



## N-Channel 60-V (D-S) MOSFETs with Zener Gate

PRODUCT SUMMARY				
Part Number	$V_{(BR)DSS}$ Min (V)	$r_{DS(on)}$ Max ( $\Omega$ )	$V_{GS(th)}$ (V)	$I_D$ (A)
VN0610L	60	5 @ $V_{GS} = 10$ V	0.8 to 2.5	0.27
VN10KLS		5 @ $V_{GS} = 10$ V	0.8 to 2.5	0.31
VN2222L		7.5 @ $V_{GS} = 10$ V	0.6 to 2.5	0.23

### FEATURES

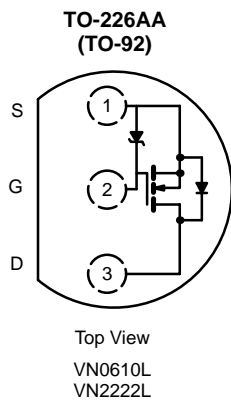
- Zener Diode Input Protected
- Low On-Resistance: 3  $\Omega$
- Ultralow Threshold: 1.2 V
- Low Input Capacitance: 38 pF
- Low Input and Output Leakage

### BENEFITS

- Extra ESD Protection
- Low Offset Voltage
- Low-Voltage Operation
- High-Speed, Easily Driven
- Low Error Voltage

### APPLICATIONS

- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc.
- Battery Operated Systems
- Solid-State Relays
- Inductive Load Drivers



Device Marking  
Front View

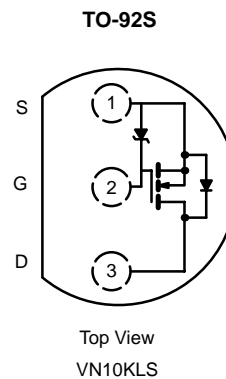
VN0610L

"S" VN  
0610L  
xxyy

VN2222L

"S" VN  
2222L  
xxyy

"S" = Siliconix Logo  
xxyy = Date Code



Device Marking  
Front View

VN10KLS

"S" VN  
10KLS  
xxyy

"S" = Siliconix Logo  
xxyy = Date Code

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

Parameter	Symbol	VN2222L VN0610L	VN10KLS	Unit
Drain-Source Voltage	$V_{DS}$	60	60	V
Gate-Source Voltage	$V_{GS}$	15/-0.3	15/-0.3	
Continuous Drain Current ( $T_J = 150^\circ\text{C}$ )	$I_D$	$T_A = 25^\circ\text{C}$	0.27	A
		$T_A = 100^\circ\text{C}$	0.17	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	1	1.0	
Power Dissipation	$P_D$	$T_A = 25^\circ\text{C}$	0.8	W
		$T_A = 100^\circ\text{C}$	0.32	
Thermal Resistance, Junction-to-Ambient	$R_{thJA}$	156	139	$^\circ\text{C/W}$
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.



SPECIFICATIONS (T <sub>A</sub> = 25 °C UNLESS OTHERWISE NOTED)								
Parameter	Symbol	Test Conditions	Typ <sup>a</sup>	Limits				Unit
				VN0610L VN10KLS		VN2222L		
				Min	Max	Min	Max	
<b>Static</b>								
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 100 μA	120	60		60		V
Gate-Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1 mA	1.2	0.8	2.5	0.6	2.5	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 15 V	1		100		100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 48 V, V <sub>GS</sub> = 0 V T <sub>J</sub> = 125 °C			10		10	μA
					500		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	1	0.75		0.75		A
Drain-Source On-Resistance <sup>b</sup>	r <sub>DS(on)</sub>	V <sub>GS</sub> = 5 V, I <sub>D</sub> = 0.2 A V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.5 A T <sub>J</sub> = 125 °C	4		7.5		7.5	Ω
			3		5		7.5	
			5.6		9		13.5	
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.5 A	300	100		100		mS
Common Source Output Conductance <sup>b</sup>	g <sub>os</sub>	V <sub>DS</sub> = 7.5 V, I <sub>D</sub> = 0.05 A	0.2					
<b>Dynamic</b>								
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz	38		60		60	pF
Output Capacitance	C <sub>oss</sub>		16		25		25	
Reverse Transfer Capacitance	C <sub>rss</sub>		2		5		5	
<b>Switching<sup>c</sup></b>								
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, V <sub>GEN</sub> = 10 V R <sub>G</sub> = 25 Ω	7		10		10	ns
Turn-Off Time	t <sub>OFF</sub>		9		10		10	

Notes

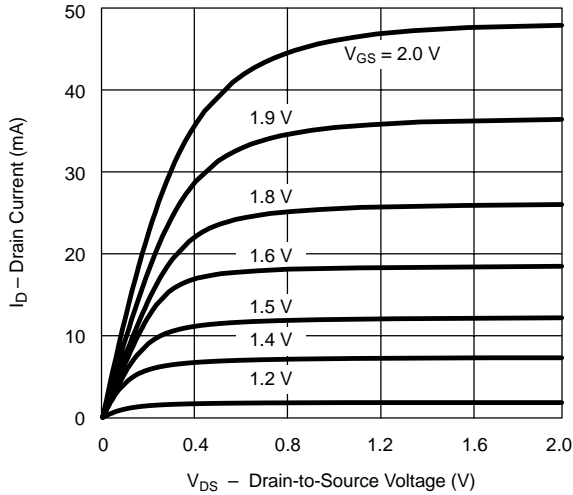
- a. For DESIGN AID ONLY, not subject to production testing.
- b. Pulse test: PW ≤ 300 μs duty cycle ≤ 2%.
- c. Switching time is essentially independent of operating temperature.

VNDP06

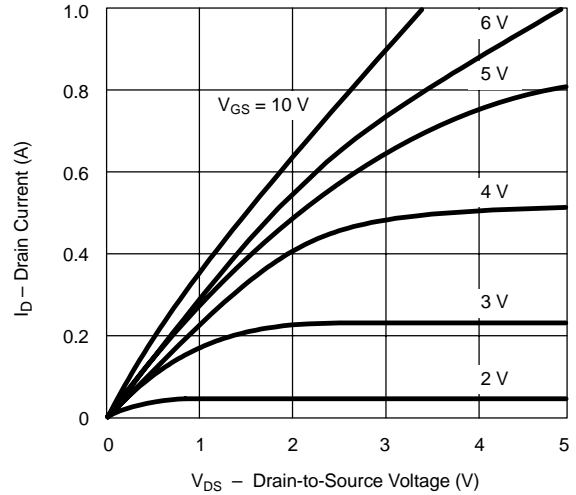


**TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C UNLESS OTHERWISE NOTED)**

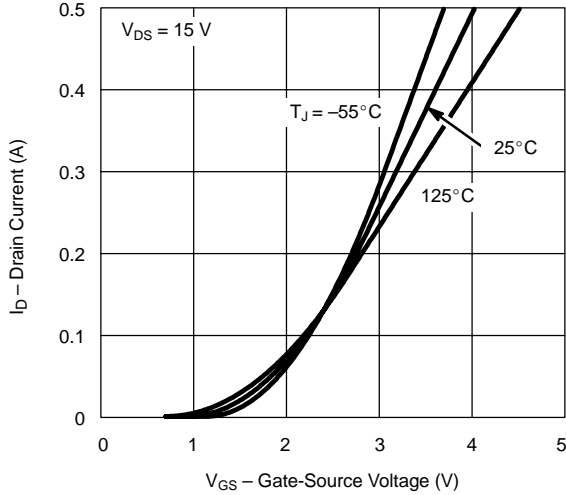
**Ohmic Region Characteristics**



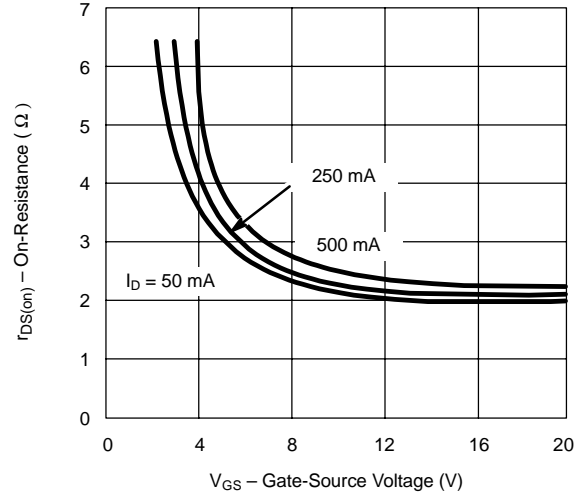
**Output Characteristics for Low Gate Drive**



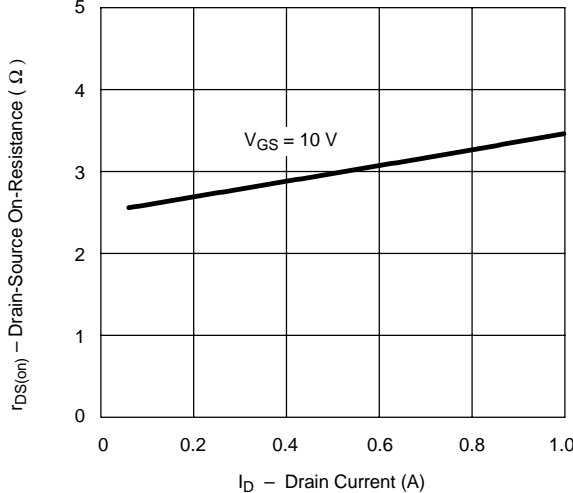
**Transfer Characteristics**



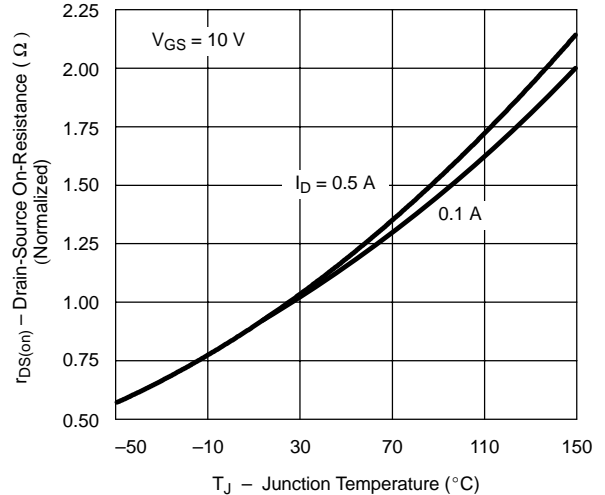
**On-Resistance vs. Gate-to-Source Voltage**



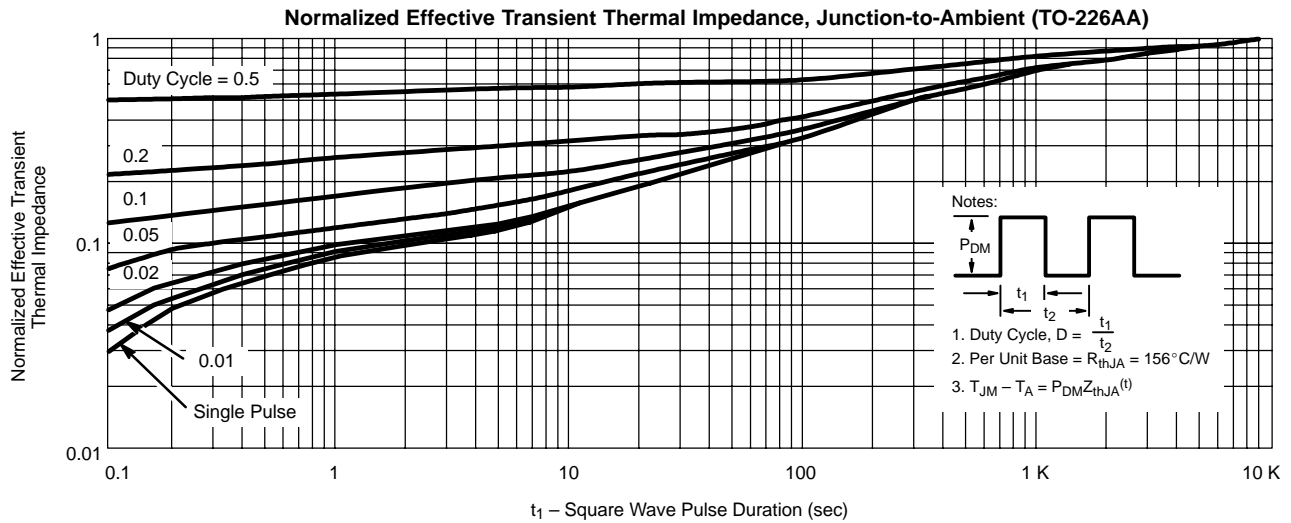
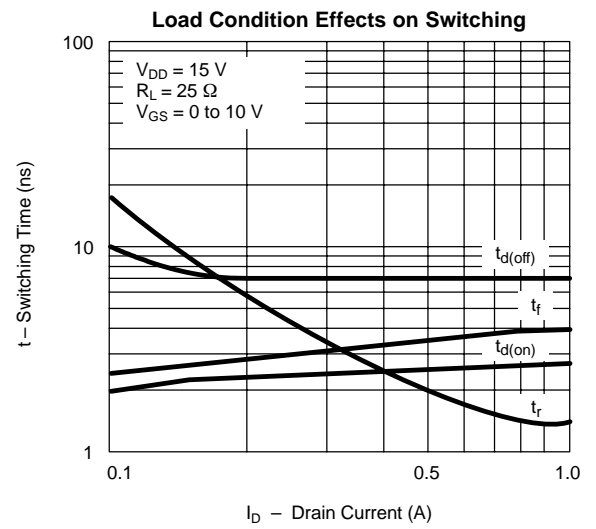
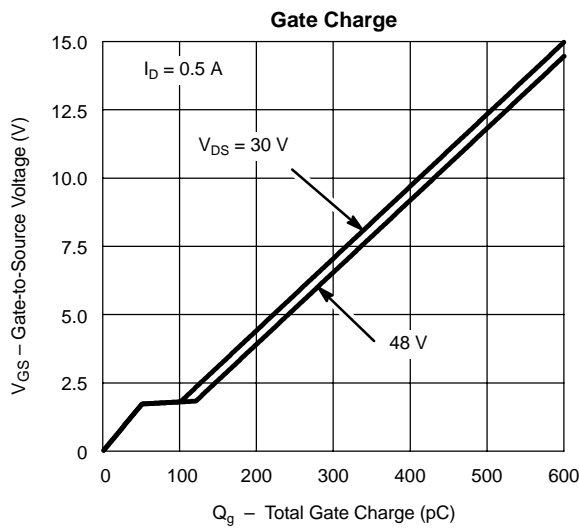
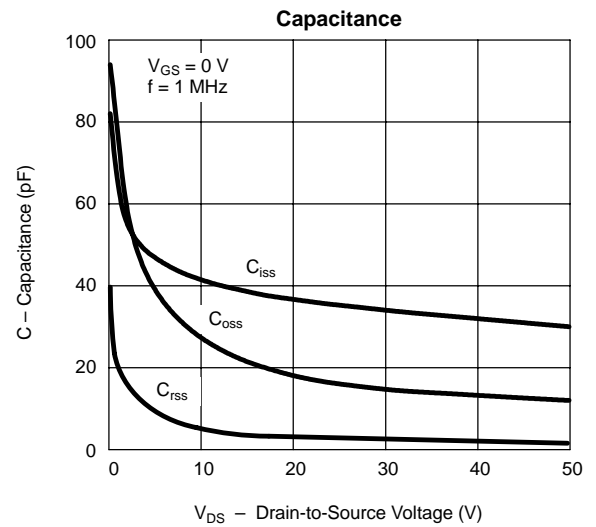
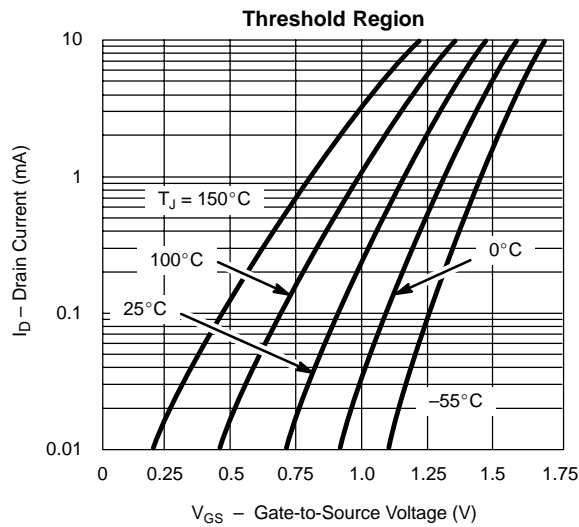
**On-Resistance vs. Drain Current**



**Normalized On-Resistance vs. Junction Temperature**



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





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