

SK02N65C

2A, 650V N-CHANNEL POWER MOSFET

DESCRIPTION

The SK02N65C is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in switching power supplies and adaptors.

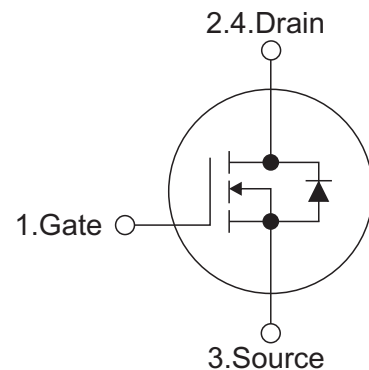
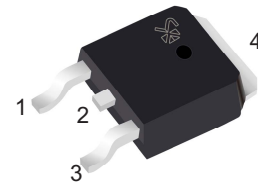
Features

- $R_{DS(ON)} \leq 5.0 \Omega$ @ $V_{GS}=10V$, $I_D=1.0A$
- Fast switching capability
- Avalanche energy tested
- Improved dv/dt capability, high ruggedness

Mechanical data

- Case: TO-252
- Approx. Weight: 0.315g (0.011oz)
- Lead free finish, RoHS compliant
- Case Material: "Green" molding compound, UL flammability classification 94V-0, "Halogen-free".

TO-252(D-PAK)



ABSOLUTE MAXIMUM RATINGS ($T_A=25^\circ\text{C}$, unless otherwise specified)

PARAMETER		Symbols	RATINGS	Units
Drain-Source Voltage		V_{DSS}	650	V
Gate-Source Voltage		V_{GSS}	± 30	V
Continuous Drain Current	$T_c=25^\circ\text{C}$	I_D	2	A
	$T_c=100^\circ\text{C}$		1.3	A
Pulsed Drain Current (Note 2)		I_{DM}	8	A
Avalanche Energy Single Pulsed (Note 3)		E_{AS}	108	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2.1	V/ns
Power Dissipation		P_D	54	W
Operation Junction Temperature and Storage Temperature		T_j, T_{stg}	-55 ~ +150	$^\circ\text{C}$

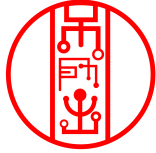
Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating: Pulse width limited by maximum junction temperature.

3. $L = 30\text{mH}$, $I_{AS} = 3.4\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25 \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $ISD \leq 2\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BVDSS$, Starting $T_J = 25^\circ\text{C}$



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THERMAL DATA

PARAMETER	Symbols	RATINGS	Units
Junction to Ambient	R_{thJA}	63	°C/W
Junction to Case	R_{thJC}	2.31	°C/W

ELECTRICAL CHARACTERISTICS (TA=25°C, unless otherwise specified)

PARAMETER		Symbols	TEST CONDITIONS	Min	Typ	Max	Units
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V,I _D =250uA	650			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =650V,V _{GS} =0V			1	uA
Gate- Source Leakage Current	Forward	I _{GSS}	V _{GS} =30V,V _{DS} =0V			100	nA
	Reverse		V _{GS} =-30V,V _{DS} =0V			-100	
ON CHARACTERISTICS							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} ,I _D =250uA	2.0		4.0	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V,I _D =1.0A		4.3	5	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1.0MHz		260		pF
Output Capacitance		C _{OSS}			30		pF
Reverse Transfer Capacitance		C _{RSS}			2.2		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q _G	V _{DS} =520V,V _{GS} =10V, I _D =2A,I _G =1mA (NOTE1,2)		8.97		nC
Gate-Source Charge		Q _{GS}			2.51		nC
Gate-Drain Charge		Q _{GD}			4.02		nC
Turn-On Delay Time (Note 1)		t _{D(ON)}	V _{DS} =325V,V _{GS} =10V, I _D =2A,R _G =25Ω (NOTE1,2)		8.4		ns
Turn-On Rise Time		t _R			22.4		ns
Turn-Off Delay Time		t _{D(OFF)}			15.1		ns
Turn-Off Fall Time		t _F			24.1		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Maximum Body-Diode Continuous Current		I _S				2	A
Maximum Body-Diode Pulsed Current		I _{SM}				8	A
Drain-Source Diode Forward Voltage (Note 1)		V _{SD}	I _S =2A,V _{GS} =0V			1.4	V
Reverse Recovery Time (Note 1)		t _{rr}	I _S =2A,V _{GS} =0V,		370		ns
Reverse Recovery Charge		Q _{rr}	di/dt=100A/us		0.95		uC

Notes:

1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.
2. Essentially independent of operating temperature.



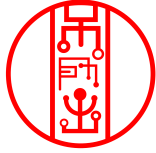
V_{GS}
 R_G
Driver
Same Type as D.U.T
 V_{DS}
D.U.T
 I_{SD}
 V_{DD}

- * dv/dt controlled by R_G
- * I_{SD} controlled by pulse period
- * D.U.T.-Device Under Test

Timing diagram for a MOSFET switching a load inductor. The diagram shows four waveforms:

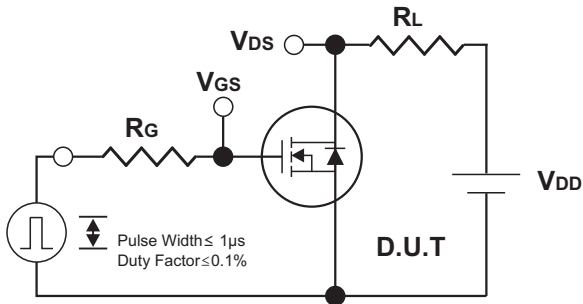
- V_{GS} (Driver):** A square wave with period and pulse width (P.W.) indicated. The duty cycle is $D = \frac{P.W.}{\text{Period}}$. The gate voltage is $V_{GS} = 10V$.
- I_{SD} (D.U.T.):** The source-drain current. It shows the inductor current with di/dt during switching, I_{RM} (Body Diode Reverse Current) during the off-state, and I_{FM} (Body Diode Forward Current) during the on-state.
- V_{DS} (D.U.T.):** The drain-source voltage. It shows the forward voltage drop during the on-state and the reverse voltage during the off-state.
- Body Diode Forward Current:** Indicated during the on-state of the MOSFET.
- Body Diode Reverse Current:** Indicated during the off-state of the MOSFET.

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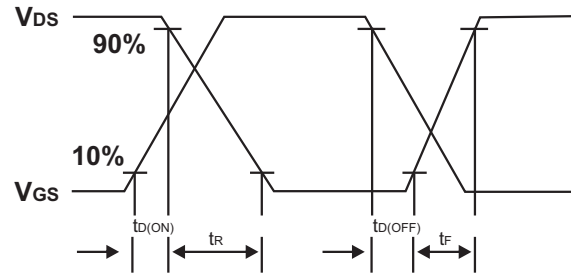


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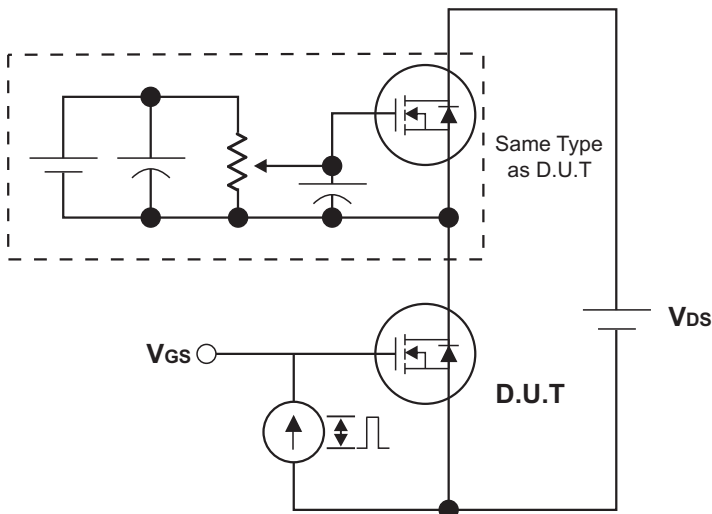
Test Circuits and waveforms



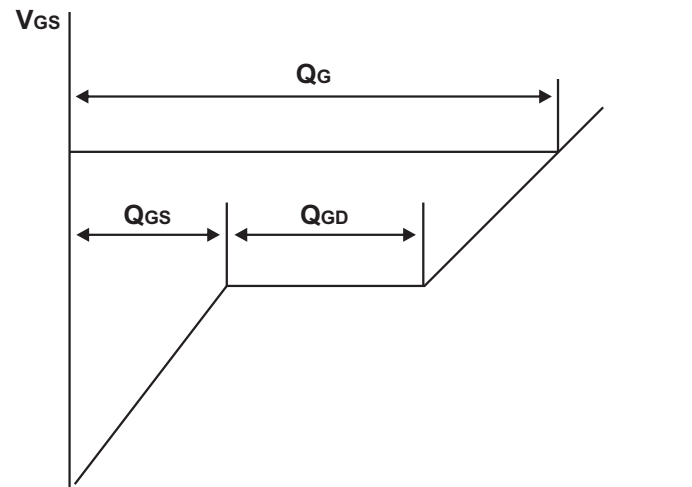
Switching Test Circuit



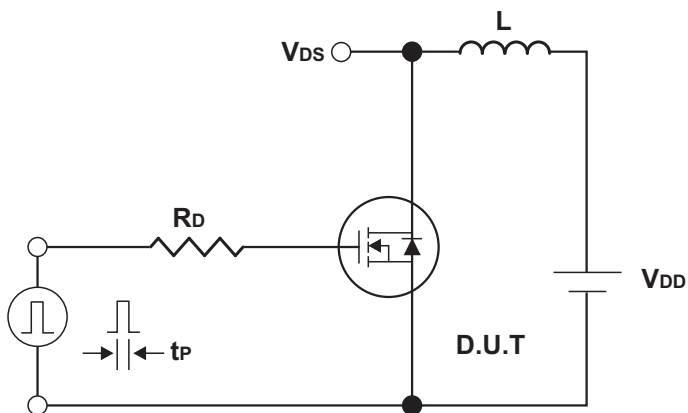
Switching Waveforms



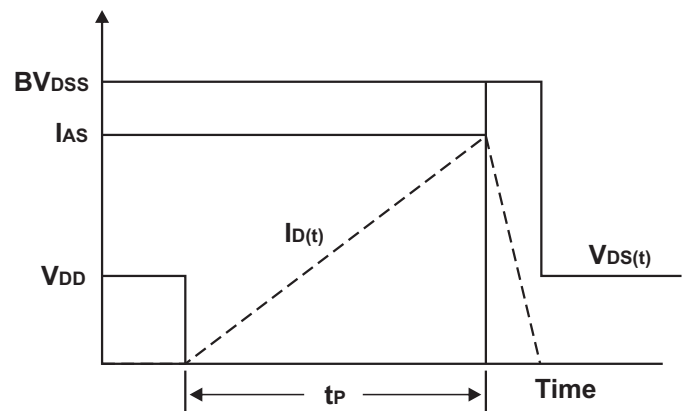
Gate Charge Test Circuit



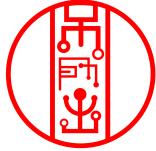
Charge
Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms



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Typical Characteristics

Fig.1 Drain Current vs. Gate-Source Voltage

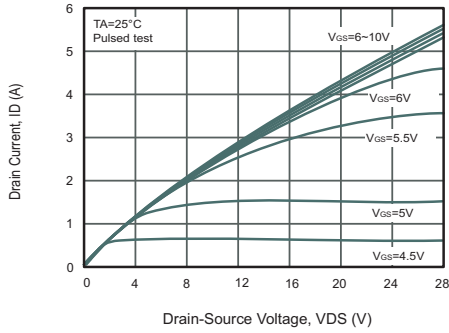


Fig.2 Drain-Source On-Resistance vs. Gate-Source Voltage

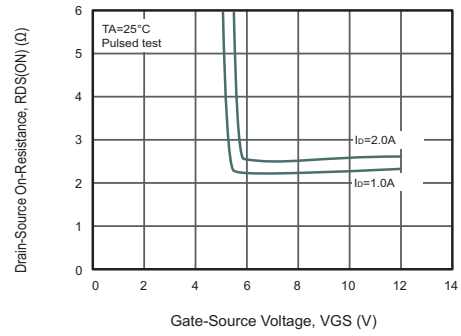


Fig.3 Gate Charge Characteristics

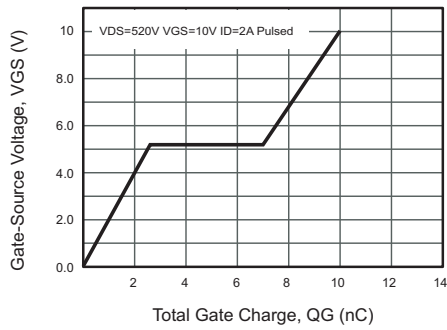


Fig.4 Capacitance Characteristics

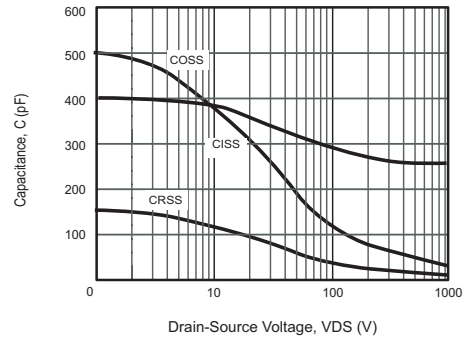


Fig.5 Drain-Source On-Resistance vs. Junction Temperature

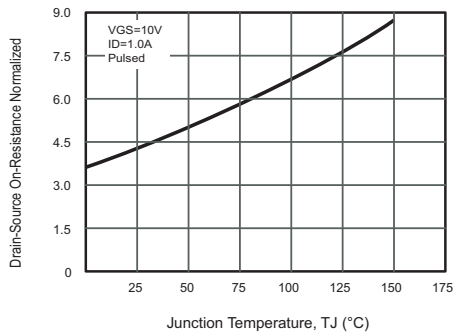


Fig.6 Breakdown Voltage vs. Junction Temperature

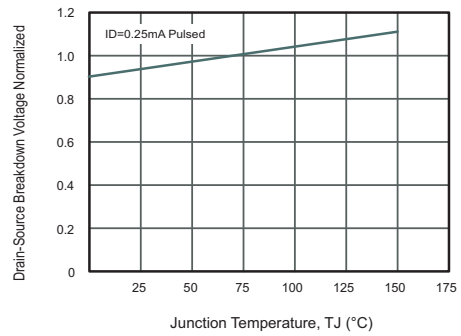


Fig.7 Gate Threshold Voltage vs. Junction Temperature

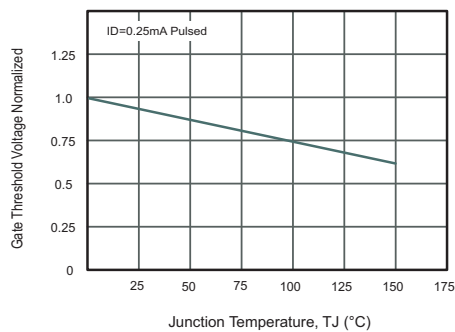
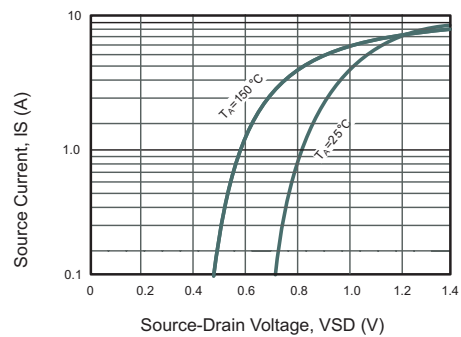
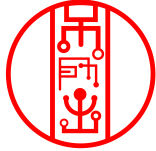


Fig.8 Source Current vs. Source-Drain Voltage





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Typical Characteristics

Fig.9 Drain Current vs. Gate-Source Voltage

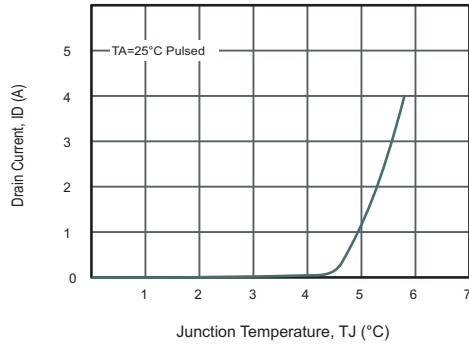


Fig.10 Drain-Source On-Resistance vs. Drain Current

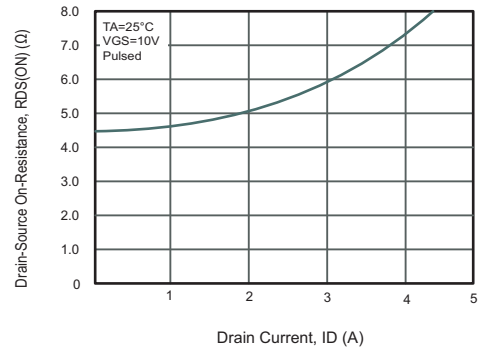


Fig.11 Drain Current vs. Junction Temperature

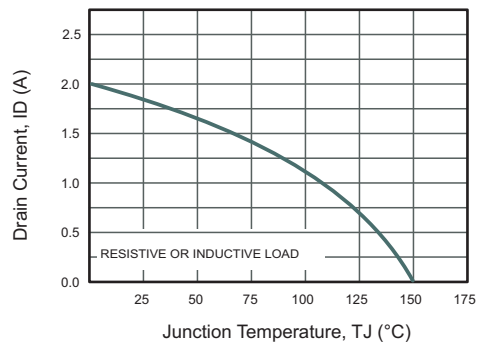


Fig.12 Power Dissipation vs. Junction Temperature

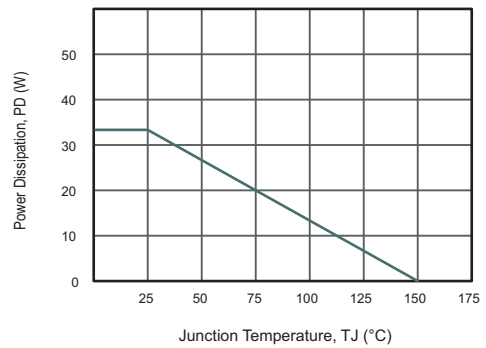
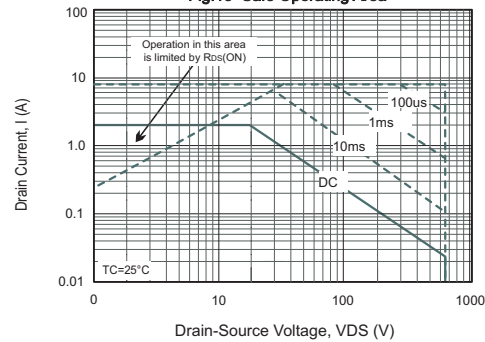
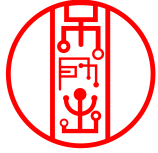


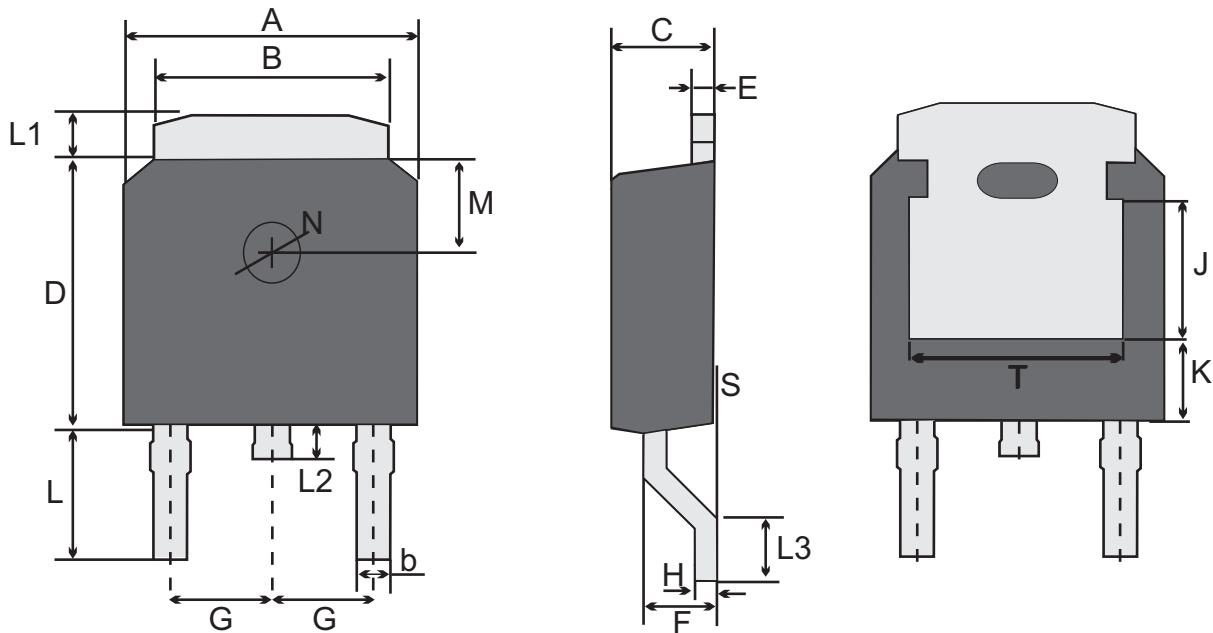
Fig.13 Safe Operating Area





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TO-252(D-PAK) Package Outline Dimensions



TO-252W(D-PAK) mechanical data

UNIT		A	B	b	C	D	E	F	G	H	L	L1	L2	L3	S	M	N	J	K	T
mm	max	6.7	5.5	0.8	2.5	6.3	0.6	1.8	2.29 TYPICAL	0.55	3.1	1.2	1.0	1.75	0.23	1.8 TYPICAL	1.3 TYPICAL	3.23 ref.	1.75 ref.	5.24 ref.
	typ	6.6	5.3	0.7	2.3	6.1	0.5	1.5		0.50	2.8	1.0	0.8	1.30	0.15					
	min	6.3	5.1	0.3	2.1	5.9	0.4	1.3		0.45	2.7	0.8	0.6	1.00	0.0					
mil	max	264	217	31	98	248	24	71	90 TYPICAL	22	122	47	39	69	9	71 TYPICAL	51 TYPICAL	127 ref.	68 ref.	206 ref.
	typ	260	209	28	90	240	20	59		20	110	39	31	51	6					
	min	248	201	12	83	232	16	51		18	106	31	24	55	0					