

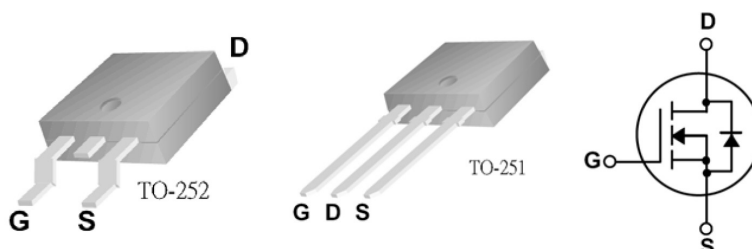
1 Description

These N-Channel enhancement mode power field effect transistors are produced using planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction based on half bridge topology.

2 Features

- 600V / 4A
- $R_{DS(on)} = 1.9\Omega(\text{typ})$, $V_{GS} = 10\text{V}$, $I_D = 2.4\text{A}$
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability..



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

Symbol	Parameter	APQ04SN60CA-XXM0	APQ04SN60CB-XXM0	Units
		APQ04SN60CA-XXJ0	APQ04SN60CB-XXM1	
		--	APQ04SN60CB-XXJ1	
		TO-251	TO-252	
V_{DSS}	Drain-Source Voltage	600		V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$)	4		A
		2.5		A
I_{DM}	Drain Current - Pulsed ①	16		A
V_{GS}	Gate-Source Voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy ②	260		mJ
I_{AR}	Avalanche Current ①	4		A
E_{AR}	Repetitive Avalanche Energy ①	10		mJ
dv/dt	Peak Diode Recovery dv/dt ③	5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$) - De-rate above 25°C	100		W
		0.8		W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		$^\circ\text{C}$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300		$^\circ\text{C}$

* note :

- ① Repetitive Rating: Pulse width limited by maximum junction temperature.
- ② $V_{DD} = 50\text{V}$, starting $T_J = 25^\circ\text{C}$, $L = \text{TBD}$ $R_G = 25\Omega$, $I_{AS} = 4\text{A}$
- ③ $I_{SD} \leq 4\text{A}$, $di/dt \leq 100\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150^\circ\text{C}$.



DEVICE SPECIFICATION

APQ04SN60CA
APQ04SN60CB

600V/4A N-Channel MOSFET

4 Thermal Characteristics

Symbol	Parameter	APQ04SN60CA-XXM0	APQ04SN60CB-XXM0	Units
		APQ04SN60CA-XXJ0	APQ04SN60CB-XXM1	
		--	APQ04SN60CB-XXJ1	
		TO-251	TO-252	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.25		$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	100		$^{\circ}\text{C}/\text{W}$

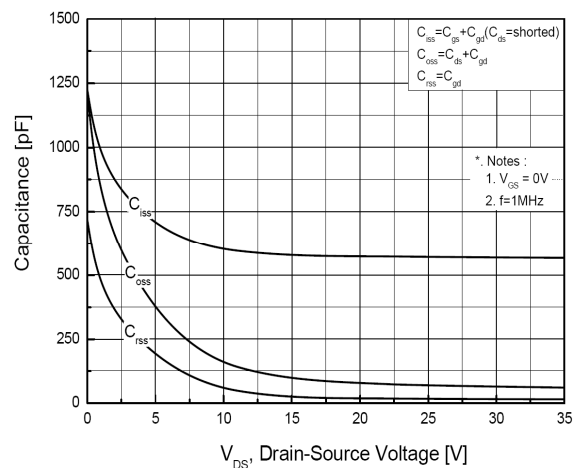
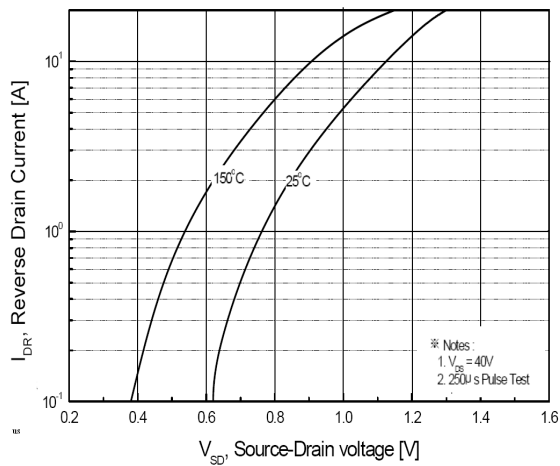
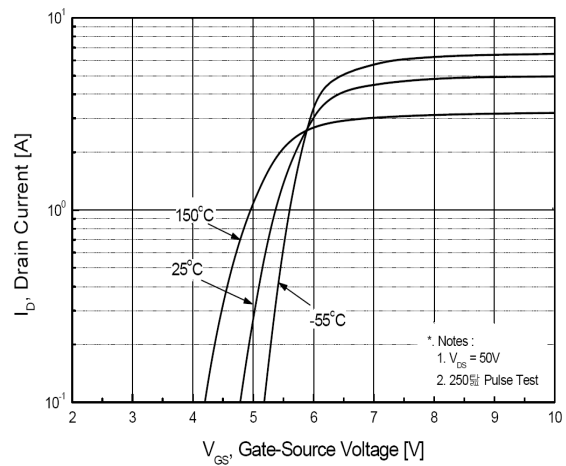
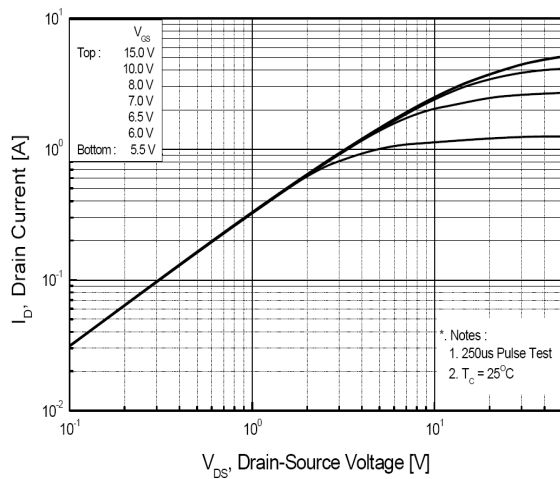
5 Electrical Characteristics $T_C = 25^{\circ}\text{C}$ unless otherwise noted

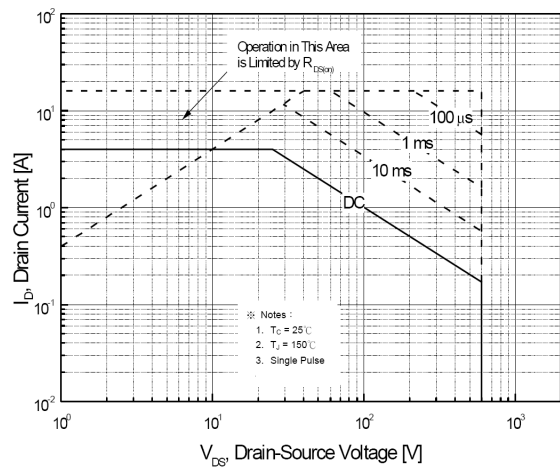
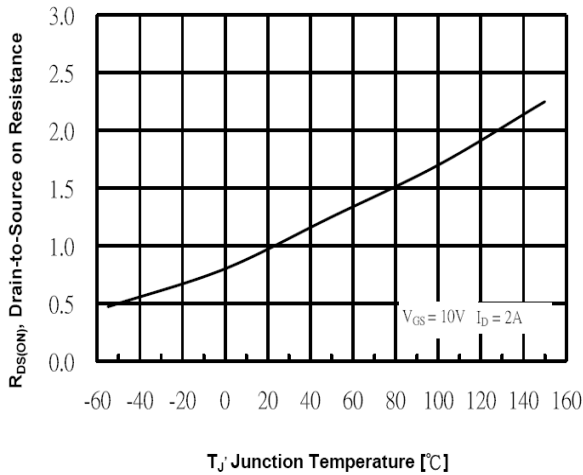
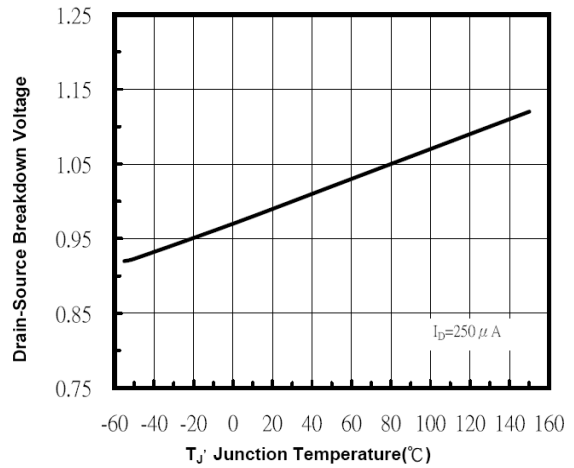
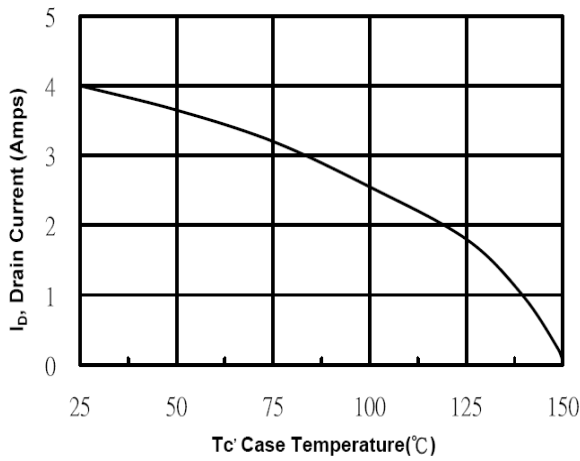
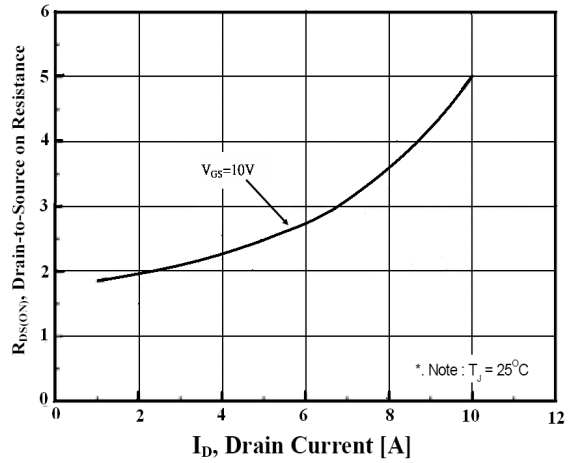
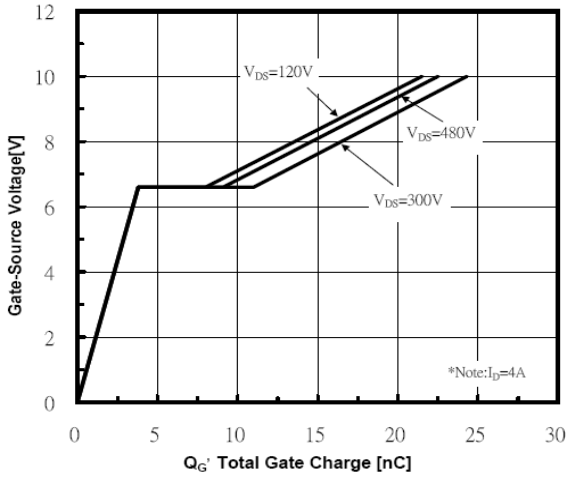
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	600	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	--	0.6	--	$\text{V}/^{\circ}\text{C}$
I_{DSS}	Gate to Source leakage current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 2.4\text{ A}$	--	1.9	2.3	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 2.0\text{ A}$ ④	--	--	15	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	--	575	--	pF
C_{oss}	Output Capacitance		--	67	--	pF
C_{rss}	Reverse Transfer Capacitance		--	12	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300\text{ V}, I_D = 4\text{ A}, R_G = 25\ \Omega$ ④	--	11	--	ns
t_r	Turn-On Rise Time		--	36	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	46	--	ns
t_f	Turn-Off Fall Time		--	42	--	ns
Q_g	Total Gate Charge	$V_{DS} = 480\text{ V}, I_D = 4\text{ A}, V_{GS} = 10\text{ V}$ ④	--	16	--	nC
Q_{gs}	Gate-Source Charge		--	2.9	--	nC
Q_{gd}	Gate-Drain Charge		--	6.3	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current	--	--	4	--	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current	--	--	16	--	A

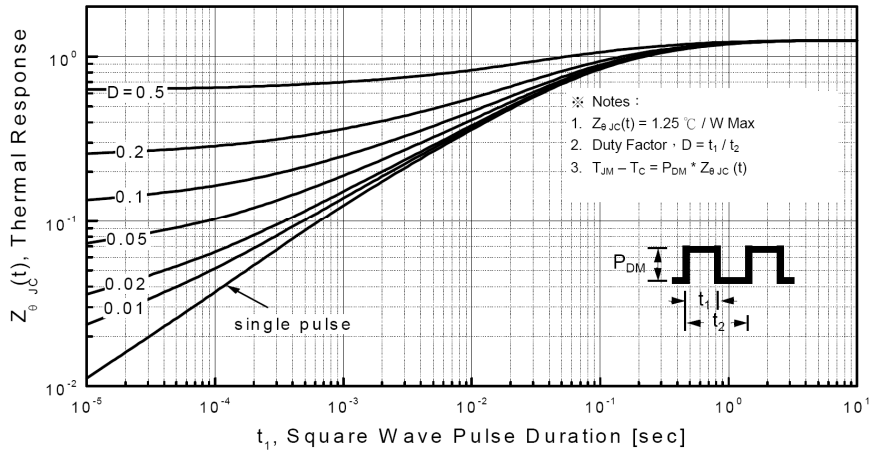
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2\text{ A}$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 4\text{ A},$ $di_F/dt = 100\text{ A}/\mu\text{s}$ ④	--	310	--	ns
Q_{rr}	Reverse Recovery Charge		--	2.3	--	μC

Notes:

- ① Repetitive Rating: Pulse width limited by maximum junction temperature.
- ② VDD=50V, starting $T_J=25^\circ\text{C}$, L=TDB, $R_G=25\Omega$, $I_{AS}=4\text{A}$
- ③ $I_{SD} \leq 4\text{A}$, $di/dt \leq 100\text{A}/\mu\text{s}$, $V_{DD} \leq V(\text{BR})\text{DSS}$, $T_J \leq 150^\circ\text{C}$
- ④ Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$. Depend on FT Test.
- ⑤ CP Test

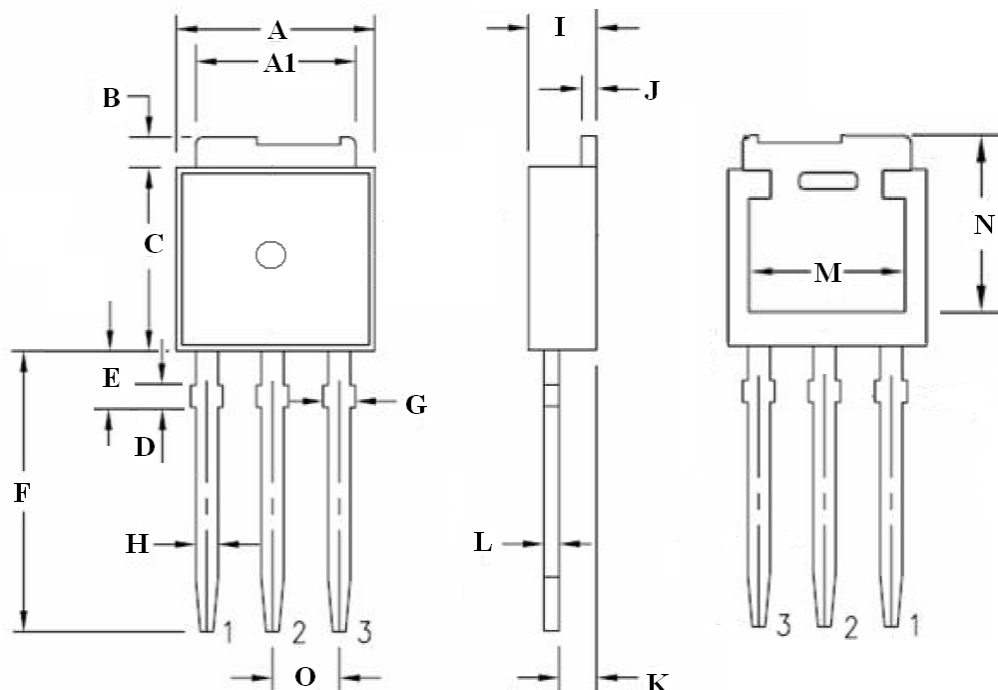






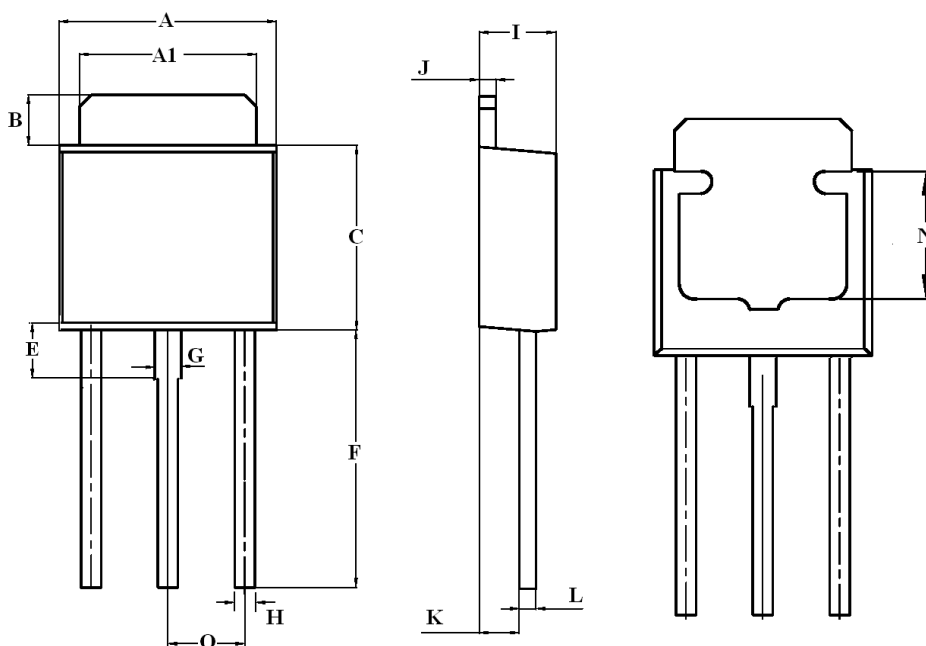
6 Package Dimensions

APQ04SN60CA-XXM0 TO-251



TO-251 DIMENSION							
DIM	MILLIMETERS						
	MIN	MAX	TYP.	DIM	MIN	MAX	TYP
A	6.35	6.73	6.54	H	0.64	0.89	0.77
A1	4.95	5.46	5.21	I	2.18	2.39	2.29
B	0.89	1.27	1.08	J	0.46	0.89	0.66
C	5.97	6.22	6.10	K	0.89	1.14	1.02
D	1.14	1.52	1.33	L	0.46	0.61	0.54
E	1.91	2.29	2.10	M	4.32	--	--
F	8.89	9.65	9.27	N	5.21	-	-
G	0.84	1.14	0.99	O	2.29 BSC		

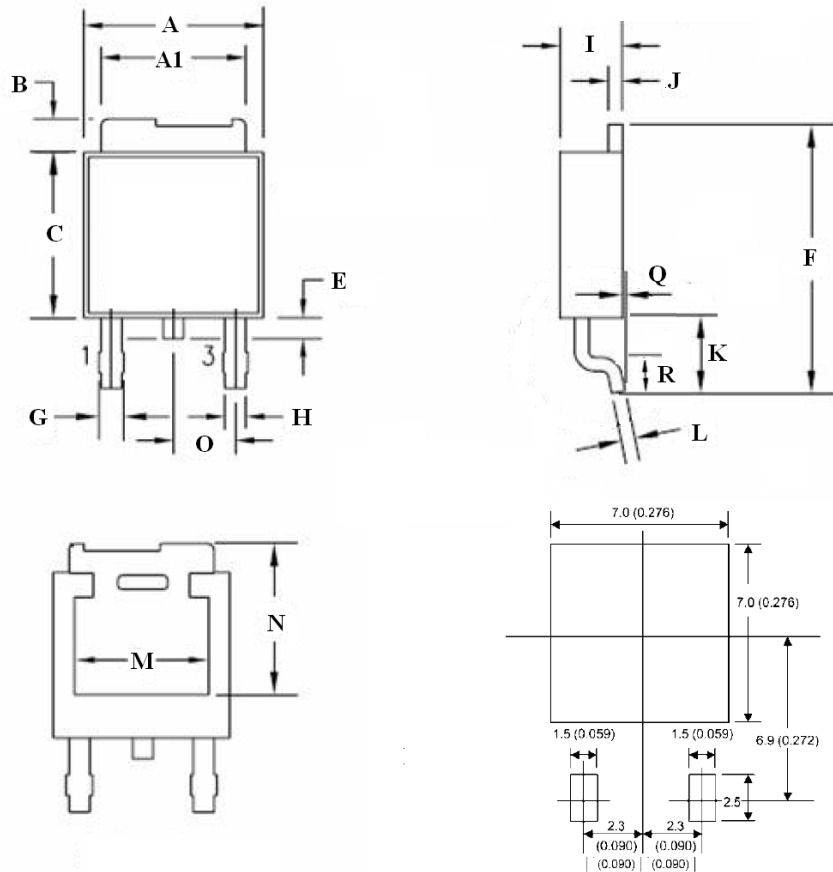
APQ04SN60CA-XXJ0

TO-251


TO-251 DIMENSION							
DIM	MILLIMETERS						
	MIN	MAX	TYP.	DIM	MIN	MAX	TYP
A	6.350	6.650	6.50	H	0.500	0.700	0.600
A1	5.200	5.400	5.300	I	2.200	2.400	2.300
B	1.350	1.650	1.500	J	0.430	0.580	0.505
C	5.400	5.700	5.550	K	1.050	1.350	1.2
E	1.91	2.29	2.100	L	0.430	0.580	0.505
F	7.500	7.900	7.700	N	3.800 REF.		
G	0.700	0.900	0.800	O	2.300 Typ.		

APQ04SN60CB-XXM0

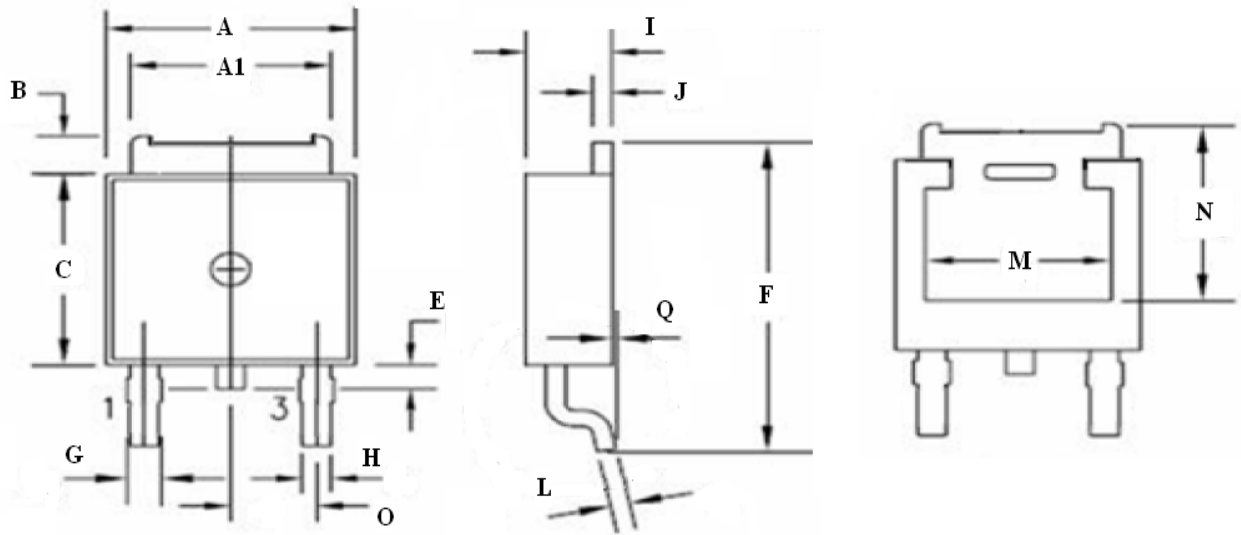
TO-252



TO-252 DIMENSION							
DIM	MILLIMETERS						
	MIN	MAX	TYP.	DIM	MIN	MAX	TYP.
A	6.35	6.73	6.54	J	0.46	0.61	0.535
A1	5.21	5.46	5.335	K	2.550	2.900	2.725
B	0.89	1.27	1.08	L	0.46	0.61	0.535
C	5.97	6.22	6.095	M	4.83	--	
E	0.64	1.01	0.825	N	5.21	--	
F	9.65	10.14	9.895	O	2.29 BSC		
G	0.84	1.14	0.99	P	0.51 BSC		
H	0.64	0.89	0.765	Q	0	0.130	0.065
I	2.19	2.38	2.285	R	1.40	1.780	1.590

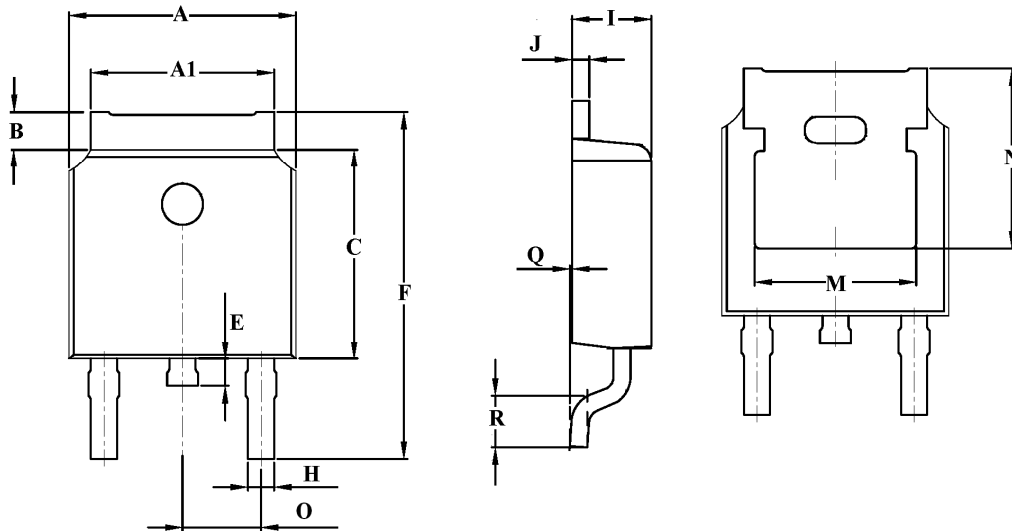
APQ04SN60CB-XXM1

TO-252



TO-252 DIMENSION							
DIM	MILLIMETERS						
	MIN	MAX	TYP.	DIM	MIN	MAX	TYP.
A	6.35	6.73	6.54	I	2.19	2.39	2.29
A1	5.22	5.48	5.35	J	0.46	0.62	0.54
B	0.89	1.27	1.08	L	0.46	0.62	0.54
C	6.06	6.44	6.25	M	4.83 MIN.		
E	0.64	1.02	0.83	N	5.21 MIN.		
F	9.65	10.41	10.03	O	2.29 TYP..		2.29
G	0.84	1.14	0.99	Q	0	0.14	0.07
H	0.64	0.90	0.77				

APQ04SN60CB-XXJ1
TO-252



TO-252 DIMENSION							
DIM	MILLIMETERS						
	MIN	MAX	TYP.	DIM	MIN	MAX	TYP
A	6.50	6.70	6.60	J	0.46	0.56	0.51
A1	5.12	5.46	5.29	K	2.9 REF		
B	0.89	1.27	1.08	L	0.56	0.46	0.51
C	6.00	6.20	6.10	M	4.83 REF		
E	0.6	1.0	0.80	N	5.35 REF		
F	9.80	10.4	10.00	O	2.19	2.39	2.29
H	0.71	0.81	0.76	Q	0	0.10	0.05
I	2.20	2.38	2.29	R	1.40	1.70	1.55



DEVICE SPECIFICATION

APQ04SN60CA
APQ04SN60CB

600V/4A N-Channel MOSFET

Note

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contact

Alpha Pacific Technologies Co., Ltd
3F-6, No.18, Lane 609, Sec.5
Chung Sin Road, Shan Chang District
New Taipei City, TAIWAN, R.O.C

tel +886-2-2999 5456
fax +886-2-2999 5270
internet www.aptw.com