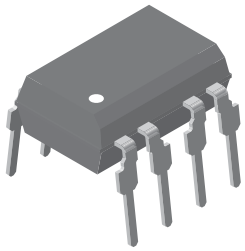
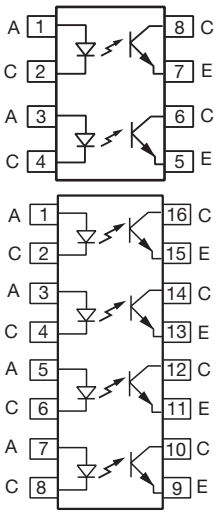
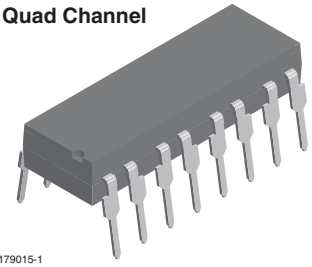
# Optocoupler, Phototransistor Output, (Dual, Quad Channel), 110 °C Rated

Dual Channel






Quad Channel



i179015-1

## FEATURES

- Operating temperature from - 55 °C to + 110 °C
- Identical channel to channel footprint
- Dual and quad packages feature:
  - Reduced board space
  - Lower pin and parts count
  - Better channel to channel CTR match
  - Improved common mode rejection
- Isolation test voltage, 5300 $V_{RMS}$
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Pb-free

e3

RoHS COMPLIANT

## AGENCY APPROVALS

- UL1577, file no. E52744 system code H, double protection
- CSA 93751
- BSI IEC 60950; IEC 60065
- DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 pending

## DESCRIPTION

The ILD1615, ILQ1615 are multi-channel 110 °C rated phototransistor optocouplers that use GaAs IRLED emiters and high gain NPN phototransistors. These devices are constructed using over/under leadframe optical coupling and double molded insulation technology resulting a withstand test voltage of 7500 $V_{AC\ PEAK}$ and a working voltage of 1700 $V_{RMS}$.

The binned min./max. and linear CTR characteristics make these devices well suited for DC or AC voltage detection. Eliminating the phototransistor base connection provides added electrical noise immunity from the transients found in many industrial control environments.

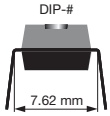
Because of guaranteed maximum non-saturated and saturated switching characteristics, the ILD1615, ILQ1615 can be used in medium speed data I/O and control systems. The binned min./max. CTR specification allow easy worst case interface calculations for both level detection and switching applications. Interfacing with a CMOS logic is enhanced by the guaranteed CTR at $I_F$ = 1.0 mA.

## ORDERING INFORMATION

| I | L | x | 1 | 6 | 1 | 5 | - | 4 |
|---|---|---|---|---|---|---|---|---|

PART NUMBER
x = D (Dual) or Q (Quad)

CTR BIN




| AGENCY CERTIFIED/PACKAGE | DUAL CHANNEL | QUAD CHANNEL |
|---|---|---|
| | CTR (%) | |
| **UL, CSA, BSI** | **160 to 320** | **160 to 320** |
| DIP-8 | ILD1615-4 | - |
| DIP-16 | - | ILQ1615-4 |

| **ABSOLUTE MAXIMUM RATINGS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | |
|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **VALUE** | **UNIT** |
| **INPUT** | | | | |
| Peak reverse voltage | | $V_R$ | 6.0 | V |
| Forward current | | $I_F$ | 60 | mA |
| Surge current | | $I_{FSM}$ | 1.5 | A |
| Power dissipation | | $P_{diss}$ | 100 | mW |
| Derate linearly from 25 °C | | | 1.0 | mW/°C |
| **OUTPUT** | | | | |
| Collector emitter breakdown voltage | | $BV_{CEO}$ | 70 | V |
| Emitter collector breakdown voltage | | $BV_{ECO}$ | 7.0 | V |
| Collector current | | $I_C$ | 50 | mA |
| | t < 1.0 ms | $I_C$ | 100 | mA |
| Power dissipation | | $P_{diss}$ | 150 | mW |
| Derate linearly from 25 °C | | | 1.5 | mW/°C |
| **COUPLER** | | | | |
| Storage temperature | | $T_{stg}$ | - 55 to + 150 | °C |
| Operating temperature | | $T_{amb}$ | - 55 to + 110 | °C |
| Soldering temperature [1] | 2.0 mm distance from case bottom | $T_{sld}$ | 260 | °C |
| Package power dissipation ILD1615 | | | 400 | mW |
| Derate linearly from 25 °C | | | 5.33 | mW/°C |
| Package power dissipation ILQ1615 | | | 500 | mW |
| Derate linearly from 25 °C | | | 6.67 | mW/°C |
| Isolation test voltage | t = 1.0 s | $V_{ISO}$ | 5300 | $V_{RMS}$ |
| Creepage distance | | | ≥ 7.0 | mm |
| Clearance distance | | | ≥ 7.0 | mm |
| Isolation resistance | $V_{IO}$ = 500 V, $T_{amb}$ = 25 °C | $R_{IO}$ | ≥ $10^{12}$ | Ω |
| | $V_{IO}$ = 500 V, $T_{amb}$ = 100 °C | $R_{IO}$ | ≥ $10^{11}$ | Ω |

**Notes**

- Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

(1) Refer to wave profile for soldering conditions for through hole devices.

| **ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **INPUT** | | | | | | |
| Forward voltage | $I_F$ = 10 mA | $V_F$ | 1.0 | 1.15 | 1.3 | V |
| Breakdown voltage | $I_R$ = 10 µA | $V_{BR}$ | 6.0 | 30 | | V |
| Reverse current | $V_R$ = 6.0 V | $I_R$ | | 0.01 | 10 | µA |
| Capacitance | $V_R$ = 0 V, f = 1.0 MHz | $C_O$ | | 25 | | pF |
| **OUTPUT** | | | | | | |
| Collector emitter capacitance | $V_{CE}$ = 5.0 V, f = 1.0 MHz | $C_{CE}$ | | 6.8 | | pF |
| Collector emitter leakage current | $V_{CE}$ = 10 V | $I_{CEO}$ | | 5.0 | 100 | nA |
| Collector emitter breakdown voltage | $I_{CE}$ = 0.5 mA | $BV_{CEO}$ | 70 | | | V |
| Emitter collector breakdown voltage | $I_E$ = 0.1 mA | $BV_{ECO}$ | 7.0 | | | V |
| **PACKAGE TRANSFER CHARACTERISTICS** | | | | | | |
| Channel/channel CTR match | $I_F$ = 10 mA, $V_{CE}$ = 5.0 V | CTRX/CTRY | 1 to 1 | | 2 to 1 | |
| **COUPLER** | | | | | | |
| Capacitance (input to output) | $V_{IO}$ = 0 V, f = 1.0 MHz | $C_{IO}$ | | 0.8 | | pF |
| Insulation resistance | $V_{IO}$ = 500 V, $T_A$ = 25 °C | $R_S$ | $10^{12}$ | $10^{14}$ | | Ω |
| Channel to channel isolation | | | 500 | | | $V_{AC}$ |

**Note**

- Minimum and maximum values are tested requierements. Typical values are characteristics of the device and are the result of engineering evaluations. Typical values are for information only and are not part of the testing requirements.

| **CURRENT TRANSFER RATIO** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Current transfer ratio (collector emitter saturated) | $I_F$ = 1.0 mA, $V_{CE}$ = 0.4 V | ILD1615-4<br>ILQ1615-4 | $CTR_{CEsat}$ | | 100 | | % |
| Current transfer ratio (collector emitter) | $I_F$ = 10 mA, $V_{CE}$ = 5.0 V | ILD1615-4<br>ILQ1615-4 | $CTR_{CE}$ | 160 | 200 | 320 | % |
| | $I_F$ = 1.0 mA, $V_{CE}$ = 5.0 V | ILD1615-4<br>ILQ1615-4 | $CTR_{CE}$ | 56 | 90 | | % |

| **SWITCHING CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **NON-SATURATED** | | | | | | | |
| Turn-on time | $I_F$ = 10 mA, $V_{CC}$ = 5.0 V, $R_L$ = 75 Ω, 50 % of $V_{PP}$ | | $t_{on}$ | | 3.0 | | µs |
| Rise time | $I_F$ = 10 mA, $V_{CC}$ = 5.0 V, $R_L$ = 75 Ω, 50 % of $V_{PP}$ | | $t_r$ | | 2.0 | | µs |
| Turn-off time | $I_F$ = 10 mA, $V_{CC}$ = 5.0 V, $R_L$ = 75 Ω, 50 % of $V_{PP}$ | | $t_{off}$ | | 2.3 | | µs |
| Fall time | $I_F$ = 10 mA, $V_{CC}$ = 5.0 V, $R_L$ = 75 Ω, 50 % of $V_{PP}$ | | $t_f$ | | 2.0 | | µs |
| Propagation H to L | $I_F$ = 10 mA, $V_{CC}$ = 5.0 V, $R_L$ = 75 Ω, 50 % of $V_{PP}$ | | $t_{PHL}$ | | 1.1 | | µs |
| Propagation L to H | $I_F$ = 10 mA, $V_{CC}$ = 5.0 V, $R_L$ = 75 Ω, 50 % of $V_{PP}$ | | $t_{PLH}$ | | 2.5 | | µs |
| **SATURATED** | | | | | | | |
| Turn-on time | $I_F$ = 5.0 mA, $V_{CC}$ = 5.0 V, $R_L$ = 1.0 kΩ, $V_{HT}$ = 1.5 V | | $t_{on}$ | | 6.0 | | µs |
| Rise time | $I_F$ = 5.0 mA, $V_{CC}$ = 5.0 V, $R_L$ = 1.0 kΩ, $V_{HT}$ = 1.5 V | | $t_r$ | | 4.6 | | µs |
| Turn-off time | $I_F$ = 5.0 mA, $V_{CC}$ = 5.0 V, $R_L$ = 1.0 kΩ, $V_{HT}$ = 1.5 V | | $t_{off}$ | | 25 | | µs |
| Fall time | $I_F$ = 5.0 mA, $V_{CC}$ = 5.0 V, $R_L$ = 1.0 kΩ, $V_{HT}$ = 1.5 V | | $t_f$ | | 15 | | µs |
| Propagation H to L | $I_F$ = 5.0 mA, $V_{CC}$ = 5.0 V, $R_L$ = 1.0 kΩ, $V_{HT}$ = 1.5 V | | $t_{PHL}$ | | 5.4 | | µs |
| Propagation L to H | $I_F$ = 5.0 mA, $V_{CC}$ = 5.0 V, $R_L$ = 1.0 kΩ, $V_{HT}$ = 1.5 V | | $t_{PLH}$ | | 7.4 | | µs |

| **COMMON MODE TRANSIENT IMMUNITY** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Common mode rejection output high | $V_{CM}$ = 50 $V_{P-P}$, $R_L$ = 1.0 kΩ, $I_F$ = 0 mA | $CM_H$ | | 5000 | | V/µs |
| Common mode rejection output low | $V_{CM}$ = 50 $V_{P-P}$, $R_L$ = 1.0 kΩ, $I_F$ = 10 mA | $CM_L$ | | 5000 | | V/µs |
| Common mode coupling capacitance | | $C_{CM}$ | | 0.01 | | pF |

## TYPICAL CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified)

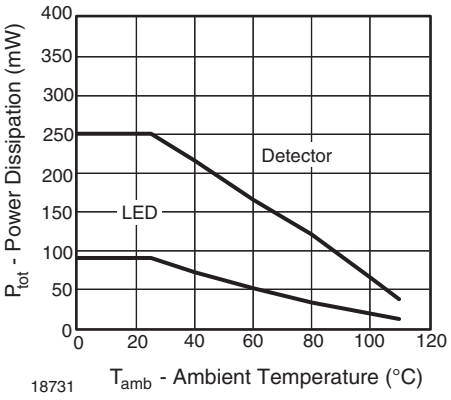



Fig. 1 - Permissible Power Dissipation vs. Temperature Non-Saturation Operation

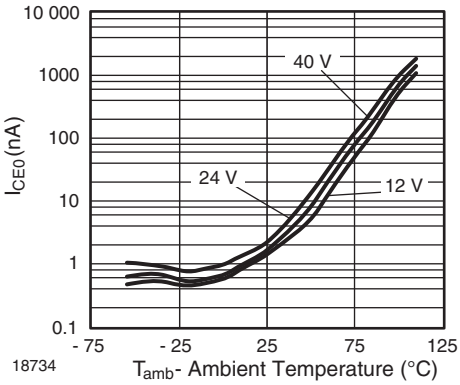



Fig. 4 - Collector to Emitter Dark Current vs. Ambient Temperature

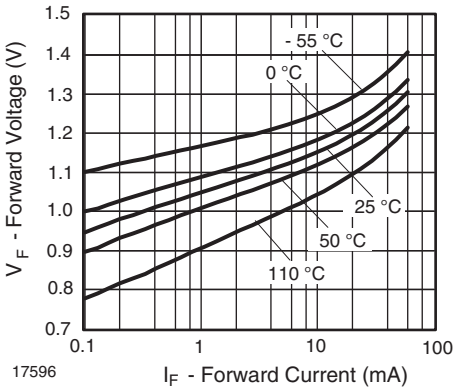



Fig. 2 - Forward Voltage vs. Forward Current

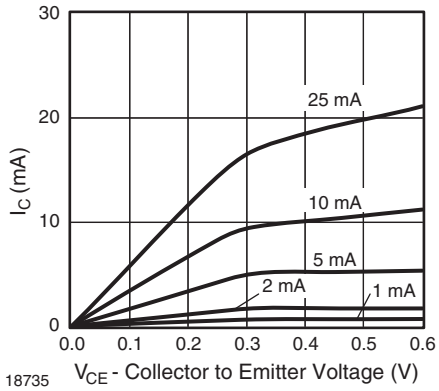



Fig. 5 - Normalized Current vs. Collector Emitter Saturation Voltage

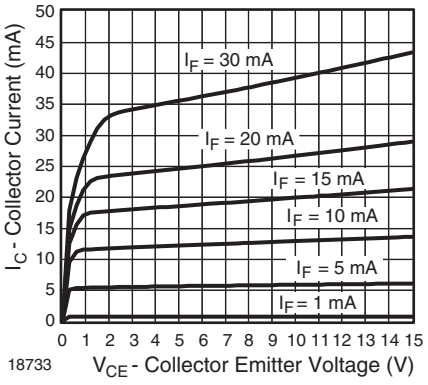



Fig. 3 - Collector Current vs. Collector Emitter Voltage

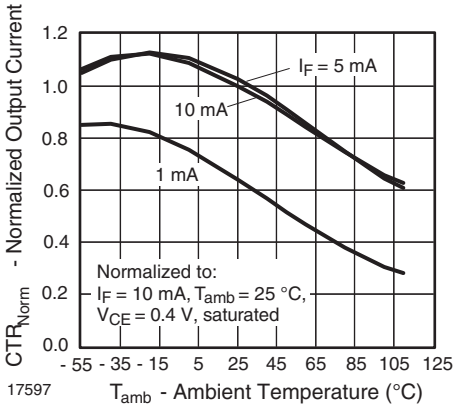



Fig. 6 - Normalized Current Transfer Ratio vs. Ambient Temperature

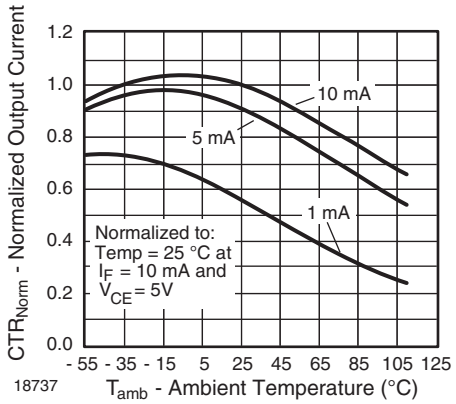



Fig. 7 - Normalized CTR vs. Temperature

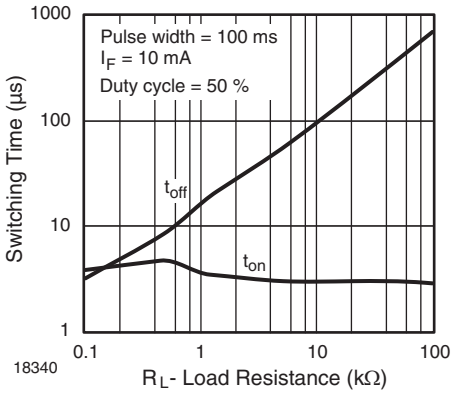



Fig. 10 - Forward Resistance vs. Forward Current

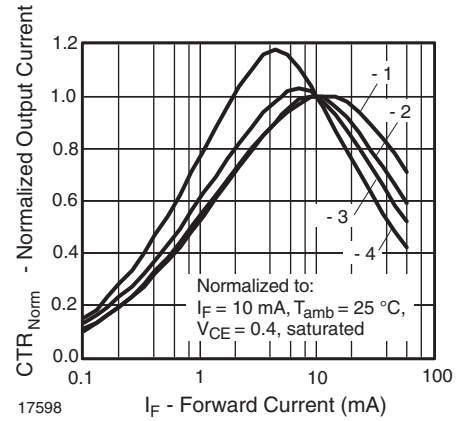



Fig. 8 - Normalized CTR vs. Forward Current

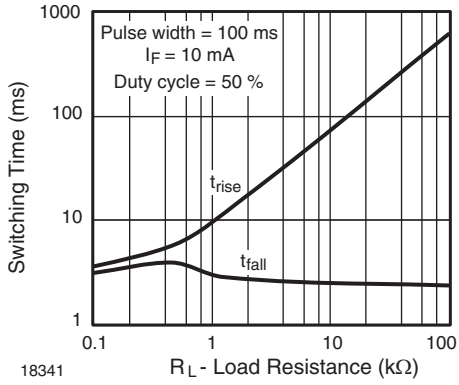



Fig. 11 - Forward Resistance vs. Forward Current

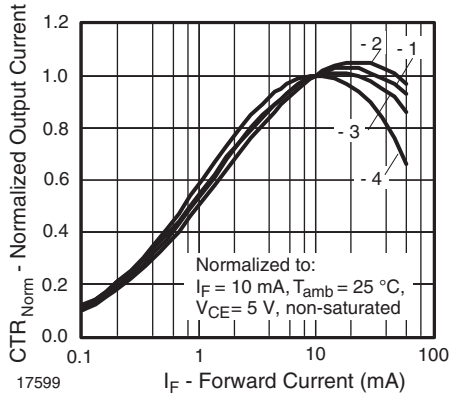
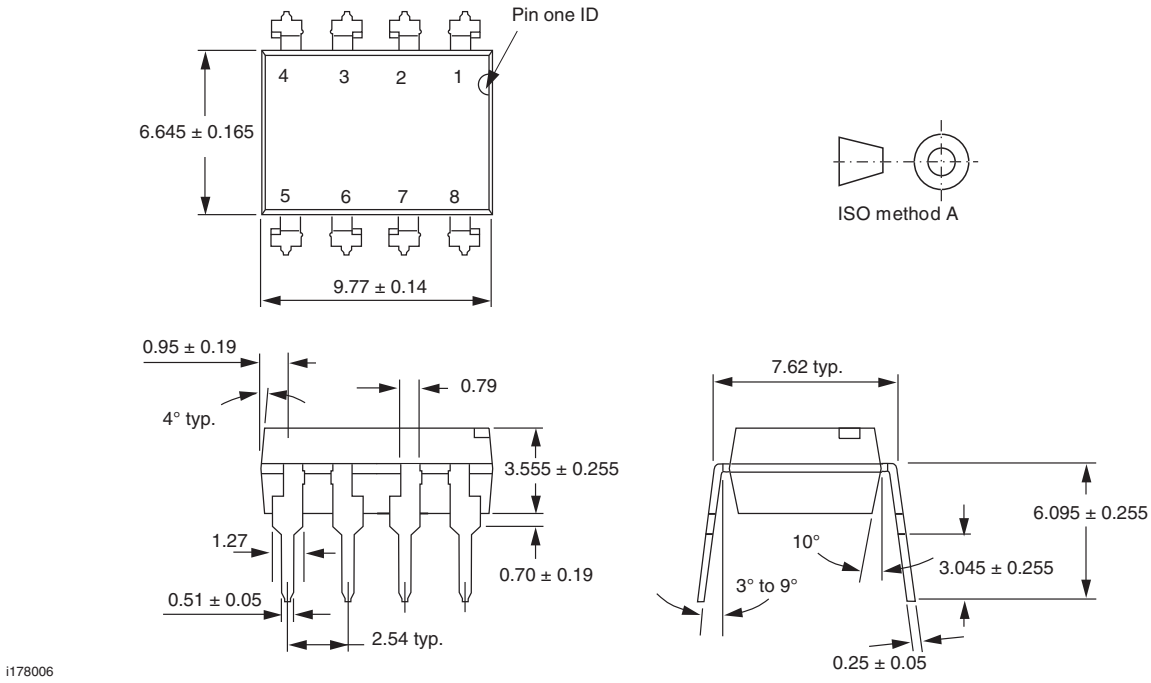
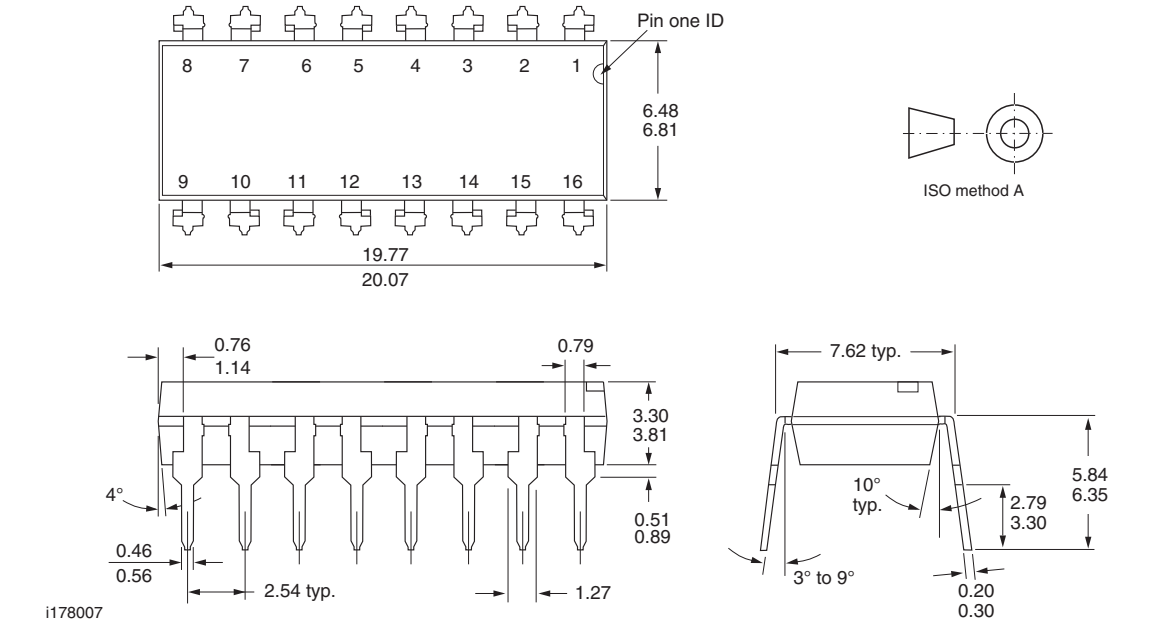



Fig. 9 - Normalized CTR vs. Forward Current

## PACKAGE DIMENSIONS in millimeters




## PACKAGE MARKING

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