



**2A ULTRA LOW DROPOUT LINEAR REGULATOR**

**FEATURES**

- **Ultra Low Dropout - 0.27V(typical) at 2A Output Current**
- **Adjustable Mode: 1.22V Reference Voltage**
- **Fixed Mode: 5V, 9V, 12V Output Voltage**
- **Operating Voltage :**  
up to 23V for TO-220-5L and TO-263-5L Packages.  
up to 16V for TO-252-5L and SO-8 Packages.
- **Current-Limit and Thermal Shutdown Protection**
- **Short Circuit Protection, Enable Function.**
- **Built-in Internal SW P-channel MOS**
- **SO-8, TO-252-5L, TO-220-5L, TO-220-5LR, PDIP-8 and TO-263-5L Pb-Free Packages.**

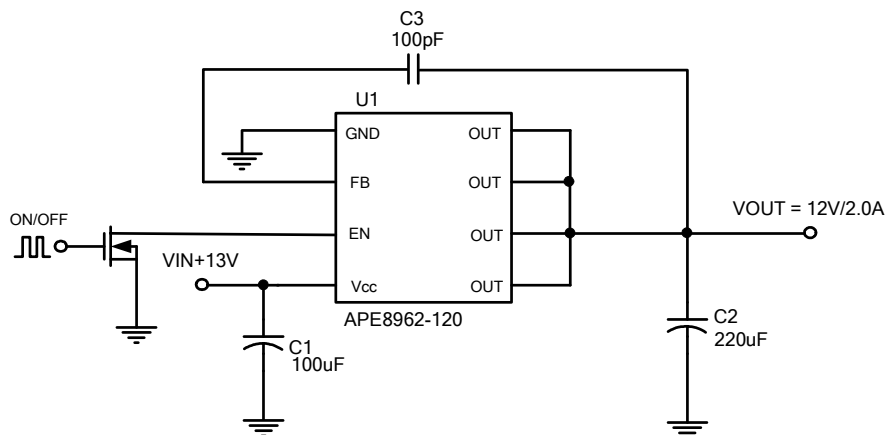
**DESCRIPTION**

The APE8962 is a low-dropout voltage regulator suitable for various electronic equipments. It provides constant voltage power source. The dropout voltage of APE8962 is below 0.27V in full rated current (2A). This regulator has various functions such as a peak current protection, a thermal shut down, a short circuit protect.

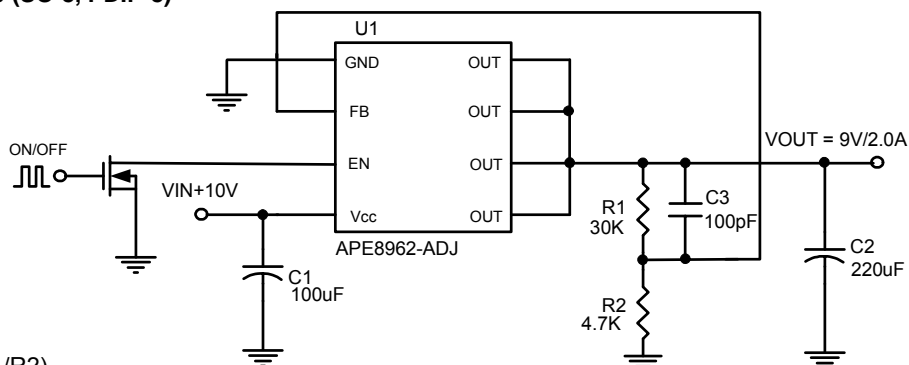
The APE8962 is available in SO-8, PDIP-8, TO-252-5L, TO-220-5L and TO-263-5L power packages which features small size to reduce the junction-to-case resistance, being applicable in 0.5~3W applications.

**TYPICAL APPLICATION**

**1.FIXED (SO-8, PDIP-8)**



**2.ADJ (SO-8, PDIP-8)**



$$V_{OUT} = V_{FB} \times (1 + R1/R2)$$

$$V_{FB} = 1.22V$$

R2 suggest 1K~5.6KΩ

C2 choose Low ESR capacitor

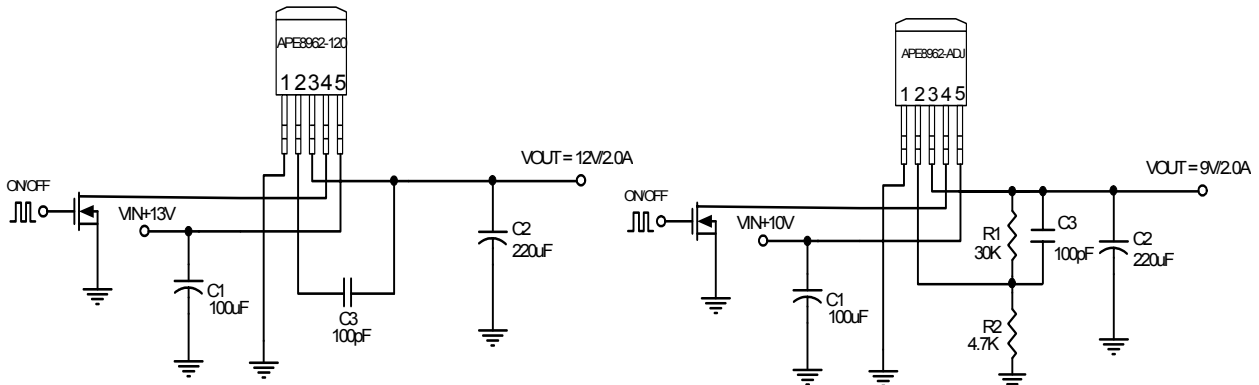
C3=47pF~100pF for stability issue



**TYPICAL APPLICATION**

3. FIXED (TO-252-5L, TO-220-5L, TO-263-5L)

4. ADJ (TO-252-5L, TO-220-5L, TO-263-5L)



$$V_{OUT} = V_{FB} \times (1 + R1/R2)$$

$$V_{FB} = 1.22V$$

R2 suggest 1K~5.6KΩ  
C2 choose Low ESR capacitor  
C3=47pF~100pF for stability issue

**ABSOLUTE MAXIMUM RATINGS** (at T<sub>A</sub>=25°C)

V <sub>CC</sub> PIN Voltage(V <sub>CC</sub> )	-----	-0.3 to 25V
Feedback PIN Voltage(V <sub>FB</sub> )	-----	-0.3V to V <sub>CC</sub> + 0.3V
EN PIN Voltage(V <sub>EN</sub> )	-----	-0.3V to 7V
Power Dissipation(P <sub>D</sub> )		
	SO-8-----	1.6W
	TO-252-----	2.3W
	TO-220-----	4W
	TO-263-----	4W
	PDIP-8-----	2W
Storage Temperature Range(T <sub>ST</sub> )	-----	-65°C To 150°C
Operating Temperature Range(T <sub>OP</sub> )	-----	-40°C To 85°C
Junction Temperature Range(T <sub>J</sub> )	-----	-40°C To 125°C
Output Current (I <sub>OUT</sub> )	-----	2.5A
Thermal Resistance from Junction to Case(R <sub>thJC</sub> )		
	SO-8-----	20°C/W
	TO-252-----	10°C/W
	TO-220-----	3.5°C/W
	TO-263-----	3.5°C/W
	PDIP-8-----	15°C/W
Thermal Resistance from Junction to Ambient(R <sub>thJA</sub> )		
	SO-8-----	60°C/W
	TO-252-----	45°C/W
	TO-220-----	25°C/W
	TO-263-----	25°C/W
	PDIP-8-----	50°C/W

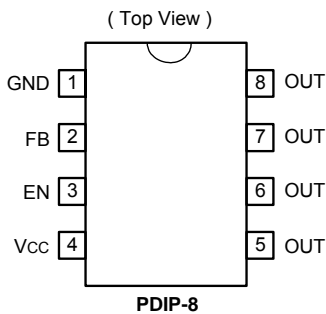
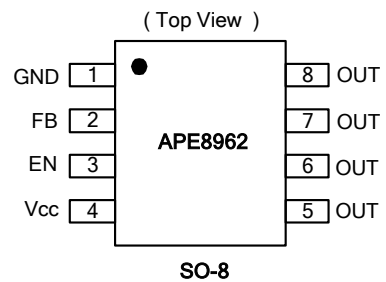
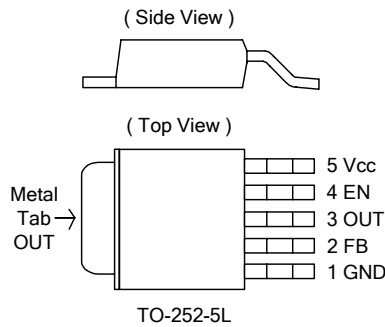
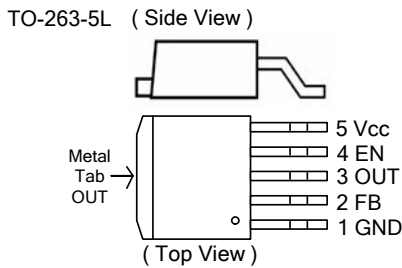
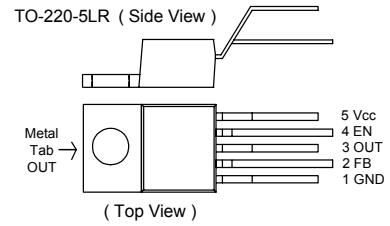
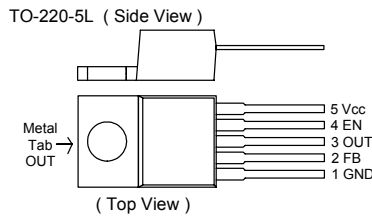
Note: R<sub>thJA</sub> is measured with the PCB copper area(need connect to OUT pin) of approximately 1.5 in<sup>2</sup> (Multi-layer).



**ORDERING/PACKAGE INFORMATION**

**APE8962X-XX**

Package	Vout
M : SO-8	Blank : Adj
H : TO-252-5L	50 = 5.0V
P : TO-220-5L	90 = 9.0V
PR : TO-220-5LR	120 = 12V
S : TO-263-5L	
D : PDIP-8	



**ELECTRICAL SPECIFICATIONS** ( $V_{CC}=12V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified)

Parameter	SYM	TEST CONDITION	MIN	TYP	MAX	UNITS
Vcc Supply Voltage	Vcc	$I_O=2A$ , TO-220, TO-263	5.1	-	23	V
		TO-252, SO-8, PDIP-8	5.1	-	16	V
Feedback Voltage	$V_{FB}$	$I_O=10mA$ , $V_{CC}=10V$	1.196	1.22	1.244	V
Output Voltage	$V_{OUT}$	$I_O=10mA$ , $V_{CC}=6V$	4.9	5	5.1	V
		$I_O=10mA$ , $V_{CC}=10V$	8.82	9	9.18	
		$I_O=10mA$ , $V_{CC}=13V$	11.76	12	12.24	
GND Current	$I_{GND}$	$I_O = 0\sim 2A$	-	1.2	3	mA
Shutdown Current	$I_{SD}$	$V_{EN} = 0V$	-	0.15	0.4	mA
Load Regulation	$V_{Load}$	$5mA < I_O < 2A$	-	0.5	1.5	%
Line Regulation	$V_{Line}$	$I_O=10mA$ , $V_{OUT}+1.0V < V_{CC} < V_{OUT}+10V$	-	0.1	0.5	%
Ripple Rejection Ratio	PSRR	Note1	-	65	-	dB
Dropout Voltage	$V_{DROP}$	$I_O = 2A$ , $V_{out}=5V$	-	0.27	0.4	V
		$I_O = 2A$ , $V_{out}=9V$	-	0.26	0.39	
		$I_O = 2A$ , $V_{out}=12V$	-	0.18	0.31	



**ELECTRICAL SPECIFICATIONS** ( $V_{CC}=12V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified)

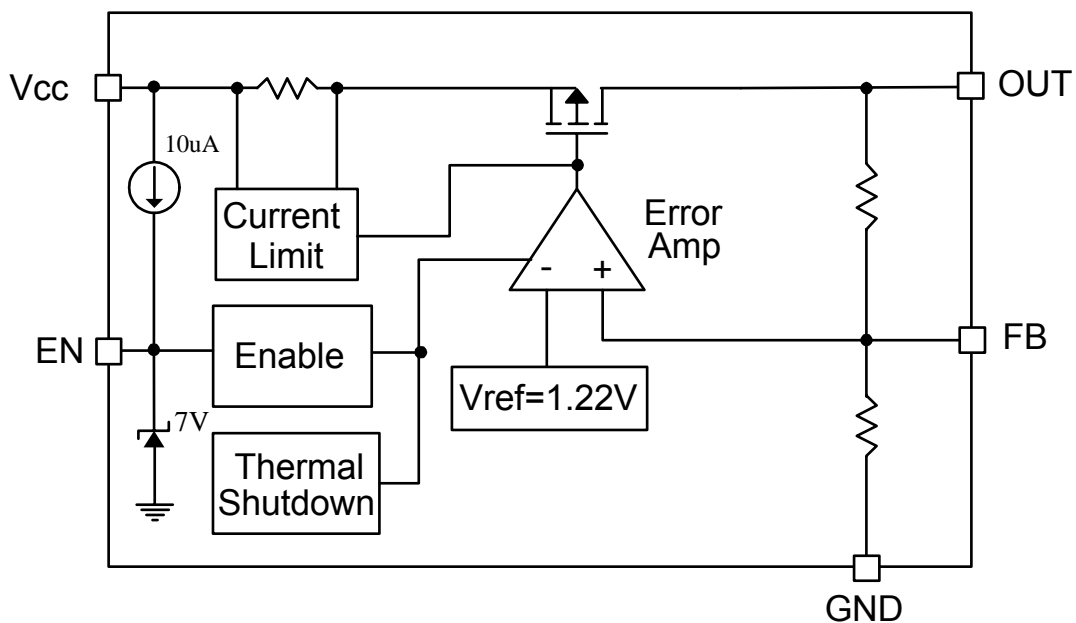
Parameter	SYM	TEST CONDITION	MIN	TYP	MAX	UNITS
Short Circuit Protect	Iscp	$V_{OUT}<20\%$	-	0.6	-	A
Current Limit	$I_L$	SO-8, PDIP-8	2.2	-	-	A
		TO-220, TO-263, TO-252	2.5	-	-	A
EN Pin Logic Input Threshold Voltage	$V_{ENH}$	High (regulator ON)	2	-	-	V
	$V_{ENL}$	Low (regulator OFF)	-	-	0.8	V
EN Pin Input Current	$I_{ENH}$	$V_{EN}=2.5V$ (ON)	-	20	-	$\mu A$
	$I_{ENL}$	$V_{EN}=0.3V$ (OFF)	-	-10	-	$\mu A$
Internal MOSFET $R_{DS(ON)}$	$R_{DS(ON)}$	$V_{CC}=5.5V$	-	120	150	$m\Omega$
		$V_{CC}=12V$	-	80	100	
Thermal Shutdown	TSD		-	140	-	$^{\circ}C$

Note1. These parameters, although guaranteed, are not 100% tested in production.

**PIN DESCRIPTIONS**

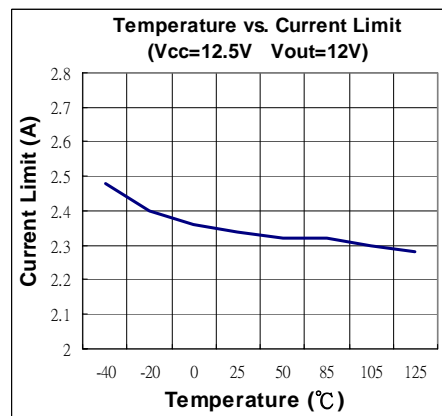
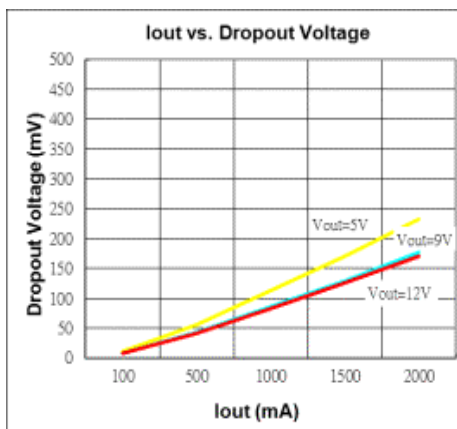
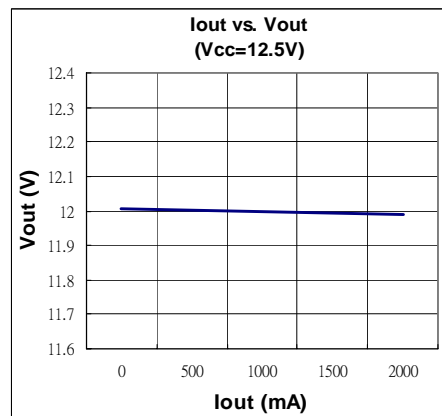
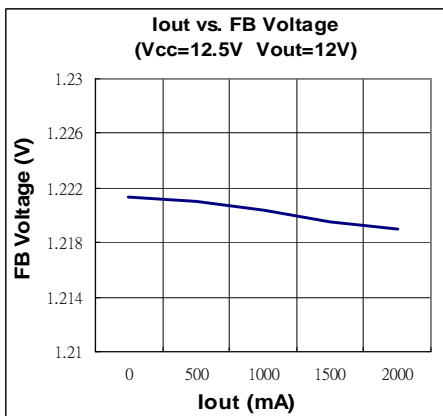
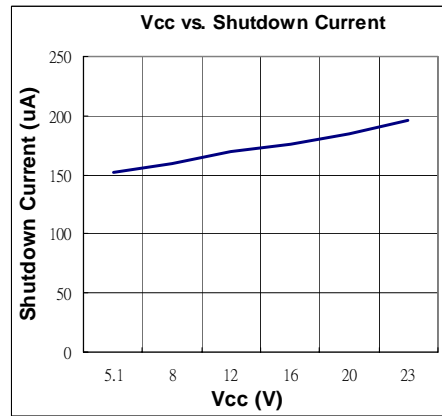
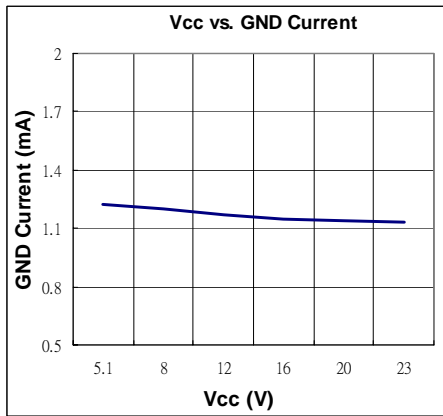
PIN SYMBOL	PIN DESCRIPTION
GND	GND Pin
FB	Feedback Pin
EN	Power -Off Pin H : Normal Operation(Step-down) L : Step-down Operation Stopped (All circuits deactivated)
OUT	Output Voltage pin
VCC	IC Power Supply Pin

**BLOCK DIAGRAM**



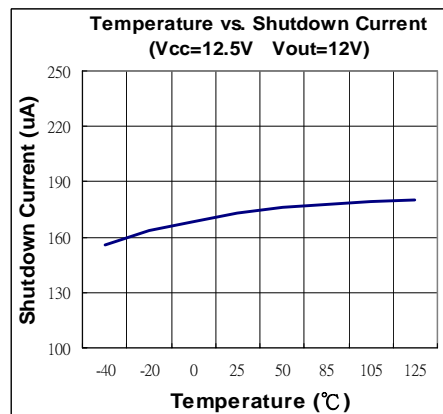
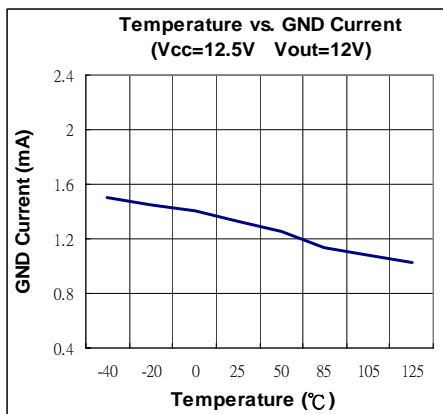
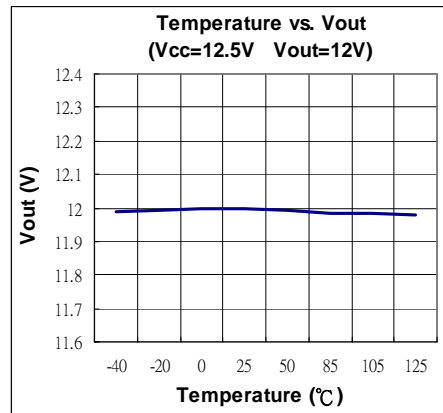
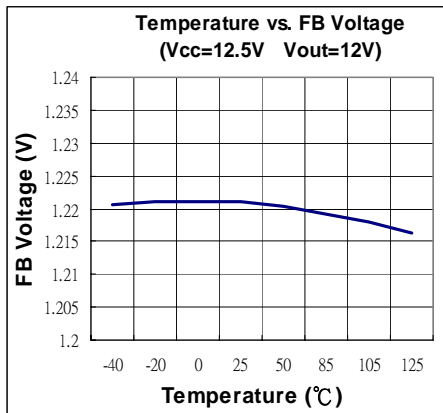


## TYPICAL PERFORMANCE CHARACTERISTICS

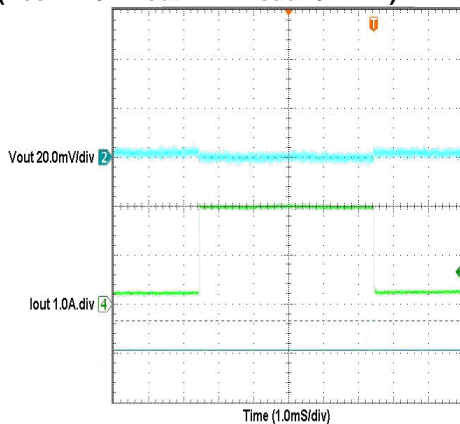




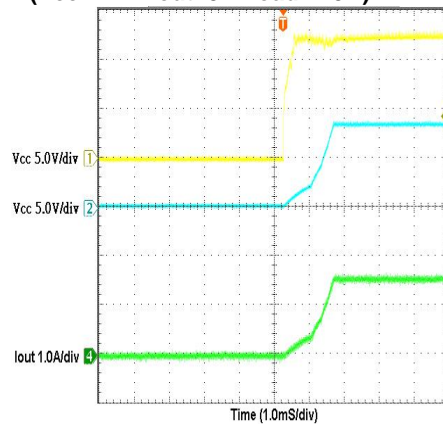
TYPICAL PERFORMANCE CHARACTERISTICS



**Load Transient**  
(Vcc=12.5V Vout=12V Load=0.1~2A)



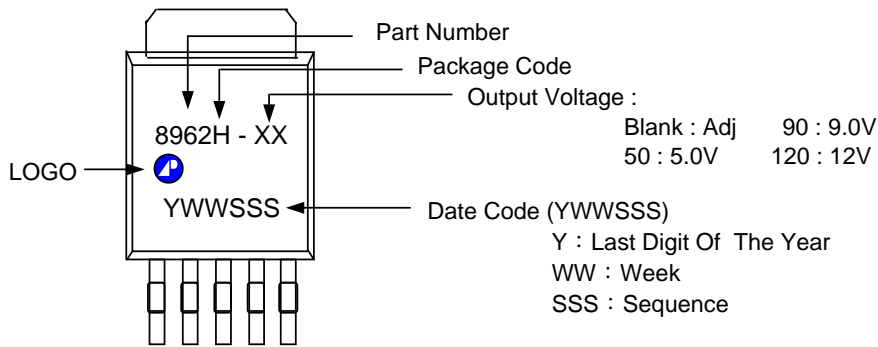
**Power-ON**  
(Vcc=12V Vout=9V Load=1.5A)



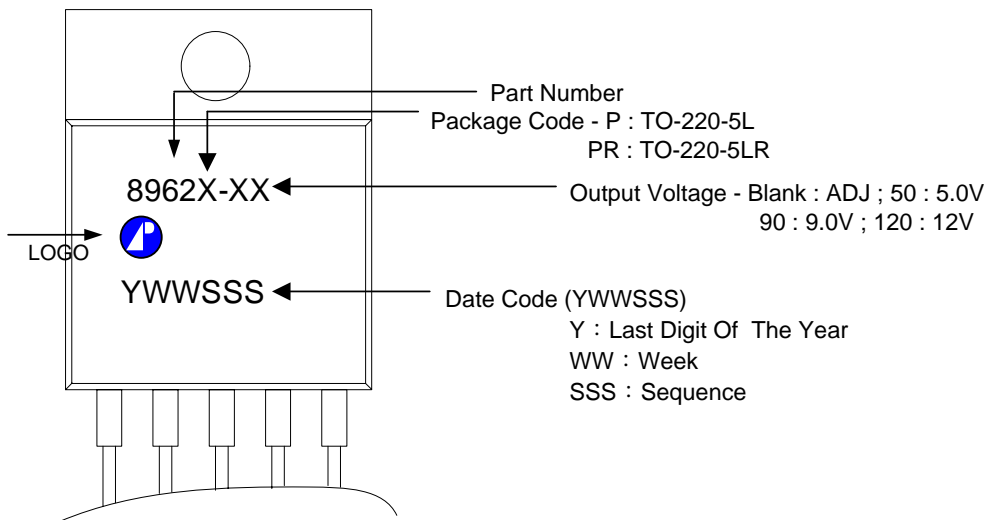


**MARKING INFORMATION**

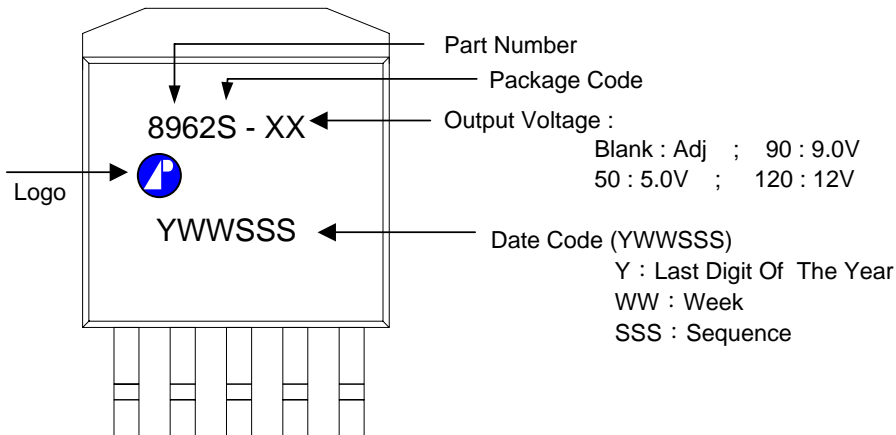
**TO-252-5L**



**TO-220-5L / TO-220-5LR**



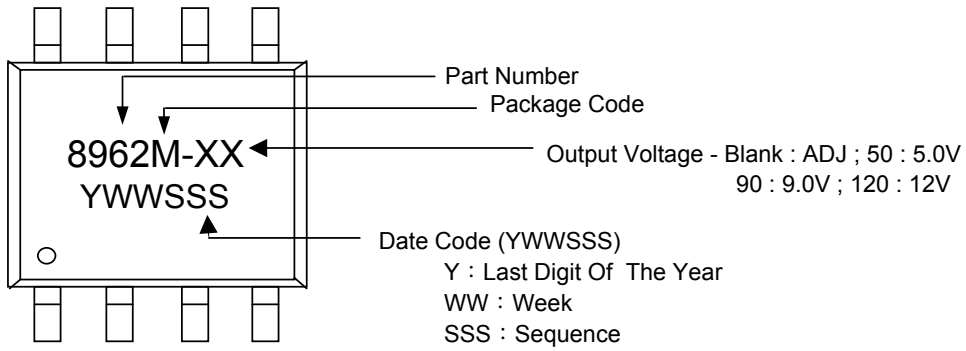
**TO-263-5L**



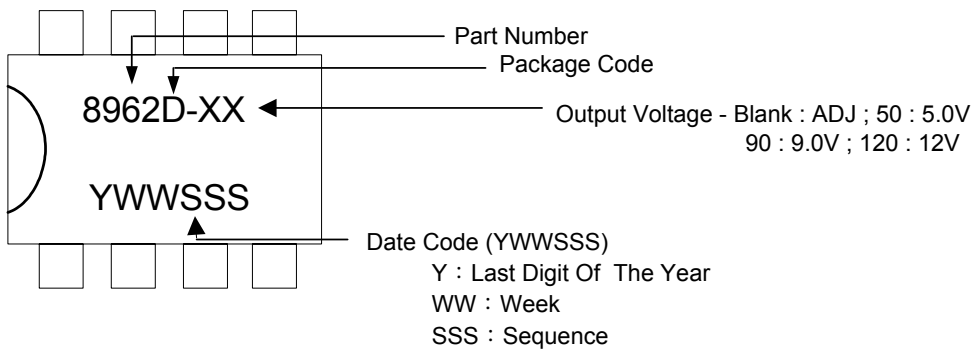


MARKING INFORMATION

SO-8



PDIP-8

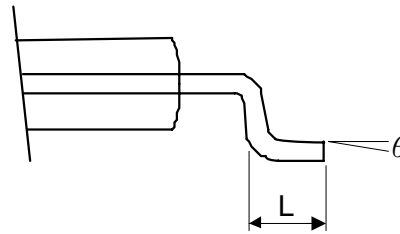
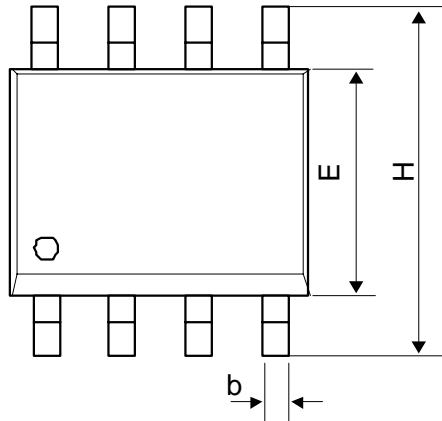




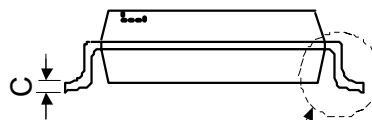
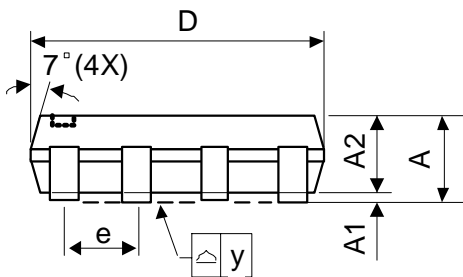


PACKAGE OUTLINES

SO-8



DETAIL A



DETAIL A

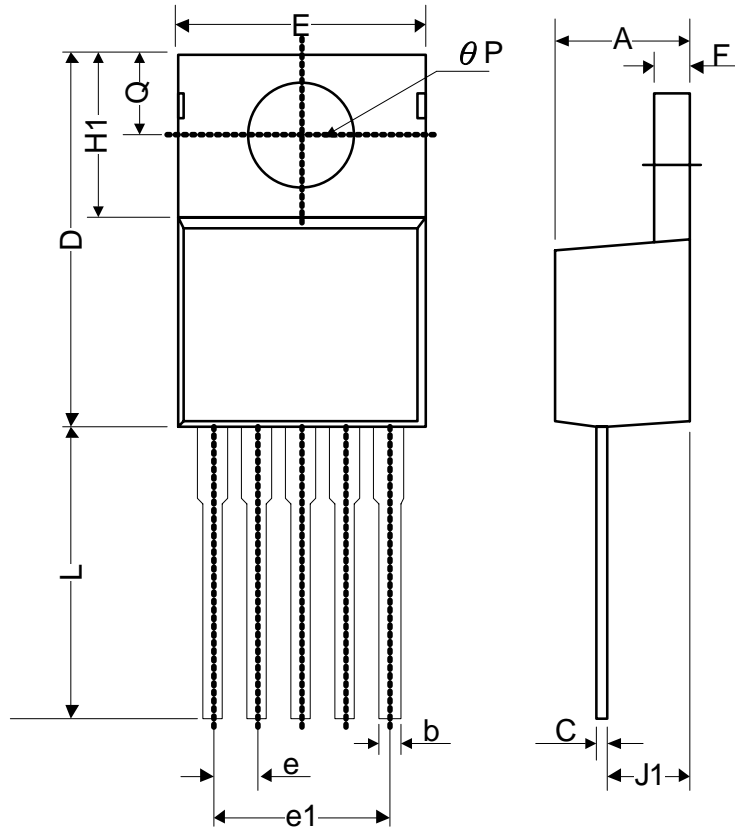
Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.75	-	-	0.069
A1	0.1	-	0.25	0.04	-	0.1
A2	1.25	-	-	0.049	-	-
C	0.1	0.2	0.25	0.0075	0.008	0.01
D	4.7	4.9	5.1	0.185	0.193	0.2
E	3.7	3.9	4.1	0.146	0.154	0.161
H	5.8	6	6.2	0.228	0.236	0.244
L	0.4	-	1.27	0.015	-	0.05
b	0.31	0.41	0.51	0.012	0.016	0.02
e	1.27 BSC			0.050 BSC		
y	-	-	0.1	-	-	0.004
$\theta$	0°	-	8°	0°	-	8°

Mold flash shall not exceed 0.25mm per side

JEDEC outline: MS-012 AA



TO220-5L



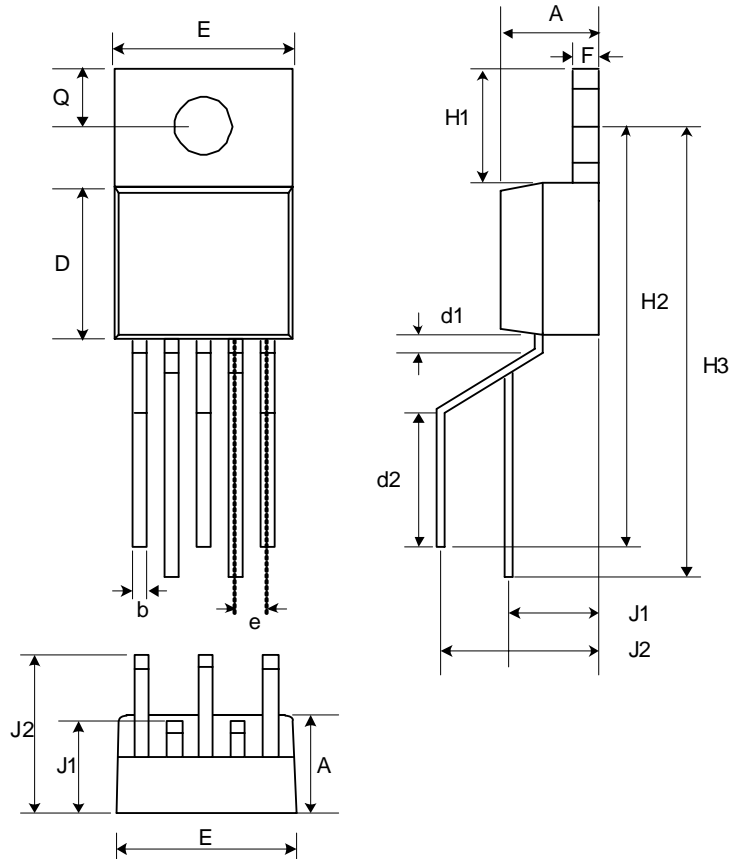
Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	4.07	4.45	4.82	0.16	0.175	0.19
b	0.76	0.89	1.02	0.03	0.035	0.04
C	0.36	0.5	0.64	0.014	0.02	0.025
D	14.22	14.86	15.5	0.56	0.585	0.61
E	9.78	10.16	10.54	0.385	0.4	0.415
e	1.57	1.71	1.85	0.062	0.067	0.073
e1	6.68	6.81	6.93	0.263	0.268	0.273
F	1.14	1.3	1.45	0.045	0.051	0.057
H1	5.46	6.16	6.86	0.215	0.243	0.27
J1	2.29	2.74	3.18	0.09	0.108	0.125
L	13.21	13.97	14.73	0.52	0.55	0.58
$\theta P$	3.68	3.81	3.96	0.145	0.15	0.156
Q	2.54	2.73	2.92	0.1	0.107	0.115

Mold flash shall not exceed 0.005inch per side

JEDEC outline: NA



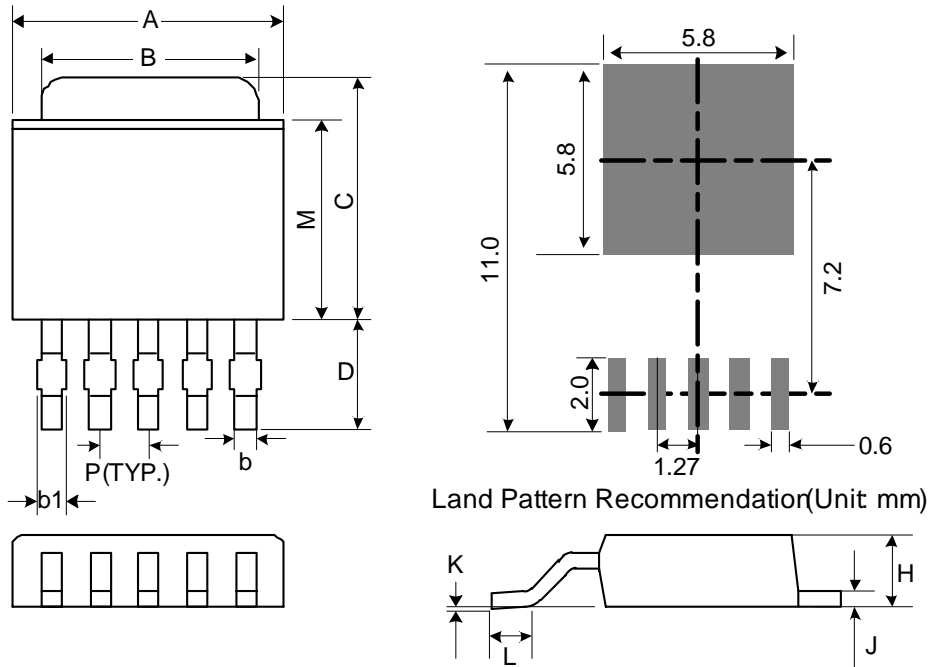
**TO220-5LR**



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	4.4	4.6	4.7	0.175	0.18	0.185
b	0.7	0.8	0.9	0.027	0.032	0.037
D	8.4	8.7	8.9	0.33	0.34	0.35
d1	1			0.039		
d2	6.3			0.248		
E	9.91	10.16	10.41	0.39	0.4	0.41
e	1.6	1.7	1.8	0.062	0.067	0.072
F	1.2	1.25	1.3	0.048	0.05	0.052
H1	6.4			0.25		
H2	20.8	21.6	22.4	0.82	0.85	0.88
H3	23.9	24.7	25.5	0.942	0.972	1.002
J1	3.7	4.5	5.3	0.147	0.177	0.207
J2	8.4			0.331		
Q	2.5	2.8	3	0.1	0.11	0.12



TO252-5L

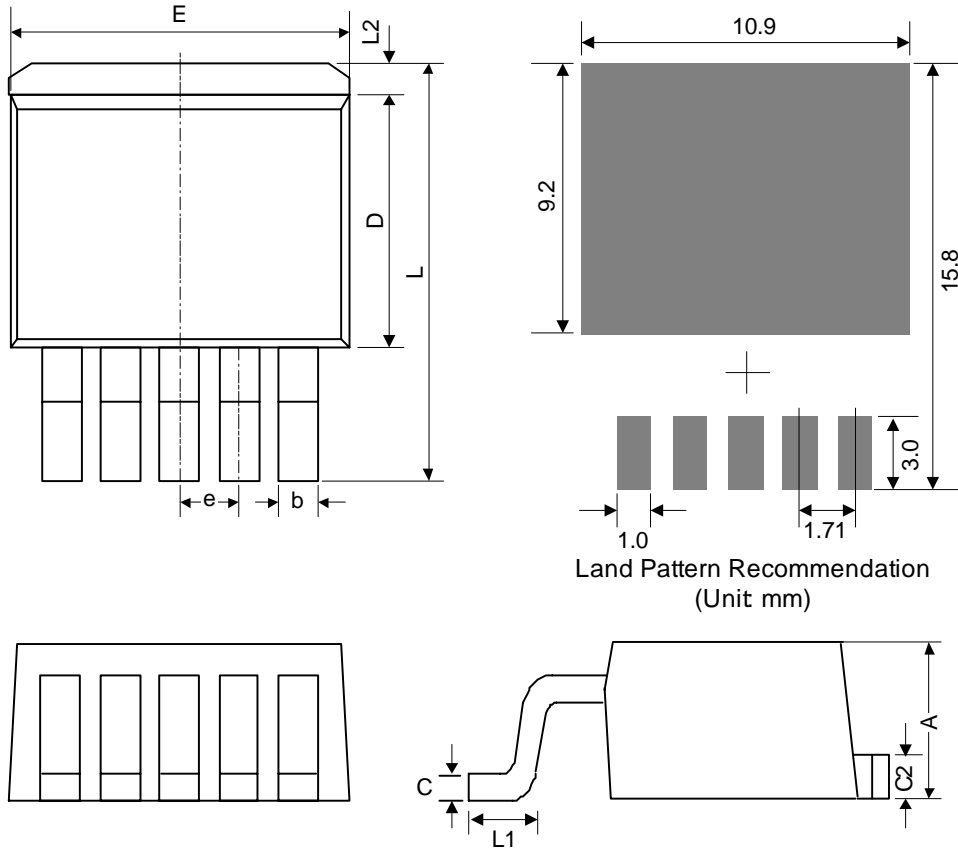


Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	6.35	6.6	6.73	0.25	0.26	0.265
B	5.21	5.33	5.46	0.205	0.21	0.215
C	6.86	7.24	7.62	0.27	0.285	0.3
D	2.67 REF			0.105 REF		
P	1.27 REF			0.050 REF		
H	2.18	2.29	2.39	0.086	0.09	0.094
J	0.46	0.51	0.58	0.018	0.02	0.023
K	0	0.08	0.13	0	0.003	0.005
L	1.4	1.6	1.78	0.055	0.063	0.07
M	5.33	5.46	5.59	0.21	0.215	0.22
b	0.38	0.56	0.71	0.015	0.022	0.028
b1	0.38	0.53	0.66	0.015	0.021	0.026

Mold flash shall not exceed 0.005inch per side



**TO263-5L**



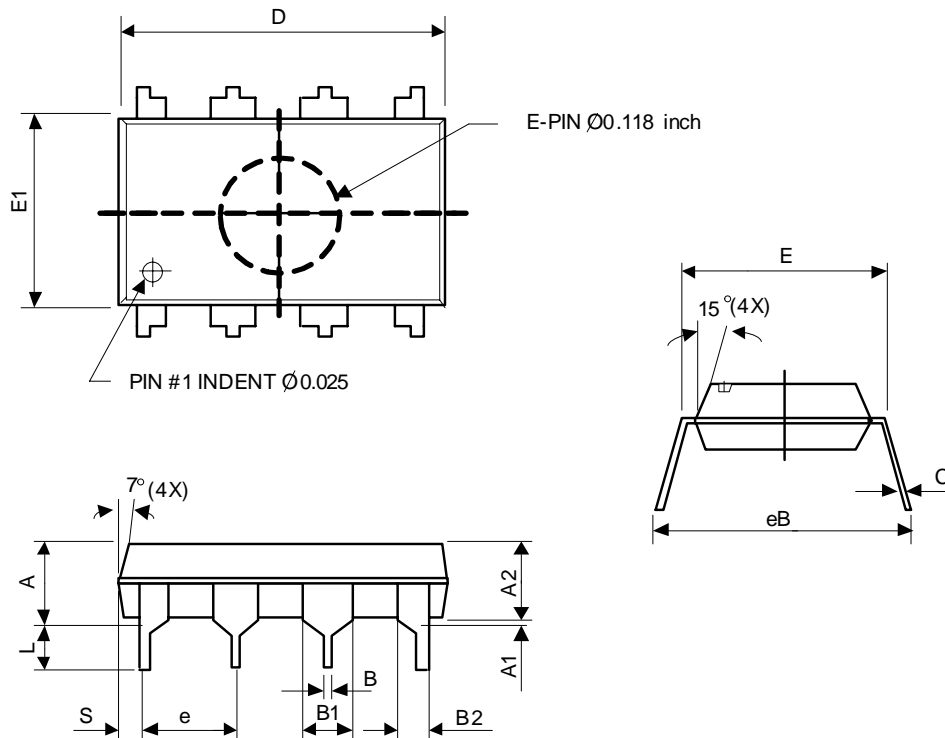
Land Pattern Recommendation  
(Unit mm)

Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	4.06	4.45	4.83	0.16	0.175	0.19
b	0.51	0.76	0.99	0.02	0.03	0.039
C	0.38	0.56	0.74	0.015	0.022	0.029
C2	1.14	1.4	1.65	0.045	0.055	0.065
D	8.38	9.02	9.65	0.33	0.355	0.38
E	9.65	10.2	10.7	0.38	0.4	0.42
e	1.70 BSC			0.067 BSC		
L	14.6	15.2	15.9	0.575	0.6	0.625
L1	1.78	2.29	2.79	0.07	0.09	0.11
L2	-	-	1.68	-	-	0.066

Mold flash shall not exceed 0.005inch per side  
JEDEC outline: TO-263 BA



**PDIP-8**



Symbol	Dimensions in millimeters			Dimensions in inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	5.33	-	-	0.21
A1	0.38			0.015	-	-
A2	2.92	3.3	4.95	0.115	0.13	0.195
B	0.36	0.46	0.51	0.014	0.018	0.02
B1	1.14	1.52	1.78	0.045	0.06	0.07
B2	0.76	0.99	1.14	0.03	0.039	0.045
C	0.2	0.25	0.36	0.008	0.01	0.014
D	9.02	9.27	10.16	0.355	0.365	0.4
E	7.62	7.87	8.26	0.3	0.31	0.325
E1	6.1	6.35	7.11	0.24	0.25	0.28
e	2.54 BSC			0.100 BSC		
L	2.92	3	3.81	0.115	0.13	0.15
eB	-	-	10.92	-	-	0.43
S	0.13	-	-	0.005	-	-

JEDEC outline: MO-100 BA