## 650V 6A Trench and Field Stop IGBT

DESCRIPTION：
- High ruggedness performance
- Very tight parameter distribution
- Positive $V_{CE(SAT)}$ temperature coefficient
- High efficiency for motor control
- Excellent current sharing in parallel operation
- RoHS compliant.

TO-263

TYPICAL APPLICATIONS：
- Home appliances
- Motor drives
- Fan, Pumps, Vacuum cleaner

## IGBT

MAXIMUM RATINGS (Tvj=25℃ unless otherwise specified)

| Characteristic | Condition | Symbol | Value | Unit |
|---|---|---|---|---|
| Collector-Emitter Voltage | | $V_{CES}$ | 650 | V |
| Continuous collector current | Tc=25℃<br>Tc=100℃ | $I_{C\ nom}$ | 12<br>6 | A |
| Pulsed collector current | $t_P$ limited by Tvjmax | $I_{CM}$ | 24 | A |
| Gate emitter voltage | | $V_{GE}$ | ±20 | V |
| Short circuit withstand time | | $t_{SC}$ | 10 | us |
| Power dissipation | Tc=25℃<br>Tc=100℃ | $P_{tot}$ | 136<br>68 | W |
| Temperature under switching conditions | | Tvj op | -40~+175 | ℃ |
| Storage temperature | | $T_{STG}$ | -55~+150 | ℃ |

THERMAL CHARACTERISTICS

| Characteristic | Condition | Symbol | Max. | Unit |
|---|---|---|---|---|
| IGBT thermal resistance, junction - case | | $R_{th(j-C)}$ | 1.1 | K/W |
| Diode thermal resistance, junction - case | | $R_{th(j-C)}$ | 4.0 | K/W |
| Thermal resistance, junction - ambient | | $R_{th(j-A)}$ | 90 | K/W |

ELECTRICAL CHARATERISTICS

| Characteristic | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Collector-emitter cut-off current<br>VCE=650V, VGE=0V Tvj=25℃ | $I_{CES}$ | | | 10 | uA |
| Gate-emitter leakage current<br>VCE=0V, VGE=20V Tvj=25℃ | $I_{GES}$ | | | 100 | nA |
| Gate-Emitter threshold voltage<br>IC=1.0mA, VGE= VCE Tvj=25℃ | $V_{GE(th)}$ | 5.2 | 6.2 | 7.2 | V |
| Collector-Emitter saturation voltage<br>VGE=15V, IC=6A Tvj=25℃<br>VGE=15V, IC=6A Tvj=175℃ | $V_{CE(SAT)}$ | | 1.7<br>2.2 | | V |
| Input capacitance<br>f=1MHz, VCE=30 V, VGE=0 V Tvj=25℃ | $C_{ies}$ | | 480 | | pF |
| Output capacitance<br>f=1MHz, VCE=30 V, VGE=0 V Tvj=25℃ | $C_{oes}$ | | 22 | | pF |
| Reverse transfer capacitance<br>f=1MHz, VCE=30 V, VGE=0 V Tvj=25℃ | $C_{res}$ | | 8 | | pF |
| Gate charge<br>IC = 6A, VGE = 15 V,VCC =520V Tvj=25℃ | $Q_G$ | | 19 | | nC |
| Turn-on delay time<br>IC=6A, VCC=400 V Tvj=25℃<br>VGE=0/15 V, RG=10Ω Tvj=175℃<br>(inductive load) | $td_{(ON)}$ | | 10<br>11 | | ns |
| Rise time<br>IC=6A, VCC=400 V Tvj=25℃<br>VGE=0/15 V, RG=10Ω Tvj=175℃<br>(inductive load) | tr | | 8<br>10 | | ns |
| Turn-off delay time<br>IC=6A, VCC=400 V Tvj=25℃<br>VGE=0/15 V, RG=10Ω Tvj=175℃<br>(inductive load) | $td_{(OFF)}$ | | 79<br>108 | | ns |
| Fall time<br>IC=6A, VCC=400 V Tvj=25℃<br>VGE=0/15 V, RG=10Ω Tvj=175℃<br>(inductive load) | tf | | 56<br>89 | | ns |
| Turn-on energy<br>IC=6A, VCC=400 V Tvj=25℃<br>VGE=0/15 V, RG=10Ω Tvj=175℃<br>(inductive load) | $E_{(ON)}$ | | 0.11<br>0.16 | | mJ |

| | | | | | |
|---|---|---|---|---|---|
| Turn-off energy loss per pulse<br>IC=6A, VCC=400 V Tvj=25℃<br>VGE=0/15 V, RG=10Ω Tvj=175℃<br>(inductive load) | $E_{(OFF)}$ | | 0.10<br>0.16 | | mJ |

## Diode

MAXIMUM RATINGS (Tvj=25℃ unless otherwise specified)

| Characteristic | Condition | Symbol | Value | Unit |
|---|---|---|---|---|
| Repetitive peak reverse voltage | Tvj=25℃ | $V_{RRM}$ | 650 | V |
| Continuous forward current | Tc=100℃ | $I_F$ | 6 | A |
| Diode maximum current | $t_P$ limited by Tvj max | $I_{FM}$ | 24 | A |

ELECTRICAL CHARATERISTICS

| Characteristic | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Forward voltage<br>IF=6A, VGE=0 V Tvj=25℃<br>IF=6A, VGE=0 V Tvj=175℃ | $V_F$ | | 1.6<br>1.4 | | V |
| Reverse Recovered Time<br>IF=6 A, Tvj=25℃<br>-diF/dt =500A/μs Tvj=175℃<br>VR=400 V | $T_{rr}$ | | 55<br>98 | | ns |
| Peak reverse recovery current<br>IF=6 A, Tvj=25℃<br>-diF/dt =500A/μs Tvj=175℃<br>VR=400 V | $I_{RRM}$ | | 10<br>12 | | A |
| Reverse Recovered charge<br>IF=6 A, Tvj=25℃<br>-diF/dt =500A/μs Tvj=175℃<br>VR=400 V | $Q_{rr}$ | | 306<br>529 | | nC |

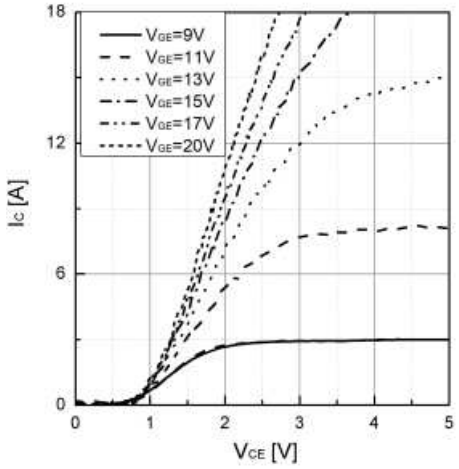



Figure 1. Typical output characteristics (Tvj=25℃)

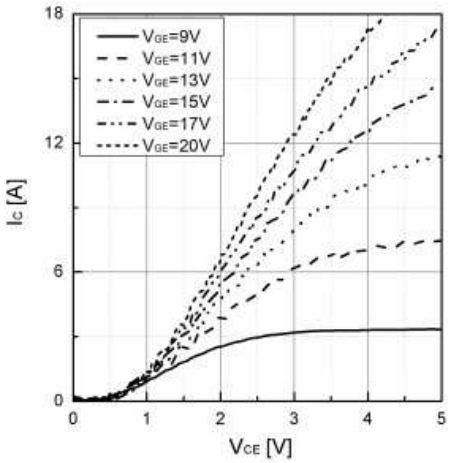



Figure 2. Typical output characteristics (Tvj=175℃)

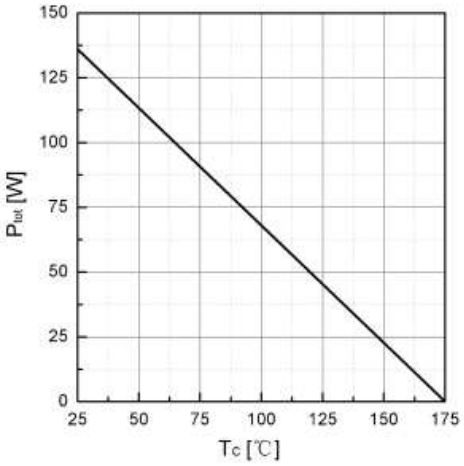



Figure 3. Power dissipation as a function of TC

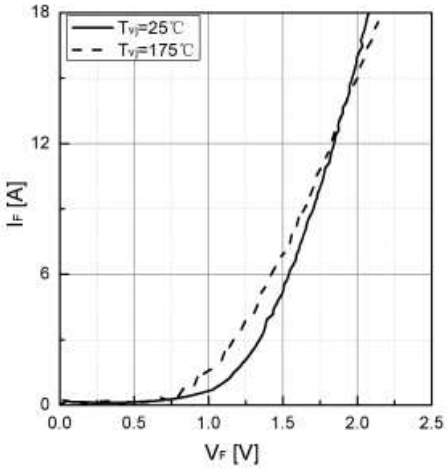



Figure 4. Typical IF as a function of VF

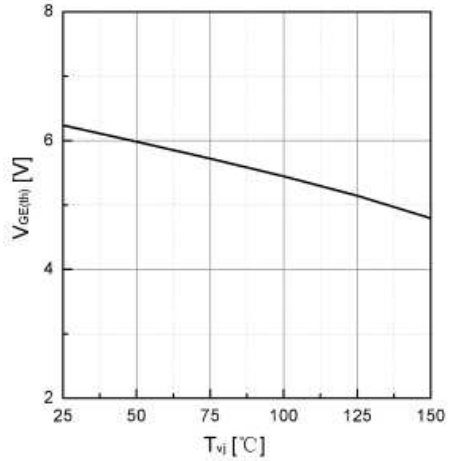



Figure 5. Typical VGE(th) as a function of Tvj ($I_C$=1mA)

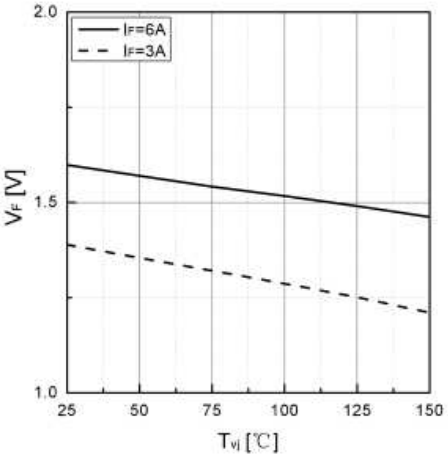



Figure 6. Typical VF as a function of Tvj

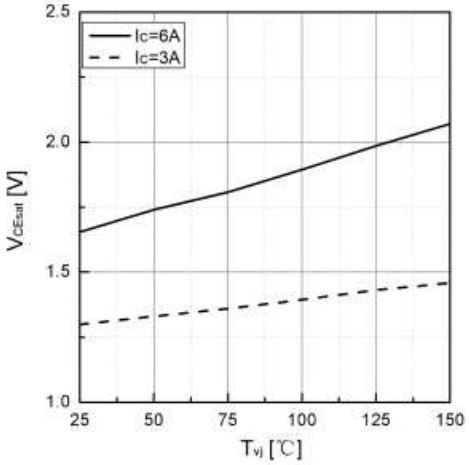



Figure 7. Typical VCEsat as a function of Tvj

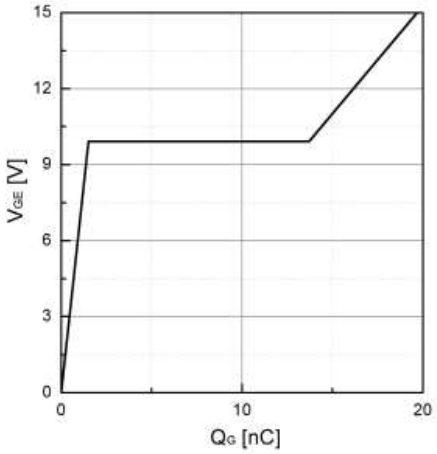



Figure 8. Typical Gate charge

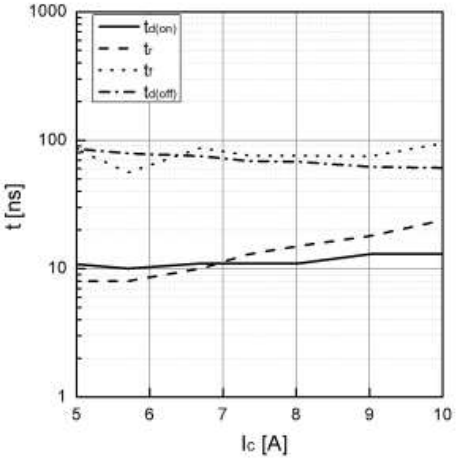



Figure 9. Typical switching times as a function of IC

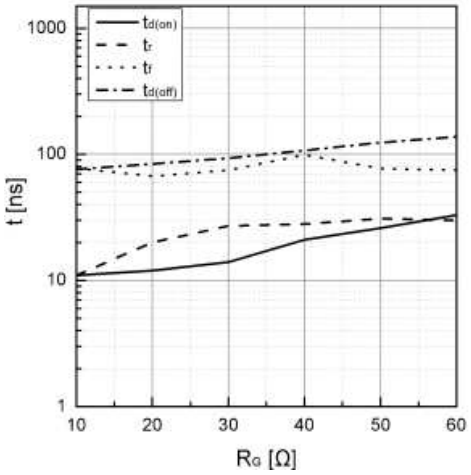



Figure 10. Typical switching times as a function of RG

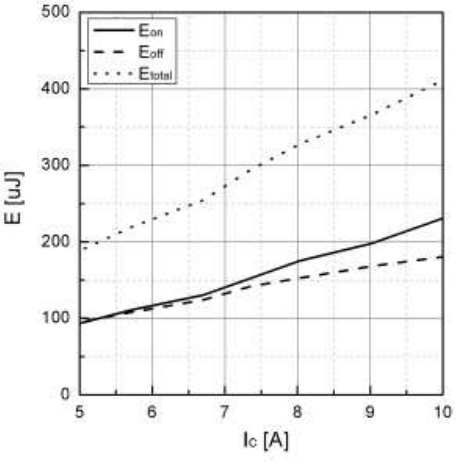



Figure 11. Typical switching energy losses as a function of IC

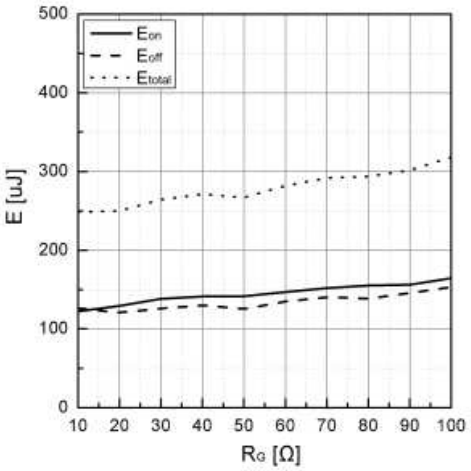



Figure 12. Typical switching energy losses as a function of RG

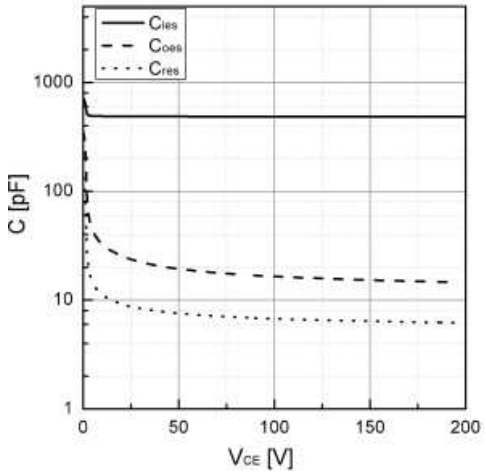



Figure 13. Typical capacitance as a function of VCE (f=1Mhz, VGE=0V)

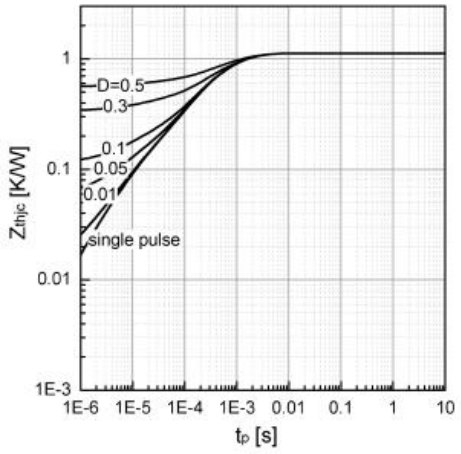
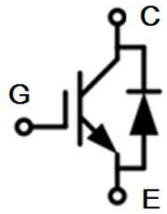
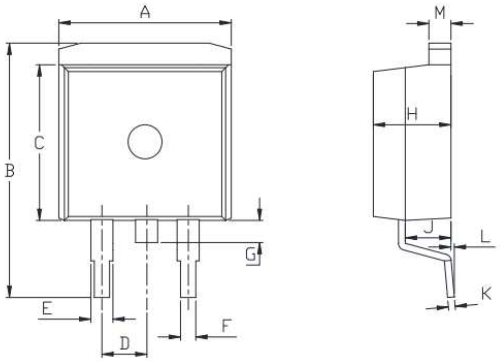



Figure 14. Transient thermal impedance of IGBT

• Circuit diagram




• Package outlines : Dimensions in (mm)




| DIM | MILLIMETERS | |
|---|---|---|
| | MIN | MAX |
| A | 9.90 | 10.20 |
| B | 14.70 | 15.80 |
| C | 9.40 | 9.60 |
| D | Typ. 2.54 | |
| E | 1.20 | 1.40 |
| F | 0.75 | 0.85 |
| G | --- | 1.75 |
| H | 4.40 | 4.70 |
| J | 2.30 | 2.70 |
| K | 0.38 | 0.55 |
| L | 0.00 | 0.25 |
| M | 1.25 | 1.35 |

# Notice

MOSPEC reserves the rights to make changes of the content herein the document anytime without notification. MOSPEC or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies. Please refer to MOSPEC website for the last document.

MOSPEC disclaims any and all liability arising out of the application or use of any product including damages incidentally and consequentially incurred.

Application shown on the herein document are examples of standard use and operation. Customers are responsible for comprehending suitable use in particular applications. MOSPEC makes no representation or warranty that such application will be suitable for the specified use without further testing or modification.

The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by MOSPEC for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of MOSPEC or others.

These MOSPEC products are intended for usage in general electronic equipment. Please make sure to consult with MOSPEC before you use these MOSPEC products in equipment which require specialized quality and/or reliability, and in equipment which could have major impact to the welfare of human life ( atomic energy control, aeronautics , traffic control, combustion control, safety devices etc.)