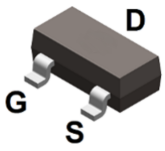
2N7002H

N-Channel Enhancement Mode MOSFET

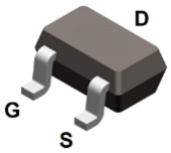
Features

- Low on-resistance
- High-speed switching
- Drive circuits can be simple
- Parallel use is easy
- HBM: JESD22-A114-B: 2



2N7002H

SOT-23

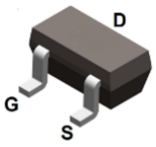


2N7002HW

SOT-323

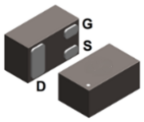
Typical Applications

- N-channel enhancement mode effect transistor
- Switching application



2N7002HT

SOT-523

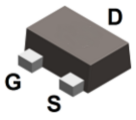


2N7002HL

DFN1006-3

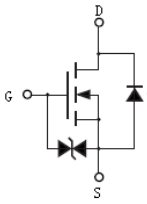
Mechanical Data

- Case: SOT-23, SOT-323, SOT-523, DFN1006-3, SOT-723
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte Tin-Plated Leads, Solderability-per MIL-STD-202, Method 208



2N7002HM

SOT-723



Ordering Information

Part Number	Package	Shipping Quantity	Marking Code
2N7002H	SOT-23	3000 pcs / Tape & Reel	7002K
2N7002HW	SOT-323	3000 pcs / Tape & Reel	RKS
2N7002HT	SOT-523	3000 pcs / Tape & Reel	7002K
2N7002HL	DFN1006-3	10000 pcs / Tape & Reel	72
2N7002HM	SOT-723	10000 pcs / Tape & Reel	72

Maximum Ratings (@ T_A = 25°C unless otherwise specified)

Parameter		Symbol	Value	Unit
Drain-Source Voltage		V_{DSS}	60	V
Gate -Source Voltage		V_{GSS}	±20	V
Continuous Drain Current (T_A = 25°C) *1		I_D	300	mA
Continuous Drain Current (T_A = 70°C) *1			240	mA
Pulsed Drain Current (t_p =10μs, T_A = 25°C)		I_{DM}	2000	mA
Single Pulse Avalanche Energy *3		E_{AS}	0.11	mJ
Operating Junction Temperature Range		T_J	-55 to +150	°C
Storage Temperature Range		T_{STG}	-55 to +150	°C
Power Dissipation (T_A = 25°C) *1	SOT-23	P_D	0.35	W
	SOT-323		0.25	
	SOT-523		0.15	
	DFN1006-3		0.15	
	SOT-723		0.15	

Thermal Characteristics

Parameter		Symbol	Value	Unit
Thermal Resistance Junction to Ambient Air		$R_{\theta JA}$	357	°C/W
	SOT-323		500	
	SOT-523		833	
	DFN1006-3		833	
	SOT-723		833	
Thermal Resistance Junction to Lead	SOT-23	$R_{\theta JL}$	234	°C/W
	SOT-323		313	
	SOT-523		521	
	DFN1006-3		521	
	SOT-723		521	
Thermal Resistance Junction to Case	SOT-23	$R_{\theta JC}$	195	°C/W
	SOT-323		261	
	SOT-523		434	
	DFN1006-3		434	
	SOT-723		434	

Electrical Characteristics (@ T_A = 25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
V_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA	60	-	-	V
I_{DSS}	Drain to Source Leakage Current	V_{DS} = 60V, V_{GS} = 0V	-	-	1	μA
I_{GSS}	Gate-body Leakage	V_{GS} = ±20V, V_{DS} = 0V	-	-	±10	μA
On Characteristics						
$R_{DS(ON)}$	Drain-Source On-resistance *2	V_{GS} = 10V, I_D = 0.5A	-	1	2.5	Ω
		V_{GS} = 5V, I_D = 0.05A	-	1.1	3	
		V_{GS} = 4.5V, I_D = 0.5A	-	1.2	4	
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	1	1.5	2.5	V
R_G	Gate Resistance	V_{GS} = 0V, f = 1MHz	-	39	-	Ω
Dynamic Characteristics						
C_{ISS}	Input Capacitance	V_{GS} = 0V V_{DS} = 20V f = 1.0MHz	-	26.7	-	pF
C_{OSS}	Output Capacitance		-	7.1	-	
C_{RSS}	Reverse Transfer Capacitance		-	2.2	-	
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time *4	V_{DD} = 30V, I_D = 0.2A V_{GS} = 10V, R_G = 25Ω R_L = 150Ω	-	6	-	ns
t_r	Turn-on Rise Time *4		-	5	-	
$t_{d(off)}$	Turn-Off Delay Time *4		-	25	-	
t_f	Turn-Off Fall Time *4		-	15	-	
Q_G	Total Gate-Charge	V_{DS} = 10V V_{GS} = 4.5V I_D = 0.2A	-	0.44	-	nC
Q_{GS}	Gate to Source Charge		-	0.14	-	nC
Q_{GD}	Gate to Drain (Miller) Charge		-	0.2	-	nC
Source-Drain Diode Characteristics						
V_{SD}	Diode Forward Voltage *2	I_S = 0.3A, V_{GS} = 0V	-	0.85	1.2	V

Notes:

1. The data tested by surface mounted on a 1 inch^2 FR-4 board with 2OZ copper
2. The data tested by pulsed, pulse width ≤ 300μs, duty cycle ≤ 2%
3. The E_{AS} data shows Max. rating. The test condition is V_{DD} = 30V, V_{GS} = 10V, L = 0.1mH
4. Guaranteed by design, not subject to production

Ratings and Characteristics Curves (@ T_A = 25°C unless otherwise specified)

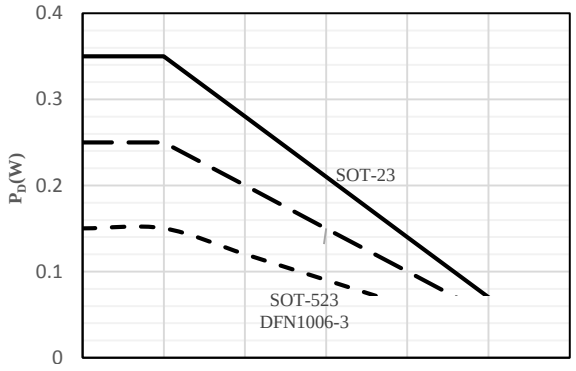


Fig 1 Power Dissipation

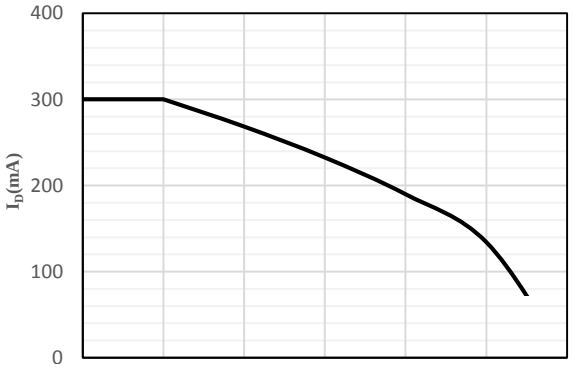


Fig 2 Drain Current

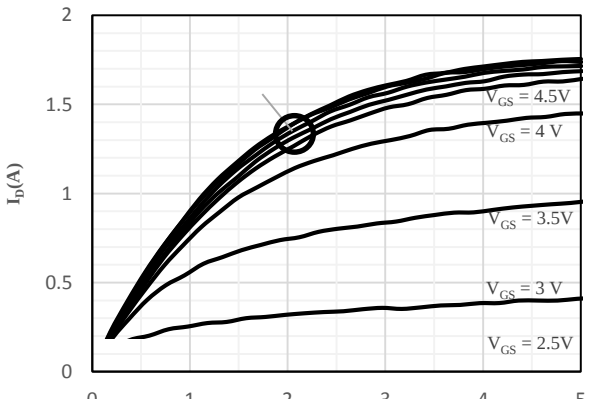


Fig 3 Typical Output Characteristics

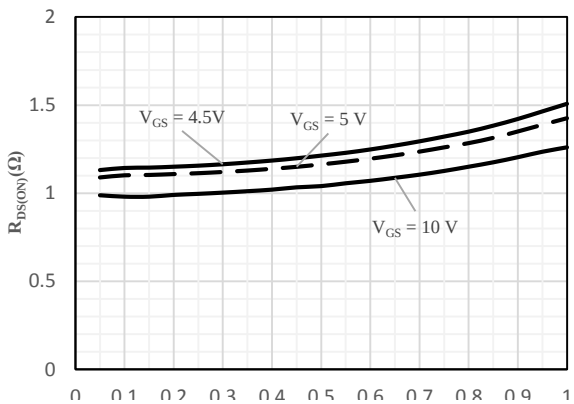


Fig 4 On-Resistance vs. Drain Current and Gate Voltage

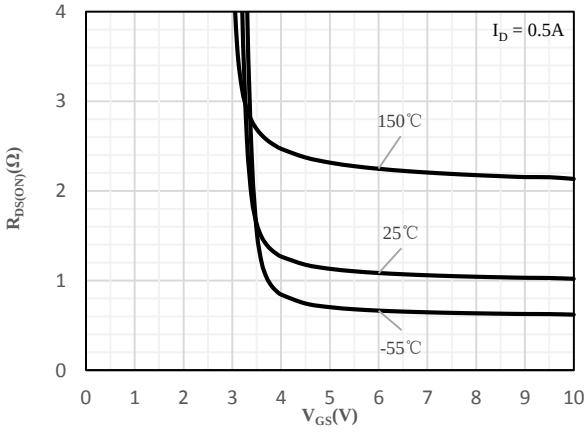


Fig 5 On-Resistance vs. Gate-Source Voltage

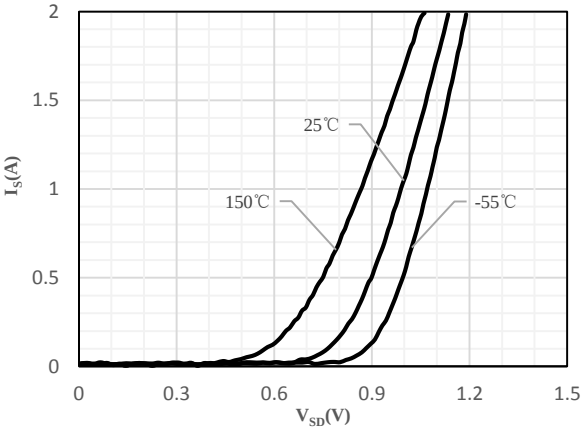


Fig 6 Body-Diode Characteristics

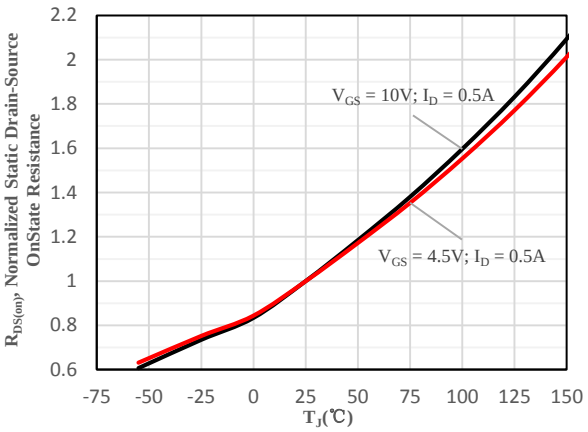


Fig 7 Normalized On-Resistance vs. Junction Temperature

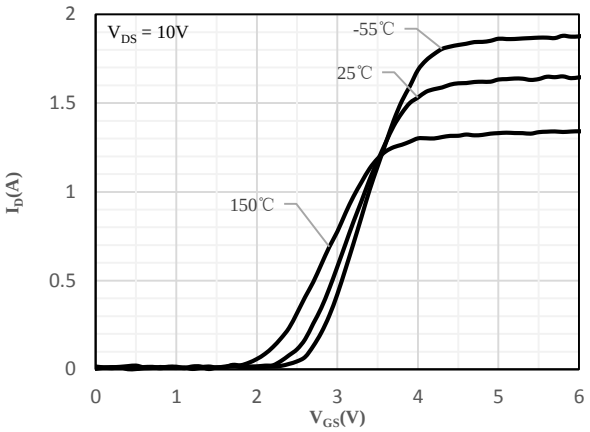


Fig 8 Transfer Characteristics

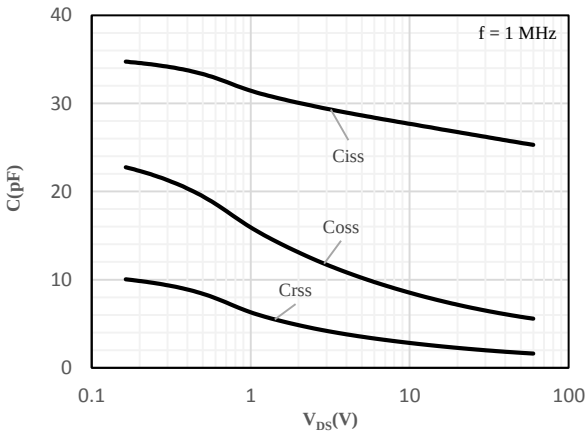


Fig 9 Capacitance Characteristics

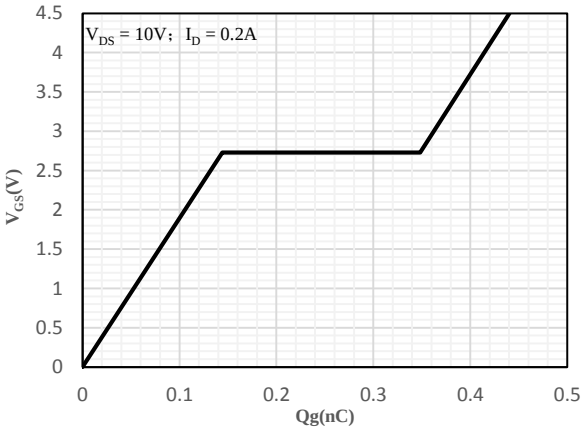


Fig 10 Gate-Charge Characteristics

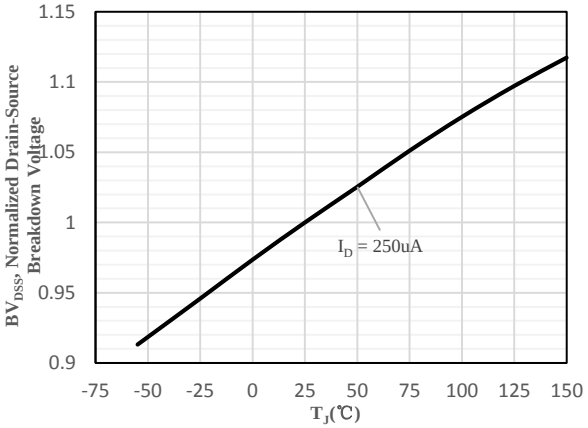


Fig 11 Normalized Breakdown Voltage vs. Junction Temperature

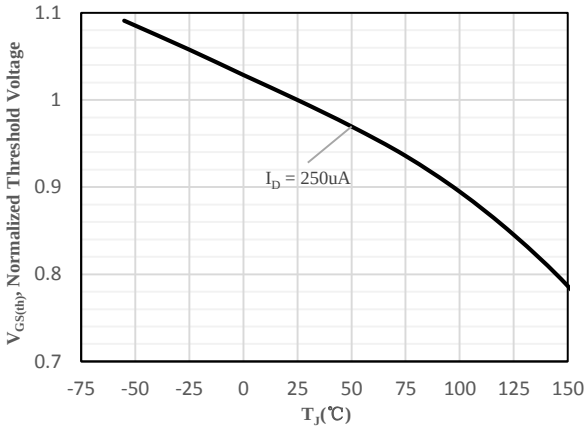


Fig 12 Normalized $V_{GS(th)}$ vs. Junction Temperature

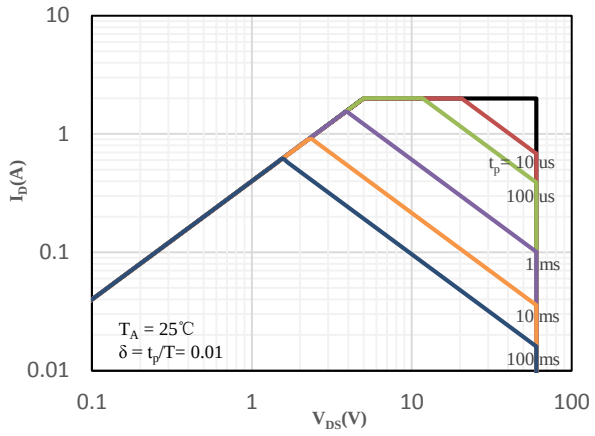


Fig 13 Safe Operating Area

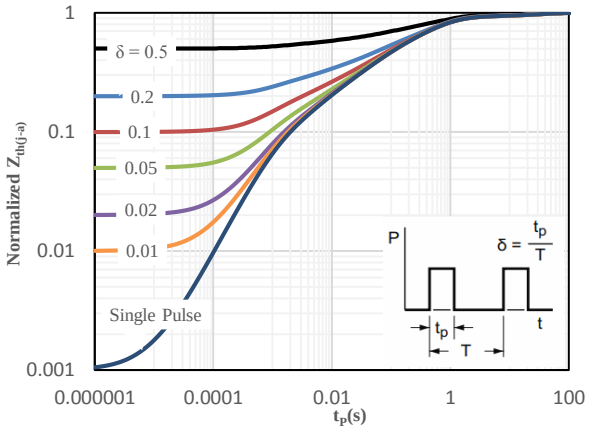
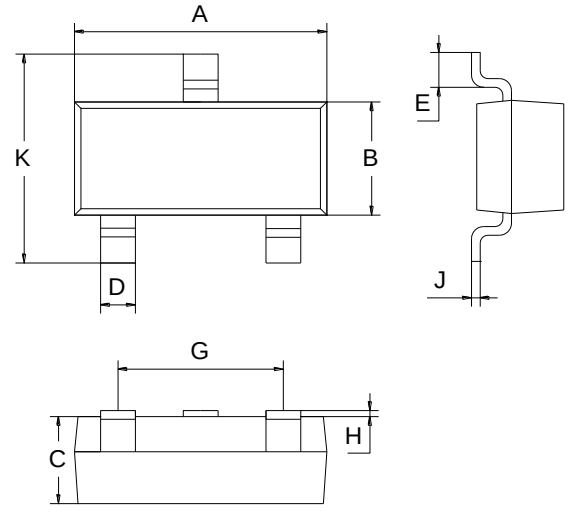


Fig 14 Normalized Maximum transient thermal impedance

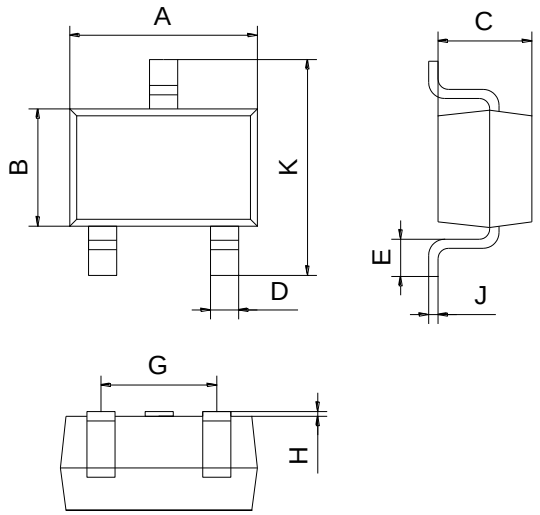
2N7002H

N-Channel Enhancement Mode MOSFET

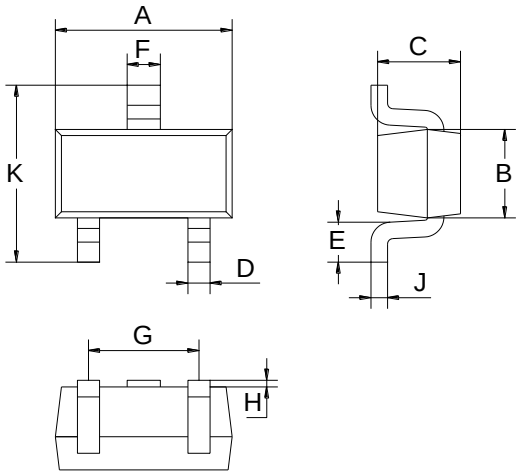
Package Outline Dimensions (Unit: mm)



SOT-23		
Dimension	**Min.**	**Max.**
A	2.70	3.10
B	1.10	1.50
C	0.90	1.10
D	0.30	0.50
E	0.35	0.48
G	1.80	2.00
H	0.02	0.10
J	0.05	0.15
K	2.20	2.60



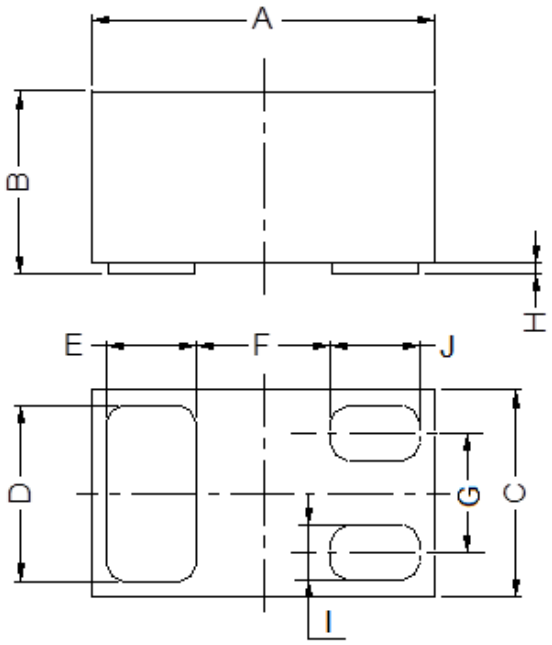
SOT-323		
Dimension	**Min.**	**Max.**
A	2.00	2.20
B	1.15	1.35
C	0.90	1.10
D	0.15	0.35
E	0.25	0.40
G	1.20	1.40
H	0.02	0.10
J	0.05	0.15
K	2.20	2.40



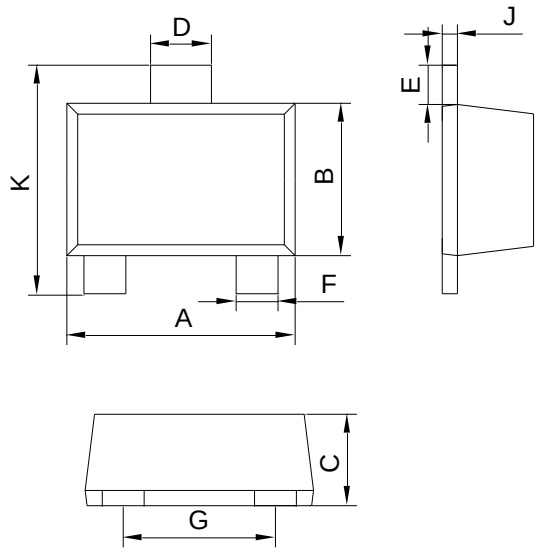
SOT-523		
Dimension	**Min.**	**Max.**
A	1.50	1.70
B	0.75	0.85
C	0.60	0.80
D	0.15	0.30
E	0.30	0.40
F	0.25	0.40
G	0.90	1.10
H	0.02	0.10
J	0.08	0.18
K	1.45	1.75

2N7002H

N-Channel Enhancement Mode MOSFET



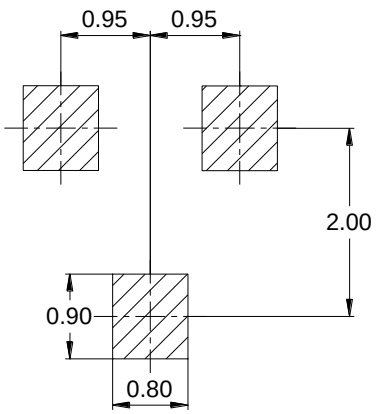
DFN1006-3			
Dimension	**Min.**	**Typ.**	**Max.**
A	0.95	1.00	1.075
B	0.47	0.50	0.53
C	0.55	0.60	0.675
D	0.45	0.50	0.55
E/J	0.20	0.25	0.30
F	-	0.40	-
G	-	0.35	-
H	0	0.03	0.05
I	0.10	0.15	0.20



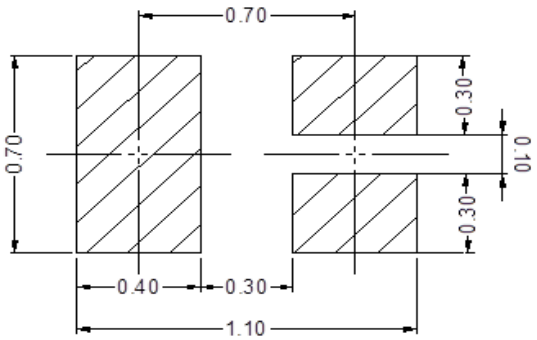
SOT-723		
Dim	Min	Max
A	1.10	1.30
B	0.70	0.90
C	0.40	0.54
D	0.22	0.42
E	0.10	0.30
F	0.12	0.32
G	0.70	0.90
J	0.08	0.15
K	1.10	1.30

Mounting Pad Layout (Unit: mm)

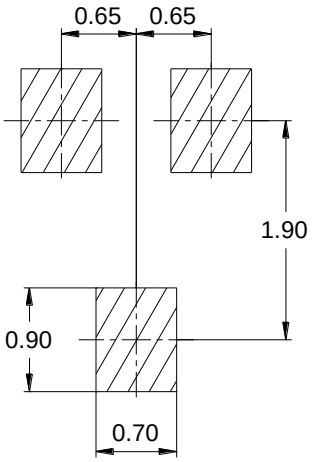
SOT-23



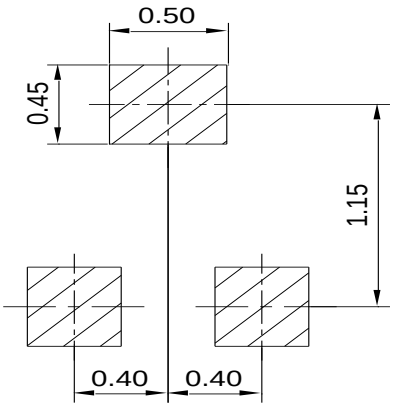
DFN1006-3



SOT-323



SOT-723



SOT-523