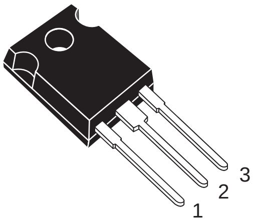
SCT30N120

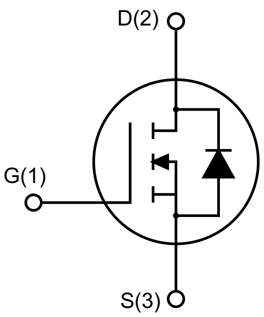
Silicon carbide Power MOSFET: 45 A, 1200 V, 80 mΩ, N-channel in HiP247™ package

Datasheet - production data



HiP247™

Figure 1. Internal schematic diagram



Features

- Very tight variation of on-resistance vs. temperature
- Slight variation of switching losses vs. temperature
- Very high operating temperature capability (200 °C)
- Very fast and robust intrinsic body diode
- Low capacitance
- Easy to drive

Applications

- Solar inverters, UPS
- Motor drives
- High voltage DC-DC converters
- Switch mode power supply

Description

This silicon carbide Power MOSFET is produced exploiting the advanced, innovative properties of wide bandgap materials. This results in unsurpassed on-resistance per unit area and very good switching performance almost independent of temperature. The outstanding thermal properties of the SiC material, combined with the device's housing in the proprietary HiP247™ package, allows designers to use an industry-standard outline with significantly improved thermal capability. These features render the device perfectly suitable for high-efficiency and high power density applications.

Table 1. Device summary

Order code	Marking	Package	Packaging
SCT30N120	SCT30N120	HiP247™	Tube

Note: The device meets ECOPACK standards, an environmentally-friendly grade of products commonly referred to as "halogen-free". See Section 3: Package mechanical data.

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	1200	V
V_{GS}	Gate-source voltage	-10/+25	V
I_D	Drain current (continuous) at T_C = 25 °C (limited by die)	45	A
I_D	Drain current (continuous) at T_C = 25 °C (limited by package)	40	A
I_D	Drain current (continuous) at T_C = 100 °C	34	A
I_{DM} (1)	Drain current (pulsed)	90	A
P_{TOT}	Total dissipation at T_C = 25 °C	270	W
T_{stg}	Storage temperature	-55 to 200	°C
T_j	Max. operating junction temperature		°C

1. Pulse width limited by safe operating area.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
Rthj-case	Thermal resistance junction-case max	0.65	°C/W
Rthj-amb	Thermal resistance junction-ambient max	40	°C/W

2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified).

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 1200 V V_{DS} = 1200 V, T_J = 200 °C		1 50	100	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = +22 / -10 V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 1 mA	1.8	2.6		V
$R_{DS(on)}$	Static drain-source on- resistance	V_{GS} = 20 V, I_D = 20 A		80	100	mΩ
		V_{GS} = 20 V, I_D = 20 A, T_J = 150 °C		90		mΩ
		V_{GS} = 20 V, I_D = 20 A, T_J = 200 °C		100		mΩ

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 400 V, f = 1 MHz, V_{GS} = 0	-	1700 130 25	-	pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 800 V, I_D = 20 A, V_{GS} = 0 — 20 V	-	105 16 40	-	nC nC nC
R_g	Gate input resistance	f=1 MHz open drain	-	5	-	Ω

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on} E_{off}	Turn-on switching losses Turn-off switching losses	V_{DD} = 800 V, I_D = 20 A R_G= 6.8 Ω, V_{GS} = -2/20 V	-	500 350	-	µJ µJ
E_{on} E_{off}	Turn-on switching losses Turn-off switching losses	V_{DD} = 800 V, I_D = 20 A R_G= 6.8 Ω, V_{GS} = -2/20 V T_J= 150 °C	-	500 400	-	µJ µJ

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)V}$ $t_{f(V)}$ $t_{d(off)V}$ $t_{r(V)}$	Turn-on delay time Fall time Turn-off delay time Rise time	V_{DD} = 800 V, I_D = 20 A, R_G = 0 Ω, V_{GS} = 0/20 V	-	19 28 45 20	-	ns ns ns ns

Table 8. Reverse SiC diode characteristics

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
V_{SD}	Diode forward voltage	I_F = 10 A, V_{GS} = 0	-	3.5	-	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 20 A, di/dt = 100 A/µs V_{DD} = 800 V	-	140 140 2		ns nC A

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

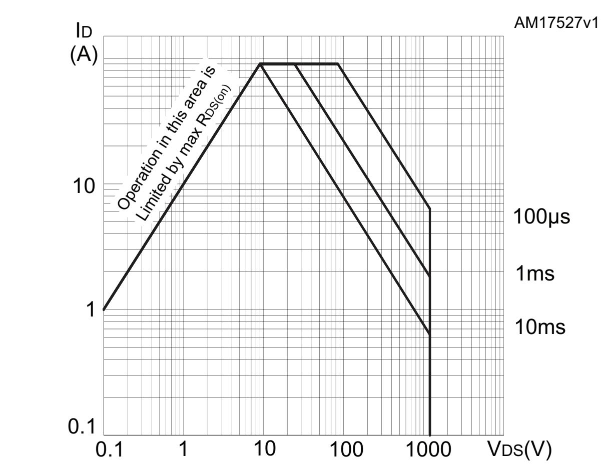


Figure 3. Thermal impedance

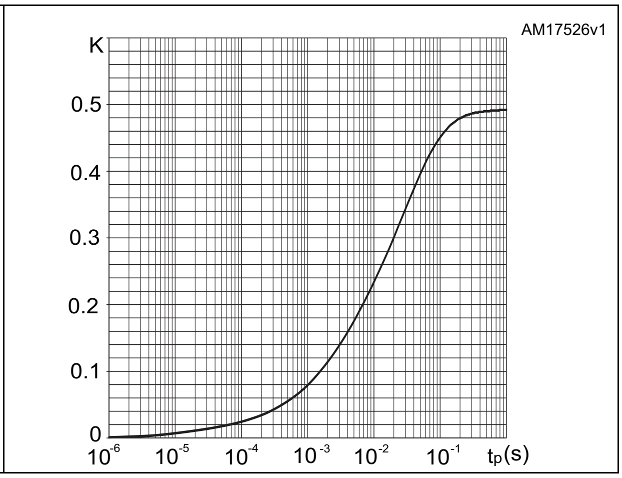


Figure 4. Output characteristics (T_J=25°C)

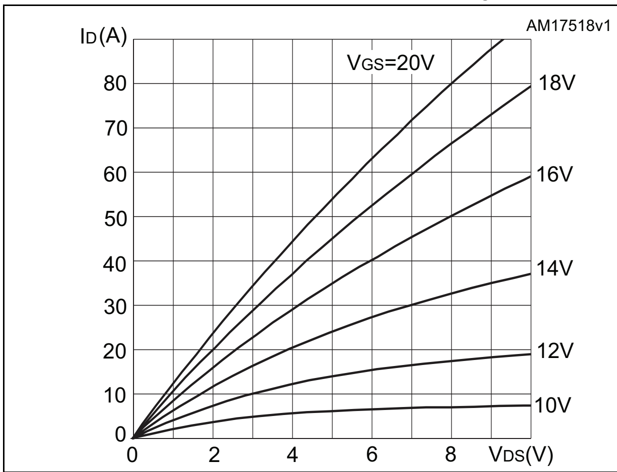


Figure 5. Output characteristics (T_J=200°C)

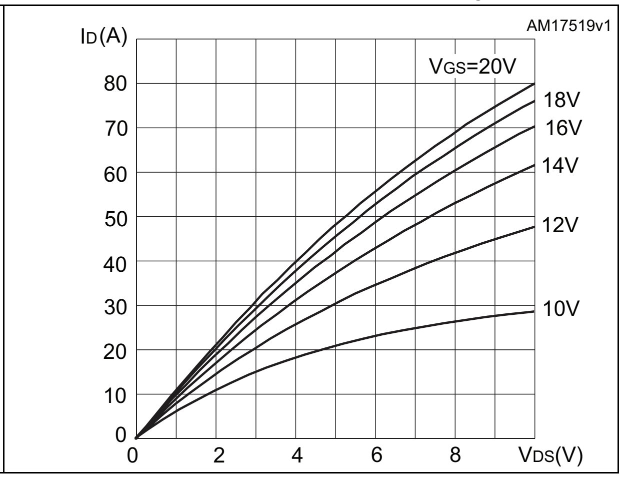


Figure 6. Transfer characteristics

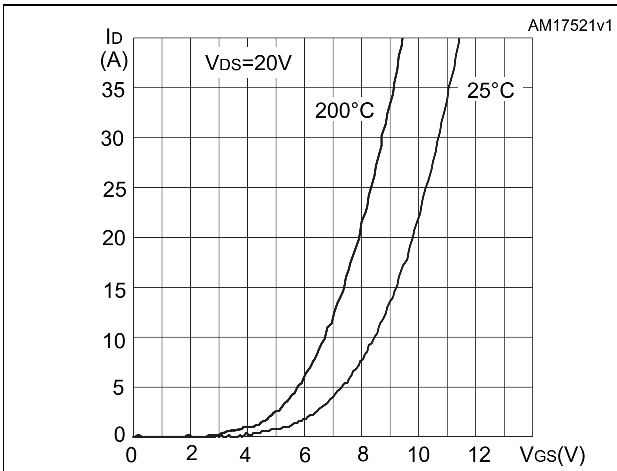


Figure 7. Power dissipation

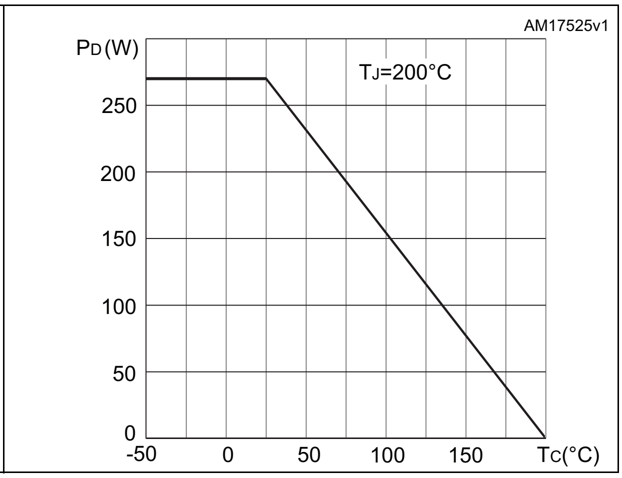


Figure 8. Gate charge vs gate-source voltage

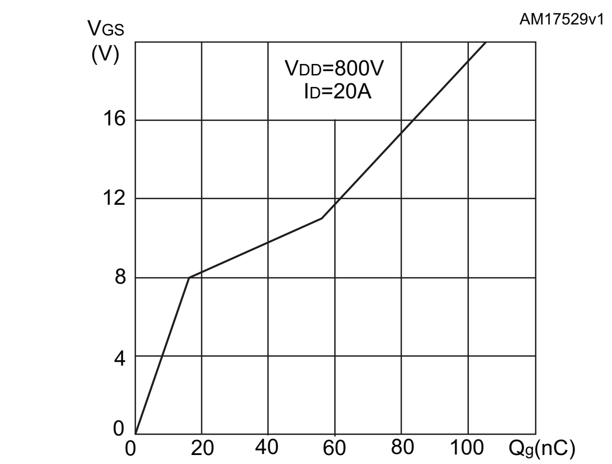


Figure 9. Capacitance variations

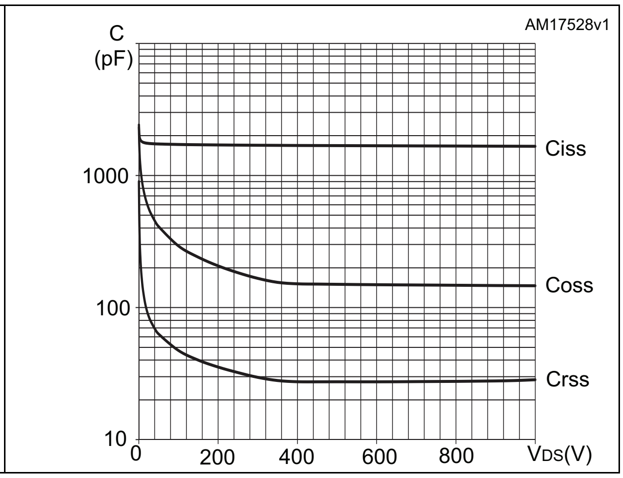


Figure 10. Switching energy vs. drain current

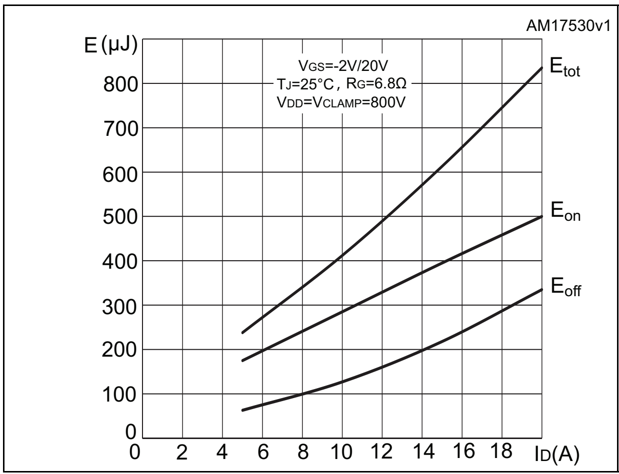


Figure 11. Switching energy vs. junction temperature

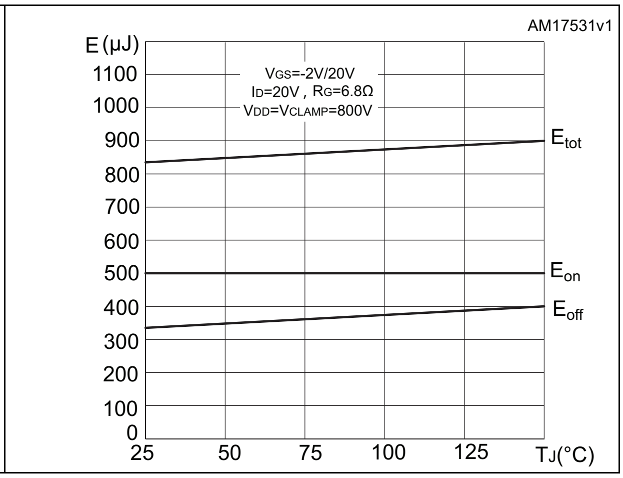


Figure 12. Normalized B_{VDSS} vs. temperature

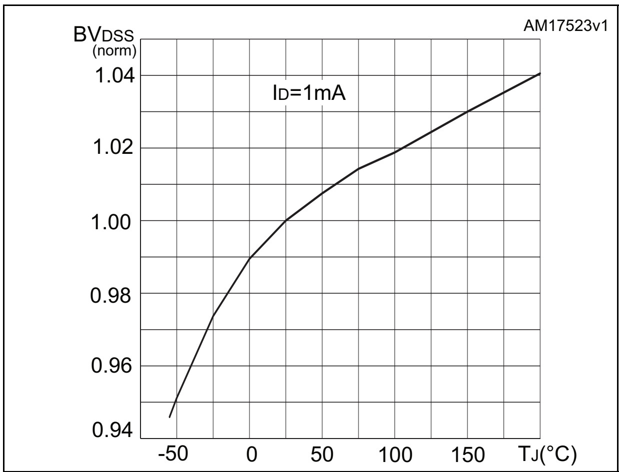


Figure 13. Normalized gate threshold voltage vs. temperature

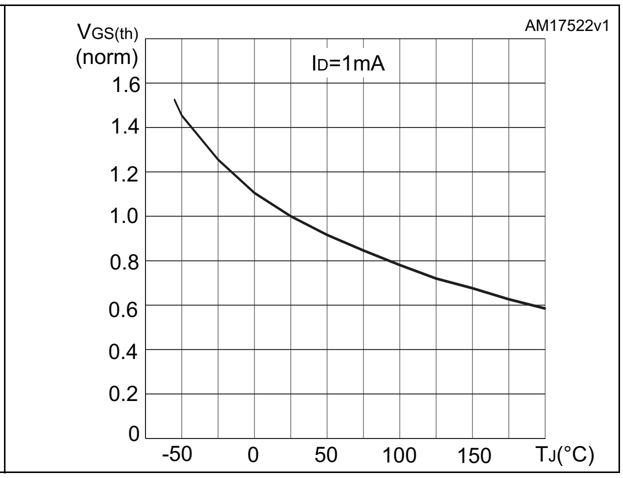


Figure 14. Normalized on-resistance vs. temperature

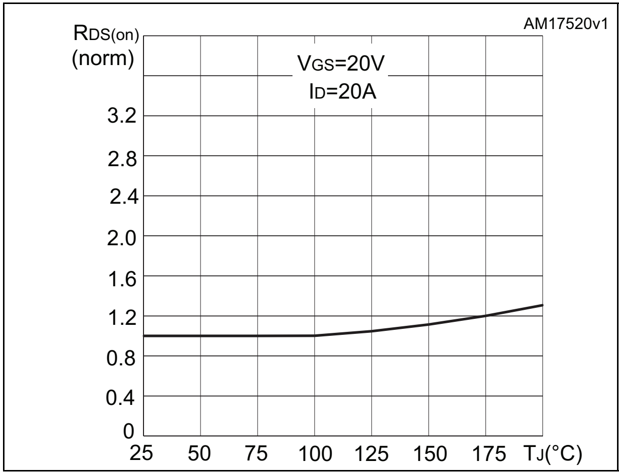
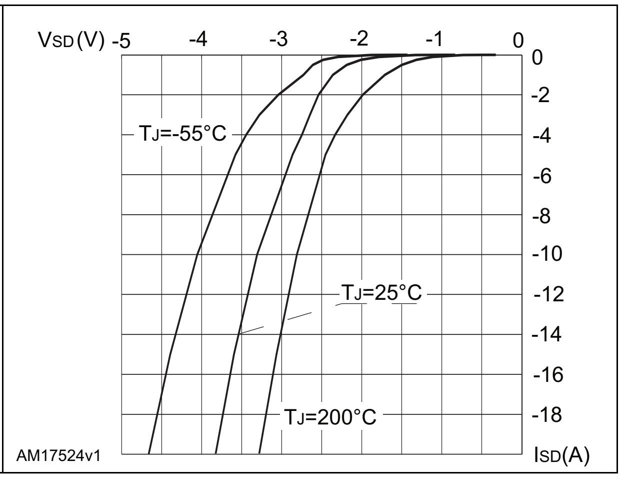


Figure 15. Body diode characteristics



3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Figure 16. HiP247™ drawing

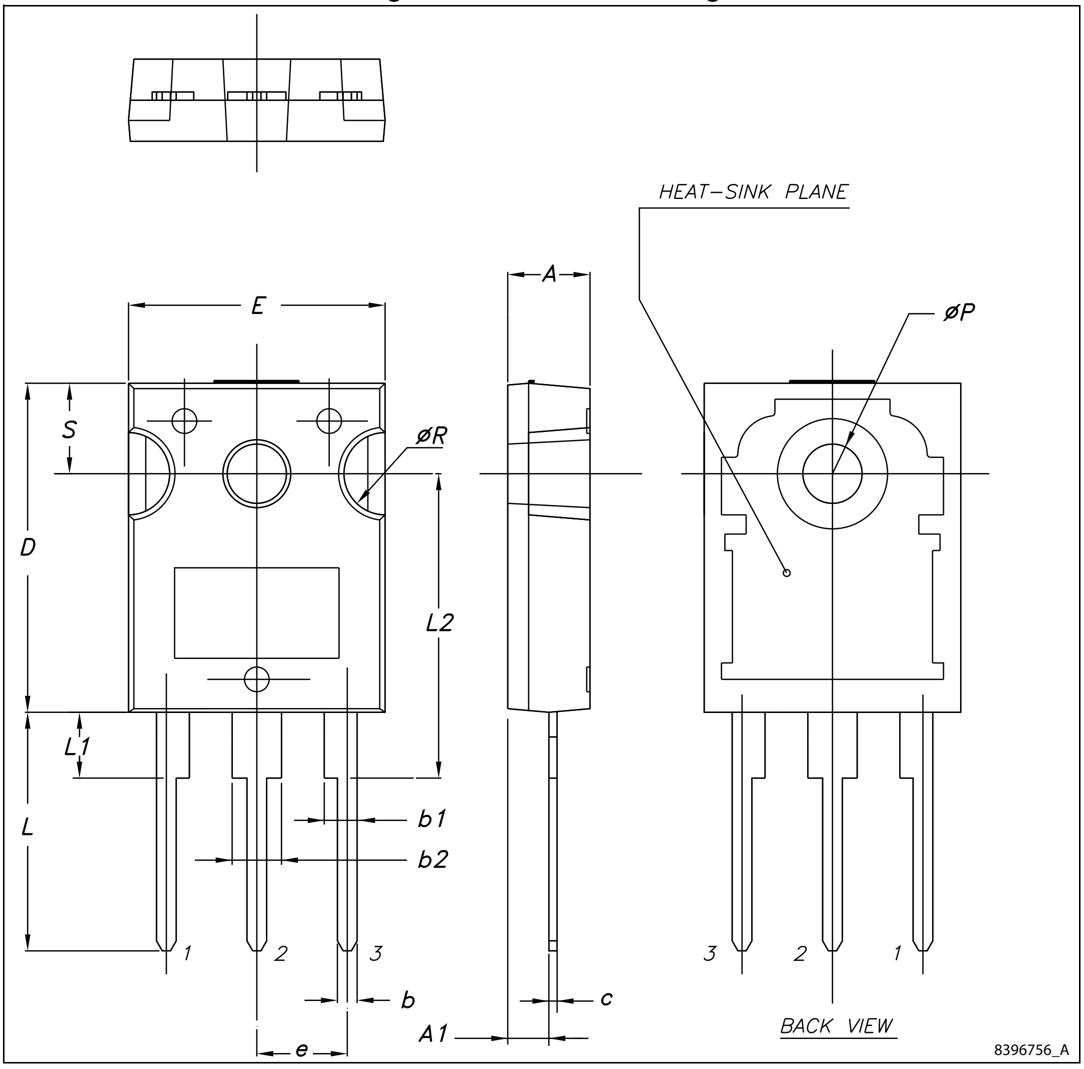


Table 9. HiP247™ mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
∅P	3.55		3.65
∅R	4.50		5.50
S	5.30	5.50	5.70

4 Revision history

Table 10. Document revision history

Date	Revision	Changes
10-May-2012	1	First release
21-May-2013	2	Updated t_{rr} value in *Table 8*. Updated dynamic parameters in *Table 5*, $V_{GS(th)}$ in *Table 4* and E_{on} in *Table 6*.
24-Jun-2013	3	Document status promoted from target to preliminary data. Added: *Section 2.1: Electrical characteristics (curves)*
11-Jul-2013	4	Updated *Figure 4: Output characteristics (T_J=25°C)* and *Figure 5: Output characteristics (T_J=200°C)*.
18-Dec-2013	5	Updated parameters in *Table 2: Absolute maximum ratings* and *Table 4: On/off states*.
27-May-2014	6	Added *Table 7: Switching times*. Updated *Section 3: Package mechanical data*. Minor text changes.
25-Sep-2014	7	Document status promoted from preliminary to production data.