



Trench FS IGBT

Features

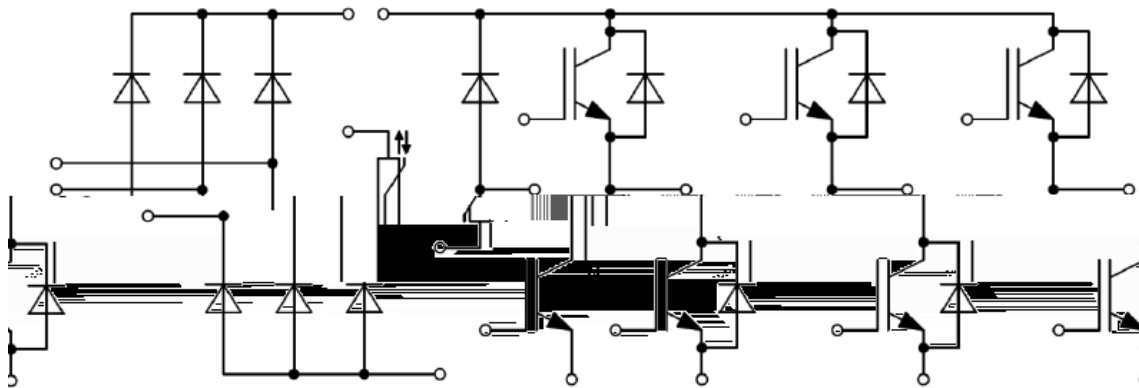
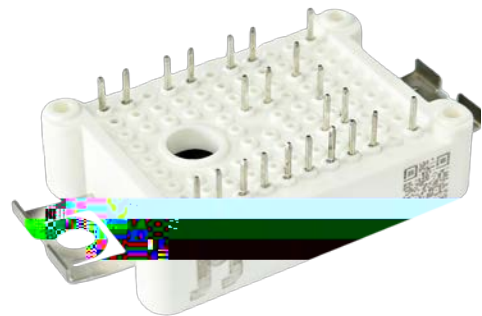
- High Power Density
- High mechanical robustness
- Compact design
- Isolated heatsink using DBC technology
- Very low forward voltage drop
- Fast & soft reverse recovery anti-parallel FWD

Product Summary

Parameter	Value	Unit
V_{CES}	1200	V
I_C (@ $T_C = 100^\circ\text{C}$)	15	A
I_{CRM} (@ $t_P = 1\text{ms}$)	30	A
$V_{CE(sat)}$ (Typ)	1.85	V

Applications

- Active Rectifier
- Air Conditioning
- Motor Drives



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

Parameter	Conditions	Symbol	Values	Unit
Collector-emitter voltage	$T_{vj} = 25^\circ\text{C}$	V_{CES}	1200	V
Gate-emitter peak voltage		V_{GES}	± 20	V
Continuous collector current	$T_C = 25^\circ\text{C}, T_{vj} = 175^\circ\text{C}$	I_C	28	A
	$T_C = 100^\circ\text{C}, T_{vj} = 175^\circ\text{C}$	$I_{C\text{ nom}}$	15	
Repetitive peak collector current	$t_P = 1\text{ms}$	I_{CRM}	30	A
Total power dissipation	$T_C = 25^\circ\text{C}, T_{vj\text{ max}} = 175^\circ\text{C}$	P_{tot}	130	W



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

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	$I_C = 15\text{A}$, $V_{GE} = 15\text{V}$	$V_{CE(sat)}$		1.85	2.25	V
				2.30		
				2.35		
Gate threshold voltage	$V_{CE}=V_{GE}$, $I_C=0.3\text{mA}$	$V_{GE(th)}$	5.2	5.8	6.4	V
Gate-emitter leakage current	$V_{CE} = 0\text{V}$, $V_{GE} = 20\text{V}$	I_{GES}			400	nA
Collector leakage current	$V_{CE}=1200\text{V}$ $V_{GE}=0\text{V}$	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}		0.89		nF
Output capacitance		C_{oes}		0.03		nF
Gate charge	$V_{GE} = -15\text{V}\dots+15\text{V}$	Q_G		0.12		uC
Turn-on delay time, inductive load	$V_{CE} = 600\text{V}$, $I_C = 15\text{A}$, $R_G = 51$, $V_{GE} = \pm 15\text{V}$, $T_{vj} = 25$	$t_{d(on)}$		98.4		ns
Rise time, inductive load		t_r		98.2		ns
Turn-off delay time, inductive load		$t_{d(off)}$		114		ns
Fall time, inductive load		t_f		174		ns
Turn-on energy loss per pulse		E_{on}		1.81		mJ
Turn-off energy loss per pulse		E_{off}		0.69		mJ
Turn-on delay time, inductive load		$V_{CE} = 600\text{V}$, $I_C = 15\text{A}$, $R_G=51$, $V_{GE} = \pm 15\text{V}$, $T_{vj} = 125$	$t_{d(on)}$		94.2	
Rise time, inductive load	t_r			107.2		ns
Turn-off delay time, inductive load	$t_{d(off)}$			132		ns
Fall time, inductive load	t_f			220		ns
Turn-on energy loss per pulse	E_{on}			2.61		mJ
Turn-off energy loss per pulse	E_{off}			0.86		mJ
SC date	$t_p 10\mu\text{s}$ $V_{GE} 15\text{V}$ $V_{CC}=800\text{V}$, $V_{CEM} 1200\text{V}$, $T_{vj}=125$		I_{sc}		55	
Thermal resistance, junction to case	per module	$R_{th(j-c)}$		1.05	1.15	K/W
Temperature under switching conditions		$T_{vj op}$	-40		150	



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

Parameter	Conditions	Symbol	Values	Unit
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**Diode, Rectifier 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}	1600	V
Maximum RMS forward current per chip	$T_C = 80^\circ\text{C}$	I_{FRMSM}	30	A
Maximum RMS current at rectifier output	$T_C = 80^\circ\text{C}$	I_{RMSM}	30	A
Repetitive peak forward current	$t_P = 10\text{ ms}, T_{vj} = 25^\circ\text{C}$	I_{FSM}	300	A
I^2t value for fusing	$t_P = 10\text{ ms}, T_{vj} = 25^\circ\text{C}$	I^2t	450	A^2s

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

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	$T_{vj} = 150^\circ\text{C}, I_F = 15\text{A}$	V_F		1.10		V
Reverse current	$T_{vj} = 150^\circ\text{C}, V_R = 1600\text{V}$	I_R		1.0		mA
Thermal resistance, junction to case	per module	$R_{th(j-c)}$		1.20	1.35	K/W
Temperature under switching conditions		$T_{vj\text{ op}}$	-40		150	

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

Parameter	Conditions	Symbol	Values	Unit
Collector-emitter voltage	$T_{vj} = 25^\circ\text{C}$	V_{CES}	1200	V
Gate-emitter peak voltage		V_{GES}	± 20	V
Continuous collector current	$T_C = 25^\circ\text{C}, T_{vj} = 175^\circ\text{C}$	I_C	28	A
	$T_C = 100^\circ\text{C}, T_{vj} = 175^\circ\text{C}$	$I_{C\text{ nom}}$	15	
Repetitive peak collector current	$t_P = 1\text{ ms}$	I_{CRM}	30	A
Total power dissipation	$T_C = 25^\circ\text{C}, T_{vj\text{ max}} = 125^\circ\text{C}$	P_{tot}	130	W



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

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	$I_C = 15\text{A}$, $V_{GE} = 15\text{V}$	$V_{CE(sat)}$		1.85	2.25	V
			$T_{vj} = 125^\circ\text{C}$	2.30		
			$T_{vj} = 150^\circ\text{C}$	2.35		
Gate threshold voltage	$V_{CE}=V_{GE}$, $I_C=0.3\text{mA}$	$V_{GE(th)}$	5.2	5.8	6.4	V
Gate-emitter leakage current	$V_{CE} = 0\text{V}$, $V_{GE} = 20\text{V}$	I_{GES}			400	nA
Collector leakage current	$V_{CE}=1200\text{V}$ $V_{GE}=0\text{V}$	I_{CES}			1.0	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}		0.89		nF
Output capacitance		C_{oes}		0.03		nF
Gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$	Q_G		0.12		uC
Turn-on delay time, inductive load	$V_{CC} = 600\text{V}$, $I_C = 15\text{A}$, $R_G = 51$, $V_{GE} = \pm 15\text{V}$, $T_{vj} = 25$	$t_{d(on)}$		93.6		ns
Rise time, inductive load		t_r		81.6		ns
Turn-off delay time, inductive load		$t_{d(off)}$		112.8		ns
Fall time, inductive load		t_f		131.2		ns
Turn-on energy loss per pulse		E_{on}		0.95		mJ
Turn-off energy loss per pulse		E_{off}		0.47		mJ
Turn-on delay time, inductive load		$V_{CC} = 600\text{V}$, $I_C = 15\text{A}$, $R_G = 51$, $V_{GE} = \pm 15\text{V}$, $T_{vj} = 125$	$t_{d(on)}$		88	
Rise time, inductive load	t_r			84.8		ns
Turn-off delay time, inductive load	$t_{d(off)}$			123.2		ns

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FRED, Brake-Chopper 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	10	A
Repetitive peak forward current	$t_P = 1\text{ms}$	I_{FRM}	20	A
I^2t value for fusing	$T_{vj}=125^\circ\text{C}$, $t_P = 10\text{ms}$, $V_R = 0\text{V}$	I^2t	16	A^2s

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

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F = 10\text{A}$, $V_{GE} = 0\text{V}$	V_F		1.90	2.25	V
				1.55		
				1.50		

Peak reverse recovery current

$I_F = 10\text{A}$,
 $di/dt = 100\text{A}/\mu\text{s}$,
 $V_R = 600\text{V}$,
 V

**NTC-Thermistor Characteristics (@ T_C = 25°C unless otherwise specified)**

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	T _C =25	R ₂₅		5		K
Deviation of R100	T _C = 100°C, R ₁₀₀ = 493	R/R	-5		5	%
Power dissipation	T _C = 25°C	P ₂₅			20	mW
B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 K))]$	B _{25/50}		3375		K
B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 K))]$	B _{25/80}		3411		K
B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 K))]$	B _{25/100}		3433		K

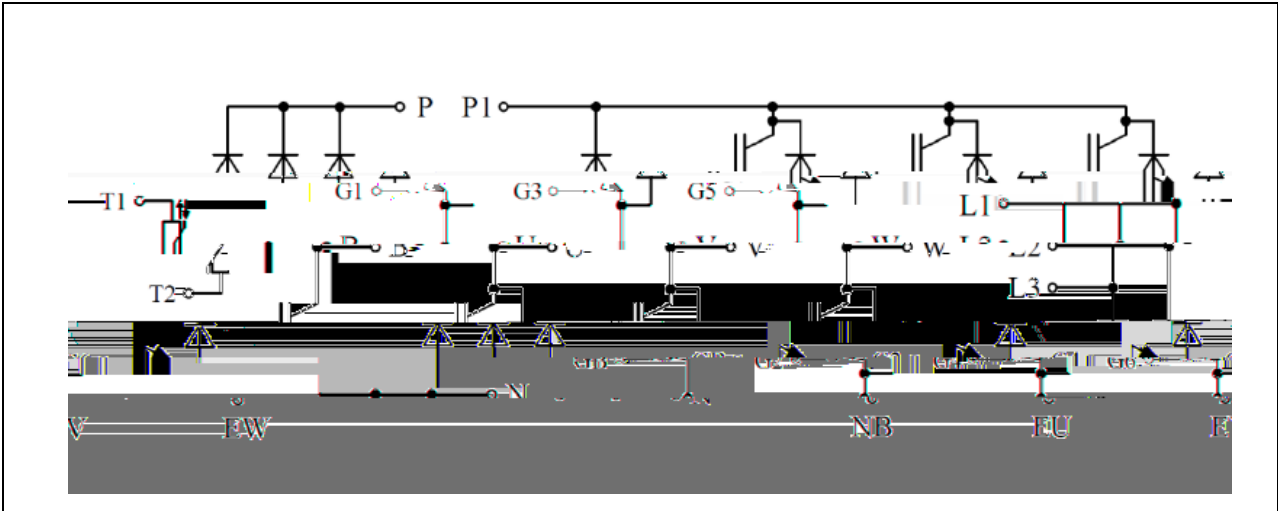
Module Characteristics

Parameter	Conditions	Symbol	Values			Unit
			Min.	Typ.	Max.	
Isolation Voltage (All Terminals Shorted)	RMS, f = 50Hz, 1 minute	V _{iso}	2.5			KV
Thermal resistance, case to heatsink	per module	R _{th(c-s)}		0.037		K/W
Maximum Junction Temperature	Inverter, brake-chopper	T _{vj max}			175	
	rectifier				150	
Stray inductance module		L _{SCE}		30		nH
Module lead resistance, terminals - chip	per switch	R _{CC'+EE'}		8.0		m
		R _{AA'+CC'}		6.0		m
Storage Temperature		T _{stg}	-40		125	
Mounting force per clamp		F	20		50	N

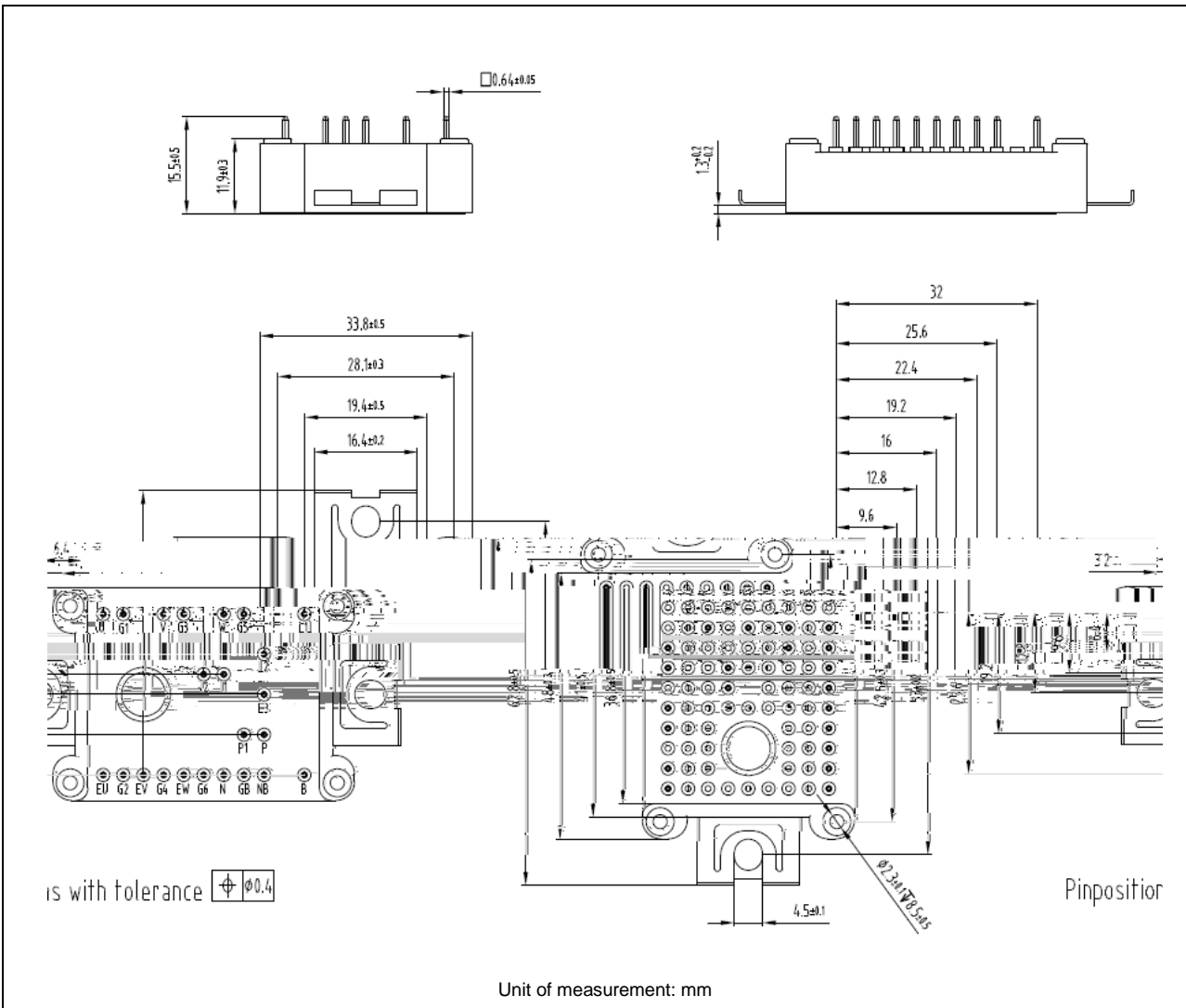
Ordering Information

Device	Marking	Package	Weight	Inner Box	Pre Carton
JMG15PM12E1S1	JMG15PM12E1S1	E1(33.8mm)	24±3g/PCS	30PCS	150PCS

Circuit Diagram



Package Outlines (mm)



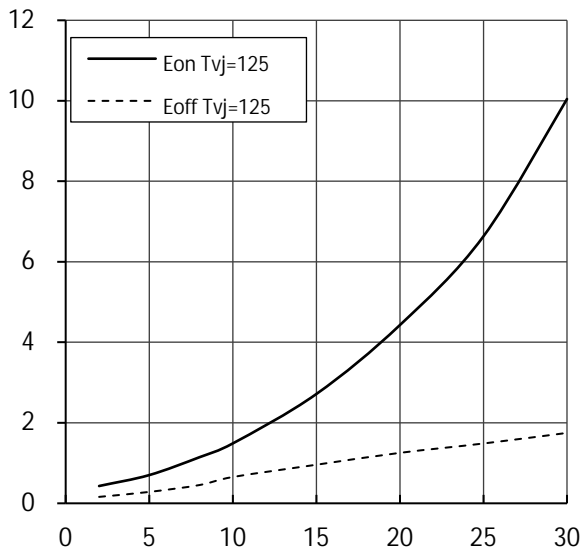
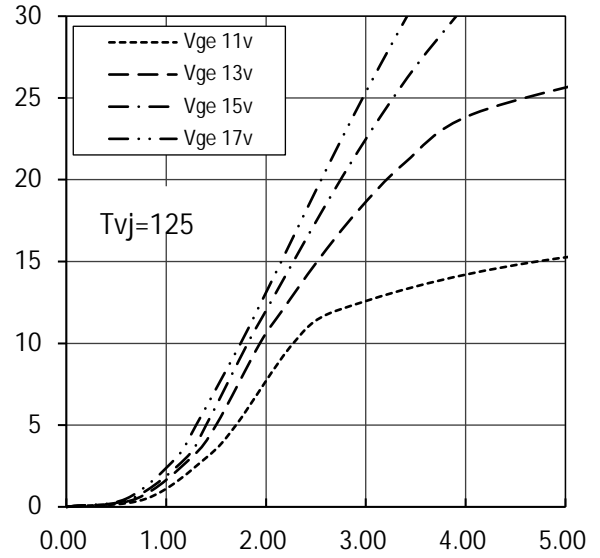
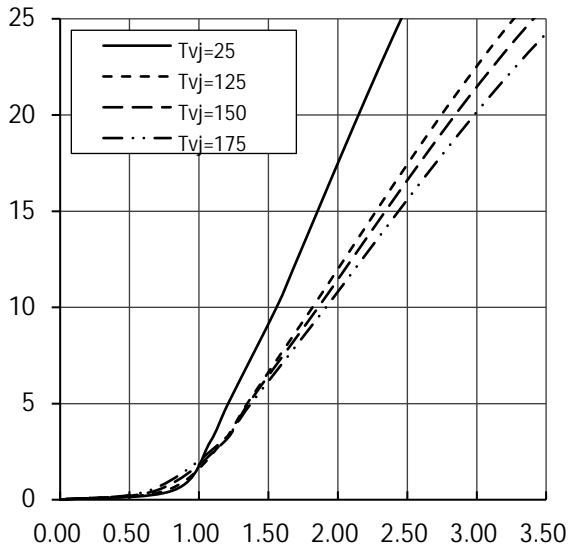
Typical Electrical & Thermal Characteristics


Fig 5. FRED Foward Characteristics, Inverter(typcial)

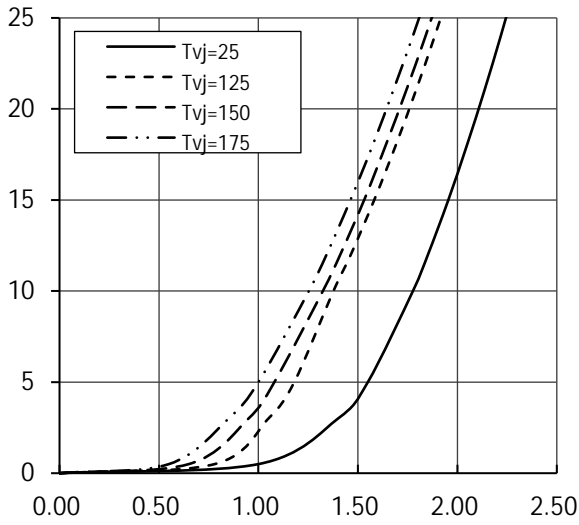


Fig 6. FRED Forward Characteristics, Inverter(typcial)

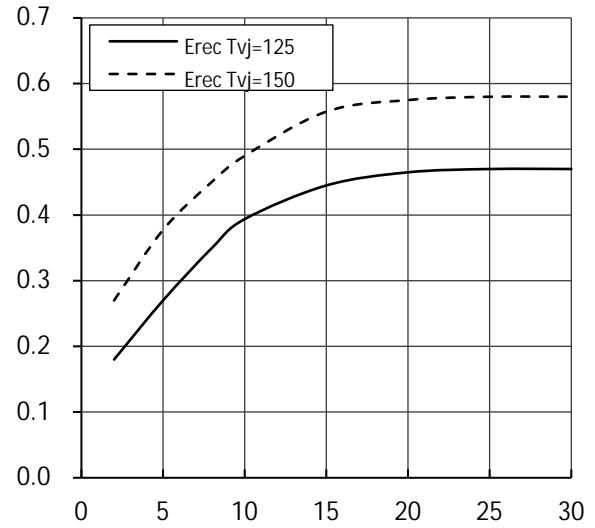
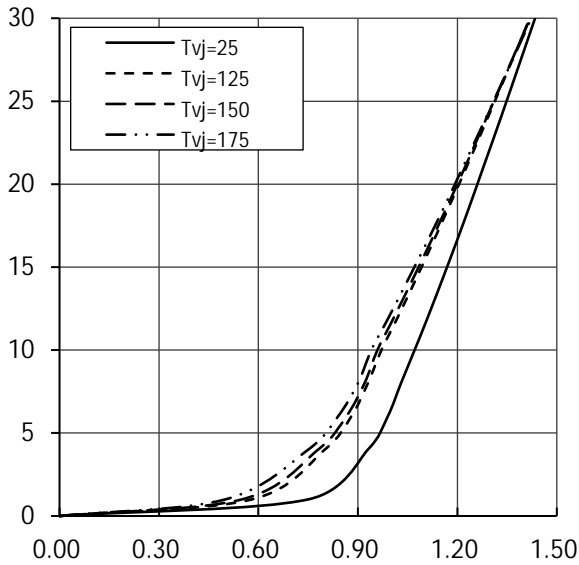



Fig 7. Diode Rectifier Forward Characteristics





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