

# IGBT Modules

## Sixpack

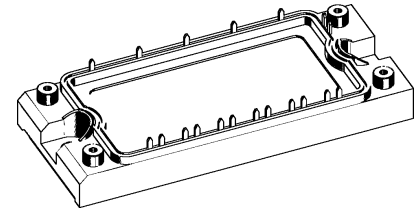
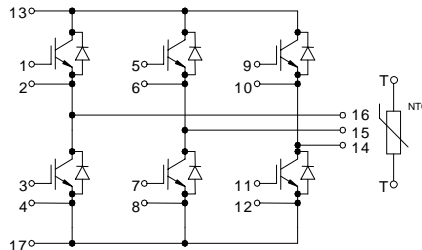
Short Circuit SOA Capability  
 Square RBSOA

$I_{C25} = 62 \text{ A}$   
 $V_{CES} = 1200 \text{ V}$   
 $V_{CE(sat) \text{ typ.}} = 2.2 \text{ V}$

### Preliminary Data

**Type:** NTC - Option:

**MWI 35-12 A7** without NTC  
**MWI 35-12 A7T** with NTC



IGBTs			
Symbol	Conditions	Maximum Ratings	
$V_{CES}$	$T_{VJ} = 25^\circ\text{C to } 150^\circ\text{C}$	1200	V
$V_{GES}$		$\pm 20$	V
$I_{C25}$	$T_C = 25^\circ\text{C}$	62	A
$I_{C80}$	$T_C = 80^\circ\text{C}$	44	A
<b>RBSOA</b>	$V_{GE} = \pm 15 \text{ V}; R_G = 39 \Omega; T_{VJ} = 125^\circ\text{C}$ Clamped inductive load; $L = 100 \mu\text{H}$	$I_{CM} = 70$ $V_{CEK} \leq V_{CES}$	A
<b><math>t_{SC}</math> (SCSOA)</b>	$V_{CE} = V_{CES}; V_{GE} = \pm 15 \text{ V}; R_G = 39 \Omega; T_{VJ} = 125^\circ\text{C}$ non-repetitive	10	$\mu\text{s}$
<b><math>P_{tot}</math></b>	$T_C = 25^\circ\text{C}$	280	W

### 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 parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

### Advantages

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

Symbol	Conditions	Characteristic Values ( $T_{VJ} = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$V_{CE(sat)}$	$I_C = 35 \text{ A}; V_{GE} = 15 \text{ V}; T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$	2.2	2.6	2.8 V
$V_{GE(th)}$	$I_C = 1.2 \text{ mA}; V_{GE} = V_{CE}$	4.5		6.5 V
$I_{CES}$	$V_{CE} = V_{CES}; V_{GE} = 0 \text{ V}; T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$	2		2 mA
$I_{GES}$	$V_{CE} = 0 \text{ V}; V_{GE} = \pm 20 \text{ V}$			200 nA
$t_{d(on)}$ $t_r$ $t_{d(off)}$ $t_f$ $E_{on}$ $E_{off}$	Inductive load, $T_{VJ} = 125^\circ\text{C}$ $V_{CE} = 600 \text{ V}; I_C = 35 \text{ A}$ $V_{GE} = \pm 15 \text{ V}; R_G = 39 \Omega$		100	ns
			80	ns
			500	ns
			70	ns
			5.4	mJ
			4.2	mJ
$C_{ies}$	$V_{CE} = 25 \text{ V}; V_{GE} = 0 \text{ V}; f = 1 \text{ MHz}$	2000		pF
$Q_{Gon}$	$V_{CE} = 600 \text{ V}; V_{GE} = 15 \text{ V}; I_C = 35 \text{ A}$	140		nC
$R_{thJC}$	(per IGBT)			0.44 K/W

### Typical Applications

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

### Diodes

Symbol	Conditions	Maximum Ratings	
$I_{F25}$	$T_C = 25^\circ\text{C}$	50	A
$I_{F80}$	$T_C = 80^\circ\text{C}$	33	A

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
$V_F$	$I_F = 35\text{ A}; V_{GE} = 0\text{ V}; T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$		1.9	2.8 V
$I_{RM}$ $t_{tr}$	$I_F = 35\text{ A}; di_F/dt = -400\text{ A}/\mu\text{s}; T_{VJ} = 125^\circ\text{C}$ $V_R = 600\text{ V}; V_{GE} = 0\text{ V}$		20	A
			200	ns
$R_{thJC}$	(per diode)			1.19 K/W

### Temperature Sensor NTC (MWI ... A7T version only)

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
$R_{25}$ $B_{25/50}$	$T = 25^\circ\text{C}$	4.75	5.0 3375	5.25 k $\Omega$ K

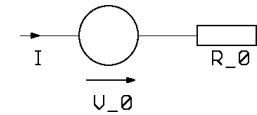
### Module

Symbol	Conditions	Maximum Ratings	
$T_{VJ}$ $T_{stg}$		-40...+150	$^\circ\text{C}$
$V_{ISOL}$	$I_{ISOL} \leq 1\text{ mA}; 50/60\text{ Hz}$	2500	V~
$M_d$	Mounting torque (M5)	2.7 - 3.3	Nm

Symbol	Conditions	Characteristic Values		
		min.	typ.	max.
$R_{pin-chip}$			5	m $\Omega$
$d_S$ $d_A$	Creepage distance on surface Strike distance in air	6		mm
$R_{thCH}$	with heatsink compound		0.02	K/W
Weight			180	g

### Equivalent Circuits for Simulation

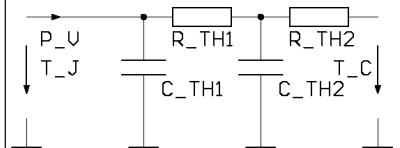
#### Conduction



IGBT (typ. at  $V_{GE} = 15\text{ V}; T_J = 125^\circ\text{C}$ )  
 $V_0 = 1.6\text{ V}; R_0 = 28\text{ m}\Omega$

Free Wheeling Diode (typ. at  $T_J = 125^\circ\text{C}$ )  
 $V_0 = 1.3\text{ V}; R_0 = 24.9\text{ m}\Omega$

#### Thermal Response



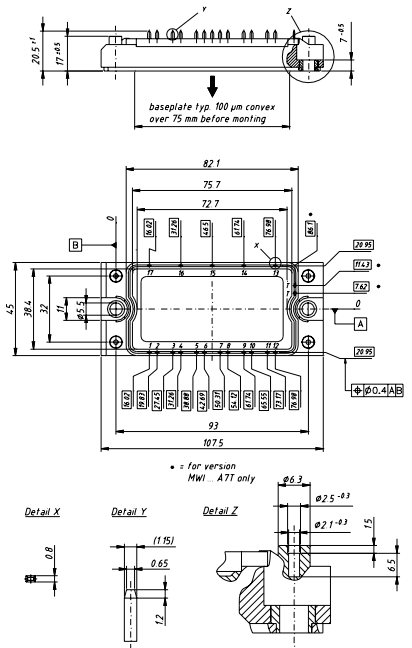
IGBT (typ.)

$C_{th1} = 0.166\text{ J/K}; R_{th1} = 0.342\text{ K/W}$   
 $C_{th2} = 1.921\text{ J/K}; R_{th2} = 0.098\text{ K/W}$

Free Wheeling Diode (typ.)

$C_{th1} = 0.081\text{ J/K}; R_{th1} = 0.973\text{ K/W}$   
 $C_{th2} = 0.915\text{ J/K}; R_{th2} = 0.217\text{ K/W}$

### Dimensions in mm (1 mm = 0.0394")



Higher magnification see outlines.pdf

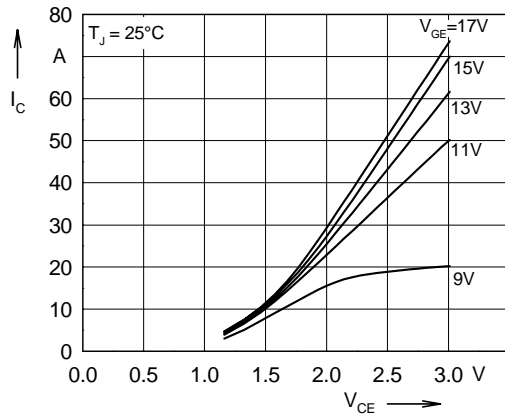


Fig. 1 Typ. output characteristics

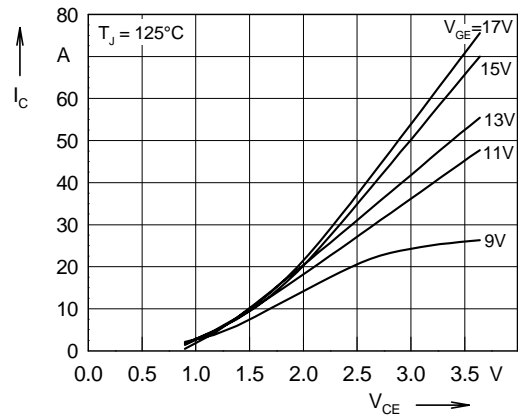


Fig. 2 Typ. output characteristics

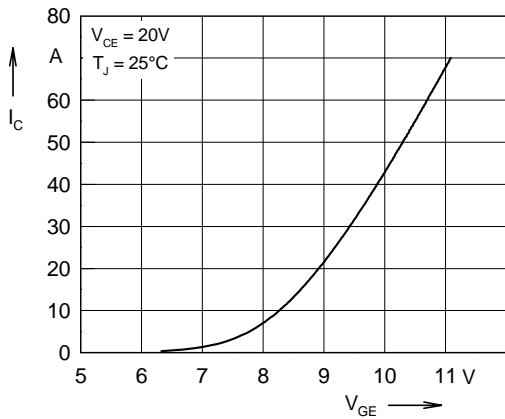


Fig. 3 Typ. transfer characteristics

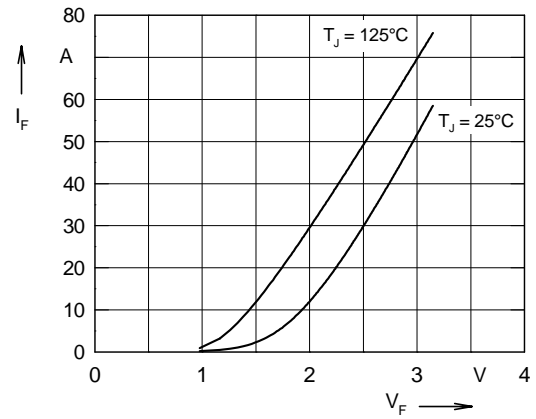


Fig. 4 Typ. forward characteristics of free wheeling diode

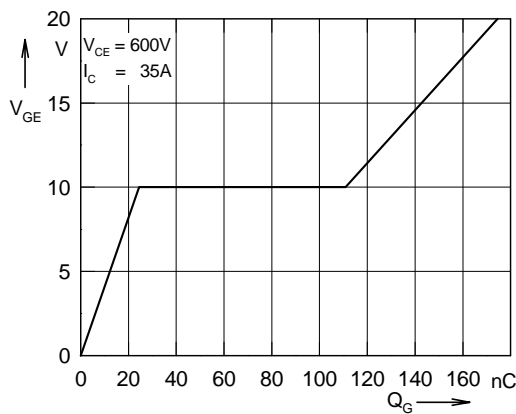


Fig. 5 Typ. turn on gate charge

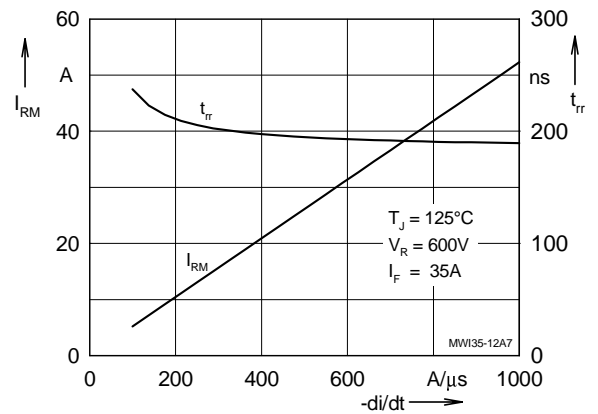


Fig. 6 Typ. turn off characteristics of free wheeling diode

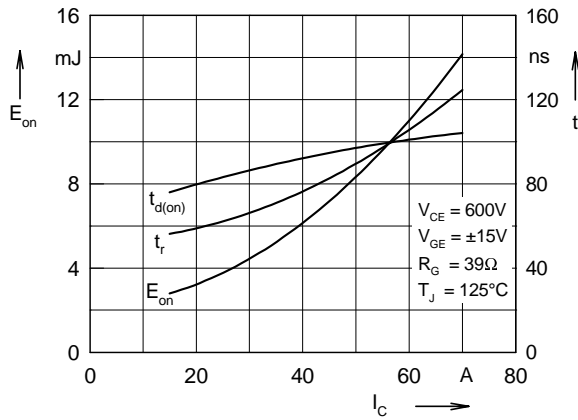


Fig. 7 Typ. turn on energy and switching times versus collector current

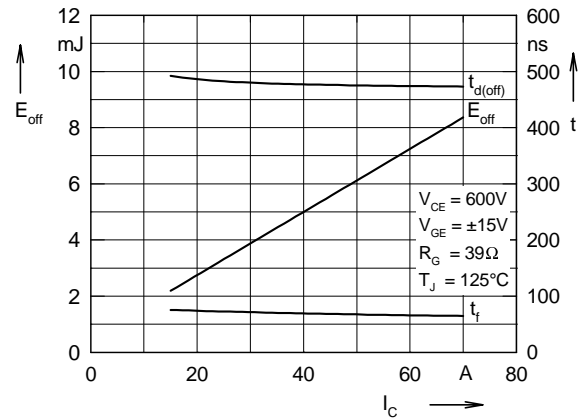


Fig. 8 Typ. turn off energy and switching times versus collector current

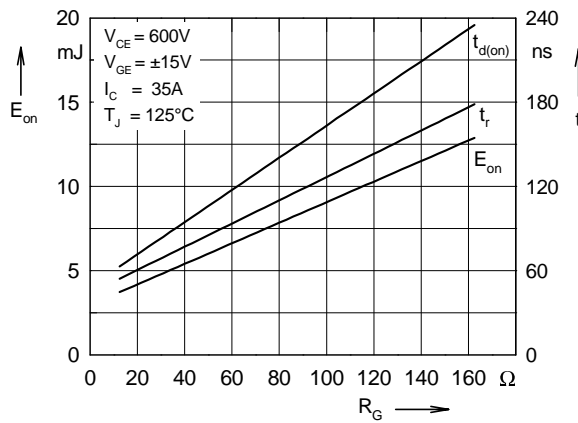


Fig. 9 Typ. turn on energy and switching times versus gate resistor

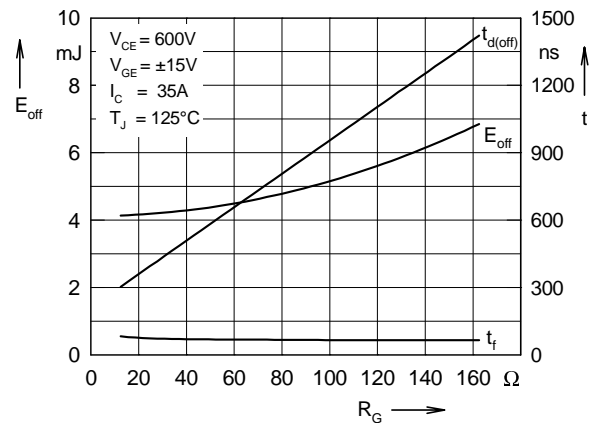


Fig.10 Typ. turn off energy and switching times versus gate resistor

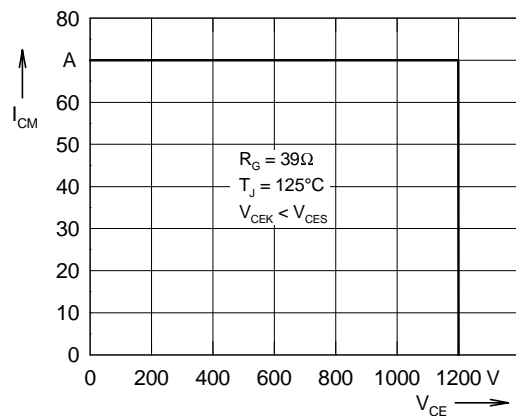


Fig. 11 Reverse biased safe operating area RBSOA

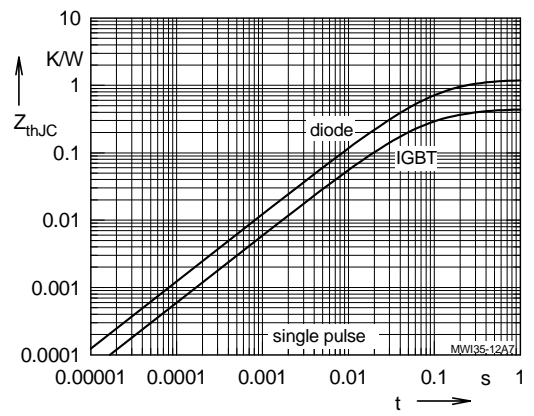


Fig. 12 Typ. transient thermal impedance