BROADCOM®

Data Sheet

ASSR-5211

High-Current, 1 Form A, Solid State Relay (MOSFET) (600V/0.2A/16Ω)

Description

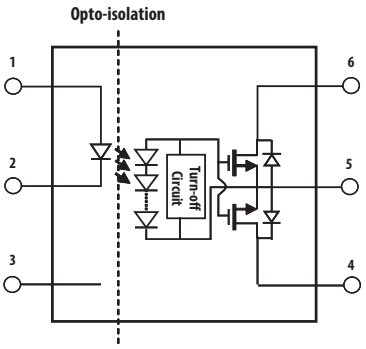
The ASSR-5211 is specifically designed for high-current applications commonly found in the industrial equipment. The relay is a solid-state replacement for single-pole, normally open (1 Form A) electromechanical relays.

The ASSR-5211 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 3 mA through the input LED. The relay turns off (contact opens) with an input voltage of 0.8V or less.

The ASSR-5211 connection A, as shown in the schematic, allows the relay to switch either AC or DC loads. 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 bidirectional signal switch
- Single-channel, normally off, single-pole single-throw (SPST) relay
- 600V output withstand voltage
- 0.2A or 0.4A current rating
- Low input current: CMOS compatibility
- Low on-resistance:
  2.5Ω typical for DC-only, 10Ω typical for AC/DC
- High-speed switching:
  0.7 ms (T_{ON}), 0.07 ms (T_{OFF}) typical @ I_F = 5 mA
- High transient immunity: >1 kV/µs
- High input-to-output insulation voltage
  (safety and regulatory approvals pending)
  - 3750 V_{RMS} for 1 minute per UL1577
  - CSA Component Acceptance
  - 5000-V_{RMS}/1-minute rating is for option X21* only (Please consult your regional Broadcom representative.)

Applications

- Industrial controls
- Factory automation
- Data acquisition
- Measuring instruments
- Medical systems
- Security systems
- EMR / reed relay replacement

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 Table

The ASSR-5211 is UL recognized with 3750 V_{RMS} and 5000 V_{RMS} (option x21* [a]) for 1 minute per UL1577 and is approved under CSA Components Acceptance Notice #5.

Part Number	Option RoHS Compliant	Package	Surface Mount	Gull Wing	Tape & Reel	Quantity
ASSR-5211	-001E	300-mil DIP-6				50 units per tube
	-301E		X	X		
	-501E		X	X	X	1000 units per reel

a. x21* – Please consult your regional Broadcom representative.

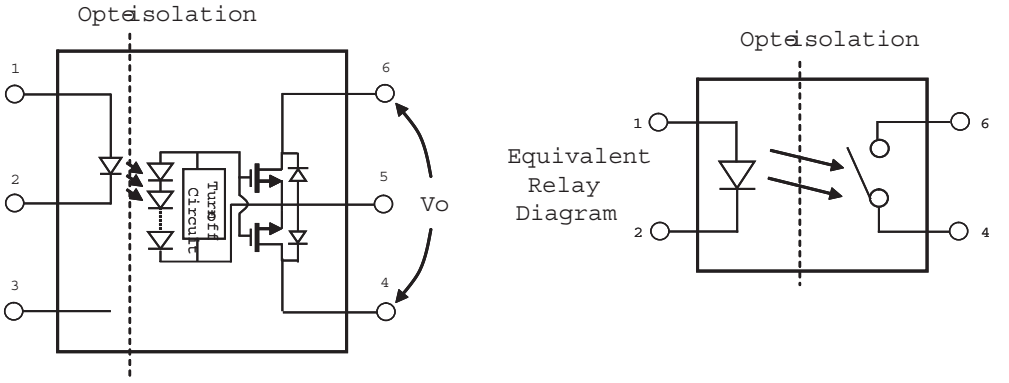
To form an order entry, choose a part number from the Part Number column and combine IT with the desired option from the Option column.

Example 1:

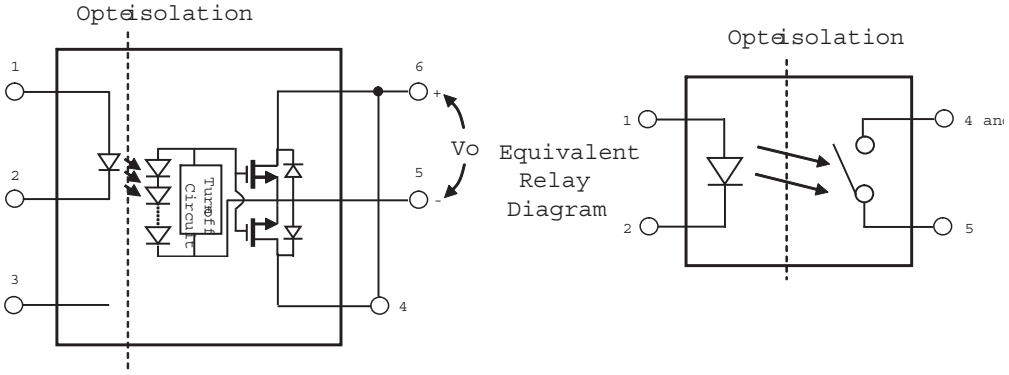
Use ASSR-5211-501E to order the product with a 300-mil DIP-6, gull-wing, surface-mount package in tape and reel packaging and RoHS compliant.

Schematic

Connection A – AC/DC

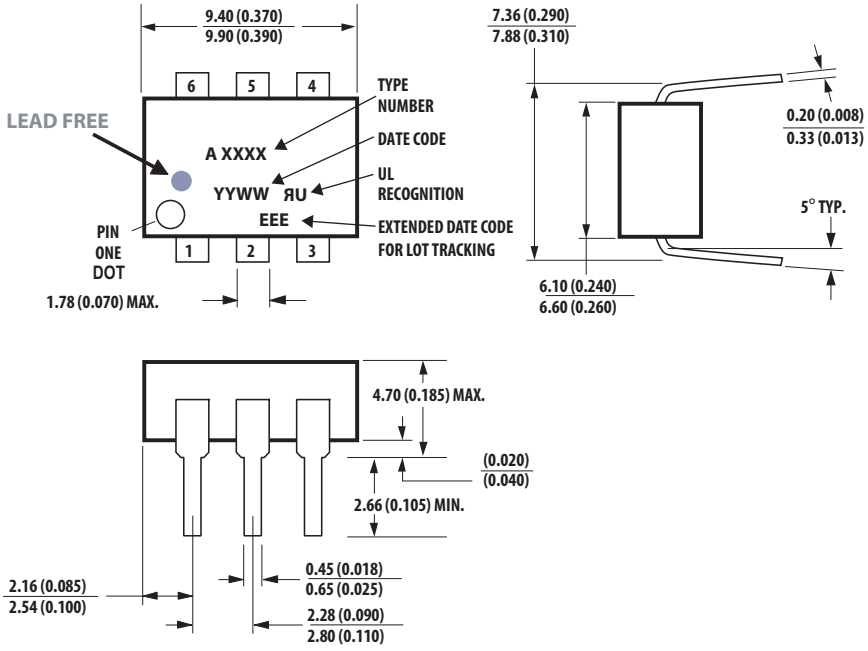


Connection B – DC Only



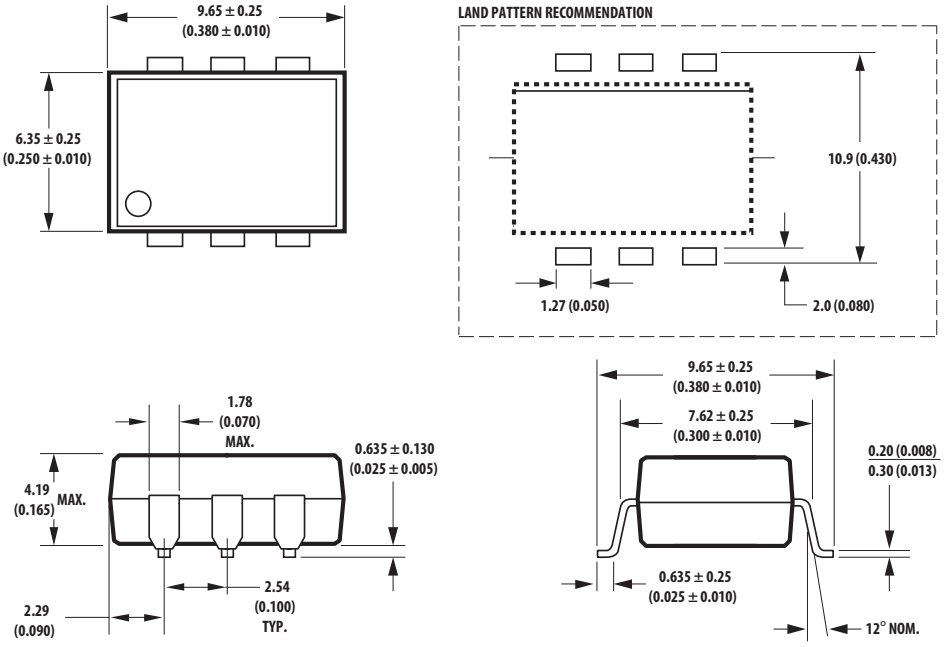
Package Outline Drawings

ASSR-5211 6-Pin DIP Package



NOTE: Dimensions are in millimeters and (inches).

ASSR-5211 6-Pin DIP Package with Gull-Wing Surface-Mount Option 300



NOTE: Floating lead protrusion is 0.25 mm (10 mil) maximum.

Solder Reflow Temperature Profile

The recommended reflow condition is as per JEDEC standard J-STD-020 (latest revision). Nonhalide flux should be used.

Regulatory Information

The ASSR-5211 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-5211	Units	Conditions
Minimum External Air Gap (Clearance)	L(101)	7.1	mm	Measured from input terminals to output terminals, shortest distance the through air.
Minimum External Tracking (Creepage)	L(102)	7.4	mm	Measured from input terminals to output terminals, shortest distance path along the 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 the 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	seconds	
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	—	640	mW	
	Connection B		—	640	mW	
Average Output Current (T_A = 25°C, T_C ≤ 100°C)	Connection A	I_O	—	0.2	A	
	Connection B		—	0.4	A	
Output Voltage (T_A = 25°C)	Connection A	V_O	–600	600	V	a
	Connection B		0	600	V	
ESD Human Body Model: MIL-STD-883 Method 3015.7		—	—	4	kV	
Solder Reflow Temperature Profile		See the lead-free IR profile.				

a. For derating, see Figure 1 and Figure 2.

Recommended Operating Conditions

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

Package Characteristics

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

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions	Note
Input-Output Momentary Withstand Voltage	VISO	3750	—	—	V_{RMS}	RH ≤ 50%, t = 1 minute, T_A = 25°C	a, b
		5000				RH ≤ 50%, t = 1 minute, T_A = 25°C, option x21	
Input-Output Resistance	R_{I-O}	—	10^{14}	—	Ω	V_{I-O} = 500 Vdc	a
Input-Output Capacitance	C_{I-O}	—	0.8	—	pF	V_{I-O} = 0 Vdc, f = 1 MHz	a

a. The device is considered as a two-terminal device: pins 1, 2, and 3 are shorted together, and pins 5, 6, and 7 are shorted together.

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)

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

Parameter		Symbol	Min.	Typ.	Max.	Units	Conditions	Figure	Note
Output Withstand Voltage		$\lvert V_{O(OFF)} \rvert$	600	650	—	V	V_F = 0.8V, I_O = 250 µA, T_A = 25°C		
			550	—	—	V	V_F = 0.8V, I_O = 250 µA		
Output On-Resistance	Connection A	$R_{(ON)}$	—	10	16	Ω	I_F = 5 mA, I_O = 0.2A, Pulse ≤ 30 ms, T_A = 25°C	3, 10	a
	Connection B	$R_{(ON)}$	—	2.5	4	Ω	I_F = 5 mA, I_O = 0.4A, Pulse ≤ 30 ms, T_A = 25°C	11	a
Output Leakage Current		$I_{O(OFF)}$	—	0.001	0.1	µA	V_F = 0.8V, V_O = 600V, T_A = 25°C	5	
			—	—	1	µA	V_F = 0.8V, V_O = 550V	4	
Output Off-Capacitance		$C_{(OFF)}$	—	500	—	pF	V_F = 0.8V, V_O = 0V, f = 1 MHz	6	
Output Offset Voltage		$\lvert V_{(OS)} \rvert$	—	1	—	µV	I_F = 5 mA, I_O = 0 mA		
Input Reverse Breakdown Voltage		V_R	5	—	—	V	I_R = 10 µA		
Input Forward Voltage		V_F	1.1	1.3	1.7	V	I_F = 5 mA	7, 8	

a. For the transient rejection measurements, refer to the Broadcom white paper AV01-0610EN, *Solid State Relay Transient Immunity*.

Switching Specifications (AC)

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

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions	Figure	Note
Turn-On Time	T_{ON}	—	0.7	2.5	ms	I_F = 5 mA, I_O = 0.2A, T_A = 25°C	12, 17	
		—	—	5.0	ms	I_F = 5 mA, I_O = 0.2A	13, 17	
		—	0.4	1.5	ms	I_F = 10 mA, I_O = 0.2A, T_A = 25°C	12, 17	
		—	—	3.0	ms	I_F = 10 mA, I_O = 0.2A	13, 17	
Turn-Off Time	T_{OFF}	—	0.07	0.5	ms	I_F = 5 mA, I_O = 0.2A, T_A = 25°C	14, 17	
		—	—	1	ms	I_F = 5 mA, I_O = 0.2A	15, 17	
		—	0.06	0.2	ms	I_F = 10 mA, I_O = 0.2A, T_A = 25°C	14, 17	
		—	—	0.5	ms	I_F = 10 mA, I_O = 0.2A	15, 17	
Output Transient Rejection	dV_O/dt	1	7	—	kV/µs	ΔV_O = 600V, R_M ≥ 1 MΩ, C_M = 1000 pF, T_A=25°C	17	a
Input-Output Transient Rejection	dV_{I-O}/dt	1	20	—	kV/µs	V_{DD} = 5V, ΔV_{I-O} = 1000V, R_L = 1 kΩ, C_L = 25 pF, T_A = 25°C	18	a

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

Figure 1: Maximum Output Current Rating vs Ambient Temperature (AC/DC Connection)

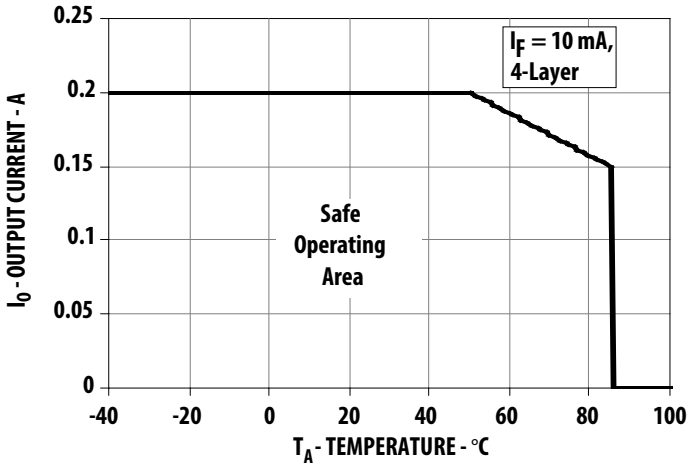


Figure 2: Maximum Output Current Rating vs Ambient Temperature (DC Connection)

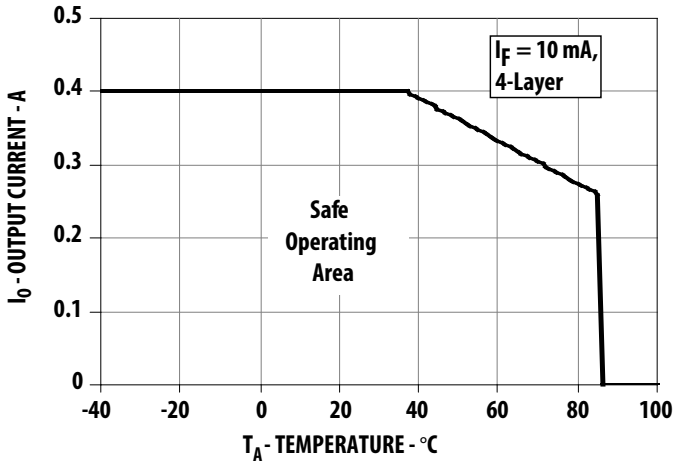


Figure 3: Normalized Typical Output Withstand Voltage vs Temperature

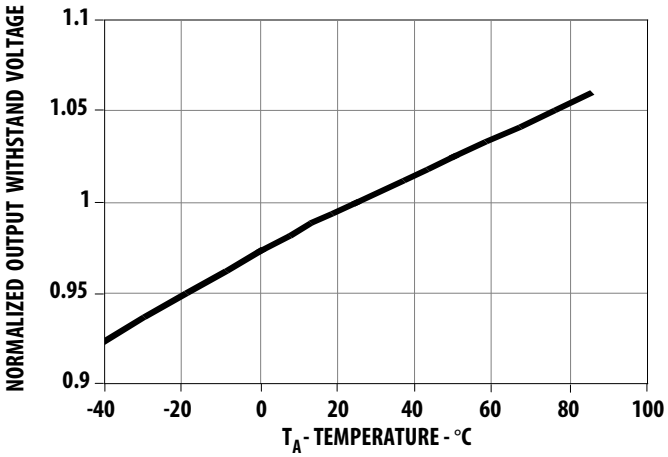


Figure 4: Typical Output Leakage Current vs Ambient Temperature

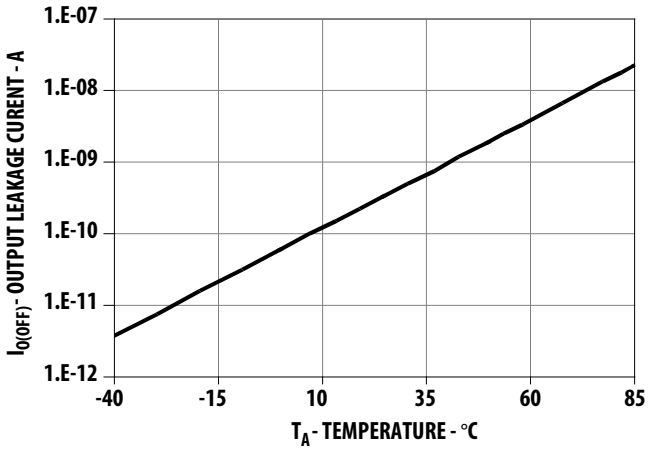


Figure 5: Typical Output Leakage Current vs Output Voltage

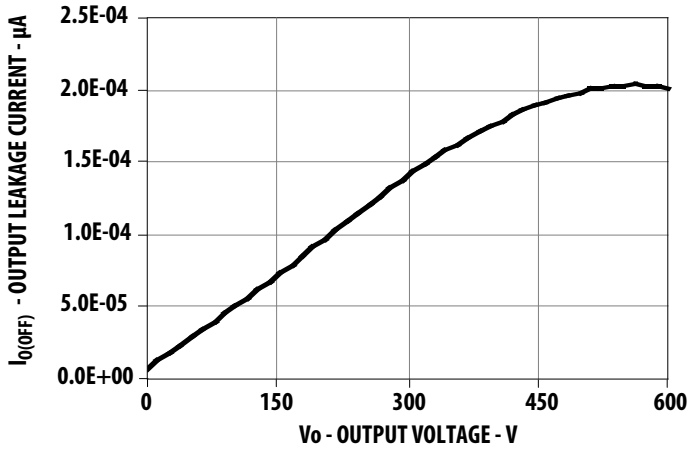


Figure 6: Typical Output Off-State Capacitance vs Output Voltage

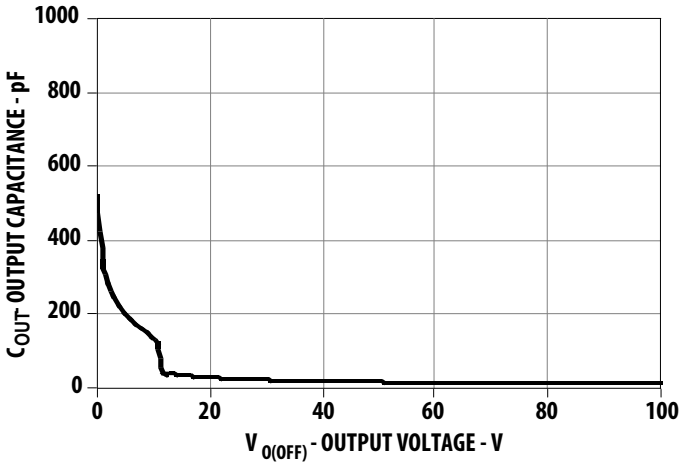


Figure 7: Typical Forward Voltage vs Ambient Temperature

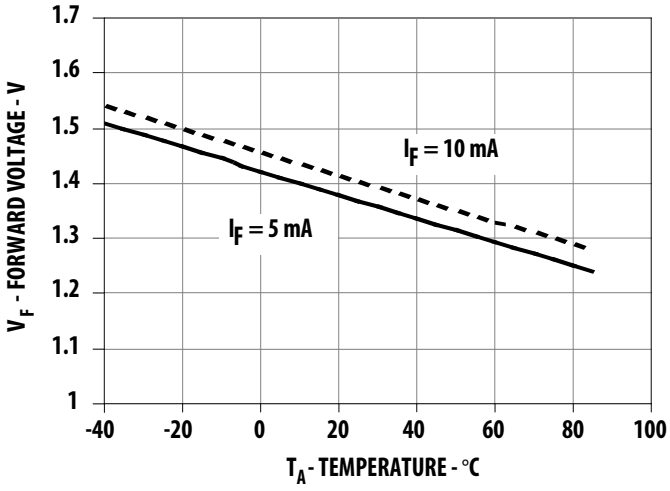


Figure 8: Typical Forward Current vs Forward Voltage

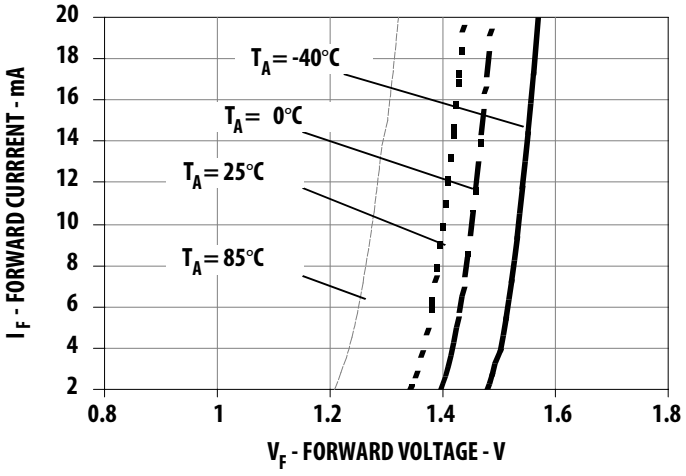


Figure 9: Typical Output Current vs Output Voltage

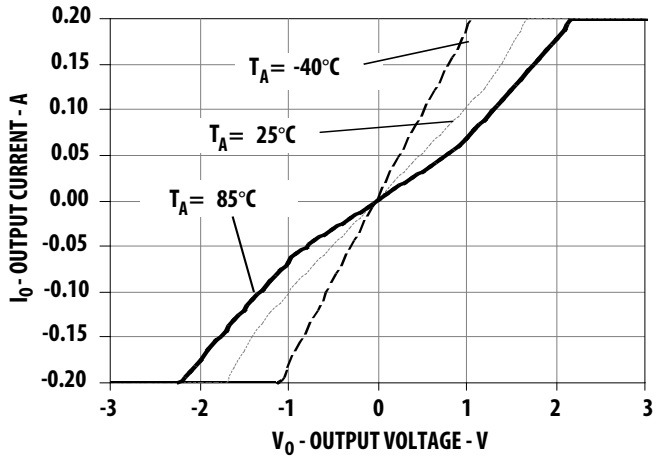


Figure 10: Typical On-Resistance (AC/DC Connection) vs Temperature

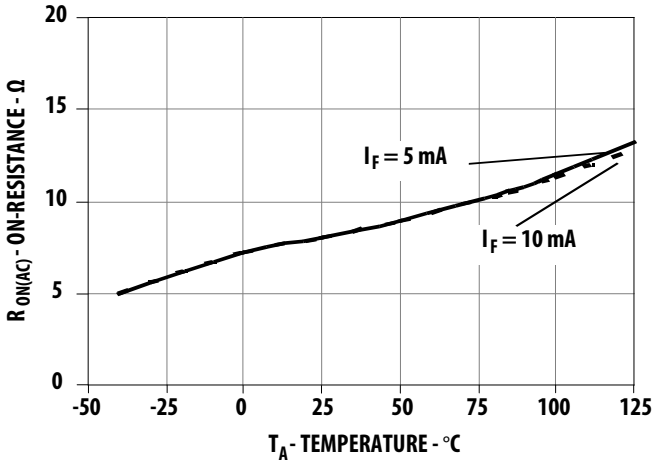


Figure 11: Typical On-Resistance (DC Connection) vs Temperature

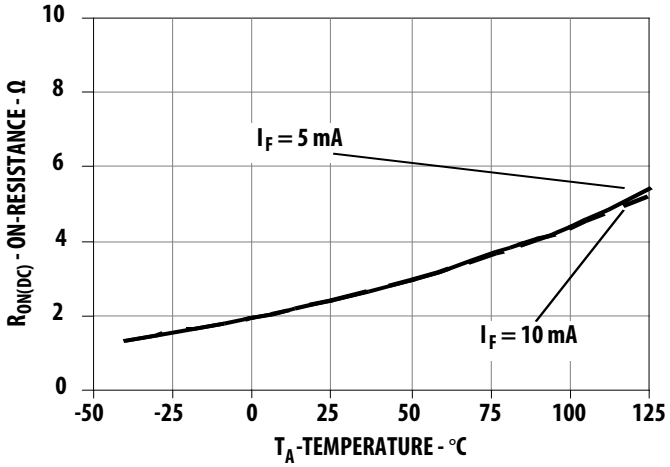


Figure 12: Typical Turn-On Time vs Input Current

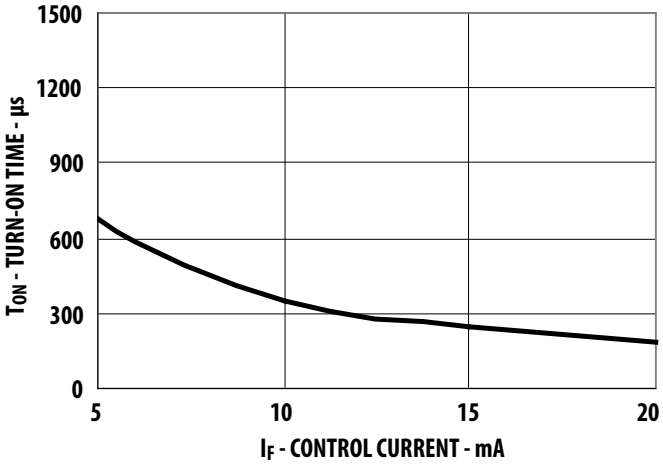


Figure 13: Typical Turn-On Time vs Temperature

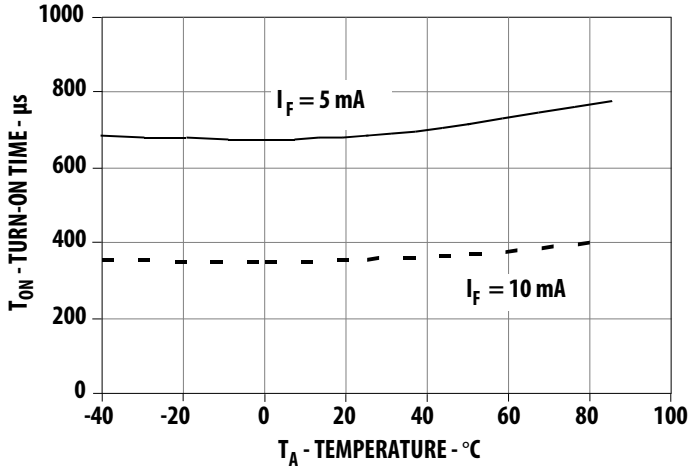


Figure 14: Typical Turn-Off Time vs Input Current

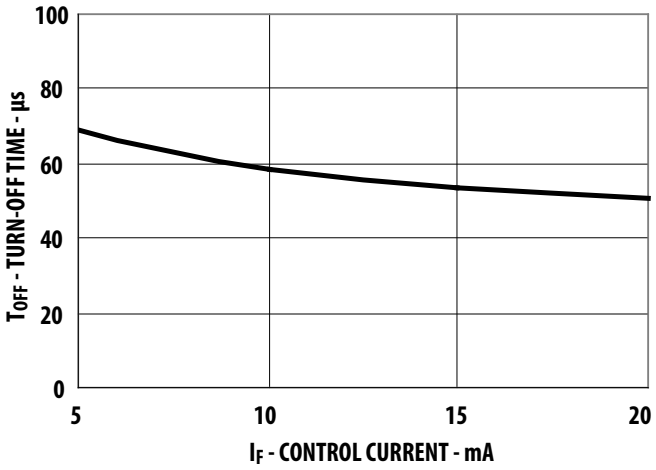


Figure 15: Typical Turn-Off Time vs Temperature

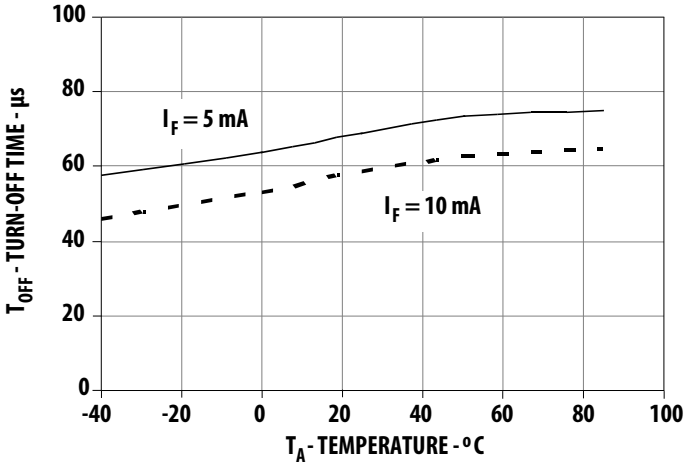


Figure 16: Switching Circuit for T_{ON}, T_{OFF}

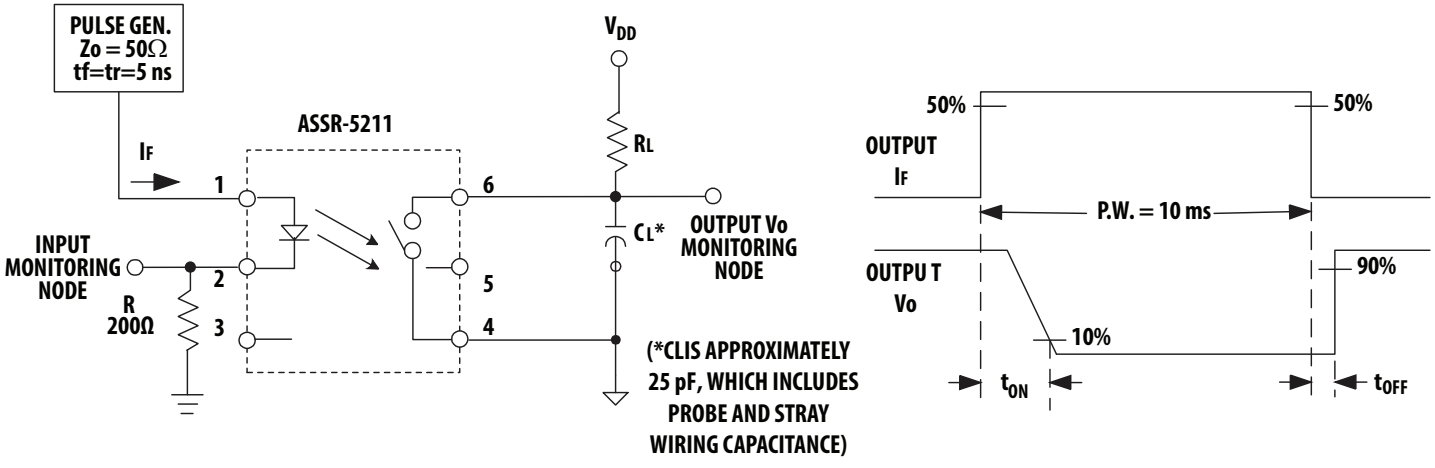
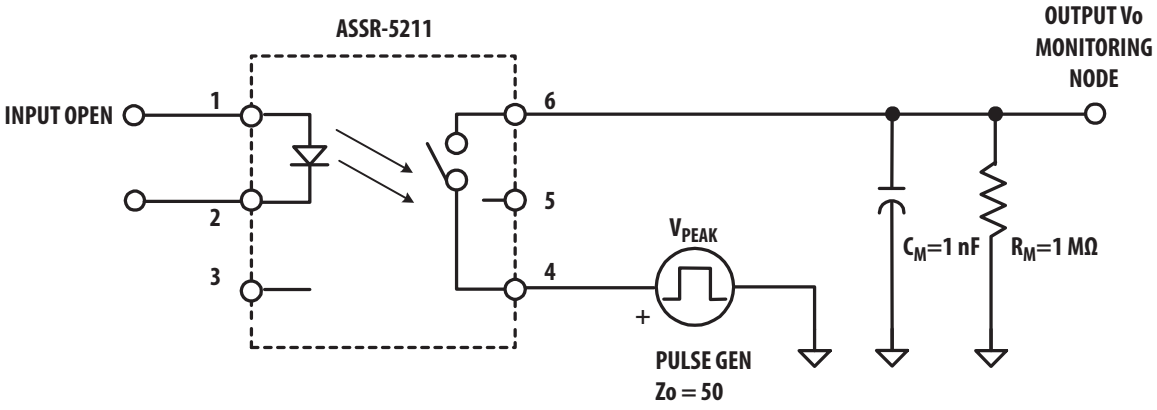
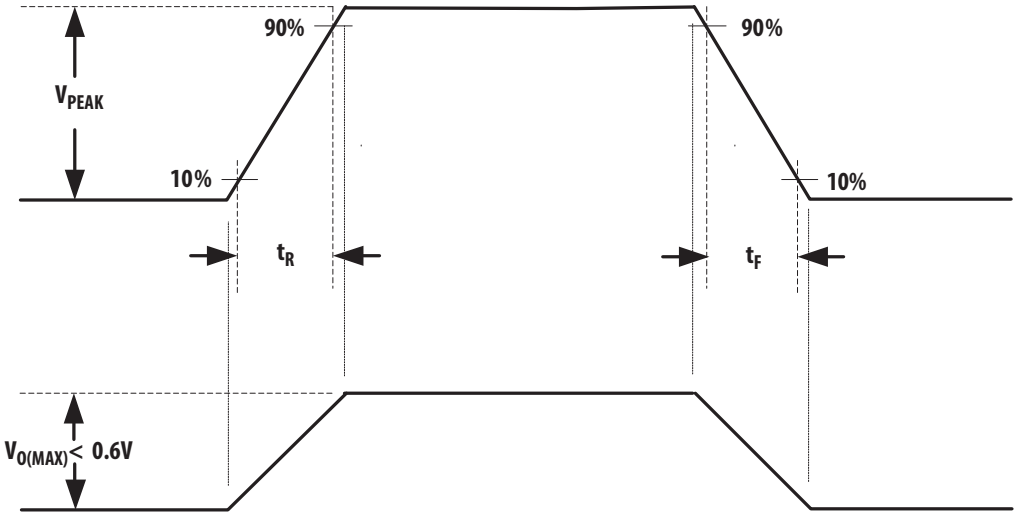


Figure 17: Test Circuit for Output Transient Immunity



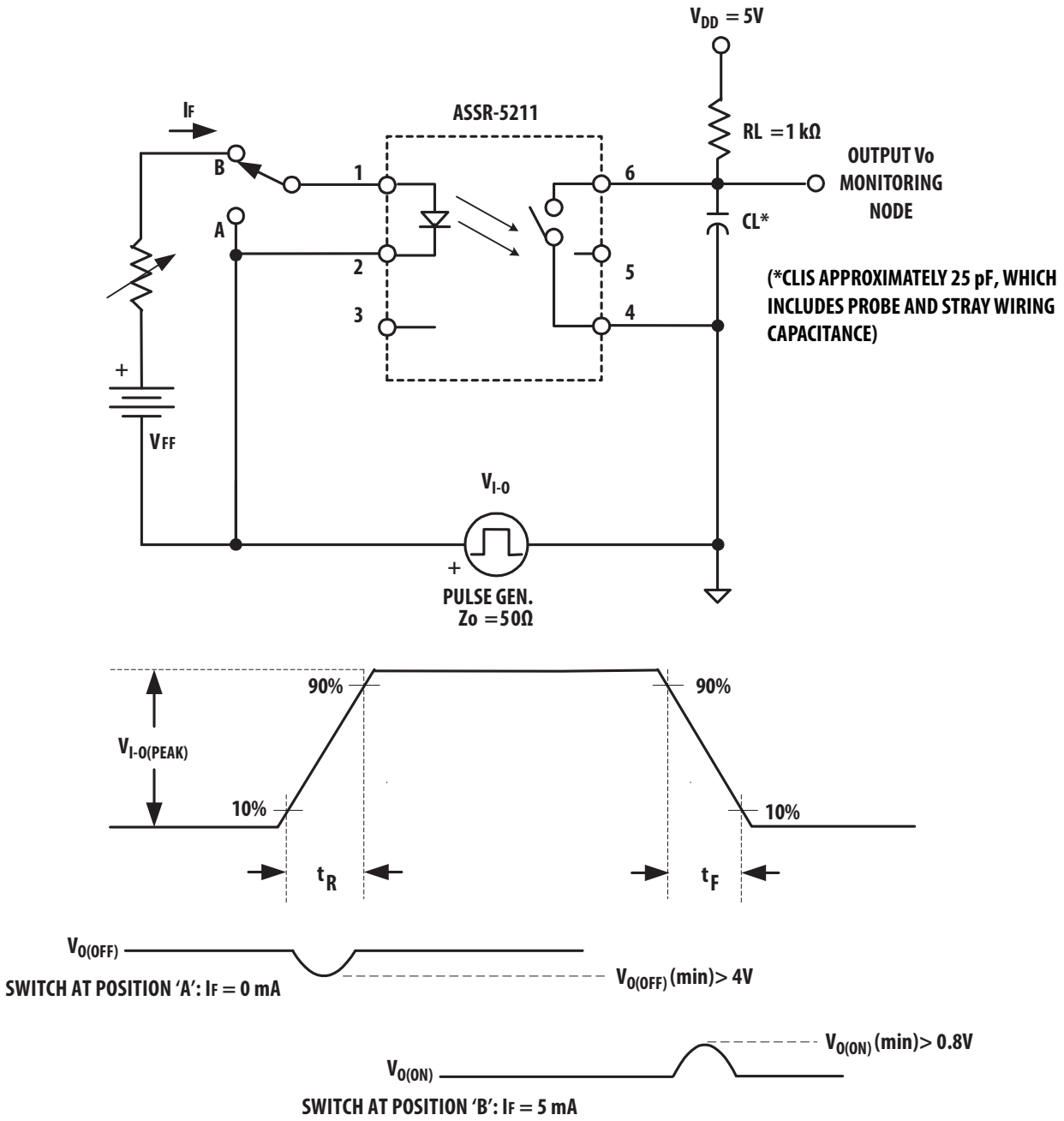
C_M INCLUDES PROBE AND FIXTURE CAPACITANCE
R_M INCLUDES PROBE AND FIXTURE RESISTANCE



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

OVERSHOOT ON V_{PEAK} IS TO BE 10%

Figure 18: Test Circuit for Input-Output Transient Immunity



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RoHS 6 fully compliant

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-xxxE denotes a lead-free product