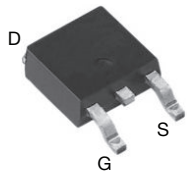
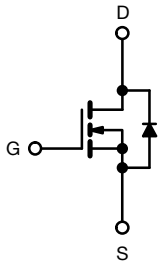
# E Series Power MOSFET

DPAK (TO-252)




N-Channel MOSFET

## FEATURES

- 4th generation E series technology
- Low figure-of-merit (FOM) $R_{on}$ x $Q_g$
- Low effective capacitance ($C_{o(er)}$)
- Reduced switching and conduction losses
- 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
  - Solar (PV inverters)

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) at $T_J$ max. | 650 | |
| $R_{DS(on)}$ typ. (Ω) at 25 °C | $V_{GS}$ = 10 V | 0.170 |
| $Q_g$ max. (nC) | 32 | |
| $Q_{gs}$ (nC) | 7 | |
| $Q_{gd}$ (nC) | 10 | |
| Configuration | Single | |

| ORDERING INFORMATION | |
|---|---|
| Package | DPAK (TO-252) |
| Lead (Pb)-free and halogen-free | SiHD180N60E-GE3 |
| | SiHD180N60ET1-GE3 |
| | SiHD180N60ET4-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 | $I_D$ | 19 | A |
| | | $T_C$ = 100 °C | | 12 | |
| Pulsed drain current [a] | | | $I_{DM}$ | 40 | |
| Linear derating factor | | | | 1.25 | W/°C |
| Single pulse avalanche energy [b] | | | $E_{AS}$ | 88 | mJ |
| Maximum power dissipation | | | $P_D$ | 156 | W |
| Operating junction and storage temperature range | | | $T_J$, $T_{stg}$ | -55 to +150 | °C |
| Drain-source voltage slope | | $T_J$ = 125 °C | dv/dt | 100 | V/ns |
| Reverse diode dv/dt [d] | | | | 22 | |
| Soldering recommendations (peak temperature) [c] | | For 10 s | | 260 | °C |

**Notes**

a. Repetitive rating; pulse width limited by maximum junction temperature
b. $V_{DD}$ = 120 V, starting $T_J$ = 25 °C, L = 28.2 mH, $R_g$ = 25 Ω, $I_{AS}$ = 2.5 A
c. 1.6 mm from case
d. $I_{SD} \leq I_D$, di/dt = 100 A/µs, starting $T_J$ = 25 °C



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| THERMAL RESISTANCE RATINGS | | | | |
|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TYP.** | **MAX.** | **UNIT** |
| Maximum junction-to-ambient | $R_{thJA}$ | - | 62 | °C/W |
| Maximum junction-to-case (drain) | $R_{thJC}$ | - | 0.8 | |

| **SPECIFICATIONS** ($T_J$ = 25 °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 | $\Delta V_{DS}/T_J$ | Reference to 25 °C, $I_D$ = 1 mA | - | 0.66 | - | V/°C |
| Gate-source threshold voltage (N) | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 3.0 | - | 5.0 | 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, $I_D$ = 9.5 A | - | 0.170 | 0.195 | Ω |
| Forward transconductance [a] | $g_{fs}$ | $V_{DS}$ = 20 V, $I_D$ = 9.5 A | - | 6.5 | - | S |
| **Dynamic** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 100 V, f = 1 MHz | - | 1080 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 56 | - | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 5 | - | |
| Effective output capacitance, energy related [a] | $C_{o(er)}$ | $V_{DS}$ = 0 V to 480 V, $V_{GS}$ = 0 V | - | 39 | - | |
| Effective output capacitance, time related [b] | $C_{o(tr)}$ | | - | 244 | - | |
| Total gate charge | $Q_g$ | $V_{GS}$ = 10 V; $I_D$ = 9.5 A, $V_{DS}$ = 480 V | - | 21 | 32 | nC |
| Gate-source charge | $Q_{gs}$ | | - | 7 | - | |
| Gate-drain charge | $Q_{gd}$ | | - | 11 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$ = 480 V, $I_D$ = 9.5 A, $V_{GS}$ = 10 V, $R_g$ = 9.1 Ω | - | 15 | 30 | ns |
| Rise time | $t_r$ | | - | 22 | 44 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 23 | 46 | |
| Fall time | $t_f$ | | - | 9 | 18 | |
| Gate input resistance | $R_g$ | f = 1 MHz, open drain | 0.2 | 0.6 | 1.2 | Ω |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous source-drain diode current | $I_S$ | MOSFET symbol showing the integral reverse p - n junction diode  | - | - | 19 | A |
| Pulsed diode forward current | $I_{SM}$ | | - | - | 40 | |
| Diode forward voltage | $V_{SD}$ | $T_J$ = 25 °C, $I_S$ = 9.5 A, $V_{GS}$ = 0 V | - | - | 1.2 | V |
| Reverse recovery time | $t_{rr}$ | $T_J$ = 25 °C, $I_F$ = $I_S$ = 9.5 A, di/dt = 100 A/µs, $V_R$ = 25 V | - | 275 | 550 | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 3.6 | 7.2 | µC |
| Reverse recovery current | $I_{RRM}$ | | - | 23 | - | 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 % to 80 % $V_{DSS}$

b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 % to 80 % $V_{DSS}$



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

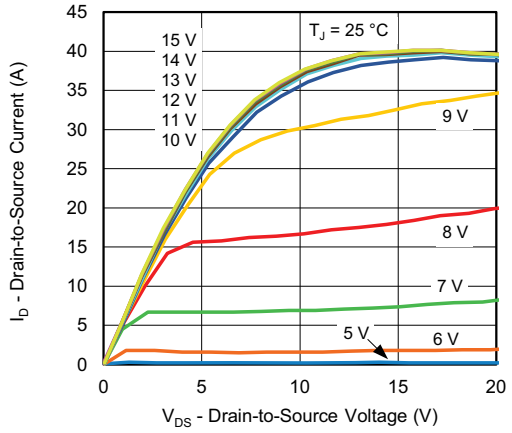



**Fig. 1 - Typical Output Characteristics**

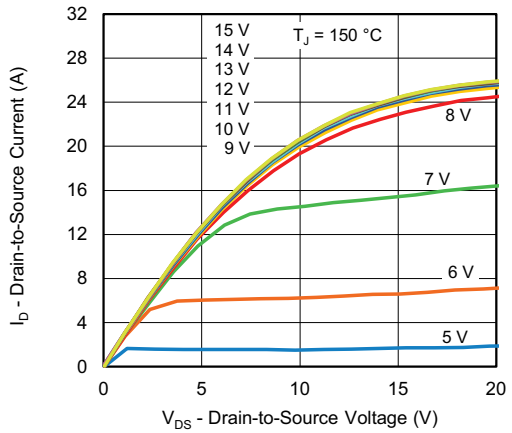



**Fig. 2 - Typical Output Characteristics**

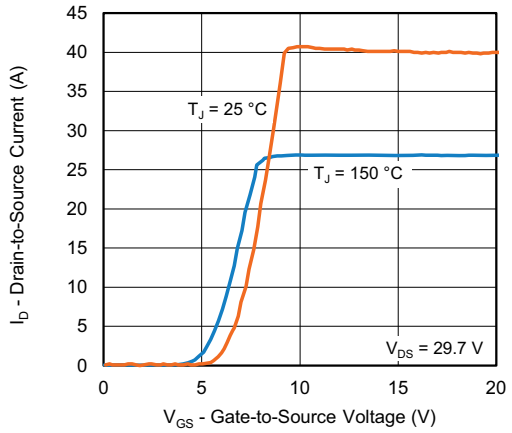



**Fig. 3 - Typical Transfer Characteristics**

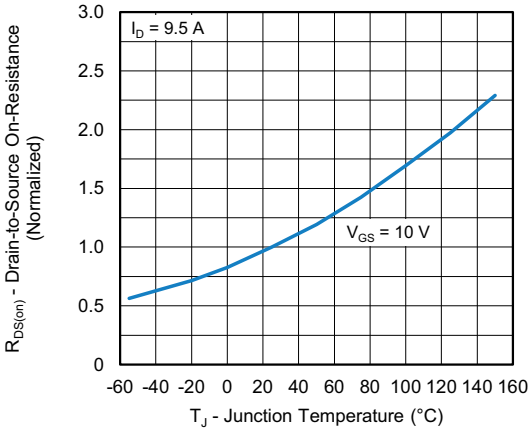



**Fig. 4 - Normalized On-Resistance vs. Temperature**

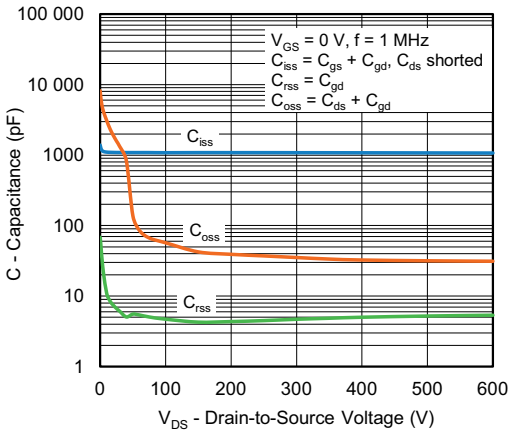



**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**

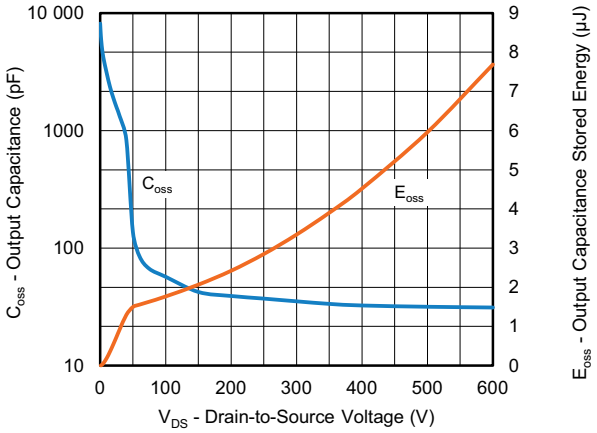



**Fig. 6 - $C_{oss}$ and $E_{oss}$ vs. $V_{DS}$**


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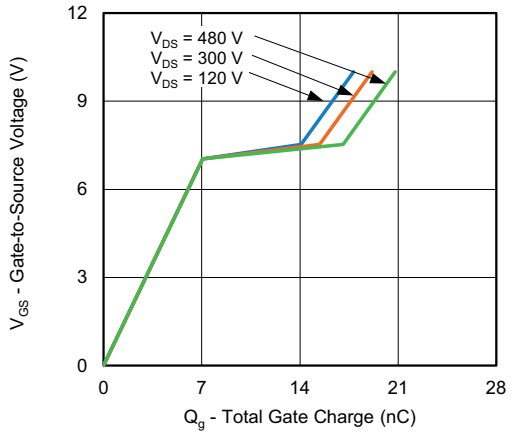



**Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage**

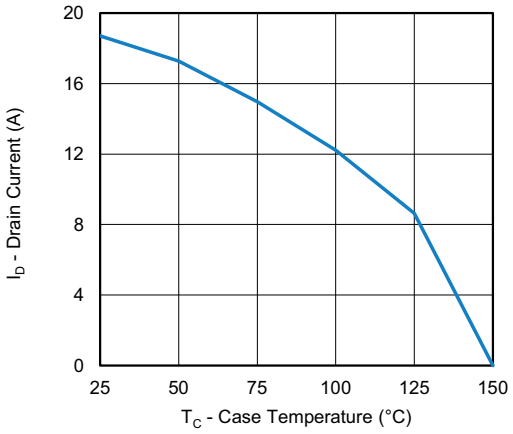



**Fig. 10 - Maximum Drain Current vs. Case Temperature**

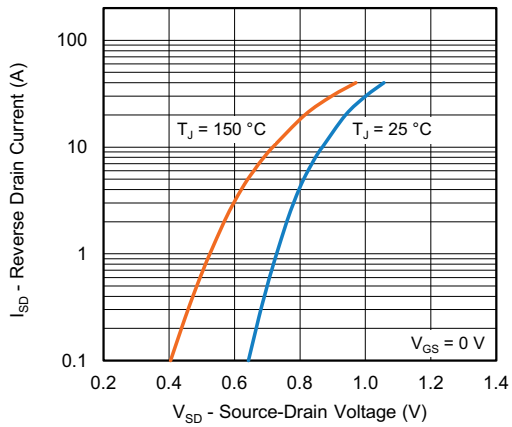



**Fig. 8 - Typical Source-Drain Diode Forward Voltage**

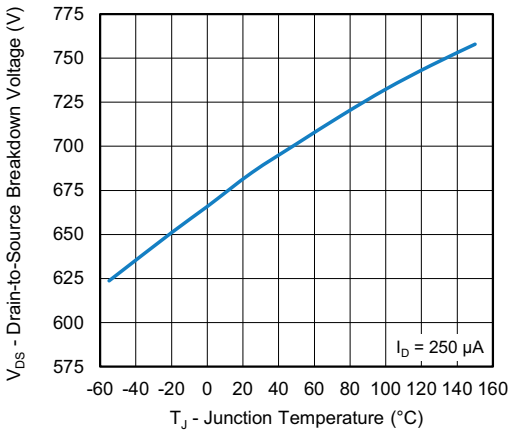



**Fig. 11 - Temperature vs. Drain-to-Source Voltage**

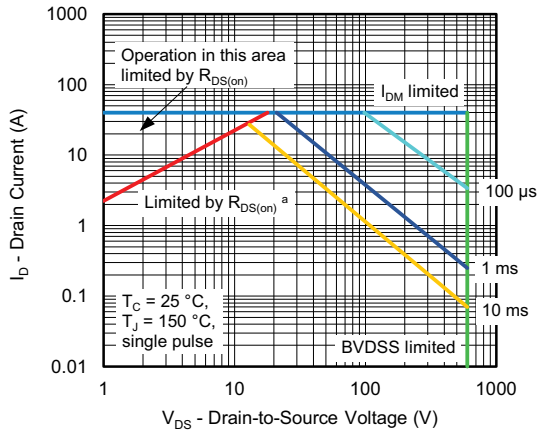



**Fig. 9 - Maximum Safe Operating Area**

**Note**

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


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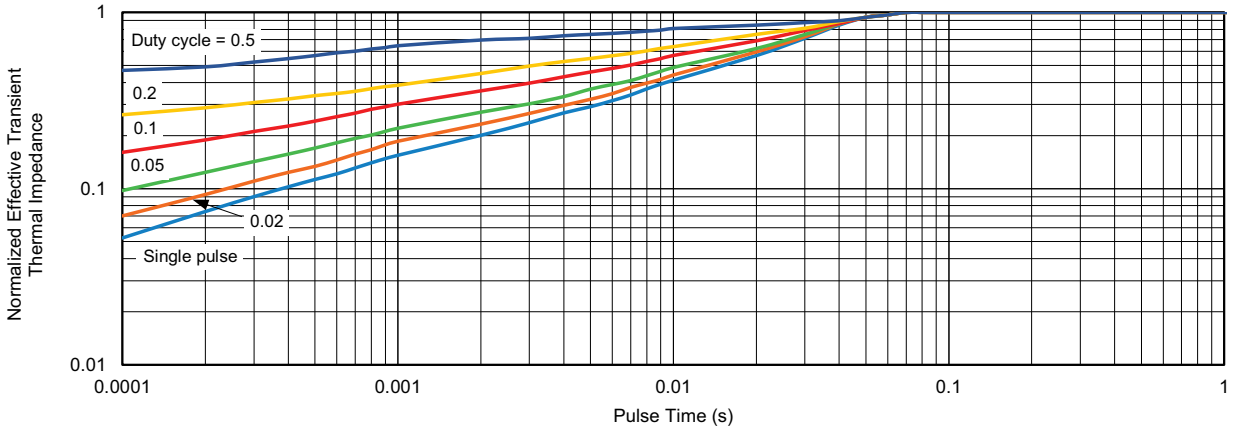



**Fig. 12 - Normalized Transient Thermal Impedance, Junction-to-Case**

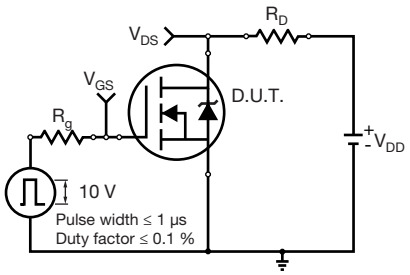



**Fig. 13 - Switching Time Test Circuit**

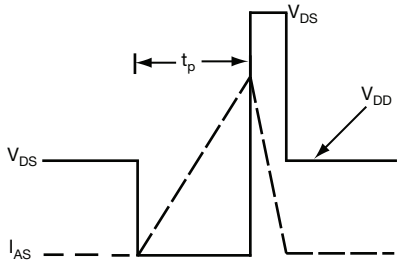



**Fig. 16 - Unclamped Inductive Waveforms**

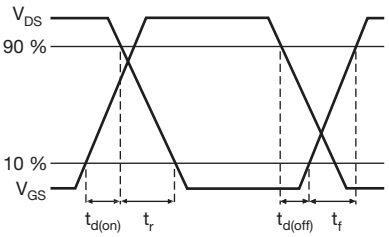



**Fig. 14 - Switching Time Waveforms**

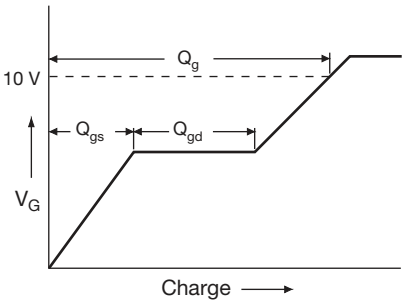



**Fig. 17 - Basic Gate Charge Waveform**

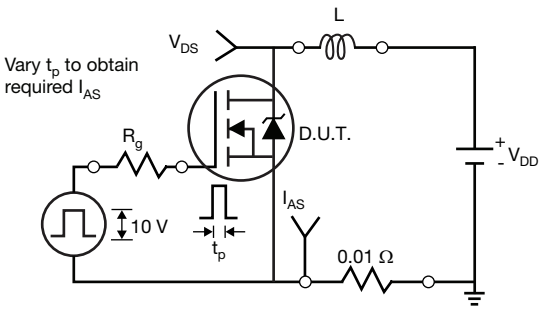



**Fig. 15 - Unclamped Inductive Test Circuit**

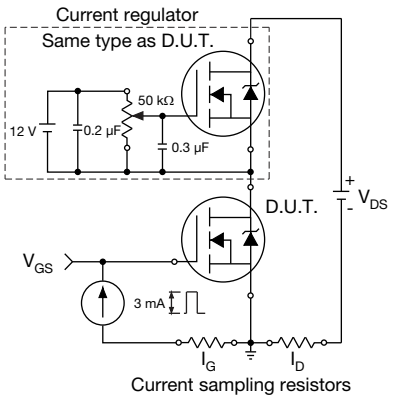
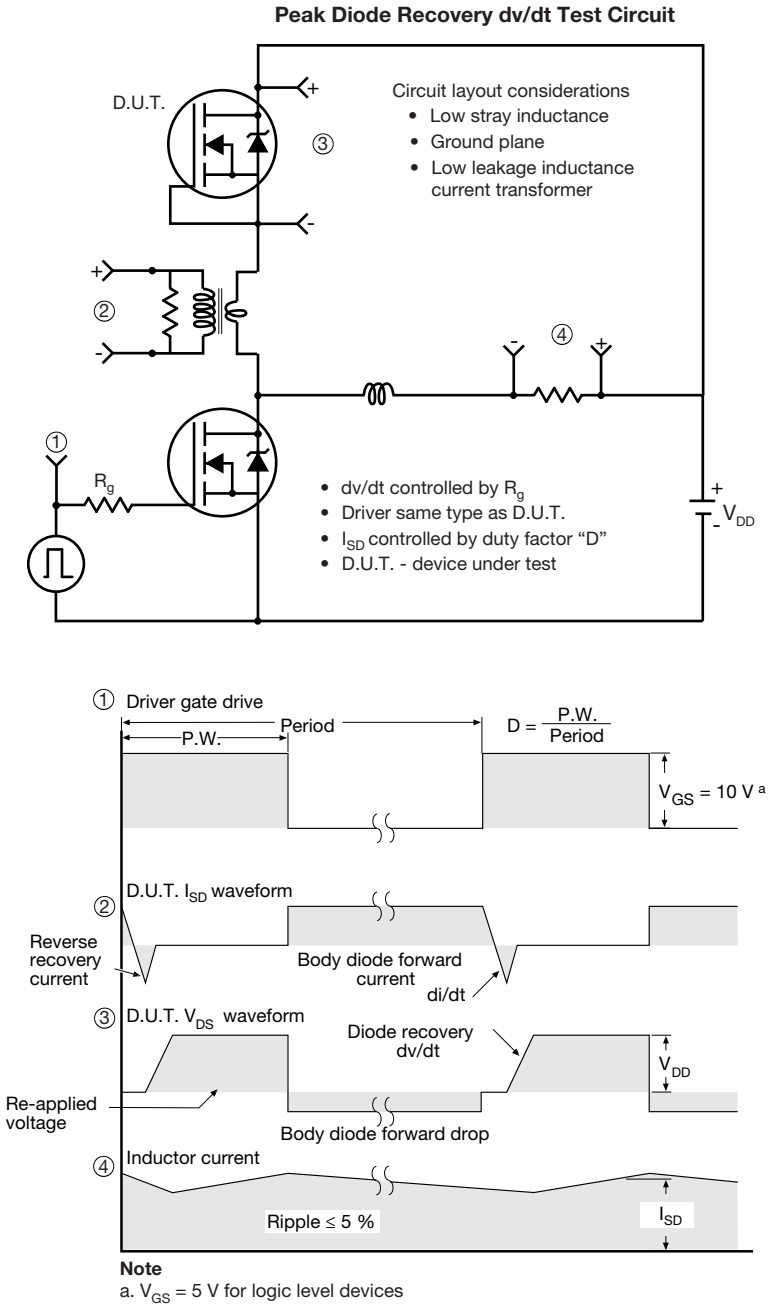



**Fig. 18 - Gate Charge Test Circuit**


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**Note**

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

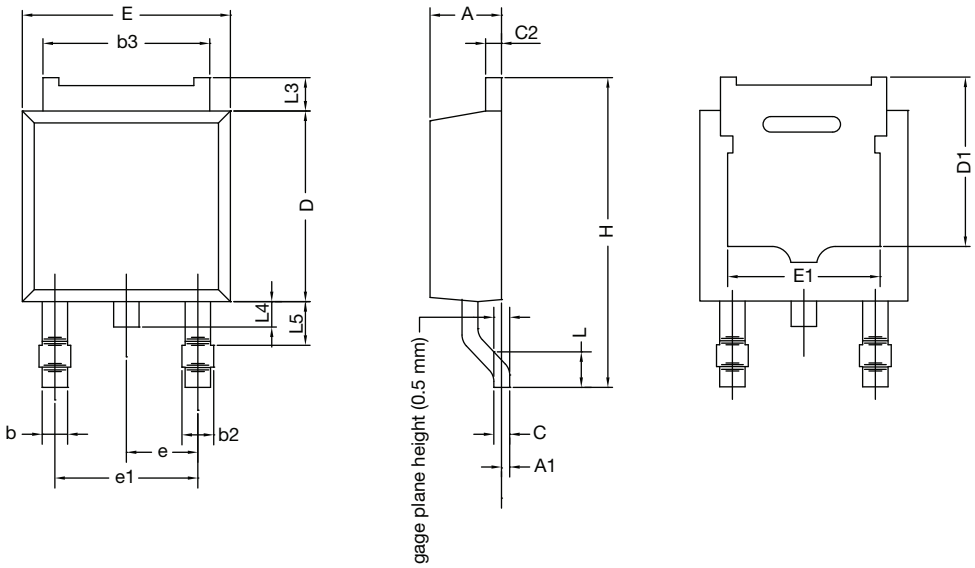
**Fig. 19 - For N-Channel**

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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**

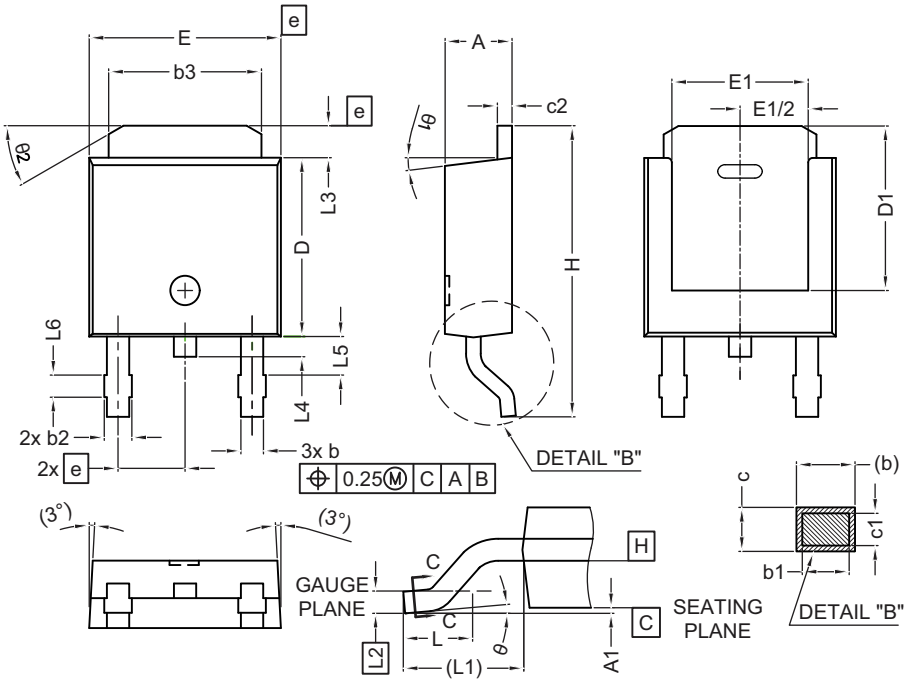
- Dimension L3 is for reference only



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## VERSION 2: FACILITY CODE = N




| | MILLIMETERS | |
|---|---|---|
| DIM. | 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 |

| | MILLIMETERS | |
|---|---|---|
| DIM. | 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 |
| θ | 0° | 10° |
| θ1 | 0° | 15° |
| θ2 | 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

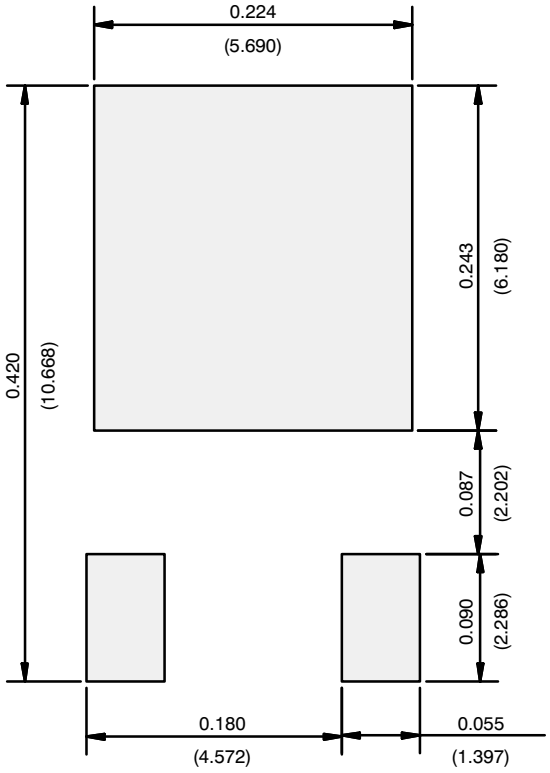
ECN: E22-0399-Rev. R, 03-Oct-2022
DWG: 5347



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




Recommended Minimum Pads
Dimensions in Inches/(mm)

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APPLICATION NOTE

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# Elektronik komponent tedarikinde Entegreci

Entegreci, Eskişehir merkezli, Türkiye geneline satış yapan bir elektronik komponent mağazasıdır. Entegreler (IC), mikrodenetleyiciler, transistörler, diyotlar, pasif elemanlar, konnektörler, modüller ve geliştirme kartları tek adetten seri üretim adetlerine kadar satılır. Ürün sayfalarında güncel stok durumunu, fiyatı ve datasheet bağlantısını bulabilirsiniz.

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