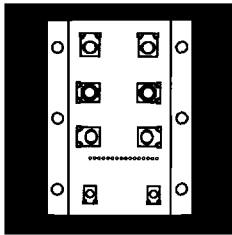


## H-BRIDGE, MULTI-CHIP MODULES IN AN INDUSTRIAL ISOLATED PACKAGE



60 To 600 Volt, 50 To 150 Amp Modules With Internal Gate Drive, H-Bridge Configuration

### FEATURES

- Internal Gate Drive
- Isolated Heat Sink
- Low Inductance Design
- Fast Switching Speed
- Low On Voltage
- Easy-To-Connect To Package

### DESCRIPTION

These modules are ideally suited for high density, high reliability switching applications such as Motion Control, UPS and high power SMPS. These multi-chip modules incorporate in one package both the power semiconductors and the gate drive circuitry.

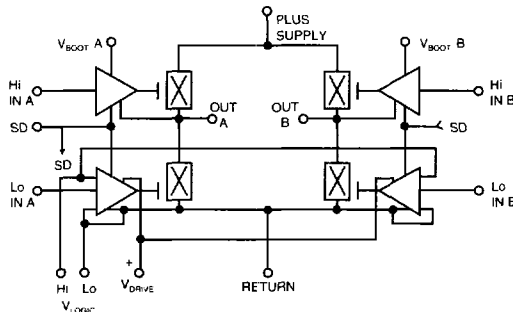
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### GENERAL CHARACTERISTICS (Per Switch) @ 25°C

Part Number	Power Device	Voltage (V)*	Current (A)	R <sub>DS(on)</sub> or V <sub>CE(sat)</sub>	Fall Time
OMD150N06FL	MOSFET	60	150	8 m ohms	-
OMD120N10FL	MOSFET	100	120	16 m ohms	-
OMD60L60FL	IGBT	600	75	1.8 Volts	1 μs
OMD50F60FL	IGBT	600	75	2.7 Volts	500 ns

\*Other voltages available.

### SCHEMATIC



Note: IGBT's have anti-parallel diodes included.

**ELECTRICAL CHARACTERISTICS: OMD150N06FL/Per Switch** ( $T_C = 25^\circ\text{C}$  unless otherwise specified)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
<b>OFF CHARACTERISTICS</b>					
Drain-Source Breakdown Voltage, $I_D = 500 \mu\text{A}$ , $V_{GS} = 0$	$V_{(BR)DSS}$	60	-	-	V
Zero Gate Voltage Drain Current = $V_{GS}$ , $V_{DS} = \text{Max. Rat.}$ $V_{DS} = \text{Max. Rat.} \times 0.8$ , $T_J = 125^\circ\text{C}$	$I_{DSS}$	-	-	25	$\mu\text{A}$
		-	-	250	$\mu\text{A}$

**ON CHARACTERISTICS**

Static Drain-Source On-Resistance, $V_{GS} = 10 \text{ Vdc}$ , $I_D = 10 \text{ A}$ $T_J = 100^\circ\text{C}$	$R_{DS(on)}$	-	-	8	$\text{m}\Omega$
		-	-	16	$\text{m}\Omega$

**DYNAMIC CHARACTERISTICS**

Output Capacitance	$V_{DS} = 25 \text{ V}$ , $V_{GS} = 0$ , $f = 1.0 \text{ MHz}$	$C_{oss}$	-	2000	-	pF
Reverse Transfer Capacitance		$C_{rss}$	-	400	-	pF

**SWITCHING CHARACTERISTICS**

Turn-On Delay Time	$V_{DO} = 30 \text{ V}$ , $I_D = 150 \text{ A}$	$t_{d(on)}$	-	1000	-	ns
Rise Time		$t_r$	-	500	-	ns
Turn-Off Delay Time		$t_{d(off)}$	-	1000	-	ns
Fall Time		$t_f$	-	250	-	ns

**SOURCE DRAIN DIODE CHARACTERISTICS**

Forward On-Voltage	$I_{SD} = 150 \text{ A}$ , $V_{GS} = 0$	$V_{SD}$	-	-	1.1	V
Reverse Recovery Time		$t_{rr}$	-	50	-	ns
Reverse Recovered Charge		$Q_{rr}$	-	.2	-	$\mu\text{C}$

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**ELECTRICAL CHARACTERISTICS: OMD120N10FL/Per Switch** ( $T_C = 25^\circ\text{C}$  unless otherwise specified)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
<b>OFF CHARACTERISTICS</b>					
Drain-Source Breakdown Voltage, $I_D = 500 \mu\text{A}$ , $V_{GS} = 0$	$V_{(BR)DSS}$	100	-	-	V
Zero Gate Voltage Drain Current = $V_{GS}$ , $V_{DS} = \text{Max. Rat.}$ $V_{DS} = \text{Max. Rat.} \times 0.8$ , $T_C = 70^\circ\text{C}$	$I_{DSS}$	-	-	500	$\mu\text{A}$
		-	-	2000	$\mu\text{A}$

**ON CHARACTERISTICS**

Static Drain-Source On-Resistance, $V_{GS} = 10 \text{ Vdc}$ , $I_D = 10 \text{ A}$ $T_C = 70^\circ\text{C}$	$R_{DS(on)}$	-	-	16	$\text{m}\Omega$
		-	-	32	$\text{m}\Omega$

**DYNAMIC CHARACTERISTICS**

Output Capacitance	$V_{DS} = 25 \text{ V}$ , $V_{GS} = 0$ , $f = 1.0 \text{ MHz}$	$C_{oss}$	-	2400	-	pF
Reverse Transfer Capacitance		$C_{rss}$	-	600	-	pF

**SWITCHING CHARACTERISTICS**

Turn-On Delay Time	$V_{DO} = 80 \text{ V}$ , $I_D = 60 \text{ A}$ $R_{GS} = 50 \Omega$ , $V_{GS} = 10 \text{ V}$	$t_{d(on)}$	-	1000	-	ns
Rise Time		$t_r$	-	300	-	ns
Turn-Off Delay Time		$t_{d(off)}$	-	1000	-	ns
Fall Time		$t_f$	-	250	-	ns

**SOURCE DRAIN DIODE CHARACTERISTICS**

Forward On-Voltage	$I_{SD} = 120 \text{ A}$ , $V_{GS} = 0$ , $di/dt = 100 \text{ A}/\mu\text{Sec}$	$V_{SD}$	-	-	1.6	V
Reverse Recovery Time		$t_{rr}$	-	180	-	ns
Reverse Recovered Charge		$Q_{rr}$	-	4	-	$\mu\text{C}$

**ELECTRICAL CHARACTERISTICS: OMD60L60FL/Per Switch** ( $T_C = 25^\circ\text{C}$  unless otherwise specified)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
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**OFF CHARACTERISTICS**

Collector Emitter Breakdown Voltage, $I_C = 250 \mu\text{A}$ , $V_{CE} = 0$	$V_{(BR)CES}$	600	-	-	V
Zero Gate Voltage Drain Current, $V_{CE} = \text{Max. Rat.}$ , $V_{GE} = 0$ $V_{CE} = 0.8 \text{ Max. Rat.}$ , $V_{GE} = 0$ , $T_J = 125^\circ\text{C}$	$I_{CES}$	-	-	.25	mA
		-	-	1.0	mA

**ON CHARACTERISTICS**

Collector Emitter Saturation Voltage, $V_{GE} = 15 \text{ V}$ , $I_C = 60 \text{ A}$ , $T_C = 25^\circ\text{C}$	$V_{CE(sat)}$	-	-	1.8	V
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**DYNAMIC CHARACTERISTICS**

Output Capacitance	$V_{GE} = 0 \text{ V}$ , $V_{CE} = 25 \text{ V}$ , $f = 1.0 \text{ MHz}$	$C_{oss}$	-	350	-	pF
Reverse Transfer Capacitance		$C_{rss}$	-	100	-	pF

**SWITCHING CHARACTERISTICS**

Turn-On Delay Time	$V_{CC} = 480 \text{ V}$ , $I_C = 60 \text{ A}$ $V_{GE} = 15 \text{ V}$	$t_{(on)}$	-	1000	-	ns
Rise Time		$t_r$	-	250	-	ns
Turn-Off Delay Time		$t_{(off)}$	-	1000	-	ns
Fall Time		$t_f$	-	500	-	ns

**SOURCE DRAIN DIODE CHARACTERISTICS**

Maximum Forward Voltage	$I_F = 60 \text{ A}$ , $T_C = 25^\circ\text{C}$	$V_f$	-	-	1.85	V
	$I_F = 60 \text{ A}$ , $T_J = 125^\circ\text{C}$		-	-	1.5	
Maximum Reverse Current	$V_R = 600 \text{ V}$ , $T_C = 25^\circ\text{C}$	$I_r$	-	-	200	$\mu\text{A}$
	$V_R = 480 \text{ V}$ , $T_J = 125^\circ\text{C}$		-	-	14	mA
Reverse Recovery Time	$I_F = 1 \text{ A}$ , $di/dt = 200 \text{ A}/\mu\text{S}$ $V_R = 30 \text{ V}$ , $T_J = 25^\circ\text{C}$	$t_{rr}$	-	-	50	nS

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**ELECTRICAL CHARACTERISTICS: OMD150F60ML/Per Switch** ( $T_C = 25^\circ\text{C}$  unless otherwise specified)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
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**OFF CHARACTERISTICS**

Collector Emitter Breakdown Voltage, $I_C = 250 \mu\text{A}$ , $V_{CE} = 0$	$V_{(BR)CES}$	600	-	-	V
Zero Gate Voltage Drain Current, $V_{CE} = \text{Max. Rat.}$ , $V_{GE} = 0$ $V_{CE} = 0.8 \text{ Max. Rat.}$ , $V_{GE} = 0$ , $T_J = 125^\circ\text{C}$	$I_{CES}$	-	-	.25	mA
		-	-	1.0	mA

**ON CHARACTERISTICS**

Collector Emitter Saturation Voltage, $V_{GE} = 15 \text{ V}$ , $I_C = 50 \text{ A}$ , $T_C = 25^\circ\text{C}$	$V_{CE(sat)}$	-	-	2.7	V
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**DYNAMIC CHARACTERISTICS**

Output Capacitance	$V_{GE} = 0 \text{ V}$ , $V_{CE} = 25 \text{ V}$ , $f = 1.0 \text{ MHz}$	$C_{oss}$	-	350	-	pF
Reverse Transfer Capacitance		$C_{rss}$	-	100	-	pF

**SWITCHING CHARACTERISTICS**

Turn-On Delay Time	$V_{OC} = 480 \text{ V}$ , $I_C = 50 \text{ A}$ $V_{GE} = 15 \text{ V}$	$t_{(on)}$	-	1000	-	ns
Rise Time		$t_r$	-	200	-	ns
Turn-Off Delay Time		$t_{(off)}$	-	1000	-	ns
Fall Time		$t_f$	-	300	-	ns

**SOURCE DRAIN DIODE CHARACTERISTICS**

Maximum Forward Voltage	$I_F = 100 \text{ A}$ , $T_C = 25^\circ\text{C}$	$V_f$	-	-	1.85	V
	$I_F = 100 \text{ A}$ , $T_J = 125^\circ\text{C}$		-	-	1.5	
Maximum Reverse Current	$V_R = 600 \text{ V}$ , $T_C = 25^\circ\text{C}$	$I_r$	-	-	200	$\mu\text{A}$
	$V_R = 480 \text{ V}$ , $T_J = 125^\circ\text{C}$		-	-	14	mA
Reverse Recovery Time	$I_F = 1 \text{ A}$ , $di/dt = 200 \text{ A}/\mu\text{S}$ $V_R = 30 \text{ V}$ , $T_J = 25^\circ\text{C}$	$t_{rr}$	-	-	50	nS

**ABSOLUTE MAXIMUM RATINGS** Per Switch ( $T_C = 25^\circ\text{C}$  unless otherwise noted)  
**IGBT / MOSFET**

Parameters		150N06FL	120N10FL	60L60FL	50F60FL	Units
	Plus Supply	60	100	600	600	V
$I_C @ T_C = 25^\circ\text{C}$	Continuous Drain Current	150	120	75	75	A
$I_C @ T_J = 100^\circ\text{C}$	Continuous Drain Current	130	90	60	50	A
$I_C$ Pulsed	Pulsed Drain Current <sup>1</sup>	450	450	200	200	A
Junction-To-Case	Linear Derating Factor	1.0	1.67	1.67	1.67	W/ $^\circ\text{C}$
Junction-To-Ambient	Linear Derating Factor	.02	.02	.02	.02	W/ $^\circ\text{C}$
$R_{\theta JC}$	Junction-To-Case	1.0	.60	.60	.60	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-To-Ambient	50	50	50	50	$^\circ\text{C}/\text{W}$

**Rectifier**

PIV		60	100	600	600	V
$I_O$		150	120	60	50	A
$t_{rr}$		50	180	35	35	nsec

**Gate Driver**

$V_{DD}$	Either Chip	18	18	18	18	V
$V_{LSD}$ to $V_{HSD}$		75	100	500	500	V
Logic Input Voltage		-0.3 to $V_L$	-0.3 to $V_L$	-0.3 to $V_L$	-0.3 to $V_L$	V
$T_I$		150	150	150	150	$^\circ\text{C}$

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**MECHANICAL OUTLINE (LP-8)**

