



New Product

Si1033X  
Vishay Siliconix

P-Channel 20-V (D-S) MOSFET

**TrenchFET®**  
MOSFETs  
**1.5-V Rated**



**ESD Protected  
2000 V**

PRODUCT SUMMARY		
V <sub>DS</sub> (V)	r <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (mA)
-20	8 @ V <sub>GS</sub> = -4.5 V	-150
	12 @ V <sub>GS</sub> = -2.5 V	-125
	15 @ V <sub>GS</sub> = -1.8 V	-100
	20 @ V <sub>GS</sub> = -1.5 V	-30

**FEATURES**

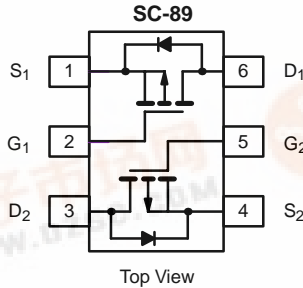
- High-Side Switching
- Low On-Resistance: 8 Ω
- Low Threshold: 0.9 V (typ)
- Fast Switching Speed: 45 ns (typ)
- 1.5-V Operation
- Gate-Source ESD Protection

**BENEFITS**

- Ease in Driving Switches
- Low Offset (Error) Voltage
- Low-Voltage Operation
- High-Speed Circuits
- Low Battery Voltage Operation

**APPLICATIONS**

- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories
- Battery Operated Systems
- Power Supply Converter Circuits
- Load/Power Switching Cell Phones, Pagers



Marking Code: K

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

Parameter	Symbol	5 secs	Steady State	Unit	
Drain-Source Voltage	V <sub>DS</sub>	-20		V	
Gate-Source Voltage	V <sub>GS</sub>	±5			
Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>	I <sub>D</sub>	T <sub>A</sub> = 25 °C	-155	-145	mA
		T <sub>A</sub> = 85 °C	-110	-105	
Pulsed Drain Current <sup>b</sup>	I <sub>DM</sub>	-650			
Continuous Source Current (diode conduction) <sup>a</sup>	I <sub>S</sub>	-450	-380		
Maximum Power Dissipation <sup>a</sup>	P <sub>D</sub>	T <sub>A</sub> = 25 °C	280	250	mW
		T <sub>A</sub> = 85 °C	145	130	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to 150		°C	
Gate-Source ESD Rating (HBM, Method 3015)	ESD	2000		V	

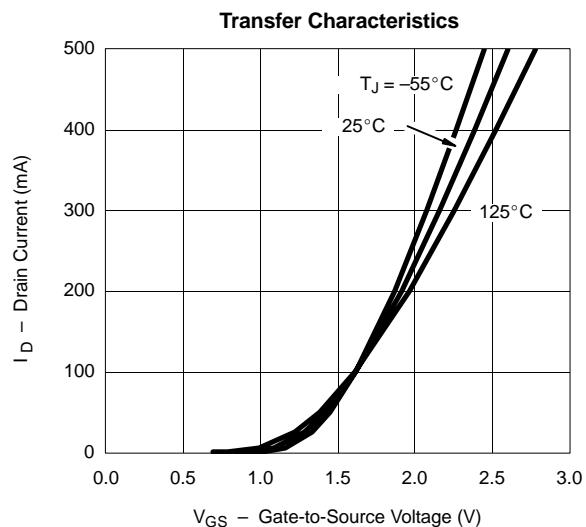
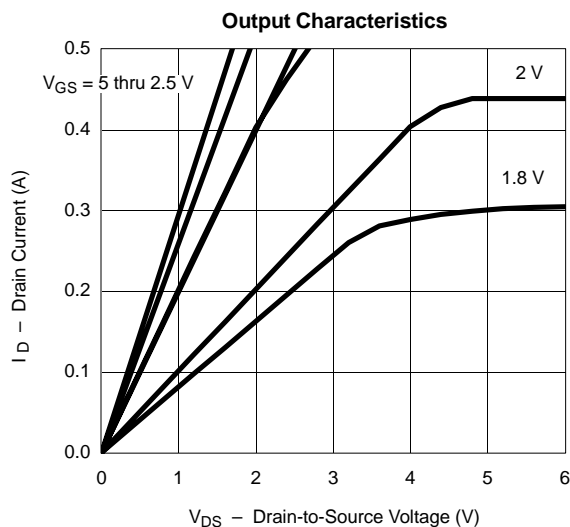
Notes:  
 a. Surface Mounted on FR4 Board.  
 b. Pulse width limited by maximum junction temperature.


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

Parameter	Symbol	Test Condition	Min	Typ <sup>a</sup>	Max	Unit
<b>Static</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250 \mu\text{A}$	-0.40		-1.20	V
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 2.8 \text{ V}$		$\pm 0.5$	$\pm 1$	$\mu\text{A}$
		$V_{DS} = 0 \text{ V}, V_{GS} = \pm 4.5 \text{ V}$		$\pm 1$	$\pm 2$	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -16 \text{ V}, V_{GS} = 0 \text{ V}$		-1	-500	nA
		$V_{DS} = -16 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 85^\circ\text{C}$			-10	$\mu\text{A}$
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} = -5 \text{ V}, V_{GS} = -4.5 \text{ V}$	-200			mA
Drain-Source On-State Resistance <sup>a</sup>	$r_{DS(on)}$	$V_{GS} = -4.5 \text{ V}, I_D = -150 \text{ mA}$			8	$\Omega$
		$V_{GS} = -2.5 \text{ V}, I_D = -125 \text{ mA}$			12	
		$V_{GS} = -1.8 \text{ V}, I_D = -100 \text{ mA}$			15	
		$V_{GS} = -1.5 \text{ V}, I_D = -30 \text{ mA}$			20	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -10 \text{ V}, I_D = -150 \text{ mA}$		0.4		S
Diode Forward Voltage <sup>a</sup>	$V_{SD}$	$I_S = -150 \text{ mA}, V_{GS} = 0 \text{ V}$			-1.2	V
<b>Dynamic<sup>b</sup></b>						
Total Gate Charge	$Q_g$	$V_{DS} = -10 \text{ V}, V_{GS} = -4.5 \text{ V}, I_D = -150 \text{ mA}$		1500		$\mu\text{C}$
Gate-Source Charge	$Q_{gs}$			150		
Gate-Drain Charge	$Q_{gd}$			450		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10 \text{ V}, R_L = 65 \Omega$ $I_D \approx -150 \text{ mA}, V_{GEN} = -4.5 \text{ V}, R_G = 10 \Omega$			55	ns
Rise Time	$t_r$				30	
Turn-Off Delay Time	$t_{d(off)}$				60	
Fall Time	$t_f$				30	

## Notes

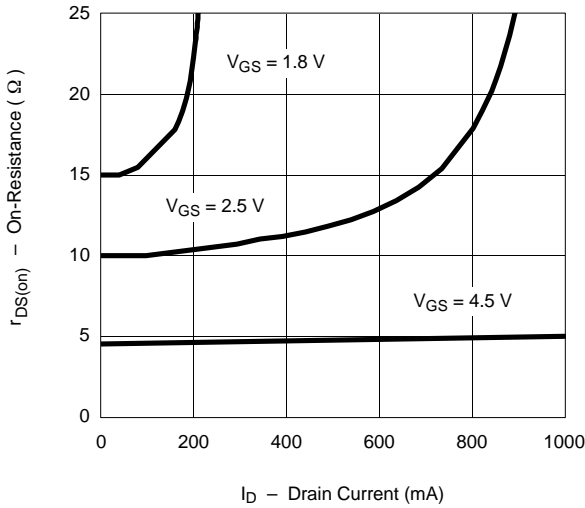
- a. Pulse test; pulse width  $\leq 300 \mu\text{s}$ , duty cycle  $\leq 2\%$ .  
b. Guaranteed by design, not subject to production testing.

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


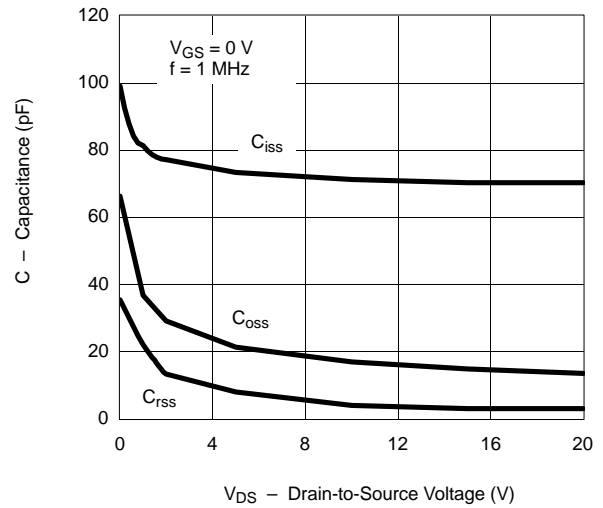


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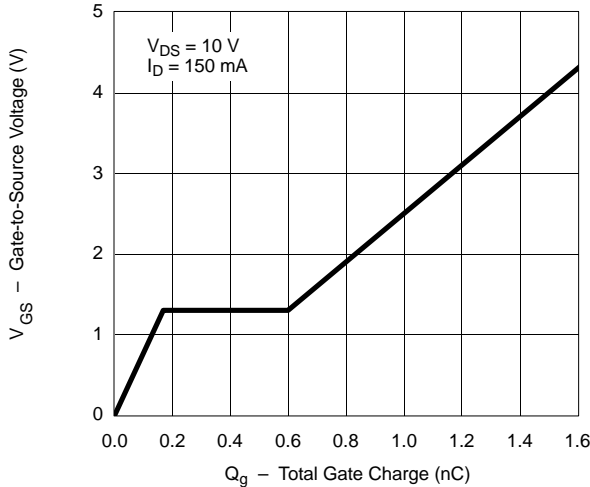
On-Resistance vs. Drain Current



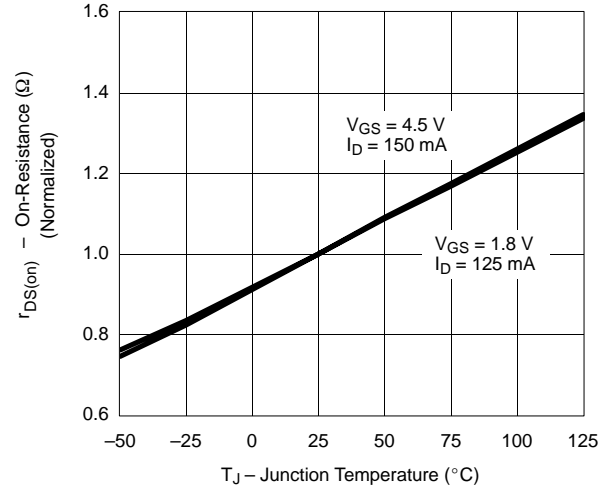
Capacitance



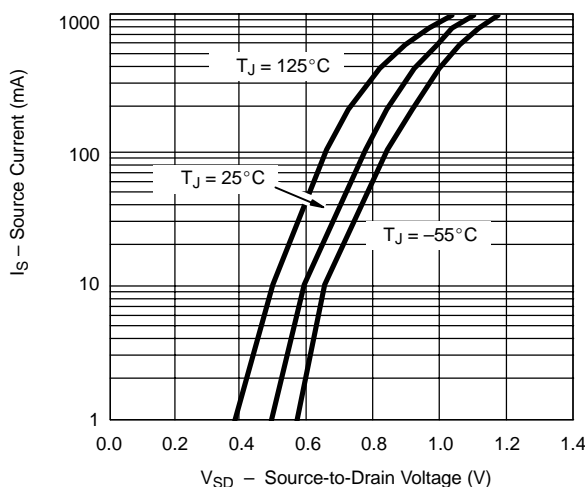
Gate Charge



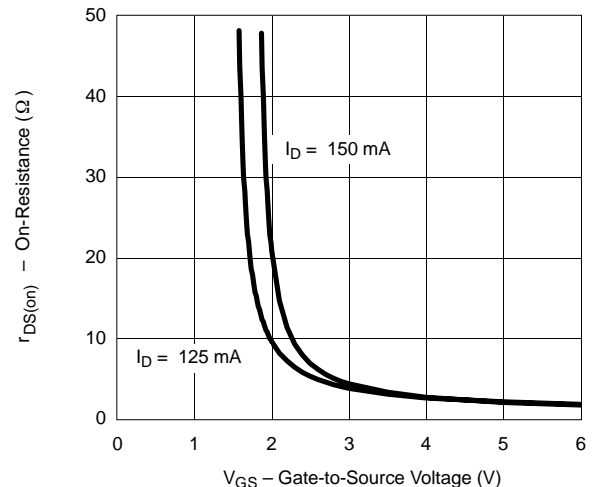
On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage





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

