



## N-Channel 60-V (D-S) MOSFETs

| PRODUCT SUMMARY |                       |                               |                  |               |
|-----------------|-----------------------|-------------------------------|------------------|---------------|
| Part Number     | $V_{(BR)DSS}$ Min (V) | $r_{DS(on)}$ Max ( $\Omega$ ) | $V_{GS(th)}$ (V) | $I_D$ Min (A) |
| VN10LLS         | 60                    | 5 @ $V_{GS} = 10$ V           | 0.8 to 2.5       | 0.32          |
| VN0605T         |                       | 5 @ $V_{GS} = 10$ V           | 0.8 to 3.0       | 0.18          |
| VN0610LL        |                       | 5 @ $V_{GS} = 10$ V           | 0.8 to 2.5       | 0.28          |
| VN2222LL        |                       | 5 @ $V_{GS} = 10$ V           | 0.6 to 2.5       | 0.23          |

## FEATURES

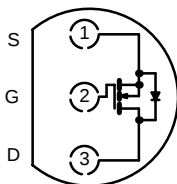
- Low On-Resistance: 2.5  $\Omega$
- Low Threshold: <2.1 V
- Low Input Capacitance: 22 pF
- Fast Switching Speed: 7 ns
- Low Input and Output Leakage

## BENEFITS

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

## APPLICATIONS

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

TO-226AA  
(TO-92)Top View  
VN0610LL  
VN2222LL

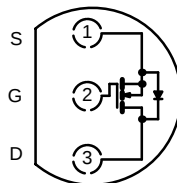
Front View

VN0610LL  
"S" VN0  
610LL  
xxyy

VN2222LL  
"S" VN2  
222LL  
xxyy

"S" = Siliconix Logo  
xxyy = Date Code

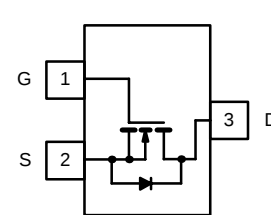
TO-92S

Top View  
VN10LLS

Front View

VN10LLS  
"S" VN  
10LLS  
xxyy

"S" = Siliconix Logo  
xxyy = Date Code

TO-236  
(SOT-23)Top View  
VN0605T

VN0605T  
V2wll

V2 = Part Number Code  
for VN0605T  
w = Week Code  
ll = Lot Traceability

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED)

| Parameter                                                 | Symbol                    | VN10LLS    | VN0605T  | VN0610LL | VN2222LL | Unit               |
|-----------------------------------------------------------|---------------------------|------------|----------|----------|----------|--------------------|
| Drain-Source Voltage                                      | $V_{DS}$                  | 60         | 60       | 60       | 60       | V                  |
| Gate-Source Voltage—Non-Repetitive <sup>b</sup>           | $V_{GSM}$                 | $\pm 30$   | $\pm 30$ | $\pm 30$ | $\pm 30$ |                    |
| Gate-Source Voltage—Continuous                            | $V_{GS}$                  | $\pm 20$   | $\pm 20$ | $\pm 20$ | $\pm 20$ |                    |
| Continuous Drain Current<br>( $T_J = 150^\circ\text{C}$ ) | $T_A = 25^\circ\text{C}$  | 0.32       | 0.18     | 0.28     | 0.23     | A                  |
|                                                           | $T_A = 100^\circ\text{C}$ | 0.2        | 0.11     | 0.17     | 0.14     |                    |
| Pulsed Drain Current <sup>a</sup>                         | $I_{DM}$                  | 1.4        | 0.72     | 1.3      | 1.0      |                    |
| Power Dissipation                                         | $T_A = 25^\circ\text{C}$  | 0.9        | 0.36     | 0.8      | 0.8      | W                  |
|                                                           | $T_A = 100^\circ\text{C}$ | 0.4        | 0.14     | 0.32     | 0.32     |                    |
| Thermal Resistance, Junction-to-Ambient                   | $R_{thJA}$                | 139        | 350      | 156      | 156      | $^\circ\text{C/W}$ |
| Operating Junction and Storage Temperature Range          | $T_J, T_{stg}$            | -55 to 150 |          |          |          | $^\circ\text{C}$   |

## Notes

- a. Pulse width limited by maximum junction temperature.  
b.  $t_p \leq 50 \mu\text{s}$ .

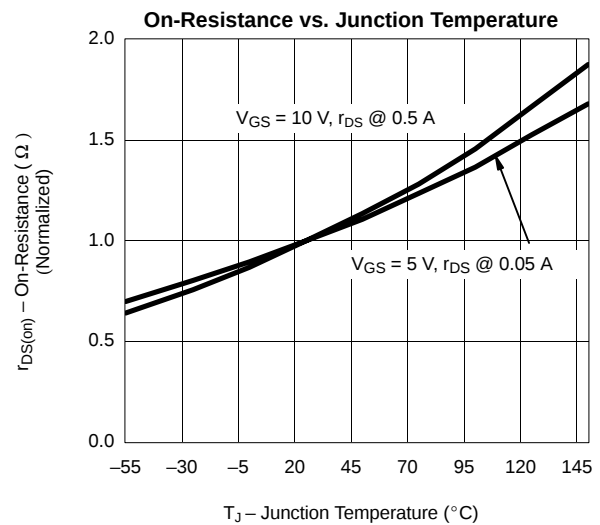
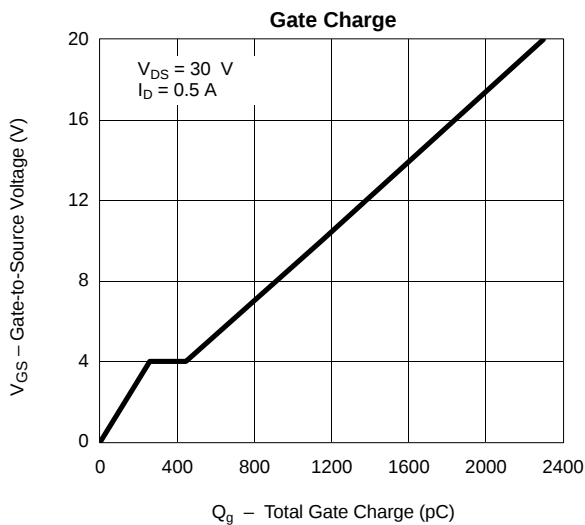
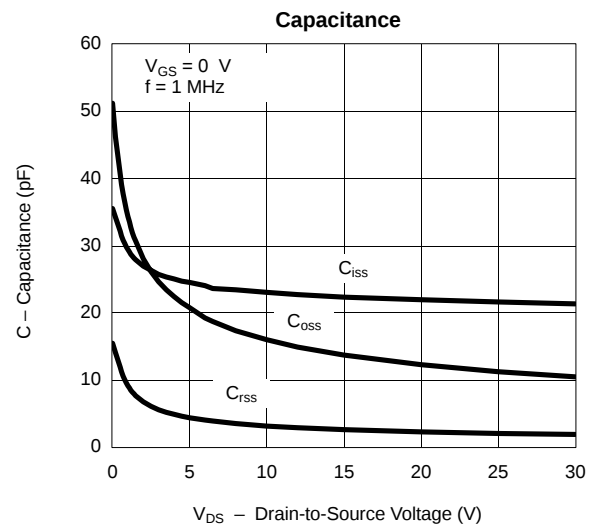
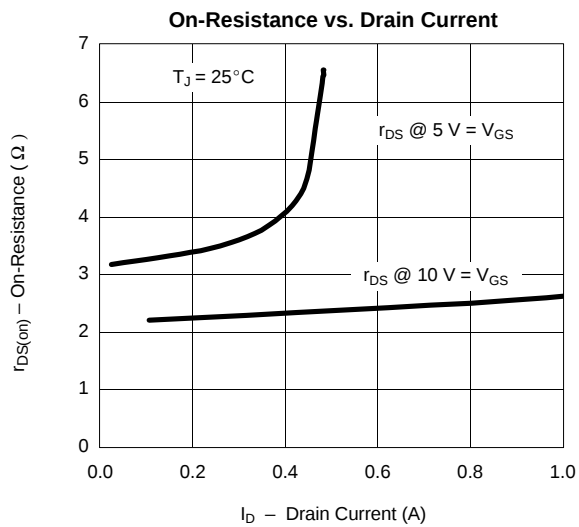
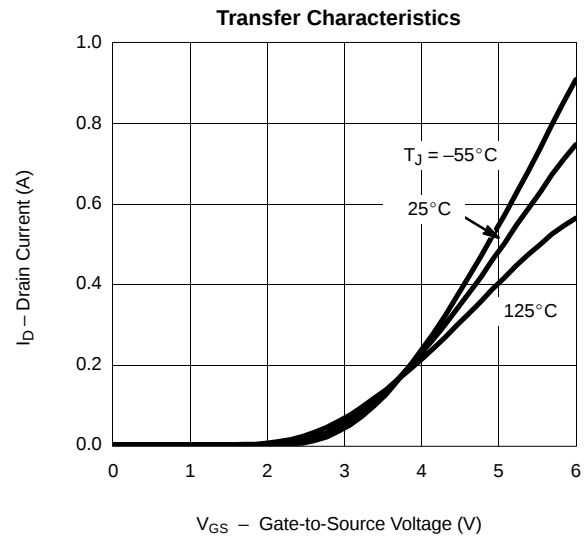
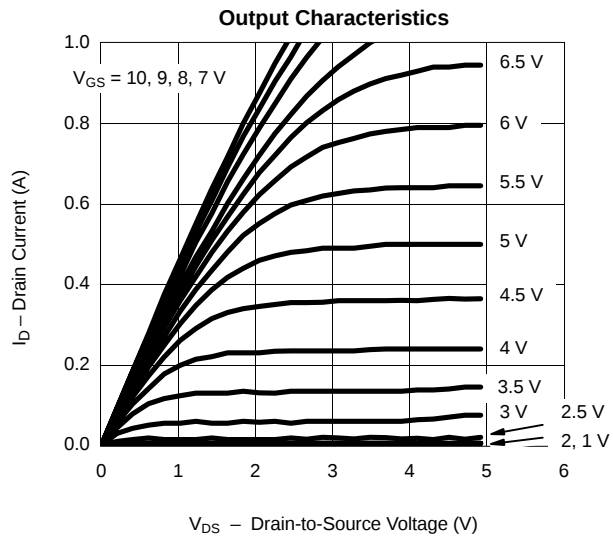
**SPECIFICATIONS (T<sub>A</sub> = 25 °C UNLESS OTHERWISE NOTED)**

| Parameter                                     | Symbol               | Test Conditions                                                                                                          | Typ <sup>a</sup> | Limits              |      |         |      |          |      | Unit |
|-----------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|------|---------|------|----------|------|------|
|                                               |                      |                                                                                                                          |                  | VN10LLS<br>VN0610LL |      | VN0605T |      | VN2222LL |      |      |
|                                               |                      |                                                                                                                          |                  | Min                 | Max  | Min     | Max  | Min      | Max  |      |
| Static                                        |                      |                                                                                                                          |                  |                     |      |         |      |          |      |      |
| Drain-Source Breakdown Voltage                | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 100 μA                                                                           | 70               | 60                  |      |         |      | 60       |      | V    |
|                                               |                      | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 10 μA                                                                            | 70               |                     |      | 60      |      |          |      |      |
| Gate-Threshold Voltage                        | V <sub>GS(th)</sub>  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1 mA                                                                | 2.1              | 0.8                 | 2.5  | 0.8     | 3.0  | 0.6      | 2.5  |      |
| Gate-Body Leakage                             | I <sub>GSS</sub>     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V                                                                           |                  |                     |      |         | ±100 |          | ±100 | nA   |
|                                               |                      | T <sub>J</sub> =125°C                                                                                                    |                  |                     |      |         | ±500 |          |      |      |
|                                               |                      | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±30 V                                                                           |                  |                     | ±100 |         |      |          |      |      |
| Zero Gate-Voltage Drain Current               | I <sub>DSS</sub>     | V <sub>DS</sub> = 50 V, V <sub>GS</sub> = 0 V                                                                            |                  |                     | 10   |         | 1.0  |          |      | μA   |
|                                               |                      | T <sub>J</sub> = 125°C                                                                                                   |                  |                     | 500  |         | 500  |          |      |      |
|                                               |                      | V <sub>DS</sub> = 48 V, V <sub>GS</sub> = 0 V                                                                            |                  |                     |      |         |      |          | 10   |      |
|                                               |                      | T <sub>J</sub> = 125°C                                                                                                   |                  |                     |      |         |      |          | 500  |      |
| On-State Drain Current <sup>b</sup>           | I <sub>D(on)</sub>   | V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 10 V                                                                           | 1000             | 750                 |      | 500     |      | 750      |      | mA   |
| Drain-Source On-Resistance <sup>b</sup>       | r <sub>DS(on)</sub>  | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 50 mA                                                                          | 4.5              |                     |      |         | 7.5  |          |      | Ω    |
|                                               |                      | V <sub>GS</sub> = 5 V, I <sub>D</sub> = 0.2 A                                                                            | 4.5              |                     | 7.5  |         |      |          | 7.5  |      |
|                                               |                      | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.5 A                                                                           | 2.4              |                     | 5    |         | 5    |          | 7.5  |      |
|                                               |                      | T <sub>J</sub> = 125°C                                                                                                   | 4.4              |                     | 9    |         | 10   |          | 13.5 |      |
| Forward Transconductance <sup>b</sup>         | g <sub>fs</sub>      | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.5 A                                                                           | 230              | 100                 |      |         |      | 100      |      | mS   |
|                                               |                      | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.2 A                                                                           | 180              |                     |      | 80      |      |          |      |      |
| Common Source Output Conductance <sup>b</sup> | g <sub>os</sub>      | V <sub>DS</sub> = 5 V, I <sub>D</sub> = 50 mA                                                                            | 500              |                     |      |         |      |          |      | μS   |
| Dynamic                                       |                      |                                                                                                                          |                  |                     |      |         |      |          |      |      |
| Input Capacitance                             | C <sub>iss</sub>     | V <sub>DS</sub> =25 V, V <sub>GS</sub> = 0 V<br>f = 1 MHz                                                                | 22               |                     | 60   |         | 60   |          | 60   | pF   |
| Output Capacitance                            | C <sub>oss</sub>     |                                                                                                                          | 11               |                     | 25   |         | 25   |          | 25   |      |
| Reverse Transfer Capacitance                  | C <sub>rss</sub>     |                                                                                                                          | 2                |                     | 5    |         | 5    |          | 5    |      |
| Switching <sup>c</sup>                        |                      |                                                                                                                          |                  |                     |      |         |      |          |      |      |
| Turn-On Time                                  | t <sub>ON</sub>      | V <sub>DD</sub> = 15 V, R <sub>L</sub> = 23 Ω, I <sub>D</sub> ≅ 0.6 A<br>V <sub>GEN</sub> = 10 V, R <sub>G</sub> = 25 Ω  | 7                |                     | 10   |         |      |          | 10   | ns   |
| Turn-Off Time                                 | t <sub>OFF</sub>     |                                                                                                                          | 7                |                     | 10   |         |      |          | 10   |      |
| Turn-On Time                                  | t <sub>ON</sub>      | V <sub>DD</sub> = 30 V, R <sub>L</sub> = 150 Ω, I <sub>D</sub> ≅ 0.2 A<br>V <sub>GEN</sub> = 10 V, R <sub>G</sub> = 25 Ω | 7                |                     |      |         | 20   |          |      |      |
| Turn-Off Time                                 | t <sub>OFF</sub>     |                                                                                                                          | 11               |                     |      |         | 20   |          |      |      |

## Notes

- a. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.  
b. Pulse test: PW ≤ 300 μs duty cycle ≤ 3%.  
c. Switching time is essentially independent of operating temperature.

VNBF06

**TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED)**

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