ALPHA & OMEGA SEMICONDUCTOR

# AOK40B120M1

## 1200V, 40A Alpha IGBT™

## With soft and fast recovery anti-parallel diode

### General Description

- Latest Alpha IGBT (α IGBT) technology
- 1200V breakdown voltage
- Fast and soft recovery freewheeling diode
- High efficient turn-on di/dt controllability
- High switching speed
- Low turn-off switching loss and softness
- Very good EMI behavior

### Applications

- Welding Machines
- UPS & Solar Inverters
- Very High Switching Frequency Applications

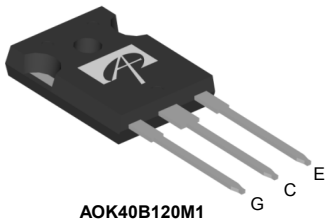
### Product Summary

| | |
|---|---|
| $V_{CE}$ | 1200V |
| $I_C$ ($T_C$=100°C) | 40A |
| $V_{CE(sat)}$ ($T_J$=25°C) | 1.95V |

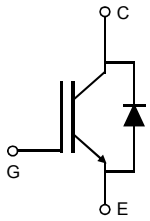
RoHS Compliant

Top View

TO-247




AOK40B120M1




| Orderable Part Number | Package Type | Form | Minimum Order Quantity |
|---|---|---|---|
| AOK40B120M1 | TO247 | Tube | 240 |

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

| Parameter | | Symbol | AOK40B120M1 | Units |
|---|---|---|---|---|
| Collector-Emitter Voltage | | $V_{CE}$ | 1200 | V |
| Gate-Emitter Voltage | | $V_{GE}$ | ±30 | V |
| Continuous Collector Current | $T_C$=25°C | $I_C$ | 80 | A |
| | $T_C$=100°C | | 40 | |
| Pulsed Collector Current, Limited by $T_{Jmax}$ | | $I_{CM}$ | 120 | A |
| Turn off SOA, $V_{CE} \leqslant$ 650V, Limited by $T_{Jmax}$ | | $I_{LM}$ | 120 | A |
| Continuous Diode Forward Current | $T_C$=25°C | $I_F$ | 80 | A |
| | $T_C$=100°C | | 40 | |
| Diode Pulsed Current, Limited by $T_{Jmax}$ | | $I_{FM}$ | 120 | A |
| Power Dissipation | $T_C$=25°C | $P_D$ | 600 | W |
| | $T_C$=100°C | | 300 | |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 175 | °C |
| Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds | | $T_L$ | 300 | °C |

**Thermal Characteristics**

| Parameter | Symbol | AOK40B120M1 | Units |
|---|---|---|---|
| Maximum Junction-to-Ambient | $R_{\theta JA}$ | 40 | °C/W |
| Maximum IGBT Junction-to-Case | $R_{\theta JC}$ | 0.25 | °C/W |
| Maximum Diode Junction-to-Case | $R_{\theta JC}$ | 0.4 | °C/W |

**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 | | 1200 | - | - | V |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}$=15V, $I_C$=40A | $T_J$=25°C | - | 1.95 | 2.45 | V |
| | | | $T_J$=125°C | - | 2.35 | - | |
| | | | $T_J$=175°C | - | 2.55 | - | |
| $V_F$ | Diode Forward Voltage | $V_{GE}$=0V, $I_C$=40A | $T_J$=25°C | - | 2.5 | 3.15 | V |
| | | | $T_J$=125°C | - | 2.75 | - | |
| | | | $T_J$=175°C | - | 2.55 | - | |
| $V_{GE(th)}$ | Gate-Emitter Threshold Voltage | $V_{CE}$=5V, $I_C$=1mA | | - | 5.8 | - | V |
| $I_{CES}$ | Zero Gate Voltage Collector Current | $V_{CE}$=1200V, $V_{GE}$=0V | $T_J$=25°C | - | - | 0.1 | mA |
| | | | $T_J$=125°C | - | - | 4 | |
| | | | $T_J$=175°C | - | - | 20 | |
| $I_{GES}$ | Gate-Emitter leakage current | $V_{CE}$=0V, $V_{GE}$=±30V | | - | - | ±100 | nA |
| $g_{FS}$ | Forward Transconductance | $V_{CE}$=20V, $I_C$=40A | | - | 28 | - | S |
| **DYNAMIC PARAMETERS** | | | | | | | |
| $C_{ies}$ | Input Capacitance | $V_{GE}$=0V, $V_{CC}$=25V, f=1MHz | | - | 4770 | - | pF |
| $C_{oes}$ | Output Capacitance | | | - | 270 | - | pF |
| $C_{res}$ | Reverse Transfer Capacitance | | | - | 85 | - | pF |
| $Q_g$ | Total Gate Charge | $V_{GE}$=15V, $V_{CC}$=960V, $I_C$=40A | | - | 140 | - | nC |
| $Q_{ge}$ | Gate to Emitter Charge | | | - | 62 | - | nC |
| $Q_{gc}$ | Gate to Collector Charge | | | - | 48 | - | nC |
| $R_g$ | Gate resistance | $V_{GE}$=0V, $V_{CC}$=0V, f=1MHz | | - | 15 | - | Ω |
| **SWITCHING PARAMETERS, (Load Inductive, $T_J$=25°C)** | | | | | | | |
| $t_{D(on)}$ | Turn-On DelayTime | $T_J$=25°C<br>$V_{GE}$=15V, $V_{CC}$=600V, $I_C$=40A,<br>$R_G$=7.5Ω | | - | 90 | - | ns |
| $t_r$ | Turn-On Rise Time | | | - | 85 | - | ns |
| $t_{D(off)}$ | Turn-Off Delay Time | | | - | 226 | - | ns |
| $t_f$ | Turn-Off Fall Time | | | - | 46 | - | ns |
| $E_{on}$ | Turn-On Energy | | | - | 3.87 | - | mJ |
| $E_{off}$ | Turn-Off Energy | | | - | 1.25 | - | mJ |
| $E_{total}$ | Total Switching Energy | | | - | 5.12 | - | mJ |
| $t_{rr}$ | Diode Reverse Recovery Time | $T_J$=25°C<br>$I_F$=40A, di/dt=200A/µs, $V_{CC}$=600V | | - | 340 | - | ns |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | | - | 1.5 | - | µC |
| $I_{rm}$ | Diode Peak Reverse Recovery Current | | | - | 9.3 | - | A |
| **SWITCHING PARAMETERS, (Load Inductive, $T_J$=175°C)** | | | | | | | |
| $t_{D(on)}$ | Turn-On DelayTime | $T_J$=175°C<br>$V_{GE}$=15V, $V_{CC}$=600V, $I_C$=40A,<br>$R_G$=7.5Ω | | - | 86 | - | ns |
| $t_r$ | Turn-On Rise Time | | | - | 92 | - | ns |
| $t_{D(off)}$ | Turn-Off Delay Time | | | - | 287 | - | ns |
| $t_f$ | Turn-Off Fall Time | | | - | 144 | - | ns |
| $E_{on}$ | Turn-On Energy | | | - | 4.48 | - | mJ |
| $E_{off}$ | Turn-Off Energy | | | - | 2.44 | - | mJ |
| $E_{total}$ | Total Switching Energy | | | - | 6.92 | - | mJ |
| $t_{rr}$ | Diode Reverse Recovery Time | $T_J$=175°C<br>$I_F$=40A, di/dt=200A/µs, $V_{CC}$=600V | | - | 605 | - | ns |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | | - | 4.7 | - | µC |
| $I_{rm}$ | Diode Peak Reverse Recovery Current | | | - | 15.5 | - | A |

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## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

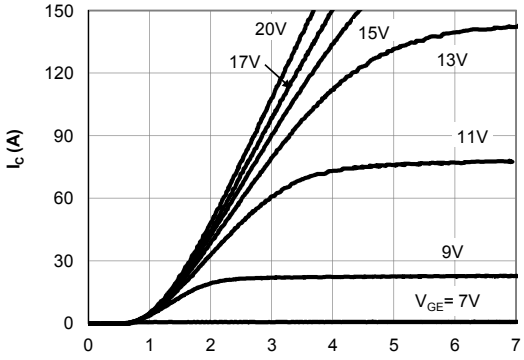



**Figure 1: Output Characteristic ($T_j$=25°C)**

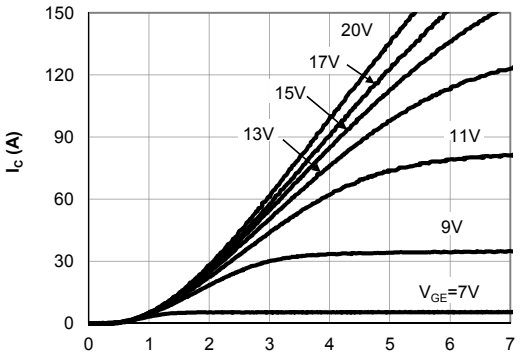



**Figure 2: Output Characteristic ($T_j$=175°C)**

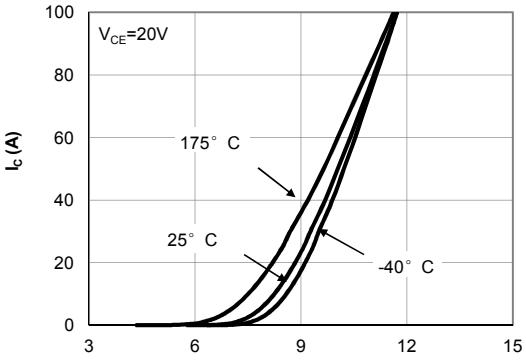



**Figure 3: Transfer Characteristic**

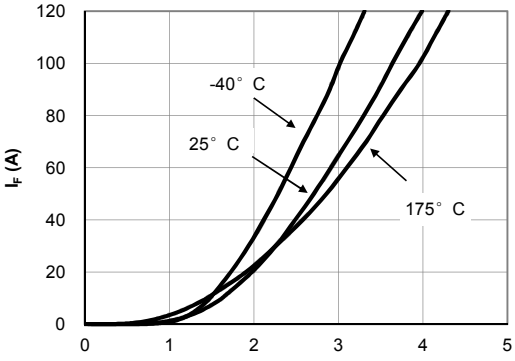



**Figure 4: Diode Characteristic**

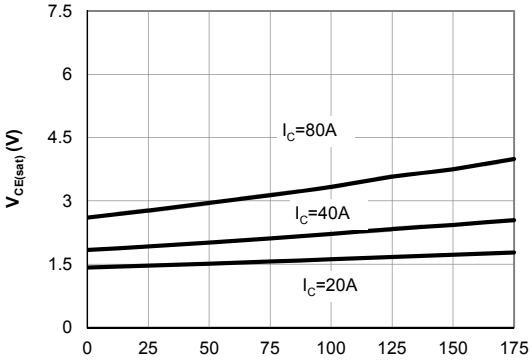



**Figure 5: Collector-Emitter Saturation Voltage vs. Junction Temperature**

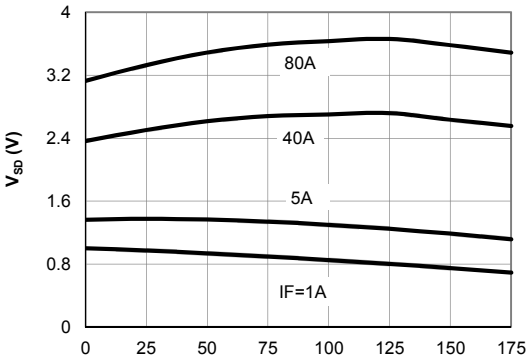



**Figure 6: Diode Forward voltage vs. Junction Temperature**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

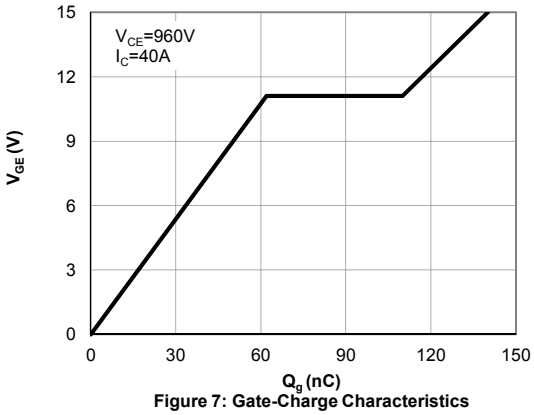



Figure 7: Gate-Charge Characteristics

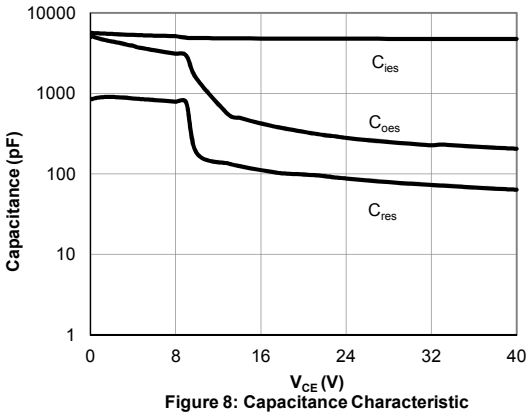



Figure 8: Capacitance Characteristic

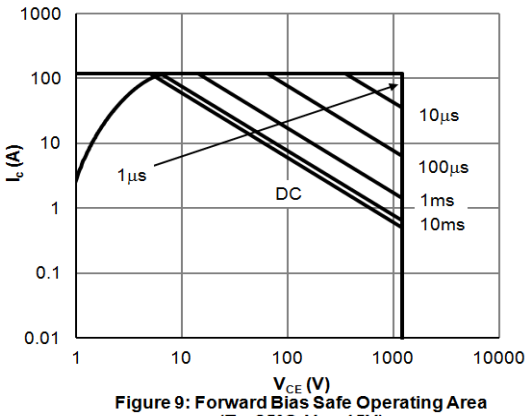



Figure 9: Forward Bias Safe Operating Area
($T_C$=25°C, $V_{GE}$=15V)

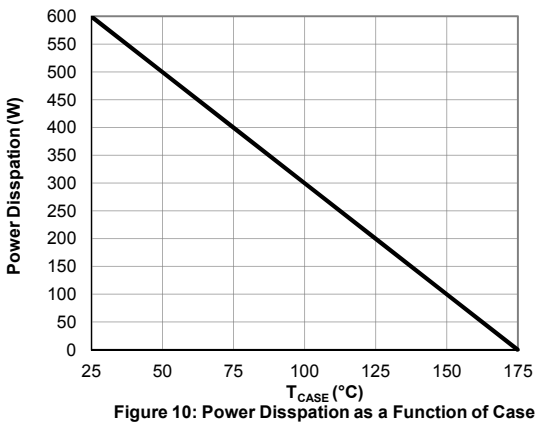



Figure 10: Power Disspation as a Function of Case

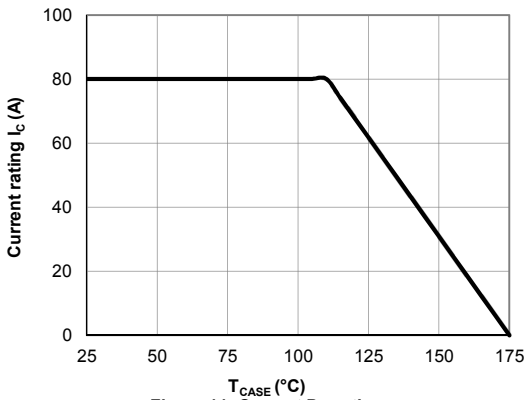



Figure 11: Current De-rating

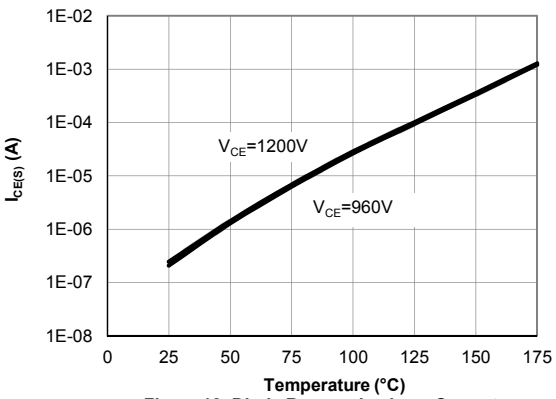



Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

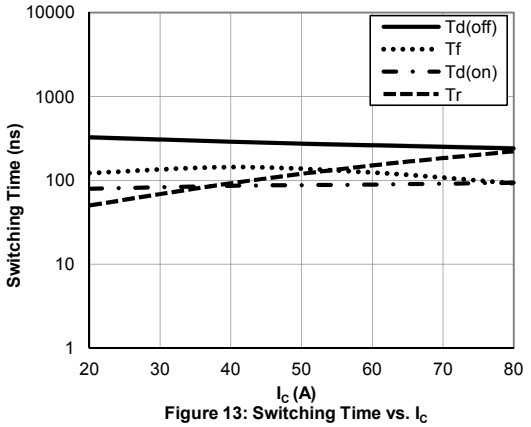



**Figure 13: Switching Time vs. $I_C$**
**($T_j$=175°C, $V_{GE}$=15V, $V_{CE}$=600V, $R_g$=7.5Ω)**

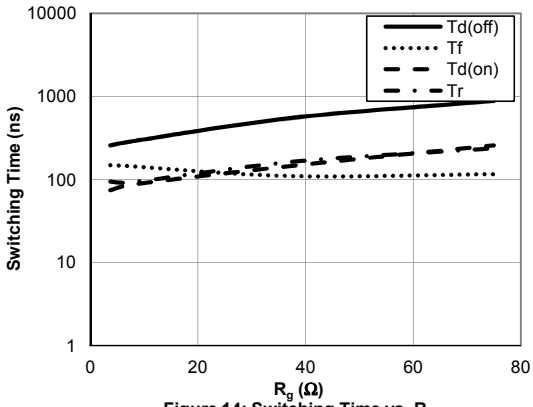



**Figure 14: Switching Time vs. $R_g$**
**($T_j$=175°C, $V_{GE}$=15V, $V_{CE}$=600V, $I_C$=40A)**

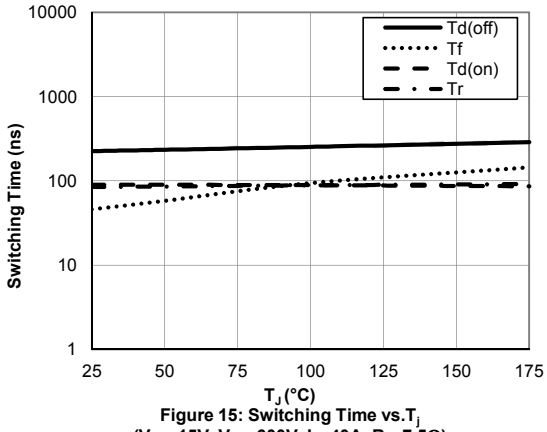



**Figure 15: Switching Time vs.$T_j$**
**($V_{GE}$=15V, $V_{CE}$=600V, $I_C$=40A, $R_g$=7.5Ω)**

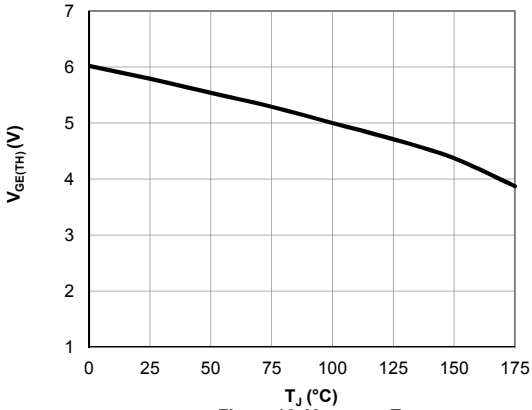



**Figure 16: $V_{GE(TH)}$ vs. $T_j$**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

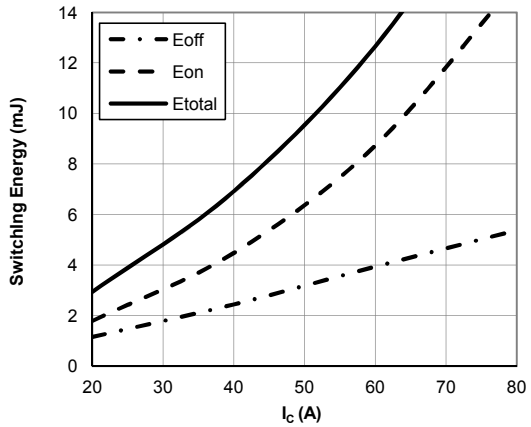



**Figure 17: Switching Loss vs. $I_C$**
**($T_j$=175°C, $V_{GE}$=15V, $V_{CE}$=600V, $R_g$=7.5Ω)**

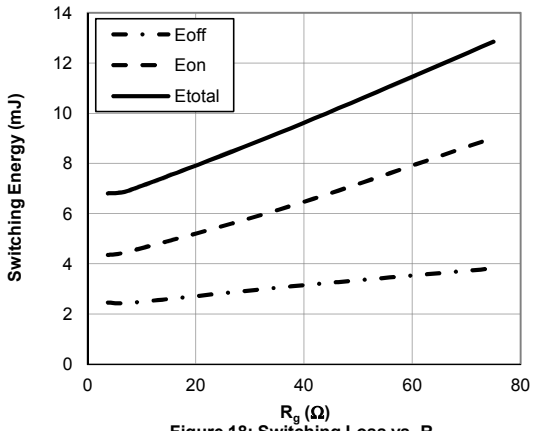



**Figure 18: Switching Loss vs. $R_g$**
**($T_j$=175°C, $V_{GE}$=15V, $V_{CE}$=600V, $I_C$=40A)**

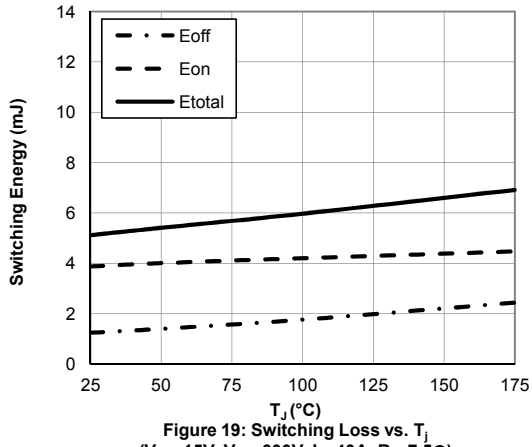



**Figure 19: Switching Loss vs. $T_j$**
**($V_{GE}$=15V, $V_{CE}$=600V, $I_C$=40A, $R_g$=7.5Ω)**

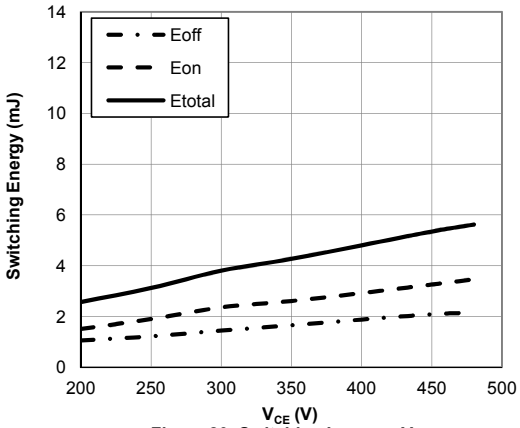



**Figure 20: Switching Loss vs. $V_{CE}$**
**($T_j$=175°C, $V_{GE}$=15V, $I_C$=40A, $R_g$=7.5Ω)**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

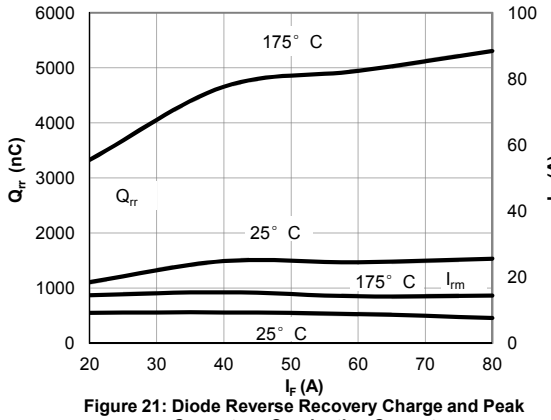



**Figure 21: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current ($V_{GE}$=15V, $V_{CE}$=600V, di/dt=200A/µs)**

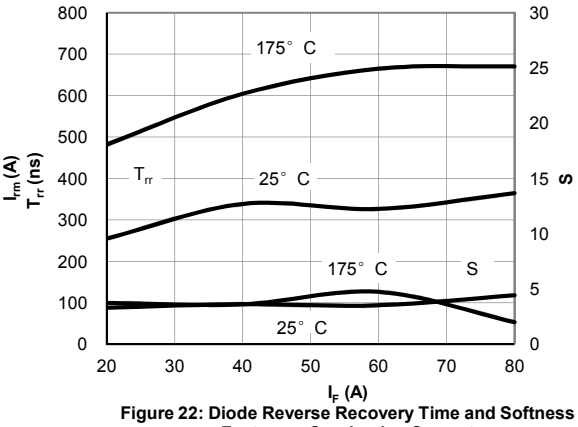



**Figure 22: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current ($V_{GE}$=15V, $V_{CE}$=600V, di/dt=200A/µs)**

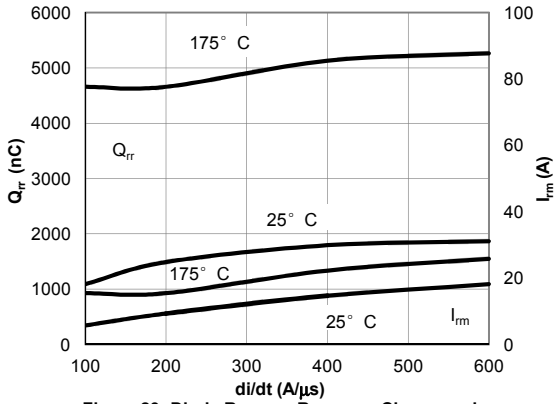



**Figure 23: Diode Reverse Recovery Charge and Peak Current vs. di/dt ($V_{GE}$=15V, $V_{CE}$=600V, $I_F$=40A)**

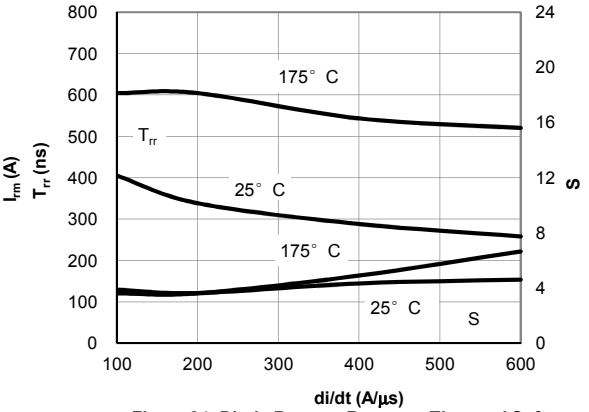



**Figure 24: Diode Reverse Recovery Time and Softness Factor vs. di/dt ($V_{GE}$=15V, $V_{CE}$=600V, $I_F$=40A)**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

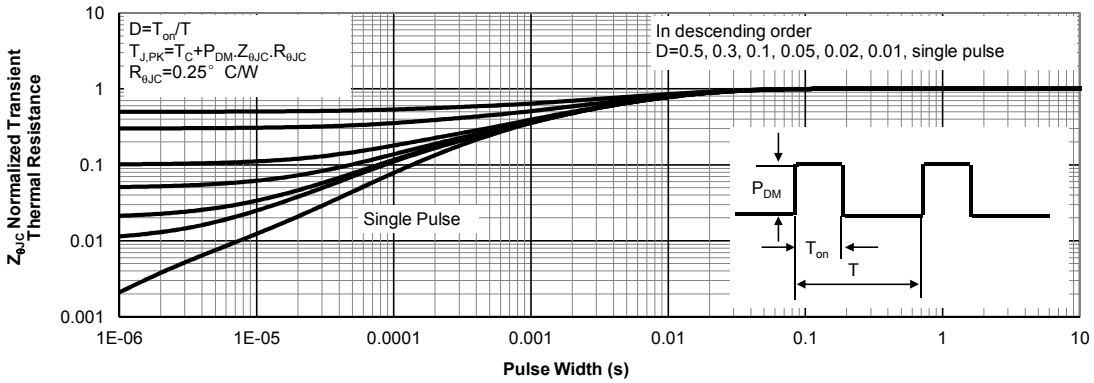



**Figure 25: Normalized Maximum Transient Thermal Impedance for IGBT**

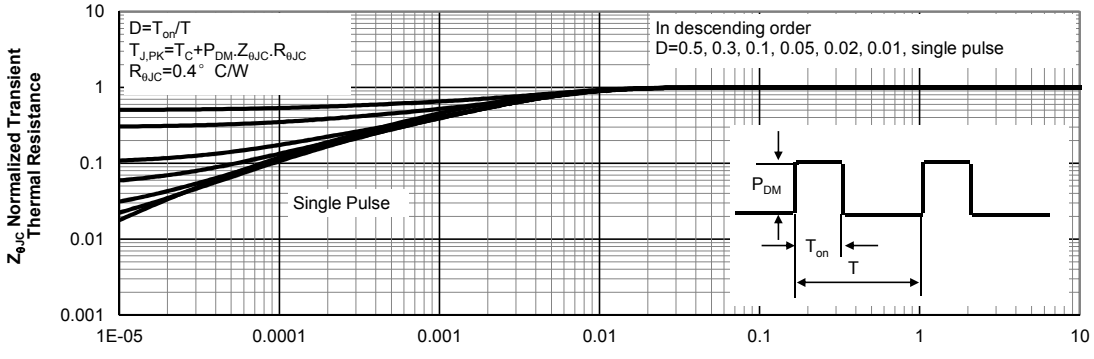



**Figure 26: Normalized Maximum Transient Thermal Impedance for Diode**

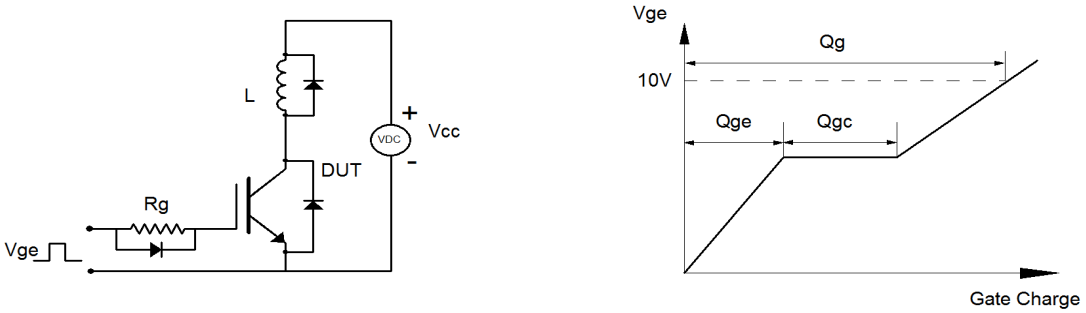



Figure A: Gate Charge Test Circuit & Waveforms

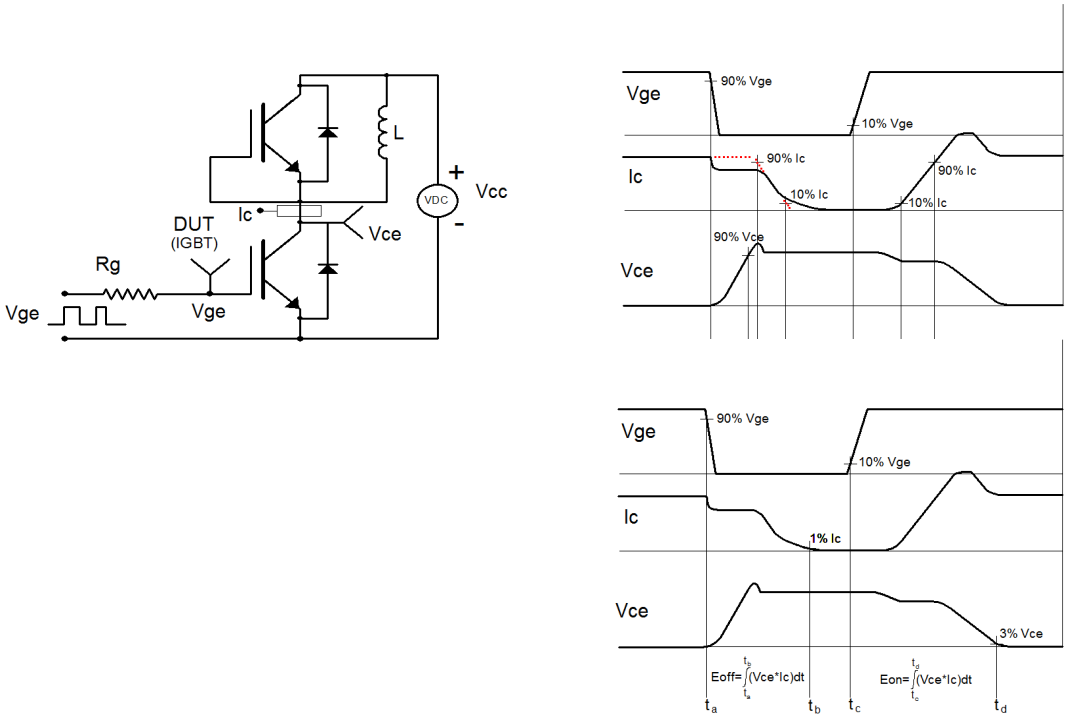



Figure B: Inductive Switching Test Circuit & Waveforms

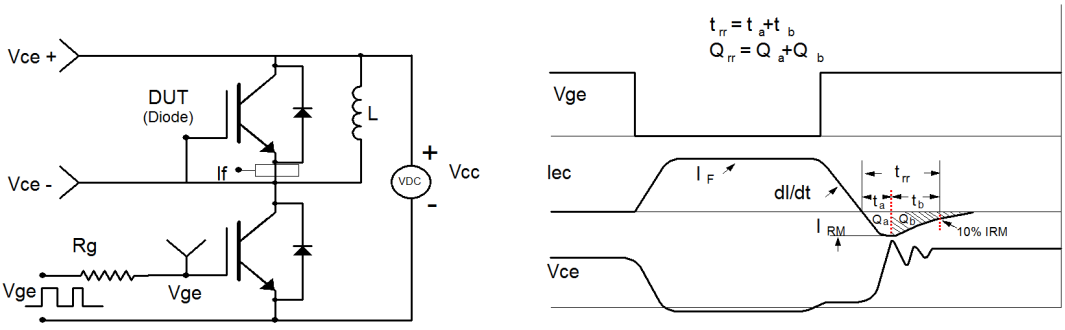



Figure C: Diode Recovery Test Circuit & Waveforms

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# 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.

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### 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**

**www.entegreci.com** | **destek@entegreci.com** | **0850 305 90 34**

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