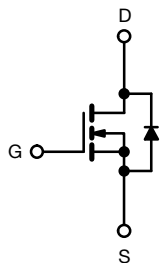
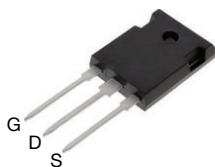


E Series Power MOSFET

TO-247AD


N-Channel MOSFET

FEATURES

- Low figure-of-merit (FOM): $R_{on} \times Q_g$
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)
- Material categorization: for definitions of compliance please see 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. | 650 | |
| $R_{DS(on)}$ max. (Ω) at 25 °C | $V_{GS} = 10$ V | 0.099 |
| Q_g max. (nC) | 150 | |
| Q_{gs} (nC) | 24 | |
| Q_{gd} (nC) | 42 | |
| Configuration | Single | |

ORDERING INFORMATION

| | |
|---------------------------------|----------------|
| Package | TO-247AD |
| Lead (Pb)-free and Halogen-free | SiHW33N60E-GE3 |

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

| PARAMETER | SYMBOL | LIMIT | UNIT |
|-----------------------------------------------------------|------------------|----------------|------|
| Drain-Source Voltage | V_{DS} | 600 | V |
| Gate-Source Voltage | V_{GS} | ± 30 | |
| Continuous Drain Current ($T_J = 150$ °C) | V_{GS} at 10 V | $T_C = 25$ °C | A |
| | | $T_C = 100$ °C | |
| Pulsed Drain Current ^a | I_{DM} | 88 | |
| Linear Derating Factor | | 2.2 | W/°C |
| Single Pulse Avalanche Energy ^b | E_{AS} | 793 | mJ |
| Maximum Power Dissipation | P_D | 278 | W |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | -55 to +150 | °C |
| Drain-Source Voltage Slope | dV/dt | 70 | V/ns |
| Reverse Diode dV/dt ^d | | 12 | |
| Soldering Recommendations (Peak temperature) ^c | for 10 s | 300 | °C |


Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 28.2$ mH, $R_g = 25$ Ω , $I_{AS} = 7.5$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, starting $T_J = 25$ °C.

**THERMAL RESISTANCE RATINGS**

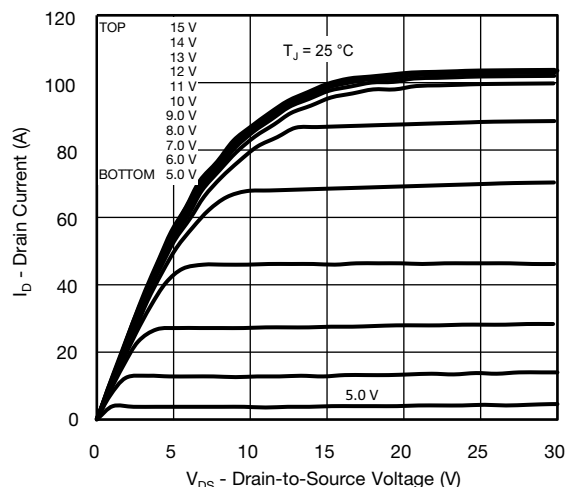
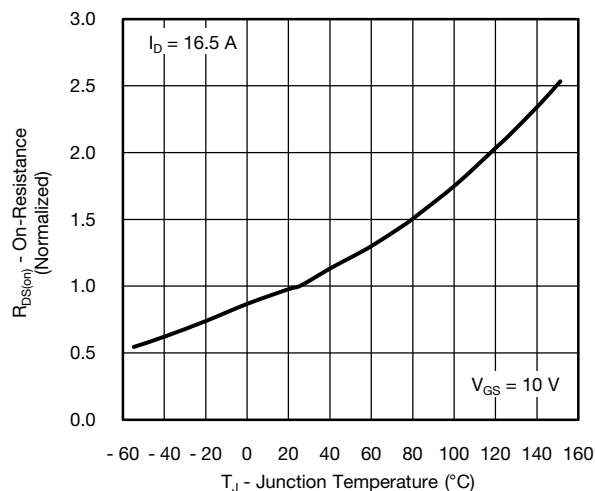
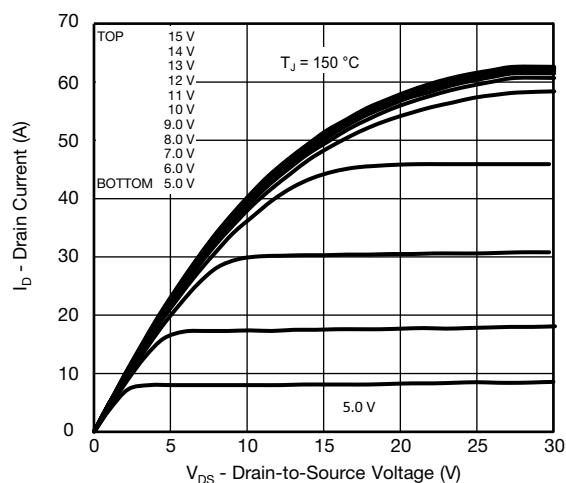
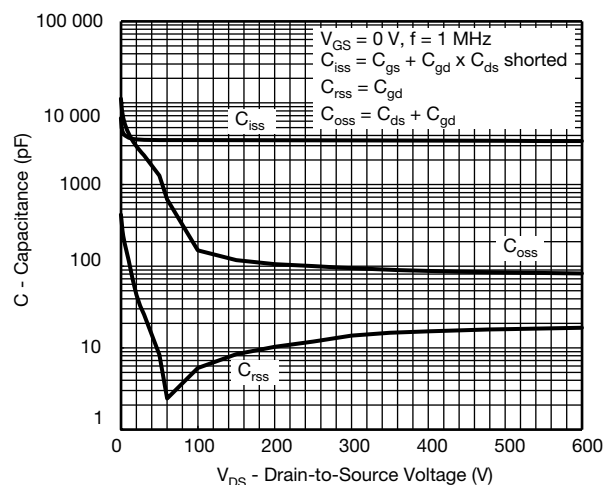
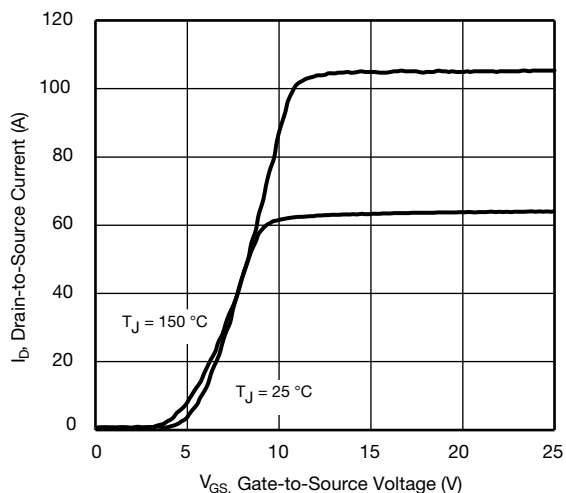
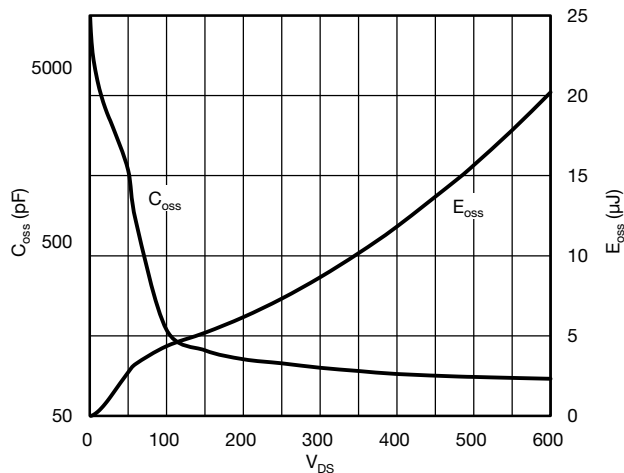
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
|----------------------------------|------------|------|------|------|
| Maximum Junction-to-Ambient | R_{thJA} | - | 40 | °C/W |
| Maximum Junction-to-Case (Drain) | R_{thJC} | - | 0.45 | |

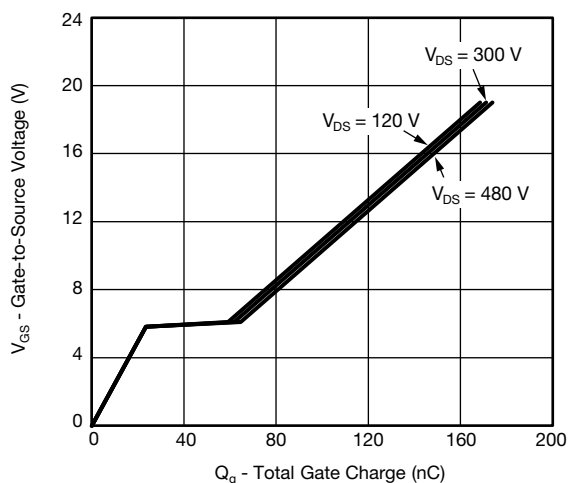
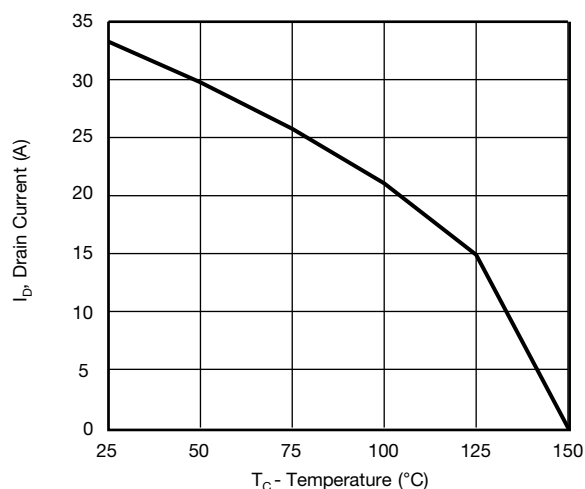
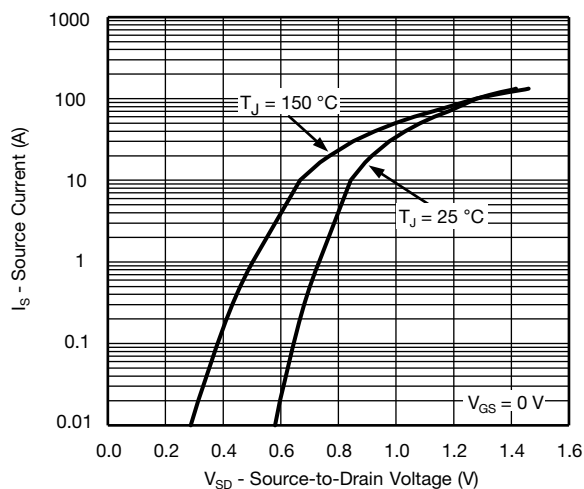
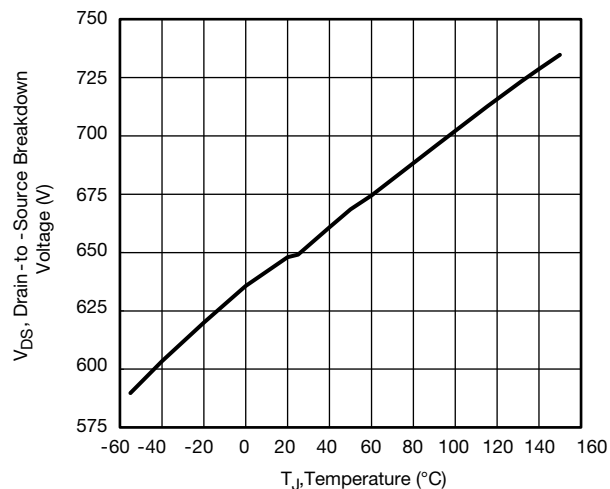
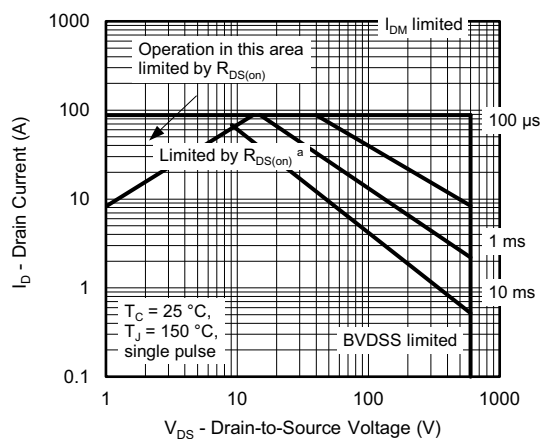
SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

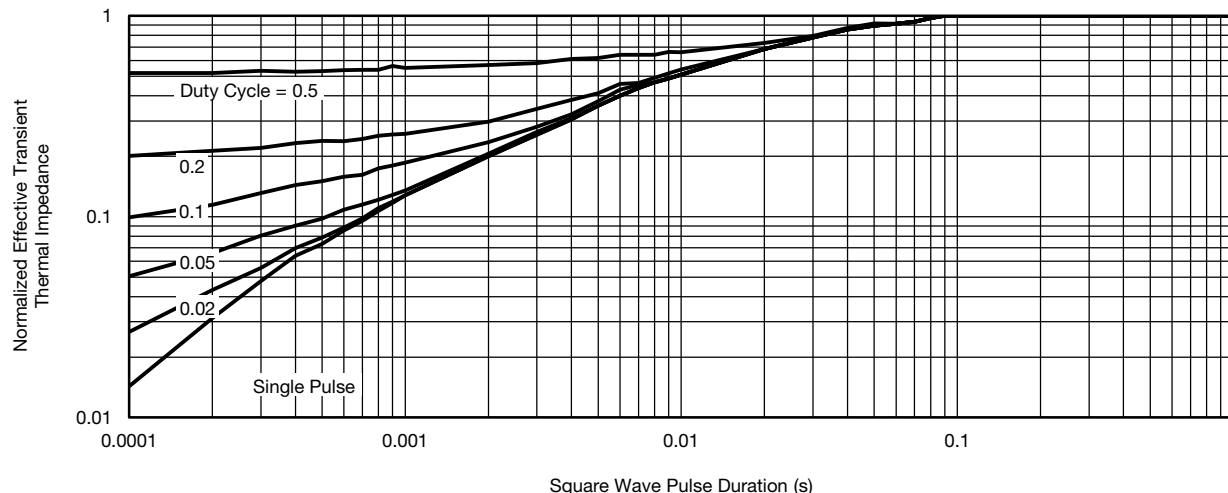
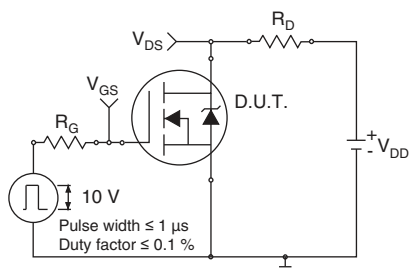
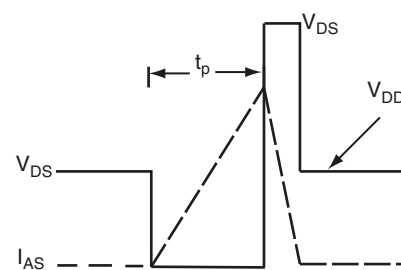
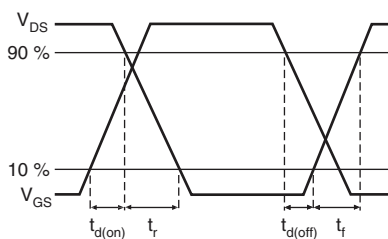
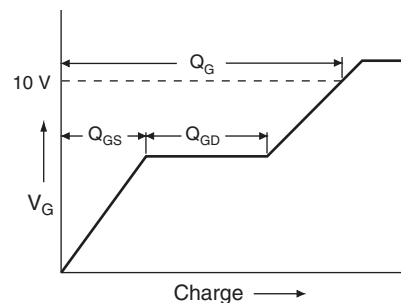
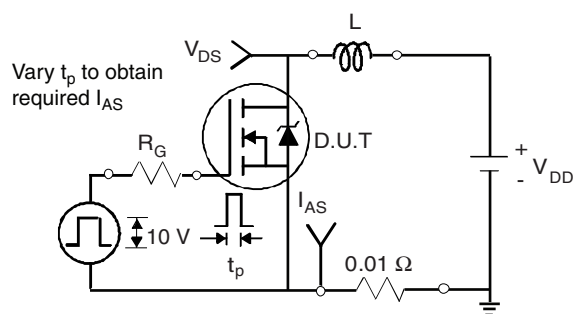
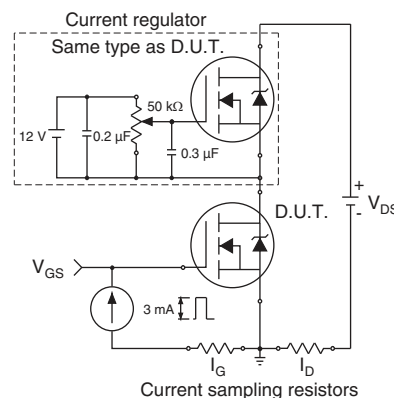
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
|-----------------------------------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------|-------|-------|------|
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V _{DS} | V _{GS} = 0 V, I _D = 250 μA | | 600 | - | - | V |
| V _{DS} Temperature Coefficient | ΔV _{DS} /T _J | Reference to 25 °C, I _D = 1 mA | | - | 0.71 | - | V/°C |
| Gate-Source Threshold Voltage (N) | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 250 μA | | 2.0 | - | 4.0 | V |
| Gate-Source Leakage | I _{GSS} | V _{GS} = ± 20 V | | - | - | ± 100 | nA |
| | | V _{GS} = ± 30 V | | - | - | ± 1 | μA |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} = 600 V, V _{GS} = 0 V | | - | - | 1 | μA |
| | | V _{DS} = 480 V, V _{GS} = 0 V, T _J = 125 °C | | - | - | 10 | |
| Drain-Source On-State Resistance | R _{DS(on)} | V _{GS} = 10 V | I _D = 16.5 A | - | 0.083 | 0.099 | Ω |
| Forward Transconductance ^a | g _{fs} | V _{DS} = 30 V, I _D = 16.5 A | | - | 11 | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz | | - | 3508 | - | pF |
| Output Capacitance | C _{oss} | | | - | 156 | - | |
| Reverse Transfer Capacitance | C _{rss} | | | - | 6 | - | |
| Effective Output Capacitance, Energy Related ^b | C _{o(er)} | V _{GS} = 0 V, V _{DS} = 0 V to 480 V | | - | 136 | - | |
| Effective Output Capacitance, Time Related ^c | C _{o(tr)} | | | - | 468 | - | |
| Total Gate Charge | Q _g | V _{GS} = 10 V | I _D = 16.5 A, V _{DS} = 480 V | - | 100 | 150 | nC |
| Gate-Source Charge | Q _{gs} | | | - | 24 | - | |
| Gate-Drain Charge | Q _{gd} | | | - | 42 | - | |
| Turn-On Delay Time | t _{d(on)} | V _{DD} = 480 V, I _D = 16.5 A R _g = 9.1 Ω, V _{GS} = 10 V | | - | 28 | 56 | ns |
| Rise Time | t _r | | | - | 60 | 90 | |
| Turn-Off Delay Time | t _{d(off)} | | | - | 99 | 150 | |
| Fall Time | t _f | | | - | 54 | 80 | |
| Gate Input Resistance | R _g | f = 1 MHz, open drain | | 0.2 | 0.7 | 1.0 | Ω |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous Source-Drain Diode Current | I _S | MOSFET symbol showing the integral reverse p - n junction diode  | | - | - | 33 | A |
| Pulsed Diode Forward Current | I _{SM} | | | - | - | 88 | |
| Diode Forward Voltage | V _{SD} | T _J = 25 °C, I _S = 16.5 A, V _{GS} = 0 V | | - | 0.9 | 1.2 | V |
| Reverse Recovery Time | t _{rr} | T _J = 25 °C, I _F = I _S , dI/dt = 100 A/μs, V _R = 20 V | | - | 503 | 1006 | ns |
| Reverse Recovery Charge | Q _{rr} | | | - | 8.5 | 17 | μC |
| Reverse Recovery Current | I _{RRM} | | | - | 26 | - | A |

Notes

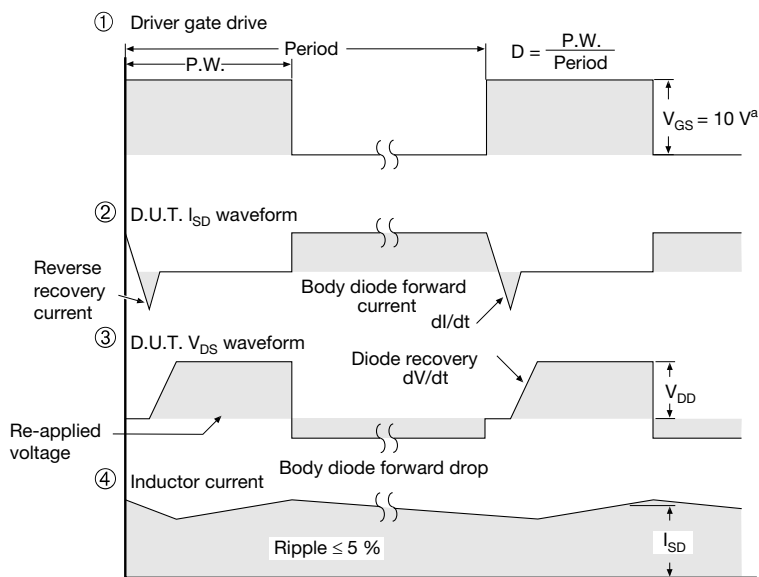
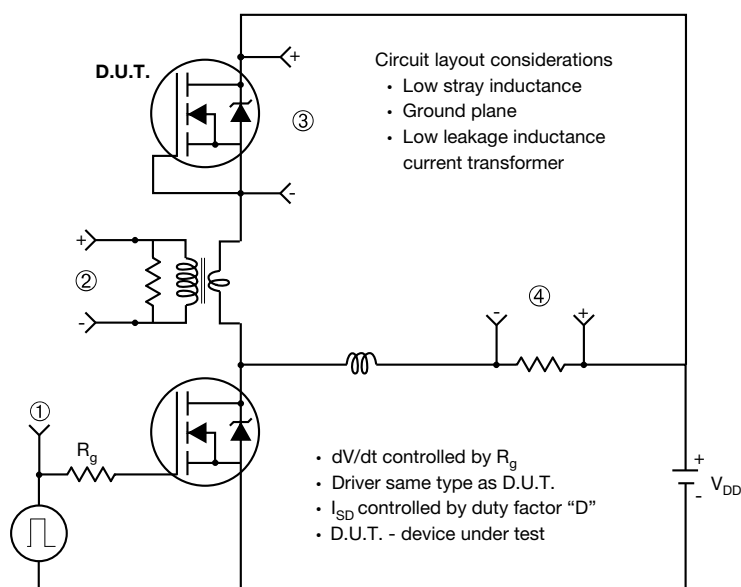
- a. Repetitive rating; pulse width limited by maximum junction temperature.
b. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .
c. $C_{oss(tr)}$ is a fixed capacitance that gives the charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % 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 - Typical Drain-to-Source Voltage vs. Temperature

Fig. 9 - Maximum Safe Operating Area


Fig. 12 - Normalized Thermal Transient 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

Peak Diode Recovery dV/dt Test Circuit



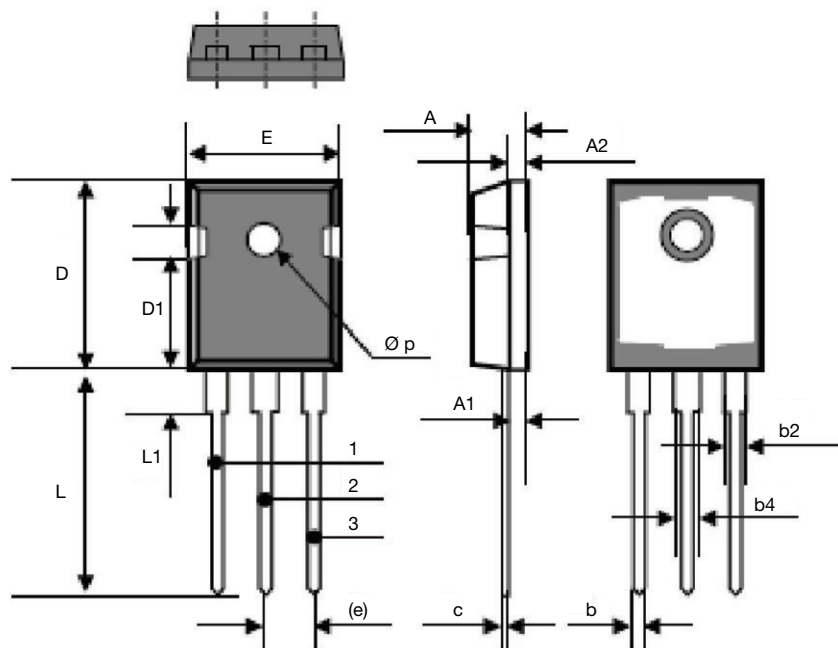
Note

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

Fig. 19 - For N-Channel

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TO-247AD (High Voltage)



| DIM. | MILLIMETERS | | INCHES | |
|----------------------------------------------|-------------|-------|-----------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.70 | 5.31 | 0.185 | 0.209 |
| A1 | 2.21 | 2.59 | 0.087 | 0.102 |
| A2 | 1.50 | 2.49 | 0.059 | 0.098 |
| b | 0.99 | 1.40 | 0.039 | 0.055 |
| b2 | 1.65 | 2.41 | 0.065 | 0.095 |
| b4 | 2.59 | 3.43 | 0.102 | 0.135 |
| c | 0.61 BSC | | 0.024 BSC | |
| D | 20.80 | 21.46 | 0.819 | 0.845 |
| D1 | 3.68 | 5.49 | 0.145 | 0.216 |
| (e) | 5.46 BSC | | 0.215 BSC | |
| E | 15.49 | 16.26 | 0.610 | 0.640 |
| L | 19.81 | 20.32 | 0.780 | 0.800 |
| L1 | 4.06 | 4.50 | 0.160 | 0.177 |
| $\varnothing p$ | 3.51 | 3.66 | 0.138 | 0.144 |
| ECN: S17-0178-Rev. B, 06-Feb-17 DWG: 6010 | | | | |



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