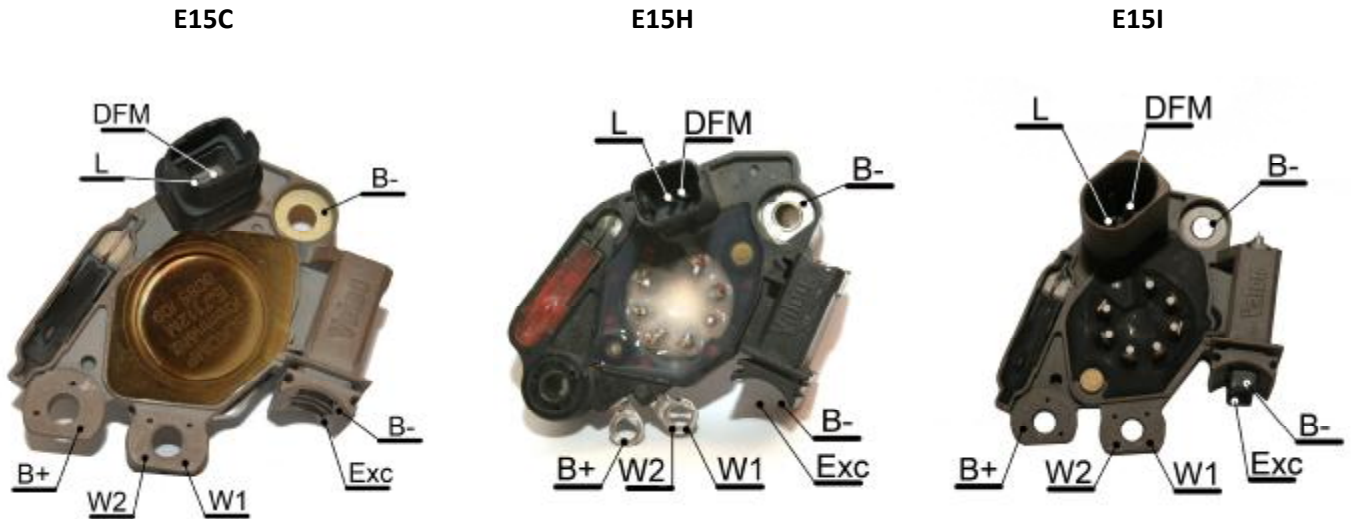


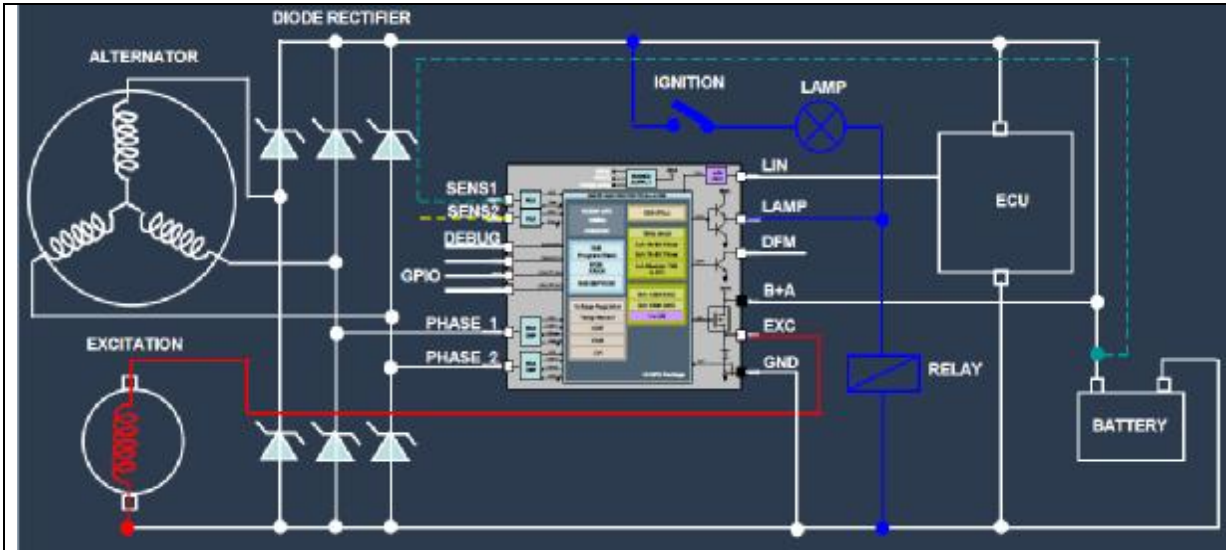
## E15 C-H-I - 14V Replaces Valeo



### Description

The E15 C - H - I -14V Replaces Valeo are a monolithic multifunction alternator voltage regulator based on Motorola chipset and intended for use in automotive application. It includes the control section, the field power stage, fault diagnostic circuit which drives a warning lamp.

Application diagram:



1.1 ELECTRICAL RATINGS

(-40°C to 140°C, unless otherwise stated)

Rating	Symbol	MIN value	Typical value	MAX value	Unit
B+A supply pin: DC Voltage	$V_{B+Acont}$			24	V
Transient voltage (Load Dump)	$V_{B+Atrans}$			37	V
Reverse <sup>1</sup>	$V_{B+Arev}$	-2.5V			V
LAMP pin	$V_{MAX[LAMP]}$	-2		$V_{B+A} + 1$	V
DF pin	$V_{MAX[DF]}$	-2		40	V
Phase pins	$V_{MAX[phase]}$	-40		40	V
EXC pin <sup>1</sup>	$V_{MAX[EXC]}$	-2.5		$V_{B+A} + 1$	V

1. Dependant upon bond wire diameter and package

1.2 THERMAL RATINGS:

Rating	Symbol	MIN value	MAX value	Unit
Storage temperature	$T_{stor}$	-45	175	°C
Junction temperature	$T_{op}$	-40	160	°C
Parametric operating temperature	$T_{pop}$	-40	140	°C

## 2 Electrical characteristics

(-40°C to 140°C, unless otherwise stated)

Rating	Symbol	MIN value	typ value	MAX value	Unit
Operating normal $V_{B+A}$	$V_{norm}$	7		18	V
Quiescent current <sup>1</sup>	$I_{SB}$		400	500 <sup>2</sup>	$\mu$ A
Operating current <sup>3</sup>	$I_{op}$		12.0		mA
Range of regulation voltage (50%DC) <sup>4</sup>	$V_{reg}$	14		15	V
$\Delta V_{reg}$ <sup>5</sup>	$\Delta V_{reg}$	-150		+150	mV
$\Delta V_{reg,load}$ <sup>6</sup>	$\Delta V_{reg,L}$	-150		0	mV
$\Delta V_{reg,speed}$ <sup>7</sup>	$\Delta V_{reg,S}$	-100		100	mV
LAMP power-up threshold voltage	$V_{LAMP}$	0.5		1.0	V
LAMP power-up threshold current	$I_{LAMP}$	0.1		0.5	mA
LAMP $V_{on}$ @2mA <sup>8</sup>	$V_{ONL1}$	0.9		1.7	V
LAMP $V_{on}$ @300mA <sup>8</sup>	$V_{ONL2}$	0.9		1.8	V
LAMP $V_{on}$ @1A <sup>8</sup>	$V_{ONL3}$	0.9		2.5	V
TRIO $V_{on}$ @1A <sup>8</sup>	$V_{ONT}$	0		0.5	V
EXC diode $V_{forward}$ @3A <sup>8</sup>	$V_{f[diode]}$	0.6		1.4	V
EXC diode leakage <sup>8</sup>	$V_{leak[diode]}$	-1 <sup>9</sup>		10	$\mu$ A

Rating	Symbol	MIN value	typ value	MAX value	Unit
DF $V_{on}$ (B+A=13V, R=300 $\Omega$ ) <sup>8</sup>	$V_{ONDF1}$		1.0		V
DF $V_{on}$ (B+A=13V, R=300 $\Omega$ ) <sup>10</sup>	$V_{ONDFIT}$			2	V
DF $V_{on}$ (B+A=13V, R=1700 $\Omega$ )	$V_{ONDF2}$		0.3		V
FIELD $R_{DS_{ON}}$ <sup>8</sup>	$R_{DSON}^F$			150	m $\Omega$
FIELD TMOs leakage	$V_{leak[FIELD]}$	-10 <sup>9</sup>		100	$\mu$ A
Over-current LAMP protection threshold	$I_{LAMPCC}$	0.8	1.4	2.2	A
Over-current TRIO protection threshold	$I_{TRIOCC}$	2		4	A
Over-current FIELD protection threshold	$I_{FIELDCC}$	15		20	A
Over-current DF protection threshold	$I_{DFCC}$		500		mA

1. Phase1 and Phase2 @0V
2. At 25°C.
3. 17%DC, no EXC or LAMP loads
4. See Table 1 for actual available values.
5. alternator speed 6000rpm, alternator output current=10A.
6. alternator speed 6000rpm, Field duty cycle from 5% to 90%.
7. alternator speed from 18000 rpm to 1500rpm, alternator output current=5A.
8. At 25°C.
9. The small negative limit is to allow for test equipment variation.
10. At 140°C.

### **3 Thermal characteristics (Junction).**

Rating	Symbol	MIN value	typ value	MAX value	Unit
Over-temperature Field Shutdown threshold	$T_{EXC}$	160	180	190	°C
Over-temperature lamp Shutdown threshold	$T_{LAMP}$	160	175	190	°C
Over-temperature lamp Shutdown hysteresis	$\delta T_{lamp}$		10		°C
Regulation voltage primary TC <sup>1</sup>	$TC_{reg}$				mV/ °C

1. see Table 1: on page 9

### **4 Electrical over-stress characteristics**

(@25°C unless otherwise stated)

Rating	Symbol	MIN value	typ value	MAX value	Unit
Load Dump <sup>1</sup>	$V_{LD}$			37	V
Reverse battery voltage (@ $\tau_{B+A}^{Rev}$ )	$V_{B+A}^{Rev}$	-2.8 <sup>2</sup>			V
Reverse battery duration (@ $V_{B+A}^{Rev}$ )	$\tau_{B+A}^{Rev}$	5			s
Schaffner test <sup>1</sup>	$V_{Schaffner}$	-150		150	V

1. See Appendix A for test configuration

2. Duration is 10 seconds and the result is dependant on bond wire diameter and package

## 5 Dynamic Electrical Characteristics

(T<sub>j</sub> = -40°C to 140°C)

Rating	Symbol	MIN value	For a typical alternator	MAX value	Unit
Regulation cycle frequency <sup>1</sup>	f <sub>reg</sub>	60		80	Hz
Lack of phase Duty Cycle <sup>2</sup>	DC <sub>noph</sub>	15 27	17 29	19 31	%
Minimum Duty Cycle	DC <sub>min</sub>	3		7	%
LOW phase voltage threshold <sup>3</sup>	V <sub>LPH</sub>	0.1		0.5	V
LOW phase speed threshold <sup>4</sup>	Θ <sub>LPH</sub>	120	140	160	Hz
LOW phase filter	t <sub>LPH</sub>			50	kHz
Auto amorage on Phase1 <sup>5</sup>	Θ <sub>AA1</sub>			150	Hz
Auto amorage on Phase2 <sup>5</sup>	Θ <sub>AA2</sub>			150	Hz
HIGH phase voltage threshold	V <sub>HPH</sub>	7.5	8.5	9.5	V
HIGH phase voltage hysteresis	δV <sub>HPH</sub>		0.5		V
LRC disable frequency <sup>6</sup>	Θ <sub>LRC</sub>		2xΘ <sub>LPH</sub>		Hz
Lamp switch ON delay <sup>7</sup>	τ <sub>LON</sub>	200		400	ms
Lamp switch OFF delay <sup>7</sup>	τ <sub>LOFF</sub>			18	ms
Duty Cycle Error  DF:EXC  <sup>8</sup>	τ <sub>DF:EXC</sub>	-2		2	%

1. See Table 3 for frequency ranges, depending on number of poles in alternator and required cut-in speed.

2. Typical 17%DC for CP type or 29%DC for LRC type regulators.

3. For 2-phase operation threshold is the difference between PHASE1 and PHASE2.

4. See Table 3 for frequency ranges, depending on number of poles in alternator and required cut-in speed.

5. Typical speed requirement for the alternator to obtain V<sub>LPH</sub> threshold

6. Option LRC has only PHASE2.

7. Dependent on regulation frequency.

8. Percentage difference between switching edges of DF and EXC outputs.

## 6 Dynamic Electrical Characteristics (Cont.)

(T<sub>j</sub> = -40°C to 140°C)

Rating	Symbol	MIN value	typ value	MAX value	Unit
Over-voltage detection threshold	V <sub>OV</sub>	1.04x V <sub>reg</sub>		1.10x V <sub>reg</sub>	V
Over-voltage detection qualification	V <sub>EXCDET</sub>	0.2		1.0	V
Low-voltage detection threshold	V <sub>LV</sub>		0.80x V <sub>reg</sub>		V
Low-voltage detection qualification <sup>1</sup>	Θ <sub>LV</sub>	240	280	320	Hz
UnderVoltage	V <sub>VCCLB</sub>		8.5		V
Power-On-Reset threshold	V <sub>POR</sub>		5		V
Proportional Voltage Band on V <sub>reg</sub>	V <sub>PVB</sub>	40		150	mV
Delta CP Duty Cycle	ΔCP	3.0		3.2	%
Number of CP steps <sup>2</sup>	η <sub>CP</sub>	31	32	32	n

1. See Table 3 for frequency ranges, depending on number of poles in alternator and required cut-in speed.
2. N.B. 31 is the maximum that can exist, however testing may detect 32.

## 7 Environmental characteristics

(@25°C unless otherwise stated)

Rating	Standard	Value
Susceptibility	ISO11452-2 ISO11452-4	@100V/m @200mA
Emissions	VDE0879 C15PR/D/WG2	@200mA
ESD (IC)	MIL883 (HBM)	+/-2KV
ESD (LAMP) <sup>1</sup>	IEC801	+/-4KV
ESD (DF) <sup>1</sup>	IEC801	+/-3kV <sup>2</sup>
Transients	ISO7637-1	Appendix A

1. Regulator mounted on the alternator
2. Voltages in excess of this can require external protection components.

## 8 ADJUSTMENTS/SETTINGS

Suffix	Regulation voltage (V)	Precision (mV)
C, E, H, I, J, L, T	14.55	+/-100
K	14.30	+/-100

Table 1: Model type and regulation voltage at 20°C.

Suffix	$\delta$ temp mV/K	Precision mV/K
C, E, H, L, T	-10	+/- 2
	-7	+/- 2
	-5	+/- 2
I, J	-3.5	+/- 1
K	-0	+/- 1

Table 2: Model Type and Temperature Coefficient.

Suffix	Cut-in speed rpm	Nº of pole-pairs	Cut-in Frequency Hz	$\Theta_{LV}$ Hz	$F_{osc}$ kHz	$F_{reg}$ Hz
E, H, K, T	1400	6	140.0	280.0	143.4	68.4
	1400	8	186.7	373.3	191.1	91.1
J	1440	6	144.0	288.0	147.5	70.5
I	1440	8	192.0	384.0	196.6	93.8
	1600	6	160.0	320.0	163.8	78.1
	1600	8	213.3	426.7	218.5	104.2
C, L	1800	6	180.0	360.0	184.3	87.9
	1800	8	240.0	480.0	245.8	117.2

Table 3: Model Type and Cut-in RPM/PHASE speed

Prog. table T, T, T, T

Suffix	$\eta_{CP}$	PAD CP1	PAD CP2
	0s	0	0
	2.5s	1	0
	5s	0	1
E, H	10s	1	1

Table 4: CP Fuse Settings

0: FUSE IN PLACE  
1: FUSE BLOWN

0s :No CP functionality  
2.5s :2.5s at a PHASE frequency of 180Hz  
5s :5s at a PHASE frequency of 180Hz  
10s :10s at a PHASE frequency of 180Hz

Suffix	$\eta_{LRC}$	PAD CP1	PAD CP2
	0s	0	0
K, L, T	2.5s	1	0
I, J	5s	0	1
C	10s	1	1

Table 5: LRC Fuse Settings

0: FUSE IN PLACE  
1: FUSE BLOWN

0s :No LRC functionality  
2.5s :Time from 0% to 100%DC = 2.5s  
5s :Time from 0% to 100%DC = 5s  
10s :Time from 0% to 100%DC = 10s