DIM400XSM65-K000

Single Switch IGBT Module

DS5808-1.1 October 2005 (LN24289)

FEATURES

- High Thermal Cycling Capability
- Soft Punch Through Silicon
- Isolated MMC Base with AlN Substrates

APPLICATIONS

- High Reliability Inverters
- Motor Controllers
- Traction Auxiliaries

The Powerline range of high power modules includes half bridge, chopper, dual, single and bi-directional switch configurations covering voltages from 600V to 6500V and currents up to 2400A.

The DIM400XSM65-K000 is a single switch 6500V,n channel enhancement mode, insulated gate bipolar transistor (IGBT) module. The IGBT has a wide reverse bias safe operating area (RBSOA). This device is optimised for traction drives and other applications requiring high thermal cycling capability.

The module incorporates an electrically isolated base plate and low inductance construction enabling circuit designers to optimise circuit layouts and utilise grounded heat sinks for safety.

ORDERING INFORMATION

Order As:

DIM400XSM65-K000

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}		**6500V**
$V_{CE(sat)}$ *	**(typ)**	**4.0V**
I_C	**(max)**	**400A**
$I_{C(PK)}$	**(max)**	**800A**

*(measured at the power busbars and not the auxiliary terminals)

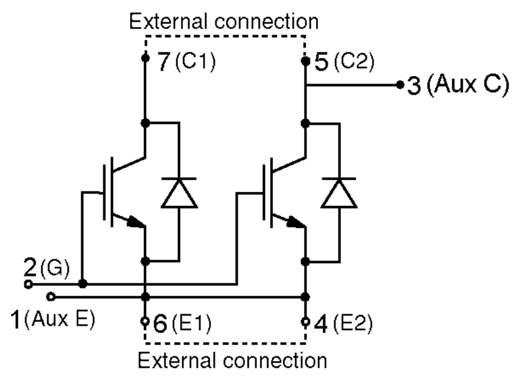

Fig. 1 Single switch circuit diagram

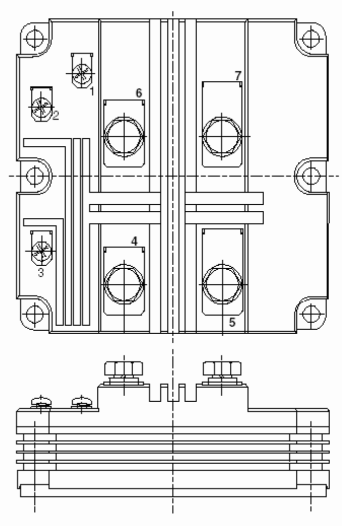

Fig. 2 Electrical connections - (not to scale)

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ABSOLUTE MAXIMUM RATINGS

Stresses above those listed under 'Absolute Maximum Ratings' may cause permanent damage to the device. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture of the package. Appropriate safety precautions should always be followed. Exposure to Absolute Maximum Ratings may affect device reliability.

T_{case} = 25°C unless stated otherwise

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	V_{GE} =0V, T_{VJ} = -40 °C	5800	V
		V_{GE} =0V	6300	V
		V_{GE} =0V, T_{VJ} = 125 °C	6500	V
V_{GES}	Gate-emitter voltage		±20	V
I_C	Continuous collector current	T_{case} =90 °C	400	A
$I_{C(PK)}$	Peak collector current	1ms, T_{case}=115 °C	800	A
P_{max}	Max.transistor power dissipation	T_{case} =25 °C, T_j =150 °C	8.3	kW
I^2t	Diode I^2t value (Diode arm)	V_R =0,t_p =10ms,T_{vj} =125 °C	97	kA^2s
V_{isol}	Isolation voltage-per module	Commoned terminals to base plate. AC RMS,1 min,50Hz	10.2	kV
Q_{PD}	Partial discharge-per module	IEC1287.V_1 =7000V, V_2 =5100V, 50Hz RMS	10	pC

THERMAL AND MECHANICAL RATINGS

Internal insulation material: AlN

Baseplate material: AlSiC

Creepage distance: 56mm

Clearance: 26mm

CTI (Critical Tracking Index): >600

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$R_{th(j-c)}$	Thermal resistance -transistor (per switch)	Continuous dissipation - junction to case		-	15	°C/kW
$R_{th(j-c)}$	Thermal resistance -diode (per switch)	Continuous dissipation - junction to case		-	30	°C/kW
$R_{th(c-h)}$	Thermal resistance -case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)		-	8	°C/kW
T_j	Junction temperature	Transistor	-	-	125	°C
		Diode	-	-	125	°C
T_{stg}	Storage temperature range	-	-40	-	125	°C
	Screw torque	Mounting M6	-	-	5	Nm
		Electrical connections -M4	-	-	2	Nm
		Electrical connections -M8	-	-	10	Nm

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

ELECTRICAL CHARACTERISTICS

T_{case} = 25°C unless stated otherwise.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_{CES}	Collector cut-off current	V_{GE} =0V, V_{CE} = V_{CES}			3	mA
		V_{GE} =0V, V_{CE} = V_{CES}, T_{case} =125 °C			60	mA
I_{GES}	Gate leakage current	V_{GE} =±20V, V_{CE} =0V			8	uA
$V_{GE(TH)}$	Gate threshold voltage	I_C =80mA, V_{GE} = V_{CE}	5.5	6.5	7.5	V
$V_{CE(sat)}$†	Collector-emitter saturation voltage	V_{GE} =15V, I_C =400A		4.0		V
		V_{GE} =15V, I_C =400A,, T_{VJ} =125 °C		5.6		V
I_F	Diode forward current	DC			400	A
I_{FM}	Diode maximum forward current	t_p =1ms			800	A
V_F	Diode forward voltage	I_F =400A		3.6		V
		I_F =400A, T_{VJ} =125 °C		4.1		V
C_{ies}	Input capacitance	V_{CE} =25V, V_{GE} =0V, f =1MHz		120		nF
C_{res}	Reverse transfer capacitance	V_{CE} =25V, V_{GE} =0V, f =1MHz		1.5		nF
L_M	Module inductance	--		20		nH
R_{INT}	Internal transistor resistance			0.18		mΩ
SC_{Data}	Short circuit.I SC	T_j ≤125 °C, V_{CC} ≤4400V, I_1		TBD		A
		t_p =10 us, I_2 $V_{CE(max)}$ = V_{CES} – L*.di/dt IEC 60747-9		TBD		A

Note:

†Measured at the power busbars and not the auxiliary terminals

L*is the circuit inductance + L_M

ELECTRICAL CHARACTERISTICS

T_{case} = 25°C unless stated otherwise

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(off)}$	Turn-off delay time	I_C =400A		6.0		us
t_f	Fall time	V_{GE} =±15V		250		ns
E_{OFF}	Turn-off energy loss	V_{CE} =3600V		1450		mJ
$t_{d(on)}$	Turn-on delay time	$R_{G(ON)}$ =6.2Ω $R_{G(OFF)}$=18Ω		900		ns
t_r	Rise time	C_{ge} =44nF		250		ns
E_{ON}	Turn-on energy loss	L ~200nH		3000		mJ
Q_g	Gate charge			8		uC
Q_{rr}	Diode reverse recovery charge	I_F =400A,V_{CE} =3600V,		700		uC
I_{rr}	Diode reverse recovery current	dI_F/dt =1300A/us		300		A
E_{rec}	Diode reverse recovery energy			1300		mJ

T_{case} = 125°C unless stated otherwise

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(off)}$	Turn-off delay time	I_C =400A		6.0		us
t_f	Fall time	V_{GE} =±15V		250		ns
E_{OFF}	Turn-off energy loss	V_{CE} =3600V		1750		mJ
$t_{d(on)}$	Turn-on delay time	$R_{G(ON)}$ =6.2Ω $R_{G(OFF)}$=18Ω		700		ns
t_r	Rise time	C_{ge} =44nF		200		ns
E_{ON}	Turn-on energy loss	L ~200nH		3500		mJ
Q_{rr}	Diode reverse recovery charge	I_F =400A,V_{CE} =3600V,		1000		uC
I_{rr}	Diode reverse recovery current	dI_F/dt =1600A/us		370		A
E_{rec}	Diode reverse recovery energy			2000		mJ

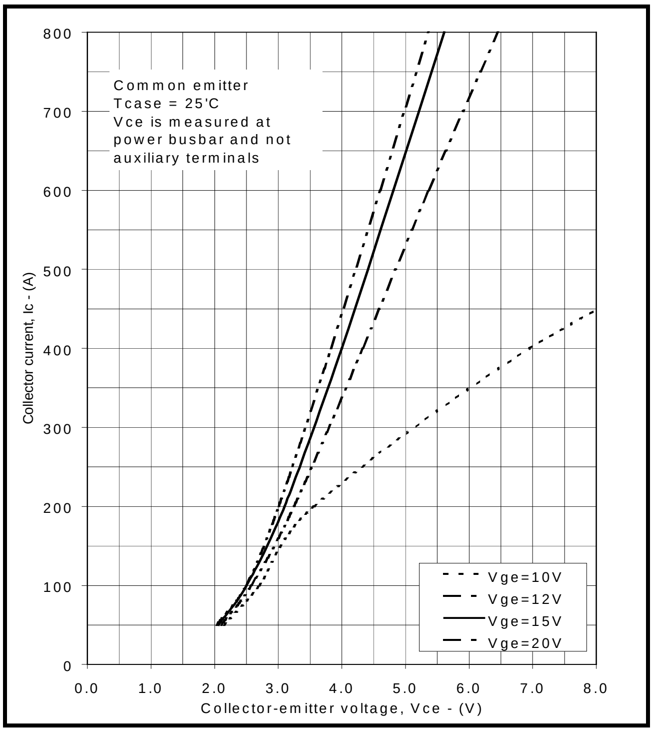


Fig.3 Typical output characteristics

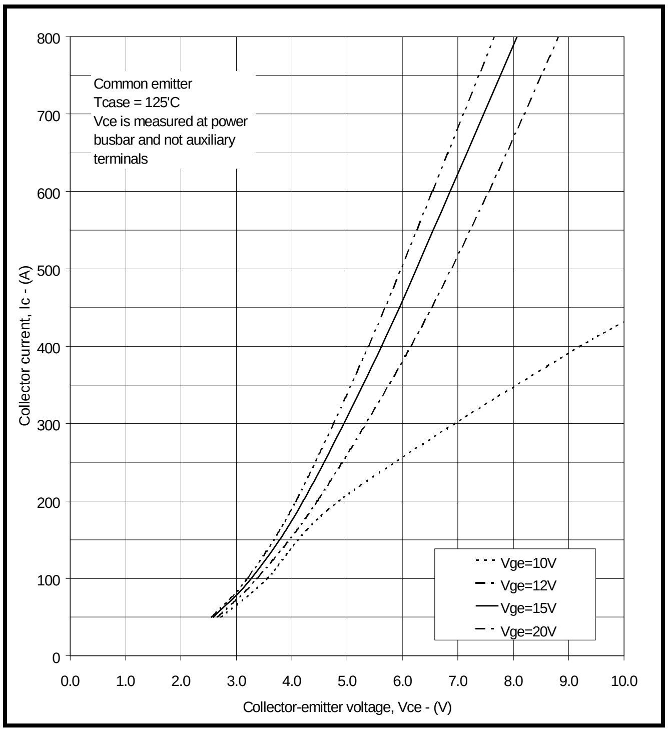


Fig.4 Typical output characteristics

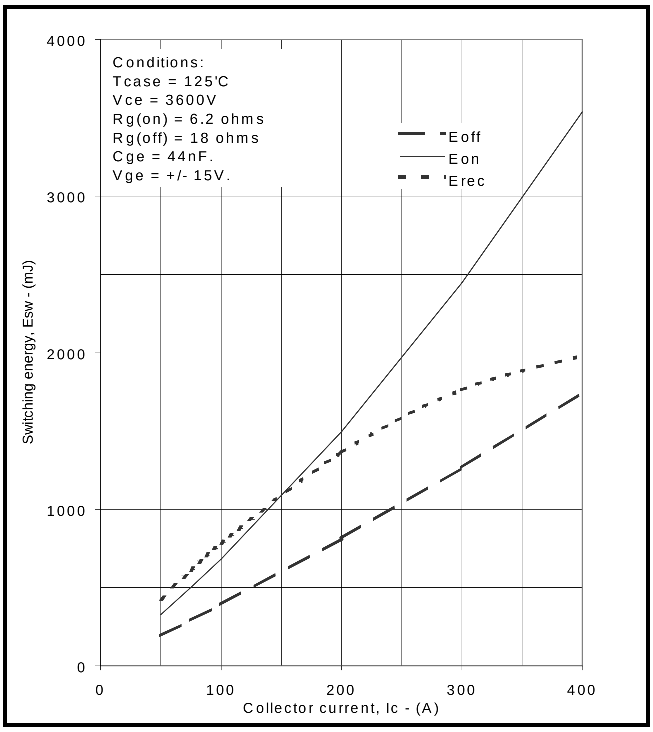


Fig.5 Typical switching energy vs collector current

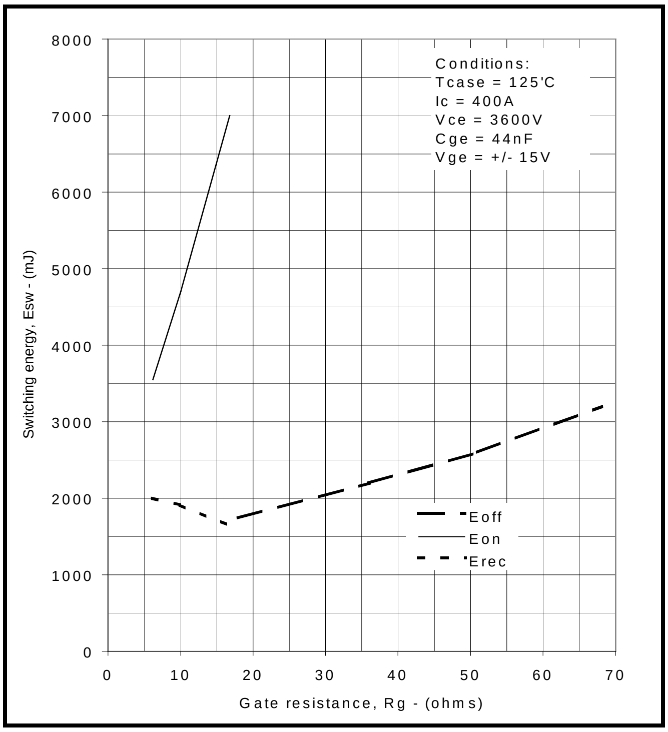


Fig.6 Typical switching energy vs gate resistance

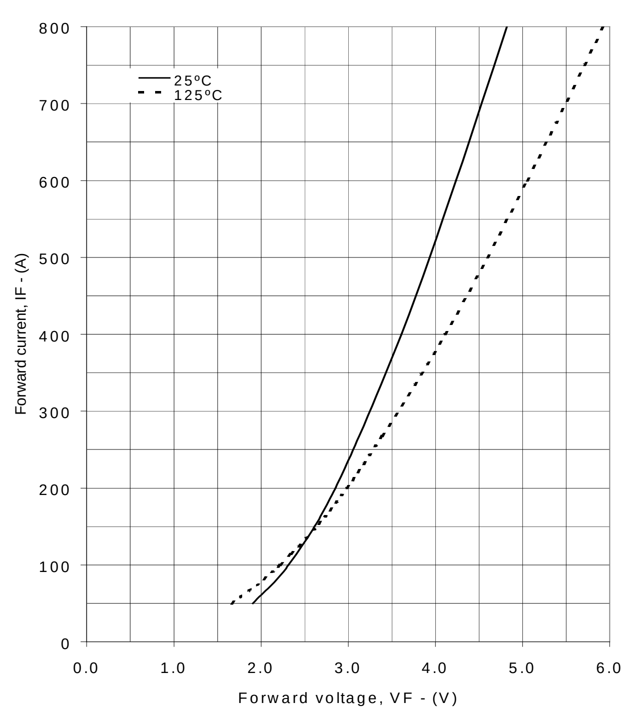


Fig.7 Diode typical forward characteristics

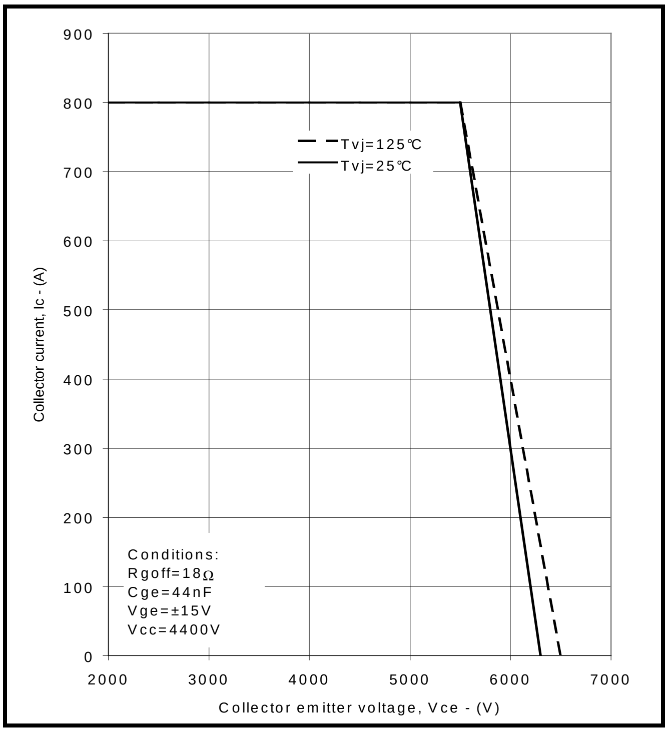


Fig.8 Reverse bias safe operating area

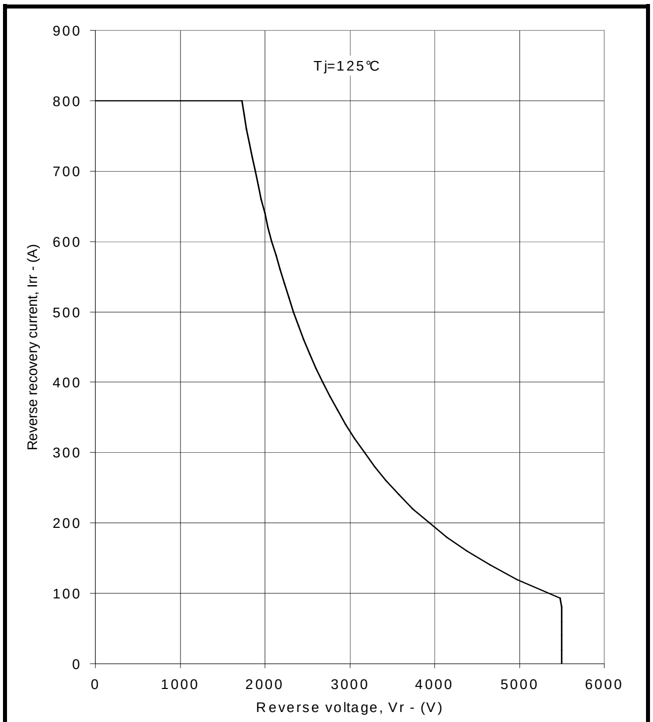
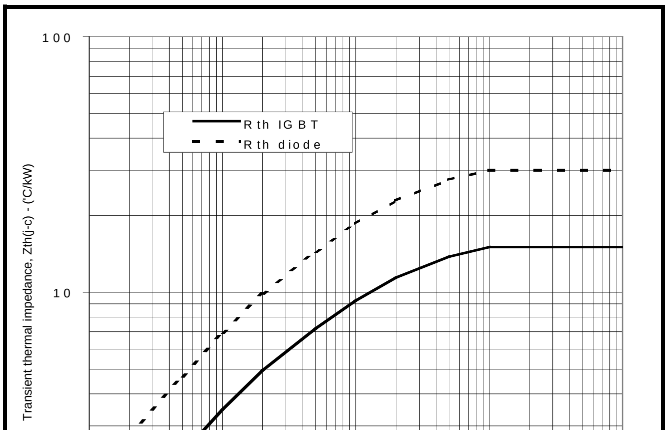


Fig.9 Diode reverse bias safe operating area



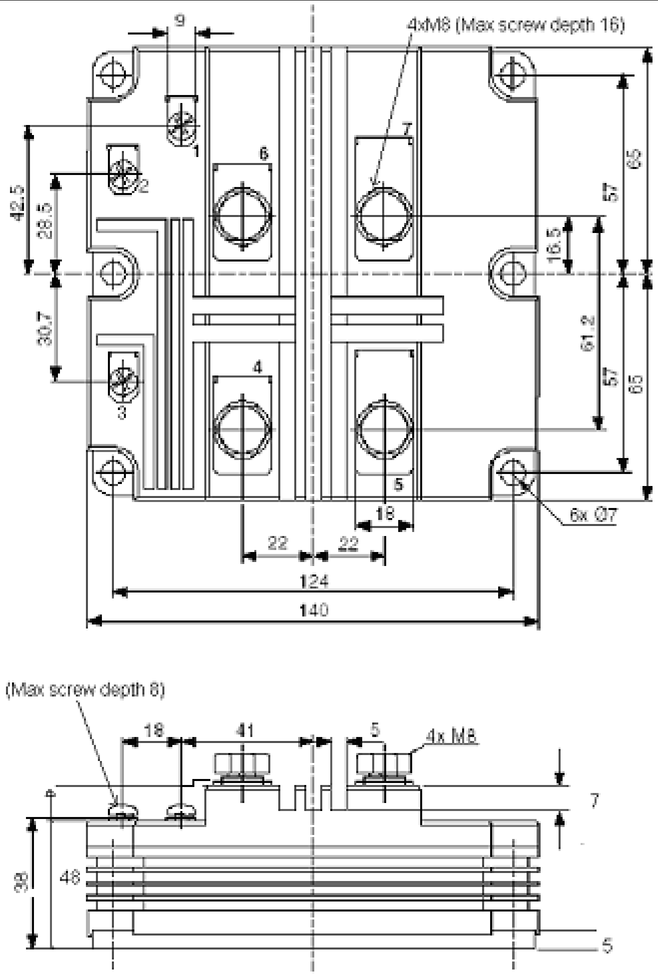
		1	2	3	4
IGBT	Ri (°C/kW)	0.57	2.63	4.55	7.32
	τi (ms)	0.17	8.08	51.92	280.5
Diode	Ri (°C/kW)	1.13	5.27	9.1	14.64
	τi (ms)	0.17	8.08	51.92	280.5

Fig.10 Transient thermal impedance

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.

PACKAGE DETAILS

For further package information, please visit our website or contact Customer Services. All dimensions in mm, unless stated otherwise.
DO NOT SCALE.



Nominal weight: 1100g

Module outline type code: X

POWER ASSEMBLY CAPABILITY

The Power Assembly group was set up to provide a support service for those customers requiring more than the basic semiconductor, and has developed a flexible range of heatsink and clamping systems in line with advances in device voltages and current capability of our semiconductors.

We offer an extensive range of air and liquid cooled assemblies covering the full range of circuit designs in general use today. The Assembly group offers high quality engineering support dedicated to designing new units to satisfy the growing needs of our customers.

Using the latest CAD methods our team of design and applications engineers aim to provide the Power Assembly Complete Solution (PACs).

HEATSINKS

The Power Assembly group has its own proprietary range of extruded aluminium heatsinks which have been designed to optimise the performance of Dynex semiconductors. Data with respect to air natural, forced air and liquid cooling (with flow rates) is available on request.

For further information on device clamps, heatsinks and assemblies, please contact your nearest sales representative or Customer Services.

http://www.dynexsemi.com

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Datasheet Annotations:

Dynex Semiconductor annotate datasheets in the top right hand corner of the front page, to indicate product status. The annotations are as follows:-

Target Information: This is the most tentative form of information and represents a very preliminary specification. No actual design work on the product has been started.

Preliminary Information: The product is in design and development. The datasheet represents the product as it is understood but details may change.

Advance Information: The product design is complete and final characterisation for volume production is well in hand.

No Annotation: The product parameters are fixed and the product is available to datasheet specification.

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.