



## 60V/0.3A N-Channel Advanced Power MOSFET

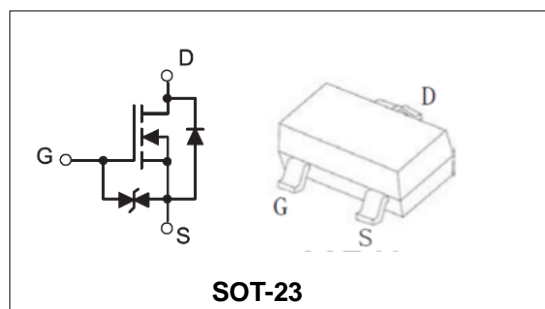
### Features

- Lead free product is acquired
- Surface mount package
- High power and current handling capability
- ESD Rating: HBM 2000V

BVDSS	60	V
ID	0.3	A
RDSON@VGS=10V	1	Ω
RDSON@VGS=5V	1.3	Ω

### Applications

- Direct logic-level interface: TTL/CMOS
- Drivers: relays, solenoids, lamps, hammers, display, memories, transistors, etc.
- Battery operated systems
- Solid-state relays



### Order Information

Product	Package	Marking	Reel Size	Reel	Carton
2N7002K	SOT-23	72K	7inch	3000PCS	180000PCS

### Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit	
<b>Common Ratings (TC=25°C Unless Otherwise Noted)</b>				
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	60	V	
$V_{GS}$	Gate-Source Voltage	±20	V	
$T_J$	Maximum Junction Temperature	150	°C	
$T_{STG}$	Storage Temperature Range	-55 to 150	°C	
$I_S$	Diode Continuous Forward Current	$T_A = 25^\circ\text{C}$	0.3	A
<b>Mounted on Large Heat Sink</b>				
$I_{DM}$	Pulse Drain Current Tested (Silicon Limit) (Note1)	$T_A = 25^\circ\text{C}$	0.8	A
$I_D$	Continuous Drain current	$T_A = 25^\circ\text{C}$	0.3	A
$P_D$	Maximum Power Dissipation	$T_A = 25^\circ\text{C}$	0.35	W
$R_{\theta JA}$	Thermal Resistance Junction-to-Ambient (Note2)		350	°C/W

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Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
<b>Static Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise stated)</b>						
V <sub>(BR)DSS</sub>	Drain- Source Breakdown Voltage	VGS=0V ID=250μA	60	--	--	V
I <sub>DSS</sub>	Zero Gate Voltage Drain current	VDS=60V,VGS=0V	--	--	1	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	VGS=±20V,VDS=0V	--	±4	±10	μA
V <sub>GS(TH)</sub>	Gate Threshold Voltage	VDS=VGS,ID=250μA	1	1.5	2.5	V
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance (Note3)	VGS=5V, ID=0.2A	--	1.3	4	Ω
		VGS=10V, ID=0.5A	--	1	3	Ω
<b>Dynamic Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise stated) (Note4)</b>						
C <sub>iss</sub>	Input Capacitance	VDS=25V, VGS=0V, F=1MHz	--	21	--	pF
C <sub>oss</sub>	Output Capacitance		--	11	--	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	4.2	--	pF
Q <sub>g</sub>	Total Gate Charge	VDS=10V, ID=0.3A, VGS=4.5V	--	1.7	--	nC
<b>Switching Characteristics (Note4)</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	VDS=30V, ID=0.2A, RG=10Ω, VGS=10V	--	10	--	nS
t <sub>r</sub>	Turn-on Rise Time		--	50	--	nS
t <sub>d(off)</sub>	Turn-off Delay Time		--	17	--	nS
t <sub>f</sub>	Turn-off Fall Time		--	10	--	nS
<b>Source- Drain Diode Characteristics @ T<sub>J</sub> = 25°C (unless otherwise stated)</b>						
V <sub>SD</sub>	Forward on voltage	IS=0.2A,VGS=0V	--	--	1.3	V

Note:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: pulse width ≤ 300 us, duty cycle ≤ 2%.
4. Guranteed by design, not subject to production testing.



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Typical Characteristics

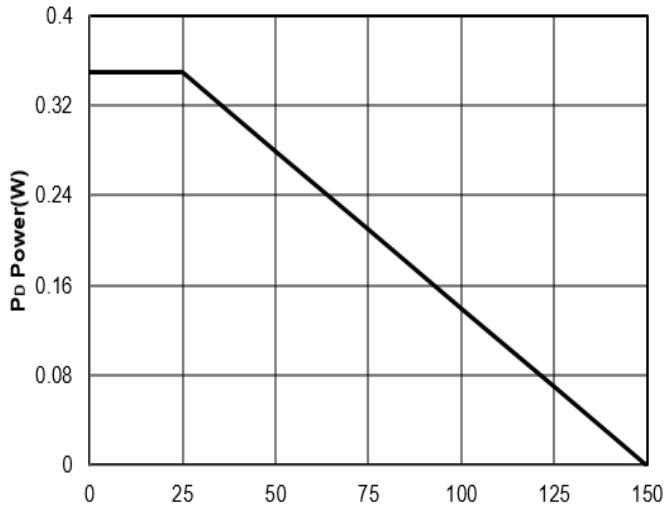


Figure1: T<sub>j</sub> Junction Temperature (°C)

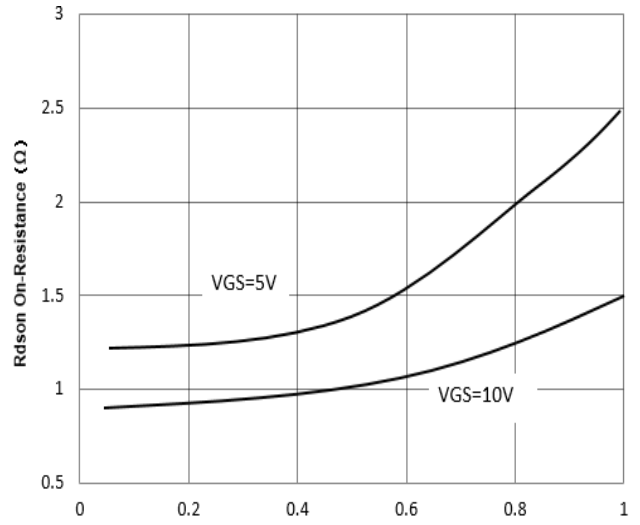


Figure2: I<sub>d</sub> Drain Current (A)

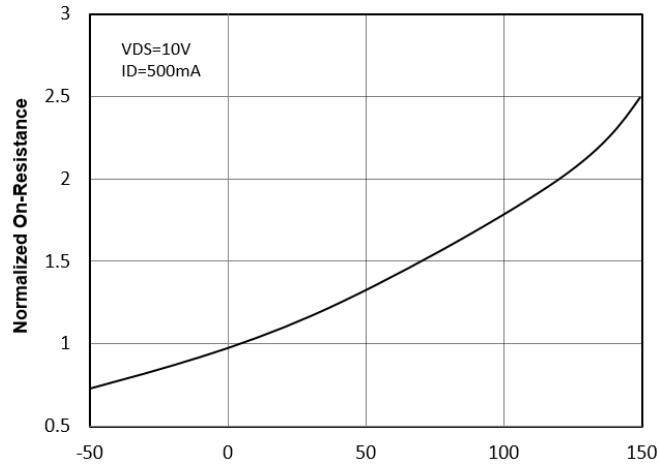


Figure3: T<sub>j</sub> Junction Temperature (°C)

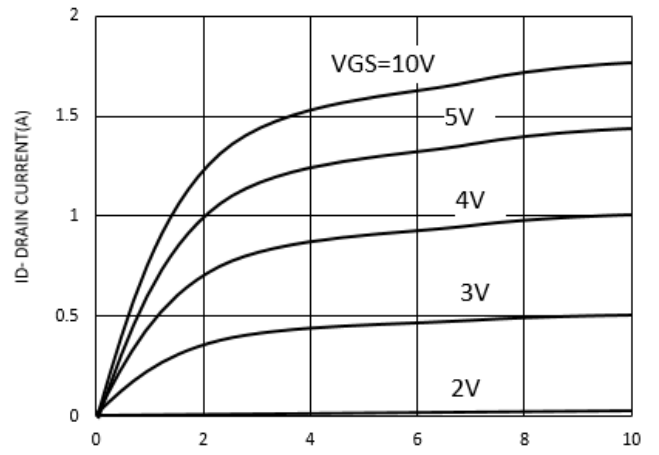


Figure4: V<sub>ds</sub> Drain-Source Voltage (V)

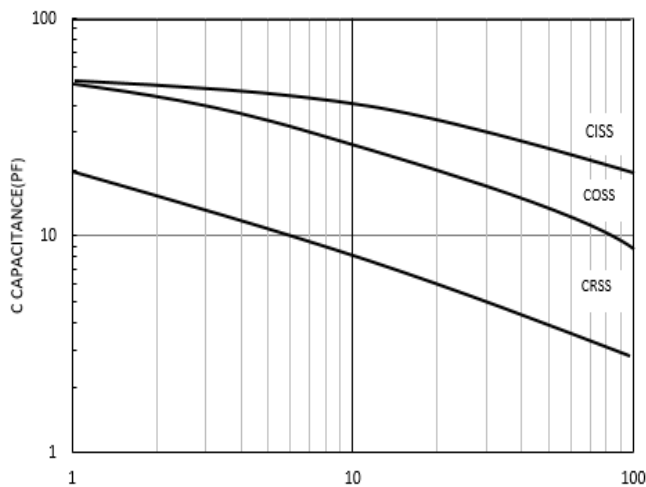


Figure5: V<sub>DS</sub> Drain-Source Voltage (V)

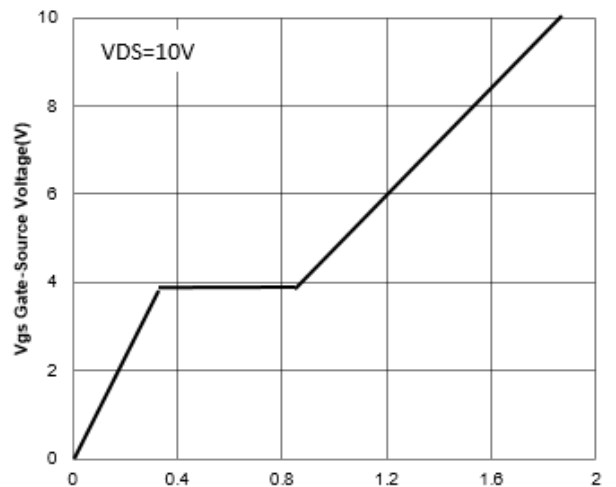


Figure6: Q<sub>g</sub> Gate Charge (nC)



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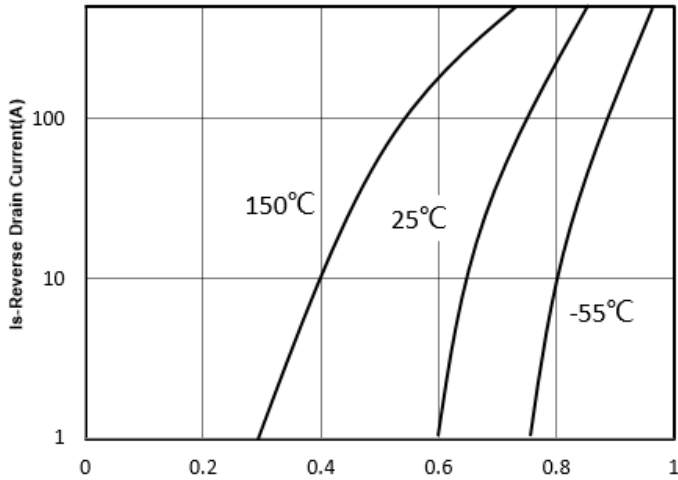


Figure7: Vsd Source-Drain Voltage (V)

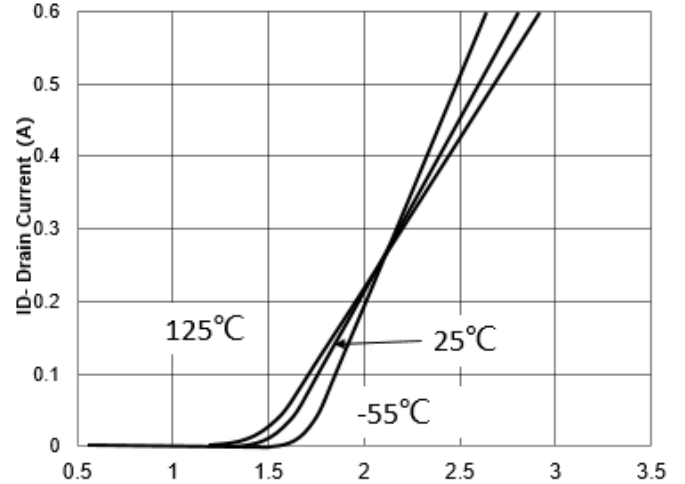


Figure8: Vgs Gate-Source Voltage (V)

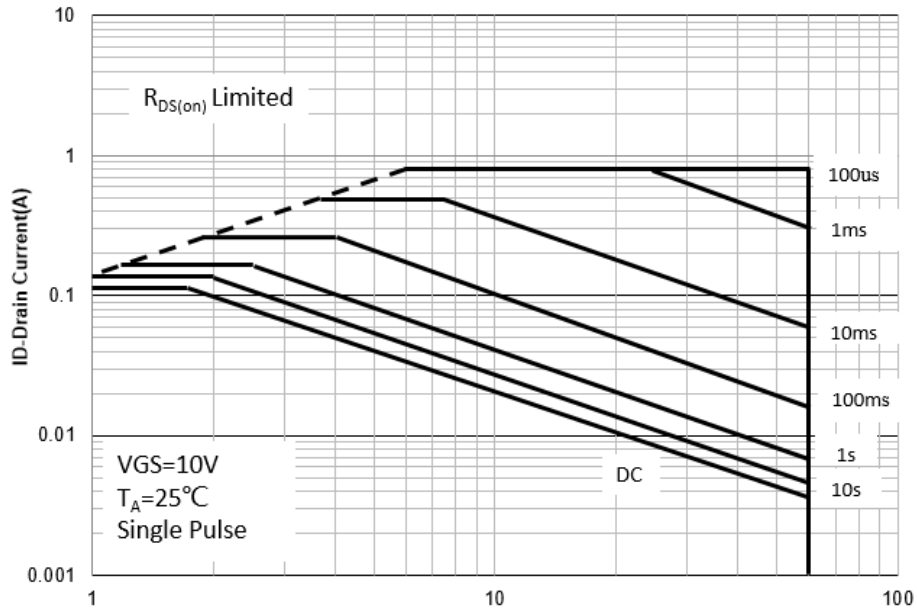


Figure9: Vsd Drain -Source Voltage (V)

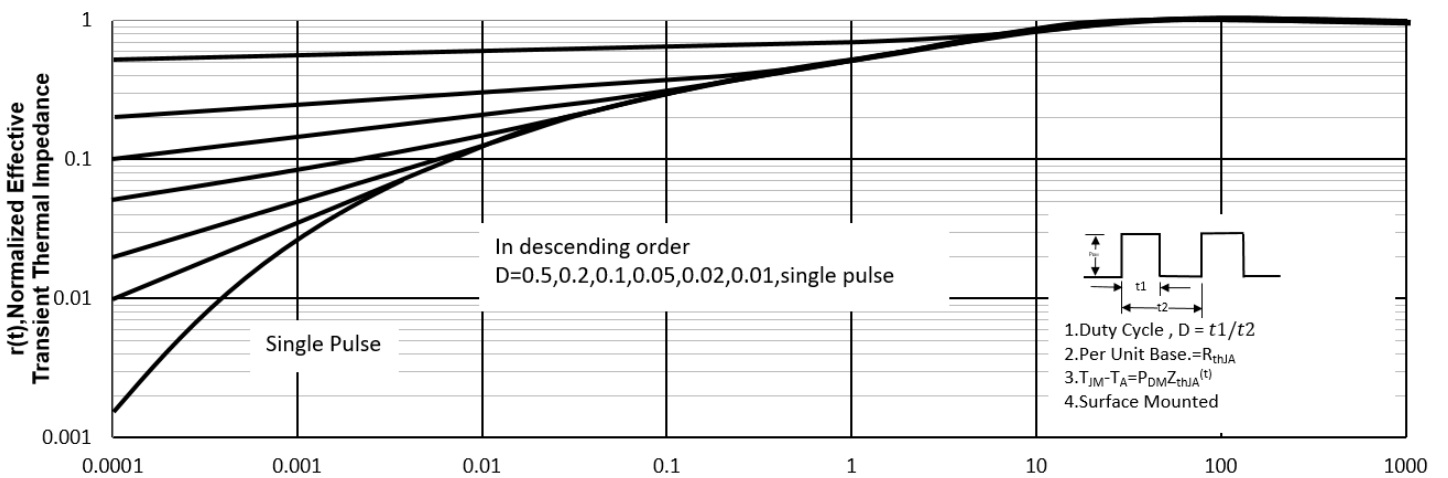


Figure10: Square Wave Pulse Duration (sec)

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### Test Circuit and Waveform:

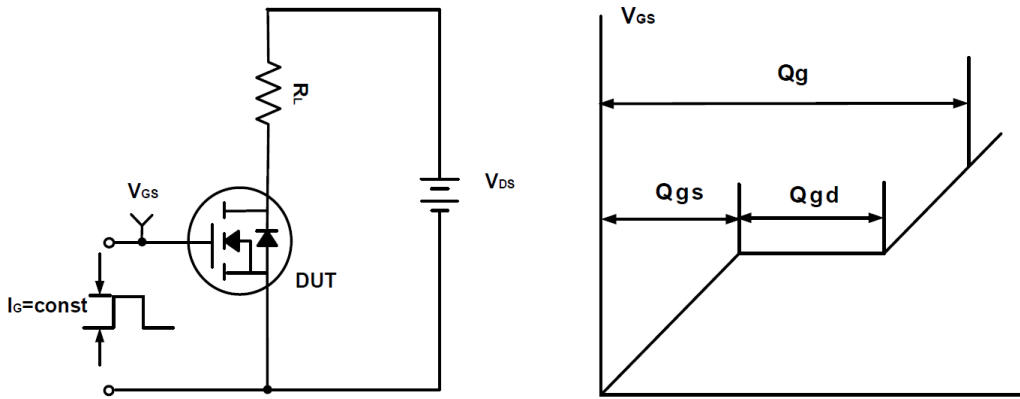


Figure A Gate Charge Test Circuit & Waveforms

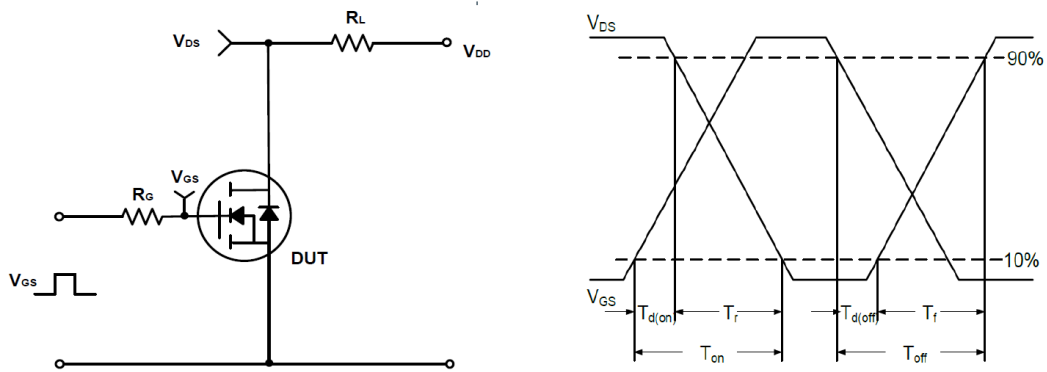


Figure B Switching Test Circuit & Waveforms

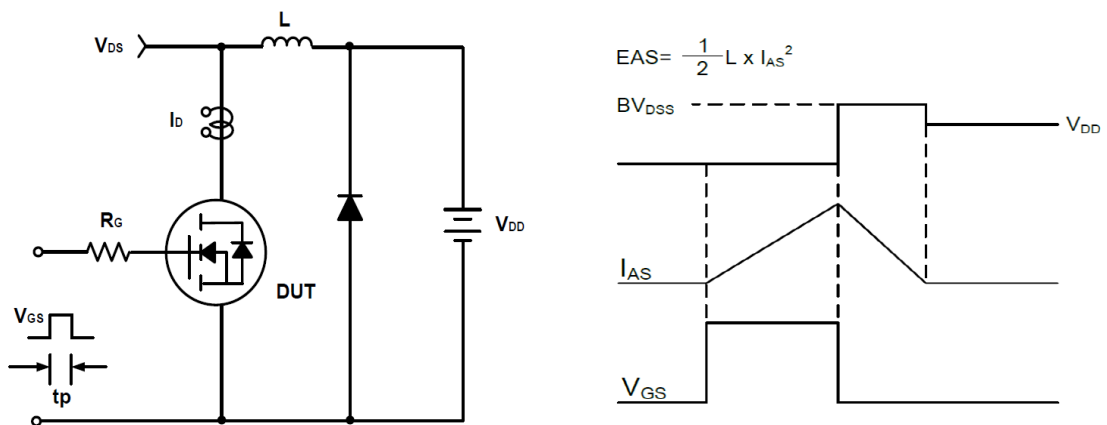
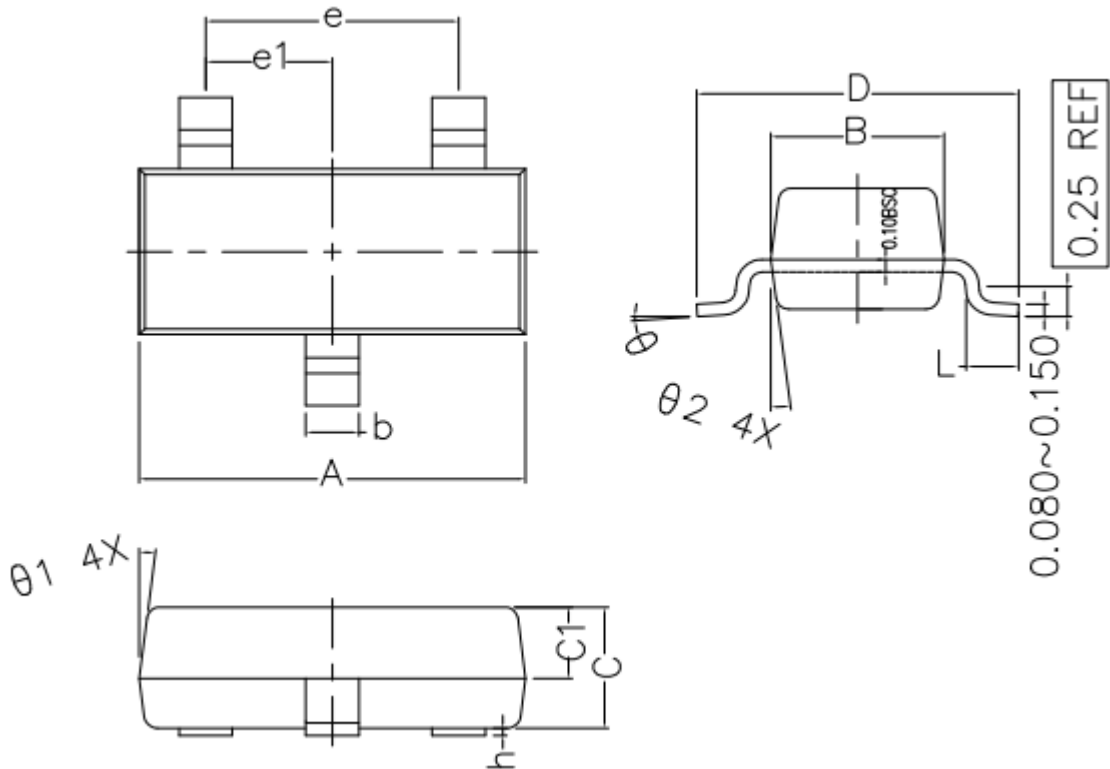


Figure C Unclamped Inductive Switching Circuit & Waveforms



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SOT-23 Package Outline Dimensions (Units: mm)



COMMON DIMENSIONS (UNITS OF MEASURE IS mm)			
	MIN	NORMAL	MAX
A	2.800	2.900	3.000
B	1.200	1.300	1.400
C	0.900	1.000	1.100
C1	0.500	0.550	0.600
D	2.250	2.400	2.550
L	0.300	0.400	0.500
h	0.010	0.050	0.100
b	0.300	0.400	0.500
e	1.90 TYPE		
e1	0.95 TYPE		
theta1	7° TYPE		
theta2	7° TYPE		
theta	0° ~ 7°		