



# STV160NF03L

N-CHANNEL 30V - 0.0019Ω - 160A PowerSO-10

STripFET™ POWER MOSFET

| TYPE        | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-------------|------------------|---------------------|----------------|
| STV160NF03L | 30 V             | < 0.0028 Ω          | 160 A          |

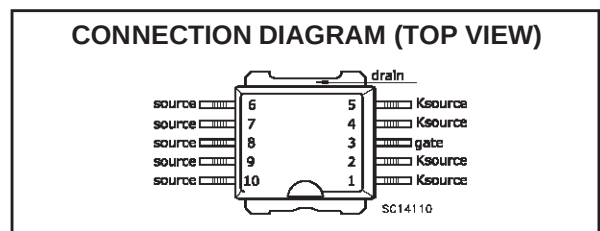
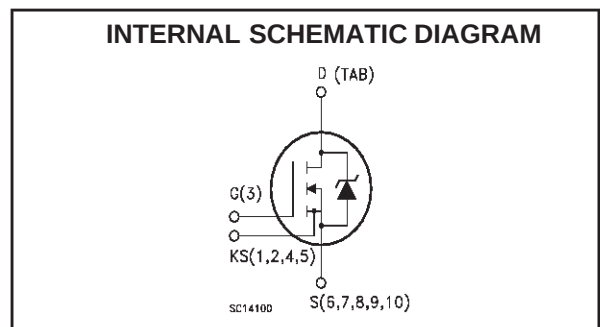
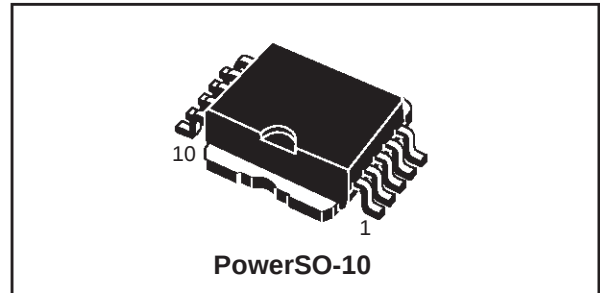
- TYPICAL R<sub>DS(on)</sub> = 0.0019 Ω
- LOW THRESHOLD DRIVE
- ULTRA LOW ON-RESISTANCE
- ULTRA FAST SWITCHING
- 100% AVALANCHE TESTED
- VERY LOW GATE CHARGE
- LOW PROFILE, VERY LOW PARASITIC INDUCTANCE PowerSO-10 PACKAGE

## DESCRIPTION

The **STV160NF03L** represents the second generation of Application Specific STMicroelectronics well established STripFET™ process based on a very unique strip layout design. The resulting MOSFET shows unrivalled high packing density with ultra low on-resistance and superior switching characteristics. Process simplification also translates into improved manufacturing reproducibility. This device is particularly suitable for high current, low voltage switching application where efficiency is crucial

## APPLICATIONS

- BUCK CONVERTERS IN HIGH PERFORMANCE TELECOM AND VRMs DC-DC CONVERTERS



## ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                           | Value      | Unit |
|---------------------|-----------------------------------------------------|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)          | 30         | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)        | 30         | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                | ± 15       | V    |
| I <sub>D</sub> (**) | Drain Current (continuos) at T <sub>C</sub> = 25°C  | 160        | A    |
| I <sub>D</sub>      | Drain Current (continuos) at T <sub>C</sub> = 100°C | 113        | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                              | 640        | A    |
| P <sub>TOT</sub>    | Total Dissipation at T <sub>C</sub> = 25°C          | 210        | W    |
|                     | Derating Factor                                     | 1.4        | W/°C |
| E <sub>AS</sub> (1) | Single Pulse Avalanche Energy                       | 330        | mJ   |
| T <sub>stg</sub>    | Storage Temperature                                 | -65 to 175 | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                 | 175        | °C   |

(●) Pulse width limited by safe operating area

(1) V<sub>DD</sub> = 35V, I<sub>D</sub> = 45A, R<sub>G</sub> = 22Ω, L = 330μH, Starting T<sub>j</sub> = 25°C  
 (\*\*) Limited only maximum junction temperature allowed by PowerSO-10

## STV160NF03L

### THERMAL DATA

|                |                                                |      |      |
|----------------|------------------------------------------------|------|------|
| Rthj-case      | Thermal Resistance Junction-case Max           | 0.71 | °C/W |
| Rthj-amb       | Thermal Resistance Junction-ambient Max        | 50   | °C/W |
| T <sub>I</sub> | Maximum Lead Temperature For Soldering Purpose | 300  | °C   |

### ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

| Symbol               | Parameter                                             | Test Conditions                                                                       | Min. | Typ. | Max.    | Unit     |
|----------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------|------|------|---------|----------|
| V <sub>(BR)DSS</sub> | Drain-source Breakdown Voltage                        | I <sub>D</sub> = 250 µA, V <sub>GS</sub> = 0                                          | 30   |      |         | V        |
| I <sub>DSS</sub>     | Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = Max Rating<br>V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C |      |      | 1<br>10 | µA<br>µA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ± 15 V                                                              |      |      | ±100    | nA       |

ON (1)

| Symbol              | Parameter                         | Test Conditions                                                                                                                                                                                                                                                                                                                                                                                                         | Min. | Typ.                  | Max.                                           | Unit                                   |
|---------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------------|------------------------------------------------|----------------------------------------|
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA                                                                                                                                                                                                                                                                                                                                                              | 1    |                       |                                                | V                                      |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 80 A<br>V <sub>GS</sub> = 10 V, I <sub>D</sub> = 45 A<br>V <sub>GS</sub> = 8 V, I <sub>D</sub> = 80 A<br>V <sub>GS</sub> = 5 V, I <sub>D</sub> = 40 A<br>V <sub>GS</sub> = 10 V, I <sub>D</sub> =80 A; T <sub>j</sub> = 175 °C<br>V <sub>GS</sub> = 8 V, I <sub>D</sub> =80 A; T <sub>j</sub> = 175 °C<br>V <sub>GS</sub> = 5 V, I <sub>D</sub> =40 A; T <sub>j</sub> = 175 °C |      | 1.9<br>1.86<br>2<br>4 | 2.8<br>2.8<br>3.8<br>6.7<br>6.4<br>7.8<br>12.8 | mΩ<br>mΩ<br>mΩ<br>mΩ<br>mΩ<br>mΩ<br>mΩ |
| I <sub>D(on)</sub>  | On State Drain Current            | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)</sub> max,<br>V <sub>GS</sub> = 10V                                                                                                                                                                                                                                                                                                                                | 160  |                       |                                                | A                                      |

### DYNAMIC

| Symbol                                                   | Parameter                                                               | Test Conditions                                                                          | Min. | Typ.                 | Max. | Unit           |
|----------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------|----------------------|------|----------------|
| g <sub>fs</sub> (1)                                      | Forward Transconductance                                                | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)</sub> max,<br>I <sub>D</sub> = 80 A |      | 210                  |      | S              |
| R <sub>g</sub>                                           | Gate resistance                                                         | V <sub>DS</sub> = 0 V, f = 1 MHz, V <sub>GS</sub> = 0                                    |      | 0.5                  |      | Ω              |
| C <sub>iss</sub><br>C <sub>oss</sub><br>C <sub>rss</sub> | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | V <sub>DS</sub> = 25 V, f = 1 MHz, V <sub>GS</sub> = 0                                   |      | 4700<br>1580<br>240  |      | pF<br>pF<br>pF |
| C <sub>iss</sub><br>C <sub>oss</sub><br>C <sub>rss</sub> | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | V <sub>DS</sub> = 0 V, f = 1 MHz, V <sub>GS</sub> = 0                                    |      | 6500<br>9500<br>4000 |      | pF<br>pF<br>pF |
| L <sub>S</sub>                                           | Internal Source Inductance                                              | From the Lead End (6mm from Package Body) to the Die Center                              |      | 4                    |      | nH             |
| L <sub>D</sub>                                           | Internal Drain Inductance                                               | Not Available on Surface Mounting Package                                                |      |                      |      |                |

## ELECTRICAL CHARACTERISTICS (CONTINUED)

## SWITCHING ON

| Symbol      | Parameter          | Test Conditions                                                            | Min. | Typ. | Max. | Unit |
|-------------|--------------------|----------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 15\text{ V}$ , $I_D = 80\text{ A}$                               |      | 30   |      | ns   |
| $t_r$       | Rise Time          | $R_G = 4.7\Omega$ , $V_{GS} = 10\text{ V}$<br>(see test circuit, Figure 3) |      | 380  |      | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 24\text{ V}$ , $I_D = 160\text{ A}$ ,<br>$V_{GS} = 10\text{ V}$  |      | 103  | 140  | nC   |
| $Q_{gs}$    | Gate-Source Charge |                                                                            |      | 21   |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |                                                                            |      | 38   |      | nC   |

## SWITCHING OFF

| Symbol         | Parameter             | Test Conditions                                                                                                              | Min. | Typ. | Max. | Unit |
|----------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(off)}$   | Turn-off-Delay Time   | $V_{DD} = 15\text{ V}$ , $I_D = 80\text{ A}$ ,<br>$R_G = 4.7\Omega$ , $V_{GS} = 10\text{ V}$<br>(see test circuit, Figure 5) |      | 80   |      | ns   |
| $t_f$          | Fall Time             |                                                                                                                              |      | 170  |      | ns   |
| $t_{d(off)}$   | Turn-off Delay Time   | $V_{clamp} = 24\text{ V}$ , $I_D = 40\text{ A}$                                                                              |      | 75   |      | ns   |
| $t_r(V_{off})$ | Off-voltage Rise Time | $R_G = 4.7\Omega$ , $V_{GS} = 10\text{ V}$                                                                                   |      | 25   |      | ns   |
| $t_f$          | Fall Time             |                                                                                                                              |      | 90   |      | ns   |
| $t_c$          | Cross-over Time       |                                                                                                                              |      | 125  |      | ns   |

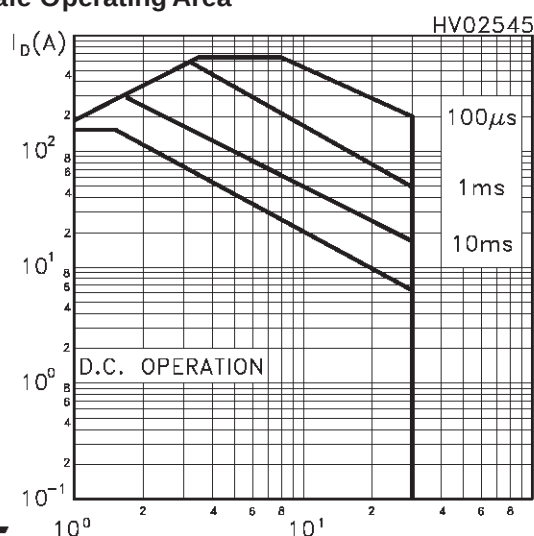
## SOURCE DRAIN DIODE

| Symbol       | Parameter                     | Test Conditions                                                                                                                                    | Min. | Typ. | Max. | Unit |
|--------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $I_{SD}$     | Source-drain Current          |                                                                                                                                                    |      |      | 160  | A    |
| $I_{SDM(1)}$ | Source-drain Current (pulsed) |                                                                                                                                                    |      |      | 640  | A    |
| $V_{SD(2)}$  | Forward On Voltage            | $I_{SD} = 160\text{ A}$ , $V_{GS} = 0$                                                                                                             |      |      | 1.5  | V    |
| $t_{rr}$     | Reverse Recovery Time         | $I_{SD} = 80\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 15\text{ V}$ , $T_J = 25^\circ\text{C}$<br>(see test circuit, Figure 5) |      | 80   |      | ns   |
| $Q_{rr}$     | Reverse Recovery Charge       |                                                                                                                                                    |      | 180  |      | nC   |
| $I_{RRM}$    | Reverse Recovery Current      |                                                                                                                                                    |      | 4.5  |      | A    |

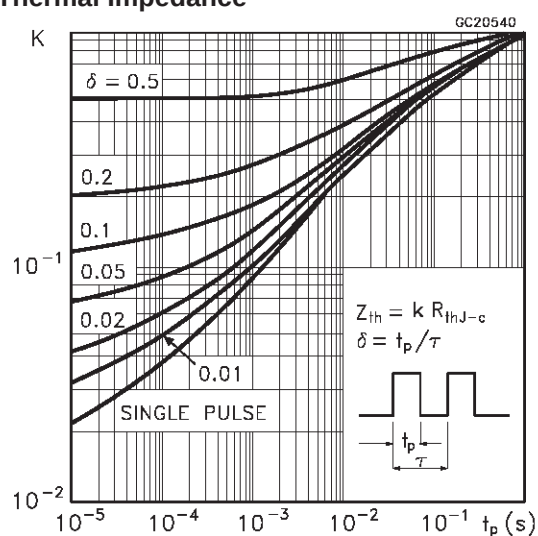
Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.

2. Pulse width limited by safe operating area.

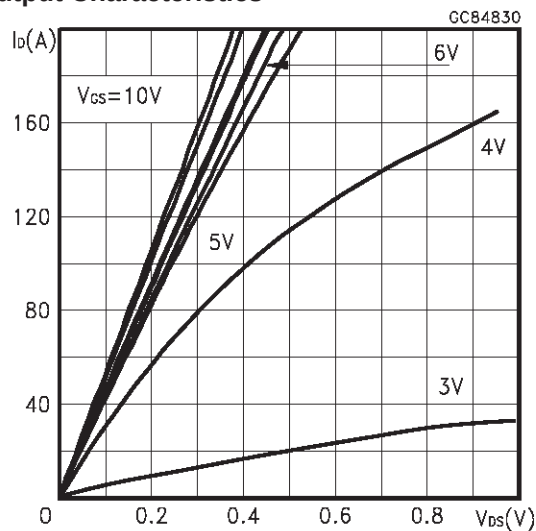
## Safe Operating Area



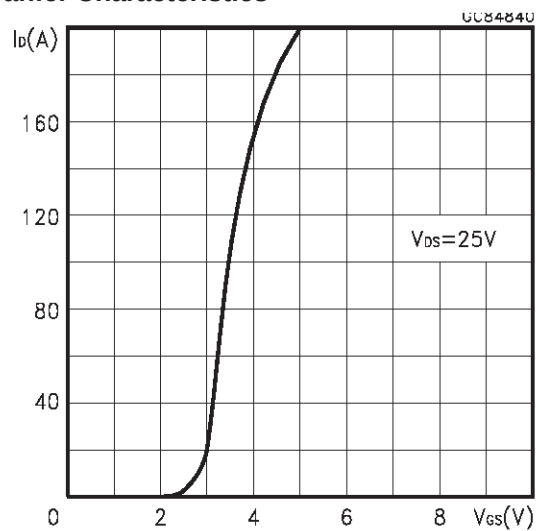
## Thermal Impedance



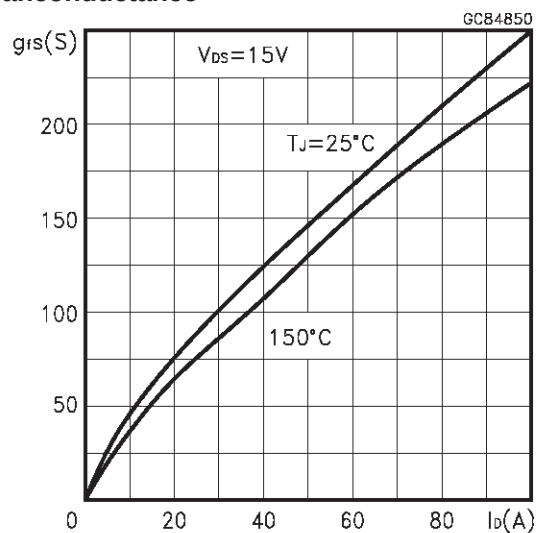
### Output Characteristics



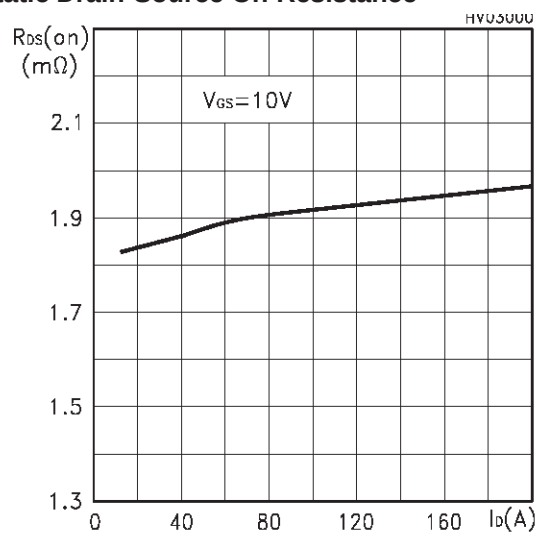
### Transfer Characteristics



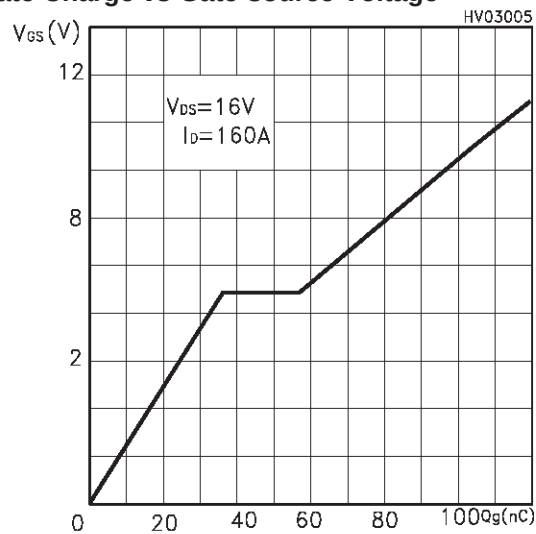
### Transconductance



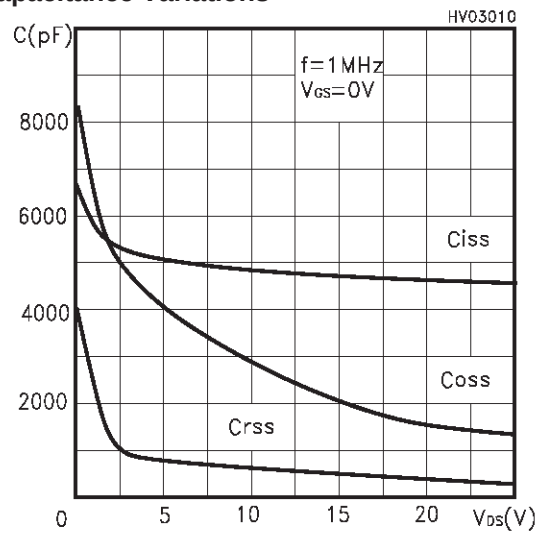
### Static Drain-Source On Resistance



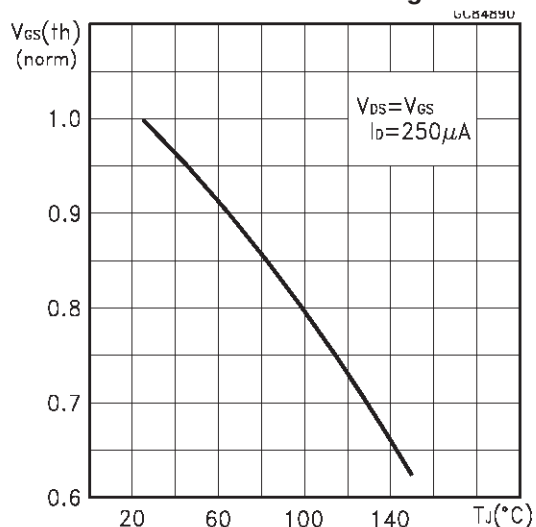
### Gate Charge vs Gate-source Voltage



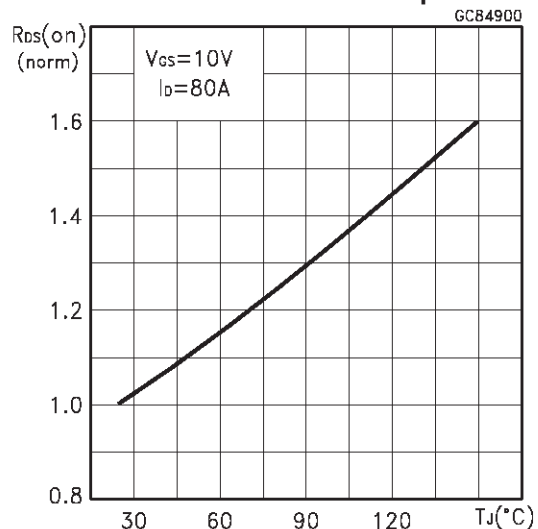
### Capacitance Variations



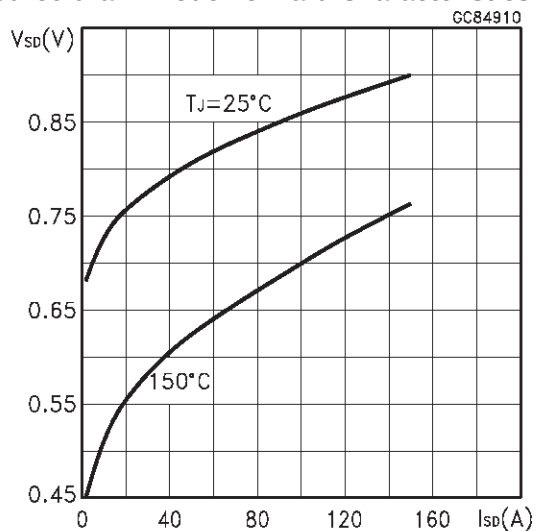
Normalized Gate Threshold Voltage vs Temp.



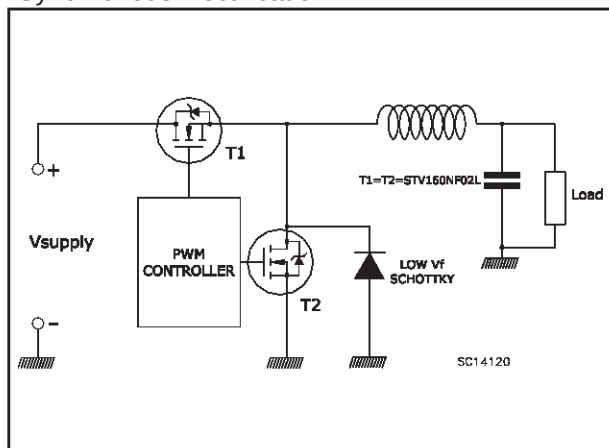
Normalized On Resistance vs Temperature



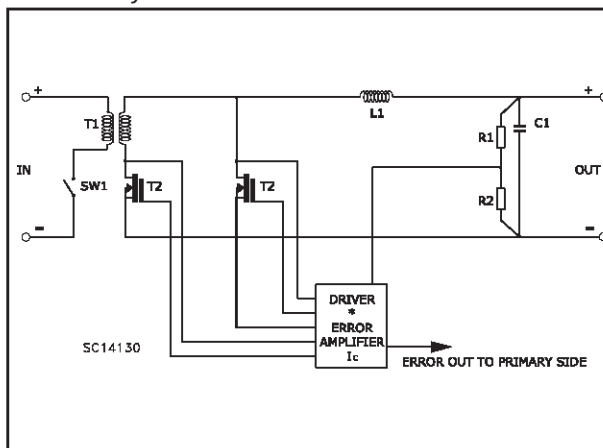
Source-drain Diode Forward Characteristics



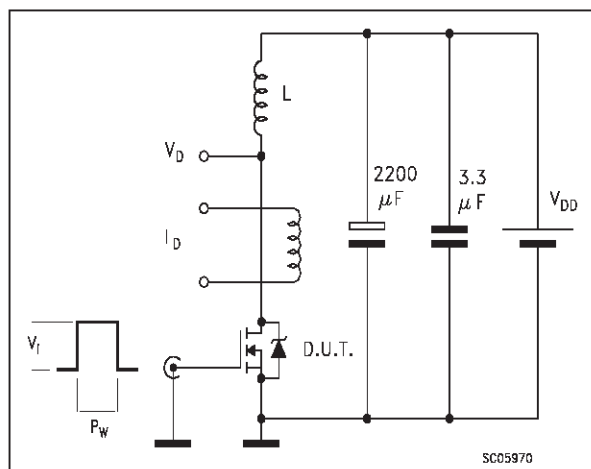
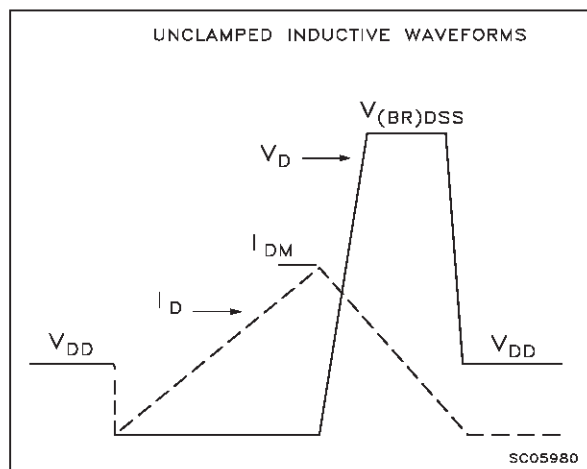
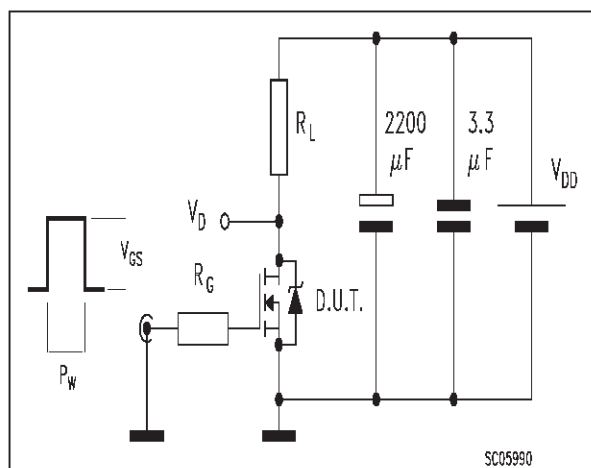
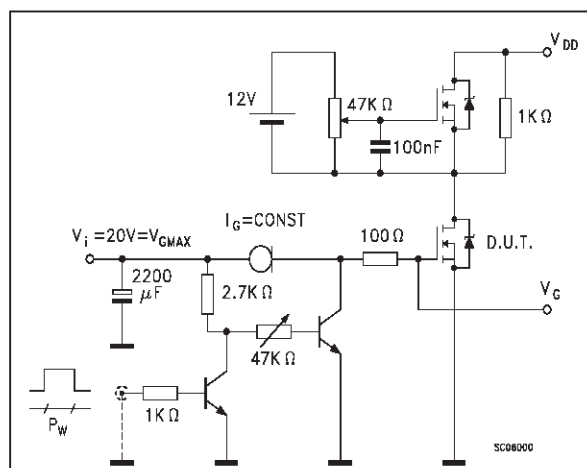
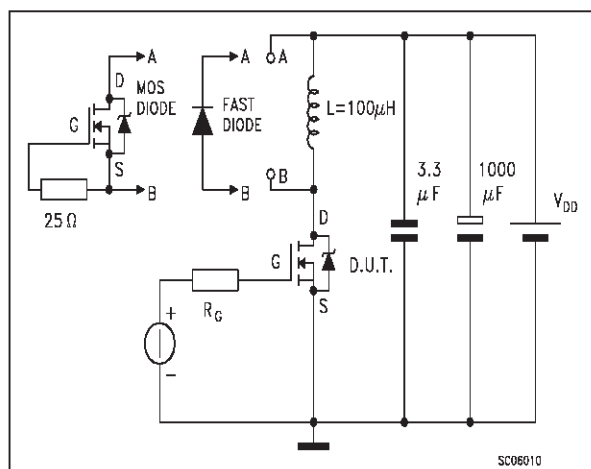
Basic Schematic For Motherboard VRM With Synchronous Rectification



Basic Schematic Mosfets Switch Used In Secondary Side Of a Froward Convert

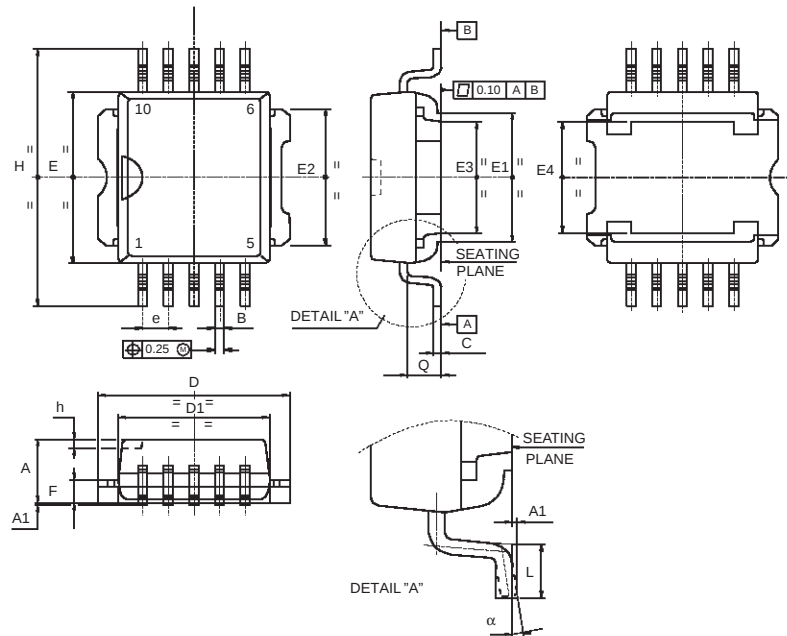




**Fig. 1: Unclamped Inductive Load Test Circuit****Fig. 2: Unclamped Inductive Waveform****Fig. 3: Switching Times Test Circuit For Resistive Load****Fig. 4: Gate Charge test Circuit****Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**

PowerSO-10 MECHANICAL DATA

| DIM.     | mm    |      |       | inch  |       |       |
|----------|-------|------|-------|-------|-------|-------|
|          | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A        | 3.35  |      | 3.65  | 0.132 |       | 0.144 |
| A1       | 0.00  |      | 0.10  | 0.000 |       | 0.004 |
| B        | 0.40  |      | 0.60  | 0.016 |       | 0.024 |
| C        | 0.35  |      | 0.55  | 0.013 |       | 0.022 |
| D        | 9.40  |      | 9.60  | 0.370 |       | 0.378 |
| D1       | 7.40  |      | 7.60  | 0.291 |       | 0.300 |
| e        |       | 1.27 |       |       | 0.050 |       |
| E        | 9.30  |      | 9.50  | 0.366 |       | 0.374 |
| E1       | 7.20  |      | 7.40  | 0.283 |       | 0.291 |
| E2       | 7.20  |      | 7.60  | 0.283 |       | 0.300 |
| E3       | 6.10  |      | 6.35  | 0.240 |       | 0.250 |
| E4       | 5.90  |      | 6.10  | 0.232 |       | 0.240 |
| F        | 1.25  |      | 1.35  | 0.049 |       | 0.053 |
| h        |       | 0.50 |       |       | 0.002 |       |
| H        | 13.80 |      | 14.40 | 0.543 |       | 0.567 |
| L        | 1.20  |      | 1.80  | 0.047 |       | 0.071 |
| q        |       | 1.70 |       |       | 0.067 |       |
| $\alpha$ | 0°    |      | 8°    |       |       |       |



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