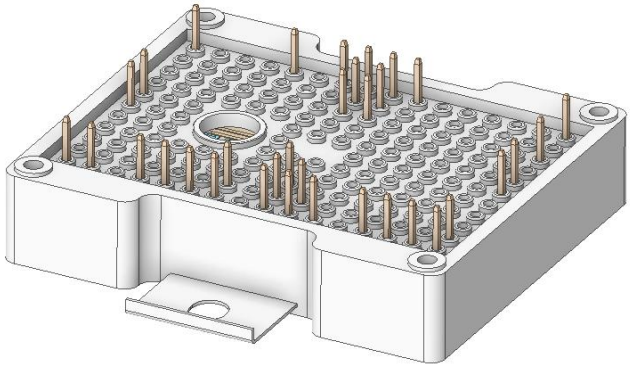
IGBT - Field Stop,Trench,Soft Fast Recovery Diode

650V/160A



Features

- Electrical features
  - V_{CES} = 650 V
  - $I_{C\ nom}$ = 160 A / I_{CRM} = 300 A
  - Increased blocking voltage capability up to 650 V
  - Low inductive design
  - Low switching losses
  - Low $V_{CE,sat}$

- Mechanical features
  - Al_2O_3 substrate with low thermal resistance
  - Compact design
  - Rugged mounting due to integrated mounting clamps
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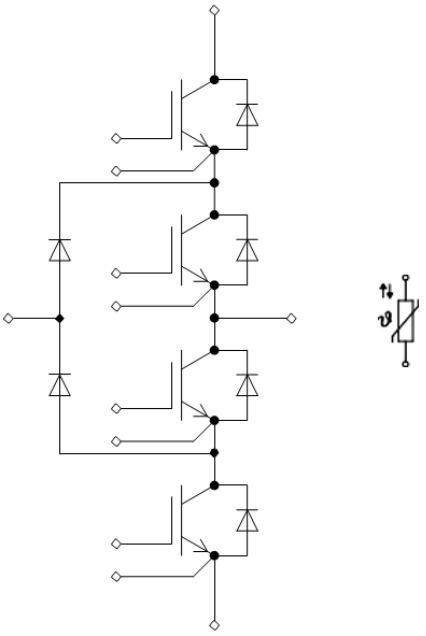
Potential applications

- Three-level applications
- Solar applications
- UPS systems



Device	Package	Shipping
SPM160V065P2BS	P2B	Tray

Table 1. ABSOLUTE MAXIMUM RATINGS (T_J = 25°C unless otherwise noted) (Note 1)

Rating	Symbol	Value	Unit
IGBT (T1, T2, T3, T4)			
Collector-Emitter Voltage	V_{CES}	650	V
Gate-Emitter Voltage Positive Transient Gate−Emitter Voltage (T_{pulse} = 5 s, D < 0.10)	V_{GE}	±20 30	V
Continuous Collector Current @ T_C = 100°C	I_C	160	A
Pulsed Peak Collector Current @ T_C = 80°C (T_J = 175°C)	$I_{C(Pulse)}$	300	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	450	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature (Note 2)	T_{JMAX}	175	°C
IGBT INVERSE DIODE (D1, D2, D3, D4)			
Peak Repetitive Reverse Voltage	V_{RRM}	650	V
Continuous Forward Current @ T_C = 80°C	I_F	90	A
Repetitive Peak Forward Current (T_J = 175°C)	I_{FRM}	180	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	250	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C
NEUTRAL POINT DIODE (D5, D6)			
Peak Repetitive Reverse Voltage	V_{RRM}	650	V
Continuous Forward Current @ T_C = 80°C	I_F	100	A
Repetitive Peak Forward Current (T_J = 175°C)	I_{FRM}	200	A
Maximum Power Dissipation (T_J = 175°C)	P_{tot}	250	W
Minimum Operating Junction Temperature	T_{JMIN}	−40	°C
Maximum Operating Junction Temperature	T_{JMAX}	175	°C

Any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Table 2. THERMAL AND INSULATION PROPERTIES (T_J = 25°C unless otherwise noted) (Note 1)

Rating	Symbol	Value	Unit
THERMAL PROPERTIES			
Operating Temperature under Switching Condition	T_{VJOP}	−40 to 150	°C
Storage Temperature Range	T_{stg}	−40 to 125	°C
INSULATION PROPERTIES			
Isolation Test Voltage, t = 1 s, 50 Hz (Note 2)	V_{is}	4000	V_{RMS}
Creepage Distance		6.7	mm
Comparative Tracking Index	CTI	>200	

1. **Refer to ELECTRICAL CHARACTERISTICS, RECOMMENDED OPERATING RANGES and/or APPLICATION INFORMATION for Safe Operating parameters.**
2. **4000 VACRMS for 1 second duration is equivalent to 3333 VACRMS for 1 minute duration.**

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
IGBT (T1, T2, T3, T4) CHARACTERISTICS						
Collector-Emitter Cutoff Current	I_{CES}	V_{GE} = 0 V, V_{CE} = 650 V	–	–	25	μA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15 V, IC = 160 A, T_J = 25°C	–	1.36	1.6	V
		V_{GE} = 15 V, IC = 160 A, T_J = 175°C	–	1.6	2.0	
Gate-Emitter Threshold Voltage	$V_{GE(TH)}$	V_{GE} = V_{CE}, I_C = 250uA	3.7	4.1	4.5	V
Gate Leakage Current	I_{GES}	V_{GE} = ±20 V, V_{CE} = 0 V	–	–	±1.0	μA
Turn-on Delay Time	$t_{d(on)}$	T_J = 25°C V_{CE} = 300 V, IC = 160 A V_{GE} = −9 V, 15 V, RGon = 10Ω, RGoff = 10 Ω	–	tbd	–	ns
Rise Time	t_r		–	tbd	–	
Turn-off Delay Time	$t_{d(off)}$		–	tbd	–	
Fall Time	t_f		–	tbd	–	
Turn-on Switching Loss per Pulse	E_{on}		–	5.9	–	mJ
Turn-off Switching Loss per Pulse	E_{off}		–	4.5	–	
Turn-on Delay Time	$t_{d(on)}$	T_J = 150°C VCE = 300 V, IC = 160 A V_{GE} = −9 V, 15 V, RGon = x Ω, RGoff = x Ω	–	tbd	–	ns
Rise Time	t_r		–	tbd	–	
Turn-off Delay Time	$t_{d(off)}$		–	tbd	–	
Fall Time	t_f		–	tbd	–	
Turn-on Switching Loss per Pulse	E_{on}		–	8.5	–	mJ
Turn-off Switching Loss per Pulse	E_{off}		–	4.8	–	
Input Capacitance	C_{ies}	V_{CE} = 20 V, V_{GE} = 0 V, f = 1 MHz	–	9674	–	pF
Output Capacitance	C_{oes}		–	394	–	
Reverse Transfer Capacitance	C_{res}		–	43	–	
Total Gate Charge	Q_g	V_{CE} = 300 V, IC = 160 A, V_{GE} = −15 V~15 V	–	320	–	nC
Thermal Resistance – Chip-to-Heatsink	R_{thJH}	Thermal grease, Thickness = 100 μm ±2% λ = 2.9 W/mK	–	tbd	–	K/W
Thermal Resistance – Chip-to-Case	R_{thJC}		–	0.1	–	K/W
NEUTRAL POINT DIODE (D5, D6) CHARACTERISTICS						
Diode Forward Voltage	V_F	IF = 160 A, T_J = 25°C	–	2.1	2.7	V
		IF = 160 A, T_J = 150°C	–	1.9	–	
Reverse Recovery Time	t_{rr}	T_J = 25°C VCE = 300 V, IC = 160 A V_{GE} = −9 V, 15 V, R_G = 9 Ω	–	tbd	–	ns
Reverse Recovery Charge	Q_{rr}		–	tbd	–	nC
Peak Reverse Recovery Current	I_{RRM}		–	tbd	–	A
Peak Rate of Fall of Recovery Current	di/dt		–	tbd	–	A/ns
Reverse Recovery Energy	E_{rr}		–	tbd	–	μJ
Reverse Recovery Time	t_{rr}	T_J = 125°C VCE = 300 V, IC = 160 A V_{GE} = −9 V, 15 V, R_G = 9 Ω	–	tbd	–	ns
Reverse Recovery Charge	Q_{rr}		–	tbd	–	nC
Peak Reverse Recovery Current	I_{RRM}		–	tbd	–	A
Peak Rate of Fall of Recovery Current	di/dt		–	tbd	–	A/ns
Reverse Recovery Energy	E_{rr}		–	tbd	–	μJ
Thermal Resistance – Chip-to-Heatsink	R_{thJH}	Thermal grease, Thickness = 100 μm ±2% λ = 2.9 W/mK	–	tbd	–	K/W
Thermal Resistance – Chip-to-Case	R_{thJC}		–	0.17	–	K/W

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit

IIGBT INVERSE DIODE (D1, D2, D3, D4) CHARACTERISTICS

Diode Forward Voltage	VF	IF = 90 A, TJ = 25°C	–	Tbd		V
		IF = 90 A, TJ = 150°C	–	Tbd	–	
Reverse Recovery Time	t_{rr}	TJ = 25°C VCE = 300 V, IC = 160 A VGE = –9 V, 15 V, RG = 9 Ω	–	Tbd	–	ns
Reverse Recovery Charge	Q_{rr}		–	Tbd	–	nC
Peak Reverse Recovery Current	I_{RRM}		–	Tbd	–	A
Peak Rate of Fall of Recovery Current	di/dt		–	Tbd	–	A/ns
Reverse Recovery Energy	E_{rr}		–	Tbd	–	µJ
Reverse Recovery Time	t_{rr}	TJ = 125°C VCE = 300 V, IC = 160 A VGE = –9 V, 15 V, RG = 9 Ω	–	Tbd	–	ns
Reverse Recovery Charge	Q_{rr}		–	Tbd	–	nC
Peak Reverse Recovery Current	I_{RRM}		–	Tbd	–	A
Peak Rate of Fall of Recovery Current	di/dt		–	Tbd	–	A/ns
Reverse Recovery Energy	E_{rr}		–	Tbd	–	µJ
Thermal Resistance – Chip-to-Heatsink	R_{thJH}	Thermal grease, Thickness = 100 µm ±2%入 = 2.9 W/mK	–	Tbd	–	K/W
Thermal Resistance – Chip-to-Case	R_{thJC}		–	0.1397	–	K/W

THERMISTOR CHARACTERISTICS

Nominal Resistance	R_{25}	T = 25°C	–	5	–	kΩ
Nominal Resistance	R_{100}	T = 100°C	–	490.6	–	Ω

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit

THERMISTOR CHARACTERISTICS

Deviation of R25	R/R		−1	–	1	%
Power Dissipation	PD		–	5	–	mW
Power Dissipation Constant			–	1.3	–	mW/K
B-value		B (25/85), tolerance ±1%	–	3435	–	K

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.