

## N-channel 60 V, 0.07 $\Omega$ typ., 12 A, STripFET™ II Power MOSFET in an IPAK package

Datasheet - production data

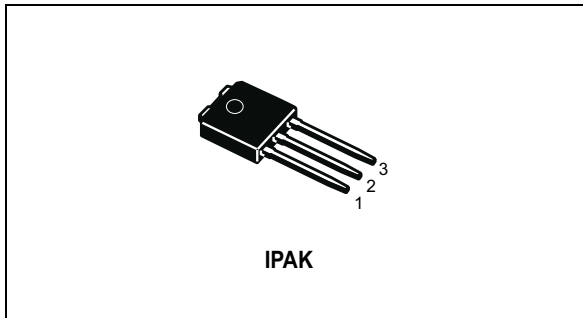
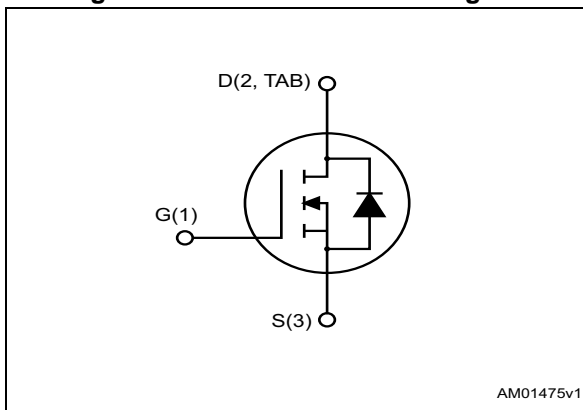


Figure 1. Internal schematic diagram



### Features

Order code	$V_{DS}$	$R_{DS(on)}$ max.	$I_D$
STD12NF06L-1	60 V	0.09 $\Omega$	12 A

- Exceptional dv/dt capability
- Low gate charge

### Applications

- Switching applications

### Description

This Power MOSFET has been developed using STMicroelectronics' unique STripFET™ process, which is specifically designed to minimize input capacitance and gate charge. This renders the device suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

Table 1. Device summary

Order code	Marking	Package	Packaging
STD12NF06L-1	D12NF06L	IPAK	Tube

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	60	V
$V_{GS}$	Gate-source voltage	$\pm 16$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	12	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	8.5	A
$I_{DM}^{(1)}$	Drain current (pulsed)	48	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	30	W
	Derating factor	0.2	W/ $^\circ\text{C}$
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$E_{AS}^{(3)}$	Single pulse avalanche energy	100	mJ
$T_{stg}$	Storage temperature	-55 to 175	$^\circ\text{C}$
$T_J$	Max. operating junction temperature		

1. Pulse width limited by safe operating area
2.  $I_{SD} \leq 12\text{ A}$ ,  $di/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DS} \leq 40\text{ V}$ ,  $T_J \leq T_{JMAX}$
3. Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $I_D = 6\text{ A}$ ,  $V_{DD} = 30\text{ V}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max.	5	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max.	100	$^\circ\text{C}/\text{W}$

## 2 Electrical characteristics

( $T_{CASE} = 25\text{ °C}$  unless otherwise specified)

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 250\ \mu\text{A}$ ,	60			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 60$			1	$\mu\text{A}$
		$V_{GS} = 0, V_{DS} = 60$ $T_C = 125\text{ °C}$			10	$\mu\text{A}$
$I_{GSS}$	Gate body leakage current	$V_{DS} = 0$ $V_{GS} = \pm 16\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1		2	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 6\text{ A}$		0.07	0.09	$\Omega$
		$V_{GS} = 5\text{ V}, I_D = 6\text{ A}$		0.08	0.10	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$		350		pF
$C_{oss}$	Output capacitance			75		pF
$C_{rss}$	Reverse transfer capacitance			30		pF
$Q_g$	Total gate charge	$V_{DD} = 48\text{ V}, I_D = 12\text{ A}$ $V_{GS} = 5\text{ V}$ (see <a href="#">Figure 14</a> )		7.5	10	nC
$Q_{gs}$	Gate-source charge			2.5		nC
$Q_{gd}$	Gate-drain charge			3.0		nC

**Table 6. Switching times**

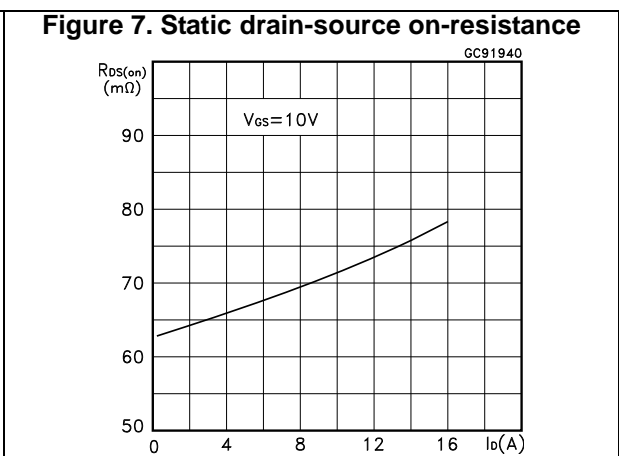
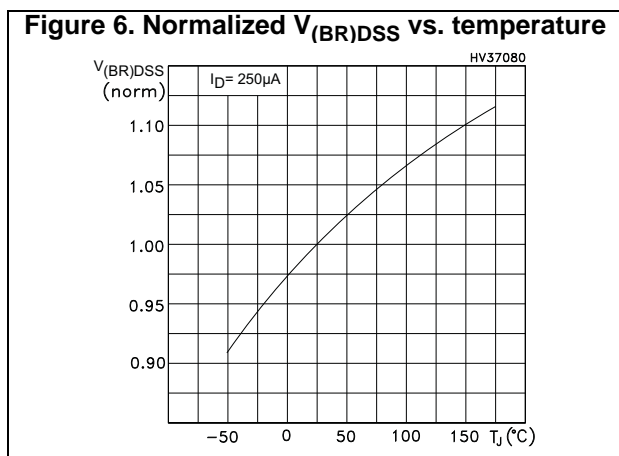
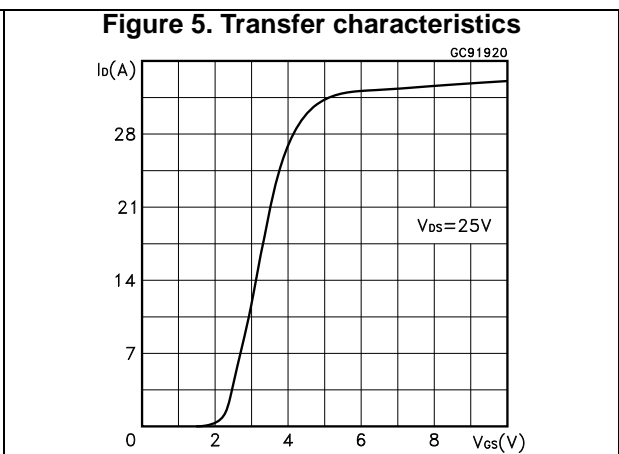
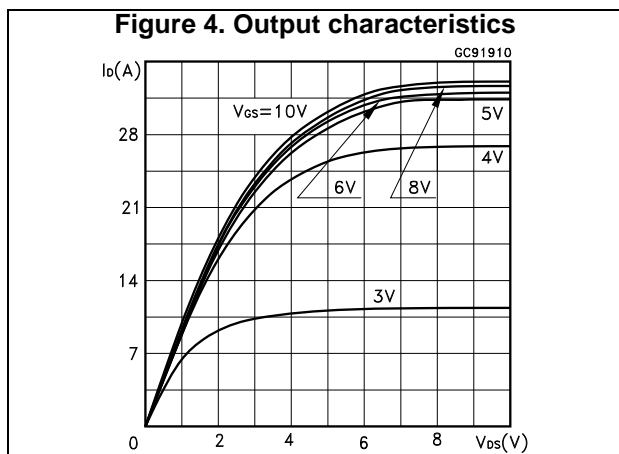
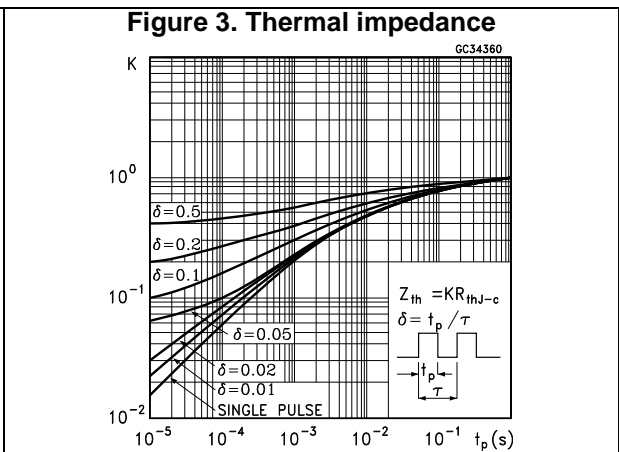
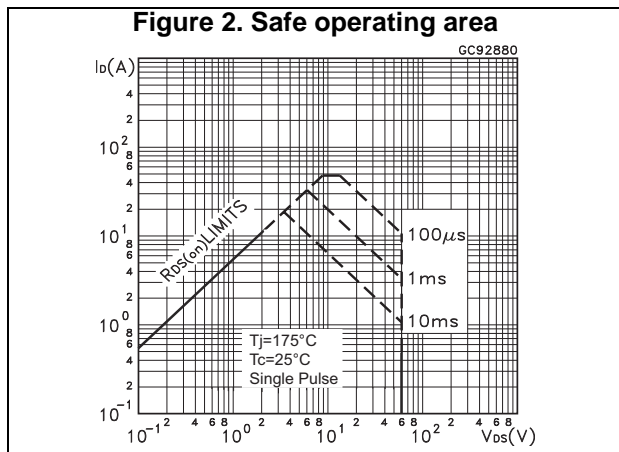
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\text{ V}, I_D = 6\text{ A},$ $R_G = 4.7\ \Omega, V_{GS} = 4.5\text{ V}$ (see <a href="#">Figure 13</a> )		10		ns	
$t_r$	Rise time			35		ns	
$t_{d(off)}$	Turn-off delay time				20		ns
$t_f$	Fall time				13		ns

Table 7. Source-drain diode

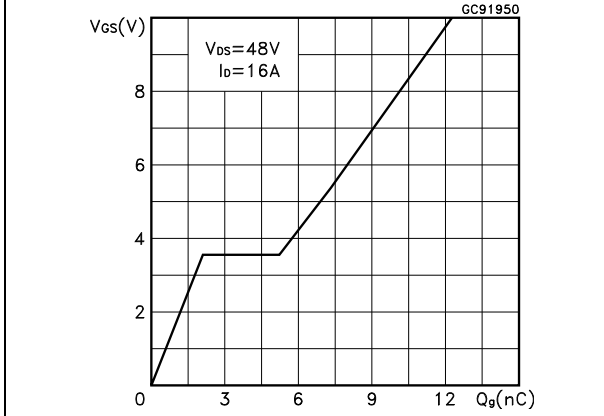
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current				12	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				48	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 12\text{ A}$ , $V_{GS} = 0$			1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 12\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 16\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$ (see <a href="#">Figure 15</a> )		50		ns
$Q_{rr}$	Reverse recovery charge			65		nC
$I_{RRM}$	Reverse recovery current			2.5		A

1. Pulse width limited by safe operating area.
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

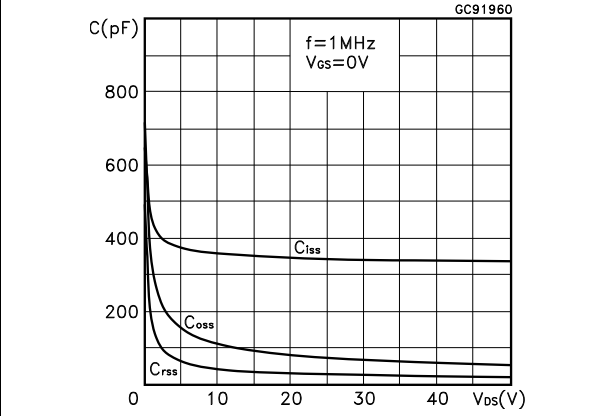
## 2.1 Electrical characteristics (curves)



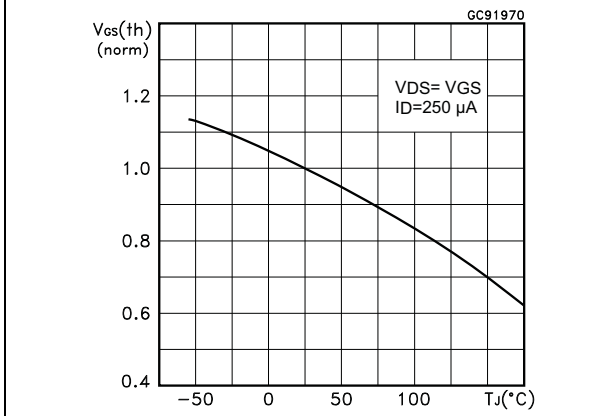
**Figure 8. Gate charge vs. gate-source voltage**



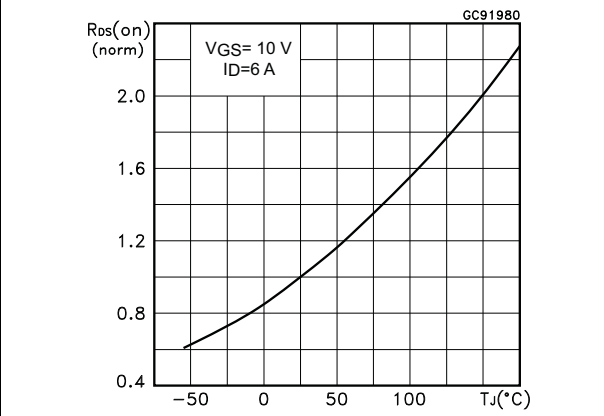
**Figure 9. Capacitance variations**



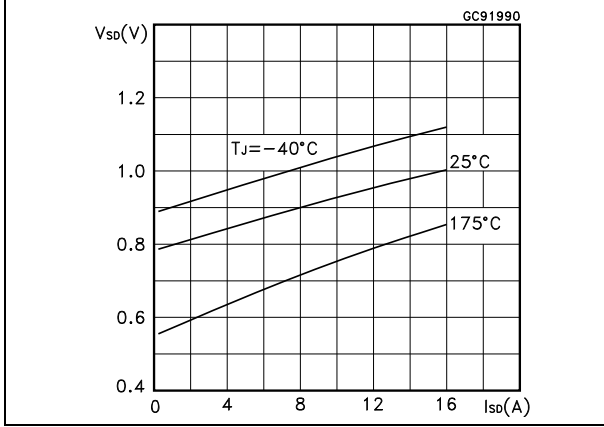
**Figure 10. Normalized gate threshold voltage vs. temperature**



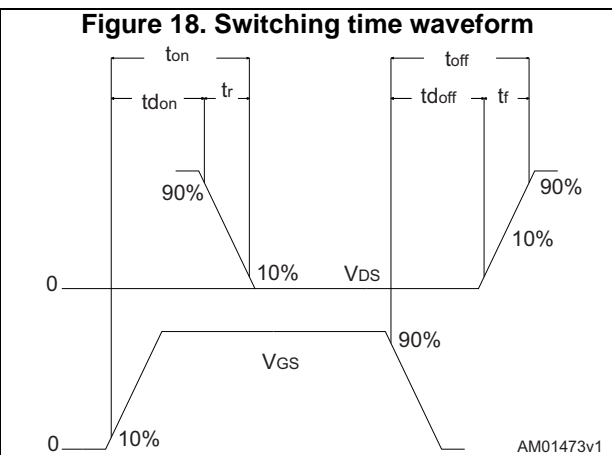
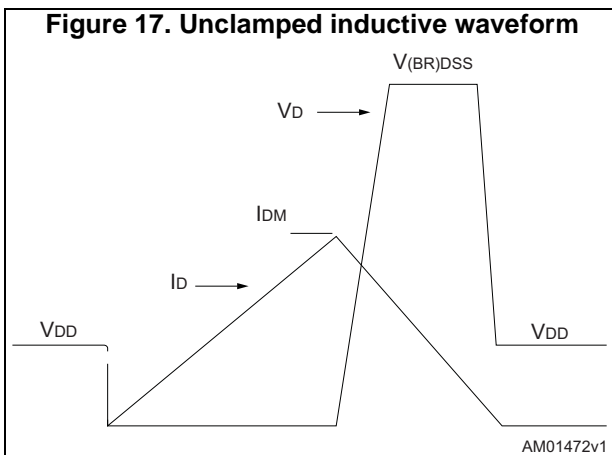
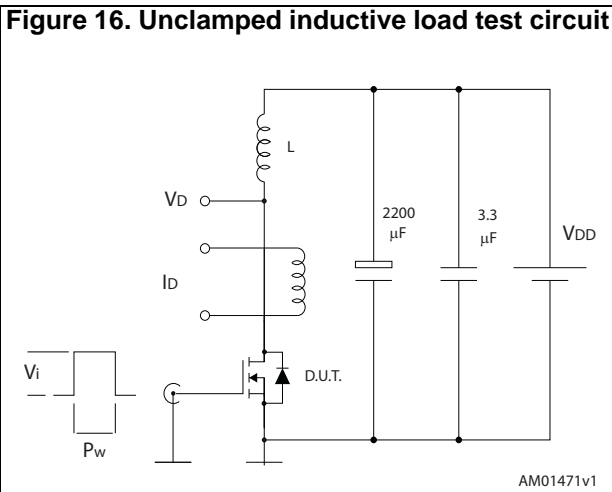
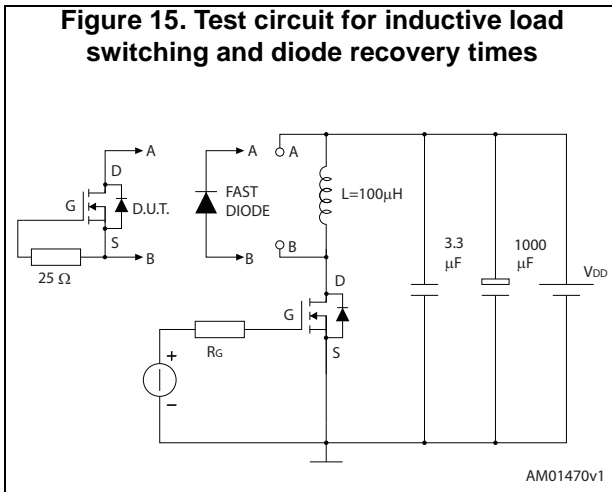
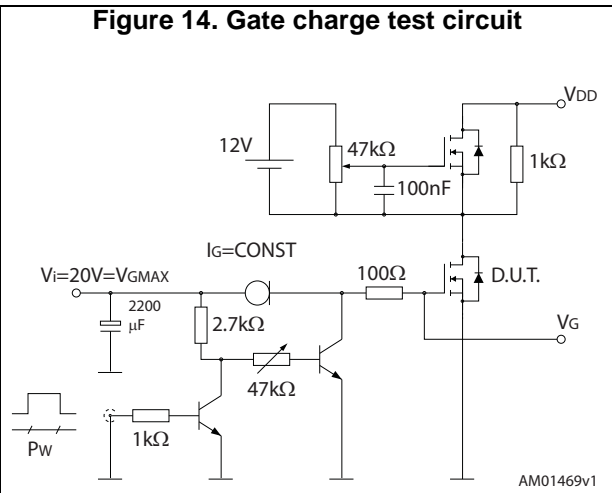
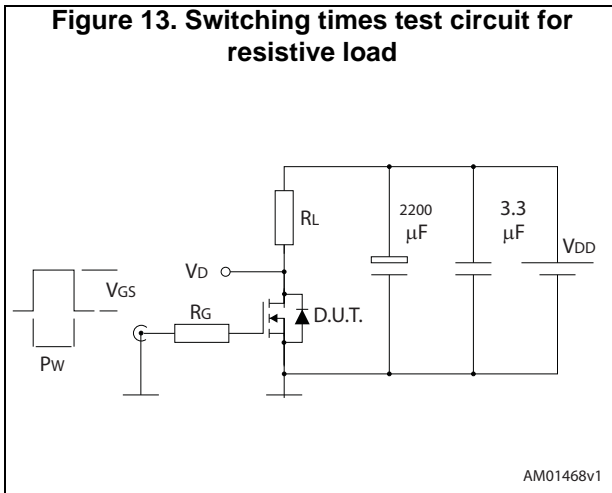
**Figure 11. Normalized on-resistance vs. temperature**



**Figure 12. Source-drain diode forward characteristics**



### 3 Test circuit





## 4 Package mechanical data

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

Figure 19. IPAK (TO-251) type A drawing

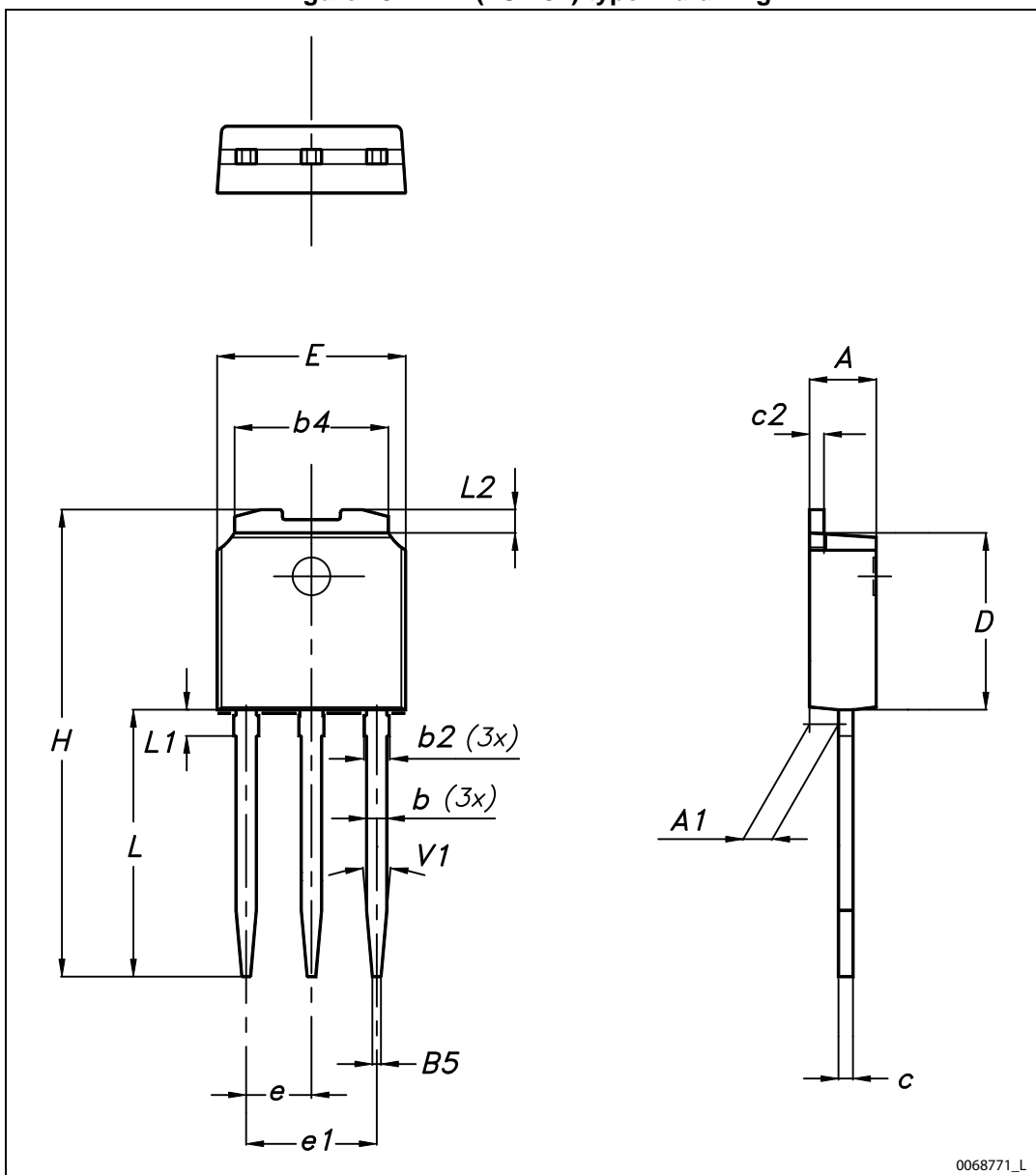


Table 8. IPAK (TO-251) type A mechanical data

DIM	mm.		
	min.	typ.	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
B5		0.30	
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
L1	0.80		1.20
L2		0.80	1.00
V1		10°	

Figure 20. IPAK (TO-251) type C drawing

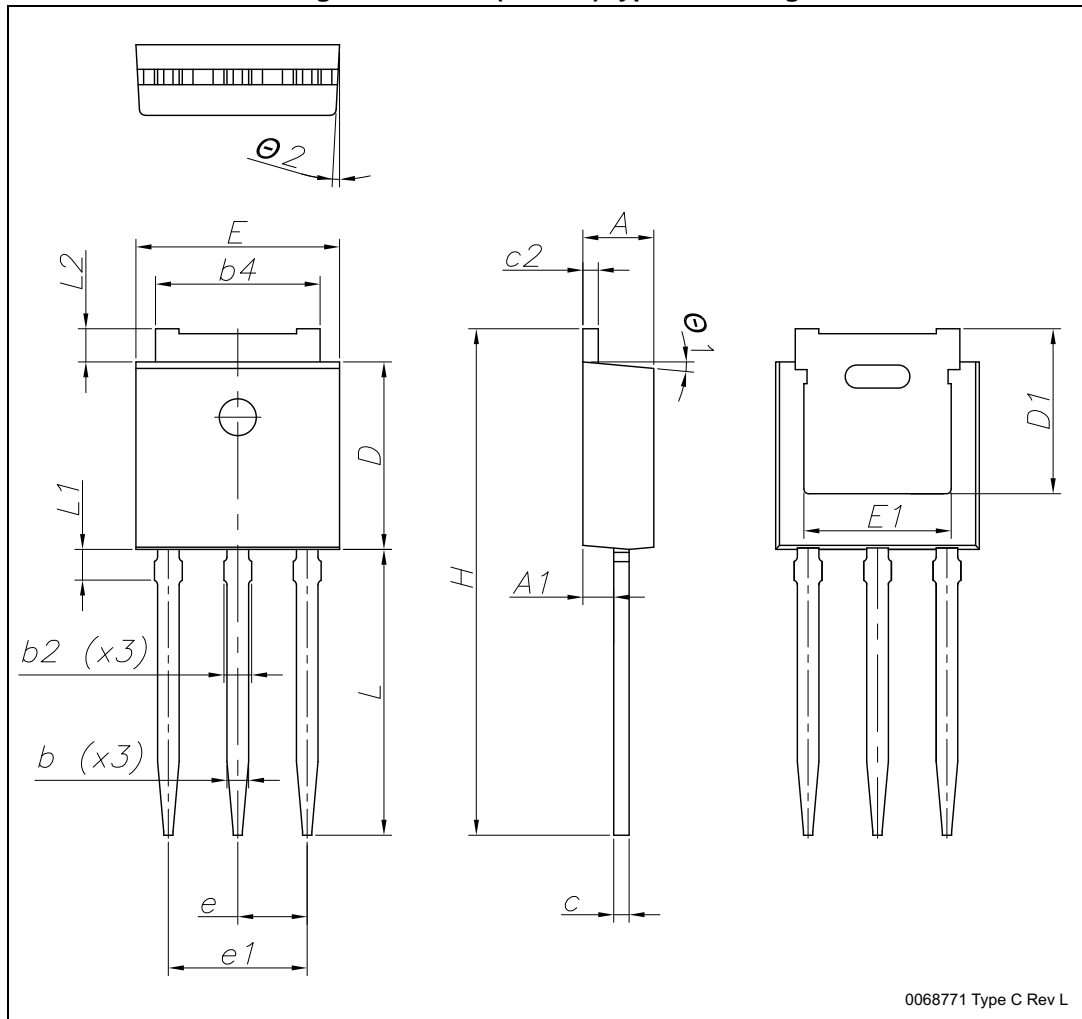


Table 9. IPAK (TO-251) type C mechanical data

Dim.	mm		
	min.	typ.	max.
A	2.20	2.30	2.35
A1	0.90	1.00	1.10
b	0.66		0.79
b2			0.90
b4	5.23	5.33	5.43
c	0.46		0.59
c2	0.46		0.59
D	6.00	6.10	6.20
D1	5.20	5.37	5.55
E	6.50	6.60	6.70
E1	4.60	4.78	4.95
e	2.20	2.25	2.30
e1	4.40	4.50	4.60
H	16.18	16.48	16.78
L	9.00	9.30	9.60
L1	0.80	1.00	1.20
L2	0.90	1.08	1.25
$\theta 1$	3°	5°	7°
$\theta 2$	1°	3°	5°

## 5 Revision history

**Table 10. Document revision history**

Date	Revision	Changes
03-Jul-2014	1	Initial release. The part number STD12NF06L-1 previously included in datasheet with docID8179.
15-Oct-2014	2	Updated <a href="#">Section 4: Package mechanical data</a> .
14-Nov-2014	3	Updated title in cover page and <a href="#">Table 4: On/off states</a> . Updated <a href="#">Figure 2: Safe operating area</a> , <a href="#">Figure 3: Thermal impedance</a> , <a href="#">Figure 10: Normalized gate threshold voltage vs. temperature</a> and <a href="#">Figure 11: Normalized on-resistance vs. temperature</a> . Minor text changes.

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