ASSR-1611

High Current, 1 Form A, Solid State Relay (MOSFET)
(60V/2.5A/0.1Ω)

Data Sheet

Lead (Pb) Free
RoHS 6 fully
compliant

Description

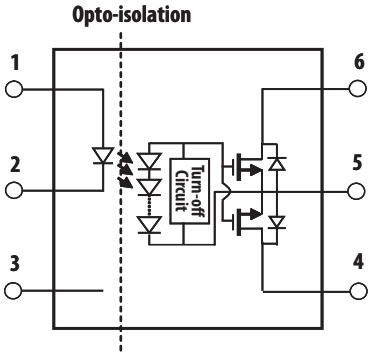
The ASSR-1611 is specifically designed for high current applications, commonly found in the industrial equipments. The relay is a solid-state replacement for single-pole, normally-open, (1 Form A) electromechanical relays.

The ASSR-1611 consists of an AlGaAs infrared light-emitting diode (LED) input stage 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 5mA through the input LED. The relay turns off (contact opens) with an input voltage of 0.8V or less.

The ASSR-1611 connection A, as shown in the schematic, allows the relay to switch either ac or dc loads. The connection B, with its advantages of reduced on-resistance and higher output current, allows the relays to switch dc loads only.

The electrical and switching characteristics are specified over the temperature range of -40°C to +85°C.

Functional Diagram



Truth Table

LED	Output
Off	Open
On	Close

Features

- Compact Solid-State Bi-directional Signal Switch
- Single Channel Normally-off Single-Pole-Single-Throw (SPST) Relay
- 60V Output Withstand Voltage
- 2.5A or 5A Current Rating
- Low Input Current: CMOS Compatibility
- Low On-Resistance: 20mΩ Typical for DC-only, 65mΩ Typical for AC/DC
- High Speed Switching: 3.2ms (T_{on}), 0.1ms (T_{off}) Typical
- High Transient Immunity: >1kV/µs
- High Input-to-Output Insulation Voltage
  - (Safety and Regulatory Approvals)
    UL recognized - 3750 V_{RMS} and 5000 V_{RMS}* for 1 min per UL1577
  - CSA Component Acceptance

*5000 V_{RMS}/1 Minute rating is for Option X21 only.
(Please consult your regional Avago representatives)

Applications

- Industrial Controls
- Factory Automation
- Data Acquisition
- Measuring Instrument
- Medical System
- Security System
- EMR / Reed Relay Replacement

CAUTION: *It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD.*

Ordering Information

ASSR-1611 is UL Recognized with 3750 V_{RMS} and 5000 V_{RMS} (option X21*) for 1 minute per UL1577 and is approved under CSA Components Acceptance Notice #5.

Part Number	Option RoHS Compliant	Package	Surface Mount	Gullwing	Tape & Reel	Quantity
ASSR-1611	-001E	300mil DIP-6				50 units per tube
	-301E		X	X		
	-501E		X	X	X	1000 units per reel

To order, choose a part number from the part number column and combine with the desired option from the option column to form an order entry.

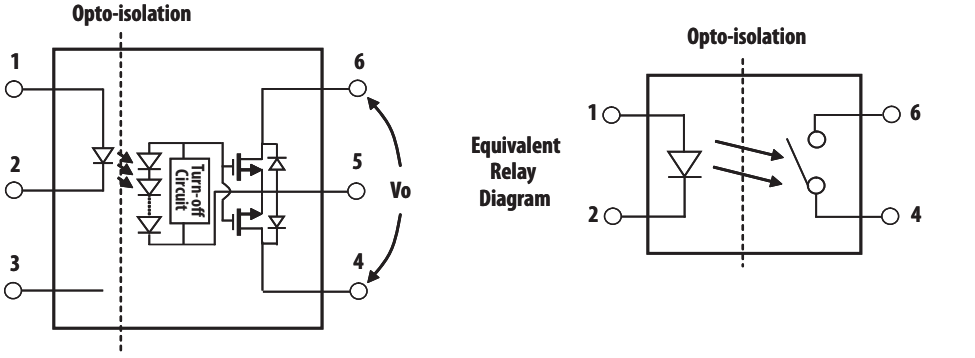
Example 1:

ASSR-1611-501E to order product of 300mil DIP-6 Gull Wing Surface Mount package in Tape and Reel packaging and RoHS Compliant.

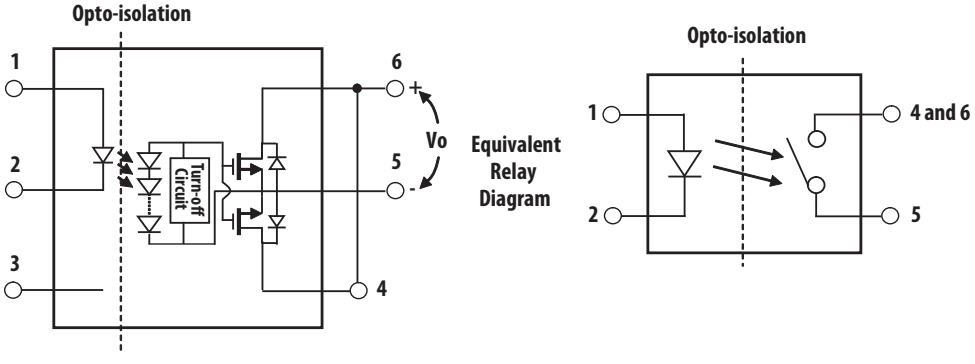
x021* - 'Please consult your regional Avago representatives'

Schematic

ASSR-1611



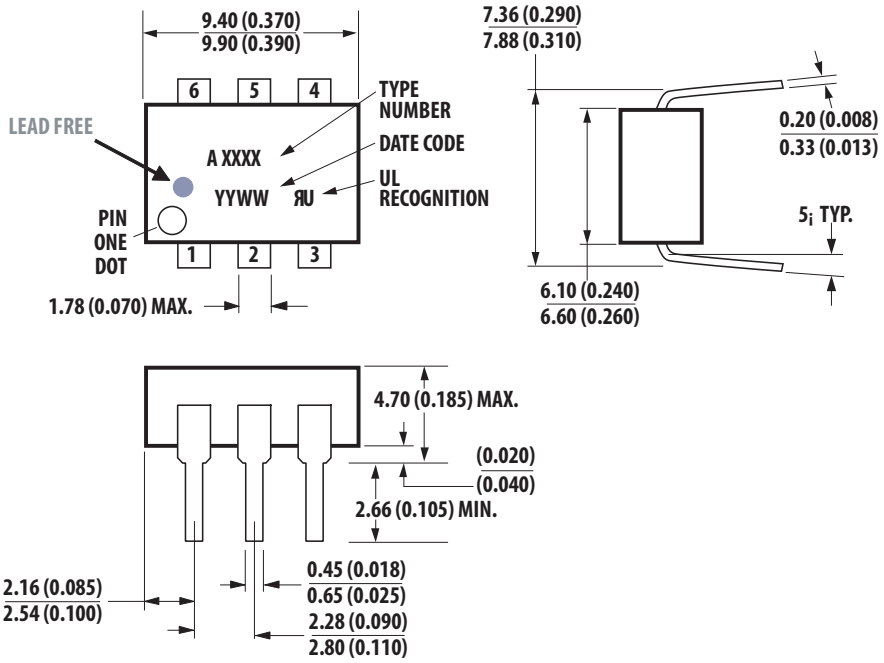
Connection A – AC/DC



Connection B – DC Only

Package Outline Drawings

ASSR-1611 6-Pin DIP Package



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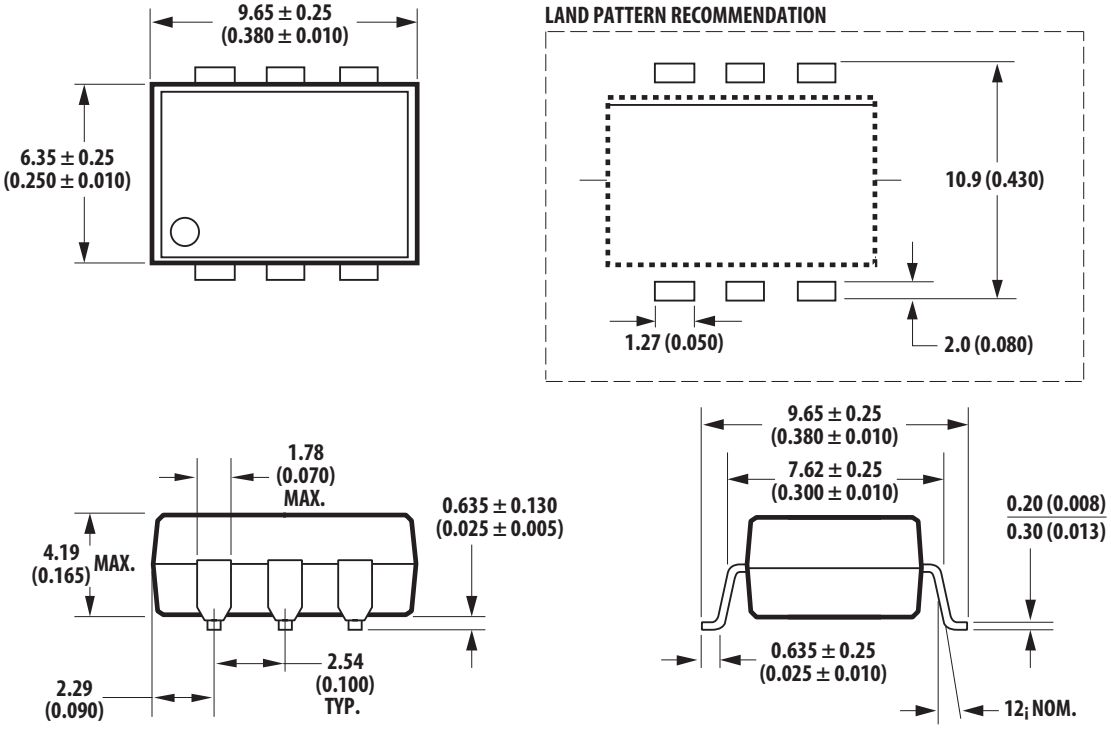
ASSR-1611 6-Pin DIP Package with Gull Wing Surface Mount Option 300



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

Solder Reflow Temperature Profile

Recommended reflow condition as per JEDEC Standard, J-STD-020 (latest revision). Non-Halide Flux should be used.

Regulatory Information

The ASSR-1611 is approved by the following organizations:

UL

Approved under UL 1577, component recognition program up to V_{ISO} = 3750 V_{RMS} and 5000 V_{RMS} (option x21).

CSA

Approved under CSA Component Acceptance Notice #5.

Insulation and Safety Related Specifications

Parameter	Symbol	ASSR-1611	Units	Conditions
Minimum External Air Gap (Clearance)	L(101)	7.1	mm	Measured from input terminals to output terminals, shortest distance through air.
Minimum External Tracking (Creepage)	L(102)	7.4	mm	Measured from input terminals to output terminals, shortest distance path along body.
Minimum Internal Plastic Gap (Internal Clearance)		0.08	mm	Through insulation distance conductor to conductor, usually the straight line distance thickness between the emitter and detector.
Tracking Resistance (Comparative Tracking Index)	CTI	175	V	DIN IEC 112/VDE 0303 Part 1
Isolation Group (DIN VDE0109)		IIIa		Material Group (DIN VDE 0109)

Absolute Maximum Ratings

Parameter		Symbol	Min.	Max.	Units	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	sec	
Input Current	Average	I_F		25	mA	
	Surge			50	mA	
	Transient			1000	mA	
Reversed Input Voltage		V_R		5	V	
Input Power Dissipation		P_{IN}		40	mW	
Output Power Dissipation	Connection A	P_O		625	mW	
	Connection B			880	mW	
Average Output Current (T_A=25°C, $T_C \leq$ 100°C)	Connection A	I_O		2.5	A	1
	Connection B			5	A	1
Output Voltage (T_A=25°C)	Connection A	V_O	- 60	60	V	2
	Connection B		0	60	V	
Solder Reflow Temperature Profile				See Lead Free IR Profile		

Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Units	Note
Input Current (ON)	$I_{F(ON)}$	5	20	mA	
Input Voltage (OFF)	$V_{F(OFF)}$	0	0.8	V	
Operating Temperature	T_A	-40	+85	°C	

Package Characteristics

Unless otherwise specified, operating temperature T_A = 25°C.

Parameter	Sym.	Min.	Typ.	Max.	Units	Conditions	Note
Input-Output Momentary Withstand Voltage	V_{ISO}	3750			V_{RMS}	RH ≤ 50%, t=1min, T_A=25°C	3, 4
		5000				RH ≤ 50%, t=1min, T_A=25°C, option X21	
Input-Output Resistance	R_{I-O}		10^{14}		Ω	V_{I-O}=500 Vdc	
Input-Output Capacitance	C_{I-O}		0.8		pF	V_{I-O}=0Vdc, f=1MHz	3

Electrical Specifications (DC)

Over recommended operating T_A = - 40°C to 85°C, I_F = 5mA to 10mA, unless otherwise specified.

Parameter		Sym.	Min.	Typ.	Max.	Units	Conditions	Fig.	Note
Output Withstand Voltage		$\|V_{O(OFF)}\|$	60	68		V	V_F=0.8V, I_O=250µA, T_A=25°C	3	
			55			V	V_F=0.8V, I_O=250µA	3	
Output Leakage Current		$I_{O(OFF)}$		0.01	0.1	µA	V_F=0.8V, V_O=60V, T_A=25°C	5	
					5	µA	V_F=0.8V, V_O=55V	4	
Output Off-Capacitance		$C_{(OFF)}$		1400		pF	V_F=0.8V, V_O=0V, f=1MHz	6	
Output Offset Voltage		$\|V_{(OS)}\|$		1		µV	I_F=5mA, I_O=0mA		
Input Reverse Breakdown Voltage		V_R	5			V	I_R=10µA		
Input Forward Voltage		V_F	1.1	1.3	1.7	V	I_F=5mA	7, 8	
Output On-resistance	Connection A	$R_{(ON)}$		0.065	0.1	Ω	I_F=5mA, I_O=2.5A, Pulse ≤30ms, T_A=25°C	9, 10	5
	Connection B			0.02	0.035	Ω		11	

Switching Specifications (AC)

Over recommended operating T_A = - 40°C to 85°C, I_F = 5mA to 10mA, unless otherwise specified.

Parameter	Sym.	Min.	Typ.	Max.	Units	Conditions	Fig.	Note
Turn On Time	T_{ON}		3.2	5.0	ms	I_F=5mA, I_O=1.0A, T_A=25°C	12, 13	
				10.0	ms	I_F=5mA, I_O=1.0A		
			1.6	2.5	ms	I_F=10mA, I_O=1.0A, T_A=25°C	12, 14	
				5.0	ms	I_F=10mA, I_O=1.0A		
Turn Off Time	T_{OFF}		0.1	0.5	ms	I_F=5mA, I_O=1.0A, T_A=25°C	15, 16	
				1	ms	I_F=5mA, I_O=1.0A		
			0.06	0.2	ms	I_F=10mA, I_O=1.0A, T_A=25°C	15, 17	
				0.5	ms	I_F=10mA, I_O=1.0A		
Output Transient Rejection	dV_O/dt	1	7		kV/µs	ΔV_O=60V, $R_M \geq$ 1MΩ, C_M=1000pF, T_A=25°C		6
Input-Output Transient Rejection	dVI_{-O}/dt	1	≥10		kV/µs	V_{DD}=5V, ΔVI_{-O}=1000V, R_L=1kΩ, C_L=25pF, T_A=25°C		6

Notes:

1. For derating, refer to Figure 1 and 2.
2. The voltage across the output terminals of the relay should not exceed this rated withstand voltage. Over-voltage protection circuits should be added in some applications to protect against over-voltage transients.
3. Device is considered as a two terminal device: pins 1, 2, and 3 shorted together and pins 5, 6, and 7 shorted together.
4. 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 Avago Application Note 1074, "Optocoupler Input-Output Endurance Voltage."
5. During the pulsed $R_{(ON)}$ measurement (I_O duration ≤30ms), ambient (T_A) and case temperature (T_C) are equal.
6. For the transient rejection measurements, refer to Avago whitepaper, AV01-0610EN, "Solid State Relay Transient Immunity".

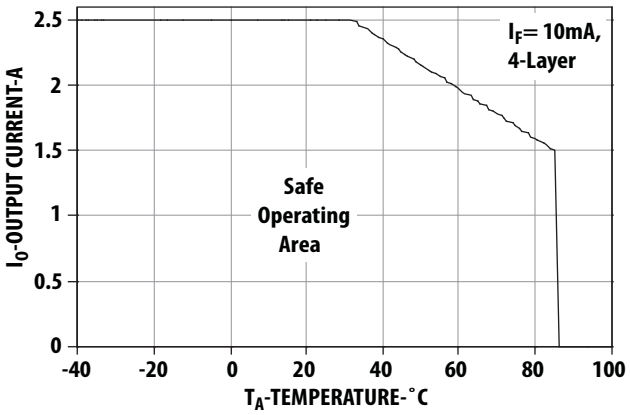


Figure 1. Maximum Output Current rating vs Ambient Temperature (AC/DC Connection)

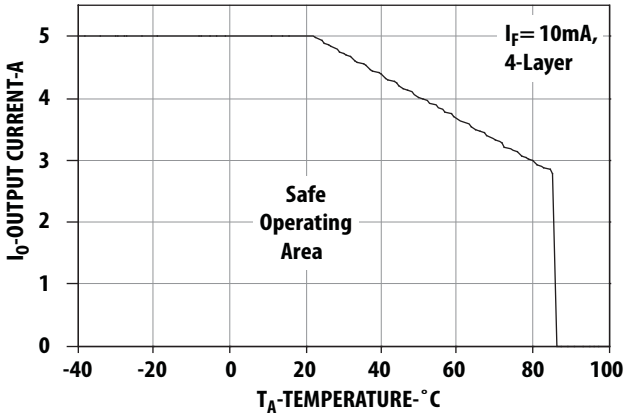


Figure 2. Maximum Output Current rating vs Ambient Temperature (DC Connection)

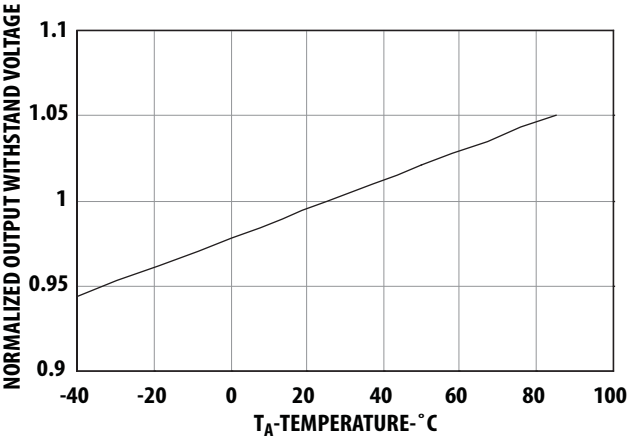


Figure 3. Normalized Typical Output Withstand Voltage vs Ambient Termperature

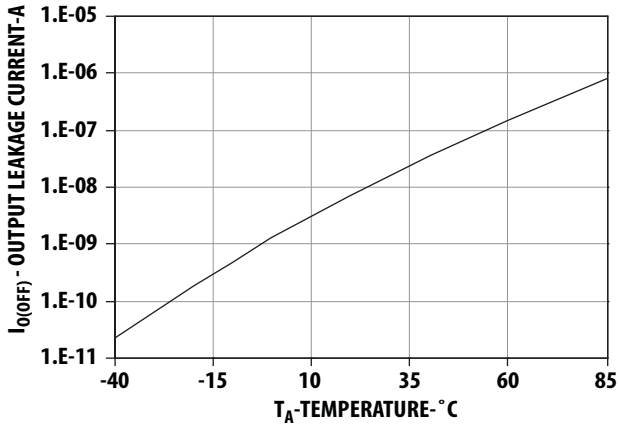


Figure 4. Typical Output Leakage vs Ambient Temperature

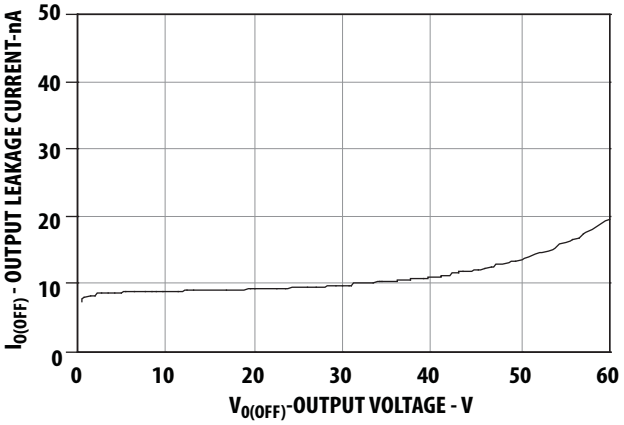


Figure 5. Typical Output Leakage vs Output Voltage

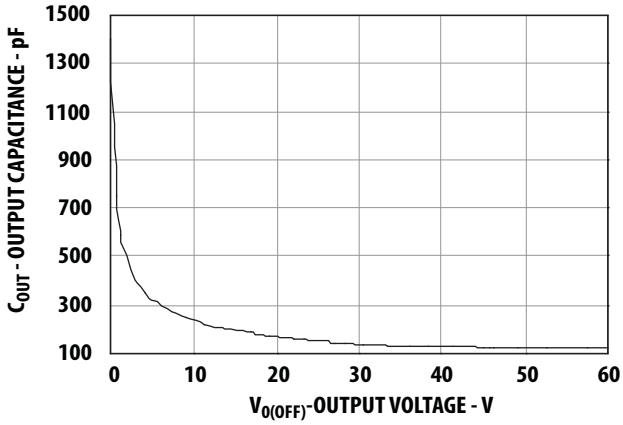


Figure 6. Typical Output Capacitance vs Output Voltage

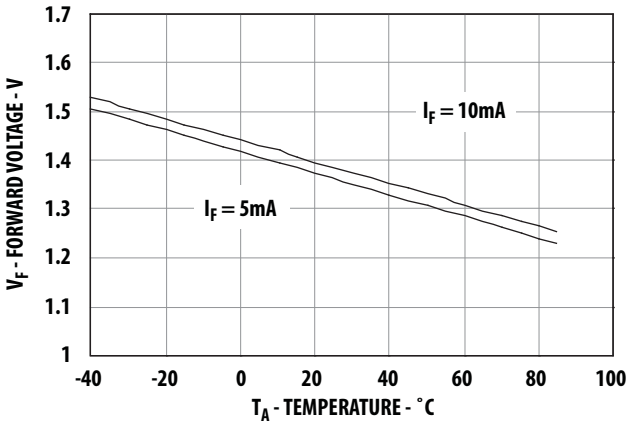


Figure 7. Typical Forward Voltage vs Temperature

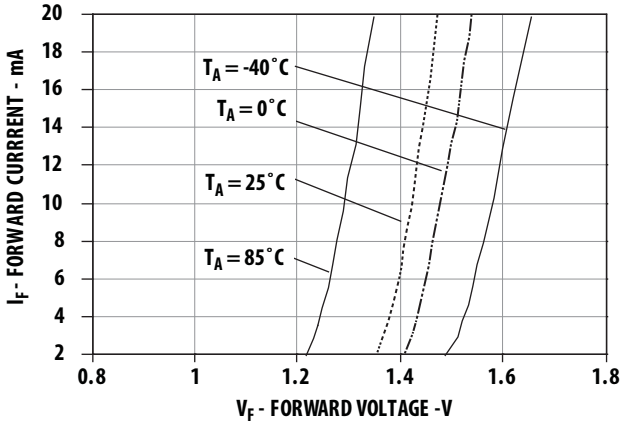


Figure 8. Typical Forward Current vs Forward Voltage over Temperature

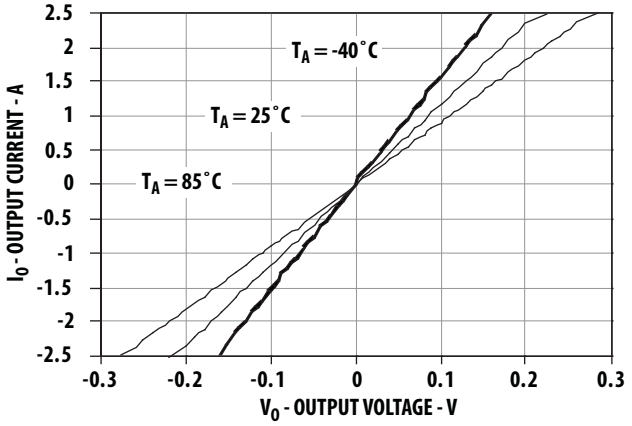


Figure 9. Typical Output Current vs Typical Output Voltage over Temperature

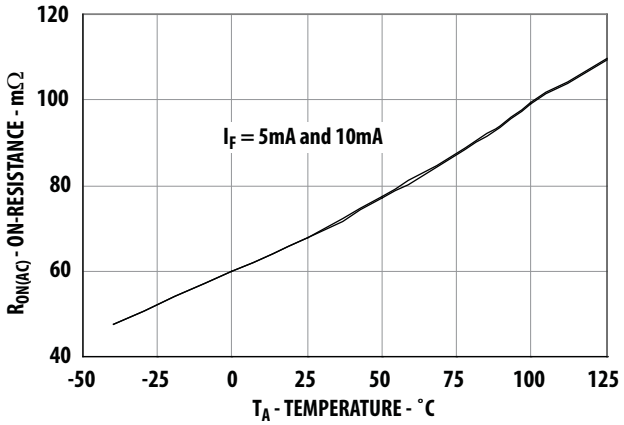


Figure 10. Typical Ron (AC/DC Connection) vs Temperature

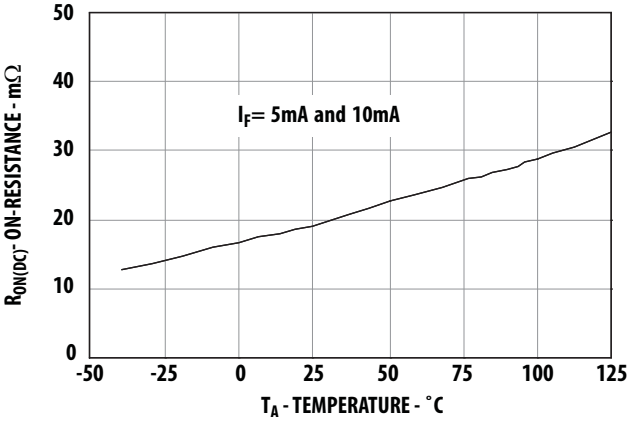


Figure 11. Typical Ron (DC Connection) vs Temperature

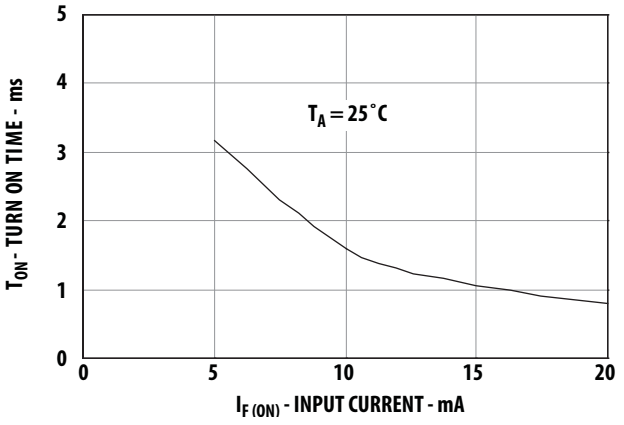


Figure 12. Typical Turn On Time vs Input Current

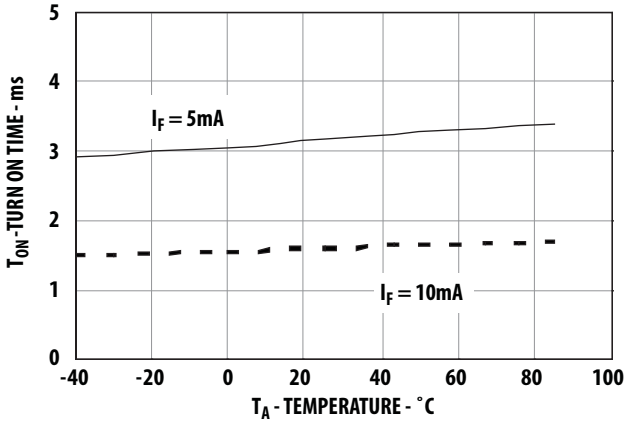


Figure 13. Typical Turn On Time vs Ambient Temperature

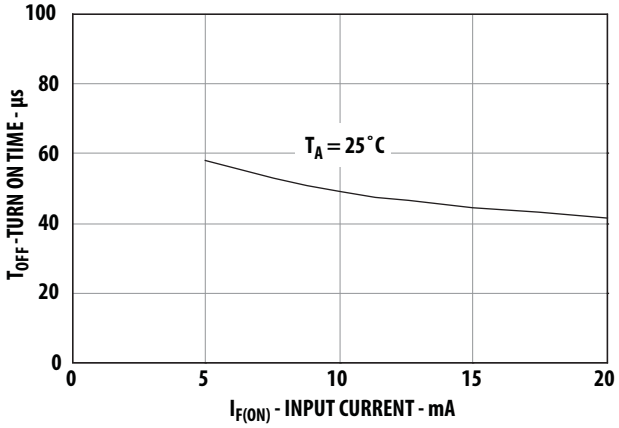


Figure 14. Typical Turn Off Time vs Input Current

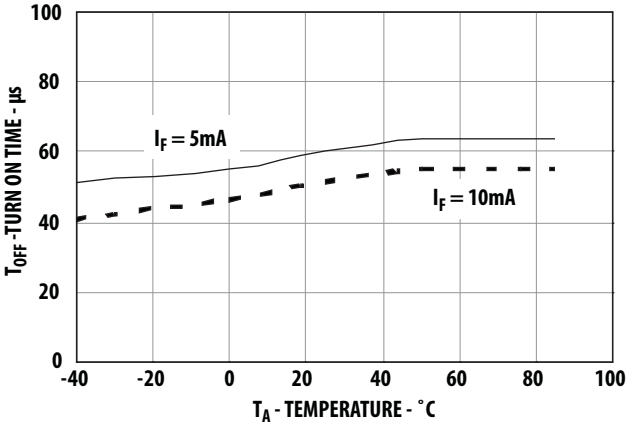


Figure 15. Typical Turn Off Time vs Ambient Temperature

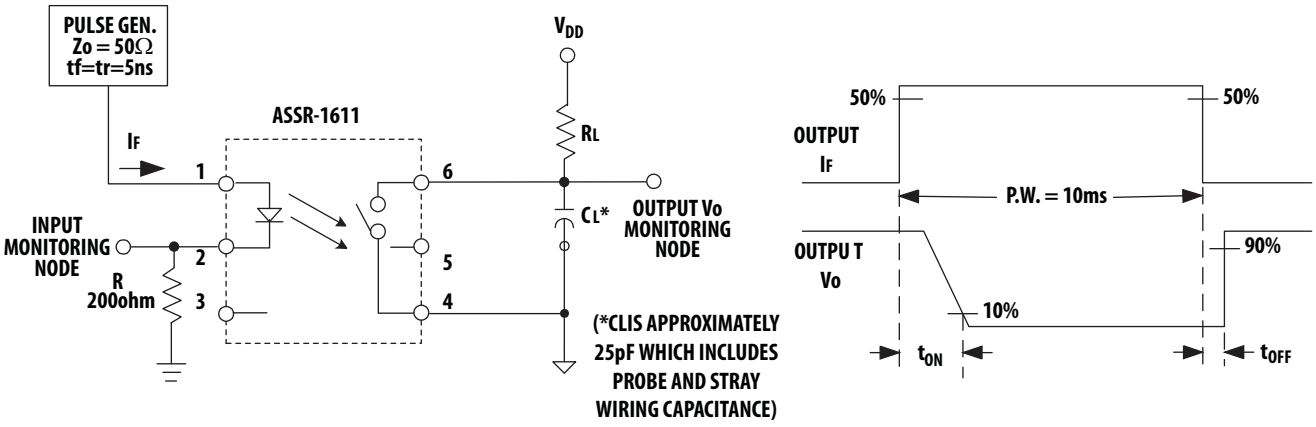
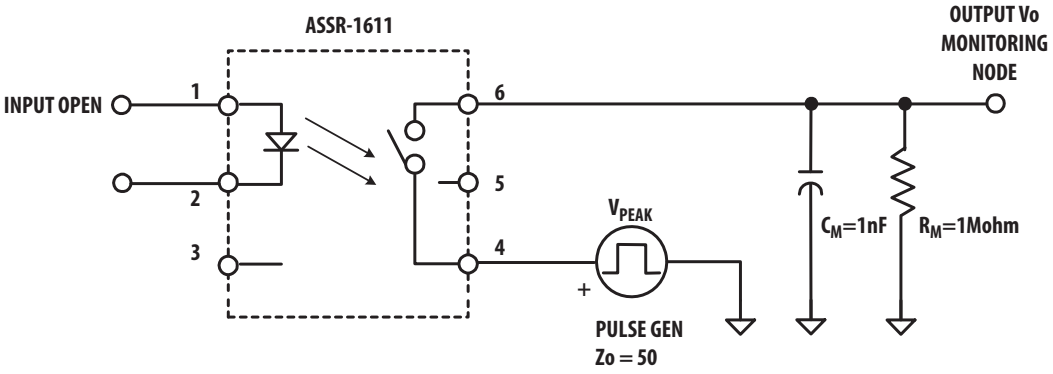
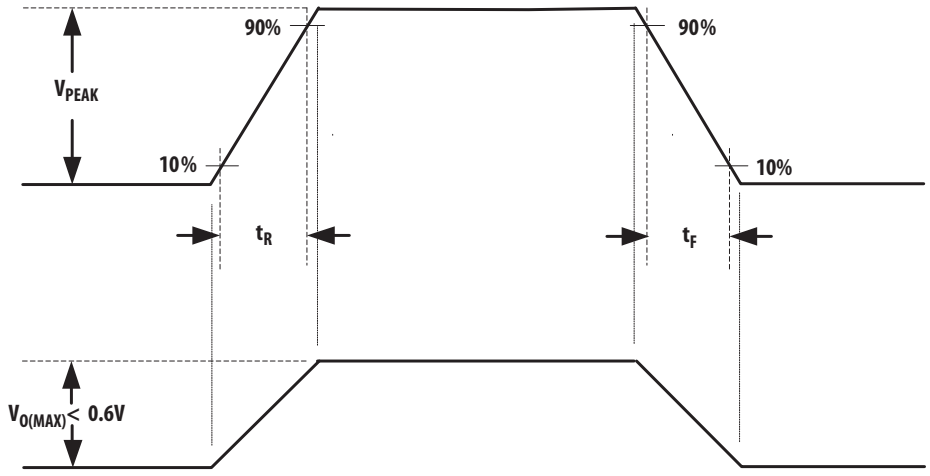


Figure 16. Switching Circuit



C_M INCLUDES PROBE AND FIXTURE CAPACITANCE
R_M INCLUDES PROBE AND FIXTURE RESISTANCE



$$\frac{dV_0}{dt} = \frac{(0.8)V_{PEAK}}{t_R} \text{ OR } \frac{(0.8)V_{PEAK}}{t_F}$$

OVER SHOOT ON V_{PEAK} IS TO BE 10%

Figure 17. Output Transient Rejection Test Circuit

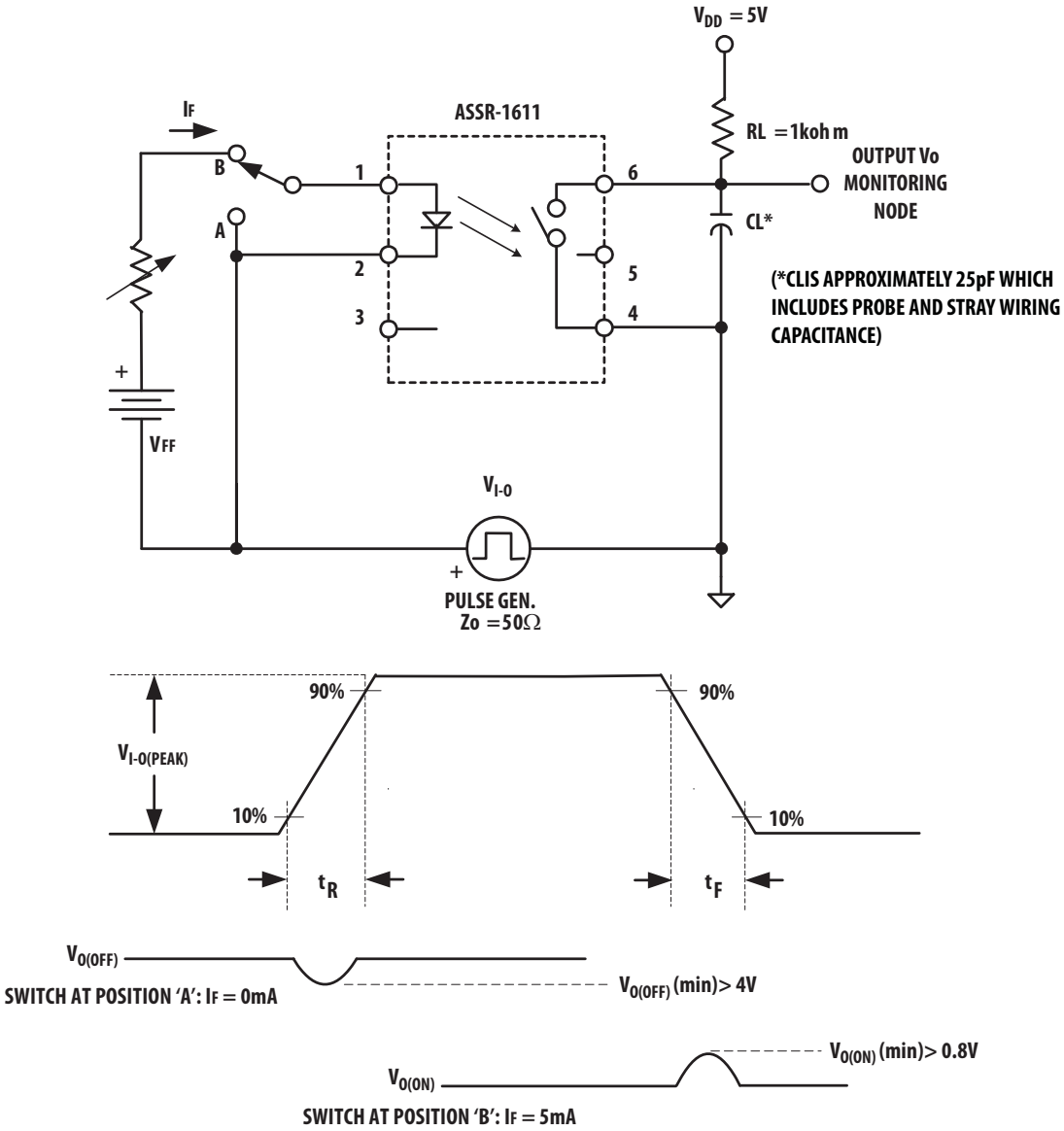


Figure 18. Input-Output Transient Rejection Test Circuit

AV02-1181EN - March 19, 2012