MITSUBISHI ELECTRIC

< HVMOSFET MODULE >

Preliminary

FMF800DC-66BEW

HIGH POWER SWITCHING USE
INSULATED TYPE 2nd gen. HVMOSFET (High Voltage Metal Oxide Semiconductor Field Effect Transistor) Modules

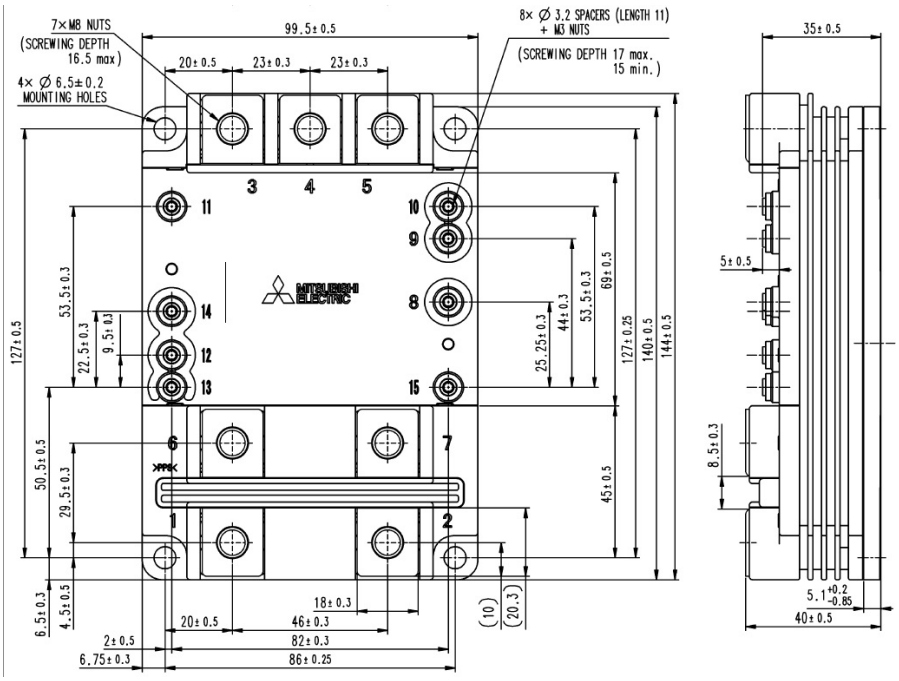
FMF800DC-66BEW

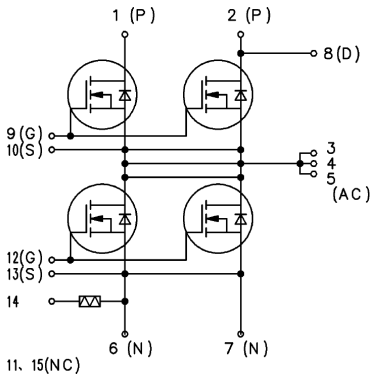
- I_D 800A
- V_{DSX} 3300V
- 2-element in a Pack
- Insulated Type
- SiC SBD embedded MOSFET

APPLICATION

Traction drives, High Reliability Converters / Inverters, DC choppers

OUTLINE DRAWING & CIRCUIT DIAGRAM **Dimensions in mm**





CIRCUIT DIAGRAM

No.	Terminals
1, 2	DC+, D(P)
3, 4, 5	AC, S(P), D(N)
6, 7	DC-, S(N)
8	D(P)
9	G(P)
10	S(P)
11	NC
12	G(N)
13	S(N)
14	NTC
15	NC

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MAXIMUM RATINGS

Item	Symbol	Condiitons		Ratings	Unit
Drain-Source voltage, specified gate-source voltage	V_{DSX}	V_{GS} = -7 V	T_j = -40~175 °C	3300	V
Gate-Source voltage	V_{GSS}	V_{DS} = 0 V	T_j = -40~175 °C	±20	V
Drain current	I_D	V_{GS} = 17 V , T_c = 87 °C , AC terminal output current(Note 1)		800	A
Drain current	I_{DP}	Non repetitive pulse	T_j = T_{op}	1600	A
Reverse drain current (FWD forward current)	I_S	V_{GS} = -7 V , T_c = 85 °C , AC terminal output current(Note 1)		800	A
Reverse drain current (FWD forward current)	I_{SP}	Non repetitive pulse	T_j = T_{op}	1600	A
Total power dissipation	P_{tot}	T_c = 25 °C , MOSFET part(Note 2)		6650	W
Isolation voltage	V_{isol}	Charged part to the baseplate RMS sinusoidal, 60 Hz 1 min		6000	Vrms
Partial discharge charge	Q_{pd}	Charged part to the baseplate RMS sinusoidal, 60 Hz 1 min V1 = 3500 V, V2 = 2600 V (acc. to IEC 61287-1)		10	pC
Junction temperature	T_j	Maximum temperature range in off-state or on-state (non-switching)		-40~175	°C
Case temperature	T_c	Maximum case temperature range in on-state		-40~150	°C
Storage temperature	T_{stg}	Maximum case temperature range in off-state		-50~175	°C
Operating junction temperature	T_{jop}	Maximum junction temperature range for switching operation		-40~175	°C
Short-circuit withstand pulse duration	t_{pSC}	V_{DD} = 2500 V , V_{GS} = +17 / -7 V , L_s = 40 nH , VGS50%-VGS50%	T_j = T_{op}	1.7	µs
Non-repetitive surge forward current	I_{FSM}	t_p = 10ms, Half sinewave	T_j = 175 °C	5.9	kA
I2t value	I^2t	t_p = 10ms, Half sinewave	T_j = 175 °C	180	kA2s

ELECTRICAL CHARACTERISTICS

Item	Symbol	Conditions		Limits			Unit
				Min.	Typ.	Max.	
Gate-source leakage current	I_{GSS}	V_{DS} = 0 V , V_{GS} = V_{GSS}	T_j = 25 °C	-2.0	-	2.0	µA
Drain-source cut-off current	I_{DSX}	V_{DS} = V_{DSX} , V_{GS} = -7 V	T_j = 25 °C	-	0.003	-	mA
			T_j = 150 °C	-	0.050	-	mA
			T_j = 175 °C	-	0.080	3.0	mA
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = 10 V , I_D = 80mA	T_j = 25 °C	1.60	2.10	2.60	V
			T_j = 150 °C	-	1.50	-	V
			T_j = 175 °C	0.90	1.45	1.90	V
Drain-source on resistance	$r_{DS(on)}$	V_{DS} = VDS(on) , V_{GS} = 17 V , (Note 3)	T_j = 25 °C	-	2.00	-	mΩ
			T_j = 150 °C	-	4.31	-	mΩ
			T_j = 175 °C	-	5.00	6.06	mΩ
Drain-source on-state voltage	$V_{DS(on)}$	I_D = 800 A , V_{GS} = 17 V , (Note 3)	T_j = 25 °C	-	1.60	-	V
			T_j = 150 °C	-	3.45	-	V
			T_j = 175 °C	-	4.00	4.85	V
Source-drain voltage	$V_{SD(on)}$	I_S = 800 A , V_{GS} = 17 V , (Note 3, 4)	T_j = 25 °C	-	1.45	-	V
			T_j = 150 °C	-	3.25	-	V
			T_j = 175 °C	-	3.80	4.40	V
Source-drain voltage	V_{SD}	I_S = 800 A , V_{GS} = 0 V , (Note 3, 4)	T_j = 25 °C	-	2.00	-	V
			T_j = 150 °C	-	3.85	-	V
			T_j = 175 °C	-	4.35	5.00	V
Source-drain voltage	$V_{SD(off)}$	I_S = 800 A , V_{GS} = -7 V , (Note 3, 4)	T_j = 25 °C	-	2.00	-	V
			T_j = 150 °C	-	3.85	-	V
			T_j = 175 °C	-	4.35	5.00	V

ELECTRICAL CHARACTERISTICS (continuation)

Item	Symbol	Conditions		Limits			Unit
				Min.	Typ.	Max.	
Input capacitance	C_{iss}	V_{DS} = 10 V , V_{GS} = 0 V , f = 100kHz , 1/2 module	T_j = 25 °C	-	110	-	nF
Output capacitance	C_{oss}	V_{DS} = 10 V , V_{GS} = 0 V , f = 100kHz , 1/2 module	T_j = 25 °C	-	70	-	nF
Reverse transfer capacitance	C_{rss}	V_{DS} = 10 V , V_{GS} = 0 V , f = 100kHz , 1/2 module	T_j = 25 °C	-	2.7	-	nF
Gate charge	Q_G	V_{DD} = 1800 V , I_D = 800 A , V_{GS} = +17 / -7 V , 1/2 module	T_j = 25 °C	-	3.3	-	µC
Turn-on delay time	$t_{d(on)}$	V_{DD} = 1800 V , I_D = 800 A , V_{GS} = +17 / -7 V , L_s = 40 nH , $R_{G(on)}$ = 1.5 Ω , $R_{G(off)}$ = 1.5 Ω , Inductive load	T_j = 25 °C	-	0.36	-	µs
			T_j = 150 °C	-	0.32	-	µs
			T_j = 175 °C	-	0.32	0.50	µs
Rise time	t_r	V_{DD} = 1800 V , I_D = 800 A , V_{GS} = +17 / -7 V , L_s = 40 nH , $R_{G(on)}$ = 1.5 Ω , $R_{G(off)}$ = 1.5 Ω , Inductive load	T_j = 25 °C	-	0.18	-	µs
			T_j = 150 °C	-	0.15	-	µs
			T_j = 175 °C	-	0.15	0.30	µs
Turn-on (switching) energy per pulse 10% integral	$E_{on(10\%)}$	V_{DD} = 1800 V , I_D = 800 A , V_{GS} = +17 / -7 V , L_s = 40 nH , $R_{G(on)}$ = 1.5 Ω , $R_{G(off)}$ = 1.5 Ω , Inductive load	T_j = 25 °C	-	0.24	-	J/P
			T_j = 150 °C	-	0.20	-	J/P
			T_j = 175 °C	-	0.20	-	J/P
Turn-off delay time	$t_{d(off)}$	V_{DD} = 1800 V , I_D = 800 A , V_{GS} = +17 / -7 V , L_s = 40 nH , $R_{G(on)}$ = 1.5 Ω , $R_{G(off)}$ = 1.5 Ω , Inductive load	T_j = 25 °C	-	0.50	-	µs
			T_j = 150 °C	-	0.61	-	µs
			T_j = 175 °C	-	0.64	-	µs
Fall time	t_{f1}	V_{DD} = 1800 V , I_D = 800 A , V_{GS} = +17 / -7 V , L_s = 40 nH , $R_{G(on)}$ = 1.5 Ω , $R_{G(off)}$ = 1.5 Ω , Inductive load	T_j = 25 °C	-	0.17	-	µs
			T_j = 150 °C	-	0.19	-	µs
			T_j = 175 °C	-	0.19	-	µs
Turn-off (switching) energy per pulse 10% integral	$E_{off(10\%)}$	V_{DD} = 1800 V , I_D = 800 A , V_{GS} = +17 / -7 V , L_s = 40 nH , $R_{G(on)}$ = 1.5 Ω , $R_{G(off)}$ = 1.5 Ω , Inductive load	T_j = 25 °C	-	0.11	-	J/P
			T_j = 150 °C	-	0.13	-	J/P
			T_j = 175 °C	-	0.13	-	J/P

THERMAL CHARACTERISTICS

Item	Symbol	Conditions	Limits			Unit
			Min.	Typ.	Max.	
Thermal resistance junction to case	$R_{th(j-c)}$	Junction to Case, MOSFET + embeded SBD part,1/2 module	-	-	22.5	K/kW
Contact thermal resistance, case to heatsink	$R_{th(c-s)}$	Case to heat sink λ_{grease} = 1W/m·K, D(c-s) = 70µm, 1/2 module	-	22.5	-	K/kW

MECHANICAL CHARACTERISTICS

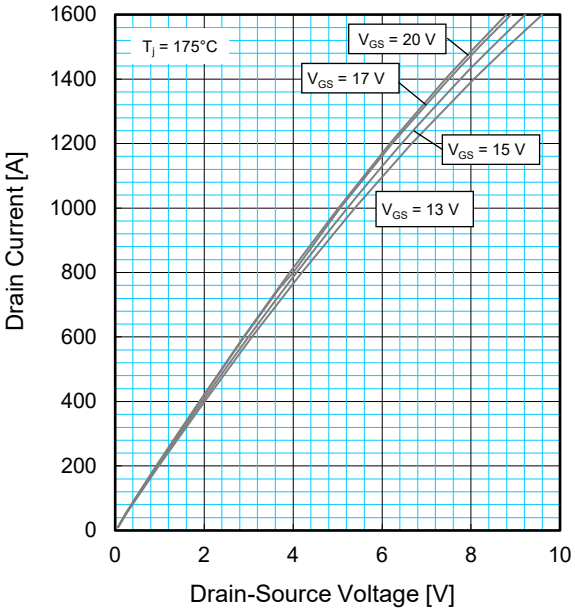
Item	Symbol	Conditions	Limits			Unit
			Min.	Typ.	Max.	
Mounting torque	M_t	Main terminals screw M8 This is the case when installing the product on the bus bar	7.0	-	22.0	N·m
Mounting torque	M_t	Mounting screw M6	3.0	-	6.0	N·m
Mounting torque	M_t	Auxiliary terminals screw M3	0.4	-	0.8	N·m
mass, Mass(IEC)	m	-	-	0.8	-	kg
Comparative tracking index	CTI	-	600	-	-	-
Clearance distance in air	d_a	Between main terminal	8.0	-	-	mm
Creepage distance along surface	d_s	-	32.0	-	-	mm
Internal inductance, D-S	$L_{P\ DS}$	Between DC+ and DC- (terminal 1,2-6,7)	-	14	-	nH
	$L_{P\ DS}$	Between DC+ and AC (terminal 1,2-3,4,5)	-	40	-	nH
	$L_{P\ DS}$	Between AC and DC- (terminal 3,4,5-6,7)	-	40	-	nH
Internal lead resistance, DD'-SS'	$R_{DD'+SS'}$	Tc=25°C, Between DC+ and DC- (terminal 1,2-6,7)	-	0.46	-	mΩ
	$R_{DD'+SS'}$	Tc=25°C, Between DC+ and AC (terminal 1,2-3,4,5)	-	0.22	-	mΩ
	$R_{DD'+SS'}$	Tc=25°C, Between AC and DC- (terminal 3,4,5-6,7)	-	0.33	-	mΩ
Zero-power resistance	R_{25}	T_C=25°C	4.65	5.00	5.35	kΩ
B-constant	$B_{(25/50)}$	-	-	3375	-	K
Screw hole depth for auxiliary electrode	l	M3	15	-	17	mm

Note 1. Control Case Temperature (Tc) so that the junction temperature (T_j) does not exceed the maximum rating.
Note 2. Junction temperature (Tj) should not exceed Tjmax rating.
Note 3. Pulse width and repetition rate should be such as to cause negligible temperature rise.
Note 4. The symbols represent characteristics of the anti-parallel, source to drain free-wheel diode (FWDi).
Note 5. $B_{(25/50)} = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$

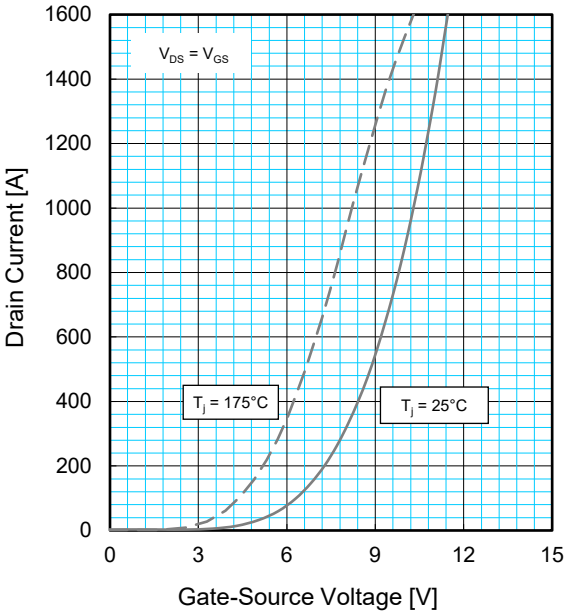
R_{25}: resistance at absolute temperature T_{25} [K]; T_{25} = 25[°C] + 273.15 = 298.15[K]
R_{50}: resistance at absolute temperature T_{50} [K]; T_{50} = 50[°C] + 273.15 = 323.15[K]

PERFPRMANCE CURVES

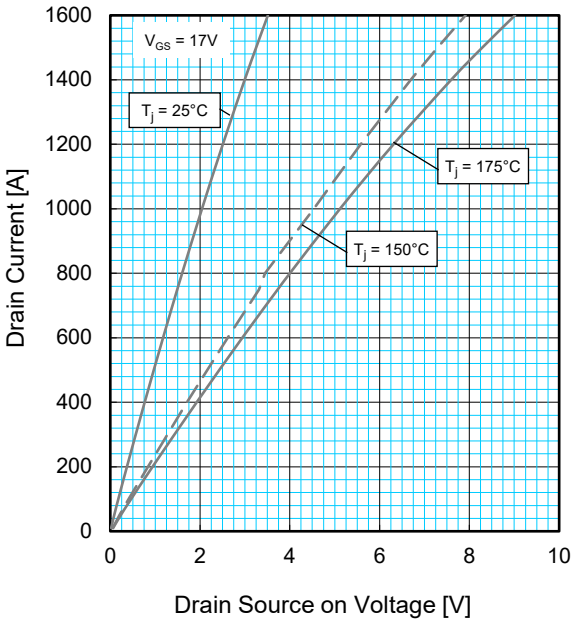
OUTPUT CHARACTERISTICS (TYPICAL)



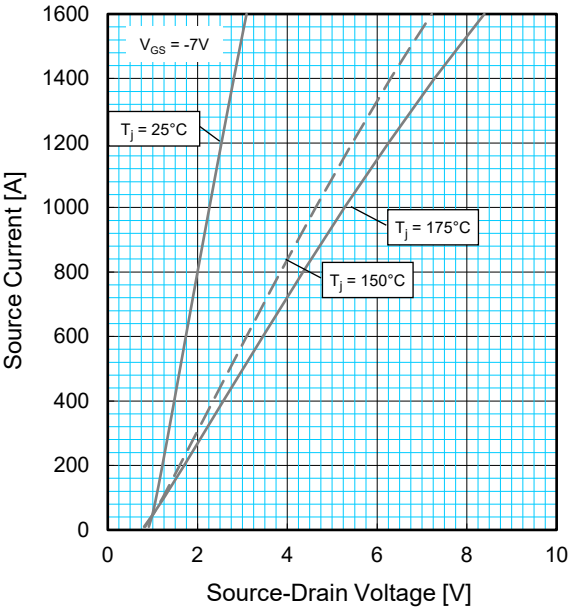
TRANSFER CHARACTERISTICS (TYPICAL)



DRAIN-SOURCE ON VOLTAGE CHARACTERISTICS (TYPICAL)

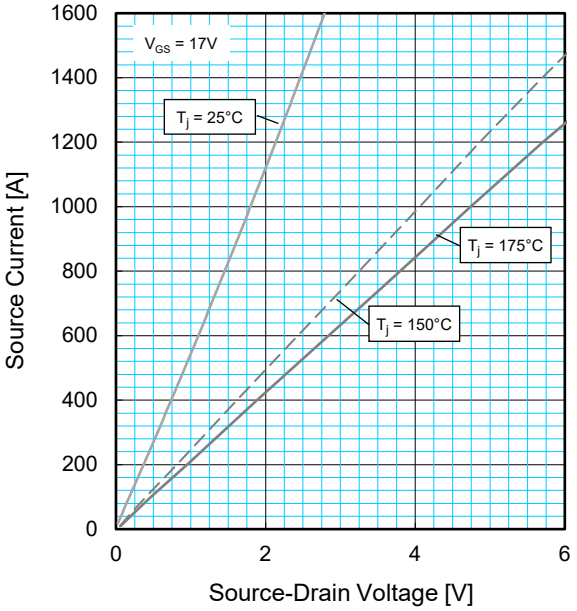


FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)

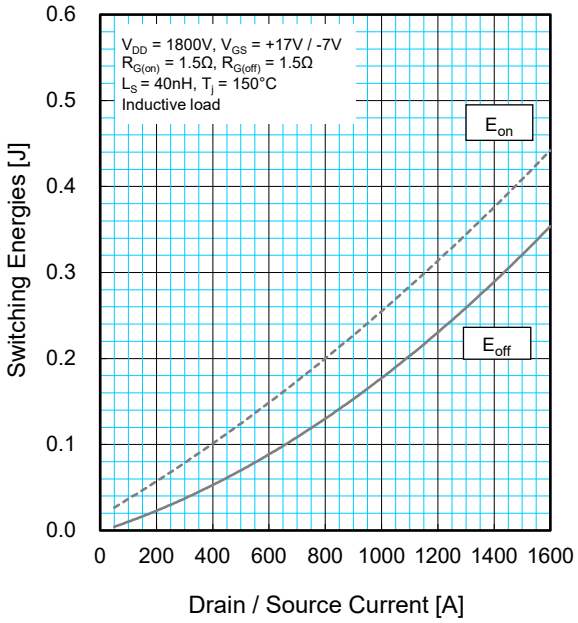


PERFORMANCE CURVES

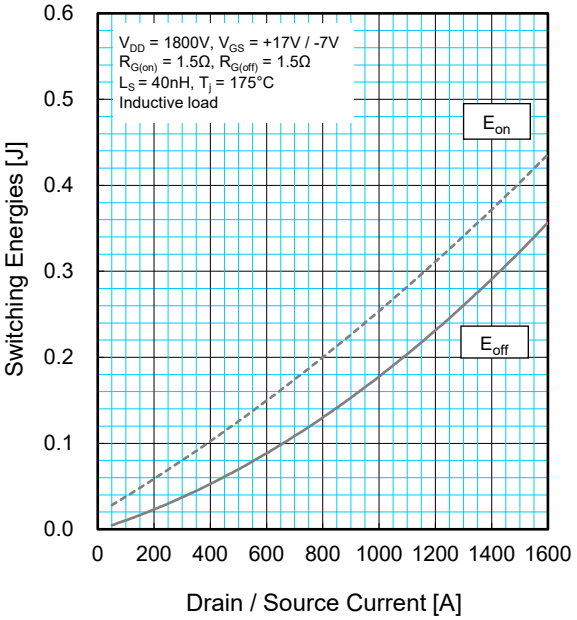
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



HALF-BRIDGE SWITCHING ENERGY CHARACTERISTICS (TYPICAL)



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