
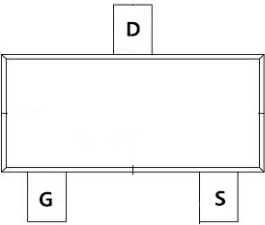


TM04N02I

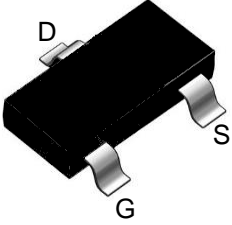
N-Channel Enhancement Mosfet

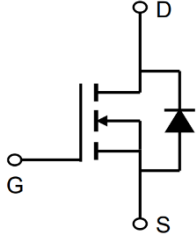
<p><b>General Description</b></p> <ul style="list-style-type: none"> <li>• Low <math>R_{DS(ON)}</math></li> <li>• RoHS and Halogen-Free Compliant</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Load switch</li> <li>• PWM</li> </ul>	<p><b>Product Summary</b></p> <p><math>V_{DS} = 20V</math> <math>I_D = 4.0A</math></p> <p><math>R_{DS(ON)} = 35\ m\Omega</math> (Typ.) @ <math>V_{GS} = 4.5V</math></p> <p>100% UIS Tested              100% <math>R_g</math> Tested</p> 
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Marking: A2SHB OR 04N02

I: SOT-23





**Absolute Maximum Ratings ( $T_c = 25^\circ C$  unless otherwise noted)**

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	20	V
$V_{GS}$	Gate-Source Voltage	$\pm 12$	V
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	4.0	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	1.45	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	10	A
$P_D @ T_A = 25^\circ C$	Total Power Dissipation <sup>3</sup>	1.05	W
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ C$

**Thermal Data**

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-ambient <sup>1</sup>	---	112	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	---	---	$^\circ C/W$



TM04N02I

N-Channel Enhancement Mosfet

**Electrical Characteristics**

T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	20	--	--	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V	--	--	1	μA
		V <sub>DS</sub> = 16V, T <sub>C</sub> = 125°C	--	--	10	μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 0 V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -10 V, V <sub>DS</sub> = 0 V	--	--	-100	nA

**On Characteristics**

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	0.45	0.7	1.1	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 3.5A	--	35	55	mΩ
		V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 2.0A	-	55	70	

**Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 10V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	--	180	-	pF
C <sub>oss</sub>	Output Capacitance		--	37	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	34	-	pF

**Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>GS</sub> =5 V, V <sub>DS</sub> =10V, I <sub>D</sub> =3A, R <sub>G</sub> = 6 Ω ,R <sub>L</sub> = 2.7 Ω	--	4.5	--	ns
t <sub>r</sub>	Turn-On Rise Time		--	31	--	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	12	--	ns
t <sub>f</sub>	Turn-Off Fall Time		--	4.0	--	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 10 V, I <sub>D</sub> =3A, V <sub>GS</sub> = 5V	--	6.23	--	nC
Q <sub>gs</sub>	Gate-Source Charge		--	6	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	0.5	--	nC

**Drain-Source Diode Characteristics and Maximum Ratings**

I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current	--	--	3.5	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current	--	--	10.5	A
V <sub>SD</sub>	Drain to Source Diode Forward Voltage, V <sub>GS</sub> = 0V, I <sub>SD</sub> = 3.5A, T <sub>J</sub> = 25°C	--	--	1.2	V

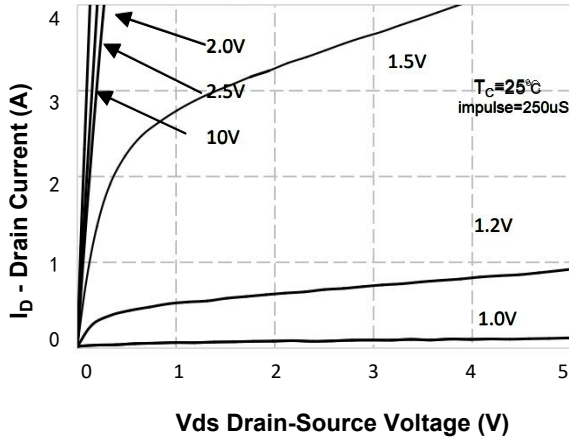
**Notes:**

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. Device mounted on FR-4 PCB, 1inch x 0.85inch x 0.062 inch
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 0.5%

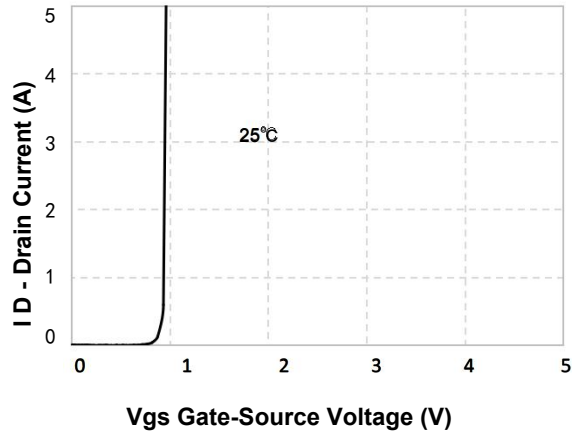


Typical Performance Characteristics

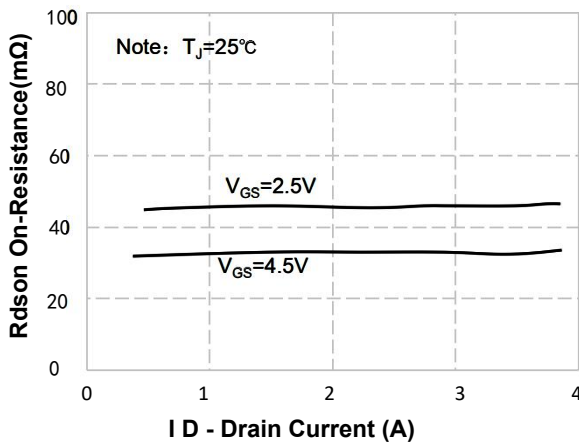
N- Channel Typical Characteristics



Vds Drain-Source Voltage (V)  
 Figure 1. On-Region Characteristics



Vgs Gate-Source Voltage (V)  
 Figure 2. Transfer Characteristics



Note: Tj=25°C  
 Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

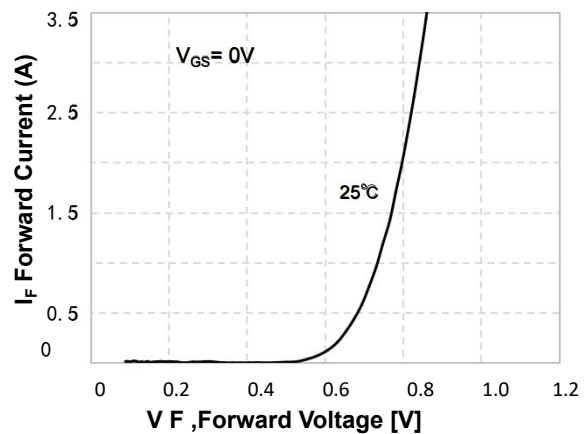


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

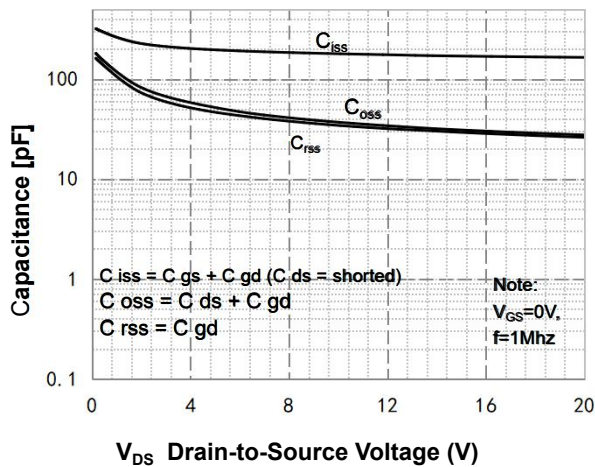


Figure 5. Capacitance Characteristics

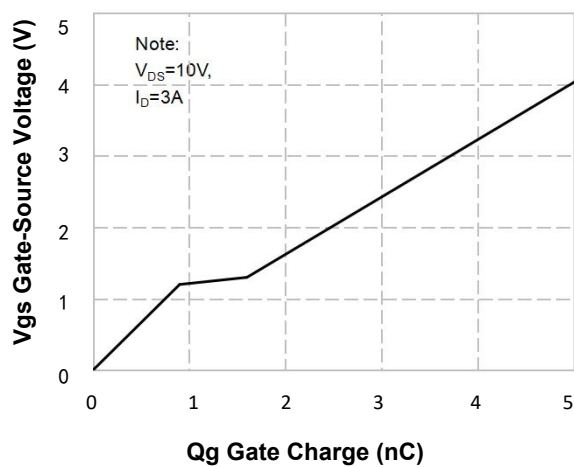


Figure 6. Gate Charge Characteristics



N- Channel Typical Characteristics (Continued)

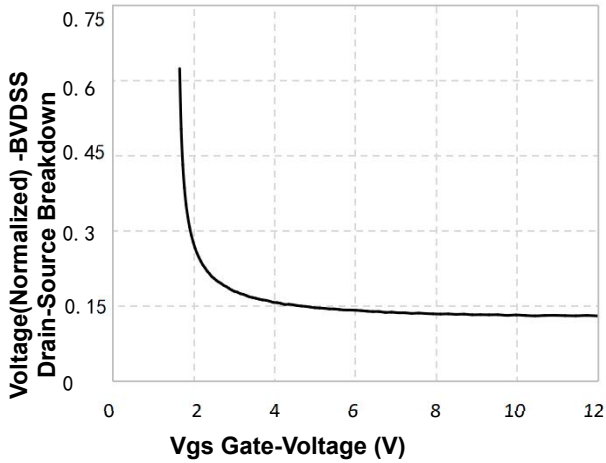


Figure 7. Breakdown Voltage Variation vs Gate-Voltage

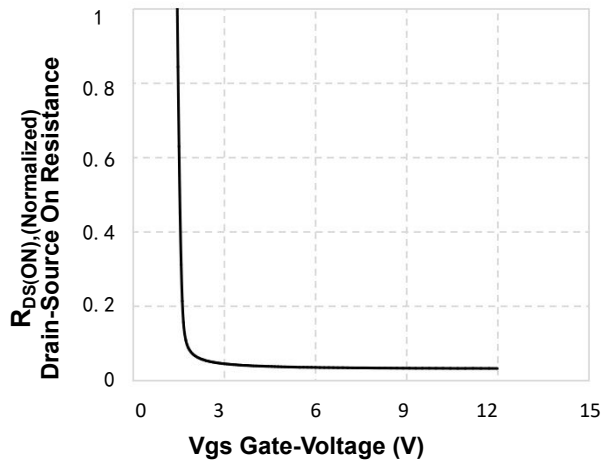


Figure 8. On-Resistance Variation vs Gate Voltage

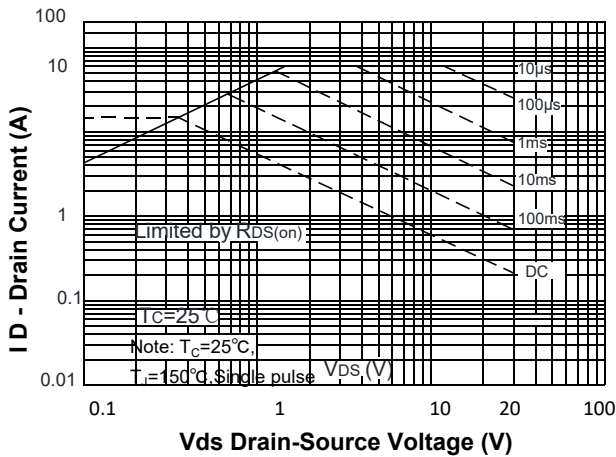


Figure 9. Maximum Safe Operating Area

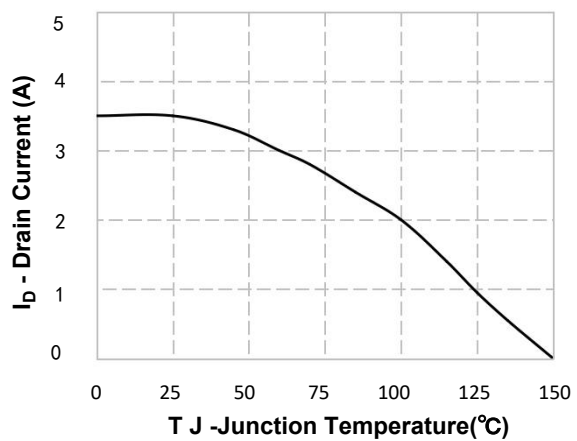


Figure 10. Maximum PContinuous Drain Current vs Case Temperature

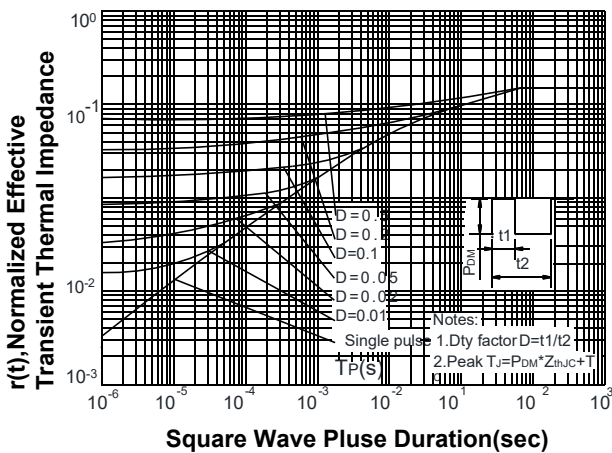
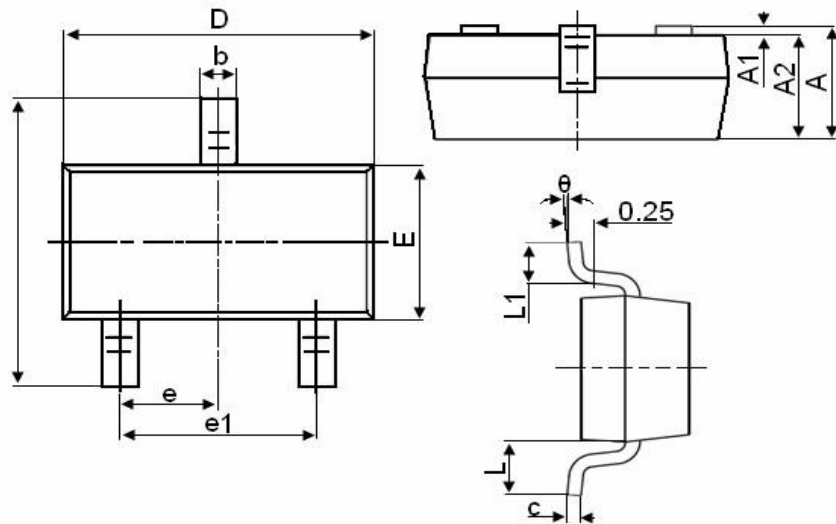


Figure 11. Transient Thermal Response Curve

## Package Mechanical Data: SOT-23



Symbol	Dimensions in Millimeters	
	MIN.	MAX.
A	0.900	1.150
A1	0.000	0.100
A2	0.900	1.050
b	0.300	0.500
c	0.080	0.150
D	2.800	3.000
E	1.200	1.400
E1	2.250	2.550
e	0.950TYP	
e1	1.800	2.000
L	0.550REF	
L1	0.300	0.500
θ	0°	8°