

40V N-Channel Enhancement Mode MOSFET

Description

The AP220N04P/T uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 10V. This device is suitable for use as a Battery protection or in other Switching application.

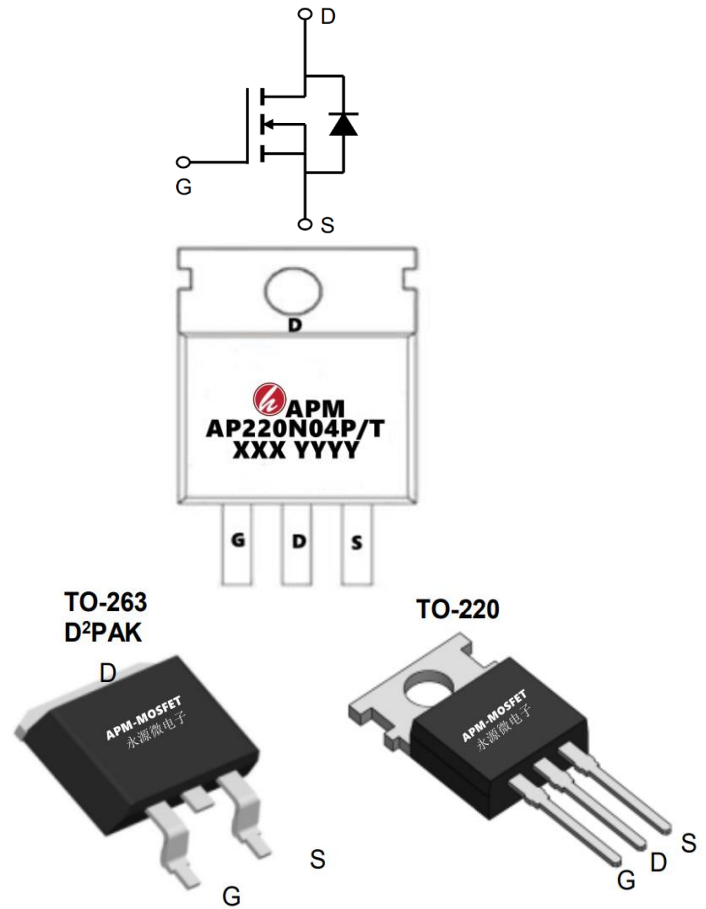
General Features

$V_{DS} = 40V$ $I_D = 220A$

$R_{DS(ON)} < 2.3m\Omega$ @ $V_{GS}=10V$ (Type: 1.6m Ω)

Application

Battery protection
Load switch
Uninterruptible power supply



Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
AP220N04P	TO-220-3L	AP220N04P XXX YYYY	1000
AP220N04T	TO-263-3L	AP220N04T XXX YYYY	800

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

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	40	V
V_{GS}	Gate-Source Voltage	± 20	V
$I_D @ T_C=25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	220	A
$I_D @ T_C=100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	124	A
IDM	Pulsed Drain Current ²	760	A
EAS	Single Pulse Avalanche Energy ³	576	mJ
IAS	Avalanche Current	48	A
$P_D @ T_C=25^\circ C$	Total Power Dissipation ⁴	197	W
$TSTG$	Storage Temperature Range	-55 to 150	$^\circ C$
T_J	Operating Junction Temperature Range	-55 to 150	$^\circ C$
$R_{\theta JA}$	Thermal Resistance Junction-ambient (Steady State) ¹	62	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	0.76	$^\circ C/W$

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Units
V(BR)DSS	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	40	49	-	V
IDSS	Zero Gate Voltage Drain Current	$V_{DS}=40V, V_{GS}=0V,$	-	-	1.0	μA
IGSS	Gate to Body Leakage Current	$V_{DS}=0V, V_{GS}= \pm 25V$	-	-	± 100	nA
VGS(th)	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2	2.8	4	V
RDS(on)	Static Drain-Source on-Resistance	$V_{GS}=10V, I_D=30A$	-	1.6	2.3	m Ω
Ciss	Input Capacitance	$V_{DS}=20V, V_{GS}=0V,$ $f=1.0MHz$	-	9060	-	pF
Coss	Output Capacitance		-	1000	-	pF
Crss	Reverse Transfer Capacitance		-	666	-	pF
Qg	Total Gate Charge	$V_{DS}=20V, I_D=30A,$ $V_{GS}=10V$	-	145	-	nC
Qgs	Gate-Source Charge		-	30	-	nC
Qgd	Gate-Drain("Miller") Charge		-	37	-	nC
td(on)	Turn-on Delay Time	$V_{DD}=20V, I_D=30A,$ $R_L=1\Omega, R_{GEN}=3\Omega,$ $V_{GS}=10V$	-	39	-	ns
tr	Turn-on Rise Time		-	56	-	ns
td(off)	Turn-off Delay Time		-	108	-	ns
tf	Turn-off Fall Time		-	71	-	ns
IS	Maximum Continuous Drain to Source Diode Forward Current		-	-	220	A
ISM	Maximum Pulsed Drain to Source Diode Forward Current		-	-	760	A
VSD	Drain to Source Diode Forward Voltage	$V_{GS}=0V, I_S=30A$	-	-	1.2	V
trr	Body Diode Reverse Recovery Time	$T_J=25^{\circ}\text{C},$ $I_F=20A, di/dt=100A/\mu s$	-	50	-	ns
Qrr	Body Diode Reverse Recovery Charge		-	81	-	nC

Note :

- 1、The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
- 2、The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- 3、The EAS data shows Max. rating . The test condition is $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5mH, R_g=25\Omega, I_{AS}=48A$
- 4、The power dissipation is limited by 150°C junction temperature
- 5、The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.

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Typical Characteristics

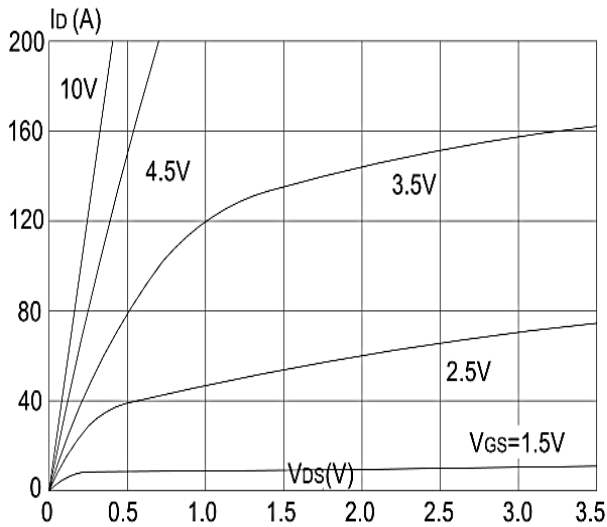


Figure1: Output Characteristics

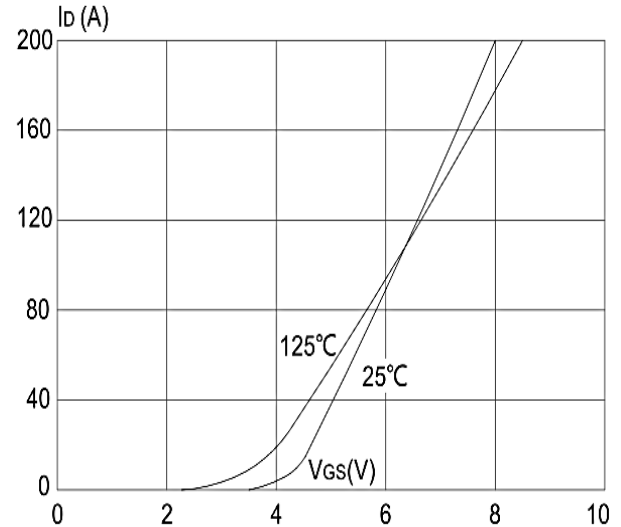


Figure 2: Typical Transfer Characteristics

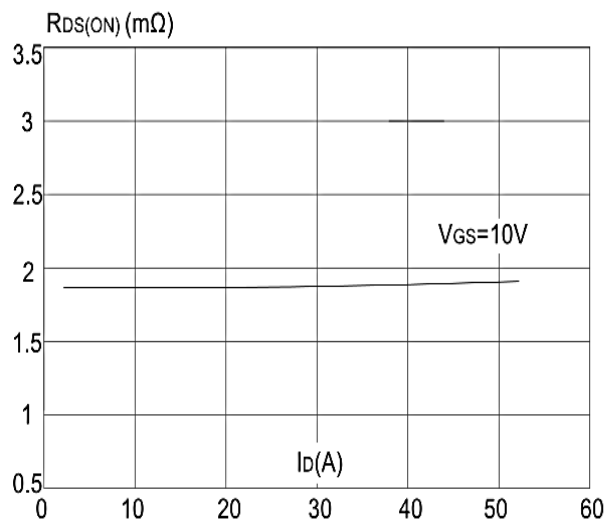


Figure 3: On-resistance vs. Drain Current

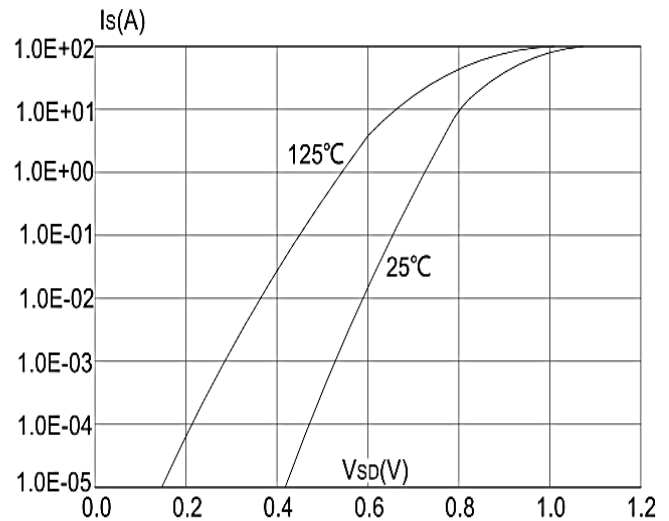


Figure 4: Body Diode Characteristics

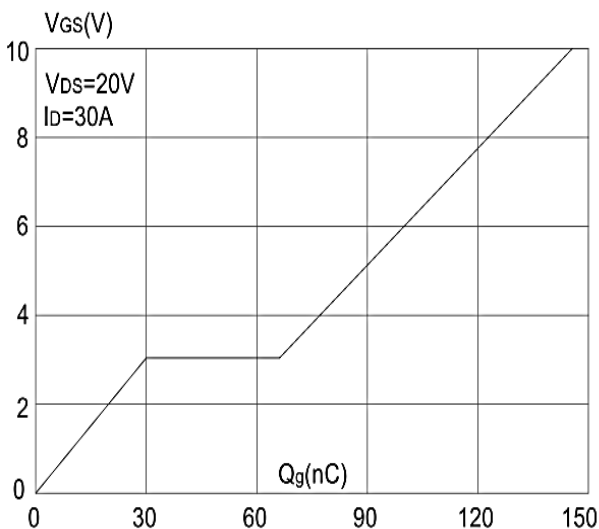


Figure 5: Gate Charge Characteristics

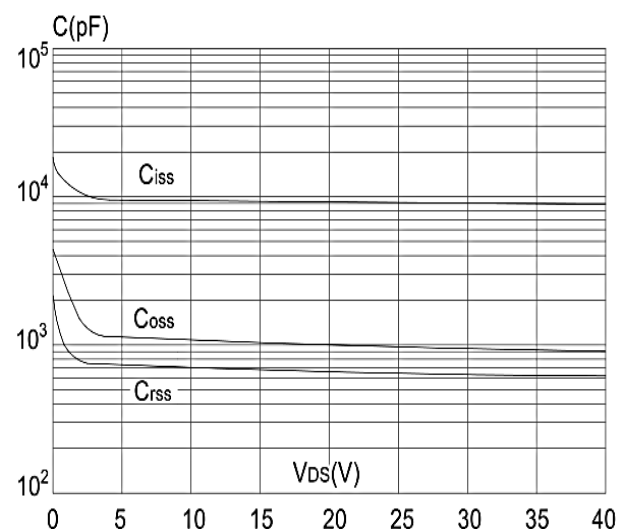


Figure 6: Capacitance Characteristics

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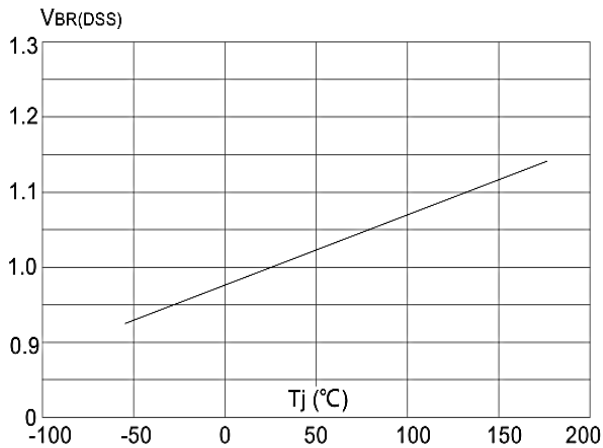


Figure 7: Normalized Breakdown Voltage vs Junction Temperature

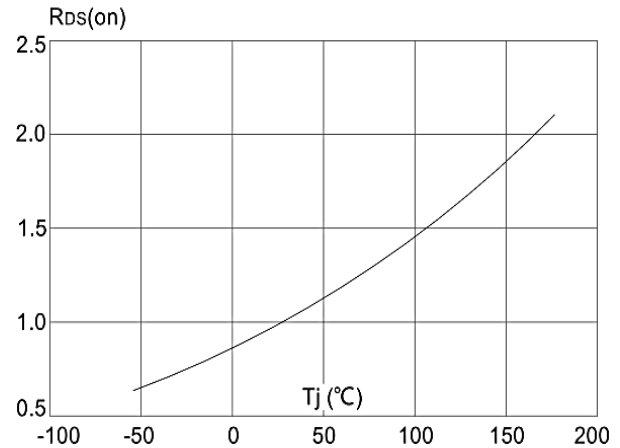


Figure 8: Normalized on Resistance vs. Junction Temperature

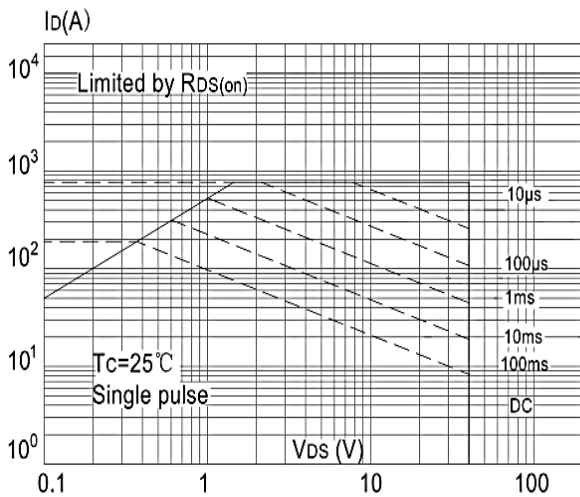


Figure 9: Maximum Safe Operating Area

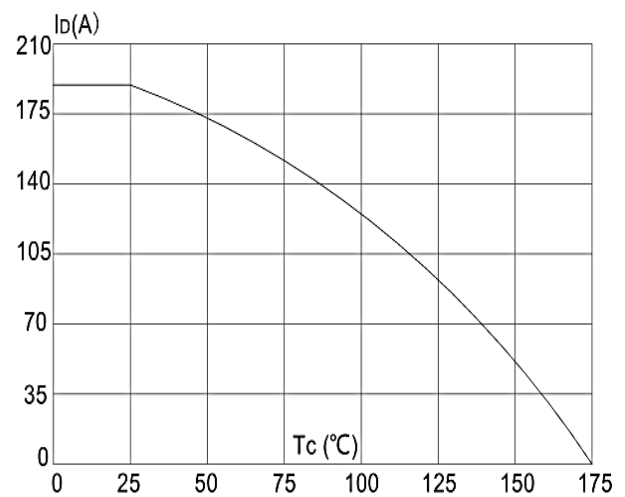


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

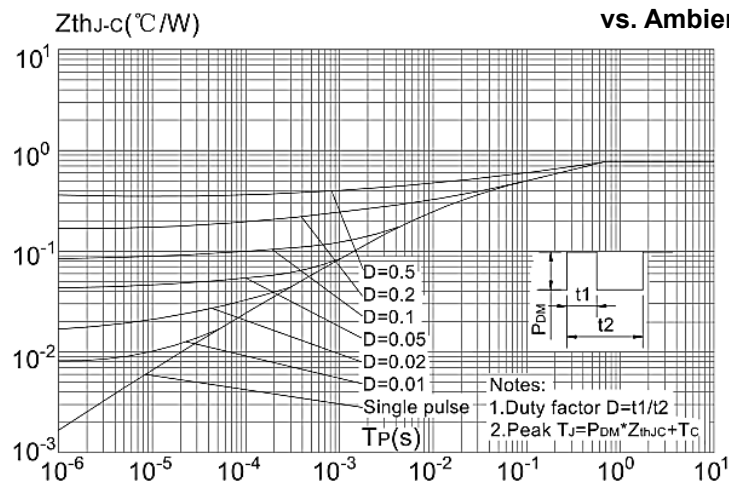
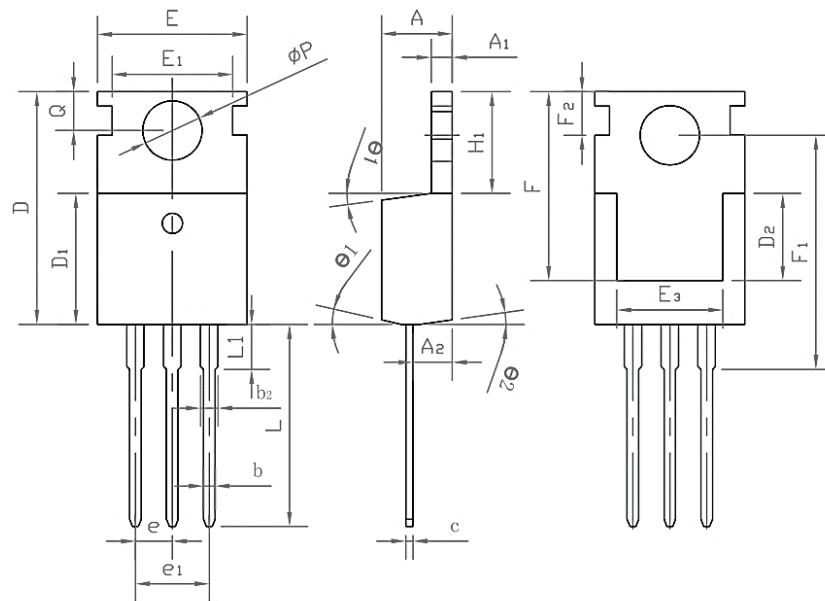


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambien

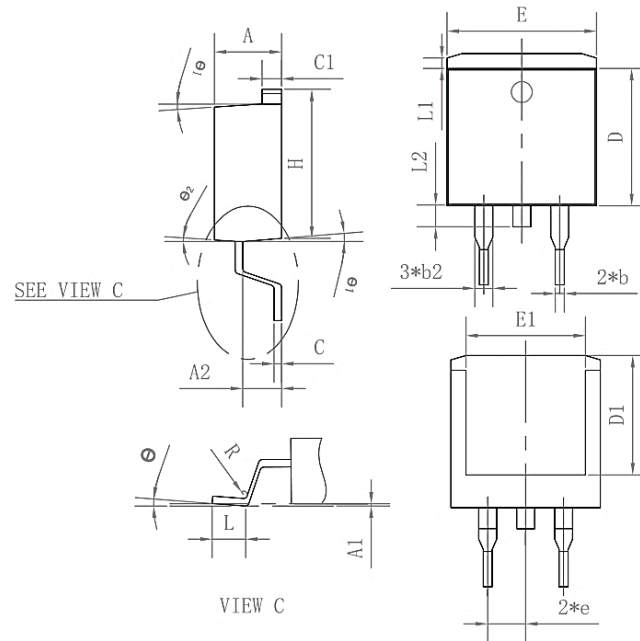
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Package Mechanical Data-TO-220-3L-SLK



Symbol	Common		
	mm		
	Mim	Nom	Max
A	4.27	4.57	4.87
A1	1.15	1.30	1.45
A2	2.10	2.40	2.70
b	0.70	0.80	1.00
b2	1.17	1.27	1.50
D	0.40	0.50	0.65
D1	8.80	9.10	9.40
D2	5.70	6.70	7.00
E	9.70	10.00	10.30
E1	-	8.70	-
E2	9.63	10.00	10.35
E3	7.00	8.00	8.40
e	0.37		
e1	0.10		
H1	6.00	6.50	6.85
L	12.75	13.50	13.90
L1	-	3.10	3.40
Φp	3.45	3.60	3.75
Q	2.60	2.80	3.00
θ1	4°	7°	10°
θ2	0°	3°	6°
F	13.30	13.50	13.70
F1	15.50	15.90	16.30
F2	2.80	3.00	3.20

40V N-Channel Enhancement Mode MOSFET Package Mechanical Data-TO-263-3L-SLK



Symbol	Common		
	mm		
	Mim	Nom	Max
A	4.35	4.47	4.60
A1	0.09	0.10	0.11
A2	2.30	2.40	2.70
b	0.70	0.80	1.00
b2	1.25	1.36	1.50
C	0.45	0.50	0.65
C1	1.29	1.30	9.40
D	9.10	9.20	9.30
D1	7.90	8.00	8.10
E	9.85	10.00	10.20
E1	7.90	8.00	8.10
H	15.30	15.50	15.70
e	-	2.54	-
L	2.34	2.54	2.74
L1	1.00	1.10	1.20
L2	1.30	1.40	1.50
R	0.24	0.25	0.26
theta	0°	4°	8°
theta1	4°	7°	10°
theta2	0°	3°	6°

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Edition	Date	Change
REV1.0	2023/8/1	Initial release

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