ALPHA & OMEGA SEMICONDUCTOR

# AOTF8B65MQ1

## 650V, 8A AlphaIGBT™

## With Soft and Fast Recovery Anti-Parallel Diode

### General Description

- Latest AlphaIGBT (αIGBT) technology
- 650V breakdown voltage
- Very fast and soft recovery freewheeling diode
- Low $V_{CE(sat)}$ and Vf
- Low turn-off switching loss and softness
- High effective turn-on di/dt
- Low Qrr
- Very good EMI behavior
- High short-circuit ruggedness

### Applications

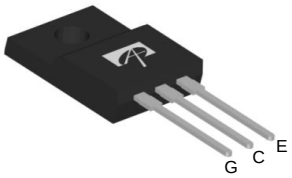
- Motor drives
- Home appliance applications such as refrigerators and washing machines
- Fan, pumps, vacuum cleaner
- Other hard switching applications

### Product Summary

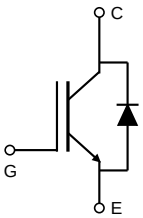
| | |
|---|---|
| $V_{CE}$ | 650V |
| $I_C$ ($T_C$=100°C) | 8A |
| $V_{CE(sat)}$ ($T_J$=25°C) | 1.8V |

Green Product

TO-220F




AOTF8B65MQ1




| Orderable Part Number | Package Type | Form | Minimum Order Quantity |
|---|---|---|---|
| AOTF8B65MQ1 | TO220F | Tube | 1000 |

**Absolute Maximum Ratings $T_A$=25°C unless otherwise noted**

| Parameter | | Symbol | AOTF8B65MQ1 | Units |
|---|---|---|---|---|
| Collector-Emitter Voltage | | $V_{CE}$ | 650 | V |
| Gate-Emitter Voltage | | $V_{GE}$ | ±30 | V |
| Continuous Collector Current | $T_C$=25°C | $I_C$ | 16(2) | A |
| | $T_C$=100°C | | 8(2) | |
| Pulsed Collector Current, Limited by $T_{Jmax}$ | | $I_{CM}$ | 24 | A |
| Turn-Off SOA, $V_{CE}$≤650V, Limited by $T_{Jmax}$ | | $I_{LM}$ | 24 | A |
| Continuous Diode Forward Current | $T_C$=25°C | $I_F$ | 16(2) | A |
| | $T_C$=100°C | | 8(2) | |
| Diode Pulsed Current, Limited by $T_{Jmax}$ | | $I_{FM}$ | 24 | A |
| Short Circuit Withstanding Time (1) $V_{GE}$=15V, $V_{CC}$≤400V, $T_J$≤150°C | | $t_{SC}$ | 5 | µs |
| Power Dissipation | $T_C$=25°C | $P_D$ | 30 | W |
| | $T_C$=100°C | | 12 | |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | °C |
| Maximum Lead Temperature for Soldering Purpose, 1/8" from case for 5 seconds | | $T_L$ | 300 | °C |

**Thermal Characteristics**

| Parameter | Symbol | AOTF8B65MQ1 | Units |
|---|---|---|---|
| Maximum Junction-to-Ambient | $R_{\theta JA}$ | 65 | °C/W |
| Maximum IGBT Junction-to-Case | $R_{\theta JC}$ | 4.2 | °C/W |
| Maximum Diode Junction-to-Case | $R_{\theta JC}$ | 7 | °C/W |

(1) Allowed number of short circuits: <1000; time between short circuits: >1s.

(2) TO220F $I_C$ follows DPAK(TO-252).

**Electrical Characteristics ($T_J$=25°C unless otherwise noted)**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **STATIC PARAMETERS** | | | | | | | |
| $BV_{CES}$ | Collector-Emitter Breakdown Voltage | $I_C$=1mA, $V_{GE}$=0V, $T_J$=25°C | | 650 | - | - | V |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}$=15V, $I_C$=8A | $T_J$=25°C | - | 1.8 | 2.25 | V |
| | | | $T_J$=125°C | - | 2.09 | - | |
| | | | $T_J$=150°C | - | 2.19 | - | |
| $V_F$ | Diode Forward Voltage | $V_{GE}$=0V, $I_F$=8A | $T_J$=25°C | - | 1.52 | 1.9 | V |
| | | | $T_J$=125°C | - | 1.59 | - | |
| | | | $T_J$=150°C | - | 1.56 | - | |
| $V_{GE(th)}$ | Gate-Emitter Threshold Voltage | $V_{CE}$=5V, $I_C$=1mA | | - | 4.9 | - | V |
| $I_{CES}$ | Zero Gate Voltage Collector Current | $V_{CE}$=650V, $V_{GE}$=0V | $T_J$=25°C | - | - | 10 | µA |
| | | | $T_J$=125°C | - | - | 500 | |
| | | | $T_J$=150°C | - | - | 1000 | |
| $I_{GES}$ | Gate-Emitter Leakage Current | $V_{CE}$=0V, $V_{GE}$=±30V | | - | - | ±100 | nA |
| $g_{FS}$ | Forward Transconductance | $V_{CE}$=20V, $I_C$=8A | | - | 5 | - | S |
| **DYNAMIC PARAMETERS** | | | | | | | |
| $C_{ies}$ | Input Capacitance | $V_{GE}$=0V, $V_{CC}$=25V, f=1MHz | | - | 500 | - | pF |
| $C_{oes}$ | Output Capacitance | | | - | 45 | - | pF |
| $C_{res}$ | Reverse Transfer Capacitance | | | - | 16 | - | pF |
| $Q_g$ | Total Gate Charge | $V_{GE}$=15V, $V_{CC}$=520V, $I_C$=8A | | - | 22 | - | nC |
| $Q_{ge}$ | Gate to Emitter Charge | | | - | 6.5 | - | nC |
| $Q_{gc}$ | Gate to Collector Charge | | | - | 10 | - | nC |
| $I_{C(SC)}$ | Short Circuit Collector Current | $V_{GE}$=15V, $V_{CC}$=400V, $t_{sc}$≤5us, $T_J$≤150°C | | - | 50 | - | A |
| $R_g$ | Gate Resistance | $V_{GE}$=0V, $V_{CC}$=0V, f=1MHz | | - | 7 | - | Ω |
| **SWITCHING PARAMETERS, (Load Inductive, $T_J$=25°C)** | | | | | | | |
| $t_{D(on)}$ | Turn-On Delay Time | $T_J$=25°C, $V_{GE}$=15V, $V_{CC}$=400V, $I_C$=8A, $R_G$=37.5Ω | | - | 8.5 | - | ns |
| $t_r$ | Turn-On Rise Time | | | - | 14 | - | ns |
| $t_{D(off)}$ | Turn-Off Delay Time | | | - | 102 | - | ns |
| $t_f$ | Turn-Off Fall Time | | | - | 16 | - | ns |
| $E_{on}$ | Turn-On Energy | | | - | 0.16 | - | mJ |
| $E_{off}$ | Turn-Off Energy | | | - | 0.11 | - | mJ |
| $E_{total}$ | Total Switching Energy | | | - | 0.27 | - | mJ |
| $t_{rr}$ | Diode Reverse Recovery Time | $T_J$=25°C, $I_F$=8A, di/dt=200A/µs, $V_{CC}$=400V | | - | 94 | - | ns |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | | - | 0.2 | - | µC |
| $I_{rm}$ | Diode Peak Reverse Recovery Current | | | - | 3.49 | - | A |
| **SWITCHING PARAMETERS, (Load Inductive, $T_J$=150°C)** | | | | | | | |
| $t_{D(on)}$ | Turn-On Delay Time | $T_J$=150°C, $V_{GE}$=15V, $V_{CC}$=400V, $I_C$=8A, $R_G$=37.5Ω | | - | 7.5 | - | ns |
| $t_r$ | Turn-On Rise Time | | | - | 15 | - | ns |
| $t_{D(off)}$ | Turn-Off Delay Time | | | - | 122 | - | ns |
| $t_f$ | Turn-Off Fall Time | | | - | 26 | - | ns |
| $E_{on}$ | Turn-On Energy | | | - | 0.19 | - | mJ |
| $E_{off}$ | Turn-Off Energy | | | - | 0.18 | - | mJ |
| $E_{total}$ | Total Switching Energy | | | - | 0.37 | - | mJ |
| $t_{rr}$ | Diode Reverse Recovery Time | $T_J$=150°C, $I_F$=8A, di/dt=200A/µs, $V_{CC}$=400V | | - | 133 | - | ns |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | | - | 0.38 | - | µC |
| $I_{rm}$ | Diode Peak Reverse Recovery Current | | | - | 4.39 | - | A |

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## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

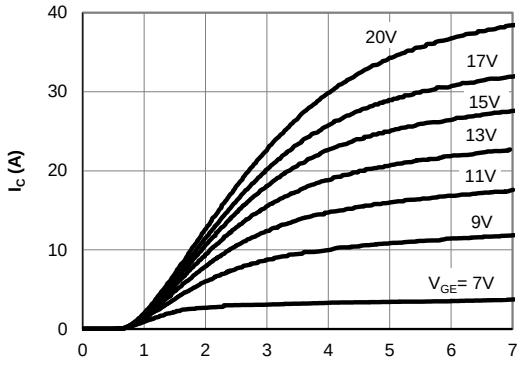



**Figure 1: Output Characteristic ($T_j$=25°C)**

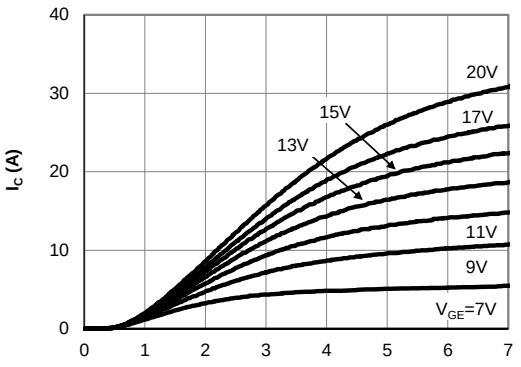



**Figure 2: Output Characteristic ($T_j$=150°C)**

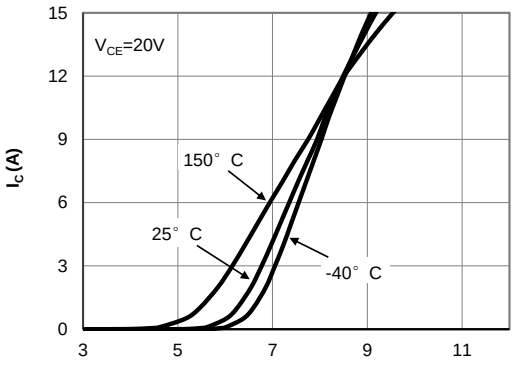



**Figure 3: Transfer Characteristic**

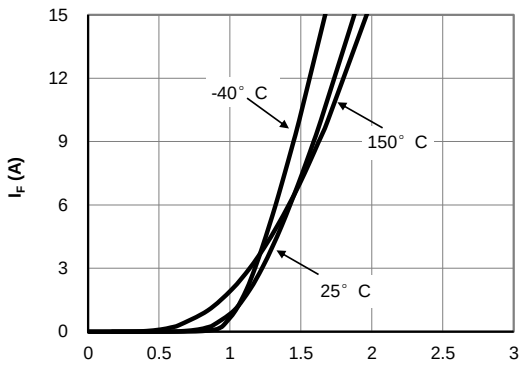



**Figure 4: Diode Characteristic**

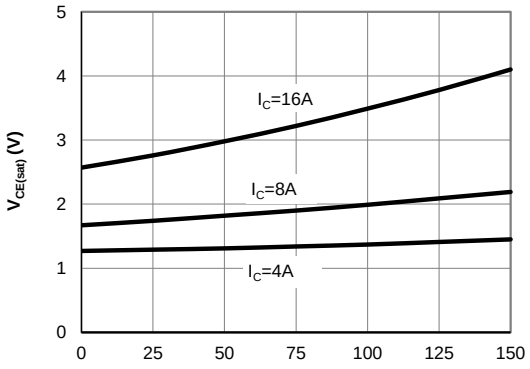



**Figure 5: Collector-Emitter Saturation Voltage vs. Junction Temperature**

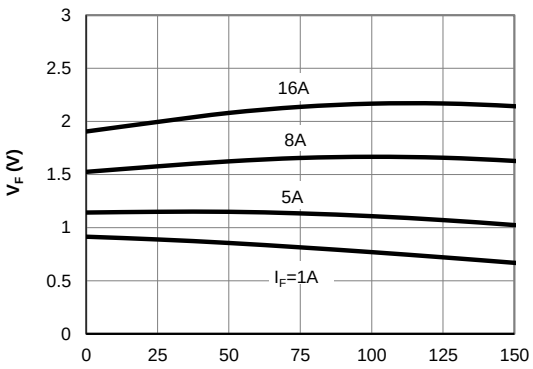



**Figure 6: Diode Forward voltage vs. Junction Temperature**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

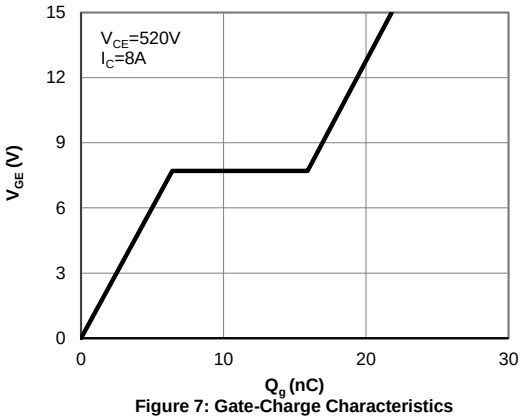


Figure 7: Gate-Charge Characteristics

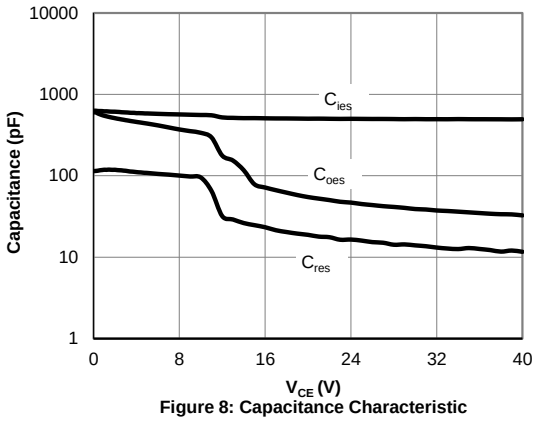


Figure 8: Capacitance Characteristic

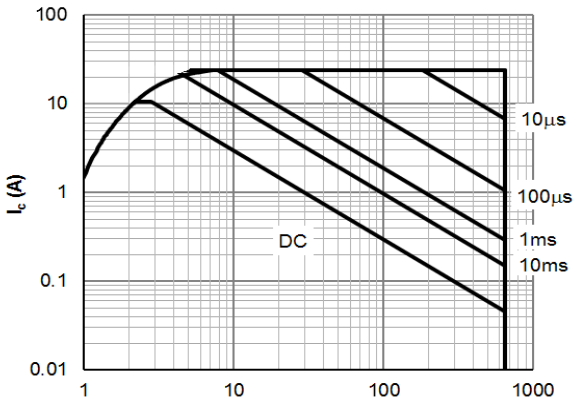


Figure 9: Forward Bias Safe Operating Area ($T_C$=25°C, $V_{GE}$=15V)

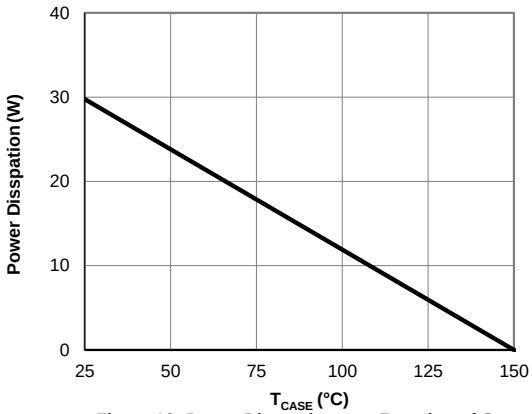


Figure 10: Power Disspation as a Function of Case

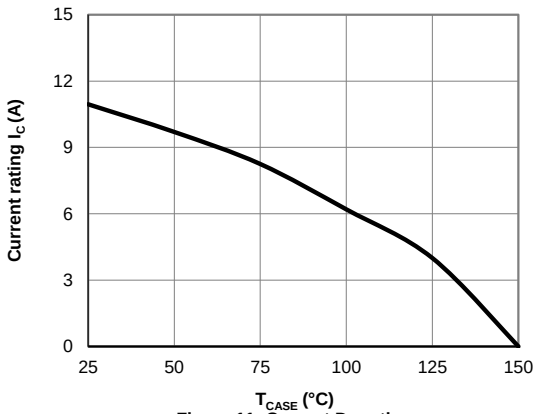


Figure 11: Current De-rating

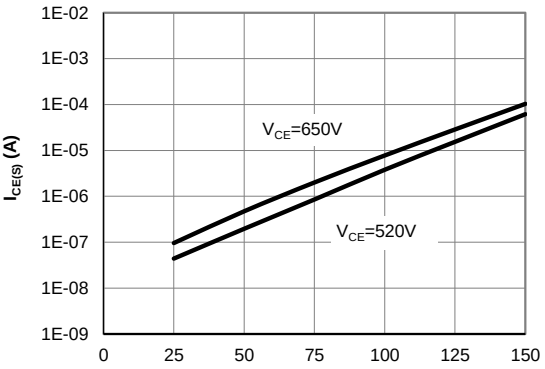


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

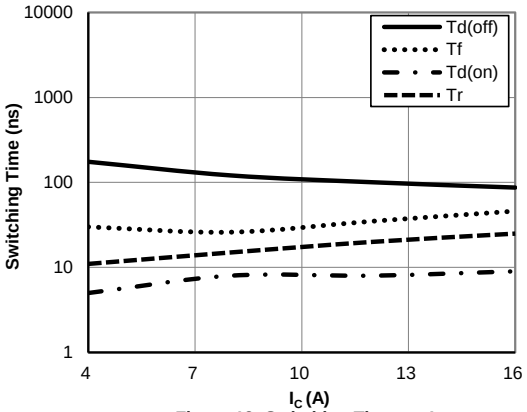



**Figure 13: Switching Time vs. $I_C$**
**($T_j$=150°C, $V_{GE}$=15V, $V_{CE}$=400V, $R_g$=37.5Ω)**

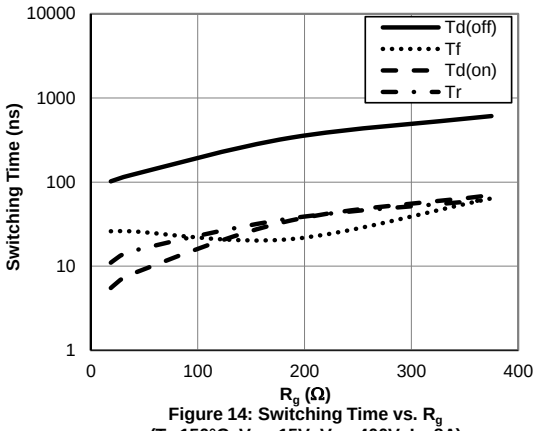



**Figure 14: Switching Time vs. $R_g$**
**($T_j$=150°C, $V_{GE}$=15V, $V_{CE}$=400V, $I_C$=8A)**

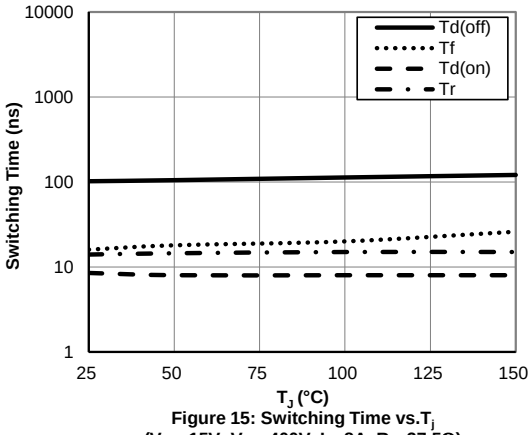



**Figure 15: Switching Time vs.$T_j$**
**($V_{GE}$=15V, $V_{CE}$=400V, $I_C$=8A, $R_g$=37.5Ω)**

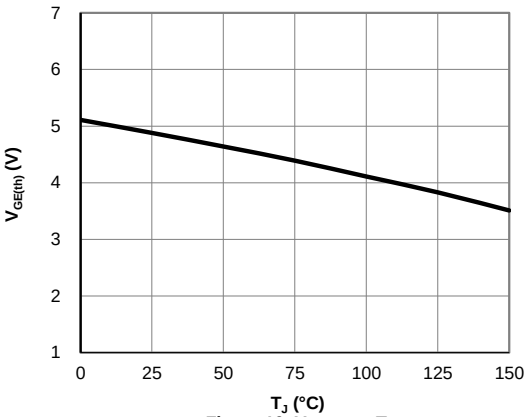



**Figure 16: $V_{GE(th)}$ vs. $T_j$**

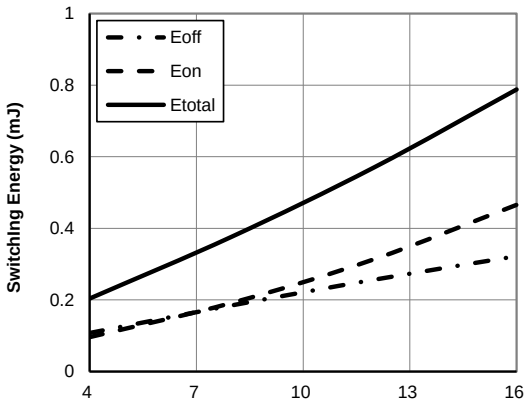



**Figure 17: Switching Loss vs. $I_C$**
**($T_j$=150°C, $V_{GE}$=15V, $V_{CE}$=400V, $R_g$=37.5Ω)**

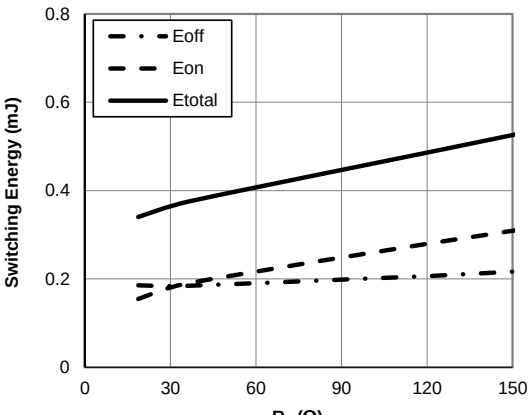



**Figure 18: Switching Loss vs. $R_g$**
**($T_j$=150°C, $V_{GE}$=15V, $V_{CE}$=400V, $I_C$=8A)**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

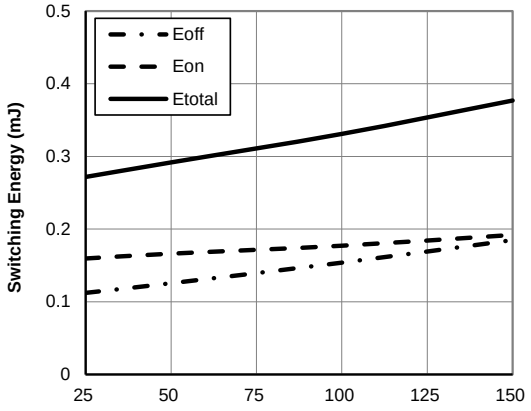



**Figure 19: Switching Loss vs. $T_j$**
**($V_{GE}$=15V, $V_{CE}$=400V, $I_C$=8A, $R_g$=37.5Ω)**

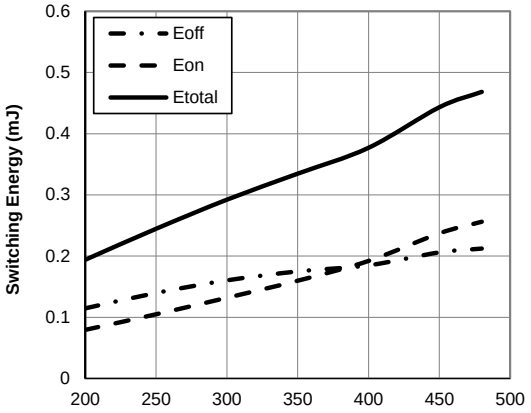



**Figure 20: Switching Loss vs. $V_{CE}$**
**($T_j$=150°C, $V_{GE}$=15V, $I_C$=8A, $R_g$=37.5Ω)**

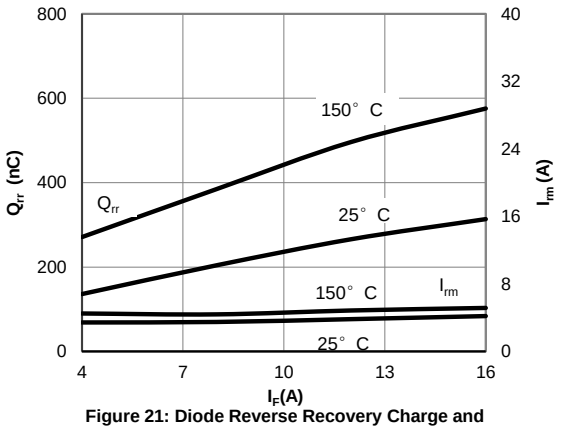



**Figure 21: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current**
**($V_{GE}$=15V, $V_{CE}$=400V, di/dt=200A/µs)**

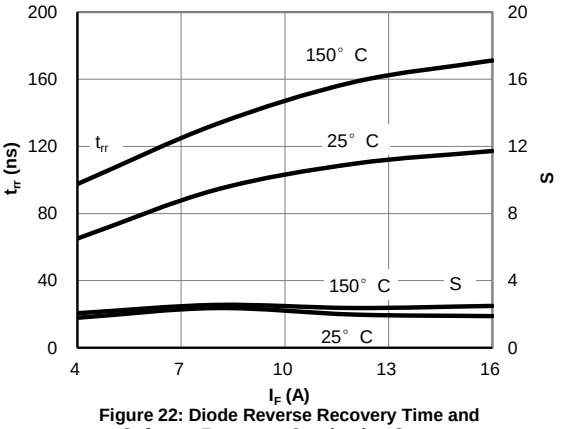



**Figure 22: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current**
**($V_{GE}$=15V, $V_{CE}$=400V, di/dt=200A/µs)**

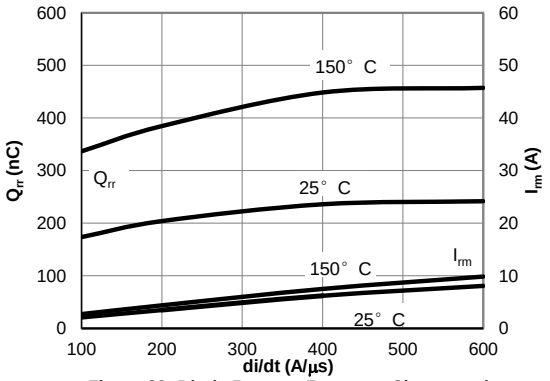



**Figure 23: Diode Reverse Recovery Charge and Peak Current vs. di/dt**
**($V_{GE}$=15V, $V_{CE}$=400V, $I_F$=8A)**

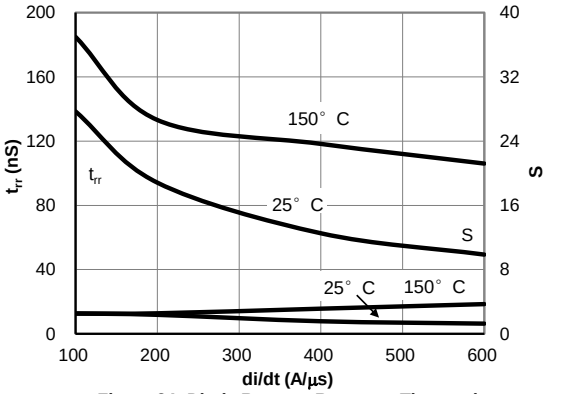



**Figure 24: Diode Reverse Recovery Time and Softness Factor vs. di/dt**
**($V_{GE}$=15V, $V_{CE}$=400V, $I_F$=8A)**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

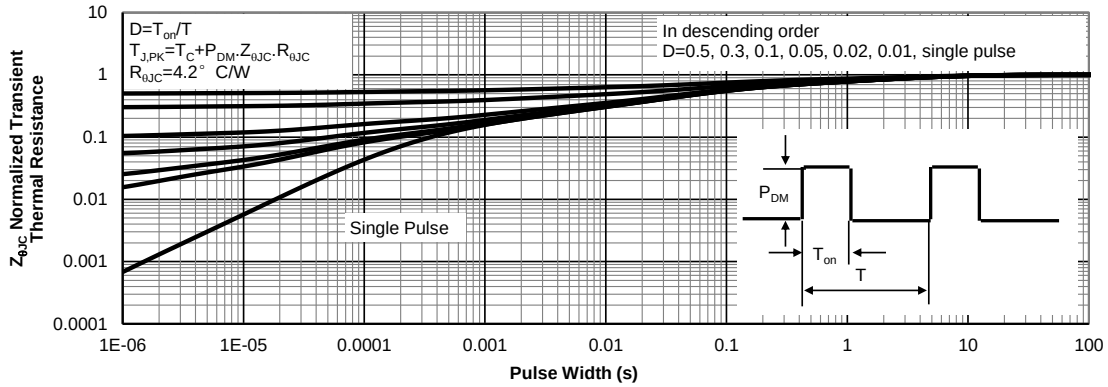



**Figure 25: Normalized Maximum Transient Thermal Impedance for IGBT**

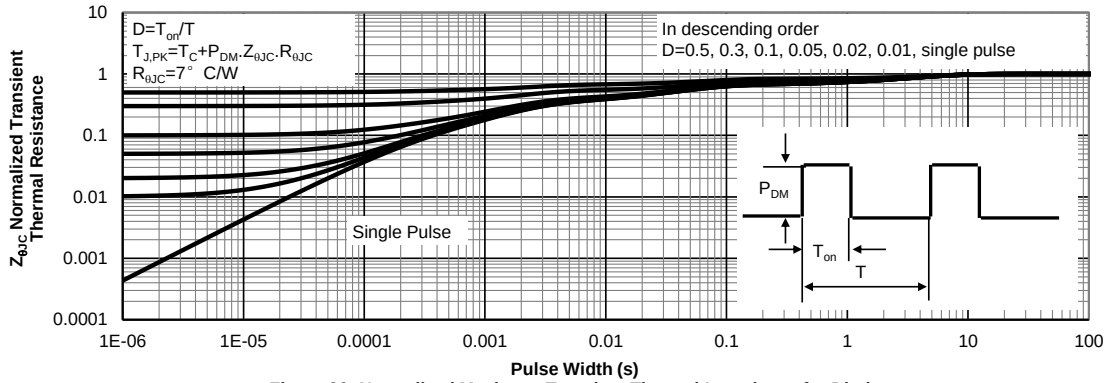



**Figure 26: Normalized Maximum Transient Thermal Impedance for Diode**

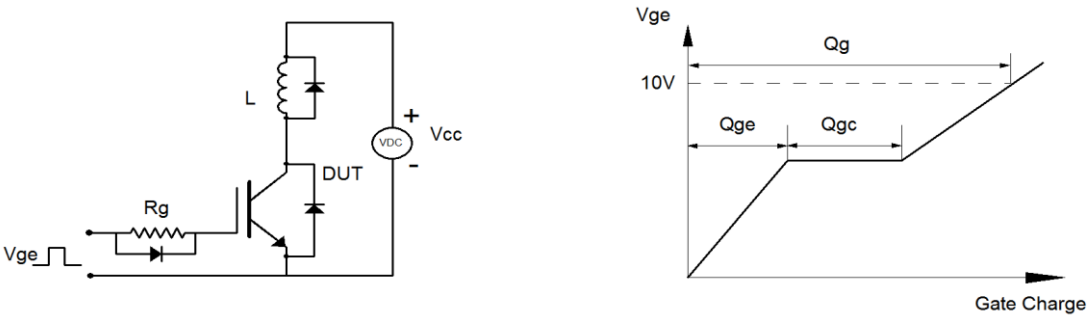



Figure A: Gate Charge Test Circuit & Waveforms

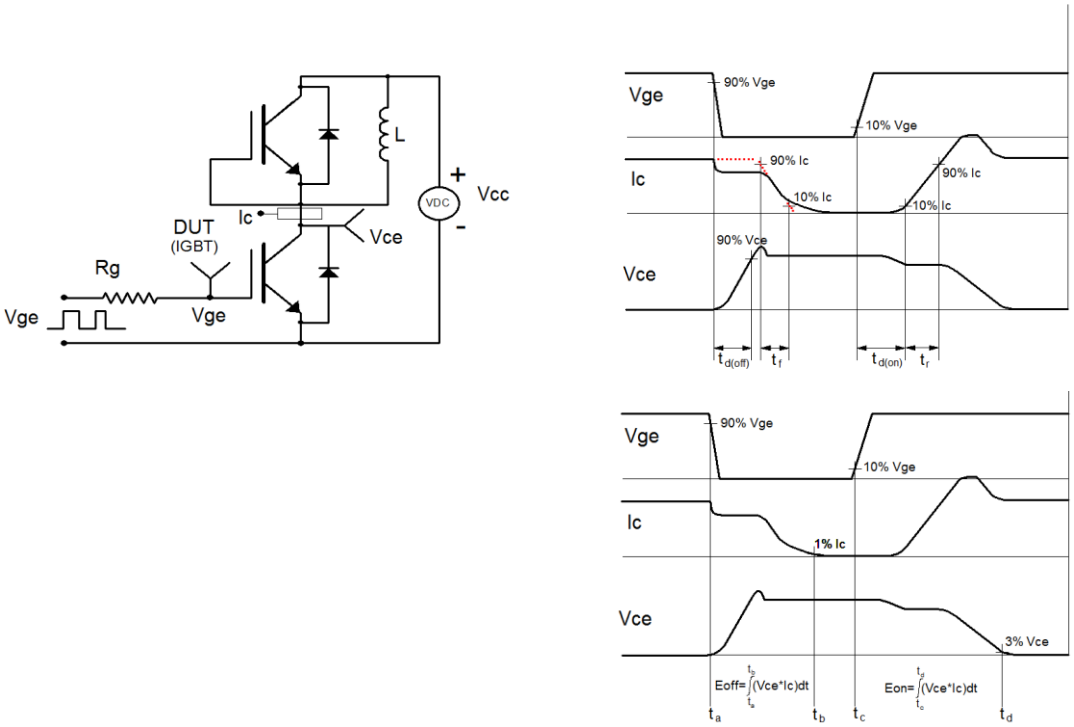



Figure B: Inductive Switching Test Circuit & Waveforms

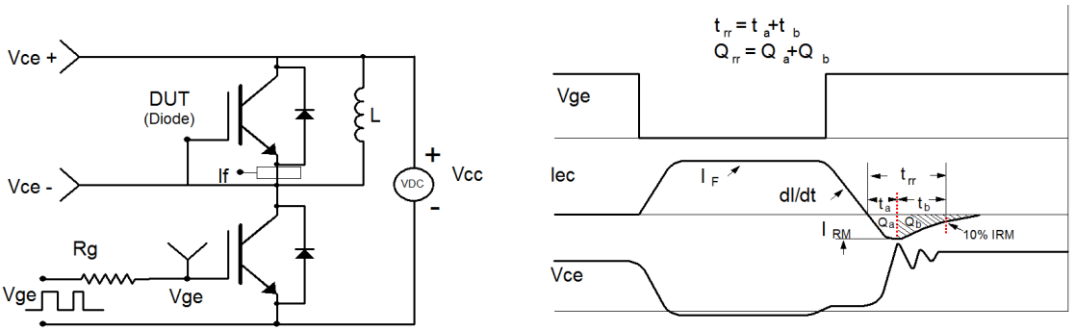



Figure C: Diode Recovery Test Circuit & Waveforms

ENTEGRECİ

Bu belge www.entegreci.com üzerinden sunulmaktadır.

# Elektronik komponent tedarikinde Entegreci

Entegreci, Eskişehir merkezli, Türkiye geneline satış yapan bir elektronik komponent mağazasıdır. Entegreler (IC), mikrodenetleyiciler, transistörler, diyotlar, pasif elemanlar, konnektörler, modüller ve geliştirme kartları tek adetten seri üretim adetlerine kadar satılır. Ürün sayfalarında güncel stok durumunu, fiyatı ve datasheet bağlantısını bulabilirsiniz.

### Parça koduyla arama

Üretici parça numarasını yazın; stok ve fiyatı hemen görün.

**www.entegreci.com**

### Ürün kategorileri

Entegreden kapasitöre tüm elektronik komponent kategorileri.

**Kategorilere göz atın**

### Üreticiler

Aradığınız üreticinin ürünlerini tek sayfada inceleyin.

**Üreticileri görün**

### Toplu alım ve teklif

Listede olmayan ya da yüksek adetli parçalar için teklif isteyin.

**Teklif isteyin**

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Entegreci is an online electronic components store based in Türkiye. Search by manufacturer part number to see stock, prices and datasheets for integrated circuits, microcontrollers, transistors, passive components and connectors, or request a quote for parts that are not listed.

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