P-Channel 30-V (D-S) MOSFET

TrenchFET® MOSFETs

ESD Protected
2000 V

PRODUCT SUMMARY

| $V_{(BR)DSS(min)}$ (V)	$r_{DS(on)}$ (Ω)	$V_{GS(th)}$ (V)	I_D (mA)	Q_g (Typ)
−30	1.4 @ V_{GS} = −10 V	−1.3 to −3.0	−385	1000
	3.5 @ V_{GS} = −4.5 V	−1.3 to −3.0	−240	

FEATURES

- High-Side Switching
- Low On-Resistance: 1.2 Ω (typ)
- Low Threshold: −2.0 V (typ)
- Fast Swtiching Speed: 14 ns (typ)
- Low Input Capacitance: 31 pF (typ)
- Gate-Source ESD Protection

BENEFITS

- Ease in Driving Switches
- Low Offset (Error) Voltage
- Low-Voltage Operation
- High-Speed Circuits
- Easily Driven Without Buffer

APPLICATIONS

- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc.
- Battery Operated Systems
- Power Supply Converter Circuits
- Solid State Relays

TO-236
(SOT-23)

G [1]

S [2]

[3] D

Top View
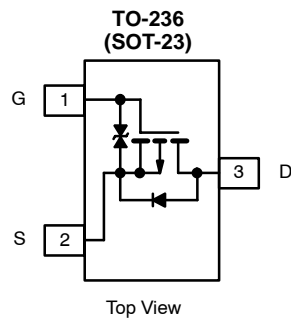
Ordering Information: TP0202K-T1
TP0202K-T1—E3 (Lead (Pb)-Free)

Marking Code: 2K*wll*

2K = Part Number Code for TP0202K
w = Week Code
ll = Lot Traceability

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C UNLESS OTHERWISE NOTED)

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V_{DS}	−30	V
Gate-Source Voltage		V_{GS}	±20	
Continuous Drain Current (T_J = 150°C)[a]	T_A = 25°C	I_D	−385	mA
	T_A = 85°C		−280	
Pulse Drain Current[b]		I_{DM}	−750	
Power Dissipation[a]	T_A = 25°C	P_D	350	mW
	T_A = 85°C		185	
Maximum Junction-to-Ambient[a]		R_{thJA}	350	°C/W
Operating Junction and Storage Temperature Range		T_J, T_{stg}	−55 to 150	°C

Notes
a. Surface mounted on FR4 board.
b. Pulse width limited by maximum junction temperature.

SPECIFICATIONS (T_A = 25°C UNLESS OTHERWISE NOTED)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ V, $I_D = -100$ μA	−30	−38		V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = -250$ μA	−1.3	−2	−3.0	
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0$ V, $V_{GS} = \pm 5$ V			±50	nA
		$V_{DS} = 0$ V, $V_{GS} = \pm 10$ V			±300	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -30$ V, $V_{GS} = 0$ V			−100	
		$V_{DS} = -30$ V, $V_{GS} = 0$ V, $T_J = 85$°C			−10	μA
On-State Drain Current[a]	$I_{D(on)}$	$V_{DS} = -10$ V, $V_{GS} = -10$ V	−500			mA
Drain-Source On-Resistance[a]	$r_{DS(on)}$	$V_{GS} = -4.5$ V, $I_D = -50$ mA		2.1	3.5	Ω
		$V_{GS} = -10$ V, $I_D = -500$ mA		1.25	1.4	
Forward Transconductance[a]	g_{fs}	$V_{DS} = -5$ V, $I_D = -200$ mA		315		mS
Diode Forward Voltage[a]	V_{SD}	$I_S = -250$ mA, $V_{GS} = 0$ V			−1.2	V
Dynamic						
Total Gate Charge	Q_g	$V_{DS} = -16$ V, $V_{GS} = -10$ V, $I_D \cong -200$ mA		1000		pC
Gate-Source Charge	Q_{gs}			225		
Gate-Drain Charge	Q_{gd}			175		
Input Capacitance	C_{iss}	$V_{DS} = -15$ V, $V_{GS} = 0$ V, f = 1 MHz		31		pF
Output Capacitance	C_{oss}			11		
Reverse Transfer Capacitance	C_{rss}			4		
Switching[b]						
Turn-On Time	$t_{d(on)}$	$V_{DD} = -15$ V, $R_L = 75$ Ω, $I_D \cong -200$ mA, $V_{GEN} = -10$ V, $R_G = 6$ Ω		9		ns
	t_r			6		
Turn-Off Time	$t_{d(off)}$			30		
	t_f			20		

Notes
a. Pulse test: PW ≤ 300 ms duty cycle ≤ 2%.
b. 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.
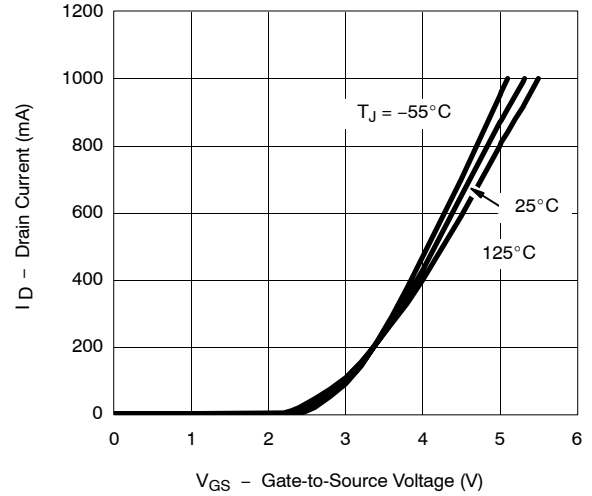
TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

For the following graphs, p-channel negative polarities for all voltage and current values are represented as positive values.
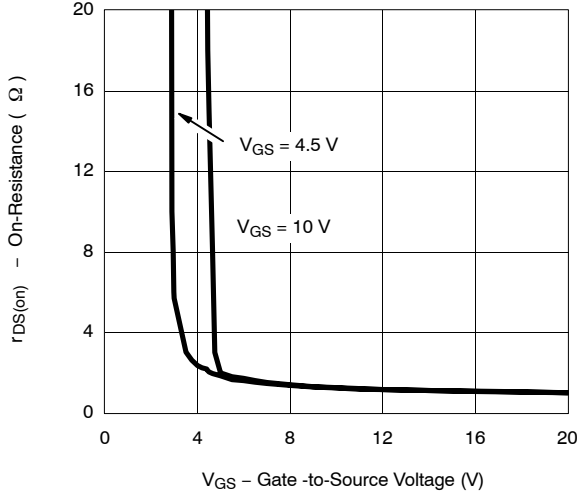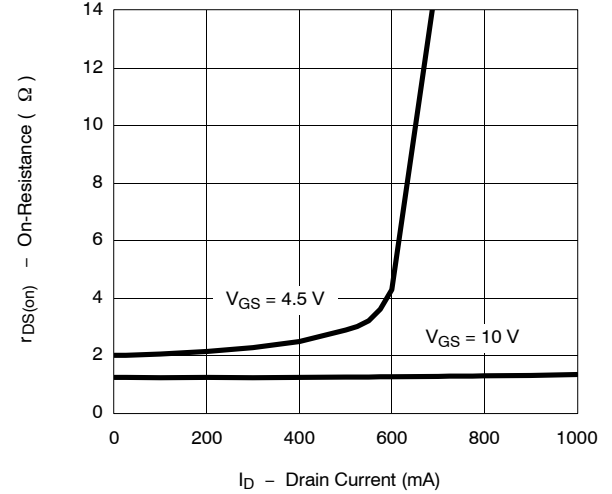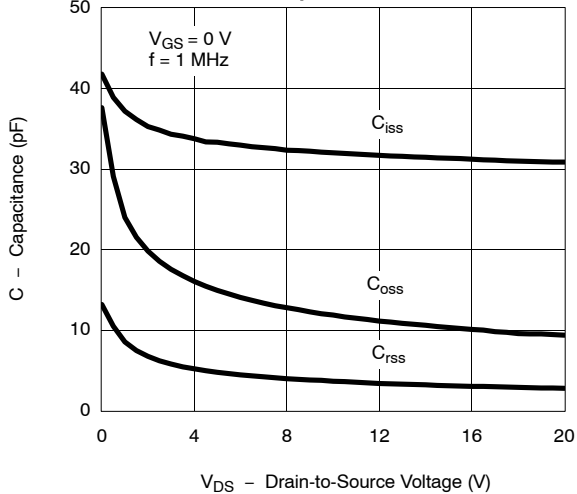
Output Characteristics
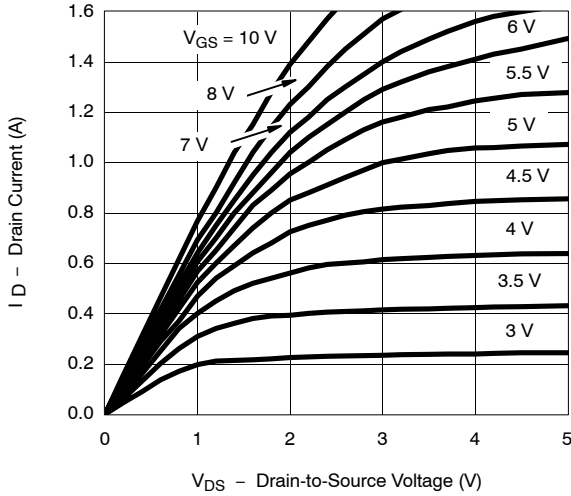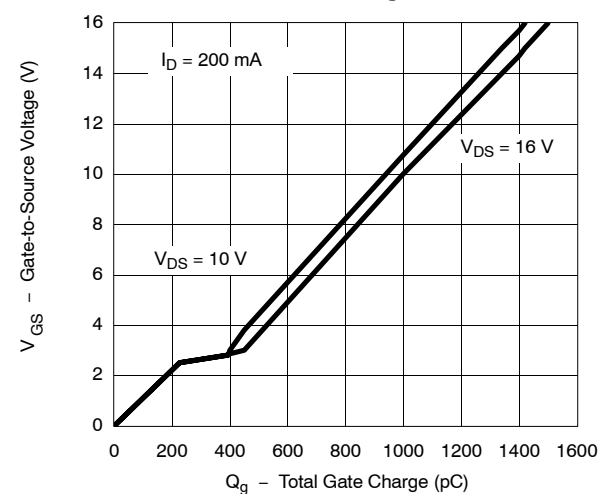

Transfer Characteristics

On-Resistance vs. Gate-Source Voltage

On-Resistance vs. Drain Current

Capacitance

Gate Charge

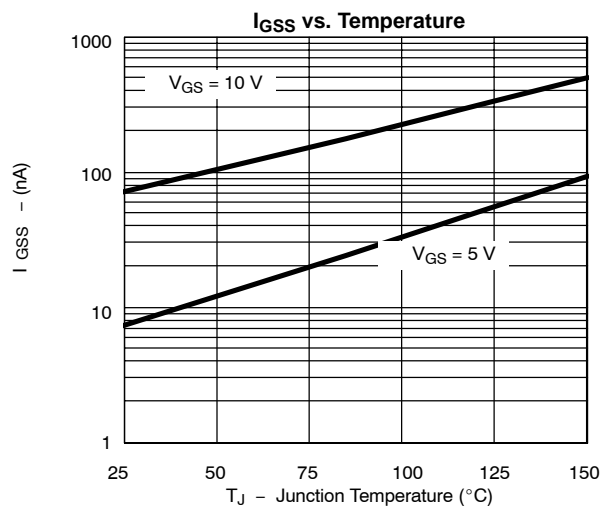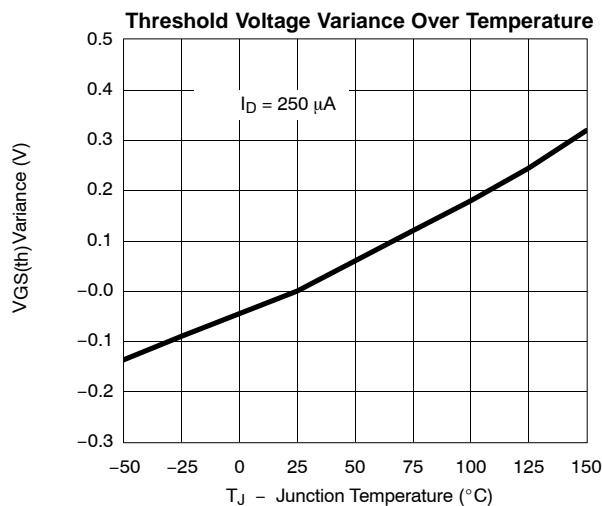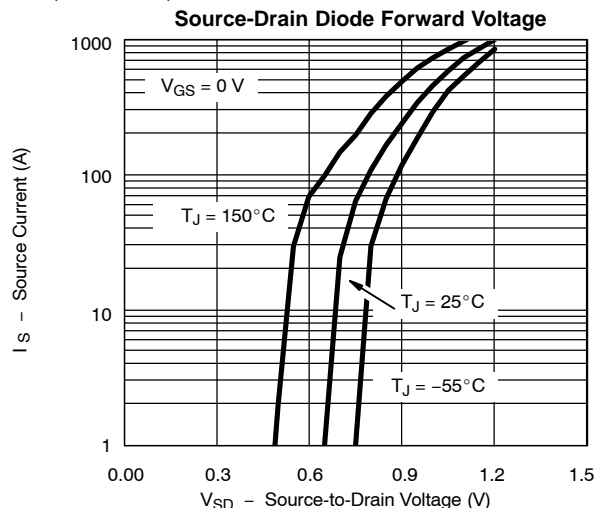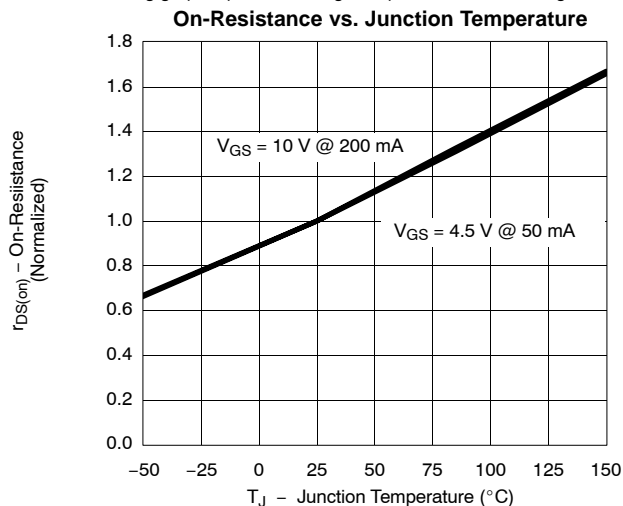## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

For the following graphs, p-channel negative polarities for all voltage and current values are represented as positive values.

On-Resistance vs. Junction Temperature

$V_{GS} = 10$ V @ 200 mA

$V_{GS} = 4.5$ V @ 50 mA

$r_{DS(on)}$ – On-Resistance (Normalized)

T_J – Junction Temperature (°C)

Source-Drain Diode Forward Voltage

$V_{GS} = 0$ V

$T_J = 150°C$

$T_J = 25°C$

$T_J = -55°C$

I_S – Source Current (A)

V_{SD} – Source-to-Drain Voltage (V)

Threshold Voltage Variance Over Temperature

$I_D = 250$ μA

$V_{GS(th)}$ Variance (V)

T_J – Junction Temperature (°C)

I_{GSS} vs. Temperature

$V_{GS} = 10$ V

$V_{GS} = 5$ V

I_{GSS} – (nA)

T_J – Junction Temperature (°C)

Normalized Thermal Transient Impedance, Junction-to-Ambient

Duty Cycle = 0.5

0.2

0.1

0.05

0.02

Single Pulse

Normalized Effective Transient Thermal Impedance

Square Wave Pulse Duration (sec)

Notes:

P_{DM}

t_1

t_2

1. Duty Cycle, D = $\dfrac{t_1}{t_2}$
2. Per Unit Base = $R_{thJA} = 350°C/W$
3. $T_{JM} - T_A = P_{DM}Z_{thJA}(t)$
4. Surface Mounted

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