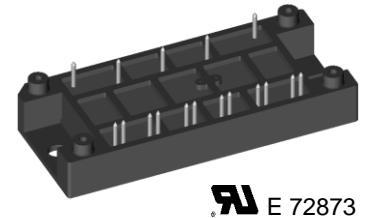
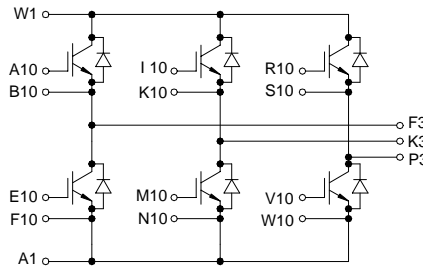


# IGBT Modules

## Sixpack

$I_{C25} = 90 \text{ A}$   
 $V_{CES} = 1200 \text{ V}$   
 $V_{CE(sat) \text{ typ.}} = 2.2 \text{ V}$

Short Circuit SOA Capability  
Square RBSOA



Preliminary data

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	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ\text{C}$	90	A
$I_{C80}$	$T_C = 80^\circ\text{C}$	60	A
$I_{CM}$	$T_C = 80^\circ\text{C}, t_p = 1 \text{ ms}$	120	A
$t_{SC}$ (SCSOA)	$V_{GE} = \pm 15 \text{ V}, V_{CE} = V_{CES}, T_J = 125^\circ\text{C}$ $R_G = 22 \Omega, \text{ non repetitive}$	10	$\mu\text{s}$
<b>RBSOA</b>	$V_{GE} = \pm 15 \text{ V}, T_J = 125^\circ\text{C}, R_G = 22 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 100$ $V_{CEK} \leq V_{CES}$	A
$P_{tot}$	$T_C = 25^\circ\text{C}$	370	W
$T_J$		150	$^\circ\text{C}$
$T_{stg}$		-40 ... +150	$^\circ\text{C}$
$V_{ISOL}$	50/60 Hz, RMS $t = 1 \text{ min}$	4000	V~
	$I_{ISOL} \leq 1 \text{ mA}$ $t = 1 \text{ s}$ Insulating material: $\text{Al}_2\text{O}_3$	4800	V~
$M_d$	Mounting torque (M5)	2.0 - 2.5	Nm
		18 - 22	lb.in.
$d_s$	Creepage distance on surface	9	mm
$d_A$	Strike distance through air	9	mm
$a$	Max. allowable acceleration	50	$\text{m/s}^2$
<b>Weight</b>	Typical	80	g
		2.8	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
- solderable pins for PCB mounting
- package with DCB ceramic base plate
- isolation voltage 4800 V
- UL registered E72873

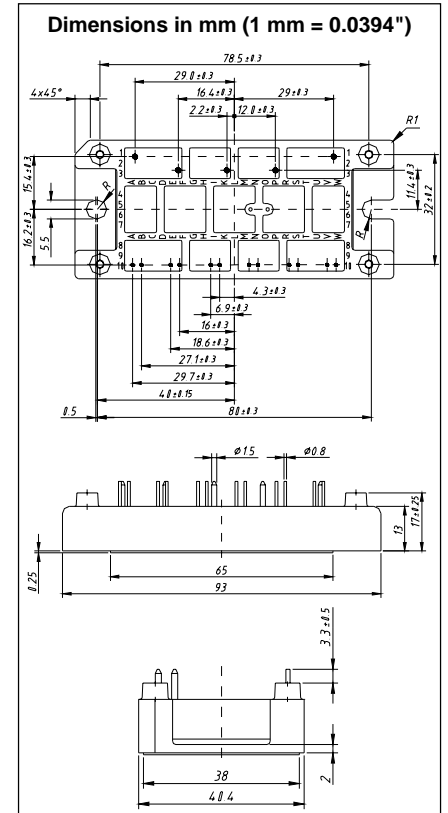
### Advantages

- space and weight savings
- reduced protection circuits
- package designed for wave soldering

### Typical Applications

- AC motor control
- AC servo and robot drives
- power supplies

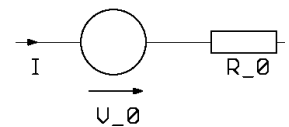
Symbol	Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$V_{(BR)CES}$	$V_{GE} = 0\text{ V}$	1200		V
$V_{GE(th)}$	$I_C = 2\text{ mA}, V_{CE} = V_{GE}$	4.5		6.5 V
$I_{CES}$	$V_{CE} = V_{CES}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$		6	4 mA mA
$I_{GES}$	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$			$\pm 200$ nA
$V_{CE(sat)}$	$I_C = 50\text{ A}, V_{GE} = 15\text{ V}$		2.2	2.7 V
$C_{ies}$	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$		3300	pF
$C_{oes}$			500	pF
$C_{res}$			220	pF
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = 50\text{ A}, V_{GE} = \pm 15\text{ V}$ $V_{CE} = 600\text{ V}, R_G = 22\ \Omega$		100	ns
$t_r$			70	ns
$t_{d(off)}$			500	ns
$t_f$			70	ns
$E_{on}$				7.6
$E_{off}$			5.6	mJ
$R_{thJC}$	with heatsink compound			0.33 K/W
$R_{thJS}$			0.66	K/W



Reverse Diode (FRED)		Characteristic Values		
		min.	typ.	max.
$V_F$	$I_F = 50\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 50\text{ A}, V_{GE} = 0\text{ V}, T_J = 125^\circ\text{C}$		2.3 1.8	2.5 V 2.1 V
$I_F$	$T_C = 25^\circ\text{C}$ $T_C = 80^\circ\text{C}$			100 A 60 A
$I_{RM}$	$I_F = 50\text{ A}, V_{GE} = 0\text{ V}, -di_F/dt = 400\text{ A}/\mu\text{s}$		40	A
$t_{rr}$	$T_J = 125^\circ\text{C}, V_R = 600\text{ V}$		200	ns
$R_{thJC}$	with heatsink compound			0.66 K/W
$R_{thJS}$			1.32	K/W

### Equivalent Circuits for Simulation

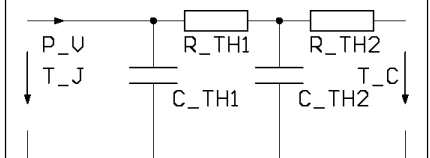
#### Conduction



IGBT (typ. at  $V_{GE} = 15\text{ V}; T_J = 125^\circ\text{C}$ )  
 $V_0 = 1.5\text{ V}; R_0 = 20.7\text{ m}\Omega$

Free Wheeling Diode (typ. at  $T_J = 125^\circ\text{C}$ )  
 $V_0 = 1.3\text{ V}; R_0 = 11.3\text{ m}\Omega$

#### Thermal Response



IGBT (typ.)

$C_{th1} = 0.13\text{ J/K}; R_{th1} = 0.323\text{ K/W}$   
 $C_{th2} = 0.32\text{ J/K}; R_{th2} = 0.008\text{ K/W}$

Free Wheeling Diode (typ.)

$C_{th1} = 0.10\text{ J/K}; R_{th1} = 0.645\text{ K/W}$   
 $C_{th2} = 0.18\text{ J/K}; R_{th2} = 0.013\text{ K/W}$

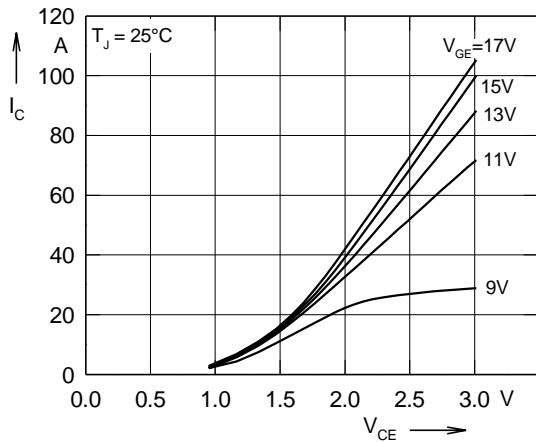


Fig. 1 Typ. output characteristics

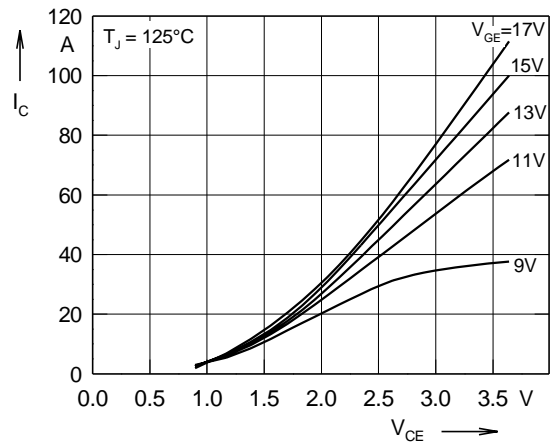


Fig. 2 Typ. output characteristics

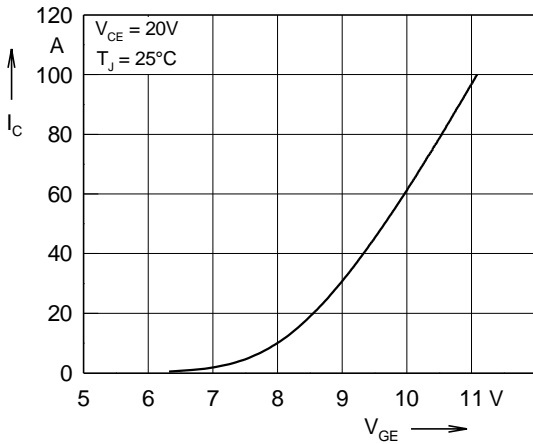


Fig. 3 Typ. transfer characteristics

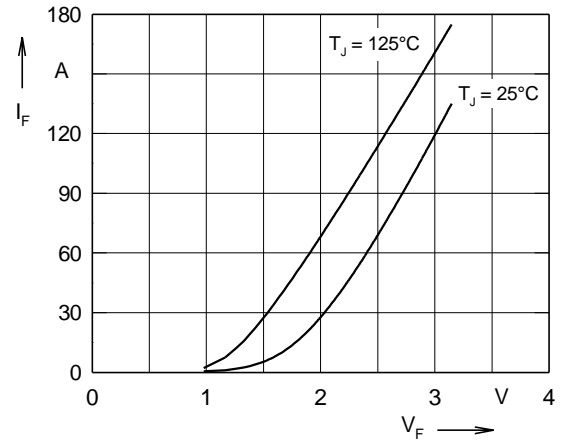


Fig. 4 Typ. forward characteristics of free wheeling diode

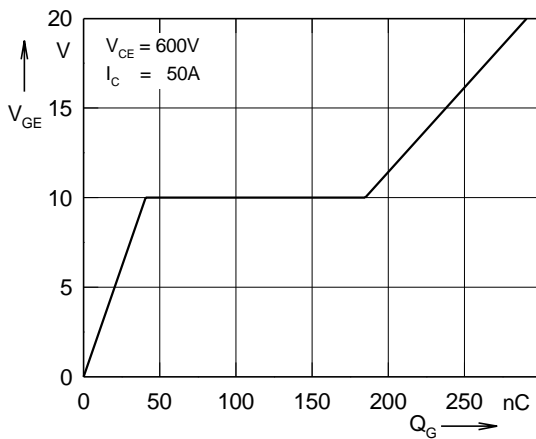


Fig. 5 Typ. turn on gate charge

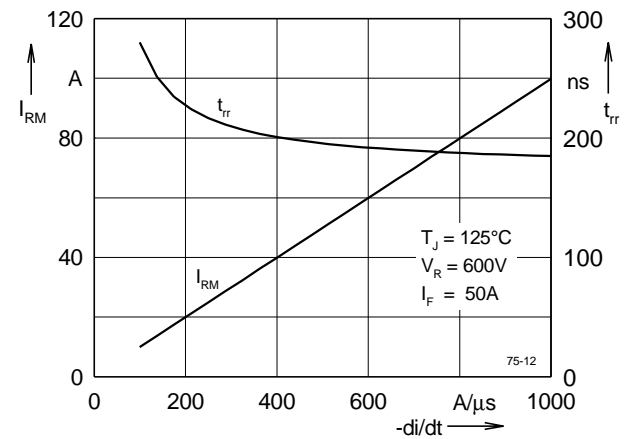


Fig. 6 Typ. turn off characteristics of free wheeling diode

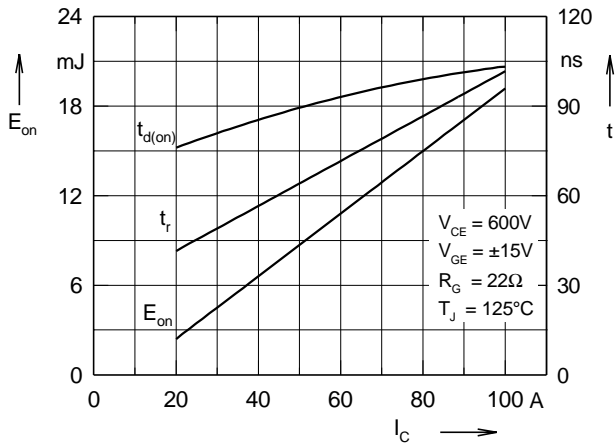


Fig. 7 Typ. turn on energy and switching times versus collector current

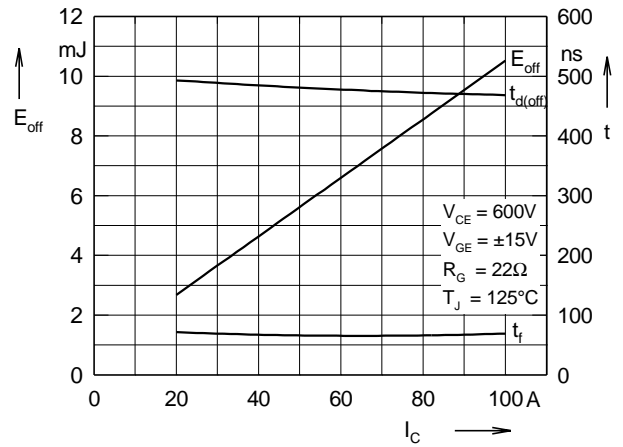


Fig. 8 Typ. turn off energy and switching times versus collector current

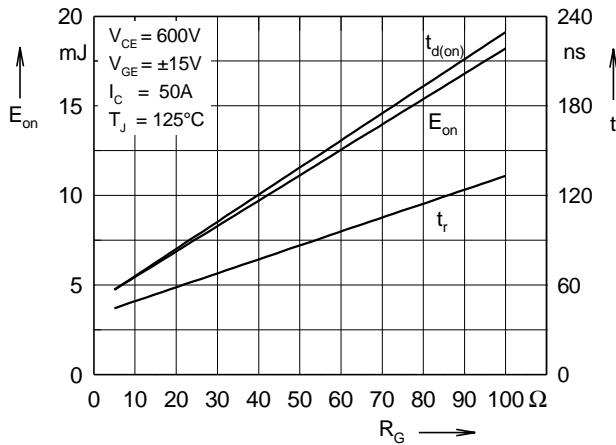


Fig. 9 Typ. turn on energy and switching times versus gate resistor

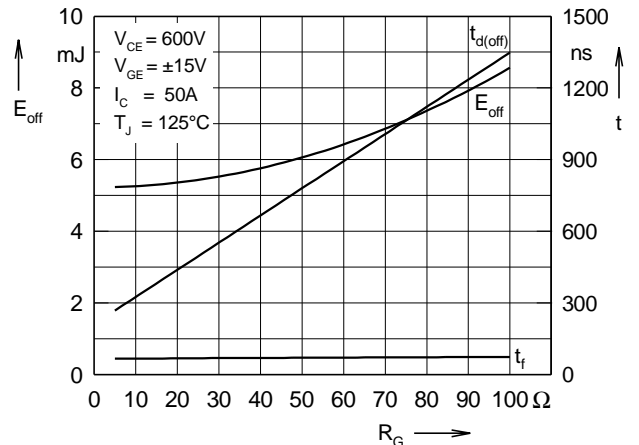


Fig.10 Typ. turn off energy and switching times versus gate resistor

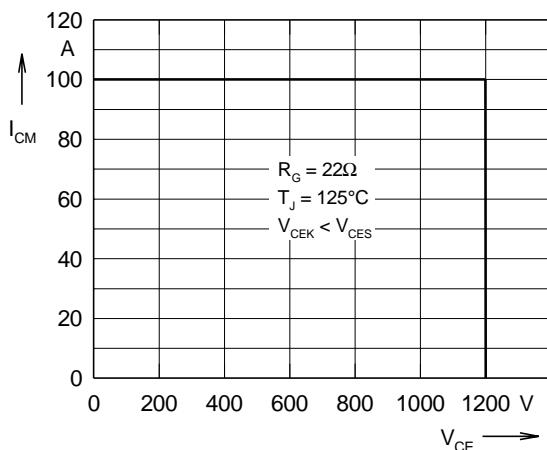


Fig. 11 Reverse biased safe operating area RBSOA

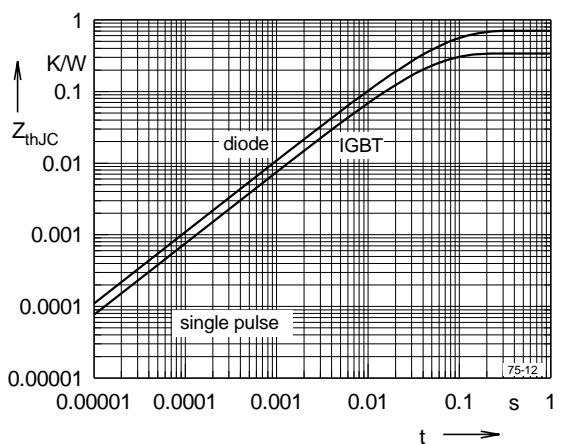


Fig. 12 Typ. transient thermal impedance