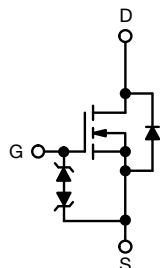
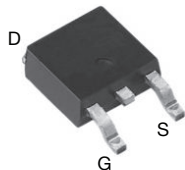


## E Series Power MOSFET

**DPAK (TO-252)**


N-Channel MOSFET

### FEATURES

- Low figure-of-merit (FOM)  $R_{on} \times Q_g$
- Low effective capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Ultra low gate charge ( $Q_g$ )
- Avalanche energy rated (UIS)
- Integrated Zener diode ESD protection
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
  - High-intensity discharge (HID)
  - Fluorescent ballast lighting
- Industrial
  - Welding
  - Induction heating
  - Motor drives
  - Battery chargers
  - Renewable energy
  - Solar (PV inverters)

### PRODUCT SUMMARY

|                                         |                 |     |
|-----------------------------------------|-----------------|-----|
| $V_{DS}$ (V) at $T_J$ max.              | 850             |     |
| $R_{DS(on)}$ typ. ( $\Omega$ ) at 25 °C | $V_{GS} = 10$ V | 2.5 |
| $Q_g$ max. (nC)                         | 10.5            |     |
| $Q_{gs}$ (nC)                           | 3               |     |
| $Q_{gd}$ (nC)                           | 2               |     |
| Configuration                           | Single          |     |

### ORDERING INFORMATION

| Package                         | DPAK (TO-252)     | DPAK (TO-252)     |
|---------------------------------|-------------------|-------------------|
| Lead (Pb)-free and halogen-free | SiHD2N80AE-GE3    | SiHD2N80AE-T1-GE3 |
|                                 | SiHD2N80AE-T4-GE3 | SiHD2N80AE-T5-GE3 |

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

| PARAMETER                                                 |                         |                         | SYMBOL                            | LIMIT       | UNIT |
|-----------------------------------------------------------|-------------------------|-------------------------|-----------------------------------|-------------|------|
| Drain-source voltage                                      |                         |                         | V <sub>DS</sub>                   | 800         | V    |
| Gate-source voltage                                       |                         |                         | V <sub>GS</sub>                   | ± 30        |      |
| Continuous drain current (T <sub>J</sub> = 150 °C)        | V <sub>GS</sub> at 10 V | T <sub>C</sub> = 25 °C  | I <sub>D</sub>                    | 2.9         | A    |
|                                                           |                         | T <sub>C</sub> = 100 °C |                                   | 1.8         |      |
| Pulsed drain current <sup>a</sup>                         |                         |                         | I <sub>DM</sub>                   | 3.6         |      |
| Linear derating factor                                    |                         |                         |                                   | 0.5         | W/°C |
| Single pulse avalanche energy <sup>b</sup>                |                         |                         | E <sub>AS</sub>                   | 14.1        | mJ   |
| Maximum power dissipation                                 |                         |                         | P <sub>D</sub>                    | 62.5        | W    |
| Operating junction and storage temperature range          |                         |                         | T <sub>J</sub> , T <sub>stg</sub> | -55 to +150 | °C   |
| Drain-source voltage slope                                |                         | T <sub>J</sub> = 125 °C | dv/dt                             | 70          | V/ns |
| Reverse diode dv/dt <sup>d</sup>                          |                         |                         |                                   | 0.1         |      |
| Soldering recommendations (peak temperature) <sup>c</sup> |                         | For 10 s                |                                   | 260         | °C   |

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 140$  V, starting  $T_J = 25$  °C,  $L = 28.2$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 1$  A
- 1.6 mm from case
- $I_{SD} \leq I_D$ ,  $di/dt = 100$  A/ $\mu$ s, starting  $T_J = 25$  °C

**THERMAL RESISTANCE RATINGS**

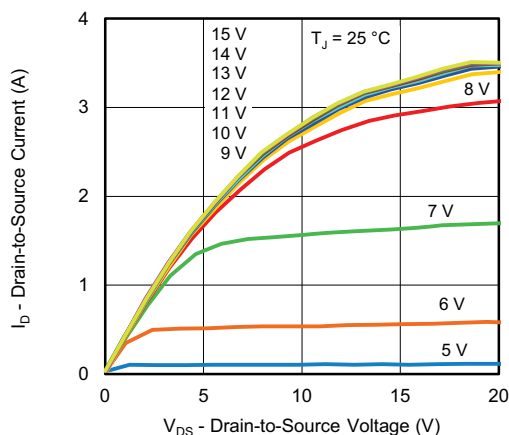
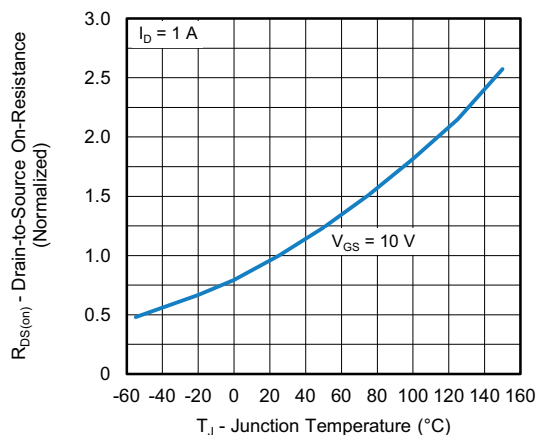
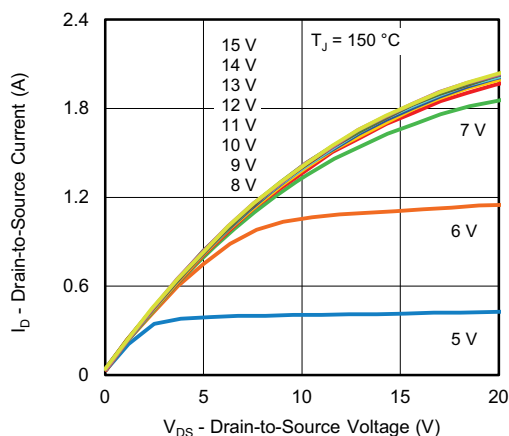
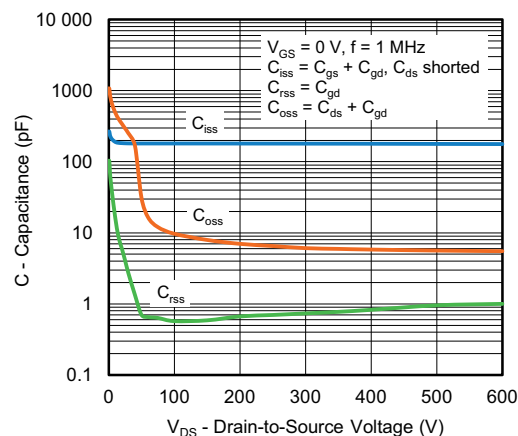
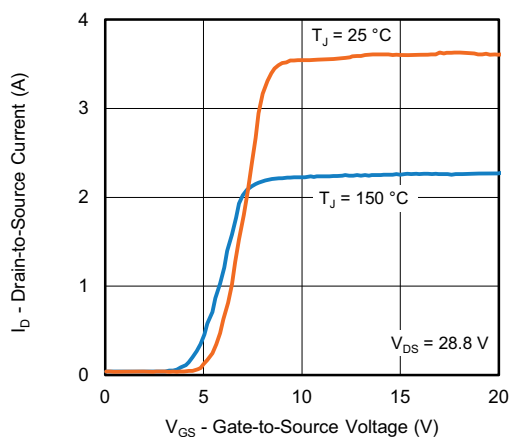
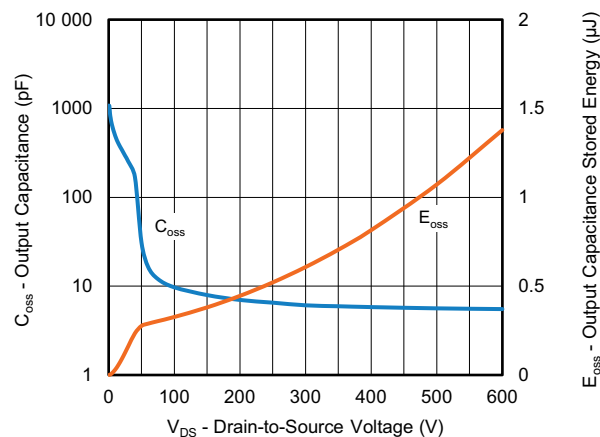
| PARAMETER                        | SYMBOL     | TYP. | MAX. | UNIT |
|----------------------------------|------------|------|------|------|
| Maximum junction-to-ambient      | $R_{thJA}$ | -    | 62   | °C/W |
| Maximum junction-to-case (drain) | $R_{thJC}$ | -    | 2.0  |      |

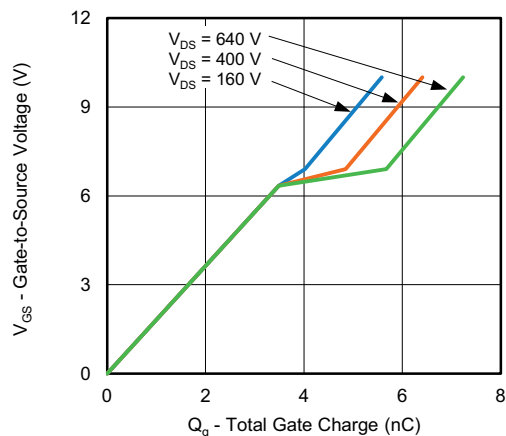
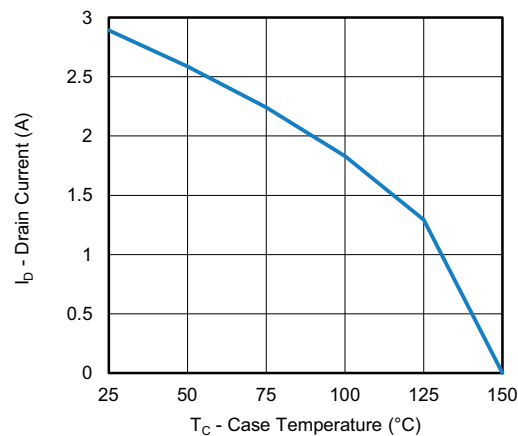
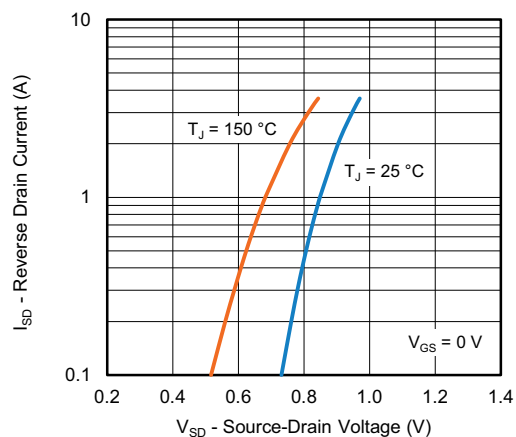
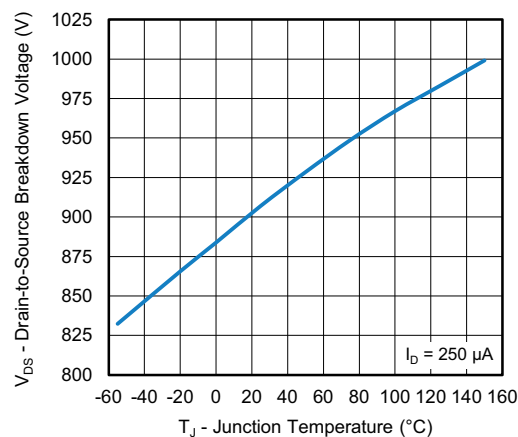
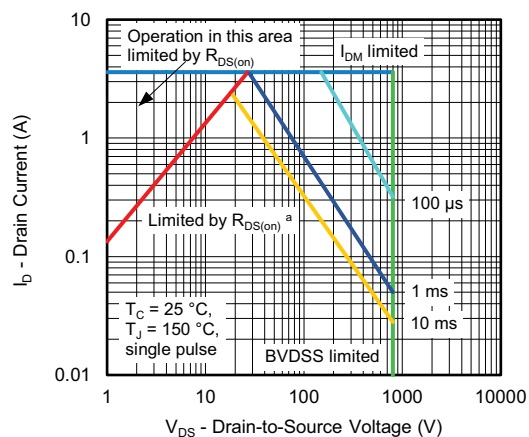
**SPECIFICATIONS** ( $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

| PARAMETER                                                 | SYMBOL              | TEST CONDITIONS                                                                                                                                          |                                                | MIN. | TYP. | MAX.     | UNIT                  |
|-----------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------|------|----------|-----------------------|
| Static                                                    |                     |                                                                                                                                                          |                                                |      |      |          |                       |
| Drain-source breakdown voltage                            | $V_{DS}$            | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                                   |                                                | 800  | -    | -        | V                     |
| $V_{DS}$ temperature coefficient                          | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^{\circ}\text{C}$ , $I_D = 1\text{ mA}$                                                                                          |                                                | -    | 0.8  | -        | V/ $^{\circ}\text{C}$ |
| Gate-source threshold voltage (N)                         | $V_{GS(th)}$        | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                                       |                                                | 2.0  | -    | 4.0      | V                     |
| Gate-source leakage                                       | $I_{GSS}$           | $V_{GS} = \pm 20\text{ V}$                                                                                                                               |                                                | -    | -    | $\pm 10$ | $\mu\text{A}$         |
|                                                           |                     | $V_{GS} = \pm 30\text{ V}$                                                                                                                               |                                                | -    | -    | $\pm 50$ |                       |
| Zero gate voltage drain current                           | $I_{DSS}$           | $V_{DS} = 800\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                                          |                                                | -    | -    | 1        | $\mu\text{A}$         |
|                                                           |                     | $V_{DS} = 640\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^{\circ}\text{C}$                                                                    |                                                | -    | -    | 10       |                       |
| Drain-source on-state resistance                          | $R_{DS(on)}$        | $V_{GS} = 10\text{ V}$                                                                                                                                   | $I_D = 0.5\text{ A}$                           | -    | 2.5  | 2.9      | $\Omega$              |
| Forward transconductance <sup>a</sup>                     | $g_{fs}$            | $V_{DS} = 30\text{ V}$ , $I_D = 1\text{ A}$                                                                                                              |                                                | -    | 0.6  | -        | S                     |
| Dynamic                                                   |                     |                                                                                                                                                          |                                                |      |      |          |                       |
| Input capacitance                                         | $C_{iss}$           | $V_{GS} = 0\text{ V}$ ,<br>$V_{DS} = 100\text{ V}$ ,<br>$f = 1\text{ MHz}$                                                                               |                                                | -    | 180  | -        | pF                    |
| Output capacitance                                        | $C_{oss}$           |                                                                                                                                                          |                                                | -    | 10   | -        |                       |
| Reverse transfer capacitance                              | $C_{rss}$           |                                                                                                                                                          |                                                | -    | 1    | -        |                       |
| Effective output capacitance, energy related <sup>a</sup> | $C_{o(er)}$         | $V_{DS} = 0\text{ V to } 480\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                           |                                                | -    | 7    | -        | pF                    |
| Effective output capacitance, time related <sup>b</sup>   | $C_{o(tr)}$         |                                                                                                                                                          |                                                | -    | 42   | -        |                       |
| Total gate charge                                         | $Q_g$               | $V_{GS} = 10\text{ V}$                                                                                                                                   | $I_D = 1.5\text{ A}$ , $V_{DS} = 640\text{ V}$ | -    | 7    | 10.5     | nC                    |
| Gate-source charge                                        | $Q_{gs}$            |                                                                                                                                                          |                                                | -    | 3    | -        |                       |
| Gate-drain charge                                         | $Q_{gd}$            |                                                                                                                                                          |                                                | -    | 2    | -        |                       |
| Turn-on delay time                                        | $t_{d(on)}$         | $V_{DD} = 640\text{ V}$ , $I_D = 1.5\text{ A}$ ,<br>$V_{GS} = 10\text{ V}$ , $R_g = 4.7\text{ }\Omega$                                                   |                                                | -    | 13   | 26       | ns                    |
| Rise time                                                 | $t_r$               |                                                                                                                                                          |                                                | -    | 8    | 16       |                       |
| Turn-off delay time                                       | $t_{d(off)}$        |                                                                                                                                                          |                                                | -    | 10   | 20       |                       |
| Fall time                                                 | $t_f$               |                                                                                                                                                          |                                                | -    | 23   | 46       |                       |
| Gate input resistance                                     | $R_g$               | $f = 1\text{ MHz}$ , open drain                                                                                                                          |                                                | 2.0  | 5.2  | 10.4     | $\Omega$              |
| Drain-Source Body Diode Characteristics                   |                     |                                                                                                                                                          |                                                |      |      |          |                       |
| Continuous source-drain diode current                     | $I_S$               | MOSFET symbol showing the integral reverse p - n junction diode<br> |                                                | -    | -    | 2.9      | A                     |
| Pulsed diode forward current                              | $I_{SM}$            |                                                                                                                                                          |                                                | -    | -    | 3.6      |                       |
| Diode forward voltage                                     | $V_{SD}$            | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_S = 1\text{ A}$ , $V_{GS} = 0\text{ V}$                                                                          |                                                | -    | -    | 1.2      | V                     |
| Reverse recovery time                                     | $t_{rr}$            | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_F = I_S = 1\text{ A}$ ,<br>$di/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 25\text{ V}$                              |                                                | -    | 313  | 626      | ns                    |
| Reverse recovery charge                                   | $Q_{rr}$            |                                                                                                                                                          |                                                | -    | 0.7  | 1.4      | $\mu\text{C}$         |
| Reverse recovery current                                  | $I_{RRM}$           |                                                                                                                                                          |                                                | -    | 3.8  | -        | A                     |

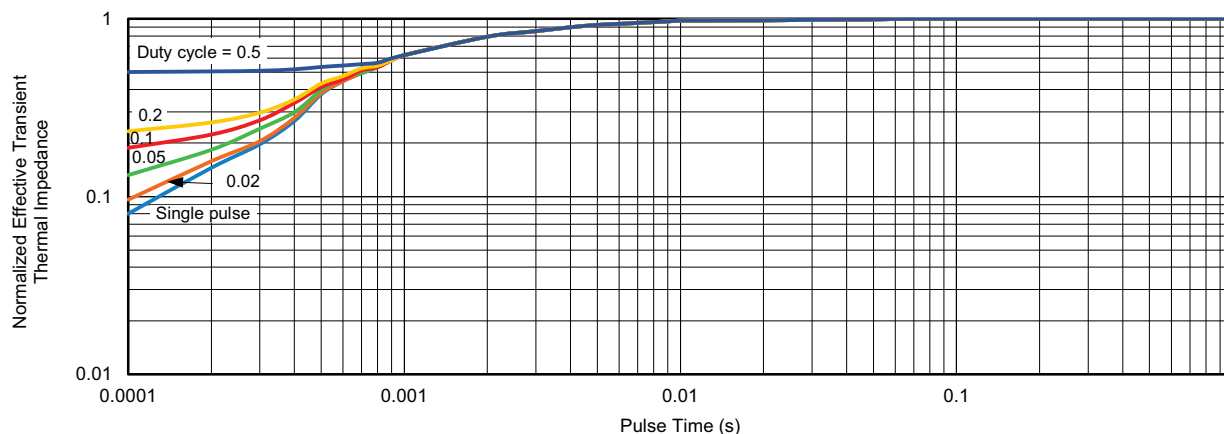
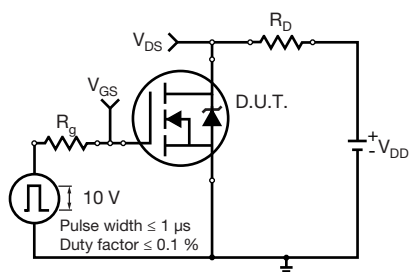
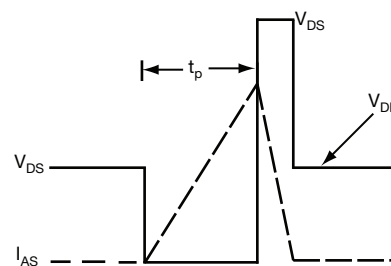
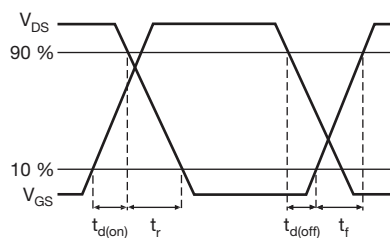
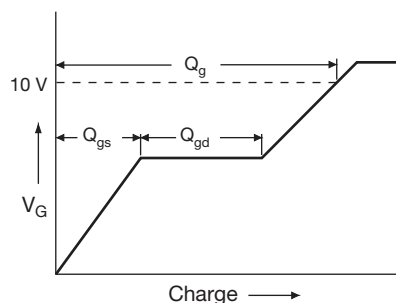
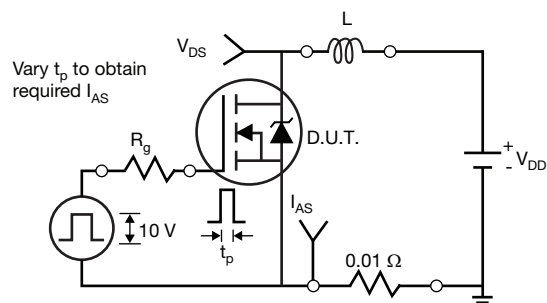
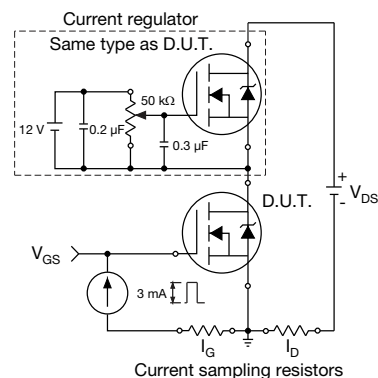
**Notes**

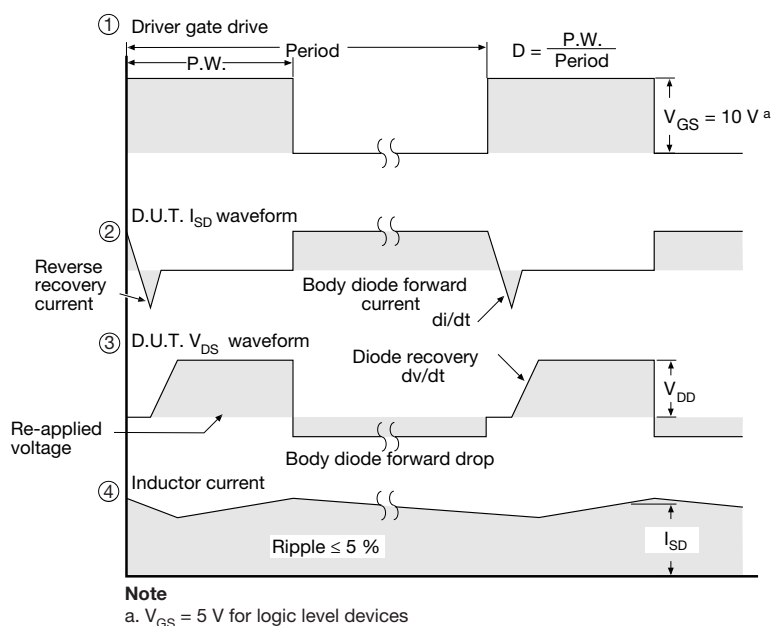
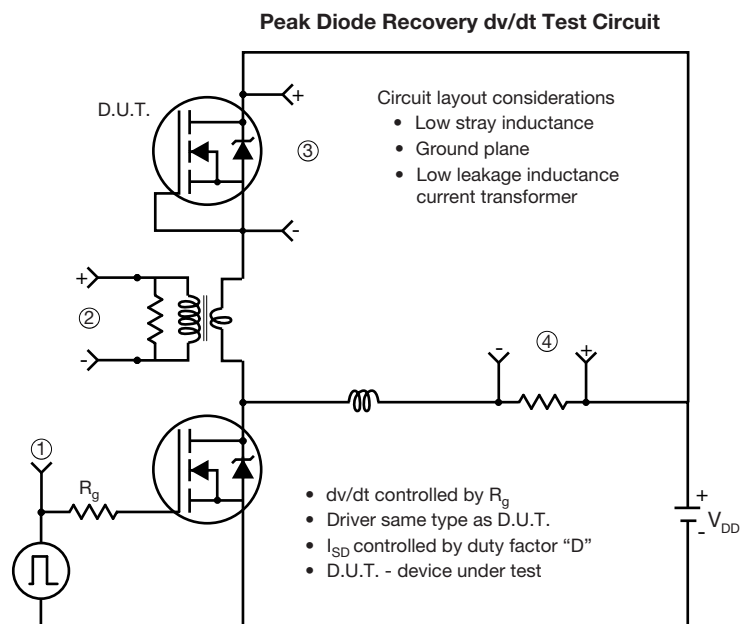
- a.  $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from  $0\text{ V}$  to  $480\text{ V}$   $V_{DSS}$   
b.  $C_{oss(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from  $0\text{ V}$  to  $480\text{ V}$   $V_{DSS}$

**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 -  $C_{oss}$  and  $E_{oss}$  vs.  $V_{DS}$**


**Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage**

**Fig. 10 - Maximum Drain Current vs. Case Temperature**

**Fig. 8 - Typical Source-Drain Diode Forward Voltage**

**Fig. 11 - Temperature vs. Drain-to-Source Voltage**

**Fig. 9 - Maximum Safe Operating Area**
**Note**

a.  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified


**Fig. 12 - Normalized Transient Thermal Impedance, Junction-to-Case**

**Fig. 13 - Switching Time Test Circuit**

**Fig. 16 - Unclamped Inductive Waveforms**

**Fig. 14 - Switching Time Waveforms**

**Fig. 17 - Basic Gate Charge Waveform**

**Fig. 15 - Unclamped Inductive Test Circuit**

**Fig. 18 - Gate Charge Test Circuit**

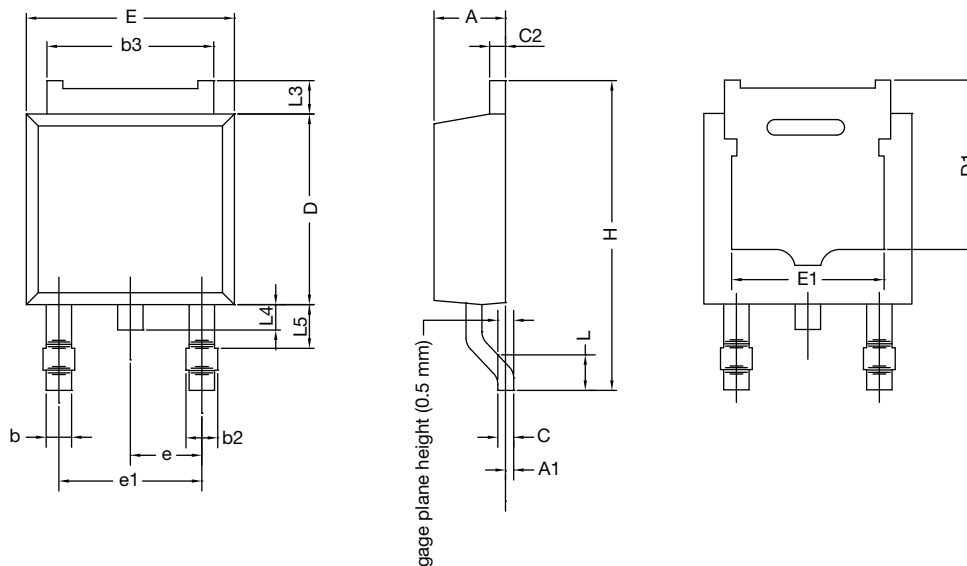


**Fig. 19 - For N-Channel**

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## TO-252AA Case Outline

### VERSION 1: FACILITY CODE = Y



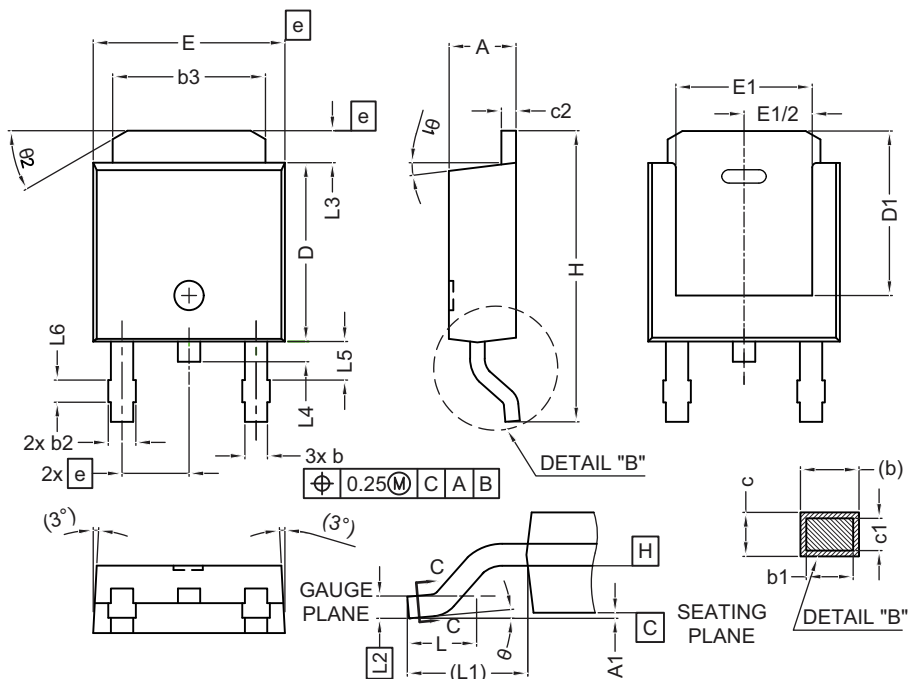
| MILLIMETERS |          |       |
|-------------|----------|-------|
| DIM.        | MIN.     | MAX.  |
| A           | 2.18     | 2.38  |
| A1          | -        | 0.127 |
| b           | 0.64     | 0.88  |
| b2          | 0.76     | 1.14  |
| b3          | 4.95     | 5.46  |
| C           | 0.46     | 0.61  |
| C2          | 0.46     | 0.89  |
| D           | 5.97     | 6.22  |
| D1          | 4.10     | -     |
| E           | 6.35     | 6.73  |
| E1          | 4.32     | -     |
| H           | 9.40     | 10.41 |
| e           | 2.28 BSC |       |
| e1          | 4.56 BSC |       |
| L           | 1.40     | 1.78  |
| L3          | 0.89     | 1.27  |
| L4          | -        | 1.02  |
| L5          | 1.01     | 1.52  |

#### Note

- Dimension L3 is for reference only



## VERSION 2: FACILITY CODE = N



| DIM. | MILLIMETERS |       |
|------|-------------|-------|
|      | MIN.        | MAX.  |
| A    | 2.18        | 2.39  |
| A1   | -           | 0.13  |
| b    | 0.65        | 0.89  |
| b1   | 0.64        | 0.79  |
| b2   | 0.76        | 1.13  |
| b3   | 4.95        | 5.46  |
| c    | 0.46        | 0.61  |
| c1   | 0.41        | 0.56  |
| c2   | 0.46        | 0.60  |
| D    | 5.97        | 6.22  |
| D1   | 5.21        | -     |
| E    | 6.35        | 6.73  |
| E1   | 4.32        | -     |
| e    | 2.29 BSC    |       |
| H    | 9.94        | 10.34 |

| DIM.   | MILLIMETERS |      |
|--------|-------------|------|
|        | MIN.        | MAX. |
| L      | 1.50        | 1.78 |
| L1     | 2.74 ref.   |      |
| L2     | 0.51 BSC    |      |
| L3     | 0.89        | 1.27 |
| L4     | -           | 1.02 |
| L5     | 1.14        | 1.49 |
| L6     | 0.65        | 0.85 |
| theta  | 0°          | 10°  |
| theta1 | 0°          | 15°  |
| theta2 | 25°         | 35°  |

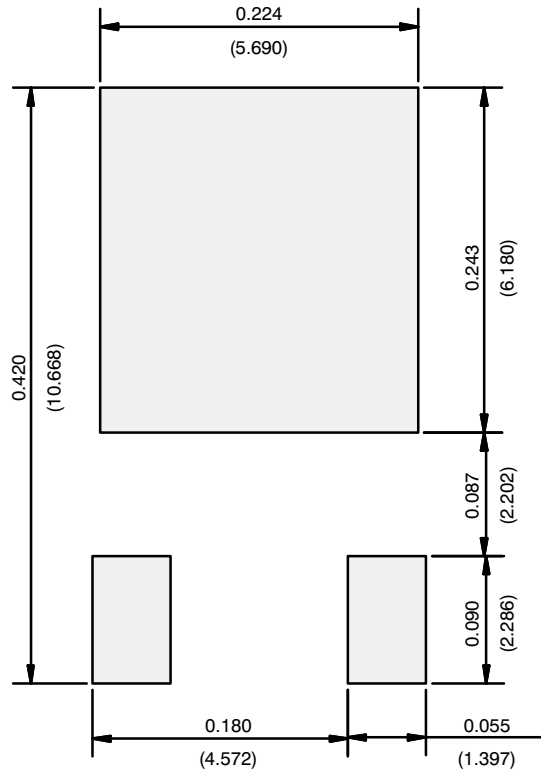
### Notes

- Dimensioning and tolerance confirm to ASME Y14.5M-1994
- All dimensions are in millimeters. Angles are in degrees
- Heat sink side flash is max. 0.8 mm
- Radius on terminal is optional

ECN: E22-0399-Rev. R, 03-Oct-2022  
DWG: 5347



## RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads  
Dimensions in Inches/(mm)

[Return to Index](#)



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