![DIODES INCORPORATED]

Lead-free Green

N-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

BV$_{DSS}$	R$_{DS(ON)}$ Max	I$_D$ Max T$_A$ = +25°C
60V	2Ω @ V$_{GS}$ = 10V	380mA
	3Ω @ V$_{GS}$ = 5V	310mA

Description and Applications

This MOSFET is designed to meet the stringent requirements of automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

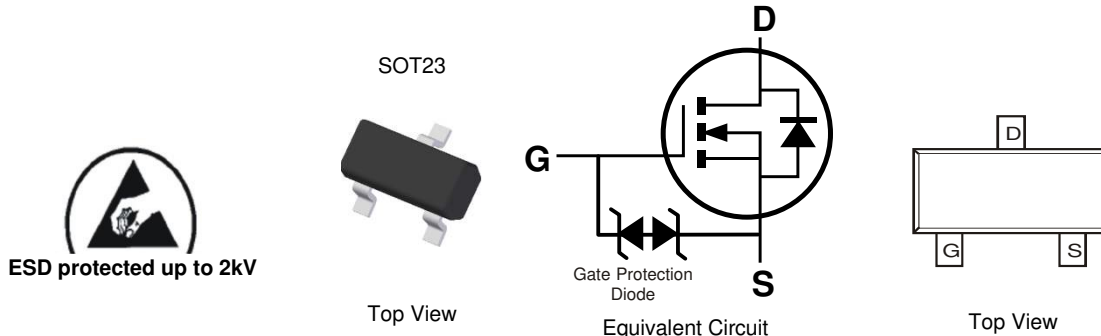- Motor Control
- Power Management Functions
- Backlighting

Features and Benefits

- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- **ESD Protected Up To 2kV**
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The 2N7002KQ is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**
  https://www.diodes.com/quality/product-definitions/

Mechanical Data

- Case: SOT23
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — Matte Tin Annealed over Alloy 42 Leadframe. Solderable per MIL-STD-202, Method 208 ⓔ3
- Weight: 0.008 grams (Approximate)

SOT23

ESD protected up to 2kV

Top View

Equivalent Circuit

Gate Protection Diode

Top View

Ordering Information (Note 4)

Part Number	Case	Packaging
2N7002KQ-7	SOT23	3,000/Tape & Reel
2N7002KQ-13	SOT23	10,000/Tape & Reel

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information

K7K   YM
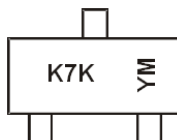
K7K = Product Type Marking Code
YM = Date Code Marking
Y or Ȳ = Year (ex: I = 2021)
M = Month (ex: 9 = September)

Date Code Key

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Code	I	J	K	L	M	N	O	P	R	S	T	U

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	O	N	D

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Maximum Ratings (@T$_A$ = +25°C, unless otherwise specified.)

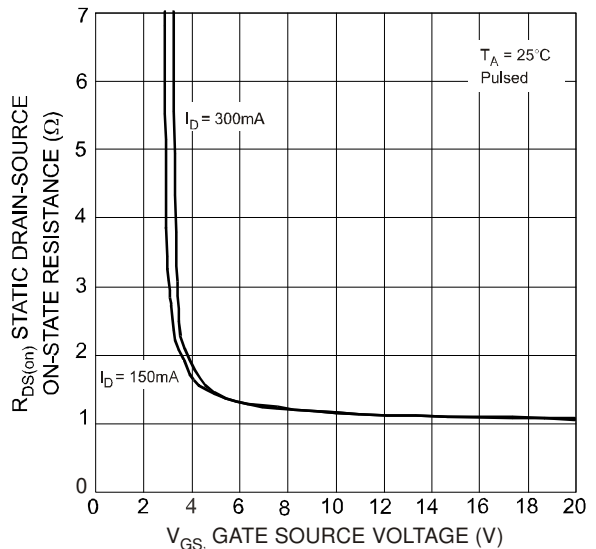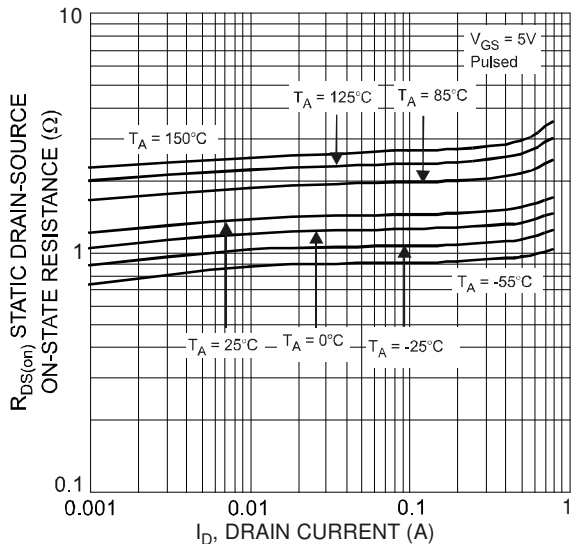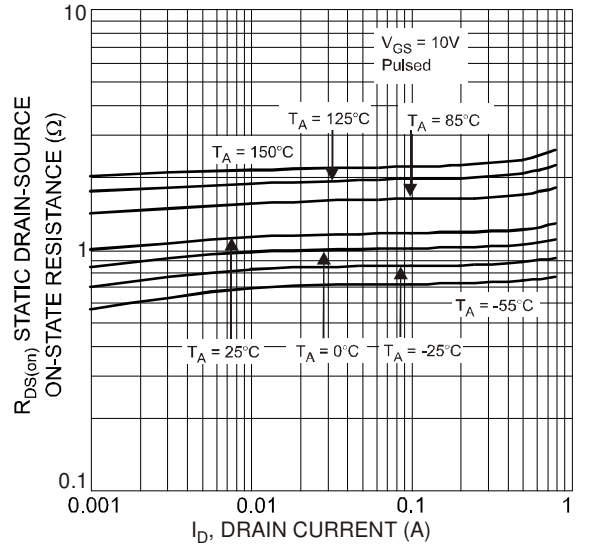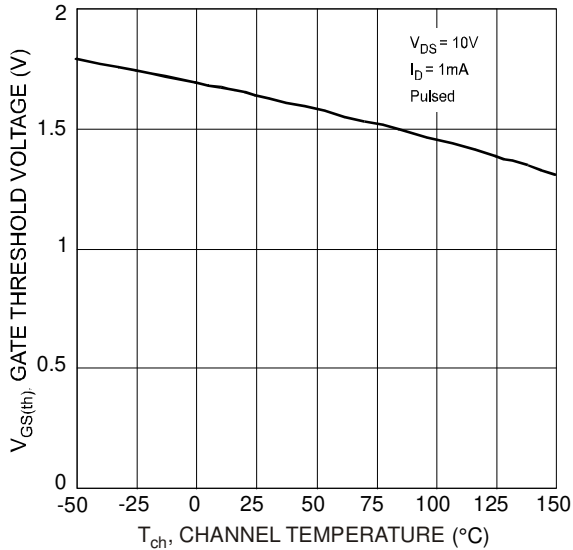| Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V$_{DSS}$	60	V
Gate-Source Voltage			V$_{GSS}$	±20	V
Continuous Drain Current (Note 6) V$_{GS}$ = 10V	Steady State	T$_A$ = +25°C	I$_D$	380	mA
		T$_A$ = +70°C		300	
	t<5s	T$_A$ = +25°C	I$_D$	430	mA
		T$_A$ = +70°C		340	
Continuous Drain Current (Note 6) V$_{GS}$ = 5V	Steady State	T$_A$ = +25°C	I$_D$	310	mA
		T$_A$ = +70°C		240	
	t<5s	T$_A$ = +25°C	I$_D$	350	mA
		T$_A$ = +70°C		270	
Maximum Continuous Body Diode Forward Current (Note 6)			I$_S$	0.5	A
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) (Note 6)			I$_{DM}$	1.2	A

Thermal Characteristics (@T$_A$ = +25°C, unless otherwise specified.)

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 5)		P$_D$	370	mW
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	R$_{θJA}$	357	°C/W
	t<5s		292	
Total Power Dissipation (Note 6)		P$_D$	540	mW
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	R$_{θJA}$	240	°C/W
	t<5s		197	
Thermal Resistance, Junction to Case (Note 6)		R$_{θJC}$	91	
Operating and Storage Temperature Range		T$_J$, T$_{STG}$	-55 to +150	°C

Electrical Characteristics (@T$_A$ = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 7)						
Drain-Source Breakdown Voltage	BV$_{DSS}$	60	—	—	V	V$_{GS}$ = 0V, I$_D$ = 10µA
Zero Gate Voltage Drain Current	I$_{DSS}$	—	—	1.0	µA	V$_{DS}$ = 60V, V$_{GS}$ = 0V
Gate-Source Leakage	I$_{GSS}$	—	—	±10	µA	V$_{GS}$ = ±20V, V$_{DS}$ = 0V
ON CHARACTERISTICS (Note 7)						
Gate Threshold Voltage	V$_{GS(TH)}$	1.0	1.6	2.5	V	V$_{DS}$ = 10V, I$_D$ = 1mA
Static Drain-Source On-Resistance	R$_{DS(ON)}$	—	1.2	2.0	Ω	V$_{GS}$ = 10V, I$_D$ = 0.5A
			1.4	3.0		V$_{GS}$ = 5V, I$_D$ = 0.05A
Forward Transfer Admittance	|Y$_{fs}$|	80	—	—	ms	V$_{DS}$ =10V, I$_D$ = 0.2A
Diode Forward Voltage	V$_{SD}$	—	0.75	1.1	V	V$_{GS}$ = 0V, I$_S$ = 115mA
DYNAMIC CHARACTERISTICS (Note 8)						
Input Capacitance	C$_{iss}$	—	30	50	pF	V$_{DS}$ = 25V, V$_{GS}$ = 0V f = 1.0MHz
Output Capacitance	C$_{oss}$	—	4.2	25	pF	
Reverse Transfer Capacitance	C$_{rss}$	—	2.9	5.0	pF	
Gate Resistance	R$_g$	—	133	—	Ω	f = 1MHz, V$_{GS}$ = 0V, V$_{DS}$ = 0V
Total Gate Charge	Q$_g$	—	0.3	—	nC	V$_{GS}$ = 4.5V, V$_{DS}$ = 10V, I$_D$ = 250mA
Gate-Source Charge	Q$_{gs}$	—	0.2	—	nC	
Gate-Drain Charge	Q$_{gd}$	—	0.08	—	nC	
Turn-On Delay Time	t$_{D(ON)}$	—	3.9	—	ns	V$_{DD}$ = 30V, V$_{GS}$ = 10V, R$_G$ = 25Ω, I$_D$ = 200mA
Turn-On Rise Time	t$_R$	—	3.4	—	ns	
Turn-Off Delay Time	t$_{D(OFF)}$	—	15.7	—	ns	
Turn-Off Fall Time	t$_F$	—	9.9	—	ns	

Notes: 5. Device mounted on FR-4 PCB, with minimum recommended pad layout.
6. Device mounted on 1" x 1" FR-4 PCB with high coverage 2oz. Copper, single sided.
7. Short duration pulse test used to minimize self-heating effect.
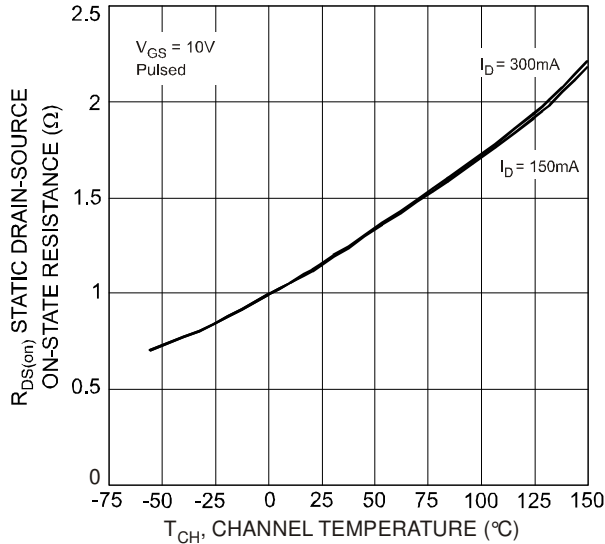8. Guaranteed by design. Not subject to product testing.

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Fig. 1 Typical Output Characteristics

Fig. 2 Typical Transfer Characteristics

Fig. 3 Gate Threshold Voltage vs. Channel Temperature

Fig. 4 Static Drain-Source On-Resistance vs. Drain Current

Fig. 5 Static Drain-Source On-Resistance vs. Drain Current

Fig. 6 Static Drain-Source On-Resistance vs. Gate-Source Voltage

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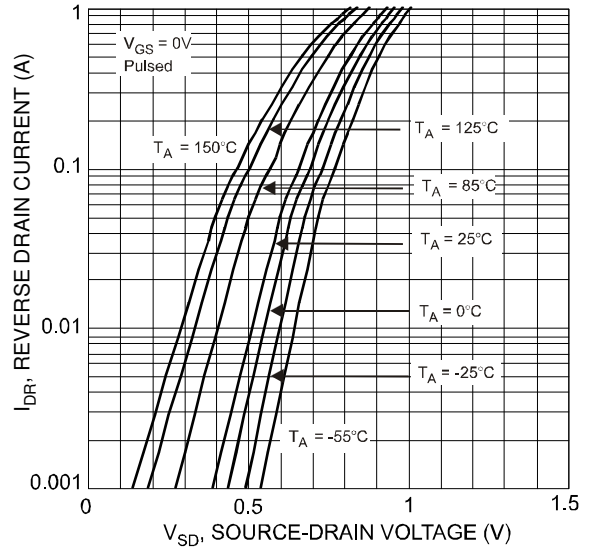Fig. 7 Static Drain-Source On-State Resistance vs. Channel Temperature

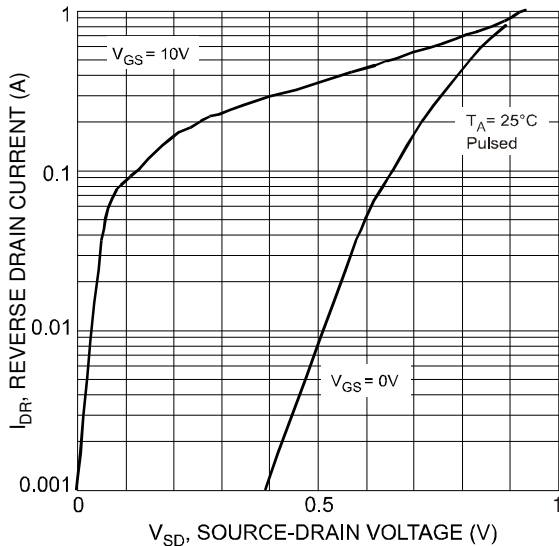Fig. 8 Reverse Drain Current vs. Source-Drain Voltage

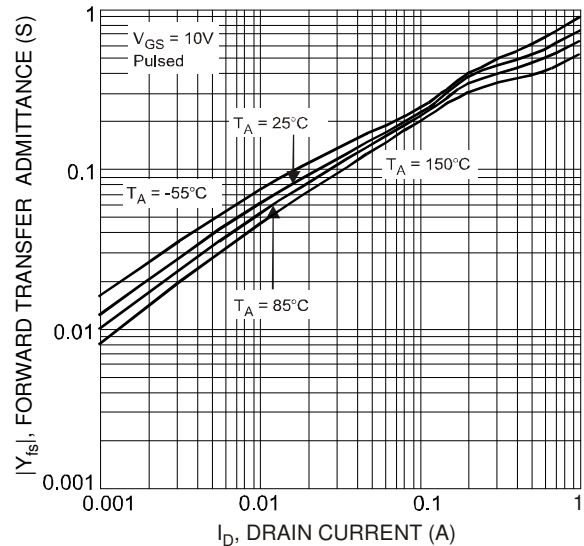Fig. 9 Reverse Drain Current vs. Source-Drain Voltage
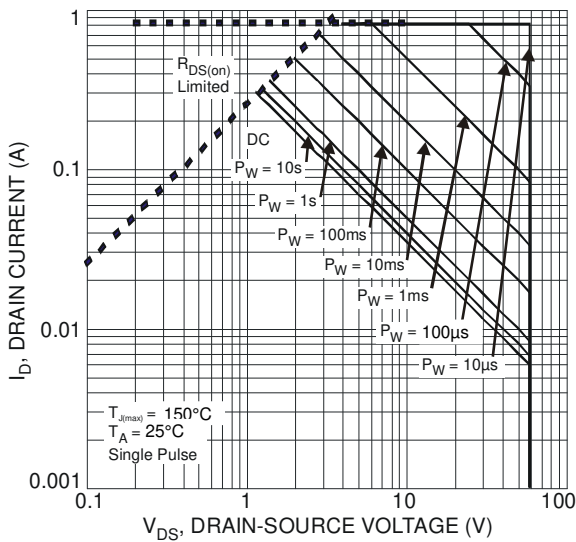

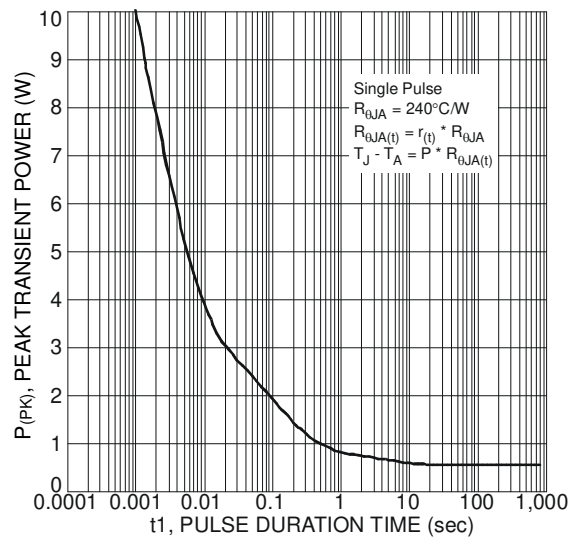Fig.10 Forward Transfer Admittance vs. Drain Current

Fig. 11 Safe Operation Area

Fig. 12 Single Pulse Maximum Power Dissipation

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Fig. 13 Transient Thermal Resistance

Chart: r(t), TRANSIENT THERMAL RESISTANCE vs t1, PULSE DURATION TIME (sec)

Curves: D = 0.9, D = 0.7, D = 0.5, D = 0.3, D = 0.1, D = 0.05, D = 0.02, D = 0.01, D = 0.005, D = Single Pulse

$R_{\theta JA(t)} = r_{(t)} * R_{\theta JA}$
$R_{\theta JA} = 240°C/W$
Duty Cycle, D = t1/t2

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Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.
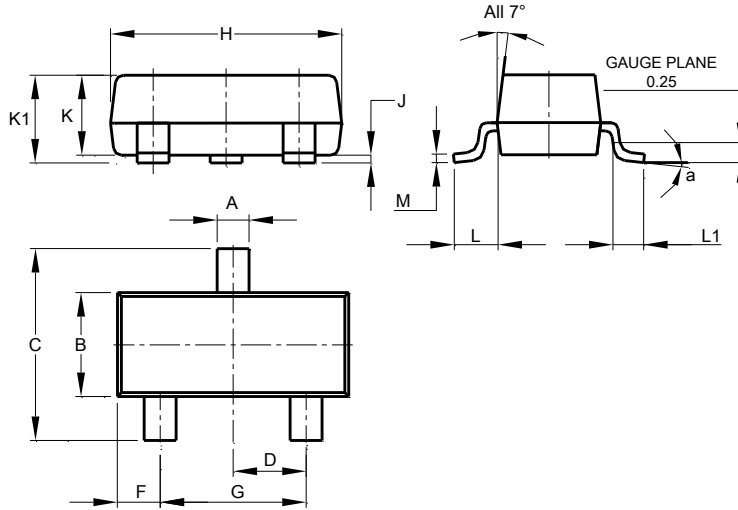
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Dim	**Min**	**Max**	**Typ**
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

SOT23
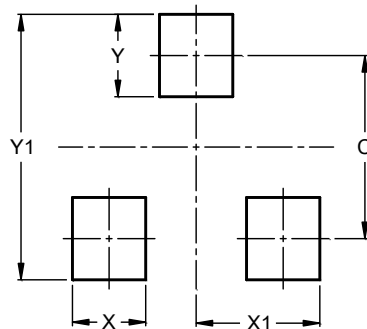
Dimensions	Value (in mm)
C	2.0
X	0.8
X1	1.35
Y	0.9
Y1	2.9

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