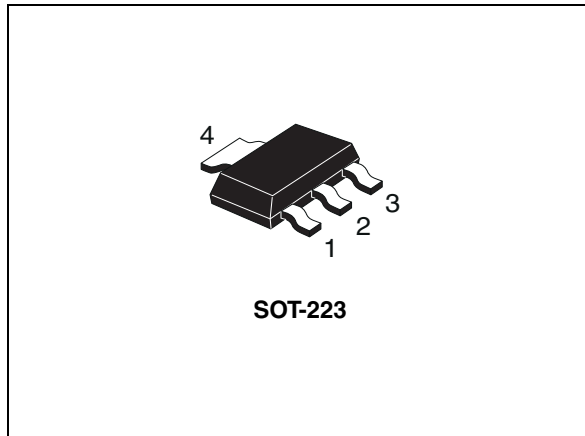


P-channel 60 V, 0.13 Ω typ., 3 A STripFET™ VI DeepGATE™ Power MOSFET in a SOT-223 package

Datasheet - production data



Features

| Order code | V _{DSS} | R _{DS(on)max} | I _D |
|------------|------------------|------------------------|----------------|
| STN3P6F6 | 60 V | 0.16 Ω @ 10 V | 3 A |

- R_{DS(on)} * Qg industry benchmark
- Extremely low on-resistance R_{DS(on)}
- High avalanche ruggedness
- Low gate drive power losses

Applications

- Switching applications

Description

This device is a P-channel Power MOSFET developed using the 6th generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R_{DS(on)} in all packages.

Figure 1. Internal schematic diagram

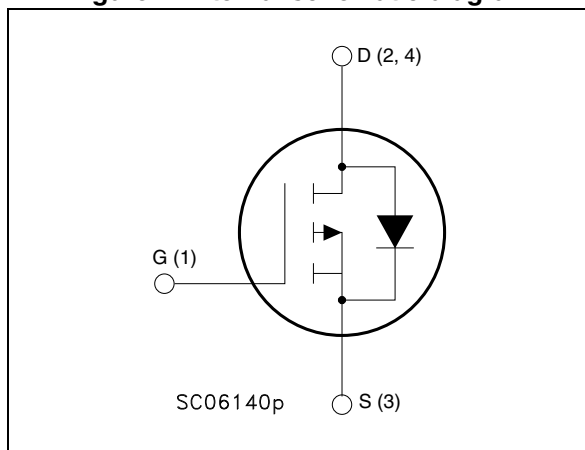


Table 1. Device summary

| Order code | Marking | Package | Packaging |
|------------|----------|---------|---------------|
| STN3P6F6 | STN3P6F6 | SOT-223 | Tape and reel |

Note: For the P-channel Power MOSFET the actual polarity of the voltages and the current must be reversed.

Contents

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1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|--------------------|---|------------|------------------|
| V_{DS} | Drain-source voltage | 60 | V |
| V_{GS} | Gate-source voltage | ± 20 | V |
| I_D | Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$ | 3 | A |
| I_D | Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$ | 2 | A |
| I_{DM} | Drain current (pulsed) | 12 | A |
| $P_{TOT}^{(1)}$ | Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$ | 2.6 | W |
| T_j P_{stg} | Operating junction temperature Storage temperature | -55 to 175 | $^\circ\text{C}$ |

1. Pulse width is limited by safe operating area.

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|---------------------|-------------------------------------|-------|--------------------|
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb max | 57 | $^\circ\text{C/W}$ |

1. When mounted on FR-4 board of 15 mm^2 , 2 Oz Cu, $t < 10\text{ sec}$

Note: For the P-channel Power MOSFET actual polarity of voltages and current has to be reversed.

2 Electrical characteristics

(T_{case} = 25 °C unless otherwise specified).

Table 4. On /off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------|---|---|------|------|---------|----------|
| V _{(BR)DSS} | Drain-source breakdown voltage (V _{GS} = 0) | I _D = 250 μA | 60 | | | V |
| I _{DSS} | Zero gate voltage drain current (V _{GS} = 0) | V _{DS} = 60 V V _{DS} = 60 V, T _C = 125 °C | | | 1 10 | μA μA |
| I _{GSS} | Gate-body leakage current (V _{DS} = 0) | V _{GS} = ± 20 V | | | ±100 | nA |
| V _{GS(th)} | Gate threshold voltage | V _{DS} = V _{GS} , I _D = 250 μA | 2 | | 4 | V |
| R _{DS(on)} | Static drain-source on-resistance | V _{GS} = 10 V, I _D = 1.5 A | | 0.13 | 0.16 | Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------------|------------------------------|---|------|------|------|------|
| C _{iss} | Input capacitance | V _{DS} = 48 V, f = 1 MHz, V _{GS} = 0 | - | 340 | - | pF |
| C _{oss} | Output capacitance | | | 40 | | pF |
| C _{rss} | Reverse transfer capacitance | | | 20 | | pF |
| Q _g | Total gate charge | V _{DD} = 48 V, I _D = 3 A, | - | 6.4 | - | nC |
| Q _{gs} | Gate-source charge | V _{GS} = 10 V | | 1.7 | | nC |
| Q _{gd} | Gate-drain charge | (see Figure 14) | | 1.7 | | nC |

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------------|---------------------|---|------|------|------|------|
| t _{d(on)} | Turn-on delay time | V _{DD} = 48 V, I _D = 1.5 A, R _G = 4.7 Ω, V _{GS} = 10 V (see Figure 13) | - | 6.4 | - | ns |
| t _r | Rise time | | | 5.3 | | ns |
| t _{d(off)} | Turn-off delay time | | | 14 | | ns |
| t _f | Fall time | | | 3.7 | | ns |

Note: For the P-channel Power MOSFET actual polarity of voltages and current has to be reversed.

Table 7. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|---|------|------|------|------|
| I_{SD} | Source-drain current | | - | | 3 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 12 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 3\text{ A}, V_{GS} = 0$ | - | | 1.1 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$ | - | 20 | | ns |
| Q_{rr} | Reverse recovery charge | $V_{DD} = 16\text{ V}, T_j = 150\text{ }^\circ\text{C}$ | - | 17.8 | | nC |
| I_{RRM} | Reverse recovery current | (see Figure 15) | - | 1.8 | | A |

1. Pulse width limited by safe operating area.
2. Pulse duration = 300 μs , duty cycle 1.5%

Note: For the P-channel Power MOSFET actual polarity of voltages and current has to be reversed.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

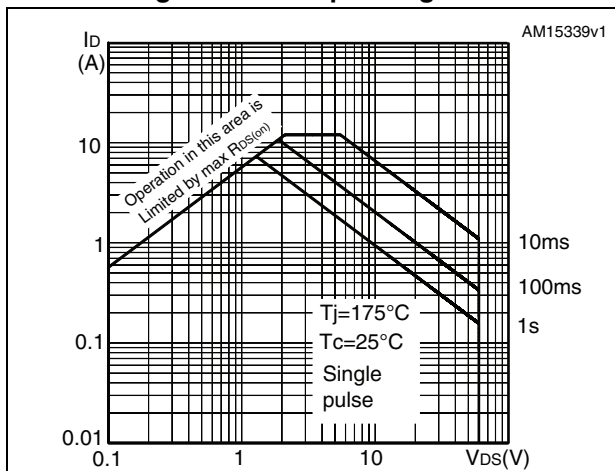


Figure 3. Thermal impedance

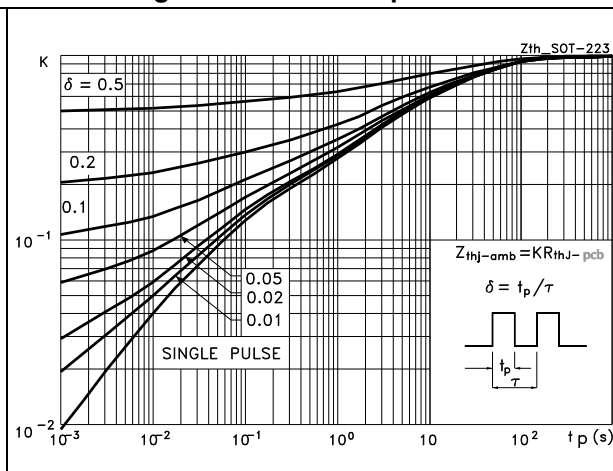


Figure 4. Output characteristics

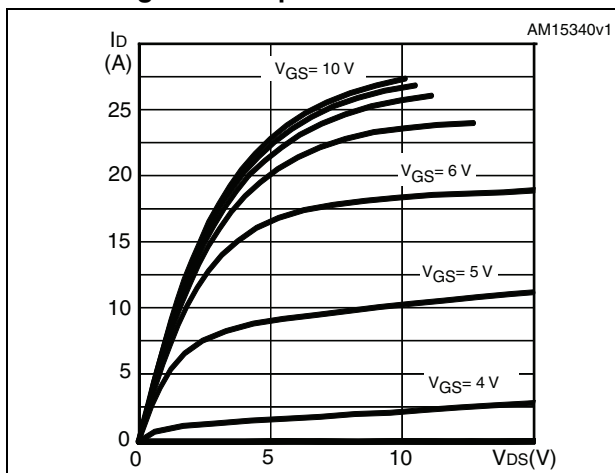


Figure 5. Transfer characteristics

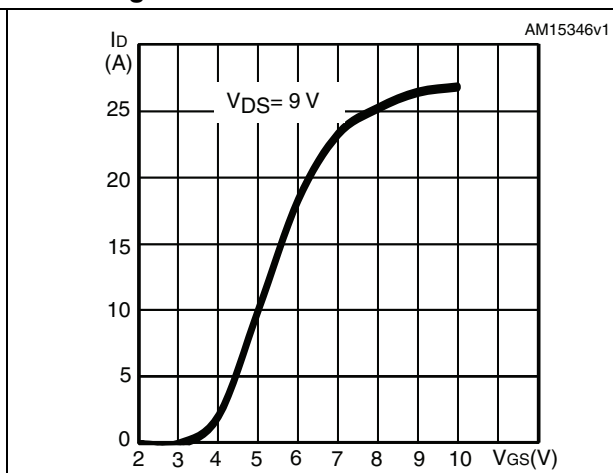


Figure 6. Gate charge vs gate-source voltage

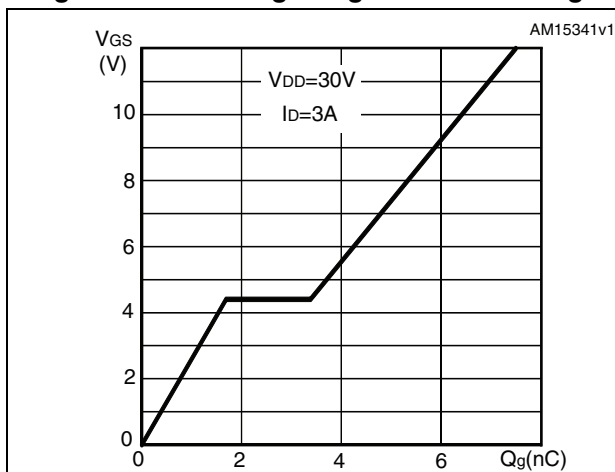


Figure 7. Static drain-source on-resistance

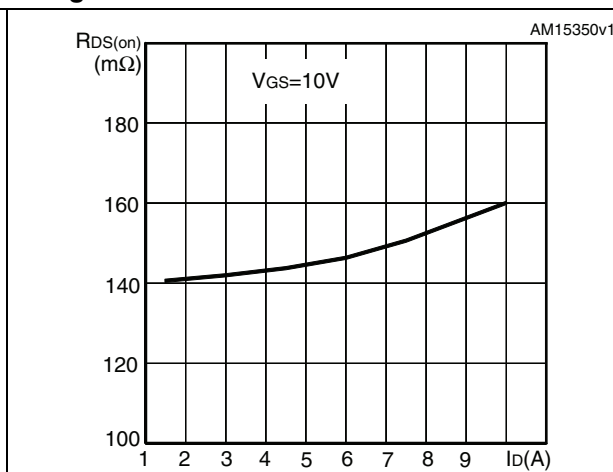


Figure 8. Capacitance variations

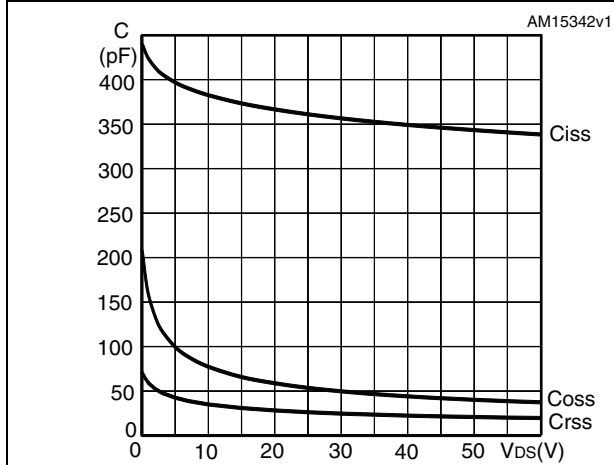


Figure 9. Normalized B_{VDSS} vs temperature

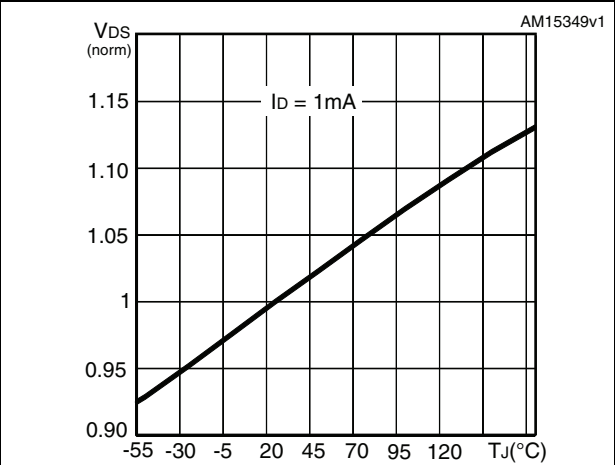


Figure 10. Normalized gate threshold voltage vs temperature

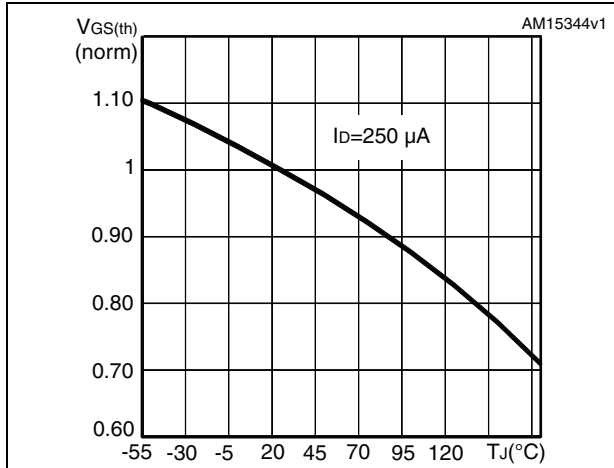


Figure 11. Normalized on-resistance vs temperature

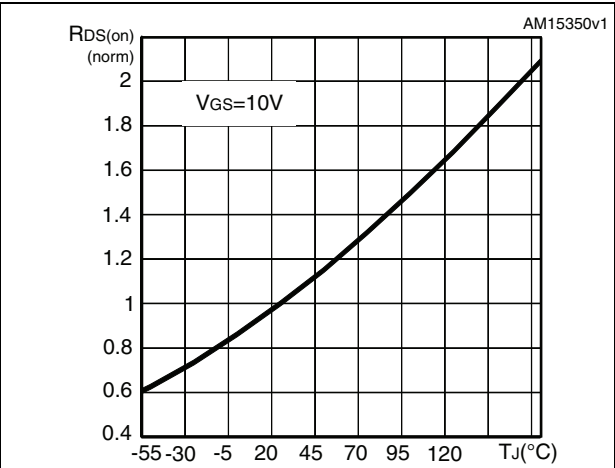
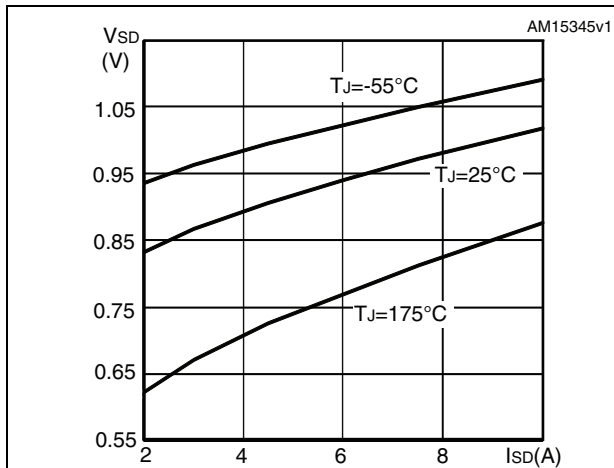


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

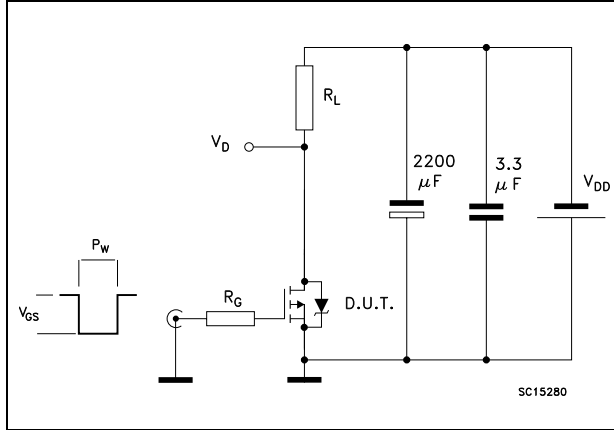


Figure 14. Gate charge test circuit

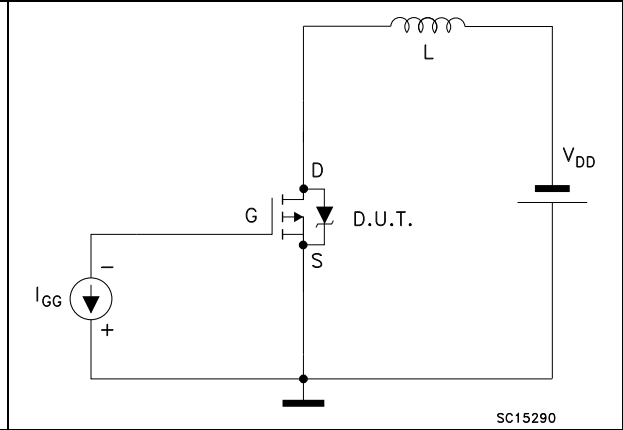
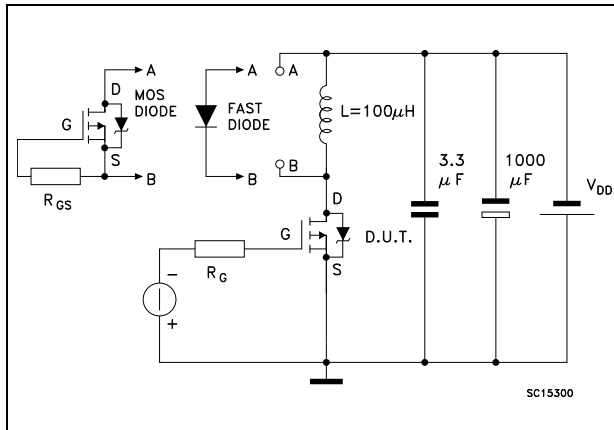


Figure 15. Test circuit for inductive load switching and diode recovery times



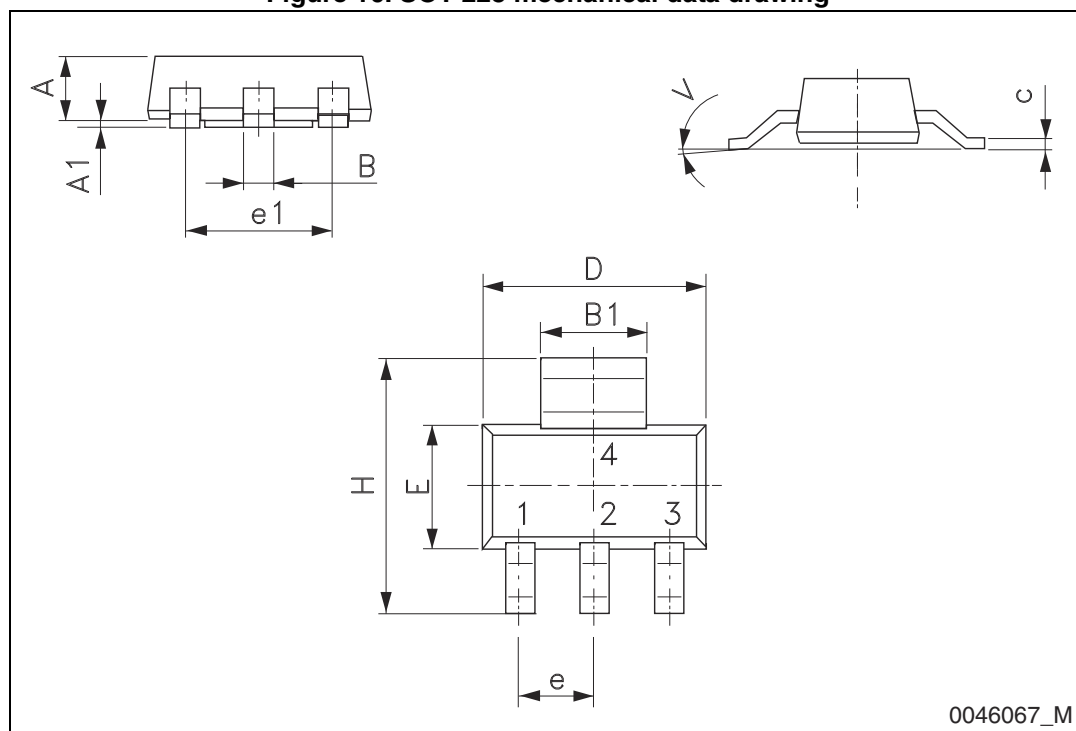
4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK[®] is an ST trademark.

Table 8. SOT-223 mechanical data

| Dim. | mm | | |
|------|------|------|------|
| | Min. | Typ. | Max. |
| A | | | 1.80 |
| A1 | 0.02 | | 0.1 |
| B | 0.60 | 0.70 | 0.85 |
| B1 | 2.90 | 3.00 | 3.15 |
| c | 0.24 | 0.26 | 0.35 |
| D | 6.30 | 6.50 | 6.70 |
| e | | 2.30 | |
| e1 | | 4.60 | |
| E | 3.30 | 3.50 | 3.70 |
| H | 6.70 | 7.00 | 7.30 |
| V | | | 10° |

Figure 16. SOT-223 mechanical data drawing



5 Revision history

Table 9. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 31-Oct-2012 | 1 | First release. |
| 09-Nov-2012 | 2 | Modified: note 1 in Table 3 |
| 16-Jan-2013 | 3 | Document status promoted from preliminary data to production data |
| 14-Mar-2013 | 4 | Modified: Figure 1, 3 , C_{ISS} , C_{OSS} , C_{RSS} typical values in Table 5 |

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