HITACHI
Inspire the Next

Target specification 5SFG 0980B12000x

1200 V, 980 A*

RoadPak SiC phase-leg module

- V_{DSS} = 1200 V
- I_D = 2 x 980 A*
- Molded package optimized for EV application
- Pin-fin structure for lowest thermal resistance
- lowest losses thanks to Silicon Carbide chip-set
- main terminals with holes (screw connection) or without holes for welding

*Current rating based on chip rating times number of chips

Maximum rated values [1)]

Parameter	Symbol	Conditions	Min.	Max.	Unit
Drain-source voltage	V_{DS}	V_{GS} = 0 V, T_{vj} ≥ 25 °C		1200	V
DC drain current	I_D	T_{Cool} = 55 °C, T_{vj} = 175 °C		640	A
Peak drain current	I_{DM}	t_p = 1 ms, duty cycle = 20%, T_{Cool} = 55 °C, T_{vj} = 175 °C		1500	A
Gate-source voltage	V_{GSS}		-4	15	V
Transient gate-source voltage 2)	$V_{GSS,max}$	Maximum values under transient events < 50 ns	-8	16	V
DC reverse drain current (body diode)	I_{DR}	V_{GS} = -4 V, T_{Cool} = 55 °C, T_{vj} = 175 °C		350	A
Peak reverse drain current (body diode)	I_{DRM}	V_{GS} = -4 V, t_p = 1 ms		1500	A
Surge source current (body diode)	I_{SSM}	V_{GS} = -4 V		3000	A
DC reverse drain current (channel open)	I_{DRS}	V_{GS} = 15 V, T_{Cool} = 55 °C, T_{vj} = 175 °C		640	A
Surge source current (channel open)	I_{SSX}	V_{GS} = 15 V		3000	A
Isolation voltage	V_{isol}	1 min, f = 50 Hz		3300	V
Junction temperature	T_{vj}			175	°C
Junction operating temperature	$T_{vj(op)}$		-40	175	°C
Storage temperature	T_{stg}		-40	150	°C
Mounting torque	M_s	Module to cooler with M4 screws	2.6	3.1	Nm

[1)] Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747

[2)] Based on chip capability

Hitachi Energy

MOSFET characteristic values [3]

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0 V	T_{vj} = 175 °C	1200			V
			T_{vj} = 25 °C	1200			V
			T_{vj} = -40 °C	1200			V
Static drain-source on-state resistance [4]	$R_{DS(on)}$	I_D = 640 A, V_{GS} = 15 V	T_{vj} = 25 °C		1.8	2.2	mΩ
			T_{vj} = 175 °C		3.3	3.9	mΩ
Zero gate voltage drain current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V	T_{vj} = 25 °C		2	10	uA
			T_{vj} = 175 °C		6	20	uA
Gate-source leakage current	I_{GSS}	V_{DS} = 0 V, V_{GS} = 15 V, T_{vj} = 25 °C				500	nA
Gate threshold voltage [2]	$V_{GS(th)}$	I_D = 200 mA, V_{DS} = $V_{GS, Tvj}$ = 25 °C		1.8	2.5	3.6	V
Gate charge [2]	Q_G	I_D = 750 A, V_{DS} = 800 V, V_{GE} = -4 V ... +15 V			1.84		uC
Input capacitance [2]	C_{ISS}	V_{DS} = 1000 V, V_{GS} = 0 V, T_{vj} = 25 °C, f = 100 kHz			39		nF
Internal gate resistance [2]	R_{Gint}				0.34		Ω
Turn-on switching energy	E_{on}	V_{DD} = 800 V, I_D = 750 A, R_G = 0.47 Ω, C_G = 47 nF, V_{GS} = -4 / +15 V, L_σ = 10 nH, inductive load	T_{vj} = 25 °C		30		mJ
			T_{vj} = 175 °C		37		mJ
Turn-off switching energy	E_{off}	V_{DD} = 800 V, I_D = 750 A, R_G = 1 Ω, C_G = 47 nF, V_{GS} = -4 / +15 V, L_σ = 10 nH, inductive load	T_{vj} = 25 °C		20		mJ
			T_{vj} = 175 °C		20		mJ

[2] Based on chip capability
[3] Characteristic values according to IEC 60747 – 8
[4] R_{DSon} is given at chip level

Body diode characteristic values [5]

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Diode forward voltage 2) 6)	V_{SD}	I_S = 360 A, V_{GS} = -4 V	T_{vj} = 25 °C		4.6		V
			T_{vj} = 175 °C		4.2		V
Reverse recovery current	I_{rr}	V_R = 800 V, I_F = 750 A, V_{GS} = -4 / +15 V, R_G = 0.47 Ω, di/dt = 18 kA/µs L_σ = 10 nH inductive load	T_{vj} = 25 °C		200		A
			T_{vj} = 175 °C		440		A
Recovered charge	Q_{rr}		T_{vj} = 25 °C		21		µC
			T_{vj} = 175 °C		28		µC
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		30		ns
			T_{vj} = 175 °C		45		ns
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		4		mJ
			T_{vj} = 175 °C		6		mJ

[2] Based on chip capability
[5] Characteristic values according to IEC 60747 – 2
[6] Forward voltage is given at chip level

Hitachi Energy Switzerland Ltd
Semiconductors
Fabrikstrasse 3
5600 Lenzburg
Switzerland
Tel: +41 58 586 10 00

E-Mail: salesdesksem@hitachienergy.com
www.hitachienergy.com/semiconductors

Package properties [7)]

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal resistance junction to fluid	$R_{th(j-f)}$	T_{in} = 55°C, Coolant: 50% glycol/ 50% water, per switch, 10 l/min, dP < 120 mbar water-glycol		87	93.5	K/kW
Comparative tracking index	CTI		400			V
Module stray inductance	$L_{\sigma DS}$			5		nH
Resistance, terminal-chip	$R_{DD'+SS'}$	T_C = 25 °C		0.117		mΩ
		T_C = 150 °C		0.227		mΩ

Mechanical properties[7)]

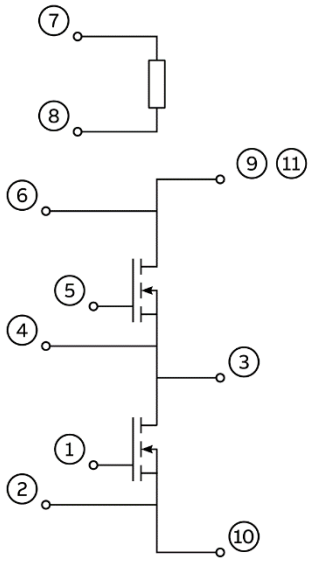
Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Dimensions	L	AC terminal to DC terminal			110		mm
	W	Mold width			69		mm
	H	Baseplate cooler surface to middle of PCB/pressfit			17.35		mm
Clearance distance in air	d_a	According to IEC 60664-1	Term. to base:		6.9		mm
			Term. to term:		3.3		mm
Surface creepage distance	d_s	According to IEC 60664-1	Term. to base:		8.5		mm
			Term. to term:		8		mm
Mass	m				300		g

[7)] Package and mechanical properties according to IEC 60747 – 15

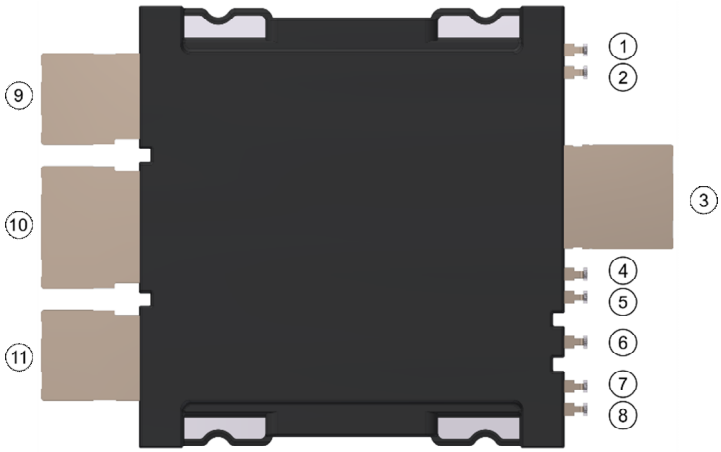
Hitachi Energy Switzerland Ltd
Semiconductors
Fabrikstrasse 3
5600 Lenzburg
Switzerland
Tel: +41 58 586 10 00

E-Mail: salesdesksem@hitachienergy.com
www.hitachienergy.com/semiconductors

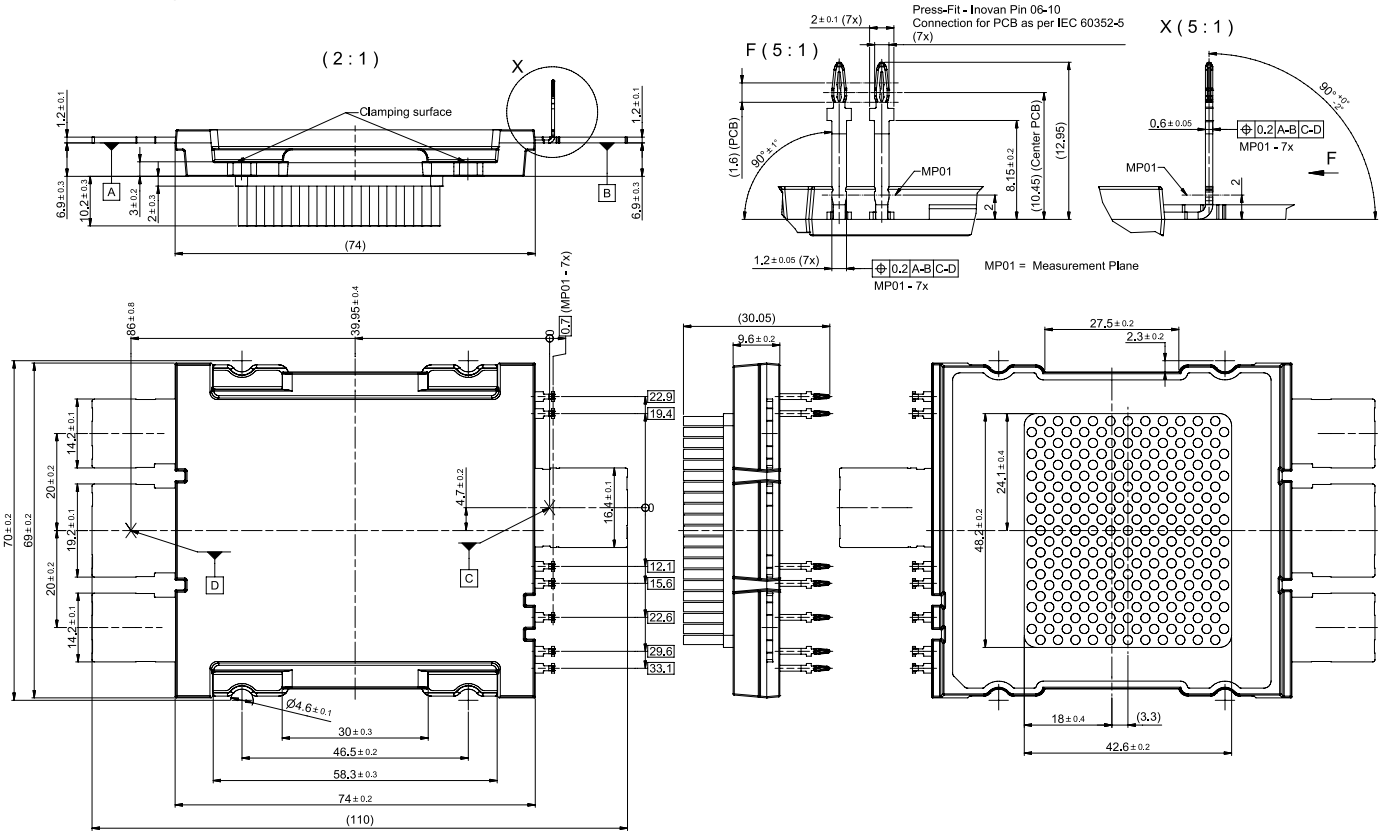
Electrical configuration



1 → Gate LS
2 → Source LS
3 → AC
4 → Source HS
5 → Gate HS
6 → Drain HS
7,8 → NTC
9 → DC+
10 → DC-
11 → DC+



Mechanical drawing



Note: all dimensions are shown in millimeters

Hitachi Energy Switzerland Ltd
Semiconductors
Fabrikstrasse 3
5600 Lenzburg
Switzerland
Tel: +41 58 586 10 00

E-Mail: salesdesksem@hitachienergy.com
www.hitachienergy.com/semiconductors

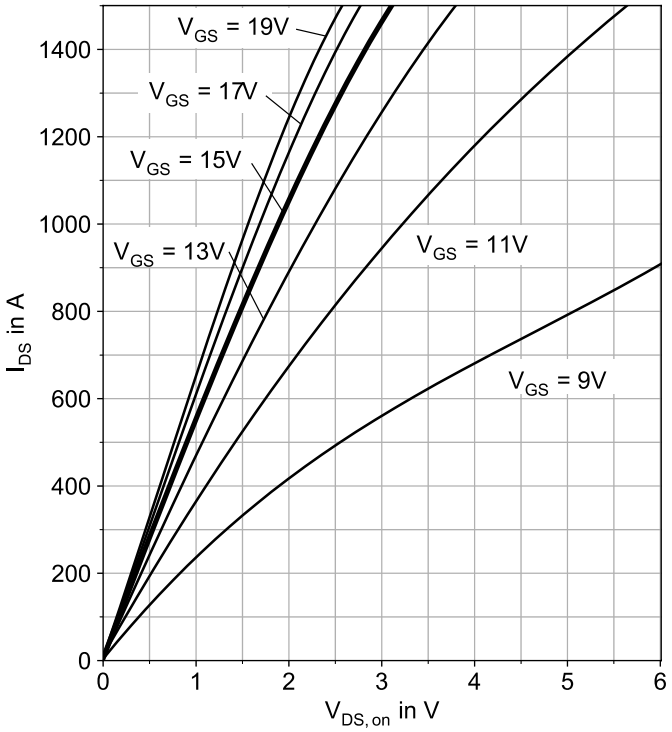


Fig. 1 Typical output characteristics

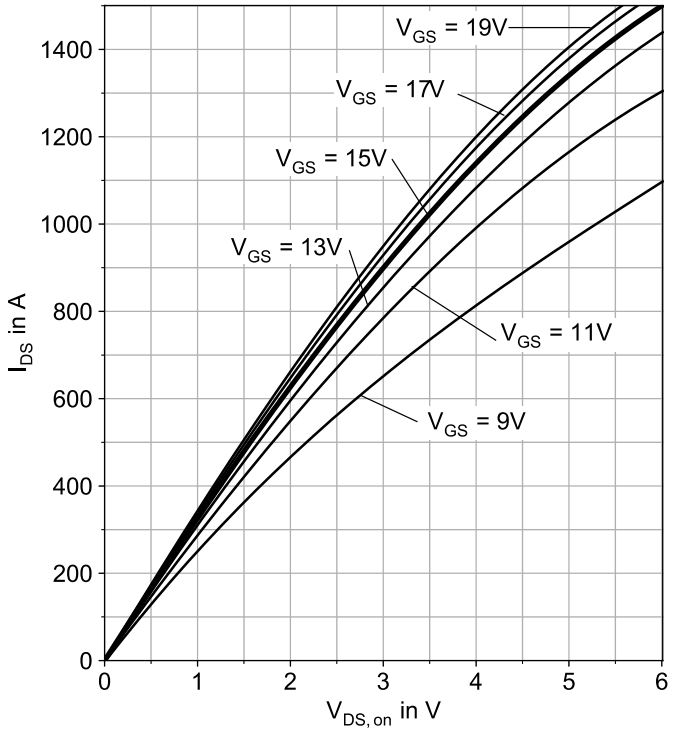


Fig. 2 Typical output characteristics

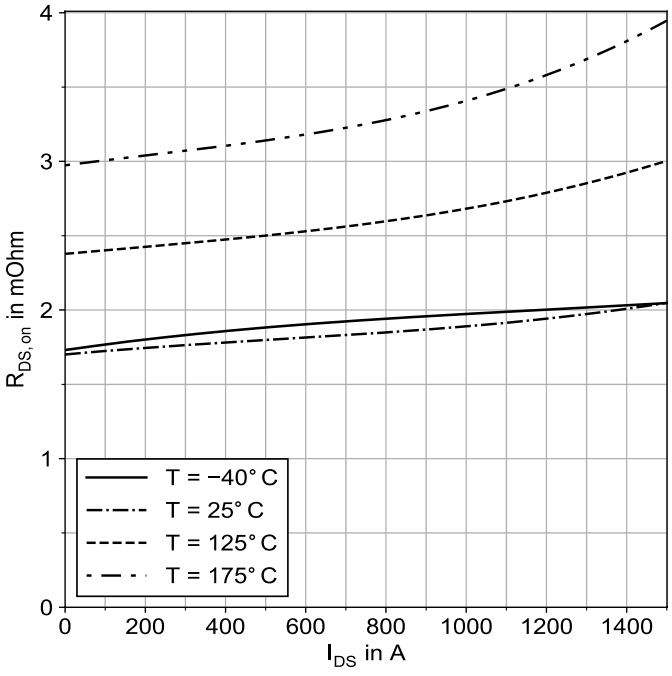


Fig. 3 Typical on-state resistance vs drain current for various junction temperatures

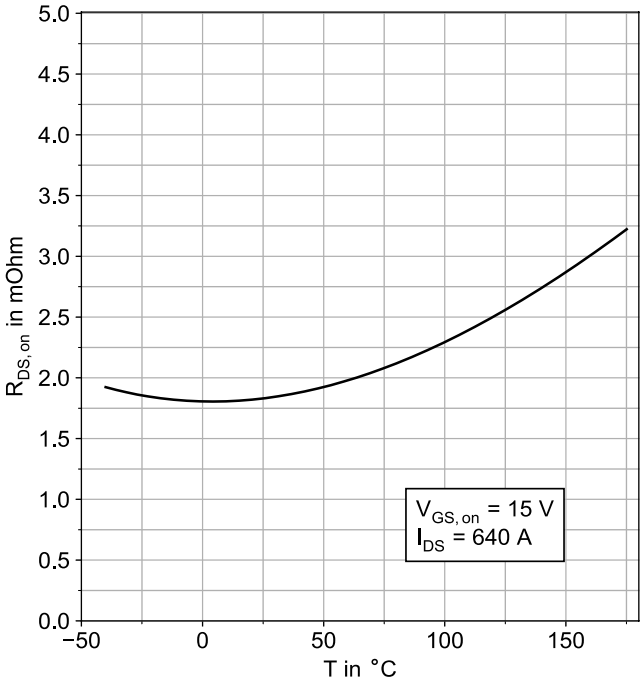


Fig. 4 Typical on-state resistance vs temperature

Hitachi Energy Switzerland Ltd
Semiconductors
Fabrikstrasse 3
5600 Lenzburg
Switzerland
Tel: +41 58 586 10 00

E-Mail: salesdesksem@hitachienergy.com
www.hitachienergy.com/semiconductors

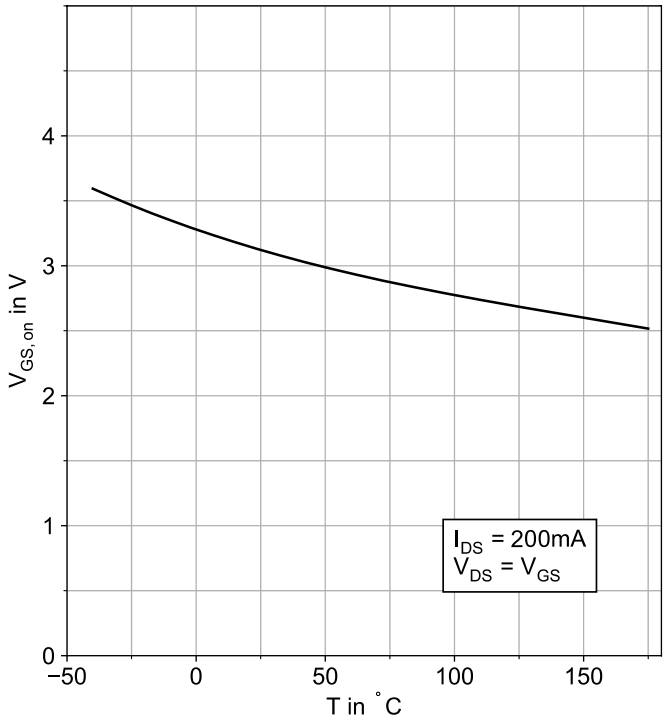


Fig. 5 Threshold voltage vs junction temperature

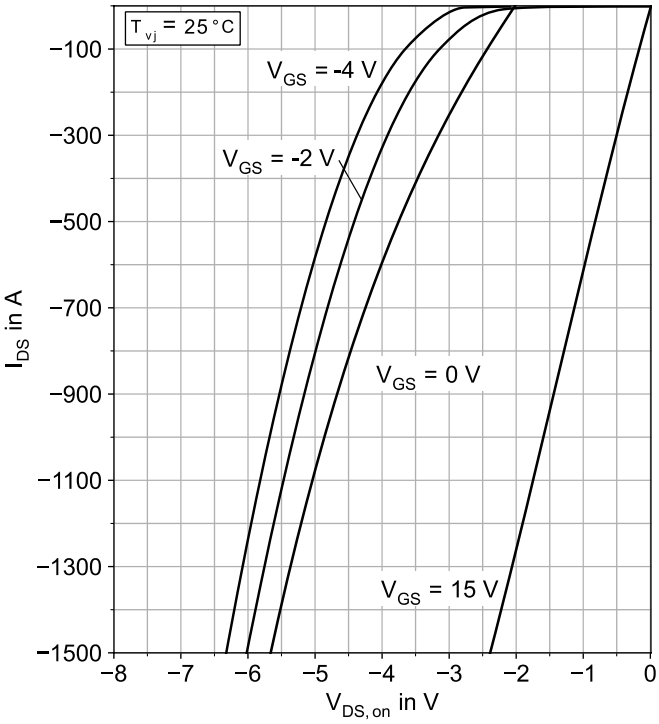


Fig. 6 Typical 3rd quadrant characteristics vs drain current

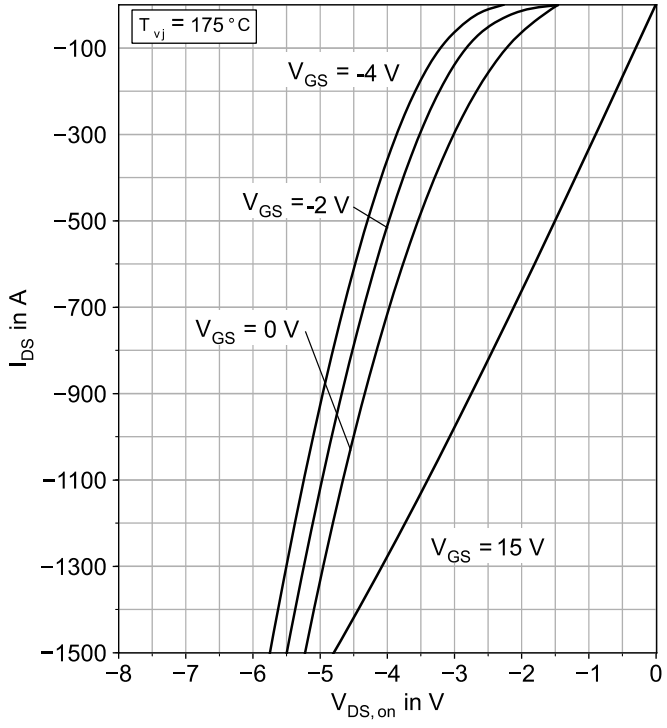


Fig. 7 Typical 3rd quadrant characteristics vs drain current

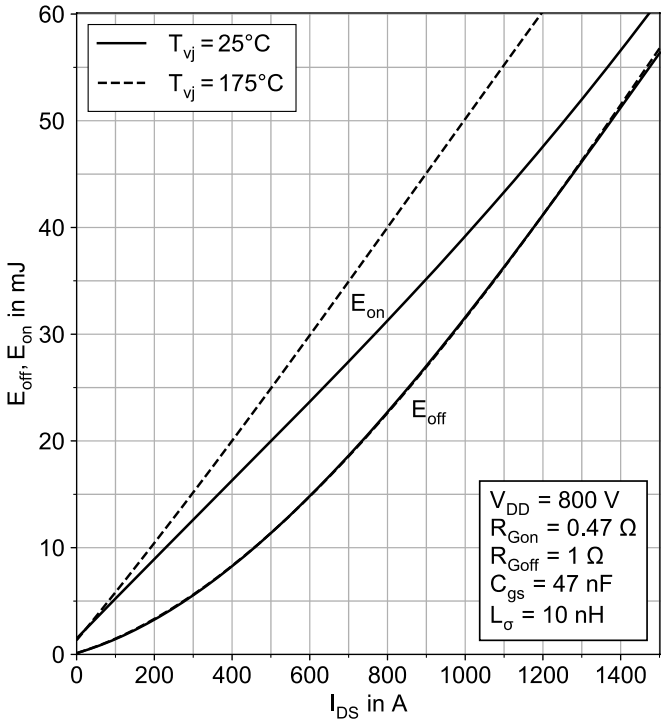


Fig. 8 Typical switching energies per pulse vs. drain current

Hitachi Energy Switzerland Ltd
Semiconductors
Fabrikstrasse 3
5600 Lenzburg
Switzerland
Tel: +41 58 586 10 00

E-Mail: salesdesksem@hitachienergy.com
www.hitachienergy.com/semiconductors

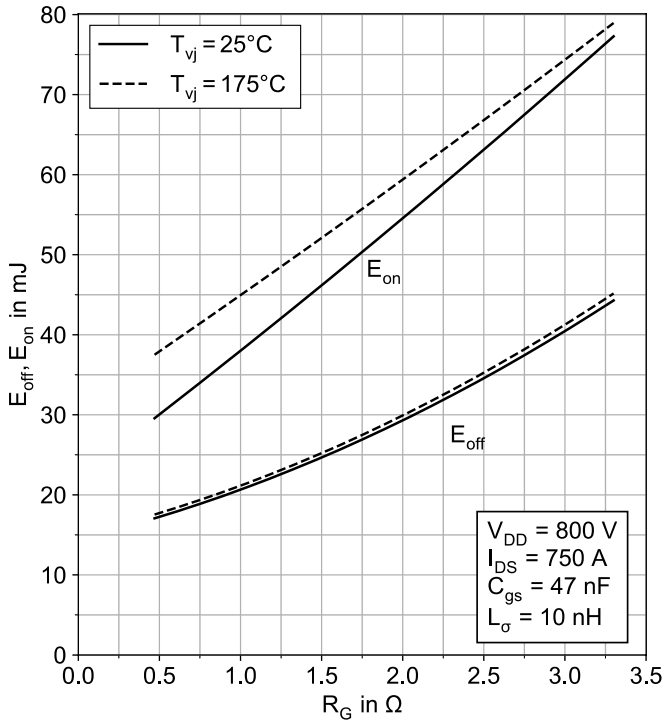


Fig. 9 Typical switching energies per pulse vs. gate resistor

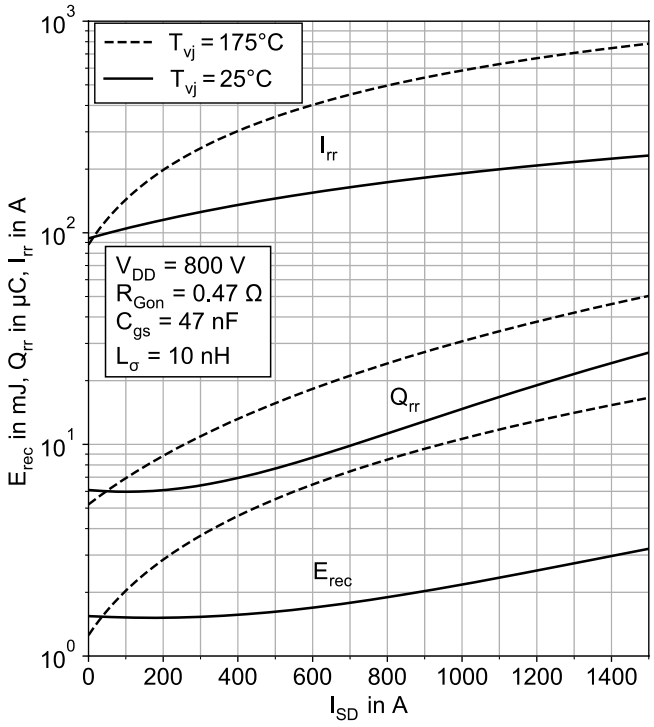


Fig. 10 Typical reverse recovery characteristics vs. forward current

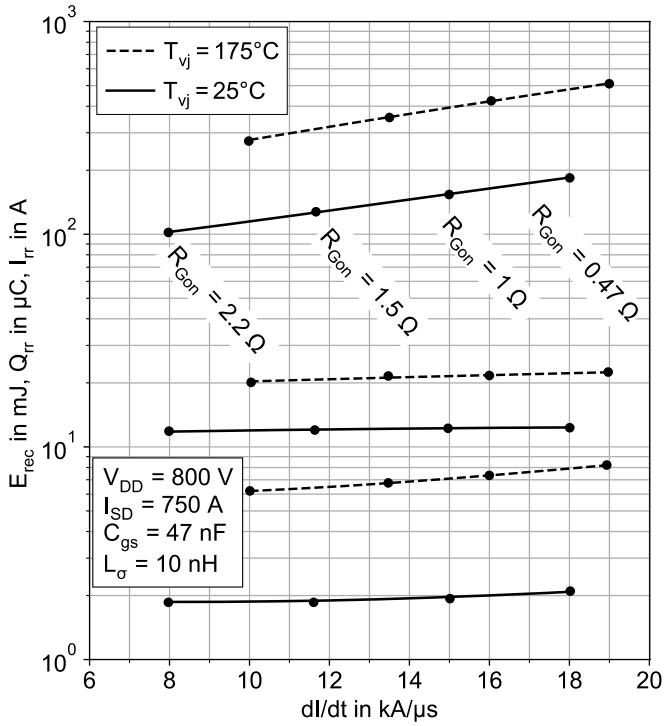


Fig. 11 Typical reverse recovery characteristics vs. di/dt

Hitachi Energy Switzerland Ltd
Semiconductors
Fabrikstrasse 3
5600 Lenzburg
Switzerland
Tel: +41 58 586 10 00

E-Mail: salesdesksem@hitachienergy.com
www.hitachienergy.com/semiconductors