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**4N25
4N37**

**4N26
H11A1**

**4N27
H11A2**

**4N28
H11A3**

**4N35
H11A4**

**4N36
H11A5**

WHITE PACKAGE (-M SUFFIX)



SCHEMATIC



PIN 1. ANODE
2. CATHODE
3. NO CONNECTION
4. EMITTER
5. COLLECTOR
6. BASE

BLACK PACKAGE (NO -M SUFFIX)



DESCRIPTION

The general purpose optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 6-pin dual in-line package.

FEATURES

- Also available in white package by specifying -M suffix, eg. 4N25-M
- UL recognized (File # E90700)
- VDE recognized (File # 94766)
 - Add option V for white package (e.g., 4N25V-M)
 - Add option 300 for black package (e.g., 4N25.300)

APPLICATIONS

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs

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H11A5**

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise specified)

| Parameter | Symbol | Value | Units |
|--|-------------|---|----------------------------|
| TOTAL DEVICE | | | |
| Storage Temperature | T_{STG} | -55 to +150 | $^\circ\text{C}$ |
| Operating Temperature | T_{OPR} | -55 to +100 | $^\circ\text{C}$ |
| Wave solder temperature (see page 14 for reflow solder profiles) | T_{SOL} | 260 for 10 sec | $^\circ\text{C}$ |
| Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 250 3.3 (non-M), 2.94 (-M) | mW |
| EMITTER | | | |
| DC/Average Forward Input Current | I_F | 100 (non-M), 60 (-M) | mA |
| Reverse Input Voltage | V_R | 6 | V |
| Forward Current - Peak (300 μs , 2% Duty Cycle) | $I_{F(pk)}$ | 3 | A |
| LED Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 150 (non-M), 120 (-M) 2.0 (non-M), 1.41 (-M) | mW mW/ $^\circ\text{C}$ |
| DETECTOR | | | |
| Collector-Emitter Voltage | V_{CEO} | 30 | V |
| Collector-Base Voltage | V_{CBO} | 70 | V |
| Emitter-Collector Voltage | V_{ECO} | 7 | V |
| Detector Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 150 2.0 (non-M), 1.76 (-M) | mW mW/ $^\circ\text{C}$ |

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**4N36
H11A5**

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise specified)

INDIVIDUAL COMPONENT CHARACTERISTICS

| Parameter | Test Conditions | Symbol | Min | Typ* | Max | Unit |
|-------------------------------------|---|------------|-----|-------|------|---------------|
| EMITTER | | | | | | |
| Input Forward Voltage | ($I_F = 10 \text{ mA}$) | V_F | | 1.18 | 1.50 | V |
| Reverse Leakage Current | ($V_R = 6.0 \text{ V}$) | I_R | | 0.001 | 10 | μA |
| DETECTOR | | | | | | |
| Collector-Emitter Breakdown Voltage | ($I_C = 1.0 \text{ mA}, I_F = 0$) | BV_{CEO} | 30 | 100 | | V |
| Collector-Base Breakdown Voltage | ($I_C = 100 \mu\text{A}, I_F = 0$) | BV_{CBO} | 70 | 120 | | V |
| Emitter-Collector Breakdown Voltage | ($I_E = 100 \mu\text{A}, I_F = 0$) | BV_{ECO} | 7 | 10 | | V |
| Collector-Emitter Dark Current | ($V_{CE} = 10 \text{ V}, I_F = 0$) | I_{CEO} | | 1 | 50 | nA |
| Collector-Base Dark Current | ($V_{CB} = 10 \text{ V}$) | I_{CBO} | | | 20 | nA |
| Capacitance | ($V_{CE} = 0 \text{ V}, f = 1 \text{ MHz}$) | C_{CE} | | 8 | | pF |

ISOLATION CHARACTERISTICS

| Characteristic | Test Conditions | Symbol | Min | Typ* | Max | Units |
|--------------------------------|--|-----------|-----------|------|-----|----------|
| Input-Output Isolation Voltage | (Non '-M', Black Package) ($f = 60 \text{ Hz}, t = 1 \text{ min}$) | V_{ISO} | 5300 | | | Vac(rms) |
| | ('M', White Package) ($f = 60 \text{ Hz}, t = 1 \text{ sec}$) | | 7500 | | | Vac(pk) |
| Isolation Resistance | ($V_{I-O} = 500 \text{ VDC}$) | R_{ISO} | 10^{11} | | | Ω |
| Isolation Capacitance | ($V_{I-O} = \&, f = 1 \text{ MHz}$) | C_{ISO} | | 0.5 | | pF |
| | ('M' White Package) | | | 0.2 | 2 | pF |

Note

* Typical values at $T_A = 25^\circ\text{C}$

**4N25
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**4N26
H11A1**

**4N27
H11A2**

**4N28
H11A3**

**4N35
H11A4**

**4N36
H11A5**

TRANSFER CHARACTERISTICS ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)

| DC Characteristic | Test Conditions | Symbol | Device | Min | Typ* | Max | Unit |
|---|---|---------------|---|-----|------|-----|---------------|
| Current Transfer Ratio, Collector to Emitter | $(I_F = 10 \text{ mA}, V_{CE} = 10 \text{ V})$ | CTR | 4N35 4N36 4N37 | 100 | | | % |
| | | | H11A1 | 50 | | | |
| | | | H11A5 | 30 | | | |
| | 4N25 4N26 H11A2 H11A3 | | 20 | | | | |
| | 4N27 4N28 H11A4 | | 10 | | | | |
| | 4N35 4N36 4N37 | | 40 | | | | |
| | $(I_F = 10 \text{ mA}, V_{CE} = 10 \text{ V}, T_A = -55^\circ\text{C})$ | | 40 | | | | |
| | $(I_F = 10 \text{ mA}, V_{CE} = 10 \text{ V}, T_A = +100^\circ\text{C})$ | | 40 | | | | |
| Collector-Emitter Saturation Voltage | $(I_C = 2 \text{ mA}, I_F = 50 \text{ mA})$ | $V_{CE(SAT)}$ | 4N25 4N26 4N27 4N28 | | | 0.5 | V |
| | $(I_C = 0.5 \text{ mA}, I_F = 10 \text{ mA})$ | | 4N35 4N36 4N37 | | | 0.3 | |
| | | | H11A1 H11A2 H11A3 H11A4 H11A5 | | | 0.4 | |
| AC Characteristic | | | | | | | |
| Non-Saturated Turn-on Time | $(I_F = 10 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100\Omega)$ (Fig.20) | T_{ON} | 4N25 4N26 4N27 4N28 H11A1 H11A2 H11A3 H11A4 H11A5 | | 2 | | μs |
| Non Saturated Turn-on Time | $(I_C = 2 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100\Omega)$ (Fig.20) | T_{ON} | 4N35 4N36 4N37 | | 2 | 10 | μs |

**4N25
4N37**

**4N26
H11A1**

**4N27
H11A2**

**4N28
H11A3**

**4N35
H11A4**

**4N36
H11A5**

TRANSFER CHARACTERISTICS ($T_A = 25^\circ\text{C}$ Unless otherwise specified.) (Continued)

| AC Characteristic | Test Conditions | Symbol | Device | Min | Typ* | Max | Unit |
|-------------------|---|-----------|---|-----|------|-----|---------------|
| Turn-off Time | ($I_F = 10 \text{ mA}$, $V_{CC} = 10 \text{ V}$, $R_L = 100\Omega$) (Fig.20) | T_{OFF} | 4N25 4N26 4N27 4N28 H11A1 H11A2 H11A3 H11A4 H11A5 | | 2 | | μs |
| | ($I_C = 2 \text{ mA}$, $V_{CC} = 10 \text{ V}$, $R_L = 100\Omega$) (Fig.20) | | 4N35 4N36 4N37 | | 2 | 10 | |

* Typical values at $T_A = 25^\circ\text{C}$

**4N25
4N37**

**4N26
H11A1**

**4N27
H11A2**

**4N28
H11A3**

**4N35
H11A4**

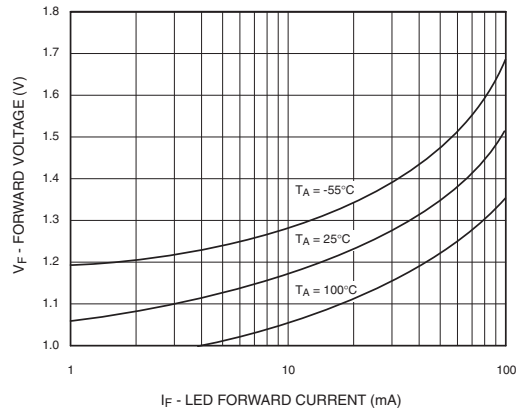
**4N36
H11A5**

TYPICAL PERFORMANCE CURVES

**Fig. 1 LED Forward Voltage vs. Forward Current
(Black Package)**



**Fig. 2 LED Forward Voltage vs. Forward Current
(White Package)**



**Fig.3 Normalized CTR vs. Forward Current
(Black Package)**



**Fig.4 Normalized CTR vs. Forward Current
(White Package)**



**Fig. 5 Normalized CTR vs. Ambient Temperature
(Black Package)**



**Fig. 6 Normalized CTR vs. Ambient Temperature
(White Package)**



**4N25
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**4N26
H11A1**

**4N27
H11A2**

**4N28
H11A3**

**4N35
H11A4**

**4N36
H11A5**

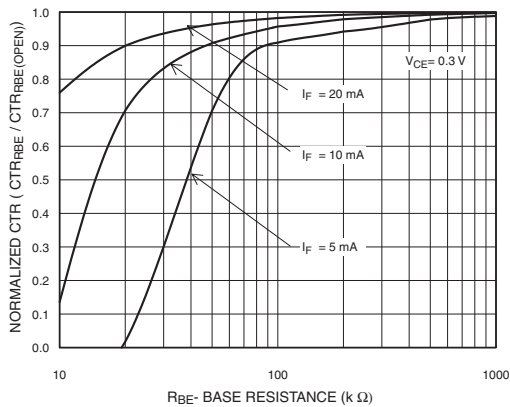
**Fig. 7 CTR vs. RBE (Unsaturated)
(Black Package)**



**Fig. 8 CTR vs. RBE (Unsaturated)
(White Package)**



**Fig. 9 CTR vs. RBE (Saturated)
(Black Package)**



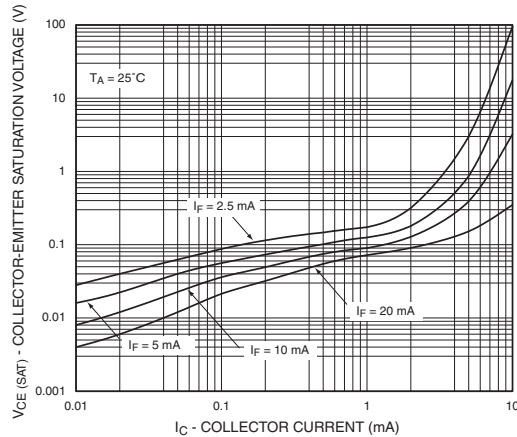
**Fig. 10 CTR vs. RBE (Saturated)
(White Package)**



**Fig. 11 Collector-Emitter Saturation Voltage vs. Collector Current
(Black Package)**



**Fig. 12 Collector-Emitter Saturation Voltage vs. Collector Current
(White Package)**



**4N25
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**4N26
H11A1**

**4N27
H11A2**

**4N28
H11A3**

**4N35
H11A4**

**4N36
H11A5**

**Fig. 13 Switching Speed vs. Load Resistor
(Black Package)**



**Fig. 14 Switching Speed vs. Load Resistor
(White Package)**



**Fig. 15 Normalized t_{on} vs. R_{BE}
(Black Package)**



**Fig. 16 Normalized t_{on} vs. R_{BE}
(White Package)**



**Fig. 17 Normalized t_{off} vs. R_{BE}
(Black Package)**



**Fig. 18 Normalized t_{off} vs. R_{BE}
(White Package)**



4N25
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4N26
H11A1

4N27
H11A2

4N28
H11A3

4N35
H11A4

4N36
H11A5

Fig. 19 Dark Current vs. Ambient Temperature



Figure 20. Switching Time Test Circuit and Waveforms

**4N25
4N37**

**4N26
H11A1**

**4N27
H11A2**

**4N28
H11A3**

**4N35
H11A4**

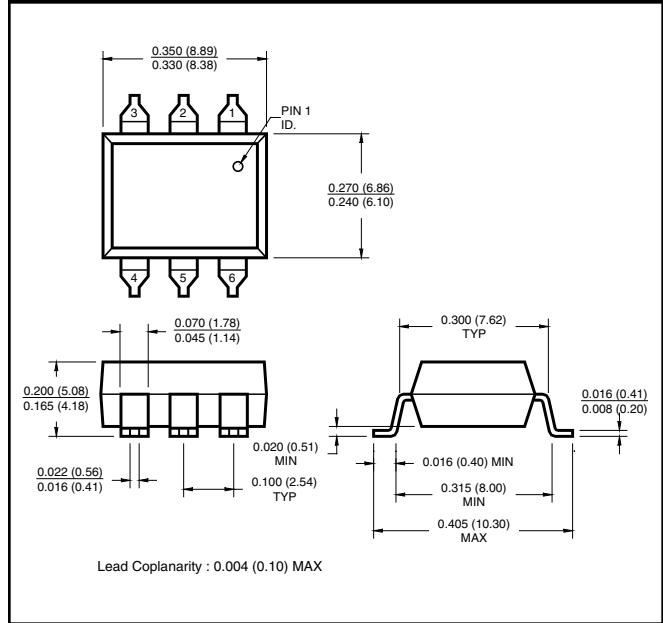
**4N36
H11A5**

Black Package (No -M Suffix)

Package Dimensions (Through Hole)



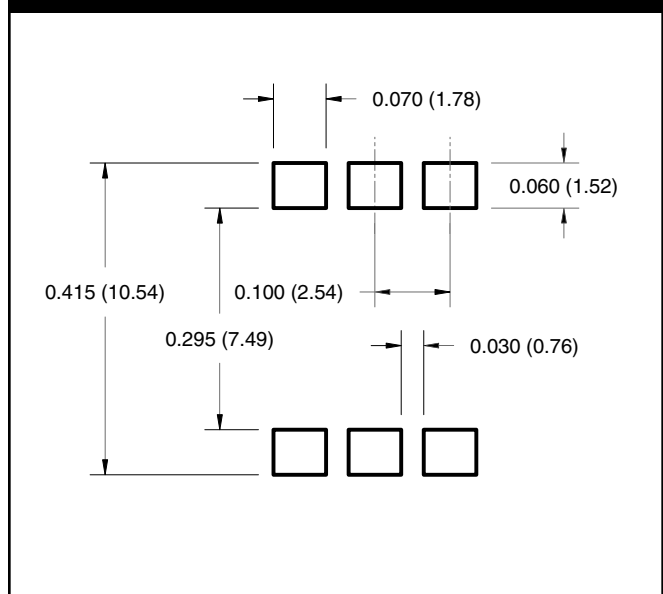
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



**Recommended Pad Layout for
Surface Mount Leadform**



NOTE

All dimensions are in inches (millimeters)

**4N25
4N37**

**4N26
H11A1**

**4N27
H11A2**

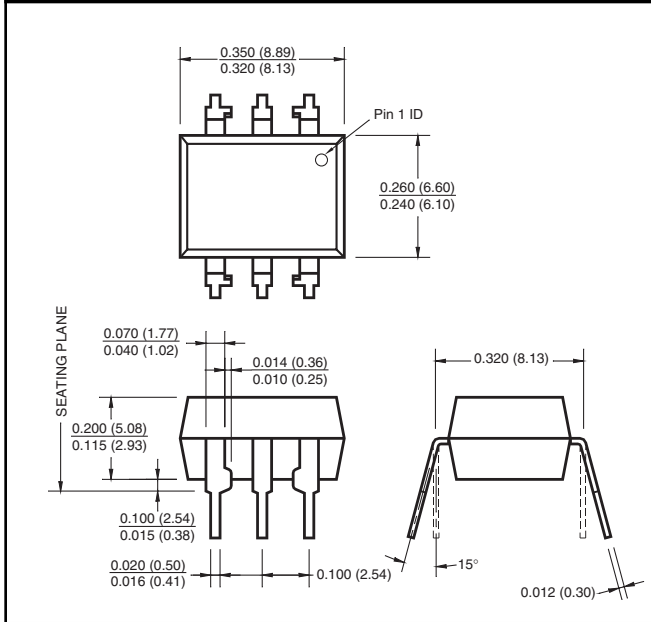
**4N28
H11A3**

**4N35
H11A4**

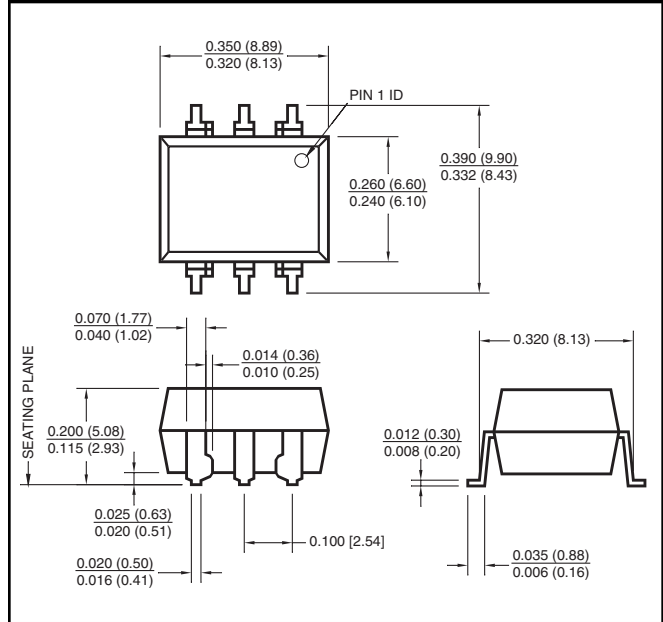
**4N36
H11A5**

White Package (-M Suffix)

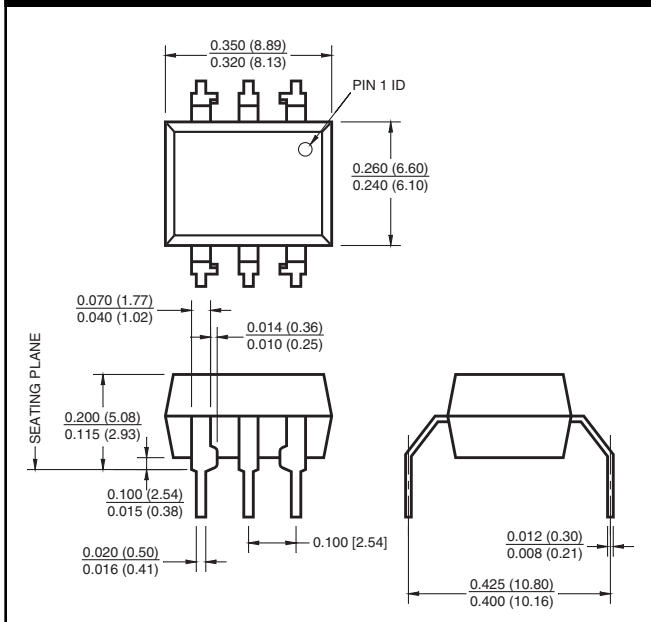
Package Dimensions (Through Hole)



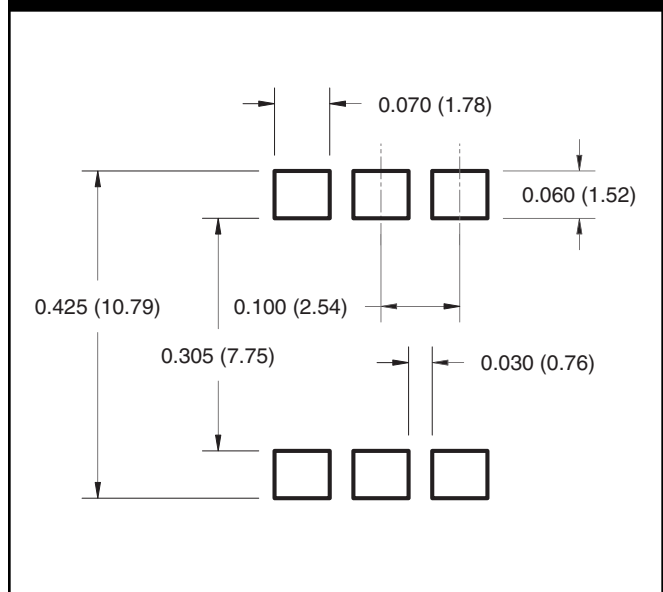
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



**Recommended Pad Layout for
Surface Mount Leadform**



NOTE

All dimensions are in inches (millimeters)

**4N25
4N37**

**4N26
H11A1**

**4N27
H11A2**

**4N28
H11A3**

**4N35
H11A4**

**4N36
H11A5**

ORDERING INFORMATION

| Order Entry Identifier | | |
|---------------------------|---------------------------|--------------------------------------|
| Black Package (No Suffix) | White Package (-M Suffix) | Option |
| .S | S | Surface Mount Lead Bend |
| .SD | SR2 | Surface Mount; Tape and reel |
| .W | T | 0.4" Lead Spacing |
| .300 | V | VDE 0884 |
| .300W | TV | VDE 0884, 0.4" Lead Spacing |
| .3S | SV | VDE 0884, Surface Mount |
| .3SD | SR2V | VDE 0884, Surface Mount, Tape & Reel |

MARKING INFORMATION



Black Package, No Suffix



White Package, -M Suffix

| Definitions | |
|-------------|--|
| 1 | Fairchild logo |
| 2 | Device number |
| 3 | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4 | One or two digit year code • Two digits for black package parts, e.g., '03' • One digit for white package parts, e.g., '3' |
| 5 | Two digit work week ranging from '01' to '53' |
| 6 | Assembly package code |

*Note – Parts built in the white package (M suffix) that do not have the 'V' option (see definition 3 above) that are marked with date code '325' or earlier are marked in the portrait format.

**4N25
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**4N26
H11A1**

**4N27
H11A2**

**4N28
H11A3**

**4N35
H11A4**

**4N36
H11A5**

QT Carrier Tape Specifications (Black Package, No Suffix)



QT Carrier Tape Specifications (White Package, -M Suffix)



**4N25
4N37**

**4N26
H11A1**

**4N27
H11A2**

**4N28
H11A3**

**4N35
H11A4**

**4N36
H11A5**

Reflow Profile (White Package, -M Suffix)



- Peak reflow temperature: 245°C (package surface temperature)
- Time of temperature higher than 183°C for 120-180 seconds
- One time soldering reflow is recommended

Reflow Profile (Black Package, No Suffix)



- Peak reflow temperature: 225°C (package surface temperature)
- Time of temperature higher than 183°C for 60-150 seconds
- One time soldering reflow is recommended

**4N25
4N37**

**4N26
H11A1**

**4N27
H11A2**

**4N28
H11A3**

**4N35
H11A4**

**4N36
H11A5**

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