



SP6051

Synchronous Rectifier Driver

DESCRIPTION

The fundamental of SP6051 synchronous rectifier (SR) driver IC is based on our U.S. patented methods that utilize the principle of “prediction” logic circuit. The IC deliberates previous cycle timing to linear control the SR in present cycle by “predictive” algorithm that makes adjustments to the turn-off time, in order to achieve maximum efficiency and avoid cross-conduction at the same time. Specially, SP6051 is designed for Full Bridge or Forward applications, and variable switching frequency system.

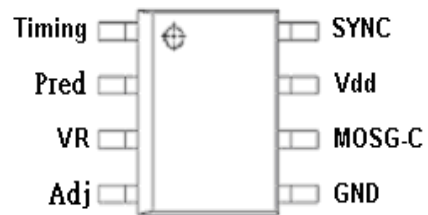
APPLICATIONS

- Switching Mode Power Supply
For Full Bridge or Forward Applications
- Storage area network power supplies
- Telecommunication converters
- Embedded systems
- Industrial & commercial systems using high current processors
- Power converters to meet Lot 6 requirement

FEATURES

- Offers efficiency improvement over Schottky Diode.
- Low Standby Power to meet DOE Lot 6 Requirement.
- Drives all level Power MOSFET.
- Prediction gate timing control.
- Minimum MOSFET body diode conduction.
- Operating frequency up to 250 KHz.
- Synchronize to transformer secondary voltage waveform.
- Self-detect DCM / CCM to enhance the performance under the variable switching frequency condition
- Prediction time for DCM is set to be 4 times longer than CCM to avoid the cross conduction during rapid load change
- Different minimum ON time for CCM and DCM
- Bi-directional rapid load protection

PIN CONFIGURATION (SOP-8)



PART MARKING

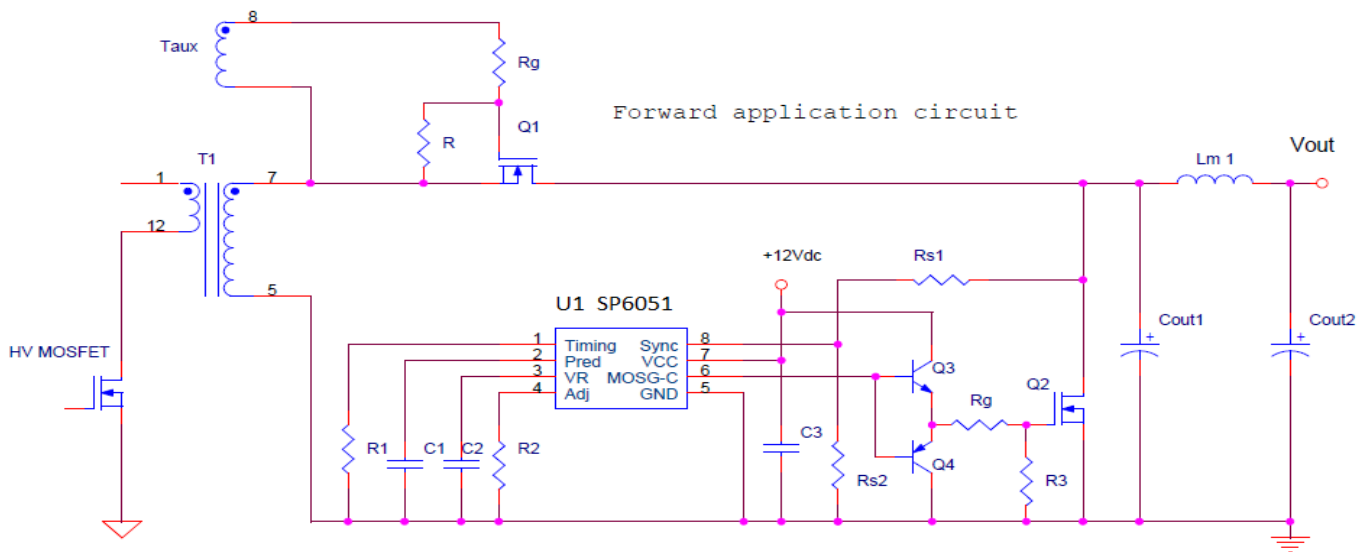




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TYPICAL APPLICATION CIRCUIT



PIN DESCRIPTION

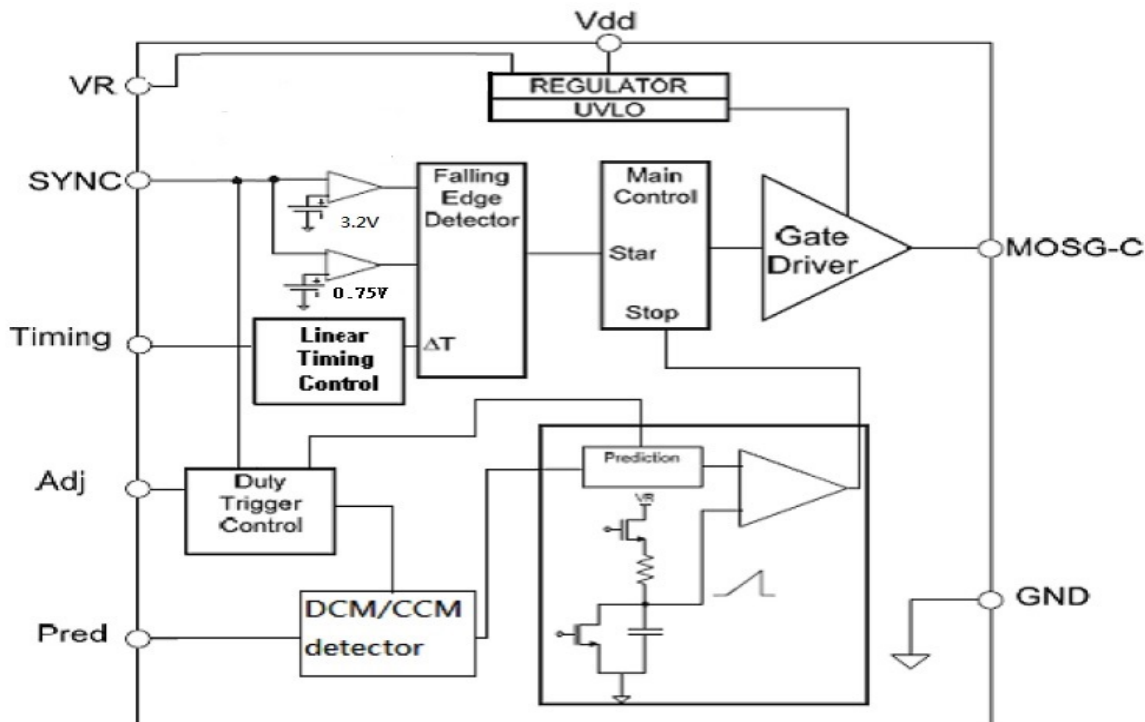
| Pin | Symbol | Description |
|-----|--------|---|
| 1 | Timing | Discontinuous current filter timing adjustment resistor connection. |
| 2 | Pred | Capacitor to store previous cycle timing for SR MOSFET. |
| 3 | VR | Voltage Regulator. |
| 4 | Adj | Trigger point adjustment for Dynamic state. |
| 5 | GND | Ground connection. |
| 6 | MOSG-C | Catch MOSFET gate drive. |
| 7 | Vdd | DC supply voltage. |
| 8 | SYNC | Synchronized signal from the V_{DS} of SR MOSFET. |



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BLOCK DIAGRAM



ORDERING INFORMATION

| Part Number | Package | Part Marking |
|-------------|---------|--------------|
| SP6051S8RGB | SOP-8 | SP6051 |

※ SP6051S8RGB : Tape Reel ; Pb – Free ; Halogen - Free

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

The following ratings designate persistent limits beyond which damage to the device may occur.

| Symbol | Parameter | Value | Unit |
|--------------------------------|--|------------|------|
| V _{DD/MOS-G/SYNC} | DC Supply/Output/Sync Voltage | 17 | V |
| V _{R/Timing/pred/Adj} | Voltage Regulator/Timing/Pred/Sync Voltage | -0.3~6 | V |
| I _{OUT} | Peak Source Current (Pulsed) | 2.0 | A |
| | Peak Sink Current (Pulsed) | 2.0 | A |
| P _D | Power Dissipation @ T _A =85°C (*) | 0.25 | W |
| T _J | Operating Junction Temperature Range | -40 to 125 | °C |
| T _{STG} | Storage Temperature Range | -40 to 150 | °C |
| T _{LEAD} | Lead Soldering Temperature for 5 sec. | 260 | °C |

THERMAL RESISTANCE

| Symbol | Parameter | Value | Unit |
|-----------------|--|-------|------|
| R _{ΘJ} | Thermal Resistance Junction to Ambient (*) | 150 | °C/W |

(*) The power dissipation and thermal resistance are evaluated under copper board mounted with free air conditions.



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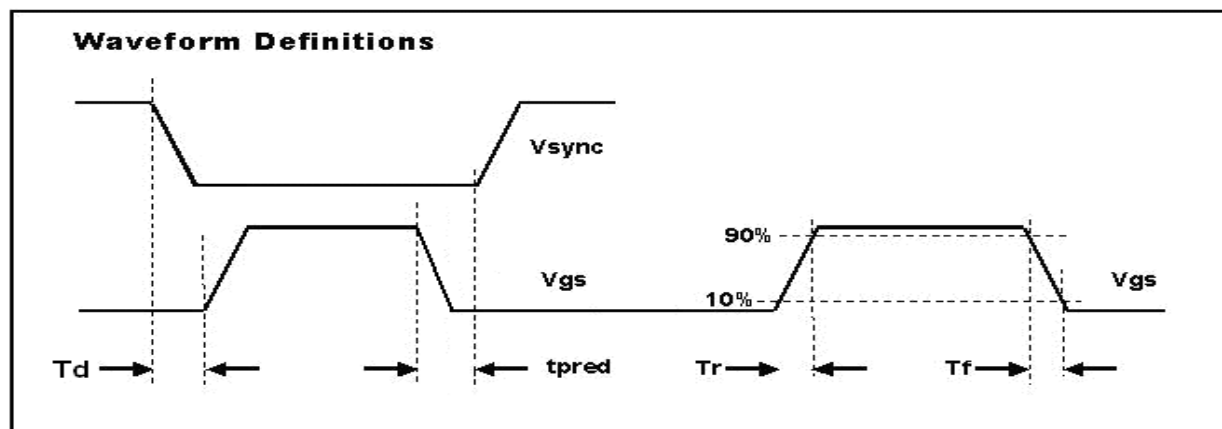
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ELECTRICAL CHARACTERISTICS

($T_A=25^{\circ}\text{C}$, $V_{dd}=12\text{V}$, Freq. =50 KHz, Duty Cycle=50%, unless otherwise specified.)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|-------------------------|---|------|------|------|---------------|
| SUPPLY INPUT | | | | | | |
| I_{DD} | Supply current | $V_{SYNC}=0$, V_{dd} on, | 1.5 | 2.6 | 3.5 | mA |
| V_{dd} | Supply voltage | $I_{dd\ peak} < 2\text{A}$ | | | 15 | V |
| $V_{dd\ on}$ | Enable voltage | | 7.6 | 8.0 | 8.4 | V |
| $V_{dd\ hysteresis}$ | Enable voltage | | | 0.25 | 0.5 | V |
| V_{ovp} | Over voltage protection | | 16 | 16.5 | 17 | V |
| $V_{ovp\ hysteresis}$ | | | | 0.35 | 0.6 | V |
| SYNC REFERENCE (SYNC) | | | | | | |
| V_{shth} | SYNC high threshold | | | 3.2 | | V |
| V_{slth} | SYNC low threshold | | | 0.75 | | V |
| I_{sync} | SYNC input current | | | | 3 | mA |
| V_{swake} | SYNC wake-up voltage | V_{sync} minimum pulse $> 1.5\mu\text{s}$ | 4.5 | 5.4 | 6 | V |
| Voltage Regulator REFERENCE (VR) | | | | | | |
| V_R | voltage | | 5.2 | | 5.4 | V |
| I_{VR} | VR Output Current | | | | 50 | mA |
| ON TIME DUTY SETUP (PIN 6) | | | | | | |
| $T_{on-time}$ | | Frequency= 10KHz-20KHz, Duty=20%~50% | | 26 | 32 | μs |
| MOSFET GATE DRIVER (MOSG-C) | | | | | | |
| V_{oh} | Output high voltage | $I_o = -200\text{mA}$ | 10.5 | 11.0 | | V |
| V_{ol} | Output low voltage | $I_o = 200\text{mA}$ | | 0.5 | 0.8 | V |
| T_d | Propagation delay | No load | 25 | 50 | 155 | nS |
| T_{pred_CCM} | Prediction time in CCM | The pred pin is open | | 200 | | nS |
| T_{pred_DCM} | Prediction time in DCM | The pred pin is open | | 800 | | ns |
| T_r | Rise time | Load = 1nF (*) | | 10 | 25 | nS |
| T_f | Fall time | Load = 1nF (*) | | 10 | 25 | nS |
| Dynamic Protect | | | | | | |
| Dt_CCM | Dynamic variable | Pin 4 , 25K Ω to GND (CCM) | | 500 | | nS |
| T_{on-min} | MOSG-C on time | PWM adjusts time $> Dt$ (CCM) | | 2.4 | | μs |
| Dt_DCM | Dynamic variable | Pin 4 , 25K Ω to GND (DCM) | | 1000 | | nS |
| T_{on-min} | MOSG-C on time | PWM adjusts time $> Dt$ (DCM) | | 0.45 | | μs |

(*) T_r & T_f are measured among 10% and 90% of starting and final voltage

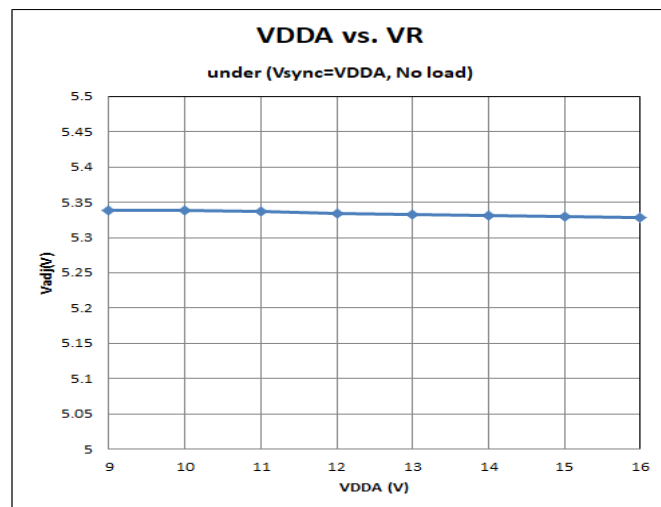
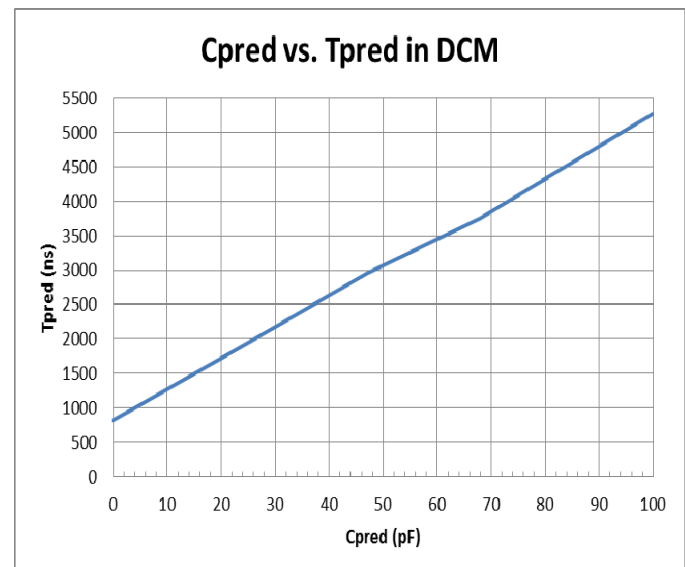
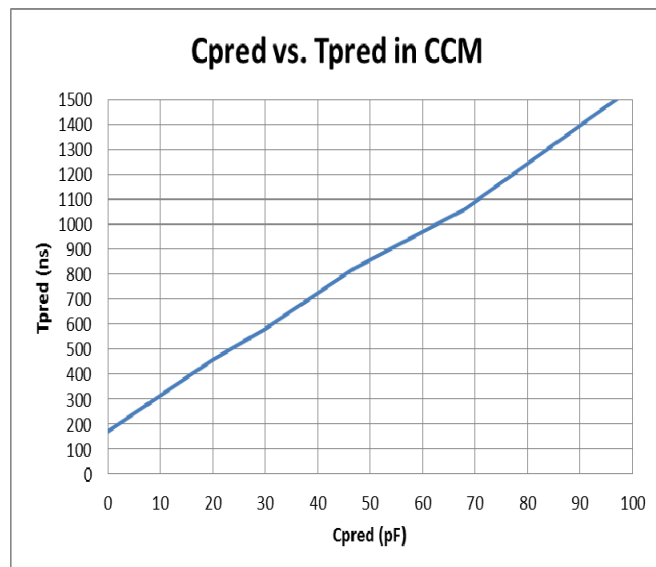
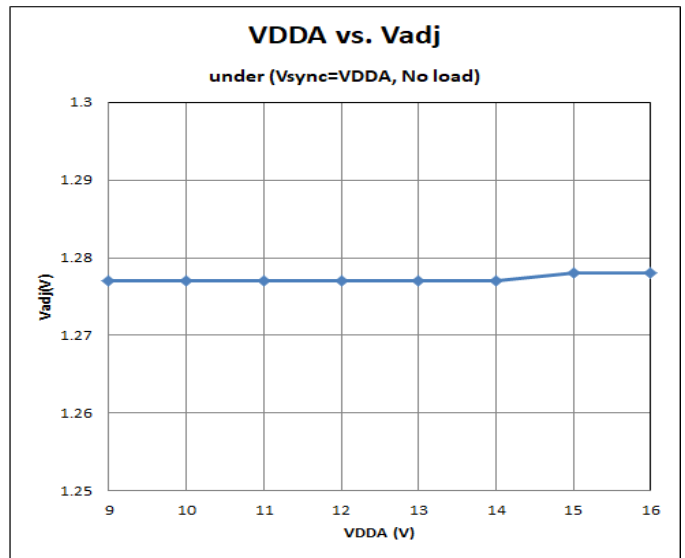
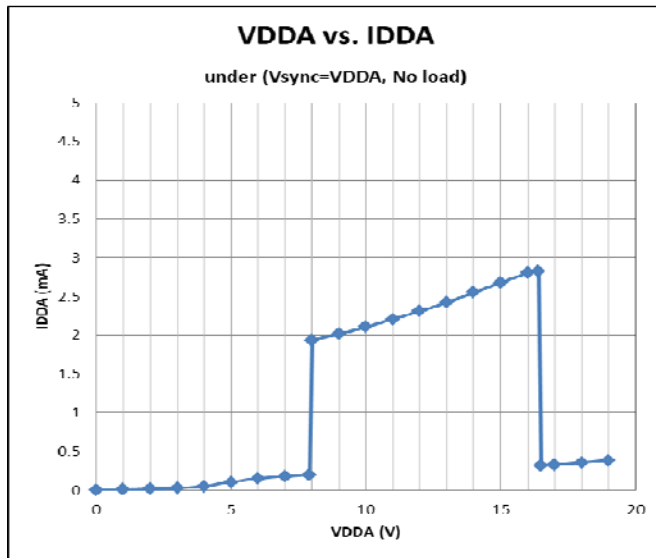




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PERFORMANCE CHARACTERISTICS



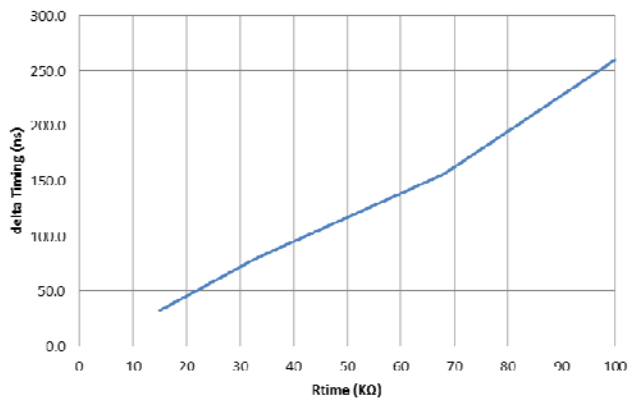


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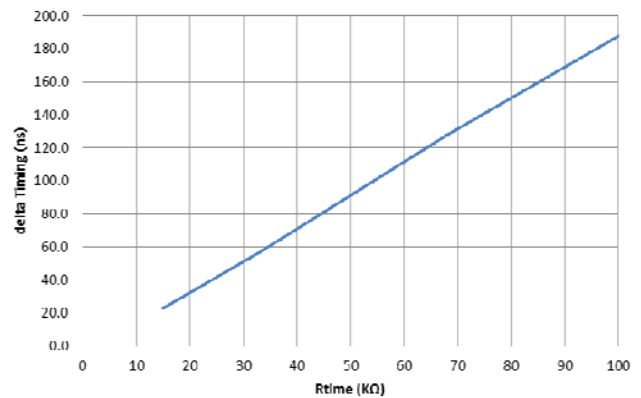
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PERFORMANCE CHARACTERISTICS

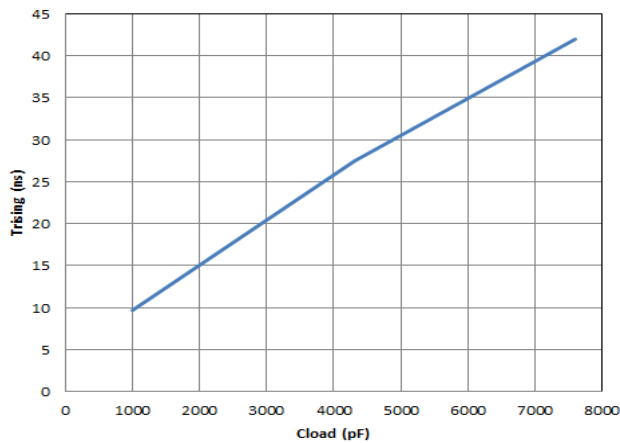
Rt vs. T set of Timing (rising 0.75V to 3.2V)



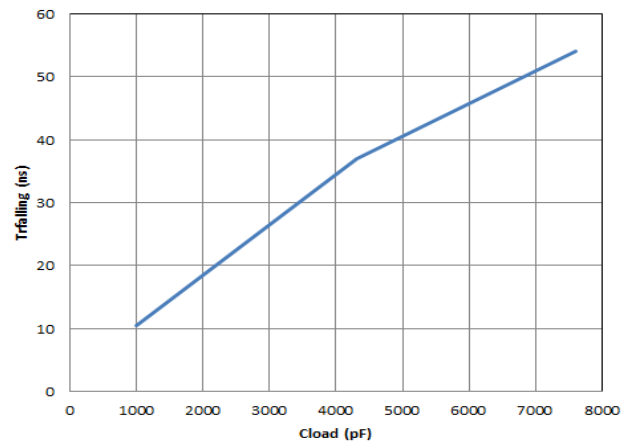
Rt vs. T set of Timing (Falling 3.2V to 0.75V)



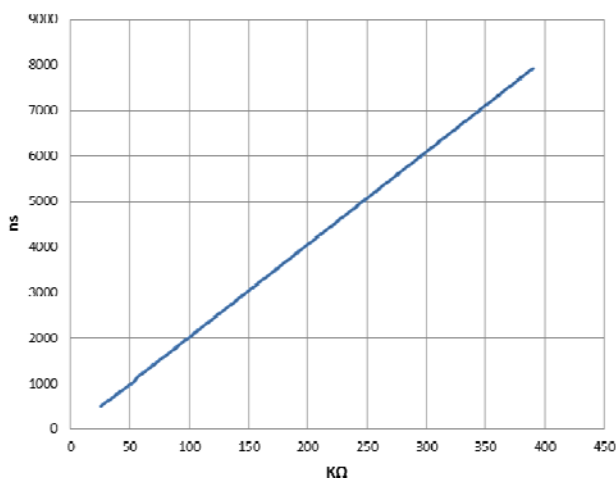
Output rising time vs. Load capacitance



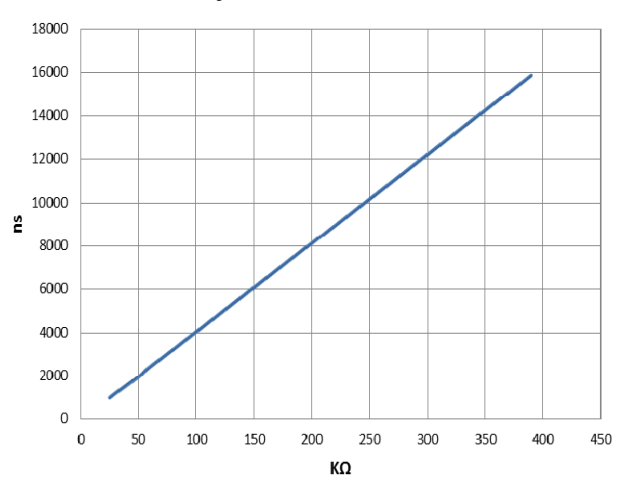
Output falling time vs. Load capacitance



Radj vs T1-T2 in CCM



Radj vs T1-T2 in DCM





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