



ORIENT

Photo coupler

Product Data Sheet

Part Number: OR-601JX

Customer: _____

Date: _____

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1. Features

- (1) Battery Control in Automotive Equipment
- (2) Fuel Battery Control in Automotive Equipment
- (3) Application for Electrical Vehicle
- (4) Normally open (1-Form-A) device
- (5) Isolation voltage: 5000 Vrms (min)
- (6) Low operating current: 3 mA (max)
- (7) 1,500V load voltage
- (8) Low on resistance: $250\Omega(\text{max})(@ t < 1 \text{ s})$
- (9) Package: 300 mil SO-16
- (10) Wide operating temperature range of -40°C to 125°C
- (11) Safety approval
 - UL approved(No.E323844)
 - VDE approved(No.40029733)
 - CQC approved (No.CQC19001231480)
- (12) In compliance with RoHS, REACH standards
- (13) MSL Level 1

2. Description

The OR-601J consists of an infrared emitting diode optically coupled to a photo-MOSFET in a SO16 package.

This coupler uses high voltage MOSFET between output terminals.

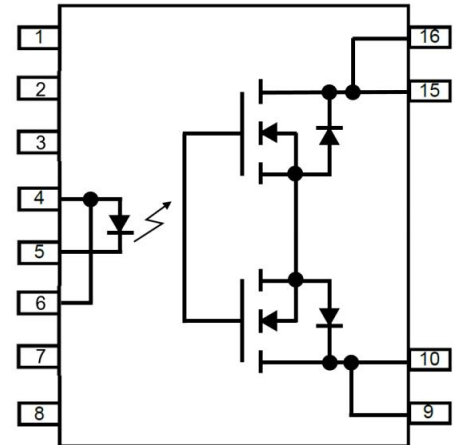
It adequate for the automotive control applications with a battery voltage of 1000V or less in an environment with a pollution degree 2 since the creepage distance on the detector side is 5mm or more.

3. Application Range

- Battery/motor/solar panel insulation resistance measurement/leakage detection
- BMS flying capacitor topology for sensing batteries
- Electro mechanical relay replacement
- Inrush current limiter protection



Pin Configuration (top view)



Pin Configuration

1:NC	9:Drain
2:NC	10:Drain
3:NC	15:Drain
4:Anode	16:Drain
5:Cathode	
6:Anode	
7:NC	
8:NC	

4. Absolute Maximum Rating (Unless otherwise specified, Ta = 25°C) (Note)

Parameter			Symbol	Rating	Unit
Input	Forward Current		IF	30	mA
	Reverse Voltage		VR	5	V
	Input Power Dissipation		PD	50	mW
	Junction temperature		Tj	135	°C
Detector	On-state current	Ta = 25 °C	ION	50	mA
		Ta = 105 °C		20	mA
		Ta = 125 °C		10	mA
	On-state current (Peak) (Note 3)	Ta = 25 °C	IONpk	150	mA
		Ta = 105 °C		60	mA
		Ta = 125 °C		30	mA
	Avalanche current (Note 1)		I _{AV}	0.6	mA
	Output power dissipation		PO	600	mW
	Junction temperature		Tj	135	°C
Isolation Voltage(AC, 60 s, R.H. ≤ 60%) (Note 2)			V _{iso}	5000	V _{rms}
Storage Temperature			T _{STG}	-55 to 150	°C
Operating Temperature			T _{OPR}	-40 to 125	°C
Soldering Temperature			T _{SOL}	260	°C

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings. Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note: This product is more sensitive than conventional products to electrostatic discharge (ESD). It is therefore all the more necessary to observe general precautions regarding ESD when handling this component.

Note 1: 1min (max. continuous), Duty cycle=0.1%, 5 time over lifetime.

Note 2: LED pins are shorted together. Detector pins are also shorted together.

Note 3: Exponential curve, pulse width < 1ms, f ≤ 150Hz

5. Recommended Operating Conditions (Note)

Characteristics		Symbol	Min	Typ.	Max	Unit
Supply voltage		VDD	---	---	1000	V
Forward current		IF	5	10	20	mA
On-state current		ION	---	---	50	mA
Operating temperature	601J	Topr	-40	---	125	°C
	601JV		-40	---	105	°C
	601JT		-40	---	125	°C

Note: Recommended operating conditions are given as a design guideline to obtain expected performance of the device. Additionally, each item is an independent guideline respectively. In developing designs using this product, please confirm specified characteristics shown in this document.

6. Electrical Optical Characteristics at Ta=25°C

Unless otherwise stated, all minimum/maximum specifications are over recommended operating conditions. All typical values are at TA = 25°C, IF = 10 mA.

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition
Input	Forward Voltage	VF	---	1.35	1.85	V	IF = 10mA
	Reverse Current	IR	---	---	10	μA	VR = 5V
Detector	Output Withstand Voltage	VO(OFF)	1500	1700	---	μA	IO = 250 μA, TA = 25°C
	Output Leakage Current	601J	---	1	10	nA	VO = 1000V, TA = 25°C
		601JV	---	1	1000	nA	VO = 1000V, TA = 25°C
		601JT	---	1	5000	nA	VO = 1000V, TA = 25°C
	Output Capacitance	C(out)	---	190	---	pF	VO = 0V, f = 1 MHz
	Output Resistance	RON	---	77	300	Ω	IO = 2 mA
			---	77	250	Ω	IO = 10 mA
			---	45	250	Ω	IO = 50 mA, TA = 25°C
Transfer Characteristics	LED turn on current	IFon	---	1.1	3	mA	ION = 50 mA, Ta=25 °C, t = 10 ms
			---	---	3	mA	ION = 20 mA, Ta= -40 to 105 °C, t = 10 ms
			---	---	3	mA	ION = 10 mA, Ta= -40 to 125 °C, t = 10 ms
	LED turn off Current	IF(off)	0.05	---	---	mA	IOFF = 100 μA, Ta= -40 to 125 °C, t = 40 ms
	Turn On Time	Ton	---	0.8	4.0	ms	IF = 10 mA, VDD = 4V, RLOAD = 2 kΩ
	Turn Off Time*	Toff	---	0.3	1.0	ms	IF = 30 mA, VDD = 4V, RLOAD = 2 kΩ
	Isolation Resistance	RI-O	5×10 ¹⁰	1×10 ¹²	---	Ω	VI-O = 1000 VDC
	Isolation Capacitance	CI-O	---	0.6	---	pF	V = 0V, f = 1MHz



7. Order Information

Part Number

OR-601JX-Y-Z

Note

601JX = Part Number,(X=none, V or T)

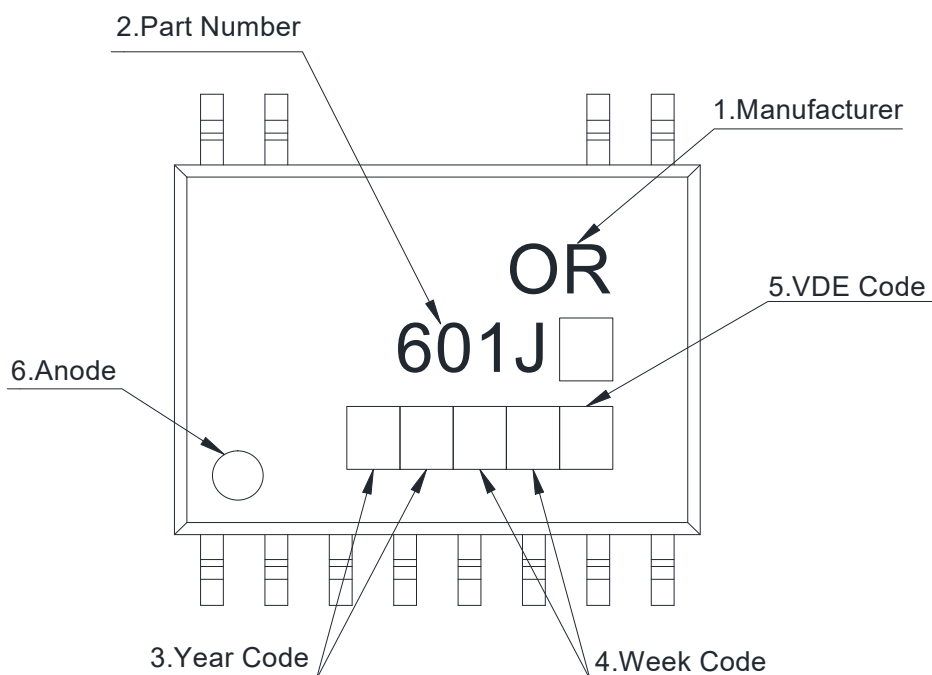
Y = Tape and reel option (TA,TA1 or none).

Z = 'V' code for VDE safety (This options is not necessary).

* VDE Code can be selected.

Option	Description	Packing quantity
TP1	TP1 tape & reel option	850 units per reel

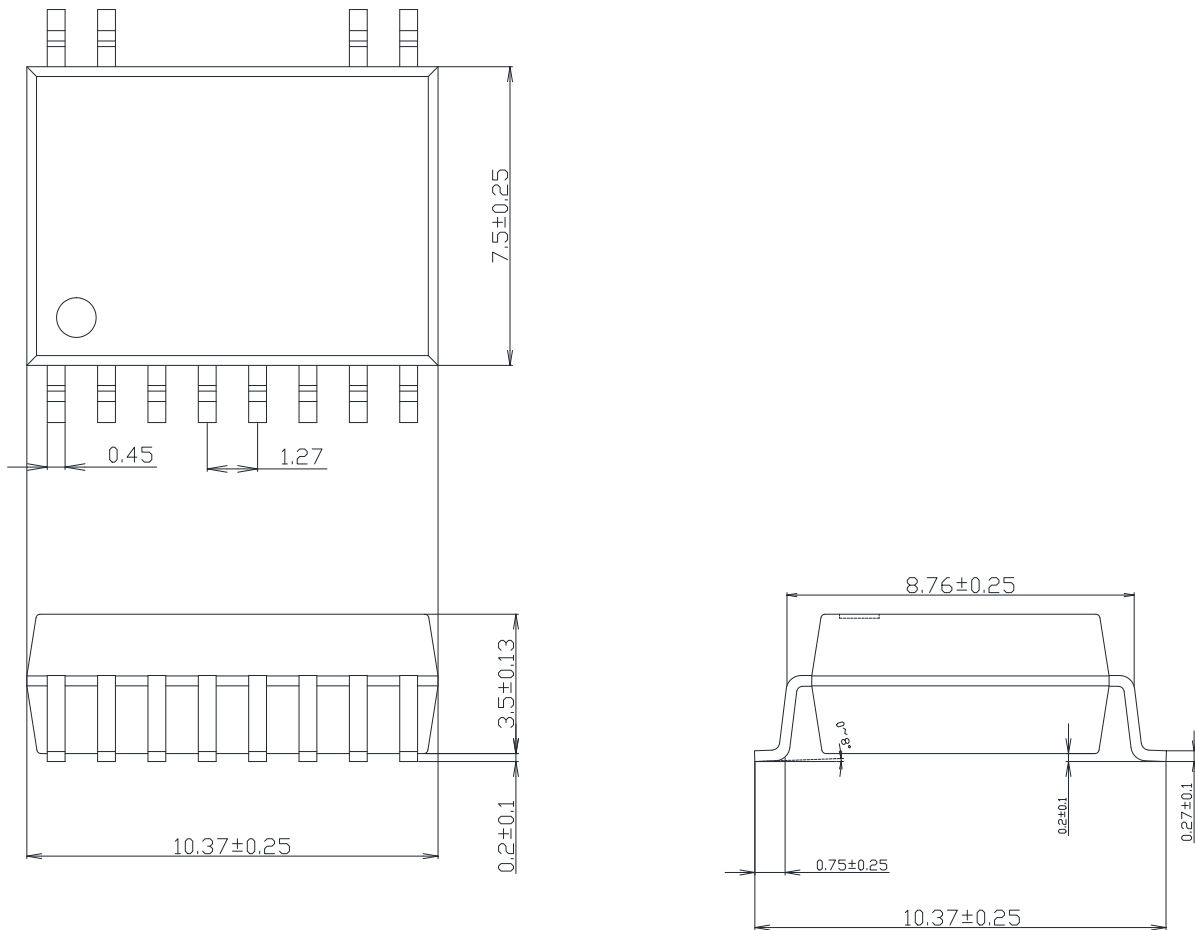
8. Naming Rule



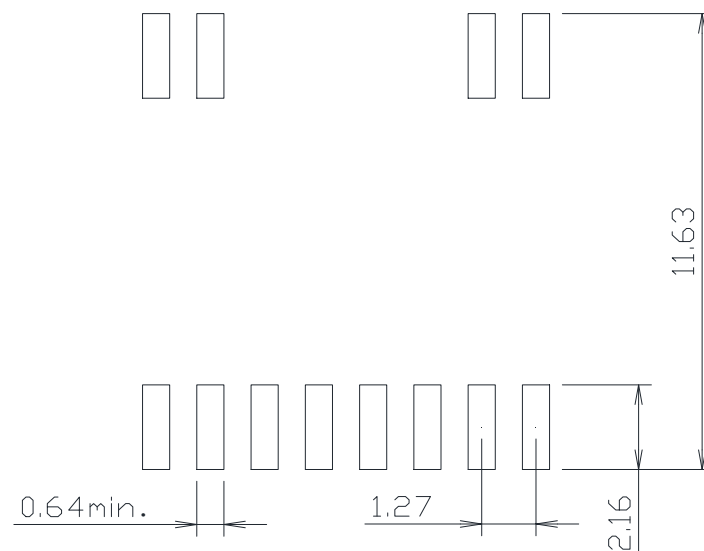
1. Manufacturer : ORIENT.
2. Part Number : 601J, (X=none, V or T)
3. Year Code : '23' means '2023' and so on.
4. Week Code : 01 means the first week, 02 means the second week and so on.
5. VDE Code : (Optional)
6. Anode.

9. Package Dimension

(1).OR-601J



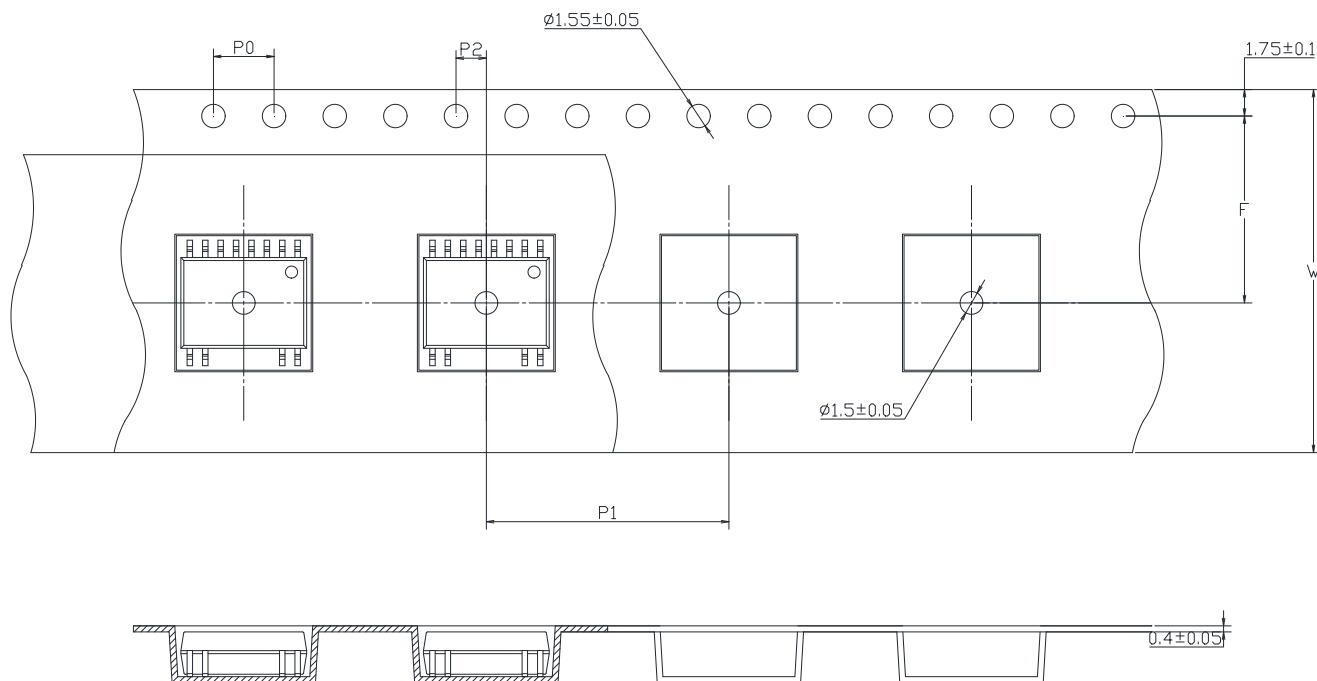
10. Recommended pad layout for surface mount leadform



Unit: mm

11. Taping Dimensions

(1).OR-601J-TP1



Description	Symbol	Dimension in mm (inch)
Tape wide	W	16±0.3 (0.63)
Pitch of sprocket holes	P_0	4±0.1 (0.15)
Distance of compartment	F	11.5±0.1 (0.452)
	P_2	2±0.1 (0.079)
Distance of compartment to compartment	P_1	16±0.1 (0.472)

Package Type	OR-601J
Quantities(pcs)	850




12. Package Dimension

(1) package dimension

SOP type

Packing Information	
Packing type	Reel type
Tape Width	16mm
Qty per Reel	850pcs
Small box (inner) Dimension	345*345*58.5mm
Large box (Outer) Dimension	620x360x360mm
Max qty per small box	1700pcs
Max qty per large box	17,000pcs

(2)Packing Label Sample


Material Code : 120PCXXXXXX
P/N : OR-XXXXXX
Lot No. : XXXXXX-XXXXX-TX-X
D/C : XXXX
Qty : XXXX PCS

内箱码

外箱码

“XXXXXXXXXXXXXXXX” (一体机序列码)
Made in China

Note:

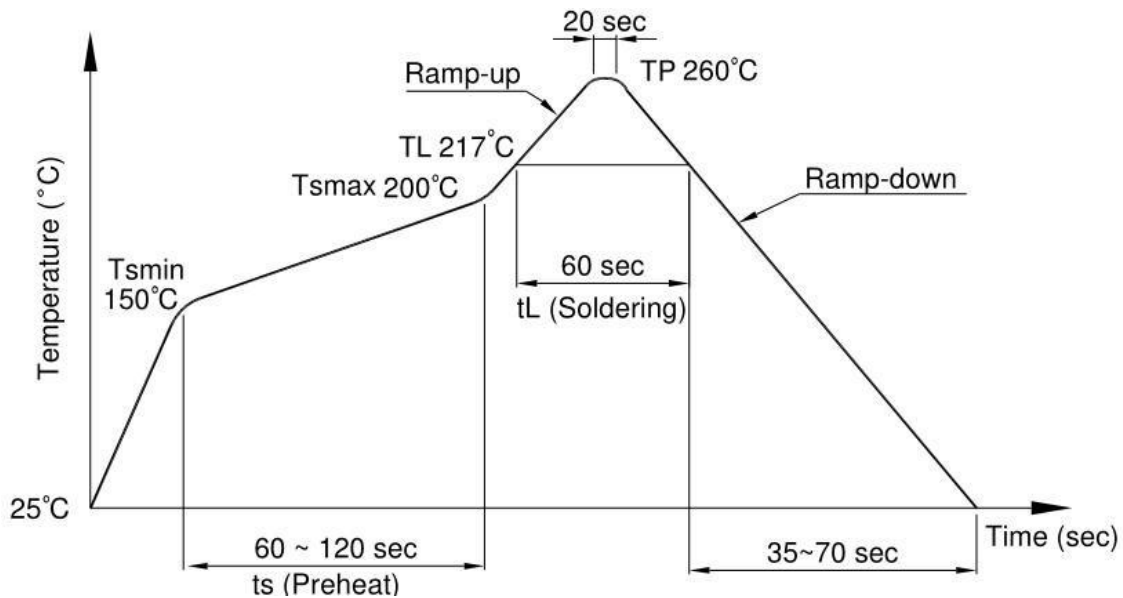
1. Material Code :Product ID.
2. P/N :Contents with "Order Information" in the specification.
3. Lot No. :Product data.
4. D/C :Product weeks.
5. Quantity :Packaging quantity.

13. Temperature Profile Of Soldering

(1).IR Reflow soldering (JEDEC-STD-020C compliant)

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

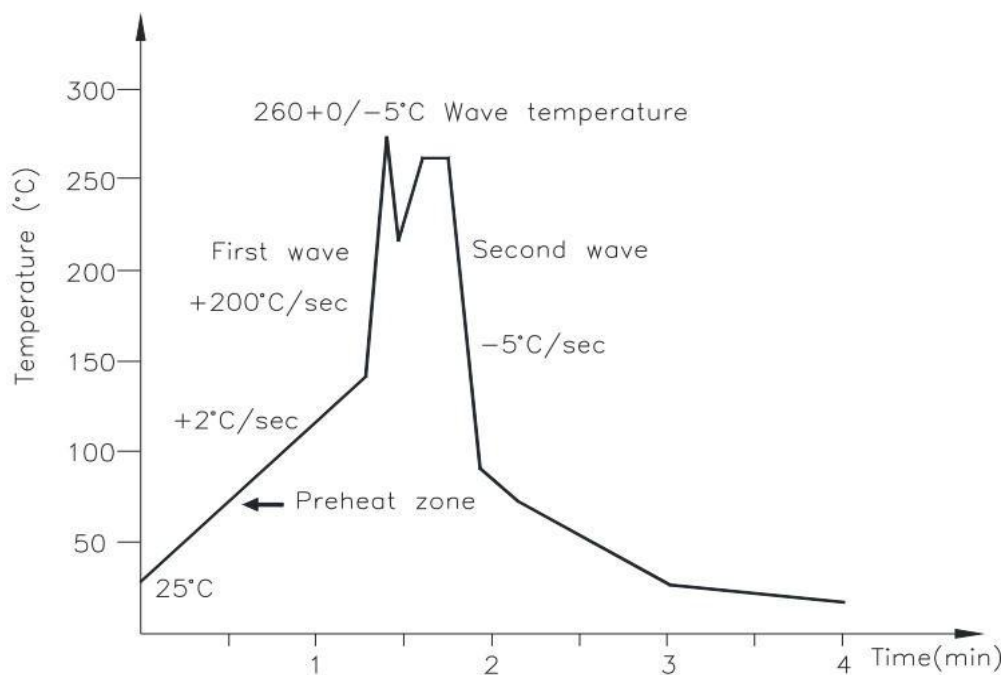
Profile item	Conditions
Preheat - Temperature Min (T Smin) - Temperature Max (T Smax) - Time (min to max) (ts)	150°C 200°C 90±30 sec
Soldering zone - Temperature (TL) - Time (t L)	217°C 60 sec
Peak Temperature	260°C
Peak Temperature time	20 sec
Ramp-up rate	3°C / sec max.
Ramp-down rate from peak temperature	3~6°C / sec
Reflow times	≤3



(3) .Wave soldering (JEDEC22A111 compliant)

One time soldering is recommended within the condition of temperature.

Temperature	260+0/-5°C
Time	10 sec
Preheat temperature	5 to 140°C
Preheat time	30 to 80 sec



(3).Hand soldering by soldering iron

Allow single lead soldering in every single process. One time soldering is recommended.

Temperature	380+0/-5°C
Time	3 sec max

14. Typical Electro-Optical Characteristics Curves

Figure 1: LED Forward Current vs. LED Forward Voltage

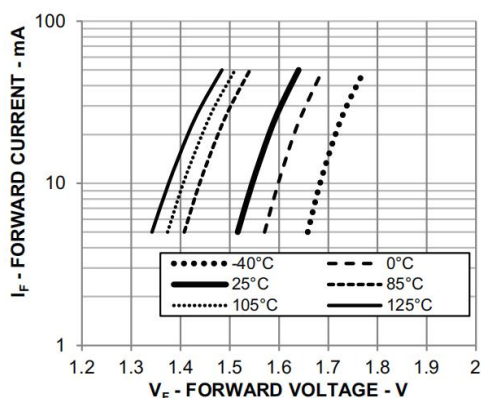


Figure 2: LED Forward Current Threshold vs. Ambient Temperature (Test Condition: $I_O = 2 \text{ mA}$)

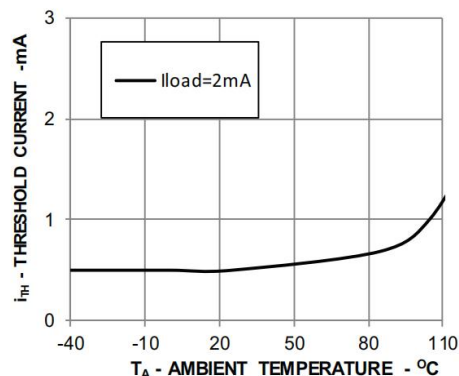


Figure 3: Output Withstand Voltage vs. Ambient Temperature (Test Condition: $I_O = 250 \mu\text{A}$)

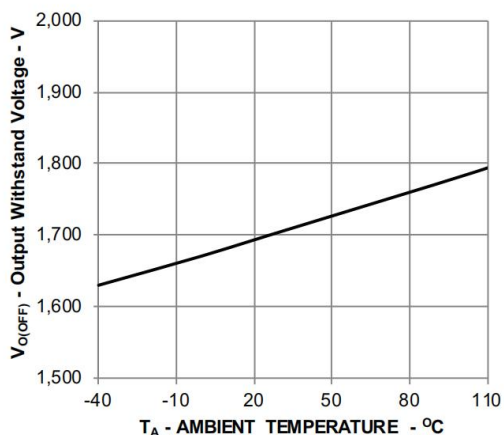


Figure 4: Output Leakage Current vs. Ambient Temperature (Test Condition: $V_O = 1000 \text{ V}$)

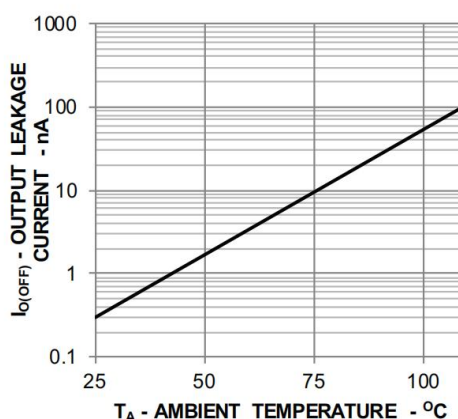


Figure 5: Output Leakage Current vs. Load Voltage (Test Condition: $T_A = 25^\circ\text{C}$)

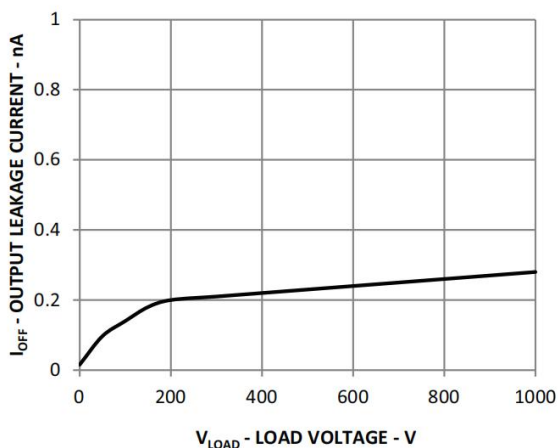


Figure 6: Output Current vs. Output Voltage

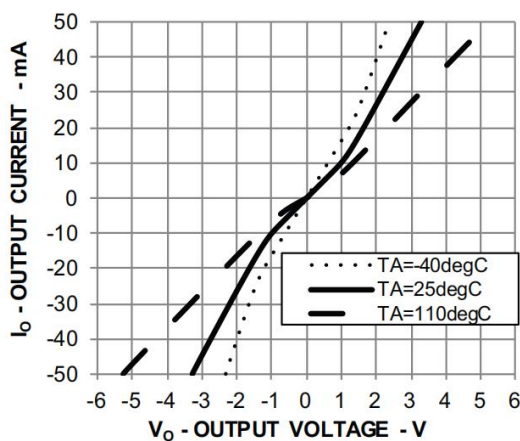


Figure 7: Output Capacitance vs. Load Voltage
(Test Condition: $V_{LOAD} = 0V$, $f = 1\text{ MHz}$, $T_A = 25^\circ\text{C}$)

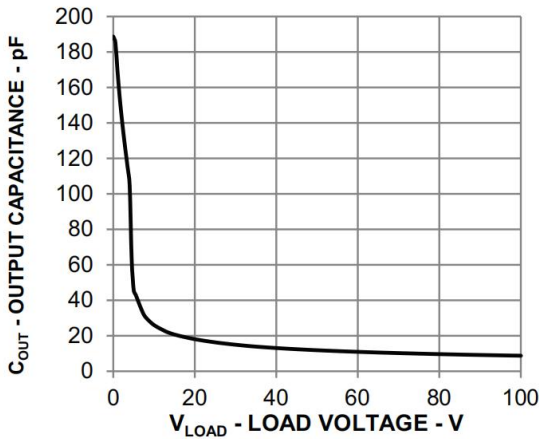


Figure 8: Typical On-Resistance vs. Ambient Temperature

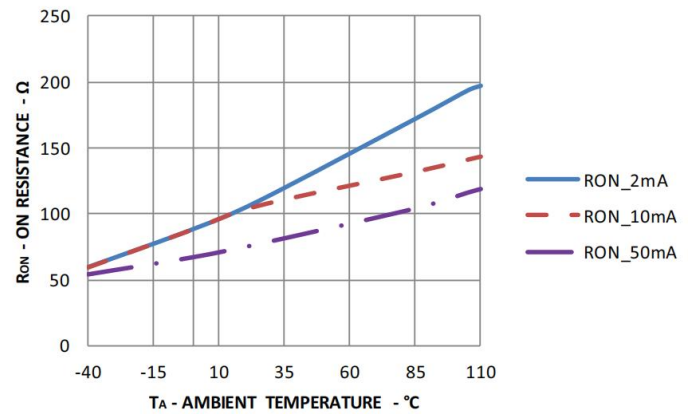


Figure 9: Turn-On Time vs. Ambient Temperature
(Test Condition: $V_{DD} = 40V$, $R_{LOAD} = 20\text{ k}\Omega$)

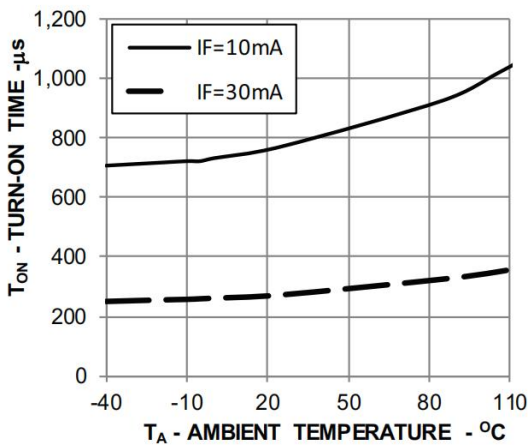


Figure 10: Turn-Off Time vs. Ambient Temperature
(Test Condition: $V_{DD} = 40V$, $R_{LOAD} = 20\text{ k}\Omega$)

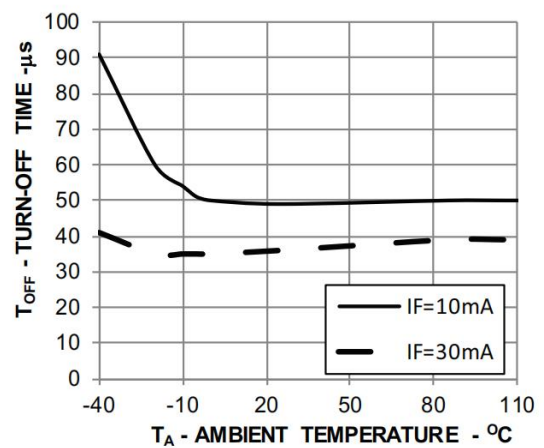


Figure 11: Turn-On Time vs. Input Forward Current
(Test Condition: $V_{DD} = 40V$, $R_{LOAD} = 20\text{ k}\Omega$)

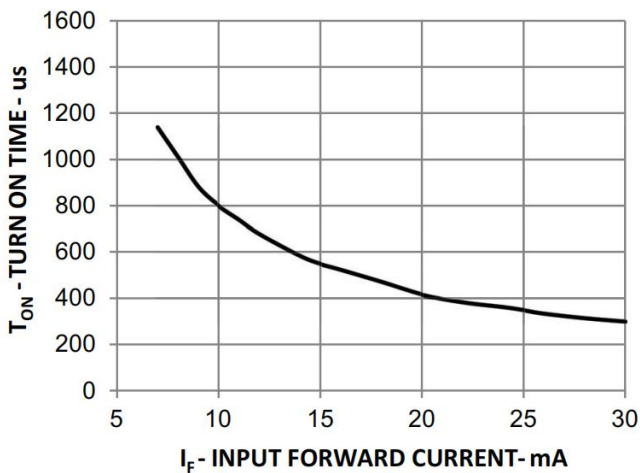


Figure 12: Turn-Off Time vs. Input Forward Current
(Test Condition: $V_{DD} = 40V$, $R_{LOAD} = 20\text{ k}\Omega$)

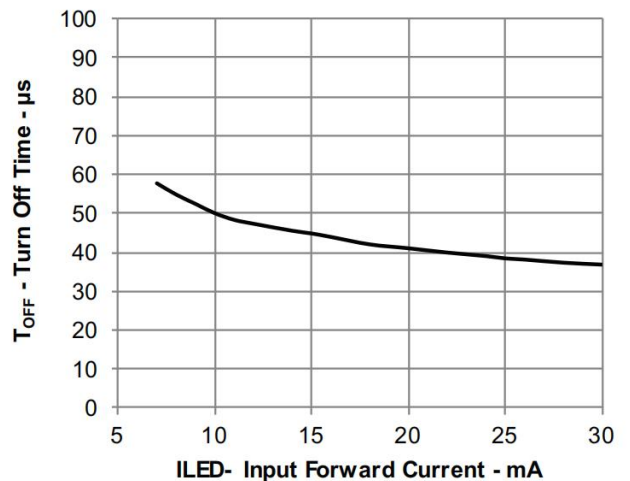


Figure 13: Switching Time Test Circuit and Waveform

