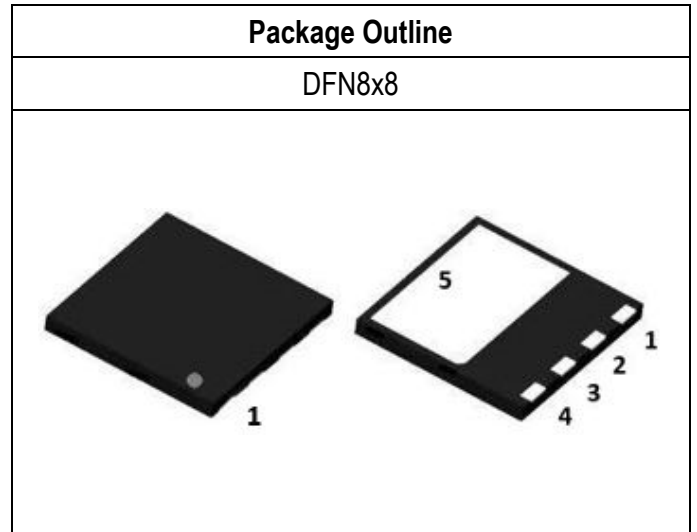


| Key Electrical Characteristics | | |
|--------------------------------|---------------------|------------|
| Parameter / Symbol | Value / Description | Unit |
| $BV_{DSS \text{ min.}}$ | 650 | V |
| $R_{DS(ON) \text{ Typ. @10V}}$ | 110 | m Ω |
| I_D | 22.2 | A |
| $V_{TH \text{ Typ.}}$ | 3.9 | V |
| $C_{iss \text{ Typ.}}$ | 2464 | pF |
| $Q_g \text{ 10V}$ | 54.2 | nC |
| FRD fast recovery diode | Yes | N/A |



General Description

These devices are N-channel power MOSFET developed using Super Junction structure technology. There is high speed switching capacity, low $R_{DS(ON)}$ parameter, excellent quality and characteristics for these devices. Moreover, it is a good choice in improved efficiency of circuit and raise power density are required. These features combine to be an advantage design for use in wide variety of application including switch mode power design.

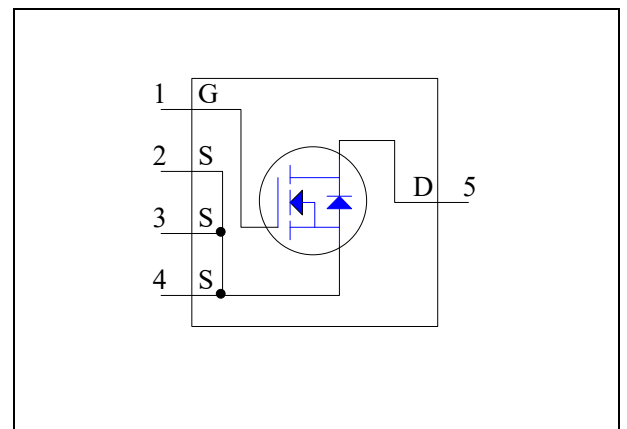
Features

- ✧ FRD (fast recovery diode)
- ✧ Fast reverse recovery time (t_{rr})
- ✧ Low $R_{DS(ON)}$ resistance
- ✧ Low Switching Loss
- ✧ More compact and smaller size in package
- ✧ Excellent single pulse avalanche energy
- ✧ Pb-free lead plating and RoHS compliant

Potential Applications

- ◆ Switch Mode Power Supply
- ◆ High efficiency power module
- ◆ LED lighting power system
- ◆ Consumption electronics adaptor or charger
- ◆ Slim and light power circuit

Symbol and Pin assignment



Ordering Information

| N.o | Item | Description |
|-----|---------------|--------------|
| 01 | Orderable P/N | SJ650N125B3 |
| 02 | Part Number | SJ650N125B3 |
| 03 | Package Type | DFN8x8 |
| 04 | Package Code | B |
| 05 | Packing Type | Tape & Reel |
| 06 | Quantity/pcs | 3,000 |
| 07 | RoHS Status | Halogen-Free |

Content

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| 2. | Thermal Resistance Ratings ----- | 3 |
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1. Absolute Maximum Ratings ($T_J=25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Values | | | Unit | |
|---|-----------|--|------|----------|------------------|---------------------|
| | | Min. | Typ. | Max. | | |
| Drain-Source Voltage | V_{DS} | - | - | 650 | V | |
| Gate-Source Voltage | V_{GS} | - | - | ± 30 | V | |
| Drain Current-Continuous ^{Note 1} | I_D | $T_C=25^\circ\text{C}$ | - | - | 22.2 | A |
| | | $T_C=100^\circ\text{C}$ | - | - | 14.0 | A |
| Drain Current-Pulsed ^{Note 2} | I_{DM} | - | - | 70 | A | |
| Avalanche Current | I_{AS} | - | - | 9.9 | A | |
| Single Pulse Avalanche Energy ^{Note 3} | E_{AS} | - | - | 392 | mJ | |
| Maximum Power Dissipation | P_D | $T_C=25^\circ\text{C}$ | - | - | 83.3 | W |
| | | $T_C=100^\circ\text{C}$ | - | - | 33.3 | W |
| | | Derate Factor Above $T_C=25^\circ\text{C}$ | - | - | 0.66 | W/ $^\circ\text{C}$ |
| Body Diode dv/dt ^{Note 4} | dv/dt | - | - | 13.1 | V/nS | |
| Max. Operating Junction Temperature | T_J | - | - | 150 | $^\circ\text{C}$ | |
| Storage Temperature Range | T_{STG} | -55 | - | 150 | $^\circ\text{C}$ | |

2. Thermal Resistance Ratings

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|--|-----------------|--------------|------|------|-------|---------------------------|
| Thermal resistance, Junction-Case ^{Note 5} | $R_{\theta JC}$ | Steady State | - | - | 1.50 | $^\circ\text{C}/\text{W}$ |
| Thermal resistance, Junction-Ambient ^{Note 5} | $R_{\theta JA}$ | Steady State | - | - | 58.12 | $^\circ\text{C}/\text{W}$ |

Notes:

- Limited by silicon chip capability and $R_{\theta JC}$ junction-to-case thermal resistance.
- Must be ensure junction temperature does not exceed 150-degree C. (Pulse Width $\leq 380\mu\text{s}$, Duty $\leq 2\%$)
- Limited by T_{Jmax} , starting $T_J=25^\circ\text{C}$, $L=8\text{ mH}$, $R_g=25\Omega$, $I_{AS}=9.9\text{A}$, $V_{GS}=10\text{V}$.
- $V_{DD} = 0\sim 400\text{ V}$, $I_{SD}=I_S \leq 10\text{ A}$ starting $T_C = 25^\circ\text{C}$
- The value of thermal resistance is measured with the single device put on cooling plate under a still air environment temperature is 25 degree C based on JEDEC standard JESD51-14 and JESD51-2a. Thermal resistance obtained depends on the user's specific board design and given application.
- $C_{o(er)}$ is fixed capacitance that gives same stored energy as C_{OSS} while V_{DS} rising to 400V from 0V.
- $C_{o(tr)}$ is fixed capacitance that gives same charging time as C_{OSS} while V_{DS} rising to 400V from 0V.

3. Electrical Characteristics (T_J=25°C unless otherwise noted)

| STATIC CHARACTERISTICS | | | | | | |
|---------------------------------|-------------------|---|------|------|------|------|
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
| Drain-Source Breakdown Voltage | BV _{DSS} | V _{GS} =0V, I _{DS} =250μA | 650 | - | - | V |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} =650V, V _{GS} =0V | - | - | 5 | μA |
| | | V _{DS} =650V, V _{GS} =0V, T _J =125°C | - | - | 1 | mA |
| Gate-Body Leakage Current | I _{GSS} | V _{GS} =±30V, V _{DS} =0V | - | - | ±100 | nA |

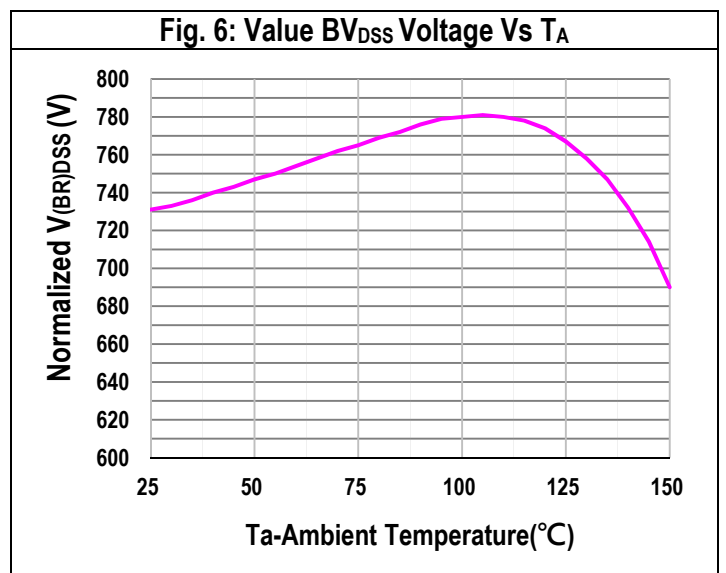
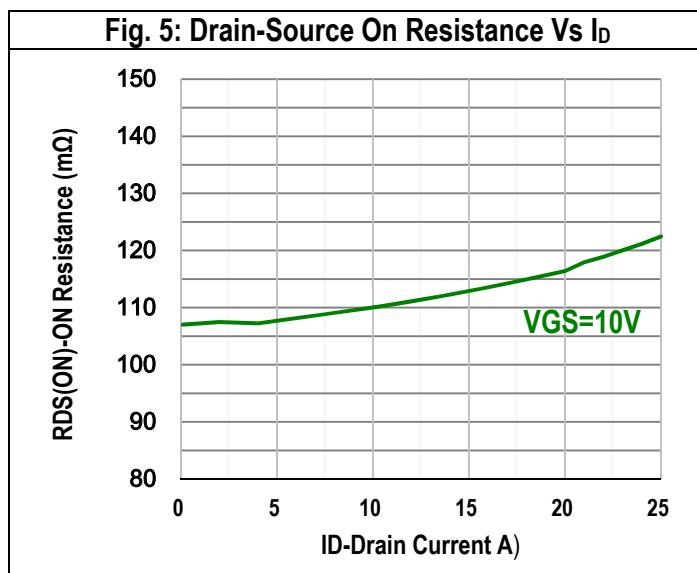
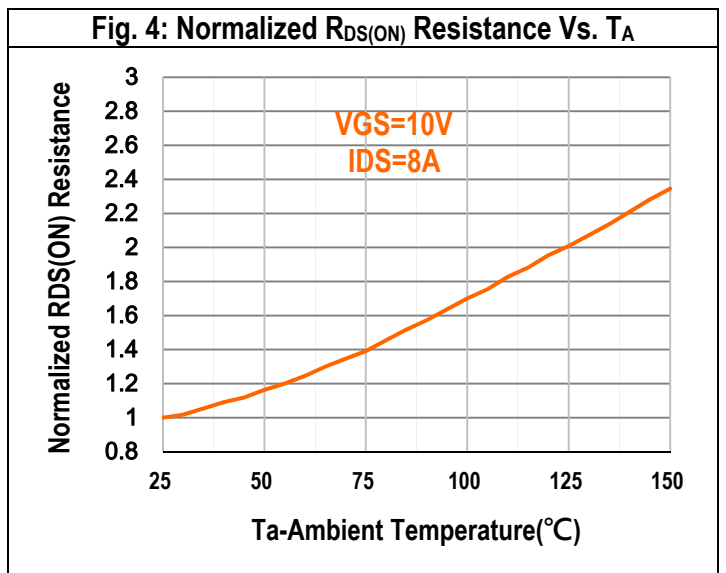
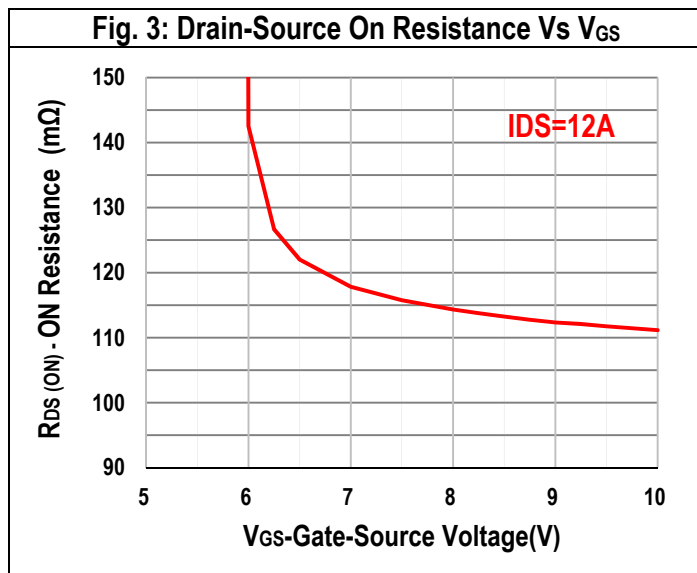
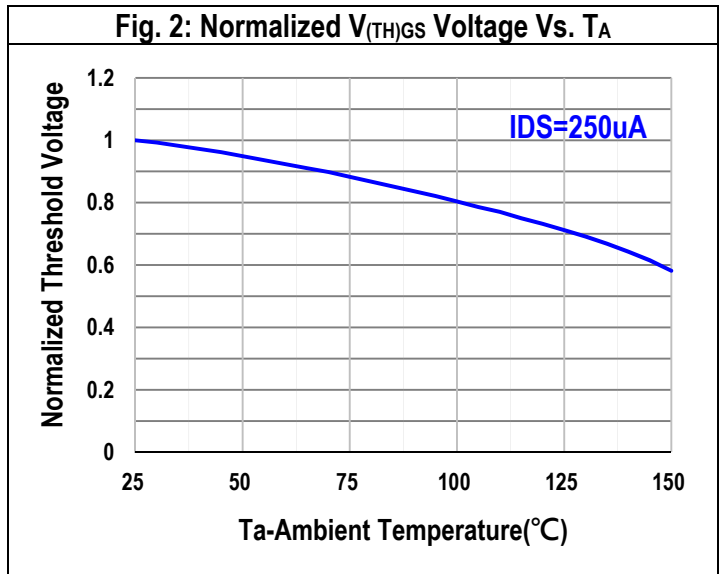
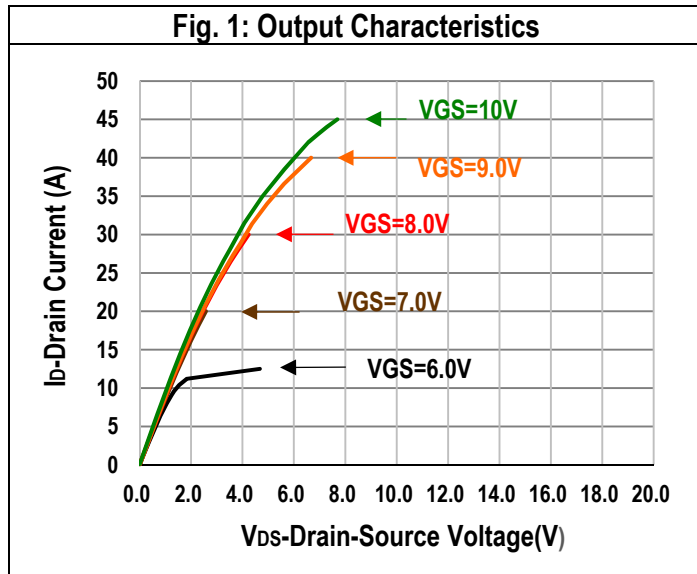
| STATIC CHARACTERISTICS | | | | | | |
|----------------------------------|---------------------|---|------|------|------|------|
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
| Gate Threshold Voltage | V _{GS(TH)} | V _{DS} =V _{GS} , I _{DS} =250μA | 3.5 | 3.9 | 4.5 | V |
| Drain-Source On-State Resistance | R _{DS(ON)} | V _{GS} =10V, I _{DS} =12A | - | 110 | 125 | mΩ |
| Gate Resistance | R _G | V _{GS} =0V, V _{DS} =0V, f=1MHz | - | 0.9 | - | Ω |
| Forward Transconductance | g _{fs} | V _{DS} =10V, I _{DS} =12A | - | 15 | - | S |

| DYNAMIC CHARACTERISTICS | | | | | | |
|-------------------------------------|---------------------|--|------|------|------|------|
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
| Input Capacitance | C _{iss} | V _{DD} =650V, V _{DS} =325V, V _{GS} =0V, F=1MHz | - | 2464 | - | pF |
| Output Capacitance | C _{oss} | V _{DD} =650V, V _{DS} =325V, V _{GS} =0V, F=1MHz | - | 60.3 | - | pF |
| Reverse Transfer Capacitance | C _{rss} | V _{DD} =650V, V _{DS} =325V, V _{GS} =0V, F=1MHz | - | 4.5 | - | pF |
| Effective output capacitance-energy | C _{o(er)} | V _{DD} =400V, V _G =10V, energy related ^{Note 6} | - | 192 | - | pF |
| Effective output capacitance-time | C _{o(tr)} | V _{DD} =400V, V _G =10V, time related ^{Note 7} | - | 813 | - | pF |
| Turn-On Delay Time | T _{d(on)} | V _{DS} =400V, V _{GS} =10V, I _{DS} =10A, R _{GEN} =10Ω | - | 23.8 | - | nS |
| Rise Time | t _r | V _{DS} =400V, V _{GS} =10V, I _{DS} =10A, R _{GEN} =10Ω | - | 24.3 | - | nS |
| Turn-Off Delay Time | T _{d(off)} | V _{DS} =400V, V _{GS} =10V, I _{DS} =10A, R _{GEN} =10Ω | - | 75.2 | - | nS |
| Fall Time | t _f | V _{DS} =400V, V _{GS} =10V, I _{DS} =10A, R _{GEN} =10Ω | - | 29.9 | - | nS |

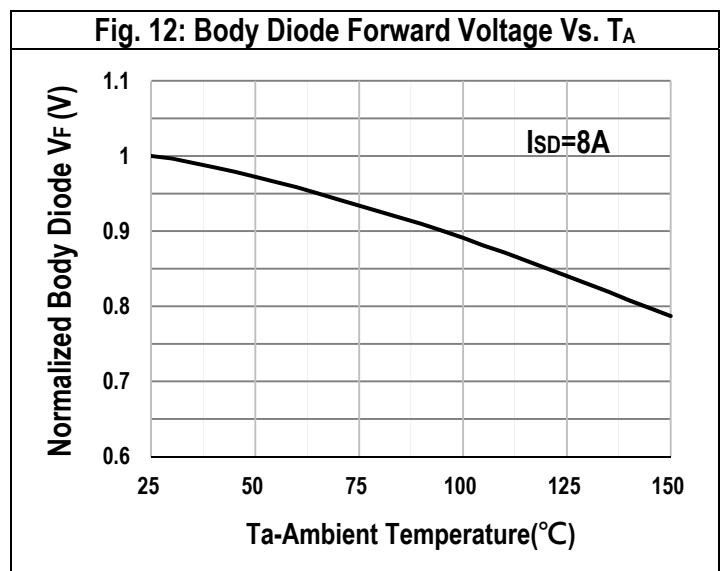
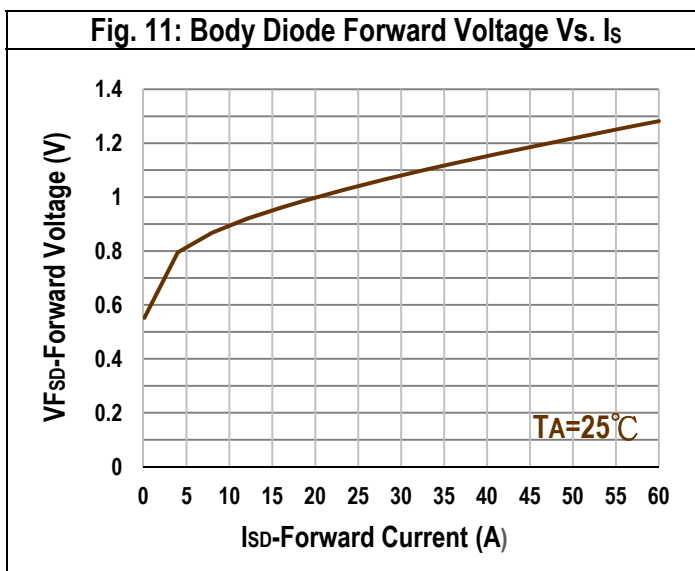
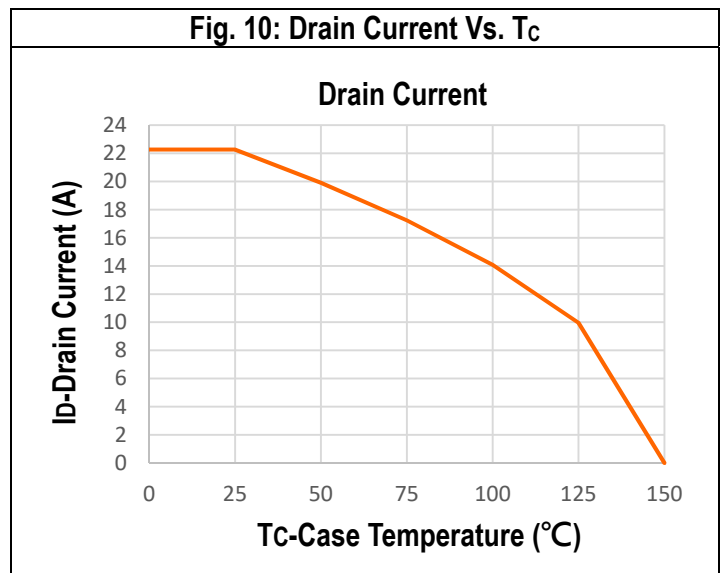
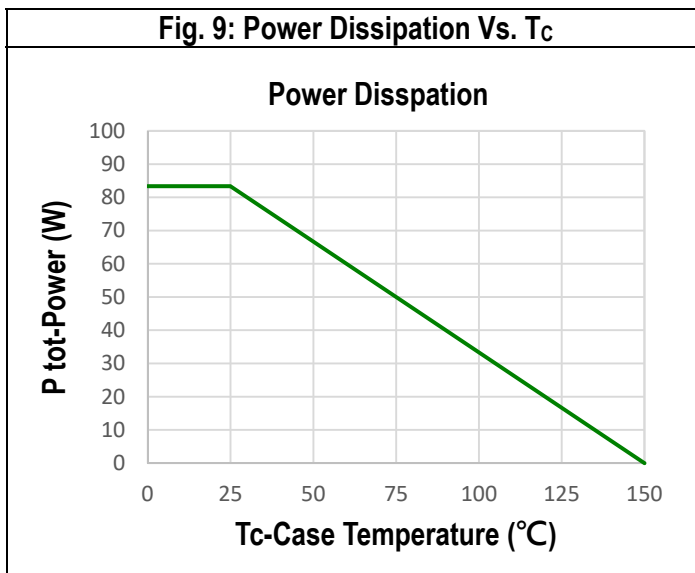
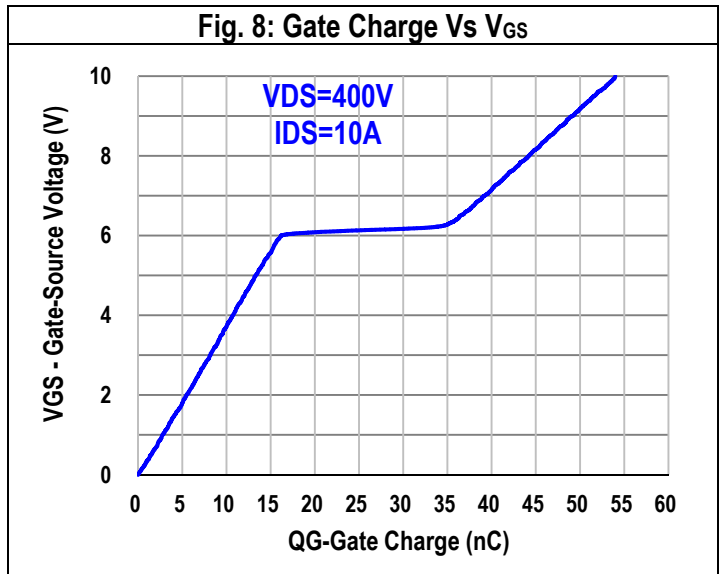
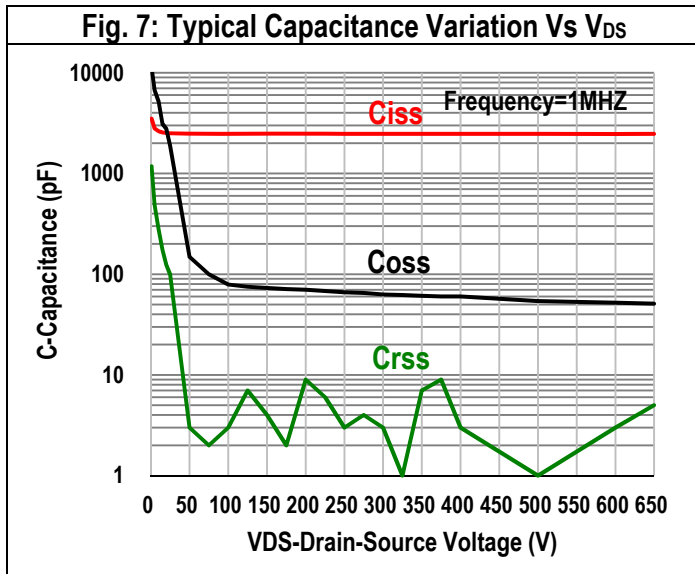
| GATE CHARGE CHARACTERISTICS | | | | | | |
|-----------------------------|----------------------|---|------|------|------|------|
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
| Gate charge total | Q _{g 10V} | V _{DD} =400V, I _D =10A, V _{GS} =0 to 10V | - | 54.2 | - | nC |
| Gate to Source Gate Charge | Q _{gs} | V _{DD} =400V, I _D =10A, V _{GS} =0 to 10V | - | 16.5 | - | nC |
| Gate to Drain Charge | Q _{gd} | V _{DD} =400V, I _D =10A, V _{GS} =0 to 10V | - | 18.6 | - | nC |
| Gate plateau voltage | V _{plateau} | V _{DD} =400V, I _D =10A, V _{GS} =0 to 10V | - | 6.1 | - | V |

| BODY DIODE CHARACTERISTICS AND MAXIMUM RATINGS | | | | | | |
|--|-----------------|---|------|------|------|------|
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
| Diode continuous forward current | I _S | T _C =25°C | - | - | 22.2 | A |
| Diode pulsed forward current | I _{SM} | T _C =25°C | - | - | 70 | A |
| Diode forward Voltage | V _{SD} | T _C =25°C, V _{GS} =0V, I _S = 12A | - | 0.91 | 1.0 | V |
| Diode reverse Recovery Time | t _{rr} | V _{DD} =400V, I _{SD} =10A, T _C =25°C, di/dt=50A/μs | - | 516 | - | nS |
| Diode reverse Recovery Charge | Q _{rr} | V _{DD} =400V, I _{SD} =10A, T _C =25°C, di/dt=50A/μs | - | 144 | - | nC |
| Diode peak reverse recovery current | I _{rm} | V _{DD} =400V, I _{SD} =10A, T _C =25°C, di/dt=50A/μs | - | 7.3 | - | A |

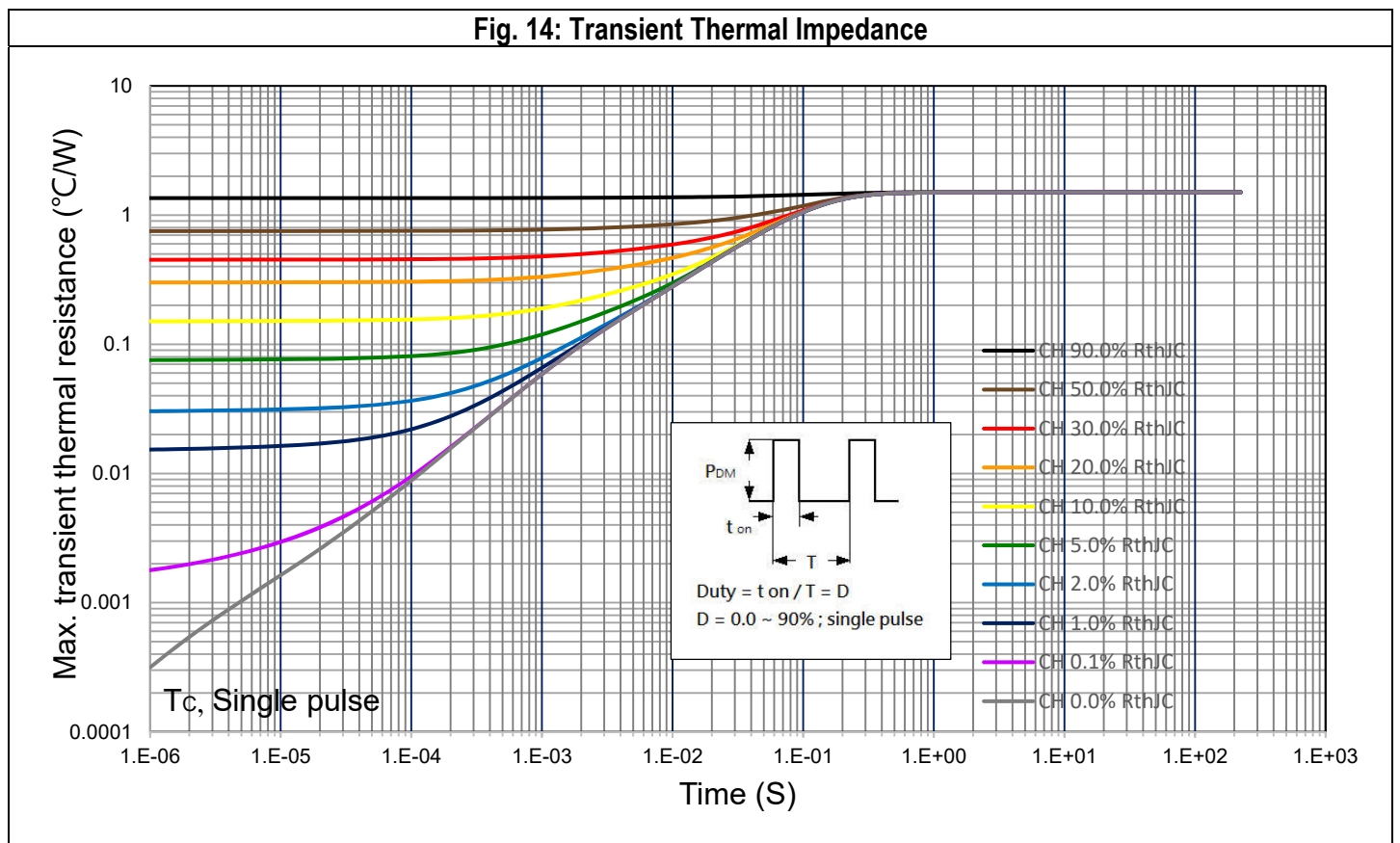
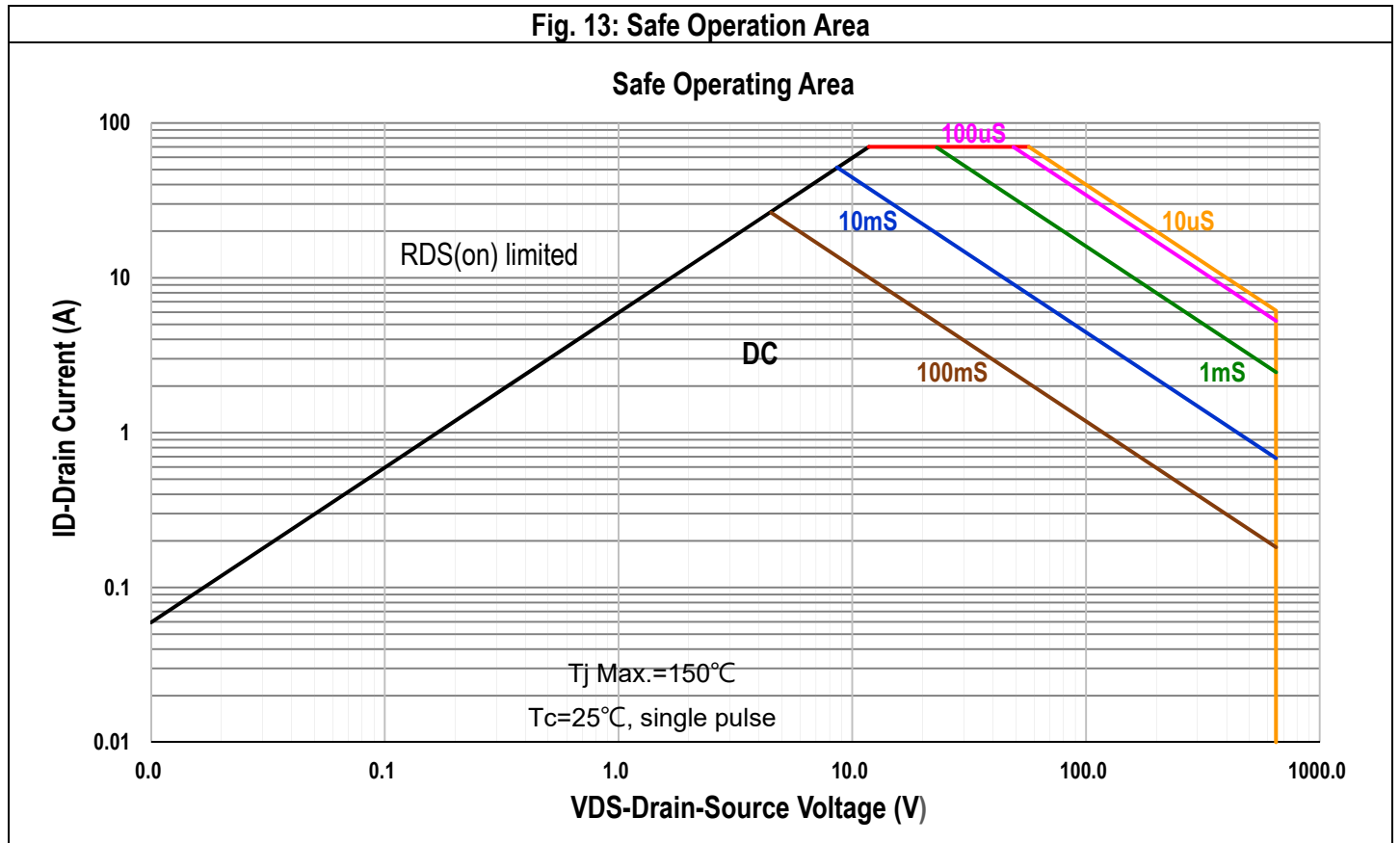
4. Typical Operating Characteristics diagrams



4. Typical Operating Characteristics diagrams



4. Typical Operating Characteristics diagrams



5. Measurement Schematic

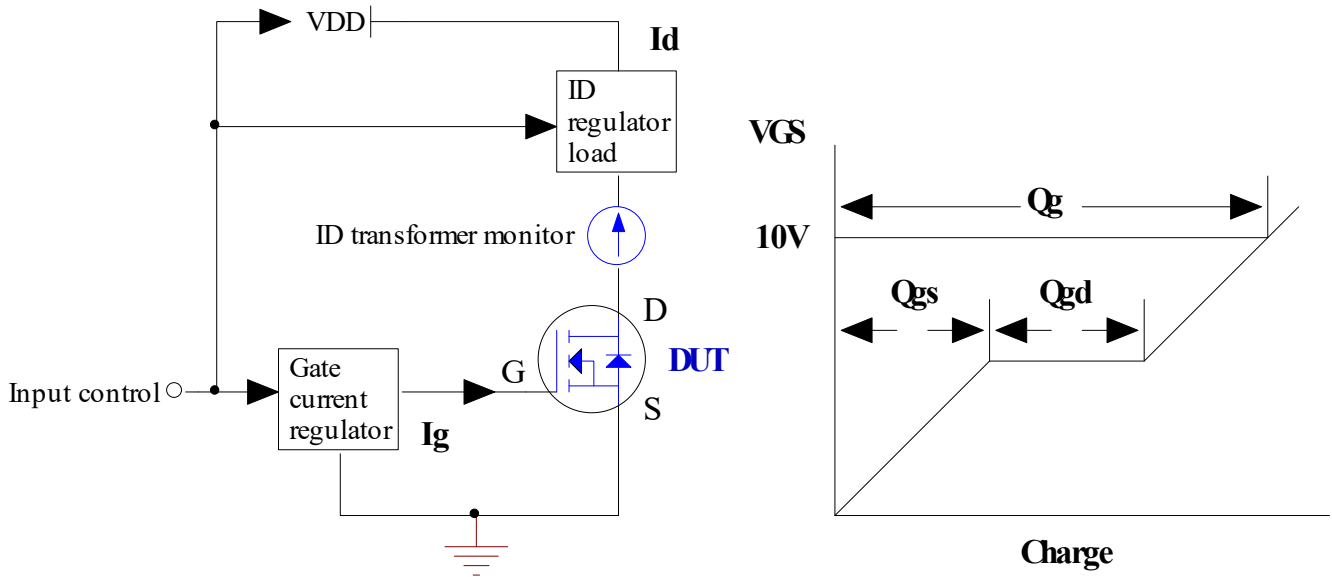


Diagram 5.1 Gate Charge Measurement Circuit and Waveforms

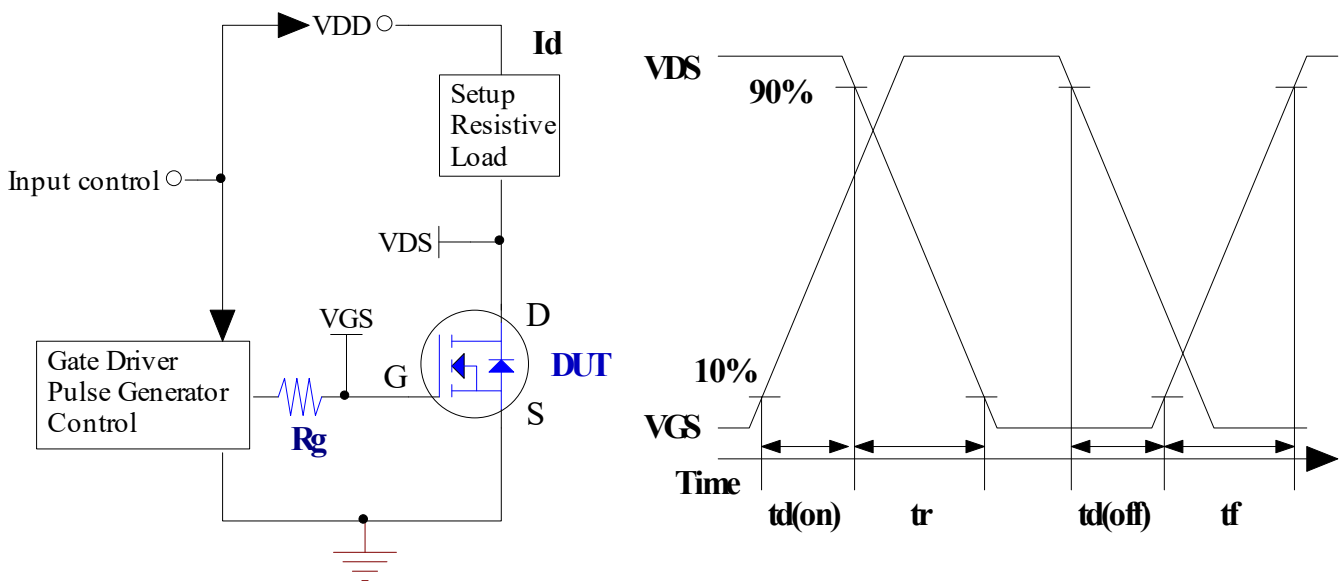


Diagram 5.2 Resistive Switching Measurement Circuit and Waveforms

5. Measurement Schematic

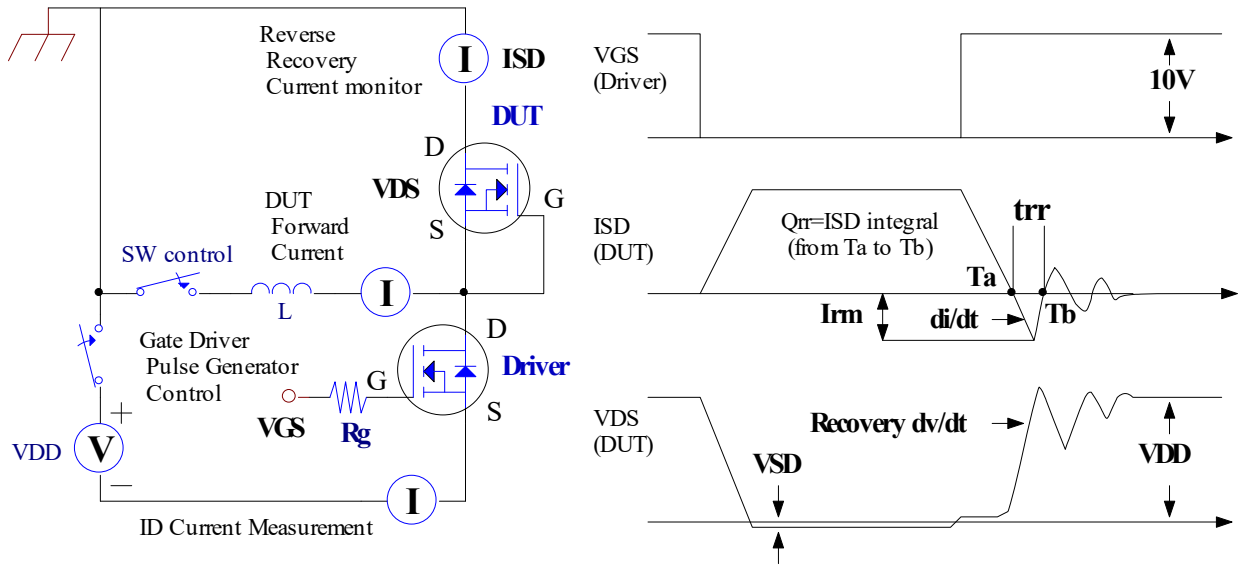


Diagram 5.3 Body Diode Recovery Characteristics Measurement Circuit and Waveforms

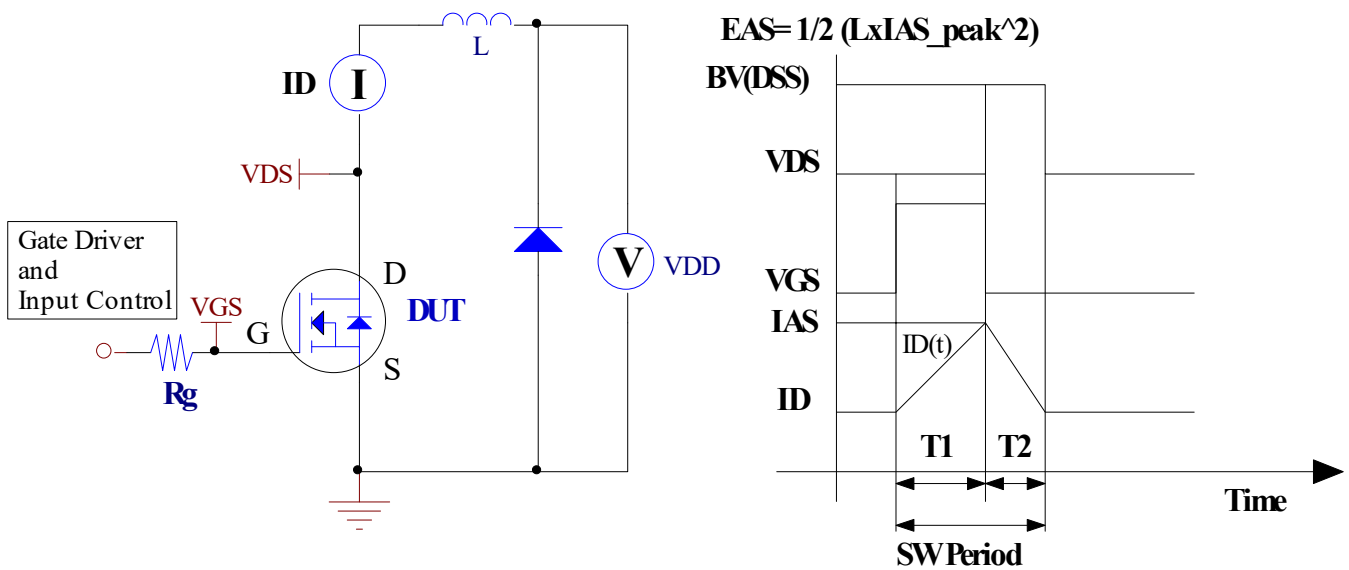
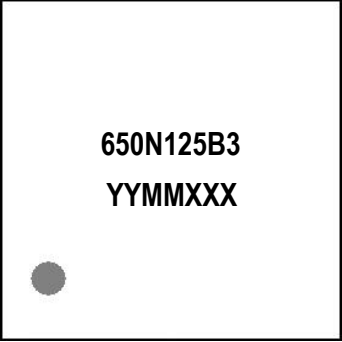


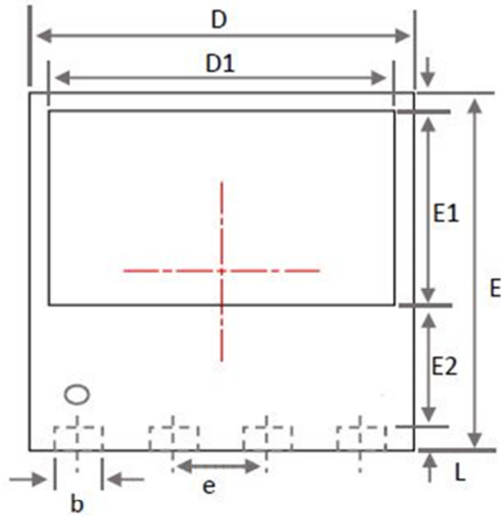
Diagram 5.4 Unclamped Inductive Switching Measurement Circuit and Waveforms

6. Marking Information

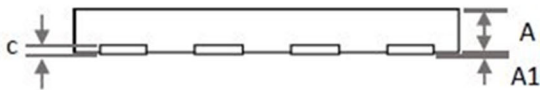
| DFN8x8 (B) | Marking Rule |
|--|--|
| <p>Laser Marking</p>  | <p><u>Line 1</u> : Device 650N125B3</p> <p><u>Line 2</u> : Date Code YYMMXXX</p> <p>YY : Year Code MM : Month Code XXX : Serial Number</p> |

7. Package of Dimension

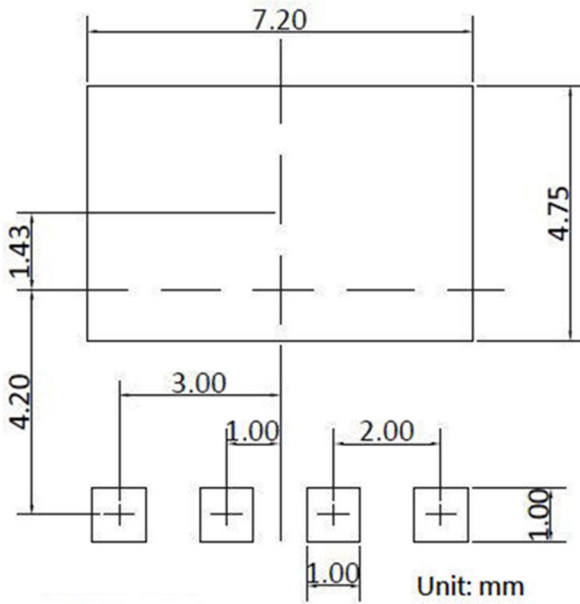
Package type: DFN8x8



| Symbol | Min | Nor | Max |
|--------|------|------|------|
| A | 0.90 | 1.00 | 1.10 |
| A1 | 0.00 | - | 0.05 |
| b | 0.90 | 1.00 | 1.10 |
| c | 0.10 | 0.20 | 0.30 |
| D | 7.90 | 8.00 | 8.10 |
| D1 | 7.10 | 7.20 | 7.30 |
| E | 7.90 | 8.00 | 8.10 |
| E1 | 4.25 | 4.35 | 4.45 |
| E2 | 2.65 | 2.75 | 2.85 |
| E3 | 0.30 | 0.40 | 0.50 |
| e | 2.00 | 2.00 | 2.00 |
| L | 0.40 | 0.50 | 0.60 |



8. Land pattern (Footprint)



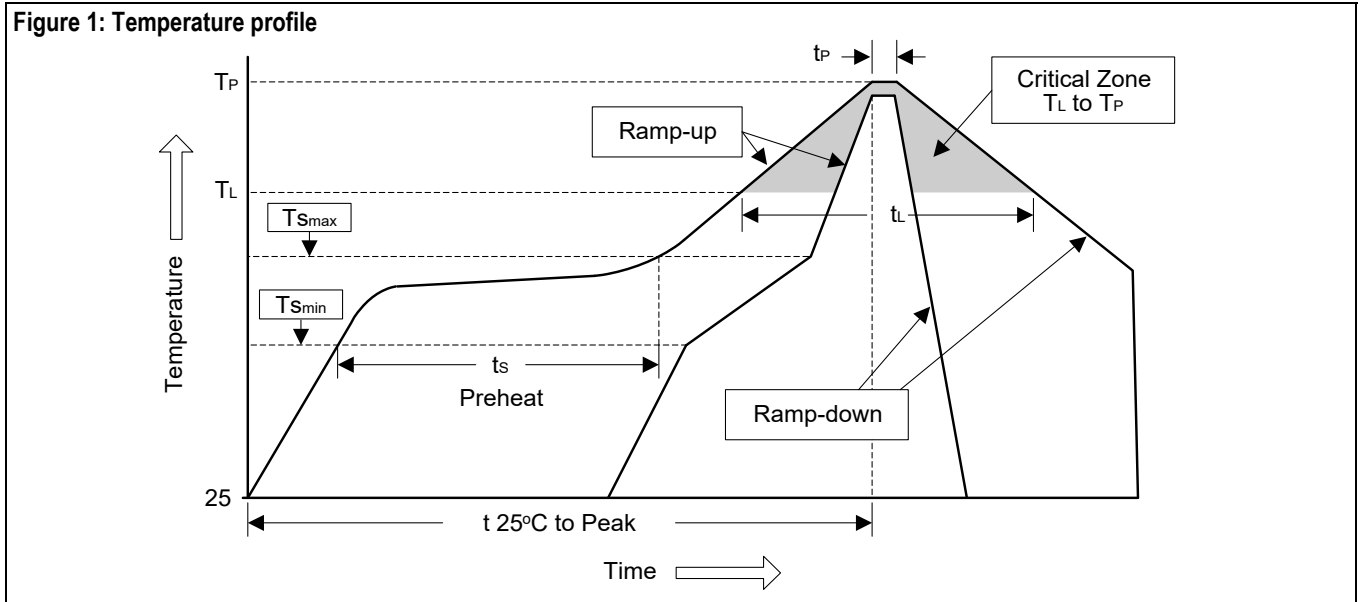
- Note 1: Land pattern (Footprint) design is for reference only.
- Note 2: Package body sizes exclude mold flash and burrs.
- Note 3: Dimension is measured in gauge plane.
- Note 4: Tolerance 0.1mm unless otherwise specified.

9. Appendix

Appendix-A

Soldering Methods for Silicongear's Products (Just for SMD type of device)

1. Storage environment: Temperature=10°C to 35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices



| Profile Feature | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|--|-------------------------|------------------|
| Average ramp-up rate (T_L to T_P) | <3°C/sec | <3°C/sec |
| Preheat | | |
| - Temperature Min (T_{smin}) | 100°C | 150°C |
| - Temperature Max (T_{smax}) | 150°C | 200°C |
| - Time (min to max) (t_s) | 60 to 120 sec | 60 to 180 sec |
| T_{smax} to T_L | | |
| - Ramp-up Rate | <3°C/sec | <3°C/sec |
| Time maintained above: | | |
| - Temperature (T_L) | 183°C | 217°C |
| - Time (t_L) | 60 to 150 sec | 60 to 150 sec |
| Peak Temperature (T_P) | 240°C +0/-5°C | 260°C +0/-5°C |
| Time within 5°C of actual Peak Temperature (t_P) | 10 to 30 sec | 20 to 40 sec |
| Ramp-down Rate | <6°C/sec | <6°C/sec |
| Time 25°C to Peak Temperature | <6 minutes | <8 minutes |

3. Flow (wave) soldering (solder dipping)

| Products | Peak Temperature | Dipping Time |
|------------------|------------------|--------------|
| Pb devices. | 245°C ±5°C | 5sec ±1sec |
| Pb-Free devices. | 260°C +0/-5°C | 5sec ±1sec |

9. Appendix**Appendix-B****Important Notice****© Silicongear Corporation**

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