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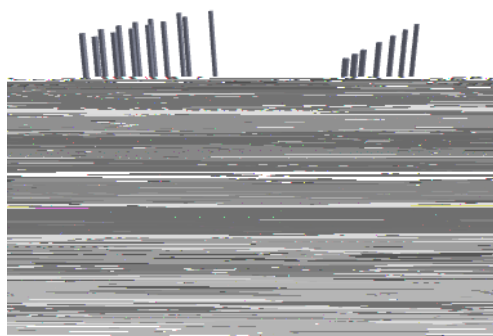
FNA51560TD3

Motion SPM® 55 Series

Features

- UL Certified No. E209204 (UL1557)
- 600 V - 15 A 3-Phase IGBT Inverter Including Control IC for Gate Drive and Protections
- Low-Loss, Short-Circuit Rated IGBTs
- Built-In Bootstrap Diodes in HVIC
- Separate Open-Emitter Pins from Low-Side IGBTs for Three-Phase Current Sensing
- Active-HIGH interface, works with 3.3 / 5 V Logic, Schmitt-trigger Input
- HVIC for Gate Driving, Under-Voltage and Short-Circuit Current Protection
- Fault Output for Under-Voltage and Short-Circuit Current Protection
- Inter-Lock Function to Prevent Short-Circuit
- Shut-Down Input
- HVIC Temperature-Sensing Built-In for Temperature Monitoring
- Optimized for 5 kHz Switching Frequency
- Isolation Rating: 1500 V_{rms} / min.

Applications



Integrated Power Functions

- 600 V - 15 A IGBT inverter for three phase DC / AC power conversion (Please refer to Figure 3)

Integrated Drive, Protection and System Control Functions

- For inverter high-side IGBTs: gate drive circuit, high-voltage isolated high-speed level shifting control circuit Under-Voltage Lock-Out (UVLO) protection
- For inverter low-side IGBTs: gate drive circuit, Short-Circuit Protection (SCP) control supply circuit Under-Voltage Lock-Out (UVLO) protection
- Fault signaling: corresponding to UVLO (low-side supply) and SC faults
- Input interface: High-active interface, works with 3.3 / 5 V logic, Schmitt trigger input
- Built in Bootstrap circuitry in HVIC

Pin Configuration

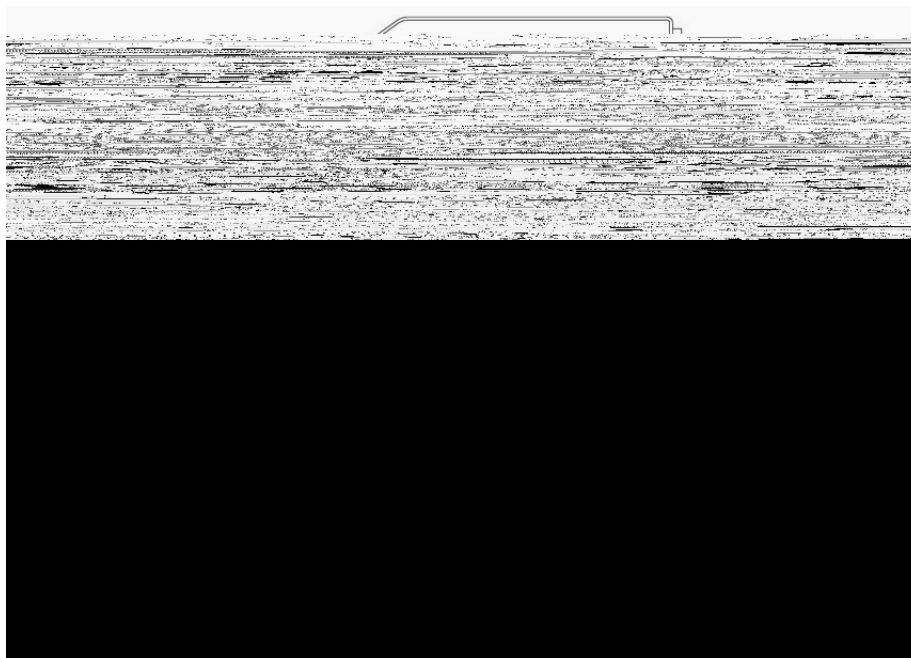
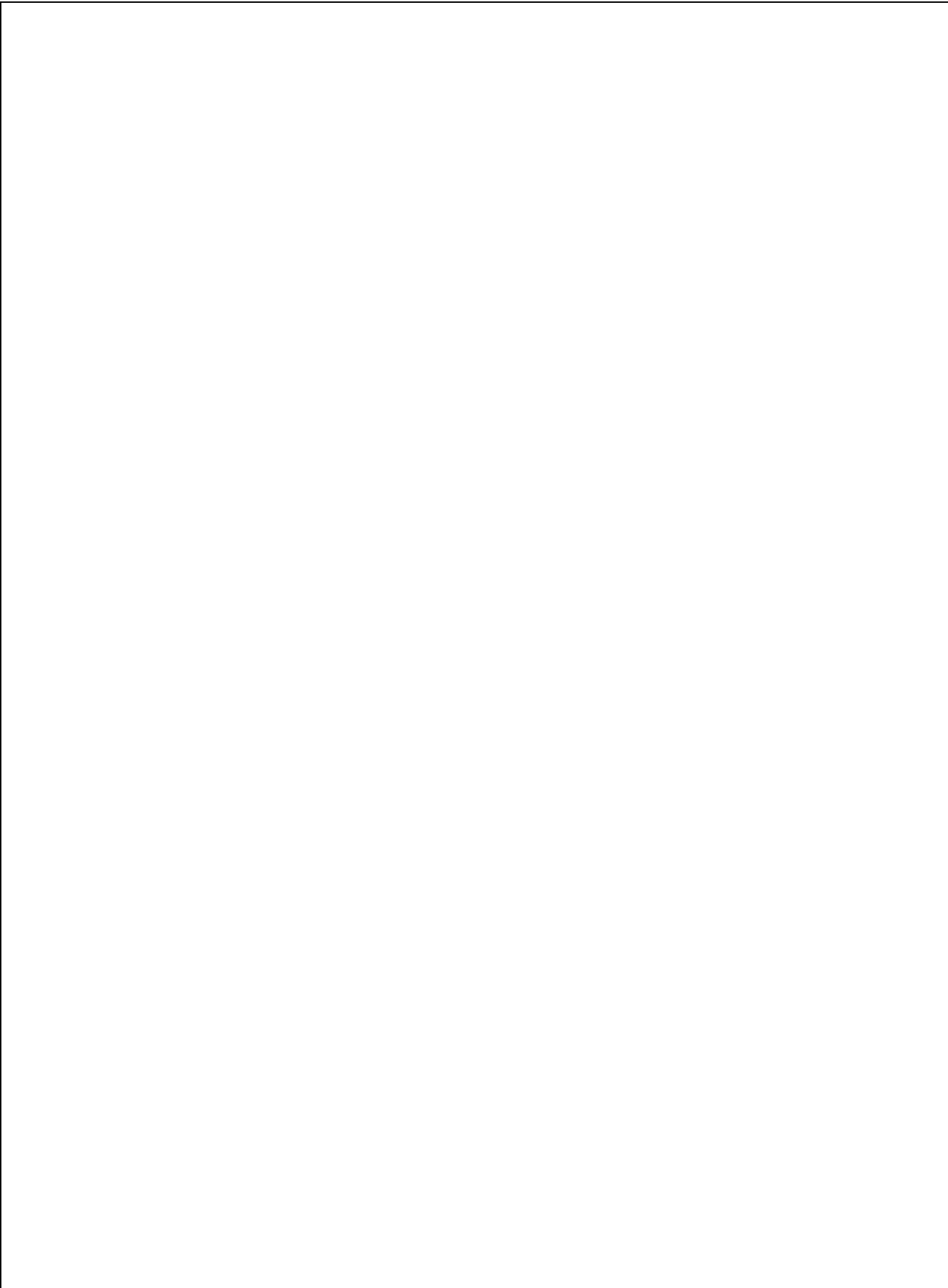


Figure 2. Top View

Pin Descriptions

| Pin Number | Pin Name | Pin Description |
|------------|----------|------------------------|
| 1 | P | Positive DC-Link Input |



Absolute Maximum Ratings ($T_J = 25^\circ\text{C}$, unless otherwise specified.)**Inverter Part**

| Symbol | Parameter | Conditions | Rating | Unit |
|------------------------|------------------------------------|---|-----------|------------------|
| V_{PN} | Supply Voltage | Applied between P - N_U , N_V , N_W | 450 | V |
| $V_{PN(\text{Surge})}$ | Supply Voltage (Surge) | Applied between P - N_U , N_V , N_W | 500 | V |
| V_{CES} | Collector - Emitter Voltage | | 600 | V |
| $*\pm I_C$ | Each IGBT Collector Current | $T_C = 25^\circ\text{C}$, $T_J = 150^\circ\text{C}$ | 15 | A |
| $*\pm I_{CP}$ | Each IGBT Collector Current (Peak) | $T_C = 25^\circ\text{C}$, $T_J = 150^\circ\text{C}$, Under 1 ms Pulse Width | 30 | A |
| $*P_C$ | Collector Dissipation | $T_C = 25^\circ\text{C}$ per Chip | 27 | W |
| T_J | Operating Junction Temperature | (Note 5) | -40 ~ 150 | $^\circ\text{C}$ |

Note:

5. The maximum junction temperature rating of the power chips integrated within the Motion SPM® 55 product is 150 C.

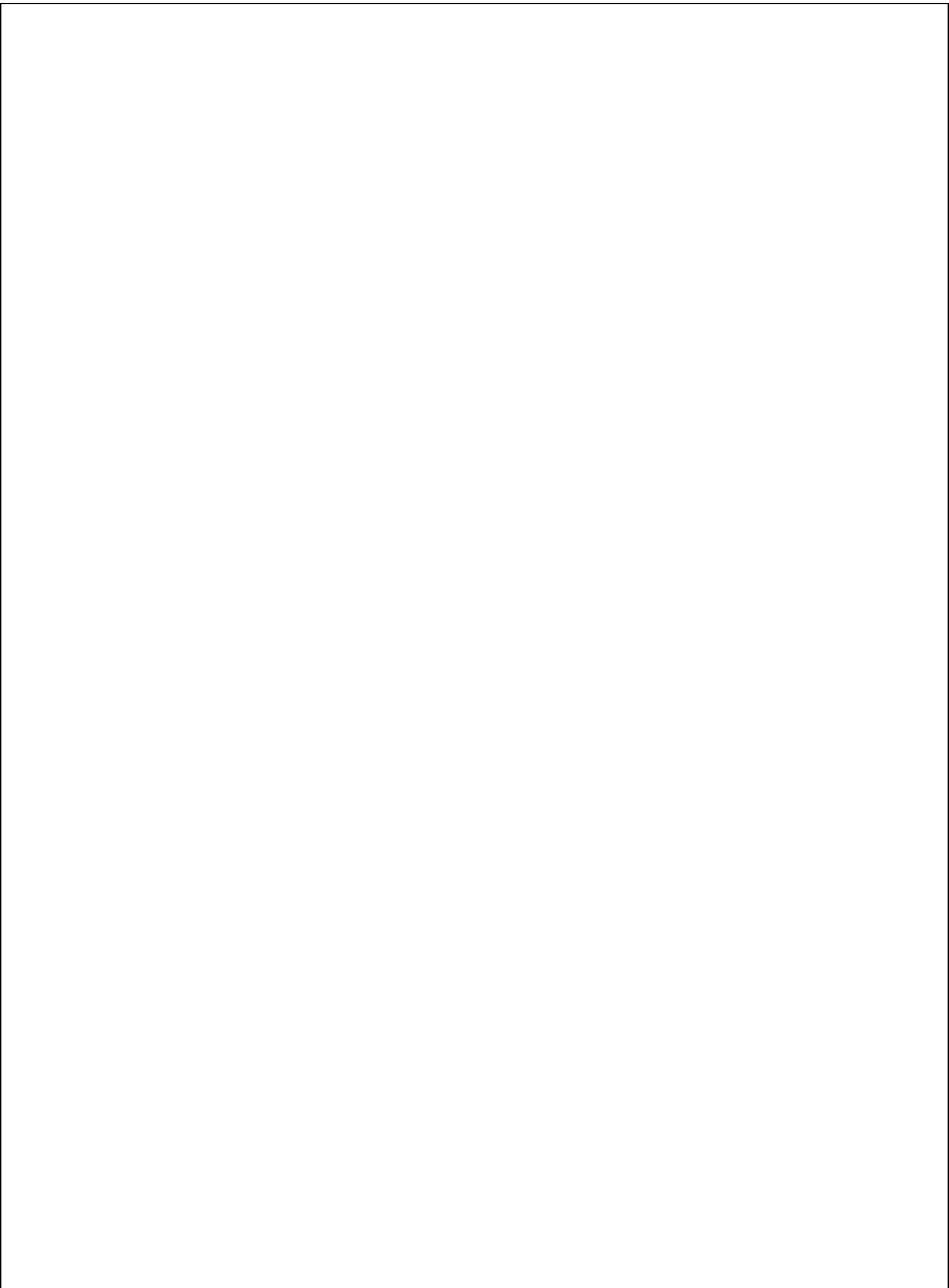
Control Part

| Symbol | Parameter | Conditions | Rating | Unit |
|----------|------------------------|--------------------------|--------|------|
| V_{DD} | Control Supply Voltage | Applied between V_{DD} | | |

Total System**Thermal Resistance****Note:**

6. For Marking " ** ", These Value had been made an acquisition by the calculation considered to design factor.

7. For the measurement point of case temperature (T_C), please refer to Figure 2.



Bootstrap Diode Part

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-----------------|---------------------------|--|------|------|------|------|
| R _{BS} | Bootstrap Diode Resitance | V _{DD} = 15V, T _C = 25°C | - | 280 | - | |

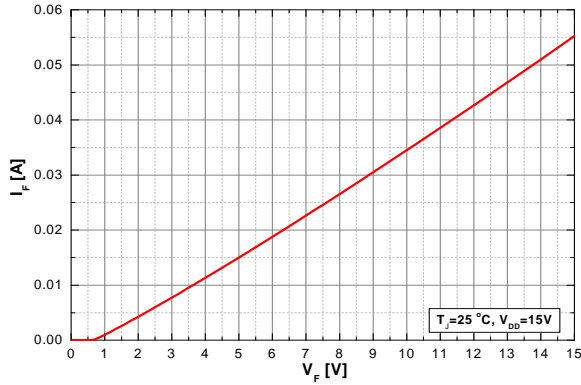


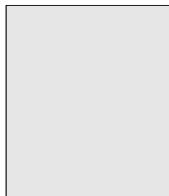
Figure 6. Built-In Bootstrap Diode Charaterstics

Recommended Operating Conditions

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|--|--|---|------|------|------|-------|
| V _{PN} | Supply Voltage | Applied between P - N _U , N _V , N _W | - | 300 | 400 | V |
| V _{DD} | Control Supply Voltage | Applied between V _{DD} - COM | 14.0 | 15 | 16.5 | V |
| V _{BS} | High - Side Bias Voltage | Applied between V _{B(U)} - V _{S(U)} , V _{B(V)} - V _{S(V)} , V _{B(W)} - V _{S(W)} | 13.0 | 15 | 18.5 | V |
| dV _{DD} / dt, dV _{BS} / dt | Control Supply Variation | | -1 | - | 1 | V / s |
| t _{dead} | Blanking Time for Preventing Arm - Short | For each input signal | 1.5 | - | - | s |
| f _{PWM} | PWM Input Signal | - 40 C T _J 150°C | - | - | 20 | kHz |
| V _{SEN} | Voltage for Current Sensing | Applied between N _U , N _V , N _W - COM (Including surge voltage) | -4 | | 4 | V |
| P _{WIN(ON)} | Minimum Input Pulse Width | (Note 9) | 0.7 | - | - | s |
| P _{WIN(OFF)} | | | 0.7 | - | - | |

Note:

10. This product might not make response if input pulse width is less than the recommended value.



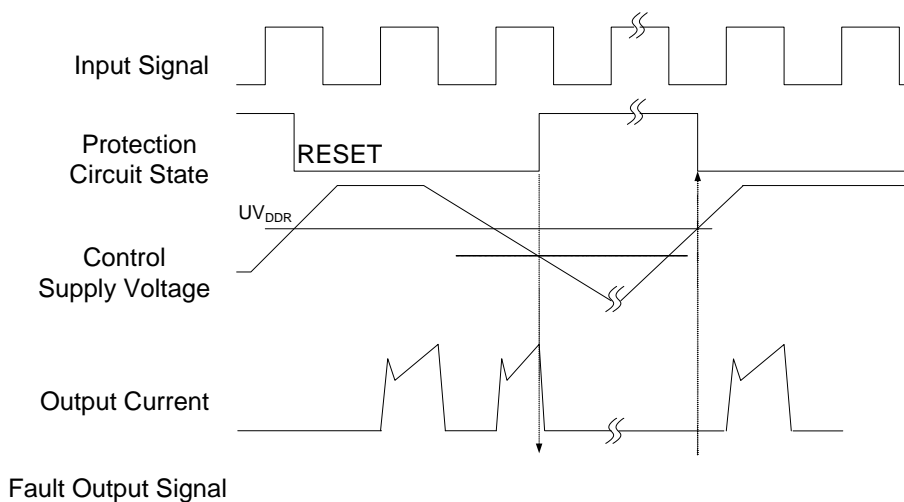
Note:

11. RC coupling at each input (parts shown dotted) might change depending on the PWM control scheme used in the application and the wiring impedance of the application's printed circuit board. The input signal section of the SPM 55 product integrates 10 k (typ.) pull-down resistor. Therefore, when using an external filtering resistor, please pay attention to the signal voltage drop at input terminal.

Figure 7. Recommended MCU I/O Interface Circuit

Mechanical Characteristics and Ratings

Time Charts of Protective Function

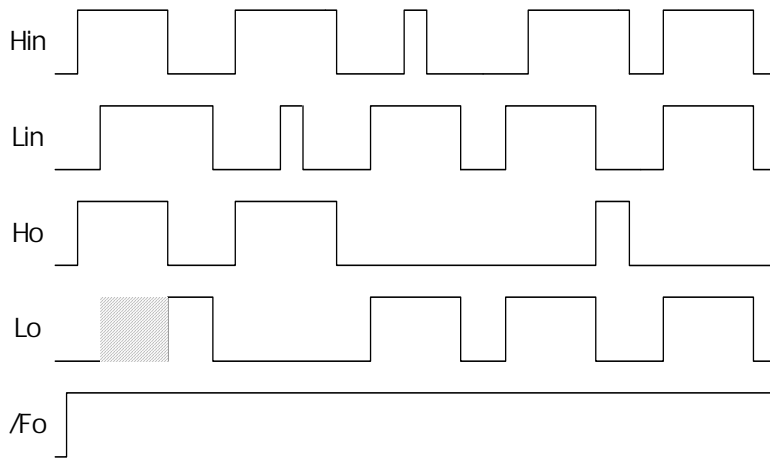


- a1 : Control supply voltage rises: After the voltage rises UV_{DDR} , the circuits start to operate when next input is applied.
- a2 : Normal operation: IGBT ON and carrying current.
- a3 : Under voltage detection (UV_{DD}).
- a4 : IGBT OFF in spite of control input condition.
- a5 : Fault output operation starts.
- a6 : Under voltage reset (UV_{DDR}).
- a7 : Normal operation: IGBT ON and carrying current.

Figure 10. Under-Voltage Protection (Low-Side)

- b1 : Control supply voltage rises: After the voltage reaches UV_{BSR} , the circuits start to operate when next input is applied.
- b2 : Normal operation: IGBT ON and carrying current.
- b3 : Under voltage detection (UV_{BSD}).
- b4 : IGBT OFF in spite of control input condition, but there is no fault output signal.
- b5 : Under voltage reset (UV_{BSR})
- b6 : Normal operation: IGBT ON and carrying current

Figure 11. Under-Voltage Protection (High-Side)

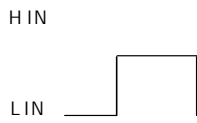


- d1 : High Side First - Input - First - Output Mode
- d2 : Low Side Noise Mode : No Lo
- d3 : High Side Noise Mode : No Ho
- d4 : Low Side First - Input - First - Output Mode
- d5 : In - Phase Mode : No Ho

Figure 12. Inter-Lock Function

- HIN : High-side Input Signal
- LIN : Low-side Input Signal
- HO : High-Side Output Signal
- LO : Low-Side Output Signal
- CSC : Over Current Detection Input
- VF : Fault Out Function

Figure 13. Fault-Out Function By Over Current Protection



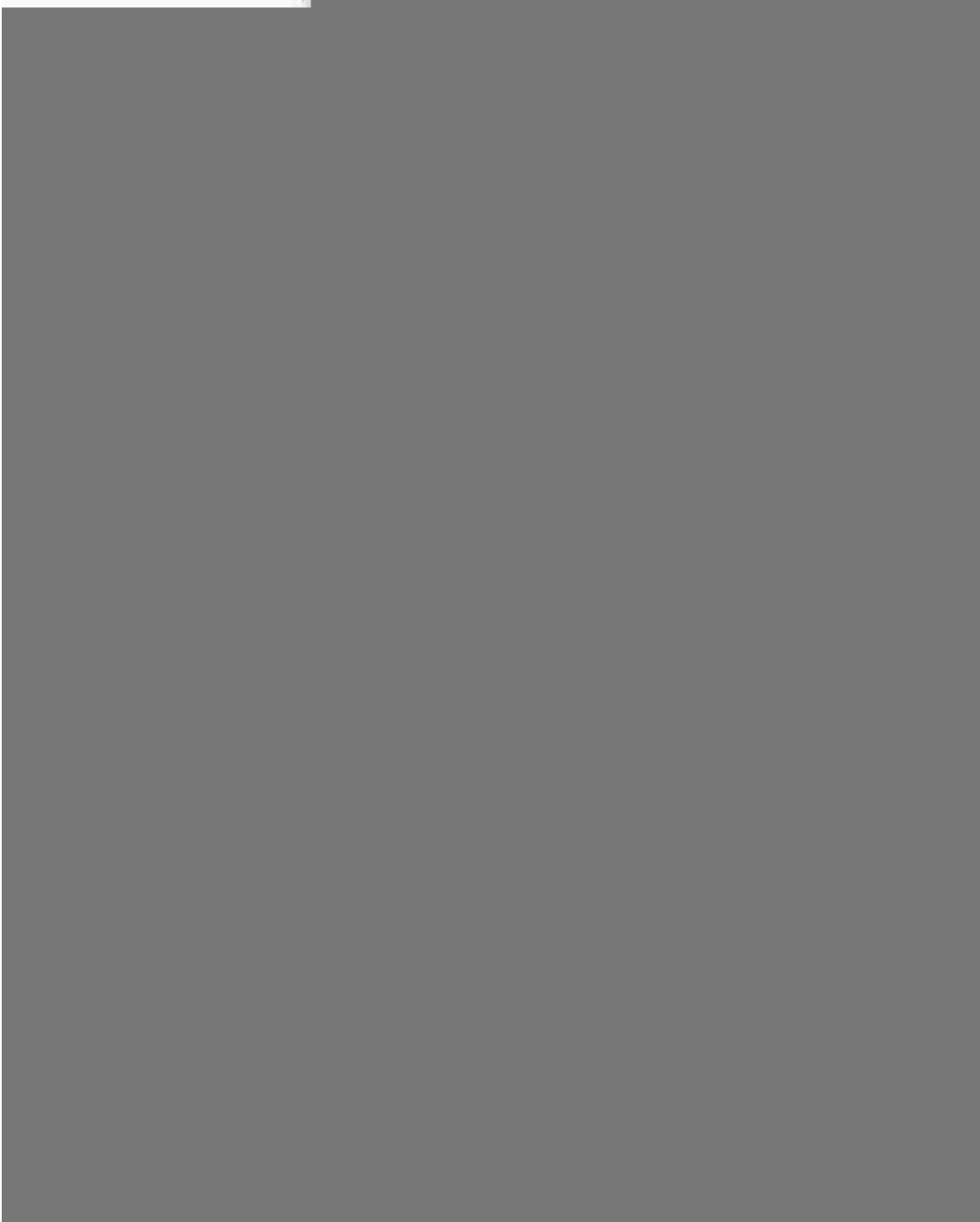
HIN : High-side Input Signal
 LIN : Low-side Input Signal
 HO : High-Side Output Signal
 LO : Low-Side Output Signal
 CSC : Over Current Detection Input
 VF : Shutdown Input Function

Figure 14. Shutdown Input Function By External Command


Note:

- 1) To avoid malfunction, the wiring of each input should be as short as possible. (less than 2 ~ 3 cm)
- 2) By virtue of integrating an application specific type of HVIC inside the SPM®

Detailed Package Outline Drawings (FNA51560TD3, Long Lead)



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