

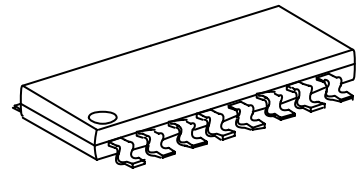
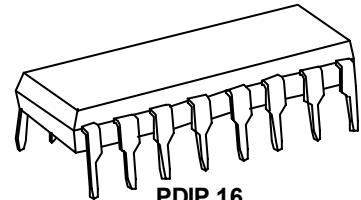
**DUAL CHANNEL PWM CONTROL IC
WITH SCP/DTC FUNCTION****GENERAL DESCRIPTION**

The FP1451, a 1-chip composed of dual open collector transistor pulse-width-modulation control circuits with two error amplifiers and dead-time comparators (DTC), the FP1451 contains a 2.5V precision voltage reference regulator, under-voltage lockout circuit (UVLO), short circuit protection circuit (SCP), applied to offer space and low cost in many applications such as the DC/DC converter and backlight inverter.

Using few external components, FP1451, a high performance integrated IC, is designed for a control circuit. The circuit diagram of the typical application example is as below.

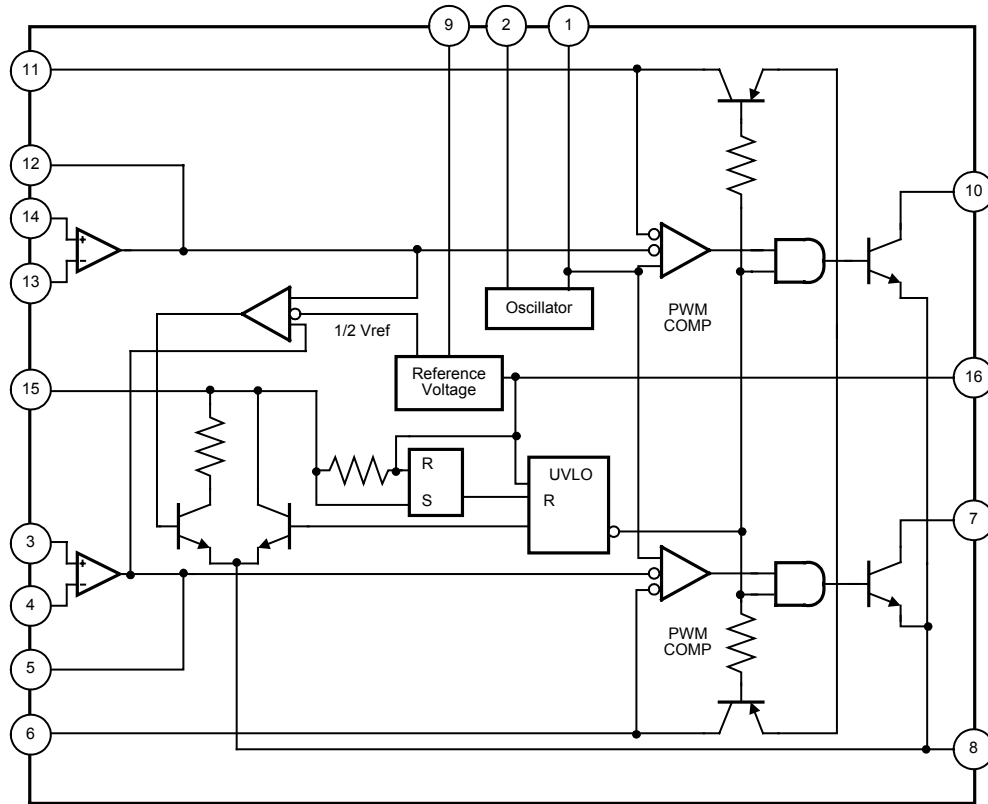
FEATURES

- Fixed Reference Voltage: 2.5V
- Reference Voltage Precision: 2% (FP1451)
- Output sink current up to 100mA
- Low quiescent supply current
- Wide operating voltage range: 3.6~40V
- Variable dead-time control (DTC)
- UVLO protection function
- SCP protection function
- Oscillator Frequency: Max. 500KHz
- Package: SOP16 / PDIP16

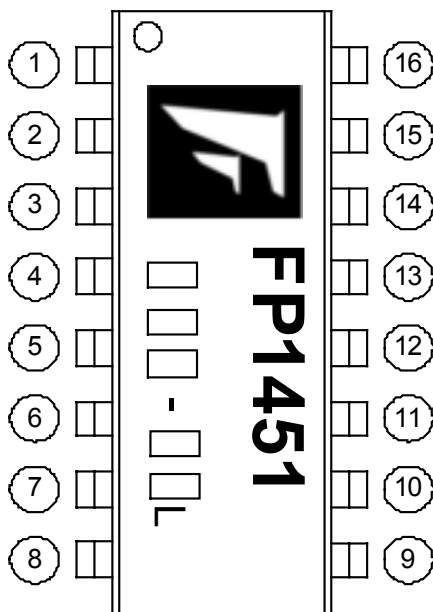
**SOP16****PDIP 16****TYPICAL APPLICATION**

- DC/DC converters for video cameras and TFT LCD monitor
- Back light CCFL inverter.

FUNCTIONAL BLOCK DIAGRAM



MARK VIEW



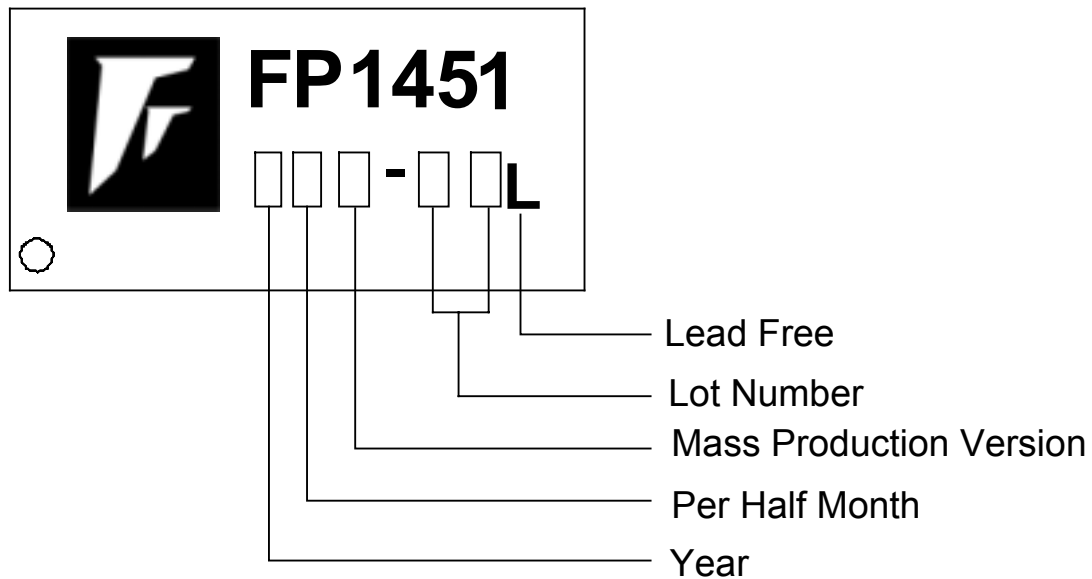
PIN DESCRIPTION

| NAME | NO. | STATUS | DESCRIPTION |
|------|-----|--------|---------------------------------------|
| CT | 1 | I | Connect a Capacitor for Oscillator |
| RT | 2 | I | Connect a Resistor for Oscillator |
| EA1+ | 3 | I | Error Amplifier 1 Non-inverting Input |
| EA1- | 4 | I | Error Amplifier 1 Inverting Input |
| FB1 | 5 | O | Error Amplifier 1 Feedback Output |
| DTC1 | 6 | I | Output 1 Dead-Time Comparator |
| OUT1 | 7 | O | Open Collector Output 1 |
| GND | 8 | P | IC Ground |
| VCC | 9 | P | IC Power Supply |
| OUT2 | 10 | O | Open Collector Output 2 |
| DTC2 | 11 | I | Output 2 Dead-Time Comparator |
| FB2 | 12 | O | Error Amplifier 2 Feedback Output |
| EA2- | 13 | I | Error Amplifier 2 Inverting Input |
| EA2+ | 14 | I | Error Amplifier 2 Non-inverting Input |
| SCP | 15 | I | Short Circuit Protection Input |
| VREF | 16 | O | 2.5V Reference Voltage Output |

ORDER INFORMATION

| Part Number | Operating Temperature | Package | Description |
|-------------|-----------------------|---------|-------------|
| FP1451P-LF | -20°C 85°C | PDIP16 | Tube |
| FP1451D-LF | -20°C 85°C | SOP16 | Tube |
| FP1451DR-LF | -20°C 85°C | SOP16 | 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

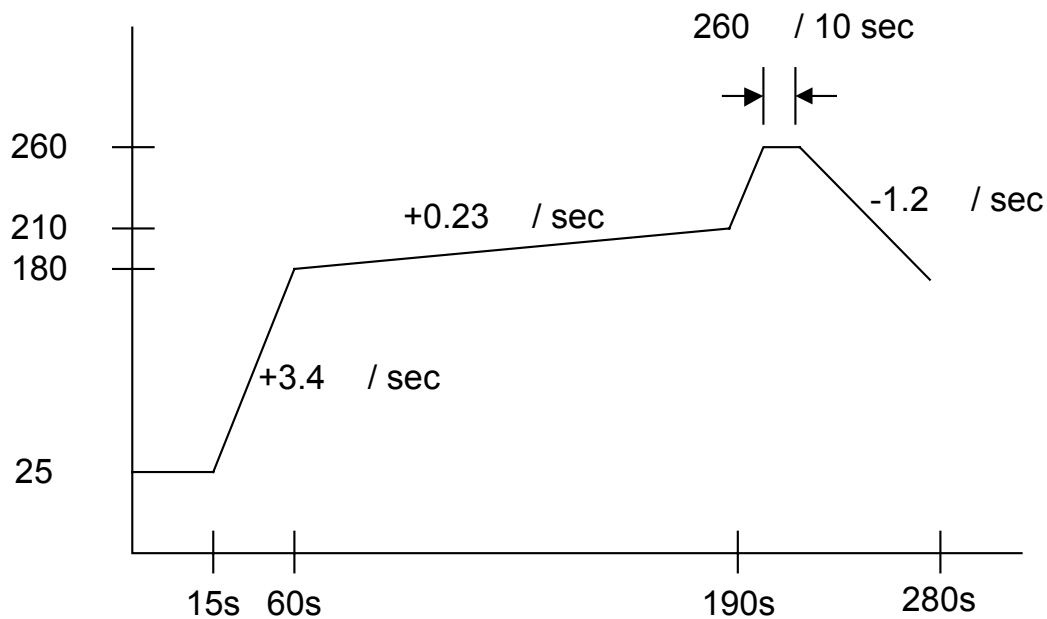
For Example:

A3311C62L

→ Lot Number

ABSOLUTE MAXIMUM RATINGS

| | | |
|--|-------|-------------|
| Supply Voltage (V _{cc}) | ----- | +40V |
| Differential Input Voltage(V _{id}) | ----- | +20V |
| Collector Output Voltage(V _o) | ----- | +40V |
| Collector Output Current (I _o) | ----- | +150mA |
| Maximum Junction Temperature (T _j) | ----- | 150°C |
| Thermal Resistance Junction to Ambient (SOP package) | ----- | 175°C /W |
| Power Dissipation | | |
| SOP16 package | | |
| T _a =25 | ----- | 650mW |
| T _a =70 | ----- | 550mW |
| PDIP16 package | | |
| T _a =25 | ----- | 1000mW |
| T _a =70 | ----- | 640mW |
| Operating Temperature Range | ----- | -20°C 85°C |
| Storage Temperature Range | ----- | -65°C 150°C |
| SOP16 Lead Temperature (soldering, 10 sec) | ----- | +260 |
| PDIP16 Lead Temperature (soldering, 20 sec) | ----- | +260 |



DC ELECTRICAL CHARACTERISTICS

Electrical characteristics over recommended operating free-air temperature range, $V_{CC}=6V$, $f=200kHz$ (unless otherwise noted)

Reference section

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|-------------------|-----------------------|------|-------|-----------|------|
| Output voltage (pin 16) | V_{REF} | $I_O=1mA$ | 2.45 | 2.5 | 2.55 | V |
| Output voltage change with Temperature | | $T_A=-20$ to 25 | | -0.1% | $\pm 1\%$ | |
| | | $T_A=25$ to 85 | | -0.2% | $\pm 1\%$ | |
| Input voltage regulation | V_{REF}/V_{REF} | $V_{CC}=3.6V$ 40V | | 2 | 12.5 | mV |
| Output voltage regulation | V_{REF}/V_{REF} | $I_O = 0.1mA$ to 1 mA | | 1 | 7.5 | mV |
| Short-circuit output current | I_{SHORT} | $V_O=0$ | 3 | 10 | 30 | mA |

Undervoltage lockout section

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-------------------------------------|-------------|-------------------------------------|-----|------|-----|------|
| Upper threshold voltage(V_{CC}) | V_{UPPER} | $I_{O(REF)} = 0.1 mA$, $T_A=25$ | | 2.72 | | V |
| Lower threshold voltage(V_{CC}) | V_{LOW} | | | 2.6 | | V |
| Hysteresis (V_{CC}) | V_{HYS} | | 80 | 120 | | mV |
| Reset threshold voltage(V_{CC}) | V_{RESET} | | 1.5 | 1.9 | | V |

Short-circuit protection control section

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|----------------|-----------------------|------|------|------|---------|
| Input threshold voltage (SCP) | V_{TH} | $T_A=25$ | 0.65 | 0.7 | 0.75 | V |
| Standby voltage (SCP) | $V_{STANDBY}$ | No pullup | 140 | 185 | 230 | mV |
| Latched input voltage (SCP) | V_{LATCH} | No pullup | | 60 | 120 | mV |
| Input (source) current | I_{SOURCE} | $V_I=0.7V$, $T_A=25$ | -10 | -15 | -20 | μA |
| Comparator threshold voltage (FEEDBACK) | $V_{COMP(TH)}$ | | | 1.18 | | V |

Oscillator section

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------------------|--------|-------------------------|-----|-------|-----------|------|
| Frequency | f | $C_T=330pF$, $R_T=10K$ | | 200 | | KHz |
| Standard deviation of frequency | f | $C_T=330pF$, $R_T=10K$ | | 10% | | |
| Frequency change with voltage | f/ V | $V_{CC}=3.6V$ to 40V | | 1% | | |
| Frequency change with Temperature | f/ T | $T_A=-20$ to 25 | | -0.4% | $\pm 2\%$ | |
| | | $T_A=25$ to 85 | | -0.2% | $\pm 2\%$ | |

Dead-time control section

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|--------------|--------------------|-----|------|------|---------|
| Input bias current (DTC) | I_{BIAS} | | | | 1 | μA |
| Latch mode (source) current(DTC) | I_{SOURCE} | $T_A=25$ | -80 | -200 | | μA |
| Latched input voltage (DTC) | V_{LATCH} | $I_O=40 \mu A$ | 2.3 | | | V |
| Input threshold voltage at $f=10kHz$ (DTC) | V_{TH} | Zero duty cycle | | 2.05 | 2.25 | V |
| | | Maximum duty cycle | 1.2 | 1.45 | | |

DC ELECTRICAL CHARACTERISTICS (Cont.)

Error –amplifier section

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------------------------|--------------|--|---------------|-----|-----------|---------------|
| Input offset voltage | V_{IO} | $V_O(\text{FEEDBACK})=1.25\text{V}$ | | | ± 6 | mV |
| Input offset current | I_{IO} | $V_O(\text{FEEDBACK})=1.25\text{V}$ | | | ± 100 | nA |
| Input bias current | I_{BIAS} | $V_O(\text{FEEDBACK})=1.25\text{V}$ | | 160 | 500 | nA |
| Common-mode input voltage range | V_{ICM} | $V_{CC}=3.6\text{V to }40\text{V}$ | 0.3 | | 1.6 | V |
| Open-loop voltage amplification | A_{VO} | $R_F=200\text{K}$ | 70 | 80 | | dB |
| Unity-gain bandwidth | BW | | | 1.5 | | MHz |
| Common-mode rejection ratio | CMRR | | 60 | 80 | | dB |
| Positive output voltage swing | V_{POS} | | $V_{ref}-0.2$ | | | V |
| Negative output voltage swing | V_{NEG} | | | | 1 | V |
| Output (sink) current (FEEDBACK) | I_{SINK} | $V_{ID}= -0.1\text{V}, V_O=1.25\text{V}$ | 1 | 4.0 | | mA |
| Output (source) current (FEEDBACK) | I_{SOURCE} | $V_{ID}=0.1\text{V}, V_O=1.25\text{V}$ | -45 | -90 | | μA |

Output section

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------------------|-----------|-------------------|-----|-----|-----|---------------|
| Collector off-state current | I_{OFF} | $V_O=40\text{V}$ | | | 10 | μA |
| Output saturation voltage | V_{SAT} | $I_O=10\text{mA}$ | | 0.7 | 1 | V |
| Short-circuit output current | I_{SC} | $V_O=6\text{V}$ | | 150 | | mA |

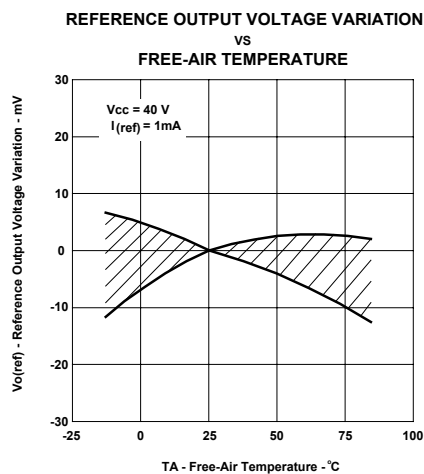
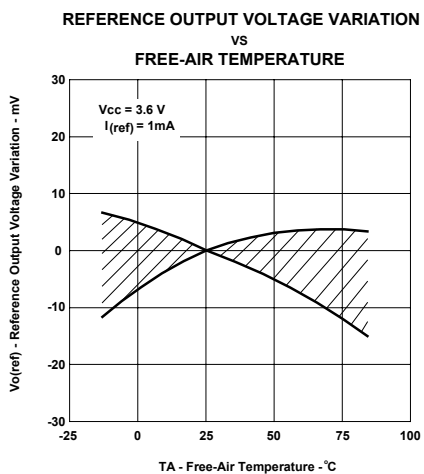
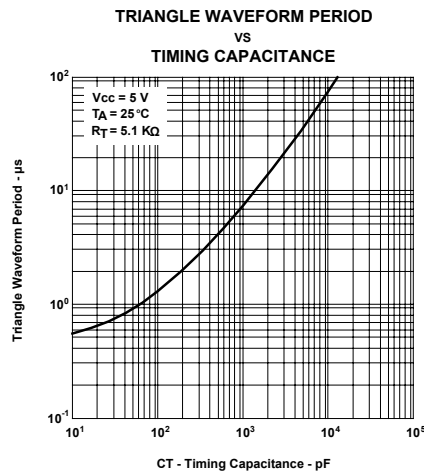
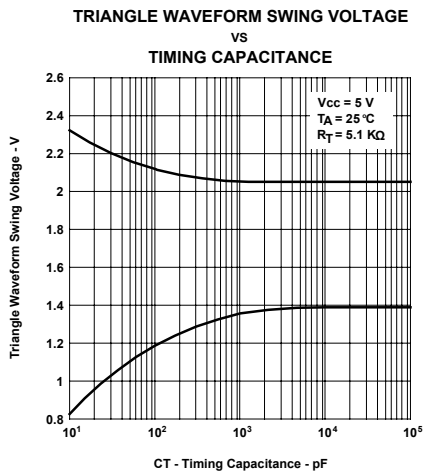
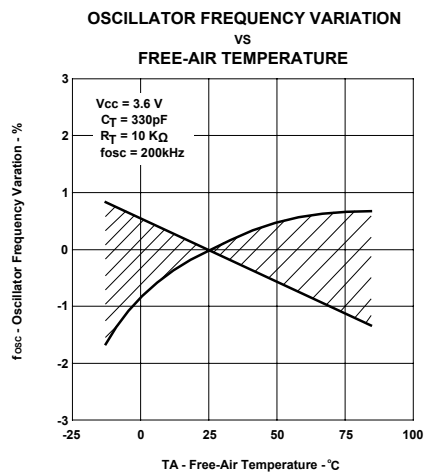
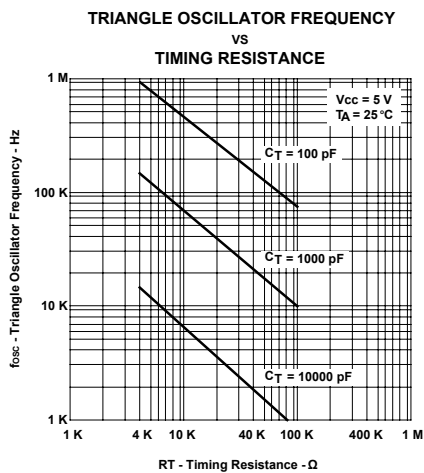
Pwm comparator section

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|----------|--------------------|-----|------|------|------|
| Input threshold voltage at $f=10\text{kHz}(\text{FEEDBACK})$ | V_{TH} | Zero duty cycle | | 2.05 | 2.25 | V |
| | | Maximum duty cycle | 1.2 | 1.45 | | |

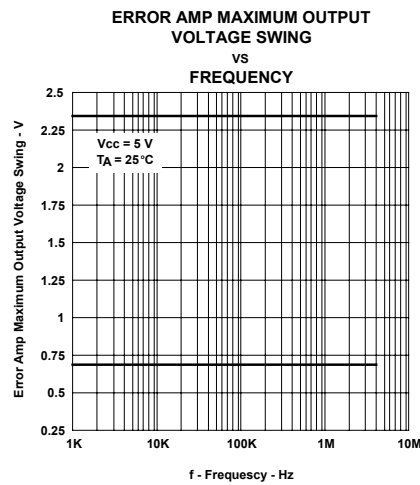
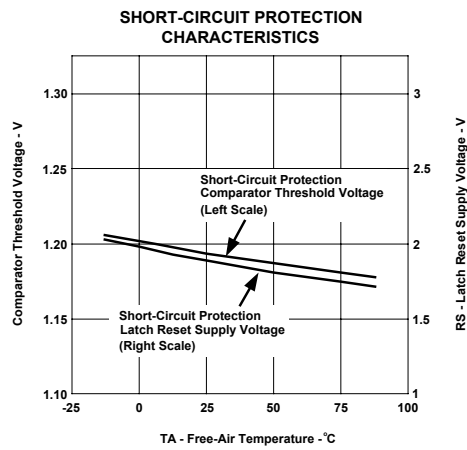
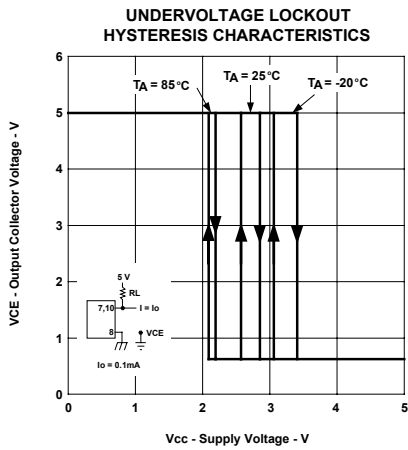
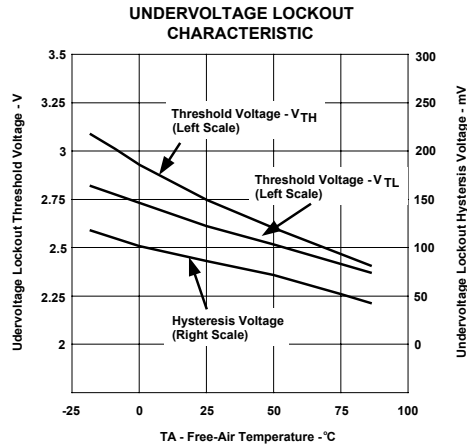
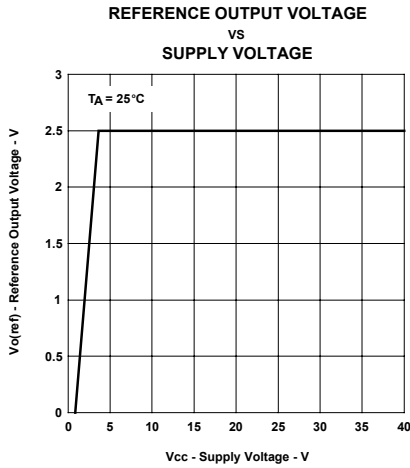
Total device

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP+ | MAX | UNIT |
|------------------------|---------------|------------------|-----|------|-----|------|
| Standby supply current | $I_{STANDBY}$ | Off-state | | 1.3 | 1.8 | mA |
| Average supply current | I_{AVE} | $R_T=10\text{K}$ | | 1.7 | 2.4 | mA |

TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS (Cont.)



TYPICAL CHARACTERISTICS (Cont.)

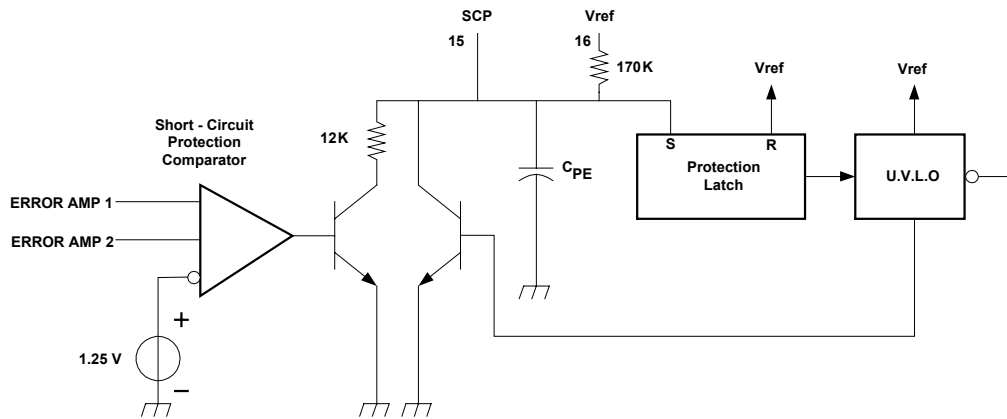
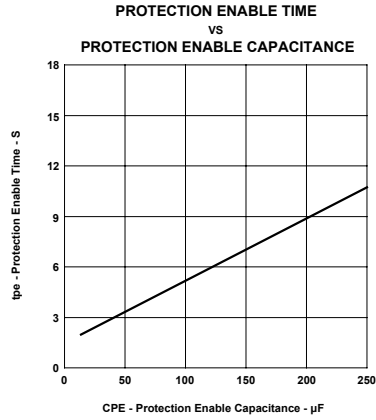
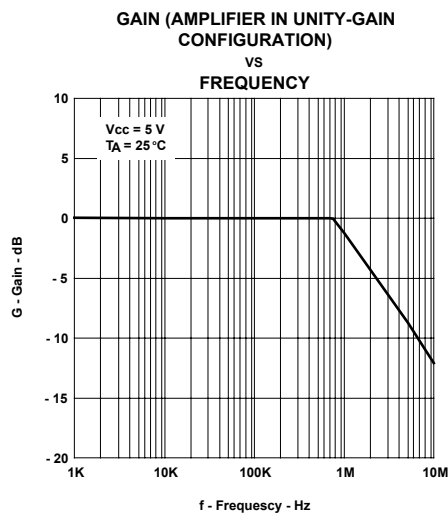
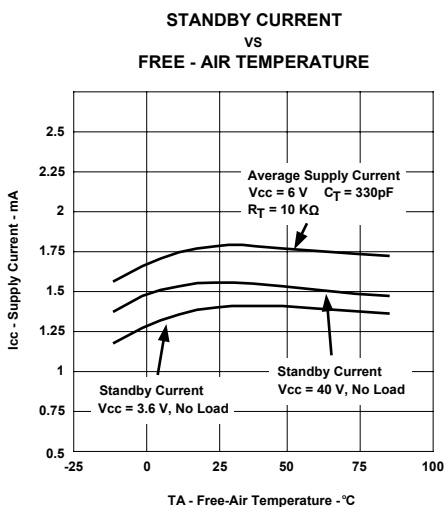
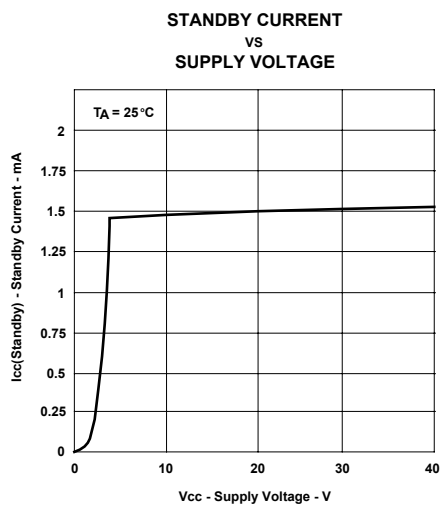
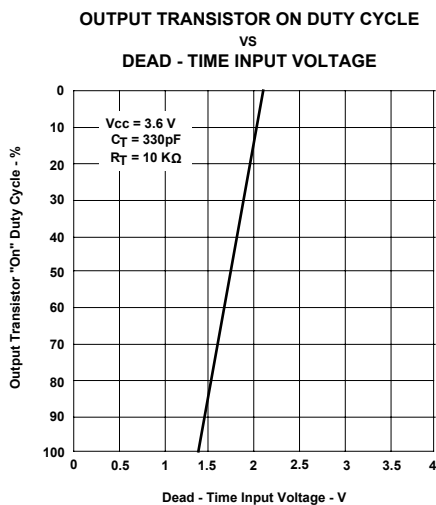
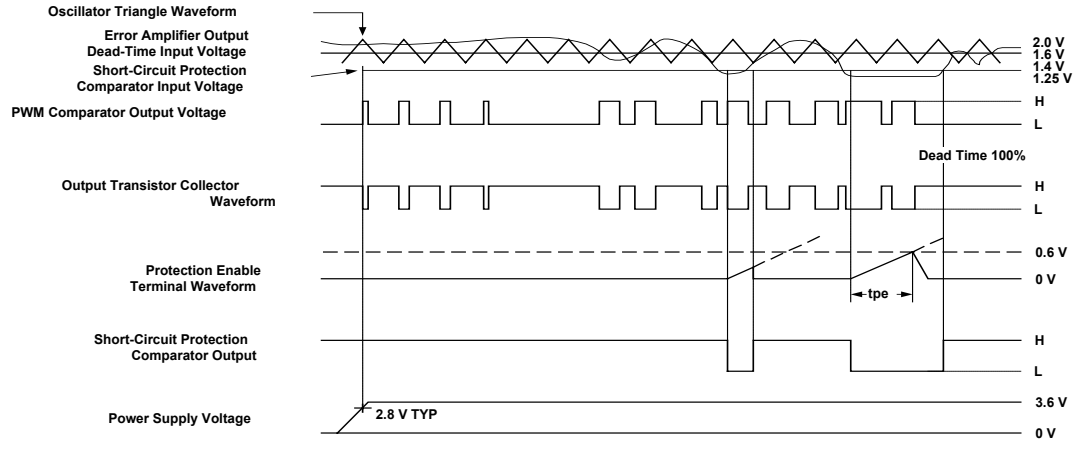


Figure 12

TYPICAL CHARACTERISTICS (Cont.)



TIMING WAVEFORM



Protection Enable Time, $t_{pe} = (0.047 * 10E6 * C_{pe})$ in seconds

FP1451 Timing Diagram

APPLICATION NOTE

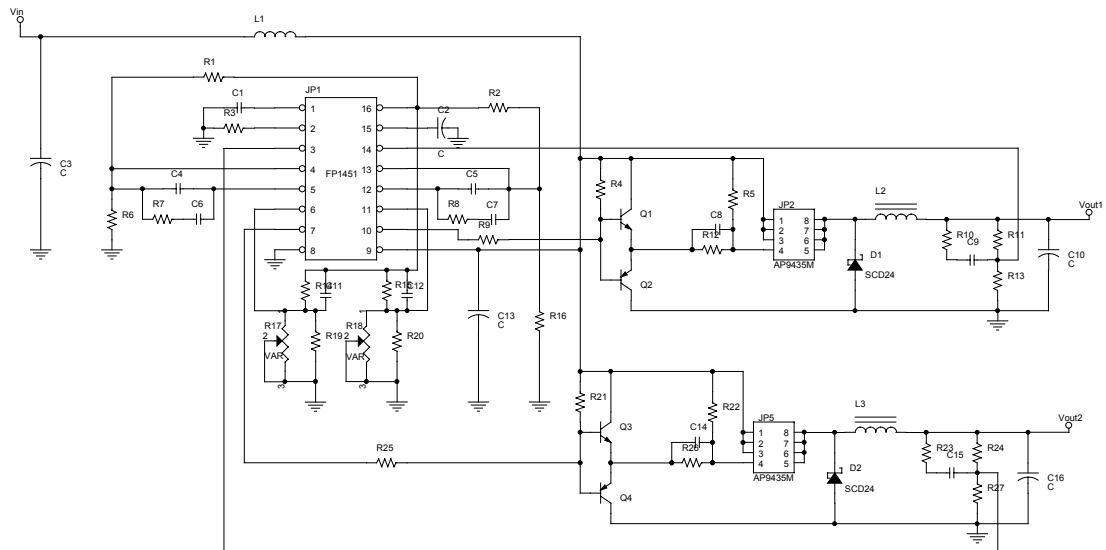
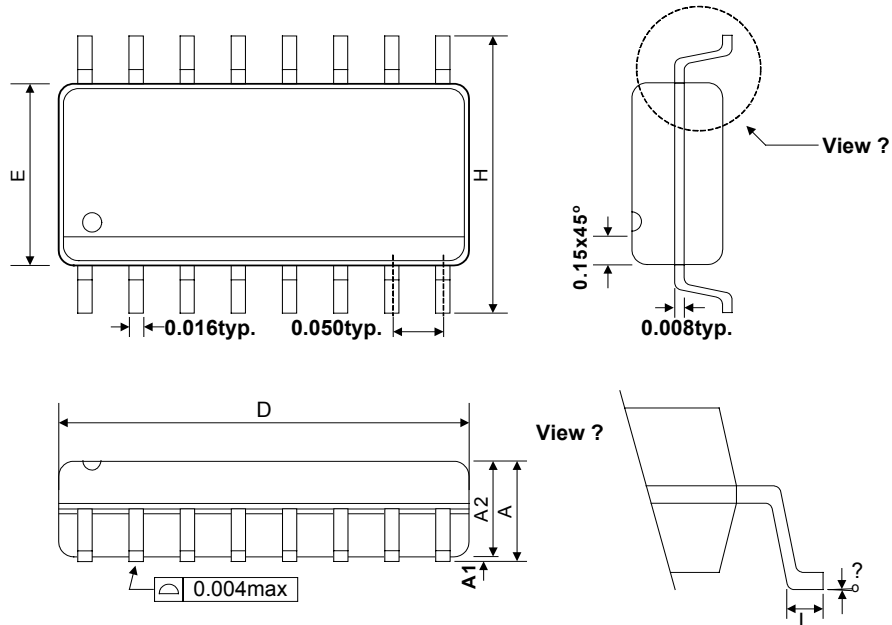


Figure 17. 2-channel dc-dc converter circuit

PACKAGE OUTLINE

SOP16

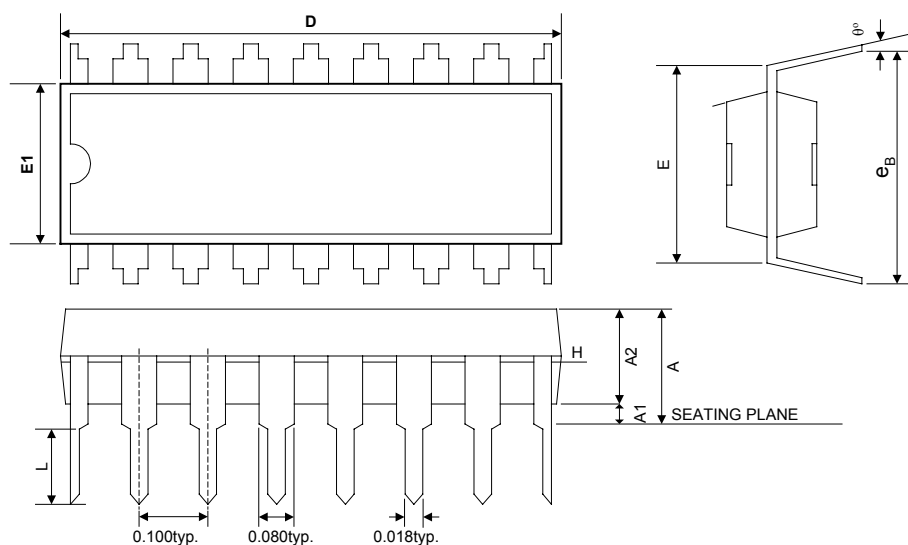


| SYMBOLS | MIN | MAX |
|---------|-------|-------|
| A | 0.053 | 0.069 |
| A1 | 0.004 | 0.010 |
| D | 0.386 | 0.394 |
| E | 0.150 | 0.157 |
| H | 0.228 | 0.244 |
| L | 0.016 | 0.050 |
| ° | 0 | 8 |

NOTE:

1. JEDEC OUTLINE: MS-012 AC
2. DIMENSIONS "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .15mm (.006in) PER SIDE
3. DIMENSIONS "E" DOES NOT INCLUDE INTER-LEAD FLASH, OR PROTRUSIONS.
4. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED .25mm (.010in) PER SIDE.

PDIP16



| SYMBOLS | MIN. | NOR. | MAX. |
|----------|------------|-------|-------|
| A | — | — | 0.210 |
| A1 | 0.015 | — | — |
| A2 | 0.125 | 0.130 | 0.135 |
| D | 0.735 | 0.755 | 0.775 |
| E | 0.300 BSC. | | |
| E1 | 0.245 | 0.250 | 0.255 |
| L | 0.115 | 0.130 | 0.150 |
| e_B | 0.335 | 0.355 | 0.375 |
| $^\circ$ | 0 | 7 | 15 |

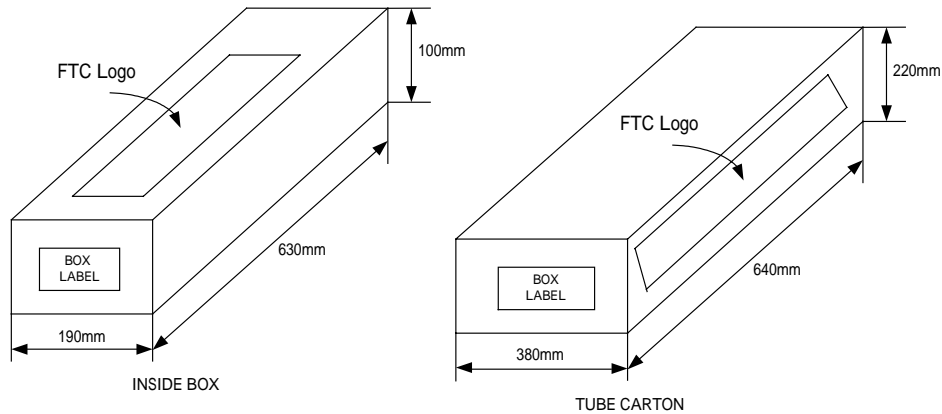
NOTES:

1. JEDEC OUTLINE: MS-001 BB
2. "D", "E1" DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH.
3. e_B IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
4. POINTED OR ROUNDED LEAD TIPS ARE PREFERRED TO EASE INSERTION. DISTANCE BETWEEN LEADS INCLUDING DAM BAR PROTRUSIONS TO BE .005 INCH MINIMUM.
5. DATUM PLANE CONCORDANT WITH THE BOTTOM OF LEAD, WHERE LEAD EXITS BODY.

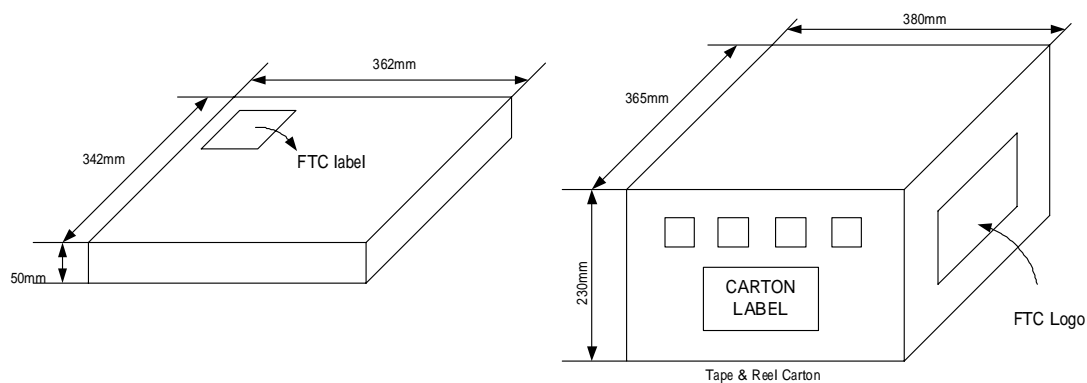
PACKING SPECIFICATIONS

BOX DIMENSION

TUBE INSIDE BOX AND CARTON



TAPE AND REEL INSIDE BOX AND CARTON



PACKING QUANTITY SPECIFICATIONS

| | |
|-------------------------|-------------------------|
| 50 EA/TUBE | 2500 EA / REEL |
| 50 TUBES / INSIDE BOX | 4 INSIDE BOXES / CARTON |
| 4 INSIDE BOXES / CARTON | |

LABEL SPECIFICATIONS

TAPPING & REEL

| | |
|--|--|
| Feeling Technology Corp. Product : FP1451 Lot No : A3311C62 D/C : 4Xx-XXL Q'ty : | <div style="border: 1px solid black; padding: 2px; display: inline-block;"> 無鉛 Lead Free </div> |
|--|--|

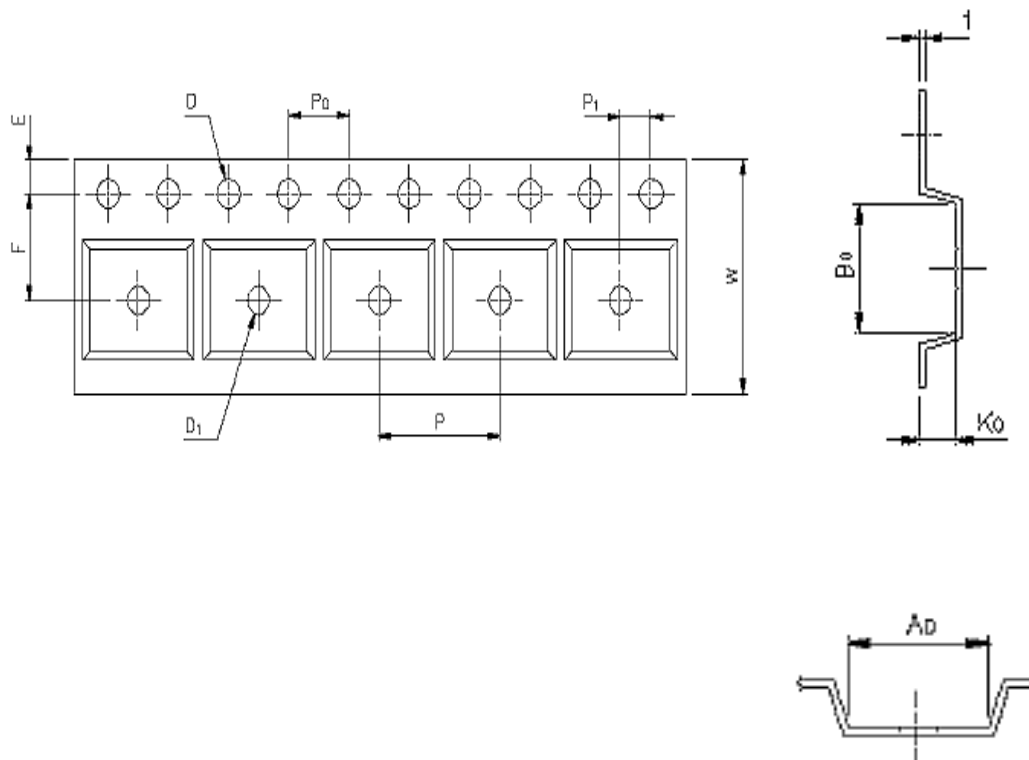
CARTON

| | |
|--------------------------|-----------------|
| Feeling Technology Corp. | |
| Product Type: FP1451 | |
| Lot No: A3311C62 | |
| Date Code: 4Xx-XXL | |
| Package Type: SOP-16L | |
| Marking Type: Laser | 無鉛 Lead Free |
| Total Q'ty: 10,000 | |

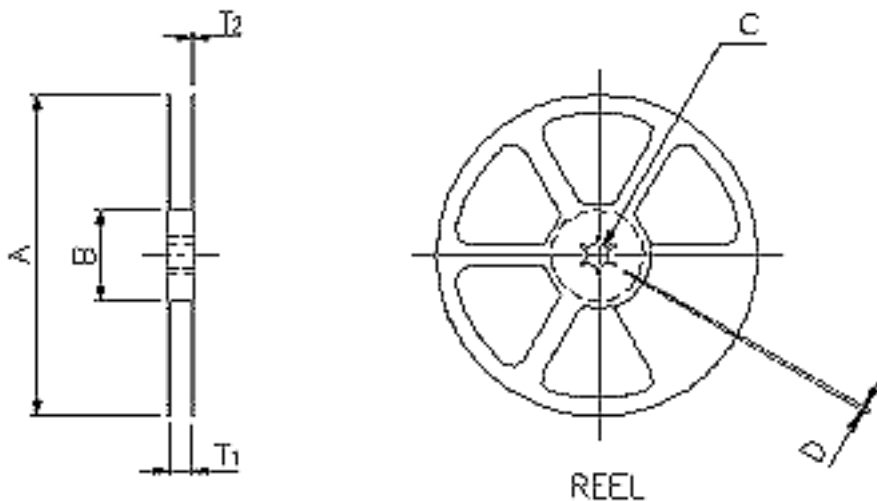
CARRIER TAPE DIMENSIONS

| APPLICATION | W | P | E | F | D | D ₁ |
|-------------|----------|---------|----------|---------|----------------------|----------------------|
| SOP16 | 16.0±0.3 | 8.0±0.1 | 1.75±0.1 | 7.5±0.1 | 1.55 ^{+0.1} | 1.5 ^{+0.25} |

| APPLICATION | P ₀ | P ₁ | A ₀ | B ₀ | K ₀ | t |
|-------------|----------------|----------------|----------------|----------------|----------------|-----------|
| SOP16 | 4.0±0.1 | 2.0±0.1 | 6.5±0.1 | 10.3±0.1 | 2.1±0.1 | 0.30±0.05 |




REEL DIMENSIONS



| APPLICATION | MATERIAL | A | B | C | D | T ₁ | T ₂ |
|-------------|------------------------|-------|---------|----------|---------|--------------------------------------|----------------|
| SOP16 | PLASTIC REEL (BLUE) | 330±3 | 100±2.0 | 13.0±0.5 | 2.0±0.5 | 16.4 ^{+0.3} _{-0.2} | 2.5±0.5 |

SGS REPORT



Test Report

FEELING TECHNOLOGY CORP. Report No. : CE/2003/81705
 2F, NO.287, SEC.2, KUANG-FU RD., SHIN-CHU Date : 2003/08/28
 CITY, TAIWAN, R.O.C. Page : 1 of 1

The following merchandise was(were) submitted and identified by the client as :


Type of Product : POWER IC (FP1451D)
Style/Item No : SOP-16
Sample Received : 2003/08/25
Testing Date : 2003/08/25 TO 2003/08/28

Test Result

PART NAME NO.1 : IC(MIX ALL PARTS)

| Test Item(s) | Unit | Method | MDL | Result | | | | Spec. |
|--------------|------|---|-----|--------|--|--|--|-------|
| | | | | NO.1 | | | | |
| Lead (Pb) | ppm | ICP-AES After As per US EPA3050B or Acid digestion. | 2 | 7.0 | | | | |

NOTE: (1) N.D. = Not detected. (<MDL)
 (2) ppm = mg/kg
 (3) MDL= Method Detection Limit
 (4) * -- * = Not Applicable
 (5) *--=Results shown are of the adjusted analytical results.


 Aaron Lee, M.R./ Supervisor
 Signed for and on behalf of
 SGS TAIWAN LTD.

This Test Report is issued to the Client, subject to the General Conditions of Service printed on the back. Reference is made to the terms of the Client's agreement with SGS Taiwan Ltd. dated 2001/01/01. The results shown on this report may refer to the standard method unless otherwise stated. The test results are for information only and do not constitute a warranty. For more information, please contact your SGS representative.

0235583

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 www.sgs.com.tw