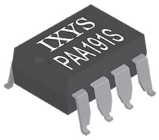
IXYS
INTEGRATED CIRCUITS DIVISION



PAA191
400V, 250mA Dual Single-Pole Normally Open Relays

Parameter	Rating	Units
Blocking Voltage	400	V_P
Load Current	250	mA_{rms} / mA_{DC}
On-Resistance (max)	8	Ω

Features
- $5000V_{rms}$ Input/Output Isolation
- Low Drive Power Requirements
- Greater Reliability than Electromechanical Relays
- No EMI/RFI Generation
- Small 8-Pin Packages
- Surface Mount Tape & Reel Version Available

Applications
- Telecommunications
  - Telecom Switching
  - Tip/Ring Circuits
  - Modem Switching (Laptop, Notebook, Pocket Size)
  - Hook Switch
  - Dial Pulsing
  - Ground Start
  - Ringing Injection
- Instrumentation
- Multiplexers
- Data Acquisition
- Electronic Switching
- I/O Subsystems
- Meters (Watt-Hour, Water, Gas)
- Medical Equipment-Patient/Equipment Isolation
- Security
- Industrial Controls

Description
PAA191 is a dual 400V, 250mA, 8Ω, normally open (1-Form-A) solid state relay that uses optically coupled MOSFET technology to provide $5000V_{rms}$ of input to output isolation.

Its optically coupled outputs, which use the patented OptoMOS architecture, are controlled by a highly efficient infrared LED.

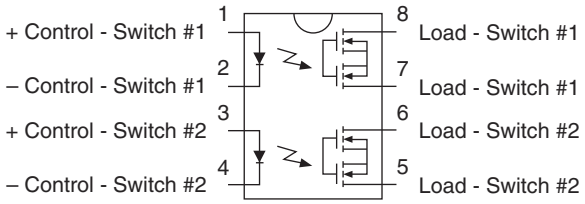
This dual single-pole OptoMOS relay provides a more compact design solution than discrete single-pole relays in a variety of applications, and saves board space by incorporating both switches in a single 8-pin package.

Approvals
- UL Recognized Component: File # E76270
- TUV EN 62368-1: Certificate # B 082667 0008

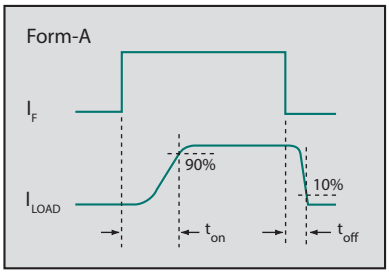
Ordering Information

Part #	Description
PAA191	8-Lead DIP (50/tube)
PAA191S	8-Lead Surface Mount (50/tube)
PAA191STR	8-Lead Surface Mount (1000/Reel)

Pin Configuration



Switching Characteristics of Normally Open Devices



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Absolute Maximum Ratings @ 25ºC

Parameter	Ratings	Units
Blocking Voltage	400	V_P
Reverse Input Voltage	5	V
Input Control Current	50	mA
Peak (10ms)	1	A
Input Power Dissipation [1]	150	mW
Total Power Dissipation [2]	800	mW
Isolation Voltage, Input to Output	5000	V_{rms}
Operational Temperature, Ambient	-40 to +85	°C
Storage Temperature	-40 to +125	°C

[1] Derate linearly 1.33 mW / ºC
[2] Derate output power linearly 6.67 mW / ºC

Absolute Maximum Ratings are stress ratings. Stresses in excess of these ratings can cause permanent damage to the device. Functional operation of the device at conditions beyond those indicated in the operational sections of this data sheet is not implied.

Typical values are characteristic of the device at +25°C, and are the result of engineering evaluations. They are provided for information purposes only, and are not part of the manufacturing testing requirements.

Electrical Characteristics @ 25ºC

Parameter	Conditions	Symbol	Min	Typ	Max	Units
Output Characteristics						
Blocking Voltage	I_L=1µA	V_{DRM}	400	-	-	V_P
Load Current [1]						
Continuous	-	I_L	-	-	250	mA_{rms} / mA_{DC}
Peak	t=10ms	I_{LPK}	-	-	±500	mA_P
On-Resistance [2]	I_L=250mA	R_{ON}	-	6	8	Ω
Off-State Leakage Current	V_L=400V_P	I_{LEAK}	-	-	1	µA
Switching Speeds						
Turn-On	I_F=5mA, V_L=10V	t_{on}	-	-	3	ms
Turn-Off		t_{off}	-	-	1	
Output Capacitance	I_F=0mA, V_L=50V, f=1MHz	C_{OUT}	-	25	-	pF
Input Characteristics						
Input Control Current to Activate	I_L=250mA	I_F	-	-	5	mA
Input Control Current to Deactivate	-	I_F	0.2	0.7	-	mA
Input Voltage Drop	I_F=5mA	V_F	0.9	1.36	1.5	V
Reverse Input Current	V_R=5V	I_R	-	-	10	µA
Common Characteristics						
Capacitance, Input to Output	V_{IO}=0V, f=1MHz	C_{IO}	-	3	-	pF

[1] If both poles operate simultaneously, then load current must be derated in order not to exceed the package power dissipation value.

[2] Measurement taken within one second of on-time.

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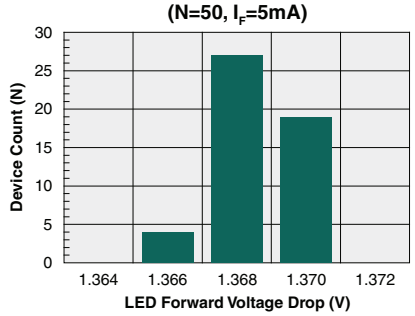
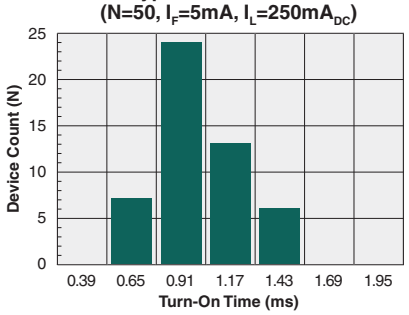
PERFORMANCE DATA*

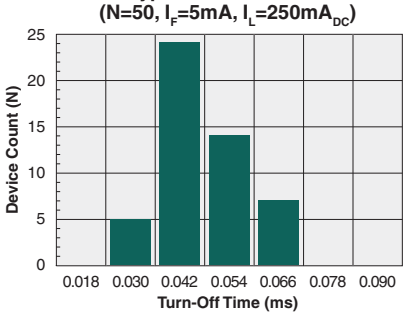
Typical LED Forward Voltage Drop (N=50, I_F=5mA)



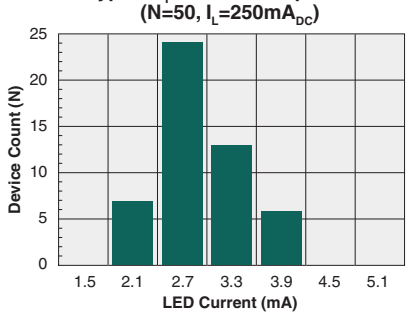
Typical Turn-On Time (N=50, I_F=5mA, I_L=250mA$_{DC}$)



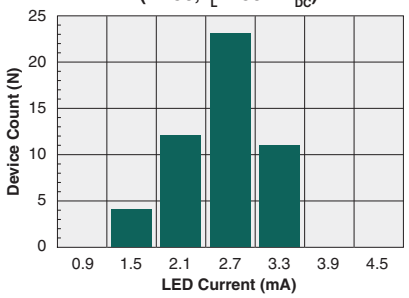
Typical Turn-Off Time (N=50, I_F=5mA, I_L=250mA$_{DC}$)



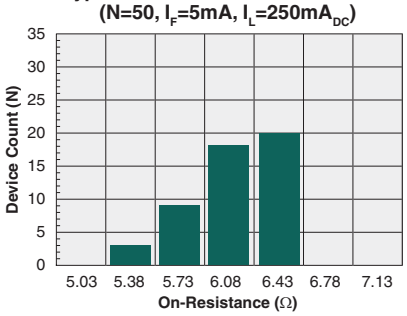
Typical I_F for Switch Operation (N=50, I_L=250mA$_{DC}$)



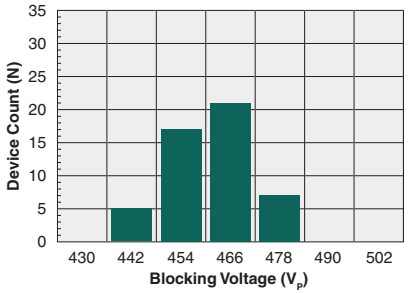
Typical I_F for Switch Dropout (N=50, I_L=250mA$_{DC}$)



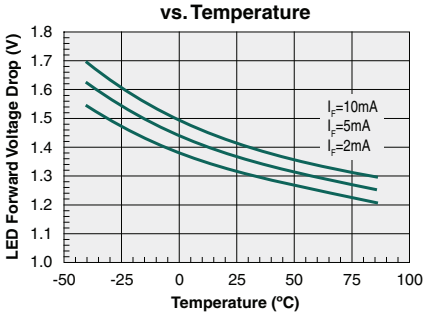
Typical On-Resistance Distribution (N=50, I_F=5mA, I_L=250mA$_{DC}$)



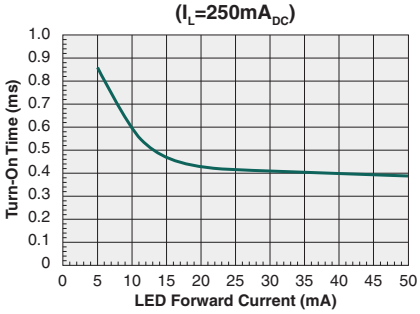
Typical Blocking Voltage Distribution (N=50)



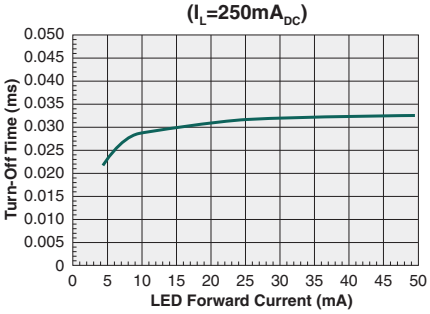
Typical LED Forward Voltage Drop vs. Temperature



Typical Turn-On Time vs. LED Forward Current (I_L=250mA$_{DC}$)



Typical Turn-Off Time vs. LED Forward Current (I_L=250mA$_{DC}$)



*Unless otherwise noted, data presented in these graphs is typical of device operation at 25ºC.

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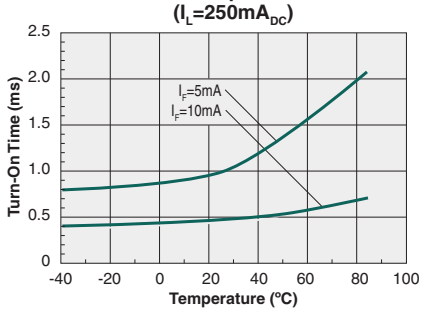
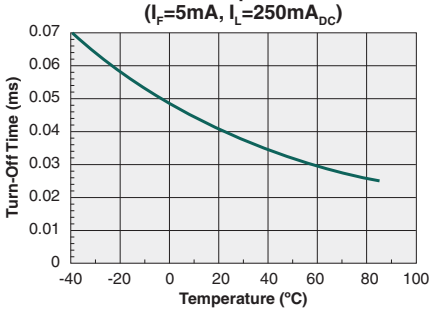
PERFORMANCE DATA*

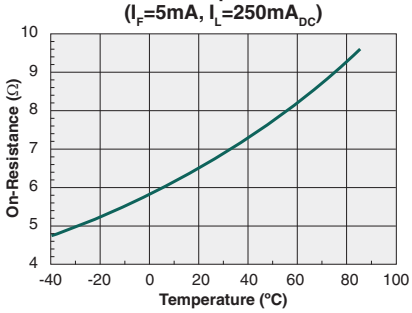
Typical Turn-On Time vs. Temperature (I_L=250mA$_{DC}$)



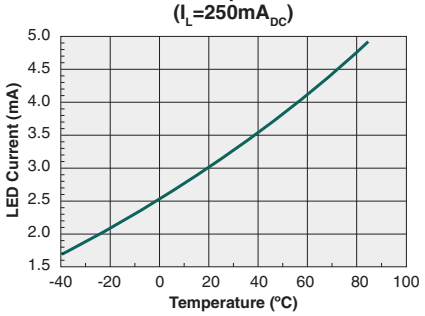
Typical Turn-Off Time vs. Temperature (I_F=5mA, I_L=250mA$_{DC}$)



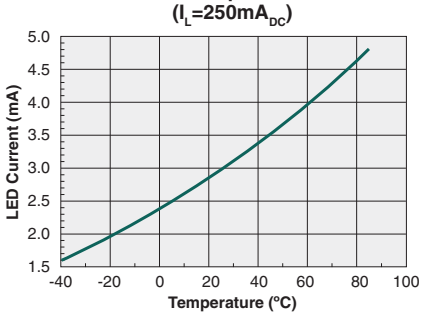
Typical On-Resistance vs. Temperature (I_F=5mA, I_L=250mA$_{DC}$)



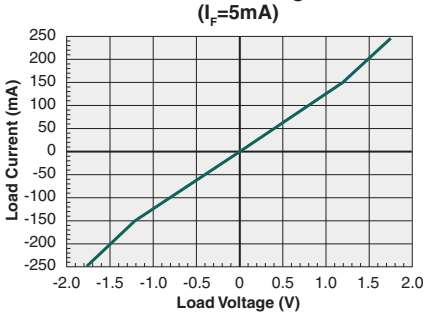
Typical I_F for Switch Operation vs. Temperature (I_L=250mA$_{DC}$)



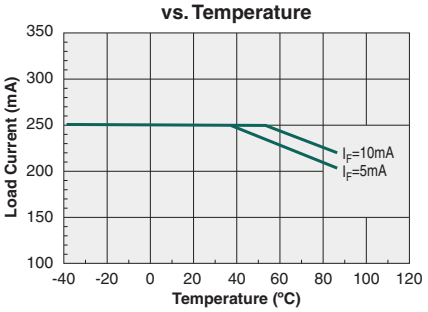
Typical I_F for Switch Dropout vs. Temperature (I_L=250mA$_{DC}$)



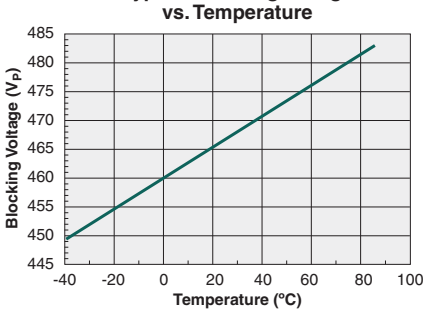
Typical Load Current vs. Load Voltage (I_F=5mA)



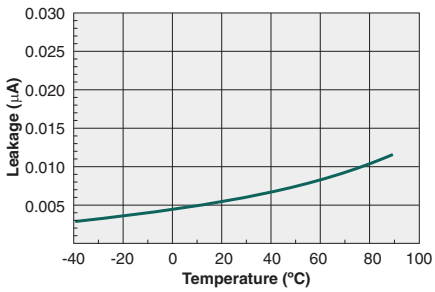
Maximum Load Current vs. Temperature



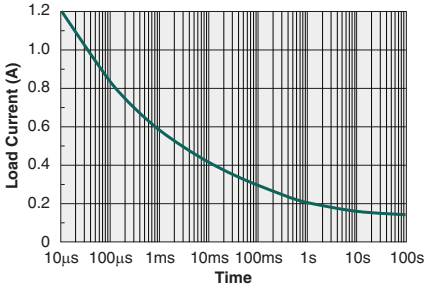
Typical Blocking Voltage vs. Temperature



Typical Leakage vs. Temperature Measured across Pins 5&6 or 7&8



Energy Rating Curve



*Unless otherwise noted, data presented in these graphs is typical of device operation at 25°C.

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Manufacturing Information

Moisture Sensitivity

All plastic encapsulated semiconductor packages are susceptible to moisture ingression. IXYS Integrated Circuits classifies its plastic encapsulated devices for moisture sensitivity according to the latest version of the joint industry standard, **IPC/JEDEC J-STD-020**, in force at the time of product evaluation. We test all of our products to the maximum conditions set forth in the standard, and guarantee proper operation of our devices when handled according to the limitations and information in that standard as well as to any limitations set forth in the information or standards referenced below.

Failure to adhere to the warnings or limitations as established by the listed specifications could result in reduced product performance, reduction of operable life, and/or reduction of overall reliability.

This product carries a **Moisture Sensitivity Level (MSL)** classification as shown below, and should be handled according to the requirements of the latest version of the joint industry standard **IPC/JEDEC J-STD-033**.

Device	Moisture Sensitivity Level (MSL) Classification
PAA191S	MSL 1

ESD Sensitivity

This product is ESD Sensitive, and should be handled according to the industry standard **JESD-625**.

Soldering Profile

Provided in the table below is the **IPC/JEDEC J-STD-020** Classification Temperature (T_C) and the maximum total dwell time (t_P) in all reflow processes that the body temperature of these surface mount devices may be (T_C - 5)°C or greater. The device's body temperature must not exceed the Classification Temperature at any time during reflow soldering processes.

Device	Classification Temperature (T_c)	Dwell Time (t_P)	Max Reflow Cycles
PAA191S	250ºC	30 seconds	3

For through-hole devices, the maximum pin temperature and maximum dwell time through all solder waves is provided in the table below. Dwell time is the interval beginning when the pins are initially immersed into the solder wave until they exit the solder wave. For multiple waves, the dwell time is from entering the first wave until exiting the last wave. During this time, pin temperatures must not exceed the maximum temperature given in the table below. Body temperature of the device must not exceed the limit shown in the table below at any time during the soldering process.

Device	Maximum Pin Temperature	Maximum Body Temperature	Maximum Dwell Time	Wave Cycles
PAA191	260ºC	250ºC	10 seconds*	1

*Total cumulative duration of all waves.

Board Wash

IXYS Integrated Circuits recommends the use of no-clean flux formulations. Board washing to reduce or remove flux residue following the solder reflow process is acceptable provided proper precautions are taken to prevent damage to the device. These precautions include but are not limited to: using a low pressure wash and providing a follow up bake cycle sufficient to remove any moisture trapped within the device due to the washing process. Due to the variability of the wash parameters used to clean the board, determination of the bake temperature and duration necessary to remove the moisture trapped within the package is the responsibility of the user (assembler). Cleaning or drying methods that employ ultrasonic energy may damage the device and should not be used. Additionally, the device must not be exposed to halide flux or solvents.

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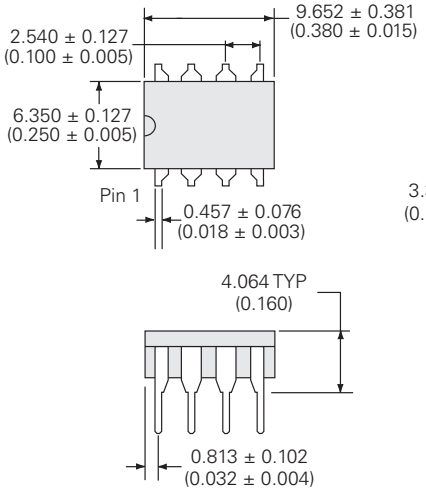
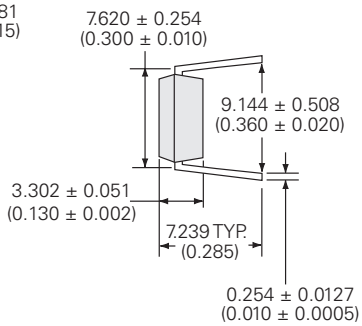
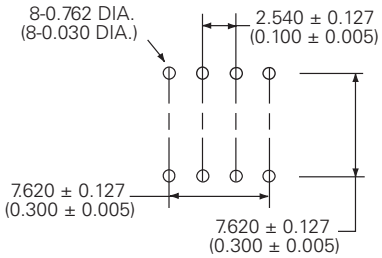
Mechanical Dimensions

PAA191





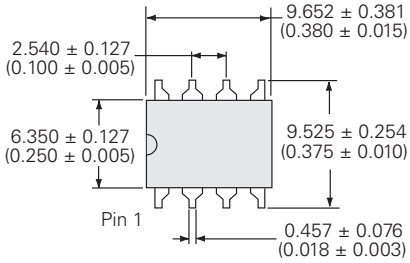
PCB Hole Pattern

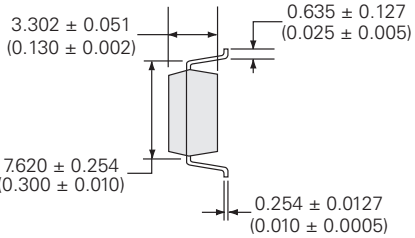


Notes:
1. Controlling dimension: Inches
2. Leadframe thickness does not include solder plating (1000µinches max)

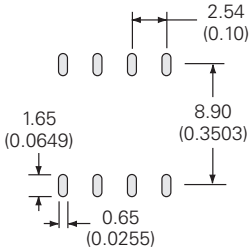
Dimensions
mm
(inches)

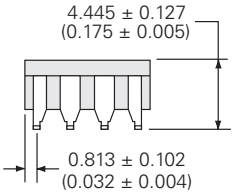
PAA191S





PCB Land Pattern





Notes:
1. Controlling dimension: Inches
2. Coplanarity = 0.004" (0.102 mm) max
3. Leadframe thickness does not include solder plating (1000µinches max)

Dimensions
mm
(inches)

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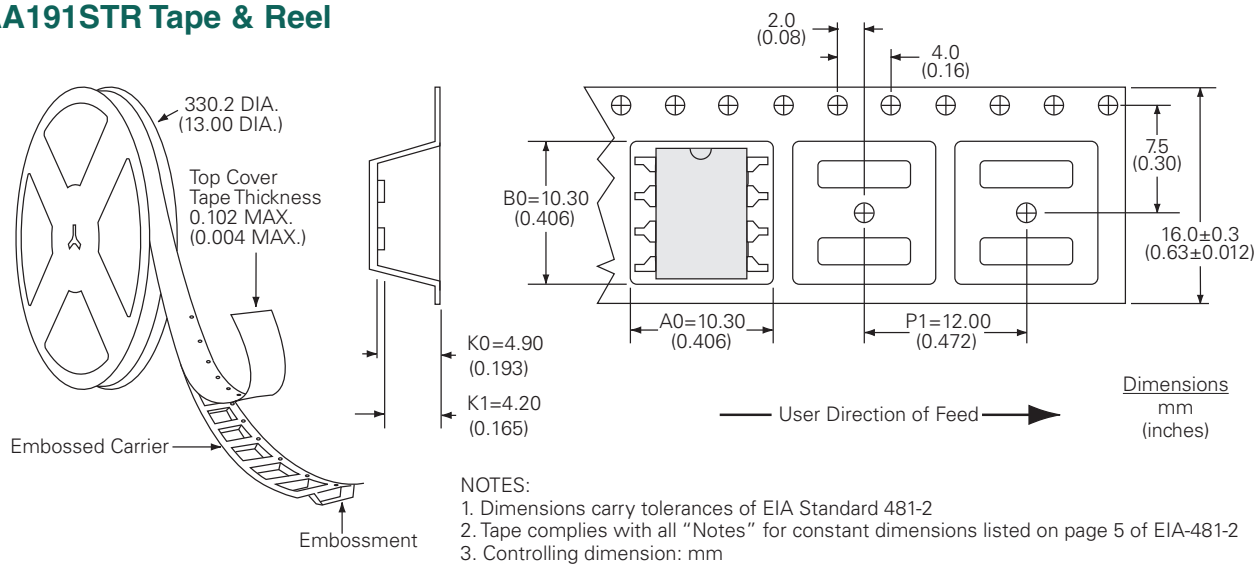
PAA191STR Tape & Reel



NOTES:
1. Dimensions carry tolerances of EIA Standard 481-2
2. Tape complies with all "Notes" for constant dimensions listed on page 5 of EIA-481-2
3. Controlling dimension: mm

For additional information please visit our website at: https://www.ixysic.com

IXYS
A Littelfuse Technology

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Read complete Disclaimer Notice at https://www.littelfuse.com/disclaimer-electronics.

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