

KA5Q-SERIES

Absolute Maximum Ratings

(Ta=25°C, unless otherwise specified)

| Characteristic | Symbol | Value | Unit |
|--|----------|-------------|-------|
| KA5Q0765RT | | | |
| Drain-Gate Voltage(RGS=1MΩ) | VDGR | 650 | V |
| Gate-Source(GND) Voltage | VGS | ±30 | V |
| Drain Current Pulsed ⁽¹⁾ | IDM | 28 | ADC |
| Continuous Drain Current (Tc = 25°C) | ID | 7.0 | ADC |
| Continuous Drain Current (Tc = 100°C) | ID | 5.6 | ADC |
| Single Pulsed Avalanch Current ⁽³⁾ (Energy ⁽²⁾) | IAS(EAS) | 20(570) | A(mJ) |
| Maximum Supply Voltage | VCC,MAX | 40 | V |
| Input Voltage Range | VFB | -0.3 to VCC | V |
| | VSynC | -0.3 to 13 | V |
| Total Power Dissipation | PD | 47 | W |
| | Derating | 0.37 | W/°C |
| Operating Junction Temperature. | TJ | +160 | °C |
| Operating Ambient Temperature. | TA | -25 to +85 | °C |
| Storage Temperature Range. | TSTG | -55 to +150 | °C |
| Thermal Resistance | Rthjc | 2.7 | °C/W |
| KA5Q12656RT | | | |
| Drain-Gate Voltage(RGS=1MΩ) | VDGR | 650 | V |
| Gate-Source(GND) Voltage | VGS | ±30 | V |
| Drain Current Pulsed ⁽¹⁾ | IDM | 48 | ADC |
| Continuous Drain Current (Tc = 25°C) | ID | 12 | ADC |
| Continuous Drain Current (Tc = 100°C) | ID | 8.4 | ADC |
| Single Pulsed Avalanch Current(Energy ⁽²⁾) | IAS(EAS) | 30(950) | A(mJ) |
| Maximum Supply Voltage | VCC,MAX | 40 | V |
| Input Voltage Range | VFB | -0.3 to VCC | V |
| | VSynC | -0.3 to 13 | V |
| Total Power Dissipation | PD | 55 | W |
| | Derating | 0.4 | W/°C |
| Operating Junction Temperature. | TJ | +160 | °C |
| Operating Ambient Temperature. | TA | -25 to +85 | °C |
| Storage Temperature Range. | TSTG | -55 to +150 | °C |
| Thermal Resistance | Rthjc | 2.5 | °C/W |

Absolute Maximum Ratings (Continued)

(Ta=25°C, unless otherwise specified)

| Characteristic | Symbol | Value | Unit |
|--|-----------------------|-------------------------|-------|
| KA5Q1265RF | | | |
| Drain-Gate Voltage(R _{GS} =1MΩ) | V _{DGR} | 650 | V |
| Gate-Source(GND) Voltage | V _{GS} | ±30 | V |
| Drain Current Pulsed ⁽¹⁾ | I _{DM} | 48 | ADC |
| Continuous Drain Current (T _c = 25°C) | I _D | 12 | ADC |
| Continuous Drain Current (T _c = 100°C) | I _D | 8.4 | ADC |
| Single Pulsed Avalanch Current(Energy ⁽²⁾) | I _{AS} (EAS) | 33(950) | A(mJ) |
| Maximum Supply Voltage | V _{CC,MAX} | 40 | V |
| Input Voltage Range | V _{FB} | -0.3 to V _{CC} | V |
| | V _{Sync} | -0.3 to 13 | V |
| Total Power Dissipation | P _D | 95 | W |
| | Derating | 0.76 | W/°C |
| Operating Junction Temperature. | T _J | +160 | °C |
| Operating Ambient Temperature. | T _A | -25 to +85 | °C |
| Storage Temperature Range. | T _{STG} | -55 to +150 | °C |
| Thermal Resistance | R _{thjc} | 1.31 | °C/W |

| | | | |
|--|-----------------------|-------------------------|-------|
| KA5Q1565RF | | | |
| Drain-Gate Voltage(R _{GS} =1MΩ) | V _{DGR} | 650 | V |
| Gate-Source(GND) Voltage | V _{GS} | ±30 | V |
| Drain Current Pulsed ⁽¹⁾ | I _{DM} | 60 | ADC |
| Continuous Drain Current (T _c = 25°C) | I _D | 15 | ADC |
| Continuous Drain Current (T _c = 100°C) | I _D | 12.0 | ADC |
| Single Pulsed Avalanch Current(Energy ⁽²⁾) | I _{AS} (EAS) | 36(1050) | A(mJ) |
| Maximum Supply Voltage | V _{CC,MAX} | 40 | V |
| Input Voltage Range | V _{FB} | -0.3 to V _{CC} | V |
| | V _{Sync} | -0.3 to 13 | V |
| Total Power Dissipation | P _D | 98 | W |
| | Derating | 0.78 | W/°C |
| Operating Junction Temperature. | T _J | +160 | °C |
| Operating Ambient Temperature. | T _A | -25 to +85 | °C |
| Storage Temperature Range. | T _{STG} | -55 to +150 | °C |
| Thermal Resistance | R _{thjc} | 1.28 | °C/W |

Note:

1. Repetitive rating : Pulse width limited by maximum junction temperature
2. L = 10mH, V_{DD} =50V, R_G = 27Ω, starting T_j = 25°C
3. L = 13uH, starting T_j = 25°C

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Electrical Characteristics (SFET part)

(Ta=25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|--|---------|---|------|------|------|------|
| KA5Q0765RT | | | | | | |
| Drain-Source Breakdown Voltage | BVDSS | VGS=0V, ID=50μA | 650 | - | - | V |
| Zero Gate Voltage Drain Current | IDSS | VDS=Max., Rating, VGS=0V | - | - | 200 | μA |
| | | VDS=0.8Max., Rating, VGS=0V, TC=85°C | - | - | 300 | μA |
| Static Drain-Source on Resistance ⁽¹⁾ | RDS(on) | VGS=10V, ID=4.0A | - | 1.3 | 1.6 | Ω |
| Input Capacitance | Ciss | VGS=0V, VDS=25V, f = 1MHz | - | 1110 | - | pF |
| Output Capacitance | Coss | | - | 105 | - | |
| Reverse Transfer Capacitance | Crss | | - | 50 | - | |
| Turn on Delay Time | td(on) | VDD=0.5BVDSS, ID=7.0A (MOSFET switching time are essentially independent of operating temperature) | - | 25 | - | nS |
| Rise Time | tr | | - | 55 | - | |
| Turn Off Delay Time | td(off) | | - | 80 | - | |
| Fall Time | tf | | - | 50 | - | |
| Total Gate Charge (Gate-Source+Gate-Drain) | Qg | VGS=10V, ID=7.0A, VDS=0.5BVDSS(MOSFET Switching time are Essentially independent of Operating temperature) | - | 57 | 74 | nC |
| Gate-Source Charge | Qgs | | - | 9.3 | - | |
| Gate-Drain (Miller) Charge | Qgd | | - | 29.3 | - | |
| KA5Q12656RT/KA5Q1265RF | | | | | | |
| Drain-Source Breakdown Voltage | BVDSS | VGS=0V, ID=50μA | 650 | - | - | V |
| Zero Gate Voltage Drain Current | IDSS | VDS=Max., Rating, VGS=0V | - | - | 200 | μA |
| | | VDS=0.8Max., Rating, VGS=0V, TC=85°C | - | - | 300 | μA |
| Static Drain-Source on Resistance ⁽¹⁾ | RDS(on) | VGS=10V, ID=6A | - | 0.7 | 0.9 | Ω |
| Input Capacitance | Ciss | VGS=0V, VDS=25V, f = 1MHz | - | 1820 | - | pF |
| Output Capacitance | Coss | | - | 185 | - | |
| Reverse Transfer Capacitance | Crss | | - | 32 | - | |
| Turn on Delay Time | td(on) | VDD=0.5BVDSS, ID=12.0A (MOSFET switching time are essentially independent of operating temperature) | - | 38 | - | nS |
| Rise Time | tr | | - | 120 | - | |
| Turn Off Delay Time | td(off) | | - | 200 | - | |
| Fall Time | tf | | - | 100 | - | |
| Total Gate Charge (Gate-Source+Gate-Drain) | Qg | VGS=10V, ID=12.0A, VDS=0.5BVDSS(MOSFET Switching time are Essentially independent of Operating temperature) | - | 60 | 78 | nC |
| Gate-Source Charge | Qgs | | - | 10 | - | |
| Gate-Drain (Miller) Charge | Qgd | | - | 30 | - | |

Absolute Maximum Ratings (SFET Part)

(Ta=25°C, unless otherwise specified)

| Characteristic | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|---|---------|--|------|------|------|------|
| KA5Q1565RF | | | | | | |
| Drain-Source Breakdown Voltage | BVDSS | VGS=0V, ID=50μA | 650 | - | - | V |
| Zero Gate Voltage Drain Current | IDSS | VDS=Max., Rating, VGS=0V | - | - | 200 | μA |
| | | VDS=0.8Max., Rating, VGS=0V, TC=85°C | - | - | 300 | μA |
| Static Drain-Source on Resistance ^(Note) | RDS(ON) | VGS=10V, ID=7.3A | - | 0.5 | 0.65 | W |
| Input Capacitance | Ciss | VGS=0V, VDS=25V, f=1MHz | - | 2580 | - | pF |
| Output Capacitance | Coss | | - | 270 | - | |
| Reverse Transfer Capacitance | Crss | | - | 50 | - | |
| Turn on Delay Time | td(on) | VDD=0.5BVDSS, ID=14.6A (MOSFET switching time are essentially independent of operating temperature) | - | 50 | - | nS |
| Rise Time | tr | | - | 155 | - | |
| Turn Off Delay Time | td(off) | | - | 270 | - | |
| Fall Time | tf | | - | 125 | - | |
| Total Gate Charge (Gate-Source+Gate-Drain) | Qg | VGS=10V, ID=14.6A, VDS=0.8BVDSS (MOSFET switching time are essentially independent of operating temperature) | - | 90 | 117 | nC |
| Gate-Source Charge | Qgs | | - | 15 | - | |
| Gate-Drain (Miller) Charge | Qgd | | - | 45 | - | |

Note:

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

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Electrical Characteristics (Control Part)

(Ta=25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|--|---------------------|---|-------|-------|-------|------|
| UVLO SECTION | | | | | | |
| Start Threshold Voltage | V _{START} | V _{FB} =GND | 14 | 15 | 16 | V |
| Stop Threshold Voltage | V _{STOP} | V _{FB} =GND | 8 | 9 | 10 | V |
| OSCILLATOR SECTION | | | | | | |
| Initial Frequency | F _{OSC} | - | 18 | 20 | 22 | kHz |
| Voltage Stability | F _{STABLE} | 12V ≤ V _{CC} ≤ 23V | 0 | 1 | 3 | % |
| Temperature Stability (Note2) | ΔF _{OSC} | -25°C ≤ Ta ≤ 85°C | 0 | ±5 | ±10 | % |
| Maximum Duty Cycle | D _{MAX} | - | 92 | 95 | 98 | % |
| Minimum Duty Cycle | D _{MIN} | - | - | - | 0 | % |
| FEEDBACK SECTION | | | | | | |
| Feedback Source Current | I _{FB} | V _{FB} =GND | 0.7 | 0.9 | 1.1 | mA |
| Shutdown Feedback Voltage | V _{SD} | V _{FB} ≥ 6.9V | 6.9 | 7.5 | 8.1 | V |
| Shutdown Delay Current | I _{DELAY} | V _{FB} =5V | 4 | 5 | 6 | μA |
| SYNC. SECTION | | | | | | |
| Normal Sync High Threshold Voltage | V _{NSH} | V _{CC} =16V, V _{fb} =5V | 4.0 | 4.6 | 5.2 | V |
| Normal Sync Low Threshold Voltage | V _{NSL} | V _{CC} =16V, V _{fb} =5V | 2.3 | 2.6 | 2.9 | V |
| Burst Sync High Threshold Voltage | V _{BSH} | V _{CC} =10.5V, V _{fb} =0V | 3.2 | 3.6 | 4.0 | V |
| Burst Sync Low Threshold Voltage | V _{BSL} | V _{CC} =10.5V, V _{fb} =0V | 1.1 | 1.3 | 1.5 | V |
| BURST MODE SECTION | | | | | | |
| Burst Mode Low Threshold Voltage | V _{BURL} | V _{FB} =0V | 10.4 | 11.0 | 11.6 | V |
| Burst Mode High Threshold Voltage | V _{BURH} | V _{FB} =0V | 11.4 | 12.0 | 12.6 | V |
| Burst Mode Enable Feedback Voltage | V _{BEN} | V _{CC} =10.5V | 0.7 | 1.0 | 1.3 | V |
| Burst Mode Peak Current Limit(Note4) | I _{BURPK} | V _{CC} =10.5V, V _{FB} =0V | 0.65 | 0.85 | 1.1 | A |
| CURRENT LIMIT(SELF-PROTECTION)SECTION | | | | | | |
| Peak Current Limit (Note4) | I _{OVER} | KA5Q0765RT | 4.40 | 5.00 | 5.60 | A |
| | | KA5Q12656RT | 5.28 | 6.00 | 6.72 | |
| | | KA5Q1265RF | 7.04 | 8.00 | 8.96 | |
| | | KA5Q1565RF | 10.12 | 11.50 | 12.88 | |
| PROTECTION SECTION | | | | | | |
| Over Voltage Protection | V _{OV} P | V _{SYNC} ≥ 11V | 11 | 12 | 13 | V |
| Over Current Latch voltage(Note3) | V _{OCL} | - | 0.9 | 1.0 | 1.1 | V |
| Thermal Shutdown Tempature(Note2) | T _{SD} | - | 140 | 160 | - | °C |

Electrical Characteristics (Control Part) (Continued)

(Ta=25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|--|----------------------|---|------|------|------|------|
| TOTAL DEVICE SECTION | | | | | | |
| Start Up Current | I _{START} | V _{FB} =GND, V _{CC} =14V | - | 0.1 | 0.2 | mA |
| Operating Supply Current(Note1) | I _{OP} | V _{FB} =GND, V _{CC} =16V | - | 10 | 18 | mA |
| | I _{OP(MIN)} | V _{FB} =GND, V _{CC} =12V | | | | |
| | I _{OP(MAX)} | V _{FB} =GND, V _{CC} =28V | | | | |
| PRIMARY SIDE REGULATION SECTION (ONLY KA5Q0765RT/KA5Q12656RT) | | | | | | |
| Primary Regulation Threshold Voltage | V _{PR} | I _{FB} =700uA, V _{FB} =4V | 32.0 | 32.5 | 33.0 | V |
| Primary Regulation Transconductance | G _{PR} | - | 2.0 | 2.6 | - | mA/V |

Note:

1. These parameters is the Current Flowing in the Control IC.
2. These parameters, although guaranteed, are not 100% tested in production
3. These parameters, although guaranteed, are tested in EDS(wafer test) process
4. These parameters are indicated Inductor Current.

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Typical Performance Characteristics

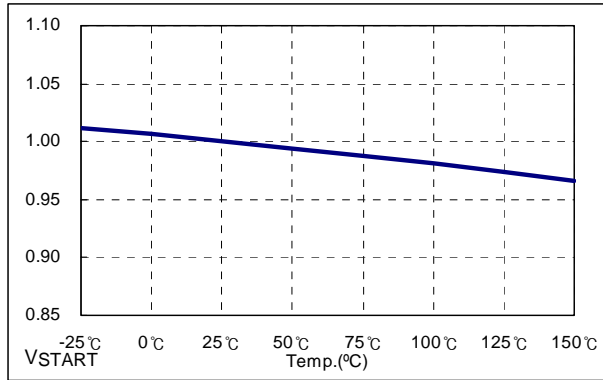


Figure 1. Start Threshold Voltage

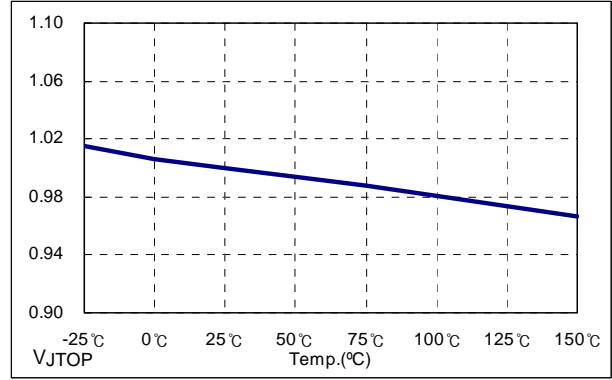


Figure 2. Stop Threshold Voltage

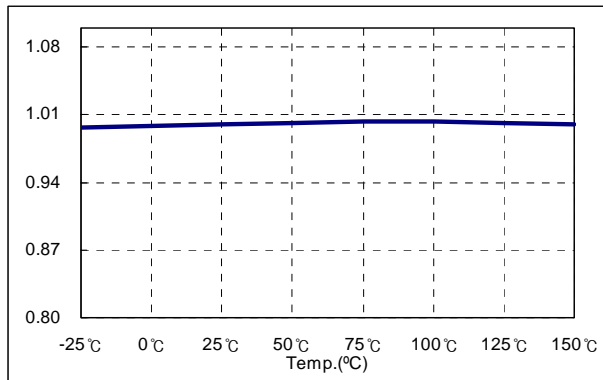


Figure 3. Start Up Current

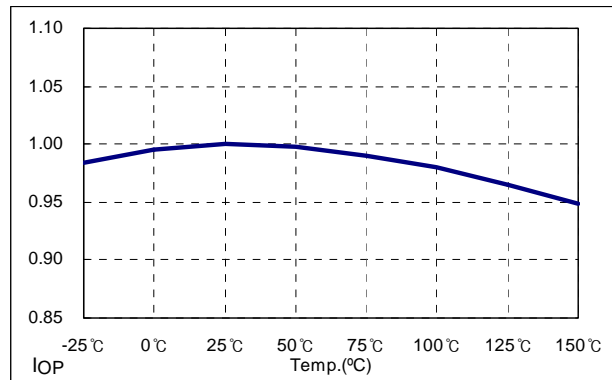


Figure 4. Operating Supply Current

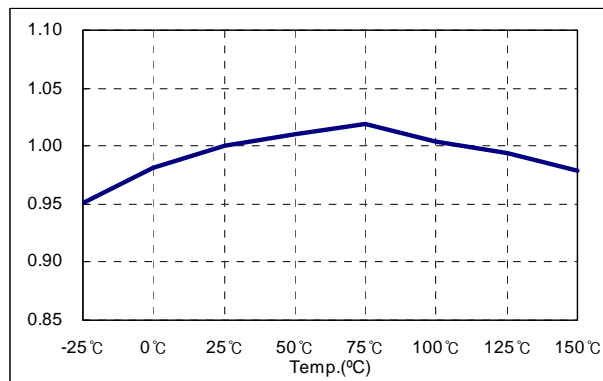


Figure 5. Initial Frequency

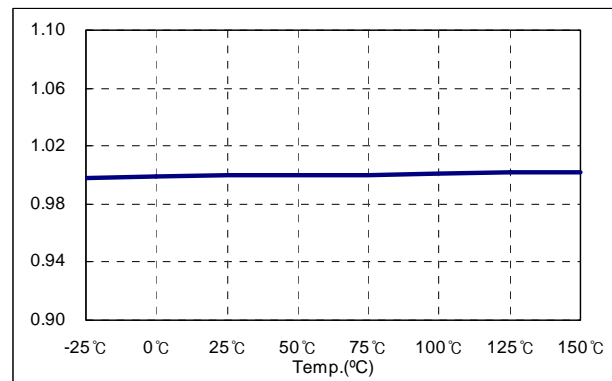


Figure 6. Maximum Duty

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Typical Performance Characteristics (Continued)

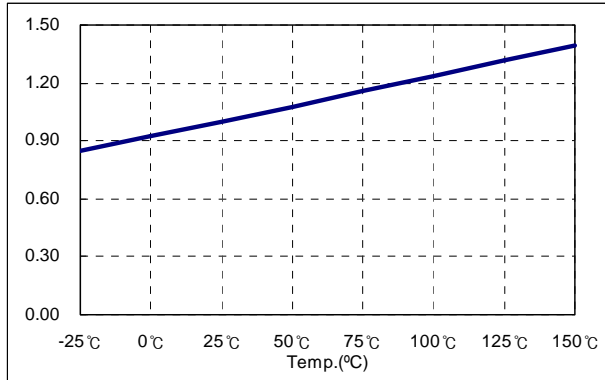


Figure 7. Feedback Offset Voltage

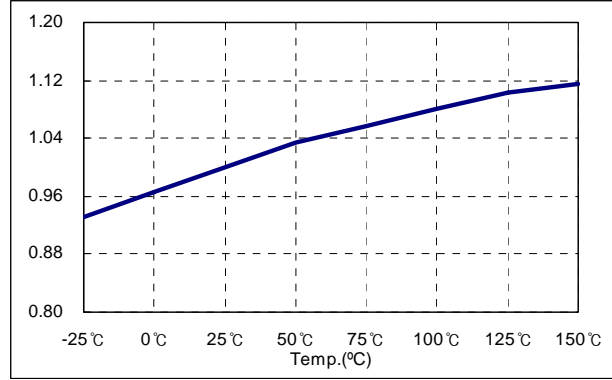


Figure 8. Feedback Source Current

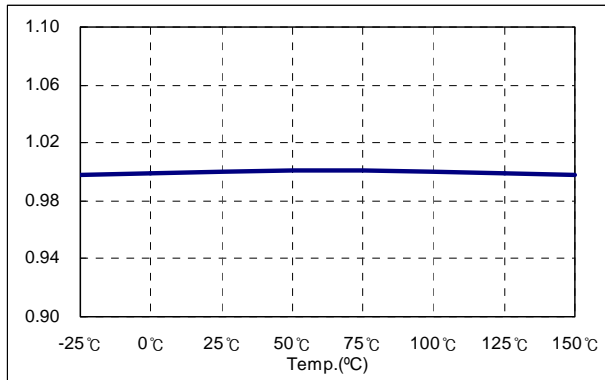


Figure 9. Over Voltage Protection

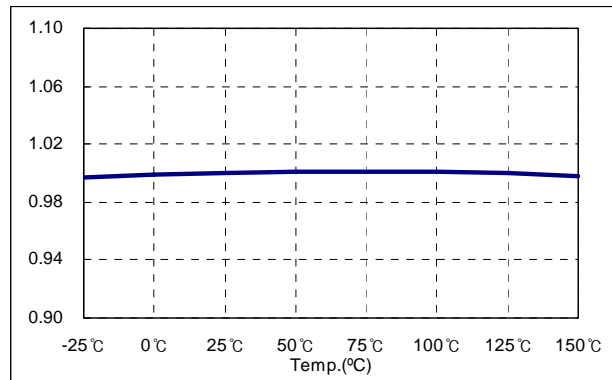


Figure 10. Shutdown Feedback Voltage

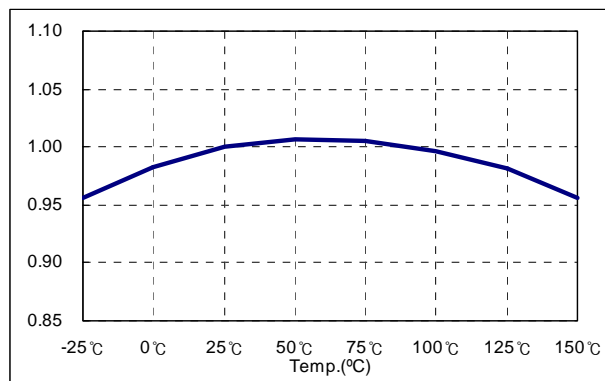


Figure 11. Shutdown Delay Current

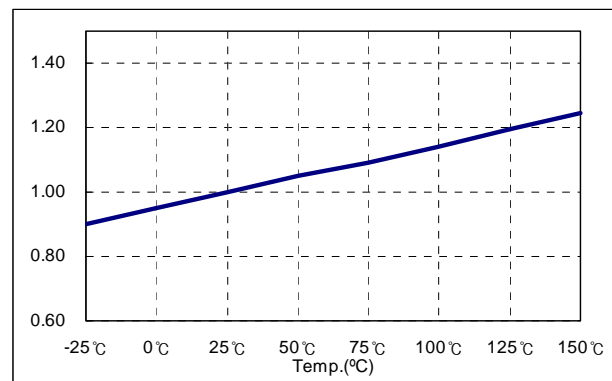


Figure 12. Burst mode Enable Feedback Voltage

Typical Performance Characteristics (Continued)

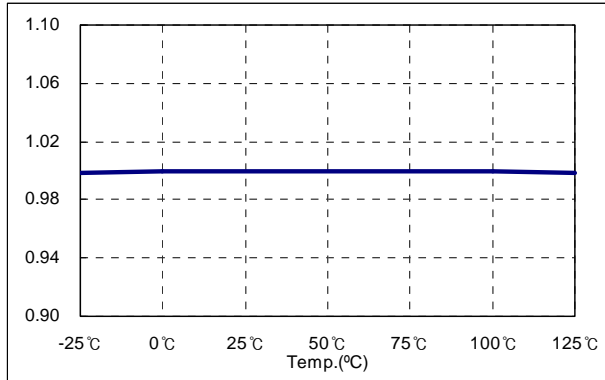


Figure 13. Burst mode Low Threshold Voltage

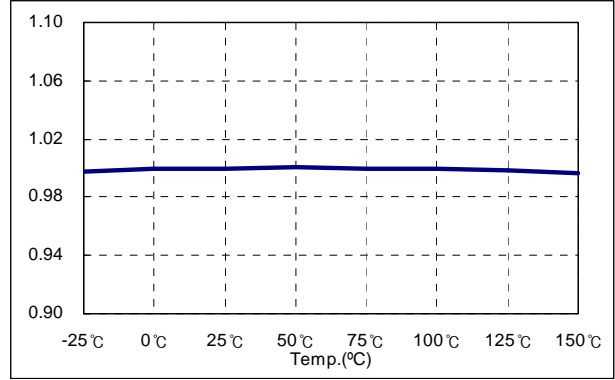


Figure 14. Burst mode High Threshold Voltage

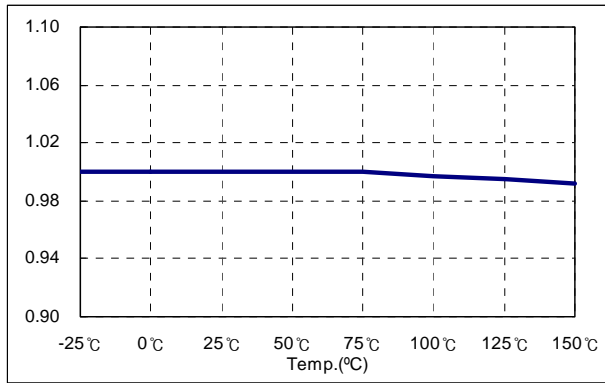


Figure 15. Burst Sync. High Threshold Voltage

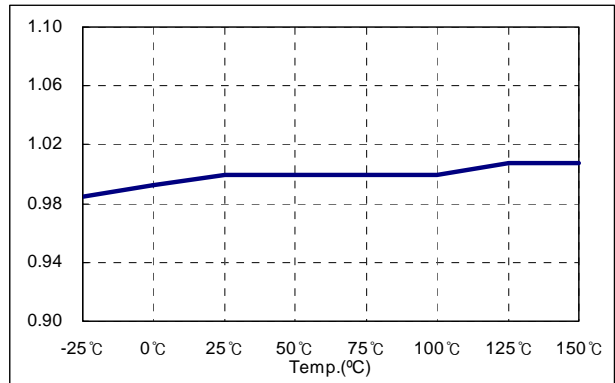


Figure 16. Burst Sync. Low Threshold Voltage

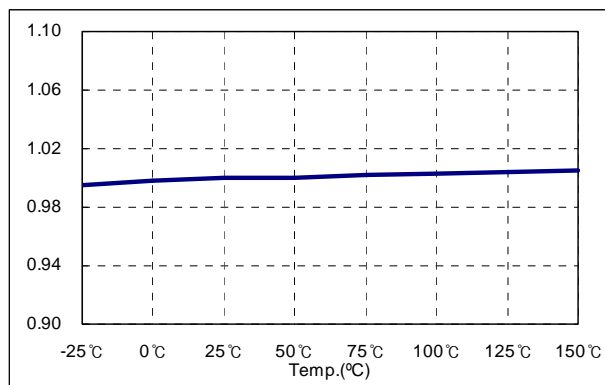


Figure 17. Primary Regulation Threshold Voltage

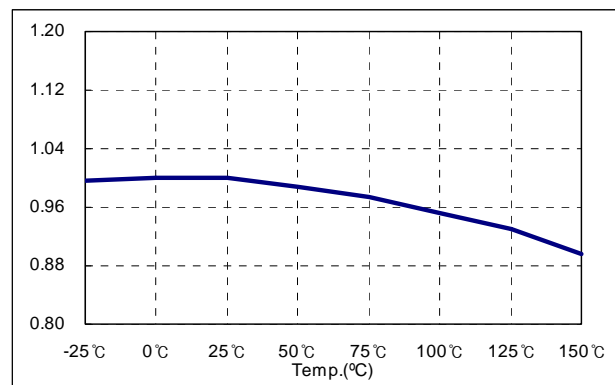


Figure 18. Primary Regulation Transconductance

Typical Performance Characteristics (Continued)

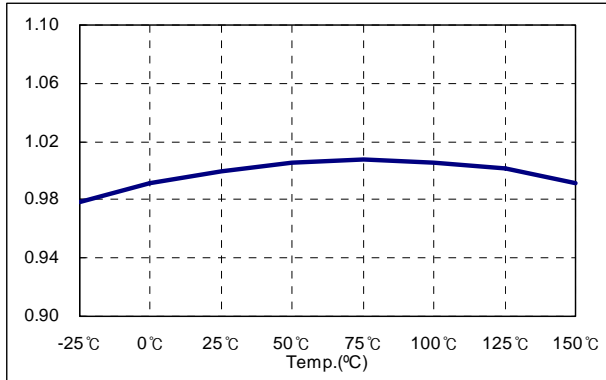


Figure 19. Peak Current Limit

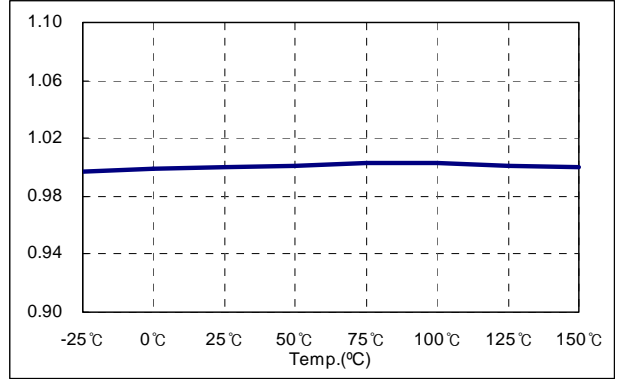


Figure 20. Burst mode Peak Current Limit

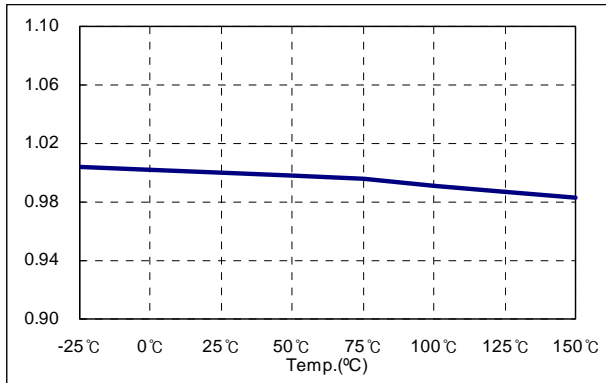


Figure 21. Normal Sync. High Threshold Voltage

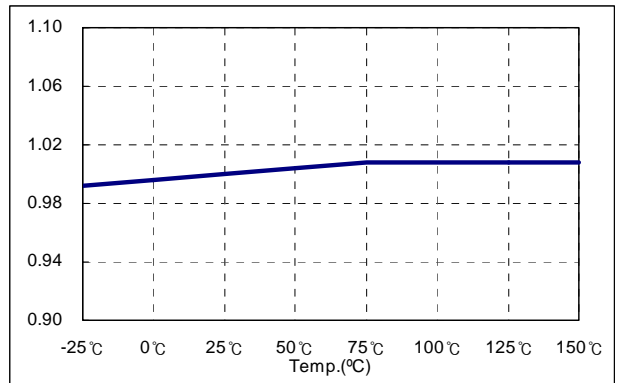
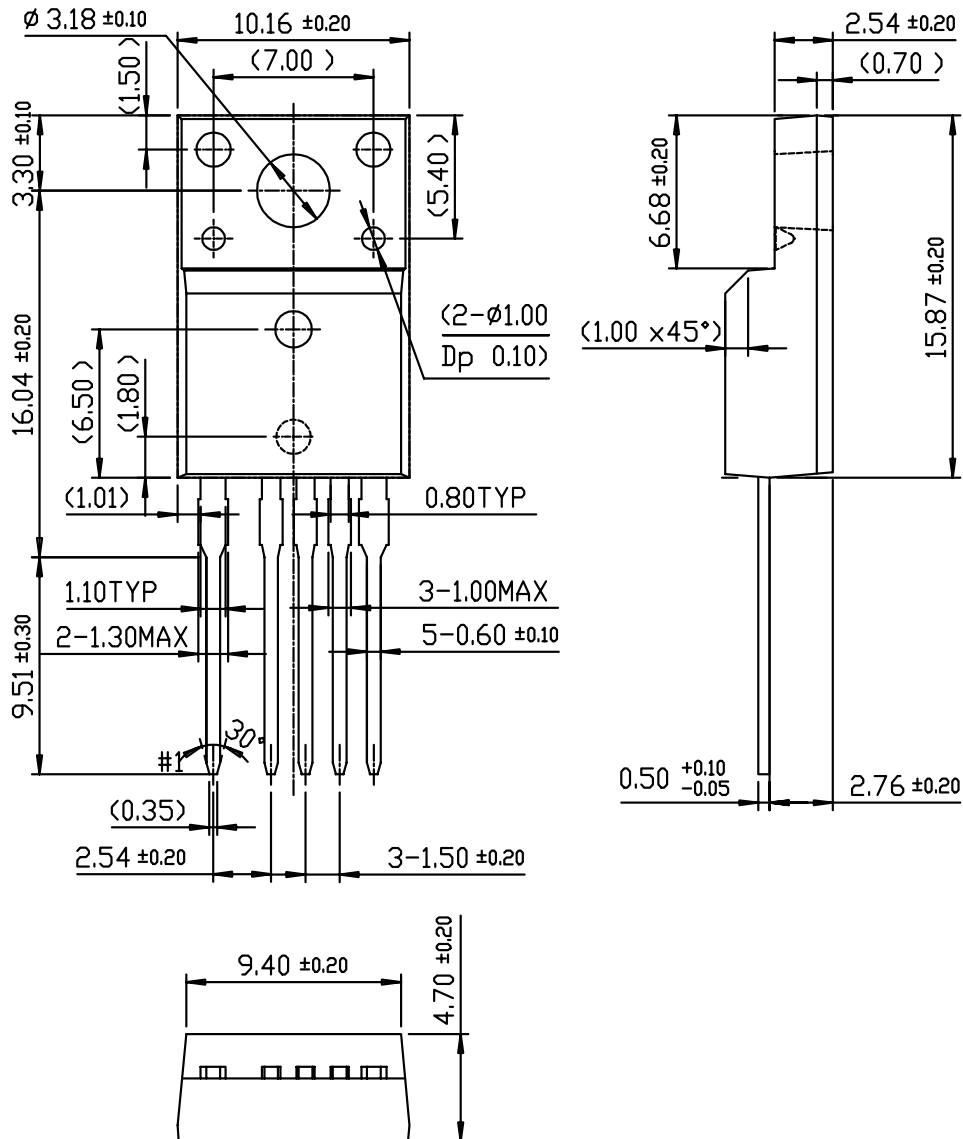


Figure 22. Normal Sync. Low Threshold Voltage

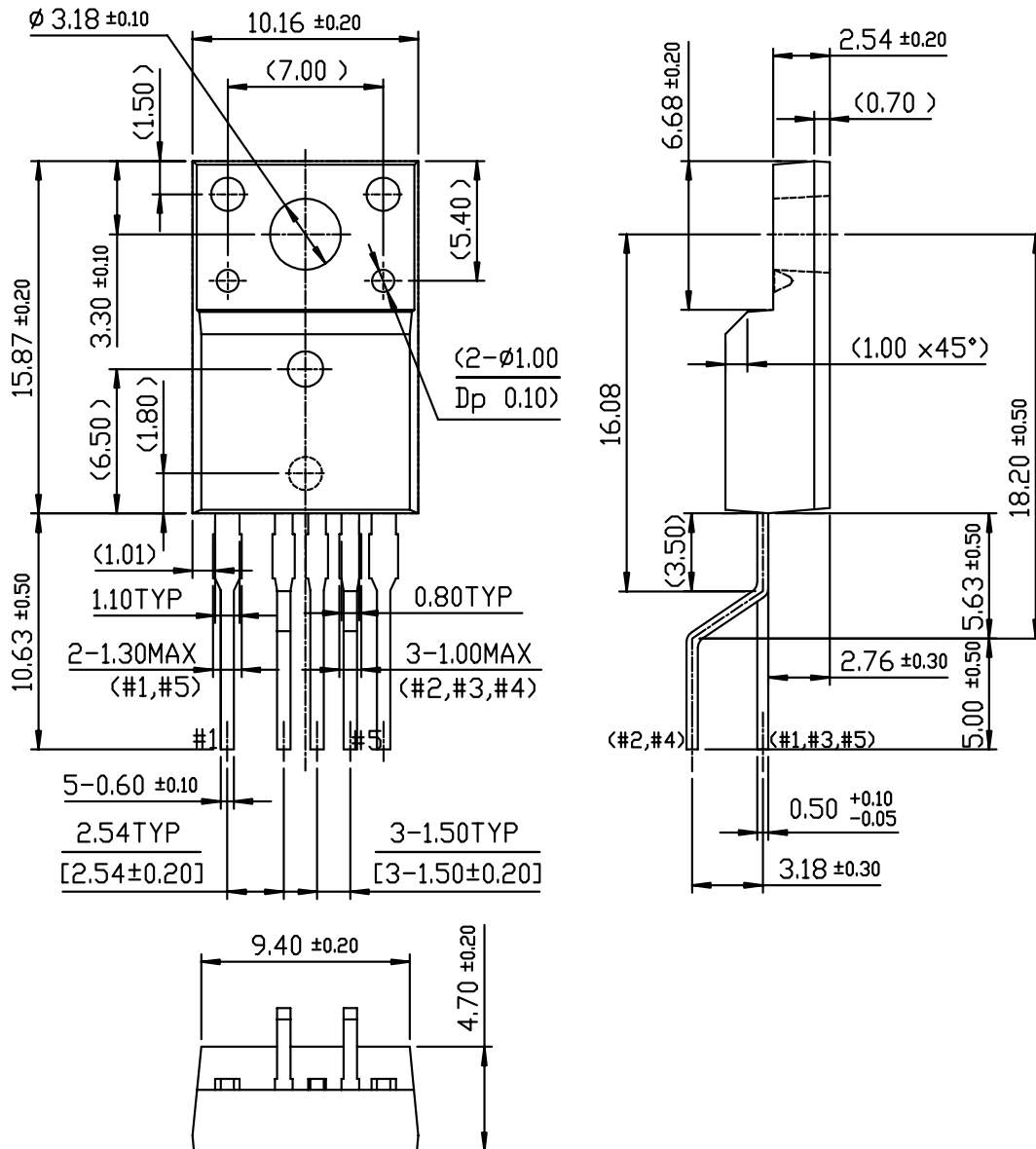
Package Dimensions

TO-220F-5L



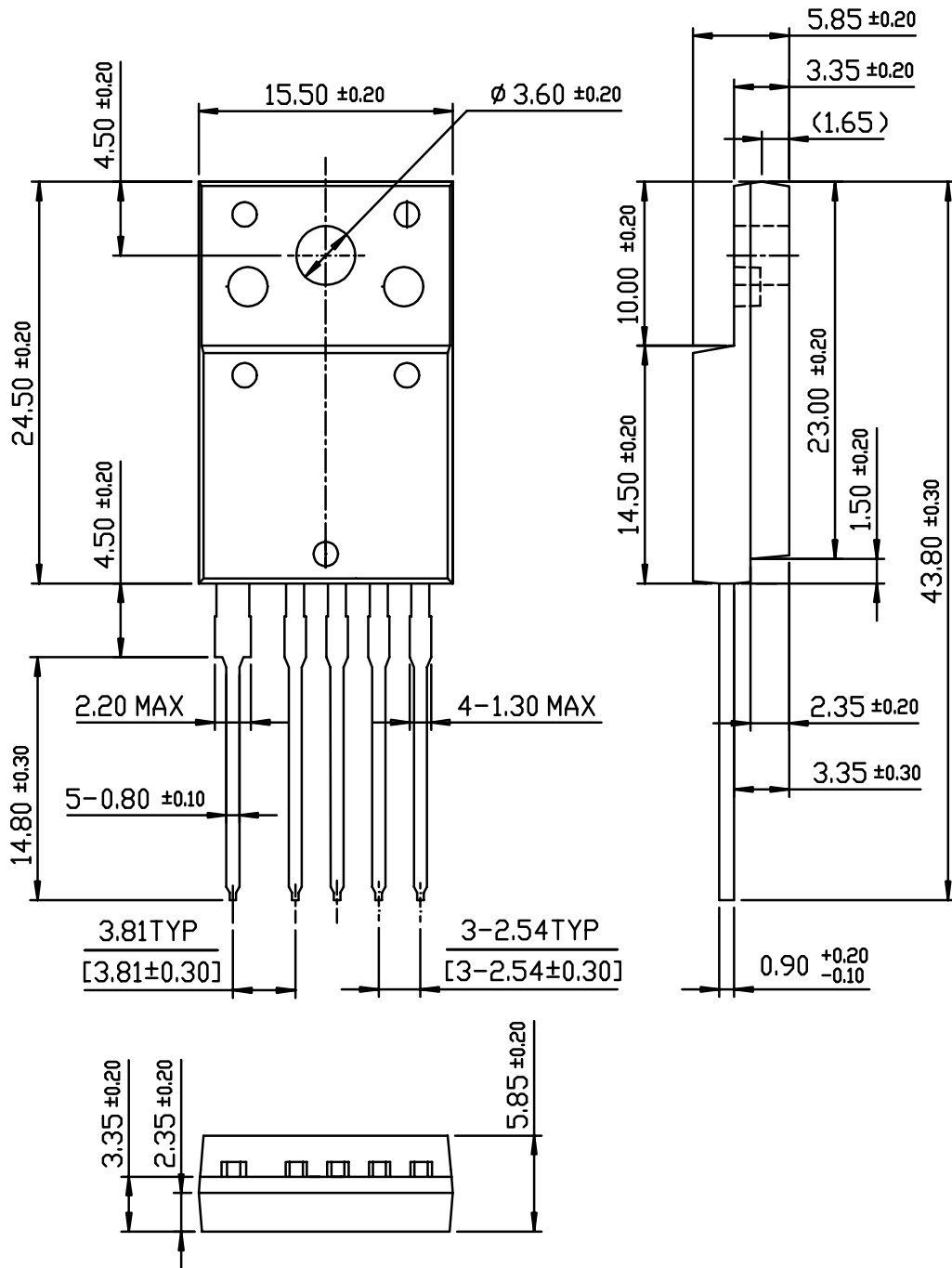
Package Dimensions (Continued)

TO-220F-5L(Forming)



Package Dimensions (Continued)

TO-3PF-5L



KA5Q-SERIES**Ordering Information**

| Product Number | Package | Rating | IOVER |
|-----------------|----------------------|-----------|-------|
| KA5Q0765RTTU | TO-220F-5L | 650V, 7A | 5A |
| KA5Q0765RTYDTU | TO-220F-5L (Forming) | | |
| KA5Q12656RTTU | TO-220F-5L | 650V, 12A | 6A |
| KA5Q12656RTYDTU | TO-220F-5L (Forming) | | |
| KA5Q1265RFTU | TO-3PF-5L | 650V, 12A | 8A |
| KA5Q1265RFYDTU | TO-3PF-5L (Forming) | | |
| KA5Q1565RFTU | TO-3PF-5L | 650V, 15A | 11.5A |
| KA5Q1565RFYDTU | TO-3PF-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.