



**THE DATASHEET OF  
TP0610KL-TR1-E3**





## P-Channel 60-V (D-S) MOSFET

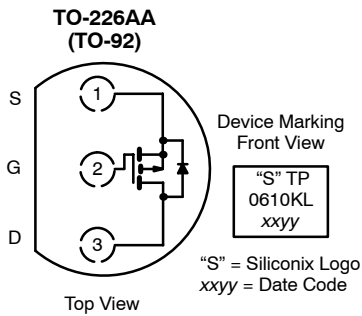
PRODUCT SUMMARY			
$V_{(BR)DSS(min)}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$V_{GS(th)}$ (V)	$I_D$ (A)
-60	6 @ $V_{GS} = -10$ V	-1 to -3.0	-0.27
	10 @ $V_{GS} = -4.5$ V		-0.21

### FEATURES

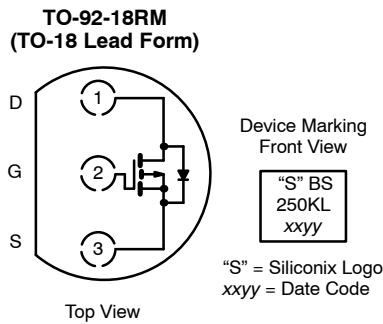
- TrenchFET® Power MOSFET
- ESD Protected: 2000 V

### APPLICATIONS

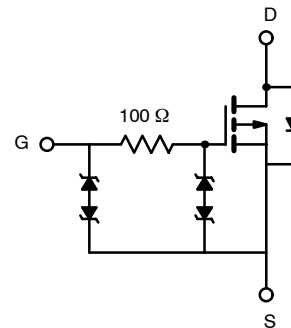
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc.
- Battery Operated Systems
- Power Supply, Converter Circuits
- Motor Control



Ordering Information: TP0610KL-TR1



Ordering Information: BS250KL-TR1



ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)			
Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current	$I_D$	$T_A = 25^\circ\text{C}$	-0.27
		$T_A = 70^\circ\text{C}$	-0.22
Pulse Drain Current <sup>a</sup>	$I_{DM}$	-1.0	A
Power Dissipation	$P_D$	$T_A = 25^\circ\text{C}$	0.8
		$T_A = 70^\circ\text{C}$	0.51
Maximum Junction-to-Ambient	$R_{thJA}$	156	$^\circ\text{C}/\text{W}$
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.

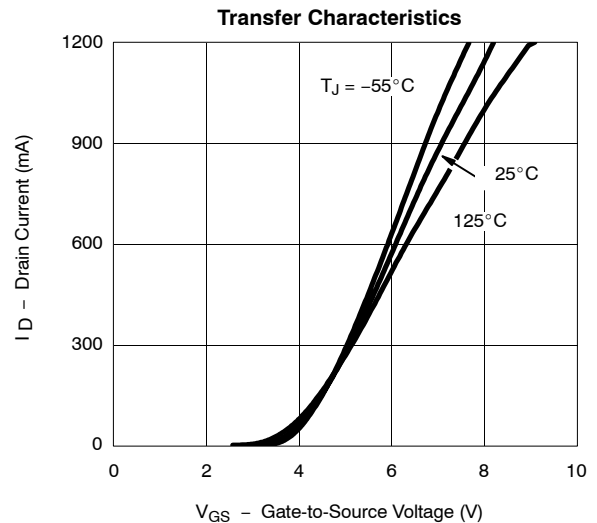
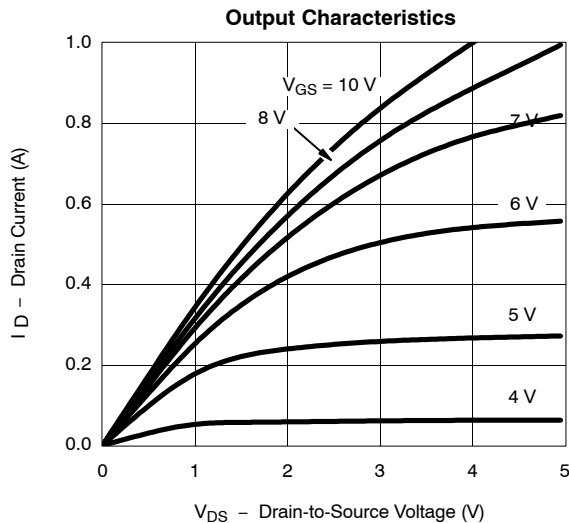
SPECIFICATIONS (T <sub>A</sub> = 25 °C UNLESS OTHERWISE NOTED)						
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = -10 μA	-60			V
Gate-Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA	-1	-2.1	-3.0	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V			±10	μA
		V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±10 V			±200	
		V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±10 V, T <sub>J</sub> = 85 °C			±500	nA
		V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±5 V			±100	
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = -60 V, V <sub>GS</sub> = 0 V			-1	μA
		V <sub>DS</sub> = -60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			-10	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = -10 V, V <sub>GS</sub> = -4.5 V	-50			mA
		V <sub>DS</sub> = -10 V, V <sub>GS</sub> = -10 V	-600			
Drain-Source On-Resistance <sup>a</sup>	r <sub>DS(on)</sub>	V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -25 mA		5.5	10	Ω
		V <sub>GS</sub> = -10 V, I <sub>D</sub> = -500 mA		3.1	6	
		V <sub>GS</sub> = -10 V, I <sub>D</sub> = -500 mA, T <sub>J</sub> = 125 °C		4.7	9	
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -100 mA		180		mS
Diode Forward Voltage <sup>a</sup>	V <sub>SD</sub>	I <sub>S</sub> = -200 mA, V <sub>GS</sub> = 0 V		-0.9	-1.4	V
<b>Dynamic<sup>b</sup></b>						
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = -30 V, V <sub>GS</sub> = -15 V, I <sub>D</sub> ≅ -500 mA		1.7	3	nC
Gate-Source Charge	Q <sub>gs</sub>			0.26		
Gate-Drain Charge	Q <sub>gd</sub>			0.46		
Gate Resistance	R <sub>g</sub>			285		Ω
Turn-On Time	t <sub>d(on)</sub>	V <sub>DD</sub> = -25 V, R <sub>L</sub> = 150 Ω I <sub>D</sub> ≅ -150 mA, V <sub>GEN</sub> = -10 V R <sub>g</sub> = 10 Ω		2.4	5	ns
	t <sub>r</sub>			15.5	25	
Turn-Off Time	t <sub>d(off)</sub>			21	35	
	t <sub>f</sub>			12.5	20	

Notes

- a. Pulse test: PW ≤ 300 ms duty cycle ≤ 2%.
- b. Guaranteed by design, not subject to production testing.

**TYPICAL CHARACTERISTICS (25 °C UNLESS NOTED)**

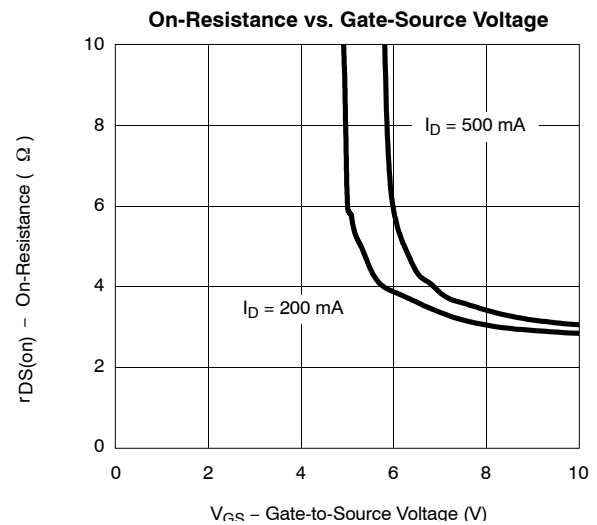
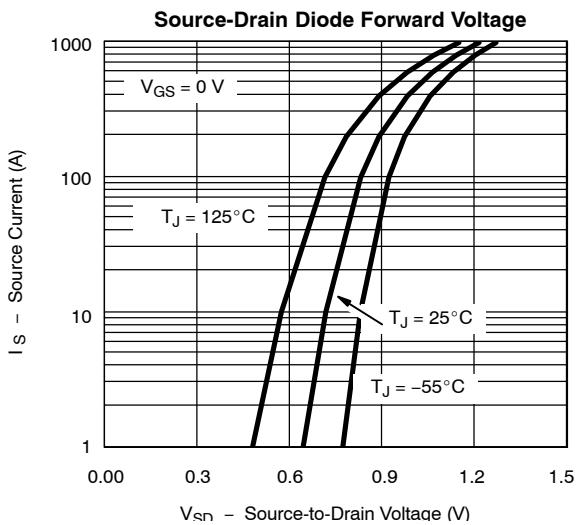
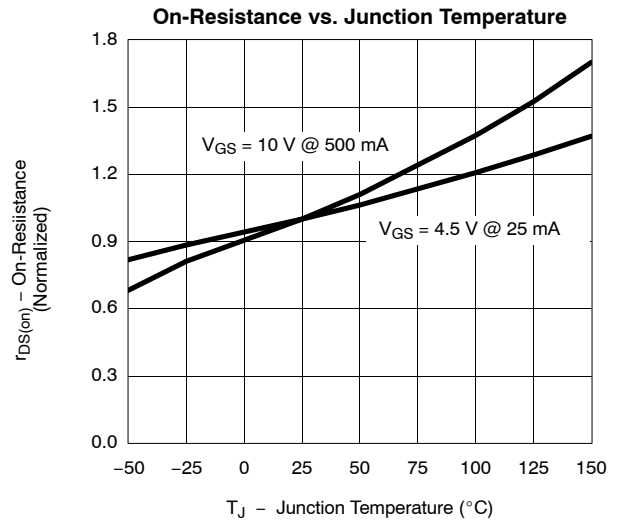
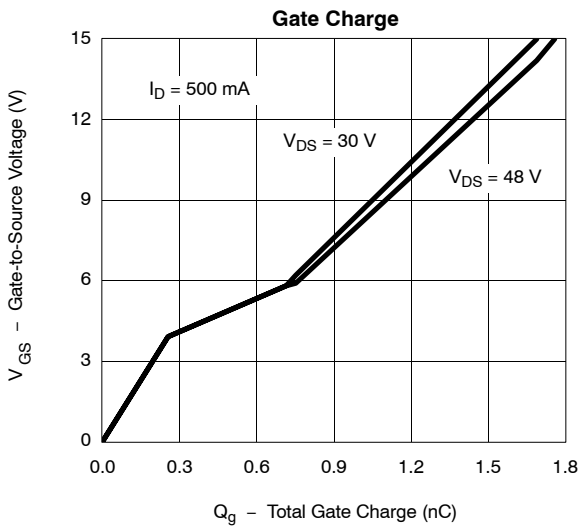
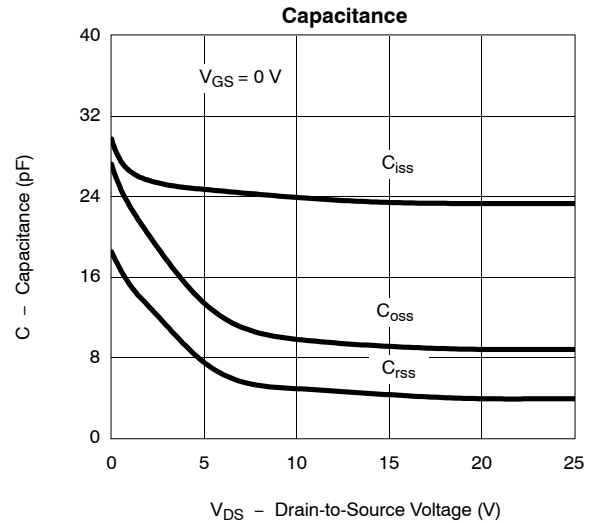
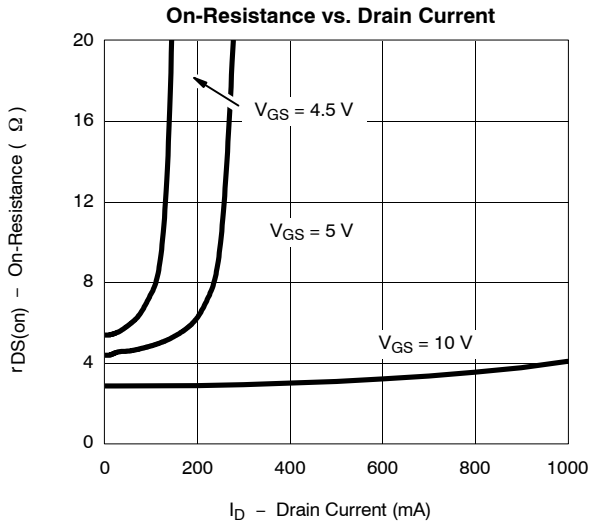
For the following graphs, p-channel negative polarities for all voltage and current values are represented as positive values.





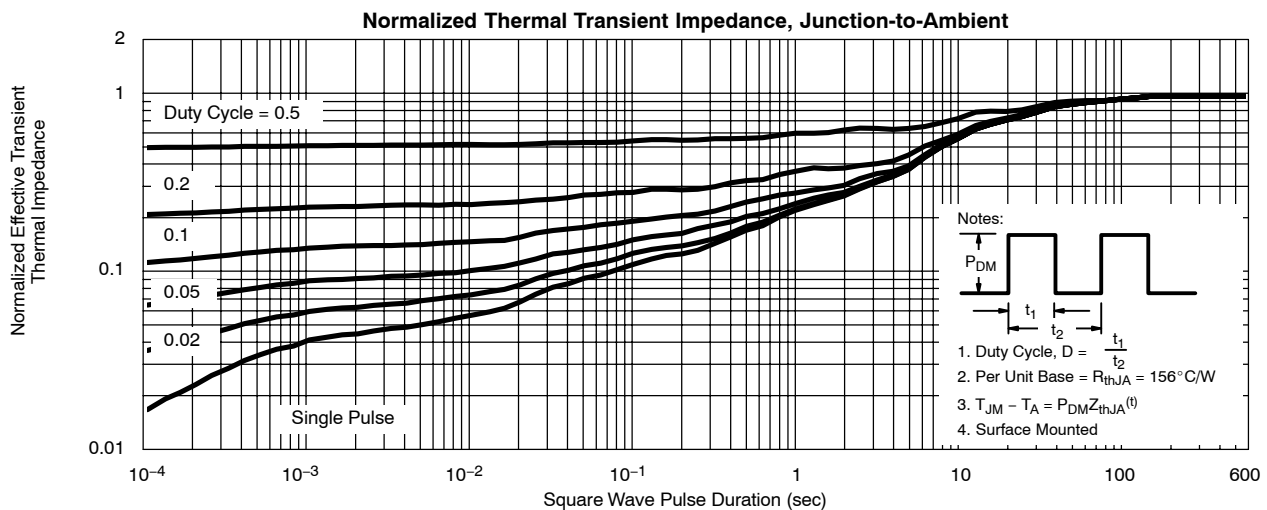
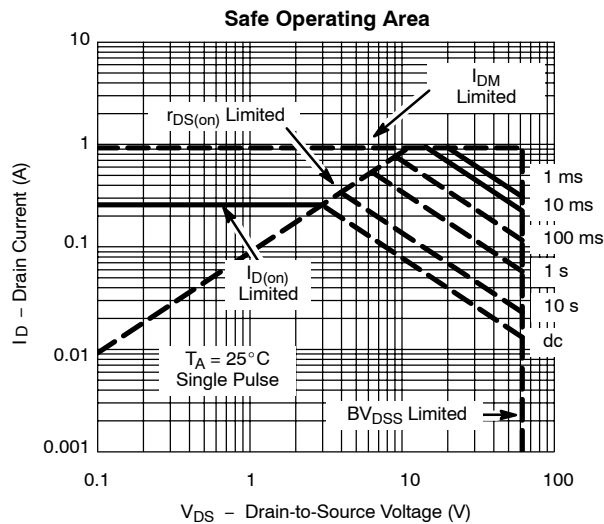
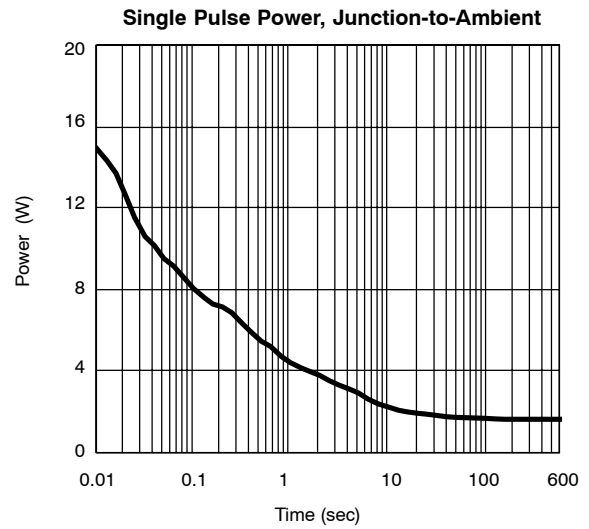
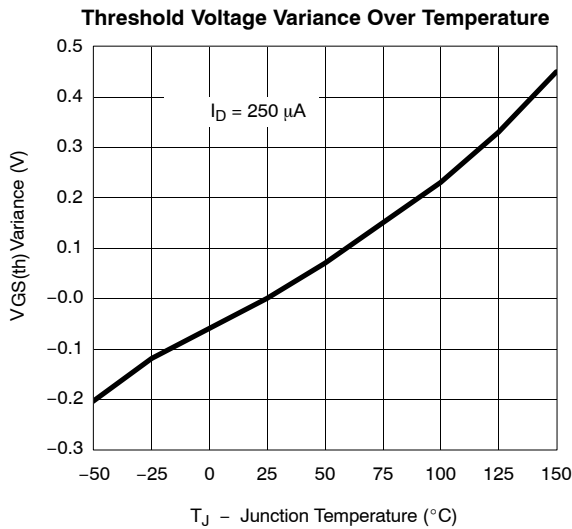
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