

60N04KUG-VB Datasheet

N-Channel 40 V (D-S) MOSFET

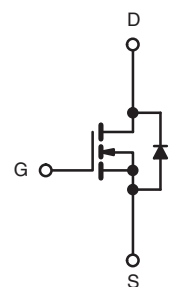
PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω) MAX.	I_D (A)	Q_g (TYP.)
40	0.005 at $V_{GS} = 10$ V	100	53 nC
	0.006 at $V_{GS} = 4.5$ V	98	

FEATURES

- Thunder power MOSFET
- Maximum 175 °C junction temperature
- 100 % R_g and UIS tested
- Material categorization:
for definitions of compliance please see



RoHS
COMPLIANT
HALOGEN
FREE



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V_{DS}	40	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current ($T_J = 150$ °C)	I_D	100	A
		60	
Pulsed Drain Current ($t = 100$ μ s)	I_{DM}	220	
Avalanche Current	I_{AS}	50	
Single Avalanche Energy ^a	E_{AS}	125	mJ
Maximum Power Dissipation ^a	P_D	150 ^b	W
		98 ^b	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +175	°C

THERMAL RESISTANCE RATINGS			
PARAMETER	SYMBOL	LIMIT	UNIT
Junction-to-Ambient (PCB Mount) ^c	R_{thJA}	40	°C/W
Junction-to-Case (Drain)	R_{thJC}	0.75	

Notes

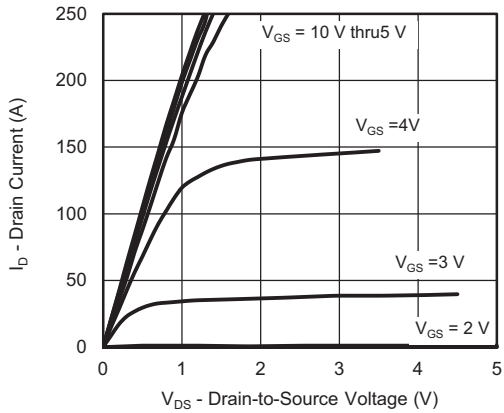
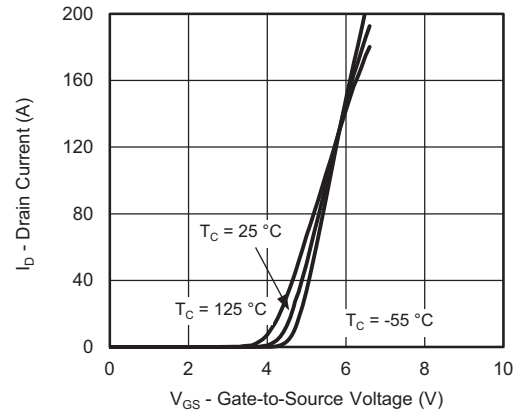
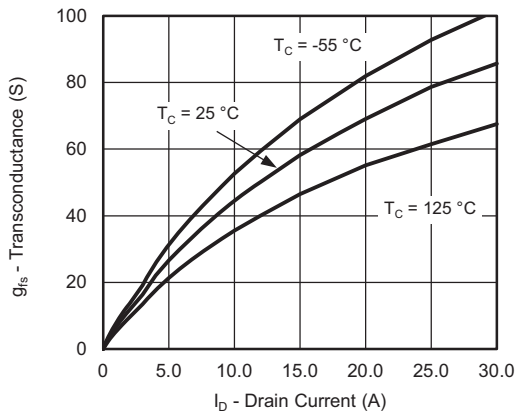
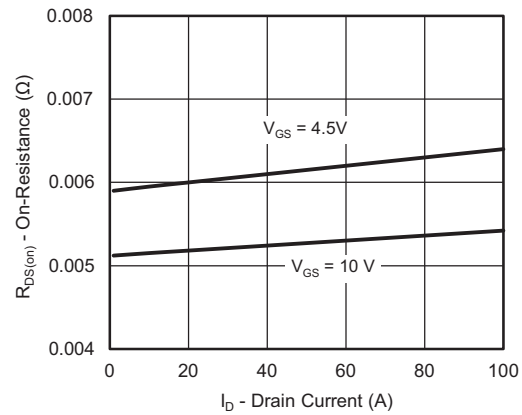
- Duty cycle ≤ 1 %.
- See SOA curve for voltage derating.
- When mounted on 1" square PCB (FR4 material).

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA	40	-	-	V
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	1	-	3	
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V	-	-	± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 40 V, V _{GS} = 0 V	-	-	1	μA
		V _{DS} = 40 V, V _{GS} = 0 V, T _J = 125 °C	-	-	100	
		V _{DS} = 40 V, V _{GS} = 0 V, T _J = 175 °C	-	-	2	mA
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≥ 10 V, V _{GS} = 10 V	90	-	-	A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 10 V, I _D = 30 A	-	0.005	-	Ω
		V _{GS} = 4.5 V, I _D = 30 A	-	0.006	-	
Forward Transconductance ^a	g _{fs}	V _{DS} = 15 V, I _D = 30 A	-	85	-	S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 20 V, f = 1 MHz	-	3330	-	pF
Output Capacitance	C _{oss}		-	1395	-	
Reverse Transfer Capacitance	C _{rss}		-	95	-	
Total Gate Charge ^c	Q _g	V _{DS} =20 V, V _{GS} = 10 V, I _D = 30 A	-	53.5	81	nC
Gate-Source Charge ^c	Q _{gs}		-	14.5	-	
Gate-Drain Charge ^c	Q _{gd}		-	13.2	-	
Gate Resistance	R _g	f = 1 MHz	0.9	1.9	3.8	Ω
Turn-On Delay Time ^c	t _{d(on)}	V _{DD} = 20 V, R _L = 1.67 Ω I _D ≅ 30 A, V _{GEN} = 10 V, R _g = 1 Ω	-	13	26	ns
Rise Time ^c	t _r		-	22	44	
Turn-Off Delay Time ^c	t _{d(off)}		-	27	54	
Fall Time ^c	t _f		-	9	18	
Drain-Source Body Diode Ratings and Characteristics ^b (T _C = 25 °C)						
Pulsed Current (t = 100 μs)	I _{SM}		-	220	-	-
Forward Voltage ^a	V _{SD}	I _F = 30 A, V _{GS} = 0 V	-	0.86	1.4	V
Reverse Recovery Time	t _{rr}	I _F = 30 A, di/dt = 100 A/μs	-	88	176	ns
Peak Reverse Recovery Charge	I _{RM(REC)}		-	5	10	A
Reverse Recovery Charge	Q _{rr}		-	0.22	0.44	μC

Notes

- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
 b. Guaranteed by design, not subject to production testing.
 c. Independent of operating temperature.

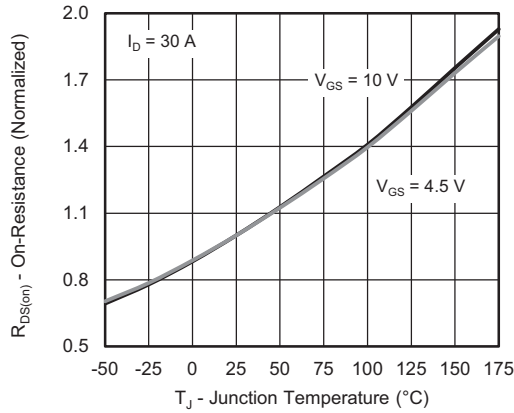
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise noted)

Output Characteristics

Transfer Characteristics

Transconductance

On-Resistance vs. Drain Current

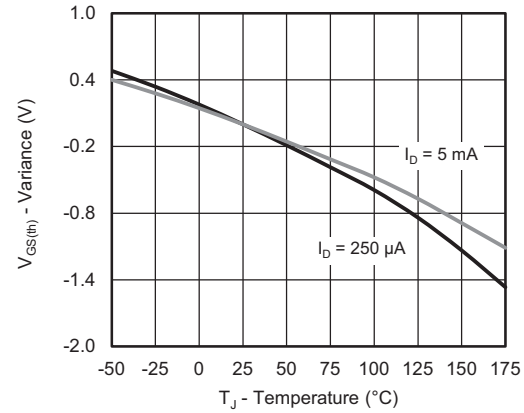
Capacitance

Gate Charge

TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)



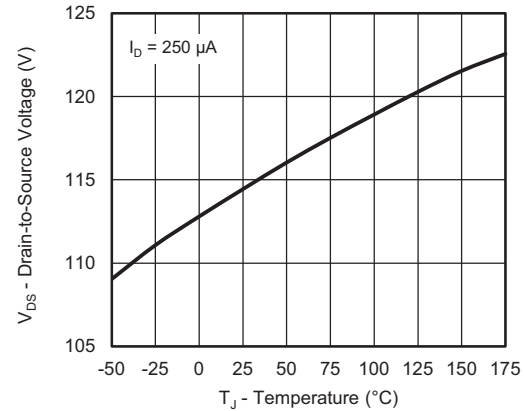
On-Resistance vs. Junction Temperature



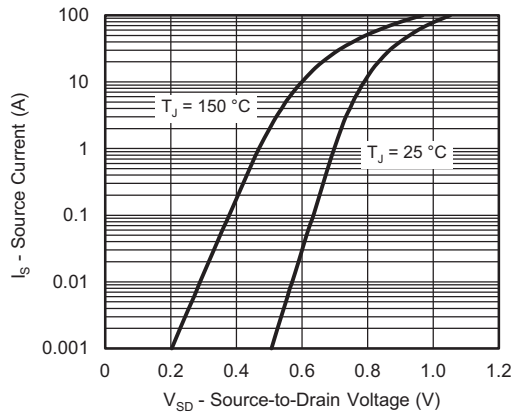
Threshold Voltage



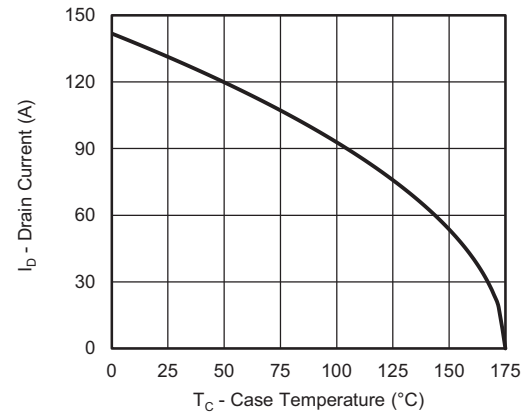
On-Resistance vs. Gate-to-Source Voltage



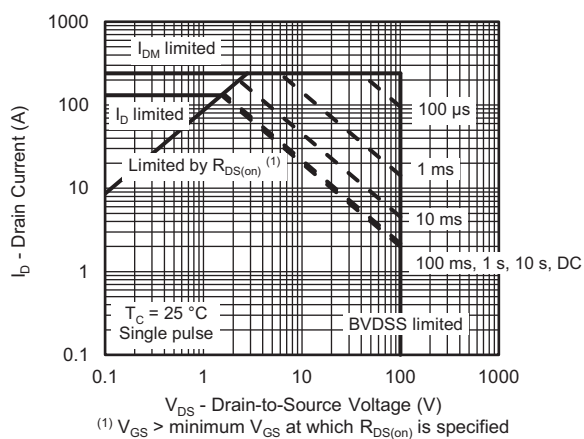
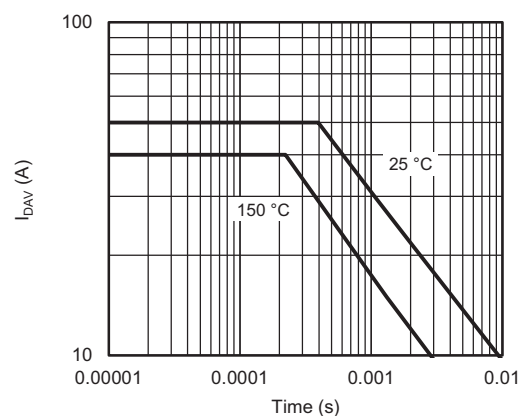
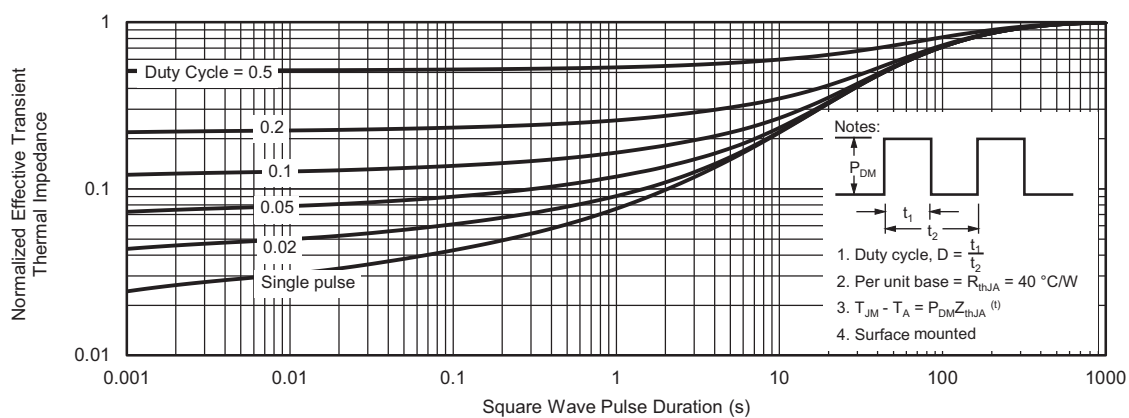
Drain Source Breakdown vs. Junction Temperature



Source Drain Diode Forward Voltage



Current De-Rating

THERMAL RATINGS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Safe Operating Area

 I_{DAV} vs. Time

Normalized Thermal Transient Impedance, Junction-to-Ambient

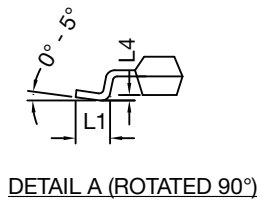
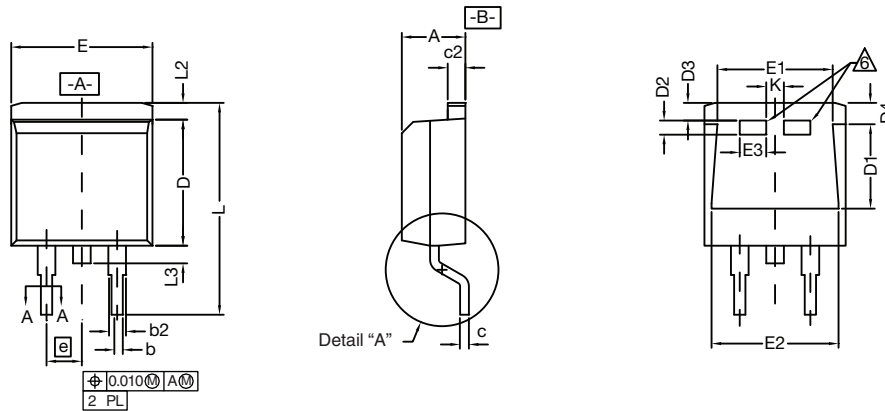
THERMAL RATINGS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)


Normalized Thermal Transient Impedance, Junction-to-Case

Note

- The characteristics shown in the two graphs
 - Normalized Transient Thermal Impedance Junction to Ambient ($25\text{ }^{\circ}\text{C}$)
 - Normalized Transient Thermal Impedance Junction to Case ($25\text{ }^{\circ}\text{C}$)
- are given for general guidelines only to enable the user to get a "ball park" indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

TO-263 (D²PAK): 3-LEAD



DIM.		INCHES		MILLIMETERS	
		MIN.	MAX.	MIN.	MAX.
A		0.160	0.190	4.064	4.826
b		0.020	0.039	0.508	0.990
b1		0.020	0.035	0.508	0.889
b2		0.045	0.055	1.143	1.397
c*	Thin lead	0.013	0.018	0.330	0.457
	Thick lead	0.023	0.028	0.584	0.711
c1	Thin lead	0.013	0.017	0.330	0.431
	Thick lead	0.023	0.027	0.584	0.685
c2		0.045	0.055	1.143	1.397
D		0.340	0.380	8.636	9.652
D1		0.220	0.240	5.588	6.096
D2		0.038	0.042	0.965	1.067
D3		0.045	0.055	1.143	1.397
D4		0.044	0.052	1.118	1.321
E		0.380	0.410	9.652	10.414
E1		0.245	-	6.223	-
E2		0.355	0.375	9.017	9.525
E3		0.072	0.078	1.829	1.981
e		0.100 BSC		2.54 BSC	
K		0.045	0.055	1.143	1.397
L		0.575	0.625	14.605	15.875
L1		0.090	0.110	2.286	2.794
L2		0.040	0.055	1.016	1.397
L3		0.050	0.070	1.270	1.778
L4		0.010 BSC		0.254 BSC	
M		-	0.002	-	0.050

ECN: T13-0707-Rev. K, 30-Sep-13
DWG: 5843

Notes

- Plane B includes maximum features of heat sink tab and plastic.
- No more than 25 % of L1 can fall above seating plane by max. 8 mils.
- Pin-to-pin coplanarity max. 4 mils.
- *: Thin lead is for SUB, SYB.
Thick lead is for SUM, SYM, SQM.
- Use inches as the primary measurement.
-  This feature is for thick lead.

RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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