

FEATURES

- Constant LED Current for Varying Input Voltage
- Adjusted Current Operation
- Low Quiescent Current
- Simplifies Circuit and System Designs
- Compact Component Count
- Provided Higher Current by Parallel
- Temperature Compensated Constant Current
- Over Current Protection
- Over Temperature Protection
- LED Current Programmable Thermal Foldback for thermal Protection
- SOP-8L Package or DFN-8L Package or TO252-5L Package

APPLICATIONS

- LED Driver
- Lighting Applications
- Lamp Indicators
- Candle Light
- Low Cost solution
- Constant Current Source

GENERAL DESCRIPTION

The EC4211 is a constant current linear LED driver for replace discrete solutions in AC/DC power application (up to 265V). The device is to drive a constant current of $\pm 5\%$ variation by an external resistor for different LED strings. The solution eliminates the need of individual components by combining them into a single package, which results in a significant reduction of both system cost and board space. For higher current application, multiple EC4211s can also be used in parallel such as 40mA, 80mA or 160mA. The EC4211 is self-protected against over temperature and over current. Internal thermal foldback function regulates LED driver current automatically to limit die temperature during high power operation or high ambient temperature conditions. These features provide maximum system protection for the demanding lighting applications. The EC4211 is available in a space saving SOP-8L package, DFN-8L package or TO252-5L package, and the operating temperature is from -40°C to $+125^{\circ}\text{C}$.

TYPICAL APPLICATION CIRCUIT

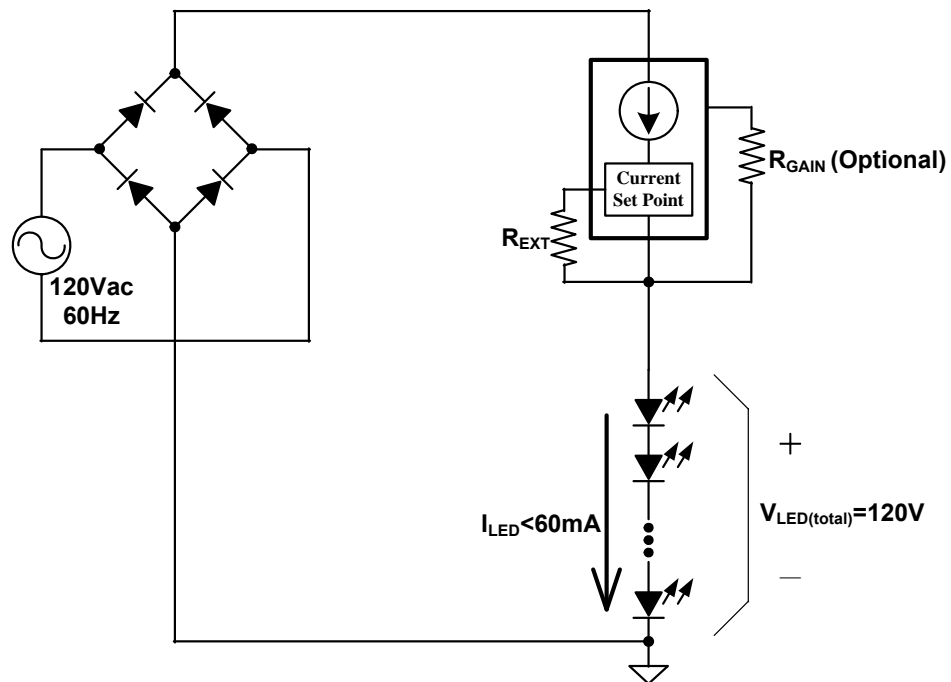
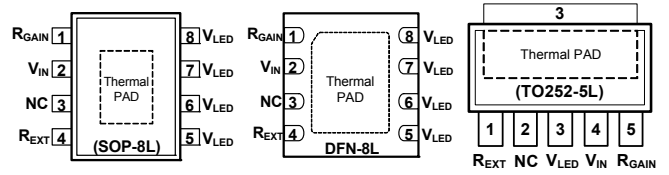


Fig. 1 Simplified Application Circuit

ABSOLUTE MAXIMUM RATINGS

V_{IN} Supply Voltage.....	500V
R_{EXT} , R_{GAIN} Operation Voltages.....	6V
Operating Temperature.....	-40°C to +125°C
Storage Temperature.....	-55°C to +150°C
Maximum Die Temperature.....	+150°C
Lead Temperature.....	+260°C
ESD HBM Voltage.....	2.5kV
ESD MM Voltage.....	300V

PIN CONFIGURATION



Note:

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability.

Ordering Information

Part No.	Package Type	Marking Information	Remark
EC4211NNMHR	SOP-8L	EC4211 YYWW LLLLLT	YYWW : Date Code LLLLL : Lot No T : internal tracking code
EC4211NNF2R	DFN-8L	EC4211 LLLLL YYWWT	
EC4211NNA5R	TO252-5L	EC4211 YYWW LLLLLT	

ELECTRICAL CHARACTERISTICS

$T_A = 25^\circ\text{C}$ unless otherwise specified

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNIT
Electrical Characteristic						
V_{IN}	Operation Voltage		15		265	V
I_{LED}	Current Regulation (Note 1)	$V_{IN}=120\text{Vdc}$, $R_{EXT}=15\Omega$, $V_{LED}=100\text{V}$	38.16	40.17	42.18	mA
		$V_{IN}=220\text{Vdc}$, $R_{EXT}=30\Omega$, $V_{LED}=200\text{V}$	19.16	20.17	21.18	mA
$I_{LED(MAX)}$	Maximum Current Regulation	$V_{DROP} \leq 16\text{V}$ (Note 2)			60	mA
I_Q	Quiescent Current	$V_{IN}=20\text{Vdc}$, $R_{EXT}=\text{Open}$		170		μA
V_{REF}	Reference Voltage (Note 3)			0.6		V
$V_{DROP(MAX)}$	Maximum Dropout Voltage (Note 4)	$V_{IN}=265\text{Vac}$, $R_{EXT}=30\Omega$, $V_{LED}=220\text{V}$			170	V
Thermal Characteristic						
$\Delta V_{REF(T)}$	V_{REF} Temperature Coefficient	$T_A=-40^\circ\text{C} \sim 125^\circ\text{C}$		0.01		$\%/\text{C}$
T_A	Operating Temperature		-40		125	$^\circ\text{C}$
P_D	Total Power Dissipation (Operation)				1	W
$R_{\theta JA}$	Thermal Resistance	SOP-8L Package		75		$^\circ\text{C}/\text{W}$
		DFN-8L Package		33.2		$^\circ\text{C}/\text{W}$
		TO252-5L Package		68		$^\circ\text{C}/\text{W}$
Protection						
OCP	Over Current Protection			150		mA
OTP	Over Temperature Protection			150		$^\circ\text{C}$
TFP	Thermal Foldback Protection (Note 5)			90		$^\circ\text{C}$
Note:						
1. $I_{LED}=0.6/R_{EXT}+I_Q$						
2. $V_{DROP}=V_{IN}-V_{LED}-0.6$, $P_D < 1\text{W}$ (No heat sink)						
3. $V_{REF}=V(R_{EXT})-V_{LED}$						
4. The current regulation is for a instantaneous AC line input current only, not to exceed thermal characteristics of package.						
5. $I_{LED(TFP)}=I_{LED}-V(R_{GAIN})/R_{GAIN}$						

FUNCTION DIAGRAM

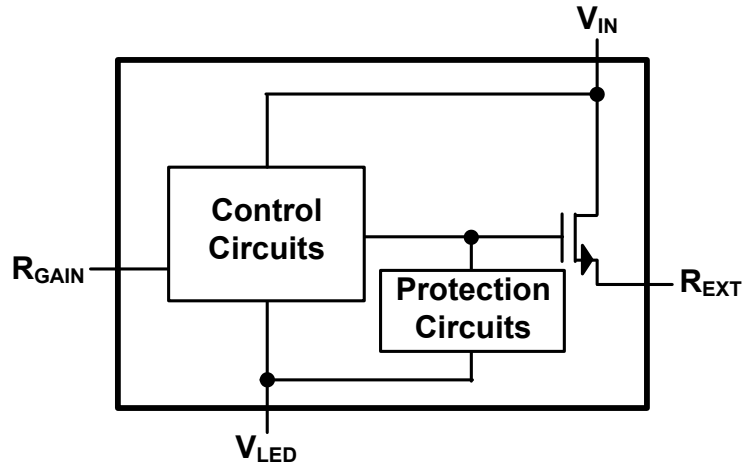


Fig. 2 Detailed Block Diagram

PIN DESCRIPTIONS

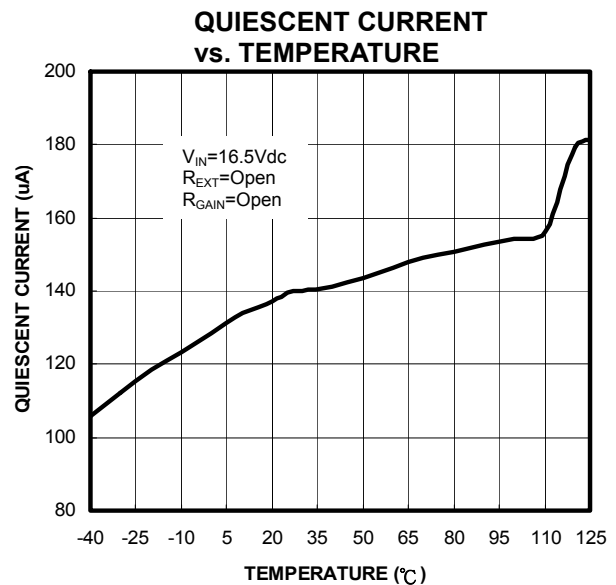
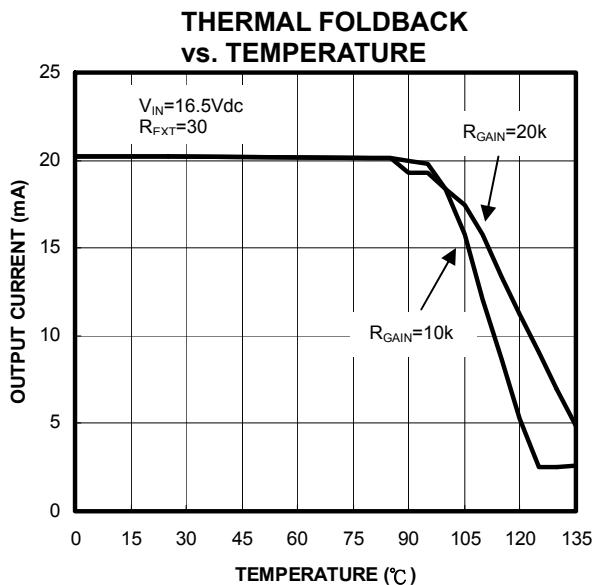
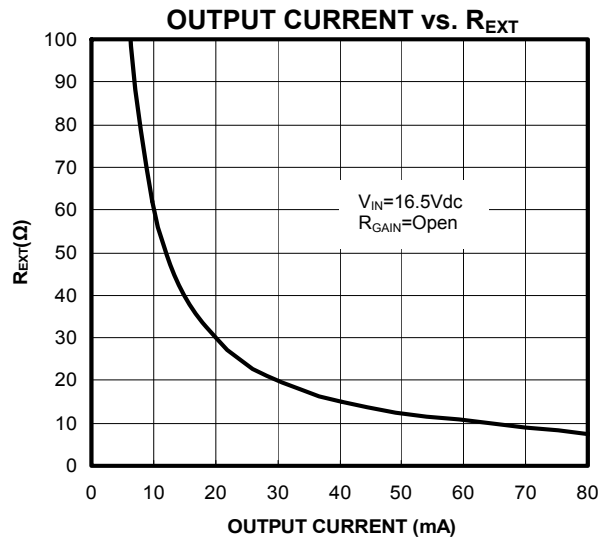
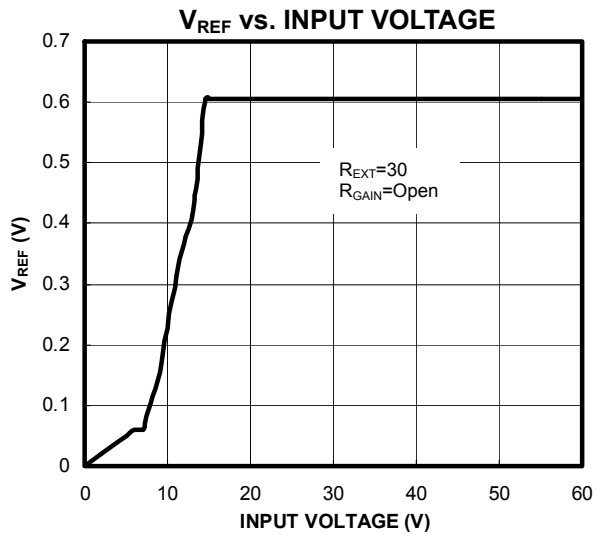
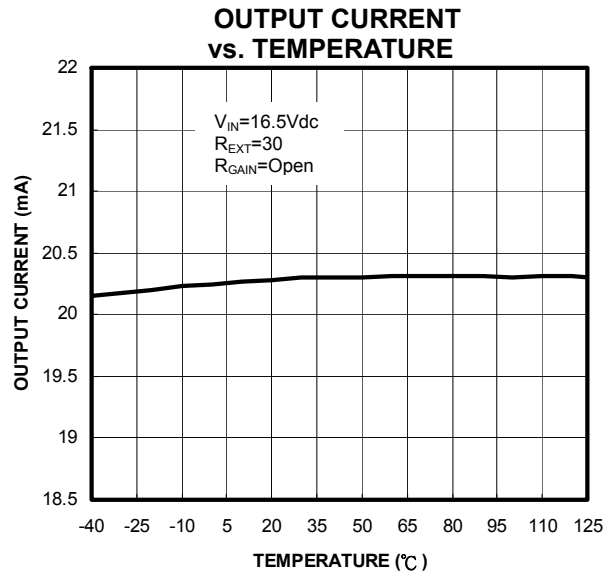
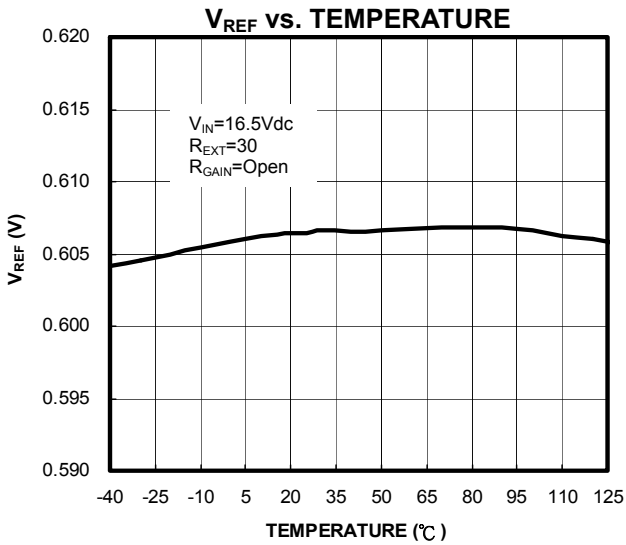
TO252-5L Package

PIN	Symbol	Description
1	R_{EXT}	An external resistor between R_{EXT} and V_{LED} pin sets different current regulation for LED strings.
2	NC	No internal mechanically connection. Leave this pin open.
3	V_{LED}	The LED strings are connected from this pin to ground.
4	V_{IN}	Input supply voltage.
5	R_{GAIN}	Programmable thermal foldback protection for current regulation to limit die temperature during high power operation or high ambient temperature conditions.

DFN-8L / SOP-8L Package

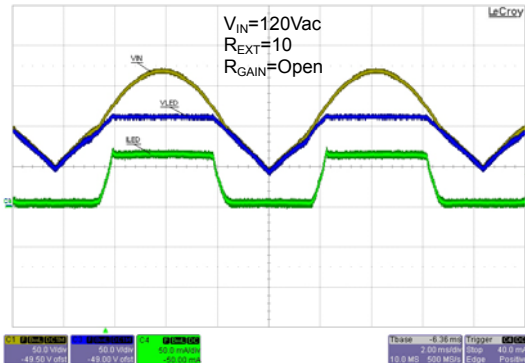
PIN	Symbol	Description
1	R_{GAIN}	Programmable thermal foldback protection for current regulation to limit die temperature during high power operation or high ambient temperature conditions.
2	V_{IN}	Input supply voltage.
3	NC	No internal mechanically connection. Leave this pin open.
4	R_{EXT}	An external resistor between R_{EXT} and V_{LED} pin sets different current regulation for LED strings.
5, 6, 7, 8	V_{LED}	The LED strings are connected from these pins to ground.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise specified)

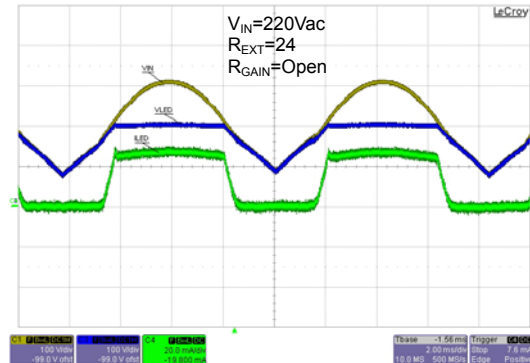


ELECTRICAL CHARACTERISTICS (Continued)

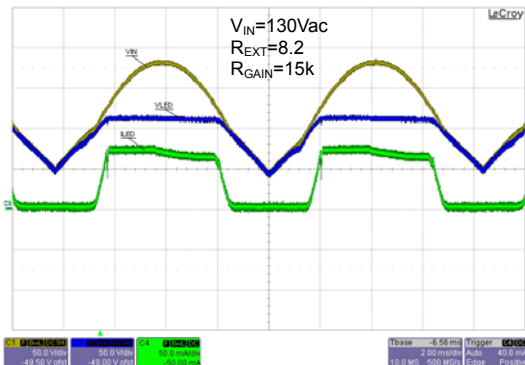
TRANSIENT RESPONSE



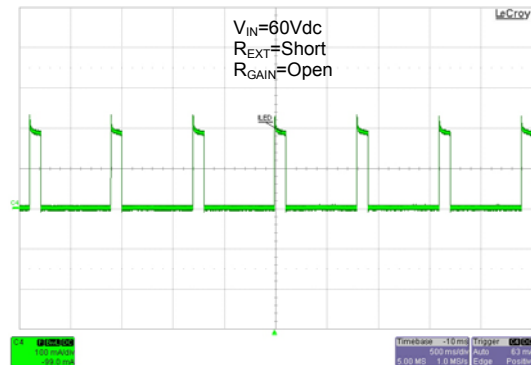
TRANSIENT RESPONSE



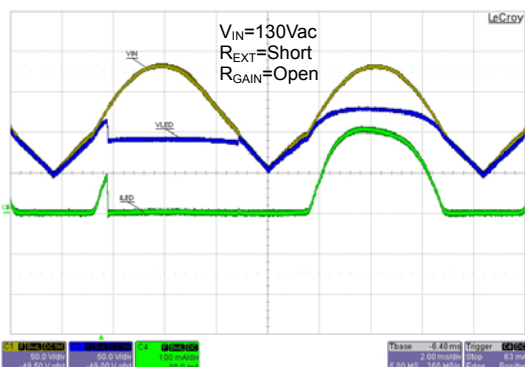
TRANSIENT RESPONSE vs. THERMAL FOLDBACK



OVER CURRENT PROTECTION



OVER TEMPERATURE PROTECTION



LED Lighting EC4211 Application Circuit Schematic

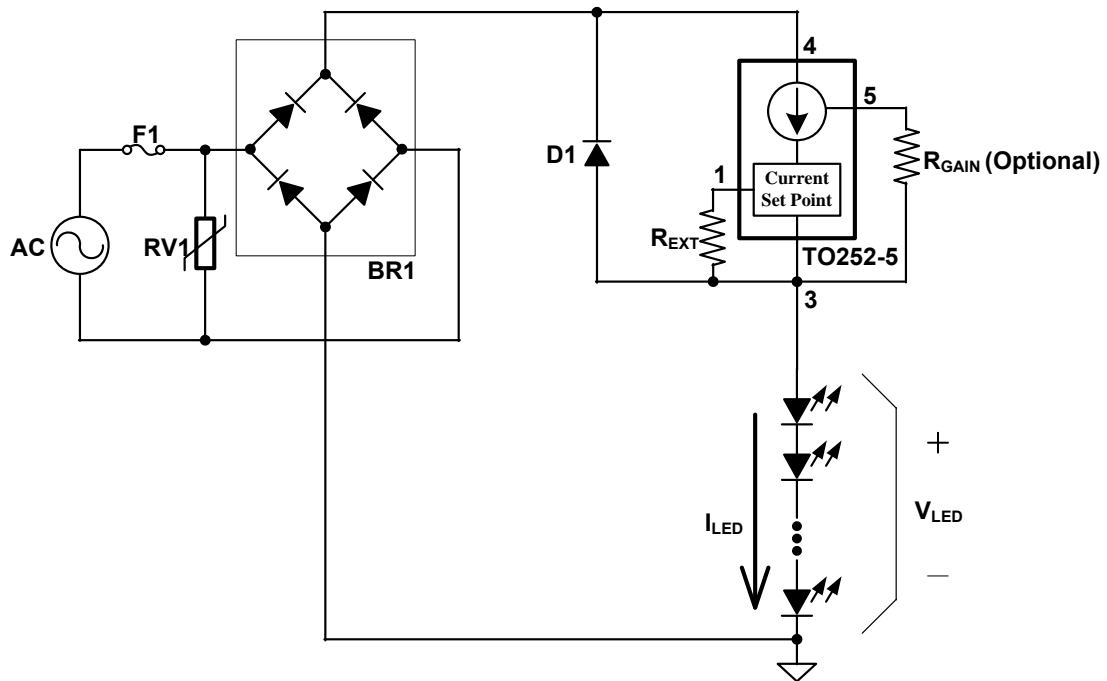


Fig. 3 Typical Application Circuit

110VAC 4W LED Lighting Demo Board Part List

COMPONENT	VALUE	PACKAGE
U1	EC4211	TO252-5L
BR1	B10S	SMD
F1	1A	DIP
RV1	221KD14 (140VAC)	DIP
D1	1N4003	DIP
R _{EXT}	8.5	0603
R _{GAIN}	7.5k	0603
V _{LED}	120V	NA

220VAC 4W LED Lighting Demo Board Part List

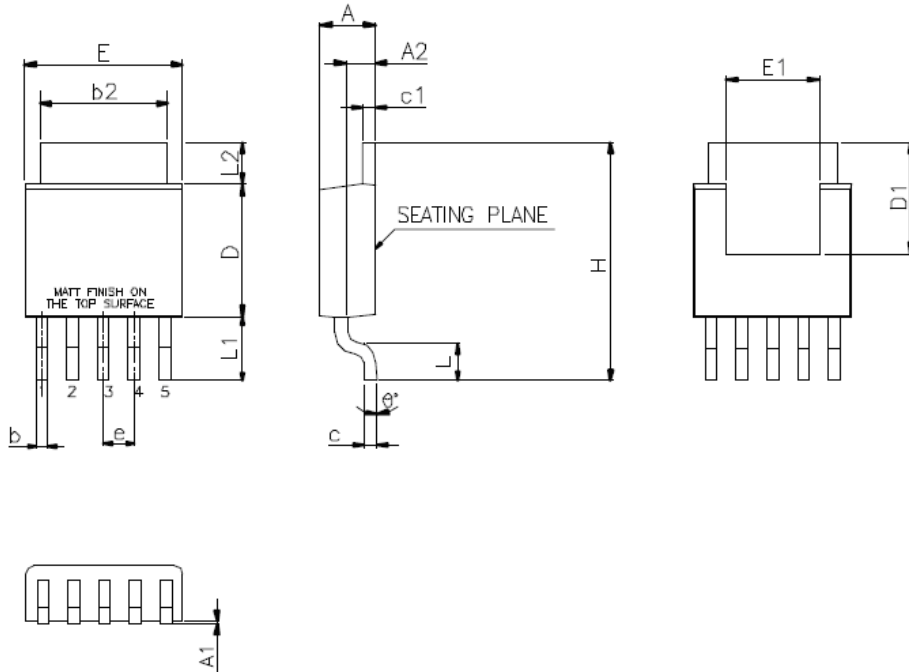
COMPONENT	VALUE	PACKAGE
U1	EC4211	TO252-5L
BR1	B10S	SMD
F1	1A	DIP
RV1	431KD14 (275VAC)	DIP
D1	1N4003	DIP
R _{EXT}	24	0603
R _{GAIN}	7.5k	0603
V _{LED}	240V	NA

Note:

1. RV1 is for Surge Protection.
2. D1 is for Hi-POT protection.

OUTLINE DIMENSIONS (Dimensions shown in millimeters)

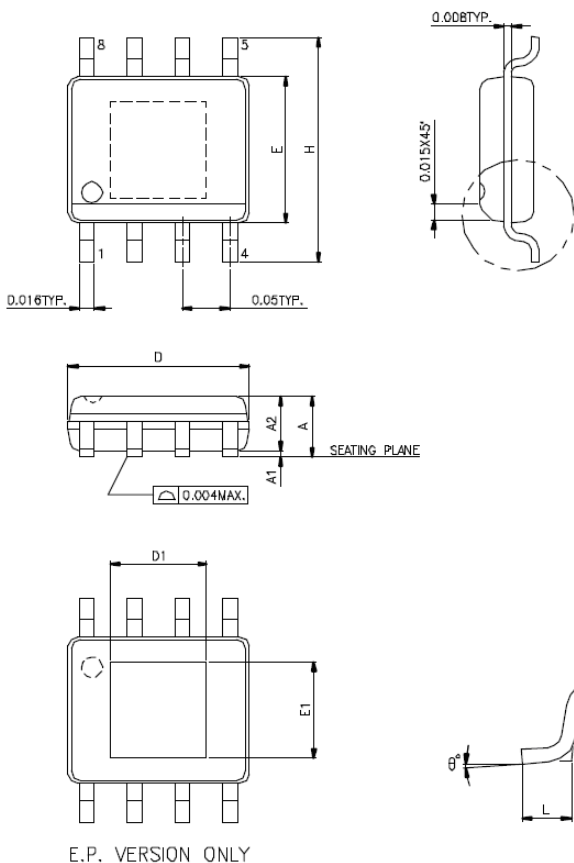
TO252-5L Package



SYMBOLS	DIMENSIONS IN MILLIMETER	
	MIN.	MAX.
A	2.18	2.39
A1	0.00	0.13
A2	1.02	1.27
b	0.51 TYP.	
b2	5.21	5.46
c	0.46	0.58
c1	0.46	0.58
D	5.33	5.59
D1	4.57	—
E	6.35	6.73
E1	3.81	—
e	1.27 BSC.	
H	9.40	10.41
L	1.40	1.78
L1	2.67 REF.	
L2	1.52	2.03
θ	0°	4°

NOTES:
1. JEDEC OUTLINE : N/A

SOP-8L Package



SYMBOLS	MIN.	MAX.
A	1.35	1.75
A1	0.05	0.15
A2	—	1.5
D	4.8	4.98
E	3.8	4.0
H	5.8	6.2
L	0.4	1.27
θ	0	8

UNIT:mm

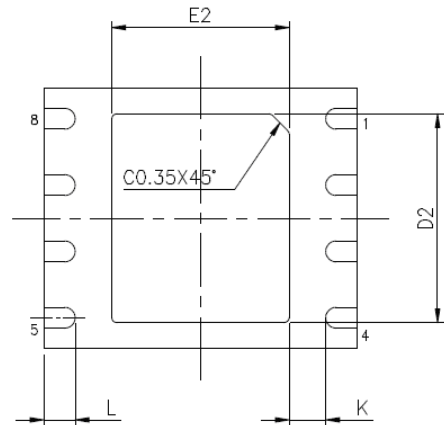
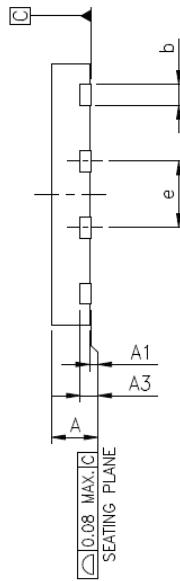
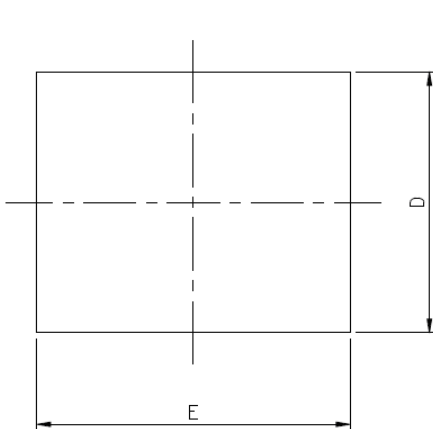
THERMALLY ENHANCED DIMENSIONS

E1	D1
2.2 REF	3.0 REF

UNIT:mm

NOTES:
1. JEDEC OUTLINE : N/A
2. DIMENSIONS "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .15mm (.006in) PER SIDE.
3. DIMENSIONS "E" DOES NOT INCLUDE INTER-LEAD FLASH, OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED .25mm (.010in) PER SIDE.

DFN-8L Package



JEDEC OUTLINE	PACKAGE TYPE					
	N/A			VDFN(N/A)		
PKG CODE	WDFN(X608)			VDFN(N/A)		
SYMBOLS	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.80	0.85	0.90
A1	0.00	0.02	0.05	0.00	0.02	0.05
A3	0.20 REF.			0.20 REF.		
b	0.35	—	0.48	0.35	—	0.48
D	5.00 BSC			5.00 BSC		
E	6.00 BSC			6.00 BSC		
e	1.27 BSC			1.27 BSC		
L	0.50	—	0.70	0.50	—	0.70
K	0.20	—	—	0.20	—	—

PAD SIZE	E2			D2			LEAD FINISH		JEDEC CODE
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	Pure Tin	PPF	
142X165 MIL	3.30	3.40	3.45	3.90	4.00	4.05	V	V	N/A

UNIT:mm

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.15mm AND 0.30mm FROM THE TERMINAL TIP, IF THE TERMINAL HAS THE OPTIONAL RADIUS ON THE OTHER END OF THE TERMINAL, THE DIMENSION b SHOULD NOT BE MEASURED IN THAT RADIUS AREA.
3. BILATERAL COPLANARITY ZONE APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.