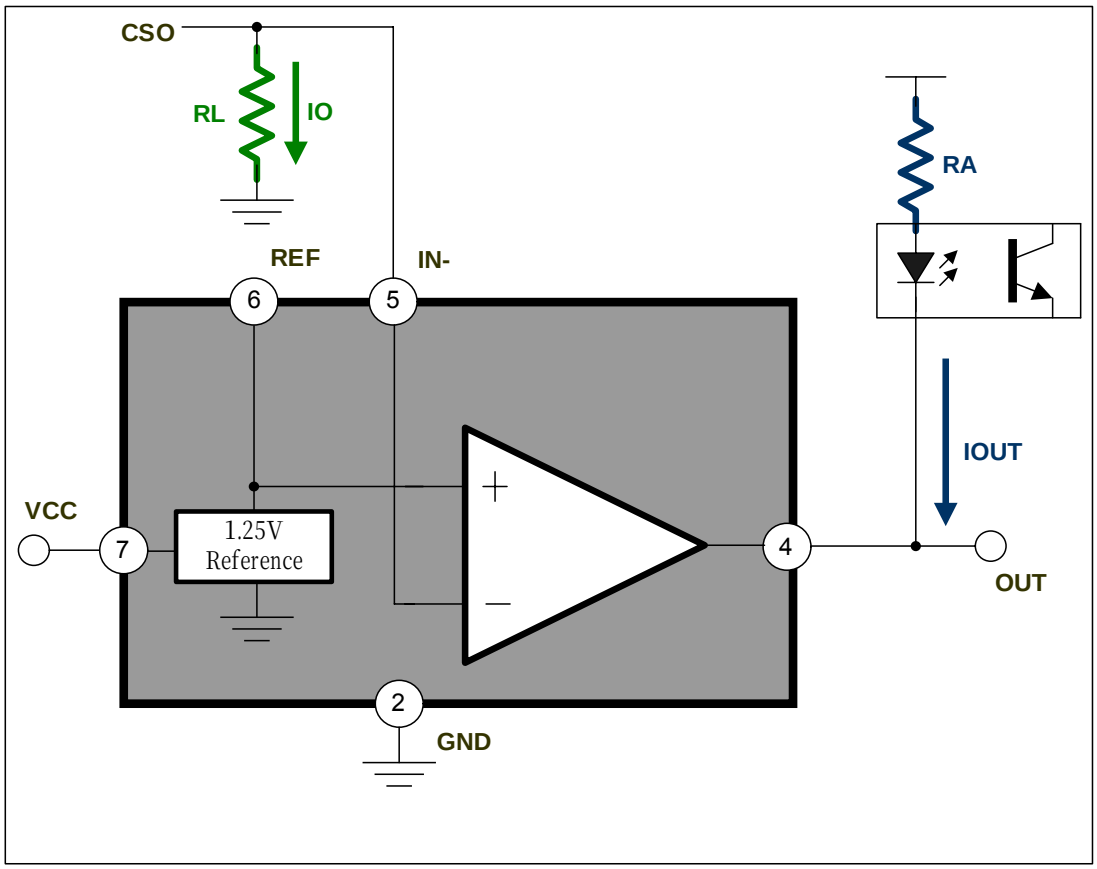
1. The minimum operating voltages of V_{CC}, V_{IP} and V_{IN} are 2.7V, if these supply voltages are low than 2.7V, the transfer function at current shunt output (CSO) of **FP131** isn't correct.
2. Don't force a V_{IN} voltage that is over 15V than V_{IP}, this condition would generate a leakage current and an incorrect voltage at **FP131** output.

Photo-drive Comparator

The figure shows the **FP131** comparator, it has an internal reference **1.25V** connecting to the IN+ of comparator and high sink current output ability for an OCP protection circuit using photo-coupler.

The current shunt output (CSO) connects to IN- for the load current (I_S) detection and comparator connects to the photo-coupler for the over load protection:

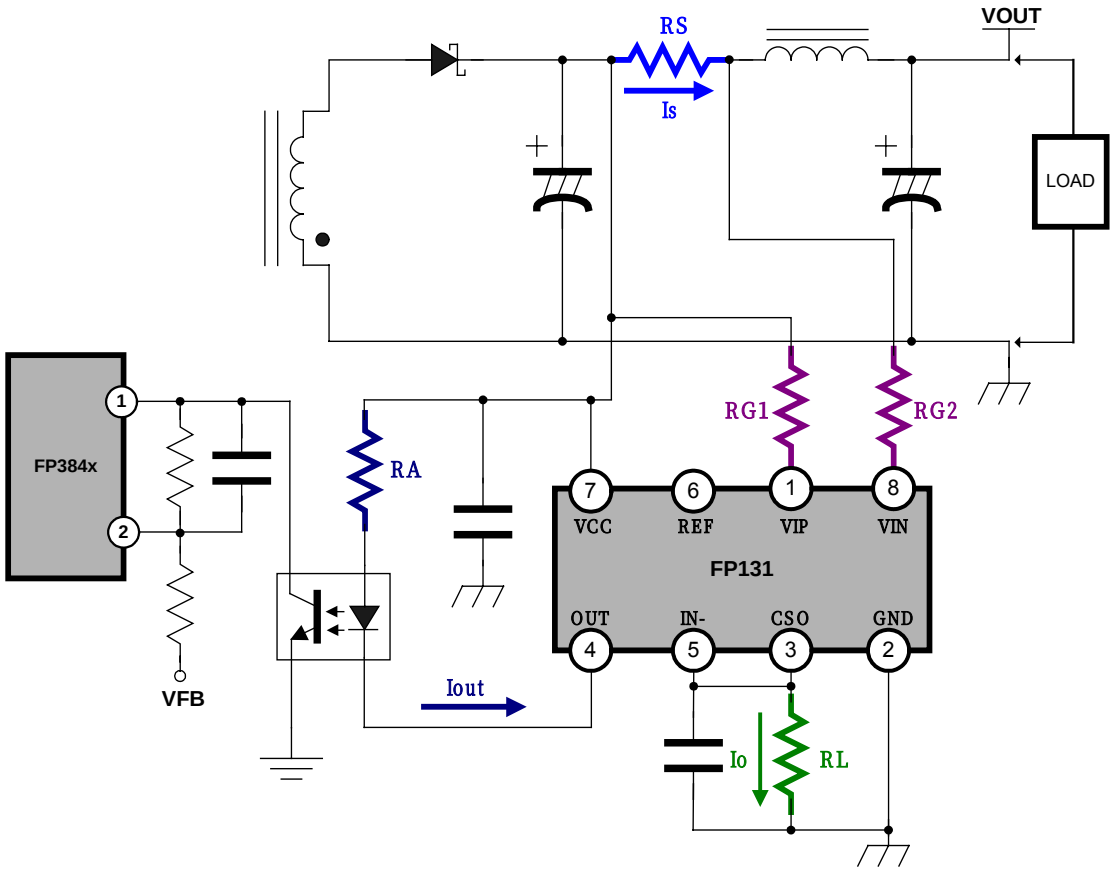
When the load current (I_S) is increasing, the transfer function gain would amplify the CSO voltage until the value (I_O*RL) is more than **1.25V**, comparator output would change from high to low state and sink the photo-coupler current (I_{OUT}).



NOTE

1. The **1.25V** reference output doesn't have any source and sink capability, any resistance divider from **1.25V** bias voltage would change its precision.
2. The comparator has an input hysteresis (typ. **200mV**) for noise rejection, if IN- voltage is large than **1.25V** (REF) reference, the output (OUT) would change from high state to low, and when IN- voltage is lower than 1.0V, the output (OUT) would change to high again.

APPLICATION NOTE

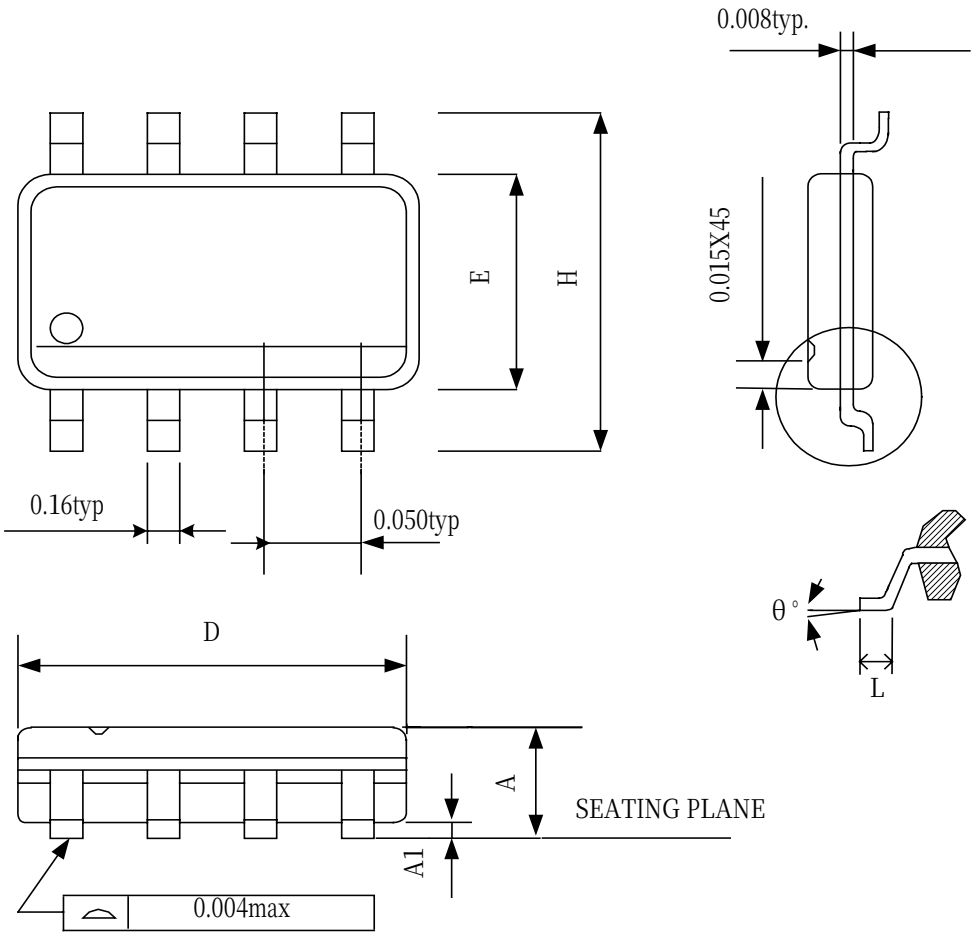


Adaptor secondary over current detection/protection circuit

The above circuits are a simple application for AC/DC adaptor over current protection (OCP) function, for example, when load current (I_S) increases, the **FP131** CSO voltage would increase as formula (2) until the IN- connecting to CSO pin is higher than **1.25V** reference, that has a sink current (I_{OUT}) flowing through the photo-coupler, and FP384x PWM IC will change the NMOS drive terminal to a minimum duty cycle current limitation for secondary over current protection, and primary side auxiliary voltage can not maintain the FP384x power supply, the FP384x will be shutdown until AC line start-up voltage is re-start the PWM IC.

PACKAGE OUTLINE

SOP 8

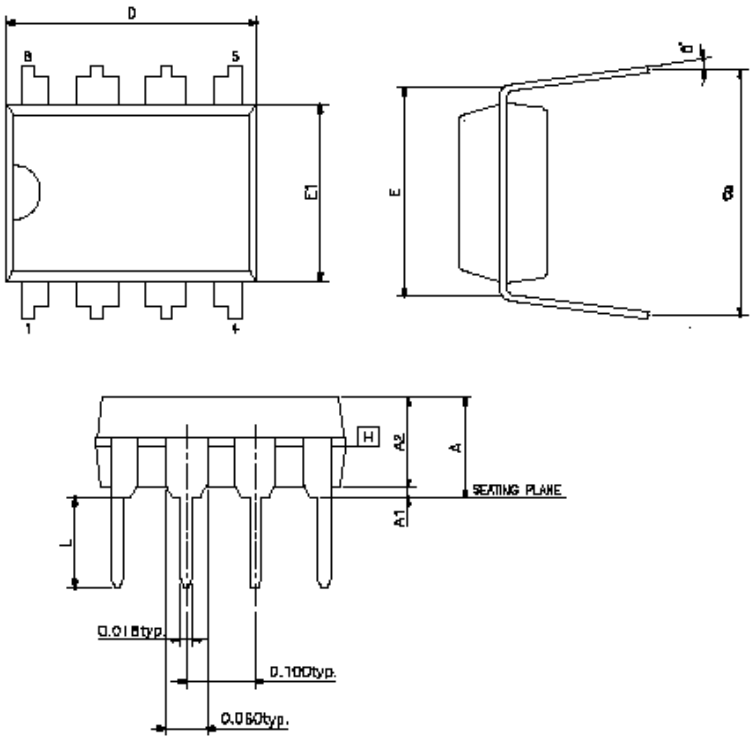


SYMBOLS	MIN	MAX
A	0.053	0.069
A1	0.004	0.010
D	0.189	0.196
E	0.150	0.157
H	0.228	0.244
L	0.016	0.050
θ°	0	8

NOTE:

1. JEDEC OUTLINE:MS-012 AA
2. DIMENSIONS “D” DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .15mm (.0.06in) PER SIDE
3. DIMENSIONS “E” DOES NOT INCLUDE INTER-LEAD FLASH, OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED .25mm (.0.10in) PER SIDE.

PDIP 8



SYMBOLS	MIN	NOR	MAX
A	-	-	0.210
A1	0.015	-	-
A2	0.125	0.130	0.135
D	0.355	0.365	0.400
E		0.300BSC	
E1	0.245	0.250	0.255
L	0.115	0.130	0.150
e_Θ	0.335	0.355	0.375
Θ°	0	7	15

Note:

0. JEDEC OUTLINE:MS-001 BA

1. “D””E1”DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH

2. eB IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED

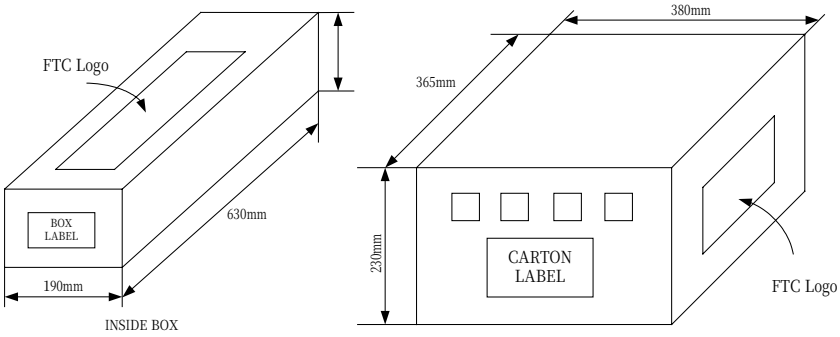
3. POINTED OR ROUNDED LEAD TIPS ARE PREFERRED TO EASE INSERTIDN

4. DISTANCE BETWEEN LEADSINCLUDING DAM BAR PROTRUSIONS TO BE .005 INC MININUM

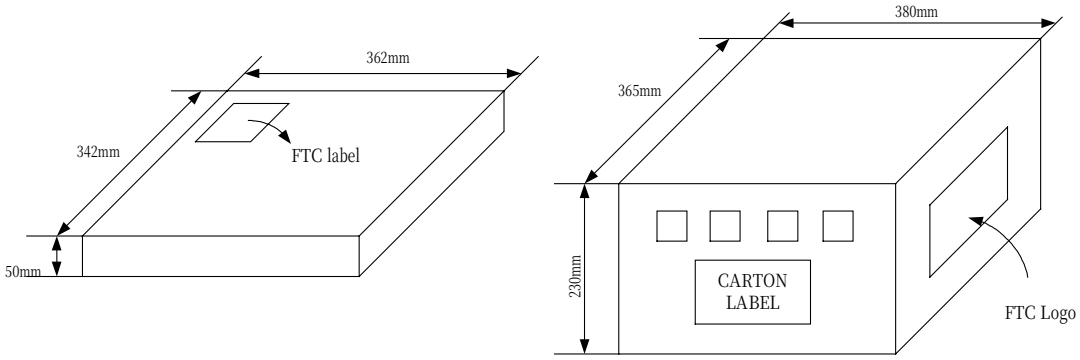
5.DATUM PLANE H CONINCIDENT WITH THE BOTTOM OF LEAD, WHERE LEAD EXITS BODY.

PACKING SPECIFICATIONS
BOX DIMENSION

TUBE INSIDE BOX AND CARTON



TAPE & REEL INSIDE BOX AND CARTON



PACKING QUANTITY SPECIFICATIONS

100 EA / TUBE	2500 EA / REEL
100 TUBES / INSIDE BOX	4 INSIDE BOXES / CARTON
4 INSIDE BOXES / CARTON	

LABEL SPECIFICATIONS

TAPPING & REEL

Feeling Technology Corp.
Product : FP131
Lot No : A3311C62
D/C : 4Xx-XXL
Q'ty : ◎ ◎

無鉛
Lead Free

CARTON

Feeling Technology Corp.

Product Type: FP131

Lot No: A3311C62

Date Code: 4Xx-XXL

Package Type: SOP-8L

Marking Type: Laser

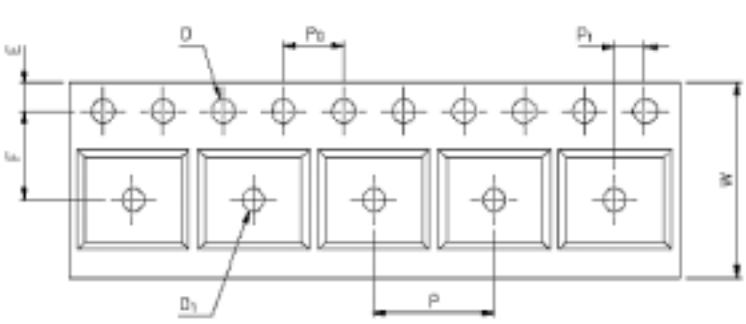
Total Q'ty: 10,000

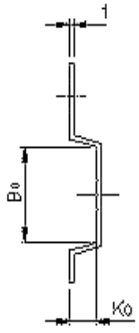
無鉛
Lead Free

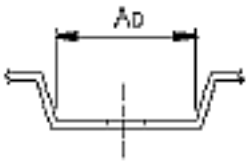
CARRIER TAPE DIMENSIONS

APPLICATION	W	P	E	F	D	D_1
SOP8	$12.0^{+0.3}_{-0.1}$	8.0±0.1	1.75±0.1	5.5±0.1	1.55±0.1	$1.5^{+0.25}$

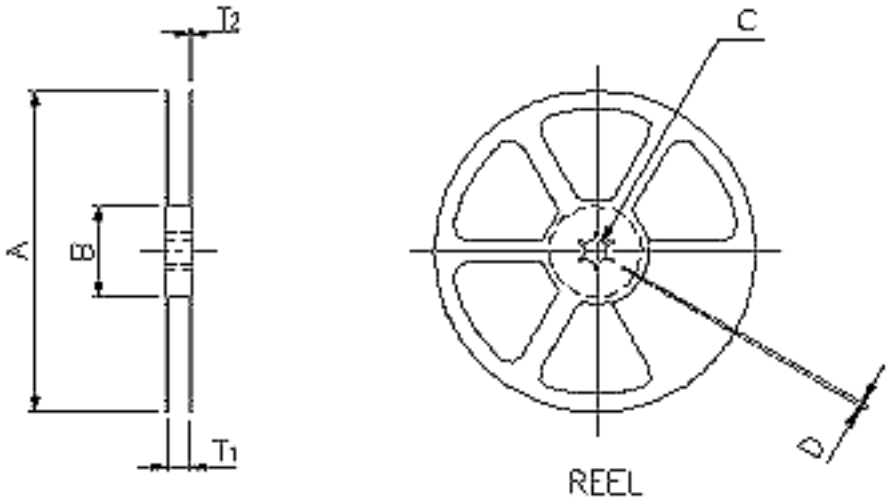
APPLICATION	P_0	P_1	A_0	B_0	K_0	t
SOP8	4.0±0.1	2.0±0.1	6.4±0.1	5.20±0.1	2.1±0.10	0.30±0.013







REEL DIMENISIONS



APPLICATION	MATERIAL	A	B	C	D	T_1	T_2
SOP8	PLASTIC REEL (WHILE)	330±0.1	62±1.5	12.75+0.15	2+0.6	12.4+0.2	2.0+0.2