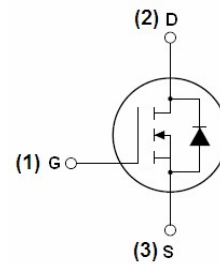N-Channel Enhancement Mode Power MOSFET

Description

The AP50N06K uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.
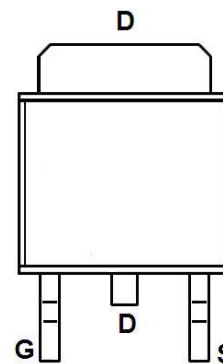
General Features

- V_{DS} =60V, I_D =50A

  $R_{DS(ON)}$ <20mΩ @ V_{GS}=10V   (Typ:13mΩ)

- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation
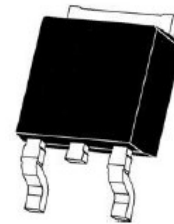- Special process technology for high ESD capability

Application

- Power switching application
- LED backlighting
- Uninterruptible power supply

Schematic diagram

Marking and pin assignment

TO-252-2L top view

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
AP50N06	AP50N06K	TO-252-2L	-	-	-

Absolute Maximum Ratings (T_C=25℃ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	±20	V
Drain Current-Continuous	I_D	50	A
Drain Current-Continuous(T_C=100℃)	I_D (100℃)	33	A
Pulsed Drain Current	I_{DM}	120	A
Maximum Power Dissipation	P_D	60	W
Debating factor		0.57	W/℃
Single pulse avalanche energy [Note 5]	E_{AS}	45	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 175	℃

N-Channel Enhancement Mode Power MOSFET

Thermal Characteristic

Thermal Resistance,Junction-to-Case[Note 2]	$R_{\theta JC}$	1.76	℃/W

Electrical Characteristics (T_C=25℃ unless otherwise noted)

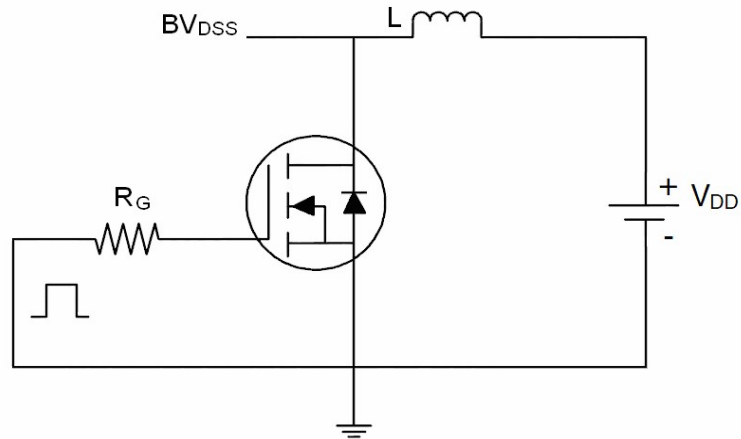| Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=250µA	60	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=60V,V_{GS}=0V	-	-	1	µA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±20V,V_{DS}=0V	-	-	±100	nA
On Characteristics [Note 3]						
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250µA	1	1.65	3	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=20A	-	13	20	mΩ
Forward Transconductance	g_{FS}	V_{DS}=5V,I_D=20A	30	-	-	S
Dynamic Characteristics [Note4]						
Input Capacitance	C_{Iss}	V_{DS}=25V,V_{GS}=0V, F=1.0MHz	-	1920	-	PF
Output Capacitance	C_{oss}		-	185	-	PF
Reverse Transfer Capacitance	C_{rss}		-	80	-	PF
Switching Characteristics [Note 4]						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=30V,I_D=2A,R_L=1Ω V_{GS}=10V,R_{GEN}=3Ω	-	12	-	nS
Turn-on Rise Time	t_r		-	5.2	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	38	-	nS
Turn-Off Fall Time	t_f		-	27	-	nS
Total Gate Charge	Q_g	V_{DS}=30V,I_D=30A, V_{GS}=10V	-	36	-	nC
Gate-Source Charge	Q_{gs}		-	9.9	-	nC
Gate-Drain Charge	Q_{gd}		-	6.6	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage [Note 3]	V_{SD}	V_{GS}=0V,I_S=30A	-	-	1.2	V
Diode Forward Current [Note 2]	I_S		-	-	48	A
Reverse Recovery Time	t_{rr}	TJ = 25°C, IF =30A di/dt = 100A/µs [Note3]	-	35		nS
Reverse Recovery Charge	Q_{rr}		-	47		nC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.

2. Surface Mounted on FR4 Board, t ≤ 10 sec.

3. Pulse Test: Pulse Width ≤ 300µs, Duty Cycle ≤ 2%.

4. Guaranteed by design, not subject to production

5. E_{AS} condition: Tj=25℃,V_{DD}=30V,V_G=10V,L=0.5mH,Rg=25Ω
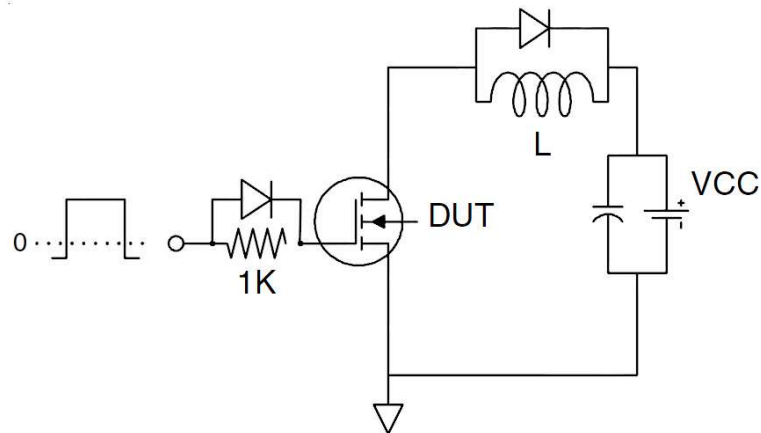
N-Channel Enhancement Mode Power MOSFET
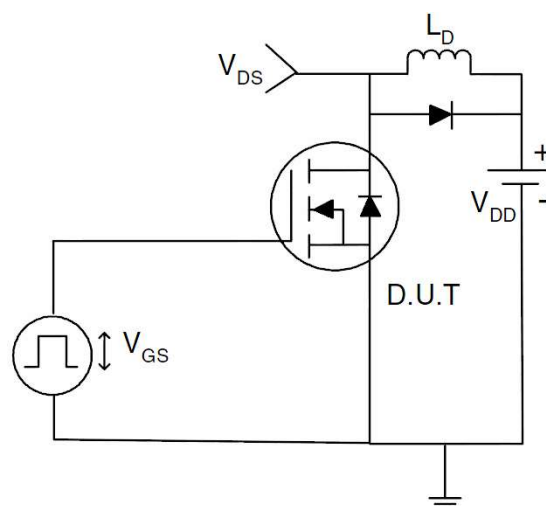
Test circuit

1) E$_{AS}$ test Circuits

2) Gate charge test Circuit

3) Switch Time Test Circuit

N-Channel Enhancement Mode Power MOSFET

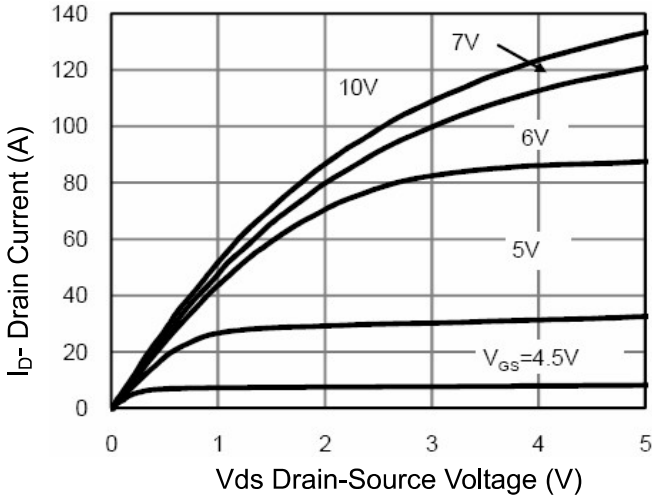## Typical Electrical and Thermal Characteristics (Curves)
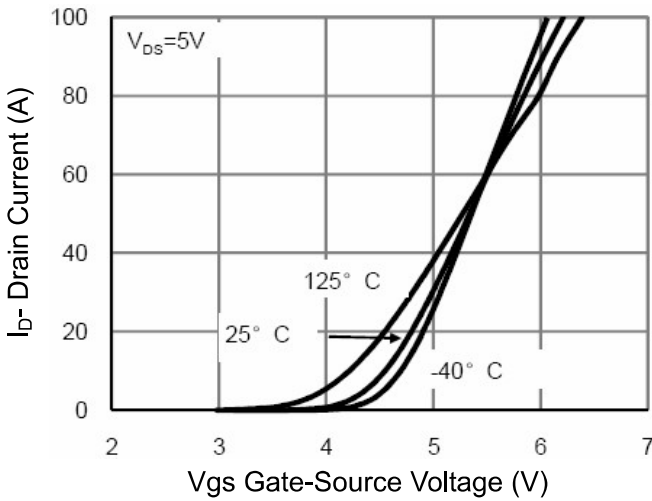
Figure 1 Output Characteristics

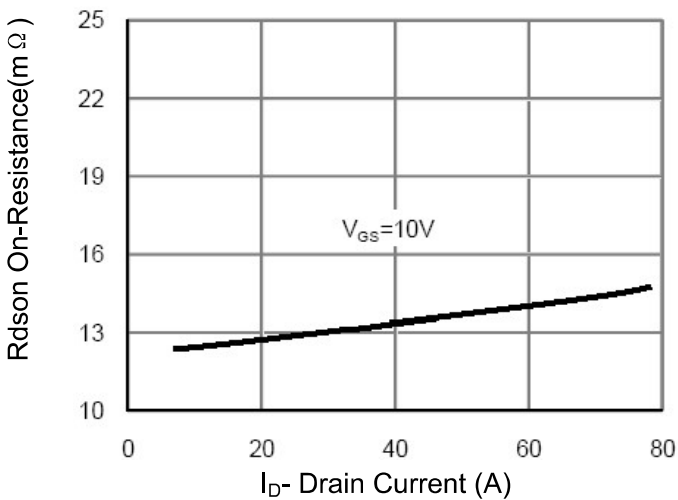*I_D* Drain Current (A) vs Vds Drain-Source Voltage (V); curves labeled 7V, 10V, 6V, 5V, V_{GS}=4.5V

Figure 4 Rdson-JunctionTemperature

Normalized On-Resistance vs T_J-Junction Temperature(℃); V_{GS}=10V, I_D=30A

Figure 2 Transfer Characteristics

I_D Drain Current (A) vs Vgs Gate-Source Voltage (V); V_{DS}=5V; curves 125°C, 25°C, -40°C

Figure 5 Gate Charge

Vgs Gate-Source Voltage (V) vs Qg Gate Charge (nC); V_{DS}=30V, I_D=30A

Figure 3 Rdson- Drain Current

Rdson On-Resistance(mΩ) vs I_D- Drain Current (A); V_{GS}=10V

Figure 6 Source- Drain Diode Forward

I_s- Reverse Drain Current (A) vs Vsd Source-Drain Voltage (V); curves 125°C, 25°, -40°C

N-Channel Enhancement Mode Power MOSFET
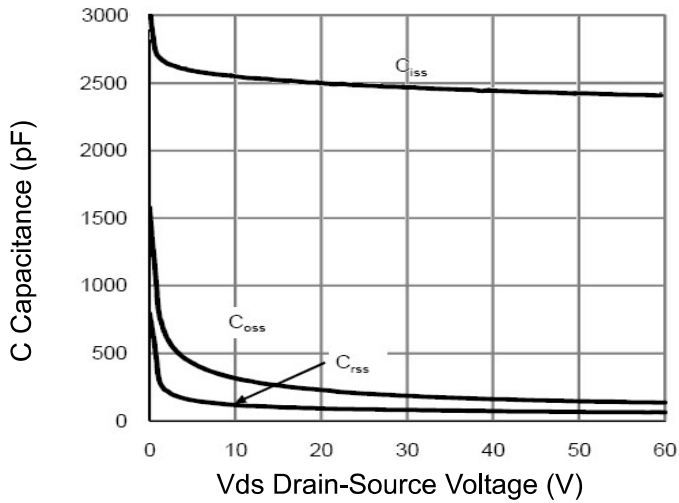

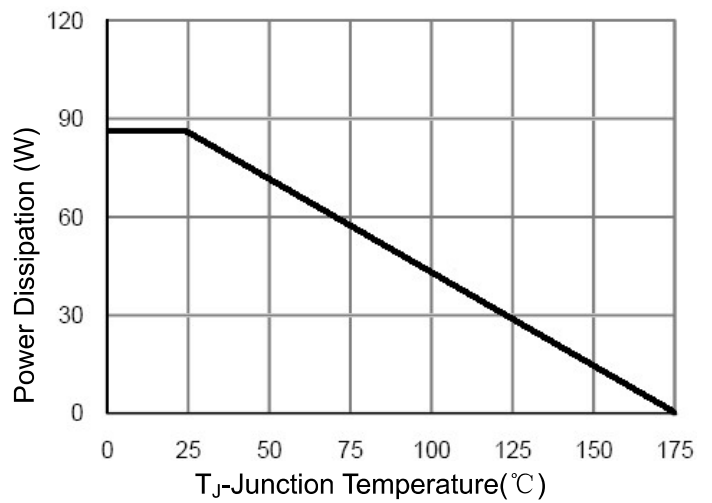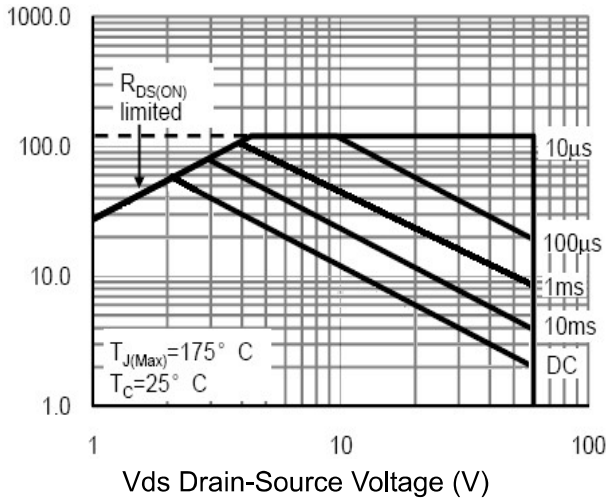**Figure 7 Capacitance vs Vds**

Figure 9 Power De-rating

Figure 8 Safe Operation Area

Figure 10 ID Current- JunctionTemperature
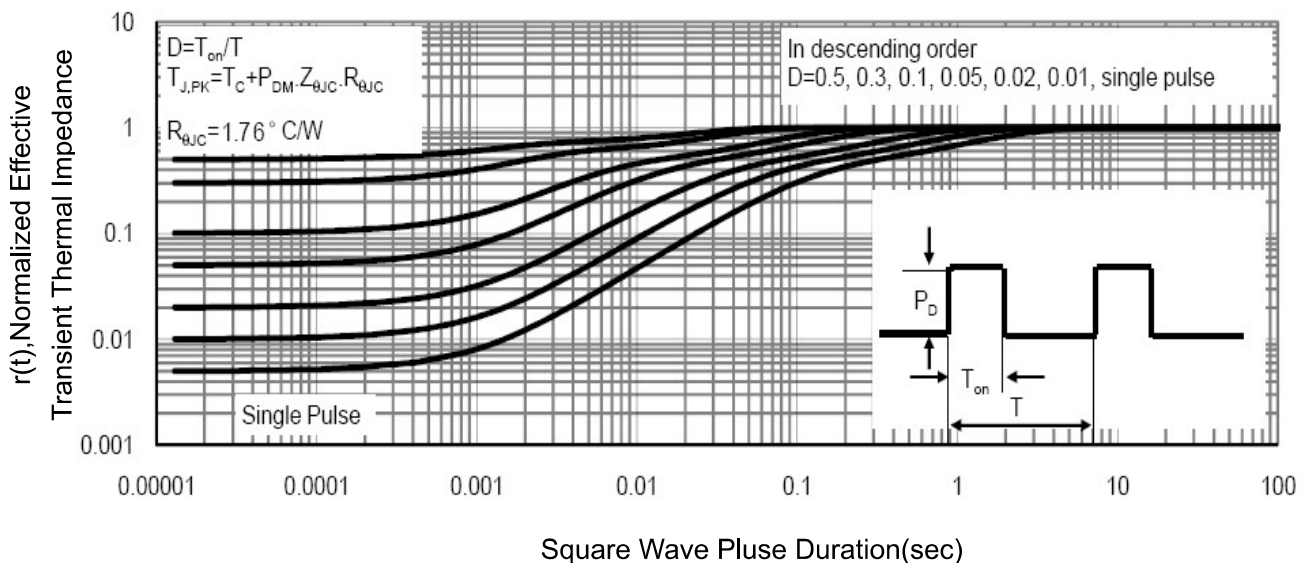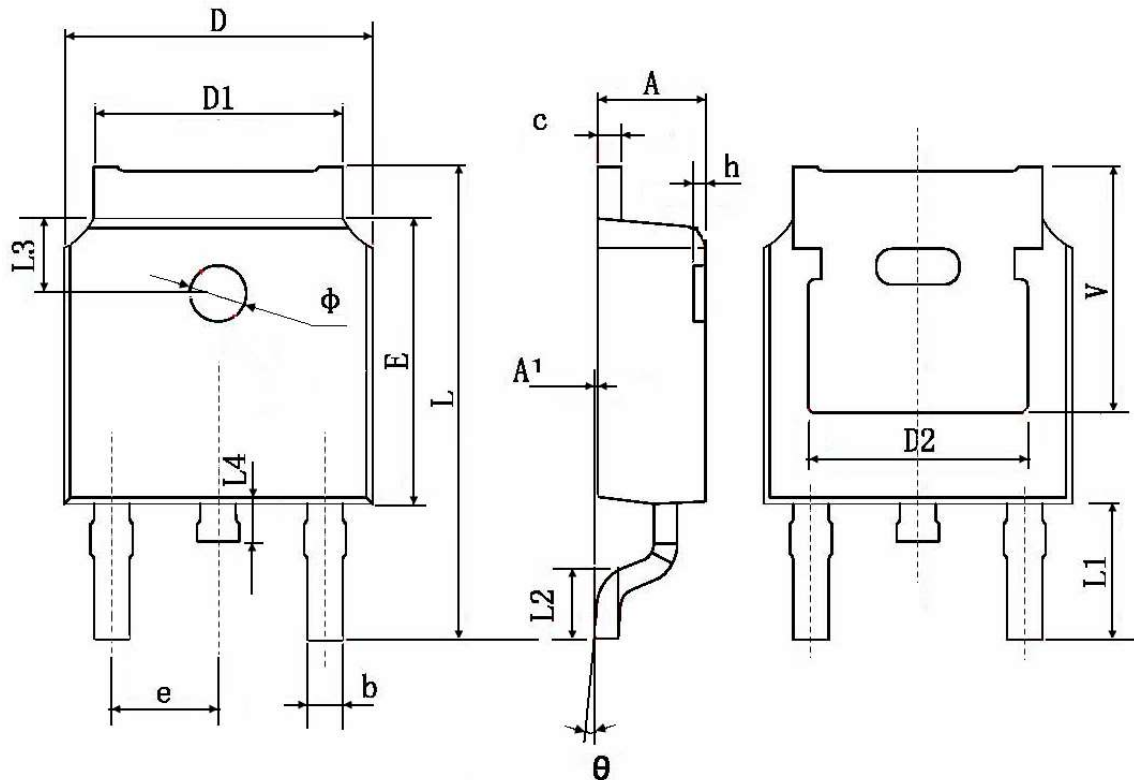

Square Wave Pluse Duration(sec)

Figure 11 Normalized Maximum Transient Thermal Impedance

N-Channel Enhancement Mode Power MOSFET

TO-252 Package Information

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	

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