GENERAL DESCRIPTION

This data sheet will show how to remove Phantom Power consumption. It may not be necessary to use ***Magic Switch*** (Fig1) and an equivalent circuit (Fig2) has been provided in the data sheet. The Phantom Power consumption due to EMI Cap.'s discharge resistor can be removed by a pretty simple circuit as describe in the block diagram. However, ***Magic Switch*** could be most cost-effective, layout easy…..choice for designing zero no load consumption application.

Magic Switch, it behaves like a magic switch or a low-pass filter. Magic switch allows DC passes and AC is blocked. Magic switch is a low pass filter. It allows frequency more than 20 Hz to pass (AC plug-in Magic switch turn off) with ~ Zero Input Power. When frequency small than 20Hz, Magic switch is turn on discharge EMI's Cap.

Magic switch power consumption is approaching to 0mW when line voltage appears.

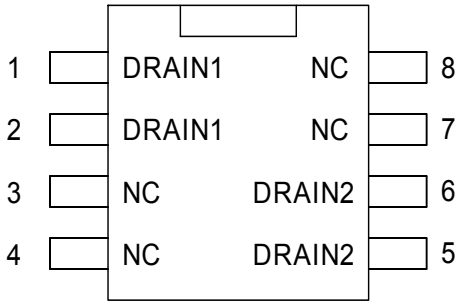
Note : When 264VAC input: Magic Switch consumption is approaching $(264VAC)^2$ /12Mohm (internal resistor)~5.8mW

FEATURES

- Remove Phantom Power consumption
- 4 terminal with > 5 mm space on package and PCB
- 2 terminal with >3 mm space on package and PCB
- Meet safety ICE 60065/60950
- Break down voltage ~1KV
- Design for lightning surge sensitive environment
- One product works with any EMI's capacitor filter design
- Most cost effective, Layout easy solution, easily to meet Erp lot6 tier 2 requirement
- SOP8 / SOD123 packages for Adaptor / Desktop Application
- The package is polarity insensitive.

PIN CONFIGURATION

SOP8 TOP View



SOD123 TOP View

Magic Switch ORDERING INFORMATION

Part Number	Temperature Range	Package
CM02XISTR*	-65℃ to150℃	SOP-8
CM02XIUTR*	-55℃ to150℃	SOD123
CMD02XISTR*	-65℃ to150℃	SOP-8
CMD02XIUTR*	-55℃ to150℃	SOD123

***Note:** X : Suffix for Halogen Free and PB Free Product
TR : Package is Type & Reel

ABSOLUTE MAXIMUM RATINGS (TA=25℃, unless otherwise specified)

PARAMETER		Symbol	RATINGS	Unit
Turn on ID Max. Current Continues		(Rd1+Rd2>264VAC*1.414/2mA=186Kohm)	2	mA
Package Power Dissipation @ $T_A \le 25^oC$ (SOP8)		P_D	0.86	W
Package Power Dissipation @ $T_A \le 25^oC$ (SOD123)		P_D	0.5	W
Drain1 to Drain2 Voltage		V_{DSS}	1000	V
Junction Temperature	SOP-8	T_J	+150	℃
Storage Temperature	SOP-8	T_{STG}	-65~+150	℃
Junction to Ambient *	SOP-8	θ_{JA}	145.7	℃/W
Case Temperature		θ_{JC}	27.8	
Junction Temperature	SOD123	T_J	+150	℃
Storage Temperature	SOD123	T_{STG}	-55~+150	℃
Junction to Ambient *	SOD123	θ_{JA}	250	℃/W
Case Temperature		θ_{JC}	50	

Note : 1. Surface Mounted on $1in^2$ pad area, t≦10sec

2. Operating Ambient Temperature is 85±2℃

APPLICATION CIRCUIT:

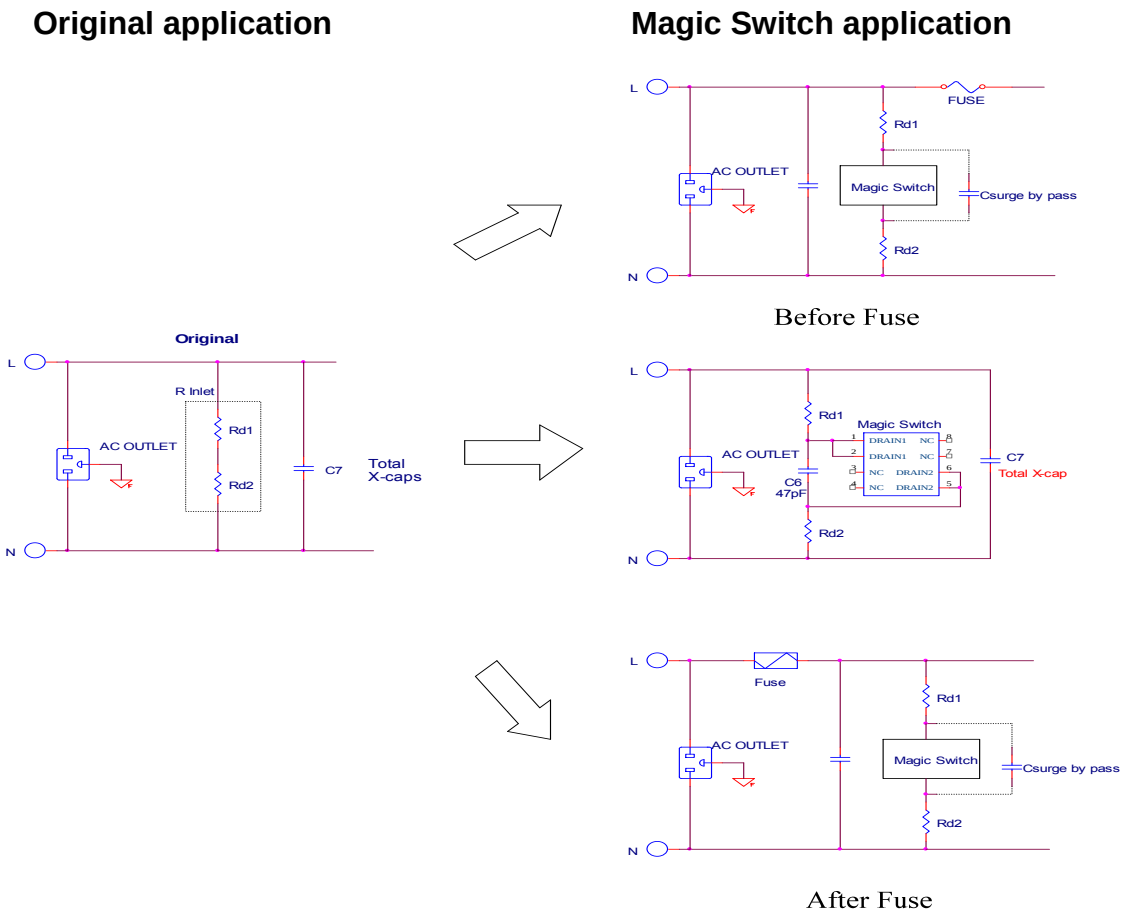


Figure 1. Magic switch application

SIMPLIFIED BLOCK DIAGRAM : Equivalent Circuit

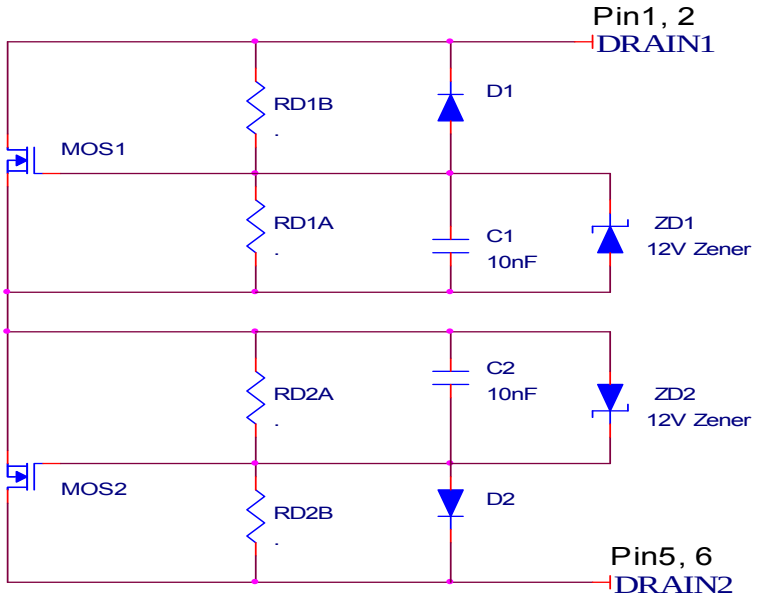


Figure 2. Magic Switch equivalent circuit

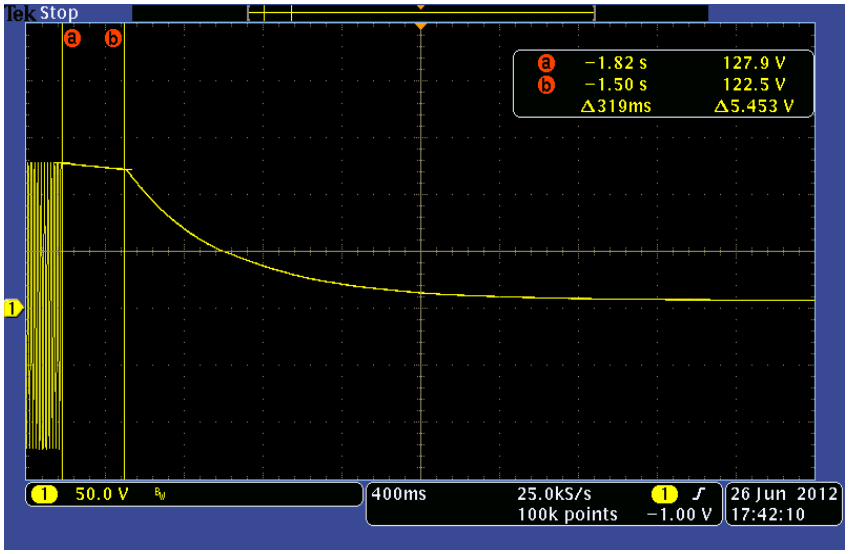
ELECTRICAL CHARACTERISTICS

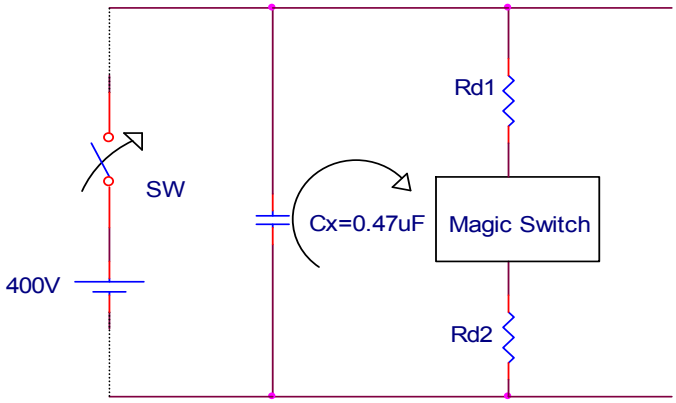
Unless otherwise specified, T_A = 25℃.

PARAMETER	SYMBOL	TEST CONDITIONS	Magic Switch			
			Min	Typ	Max	Unit
Breakdown Voltage						
Drain1 to Drain2	BV_{DSS}			1		KV
Internal 1KV MOSFET turn On delay time						
1KV MOSFET On delay time	Ton delay	Vd1d2 = 50V, Rd1+Rd2= 250K		385	550	mS
1000V MOSFET On delay time	Ton delay	Vd1d2 = 127V, Rd1+Rd2= 250K (Figure1)			350	mS
1KV MOSFET Rdson						
1KV MOSFET Rdson	Rdson	Vgs = 12V @ room temp		60		Kohm
Discharge Time test (400V discharged to 60V)						
400V to 60V discharging time test	Tdischarging	Rd1+Rd2=250K; Cx =0.47uF		0.5		S
Magic switch supply current without turning on 1kV MOSFET						
Magic Switch current @ line Frequency =47 Hz	I supply ac	Vin = 230 Vac and Frequency =47Hz			20	uA

Note for 1KV Mosfet On delay time: Ton delay is inversely proportional to Vd1d2, Ton delay is around 25~40ms in Vd1d2=380V

DELAY TIMER (Figure1 : cursor a to cursor b)

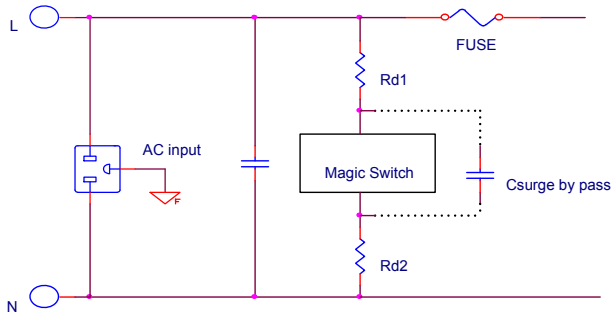


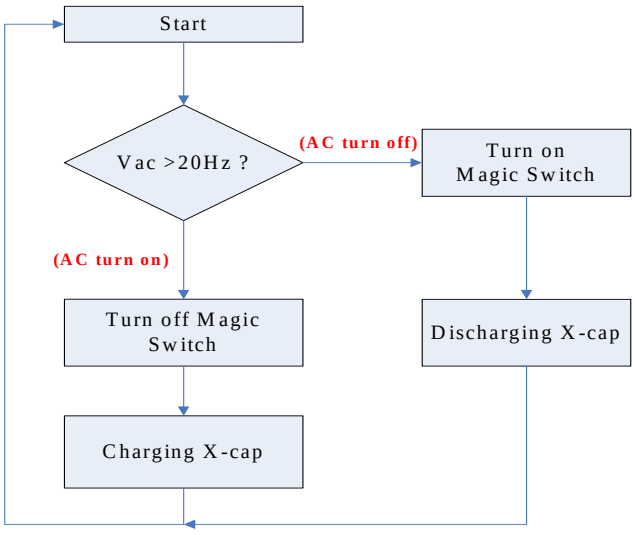


IC Test Equipment circuit

DESCRIPTION

Magic switch is designed to replace the discharging resistor of EMI filter. Magic switch is one product to fit for any EMI's capacitor Design. Magic switch is a low-pass filter. When the input frequency is lower than 20Hz (AC plug out), the two-integrated 1KV MOSFETS will be turned on and when the input frequency is higher than ~ 20Hz(AC plug in), the two-integrated 1KV MOSFET will be off.





Magic switch has 4 or 2 terminals. Magic switch's two 1KV MOSFET connects 2 external discharging resistor when input frequency < 20Hz. Magic switch's two 1KV MOSFET disconnects 2 external discharging resistor when input frequency is > 20Hz.

The total value of two external resistor value should be determined by the (Rd1+Rd2)*Cx time constant,
If Tdischarge time need small than 0.5Sec. Therefore, Tdischarge = (Rd1+Rd2) x Cx < 0.5Sec. Cx is the EMI x capacitor. In actual application, using Magic Switch just need select external discharge resistor Rd1 and Rd2 from table1.Finally,X-capactior discharge to 37% voltage is (Tdischarge time+Ton delay time)

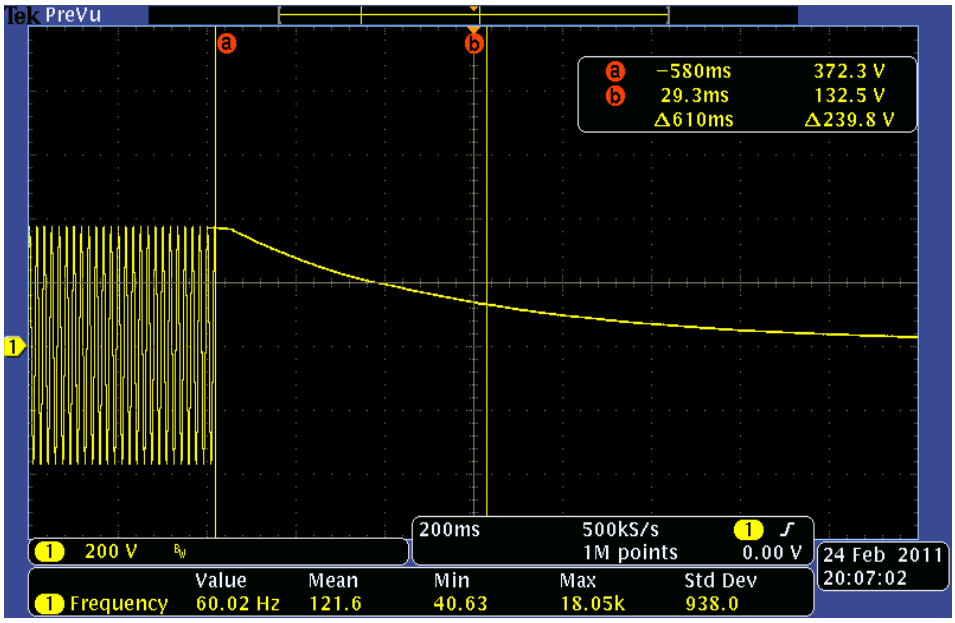
For example:
The EMI Capacitor Tdischarge time equation->$V2=V1*e^{(-T/RC)}$; V2 is discharge voltage;V1 is initial voltage , If your Tdischarge time select=0.6sec From Table 1 you can obtain Cx and (Rd1+Rd2).
The X –capacitor discharge to 37% voltage=(Tdischarge timr +Ton delay time)=0.9sec

Product	Magic Switch (for any EMI capacitor)							
Calculate Discharge Resistor	Comparison Sheet							
Total X Capacitor (uF) : C_X	0.47	0.68	1	1.5	2	2.2	3	4.7
Discharging Time (S) : T_D (Rc Time Constant)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Total Discharge Resistor (KΩ) : R_{D1}+R_{D2} (Careful of Surge Current)	1282	885	600	400	300	272	200	126
Discharge Resistor (KΩ) : R_{D1}=R_{D2} (Kohm)	641	443	300	200	150	136	100	63
AC Input (V) : V_1 (Spec. 90~264Vac)	90~264	90~264	90~264	90~264	90~264	90~264	90~264	90~264
Discharg Ratio (%) (Spec. ~37%) Consider EMI Cap. Tolerance	37%	37%	37%	37%	37%	37%	37%	37%
Discharg to V2 (V) (90 or 264)*1.414*37%	46V/138V	46V/138V	46V/138V	46V/138V	46V/138V	46V/138V	46V/138V	46V/138V
Delay time max. 300mS	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
X Capacitor (uF) : CX Discharge Time to 37%	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Table 1. Discharge resistor select

DISCHARGE TIMING TEST

Condition : 264VAC , Cx = 0.62uF ;Tdischarge time <0.6sec--------look up table1-→ Rd1+Rd2 ~~~ 906K



A Csurge ~ 47pF capacitor should be added to parallel with Magic switch for strenuous lightning surge test. The Csurge is added to suppress the voltage across Magic Switch.

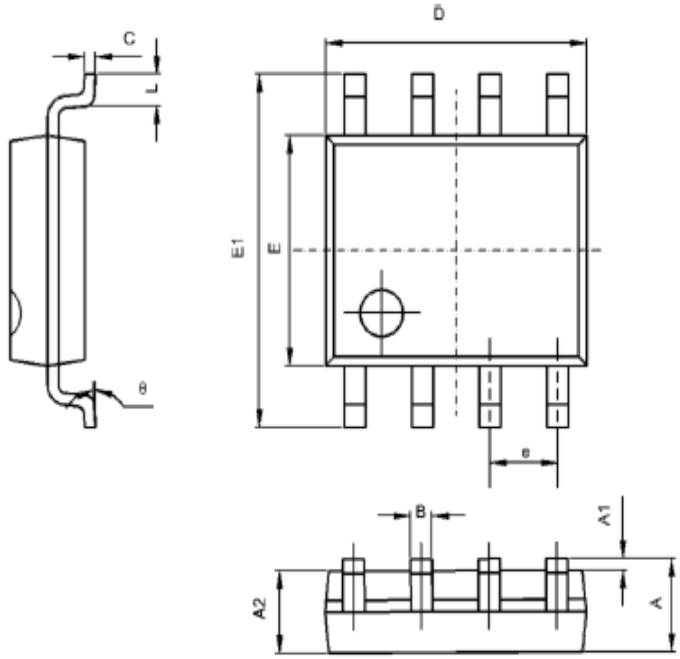
Magic switch 4/2 terminal package provides minimum 50/3 mm space for PCB layout. Magic Switch is designed for lightning surge sensitive environment.

Without Magic Switch, the equivalent circuit on the simplified block figure has been provided and it will have the similar good performance. However, Magic Switch is more cost-effective and easy layout.

The maximum Rd1+Rd2=0 ohm and the minimum *Cx*=2UF (1sec discharge 37% or 42V)
The maximum Rd1+Rd2=1.1M ohm and the minimum *Cx*=0.1UF

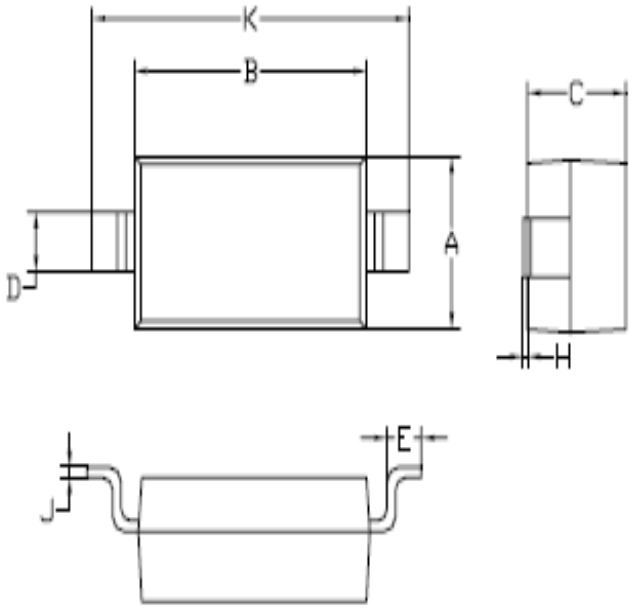
PACKAGE DIMENSION

8-PIN SOP (S8)



SYMBOL	DIMENSION IN MILLIMETERS		DIMENSION IN INCHES	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270 TYP		0.050 TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

SOD123



SOD-123		
Dim	Min	Max
A	1.4	1.8
B	2.55	2.85
C	1.15 Typical	
D	0.5	0.6
E	0.3	0.4
H	0.02	0.10
J	0.1 Typical	
K	3.55	3.85
All Dimensions in mm		

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