

-20V P-Channel Enhancement Mode MOSFET

Features

- $V_{DS} = -20V$ $I_D = -4.9A$
- $R_{DS(ON)} < 35m\Omega$ @ $V_{GS} = -4.5V$
- AEC-Q101 Qualified
- Extremely low threshold voltage
- Built-in G-S Protection Diode
- Halogen and Antimony Free(HAF), RoHS compliant
- Typical ESD Protection HBM Class 2000 V to ≤ 4000 V

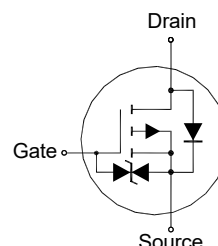
Applications

- Portable appliances
- Battery management

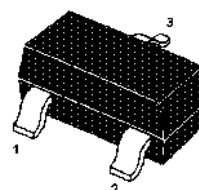
Package Marking and Ordering Information

Marking	Part Number	Package	Packing	Qty.
.VX1	KLMTL5P02KQ	SOT-23	Reel	3000 Pcs

Inner Equivalent Principium Chart



Pin Assignment



1. Gate 2. Source 3. Drain
SOT-23 Plastic Package

Absolute Maximum Ratings(at $T_a = 25^\circ C$ unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	-20	V
Gate-Source Voltage	V_{GS}	± 12	V
Continuous Drain Current	I_D	-4.9	A
Pulsed Drain Current ¹⁾	I_{DM}	-24	A
Total Power Dissipation ²⁾	P_{tot}	1.2	W
Operating Junction and Storage Temperature Range	T_j, T_{stg}	-55 to +150	$^\circ C$

Thermal Resistance Ratings

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Ambient ²⁾	$R_{\theta JA}$	104	$^\circ C/W$

¹⁾ Pulse Test: Pulse Width $\leq 100 \mu s$, Duty Cycle $\leq 2\%$, Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)} = 150^\circ C$.

²⁾ Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air, $t \leq 10$ s.

Characteristics at $T_a = 25^\circ\text{C}$ unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at $I_D = -250\ \mu\text{A}$	$V_{(BR)DSS}$	- 20	-	-	V
Drain-Source Leakage Current at $V_{DS} = -20\ \text{V}$	I_{DSS}	-	-	- 1	μA
Gate-Source Leakage at $V_{GS} = \pm 10\ \text{V}$	I_{GSS}	-	-	± 10	μA
Gate-Source Threshold Voltage at $V_{DS} = V_{GS}$, $I_D = -250\ \mu\text{A}$	$V_{GS(th)}$	- 0.4	-	- 1	V
Drain-Source On-State Resistance at $V_{GS} = 4.5\ \text{V}$, $-I_D = -4\ \text{A}$ at $V_{GS} = 2.5\ \text{V}$, $-I_D = -4\ \text{A}$ at $V_{GS} = 1.8\ \text{V}$, $-I_D = -2\ \text{A}$	$R_{DS(on)}$	- - -	- - -	35 45 62	m Ω
DYNAMIC PARAMETERS					
Forward Transconductance at $V_{DS} = -5\ \text{V}$, $I_D = -4\ \text{A}$	g_{fs}	-	16	-	S
Gate resistance at $V_{GS} = 0\ \text{V}$, $V_{DS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	R_g	-	4.4	-	Ω
Input Capacitance at $V_{GS} = 0\ \text{V}$, $-V_{DS} = 10\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	1242	-	pF
Output Capacitance at $V_{GS} = 0\ \text{V}$, $-V_{DS} = 10\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	188	-	pF
Reverse Transfer Capacitance at $V_{GS} = 0\ \text{V}$, $-V_{DS} = 10\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	148	-	pF
Total Gate Charge at $V_{GS} = -4.5\ \text{V}$, $V_{DS} = -10\ \text{V}$, $I_D = -4\ \text{A}$ at $V_{GS} = -2.5\ \text{V}$, $V_{DS} = -10\ \text{V}$, $I_D = -4\ \text{A}$	Q_g	- -	13 7.8	- -	nC
Gate-Source Charge at $V_{GS} = -4.5\ \text{V}$, $V_{DS} = -10\ \text{V}$, $I_D = -4\ \text{A}$	Q_{gs}	-	3	-	nC
Gate-Drain Charge at $V_{GS} = -4.5\ \text{V}$, $V_{DS} = -10\ \text{V}$, $I_D = -4\ \text{A}$	Q_{gd}	-	3	-	nC
Turn-On Delay Time at $V_{GS} = -10\ \text{V}$, $V_{DS} = -10\ \text{V}$, $I_D = -4\ \text{A}$, $R_G = 3.3\ \Omega$	$t_{d(on)}$	-	10	-	ns
Turn-On Rise Time at $-V_{GS} = 10\ \text{V}$, $-V_{DS} = 10\ \text{V}$, $-I_D = 4\ \text{A}$, $R_G = 3.3\ \Omega$	t_r	-	34	-	ns
Turn-Off Delay Time at $V_{GS} = -10\ \text{V}$, $V_{DS} = -10\ \text{V}$, $I_D = -4\ \text{A}$, $R_G = 3.3\ \Omega$	$t_{d(off)}$	-	21	-	ns
Turn-Off Fall Time at $V_{GS} = -10\ \text{V}$, $V_{DS} = -10\ \text{V}$, $I_D = -4\ \text{A}$, $R_G = 3.3\ \Omega$	t_f	-	7	-	ns
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at $I_S = -1\ \text{A}$	V_{SD}	-	-	- 1	V
Body-Diode Continuous Current	I_S	-	-	- 4.9	A
Body Diode Reverse Recovery Time at $I_S = 4\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	t_{rr}	-	10.4	-	ns
Body Diode Reverse Recovery Charge at $I_S = 4\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	Q_{rr}	-	1.7	-	nC

Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

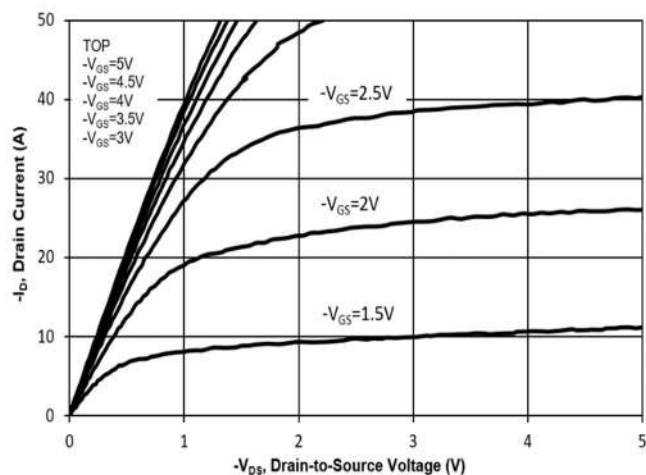


Fig. 2 Typical Transfer Characteristics

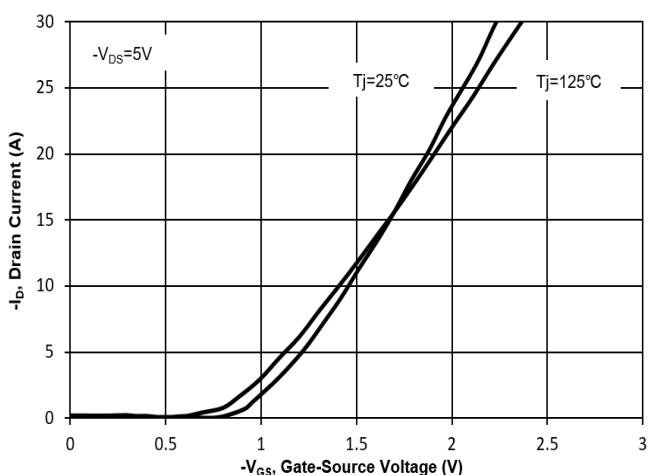


Fig. 3 On-Resistance vs. Drain Current

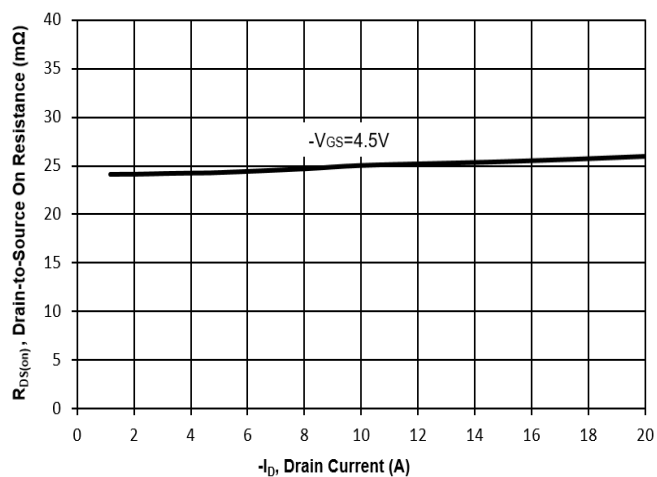


Fig. 4 on-Resistance vs. Gate to Source Voltage

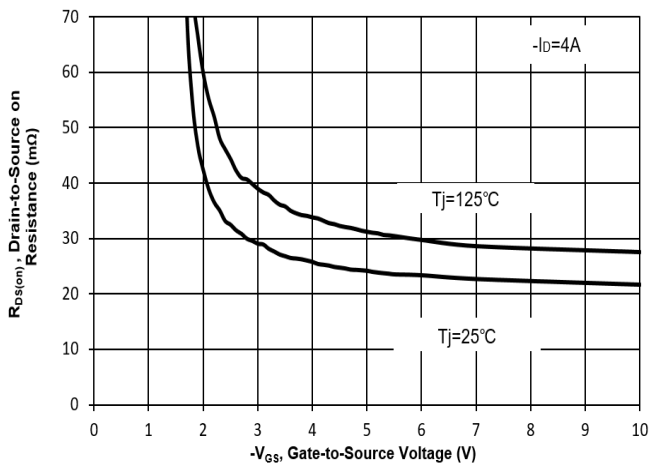


Fig. 5 On-Resistance vs. T_J

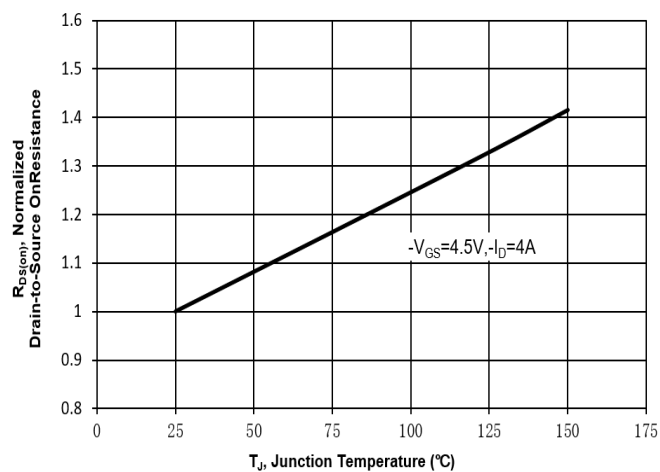
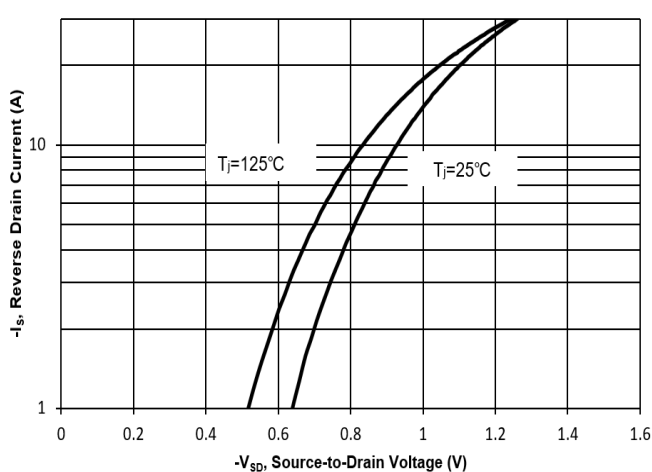


Fig. 6 Typical Body-Diode Forward Characteristics



Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

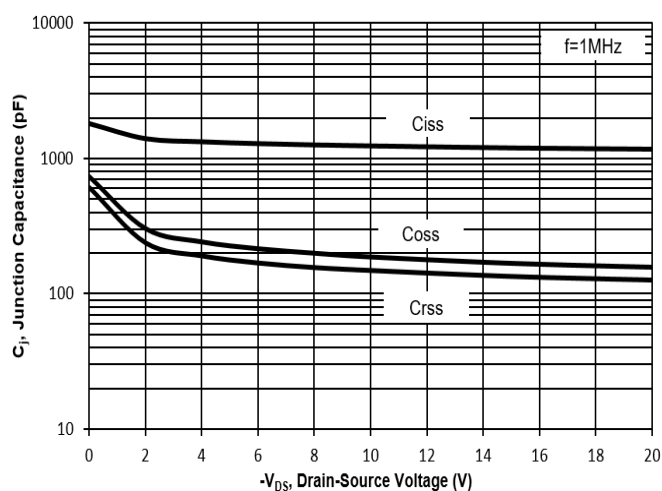


Fig. 8 Drain-Source Leakage Current vs. T_J

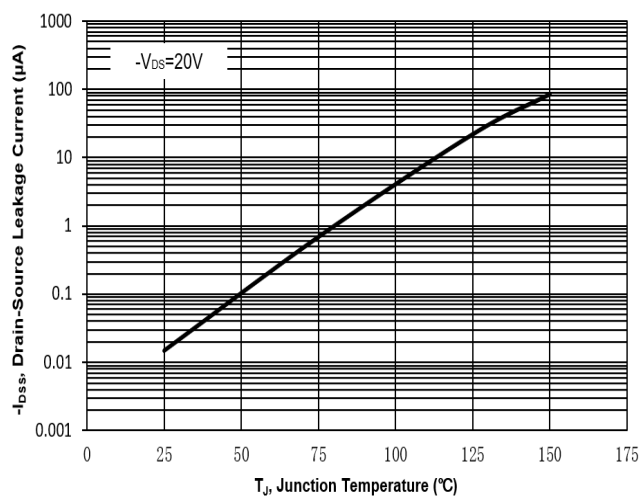


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

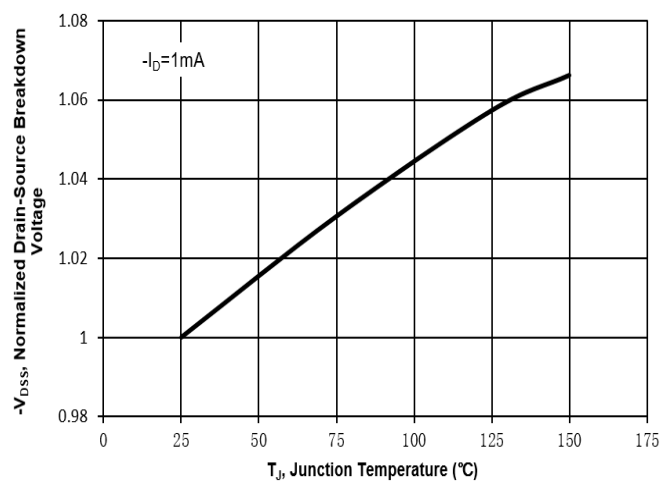


Fig. 10 Gate-Source Threshold Voltage vs. T_J

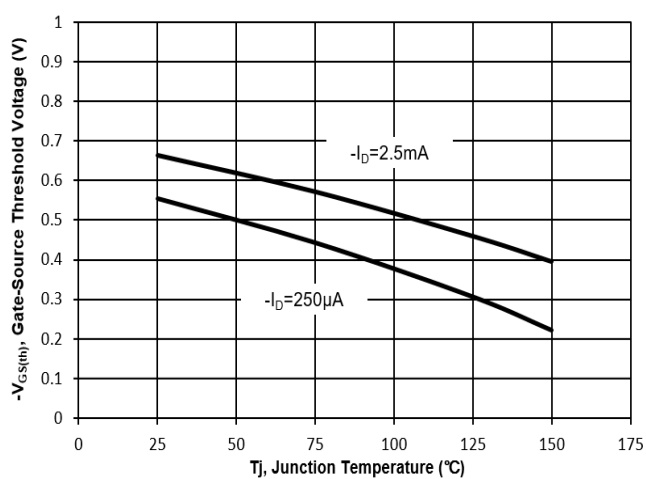
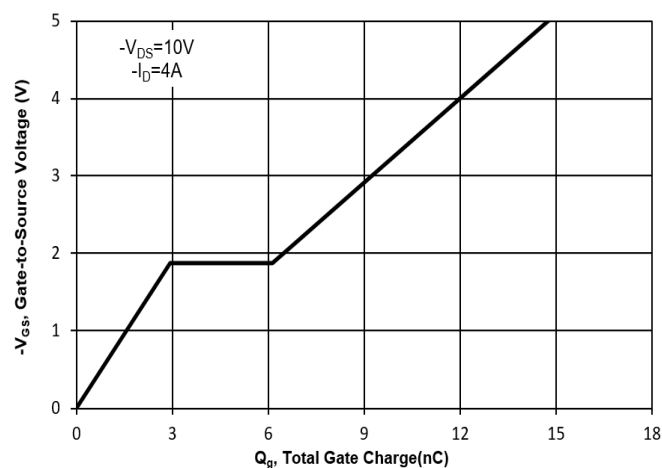


Fig. 11 Gate Charge



Test Circuits

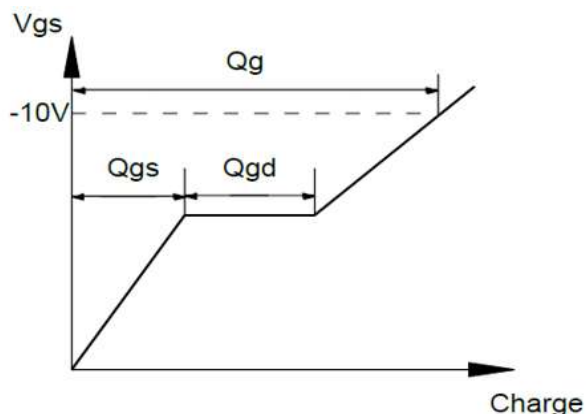
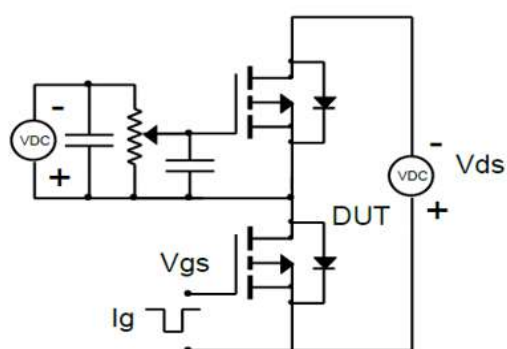


Figure 14: Gate Charge Test Circuit & Waveform

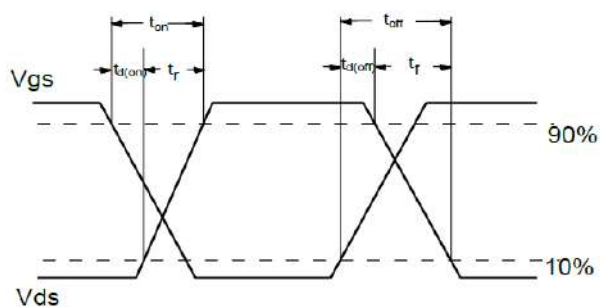
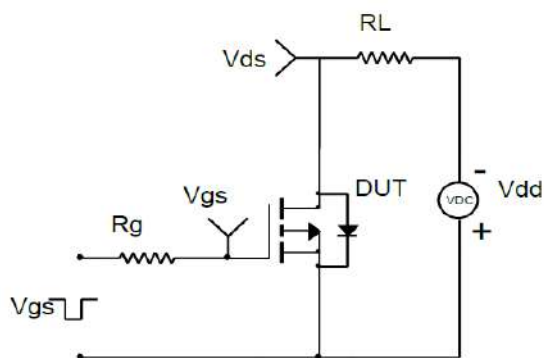


Figure 15: Resistive Switching Test Circuit & Waveforms

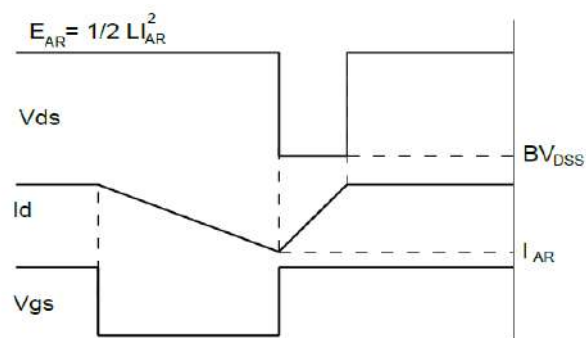
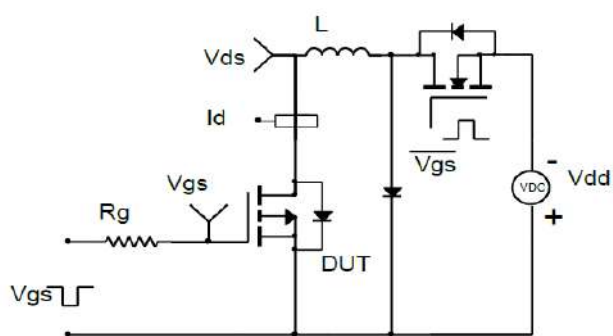
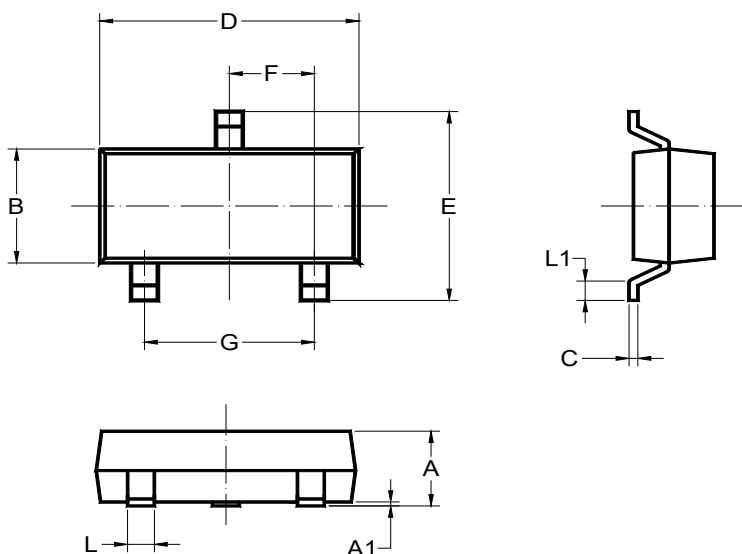


Figure 16: Unclamped Inductive Switching Test Circuit & Waveforms

Package Outline (Dimensions in mm)

SOT-23



Unit	A	A1	B	C	D	E	F	G	L	L1
mm	1.20 0.89	0.100 0.013	1.40 1.20	0.19 0.08	3.04 2.80	2.6 2.2	1.02 0.89	2.04 1.78	0.51 0.37	0.2 MIN

Recommended Soldering Footprint

