

2N7000, 2N7002, NDS7002A

ABSOLUTE MAXIMUM RATINGS Values are at $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Value			Unit
		2N7000	2N7002	NDS7002A	
V _{DSS}	Drain-to-Source Voltage	60			V
V _{DGR}	Drain-Gate Voltage (R _{GS} ≤ 1 MW)	60			V
V _{GSS}	Gate-Source Voltage – Continuous	±20			V
	Gate-Source Voltage – Non Repetitive (tp < 50 ms)	±40			
I _D	Maximum Drain Current – Continuous	200	115	280	mA
	Maximum Drain Current – Pulsed	500	800	1500	
P _D	Maximum Power Dissipation Derated above 25°C	400	200	300	mW
		3.2	1.6	2.4	mW/°C
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to 150		-65 to 150	°C
T _L	Maximum Lead Temperature for Soldering Purposes, 1/16-inch from Case for 10 s	300			°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS Values are at $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Value			Unit
		2N7000	2N7002	NDS7002A	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	312.5	625	417	$^\circ\text{C}/\text{W}$

ELECTRICAL CHARACTERISTICS

Values are at $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Conditions	Type	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 10 \mu\text{A}$	All	60	–	–	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 48 \text{ V}, V_{GS} = 0 \text{ V}$	2N7000	–	–	1	μA
		$V_{DS} = 48 \text{ V}, V_{GS} = 0 \text{ V}, T_C = 125^\circ\text{C}$		–	–	1	mA
		$V_{DS} = 60 \text{ V}, V_{GS} = 0 \text{ V}$	2N7002	–	–	1	μA
		$V_{DS} = 60 \text{ V}, V_{GS} = 0 \text{ V}, T_C = 125^\circ\text{C}$	NDS7002A	–	–	0.5	mA
I_{GSSF}	Gate – Body Leakage, Forward	$V_{GS} = 15 \text{ V}, V_{DS} = 0 \text{ V}$	2N7000	–	–	10	nA
		$V_{GS} = 20 \text{ V}, V_{DS} = 0 \text{ V}$	2N7002 NDS7002A	–	–	100	
I_{GSSR}	Gate – Body Leakage, Reverse	$V_{GS} = -15 \text{ V}, V_{DS} = 0 \text{ V}$	2N7000	–	–	-10	nA
		$V_{GS} = -20 \text{ V}, V_{DS} = 0 \text{ V}$	2N7002 NDS7002A	–	–	-100	

ON CHARACTERISTICS

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 1 \text{ mA}$	2N7000	0.8	2.1	3	V
		$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	2N7002 NDS7002A	1	2.1	2.5	

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ELECTRICAL CHARACTERISTICS (continued)

Values are at $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Conditions	Type	Min	Typ	Max	Unit
ON CHARACTERISTICS							
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$	2N7000	–	1.2	5	Ω
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}, T_C = 125^\circ\text{C}$		–	1.9	9	
		$V_{GS} = 4.5\text{ V}, I_D = 75\text{ mA}$		–	1.8	5.3	
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$	2N7002	–	1.2	7.5	
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}, T_C = 100^\circ\text{C}$		–	1.7	13.5	
		$V_{GS} = 5\text{ V}, I_D = 50\text{ mA}$		–	1.7	7.5	
		$V_{GS} = 5\text{ V}, I_D = 50\text{ mA}, T_C = 100^\circ\text{C}$		–	2.4	13.5	
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$	NDS7002A	–	1.2	2	
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}, T_C = 125^\circ\text{C}$		–	2	3.5	
		$V_{GS} = 5\text{ V}, I_D = 50\text{ mA}$		–	1.7	3	
		$V_{GS} = 5\text{ V}, I_D = 50\text{ mA}, T_C = 125^\circ\text{C}$		–	2.8	5	
$V_{DS(on)}$	Drain–Source On–Voltage	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$	2N7000	–	0.6	2.5	V
		$V_{GS} = 4.5\text{ V}, I_D = 75\text{ mA}$		–	0.14	0.4	
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$	2N7002	–	0.6	3.75	
		$V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$		–	0.09	1.5	
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$	NDS7002A	–	0.6	1	
		$V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$		–	0.09	0.15	
$I_{D(on)}$	On–State Drain Current	$V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}$	2N7000	75	600	–	mA
		$V_{GS} = 10\text{ V}, V_{DS} \geq 2 V_{DS(on)}$	2N7002	500	2700	–	
		$V_{GS} = 10\text{ V}, V_{DS} \geq 2 V_{DS(on)}$	NDS7002A	500	2700	–	
g_{FS}	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 200\text{ mA}$	2N7000	100	320	–	mS
		$V_{DS} \geq 2 V_{DS(on)}, I_D = 200\text{ mA}$	2N7002	80	320	–	
		$V_{DS} \geq 2 V_{DS(on)}, I_D = 200\text{ mA}$	NDS7002A	80	320	–	

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	All	–	20	50	pF
C_{oss}	Output Capacitance		All	–	11	25	
C_{rss}	Reverse Transfer Capacitance		All	–	4	5	
t_{on}	Turn–On Time	$V_{DD} = 15\text{ V}, R_L = 25\ \Omega, I_D = 500\text{ mA}, V_{GS} = 10\text{ V}, R_{GEN} = 25\ \Omega$	2N7000	–	–	10	ns
		$V_{DD} = 30\text{ V}, R_L = 150\ \Omega, I_D = 200\text{ mA}, V_{GS} = 10\text{ V}, R_{GEN} = 25\ \Omega$	2N7002 NDS7002A	–	–	20	
t_{off}	Turn–Off Time	$V_{DD} = 15\text{ V}, R_L = 25\ \Omega, I_D = 500\text{ mA}, V_{GS} = 10\text{ V}, R_{GEN} = 25\ \Omega$	2N7000	–	–	10	ns
		$V_{DD} = 30\text{ V}, R_L = 150\ \Omega, I_D = 200\text{ mA}, V_{GS} = 10\text{ V}, R_{GEN} = 25\ \Omega$	2N7002 NDS7002A	–	–	20	

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ELECTRICAL CHARACTERISTICS (continued)

Values are at $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Conditions	Type	Min	Typ	Max	Unit
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
I_S	Maximum Continuous Drain-Source Diode Forward Current	2N7002	–	–	–	115	mA
		NDS7002A	–	–	–	280	
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current	2N7002	–	–	–	0.8	A
		NDS7002A	–	–	–	1.5	
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 115\text{ mA}$ (Note 1)	2N7002	–	0.88	1.5	V
		$V_{GS} = 0\text{ V}, I_S = 400\text{ mA}$ (Note 1)	NDS7002A	–	0.88	1.2	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. Pulse test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$

TYPICAL PERFORMANCE CHARACTERISTICS

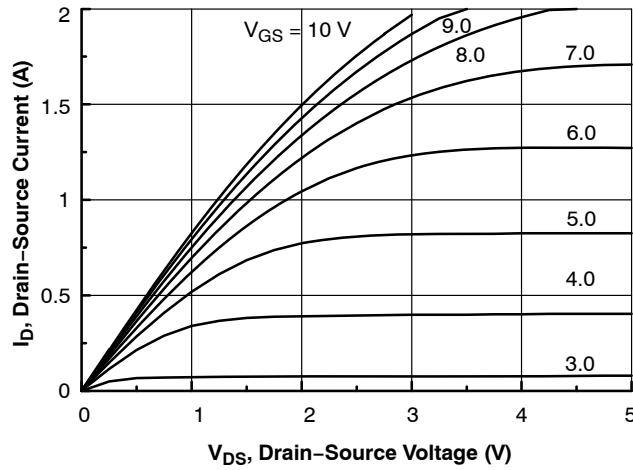


Figure 1. On-Region Characteristics

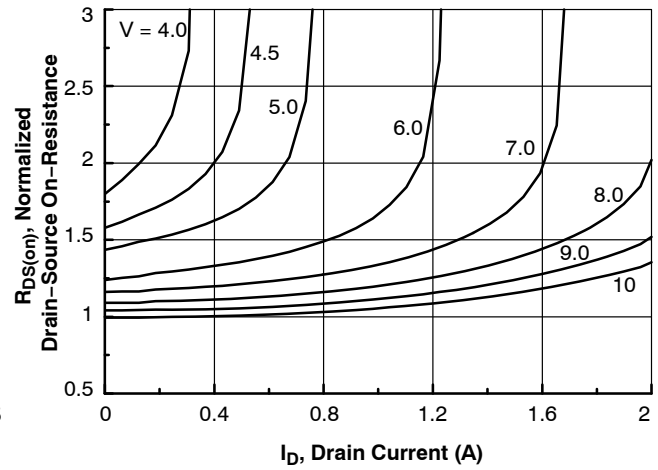


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

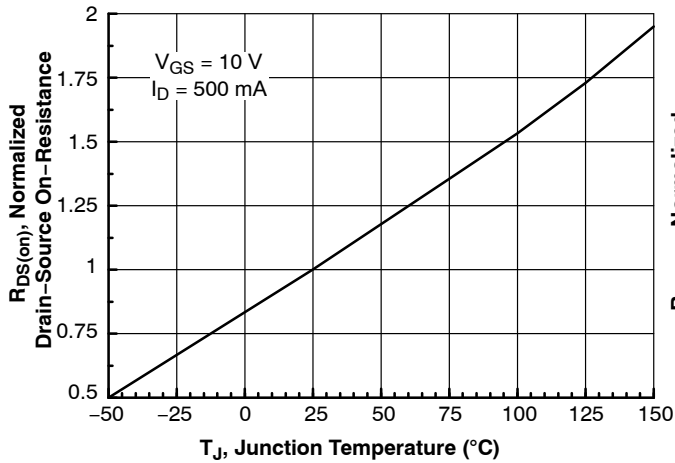


Figure 3. On-Resistance Variation with Temperature

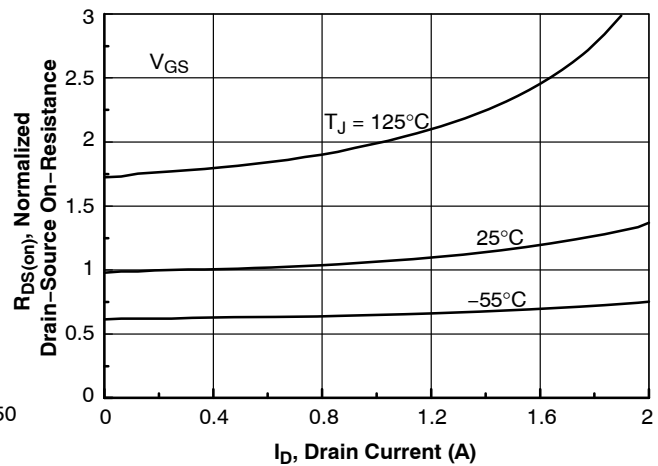


Figure 4. On-Resistance Variation with Drain Current and Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

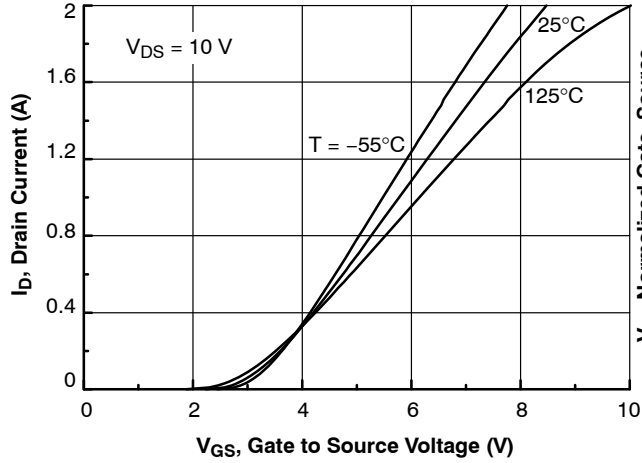


Figure 5. Transfer Characteristics

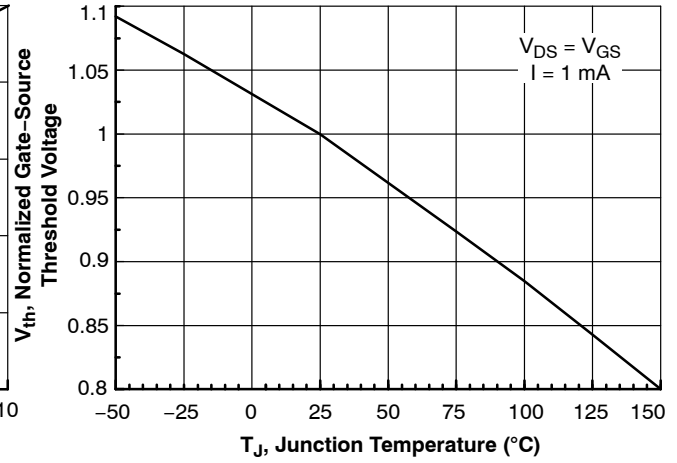


Figure 6. Gate Threshold Variation with Temperature

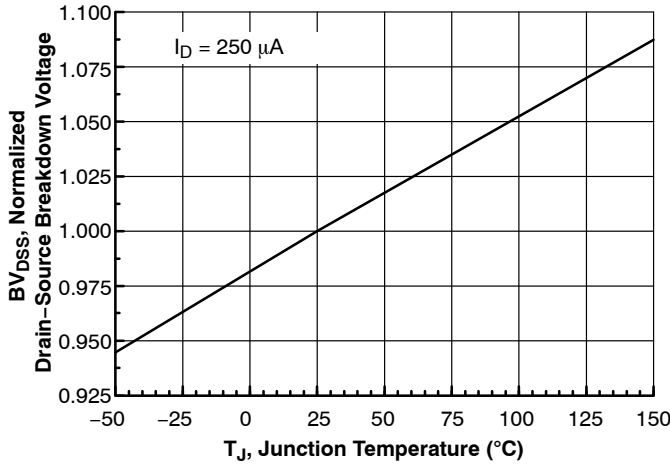


Figure 7. Breakdown Voltage Variation with Temperature

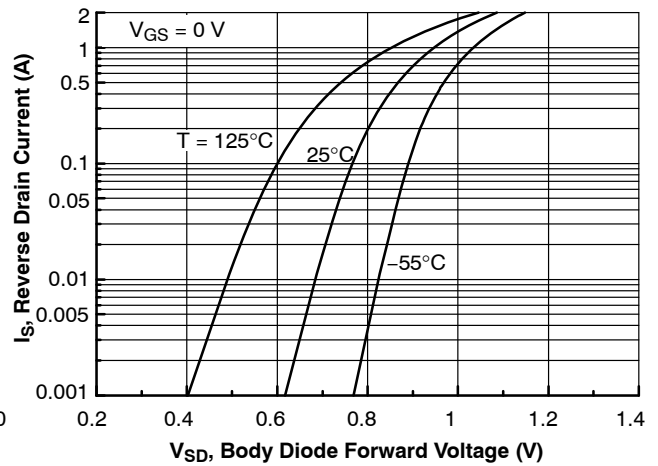


Figure 8. Body Diode Forward Voltage Variation with Temperature

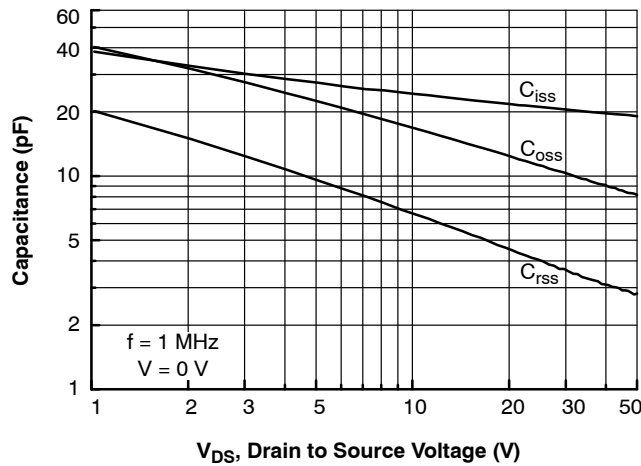


Figure 9. Capacitance Characteristics

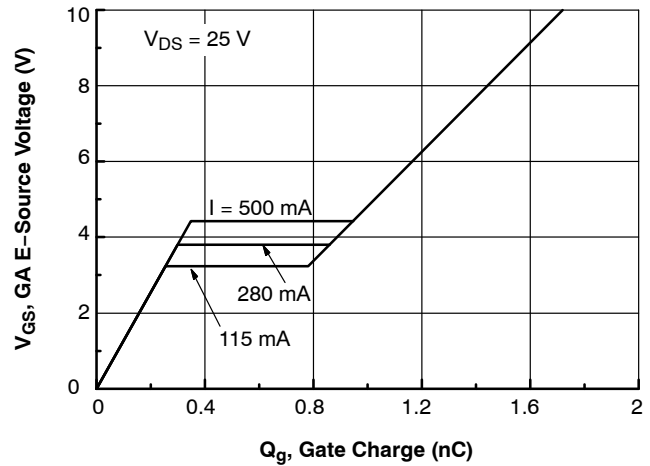


Figure 10. Gate Charge Characteristics