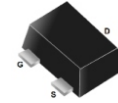


## 2N7002HM-HF

**N-Channel  
RoHS Device  
Halogen Free**

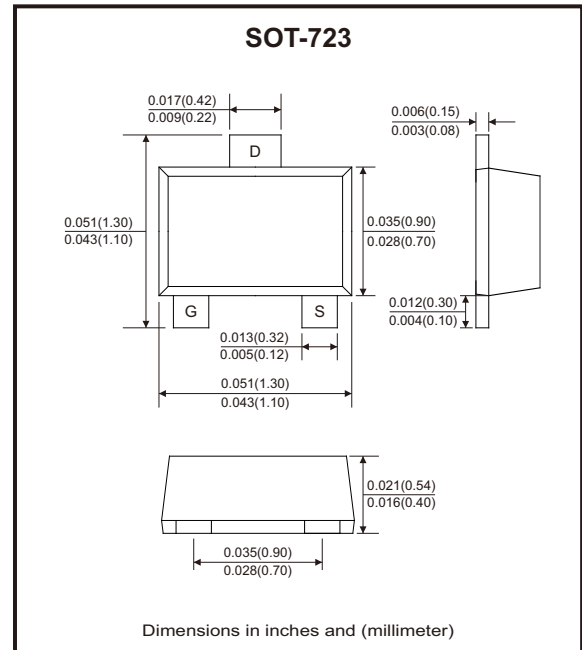


### Features

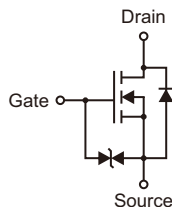
- Low on-resistance.
- ESD protected gate up to 2KV HBM.
- High-speed switching.
- Drive circuits can be simple.
- Parallel use is easy.

### Mechanical data

- Case: SOT-723, molded plastic.
- Molding compound: UL flammability classification rating 94V-0.
- Terminals: Matte tin plated leads, solderable per MIL-STD-202, method 208.



### Circuit Diagram



### Maximum Rating (at $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-source voltage	$V_{DSS}$	60	V
Gate-source voltage	$V_{GSS}$	$\pm 20$	V
Continuous drain current	$I_D$	300	mA
Pulsed drain current (Note 1) $t_p = 10\mu\text{s}$	$I_{DM}$	2000	mA
Single pulse avalanche energy (Note 2)	$E_{AS}$	0.11	mJ
Power dissipation	$P_D$	0.15	W
Thermal resistance junction to ambient air	$R_{\theta JA}$	833	$^\circ\text{C/W}$
Thermal resistance junction to lead	$R_{\theta JL}$	521	$^\circ\text{C/W}$
Thermal resistance junction to case	$R_{\theta JC}$	434	$^\circ\text{C/W}$
Operating junction temperature range	$T_J$	-55 to +150	$^\circ\text{C}$
Storage temperature range	$T_{STG}$	-55 to +150	$^\circ\text{C}$

Notes: 1. Pulse width limited by maximum junction temperature.

2. The EAS data shows Max. rating. The test condition is  $L=0.1\text{mH}$ ,  $V_{DD}=30\text{V}$ ,  $V_{GS}=10\text{V}$ .

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-source breakdown voltage	$V_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	60			V
Drain-source leakage current	$I_{DSS}$	$V_{DS} = 60V, V_{GS} = 0V$			1	$\mu A$
Gate-body leakage	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$			$\pm 10$	$\mu A$
		$V_{GS} = \pm 5V, V_{DS} = 0V$			$\pm 100$	nA
<b>On Characteristics (Note 1)</b>						
Static drain-source on resistance	$R_{DS(ON)}$	$V_{GS} = 5V, I_D = 0.05A$		1.5	3	$\Omega$
		$V_{GS} = 4.5V, I_D = 0.5A$		2.4	4	
		$V_{GS} = 10V, I_D = 0.5A$		1.45	2.5	
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	1	1.5	2.5	V
Gate resistance	$R_G$	$V_{GS} = 0.5V, V_{DS} = 0V, f = 1MHz$		520		$\Omega$
<b>Dynamic Characteristics (Note 2)</b>						
Input capacitance	$C_{iss}$	$V_{GS} = 0V, V_{DS} = 20V, f = 1MHz$		41		pF
Output capacitance	$C_{oss}$			15		
Reverse transfer capacitance	$C_{rss}$			4		
<b>Switching Characteristics (Note 2)</b>						
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 30V, I_D = 0.2A, V_{GS} = 10V, R_G = 25\Omega, R_L = 150\Omega$		6		nS
Turn-on rise time	$t_r$			5		
Turn-off delay time	$t_{d(off)}$			25		
Turn-off fall time	$t_f$			15		
Total gate-charge	$Q_G$	$V_{DS} = 10V, V_{GS} = 4.5V, I_D = 0.4A$		2.2		nC
Gate to source charge	$Q_{GS}$			1.6		
Gate to drain (Miller) charge	$Q_{GD}$			0.1		
<b>Drain-Source Diode Characteristics</b>						
Diode forward voltage (Note 3)	$V_{SD}$	$I_S = 0.3A, V_{GS} = 0V$		0.85	1.2	V
Diode continuous forward current	$I_S$	$T_C = 25^{\circ}\text{C}$			0.3	A

Notes: 1. Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .

2. Guaranteed by design, not subject to production.

3. Surface mounted on FR4 board,  $t \leq 10$  sec.

## Rating and Characteristic Curves (2N7002HM-HF)

Fig.1 - On-Region Characteristics

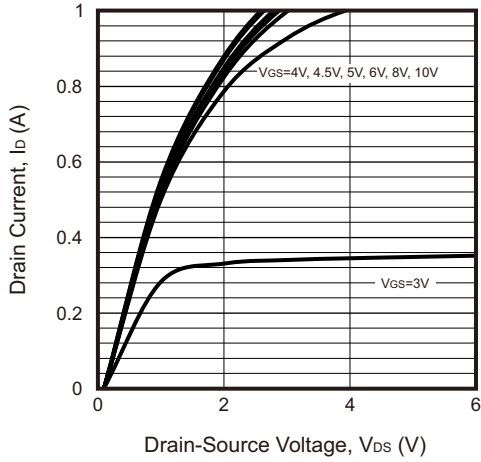


Fig.2 - On-Resistance vs. Drain Current and Gate Voltage

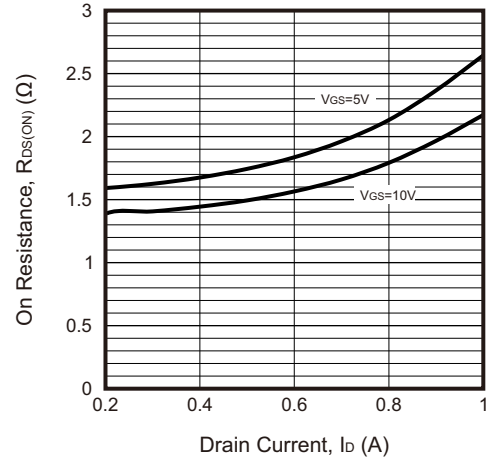


Fig.3 - On-Resistance vs. Gate-Source Voltage

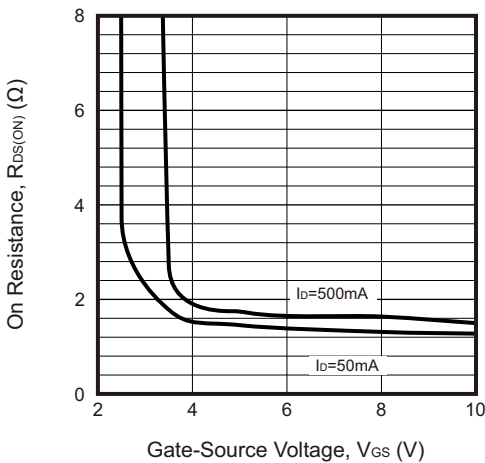


Fig.4 - Gate Voltage vs. Junction Temperature

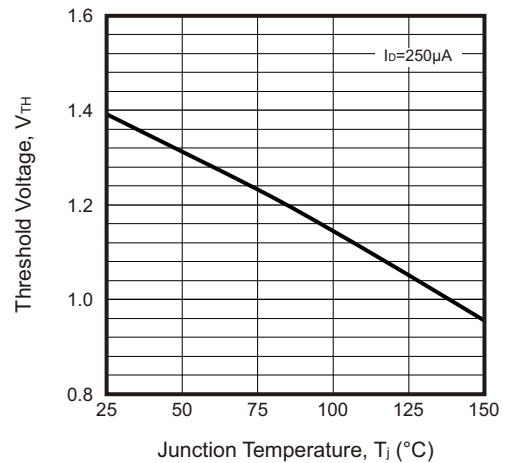


Fig.5 - On Resistance vs. Junction Temperature

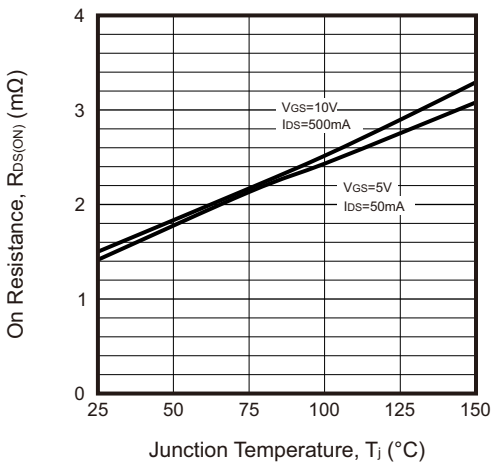
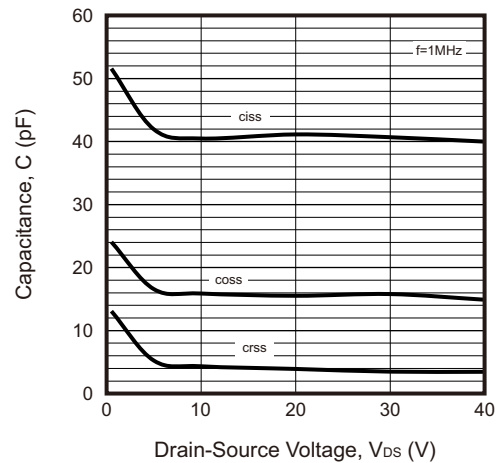
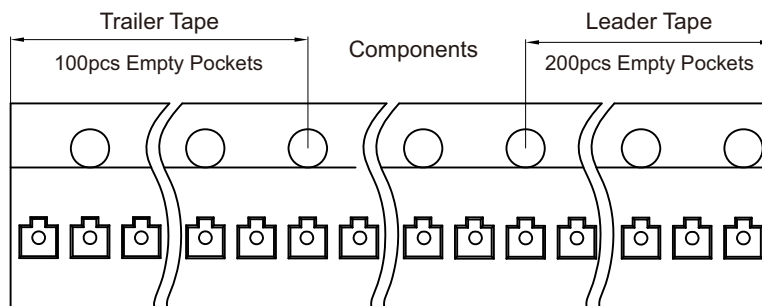
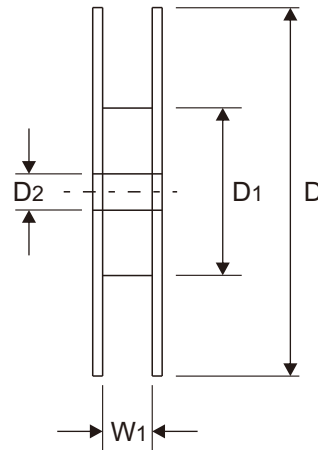
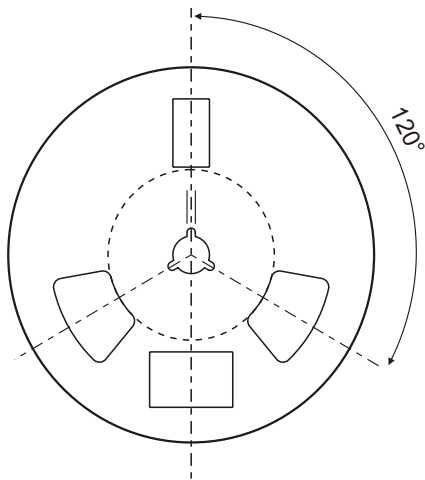
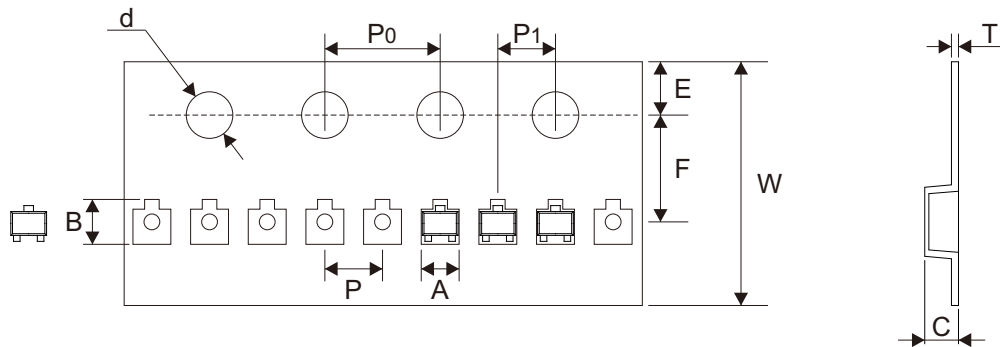


Fig.6 - Capacitance Characteristics



Reel Taping Specification

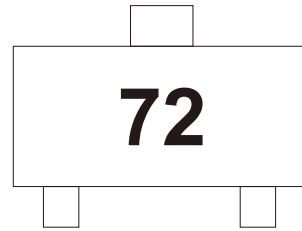


SOT-723	SYMBOL	A	B	C	d	D	D1	D2
	(mm)	1.31 ± 0.05	1.45 ± 0.05	0.61 ± 0.05	1.50 ± 0.10	178.00 ± 1.00	54.00 ± 0.50	13.00 ± 0.50
	(inch)	0.052 ± 0.002	0.057 ± 0.002	0.024 ± 0.002	0.059 ± 0.004	7.008 ± 0.039	2.126 ± 0.020	0.512 ± 0.020

SOT-723	SYMBOL	E	F	P	P0	P1	T	W	W1
	(mm)	1.75 ± 0.10	3.50 ± 0.05	2.00 ± 0.05	4.00 ± 0.10	2.00 ± 0.05	0.20 ± 0.02	8.00 + 0.30 - 0.10	9.50 ± 1.00
	(inch)	0.069 ± 0.004	0.138 ± 0.002	0.079 ± 0.002	0.157 ± 0.004	0.079 ± 0.002	0.008 ± 0.001	0.315 + 0.012 - 0.004	0.374 ± 0.039

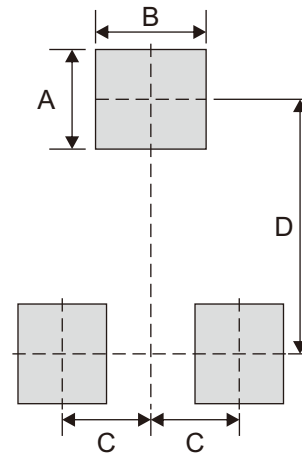
## Marking Code

Part Number	Marking Code
2N7002HM-HF	72



## Suggested P.C.B. PAD Layout

SIZE	SOT-723	
	(mm)	(inch)
A	0.45	0.018
B	0.50	0.020
C	0.40	0.016
D	1.15	0.045



## Standard Packaging

Case Type	REEL PACK	
	REEL (pcs)	Reel Size (inch)
SOT-723	10,000	7