

( )



1 Surge

1. Surge

2. Surge

3. Surge

4. Surge

5.

6. Surge

2

3

4 Surge Protection

5 Surge

6 Surge

1 .

1.

(Surge) line  
가

,  
,  
(IEC IEC 61643-12-01)  
가 , 가 가  
, 가

, TV

Surge .

가 , Surge 가

가

(短絡.Short circuit)

가 , system Surge



Surge  
 (雷.Lightning) Surge ground  
 , switch · relay · Surge,  
 Arc Surge  
 Motor · Surge  
 Surge가 system  
 , Surge  
 Surge  
 system  
 , system system total  
 system 가  
 system 가 ,  
 system Surge 가  
 Surge 가  
 Surge Protection System

88.3% Surge

Power Disturbance		(%)
Oscillatory Transients	62.2	48.8
Voltage Spike	50.7	39.5
Undervoltage	14.4	11.2
Overvoltage	00.0	00.0
Blackout	00.6	00.5
Total	127.9	100

\* Transactions on "Power Apparatus and Systems"  
 July-August, 1974 issue 1974 IEEE  
 (IEEE : )

2. Surge

2.1

Surge  
 가 ,  
 system  
 가  
 260  
 1 1%  
 , 가  
 5% 가  
 가

2.2

1)

. 가

가

2)

가

3. Surge

3.1

1) Surge  
 Surge 가

2) Surge  
 Inductive Switching.

Surge 75~90%가

3.2

2.1) Surge

Inductive load On/Off

1) Surge

Surge

, Inductive motor, Compressors  
(Turn Off/6,000V), Pump, Welding machines(  
, Furnace igniter ( ) switch On  
/Off Spike 250~6,000V  
Surge가 0~500ms

2) Surge

cable signal cable

2.2) Surge

Induction motor, DC motor drives,  
Inverter(or VVVF), Power switching,  
Elevators, , Compressors, Pump  
motors, Capacitor, Relay,  
Tr, IC 250~1,000V  
Surge가

3) Surge

FRI(Radio Frequency Interference)

3) Surge

ESD(Electro-Shortic Discharge) rise  
time 2kv/ns 20kv  
lighting surge

가

4) Surge

NEMP(Nuclear Eletro-Magnetic Pulse)  
rise time 5kv/ns surge 가

4) Surge

3가 가  
가

. NEMP  
NEMP

3.3 Surge

R-C L-C

1) Surge

가

IC

soldering 가  
Surge low impedance

5) Surge

	FIELD DENSITY OR MAGNITUDE	RISE TIME
NEMP	50KV/m @500km	5KV/uS
LIGHTING	3V/m @10km	600V/uS
STATIC DISCHARGE	20KV/m AT IMPACT	2KV/uS

2) Surge

Surge



, MOS 가  
Surge high impedance

, General Semiconductor Industries  
Transient Surge

3.4

1) Normal Mode  
Surge가 Line Line ,  
Line(Hot) Neutral  
controll system ,

2) Command Mode  
Surge가 Line Ground ,  
Neutral Ground  
Processor Memory Logic

Microprocessor or Digital Logic Controll  
System Neutral Ground  
Zero Voltage  
Neutral Ground Surge

Command Mode Surge Software ,  
Memory Loss , Data

Transient		
1.	8.4 $\mu$ s	
2.	(sine wave)	
3.	high impedance source	
가		
4.	level	
mV	18,000	
Surge		
1.	8.4 $\mu$ s	
2.		
3.	low impedance source	
가		
4. Surge	90%가	2
4. Surge	99%가	3

Command Mode Surge

1) Transient  
1.1) Impulse Transient

4 Surge

(Unipolar) V V

Surge

msec 200msec  
Impulse Transient 0V 가  
sine-wave  
Positive Impulse Transient " Spike"  
, Negative Impulse Transient  
" Notch"

4.1 Surge

1.2) Oscillatory Transient or Ringwave  
Transient

(Transient) (Surge)  
(IEEE,UL,NEC )

Hz ~ MHz  
oscillation ,

Impulse Transient  
 energy (250 ~ 2500V)  
 1cycle (16.7msec)  
 가

low impedance

가

\* Transient Sources

	Voltage	Current	Rise Time	Duration
Lightning	a)25KV/M	20KA	1.5 $\mu$ s	40 $\mu$ s
	b)6KV	1KA	10 $\mu$ s	1ns
Switching	a)2500KV	200A	10 $\mu$ s	1ns
	b)600KV	500A	50 $\mu$ s	10ns
EMP	a)100KV/M	10KA	10ns	150ns
	b)1KV	1KA	20ns	1 $\mu$ s
ESD	a)40KV/M	80A	1-5ns	100ns
	b)5-1KV	10A	10ns	100ns

\* Disruption Energy

energy  
 memory error,

\* Destruction Energy

가 energy  
 , system hardware

5

Surge

가 impulse rising  
 , time energy  
 , Surge

6

6.1

$\mu$ s

150MHz( : 300MHz)

가

limit event

(Failure Threshold)

Semiconductor Device Type	Disruption (Joules)	Disruption Energy(Joules)
Digital integrated Dircuts	10 <sup>9</sup>	10 <sup>-6</sup>
Analog integrated Dircuts	10 <sup>8</sup>	10 <sup>-6</sup>
Lower Noise Transistor & Diodes	10 <sup>7</sup>	10 <sup>-6</sup>
High Speed Transistor & ICs	10 <sup>6</sup>	10 <sup>-5</sup>
Lower Power Transistor & Single Diodes	10 <sup>5</sup>	10 <sup>-2</sup>
Medium Power Transistor	10 <sup>4</sup>	10 <sup>-3</sup>
Zeners & Rectifiers	10 <sup>3</sup>	10 <sup>-2</sup>
High Power Transistor	10 <sup>2</sup>	10 <sup>-1</sup>
Power SCRs and Power Diodes	10 <sup>1</sup>	10 <sup>0</sup>

가

가

6000V

가 ms

가

1000:1



가

가



가

가

220V

485 (5V)

6,180V 1:1 가

6.2

가

가

1)

가

가

가

( , , )

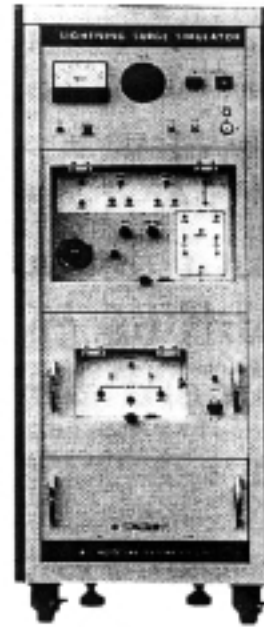
가

가

/

가

가



2)

12,000V

