BLM10D2327-40AB

LDMOS 2-stage integrated Doherty MMIC

Rev. 1 — 15 August 2019

AMPLEON

Product data sheet

1. Product profile

1.1 General description

The BLM10D2327-40AB is a 2-stage fully integrated asymmetrical Doherty MMIC solution using Ampleon's state of the art GEN10 LDMOS technology. The carrier and peaking device, input splitter, output combiner and pre-match are integrated in a single package. This multiband device is perfectly suited as a final stage for small cells and massive MIMO applications in the frequency range from 2500 MHz to 2700 MHz. Available in PQFN outline.

Table 1. Application performance

Typical RF performance at T_{case} = 25 °C; I_{Dq} = 46 mA (carrier and peaking); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.4$ V. Test signal: 8-carrier LTE 20 MHz; PAR = 8.5 dB; measured in an Ampleon f = 2515 MHz to 2675 MHz integrated Doherty application circuit.

Test signal	f	V_{DS}	$P_{L(AV)}$	G_p	η_D
	(MHz)	(V)	(W)	(dB)	(%)
8-carrier LTE 20 MHz (160 MHz) PAR = 8.5 dB	2595	28	5.75	28	44

1.2 Features and benefits

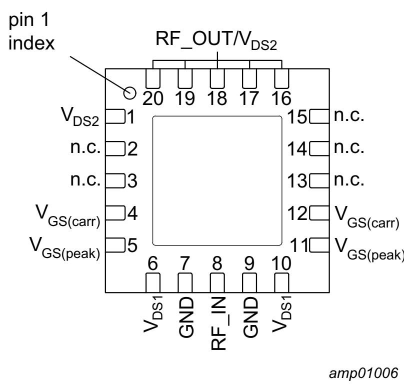
- Integrated input splitter
- Integrated output combiner
- 20 Ω output impedance thanks to integrated pre-match
- Very high efficiency thanks to asymmetry
- Designed for wideband operation (frequency 2500 MHz to 2700 MHz)
- Independent control of carrier and peaking bias
- Integrated ESD protection
- Source impedance 50 Ω; high power gain
- For RoHS compliance see the product details on the Ampleon website

1.3 Applications

- RF power MMIC for multi-carrier and multi-standard GSM, W-CDMA and LTE base stations in the 2500 MHz to 2700 MHz frequency range

2. Pinning information

2.1 Pinning



Transparent top view.

The exposed backside of the package is the ground terminal of the device.

Fig 1. Pin configuration

2.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
V_{DS2}	1	drain-source voltage of final stages [1]
n.c.	2	not connected
n.c.	3	not connected
$V_{GS(carr)}$	4	gate-source voltage of carrier
$V_{GS(peak)}$	5	gate-source voltage of peaking
V_{DS1}	6	drain-source voltage of driver stages
GND	7	RF ground
RF_IN	8	RF input
GND	9	RF ground
V_{DS1}	10	drain-source voltage of driver stages
$V_{GS(peak)}$	11	gate-source voltage of peaking
$V_{GS(carr)}$	12	gate-source voltage of carrier
n.c.	13	not connected
n.c.	14	not connected
n.c.	15	not connected
RF_OUT/V_{DS2}	16	RF output / drain-source voltage of final stages
RF_OUT/V_{DS2}	17	RF output / drain-source voltage of final stages
RF_OUT/V_{DS2}	18	RF output / drain-source voltage of final stages
RF_OUT/V_{DS2}	19	RF output / drain-source voltage of final stages
RF_OUT/V_{DS2}	20	RF output / drain-source voltage of final stages

Table 2. Pin description *...continued*

Symbol	Pin	Description
GND	flange	RF ground

[1] $I_{max(DC)} \leq 500$ mA.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLM10D2327-40AB	PQFN20	plastic thermal enhanced quad flat package; no leads; 20 terminals; body 8.0 x 8.0 x 2.1 mm	SOT1462-1

4. Block diagram

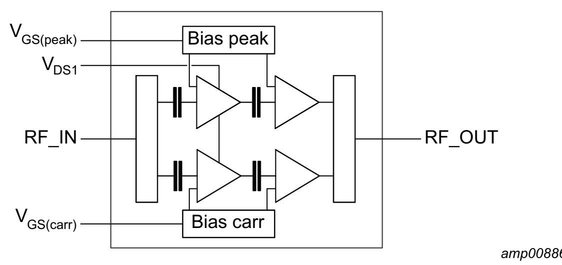


Fig 2. Block diagram

5. Limiting values

Table 4. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage		–0.5	+65	V
V_{GS}	gate-source voltage		–0.5	+13	V
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature	[1]	-	200	°C

[1] Continuous use at maximum temperature will affect the reliability. For details refer to the online MTF calculator.

6. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	T_{case} = 90 °C; P_L = 3.16 W [1]	4.7	K/W
		T_{case} = 90 °C; P_L = 5.75 W [1]	3.6	K/W

[1] When operated with a 1-carrier LTE with PAR = 7.6 dB.

7. Characteristics

Table 6. DC characteristics

T_{case} = 25 °C.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Carrier						
V_{GSq}	gate-source quiescent voltage	V_{DS} = 28 V; I_D = 45 mA	1.7	2.2	2.75	V
I_{GSS}	gate leakage current	V_{GS} = 1 V; V_{DS} = 0 V	-	-	140	nA
Peaking						
I_{GSS}	gate leakage current	V_{GS} = 1 V; V_{DS} = 0 V	-	-	140	nA
Final stages						
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	1.4	μA
Driver stages						
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	1.4	μA

Table 7. RF Characteristics

Typical RF performance at T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq} = 45 mA (carrier); $V_{GSq(peaking)}$ = $V_{GSq(carrier)}$ − 0.4 V; $P_{L(AV)}$ = 5.75 W. f = 2700 MHz measured in an Ampleon production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain		27.5	29	31.1	dB
η_D	drain efficiency	P_L = 5.75 W (37.6 dBm)	38	43	-	%
		P_L = $P_{L(3dB)}$	46	50	-	%
RL_{in}	input return loss		-	-	−10	dB
$P_{L(M)}$	peak output power		44.7	45.7	-	dBm

8. Application information

Table 8. Typical performance

T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq} = 46 mA (carrier and peaking); $V_{GSq(peaking)}$ = $V_{GSq(carrier)}$ − 0.4 V. Test signal: 1-carrier LTE 20 MHz; PAR = 7.6 dB; measured in an Ampleon f = 2515 MHz to 2675 MHz frequency band application circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{L(M)}$	peak output power	f = 2595 MHz [1]	-	46.3	-	dBm
$\varphi_{s21}/\varphi_{s21(norm)}$	normalized phase response	at 3 dB compression point; f = 2595 MHz [2]	-	−28.5	-	°
η_D	drain efficiency	8.7 dB OBO ($P_{L(AV)}$ = 37.6 dBm); f = 2595 MHz	-	44.5	-	%
		8.7 dB OBO ($P_{L(AV)}$ = 37.6 dBm); f = 2595 MHz [3]	-	44.1	-	%
G_p	power gain	$P_{L(AV)}$ = 37.6 dBm; f = 2595 MHz	-	28.9	-	dB
B_{video}	video bandwidth	$P_{L(AV)}$ = 35 dBm set to obtain IMD3 = −25 dBc; f = 2595 MHz	-	371	-	MHz
G_{flat}	gain flatness	$P_{L(AV)}$ = 37.6 dBm; f = 2515 MHz to 2675 MHz	-	0.5	-	dB

Table 8. Typical performance *…continued*

T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq} = 46 mA (carrier and peaking); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.4$ V. Test signal: 1-carrier LTE 20 MHz; PAR = 7.6 dB; measured in an Ampleon f = 2515 MHz to 2675 MHz frequency band application circuit.

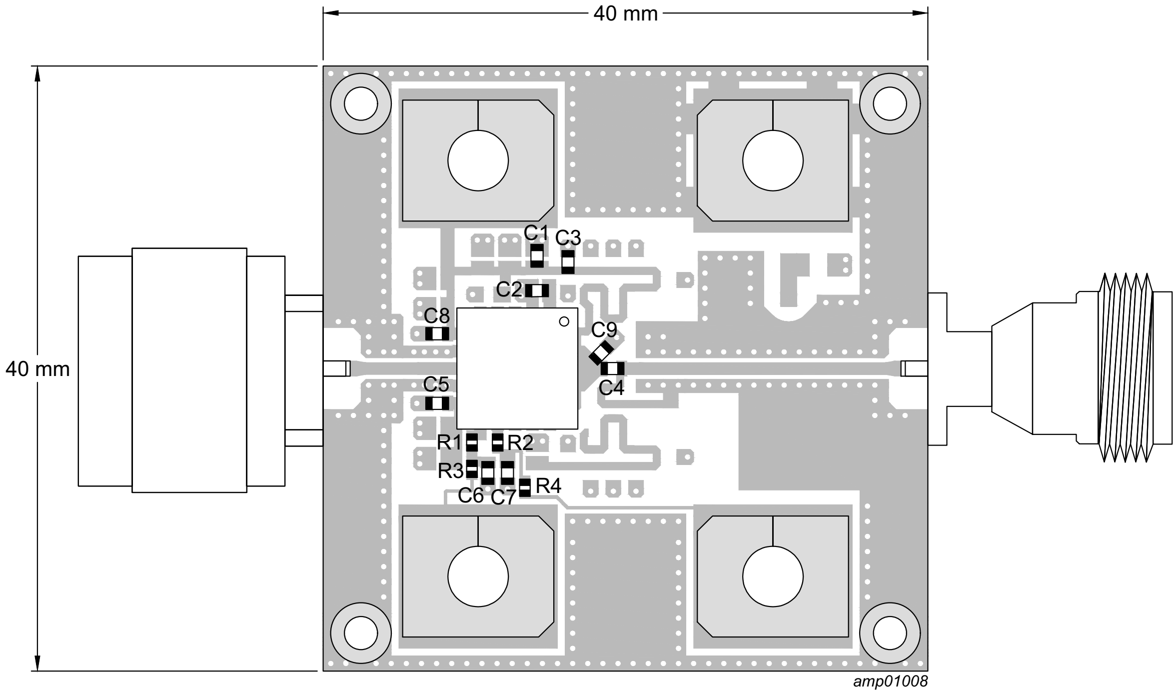
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$ACPR_{20M}$	adjacent channel power ratio (20M)	$P_{L(AV)}$ = 37.6 dBm; f = 2595 MHz		-	–39.1	-	dBc
ΔG/ΔT	gain variation with temperature	f = 2595 MHz	[4]	-	–0.05	-	dB/°C
K	Rollett stability factor	T_{case} = –40 °C; f = 0.5 GHz to 85 GHz; VSWR at source > 20 : 1 at 2.6 GHz	[4]	-	>1	-	

[1] Test signal: 1-carrier W-CDMA; test model 1; 64 DPCH; PAR = 9.9 dB at 0.01 % probability CCDF.

[2] 25 ms CW power sweep measurement.

[3] Test signal: 8C LTE 20 MHz, PAR 8.5 dB at 0.01 % probability CCDF linearized.

[4] S-parameters measured with broadband demo board.



Printed-Circuit Board (PCB): Rogers 4350; thickness = 0.508 mm.

Fig 3. Component layout

Table 9. Demo test circuit list of components

See Figure 3 for component layout.

Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	10 μF, 50 V	TDK: GC2012X5R1V106K; 805
C2	multilayer ceramic chip capacitor	100 nF	AVX: 06035D104KAT2A; 603
C3	multilayer ceramic chip capacitor	6.8 pF	Murata: GQM1885C2A6R8CB01; 603
C4	multilayer ceramic chip capacitor	1.5 pF	Murata: GQM1885C1A5R0CB01; 603
C6, C7	multilayer ceramic chip capacitor	10 μF, 6.3 V	AVX: 06036D106MAT2A; 603
C5, C8	multilayer ceramic chip capacitor	10 μF, 35 V	TDK: C2012X5R1V106K; 805
C9	multilayer ceramic chip capacitor	0.5 pF	Murata: GQM1885C2AR05CB01; 603
R1, R2, R3	resistor	0 Ω	Multicomp: 402
R4	resistor	2700 Ω	Multicomp: 402

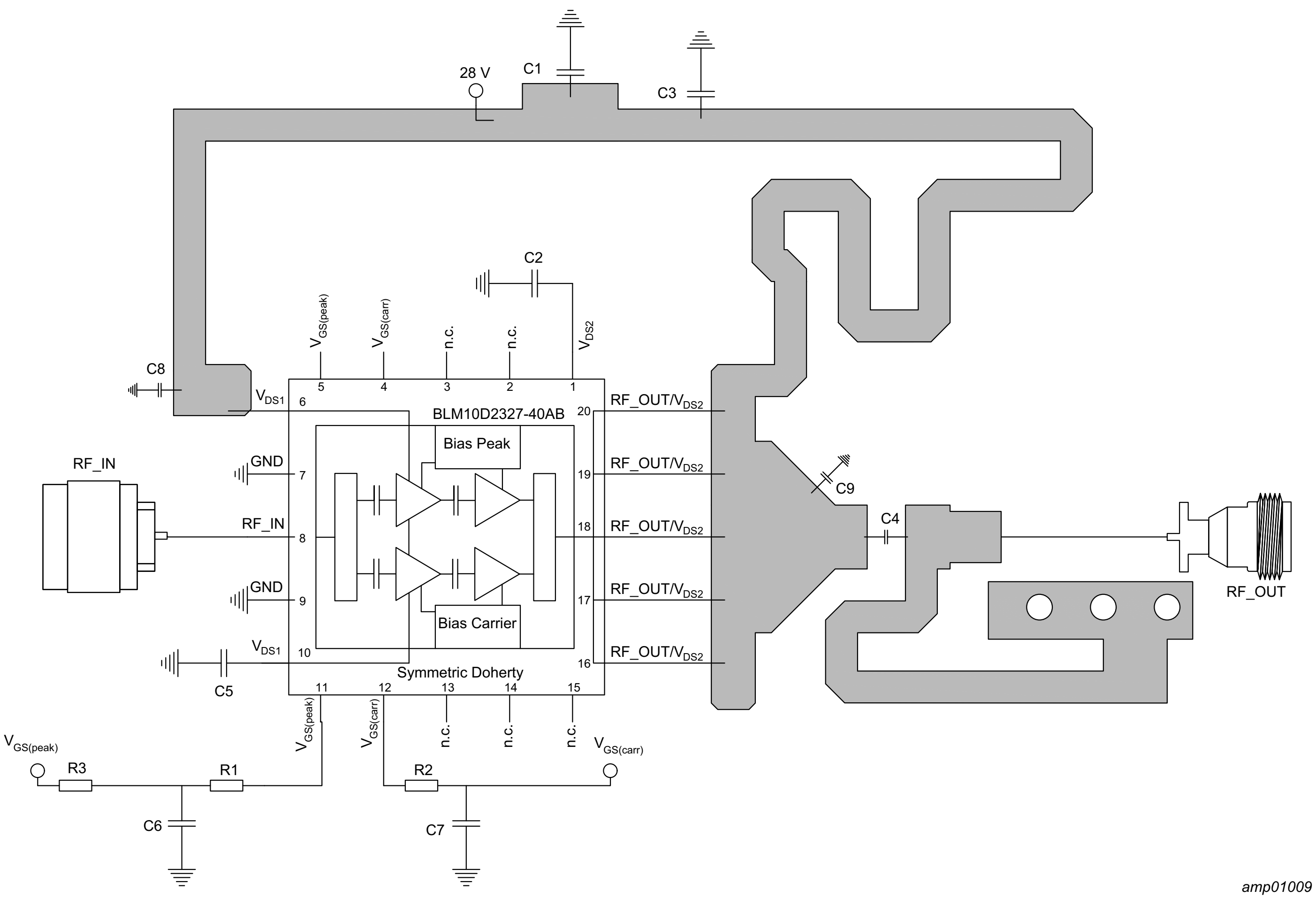


Fig 4. Electrical schematic

8.1 Ruggedness in a Doherty operation

The BLM10D2327-40AB is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: V_{DS} = 28 V; I_{Dq} = 46 mA (carrier); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.42$ V; P_i corresponding to $P_{L(3dB)} - 5$ dB under $Z_S = 50\ \Omega$ load; f = 2700 MHz (1-carrier W-CDMA); T_{case} = 25 °C.

8.2 Impedance information

Table 10. Typical impedance for optimum Doherty operation

Measured load-pull data; test signal: pulsed CW; T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq} = 45 mA (carrier); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.4$ V; t_p = 100 μs; δ = 10 %.

	tuned for optimum Doherty operation				
f	Z_L [1]	$P_{L(3dB)}$	$G_{p(max)}$	η_{add} [2]	η_{add} [3]
(MHz)	(Ω)	(dBm)	(dB)	(%)	(%)
2500	21.45 – j10.70	45.82	30.32	48.9	51.4
2600	19.00 – j9.75	46.02	30.87	48.3	53.5
2700	18.70 – j9.70	45.88	30.82	45.3	52.7

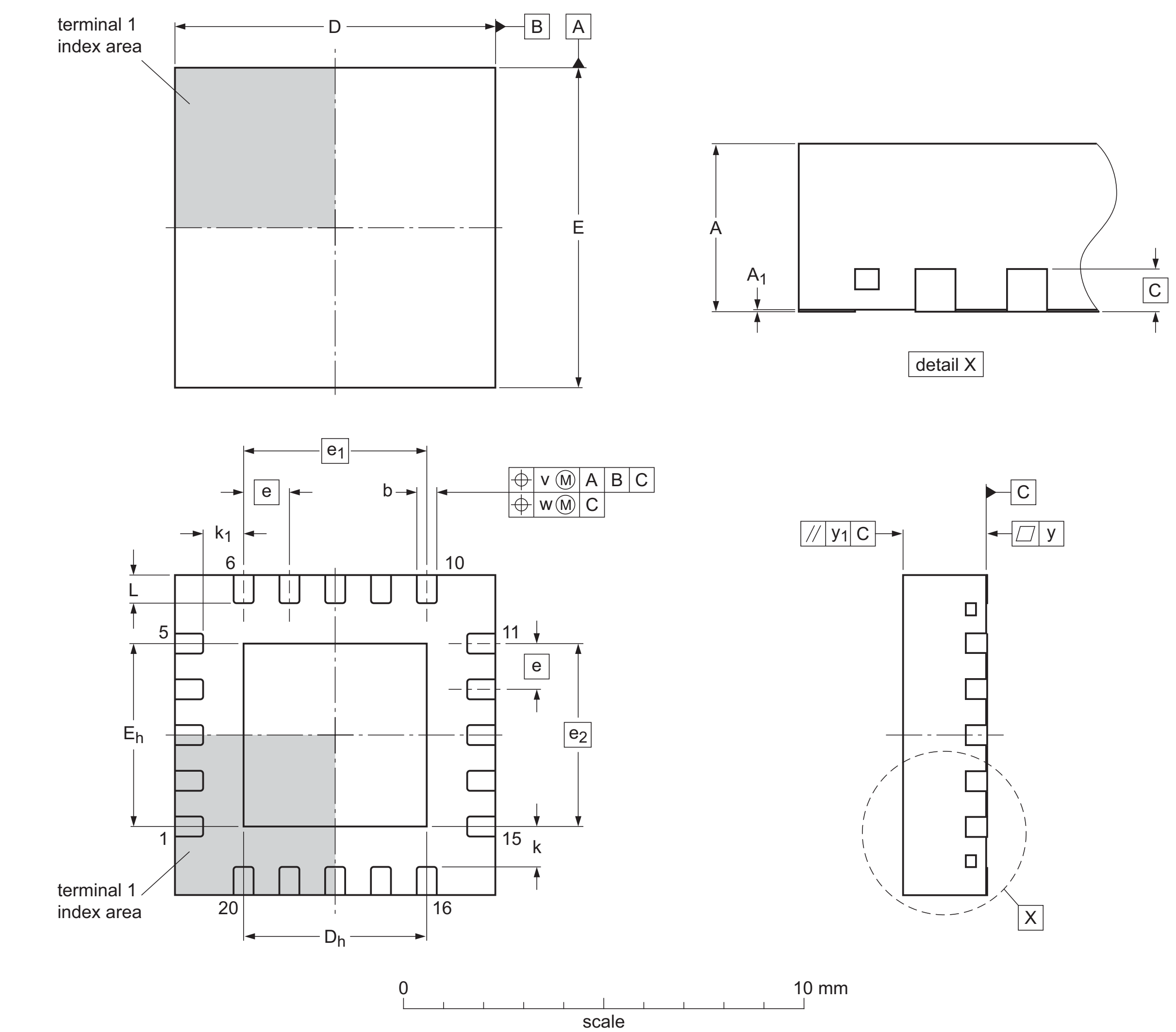
[1] Reference package plane.

[2] At 37.6 dBm.

[3] At $P_{L(3dB)}$.

9. Package outline

PQFN20: plastic thermal enhanced quad flat package; no leads; 20 terminals; body 8.0 x 8.0 x 2.1 mm **SOT1462-1**



Dimensions

Unit		$A^{(1)}$	A_1	b	C	$D^{(1)}$	D_h	$E^{(1)}$	E_h	e	e_1	e_2	k	k_1	L	v	w	y	y_1
	max	2.20	0.05	0.60		8.1	4.72	8.1	4.72						0.8				
mm	nom	2.10		0.50	0.508	8.0	4.62	8.0	4.62	1.15	4.6	4.6			0.7	0.1	0.05	0.1	0.1
	min	2.00	0.00	0.40		7.9	4.52	7.9	4.52				0.99	0.99	0.6				

Note
1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot1462-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1462-1						~~15-10-12~~ 17-06-23

Fig 5. Package outline SOT1462-1 (PQFN20)

10. Handling information

CAUTION	
	This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices. Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

Table 11. ESD sensitivity

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C3 [1]
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	1C [2]

[1] CDM classification C3 is granted to any part that passes after exposure to an ESD pulse of 1000 V.

[2] HBM classification 1C is granted to any part that passes after exposure to an ESD pulse of 1000 V.

11. Abbreviations

Table 12. Abbreviations

Acronym	Description
CW	Continuous Wave
ESD	ElectroStatic Discharge
GEN10	Tenth Generation
GSM	Global System for Mobile Communications
LDMOS	Laterally Diffused Metal Oxide Semiconductor
LTE	Long Term Evolution
MMIC	Monolithic Microwave Integrated Circuit
MIMO	Multiple Input Multiple Output
MTF	Median Time to Failure
OBO	Output Back Off
PAR	Peak-to-Average Ratio
RoHS	Restriction of Hazardous Substances
VSWR	Voltage Standing Wave Ratio
W-CDMA	Wideband Code Division Multiple Access

12. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLM10D2327-40AB v.1	20190815	Product data sheet	-	-

13. Legal information

13.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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15. Contents

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