

MOSFET – N-Channel, SUPERFET[®], FRFET[®]

600 V, 47 A, 73 mΩ

FCA47N60F

Description

SUPERFET MOSFET is onsemi's first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SUPERFET MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications. SUPERFET FRFET MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.

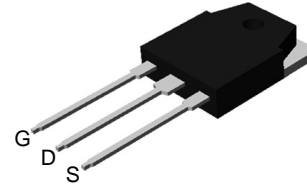
Features

- 650 V @ $T_J = 150^{\circ}\text{C}$
- Typ. $R_{DS(on)} = 62\text{ m}\Omega$
- Fast Recovery Time (Typ. $T_{rr} = 240\text{ ns}$)
- 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

Applications

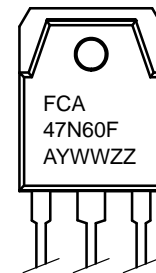
- Solar Inverter
- AC-DC Power Supply

| V_{DSS} | $R_{DS(on)}\text{ MAX}$ | $I_D\text{ MAX}$ |
|-----------|-------------------------|------------------|
| 600 V | 73 mΩ @ 10 V | 47 A |



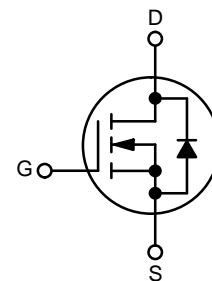
TO-3P-3LD / EIAJ SC-65, ISOLATED
 CASE 340BZ

MARKING DIAGRAM



FCA47N60F = Specific Device Code
 A = Assembly Location
 YWW = Date Code (Year & Week)
 ZZ = Assembly Lot

N-CHANNEL MOSFET



ORDERING INFORMATION

| Part Number | Package | Shipping |
|-------------|------------------------|------------------|
| FCA47N60F | TO-3P-3LD (Pb-Free) | 450 Units / Tube |

FCA47N60F

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, unless otherwise noted)

| Symbol | Parameter | FCA47N60F | Unit |
|-----------------------------------|--|---------------------------------------|------|
| V _{DSS} | Drain–Source Voltage | 600 | V |
| I _D | Drain Current | – Continuous (T _C = 25°C) | 47 |
| | | – Continuous (T _C = 100°C) | 29.7 |
| I _{DM} | Drain Current | – Pulsed (Note 1) | 141 |
| 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) | 50 | V/ns |
| P _D | Power Dissipation | (T _C = 25°C) | 417 |
| | | – Derate above 25°C | 3.33 |
| T _J , T _{STG} | Operating and Storage Temperature Range | –55 to +150 | °C |
| T _L | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds | 300 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive rating: pulse–width limited by maximum junction temperature.
2. I_{AS} = 18 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 47 A, di/dt ≤ 1200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.

THERMAL CHARACTERISTICS

| Symbol | Parameter | FCA47N60F | Unit |
|------------------|---|-----------|------|
| R _{θJC} | Thermal Resistance, Junction–to–Case, Max. | 0.3 | °C/W |
| R _{θJA} | Thermal Resistance, Junction–to–Ambient, Max. | 41.7 | °C/W |

FCA47N60F

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------------|---|--|-----|-----|------|------|
| OFF CHARACTERISTICS | | | | | | |
| BV _{DSS} | Drain–Source Breakdown Voltage | V _{GS} = 0 V, I _D = 250 μA, T _J = 25°C | 600 | – | – | V |
| | | V _{GS} = 0 V, I _D = 250 μA, T _J = 150°C | – | 650 | – | |
| ΔBV _{DSS} / ΔT _J | Breakdown Voltage Temperature Coefficient | I _D = 250 μA, Referenced to 25°C | – | 0.6 | – | V/°C |
| BV _{DS} | Drain to Source Avalanche Breakdown Voltage | V _{GS} = 0 V, I _D = 47 A | – | 700 | – | V |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} = 600 V, V _{GS} = 0 V | – | – | 10 | μA |
| | | V _{DS} = 480 V, T _C = 125°C | – | – | 100 | |
| I _{GSSF} | Gate–Body Leakage Current, Forward | V _{GS} = 30 V, V _{DS} = 0 V | – | – | 100 | nA |
| I _{GSSR} | Gate–Body Leakage Current, Reverse | V _{GS} = –30 V, V _{DS} = 0 V | – | – | –100 | nA |

ON CHARACTERISTICS

| | | | | | | |
|---------------------|-----------------------------------|---|-----|-------|-------|---|
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} = V _{GS} , I _D = 250 μA | 3.0 | – | 5.0 | V |
| R _{DS(on)} | Static Drain–Source On–Resistance | V _{GS} = 10 V, I _D = 23.5 A | – | 0.062 | 0.073 | Ω |
| g _{FS} | Forward Transconductance | V _{DS} = 20 V, I _D = 23.5 A | – | 40 | – | S |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|------------------------|------------------------------|---|---|------|------|----|
| C _{iss} | Input Capacitance | V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz | – | 5900 | 8000 | pF |
| C _{oss} | Output Capacitance | | – | 3200 | 4200 | pF |
| C _{rss} | Reverse Transfer Capacitance | | – | 250 | – | pF |
| C _{oss} | Output Capacitance | V _{DS} = 480 V, V _{GS} = 0 V, f = 1 MHz | – | 160 | – | pF |
| C _{oss(eff.)} | Effective Output Capacitance | V _{DS} = 0 to 400 V, V _{GS} = 0 V | – | 420 | – | pF |

SWITCHING CHARACTERISTICS

| | | | | | | |
|---------------------|---------------------|--|---|-----|------|----|
| t _{d(on)} | Turn–On Delay Time | V _{DD} = 300 V, I _D = 47 A, V _{GS} = 10 V, R _G = 25 Ω (Note 4) | – | 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} = 480 V, I _D = 47 A, V _{GS} = 10 V (Note 4) | – | 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} = 0 V, I _S = 47 A | – | – | 1.4 | V |
| t _{rr} | Reverse Recovery Time | V _{GS} = 0 V, I _S = 47 A, dI _F /dt = 100 A/μs | – | 240 | – | ns |
| Q _{rr} | Reverse Recovery Charge | | – | 2.04 | – | μC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

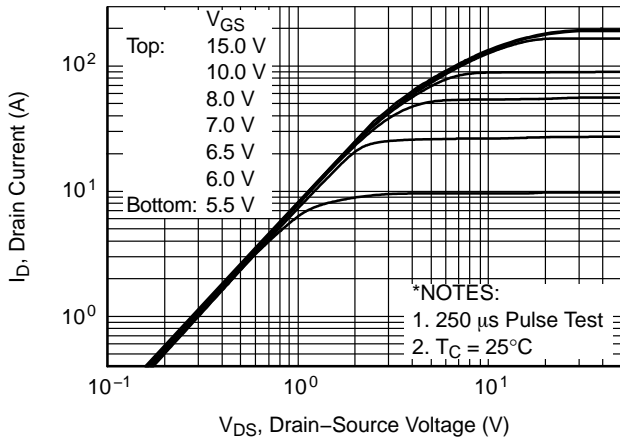


Figure 1. On-Region Characteristics

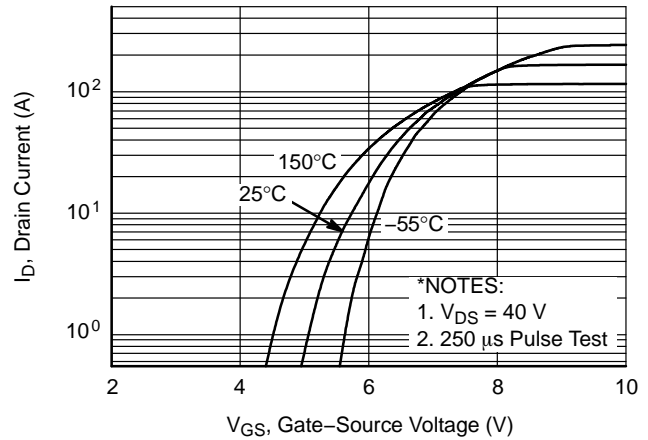


Figure 2. Transfer Characteristics

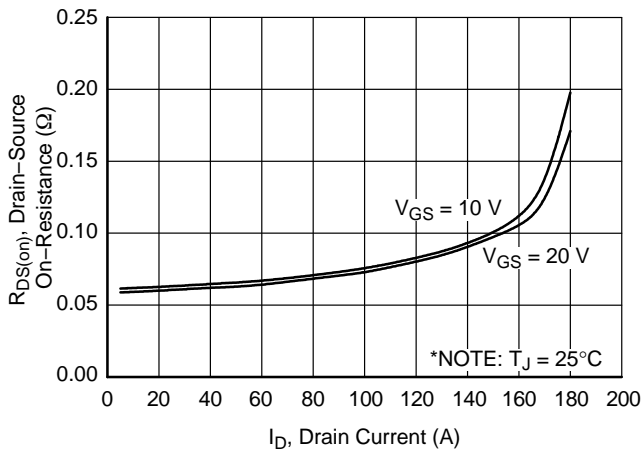


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

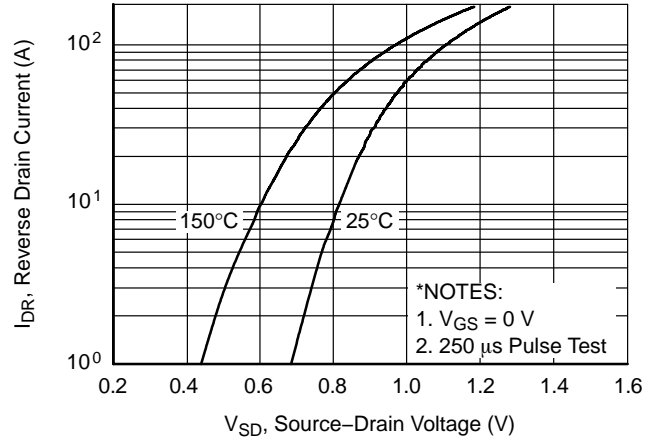


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

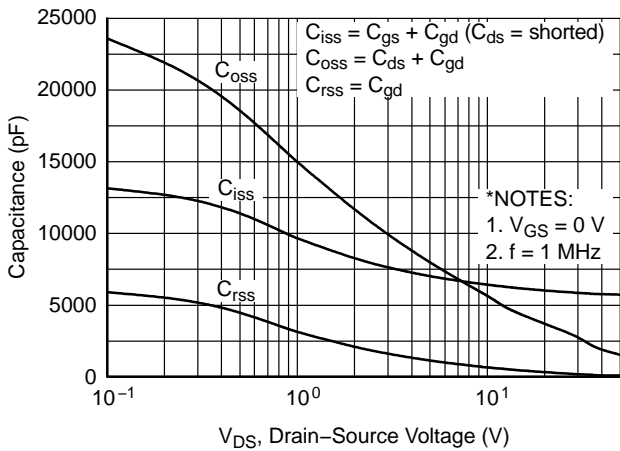


Figure 5. Capacitance Characteristics

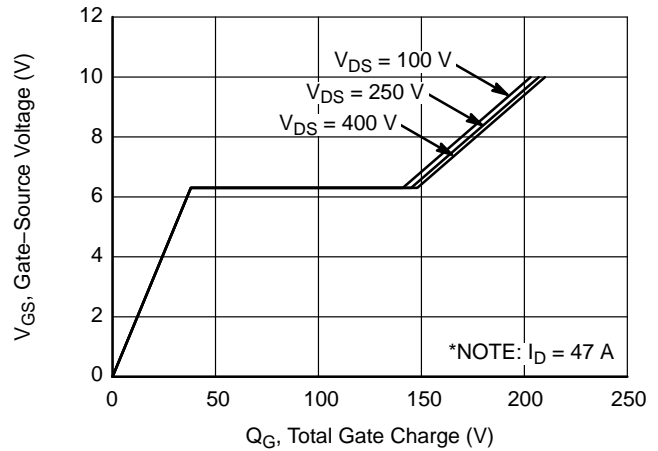


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

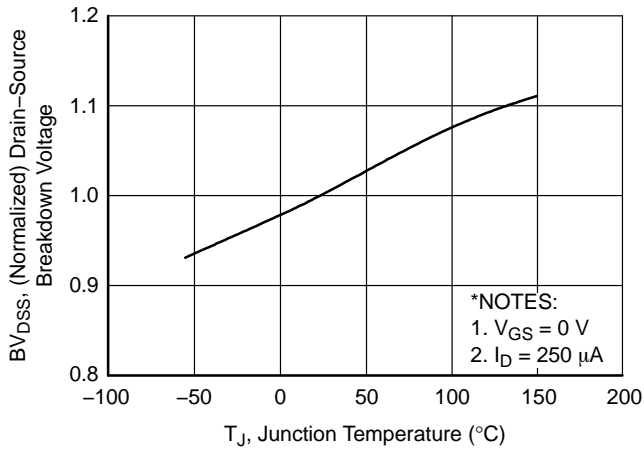


Figure 7. Breakdown Voltage Variation vs. Temperature

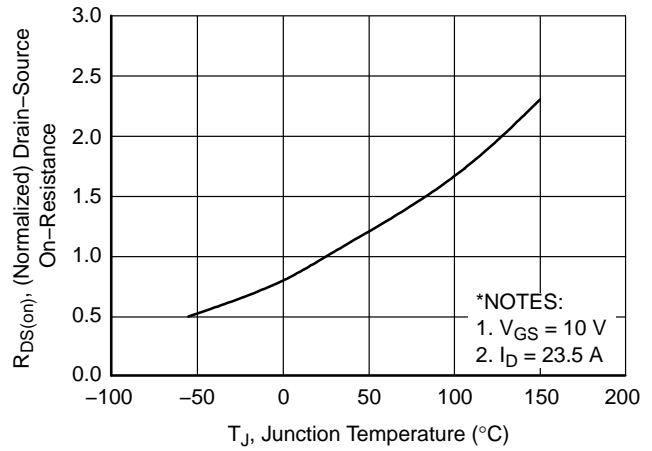


Figure 8. On-Resistance Variation vs. Temperature

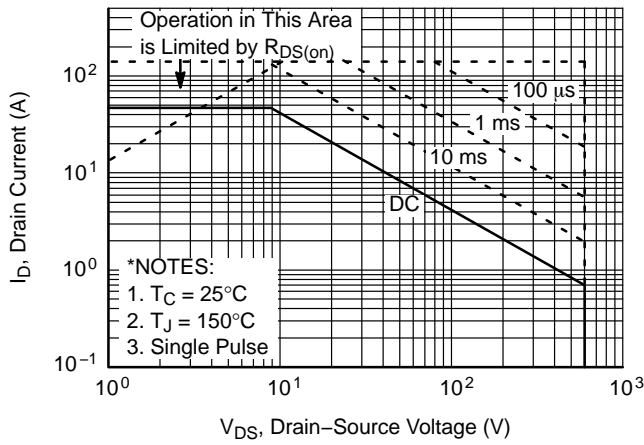


Figure 9. Safe Operating Area

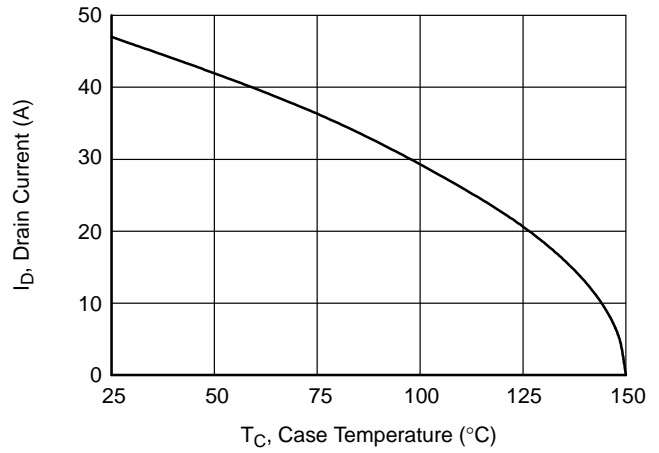


Figure 10. Maximum Drain Current vs. Case Temperature

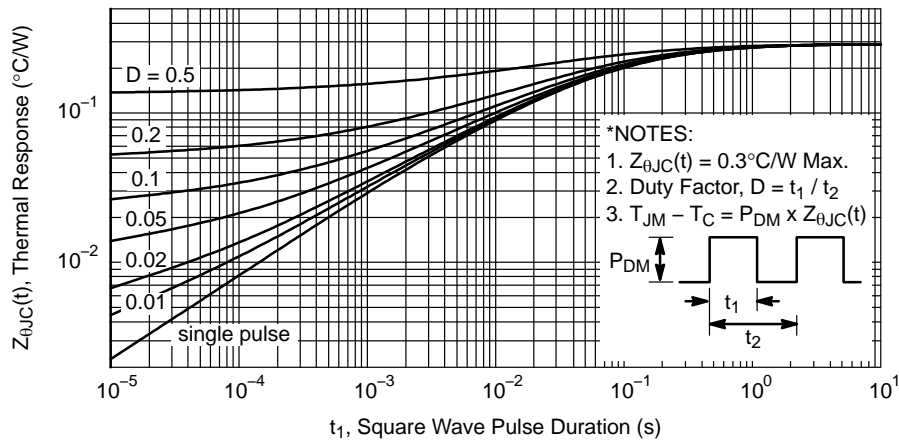


Figure 11. Transient Thermal Response Curve

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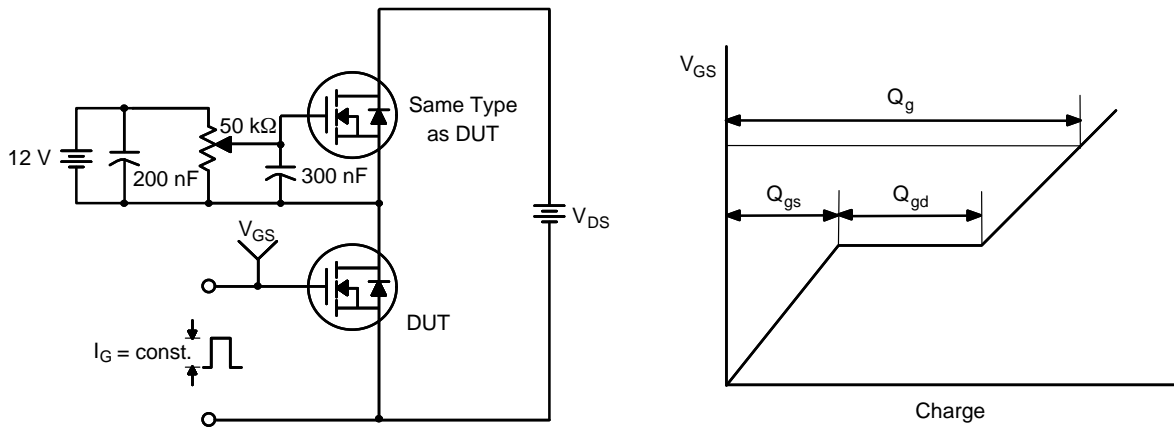


Figure 12. Gate Charge Test Circuit & Waveform

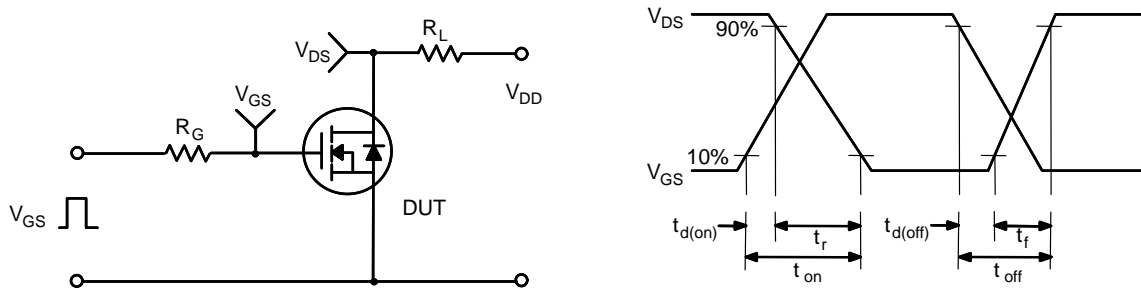


Figure 13. Resistive Switching Test Circuit & Waveforms

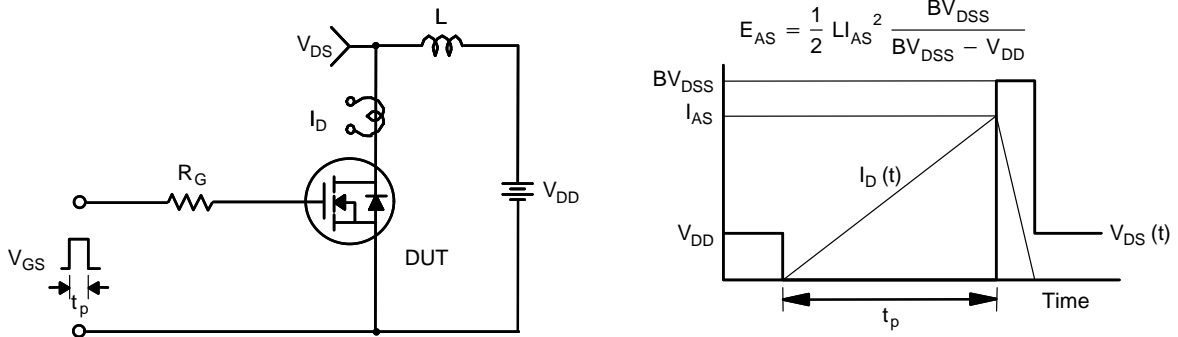


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

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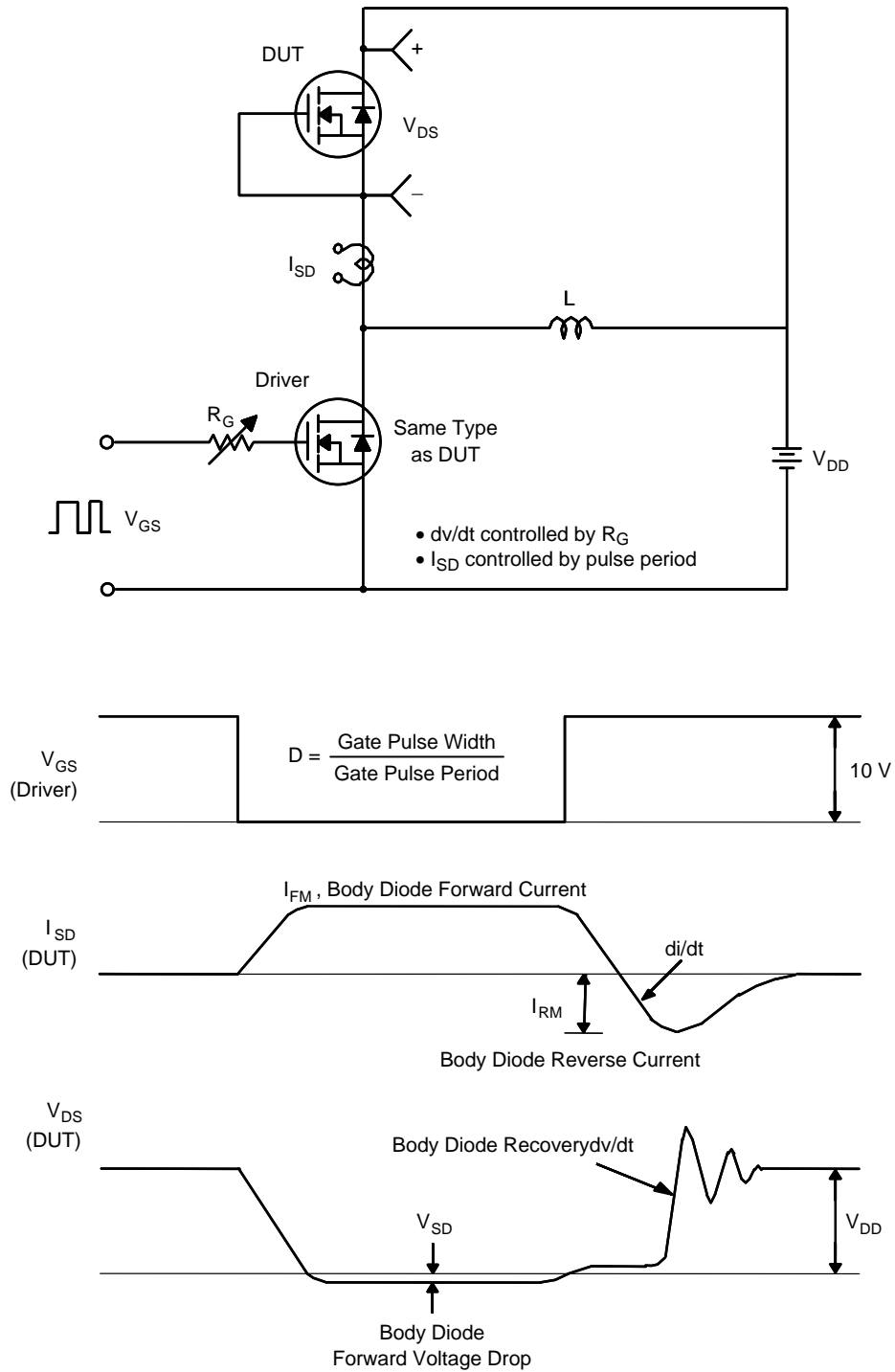
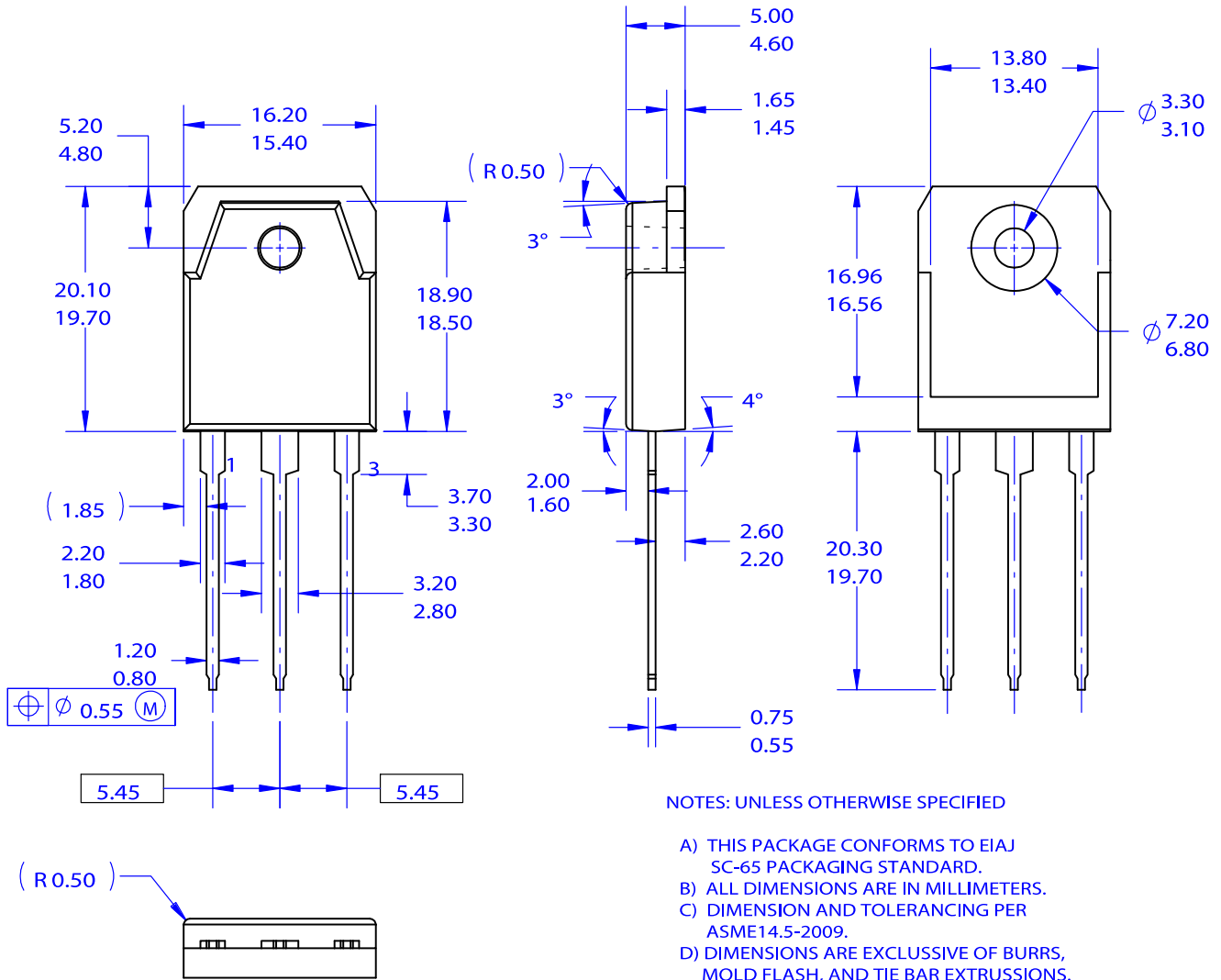


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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TO-3P-3LD / EIAJ SC-65, ISOLATED
CASE 340BZ
ISSUE O

DATE 31 OCT 2016



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