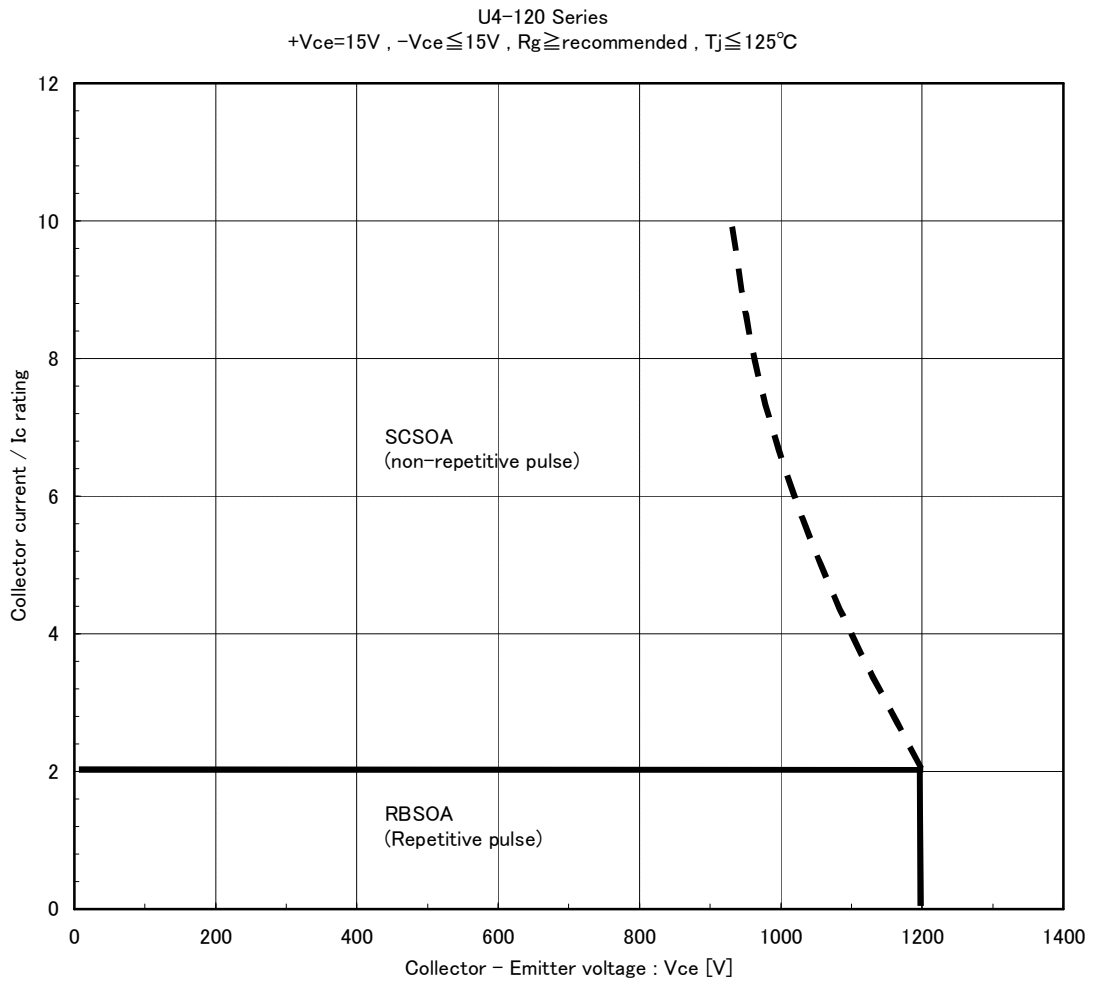

FUJI IGBT Modules U4-120 Series

Technical Documents

1.	RBSOA, SCSOA	MT5F15412
2.	High current output-characteristics	MT5F19808
3.	2 in one-package module parallel connection application	MT5F17044
4.	Switching loss, dv/dt vs. C_{GE} , R_G	MT5F19703
5.	$-V_{GE}$ vs. switching loss characteristics	MT5F17044
6.	$-di/dt$ vs. T_j characteristics	MT5F19887
7.	Dynamic avalanche voltage vs. T_j characteristics	MT5F19890

FUJI IGBT Modules U4-120 Series
RBSOA, SCSOA



Technical documents | MT5F15412

2008-03-27

FUJI IGBT Modules U4-120 Series
High current output-characteristics

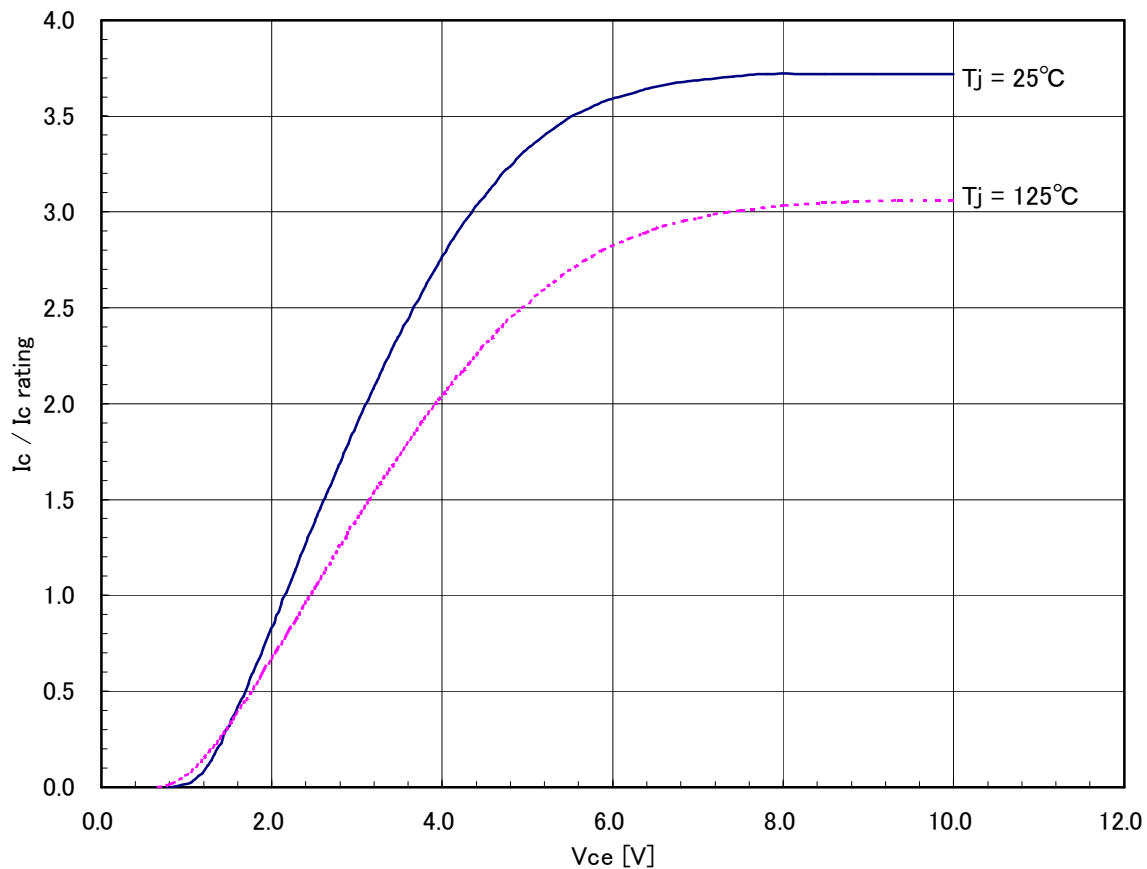
U4-120Series

Conditions: $T_j=25/125^{\circ}\text{C}$

$V_{GE}=15\text{V}$

Include internal-drop voltage due to internal-resistance of module.

U4 - 120 Series



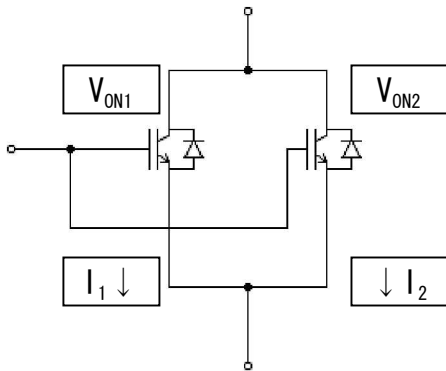
Technical documents | MT5F19808

2008-03-27

FUJI IGBT Modules U4-120 Series

2 in one-package module parallel connection application

Current imbalance in parallel connection



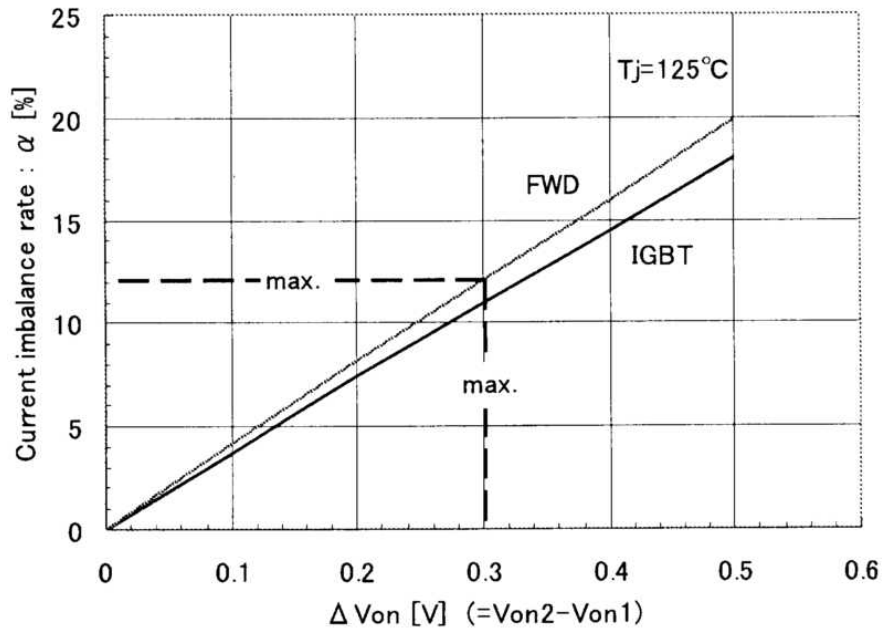
Configuration and equation

$$\Delta V_{on} = V_{on2} - V_{on1} \quad (V_{on1} < V_{on2})$$

$$I_{C(ave)} = (I_1 + I_2) / 2$$

Current imbalance was caused by difference between V_{on1} , V_{on2} , current will be divided to I_1 and I_2 respectively. In this case, the current imbalance rate is defined as following equation.

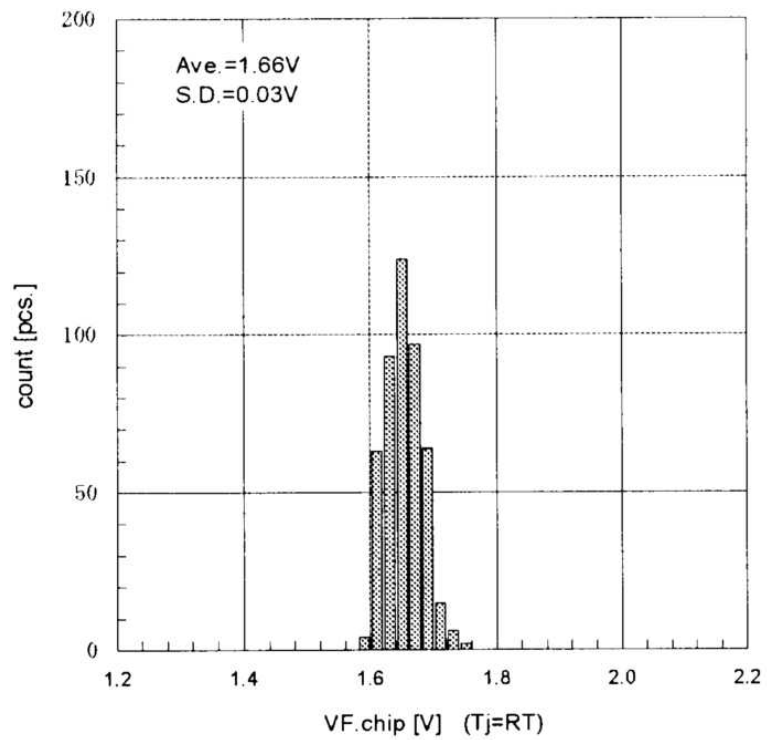
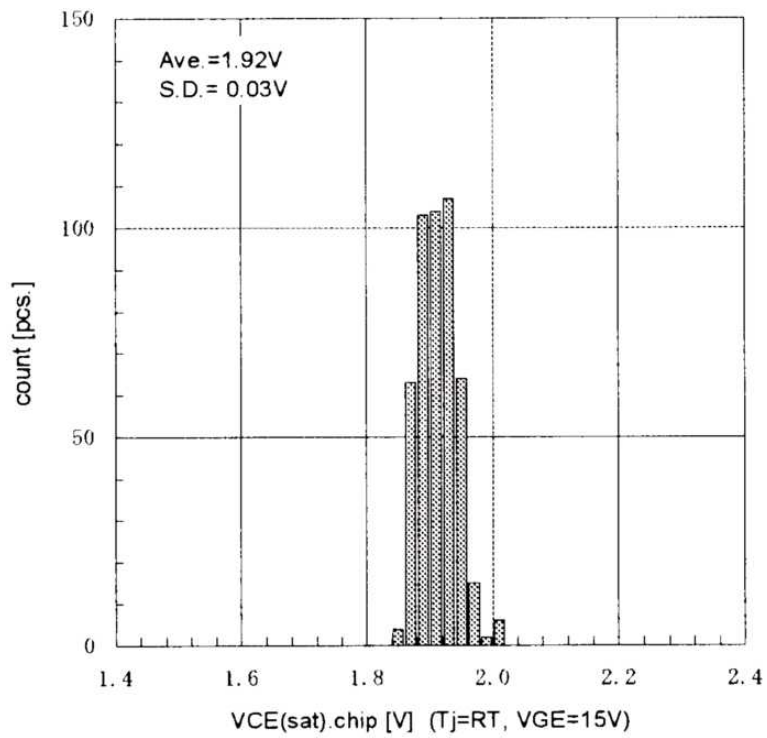
$$\alpha = [I_1 / I_{C(ave)} - 1] \times 100(\%)$$



The rank division of V_{on} is unnecessary for U4 Series by the set value of $\alpha = 12\%$ (IGBT: $\alpha = 11\%$, FWD: $\alpha = 12\%$). When connecting parallel the chips of N piece, overall permissible current is shown by the follow (I_{max} is made maximum permissible current).

$$\text{Overall permissible current } \Sigma I = I_{max} \times [1 + (n-1) \times (1 - \alpha/100) / (1 + \alpha/100)]$$

Distribution chart of $V_{CE(sat)}$ and V_F (example)



Technical documents | MT5F17044

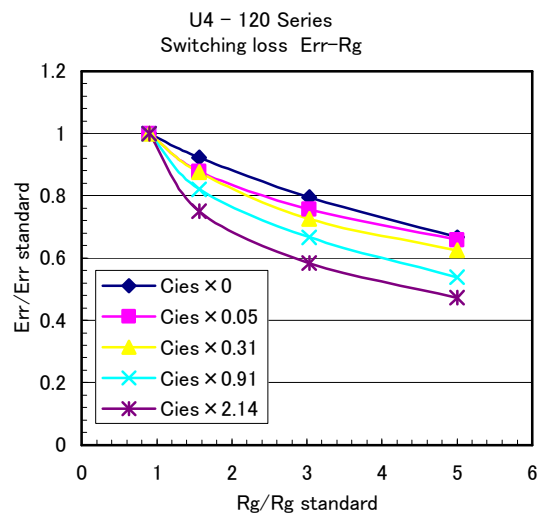
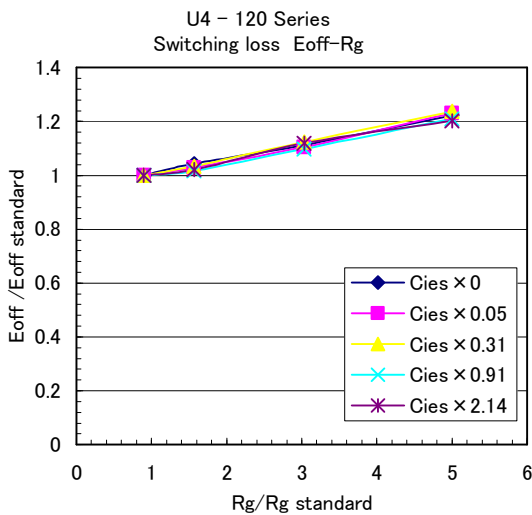
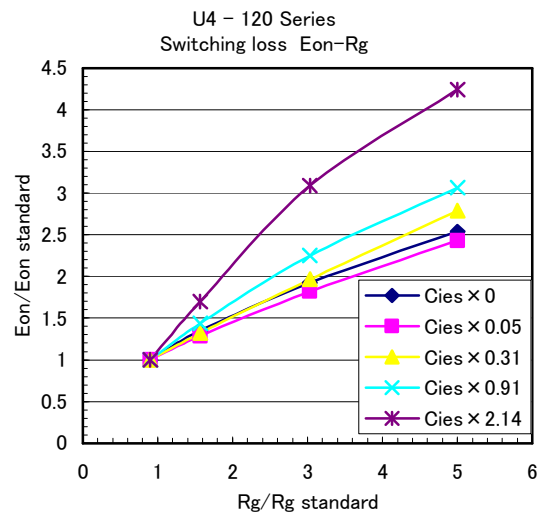
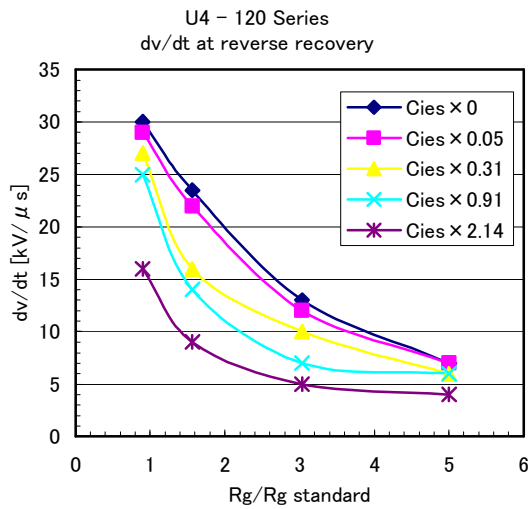
2008-03-27

FUJI IGBT Modules U4-120 Series
Switching loss, dv/dt vs. C_{GE} , R_g

Sample: 2MBI200U4H-120

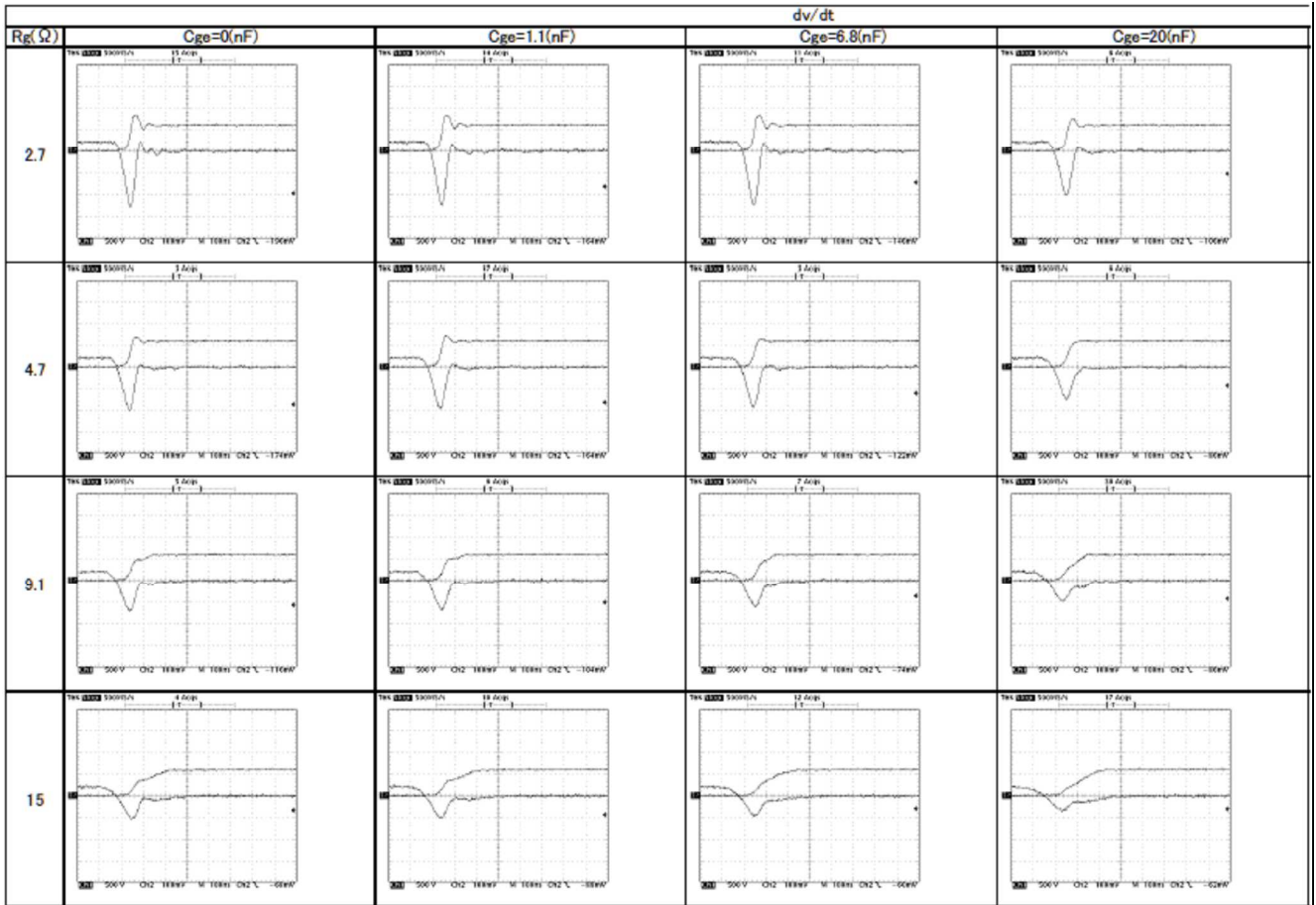
Conditions: Reverse recovery dv/dt: $V_{CC}=600V$, $I_C=20A$, $V_{GE}=+15V/-8V$, $T_j=RT$

Switching loss: $V_{CC}=600V$, $I_C=20A$, $V_{GE}=+15V/-8V$, $T_j=RT$



- ※ E_{on} standard : $R_g=R_g$ standard , $C_{ies}=0 \mu F$ (they are similar for E_{off} and E_{rr})
- ※ Connecting C_{ge} is unnecessary for U4-Series because it able to control the switching loss, dv/dt by the gate resistance.

Switching waveform



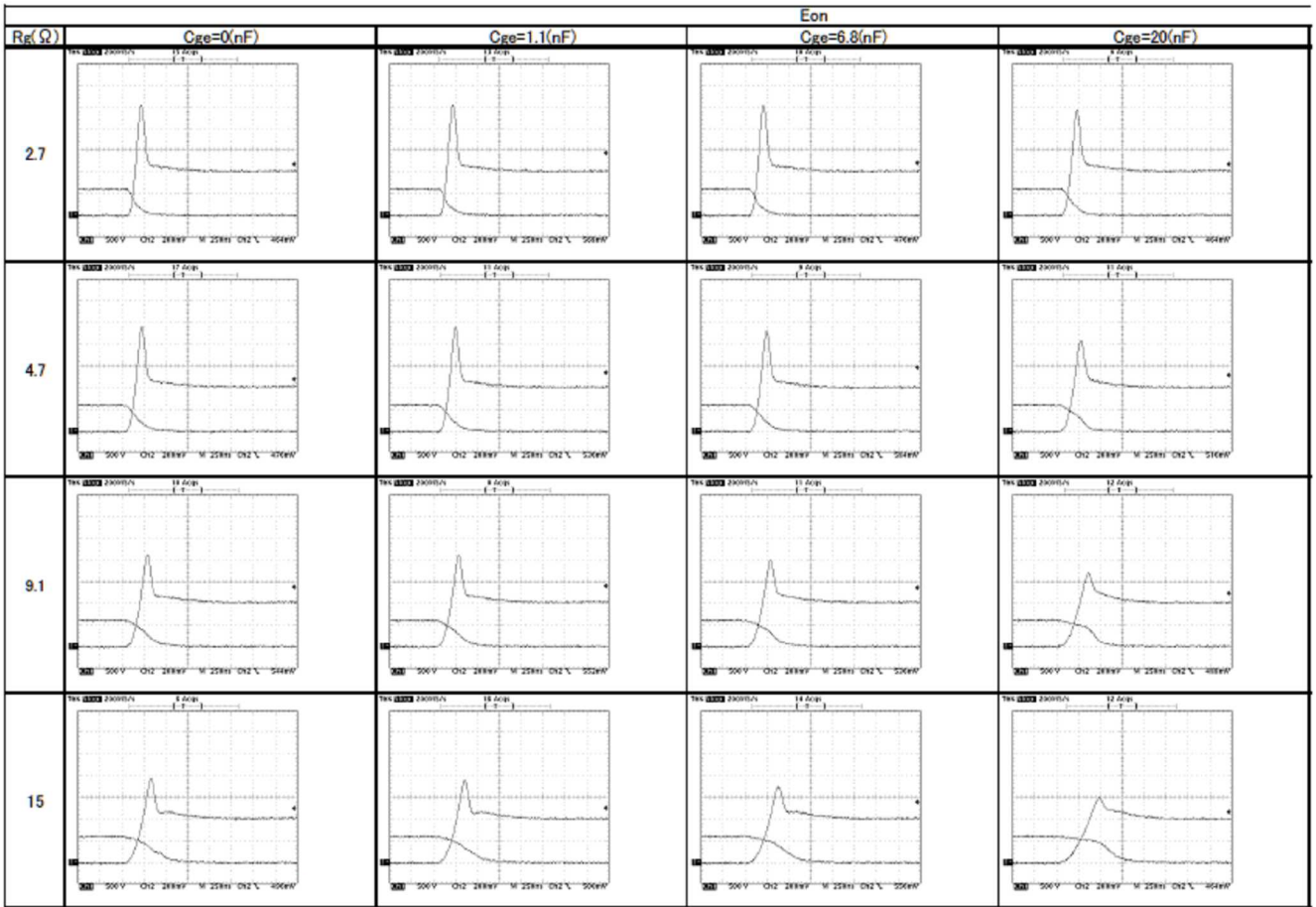
$E_d=600V, I_c=20A, 2MBI200U4H-120, V_{ge}=+15V/-8V, T_j=RT$

$I_c: 100A/div, V_{ce}: 500V/div, t: 100ns/div$

Figure 1. Reverse-recovery waveform

Technical documents | MT5F19703

2008-03-27



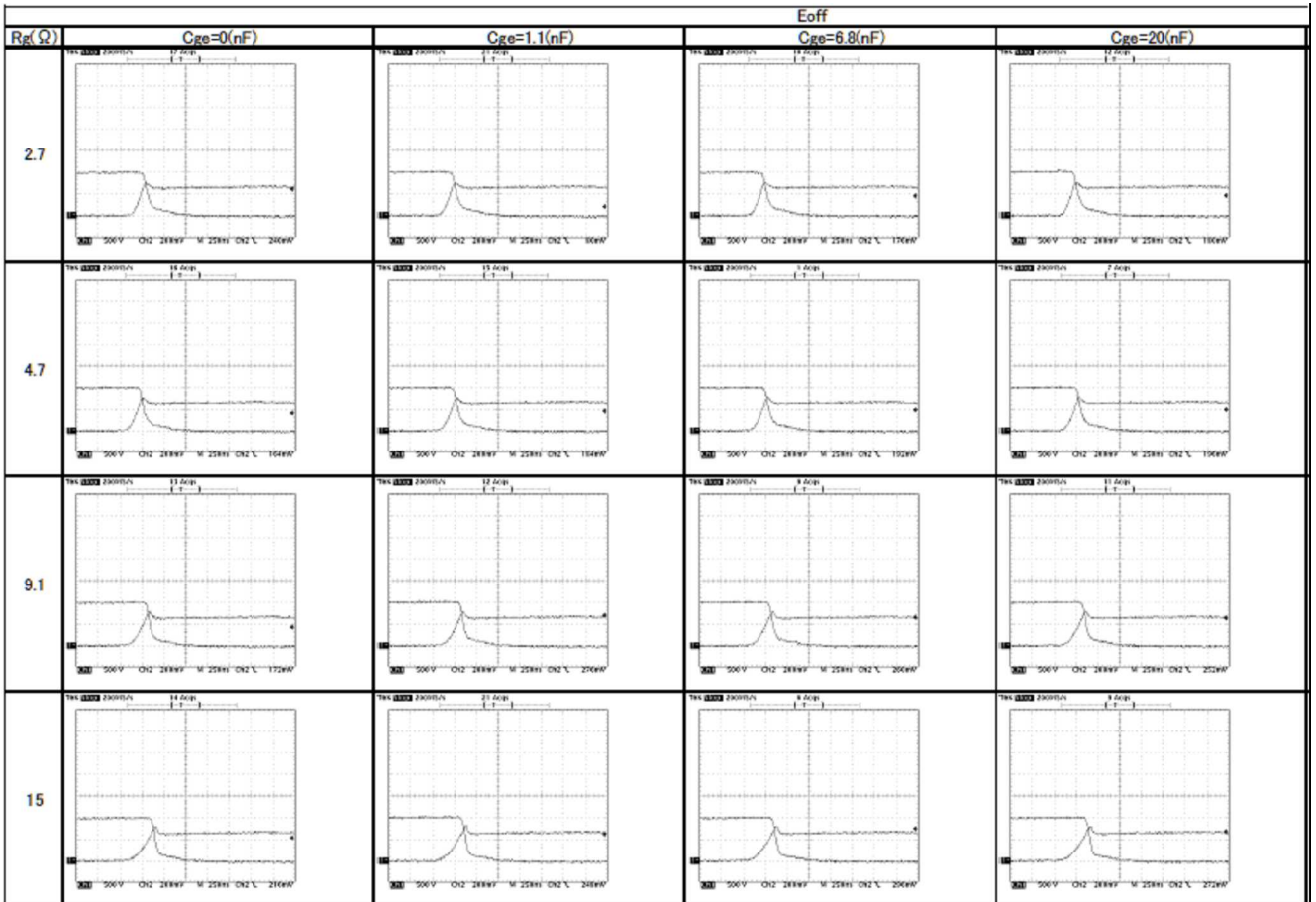
$E_d=600V, I_c=200A, 2MBI200U4H-120, V_{ge}=+15V/-8V, T_j=125^\circ C$

$I_c: 100A/div, V_{ce}: 500V/div, t: 250ns/div$

Figure 2. Turn-on waveform

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2008-03-27



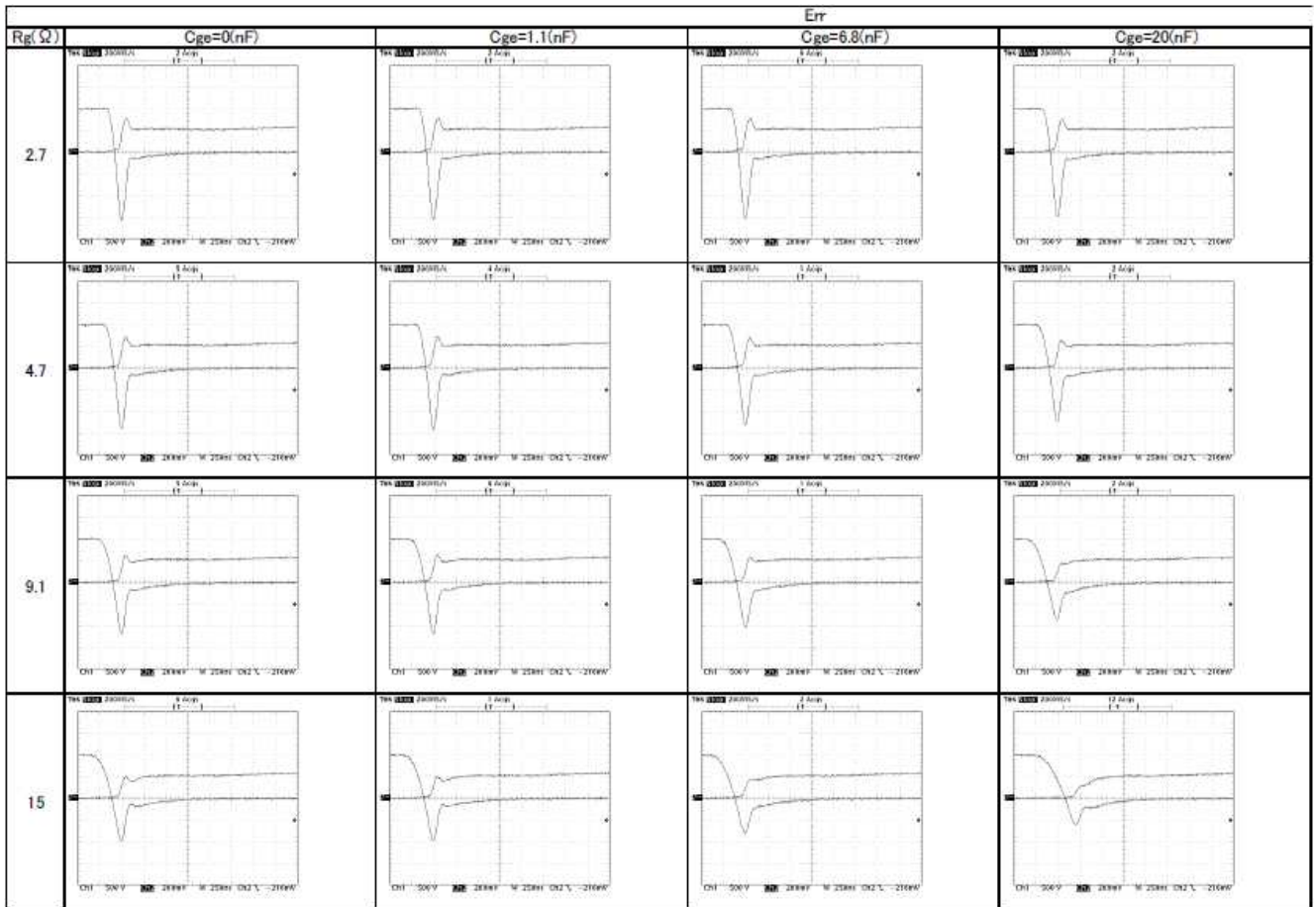
$E_d=600V, I_c=200A, 2MBI200U4H-120, V_{ge}=+15V/-8V, T_j=125^\circ C$

$I_c: 100A/div, V_{ce}: 500V/div, t: 250ns/div$

Figure 3. Turn-off waveform

Technical documents | MT5F19703

2008-03-27



$E_d=600V, I_c=200A, 2MBI200U4H-120, V_{ge}=+15V/-8V, T_j=125^\circ C$

$I_c: 100A/div, V_{ce}: 500V/div, t: 250ns/div$

Figure 4. Reverse-recovery waveform

Technical documents | MT5F19703

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FUJI IGBT Modules U4-120 Series
-V_{GE} vs. switching loss characteristics

Sample: 1MBI400U4-120

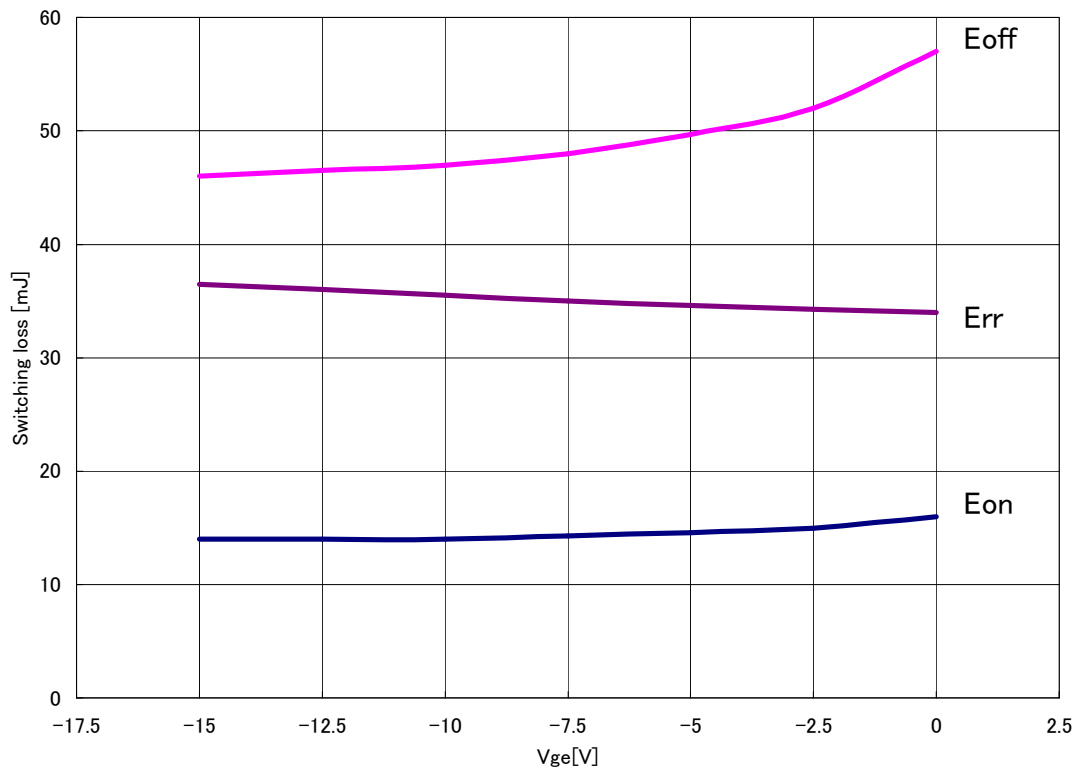
Conditions: T_j=125°C

V_{DC}=600V

V_{GEon}=+15V

I_C=300A

R_G=2.2Ω



Technical documents | MT5F17044

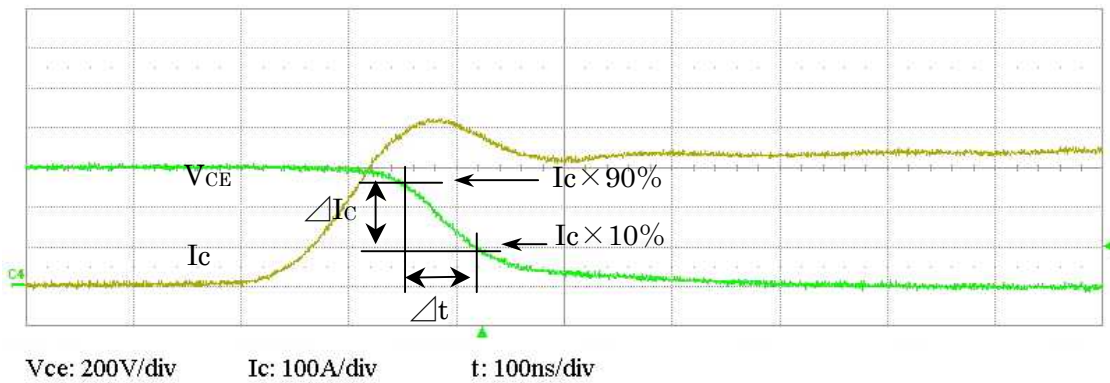
2008-03-27

FUJI IGBT Modules U4-120 Series
-dIc/dt vs. Tj characteristics

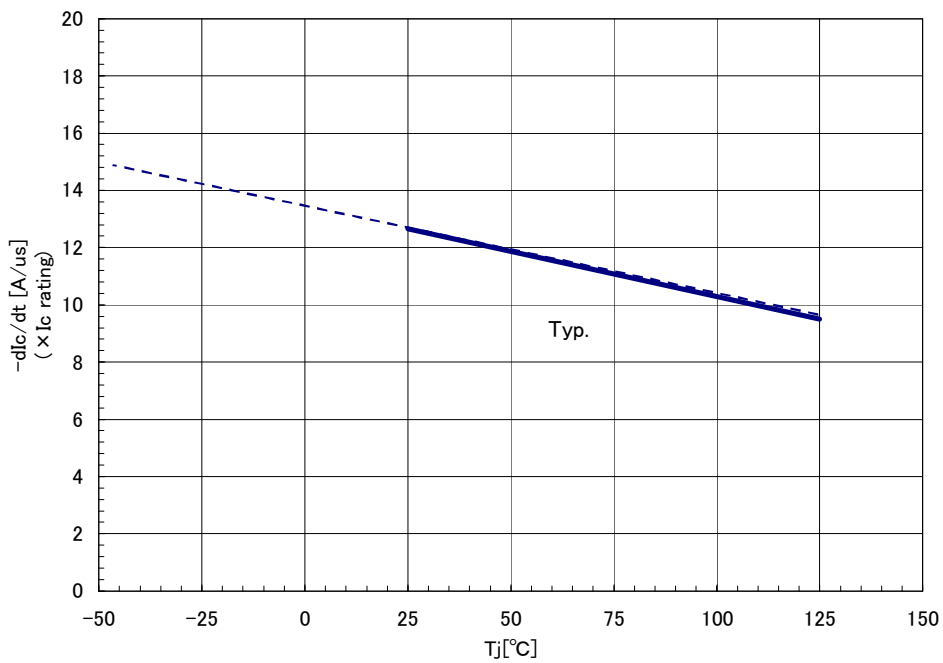
Sample: 2MBI300U4H-120

Conditions: V_{DC}=600V, I_C=300A

V_{GE}=±15V, R_G=2.2Ω



U4-120 Series



Technical documents **MT5F19887**

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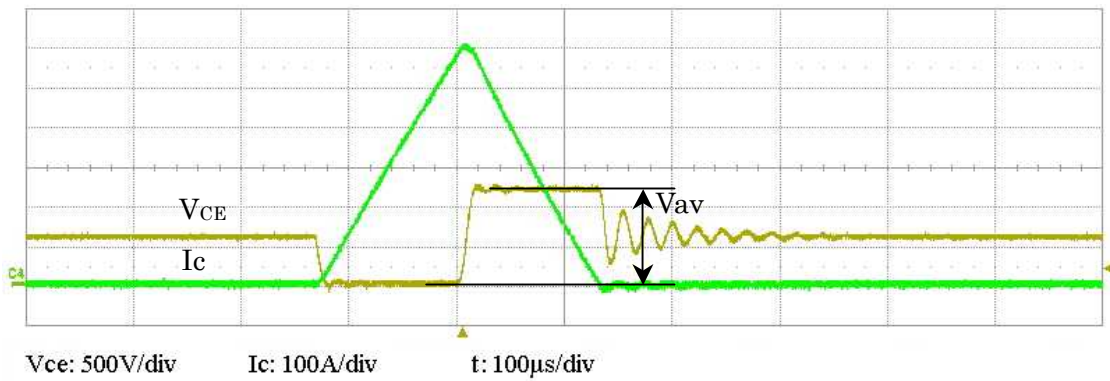
FUJI IGBT Modules U4-120 Series

Dynamic avalanche voltage vs. T_j characteristics

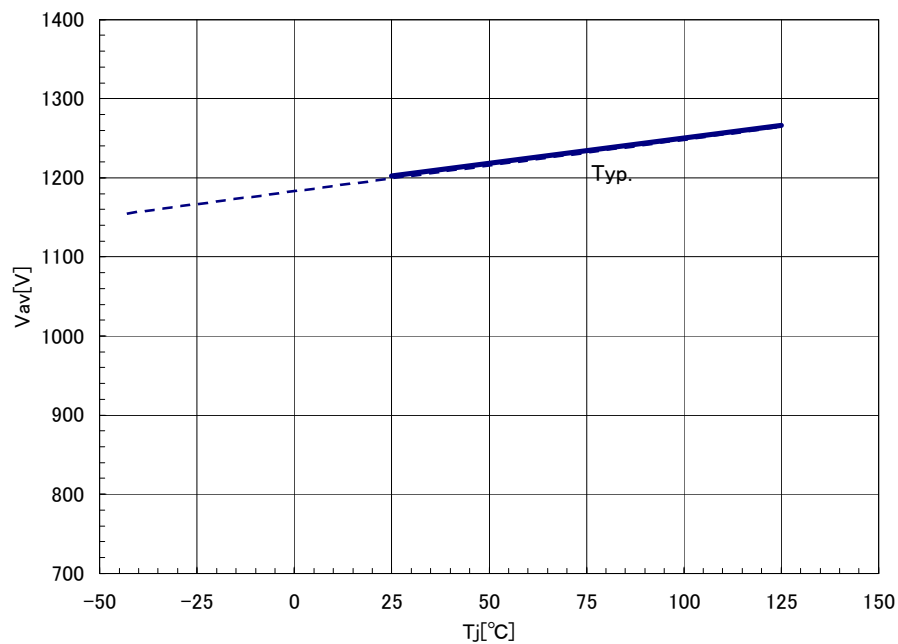
Sample: 2MBI300U4H-120

Conditions: $V_{DC}=600V$, $I_C=2 \times \text{Rated}$

$V_{GE}=\pm 15V$, $R_G=\text{Recommended}$



2MBI300U4H-120



Technical documents **MT5F19890**

2008-03-27

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