

60V, 24A, 31mΩ N-channel Power Trench MOSFET

JMTK330N06AQ

Features

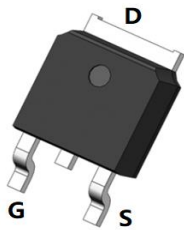
- Ultra-low ON-resistance, $R_{DS(ON)}$
- Low Gate Charge
- 100% UIS Tested
- 100% ΔV_{ds} Tested
- Halogen-free; RoHS-compliant
- AEC-Q101 Qualified

Applications

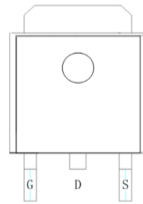
- Load Switch
- PWM Application
- General Automotive Application

Product Summary

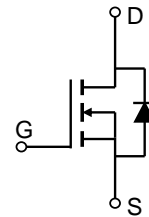
Parameters	Value	Unit
V_{DSS}	60	V
$V_{GS(th)_{Typ}}$	1.6	V
$I_D(@V_{GS}=10V)$	24	A
$R_{DS(ON)_{Typ}}(@V_{GS}=10V)$	28	mΩ
$R_{DS(ON)_{Typ}}(@V_{GS}=4.5V)$	31	mΩ



TO-252-3L



Pin Assignment



Schematic Diagram

Ordering Information

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMTK330N06AQ	JMTK330N06AQ	1	Tape&Reel	TO-252-3L	2500	25000

Absolute Maximum Ratings (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit
V_{DS}	Drain-to-Source Voltage	60	V
V_{GS}	Gate-to-Source Voltage	± 20	V
I_D	Continuous Drain Current	$T_C = 25^\circ\text{C}$	24
		$T_C = 100^\circ\text{C}$	17
I_{DM}	Pulsed Drain Current ⁽¹⁾	Refer to Fig.4	A
E_{AS}	Single Pulsed Avalanche Energy ⁽²⁾	24	mJ
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$	44
		$T_C = 100^\circ\text{C}$	22
T_J, T_{STG}	Junction & Storage Temperature Range	-55 to 175	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient ⁽³⁾	42	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.4	

**Electrical Characteristics** ($T_J = 25^\circ\text{C}$ unless otherwise specified)

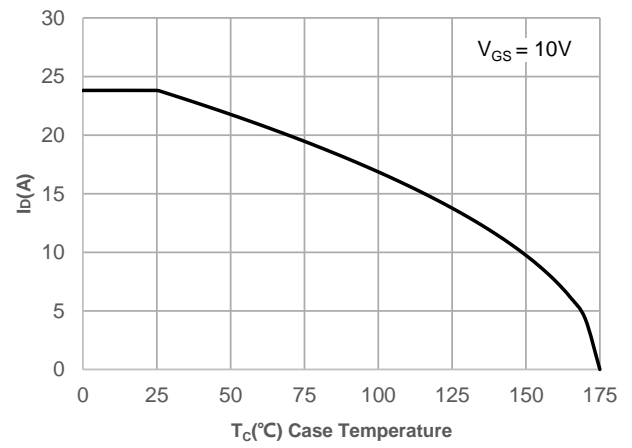
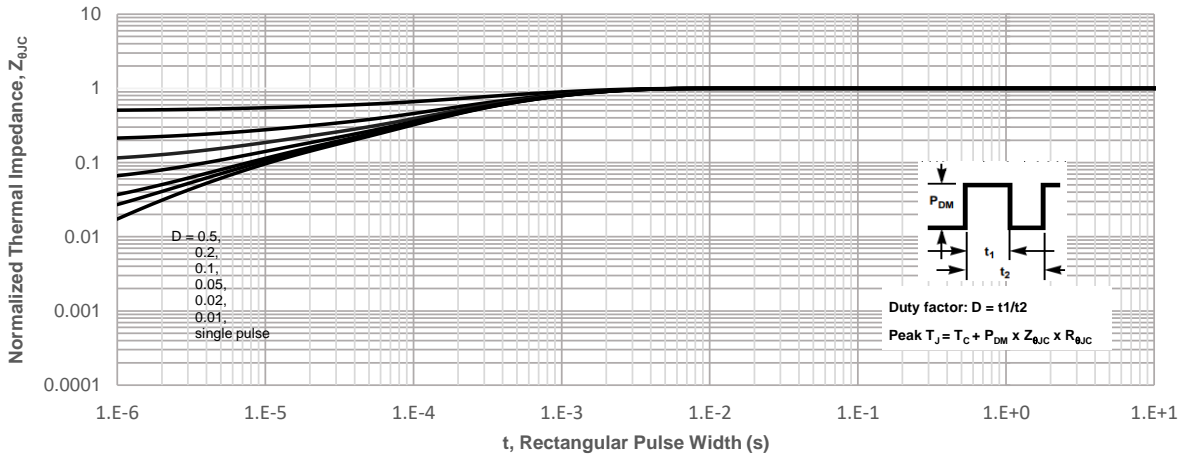
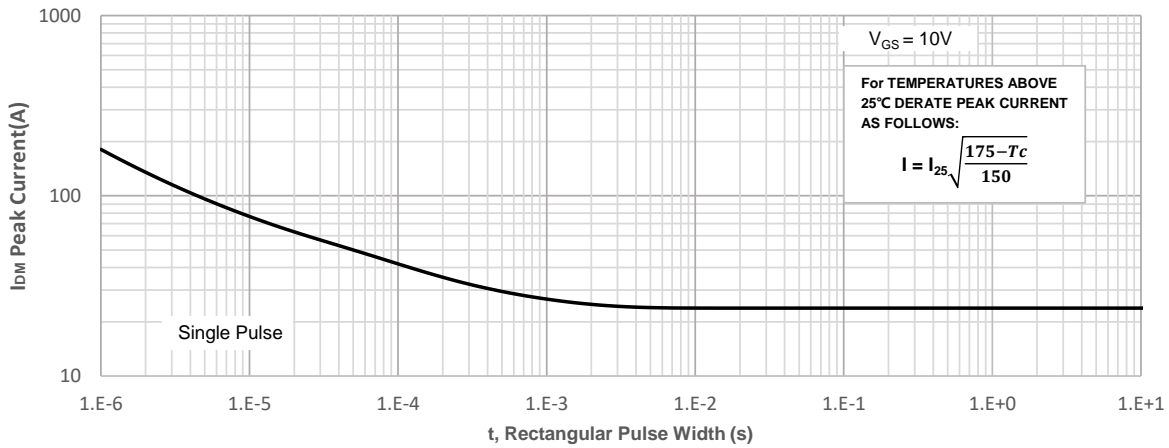
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$	60	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 60\text{V}$, $V_{GS} = 0\text{V}$	-	-	1.0	μA
I_{GSS}	Gate-Body Leakage Current	$V_{DS} = 0\text{V}$, $V_{GS} = \pm 20\text{V}$	-	-	± 100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$	1.1	1.6	2.5	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance ⁽⁴⁾	$V_{GS} = 10\text{V}$, $I_D = 10\text{A}$	-	28	33	m Ω
		$V_{GS} = 4.5\text{V}$, $I_D = 5\text{A}$	-	31	45	m Ω
Dynamic Characteristics						
R_g	Gate Resistance	$f = 1\text{MHz}$	-	1.4	-	Ω
C_{iss}	Input Capacitance	$V_{GS} = 0\text{V}$, $V_{DS} = 30\text{V}$, $f = 1\text{MHz}$	848	1187	1602	pF
C_{oss}	Output Capacitance		40	56	76	pF
C_{riss}	Reverse Transfer Capacitance		34	47	63	pF
Q_g	Total Gate Charge	$V_{GS} = 0$ to 10V $V_{DS} = 30\text{V}$, $I_D = 10\text{A}$	17	24	33	nC
Q_{gs}	Gate Source Charge		-	4.5	-	nC
Q_{gd}	Gate Drain("Miller") Charge		-	4.5	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On DelayTime	$V_{GS} = 10\text{V}$, $V_{DD} = 30\text{V}$ $I_D = 10\text{A}$, $R_{GEN} = 3\Omega$	-	6.7	-	ns
t_r	Turn-On Rise Time		-	15	-	ns
$t_{d(off)}$	Turn-Off DelayTime		-	24	-	ns
t_f	Turn-Off Fall Time		-	2.7	-	ns
Body Diode Characteristics						
I_S	Maximum Continuous Body Diode Forward Current		-	-	24	A
I_{SM}	Maximum Pulsed Body Diode Forward Current		-	-	95	A
V_{SD}	Body Diode Forward Voltage	$V_{GS} = 0\text{V}$, $I_S = 10\text{A}$	-		1.2	V
t_{rr}	Body Diode Reverse Recovery Time	$I_F = 10\text{A}$, $di/dt = 100\text{A/us}$	13	19	25	ns
Q_{rr}	Body Diode Reverse Recovery Charge		-	19	-	nC

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
 2. E_{AS} condition: Starting $T_J = 25^\circ\text{C}$, $V_{DD} = 30\text{V}$, $V_{GS} = 10\text{V}$, $R_G = 25\text{ohm}$, $L = 0.5\text{mH}$, $I_{AS} = 9.8\text{A}$, $V_{DD} = 0\text{V}$ during time in avalanche.
 3. $R_{\theta JA}$ is measured with the device mounted on a 1inch^2 pad of 2oz copper FR4 PCB.
 4. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 0.5\%$.

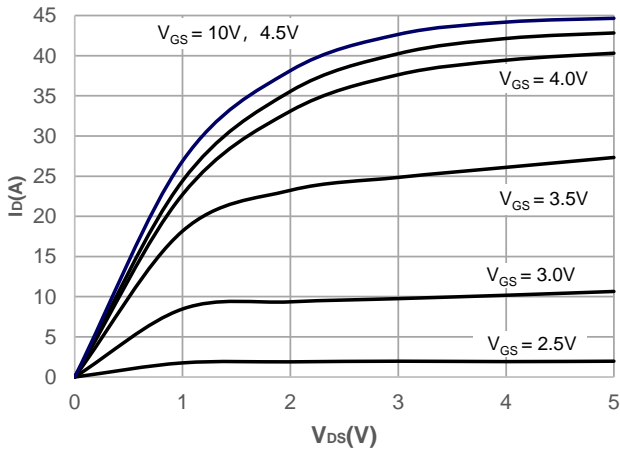
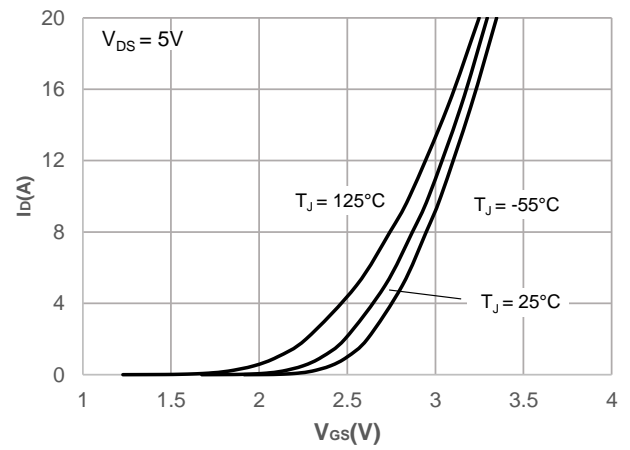
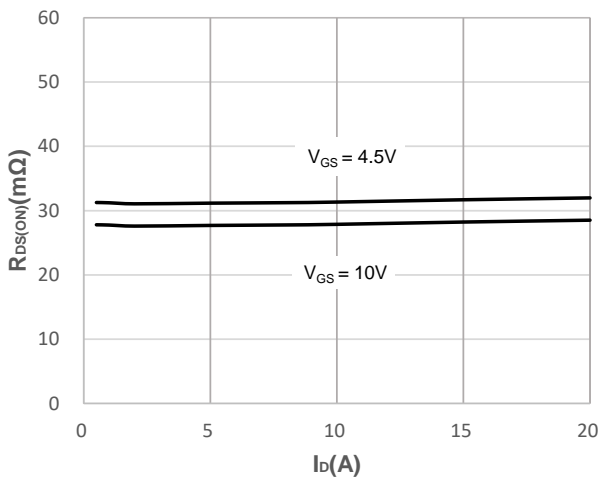
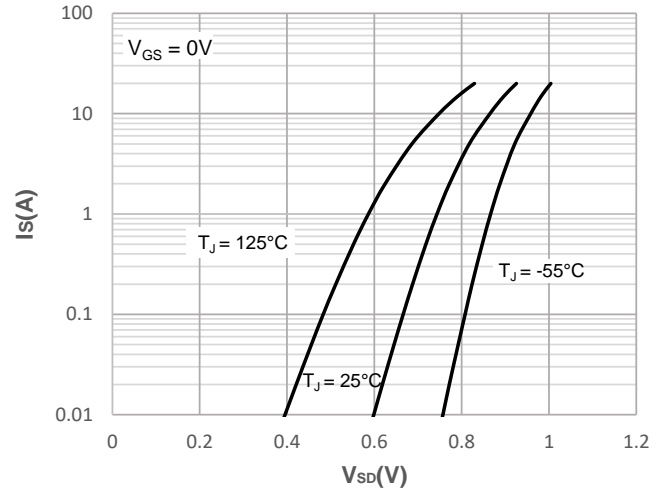
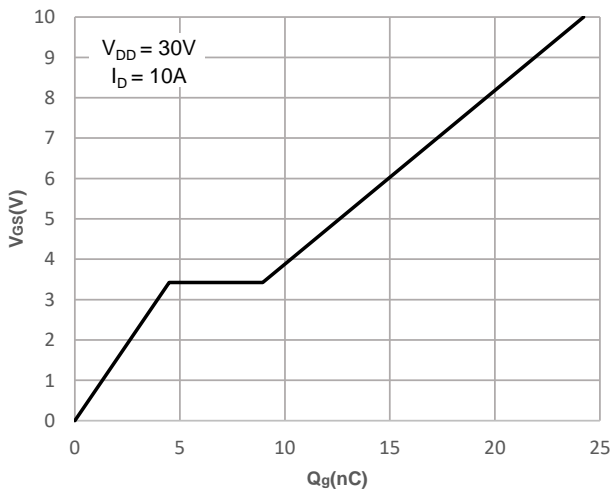
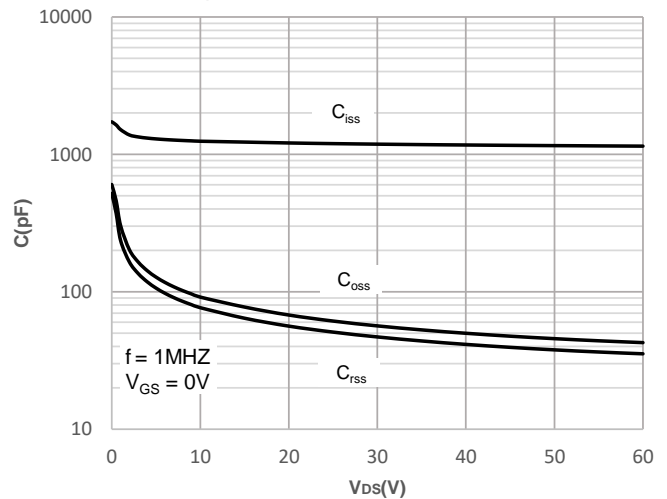


Typical Performance Characteristics

Figure 1: Power De-rating

Figure 2: Current De-rating

Figure 3: Normalized Maximum Transient Thermal Impedance

Figure 4: Peak Current Capacity


Typical Performance Characteristics

Figure 5: Output Characteristics

Figure 6: Typical Transfer Characteristics

Figure 7: On-resistance vs. Drain Current

Figure 8: Body Diode Characteristics

Figure 9: Gate Charge Characteristics

Figure 10: Capacitance Characteristics


Typical Performance Characteristics

Figure 11: Normalized Breakdown voltage vs. Junction Temperature

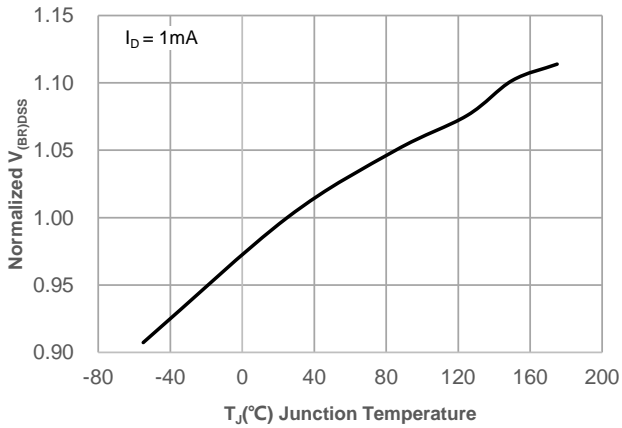


Figure 12: Normalized on Resistance vs. Junction Temperature

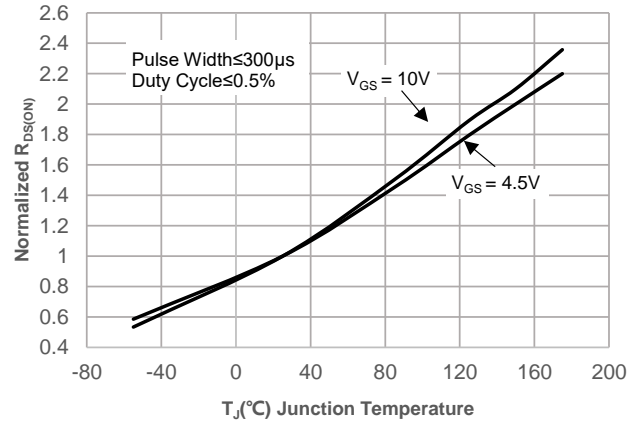


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

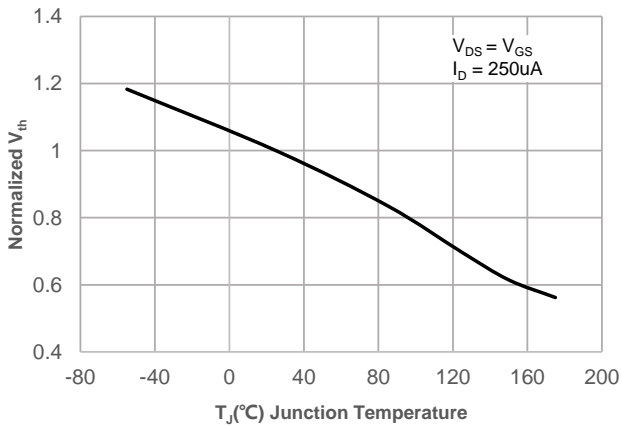


Figure 14: $R_{DS(ON)}$ vs. V_{GS}

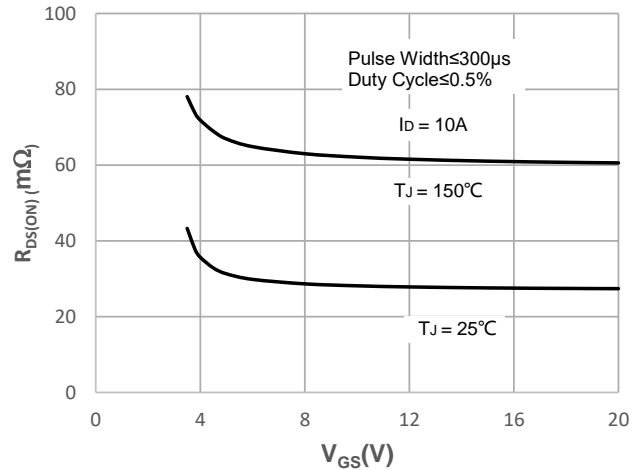
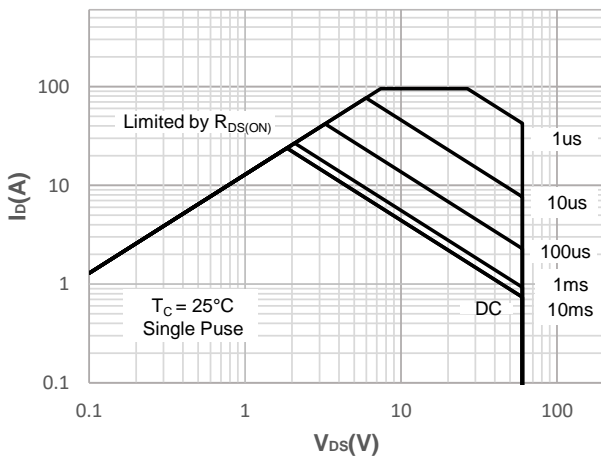


Figure 15: Maximum Safe Operating Area



Test Circuit

Figure 1: Gate Charge Test Circuit & Waveform

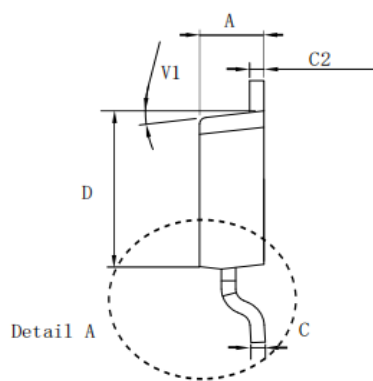
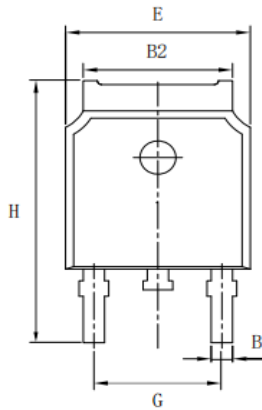
Figure 2: Resistive Switching Test Circuit & Waveform

Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

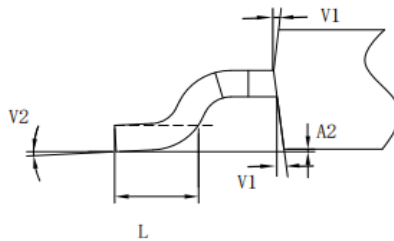
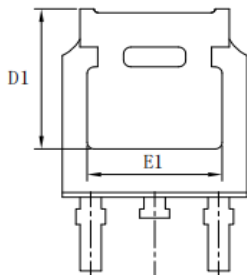
Figure 4: Diode Recovery Test Circuit & Waveform

Package Mechanical Data(TO-252-3L)

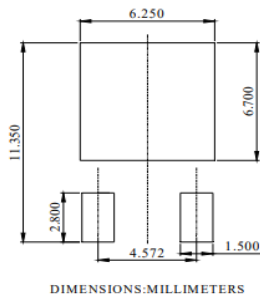
Package Outline



DIM.	MILLIMETER		
	MIN.	TYP.	MAX.
A	2.275	2.3	2.325
A2	0	0.05	0.1
B	0.72	0.76	0.85
B2	5.234	5.334	5.434
C	-	0.508	-
C2	0.507	0.508	0.517
D	6.075	6.1	6.125
D1	-	5.399	-
E	6.575	6.6	6.625
E1	-	4.826	-
G	4.472	4.572	4.672
H	9.9	10.1	10.3
L	1.4	1.5	1.6
V1	6°	7°	8°
V2	1°	3°	5°



Recommended Soldering Footprint



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