

# 40-5 SERIES

## HIGH VOLTAGE ▲ Si MOSFET RELAY

**SILICON Si MOSFET RELAY ▲ DIP and SMD type**  
 Switches AC or DC load  
 1500V load voltage  
 Input TTL / CMOS compatible  
 Moisture Sensitivity Level ▲ MSL 1  
**UL 1577 approved ▲ File no E344988**

### SPECIFICATION

Item	Characteristics	
Contact Form	1 Form A ▲ Normally open switch	
Load Voltage	$V_L$	1500V
Operation LED Current	$I_{F ON}$	5mA
Load Current	$I_L$	45mA
On-Resistance	$R_{ON}$	180Ω
Output Capacitance	$C_{OUT}$	83pF
Low Off-State Leakage Current	$I_{LEAK}$	10μA at 1500V <sub>DC</sub>

### APPLICATIONS

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

### DIMENSIONS

Package	Illustration	Dimensions	PCB Board Pattern
DIP-6-5			
SMD-6-5			

**ABSOLUTE MAXIMUM RATINGS ▲ AMBIENT TEMPERATURE  $T_A = 25^\circ\text{C}$** 

Item	Condition	Symbol	Value	Unit
<b>Type</b>	Outline package		DIP-6-5	SMD-6-5
	Part number		AA40-5	AA40F-5
	Output channels		1	1
<b>Input</b>	Continuous LED Current		$I_F$	50
	Peak LED Current	100 Hz, Duty 1%	$I_{FP}$	500
	LED Reverse Voltage		$V_R$	5
	Input Power Dissipation		$P_{IN}$	75
<b>Output</b>	Load Voltage		$V_L$	1500 (AC peak or DC)
	Load Current		$I_L$	45
	Peak Load Current	1 ms, 1 shot	$I_{PEAK}$	180
	Output Power Dissipation		$P_{OUT}$	450
<b>Relay</b>	Total Power Dissipation		$P_T$	500
	I/O Breakdown Voltage		$V_{I/O}$	3750
	I/O Breakdown Voltage (Suffix-H)		$V_{I/O}$	5000
	Operating Temperature Range		$T_{OPR}$	-40 to +85
	Storage Temperature Range		$T_{STG}$	-40 to +100

**ELECTRICAL CHARACTERISTICS ▲ AMBIENT TEMPERATURE  $T_A = 25^\circ\text{C}$** 

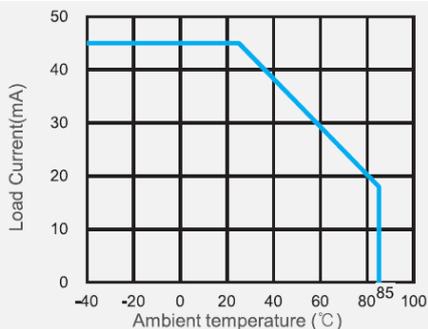
Item	Condition	Symbol	Min.	Typ.	Max.	Unit
<b>Input</b>	LED Forward Voltage	$I_F = 10\text{mA}$	$V_F$	1	1.17	1.5
	Operation LED Current		$I_{FON}$		0.8	5
	Recovery LED Voltage		$V_{FOFF}$	0.5	1	
<b>Output</b>	On-Resistance	$I_F=10\text{mA}, I_L=\text{Rating}$	$R_{ON}$		110	200
	Drain to Drain (tested within 1 sec.)	$I_F=10\text{mA}, I_L<5\text{mA}$			180	300
	Off-State Leakage Current	$V_L = 1500\text{V}$	$I_{LEAK}$			10
	Output Capacitance	$V_L=0\text{V}, f=1\text{MHz}$	$C_{OUT}$		83	
<b>Trans- mission</b>	Turn-On Time	$I_F=10\text{mA}, I_L=\text{Rating}$	$t_{ON}$		0.2	1
	Turn-Off Time	$I_F=10\text{mA}, I_L=\text{Rating}$	$t_{OFF}$		0.04	0.5
<b>Coupled</b>	I/O Insulation Resistance		$R_{I/O}$	$10^{10}$		$\Omega$
	I/O Capacitance	$f=1\text{MHz}$	$C_{I/O}$		1.3	pF

**RECOMMENDED OPERATING CONDITION ▲ AMBIENT TEMPERATURE  $T_A = 25^\circ\text{C}$** 

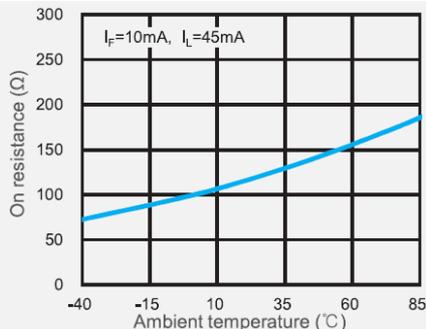
Item	Condition	Symbol	Min.	Typ.	Max.	Unit
<b>Input</b>	Continuous LED Current	$I_F$	8	10	20	mA
<b>Output</b>	Load Voltage	$V_L$			600	V
	Load Current	$I_L$			10	mA

REFERENCE DATA

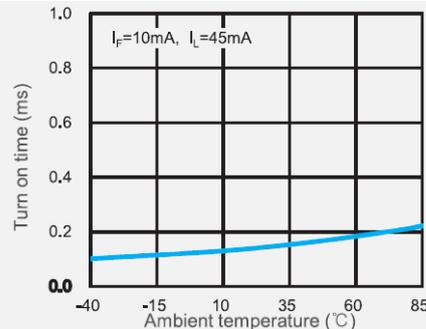
Load current vs. ambient temp.



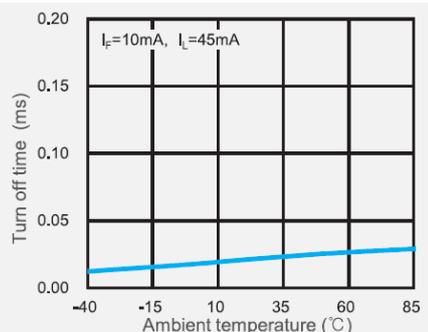
On resistance vs. ambient temp.



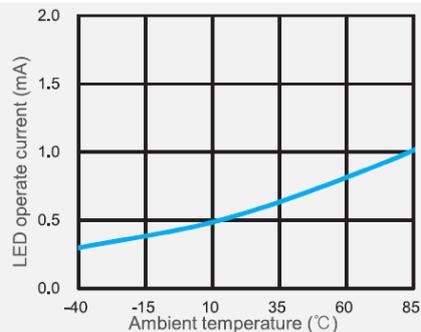
Turn on time vs. ambient temp.



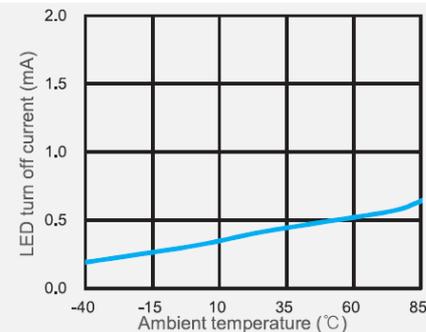
Turn off time vs. ambient temp.



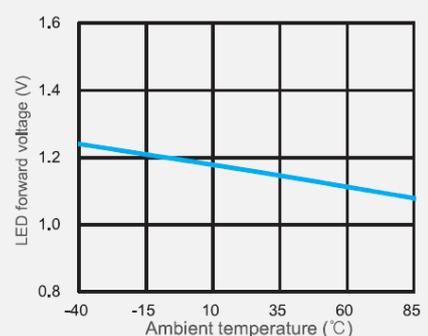
LED operate current vs. ambient temp



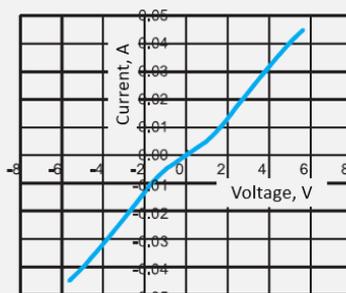
LED turn off current vs. ambient temp.



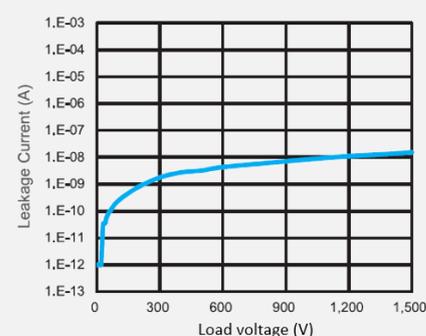
LED forward voltage vs. ambient temp.



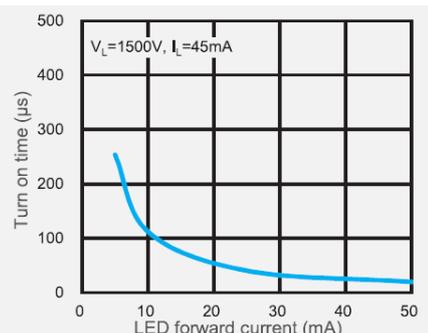
Current vs. voltage characteristics of output at MOS portion



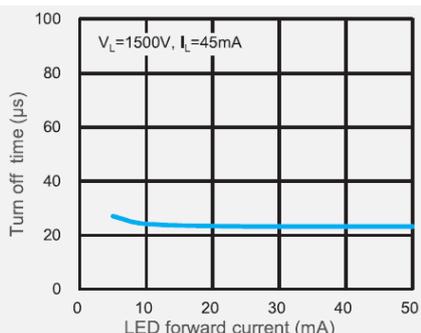
Off state leakage current vs. load voltage



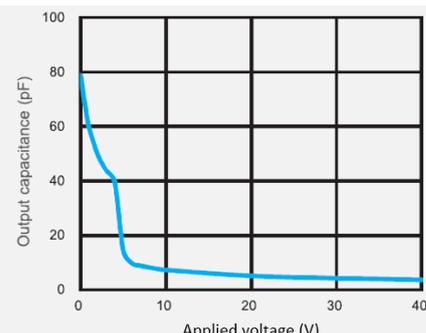
Turn on time vs. LED forward current



Turn off time vs. LED forward current

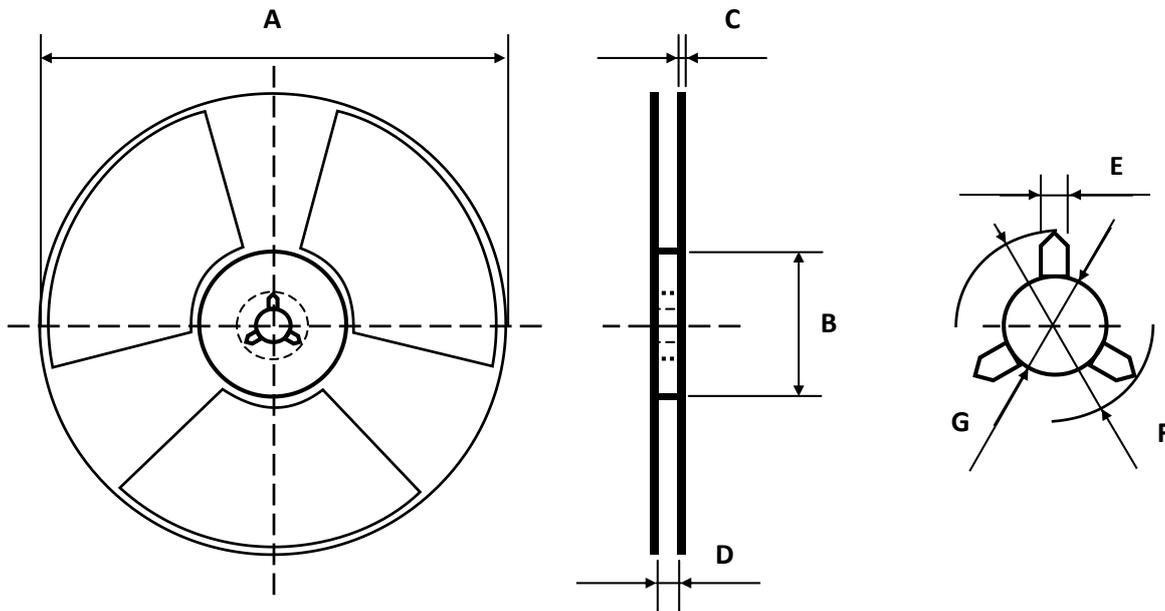


Output capacitance vs. applied voltage

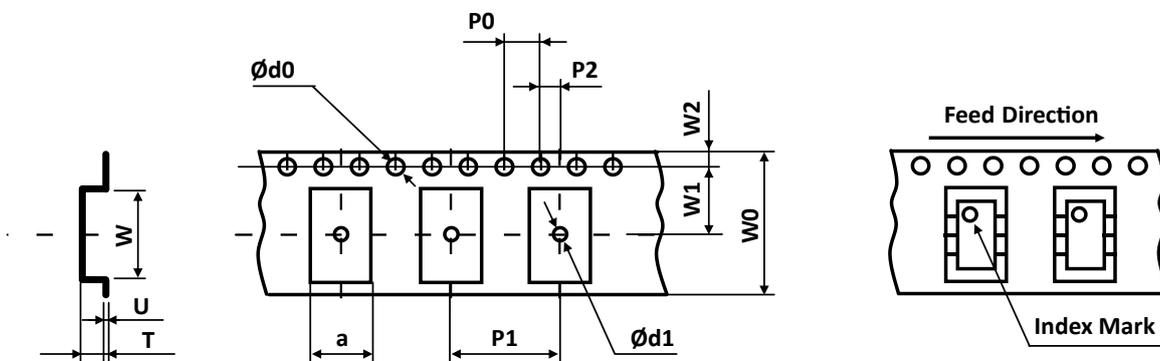


**PIN DESCRIPTION AND PART NUMBER**

Circuit Diagram	Pin Description	Part No.	Package	Packing
	1 Anode (+) ▪ LED 2 Cathode (-) ▪ LED 3 NC 4,6 Drain ▪ MOSFET	AA40-5 AA40F-5 AA40F-5-R1	DIP-6-5 SMD-6-5 SMD-6-5	Tube (50pcs) Tube (50pcs) Reel (1000pcs)

**REEL DIMENSIONS ▲ All dimensions in mm**


Size	A	B	C	D	E	F	G
SMD-6-5	380	80	2.2	17	2	13	21

**TAPE DIMENSIONS ▲ All dimensions in mm**


Size	W	U	T	a	Ød0	Ød1	P0	P1	P2	W0	W1	W2
SMD-6-5	9.15	0.3	4.45	10.4	1.5	1.5	4	16	2	16	11.5	1.75

### PACKING QUANTITIES

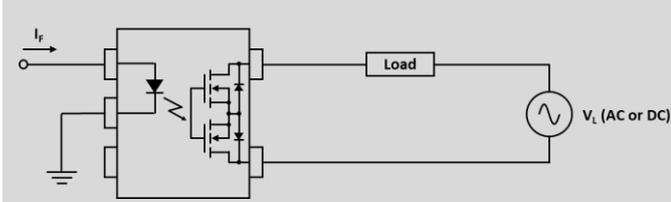
Tape and Reel Packing	PCS/Reel
SMD-6-5	1000

Tube Packing	PCS/Tube	Tubes/Box	Units/Box
DIP-6-5	50	30	1500

### STORAGE AND HANDLING CONDITIONS

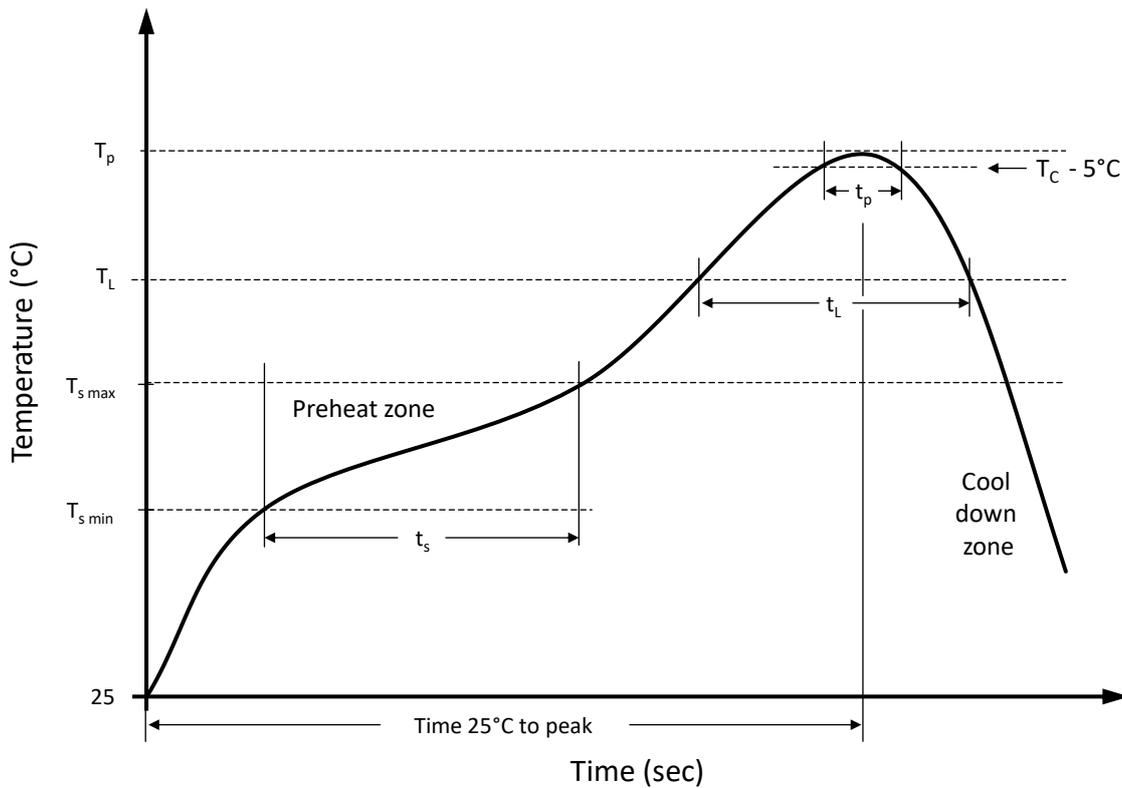
ESD level	Floor life	Conditions	MSL
HBM class 2	Unlimited	$T_A < 30^{\circ}\text{C}$ , RH < 85%	1

### LOAD CONNECTING METHOD

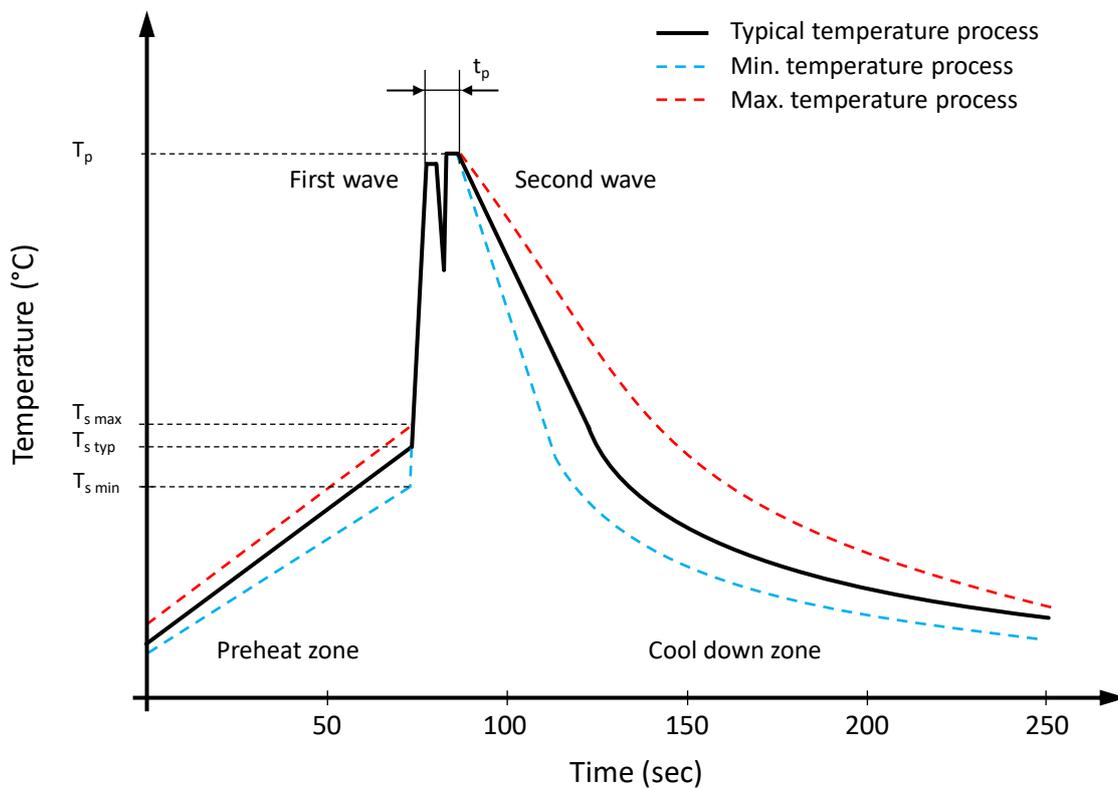
Type	Load	Connection	Feature
5 pins	AC or DC		Control bi-directional signal

### CONTINUAL DC BIAS

In case of a continual DC bias is applied between outputs, the output MOSFET may deteriorate due to the voltage. Please verify operation of the actual design before using, or contact MGT.

**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.	$T_{s \text{ min}}$	100 °C	150 °C
Preheat temperature max.	$T_{s \text{ max}}$	150 °C	200 °C
Preheat time $t_s$ from $T_{s \text{ min}}$ to $T_{s \text{ max}}$	$t_s$	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

**RECOMMENDED WAVE SOLDERING PROFILE ▲ THT PACKAGE**

**Classification wave soldering profile ▲ Refer to EN 61760-1: 2006**

Profile Features		Value ▲ Sn-Pb Assembly	Value ▲ Pb-free Assembly
Preheat temperature min.	$T_{s\ min}$	100 °C	100 °C
Preheat temperature typical	$T_{s\ typ}$	120 °C	120 °C
Preheat temperature max.	$T_{s\ max}$	130 °C	130 °C
Preheat time $t_s$ from $T_{s\ min}$ to $T_{s\ max}$	$t_s$	70 seconds	70 seconds
Peak temperature	$T_p$	235 °C to 260 °C	245 °C to 260 °C
Time of actual peak temperature	$t_p$	Max. 10 seconds Max. 5 second each wave	Max. 10 seconds Max. 5 second each wave
Ramp-down rate min.		~ 2 °C/second	~ 2 °C/second
Ramp-down rate typical		~ 3.5 °C/second	~ 3.5 °C/second
Ramp-down rate max.		~ 5 °C/second	~ 5 °C/second
Time 25°C to 25°C		4 minutes	4 minutes

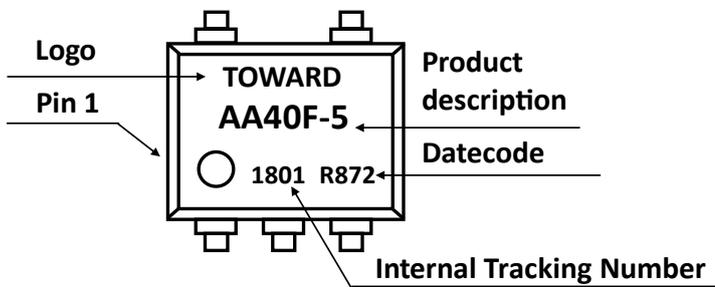
### PRODUCT CODE

Example: AA40F-5 series ▲ 1 Form A ▲ 1500V ▲ SMD-6-5 ▲ Tape & Reel

AA		40		-		F		5		R1	
Package		Series		Special Suffix		Type		Special Package		Packing	
AA	6 Pin ▲ 1 Form A	40	1500V	Blank H	Standard High Insulation	Blank F	DIP SMD	5	5 Pin	Blank R1	Tube Reel

### PRODUCT MARKING

Example: AA40F-5 series ▲ 1 Form A ▲ 1500V ▲ SMD-6-5 ▲ 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	1 <sup>st</sup>	
		9	2019	2	Feb		2 <sup>nd</sup>	
H	Halogen free	A	2020	3	Mar		3	3 <sup>rd</sup>
		B	2021	4	Apr		4	4 <sup>th</sup>
		C	2022	5	May			
		...	...	...	...			
		G	2026	12	Dec			

## RELIABILITY TESTS ▲ STANDARD

Standard: JESD22-A

No.	Test	Test Specification	Test Standard	Test Limits
1	Moisture Sensitivity Level Test	Bake condition: Temperature: 125°C; Duration 24 hours Soak condition: Temperature: 30°C; Humidity: 60% RH Duration 192 hours Reflow condition: Peak temperature: 260°C Duration: 3 cycles	JESD22-A113H	No abnormal phenomenon was found. Functional test passed.
2	High Temperature Storage Test	Temperature: 150°C Duration: 500 hours	JESD22-A103E	No abnormal phenomenon was found. Functional test passed.
3	Temperature Cycling Test	Temperature range: -55°C to +125°C -55°C for 30 minutes +125°C for 30 minutes Duration: 100 cycles with 1 cycle = 70 minutes	JESD22-A104E	No abnormal phenomenon was found. Functional test passed.
4	Low Temperature Storage Test	Temperature: -40°C Duration: 500 hours	JESD22-A119E	No abnormal phenomenon was found. Functional test passed.
5	Temperature & Humidity Storage Test	Temperature: 85°C Humidity: 85% RH Duration: 500 hours	JESD22-A101D	No abnormal phenomenon was found. Functional test passed.
6	Highly Accelerated Temperature and Humidity Stress Test	Temperature: 130°C Humidity: 85% RH Duration: 96 hours	JESD22-A-118B	No abnormal phenomenon was found. Functional test passed.

## REVISION TABLE

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

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