

IGBT Modules

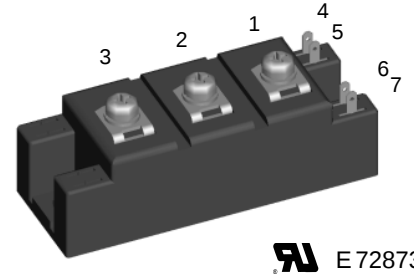
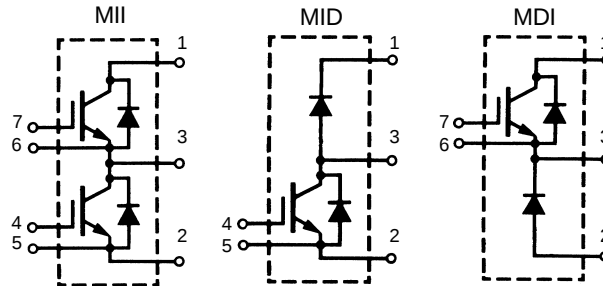
Short Circuit SOA Capability

Square RBSOA

$$I_{C25} = 135 \text{ A}$$

$$V_{CES} = 1200 \text{ V}$$

$$V_{CE(sat) \text{ typ.}} = 2.2 \text{ V}$$



Symbol	Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	1200	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 20 \text{ k}\Omega$	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	135	A
I_{C80}	$T_C = 80^\circ\text{C}$	90	A
I_{CM}	$T_C = 80^\circ\text{C}, t_p = 1 \text{ ms}$	180	A
t_{SC} (SCSOA)	$V_{GE} = \pm 15 \text{ V}, V_{CE} = V_{CES}, T_J = 125^\circ\text{C}$ $R_G = 15 \Omega, \text{ non repetitive}$	10	μs
RBSOA	$V_{GE} = \pm 15 \text{ V}, T_J = 125^\circ\text{C}, R_G = 15 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 150$ $V_{CEK} \leq V_{CES}$	A
P_{tot}	$T_C = 25^\circ\text{C}$	560	W
T_J		150	$^\circ\text{C}$
T_{stg}		-40 ... +150	$^\circ\text{C}$
V_{ISOL}	50/60 Hz, RMS $t = 1 \text{ min}$ $I_{ISOL} \leq 1 \text{ mA}$ $t = 1 \text{ s}$ Insulating material: Al_2O_3	4000 4800	V~ V~
M_d	Mounting torque (module) (terminals)	2.25-2.75 20-25 2.5-3.7 22-33	Nm lb.in. Nm lb.in.
d_s	Creepage distance on surface	12.7	mm
d_A	Strike distance through air	9.6	mm
a	Max. allowable acceleration	50	m/s^2
Weight	Typical	130 4.6	g oz.

Data according to a single IGBT/FRED unless otherwise stated.

Features

- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy paralleling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- package with DCB ceramic base plate
- isolation voltage 4800 V
- UL registered E72873

Advantages

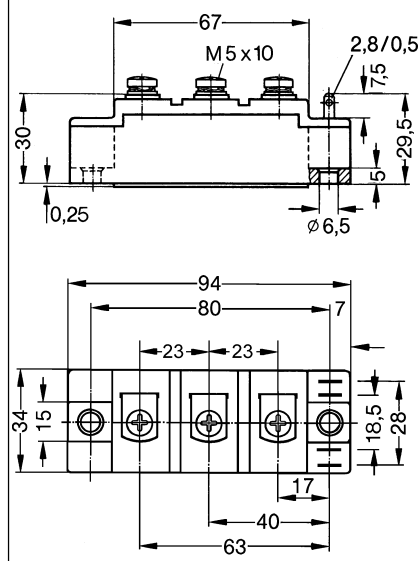
- space and weight savings
- reduced protection circuits

Typical Applications

- AC and DC motor control
- AC servo and robot drives
- power supplies
- welding inverters

Symbol	Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
$V_{(BR)CES}$	$V_{GE} = 0 \text{ V}$	1200		V
$V_{GE(th)}$	$I_C = 3 \text{ mA}$, $V_{CE} = V_{GE}$	4.5		6.5 V
I_{CES}	$V_{CE} = V_{CES}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$		7.5	5 mA mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			± 300 nA
$V_{CE(sat)}$	$I_C = 75 \text{ A}$, $V_{GE} = 15 \text{ V}$	2.2	2.7	V
C_{ies}	$V_{CE} = 25 \text{ V}$, $V_{GE} = 0 \text{ V}$, $f = 1 \text{ MHz}$	5.5		nF
C_{oes}		0.75		nF
C_{res}		0.33		nF
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = 75 \text{ A}$, $V_{GE} = \pm 15 \text{ V}$ $V_{CE} = 600 \text{ V}$, $R_G = 15 \Omega$	100		ns
t_r		50		ns
$t_{d(off)}$		650		ns
t_f		50		ns
E_{on}		12.1		mJ
E_{off}		10.5		mJ
R_{thJC}	with heatsink compound			0.22 K/W
R_{thJS}		0.44		K/W

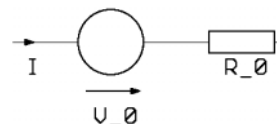
Dimensions in mm (1 mm = 0.0394")



Reverse Diode (FRED)		Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = 75 \text{ A}$, $V_{GE} = 0 \text{ V}$, $I_F = 75 \text{ A}$, $V_{GE} = 0 \text{ V}$, $T_J = 125^\circ\text{C}$	2.2	1.7	2.5 V V
I_F	$T_C = 25^\circ\text{C}$ $T_C = 80^\circ\text{C}$			150 A 95 A
I_{RM}	$I_F = 75 \text{ A}$, $V_{GE} = 0 \text{ V}$, $-di_F/dt = 600 \text{ A}/\mu\text{s}$	62		A
t_{rr}	$T_J = 125^\circ\text{C}$, $V_R = 600 \text{ V}$	200		ns
R_{thJC}	with heatsink compound			0.45 K/W
R_{thJS}		0.9		K/W

Equivalent Circuits for Simulation

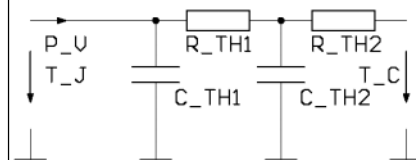
Conduction



IGBT (typ. at $V_{GE} = 15 \text{ V}$; $T_J = 125^\circ\text{C}$)
 $V_0 = 1.5 \text{ V}$; $R_0 = 13.6 \text{ m}\Omega$

Free Wheeling Diode (typ. at $T_J = 125^\circ\text{C}$)
 $V_0 = 1.3 \text{ V}$; $R_0 = 6.5 \text{ m}\Omega$

Thermal Response



IGBT (typ.)
 $C_{th1} = 0.20 \text{ J/K}$; $R_{th1} = 0.218 \text{ K/W}$
 $C_{th2} = 0.47 \text{ J/K}$; $R_{th2} = 0.005 \text{ K/W}$

Free Wheeling Diode (typ.)
 $C_{th1} = 0.14 \text{ J/K}$; $R_{th1} = 0.443 \text{ K/W}$
 $C_{th2} = 0.26 \text{ J/K}$; $R_{th2} = 0.009 \text{ K/W}$

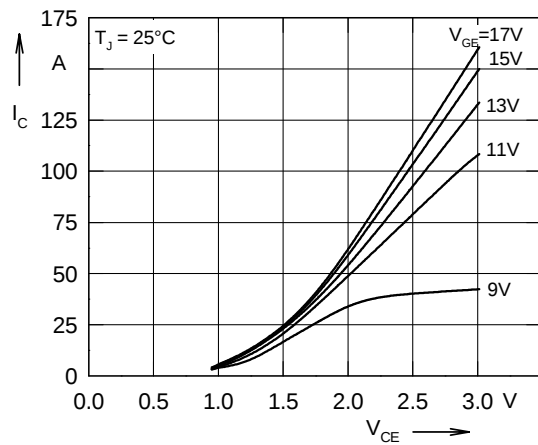


Fig. 1 Typ. output characteristics

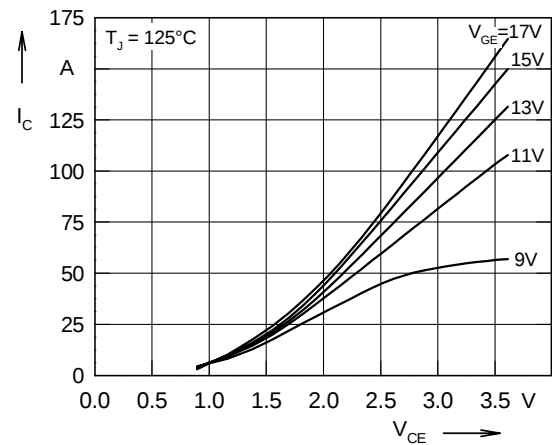


Fig. 2 Typ. output characteristics

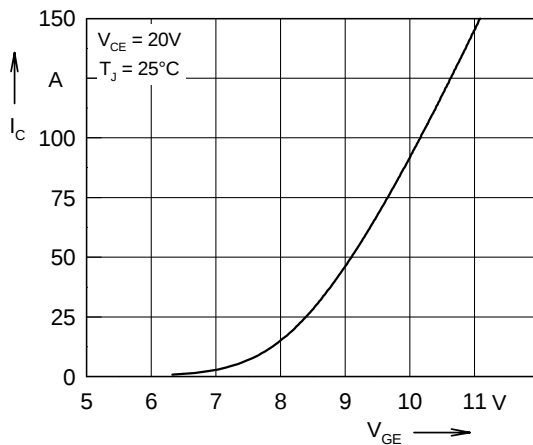


Fig. 3 Typ. transfer characteristics

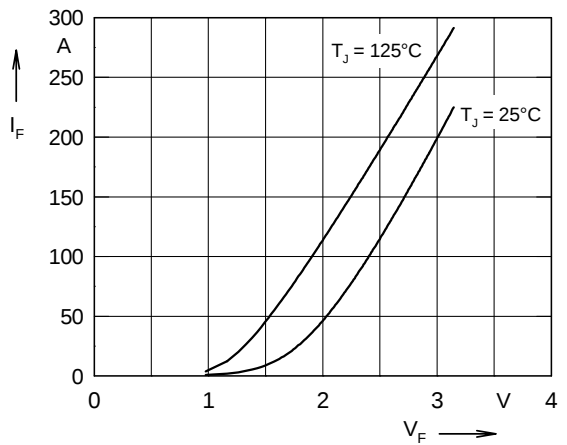


Fig. 4 Typ. forward characteristics of free wheeling diode

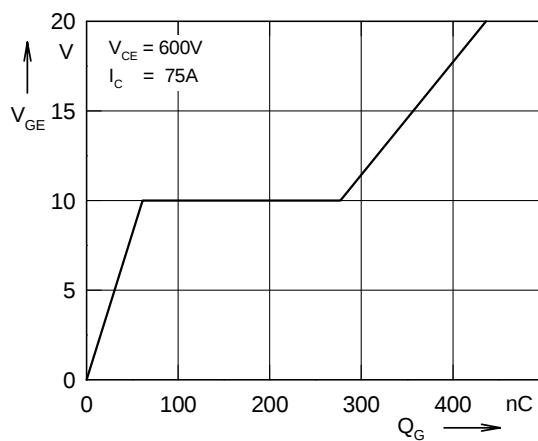


Fig. 5 Typ. turn on gate charge

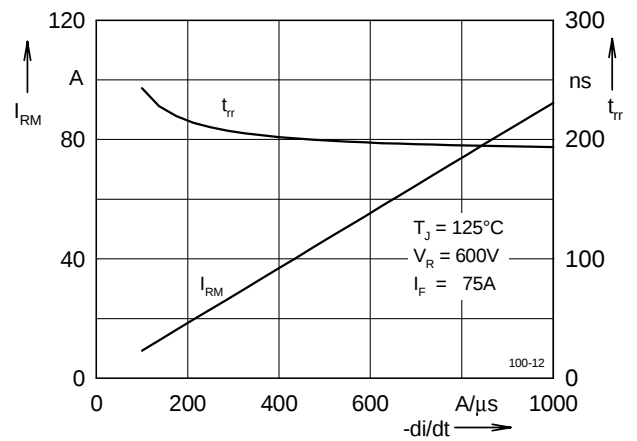


Fig. 6 Typ. turn off characteristics of free wheeling diode

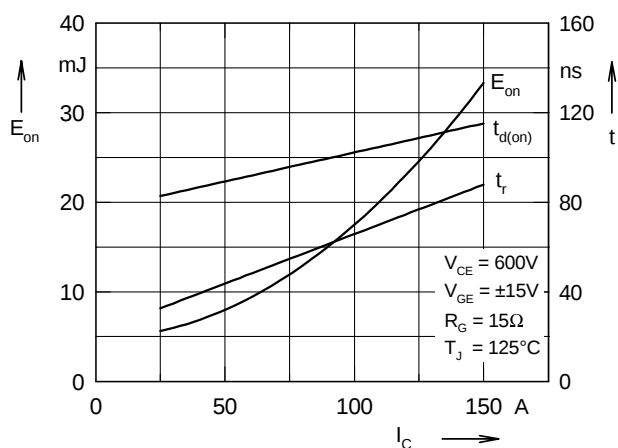


Fig. 7 Typ. turn on energy and switching times versus collector current

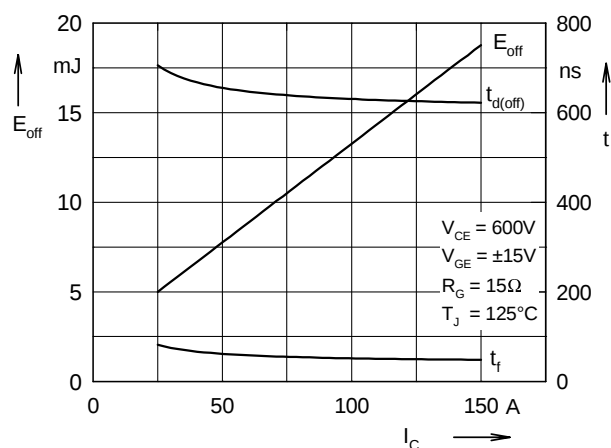


Fig. 8 Typ. turn off energy and switching times versus collector current

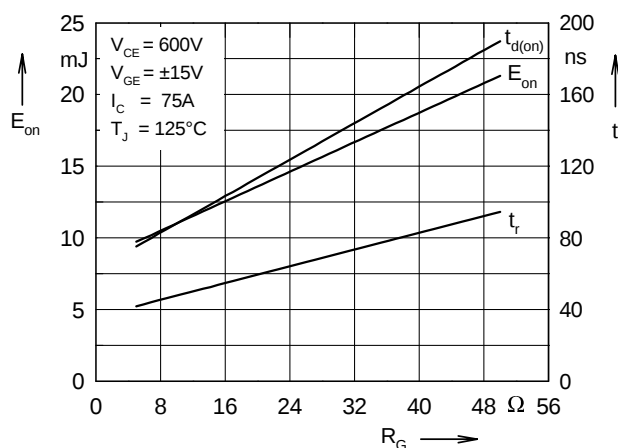


Fig. 9 Typ. turn on energy and switching times versus gate resistor

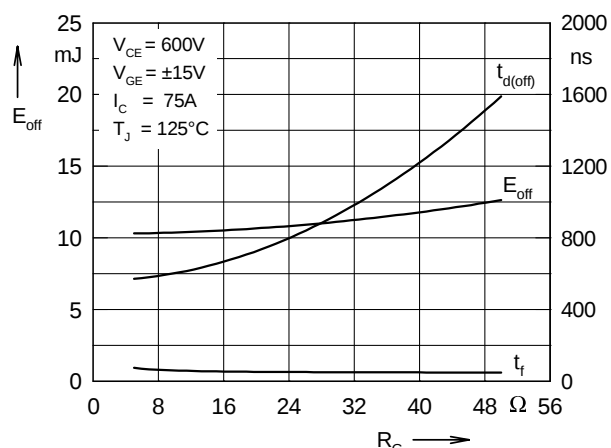


Fig. 10 Typ. turn off energy and switching times versus gate resistor

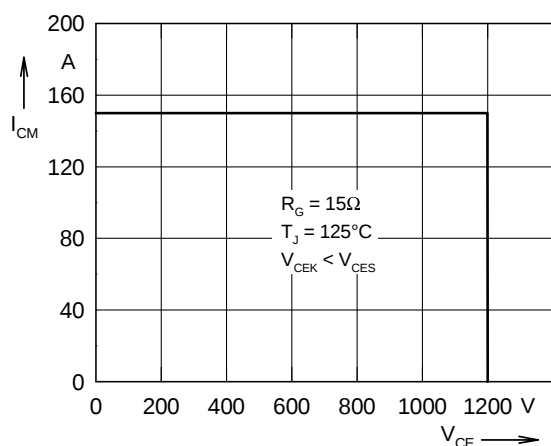


Fig. 11 Reverse biased safe operating area RBSOA

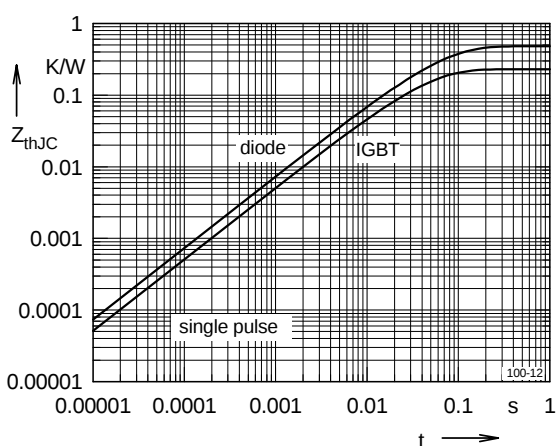


Fig. 12 Typ. transient thermal impedance