UNISONIC TECHNOLOGIES CO., LTD

UF630

Power MOSFET

## 200V, 9A   N-CHANNEL POWER MOSFET

■ DESCRIPTION

The N-Channel enhancement mode silicon gate power MOSFET is designed for high voltage, high speed power switching applications such as switching regulators, switching converters, solenoid, motor drivers, relay drivers.

■ FEATURES

* $R_{DS(ON)}$ = 0.4Ω@ V_{GS} = 10 V
* Ultra Low Gate Charge (typical 19 nC)
* Low Reverse Transfer Capacitance (C_{RSS} = typical 80 pF)
* Fast Switching Capability
* Avalanche Energy Specified
* Improved dv/dt Capability

■ SYMBOL
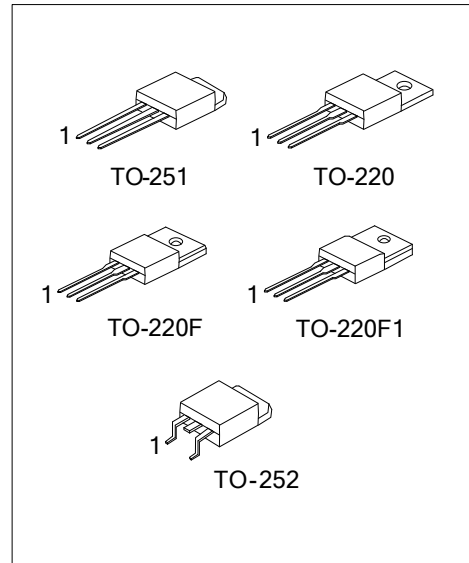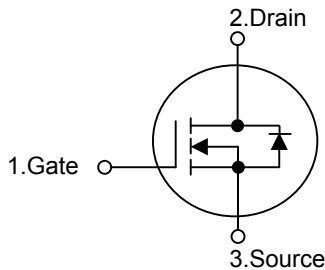
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
UF630L-TA3-T	UF630G-TA3-T	TO-220	G	D	S	Tube
UF630L-TF1-T	UF630G-TF1-T	TO-220F1	G	D	S	Tube
UF630L-TF3-T	UF630G-TF3-T	TO-220F	G	D	S	Tube
UF630L-TM3-T	UF630G-TM3-T	TO-251	G	D	S	Tube
UF630L-TN3-R	UF630G-TN3-R	TO-252	G	D	S	Tape Reel
UF630L-TN3-T	UF630G-TN3-T	TO-252	G	D	S	Tube

Note: Pin Assignment: G: Gate   D: Drain   S: Source

UF630L-TA3-T
- (1) Packing Type
- (2) Package Type
- (3) Lead Free

(1) R: Tape Reel, T: Tube

(2) TA3: TO-220, TF1: TO-220F1, TF3: TO-220F, TM3: TO-251, TN3: TO-252

(3) G: Halogen Free, L: Lead Free

■ **ABSOLUTE MAXIMUM RATINGS** (T_C = 25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	200	V
Drain-Gate Voltage (R_{GS} = 20kΩ, T_J =25°C ~125°C)		V_{DGR}	200	V
Gate-Source Voltage		V_{GSS}	±20	V
Continuous Drain Current		I_D	9	A
Pulsed Drain Current (Note 2)		I_{DM}	36	A
Single Pulse Avalanche Energy (Note 3)		E_{AS}	150	mJ
Power Dissipation	TO-220	P_D	75	W
	TO-220F1/ TO-220F		51	
	TO-251/ TO-252		54	
Junction Temperature		T_J	+150	°C
Storage Temperature		T_{STG}	-55 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating : Pulse width limited by T_J
3. L = 4mH, I_{AS} = 8.3A, V_{DD} = 20V, R_G = 25 Ω, Starting T_J = 25°C

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/ TO-220F1/ TO-220F	$θ_{JA}$	80	°C/W
	TO-251/ TO-252		110	
Junction to Case	TO-220	$θ_{JC}$	1.67	°C/W
	TO-220F1/ TO-220F		2.45	
	TO-251/ TO-252		2.3	

UF630

■ **ELECTRICAL SPECIFICATIONS** (T_C =25°C, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS} = 0V, I_D = 250µA	200			V
On-State Drain Current (Note 1)		$I_{D(ON)}$	V_{DS} > $I_{D(ON)}$ x $R_{DS(ON)MAX}$, V_{GS} = 10V	9			A
Drain-Source Leakage Current		I_{DSS}	V_{DS} = Rated BV_{DSS}, V_{GS} = 0V			10	µA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS} = 20V, V_{DS} = 0V			100	nA
	Reverse		V_{GS} = -20V, V_{DS} = 0V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250µA	2		4	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS} = 10V, I_D = 5A		0.25	0.4	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz		600		pF
Output Capacitance		C_{OSS}			250		pF
Reverse Transfer Capacitance		C_{RSS}			80		pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		$t_{D(ON)}$	V_{DD} = 90V, I_D≈9A, R_{GS} = 9.1Ω, V_{GS} = 10V, R_L = 9.6Ω (Note 1, 2)			30	ns
Turn-On Rise Time		t_R				50	ns
Turn-Off Delay Time		$t_{D(OFF)}$				50	ns
Turn-Off Fall Time		t_F				40	ns
Total Gate Charge		Q_G	V_{GS} = 10V, I_D = 9A, V_{DS} = 0.8 x Rated BV_{DSS} $I_{G(REF)}$ = 1.5mA		19	30	nC
Gate-Source Charge		Q_{GS}			10		nC
Gate-Drain Charge		Q_{GD}			9		nC
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS} =0V, I_S = 9.0A			2	V
Maximum Continuous Drain-Source Diode Forward Current		I_S				9	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				36	A
Reverse Recovery Time		t_{rr}	I_S = 9.0A, dI_S/dt = 100A/µs (Note 1)		450		ns
Reverse Recovery Charge		Q_{RR}			3		µC

Notes: 1. Pulse Test: Pulse width ≤300µs, Duty cycle≤2%

2. Essentially independent of operating temperature
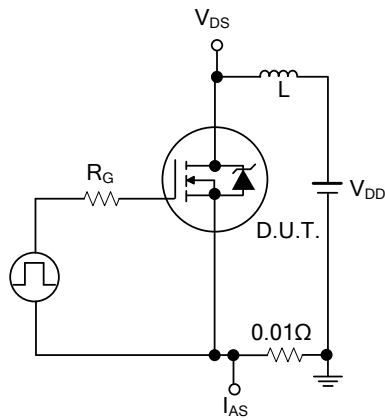
■ TEST CIRCUITS AND WAVEFORMS
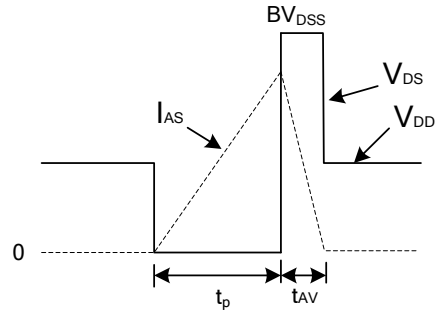

Fig1. Unclamped Energy Test Circuit

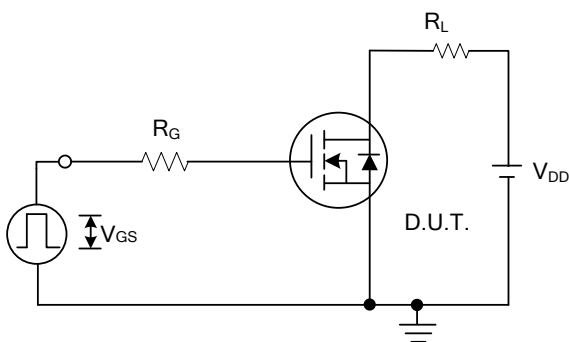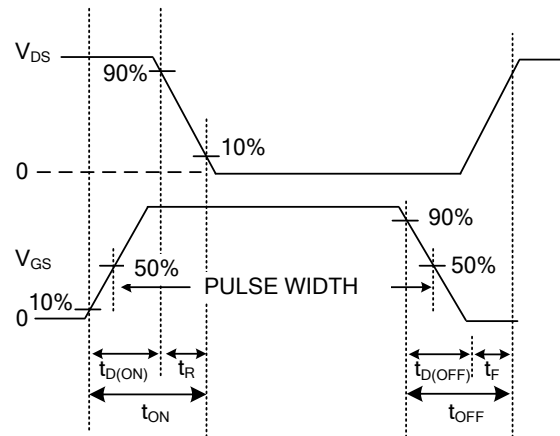Fig.2 Unclamped Energy Waveforms

Fig.3 Switching Time Test Circuit
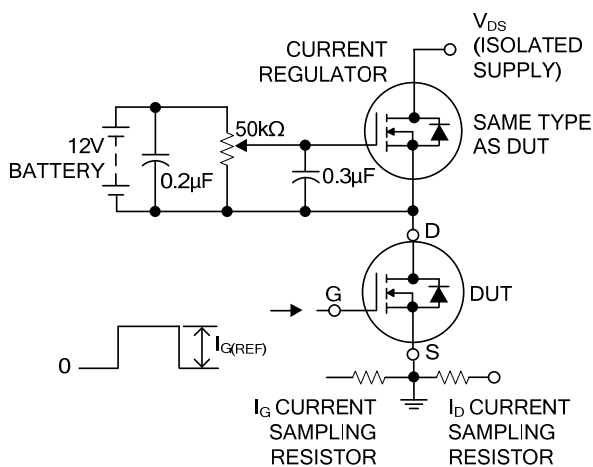

Fig.4 Resistive Switching Waveforms
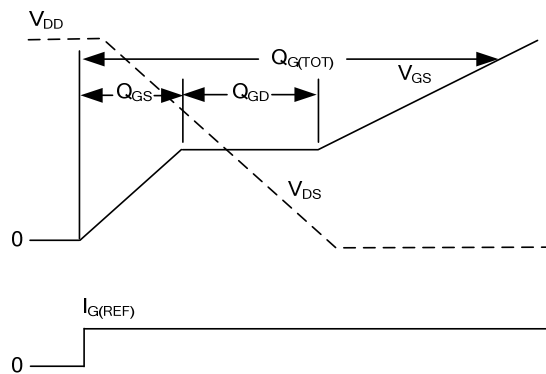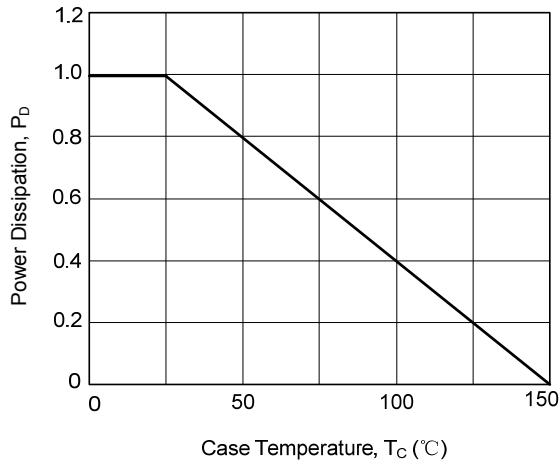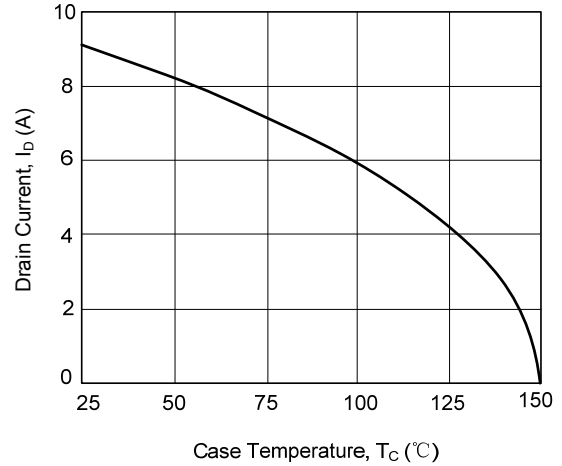

Fig.5 Gate Charge Test Circuit

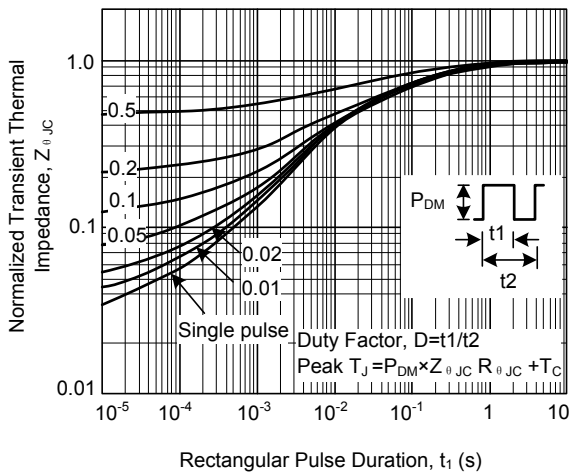Fig.6 Gate Charge Waveforms

■ **TYPICAL CHARACTERISTICS**

Normalized Power Dissipation vs.
Case Temperature
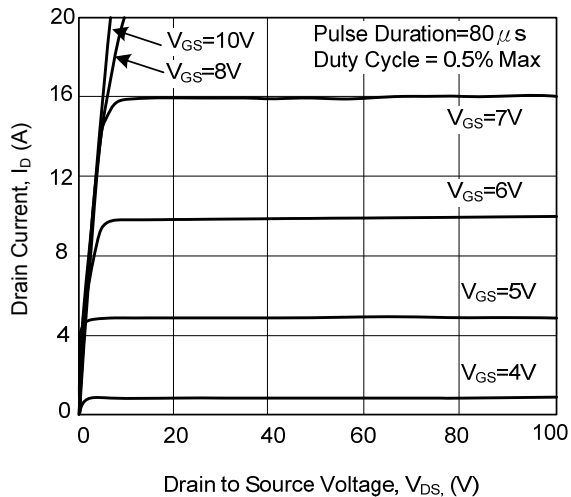

Maximum Contionuous Drain Current vs.
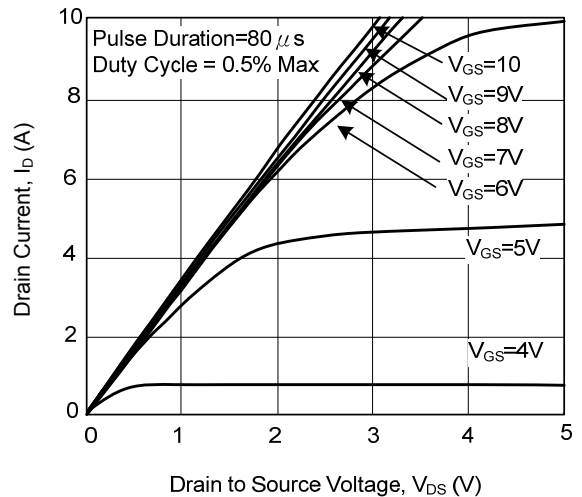Case Temperature

Normalized Transient Thermal Impedance

Duty Factor, D=t1/t2
Peak $T_J = P_{DM} \times Z_{\theta JC} R_{\theta JC} + T_C$

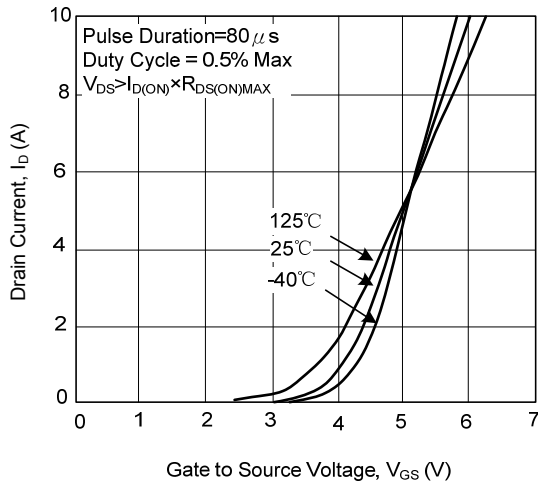Forward Bias Safe Operating Area
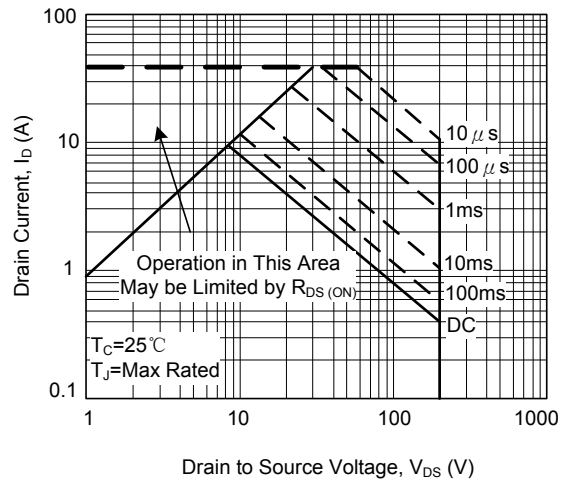
Output Characteristics

Saturation Characteristics

■ **TYPICAL CHARACTERISTICS (Cont.)**

Transfer Characteristics
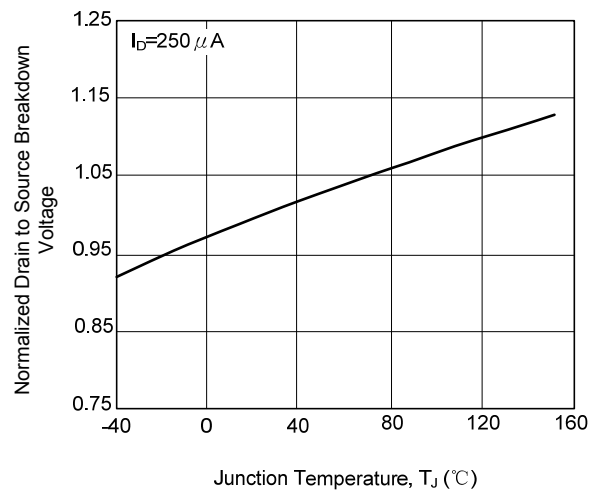

Pulse Duration=80μs
Duty Cycle = 0.5% Max
V_{DS}>$I_{D(ON)}$×$R_{DS(ON)MAX}$

Drain Current, I_D (A)

125℃
25℃
-40℃

Gate to Source Voltage, V_{GS} (V)

Drain to Source on Resistance vs.
Gate Voltage and Drain Current

2μs Pulse Test

V_{GS}=10V
V_{GS}=20V

Drain to Source on Resistance, $R_{DS(ON)}$

Drain Current, I_D (A)
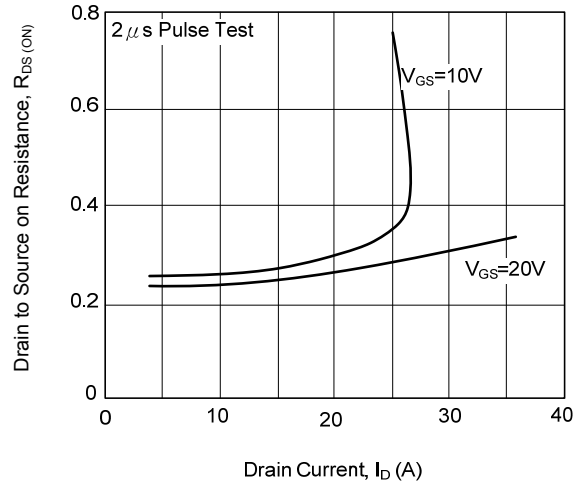
Normalized Drain to Source on Resistance vs.
Junction Temperture

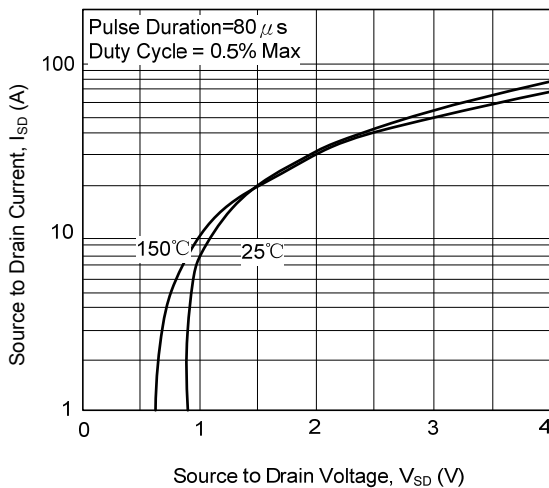Pulse Duration=80μs
Duty Cycle = 0.5% Max
V_{GS}=10V, I_D=5A

Normalized Drain to Source on Resistance

Junction Temperature, T_J (℃)
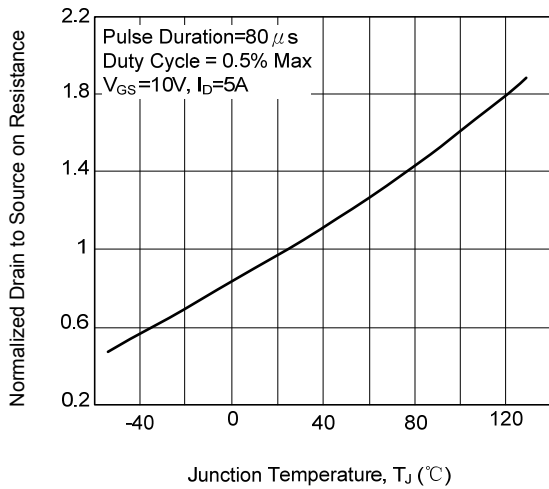
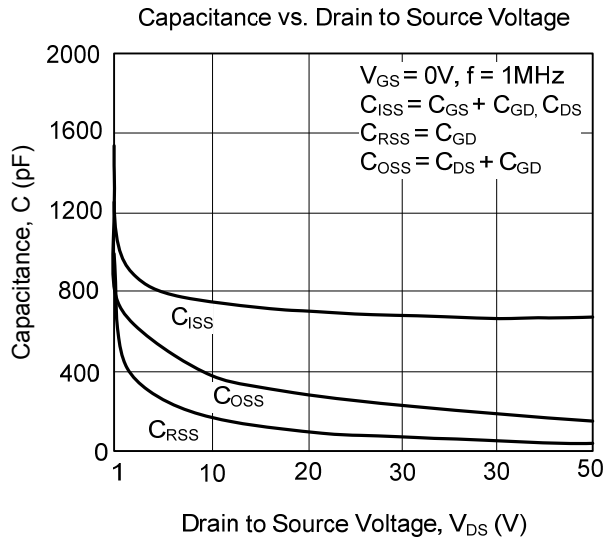Normalized Drain to Source Breakdown Voltage vs.
Junction Temperature

I_D=250μA

Normalized Drain to Source Breakdown Voltage

Junction Temperature, T_J (℃)

Source to Drain Diode Voltage

Pulse Duration=80μs
Duty Cycle = 0.5% Max

Source to Drain Current, I_{SD} (A)

150℃   25℃

Source to Drain Voltage, V_{SD} (V)

Gate to Source Voltage vs. Gate Charge

I_D=9A

V_{DS}=40V
V_{DS}=100V
V_{DS}=160V

Gate to Source Voltage, V_{GS} (V)

Gate Charge, Q_G (nC)

■ **TYPICAL CHARACTERISTICS (Cont.)**

Capacitance vs. Drain to Source Voltage

$V_{GS} = 0V$, f = 1MHz
$C_{ISS} = C_{GS} + C_{GD}$, C_{DS}
$C_{RSS} = C_{GD}$
$C_{OSS} = C_{DS} + C_{GD}$

C_{ISS}

C_{OSS}

C_{RSS}

Capacitance, C (pF)

Drain to Source Voltage, V_{DS} (V)