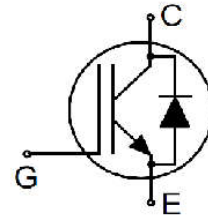




## Features

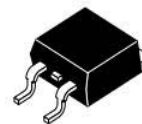
- Max Junction Temperature 150°C
- High breakdown voltage up to 650V for improved reliability
- Short Circuit Rated
- Very Low Saturation Voltage:  
 $V_{CE(SAT)} = 1.65V$  (Typ.) @  $I_C = 15A$
- Soft current turn-off waveforms

$V_{CE}$	<b>650</b>	<b>V</b>
$I_C$	<b>15</b>	<b>A</b>
$V_{CE(SAT)} \quad I_C=15A$	<b>1.65</b>	<b>V</b>

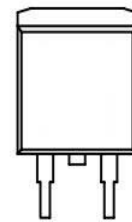


## Applications

- Soft switching applications
- Air conditioning
- Motor drive inverter



D<sup>2</sup>PAK  
CASE 418B  
STYLE 1



Product	Package	Packaging
SPD15N65T1	TO-263	Tube



**Maximum Ratings** ( $T_j = 25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-Emitter Breakdown Voltage	$V_{CE}$	650	V
DC collector current, limited by $T_{jmax}$ $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	$I_C$	30 15	A
Diode Forward current, limited by $T_{jmax}$ $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	$I_F$	30 15	A
Continuous Gate-emitter voltage	$V_{GE}$	$\pm 20$	V
Transient Gate-emitter voltage	$V_{GE}$	$\pm 30$	V
Turn off safe operating area $V_{CE} \leq 650\text{V}$ , $T_j \leq 150^\circ\text{C}$	-	60	A
Pulsed collector current, $V_{GE} = 15\text{V}$ , $t_p$ limited by $T_{jmax}$	$I_{CM}$	45	A
Short Circuit Withstand Time, $V_{GE} = 15\text{V}$ , $V_{CE} \leq 400\text{V}$	$T_{sc}$	5	$\mu\text{s}$
Power dissipation, $T_j = 25^\circ\text{C}$	$P_{tot}$	27	W
Operating junction temperature	$T_j$	$-40 \dots +150$	$^\circ\text{C}$
Storage temperature	$T_s$	$-55 \dots +150$	$^\circ\text{C}$
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s	-	260	$^\circ\text{C}$

**Thermal Resistance**

Parameter	Symbol	Max. Value	Unit
IGBT thermal resistance, junction - case	$R_{\theta(j-c)}$	4.9	K/W
Diode thermal resistance, junction - case	$R_{\theta(j-c)}$	5.8	K/W
Thermal resistance, junction - ambient	$R_{\theta(j-a)}$	62.5	K/W



**Electrical Characteristics of the IGBT** ( $T_J = 25^\circ\text{C}$  unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
<b>Static Characteristics</b> (Tested on wafers)						
$BV_{CES}$	Collector to Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 1mA$	650	-	-	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_C = 15A, V_{GE} = 15V$	-	1.65	1.95	V
$V_{GE(th)}$	G-E Threshold Voltage	$V_{GE} = V_{CE}, I_C = 250\mu A$	4.1	5.0	5.7	V
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = 650V, V_{GE} = 0V$	-	-	10	$\mu A$
$I_{GES}$	G-E Leakage Current	$V_{GE} = \pm 20V, V_{CE} = 0V$	-	-	$\pm 200$	nA
$g_{fs}$	Transconductance	$V_{CE}=20V, I_C=15A$	-	10	-	S

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Dynamic</b>						
Input capacitance	$C_{ies}$	$V_{CE} = 25V, V_{GE} = 0V,$ $f = 1MHz$	-	1910	-	pF
Output capacitance	$C_{oes}$		-	80	-	
Reverse transfer capacitance	$C_{res}$		-	46	-	
Gate charge	$Q_G$	$V_{CC} = 480V, I_C = 15A,$ $V_{GE} = 15V$	-	92	-	nC
Short circuit collector current	$I_{C(SC)}$	$V_{GE}=15V, t_{SC} \leq 5us$ $V_{CC}=400V,$ $T_{j, start}=25^\circ C$	-	98	-	A



**Switching Characteristic, Inductive Load** ( $T_j = 25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>Dynamic</b>						
Turn-on Delay Time	$t_{d(on)}$	$T_j = 25^\circ\text{C}$ $V_{CC} = 400\text{V}$ , $I_C = 15\text{A}$ , $V_{GE} = 0/15\text{V}$ , $R_g = 12\Omega$	-	15	-	ns
Rise Time	$t_r$		-	25	-	ns
Turn-off Delay Time	$t_{d(off)}$		-	60	-	ns
Fall Time	$t_f$		-	46	-	ns
Turn-on Energy	$E_{on}$		-	0.75	-	mJ
Turn-off Energy	$E_{off}$		-	0.1	-	mJ

**Electrical Characteristics of the DIODE** ( $T_j = 25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Dynamic</b>						
Diode Forward Voltage	$V_{FM}$	$I_F = 15\text{A}$	-	1.7	-	V
Reverse Recovery Time	$T_{rr}$	$I_F = 15\text{A}$ $V_R = 300\text{V}$ , $di/dt = 200\text{A}/\mu\text{s}$	-	50	-	ns
Reverse Recovery Current	$I_{rr}$		-	4	-	A
Reverse Recovery Charge	$Q_{rr}$		-	83	-	nC



Fig. 1 FBSOA characteristics

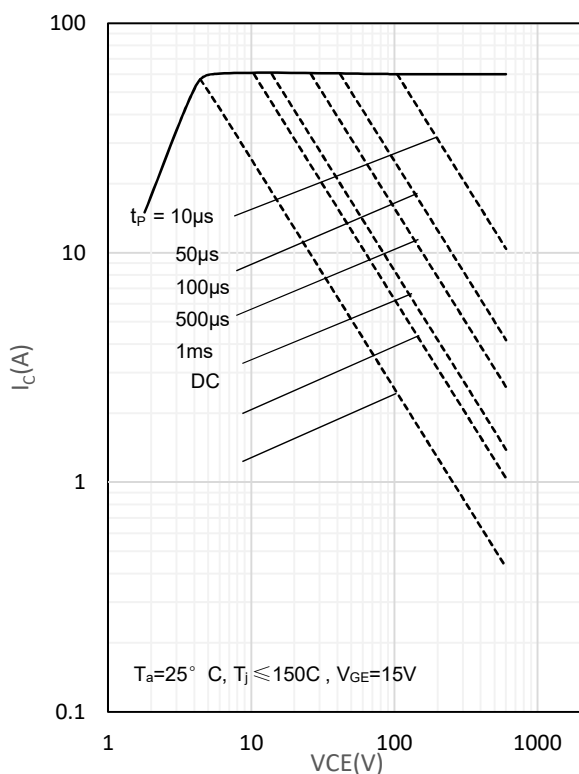


Fig. 2 Load Current vs. Frequency

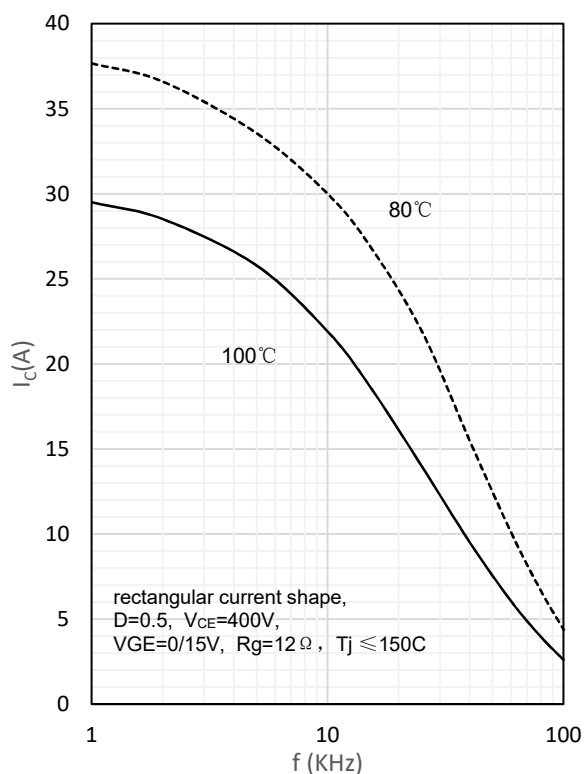


Fig. 3 Output characteristics

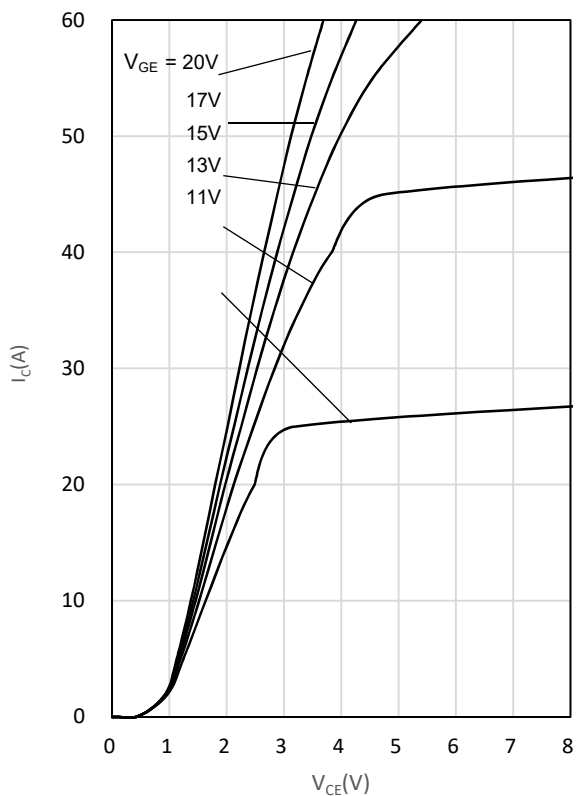


Fig. 4 Saturation voltage characteristics

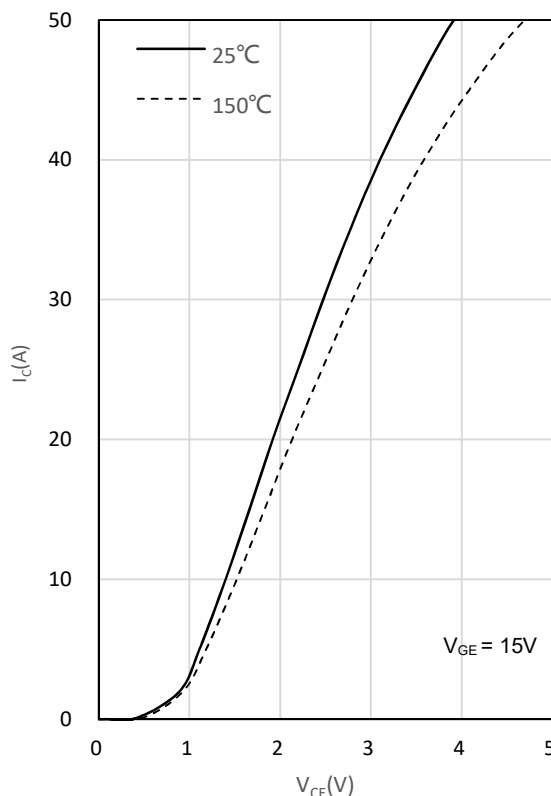




Fig. 5 Switching times vs. gate resistor

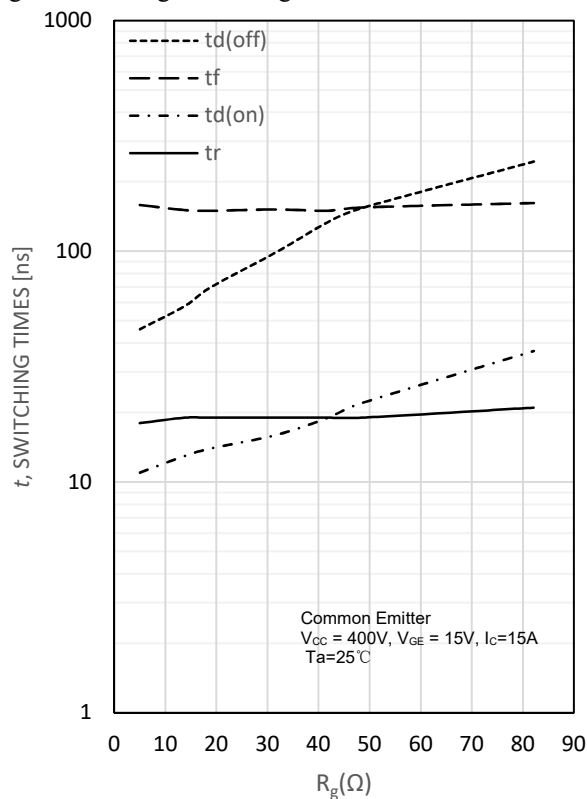


Fig. 6 Switching times vs. collector current

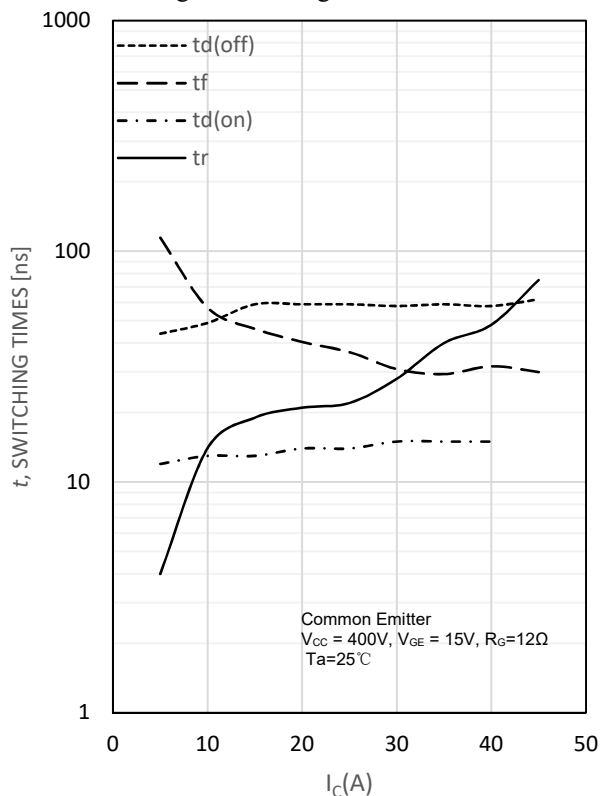


Fig. 7 Switching loss vs. gate resistor

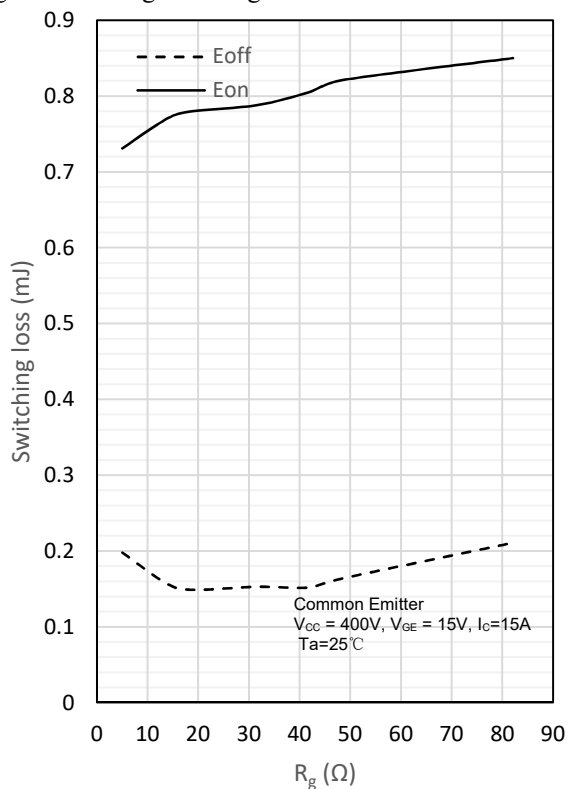


Fig. 8 Switching loss vs. collector current

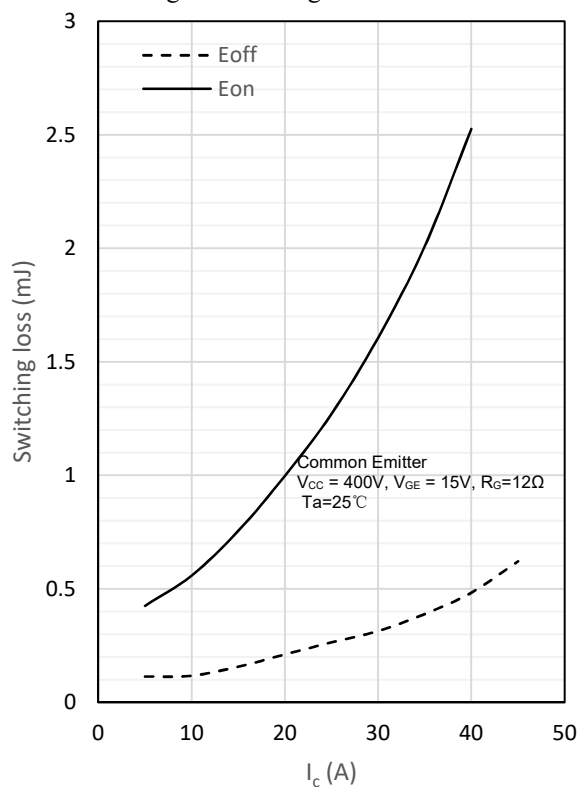




Fig. 9 Gate charge characteristics

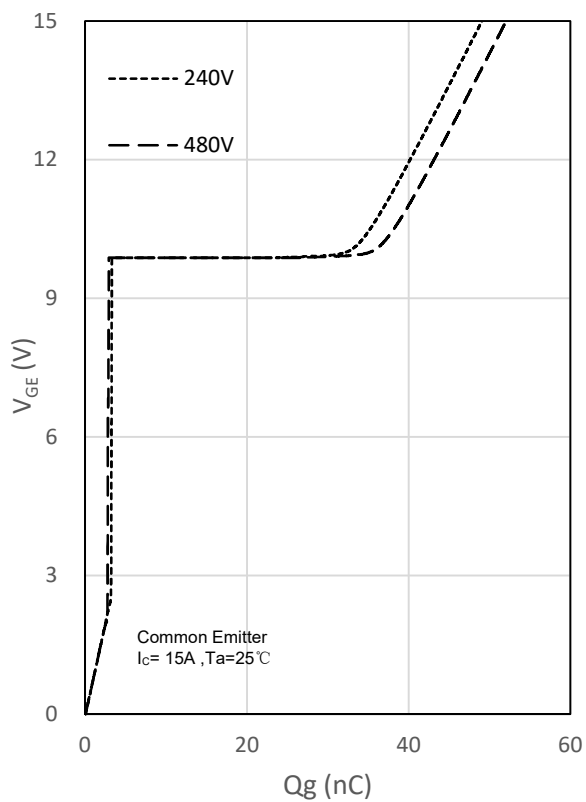


Fig. 10 Capacitance characteristics

