

**Trench FS IGBT****Features**

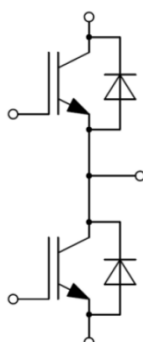
- Short Circuit Rated 10 μ s
- Low Stray Inductance
- Low Saturation Voltage
- Ultra Low loss
- HI-REL Power Terminals
- Lead Free, Compliant with RoHS Requirement

Applications

- Industrial Inverters
- Servo Applications
- SMPS UPS
- Induction Heating
- Welder

Product Summary

Parameter	Value	Unit
V_{CES}	1200	V
$I_C(@ T_C = 100^{\circ}C)$	450	A
$I_{CRM}(@ t_P = 1ms)$	900	A
$V_{CE(sat)}(Typ)$	1.75	V

**IGBT, Absolute Maximum Ratings (@ $T_C = 25^{\circ}C$ unless otherwise specified)**

Parameter	Conditions	Symbol	Values	Unit
Collector-emitter voltage	$T_{vj} = 25^{\circ}C$	V_{CES}	1200	V
Gate-emitter peak voltage		V_{GES}	± 20	V
Continuous collector current	$T_C = 100^{\circ}C$	$I_{C\ nom}$	450	A
Repetitive peak collector current	$t_P = 1ms$	I_{CRM}	900	A
Total power dissipation	$T_C = 25^{\circ}C, T_{vj\ max} = 175^{\circ}C$	P_{tot}	2307	W

**IGBT, Electrical Characteristics (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)**

Parameter	Conditions		Symbol	Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$I_C = 450\text{A}$, $V_{GE} = 15\text{V}$	$T_{vj} = 25^\circ\text{C}$	$V_{CE(sat)}$		1.75	2.20	V
		$T_{vj} = 125^\circ\text{C}$			2.05		
		$T_{vj} = 150^\circ\text{C}$			2.10		
Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 18\text{mA}$		$V_{GE(th)}$	5.4	6.0	6.6	V
Gate-emitter leakage current	$V_{CE} = 0\text{V}$, $V_{GE} = 20\text{V}$		I_{GES}			400	nA
Collector leakage current	$V_{GE} = 0\text{V}$, $V_{CE} = 1200\text{V}$		I_{CES}			1	mA
Input capacitance	$f = 1\text{MHz}$, $T_{vj} = 25^\circ\text{C}$, $V_{CE} = 25\text{V}$, $V_{GE} = 0\text{V}$		C_{ies}		45.9		nF
Reverse transfer capacitance			C_{res}		1.1		nF
Gate charge	$V_{GE} = -15 \dots +15\text{V}$		Q_G		3.5		uC
Internal gate resistor			R_{Gint}		1.67		Ω
Turn-on delay time, inductive load	$V_{CC} = 600\text{V}$, $I_C = 450\text{A}$, $R_G = 4\Omega$, $V_{GE} = \pm 15\text{V}$, $T_{vj} = 25^\circ\text{C}$		$t_{d(on)}$		272		ns
Rise time, inductive load			t_r		161		ns
Turn-off delay time, inductive load			$t_{d(off)}$		536		ns
Fall time, inductive load			t_f		40		ns
Turn-on energy loss per pulse			E_{on}		85.7		mJ
Turn-off energy loss per pulse			E_{off}		30.6		mJ
Turn-on delay time, inductive load	$V_{CC} = 600\text{V}$, $I_C = 450\text{A}$, $R_G = 4\Omega$, $V_{GE} = \pm 15\text{V}$, $T_{vj} = 125^\circ\text{C}$		$t_{d(on)}$		265		ns
Rise time, inductive load			t_r		176		ns
Turn-off delay time, inductive load			$t_{d(off)}$		579		ns
Fall time, inductive load			t_f		44		ns
Turn-on energy loss per pulse			E_{on}		110.2		mJ
Turn-off energy loss per pulse			E_{off}		35.5		mJ
SC data	$t_p \leq 10\mu\text{s}$, $V_{GE} = 15\text{V}$, $V_{CC} = 900\text{V}$, $V_{CEM} \leq 1200\text{V}$, $T_{vj} = 125^\circ\text{C}$		I_{sc}		1800		A
Thermal resistance, junction to case	per IGBT		$R_{th(j-c)}$			0.065	K/W
Temperature under switching conditions			$T_{vj op}$	-40		150	$^\circ\text{C}$

**FRED, Absolute Maximum Ratings (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)**

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	$T_{vj} = 25^\circ\text{C}$	V_{RRM}	1200	V
Continuous DC forward current		$I_{F(AV)}$	450	A
Repetitive peak forward current	$t_P = 1\text{ms}$	I_{FRM}	900	A
I^2t value for fusing	$T_{vj} = 150^\circ\text{C}$, $t_P = 10\text{ms}$, $V_R = 0\text{V}$	I^2t	32000	A^2s

FRED, Electrical Characteristics (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)

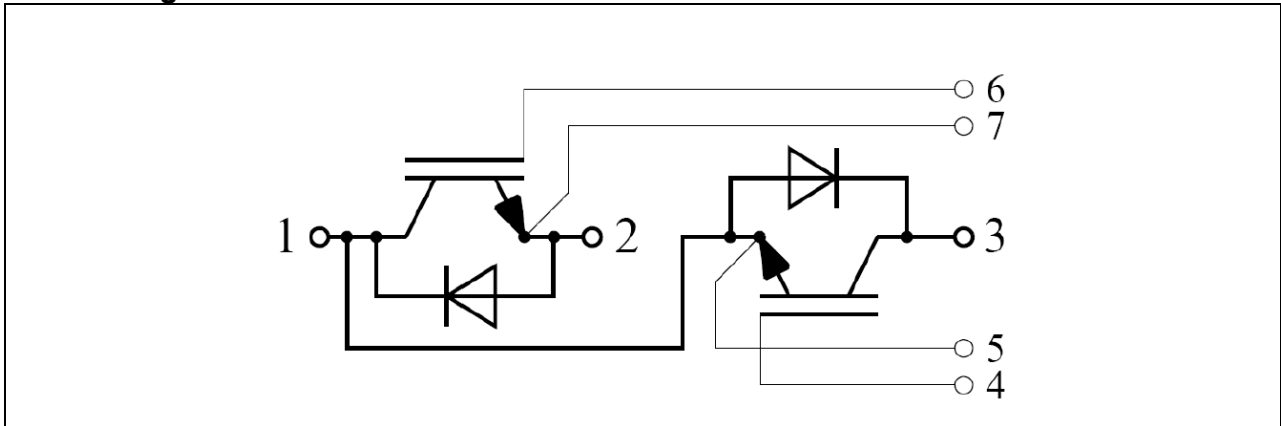
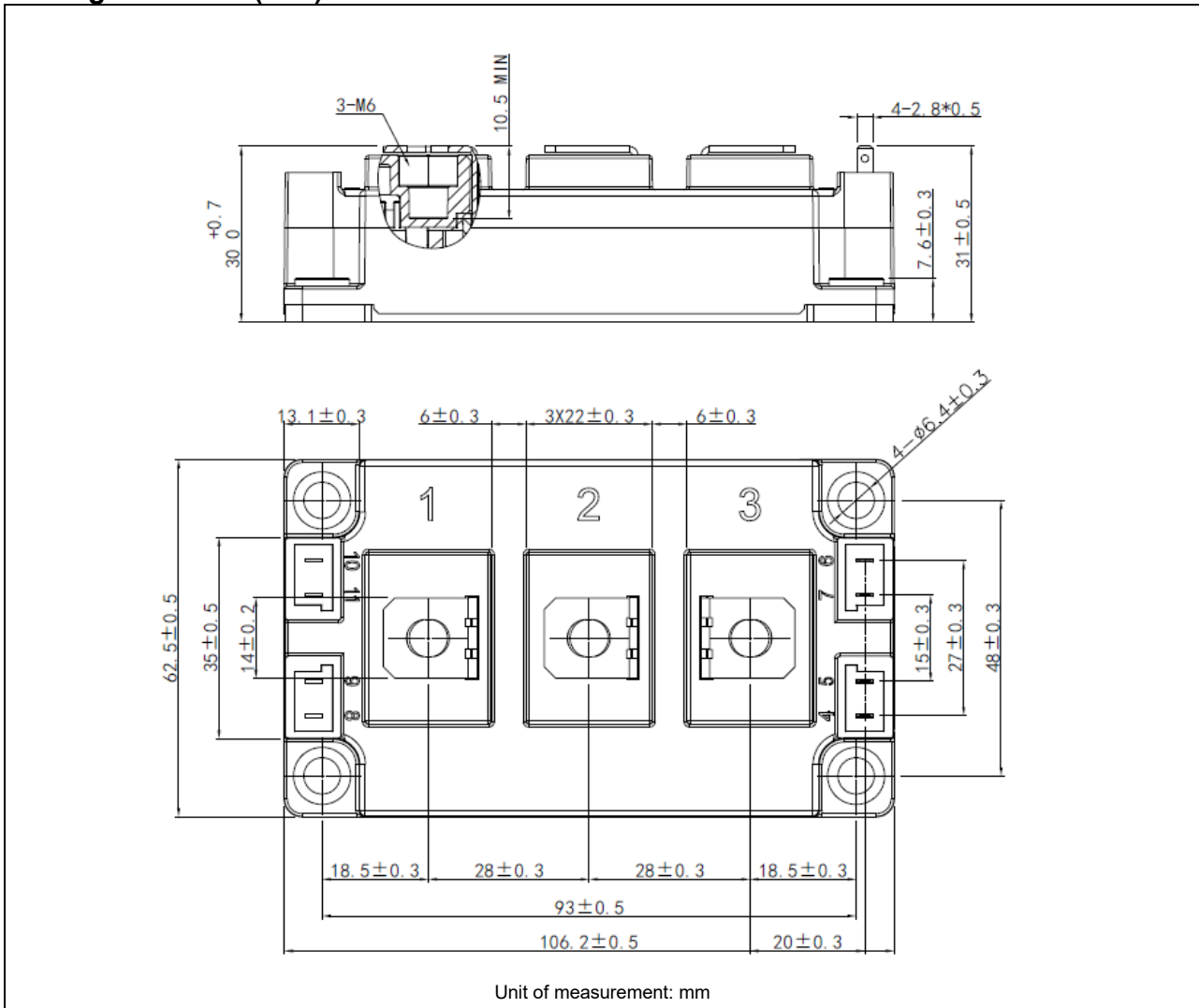
Parameter	Conditions		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage	I _F = 450A, V _{GE} = 0V	T _{vj} = 25°C	V _F		2.10	2.50	V
		T _{vj} = 125°C			1.75		
		T _{vj} = 150°C			1.65		
Peak reverse recovery current	I _F = 450A, di/dt = 1900A/μs, V _R = 600V, V _{GE} = -15V	T _{vj} = 25°C	I _{RM}		89.8		A
		T _{vj} = 125°C			148.2		
Recovered charge		T _{vj} = 25°C	Q _{rr}		11.85		μC
		T _{vj} = 125°C			35.94		
Reverse Recovery energy		T _{vj} = 25°C	E _{rec}		3.20		mJ
		T _{vj} = 125°C			9.36		
Thermal resistance, junction to case	per Diode		R _{th(j-c)}			0.13	K/W
Temperature under switching conditions			T _{vj op}	-40		150	°C

**Module Characteristics**

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Isolation voltage (All terminals shorted)	f = 50Hz, 1minute	V_{iso}	2.5			kV
Maximum junction temperature		T_J			175	°C
Thermal resistance, case to heatsink	per module	$R_{th(c-s)}$		0.012		K/W
Storage temperature		T_{stg}	-40		125	°C
Stray inductance module		L_{SCE}		20		nH
Module lead resistance, terminals - chip	per switch	$R_{CC'+EE'}$		0.7		mΩ
Mounting torque	M6	M	2.5		5.0	N·m
Terminal connection torque	M6	M	3.0		6.0	N·m

Ordering Information

Device	Marking	Package	Weight	Inner Box	Per Carton
JMG450HF12G2S1	JMG450HF12G2S1	G2	300g/PCS	12PCS	60PCS

Circuit Diagram

Package Outlines (mm)


Typical Electrical & Thermal Characteristics

Fig 1. IGBT Output Characteristics
Inverter (typical) $V_{GE}=15\text{ V}$

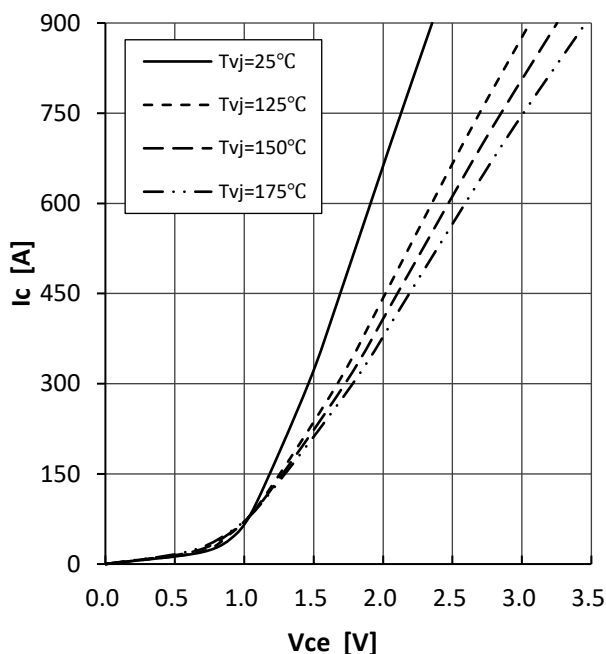


Fig 2. IGBT Output Characteristics
Inverter (typical)

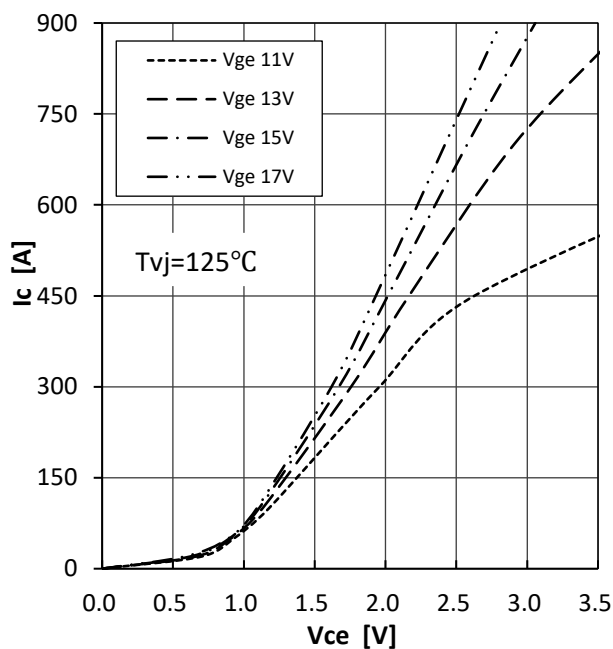


Fig 3. IGBT Transfer Characteristics
Inverter (typical) $V_{CE}=20\text{ V}$

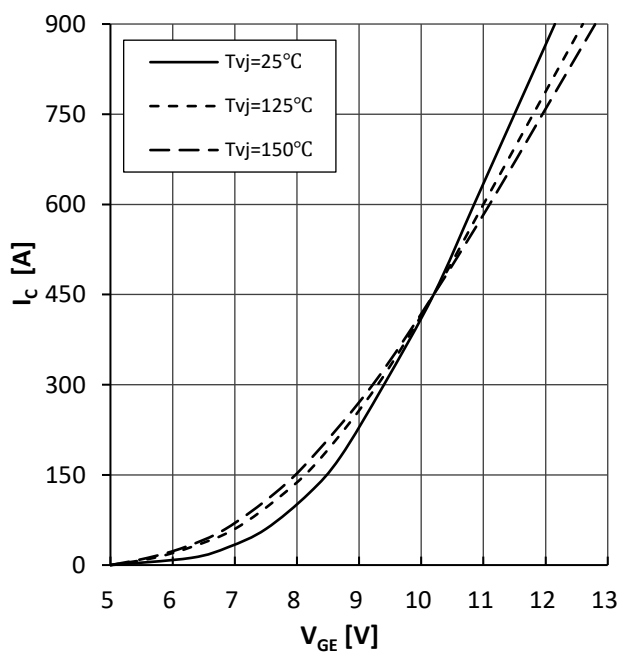


Fig 4. IGBT Switching Loss vs Ic
Inverter (typical)
 $R_g=4\ \Omega$, $V_{CE}=600\text{ V}$, $V_{GE}=\pm 15\text{ V}$

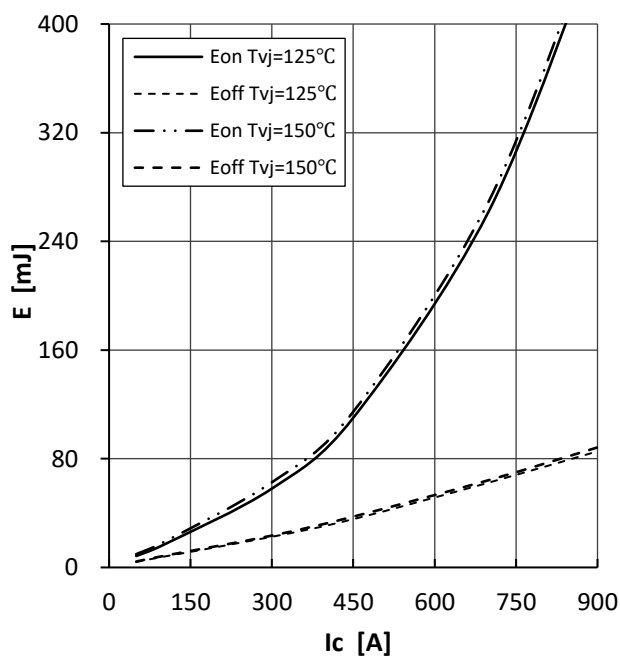


Fig 5. IGBT Switching Loss vs. R_g ,
Inverter (typical)
 $I_c=450$ A, $V_{CE}=600$ V, $V_{GE}=\pm 15$ V

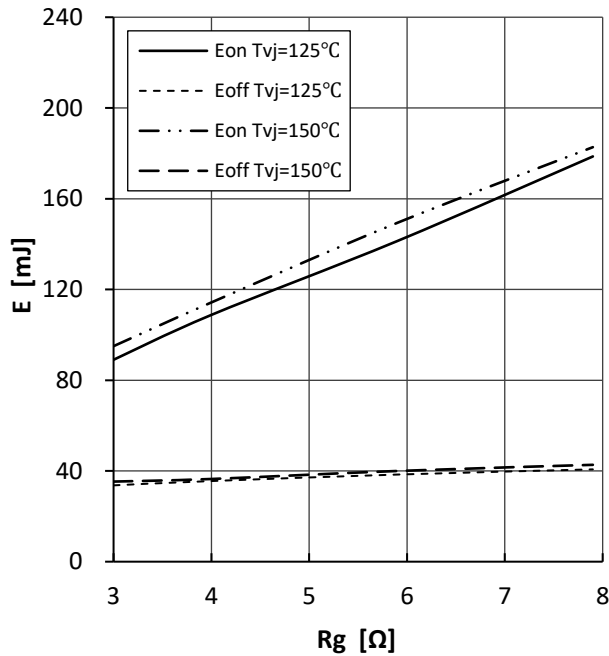


Fig 6. IGBT Transient Thermal Impedance
Inverter

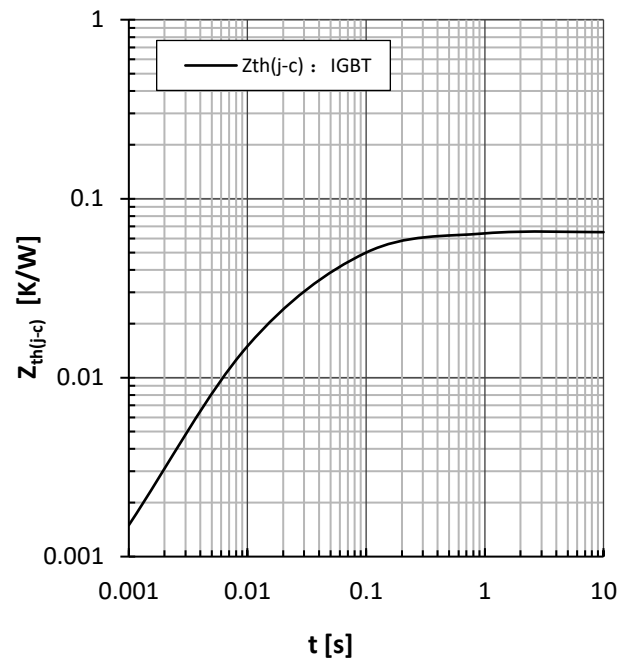


Fig 7. Reverse bias safe operating area
IGBT, Inverter (RBSOA)

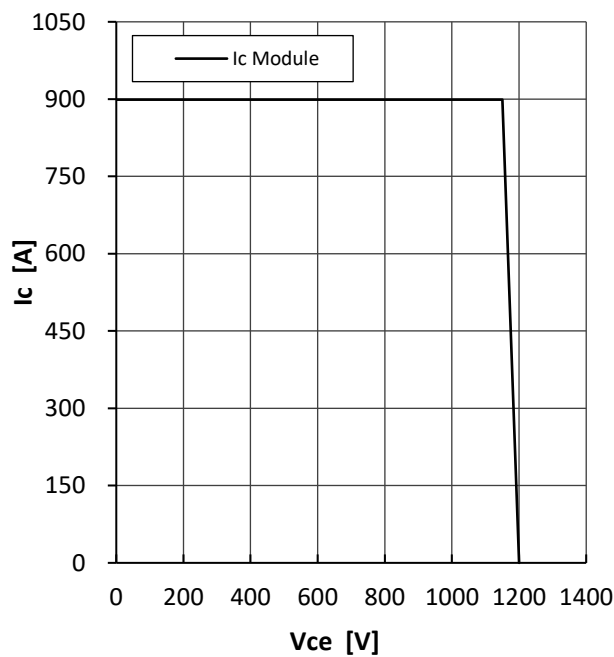


Fig 8. FRED Forward Characteristics,
Inverter (typical)

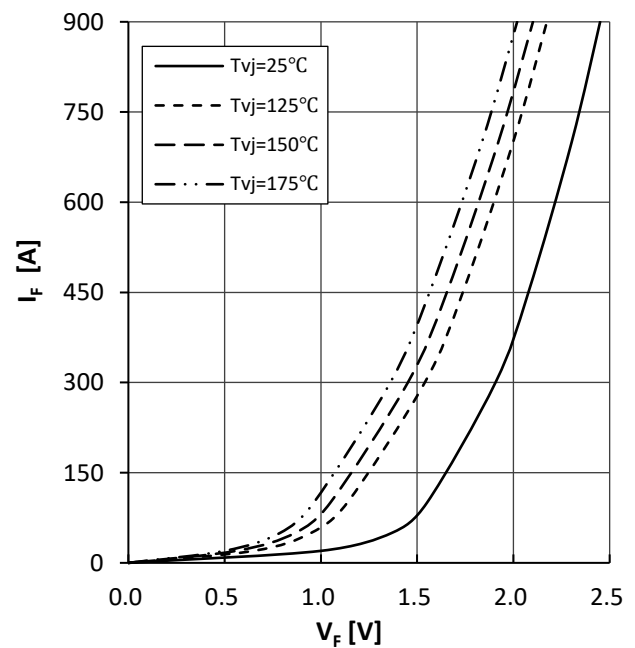


Fig 9. FRED Switching Loss vs. I_c ,
Inverter (typical)
 $R_g=4\ \Omega$, $V_{CE}=600\ V$

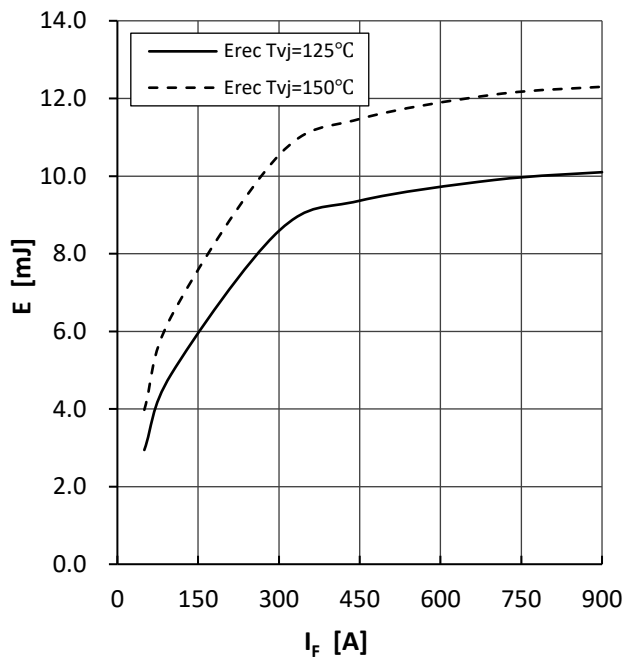


Fig 10. FRED Switching Loss vs. R_g ,
Inverter (typical)
 $I_c=450\ A$, $V_{CE}=600\ V$

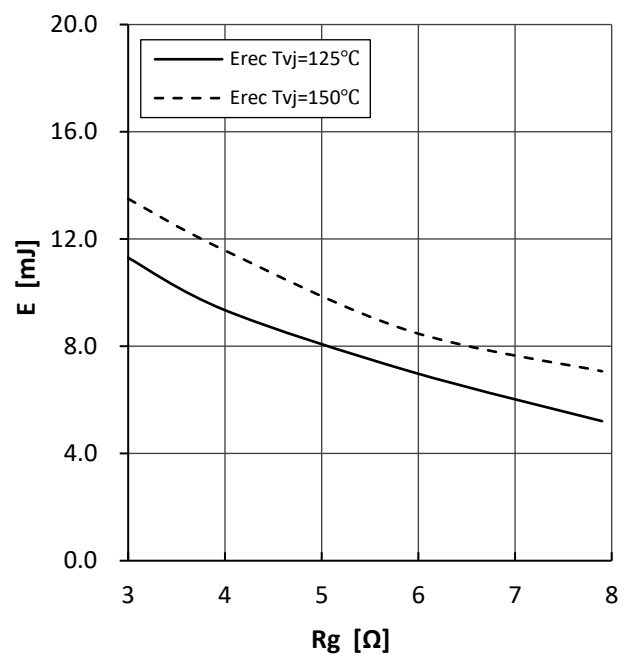
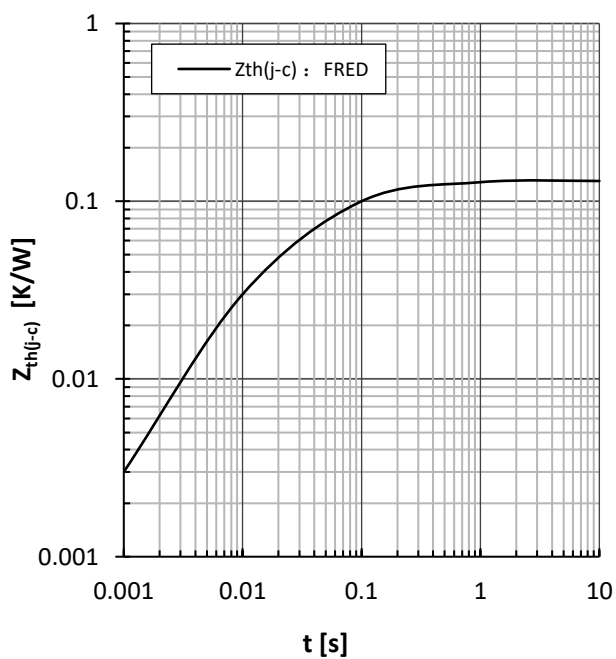


Fig 11. FRED Transient Thermal Impedance
Inverter





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