SEMICONDUCTOR

# D40N16M

## 40A 160V N-Channel Enhancement Mode Power MOSFET

## Features

- Fast switching
- Low reverse transfer capacitances
- Low gate charge and Low on-resistance
- 100% avalanche tested

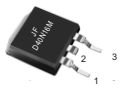
| Product Summary | | | |
|---|---|---|---|
| $V_{DS}$ | $R_{DS(on)}$ (mΩ) Typ | $I_D$ (A) | Qg (Typ) |
| 160V | 26 @ 10V 20A | 40 | 15nc |

## Mechanical Data

- Case:TO-252 Package

TO-252

D40N16M



## Application

- Motor Control and Drive
- Charge/Discharge for Battery Management System
- Synchronous Rectifier for SMPS

## Ordering Information

| Part No. | Package Type | Package | Quality(box) |
|---|---|---|---|
| D40N16M | TO-252 | Tape & Reel | 2500 |

## Block Diagram

Pin Definition:

1. Gate
2. Drain
3. Source

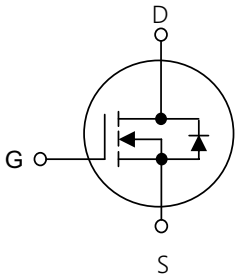



Table1 Absolute Maximum Ratings ($T_C$=25°C, unless otherwise specified)

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 160 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current (Note 5) | $T_C$=25°C | $I_D$ | 40 | A |
| | $T_C$=100°C | | 26 | |
| Pulsed Drain Current (Note 1) | | $I_{DM}$ | 168 | A |
| Single Pulse Avalanche Energy(Note 2) | | $E_{AS}$ | 90 | mJ |
| Power Dissipation | Ta=25°C | $P_D$ | 1.8 | W |
| | $T_C$=25°C | | 96 | |
| Operating Junction and Storage Temperature | | $T_J/T_{STG}$ | -55~+150 | °C |

Table 2.Thermal Characteristics

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Thermal resistance Junction to Ambient,Max | $R_{\theta JA}$ | 85 | °C/W |
| Thermal resistance Junction to Case,Max | $R_{\theta JC}$ | 1.3 | °C/W |

Table 3. Electrical Characteristics ($T_C$=25°C, unless otherwise specified)

| Parameter | | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Off Characteristics | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $V_{GS}$=0V,$I_D$=250μA | 160 | - | - | V |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$=160V,$V_{GS}$=0V | - | - | 1 | μA |
| Gate- Source Leakage Current | Forward | $I_{GSS}$ | $V_{GS}$=20V,$V_{DS}$=0V | - | - | 100 | nA |
| | Reverse | | $V_{GS}$=-20V,$V_{DS}$=0V | - | - | -100 | nA |
| On Characteristics(Note 3) | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 2.5 | - | 4.5 | V |
| Static Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}$=10V,$I_D$=10A | - | 26 | 31 | mΩ |
| Dynamic Characteristics(Note 4) | | | | | | | |
| Input Capacitance | | $C_{ISS}$ | $V_{DS}$=75V,$V_{GS}$=0V,f=1MHz | - | 820 | - | pF |
| Output Capacitance | | $C_{OSS}$ | | - | 129 | - | pF |
| Reverse Transfer Capacitance | | $C_{RSS}$ | | - | 7 | - | pF |
| Transconductance | | $g_{fs}$ | $V_{DS}$=5V,$I_D$=10A | - | 20 | - | S |
| Switching Characteristics (Note 4) | | | | | | | |
| Turn-On Delay Time | | td(on) | $V_{DD}$=75V,$I_D$=20A<br>$V_{GS}$=10V,$R_{GEN}$=3Ω, | - | 7.5 | - | ns |
| Turn-On Rise Time | | $t_R$ | | - | 20 | - | ns |
| Turn-Off Delay Time | | td(off) | | - | 12 | - | ns |
| Turn-Off Fall Time | | tf | | - | 5 | - | ns |
| Total Gate Charge | | $Q_G$ | $V_{DS}$=30V,$I_D$=5A,<br>$V_{GS}$=10V | - | 15 | - | nC |
| Gate-Source Charge | | $Q_{GS}$ | | - | 5.8 | - | nC |
| Gate-Drain Charge | | $Q_{GD}$ | | - | 3.8 | - | nC |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | | |
| Drain-Source Diode Forward Voltage | | $V_{SD}$ | $V_{GS}$=0V,$I_S$=20A | - | - | 1.2 | V |
| Maximum Continuous Drain-Source Diode Forward Current | | $I_S$ | | - | - | 40 | A |
| Reverse Recovery Time | | trr | $V_{GS}$=0V,$I_F$=20A<br>$dI_F/dt$=100A/μs(Note 1) | - | 64 | - | ns |
| Reverse Recovery Charge | | $Q_{RR}$ | | - | 94 | - | nC |

Notes: 1 Repetitive Rating:Pulse width limited by maximum junction temperature
2 L=0.5mH, $R_G$=25Ω,$I_D$=14A,Starting $T_J$=25°C
3 Pulse Test: Pulse width ≤300μS,Duty cycle≤2%
4 Guaranteed by design,not subject to production
5 The maximum current is limited by the package.

## Typical Characteristics Diagrams

Figure 1.Output Characteristics

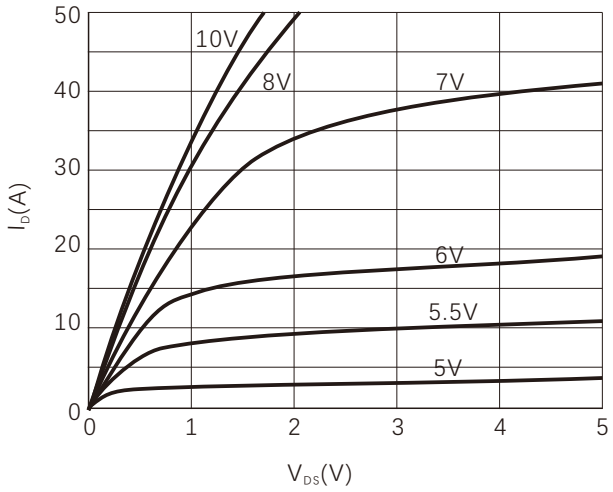



Figure2.Normalized $R_{DS(ON)}$ vs Temperature

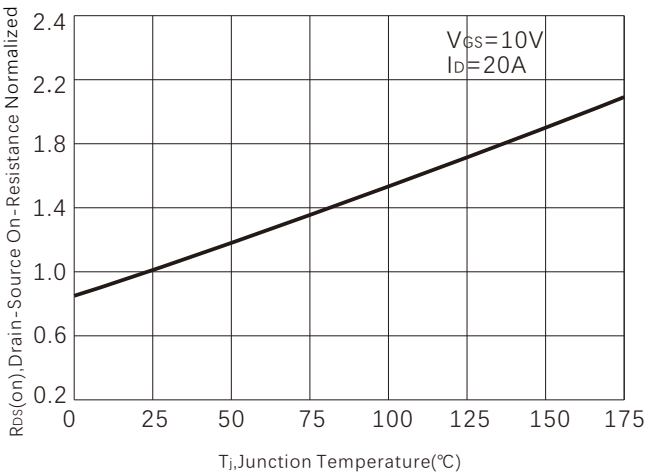



Figure 3.On-Resistance vs.Drain Current

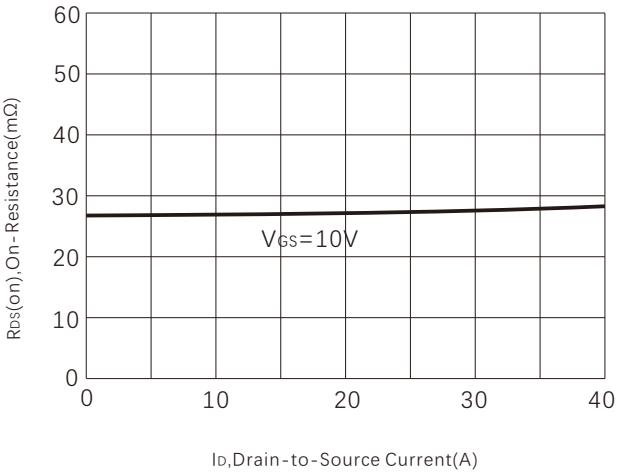



Figure 4. Capacitance

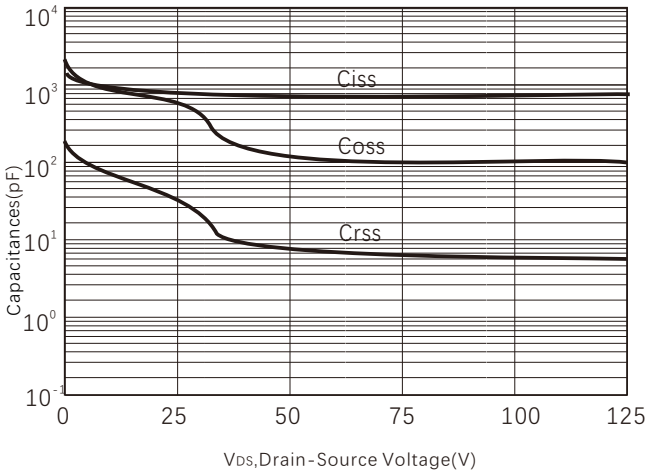



Figure 5.Gate charge

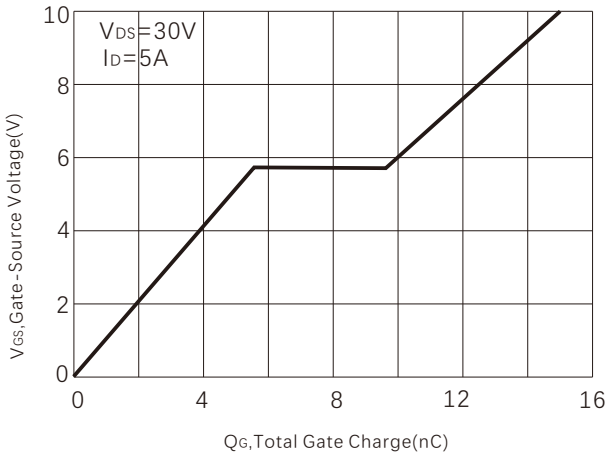



Figure 6. Transfer Characteristics

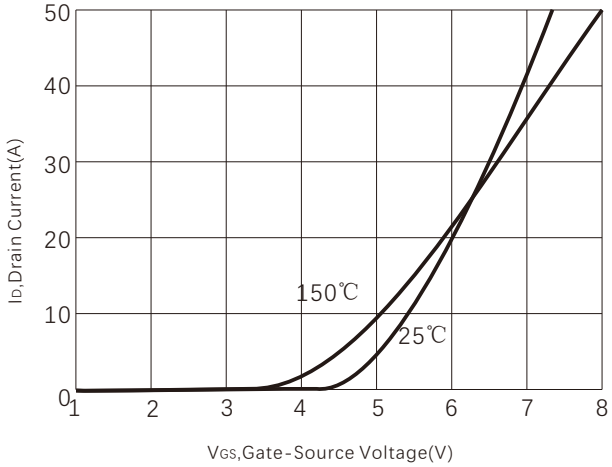


Figure7.Maximum Drain Current vs Temperature

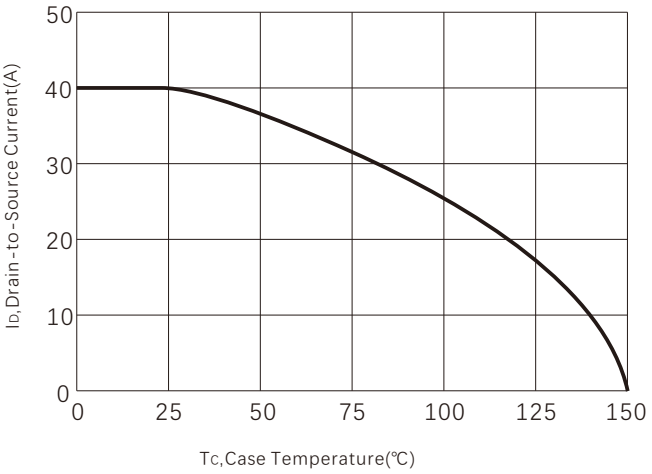



Figure 8. Power dissipation

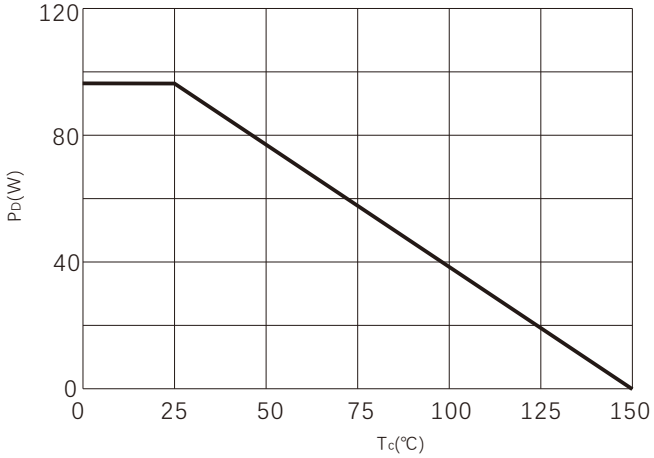



Figure 9. Safe operating area

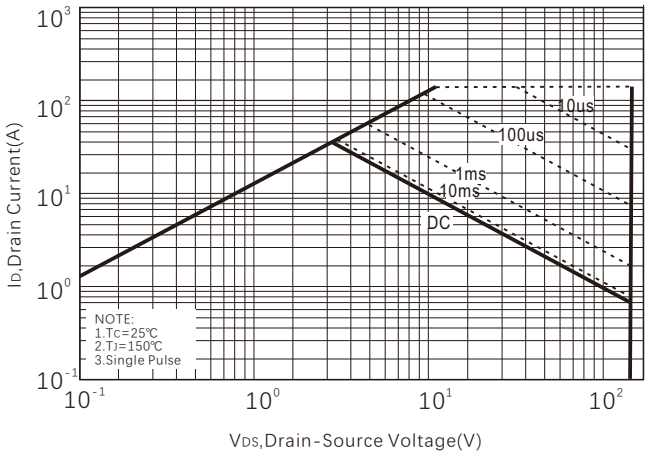
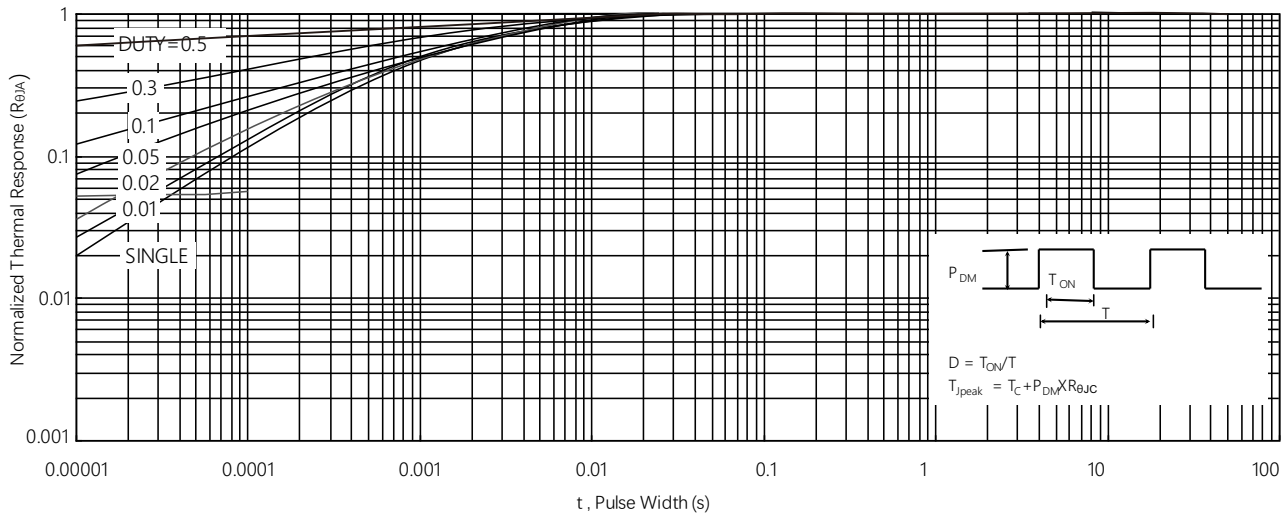
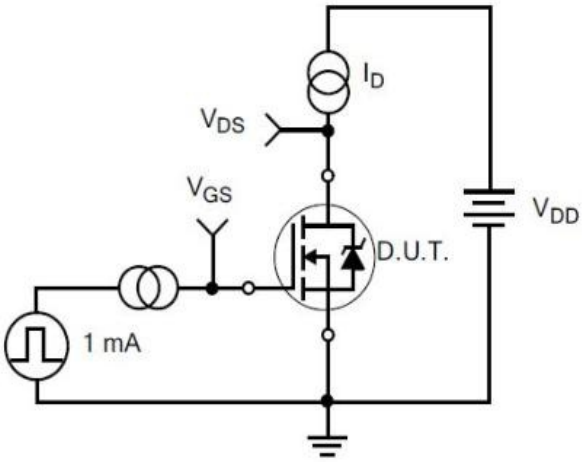


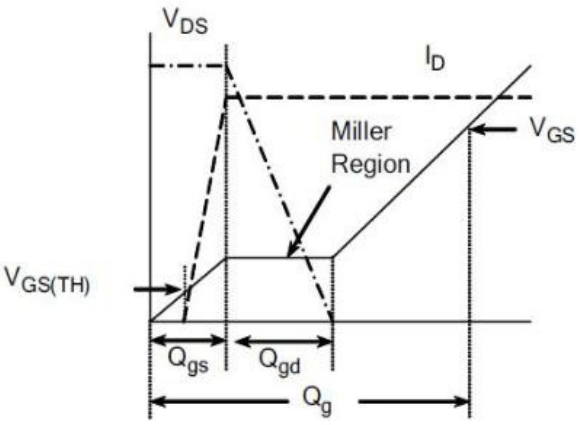

Figure 10.Normalized Maximum Transient Thermal Impedance



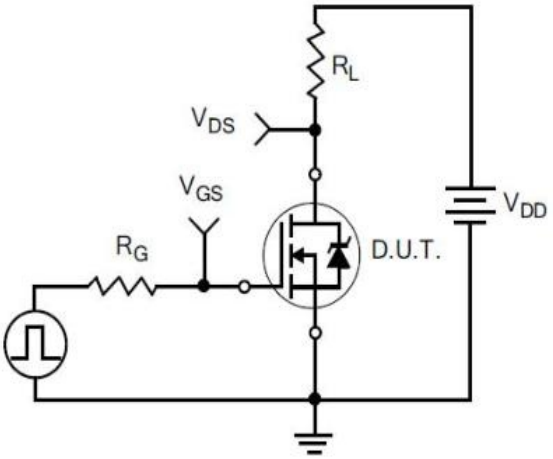
Typical Test Circuit



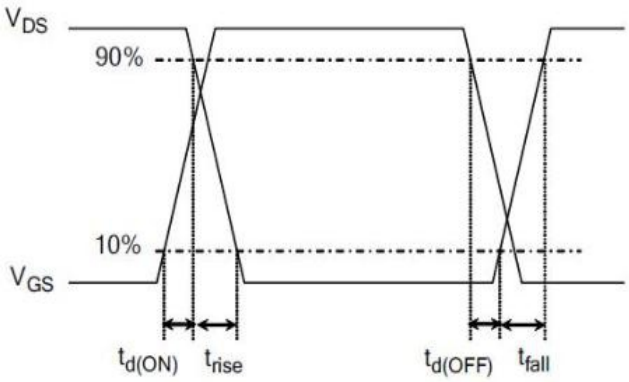

1) Gate Charge Test Circuit



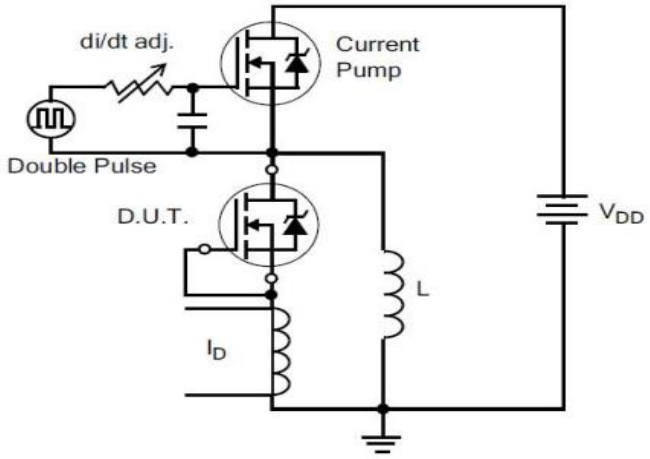

2) . Gate Charge Waveform



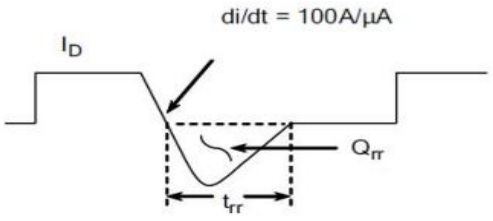

3) Resistive Switching Test Circuit



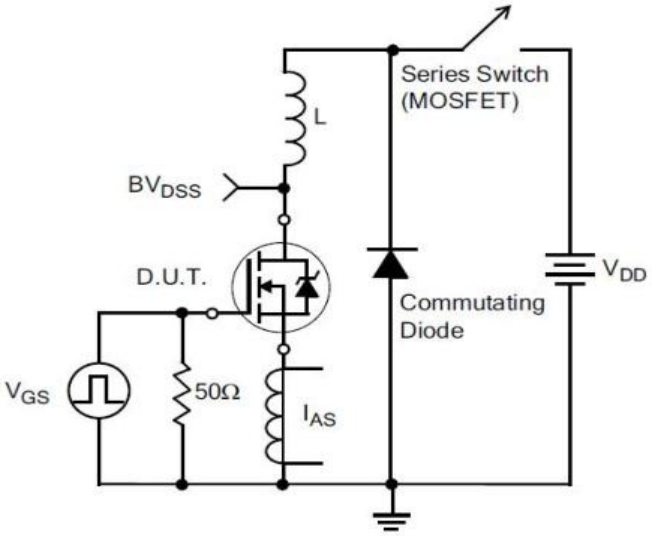

4) Resistive Switching Waveforms



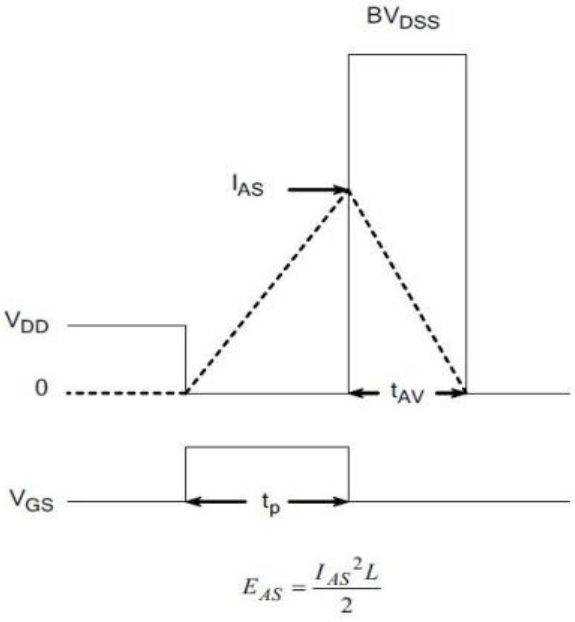

5) Diode Reverse Recovery Test Circuit




6) Diode Reverse Recovery Waveform



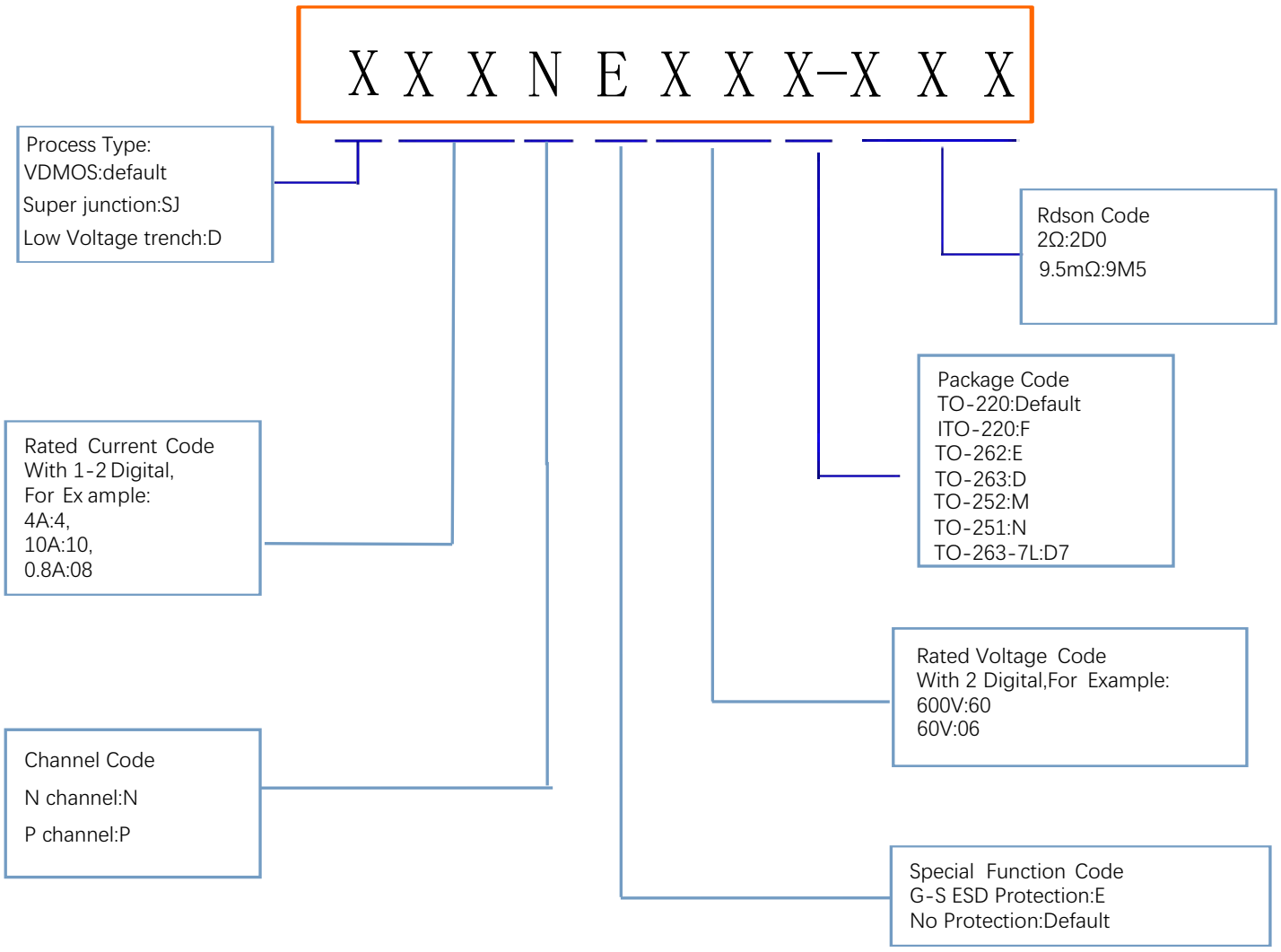

7) . Unclamped Inductive Switching Test Circuit




$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

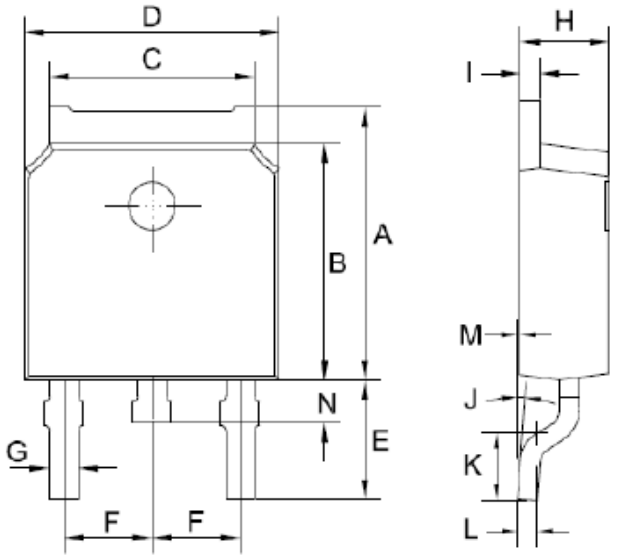
8) Unclamped Inductive Switching Waveforms

## Product Names Rules



Dimensions

## TO-252 PACKAGE OUTLINE DIMENSIONS




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 6.85 | 7.25 | 0.270 | 0.285 |
| B | 5.8 | 6.3 | 0.228 | 0.248 |
| C | 5 | 5.53 | 0.197 | 0.218 |
| D | 6.3 | 6.8 | 0.248 | 0.268 |
| E | 2.6 | 3.3 | 0.102 | 0.130 |
| F | 2.19 | 2.39 | 0.086 | 0.094 |
| G | 0.45 | 0.85 | 0.018 | 0.033 |
| H | 2.2 | 2.4 | 0.087 | 0.094 |
| I | 0.41 | 0.61 | 0.016 | 0.024 |
| J | 0° | 8° | 0° | 8° |
| K | 1.45 | 1.85 | 0.057 | 0.073 |
| L | 0.41 | 0.61 | 0.016 | 0.024 |
| M | 0 | 0.12 | 0.000 | 0.005 |
| P | 0.6 | 1 | 0.024 | 0.039 |

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