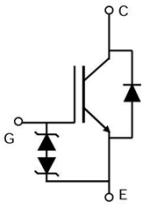
Key performance:

- V_{CE}=650V
- I_C=10A@T_C=100℃
- $V_{CE(sat)}$=1.8 V

TO-263

Features:

- High ruggedness performance
- 10μs short circuit capability
- Positive $V_{CE\ (sat)}$ temperature coefficient
- High efficiency for motor control
- Excellent current sharing in parallel operation
- RoHS compliant
- HBM ≥ ±2000V



Applications:

- Home appliances
- Motor drives

Package parameters

Type	Marking	Package	Packaging method
VSG10N65-T3	VSG10N65	TO-263	Tape and reel

Maximum ratings

Symbol	Parameter	Values	Unit
V_{CES}	Collector-emitter voltage	650	V
V_{GES}	Gate-emitter voltage	±20	V
I_C	Continuous collector current (T_C=25°C)	20	A
	Continuous collector current (T_C=100°C)	10	A
I_{CM}	Pulsed collector current, t_p limited by T_{vjmax}	40	A
I_F	Diode continuous forward current (T_C=100°C)	10	A
I_{FM}	Diode maximum current, t_p limited by T_{vjmax}	40	A
t_{sc}	Short circuit withstand time	10	μs
P_{tot}	Power dissipation (T_C=25°C)	136	W
	Power dissipation (T_C=100°C)	68	W
T_{vj}	Operating junction temperature range	-40 to +175	°C
T_{stg}	Storage temperature range	-55 to +150	°C

Thermal characteristics

Symbol	Parameter	Values		Unit
		Typ.	Max.	
$R_{th(j-c)}$	Thermal resistance, junction to case for IGBT	-	1.1	K/ W
$R_{th(j-c)}$	Thermal resistance, junction to case for Diode	-	2.0	K/ W
$R_{th(j-a)}$	Thermal resistance,junction to ambient	-	50	K/ W

Electrical characteristics of IGBT (T_{vj}=25℃ unless otherwise specified)

Static characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
BV_{CES}	Collector-emitterbreakdown voltage	V_{GE}=0V, I_C=250μA	650	-	-	V
I_{CES}	Collector-emitter leakage current	V_{CE}=650V, V_{GE}=0V	-	-	50	μA
I_{GES}	Gate leakage current, forward	V_{GE}=20V, V_{CE}=0V	-	-	100	μA
	Gate leakage current, reverse	V_{GE}=-20V, V_{CE}=0V	-	-	-100	μA
$V_{GE(th)}$	Gate-emitter threshold voltage	V_{GE}=V_{CE}, I_C=1mA	5.5	5.8	6.2	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}=15V, I_C=10A	-	1.8	-	V
		V_{GE}=15V, I_C=10A,T_{vj}=175℃	-	2.3	-	V

Dynamic characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
C_{ies}	Input capacitance	V_{CE}=30V V_{GE}=0V f=1MHz	-	670	-	pF
C_{oes}	Output capacitance		-	37	-	pF
C_{res}	Reverse transfer capacitance		-	10	-	pF
Q_g	Total gate charge	V_{CC}=520V V_{GE}=15V I_C=10A	-	28	-	nC

Switching characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on delay time	V_{CC}=400V V_{GE}=0/15V I_C=10A R_G=10Ω Inductive load	-	10	-	ns
t_r	Rise time		-	112	-	ns
$t_{d(off)}$	Turn-offdelay time		-	32	-	ns
t_f	Fall time		-	96	-	ns
E_{on}	Turn-on energy		-	0.30	-	mJ
E_{off}	Turn-off energy		-	0.17	-	mJ
E_{ts}	Total switching energy		-	0.47	-	mJ
$t_{d(on)}$	Turn-on delay time	V_{CC}=400V V_{GE}=0/15V I_C=10A R_G=10Ω Inductive load T_{vj}=175℃	-	9	-	ns
t_r	Rise time		-	119	-	ns
$t_{d(off)}$	Turn-offdelay time		-	105	-	ns
t_f	Fall time		-	120	-	ns
E_{on}	Turn-on energy		-	0.36	-	mJ
E_{off}	Turn-offenergy		-	0.25	-	mJ
E_{ts}	Total switching energy		-	0.61	-	mJ

Electrical characteristics of Diode (T_{vj}=25℃ unless otherwise specified)

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
V_F	Diode forward voltage	I_F=10A	-	1.4	-	V
		I_F=10A, T_{vj}=175℃	-	1.2	-	V
t_{rr}	Diode reverse recovery time	V_R=400V I_F=10A di_F/dt=-750A/μs	-	57	-	ns
I_{rrm}	Diode peak reverse recovery current		-	12	-	A
Q_{rr}	Diode reverse recovery charge		-	411	-	nC
t_{rr}	Diode reverse recovery time	V_R=400V I_F=10A di_F/dt=-750A/μs T_{vj}=175℃	-	122	-	ns
I_{rrm}	Diode peak reverse recovery current		-	14	-	A
Q_{rr}	Diode reverse recovery charge		-	741	-	nC

Typical performance characteristics

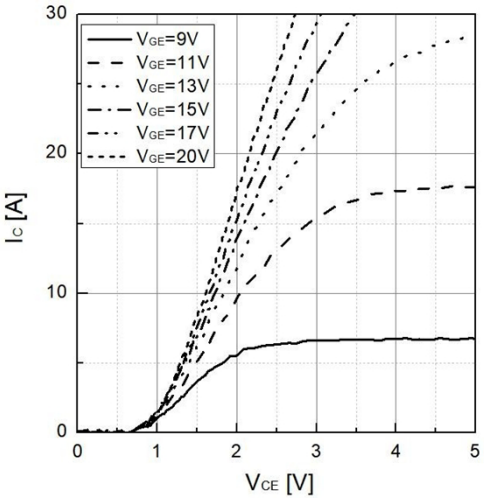


Fig 1. Typical output characteristic (T_{vj}=25℃)

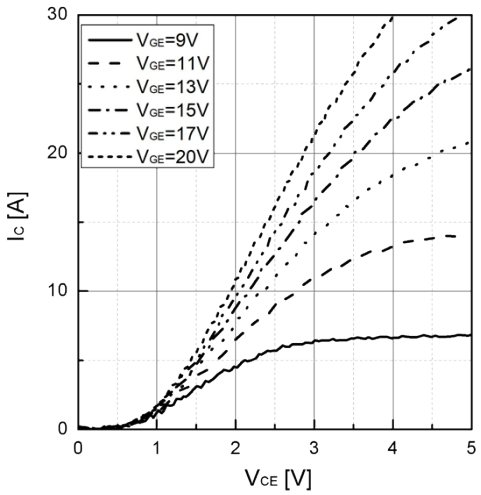


Fig 2. Typical output characteristic(T_{vj}=175℃)

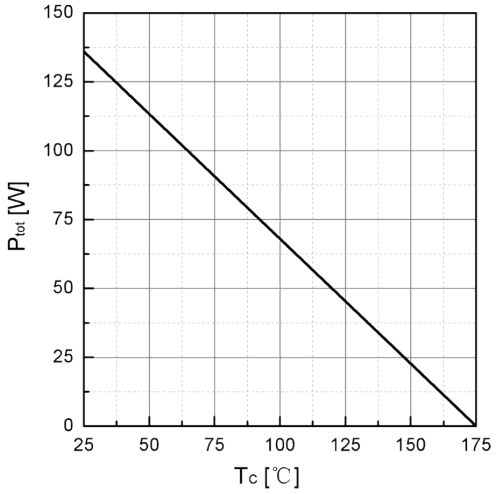


Fig 3. Power dissipation as a function of T_C

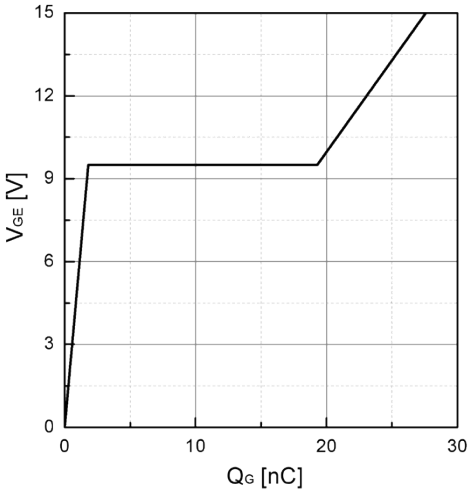


Fig 4. Typical Gate charge

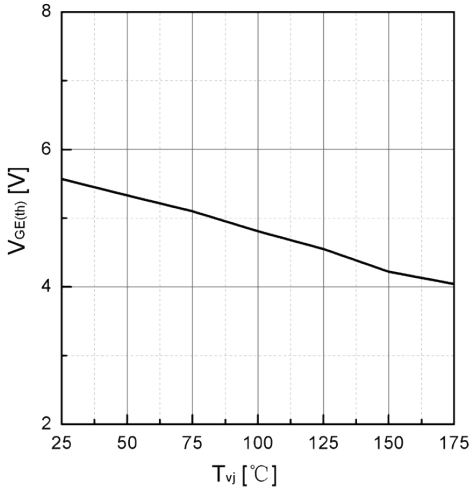


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj} (I_C=1mA)

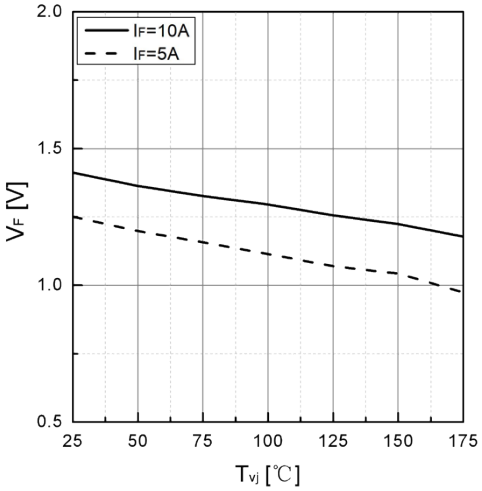


Fig 6. Typical V_F as a function of T_{vj}

Typical performance characteristics

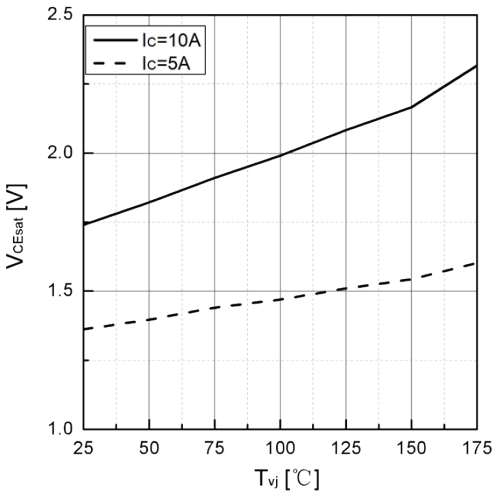


Fig 7. Typical V_{CEsat} as a function of T_{vj}

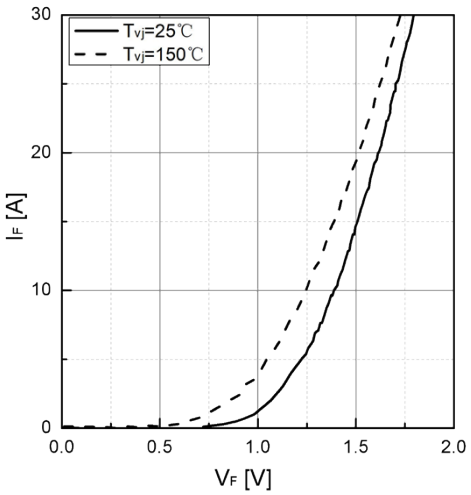


Fig 8. Typical I_F as a function of V_F

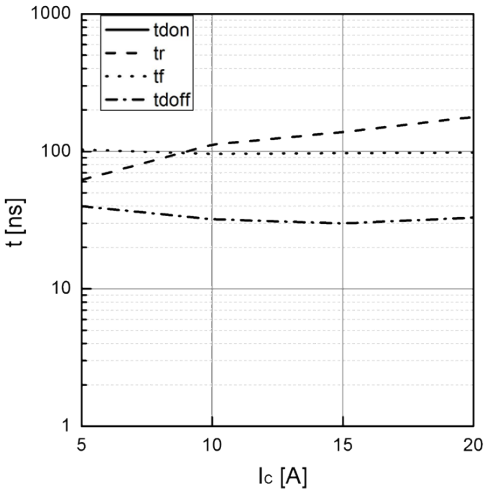


Fig 9. Typical switching time as a function of I_C

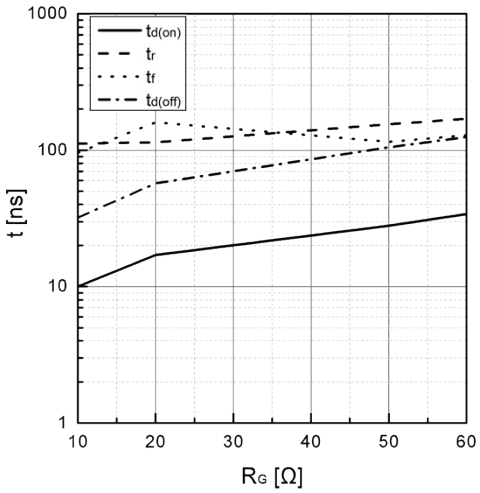


Fig 10. Typical switching times as a function of R_G

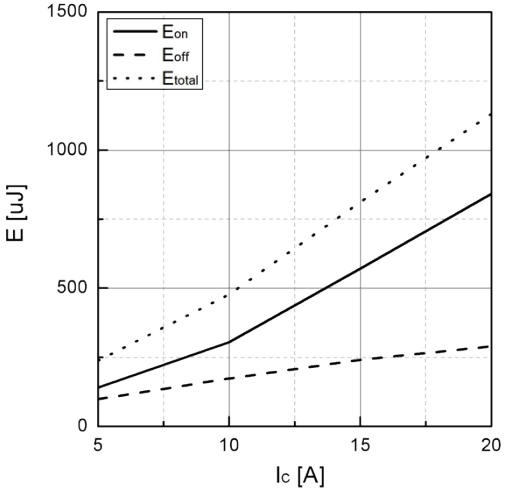


Fig 11. Typical switching energy losses as a function of I_C

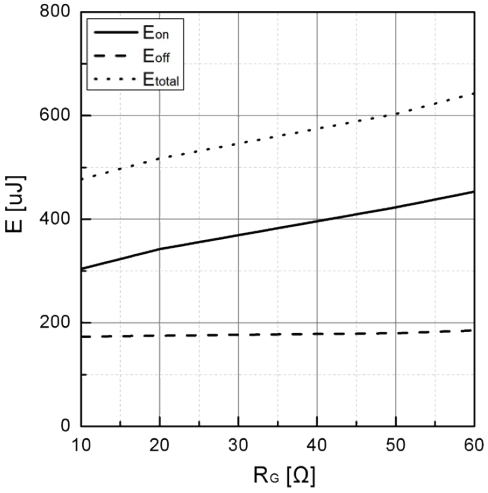


Fig 12. Typical switching energy losses as a function of R_G

Typical performance characteristics

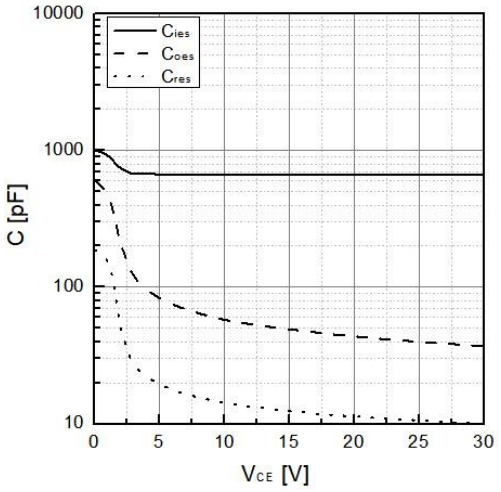


Fig 13. Typical capacitance as a function of V_{CE} (f=1Mhz, V_{GE}=0V)

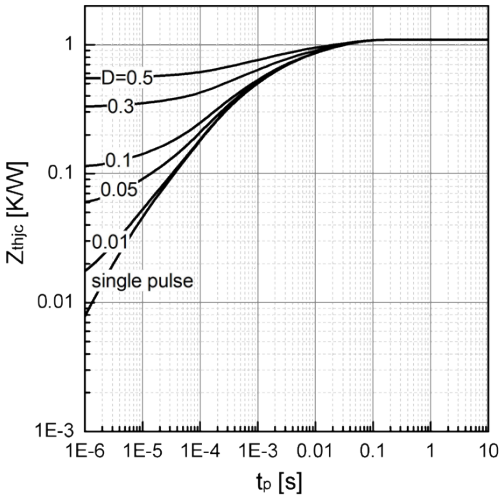


Fig 14. Transient thermal impedance of IGBT