

### Features

- Low on-resistance
- ESD protected gate up to 2kV HBM
- High-speed switching
- Drive circuits can be simple
- Parallel use is easy

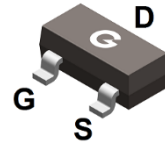
HF

### Typical Applications

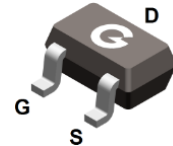
- N-channel enhancement mode effect transistor
- Switching application

### Mechanical Data

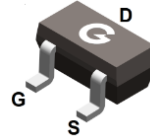
- Case: SOT-23, SOT-323, SOT-523, DFN1006-3, SOT-723
- Molding Compound, UL Flammability Classification Rating 94V-0
- Terminals: Matte Tin Plated Leads, Solderable Per MIL-STD-202, Method 208



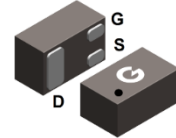
2N7002H  
SOT-23



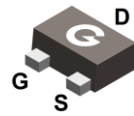
2N7002HW  
SOT-323



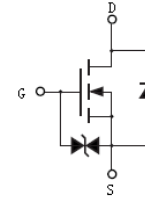
2N7002HT  
SOT-523



2N7002HL  
DFN1006-3



2N7002HM  
SOT-723



### Ordering Information

Part Number	Package	Shipping	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<sub>A</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Value	Units
Drain-Source Voltage	V <sub>DSS</sub>	60	V
Gate -Source Voltage	V <sub>GSS</sub>	±20	V
Continuous Drain Current	I <sub>D</sub>	300	mA
Pulsed Drain Current (t <sub>p</sub> = 10μs)	I <sub>DM</sub>	2000	mA
Single Pulse Avalanche Energy <sup>*2</sup>	E <sub>AS</sub>	0.11	mJ
Power Dissipation	P <sub>D</sub>	0.35	W
		0.25	
		0.15	
		0.15	
		0.15	

### Thermal Characteristics

Parameter		Symbol	Limits	Unit
Thermal Resistance Junction to Ambient Air	SOT-23	$R_{\theta JA}$	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	
Operating Junction Temperature Range		$T_J$	-55 to +150	°C
Storage Temperature Range		$T_{STG}$	-55 to +150	°C

### Electrical Characteristics (@ $T_A = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Test conditions	MIN	TYP	MAX	UNIT
<b>OFF Characteristics</b>						
$V_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	60	-	-	V
$I_{DSS}$	Drain to Source Leakage Current	$V_{DS} = 60V, V_{GS} = 0V$	-	-	1	$\mu A$
$I_{GSS}$	Gate-body Leakage	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	$\pm 10$	$\mu A$
<b>ON Characteristics</b>						
$R_{DS(ON)}$	Drain-Source On-resistance <sup>*1</sup>	$V_{GS} = 5V, I_D = 0.05A$	-	1.5	3	$\Omega$
		$V_{GS} = 4.5V, I_D = 0.5A$	-	1.8	4	
		$V_{GS} = 10V, I_D = 0.5A$	-	1.45	2.5	
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	1	1.5	2.5	V
$R_G$	Gate Resistance	$V_{GS} = 0V, f = 1.0MHz$	-	39	-	$\Omega$
<b>Dynamic Characteristics</b>						
$C_{ISS}$	Input Capacitance	$V_{GS} = 0V$	-	47.2	-	$\mu F$
$C_{OSS}$	Output Capacitance	$V_{DS} = 20V$	-	7.3	-	
$C_{RSS}$	Reverse Transfer Capacitance	$f = 1.0MHz$	-	4.7	-	
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-on Delay Time <sup>*3</sup>	$V_{DD} = 30V, I_D = 0.2A$ $V_{GS} = 10V, R_G = 25\Omega$ $R_L = 150\Omega$	-	6	-	$nS$
$t_r$	Turn-on Rise Time <sup>*3</sup>		-	5	-	
$t_{d(off)}$	Turn-Off Delay Time <sup>*3</sup>		-	25	-	
$t_f$	Turn-Off Fall Time <sup>*3</sup>		-	15	-	
$Q_G$	Total Gate-Charge	$V_{DS} = 10V$	-	0.44	-	nC
$Q_{GS}$	Gate to Source Charge	$V_{GS} = 4.5V$	-	0.14	-	nC
$Q_{GD}$	Gate to Drain (Miller) Charge	$I_D = 0.2A$	-	0.2	-	nC
<b>Source-Drain Diode Characteristics</b>						
$V_{SD}$	Diode Forward Voltage <sup>*1</sup>	$I_S = 0.3A, V_{GS} = 0V$	-	0.85	1.2	V
$I_S$	Diode Continuous Forward Current	$T_C = 25^\circ\text{C}$	-	-	0.3	A

Notes:

1. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
2. The  $E_{AS}$  data shows Max. rating. The test condition is  $V_{DD} = 30V, V_{GS} = 10V, L = 0.1mH$
3. Guaranteed by design, not subject to production

Ratings and Characteristic Curves (@  $T_A = 25^\circ\text{C}$  unless otherwise specified)

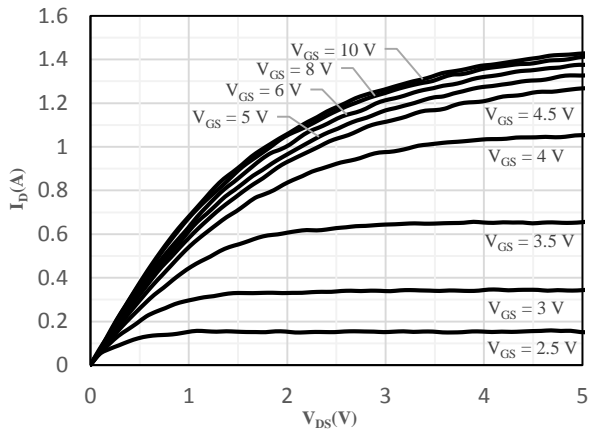


Fig 1 Typical Output Characteristics

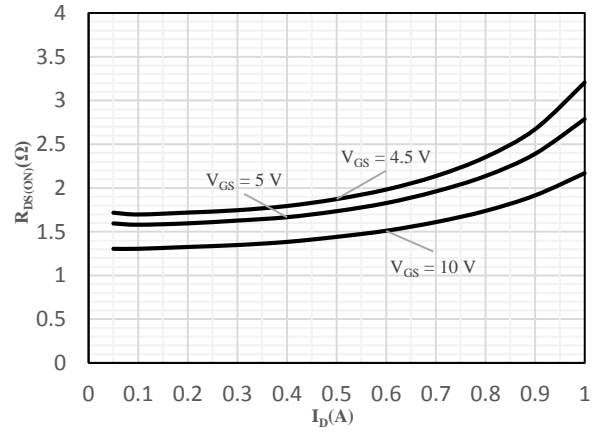


Fig 2 On-Resistance vs. Drain Current and Gate Voltage

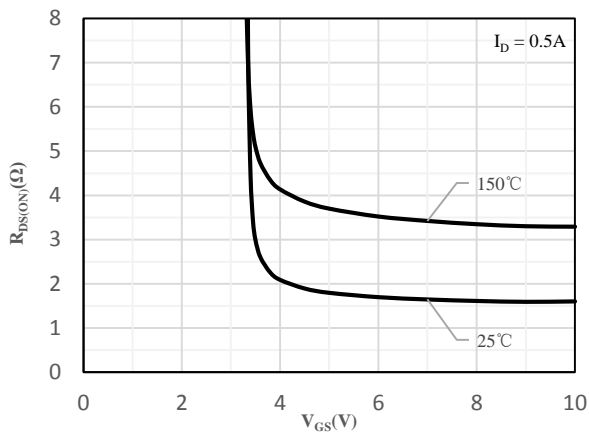


Fig 3 On-Resistance vs. Gate-Source Voltage

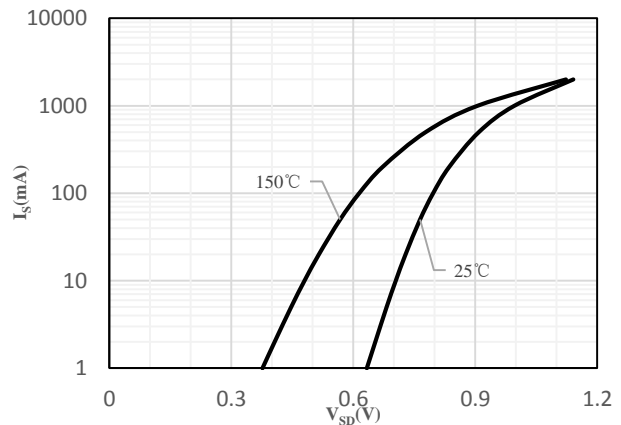


Fig 4 Body-Diode Characteristics

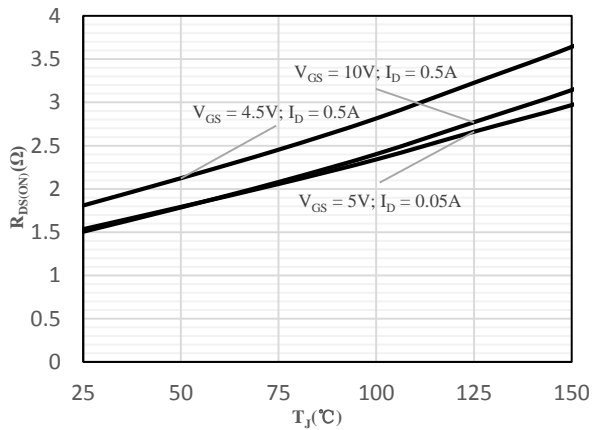


Fig 5 On-Resistance vs. Junction Temperature

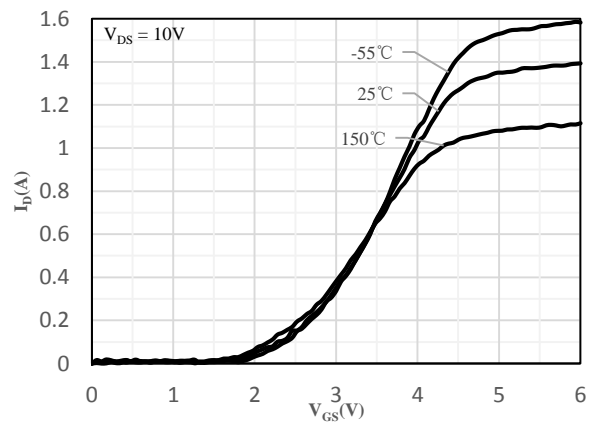


Fig 6 Transfer Characteristics

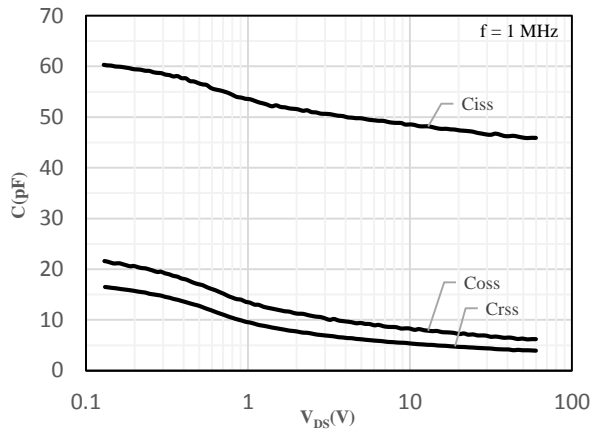


Fig 7 Capacitance Characteristics

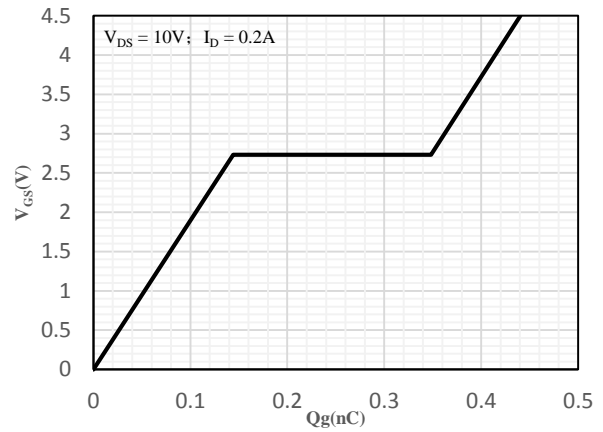


Fig 8 Gate-Charge Characteristics

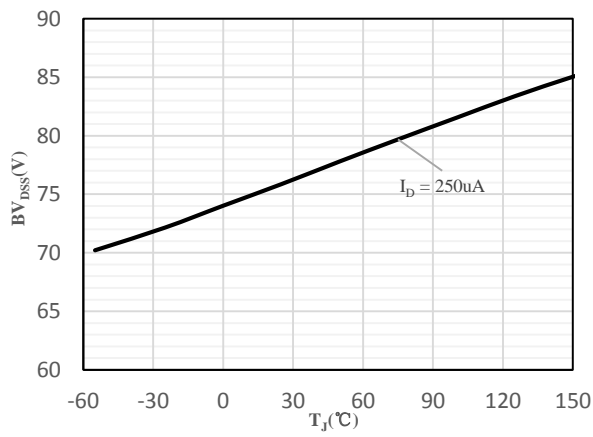


Fig 9 Breakdown Voltage vs. Junction  
Temperature

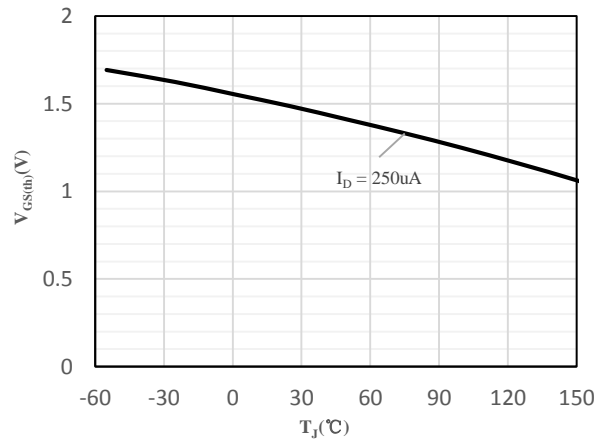
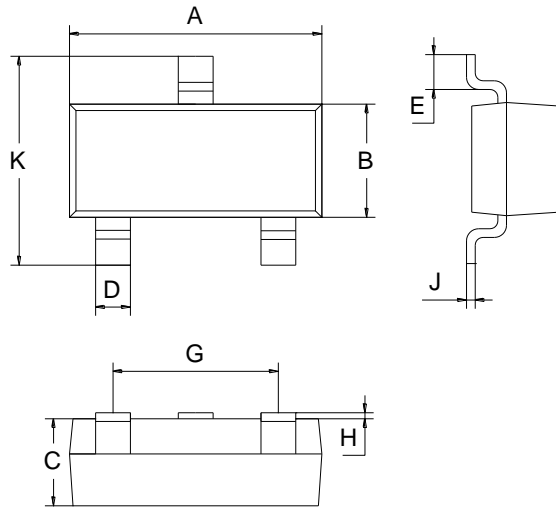


Fig 10  $V_{GS(th)}$  vs. Junction Temperature

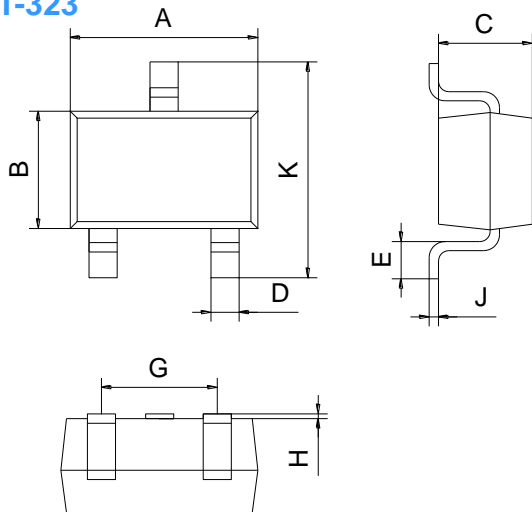
### Package Outline Dimensions (unit: mm)

#### SOT-23



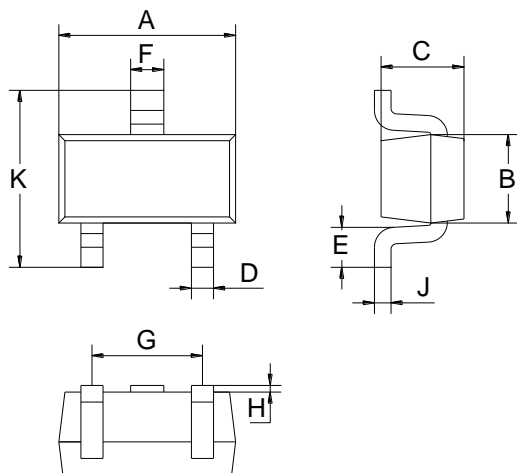
SOT-23		
Dim	Min	Max
A	2.70	3.10
B	1.10	1.50
C	0.90	1.10
D	0.30	0.50
E	0.35	0.48
G	1.80	2.00
H	0.02	0.10
J	0.05	0.15
K	2.20	2.60

#### SOT-323



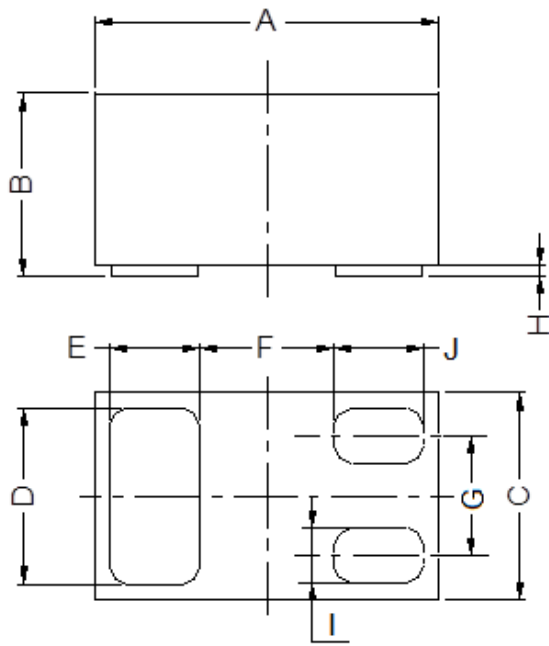
SOT-323		
Dim	Min	Max
A	2.00	2.20
B	1.15	1.35
C	0.90	1.10
D	0.15	0.35
E	0.25	0.40
G	1.20	1.40
H	0.02	0.10
J	0.05	0.15
K	2.20	2.40

#### SOT-523



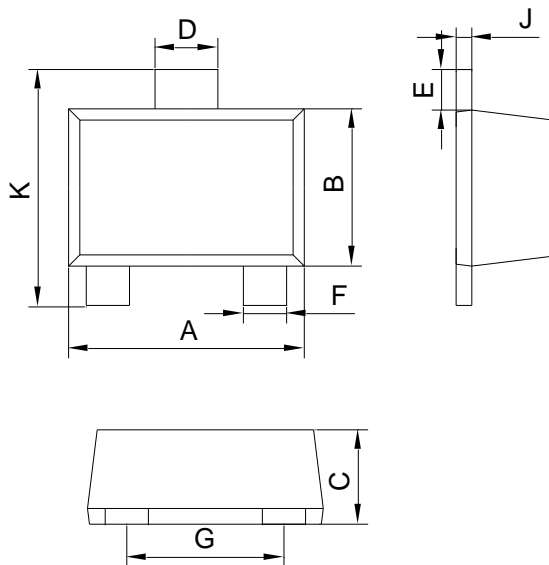
SOT-523		
Dim	Min	Max
A	1.50	1.70
B	0.75	0.85
C	0.60	0.80
D	0.15	0.30
E	0.30	0.40
F	0.25	0.40
G	0.90	1.10
H	0.02	0.10
J	0.08	0.18
K	1.45	1.75

**DFN1006-3**



DFN1006-3			
Dim	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
All Dimensions in mm			

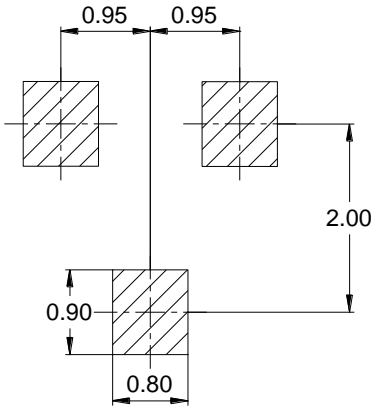
**SOT-723**



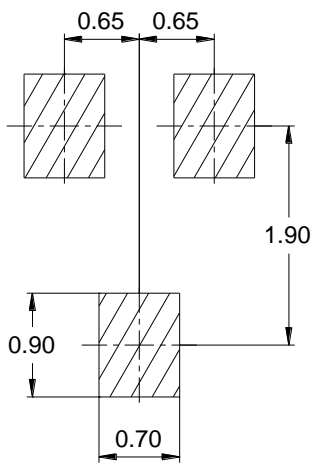
SOT-723		
Dimension	Min.	Max.
A	1.10	1.30
B	0.70	0.90
C	0.40	0.54
D	0.22	0.42
E	0.10	0.30
F	0.12	0.32
G	0.70	0.90
J	0.08	0.15
K	1.10	1.30

Mounting Pad Layout (unit: mm)

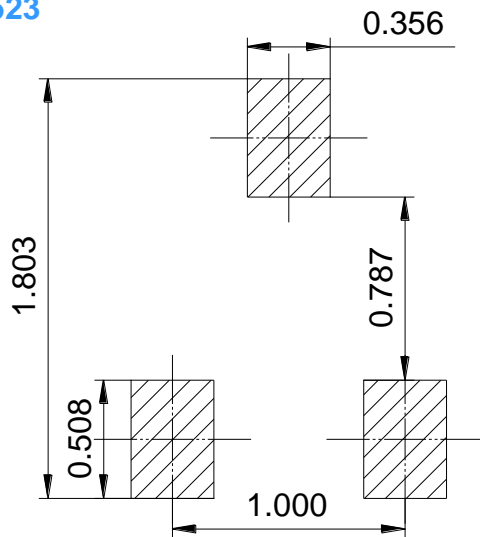
SOT-23



SOT-323

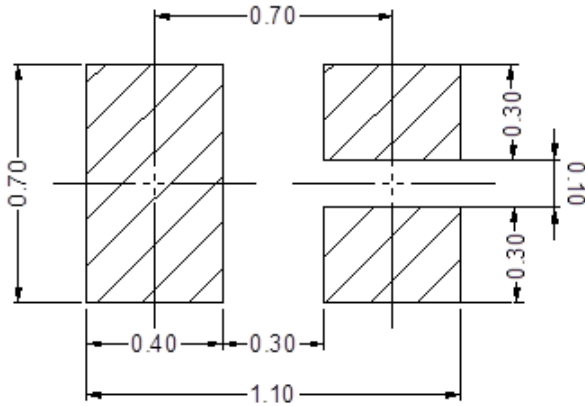


SOT-523

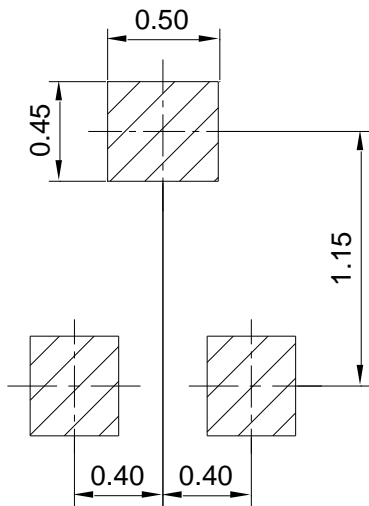




DFN1006-3



SOT-723



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