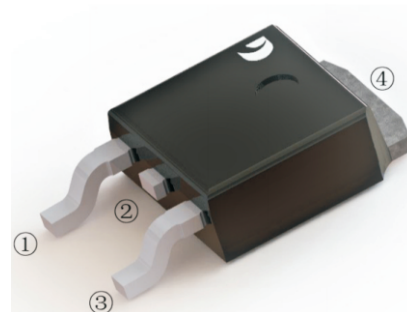


4A, 600V N-CANNEL POWER MOSFET

TO-252W

DESCRIPTION

The D4N60 is a high voltage power MOSFET combines advanced trench MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche characteristics. This power MOSFET is usually used in high speed switching applications of switching power supplies and adaptors.



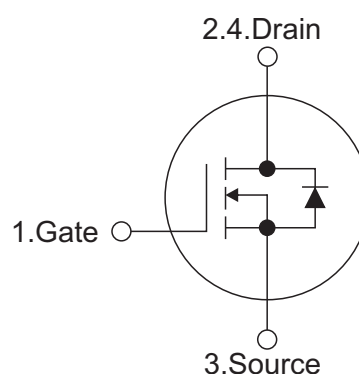
Features

- $R_{DS(ON)} \leq 2.8 \Omega$ @ $V_{GS}=10V, I_D=2.0A$
- Fast switching capability
- Avalanche energy tested
- Improved dv/dt capability, high ruggedness

Mechanical data

- Case: TO-252W
- Approx. Weight: 0.315g (0.011oz)
- Lead free finish, RoHS compliant
- Case Material: "Green" molding compound, UL flammability classification 94V-0, "Halogen-free".

SYMBOL



ABSOLUTE MAXIMUM RATINGS (TA=25°C, unless otherwise specified)

| PARAMETER | Symbols | RATINGS | Units |
|--|----------------|------------|-------|
| Drain-Source Voltage | V_{DSS} | 600 | V |
| Gate-Source Voltage | V_{GSS} | ± 30 | V |
| Continuous Drain Current | I_D | Tc=25°C | 4 |
| | | Tc=100°C | 2.5 |
| Pulsed Drain Current (Note 2) | I_{DM} | 8 | A |
| Avalanche Energy Single Pulsed (Note 3) | E_{AS} | 173 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | dv/dt | 2.1 | V/ns |
| Power Dissipation | P_D | 32 | W |
| Operation Junction Temperature and Storage Temperature | T_j, T_{stg} | -55 ~ +150 | °C |

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating: Pulse width limited by maximum junction temperature.

3. L = 30mH, IAS = 3.4A, VDD = 50V, RG = 25 Ω , Starting TJ = 25°C

4. ISD \leq 4A, di/dt \leq 200A/ μ s, VDD \leq BVDSS, Starting TJ = 25°C

THERMAL DATA

| PARAMETER | Symbols | RATINGS | Units |
|---------------------|------------|---------|-------|
| Junction to Ambient | R_{thJA} | 63 | °C/W |
| Junction to Case | R_{thJC} | 2.31 | °C/W |



ELECTRICAL CHARACTERISTICS (TA=25°C, unless otherwise specified)

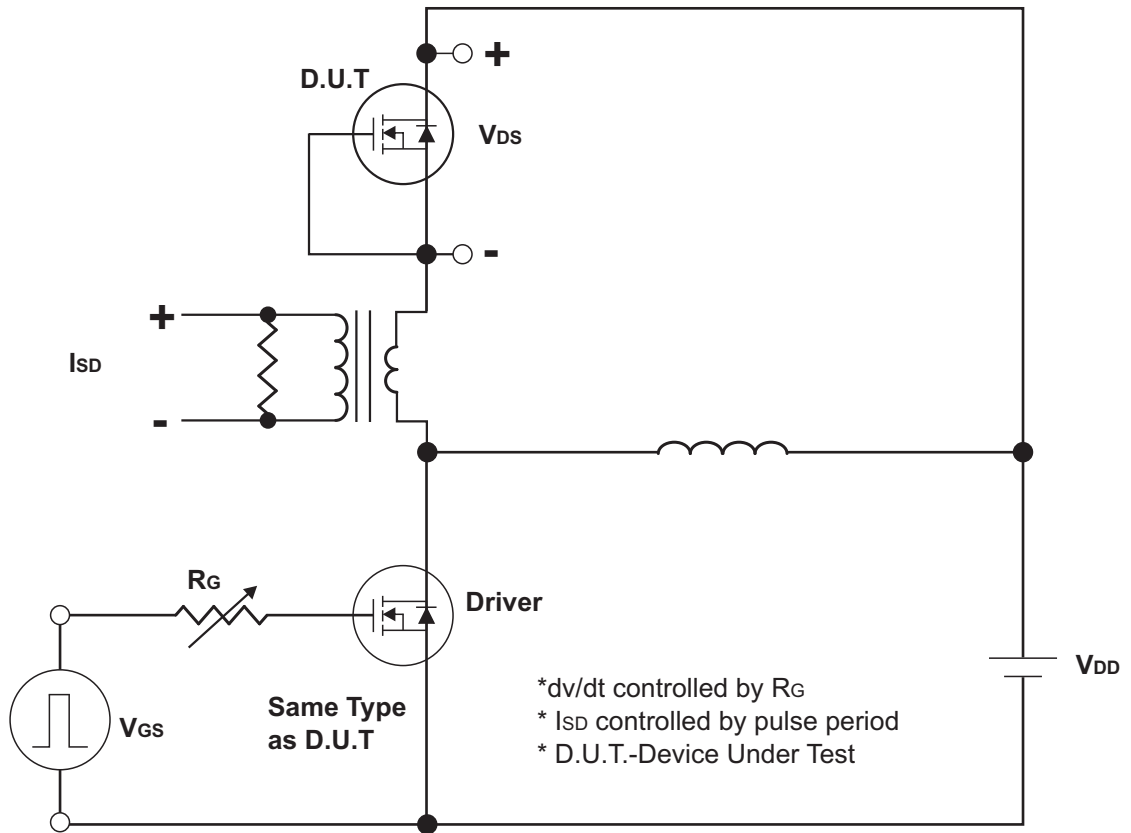
| PARAMETER | | Symbols | TEST CONDITIONS | Min | Typ | Max | Units | |
|---|---------|--------------|--|-----|-----|------|----------|----|
| OFF CHARACTERISTICS | | | | | | | | |
| Drain-Source Breakdown Voltage | | BV_{DSS} | $V_{DS}=0V, I_D=250\mu A$ | 600 | | | V | |
| Drain-Source Leakage Current | | I_{DSS} | $V_{DS}=600V, V_{GS}=0V$ | | | 10 | μA | |
| Gate- Source Leakage Current | Forward | I_{GSS} | $V_{GS}=30V, V_{DS}=0V$ | | | 100 | nA | |
| | Reverse | | $V_{GS}=-30V, V_{DS}=0V$ | | | -100 | | |
| ON CHARACTERISTICS | | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 2.0 | | 4.0 | V | |
| Static Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=2.0A$ | | | 2.5 | Ω | |
| DYNAMIC CHARACTERISTICS | | | | | | | | |
| Input Capacitance | | C_{ISS} | $V_{DS}=25V,$ $V_{GS}=0V,$ $f=1.0MHz$ | | 564 | | pF | |
| Output Capacitance | | C_{OSS} | | | | 66 | | pF |
| Reverse Transfer Capacitance | | C_{RSS} | | | | 12 | | pF |
| SWITCHING CHARACTERISTICS | | | | | | | | |
| Total Gate Charge (Note 1) | | Q_G | $V_{DS}=480V, V_{GS}=10V,$ $I_D=4A, I_G=1mA$ (NOTE1,2) | | 13 | | nC | |
| Gate-Source Charge | | Q_{GS} | | | | 4 | | nC |
| Gate-Drain Charge | | Q_{GD} | | | | 2.2 | | nC |
| Turn-On Delay Time (Note 1) | | $t_{D(ON)}$ | $V_{DS}=100V, V_{GS}=10V,$ $I_D=4A, R_G=2.8\Omega$ (NOTE1,2) | | 7 | | ns | |
| Turn-On Rise Time | | t_R | | | | 16 | | ns |
| Turn-Off Delay Time | | $t_{D(OFF)}$ | | | | 36 | | ns |
| Turn-Off Fall Time | | t_F | | | | 22 | | ns |
| DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS | | | | | | | | |
| Maximum Body-Diode Continuous Current | | I_S | | | | 4 | A | |
| Maximum Body-Diode Pulsed Current | | I_{SM} | | | | 8 | A | |
| Drain-Source Diode Forward Voltage (Note 1) | | V_{SD} | $I_S=4A, V_{GS}=0V$ | | | 1.4 | V | |
| Reverse Recovery Time (Note 1) | | t_{rr} | $I_S=4A, V_{GS}=0V,$ | | 250 | | ns | |
| Reverse Recovery Charge | | Q_{rr} | $di/dt=100A/\mu s$ | | 4.5 | | μC | |

Notes:

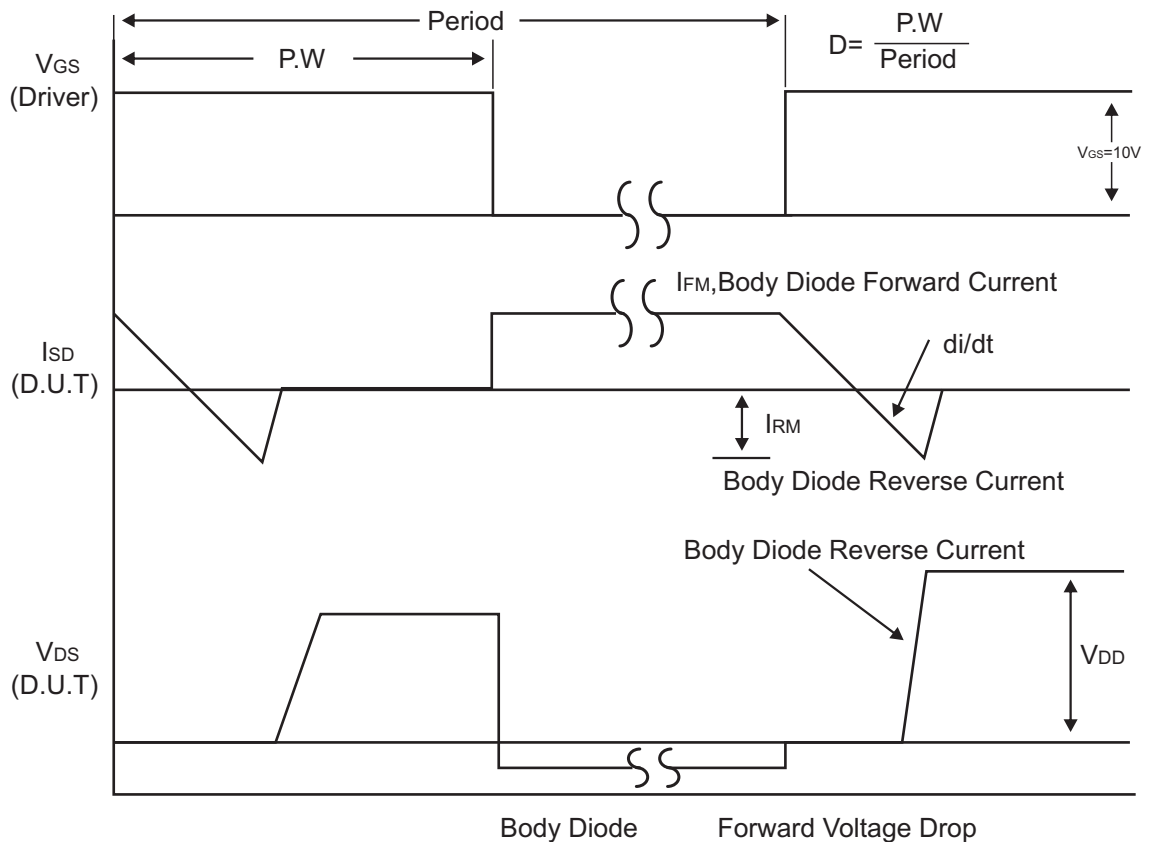
1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.
2. Essentially independent of operating temperature.



Test Circuits and waveforms



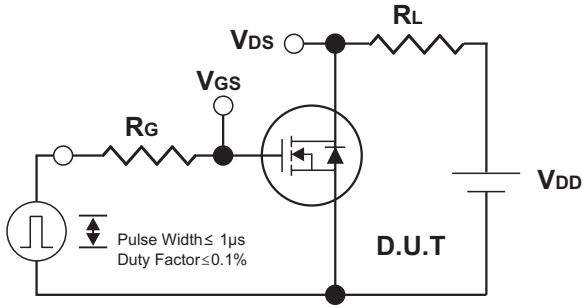
Peak Diode Recovery dv/dt Test Circuit



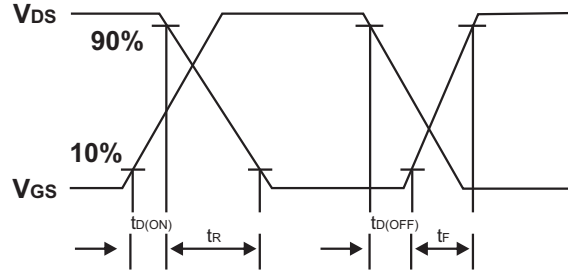
Peak Diode Recovery dv/dt Waveforms



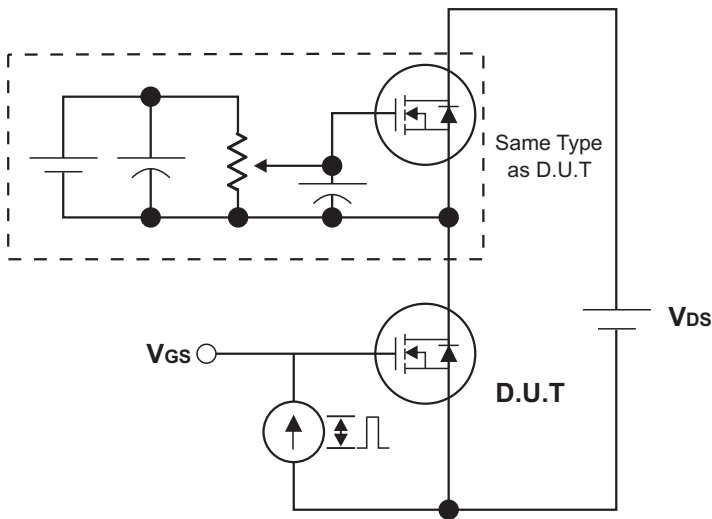
Test Circuits and waveforms



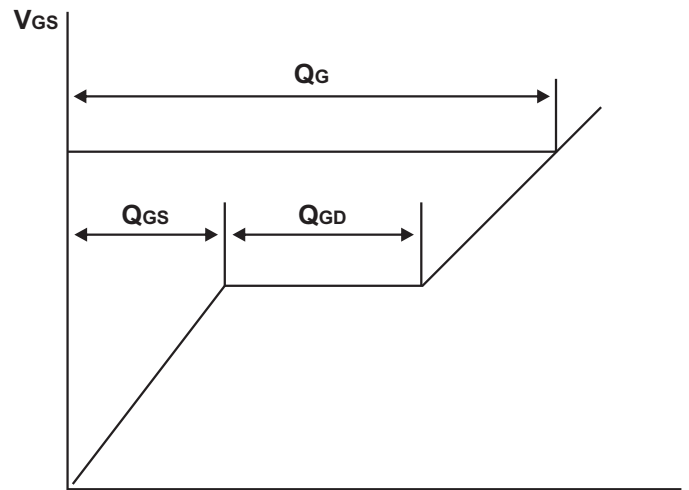
Switching Test Circuit



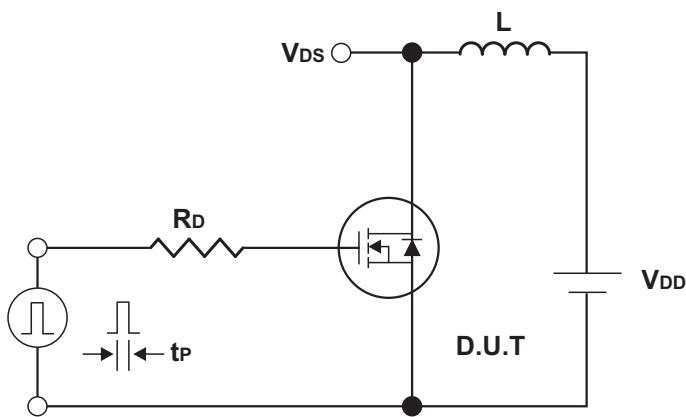
Switching Waveforms



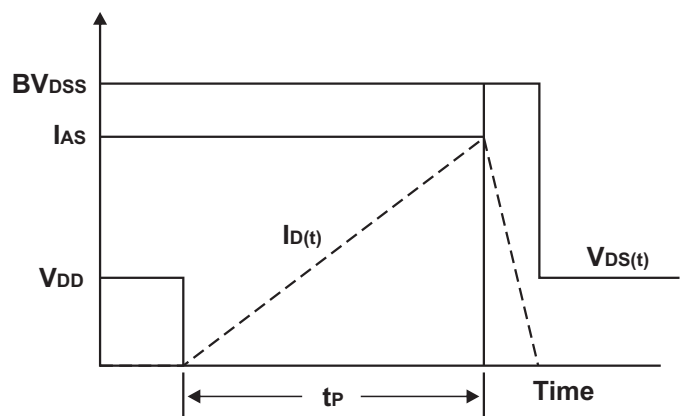
Gate Charge Test Circuit



Charge
Gate Charge Waveform



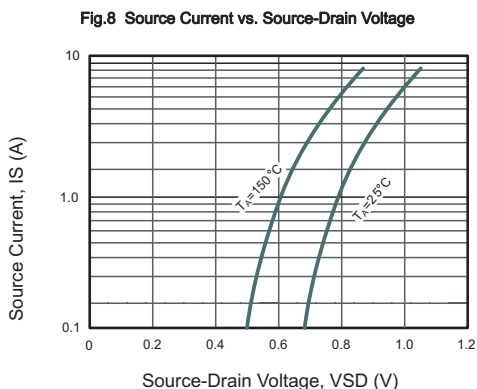
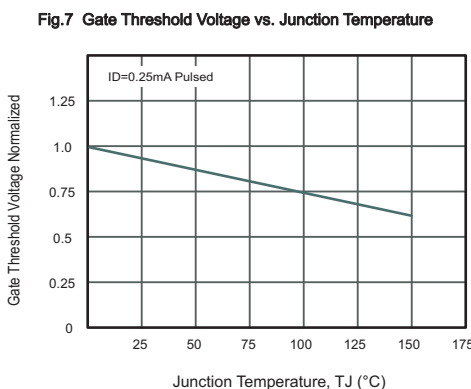
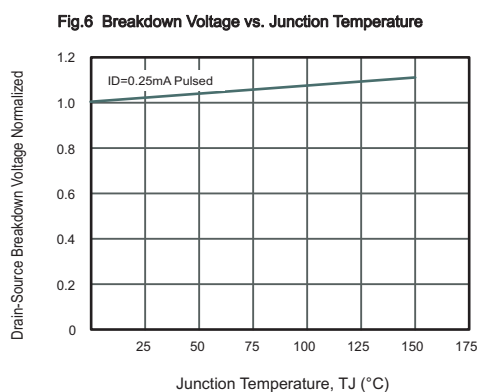
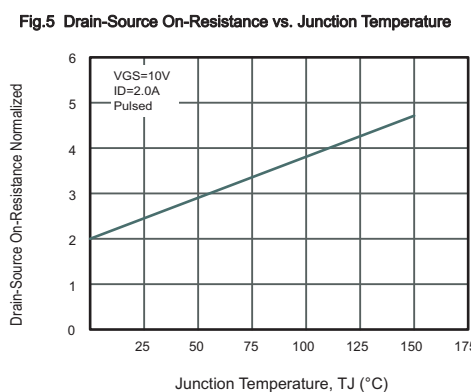
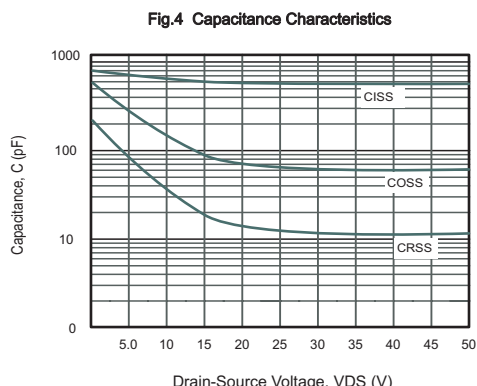
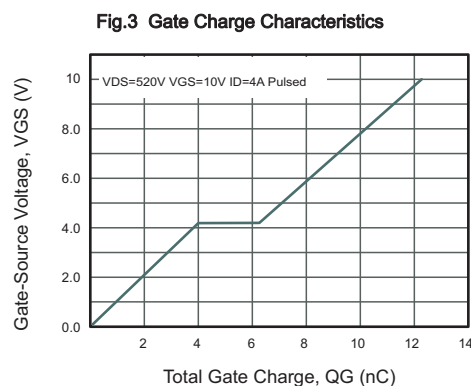
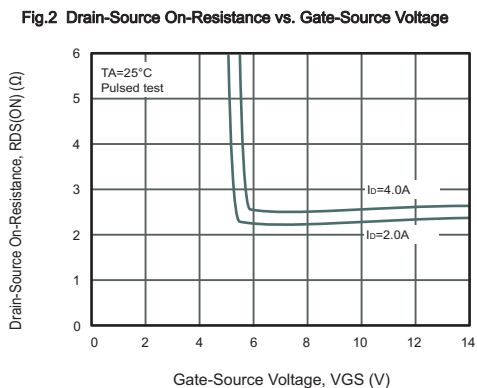
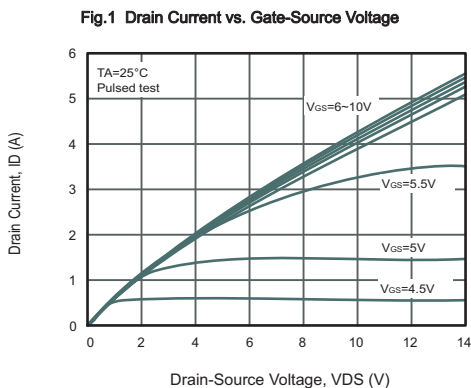
Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms



Typical Characteristics





Typical Characteristics

Fig.9 Drain Current vs. Gate-Source Voltage

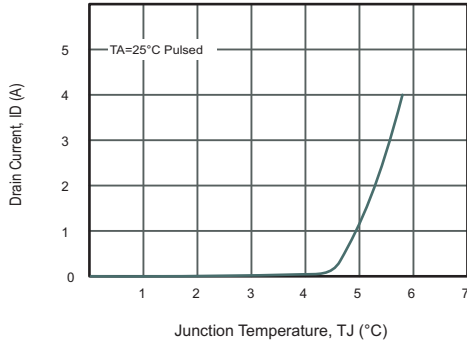


Fig.10 Drain-Source On-Resistance vs. Drain Current

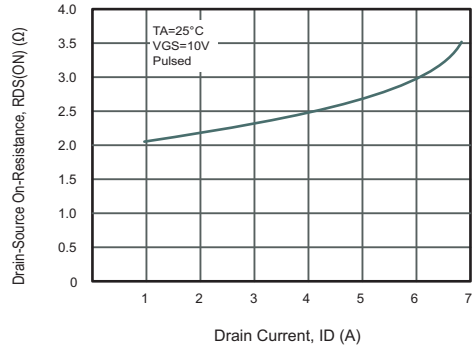


Fig.11 Drain Current vs. Junction Temperature

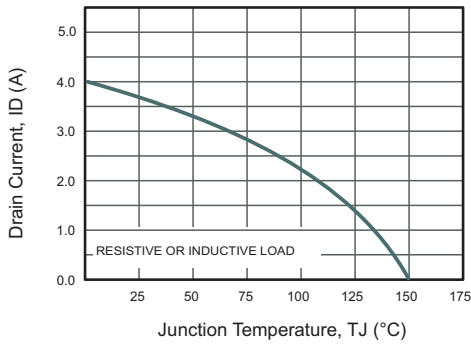


Fig.12 Power Dissipation vs. Junction Temperature

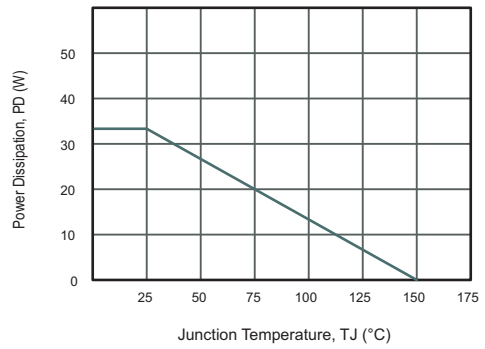
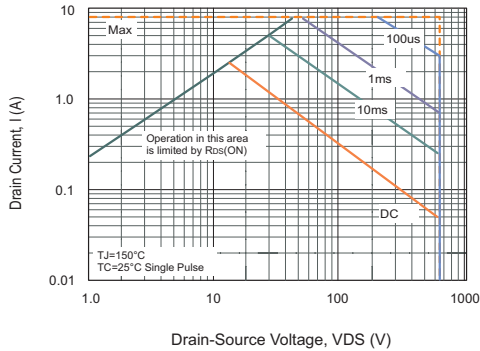
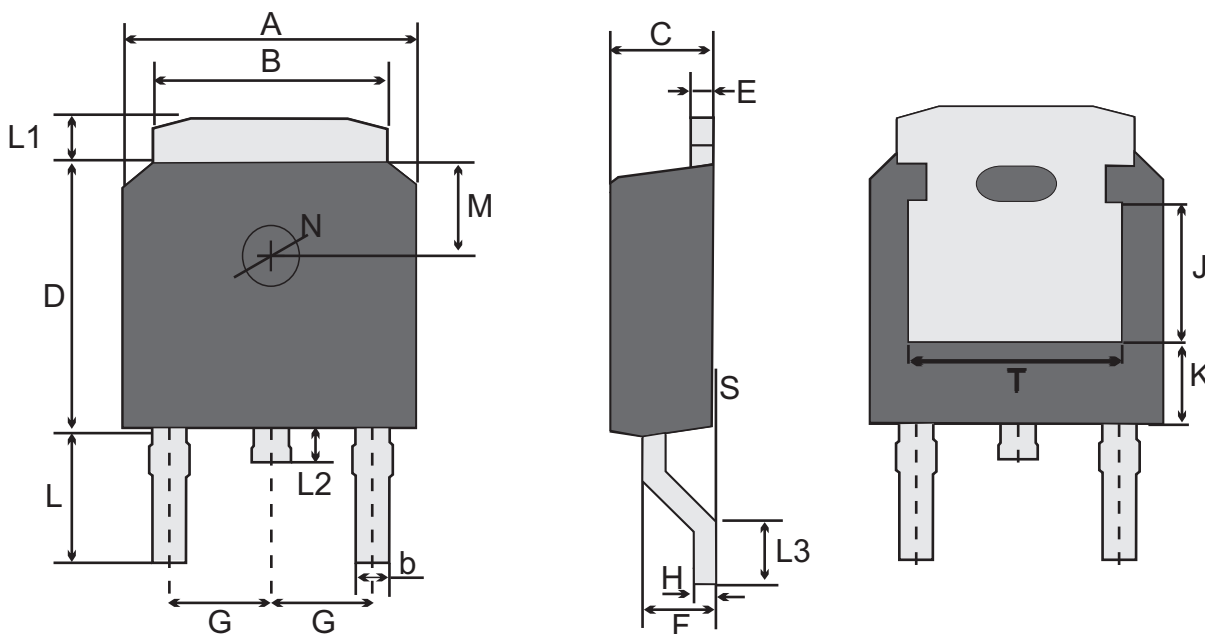


Fig.13 Safe Operating Area





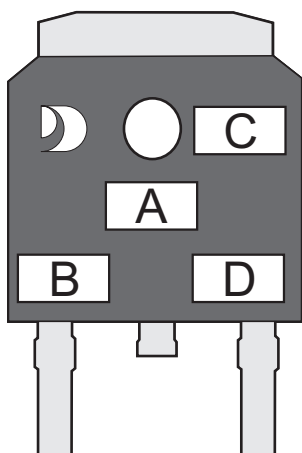
TO-252W(D-PAK) Package Outline Dimensions



TO-252W(D-PAK) mechanical data

| UNIT | A | B | b | C | D | E | F | G | H | L | L1 | L2 | L3 | S | M | N | J | K | T | |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----------------|------|-----|-----|-----|------|------|----------------|----------------|--------------|--------------|--------------|
| mm | max | 6.7 | 5.5 | 0.8 | 2.5 | 6.3 | 0.6 | 1.8 | 2.29 TYPICAL | 0.55 | 3.1 | 1.2 | 1.0 | 1.75 | 0.1 | 1.8 TYPICAL | 1.3 TYPICAL | 3.16 ref. | 1.80 ref. | 4.83 ref. |
| | typ | 6.6 | 5.3 | 0.7 | 2.3 | 6.1 | 0.5 | 1.5 | | 0.50 | 2.5 | 1.0 | 0.6 | 1.30 | 0.08 | | | | | |
| | min | 6.3 | 5.1 | 0.3 | 2.1 | 5.9 | 0.4 | 1.3 | | 0.45 | 2.7 | 0.8 | 0.6 | 1.00 | 0.0 | | | | | |
| mil | max | 264 | 217 | 31 | 98 | 248 | 24 | 71 | 90 TYPICAL | 22 | 122 | 47 | 39 | 69 | 4 | 71 TYPICAL | 51 TYPICAL | 124 ref. | 71 ref. | 190 ref. |
| | typ | 260 | 209 | 28 | 90 | 240 | 20 | 59 | | 20 | 98 | 39 | 24 | 51 | 3 | | | | | |
| | min | 248 | 201 | 12 | 83 | 232 | 16 | 51 | | 18 | 106 | 31 | 24 | 55 | 0 | | | | | |

MARKING DIAGRAM



- Unmarkable Surfacea
- Marking Composition Field
- A: Marking Area
- B: Lot Code
- C: Additional Information
- D: Date Code (YWW)
- Y: Years(0~9)
- WW: Week



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[DMN1017UCP3-7](#) [EFC2J004NUZTDG](#) [P85W28HP2F-7071](#) [DMN1053UCP4-7](#) [NTE2384](#) [DMC2700UDMQ-7](#) [DMN2080UCB4-7](#)
[DMN61D9UWQ-13](#) [US6M2GTR](#) [DMN31D5UDJ-7](#) [DMP22D4UFO-7B](#) [IPS60R3K4CEAKMA1](#) [DMN1006UCA6-7](#) [DMN16M9UCA6-7](#)
[STF5N65M6](#) [IRF40H233XTMA1](#) [STU5N65M6](#) [DMN6022SSD-13](#) [DMN13M9UCA6-7](#) [DMTH10H4M6SPS-13](#) [IPS60R360PFD7SAKMA1](#)
[DMN2990UFB-7B](#) [SSM3K35CT,L3F](#) [IPLK60R1K0PFD7ATMA1](#) [2N7002W-G](#) [MCAC30N06Y-TP](#) [IPWS65R035CFD7AXKSA1](#)
[MCQ7328-TP](#) [SSM3J143TU,LXHF](#) [DMN12M3UCA6-7](#) [PJMF280N65E1_T0_00201](#) [PJMF380N65E1_T0_00201](#)
[PJMF280N60E1_T0_00201](#) [PJMF600N65E1_T0_00201](#) [PJMF900N65E1_T0_00201](#)