# N-Channel Enhancement Mode MOSFET

Features

- Fast switching speed
- Reliable and Rugged
- ROHS Compliant
- 100% UIS and Rg Tested

Applications

- Power Management in Desktop Computer
- DC/DC Converters

Pin Description

TO-220	Symbol
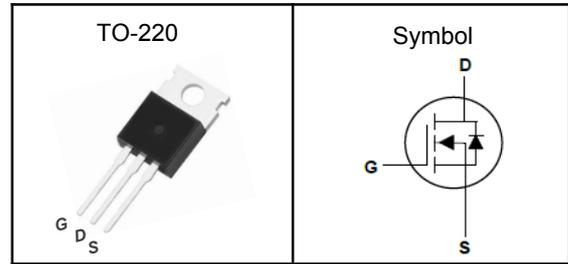
V_{DSS}	650	V
$R_{DS(ON)-Typ}$	2.1	Ω
I_D	4	A

Absolute Maximum Ratings(T$_J$=25℃, Unless Otherwise Noted)

Symbol	Parameter		N-Channel	Unit
V_{DSS}	Drain-Source Voltage		650	V
V_{GSS}	Gate-Source Voltage		±30	V
T_J	Maximum Junction Temperature		-55 to 150	℃
T_{STG}	Storage Temperature Range		-55 to 150	℃
E_{AS}	Single Pulse Avalanche Energy3		240	mJ
I_{DM} [①]	Pulse Drain Current Tested		16	A
I_D	Continuous Drain Current	T_C=25°C	4	A
P_D	Maximum Power Dissipation	T_C=25°C	80	W

Thermal Characteristics

Symbol	Parameter	Rating	Unit
$R_{θJA}$	Thermal Resistance Junction-Ambient$_1$ （Max）	60	℃/W
$R_{θJC}$	Thermal Resistance Junction-Case$_1$	1.66	℃/W

Note ① : Max. current is limited by bonding wire.

Note ② : UIS tested and pulse width are limited by maximum junction temperature 150℃.

Note ③ : Surface Mounted on 1in^2 FR-4 board with 1oz.

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Electrical Characteristics (T$_J$=25℃, Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Static Electrical Characteristics					
BV$_{DSS}$	Drain-Source Breakdown Voltage	V$_{GS}$=0V, I$_D$=250uA	650	---	---	V
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=650V, V$_{GS}$=0V	---	---	1	uA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$, I$_D$=250uA	2	---	4	V
I$_{GSS}$	Gate Leakage Current	V$_{GS}$=±30V, V$_{DS}$=0V	---	---	±100	nA
R$_{DS(ON)}$	Drain-Source On-state Resistance	V$_{GS}$=10V , I$_D$=2A	---	2.1	2.4	Ω
Dynamic Characteristics[5]					
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=25V, Freq.=1MHz	---	490	---	pF
C$_{oss}$	Output Capacitance		---	45	---	
C$_{rss}$	Reverse Transfer Capacitance		---	6	---	
T$_{d(on)}$	Turn-on Delay Time	V$_{DD}$=325V, R$_G$=25Ω, I$_D$=4A	---	20	---	nS
T$_r$	Turn-on Rise Time		---	55	---	
T$_{d(off)}$	Turn-off Delay Time		---	70	---	
T$_f$	Turn-off Fall Time		---	50	---	
Q$_g$	Total Gate Charge	V$_{DD}$=400V , V$_{GS}$=10V , I$_D$=4A	---	10	---	nC
Q$_{gs}$	Gate-Source Charge		---	2	---	
Q$_{gd}$	Gate-Drain Charge		---	5	---	
Source-Drain Characteristics （T$_J$=25℃）					
V$_{SD}$	Diode Forward Voltage$_2$	V$_{GS}$=0V , I$_S$=4A ,T$_J$=25℃	---	---	1.4	V
t$_{rr}$	Reverse Recovery Time	V$_R$=400V, I$_F$=4A, di/dt=100A/μs， T$_J$=25℃	---	390	---	nS
Q$_{rr}$	Reverse Recovery Charge		---	2.2	---	nC

Note ④： Pulse test (pulse width≤300us, duty cycle≤2%).

Note ⑤：Guaranteed by design, not subject to production testing.

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Typical Characteristics

Figure 1. Output Characteristics
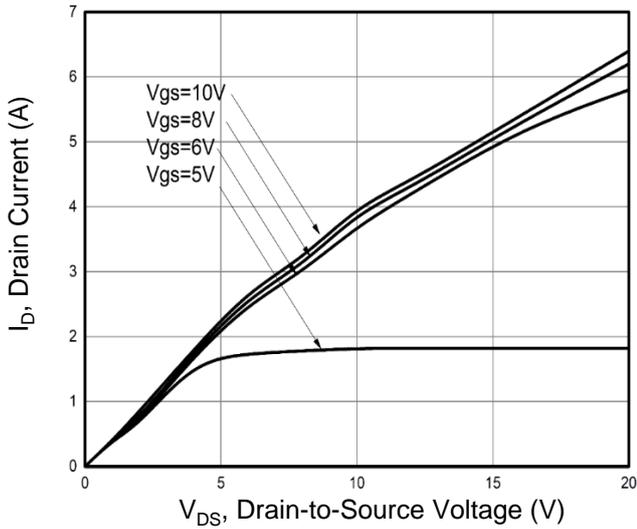
Figure 2. Transfer Characteristics
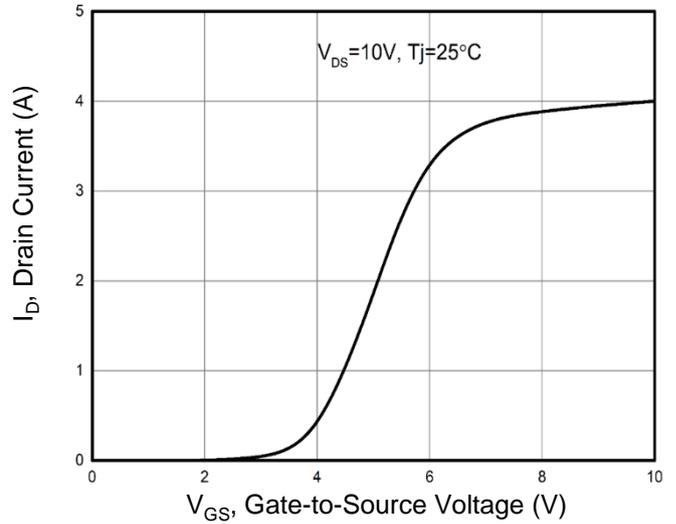
Figure 3. Drain Current vs. Temperature
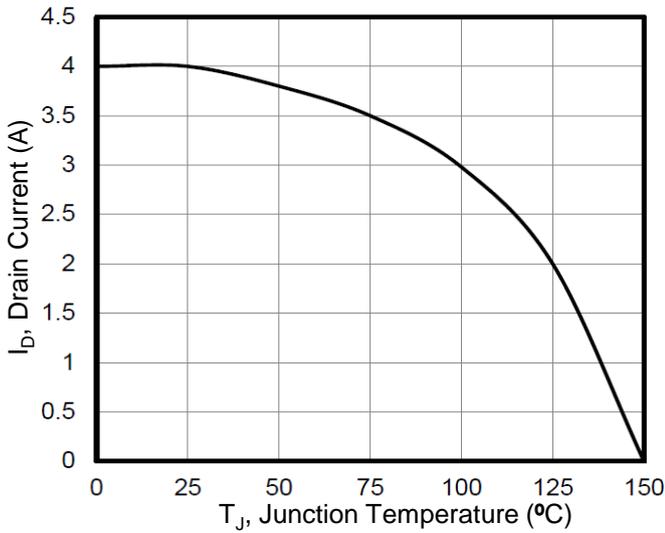
Figure 4. Capacitance
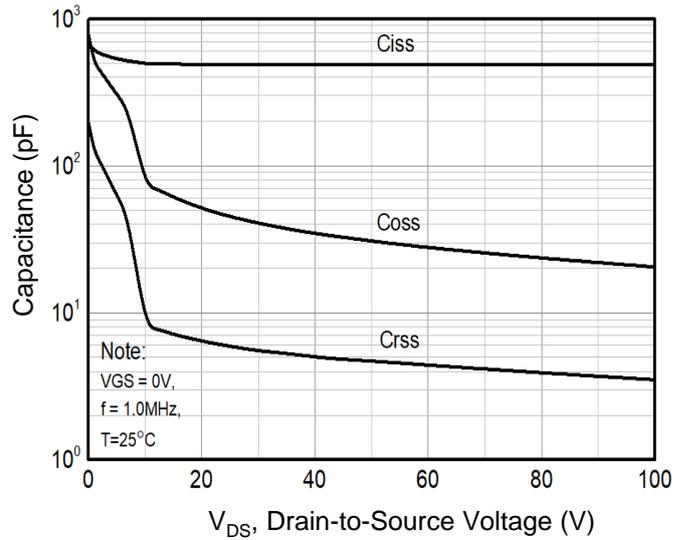
Figure 5. Gate Charge
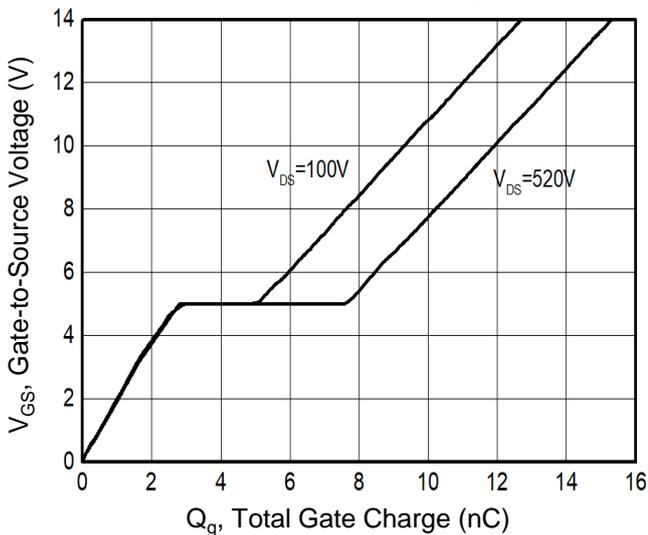
Figure 6. Body Diode Forward Voltage
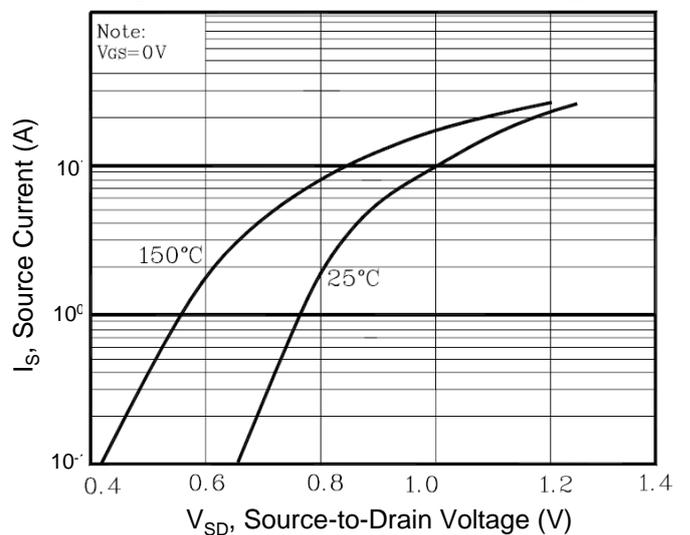
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Figure 7. On-Resistance vs. Temperature

V_{GS} = 10V I_D=4A

R$_{DS(on)}$, (Normalized) vs. T$_J$, Junction Temperature (°C)
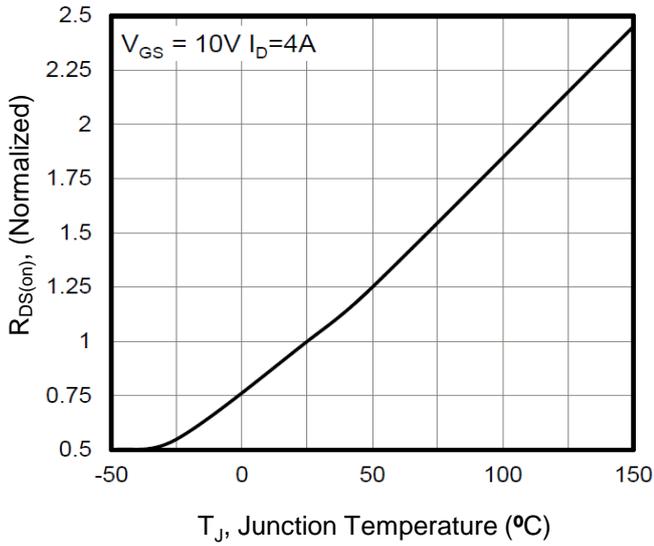
Figure 8. BV$_{DSS}$ vs. Temperature

Note:
1. V$_{GS}$=0V
2. I$_D$=250uA

BV$_{DSS}$, (Normalized) vs. T$_J$, Junction Temperature (°C)
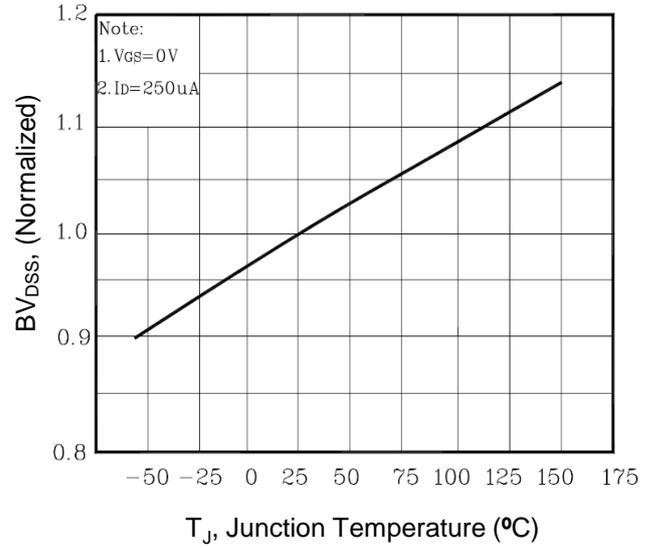
Figure 9. Transient Thermal Impedance

(TO-220 TO-252)

Thermal Resistance(°C/W) vs. T(sec)

0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse
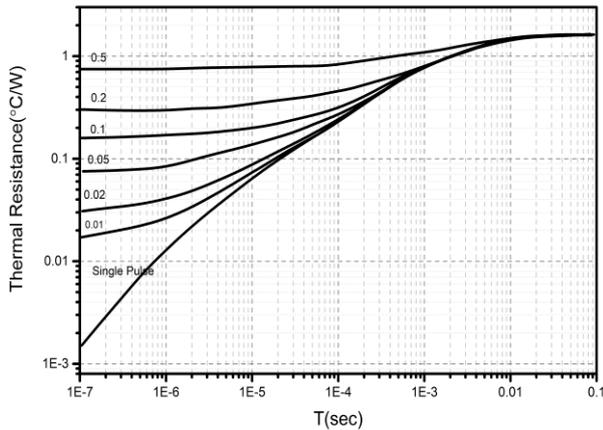
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TO-220 Package Outline Data
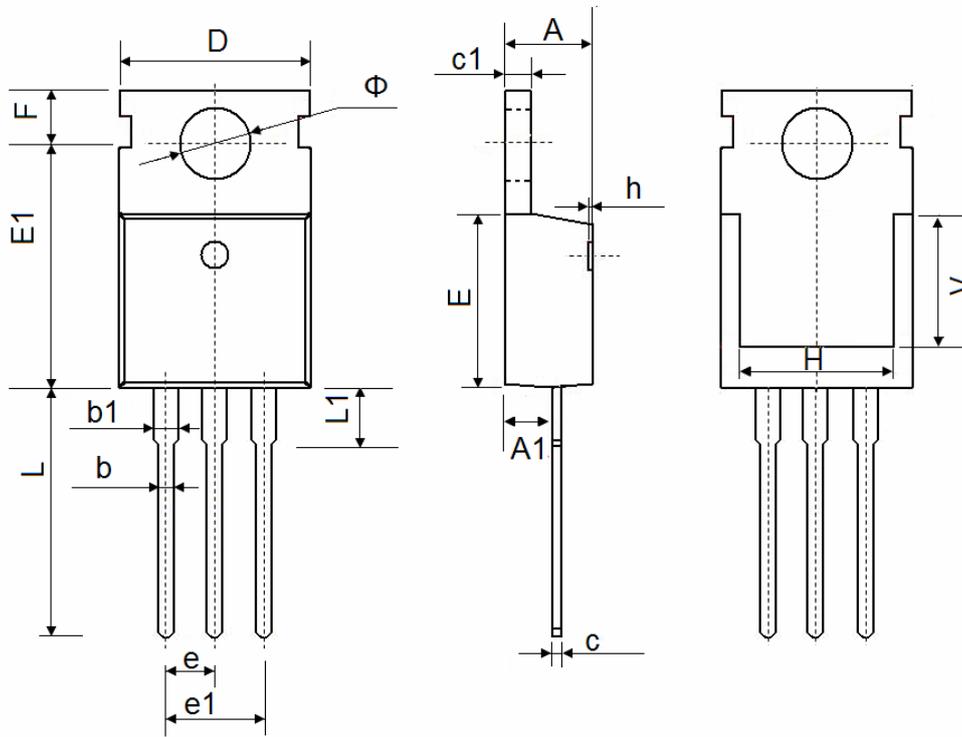
Symbol	Dimensions In Millimeters	
	Min.	Max.
A	4.350	4.650
A1	2.250	2.550
b	0.710	0.910
b1	1.170	1.400
c	0.330	0.650
c1	1.200	1.400
D	9.910	10.250
E	8.9500	9.750
E1	12.650	12.950
e	2.540 TYP.	
e1	4.980	5.180
F	2.650	2.950
H	7.900	8.100
h	0.000	0.300
L	12.700	13.500
L1	2.850	3.250
V	7.500 REF.	
Φ	3.400	3.800