

650V 40A Trench and Field Stop IGBT

DESCRIPTION :

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

TYPICAL APPLICATIONS :

- PFC appliances
- Welding machine



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 | $I_{C\ nom}$ | 80 40 | A |
| Pulsed collector current | t _p limited by Tvjmax | I_{CM} | 160 | A |
| Gate emitter voltage | | V_{GE} | ±20 | V |
| Short circuit withstand time | | t _{SC} | 10 | us |
| Power dissipation | Tc=25°C Tc=100°C | P_{tot} | 300 150 | 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 | | $R_{th(j-C)}$ | 0.5 | K/W |
| Diode thermal resistance, junction - case | | $R_{th(j-C)}$ | 0.9 | 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 | $V_{GE(th)}$ | 4.0 | 5.0 | 6.0 | V |
| Collector-Emitter saturation voltage VGE=15V, IC=40A Tvj=25°C VGE=15V, IC=40A Tvj=150°C | $V_{CE(SAT)}$ | | 1.9 2.3 | | V |
| Input capacitance f=1MHz, VCE=30 V, VGE=0 V Tvj=25°C | C_{ies} | | 2480 | | pF |
| Output capacitance f=1MHz, VCE=30 V, VGE=0 V Tvj=25°C | C_{oes} | | 95 | | pF |
| Reverse transfer capacitance f=1MHz, VCE=30 V, VGE=0 V Tvj=25°C | C_{res} | | 21 | | pF |
| Gate charge IC = 40A, VGE = 15 V, VCC = 520V Tvj=25°C | Q_G | | 78 | | nC |
| Turn-on delay time IC=40A, VCC=400 V Tvj=25°C VGE=0/15 V, RG=10Ω Tvj=150°C (inductive load) | $t_{d(ON)}$ | | 32 28 | | ns |
| Rise time IC=40A, VCC=400 V Tvj=25°C VGE=0/15 V, RG=10Ω Tvj=150°C (inductive load) | t_r | | 55 52 | | ns |
| Turn-off delay time IC=40A, VCC=400 V Tvj=25°C VGE=0/15 V, RG=10Ω Tvj=150°C (inductive load) | $t_{d(OFF)}$ | | 106 128 | | ns |
| Fall time IC=40A, VCC=400 V Tvj=25°C VGE=0/15 V, RG=10Ω Tvj=150°C (inductive load) | t_f | | 51 75 | | ns |
| Turn-on energy IC=40A, VCC=400 V Tvj=25°C VGE=0/15 V, RG=10Ω Tvj=150°C (inductive load) | $E_{(ON)}$ | | 0.9 0.9 | | mJ |

| | | | | | |
|--|--------------------|--|------------|--|----|
| Turn-off energy loss per pulse IC=40A, VCC=400 V Tvj=25°C VGE=0/15 V, RG=10Ω Tvj=150°C (inductive load) | E _(OFF) | | 0.5 0.9 | | mJ |
|--|--------------------|--|------------|--|----|

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 | 40 | A |
| Diode maximum current | t _p limited by Tvj max | I _{FM} | 160 | A |

ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Min. | Typ. | Max. | Unit |
|--|------------------|------|-------------|------|------|
| Forward voltage IF=40A, VGE=0 V Tvj=25°C IF=40A, VGE=0 V Tvj=150°C | V _F | | 2.4 1.8 | | V |
| Reverse Recovered Time IF=40 A, Tvj=25°C -diF/dt =950A/μs Tvj=150°C VR=400 V | T _{rr} | | 68 106 | | ns |
| Peak reverse recovery current IF=40 A, Tvj=25°C -diF/dt =950A/μs Tvj=150°C VR=400 V | I _{RRM} | | 15 24 | | A |
| Reverse Recovered charge IF=40 A, Tvj=25°C -diF/dt =950A/μs Tvj=150°C VR=400 V | Q _{rr} | | 522 1423 | | nC |

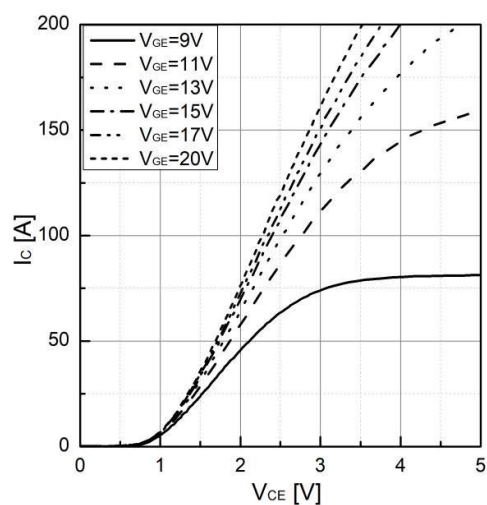


Figure 1. Typical output characteristics ($T_{vj}=25^{\circ}\text{C}$)

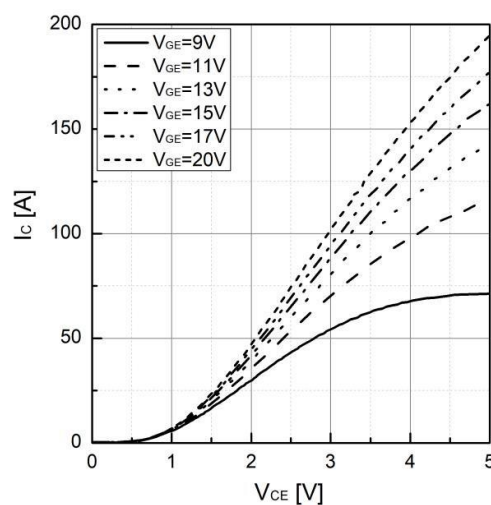


Figure 2. Typical output characteristics ($T_{vj}=175^{\circ}\text{C}$)

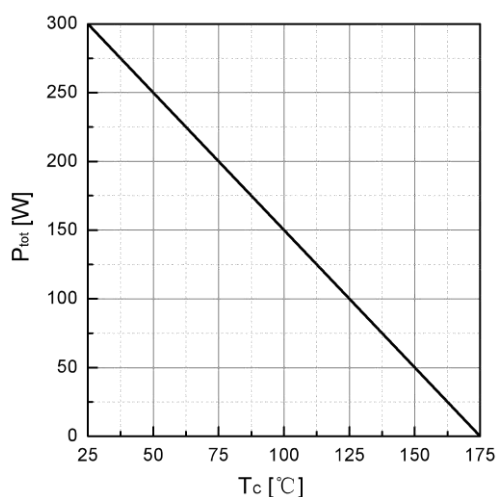


Figure 3. Power dissipation as a function of T_c

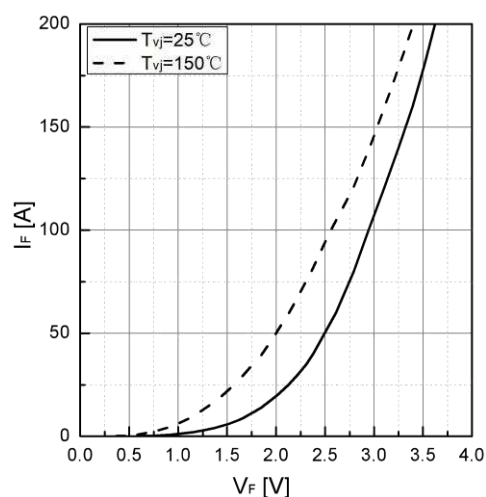


Figure 4. Typical I_F as a function of V_F

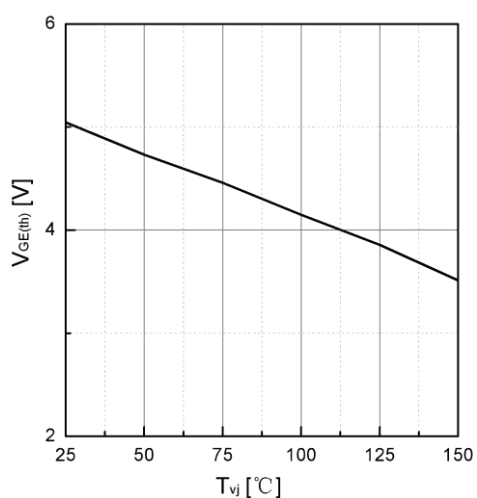


Figure 5. Typical $V_{GE(th)}$ as a function of T_{vj} ($I_c=1\text{mA}$)

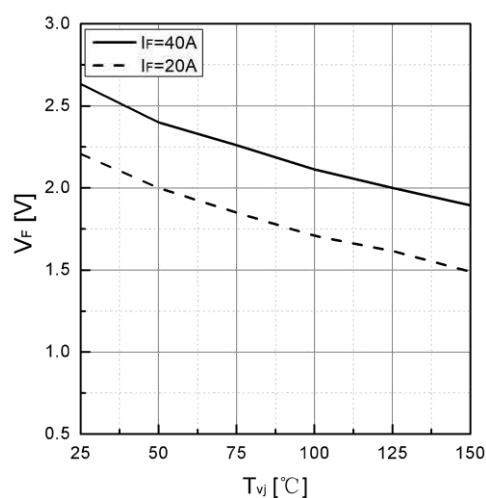


Figure 6. Typical V_F as a function of T_{vj}

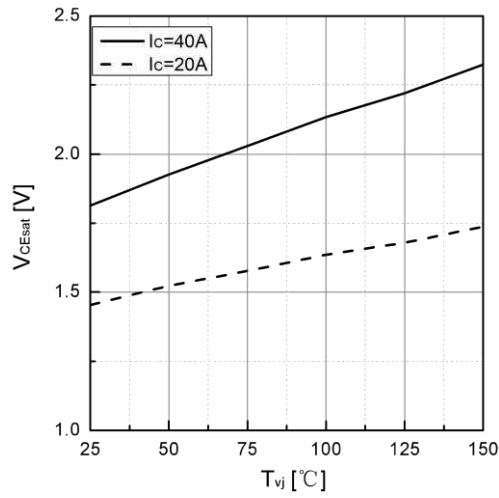


Figure 7. Typical V_{CEsat} as a function of T_{vj}

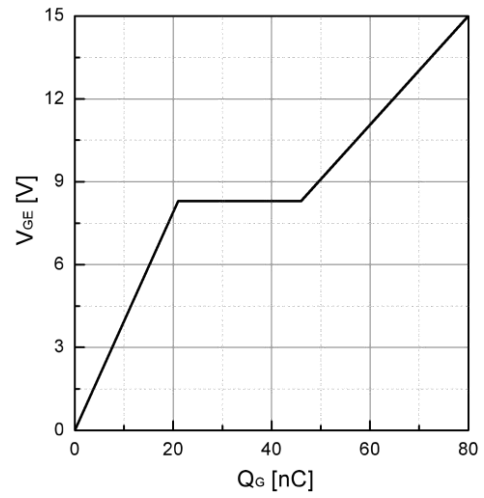


Figure 8. Typical Gate charge

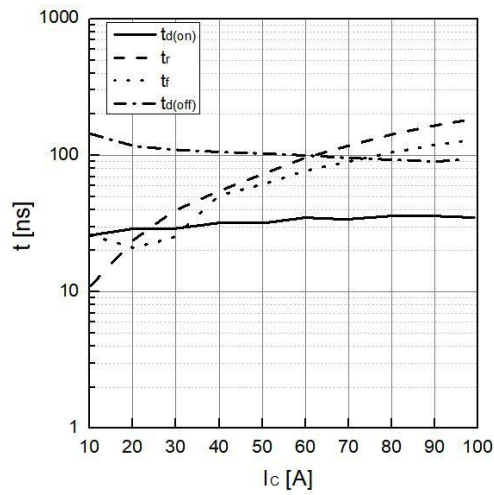


Figure 9. Typical switching times as a function of I_C

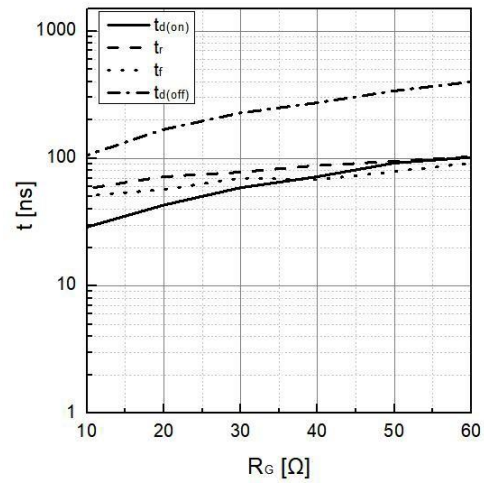


Figure 10. Typical switching times as a function of R_G

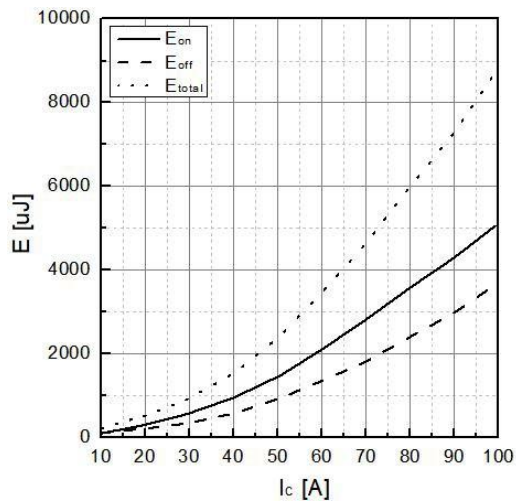


Figure 11. Typical switching energy losses as a function of I_C

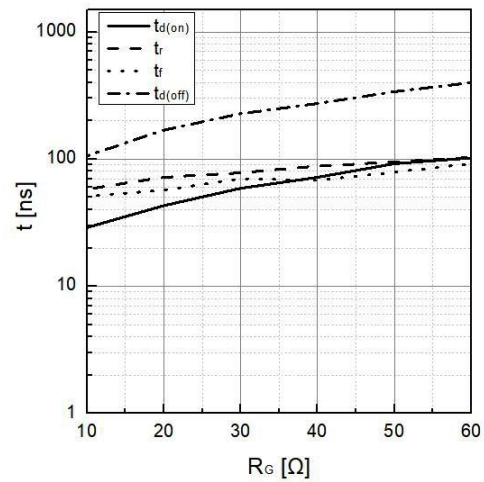


Figure 12. Typical switching energy losses as a function of R_G

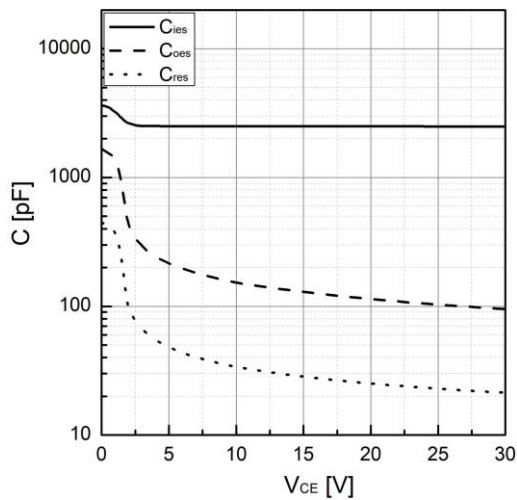


Figure 13. Typical capacitance as a function of VCE (f=1Mhz, VGE=0V)

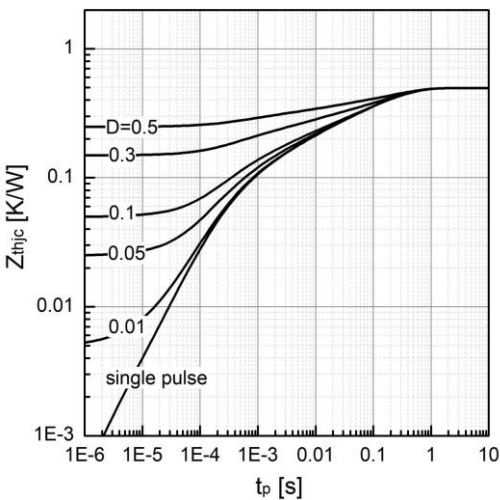
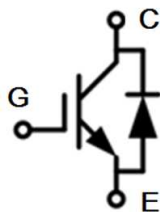
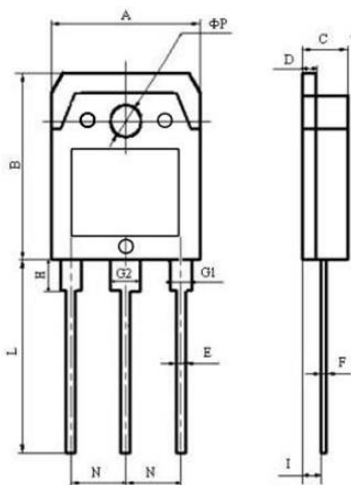


Figure 14. Transient thermal impedance, IGBT

• 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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