

40V N-Channel Enhancement Mode MOSFET

Description

The AP60N04BD uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

General Features

$V_{DS} = 40V$ $I_D = 60A$

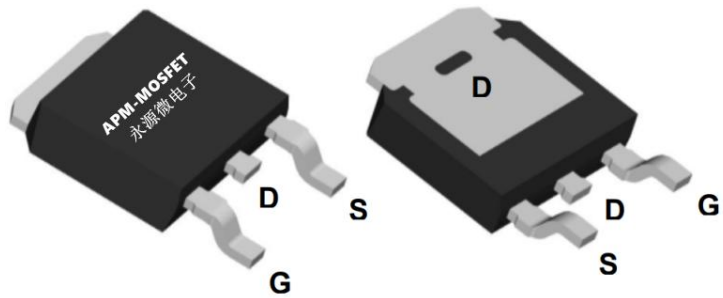
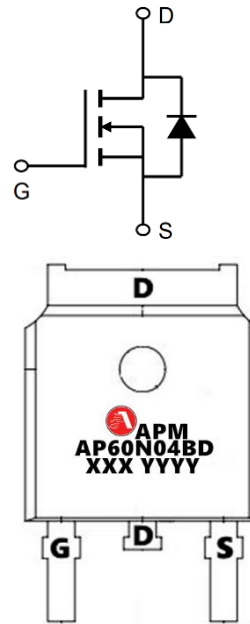
$R_{DS(ON)} < 17m\Omega$ @ $V_{GS}=10V$ (Type: 11m Ω)

Application

VBUS

Wireless impact

Mobile phone fast charging



Package Marking and Ordering Informati

Product ID	Pack	Marking	Qty(PCS)
AP60N04BD	TO252-3L	AP60N04BD XXX YYYY	2500

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

Symbol	Parameter	Value	Unit
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	60	A
$I_D@T_C=100^{\circ}C$	Continuous Drain Current, V_{GS} @ 10V ¹	25	A
IDM	Pulsed Drain Current ²	180	A
EAS	Single Pulse Avalanche Energy ³	313	mJ
IAS	Avalanche Current	25	A
$P_D@T_C=25^{\circ}C$	Total Power Dissipation ⁴	31.3	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	62.5	$^{\circ}C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	3	$^{\circ}C/W$

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BVDSS	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	40	47	---	V
$\Delta BVDSS/\Delta T_J$	BVDSS Temperature Coefficient	Reference to 25°C , $I_D=1mA$	---	0.032	---	$V/^{\circ}\text{C}$
RDS(ON)	Static Drain-Source On-Resistance ²	$V_{GS}=10V, I_D=15A$	---	11	17	m Ω
		$V_{GS}=4.5V, I_D=10A$	---	16	24	
VGS(th)	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	1.2	1.6	2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	-4.8	---	mV/ $^{\circ}\text{C}$
IDSS	Drain-Source Leakage Current	$V_{DS}=32V, V_{GS}=0V, T_J=25^{\circ}\text{C}$	---	---	1	μA
		$V_{DS}=32V, V_{GS}=0V, T_J=55^{\circ}\text{C}$	---	---	5	
IGSS	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	± 100	nA
gfs	Forward Transconductance	$V_{DS}=5V, I_D=15A$	---	34	---	S
R _g	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1MHz$	---	2.1	---	Ω
Q _g	Total Gate Charge (4.5V)	$V_{DS}=32V, V_{GS}=4.5V, I_D=15A$	---	10	---	nC
Q _{gs}	Gate-Source Charge		---	2.55	---	
Q _{gd}	Gate-Drain Charge		---	4.8	---	
Td(on)	Turn-On Delay Time	$V_{DD}=20V, V_{GS}=10V, R_G=3.3\Omega, I_D=15A$	---	2.8	---	ns
T _r	Rise Time		---	12.8	---	
Td(off)	Turn-Off Delay Time		---	21.2	---	
T _f	Fall Time		---	6.4	---	
Ciss	Input Capacitance	$V_{DS}=15V, V_{GS}=0V, f=1MHz$	---	1013	---	pF
Coss	Output Capacitance		---	107	---	
Crss	Reverse Transfer Capacitance		---	76	---	
IS	Continuous Source Current ^{1,5}	$V_G=V_D=0V, \text{Force Current}$	---	---	40	A
ISM	Pulsed Source Current ^{2,5}		---	---	85	A
VSD	Diode Forward Voltage ²	$V_{GS}=0V, I_S=1A, T_J=25^{\circ}\text{C}$	---	---	1.2	V
trr	Reverse Recovery Time	$I_F=15A, dI/dt=100A/\mu s, T_J=25^{\circ}\text{C}$	---	10	---	nS
Q _{rr}	Reverse Recovery Charge		---	3.1	---	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 $V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=25A$
- 4、The power dissipation is limited by 150°C junction temperature
- 5、The data is theoretically the same as ID and IDM , in real applications , should be limited by total power dissipation.

Typical Characteristics

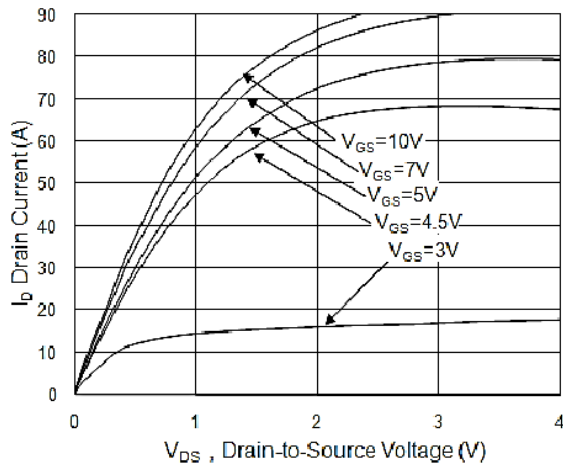


Fig.1 Typical Output Characteristics

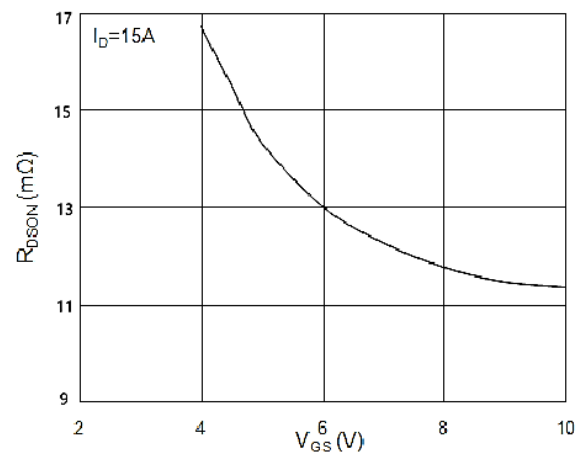


Fig.2 On-Resistance vs. G-S Voltage

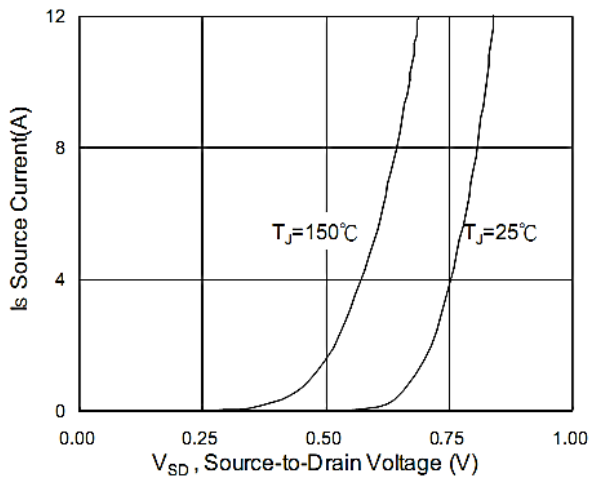


Fig.3 Forward Characteristics Of Reverse

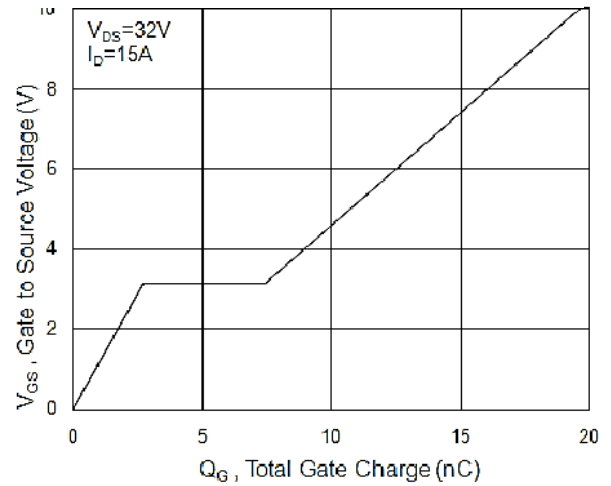


Fig.4 Gate-Charge Characteristics

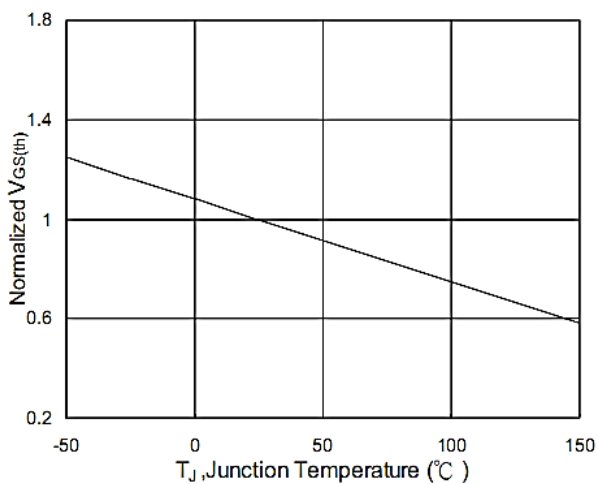


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

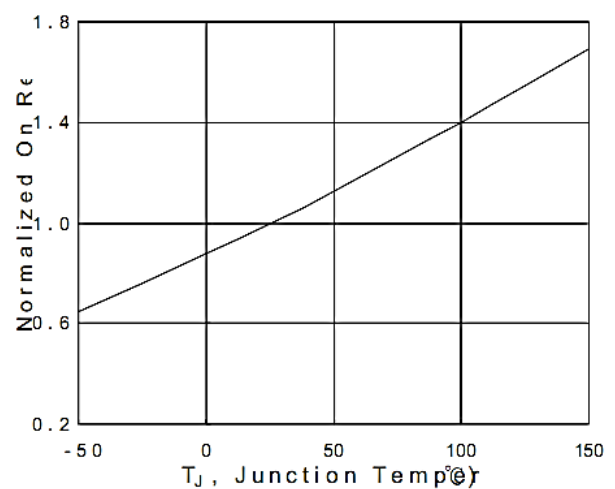


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

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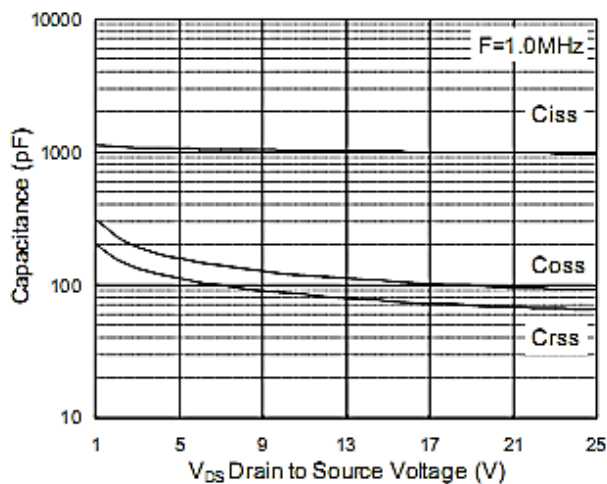


Fig.7 Capacitance

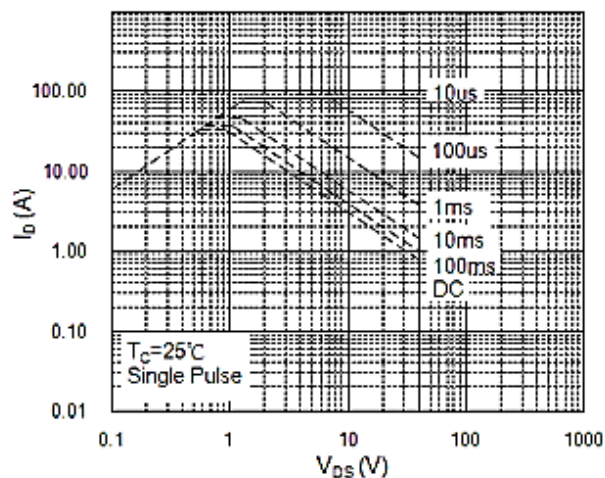


Fig.8 Safe Operating Area

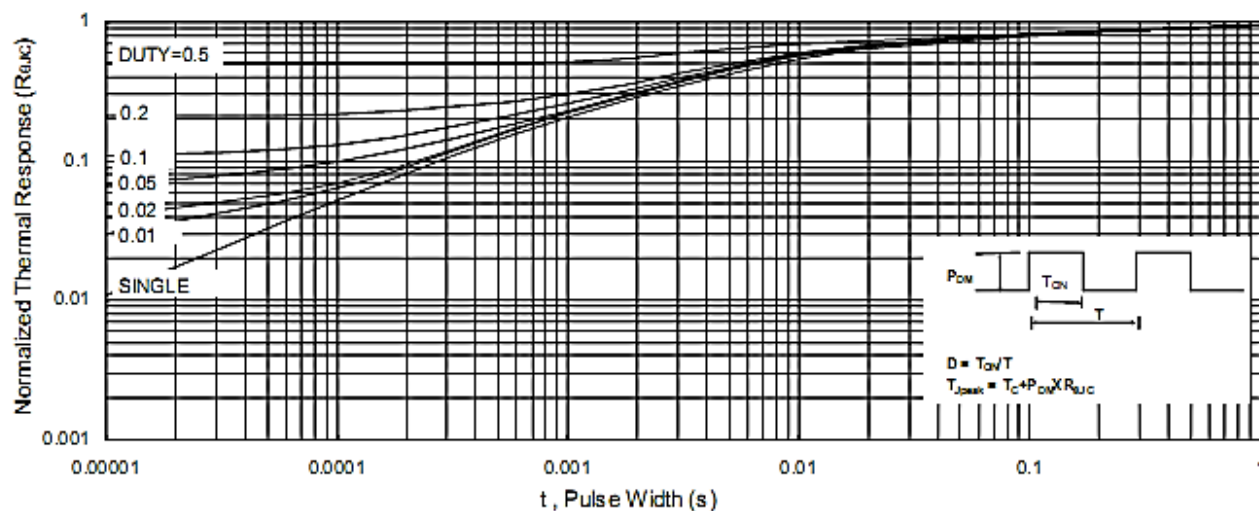


Fig.9 Normalized Maximum Transient Thermal Impedance

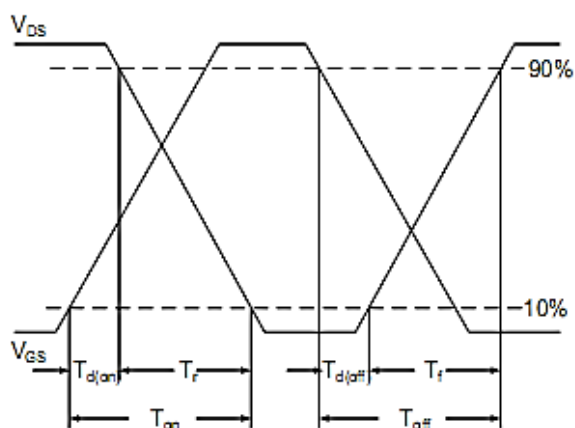


Fig.10 Switching Time Waveform

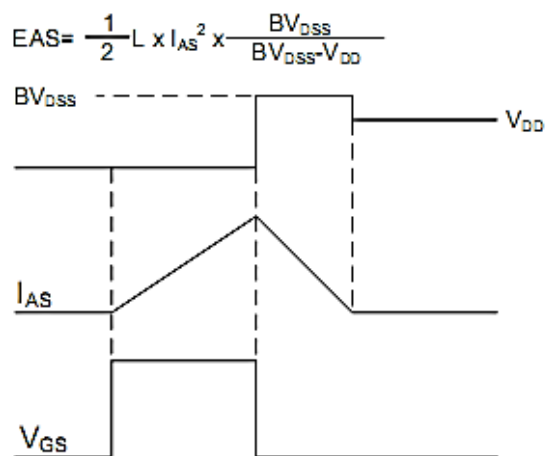
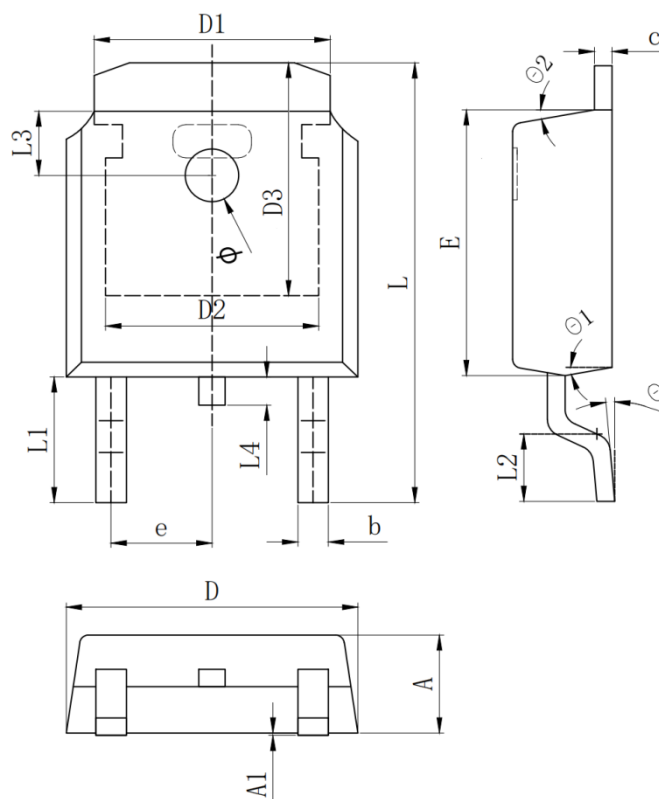


Fig.11 Unclamped Inductive Switching Waveform

Package Mechanical Data-TO252-3L



Symbol	Dimensions In Millimeters		
	min.	typ.	max.
A	2.10	2.30	2.50
A1	0.00	0.064	0.128
b	0.64	0.75	0.86
c	0.45	0.52	0.60
D	6.40	6.60	6.80
D1	5.33REF		
D2	4.83REF		
D3	5.25REF		
E	5.90	6.10	6.30
e	2.286TYP		
L	9.80	10.10	10.40
L1	2.888REF		
L2	1.40	1.50	1.70
L3	1.65REF		
L4	0.60	0.80	1.00
φ	1.10	1.20	1.30
θ	0°		10°
θ1	5°		10°
θ2	5°		10°

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Edition	Date	Change
REV1.0	2024/4/10	Initial release

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