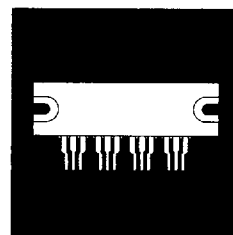


500 Volt And 1000 Volt, 5 To 25 Amp, N-Channel IGBTs With Uncommitted Ultra Fast Diodes In Multi-Chip Packages



FEATURES

- One Or Two Circuits Per Package
- 2500V Isolated Packages
- Low Turn-Off Switching Losses
- 50nS Soft Recovery Diode

APPLICATIONS

- Buck, Boost, Flyback Converters
- Assymetrical Half-Bridges
- Induction Heating
- High Density Inductive Switching

DESCRIPTION

The OM65xx series is a line of IGBT power modules including an uncommitted fast recovery diode. They are both available in 500 Volt and 1000 Volt, 5 Amp to 25 Amp, single and dual configuration being standard. Thanks to the use of a ceramic DBC substrate, optimum thermal management as well as isolation are provided.

IGBT	Maximum Ratings (Per Device)	500V			1000V			Units
		OM6537	OM6538	OM6539	OM6540	OM6541	OM6542	
$I_C @ T_C = 25^\circ\text{C}$	Continuous Collector Current	10	26	49	10	21	25	A
$I_C @ T_C = 85^\circ\text{C}$	Continuous Collector Current	5	12	25	5	10	15	A
$V_{IBRICES}$	Collector to Emitter Breakdown Voltage	500	500	500	1000	1000	1000	V
V_{GE}	Gate to Emitter Voltage	± 20	± 20	± 20	± 20	± 20	± 20	V
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	35	68	147	35	68	80	W
$P_D @ T_C = 85^\circ\text{C}$	Maximum Power Dissipation	16	36	75	16	55	55	W
T_{J}, T_{ISg}	Operating and Storage Temperature	-40 to 150	-40 to 150	-40 to 150	-40 to 150	-40 to 150	-40 to 150	$^\circ\text{C}$

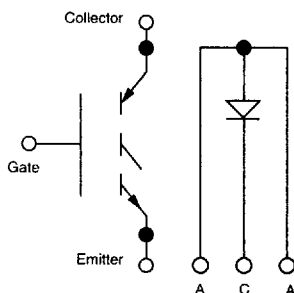
Diode

V_{rm}	Peak Repetitive Reverse Voltage	600	600	600	1000	1000	1000	V
$I_{F(AV)} @ T_C = 25^\circ\text{C}$	Average Rectified Forward Current	8	30	30	8	30	30	A
$I_{F(AV)} @ T_C = 85^\circ\text{C}$	Average Rectified Forward Current	5	19	19	5	19	19	A
T_{J}, T_{ISg}	Operating and Storage Temperature	-40 to 150	-40 to 150	-40 to 150	-40 to 150	-40 to 150	-40 to 150	$^\circ\text{C}$

Module Thermal Characteristics

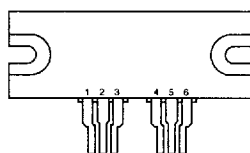
$R\theta_{JC}$, IGBT	Thermal Resistance, Junction-to-Case	4	1.2	0.85	1.7	1.7	1.2	$^\circ\text{C/W}$
$R\theta_{JC}$, Diode	Thermal Resistance, Junction-to-Case	4	2.6	2.6	4	2.6	2.6	$^\circ\text{C/W}$
$R\theta_{CS}$, Module	Thermal Resistance, Case-to-Sink (1)	0.1	0.1	0.1	0.1	0.1	0.1	$^\circ\text{C/W}$

SCHEMATIC



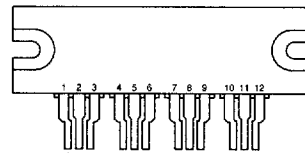
PIN CONNECTIONS

OM65XXSP1



Pin 1: Gate Pin 4: Anode
Pin 2: Collector Pin 5: Cathode
Pin 3: Emitter Pin 6: Anode

OM65XXSP2



Pin 1, 7: Gate Pin 4, 10: Anode
Pin 2, 8: Collector Pin 5, 11: Cathode
Pin 3, 9: Emitter Pin 6, 12: Anode

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OM6537SP1/OM6537SP2**IGBT CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)****Parameter - OFF**

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)CES}$	Collector to Emitter Breakdown Voltage	500			V	$V_{GE} = 0$ $I_C = 250 \mu\text{A}$
I_{CES}	Zero Gate Voltage Drain Current			0.25 1	mA mA	$V_{CE} = \text{Max. Rat.}, V_{GE} = 0$ $V_{CE} = 0.8 \text{ Max. Rat.}, V_{GE} = 0$ $T_J = 150^\circ\text{C}$
I_{GES}	Gate Emitter Leakage Current			± 100	nA	$V_{GE} = \pm 20 \text{ V}$ $V_{CE} = 0 \text{ V}$

Parameter - ON

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{GE(th)}$	Gate Threshold Voltage	2		4	V	$V_{CE} = V_{GE}, I_C = 1 \text{ mA}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage		3.2		V	$V_{GE} = 15 \text{ V}, I_C = 10 \text{ A}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage			3	V	$V_{GE} = 15 \text{ V}, I_C = 5 \text{ A}$ $T_J = 150^\circ\text{C}$

Dynamic

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
G_{fs}	Forward Transconductance		2		S	$V_{CE} = 20 \text{ V}, I_C = 5 \text{ A}$
C_{iss}	Input Capacitance		260		pF	$V_{GE} = 0$
C_{oss}	Output Capacitance		50		pF	$V_{CE} = 25 \text{ V}$
C_{res}	Reverse Transfer Capacitance		20		pF	$f = 1 \text{ MHz}$
$T_{d(on)}$	Turn-On Delay Time		37		nS	$V_{CC} = 400 \text{ V}, I_C = 5 \text{ A}$ $V_{GE} = 15 \text{ V}$ $R_g = 47 \Omega$ $L = .1 \text{ mH}$ $T_J = 150^\circ\text{C}$
T_r	Rise Time		150		nS	
$T_{d(off)}$	Turn-Off Delay Time		350		nS	
T_f	Fall Time		810		nS	
E_{ts}	Turn-Off Switching Losses		0.95		mJ	

DIODE CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
V_f	Maximum Forward Voltage			1.5 1.4	V V	$I_F = 8 \text{ A}, T_J = 25^\circ\text{C}$ $I_F = 5 \text{ A}, T_J = 150^\circ\text{C}$
I_r	Maximum Reverse Current			150 1.5	μA mA	$V_R = 500 \text{ V}, T_J = 25^\circ\text{C}$ $V_R = 400 \text{ V}, T_J = 150^\circ\text{C}$
T_{rr}	Reverse Recovery Time			100	nS	$I_F = 1 \text{ A}, d_i/d_r = -15 \text{ A}/\mu\text{S}$ $V_R = 30 \text{ V}, T_J = 25^\circ\text{C}$

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OM6538SP1/OM6538SP2**IGBT CHARACTERISTICS ($T_j = 25^\circ\text{C}$ unless otherwise specified)****Parameter - OFF**

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)CES}$	Collector to Emitter Breakdown Voltage	500			V	$V_{GE} = 0$ $I_C = 250 \mu\text{A}$
I_{CES}	Zero Gate Voltage Drain Current			0.25 1	mA mA	$V_{CE} = \text{Max. Rat.}, V_{GE} = 0$ $V_{CE} = 0.8 \text{ Max. Rat.}, V_{GE} = 0$ $T_j = 150^\circ\text{C}$
I_{GES}	Gate Emitter Leakage Current			± 100	nA	$V_{GE} = \pm 20 \text{ V}$ $V_{CE} = 0 \text{ V}$

Parameter - ON

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{GE(th)}$	Gate Threshold Voltage	2		4	V	$V_{CE} = V_{GE}, I_C = 1 \text{ mA}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage		2.6		V	$V_{GE} = 15 \text{ V}, I_C = 26 \text{ A}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage			3	V	$V_{GE} = 15 \text{ V}, I_C = 12 \text{ A}$ $T_j = 150^\circ\text{C}$

Dynamic

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
G_{fs}	Forward Transconductance		6		S	$V_{CE} = 20 \text{ V}, I_C = 10 \text{ A}$
C_{iss}	Input Capacitance		980		pF	$V_{GE} = 0$
C_{oss}	Output Capacitance		106		pF	$V_{CE} = 25 \text{ V}$
C_{res}	Reverse Transfer Capacitance		30		pF	$f = 1 \text{ MHz}$
$T_{d(on)}$	Turn-On Delay Time		56		nS	$V_{CC} = 400 \text{ V}, I_C = 10 \text{ A}$ $V_{GE} = 15 \text{ V}$ $R_g = 47 \Omega$ $L = .1 \text{ mH}$ $T_j = 150^\circ\text{C}$
T_r	Rise Time		115		nS	
$T_{d(off)}$	Turn-Off Delay Time		170		nS	
T_f	Fall Time		300		nS	
E_{is}	Turn-Off Switching Losses		1		mJ	

DIODE CHARACTERISTICS ($T_j = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
V_f	Maximum Forward Voltage			1.9 1.8	V V	$I_F = 30 \text{ A}, T_j = 25^\circ\text{C}$ $I_F = 19 \text{ A}, T_j = 150^\circ\text{C}$
I_r	Maximum Reverse Current			150 1.5	μA mA	$V_R = 500 \text{ V}, T_j = 25^\circ\text{C}$ $V_R = 400 \text{ V}, T_j = 150^\circ\text{C}$
T_{rr}	Reverse Recovery Time			100	nS	$I_F = 1 \text{ A}, d_i/d_r = -15 \text{ A}/\mu\text{S}$ $V_R = 30 \text{ V}, T_j = 25^\circ\text{C}$

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OM6539SP1/OM6539SP2IGBT CHARACTERISTICS ($T_j = 25^\circ\text{C}$ unless otherwise specified)**Parameter - OFF**

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)CES}$	Collector to Emitter Breakdown Voltage	500			V	$V_{GE} = 0$ $I_C = 250\ \mu\text{A}$
I_{CES}	Zero Gate Voltage Drain Current			0.25 1	mA mA	$V_{CE} = \text{Max. Rat.}, V_{GE} = 0$ $V_{CE} = 0.8 \text{ Max. Rat.}, V_{GE} = 0$ $T_j = 150^\circ\text{C}$
I_{GES}	Gate Emitter Leakage Current			± 100	nA	$V_{GE} = \pm 20\ \text{V}$ $V_{CE} = 0\ \text{V}$

Parameter - ON

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{GE(th)}$	Gate Threshold Voltage	2		4	V	$V_{CE} = V_{GE}, I_C = 1\ \text{mA}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage		2.6		V	$V_{GE} = 15\ \text{V}, I_C = 50\ \text{A}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage			3	V	$V_{GE} = 15\ \text{V}, I_C = 25\ \text{A}$ $T_j = 150^\circ\text{C}$

Dynamic

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
G_{fs}	Forward Transconductance		6		S	$V_{CE} = 20\ \text{V}, I_C = 10\ \text{A}$
C_{iss}	Input Capacitance		980		pF	$V_{GE} = 0$
C_{oss}	Output Capacitance		106		pF	$V_{CE} = 25\ \text{V}$
C_{res}	Reverse Transfer Capacitance		30		pF	$f = 1\ \text{MHz}$
$T_{d(on)}$	Turn-On Delay Time		56		nS	$V_{CC} = 400\ \text{V}, I_C = 10\ \text{A}$ $V_{GE} = 15\ \text{V}$ $R_g = 47\ \Omega$ $L = .1\ \text{mH}$ $T_j = 150^\circ\text{C}$
T_r	Rise Time		115		nS	
$T_{d(off)}$	Turn-Off Delay Time		170		nS	
T_f	Fall Time		300		nS	
E_{ts}	Turn-Off Switching Losses		1		mJ	

DIODE CHARACTERISTICS ($T_j = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
V_f	Maximum Forward Voltage			1.9 1.8	V V	$I_F = 30\ \text{A}, T_j = 25^\circ\text{C}$ $I_F = 19\ \text{A}, T_j = 150^\circ\text{C}$
I_r	Maximum Reverse Current			150 1.5	μA mA	$V_R = 500\ \text{V}, T_j = 25^\circ\text{C}$ $V_R = 400\ \text{V}, T_j = 150^\circ\text{C}$
T_{rr}	Reverse Recovery Time			110	nS	$I_F = 1\ \text{A}, d_i/d_t = -15\ \text{A}/\mu\text{S}$ $V_R = 30\ \text{V}, T_j = 25^\circ\text{C}$

OM6540SP1/OM6540SP2**IGBT CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)****Parameter - OFF**

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)CES}$	Collector to Emitter Breakdown Voltage	500			V	$V_{GE} = 0$ $I_C = 250 \mu\text{A}$
I_{CES}	Zero Gate Voltage Drain Current			0.25 1	mA mA	$V_{CE} = \text{Max. Rat.}, V_{GE} = 0$ $V_{CE} = 0.8 \text{ Max. Rat.}, V_{GE} = 0$ $T_J = 150^\circ\text{C}$
I_{GES}	Gate Emitter Leakage Current			± 100	nA	$V_{GE} = \pm 20 \text{ V}$ $V_{CE} = 0 \text{ V}$

Parameter - ON

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{GE(th)}$	Gate Threshold Voltage	4.5		6.5	V	$V_{CE} = V_{GE}, I_C = 1 \text{ mA}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage		3.5		V	$V_{GE} = 15 \text{ V}, I_C = 10 \text{ A}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage			3.8	V	$V_{GE} = 15 \text{ V}, I_C = 5 \text{ A}$ $T_J = 150^\circ\text{C}$

Dynamic

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
G_{fs}	Forward Transconductance		1.7		S	$V_{CE} = 20 \text{ V}, I_C = 15 \text{ A}$
C_{iss}	Input Capacitance		650		pF	$V_{GE} = 0$
C_{oss}	Output Capacitance		50		pF	$V_{CE} = 25 \text{ V}$
C_{res}	Reverse Transfer Capacitance		20		pF	$f = 1 \text{ MHz}$
$T_{d(on)}$	Turn-On Delay Time		50		nS	$V_{CC} = 600 \text{ V}, I_C = 5 \text{ A}$ $V_{GE} = 15 \text{ V}$ $R_g = 3.3 \Omega$ $L = .1 \text{ mH}$ $T_J = 150^\circ\text{C}$
T_r	Rise Time		200		nS	
$T_{d(off)}$	Turn-Off Delay Time		200		nS	
T_f	Fall Time		300		nS	
E_{ts}	Turn-Off Switching Losses		1.2		mJ	

DIODE CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
V_f	Maximum Forward Voltage			1.9 1.7	V V	$I_F = 8 \text{ A}, T_J = 25^\circ\text{C}$ $I_F = 5 \text{ A}, T_J = 150^\circ\text{C}$
I_r	Maximum Reverse Current			1.2 2.5	mA mA	$V_R = 1000 \text{ V}, T_J = 25^\circ\text{C}$ $V_R = 800 \text{ V}, T_J = 150^\circ\text{C}$
T_{rr}	Reverse Recovery Time			135	nS	$I_F = 1 \text{ A}, dI/dt = -15 \text{ A}/\mu\text{S}$ $V_R = 30 \text{ V}, T_J = 25^\circ\text{C}$

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OM6541SP1/OM6542SP2**IGBT CHARACTERISTICS** ($T_j = 25^\circ\text{C}$ unless otherwise specified)**Parameter - OFF**

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)CES}$	Collector to Emitter Breakdown Voltage	1000			V	$V_{GE} = 0$ $I_C = 250\ \mu\text{A}$
I_{CES}	Zero Gate Voltage Drain Current			0.25 1	mA mA	$V_{CE} = \text{Max. Rat.}, V_{GE} = 0$ $V_{CE} = 0.8 \text{ Max. Rat.}, V_{GE} = 0$ $T_j = 150^\circ\text{C}$
I_{GES}	Gate Emitter Leakage Current			± 100	nA	$V_{GE} = \pm 20\ \text{V}$ $V_{CE} = 0\ \text{V}$

Parameter - ON

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{GE(th)}$	Gate Threshold Voltage	4.5		6.5	V	$V_{CE} = V_{GE}, I_C = 1\ \text{mA}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage		3.5		V	$V_{GE} = 15\ \text{V}, I_C = 21\ \text{A}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage			3.8	V	$V_{GE} = 15\ \text{V}, I_C = 10\ \text{A}$ $T_j = 150^\circ\text{C}$

Dynamic

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
G_{fs}	Forward Transconductance		1.7		S	$V_{CE} = 20\ \text{V}, I_C = 15\ \text{A}$
C_{iss}	Input Capacitance		650		pF	$V_{GE} = 0$
C_{oss}	Output Capacitance		50		pF	$V_{CE} = 25\ \text{V}$
C_{res}	Reverse Transfer Capacitance		20		pF	$f = 1\ \text{MHz}$
$T_{d(on)}$	Turn-On Delay Time		50		nS	$V_{CC} = 600\ \text{V}, I_C = 10\ \text{A}$ $V_{GE} = 15\ \text{V}$ $R_g = 3.3\ \Omega$ $L = .1\ \text{mH}$ $T_j = 150^\circ\text{C}$
T_r	Rise Time		200		nS	
$T_{d(off)}$	Turn-Off Delay Time		200		nS	
T_f	Fall Time		300		nS	
E_{ts}	Turn-Off Switching Losses		2.4		mJ	

DIODE CHARACTERISTICS ($T_j = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
V_f	Maximum Forward Voltage			1.9 1.7	V V	$I_F = 8\ \text{A}, T_j = 25^\circ\text{C}$ $I_F = 5\ \text{A}, T_j = 150^\circ\text{C}$
I_r	Maximum Reverse Current			1.2 2	mA mA	$V_R = 1000\ \text{V}, T_j = 25^\circ\text{C}$ $V_R = 800\ \text{V}, T_j = 150^\circ\text{C}$
T_{rr}	Reverse Recovery Time			110	nS	$I_F = 1\ \text{A}, dI/dt = -15\ \text{A}/\mu\text{S}$ $V_R = 30\ \text{V}, T_j = 25^\circ\text{C}$

OM6542SP1/OM6542SP2**IGBT CHARACTERISTICS** ($T_j = 25^\circ\text{C}$ unless otherwise specified)**Parameter - OFF**

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)CES}$	Collector to Emitter Breakdown Voltage	500			V	$V_{GE} = 0$ $I_C = 250\text{ }\mu\text{A}$
I_{CES}	Zero Gate Voltage Drain Current			0.25 1	mA mA	$V_{CE} = \text{Max. Rat.}, V_{GE} = 0$ $V_{CE} = 0.8 \text{ Max. Rat.}, V_{GE} = 0$ $T_j = 150^\circ\text{C}$
I_{GES}	Gate Emitter Leakage Current			± 100	nA	$V_{GE} = \pm 20\text{ V}$ $V_{CE} = 0\text{ V}$

Parameter - ON

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{GE(th)}$	Gate Threshold Voltage	4.5		6.5	V	$V_{CE} = V_{GE}, I_C = 1\text{ mA}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage		3.5		V	$V_{GE} = 15\text{ V}, I_C = 25\text{ A}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage			4.5	V	$V_{GE} = 15\text{ V}, I_C = 15\text{ A}$ $T_j = 150^\circ\text{C}$

Dynamic

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
G_{fs}	Forward Transconductance		5.5		S	$V_{CE} = 20\text{ V}, I_C = 15\text{ A}$
C_{iss}	Input Capacitance		2000		pF	$V_{GE} = 0$
C_{oss}	Output Capacitance		160		pF	$V_{CE} = 25\text{ V}$
C_{res}	Reverse Transfer Capacitance		65		pF	$f = 1\text{ MHz}$
$T_{d(on)}$	Turn-On Delay Time		50		nS	$V_{CC} = 600\text{ V}, I_C = 5\text{ A}$ $V_{GE} = 15\text{ V}$ $R_g = 3.3\text{ }\Omega$ $L = .1\text{ mH}$ $T_j = 150^\circ\text{C}$
T_r	Rise Time		200		nS	
$T_{d(off)}$	Turn-Off Delay Time		200		nS	
T_f	Fall Time		200		nS	
E_{ts}	Turn-Off Switching Losses		1.5		mJ	

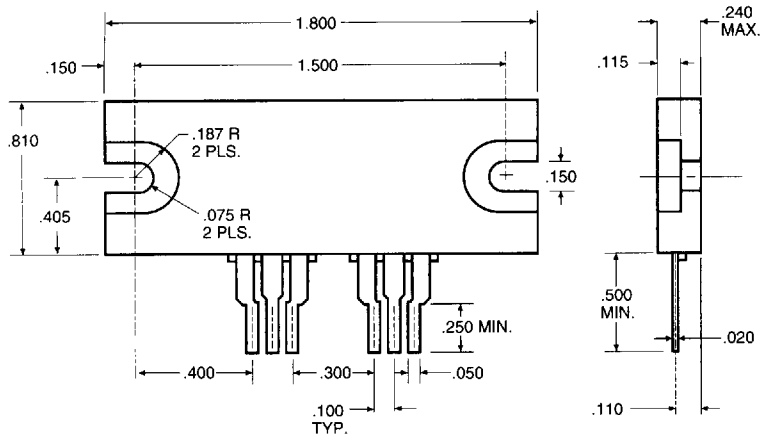
DIODE CHARACTERISTICS ($T_j = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
V_f	Maximum Forward Voltage			2 1.85	V V	$I_F = 25\text{ A}, T_j = 25^\circ\text{C}$ $I_F = 15\text{ A}, T_j = 150^\circ\text{C}$
I_r	Maximum Reverse Current			1.2 5	mA mA	$V_R = 1000\text{ V}, T_j = 25^\circ\text{C}$ $V_R = 800\text{ V}, T_j = 150^\circ\text{C}$
T_{rr}	Reverse Recovery Time			110	nS	$I_F = 1\text{ A}, d_f/d_i = -15\text{ A}/\mu\text{S}$ $V_R = 30\text{ V}, T_j = 25^\circ\text{C}$

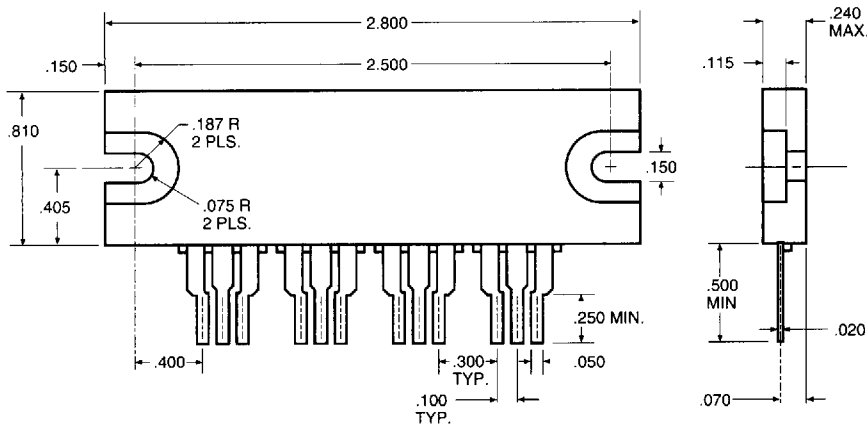
2.1

Mechanical Outlines

Omnirel Package P-1 (Industrial 6-Pin)



Omnirel Package P-2 (Industrial 12-Pin)



2.1

Mechanical Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Torque	Mounting Torque $\pm 10\%$		10.5 6		Nm in/lbs	Package to heat sink (1, 2)
wt	Approximate Weight		0.8 17		g oz	SP1 Package
			1.3 28		g oz	SP2 Package

- Notes:
1. Mounting surface flat, smooth, and greased. Recommended mounting compound Dow Corning DC340
 2. Mount using two #6 size screws with flat washers (.375" OD, .188" ID, .040" Thickness)

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