



## Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

| Parameter                                        | Symbol            | Value                   | Unit |
|--------------------------------------------------|-------------------|-------------------------|------|
| Drain-source Voltage                             | V <sub>DSS</sub>  | 650                     | V    |
| Drain-Gate Voltage (R <sub>GS</sub> =1MΩ)        | V <sub>DGR</sub>  | 650                     | V    |
| Gate-Source (GND) Voltage                        | V <sub>GS</sub>   | ±30                     | V    |
| Drain Current Pulsed <sup>(2)</sup>              | I <sub>DM</sub>   | 15                      | ADC  |
| Single Pulsed Avalanche Energy <sup>(3)</sup>    | E <sub>AS</sub>   | 370                     | mJ   |
| Avalanch Current <sup>(4)</sup>                  | I <sub>AS</sub>   | 17                      | A    |
| Continuous Drain Current (T <sub>c</sub> = 25°C) | I <sub>D</sub>    | 3.8                     | ADC  |
| Continuous Drain Current (T <sub>C</sub> =100°C) | I <sub>D</sub>    | 2.4                     | ADC  |
| Supply Voltage                                   | V <sub>CC</sub>   | 40                      | V    |
| Analog Input Voltage Range                       | V <sub>sync</sub> | -0.3 to 13V             | V    |
|                                                  | V <sub>FB</sub>   | -0.3 to V <sub>CC</sub> | V    |
| Total Power Dissipation                          | P <sub>D</sub>    | 45                      | W    |
| Operating Junction Temperature                   | T <sub>J</sub>    | +150                    | °C   |
| Operating Ambient Temperature                    | T <sub>A</sub>    | -25 to +85              | °C   |
| Storage Temperature Range                        | T <sub>STG</sub>  | -55 to +150             | °C   |
| Thermal Resistance                               | R <sub>thjc</sub> | 2.98                    | °C/W |
| ESD Capability, HBM Model (All pins)             | -                 | 2.0                     | kV   |
| ESD Capability, Machine Model (All pins)         | -                 | 300                     | V    |

### Notes:

1. T<sub>j</sub> = 25°C to 150°C
2. Repetitive rating: Pulse width limited by maximum junction temperature
3. L = 30mH, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, starting T<sub>j</sub> = 25°C
4. L = 13uH, starting T<sub>j</sub> = 25°C

## Electrical Characteristics (SFET Part)

(Ta=25°C unless otherwise specified)

| Parameter                                           | Symbol              | Condition                                                                                                                                                                      | Min. | Typ. | Max. | Unit |
|-----------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Drain-Source Breakdown Voltage                      | BV <sub>DSS</sub>   | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                                                                                                                                   | 650  | -    | -    | V    |
| Zero Gate Voltage Drain Current                     | I <sub>DSS</sub>    | V <sub>DS</sub> = Max, Rating, V <sub>GS</sub> = 0V                                                                                                                            | -    | -    | 200  | μA   |
|                                                     |                     | V <sub>DS</sub> = 0.8*Max., Rating<br>V <sub>GS</sub> = 0V, T <sub>C</sub> = 85°C                                                                                              | -    | -    | 300  | μA   |
| Static Drain-source on Resistance <sup>(Note)</sup> | R <sub>DS(ON)</sub> | V <sub>GS</sub> = 10V, I <sub>D</sub> = 2.3A                                                                                                                                   | -    | 1.4  | 1.6  | Ω    |
| Input Capacitance                                   | C <sub>iss</sub>    | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V,<br>f = 1MHz                                                                                                                       | -    | 1415 | -    | pF   |
| Output Capacitance                                  | C <sub>oss</sub>    |                                                                                                                                                                                | -    | 100  | -    |      |
| Reverse Transfer Capacitance                        | C <sub>rss</sub>    |                                                                                                                                                                                | -    | 15   | -    |      |
| Turn on Delay Time                                  | t <sub>d(on)</sub>  | V <sub>DD</sub> = 0.5BV <sub>DSS</sub> , I <sub>D</sub> = 7.0A<br>(MOSFET switching<br>time are essentially<br>independent of operating<br>temperature)                        | -    | 25   | -    | nS   |
| Rise Time                                           | t <sub>r</sub>      |                                                                                                                                                                                | -    | 60   | -    |      |
| Turn Off Delay Time                                 | t <sub>d(off)</sub> |                                                                                                                                                                                | -    | 110  | -    |      |
| Fall Time                                           | t <sub>f</sub>      |                                                                                                                                                                                | -    | 65   | -    |      |
| Total Gate Charge<br>(Gate-Source+Gate-Drain)       | Q <sub>g</sub>      | V <sub>GS</sub> = 10V, I <sub>D</sub> = 7.0A,<br>V <sub>DS</sub> = 0.5B V <sub>DSS</sub> (MOSFET<br>Switching time are Essentially<br>independent of operating<br>temperature) | -    | 40   | -    | nC   |
| Gate-Source Charge                                  | Q <sub>gs</sub>     |                                                                                                                                                                                | -    | 7    | -    |      |
| Gate-Drain (Miller) Charge                          | Q <sub>gd</sub>     |                                                                                                                                                                                | -    | 12   | -    |      |

### Note:

1. Pulse test : Pulse width ≤ 300μS, duty ≤ 2%

**Electrical Characteristics** (Continued)

(Ta=25°C unless otherwise specified)

| Parameter                          | Symbol              | Condition                            | Min. | Typ. | Max. | Unit |
|------------------------------------|---------------------|--------------------------------------|------|------|------|------|
| <b>UVLO SECTION</b>                |                     |                                      |      |      |      |      |
| Start Threshold Voltage            | V <sub>START</sub>  | V <sub>FB</sub> = GND                | 14   | 15   | 16   | V    |
| Stop Threshold Voltage             | V <sub>STOP</sub>   | V <sub>FB</sub> = GND                | 8    | 9    | 10   | V    |
| <b>SENSEFET SECTION</b>            |                     |                                      |      |      |      |      |
| Drain To PKG Breakdown Voltage     | BV <sub>pkg</sub>   | 60HZ AC, Ta = 25°C                   | 3500 | -    | -    | V    |
| Drain To Source Breakdown Voltage  | BV <sub>dss</sub>   | Ta = 25°C                            | 650  | -    | -    | V    |
| Drain To Source Leakage Current    | I <sub>dss</sub>    | V <sub>drain</sub> = 400V, Ta = 25°C | -    | -    | 200  | uA   |
| <b>OSCILLATOR SECTION</b>          |                     |                                      |      |      |      |      |
| Initial Frequency                  | F <sub>OSC</sub>    | -                                    | 18   | 20   | 22   | kHz  |
| Voltage Stability                  | F <sub>STABLE</sub> | 12V ≤ V <sub>cc</sub> ≤ 23V          | 0    | 1    | 3    | %    |
| Temperature Stability (Note2)      | ΔF <sub>OSC</sub>   | -25°C ≤ Ta ≤ 85°C                    | 0    | ±5   | ±10  | %    |
| Maximum Duty Cycle                 | D <sub>MAX</sub>    | -                                    | 92   | 95   | 98   | %    |
| Minimum Duty Cycle                 | D <sub>MIN</sub>    | -                                    | -    | -    | 0    | %    |
| <b>FEEDBACK SECTION</b>            |                     |                                      |      |      |      |      |
| Feedback Source Current            | I <sub>FB</sub>     | V <sub>FB</sub> = GND                | 0.7  | 0.9  | 1.1  | mA   |
| Shutdown Feedback Voltage          | V <sub>SD</sub>     | V <sub>fb</sub> ≥ 6.9V               | 6.9  | 7.5  | 8.1  | V    |
| Shutdown Delay Current             | I <sub>DELAY</sub>  | V <sub>FB</sub> = 5V                 | 4    | 5    | 6    | μA   |
| <b>PROTECTION SECTION</b>          |                     |                                      |      |      |      |      |
| Over Voltage Protection            | V <sub>OVP</sub>    | V <sub>sync</sub> ≥ 11V              | 11   | 12   | 13   | V    |
| Over Current Latch Voltage (Note2) | V <sub>OCL</sub>    | -                                    | 0.9  | 1.0  | 1.1  | V    |
| Thermal Shutdown Temp.             | T <sub>SD</sub>     | -                                    | 140  | 160  | -    | °C   |

**Note:**

1. These parameters is the current flowing in the Control IC.
2. These parameters, although guaranteed, are tested in EDS(wafer test) process.
3. These parameters indicate Inductor Current.

**Electrical Characteristics** (Continued)

(Ta=25°C unless otherwise specified)

| Parameter                                    | Symbol   | Condition                         | Min. | Typ. | Max. | Unit |
|----------------------------------------------|----------|-----------------------------------|------|------|------|------|
| <b>Sync SECTION</b>                          |          |                                   |      |      |      |      |
| Normal Sync High Threshold Voltage           | VNSH     | Vcc = 16V, Vfb = 5V               | 4.0  | 4.6  | 5.2  | V    |
| Normal Sync Low Threshold Voltage            | VNSL     | Vcc = 16V, Vfb = 5V               | 2.3  | 2.6  | 2.9  | V    |
| Burst Sync High Threshold Voltage            | VBSH     | Vcc = 10.5V, Vfb = 0V             | 3.2  | 3.6  | 4.0  | V    |
| Burst Sync Low Threshold Voltage             | VBSL     | Vcc = 10.5V, Vfb = 0V             | 1.1  | 1.3  | 1.5  | V    |
| <b>BURST MODE SECTION</b>                    |          |                                   |      |      |      |      |
| Burst mode Low Threshold Voltage             | VBURL    | Vfb = 0V                          | 10.4 | 11.0 | 11.6 | V    |
| Burst mode High Threshold Voltage            | VBURH    | Vfb = 0V                          | 11.4 | 12.0 | 12.6 | V    |
| Burst mode Enable Feedback Voltage           | VBEN     | Vcc = 10.5V                       | 0.7  | 1.0  | 1.3  | V    |
| Burst mode Peak Current Limit                | IBU_PK   | Vcc = 10.5V                       | 0.65 | 0.85 | 1.1  | A    |
| <b>PRIMARY SIDE REGULATION SECTION</b>       |          |                                   |      |      |      |      |
| Primary Regulation Threshold Voltage         | VPR      | I <sub>fb</sub> = 700uA, Vfb = 4V | 32.0 | 32.5 | 33.0 | V    |
| Primary Regulation Transconductance          | GPR      | -                                 | 2.0  | 2.6  | -    | mA/V |
| <b>CURRENT LIMIT(SELF-PROTECTION)SECTION</b> |          |                                   |      |      |      |      |
| Peak Current Limit(Note3)                    | IPK      | -                                 | 4.4  | 5.0  | 5.6  | A    |
| <b>TOTAL DEVICE SECTION</b>                  |          |                                   |      |      |      |      |
| Start Up Current                             | ISTART   | Vfb = GND, VCC = 14V              | -    | 0.1  | 0.2  | mA   |
| Operating Supply Current (Note1)             | IOP      | Vfb = GND, VCC = 16V              | -    | 10   | 18   | mA   |
|                                              | IOP(MIN) | Vfb = GND, VCC = 10V              |      |      |      |      |
|                                              | IOP(MAX) | Vfb = GND, VCC = 28V              |      |      |      |      |

**Note:**

1. These parameters is the current flowing in the Control IC.
2. These parameters, although guaranteed, are tested in EDS(wafer test) process.
3. These parameters indicate Inductor Current.

Typical Performance Characteristics

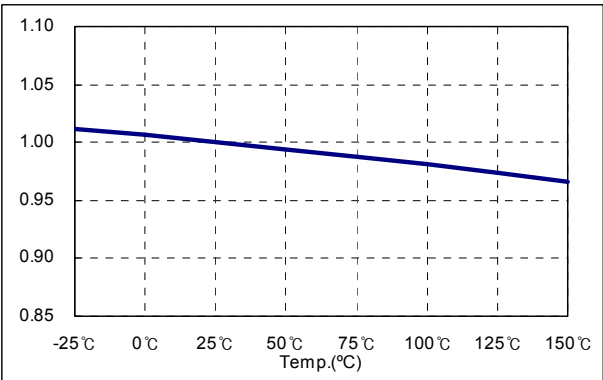


Figure 1. Start Voltage

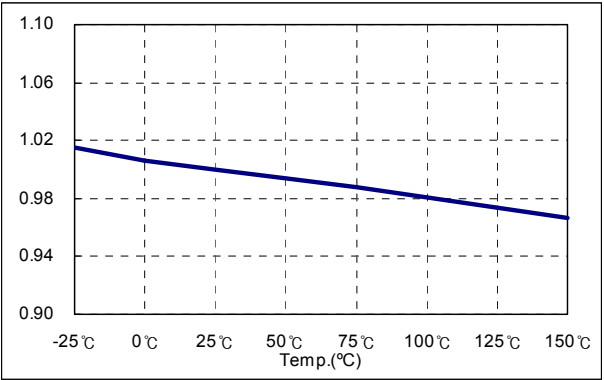


Figure 2. Stop Voltage

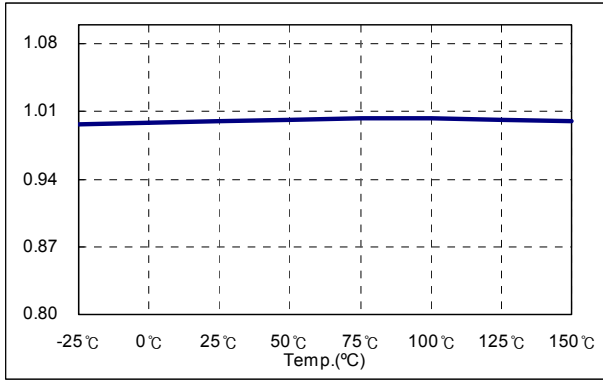


Figure 3. Stand by Current

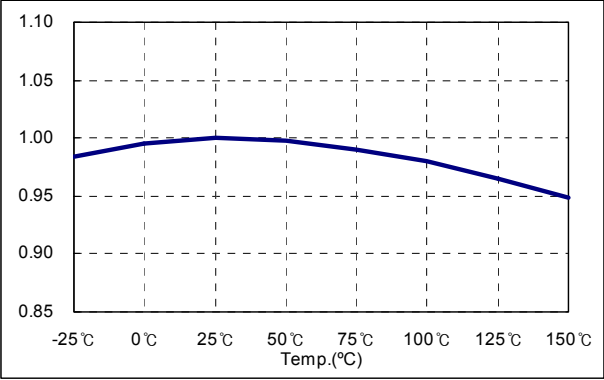


Figure 4. Operating Current

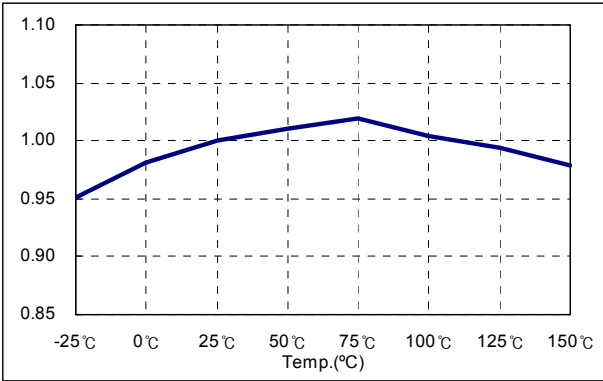


Figure 5. Initial Frequency

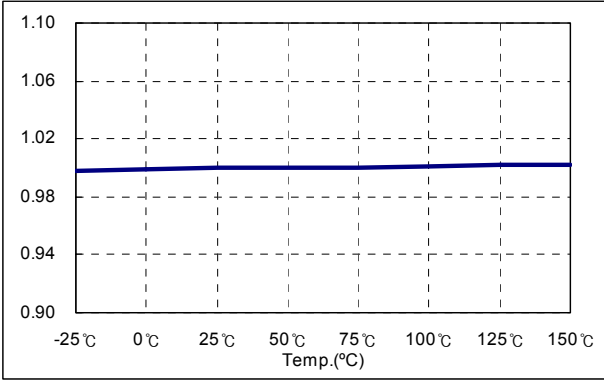


Figure 6. Maximum Duty

## Typical Performance Characteristics (Continued)

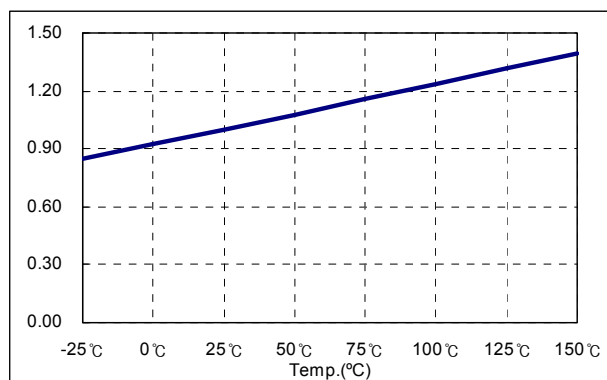


Figure 7. Feedback Offset Voltage

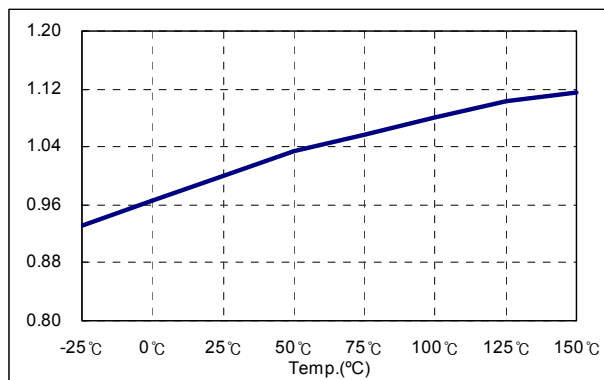


Figure 8. Feedback Source Current

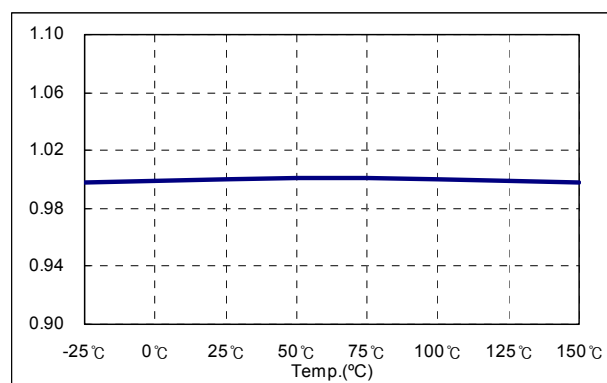


Figure 9. Over Voltage Protection

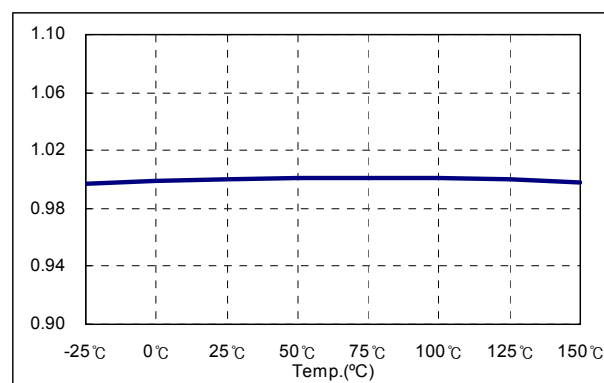


Figure 10. Shutdown Feedback Voltage

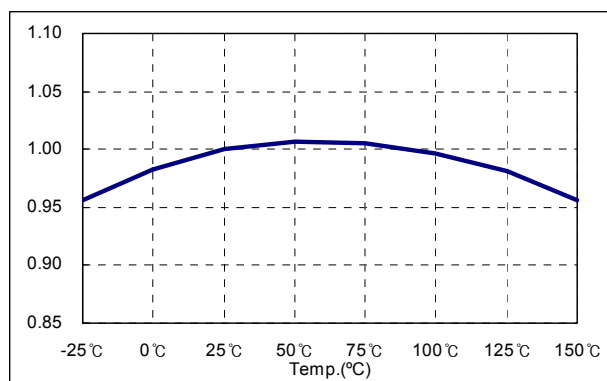


Figure 11. ShutDown Delay Current

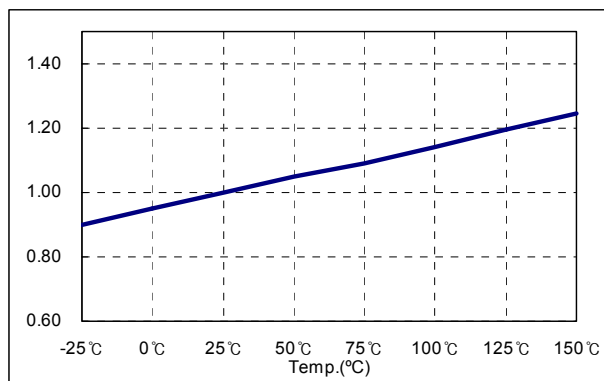


Figure 12. Burst Mode Enable Feedback Voltage

## Typical Performance Characteristics (Continued)

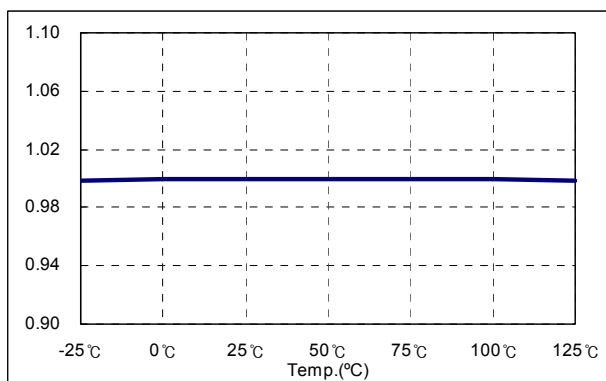


Figure 13. Burst Mode Low Threshold Voltage

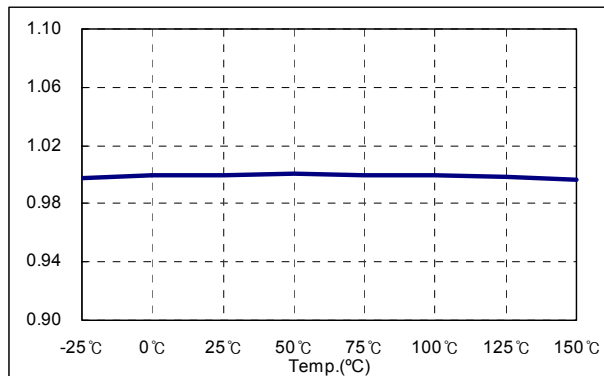


Figure 14. Burst Mode High Threshold Voltage

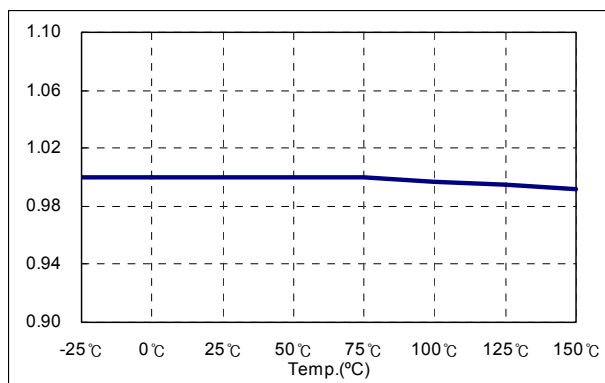


Figure 15. Burst Mode Sync. High Threshold Voltage

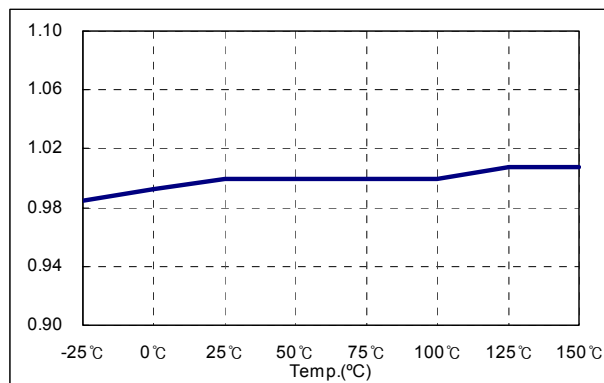


Figure 16. Burst Mode Sync. Low Threshold Voltage

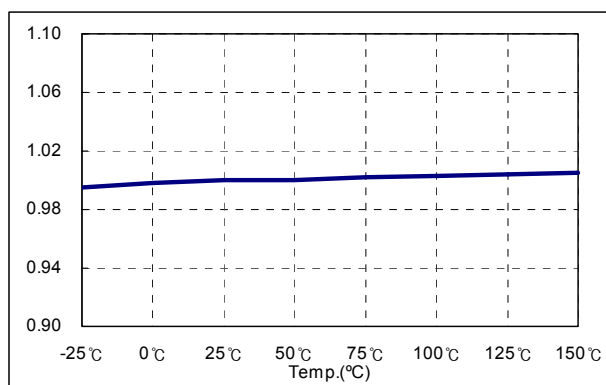


Figure 17. Primary Voltage

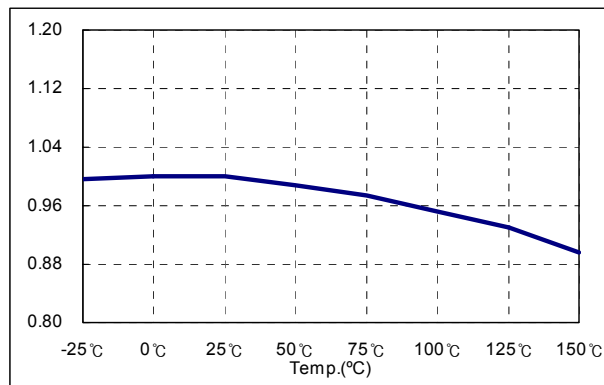


Figure 18. Primary Mode Gain

## Typical Performance Characteristics (Continued)

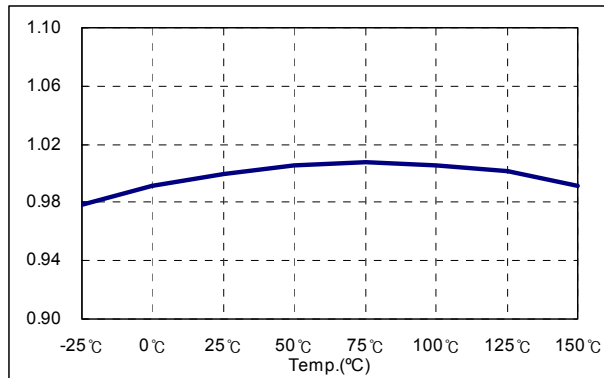


Figure 19. Peak Current Limit

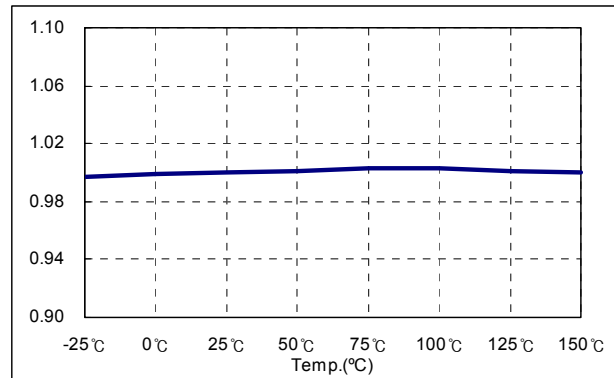


Figure 20. Burst Mode Peak Current Limit

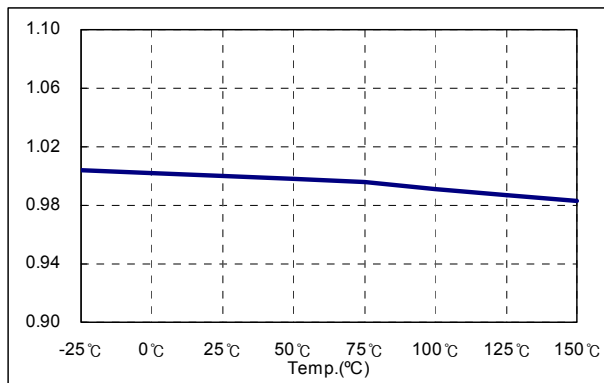


Figure 21. Normal Mode Sync. High Threshold Voltage

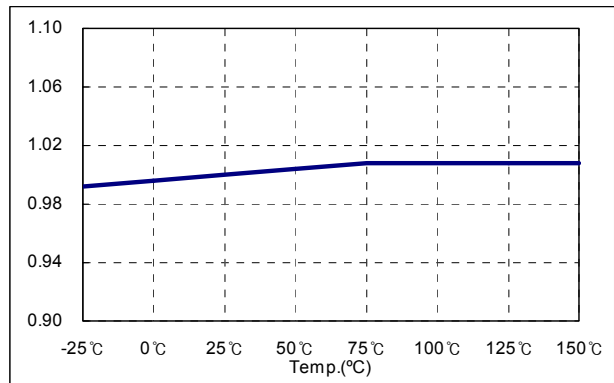


Figure 21. Normal Mode Sync. Low Threshold Voltage

## Typical Performance Characteristics(MOSFET Part)

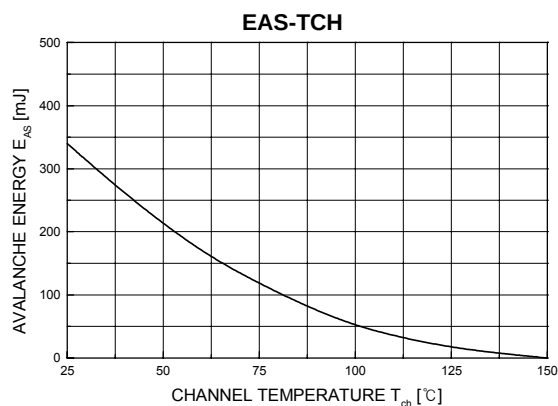


Figure 22. Temperature ( $T_C$ ) vs. Eas Curve

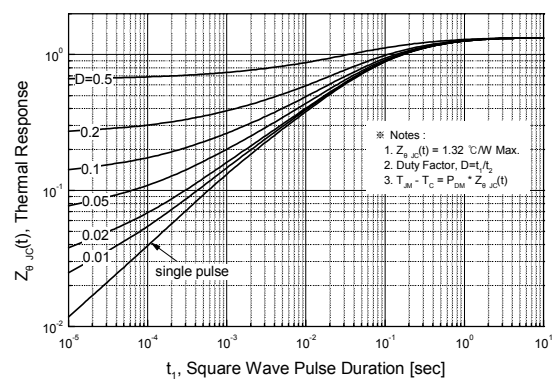
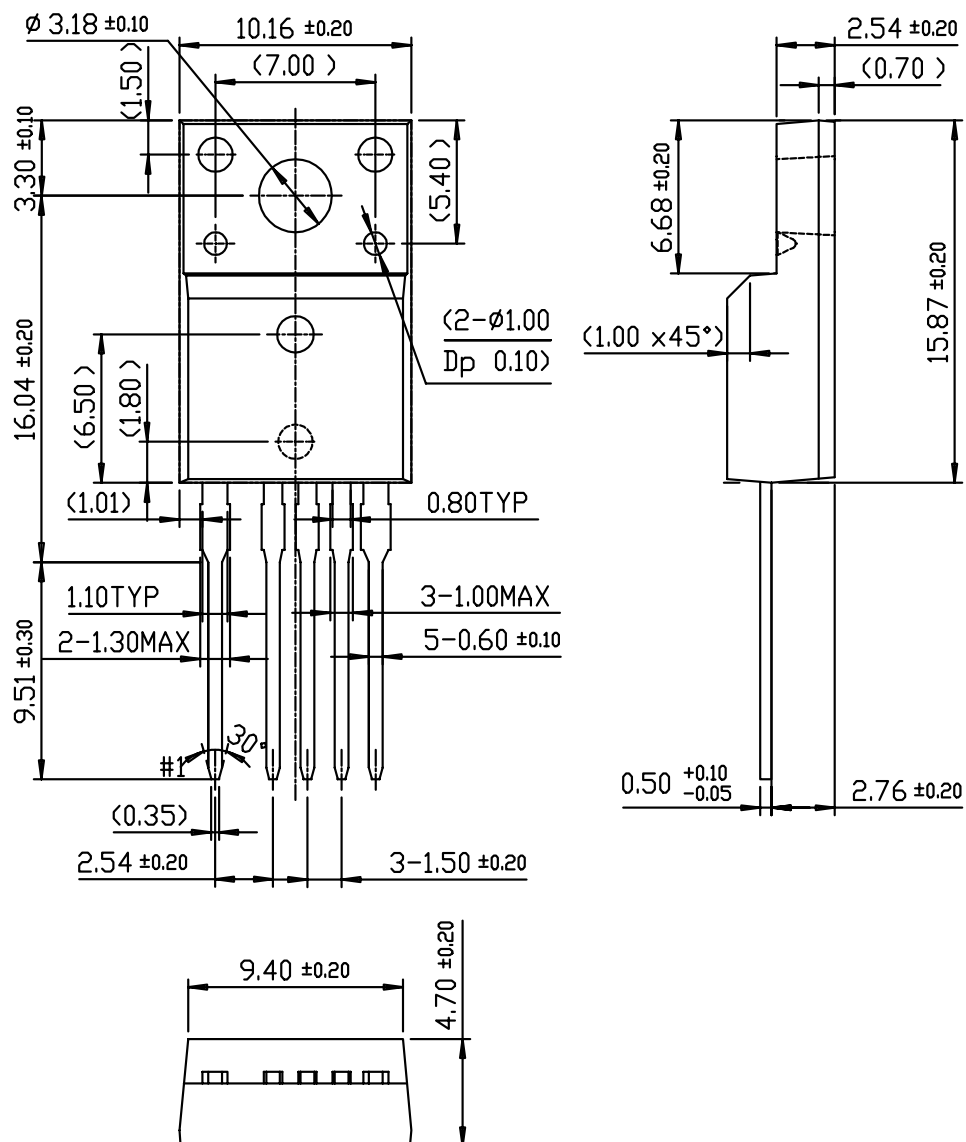


Figure 23. Transient Thermal Response Curve

# TO-220F-5L





## Ordering Information

| Product Number  | Package             | Operating Temp. |
|-----------------|---------------------|-----------------|
| KA5Q0765RTHTU   | TO-220F-5L          | -25°C to +85°C  |
| KA5Q0765RTHYDTU | TO-220F-5L(Forming) |                 |

TU : Non Forming Type

YDTU : Forming Type

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.