DATA SHEET

NEC

PHOTOCOUPLER

# PS2653,PS2654,PS2653L2,PS2654L2

## LONG CREEPAGE TYPE HIGH ISOLATION VOLTAGE 6-PIN PHOTOCOUPLER

–NEPOC™ Series–

### DESCRIPTION

The PS2653, PS2654, PS2653L2, PS2564L2 are optically coupled isolators containing a GaAs light emitting diode and an NPN silicon darilngton-connected phototransistor in a plastic DIP (Dual In-line Package).

The PS2653 has base pin and the PS2654 has no base pin.

Creepage distance and clearance of leads are over 8 millimeters.

The PS2653L2, PS2654L2 are lead bending type (Gull-wing) for surface mount.

### FEATURES

- Long creepage distance (8 mm)
- High Isolation voltage (BV = 5 000 Vr.m.s.)
- High-speed switching ($t_r$, $t_f$ = 100 $\mu$s TYP.)
- High current transfer ratio (CTR = 2 000 % TYP.)
- UL approved: File No. E72422 (S)
- BSI approved (EN 60065/IEC 65, EN 60950/IEC 950) : No. 7250
- SEMKO approved (EN 60065/IEC 60065, EN 60950/IEC 60950) : No. 9317144
- NEMKO approved (EN 60065/IEC 65, EN 60950/IEC 950) : No. A21409
- DEMKO approved (EN 60065/IEC 60665, EN 60950/IEC 950) : No. 300535
- FIMKO approved (EN 60065/IEC 65, EN 60950/IEC 950) : No. 167265-08
- VDE0884 approved (Option)

### ★ APPLICATIONS

- Power supply
- Telephone, FAX
- FA/OA equipment

**The information in this document is subject to change without notice.**

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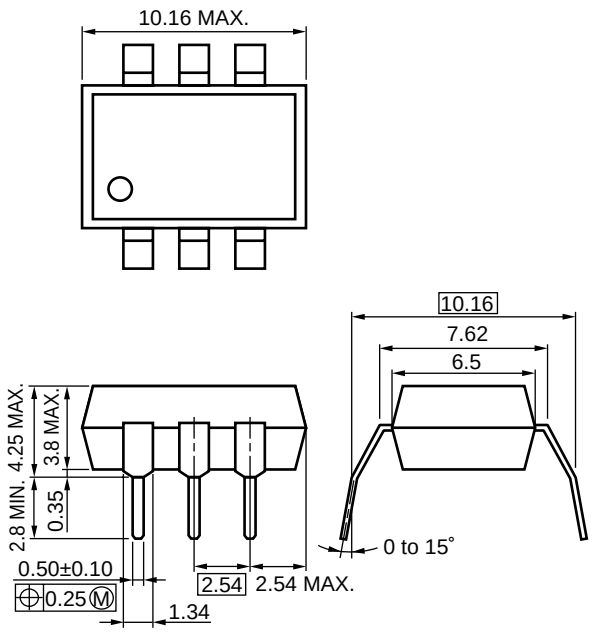
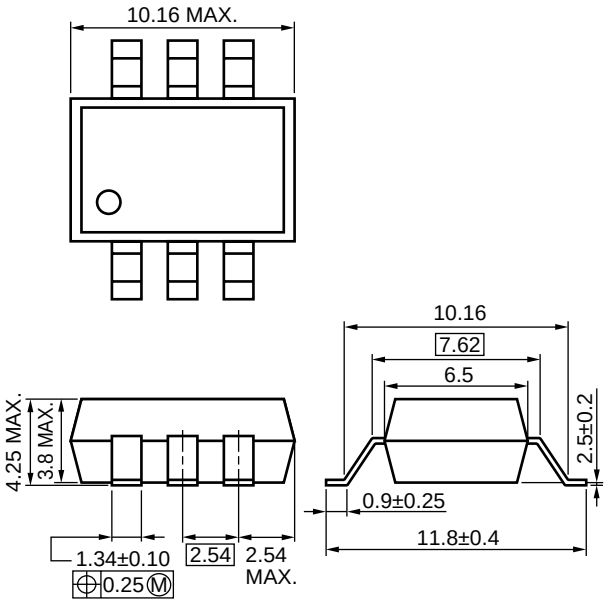
**The mark ★ shows major revised points.**

★ **PACKAGE DIMENSIONS (in millimeters)**

**PS2653, PS2654**
DIP type

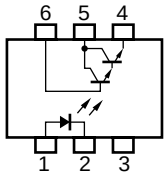



**PS2653L2, PS2654L2**
Lead bending type



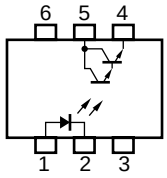

**PIN CONNECTIONS (TOP VIEW)**

**PS2653, PS2653L2**




1. Anode
2. Cathode
3. NC
4. Emitter
5. Collector
6. Base

**PS2654, PS2654L2**




1. Anode
2. Cathode
3. NC
4. Emitter
5. Collector
6. NC

## ★ ORDERING INFORMATION

| Part Number | Package | Safety Standard Approval | Application Part Number*1 |
|---|---|---|---|
| PS2653, PS2654 | 6-pin DIP | Standard products | PS2653 |
| PS2653L2, PS2654L2 | 6-pin DIP (lead bending surface mount) | • UL approved • BSI approved<br>• SEMKO approved • NEMKO approved<br>• DEMKO approved • FIMKO approved | PS2654 |
| PS2653-V, PS2654-V | 6-pin DIP | VDE0884 approved products (Option) | |
| PS2653L2-V, PS2654L2-V | 6-pin DIP (lead bending surface mount) | • VDE approved • UL approved<br>• BSI approved • SEMKO approved<br>• NEMKO approved • DEMKO approved<br>• FIMKO approved | |

***1** As applying to Safety Standard, following part number should be used.

**ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25 °C, unless otherwise specified)**

| Parameter | | Symbol | Ratings | Unit |
|---|---|---|---|---|
| Diode | Forward Current (DC) | $I_F$ | 80 | mA |
| | Reverse Voltage | $V_R$ | 6 | V |
| | Power Dissipation Derating | $\Delta P_D$/°C | 1.5 | mW/°C |
| | Power Dissipation | $P_D$ | 150 | mW |
| | Peak Forward Current *1 | $I_{FP}$ | 1 | A |
| Transistor | Collector to Emitter Voltage | $V_{CEO}$ | 40 | V |
| | Emitter to Collector Voltage | $V_{ECO}$ | 6 | V |
| | Collector Current | $I_C$ | 200 | mA |
| | Power Dissipation Derating | $\Delta P_C$/°C | 2.0 | mW/°C |
| | Power Dissipation | $P_C$ | 200 | mW |
| Isolation Voltage *2 | | BV | 5 000 | Vr.m.s. |
| Operating Ambient Temperature | | $T_A$ | –55 to +100 | °C |
| Storage Temperature | | $T_{stg}$ | –55 to +150 | °C |

***1** PW = 100 $\mu$s, Duty Cycle = 1 %

***2** AC voltage for 1 minute at $T_A$ = 25 °C, RH = 60 % between input and output

## ELECTRICAL CHARACTERISTICS ($T_A$ = 25 °C)

| Parameter | | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|---|
| Diode | Forward Voltage | $V_F$ | $I_F$ = 10 mA | | 1.1 | 1.4 | V |
| | Reverse Current | $I_R$ | $V_R$ = 5 V | | | 5 | μA |
| | Terminal Capacitance | $C_t$ | V = 0 V, f = 1.0 MHz | | 30 | | pF |
| Transistor | Collector to Emitter Dark Current | $I_{CEO}$ | $V_{CE}$ = 40 V, $I_F$ = 0 mA | | | 400 | nA |
| | DC Current Gain *1 | $h_{FE}$ | $I_C$ = 5 mA, $V_{CE}$ = 2 V | | 180 | | |
| Coupled | Current Transfer Ratio *2 | CTR | $I_F$ = 1 mA, $V_{CE}$ = 2 V | 200 | 2 000 | | % |
| | Collector Saturation Voltage | $V_{CE (sat)}$ | $I_F$ = 1 mA, $I_C$ = 2 mA | | | 1.0 | V |
| | Isolation Resistance | $R_{I-O}$ | $V_{I-O}$ = 1.0 $kV_{DC}$ | $10^{11}$ | | | Ω |
| | Isolation Capacitance | $C_{I-O}$ | V = 0 V, f = 1.0 MHz | | 0.6 | | pF |
| | Rise Time *3 | $t_r$ | $V_{CC}$ = 5 V, $I_C$ = 10 mA, $R_L$ = 100 Ω | | 100 | | μs |
| | Fall Time *3 | $t_f$ | | | 100 | | |

***1** Second stage transistor (PS2653, PS2653L2 only)

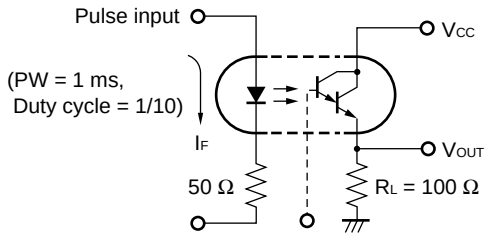
***2** CTR rank

K : 2 300 to (%)

L : 700 to 3 400 (%)

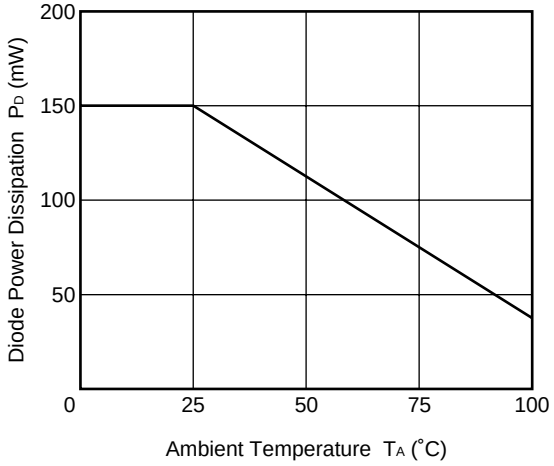
M : 200 to 1 000 (%)

***3** Test circuit for switching time

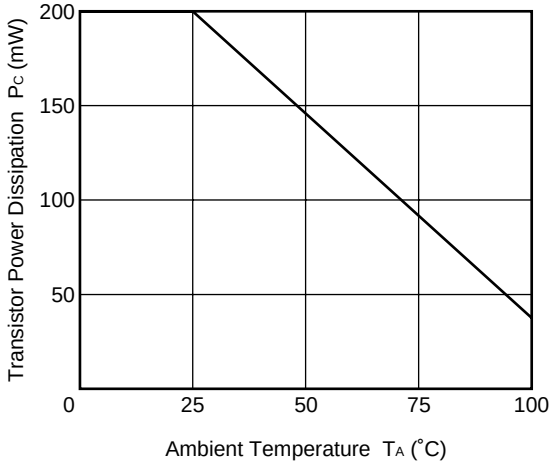


**TYPICAL CHARACTERISTICS ($T_A$ = 25 °C, unless otherwise specified)**

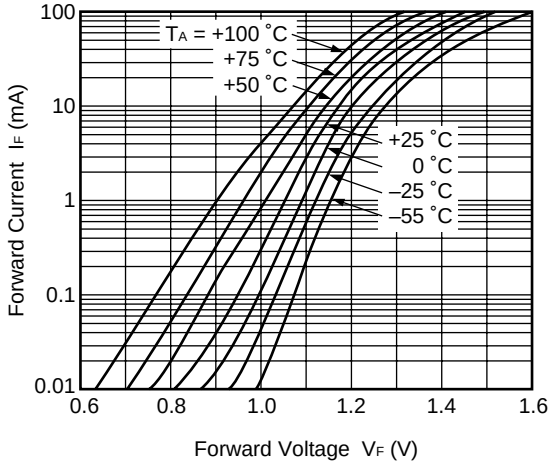
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



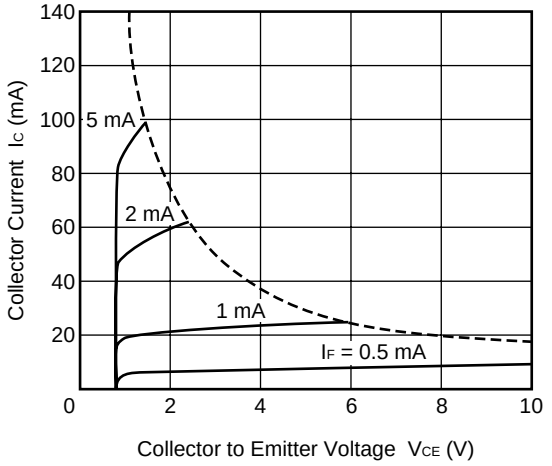

TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



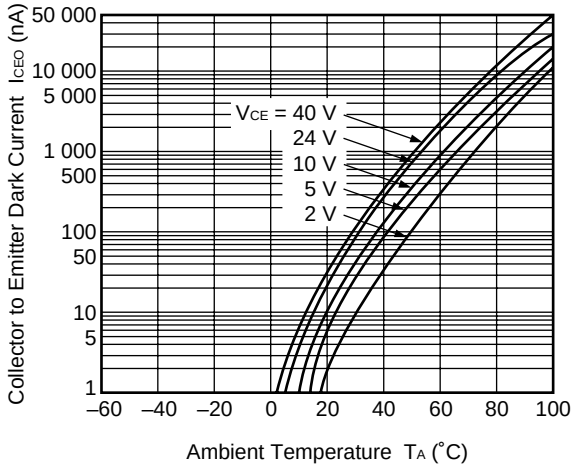

FORWARD CURRENT vs. FORWARD VOLTAGE



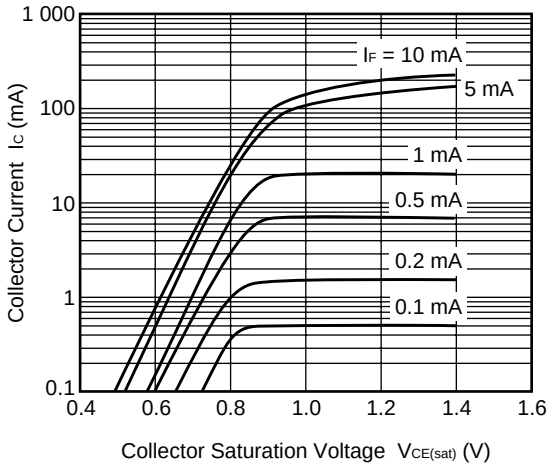

COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



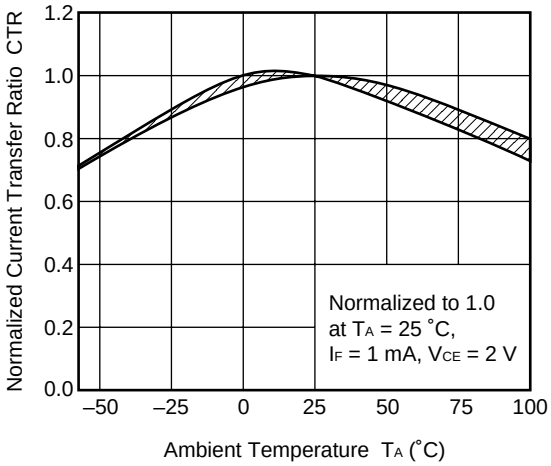

COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE



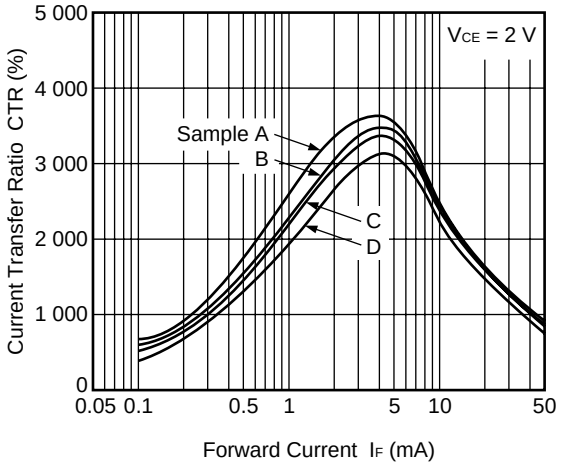

COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE



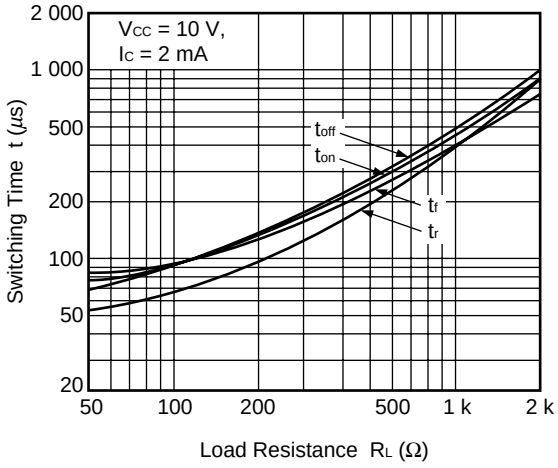
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



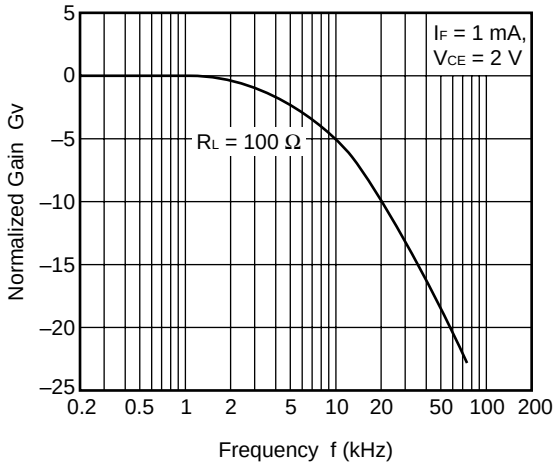

CURRENT TRANSFER RATIO vs. FORWARD CURRENT



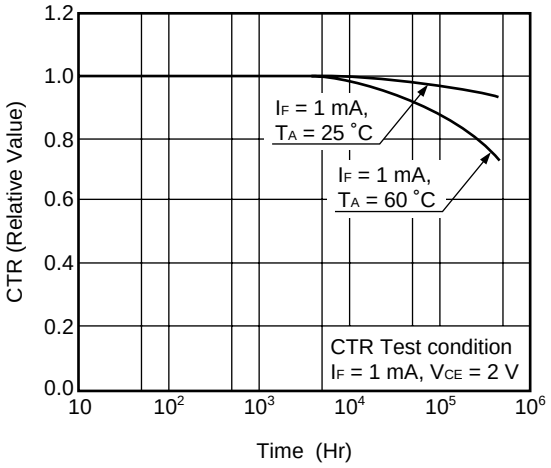

SWITCHING TIME vs. LOAD RESISTANCE




FREQUENCY RESPONSE




LONG TERM CTR DEGRADATION



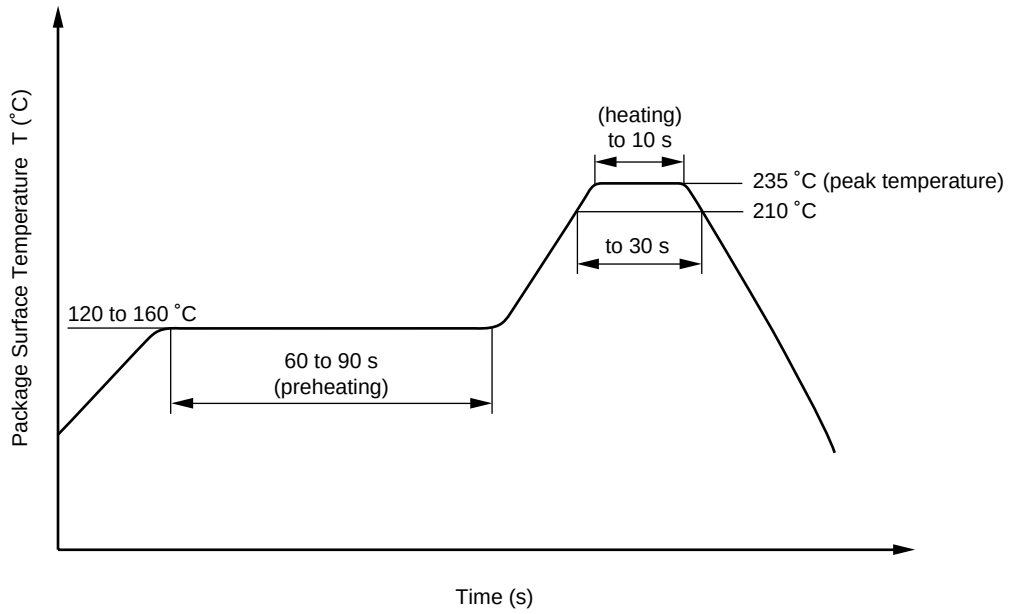

**Remark** The measurement of TYPICAL CHARACTERISTICS are only for reference, not guaranteed.

## RECOMMENDED SOLDERING CONDITIONS

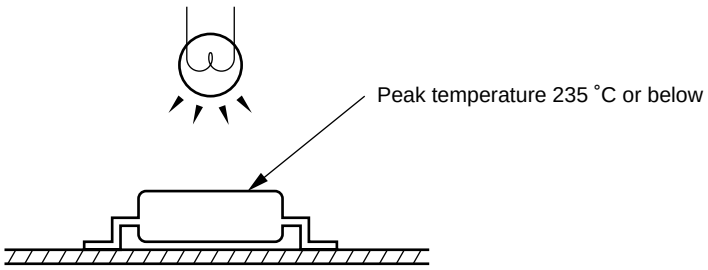
**(1) Infrared reflow soldering**

- Peak reflow temperature — 235 °C (package surface temperature)
- Time of temperature higher than 210 °C — 30 seconds or less
- Number of reflows — Three
- Flux — Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt % is recommended.)

Recommended Temperature Profile of Infrared Reflow




**Caution Please avoid to removed the residual flux by water after the first reflow processes.**




**(2) Dip soldering**

- Temperature — 260 °C or below (molten solder temperature)
- Time — 10 seconds or less
- Number of times — One
- Flux — Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt % is recommended.)

## SPECIFICATION OF VDE MARKS LICENSE DOCUMENT (VDE0884)

| Parameter | Symbol | Speck | Unit |
|---|---|---|---|
| Application classification (DIN VDE 0109)<br>for rated line voltages ≤ 300 Vr.m.s.<br>for rated line voltages ≤ 600 Vr.m.s. | | <br>IV<br>III | |
| Climatic test class (DIN IEC 68 Teil 1/09.80) | | 55/100/21 | |
| Dielectric strength<br>Maximum operating isolation voltage<br>Test voltage (partial discharge test, procedure a for type test and random test)<br>$U_{pr}$ = 1.2 × $U_{IORM}$, $P_d$ < 5 pC | <br>$U_{IORM}$<br>$U_{pr}$ | <br>890<br>1 068 | <br>$V_{peak}$<br>$V_{peak}$ |
| Test voltage (partial discharge test, procedure b for random test)<br>$U_{pr}$ = 1.6 × $U_{IORM}$, $P_d$ < 5 pC | $U_{pr}$ | 1 424 | $V_{peak}$ |
| Highest permissible overvoltage | $U_{TR}$ | 8 000 | $V_{peak}$ |
| Degree of pollution (DIN VDE 0109) | | 2 | |
| Clearance distance | | > 8.0 | mm |
| Creepage distance | | > 8.0 | mm |
| Comparative tracking index (DIN IEC 112/VDE 0303 part 1) | CTI | 175 | |
| Material group (DIN VDE 0109) | | III a | |
| Storage temperature range | $T_{stg}$ | –55 to +150 | °C |
| Operating temperature range | $T_A$ | –55 to +100 | °C |
| Isolation resistance, minimum value<br>$V_{IO}$ = 500 V dc at $T_A$ = 25 °C<br>$V_{IO}$ = 500 V dc at $T_A$ MAX. at least 100 °C | <br>Ris MIN.<br>Ris MIN. | <br>$10^{12}$<br>$10^{11}$ | <br>Ω<br>Ω |
| Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve)<br>Package temperature<br>Current (input current $I_F$, Psi = 0)<br>Power (output or total power dissipation)<br>Isolation resistance<br>$V_{IO}$ = 500 V dc at $T_A$ = 175 °C (Tsi) | <br>Tsi<br>Isi<br>Psi<br><br>Ris MIN. | <br>175<br>400<br>700<br><br>$10^9$ | <br>°C<br>mA<br>mW<br><br>Ω |

**[MEMO]**

**[MEMO]**

## CAUTION

**Within this device there exists GaAs (Gallium Arsenide) material which is a harmful substance if ingested. Please do not under any circumstances break the hermetic seal.**

**NEPOC is a trademark of NEC Corporation.**



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