

# 47 SERIES

## HIGH CURRENT ▲ Si MOSFET RELAY

**SILICON Si MOSFET RELAY ▲ DIP and SMD type**  
 Switches AC or DC load  
 High load current with 1.5A  
 Input TTL / CMOS compatible  
 Moisture Sensitivity Level ▲ MSL 1  
**UL 1577 approved ▲ File no E344988**

### SPECIFICATION

Item	Characteristics	
Contact Form	1 Form A / 2 Form A ▲ Normally open switch	
Load Voltage	$V_L$	80V
Operation LED Current	$I_{F ON}$	3mA
Load Current	$I_L$	1.5A
On-Resistance	$R_{ON}$	0.13Ω
Output Capacitance	$C_{OUT}$	220pF
Low Off-State Leakage Current	$I_{LEAK}$	1μA at 80V <sub>DC</sub>

### APPLICATIONS

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

### DIMENSIONS

Package	Illustration	Dimensions	PCB Board Pattern
DIP-4			
SMD-4			

## DIMENSIONS

Package	Illustration	Dimensions	PCB Board Pattern
DIP-6			
SMD-6			
DIP-8			
SMD-8			
SOP-4			
SOP-8			

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

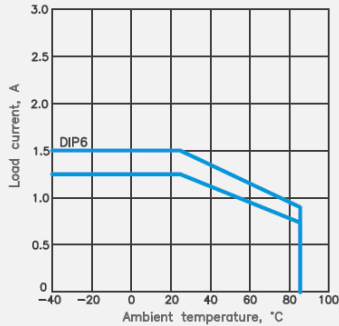
Type	Item	Condition	Symbol	Value					Unit
				SOP-4	SOP-8	DIP-4 SMD-4	DIP-8 SMD-8	DIP-6 SMD-6	
Type	Outline package			SOP-4	SOP-8	DIP-4 SMD-4	DIP-8 SMD-8	DIP-6 SMD-6	
	Part number			AB47S	AC47S	AB47(F)	AC47(F)	AA47(F)	
	Output channels			1	2	1	2	1	Channels
Input	Continuous LED Current		$I_F$	50					mA
	Peak LED Current	100 Hz, Duty 1%	$I_{FP}$	500					mA
	LED Reverse Voltage		$V_R$	5					V
	Input Power Dissipation		$P_{IN}$	75					mW
Output	Load Voltage		$V_L$	80 (AC peak or DC)					V
	Load Current		$I_L$	1.25	1	1.25	1	1.5	A
	Peak Load Current	1 ms, 1 shot	$I_{PEAK}$	3	3	3	3	3	mA
	Output Power Dissipation		$P_{OUT}$	350	450	350	450	500	mW
Relay	Total Power Dissipation		$P_T$	400	500	400	500	550	mW
	I/O Breakdown Voltage		$V_{I/O}$	1500	1500	3750	3750	3750	$V_{RMS}$
	I/O Breakdown Voltage (Suffix-H)		$V_{I/O}$	3750	3750	5000	5000	5000	$V_{RMS}$
	Operating Temperature Range		$T_{OPR}$	-40 to +85					$^\circ\text{C}$
	Storage Temperature Range		$T_{STG}$	-40 to +100					$^\circ\text{C}$

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

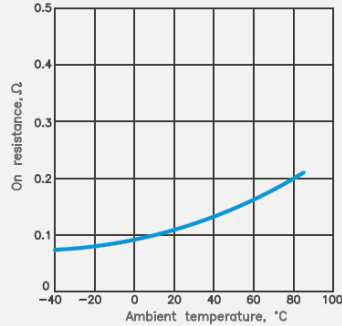
Type	Item	Condition	Symbol	Min.	Typ.	Max.	Unit
Input	LED Forward Voltage	$I_F = 10\text{mA}$	$V_F$	1	1.37	1.5	V
	Operation LED Current		$I_{FON}$		1	3	mA
	Recovery LED Voltage		$V_{FOFF}$	0.5	1		V
Output	On-Resistance Drain to Drain (tested within 1 sec.)	$I_F=5\text{mA}, I_L=\text{Rating}$	$R_{ON}$		0.13	0.16	$\Omega$
	Off-State Leakage Current	$V_L = 80\text{V}$	$I_{LEAK}$			1	$\mu\text{A}$
	Output Capacitance	$V_L=0\text{V}, f=1\text{MHz}$	$C_{OUT}$		220		pF
Transmission	Turn-On Time (for SOP type)	$I_F=5\text{mA}, I_L=\text{Rating}$	$t_{ON}$		0.4	3	ms
	Turn-Off Time (for SOP type)	$I_F=5\text{mA}, I_L=\text{Rating}$	$t_{OFF}$		0.05	0.5	ms
	Turn-On Time (for DIP/SMD type)	$I_F=10\text{mA}, I_L=\text{Rating}$	$t_{ON}$		0.3	3	ms
	Turn-Off Time (for DIP/SMD type)	$I_F=10\text{mA}, I_L=\text{Rating}$	$t_{OFF}$		0.05	0.5	ms
Coupled	I/O Insulation Resistance		$R_{I/O}$	$10^9$			$\Omega$
	I/O Capacitance	$f=1\text{MHz}$	$C_{I/O}$		1.3		pF

REFERENCE DATA

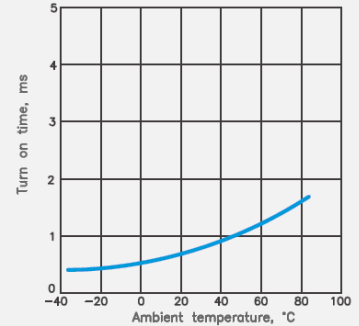
Load current vs. ambient temp.



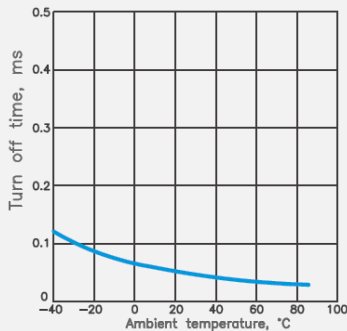
On resistance vs. ambient temp.



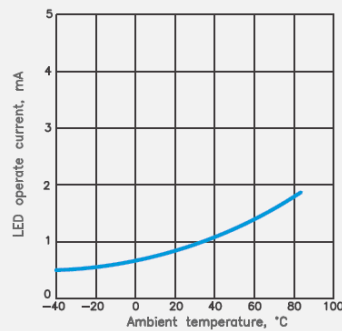
Turn on time vs. ambient temp.



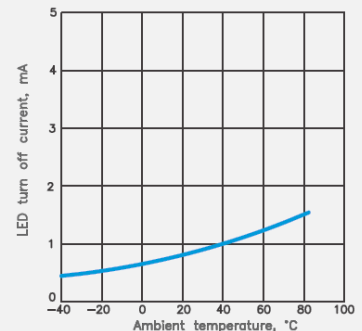
Turn off time vs. ambient temp.



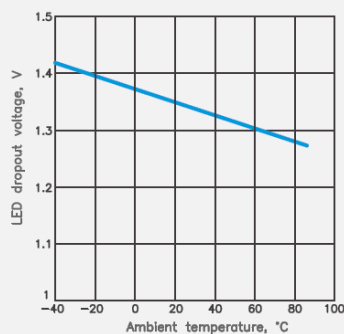
LED operate current vs. ambient temp



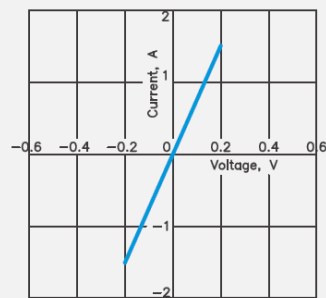
LED turn off current vs. ambient temp.



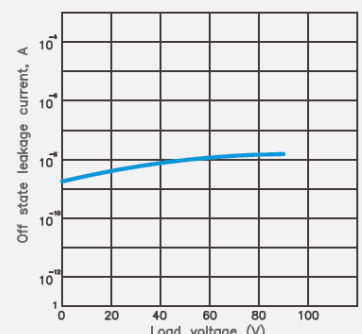
LED forward voltage vs. ambient temp.



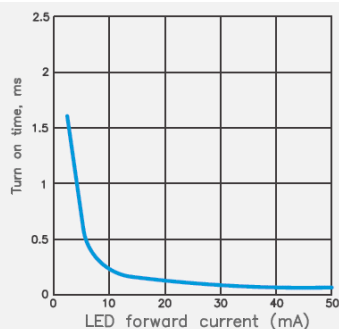
Current vs. voltage characteristics of output at MOS portion



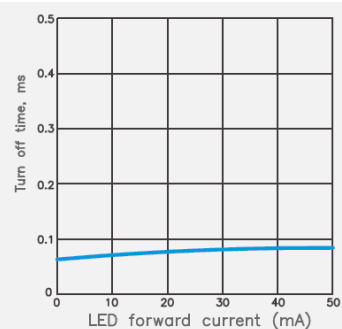
Off state leakage current vs. load voltage



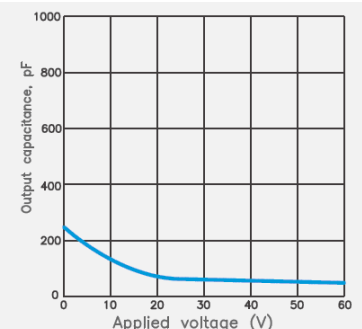
Turn on time vs. LED forward current



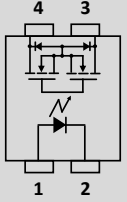
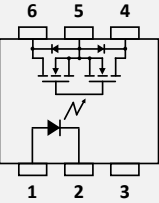
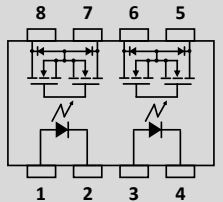
Turn off time vs. LED forward current

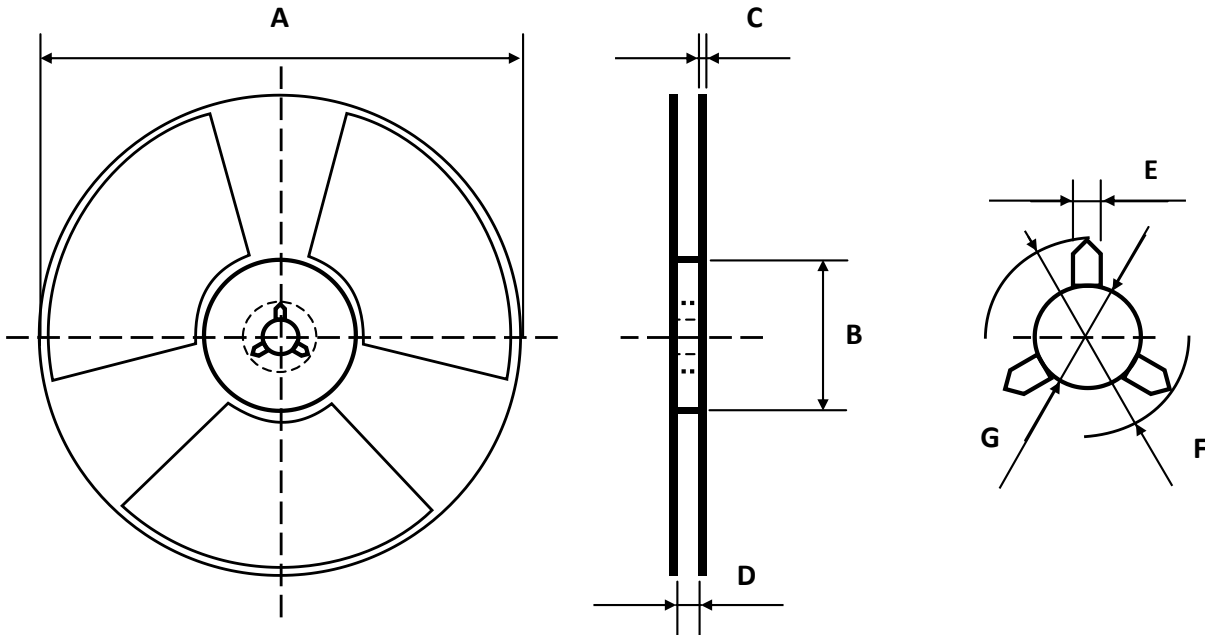


Output capacitance vs. applied voltage

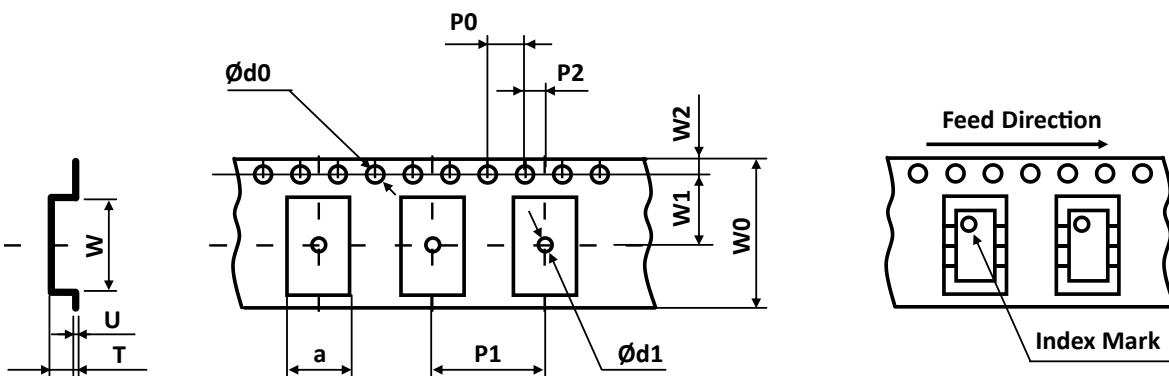


**PIN DESCRIPTION AND PART NUMBER**

Circuit Diagram	Pin Description	Part No.	Package	Packing
	1 Anode (+) ▪ LED 2 Cathode (-) ▪ LED 3,4 Drain ▪ MOSFET	AB47 AB47F AB47S AB47F-R1 AB47S-R1	DIP-4 SMD-4 SOP-4 SMD-4 SOP-4	Tube (90pcs) Tube (90pcs) Tube (100pcs) Reel (1 000pcs) Reel (1 000pcs)
	1 Anode (+) ▪ LED 2 Cathode (-) ▪ LED 3 NC 4,6 Drain ▪ MOSFET 5 Source ▪ MOSFET	AA47 AA47F AA47F-R1	DIP-6 SMD-6 SMD-6	Tube (50pcs) Tube (50pcs) Reel (1 000pcs)
	1,3 Anode (+) ▪ LED 2,4 Cathode (-) ▪ LED 5,6,7,8 Drain ▪ MOSFET	AC47 AC47F AC47S AC47F-R1 AC47S-R1	DIP-8 SMD-8 SOP-8 SMD-8 SOP-8	Tube (45pcs) Tube (45pcs) Tube (50pcs) Reel (1 000pcs) Reel (1 000pcs)

**REEL DIMENSIONS ▲ All dimensions in mm**


Size	A	B	C	D	E	F	G
SOP-4	330	100	2	13	2	13	21
SOP-8	330	100	2	17	2	13	21
SMD-4	380	80	2.2	17	2	13	21
SMD-6	380	80	2.2	17	2	13	21
SMD-8	380	80	2.2	17	2	13	21

**TAPE DIMENSIONS ▲ All dimensions in mm**


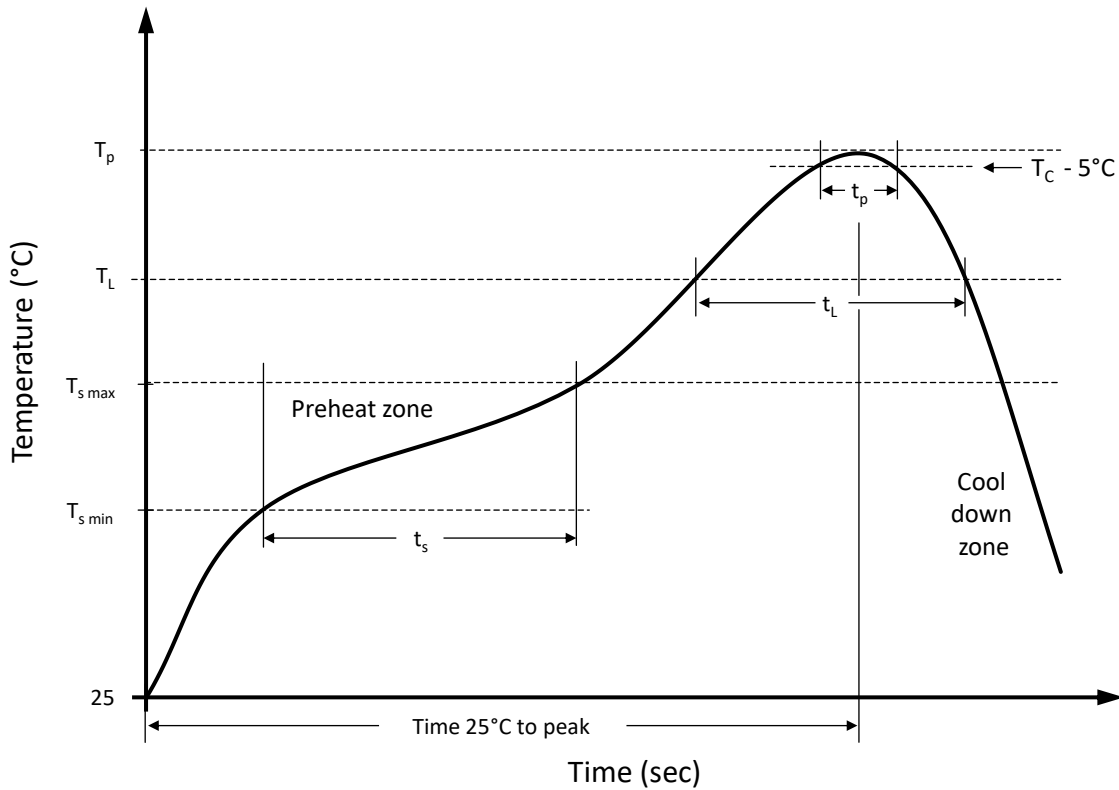
Size	W	U	T	a	Ød0	Ød1	P0	P1	P2	W0	W1	W2
SOP-4	4.6	0.3	2.3	7.2	1.5	1.5	4	12	2	12	7.5	1.75
SOP-8	10.4	0.3	2.3	7.5	1.5	1.5	4	12	2	16	7.5	1.75
SMD-4	5.3	0.3	4	10.6	1.5	1.5	4	16	2	16	7.5	1.75
SMD-6	9.15	0.3	4.45	10.4	1.5	1.5	4	16	2	16	11.5	1.75
SMD-8	9.9	0.3	4	10.6	1.5	1.5	4	16	2	16	7.5	1.75

Tape and Reel Packing	PCS/Reel
SMD-4	1000
SMD-6	1000
SMD-8	1000
SOP-4	1000
SOP-8	1000

Tube Packing	PCS/Tube	Tubes/Box	Units/Box
DIP-4	90	30	2700
DIP-6	50	30	1500
DIP-8	45	30	1350
SMD-4	90	30	2700
SMD-6	50	30	1500
SMD-8	45	30	1350
SOP-4	100	30	3000
SOP-8	50	30	1500

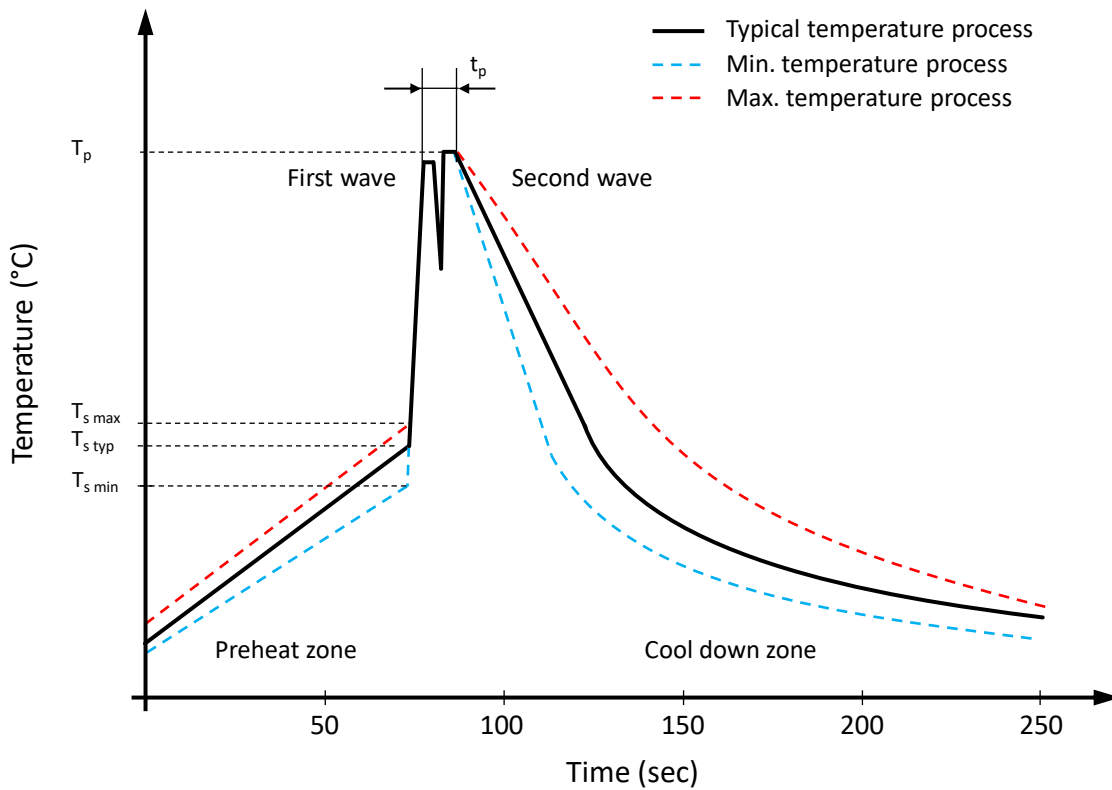
## STORAGE AND HANDLING CONDITIONS

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

**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



**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

### LOAD CONNECTING METHOD

Type	Load	Connection	Feature
4 pins	AC or DC		Control bi-directional signal
6 pins	A		Control bi-directional signal
	B		On-resistance is 1/2 of A-connection 2-Make-contacts (Source Common)
C		On-Resistance is 1/2 of B-connection	
8 pins	AC or DC		2 input and 2 output
			1 input and 2 output

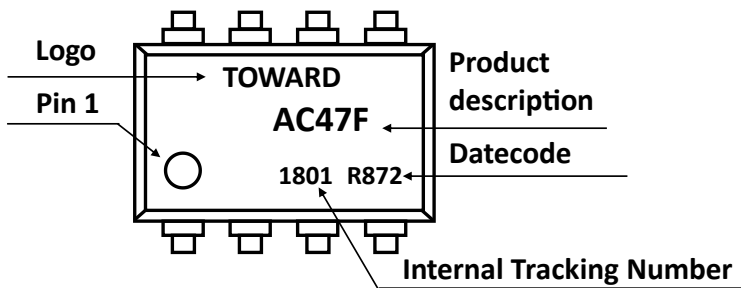
### PRODUCT CODE

Example: AC47F series ▲ 2 Form A ▲ 80V ▲ SMD-8 ▲ Tape & Reel

AC		38		-		F		R1	
Package		Series		Special Suffix		Type		Packing	
AA	6 Pin ▲ 1 Form A	47	80V	Blank H	Standard High Insulation	Blank F S	DIP SMD SOP	Blank R1	Tube Reel
AB	4 Pin ▲ 1 Form A								
AC	8 Pin ▲ 2 Form A								

### PRODUCT MARKING

Example: AC47F series ▲ 2 Form A ▲ 80V ▲ SMD-8 ▲ 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		
		A	2020	3	Mar		
		B	2021	4	Apr		
H	Halogen free	C	2022	5	May	3	3 <sup>rd</sup>
		...	...	...	...	4	4 <sup>th</sup>
		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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