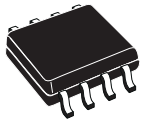
# STS1C1S250

## N-CHANNEL 250V - 0.9Ω - 0.75A SO-8
## P-CHANNEL 250V - 2.1Ω - 0.6A SO-8
## MESH OVERLAY POWER MOSFET

| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STS1C1S250(N-Channel) | 250 V | <1.4Ω | 0.80 A |
| STS1C1S250(P-Channel) | 250 V | <2.8Ω | 0.60 A |

- TYPICAL $R_{DS(on)}$ (N-Channel) = 0.9 Ω
- TYPICAL $R_{DS(on)}$ (P-Channel) = 2.1 Ω
- GATE-SOURCE ZENER DIODE
- STANDARD OUTLINE FOR EASY AUTOMATED SURFACE MOUNT ASSEMBLY



**SO-8**

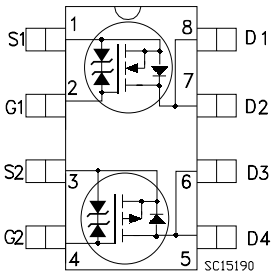
### DESCRIPTION

This complementary pair uses the Company's proprietary high voltage MESH OVERLAY™ process based on advanced strip layout and efficient edge termination. Designed for high volume manufacturing capability, it is ideal in lighting converters such as CFL supplied from 120V mains.

### APPLICATIONS

- LIGHTING

### INTERNAL SCHEMATIC DIAGRAM




### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | N-CHANNEL | P-CHANNEL | |
| $V_{DS}$ | Drain-source Voltage ($V_{GS}$ = 0) | 250 | 250 | V |
| $V_{DGR}$ | Drain-gate Voltage ($R_{GS}$ = 20 kΩ) | 250 | 250 | V |
| $V_{GS}$ | Gate- source Voltage | ±25 | | V |
| $I_D$ | Drain Current (continuous) at $T_C$ = 25°C | 0.75 | 0.60 | A |
| $I_D$ | Drain Current (continuous) at $T_C$ = 100°C | 0.47 | 0.38 | A |
| $I_{DM}$ (1) | Drain Current (pulsed) | 3 | 2.4 | A |
| $P_{TOT}$ | Total Dissipation at $T_C$ = 25°C Single Operation<br>Total Dissipation at $T_C$ = 25°C Dual Operation | 1.6<br>2 | | W |
| $T_{stg}$ | Storage Temperature | –65 to 150 | | °C |
| $T_j$ | Max. Operating Junction Temperature | 150 | | °C |

(1)Pulse width limited by safe operating area

## THERMAL DATA

| | | | |
|---|---|---|---|
| Rthj-amb (2) | Thermal Resistance Junction-ambient Max (Single Operating)<br>(Dual Operating) | 62.5<br>78 | °C/W |

(2) Mounted on 0.5 in² pad of 2oz. copper.

## ELECTRICAL CHARACTERISTICS ($T_{CASE}$ = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage | **N-CHANNEL**<br>$I_D$ = 250 µA, $V_{GS}$ = 0<br>**P-CHANNEL**<br>$I_D$ = 250 µA, $V_{GS}$ = 0 | n-ch<br><br>p-ch | 250<br><br>250 | | | V<br><br>V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{GS}$ = 0) | $V_{DS}$ = Max Rating<br>$V_{DS}$ = Max Rating, $T_C$ = 125 °C | n-ch<br>p-ch<br>n-ch<br>p-ch | | | 1<br>1<br>10<br>10 | µA<br>µA<br>µA<br>µA |
| $I_{GSS}$ | Gate-body Leakage Current ($V_{DS}$ = 0) | $V_{GS}$ = ±20V | n-ch<br>p-ch | | | ±10<br>±10 | µA<br>µA |

ON (1)

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate Threshold Voltage | **N-CHANNEL**<br>$V_{DS}$ = $V_{GS}$, $I_D$ = 250µA<br>**P-CHANNEL**<br>$V_{DS}$ = $V_{GS}$, $I_D$ = 250µA | n-ch<br><br>p-ch | 2<br><br>2 | 3<br><br>3 | 4<br><br>4 | V<br><br>V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | **N-CHANNEL**<br>$V_{GS}$ = 10V, $I_D$ = 0.40A<br>**P-CHANNEL**<br>$V_{GS}$ = 10V, $I_D$ = 0.30A | n-ch<br><br>p-ch | | 0.9<br><br>2.1 | 1.4<br><br>2.8 | Ω<br><br>Ω |

DYNAMIC

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | **N-CHANNEL**<br>$V_{DS}$ = 25V, f = 1 MHz, $V_{GS}$ = 0 | n-ch<br>p-ch | | 325<br>260 | | pF<br>pF |
| $C_{oss}$ | Output Capacitance | **P-CHANNEL**<br>$V_{DS}$ = 25V, f = 1 MHz, $V_{GS}$ = 0 | n-ch<br>p-ch | | 51<br>52 | | pF<br>pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | n-ch<br>p-ch | | 24<br>25.5 | | pF<br>pF |
| $R_g$ | Gate Input Resistance | f=1 MHz Gate DC Bias=0<br>Test Signal Level=20mV<br>Open Drain | n-ch<br>p-ch | | 6<br>6 | | Ω<br>Ω |

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

**ELECTRICAL CHARACTERISTICS** (CONTINUED)
SWITCHING ON

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on Delay Time | **N-CHANNEL**<br>$V_{DD}$ = 125V, $I_D$ = 1.5A<br>$R_G$ = 4.7Ω $V_{GS}$ = 10V<br>**P-CHANNEL** | n-ch<br>p-ch | | 9<br>12 | | ns<br>ns |
| $t_r$ | Rise Time | $V_{DD}$ = 125V, $I_D$ = 1.5A<br>$R_G$ = 4.7Ω $V_{GS}$ = 10V<br>(Resistive, see Figure 3) | n-ch<br>p-ch | | 11<br>22 | | ns<br>ns |
| $Q_g$ | Total Gate Charge | **N-CHANNEL**<br>$V_{DD}$ =200V, $I_D$=1.5A, | n-ch<br>p-ch | | 15<br>16 | 20<br>21 | nC<br>nC |
| $Q_{gs}$ | Gate-Source Charge | $V_{GS}$ = 10V<br>**P-CHANNEL** | n-ch<br>p-ch | | 1.9<br>1.4 | | nC<br>nC |
| $Q_{gd}$ | Gate-Drain Charge | $V_{DD}$ = 200V, $I_D$= 1.5A,<br>$V_{GS}$ = 10V | n-ch<br>p-ch | | 7<br>7.6 | | nC<br>nC |

SWITCHING OFF

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $t_{d(off)}$ | Turn-off Delay Time | **N-CHANNEL**<br>$V_{DD}$ = 125V, $I_D$ = 1.5A,<br>$R_G$ = 4.7Ω, $V_{GS}$ = 10V<br>**P-CHANNEL** | n-ch<br>p-ch | | 31<br>29.5 | | ns<br>ns |
| $t_f$ | Fall Time | $V_{DD}$ = 200V, $I_D$ = 1.5A,<br>$R_G$ = 4.7Ω, $V_{GS}$ = 10V<br>(see test circuit, Figure 5) | n-ch<br>p-ch | | 11<br>7 | | ns<br>ns |

SOURCE DRAIN DIODE

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain Current | | n-ch<br>p-ch | | | 0.75<br>0.6 | A<br>A |
| $I_{SDM}$ (4) | Source-drain Current (pulsed) | | n-ch<br>p-ch | | | 3<br>2.4 | A<br>A |
| $V_{SD}$ (5) | Forward On Voltage | $I_{SD}$ = 3A, $V_{GS}$ = 0<br>$I_{SD}$ = 3A, $V_{GS}$ = 0 | n-ch<br>p-ch | | | 1.5<br>1.5 | V<br>V |
| $t_{rr}$ | Reverse Recovery Time | **N-CHANNEL**<br>$I_{SD}$ = 0.8A, di/dt = 100A/µs, | n-ch<br>p-ch | | 127<br>143 | | ns<br>ns |
| $Q_{rr}$ | Reverse Recovery Charge | $V_{DD}$ = 50V, $T_j$ = 150°C<br>**P-CHANNEL** | n-ch<br>p-ch | | 450<br>806 | | nC<br>nC |
| $I_{RRM}$ | Reverse Recovery Curren | $I_{SD}$ = 0.60A, di/dt = 100A/µs,<br>$V_{DD}$ = 40V, $T_j$ = 150°C<br>(see test circuit, Figure 5) | n-ch<br>p-ch | | 7<br>11 | | A<br>A |

GATE-SOURCE ZENER DIODE

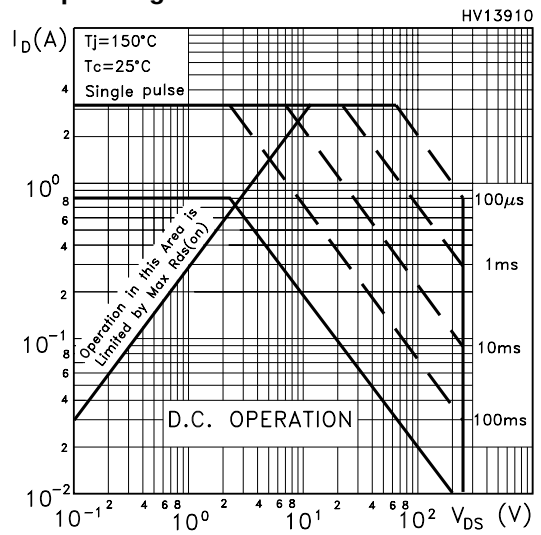
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{GSO}$ | Gate-Source Breakdown Voltage | Igs=± 500 µA (Open Drain) | ± 25 | | | V |

(4) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
(5) Pulse width limited by safe operating area

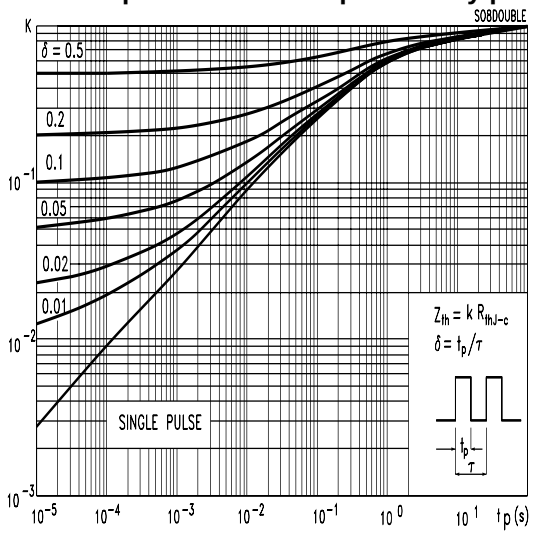
## PROTECTION FEATURES OF GATE-TO-SOURCE ZENER DIODES

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

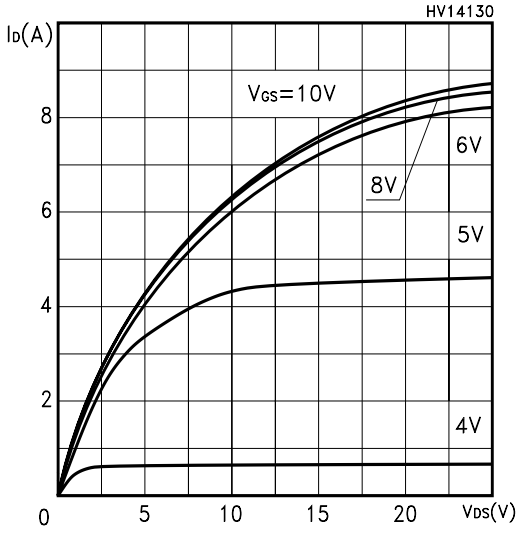
### Safe Operating Area n-ch



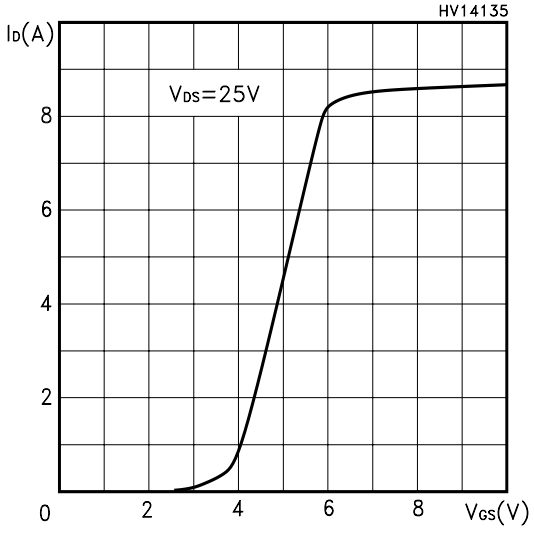

### Thermal Impedance for Complementary pair



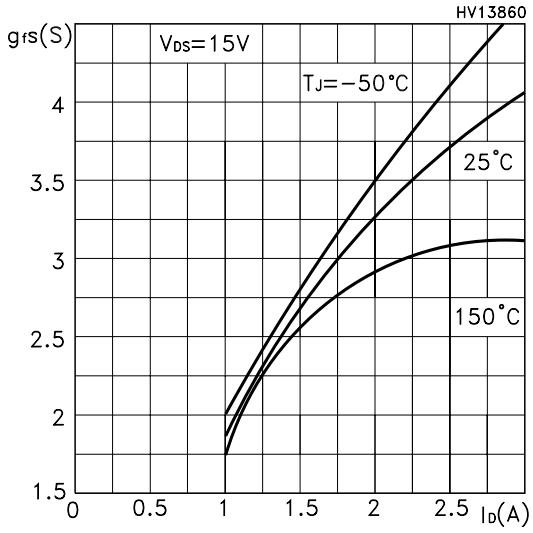

### Output Characteristics n-ch



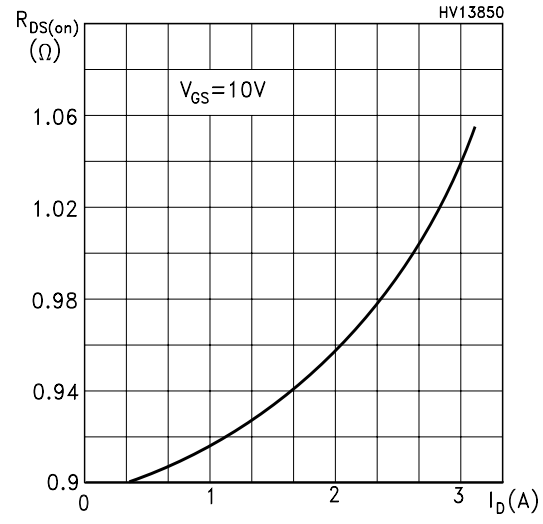

### Transfer Characteristics n-ch



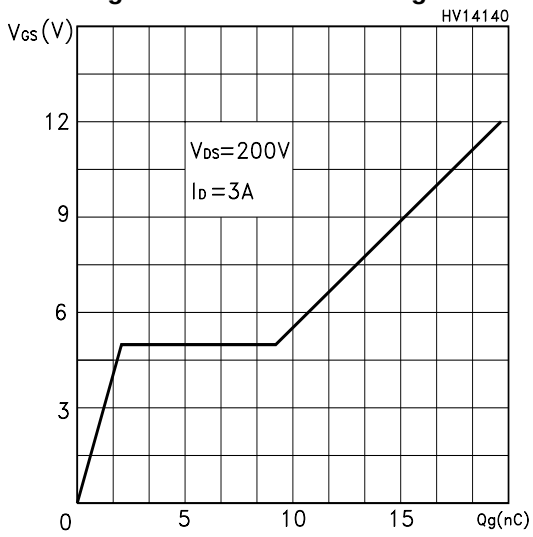

### Transconductance n-ch



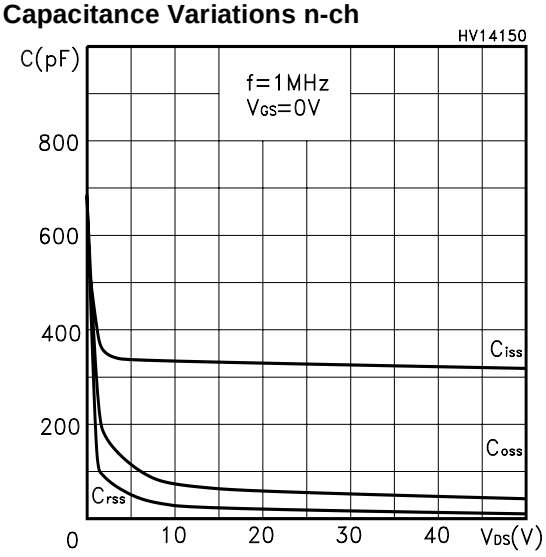

### Static Drain-source On Resistance n-ch



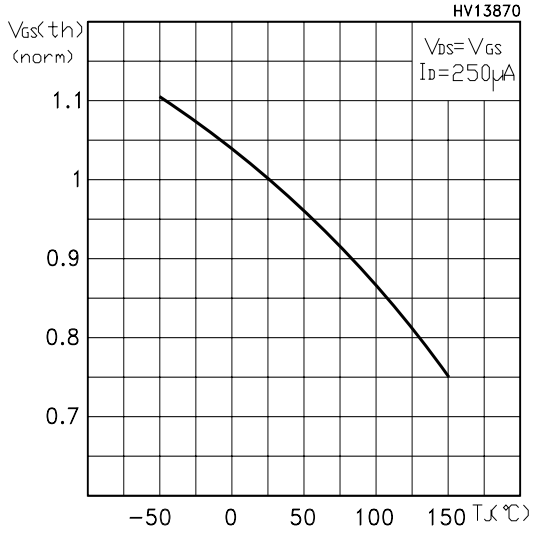
**Gate Charge vs Gate-source Voltage n-ch**




**Capacitance Variations n-ch**




**Norm. Gate Thereshold Voltage vs Temp n-ch**

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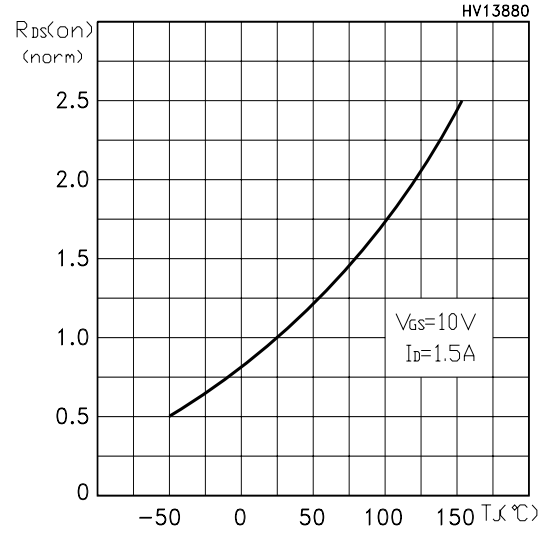
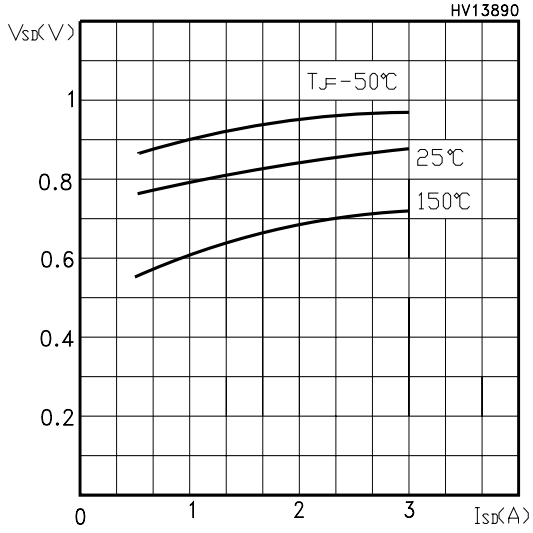
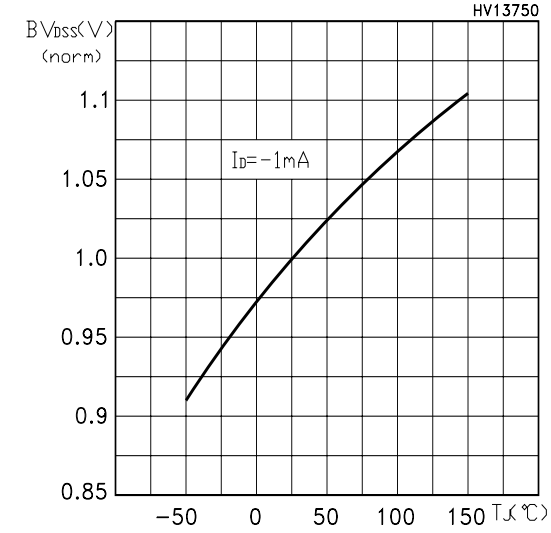


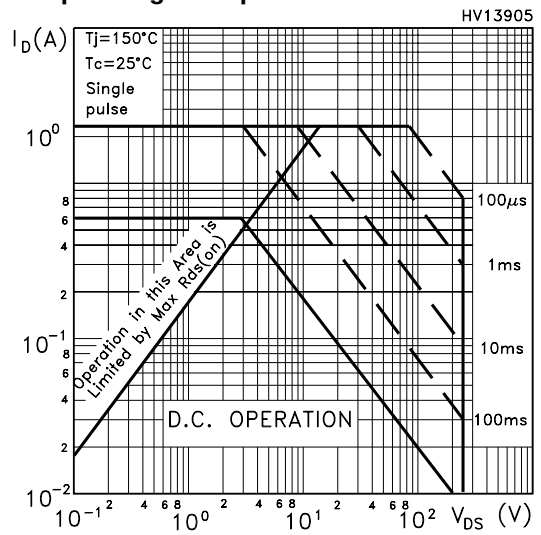

**Source-drainDiodeForwardCharacteristicsn-ch**




**Normalized BVDSS vs Temperature n-ch**



### Safe Operating Area p-ch

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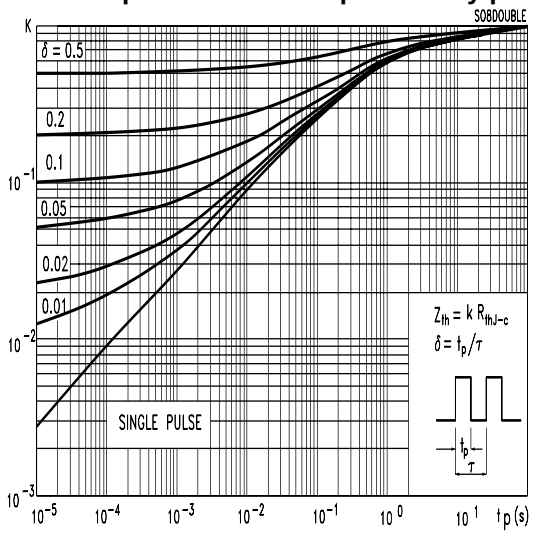
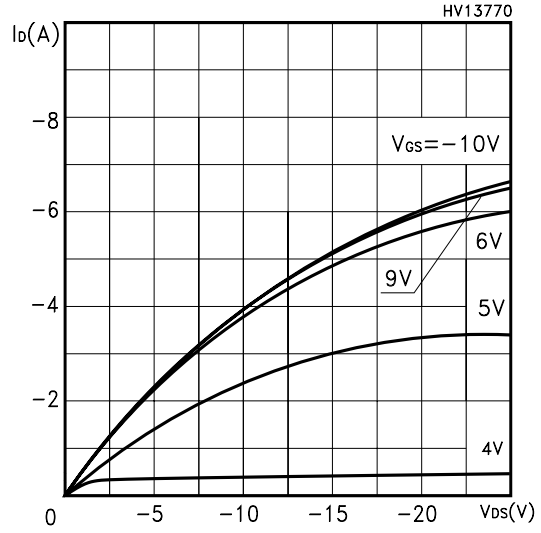
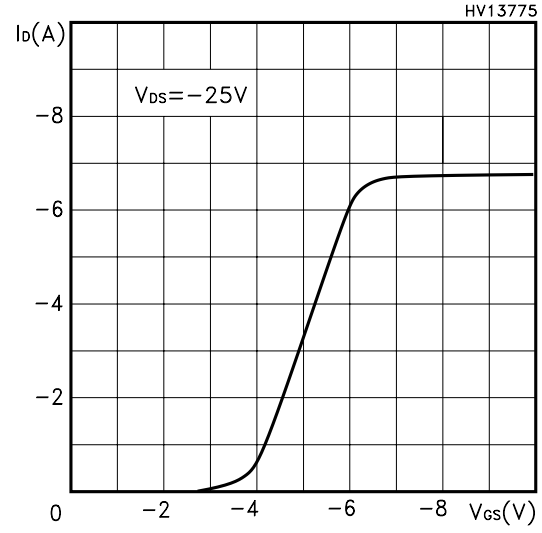


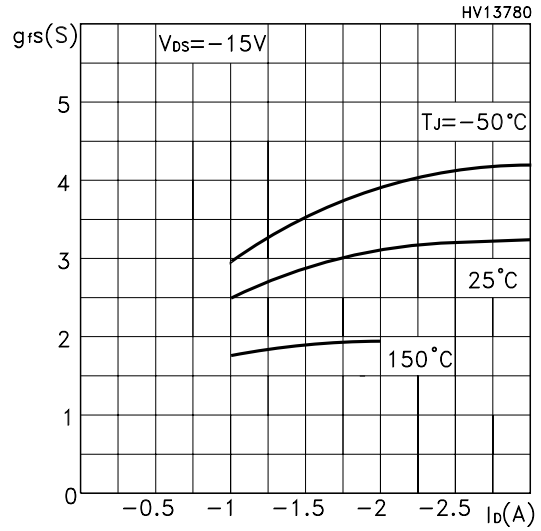

### Output Characteristics p-ch



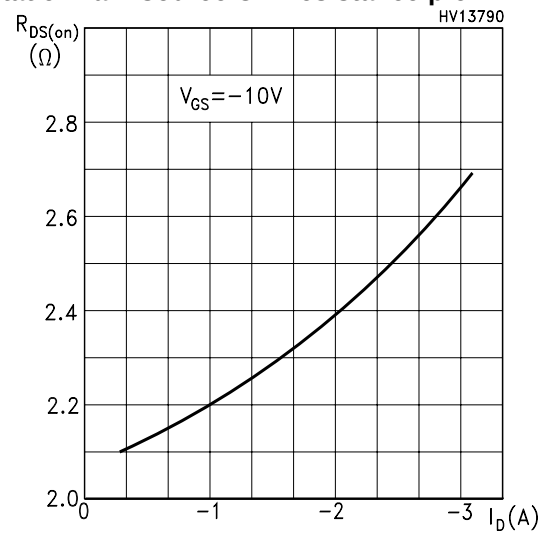

### Transfer Characteristics p-ch



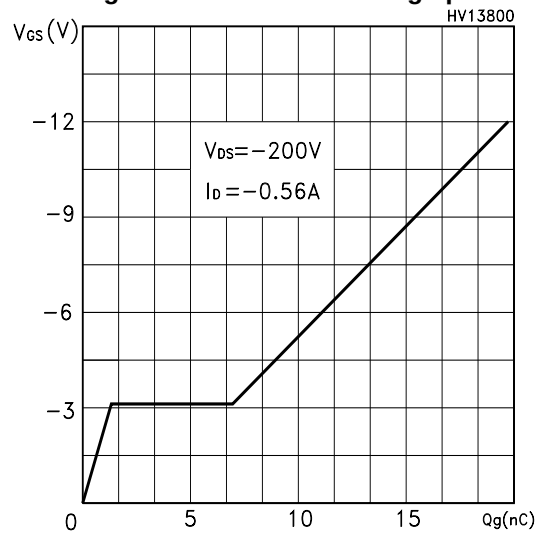

### Transconductance p-ch



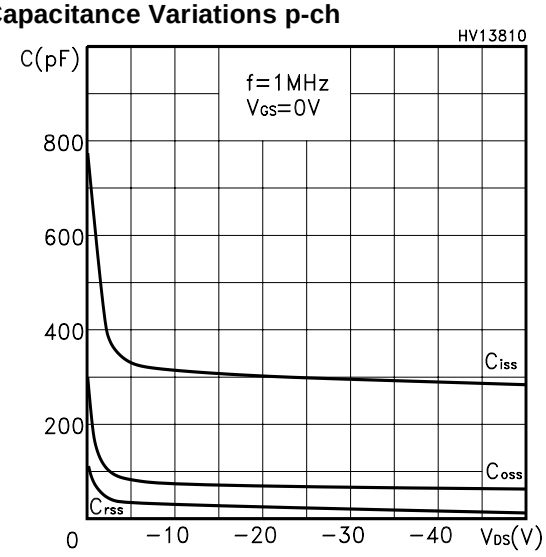

### Static Drain-source On Resistance p-ch



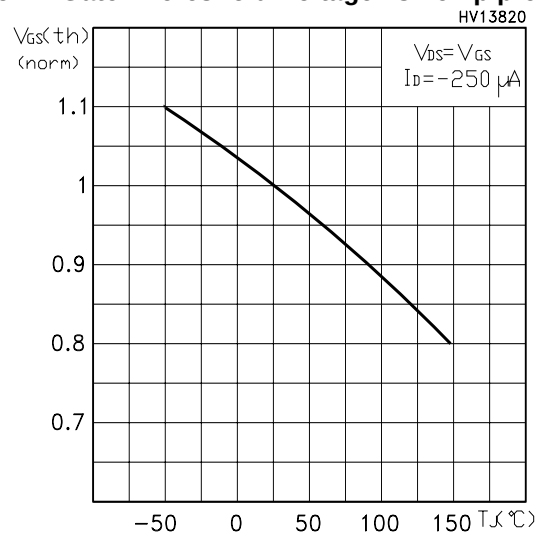
**Gate Charge vs Gate-source Voltage p-ch**



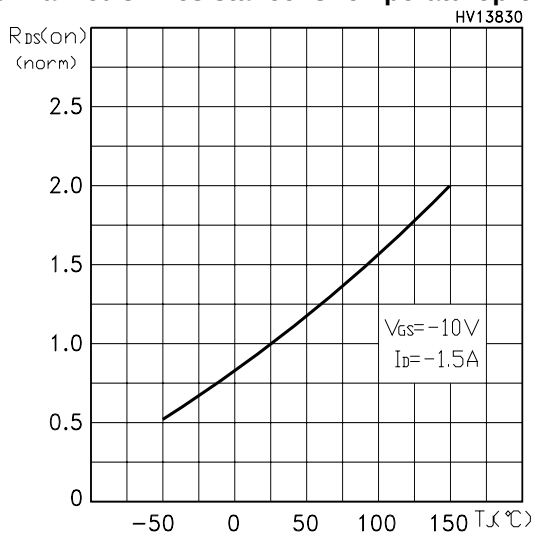

**Capacitance Variations p-ch**



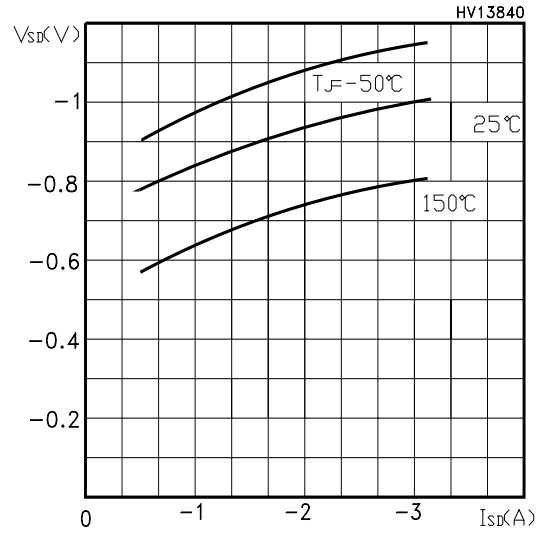

**Norm. Gate Thereshold Voltage vs Temp p-ch**




**NormalizedOnResistancevsTemperaturep-ch**




**Source-drainDiodeForwardCharacteristicsp-ch**




**Normalized BVDSS vs Temperature p-ch**

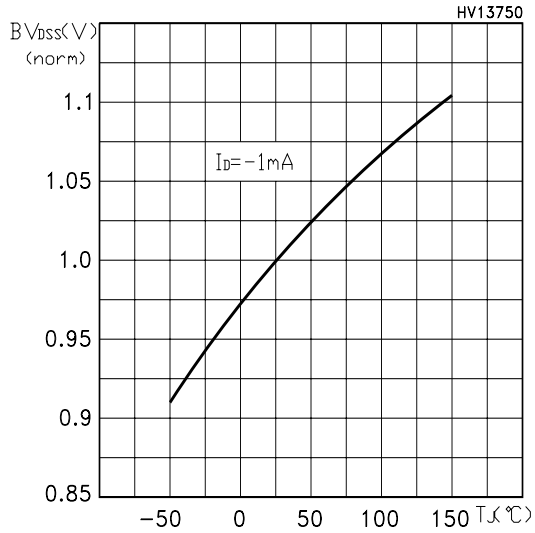


**Fig. 1:** Unclamped Inductive Load Test Circuit

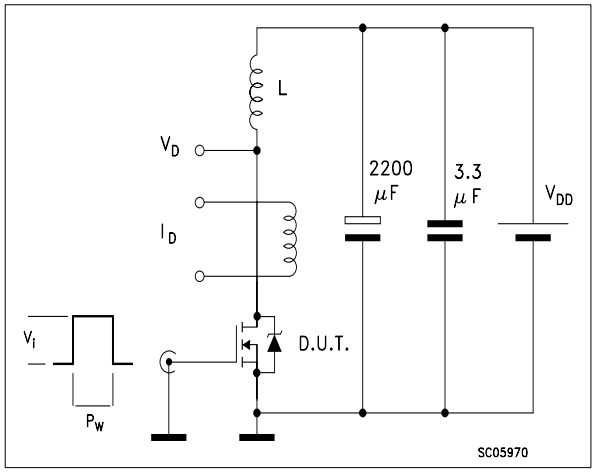



**Fig. 2:** Unclamped Inductive Waveform

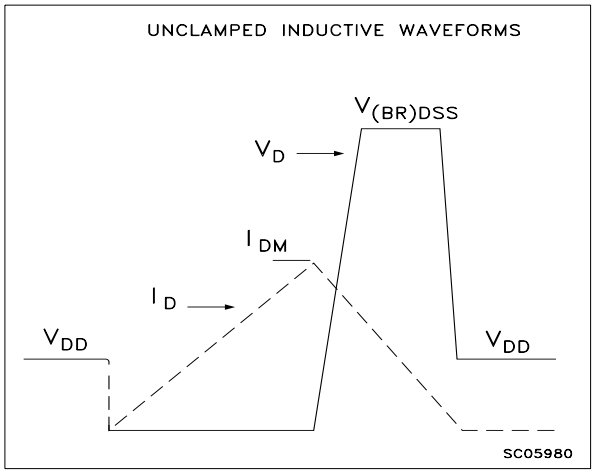



**Fig. 3:** Switching Times Test Circuit For Resistive Load

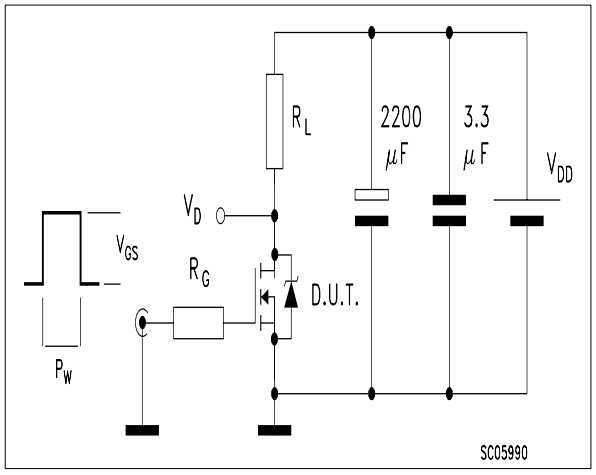



**Fig. 4:** Gate Charge test Circuit

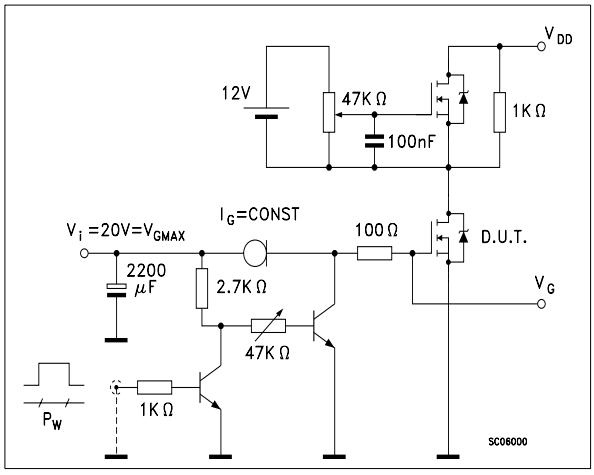
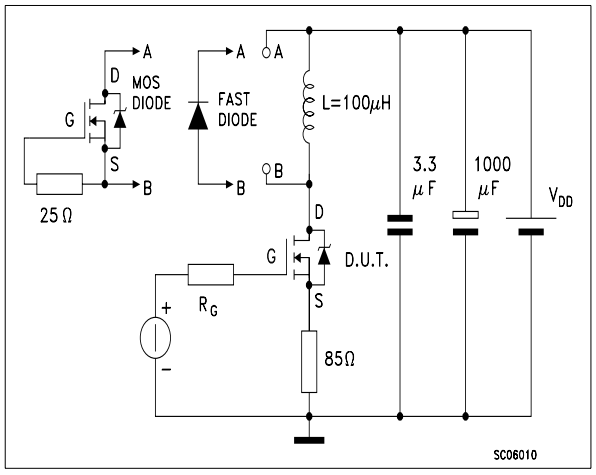
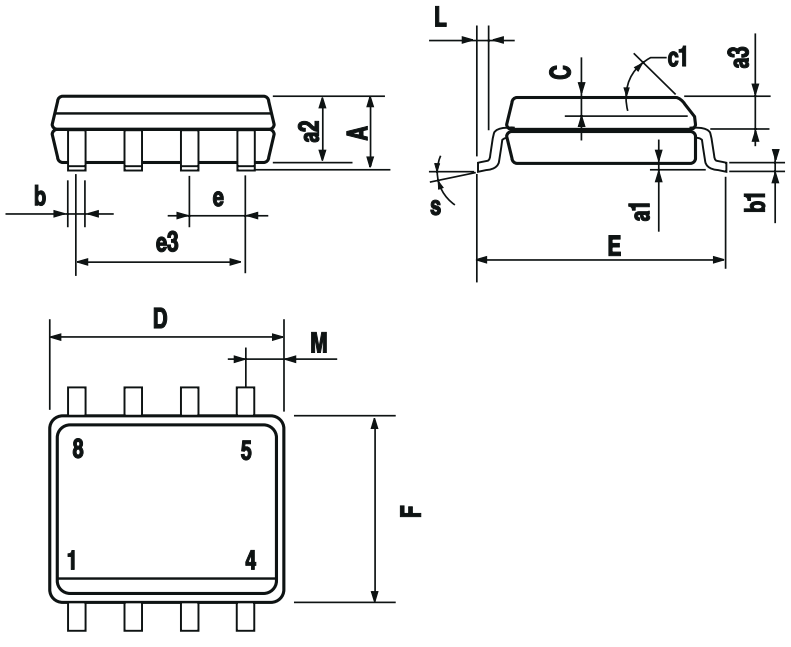



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times



## SO-8 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.25 | 0.003 | | 0.009 |
| a2 | | | 1.65 | | | 0.064 |
| a3 | 0.65 | | 0.85 | 0.025 | | 0.033 |
| b | 0.35 | | 0.48 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | 0.25 | | 0.5 | 0.010 | | 0.019 |
| c1 | 45 (typ.) | | | | | |
| D | 4.8 | | 5.0 | 0.188 | | 0.196 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 3.81 | | | 0.150 | |
| F | 3.8 | | 4.0 | 0.14 | | 0.157 |
| L | 0.4 | | 1.27 | 0.015 | | 0.050 |
| M | | | 0.6 | | | 0.023 |
| S | 8 (max.) | | | | | |

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