



# SPN7002D

## Dual N-Channel Enhancement Mode MOSFET

### DESCRIPTION

The SPN7002D is the Dual N-Channel enhancement mode field effect transistors are produced using high cell density DMOS technology. These products have been designed to minimize on-state resistance while provide rugged, reliable, and fast switching performance. They can be used in most applications requiring up to 300mA DC and can deliver pulsed currents up to 1.0A. These products are particularly suited for low voltage, low current applications such as small servo motor control, power MOSFET gate drivers, and other switching applications.

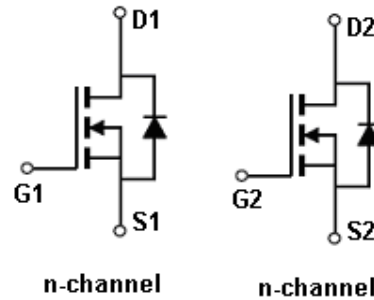
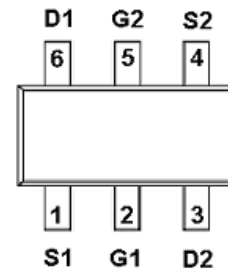
### FEATURES

- ◆ 60V/0.50A ,  $R_{DS(ON)} = 5.0\Omega @ V_{GS} = 10V$
- ◆ 60V/0.30A ,  $R_{DS(ON)} = 5.5\Omega @ V_{GS} = 5V$
- ◆ Super high density cell design for extremely low  $R_{DS(ON)}$
- ◆ Exceptional on-resistance and maximum DC current capability
- ◆ SOT-363 package design

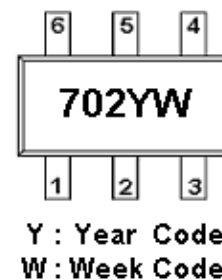
### APPLICATIONS

- Drivers: Relays, Solenoids, Lamps, Hammers, Display, Memories, Transistors, etc.
- High saturation current capability. Direct Logic-Level Interface: TTL/CMOS
- Battery Operated Systems
- Solid-State Relays

### PIN CONFIGURATION ( SOT-363 / SC-70-6L )



### PART MARKING





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### PIN DESCRIPTION

| Pin | Symbol | Description |
|-----|--------|-------------|
| 1   | S1     | Source 1    |
| 2   | G1     | Gate 1      |
| 3   | D2     | Drain 2     |
| 4   | S2     | Source 2    |
| 5   | G2     | Gate 2      |
| 6   | D1     | Drain1      |

### ORDERING INFORMATION

| Part Number    | Package | Part Marking |
|----------------|---------|--------------|
| SPN7002DS36RG  | SOT-363 | 702YW        |
| SPN7002DS36RGB | SOT-363 | 702YW        |

※ Week Code : A ~ Z ( 1 ~ 26 ) ; a ~ z ( 27 ~ 52 )

※ SPN7002DS36RG : Tape Reel ; Pb – Free

※ SPN7002DS36RGB : Tape Reel ; Pb-Free ; Halogen -Free

### ABSOLUTE MAXIMUM RATINGS (TA=25°C Unless otherwise noted)

| Parameter  | Symbol           | Typical   | Unit |
|--|------------------|-----------|------|
| Drain-Source Voltage   | V <sub>DSS</sub> | 60        | V    |
| Gate –Source Voltage - Continuous                              | V <sub>GSS</sub> | ±20       | V    |
| Gate –Source Voltage - Non Repetitive ( t <sub>p</sub> < 50μs) | V <sub>GSS</sub> | ±40       | V    |
| Continuous Drain Current(T <sub>J</sub> =150°C)                | I <sub>D</sub>   | 0.5       | A    |
|  |                  |           |      |
| Pulsed Drain Current (*)                                       | I <sub>DM</sub>  | 1.0       | A    |
| Continuous Source Current(Diode Conduction)                    | I <sub>S</sub>   | 0.25      | A    |
| Power Dissipation  | P <sub>D</sub>   | 0.35      | W    |
|  |                  |           |      |
| Operating Junction Temperature                                 | T <sub>J</sub>   | -55 ~ 150 | °C   |
| Storage Temperature Range                                      | T <sub>STG</sub> | -55 ~ 150 | °C   |
| Thermal Resistance-Junction to Ambient                         | R <sub>θJA</sub> | 375       | °C/W |

(\*) Pulse width limited by safe operating area



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### ELECTRICAL CHARACTERISTICS (TA=25°C Unless otherwise noted)

| Parameter                       | Symbol               | Conditions  | Min. | Typ  | Max. | Unit |
|---------------------------------|----------------------|---|------|------|------|------|
| <b>Static</b>                   |                      |   |      |      |      |      |
| Drain-Source Breakdown Voltage  | V <sub>(BR)DSS</sub> | V <sub>GS</sub> =0V, I <sub>D</sub> =250uA  | 60   |      |      | V    |
| Gate Threshold Voltage          | V <sub>GS(th)</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA  | 1.0  | 1.7  | 2.5  |      |
| Gate Leakage Current            | I <sub>GSS</sub>     | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V  |      |      | ±100 | nA   |
| Zero Gate Voltage Drain Current | I <sub>DSS</sub>     | V <sub>DS</sub> =60V, V <sub>GS</sub> =0V   |      |      | 1    | uA   |
|                                 |                      | V <sub>DS</sub> =60V, V <sub>GS</sub> =0V<br>T <sub>J</sub> =125°C                              |      |      | 10   |      |
| Drain-Source On-Resistance      | R <sub>DSON</sub>    | V <sub>GS</sub> =10V, I <sub>D</sub> =0.50A   |      | 3.5  | 5.0  | Ω    |
|                                 |                      | V <sub>GS</sub> = 5V, I <sub>D</sub> =0.30A   |      | 4.0  | 5.5  |      |
|                                 |                      | V <sub>GS</sub> = 4.5V, I <sub>D</sub> =0.05A   |      | 3.7  | 5.5  |      |
| Source-drain Current            | I <sub>SD</sub>      |   |      |      | 0.35 | A    |
| Source-drain Current (pulsed)   | I <sub>SDM</sub> (2) |   |      |      | 1.4  | A    |
| Forward Transconductance        | G <sub>fs</sub> (1)  | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.5 A  |      | 0.6  |      | S    |
| Diode Forward Voltage           | V <sub>SD</sub> (1)  | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 0.12A   |      | 0.85 | 1.5  | V    |
| <b>Dynamic</b>                  |                      |   |      |      |      |      |
| Total Gate Charge               | Q <sub>g</sub>       | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 1 A,<br>V <sub>GS</sub> = 5 V                          |      | 1.4  | 2.0  | nC   |
| Gate-Source Charge              | Q <sub>gs</sub>      |   |      | 0.8  |      |      |
| Gate-Drain Charge               | Q <sub>gd</sub>      |   |      | 0.5  |      |      |
| Input Capacitance               | C <sub>iss</sub>     | V <sub>DS</sub> = 25 V, f = 1 MHz,<br>V <sub>GS</sub> = 0                                       |      | 43   |      | pF   |
| Output Capacitance              | C <sub>oss</sub>     |   |      | 20   |      |      |
| Reverse Transfer Capacitance    | C <sub>rss</sub>     |   |      | 6    |      |      |
| Turn-On Time                    | t <sub>d(on)</sub>   | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 0.5 A<br>R <sub>G</sub> = 4.7Ω V <sub>GS</sub> = 4.5 V |      | 5    |      | ns   |
|                                 | t <sub>r</sub>       |   |      | 15   |      |      |
| Turn-Off Time                   | t <sub>d(off)</sub>  |   |      | 7    |      |      |
|                                 | t <sub>f</sub>       |   |      | 8    |      |      |

(1) Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %.

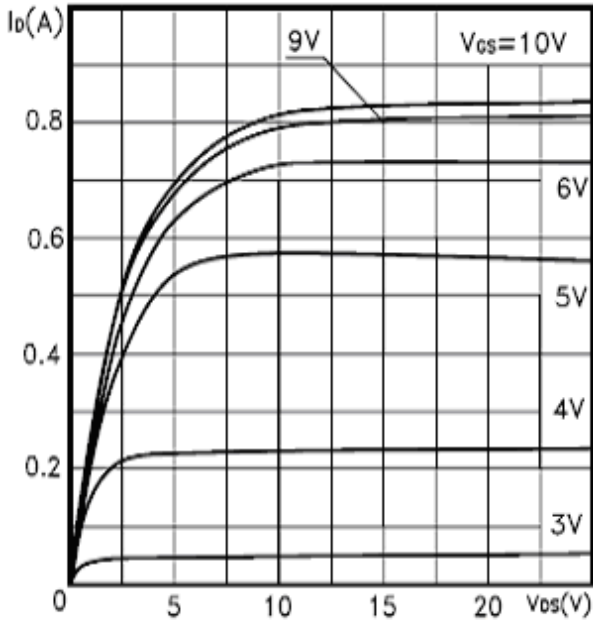
(2) Pulse width limited by safe operating area.



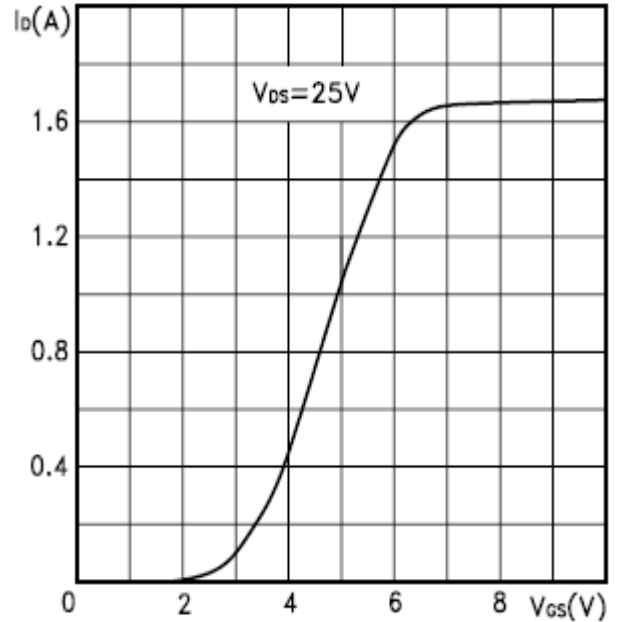
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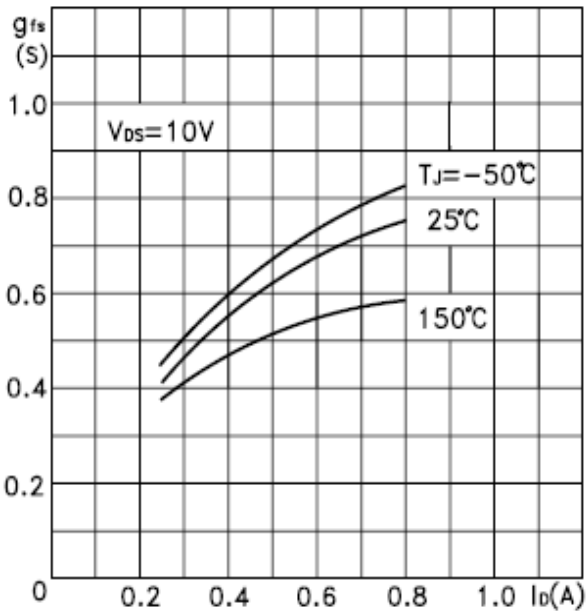
### TYPICAL CHARACTERISTICS



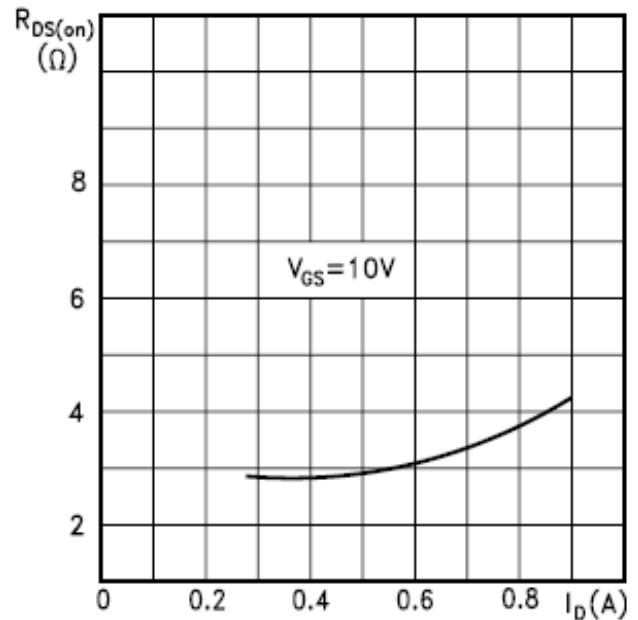
Output Characteristics



Transfer Characteristics



Transconductance



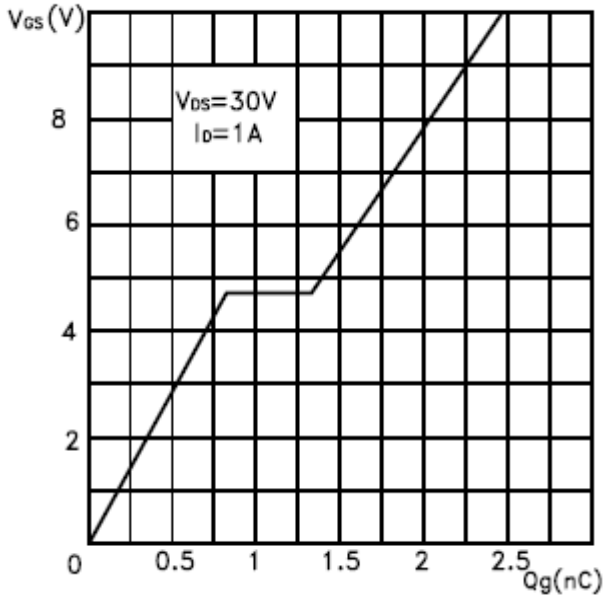
Static Drain-source On Resistance



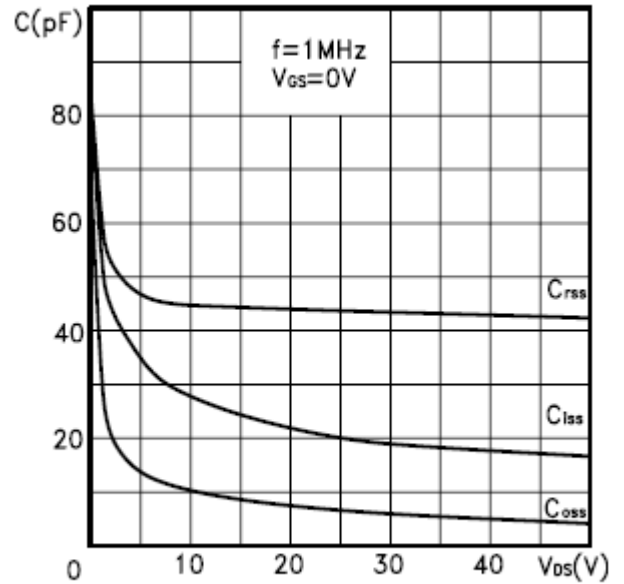
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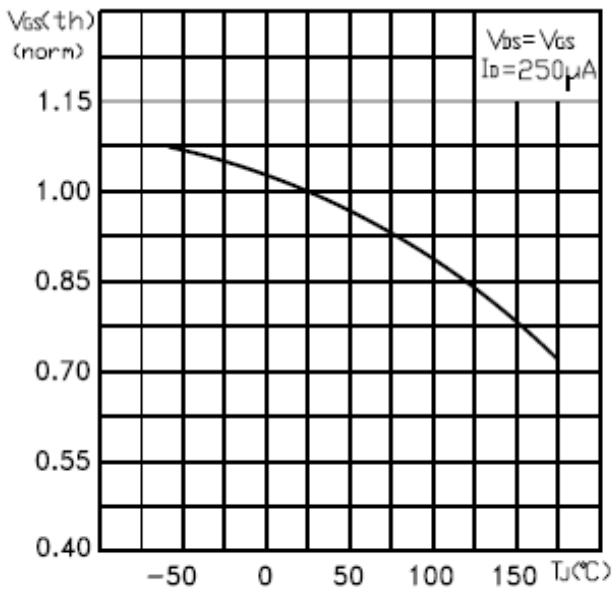
### TYPICAL CHARACTERISTICS



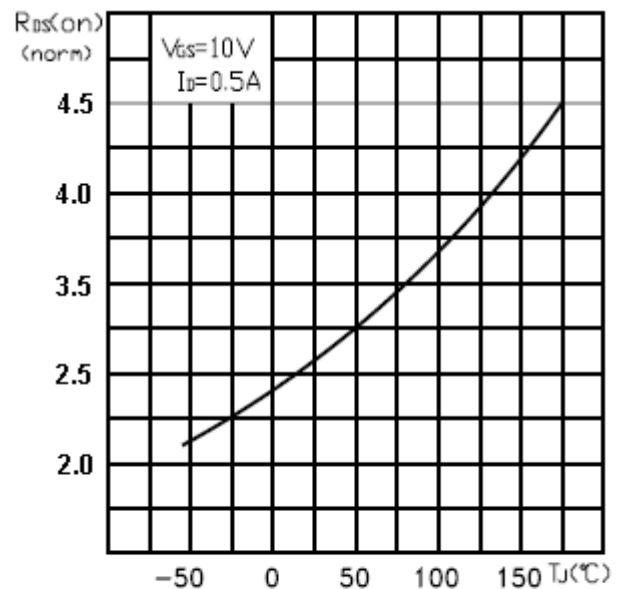
Gate Charge vs Gate-source Voltage



Capacitance Variations



Normalized Gate Threshold Voltage vs Temperature



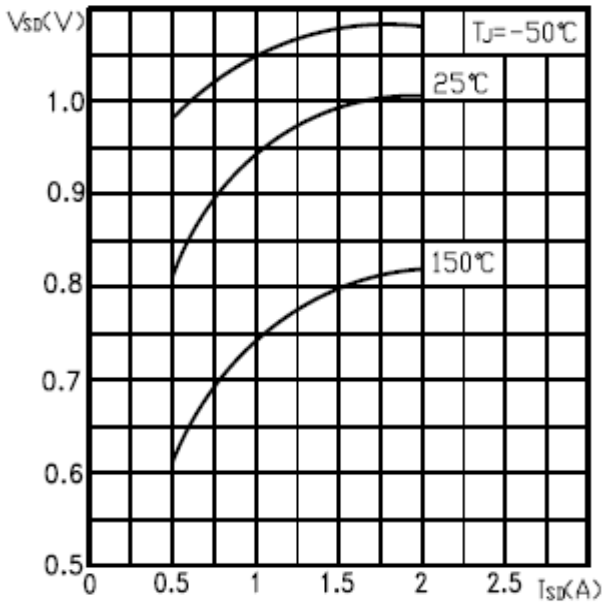
Normalized On Resistance vs Temperature



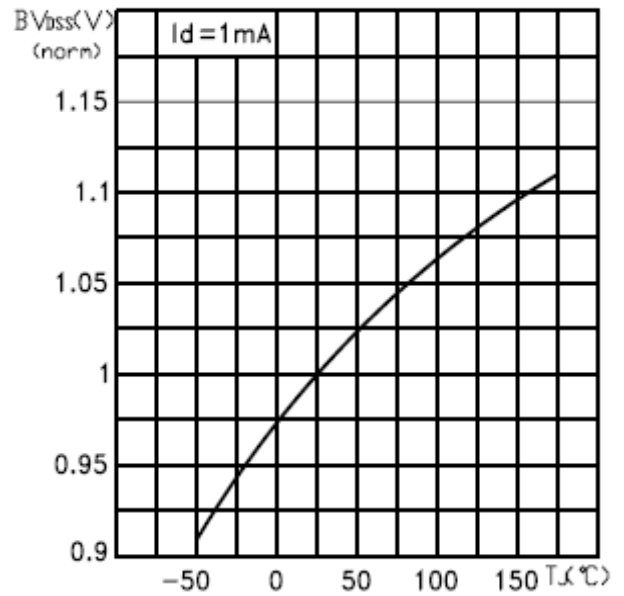
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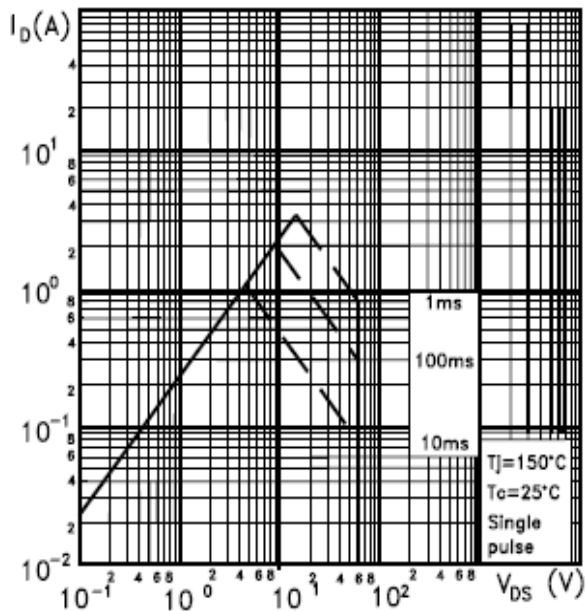
### TYPICAL CHARACTERISTICS



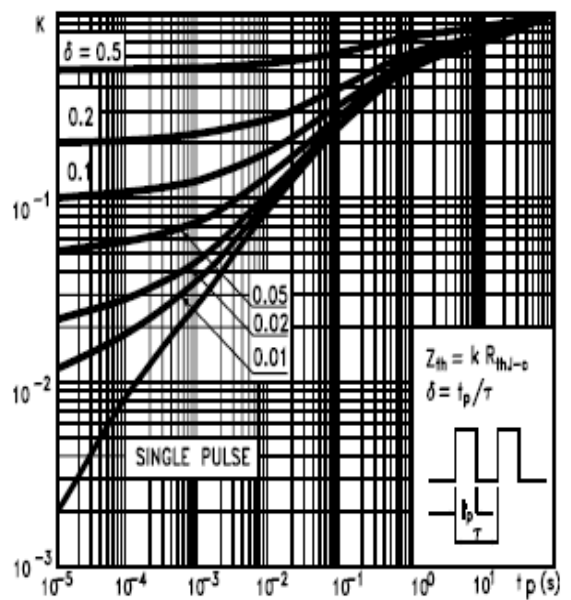
Source-Drain Forward



Normalized BVDSS vs Temperature



Safe Operating Area



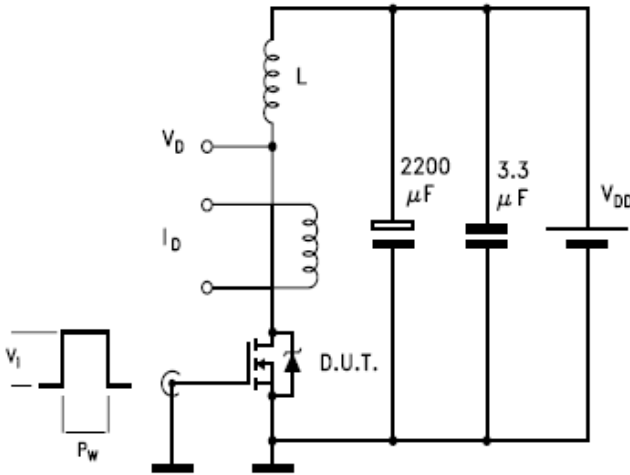
Thermal Impedance



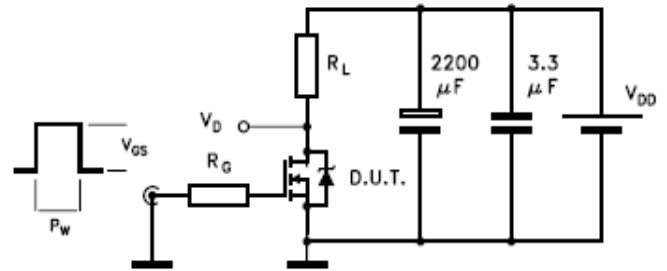
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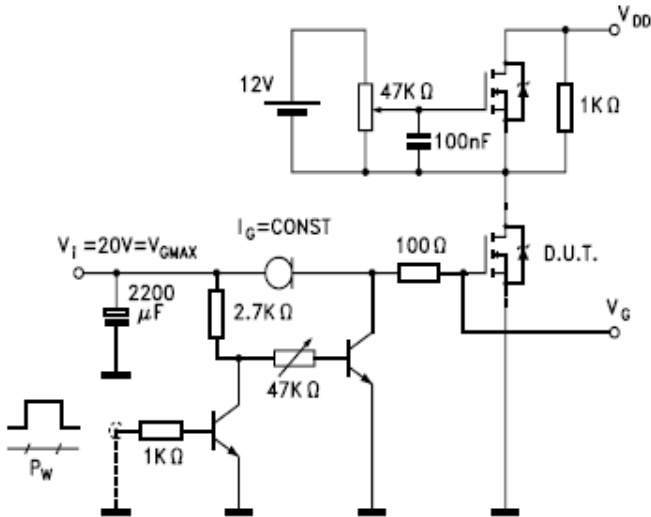
### TYPICAL TESTING CIRCUIT



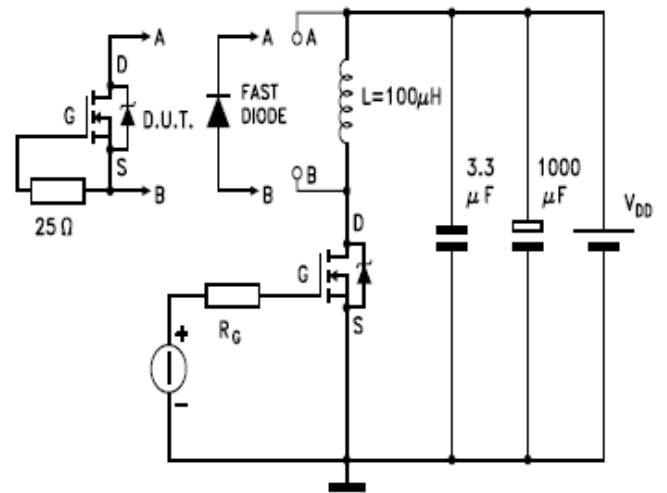
Unclamped Inductive Load Test



Switching Times Test Circuit



Gate Charge Test Circuit



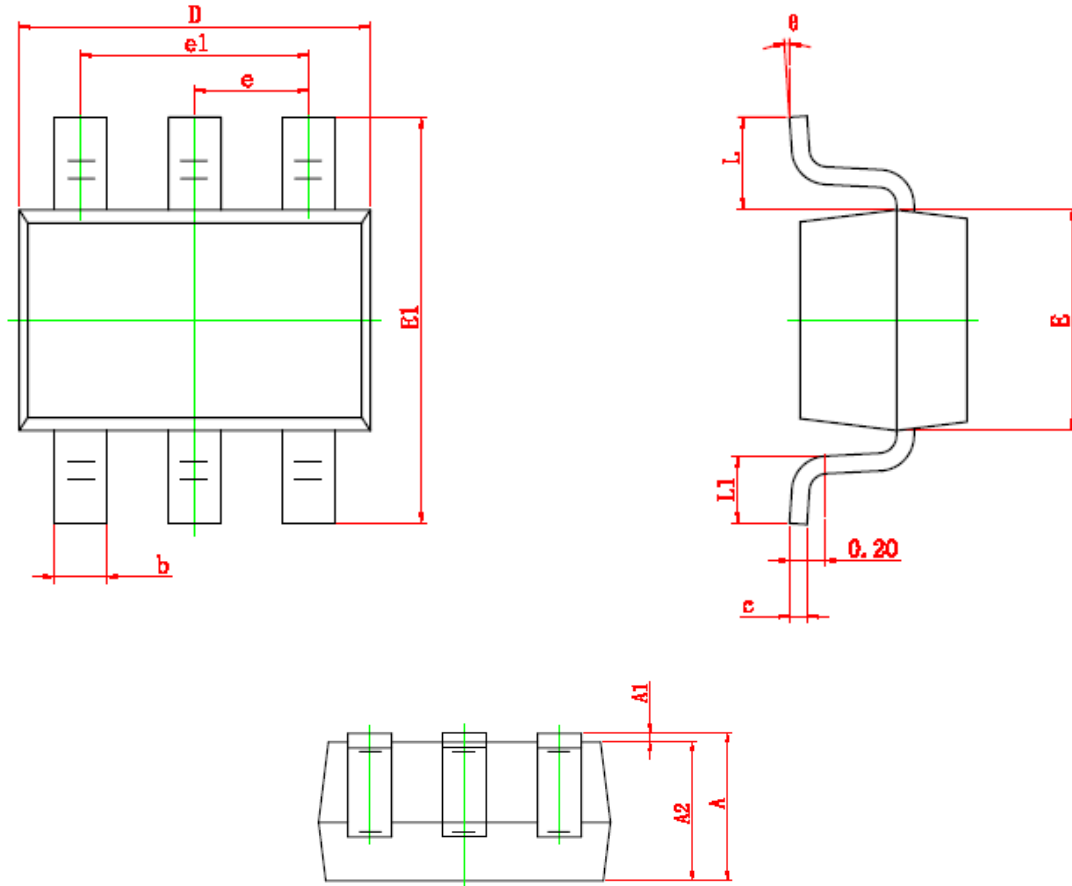
Test Circuit For Inductive Load Switching and Diode Recovery Times



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### SOT-363 PACKAGE OUTLINE



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 0.900                     | 1.100 | 0.035                | 0.043 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2     | 0.900                     | 1.000 | 0.035                | 0.039 |
| b      | 0.150                     | 0.350 | 0.006                | 0.014 |
| c      | 0.080                     | 0.150 | 0.003                | 0.006 |
| D      | 2.000                     | 2.200 | 0.079                | 0.087 |
| E      | 1.150                     | 1.350 | 0.045                | 0.053 |
| E1     | 2.150                     | 2.450 | 0.085                | 0.096 |
| e      | 0.650 TYP                 |       | 0.026 TYP            |       |
| e1     | 1.200                     | 1.400 | 0.047                | 0.055 |
| L      | 0.525 REF                 |       | 0.021 REF            |       |
| L1     | 0.260                     | 0.460 | 0.010                | 0.018 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |





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