

40V N-Channel MOSFET

General Description

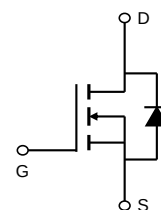
- Trench Power SGT technology
- Low $R_{DS(ON)}$
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant

Product Summary

V_{DS}	40V
I_D (at $V_{GS}=10V$)	80A
$R_{DS(ON)}$ (at $V_{GS}=10V$)	< 9m Ω
$R_{DS(ON)}$ (at $V_{GS}=4.5V$)	< 15m Ω

Applications

- DC/DC Converters in Computing
- Isolated DC/DC Converters in Telecom and Industrial

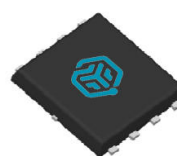


Top View

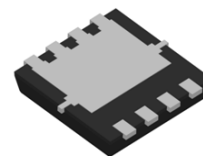


DFN 5*6

Top View



Bottom View



PIN 1

PIN 1

Orderable Part Number	Package Type	Form	Minimum Order Quantity
FNKG04N09E	DFN 5*6	Tape & Reel	5000
Absolute Maximum Ratings $T_A=25^{\circ}\text{C}$ unless otherwise noted			
Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	40	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current ^G	I_D	80	A
Pulsed Drain Current ^C	I_{DM}	320	
Avalanche energy $L=0.01\text{mH}$ ^C	E_{AS}	16	mJ
Power Dissipation ^B	P_D	96	W
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^{\circ}\text{C}$

Thermal Characteristics					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10\text{s}$	$R_{\theta JA}$	18	26	$^{\circ}\text{C/W}$
Maximum Junction-to-Ambient ^{A D}	Steady-State		35	45	$^{\circ}\text{C/W}$
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	1.1	1.3	$^{\circ}\text{C/W}$

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	I _D =250μA, V _{GS} =0V	40			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =40V, V _{GS} =0V			1	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±20V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	1.0	1.6	2.5	V
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =15A		7.0	9	mΩ
		V _{GS} =4.5V, I _D =10A		10.0	15	mΩ
		V _{GS} =3.3V, I _D =5A		16.5	26	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =20A		70		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.7	1.2	V
I _S	Maximum Body-Diode Continuous Current				30	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =20V, f=1MHz		650		pF
C _{oss}	Output Capacitance			160		pF
C _{rss}	Reverse Transfer Capacitance			125		pF
R _g	Gate resistance	f=1MHz		0.8		Ω
SWITCHING PARAMETERS						
Q _{g(10V)}	Total Gate Charge	V _{GS} =10V, V _{DS} =20V, I _D =18A		19		nC
Q _{g(4.5V)}	Total Gate Charge			8.5		nC
Q _{gs}	Gate Source Charge			5.5		nC
Q _{gd}	Gate Drain Charge			3.0		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =20V, R _L =0.75Ω, R _{GEN} =3Ω		5.0		ns
t _r	Turn-On Rise Time			12		ns
t _{D(off)}	Turn-Off DelayTime			14		ns
t _f	Turn-Off Fall Time			4		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =20A, di/dt=500A/μs		11		ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =20A, di/dt=500A/μs		21		nC

A. The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C. The Power dissipation P_{DSM} is based on R_{θJA} ≤ 10s and the maximum allowed junction temperature of 150° C. The value in any given application depends on the user's specific board design.

B. The power dissipation P_D is based on T_{J(MAX)}=150° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Single pulse width limited by junction temperature T_{J(MAX)}=150° C.

D. The R_{θJA} is the sum of the thermal impedance from junction to case R_{θJC} and case to ambient.

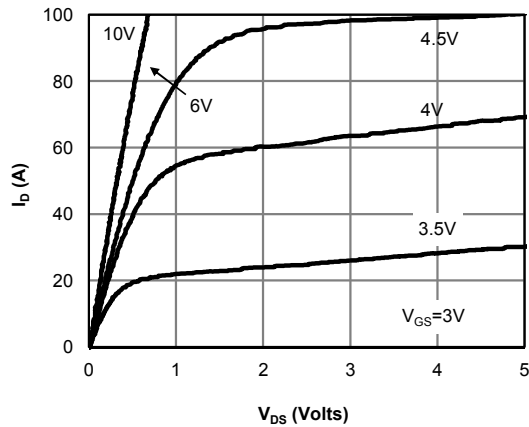
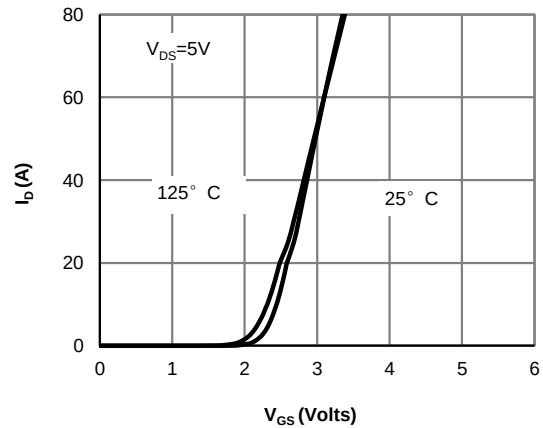
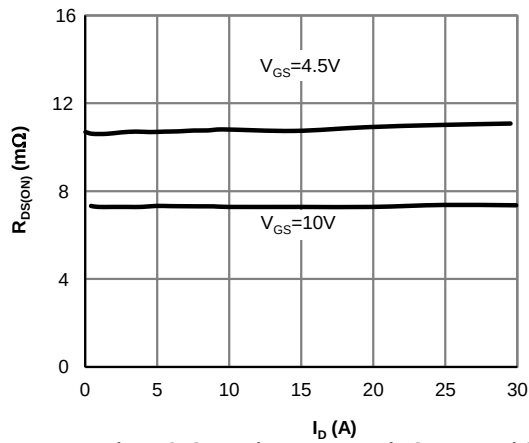
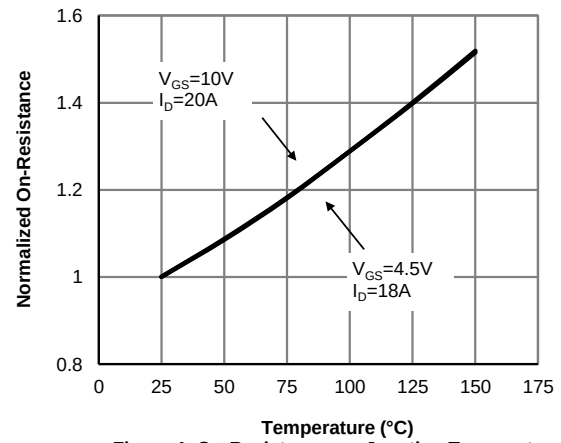
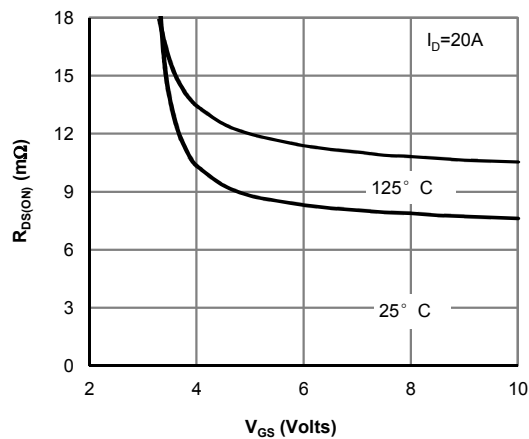
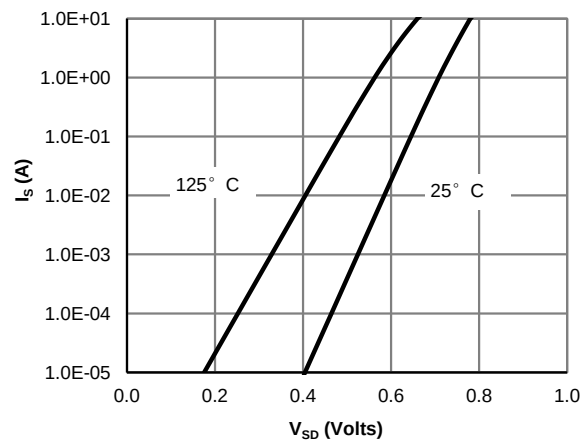
E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T_{J(MAX)}=150° C. The SOA curve provides a single pulse rating.

G. The maximum current rating is package limited.

H. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C.

I. For application requiring slow >1ms turn-on/turn-off, please consult FNK FAE for proper product selection.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 1: On-Region Characteristics (Note E)

Figure 2: Transfer Characteristics (Note E)

Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

Figure 4: On-Resistance vs. Junction Temperature (Note E)

Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

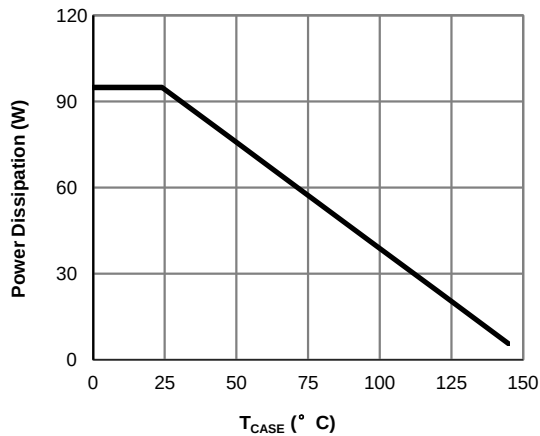


Figure 12: Power De-rating (Note F)

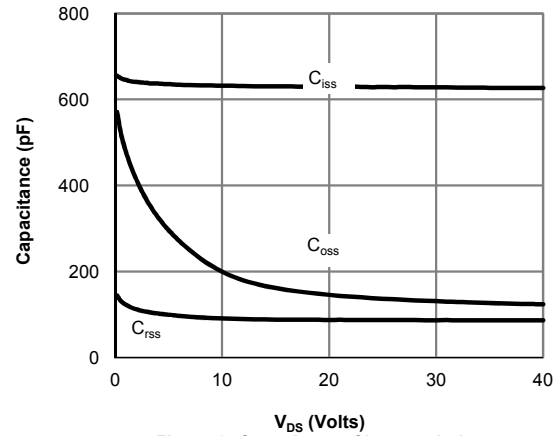


Figure 8: Capacitance Characteristics

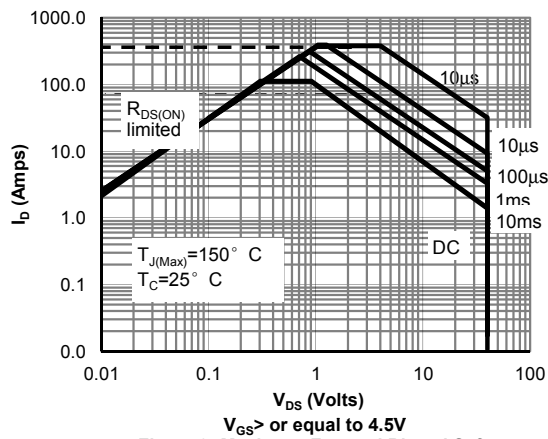


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

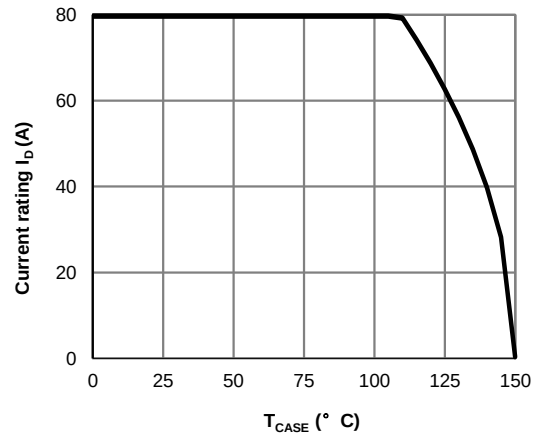


Figure 10: Current De-rating (Note F)

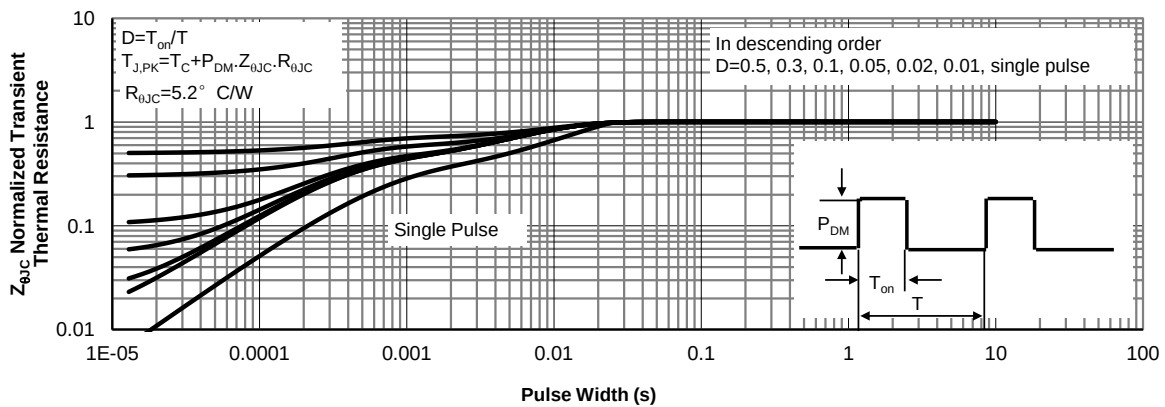


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

Figure A: Gate Charge Test Circuit & Waveforms

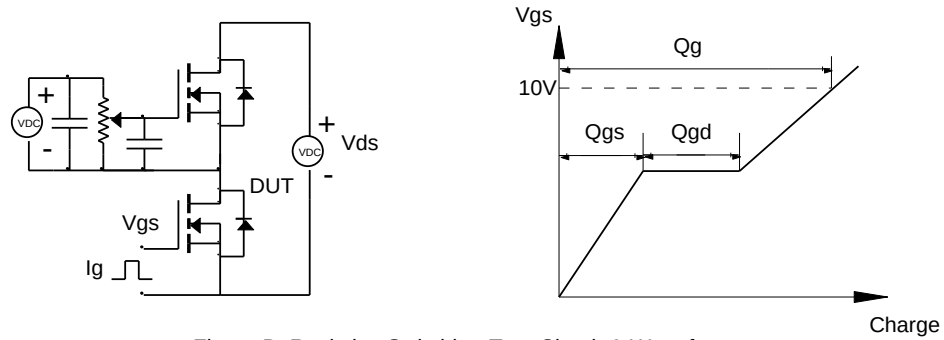


Figure B: Resistive Switching Test Circuit & Waveforms

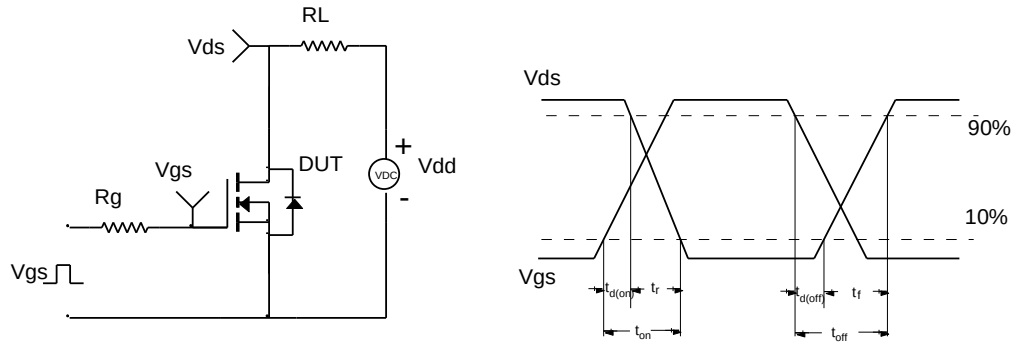


Figure C: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

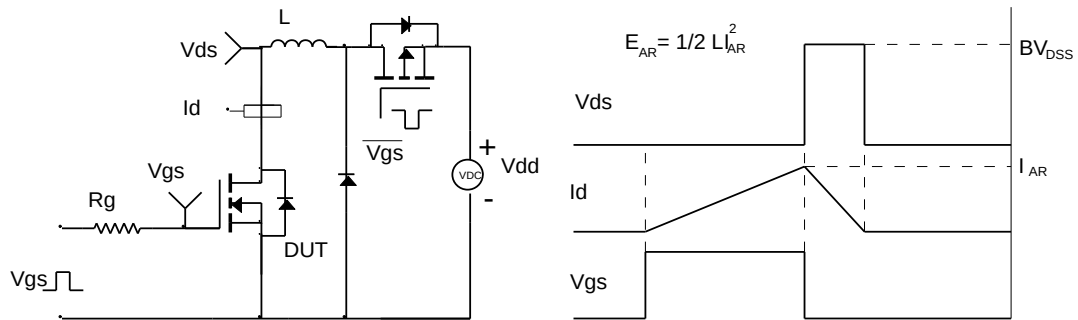
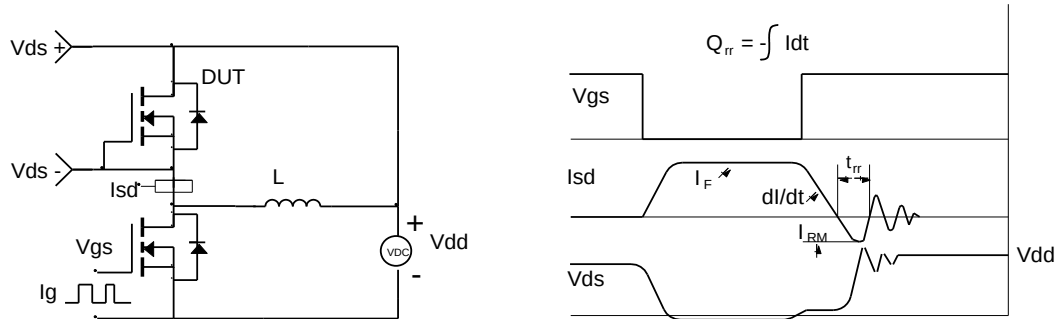
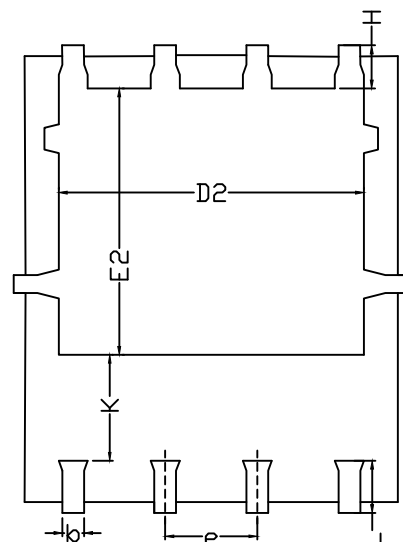
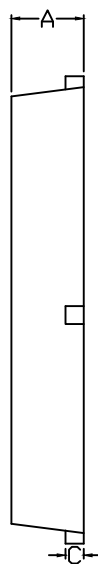
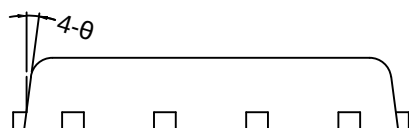
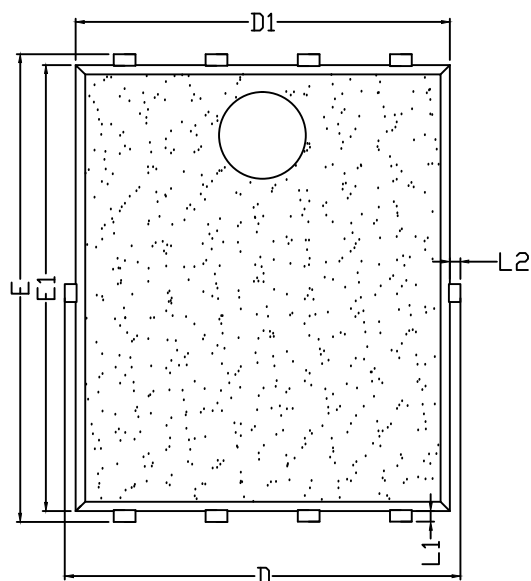


Figure D: Diode Recovery Test Circuit & Waveforms



DFN5X6 Package Information



SYMBOL	mm		
	MIN	NOM	MAX
*A	0.90	0.95	1.00
*b	0.25	0.30	0.35
*c	0.20	0.25	0.30
D	5.15BSC		
*D1	4.90	5.00	5.10
D2	3.90	4.05	4.20
*e	1.17	1.27	1.37
E	6.15BSC		
*E1	5.75	5.85	5.95
E2	3.35	3.50	3.65
H	0.51	0.61	0.71
K	1.10	—	—
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
L2	—	—	0.12
P	0.95	1.10	1.25
θ	9°	11°	13°

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