

&lt; SOPIPM &gt;

# SOPIPM Series APPLICATION NOTE

## SP2SK

---

### Table of contents

CHAPTER 1 INTRODUCTION .....	2
1.1 Features of SOPIPM .....	2
1.2 Functions.....	3
1.3 Target Applications .....	4
1.4 Product Line-up .....	4
CHAPTER 2 SPECIFICATIONS AND CHARACTERISTICS.....	5
2.1 SOPIPM Specifications .....	5
2.1.1 Maximum Ratings.....	5
2.1.2 Thermal Resistance.....	7
2.1.3 Electric Characteristics and Recommended Conditions .....	8
2.1.4 Mechanical Characteristics and Ratings.....	10
2.2 Protective Functions and Operating Sequence .....	11
2.2.1 Short Circuit Protection.....	11
2.2.2 UV : Control Supply under voltage protection .....	13
2.2.3 OT : Over temperature protection .....	15
2.2.4 Vot : Temperature output function.....	17
2.2.5 Interlock function .....	20
2.3 Package Outlines .....	21
2.3.1 Package outlines .....	21
2.3.2 Marking .....	22
2.3.3 Terminal Description.....	23
2.4 Mounting Method .....	25
2.4.1 Electric Spacing.....	25
2.4.2 Storage Condition of SOPIPM .....	25
2.4.3 Recommended mount pad design .....	26
2.4.3 Soldering Conditions .....	27
CHAPTER 3 SYSTEM APPLICATION GUIDANCE.....	28
3.1 Application Guidance .....	28
3.1.1 System connection .....	28
3.1.2 Interface Circuit (Direct Coupling Interface example for using one shunt resistor).....	29
3.1.3 Interface Circuit (Example of Opto-coupler Isolated Interface).....	30
3.1.4 External SC Protection Circuit with Using Three Shunt Resistors .....	31
3.1.5 Circuits of Signal Input Terminals and Fo Terminal .....	31
3.1.6 Snubber Circuit.....	33
3.1.7 Recommended Wiring Method around Shunt Resistor .....	33
3.1.8 Precaution for Wiring on PCB .....	35
3.1.9 SOA of SOPIPM .....	36
3.1.10 SCSOA.....	36
3.1.12 Power Life Cycles .....	37
3.2 Power Loss and Thermal Dissipation Calculation .....	38
3.2.1 Power Loss Calculation .....	38
3.2.2 Allowable motor current <i>WITHOUT heatsink operation</i> .....	40
3.2.3 Allowable motor current <i>WITH heatsink operation</i> .....	40
3.2.4 Carrier frequency characteristics for Total loss vs. Motor current .....	41
3.2.5 Installation of thermocouple for case temperature monitoring .....	43
3.3 Noise and ESD Withstand Capability .....	44
3.3.1 Evaluation Circuit of Noise Withstand Capability .....	44
3.3.2 Countermeasures and Precautions .....	44
3.3.3 Static Electricity Withstand Capability .....	45
CHAPTER 4 Bootstrap Circuit Operation .....	46
4.1 Bootstrap Circuit Operation .....	46
4.2 Bootstrap Supply Circuit Current at Switching State .....	47
4.3 Note for designing the bootstrap circuit .....	47
4.4 Initial charging in bootstrap circuit .....	48
CHAPTER 5 PACKAGE HANDLING .....	49
5.1 Packaging Specification .....	49
5.2 Handling Precautions .....	51