

## IXFH22N50P-VB Datasheet

## N-Channel 500V(D-S) Super Junction Power MOSFET

| PRODUCT SUMMARY           |                 |       |
|---------------------------|-----------------|-------|
| $V_{DS}$ (V)              | 500             |       |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10$ V | 0.080 |
| $Q_g$ (Max.) (nC)         | 350             |       |
| $Q_{gs}$ (nC)             | 85              |       |
| $Q_{gd}$ (nC)             | 180             |       |
| Configuration             | Single          |       |

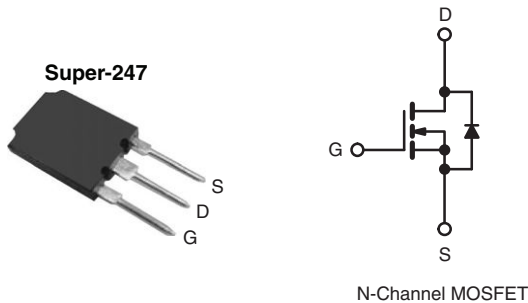
## FEATURES

- Low Gate Charge  $Q_g$  Results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic  $dV/dt$  Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Low  $R_{DS(on)}$
- Compliant to RoHS Directive 2002/95/EC



## APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switched and High Frequency Circuits




| ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ , unless otherwise noted) |                          |                |                           |                     |   |
|---|--------------------------|----------------|---------------------------|---------------------|---|
| PARAMETER   |                          | SYMBOL         | LIMIT                     | UNIT                |   |
| Drain-Source Voltage  |                          | $V_{DS}$       | 500                       | V                   |   |
| Gate-Source Voltage   |                          | $V_{GS}$       | $\pm 30$                  |                     |   |
| Continuous Drain Current  | $V_{GS}$ at 10 V         | $I_D$          | $T_C = 25^\circ\text{C}$  | 40                  | A |
|   |                          |                | $T_C = 100^\circ\text{C}$ | 25                  |   |
| Pulsed Drain Current <sup>a</sup>   |                          | $I_{DM}$       | 180                       |                     |   |
| Linear Derating Factor  |                          |                | 4.3                       | W/ $^\circ\text{C}$ |   |
| Single Pulse Avalanche Energy <sup>b</sup>                                    |                          | $E_{AS}$       | 910                       | mJ                  |   |
| Repetitive Avalanche Current <sup>a</sup>                                     |                          | $I_{AR}$       | 40                        | A                   |   |
| Repetitive Avalanche Energy <sup>a</sup>                                      |                          | $E_{AR}$       | 51                        | mJ                  |   |
| Maximum Power Dissipation   | $T_C = 25^\circ\text{C}$ | $P_D$          | 530                       | W                   |   |
| Peak Diode Recovery $dV/dt^c$   |                          | $dV/dt$        | 9.0                       | V/ns                |   |
| Operating Junction and Storage Temperature Range                              |                          | $T_J, T_{stg}$ | - 55 to + 150             | $^\circ\text{C}$    |   |
| Soldering Recommendations (Peak Temperature)                                  | for 10 s                 |                | 300 <sup>d</sup>          |                     |   |

## Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.82$  mH,  $R_g = 25\ \Omega$ ,  $I_{AS} = 47$  A (see fig. 12c).
- $I_{SD} \leq 47$  A,  $dI/dt \leq 230$  A/ $\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150^\circ\text{C}$ .
- 1.6 mm from case.

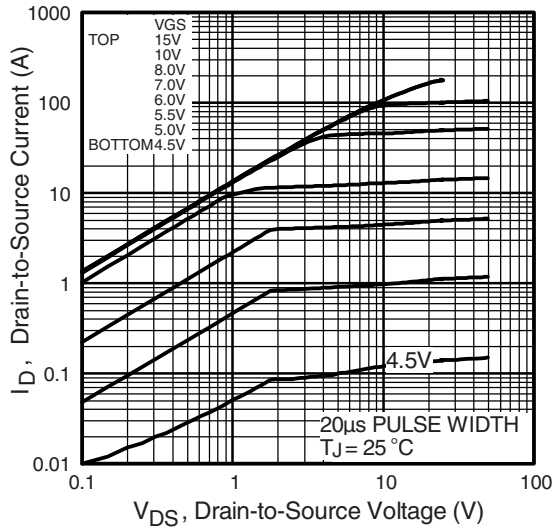
| THERMAL RESISTANCE RATINGS          |            |      |      |      |
|-------------------------------------|------------|------|------|------|
| PARAMETER                           | SYMBOL     | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient         | $R_{thJA}$ | -    | 40   | °C/W |
| Case-to-Sink, Flat, Greased Surface | $R_{thCS}$ | 0.24 | -    |      |
| Maximum Junction-to-Case (Drain)    | $R_{thJC}$ | -    | 0.23 |      |

| SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |                       |  |  |       |           |               |    |
|---|-----------------------|--|--|-------|-----------|---------------|----|
| PARAMETER   | SYMBOL                | TEST CONDITIONS  | MIN.   | TYP.  | MAX.      | UNIT          |    |
| <b>Static</b>   |                       |  |  |       |           |               |    |
| Drain-Source Breakdown Voltage  | $V_{DS}$              | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$  | 500  | -     | -         | V             |    |
| $V_{DS}$ Temperature Coefficient  | $\Delta V_{DS}/T_J$   | Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$  | -  | 0.60  | -         | V/°C          |    |
| Gate-Source Threshold Voltage   | $V_{GS(th)}$          | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$  | 3.0  | -     | 5.0       | V             |    |
| Gate-Source Leakage   | $I_{GSS}$             | $V_{GS} = \pm 30\text{ V}$   | -  | -     | $\pm 100$ | nA            |    |
| Zero Gate Voltage Drain Current   | $I_{DSS}$             | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$   | -  | -     | 50        | $\mu\text{A}$ |    |
|   |                       | $V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$  | -  | -     | 250       |               |    |
| Drain-Source On-State Resistance  | $R_{DS(on)}$          | $V_{GS} = 10\text{ V}, I_D = 28\text{ A}^b$  | -  | 0.080 | -         | $\Omega$      |    |
| Forward Transconductance  | $g_{fs}$              | $V_{DS} = 50\text{ V}, I_D = 28\text{ A}$  | 23   | -     | -         | S             |    |
| <b>Dynamic</b>  |                       |  |  |       |           |               |    |
| Input Capacitance   | $C_{iss}$             | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$ , see fig. 5   | -  | 8310  | -         | pF            |    |
| Output Capacitance  | $C_{oss}$             |  | -  | 960   | -         |               |    |
| Reverse Transfer Capacitance  | $C_{riss}$            |  | -  | 120   | -         |               |    |
| Output Capacitance  | $C_{oss}$             | $V_{GS} = 0\text{ V}$  | $V_{DS} = 1.0\text{ V}, f = 1.0\text{ MHz}$  | -     | 10170     | -             |    |
| Effective Output Capacitance  | $C_{oss\text{ eff.}}$ |  | $V_{DS} = 400\text{ V}, f = 1.0\text{ MHz}$  | -     | 240       | -             |    |
| Total Gate Charge   | $Q_g$                 |  | $V_{DS} = 0\text{ V to } 400\text{ V}^c$   | -     | 440       | -             |    |
| Gate-Source Charge  | $Q_{gs}$              | $V_{GS} = 10\text{ V}$   | $I_D = 47\text{ A}, V_{DS} = 400\text{ V}$ , see fig. 6 and 13 <sup>b</sup>                    | -     | -         | 350           | nC |
| Gate-Drain Charge   | $Q_{gd}$              |  |  | -     | -         | 85            |    |
| Turn-On Delay Time  | $t_{d(on)}$           |  |  | -     | -         | 180           |    |
| Rise Time   | $t_r$                 | $V_{GS} = 10\text{ V}$   | $V_{DD} = 250\text{ V}, I_D = 47\text{ A}, R_G = 1.0\text{ }\Omega$ , see fig. 10 <sup>b</sup> | -     | 25        | -             | ns |
| Turn-Off Delay Time   | $t_{d(off)}$          |  |  | -     | 140       | -             |    |
| Fall Time   | $t_f$                 |  |  | -     | 55        | -             |    |
| Forward Turn-On Time  | $t_{on}$              | -  | -  | 74    | -         |               |    |
| <b>Drain-Source Body Diode Characteristics</b>                              |                       |  |  |       |           |               |    |
| Continuous Source-Drain Diode Current                                       | $I_S$                 | MOSFET symbol showing the integral reverse p - n junction diode  | -  | -     | 47        | A             |    |
| Pulsed Diode Forward Current <sup>a</sup>                                   | $I_{SM}$              |  | -  | -     | 190       |               |    |
| Body Diode Voltage  | $V_{SD}$              | $T_J = 25\text{ }^\circ\text{C}, I_S = 47\text{ A}, V_{GS} = 0\text{ V}^b$   | -  | -     | 1.5       | V             |    |
| Body Diode Reverse Recovery Time  | $t_{rr}$              | $T_J = 25\text{ }^\circ\text{C}, I_F = 47\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$  | -  | 620   | 940       | ns            |    |
| Body Diode Reverse Recovery Charge  | $Q_{rr}$              |  | -  | 14    | 21        | $\mu\text{C}$ |    |
| Body Diode Recovery Current   | $I_{RRM}$             |  | -  | 38    | -         | A             |    |
| Forward Turn-On Time  | $t_{on}$              | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$ )  |  |       |           |               |    |

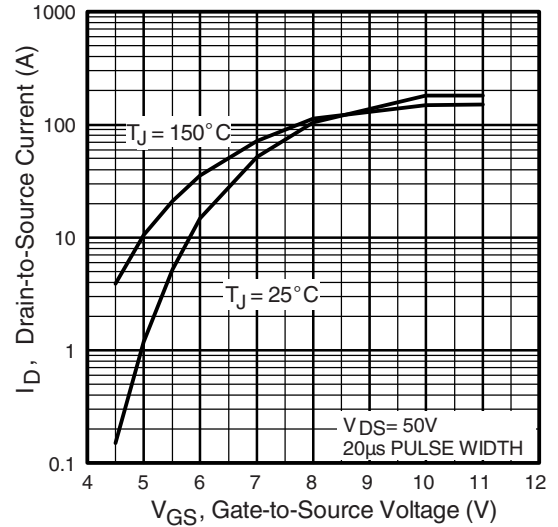
**Notes**

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width  $\leq 400\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- $C_{oss\text{ eff.}}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DS}$ .

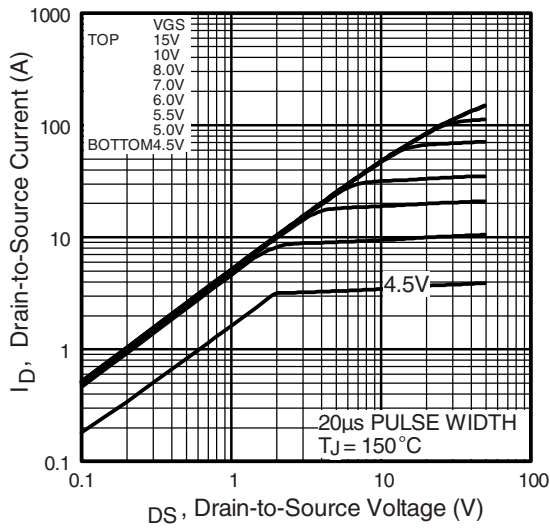
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



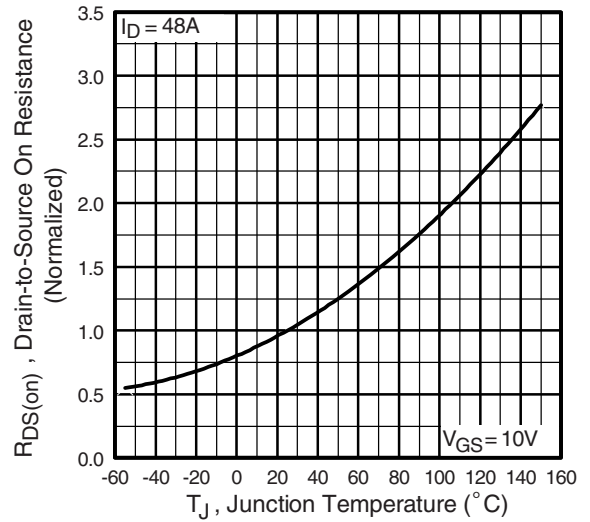
**Fig. 1 - Typical Output Characteristics**



**Fig. 3 - Typical Transfer Characteristics**



**Fig. 2 - Typical Output Characteristics**



**Fig. 4 - Normalized On-Resistance vs. Temperature**

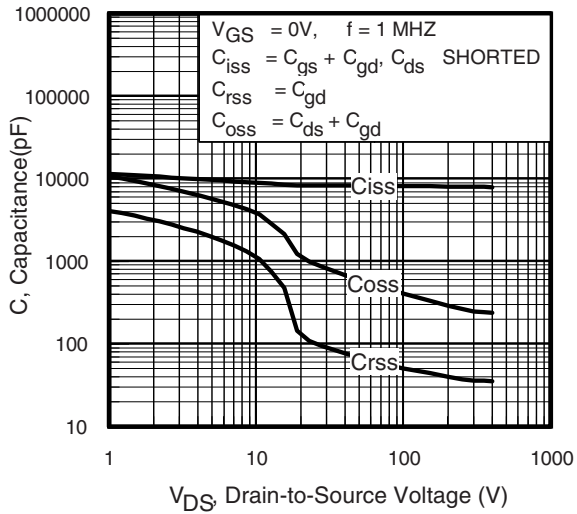


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

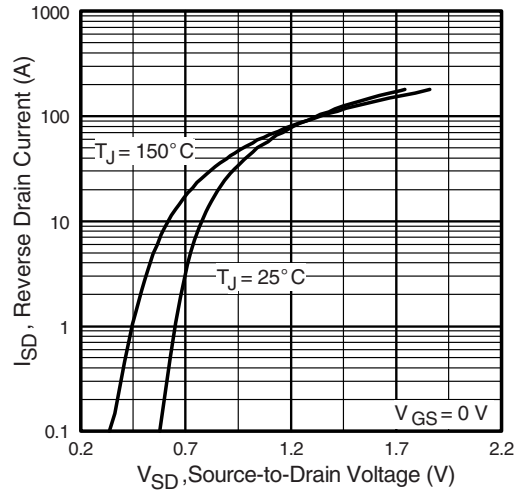


Fig. 7 - Typical Source-Drain Diode Forward Voltage

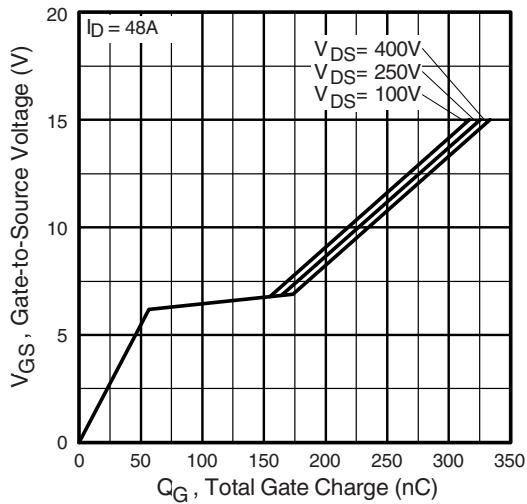


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

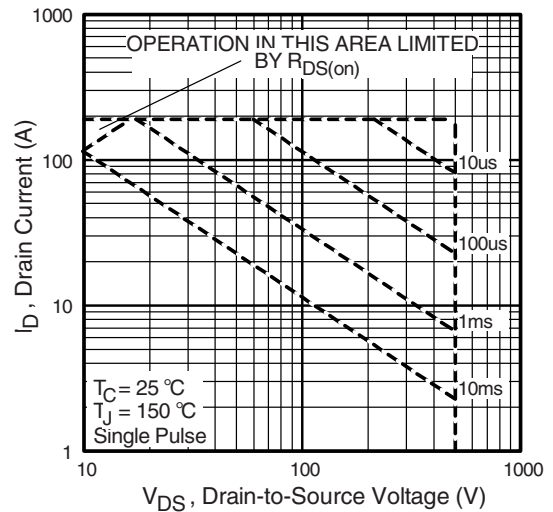


Fig. 8 - Maximum Safe Operating Area

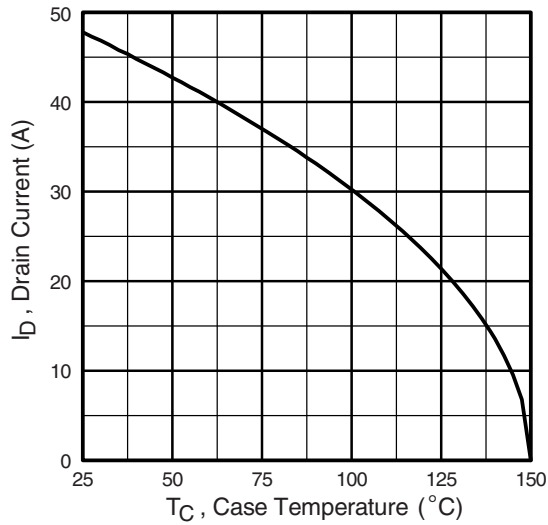


Fig. 9 - Maximum Drain Current vs. Case Temperature

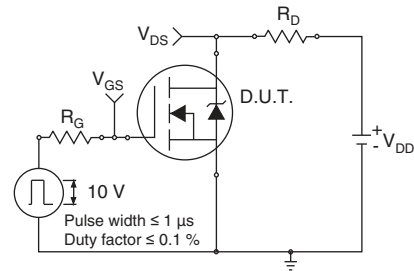


Fig. 10a - Switching Time Test Circuit



Fig. 10b - Switching Time Waveforms

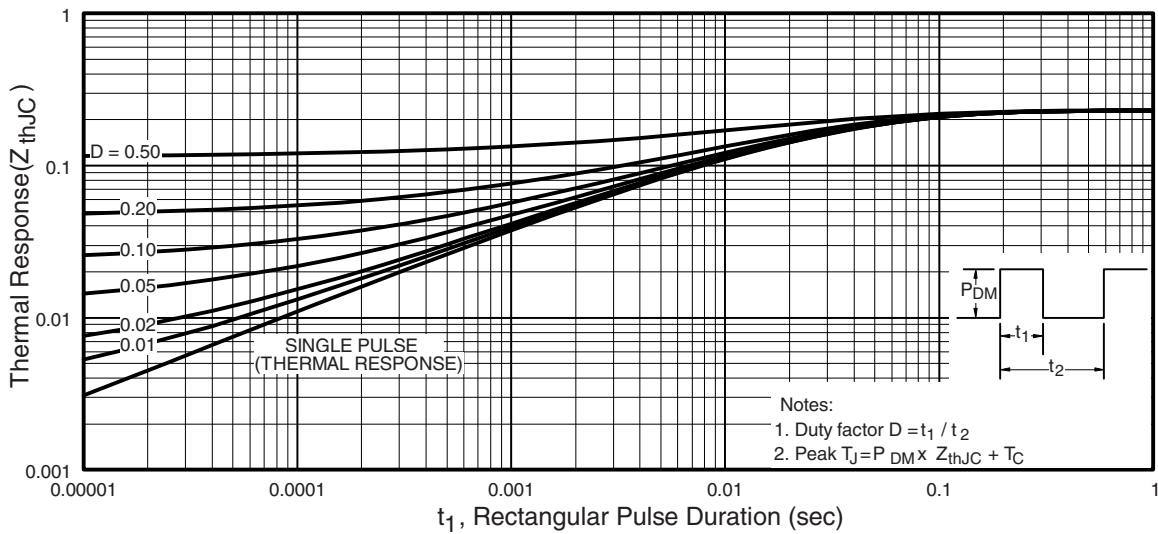


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

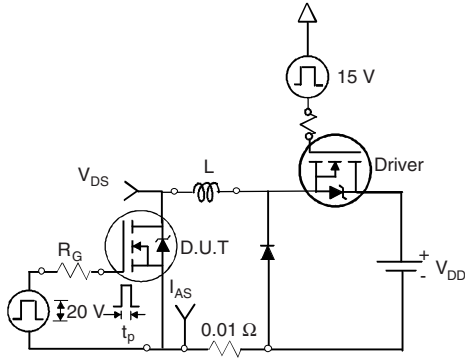


Fig. 12a - Unclamped Inductive Test Circuit

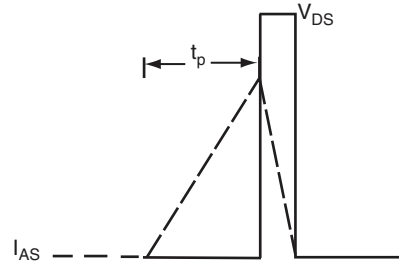


Fig. 12b - Unclamped Inductive Waveforms

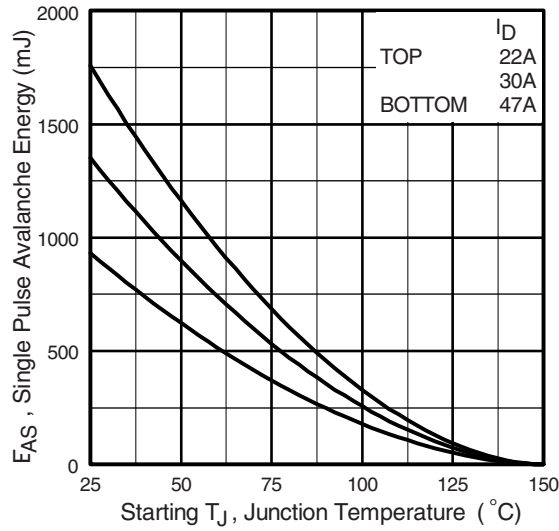


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

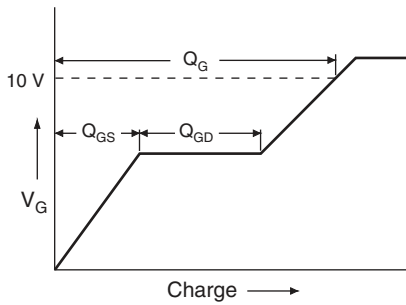


Fig. 13a - Basic Gate Charge Waveform

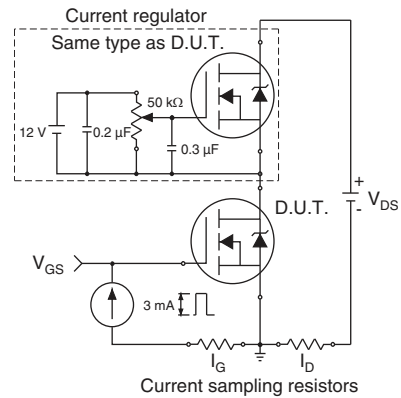
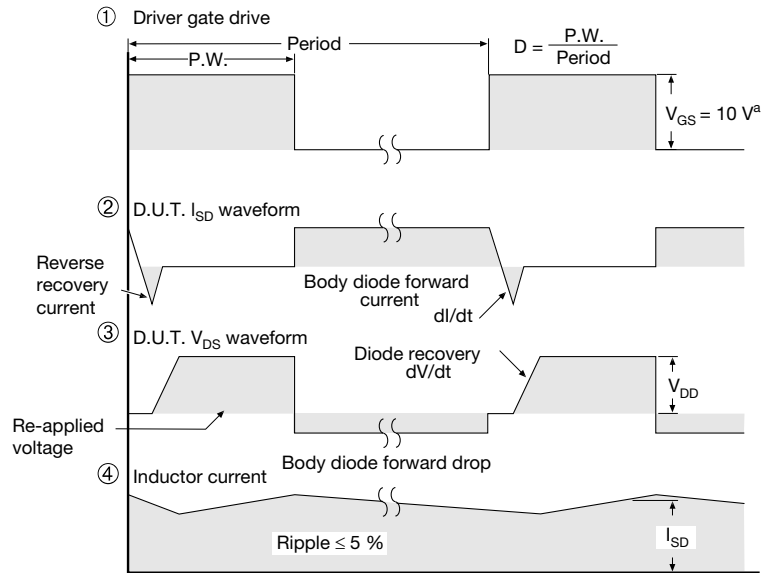
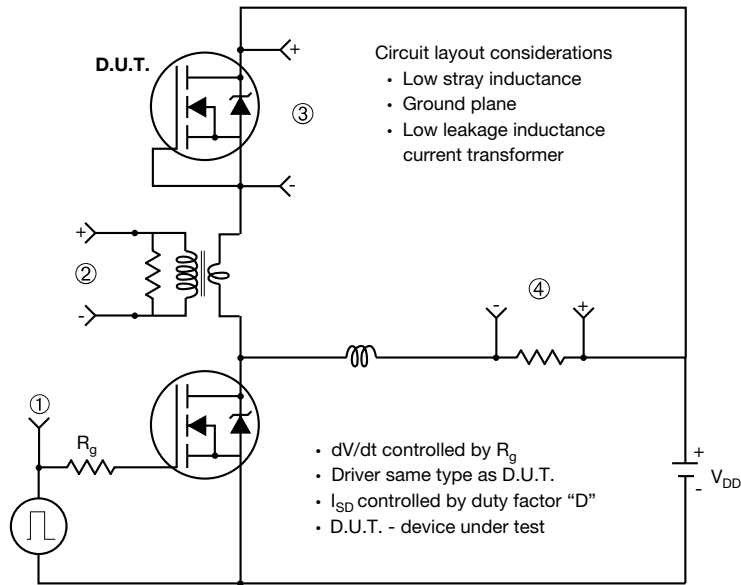


Fig. 13b - Gate Charge Test Circuit

**Peak Diode Recovery dV/dt Test Circuit**

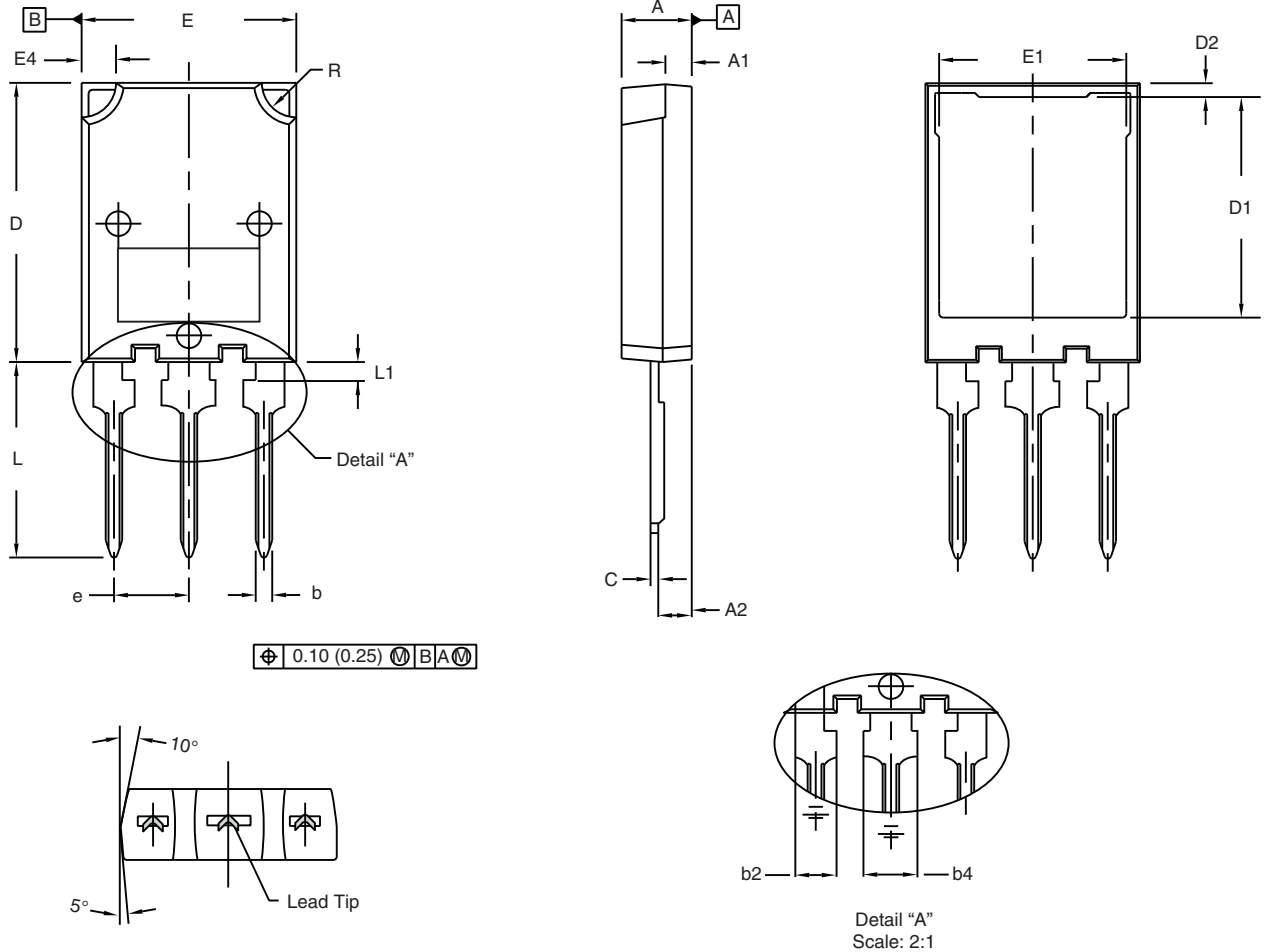


**Note**

a.  $V_{GS} = 5 V$  for logic level devices

**Fig. 14 - For N-Channel**

### TO-274AA (High Voltage)



| DIM.             | MILLIMETERS |       | INCHES |       |
|------------------|-------------|-------|--------|-------|
|                  | MIN.        | MAX.  | MIN.   | MAX.  |
| A                | 4.70        | 5.30  | 0.185  | 0.209 |
| A1               | 1.50        | 2.50  | 0.059  | 0.098 |
| A2               | 2.25        | 2.65  | 0.089  | 0.104 |
| b                | 1.30        | 1.60  | 0.051  | 0.063 |
| b2               | 1.80        | 2.20  | 0.071  | 0.087 |
| b4               | 3.00        | 3.25  | 0.118  | 0.128 |
| c <sup>(1)</sup> | 0.38        | 0.89  | 0.015  | 0.035 |
| D                | 19.80       | 20.80 | 0.780  | 0.819 |

| DIM. | MILLIMETERS |       | INCHES    |       |
|------|-------------|-------|-----------|-------|
|      | MIN.        | MAX.  | MIN.      | MAX.  |
| D1   | 15.50       | 16.10 | 0.610     | 0.634 |
| D2   | 0.70        | 1.30  | 0.028     | 0.051 |
| E    | 15.10       | 16.10 | 0.594     | 0.634 |
| E1   | 13.30       | 13.90 | 0.524     | 0.547 |
| e    | 5.45 BSC    |       | 0.215 BSC |       |
| L    | 13.70       | 14.70 | 0.539     | 0.579 |
| L1   | 1.00        | 1.60  | 0.039     | 0.063 |
| R    | 2.00        | 3.00  | 0.079     | 0.118 |

ECN: X17-0056-Rev. B, 27-Mar-17  
DWG: 5975

**Notes**

- Dimensioning and tolerancing per ASME Y14.5M-1994
- Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outer extremes of the plastic body
- Outline conforms to JEDEC® outline to TO-274AA



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