Data Sheet

ASSR-4118, ASSR-4119, and ASSR-4128

Form A, Solid State Relay (Photo MOSFET) (400V/0.10A/35Ω)

Overview

The Broadcom® ASSR-41xx series consists of an AlGaAs infrared light-emitting diode (LED) input stage that is optically coupled to a high-voltage output detector circuit. The detector consists of a high-speed photovoltaic diode array and driver circuitry to switch on/off two discrete high-voltage MOSFETs. The relay turns on (contact closes) with a minimum input current of 3 mA through the input LED. The relay turns off (contact opens) with an input voltage of 0.8V or less.

The single-channel configurations, ASSR-4118 and ASSR-4119, are equivalent to 1 Form A electromechanical relays (EMRs), and the dual-channel configuration, ASSR-4128, is equivalent to 2 Form A EMRs. They are available in 4-pin SO, 6-pin DIP, 8-pin DIP, and gull-wing surface-mount for DIP packages. The ASSR-4119 enables AC/DC and DC-only output connections. For DC-only connections, the output current, I_O, increases to 0.2A and the on-resistance, $R_{(ON)}$, reduces to 10Ω.

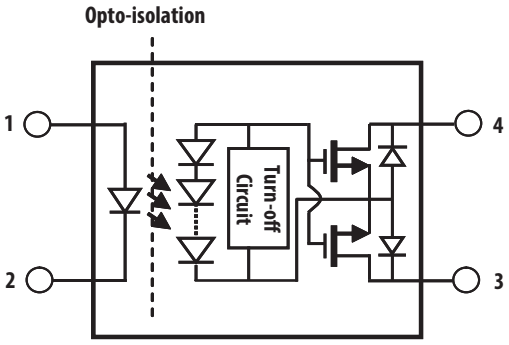
Applications

- Telecommunication switching
- Data communications
- Industrial controls
- Medical
- Security
- EMR/reed relay replacement

Features

- Compact solid-state bidirectional signal switch
- Single-channel and dual-channel normally-off single-pole-single-throw (SPST) relay
- 400V output withstand voltage
- 0.1A or 0.2A current rating
  (see the schematic for ASSR-4119 connection A and B)
- Low input current: CMOS compatibility
- Low on-resistance: 8Ω typical for DC-only, 25Ω typical for AC/DC
- High input-to-output insulation voltage
  (safety and regulatory approvals pending)
  - 3750 V_{RMS} for 1 minute per UL1577
  - CSA component acceptance

Functional Diagram



Single-Channel, SPST Relay,
1 Form A in 4-Pin SO Package

Truth Table

LED	Output
Off	Open
On	Close

CAUTION! Take normal static precautions in the handling and assembly of this component to prevent damage and/or degradation that can be induced by ESD.

Ordering Information

The ASSR-41xx series is UL recognized with 3750 V_{RMS} for 1 minute per UL1577 and is approved under CSA Component Acceptance Notice #5.

Part Number	Option RoHS Compliant	Package	Surface Mount	Gull Wing	Tape and Reel	Quantity
ASSR-4118	-003E	SO-4	X			100 units per tube
	-503E		X		X	1500 units per reel
ASSR-4119	-001E	300-mil DIP-6				50 units per tube
	-301E		X	X		50 units per tube
	-501E		X	X	X	1000 units per reel
ASSR-4128	-002E	300-mil DIP-8				50 units per tube
	-302E		X	X		50 units per tube
	-502E		X	X	X	1000 units per reel

To form an order entry, choose a part number from the Part Number column and combine it with the desired option from the Option column.

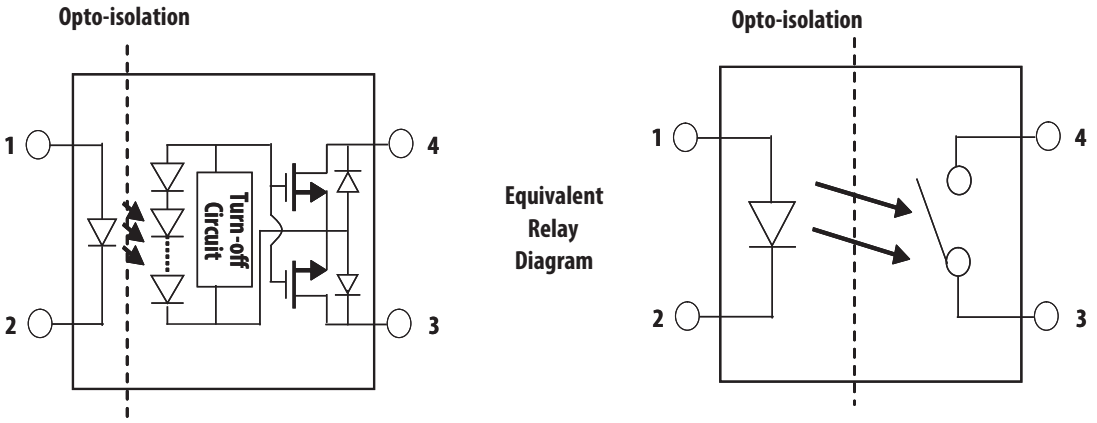
Example 1: Use ASSR-4119-501E to order the product in a 300-mil DIP-6 gull-wing surface-mount package with tape and reel packaging and RoHS compliance.

Example 2: Use ASSR-4128-002E to order the product with a 300-mil DIP-8 package in tube packaging and RoHS compliance.

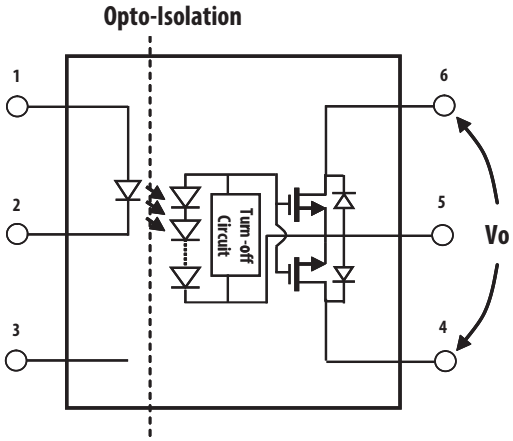
Option data sheets are available. Contact your Broadcom sales representative or authorized distributor for information.

System Schematics

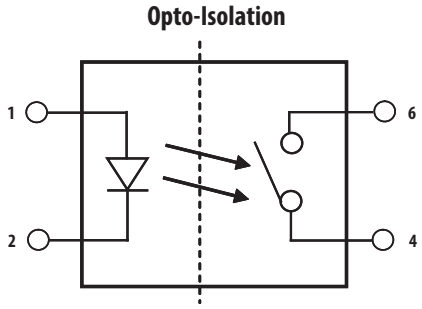
ASSR-4118



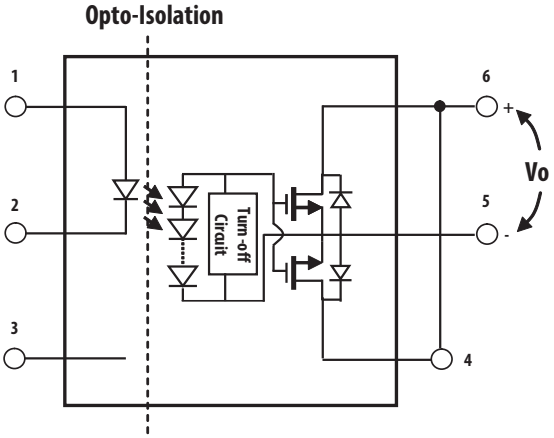
ASSR-4119 Connection A



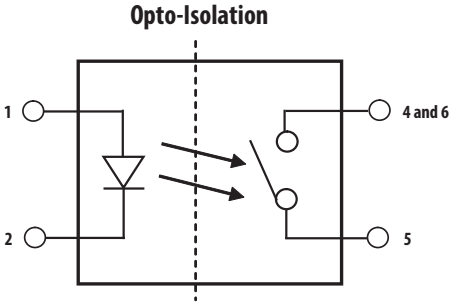
Equivalent Relay Diagram



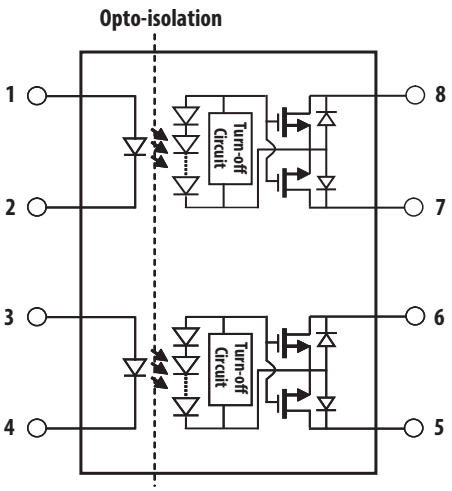
ASSR-4119 Connection B



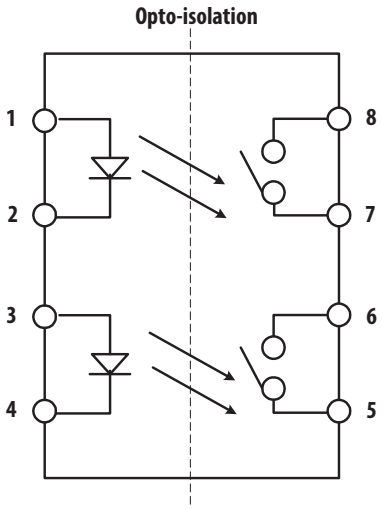
Equivalent Relay Diagram



ASSR-4128

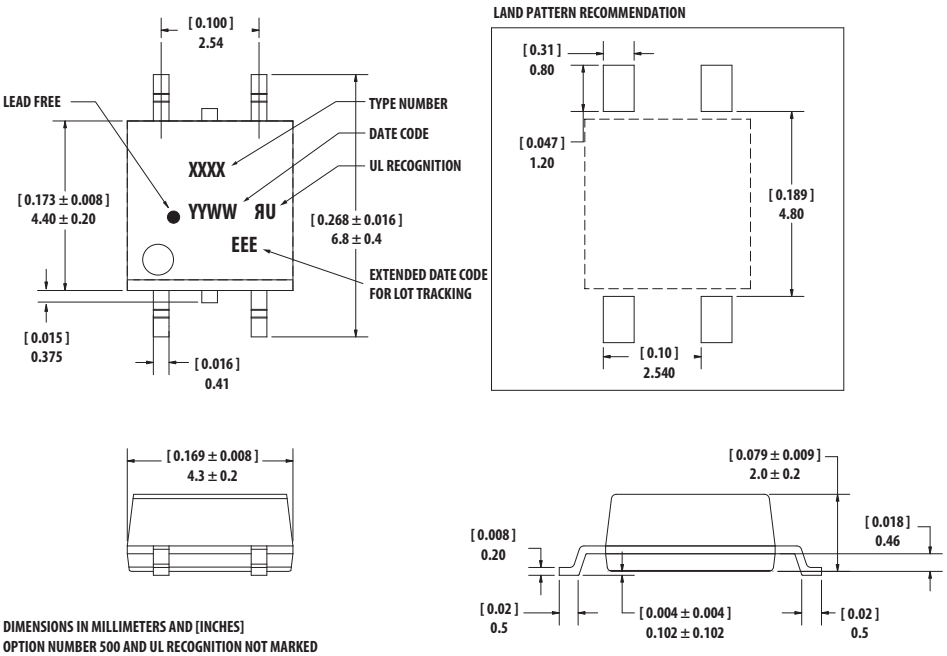


Equivalent Relay Diagram



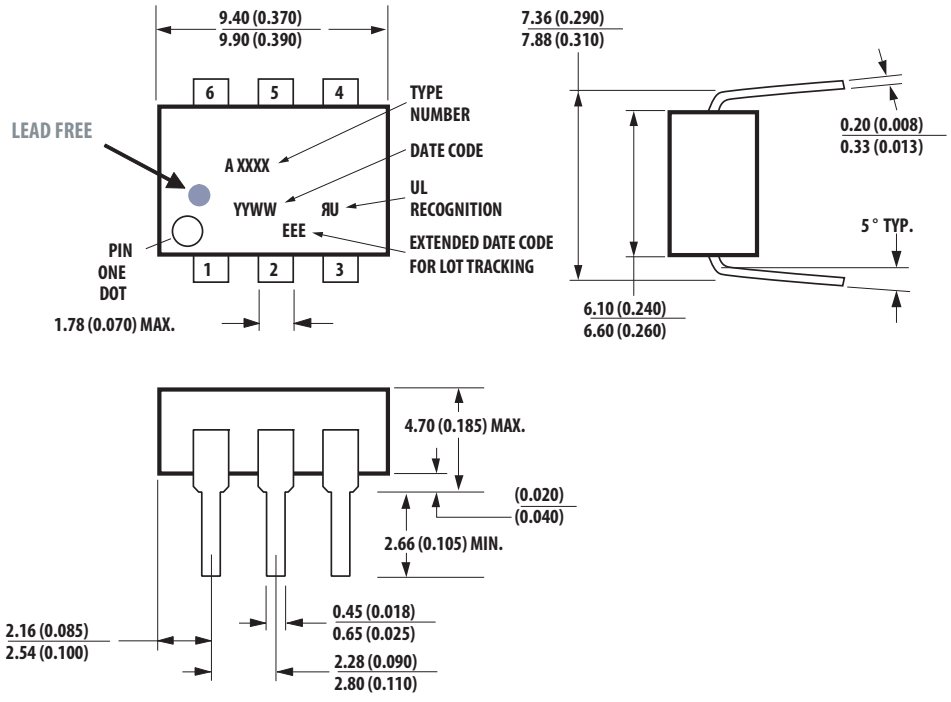
Package Outline Drawings

ASSR-4118 4-Pin Small Outline Package



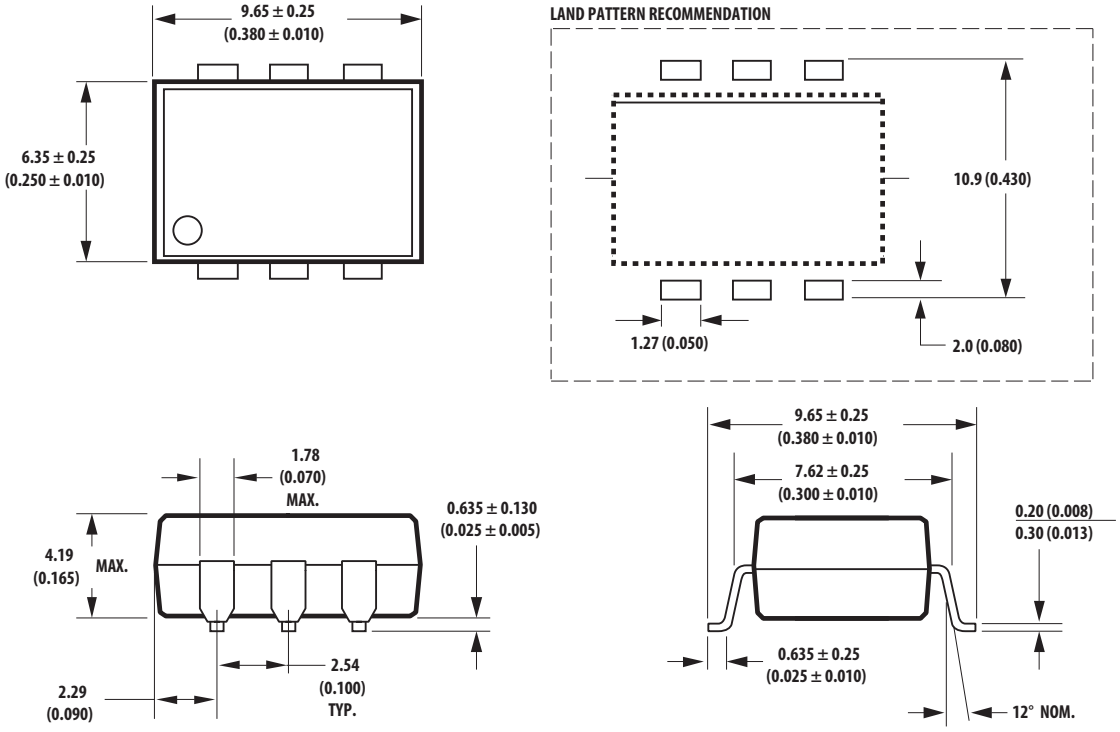
DIMENSIONS IN MILLIMETERS AND [INCHES]
OPTION NUMBER 500 AND UL RECOGNITION NOT MARKED

ASSR-4119 6-Pin DIP Package



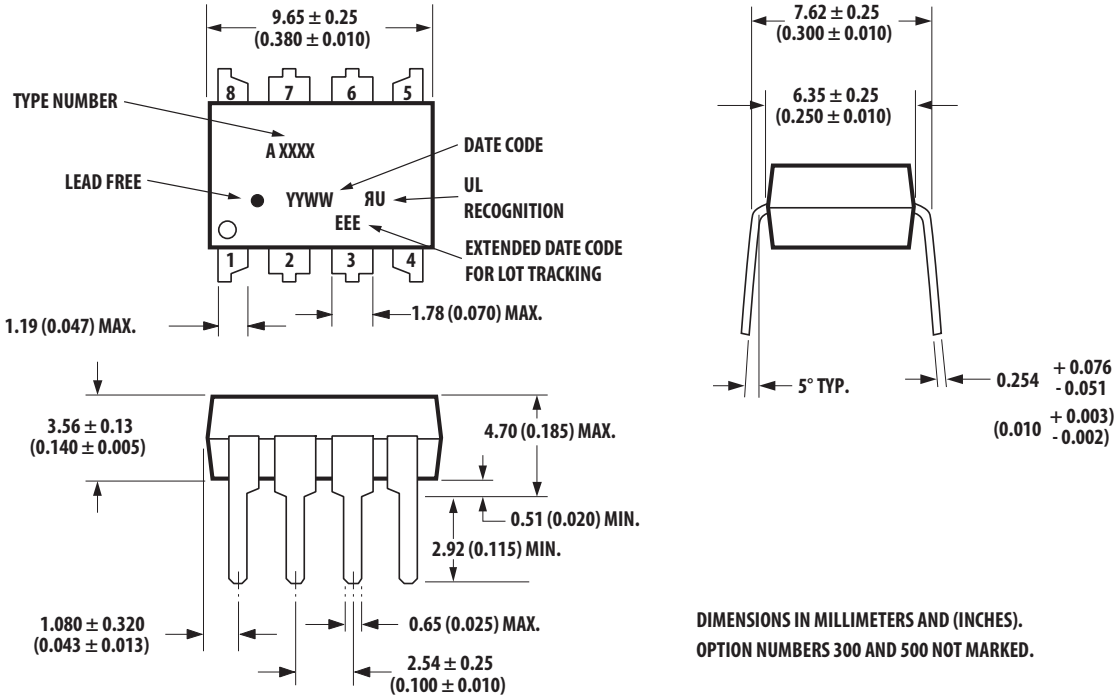
DIMENSIONS IN MILLIMETERS AND (INCHES).

ASSR-4119 6-Pin DIP Package with Gull-Wing Surface-Mount Option 300



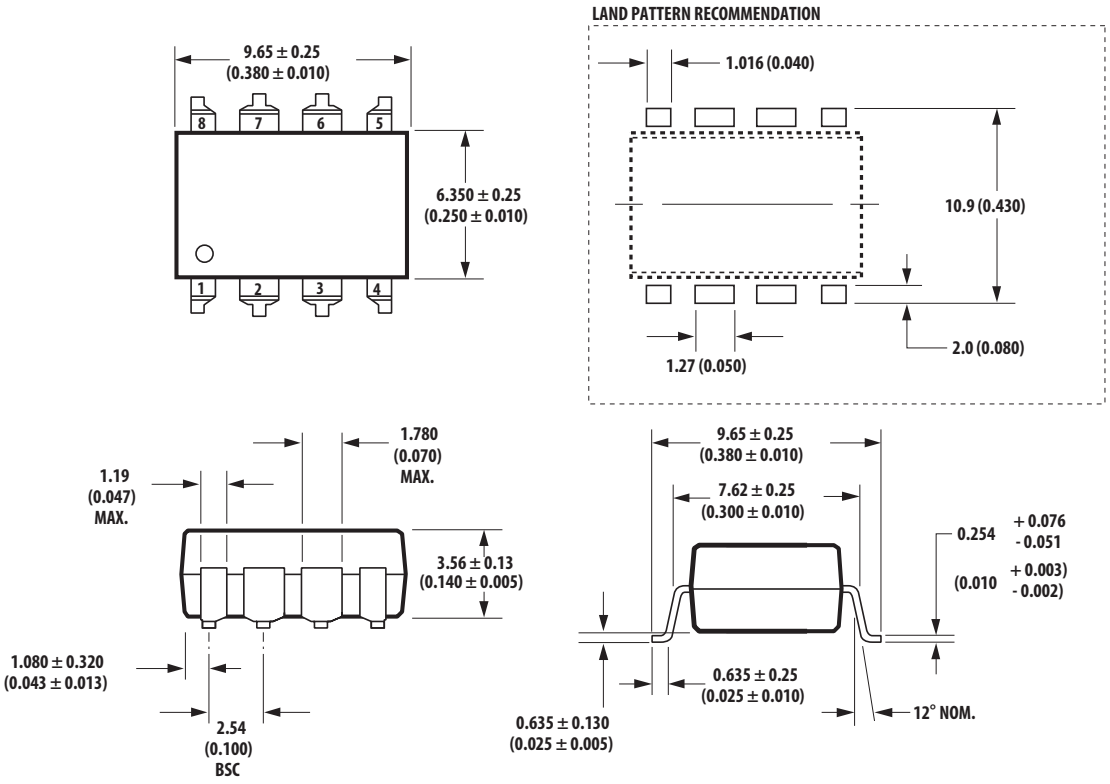
NOTE: FLOATING LEAD PROTRUSION IS 0.25 mm (10 mils) MAX.

ASSR-4128 8-Pin DIP Package



DIMENSIONS IN MILLIMETERS AND (INCHES).
OPTION NUMBERS 300 AND 500 NOT MARKED.

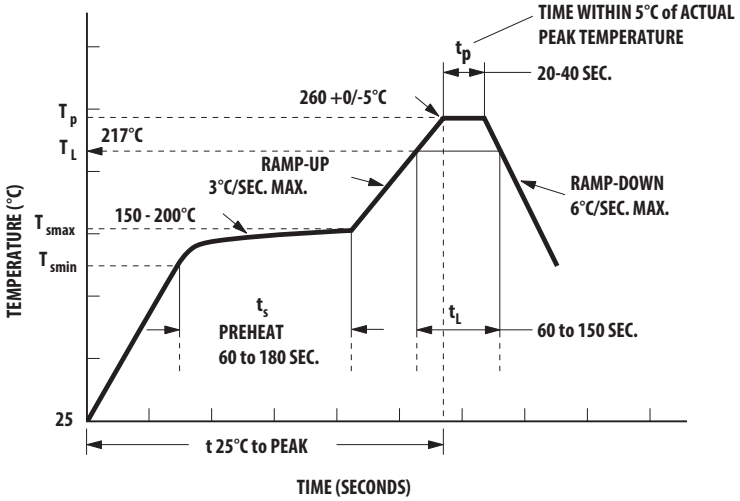
ASSR-4128 8-Pin DIP Package with Gull-Wing Surface-Mount Option 300



DIMENSIONS IN MILLIMETERS (INCHES).
LEAD COPLANARITY = 0.10 mm (0.004 INCHES).

NOTE: FLOATING LEAD PROTRUSION IS 0.25 mm (10 mils) MAX.

Lead-Free IR Profile



NOTES:
THE TIME FROM 25°C to PEAK TEMPERATURE = 8 MINUTES MAX.
T_{smax} = 200°C, T_{smin} = 150°C

Non-halide flux should be used

Regulatory Information

The ASSR-4118, ASSR-4119, and ASSR-4128 are approved by the following organizations:

- **UL:** Approved under UL 1577, component recognition program up to V_{ISO} = 3750 V_{RMS}.
- **CSA:** Approved under CSA Component Acceptance Notice #5.

Insulation and Safety Related Specifications

Parameter	Symbol	ASSR-4118	ASSR-4119 ASSR-4128	Unit	Conditions
Minimum External Air Gap (Clearance)	L(101)	4.9	7.1	mm	Measured from input terminals to output terminals, shortest distance through the air.
Minimum External Tracking (Creepage)	L(102)	4.9	7.4	mm	Measured from input terminals to output terminals, shortest distance path along the body.
Minimum Internal Plastic Gap (Internal Clearance)	—	0.08	0.08	mm	Through insulation distance conductor to conductor, usually the straight-line distance thickness between the emitter and the detector.
Tracking Resistance (Comparative Tracking Index)	CTI	175	175	V	DIN IEC 112/VDE 0303 Part 1.
Isolation Group (DIN VDE0109)	—	IIIa	IIIa	—	Material Group (DIN VDE 0109).

Absolute Maximum Ratings

Parameter		Symbol	Min.	Max.	Unit	Note
Storage Temperature		T_S	–55	125	°C	—
Operating Temperature		T_A	–40	85	°C	—
Junction Temperature		T_J	—	125	°C	—
Lead Soldering Cycle	Temperature	—	—	260	°C	—
	Time	—	—	10	seconds	—
Input Current	Average	I_F	—	25	mA	—
	Surge		—	50		—
	Transient		—	1000		—
Reversed Input Voltage		V_R	—	5	V	—
Input Power Dissipation	ASSR-4118	P_{IN}	—	40	mW	—
	ASSR-4119	P_{IN}	—	40	mW	—
	ASSR-4128	P_{IN}	—	80	mW	—
Output Power Dissipation	ASSR-4118	P_O	—	300	mW	—
	ASSR-4119	P_O	—	300	mW	—
	ASSR-4128	P_O	—	600	mW	—
Average Output Current (T_A = 25°C, T_C ≤ 100°C)	—	I_O	—	0.10	A	a
	ASSR-4119 Connection B	I_O	—	0.20	A	a
Output Voltage (T_A = 25°C)	—	V_O	–400	400	V	b
	ASSR-4119 Connection B	V_O	0	400	V	—
Solder Reflow Temperature Profile		See the Lead-Free IR Profile.				

a. For derating, see Figure 1 through Figure 4.

b. The voltage across the output terminals of the relay should not exceed this rated withstand voltage. Overvoltage protection circuits should be added in some applications to protect against overvoltage transients.

Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Unit	Note
Input Current (ON)	$I_{F(ON)}$	3	20	mA	a
Input Voltage (OFF)	$V_{F(OFF)}$	0	0.8	V	—
Operating Temperature	T_A	–40	+85	°C	—

a. The threshold to switch the device is $I_F \geq 0.5$ mA; however, for qualified device performance over the temperature range, it is recommended to operate at I_F = 5 mA.

Package Characteristics

Unless otherwise specified, T_A = 25°C.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Note
Input-Output Momentary Withstand Voltage	V_{ISO}	3750	—	—	V_{RMS}	RH ≤ 50%, t = 1 minute	a, b
Input-Output Resistance	R_{I-O}	—	10^{12}	—	Ω	V_{I-O} = 500 Vdc	—
Input-Output Capacitance	C_{I-O} (ASSR-4118)	—	0.4	—	pF	f = 1 MHz; V_{I-O} = 0 Vdc	a
	C_{I-O} (ASSR-4119)	—	0.5	—	pF	f = 1 MHz; V_{I-O} = 0 Vdc	—
	C_{I-O} (ASSR-4128)	—	0.8	—	pF	f = 1 MHz; V_{I-O} = 0 Vdc	—

a. The device is considered as a two-terminal device:
ASSR-4118 – Pin 1, 2 are shorted, and pin 3, 4 are shorted.
ASSR-4119 – Pin 1, 2, 3 are shorted, and pin 4, 5, 6 are shorted.
ASSR-4128 – Pin 1, 2, 3, 4 are shorted, and pin 5, 6, 7, 8 are shorted.

b. The input-output momentary withstand voltage is a dielectric voltage rating that should not be interpreted as an input-output continuous voltage rating. For the continuous voltage rating, refer to the IEC/EN/DIN EN 60747-5-2 Insulation Characteristics Table (if applicable), your equipment level safety specification, or Broadcom Application Note 1074, *Optocoupler Input-Output Endurance Voltage*.

Electrical Specifications (DC)

For operating T_A = +25°C.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Figure	Note
Output Withstand Voltage	$\|V_{O(OFF)}\|$	400	450	—	V	V_F = 0.8V, I_O = 250 µA	Figure 5	—
Output Leakage Current	$I_{O(OFF)}$	—	0.005	1	µA	V_F = 0.8V, V_O = 400V	—	—
Input Reverse Breakdown Voltage	V_R	5	—	—	V	I_R = 10 µA	—	—
Input Forward Voltage	V_F	1.1	1.3	1.6	V	I_F = 5 mA	Figure 6, Figure 7	—
Output On-Resistance	$R_{(ON)}$	—	25	35	Ω	I_F = 5 mA, I_O = 100 mA, Pulse ≤ 30 ms	Figure 8, Figure 9	a
	ASSR-4119 Connection B	—	8	10	Ω	I_F = 5 mA, I_O = 200 mA, Pulse ≤ 30 ms	—	—

a. During the pulsed $R_{(ON)}$ measurement (I_O duration ≤ 30 ms), the ambient (T_A) and case temperature (T_C) are equal.

Switching Specifications (AC)

For operating TA = +25°C.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Figure	Note
Turn-On Time	T_{ON}	—	0.7	5.0	ms	I_F = 5 mA, I_O = 100 mA	—	—
Turn-Off Time	T_{OFF}	—	0.04	5.0	ms	I_F = 5 mA, I_O = 100 mA	—	—

Application Information

On-Resistance and Derating Curves

The output on-resistance, $R_{(ON)}$, specified in this data sheet is the resistance measured across the output contact when a pulse current signal (I_O = 100 mA) is applied to the output pins. The use of a pulsed signal (≤30 ms) implies that each junction temperature is equal to the ambient and case temperatures. The steady-state resistance, R_{SS}, on the other hand, is the value of resistance measured across the output contact when a DC current signal is applied to the output pins for a duration sufficient to reach thermal equilibrium. R_{SS} includes the effects of the temperature rise in the device.

Figure 1 through Figure 4 specify the maximum average output current allowable for a given ambient temperature. The maximum allowable output current and power dissipation are related by the expression $R_{SS} = P_O(max) / (I_O(max))^2$ from which R_{SS} can be calculated. Staying within the safe area ensures that the steady-state MOSFET junction temperature remains less than 125°C.

Figure 1: Maximum Output Current Rating vs Ambient Temperature (ASSR-4118-003E)

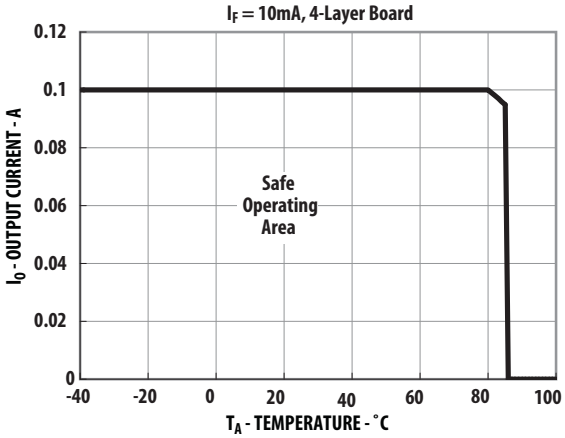


Figure 2: Maximum Output Current Rating vs Ambient Temperature (ASSR-4119-001E)

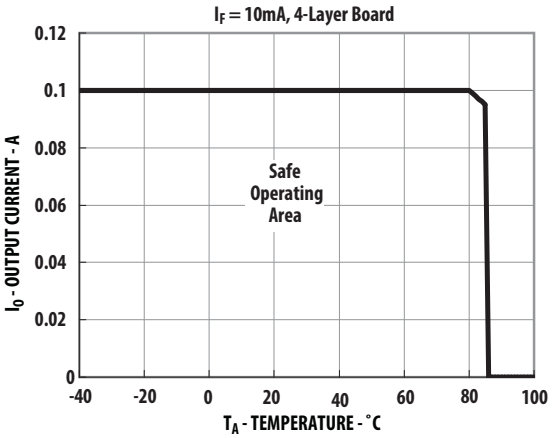


Figure 3: Maximum Output Current Rating vs Ambient Temperature (ASSR-4119-001E DC Connection)

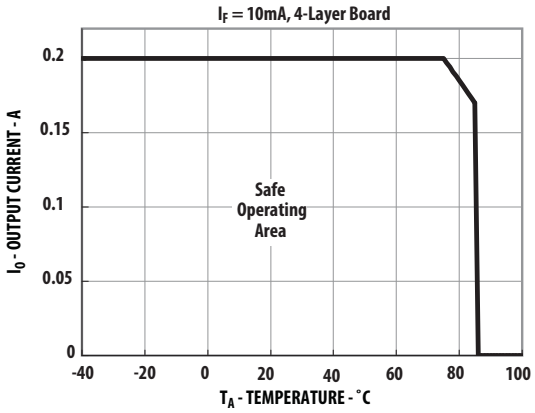


Figure 4: Maximum Output Current Rating vs Ambient Temperature (ASSR-4128-002E)

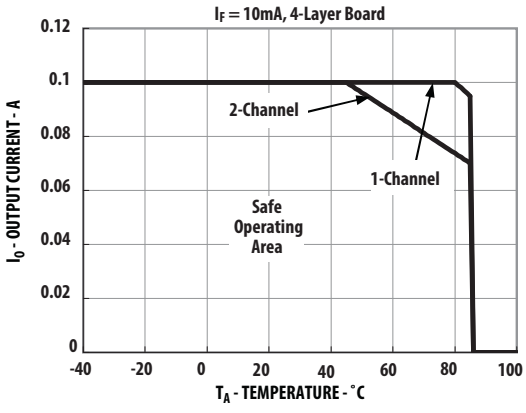


Figure 5: Normalized Output Withstand Voltage vs Temperature

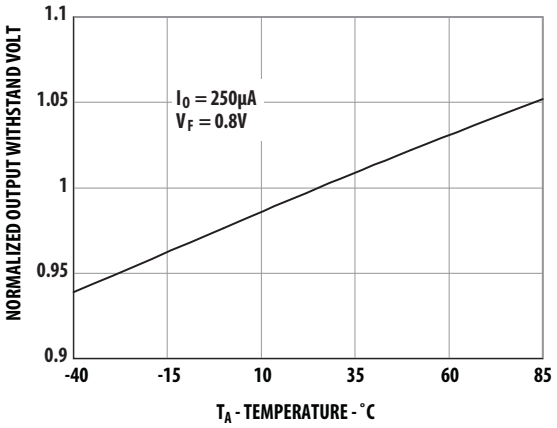


Figure 6: Typical Forward Voltage vs Temperature

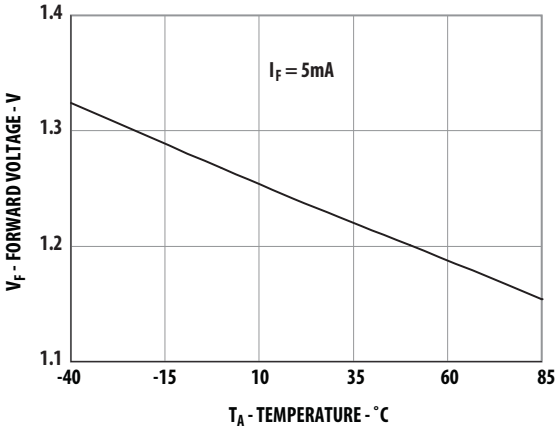


Figure 7: Typical Forward Current vs Forward Voltage

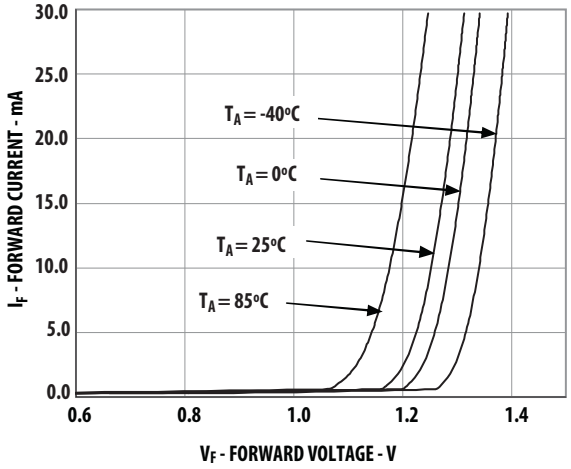


Figure 8: Typical On-Resistance vs Temperature

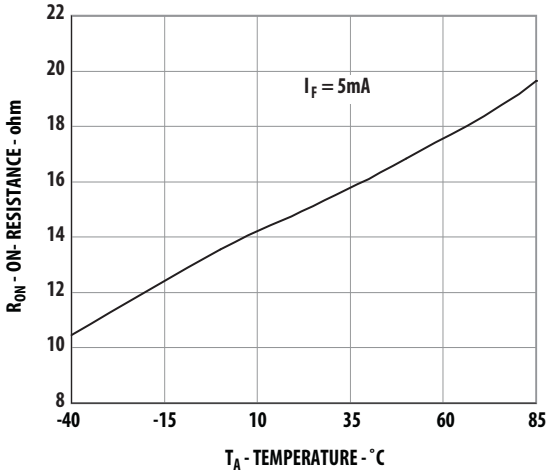
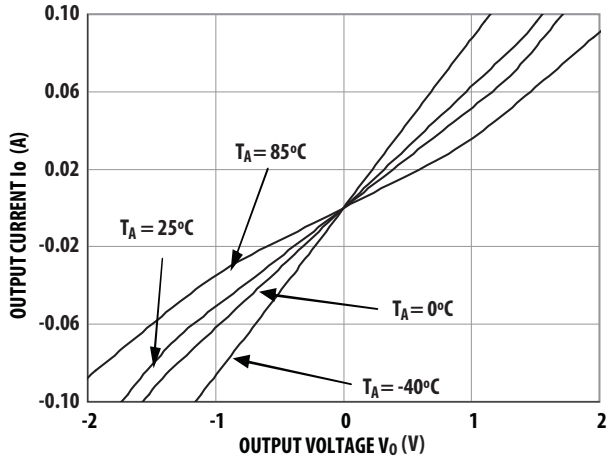


Figure 9: Typical Output Current vs Output Voltage



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