## CNY17－1，CNY17－3，CNY17－2，CNY17－4 Phototransistor Optocouplers

## Features

－CNY17－1／2／3 are also available in white package by specifying－M suffix（eg．CNY17－2－M）
■ UL recognized（File \＃E90700）
－VDE recognized
－ 102497 for white package
－Add option V for white package（e．g．，CNY17－2V－M）
－File \＃102497
－Add option＇300＇for black package（e．g．，CNY17－2．300）
－File \＃94766
－Current transfer ratio in select groups
■ High $\mathrm{BV}_{\mathrm{CEO}}-70 \mathrm{~V}$ minimum

## Applications

■ Power supply regulators
－Digital logic inputs
－Microprocessor inputs
－Appliance sensor systems
－Industrial controls

## Description

The CNY17 series consists of a Gallium Arsenide IRED coupled with an NPN phototransistor．

White Package（－M Suffix）


Black Package（No－M Suffix）


| Parameters | Symbol | Device | Value | Units |
| :---: | :---: | :---: | :---: | :---: |
| TOTAL DEVICE |  |  |  |  |
| Storage Temperature | $\mathrm{T}_{\text {STG }}$ | All | -55 to +150 | ${ }^{\circ} \mathrm{C}$ |
| Operating Temperature | $\mathrm{T}_{\text {OPR }}$ | All | -55 to +100 | ${ }^{\circ} \mathrm{C}$ |
| Lead Solder Temperature | $\mathrm{T}_{\text {SOL }}$ | All | 260 for 10 sec | ${ }^{\circ} \mathrm{C}$ |
| Total Device Power Dissipation @ $25^{\circ} \mathrm{C}$ (LED plus detector) Derate Linearly From $25^{\circ} \mathrm{C}$ | $\mathrm{P}_{\mathrm{D}}$ | -M | 250 | mW |
|  |  | non -M | 260 |  |
|  |  | -M | 2.94 | $\mathrm{mW} /{ }^{\circ} \mathrm{C}$ |
|  |  | non -M | 3.50 |  |
| EMITTER |  |  |  |  |
| Continuous Forward Current | $\mathrm{I}_{\text {F }}$ | -M | 60 | mA |
|  |  | non -M | 90 |  |
| Reverse Voltage | $\mathrm{V}_{\mathrm{R}}$ | All | 6 | V |
| Forward Current - Peak (1 $\mu \mathrm{s}$ pulse, 300 pps ) | $\mathrm{I}_{\mathrm{F}}(\mathrm{pk})$ | -M | 1.5 | A |
|  |  | non -M | 3.0 |  |
| LED Power Dissipation $25^{\circ} \mathrm{C}$ Ambient Derate Linearly From $25^{\circ} \mathrm{C}$ | $P_{\text {D }}$ | -M | 120 | mW |
|  |  | non -M | 135 |  |
|  |  | -M | 1.41 | $\mathrm{mW} /{ }^{\circ} \mathrm{C}$ |
|  |  | non -M | 1.8 |  |
| DETECTOR |  |  |  |  |
| Detector Power Dissipation @ $25^{\circ} \mathrm{C}$ Derate Linearly from $25^{\circ} \mathrm{C}$ | $\mathrm{P}_{\mathrm{D}}$ | -M | 150 | mW |
|  |  | non -M | 200 |  |
|  |  | -M | 1.76 | $\mathrm{mW} /{ }^{\circ} \mathrm{C}$ |
|  |  | non -M | 2.67 |  |

Electrical Characteristics ( $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ Unless otherwise specified.)
Individual Component Characteristics

| Parameters | Test Conditions | Symbol | Device | Min | Typ | Max | Units |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| EMITTER |  |  |  |  |  |  |  |
| Input Forward Voltage | $\mathrm{I}_{\mathrm{F}}=60 \mathrm{~mA}$ | $V_{F}$ | -M |  | 1.35 | 1.65 | V |
|  | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}$ |  | non -M |  | 1.15 | 1.50 |  |
| Capacitance | $\mathrm{V}_{\mathrm{F}}=0 \mathrm{~V}, \mathrm{f}=1.0 \mathrm{MHz}$ | CJ | non -M |  | 50 |  | pF |
|  |  |  | -M |  | 18 |  |  |
| Reverse Leakage Current | $\mathrm{V}_{\mathrm{R}}=6 \mathrm{~V}$ | $\mathrm{I}_{\mathrm{R}}$ | All |  | 0.001 | 10 | $\mu \mathrm{A}$ |
| DETECTOR |  |  |  |  |  |  |  |
| Breakdown Voltage Collector to Emitter Collector to Base Emitter to Collector | $\begin{aligned} & \mathrm{I}_{\mathrm{C}}=1.0 \mathrm{~mA}, \mathrm{I}_{\mathrm{F}}=0 \\ & \mathrm{I}_{\mathrm{C}}=10 \mu \mathrm{~A}, \mathrm{I}_{\mathrm{F}}=0 \\ & \mathrm{I}_{\mathrm{E}}=100 \mu \mathrm{~A}, \mathrm{I}_{\mathrm{F}}=0 \end{aligned}$ | $\mathrm{BV}_{\text {CEO }}$ <br> $\mathrm{BV}_{\mathrm{CBO}}$ <br> $\mathrm{BV}_{\mathrm{ECO}}$ | $\begin{aligned} & \text { All } \\ & \text { All } \\ & \text { All } \end{aligned}$ | $\begin{gathered} 70 \\ 70 \\ 7 \end{gathered}$ | $\begin{gathered} 100 \\ 120 \\ 10 \end{gathered}$ |  | $\begin{aligned} & \text { V } \\ & \text { V } \\ & \text { V } \end{aligned}$ |
| Leakage Current Collector to Emitter Collector to Base | $\begin{aligned} & \mathrm{V}_{\mathrm{CE}}=10 \mathrm{~V}, \mathrm{I}_{\mathrm{F}}=0 \\ & \mathrm{~V}_{\mathrm{CB}}=10 \mathrm{~V}, \mathrm{I}_{\mathrm{F}}=0 \end{aligned}$ | $\begin{aligned} & \mathrm{I}_{\mathrm{CEO}} \\ & \mathrm{I}_{\mathrm{CBO}} \end{aligned}$ | $\begin{aligned} & \text { All } \\ & \text { All } \end{aligned}$ |  | 1 | $\begin{aligned} & 50 \\ & 20 \end{aligned}$ | $\begin{aligned} & \text { nA } \\ & \text { nA } \end{aligned}$ |
| Capacitance Collector to Emitter Collector to Base Emitter to Base | $\begin{aligned} & \mathrm{V}_{\mathrm{CE}}=0, \mathrm{f}=1 \mathrm{MHz} \\ & \mathrm{~V}_{\mathrm{CB}}=0, \mathrm{f}=1 \mathrm{MHz} \\ & \mathrm{~V}_{\mathrm{EB}}=0, \mathrm{f}=1 \mathrm{MHz} \end{aligned}$ | $\begin{aligned} & \mathrm{C}_{\mathrm{CE}} \\ & \mathrm{C}_{\mathrm{CB}} \\ & \mathrm{C}_{\mathrm{EB}} \end{aligned}$ | $\begin{aligned} & \text { All } \\ & \text { All } \\ & \text { All } \end{aligned}$ |  | $\begin{gathered} 8 \\ 20 \\ 10 \end{gathered}$ |  | $\begin{aligned} & \mathrm{pF} \\ & \mathrm{pF} \\ & \mathrm{pF} \end{aligned}$ |

## Isolation Characteristics

| Characteristic | Test Conditions | Symbol | Device | Min | Typ** | Max | Units |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Input-Output Isolation Voltage | $\mathrm{f}=60 \mathrm{~Hz}, \mathrm{t}=1 \mathrm{~min}$. | $\mathrm{V}_{\text {ISO }}$ | Black Package | 5300 |  |  | $\mathrm{Vac}(\mathrm{rms})^{*}$ |
|  |  |  | '-M' White Package | 7500 |  |  | $\operatorname{Vac}(\mathrm{pk})$ |
| Isolation Resistance | $\mathrm{V}_{1-\mathrm{O}}=500 \mathrm{VDC}$ | $\mathrm{R}_{\text {ISO }}$ | All | 1011 |  |  | $\Omega$ |
| Isolation Capacitance | $\mathrm{V}_{\mathrm{I}-\mathrm{O}}=\varnothing, \mathrm{f}=1 \mathrm{MHz}$ | $\mathrm{C}_{\text {ISO }}$ | Black Package |  | 0.5 |  | pF |
|  |  |  | '-M' White Package |  | 0.2 |  |  |

Note

* $5300 \mathrm{Vac}(\mathrm{rms})$ for 1 minute equates to approximately $9000 \mathrm{Vac}(\mathrm{pk})$ for 1 second
** Typical values at $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$
Transfer Characteristics ( $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ Unless otherwise specified.)

| DC Characteristics | Test Conditions | Symbol | Device | Min | Typ | Max | Units |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Current Transfer Ratio, Collector to Emitter | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CE}}=5 \mathrm{~V}$ | CTR | CNY17-1/-1-M | 40 |  | 80 | \% |
|  |  |  | CNY17-2/-2-M | 63 |  | 125 |  |
|  |  |  | CNY17-3/-3-M | 100 |  | 200 |  |
|  |  |  | CNY17-4 | 160 |  | 320 |  |
| Saturation Voltage | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{I}_{\mathrm{C}}=2.5 \mathrm{~mA}$ | $\mathrm{V}_{\text {CE(SAT) }}$ | All |  |  | . 40 | V |
| AC Characteristics | Test Conditions | Symbol | Device | Min | Typ | Max | Units |
| Non-Saturated Switching Times |  |  |  |  |  |  |  |
| Turn-On Time (Fig. 19 and Fig.20) | $\mathrm{R}_{\mathrm{L}}=100 \Omega, \mathrm{I}_{\mathrm{C}}=2 \mathrm{~mA}, \mathrm{~V}_{C C}=10 \mathrm{~V}$ | $\mathrm{t}_{\text {on }}$ | non -M |  |  | 10 | $\mu \mathrm{s}$ |
| Turn-Off Time (Fig. 19 and Fig.20) | $\mathrm{R}_{\mathrm{L}}=100 \Omega, \mathrm{I}_{\mathrm{C}}=2 \mathrm{~mA}, \mathrm{~V}_{C C}=10 \mathrm{~V}$ | $\mathrm{t}_{\text {off }}$ | non -M |  |  | 10 | $\mu \mathrm{s}$ |
| Delay Time (Fig. 19 and Fig.20) | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=5 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=75 \Omega$ | $\mathrm{t}_{\text {d }}$ | -M |  |  | 5.6 | $\mu \mathrm{s}$ |
| Rise Time (Fig. 19 and Fig.20) | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=5 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=75 \Omega$ | $\mathrm{t}_{\mathrm{r}}$ | -M |  |  | 4.0 | $\mu \mathrm{s}$ |
| Storage Time (Fig. 19 and Fig.20) | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=5 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=75 \Omega$ | $\mathrm{t}_{\text {s }}$ | -M |  |  | 4.1 | $\mu \mathrm{s}$ |
| Fall Time (Fig. 19 and Fig.20) | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=5 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=75 \Omega$ | $\mathrm{t}_{\mathrm{f}}$ | -M |  |  | 3.5 | $\mu \mathrm{s}$ |


| Saturated Switching Times |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Turn-On Time (Fig. 19 and Fig.20) | $\mathrm{I}_{\mathrm{F}}=20 \mathrm{~mA}, \mathrm{~V}_{\text {CE }}=0.4 \mathrm{~V}$ | $\mathrm{t}_{\text {on }}$ | CNY17-1 |  | 5.5 | $\mu \mathrm{s}$ |
|  | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{\text {CE }}=0.4 \mathrm{~V}$ |  | CNY17-2, CNY17-3, CNY17-4 |  | 8.0 |  |
| Rise-Time (Fig. 19 and Fig.20) | $\mathrm{I}_{\mathrm{F}}=20 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CE}}=0.4 \mathrm{~V}$ | $t_{r}$ | CNY17-1 |  | 4.0 | $\mu \mathrm{s}$ |
|  | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{\text {CE }}=0.4 \mathrm{~V}$ |  | CNY17-2, CNY17-3, CNY17-4 |  | 6.0 |  |
|  | $\mathrm{I}_{\mathrm{F}}=20 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=5 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=1 \mathrm{~K} \Omega$ |  | CNY17-1-M |  | 4.0 |  |
|  | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{C C}=5 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=1 \mathrm{~K} \Omega$ |  | CNY17-2-M, CNY17-3-M |  | 6.0 |  |
| Delay Time (Fig. 19 and Fig.20) | $\mathrm{I}_{\mathrm{F}}=20 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=5 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=1 \mathrm{~K} \Omega$ | $t_{d}$ | CNY17-1-M |  | 5.5 | $\mu \mathrm{s}$ |
|  | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{C C}=5 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=1 \mathrm{~K} \Omega$ |  | CNY17-2, CNY17-3 |  | 8.0 |  |
| Turn-Off Time (Fig. 19 and Fig.20) | $\mathrm{I}_{\mathrm{F}}=20 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CE}}=0.4 \mathrm{~V}$ | $\mathrm{t}_{\text {off }}$ | CNY17-1 |  | 34.0 | ms |
|  | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{\text {CE }}=0.4 \mathrm{~V}$ |  | CNY17-2, CNY17-3, CNY17-4 |  | 39.0 |  |

Transfer Characteristics ( $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ Unless otherwise specified.) (Continued)

| DC Characteristics | Test Conditions | Symbol | Device | Min | Typ | Max | Units |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Fall-Time (Fig. 19 and Fig. 20) | $\mathrm{I}_{\mathrm{F}}=20 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CE}}=0.4 \mathrm{~V}$ | $\mathrm{t}_{\mathrm{f}}$ | CNY17-1 |  |  | 20.0 | $\mu \mathrm{s}$ |
|  | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CE}}=0.4 \mathrm{~V}$ |  | CNY17-2, <br> CNY17-3, <br> CNY17-4 |  |  | 24.0 |  |
|  | $\mathrm{I}_{\mathrm{F}}=20 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=5 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=1 \mathrm{~K} \Omega$ |  | CNY17-1-M |  |  | 20.0 |  |
|  | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=5 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=1 \mathrm{~K} \Omega$ |  | CNY17-2-M, CNY17-3-M, |  |  | 24.0 |  |
| Storage Time (Fig. 19 and Fig. 20) | $\mathrm{I}_{\mathrm{F}}=20 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=5 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=1 \mathrm{~K} \Omega$ | $\mathrm{t}_{\text {s }}$ | CNY17-1-M |  |  | 34.0 | $\mu \mathrm{s}$ |
|  | $\mathrm{I}_{\mathrm{F}}=10 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=5 \mathrm{~V}, \mathrm{R}_{\mathrm{L}}=1 \mathrm{~K} \Omega$ |  | CNY17-2-M, CNY17-3-M, |  |  | 39.0 |  |

Fig. 1 Normalized CTR vs. Forward Current (Black Package)


Fig. 3 Normalized CTR vs. Ambient Temperature (Black Package)


Fig. 5 CTR vs. RBE (Unsaturated) (Black Package)


Fig. 2 Normalized CTR vs. Forward Current (White Package)


Fig. 4 Normalized CTR vs. Ambient Temperature (White Package)


Fig. 6 CTR vs. RBE (Unsaturated) (White Package)


Fig. 7 CTR vs. RBE (Saturated) (Black Package)


RBE- BASE RESISTANCE ( $\Omega$ )
Fig. 9 Switching Speed vs. Load Resistor (Black Package)


Fig. 11 Normalized ton vs. RBE (Black Package)


Fig. 8 CTR vs. RBE (Saturated)
(White Package)


Fig. 10 Switching Speed vs. Load Resistor (White Package)


Fig. 12 Normalized $t_{\text {on }}$ vs. R BE (White Package)


Fig. 13 Normalized $t_{\text {off }}$ vs. RBE
(Black Package)


Fig. 15 LED Forward Voltage vs. Forward Current (Black Package)


Fig. 17 Collector Current vs. Collector-Emitter Saturation Voltage


Fig. 14 Normalized $t_{\text {off }}$ Vs. RBE (White Package)


Fig. 16 LED Forward Voltage vs. Forward Current (White Package)


Fig. 18 Dark Current vs. Ambient Temperature (Black Package)




Figure 19. Switching Time Test Circuit

Black Package (No -M Suffix)


Package Dimensions (0.4"Lead Spacing)


NOTE
All dimensions are in inches (millimeters)

Package Dimensions (Surface Mount)


White Package (-M Suffix)


Package Dimensions (0.4"Lead Spacing)


NOTE
All dimensions are in inches (millimeters)

Package Dimensions (Surface Mount)


Recommended Pad Layout for Surface Mount Leadform (White Package Only)


Ordering Information

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

Carrier Tape Specifications (Black Package, No Suffix)


User Direction of Feed $\longrightarrow$

Carrier Tape Specifications (White Package, -M Suffix)


User Direction of Feed $\longrightarrow$

## Marking Information



## Definitions

| 1 | Fairchild logo |
| :---: | :--- |
| 2 | Device number |
| 3 | VDE mark (Note: Only appears on parts ordered with VDE <br> option - See order entry table) |
| 4 | Two digits year code, e.g., '03' |
| 5 | Two digit work week ranging from '01' to ‘53' |
| 6 | Assembly package code |

Reflow Profile (Black Package, No Suffix)




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| :---: | :---: | :---: | :---: | :---: |
| ActiveArray ${ }^{\text {™ }}$ | FASTr ${ }^{\text {TM }}$ | LittleFET ${ }^{\text {™ }}$ | PowerTrench ${ }^{\circledR}$ | SyncFET ${ }^{\text {TM }}$ |
| Bottomless ${ }^{\text {TM }}$ | FPS ${ }^{\text {™ }}$ | MICROCOUPLER ${ }^{\text {TM }}$ | QFET ${ }^{\circledR}$ | TinyLogic ${ }^{\circledR}$ |
| Build it $\mathrm{Now}^{\text {TM }}$ | FRFET ${ }^{\text {m }}$ | MicroFET ${ }^{\text {™ }}$ | QS ${ }^{\text {™ }}$ | TINYOPTO ${ }^{\text {TM }}$ |
| CoolFET ${ }^{\text {tm }}$ | GlobalOptoisolator ${ }^{\text {TM }}$ | MicroPak ${ }^{\text {™ }}$ | QT Optoelectronics ${ }^{\text {TM }}$ | TruTranslation ${ }^{\text {T}}$ |
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| EcoSPARK ${ }^{\text {™ }}$ | $1^{2} \mathrm{C}^{\text {™ }}$ | MSXPro ${ }^{\text {™ }}$ | RapidConnect ${ }^{\text {TM }}$ | UniFET ${ }^{\text {TM }}$ |
| $\mathrm{E}^{2} \mathrm{CMOS}^{\text {™ }}$ | $i-L o^{\text {TM }}$ | OCX ${ }^{\text {™ }}$ | $\mu$ SerDes ${ }^{\text {TM }}$ | VCX ${ }^{\text {TM }}$ |
| EnSigna ${ }^{\text {™ }}$ | ImpliedDisconnect ${ }^{\text {TM }}$ | OCXProtm | SILENT SWITCHER ${ }^{\circledR}$ | Wire ${ }^{\text {TM }}$ |
| FACT ${ }^{\text {™ }}$ | IntelliMAX ${ }^{\text {™ }}$ | OPTOLOGIC ${ }^{\circledR}$ | SMART START ${ }^{\text {TM }}$ |  |
| FACT Quiet Series ${ }^{\text {TM }}$ |  | OPTOPLANAR ${ }^{\text {TM }}$ | SPM ${ }^{\text {™ }}$ |  |
| Across the board. Around the world. ${ }^{\text {TM }}$ |  | PACMAN ${ }^{\text {TM }}$ | Stealth ${ }^{\text {TM }}$ |  |
|  |  | POP ${ }^{\text {™ }}$ | SuperFET ${ }^{\text {TM }}$ |  |
| The Power Franchise ${ }^{\circledR}$ |  | Power247 ${ }^{\text {тм }}$ | SuperSOT ${ }^{\text {TM }}$-3 |  |
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PRODUCT STATUS DEFINITIONS
Definition of Terms

| Datasheet Identification | Product Status | Definition |
| :--- | :--- | :--- |
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