# Features

- **No External Components Except PIN Diode**
- **Supply-voltage Range: 4.5V to 5.5V**
- **Highest Sensitivity Due to Automatic Sensitivity Adaption (AGC) and Automatic Strong Signal Adaption (ATC)**
- **Highest Immunity Against Disturbances from Daylight and Lamps**
- **Available for Carrier Frequencies between 30 kHz to 76 kHz; Adjusted by Zener Diode Fusing**
- **TTL and CMOS Compatible**
- **Suitable Minimum Burst Length $\geq$ 10 Pulses/Burst**

# Applications

- **Home Entertainment Applications (Audio/Video)**
- **Home Appliances**
- **Remote Control Equipment**

# 1. Description

The IC T2525 is a complete IR receiver for data communication that was developed and optimized for use in carrier-frequency-modulated transmission applications. The IC offers highest sensitivity as well as highest suppression of noise from daylight and lamps. The T2525 is available with broadest range of carrier frequencies (30, 33, 36, 37, 38, 40, 44, 56, 76 kHz) and 5 different noise suppression regulation types (standard, lamp, noise, short burst, data rate) covering requirements of high-end remote control solutions (please refer to selection guide available for T2525/ATA2526). The T2525 operates in a supply voltage range of 4.5V to 5.5V.

The function of T2525 can be described using the block diagram (see Figure 1-1 on page 2). The input stage meets two main functions. First, it provides a suitable bias voltage for the PIN diode. Secondly, the pulsed photo-current signals are transformed into a voltage by a special circuit which is optimized for low-noise applications. After amplification by a **C**ontrolled **G**ain **A**mplifier (CGA), the signals have to pass a tuned integrated narrow bandpass filter with a center frequency $f_0$ which is equivalent to the chosen carrier frequency of the input signal. The demodulator is used to convert the input burst signal into a digital envelope output pulse and to evaluate the signal information quality, i.e., unwanted pulses will be suppressed at the output pin. All this is done by means of an integrated dynamic feedback circuit which varies the gain as a function of the present environmental condition (ambient light, modulated lamps etc.). Other special features are used to adapt to the current application to secure best transmission quality.

**IR Receiver ASSP**

**T2525**

**Figure 1-1.** Block Diagram
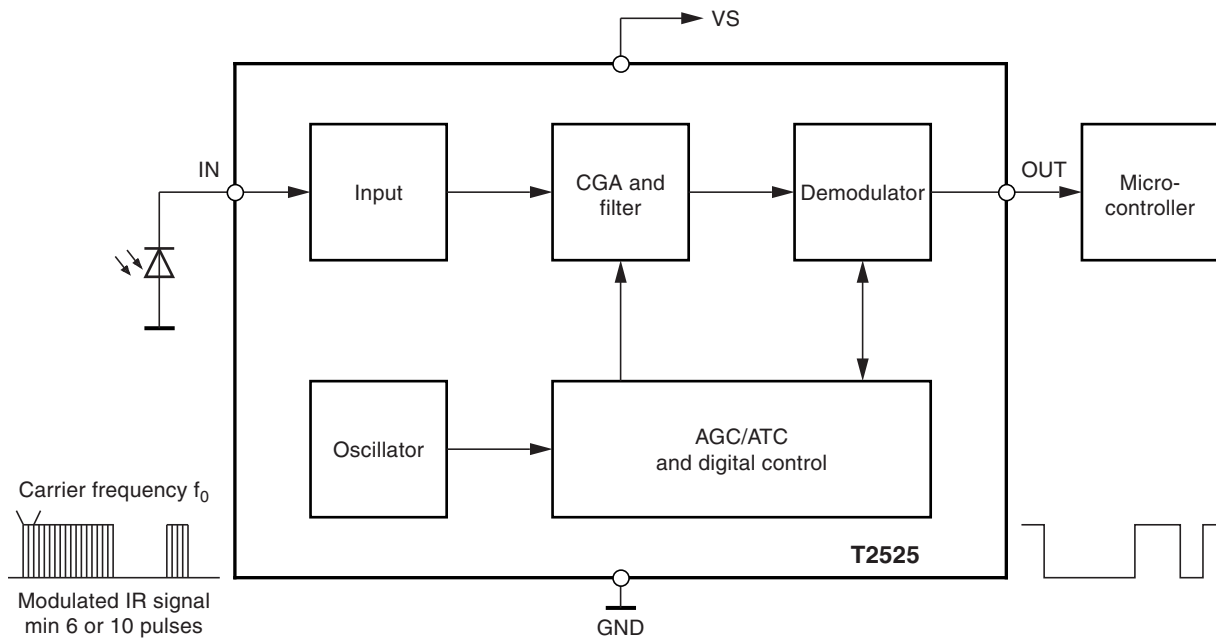
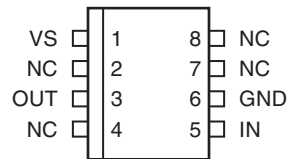# 2. Pin Configuration

**Figure 2-1.** Pinning SO8 and TSSOP8



**Table 2-1.** Pin Description

| Pin | Symbol | Function |
|-----|--------|----------|
| 1 | VS | Supply voltage |
| 2 | NC | Not connected |
| 3 | OUT | Data output |
| 4 | NC | Not connected |
| 5 | IN | Input PIN diode |
| 6 | GND | Ground |
| 7 | NC | Not connected |
| 8 | NC | Not connected |

# 3. Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

| Parameters | Symbol | Value | Unit |
|---|---|---|---|
| Supply voltage | $V_S$ | −0.3 to +6 | V |
| Supply current | $I_S$ | 3 | mA |
| Input voltage | $V_{IN}$ | −0.3 to $V_S$ | V |
| Input DC current at $V_S$ = 5V | $I_{IN}$ | 0.75 | mA |
| Output voltage | $V_O$ | −0.3 to $V_S$ | V |
| Output current | $I_O$ | 10 | mA |
| Operating temperature | $T_{amb}$ | −25 to +85 | °C |
| Storage temperature | $T_{stg}$ | −40 to +125 | °C |
| Power dissipation at $T_{amb}$ = 25°C | $P_{tot}$ | 30 | mW |

# 4. Thermal Resistance

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction ambient SO8 | $R_{thJA}$ | 130 | K/W |
| Junction ambient TSSOP8 | $R_{thJA}$ | 150 | K/W |

# 5. Electrical Characteristics

$T_{amb}$ = 25°C, $V_S$ = 5V unless otherwise specified.

| No. | Parameters | Test Conditions | Pin | Symbol | Min. | Typ. | Max. | Unit | Type* |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **Supply** | | | | | | | | |
| 1.1 | Supply-voltage range | | 1 | $V_S$ | 4.5 | 5 | 5.5 | V | C |
| 1.2 | Supply current | $I_{IN}$ = 0 | 1 | $I_S$ | 0.8 | 1.1 | 1.4 | mA | B |
| **2** | **Output** | | | | | | | | |
| 2.1 | Internal pull-up resistor[1] | $T_{amb}$ = 25°C; see Figure 6-7 on page 8 | 1,3 | $R_{PU}$ | | 30/40 | | kΩ | A |
| 2.2 | Output voltage low | $I_L$ = 2 mA; see Figure 6-7 on page 8 | 3,6 | $V_{OL}$ | | | 250 | mV | B |
| 2.3 | Output voltage high | | 3,1 | $V_{OH}$ | $V_S - 0.25$ | | Vs | V | B |
| 2.4 | Output current clamping | $R_2$ = 0; see Figure 6-7 on page 8 | 3,6 | $I_{OCL}$ | | 8 | | mA | B |
| **3** | **Input** | | | | | | | | |
| 3.1 | Input DC current | $V_{IN}$ = 0; see Figure 6-7 on page 8 | 5 | $I_{IN\_DCMAX}$ | −85 | | | µA | C |
| 3.2 | Input DC current; Figure 6-2 on page 6 | $V_{IN}$ = 0; $V_s$ = 5V, $T_{amb}$ = 25°C | 5 | $I_{IN\_DCMAX}$ | −530 | −960 | | µA | B |
| 3.3 | Minimum detection threshold current; Figure 6-1 on page 6 | Test signal: see Figure 6-6 on page 8 $V_S$ = 5V, $T_{amb}$ = 25°C, $I_{IN\_DC}$ = 1 µA; square pp, burst N = 16, f = $f_0$; $t_{PER}$ = 10 ms, Figure 6-6 on page 8; BER = 50[2] | 3 | $I_{Eemin}$ | | −500 | | pA | B |
| 3.4 | Minimum detection threshold current with AC current disturbance IIN_AC100 = 3 µA at 100 Hz | Test signal: see Figure 6-6 on page 8 $V_S$ = 5V, $T_{amb}$ = 25°C, $I_{IN\_DC}$ = 1 µA, square pp, burst N = 16, f = $f_0$; $t_{PER}$ = 10 ms, Figure 6-6 on page 8; BER = 50%[2] | 3 | $I_{Eemin}$ | | −750 | | pA | C |

*) Type means: A =100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

Notes:  1. Depending on version, see "Ordering Information"

2. BER = Bit Error Rate; e.g., BER = 5% means that with P = 20 at the input pin 19...21 pulses can appear at the pin OUT

3. After transformation of input current into voltage

# 5. Electrical Characteristics  (Continued)

$T_{amb}$ = 25°C, $V_S$ = 5V unless otherwise specified.

| No. | Parameters | Test Conditions | Pin | Symbol | Min. | Typ. | Max. | Unit | Type* |
|---|---|---|---|---|---|---|---|---|---|
| 3.5 | Maximum detection threshold current with $V_{IN}$ > 0V | Test signal: see Figure 6-6 on page 8 $V_S$ = 5 V, $T_{amb}$ = 25°C, $I_{IN\_DC}$ = 1 µA; square pp, burst N = 16, f = $f_0$; $t_{PER}$ = 10 ms, Figure 6-6 on page 8; BER = 5%[2] | 3 | $I_{Eemax}$ | −400 | | | µA | D |
| **4** | **Controlled Amplifier and Filter** | | | | | | | | |
| 4.1 | Maximum value of variable gain (CGA) | | | $G_{VARMAX}$ | | 51 | | dB | D |
| 4.2 | Minimum value of variable gain (CGA) | | | $G_{VARMIN}$ | | -5 | | dB | D |
| 4.3 | Total internal amplification[3] | | | $G_{MAX}$ | | 71 | | dB | D |
| 4.4 | Center frequency fusing accuracy of bandpass | $V_S$ = 5V, $T_{amb}$ = 25°C | | $f_{0\_FUSE}$ | −3 | $f_0$ | +3 | % | A |
| 4.5 | Overall accuracy center frequency of bandpass | | | $f_0$ | −6.7 | $f_0$ | +4.1 | % | C |
| 4.6 | BPF bandwidth: type N0 - N3 | −3 dB; $f_0$ = 38 kHz; see Figure 6-4 on page 7 | | B | | 3.5 | | kHz | C |
| | BPF bandwidth: type N6, N7 | −3 dB; $f_0$ = 38 kHz Figure 6-4 on page 7 | | B | | 5.4 | | kHz | C |

*) Type means: A =100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

Notes:  1.  Depending on version, see "Ordering Information"

2.  BER = Bit Error Rate; e.g., BER = 5% means that with P = 20 at the input pin 19...21 pulses can appear at the pin OUT

3.  After transformation of input current into voltage

## 5.1  ESD

All pins ⇒2000V HBM; 200V MM, MIL-STD-883C, Method 3015.7

## 5.2  Reliability

Electrical qualification (1000h) in molded SO8 plastic package

# 6. Typical Electrical Curves at $T_{amb} = 25°C$

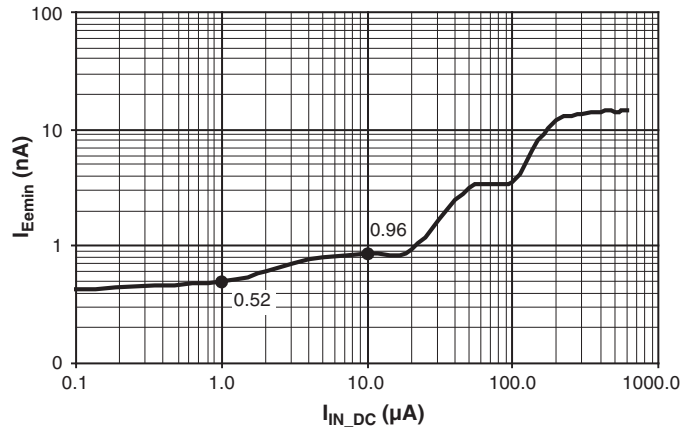**Figure 6-1.** $I_{Eemin}$ versus $I_{IN\_DC}$, $V_S = 5V$



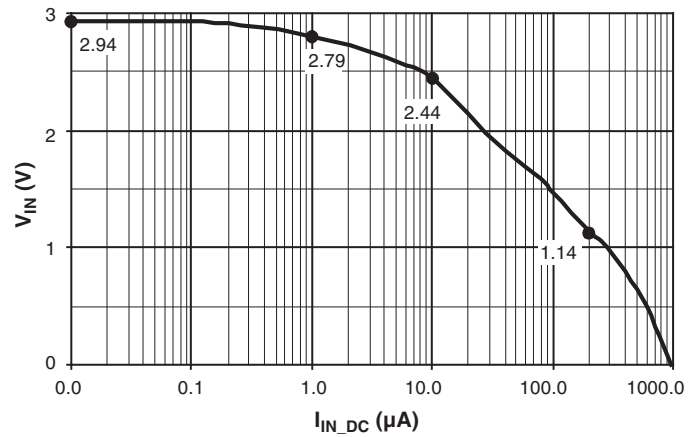**Figure 6-2.** $V_{IN}$ versus $I_{IN\_DC}$, $V_S = 5V$
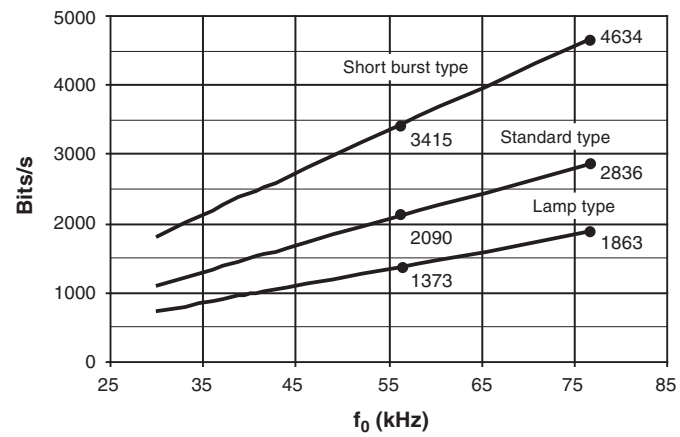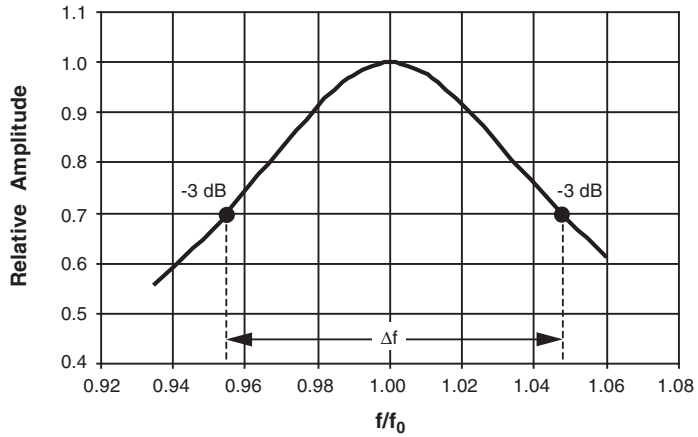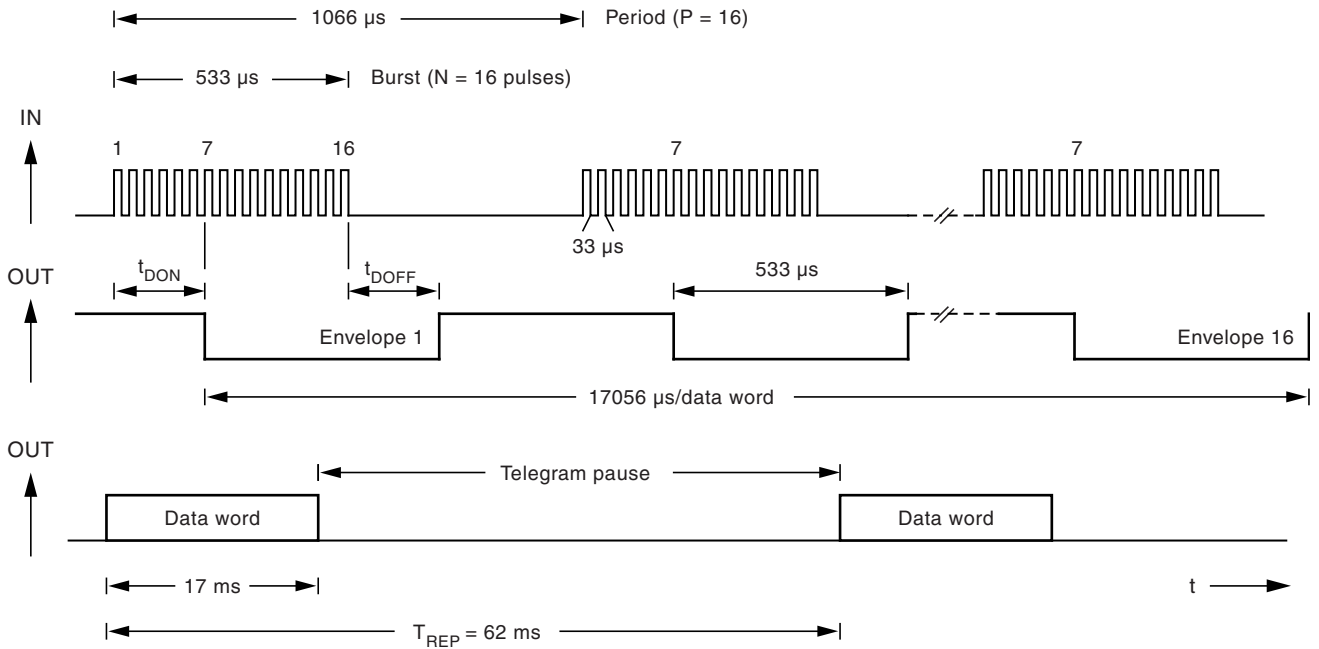


**Figure 6-3.** Data Transmission Rate, $V_S = 5V$

**Figure 6-4.** Typical Bandpass Curve



$Q = f_0/\Delta f$; $\Delta f$ = -3 dB values. Example: $Q = 1/(1.047 - 0.954) = 11$

**Figure 6-5.** Illustration of Used Terms



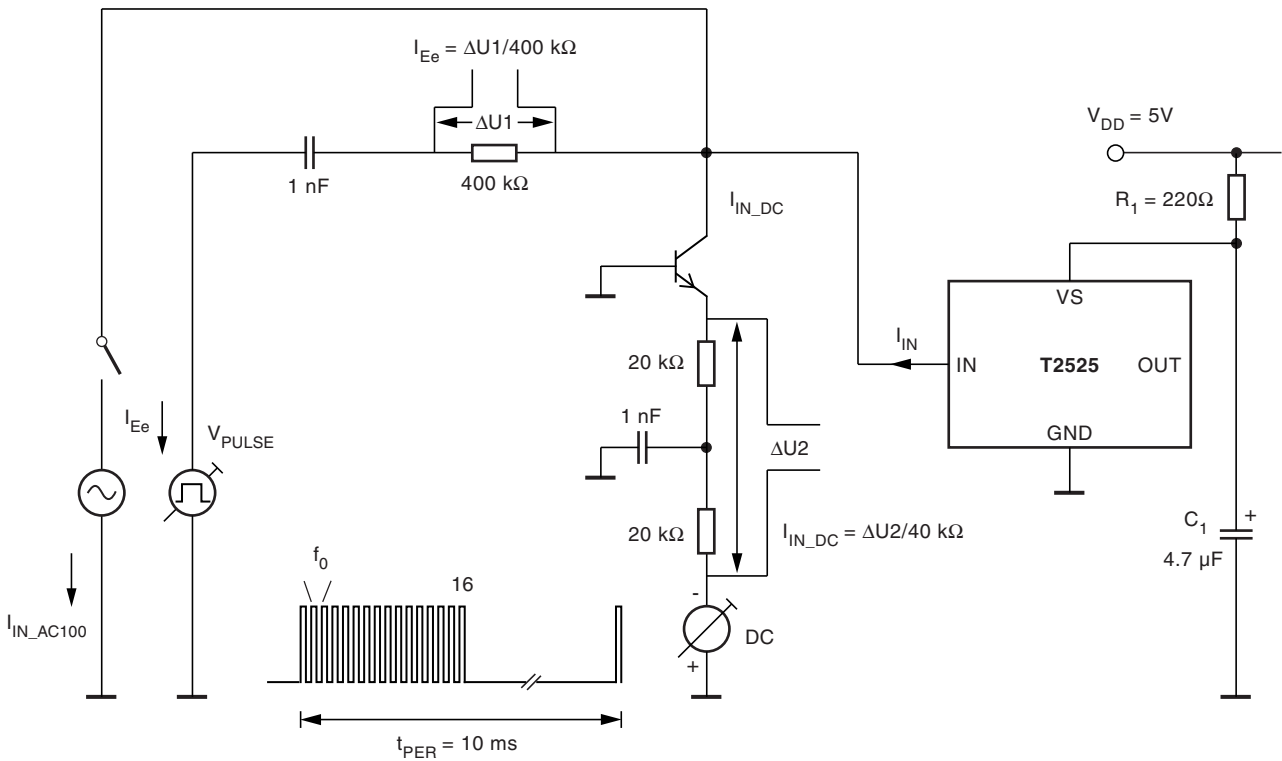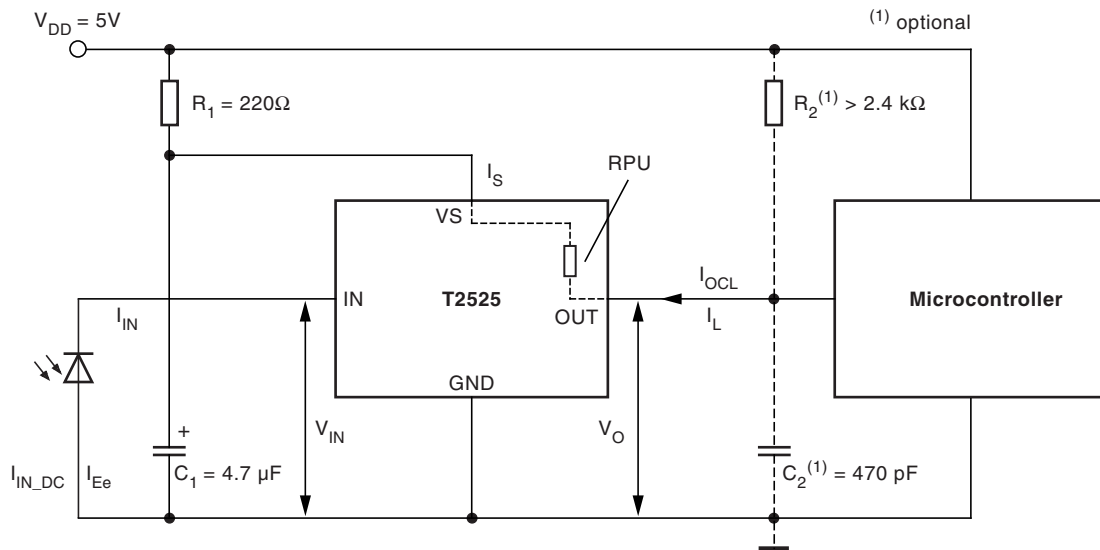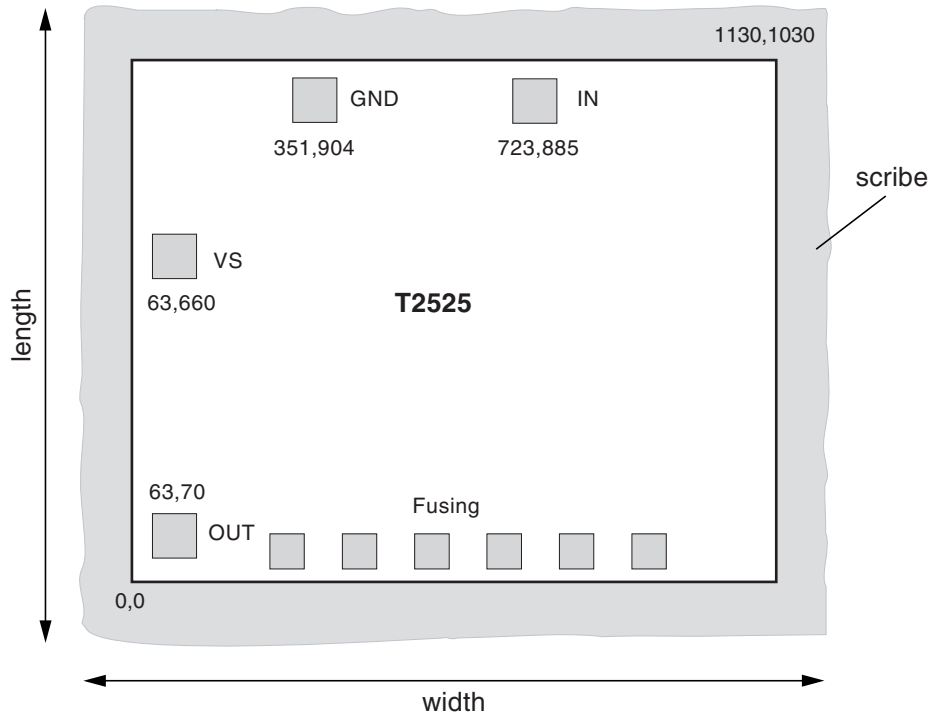Example: $f = 30$ kHz, burst with 16 pulses, 16 periods

**Figure 6-6.** Test Circuit



**Figure 6-7.** Application Circuit

# 7. Chip Dimensions

**Figure 7-1.** Chip Size in µm



Note:    Pad coordinates are for lower left corner of the pad in µm from the origin 0,0

| | | |
|---|---|---|
| **Dimensions** | Length inclusive scribe | 1.15 mm |
| | Width inclusive scribe | 1.29 mm |
| | Thickness | 290µ ± 5% |
| | Pads | 90µ × 90µ |
| | Fusing pads | 70µ × 70µ |
| **Pad metallurgy** | Material | AlCu/AlSiTi[1] |
| | Thickness | 0.8 µm |
| **Finish** | Material | $Si_3N_4/SiO_2$ |
| | Thickness | 0.7/0.3 µm |

Note:    Value depends on manufacture location.

# 8. Ordering Information

Delivering: unsawn wafers (DDW) in box.

| Extended Type Number | PL[2] | R$_{PU}$[3] | D[4] | Type[5] |
|---|---|---|---|---|
| T2525S0xx[1]C-DDW | 2 | 30 | 2090 | **Standard type:** $\geq$ 10 pulses, enhanced sensibility, high data rate |
| T2525S1xx[1]C-DDW | 1 | 30 | 2090 | **Standard type:** $\geq$ 10 pulses, enhanced sensibility, high data rate |
| T2525S2xx[1]C-DDW | 2 | 40 | 1373 | **Lamp type:** $\geq$ 10 pulses, enhanced suppression of disturbances, secure data transmission |
| T2525S3xx[1]C-DDW | 1 | 40 | 1373 | **Lamp type:** $\geq$ 10 pulses, enhanced suppression of disturbances, secure data transmission |
| T2525S6xx[1]C-DDW | 2 | 30 | 3415 | **Short burst type:** $\geq$ 6 pulses, enhanced data rate |
| T2525S7xx[1]C-DDW | 1 | 30 | 3415 | **Short burst type:** $\geq$ 6 pulses, enhanced data rate |

Notes:   1.   xx means the used carrier frequency value $f_0$ 30, 33, 36, 38, 40, 44, 56 kHz. (76 kHz type on request)
2.   Two pad layout versions (see Figure 9-1 and Figure 9-2) available for different assembly demand
3.   Integrated pull-up resistor at pin OUT (see "Electrical Characteristics")
4.   Typical data transmission rate up to bit/s with $f_0$ = 56 kHz, $V_S$ = 5V (see Figure 6-3 on page 6)
5.   On request: noise type, data rate type

# 9. Pad Layout
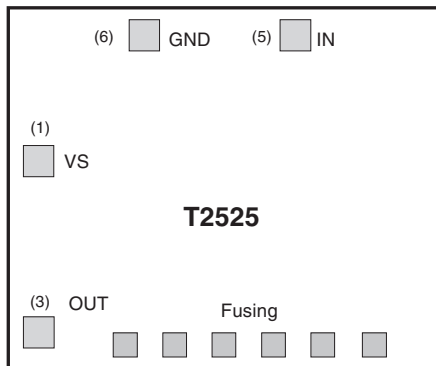
**Figure 9-1.**   Pad Layout 1
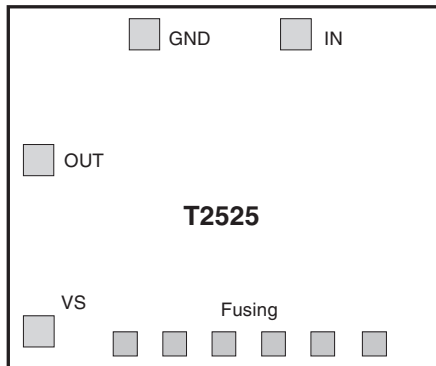


**Figure 9-2.**   Pad Layout 2

## 10. Revision History

Please note that the following page numbers referred to in this section refer to the specific revision mentioned, not to this document.

| Revision No. | History |
|---|---|
| 4657G-AUTO-09/09 | • Put datasheet in newest template<br>• Ordering Information table changed |
| 4657F-AUTO-10/06 | • Features on page 1 changed<br>• Applications on page 1 changed<br>• Section 1 "Description" on page 1 changed<br>• Section 5 "Electrical Characteristics" number 3.3 and 3.4 on page 4 changed<br>• Section 8 "Ordering Information" on page 10 changed<br>• Section 9 "Pad Layout" on page 10 changed |
| 4657E-AUTO-04/06 | • Put datasheet in a new template<br>• Section 8 "Ordering Information" on page 10 changed |

## Headquarters

**Atmel Corporation**
2325 Orchard Parkway
San Jose, CA 95131
USA
Tel: 1(408) 441-0311
Fax: 1(408) 487-2600

## International

**Atmel Asia**
Unit 1-5 & 16, 19/F
BEA Tower, Millennium City 5
418 Kwun Tong Road
Kwun Tong, Kowloon
Hong Kong
Tel: (852) 2245-6100
Fax: (852) 2722-1369

**Atmel Europe**
Le Krebs
8, Rue Jean-Pierre Timbaud
BP 309
78054
Saint-Quentin-en-Yvelines Cedex
France
Tel: (33) 1-30-60-70-00
Fax: (33) 1-30-60-71-11

**Atmel Japan**
9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
Tel: (81) 3-3523-3551
Fax: (81) 3-3523-7581

## Product Contact

**Web Site**
www.atmel.com

**Technical Support**
ir_control@atmel.com

**Sales Contact**
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