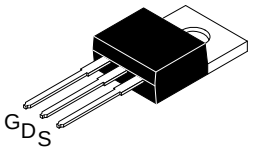
# MOSFET – N-Channel, UniFET™

## 250 V, 33 A, 94 mΩ

# FDP33N25

| $V_{DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|---|---|---|
| 250 V | 94 mΩ @ 10 V | 33 A |




**TO−220−3LD**
**CASE 340AT**

### Description

UniFET MOSFET is **onsemi**'s high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on−state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.

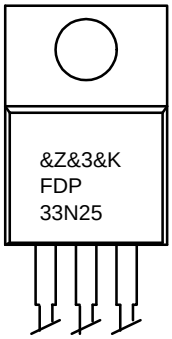
### Features

- $R_{DS(on)}$ = 94 mΩ (Max.) @ $V_{GS}$ = 10 V, $I_D$ = 16.5 A
- Low Gate Charge (Typ. 36.8 nC)
- Low $C_{rss}$ (Typ. 39 pF)
- 100% Avalanche Tested

### Applications

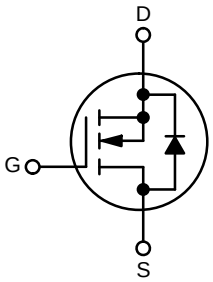
- PDP TV
- Lighting
- Uninterruptible Power Supply
- AC−DC Power Supply

### MARKING DIAGRAM




| | |
|---|---|
| &Z | = Assembly Plant Code |
| &3 | = 3−Digit Date Code |
| &K | = 2−Digits Lot Run Traceability Code |
| FDP33N25 | = Specific Device Code |

### N−CHANNEL MOSFET




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

| Symbol | Parameter | | FDP33N25 | Unit |
|---|---|---|---|---|
| $V_{DSS}$ | Drain−Source Voltage | | 250 | V |
| $I_D$ | Drain Current | − Continuous ($T_C$ = 25°C) | 33 | A |
| | | − Continuous ($T_C$ = 100°C) | 20.4 | |
| $I_{DM}$ | Drain Current | − Pulsed (Note 1) | 132 | A |
| $V_{GSS}$ | Gate−Source Voltage | | ±30 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy (Note 2) | | 918 | mJ |
| $I_{AR}$ | Avalanche Current (Note 1) | | 33 | A |
| $E_{AR}$ | Repetitive Avalanche Energy (Note 1) | | 23.5 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | | 4.5 | V/ns |
| $P_D$ | Power Dissipation | ($T_C$ = 25°C) | 235 | W |
| | | − Derate Above 25°C | 1.89 | W/°C |
| $T_J$, $T_{STG}$ | 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. L = 1.35 mH, $I_{AS}$ = 33 A, $V_{DD}$ = 50 V, $R_G$ = 25 Ω, starting $T_J$ = 25°C.
3. $I_{SD}$ ≤ 33 A, di/dt ≤ 200 A/μs, $V_{DD}$ ≤ $BV_{DSS}$, starting $T_J$ = 25°C.

### ORDERING INFORMATION

| Part Number | Package | Shipping |
|---|---|---|
| FDP33N25 | TO−220−3LD (Pb−Free, Halide Free) | 1000 Units / Tube |

## THERMAL CHARACTERISTICS

| Symbol | Parameter | FDP33N25 | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction−to−Case, Max. | 0.53 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction−to−Ambient, Max. | 62.5 | °C/W |

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

| Symbol | Parameter | Test 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 | 250 | − | − | V |
| $\Delta BV_{DSS}$ / $\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 μA, Referenced to 25°C | − | 0.25 | − | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 250 V, $V_{GS}$ = 0 V | − | − | 1 | μA |
| | | $V_{DS}$ = 200 V, $T_C$ = 125°C | − | − | 10 | |
| $I_{GSSF}$ | 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, $I_D$ = 16.5 A | − | 0.077 | 0.094 | Ω |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 40 V, $I_D$ = 16.5 A | − | 26.6 | − | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1.0 MHz | − | 1640 | 2135 | pF |
| $C_{oss}$ | Output Capacitance | | − | 330 | 430 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | − | 39 | 59 | pF |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{d(on)}$ | Turn−On Delay Time | $V_{DD}$ = 125 V, $I_D$ = 33 A, $V_{GS}$ = 10 V, $R_G$ = 25 Ω (Note 4) | − | 35 | 80 | ns |
| $t_r$ | Turn−On Rise Time | | − | 230 | 470 | ns |
| $t_{d(off)}$ | Turn−Off Delay Time | | − | 75 | 160 | ns |
| $t_f$ | Turn−Off Fall Time | | − | 120 | 250 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 200 V, $I_D$ = 33 A, $V_{GS}$ = 10 V (Note 4) | − | 36.8 | 48 | nC |
| $Q_{gs}$ | Gate−Source Charge | | − | 10 | − | nC |
| $Q_{gd}$ | Gate−Drain Charge | | − | 17 | − | nC |
| **DRAIN−SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS** | | | | | | |
| $I_S$ | Maximum Continuous Drain−Source Diode Forward Current | | − | − | 33 | A |
| $I_{SM}$ | Maximum Pulsed Drain−Source Diode Forward Current | | − | − | 132 | A |
| $V_{SD}$ | Drain−Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_{SD}$ = 33 A | − | − | 1.4 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS}$ = 0 V, $I_{SD}$ = 33 A, $dI_F/dt$ = 100 A/μs | − | 220 | − | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | − | 1.71 | − | 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 CHARACTERISTICS

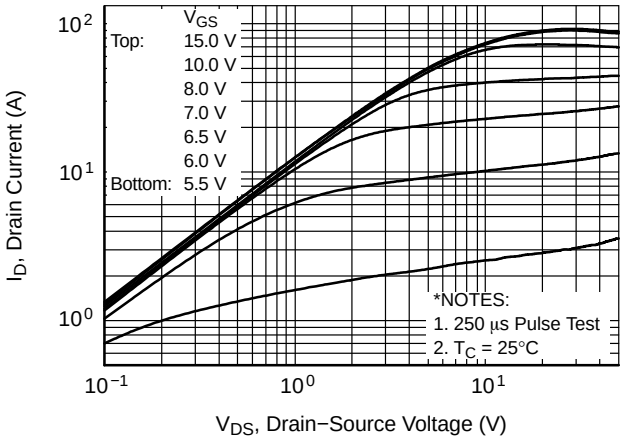



**Figure 1. On−Region Characteristics**

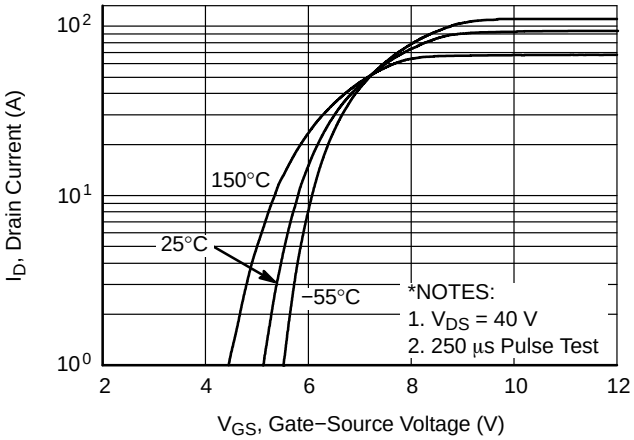



**Figure 2. Transfer Characteristics**

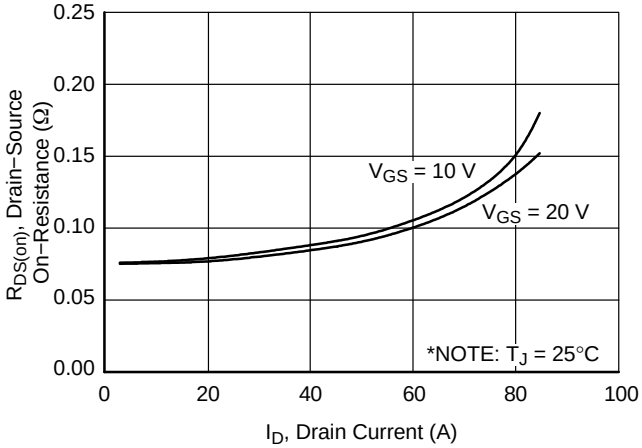



**Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage**

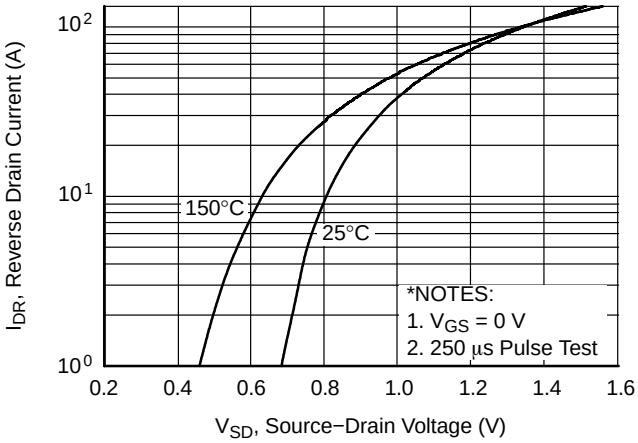



**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

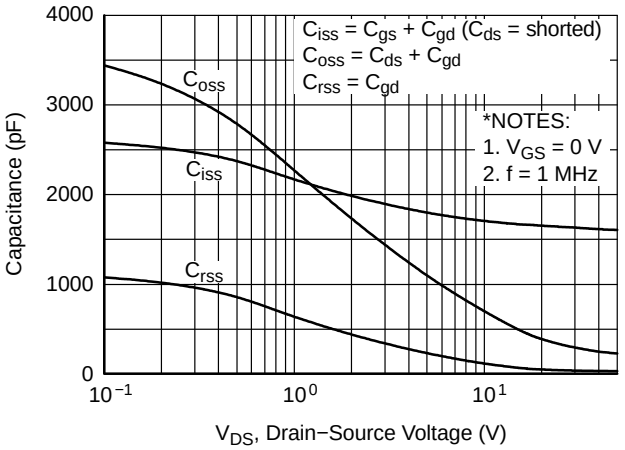



**Figure 5. Capacitance Characteristics**

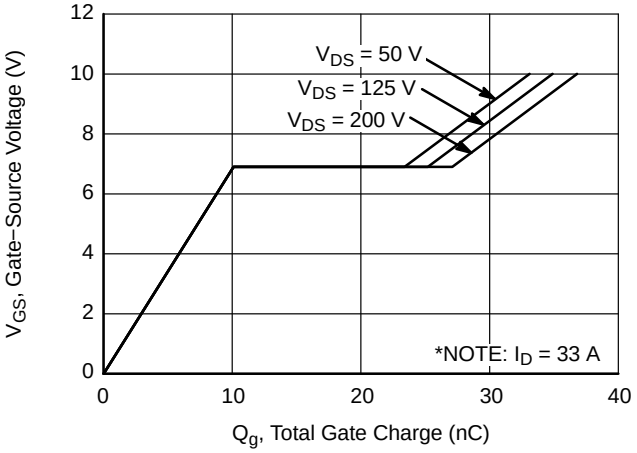



**Figure 6. Gate Charge Characteristics**

## TYPICAL CHARACTERISTICS (CONTINUED)

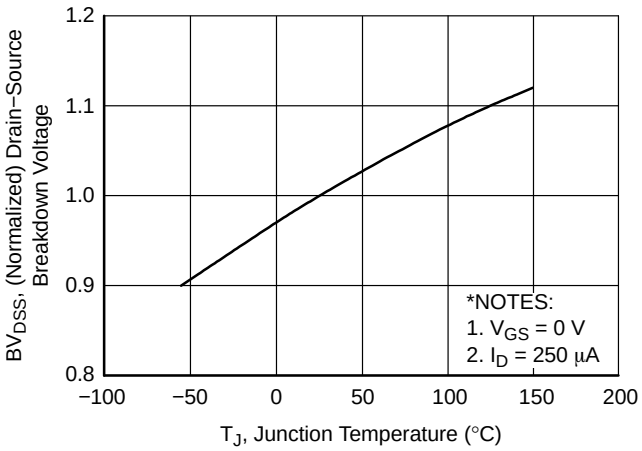



**Figure 7. Breakdown Voltage Variation vs. Temperature**

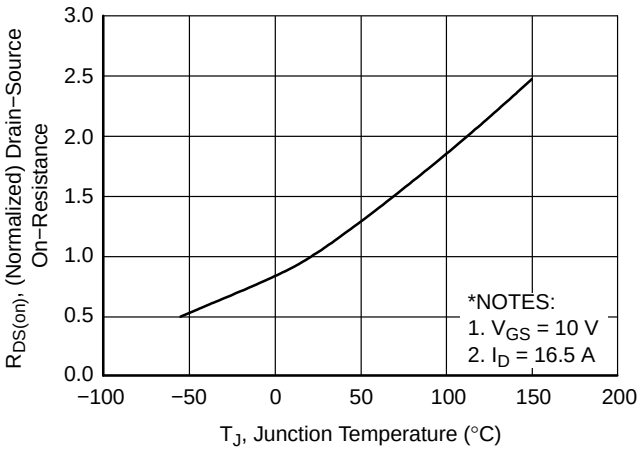



**Figure 8. On−Resistance Variation vs. Temperature**

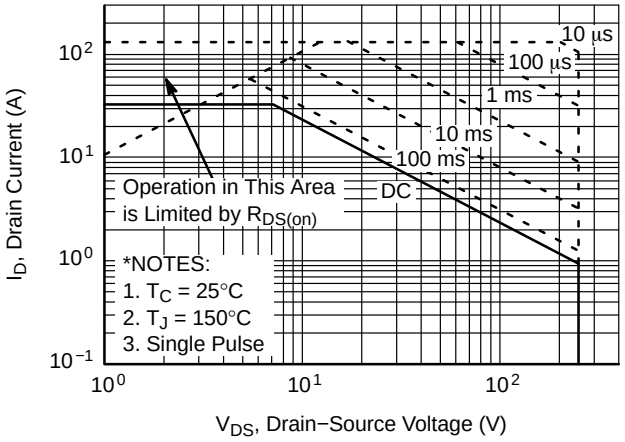



**Figure 9. Maximum Safe Operating Area**

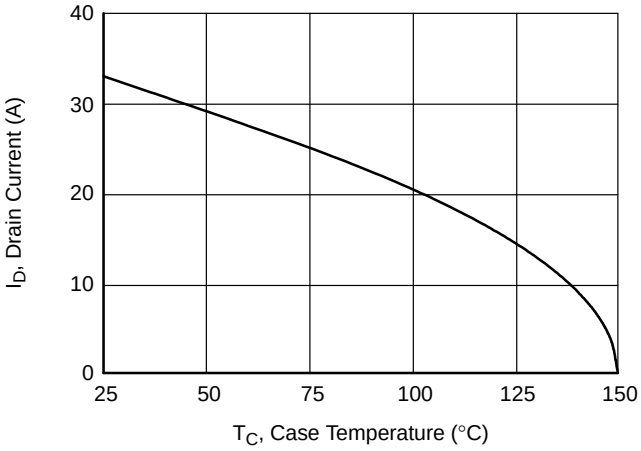



**Figure 10. Maximum Drain Current vs. Case Temperature**

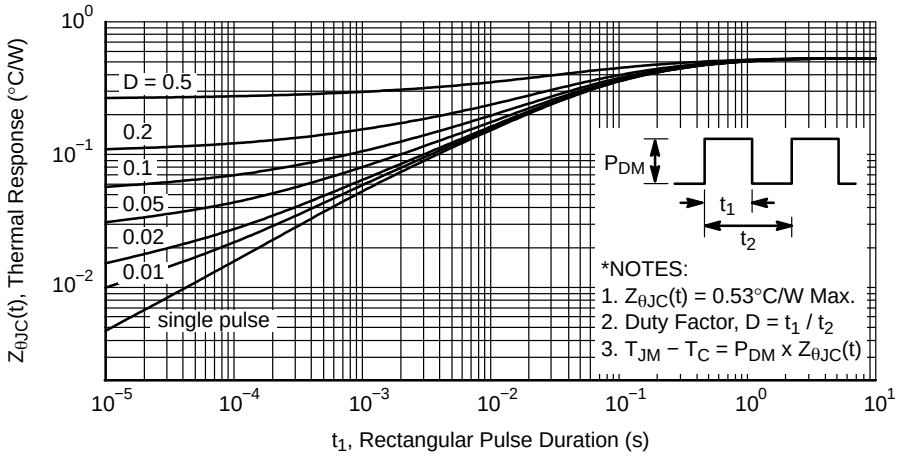



**Figure 11. Transient Thermal Response Curve**

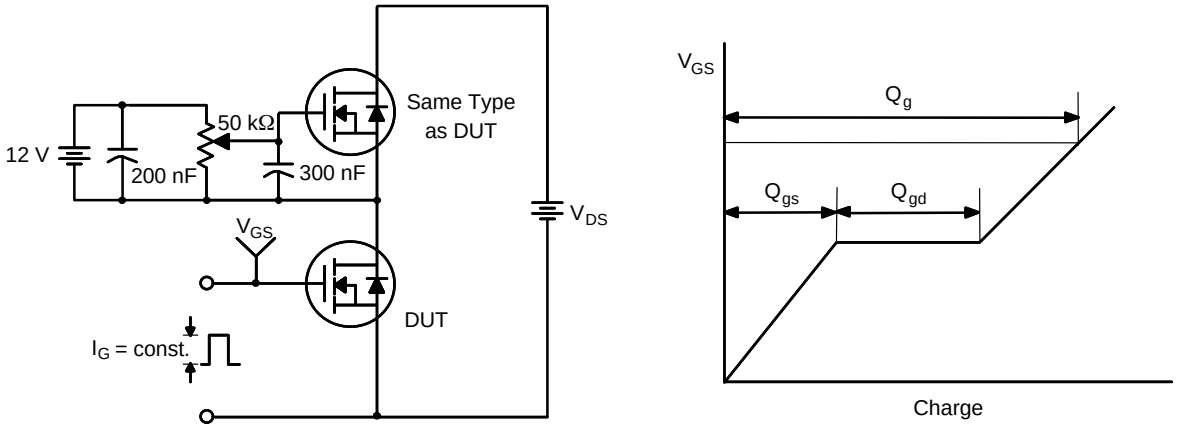



**Figure 12. Gate Charge Test Circuit & Waveform**

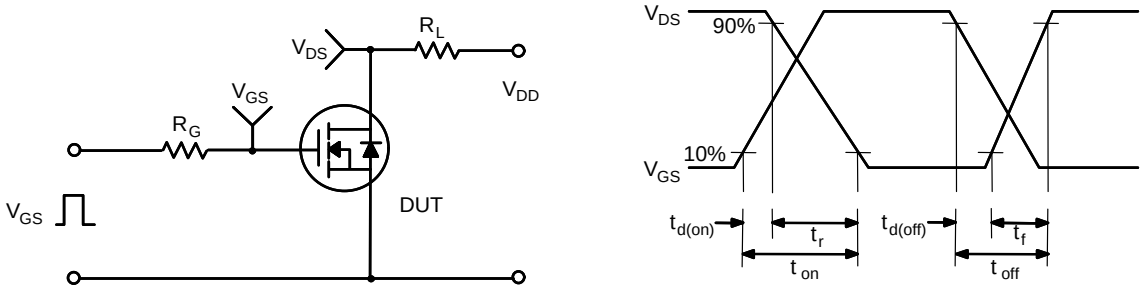



**Figure 13. Resistive Switching Test Circuit & Waveforms**

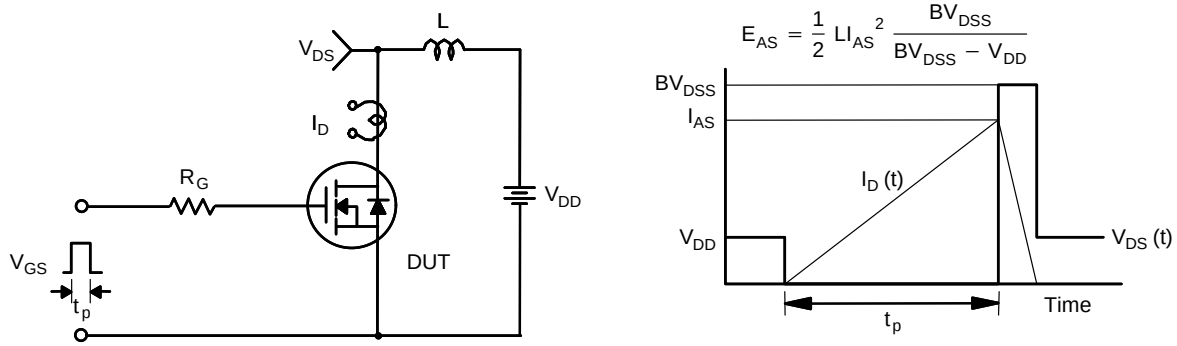



**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**

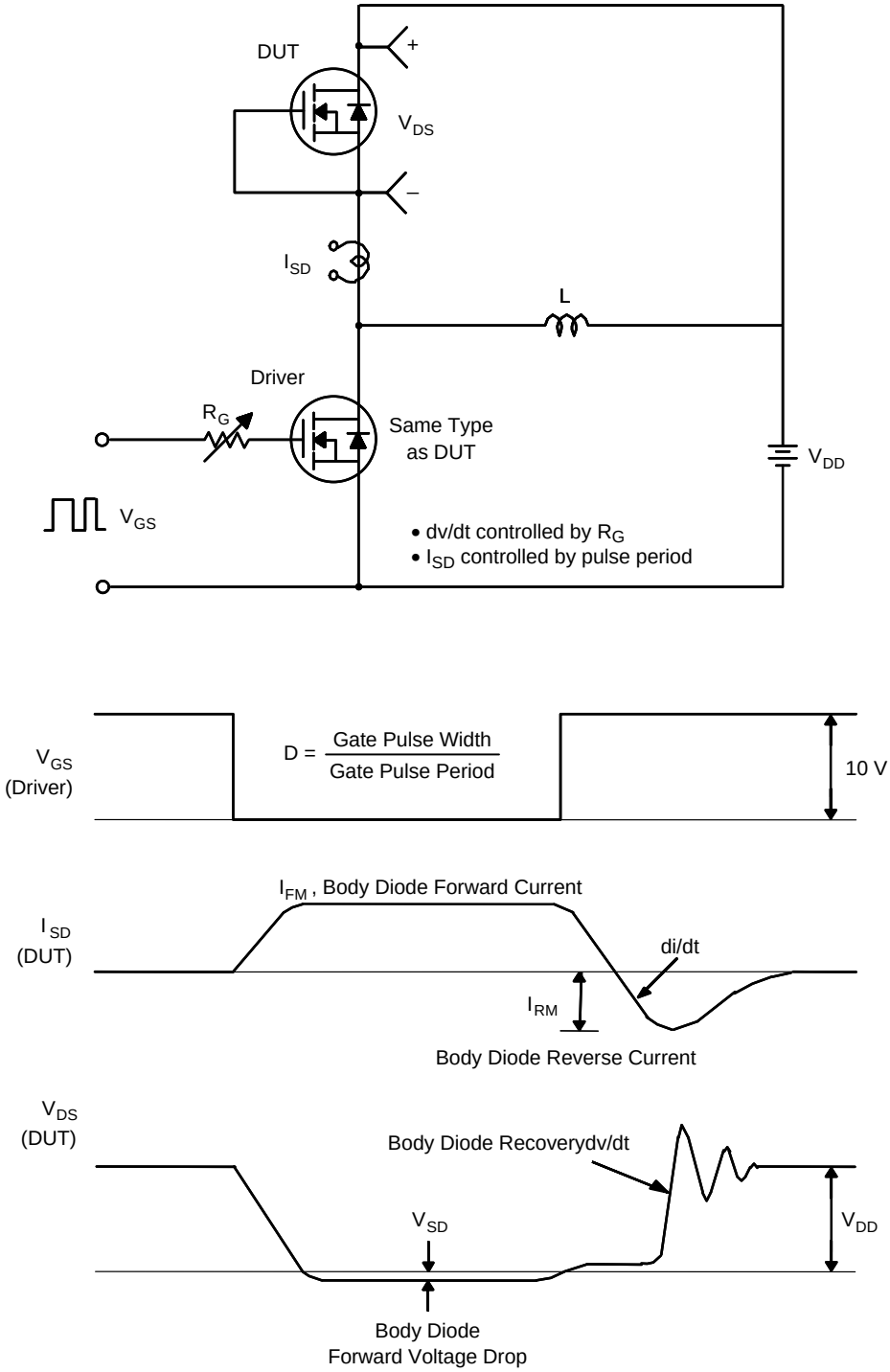
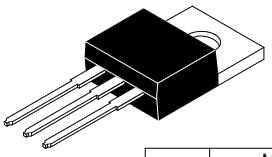


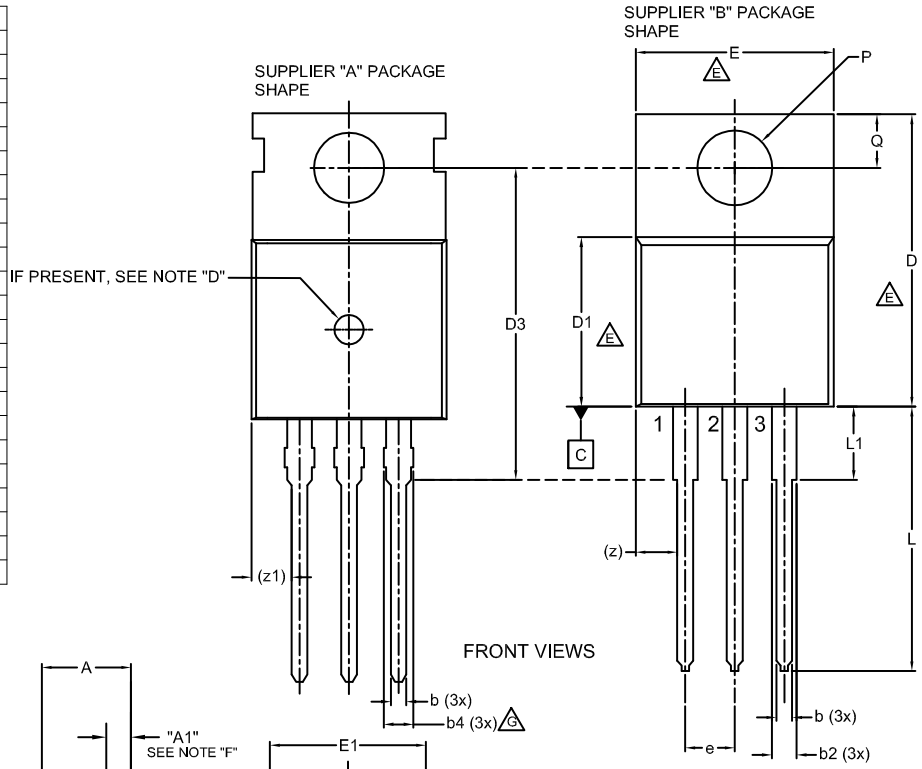

**Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms**

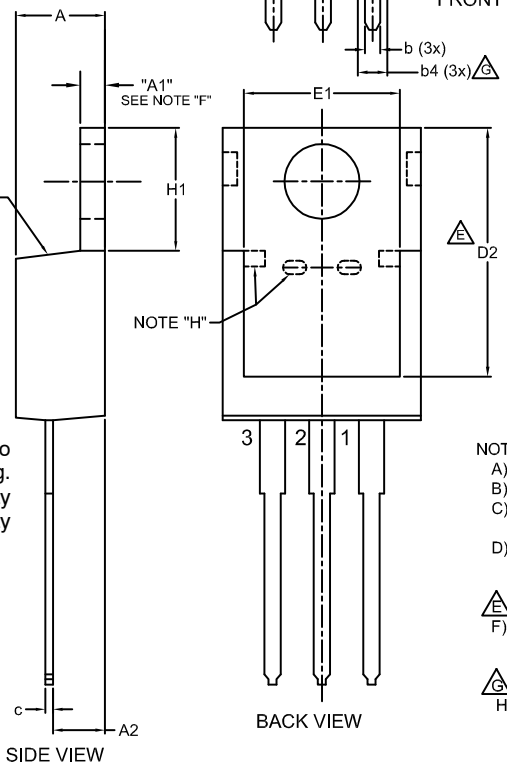


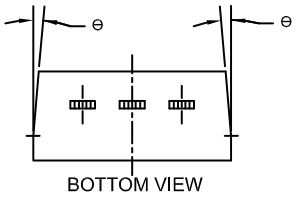
**TO−220−3LD**
CASE 340AT
ISSUE B

DATE 08 AUG 2022

| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 4.00 | -- | 4.70 |
| A1 | SEE NOTE "F" | | |
| A2 | 2.10 | -- | 2.85 |
| b | 0.55 | -- | 1.00 |
| b2 | 1.10 | -- | 1.62 |
| b4 | 1.42 | -- | 1.62 |
| c | 0.36 | -- | 0.60 |
| D | 13.90 | -- | 16.30 |
| D1 | 8.13 | -- | 9.40 |
| D2 | 11.50 | -- | 14.30 |
| D3 | 15.42 | -- | 16.51 |
| E | 9.65 | -- | 10.67 |
| E1 | 7.59 | -- | 8.65 |
| e | 2.40 | -- | 2.67 |
| H1 | 6.06 | -- | 6.69 |
| L | 12.70 | -- | 14.04 |
| L1 | 2.70 | -- | 4.10 |
| P | 3.50 | -- | 4.00 |
| Q | 2.50 | -- | 3.40 |
| z | 2.13 REF | | |
| z1 | 2.06 REF | | |
| Θ | 3° | – | 5° |




**GENERIC MARKING DIAGRAM***


XXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Assembly Lot Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

NOTES:
A) REFERENCE JEDEC, TO-220, VARIATION AB
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
E) DOES NOT COMPLY JEDEC STANDARD VALUE.
F) "A1" DIMENSIONS AS BELOW:
SINGLE GAUGE = 0.51 - 0.61
DUAL GAUGE = 1.10 - 1.45
G) PRESENCE IS SUPPLIER DEPENDENT
H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

| | | |
|---|---|---|
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| **DESCRIPTION:** | **TO−220−3LD** | **PAGE 1 OF 1** |

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