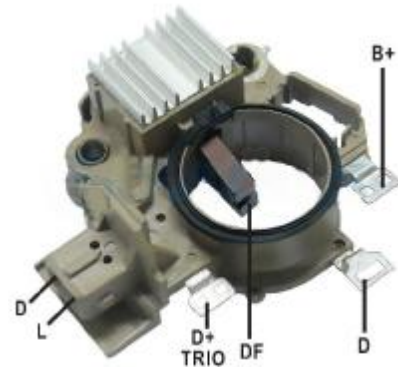


Multifunctional regulator E16D-14V – Replaces Mitsubishi

Feature overview

- FULLY MONOLITHIC DESIGN
- LOW SIDE FIELD DRIVER
- THERMAL PROTECTION
- FIELD SHORT CIRCUIT PROTECTION
- PROTECTED DIAGNOSTIC LAMP DRIVER
- PROTECTED HIGH SIDE RELAY DRIVER
- COMPLEX DIAGNOSTICS
- LOAD RESPONSE CONTROL
- DFM OUTPUT (FIELD MONITOR)



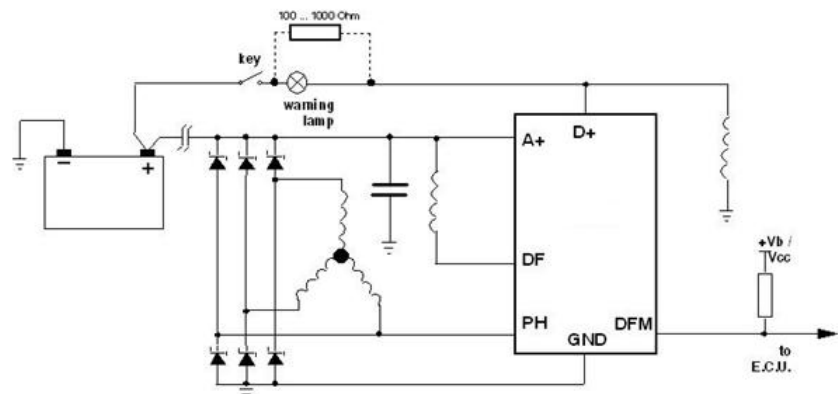
E16D-14V Replaces Mitsubishi

Original code number: A 866 X 40371
 Application: Ford, Mitsubishi
 Alternator: MITSUBISHI:A3TN1791
 FORD: 98VB10K359BB

Description

The E16D-14V is a monolithic multifunction alternator voltage regulator 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



Electrical characteristics

Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|--------|--|--------------------|------|
| VS | DC Supply Voltage (2 min. @ 25°) | 24 | V |
| | Transient Supply Voltage (load dump); t < 0.5s @ 25°C | 40 | V |
| | Transient Supply Voltage (low energy spikes pulse ISO7637/1) | 60 | V |
| IO | Output Current Capability | internally limited | A |
| Ptot | Power Dissipation(@ Tcase = 150°C, I _{field} = 5A) | Tbd | |
| | Reverse Voltage all pins @ 25°C, T = 15s | -2.5 | V |
| | DC Pin Current (bonding limitation) on DF, A+, GND pins | 11 | A |
| | EDS Voltage (Human body model) | ±4 | KV |

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Thermal data

| Symbol | Parameter | Value | Unit |
|------------------------|---------------------------------------|------------|------|
| T _{case} | Case temperature | -40 to 160 | °C |
| T _{stg} | Storage temperature | -40 to 170 | °C |
| T _{sh} | Thermal shutdown | 185 ±15 | °C |
| R _{th j-case} | Thermal Resistance Junction-case Max. | 1.5 | °C/W |

Electrical specifications

(– 40 °C ≤ T_J ≤ 125 °C, unless otherwise noted)

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|---------------------------------|---|--|---------------|-------------|--------------|------------|
| V _{bat} | Operating Supply Voltage | | 8.5 | | 18 | V |
| I _{bsink} | Supply Battery Current | | | | 50 | mA |
| I _{bstby} | Stand-by Current | V _{bat} = 12V, T = 25°C | | | 300 | μA |
| | | V _{bat} = 12V, T = 40°C | | | 500 | |
| V _{reg} | Regulated Voltage & Therm. Drift (standard version) | I _{alt} = 0.5 · I _{nom} ; rpm = 0.5 · RPM _{MAX} ; T = 20°C | 14.3 -4 | 14.45 -3 | 14.6 -2 | V mV/°C |
| V _{reg} ⁽¹⁾ | Regulated Voltage & Therm. Drift (optional version) | I _{alt} = 0.2 · I _{nom} ; rpm = 0.5 · RPM _{MAX} ; T = 20°C | 14.1 -11.5 | 14.5 -10 | 14.9 -8.5 | V mV/°C |
| f _{sw} | Switching Frequency | in FSDF | 30 | | 400 | Hz |
| V _{rpm} | Delta V _{rpm} | 1800 < rpm < 12000; I _{alt} = 0.3 · I _{nom} | | | 200 | mV |
| V _{load} | Delta V _{load} | 0.1 · I _{nom} < I _{alt} < 0.9 · I _{nom} ; rpm = 0.5 · rpm _{max} | | | 200 | mV |
| V _{reg} | Reg. Voltage without Battery | I _{alt} = 3A resistive | | | 16 | V |
| V _{OV} | D+ Drivers Disable Thershold | Voltage on pin A+ to have D+ = OFF | 18 | | 22 | V |
| T _{j-sd} | Thermal Shut-down | DF = OFF STATE D+ = OFF STATE | 170 | | 200 | °C |
| T _{j-sd-hys} | Thermal Shut-down Hysteresis | DF, D+ = from off state (due to thermal shutdown) to on | 2 | | 10 | °C |
| R _{on} | Low Side Driver R _{dson} | T = 150°C; I = 5A | | | 230 | mΩ |
| R _{on} | Low Side Driver R _{dson} | T = 25°C; I = 5A | | | 130 | mΩ |
| V _F | Freewheeling Diode DF | I _F = 5A | | | 2 | V |
| I _{fSC} | Short Circuit Threshold DF | DF = 12V; T = -40 to 25°C | 8.5 | | 18 | A |
| I _{fSC} | Short Circuit Threshold DF | DF = 12V; T = 25 to 125°C | 7 | | 18 | A |
| V _{s1} | Output Short to GROUND Threshold DF | | 2.1 | | 3.9 | V |
| FSDF | Pre-excitation F.S.D.F | f = 348Hz ±15% | 10.62 | 12.5 | 14.38 | % |

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| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|--------------------|---|--|--------------------|---------------------|---------------------|---------|
| t_{ST} | Soft Start Delay Time | activated at first running-on only | | 0 | | s |
| t_{SL} | Soft Attack Time | from 0 to 100% field duty cycle | 2.5 | 2.88 | 3.39 | s |
| BI | Soft Attack Blind Zone | % of maximum D.C. immediate variation of soft attack | 0 | | 10 | % |
| t_{rise} | Output Voltage Rise Time | $I_{field} = 3A$ resistive | 5 | | 50 | μs |
| t_{fall} | Output Voltage Fall Time | | 5 | | 50 | μs |
| I_{fk} | Output Field Driver Leakage Current | DF = 24V | | | 1 | mA |
| V_{HS} | High Side Driver Saturation Voltage | $I_{source} = 1A$ | | | 1.2 | V |
| V_{LS} | Low Side Driver Saturation Voltage | $I_{sink} = 0.25A$ | | | 1.5 | V |
| VLSB | Selfbias without supply lamp driver voltage | | | | 4 | V |
| IHSC | High Side Current Limitation | A+ = 17.5V; D+ = GND | 1.2 | | 3 | A |
| ILSC | Low Side Current Limitation | A+ = D+ = 17.5V | 0.45 | | 1.5 | A |
| V_{thD+} | Enable Regulator Voltage D+ | | 0.8 | 1 | 1.15 | V |
| I_{thD+} | Enable Regulator Pull-down Current | | 0.4 | | 3.5 | mA |
| DISAB | Soft Attack Inhibition Frequency | | 265 | 313 | 360 | Hz |
| EN ₁ | Soft start delay time enable frequency | | 88 | 104 | 120 | Hz |
| EN _{1_hy} | Soft start delay time enable frequency hysteresis | | EN ₁ -8 | EN ₁ -10 | EN ₁ -12 | Hz |
| VPHL1 | Enable Control Voltage PH high threshold | Square wave 1KHz | 0.67 | 0.795 | 0.92 | V |
| VPHL2 | Enable Control Voltage PH low threshold | | VPHL1 -0.48 | VPHL1 -0.57 | VPHL1 -0.66 | V |
| t_{PH} | PH Filtering Time | | 15 | | 120 | μs |
| VPHH1 | Diag. Phase Loss High Voltage | | 9 | 10.25 | 11.5 | V |
| VPHH2 | Diag. Phase Loss Low Voltage | | 4 | 5 | 6 | V |
| t_{PHD} | Diagnostic PH Filtering Time | | 50 | | 200 | μs |
| I_{PH} | Phase Pull-down Current | | 1 | | 8 | mA |
| t_D | Diagnostic Alarm Delay | | 0.48 | 0.575 | 0.65 | s |
| f_{DFM} | DFM Open Drain Switching Frequency | in FSDF | 30 | | 400 | Hz |
| V_{ol} | Output Low Voltage DFM | $I_{sink} = 25mA$ | | | 1.5 | V |

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| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|------------|------------------------------|---|------|------|------|---------|
| I_{dfmt} | Short Circuit Protection DFM | VDF_MON = 12V | 25 | | 200 | mA |
| I_{lk} | Output Leakage Current DFM | VDF_MON = 24V | | | 0.1 | mA |
| t_{TM} | DFM Output Voltage rise time | R = 2.7k Ω ; C = 1nF; V _{alim} = 13.5V | 0.05 | | 50 | μ s |
| T_TD | DFM Output Voltage fall time | R = 2.7k Ω ; C = 1nF; V _{alim} = 13.5V | 0.05 | | 50 | μ s |

(1) Available through a metal option of the actual device.

Thermal compensation

| Temperature (°C) | Vreg (V) | | |
|---------------------|----------|--------|-------|
| | Min. | Typ. | Max. |
| -40 | 14.43 | 14.645 | 14.86 |
| 25 | 14.30 | 14.45 | 14.60 |
| 125 | 13.90 | 14.15 | 14.40 |

