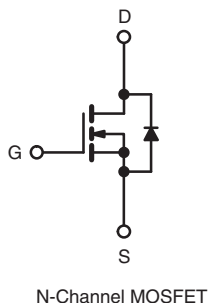
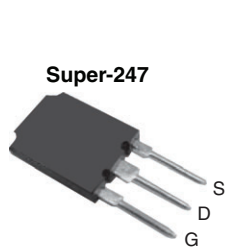


## Power MOSFET



### 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  $R_{DS(on)}$
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### PRODUCT SUMMARY

|                           |                        |       |
|---------------------------|------------------------|-------|
| $V_{DS}$ (V)              | 500                    |       |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ | 0.078 |
| $Q_g$ (Max.) (nC)         | 350                    |       |
| $Q_{gs}$ (nC)             | 85                     |       |
| $Q_{gd}$ (nC)             | 180                    |       |
| Configuration             | Single                 |       |

### APPLICATIONS

- Switch mode power supply (SMPS)
- Uninterruptible power supply
- High speed power switching
- Hard switched and high frequency circuits

### ORDERING INFORMATION

|                                 |                  |
|---------------------------------|------------------|
| Package                         | Super-247        |
| Lead (Pb)-free and halogen-free | SiHFPS43N50K-GE3 |

### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted)

| PARAMETER                                        | SYMBOL         | LIMIT                             | UNIT                |
|--------------------------------------------------|----------------|-----------------------------------|---------------------|
| Drain-source voltage                             | $V_{DS}$       | 500                               | V                   |
| Gate-source voltage                              | $V_{GS}$       | $\pm 30$                          |                     |
| Continuous drain current                         | $I_D$          | $T_C = 25\text{ }^\circ\text{C}$  | A                   |
|                                                  |                | $T_C = 100\text{ }^\circ\text{C}$ |                     |
| Pulsed drain current <sup>a</sup>                | $I_{DM}$       | 190                               |                     |
| 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>        | $I_{AR}$       | 47                                | A                   |
| Repetitive avalanche energy <sup>a</sup>         | $E_{AR}$       | 54                                | mJ                  |
| Maximum power dissipation                        | $P_D$          | 540                               | W                   |
| Peak diode recovery $dV/dt$ <sup>c</sup>         | $dV/dt$        | 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  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 0.82\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 47\text{ A}$  (see fig. 12c)
- $I_{SD} \leq 47\text{ A}$ ,  $dI/dt \leq 230\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$
- 1.6 mm from case

**THERMAL RESISTANCE RATINGS**

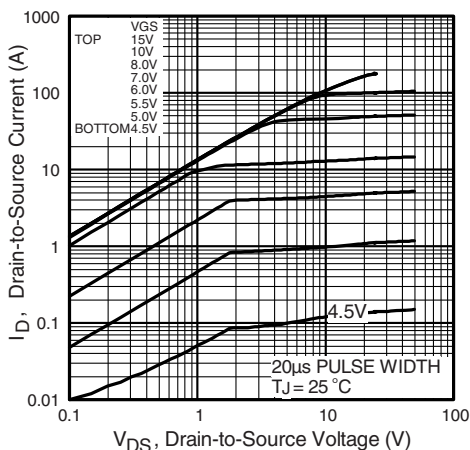
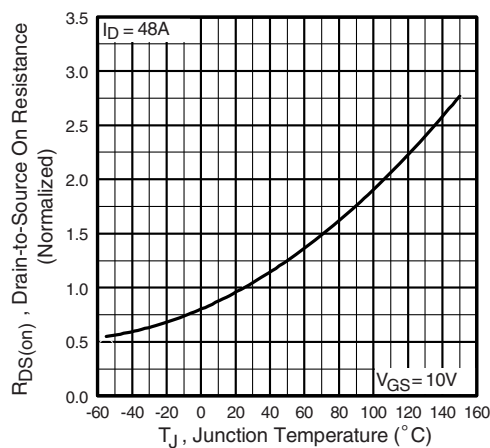
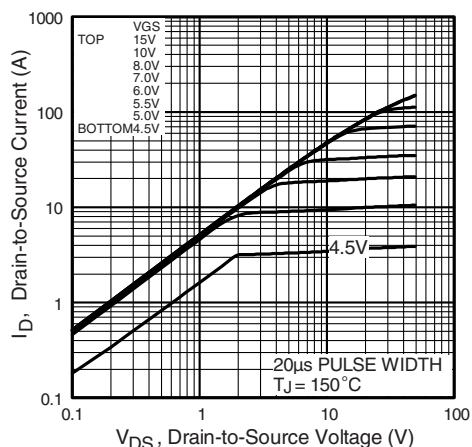
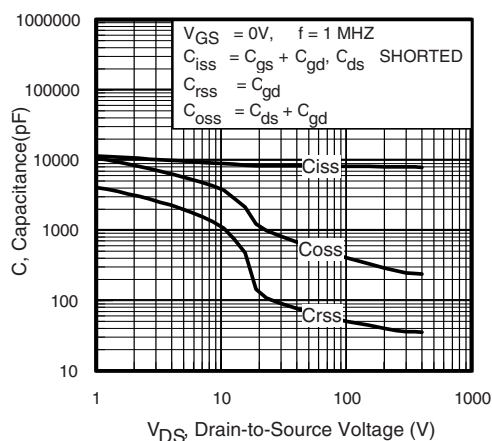
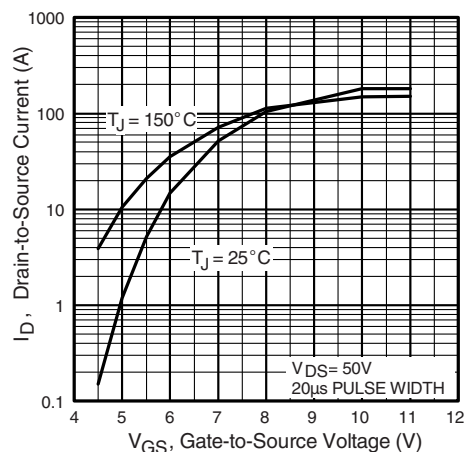
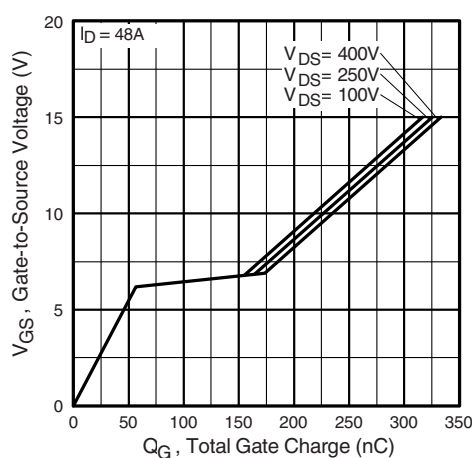
| PARAMETER                           | SYMBOL     | TYP. | MAX. | UNIT |
|-------------------------------------|------------|------|------|------|
| Maximum junction-to-ambient         | $R_{thJA}$ | -    | 40   | °C/W |
| Case-to-sink, flat, greased surface | $R_{thCS}$ | 0.24 | -    |      |
| Maximum 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 |
|-------------------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------|-------|-------|------|
| Static                                    |                                  |                                                                                                                                                          |                                                                                                     |      |       |       |      |
| Drain-source breakdown voltage            | V <sub>DS</sub>                  | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                                                                                           |                                                                                                     | 500  | -     | -     | V    |
| V <sub>DS</sub> temperature coefficient   | ΔV <sub>DS</sub> /T <sub>J</sub> | Reference to 25 °C, I <sub>D</sub> = 1 mA                                                                                                                |                                                                                                     | -    | 0.60  | -     | V/°C |
| Gate-source threshold voltage             | V <sub>GS(th)</sub>              | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                                                              |                                                                                                     | 3.0  | -     | 5.0   | V    |
| Gate-source leakage                       | I <sub>GSS</sub>                 | V <sub>GS</sub> = ± 30 V                                                                                                                                 |                                                                                                     | -    | -     | ± 100 | nA   |
| Zero gate voltage drain current           | I <sub>DSS</sub>                 | V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V                                                                                                           |                                                                                                     | -    | -     | 50    | μA   |
|                                           |                                  | V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C                                                                                  |                                                                                                     | -    | -     | 250   |      |
| Drain-source on-state resistance          | R <sub>DS(on)</sub>              | V <sub>GS</sub> = 10 V                                                                                                                                   | I <sub>D</sub> = 28 A <sup>b</sup>                                                                  | -    | 0.078 | 0.090 | Ω    |
| Forward transconductance                  | g <sub>fs</sub>                  | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 28 A                                                                                                            |                                                                                                     | 23   | -     | -     | S    |
| Dynamic                                   |                                  |                                                                                                                                                          |                                                                                                     |      |       |       |      |
| Input capacitance                         | C <sub>iss</sub>                 | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 25 V,<br>f = 1.0 MHz, see fig. 5                                                                             |                                                                                                     | -    | 8310  | -     | pF   |
| Output capacitance                        | C <sub>oss</sub>                 |                                                                                                                                                          |                                                                                                     | -    | 960   | -     |      |
| Reverse transfer capacitance              | C <sub>rss</sub>                 |                                                                                                                                                          |                                                                                                     | -    | 120   | -     |      |
| Output capacitance                        | C <sub>oss</sub>                 | V <sub>GS</sub> = 0 V                                                                                                                                    | V <sub>DS</sub> = 1.0 V, f = 1.0 MHz                                                                | -    | 10170 | -     | pF   |
|                                           |                                  |                                                                                                                                                          | V <sub>DS</sub> = 400 V, f = 1.0 MHz                                                                | -    | 240   | -     |      |
| Effective output capacitance              | C <sub>oss eff.</sub>            |                                                                                                                                                          | V <sub>DS</sub> = 0 V to 400 V <sup>c</sup>                                                         | -    | 440   | -     |      |
| Total gate charge                         | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V                                                                                                                                   | I <sub>D</sub> = 47 A, V <sub>DS</sub> = 400 V,<br>see fig. 6 and 13 <sup>b</sup>                   | -    | -     | 350   | nC   |
| Gate-source charge                        | Q <sub>gs</sub>                  |                                                                                                                                                          |                                                                                                     | -    | -     | 85    |      |
| Gate-drain charge                         | Q <sub>gd</sub>                  |                                                                                                                                                          |                                                                                                     | -    | -     | 180   |      |
| Turn-on delay time                        | t <sub>d(on)</sub>               | V <sub>GS</sub> = 10 V                                                                                                                                   | V <sub>DD</sub> = 250 V, I <sub>D</sub> = 47 A,<br>R <sub>G</sub> = 1.0 Ω, see fig. 10 <sup>b</sup> | -    | 25    | -     | ns   |
| Rise time                                 | t <sub>r</sub>                   |                                                                                                                                                          |                                                                                                     | -    | 140   | -     |      |
| Turn-off delay time                       | t <sub>d(off)</sub>              |                                                                                                                                                          |                                                                                                     | -    | 55    | -     |      |
| Fall time                                 | t <sub>f</sub>                   |                                                                                                                                                          |                                                                                                     | -    | 74    | -     |      |
| Drain-source body diode characteristics   |                                  |                                                                                                                                                          |                                                                                                     |      |       |       |      |
| Continuous source-drain diode current     | I <sub>S</sub>                   | MOSFET symbol showing the integral reverse p - n junction diode<br> |                                                                                                     | -    | -     | 47    | A    |
| Pulsed diode forward current <sup>a</sup> | I <sub>SM</sub>                  |                                                                                                                                                          |                                                                                                     | -    | -     | 190   |      |
| Body diode voltage                        | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 47 A, V <sub>GS</sub> = 0 V <sup>b</sup>                                                                        |                                                                                                     | -    | -     | 1.5   | V    |
| Body diode reverse recovery time          | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 47 A, dI/dt = 100 A/μs <sup>b</sup>                                                                             |                                                                                                     | -    | 620   | 940   | ns   |
| Body diode reverse recovery charge        | Q <sub>rr</sub>                  |                                                                                                                                                          |                                                                                                     | -    | 14    | 21    | μC   |
| Body diode recovery current               | I <sub>RRM</sub>                 |                                                                                                                                                          |                                                                                                     | -    | 38    | -     | A    |
| Forward turn-on time                      | t <sub>on</sub>                  | Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )                                                        |                                                                                                     |      |       |       |      |

**Notes**

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)  
b. Pulse width  $\leq 400\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$   
c.  $C_{oss\text{ eff.}}$  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. 4 - Normalized On-Resistance vs. Temperature**

**Fig. 2 - Typical Output Characteristics**

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

**Fig. 3 - Typical Transfer Characteristics**

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

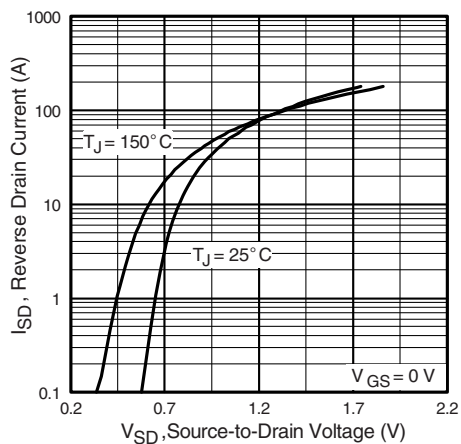


**Fig. 7 - Typical Source-Drain Diode Forward Voltage**

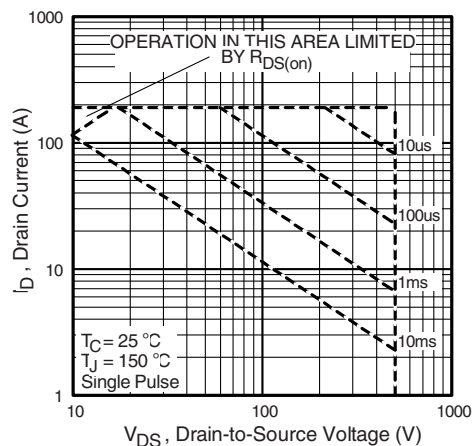


**Fig. 8 - Maximum Safe Operating Area**

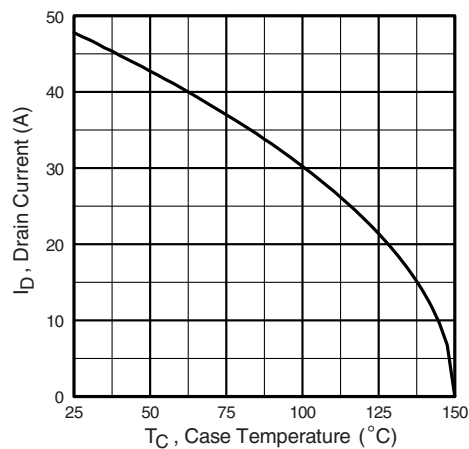


**Fig. 9 - Maximum Drain Current vs. Case Temperature**

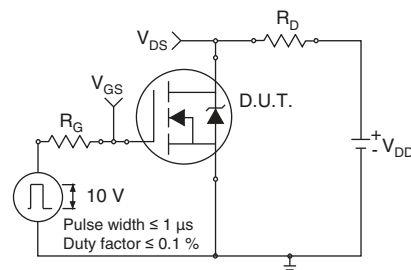


**Fig. 10a - Switching Time Test Circuit**

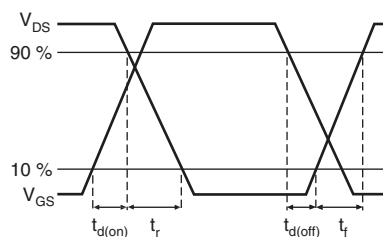
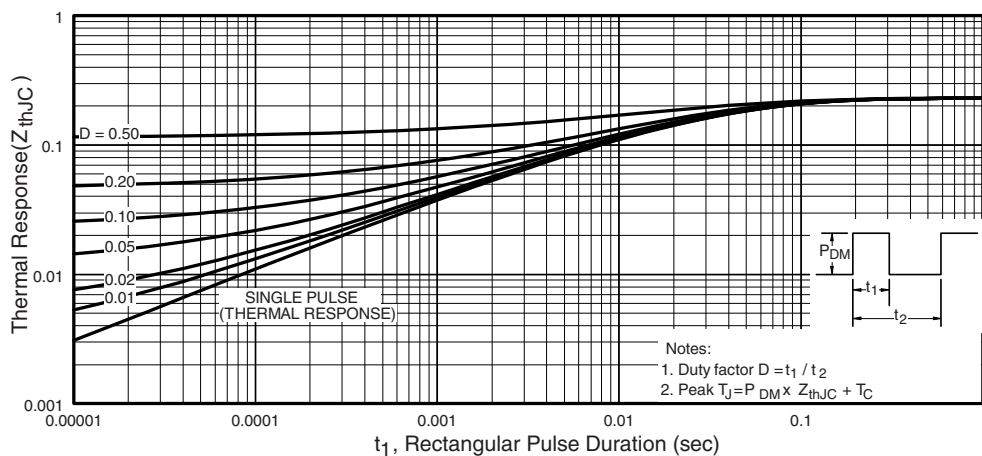
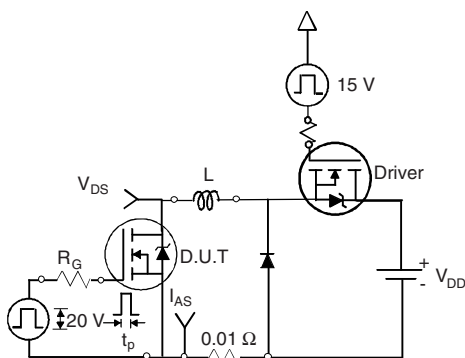
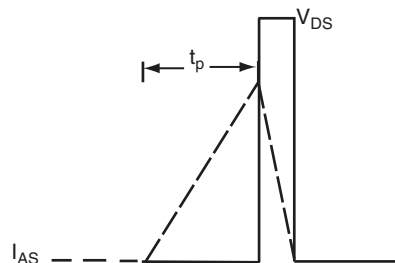
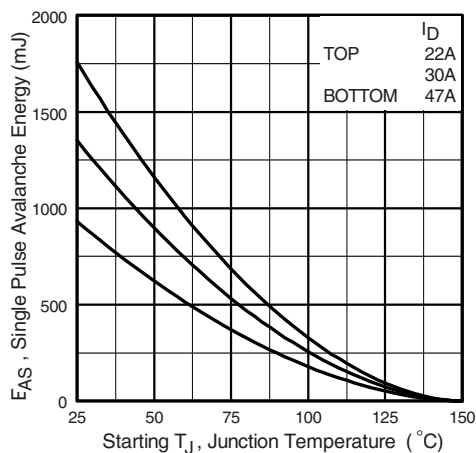
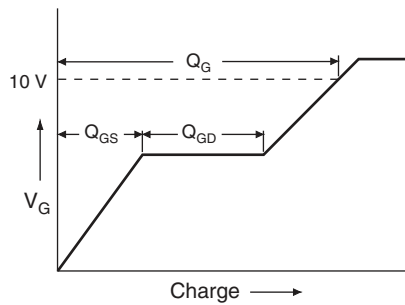
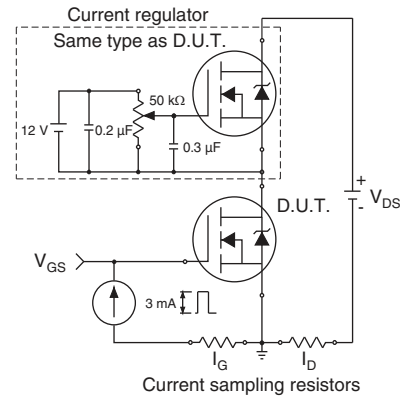
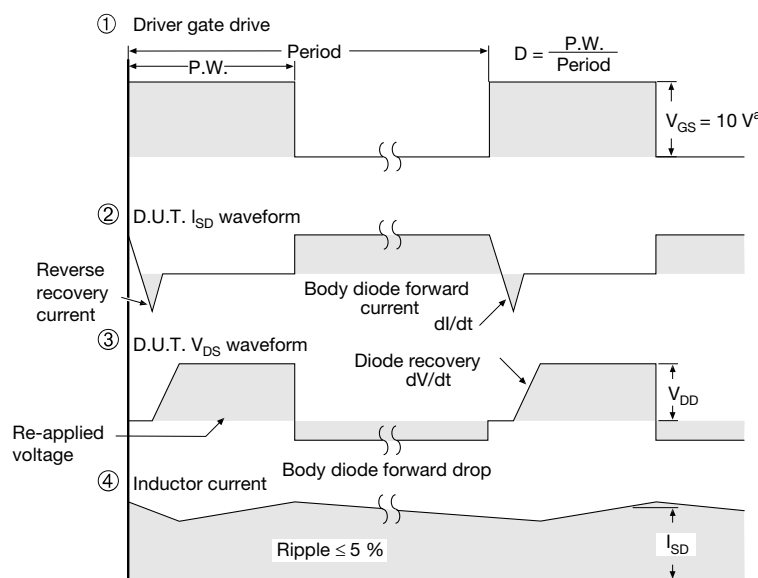
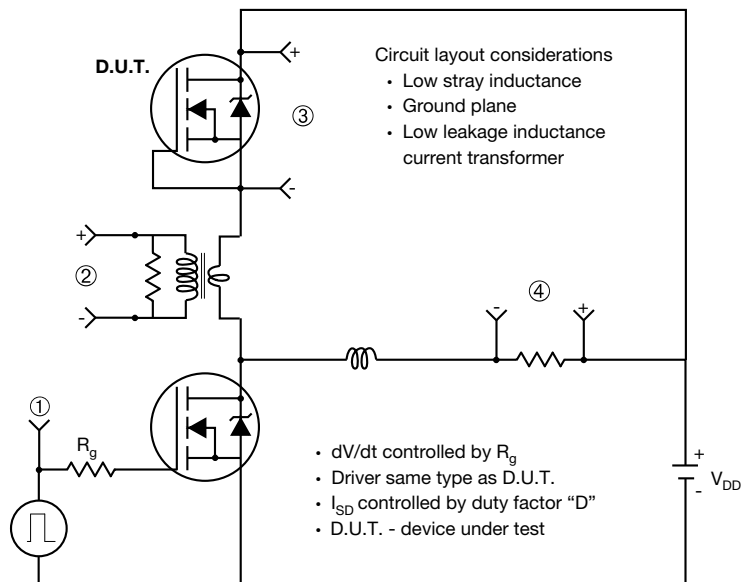


**Fig. 10b - Switching Time Waveforms**


**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.  $V_{GS} = 5\text{ V}$  for logic level devices

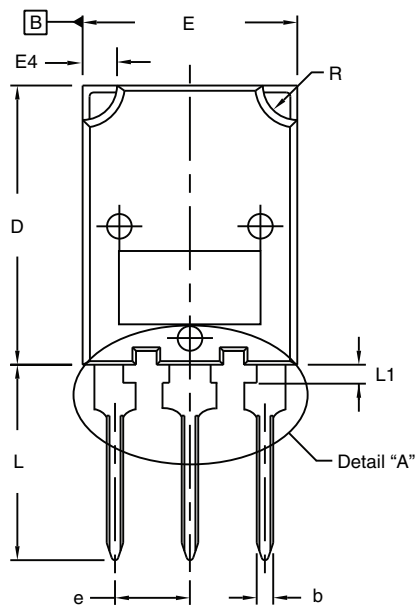
**Fig. 14 - For N-Channel**

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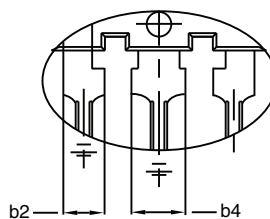
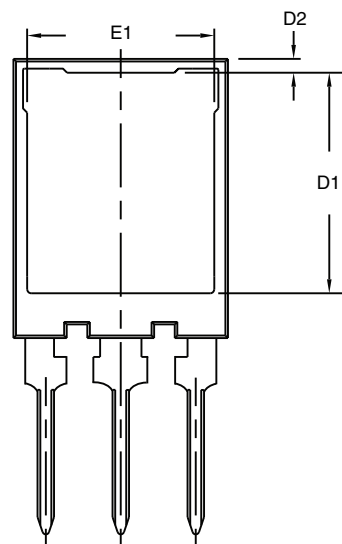
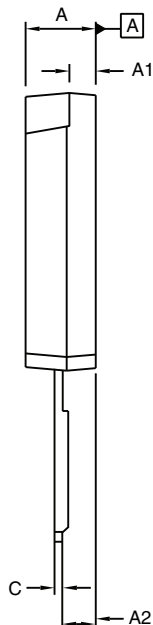
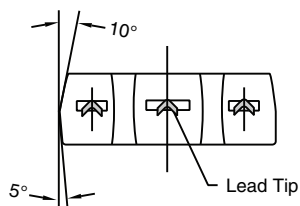


## TO-274AA (High Voltage)

### VERSION 1: FACILITY CODE = Y



⌀ 0.10 (0.25) ⌀ B A ⌀



Detail "A"  
Scale: 2:1

| 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 |

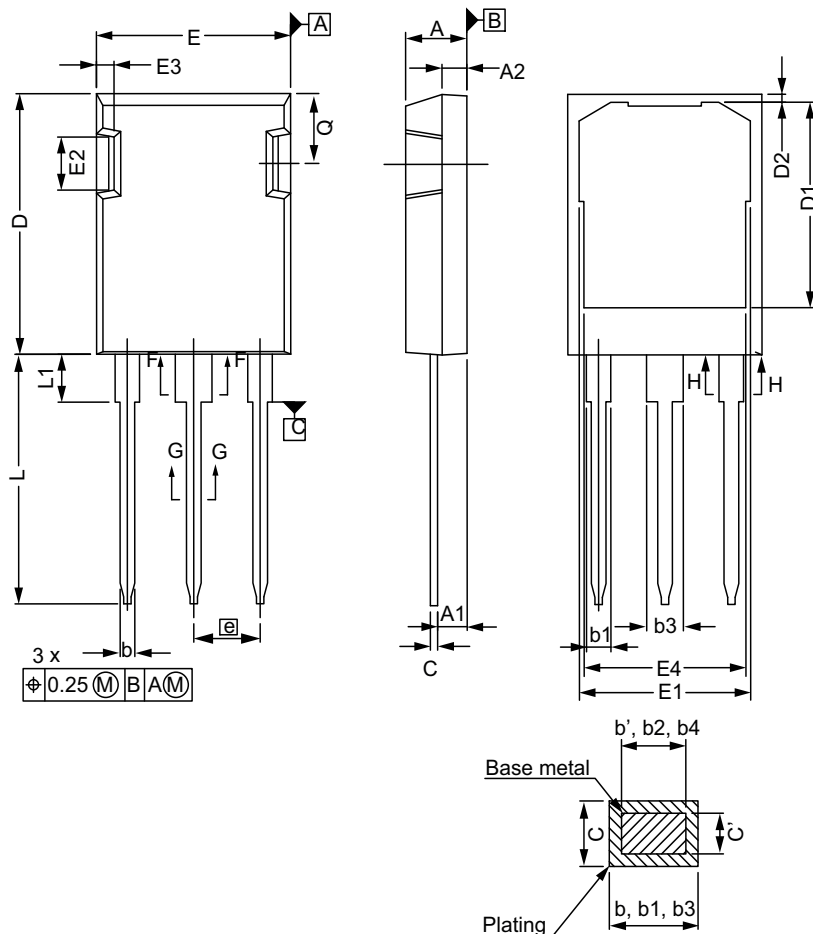
| DIM. | MILLIMETERS |       | INCHES    |       |
|------|-------------|-------|-----------|-------|
|      | MIN.        | MAX.  | MIN.      | MAX.  |
| D1   | 15.50       | 16.10 | 0.610     | 0.634 |
| D2   | 0.70        | 1.30  | 0.028     | 0.051 |
| E    | 15.10       | 16.10 | 0.594     | 0.634 |
| 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 |

#### 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
- <sup>(1)</sup> Dimension measured at tip of lead



## VERSION 2: FACILITY CODE = N



SECTION "F-F", "G-G" AND "H-H"  
SCALE: NONE

| MILLIMETERS |       |       |
|-------------|-------|-------|
| DIM.        | MIN.  | MAX.  |
| A           | 4.83  | 5.21  |
| A1          | 2.29  | 2.54  |
| A2          | 1.91  | 2.16  |
| b'          | 1.07  | 1.28  |
| b           | 1.07  | 1.33  |
| b1          | 1.91  | 2.41  |
| b2          | 1.91  | 2.16  |
| b3          | 2.87  | 3.38  |
| b4          | 2.87  | 3.13  |
| c'          | 0.55  | 0.65  |
| c           | 0.55  | 0.68  |
| D           | 20.80 | 21.10 |

| MILLIMETERS |          |       |
|-------------|----------|-------|
| DIM.        | MIN.     | MAX.  |
| D1          | 16.25    | 17.65 |
| D2          | 0.50     | 0.80  |
| E           | 15.75    | 16.13 |
| E1          | 13.10    | 14.15 |
| E2          | 3.68     | 5.10  |
| E3          | 1.00     | 1.90  |
| E4          | 12.38    | 13.43 |
| e           | 5.44 BSC |       |
| N           | 3        |       |
| L           | 19.81    | 20.32 |
| L1          | 3.70     | 4.00  |
| Q           | 5.49     | 6.00  |

ECN: E20-0538-Rev. C, 19-Oct-2020  
DWG: 5975

### Notes

- Dimensioning and tolerancing per ASME Y14.5M-1994
- Outline conforms to JEDEC® outline to TO-27AD
- Dimensions are measured in mm, angles are in degree
- Metal surfaces are tin plated, except area of cut



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