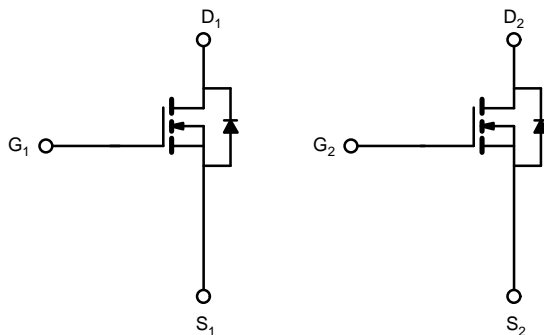
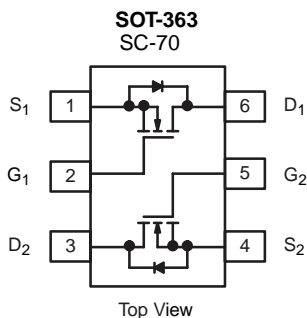


## 2N7002DW-VB Datasheet

### Dual N-Channel 60 V (D-S) MOSFET

PRODUCT SUMMARY		
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (mA)
60	1.8 at $V_{GS} = 10$ V	350



#### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Low On-Resistance: 1.8  $\Omega$
- Low Threshold: 2 V (typ.)
- Low Input Capacitance: 30 pF
- Fast Switching Speed: 25 ns
- Low Input and Output Leakage
- Trench Power MOSFET
- Compliant to RoHS Directive 2002/95/EC



**RoHS\***  
COMPLIANT  
HALOGEN  
**FREE**  
Available

#### BENEFITS

- Low Offset Voltage
- Low-Voltage Operation
- Easily Driven Without Buffer
- High-Speed Circuits
- Low Error Voltage

#### APPLICATIONS

- Direct Logic-Level Interface: TTL/CMOS
- Drivers: Relays, Solenoids, Lamps, Hammers, Display, Memories, Transistors, etc.
- Battery Operated Systems
- Solid-State Relays

ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted				
Parameter		Symbol	Limit	Unit
Drain-Source Voltage		$V_{DS}$	60	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150$ °C) <sup>b</sup>	$T_A = 25$ °C	$I_D$	350	mA
	$T_A = 100$ °C		230	
Pulsed Drain Current <sup>a</sup>		$I_{DM}$	900	
Power Dissipation <sup>b</sup>	$T_A = 25$ °C	$P_D$	0.35	W
	$T_A = 100$ °C		0.14	
Maximum Junction-to-Ambient <sup>b</sup>		$R_{thJA}$	350	°C/W
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to 150	°C

Notes:

a. Pulse width limited by maximum junction temperature.

b. Surface Mounted on FR4 board.

\* Pb containing terminations are not RoHS compliant, exemptions may apply.

SPECIFICATIONS $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ. <sup>a</sup>	Max.	
Static						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 10\text{ }\mu\text{A}$	60			V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1		2.5	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 10$	$\mu\text{A}$
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 15\text{ V}$			1	
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}$			$\pm 150$	nA
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}, T_J = 85\text{ }^{\circ}\text{C}$			$\pm 1000$	
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 5\text{ V}$			$\pm 100$	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^{\circ}\text{C}$			500	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{GS} = 10\text{ V}, V_{DS} = 7.5\text{ V}$	800			mA
		$V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}$	500			
Drain-Source On-Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$		1.8		$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 200\text{ mA}$		3		
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 10\text{ V}, I_D = 200\text{ mA}$	100			mS
Diode Forward Voltage	$V_{SD}$	$I_S = 200\text{ mA}, V_{GS} = 0\text{ V}$			1.3	V
Dynamic <sup>a</sup>						
Total Gate Charge	$Q_g$	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}$ $I_D \cong 250\text{ mA}$		0.6	0.8	nC
Input Capacitance	$C_{iss}$	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}$ $f = 1\text{ MHz}$		30		pF
Output Capacitance	$C_{oss}$			6		
Reverse Transfer Capacitance	$C_{rss}$			2.5		
Switching <sup>a, b, c</sup>						
Turn-On Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 150\text{ }\Omega$			25	ns
Turn-Off Time	$t_{d(off)}$	$I_D \cong 200\text{ mA}, V_{GEN} = 10\text{ V}, R_G = 10\text{ }\Omega$			35	

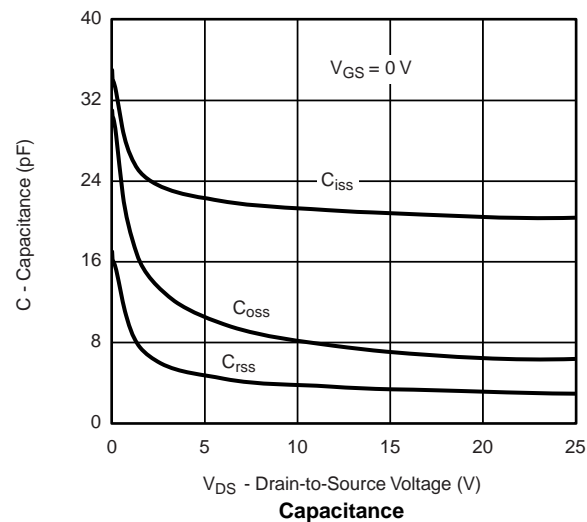
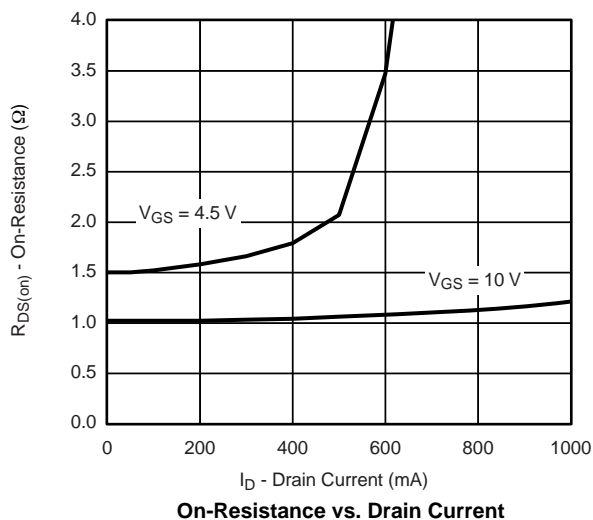
Notes:

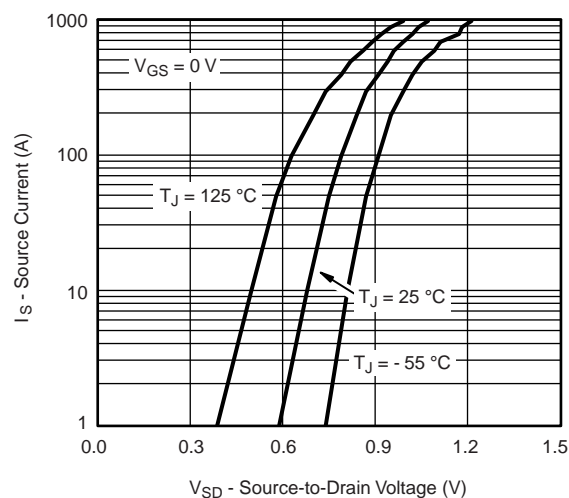
a. For DESIGN AID ONLY, not subject to production testing.

b. Pulse test:  $PW \leq 300\text{ }\mu\text{s}$  duty cycle  $\leq 2\%$ .

c. Switching time is essentially independent of operating temperature.

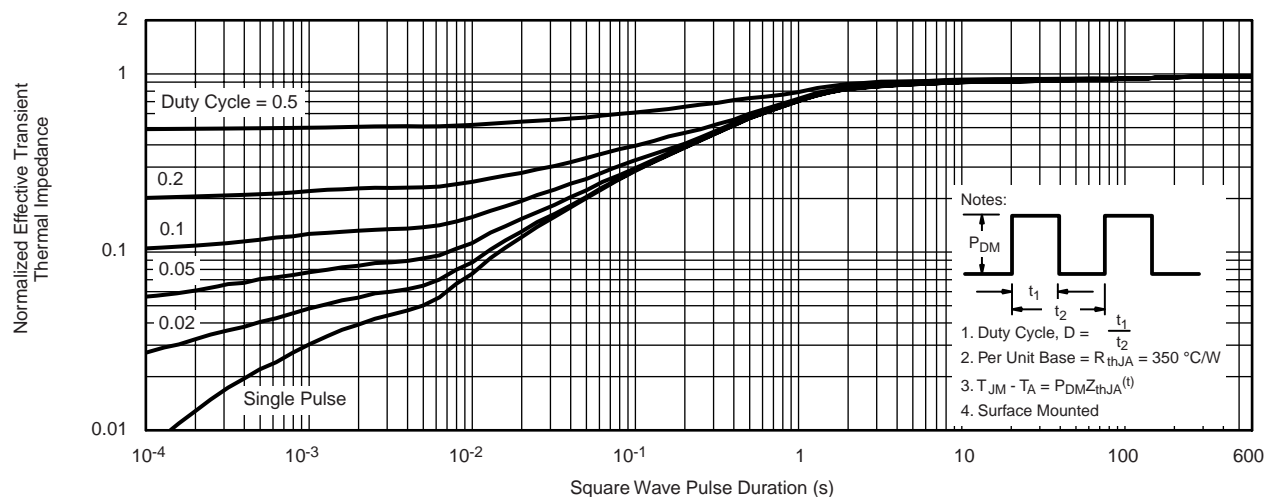
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Source-Drain Diode Forward Voltage**

**On-Resistance vs. Gate-Source Voltage**

**Threshold Voltage Variance Over Temperature**

**Single Pulse Power, Junction-to-Ambient**

**Normalized Thermal Transient Impedance, Junction-to-Ambient**

**THERMAL RATINGS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

**Note**

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient ( $25\text{ }^{\circ}\text{C}$ )
  - Normalized Transient Thermal Impedance Junction-to-Foot ( $25\text{ }^{\circ}\text{C}$ )
 are given for general guidelines only to enable the user to get a "ball park" indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

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