



**N-channel Enhancement-mode Power MOSFET**

- Simple Drive Requirement**
- Repetitive Avalanche Rated**
- Fast Switching Speed**
- RoHS-compliant, halogen-free**

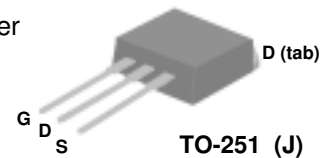


$BV_{DSS}$	600V
$R_{DS(ON)}$	8Ω
$I_D$	1.6A

**Description**

Advanced Power MOSFETs from APEC provide the designer with the best combination of fast switching, low on-resistance and cost-effectiveness.

The AP02N60H-HF-3 is in the TO-252 package which is widely preferred for commercial and industrial surface mount applications such as medium-power AC/DC converters. The through-hole TO-251 version (AP02N60J-HF-3) is available where a small PCB footprint or attached heatsink is required.



**Absolute Maximum Ratings**

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	600	V
$V_{GS}$	Gate-Source Voltage	± 30	V
$I_D$ at $T_C=25^\circ C$	Continuous Drain Current <sup>3</sup>	1.6	A
$I_D$ at $T_C=100^\circ C$	Continuous Drain Current <sup>3</sup>	1	A
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	6	A
$P_D$ at $T_C=25^\circ C$	Total Power Dissipation	39	W
	Linear Derating Factor	0.31	W/°C
$E_{AS}$	Single Pulse Avalanche Energy <sup>2</sup>	64	mJ
$I_{AR}$	Avalanche Current	1.6	A
$E_{AR}$	Repetitive Avalanche Energy	0.5	mJ
$T_{STG}$	Storage Temperature Range	-55 to 150	°C
$T_J$	Operating Junction Temperature Range	-55 to 150	°C

**Thermal Data**

Symbol	Parameter	Value	Unit
Rthj-a	Maximum Thermal Resistance, Junction-case	3.2	°C/W
Rthj-a	Maximum Thermal Resistance, Junction-ambient (PCB mount) <sup>4</sup>	62.5	°C/W
Rthj-c	Maximum Thermal Resistance, Junction-ambient	110	°C/W

**Ordering Information**

**AP02N60H-HF-3TR** : in RoHS-compliant halogen-free TO-252 shipped on tape and reel (3000 pcs/reel)

**AP02N60J-HF-3TB** : in RoHS-compliant halogen-free TO-251 shipped in tubes (80pcs/tube)



**Electrical Specifications at  $T_j=25^\circ\text{C}$  (unless otherwise specified)**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	600	-	-	V
$\Delta BV_{DSS}/\Delta T_j$	Breakdown Voltage Temperature Coefficient	Reference to $25^\circ\text{C}$ , $I_D=1\text{mA}$	-	0.6	-	V/ $^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10V, I_D=1A$	-	-	8.0	$\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2	-	4	V
$g_{fs}$	Forward Transconductance	$V_{DS}=10V, I_D=1.0A$	-	0.2	-	S
$I_{DSS}$	Drain-Source Leakage Current ( $T_j=25^\circ\text{C}$ )	$V_{DS}=600V, V_{GS}=0V$	-	-	10	$\mu A$
	Drain-Source Leakage Current ( $T_j=150^\circ\text{C}$ )	$V_{DS}=480V, V_{GS}=0V$	-	-	100	$\mu A$
$I_{GSS}$	Gate-Source Leakage	$V_{GS}=\pm 30V$	-	-	$\pm 100$	nA
$Q_g$	Total Gate Charge <sup>3</sup>	$I_D=1.6A$	-	14	20	nC
$Q_{gs}$	Gate-Source Charge	$V_{DS}=480V$	-	2	-	nC
$Q_{gd}$	Gate-Drain ("Miller") Charge	$V_{GS}=10V$	-	8.5	-	nC
$t_{d(on)}$	Turn-on Delay Time <sup>3</sup>	$V_{DD}=300V$	-	9.5	-	ns
$t_r$	Rise Time	$I_D=1.6A$	-	12	-	ns
$t_{d(off)}$	Turn-off Delay Time	$R_G=10\Omega, V_{GS}=10V$	-	21	-	ns
$t_f$	Fall Time	$R_D=150\Omega$	-	9	-	ns
$C_{iss}$	Input Capacitance	$V_{GS}=0V$	-	155	240	pF
$C_{oss}$	Output Capacitance	$V_{DS}=25V$	-	27	-	pF
$C_{rss}$	Reverse Transfer Capacitance	$f=1.0\text{MHz}$	-	14	-	pF

**Source-Drain Diode**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{SD}$	Forward On Voltage <sup>3</sup>	$I_S=1.6A, V_{GS}=0V$	-	-	1.5	V
$t_{rr}$	Reverse Recovery Time <sup>2</sup>	$I_S=1.6A, V_{GS}=0V$	-	360	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di/dt=100A/\mu s$	-	1970	-	nC

**Notes:**

1. Pulse width limited by safe operating area
2. Starting  $T_j=25^\circ\text{C}$ ,  $V_{DD}=50V$ ,  $L=50\text{mH}$ ,  $R_G=25\Omega$ ,  $I_{AS}=1.6A$ .
3. Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
4. Surface mounted on 1 in<sup>2</sup> copper pad of FR4 board

THIS PRODUCT IS SENSITIVE TO ELECTROSTATIC DISCHARGE, PLEASE HANDLE WITH CAUTION.

USE OF THIS PRODUCT AS A CRITICAL COMPONENT IN LIFE SUPPORT OR OTHER SIMILAR SYSTEMS IS NOT AUTHORIZED.

APEC DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

APEC RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN.



Typical Electrical Characteristics

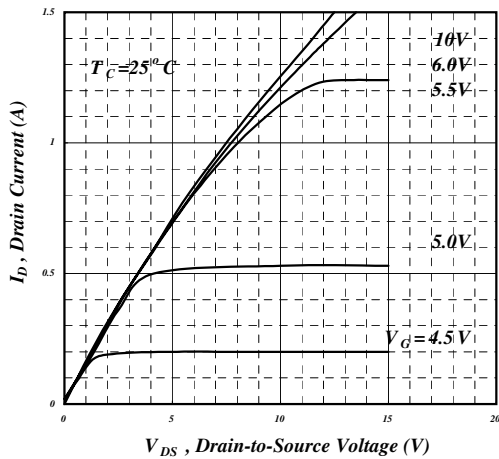


Fig 1. Typical Output Characteristics

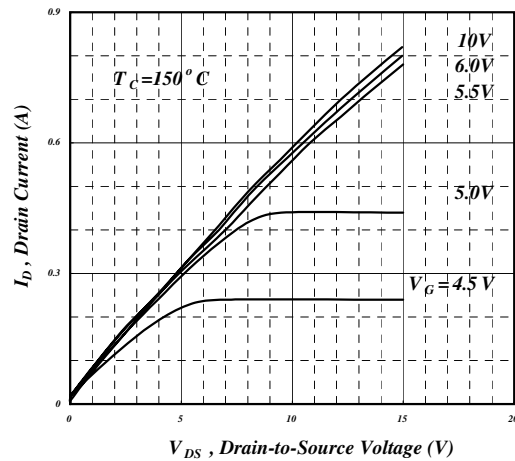


Fig 2. Typical Output Characteristics

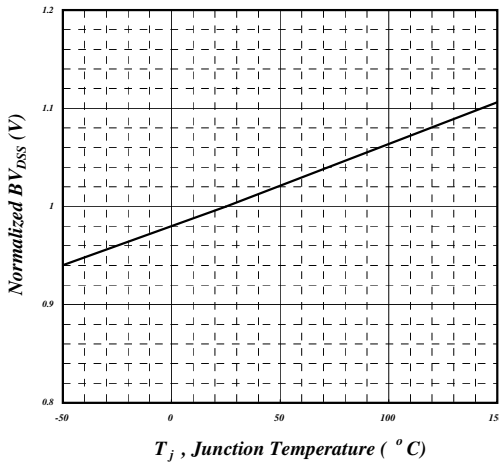


Fig 3. Normalized  $BV_{DSS}$  vs. Junction Temperature

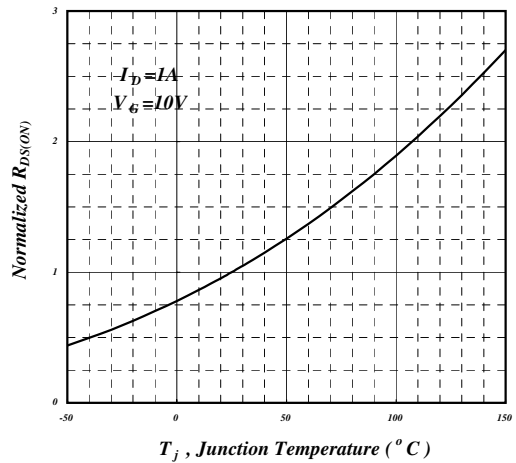


Fig 4. Normalized  $R_{DS(on)}$  vs. Junction Temperature

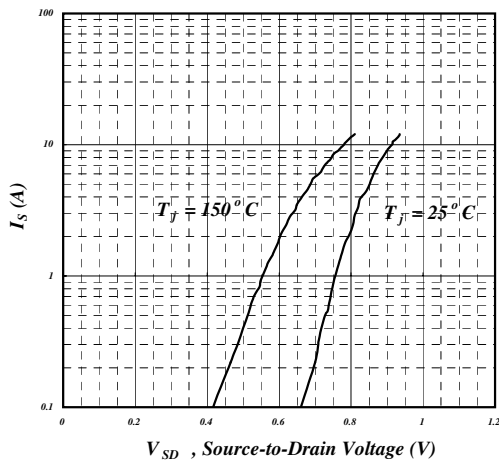


Fig 5. Forward Characteristic of Reverse Diode

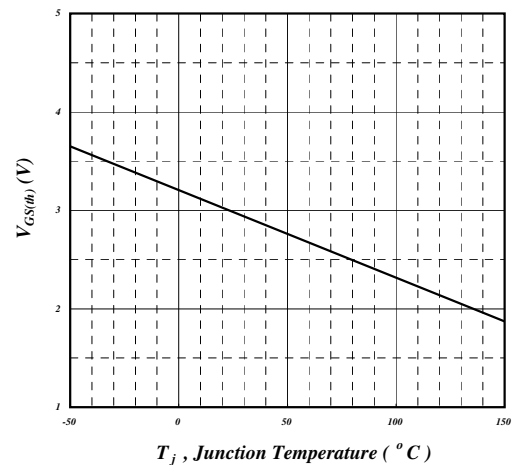


Fig 6. Gate Threshold Voltage vs. Junction Temperature



Typical Electrical Characteristics (cont.)

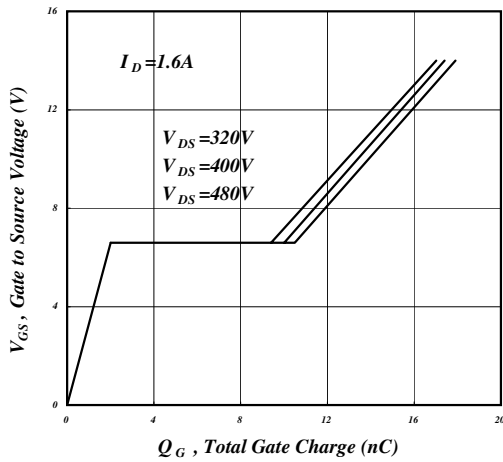


Fig 7. Gate Charge Characteristics

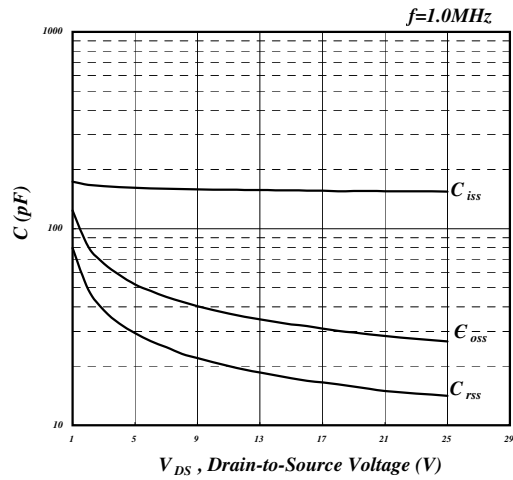


Fig 8. Typical Capacitance Characteristics

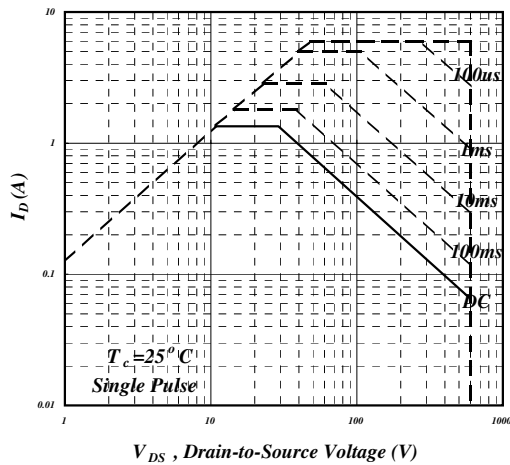


Fig 9. Maximum Safe Operating Area

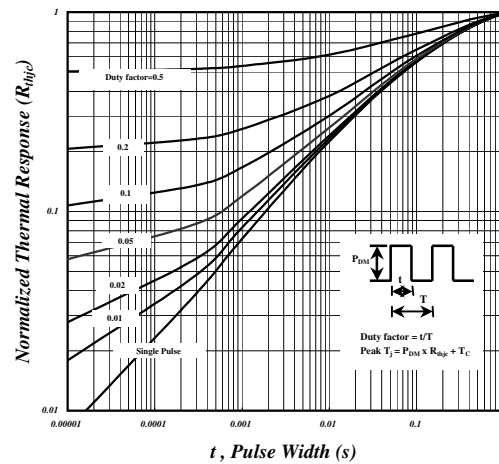


Fig 10. Effective Transient Thermal Impedance

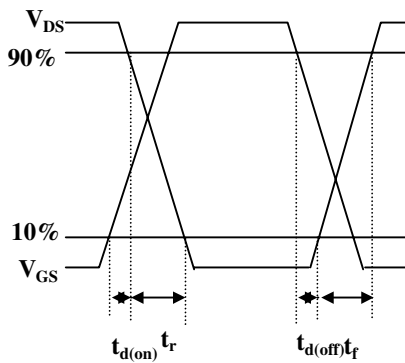


Fig 11. Switching Time Waveforms

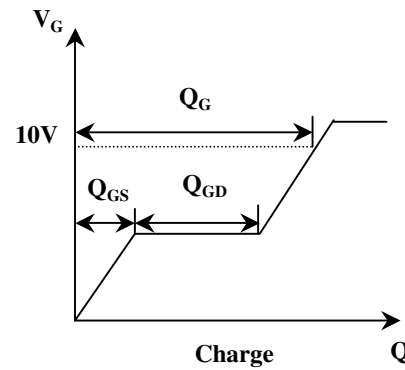
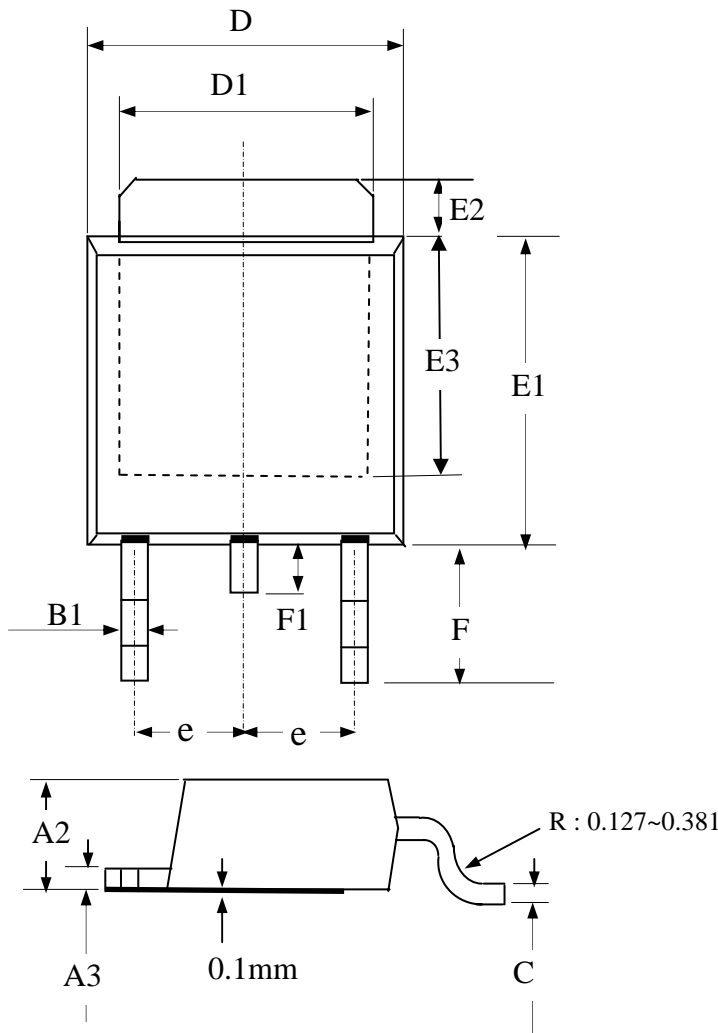


Fig 12. Gate Charge Waveform



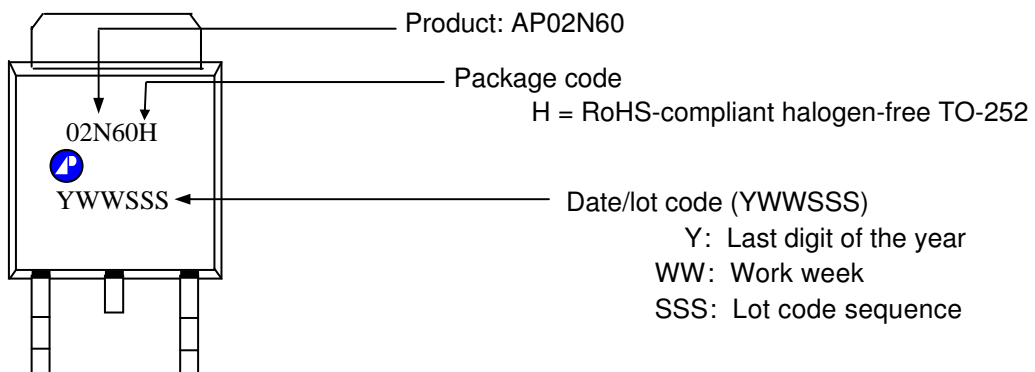
**Package Dimensions: TO-252**



SYMBOLS	Millimeters		
	MIN	NOM	MAX
A2	1.80	2.30	2.80
A3	0.40	0.50	0.60
B1	0.40	0.70	1.00
D	6.00	6.50	7.00
D1	4.80	5.35	5.90
E3	3.50	4.00	4.50
F	2.20	2.63	3.05
F1	0.50	0.85	1.20
E1	5.10	5.70	6.30
E2	0.50	1.10	1.80
e	--	2.30	--
C	0.35	0.50	0.65

1. All dimensions are in millimeters.
2. Dimensions do not include mold protrusions.

**Marking Information: TO-252**

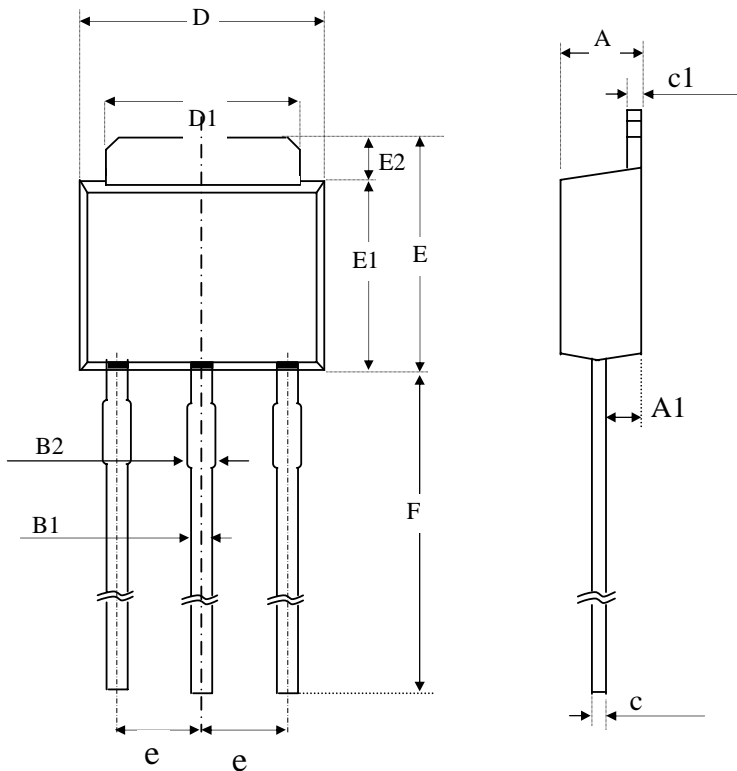


**Packing:**

Parts are shipped on tape and reel, 3000pcs per reel. The reel is sealed in a moisture barrier bag (MBB). Once the bag is opened, the parts should be considered moisture-sensitive, as defined in IPC/JEDEC standard, J-STD-020C, with MSL=3, and handled accordingly.



**Package Dimensions: TO-251**



SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	2.20	2.30	2.40
A1	0.90	1.20	1.50
B1	0.40	0.60	0.80
B2	0.60	0.85	1.05
c	0.40	0.50	0.60
c1	0.40	0.50	0.60
D	6.40	6.60	6.80
D1	4.80	5.20	5.50
E	6.70	7.00	7.30
E1	5.40	5.60	5.80
E2	1.30	1.50	1.70
e	----	2.30	----
F	7.00	8.30	9.60

1. All dimensions are in millimeters.
2. Dimensions do not include mold protrusions.

**Marking Information:**

