

FD6M033N06

60V/73A Synchronous Rectifier Module

General Features

- Very High Rectification Efficiency at Output 12V
- Integrated Solution for Saving Board Space
- RoHS Compliant



General Description

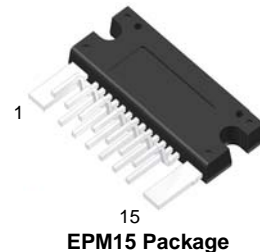
The FD6M033N06 is one product in the Power-SPM™ family that Fairchild has newly developed and designed to be most suitable for more compact and more efficient synchronous rectification applications such as internet server power supplies and telecom system power supplies. For higher efficiency, it includes built-in very low $R_{DS(ON)}$ MOSFETs. This Power-SPM device can be used in the secondary side of the PWM transformer of forward/bridge converter to provide high current rectification at output voltages ranging from 12 Volts down to 5 Volts. With this product, it is possible to design the secondary side of power supply systems with reduced parasitic elements resulting in minimized voltage spike and EMI noise.

MOSFET Features

- $V_{DSS} = 60V$
- $Q_{G(TOTAL)} = 99nC(Typ.)$, $V_{GS} = 10V$
- $R_{DS(ON)} = 2.6m\Omega(Typ.)$, $V_{GS} = 10V$, $I_D = 40A$
- Low Miller Charge
- Low Q_{rr} Body Diode
- UIS Capability (Single Pulse and Repetitive Pulse)
- Fully Isolated Package

Applications

- High Current Isolated Converter
- Distributed Power Architectures
- Synchronous Rectification
- DC/DC Converter
- Battery Supplied Application
- ORing MOSFET



Block Diagram

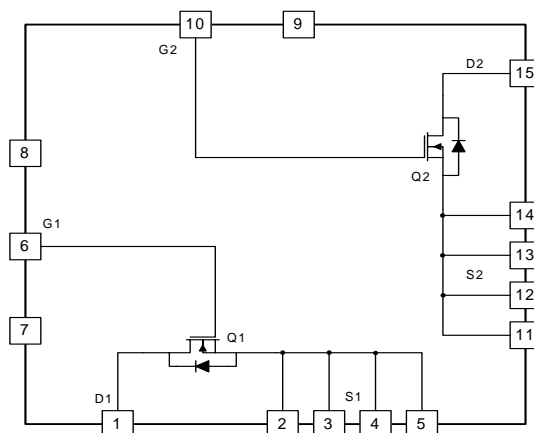


Figure 1. FD6M033N06 Module Block Diagram

Pin Configuration and Pin Description

Top View

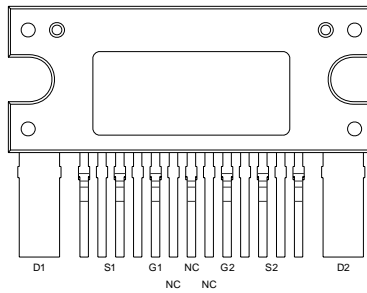


Figure 2. Pinmap of FD6M033N06

| Pin Number | Pin Name | Pin Description |
|------------|----------|----------------------|
| 1 | D1 | Drain of Q1, MOSFET |
| 2 ~ 5 | S1 | Source of Q1, MOSFET |
| 6 | G1 | Gate of Q1, MOSFET |
| 7 | NC | No Connection |
| 8 | NC | No Connection |
| 9 | NC | No Connection |
| 10 | G2 | Gate of Q2, MOSFET |
| 11 ~ 14 | S2 | Source of Q2, MOSFET |
| 15 | D2 | Drain of Q2, MOSFET |

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, Unless Otherwise Specified

| Symbol | Parameter | Rating | Unit |
|----------------|---|-----------|------------------|
| V_{DS} | Drain to Source Voltage (Note1) | 60 | V |
| V_{GS} | Gate to Source Voltage | ± 20 | V |
| I_D | Drain Current, Continuous ($V_{GS} = 10\text{V}$) (Note1) | 73 | A |
| E_{AS} | Single Pulse Avalanche Energy (Note1,2) | 924 | mJ |
| T_J, T_{STG} | Operating and Storage Temperature Range | -40 ~ 150 | $^\circ\text{C}$ |

Thermal Resistance

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|-----------------|---|------|------|------|--------------------|
| $R_{\theta JC}$ | Junction to Case Thermal Resistance (Note1) | - | - | 3.9 | $^\circ\text{C/W}$ |

Note:

- Each MOSFET Switch
- Starting $T_J = 25^\circ\text{C}$, $V_D = 40\text{V}$, $L = 0.2\text{mH}$, $I_{AS} = 55.5\text{A}$

Electrical Characteristics $T_C = 25^\circ\text{C}$, Unless Otherwise Specified

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|--------|-----------|-----------------|------|------|------|-------|
|--------|-----------|-----------------|------|------|------|-------|

Synchronous Rectifier Switch Part (Each Switch)

| | | | | | | |
|--------------|-----------------------------------|--|---------------------------|-----|-----------|---------------|
| BV_{DSS} | Drain to Source Breakdown Voltage | $I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$ | 60 | - | - | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{GS} = 0\text{V}$, $V_{DS} = 48\text{V}$ | - | - | 1 | μA |
| I_{GSS} | Gate to Source Leakage Current | $V_{GS} = \pm 20\text{V}$ | - | - | ± 100 | nA |
| $V_{GS(TH)}$ | Gate Threshold Voltage | $V_D = 20\text{V}$, $I_{DS} = 250\mu\text{A}$ | 2.0 | - | 4.0 | V |
| $R_{DS(ON)}$ | Drain to Source On Resistance | $I_D = 40\text{A}$, $V_{GS} = 10\text{V}$ | - | 2.6 | 3.3 | m Ω |
| | | | $T_J = 150^\circ\text{C}$ | - | 4.88 | |

Dynamic Charateristics

| | | | | | | |
|--------------|----------------------------------|---|---|------|-----|----|
| C_{ISS} | Input Capacitance | $V_{DS} = 25\text{V}$, $V_{GS} = 0\text{V}$, $f = 1\text{MHz}$ | - | 6010 | - | pF |
| C_{OSS} | Output Capacitance | | - | 1145 | - | pF |
| C_{RSS} | Reverse Transfer Capacitance | | - | 365 | - | pF |
| $Q_{g(TOT)}$ | Total Gate Charge at 10V | $V_{GS} = 0\text{V}$ to 10V | - | 99 | 129 | nC |
| $Q_{g(TH)}$ | Threshold Gate Charge | $V_{GS} = 0\text{V}$ to 2V | - | 11 | 14 | nC |
| Q_{gs} | Gate to Source Gate Charge | $V_{DD} = 40\text{V}$ | - | 27 | - | nC |
| Q_{gs2} | Gate Charge Threshold to Plateau | $I_D = 40\text{A}$ | - | 16 | - | nC |
| Q_{gd} | Gate to Drain "Miller" Charge | $I_g = 1.0\text{mA}$ | - | 28 | - | nC |

Switching Charateristics ($V_{GS} = 10\text{V}$)

| | | | | | | |
|--------------|---------------------|---|---|----|-----|----|
| t_{ON} | Turn-On Time | $I_D = 40\text{A}$ $V_{GS} = 10\text{V}$, $V_{DD} = 40\text{V}$, $R_G = 5\Omega$ | - | - | 90 | ns |
| $t_{d(on)}$ | Turn-On Delay Time | | - | 23 | - | ns |
| t_r | Rise Time | | - | 27 | - | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 52 | - | ns |
| t_f | Fall Time | | - | 33 | - | ns |
| t_{OFF} | Turn-Off Time | | - | - | 135 | ns |

Drain-Source Diode Charateristics

| | | | | | | |
|----------|-------------------------------|--|---|----|------|----|
| V_{SD} | Source to Drain Diode Voltage | $I_{SD} = 80\text{A}$, $V_{GS} = 0\text{V}$ | - | - | 1.25 | V |
| | | $I_{SD} = 40\text{A}$, $V_{GS} = 0\text{V}$ | - | - | 1.0 | |
| t_{rr} | Reverse Recovery Time | $I_{SD} = 40\text{A}$, $dI_{SD}/dt = 100\text{A}/\mu\text{s}$ | - | 36 | - | ns |
| Q_{rr} | Reverse Recovery Charge | $I_{SD} = 40\text{A}$, $dI_{SD}/dt = 100\text{A}/\mu\text{s}$ | - | 38 | - | nC |

Typical Performance Characteristics Each Switch, Unless Otherwise Specified

Figure 3. On-Region Characteristics

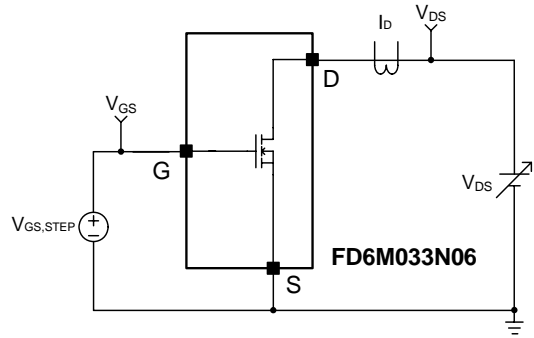
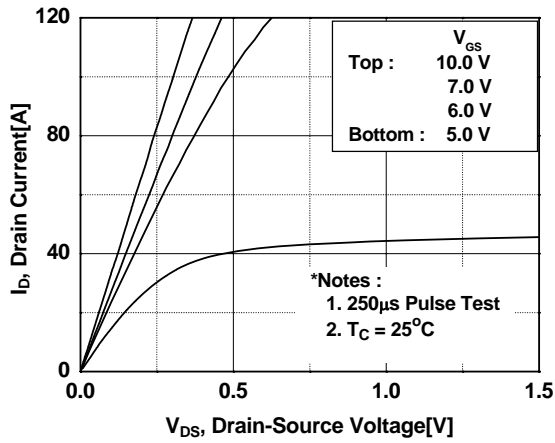


Figure 4. Transfer Characteristics

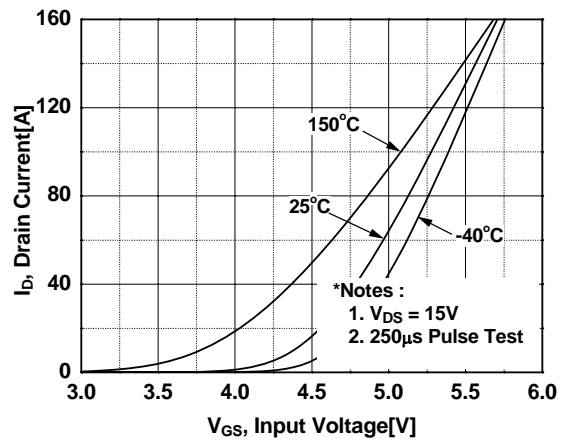
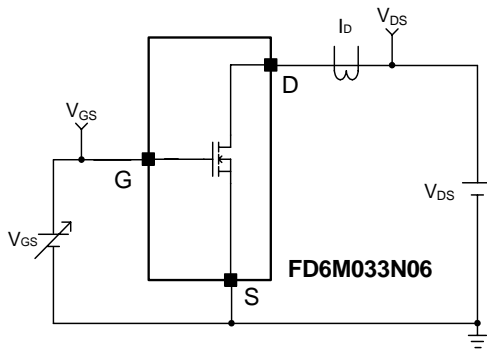


Figure 5. Body Diode Forward Voltage Variation vs. Source Current and Temperature

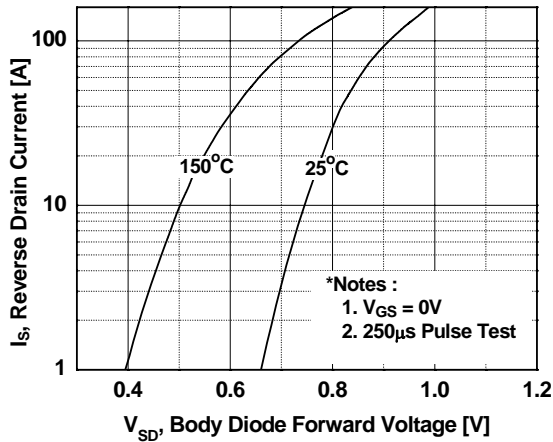
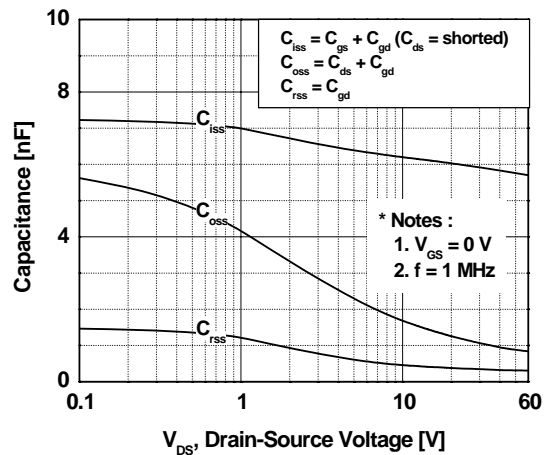


Figure 6. Output Capacitance Characteristic



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

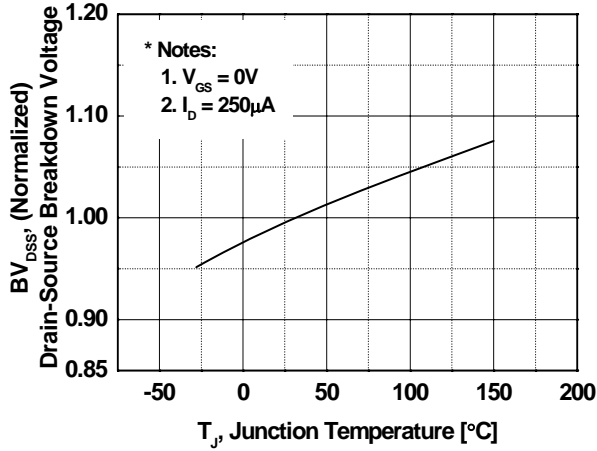


Figure 8. On-Resistance Variation vs. Temperature

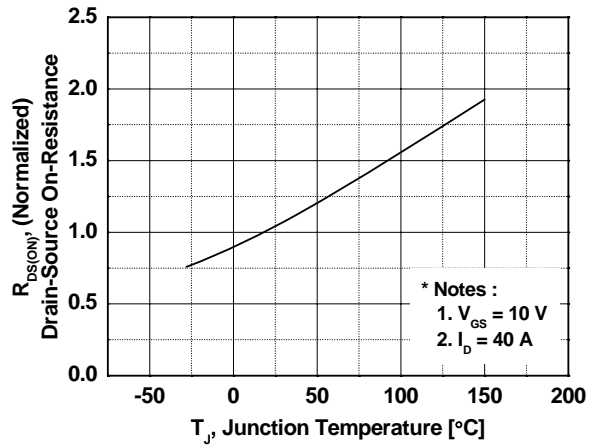


Figure 9. Transient Thermal Response Curve

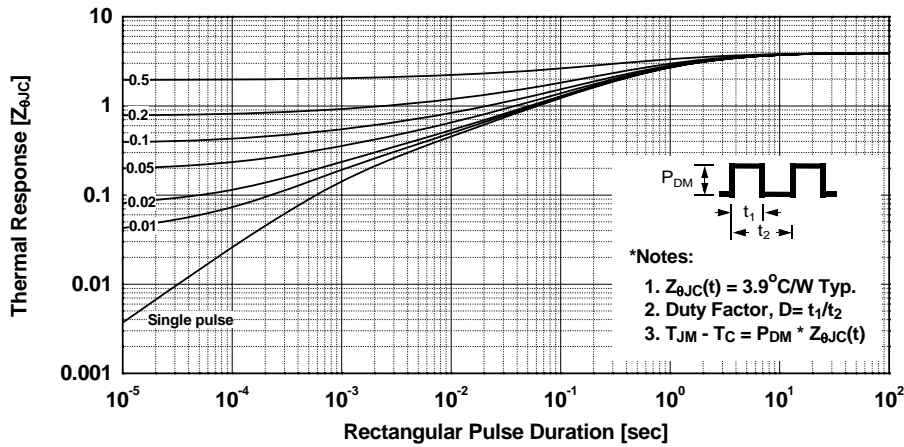


Figure 10. Maximum Safe Operating Area

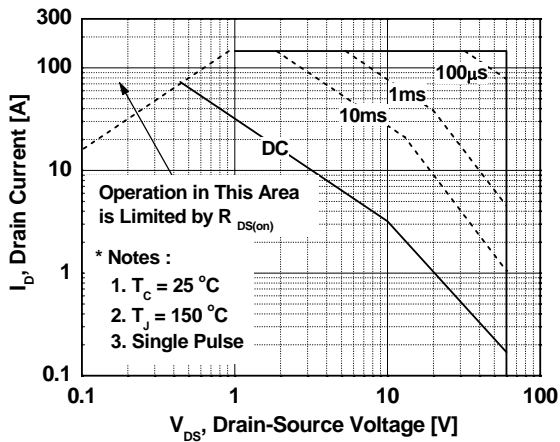
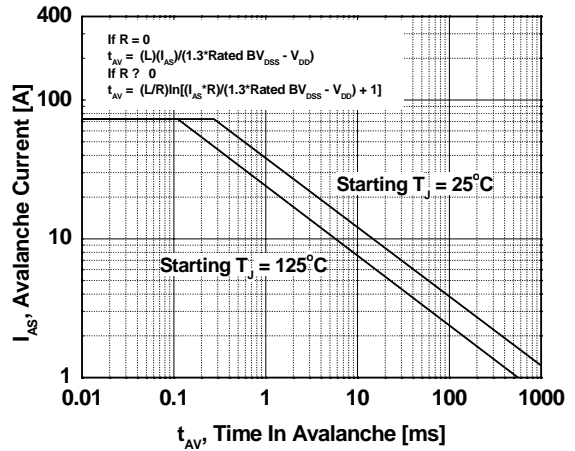


Figure 11. Unclamped Inductive Switching Capability



AC Test Circuits and Waveforms

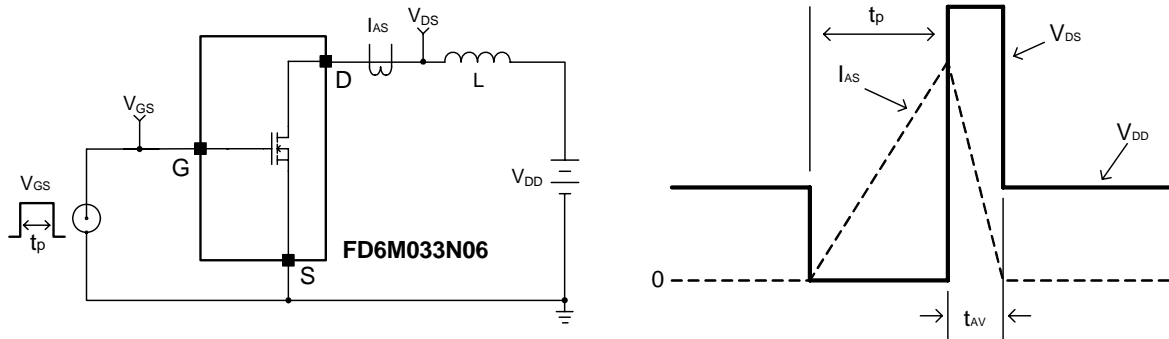


Figure 12. Unclamped Inductive Switching Test Circuit and Waveforms

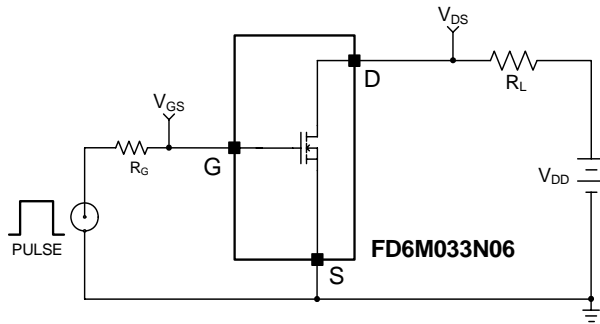


Figure 13. Switching Test Circuit

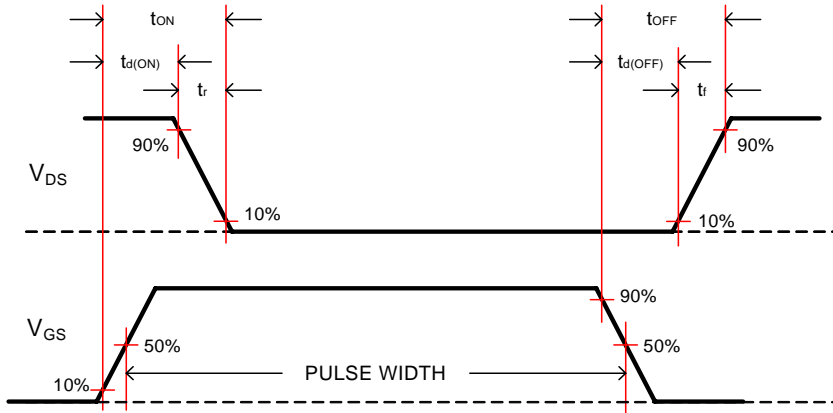


Figure 14. Switching Test Waveforms

Application circuits

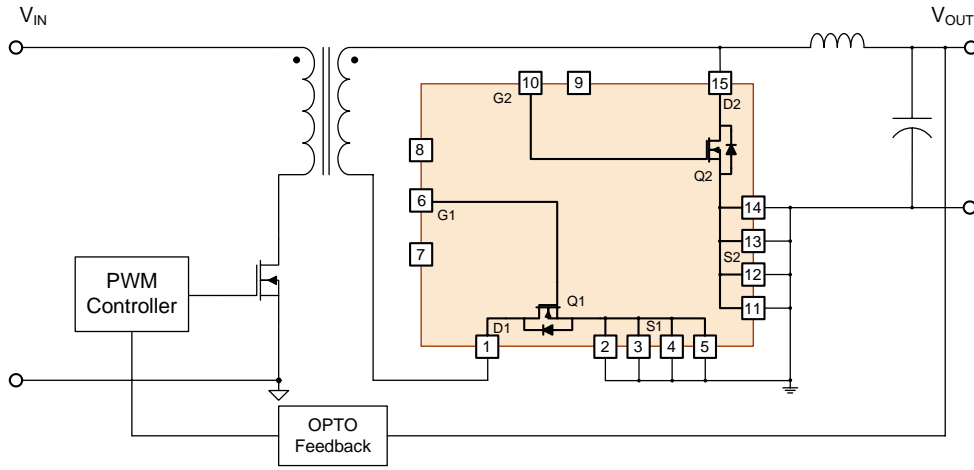


Figure 15. Application Circuit of Forward Converter with FD6M033N06

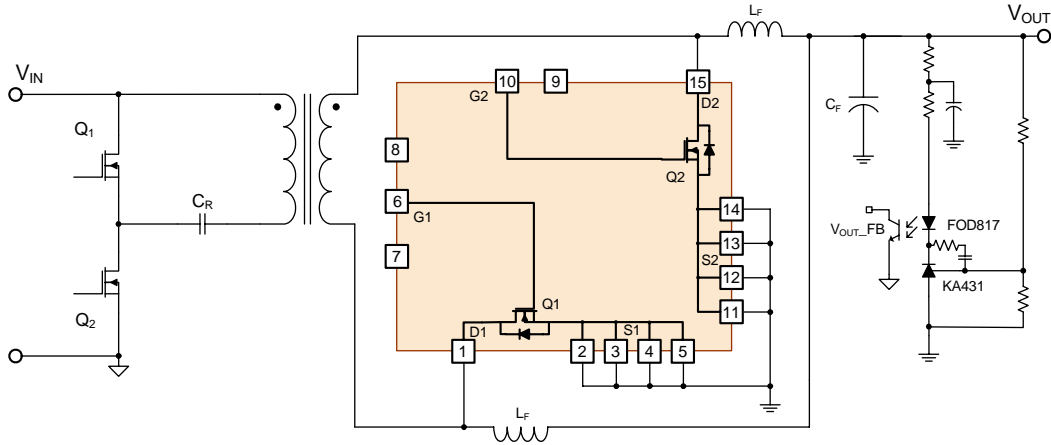


Figure 16. Application Circuit of Asymmetrical HB Converter with FD6M033N06

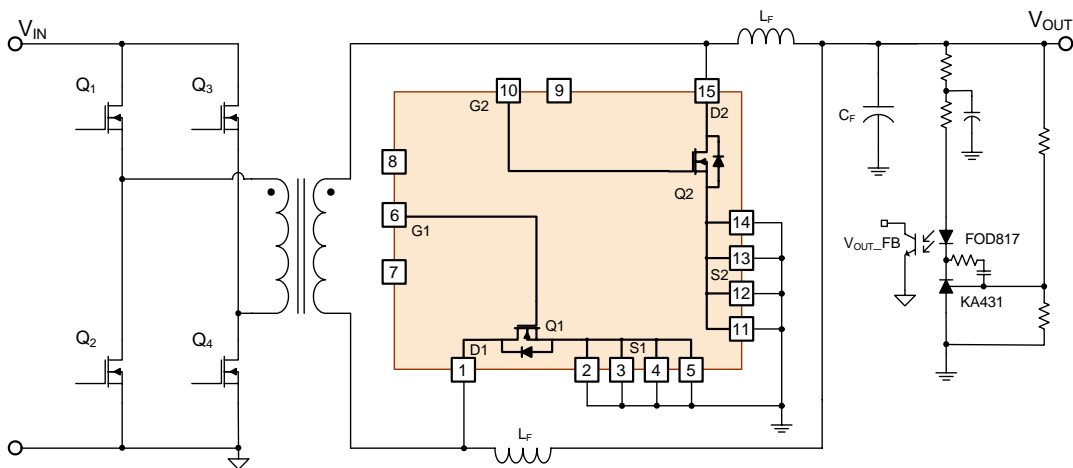


Figure 17. Application Circuit of Full Bridge Converter with FD6M033N06

Detailed Package Outline Drawings

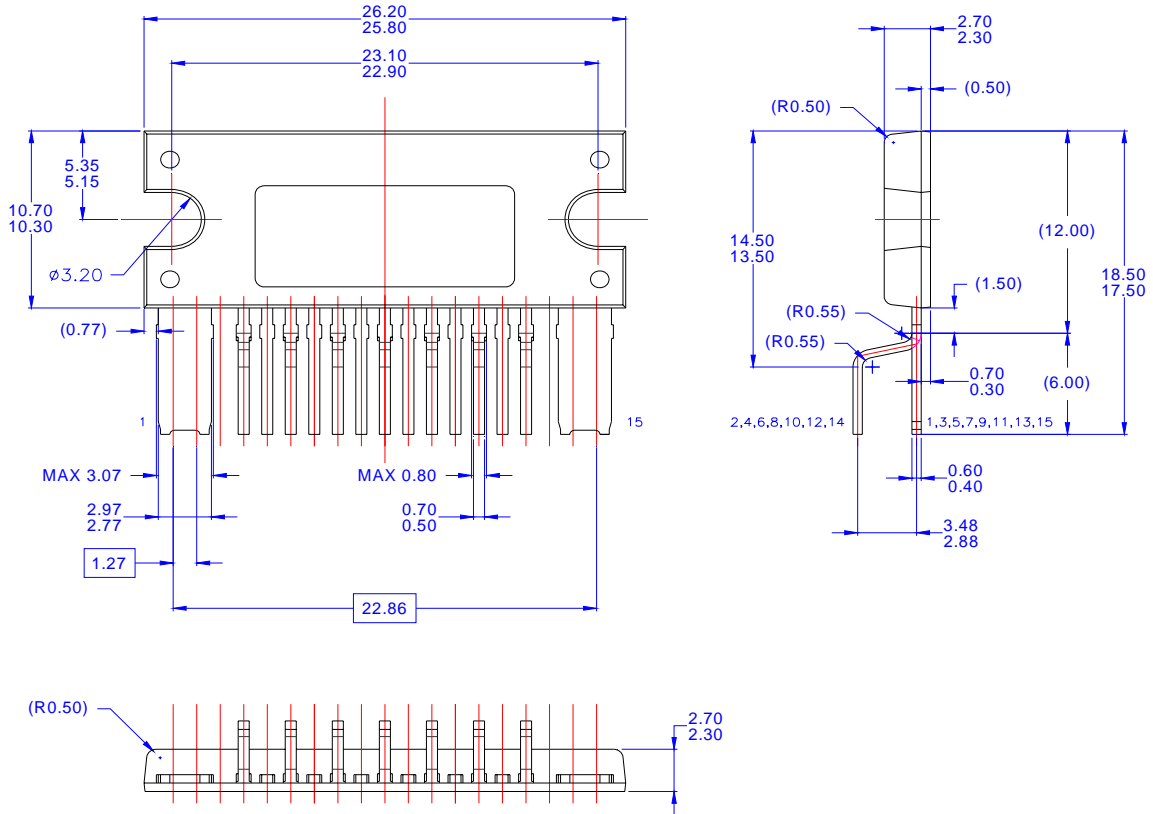






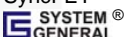
Figure 18. EPM15 Package

Dimensions in Millimeters



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