

FCH47N60_F133 / FCA47N60 / FCA47N60_F109

600V N-Channel MOSFET

Features

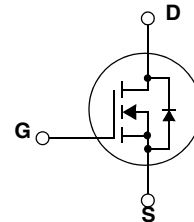
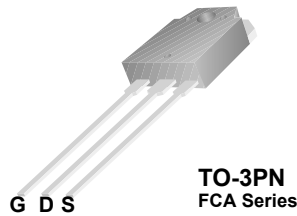
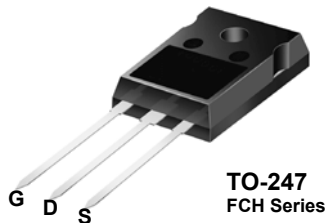
- 650V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{ds(on)} = 0.058\Omega$
- Ultra low gate charge (typ. $Q_g = 210\text{nC}$)
- Low effective output capacitance (typ. $C_{oss,eff} = 420\text{pF}$)
- 100% avalanche tested
- RoHS Compliant



Description

SuperFET® is, Fairchild's proprietary, new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance.

This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. Consequently, SuperFET is very suitable for various AC/DC power conversion in switching mode operation for system miniaturization and higher efficiency.



Absolute Maximum Ratings

| Symbol | Parameter | FCH47N60_F133 | FCA47N60 | Unit |
|----------------|--|---------------|----------|--------------------------|
| V_{DSS} | Drain-Source Voltage | 600 | | V |
| I_D | Drain Current - Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$) | 47 29.7 | | A A |
| I_{DM} | Drain Current - Pulsed (Note 1) | 141 | | A |
| V_{GSS} | Gate-Source voltage | ± 30 | | V |
| E_{AS} | Single Pulsed Avalanche Energy (Note 2) | 1800 | | mJ |
| I_{AR} | Avalanche Current (Note 1) | 47 | | A |
| E_{AR} | Repetitive Avalanche Energy (Note 1) | 41.7 | | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | 4.5 | | V/ns |
| P_D | Power Dissipation ($T_C = 25^\circ\text{C}$) - Derate above 25°C | 417 3.33 | | W W/ $^\circ\text{C}$ |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to +150 | | $^\circ\text{C}$ |
| T_L | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds | 300 | | $^\circ\text{C}$ |

Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|-----------------|---|------|------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | -- | 0.3 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta CS}$ | Thermal Resistance, Case-to-Sink | 0.24 | -- | |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | -- | 41.7 | $^\circ\text{C}/\text{W}$ |

Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|----------------|---------------|---------|-----------|------------|----------|
| FCH47N60_F133 | FCH47N60_F133 | TO-247 | - | - | 30 |
| FCA47N60 | FCA47N60 | TO-3PN | - | - | 30 |
| FCA47N60 | FCA47N60_F109 | TO-3PN | - | - | 30 |

Electrical Characteristics T_C = 25°C unless otherwise noted

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|--|-----|-------|------|-------|
| Off Characteristics | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | V _{GS} = 0V, I _D = 250μA, T _J = 25°C | 600 | -- | -- | V |
| | | V _{GS} = 0V, I _D = 250μA, T _J = 150°C | -- | 650 | -- | V |
| ΔBV _{DSS} / ΔT _J | Breakdown Voltage Temperature Coefficient | I _D = 250μA, Referenced to 25°C | -- | 0.6 | -- | V/°C |
| BV _{DS} | Drain-Source Avalanche Breakdown Voltage | V _{GS} = 0V, I _D = 47A | -- | 700 | -- | V |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} = 600V, V _{GS} = 0V | -- | -- | 1 | μA |
| | | V _{DS} = 480V, T _C = 125°C | -- | -- | 10 | μA |
| I _{GSSF} | Gate-Body Leakage Current, Forward | V _{GS} = 30V, V _{DS} = 0V | -- | -- | 100 | nA |
| I _{GSSR} | Gate-Body Leakage Current, Reverse | V _{GS} = -30V, V _{DS} = 0V | -- | -- | -100 | nA |
| On Characteristics | | | | | | |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} = V _{GS} , I _D = 250μA | 3.0 | -- | 5.0 | V |
| R _{DS(on)} | Static Drain-Source On-Resistance | V _{GS} = 10V, I _D = 23.5A | -- | 0.058 | 0.07 | Ω |
| g _{FS} | Forward Transconductance | V _{DS} = 40V, I _D = 23.5A (Note 4) | -- | 40 | -- | S |
| Dynamic Characteristics | | | | | | |
| C _{iss} | Input Capacitance | V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz | -- | 5900 | 8000 | pF |
| C _{oss} | Output Capacitance | | -- | 3200 | 4200 | pF |
| C _{rss} | Reverse Transfer Capacitance | | -- | 250 | -- | pF |
| C _{oss} | Output Capacitance | V _{DS} = 480V, V _{GS} = 0V, f = 1.0MHz | -- | 160 | -- | pF |
| C _{oss eff.} | Effective Output Capacitance | V _{DS} = 0V to 400V, V _{GS} = 0V | -- | 420 | -- | pF |
| Switching Characteristics | | | | | | |
| t _{d(on)} | Turn-On Delay Time | V _{DD} = 300V, I _D = 47A R _G = 25Ω (Note 4, 5) | -- | 185 | 430 | ns |
| t _r | Turn-On Rise Time | | -- | 210 | 450 | ns |
| t _{d(off)} | Turn-Off Delay Time | | -- | 520 | 1100 | ns |
| t _f | Turn-Off Fall Time | | -- | 75 | 160 | ns |
| Q _g | Total Gate Charge | V _{DS} = 480V, I _D = 47A V _{GS} = 10V (Note 4, 5) | -- | 210 | 270 | nC |
| Q _{gs} | Gate-Source Charge | | -- | 38 | -- | nC |
| Q _{gd} | Gate-Drain Charge | | -- | 110 | -- | nC |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| I _S | Maximum Continuous Drain-Source Diode Forward Current | | -- | -- | 47 | A |
| I _{SM} | Maximum Pulsed Drain-Source Diode Forward Current | | -- | -- | 141 | A |
| V _{SD} | Drain-Source Diode Forward Voltage | V _{GS} = 0V, I _S = 47A | -- | -- | 1.4 | V |
| t _{rr} | Reverse Recovery Time | V _{GS} = 0V, I _S = 47A dI _F /dt = 100A/μs (Note 4) | -- | 590 | -- | ns |
| Q _{rr} | Reverse Recovery Charge | | -- | 25 | -- | μC |

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 18A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 47A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

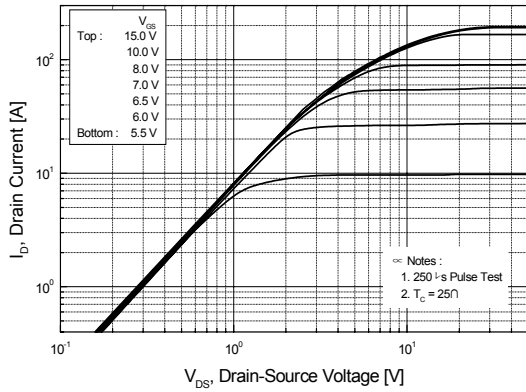


Figure 2. Transfer Characteristics

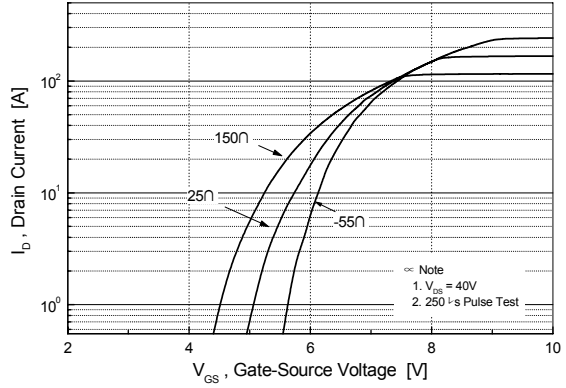


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

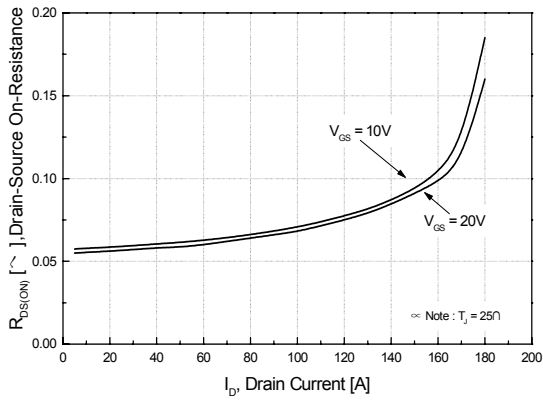


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

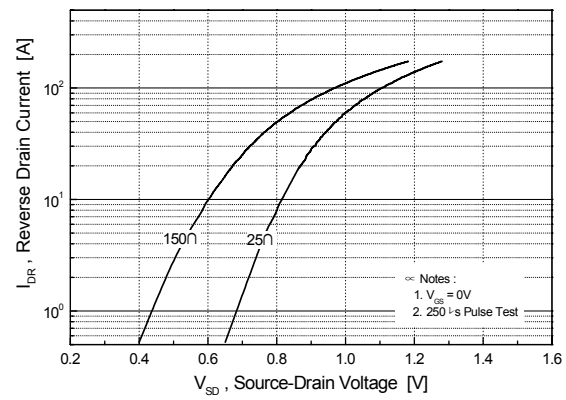


Figure 5. Capacitance Characteristics

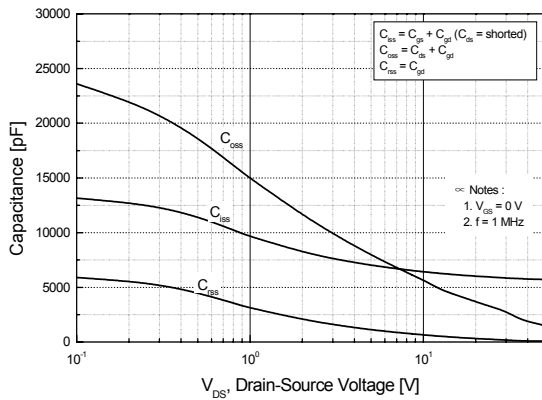
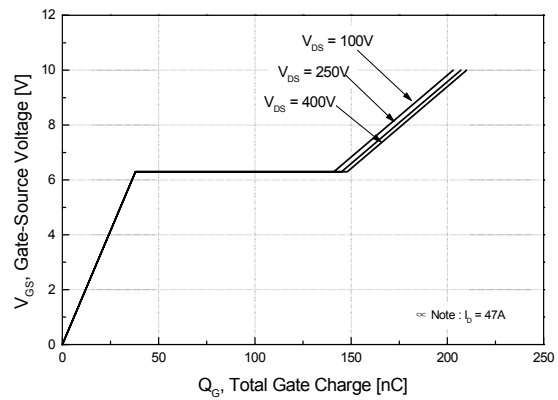


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

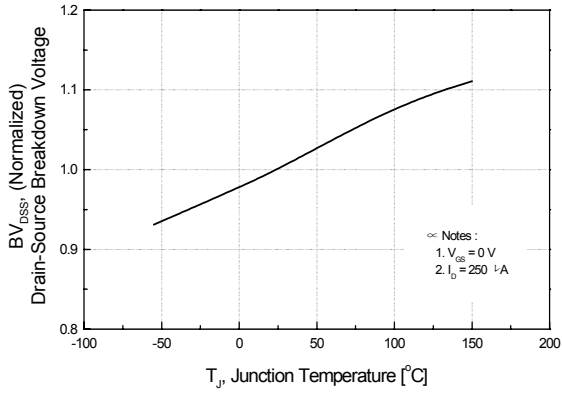


Figure 8. On-Resistance Variation vs. Temperature

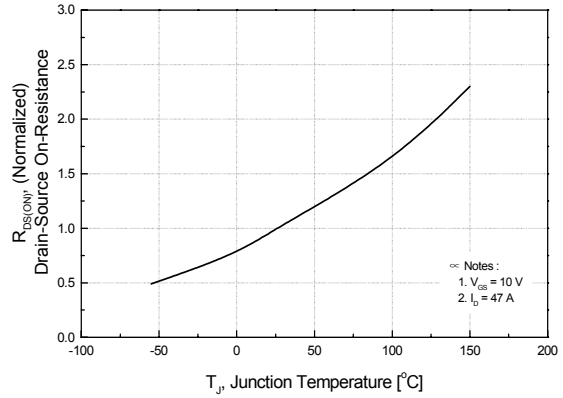


Figure 9. Safe Operating Area

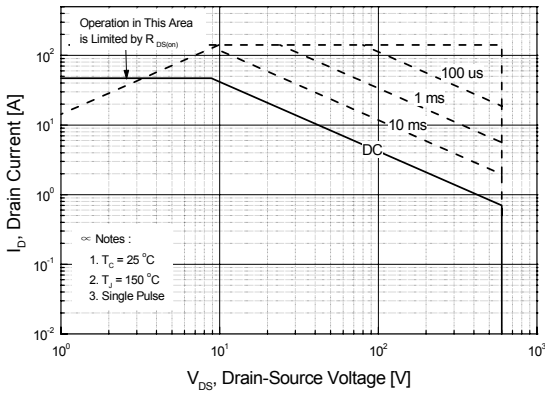


Figure 10. Maximum Drain Current vs. Case Temperature

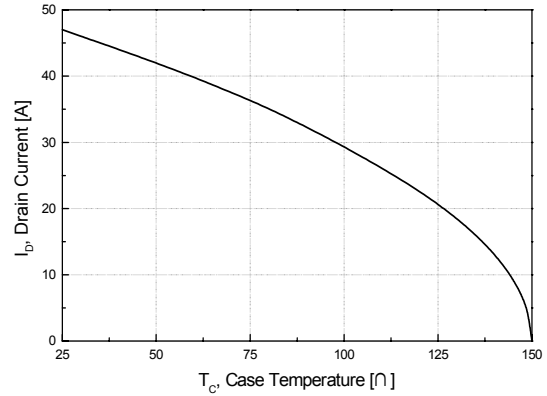
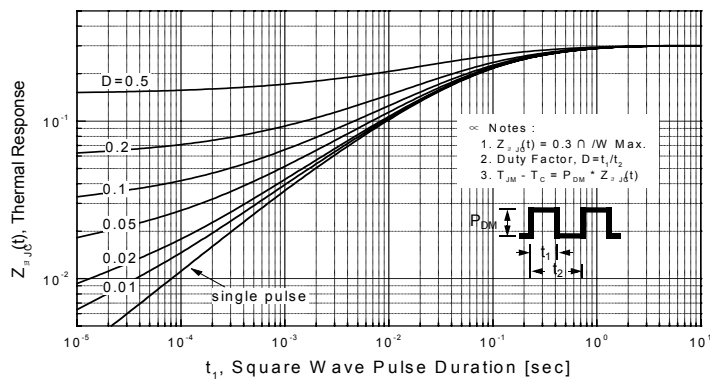
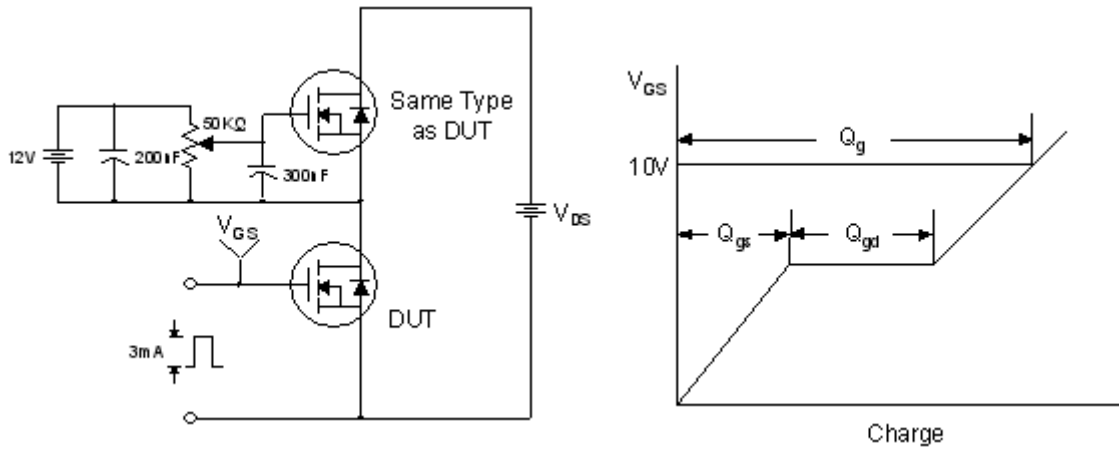


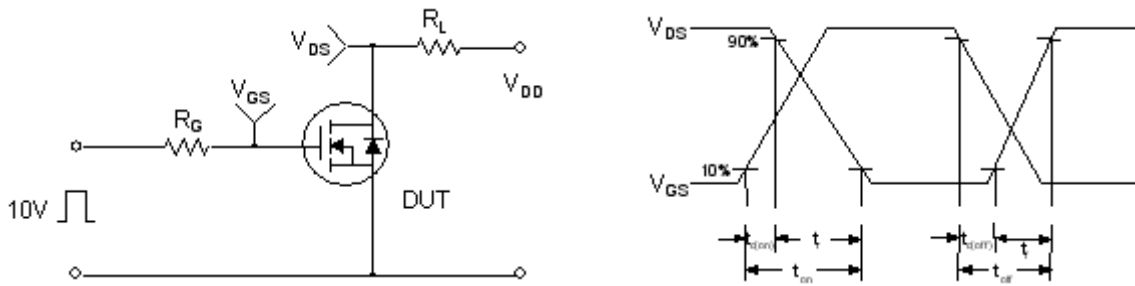
Figure 10. Transient Thermal Response Curve



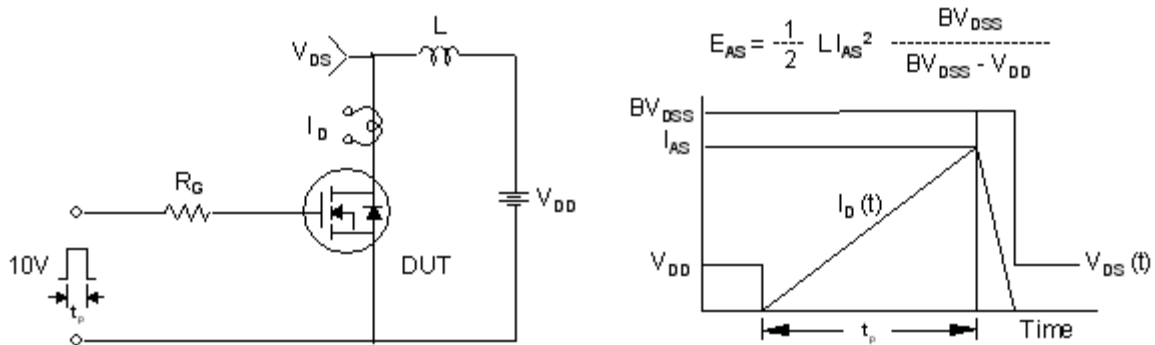
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

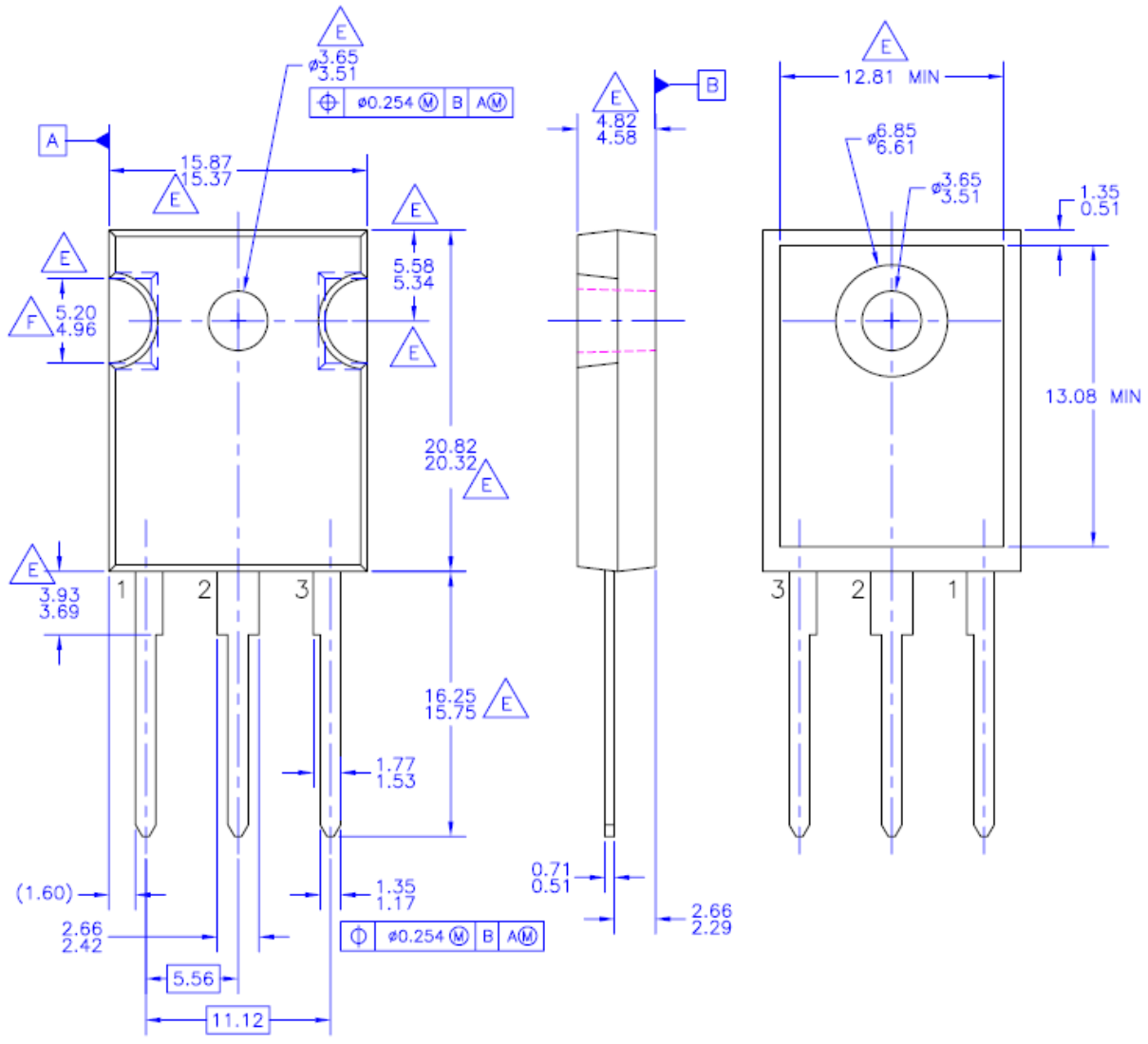


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

TO-247AB

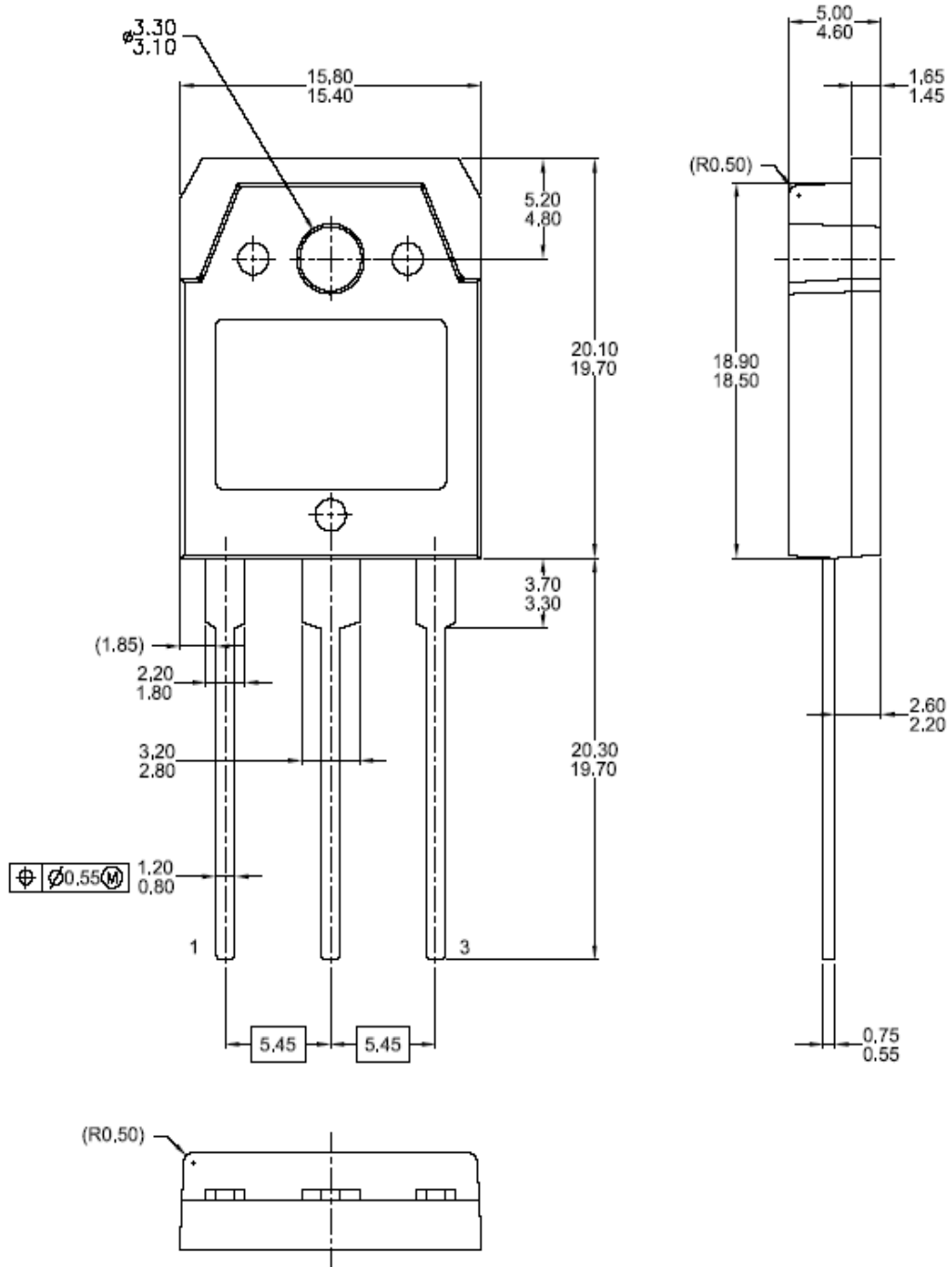


Dimensions in Millimeters

FCH47N60_F133 / FCA47N60 / FCA47N60_F109 600V N-Channel MOSFET

Mechanical Dimensions (Continued)

TO-3PN



Dimensions in Millimeters



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