

# POWER MOSFETS IN A TO-3 PACKAGE



400V Thru 1000V, N-Channel  
Size 6 MOSFETs, High Energy Capability

## FEATURES

- TO-3 Package Hermetic, .060 Dia. Leads
- Size 6 Die, High Energy
- Fast Switching, Low Drive Current
- Low  $R_{DS(on)}$
- Available Screened To MIL-S-19500, TX, TXV And S Levels

## DESCRIPTION

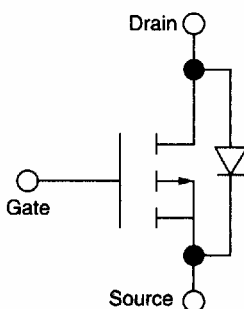
This series of hermetically packaged products feature the latest advanced MOSFET and packaging technology. They are ideally suited for Military requirements where small size, high performance and high reliability are required, and in applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers and high energy pulse circuits. This series also features avalanche high energy capability at elevated temperatures.

## MAXIMUM RATINGS

PART NUMBER	$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)
OM360NK	400	.20	24
OM460NK	500	.25	22
OM10N100NK	1000	1.30	10

3.1

## SCHEMATIC



**ELECTRICAL CHARACTERISTICS: OM360NK** (T<sub>C</sub> = 25° unless otherwise noted)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
<b>OFF CHARACTERISTICS</b>					
Drain-Source Breakdown Voltage (V <sub>GS</sub> = 0, I <sub>D</sub> = 0.25 mA)	V <sub>(BR)DSS</sub>	400	-	-	Vdc
Zero Gate Voltage Drain (V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0) (V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0, T <sub>J</sub> = 125° C)	I <sub>DSS</sub>	-	-	0.25 1.0	mAdc
Gate-Body Leakage Current, Forward (V <sub>GSF</sub> = 20 Vdc, V <sub>DS</sub> = 0)	I <sub>GSSF</sub>	-	-	100	nAdc
Gate-Body Leakage Current, Reverse (V <sub>GSR</sub> = 20 Vdc, V <sub>DS</sub> = 0)	I <sub>GSSR</sub>	-	-	100	nAdc
<b>ON CHARACTERISTICS*</b>					
Gate-Threshold Voltage (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 0.25 mAdc) (T <sub>J</sub> = 125° C)	V <sub>GS(th)</sub>	2.0 1.5	3.0	4.0 3.5	Vdc
Static Drain-Source On-Resistance (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 12 Adc)	R <sub>DS(on)</sub>	-	-	0.20	Ohm
Drain-Source On-Voltage (V <sub>GS</sub> = 10 Vdc) (I <sub>D</sub> = 24 A) (I <sub>D</sub> = 12 A, T <sub>J</sub> = 125° C)	V <sub>DS(on)</sub>	-	-	5.4 5.4	Vdc
Forward Transconductance (V <sub>DS</sub> = 15 Vdc, I <sub>D</sub> = 12 Adc)	g <sub>FS</sub>	14	-	-	mhoe
<b>DYNAMIC CHARACTERISTICS</b>					
Input Capacitance	(V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0, f = 1.0 MHz)	C <sub>iss</sub>	-	4000	pF
Output Capacitance		C <sub>oss</sub>	-	550	-
Transfer Capacitance		C <sub>rss</sub>	-	110	-
<b>SWITCHING CHARACTERISTICS</b>					
Turn-On Delay Time	(V <sub>DD</sub> = 200 V, I <sub>D</sub> = 24 A, R <sub>θ(jc)</sub> = 4.3 ohms)	t <sub>d(on)</sub>	-	30	ns
Rise Time		t <sub>r</sub>	-	95	-
Turn-Off Delay Time		t <sub>d(off)</sub>	-	80	-
Fall Time		t <sub>f</sub>	-	80	-
Total Gate Charge	(V <sub>DS</sub> = 320 V, I <sub>D</sub> = 24 A, V <sub>GS</sub> = 10 V)	Q <sub>g</sub>	-	110	nC
Gate-Source Charge		Q <sub>gs</sub>	-	22	-
Gate-Drain Charge		Q <sub>gd</sub>	-	46	-
<b>SOURCE DRAIN DIODE CHARACTERISTICS</b>					
Forward On-Voltage	(I <sub>S</sub> = 24 A, dI/dt = 100 A/μs)	V <sub>SD</sub>	-	1.1	1.6
Forward Turn-On Time		t <sub>on</sub>	-	**	-
Reverse Recovery Time		t <sub>r</sub>	-	500	1000

**ELECTRICAL CHARACTERISTICS: OM460NK** (T<sub>C</sub> = 25° unless otherwise noted)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
<b>OFF CHARACTERISTICS</b>					
Drain-Source Breakdown Voltage (V <sub>GS</sub> = 0, I <sub>D</sub> = 0.25 mA)	V <sub>(BR)DSS</sub>	500	-	-	Vdc
Zero Gate Voltage Drain (V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0) (V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0, T <sub>J</sub> = 125° C)	I <sub>DSS</sub>	-	-	0.25 1.0	mAdc
Gate-Body Leakage Current, Forward (V <sub>GSF</sub> = 20 Vdc, V <sub>DS</sub> = 0)	I <sub>GSSF</sub>	-	-	100	nAdc
Gate-Body Leakage Current, Reverse (V <sub>GSR</sub> = 20 Vdc, V <sub>DS</sub> = 0)	I <sub>GSSR</sub>	-	-	100	nAdc
<b>ON CHARACTERISTICS*</b>					
Gate-Threshold Voltage (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 0.25 mAdc) (T <sub>J</sub> = 125° C)	V <sub>GS(th)</sub>	2.0 1.5	3.0	4.0 3.5	Vdc
Static Drain-Source On-Resistance (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 11 Adc)	R <sub>DS(on)</sub>	-	-	0.25	Ohm
Drain-Source On-Voltage (V <sub>GS</sub> = 10 Vdc) (I <sub>D</sub> = 22 A) (I <sub>D</sub> = 11 A, T <sub>J</sub> = 125° C)	V <sub>DS(on)</sub>	-	-	8.0 8.0	Vdc
Forward Transconductance (V <sub>DS</sub> = 15 Vdc, I <sub>D</sub> = 11 Adc)	g <sub>FS</sub>	11	-	-	mhoe
<b>DYNAMIC CHARACTERISTICS</b>					
Input Capacitance	(V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0, f = 1.0 MHz)	C <sub>iss</sub>	-	4000	pF
Output Capacitance		C <sub>oss</sub>	-	480	-
Transfer Capacitance		C <sub>rss</sub>	-	95	-
<b>SWITCHING CHARACTERISTICS</b>					
Turn-On Delay Time	(V <sub>DD</sub> = 250 V, I <sub>D</sub> = 22 A, R <sub>θ(jc)</sub> = 4.3 ohms)	t <sub>d(on)</sub>	-	32	ns
Rise Time		t <sub>r</sub>	-	95	-
Turn-Off Delay Time		t <sub>d(off)</sub>	-	80	-
Fall Time		t <sub>f</sub>	-	80	-
Total Gate Charge	(V <sub>DS</sub> = 400 V, I <sub>D</sub> = 22 A, V <sub>GS</sub> = 10 V)	Q <sub>g</sub>	-	115	nC
Gate-Source Charge		Q <sub>gs</sub>	-	22	-
Gate-Drain Charge		Q <sub>gd</sub>	-	46	-
<b>SOURCE DRAIN DIODE CHARACTERISTICS</b>					
Forward On-Voltage	(I <sub>S</sub> = 22 A, dI/dt = 100 A/μs)	V <sub>SD</sub>	-	1.1	1.6
Forward Turn-On Time		t <sub>on</sub>	-	**	-
Reverse Recovery Time		t <sub>r</sub>	-	500	1000

\* Indicates Pulse Test = 300 μsec, Duty Cycle = 2%. \*\* Limited by circuit inductance

**ELECTRICAL CHARACTERISTICS: OM10N100NK** ( $T_C = 25^\circ$  unless otherwise noted)

Characteristic	Symbol	Min.	Typ.	Max.	Unit	
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage ( $V_{GS} = 0, I_D = 0.25 \text{ mA}$ )	$V_{(BR)DSS}$	1000	-	-	Vdc	
Zero Gate Voltage Drain ( $V_{DS} = 1000 \text{ V}, V_{GS} = 0$ ) ( $V_{DS} = 1000 \text{ V}, V_{GS} = 0, T_J = 125^\circ \text{ C}$ )	$I_{DSS}$	-	-	0.25 1.0	mAdc	
Gate-Body Leakage Current, Forward ( $V_{GSF} = 20 \text{ Vdc}, V_{DS} = 0$ )	$I_{GSSF}$	-	-	100	nAdc	
Gate-Body Leakage Current, Reverse ( $V_{GSR} = 20 \text{ Vdc}, V_{DS} = 0$ )	$I_{GSSR}$	-	-	100	nAdc	
<b>ON CHARACTERISTICS*</b>						
Gate-Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 0.25 \text{ mAdc}$ ) ( $T_J = 125^\circ \text{ C}$ )	$V_{GS(th)}$	2.0 1.5	3.0 -	4.5 4.0	Vdc	
Static Drain-Source On-Resistance ( $V_{GS} = 10 \text{ Vdc}, I_D = 5 \text{ Adc}$ )	$R_{DS(on)}$	-	-	1.3	Ohm	
Drain-Source On-Voltage ( $V_{GS} = 10 \text{ Vdc}$ ) ( $I_D = 10 \text{ A}$ ) ( $I_D = 5 \text{ A}, T_J = 125^\circ \text{ C}$ )	$V_{DS(on)}$	-	-	14 14	Vdc	
Forward Transconductance ( $V_{DS} = 15 \text{ Vdc}, I_D = 5 \text{ Adc}$ )	$g_{FS}$	5.0	-	-	mhos	
<b>DYNAMIC CHARACTERISTICS-</b>						
Input Capacitance	$(V_{DS} = 25 \text{ V}, V_{GS} = 0,$ $f = 1.0 \text{ MHz})$	$C_{iss}$	-	3900	pF	
Output Capacitance		$C_{oss}$	-	300		
Transfer Capacitance		$C_{rss}$	-	65		
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$(V_{DD} = 500 \text{ V}, I_D = 10 \text{ A},$ $R_{gen} = 9.1 \text{ ohms})$	$t_{d(on)}$	-	40	ns	
Rise Time		$t_r$	-	60		
Turn-Off Delay Time		$t_{d(off)}$	-	100		
Fall Time		$t_f$	-	70		
Total Gate Charge	$(V_{DS} = 500 \text{ V}, I_D = 10 \text{ A},$ $V_{GS} = 10 \text{ V})$	$Q_g$	-	100	nC	
Gate-Source Charge		$Q_{gs}$	-	20		
Gate-Drain Charge		$Q_{gd}$	-	40		
<b>SOURCE DRAIN DIODE CHARACTERISTICS</b>						
Forward On-Voltage	$(I_S = 10 \text{ A}, d/dt = 100 \text{ A}/\mu\text{s})$	$V_{SD}$	-	-	1.1	Vdc
Forward Turn-On Time		$t_{on}$	-	**	-	ns
Reverse Recovery Time		$t_{rr}$	-	600	1000	

\* Indicates Pulse Test = 300  $\mu\text{sec}$ , Duty Cycle = 2%

\*\* Limited by circuit inductance

**ABSOLUTE MAXIMUM RATINGS** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Parameter	OM360NK	OM460NK	OM10N100NK	Units
$V_{DS}$ Drain-Source Voltage	400	500	1000	V
$V_{DGR}$ Drain-Gate Voltage ( $R_{GS} = 1\text{ M}\Omega$ )	400	500	1000	V
$I_D @ T_C = 25^\circ\text{C}$ Continuous Drain Current	24	22	10	A
$I_{DM}$ Pulsed Drain Current	92	85	40	A
$P_D @ T_C = 25^\circ\text{C}$ Maximum Power Dissipation	200	200	200	W
Derate Above $25^\circ\text{C } T_C$	1.33	1.33	1.33	$\text{W}/^\circ\text{C}$
$W_{DSS} (1)$ Single Pulse Energy Drain To Source @ $25^\circ\text{C}$	1000	1200	1000	mJ
$T_J$ Operating and $T_{stg}$ Storage Temperature Range	-55 to 150	-55 to 150	-55 to 150	$^\circ\text{C}$
Lead Temperature (1/8" from case for 5 secs.)	275	275	275	$^\circ\text{C}$

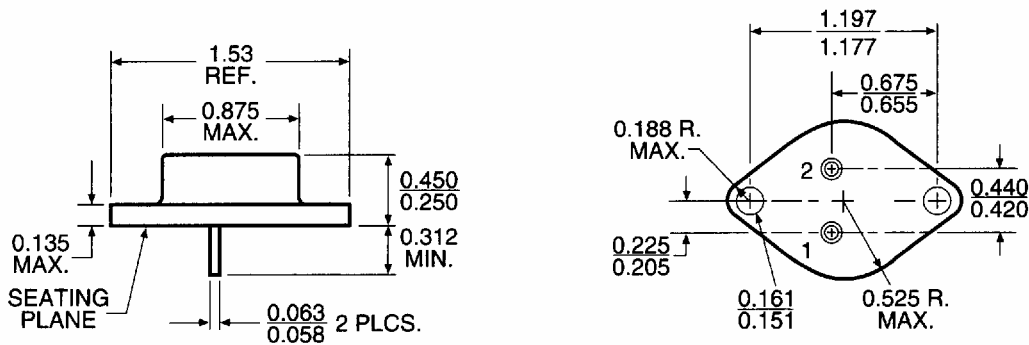
**Note 1:**  $V_{DD} = 50\text{V}$ ,  $I_D$  = as noted

**THERMAL RESISTANCE** (Maximum) at  $T_A = 25^\circ\text{C}$

$R_{thJC}$ Junction-to-Case	.75	$^\circ\text{C}/\text{W}$	
$R_{thJA}$ Junction-to-Ambient	30	$^\circ\text{C}/\text{W}$	Free Air Operation
Derate above $25^\circ\text{C } T_A$	.033	$\text{W}/^\circ\text{C}$	

**MECHANICAL OUTLINE**

3.1



**Pin Connection**  
 Pin 1: Gate  
 Pin 2: Source  
 Case: Drain