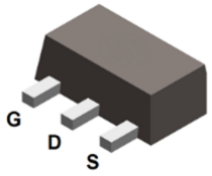
2N7002HE

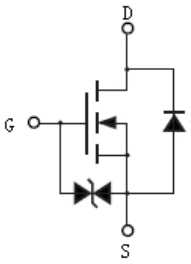
N-Channel Enhancement Mode MOSFET

Features

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

SOT-89





Typical Applications

- N-channel enhancement mode effect transistor
- Switching application

Mechanical Data

- Case: SOT-89
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte Tin-Plated Leads, Solderability-per MIL-STD-202, Method 208

Ordering Information

Part Number	Package	Shipping Quantity	Marking Code
2N7002HE	SOT-89	1000 pcs / Tape & Reel	7002K

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	400	mA
Continuous Drain Current (T_A = 70°C) *1		320	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
Power Dissipation (T_A = 25°C) *1	P_D	0.5	W
Operating Junction Temperature Range	T_J	-55 ~ +150	°C
Storage Temperature Range	T_{STG}	-55 ~ +150	°C

Thermal Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance Junction-to-Air *1	$R_{\theta JA}$	-	-	250	°C/W

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	-	1.0	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
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)

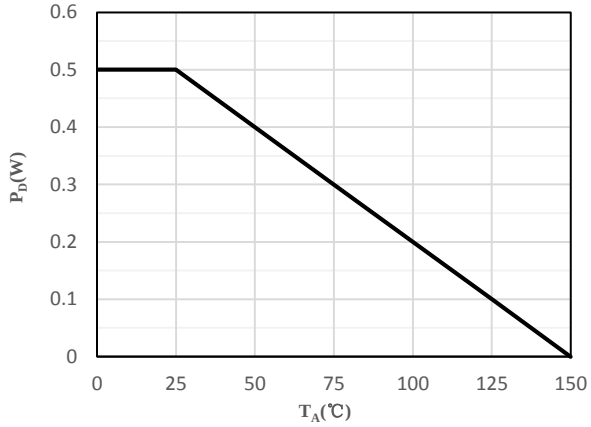


Fig 1 Power Dissipation

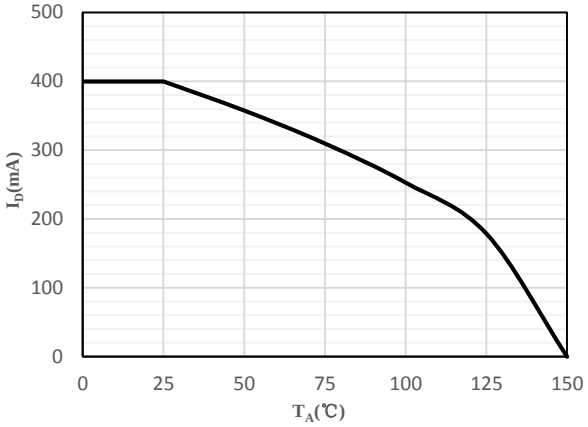


Fig 2 Drain Current

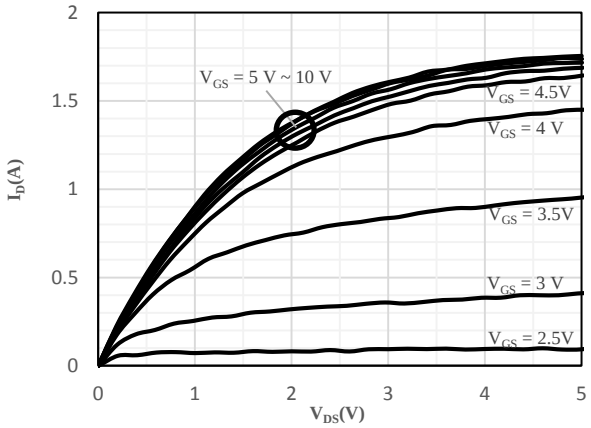


Fig 3 Typical Output Characteristics

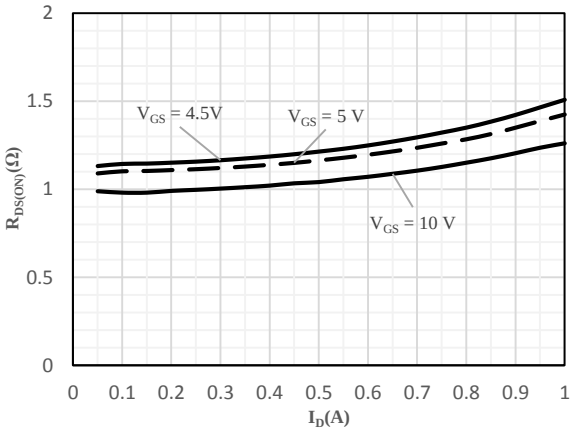


Fig 4 On-Resistance vs. Drain Current and Gate Voltage

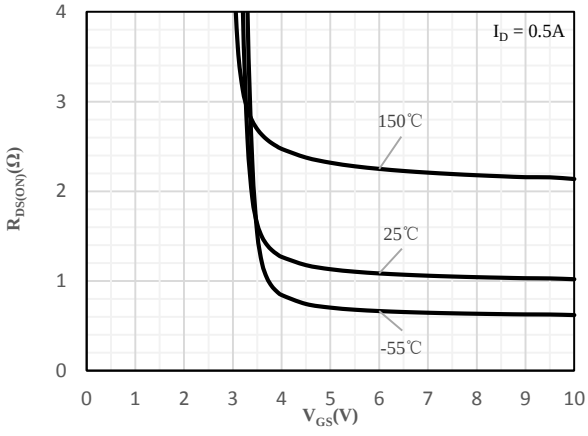


Fig 5 On-Resistance vs. Gate-Source Voltage

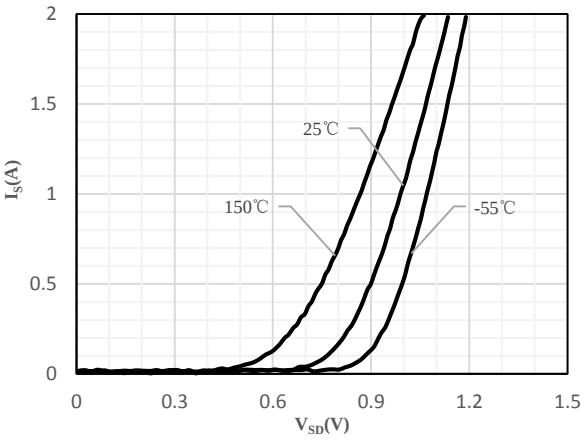


Fig 6 Body-Diode Characteristics

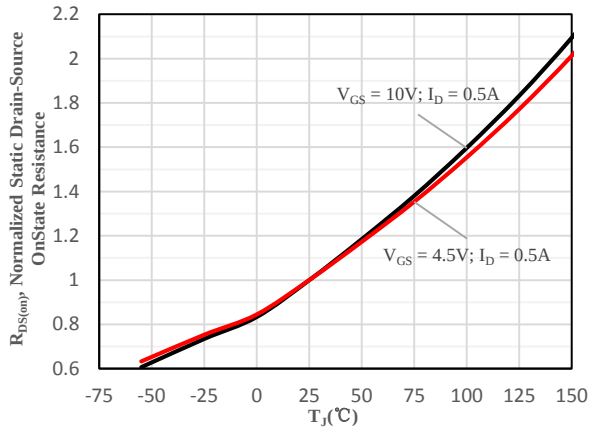


Fig 7 Normalized On-Resistance vs. Junction Temperature

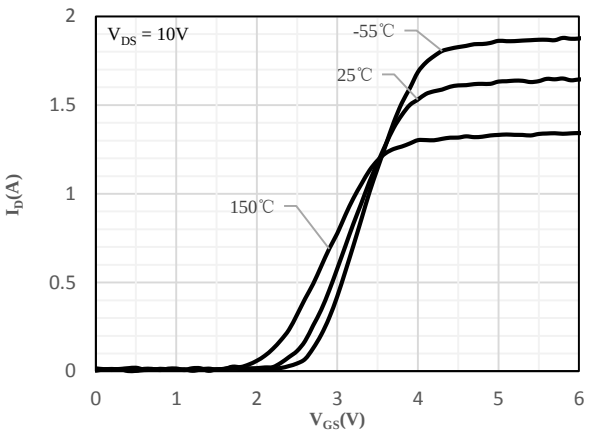


Fig 8 Transfer Characteristics

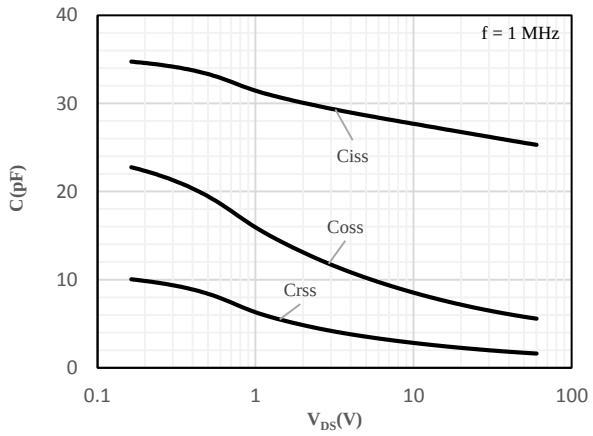


Fig 9 Capacitance Characteristics

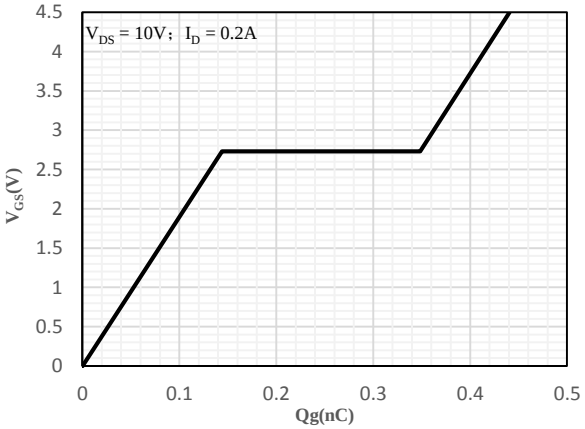


Fig 10 Gate-Charge Characteristics

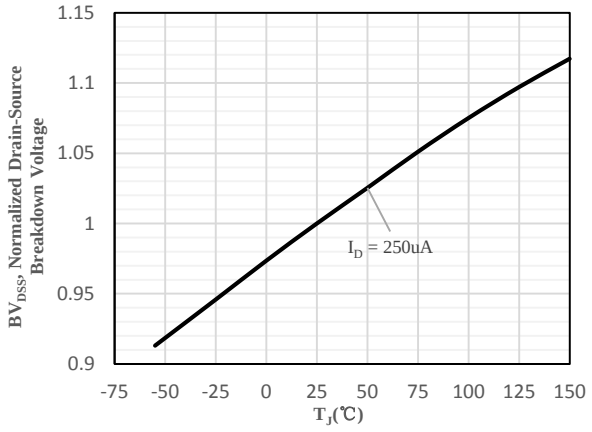


Fig 11 Normalized Breakdown Voltage vs. Junction Temperature

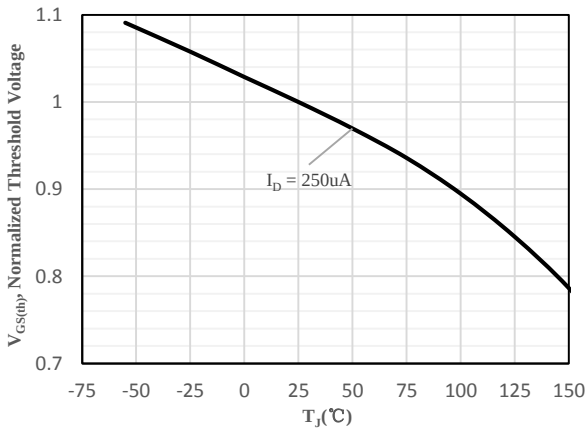


Fig 12 Normalized $V_{GS(th)}$ vs. Junction Temperature

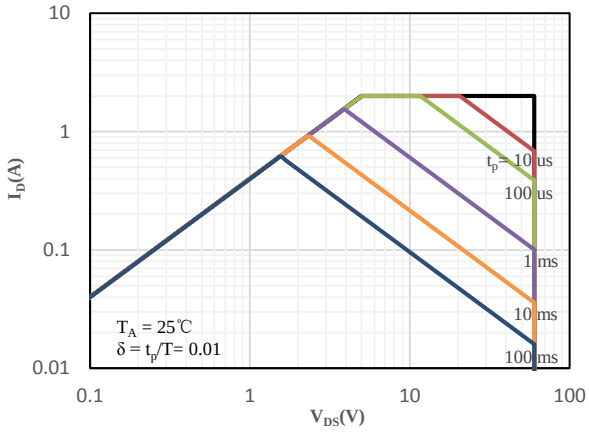


Fig 13 Safe Operating Area

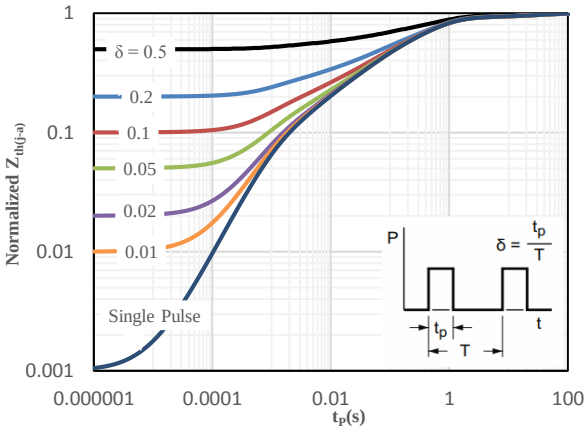


Fig 14 Normalized Maximum transient thermal impedance

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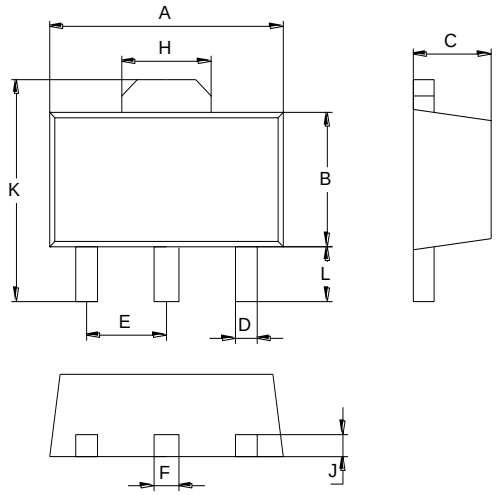
Package Outline Dimensions (Unit: mm)



SOT-89		
Dimension	**Min.**	**Max.**
A	4.30	4.70
B	2.25	2.65
C	1.30	1.70
D	0.30	0.50
E	1.40	1.60
F	0.38	0.58
H	1.60	1.80
J	0.30	0.50
L	0.90	1.10
K	3.95	4.35

Mounting Pad Layout (Unit: mm)

SOT-89