AB45S-Q SERIES

AUTOMOTIVE ▲ Si MOSFET RELAY

SILICON Si MOSFET RELAY ▲ SMD type
Switches AC or DC load
AEC-Q101 qualified
Input TTL / CMOS compatible
Moisture Sensitivity Level ▲ MSL 3
UL 1577 approved ▲File no E344988

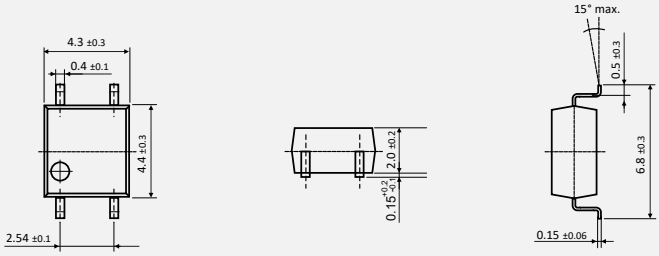
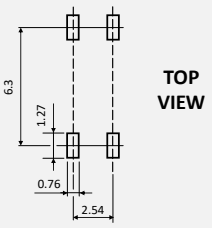
SPECIFICATION

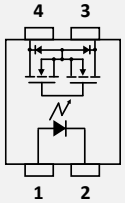
Item		Characteristics
Contact Form		1 Form A ▲ Normally open switch
Load Voltage	V_L	60V
Operation LED Current	$I_{F\ ON}$	3mA
Load Current	I_L	200mA
On-Resistance	R_{ON}	2Ω
Output Capacitance	C_{OUT}	20pF
Low Off-State Leakage Current	I_{LEAK}	1μA at $60V_{DC}$

APPLICATIONS

Automatic Test Equipment	Electric Mobility	I/O Modules	Industrial Automation	Measurement Equipment	Security Equipment	Sensing Equipment
						

DIMENSIONS, PIN DESCRIPTION AND PART NUMBER

Package	Illustration	Dimensions	PCB Board Pattern
SOP-4			

Circuit Diagram	Pin Description		Part No.	Package	Packing
	1 2 3,4	Anode (+) ▪ LED Cathode (-) ▪ LED Drain ▪ MOSFET	AB45S-Q AB45S-Q-R1	SOP-4 SOP-4	Tube (100pcs) Reel (1000pcs)

ABSOLUTE MAXIMUM RATINGS ▲ AMBIENT TEMPERATURE T_A = 25°C

Item		Condition	Symbol	Value	Unit
Type	Outline package			SOP-4	
	Part number			AB45S-Q	
	Output channels			1	Channel
Input	Continuous LED Current		I_F	50	mA
	Peak LED Current	100 Hz, Duty 1%	I_{FP}	500	mA
	LED Reverse Voltage		V_R	5	V
	Input Power Dissipation		P_{IN}	75	mV
Output	Load Voltage		V_L	60 (AC peak or DC)	V
	Load Current		I_L	200	mA
	Peak Load Current	1 ms, 1 shot	I_{PEAK}	600	mA
	Output Power Dissipation		P_{OUT}	300	mW
Relay	Total Power Dissipation		P_T	350	mW
	I/O Breakdown Voltage		$V_{I/O}$	1500	V_{RMS}
	Operating Temperature Range		T_{OPR}	-40 to +105	°C
	Storage Temperature Range		T_{STG}	-40 to +125	°C

ELECTRICAL CHARACTERISTICS ▲ AMBIENT TEMPERATURE T_A = 25°C

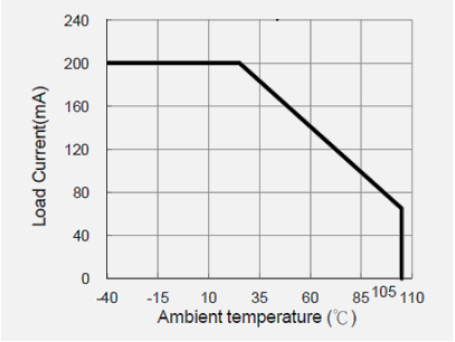
Item		Condition	Symbol	Min.	Typ.	Max.	Unit
Input	LED Forward Voltage	I_F = 10mA	V_F	0.9	1.17	1.5	V
	Operation LED Current		$I_{F\ ON}$		0.5	3	mA
	Recovery LED Voltage		$V_{F\ OFF}$	0.5	1		V
Output	On-Resistance Drain to Drain (tested within 1 sec.)	I_F=5mA, I_L=Rating	R_{ON}		2	5	Ω
	Off-State Leakage Current	V_L = 60V	I_{LEAK}			1	μA
	Output Capacitance	V_L=0V, f=1MHz	C_{OUT}		20		pF
Trans-mission	Turn-On Time	I_F=5mA, I_L=Rating	t_{ON}		0.05	0.5	ms
	Turn-Off Time	I_F=5mA, I_L=Rating	t_{OFF}		0.13	0.5	ms
Coupled	I/O Insulation Resistance		$R_{I/O}$	10^9			Ω
	I/O Capacitance	f=1MHz	$C_{I/O}$		1.3		pF

RECOMMENDED OPERATING CONDITION ▲ AMBIENT TEMPERATURE T_A = 25°C

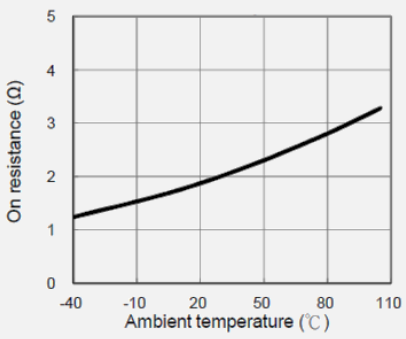
Item		Condition	Symbol	Min.	Typ.	Max.	Unit
Input	Continuous LED Current		I_F	5	10	15	mA
Output	Load Voltage		V_L			30	V
	Load Current		I_L			100	mA

REFERENCE DATA

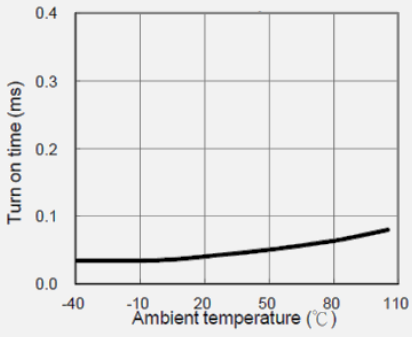
Load current vs. ambient temp.



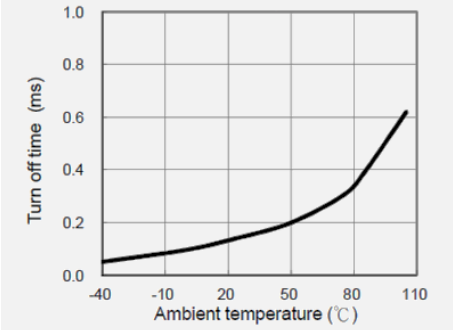
On resistance vs. ambient temp.



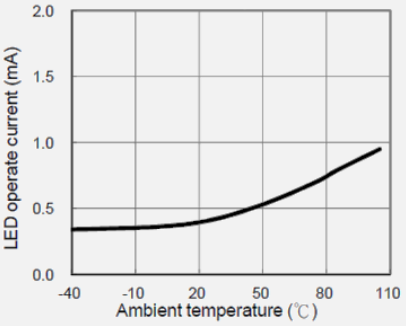
Turn on time vs. ambient temp.



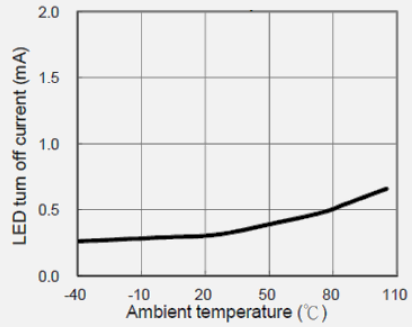
Turn off time vs. ambient temp.



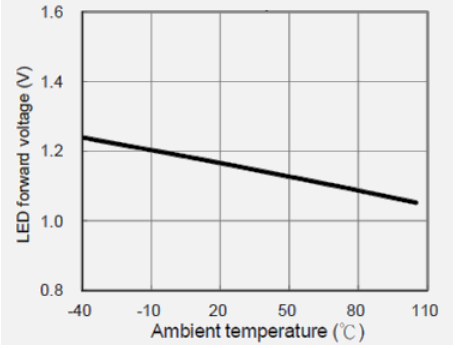
LED operate current vs. ambient temp



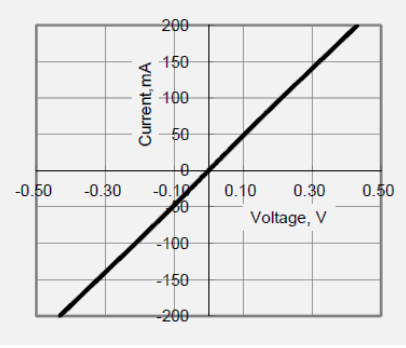
LED turn off current vs. ambient temp.



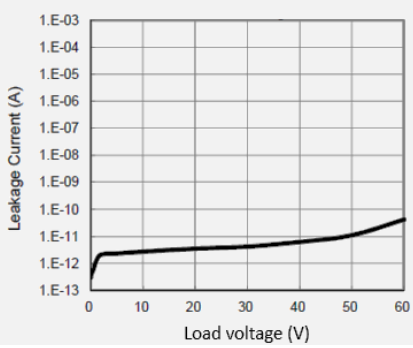
LED forward voltage vs. ambient temp.



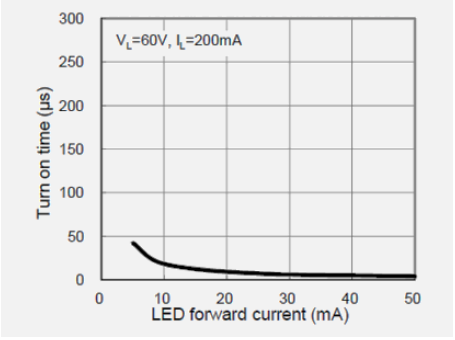
Current vs. voltage characteristics of output at MOS portion



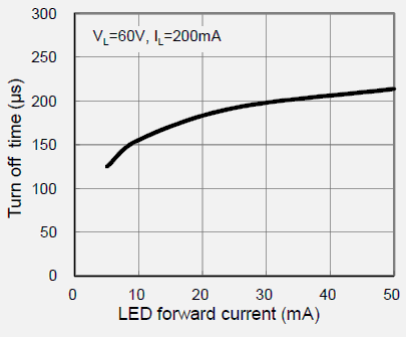
Off state leakage current vs. load voltage



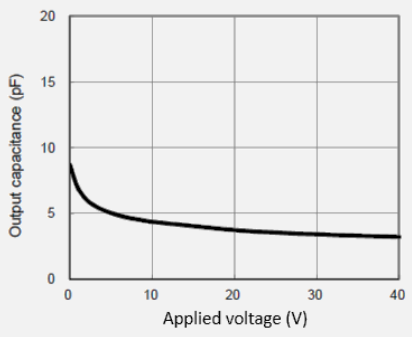
Turn on time vs. LED forward current



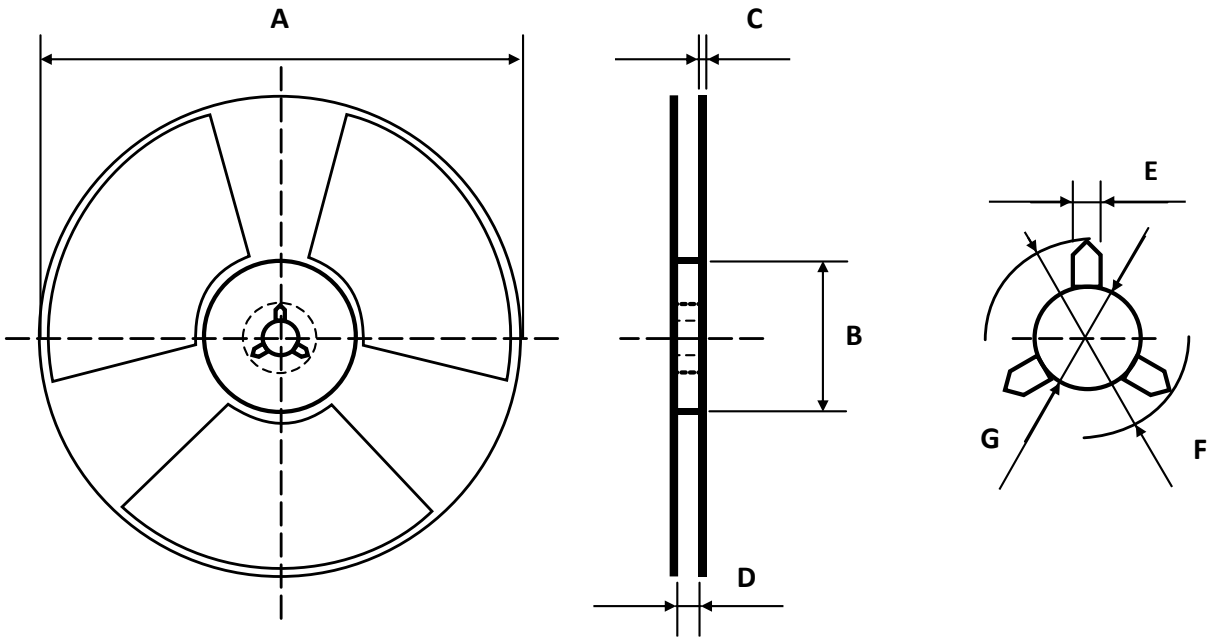
Turn off time vs. LED forward current



Output capacitance vs. applied voltage

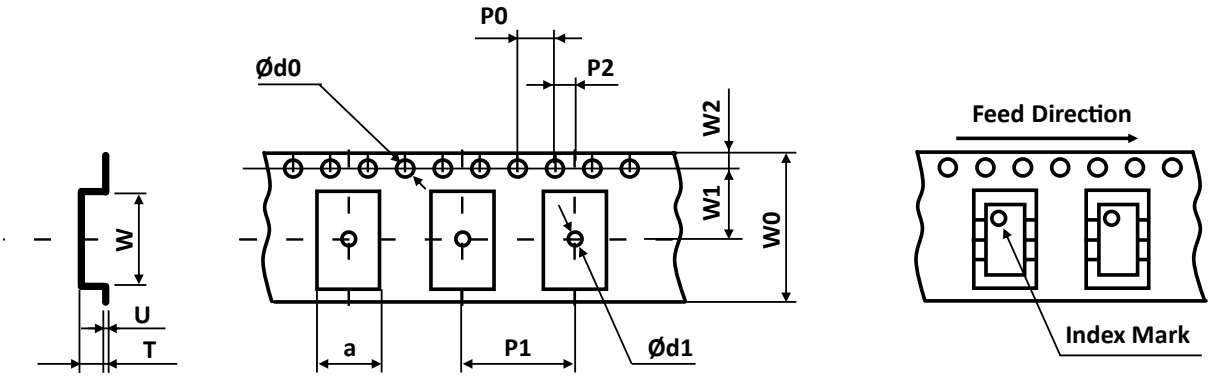


REEL DIMENSIONS ▲ All dimensions in mm



Size	A	B	C	D	E	F	G
SOP-4	330	100	2	13	2	13	21

TAPE DIMENSIONS ▲ All dimensions in mm



Size	W	U	T	a	Ød0	Ød1	P0	P1	P2	W0	W1	W2
SOP-4	4.6	0.3	2.3	7.2	1.5	1.5	4	12	2	12	7.5	1.75

PACKING QUANTITIES

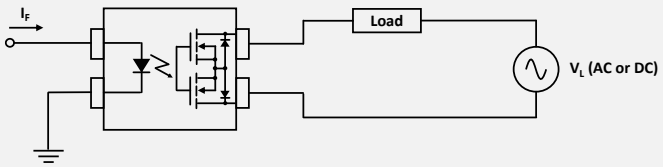
Tape and Reel Packing	PCS/Reel
SOP-4	1000

Tube Packing	PCS/Tube	Tubes/Box	Units/Box
SOP-4	100	30	3000

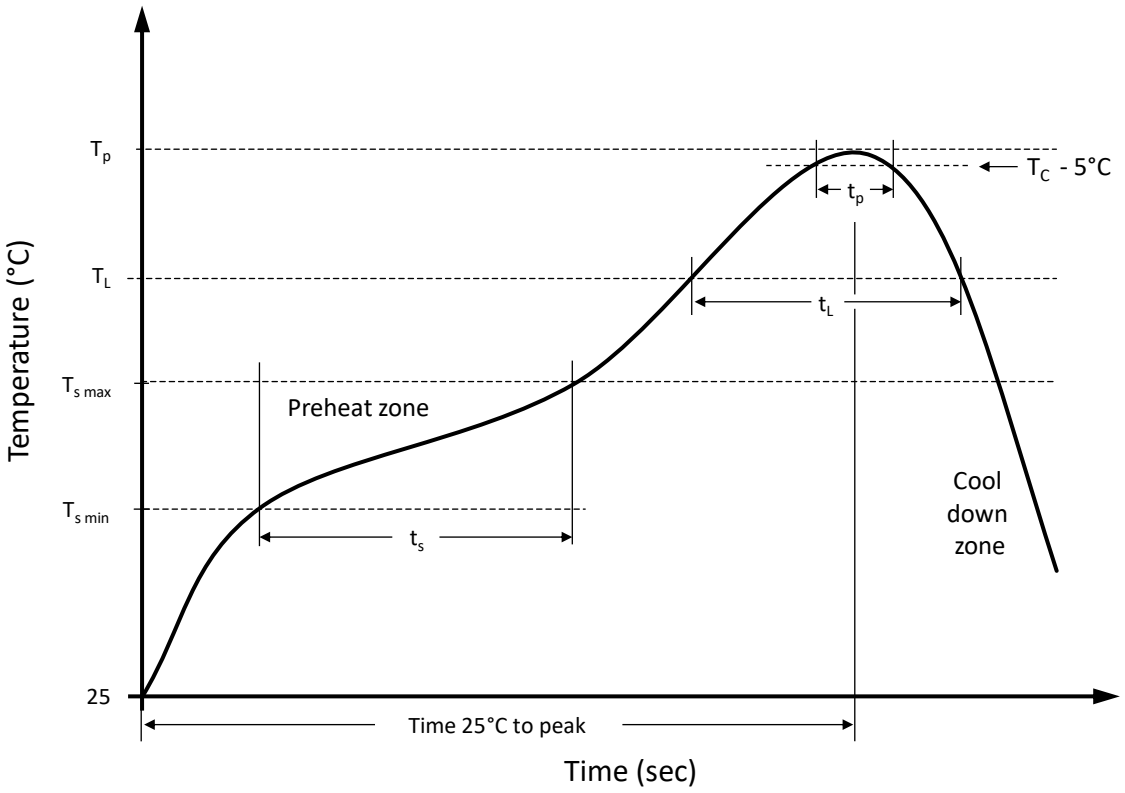
STORAGE AND HANDLING CONDITIONS

ESD level	Floor life	Conditions	MSL
HBM class 2	Unlimited	T_A < 30°C, RH < 85%	1

LOAD CONNECTING METHOD

Type	Load	Connection	Feature
4 pins	AC or DC		Control bi-directional signal

RECOMMENDED REFLOW SOLDERING PROFILE ▲ SMD PACKAGE



Recommended reflow soldering conditions ▲ Refer to JEDEC J-STD-020E

Profile Features		Sn-Pb Eutetic Assembly	Pb-Free Assembly
Preheat temperature min.	$T_{s\ min}$	100 °C	150 °C
Preheat temperature max.	$T_{s\ max}$	150 °C	200 °C
Preheat time t_s from $T_{s\ min}$ to $T_{s\ max}$	t_s	120 seconds	120 seconds
Ramp-up rate (T_L to T_p)		max. 3 °C/second	max. 3 °C/second
Liquidous temperature	T_L	183 °C	217 °C
Time t_L maintained above T_L	t_L	150 seconds max.	60 seconds max.
Peak package body temperature	T_p	235°C	260°C
Timeframe of within 5°C below and up to max actual peak body temperature	t_p	20 seconds max.	30 seconds max.
Ramp-down rate (T_L to T_p)		max. 6 °C/second	max. 6 °C/second
Time 25°C to peak temperature		max. 6 minutes	max. 8 minutes

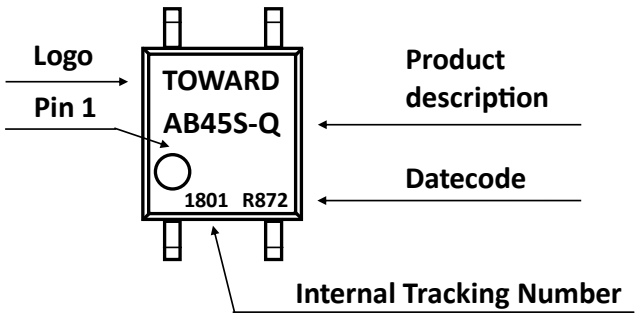
PRODUCT CODE

Example: AB45S-Q series ▲ 1 Form A ▲ AEC-Q101 ▲ 60V ▲ SOP-4 ▲ Tape & Reel

AB		45		S		Q		R1	
Package		Series		Type		Special Suffix		Packing	
AB	4 Pin ▲ 1 Form A	45	60V	S	SOP	Q	AEC-Q101	Blank R1	Tube Reel

PRODUCT MARKING

Example: AB45S-Q series ▲ 1 Form A ▲ AEC-Q101 ▲ 60V ▲ SOP-4 ▲ Tape & Reel



DATE CODE

Example: R872

R		8		7		2	
Material Characteristics		Year		Month		Week of the Month	
R	RoHS compliant	8	2018	1	Jan	1	1st
		9	2019	2	Feb	2	2nd
		A	2020	3	Mar	3	3rd
		B	2021	4	Apr	4	4th
H	Halogen free	C	2022	5	May		
		...	...	...	...		
		G	2026	12	Dec		

RELIABILITY TESTS ▲ STANDARD

Standard: AEC-Q101, JESD22-A, J-STD-002

No.	Test	Test Specification	Test Standard	Test Result
1	Precondition	Temperature: 25°C ± 5°C; Humidity: 55% RH ± 10% Bake condition: Temperature: 125°C; Duration 24 hours Soak condition: Temperature: 60°C; Humidity: 60% RH Duration 40 hours Reflow condition: Peak temperature: 250°C; time within 5°C of the peak temperature: at least 30 seconds Duration: 3 times	JESD22-A113	No abnormal phenomenon was found. Functional test passed.
2	Temperature Cycling Test	Temperature: 25°C ± 5°C; Humidity: 55% RH ± 15% Temperature range: -40°C ~ +125°C Dwell time: 10 minutes Transition time: 5 minutes Duration: 1000 cycles	JESD22-A104	No abnormal phenomenon was found. Functional test passed. No abnormal bond wire was found after DPA.
3	Unbiased Highly Accelerated Stress Test	Temperature: 25°C ± 5°C; Humidity: 55% RH ± 15% Temperature: 130°C Humidity: 85% RH Pressure: 33.3 psia Duration: 96 hours	JESD22-A118	No abnormal phenomenon was found. Functional test passed.
4	Resistance to Solder Heat Test	Temperature: 25°C ± 5°C; Humidity: 55% RH ± 10% Solder: SAC305 Flux: SM-25 (Flux #2) Temperature: 260°C Duration: 10 seconds	JESD22-A106	No abnormal phenomenon was found.
5	Solderability Test	Temperature: 25°C ± 5°C; Humidity: 55% RH ± 10% Solder: SAC305 Flux: SM-25 (Flux #2) Temperature: 245°C Duration: 5 seconds	J-STD-002D	All samples of solderability test passed the test.
6	Physical Dimensions Test	Temperature: 25°C ± 5°C; Humidity: 55% RH ± 10% Measurement: Width, depth, and height of device	JESD22-B100	All samples of physical dimension test in the criteria.
7	Power Temperature Cycling Test	Temperature: 25°C ± 5°C; Humidity: 55% RH ± 10% Temperature range: -40°C to +125°C Dwell time: 10 minutes Ramp time: 30 minutes Voltage: PS1: 5V, PS2: 1440V, On: 5 minutes, Off: 5 minutes	JESD22-A105	No abnormal phenomenon was found. Functional test passed.
8	Terminal Strength Test	Temperature: 25°C ± 5°C; Humidity: 55% RH ± 10% Test lead: Two leads on each device Loading force: 8 oz Bend angle: 90 arcs Bend cycle: Three cycles	JESD22-B105D	No broken lead of the device after three cycles of bending test.

RELIABILITY TESTS ▲ STANDARD

Standard: AEC-Q101, JESD22-A, J-STD-002

No.	Test	Test Specification	Test Standard	Test Limits
9	High Temperature Reverse Bias	Temperature: 25°C ± 5°C; Humidity: 55% RH ± 10% Temperature: 125°C Voltage: PS2: 1440V Duration: 1000 hours	MIL-STD-750 Method 1038	No abnormal phenomenon was found. Functional test passed.
10	High Humidity High Temperature Reverse Bias	Temperature: 25°C ± 5°C; Humidity: 55% RH ± 10% Temperature: 85°C; Humidity: 85% RH Voltage: PS2: 100V Duration: 1000 hours	JESD22-A101	No abnormal phenomenon was found. Functional test passed. No abnormal bond wire was found after DPA.
11	Human-Body Model Test	Temperature: 25°C ± 5°C; Humidity: 55% RH ± 10% Interval: > 1s; Zap 3 pulses Testing combinations: all to other pins	AEC-Q101-001 Rev.A	All samples of HBM test passed the test.
12	Charge Device Model Test	Temperature: 25°C ± 5°C; Humidity: 55% RH ± 15% Interval: > 1s; Zap 3 pulses; Test humidity: < 30% RH Test pin: All pins	AEC-Q101-005 Rev.A	All samples of CDM test passed the test.

REVISION TABLE

Revision	Date	Status	Notes
001	01/10/2021	Initial release	Initial publication

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