

650V 60A Trench and Field Stop IGBT

DESCRIPTION :

- High ruggedness performance
- High efficiency for inverters
- Easy parallel switching capability
- RoHS compliant.

TYPICAL APPLICATIONS :

- PFC applications
- Welding machines



TO-3PN

IGBT

MAXIMUM RATINGS (Tvj=25°C unless otherwise specified)

Characteristic	Condition	Symbol	Value	Unit
Collector-Emitter Voltage		V_{CES}	650	V
Continuous collector current	Tc=25°C Tc=100°C	$I_{C\ nom}$	120 60	A
Pulsed collector current	t _p limited by Tvjmax	I_{CM}	240	A
Gate emitter voltage		V_{GE}	±20	V
Power dissipation	Tc=25°C Tc=100°C	P_{tot}	394 197	W
Temperature under switching conditions		Tvj op	-40~+175	°C
Storage temperature		T _{STG}	-55~+150	°C

THERMAL CHARACTERISTICS

Characteristic	Condition	Symbol	Max.	Unit
IGBT thermal resistance, junction - case		$R_{th(j-C)}$	0.38	K/W
Diode thermal resistance, junction - case		$R_{th(j-C)}$	0.70	K/W
Thermal resistance, junction - ambient		$R_{th(j-A)}$	40	K/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Collector-emitter cut-off current VCE=650V, VGE=0V Tvj=25°C	I_{CES}			50	μA
Gate-emitter leakage current VCE=0V, VGE=20V Tvj=25°C	I_{GES}			100	nA
Gate-Emitter threshold voltage IC=1.0mA, VGE= VCE Tvj=25°C	$V_{GE(th)}$	5.2	5.4	5.7	V
Collector-Emitter saturation voltage VGE=15V, IC=60A Tvj=25°C VGE=15V, IC=60A Tvj=175°C	$V_{CE(SAT)}$		1.9 2.5		V
Input capacitance f=1MHz, VCE=30 V, VGE=0 V Tvj=25°C	C_{ies}		3860		pF
Output capacitance f=1MHz, VCE=30 V, VGE=0 V Tvj=25°C	C_{oes}		170		pF
Reverse transfer capacitance f=1MHz, VCE=30 V, VGE=0 V Tvj=25°C	C_{res}		30		pF
Gate charge IC = 60A, VGE = 15 V, VCC = 520V Tvj=25°C	Q_G		120		nC
Turn-on delay time IC=60A, VCC=400 V Tvj=25°C VGE=0/15 V, RG=10Ω Tvj=175°C (inductive load)	$t_{d(ON)}$		44 45		ns
Rise time IC=60A, VCC=400 V Tvj=25°C VGE=0/15 V, RG=10Ω Tvj=175°C (inductive load)	t_r		100 105		ns
Turn-off delay time IC=60A, VCC=400 V Tvj=25°C VGE=0/15 V, RG=10Ω Tvj=175°C (inductive load)	$t_{d(OFF)}$		166 180		ns
Fall time IC=60A, VCC=400 V Tvj=25°C VGE=0/15 V, RG=10Ω Tvj=175°C (inductive load)	t_f		75 76		ns
Turn-on energy IC=60A, VCC=400 V Tvj=25°C VGE=0/15 V, RG=10Ω Tvj=175°C (inductive load)	$E_{(ON)}$		2.3 3.6		mJ

Turn-off energy loss per pulse IC=60A, VCC=400 V Tvj=25°C VGE=0/15 V, RG=10Ω Tvj=175°C (inductive load)	E _(OFF)		1.3 1.6		mJ
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Diode

MAXIMUM RATINGS (Tvj=25°C unless otherwise specified)

Characteristic	Condition	Symbol	Value	Unit
Repetitive peak reverse voltage	Tvj=25°C	V _{RRM}	650	V
Continuous forward current	Tc=100°C	I _F	60	A
Diode maximum current	t _p limited by Tvj max	I _{FM}	240	A

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Forward voltage IF=60A, VGE=0 V Tvj=25°C IF=60A, VGE=0 V Tvj=175°C	V _F		2.5 2.0		V
Reverse Recovered Time IF=60 A, Tvj=25°C -diF/dt =450A/μs Tvj=175°C VR=400 V	T _{rr}		78 126		ns
Peak reverse recovery current IF=60 A, Tvj=25°C -diF/dt =450A/μs Tvj=175°C VR=400 V	I _{RRM}		15 26		A
Reverse Recovered charge IF=60 A, Tvj=25°C -diF/dt =450A/μs Tvj=175°C VR=400 V	Q _{rr}		511 2163		nC

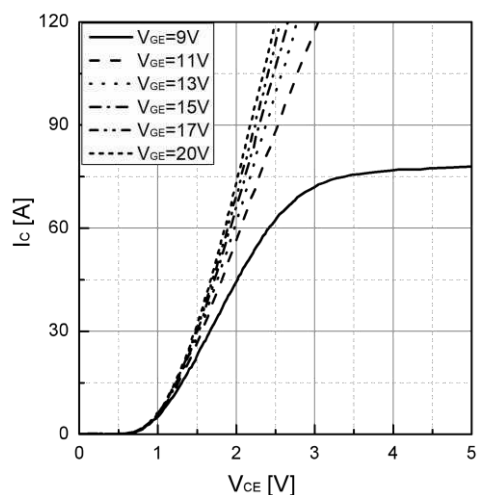


Figure 1. Typical output characteristics ($T_{vj}=25^{\circ}\text{C}$)

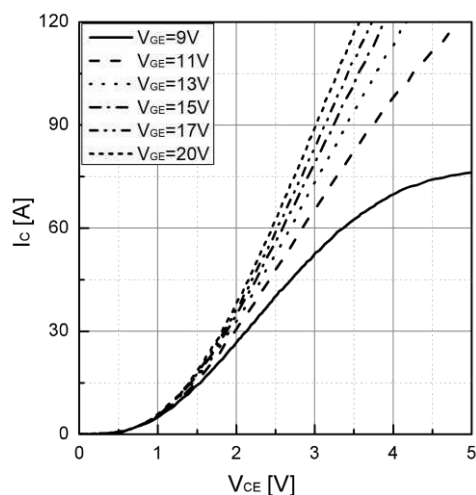


Figure 2. Typical output characteristics ($T_{vj}=175^{\circ}\text{C}$)

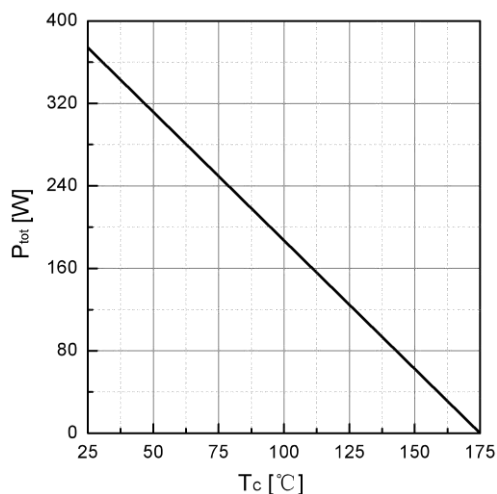


Figure 3. Power dissipation as a function of T_C

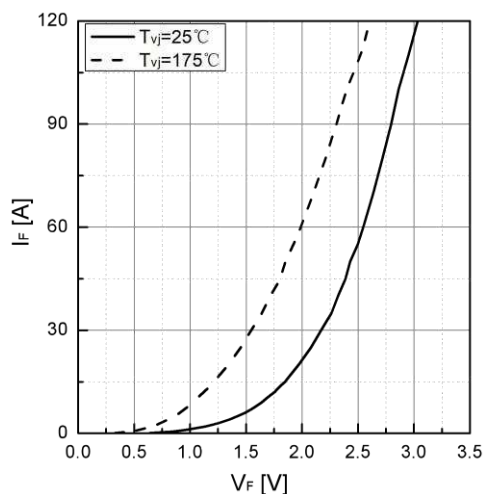


Figure 4. Typical I_F as a function of V_F

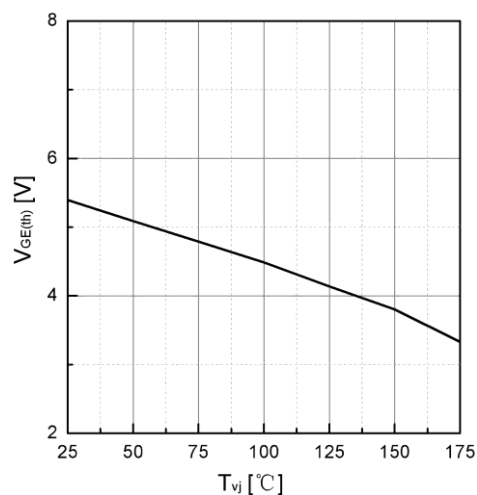


Figure 5. Typical $V_{GE(th)}$ as a function of T_{vj} ($I_C=1\text{mA}$)

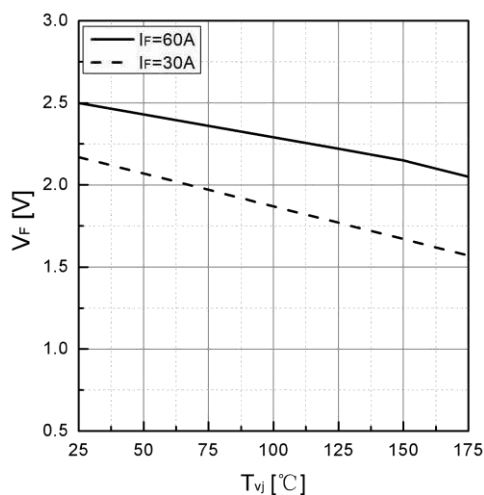


Figure 6. Typical V_F as a function of T_{vj}

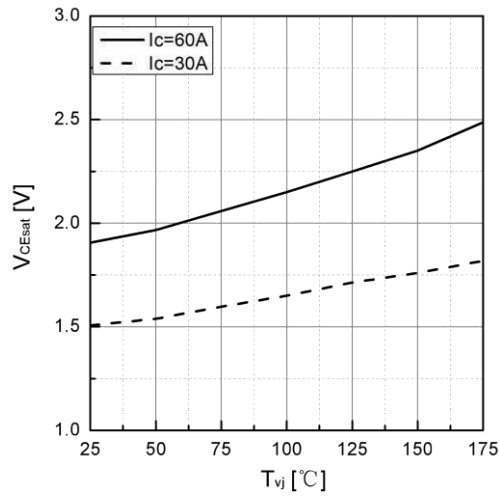


Figure 7. Typical VCEsat as a function of Tvj

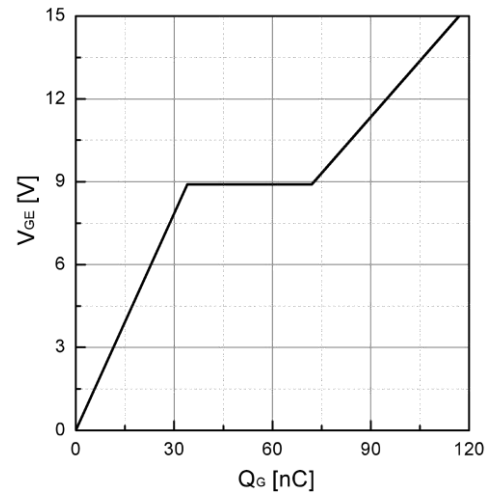


Figure 8. Typical Gate charge

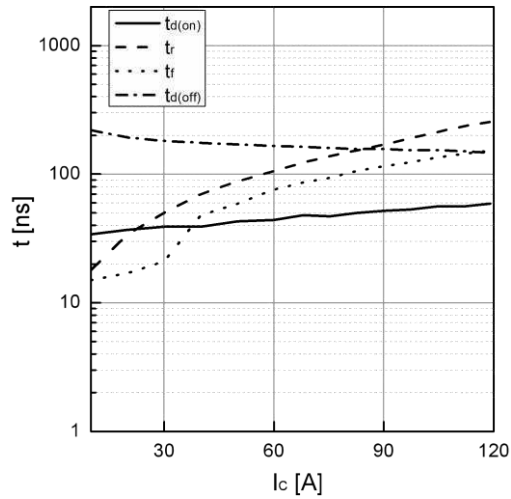


Figure 9. Typical switching times as a function of IC

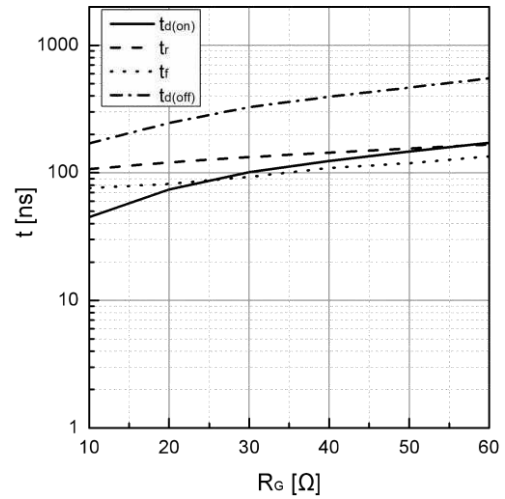


Figure 10. Typical switching times as a function of RG

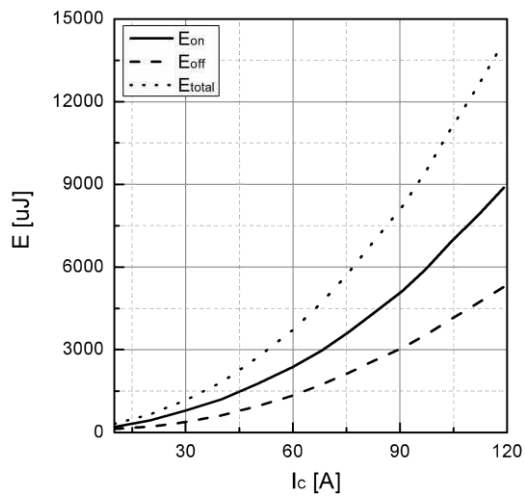


Figure 11. Typical switching energy losses as a function of IC

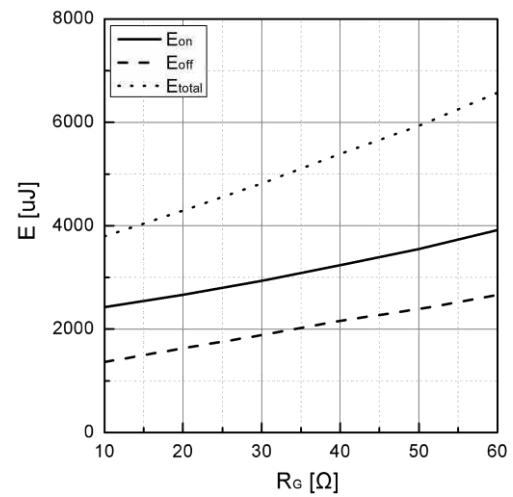


Figure 12. Typical switching energy losses as a function of RG

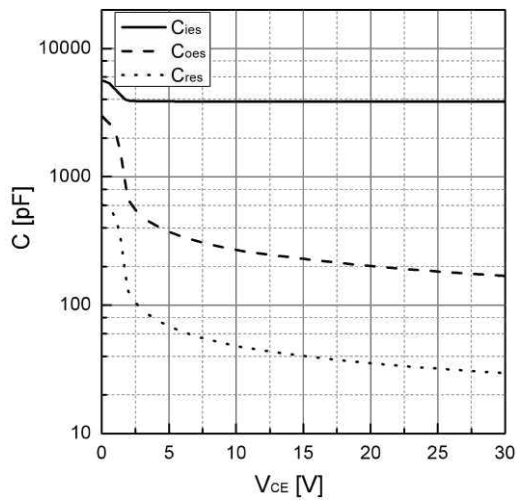


Figure 13. Typical capacitance as a function of VCE (f=1Mhz, VGE=0V)

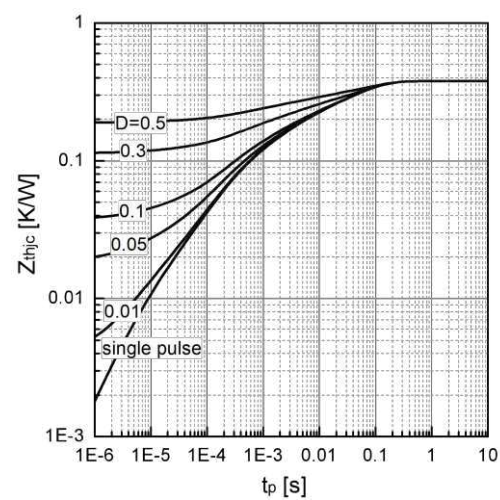
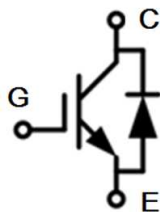
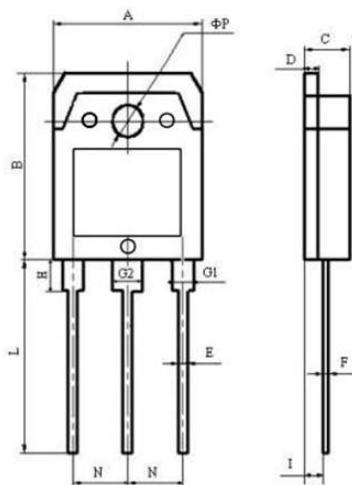


Figure 14. Transient thermal impedance, IGBT

• Circuit diagram



• Package outlines : Dimensions in (mm)



Items	Values(mm)	
	MIN	MAX
A	15.00	16.00
B	19.20	20.60
C	4.60	5.00
D	1.40	1.60
E	0.90	1.10
F	0.50	0.70
G1	2.00	2.20
G2	3.00	3.20
H	3.00	3.70
I	2.30	2.50
L*	19.00	21.00
N	5.25	5.65
Φ P	3.10	3.30

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