

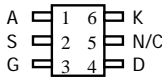
## N-Channel Enhancement Mode Field Effect Transistor with Schottky Diode

### General Description

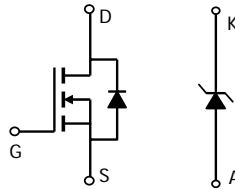
The AO6706 uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. A Schottky diode is provided to facilitate the implementation of a bidirectional blocking switch, or for DC-DC conversion applications.

### Features

$V_{DS}$  (V) = 20V  
 $I_D = 6.0A$  ( $V_{GS} = 4.5V$ )  
 $R_{DS(ON)} < 26m\Omega$  ( $V_{GS} = 4.5V$ )  
 $R_{DS(ON)} < 35m\Omega$  ( $V_{GS} = 2.5V$ )  
 $R_{DS(ON)} < 45m\Omega$  ( $V_{GS} = 1.8V$ )  
**SCHOTTKY**  
 $V_{DS}$  (V) = 20V,  $I_F = 1A$ ,  $V_F < 0.5V@0.5A$



TSOP6



### Absolute Maximum Ratings $T_A=25^\circ C$ unless otherwise noted

| Parameter                               | Symbol         | MOSFET           | Schottky   | Units      |   |
|---|----------------|------------------|------------|------------|---|
| Drain-Source Voltage                    | $V_{DS}$       | 20               |            | V          |   |
| Gate-Source Voltage                     | $V_{GS}$       | $\pm 8$          |            | V          |   |
| Continuous Drain Current <sup>A</sup>   | $I_D$          | $T_A=25^\circ C$ | 6.0        | A          |   |
|   |                | $T_A=70^\circ C$ | 4.5        |            |   |
| Pulsed Drain Current <sup>B</sup>       | $I_{DM}$       | 18               |            |            |   |
| Schottky reverse voltage                | $V_{KA}$       |                  | 20         | V          |   |
| Continuous Forward Current <sup>A</sup> | $I_F$          | $T_A=25^\circ C$ | 2          | A          |   |
|   |                | $T_A=70^\circ C$ | 1          |            |   |
| Pulsed Forward Current <sup>B</sup>     | $I_{FM}$       |                  | 10         |            |   |
| Power Dissipation                       | $P_D$          | $T_A=25^\circ C$ | 1.50       | 1.0        | W |
|   |                | $T_A=70^\circ C$ | 0.9        | 0.6        |   |
| Junction and Storage Temperature Range  | $T_J, T_{STG}$ | -55 to 150       | -55 to 150 | $^\circ C$ |   |

| Parameter: Thermal Characteristics MOSFET |              | Symbol          | Typ   | Max | Units        |
|---|--------------|-----------------|-------|-----|--------------|
| Maximum Junction-to-Ambient <sup>A</sup>  | $t \leq 10s$ | $R_{\theta JA}$ | 80.3  | 110 | $^\circ C/W$ |
| Maximum Junction-to-Ambient <sup>A</sup>  | Steady-State |                 | 117   | 150 |              |
| Maximum Junction-to-Lead <sup>C</sup>     | Steady-State | $R_{\theta JL}$ | 43    | 80  |              |
| Thermal Characteristics Schottky          |              |                 |       |     |              |
| Maximum Junction-to-Ambient <sup>A</sup>  | $t \leq 10s$ | $R_{\theta JA}$ | 109.4 | 135 | $^\circ C/W$ |
| Maximum Junction-to-Ambient <sup>A</sup>  | Steady-State |                 | 136.5 | 175 |              |
| Maximum Junction-to-Lead <sup>C</sup>     | Steady-State | $R_{\theta JL}$ | 58.5  | 80  |              |

Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

| Symbol                      | Parameter                             | Conditions   | Min                                 | Typ      | Max    | Units |
|-----------------------------|---------------------------------------|--|-------------------------------------|----------|--------|-------|
| <b>STATIC PARAMETERS</b>    |                                       |  |                                     |          |        |       |
| BV <sub>DSS</sub>           | Drain-Source Breakdown Voltage        | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V   | 20                                  |          |        | V     |
| I <sub>DSS</sub>            | Zero Gate Voltage Drain Current       | V <sub>DS</sub> =16V, V <sub>GS</sub> =0V<br>T <sub>J</sub> =55°C                        |                                     |          | 1<br>5 | μA    |
| I <sub>GSS</sub>            | Gate-Body leakage current             | V <sub>DS</sub> =0V, V <sub>GS</sub> =±8V  |                                     |          | 100    | nA    |
| V <sub>GS(th)</sub>         | Gate Threshold Voltage                | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                 | 0.4                                 |          | 1.5    | V     |
| I <sub>D(ON)</sub>          | On state drain current                | V <sub>GS</sub> =4.5V, V <sub>DS</sub> =5V   | 10                                  |          |        | A     |
| R <sub>DS(ON)</sub>         | Static Drain-Source On-Resistance     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =3.8A<br>T <sub>J</sub> =125°C                     |                                     | 23<br>42 |        | mΩ    |
|                             |                                       | V <sub>GS</sub> =2.5V, I <sub>D</sub> =3.3A  |                                     | 27       |        | mΩ    |
|                             |                                       | V <sub>GS</sub> =1.8V, I <sub>D</sub> =2.8A  |                                     | 40       |        | mΩ    |
| g <sub>FS</sub>             | Forward Transconductance              | V <sub>DS</sub> =5V, I <sub>D</sub> =3.8A  |                                     | 10.5     |        | S     |
| V <sub>SD</sub>             | Diode Forward Voltage                 | I <sub>S</sub> =1A, V <sub>GS</sub> =0V  |                                     | 0.8      | 1      | V     |
| I <sub>S</sub>              | Maximum Body-Diode Continuous Current |  |                                     |          | 1.8    | A     |
| <b>DYNAMIC PARAMETERS</b>   |                                       |  |                                     |          |        |       |
| C <sub>iss</sub>            | Input Capacitance                     | V <sub>GS</sub> =0V, V <sub>DS</sub> =10V, f=1MHz  |                                     | 449      |        | pF    |
| C <sub>oss</sub>            | Output Capacitance                    |  |                                     | 74       |        | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance          |  |                                     | 51.6     |        | pF    |
| R <sub>g</sub>              | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz   |                                     | 4.9      |        | Ω     |
| <b>SWITCHING PARAMETERS</b> |                                       |  |                                     |          |        |       |
| Q <sub>g</sub>              | Total Gate Charge                     | V <sub>GS</sub> =4.5V, V <sub>DS</sub> =10V, I <sub>D</sub> =3.8A                        |                                     | 5.9      |        | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    |  |                                     | 0.36     |        | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |  |                                     | 1.3      |        | nC    |
| t <sub>D(on)</sub>          | Turn-On Delay Time                    | V <sub>GS</sub> =5V, V <sub>DS</sub> =10V, R <sub>L</sub> =2.6Ω,<br>R <sub>GEN</sub> =0Ω |                                     | 4.5      |        | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                     |  |                                     | 6        |        | ns    |
| t <sub>D(off)</sub>         | Turn-Off Delay Time                   |  |                                     | 32.7     |        | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                    |  |                                     | 7.1      |        | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      |  | I <sub>F</sub> =3.8A, dI/dt=100A/μs |          | 13     |       |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =3.8A, dI/dt=100A/μs  |                                     | 3.3      |        | nC    |
| <b>SCHOTTKY PARAMETERS</b>  |                                       |  |                                     |          |        |       |
| V <sub>F</sub>              | Forward Voltage Drop                  | I <sub>F</sub> =0.5A   |                                     | 0.39     | 0.5    | V     |
| I <sub>rm</sub>             | Maximum reverse leakage current       | V <sub>R</sub> =16V  |                                     |          | 0.02   | mA    |
|                             |                                       | V <sub>R</sub> =16V, T <sub>J</sub> =125°C   |                                     |          | 20     |       |
| C <sub>T</sub>              | Junction Capacitance                  | V <sub>R</sub> =10V  |                                     | 34       |        | pF    |
| t <sub>rr</sub>             | Schottky Reverse Recovery Time        | I <sub>F</sub> =1A, dI/dt=100A/μs  |                                     | 5.2      | 10     | ns    |
| Q <sub>rr</sub>             | Schottky Reverse Recovery Charge      | I <sub>F</sub> =1A, dI/dt=100A/μs  |                                     | 0.8      |        | nC    |

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The value in any given application depends on the user's specific board design. The current rating is based on the t ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C: The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

D: The static characteristics in Figures 1 to 6 are obtained using 80μs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

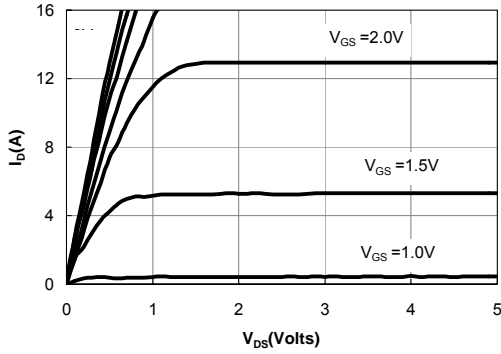


Figure 1: On-Regions Characteristics

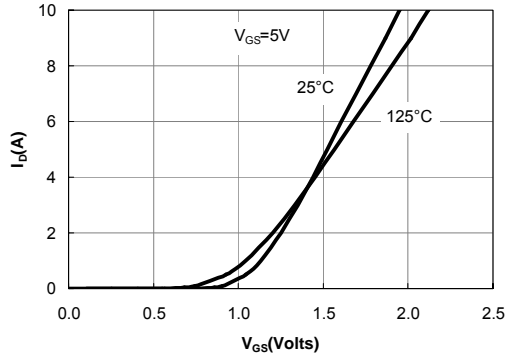


Figure 2: Transfer Characteristics

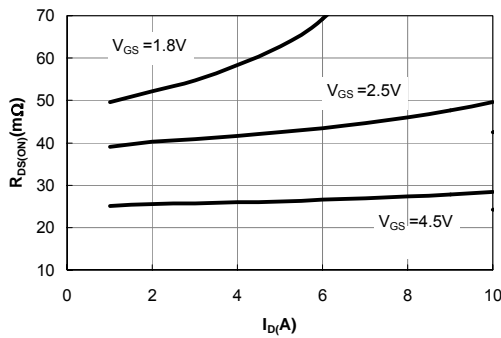


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

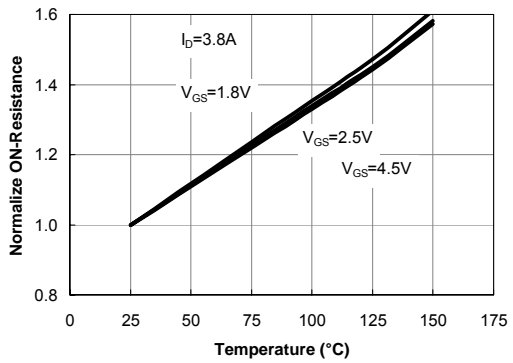


Figure 4: On-Resistance vs. Junction Temperature

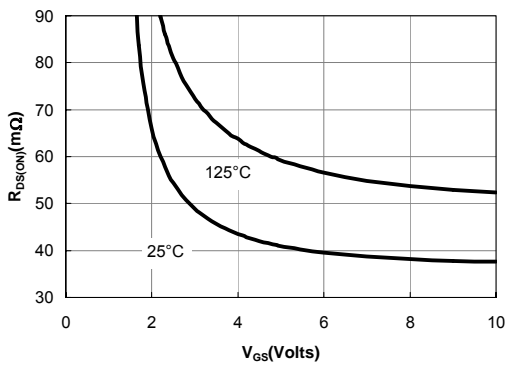


Figure 5: On-Resistance vs. Gate-Source Voltage

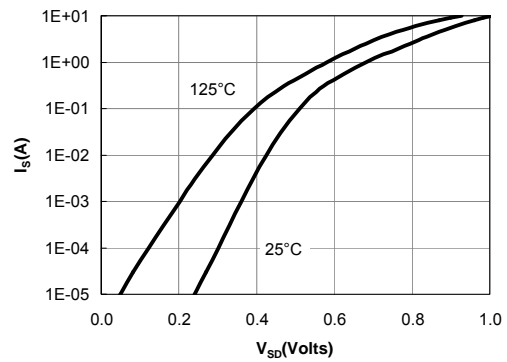


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

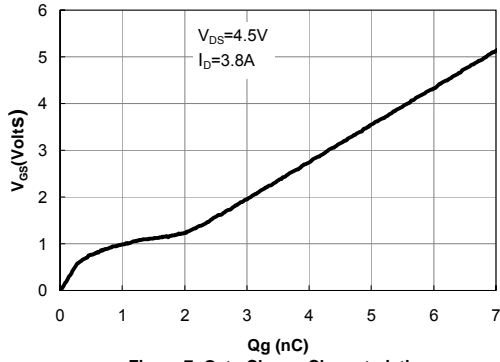


Figure 7: Gate-Charge Characteristics

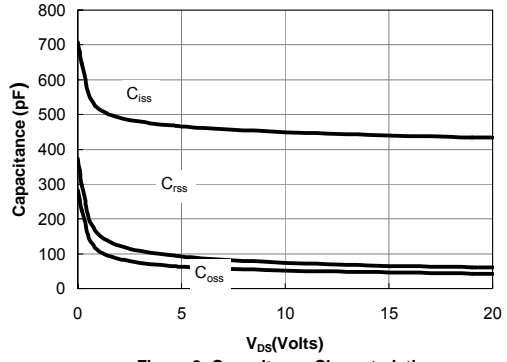


Figure 8: Capacitance Characteristics

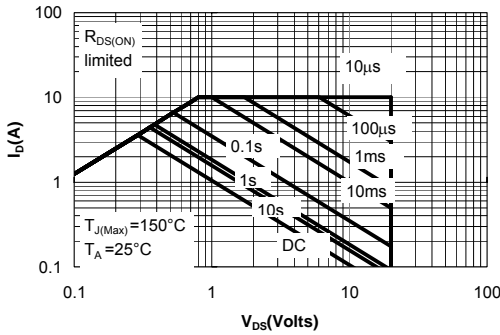


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

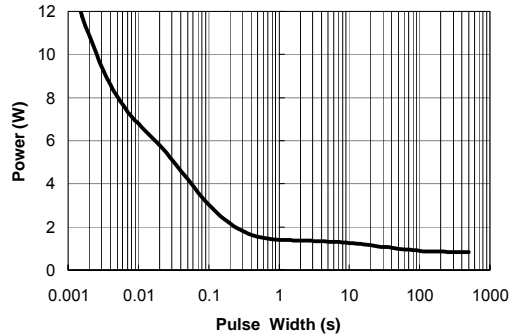


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

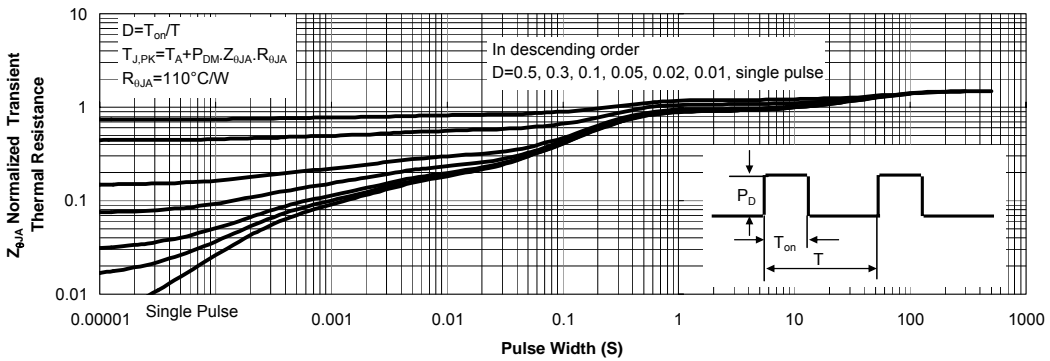


Figure 11: Normalized Maximum Transient Thermal Impedance

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: SCHOTTKY

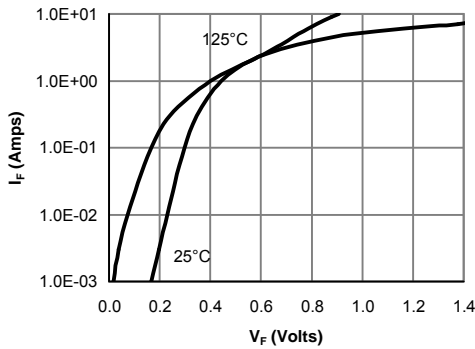


Figure 12: Schottky Forward Characteristics

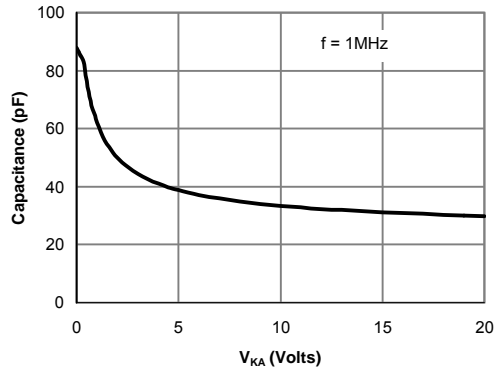


Figure 13: Schottky Capacitance Characteristics

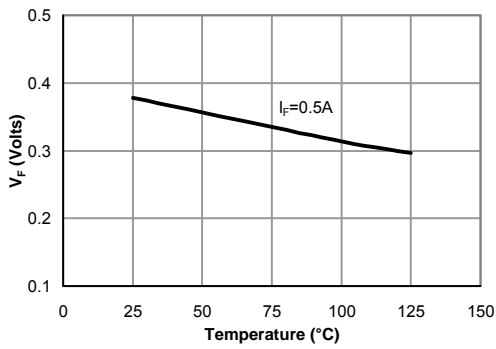


Figure 14: Schottky Forward Drop vs. Junction Temperature

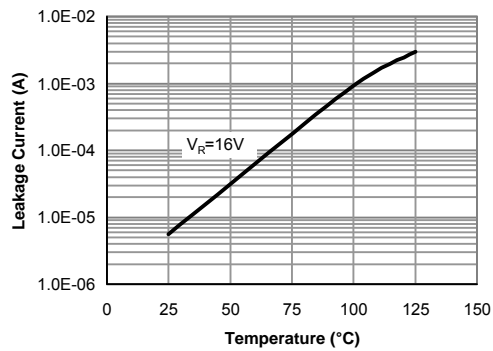


Figure 15: Schottky Leakage current vs. Junction Temperature

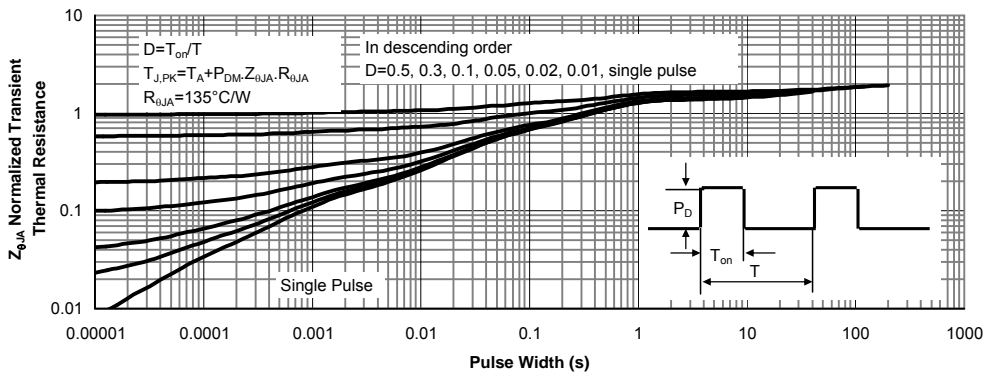
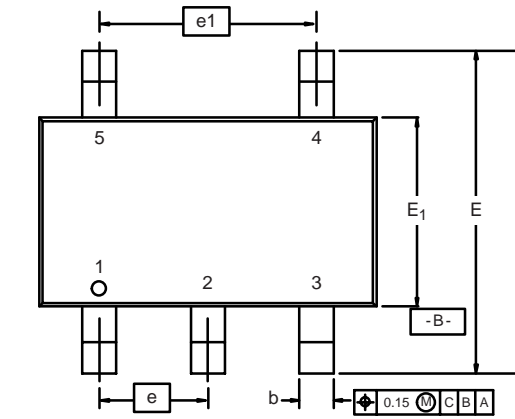


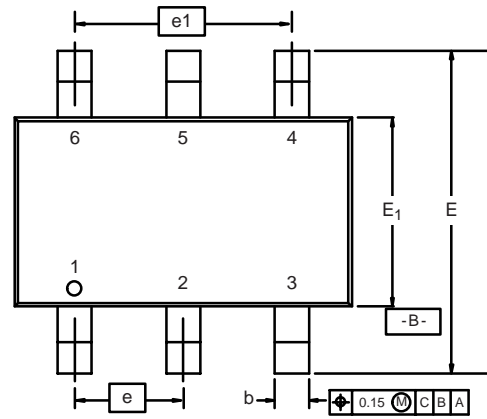
Figure 15: Schottky Normalized Maximum Transient Thermal Impedance

**TSOP: 5/6-LEAD**

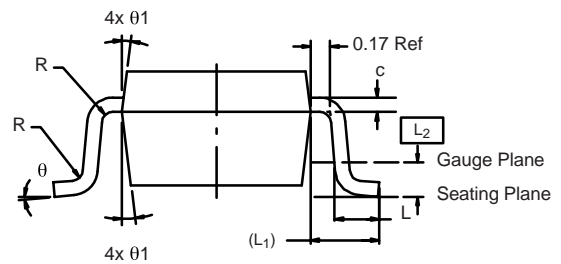
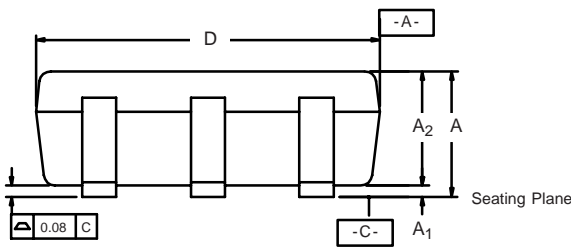
JEDEC Part Number: MO-193C



**5-LEAD TSOP**



**6-LEAD TSOP**



| Dim                            | MILLIMETERS |      |      | INCHES     |       |       |
|--------------------------------|-------------|------|------|------------|-------|-------|
|                                | Min         | Nom  | Max  | Min        | Nom   | Max   |
| A                              | 0.91        | -    | 1.10 | 0.036      | -     | 0.043 |
| A <sub>1</sub>                 | 0.01        | -    | 0.10 | 0.0004     | -     | 0.004 |
| A <sub>2</sub>                 | 0.90        | -    | 1.00 | 0.035      | 0.038 | 0.039 |
| b                              | 0.30        | 0.32 | 0.45 | 0.012      | 0.013 | 0.018 |
| c                              | 0.10        | 0.15 | 0.20 | 0.004      | 0.006 | 0.008 |
| D                              | 2.95        | 3.05 | 3.10 | 0.116      | 0.120 | 0.122 |
| E                              | 2.70        | 2.85 | 2.98 | 0.106      | 0.112 | 0.117 |
| E <sub>1</sub>                 | 1.55        | 1.65 | 1.70 | 0.061      | 0.065 | 0.067 |
| e                              | 0.95 BSC    |      |      | 0.0374 BSC |       |       |
| e <sub>1</sub>                 | 1.80        | 1.90 | 2.00 | 0.071      | 0.075 | 0.079 |
| L                              | 0.32        | -    | 0.50 | 0.012      | -     | 0.020 |
| L <sub>1</sub>                 | 0.60 Ref    |      |      | 0.024 Ref  |       |       |
| L <sub>2</sub>                 | 0.25 BSC    |      |      | 0.010 BSC  |       |       |
| R                              | 0.10        | -    | -    | 0.004      | -     | -     |
| θ                              | 0°          | 4°   | 8°   | 0°         | 4°    | 8°    |
| θ <sub>1</sub>                 | 7° Nom      |      |      | 7° Nom     |       |       |
| ECN: C-06593-Rev. I, 18-Dec-06 |             |      |      |            |       |       |
| DWG: 5540                      |             |      |      |            |       |       |

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